



Bridge Maintenance Manual

Preface

The purpose of this manual is to provide a reference guide for PENNDOT personnel at the District and County levels, and to assist them in understanding the various aspects, methods, materials, and best practices related to bridge maintenance and preservation.

This manual has been prepared as a guidance document for in-house department forces to aid them in addressing the most common types of bridge distress by providing an overview of the practical procedures for preventive maintenance and repair. It is not meant to be all-inclusive, or to overrule other policies, standards, publications. Although environmental measures are mentioned, this document does not address environmental, historic preservation, traffic control, or safety implications. They may be mentioned for reference only as it pertains to scheduling the operation. Although developed with safety and minimizing environmental harm in mind, the bridge maintenance procedures presented in this publication may not be appropriate in all situations. The practitioners will be responsible for ensuring that procedures considered are consistent with environmental standards and safety codes within the jurisdictions involved, as well as obtaining the required permits before starting work.

This manual is for guidance and information purposes only; it is not regulatory.

Table of Contents

CHAPTER 1: Introduction	1-1
CHAPTER 2: BMS – How to Get From Inspection to Repairs	2-1
CHAPTER 3: Annual and Strategic Planning	3-1
CHAPTER 4: Preventive Maintenance	4-1
CHAPTER 5: Structural Repairs	5-1
CHAPTER 6: SAP	6-1
CHAPTER 7: Procurement	7-1
CHAPTER 8: Contracts	8-1
CHAPTER 9: Response Plans and Follow-Ups	9-1
CHAPTER 10: Bridge Replacements	10-1
CHAPTER 11: Cleaning	11-1
CHAPTER 12: Painting	12-1
CHAPTER 13: Deck Expansion Joints	13-1
CHAPTER 14: Railings/Parapets	14-1
CHAPTER 15: Bearings	15-1
CHAPTER 16: Approach Roadway Work	16-1
CHAPTER 17: Decks	17-1

CHAPTER 18: Deck Drainage	18-1
CHAPTER 19: Timber	19-1
CHAPTER 20: Steel	20-1
CHAPTER 21: Concrete Members	21-1
CHAPTER 22: Truss	22-1
CHAPTER 23: Abutments, Wings, Piers	23-1
CHAPTER 24: Culverts	24-1
CHAPTER 25: Erosion Control	25-1
CHAPTER 26: Construct Temporary	26-1
CHAPTER 27: Miscellaneous Bridge Activities	27-1

Chapter 1: Introduction

ABOUT PUB 55

The purpose of PUB 55 is to provide a Bridge Maintenance reference guide for PennDOT personnel at the District and County levels. The objectives are:

To promote an understanding of the bridge inspection program, regulations and policies and to bridge the gap between the results of a bridge inspection and recommended bridge maintenance;

To inform about Best Practices for structural repairs and preventive maintenance;
 To inform about available resources for performing maintenance, including use of PennDOT forms and programs;
 To promote the development of strategic plans for bridge maintenance.

To that end, a process map has been developed (see Figure 1-1) depicting the objectives above.

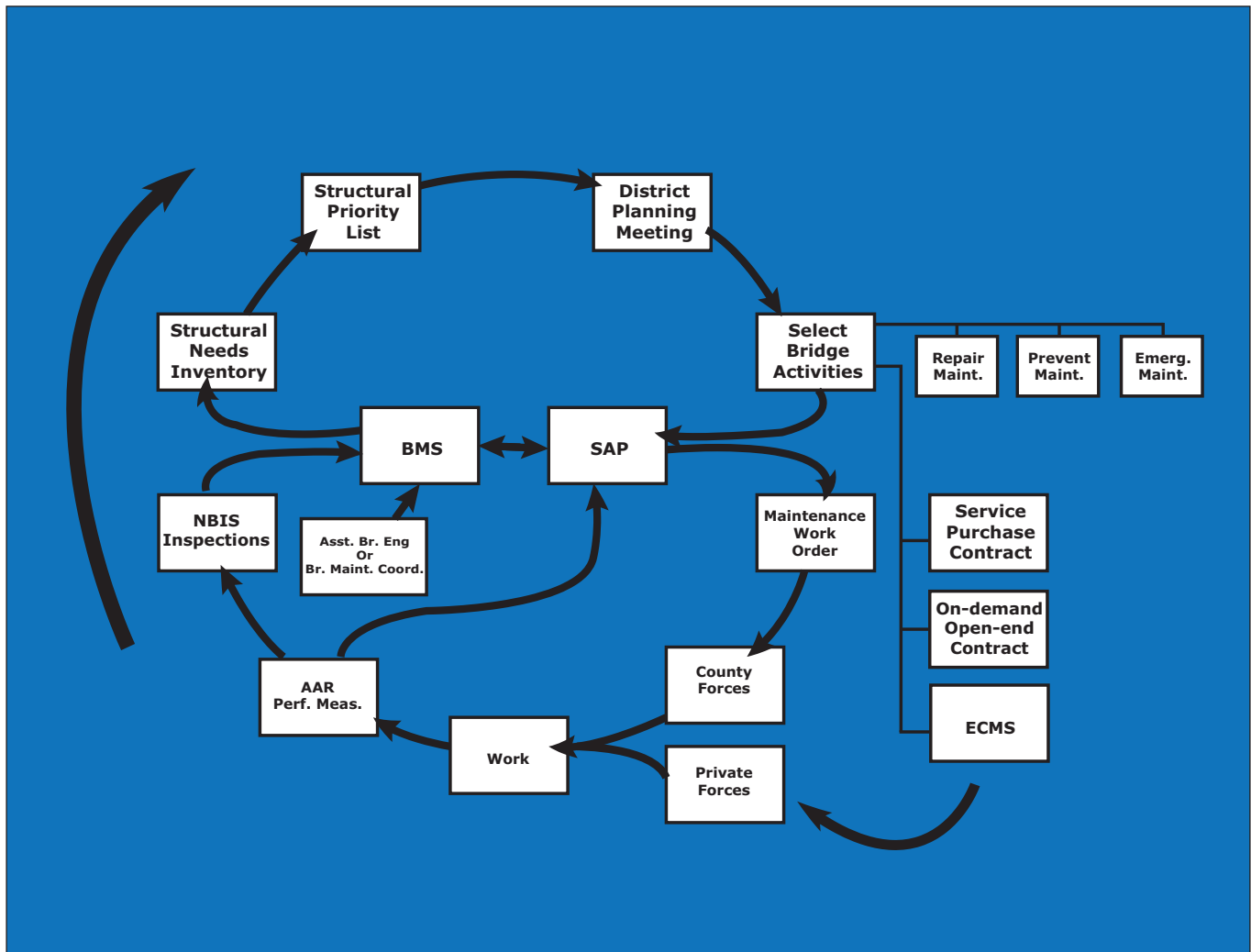


Figure 1-1 - Process Map

This Process Map is presented as a circle because of the continuity of the bridge inspection / maintenance process, which becomes a series of cycles across time. As a practical matter, the beginning of the Process Map is the place where any user of the Map recognizes their place in the

process. For the purposes of PUB 55, the process will begin with BMS because BMS is the repository of information about bridge conditions, and contains the information used to plan bridge maintenance. PUB 55 uses information from a number of PennDOT sources as well as outside

sources to outline the pathway to achieving a healthy bridge system through preventive maintenance and structural repairs. The pathway goes from the point of input (i.e. bridge inspection results and recommendations) through the processes required to manage and resolve these recommendations. The intent of this publication is to serve PennDOT District and County personnel as a desktop reference and guide. This publication contains best practices for use statewide.

Intended Use

The intended audience for this publication includes Assistant District Bridge Engineers for Inspection, District Bridge Maintenance Coordinators, Maintenance Service Engineers, and Highway Maintenance Managers.

JOB TITLES ASSOCIATED WITH BRIDGE MAINTENANCE

While the job titles listed above represent the personnel most closely involved with bridge maintenance operations, other personnel are also involved with bridge maintenance. Following is a list of personnel located at District and County offices who contribute to the processes presented in PUB 55, along with brief descriptions of their tasks associated with bridge maintenance.

County

Highway Maintenance Manager (HMM)

Coordinates with the District Bridge Unit for generation of a Structure Priority List.

Meets with the District Bridge Unit and District Bridge Maintenance Coordinator to program bridge maintenance.

Develops an annual plan of work for the upcoming fiscal year, balancing County resources including personnel, equipment, and materials.

Monitors Maintenance Accreditation Performance Index (MAPI) objectives via monthly reports.

Assistant Highway Maintenance Manager (AHMM)

Coordinates with the District Bridge Unit for generation of a Structure Priority List.

Meets with the District Bridge Unit and District Bridge Maintenance Coordinator.

Develops an annual plan of work for the upcoming fiscal year, balancing County resources including personnel, equipment and materials.

Receives notifications from the District Bridge Unit through SAP, and develops work orders for maintenance activities.

Supervises Department Bridge Crews performing bridge maintenance activities.

Schedules work for their respective County.

Determines material and equipment needs for maintenance activities and procures those resources as necessary.

Bridge Foreman

Supervises Department Bridge Crews performing bridge maintenance activities.

District Maintenance Unit

Assistant District Executive for Maintenance (ADE – Maintenance)

Monitors MAPI objectives via monthly reports.

District Bridge Maintenance Coordinator (May also be in Bridge Unit)

Meets with the District Bridge Unit and HMM to program bridge maintenance.

Ensures that plans, permits, materials, and equipment are available for scheduled maintenance activities.

Along with the Bridge Unit, considers formwork necessary to complete repairs and designs formwork if necessary.

Monitors MAPI objectives via monthly reports.

Develops repair sketches.

District Bridge Unit

Meets with the District Bridge Coordinator and the HMM to program bridge maintenance.

Generates reports from BMS data.

Generates notifications in SAP using BMS information.

Generates reports from the Structure Needs Inventory. This List is generated in cooperation with the HMMs.

**Assistant District Bridge Engineer -
Inspection**

Furnishes dimensions, specifications, and procedures for work.

Furnishes repair design.

Supervises testing of paint for lead and other hazardous materials.

Chapter 1 Best Practices

- Maintenance Environmental Planner prepares waterway permits for maintenance work orders.
- Bridge Unit can provide on-the-job Hydraulics and Hydrology training to a Maintenance Engineer so that Maintenance can perform this function for maintenance work/activities.
- Coordinate effort between design and maintenance units.

Chapter 2: BMS – How to Get from Inspection to Repairs

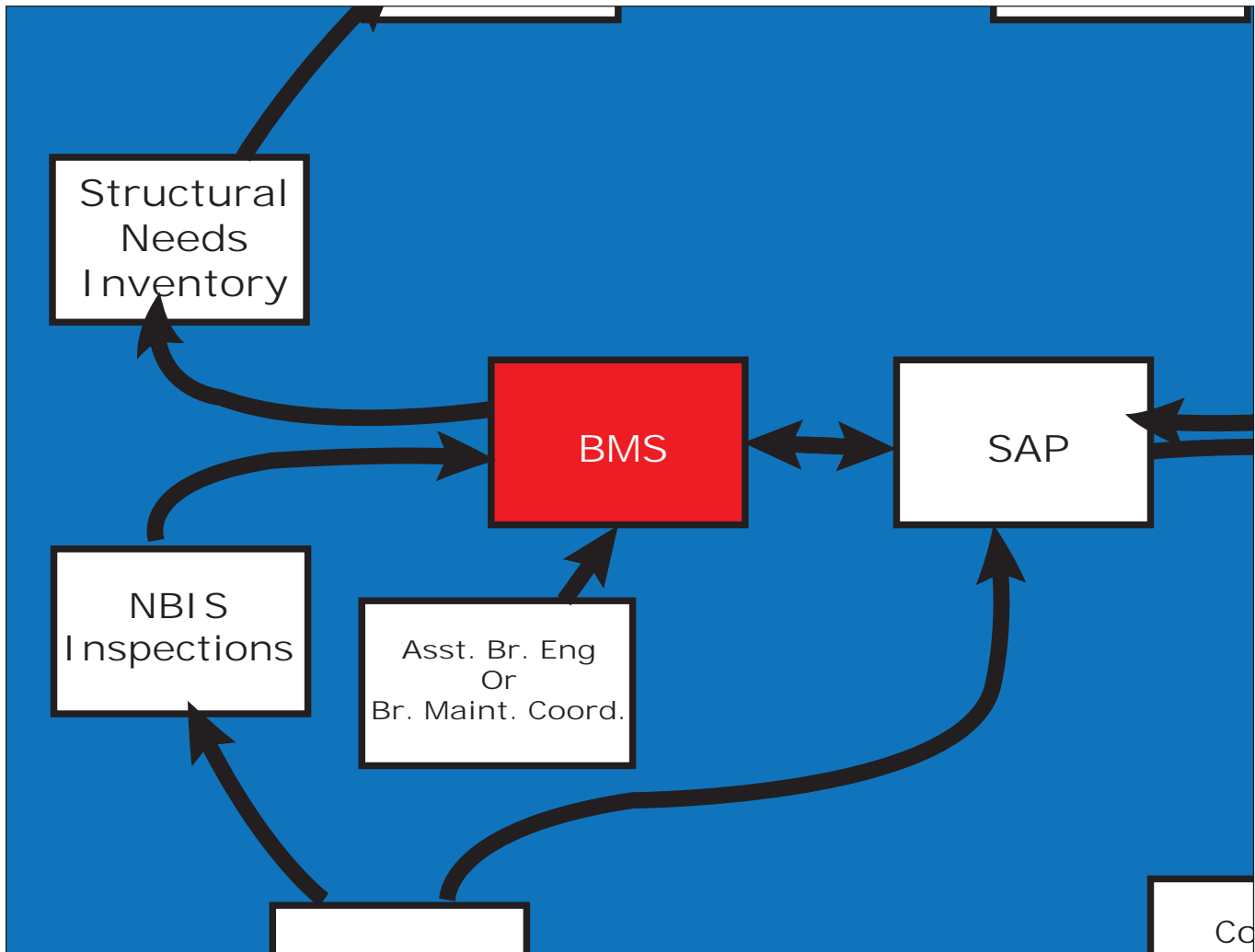


Figure 2-1 – BMS Section of Process Map

Introduction

Referring to the Process Map (Figure 2-1), the major source of data in the Bridge Maintenance Process is BMS. In essence, BMS is a web-based database containing bridge inspection results and recommendations. Inspection data feeds the Department’s BMS. The data collected and managed by BMS can provide the following assistance to the managers of the bridge maintenance process:

Bridge planning – determining bridge needs on a network basis.

Bridge programming – selection of the correct work item for an individual bridge.

Bridge maintenance management – better use of inspection data for determining maintenance needs and priority for planning and operations.

The information regarding bridge condition, maintenance needs, repair needs, and management of posted or structurally deficient bridges is placed within the database through the collection of inspection data. Because the data from ALL bridge inspections is input into BMS, future deterioration and corrective bridge costs for various maintenance and improvement options can be better managed. BMS uses a planning analysis engine to determine the resources needed on a network basis to achieve and maintain the desired level of performance for Pennsylvania’s bridges.

The process of planning and programming bridge maintenance begins with an inventory of the structural deficiencies found during routine National Bridge Inventory Standards (NBIS) inspections. A report is generated by the District Bridge Unit using BMS data showing the general condition of the bridges within the District. BMS has greatly improved data sharing capabilities with

other PennDOT management systems (e.g. RMS, SAP, APRAS, ECMS, and GIS) to assist management decisions.

The following describes how the inspectors get the data combined in the BMS data base.

BRIDGE INSPECTION BASICS

Basic Bridge Components

Deck

The deck is the portion of the bridge that provides a surface for vehicular or pedestrian traffic.

Superstructure

The superstructure is the portion of a bridge above and including the bearing device that supports the deck and vehicular or pedestrian traffic and transfers the applied loads to the bridge substructure. The major components include the deck, the beams or girders, and the parapets, railings, sidewalks, curbs, drainage features, joints and bearings.

Substructure

The portion of a bridge below the bearing device, built to support the superstructure and transmit loads to the foundation. The main components are abutments, wingwalls, piers, bents and footings.

Approach Roadway

The approach slabs that lead onto the bridge, which are usually concrete.

Traffic Safety Features

Bridge railings, parapets, approach guiderails, transitions and end treatments.

Inspection Frequency

The regular inspection cycle in every contract is two years. Bridges in poorer condition may be inspected annually, with interim inspections of critical elements required semi-annually or annually. Typically, regular safety inspections are performed during the first year of the two-year cycle, with interim inspections of critical elements performed the second year. The second year is often used as a maintenance year, during which the maintenance recommended in the inspection reports is performed.

Inspection Report

The product of a bridge safety inspection is a report showing the condition of a bridge on the day it was inspected. These inspection reports contain elements such as narrative descriptions of the bridge components, photographs, and maintenance recommendations. However, the single component

that will be common to every Pennsylvania bridge inspection report is a set of Field Sheets, PennDOT Inspection Forms. This set of Forms contains condition ratings representing the inspectors' assessment of the various bridge components at the time of inspection. The Forms also include maintenance recommendations identifying areas of the bridge that require preventive maintenance or structural repairs.

Condition Ratings

The NBIS and AASHTO rating codes and their descriptions are shown in the two sections below. It is important to note that the Professional Engineers and Certified Bridge Safety Inspectors that perform bridge inspections are well-trained in the meanings and use of these condition codes, and apply them in their field work according to strict standards.

Table 2-1 – NBIS Component-level Coding

(FHWA's Recording and Coding Guide for the Structural Inventory and Appraisal of the Nation's Bridges)

Rating Codes	Description
N	Not Applicable
9	Excellent Condition
8	Very Good Condition – No problems noted.
7	Good Condition – Some minor problems.
6	Satisfactory Condition – Structure elements show some minor deterioration.
5	Fair Condition – All primary structure elements are sound but may have minor section loss, cracking, spalling, or scour.
4	Poor Condition – Advanced section loss, deterioration, spalling, or scour.
3	Serious Condition – Loss of section, deterioration, spalling, or scour may have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	Critical Condition – Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
1	"Imminent" Failure Condition – Major deterioration or section loss present in critical structural components of obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.
0	Failed Condition – Out of service – beyond corrective action.

In accordance with PUB 238, one of the functions of the bridge inspection program is to identify the needs of bridges with regard to structural repairs, preventive maintenance, preservation, reconstruction and replacement. Bridge owners, generally, and the Department, specifically, need this information to respond to those critical deficiencies warranting immediate attention and for the long-term management of these critical infrastructure assets. The data entered into BMS will use these major improvement needs and identified maintenance needs to predict future costs to achieve a desired level of service for PA bridges.

BMS has a robust program which supports electronic data collection of bridge inspections for increased efficiency and effectiveness in the electronic collection of bridge data.

The use of the program allows PennDOT to administer program oversight and to maintain consistency and quality control in view of the numerous inspectors within PennDOT and with private consultants across the Commonwealth. The

program is used to hold the data gathered from bridge inspections, which includes site data, inventory information on the bridge, condition ratings of the bridge components, and the maintenance needs for that particular bridge.

The inspectors use the NBIS and AASHTO condition ratings (see Table 2-1) to describe and assess the condition of the bridge and bridge members. Deficiencies are located and quantified.

In addition to the condition of the bridge members, the inspectors will identify needed maintenance items (e.g. on-demand repairs, preventive maintenance, preservation, etc.) for each bridge using the standard list of Maintenance Activities. The inspector can edit existing proposed maintenance items or create new items, removing completed structural repairs and updating quantities or adding additional locations for existing maintenance items.

The program provides a means to organize the basic major improvement information. Once submitted the current inspection's recommended

actions are displayed with all inspections as a cumulative list, displaying current proposed maintenance as well as planned and completed maintenance:

Planned maintenance items are inspector-recommended or other work items that have been approved, tied to a project and programmed.

Completed maintenance items are work items for the structure that are associated with a completed project.

Information that appears in the maintenance items includes the:

Type of recommended repair

Location of a recommended maintenance item (near, far, left, right, entire span, etc.)

Estimated quantity of a recommended repair
Priority code of a recommended repair

Maintenance Priority Codes listed are:

Priority Code	Short Definition	Action Time Frame
0 Critical	Immediate response required	Within 7 days
1 High Priority	As soon as work can be scheduled	Within 6 months
2 Priority	Review work plan and reprioritize schedule	Routine inspection interval, 24 months or 48 months
3 Schedule	Add to scheduled work	Add to schedule
4 Program	Add to programmed work	When funds are available
5 Routine	Non-structural	Can be delayed until programmed

Maintenance items coded a "0" or "1" should be considered high priority maintenance items, requiring immediate attention.

This discussion was intended to provide an understanding of the BMS system as a tool with several uses. The principal use is the storage of information about the conditions and deficiencies of many individual bridges, resulting from the various inspection efforts across the state. Another important use of BMS, which will be taken up in subsequent chapters of PUB 55, is that reports about the aggregate conditions of bridges in a region, District, or County may be produced that guide the planning and programming of maintenance activities.

Chapter 2 Best Practices

- Maintenance items are extracted from BMS with a Crystal report to develop the preservation projects.
- Inspection crews notify District Bridge Engineer via cell phone of critical structural items needing repair.
- Timely review of new and outstanding Priority 0 and 1 items by bridge inspection supervisor.
- Timely and effective scheduling to perform critical structural repairs.

Chapter 3: Annual and Strategic Planning

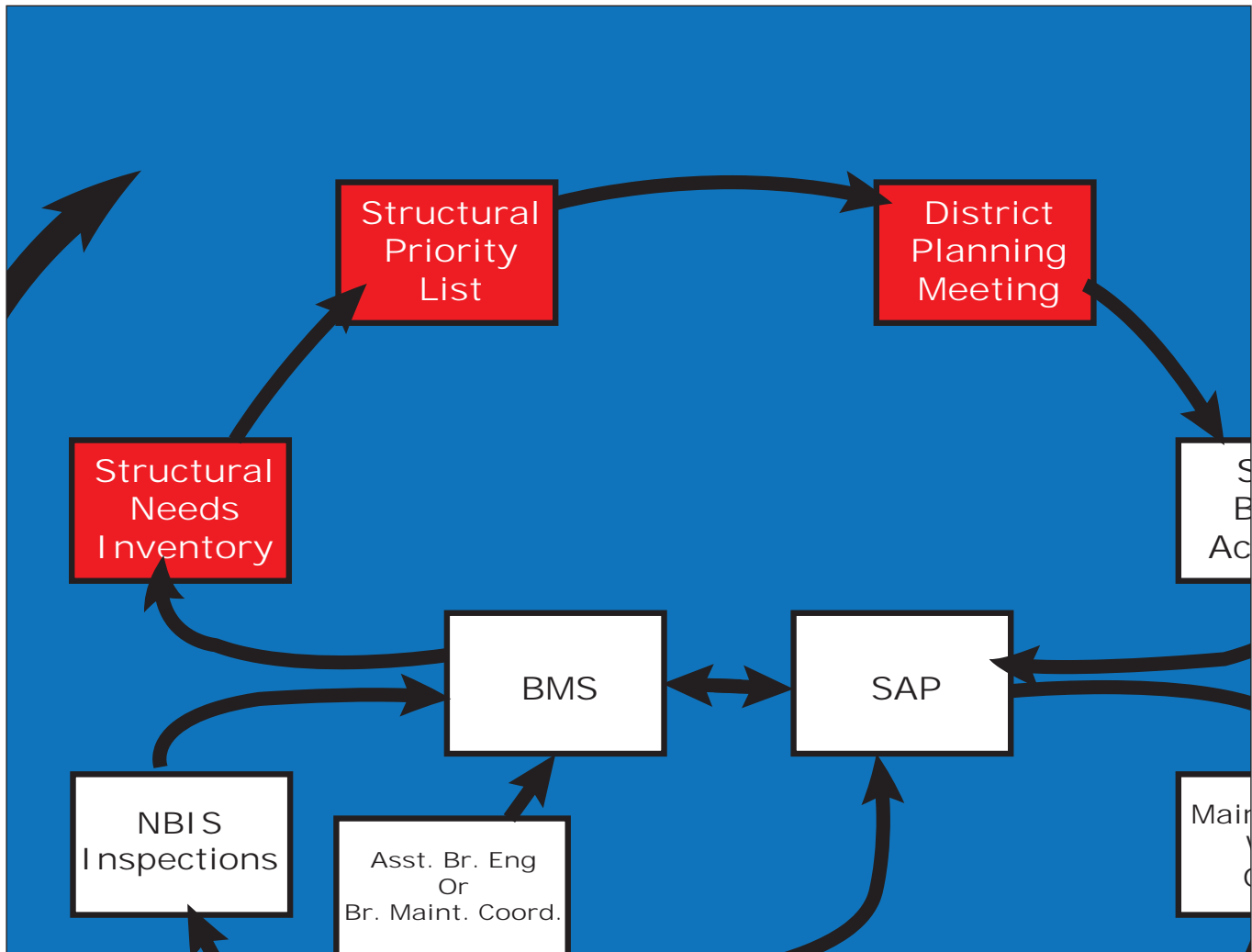


Figure 3-1 – Annual and Strategic Planning Section of Process Map

Introduction

It is clear that careful planning and programming of bridge maintenance activities is of the utmost importance. The sequence of planning is shown in Figure 3-1. *The goal of preventive maintenance is, very simply put, to keep good bridges good.* This goal can be accomplished by developing a strategic plan to address bridge maintenance for critical components of the bridge.

A strategic plan is defined as the process of articulating direction and then making decisions on allocating resources. A strategic plan is used as guidance to define functional and divisional plans, which in this case, would be to address the problem of deficient bridges. While an annual plan (also discussed in this chapter) focuses bridge maintenance efforts on immediate needs, the strategic plan looks forward several years, to upcoming and often large-scale needs, as well as

routine maintenance items that do not occur every year. If the annual plan can be regarded as a cycle of advancing, yet complementary activities, a strategic plan can be thought of as a cycle of cycles.

Developing a Strategic Plan

By developing and implementing a strong Strategic Plan, the District can accomplish a major goal, which is to support the reduction of poor condition bridges by ensuring regularly scheduled maintenance. Developing and maintaining a plan for completing critical preventive maintenance items is a vital step in ensuring continued serviceability of our bridges.

A well-developed strategic plan does not have to be large or complicated. Four or five pages that address certain components should be sufficient.

Pertinent Issues

Clear, concise document.

Cycle of cycles.

The components that should appear in a strategic plan are:

a statement of goals and objectives;
 routine maintenance cycles;
 bridge element life cycles;
 resources;
 funding; and
 performance measures.

Further, a well-developed strategic plan should prioritize the Districts' highway structures using the Business Plan Networks model. Within this model, the roadway network is prioritized by four categories: Network 1 – Interstate highways; Network 2 – NHS highways; Network 3 – Non-NHS highways with ADTs greater than 2,000; and finally Network 4 – Non-NHS highways with ADTs less than 2,000. By focusing on Business Plan Networks 1 and 2, our focus effectively becomes commercial routes, in essence caring for the "trunk of the tree."

As a concept of cycles and activities for critical components, a strategic plan can set the schedule of what work is to be done and at what frequency. The critical components best served by a strategic plan because of their acknowledged life cycle and well-documented costs and impacts include:

deck overlays,
 joints,
 scour,
 some structural repairs, and
 painting

Along with a maintenance cycle consisting of regularly scheduled cleaning of bridge decks, bearings, and joints and preventive maintenance of stream banks and channel alignments, strategically planned activities such as resealing joints and replacing deck wearing surfaces can significantly extend the service life of bridges and prevent the accumulation of higher priority maintenance items on a County's bridge system. It is essential that management of these activities include tracking and managing the repairs and combining maintenance projects for economies of scale.

Highway Maintenance Managers (HMMs) must work with the District Bridge Unit and Bridge Maintenance Coordinator in developing a strategic plan that prioritizes bridge preventive maintenance activities within the annual county maintenance work plan. The plan should address routine maintenance items such as cleaning decks and scuppers as well as preservation, such as joint repairs, scour mitigation and waterproofing decks (applying membranes, placing latex overlays and filling grid decks, etc).

For each activity in the strategic plan, careful analysis of the required schedule, budget, labor, and equipment is necessary to determine if the work can be completed by the county bridge crew or by contracted forces. Ultimately, development should result in a plan for each critical component that looks like the following example:

A district has 25 bridges, with a yearly budget equaling \$20,000. The cost to reseal the joints on a single bridge is approximately \$4,000, with labor, equipment, water truck rental, and traffic control. A typical joint seal requires replacement every 5 years. Thus, five bridges can be maintained at that yearly budget. The strategic plan is to replace the joint seals on five bridges a year for four years. In the fifth year, the cycle starts again on the first bridge.

Developing an Annual Maintenance Plan

When developing the annual maintenance plan and schedule, consideration must be given to allowing adequate time in budgets and schedules for developing design details (if necessary), procurement of materials and obtaining Erosion and Sedimentation Control and DEP stream encroachment permits, if necessary.

Additionally, bridges on routes which require significant traffic control (such as Interstates and major arterials) and/or have particular access issues (such as over major rivers, railroads, etc.) will require increased budgets and schedules. If design details cannot be prepared by the District Bridge Unit, additional time should be allotted for a contract to be executed between the District and a design consultant for the work.

For bridge maintenance to be efficiently implemented, the county must develop an annual plan that addresses the four major types of bridge maintenance:

Preventive Maintenance Activities—includes deck and drainage system cleaning, as outlined in Chapter 4;

Priority Bridge Repairs—includes structural repairs

to bridge components with Priority Codes 0 & 1, as indicated on the bridge inspection report, as outlined in Chapters 2 and 8;

Preservation Activities – includes deck, superstructure and substructure repairs to prevent, delay or reduce deterioration of bridges.

Non-Regular Maintenance—includes major bridge repairs and bridge rehabilitation projects, as discussed in this chapter.

The HMMs are responsible for coordinating with the District Bridge Unit in establishing a list of projects for each of the three bridge maintenance categories, determining available funding, and determining the amount and type of work that can be accomplished by the county bridge crew or by contractors. Details on preventive maintenance activities are included in Chapter 4 of PUB 55, structural repairs are included in Chapter 5 of PUB 55, while procurement and contracts details are addressed in Chapters 7 and 8, respectively.

NOTE: The importance of scheduling and implementing preventive maintenance measures cannot be emphasized enough. Preventive maintenance is considered to be a primary deterrent to premature deterioration of critical structural elements of bridges, and as such, commands high priority in the realm of work planning, scheduling and accomplishment.

In general, the process for planning annual bridge maintenance activities is as follows:

Structure Needs Inventory

The process of planning and programming bridge maintenance begins with an inventory of the structural deficiencies found during the routine NBIS inspections. A report is generated by the District Bridge Unit using BMS data showing the general condition of the bridges within the District to develop a picture of what the bridges need within the District.

<p>Pertinent Issues</p> <p>The basic planning process.</p> <p>Specific improvements?</p>

Structure Priority List

From the Structure Needs Inventory the District Bridge Unit develops a Structure Priority List. This

list prioritizes structures requiring work, considering both the needs and sizes of the bridges. This list is developed with communication and cooperation between the District Bridge Unit and the Highway Maintenance Managers. Work is categorized by work force capabilities, that is, determining work to be performed by Department Forces and work that should be contracted with private firms.

<p>Pertinent Issues</p> <p>Prioritizing bridge work</p> <p>Work typically done by Department Forces</p> <p>Work typically contracted out</p>

A series of meetings should take place between the District Bridge Unit, the District Maintenance Unit and the County Maintenance Office. The first meeting should be held annually in January, and should include:

- Bridge Engineer;
- Bridge Inspection Engineer;
- District Bridge Maintenance Coordinator;
- Maintenance Programs Engineer.

In this meeting, a list of needs based on BMS data will be identified for all of the County's bridges. The District Bridge Unit will develop the needs based on the bridge inspection reports and feedback from the HMMs. These needs include preventive maintenance, which is cyclic, and priority bridge repairs.

A list of projects to be completed by the county in the coming year should be prioritized and agreed upon. From this list the HMMs later develop their Annual Work Plan, which is a plan of work to be performed by Department Forces during the fiscal year, beginning July 1. An approximate cost estimate for the project should be developed and compared against the available bridge maintenance funds as well as the available funds in the county maintenance budget.

After the budget is approved, a more detailed estimate is developed to determine the personnel and equipment requirements to accomplish the work. This estimate is compared to the personnel and equipment available within the county. The need for certain skills or special equipment must be identified and accounted for.

If the Department does not have, or is unable to procure specialized equipment, or if Department Forces do not have the particular specialized skills required, a plan should be developed for contracting these items to private contractors.

A second meeting should take place before April and include the following:

Maintenance Program Engineer;
 District Bridge Maintenance Coordinator;
 Bridge Unit Representative;
 Highway Maintenance Manager;
 Assistant Highway Maintenance Manager;
 County Bridge Foreman.

The purpose of this meeting is to develop an Annual Work Plan from the list of bridge projects assigned to the county to complete during the previous meeting(s). The counties should design the work plan to have a minimum of eighty percent (80%) of available bridge crew man-hours in maintenance periods one and three for bridge maintenance activities. This requirement is not intended for counties that do not have a dedicated bridge crew. The Bridge Maintenance Coordinator will develop contracts to complete the remainder of the work by contracted forces.

Non-Regular Maintenance

During the bridge's lifespan, rehabilitation or replacement of certain elements may become necessary in order to ensure the bridge remains serviceable and to prevent advanced deterioration of critical structural members. In some instances, bridge components become deteriorated to the point that replacement of those components becomes the most cost-effective method to keep a bridge serviceable.

Evaluating bridge inspection reports to determine if a major rehabilitation is warranted plus scheduling of large-scale maintenance activities (such as bridge painting) is an important part of the planning process. The District Bridge Unit will determine the type and scope of non-regular maintenance activities, with input from the District Bridge Maintenance Coordinator and Highway Maintenance Manager (HMM). These activities can be accomplished by either the county bridge crew or by contracted forces. Each proposed activity needs to be evaluated to determine if the necessary manpower and equipment are available in the county, and if the work can be effectively scheduled into the county bridge crew's annual work plan.

Because of the larger scope of these projects, completion may be best accomplished by contractors with specialized equipment and resources (such as environmental safety equipment for sandblasting and painting). These contracts are typically prepared by the District Maintenance Unit and completed under the supervision of the Highway Maintenance Managers. Highway Maintenance Managers must consider these contracts when developing the strategic plan and budget for their county's bridge network. Refer to Chapter 8 for details on the contracting process for bridge maintenance work.

Examples of non-regular maintenance include deck replacement, underpinning, joint replacement, steel dam deck joint rehabilitation/replacement, extensive superstructure painting, pedestal replacement, and stringer/beam replacement. Design details for certain activities may need to be provided by the District Bridge Unit. Highway Maintenance Managers must allocate adequate budget resources for these activities as part of their annual budgeting process.

In general, non-regular maintenance activities should be prioritized based on the Average Daily Traffic (ADT) of the route; the structural condition/sufficiency rating of the bridge, including the number of high-priority repairs required; the ability to incorporate bridge repairs into upcoming highway restoration or improvement projects; and the anticipated time until replacement of the bridge. Maintenance activities for bridges that have already been programmed for replacement (see Transportation Improvement Plans below) should have the goal of maintaining the bridge's current serviceability level until the date of replacement. However, high-priority maintenance items that can affect the safety of the bridge (Priority 0 and 1 items) need to be addressed as soon as possible regardless of the bridge's rehabilitation or replacement status.

Transportation Improvement Plans

Maintenance projects that may be too large for Department Forces, or which can leverage Federal funding, are sometimes programmed through a regional Metropolitan Planning Organization (MPO) or Rural Planning Organization (RPO) Transportation Improvement Plan (TIP). The TIP is useful to Districts in several ways; as a means of programming large maintenance projects, and as a means to remove smaller maintenance projects from annual planning due to an upcoming rehabilitation or replacement project.

A TIP is a four-year program developed by each MPO, RPO, and one Independent County, that lists all highway, bridge, and public transportation projects that anticipate federal and state capital funds. All the MPO, RPO and Independent County TIPs are incorporated into a Statewide TIP (STIP), which is approved by the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA), and the Environmental Protection Agency (EPA).

During the District annual planning meeting the TIP should be examined for listings that match the bridge list for that District. If a rehabilitation or replacement project is upcoming, resources for preventive maintenance may be diverted to other priorities. The need for repairs to a bridge programmed for major work should be weighed against the critical nature of the repair and the time until the rehabilitation or replacement is scheduled.

As the Districts update the TIP, the process for prioritization and programming of bridge projects shall be in accordance with current Risk Assessment Procedures for PennDOT-Owned Bridges and Structures. Risk Assessment provides the methodology and factors used to calculate a risk score and rank for all 25,000 state-owned bridges. The key factors include the bridge size and physical condition, importance to the highway system, effects on road user costs and implications to commerce.

In addition, the Districts, through the Risk Assessment, can establish scopes of work (i.e. full replacement, superstructure replacement, deck replacement, etc), estimated projects costs and generate a cash flow analysis. As the Department continues to improve bridges by rehabilitation and replacement, the inventory of SD bridges will be reduced and also the risk levels.

The SAFETEA-LU authorization allows the use of federal funds for bridge preservation. The guidelines are listed in Design Manual, Part 4, Section A, Policy and Procedures, Section 5.6. This Section indicates that all highway bridges are eligible to use federal funds for bridge preservation work so long as the bridges meet the NBIS length requirement. Bridges that do not meet the NBIS length requirement must use state funds for preservation. Further, all federal aid projects must be added to the appropriate TIP. See DM-4 for a list of eligible work items for bridge preservation.

STREAM PERMITTING BASICS

Discussed below is basic stream permitting information. The Bridge Maintenance Coordinator must be familiar with types of permits and methods for obtaining permits, as they often present significant impacts to the schedule. In some districts, the Maintenance Environmental Planner prepares the waterway permits for maintenance work orders. To ensure all applicable environmental clearances are obtained, refer to PUB 294.

Terminology

Bog Turtle Habitat Screening

A screening for bog turtle habitat is required for all projects that impact wetlands in the following counties: Adams, Berks, Bucks, Chester, Carbon (Aquashicola Creek Watershed only) Cumberland, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill (Swatara Creek Watershed only) and York (PA DEP Document # 3930-PM-WM0550).

Chapter 105

The rules and regulations of Title 25 (Environmental Protection), Chapter 105 (Dam Safety and Waterway Management) as listed in the PA Code (www.pacode.com). A Chapter 105 Authorization is the Water Obstruction and Encroachment Permit.

Earth Disturbance

Any activity which disturbs the surface of the land. This includes any excavation or fill within a stream channel. This includes full-depth reconstruction but excludes mill & overlay.

Floodway

The channel of the watercourse and portions of the adjoining floodplains which are reasonably required to carry and discharge the 100-year frequency flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by the Federal Emergency Management Agency (FEMA). In an area where no FEMA maps or studies have defined the boundary of the 100-year frequency floodway, it is assumed, absent evidence to the contrary, that the floodway extends from the stream to 50 feet beyond the top of the stream bank.

GP-3 (General Permit BDWW-GP-3)

General Permit #3 for Bank Rehabilitation, Bank stabilization and (non-vegetated) Gravel Bar Removal (PA DEP Document # 3930-PM-WM0503).

GP-7 (General Permit BDWW-GP-7)

General Permit #7 for Minor Road Crossings (PA DEP Document # 3930-PM-WM0507).

GP-8 (General Permit BDWM-GP-8)

General Permit #8 for Temporary Road Crossings (PA DEP Document # 3930-PM-WM0508).

GP-11 (General Permit BWM-GP-11)

General Permit #11 for Maintenance, Testing, Repair, Rehabilitation, or Replacement of Water Obstructions and Encroachments (PA DEP Document # 3930-PM-WM0511).

HQ/EV

High-Quality/Exceptional Value stream as defined in PA Code, Title 25 Environmental Protection, Chapter 93 Water Quality Standards.

Joint Permit

The Water Obstruction and Encroachment Permit for the Chapter 105 permit authorization and US Army Corps of Engineers for the 404 authorization issued jointly by DEP (PA DEP Document # 3930-PM-WM0036).

Minor Stream Crossing

A bridge/road crossing a wetland which disturbs less than 0.1 acre of wetland and crossing length over wetlands < 100 ft., or crossing a stream where the watershed is less than 1.0 square mile.

PASPGP

USACE Pennsylvania State Programmatic General Permit. Authorizes delegation of issuance of permit to DEP.

PNDI

Pennsylvania Natural Diversity Inventory search (PA DEP Document # 8100-FM-FR0161) for threatened and endangered species. This search and clearance is required for all projects, regardless of permit level.

Programmatic Permits (General Maintenance)

Generic Permits issued by PA DEP to each District to cover minor repairs and maintenance:

E61-9999 for District 1-0;
 E17-9999 for District 2-0;
 E41-9999 for District 3-0;
 E35-9999 for District 4-0;
 E39-9999 for District 5-0;
 E23-9999 for District 6-0;
 E22-9999 for District 8-0;
 E07-9999 for District 9-0;
 E32-9999 for District 10-0;
 E02-9999 for District 11-0;
 E26-9999 for District 12-0.

Regulated Waters of the Commonwealth

Watercourses, streams or bodies of water and their floodways wholly or partly within or forming part of the boundary of the Commonwealth.

Stocked Trout Streams

Regulated waters of the Commonwealth classified by the PA Fish & Boat Commission as waters approved for trout stocking (TSF).

Stream Enclosure

A bridge, culvert or other structure in excess of 100 feet in length upstream to downstream.

Watercourse

A channel or conveyance of surface water having defined bed and banks, whether natural or artificial, with perennial or intermittent flow.

Water Obstruction

A dike, bridge, culvert, wall, wingwall, fill, pier, wharf, embankment, abutment or other structure located in, along or across or projecting into a watercourse, floodway or body of water.

Wetlands

Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs and similar areas. Wetlands must be identified in accordance with the 1987 USACOE Manual for Identifying and Delineating Wetlands.

Permit Levels

Chapter 105 (State authorization) and Section 404 (Federal Waterway) Permits are required for most bridge maintenance projects.

The three different levels of Permits from DEP, in order of level of impact and effort, which may be required for bridge maintenance projects are:

Programmatic Permit (General Maintenance);

General Permit – 11 (Maintenance, Testing, Repair, Rehabilitation or Replacement of Water Obstructions and Encroachments);

Individual (aka standard).

Typically, bridge maintenance projects are covered by either a Programmatic Permit, (also known as a General Maintenance Permit), or the General Permit – 11 (GP-11). The General Maintenance Permit is an existing authorization issued by PA DEP to each District for preventive maintenance, repair and rehabilitation. The GP-11 authorization is issued for each project individually. The General Maintenance Permit, GP-11, and Individual Permits are exclusive, meaning only one will be required for each project. If the maintenance project does not

meet the General Maintenance or General Permit requirements (ie. an Individual Permit is required), the District Environmental Unit should be contacted. Generally, maintenance projects will be covered by Maintenance or General Permits. The scope of maintenance projects does not typically require an Individual Permit from DEP.

Section 404 Federal Waterway Permits are administered by USACE. USACE has developed a General Permit (PA-SPGP3) for projects with low environmental impacts. USACE has delegated authority to DEP to issue its PA-SPGP3 along with DEP's permit. Therefore, for maintenance projects, DEP is generally the contact for permitting and will issue the necessary waterway permits (Joint Permits). If direct contact with USACE is required for a project, DEP and/or USACE will notify the District.

The above permits cover the typical bridge maintenance project. If the maintenance activity includes work outside the immediate footprint of the structure, some or all of the following DEP permits may be necessary:

Bank Rehabilitation, Bank Protection and Gravel Bar Removal: General Permit – 3 (GP-3);

Minor Road Crossings: General Permit – 7 (GP-7);

Temporary Stream Crossing: General Permit – 8 (GP-8).

These permits are separate from and in addition to the authorization for the bridge maintenance. If these conditions apply to the maintenance activity, or if the work will be performed by an outside consultant, contact the District Environmental Unit for assistance.

All permitting levels require a PNDI search and clearance that no threatened or endangered species will be impacted by the proposed activity. The clearance process can take 1-2 months if known species are present. This clearance must be performed in advance of submitting the permit application.

General Maintenance (Programmatic) Permit Exx-9999)

For many projects, the District can obtain an authorization for activities under a standing General Maintenance Permit. This District-wide permit allows for minor stream encroachment activities and is intended for use at low-sensitivity, low-impact projects. These projects meet the following criteria:

No wetlands present in project area;

No changes to hydraulic openings as part of the activity;

No HQ/EV (High Quality/Exceptional Value) streams.

Applicability

A General Maintenance Permit is valid for:

Minor repairs (deck, wingwalls, footings, etc);

Superstructure replacement;

Channel cleaning within 50' of bridge.

Stream bed paving

A General Maintenance Permit is NOT valid for any of the following:

Pier and abutment replacement;

Profile adjustments;

Horizontal and vertical clearance reductions;

Bridge widening;

Wetland impacts.

If the General Maintenance Permit is not valid for the proposed maintenance activities, evaluate the applicability of the GP-11.

Procedure

The requests for authorization to use the General Maintenance Permit are generally submitted through a letter of request to the PA Department of Environmental Protection (PA DEP). There are no permit application forms for the General Maintenance Permit. The request letters are prepared and submitted by the Bridge Maintenance coordinator with support from the District Environmental Unit. A copy of the request letter and plans sent to the PA DEP office must also be sent to both the Regional Office of the PA Fish and Boat Commission and the appropriate County Conservation District Office to inform these agencies of the proposed project. The applicable office locations and addresses for the PA DEP and Fish Commission offices are provided in tables 3-1 and 3-2. This request must include:

- a) A work schedule which includes: the roadway name/route and segment number, the stream name, Chapter 93 designation, any in stream

restrictions due to wild or stocked trout or migratory fish, and the date work is to begin and end.

- b) A location map showing each project location.
- c) A written description for each project including: dimensions of each structure, a complete narrative of all of the proposed activities including measurements and quantities of materials to be removed or placed.
- d) A sketch plan for each site which includes/shows: all staging areas, access points/roadways to the work area, all of the areas where work is to be done (including tree and brush removal), the upstream and downstream limits of the proposed activities, a complete listing of the in-stream E&S BMPs to be used and their locations.
- e) A valid PNDI search receipt for each site including clearance letters from the appropriate agencies indicating that the work will not adversely impact any species of concern.

For General Maintenance Permits, no Erosion & Sediment Pollution Control plans/authorizations are required to be included with the submission to PA DEP, even if they are required for the project.

Multiple projects can be submitted with one letter of request by using a table or a single page of information with plans, for each project. Typically, DEP turnaround time for General Maintenance Permit requests is 30 days or less. PennDOT will receive a letter of authorization from the PA DEP with the attached copy of the Federal Permit-Pennsylvania State Programmatic Permit (PASPGP-X), if applicable. These authorizations are for one time use only by PennDOT.

After obtaining the permit and for work planning purposes, use of the General Maintenance Permit entails adhering to a number of limitations and fulfilling responsibilities that must be satisfied before and during the work effort.

Unless otherwise extended in writing work authorized in accordance with the procedures outlined above must be completed within one year of the date of authorization.

Notify the appropriate Regional Office of DEP, the Pennsylvania Fish and Boat Commission's Regional Headquarters, and the appropriate County Conservation District at least 10 days in advance of starting work at each location identified in the proposed work schedule.

Maintain a copy of the work schedule, project narrative and sketch plan on site. Access points, limits of work and in-stream E&S BMPs that are to be used must be clearly indicated on the sketch plan for each site and all activities must be completely described within the project narrative.

Work in the stream is prohibited for the following, except in emergencies. Emergency work must be approved by the Department of Environmental Protection in consultation with the Pennsylvania Fish and Boat Commission.

- a. See page 11-14 for in-stream restrictions.
- b. as a part of any avoidance measures required within the PNDI clearance from 1.e.

A listing of stocked and wild trout streams can be found on the Pennsylvania Fish and Boat Commission web page.

Work must be limited within the stream channel 50 feet upstream and 50 feet downstream from the face of the bridge or culvert. Exceptions to this must be specifically identified in the proposed work schedule and shown on the sketch plan along with supporting data being submitted for DEP approval. Work should be accomplished by working from the stream banks if at all possible to minimize the operation of equipment in the water.

In-stream construction area must be enclosed the within a cofferdam of sandbags or other non-erodible, non-polluting material wherever possible when work involves repairs to piers, footers, wing walls, or retaining structures. De-watering must be done in a manner to prevent sedimentation from re-entering the stream.

Channels may be excavated to a width no greater than the natural unaffected width of the normal low flow channel immediately upstream and downstream of the influence of the bridge or culvert. The remainder of the channel width shall be maintained as an elevated flood plain and may not be excavated lower than six inches above the water level at the time of work.

Disposal of material removed from the channel must be at a location and in a manner which precludes re-entry into the stream. If material removed from the channel is needed for backfill or bank restoration, it should be faced to the ordinary high water level with riprap suitably sized according to the anticipated stream velocity. All disturbed areas above the level of the riprap must

Table 3-1 – Department of Environmental Protection Regional Addresses

DEPARTMENT OF ENVIRONMENTAL PROTECTION REGIONAL OFFICES PERMITTING AND TECHNICAL SERVICES SECTION	
Regional Office County	Responsibility
Southcentral Regional Office 909 Elmerton Avenue, Second Harrisburg, PA 17110 (717) 705-4707	Adams, Bedford, Berks, Blair, Cumberland, Floor Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Mifflin, Perry, and York
Southeast Regional Office 2 East Main Street) Norristown, PA 19401 (484) 250-5970	Bucks, Chester, Delaware, Montgomery, and Philadelphia
Southwest Regional Office 400 Waterfront Drive Pittsburgh, PA 15222-4745 (412) 442-4000	Allegheny, Armstrong, Beaver, Cambria, Fayette, Greene, Indiana, Somerset, Washington, and Westmoreland
Northwest Regional Office 230 Chestnut Street Meadville, PA 16335 (814) 332-6984	Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango, and Warren
Northeast Regional Office 2 Public Square Wilkes-Barre, PA 18711-0790 (570) 826-2511	Carbon, Lackawanna, Lehigh, Luzerne, Monroe, Northampton, Pike, Schuylkill, Susquehanna, Wayne, and Wyoming
Northcentral Regional Office 208 W. Third Street, Suite 101 Williamsport, PA 17701 (570) 327-3574	Bradford, Cameron, Centre, Clearfield, Clinton, Columbia, Lycoming, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga and Union
<p><u>Central Office</u></p> <p>Bureau of Watershed Management Division of Waterways, Wetlands and Stormwater Management P.O. Box 8775 Harrisburg, PA 17105-8775 717-787-6827</p>	

Table 3-2 – Fish and Boat Commission Regional Addresses

FISH AND BOAT COMMISSION OFFICES	
Headquarters Address	County Responsibility
NORTHWEST REGION	
Regional Manager 11528 Highway 98 Meadville, PA 16335-7320 814-337-0444	Butler, Clarion, Crawford, Erie, Forest, Lawrence, Mercer, Venango, and Warren
SOUTHWEST REGION	
Regional Manager 236 Lake Road Somerset, PA 15501-1644 814-445-8974	Allegheny, Armstrong, Beaver, Cambria, Fayette, Greene, Indiana, Somerset, Washington, and Westmoreland
NORTHCENTRAL REGION	
Regional Manager P.O. Box 5306 Pleasant Gap, PA 16823 814-359-5250	Cameron, Centre, Clearfield, Clinton, Elk, Jefferson, Lycoming, McKean, Montour, Northumberland, Potter, Snyder, Tioga and Union
SOUTHCENTRAL	
Regional Manager 1704 Pine Road Newville, PA 17241 717-486-7087	Adams, Bedford, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lebanon, Mifflin, Northumberland (Mahatango Creek in Jordan and Lower Mahanoy Townships only) Perry, and York
SOUTHEAST REGION	
Regional Manager Box 8 Elm, PA 17521 717 -626-0228	Berks, Bucks, Chester, Delaware, Lancaster, Lehigh, Montgomery, Northampton, Philadelphia, and Schuylkill
NORTHEAST REGION	
Regional Manager P.O. Box 88 Sweet Valley, PA 18656 570-477-5717	Bradford, Carbon, Columbia, Lackawanna, Luzerne, Monroe, Pike, Sullivan, Susquehanna, Wayne, and Wyoming
DIVISION OF ENVIRONMENTAL SERVICES 450 Robinson Lane, Bellefonte, PA 16823 814-359-5147	

be stabilized (vegetative stabilization preferred). Do not deposit excess excavated material in any wetland, river, lake, water course, floodway, floodplain or other regulated waters of this Commonwealth without first applying for and receiving the written permit of the Department of Environmental Protection.

Tree and shrub growth on stream banks should not be disturbed unless absolutely necessary. Any areas of vegetation to be removed must be described/justified in the project narrative and shown on the sketch plan.

Storm water diversion will be needed if an access road is to be constructed to assure water will not flow into the stream or the work area. Show the access road location on the sketch plan. Do not impact wetlands unless permitted to do so in writing by the grantor of the permit and keep earth disturbance to a minimum.

Erosion and sediment pollution control measures must be employed to minimize erosion and prevent sediment from entering the stream channel. Locate the BMPs used in-stream on the sketch plan for each site. All BMPs shall be designed in accordance with the latest edition of the Department's Erosion and Sedimentation Pollution Control Manual or PennDOT's Publication 464 -Maintenance Field Reference for Erosion and Sedimentation Control. Disturbed areas shall be permanently stabilized.

Provide a temporary stream crossing when necessary unless stream flow is shallow and the stream bed consists of solid or non-erodible material. Comply with the conditions of General Permit BDWM-GP-8, Temporary Road Crossings. Fill material provided for temporary crossings shall be clean granular material and the entire fill area shall be kept to an absolute minimum elevation to avoid obstructing flood flows and/or creating a backwater flooding condition. The Permittee is responsible for any damages resulting from the obstruction of flood flows by this temporary stream crossing. Upon completion of the project, remove the temporary crossing and restore the disturbed area to the original contours. Stabilized the area with vegetation or other appropriate approved method. Copies of the BDWM-GP-8 are available from the DEP offices listed in Table 3-1.

Provide a separate General Permit application or individual permit application if required by DEP for any project or portion thereof, which the Department determines to have a potential

significant effect on safety or protection of life, health, property, or the environment.

General Permit – 11

If a project does not qualify for the General Maintenance Permit, the applicability of the GP-11 should be evaluated. The GP-11 differs from the General Maintenance Permit in that it is issued per location (i.e., each project has its own individual permit) rather than issued District-wide. Once a GP-11 permit is issued for a location, future maintenance may be completed without a new permit submission to the PA DEP office as long as the PA DEP office is notified in writing with a reference to the issued GP-11 and also provided that the activity does not substantially change the characteristics of the bridge that were originally permitted. However, this multiple use is limited because of the need for a Federal Permit from the Corps of Engineers. The Corps of Engineers may require a review of the future maintenance and re-issuance of a new Federal permit. Contact should be made with the U.S. Army Corps of Engineers before any future maintenance is completed.

Applicability

A GP-11 is valid for the following projects:

- Maintenance, testing, repair, rehabilitation or replacement of existing bridges and culverts;

- Minor deviations in the structure's configuration and roadway profile;

- Minor deviations in hydraulic capacity;

- Increases in bridge/culvert length up to 12 feet on each side of the bridge;

- Channel clearing within 50' of bridge.

A GP-11 is NOT valid for any of the following:

- Stream relocations;

- Wetland impacts exceeding 0.05 acre;

- Projects likely to impact historical, cultural or archaeological sites;

- New structures;
Direct/indirect effects on state/federal species of special concern

If the project does not qualify for the GP-11, an Individual Water Obstruction and Encroachment Permit is required. Maintenance projects do not typically require an Individual Permit.

Procedure

The GP-11 requires the completion of the GP-11 application form, located on the DEP website. Applications are prepared and submitted by the Bridge Maintenance Coordinator. Proposed projects should be reviewed with the District Environmental Unit to determine if GP-11 is suitable for the project. Sample GP-11 submissions are located on the PA DEP website. The GP-11 application includes:

- Signed and completed GP-11 registration request;
- Act 14 Municipal Notification letter;
- Sealed sketch plans and cross sections;
- Current PNDI run and clearances;
- Bog turtle habitat screening (Adams, Berks, Bucks, Carbon (Aquashicola Creek Watershed only), Chester, Cumberland Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Schuylkill (Swatara Creek Watershed only) or York Counties only);
- Engineer’s seal and signature on the engineering drawings;
- Erosion & Sediment Control Plan;
- Detailed Hydrologic & Hydraulic Study signed and sealed by a licensed Professional Engineer for projects that may increase flooding in the 100-year storm;
- Wetland information data sheets if the project impacts wetlands (temporary or

permanent);

Location Map (USGS Quad Map);

Photos upstream and downstream of the existing structure.

DEP generally processes a GP-11 application within 60 days of receiving the application as long as no deficiencies are identified concerning the information which is submitted by PennDOT. The Federal Section 404 Permit may or may not be attached by the PA DEP office depending upon the status of PennDOT coordination concerning clearance for the project regarding the bog turtle. Contact with the PennDOT District Environmental Unit is recommended if wetlands are involved with a General Permit Number 11 application.

Existing Authorizations

Existing authorizations can be located on the PA DEP eFacts website (www.dep.state.pa.us/efacts). Normal repairs and maintenance on encroachments permitted after July 1, 1979 are authorized under the existing permit. All other activities require new authorization as described in Table 3-3.

Emergency Procedures

If it is determined that the condition of a structure poses an immediate threat to health or safety, notification shall be immediately issued to PA DEP and responsible authorities in adjacent and downstream communities, including emergency management authorities. Follow PUB 550 "Disaster Recovery Manual" for guidance on emergency repairs.

Table 3-3 – Activities That Require New Authorization

Date	Type of Maintenance	Permit Requirements
Authorization issued before July 1, 1979 . . .	All repairs and maintenance.	Requires new permit.
Authorization issued after July 1, 1979 . . .	Normal repairs and maintenance.	Authorized under existing permit
	Repairs or maintenance involving modification from its original specifications and a repair or reconstruction involving a substantial portion of the structure.	Requires new permit.

Chapter 3 Best Practices

- Develop Strategic Maintenance Plan
- Bridge Maintenance Coordinator attends monthly county manager meetings.
- Bridge Maintenance Coordinator and Assistant DBE-Inspection meet with counties on yearly basis to set work and repair priorities.
- Bridge work orders are reviewed by DBE and ADE-Maintenance prior to meetings with counties.
- District Bridge Engineer meets twice a year with county managers.
- Assistant DBE - Inspection uses Access database or Excel spreadsheet to indicate and track bridges that require preservation, such as scour protection, membrane waterproofing, and painting out 20 years.
- Performance Measure to track spending of preservation funds.
- Leverage Federal funds for preservation activities via the TIP

PRESERVATION PLAN

As bridge owners, PennDOT must continue our efforts to adapt and implement systematic processes for bridge preservation by expanding maintenance practices to include bridge preservation activities. Bridge preservation must be an integral component of our overall bridge asset management plan; opportunities to address bridge preservation activities cannot be overlooked. The “opportunity cost” of not performing preservation activities is increased life cycle cost to maintain bridges in a state of good repair.

A successful bridge program seeks a balanced approach to preventive maintenance, preservation, and bridge rehabilitation/replacement. Focusing on replacing deficient bridges, while discounting

preservation needs will be inefficient and cost-prohibitive in the long term. The objective of good bridge preservation is to employ cost effective strategies and actions to maximize the useful life of bridges. Applying the appropriate bridge preservation treatments and preventive maintenance activities at the appropriate time can extend a bridge’s useful life at a lower life cycle cost.

Bridge preservation activities must be balanced with sound preventive maintenance activities, structure replacements, and repairs required for unforeseen critical and high priority maintenance items. Some suggested frequencies for certain bridge preservation activities are listed below:

Bridge Component	Bridge Preservation Activity	Maintenance Assembly No.	Recommended Action Frequency (Years)
***Deck	Epoxy & **Polyester Polymer Concrete overlays	711-7490-01 & 711-7490-02	10 Epoxy 25 PPC
Deck	Concrete deck patching	711-7433-03 thru 06	As needed
***Deck	Asphalt overlay with membrane	711-7443-01	8 Asphalt overlay 20 Membrane
***Deck	**Latex Modified Concrete overlay	711-7443-06	15-25
Deck	Joint repair / replacement	711-7433-02 thru 03 & 711-7442-02	20 (Periodic replacement of the gland or trough should be expected)
***Deck	**Structural reinforced concrete overlay	711-7443-06	15-25
Superstructure	*Painting - spot	711-7432-01 thru 06	10 (surface cleaned w/ power tools)
Superstructure	Bearing (steel) repair / replacement	711-7435-02	50 or during a major rehabilitation project or deck replacement

Bridge Component	Bridge Preservation Activity	Maintenance Assembly No.	Recommended Action Frequency (Years)
Substructure	Pedestal / Bearing Seat repair / replacement	711-7435-03	50
Substructure	Scour counter measure	711-7453-01 & 02	10 or as required from inspection findings
Substructure	Channel restoration	711-7453-03 & 04	10 or as required from inspection findings
Superstructure & Substructure	Superstructure & Substructure Component(s) repair / replacement	711-7446-01, 711-7447-01, 711-7448-01 thru 03, 711-7450-01, 711-7451-01	50

* Before a final decision to spot paint steel members is made, perform an asbestos containing material and a lead paint / toxic heavy metal assessment. PennDOT Publication 408 (Highway Construction Specifications) – Sections 1060, 1070 and 1071, PennDOT Publication 55 (Bridge Maintenance Manual), and Publication 445 (Safety Policy Handbook) – Medical Surveillance Program Section, should be reviewed for additional information regarding lead paint / toxic heavy metals work requirements.

** This type of bridge preservation activity is typically performed by contracting.

*** Consult with the District Bridge Unit prior to completing deck preservation overlay activities.

An additional tool for bridge preservation planning is the use of National Bridge Inspection Standards (NBIS) current NBI (National Bridge Inventory) ratings for the bridge deck, superstructure, substructure or culvert. These ratings are listed in the BMS system under the "Ratings & Schedule" Screen Fields 1A01 thru 1A04. Publication 15M – Design Manual (DM) Part 4, Chapter 5.6 discusses preservation activities and estimated implementation timelines including flow charts / decision trees. DM Part 4 provides in-depth concrete deck preservation timing guidelines based on concrete deck inspection condition ratings and other criteria. Bridge preservation activities may become needed when a bridge is still in fair or satisfactory condition (NBI rating equal to 5 or 6) but some of the bridge elements have deteriorated to a point where preservation activities are effective.

Bridge element level inspections evaluate the bridge components deterioration on a per unit basis and identifies specific deterioration levels along the element. Preservation activities should be completed when the element(s) are in Condition State 2. When structural bridge elements are found to be rated as Condition State 3, the required repairs are past the level of preservation and are completed with rehabilitation efforts.

The Federal Highway Administrations 2018 – Bridge Preservation Guide provides examples of cyclical bridge preservation and preventive maintenance activities including suggested timelines. These cyclical bridge maintenance activities can help manage our bridges at their lowest life cycle cost. The Guide can be found here: <https://www.fhwa.dot.gov/bridge/preservation/guide/guide.pdf>.

Chapter 4: Preventive Maintenance

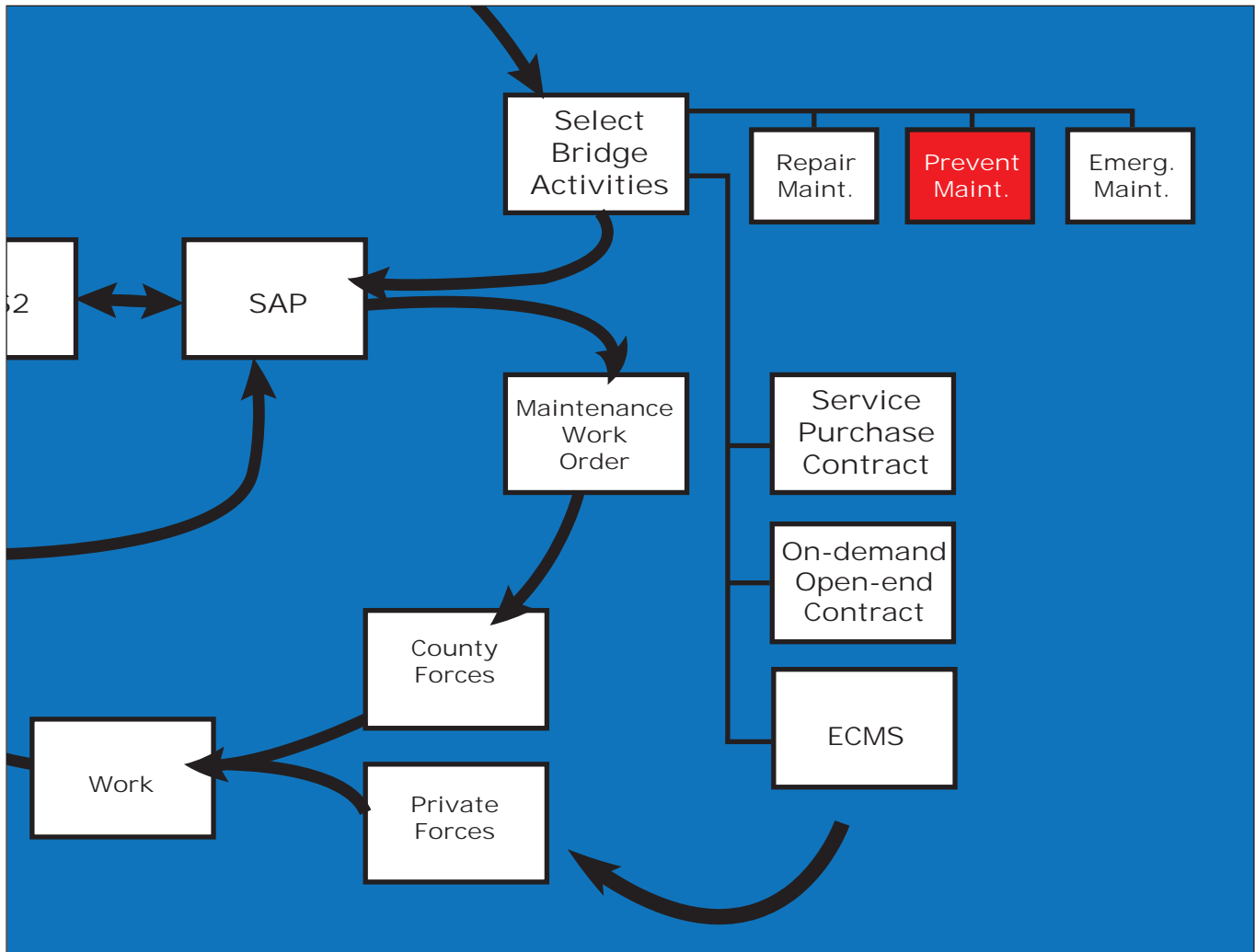


Figure 4-1 – Preventive Maintenance Section of Process Map

Introduction

Deterioration of structures must be minimized to assure the mobility and safety of the traveling public, efficient movement of goods, and appropriate return on the nation’s investment in its bridges. Preventive maintenance is a planned strategy of cost-effective treatments to a structure to preserve it in its present condition and to retard future deterioration. The objective of preventive maintenance is to extend the service life of a bridge before bridge conditions deteriorate to a level requiring corrective maintenance, such as structural repairs. On the other hand, corrective maintenance involves activities or operations applied to fix bridge deficiencies. Preventive maintenance is applying the right treatment, to the right structure, at the right time. Preventive and corrective maintenance are both desirable in a comprehensive bridge preservation program, but emphasis should be placed on preventive maintenance, since costs associated with corrective

maintenance can be significant. The ultimate goal is to perform activities that will preserve bridge components in their present (or intended) condition as well as forestalling development of a structural deficiency. Each of the preventive maintenance items recommended in D450M Maintenance Needs Data screen contain a BMS activity number that can be used to reference PUB 55 for further guidance. Figure 4-1 shows the location of Preventive Maintenance in the process map.

Typically, we can classify these activities into two groups:

Scheduled Preventive Maintenance

Scheduled preventive maintenance activities are regularly performed at a designated frequency as shown in Table 4-1.

Table 4-1 – Scheduled Preventive Maintenance

Maintenance Item	Frequency
Cleaning decks, seats, caps, and salt splash zones	Annually per MAPI Metric
Cleaning bridge drainage systems	Annually
Cleaning and lubricating expansion bearing assemblies	Annually

Response-Type Maintenance

Response-type maintenance activities are performed on an as-needed basis and identified through the inspection process:

- Resealing expansion joints
- Painting structural steel members
- Removing debris from waterway channels
- Replacing wearing surfaces
- Extending or enlarging deck drains
- Repairing impact damage

Repairing impact damage to steel girders requires very careful attention. Unless corrective measures are taken, fracture of the beam can occur due to impact at the original damage location or at another point on the beam. The corrective measure to prevent fracture is to grind the impact damage. The procedure is as follows:

Grind impact area to bright metal to remove any irregularities and surface defects. Using a sanding disc, smooth area and round over edges. Finish grinding should be done parallel to the stress so this ensures that transverse grind marks are not present.

If the impact is within the proximity of a welded detail, the weld toes should be smoothed with a die grinder to ensure that no microcracks were introduced during the impact. Using a sanding disc, smooth the area and round over edges. Finish grinding should be done parallel to the stress so this ensures that transverse grind marks are not present.

The impact area should be faired back to the material edge at not less than a 1 to 10 slope.

The area should be thoroughly inspected, including any weld toes of details within the vicinity of the impact using ultrasonic or magnetic particle testing as appropriate for the detail.

Pertinent Issues

- The most common response-type maintenance activities statewide
- The most common response-type maintenance activities regionally

Introduction to Bridge Maintenance

Much of the information regarding Preventive Maintenance is gleaned from PUB 55, titled “Bridge Maintenance Manual,” a reference tool for maintaining state-owned bridges. This manual describes the procedures and standards for a multitude of activities related to bridge repair and maintenance. It is organized into twenty-seven chapters, each chapter considering a different structure element and the repair and/or maintenance activities associated with it.

Each activity given in PUB 55 follows an outline consisting of seven components. The first component acts to identify the activity. This activity identifier includes a BMS Activity Number, an Activity Title, a Unit of Measurement and a Procedure. The BMS Activity Number is the same number that appears in Form D-450M for a particular maintenance activity.

It is encouraged that any preventive maintenance be scheduled in such a way that it will maximize economies of scale. That is, work that is similar should be applied to as many locations as possible or advantage should be taken of similar work efforts. In addition, response-type efforts should be performed when work of a scheduled nature is underway, such as: when the deck and scuppers on a bridge are being cleaned, the crew should clean the expansion joints and troughs as applicable.

Maintenance for Uncoated Weathering Steel Bridges

General

Unpainted, or otherwise referred to as uncoated weathering steel is not a maintenance-free material. Experience has shown that highway bridges accumulate much debris; become wet from condensation, leaking joints and traffic spray; and are exposed to salts and atmospheric pollutants. Different combinations of these factors may create exposure conditions under which the unpainted weathering steels cannot form a protective oxide coating, also known as patina, which is crucial to the control of steel corrosion and long term performance. Therefore, unpainted weathering steel bridges must be maintained properly with special areas of emphasis. Unpainted weathering steel bridges built before 1989 are of special concern since these bridges were likely not designed and/or built with localized environmental restrictions and other features to promote and help ensure the formation and longevity of the important protective oxide coating on weathering steel surfaces. Such restrictions and features include site selection that minimizes salt spray on the steel surfaces, minimization of deck joints, painted steel at deck expansion joints, installation of drip plates, and elimination of water traps. Therefore, these bridges may require enhanced attention and maintenance. Refer to Figure 4-2 for photographs showing weathering steel bridges in various states of condition in Pennsylvania.

Maintenance Actions

Incorporate the following maintenance actions into weathering steel bridges:


1. Control roadway drainage:
 - i. Divert roadway drainage away from the bridge structure.
 - ii. Clean troughs or reseal deck joints.
 - iii. Maintain deck drainage systems.
 - iv. Periodically clean and, when needed, paint/repaint all steel up to 5 feet from bridge joints.
2. Regularly remove all dirt, debris, and other deposits that trap moisture. Special attention should be given to steel member details where rust scale, debris, moisture, and water can accumulate, a condition that fosters excessive corrosion. Susceptible locations include bottom flanges, gusset plates for horizontal bracing, longitudinal stiffeners, bolted splices of horizontal and sloped members, and intersections of bearing and intermediate stiffeners with flanges and gusset plates.
3. Regularly remove all vegetation which can prevent the natural drying of wet steel surfaces.
4. Maintain covers and screens over access holes in steel box sections.

The District Uncoated Weathering Steel-Subject Matter Expert (UWS-SME) is responsible for coordinating needed maintenance actions for uncoated weathering steel bridges and monitoring this work for completion within established timeframes. County Maintenance personnel shall work with the UWS-SME to meet such maintenance needs

Figure 4-2 - Photographs of Weathering Steel Bridges in Pennsylvania



Figure 4-2 - Photographs of Weathering Steel Bridges in Pennsylvania

		
<p>7. View of Frame Legs</p>	<p>8. Close-Up View of Frame Leg Bearing Anchorage at Low Side</p>	<p>9. Close-Up View of Frame Leg Bearing Anchorage at High Side (Debris "Traps" Remediated with Asphalt Filler - which was ineffective and resulted in ongoing corrosion)</p>
		
<p>10. View of Steel Panel Retrofit to Remediate High Side Debris "Traps"</p>	<p>11. View of Web Corrosion Loss at Water and Debris "Trap"</p>	<p>12. View of Bottom of Frame Girder Leg (Note the Water "Trap" Condition Between Flange and Stiffener)</p>
		
<p>13. View of Stiffeners at Frame Girder Leg (Note the Water "Trap" Condition at Bottom of Stiffeners)</p>	<p>14. View of Severely Corroded Bracing Member (Past Condition)</p>	<p>15. View of Sealed Crevice Along Bolted Cover Plate</p>
		
<p>16. View of Laminar Sheet in Lower Portion of Girder and Debris Build-Up on Diaphragm</p>	<p>17. View of Good Patina on Upper Portion of Girder and Ongoing Corrosion in Lower Portion of Girder</p>	

Chapter 4 Best Practices

- Maintain the vast number of masonry arch bridges through a district-wide masonry repointing contract.
- Reseal all leaking joints on Interstate bridges.
- Bridge Maintenance Coordinator prepares work plans and coordinates with Assistant Highway Maintenance Manager.
- Bridge Maintenance Coordinator tracks schedules, develops design, performs field surveys and stakeouts, and performs construction inspection for Department Force Projects.
- Preservation work performed by Department Forces can include streambed paving, paving of metal pipes, underpinning, rock protection, joint sealing and installation of waterproofing membranes.

Chapter 5: Structural Repairs

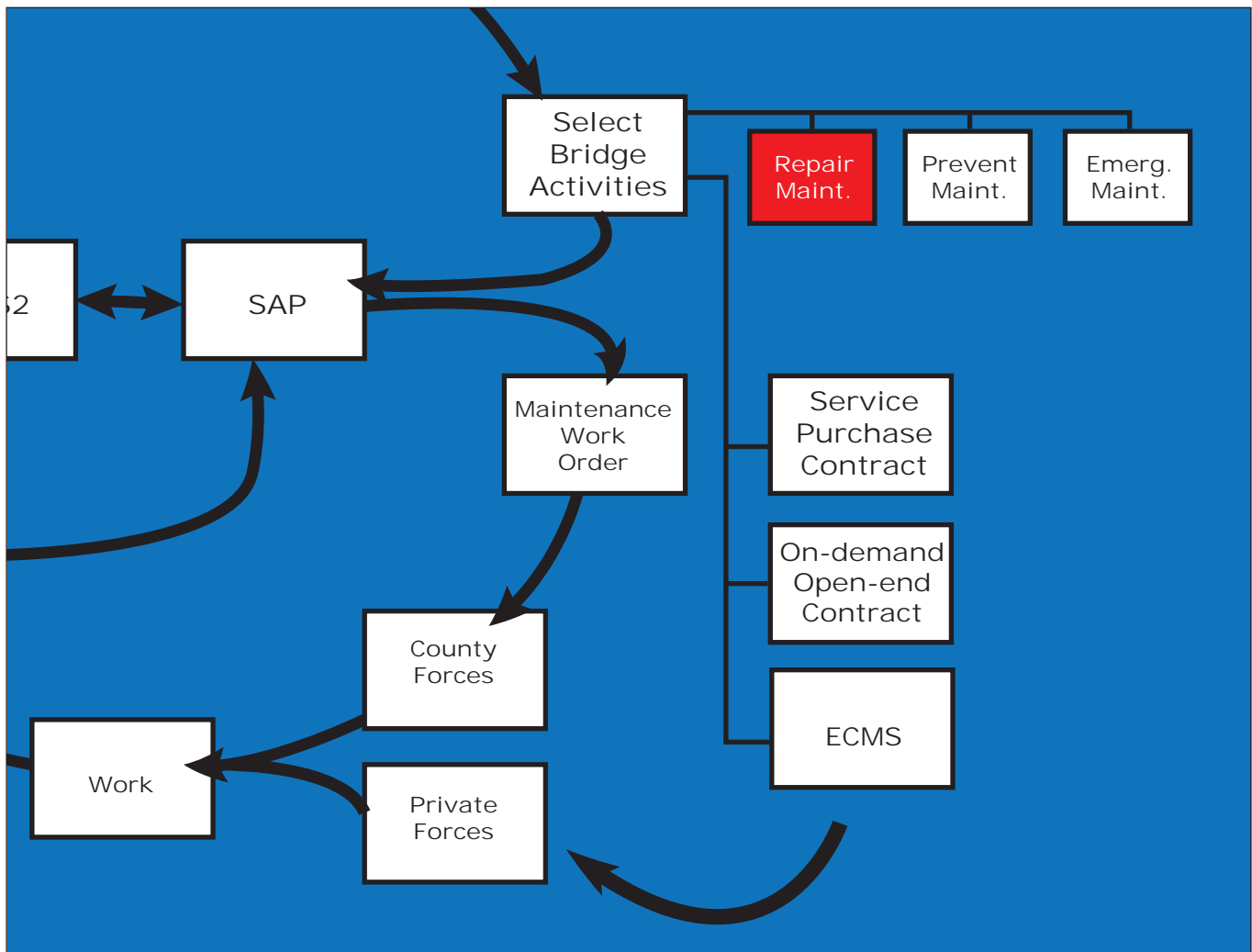


Figure 5-1 – Structural Repairs Section of Process Map

Introduction

Before discussing structural repairs, definitions showing the difference between structural repairs and preventive maintenance as it relates to maintaining state-owned bridges must be provided. Structural repairs are defined as those activities that consist of repairing structural deficiencies identified in the bridge inspection report in order to increase or maintain the existing capacity of the structure. Looking back at Chapter 4, recall that preventive maintenance is defined as those activities that consist of maintaining structural elements of a bridge on a regular or cyclic basis in order to sustain the expected service life of the structure, forestalling development of a structural deficiency. Each of the structural repairs recommended in D450M Maintenance Needs Data screen contain a BMS activity number that can be used to reference this manual and PUB 238 for further guidance. Figure 5-1 shows that location of Structural Repairs in the process map.

Top Structural Repairs

This section contains a discussion of the top structural repairs that are commonly performed on bridges. Additional information is provided in this section to supplement the information provided chapters 10-27 (see Table 5-1).

Pertinent Issues

The most common structural repair activities statewide

Table 5-1 – Top Structural Repairs

Activity	BMS Activity No.	PUB 55 Page No.	PUB 408 Section/ Standard Details	Reason for Activity
Steel Stringer or Floorbeam or Girder (Repair/Replace)	A744602 Or B744602 Or C744602	11-1	1060, 1105	Leaking deck joints of steel stringer bridges often result in rusting of the ends of the beams below the joints. When the results of the bridge inspection indicate that significant section loss to the beam webs has occurred, the load carrying capacity of the beams could be compromised. Repairing of the beam webs then becomes necessary. Reducing the water that reaches the beam ends should also be addressed when completing this beam repair.
Galvanized channel repair (damaged web)	--	--	--	Leaking deck joints of steel stringer bridges often result in rusting of the ends of the beams below the joints. When the results of the bridge inspection indicate that significant section loss to the beam webs has occurred, the load carrying capacity of the beams could be compromised. Repairing of the beam webs then becomes necessary. Reducing the water that reaches the beam ends should also be addressed when completing this beam repair.
Doubler Beam (for damaged stringers)	--	--	--	Leaking deck joints of steel stringer bridges often result in rusting of the ends of the beams below the joints. When the results of the bridge inspection indicate that significant section loss to the beam webs has occurred, the load carrying capacity of the beams could be compromised. Adding a supplemental beam is an option to increase the capacity of the member.
Reinforced/Prestressed Concrete Stringer or Diaphragm or Other Members (Repair/Replace)	A744603 Or B744603 Or C744603	12-1	1001, 1003, 1080, 1107, 1091 BC-783M	Leaking deck joints of reinforced concrete and prestressed concrete beam bridges often lead to concrete spalling at the ends of the beams below the joints. When the bridge inspection or other report indicates that significant spalling has occurred that exposes the reinforcement bars or prestressing strands, repairing of the beam webs then becomes necessary. Reducing the water that reaches the beam ends should also be addressed when completing this beam repair.
Bearing Pedestal Repair	--	--	--	Cracking or spalling of the bearing pedestal will result in the need to perform a spall repair. Spalls are caused by reinforcement bars that have expanded due to rusting and water freezing in cracks.

Table 5-1 – Top Structural Repairs (cont.)

Activity	BMS Activity No.	PUB 55 Page No.	PUB 408 Section/ Standard Details	Reason for Activity
Resetting Bearings	--	--	--	Bearings become frozen as a result of lack of regular lubrication in addition to rusting from water intrusion thru the joints, as well as debris from the deck. A frozen bearing cannot rotate in response to the expansion and contraction of the structure. In the worst case, the bearing will be pushed or pulled over, ratcheting the bearing and allowing movement in only one direction as a result of the expansion/contraction forces.
Concrete Deck (Repair)	D744303	8-7	1040 BC-783M	Deterioration of the top surface of a cement concrete deck will result in the need to perform a concrete deck repair. Rusting of the top layer of reinforcement bars, accelerated by the penetration of chlorides to the reinforcement bars, could lead to the formation of concrete spalls, due to rusting reinforcement bars expanding and water freezing.
Abutments (Spall Repair) and Bearing Seats (Repair)	B744802 And D744503	14-5	1001, 1002, 1003, 1017 BC-783M	Spalling of the exposed surface of a concrete abutment backwall, cheekwall, stem, or wingwall will result in the need to perform a spall repair. Rusting of the top layer of reinforcement bars, possibly accelerated by the penetration of chlorides to the reinforcement bars due to water leaking through deck expansion joints could lead to the formation of concrete spalls. Spalls are caused by reinforcement bars that have expanded due to rusting and water freezing in cracks.
Pier Repairs	--	--	BD-629M (Sheet 15 of 15), Special Provision 97080600	Spalling of the exposed surface of a concrete pier will result in the need to perform a spall repair. Rusting of the top layer of reinforcement bars, possibly accelerated by the penetration of chlorides to the reinforcement bars due to water leaking through deck expansion joints could lead to the formation of concrete spalls. Spalls are caused by reinforcement bars that have expanded due to rusting and water freezing in cracks.

Table 5-1 – Top Structural Repairs (cont.)

Activity	BMS Activity No.	PUB 55 Page No.	PUB 408 Section/ Standard Details	Reason for Activity
Abutments (Crack Repair)	B744802	14-5	1001, 1002, 1003, 1017, 1091, Special Provision 97080600	<p>Settlement of an abutment can lead to a crack. Concrete shrinkage due to curing, or movement due to temperature change, can also cause cracking.</p> <p>The cause of the crack should be determined first. A crack could be a symptom of a larger structural problem that should be addressed. It is important to determine if the crack is static, or is active. If the crack is static, then performing only the crack repair will be sufficient. However, if the crack is changing in width over time, the cause for the movement, such as abutment settlement, needs to be addressed or the crack will reappear.</p>
Masonry (Repoint)	B744804	14-38	1017	<p>Stone masonry mortar pointing can deteriorate over time due to water penetration and freeze/thaw, resulting in a need for repointing. The mortar bonds the stones together into a solid unit and protects the wall from water penetration. Because a stone masonry abutment also serves as a retaining wall there is often saturated backfill behind the wall. Therefore, in some instances it is advantageous to have some open joints without mortar in the wall to act as weep holes to allow water to drain from behind the wall, in which case repointing all of the joints can be detrimental to the wall unless weep holes are provided.</p>
Footing (Underpin)	E744803	14-34	1001, 1002, 1003, 205, 850	<p>High velocity stream flow during a high water event, an undersized bridge hydraulic opening, and/or an unstable stream bed can result in scour of the stream bed. If the scour depth extends below the bottom of footing elevation, a void could form in the soil or erodible rock on which the footing is founded.</p>

Table 5-1 – Top Structural Repairs (cont.)

Activity	BMS Activity No.	PUB 55 Page No.	PUB 408 Section/ Standard Details	Reason for Activity
Scour Hole	C745301	16-10	703, 205, 850	High velocity stream flow during a high water event, an undersized bridge hydraulic opening, and/or an unstable stream bed can result in scour of the stream bed. If the scour depth extends below the bottom of footing elevation, a void could form in the soil or erodible rock on which the footing is founded.
Repair/Reseal Deck Joints and Compression Seal Deck Joints (Repair/Rehabilitate)	A744101 and B744102	4-1	521, 705, Special Provisions 97050102, 97050101, 90080101, 97050201	Leaking deck joints often lead to deterioration to beam ends, bearings, and substructure units. Therefore, minimizing water penetration is a very important cost effective maintenance repair goal.
Structure Mounted Railing (Repair/Replace)	RLGSTRM	5-3	1001, 1002, 1003, 1013, 1014 BD-600M BC-700M	Many older bridges were constructed with structure mounted metal railings or other styles of railings such as open rail concrete barriers. These railings can be damaged from vehicle collision damage or have section loss due to steel corrosion or concrete spalling. Bridge inspection reports may also recommend railing replacement to improve safety features.

Other Topics for Consideration

Although PUB 55 covers a multitude of standard structural repairs, there are other structural repairs that are fairly common in maintaining today's bridges. These other structural repairs require a design by a District Bridge Engineer as well as project specific supervision. In some instances, PUB 55 does address these other structural repairs, however, it is necessary to clarify that they are more complex repairs requiring careful consideration, design and supervision. For example:

Non-composite pre-stressed concrete adjacent box beam bridges present a number of structural repairs that require careful consideration. The December 2005 collapse of a fascia beam on the bridge carrying S.R. 1014 over Interstate 70 highlighted the need for special considerations in maintaining this structure type. For non-composite pre-stressed concrete adjacent box beam bridges the tops of the beams serve as the structural deck with a bituminous wearing surface applied. A cement concrete deck slab is not used. The lack of a concrete deck slab can result in an increase in

water penetration especially if a membrane waterproofing is not present.

This type of structure relies on only the shear keys and transverse tie rods or post tensioning strands, for the beams to act together. Longitudinal cracks in the bituminous wearing surface often form above the beam joints due to independent beam deflections, resulting in more water penetration. No concrete deck also increases fascia beam web cracking below concrete barrier open joints due to an abrupt change in beam stiffness at the barrier open joints. This abrupt change in stiffness is caused by the concrete barriers acting compositely with the fascia beams, except at the barrier joints. These fascia beam web cracks are therefore located in the water path below leaking barrier joints thereby compounding the problem.

Structural repairs include concrete barrier retrofitting to eliminate open joints that cause cracks in the beams below these joints, and shear key re-grouting. In combination with shear key re-grouting, removing the existing bituminous wearing surface, installing a concrete wearing

surface or composite concrete deck can extend the life of the structure.

One other related item is cleaning the drain holes in the bottom of the box beams. Although this falls under preventive maintenance and should be a part of all bridge inspections, as applicable, it takes on a unique relevance for non-composite prestressed concrete adjacent box beams. With only a bituminous wearing surface, water is more likely to infiltrate the shear keys and curb areas, eventually entering the beam voids. If the drain holes are not open, the contained water is then subject to freezing and expansion, resulting in potential cracking of the sides and bottom of the box beams. This water adds deadload to the structure. Therefore, it is of high importance that all drain holes be cleaned during inspection, documenting which holes contain moisture/water as necessary.

Modular expansion dam repair warrants special consideration as well. Regarding this type of repair, the Engineer's design and plans as well as the Contractor's method of construction should be coordinated closely with the actual manufacturer of the proposed modular expansion dam to ensure proper preparation and installation.

Bridge painting due to lead based paint removal also warrants special consideration. Most older steel bridges contain lead based paint that results in the need for strict environmental control. Prior to starting a bridge painting project, the paint should be tested for lead and other hazardous materials under the supervision of the District Bridge Engineer. A project specific lead abatement program must be designed for the removal and proper disposal of lead based paint and blast material.

Truss or girder repairs involving a non-redundant structure load path clearly warrant special consideration. By definition, a non-redundant structure is one that the failure of one member could result in the collapse of the structure (usually a structure with only two lines of trusses or girders). Therefore, repairs of this nature should always include a design and procedure supplied by the District Bridge Engineer. Furthermore, the District Bridge Engineer should work closely with the Contractor to ensure the procedure is being satisfactorily implemented.

Districts can contact the Bureau of Construction Materials and Testing Division, Structural Materials Section if assistance is required in developing weld procedure specifications or non-destructive testing and evaluation of weldments.

Bearing replacement warrants special consideration because it entails beam jacking and bearing design. An adequate beam/girder jacking scheme needs to be developed. This scheme should satisfy the design requirements (supporting the applicable bridge loads) and construction requirements (feasible to construct). In addition, this scheme should be closely coordinated with the maintenance and protection of traffic activities. In addition, if bearings are to be replaced, these replacement bearings should be designed as well, considering all applicable movements and rotations.

Formwork is not in itself a structural repair, nonetheless, it deserves mentioning. Formwork, including prebuilt forms, is an important part of most structural repair work and some preventive maintenance of a bridge. In the past, there has been no clear direction or guidelines provided for whether formwork needs to be designed or can simply be provided by Department Forces or a Contractor, partly because of its wide variety of applications. Many foremen learned to build formwork using standard tables and guides from the tie rod manufacturers or they use metal forms with their own guidance. The sales rep for the tie system has tables that make it easy for the foreman to build safe vertical formwork.

If the work is to be completed by Department Forces, the District Bridge Maintenance Coordinator and the Bridge Unit should carefully consider the formwork necessary to complete the given repairs/maintenance for the specific bridge. Safety is the most important consideration when determining if formwork needs to be designed or can simply be provided. If it is apparent that a given formwork will present a safety concern, due consideration should be given to designing that formwork. Deflection is another consideration that may prompt a formwork design. For instance, in arch or box top slabs, the formwork may need to be designed due to deflection concerns. Finally, the location of the formwork should be considered. This includes the overall area to be formed and whether it is horizontal and/or vertical construction. If the formwork becomes too complex or extensive, consideration should be given to designing the formwork. If standard formwork is to be used, it can be designed by an Engineer. If prebuilt forms are to be used, most manufacturers provide representatives that can assist in checking over the design or provide an Engineer to design the prebuilt formwork. The District Bridge Maintenance Coordinator should work with the Bridge Unit to evaluate, review and design (if necessary) any formwork to be completed by Department Forces.

If the work is to be completed by a Contractor, it is the Contractor's responsibility to determine whether the necessary formwork needs to be designed. The structural repairs to be completed by the Contractor include the formwork, thus, the Contractor is responsible for determining if standard formwork would be adequate. If not, the Contractor can choose to call a manufacturer (for a prebuilt form) or obtain a design by an Engineer. If a prebuilt form is utilized, the Contractor should consider all aspects of the formwork (including safety) and if they are uncomfortable with the formwork, they can call the manufacturer and ask them to send a representative out to check over or design the formwork before they place the concrete, if necessary. Whether standard formwork is constructed or prebuilt forms are used, it is the Contractor's responsibility to consider the formwork associated with the necessary repairs or maintenance.

Chapter 5 Best Practices

- Utilize design squad to prepare maintenance, preservation projects and Interstate work.
- Repair sketches are developed by the Bridge Maintenance Coordinator in the Bridge Unit
- County bridge crews with substantial capabilities perform emergency type of structural repairs and routine repairs.
- Districts can develop, bid and award bridge maintenance contracts to focus on Priority 1 activities with some bridge replacements.
- Focus maintenance activities on scour, pedestal repairs and beam ends.
- Repair leaking deck joints with two-part silicone system such as XJS deck joint systems.

Chapter 6: SAP

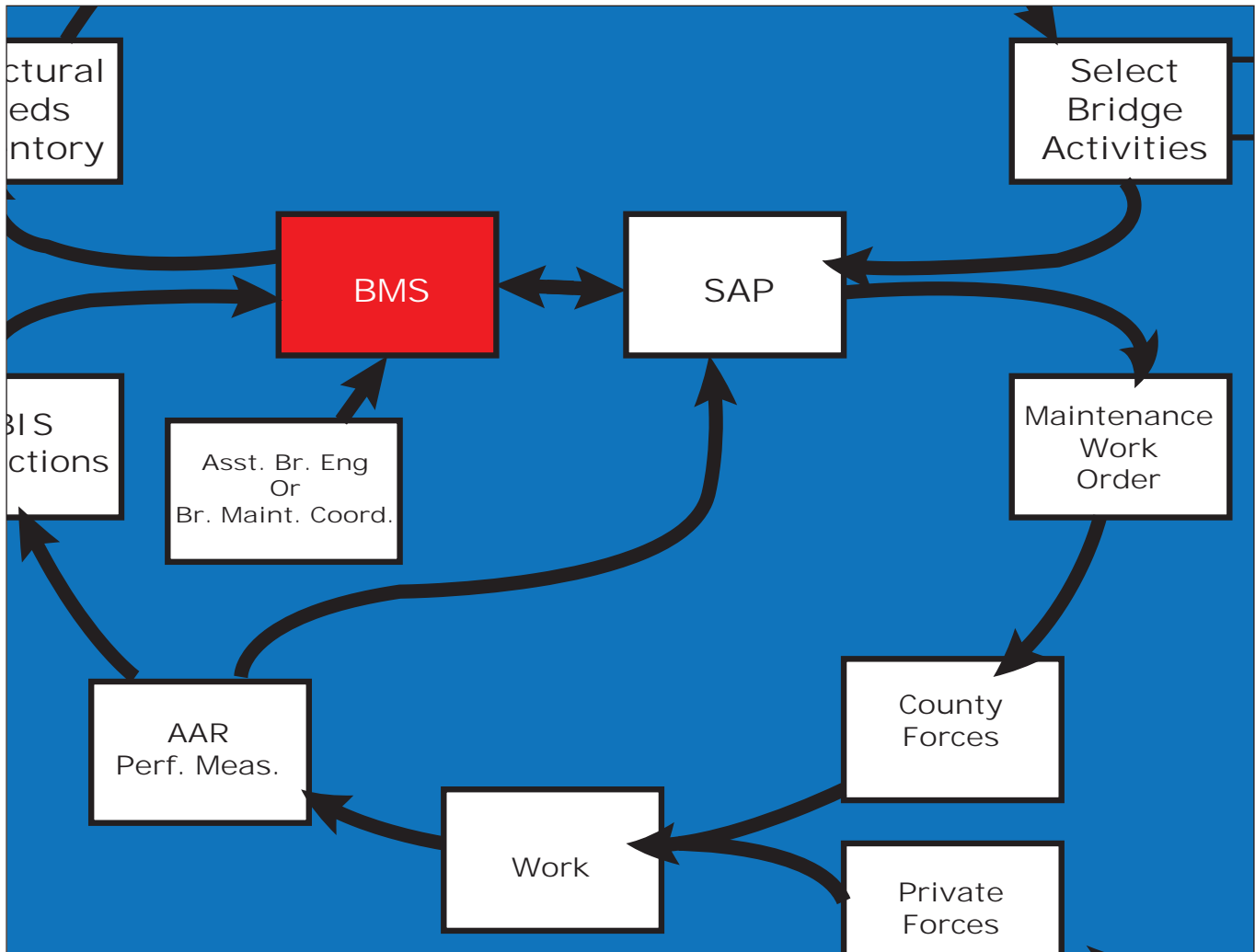


Figure 6-1 – SAP Section of Process Map

SAP/Plant Maintenance

SAP is a business-solutions software company that has developed several software modules used by PennDOT for various services, including a module called “Plant Maintenance” used for managing certain components of the bridge maintenance process. SAP/Plant Maintenance (SAP) is the second of two digital tools for managing bridge maintenance programs across the state, the first being BMS, discussed in Chapter 2. An interface between BMS and SAP/Plant Maintenance has been developed that allows the sharing of information and the generation of Notifications that become the bases for Work Orders at the Engineering Districts.

Other SAP modules used by PennDOT include R3 and Supplier Relationship Management (SRM) for purchasing, and a financing module used for payroll. Figure 6-1 shows that location of SAP in the process map.

Development of a Maintenance Work Order

The foundation of a Work Order is a Notification that appears in SAP. Under most circumstances Notifications are initiated in BMS, which automatically become Notifications in SAP during an overnight information sharing process built into the interface between the two applications. Notifications may be initiated directly in SAP, but this activity should be reserved for emergency situations or for counties scheduling routine maintenance.

Notifications Originating in BMS

For those developing a Notification in BMS, a well-defined procedure is articulated in the PennDOT PUB 100A, *Bridge Management System 2, Coding Manual*.

That procedure is reproduced below:

2.6.2. Sending Proposed Bridge Maintenance Activities to SAP

All proposed work items (bridge, element and flexible actions) will be listed on the Maintenance Applet, Proposed Work tab. The Maintenance Applet allows users to view work activities and track their status. Districts may also create work Notifications in SAP for county maintenance crews on this screen by following a series of simple steps. This new function in BMS supplies SAP with minimum information to initiate the Notification, which then becomes a work order after further review and approval. After the bridge maintenance work is completed and the information is updated in SAP, BMS retrieves select information from SAP and stores it on the Completed Work tab.

Once the District Bridge Maintenance Coordinators and County Maintenance crews have decided on which bridge maintenance activities are to be worked on in the upcoming year, the Bridge

Maintenance Coordinators may then create Notifications for SAP through BMS by doing the following (See Figure 6-2).

1. Navigate to the Maintenance Applet for the desired bridge.
2. Select the desired maintenance activity that is to be sent to SAP.
3. Set Item IM07, Status, to "1 – Work planned / Dept."
4. Set Item IM08, Target Year, to the applicable year.
5. Set Item IM11, Work Assign, to "0 –Agency."
6. Save the changes.
7. Ensure that the maintenance activity is highlighted and Click on the "Submit to SAP" button. Item IM07, Status, will change to "3 – Work Sent to SAP" the next day after successful submission to SAP.
8. After the button is pressed, the maintenance activity will appear in SAP as a Notification the next day. Further information and approval is necessary within SAP to develop a work order.

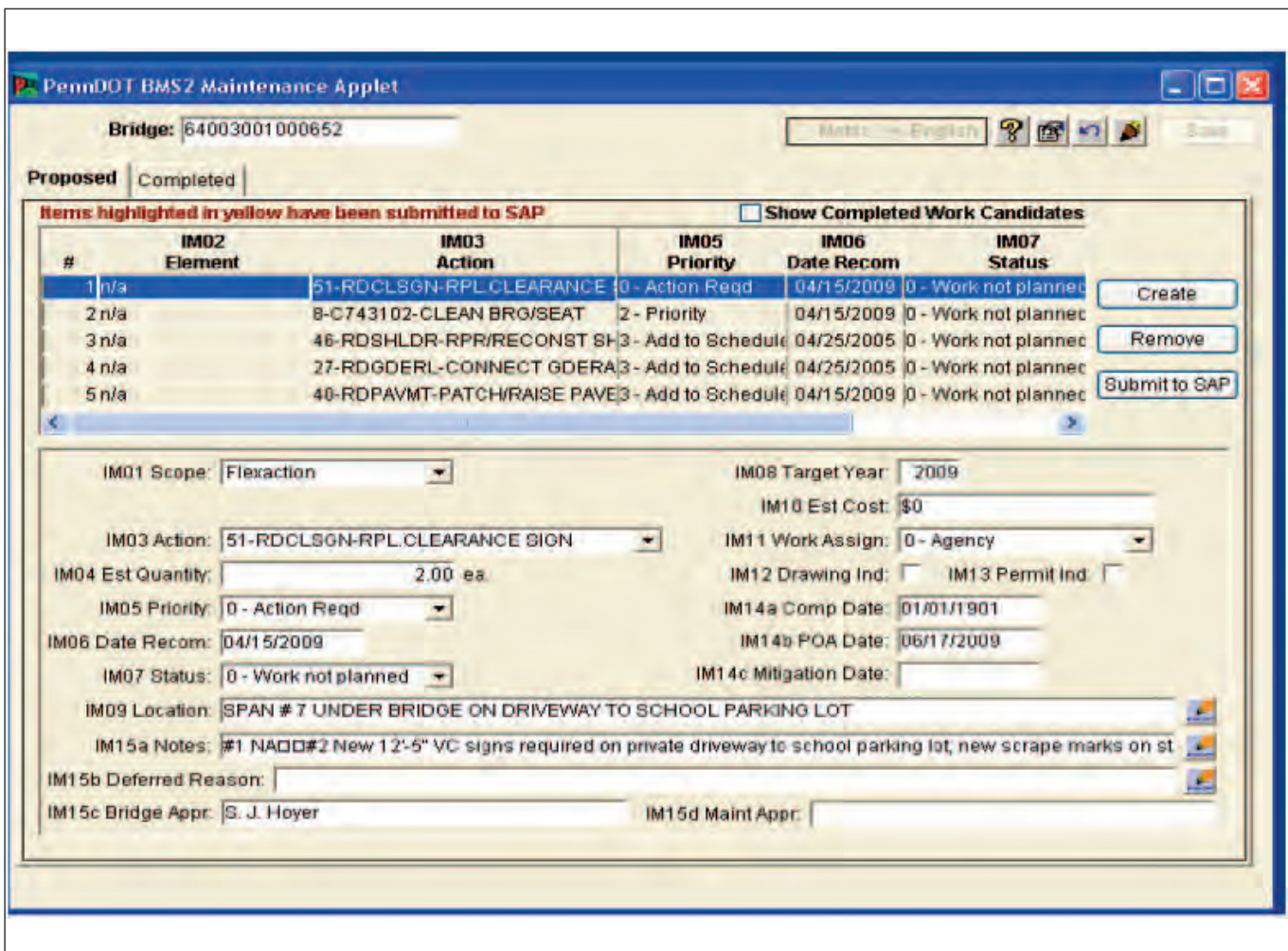


Figure 6-2 - BMS Maintenance Applet

Only planned work should be submitted to SAP. Districts should confirm that the Notification has been sent to SAP and is ready to be generated into a work order.

Another, and perhaps preferable, method of initiating a Notification in BMS is using BMS Web rather than the Maintenance Applet as described in PUB 100A and above. BMS Web has a Maintenance screen that allows the initiating of Notification similar to the procedure above, and is available to BMS Web users with Inspector Supervisor access, and above.

From the BMS Web Inventory – Structure Home screen, select Proposed Maintenance (See Figure 6-3). The BMS Web Maintenance – Proposed Maintenance screen should appear (See Figure 6-4). From this screen a maintenance Notification may be initiated by following these steps:

- Select a bridge by its identifier. A list of the proposed maintenance items for that bridge is displayed.
- Select the desired maintenance activity. A screen showing the proposed maintenance detail should be displayed. Notice that the “IM_” fields displayed are similar to those in the BMS Maintenance Applet described above.
- The desired maintenance activity may be selected.
- Clicking the “Submit to SAP” button will make the Notification available to SAP during an overnight sharing of information through the BMS/SAP interface.

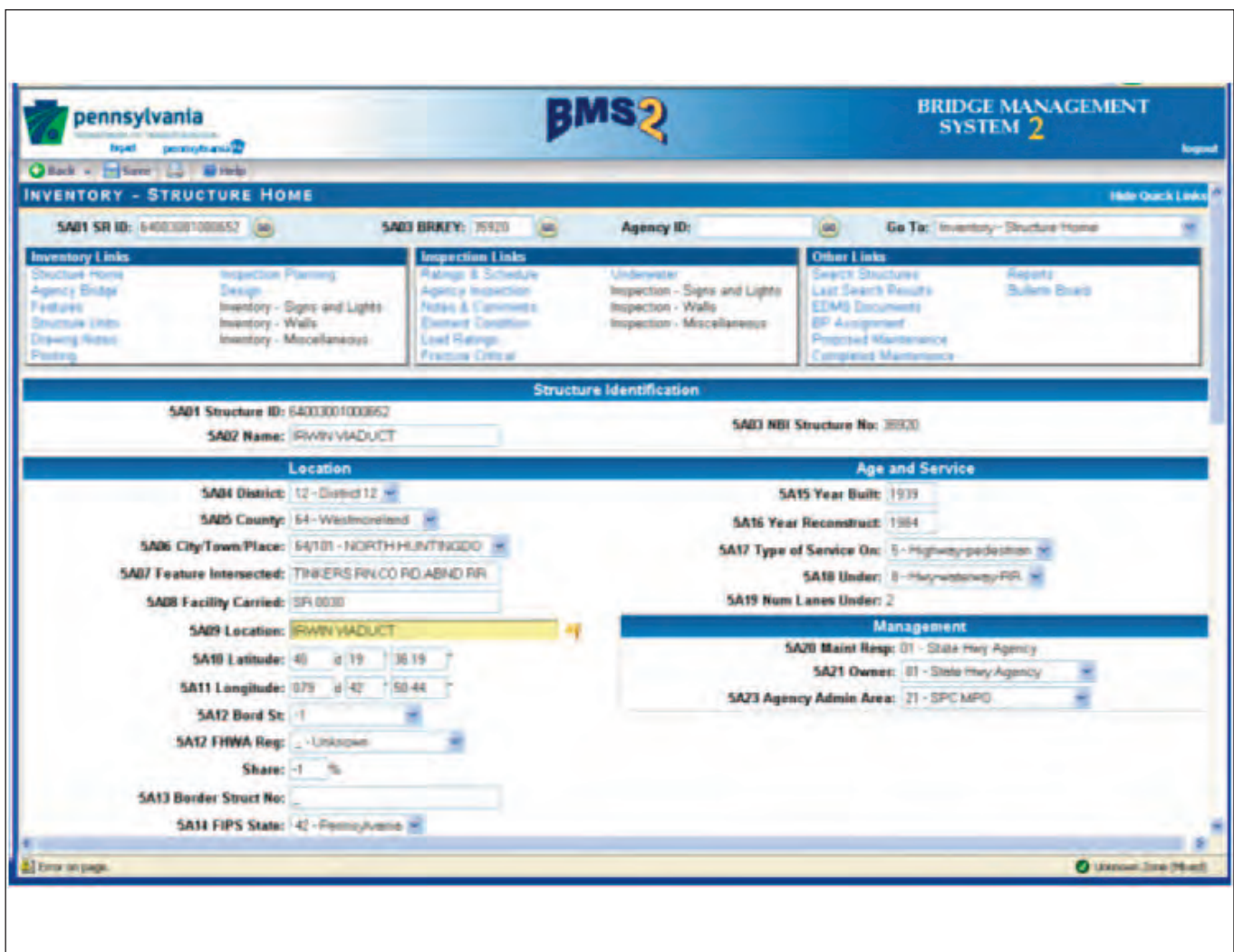


Figure 6-3 - BMS Web Inventory – Structure Screen

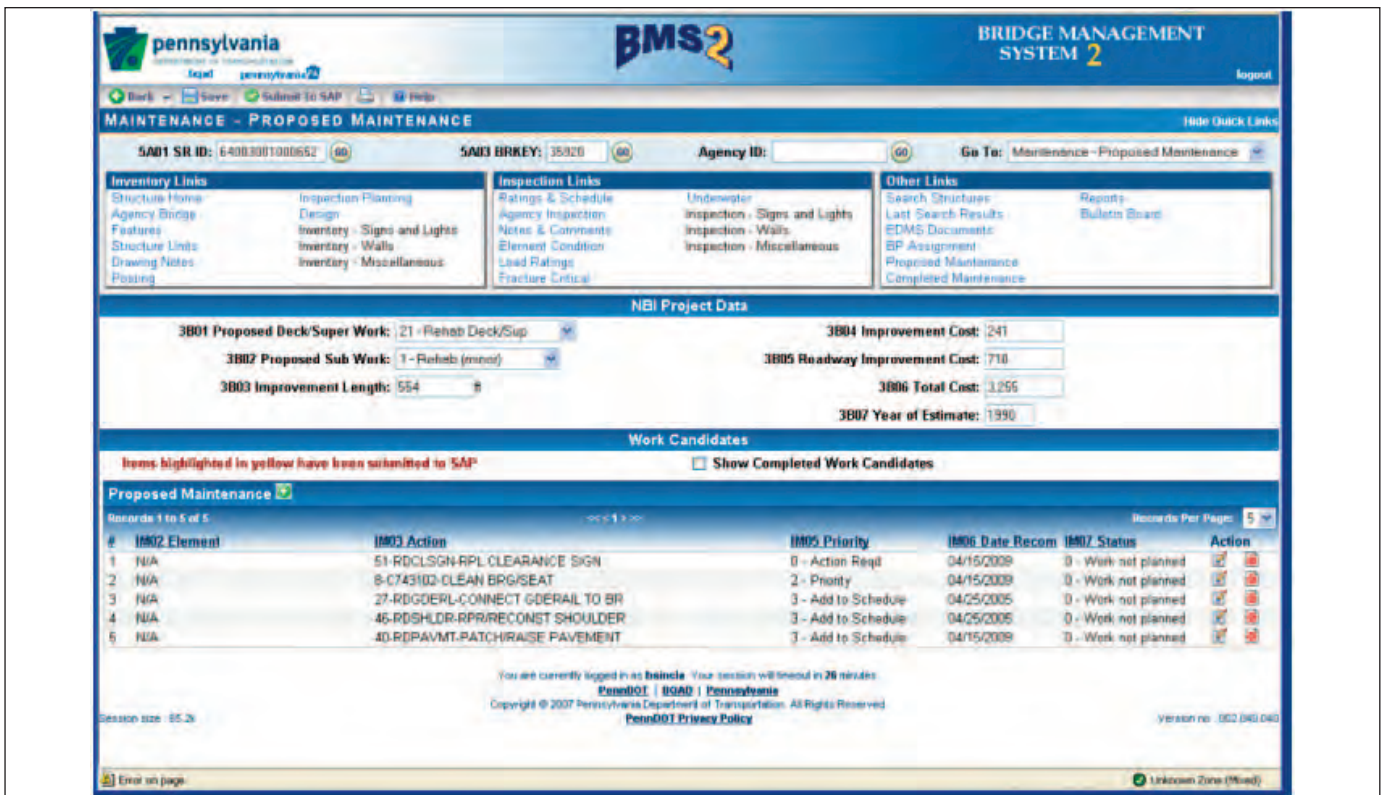


Figure 6-4 – BMS Web Maintenance – Proposed Maintenance Screen

Notifications and Work Orders in SAP

Notifications and Work Orders in SAP are managed using specific screens for each. Generally, IW2_ screens access Notifications. Specifically, an IW24 screen is used to create a Notification, an IW22 screen changes a Notification, and an IW23 screen displays a Notification.

Likewise IW3_ screens access Work Orders. Specifically, an IW31 screen is a Work Order creation screen, an IW32 screen changes a Work Order, and an IW33 screen displays a Work Order.

While the IW31 screen for creating Work Orders exists, Work Orders should only be developed from existing Notifications. In short, the IW31 screen for initiating Work Orders should not be used.

Also note that the two primary screens for making changes are the IW22 screen for Notifications, and the IW32 screen for Work Orders.

Initiating Notifications in SAP

Again, only rarely are Notifications to originate in SAP. Doing so is generally reserved for the routine operation of bridge cleaning.

However, when circumstances indicate initiating a Notification in SAP, the process is as follows:

The District Bridge Maintenance Coordinator may initiate a Notification directly in SAP. The Notification is based upon bridge inventory and history. An IW24 Screen (See Figure 6-5) is used to initiate a Notification. An IW23 screen may be used to display the Notification. The IW22 Screen is the screen used to change a Notification, including adding information for routine operations such as bridge cleaning. Do not attach a bridge, it is not necessary to get "credit" on the MAPI Measures. Also, it is from the IW22 screen that a Work Order is created.

BMS and SAP use different identifiers for bridges. BMS uses a Functional Location number, while SAP uses a bridge's Segment/Offset as its identifier, which appears on the RI tab of the IW22 screen. To attach a bridge to the Notification, a bridge must be selected from pull-down list using the Bridges/Pipes tab on the IW22 screen; manually keying the bridge identifier will not attach a bridge to the Notification.

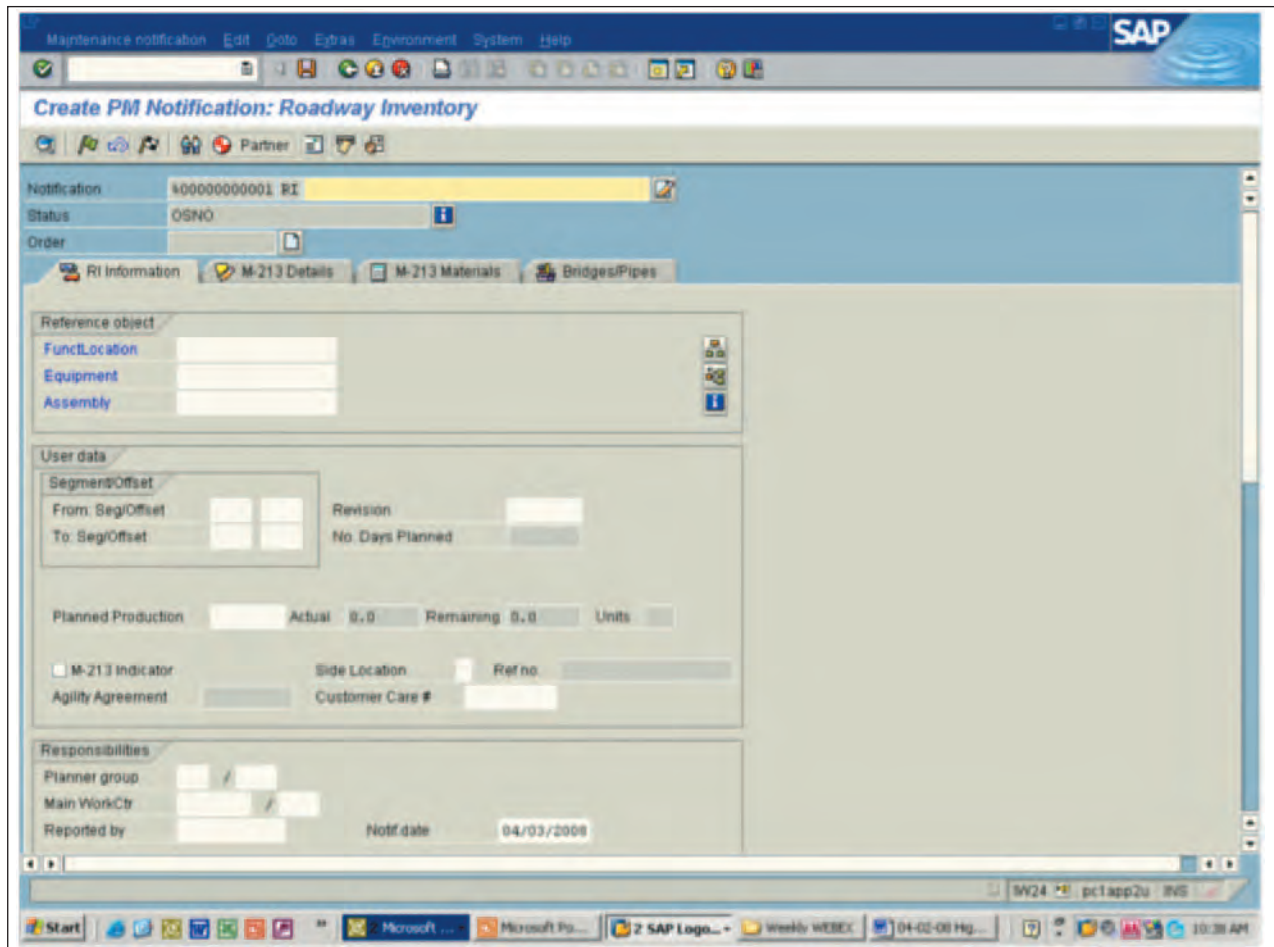


Figure 6-5 – IW24 Screen

Developing a Work Order

Whether the Notification originates in BMS or in SAP, the procedure at the District level for receiving the Notification and moving it through a Work Order to Work appears below:

Typically, the Assistant Highway Maintenance Manager receives the Notification in SAP and subsequently converts the SAP Notification to a SAP Work Order by clicking on the appropriate

button in the IW22 screen (See Figure 6-6), creating an IW32 screen and allowing time and materials charges by the County. This screen allows changes to be made, and ultimately producing a complete Work Order. The IW32 Screen below (See Figure 6-7) shows the pull-down menus used to close a Work Order.

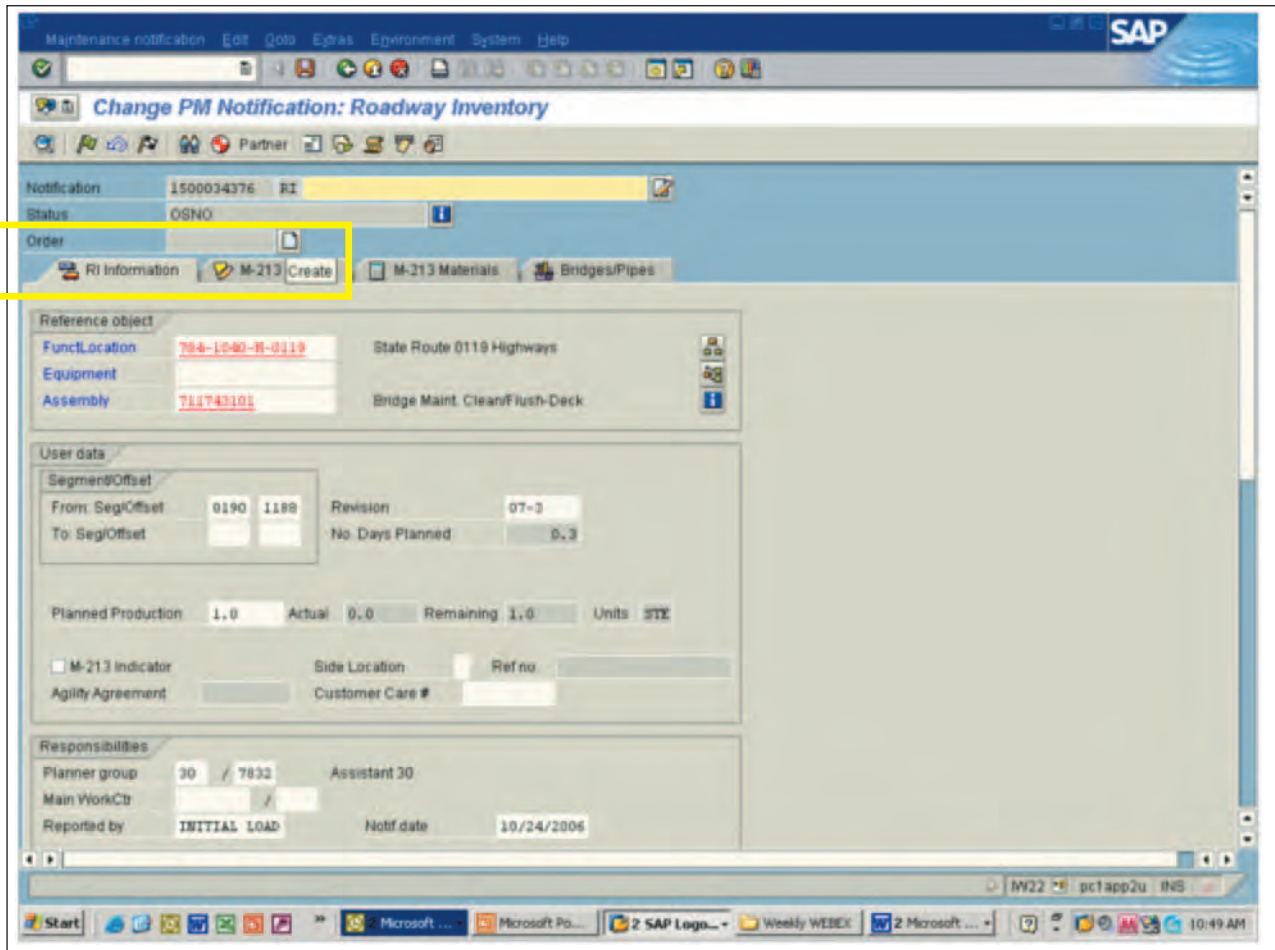


Figure 6-6 – IW22 Screen

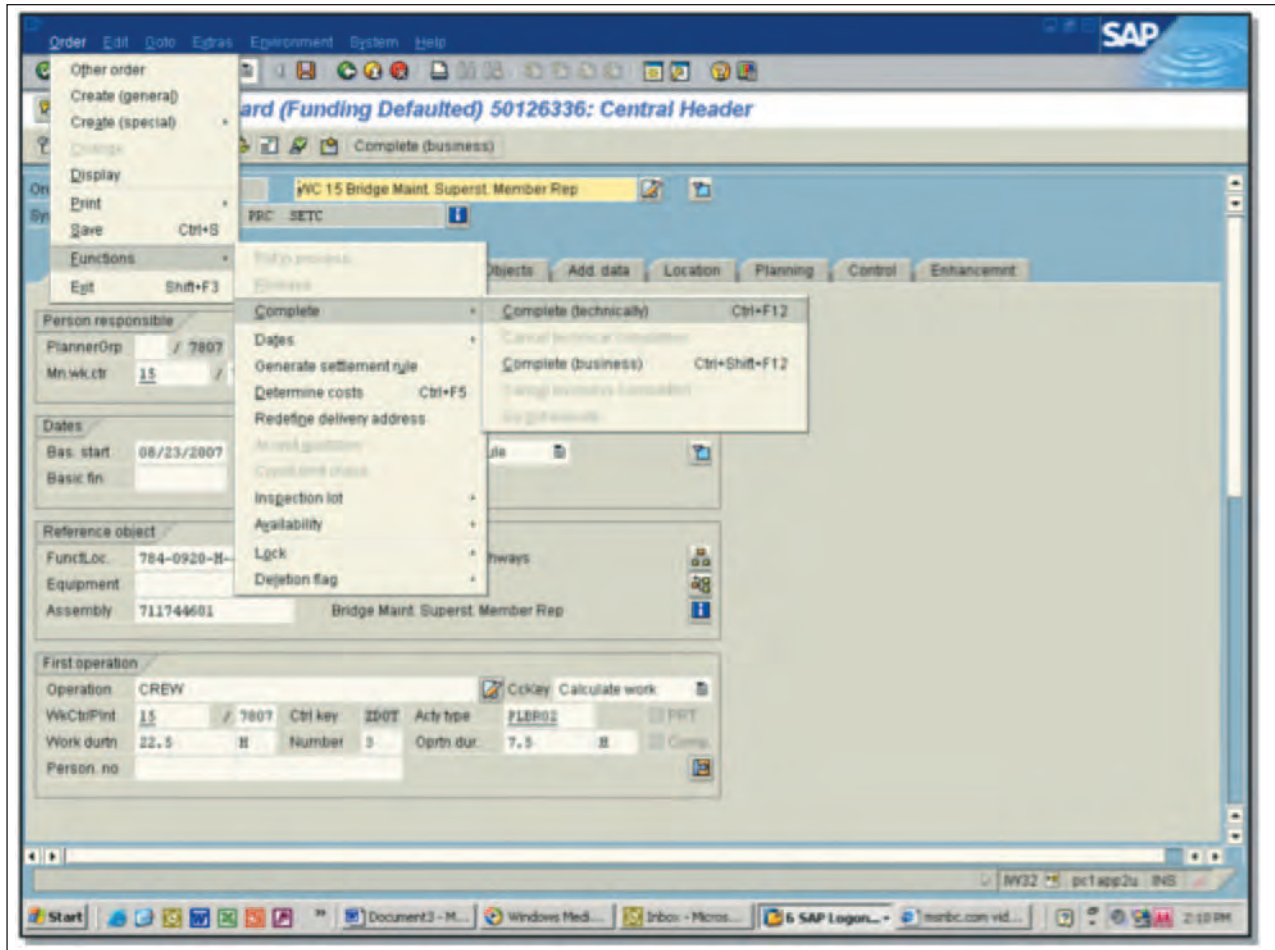


Figure 6-7 – IW32 Screen

Recording Work and Technically Complete in SAP

As work is completed, the Bridge Foreman informs the Payroll Clerk of the daily payroll to be charged, who then records that information in the Work Order using the IW32 screen. When a job is complete, the Bridge Foreman informs the Assistant Highway Maintenance Manager who then closes Work Order to additional payroll charges. This places the Work Order in Technically Complete status. When the Assistant Highway Maintenance Manager closes a Work Order, SAP automatically sends a notification to BMS. SAP automatically resends cost information to BMS 30 days after to pick up costs from vendor invoices sent within the 30 days. Vendors' invoices received after 30 days and up to one year, may be added to a Work Order, but those added costs cannot be transmitted to BMS. A Technically Complete Work Order remains open to vendor invoices for a period of one year.

Closing a Work Order in BMS

After a Work Order has been closed by the Assistant Highway Maintenance Manager in SAP, PennDOT PUB 100A, Bridge Management System 2, Coding Manual, articulates the procedure to close the Work Order in BMS. The Maintenance Applet screen has been reproduced below (See Figure 6-8):

2.6.3. Coding Completed Maintenance Items in BMS

This section discusses how to code completed maintenance items that were performed by Department Forces and by Contract.

When maintenance is completed and a work order is closed in SAP, BMS will receive notification. Depending on the type of maintenance performed, item IM07, status of the work item, will change to either a "4 – Review Required" or "5 – Completed / Dept." For those items whose status is "4 – Review Required," a follow-up review from the District Bridge Unit or consultant is required to ensure that the repair work was completed satisfactorily. After determining that the work has been performed properly, the reviewer may change the status to "5 – Completed / Dept" and save the change in status. No additional review is required for maintenance items whose status is "5 – Completed / Dept." The date completed, actual quantities and costs (Items IM14, IM18 and IM9) will be taken from SAP / Plant Maintenance.

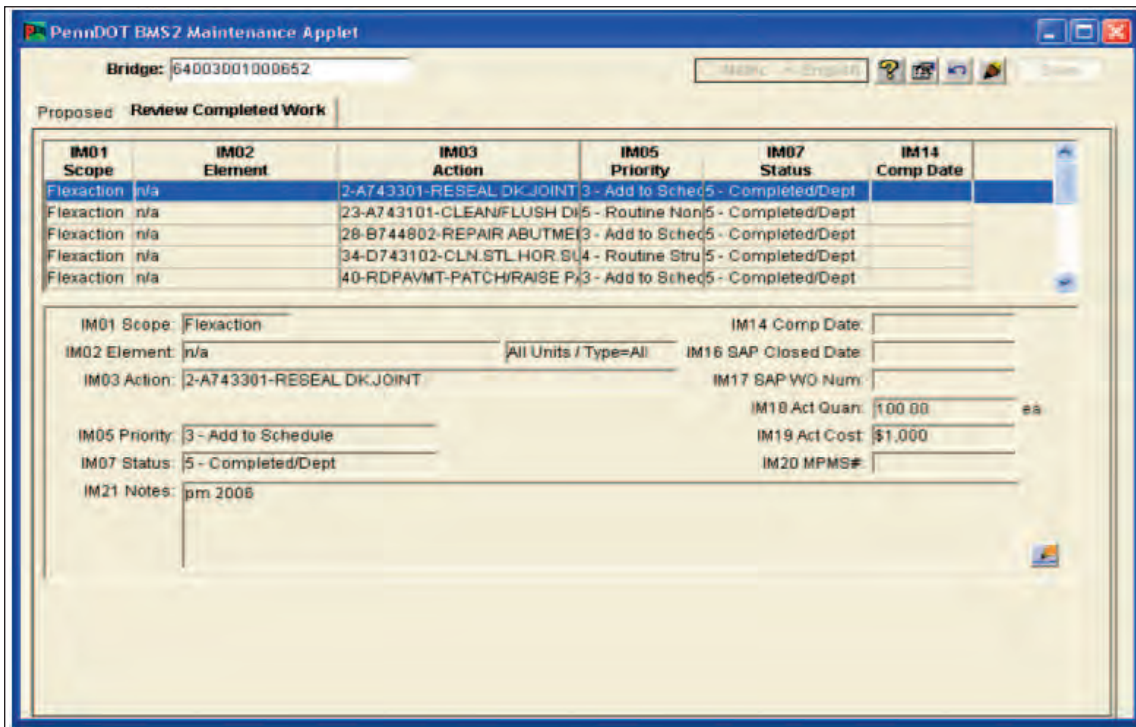


Figure 6-8 – Closing a Work Order in BMS



Figure 6-9 – Closing a Work Order in BMS Web Completed Maintenance Screen

When maintenance work is completed by contractor forces, Item IM07, Status, must be changed to “6 – Completed / Contr.” Users must also update items IM04 – Estimated Quantity and IM10 – Estimated Cost, with actual values on the Proposed Maintenance tab. Once changes to these fields have been made and saved, the work item will be stored in the Completed Work tab.

When maintenance work has been eliminated due to major rehabilitation or replacement work, then the status must be changed to “7 – Superseded,” and the actual date of the work should be coded in item IM14.

This same procedure may also be accomplished in BMS Web using the Maintenance – Completed Maintenance screen (See Figure 6-9).

Chapter 6 Best Practices
 Establish formal work order process.
 Utilize standard letter for maintenance work orders.
 Maintenance items are extracted from BMS with a Crystal report to develop the maintenance and preservation projects.

Chapter 7: Procurement

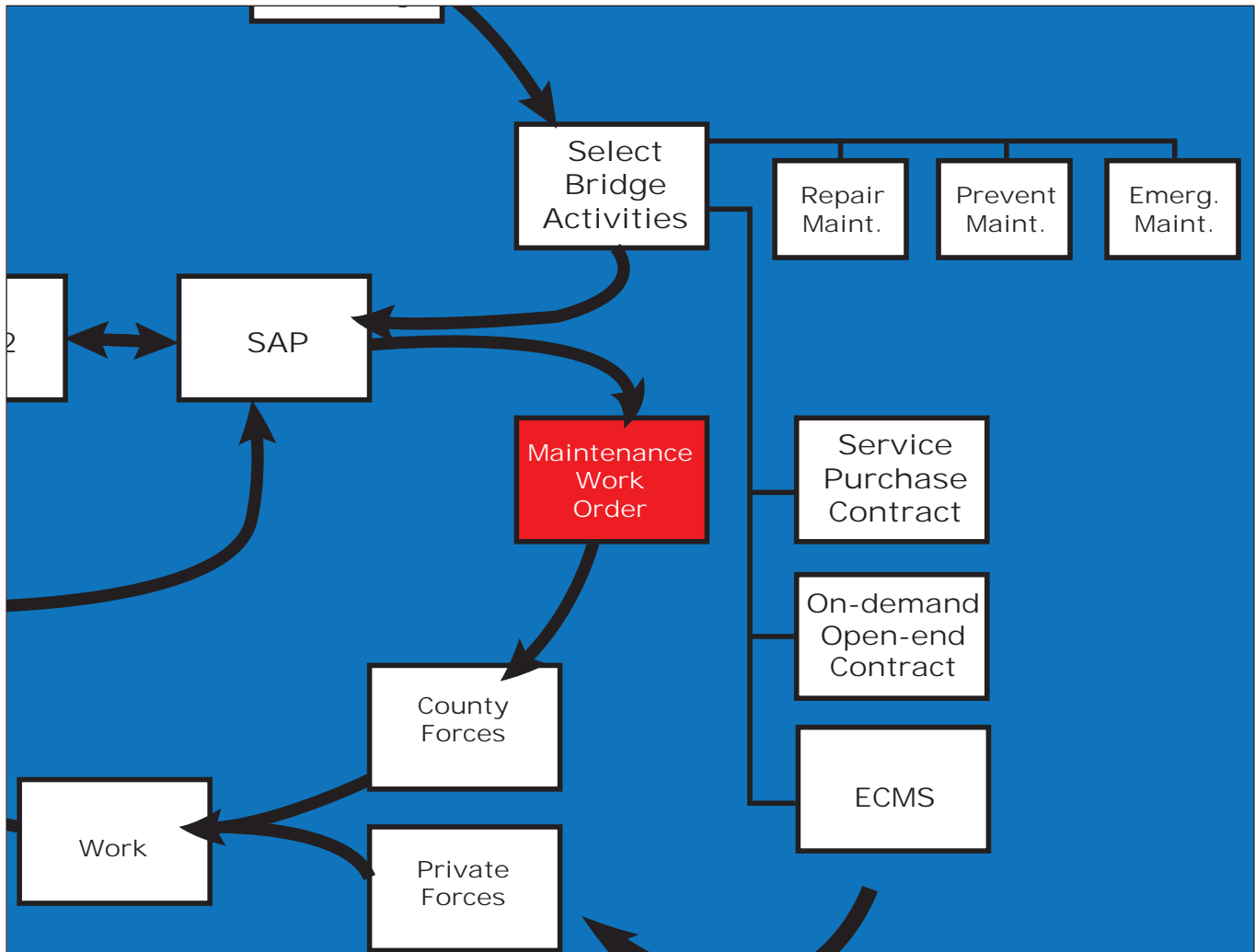


Figure 7-1 – Procurement Section of Process Map

Introduction

In addition to having maintenance activities performed by forces either inside or outside the Department, often Department forces require additional support to accomplish work orders, such as equipment, specialized tools, or materials. The equipment and materials used may be provided by private suppliers. As such, a thorough understanding of contracting with private suppliers is important. This section, along with the next section on contracting provides an overview of procurement issues as they pertain to bridge maintenance. Figure 7-1 shows the Procurement function location in the process map.

Maintenance Work Order

The use of Department forces for bridge maintenance begins with a complete work order. Work orders describe and enumerate the personnel to work on a given project, the equipment to be used or procured, and the materials to be used or

procured. Work orders are prepared by Highway Maintenance Manager and are based upon notifications generated by the District Bridge Unit through SAP using information from BMS.

Manpower

Manpower considerations include employee safety, work procedures, and job assignments. From a procurements perspective, after employees have what they need to be safe, the focus becomes job assignments. The scheduling of work requires consideration of the appropriateness of personnel skills to the particular work being scheduled, vacations, sick leave, and training schedules. However, the scheduling of Department Forces does remain within the domain of the County offices, usually with the AHMMs.

Services

Certain maintenance activities such as bridge cleaning may be contracted with private service suppliers. If deemed appropriate, services may be procured with private suppliers within three general categories of procurement methods, based upon the costs of services. The three categories are:

Small, No Bid Procurement

Small, Informal Bid Procurement

Formal, Competitive Sealed Bidding through either the Department itself or DGS, depending on the dollar amount

For a complete description of the procedures required for each of these categories, refer to PennDOT PUB 1, Supplies and Services Purchasing Guides; PennDOT PUB 358, PennDOT's Purchasing Manual; and the DGS Procurement Handbook, current editions.

Equipment

Every work crew is expected to carry a full-complement of standard tools. However, specialized tools may be required for particular maintenance projects. AHMMs should note equipment needs, with consideration for back-up in case of equipment failure.

Having determined equipment needs for a particular project, the AHMM and the County Equipment Manager should determine if the equipment is available through the Department fleet. If the equipment is available, then the use of that equipment may be scheduled via the Highway Maintenance Manager.

If the equipment needed for a particular project is not available through the Department fleet, the AHMM should determine if the equipment is available through an open rental contract. If so, then the equipment may be procured through the stipulations of that open contract and its use scheduled.

If the equipment needed for a particular project is not available through an open rental contract, the AHMM should obtain local bids from private firms that can provide the needed equipment.

Having obtained those bids, a provider may be selected and contracted to provide the needed equipment. Once under contract, the use of that equipment may be scheduled.

Materials

Estimates of required materials may be supported by past experience with similar projects, or by performance standards. Estimates should also account for a reserve of materials to be available to be sure there is sufficient lead time for the purchase of materials.

Having determined the materials needs for a particular project, the AHMM should determine if the material is available through an open-end contract. If so, a purchase order can be drawn up and the material acquired.

If the material for a particular project is not available through an open contract, the AHMM should then obtain local bids from private firms that can provide the needed material. Having obtained those bids, a provider may be selected and contracted to provide the needed material. Once under contract, the use of that material may be scheduled.

Like Services, supplies procured through contracts with private agencies fall within three general procurement categories:

Small, No Bid Procurement

Small, Informal Bid Procurement

Formal, Competitive Sealed Bidding though either the Department itself or DGS, depending on the dollar amount.

For a complete description of the procedures required for each of these categories, refer to PennDOT PUB 1, Supplies and Services Purchasing Guides; PUB 358, PennDOT's Purchasing Manual; and the DGS Procurement Handbook, current editions.

Chapter 7 Best Practices

Establish contract for cleaning bridge decks and beam seats in addition to removing brush from around the abutments and wingwalls.

Establish on-demand Bridge Maintenance Contract.

Chapter 8: Contracts

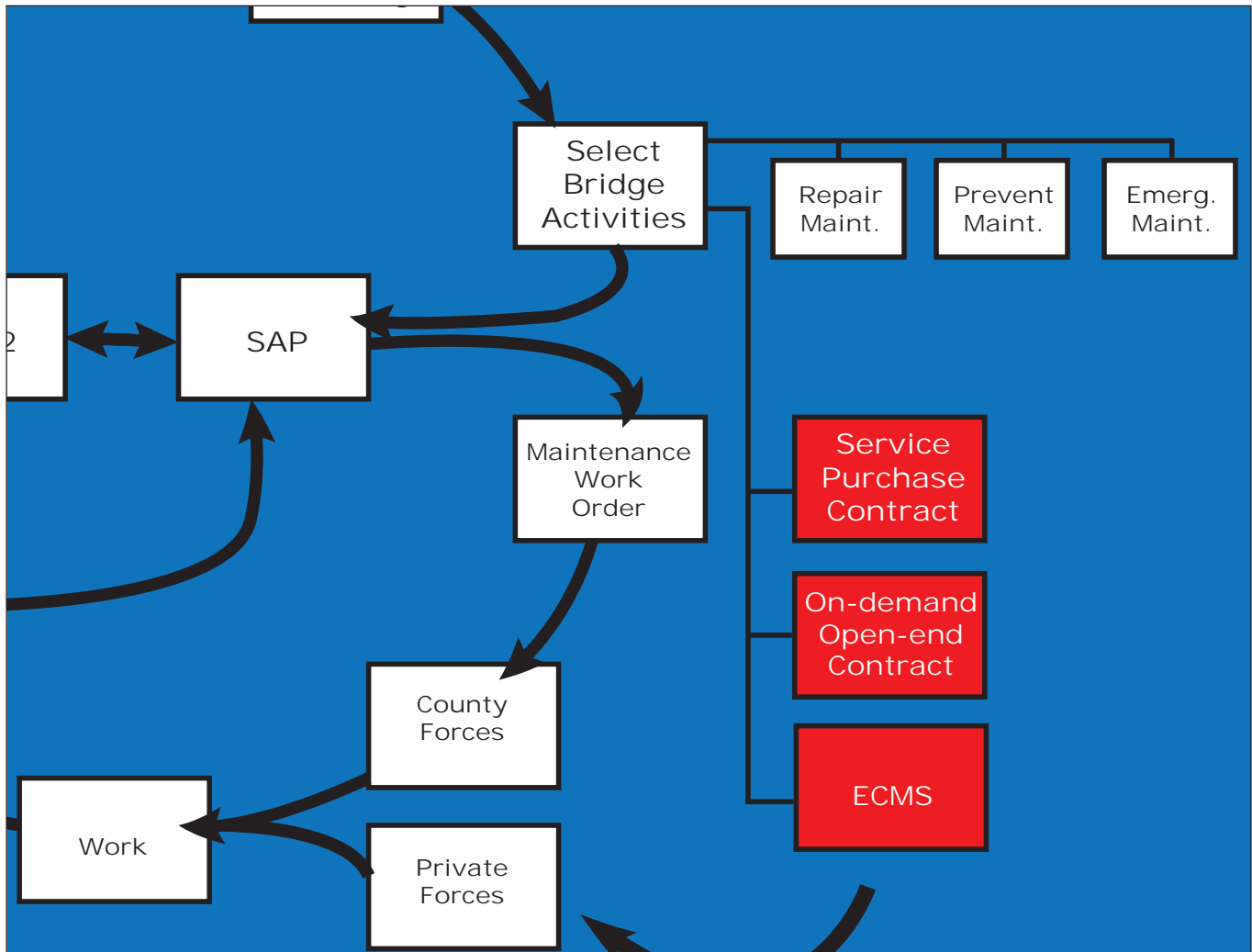


Figure 8-1 – Contracts Section of Process Map

Introduction

The numbers of bridges in each District that require preventive maintenance and repair makes careful planning and programming of those bridge maintenance activities of utmost importance. In this section the tools and processes available to Department personnel at the District and County levels are presented. While the planning and programming of bridge maintenance activities are carried out by Department personnel, the maintenance activities themselves may be carried out by Department Forces or by private contractors. Even when maintenance activities are carried out by Department Forces, the equipment and materials used may be provided by private suppliers. As such, a thorough understanding of contracting with private suppliers is important. This section presents an overview of contracting and issues as they pertain to bridge maintenance. See Figure 8-1 for the location of the contracts function location in the process map.

Bridge Activities Selection

Prioritization Criteria

The highest completion priorities are placed on those deficiencies with Maintenance Priority Codes of 0, 1, or 2 by bridge inspectors. Priority 0 items need to be repaired or mitigated within 7 days, and Priority 1 items within 6 months. The District Maintenance Coordinator is responsible for ensuring that bridge plans, permits, materials, and rented equipment are available prior to the scheduled bridge maintenance activities.

Contract work forces may be selected for certain work based upon several criteria including:

- Funding sources such as Federal, State, or Local
- size of the project

Resources of the Department such as equipment, manpower, the skills of the Department Forces

Work backlog of the Department Forces

A project that is sufficiently large to require specialized equipment not owned by the Department or otherwise requires equipment that must be rented may be contracted with private contractors. Department Force capabilities, in terms of skills or manpower may also trigger the diversion of work to private contractors. Work may also be contracted with private contractors depending upon the backlog of the Department Forces and the urgency of the structural deficiencies.

Contracting Methods Used by PennDOT

PennDOT uses three primary methods to contract with private service providers for the labor, equipment, and materials used for bridge maintenance operations. As a practical matter these methods may overlap, however they are presented here as separate categories to better articulate their particular characteristics. These three competitively bid methods are:

- Contracts or purchase orders for services
- On-demand agreements
- ECMS system

The Commonwealth Procurement Code and the DGS Procurement Handbook both define services as “the furnishing of labor, time or effort by a contractor not involving the delivery of a specific end product other than drawings, specifications or reports which are merely incidental to the required performance. The term shall include the routine operation or the maintenance of existing structures, buildings or real property”.

Roadside spraying and mowing and electrical and plumbing work at maintenance sites are examples services.

On-demand agreements are useful for obtaining “on demand” contractors’ services for predetermined work items on structures. On –Demand Contracts are awarded based on contractors’ total costs for a variety of bridge repair activities on several structures within a given geographical area. Examples of work traditionally included in “on demand” contracts include: deck repairs, scour repairs, rock abutment/pier repointing, underpinning, and welding services.

Typically, the Department designs and prepares specifications for the work, which is then performed by contracted private firms. (ECMS NUMBERS 77520 and 76423)

Another use of Open-end agreements is to contract with a design consultant that prepares maintenance designs, as requested, through work orders. The maintenance work is then performed by Department forces or contractors.

An important advantage to open-end agreements or on-demand contracts is that response times for structure repair activities are significantly reduced. Contractors can be deployed relatively quickly, depending on the terms of their respective contracts. An important disadvantage of these contracts is that funding for the contracts is obligated upfront and these funds are not available for other uses if the contracts are not used during the contract period. Potential budgetary needs should be considered before entering into these kinds of agreements.

ECMS contracts are the traditional method of obtaining construction services for highways and bridges. These projects have proceeded through preliminary and final design processes and are awarded to the low bidder based on competitive bidding. Pre-qualified certified business partner contractors submit bids through the Department’s ECMS system and projects are awarded based on lowest responsible bid. These kinds of contracts may include significant bridge repairs, rehabilitation, or replacement, but may also include more preventive maintenance items for multiple bridges, or categories of repair/maintenance, such as repointing stonework for several bridges.

ECMS contracts may apply to specific sites and clearly outline the work to be done by the contractor, using the Department’s design, of bid as a design/build contract. This procedure may also apply to categories of work, such as a contract for bearing-cleaning on several bridges. For smaller bridges, if the cost of the labor exceeds the cost of the materials, an SPC may be employed to secure a contractor, but for larger bridges requiring specialized equipment, an ECMS contract may be used.

Emergency contracts are another method; contact the District or Central Office contracting section.

Contract Types

Contracting with private firms for services, equipment, or material is a well-regulated process or set of processes that must be considered carefully. There are several kinds of contracts typically used for work such as bridge maintenance, and several methods used by PennDOT for arranging contracts. Which contract type and method to use depends upon the needs of the Department, and the characteristics of the work.

There are four contract types that may be appropriately used for contracting maintenance work. These are:

- Unit Price
- Lump Sum
- Cost Reimbursement
- Negotiated Contracts

Unit Price contracts pay contractors for the actual amount of work completed, with the contracting agency retaining control over the extent of the contract. For example, a contract might require spall repair and pay for those repairs based upon the square feet of repair completed. This kind of contract also allows the contracting agency to enumerate potential variables and offer varying payments, depending on the conditions found on-site.

Lump Sum contracts are best used when there is some assurance that most or all possible project contingencies can be and have been anticipated. The kinds of bridge maintenance projects suitable for a lump sum contract are complete replacements of structure elements. This type of contract requires sufficient detail in the design plans and specifications to preclude inaccurate interpretation. If interpretation of plans and specifications is possible or potential variable exist, bidding contractors will suggest prices that account for the worst case, driving up the price of the contract.

Cost Reimbursement contracts assign predetermined rates to labor, equipment, and materials used to perform the contracted service. This kind of contract requires careful inspection and auditing to avoid disputes over quantities of work units applied to the project. Some contracting agencies have successfully used this contract type for supplementing agency forces with specialized personnel or equipment where needed. Contractor

Force Account allows the contractor to be paid based on time and materials with specified overhead profit.

Negotiated contracts are a good way to get the best value for certain kinds of services, such as professional engineering support. However, other services may be contracted using this type of contract. Negotiated contracts may be used when only one qualified service provider is available (sole-source contract), or in emergencies when one provider may be the best choice. Prior approval is required to use this method.

The Costs of Contracting

Care must be taken when considering contracting with private service providers to account for the costs of contracting. The Department will incur its own costs associated with contract development and deployment, and these costs should be weighed against the costs of using Department Forces for the work, if possible. Department costs include administrative costs associated with proposals, bid documents, and plans, negotiations, inspections, record-keeping, and verification. Against these costs must be weighed the costs of Department Forces such as overhead, payroll maintenance during inclement weather, the operational costs of equipment, and liability.

Chapter 8 Best Practices

- Include Bridge Preservation funding on the TIP.
- Develop a joint repair contract for Interstate bridges.
- Establish a preservation contract in each county to repair specific items.
- Districts can develop, bid and award bridge maintenance contracts to focus on Priority 1 activities in conjunction with some bridge replacements.

Chapter 9: Response Plans and Follow-Ups

Once bridge repair, preservation or preventative maintenance work items are complete, including bridge cleaning, the completed work may be reviewed by respective County, District and Regional PennDOT personnel. Compliance for bridge maintenance item completion will be reviewed as required within the Maintenance Accreditation and Performance Index (MAPI) metric(s). "Response Plans" for out of compliance MAPI bridge maintenance and or bridge asset management metrics will be developed in accordance with the processes outlined within the MAPI By-Laws.

Response Plan Entry Form

Below is a sample of the Response Plan entry form for a MAPI Focus Area. Each field will be explained below.

The screenshot shows a web-based form titled "Response to Asset Management Metrics(s)".

- Header:** "Response to Asset Management Metrics(s)"
- Form Fields:**
 - Start Year: [Dropdown]
 - End Year: [Dropdown]
 - District: [Dropdown]
 - County: [Dropdown]
 - Region: [Dropdown]
 - Guidance Document: [Text Field]
- Asset Management Metrics:** A list of metrics with checkboxes:
 - AM01 - Roadway - Cure Maintenance, Joint Sealing
 - AM02 - Roadway - Cure Maintenance, Crack Sealing
 - AM03 - Roadway - Cure Maintenance, Shoulder Cutting
 - AM04 - Roadway - Cure Maintenance, Side Ditching
 - AM05 - Roadway - Cure Maintenance, Seal Coat
 - AM11 - Pavement Management, Overall Performance Index (OPI)
 - AM12 - Pavement Management, International Roughness Index (IRI)
 - AM13 - Highway Lighting Conventional Lighting
- With Response Steps to address metric(s):** [Text Area]
- Please select Yes or No for the Maintenance Strategy Plan Themes related to the steps in the Response Plan:**
 - Budget: [Dropdown]
 - Cure Maintenance: [Dropdown]
 - Equipment: [Dropdown]
 - Human Resources: [Dropdown]
 - Performance Improvement: [Dropdown]
 - Quality: [Dropdown]
 - Safety: [Dropdown]
 - Scheduling: [Dropdown]
 - Winter: [Dropdown]
- Status:** [Dropdown, set to "Draft"]
- Attachments:** [Click here to attach a file]
- To be Completed by the Regional Manager Only:**
 - ADE Review: [Dropdown]
 - ADE Issue Date: [Text Field]
 - Regional Manager Review: [Dropdown]
 - BIM Issue Date: [Text Field]
 - Best Practice Indicator: [Dropdown]
 - Regional Manager Pin Comments: [Text Area]

Chapter 10: Bridge Replacements

Table of Contents

7325-01	REPAIR OR REPLACEMENT OF BRIDGE UNDER 8' IN LENGTH	10 - 3
7425-01	TOTAL REPLACEMENT OF BRIDGE OVER 8' IN LENGTH	10 - 8

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SAP ASSEMBLY NUMBER: 711-7325-01

BMS Flex-Action: NONE

ACTIVITY TITLE: REPAIR OR REPLACEMENT OF BRIDGE UNDER 8' IN LENGTH

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)

Section - 1000 Structures

1001 Cement Concrete Structures

1002 Reinforced Bars

BC-700 Bridge Construction Standards

BD-600 Bridge Design Standards

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Work can be most efficiently performed during periods of low water, which are most likely to occur in late summer or early fall.

WORK AREA

Entire structure including footings, abutments, wingwalls, superstructure, and deck. Also includes incidental roadway work including repaving of the roadway, and needs may require total replacement guiderail installation.

ACTIVITY DESCRIPTION SUMMARY

This activity includes all actions related to the repair or replacement of a masonry, concrete, or wood structure (arch culvert, box culvert- slab or wood deck structure, masonry, structure, etc.) under 8 feet in length and which cannot be charged to activity 711-7324 pipe or metal culvert replacements. All including cleaning, painting, repainting, under pinning, deck repair or replacement, abutment repair or replacement, wing wall repair or replacement, etc. is to be charged to this activity. Complete replacement shall be accomplished with the approval of the Assistant District Engineer for Maintenance and shall be charged to this activity even if the replacement structure increases the span length to greater than 8 feet. After completion, the structure over 8 feet shall be assigned a structure I. D. number and future maintenance work charged to the appropriate bridge activity cost function. The temporary traffic control set up shall be erected in accordance with PUB 213. This activity is stationary and may be either short or long term in duration. Environmental concerns such as wetlands, erosion

control, waterway pollution are to be addressed in the disposal of excavated and waste materials. Refer to Maintenance Manual PUB 23, Chapter 20, Page 20-8. Waste materials shall not be placed in wetlands or waterways. Waste materials must be stabilized. Rolling is acceptable stabilization.

PROCEDURE

1. Review plan and order materials well in advance of the project has started. Depending on the type and cost of materials the Department of General Services may be involved.
2. Install and maintain water diversion and erosion and sediment controls in accordance with the approved erosion and sediment plan.
3. Remove existing structure including footers as required for the construction of the new bridge. Dispose of excavated material and old structure in accordance with current waste disposal regulations.
4. Build replacement structure according to the approved plan and applicable section of PUB 408.
5. Remove any water diversion and erosion and sediment controls that have been placed.
6. Provide rock protection as required.
7. Construct roadway and guiderail as designed.
8. Seed and mulch areas disturbed during construction.
9. Remove siltation devices when growth is established.

Note: Comply with all applicable permit and procedural requirements of the Department of Environmental Protection, Pennsylvania Fish and Boat Commission and local Conservation Districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
	As Required		As Required		As Required
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
E.B.		N.E.		N.E.	

Box Culvert Replacement Example:



PennDOT District 8-0
 York County
 S.R. 3047 over Tributary to Beaver Creek

Single cell box culvert replaced with a precast concrete box culvert with precast end sections.

Design: Consultant Design (Open End Agreement) including application for stream permit

Construction: Precast Concrete Box Fabrication and Placement by Contract (Bid in DGS). Excavation, backfill, paving, and safety features by Department Forces.

Duration of Construction: 2 Weeks

Maintenance and Protection of Traffic: Detour



Equipment List:

- Excavator
- Pumps, temporary pipes for stream diversion
- Paver
- Compaction Equipment

Material List:

- AASHTO No. 8 bedding and No. 2A backfill with geotextile
- Riprap
- Bituminous Pavement
- Guiderail, posts, and end treatments
- Cement Concrete (Curb & End Block)
- Reinforcing Steel (Curb & End Block)
- Membrane Waterproofing (Post-Tensioning by Fabricator)



Installation of Erosion and Sedimentation Control devices and removal of existing bridge by Department Forces



Fish baffles required (above) by Fabricator in shop



Consultant designed box culvert

Fabrication, delivery, and placement of precast box culvert and end sections by contract.



Post-tensioning required. By Fabricator



Backfill by Department Forces





Riprap placement, paving, and installation of traffic safety features by Department Forces.



Procurement:

Bids are solicited through an existing contract.

4 contractors on current contract.

Lowest bidder selected.

Tracked in SAP

SAP ASSEMBLY NUMBER: 711-7425-01

BMS Flex-Action: NONE

ACTIVITY TITLE: REPAIR OR REPLACEMENT OF BRIDGE OVER 8' IN LENGTH

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section - 1000 Structures
 1001 Cement Concrete Structures
 1002 Reinforced Bars
 BC-700 Bridge Construction Standards
 BD-600 Bridge Design Standards

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Work can be most efficiently performed during periods of low water, which are most likely to occur in late summer or early fall.

WORK AREA

Entire structure including footings, abutments, wingwalls, superstructure, and deck. Also includes incidental roadway work including repaving of the roadway, and minimum guiderail installation.

ACTIVITY DESCRIPTION

This activity includes the removal of all existing structure elements including footings, abutments, wingwalls, concrete or steel superstructure and deck, and the construction of the replacement structure. The activity also includes the installation, maintenance, and removal of all erosion and sediment pollution control devices as described in the approved Erosion and Sediment Pollution Control Plan. The reconstruction of the roadway approaches on the existing alignment and the installation of minimum approach guiderail.

This activity will usually require a "5" numbered plan signed by the District Bridge Engineer, on approved Erosion and Sediment Pollution Control plan, and a Waterways Encroachment Permit issued by the Pennsylvania Department of Environmental Resources an H & H Study and Utility Clearance (D-419).

PROCEDURE

1. Review plan and order materials well in advance of the project has started. Depending on the type and cost of materials the Department of General Services may be RFQ involved.
2. Install and maintain water diversion and erosion and sediment controls in accordance with the approved erosion and sediment plan.
3. Remove existing structure including footers as required for the construction of the new bridge. Dispose of excavated material and old structure in accordance with current waste disposal regulations.
4. Build replacement structure according to the approved plan and applicable section of PUB 408.
5. Remove any water diversion and erosion and sediment controls that have been placed.
6. Provide rock protection as required.
7. Construct roadway and guiderail as designed.
8. Seed and mulch areas disturbed during construction.
9. Remove siltation devices when growth is established.

Note: Comply with all applicable permit and procedural requirements of the Department of Environmental Protection. Pennsylvania Fish and Boat Commission and local Conservation Districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
	As Required		As Required		As Required

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
E.B.	N.B.	N.B.

SAP ASSEMBLY NUMBER: 711-7425-01

BMS FLEX-ACTION: NONE

ACTIVITY TITLE: TOTAL REPLACEMENT-BRIDGE OVER 8' LENGTH

UNIT OF MEASUREMENT: EACH BRIDGE

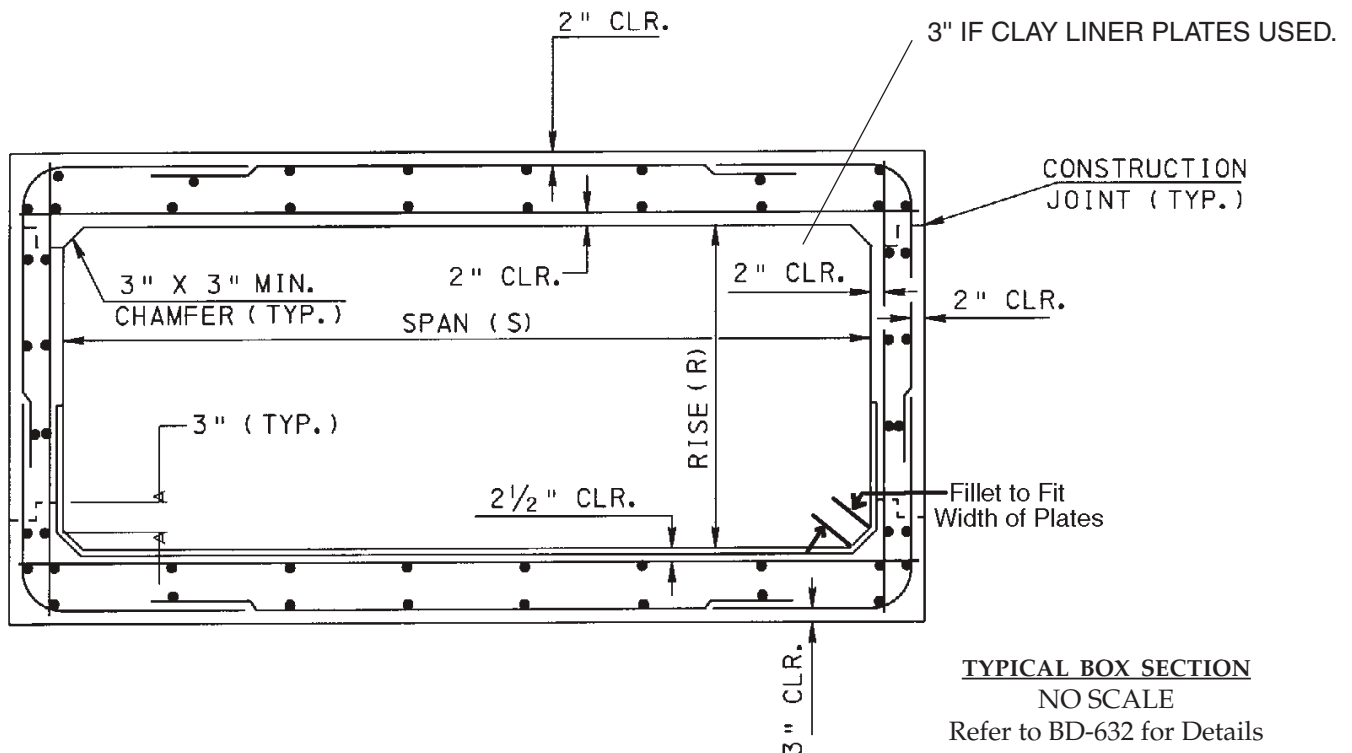
PROCEDURE: CAST IN PLACE ARCH CULVERT

PROCEDURE DESCRIPTION

1. Establish a detour, notify all involved, and check for utilities.
2. Construct sluices or other devices to divert the stream/ install siltation devices.
3. Remove the existing structure and excavate to design elevations.
4. Establish the working point locations as shown on the design.
5. Form tie rebar and place class A concrete.
6. For fills 2'-0" or less, install membrane waterproofing on the top slab of the box and 6" down each side.
7. Membrane on joints top & sides 2' width
8. Remove the sluices or other devices diverting stream.
9. Do not exceed a 2' difference in fillelevations on the sides during the placement of backfill.

10. Provide rock protection, class R-6 minimum, at each end of the box or apron up to 5' beyond the wings. The rock protection is to be 2'-6" nominal depth for the full width of the channel.
11. Construct roadway and guiderail as designed.
12. Seed and mulch areas disturbed during construction.
13. Remove siltation devices when growth is established.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish and Boat Commission and local Conservation Districts in accomplishing this procedure.



SAP ASSEMBLY NUMBER: 711-7425-01

BMS FLEX-ACTION: NONE

ACTIVITY TITLE: TOTAL REPLACEMENT-BRIDGE OVER 8' LENGTH

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: CAST IN PLACE ARCH CULVERT

PROCEDURE DESCRIPTION

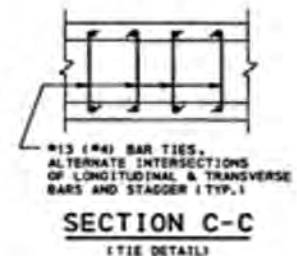
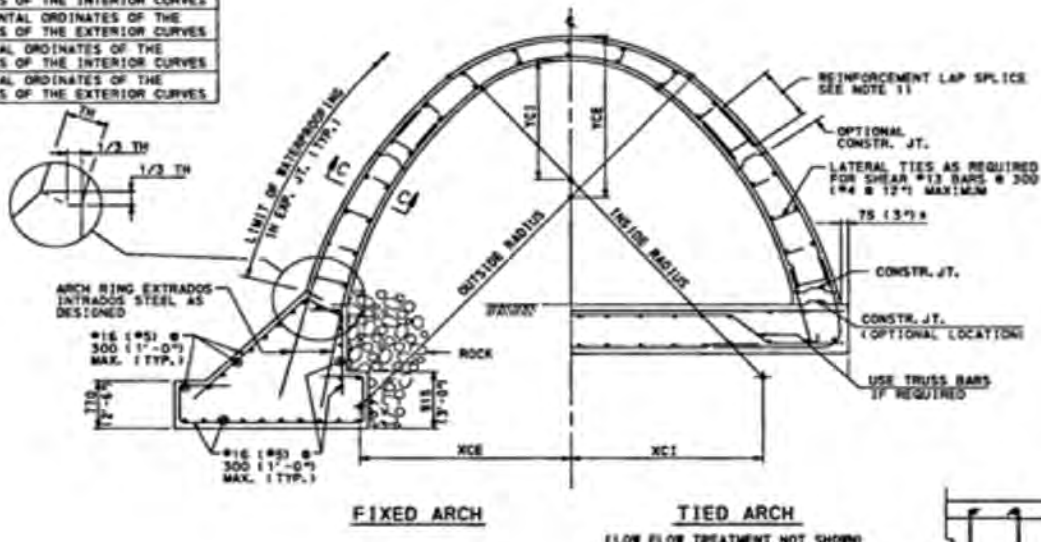
1. Establish a detour, notify all involved, and check for utilities.
2. Construct sluices or other devices to divert the stream/ install siltation devices.
3. Remove the existing structure and excavate to design elevations.
4. Establish the working point locations as shown on the design.
5. Form tie rebar and place class A concrete.
6. Remove the sluices or other devices diverting stream.
7. Do not exceed a 2' difference in fill elevations on the sides during the placement of backfill.
8. Provide rock protection, class R-6 minimum, at each end of the box or apron up to 5' beyond the wings. The rock protection is to

be 2'-6" minimum depth for the full width of the channel.

9. Construct roadway and guiderail as designed.
10. Seed and mulch areas disturbed during construction.
11. Remove siltation devices when growth is established.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Protection, Pennsylvania Fish Commission and local Conservation Districts in accomplishing this procedure.

MARK	DESCRIPTION
XCI	HORIZONTAL ORDINATES OF THE CENTERS OF THE INTERIOR CURVES
XCE	HORIZONTAL ORDINATES OF THE CENTERS OF THE EXTERIOR CURVES
YCI	VERTICAL ORDINATES OF THE CENTERS OF THE INTERIOR CURVES
YCE	VERTICAL ORDINATES OF THE CENTERS OF THE EXTERIOR CURVES



SAP ASSEMBLY NUMBER: 711-7425-01

BMS FLEX ACTION: NONE

ACTIVITY TITLE: TOTAL REPLACEMENT-BRIDGE OVER 8' LENGTH

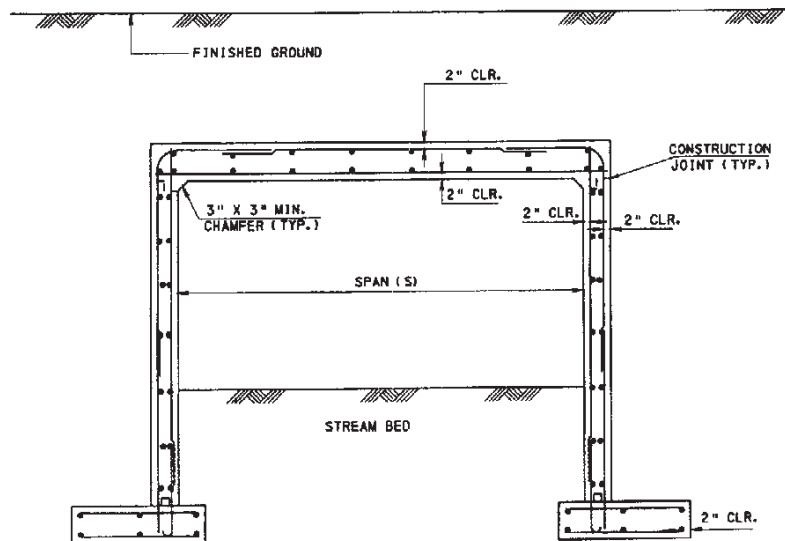
UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: CAST IN PLACE RIGID FRAME CULVERT

PROCEDURE DESCRIPTION

1. Establish a detour, notify all involved, and check for utilities.
2. Construct sluices or other devices to divert the stream/ install siltation devices.
3. Remove the existing structure and excavate to design elevations.
4. Establish the working point locations as shown on the design.
5. Form tie rebar and place class A concrete.
6. For fills 2'-0" or less, install membrane waterproofing on the top slab of the box and 6" down each side.
7. Membrane on joints top & sides 2' width
8. Remove the sluices or other devices diverting stream.
9. Do not exceed a 2' difference in fill elevations on the sides during the placement of backfill.
10. Provide rock protection, class R-6 minimum, at each end of the box or apron up to 5' beyond the wings. The rock protection is to be 2'-6" nominal depth for the full width of the channel.
11. Construct roadway and guiderail as designed.
12. Seed and mulch areas disturbed during construction.
13. Remove siltation devices when growth is established.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish and Boat Commission and local Conservation Districts in accomplishing this procedure.



TYPICAL RIGID FRAME SECTION

NO SCALE

Refer to BLC-535 for Details

SAP ASSEMBLY NUMBER: 711-7425-01**BMS FLEX ACTION:** NONE**ACTIVITY TITLE:** TOTAL REPLACEMENT-BRIDGE OVER 8' LENGTH**UNIT OF MEASUREMENT:** EACH BRIDGE**PROCEDURE:** PRECAST / PREFABRICATED CULVERTS

PROCEDURE DESCRIPTION

1. Establish and confirm a delivery date.
2. For purchased precast projects Fabricator responsible for culvert placement.
3. Establish a detour, notify all involved, and check for utilities.
4. Schedule the survey corp to establish working points with offset reference.
5. Schedule rental equipment for demolition and removal of the existing structure.
6. Construct sluices or other devices to divert the stream and install siltation devices.
7. Excavate to depths indicated on the design.
8. Prepare aggregate bedding or construct concrete footings as indicated on the design for the type of culvert to be used.
9. Prepare and follow a sequence of operations for setting and connecting the culvert and for water proofing if called for in the design.
10. Remove the sluices or other devices that diverted the stream.
11. Form, tie rebar, and place class A concrete in endwalls and wings or construct sloped endwalls.
12. Place and compact backfill in lifts uniformly on both sides of the culvert not to exceed 2' difference in fill elevations during backfill.
13. Provide rock protection class R-6 minimum at each end of the culvert.
14. Construct roadway and guiderail as designed.
15. Seed and mulch areas disturbed during construction.
16. Remove siltation devices when growth is established.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Protection, Pennsylvania Fish and Boat Commission and local Conservation Districts in accomplishing this procedure.

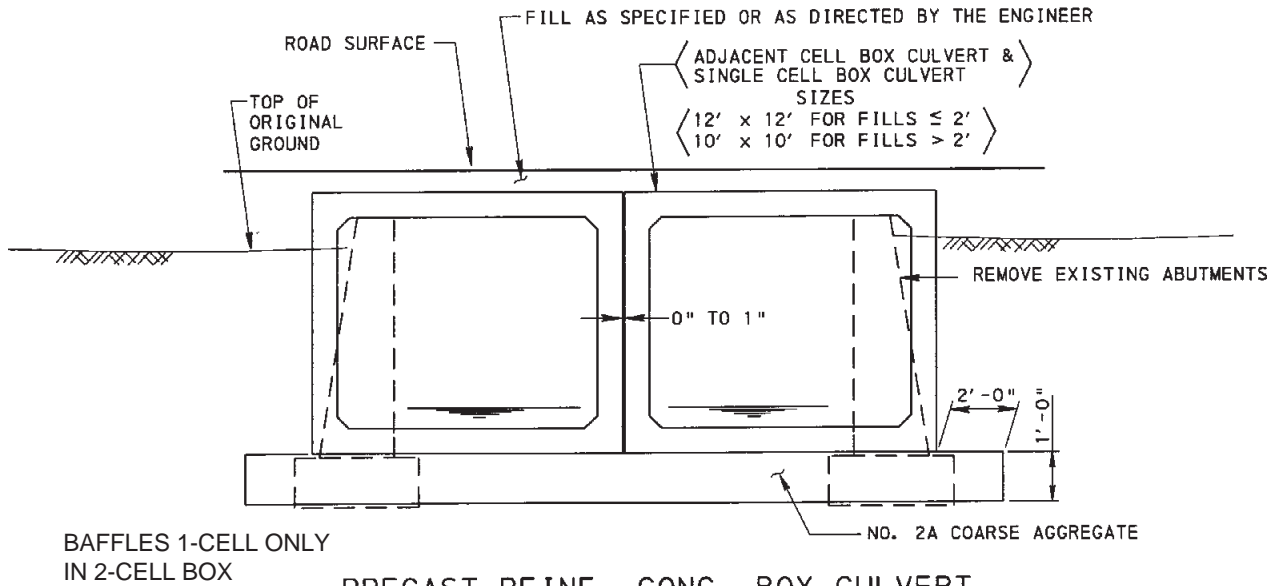
SAP ASSEMBLY NUMBER: 711-7425-01

BMS FLEX ACTION: NONE

ACTIVITY TITLE: TOTAL REPLACEMENT-BRIDGE OVER 8' LENGTH

UNIT OF MEASUREMENT: EACH BRIDGE

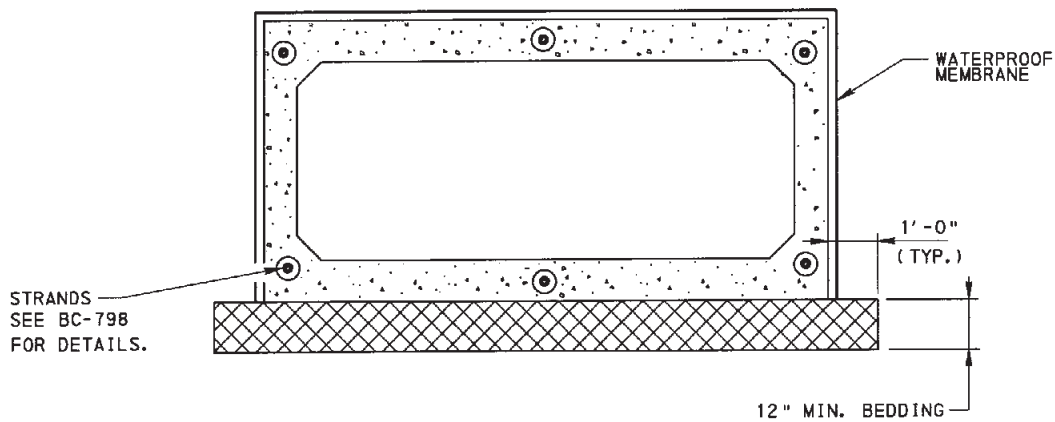
PROCEDURE: R.C. BOX CULVERT



BAFFLES 1-CELL ONLY
IN 2-CELL BOX

PRECAST REINF. CONC. BOX CULVERT

NOTE: PROVIDE CONCRETE HEADWALLS AT INLET AND OUTLET
REFER TO BD-632 FOR DETAILS



TYP. PRECAST BOX SECTION

NO SCALE
REFER TO BD-632 AND BC-798 FOR DETAILS

DEPRESS 1' W/FISH BAFFLES

SAP ASSEMBLY NUMBER: 711-7425-01

BMS FLEX ACTION: NONE

ACTIVITY TITLE: TOTAL REPLACEMENT-BRIDGE OVER 8' LENGTH

UNIT OF MEASUREMENT: EACH BRIDGE

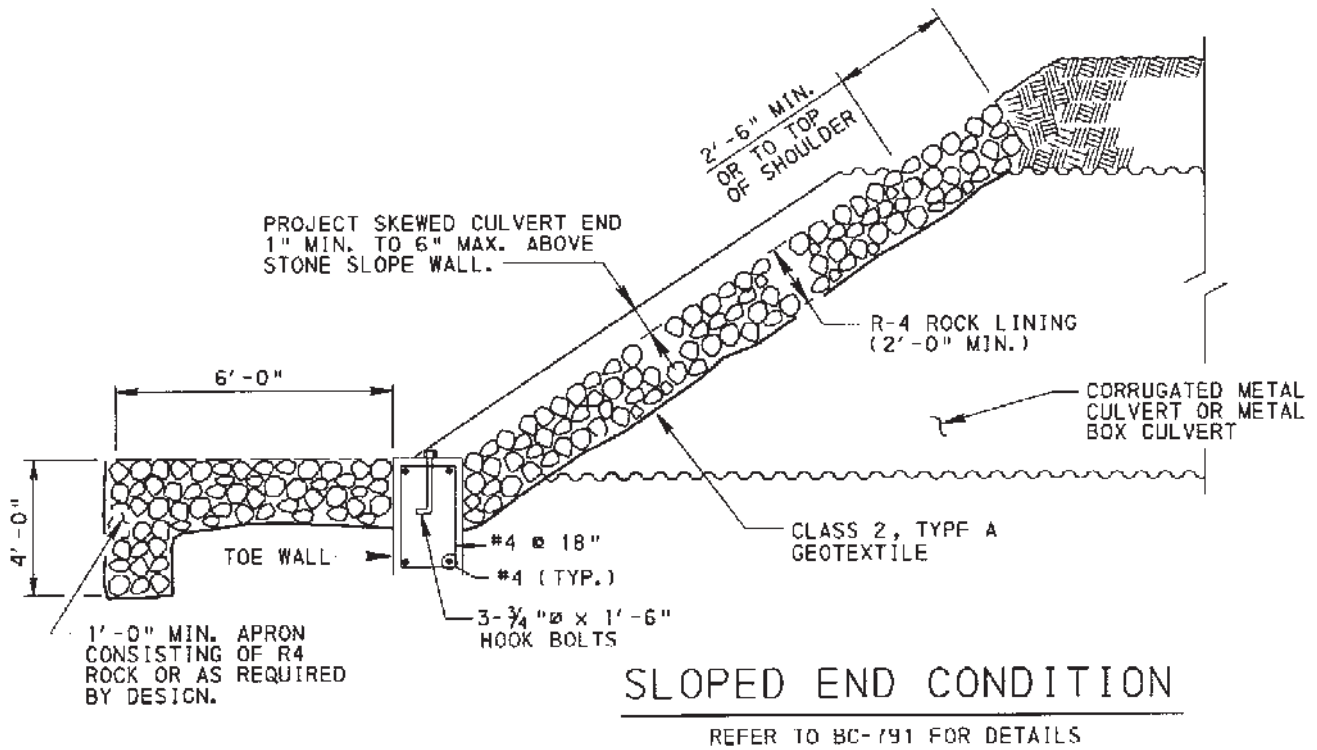
PROCEDURE: R.C. BOX CULVERT



PROCEDURE: METAL CULVERT - CONCRETE ENDWALL



PROCEDURE: METAL CULVERT - SLOPED END CONDITION



Bridge Replacement

BRIDGE REPLACEMENT – PRECAST CONCRETE CHANNEL BEAMS ON PRECAST CONCRETE BLOCK ABUTMENTS



PennDOT District 1-0
Crawford and Mercer Counties

S.R. 4011 (Crawford) and S.R. 1028 (Mercer) in
Meadville over Cussewago Creek

Single span bridge replacement with single span
reinforced concrete channel beam bridge supported
on reinforced concrete block abutments.

Design: In-House by District personnel

Construction: Crawford County Bridge Crew

Duration: 6 weeks

Maintenance and Protection of Traffic: Road
closure with detour.

Cost: \$110,390

Equipment List:

Excavator(s)
Crane
Concrete Forms
Survey Equipment
Water Pumps (E&S)

Material List:

Reinforcing Steel
Class A, AA, and AAA Cement Concrete
Structure backfill and geotextile
Precast RC Blocks (by Department Forces)
Precast RC Channel Beams (by Department forces)
Riprap



Removal of existing bridge and installation of cast-in-place spread footing by Department Forces



Installation of prestressed concrete channel beams by department forces.



Installation of precast concrete block stem and wingwalls.



Placement of barriers and bituminous overlay (non-composite), backfill, paving, and installation of traffic safety features by Department Forces.





Precast Concrete Blocks cast by Department Forces
 3 feet x 3 feet x 3 feet
 6 feet x 3 feet x 3 feet
 9 feet x 3 feet x 3 feet
 12 feet x 3 feet x 3 feet (consider handling)

Precast channel beams cast by Department Forces up to 35 feet long. May be composite or non-composite. Design from BD Standard.

Reinforced Concrete Block Abutments

Lessons Learned:

- 1 - Joints are not sealed to allow drainage (in place of weepholes).
- 2 - Consider handling when determining block sizes.
- 3 - Beam seat must be CIP.
- 4 - Width of precast blocks may allow for elimination of CIP footer. District 1-0 is investigating structure with no footer.
- 5- For additional width, a wide shear key (up to 1 foot) may be cast between two interior beams. Formwork must be supported from beneath.



Other precast structures available:

- Con-Span Arch (Shorter Span)
- Bebo Arch (Longer Span)
- Box Culvert



SAP ASSEMBLY NUMBER: 711-7425-01

BMS FLEX ACTION: NONE

ACTIVITY TITLE: TOTAL REPLACEMENT-BRIDGE OVER 8' LENGTH

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GEOSYNTHETIC REINFORCED SOIL - INTEGRATED BRIDGE SYSTEM (GRS-IBS)

REFERENCES

PennDOT Publication 447 Approved Products for Low Volume Local Roads PennDOT Bridge Design Standard BD- 697M Geosynthetic Reinforced Soil Integrated Bridge System
 FHWA-HRT-11-026 Geosynthetic Reinforced Soil Integrated Bridge System Interim Implementation Guide
 FHWA-HRT-11-027 Geosynthetic Reinforced Soil Integrated Bridge System Synthesis Report
 FHWA-HRT-12-051 Sample Guide Specification for Construction of Geosynthetic Reinforced Soil-Integrated Bridge System (GRS-IBS)

ACTIVITY DESCRIPTION

GRS-IBS is a fast, cost-effective method of bridge support that integrates the roadway and bridge superstructure to create a jointless interface (Figure 1). It consists of three main components:

- the reinforced soil foundation (RSF);
- the GRS abutment;
- the integrated approach (IA).

The RSF is composed of granular fill material that is compacted and encapsulated with a geotextile fabric. The RSF provides embedment and increases the bearing width and capacity of the GRS abutment. The RSF also prevents water

from infiltrating underneath and into the GRS mass from a river or stream crossing.

The GRS abutment consists of closely spaced layers of geosynthetic reinforcement and compacted granular fill material with a facing. The superstructure is supported by alternating layers of compacted fill and closely spaced geosynthetic reinforcement located in the upper portion of the abutment. The superstructure is placed directly on the GRS abutment without a joint.

A composite superstructure must be used for adjacent beams in Pennsylvania. Dependent on superstructure type, a cast-in-place (CIP) or precast (PC) concrete beam seat may be required (see BD-697M Note #7 of Design Methodology). Place beam seat directly on the GRS abutment before the beams are set. GRS is also used to construct the integrated approach to transition to the superstructure that allows for a smooth changeover from the roadway to bridge surface.

The three main materials involved in GRS construction are:

- the facing element (typically concrete masonry units, CMUs);
- the granular backfill;
- the geotextile material.

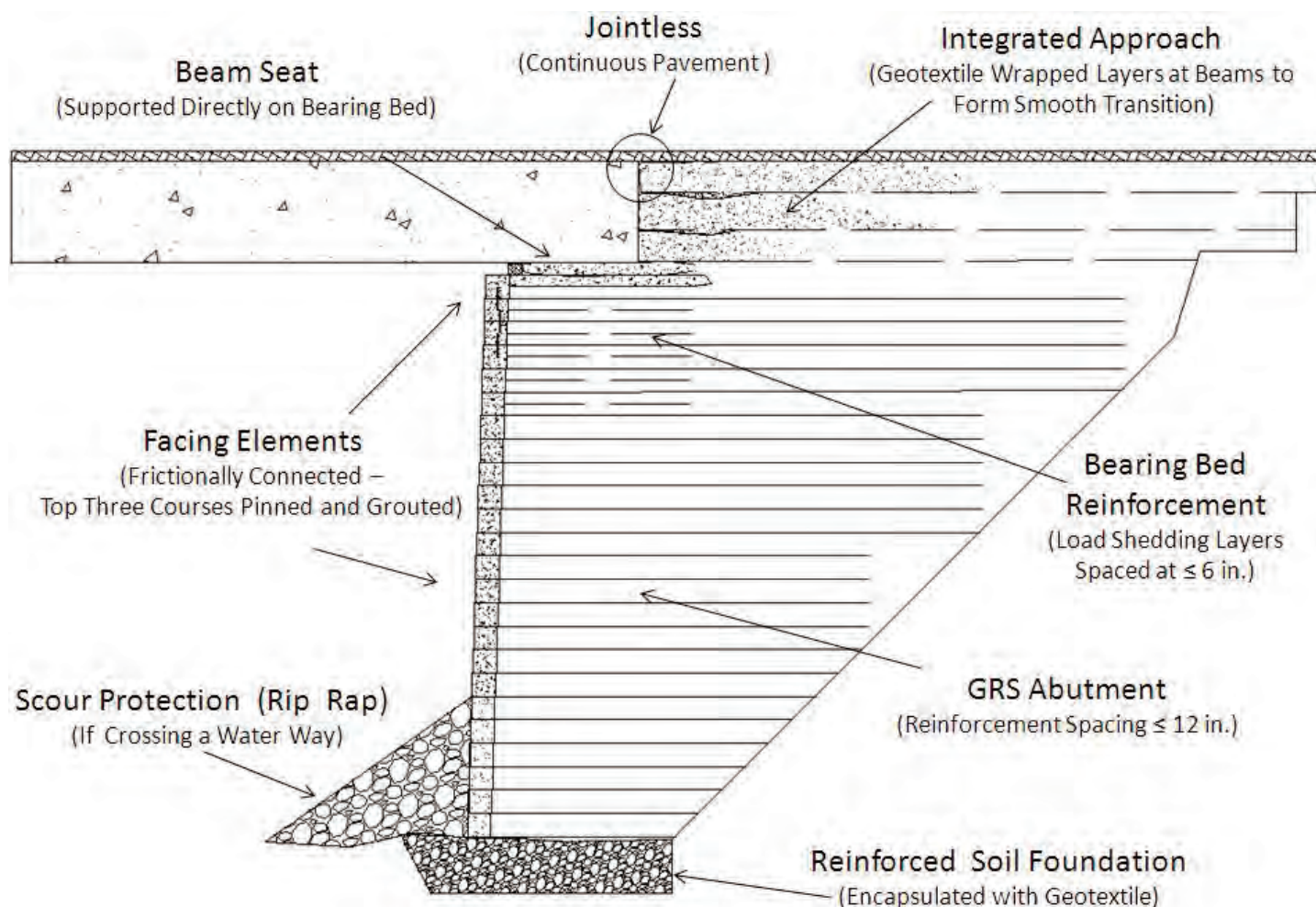


FIGURE 1. Typical GRS-IBS cross section (Image reproduced from Publication No. FHWA-HRT-11-026) (Note: PennDOT maximum Reinforcement Spacing is 8 in. and facing elements are to be true vertical.)

The first GRS bridge was completed in Pennsylvania in 2011, in Huston Township, Clearfield County. That bridge was built by a township workforce with PennDOT using PennDOT-specified materials. It has performed extremely well with an average settlement of only 0.01 feet over the first year after construction.

SCHEDULING CONSIDERATIONS

Pennsylvania-specific specification has been developed for and is included in Publication 447; Specification NP-0050 Geosynthetically Reinforced Soil – Integrated Bridge System (GRS-IBS). The design and construction of the GRS-IBS in Pennsylvania shall be based on NP-0050 Use and Design Guidelines for Evaluating and Determining the Implementation of a Geosynthetic Reinforced Soil – Integrated Bridge System. The specification can also be applied to bridges on state routes,

where appropriate as determined by the District Bridge Engineer.

The design of a GRS-IBS must be prepared in accordance with Publication 447 and Standard Drawing BD-697M and sealed by a professional engineer licensed in the Commonwealth of Pennsylvania.

The construction must be in accordance with the GRS-IBS construction specification provided in Publication 447.

The GRS abutments can be built behind the existing abutments and the existing abutments left in place for scour protection. Or, if the existing abutments are in good condition, the existing abutments can be reused as the facing unit and the geotextile wrap faced behind the abutments when suitable as determined by the District Bridge Engineer.

REFERENCES

A typical labor crew on GRS-IBS projects consists of about five workers: four laborers and an equipment operator. It takes approximately 3 days to construct one abutment. The equipment operator is responsible for shaping the excavation to facilitate construction of the RSF and the GRS abutment in addition to placing fill material and moving facing material units to the work area. Typically, one member of the labor crew has the role of foreman and is responsible for layout of excavation limits, grades, alignment of wall face, placement of facing blocks, compaction of fill, placement of geosynthetic reinforcement, and other activities to streamline production and flow of material to the job site.

PROCEDURE DESCRIPTION

1. Review Specification NP-0050, Standard Drawing BD-697M, and the project specific construction plans and specifications.
2. Establish maintenance and protection of traffic before construction. The road will need to be closed or realigned since this type of construction is typically not conducive to a phased construction environment (PennDOT Publication 408, Section 901).
3. Install and maintain water diversion and erosion and sediment controls in accordance with the approved erosion and sediment pollution control plan. Divert surface drainage away from the work area.
4. Remove portions, or all, of the existing structure as indicated on the construction plans. Dispose of excavated material and the old structure in accordance with current waste disposal regulations.
5. Establish survey point locations as shown on the construction plans.
6. Establish the position of the excavator. Locate it where it can both reach and place material with a minimal amount of movement.
7. Excavate to design elevations and level the base of the RSF. Excavate to uniform depth and remove all loose and unsuitable material. Compact the excavation, if specified. Have the completed excavation inspected by a geotechnical engineer prior to constructing the RSF.
8. Construct the RSF. Place the geotextile reinforcement extending the material up the sides of the excavation leaving adequate material for encapsulation. Place fill material in lifts and compact. Grade and level the top of the RSF prior to final encapsulation. This will serve as the leveling pad for the CMU blocks of the GRS abutment. Encapsulate the RSF in geotextile reinforcement on all sides with minimum overlap of 3.0 feet. Use a thin layer of leveling aggregate, if needed.
9. Construct the GRS Abutment. Place the first row of CMU blocks. A thin layer of leveling aggregate or mason sand can be utilized to level the first row of blocks. **The level and plumb nature of this layer is critical to the success of the remainder of the wall.** Place and compact backfill material. Use a lightweight vibrating plate within three feet of the wall. Ensure the CMUs remain in place, level and vertical during compaction. If dislodged, reset with a rubber mallet or similar manner. Maintain full contact between blocks and reinforcement. Lay successive layers of geotextile across tops of the compacted backfill and CMUs for friction connection. Extend geotextile fabric beyond the wall face and trim with a utility knife or propane torch after placement of successive courses. Cut an "X" or melt the opening with the propane torch in geotextile reinforcement where required for placement of rebar and concrete in CMUs. Continue to place the alternating layers of facing block with backfill material and geotextile fabric. Pay careful attention to wall level and plumb throughout the process. Place solid core CMUs to top of riprap. Stagger the blocks of the rows to offset the vertical joints. Place u- shaped rebar and concrete at the corners for other than 90 degree wingwalls (with overlapping wing and abutment wall blocks).

10. Place filter fabric and riprap scour protection. Carefully place the rocks to not damage the CMUs. Protect the wall face with plywood sheeting if necessary during placement.
11. Construct bearing bed zone with geotextile reinforcement at a closer vertical spacing.
12. Place rebar and concrete in voids of CMUs where indicated on the construction plans.
13. Install foam board and solid CMUs behind front face CMUs. Grade the top of the fill material as needed to provide the specified beam seat elevations and roadway crown if required.
14. Install foam board and aluminum flashing on top of front face CMUs, if required by design plans.
15. Place superstructure. The crane or equipment used for the placement of the superstructure can be

positioned on the GRS abutment provided the outrigger pad criteria described in BD-697M are met.
16. Construct integrated approach. Place the wrapped geotextile layers along the back of the superstructure to a minimum of 2 inches below the top of the superstructure to allow for at least 2 inches of aggregate base cover over the geotextile reinforcement to protect it from hot mix asphalt. Wrap face the geotextile layers at the back of the superstructure.
17. Construct roadway as designed. Construct drainage channels outside of wingwalls as needed to direct roadway drainage away from wingwalls.
18. Construct guide rail as designed. Drive steel guide rail posts through geotextile. For timber posts, precut holes in geotextile during installation.
19. Seed and mulch areas disturbed during construction.
20. Remove erosion and sediment pollution controls when vegetation growth is established.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Protection, Pennsylvania Fish and Boat Commission and local Conservation Districts in accomplishing this procedure.



FIGURE 2. The 18-ft span Mount Pleasant Road Bridge constructed in Huston Township, Clearfield County, PA, in 2011.



FIGURE 3. The Sandy Township, Clearfield County, Old Bliss Run Road Bridge over Mountain Run – Granular backfill placement.



FIGURE 4. The Sandy Township, Clearfield County, Old Bliss Run Road Bridge over Mountain Run – Geosynthetic reinforcement, granular backfill, and CMU facing element. Note “X” cut in geotextile to allow for reinforcement/concrete placement.



FIGURE 5. The Sandy Township, Clearfield County, Old Bliss Run Road Bridge over Mountain Run – Completed bridge.



FIGURE 6. The Crawford County, Brown Hill Road (SR 1016) Bridge over Federal Run – Precast concrete channel beams for a concrete bridge deck installed on GRS abutments. District 1-0 accrued cost savings by fabricating the concrete channel beams in-house.



FIGURE 7. The Sandy Township, Clearfield County, Old Bliss Run Road Bridge over Mountain Run – Completed bridge.

Chapter 11: Cleaning

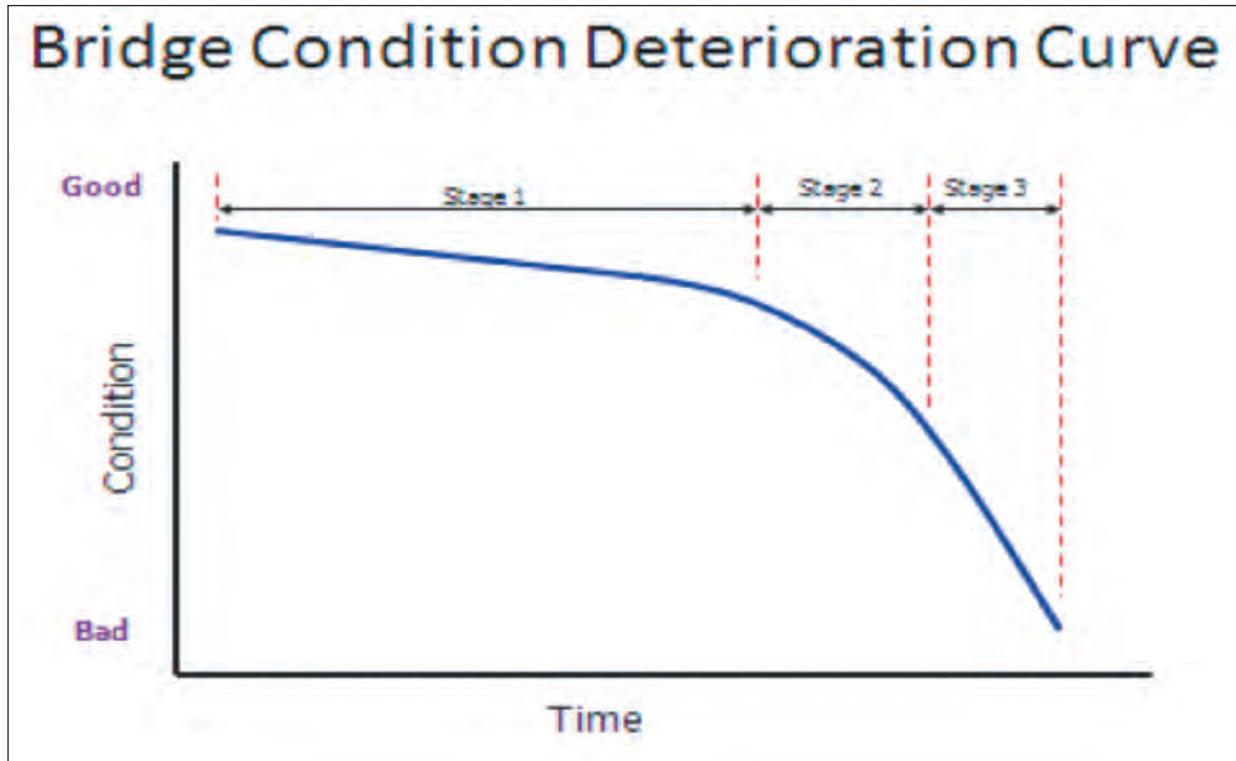
Table of Contents

7431-01	DECK	11 - 4
7431-01	SCUPPERS/DOWNSPOUTING	11 - 6
7431-02	BEARING/BEARING SEAT	11 - 8
7431-02	STEEL HORIZONTAL SURFACES	11 - 10
7431-03	OPEN GRID DECKS AND THEIR SUPPORTING STRUCTURE	11 - 12

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Introduction to Cleaning

All Districts should have an annual Preventative Maintenance Plan. This Plan is vital to extending the serviceability and life cycle of bridges. Regular cleaning and preventive maintenance can extend service life of bridges and prevent accumulation of higher priority maintenance items. Preventive maintenance activities include deck and drainage system cleaning, cleaning and lubricating expansion bearings, and sealing concrete decks or substructures. The goal is to keep the bridge health in stage 1 as long as possible.



The importance of scheduling and implementing preventive maintenance measures cannot be emphasized enough. Preventive maintenance is considered to be a primary deterrent to premature deterioration of critical structural elements of bridges, and as such, commands high priority !in the realm of work planning, scheduling, and accomplishment.

SAP ASSEMBLY NUMBER: 711-7431-01

BMS Flex-Action: A743101

ACTIVITY TITLE: CLEAN/FLUSH DECK

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

None

SCHEDULING CONSIDERATIONS

Should be performed at least once annually, after winter maintenance operations have been completed. Additional times based on need. In areas where salt and anti-skid applications are particularly heavy, additional cleanings as weather permits during the winter should be considered. Coordinate cleaning activities with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission to minimize flushing activities during periods of heavy use for fishing, boating or other water sports. Follow the Pennsylvania Fish & Boat Commission Stocked Trout Stream - Bridge Flushing Requirements section below regarding bridge flushing on stocked trout streams from (see page 11-14 for in-stream dates). For cleaning activities involving native trout streams, consult with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission for spawning periods prior to initiating work.

WORK AREA

Entire deck between backs of the abutment backwalls including joints, gutters, curbs, sidewalks, parapets, railings, concrete median strips, and the portions of appurtenances, such as light and sign standards, that can be reached without special lift equipment. Deck joints include both the upper exposed surface attached to the concrete as well as the area beneath the joint that is intended to remove water from the deck, and the top and upper edge of the compression seals joints.

ACTIVITY DESCRIPTION

Removing all salt, anti-skid, dirt, debris, and other deleterious material from the work area by brooming, shoveling, or mechanical means. Removing any residual material by flushing, as appropriate for maximum efficiency.

PROCEDURE DESCRIPTION

1. Sweep loose material from parapets, railings, and sidewalks onto bridge deck by manual or mechanical means. Utilize mechanical

removal devices (i.e., street sweepers) in areas where the equipment is available.

2. Sweep and collect material from the deck. Do not deposit material in drainage facilities or joints. Minimize discharge of loose material, grit and debris into the waters of the Commonwealth.
3. Remove remaining dirt and debris from deck joints and drains. Use high pressure air, or, when necessary, high pressure water, to remove dirt and gravel from strip seal glands and tooth dam troughs and compression joints to ensure water flows freely and that the seals don't get broken. Clean debris and dirt from top and edge of compression joints. Do not touch the seal with the wand nozzle. If using Anti-icing truck tankers, make sure the tanks have been cleaned and are free of salt before using to flush bridge decks.
4. Dispose of collected cleanings at a proper disposal or fill site.
5. Use clean water when flushing the deck. Water should be obtained from the same water body that the bridge being cleaned spans. For small streams, where a significant decrease in stream flow is likely, water may be brought to the site providing it is of equal or better quality than the background stream quality.
6. Minimize the amount of debris entering the water body. Cover or plug scuppers to prevent debris and cleaning water from entering the stream. Use best management practices (BMP's). Exercise special care when cleaning bridges over High Quality (HQ) or Exceptional Value (EV) waterways.
7. When cleaning open grid decks flush supporting structural members also.
8. Use hay bales, temporary silt fencing, and other erosion control measures where necessary to prevent stream bank sediments from entering the stream.

ACTIVITY REQUIREMENTS

LABOR	EQUIPMENT	MATERIAL
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NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Sweeper (Optional)		Water
2	Crew Members	1	Water Tank with pressure hoses or compressor (Optional)		
1	Special Crew Member (Operator)	1	Front End Loader (Optional)		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
_ Bridge */HR	3 Bridges/DAY	8 MH/Bridge

SAP ASSEMBLY NUMBER: 711-7431-01

BMS Flex-Action: B743101

ACTIVITY TITLE: CLEAN/FLUSH SCUPPERS AND DOWNSPOUTS

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

1. Clean bridge decks in accordance with Publication 23 Chapter 16.
2. See Page 11-14 for Pennsylvania Fish and Boat Commission In-stream Work Restriction dates.

SCHEDULING CONSIDERATIONS

Should be performed at least once annually, after winter maintenance operations have been completed, and is normally accomplished concurrently with cleaning of the deck. Additional cleanings, as necessary, to keep scuppers and downspouts clear and drainage water flowing freely. In areas where salt and antiskid applications are particularly heavy, additional cleanings as weather permits during the winter months should be considered. Coordinate cleaning activities with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission to minimize flushing activities during periods of heavy use for fishing, boating or other water sports. Follow the Pennsylvania Fish & Boat Commission Stocked Trout Stream - Bridge Flushing Requirements section below regarding bridge flushing on stocked trout streams from (see page 11-14 for in-stream dates). For cleaning activities involving native trout streams, consult with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission for spawning periods prior to initiating work.

WORK AREA

All scuppers and downspouts

ACTIVITY DESCRIPTION

Removing all salt, anti-skid, dirt debris and other deleterious material from scuppers and drains by hand or mechanical means. Removing any residual material by flushing, air blasting or mechanical devices, as appropriate for maximum efficiency.

PROCEDURE DESCRIPTION

1. Remove debris from grating and lift grating from scupper.

2. Remove debris and sediment from scupper box and pipe.
3. Flush pipe and downspouting with water. Do not use high-pressure water that may damage joints or anchors. Minimize discharge of loose material, grit and debris into the waters of the Commonwealth.
4. If debris has accumulated in downspouting, remove cleanout plugs as necessary and dislodge with water, snakes, or "roto-rooter" type devices.
5. Replace grating and cleanout plugs.
6. Dispose of collected cleanings at a proper disposal or fill site.
7. Use clean water when flushing scuppers and downspouts. Water should be obtained from the same water body that the bridge being cleaned spans. For small streams, where a significant decrease in stream flow is likely, water may be brought to the site providing it is of equal or better quality than the background stream quality.
8. Minimize the amount of debris entering the water body. Utilize best management practices (BMPs) when cleaning bridges over High Quality (HQ) or Exceptional Value (EV) waterways.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Water tank (Optional)		Water
2	Crew Members	1	Snakes or		
1	Special Crew Member (Operator)		Roto-rooter (Optional)		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
2 Bridge/HR	3 Bridges/DAY	2 MH/Bridge

SAP ASSEMBLY NUMBER: 711-7431-02

BMS Flex-Action: C743102

ACTIVITY TITLE: CLEAN/FLUSH BEARING/BEARING SEAT

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

1. See Page 11-14 for Pennsylvania Fish and Boat Commission In-stream Work Restriction dates.

SCHEDULING CONSIDERATIONS

Should be performed at least once annually, after winter maintenance operations have been completed, on work areas underneath open joints, finger joints and other floor expansion joints which permit the passage of water carrying salt, anti-skid and other debris. Additional times, as necessary, under open floor joints and under sealed joints to keep bearings and areas around them free of deleterious materials. Coordinate cleaning activities with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission to minimize flushing activities during periods of heavy use for fishing, boating or other water sports. Follow the Pennsylvania Fish & Boat Commission Stocked Trout Stream - Bridge Flushing Requirements section below regarding bridge flushing on stocked trout streams from (see page 11-14 for in-stream dates). For cleaning activities involving native trout streams, consult with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission for spawning periods prior to initiating work.

WORK AREA

All bearings and bearing seats at all piers and abutments.

ACTIVITY DESCRIPTION

Removing all salt, anti-skid, dirt, debris and other deleterious material from the work area by scraping, brushing, or by other hand or mechanical means. Removing any residual material by flushing, as appropriate for maximum efficiency.

PROCEDURE DESCRIPTION

1. Set up scaffolding or ladders, or position manlift or snooper truck as required.
2. Manually dry clean the bearing and bearing seats, by scraping, brushing or chipping all accumulated debris. Material should be

collected and disposed of at a proper disposal or fill site.

3. Remove loose paint by dry brushing. Collect and dispose of at an approved disposal site. Avoid paint chips from entering water bodies.
4. Thoroughly flush all bearings and bearing seats at piers and abutments with pressurized water to remove salt, dirt and debris, that could not be removed by manual cleaning methods.
5. Limit wet cleaning to (5) feet on either side of the joint at the pier, unless debris in other areas require further cleaning. Clean (5) five feet from each abutment.
6. Use clean water when flushing the bearings and bearing seat. Water should be obtained from the same water body that the bridge being cleaned spans. For small streams, where a significant decrease in stream flow is likely, water may be brought to the site providing it is of equal or better quality than the background stream quality.
7. Minimize the amount of debris entering the water body. Exercise special care when cleaning bridges over High Quality (HQ) or Exceptional Value (EV) waterways.
8. Use hay bales, temporary silt fencing, and other erosion control measures where necessary to prevent stream bank sediments from entering the stream.
9. Refer to Chapter 15 for Bearing lubrication. Perform at regular intervals. The work area is all contacted metal surfaces that are not permanently lubricated. Clean contact surfaces, surrounding area of rust, and old lubricant. Place new penetrating spray grease.



ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Water Tank with pressure hoses or compressor		Water
2	Crew Members				
1	Special Crew Member (Operator)	As Required	Access Equip		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1/2 Bridge */HR	3 Bridges/DAY	8 MH/Bridge

(* average bridge of 25' x 100'.)

SAP ASSEMBLY NUMBER: 711-7431-02

BMS Flex-Action: D743102

ACTIVITY TITLE: CLEAN/FLUSH STEEL HORIZONTAL SURFACES

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

1. See Page 11-14 for Pennsylvania Fish and Boat Commission In-stream Work Restriction dates.

SCHEDULING CONSIDERATIONS

Should be performed at least once annually, after winter maintenance operations have been completed, on surfaces exposed to water contaminated by deicing chemical, and in places where anti-skid collects. As required on other surfaces to remove dirt, debris, bird droppings, and other deleterious materials which can reduce paint longevity and/or promote corrosion. Coordinate cleaning activities with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission to minimize flushing activities during periods of heavy use for fishing, boating or other water sports. Follow the Pennsylvania Fish & Boat Commission Stocked Trout Stream - Bridge Flushing Requirements section below regarding bridge flushing on stocked trout streams from (see page 11-14 for in-stream dates). For cleaning activities involving native trout streams, consult with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission for spawning periods prior to initiating work.

WORK AREA

All horizontal surfaces of structural steel members except the top surfaces of beams and stringers to which open grid flooring is directly attached. The cleaning of these surfaces shall be included with Activity A743101, Clean/Flush Deck.

ACTIVITY DESCRIPTION

Removing all salt, anti-skid, dirt, debris and other deleterious materials from the work area by scraping, brushing or by other hand or mechanical means. Removing any residual material by flushing, as appropriate for maximum efficiency.

PROCEDURE DESCRIPTION

1. Set up scaffolding or ladders or position manlift or snooper truck as required.
2. Manually dry clean the horizontal surfaces,

by scraping, brushing or by other hand or mechanical means all accumulated debris. Material should be collected and disposed of at an approved disposal site.

3. Remove loose paint by dry brushing. Collect and dispose of at an approved disposal site. Avoid paint chips from entering water bodies.
4. Thoroughly flush all horizontal surfaces of structural steel members, with pressurized water to remove salt, dirt and debris, that could not be removed by manual cleaning methods.
5. Limit wet cleaning of steel horizontal surfaces to five (5) feet on either side of the joint at the pier and five (5) feet out from the abutment, unless debris in other areas require further cleaning. Fascia beams may be flushed their entire length.
6. Use clean water when flushing steel horizontal surfaces. Water should be obtained from the same water body that the bridge being cleaned spans. For small streams, where a significant decrease in stream flow is likely, water may be brought to the site providing it is of equal or better quality than the background stream quality.
7. Minimize the amount of debris entering the water body. Utilize Best Management Practices (BMPs) when cleaning bridges over High Quality (HQ) or Exceptional Value (EV) waterways.
8. Use hay bales, temporary silt fencing, and other erosion control measures where necessary to prevent stream bank sediments from entering the stream.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Water Tank with pressure hoses or compressor Access Equip		Water
2	Crew Members				
1	Special Crew Member (Operator)	1			
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
1/2 Bridge /HR		3 Bridges/DAY		8 MH/Bridge	

(* average bridge of 25' x 100'.)

SAP ASSEMBLY NUMBER: 711-7431-03

BMS Flex-Action: A743101

ACTIVITY TITLE: CLEAN/FLUSH OPEN GRID DECKS AND THEIR SUPPORTING STRUCTURES

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

1. See Page 11-14 for Pennsylvania Fish and Boat Commission In-stream Work Restriction dates.

SCHEDULING CONSIDERATIONS

Should be performed at least once annually, after winter maintenance operations have been completed. Additional times based on need. In areas where salt and anti-skid applications are particularly heavy, additional cleanings as weather permits during the winter should be considered. Coordinate cleaning activities with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission to minimize flushing activities during periods of heavy use for fishing, boating or other water sports. Follow the Pennsylvania Fish & Boat Commission Stocked Trout Stream - Bridge Flushing Requirements section below regarding bridge flushing on stocked trout streams (see page 11-14 for in-stream dates). For cleaning activities involving native trout streams, consult with the Pennsylvania Department of Environmental Protection and the Pennsylvania Fish and Boat Commission for spawning periods prior to initiating work.

WORK AREA

Entire deck between the backs of the abutment backwalls including gutters, curbs, sidewalks, parapets, railings, and the portions of appurtenances, such as light and sign standards, that can be reached without special lift equipment.

ACTIVITY DESCRIPTION

Removing all salt, anti-skid, dirt, debris, and other deleterious material from the work area by brooming, shoveling, or mechanical means. Removing any residual material by flushing, as appropriate for maximum efficiency.

PROCEDURE DESCRIPTION

1. Remove loose material from horizontal steel surfaces, parapets, railings, and devices (i.e., vacuum) in areas where the equipment is available.

2. Minimize discharge of loose material, grit and debris into the waters of the Commonwealth.
3. Remove remaining dirt and debris from deck joints and drains.
4. Dispose of collected cleanings at a proper disposal or fill site.
5. Use clean water when flushing the deck and supporting structure. Water should be obtained from the same water body that the bridge is being cleaned spans. For small streams, where a significant decrease in stream flow is likely, water may be brought to the site providing it is of equal or better quality than the background stream quality.
6. Minimize the amount of debris entering the water body. Use best management practices (BMP's). Exercise special care when cleaning bridges over High Quality (HQ) or Exceptional Value (EV) waterways.
7. When cleaning open grid decks flush supporting structural members also.
8. Use hay bales, temporary silt fencing, and other erosion control measures where necessary to prevent stream bank sediments from entering the stream.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Water tank with pressure hoses or compressor		Water
2	Crew Members				
1	Special Crew Member (Operator)				

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1/2 Bridge* /HR	3 Bridges/DAY	8 MH/Bridge

(* average bridge of 25' x 100'.)

Pennsylvania Fish & Boat Commission (PFBC) Stocked Trout Stream – Bridge Flushing Requirements

No bridge flushing operations shall be performed during these periods:

- 1) On any "Pre-Season" trout stream stocking day(s),
- 2) During the first two (2) weeks of trout season,
- 3) On any "In-Season" trout stream stocking day and two weeks thereafter

Outside of the periods listed above, bridge flushing can be performed during the PFBC stocked trout stream restriction period (see below time frames), when the following requirements are satisfied:

- 1) Prior to any deck flushing operations all heavy materials, e.g. dirt, debris, anti-skid aggregates, etc., shall be removed from the deck by manual or mechanical methods.
- 2) Physically block all deck drainage facilities with sand-bags or other mechanical devices to not allow deck flushing water to enter the stream directly and follow the requirements outlined in No. 4 below.
- 3) Bridge decks that do not have drainage facilities can be flushed when requirements outlined in No. 4 below are provided during the deck flushing operation(s).
- 4) Place "Hay-Bale" Erosion & Sedimentation Controls (Best Management Practice) at the bridge deck termination, where the deck flushing water flows onto the roadway embankment(s). Hay-Bale placements are not required where the existing roadway embankments provide a vegetative filter for the flushing water to flow through prior to entering the stream.

The following hyperlinks can be utilized to determine if a stream is "stocked" for trout or to determine the statewide and regional trout season "Opening Days":

- Actual trout stocking dates can be found at the hyperlink below in early February, yearly:
http://fbweb.pa.gov/stocking/TroutStockingDetails_GIS.aspx
- Statewide and Regional trout season Opening Day information can be found at the hyperlinks below.
<https://www.fishandboat.com/Fish/PennsylvaniaFishes/Trout/Pages/TroutSeasonOverview.aspx>
<https://www.fishandboat.com/Fish/FishingRegulations/Pages/OpeningDaysDetermined.aspx>

Districts should coordinate with the Pennsylvania Fish and Boat Commission (PFBC) for spawning periods prior to initiating work. <http://pfbc.pa.gov/fishpub/summaryad/troutwaters.html>

The Pennsylvania Fish and Boat Commission (PAF&BC) establishes certain in-stream work restriction dates to prevent adverse impacts to aquatic resources during construction activities. The in-stream work restrictions are identified below.

Stocked Trout: February 15 through June 1

Natural Reproduction of Wild Trout: October 1 through December 31

Class A Wild Brook/Brown Trout: October 1 through April 1

Class A Wild Rainbow Trout: February 1 through May 1

Lake Erie Tributaries: September 1 through April 1

Warmwater Fish Communities: Contact PAF&BC

If work must occur within these time frames an in-stream waiver request application must be completed and approved by PAF&BC.

Chapter 12: Painting

Table of Contents

7432-01	SUPERSTRUCTURE - SPOT/ZONE	12 - 3
7432-01	SUBSTRUCTURE - SPOT/ZONE	12 - 5

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SAP ASSEMBLY NUMBER: 711-7432-04 Aluminum
 711-7432-03 Zinc
 717-7432-01 General

BMS Flex-Action: A743201

ACTIVITY TITLE: SPOT/ZONE PAINTING-SUPERSTRUCTURE

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1060 - Shop Painting Structural Steel
 1070 - Painting Existing Structural Steel
 1071 - Painting Existing Structural Steel
 Using Aluminum Mastic System
 PUB 445 Safety Policy Manual

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections, although the requirement for spot painting should be anticipated on a cyclic basis for planning purposes. Before a final decision to spot paint is made, existing paint coats should be evaluated to determine the percent of the area that is rusting, the presence of rust scaling and pitting, the adhesion of the existing paint coat, the coatibility of existing coats with the paint system(s) proposed for use, and Perform lead paint/toxic heavy metal assessment. If lead paint/toxic heavy metals are present spot painting is not recommended (workers will need respirators/PPE for personel protection, containment and hazardous waste disposal for environmental concerns). Install environmental controls and comply with permit requirements provided by the District Bridge Maintenance Coordinator and/or Environmental Planner during all phases of the painting activity.

WORK AREA

All painted superstructure elements of a structural steel bridge above the bridge seats, including the bearings. Generally, the total area spot painted does not exceed 20% of the total painted area.

ACTIVITY DESCRIPTION

Preparing surfaces and painting limited local areas where existing paint systems have deteriorated or have been damaged to the extent that they no longer provide protection against corrosion. The work can include, but is not limited to, providing scaffolding, work platforms or other means to give access to the work; removing deteriorated paint and rust by blast cleaning and/or using assorted hand and power tools to provide a surface finish suitable for applying the paint system selected for use; cleaning existing type paint

systems, which will be repainted, by using solvents or biodegradable cleaners; applying a prime coat on bare surfaces; and applying intermediate and finish coats of paint in accordance with the requirements of the paint system selected for use.

In addition to spot painting, also report the work of applying intermediate and final coats of paint to areas prime coated under other activities and zone painting to this activity. Zone painting is the painting of certain selected areas particularly subject to conditions where accelerated corrosion is expected to occur, such as beam ends under open floor joints. Zone painting may involve the use of a different paint system than is used on the remainder of the structure.

PROCEDURE DESCRIPTION

1. Power tools shall be used to clean corroded spots to bright metal.
2. Take measures to allay dust, if necessary.
3. Take measures to protect adjacent property, vehicles, pedestrians, concrete surfaces, and waterways.
4. Insure that temperature is above 40°F, relative humidity is less than 85%, and surface is not hot or damp. Painting may be performed under cover in cold or damp weather.
5. Paint neatly with brush, roller, or sprayer.
6. Work paint into all crevices, if appropriate.
7. No coat shall be applied until preceding coat has dried.
8. Test thickness of paint.

Note: Comply with applicable permit and procedural requirements of the Department of Environmental Protection, Pennsylvania Fish and Boat Commission and local Conservation Districts in accomplishing this procedure and for containing and disposing of paint chips, sand and shot. If lead paint/toxic heavy metals are present and work is initiated, follow worker Health and Safety Standards by OSHA and in PUB 445. Wear the proper Personal Protective Equipment contact your District Safety Coordinator before starting work to ensure all safety measures have been established.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1 3	Foreman Crew Members	As Required As Required As Required As Required As Required As Required As Required As Required As Required	Power Chippers Power Brushes Sand Blaster Paint Brushes Rollers Paint Sprayer Paint Thickness Tester Access Equipment	As Required	Paint
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.02 Each/HR		.1 Each/DAY		240 MH/Each	

SAP ASSEMBLY NUMBER: 711-7432-06 Aluminum
 711-7432-05 Zinc
 717-7432-01 General

BMS Flex-Action: B743201

ACTIVITY TITLE: SPOT/ZONE PAINTING-SUBSTRUCTURE

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)

Section 1060 - Shop Painting Structural Steel
 1070 - Painting Existing Structural Steel
 1071 - Painting Existing Structural Steel
 Using Aluminum Mastic System

PUB 445 Safety Policy Manual

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections, although the requirement for spot painting should be anticipated on a cyclic basis for planning purposes. Before a final decision to spot paint is made, existing paint coats should be evaluated to determine the percent of the area that is rusting, the presence of rust scaling and pitting, the adhesion of the existing paint coat, the compatibility of existing coats with the paint system(s) proposed for use, and Perform lead paint/toxic heavy metal assessment. If lead paint/toxic heavy metals are present spot painting is not recommended (workers will need respirators/PPE for personal protection, containment and hazardous waste disposal for environmental concerns). Install environmental controls and comply with permit requirements provided by the District Bridge Maintenance Coordinator and/or Environmental Planner during all phases of the painting activity.

WORK AREA

All painted substructure components of a bridge. Generally the total area spot painted does not exceed 20% of the total painted area.

ACTIVITY DESCRIPTION

Preparing surfaces and painting limited local areas where existing paint systems have deteriorated or have been damaged to extent that they no longer provide protection against corrosion. The work can include, but is not limited to, providing scaffolding, work platforms or other means to give access to the work; removing deteriorated paint and rust by blast cleaning and/or using assorted hand and power tools to provide a surface finish suitable for applying the paint system selected for use; cleaning existing type paint systems, which will be repainted, by using solvents

or biodegradable cleaners; applying a prime coat on bare surfaces; and applying intermediate and finish coats of paint in accordance with the requirements of the paint system selected for use.

In addition to spot painting, also report the work of applying intermediate and final coats of paint to areas prime coated under other activities and zone painting to this activity. Zone painting is the painting of certain selected areas particularly subject to conditions where accelerated corrosion is expected to occur, such as beam ends under open floor joints. Zone painting may involve the use of a different paint system than is used on the remainder of the structure.

PROCEDURE DESCRIPTION

1. Power tools shall be used to clean corroded spots to bright metal.
2. Take measures to allay dust, if necessary.
3. Take measures to protect adjacent property, vehicles, pedestrians, concrete surfaces, and waterways.
4. Insure that temperature is above 40°F, relative humidity is less than 85%, and surface is not hot or damp. Painting may be performed under cover in cold or damp weather.
5. Paint neatly with brush, roller, or sprayer.
6. Work paint into all crevices, if appropriate.
7. No coat shall be applied until preceding coat has dried.
8. Test thickness of paint.

Note: Comply with all applicable permit and procedural requirements of the Department of Environmental Protection, Pennsylvania Fish and Boat Commission and local Conservation Districts in accomplishing this procedure and for containing and disposing of paint chips, sand and shot. If lead paint/toxic heavy metals are present and work is initiated, follow worker Health and Safety Standards by OSHA and in PUB 445. Wear the proper Personal Protective Equipment contact your District Safety Coordinator before starting work to ensure all safety measures have been established.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	Power Chippers	As Required	Paint
3	Crew Members	As Required	Power Brushes		
		As Required	Sand Blaster		
		As Required	Rollers		
		1	Paint Sprayer		
		1	Paint Thickness tester		
		As Required	Access equip		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.02 Each/HR	.1 Each/DAY	240 MH/Each

Chapter 13: Deck Expansion Joints

Table of Contents

7433-01	RESEAL	13 - 3
7433-02	REPAIR/RESEAL	13 - 6
7433-02	OTHER DAM TYPES (REPAIR/REHABILITATE)	13 - 8
7433-02	COMPRESSION SEAL (REPAIR/REHABILITATE)	13 - 10
7433-02	MODULAR DAM (REPAIR/REHABILITATE)	13 - 13
7433-02	STEEL DAMS (REPAIR/REHABILITATE)	13 - 20

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Preventive Maintenance Resealing Joints



Perform based on need:

- 2-part silicone – 3-5 year I.c.
- Asphaltic plug – 3-5 year I.c.
- Strip seal – 10 year (min.) I.c.

Work area:

Joints of less than 1 inch
Remove damaged, deteriorated sealing material
Clean/prepare surfaces
Pour/place new sealing material

SAP ASSEMBLY NUMBER: 711-7433-01**BMS Flex-Action:** A743301**ACTIVITY TITLE:** RESEAL DECK JOINTS (LIQUID ONLY)**UNIT OF MEASUREMENT:** LINEAR FEET OF DECK JOINT**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 521 - Transverse Joint Sealing and Cleaning
705 - Joint Material

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Joint must be dry and temperature at or above 40°F.

WORK AREA

All joints of less than one inch between portland cement concrete (PCC) deck elements including construction joints and joints between precast slab elements having limited movement that can be accommodated by poured sealing material. The joints can be located anywhere within the entire width of the superstructure for the entire length of the bridge between the backs of the backwalls.

ACTIVITY DESCRIPTION

Resealing joints using poured material at any location within the work area. The work includes removing damaged, deteriorated, or non-adhering existing sealing material; cleaning and preparing the surfaces of the concrete against which the sealing material will be poured, placing a backer rod or bond breaker, if appropriate; and pouring new joint sealing material.

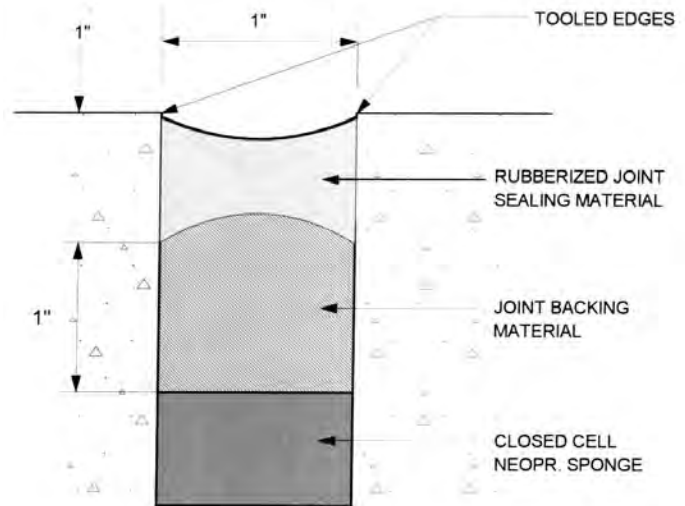
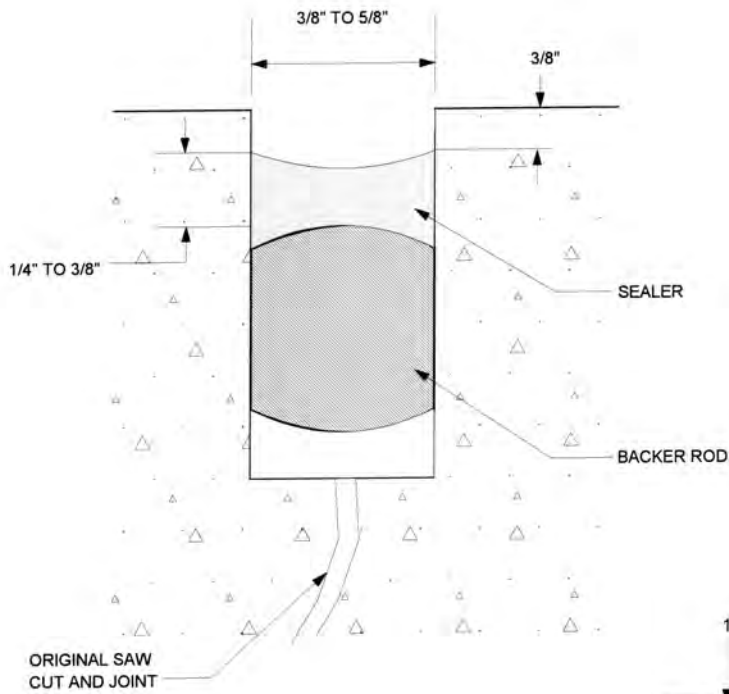
PROCEDURE DESCRIPTION

1. Clean joint of all existing sealer and backer rod using a plow. Do not remove joint filler unless it is deteriorated. If necessary, resaw joint to between 3/8" and 5/8".
2. Remove all sealer material from the joint faces by using wire brushes and remove all loose material from the joint by blowing with an air compressor.
3. Place foam joint backer rod into joint and push down approximately 3/4" below the surface of the deck. The backer rod should be approximately 1/8" wider than the joint.
4. Pour sealant into joint to within 3/8" of surface of deck surface.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	As Required	Backer Rod
3	Crew Members	1	Concrete Saw	As Required	Silicone or Rubberized Joint Material

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
Foot/HR	Foot/HR	Foot/HR



Structural Repairs Repair/Reseal Joints



Perform based on need

Work area: All joints of less than 1 inch with associated adjacent damaged concrete:

- Remove damaged, deteriorated existing sealing material and concrete
- Form and place new concrete
- Pour new sealing material

SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: A744101

ACTIVITY TITLE: REPAIR/RESEAL DECK JOINTS

UNIT OF MEASUREMENT: LINEAR FEET OF DECK JOINTS

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 521 - Transverse Joint Sealing and Cleaning
 705 - Joint Material
 1001 - Cement Concrete Structures
 1040 - Concrete Bridge Deck Repair

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Joint must be dry and temperature at or above 40°F for placing joint sealing material. After concrete joint has started to deteriorate, the affected area tends to increase rapidly if exposed to traffic. The resulting high live load impact can damage other parts of the structure, so work should not be delayed unnecessarily.

WORK AREA

All joints of less than one inch between Portland Cement Concrete (PCC) deck elements having limited movement that can be accommodated by poured sealing material. The work area includes both the joint and the adjacent concrete which must be removed and replaced to repair the joint. Report repairs to concrete outside of this work area under other appropriate activities such as Activity D744303, Concrete Deck (Repair), even if the work is being done at the same time.

ACTIVITY DESCRIPTION

Repairing and resealing joints using poured material at any location within the work area. The work can include, but is not limited to, removing damaged, deteriorated, or non-adhering existing sealing material; removing deteriorated concrete; retying or replacing reinforcing steel; constructing forms; placing concrete; placing a backer rod or bond breaker, when appropriate; and pouring new joint sealing material.

PROCEDURE DESCRIPTION

1. Remove all old joint material and backer rod.
2. Mark all areas of damaged concrete to be removed.
3. Remove concrete by saw cutting and jack hammering.
4. Put temporary form in joint and place concrete.
5. After concrete cures, remove temporary form and clean joint of any loose material.
6. Place foam joint backer rod into joint and push down so top of filler is approximately 3/4" below the surface of the deck. The filler should be approximately 1/8" wider than the joint.
7. Pour sealant into joint to within 3/8" of surface of deck surface.

SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: E744102

ACTIVITY TITLE: REPAIR OTHER DAM TYPES

UNIT OF MEASUREMENT: LINEAL FEET OF JOINT REPAIRED

PROCEDURE: OTHER

REFERENCES

PennDOT Specifications (PUB 408)

Section 1001 - Cement Concrete Structures

1040 - Concrete Bridge Deck Repair

SCHEDULING CONSIDERATIONS

Bases on need as indicated by bridge inspections.

WORK AREA

All expansion joints, regardless of movement classification, using a joint system other than compression seals, strip seals, modular dams, or steel dams.

ACTIVITY DESCRIPTION

Repairing or replacing the existing joint system, either partially or totally, with a joint system not covered under another activity. The work can include but is not be limited to the removal of the existing joint repair of the concrete adjacent to the joint if needed, and placement of the new joint system.

The new joint systems include Dow Corning XJS, Silcoflex, Jennie Joint, asphalt plugs, and other proprietary or experimental joint systems.

The joint system to be used should be approved by the District Bridge Engineer.

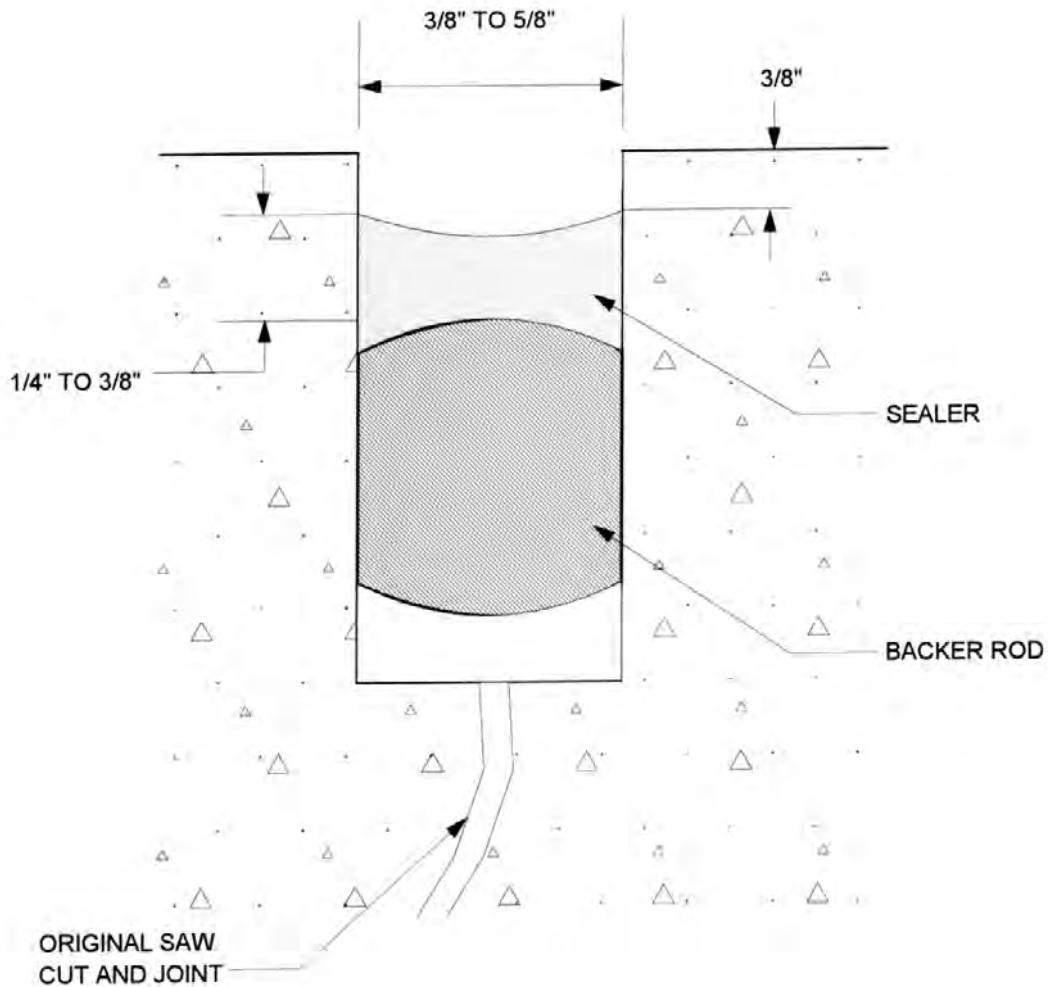
PROCEDURE DESCRIPTION

The installation procedure will vary with the type of joint system to be used. The manufacturer should furnish specific installation instructions for the joint system. A manufacturer's representative should be on the job during initial installation of demonstration or experimental joint systems.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	As Required	LF Joint Backing Material
3	Crew Members	1	Jack Hammer	As Required	Silicone or Rubberized Concrete
		1	Concrete Saw	As Required	
		1	Concrete Mixer		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
3 LF/HR		18 LF/DAY		1.3 MH/LF	

SAW CUT JOINT



SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: B744102

ACTIVITY TITLE: COMPRESSION SEAL DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF COMPRESSION SEAL DECK JOINT

PROCEDURE: REPLACE EXISTING COMPRESSION SEAL

REFERENCES

PennDOT Specifications (PUB 408)

Section 705 - Joint Material

1001 - Cement Concrete Structures

1002 - Reinforcement Bars

1008 - Preformed Neoprene Compression
Joint Seal for Bridges

1021 - Armored Preformed Neoprene
Compression Dam

1040 - Concrete Bridge Deck Repair

BC-766M Compression Seal Joint

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Preformed compression seals can be installed more efficiently during cooler, but not below freezing, temperatures. Surfaces against which seals are placed must be dry, although concrete surfaces may be "damp-dry".

WORK AREA

All armored and unarmored joints in the deck in which preformed compression seals have been or will be placed. The work area includes both the joint and deteriorated or damaged concrete adjacent to unarmored joints which must be removed and replaced to repair the joint. Report concrete repairs adjacent to armored joints and repairs to armor in joints to Activity D744102, Steel Dam Deck Joints (Repair/ Rehabilitate). Concrete repairs not directly necessary for unarmored joint repairs should be reported under Activity D744303, Concrete Deck (Repair).

ACTIVITY DESCRIPTION

Repairing or rehabilitating existing preformed compression seal deck joints or replacing poured seals with preformed compression seals at any location within the work area. The work can include, but is not limited to, removing all or portions of an existing preformed seal that has deteriorated, has been damaged, or is no longer providing a watertight seal; removing all of an existing poured seal and modifying the joint to accept a preformed seal; removing deteriorated

concrete; retying or replacing reinforcing steel; constructing forms; placing concrete; sawing seal grooves; and installing preformed compression seals.

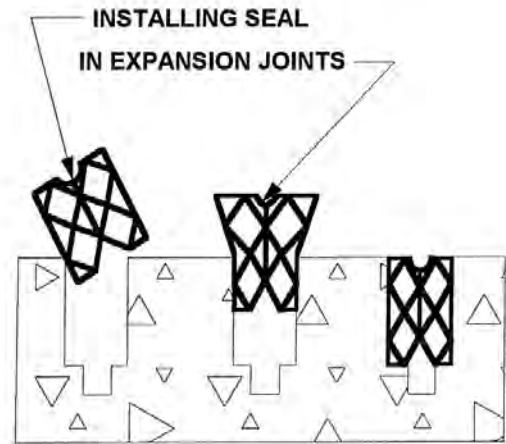
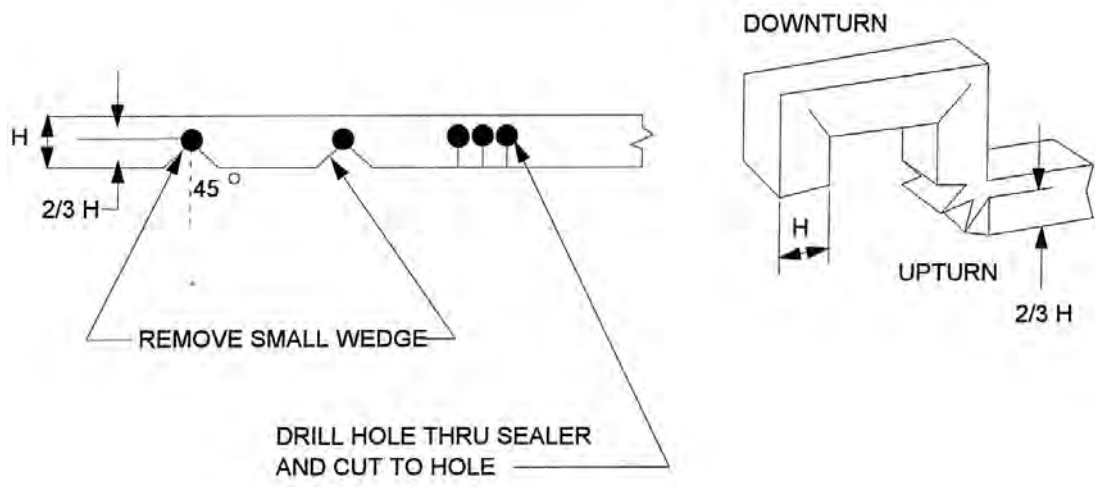
PROCEDURE DESCRIPTION

1. Remove existing compressible joint material from joint.
2. Clean joint of any foreign material using compressed air.
3. Remove and replace any deteriorated concrete.
4. Cut new compressible material to fit the joint. If joint extends beyond deck to curbs or medians, then cut according to sketch.
5. Apply lubricant adhesive to the faces of the joint.
6. Position seal over joint opening, compress and insert into joint while the adhesive is still wet. Install seal within the joint to the required depth of application, usually 1/4 to 1/2 inch below the deck surface.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	1 LF	Preformed Neoprene Compression Seal and Lubricant Adhesive
2	Crew Members	1	Concrete Mixer	As Require	
		1			
		1			
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
5 LF/HR		30 LF/DAY		.6 MH/LF	

UPTURN/DOWNTURN DETAIL



SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: B744102

ACTIVITY TITLE: COMPRESSION SEAL DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF COMPRESSION SEAL DECK JOINT

PROCEDURE: MODIFY POURED SEAL JOINT AND RESEAL WITH COMPRESSION SEAL

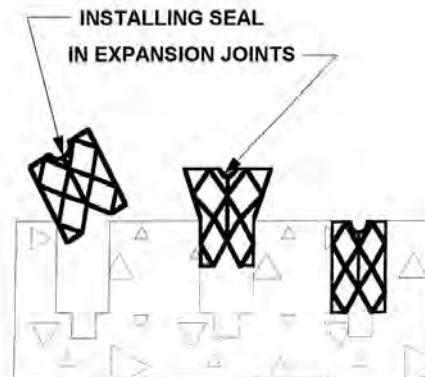
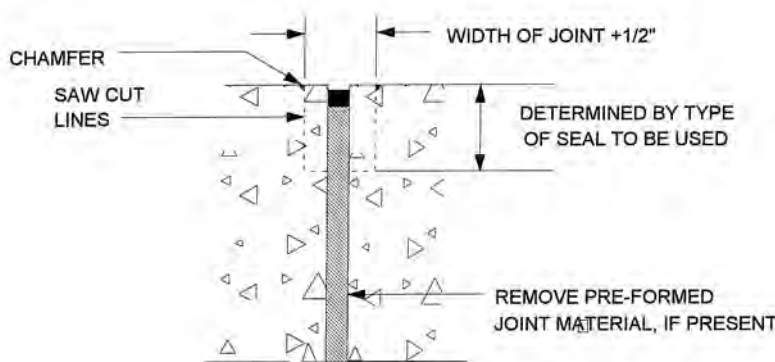
PROCEDURE DESCRIPTION

1. Remove existing poured joint material and debris from joint.
2. Saw - cut the joint to a uniform dimension across the bridge deck to the prescribed width and depth for the anticipated deck movement.
3. Grind chamfer on edges of joint from curb to curb.
4. Clean dirt and debris from the joint using compressed air.
5. Apply lubricant adhesive to the faces of the joint.
6. Position seal over joint opening, compress the bottom of the seal and insert into the joint while the adhesive is still wet.
7. Complete the installation by positioning the seal within the joint to the depth required, usually 1/4 to 1/2 inch below the deck surface.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Saw (Double Bladed)	1 LF	Preformed Neoprene Compression Seal and Lubricant Adhesive
2	Crew Members	1	Air Compressor	As Required	
		1			
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
5 LF/HR		30 LF/DAY		.6 MH/LF	

SAW CUT JOINT DETAILS



SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: C744102

ACTIVITY TITLE: MODULAR DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF MODULAR DAM DECK JOINT

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 705 - Joint Material

1001 - Cement Concrete Structures

1002 - Reinforcement Bars

1040 - Concrete Bridge Deck Repair

1105 - Fabricated Structural Steel

1021 - Neoprene Compression Dam

3. Remove all unsound concrete.

4. Set forms for concrete or position armored edges or anchors as necessary.

5. Place concrete.

6. Repair salvageable dam components by welding, strengthening, grinding, etc.

7. Replace modular dam sections or components in joint.

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections and deficiencies observed and reported by other personnel. Effective and economical repairs to modular dam deck joints are often only possible when the repairs are initiated while the defective or damaged portion of the dam is relatively small. Repairs may be facilitated when temperatures are moderate.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required

WORK AREA

All modular dams, their connections to adjacent concrete or structural steel members, and concrete adjacent to the dam which must be removed and replaced to repair or rehabilitate the joint. Report repairs to concrete outside of this work area to appropriate activities.

ACTIVITY DESCRIPTION

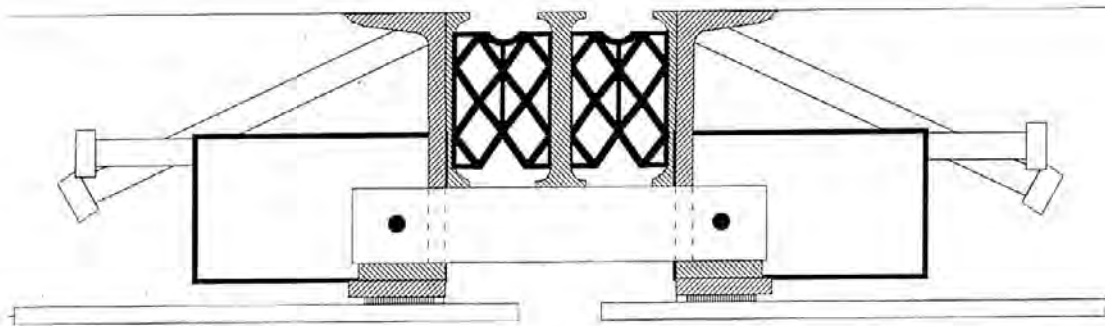
Repairing or rehabilitating modular dam deck joints within the work area. The work can include, but is not limited to, removing all or portions of an existing modular dam deck joint; disassembling portions of an existing joint; removing concrete adjacent to the joint to replace deteriorated concrete and/or to gain access to the dam connections; retying or placing reinforcing steel; replacing deficient parts of an existing joint; modifying an existing joint; constructing forms; reinstalling the repaired or modified joint; and placing concrete.

PROCEDURE DESCRIPTION

1. Remove defective component or section of modular dam from joint.
2. Mark all areas of defective concrete at joint to be removed including around anchors to be replaced or reset.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Saw	1 LF	Modular Dam Joint or Component
2	Crew Members	1	Welding Equip.		
1	Special Crew member (Certified Welder)	1	Air Compressor		
		1	Concrete Mixer		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
3 LF/HR		18 LF/DAY		1.3 MH/LF	



SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: C744102

ACTIVITY TITLE: MODULAR DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF MODULAR DAM DECK JOINT

PROCEDURE: ELASTOMETRIC OR BELL TYPE EXPANSION DAMS

PROCEDURE DESCRIPTION

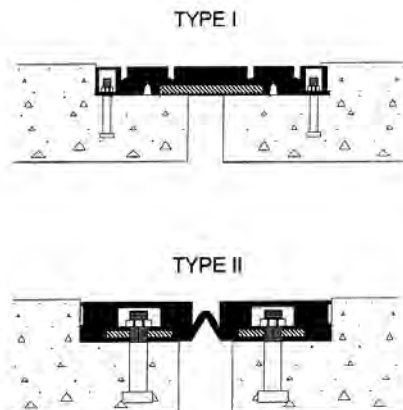
1. Remove existing poured joint material and debris from joint.
2. Saw - cut the joint to a uniform dimension across the bridge deck to the prescribed width and depth for the anticipated deck movement.
3. Grind chamfer on edges of joint from curb to curb.
4. Clean dirt and debris from the joint using compressed air.
5. Apply lubricant adhesive to the faces of the joint.
6. Position seal over joint opening, compress the bottom of the seal and insert into the joint while the adhesive is still wet.
7. Complete the installation by positioning the seal within the joint to the depth required, usually 1/4 to 2 inch below the deck surface.

ACTIVITY REQUIREMENTS

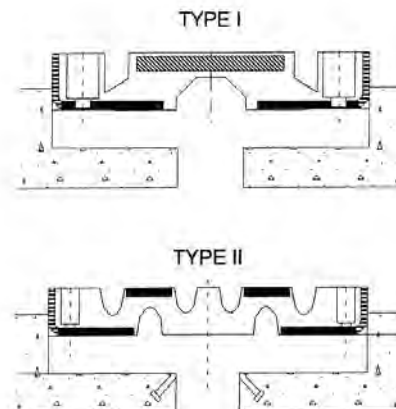
LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip.	1 LF	Modular Dam Joint or Component
2	Crew Members				
1	Special Crew Member (Certified Welder)				

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
3 LF/HR	18 LF/DAY	1.3 MH/LF

TYPICAL METAL REINFORCED AND CONTINUOUS BELT TYPE DAM SYSTEMS



REINFORCED ELASTOMERIC EXPANSION DAMS



SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: C744102

ACTIVITY TITLE: MODULAR DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF MODULAR DAM DECK JOINT

PROCEDURE: REPLACE EXISTING JOINT WITH STRIP SEAL (REHABILITATE/OVERLAY)

PROCEDURE DESCRIPTION

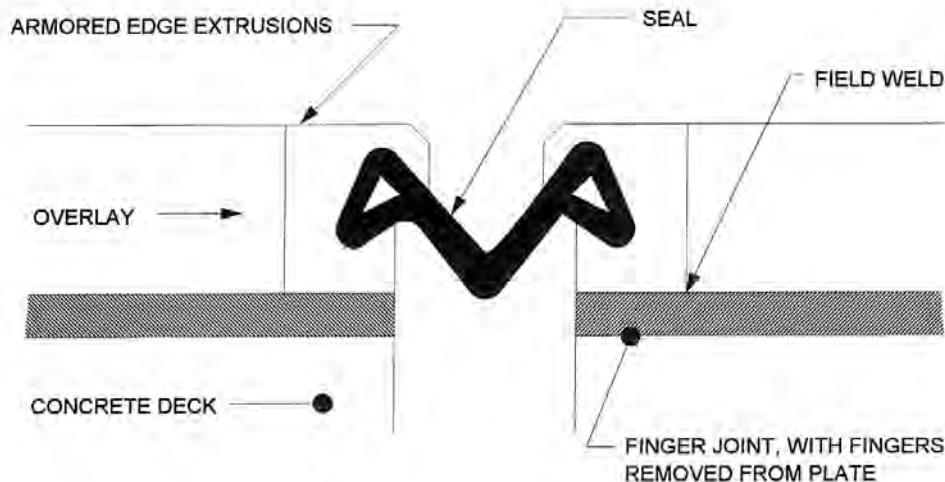
1. Remove existing expansion dam and adjacent concrete or fingers of steel finger dam.
2. Attach armored edge extrusions to concrete and reinforcing steel or weld to modified plate of finger dam.
3. Place concrete behind joint.
4. Place overlay.

5. Place strip seal gland using adhesive and special tools as recommended by the manufacturer.
6. NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

Reference PUB 408 Section: 1026 & 1027

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip.	1 LF	Strip Seal Welding Materials Concrete Reinforcing Steel L 8" x6" x 1/2"W 3/4" x 5" slots As Required Studs and Anchor bolts
2	Crew Members	1	Air Compressor	As Required	
1	Special Crew Member (Certified Welder)	1	Concrete Mixer	As Required As Required 1LF	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
3 LF/HR		18 LF/DAY		1.3 MH/LF	



Strip Seal Dam Replacement

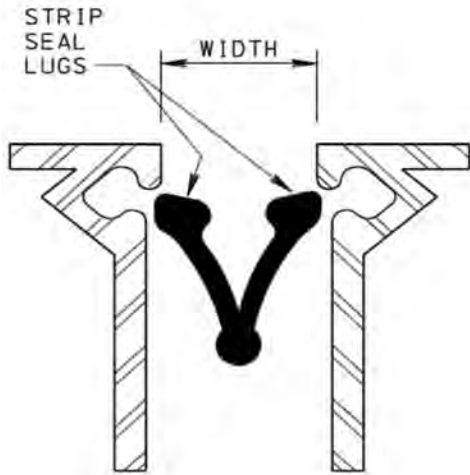


FIGURE 1



FIGURE 2

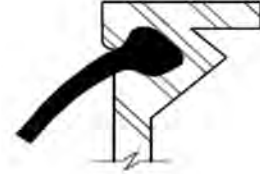


FIGURE 3

STRIP SEAL INSTALLATION PROCEDURE

SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: C744102

ACTIVITY TITLE: MODULAR DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF MODULAR DAM DECK JOINT

PROCEDURE: REPAIR STRIP SEAL SYSTEMS

PROCEDURE DESCRIPTION

1. Remove deteriorated sections of gland.
Heating the seal may be necessary to melt adhesives. Special tools from the seal manufacturer may facilitate seal removal and replacement.
2. Reanchor or replace as necessary any loose sections of the extrusion by removing and replacing deteriorated concrete and

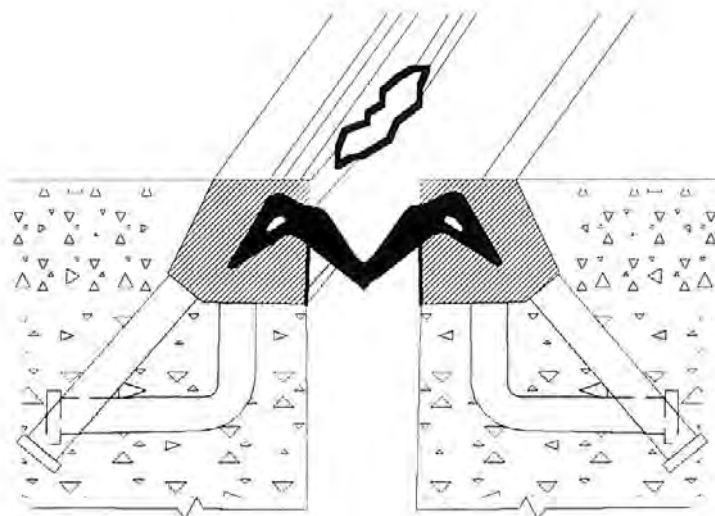
extrusion.

3. Replace gland using adhesive and special tools as recommended by the manufacturer.

Reference BC-767M Neoprene Strip Seal Dam
PUB 408 Section 1029

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip.	1 LF	Modular Dam Joint or Component
2	Crew Members				
1	Special Crew Member (Certified Welder)				
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
3 LF/HR		18 LF/DAY		1.3 MH/LF	



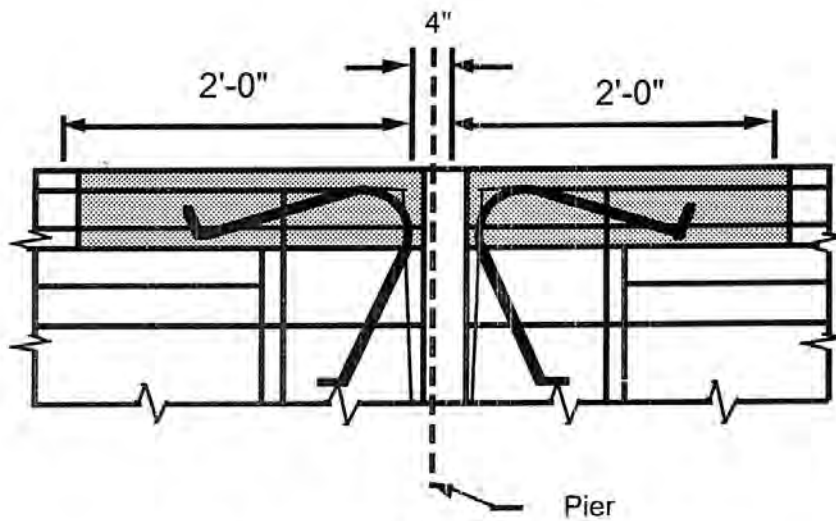
SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: C744102

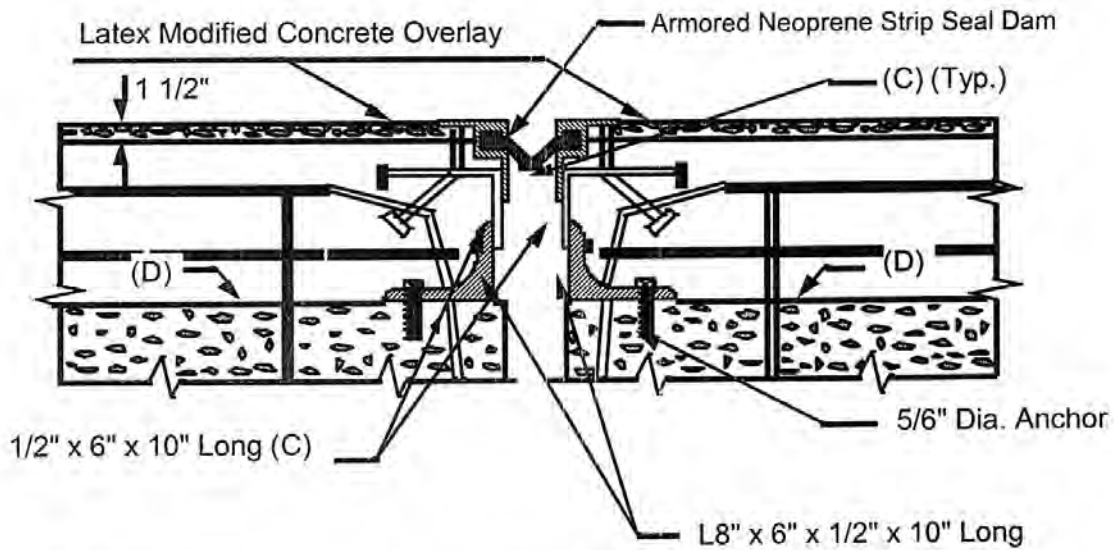
ACTIVITY TITLE: MODULAR DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF MODULAR DAM DECK JOINT

PROCEDURE: REPAIR STRIP SEAL SYSTEMS



REPLACEMENT OF EXPECTED DAM



(C) Shall be welded to steel extrusion and stud shall be welded to steel by the exp. dam manufacturer.

(D) Existing concrete chipped and smoothed to a sound surface and sufficient depth to install entire assembly.

SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: D744102

ACTIVITY TITLE: STEEL DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: *LINEAR FEET OF STEEL DAM

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 -Cement Concrete Structures
 1002 -Reinforcement Bars
 1021 -Armored Preformed Neoprene
 Compression Dam
 1040 -Concrete Bridge Deck Repair
 1105 -Fabricated Structural Steel
 BC-762M Standard tooth exp. dam

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections and deficiencies observed and reported by other personnel. Effective and economical repairs to steel dams are often only possible if the repairs are initiated while relatively small portions of the dam are deficient.

WORK AREA

All steel dams, their connections to adjacent concrete or structural steel members, and concrete adjacent to the dam which must be removed and replaced to repair or rehabilitate the dam. Report repairs to concrete outside of this work area to appropriate activities, such as Activity D744303, Concrete Deck Repair. Report the placing of the preformed neoprene compression seal to Activity B744102, Compression Seal Deck Joint (Repair/Rehabilitate).

***Special Measurement Note:** Work on each dam or each side of a joint shall be measured for reporting work on this activity.

ACTIVITY DESCRIPTION

Repairing or rehabilitating or installing steel dams within the work area. The work can include, but is not limited to, removing concrete adjacent to the dam to permit removal of the dam or to gain access to the connections used to secure the dam to concrete or steel; repairing or replacing a portion of the dam or its structural connections; straightening and aligning the dam; retying or placing reinforcing steel; securing the dam to proper line and grade; constructing forms; and placing concrete.

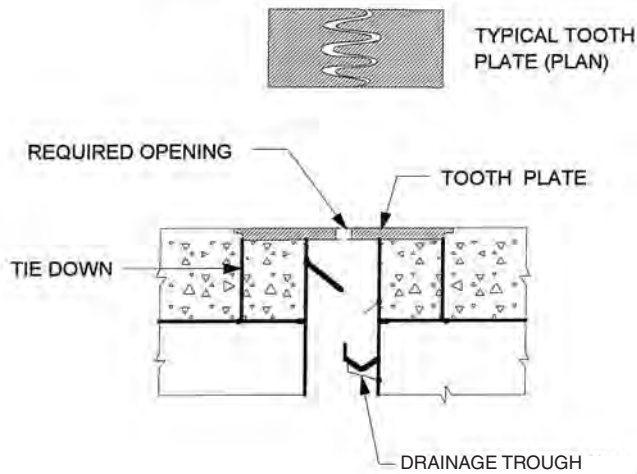
PROCEDURE DESCRIPTION

1. Remove steel dam and supports as necessary by cutting anchors or dam with cutting torch.
2. Remove unsound concrete by saw cutting and jack hammering.
3. Place forms for concrete and anchor system for dam.
4. Set dam in place.
5. Place and finish concrete.
6. Complete assembly of dam or remove temporary shipping and erection braces as necessary.
7. Place new neoprene compression seal, drainage trough or water collector as necessary.

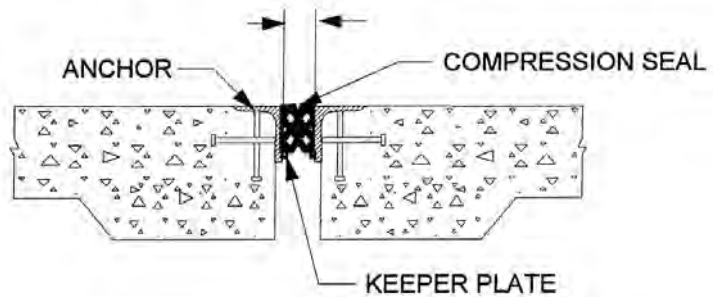
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	1 LF	Steel Dam Assembly
2	Crew Members		and Hammers		
1	Special Crew Member	1	Welding Equip		
1	(Certified Welder)	1	Concrete Mixer		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
1.5 LF/HR		9 LF/DAY		2.7 MH/LF1	

TYPICAL TOOTH PLATE SYSTEM



TYPICAL CONVENTIONAL SEAL SYSTEM



SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: D744102

ACTIVITY TITLE: STEEL DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF STEEL DAM

PROCEDURE: REPLACE EXISTING JOINT WITH ARMORED COMPRESSION SEAL

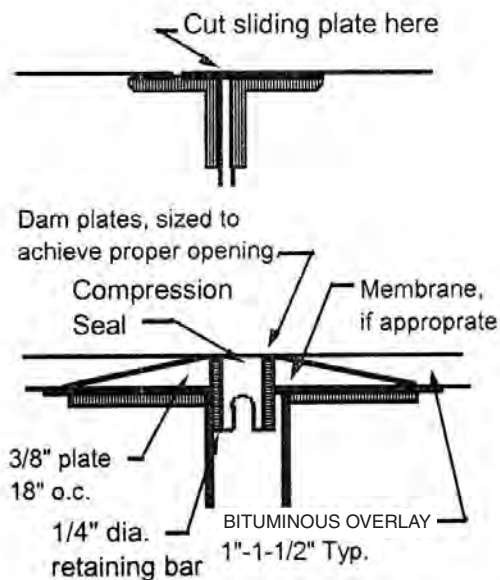
PROCEDURE DESCRIPTION

1. Cut or remove sliding plate or other joint as shown.
2. Place new armored joint reinforcing.
3. Place concrete around joint or overlay deck as required.
4. Place preformed neoprene compression seal.

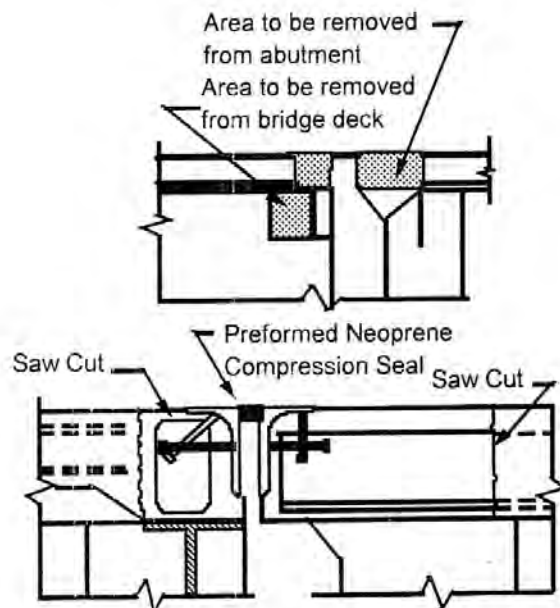
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	1 LF	Modular Joint Concrete
2	Crew Members	1	Welding Equip.	As Required	
1	Special Crew Member (Certified Welder)	1	Concrete Mixer		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
1.5 LF/HR		9 LF/DAY		2.7 MH/LF1	

TYPICAL SLIDING PLATE JOINT REPAIR



REPLACE DECK JOINT



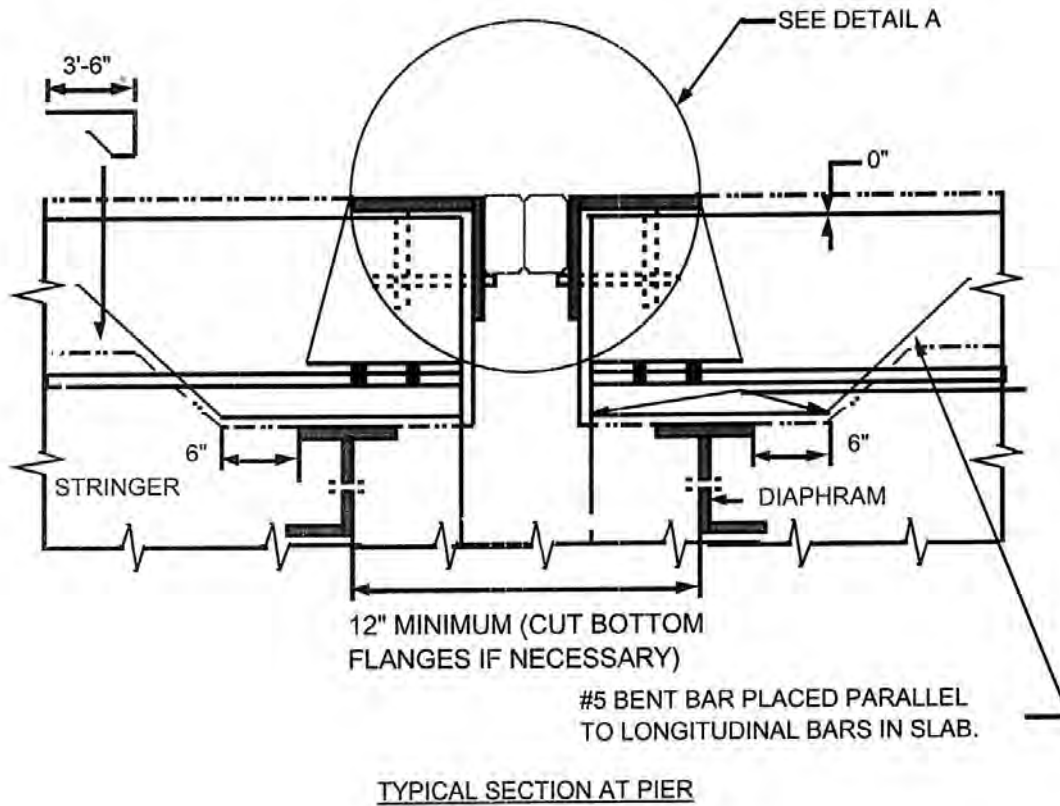
SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: D744102

ACTIVITY TITLE: STEEL DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF STEEL DAM

PROCEDURE: REPLACE EXISTING JOINT WITH ARMORED COMPRESSION SEAL



SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: D744102

ACTIVITY TITLE: STEEL DAM DECK JOINTS (REPAIR/REHABILITATE)

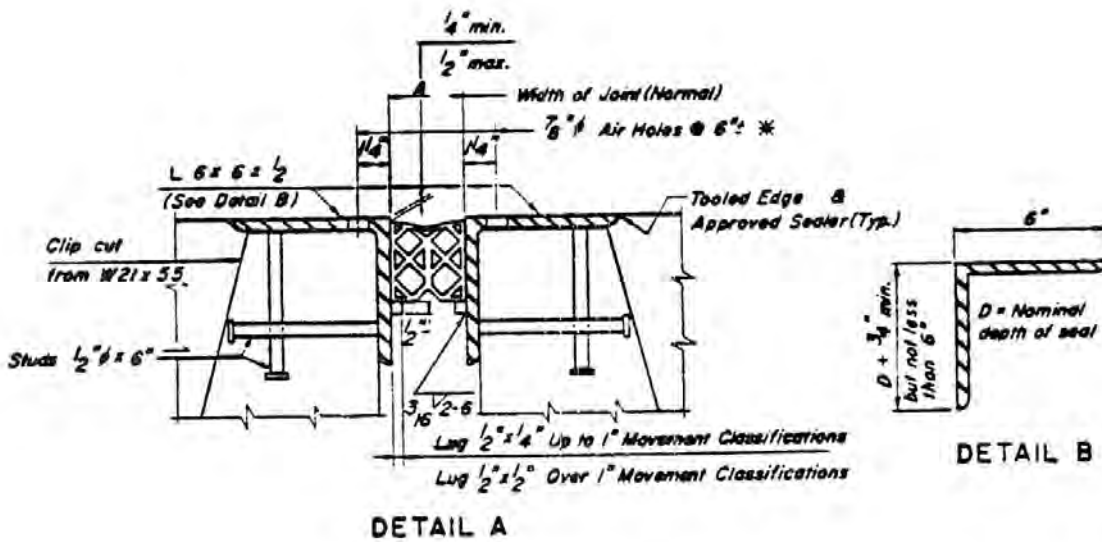
UNIT OF MEASUREMENT: LINEAR FEET OF STEEL DAM

PROCEDURE: REPLACE EXISTING JOINT WITH ARMORED COMPRESSION SEAL

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	1LF	Preformed
2	Crew Members	1	Light Air Hammer	As Required	Neoprene Compression Seal
1	Special Crew Member (Certified Welder)	1	Welder	As Required	Seal & Lubricant Adhesive
1	Special Crew Member (Certified Welder)	1	Cutting Torch	2LF	Steel 8"x6" Angle
		1	Concrete Mixer	As Required	Anchor Studs
				As Required	Concrete

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1.5 LF/HR	9 LF/DAY	2.7 MH/LF



SAP ASSEMBLY NUMBER: 711-7433-02

BMS Flex-Action: D744102

ACTIVITY TITLE: STEEL DAM DECK JOINTS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: LINEAR FEET OF STEEL DAM

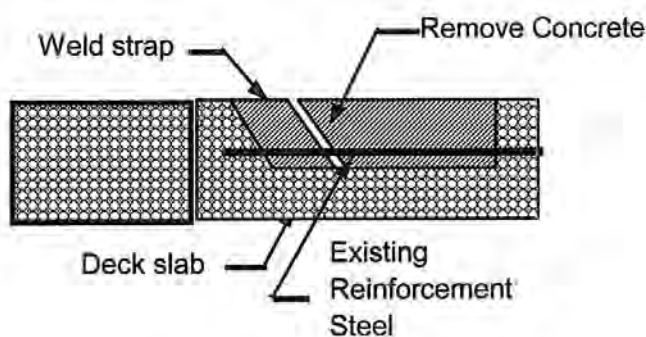
PROCEDURE: REPAIR ARMORED EXPANSION JOINT

PROCEDURE DESCRIPTION

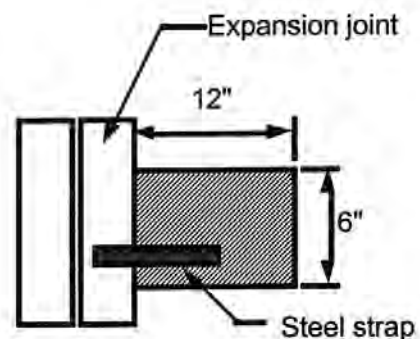
- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Locate portion of expansion that is loose and rattling. 2. On 18-in. centers, lay off 12 in. x 8 in. rectangle immediately adjacent to the dam. 3. Outline area of concrete to be removed with a 1-in. deep concrete saw cut. | <ol style="list-style-type: none"> 4. Remove concrete with air hammer. 5. Cut slot in top flange of dam. 6. Weld Z-strap in slot and to reinforcing steel. 7. Place concrete behind dam. |
|--|--|

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	1LF	1/4"x1" Steel Concrete
2	Crew Members	1	& Air Hammers	As Required	
1	Special Crew Member (Certified Welder)	1	Welding Equip.		
		1	Concrete Mixer		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
1.5 LF/HR		9 LF/DAY		2.7 MH/LF	



CROSS-SECTION



PLAN VIEW

SAP ASSEMBLY NUMBER: 711-7433-02**BMS Flex-Action:** D744102**ACTIVITY TITLE:** STEEL DAM DECK JOINTS (REPAIR/REHABILITATE)**UNIT OF MEASUREMENT:** LINEAR FEET OF STEEL DAM**PROCEDURE:** REPAIR SLIDING PLATE EXPANSION JOINT

PROCEDURE DESCRIPTION

1. Burn hole through top flange of expansion dam.
2. Drill 1 - 1/4" hole at a 45° angle through the concrete deck below the burned hole.
3. Score a 6" X 6" area of concrete 1" deep with saw around bottom of hole. Remove concrete to bottom mat of reinforcing steel.
4. Place bolt in position and weld to top flange of dam with a full penetration weld.
5. Place latex modified concrete 1/2" thick in bottom of 6" X 6" hole around bolt end.
6. Position 1/4" X 4" X 4" steel plate, add wedge washer and nut, then tighten.

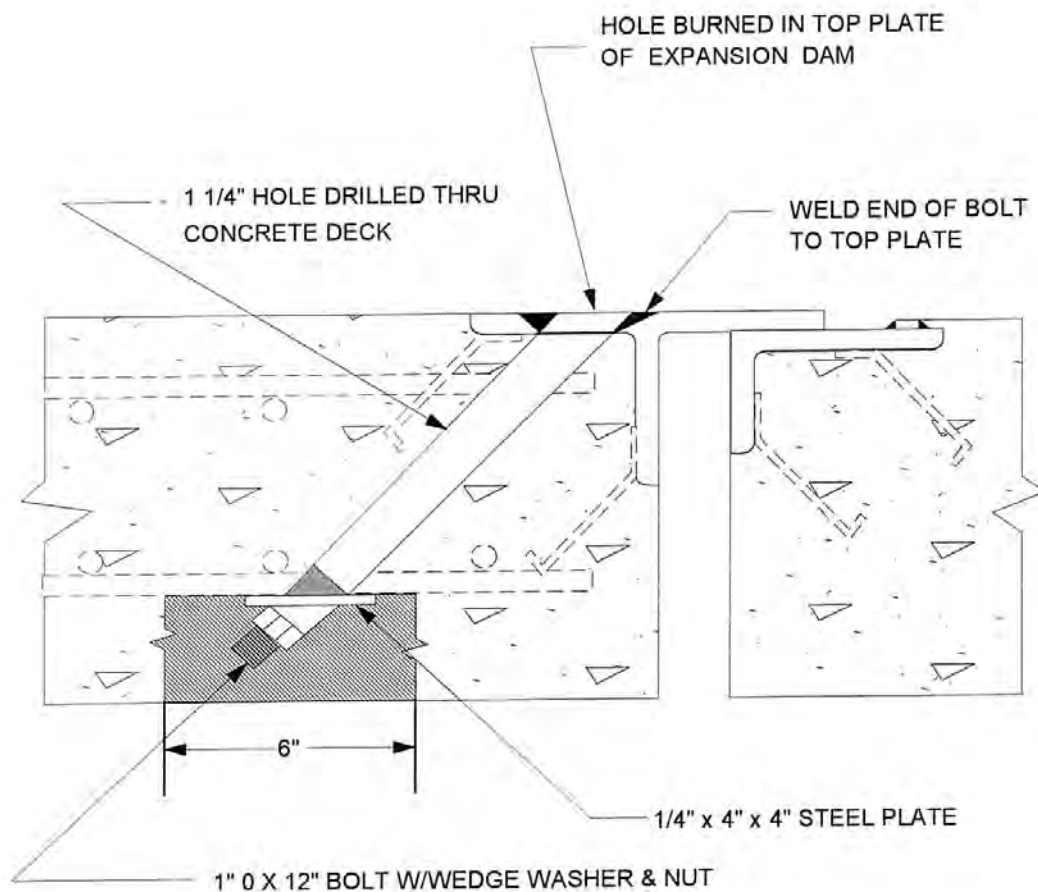
7. Coat removed concrete area with epoxy bonding compound and fill with latex modified concrete.
8. Drill and tap flange close to bolt location, install zerk fitting and pump epoxy.
9. Remove and fill zerk fitting holes with weld material. Grind and smooth welds on top flange.

NOTE: Epoxy should fill area around bolt and under expansion dam where bond between dam and concrete has been lost. Several zerk fittings may be required to fill void beneath dam.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip	As Required	12" Bolt with wedge
2	Crew Members	1	Concrete Mixer	As Required	Washer & Nut
1	Special Crew Member (Certified Welder)	1		As Required	1/4" X 4" Steel Plate
					Latex Modified Concrete

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1.5 LF/HR	9 LF/DAY	2.7 MH/LF



REPAIR SLIDING PLATE ARMORED EXPANSION JOINT

Chapter 14: Railings / Parapets

Table of Contents

7434-01	BRIDGE PARAPET (REPAIR/REPLACE)	14 - 3
7434-01	STRUCTURE MOUNTED GUIDERAIL (REPAIR/REPLACE)	14 - 7
7434-01	PEDESTRIAN (REPAIR/REPLACE)	14 - 11
7434-01	MEDIAN BARRIER (REPAIR/REPLACE)	14 - 13

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SAP ASSEMBLY NUMBER: 711-7434-01

BMS Flex-Action: RLGBRPR

ACTIVITY TITLE: BRIDGE/PARAPET RAILING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: LINEAR FEET OF RAILING

(INCLUDING TOP AND BOTTOM RAILS AS ONE UNIT)

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1013 - Aluminum Bridge Railing
 1014 - Steel Bridge Railing

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. When damage is extensive, temporary installation of signs, lights, barricades or other safety/warning devices may be required.

WORK AREA

All parapet mounted metal railing including anchor bolts between the backs of abutment backwalls, plus such railing on straight return abutment wings measured by the linear foot on the bridge and/or abatement wings. Report repairing or replacing the parapets other than minor leveling or smoothing of parapet concrete at railpost locations to Activity F744303, Concrete Curb/Parapet (Repair).

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of a parapet mounted metal railing. The work can include, but is not limited to, removing damaged or deteriorated portions of the railing; placing and securing anchor bolts preparatory to placing concrete; drilling and grouting or otherwise securing anchor bolts into hardened concrete; installing railing; and cleaning railing after installation is completed.

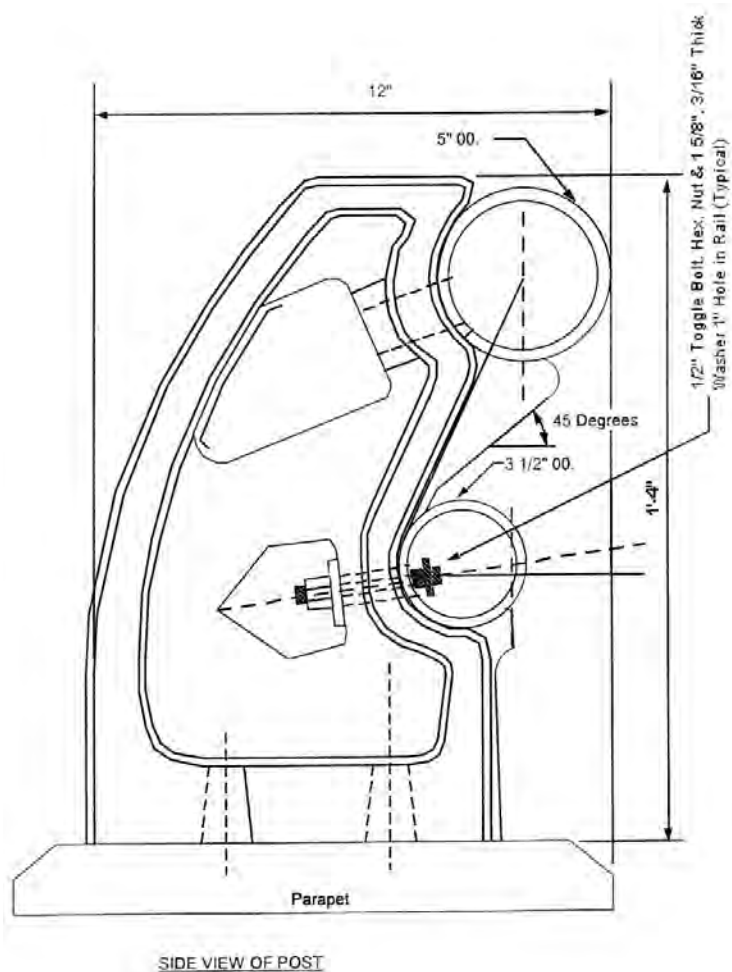
PROCEDURE DESCRIPTION

1. Remove damaged or deteriorated section of existing parapet mounted metal rail, salvaging reusable parts. Flame cutting may be necessary.
2. Remove concrete around damaged anchor bolts with a 30 lb hammer.
3. Cast new concrete to original lines
4. Drill holes in concrete for anchor bolts

5. Install anchor bolts with grout or approved adhesive. Fill any remaining space with epoxy material.
6. Prior to installation, thoroughly coat surfaces of aluminum in contact with other metals, stone masonry, or concrete with caulking compound.
7. Install new railing
8. Burr threads on anchor bolts to prevent loosening of nuts.
9. Clean railing with an acceptable solvent

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	30 Lb. Hammer	As Required	Concrete
1	Crew Members	1	Welding Torch	L.F. As	Replacement
1	Special Crew Member (Certified Welder)	1	Equipment Concrete Drill	Required	Railing
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
3.5 LF/HR		21 LF/DAY		1.1 MH/LF	



SAP ASSEMBLY NUMBER: 711-7434-01

BMS Flex-Action: RLGBRPR

ACTIVITY TITLE: BRIDGE / PARAPET RAILING (REPAIR / REPLACE)

UNIT OF MEASUREMENT: EACH

PROCEDURE: ELIMINATE DEFLECTION JOINTS IN ADJACENT NON-COMPOSITE
PRESTRESSED / CONCRETE BOX BEAM BRIDGE

REFERENCES

PennDOT Specifications (PUB 408)
Section 706- Concrete Bonding Compound
1001- Cement Concrete Structures
1002- Reinforcement Bars
1003- Dowel Holes
1025- Modification of Existing Barriers

SCHEDULING CONSIDERATIONS

Schedule based on need as indicated by inspection reports. If fracture will occur due to deflection joint, then this corrective action will be done immediately.

WORK AREA

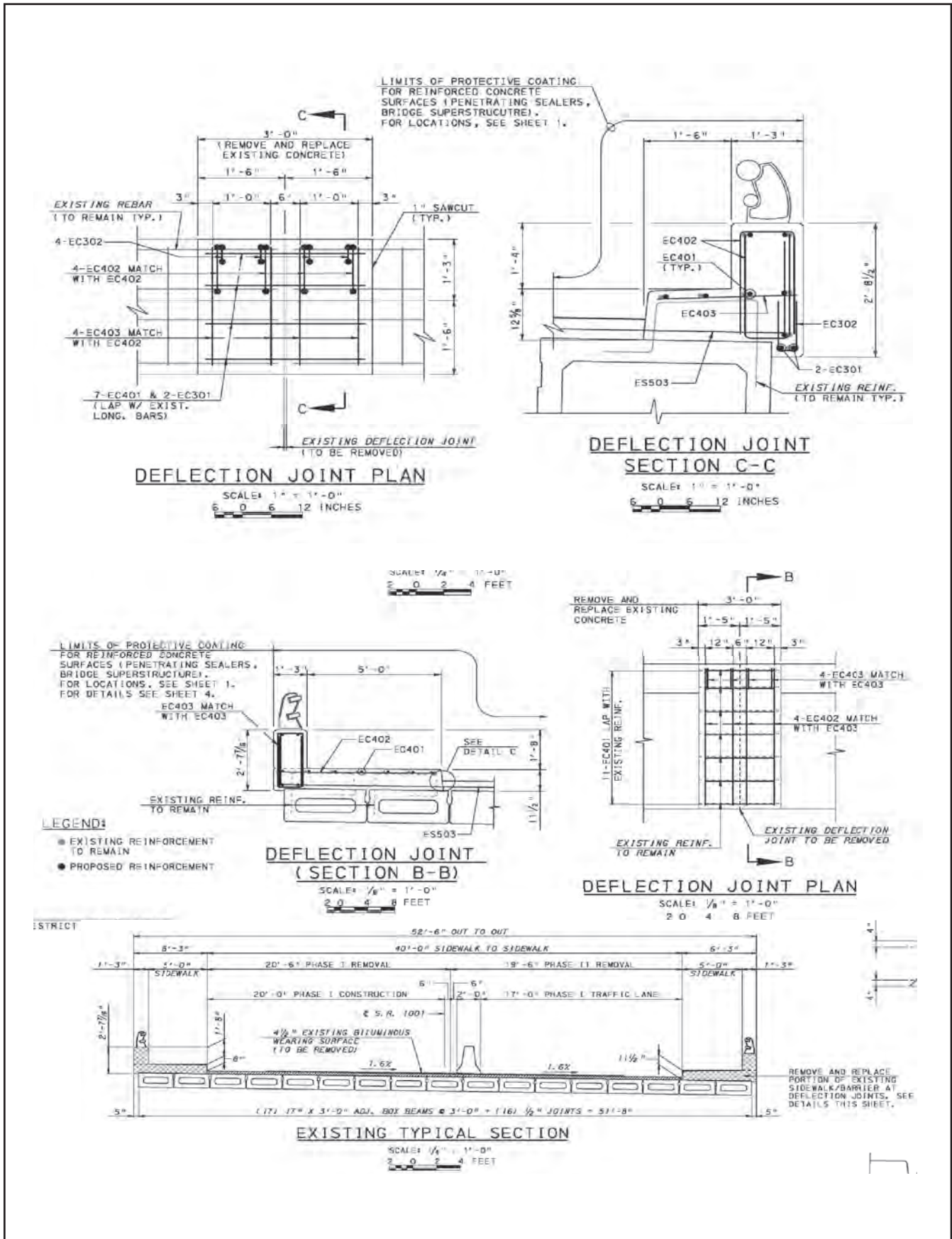
Deflection Joints on Adjacent Non-Composite Pre-stressed Concrete Box Beam Bridges.

ACTIVITY DESCRIPTION

Remove deflection joints in the parapets by removing the concrete to expose the rebar as per plans on each side of the existing joint. Install/.splice additional rebar to form continuous reinforcement of the parapet. Form and pour cement concrete in the area of excavated parapet.

PROCEDURE DESCRIPTION

1. Set up traffic control as per the proper PATA approved by the traffic Unit.
2. Saw cut 1" deep as per approved plans at the specified distance from the joint for a smooth uniform surface. Remove existing concrete without damaging existing rebar.
3. Splice new rebar as per plans to form continuous reinforcement of the parapet.
4. Once all additional rebar is installed clean all debris and or grease or de-bonding agents from existing concrete surfaces then place concrete bonding agent to all concrete surfaces.
5. Construct form work as indicated and as shown on standard drawing/approved plan. Check to make sure rebar clearance coverage conforms to approved plans or standard drawing.
6. Place Class AA cement concrete in the form.



SAP ASSEMBLY NUMBER: 711-7434-01

BMS Flex-Action: RLGSTRM

ACTIVITY TITLE: STRUCTURE MOUNTED RAILING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: LINEAR FEET OF RAILING

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes
 1013 - Aluminum Bridge Railing
 1014 - Steel Bridge Railing

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. When damage is extensive, temporary installation of signs, lights, barricades, or other safety/warning devices may be required.

WORK AREA

All structure mounted metal and concrete railings, including anchor bolts or reinforcing bars connecting railing posts to the structure between the backs of abutment backwalls, plus such railings on straight return abutment wings measured by the linear foot on the bridge and/or abutment wings. Small areas of concrete directly at the posts which require minor amounts of leveling or surface preparation before the posts can be installed are also included within the work area. Report repairs outside the work area, such as casting new concrete to support the railing or other relatively major efforts to an appropriate activity, Activity D744303, Concrete Deck (Repair), for example.

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of a structure mounted railing. The work can include, but is not limited to, removing damaged or deteriorated railing; repairing or replacing elements of metal railing; placing and securing anchor bolts preparatory to placing concrete; drilling and grouting or otherwise securing dowels or anchor bolts into hardened concrete; construction forms, installing reinforcing bars and placing concrete in concrete posts and railing elements; and installing metal railings.

PROCEDURE DESCRIPTION

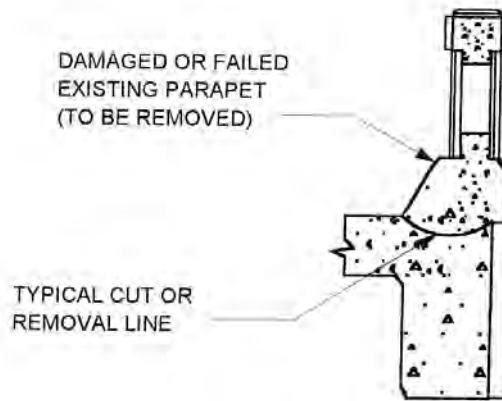
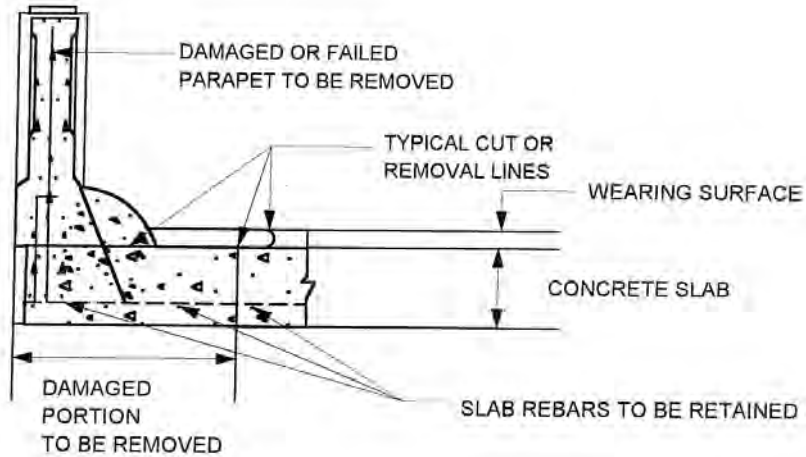
1. Remove damaged or deteriorated structure mounted railing.
2. Remove elements of the structure as necessary, salvaging reusable parts.
3. Remove concrete around damaged anchor bolts with a 30 lb hammer.
4. Cast new concrete to original lines in concrete parapets or to match existing lines for metal rails.
5. Drill holes in concrete for replacement anchor bolts.
6. Install anchor bolts with grout or an approved adhesive.
7. Prior to installation, thoroughly coat surfaces of aluminum in contact with other metals, stone masonry, or concrete with caulking compound.
8. Install new railing.
9. Burr threads on anchor bolts to prevent loosening of nuts.
10. Clean railing with an acceptable solvent.

NOTE: Details of repair/replacement of structure mounted railing should be provided by the District Bridge Engineer.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	30 Lb. Hammer	LF	Replacement Rail
2	Crew Members	1	Concrete Drill		Elements or sections
		1	Hammer and Chisel	As Required	Concrete
				As Required	Anchor Bolts

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1.5 LF/HR	8 LF/DAY	3 MH/LF



TYPICAL SECTION-EXISTING PARAPET

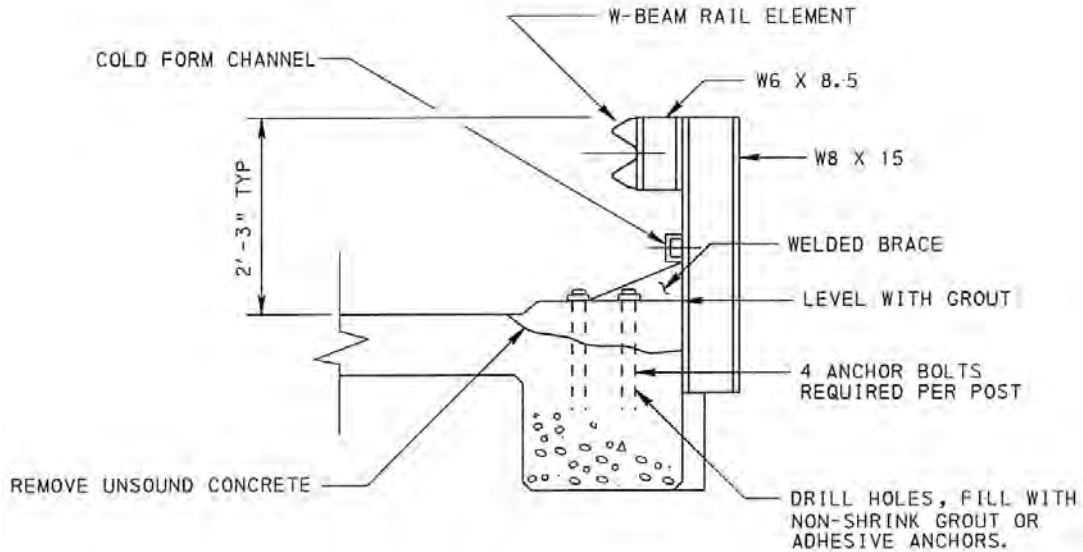
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BMS Flex-Action: RLGSTRM

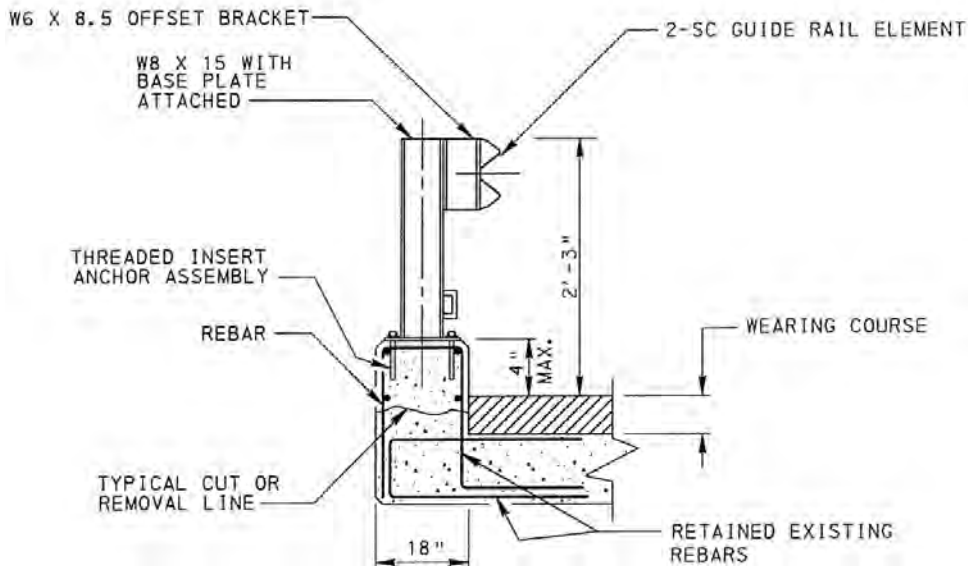
ACTIVITY TITLE: STRUCTURE MOUNTED RAILING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: LINEAR FEET OF RAILING

PROCEDURE: STEEL GUIDERAIL MOUNTED TO CONCRETE



STRUCTURE MOUNTED GUIDE RAIL INSTALLATION



NOTE: EXACT DIMENSIONS, REBAR SIZE AND REBAR SPACING TO BE FURNISHED BY THE DISTRICT BRIDGE ENGINEER

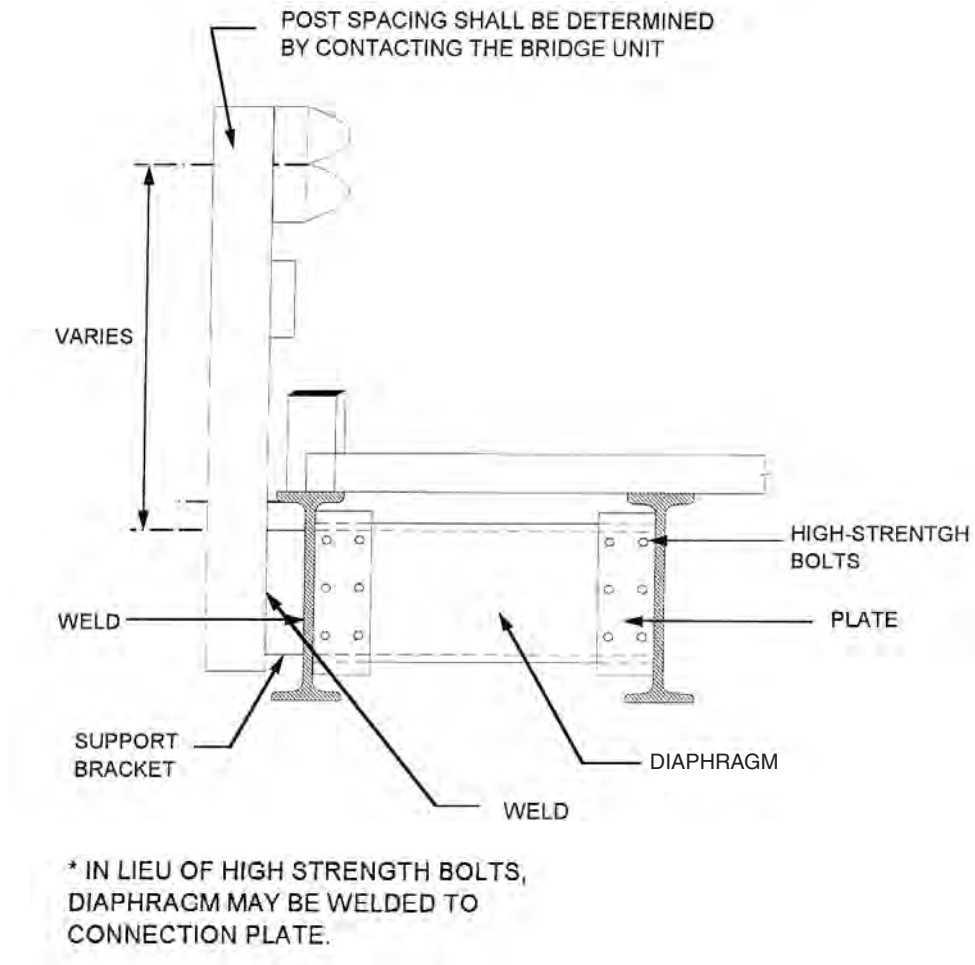
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BMS Flex-Action: RLGSTRM

ACTIVITY TITLE: STRUCTURE MOUNTED RAILING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: LINEAR FEET OF RAILING

PROCEDURE: STEEL GUIDERAIL MOUNTED TO CONCRETE



structure mounted guide rail installation

NOTE: Welding and other details to be furnished by the District Bridge Engineer. Welding should only be accomplished by a welder certified for the type and position of the welds required.

SAP ASSEMBLY NUMBER: 711-7434-01

BMS Flex-Action: RLGPEDN

ACTIVITY TITLE: PEDESTRIAN RAILING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: LINEAR FEET OF RAILING

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1012 - Pedestrian Railing

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. When damage is extensive, temporary installation of signs, lights, barricades or other safety/warning devices may be required.

WORK AREA

All pedestrian railing, including anchor bolts connecting the railing to the structure between the backs of abutment backwalls, plus such railing on straight return abutment wings measured by the linear foot on the bridge and/or abutment wings. Small areas of concrete directly at the post which require minor amounts of leveling or surface preparation before posts can be installed are also included within the work area. Report repairs outside of the work area such as casting new concrete to support the railing or other relatively major efforts to an appropriate activity. An example is activity E744303, Concrete Sidewalk (Repair).

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of a pedestrian railing. The work can include, but is not limited to, removing damaged or deteriorated railing; salvaging reusable parts; repairing or replacing elements of the railing; placing and securing anchor bolts preparatory to placing concrete; drilling and grouting or otherwise securing anchor bolts into hardened concrete; and installing railing.

PROCEDURE DESCRIPTION

1. Remove damaged or deteriorated pedestrian railing.
2. Repair or replace elements of the railing as necessary, salvaging reusable parts.
3. Remove concrete around damaged anchor bolts with a 30 lb hammer.

4. Cast new concrete to original lines.
5. Drill holes in concrete for replacement anchor bolts.
6. Install anchor bolts with grout or approved adhesive.
7. Prior to installation, thoroughly coat surfaces of aluminum in contact with other metals, stone masonry, or concrete with caulking compound.
8. Install new railing.
9. Burr threads on anchor bolts to prevent loosening of nuts.
10. Clean railing with an acceptable solvent.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	LF As Required	Replacement Rail Elements or
3	Crew Members	1	Concrete Drill	sections As Required As Required As Required	Concrete Anchor Bolts

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
2.5 LF/HR	15 LF/DAY	1.6 MH/LF

SAP ASSEMBLY NUMBER: 711-7434-01

BMS Flex-Action: RLGMEDB

ACTIVITY TITLE: MEDIAN BARRIER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: LINEAR FEET OF RAILING

PROCEDURE: PRECAST MEDIAN BARRIER

REFERENCES

PennDOT Specifications (PUB 408)
 Section 621 - Metal Median Barrier
 623 - Concrete Median Barrier
 1003 - Dowel Holes

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. When damage is extensive, temporary installation of signs, lights, barricades or other safety/warning devices may be required.

WORK AREA

All median barriers including anchor bolts or other devices securing the barriers to the structure between the backs of abutment backwalls. Small areas of deck directly at the barrier which require minor amounts of leveling or surface preparation to permit satisfactory repair or installation of the barriers are also included within the work area. Report repairs outside of this work area to other appropriate activities.

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of a median barrier. The work can include, but is not limited to, removing damaged or deteriorated median barrier; salvaging or replacing parts of a metal barrier; placing and securing anchor bolts preparatory to placing concrete; drilling and grouting or otherwise securing anchor bolts or dowels into hardened concrete; constructing forms for concrete median barriers; placing concrete; and installing metal railing.

PROCEDURE DESCRIPTION

1. Remove existing deteriorated section of median barrier with a 30 lb hammer.
2. Level deck in barrier location and drill holes for anchors into deck taking care not to punch through if through bolts are not to be used.
3. Set section of barrier on a leveling bed of mortar to bring the barrier into proper line.
4. When using through bolts, insert galvanized bolts, washers, and nuts and tighten sufficiently to retain grout poured through the access hole. If screw anchors are used, permanently tighten nuts after the anchor and bolts are grouted in and grout has set.
5. Pack bolt pocket with non-shrink mortar.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Crane	LF As Required	Precast parapet Section
3	Crew Members		Air Compressor	As Required	Epoxy Mortar Anchorage System
1	Special Crew Member (Operator)	1	with Hammer	As Required	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
8 LF/HR		48 LF/DAY		.63 MH/LF	

Chapter 15: Bearings

Table of Contents

7435-01	LUBRICATE	15 - 3
7435-02	STEEL (REPAIR/REHABILITATE)	15 - 5
7435-02	STEEL (REPLACE)	15 - 7
7435-02	EXPANSION (RESET)	15 - 9
7435-03	PEDESTAL/SEAT (RECONSTRUCT)	15 - 14

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SAP ASSEMBLY NUMBER: 711-7435-01**BMS Flex-Action:** A743501**ACTIVITY TITLE:** LUBRICATE BEARINGS**UNIT OF MEASUREMENT:** EACH BEARING**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1060 - Painting Structural Steel

SCHEDULING CONSIDERATIONS

Primarily a periodic activity, with elapsed time between lubrications based on circumstances and conditions at each structure. Bearings below open joints require more frequent cleaning and lubrication than ones below sealed joints. The time between lubrications can also be revised as a result of bridge inspection reports.

WORK AREA

All bearings having surfaces involving metal to metal movement where the metal surfaces are not permanently lubricated. The bearings can be located at abutments, piers, and in pin or pin and link assemblies for cantilever/suspended spans.

ACTIVITY DESCRIPTION

Cleaning and lubricating bearing assemblies. The work can include, but is not limited to, temporarily modifying superstructures to accept jacking loads, providing temporary supports for jacking; removing loads from bearings by either jacking from below or using needle/carrier from above; disassembling bearings; cleaning and lubricating all moving parts; reassembling bearings; and painting bearings with a prime coat.

PROCEDURE DESCRIPTION

1. Modify superstructure to accept jacking loads, if necessary.
2. Construct temporary bent or other supports for jack support or install needle/carrier beam.
3. Jack superstructure and remove the bearing assembly.
4. Disassemble bearing
5. Clean, paint and lubricate bearing.
6. Reassemble the bearing and reinstall the bearing.
7. Remove jacks or needle/carrier beams.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Crane	As Required	Temporary Bent or Needle/Carrier Lubricate Paint
3	Crew Members	As	Jacks	As Required	
1	Special Crew Member (Operator)	Required	Wire Brush	As Required	
		1		As Required	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.25 EA/HR		1.5 EA/DAY		16 MH/LF	

**Preventive Maintenance
Lubricate Bearings**



Perform at regular intervals
Work area:

Contacted metal surfaces that are not permanently lubricated. Clean contact surfaces, surrounding area of rust and old lubricant. Place new lubricant.

SAP ASSEMBLY NUMBER: 711-7435-02

BMS Flex-Action: A744501

ACTIVITY TITLE: STEEL BEARINGS (REPAIR/REHABILITATE)

UNIT OF MEASUREMENT: EACH BEARING

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB408)
Section 1105 - Fabricated Structural Steel
1060 - Painting Structure Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. A thorough inspection and evaluation can be most easily accomplished following completion of Activity C743102, Clean/Flush Bearing/Bearing Seat.

WORK AREA

All steel bearings, both fixed and expansion, at abutments and piers and pin or pin and link assemblies for cantilever/suspended spans.

ACTIVITY DESCRIPTION

Repairing or rehabilitating steel bearing assemblies of all types and sizes. The work can include, but is not limited to, temporarily modifying superstructures to accept jacking loads; providing temporary supports for jacking; removing loads from bearings by either jacking from below or using needle/carrier beams from above; disassembling bearings; prefabricating replacement parts; repairing, rehabilitating or replacing parts of bearings; reassembling bearings; and painting bearings with a prime coat.

The work of lubricating bearings and resetting expansion bearings is included in this activity. When it is performed as part of a repair or rehabilitation, separate reports to activities A743501, Lubricate Bearings, and activity C744502, Expansion Bearings (reset), should not be made.

PROCEDURE DESCRIPTION

1. Modify superstructure to accept jacking loads, if necessary.
2. Construct temporary bent or other supports for jack support or install needle/carrier beam.
3. Jack superstructure and remove the bearing.
4. Disassemble bearing
5. Install prefabricated replacement parts.
6. Clean, paint and lubricate other parts.
7. Reassemble bearing.
8. Remove jacks or needle/carrier beams.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Crane	As Required	Temporary Bent or Needle/Carrier Lubricate Paint
3	Crew Members	1	Jacks	As Required	
1	Special Crew Member (Operator)	1	Wire Brush	As Required	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.4 EA/HR		2.5 EA/DAY		12 MH/LF	

SAP ASSEMBLY NUMBER: 711-7435-02

BMS Flex-Action: B744501

ACTIVITY TITLE: STEEL BEARINGS (REPLACE)

UNIT OF MEASUREMENT: EACH BEARING

PROCEDURE: GENERAL REPLACEMENT PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1003 - Dowel Holes
 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

All steel bearings, both fixed and expansion, at abutments and piers and pin or pin and link assemblies for cantilever/suspended spans. Small areas of the pedestals/seats at and directly adjacent to masonry plates are also included for making minor repairs, leveling or adjusting the elevation of the contact surfaces, and installation of new anchor bolts.

Report major repairs of existing concrete to appropriate activities, such as Activity D744503, Bearing Pedestal/Seat (Reconstruct) or Activity B744802, Abutments (Repair).

ACTIVITY DESCRIPTION

Replacing steel bearings with bearings of the same or different types. The work can include, but is not limited to, temporarily modifying the superstructures to accept jacking loads; providing temporary supports for jacking; removing loads from bearings by either jacking from below or using needle/carrier beams from above; prefabricating new bearings; removing bearings; preparing the surface of the bridge seat/pedestal for new bearings; drilling for and installing new anchor bolts; and installing new bearings.

The work of increasing the elevations of bridge seats/pedestals to accommodate different types of bearings is included in Activity 744503, Bearing Pedestal/Seat (Reconstruct), if the work defined in that activity is also required.

PROCEDURE DESCRIPTION

1. Modify superstructure to accept jacking loads, if necessary.
2. Construct temporary bent or other supports for jack support or install needle/carrier beam.
3. Jack superstructure.
4. Remove existing bearing.
5. Remove existing anchor bolts, if necessary, by drilling or other approved methods. Grout new bolts.
6. Prepare concrete surface for new bearing.
7. Install new bearing and lubricate.
8. Remove jacks or needle/carrier beams.

NOTE: Consideration should be given to replace rocker bearing with neoprene pads instead of replacing in kind.

Activity requirements

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Crane	1	New Bearing
3	Crew Members	1	Jacks	As Required	Concrete
1	Special Crew Member (Operator)	1	Drill	As Required	Grout
				As Required	Anchor Bolts
				As Required	Temporary Bent or needle/carrier Beam
				As Required	Lubricant
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.17 EA/HR		1 EA/DAY		30 MH/LF	

SAP ASSEMBLY NUMBER: 711-7435-02

BMS Flex-Action: C744502

ACTIVITY TITLE: EXPANSION BEARINGS (RESET)

UNIT OF MEASUREMENT: EACH BEARING

PROCEDURE: RESET ROCKER BEARINGS

REFERENCES

PUB 238

PennDOT Specifications (PUB 408)

Section 1001 - Cement Concrete Structures

1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Requirement for resetting often indicates substructure movement. If substructure movement continues, investigation should be scheduled.

WORK AREA

All expansion bearings at abutments and piers. Small areas of the pedestals/seats at and directly adjacent to masonry plates are also included for making minor repairs, leveling or adjusting the elevation of the contact surfaces, and installing new anchor bolts. Superstructure members at the bearings are included to permit modification or adjustment required as a result of the resetting.

ACTIVITY DESCRIPTION

Resetting and relocating expansion bearings by adjusting the location of masonry plates on the bottom of bearing assemblies or, alternatively, relocating sole plates on top of bearing assemblies. If using alternate method consider relocating bearing stiffeners, to accept relocated bearing loads. The work can include, but is not limited to, temporarily modifying the superstructure to accept jacking loads; providing temporary supports for jacking; removing loads from bearings by either jacking from below or using needle beams from above; disassembling bearings; cutting off anchor bolts; preparing concrete contact surfaces for relocation of masonry plates; locating masonry plates so that bearings will be properly positioned for the temperature at time of resetting; drilling holes for and grouting in new anchor bolts and reassembling bearings; or, as an alternative to relocating masonry plates, disconnecting sole plates from superstructure members; modifying superstructure members to accept relocated bearing loads; and reconnecting sole plates to

super-structure members so that bearings will be properly positioned for the temperature at time of resetting. Consider replacing rocker bearing with neoprene bearing if possible.

PROCEDURE DESCRIPTION

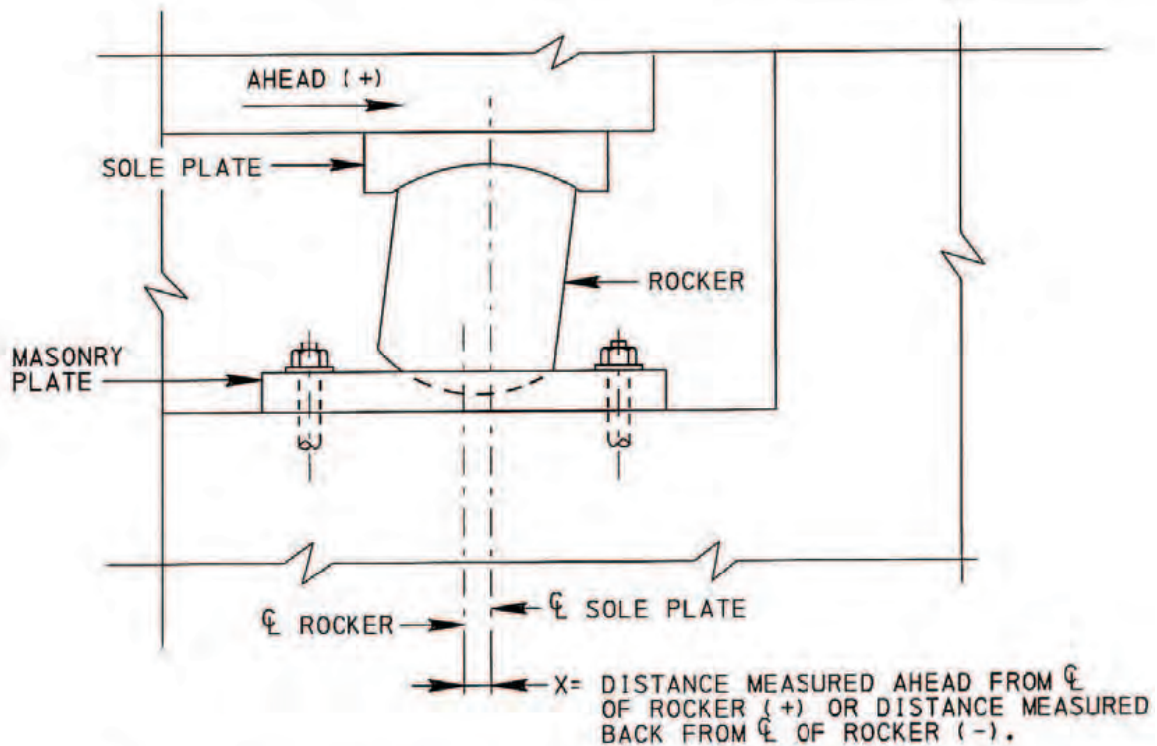
1. Jack the bridge to a height required to reset or reposition bearings. A detailed jacking plan shall be developed by the District Bridge Engineer based on structure details. Precautions shall be taken to prevent damage to the bridge during the resetting or repositioning of the bearings.
2. Reset rocker bearings so that the total travel it experiences can be divided equally by its median position. A table based on the length of bridge expanding at the bearing shall be developed by the District Bridge Engineer for various temperatures.
3. Bearing areas shall be so reconstructed as necessary that no water accumulates or stands at any point. The bearing surface shall be smooth and level. Fill minor depressions with an accepted low-viscosity epoxy, applied with a squeegee.
4. Remove jacks.

BACK GROUND

Rocker bearings are generally designed to be set at 68° F, which means that the rocker bearings should be vertical (no tilt) at 68°F by design. However, due to fabrication and construction tolerances, rocker bearings in the vertical position at ambient temperatures up to 15°F higher and lower than 68°F would still be acceptable. The normal behavior of rocker bearings is to tilt away from the fixed bearing for that span unit when temperatures rise and to tilt toward the fixed bearing for that span unit when the temperature falls.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	2	Access Equip.	As Required	Epoxy
3	Crew Members	As Required	Jacks		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.25 EA/HR		1.5 EA/DAY		16 MH/LF	



DEGREES FAHRENHEIT	X IN INCHES PER 100 FT. OF BRIDGE EXPANDING AT ROCKER
40	-0.16
50	-0.10
60	-0.06
70	0.00
80	0.70
90	0.13
100	0.19

Realign Steel Rocker Bearings



Example of Failed Rocker



Resetting Rocker Bearings

Renewed focus on rocker bearing alignment due to Birmingham Bridge.

If you see misalignment, notify Bridge Engineer.



Resetting Rocker Bearings
PennDOT District 1-0
Erie County
S.R. 4012 over Interstate 90

4 span steel girder bridge with composite concrete deck. Steel rocker bearings over two piers misaligned.

October 2008



Design: In-House by District personnel.
Construction: Erie County Bridge Crew
Duration of Construction: 7 days
Maintenance and Protection of Traffic: Half-width to close lanes over bearings being repaired.

Cost: \$10,000

Resetting Rocker Bearings



Equipment List:

- Hydraulic Jack (Hand Operated)
- Timber Cribbing
- Scaffold
- Grinder
- Welder

Each beam jacked as shown and rocker bearing assembly removed from beam.



Rocker bearing assembly moved along beam to align with masonry plate.

Rocker bearing assembly welded to bottom flange in new location as shown.

Jacks removed and bearing assembly re-painted.

Resetting Rocker Bearings



Lessons Learned:

- 1-Timber blocking interfered with removal of bearing assembly.
- 2-Fixed this by cutting 3 sides of the weld prior to jacking.
- 3-Reduced construction duration from 5 days at Pier 1 to 2 days at Pier 2.

Alternate Method:

Extend concrete pedestal and install neoprene bearing pads (must design bearing pad)



SAP ASSEMBLY NUMBER: 711-7435-03**BMS Flex-Action:** D744503**ACTIVITY TITLE:** BEARING PEDESTAL/SEATS (RECONSTRUCT)**UNIT OF MEASUREMENT:** EACH PEDESTAL/SEAT**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

Bridge seats and/or pedestals at abutments and piers to a maximum depth of approximately 1-1/2 times the length of the anchor bolts. Report more extensive repairs entirely to Activity B744802, Abutments (Repair), or Activity D744802, Piers (Repair) as appropriate.

ACTIVITY DESCRIPTION

Reconstructing bearing pedestals and/or bridge seats. The work can include, but is not limited to, temporarily modifying superstructures to accept jacking loads; providing temporary supports for jacking; removing loads from bearings either by jacking from below or by using a needle beam from above; disassembling bearings and/or providing means to support the bearings or portions of the bearings from the superstructure members; removing deteriorated or damaged concrete and reinforcing steel; drilling and grouting or otherwise securing dowels into existing concrete; placing and tying reinforcing steel; constructing forms; installing anchor bolts; placing concrete; preparing contact surfaces of concrete; and replacing bearing assemblies. When work under this activity is accomplished, necessary tasks as described under Activities A743501, Lubricate Bearings; A744501, Steel Bearings (Repair/Rehabilitate); B744501, Steel Bearings (Replace); and C744502, Expansion Bearings (Reset) are to be performed, but separate activity reports are not necessary. All required work is to be reported under this activity, D744503.

PROCEDURE DESCRIPTION

1. Construct temporary bent for supporting jacks and blocking if jacking from abutment or pier elements cannot be accomplished.
2. Place jacks and lift beam until bearing pressure is completely relieved.
3. Remove the deteriorated concrete to horizontal and vertical planes.
4. Form as required apply epoxy bonding compound to prepare the surfaces of sheared beam seats and cast new concrete.
5. After the concrete has reached required strength, remove forming, blocking, jacks and temporary supports.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman Crew Members	1	Concrete Mixer	As Required	Concrete Epoxy bonding Material Reinforcing Steel
3		1	Air Compressor with Hammer	As Required	
		As Required	Jacks	As Required	
		As Required	Access Equip.	As Required	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.17 EA/HR		1 EA/DAY		30 MH/LF	

Structural Repairs

Bearing Pedestal Spall Repair



Perform based on need

Work Area: bearing pedestal

- Remove deteriorated or damaged concrete, reinforcing steel or masonry
- Drill and install dowels; install reinforcing steel; construct forms
- Place concrete
- Involve District Bridge Engineer for design

SAP ASSEMBLY NUMBER: 711-7435-03

BMS Flex-Action: D744503

ACTIVITY TITLE: BEARING PEDESTAL/SEATS (RECONSTRUCT)

UNIT OF MEASUREMENT: EACH PEDESTAL/SEAT

PROCEDURE: GENERAL PROCEDURE

PROCEDURE DESCRIPTION

1. Construct temporary bent for supporting jacks and blocking if jacking from abutment or pier elements cannot be accomplished.
2. Place jacks and lift beam until bearing pressure is completely relieved.
3. Remove deteriorated concrete to horizontal and vertical planes.
4. Add new reinforcing steel where required.
5. Form as required. Apply epoxy bonding compound to prepared surface of sheared beam and cast new concrete.
6. After concrete has reached required strength, remove forming, blocking, jacks and temporary supports.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	As Required	Concrete
3	Crew Members	1	Air Compressor with Hammer	As Required	Epoxy bonding Material
		As Required	Jacks	As Required	Reinforcing Steel
		As Required	Access Equip.	As Required	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.17 EA/HR		1 EA/DAY		30 MH/LF	

SAP ASSEMBLY NUMBER: 711-7435-03

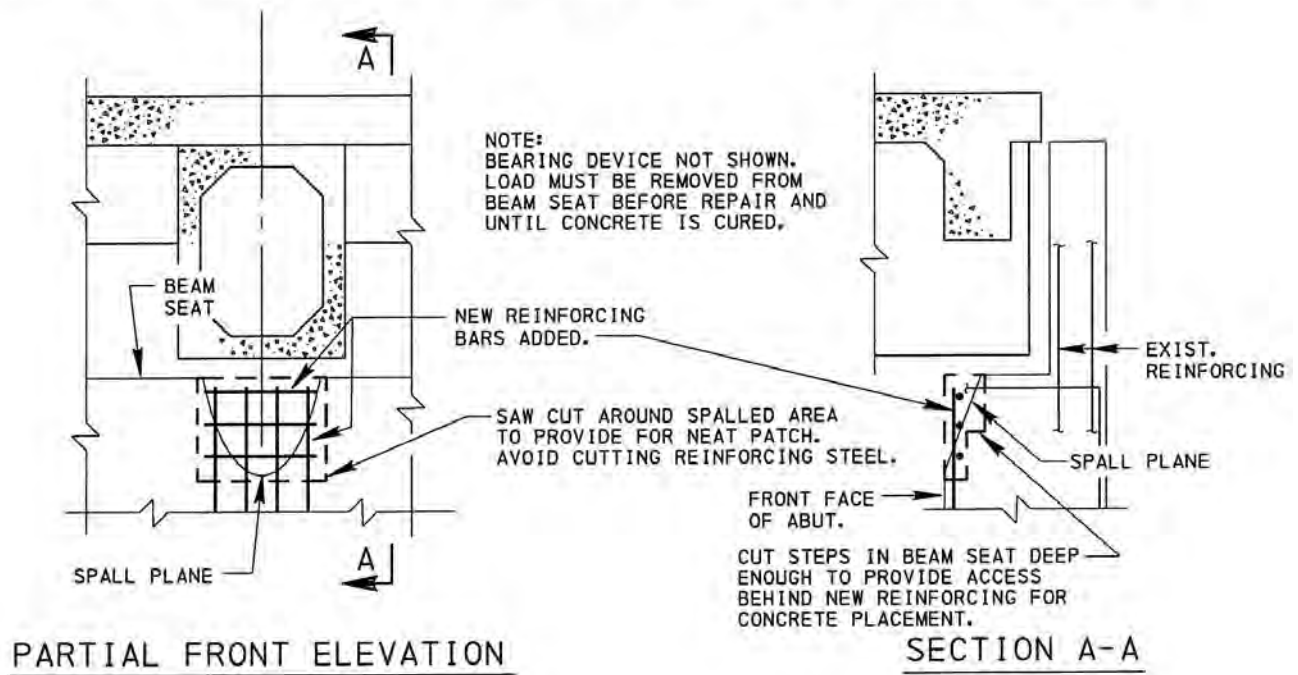
BMS Flex-Action: D744503

ACTIVITY TITLE: BEARING PEDESTAL/SEATS (RECONSTRUCT)

UNIT OF MEASUREMENT: EACH PEDESTAL/SEAT

PROCEDURE: GENERAL PROCEDURE

TYPICAL REPAIR OF SHEARED CONCRETE BEAM SEATS



SAP ASSEMBLY NUMBER: 711-7435-03

BMS Flex-Action: D744503

ACTIVITY TITLE: BEARING PEDESTAL/SEATS (RECONSTRUCT)

UNIT OF MEASUREMENT: EACH PEDESTAL/SEAT

PROCEDURE: PEDESTAL INSTALLATION TO ELEVATE BRIDGE PROFILE

PROCEDURE DESCRIPTION

1. Prefabricate the pedestals.
2. Jack the bridge to the height required to install the new pedestals. A detailed jacking plan shall be developed by the District Bridge Engineer based on structural details. Precautions shall be taken to prevent damage to the bridge during jacking.
3. Remove any temporary blocking, install 1/4 in. preformed fabric pad on the bearing surface, and place the permanent pedestals in position. The fabric pad and bearing surface should be swabbed with red lead paint.
4. Install cross bracing or other type bracing; field weld or bolt as required and make any necessary adjustments; anchor the pedestal to the pier or abutment.
5. Reposition the beam bearing assemblies on top of the pedestals.
6. Lower the span to bear evenly on the pedestal bearings.
7. Complete all field welding and/or make other final adjustments; tighten all anchor bolts.
8. Remove jacking equipment, cribbing etc.
9. Excavate behind the abutment backwalls and wingwalls to a depth sufficient to facilitate the removal of concrete as required to ensure bond to the existing reinforcing steel.
10. Construct back and wingwalls to the new elevation as required.
11. Backfill abutment and wingwalls; reconstruct bridge approaches as required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	Staging Equip.	1	Prefabricated Pedestals Fabric Pads
3	Crew Members	As Required	Access Equip.	1	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.17 EA/HR		9 EA/DAY		2.7 MH/LF	

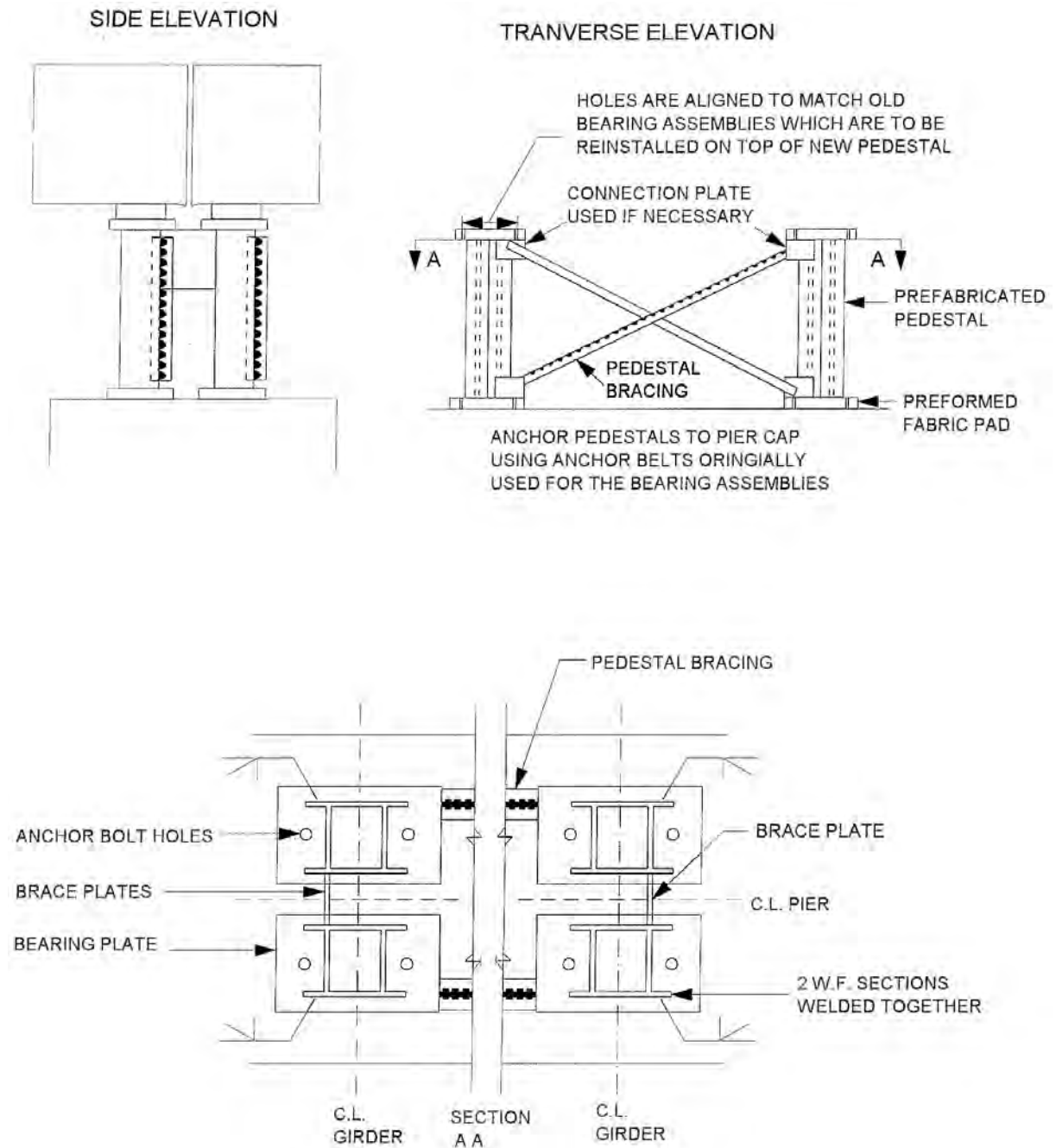
SAP ASSEMBLY NUMBER: 711-7435-03

BMS Flex-Action: D744503

ACTIVITY TITLE: BEARING PEDESTAL/SEATS (RECONSTRUCT)

UNIT OF MEASUREMENT: EACH PEDESTAL/SEAT

PROCEDURE: PEDESTAL INSTALLATION TO ELEVATE BRIDGE PROFILE



Chapter 16: Approach Roadway Work

Table of Contents

7442-01	APPROACH SLAB (REPLACE)	16 - 3
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SAP ASSEMBLY NUMBER: 711-7442-01

BMS Flex-Action: A744201

ACTIVITY TITLE: APPROACH SLAB (REPLACE)

UNIT OF MEASUREMENT: SQUARE YARDS

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 501 - Reinforced Cement Concrete Pavements
 505 - Bridge Approach Slabs
 516 - Concrete Pavement Patching
 Standard Drawings RC-23

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Deterioration is often more extensive than is apparent from observation alone.

WORK AREA

Entire Reinforced Cement Concrete Approach Slab from the backs of the abutment backwalls to the first Transverse Joint in the approach roadway.

ACTIVITY DESCRIPTION

Repairing or replacing all or any portions of a Reinforced Cement Concrete Approach Slab. The work can include, but is not limited to removing deteriorated or damaged concrete; removing deteriorated or damaged reinforcing steel; retying existing reinforcing steel; supporting and tying new reinforcing steel; and placing new concrete.

PROCEDURE DESCRIPTION

1. Saw cut the boundaries of the deteriorated or damaged concrete to be replaced. Before sawing, use a pachometer to locate the reinforced bars and avoid cutting them.
2. Remove the deteriorated concrete with jack hammers. Cut and remove deteriorated reinforced steel. Provide minimum 3/4" clearance around all reinforcing steel in top material regardless of concrete deterioration.
3. Place replacement reinforcing steel by tying into existing sound steel.
4. Place side forms for concrete where appropriate.
5. Erect the concrete screed to permit finishing the plastic concrete of the proper elevation.
6. Pour concrete in one continuous operation.
7. Finish and texture the Slab and cure the concrete.
8. Remove side forms if applicable.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	As Required	Reinforced Steel
3	Crew Members	1	Air Compressor with Jack Hammer appropriate to depth to be removed	As Required	Concrete
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
2.3 SY/HR		14 SY/DAY		2.2 MH/SY	

Chapter 17: Decks

Table of Contents

7443-01	BITUMINOUS DECK WEARING SURFACE (REPAIR/REPLACE)	17 - 3
7443-01	TIMBER DECK (REPAIR/REPLACE)	17 - 5
7443-01	OPEN STEEL GRID (REPAIR/REPLACE)	17 - 7
7443-01	CONCRETE DECK (REPAIR)	17 - 9
7443-01	PRECAST DECK (REPAIR/REPLACE)	17 - 13
7443-02	CONCRETE SIDEWALK (REPAIR)	17 - 16
7443-02	CONCRETE CURB/PARAPET (REPAIR)	17 - 17
7449-01	CONCRETE DECK OVERLAY – EPOXY	17 - 20
7449-02	CONCRETE DECK OVERLAY - POLYESTER POLYMER CONCRETE OVERLAY . . .	17 - 24

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SAP ASSEMBLY NUMBER: 711-7443-01

BMS Flex-Action: BITWRGS

ACTIVITY TITLE: BITUMINOUS DECK WEARING SURFACE (REPAIR/REPLACE)

UNIT OF MEASUREMENT: SQ. YARDS OF BITUMINOUS CONCRETE WEARING SURFACE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 409 - Super Pave
 422 - Bituminous Wearing Course
 460 - Bituminous Tack Coat
 467 - Heavy Duty Membranes
 469 - Crack Filling and Sealing
 705 - Joint Material
 962 - Painting Traffic Lines & Markings

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Permanent repairs should not normally be attempted when the air or surface temperature is at or below 40°F or when the surface is wet. Permanent replacement of wearing course is not to occur from October 1 to March 31 depending on the District (Refer to PUB 408, Section 409.3b1)

WORK AREA

Entire bituminous concrete wearing surface on bridge between curbs and the backs of abutment backwalls. Concrete or timber decks below the wearing surface are not included in this work area so report the repair of any defects in decks revealed by the removal of the wearing surface to the appropriate deck repair activity. End dams and scuppers against which the bituminous concrete wearing surface is to be placed are included within the work area for the purposes of cleaning contact surfaces, applying tack coat, or making minor adjustments.

If major modifications or replacements of these items are required however, the work is to be reported under the appropriate activity such as Activity B744401 Drain/Scupper (Install) or Activity D744102, Steel Dams (Repair/ Rehabilitate).

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of a bituminous concrete wearing surface. The work can include, but is not limited to, excavating deteriorated or defective material and preparing surfaces against which new material is to be placed; placing new bituminous concrete in prepared excavations; placing new bituminous concrete overlay to improve skid resistance; repairing or replacing of waterproofing membrane; crack filling; and caulking or sealing the joint between the bituminous concrete wearing surface and curb faces.

PROCEDURE DESCRIPTION

1. Remove existing deck wearing surface by milling or pneumatic hammering to concrete or timber deck or desired depth of existing bituminous surface.
2. Patch spalled or cracked areas.
3. Raise end dams and scuppers as necessary. Clean contact surfaces of end dams and scuppers.
4. Apply bituminous tack coat to the deck surface and contact surfaces of end dams and scuppers.
5. Place heavy duty membrane as required.
6. Place and compact bituminous wearing course to the required thickness.
7. Apply paint traffic lines and markings after the wearing course has cured in accordance with the paint manufacturer's recommendation.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Paver	1 SY	Bituminous
3	Crew members	1	Rollers & hand compaction equip	.05 gal./SY	Concrete
3	Special Crew Members (Operator)	1	Air compressor with jack hammer	1 SY	Tack Coat
		1	Milling Machine		Heavy Duty Membrane
		1	Asphalt Distributor		
		As Required	Dump trucks for bituminous concrete		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
18 SY/HR		110 SY/DAY		.4 MH/SY	

SAP ASSEMBLY NUMBER: 711-7443-01**BMS Flex-Action:** B744301**ACTIVITY TITLE:** TIMBER DECK (REPAIR/REPLACE)**UNIT OF MEASUREMENT:** SQUARE YARDS OF TIMBER DECK**PROCEDURE:** GENERAL REPAIR/REPLACEMENT PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1031 - Timber Structures

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Work can be performed during any season and at any temperature which is reasonable for outdoor work. Scope of work can increase substantially as work progresses, so time allotted should not be too restrictive.

WORK AREA

Entire timber deck between the backs of abutment backwalls, including deck; timber curbs; timber sidewalks; timber railings or timber portions of composite railings; or nailing strips, or bolsters, on top of steel stringers.

ACTIVITY DESCRIPTION

Repairing or replacing all or any portion of a timber element within the work area. Work can also include replacing or supplementing the connections between existing members by spiking or bolting. Placing a bituminous wearing surface on a timber deck should be charged to item BITWRGS.

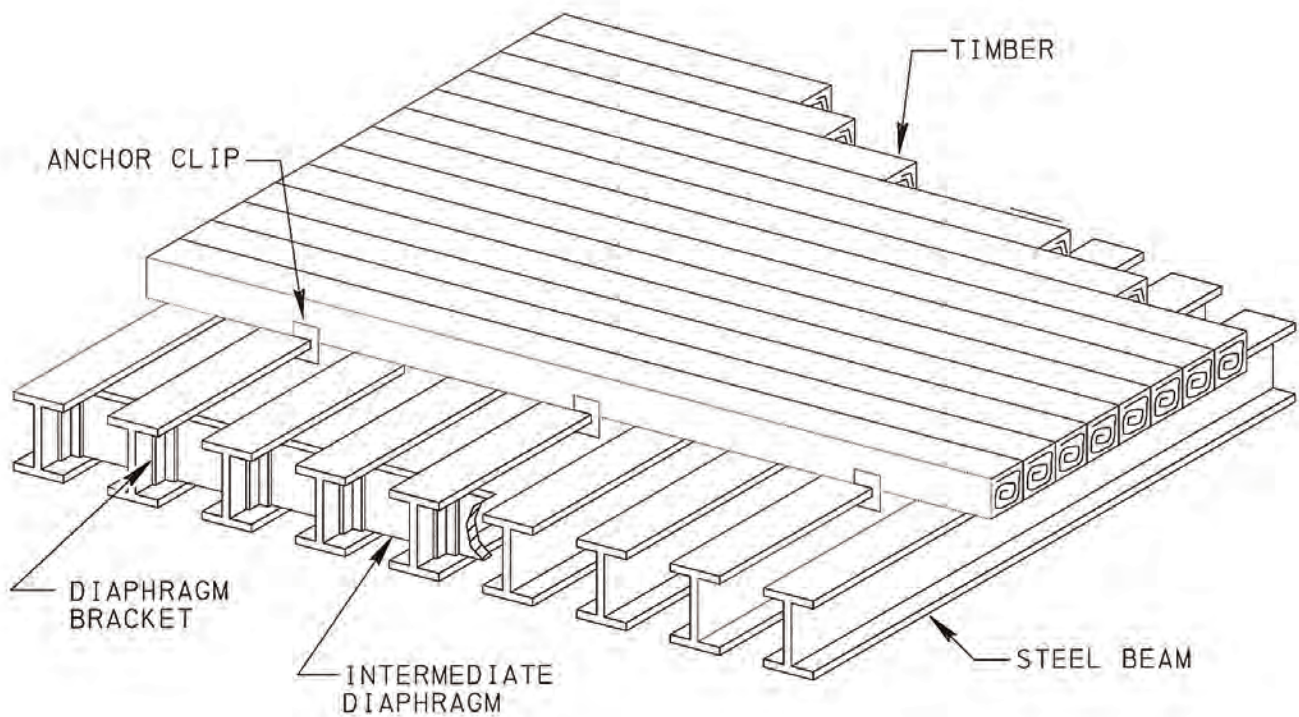
PROCEDURE DESCRIPTION

1. Remove and store deck mounted curbs, parapets, wheel guards and railing.
2. Remove existing deteriorated decking that can be repaired or replaced in the same day.
3. Clean and paint top flanges of stringers.
4. Place pressure-treated lumber on the stringers parallel to the abutment. Lumber should be placed with the smallest dimension on the stringer. No stick shall bear on fewer than three stringers and joints should be staggered.
5. Spike each stick in place with spikes spaced as specified by the District Bridge Engineer.
6. Place Anchor plates spaced as specified by the District Bridge Engineer along every stringer, alternating sides of the stringer flange with every stringer.
7. Apply wood preservative to the ends of any stick that is field cut.
8. Place preformed membrane waterproofing if authorized by the District Bridge Engineer and place the bituminous wearing surface if authorized.
9. Replace deck mounted appurtenances (after wearing surface applied if applicable).

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman		No Special equipment required	As Required	Pressure Treated Timber Spikes Anchor Plates Treated timber to match existing if a repair or in accordance with design if replacement
3	Crew Members			As Required As Required	

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1.8 SY/HR	11 SY/DAY	2.2 MH/SY



NOTE: THIS IS A SCHEMATIC DRAWING, CONSULT THE DISTRICT BRIDGE ENGINEER FOR STANDARDS OF SPIKING, SPLICING, AND ANCHOR PLATE ATTACHMENTS.

SAP ASSEMBLY NUMBER: 711-7443-01

BMS Flex-Action: C744302

ACTIVITY TITLE: OPEN STEEL GRID DECK (REPAIR/REPLACE)

UNIT OF MEASUREMENT: SQUARE YARDS OF OPEN STEEL GRID DECK

PROCEDURE: GENERAL REPAIR/REPLACEMENT PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections and deficiencies observed and reported by other personnel. For maximum effectiveness, deficiencies in steel grid floors and their connections to stringers should be corrected promptly to limit the area of the deck which is affected.

WORK AREA

Entire steel grid deck between the backs of abutment backwalls, including curbs and sidewalks, and connections to steel stringers, to include fasteners and shim plates.

ACTIVITY DESCRIPTION

Repairing or replacing portions of an existing open steel grid deck. The work can include, but is not limited to, removing deteriorated or damaged sections and replacing them; rewelding elements of a deck; rewelding a deck to steel stringers;

installing shims to reduce extraneous tension loads on welded connections; increasing skid resistance by serrating or adding studs to the top of the grid; and repairing or replacing structural elements of curbs and sidewalks. Do not replace entire decks with open steel grid decking.

PROCEDURE DESCRIPTION

1. Locate damaged sections of grid, broken welds between grid and stringers and other areas requiring repair.
2. Cut and remove damaged steel as required. Repairs should be continuous over at least three stringers.
3. Weld replacement steel and/or reweld deck to stringers. Insure splice joints are over supporting stringer.

NOTE: Welding detail for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip.	1 SY	Steel Plates as Necessary
3	Crew Members			As Required	Necessary
1	Special Crew Members (Certified Welder)			As Required	Welding Rod
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.3 SY/HR		2 SY/DAY		12MH/SY	

SAP ASSEMBLY NUMBER: 711-7443-01

BMS Flex-Action: C744302

ACTIVITY TITLE: OPEN STEEL GRID DECK (REPAIR/REPLACE)

UNIT OF MEASUREMENT: SQUARE YARDS OF OPEN STEEL GRID DECK

PROCEDURE: GENERAL REPLACEMENT PROCEDURE

PROCEDURE DESCRIPTION

1. Ensure replacement grid deck sections are on hand prior to beginning work.
 2. Remove existing deck sections as required.
 3. Erect steel grid and weld to steel beams. Follow any recommendations of the grid manufacturer.
 4. If the grid system includes a wearing surface, place concrete.
- Note:** Welding detail for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip.	SY As required	Steel Grid Deck
2	Crew members	2	Crane or Lifting Equipment	As Required	Welding Rod
2	Special Crew Members (Certified Welder)	1	Concrete Mixer (Optional)		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.3 SY/HR	2 SY/DAY	12MH/SY

SAP ASSEMBLY NUMBER: 711-7443-01

BMS Flex-Action: D744303

ACTIVITY TITLE: CONCRETE DECK REPAIR

UNIT OF MEASUREMENT: SQUARE YARDS OF CONCRETE DECK

PROCEDURE: GENERAL REPAIR PROCEDURE

REFERENCES

PennDOT Specifications (PUB408)

Section 1001- Cement Concrete Structure

1002- Reinforcement Bars

1040- Concrete Bridge Deck repair

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or by work order issued on an emergency basis. Deterioration is often more extensive than is apparent from observation alone, so allotted time should not be too restrictive.

WORK AREA

Entire structural concrete slab out-to-out of the superstructure between the backs of abutment backwalls. Portland cement concrete (PCC) wearing surfaces are also included, but any repairs or replacements to bituminous concrete wearing surface or membrane waterproofing necessitated by this activity are to be included under Activity BITWRGS, Bituminous Deck Wearing Surface (Repair/Replace)

ACTIVITY DESCRIPTION

Repairing or replacing all or any portions of a structural deck or wearing surface. The work can include, but is not limited to, removing deteriorated or damaged concrete; removing deteriorated or damaged reinforcing steel; constructing forms; retying existing reinforcing steel; supporting and tying new reinforcing steel; and placing new concrete.

DOCUMENT REQUIREMENT

The foreman must complete the attached Bridge Concrete Deck Patching Documentation Form at the end of the work day and submit the completed form to the District Bridge Maintenance Coordinator so that the form can be filed in the District Bridge Inspection Unit.

For temporary deck patching using cold bituminous mix or hot mix, the foreman must fill out the Bridge Deck Patching Documentation Form provided in PUB 113 (Activity number 711-7121-04 "Road Paved Spray Patch, Manual or Mechanized")

PROCEDURE DESCRIPTION

Type 1 repair - Deteriorated concrete extends to ½ inch above the top mat of the reinforcement bars. If reinforcement bar is exposed, this is considered a Type 2 condition.

Type 1 repair is to be rarely used. Use Type 2 repairs in most situations.

Type 2 repair - Deteriorated concrete extends 1 inch below the top mat of reinforcement bars.

1. Outline the perimeter of the deteriorated concrete to be patched with a ¾ inch deep saw cut.
2. Remove deteriorated or damaged concrete with jack hammer (30 lb. maximum class size). Cut and remove deteriorated reinforcing steel. Provide a minimum ¾ inch clearance around all reinforcing bars in the top mat, regardless of concrete deterioration.
3. Place replacement reinforcing steel by tying into existing sound steel at a minimum of 18 inch overlap.
4. Place concrete patch in one continuous operation when possible.
5. Finish and texture the deck and cure the concrete.

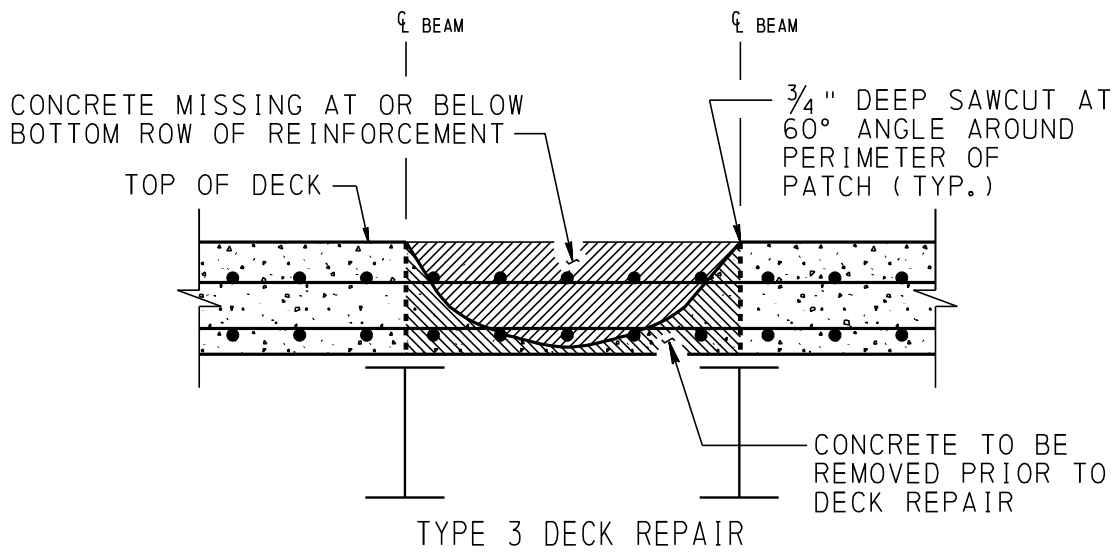
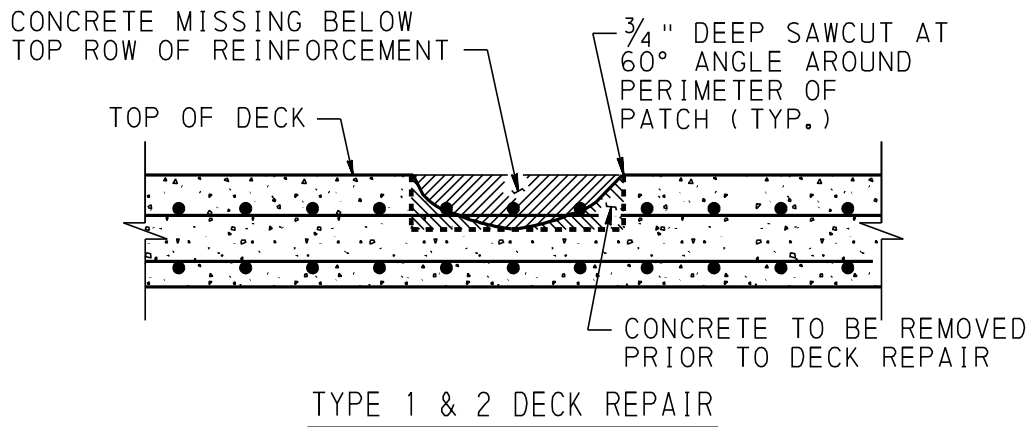
Type 3 repair - Deteriorated concrete extends to a depth more than half of the deck thickness.

1. Outline the perimeter of the deteriorated or damaged concrete to be replaced with a $\frac{3}{4}$ inch deep saw cut.
2. Provide shielding to prevent debris from falling below the deck. Prevent damage to the underlying beam.
3. Remove deteriorated concrete with jack hammer (30 lb. maximum class size).
4. Full depth deck repairs over stringers should be performed for a width from centerline to centerline of the stringers.
5. Use removable formwork of sufficient strength to prevent vertical deflection. For deck overhang areas, provide side formwork with drip strip and chamfering as appropriate.
6. Place replacement reinforcing steel by tying into existing sound steel at a minimum of 18 inch overlap.
7. Place concrete patch in one continuous operation when possible.
8. Finish and texture the deck, and cure the concrete.
9. Remove formwork

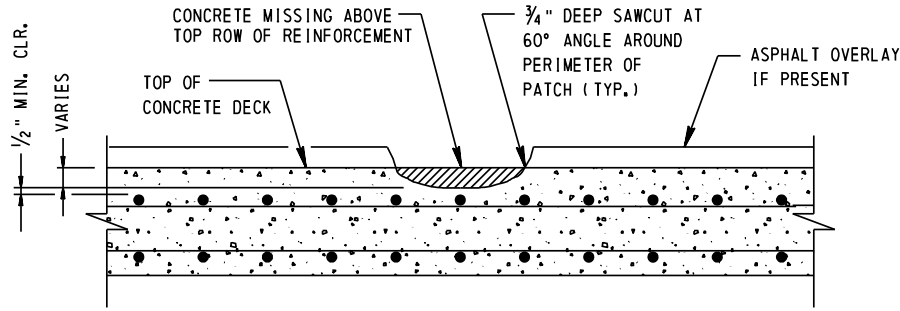
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip.	As Required	Reinf. Steel
3	Crew members	1	Concrete Mixer	As Required	Concrete
1	Special Crew Members (Operator)	1	Air Compressor with Jack Hammer Appropriate to Depth to be removed		

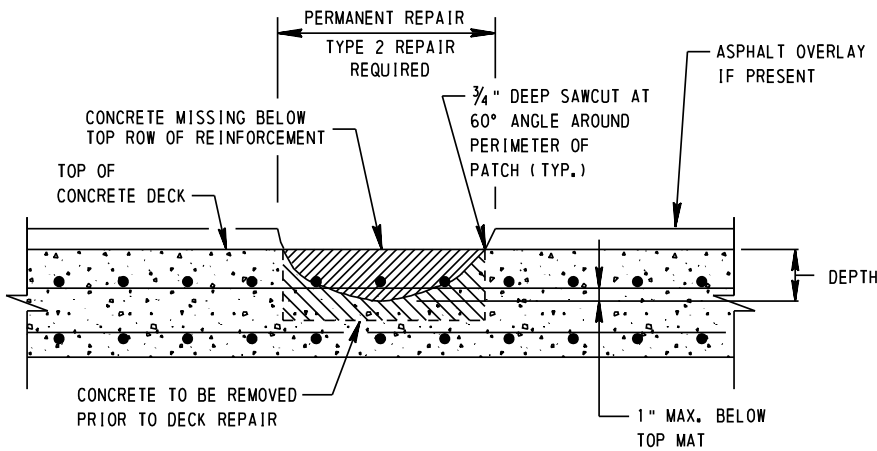
PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
2.3 SY/HR	14 SY/DAY	2.2 MH/SY



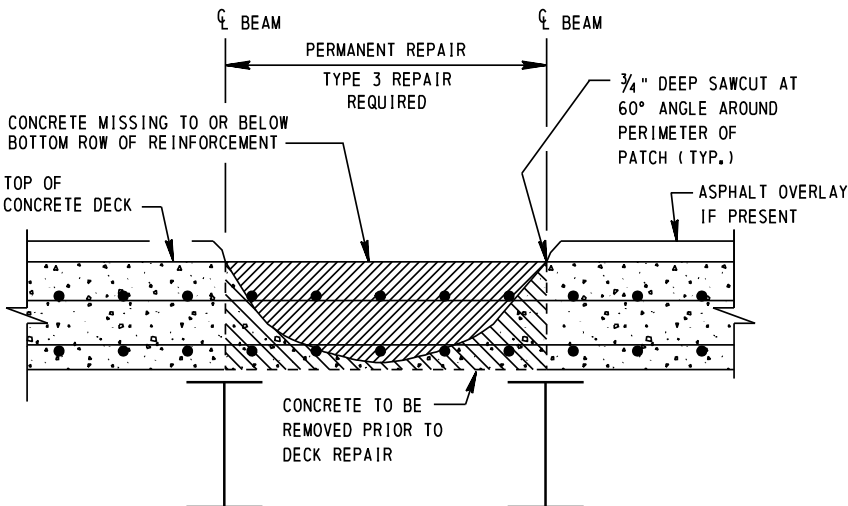
BRIDGE DECK REPAIR
NOT TO SCALE



TYPE 1 CONDITION
USE TYPE 2 REPAIR
FOR TYPE 1 CONDITION



TYPE 2 CONDITION AND REPAIR



TYPE 3 CONDITION AND REPAIR

DATE: _____
TIME: _____
WEATHER: _____
NAME: _____

REPAIR COMMENTS

TYPE CONDITION:
 TYPE 1 TYPE 2 TYPE 3

TYPE REPAIR:
 TYPE 2 TYPE 3

PREVIOUSLY PATCHED:
 YES NO UNKNOWN

TEMPORARY PATCH WITH:
 QUICKSET CONCRETE, NAME _____
 HAND MIX CONCRETE
TRUCK MIX CONCRETE:
 AAA
 AA

DIMENSIONS OF PATCH AREA
LENGTH: _____
WIDTH: _____
DEPTH: _____

SPAN LOCATION:
1 2 3 4 5 6 (CIRCLE ONE)

EST. AMT OF MAT.
USED _____ SY

EXISTING ASPHALT OVERLAY:
 YES NO

DEPTH OF OVERLAY:

COUNTY: _____
S. R. : _____
SEGMENT: _____
OFFSET: _____
FEATURE INTERSECTED: _____

SAP ASSEMBLY NUMBER: 711-7443-01

BMS Flex-Action: D744303

ACTIVITY TITLE: CONCRETE DECK (REPAIR)

UNIT OF MEASUREMENT: SQUARE YARDS OF CONCRETE BLOCK

PROCEDURE: PRECAST CONCRETE DECK REPLACEMENT

PROCEDURE DESCRIPTION

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Precast deck sections or purchase from supplier. 2. Remove deteriorated concrete deck section with jack hammers. Cut and remove deteriorated reinforcing steel. | <ol style="list-style-type: none"> 3. Prepare the abutments or beams for the precast units. 4. Place precast deck sections. 5. Fill stud void areas or panel connecting joints.— Grout keyways. |
|---|--|

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor with Jack Hammer	As Required	Precast panel Section Epoxy Motar or Concrete
2	Crew members			As Required	
2	Special Crew Members (Certified Welder)	1	Welding Equip.		
		1	Crane		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
2.3 SY/HR		2 SY/DAY		12 MH/SY	

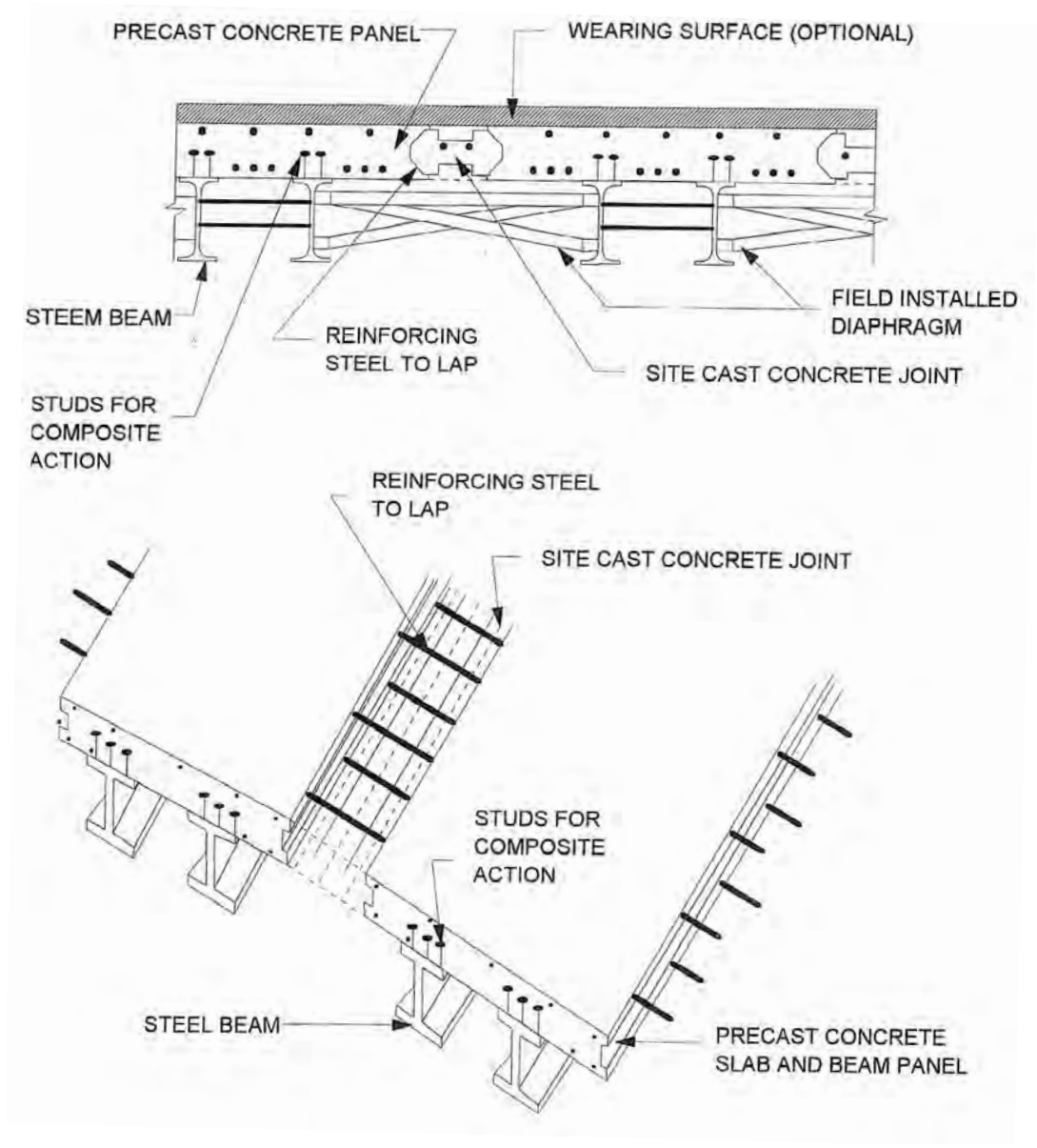
SAP ASSEMBLY NUMBER: 711-7443-01

BMS Flex-Action: D744303

ACTIVITY TITLE: CONCRETE DECK (REPAIR)

UNIT OF MEASUREMENT: SQUARE YARDS OF CONCRETE DECK

PROCEDURE: PRECAST CONCRETE DECK REPLACEMENT



PRECAST CONCRETE PANELS PLACED LONGITUDINALLY

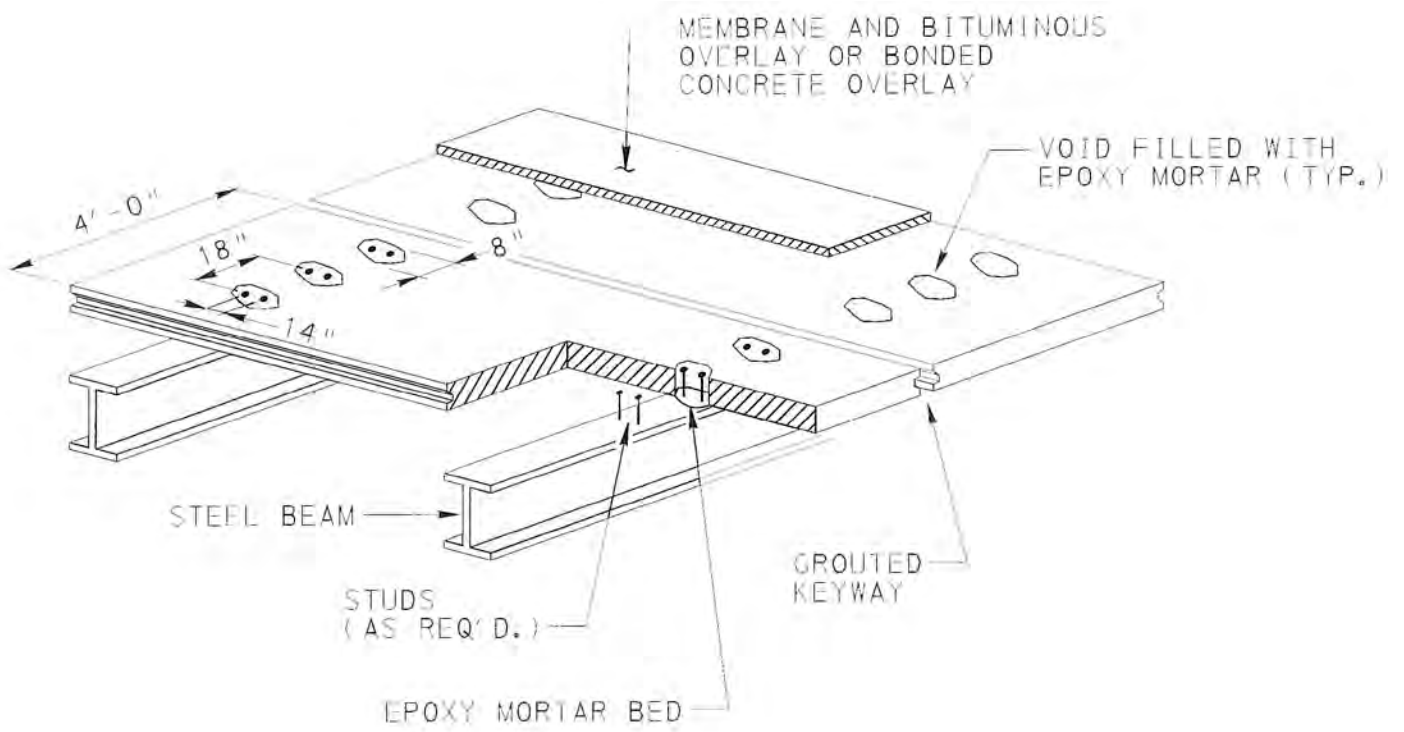
SAP ASSEMBLY NUMBER: 711-7443-01

BMS Flex-Action: D744303

ACTIVITY TITLE: CONCRETE DECK (REPAIR)

UNIT OF MEASUREMENT: SQUARE YARDS OF CONCRETE DECK

PROCEDURE: PRECAST CONCRETE DECK REPLACEMENT



PRECAST CONCRETE PANELS PLACED TRANSVERSELY

SAP ASSEMBLY NUMBER: 711-7443-02**BMS Flex-Action:** E744303**ACTIVITY TITLE:** CONCRETE SIDEWALK (REPAIR)**UNIT OF MEASUREMENT:** SQUARE YARDS OF CONCRETE SIDEWALK (REPAIR)**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1040 - Concrete Bridge Deck Repair

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

Entire Portland cement concrete (PCC) sidewalk between the backs of abutment backwalls. Includes supporting curbs and any beams, diaphragms, brackets, or other structural superstructure members which are exclusively for the purpose of supporting a sidewalk on vehicular bridges. The repair of main supporting beams or girders on pedestrian bridges are to be included in the appropriate activity under timber, steel, or reinforced concrete/prestressed concrete stringer or girder items.

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of a PCC sidewalk within the work area. The work can include, but is not limited to, removing deteriorated or damaged concrete; removing deteriorated or damaged reinforcing steel; constructing forms; retying existing reinforcing steel; supporting and tying new reinforcing steel; repairing or replacing sidewalk supporting members; and placing new concrete.

PROCEDURE DESCRIPTION

1. Remove existing deteriorated sections of sidewalk to sound concrete.
2. Place replacement reinforcing mesh or bars by tying them into reinforcing in sound concrete.
3. Place forms for concrete.
4. Place and cure concrete.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

SAP ASSEMBLY NUMBER: 711-7443-02

BMS Flex-Action: F744303

ACTIVITY TITLE: CONCRETE CURB/PARAPET (REPAIR)

UNIT OF MEASUREMENT: SQUARE YARDS OF CURB OR PARAPET (REPAIR)

PROCEDURE: PRECAST CONCRETE PARAPET

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes
 1025 - Modification of Existing Parapets
 1040 - Concrete Bridge Deck Repair

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. When accidental damage is extensive, temporary installation of signs, lights, barricades or other safety/warning devices may be required until repairs are completed.

WORK AREA

Curbs and/or parapets for the entire length of a bridge between the backs of abutment backwalls. The work area also includes the slab directly underneath and adjacent to the curbs or parapets when minor repairs or adjustments must be made to the slab to accomplish this activity. Report other repairs to the slab to Activity D744303, Concrete Deck (Repair).

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of Portland cement concrete (PCC) curbs and parapets. The work can include, but is not limited to, removing deteriorated or damaged concrete and reinforcing steel; drilling and grouting or otherwise securing dowels into existing concrete; placing and tying reinforcing bars; constructing forms; and placing new concrete.

PROCEDURE DESCRIPTION

1. Remove existing deteriorated section of parapet and curb with light hammer.
2. Level deck in parapet location and drill holes for anchors into deck. Do not penetrate deck unless approved.
3. Set section of parapet on a leveling bed of mortar to bring the parapet into proper line.
4. Insert galvanized bolts, washers, and nuts and tighten sufficiently to retain poured grout through the access hole (Method I). Permanently tighten nuts (Method I).
5. Pack bolt pocket with non-shrink, non-staining mortar.

ACTIVITY REQUIREMENTS

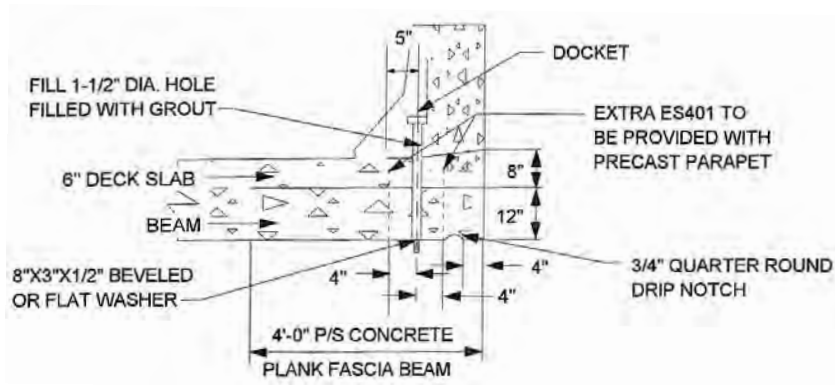
LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	As Required	Concrete Reinforcing Steel
3	Crew Members		with Hammer	As Required	
1	Special Crew Members (Certified Welder)	1	Welding Equip.		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.5 SY/HR	3 SY/DAY	10 MH/SY

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Crane	As Required	Precast parapet section
3	Crew Members	1	Air Compressor with hammer	As Required	Epoxy mortar
1	Special Crew Members (Operator)	1		As Required	Anchorage system

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
5 SY/HR	30 SY/DAY	.6 MH/SY



PRECAST PARAPET ANCHORAGE - METHOD I

SAP ASSEMBLY NUMBER: 711-7449-01

BMS Flex-Action: None

ACTIVITY TITLE: CONCRETE DECK OVERLAY - EPOXY

UNIT OF MEASUREMENT: SQUARE YARDS

PROCEDURE: GENERAL INSTALLATION PROCEDURE

REFERENCES

PennDOT Standard Special Provision c10431
Item 9043-0101

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or by issued work order.

WORK AREA

Entire structural concrete slab out-to-out of the superstructure between the limits of abutment backwalls.

ACTIVITY DESCRIPTION

This work is preparing deck surfaces, furnishing and construction of a multiple layer wearing surface of epoxy resin or epoxy- urethane resin and aggregate on in-service concrete bridge decks.

PROCEDURE DESCRIPTION

1. Order, stock and store the material necessary to perform the entire overlay application prior to any field preparation.
2. Deliver and store all epoxy-resin and epoxy-urethane resin materials in containers, with the manufacturer's name, date of manufacture, batch number, trade name, quantity and mixing ratio printed on the label.
3. Store and protect the materials from the elements to insure their quality and fitness for the work. Keep the storage space clean and dry, and do not allow the temperature of the storage space to fall below 16 C (60 F) or exceed 38 C (100 F). Avoid contact with flame.
4. Immediately remove from the work site any material which is rejected because of failure to meet the required tests or that has been damaged.
5. Have all equipment for the deck preparation, mixing and placement of the epoxy-based concrete overlay approved by the District

Bridge Engineer prior to the start of any work.

6. Provide shot blasting equipment capable of removing partially loosened chips of concrete, cleaning the bridge deck surface, roughening the bridge deck surface, and removing rust and/or corrosion from steel expansion joint assemblies or steel-grid decking. Do not use scarifiers, milling machines, or sandblasting in lieu of shot blasting, unless otherwise approved by the District Bridge Engineer.
7. Provide a self-propelled vacuum capable of picking up dust and other loose material from the shot blasting operation.
8. Provide air compressors equipped with an oil/ water separator capable of drying all moisture from the bridge deck.
9. For hand applications, obtain calibrated containers for proper proportioning of the base and hardening components. Obtain a clean, dry, container large enough to blend and mix the proper proportions of base and hardening components. Provide a powered, paddle-type mixer for blending the base and hardening components. Obtain squeegees, rollers or brooms that are suitable for applying the mixed epoxy- based resin on the bridge deck surface at the specified application rate. Obtain shovels, hand spreaders, and/or other hand tools that are suitable for applying the aggregate at the specified rate. Obtain brooms or air compressors equipped with an oil/water separator to remove excess aggregate after each layer of the overlay has cured.
10. Surface Preparation: Remove any unsound concrete and repair the areas in accordance with Publication 55 and Pub 408 Section 1040, as directed by the District Bridge Engineer. Do not use patching material containing magnesium phosphate. Do not apply the epoxy-based concrete overly on hydraulic cement concrete that is less than 28 days of age. Not more than 24 hours before overlay placement begins, clean the

surface of the bridge deck by shot blasting and/or other approved methods to expose the coarse aggregate, and to remove any asphaltic material, oils, dirt, rubber, curing compounds, paint carbonation, laitance, weak surface mortar, and other detrimental materials that would interfere with the bond or cure of the overlay. After shot blasting, vacuum the bridge deck surface to remove all dust and other loose material. Brooms are not to be a substitute for the vacuum. Protect the existing expansion dams in a manner acceptable to the District Bridge Engineer during surface preparation.

11. Use compressed air that is free of oil and water to remove all moisture from the surface of the bridge deck before application of the overlay. Maintain a completely dry surface during the application of the epoxy-based concrete overlay. Protect the deck against damage, contamination and traffic until the overlay operation is completed. Satisfactorily repair damaged areas prior to placing succeeding construction.
12. Cover exposed areas not to be overlaid with the epoxy-based concrete overlay, such as curbs, sidewalks, railings, parapets, or inlets with suitable coverings.
13. Place the epoxy based overlay: It is recommended that a trained Manufacture Technical Representative (MTR) from the epoxy manufacture be present during every phase of the application. The MTR will provide recommendations on approval or disapproval of the deck surface preparation, equipment, mixing of components, type and method of application, and finish. Utilize deck test strips & premark the bridge deck surface as a guide to obtain the proper application rate when applying the mixed epoxy-based resin by hand. Combine and mix the base and hardener components as specified by the Manufacturer. Immediately after mixing, apply the mixed epoxy-based resin by a distributor, squeegee, or paint roller, or combinations thereof. Apply the material smoothly, uniformly and continuously over 100 percent of the deck surface. do not allow the mixed epoxy-based resin to puddle or accumulate in holes or depressions in the deck. Apply the epoxy-based concrete overlay using a minimum of two (2) separate courses at the following application rates:

COURSE	MIXED EPOXY-BASED RESIN APPLICATION RATE: GAL./100SQ. FT.	AGGREGATE APPLICATION RATE: LBS./SQ. YD.
1	2.5 minimum	10
2+	5.0 minimum	14

14.
 15. Apply the aggregate at the specified rate, in a uniform manner, such that the aggregate just covers the epoxy base resin. Apply the aggregate within five minutes after application of the mixed epoxy-based resin or as recommended by the Manufacturer.
 16. Repair areas of individual courses identified by the District Bridge Engineer that did not receive a uniform and sufficient application of aggregate before the epoxy based resin is cured. Sandblast areas identified as having insufficient aggregate. Clean sandblasted areas of all loose material. Apply the epoxy-based resin and aggregate to the clean, sandblasted areas in accordance with these specifications.
 17. Remove the excess aggregate from each course after the course has completely cured. Use brooms, vacuums, compressed air free from oil and water, or other approved methods to remove the excess aggregate. Do not remove excess aggregate until vacuuming or brooming can be performed without tearing or damaging the surface.
 18. Protect the existing expansion dams with suitable covers during application of the multilayer epoxy based concrete overlay.
 19. Limitation of Operations: Do not apply the epoxy-based concrete overlay at surface, air, or resin and aggregate component temperatures lower than 60 degrees F. Do not apply the epoxy-based concrete overlay if the temperature is expected to drop below 55 degrees F within 8 hours after application, or the gel time of the mixed epoxy-based resin experienced becomes less than 10 minutes. Do not allow vehicular traffic on the first course. Do not allow vehicular traffic on any course during the cure period. Cure each course for the minimum cure period as follows unless longer periods are recommended by the Manufacturer. Average temperature of deck

surface, resin, and aggregate components in degree F:

COURSE	60-64	65-69	70-74	75-79	80-84	85+
1	4 hrs	3hrs	2.5 hrs	2 hrs	1.5 hrs	1 hr
2+	6.5 hrs	5 hrs	4 hrs	3 hrs	3 hrs	3 hrs

20. Protect freshly applied epoxy-based concrete overlays from sudden or unexpected rain. Stop all application operations when it starts to rain. Do not allow vehicular equipment or the traveling public on the epoxy-based concrete overlay before the overlay is cured.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Epoxy Resin	As Required	* See Below
9	Crew Members	1	mixing quip.		
1	Crew Members (Operator)	1	Air Compressor w/ dryer unit,		
		1	Shot Blaster		
		1	Vacuum System		
			Hand Tools	As Required	

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
7.5 SY/HR	55.5 SY/DAY	.27 SY/MH

*MATERIAL:

Epoxy Resin. A two-component, (base and hardener), 100% solids, thermosetting, moisture insensitive, flexible, high elongation epoxy resin, from a manufacturer listed in Bulletin 15, and meeting the following physical requirements at 24 +/- 1 C (75 +/- 2 F) when base and hardener are combined:

Viscosity (ASTM D 2393-86, Model RVT Brookfield, Spindle No. 3 at 20 rpm)	10-25 poises
Gel Time (ASTM C 881, para. 11.2 modified, 70 ml sample)	15-45 minutes
Tensile Strength (neat), 7-day (ASTM D 638) (2,500-5,000 psi)	17.2 - 34.4 MPa
Tensile Elongation (neat), 7-day (ASTM D 638)	30-70%
Absorption (neat), 24-hour (ASTM D 570)	1%, Maximum
Compressive Strength (mixed with aggregate), 3 hrs. (1,000 psi, minimum) (ASTM C 109, 50 mm square mortar cube with plastic inserts)	6.9 MPa
Compressive Strength (mixed with aggregate), 24 hrs. (5,000 psi, minimum) (ASTM C 109, 50 mm square mortar cube with plastic inserts)	34.4MPa
Permeability to chloride ion, 28-days (AASHTO T277)	100 coulombs, Maximum
Thermal Compatibility (Mixed with aggregate) (ASTM C 884)	No delamination of overlay or cracks in the concrete
Infrared spectrum (AASHTO T237, para. 4 & 5)	Established for each for each component for each Manufacturer

Epoxy-Urethane Resin. A two-component, (base and hardener), 100% solids, thermosetting, moisture insensitive, flexible, high elongation epoxy-urethane resin, from a Manufacturer listed in Bulletin 15, and meeting the following physical requirements at 24 +/- 1 C when the base and hardener are combined:

Viscosity (ASTM D 2393-86, Model RVT Brookfield, Spindle No. 3 at 20 rpm)	35-70 poises
Gel Time (ASTM C 881, para. 11.2 modified, 70 ml sample)	15-45 minutes
Tensile Strength (neat), 7-day (ASTM D 638) (2,500-5,000 psi)	17.2 - 34.4 MPa
Tensile Elongation (neat), 7-day (ASTM D 638)	30-70%
Absorption (neat), 24-hour (ASTM D 570)	1%, Maximum
Compressive Strength (mixed with aggregate), 3 hrs. (1,000 psi, minimum) (ASTM C 109, 50 mm square mortar cube with plastic inserts)	6.9 MPa
Compressive Strength (mixed with aggregate), 24 hrs. (5,000 psi, minimum) (ASTM C 109, 50 mm square mortar cube with plastic inserts)	34.4MPa
Permeability to chloride ion, 28-days (AASHTO T277)	100 coulombs, Maximum
Thermal Compatibility (Mixed with aggregate) (ASTM C 884)	No delamination of overlay or cracks in the concrete
Infrared spectrum (AASHTO T237, para. 4 & 5)	Established for each for each component for each Manufacturer

Fine Aggregate. Provide aggregate from an approved source of Type A fine aggregate listed in Bulletin 14 and/or approved by the Bureau of Construction and Materials, and approved by the epoxy- based concrete overlay Manufacturer. This aggregate consists of angular silica sand, basalt, or other highly siliceous metamorphic or igneous rock having less than 0.2 percent moisture, and free of dirt, clay asphalt and other foreign or organic materials. Provide an aggregate with a minimum Mohs' scale hardness of 7, and meeting the following gradation:

Sieve Size	Percent Passing by Weight
4.75 mm (#4)	100
2.36 mm (#8)	30-75
1.18 mm (#16)	0-5
600 m (#30)	0-1

SAP ASSEMBLY NUMBER: 711-7449-02

BMS Flex-Action: None

ACTIVITY TITLE: CONCRETE DECK OVERLAY- POLYESTER POLYMER OVERLAY (PPC)

UNIT OF MEASUREMENT: SQUARE YARDS

PROCEDURE: GENERAL INSTALLATION PROCEDURE

REFERENCES

PennDOT Standard Special Provision b10451 Use with guidelines in Design Manual 4 (DM-4) Chapter 5.6.4.1

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or by issued work order.

WORK AREA

Entire structural concrete slab out-to-out of the superstructure between the limits of abutment backwalls.

ACTIVITY DESCRIPTION

This work consists of providing all labor, materials, and equipment for cleaning/preparing the entire deck surface and applying a Polyester Polymer Concrete (PPC) overlay system with a High Molecular Weight Methacrylate (HMWM) resin primer on concrete surfaces.

PROCEDURE DESCRIPTION

1. Order, stock and store the material necessary to perform the entire overlay application prior to any field preparation.
2. Store materials in a clean, dry environment and in accordance with the manufacturer's recommendations. Material that exceeds the System Provider recommended shelf life or storage requirements will be rejected. The shelf life for liquid materials stored out of direct sunlight and at temperatures and below must be at least twelve (12) months. All aggregates must be stored in a clean, dry location away from moisture. Applicable fire codes may require special storage facilities for some components of the overlay system.
3. Obtain and post at the storage areas the Material Safety Data Sheet (MSDS), Product Data Sheet, and other information from the System Provider pertaining to the safe practices for the storage, handling, and disposal of the materials, and to their health hazards.
4. Each storage container with binder components and primer must have the System Provider's name, date of manufacture, batch/lot number, trade name, quantity, and mixing ratio printed on the label.
5. Containers with aggregate as supersack must have the producer name, date of shipment, batch/lot number, weight and independent lab test reference number.
6. Material that exceeds the System Provider recommended shelf life or storage requirements will be rejected. Do not apply PPC on a wet surface, when the temperature is below System Provider's recommendation, or when the anticipated weather conditions would prevent the proper application of the surface treatment.
7. During surface preparation and overlay application, precaution must be taken to assure that traffic is protected from rebound, dust, and construction activities. Appropriate shielding must be provided as required.
8. During overlay application, provide suitable coverings (i.e. heavy duty drop cloths) as needed to protect all exposed areas not to receive overlay, such as curbs, sidewalks, parapets, etc.
9. All equipment for cleaning the existing concrete surface and mixing and applying the overlay system must be in accordance with the Systems Provider's recommendations. Surface Preparation Equipment: Provide appropriate shot blasting or sandblasting equipment to adequately prepare the bridge deck substrate. Provide a self-propelled vacuum capable of picking up dust and other loose material from the shot blasting or sandblasting operation. Provide equipment to supply compressed air free of oil and moisture for final surface preparation.
10. Mixing Equipment: Mixing may be accomplished by a Portable Mechanical Mixer suitable for concrete or by a Continuous Automated Mixer. Portable Concrete Mechanical Mixer: The portable concrete

mixer must be of appropriate size for proposed batches, as recommended by the System Provider. Continuous Automated Mixer: The continuous mixer must be of appropriate size for proposed batches, as recommended by the System Provider and approved by the District Bridge Engineer. The continuous mixer must be capable of handling polyester binder resin and catalyst while sufficiently mixing catalyzed resin with dry aggregate and maintaining proper ratios to achieve set/cure times within the specified limits. The continuous mixer must be equipped with an automatic metering device that measures and records aggregate and resin volumes, at least every five minutes, including time and date. Obtain the recorded volumes at the end of the work shift. A visible readout gauge that displays volumes of aggregate and resin being recorded must be provided.

11. Finishing Equipment: Finishing may be accomplished with a Vibratory Screed or a Self-Propelled Slip-Form Paving Machine. Vibratory Screed: Vibratory Screed riding on preset forms or rails must be used for all polyester concrete overlay applications. Roller type screeds are not to be used. Self-Propelled Slip-Form Paving Machine: A Self-Propelled Slip-Form Paving Machine, which is modified or specially built to effectively place the PPC overlay. The paving machine must employ a vibrating pan to consolidate and finish the PPC. The paving machine must be fitted with hydraulically controlled grade automation to establish the finished profile to match grade when placing lanes adjacent to previously placed PPC. Sufficient engine power and weight are required to provide adequate vibration of the finishing pan while maintaining consistent forward placement speed. The machine must be capable of both forward and reverse motion under its own power.
12. Prior to constructing the overlay, one or more trial applications must be placed on the prepared substrate to demonstrate proper initial set time and the effectiveness of the surface preparation, mixing, placing and finishing equipment proposed. Each trial application must be at least 10 feet long and at the planned paving width and specified overlay thickness.
13. If the cleaning practice, materials, installation, finishing and/or texturing are not acceptable, remove the failed trial application and reinstall the trial application.
14. Surface Preparation: All structural slab surfaces that will be in contact with the overlay must be prepared by shot blasting to remove all existing grease, slurry, oils, paint, dirt, striping, cure compound, rust, membrane, asphalt, weak surface mortar or any other contaminants that could interfere with the proper adhesion of the overlay system.
15. Areas to receive the PPC overlay must be cleaned by shot blasting, or abrasive sandblasting if the shot blaster cannot access certain areas.
15. (Cont.) Cleaning must not commence until all work involving the repair of the concrete substrate surface has been completed and repair materials have cured.
16. All contaminants must be picked up and contained, dust shall not be created during the cleaning operation that will obstruct the view of motorists. Determine the size of shot, flow of shot, forward speed of shot blast machine and number of passes necessary to provide a surface free of weak or loose surface mortar, exposing the aggregates within the substrate concrete and visibly changing the color of the substrate concrete. Mortar which is sound and firmly bonded to the coarse aggregate must have open pores due to cleaning to be considered adequate for bond.
17. Cleaned surfaces must not be exposed to vehicular traffic unless required by the overlay operation and approved by the District Bridge Engineer. Cleaned concrete substrates that have been contaminated might interfere with the bonding or curing of the overlay, so they must be cleaned to the satisfaction of the District Bridge Engineer prior to placing the overlay. The cleaned concrete substrate must be dry at the time of application of the primer and overlay.
18. All steel surfaces that will be in contact with the overlay must be cleaned in accordance with SSPC- SP No. 10, Near-White Blast Cleaning, except that wet blasting methods must not be allowed.

19. Application of the primer and PPC overlay shall not begin until the substrate is visibly surface dry, free of water and moisture. ASTM D 4263 modified for 2 hours may be used to verify dryness at the discretion of the District Bridge Engineer in cases when surface dryness is difficult to determine. The use of a moisture meter can be helpful to determine if the concrete is sufficiently dry.
20. The substrate surface temperature must be between 40-100 F at the time of primer and overlay placement. Night work may be required when temperatures cannot be met during the day.
21. Prior to applying the HMWM (High Molecular Weight Methacrylate) prime coat, the area must be completely dry and blown clean with oil-free compressed air. Primer must be mixed and applied in accordance with the System Provider's recommendations. Primer must be applied within 5 minutes of mixing initiator and resin at a rate of approximately 90-100 ft/gal or as otherwise recommended by the System Provider. Primer must be applied by flooding and uniformly spread to completely cover all surfaces to receive overlay, including any adjacent vertical surfaces. Care should be taken to avoid heavy application that results in excess puddling. Excess material must be removed or distributed to meet the recommended application rate. Primer must be reapplied to any areas that appear visibly dry prior to overlay placement.
22. Polyester Polymer Concrete (PPC): The PPC must be mixed and applied in accordance with the System Provider's recommendations. PPC must be applied after 15 minutes and within 2 hours of placing the primer. The PPC must be placed prior to gelling or within 15 minutes following addition of the initiator, whichever occurs first, or as recommended by the System Provider.
23. The PPC mixture must have an initial set time between 30 minutes and 90 minutes. The initial set is defined as when the in-place PPC cannot be deformed by pressing with a finger. If the initial set is not within 30-90 minutes, the material must be removed and replaced.
24. The PPC must be consolidated and finished using placement equipment as defined above to the required grade and cross-section as shown in the Plans.
25. The PPC overlay must be placed at a profile necessary to meet the desired grade and cross-section as shown in the Plans with a minimum thickness of one inch. Termination edges of the overlay may require application and finishing by hand trowel due to obstructions such as a curb. Expansion joints must be adequately isolated prior to overlaying or may be sawed within four hours after overlay placement, as approved by the District Bridge Engineer. The exact time of sawing will be determined by the District Bridge Engineer.
26. Abrasive Finish Sand: The abrasive finish sand must be applied evenly on the finished overlay surface at a rate of at least 2.2 LBS/SY by broadcasting, immediately after the overlay placement before gelling. To ensure adequate pavement friction, the completed overlay surface must be free of any smooth or glassy areas such as those resulting from insufficient quantities of abrasive finish sand. Any such surface defects must be repaired.
27. Texturing: Texture the surface as specified in Pub 408 Section 501.3(k)4.
28. Curing: The overlay must be considered cured to a traffic ready state after four (4) hours following finishing or when a minimum reading of 3,000 psi at a minimum of every 10 lineal feet of deck on a properly calibrated Schmidt hammer is achieved.
29. Acceptance: Acceptance of the surface preparation and PPC overlay will be determined by the District Bridge Engineer based on vertical axis bond tests and smoothness quality testing must satisfy the requirements of Pub 408, Section 501.3(o).
30. Vertical Axis Pull Bond Test: Vertical pull bond test in accordance with ASTM C1583 should be performed between 24 hours and 72 hours after placement of the overlay and witnessed by the Representative of the District Bridge Unit. A minimum of one pull bond test should be performed on each bridge. Additional testing may be required. If multiple tests are taken, the test result must be the average of the tests for each structure. The minimum bond strength of the PPC overlay system on normal weight concrete must be 250 psi. An acceptable test will demonstrate that the overlay bond strength is sufficient by producing a concrete subsurface failure area greater than 50% of the test surface area.

31. Thickness Requirements: Variable thickness overlay placement may be required to account for variations in substrate profile to meet the desired grade and cross-section as shown in the Plans. If the District Bridge Unit determines that the minimum thickness has not been attained, an additional layer must be applied after the overlay has cured for a minimum of four (4) hours. This layer must be a minimum of 1/4" and must be applied as recommended by the System Provider.
32. Surface Smoothness: Areas to be measured will be as directed by the District Bridge Engineer. Smoothness quality testing should be performed by the District Bridge Unit. Unless otherwise noted on the Plans the overlay surface must not vary more than 1/4 inch from the lower edge of a 10' ± 2" long straight edge placed in any direction. Surface area larger than 30,000 SF may require an inertial profiler as indicated on the Plans. Any surfaces which fail to conform to the specified tolerance should be re-profiled by diamond grinding in accordance with the requirements of Diamond Grinding special provisions. Diamond grinding must not occur until at least 24 hours after placement of the overlay.
33. Cracking: Seek guidance from the District Bridge Unit.
34. A suggested QA/QC plan can be reviewed in the standard special provision.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	PPC mixing quip.	As Required	* See Below
10	Crew Members	1	Air Compressor	As Required	
1	Crew Members (Operator)	1	Misc Hand Tools		
		1	Shot Blasting		
		1	Vacuum System		
		1	Air Screed		
		1	Air Comp w/Dryer		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
7.5 SY/HR	55.5 SY/DAY	.27 SY/MH

MATERIAL:

High Molecular Weight Methacrylate (HMWM) Primer: Must be a wax-free, low odor, high molecular weight methacrylate primer, and consist of a resin, initiator, and promoter. The primer must conform to table below. All components must be stored in accordance with the System Provider's recommendations. Initiator for the methacrylate resin must consist of a metal drier and peroxide. If supplied separately from the resin, the metal drier must not be mixed with the peroxide directly; a VIOLENT EXOTHERMIC REACTION will occur. The containers and measuring devices must not be stored in a manner that allows leakage or spilling to contact the containers or materials of the other.

PROPERTY	REQUIREMENT	TEST METHOD
Viscosity*	25 cps maximum	ASTM D 2196 (Brookfield RVT with UL adapter, 50 RPM at 77 °F)
Volatile Content*	30 percent, maximum	ASTM D 2369
Specific Gravity*	0.90 minimum at 77 °F	ASTM D 1475
Flash Point	180 °F minimum	ASTM D 3278
Vapor Pressure*	1.0 mm Hg, maximum at 77 ° F	ASTM D 323
PCC Saturated Surface-Dry Bond Strength (Adhesive)	700 psi, minimum at 24 hours and 70 ± 1°F	CalTrans Test 551**, part (with initiated PPC at 12% resin content by weight of the dry aggregate), primed surface
<p>*Test must be performed before initiator is added ** CalTrans Test 551 http://www.dot.ca.gov/ctm/pdf/CT_551.pdf</p>		

MATERIAL (Cont.):

Polyester Resin Binder: Polyester resin binder must have the following properties:

1. Be an unsaturated isophthalic polyester-styrene co-polymer. The resin content must be 12%±1% of the weight of the dry aggregate.
2. Contain at least 1% by weight gamma-methacryloxypropyltrimethoxysilane, anorganosilaneester silane coupler.
3. Be used with a promoter that is compatible with suitable methyl ethyl ketone peroxide (MEKP) and cumene hydroperoxide (CHP) initiators.
4. Meet the required values for the material properties shown in the table below. Accelerators or inhibitors may be required to achieve proper setting time of PPC. They must be used as recommended by the overlay System Provider.

PROPERTY	REQUIREMENT	TEST METHOD
Viscosity*	75 -200 cps	ASTM D 2196, (RVT No.1 Spindle, 20 RPM at 77°F)
Specific Gravity*	1.05 to 1.10 at 77 °F	ASTM D 1475
Elongation	35% minimum	ASTM D 638, Type I specimen, thickness 0.25 ± 0.03" at Rate = 0.45 inch/minute. Sample conditioning according to ASTM D 618 and 18/25/50+5/70
Tensile Strength	2,500 psi, minimum	ASTM D 638, Type I specimen, thickness 0.25 ± 0.03" at Rate = 0.45 inch/minute. Sample conditioning according to ASTM 618 and 18/25/50+5/70.
*Test must be performed before adding initiator.		

PPC Aggregate: Aggregate for PPC must meet the requirements.

PROPERTY	REQUIREMENT	TEST METHOD
Fine aggregate composition	Natural sand only	
Weighted average aggregate Absorption	Not exceed 1.0%	AASHTO T84 and T85
Moisture content, at the time of mixing with resin	<=0.5% of aggregate absorption	AASHTO T255
Mohs hardness	7 minimum	

AGGREGATE GRADATION

Sieve Size	Percent Passing
3/8"	100
No. 4	62-85
No. 8	45-67
No. 16	29-50
No. 30	16-36
No. 50	5-20
No. 100	0-7
No. 200	0-3

Polyester Polymer Concrete (PPC): The PPC composite mixture must meet the following requirements.

PROPERTY	REQUIREMENT	TEST METHOD
PCC Saturated-Surface Dry Bond Strength, without primer* (at 24 hours and 70 ± 1°F)	500 psi, minimum	CalTrans Test 551**
Abrasion Resistance	2g weight loss, maximum	CalTrans Test 550***
Modulus of Elasticity	1,000 to 2,000 ksi	ASTM C 469
Chloride Permeability	0-200 (max)coulombs	ASTM C 1202
<p>*Initiated PPC mixture tested at 12% resin content by weight of dry aggregates.</p> <p>** CalTrans Test 551 http://www.dot.ca.gov/ctm/pdf/CT_551.pdf</p> <p>*** CalTrans Test 550 http://www.dot.ca.gov/ctm/pdf/CT_550.pdf</p>		

Surface Finishing Sand:

1. Must be commercial quality blast sand.
2. Must have at least 95% passing the No.8 sieve and at least 95% retained on the No. 20 sieve when tested under AASHTO T27.
3. Must be dry at the time of application. All material components are supplied collectively through the System Provider. Aggregates will be supplied by the System Provider and delivered in packaging to the site clean and dry.

Chapter 18: Deck Drainage

Table of Contents

7444-01	SCUPPER GRATE (REPLACE)	18 - 3
7444-01	DRAIN/SCUPPER (INSTALL)	18 - 5
7444-01	DOWNSPOUTING (REPAIR/REPLACE)	18 - 15

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SAP ASSEMBLY NUMBER: 711-7444-01**BMS Flex-Action:** DRNGRAT**ACTIVITY TITLE:** SCUPPER GRATE (REPLACE)**UNIT OF MEASUREMENT:** EACH SCUPPER GRATE**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 219M)

BC-751

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Consideration should be given to replacing damaged or deteriorated scupper grates in early spring in areas where bicycling is common.

WORK AREA

All existing scuppers between backs of abutment backwalls.

ACTIVITY DESCRIPTION

Removing existing grates; preparing scuppers for installation of new grates; fabricating replacement grates or obtaining prefabricated grates; and installing replacement scupper grates.

PROCEDURE DESCRIPTION

1. Prepare replacement grate by fabricating new grate, modifying an existing grate or obtaining a prefabricated grate.
2. Remove existing grate.
3. Repair or modify scupper as necessary for replacement grate.
4. Place grate on scupper.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip	IEA	Replacement grate assembly
2	Crew Members				
3	Special Crew Member (Certified Welder)				

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1 EA/HR	6 EA/DAY	4 MH/EA

SAP ASSEMBLY NUMBER: 711-7444-01

BMS Flex-Action: B744401

ACTIVITY TITLE: DRAIN/SCUPPER (INSTALL)

UNIT OF MEASUREMENT: EACH DRAIN/SCUPPER

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1040 - Concrete Bridge Deck Repair
 1052 - Metal Curb Drain
 PennDOT Specifications (PUB 219M)
 BC-751

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

All locations at curbs or parapets selected for installation of a scupper between backs of abutment backwalls. Included in the work area is a sufficient portion of the deck so that the installation can be accomplished. Also included is a sufficient number of the superstructure members so that any connection required by the design of the drain can be attached. Installing grates and down spouting incidental to installation of a new or replacement scupper are included in this activity.

ACTIVITY DESCRIPTION

Installing scuppers and drains. The work can include, but is not limited to, removing sufficient wearing surface if present, to permit drilling a hole in the deck and shaping the surface to facilitate the flow of drainage water; drilling a hole of the correct size in the concrete deck to accommodate the drain pipe; grouting the pipe into position; connecting the pipe to the concrete or steel superstructure elements; replacing the wearing surface; and

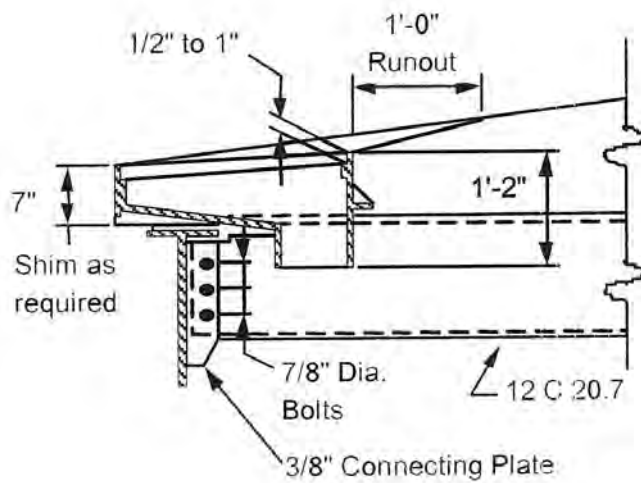
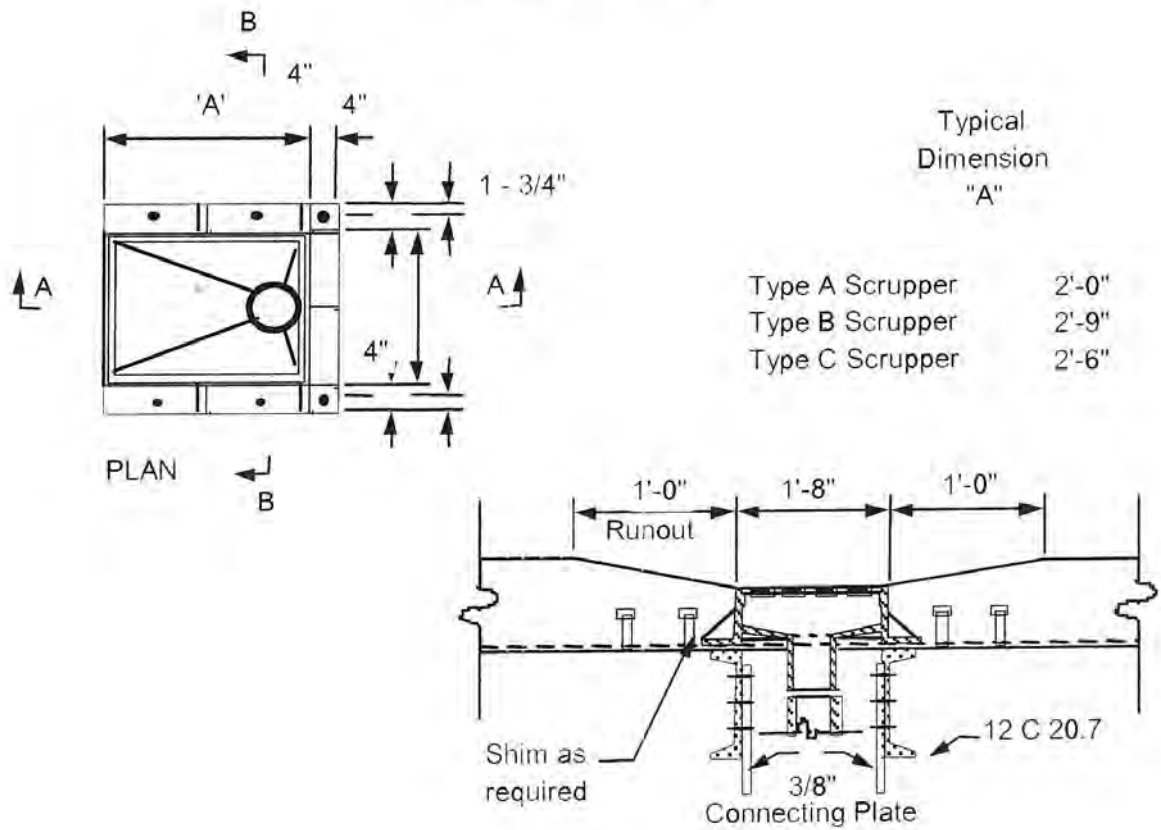
placing grate bars if they are not part of the prefabricated scupper.

PROCEDURE DESCRIPTION

1. Drill hole or holes through the deck to act as drain or to remove sufficient material to place grate, drain, or scupper assembly. Carefully cut and bend any reinforcing bars encountered to permit placement of the drain or scupper.
2. Place grate, drain or scupper.
3. Recast deck around grate, drain or scupper shaping the deck to facilitate drainage.
4. Attach any down spouting supports to beam as necessary.
5. Install down spouting as necessary.
6. Place riprap or splash blocks under drains or down spouting.
7. Plug any old existing drain holes with epoxy or rapid-set concrete patching material.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

CAST CONSTRUCTION



ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip	IEA	Replacement grate assembly
2	Crew Members				
3	Special Crew Member (Certified Welder)				

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1 EA/HR	6 EA/DAY	4 MH/EA

SAP ASSEMBLY NUMBER: 711-7444-01

BMS Flex-Action: B744401

ACTIVITY TITLE: DRAIN/SCUPPER (INSTALL)

UNIT OF MEASUREMENT: EACH DRAIN/SCUPPER

PROCEDURE: PVC DECK DRAIN

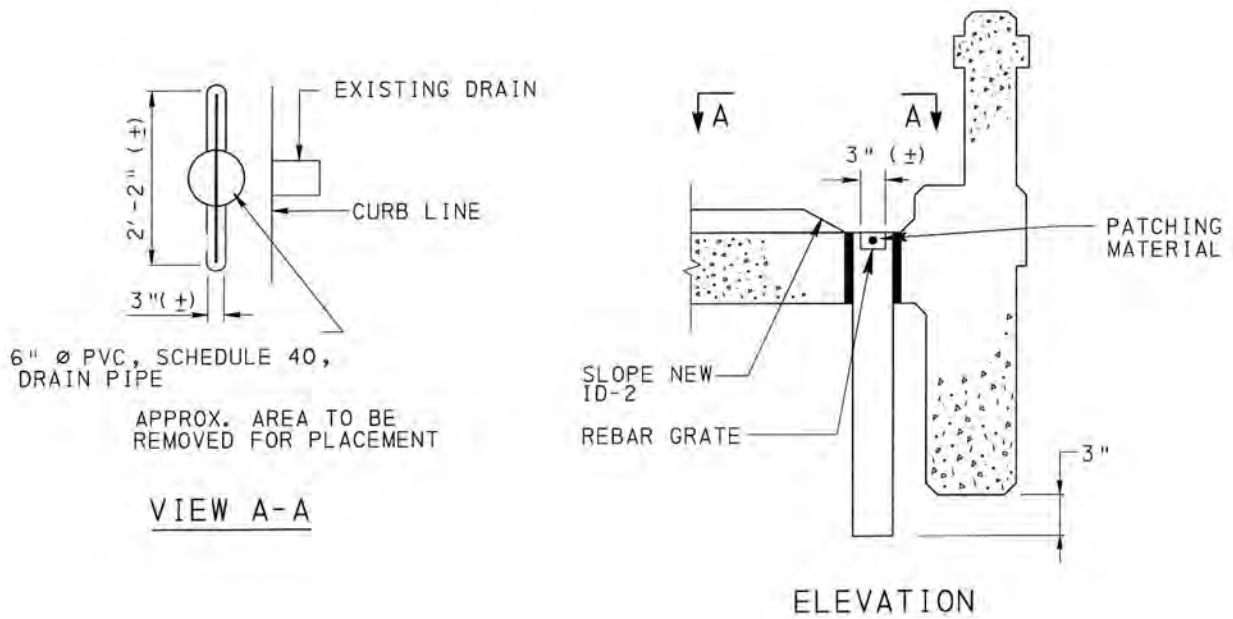
PROCEDURE DESCRIPTION

1. Drill holes through deck and remove sufficient concrete to set grate of epoxy coated No. 6 reinforcing bar.
2. Set drain pipe and grate bar with epoxy or rapid set concrete patching material.
3. Plug any old existing drain holes with epoxy or rapid-set concrete patching material.
4. Place riprap or splash blocks as required under drains.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Compressor	As Required	6" diameter PVC schedule 40 pipe No. 6 epoxy coated reinforcing bar Concrete patching material
3	Crew Members	1	Pneumatic Drill	2 ft.	
		1	Concrete Mixer	As required	

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.5 EA/HR	3 EA/DAY	8 MH/EA



SAP ASSEMBLY NUMBER: 711-7444-01

BMS Flex-Action: B744401

ACTIVITY TITLE: DRAIN/SCUPPER (INSTALL)

UNIT OF MEASUREMENT: EACH DRAIN/SCUPPER

PROCEDURE: METALS DRAINS THROUGH PARAPETS

PROCEDURE DESCRIPTION

1. Remove existing concrete parapet and deck as required.
2. Cut metal drain section to proper length (typically 2'-3') and butt weld together.
3. Place metal drain in proper position.

4. Place concrete around drain and replace concrete in parapet deck as required.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	As Required	C 8x 4.25 aluminum or C 8x 11.5' A36
3	Crew Members	1	Welding Equip		
1	Special Crew Member (Certified Welder)				
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.5 EA/HR		3 EA/DAY		8 MH/EA	

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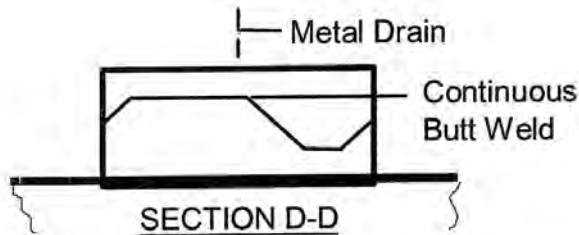
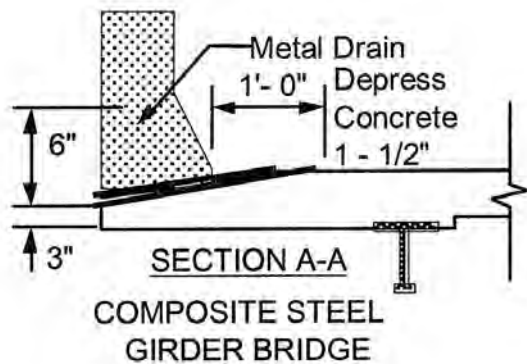
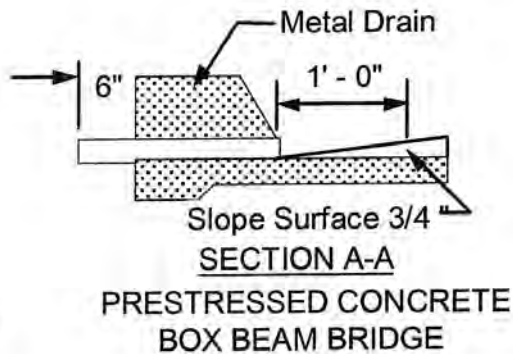
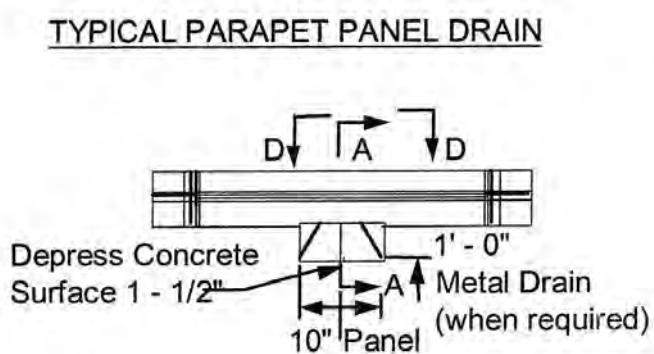
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ACTIVITY TITLE: DRAIN/SCUPPER (INSTALL)

UNIT OF MEASUREMENT: EACH DRAIN/SCUPPER

PROCEDURE: METALS DRAINS THROUGH PARAPETS

TYPICAL PARAPET PANEL DRAIN



NOTE: Aluminum drains in contact with concrete shall be thoroughly coated with an alkali-resistant bituminous paint.

SAP ASSEMBLY NUMBER: 711-7444-01

BMS Flex-Action: B744401

ACTIVITY TITLE: DRAIN/SCUPPER (INSTALL)

UNIT OF MEASUREMENT: EACH DRAIN/SCUPPER

PROCEDURE: DECK DRAIN USING ECCENTRIC REDUCERS

PROCEDURE DESCRIPTION

1. Drill holes through the deck and remove sufficient material to place the drain assembly. Carefully cut and bend any reinforcing bars encountered to permit placement of the drain.
 2. Place drain assembly and weld support to beam web.
 3. Recast deck around drain shaping the top of the deck to facilitate drainage.
 4. Replace wearing surface around drain as necessary.
 5. Plug any old existing drain holes with epoxy or rapid-set concrete patching material.
 6. Place riprap or splash blocks under drains as required.
- NOTE:** Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip	1	Eccentric reducer assembly with grate
2	Crew Members	1	Concrete Mixer	As Required	6" diameter standard with steel pipe
1	Special Crew Member (Certified Welder)	As Required	Access Equip		
				1	Splash block or riprap

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.5 EA/HR	3 EA/DAY	8 MH/EA

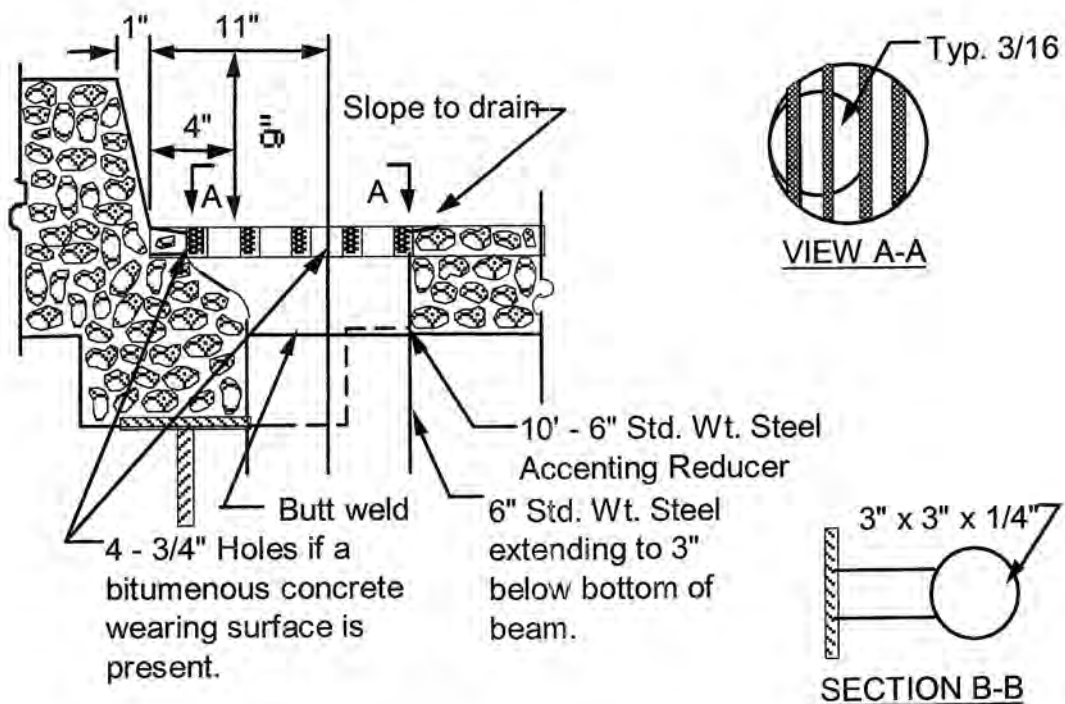
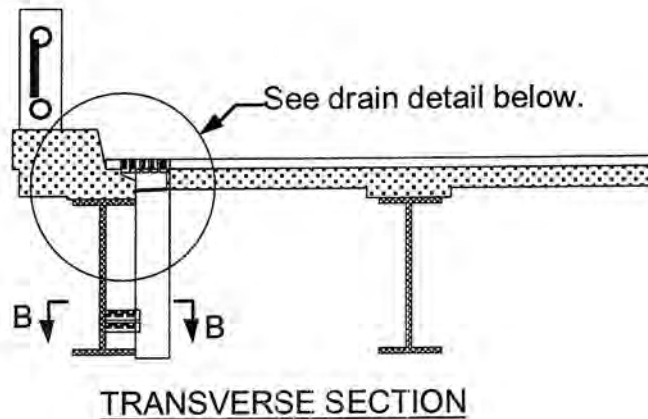
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BMS Flex-Action: B744401

ACTIVITY TITLE: DRAIN/SCUPPER (INSTALL)

UNIT OF MEASUREMENT: EACH DRAIN/SCUPPER

PROCEDURE: DECK DRAIN USING ECCENTRIC REDUCERS



SAP ASSEMBLY NUMBER: 711-7444-01

BMS Flex-Action: B744401

ACTIVITY TITLE: DRAIN/SCUPPER (INSTALL)

UNIT OF MEASUREMENT: EACH DRAIN/SCUPPER

PROCEDURE: STANDARD SCUPPER

PROCEDURE DESCRIPTION

1. Drill holes through the deck and remove sufficient material to place the standard scupper. Carefully cut and bend any reinforcing bars encountered to permit placement of the scupper.
 2. Place scupper assembly and weld or bolt support to beam web.
 3. Recast deck around scupper. Shape deck to facilitate drainage.
 4. Plug any old existing drain holes with epoxy or rapid-set concrete patching material.
 5. Install down spouting as necessary.
 6. Place riprap or splash blocks under drains as necessary.
- NOTE:** Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip	1	Standard Scupper assembly
2	Crew Members	1	Concrete Mixer		
1	Special Crew Member (Certified Welder)	1	Concrete Mixer	As Required	Concrete
		As Required	Access Equip	As Required	6" diameter standard with steel pipe
				As Required	Pipe supports, straps, hangers
				1	Splash block or riprap

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.5 EA/HR	3 EA/DAY	8 MH/EA

SAP ASSEMBLY NUMBER: 711-7444-01

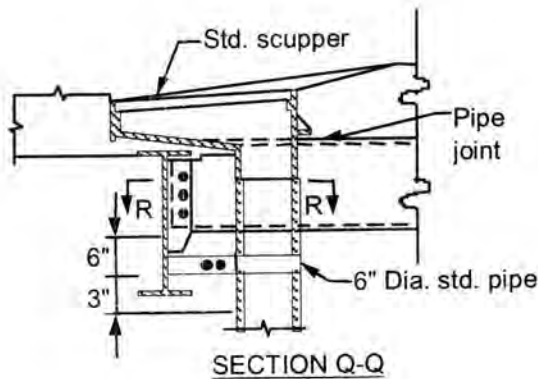
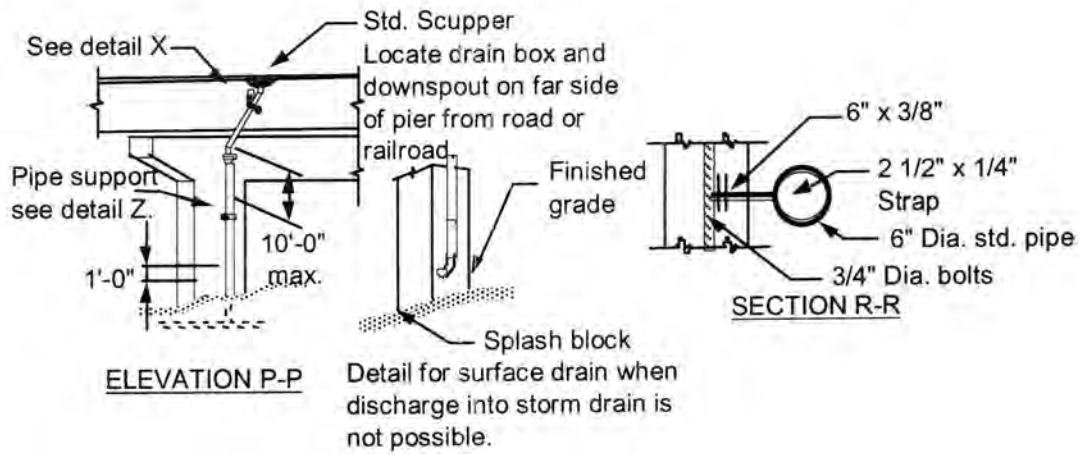
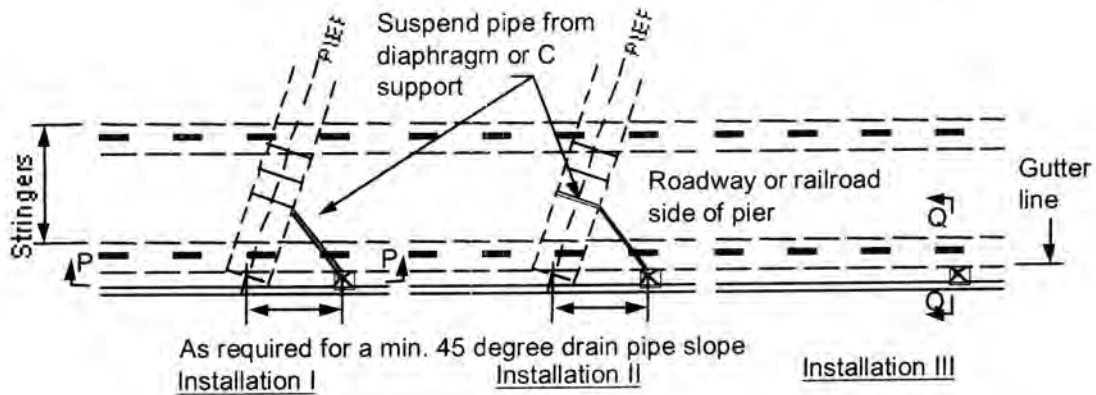
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ACTIVITY TITLE: DRAIN/SCUPPER (INSTALL)

UNIT OF MEASUREMENT: EACH DRAIN/SCUPPER

PROCEDURE: STANDARD SCUPPER

PLAN SHOWING TYPICAL INSTALLATION OF SCUPPERS



SAP ASSEMBLY NUMBER: 711-7444-01**BMS Flex-Action:** C744402**ACTIVITY TITLE:** DOWNSPOUTING (REPAIR/REPLACE)**UNIT OF MEASUREMENT:** EACH DOWNSPOUT**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1001 - Cement Concrete Structures
1051 - Down Spouting
1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

All down spouting and connections of down spouting to superstructure and substructure elements. The work area also includes sufficient areas of the superstructure and substructure elements to make minor repairs to them when necessary and/or to remove existing down spouting anchorages and install new ones.

ACTIVITY DESCRIPTION

Repairing or replacing portions or all of bridge down spouting. The work can include, but is not limited to, removing deteriorated or damaged dand anchorages to superstructure or substructure elements; repairing portions of superstructure or substructure elements damaged at the down spouting anchorage points using standard concrete or structural steel repair methods, as appropriate; prefabricating all or portions of the down spouting as required; drilling and installing anchorages to the bridge superstructure and substructure; and installing repaired or replacement down spouting.

PROCEDURE DESCRIPTION

1. Remove pipe supports, hangers, drain boxes and pipe sections as necessary.
2. Drill new anchor holes in concrete or steel surfaces.
3. Fasten supports to concrete surfaces with expansion anchor bolts or other approved fastener. Fasten supports to steel surfaces with bolts or by welding.
4. Install new pipe sections and attach to supports and hangers.
5. NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

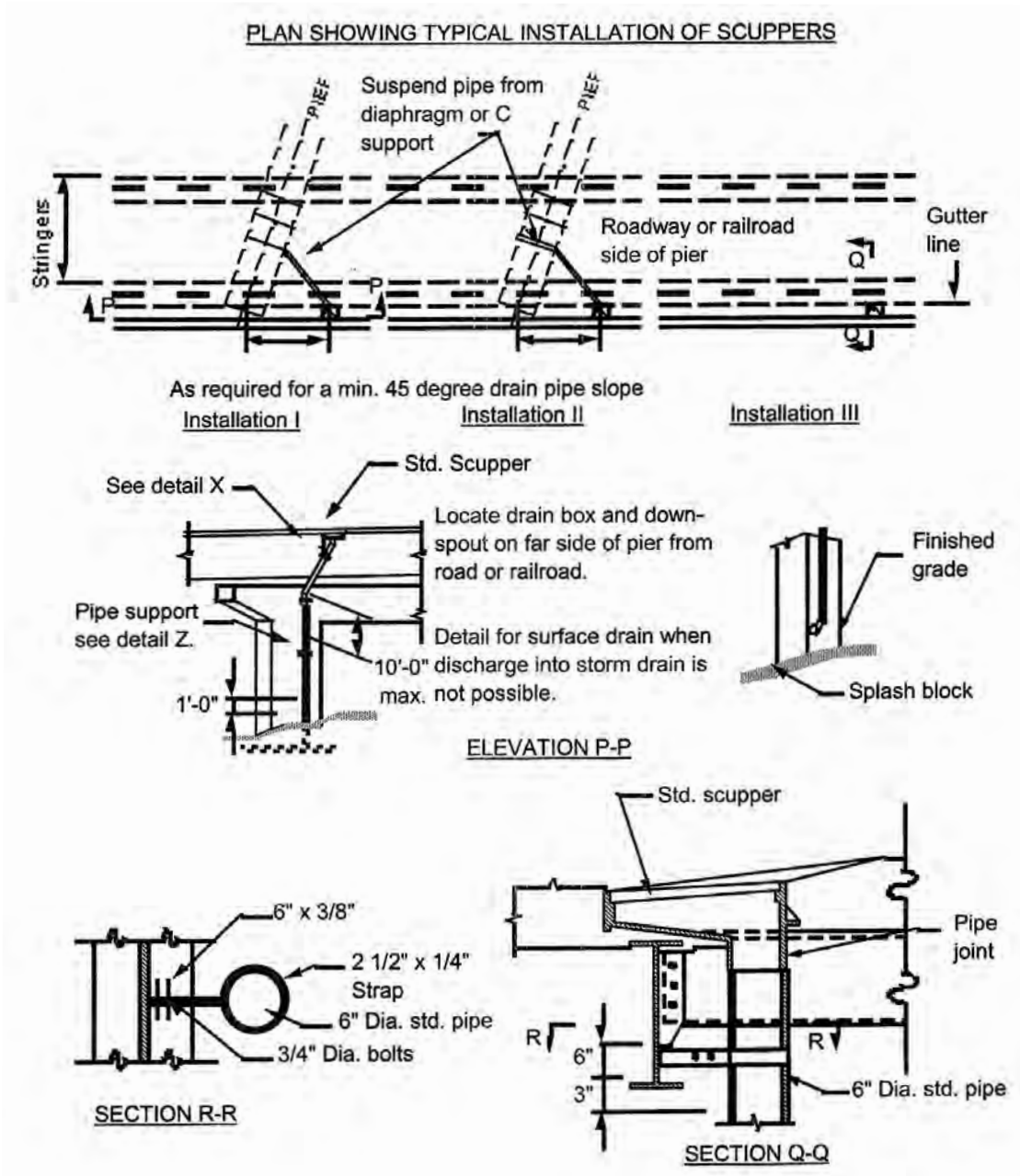
SAP ASSEMBLY NUMBER: 711-7444-01

BMS Flex-Action: C744402

ACTIVITY TITLE: DOWNSPOUTING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH DOWNSPOUT

PROCEDURE: GENERAL PROCEDURE



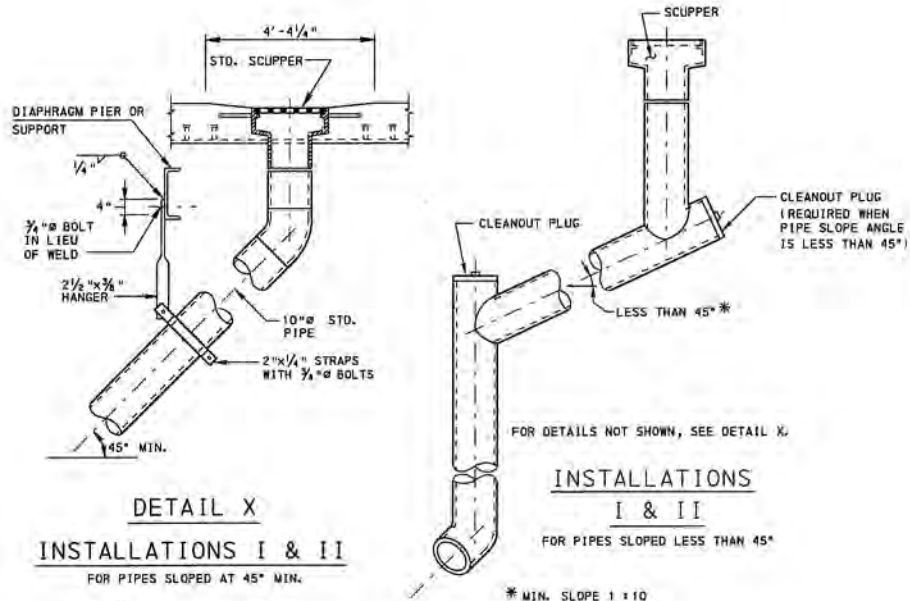
SAP ASSEMBLY NUMBER: 711-7444-01

BMS Flex-Action: C744402

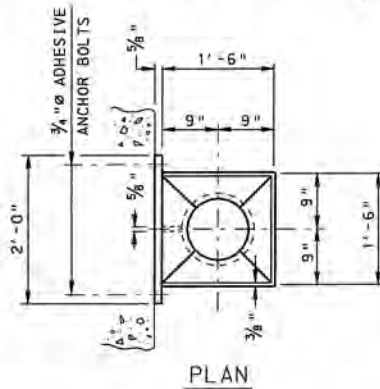
ACTIVITY TITLE: DOWNSPOUTING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH DOWNSPOUT

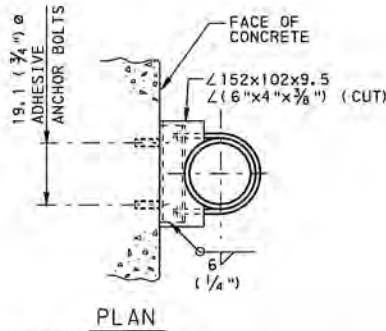
PROCEDURE: GENERAL PROCEDURE



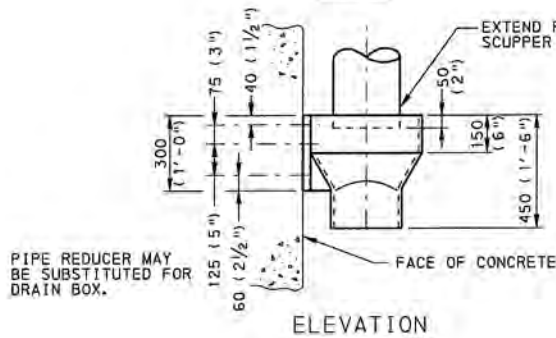
DETAIL X
INSTALLATIONS I & II
FOR PIPES SLOPED AT 45° MIN.



PLAN

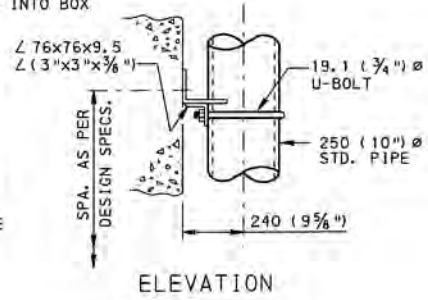


PLAN



ELEVATION

DETAIL Y



ELEVATION

DETAIL Z

DETAILS SHOWN ARE SUITABLE FOR PLANE CONCRETE SURFACES.
MODIFY THE DETAILS AS REQUIRED FOR ROUND CONCRETE SURFACES.

SAP ASSEMBLY NUMBER: 711-7444-01

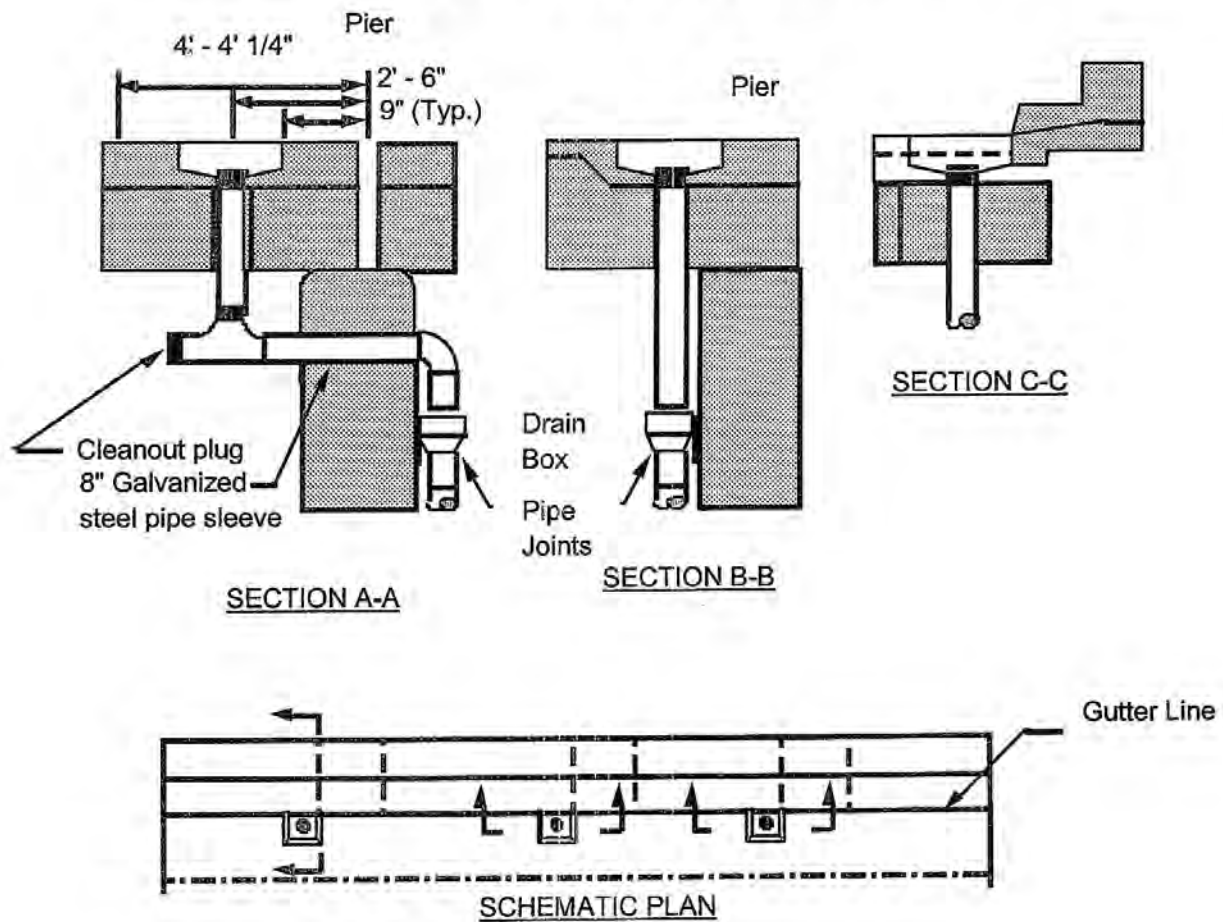
BMS Flex-Action: C744402

ACTIVITY TITLE: DOWNSPOUTING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH DOWNSPOUT

PROCEDURE: GENERAL PROCEDURE

TYPICAL DOWNSPOUTING DETAILS FOR PRESTRESSED
CONCRETE BOX BEAR BRIDGES.



ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip	As Required	6" diameter
2	Crew Members	1	Concrete Mixer	As Required	standard pipe
1	Special Crew Member (Certified Welder)	As Required	Access Equip	As Required	Anchor fittings
		As Required		As Required	Concrete

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.5 EA/HR	3 EA/DAY	8 MH/EA

Chapter 19: Timber

Table of Contents

7446-01	STRINGER (REPAIR/REPLACE)	19 - 3
7446-01	OTHER MEMBERS (REPAIR/REPLACE)	19 - 8

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SAP ASSEMBLY NUMBER: 711-7446-01**BMS Flex-Action:** A744601**ACTIVITY TITLE:** TIMBER STRINGERS (REPAIR/REPLACE)**UNIT OF MEASUREMENT:** EACH STRINGER**PROCEDURE:** REPAIR OF SPLIT STRINGER

REFERENCES

PennDOT Specifications (PUB 408)
Sections 1031 - Timber Structures
Sections 1032 - Timber Stringers

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

Timber stringers, cross bracing attached to stringers being repaired or replaced, and fasteners to decks.

ACTIVITY DESCRIPTION

Repairing or replacing timber stringers. The work can include, but is not limited to, providing temporary supports for jacking; jacking stringers and/or portions of the deck; removing fasteners

between stringers and the deck and cross bracing; removing existing stringers; fabricating and installing new stringers; treating cuts and holes with wood preservative; replacing existing cross bracing, if necessary, and fastening cross bracing to stringers; and fastening new stringers to the deck. The work can also include all work necessary for installing sister beams which does not involve removing existing stringers. Report replacing or repairing cross bracing not associated with replacing and repairing stringers under Activity B744601, Other Timber Members (Repair/Replace). Report work on timber deck not directly associated with stringer repair or replacement under Activity B744301, Timber Deck (Repair/Replace).

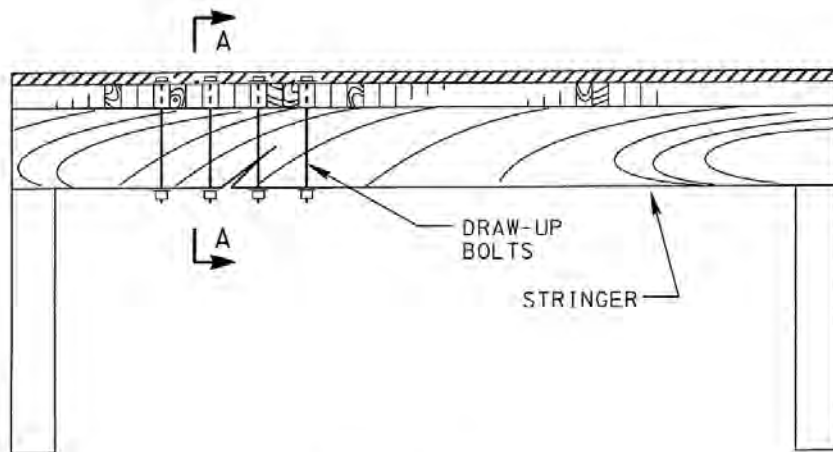
PROCEDURE DESCRIPTION

1. Use template to locate holes on cap and scab
2. Drill holes and treat holes
3. Insert rings in cap
4. Install scab.

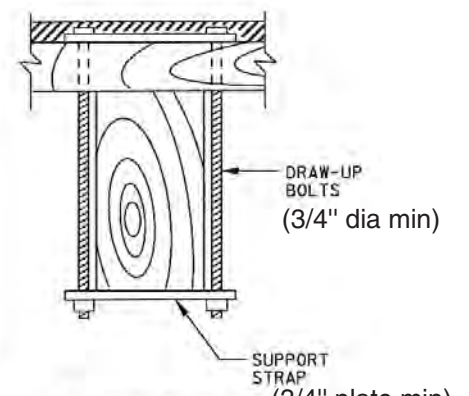
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Saw	As Required	Prefabricated
3	Crew Members	1	15 lb hammer	As Required	Straps Concrete
		1	Concrete/Asphalt Saw	As Required	3/4" Dia Plates
				As Required	3/4" Dia Bolts
				As Required	with Nuts and Washers
				As Required	Bituminous Patching Material
				As Required	

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.67EA/HR	4 EA/DAY	6 MH/SY



ELEVATION



SECTION A-A

REPAIR OF CRACKED OR SPLIT STRINGERS

SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744601

ACTIVITY TITLE: TIMBER STRINGERS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: REPAIR OF DECAYED STRINGER ENDS

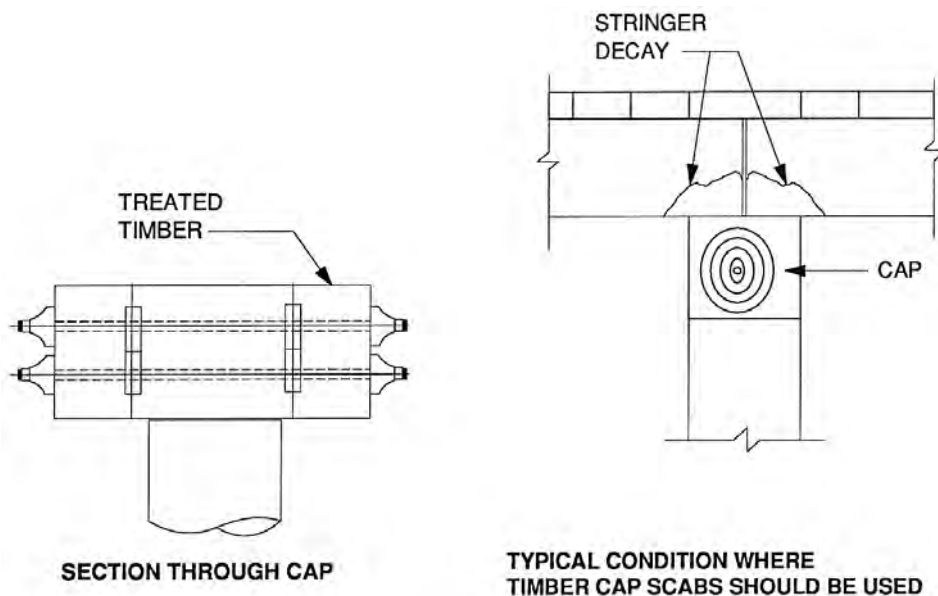
PROCEDURE DESCRIPTION

1. Use a template to locate holes on cap and scab.
2. Drill holes for draw-up bolts and treat.
3. Insert rings in the cap.
4. Install scab.
5. Install plates and tighten bolts.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Power Drill	As Required	Scabs
3	Crew Members			As Required	Bolts
				As Required	Rings
				As Required	OG Washers
				As Required	Wood Preservative

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.67EA/HR	4 EA/DAY	6 MH/SY



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744601

ACTIVITY TITLE: TIMBER STRINGERS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: UNDER THE DECK REPLACEMENT

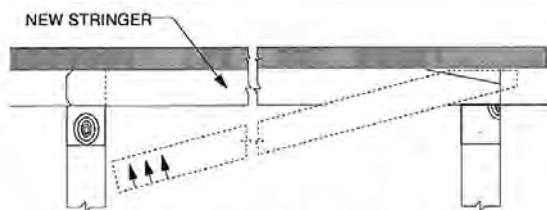
PROCEDURE DESCRIPTION

1. Construct temporary bent for jacking.
2. Lift superstructure jacking against steel plate.
3. Remove cross bracing between stringers.
4. Remove existing timber stringer.
5. Cut new stringer as shown.
6. Treat cut and any holes with wood preservative.
7. Install new stringer using a come-along.
8. Nail cut section to stringer.
9. Fasten cross bracing to new stringer.
10. Fasten deck to new stringers.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman		No Special	1	Replacement
2	Crew Members		Equipment	As Required	Stringer
			Required	As Required	Wood Preservative
				As Required	Crossbracing
					Temporary Bent

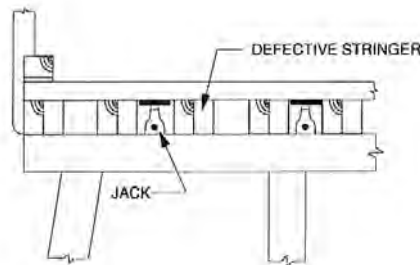
PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.67 EA/HR	4 EA/DAY	6 MH/SY



ERECTION SCHEME



NEW STRINGER



TYPICAL JACKING ARRANGEMENT

SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744601

ACTIVITY TITLE: TIMBER STRINGERS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: ABOVE THE DECK REPLACEMENT

PROCEDURE DESCRIPTION

1. Remove cross bracing between stringers.
2. Cut deck along center lines of stringers adjacent to stringer to be removed.
3. Remove stringer and continuous deck.
4. Install new stringer.
5. Replace deck and nail decking in the same manner as existing.
6. Fasten cross bracing to new stringers in the same manner as existing.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman		No Special Equipment Required	1	Replacement Stringer
3	Crew Members			As Required	Cross Bracing Decking

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.67 EA/HR	4 EA/DAY	6 MH/SY

SAP ASSEMBLY NUMBER: 711-7446-01**BMS Flex-Action:** B744601**ACTIVITY TITLE:** OTHER TIMBER MEMBERS (REPAIR/REPLACE)**UNIT OF MEASUREMENT:** EACH MEMBER**PROCEDURE:** OTHER TIMBER MEMBERS (REPAIR/REPLACE)**REFERENCES**

PennDOT Specifications (PUB 408)
 Sections 1031 - Timber Structures
 Sections 1032 - Timber Stringers

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

All timber elements of bridges and their fasteners between the backs of abutment backwalls, including pile caps and bracing bents but excluding timber items included under Activity B744301, Timber Deck (Repair/Replace), and Activity A744601, Timber Stringers, (Repair/Replace).

ACTIVITY DESCRIPTION

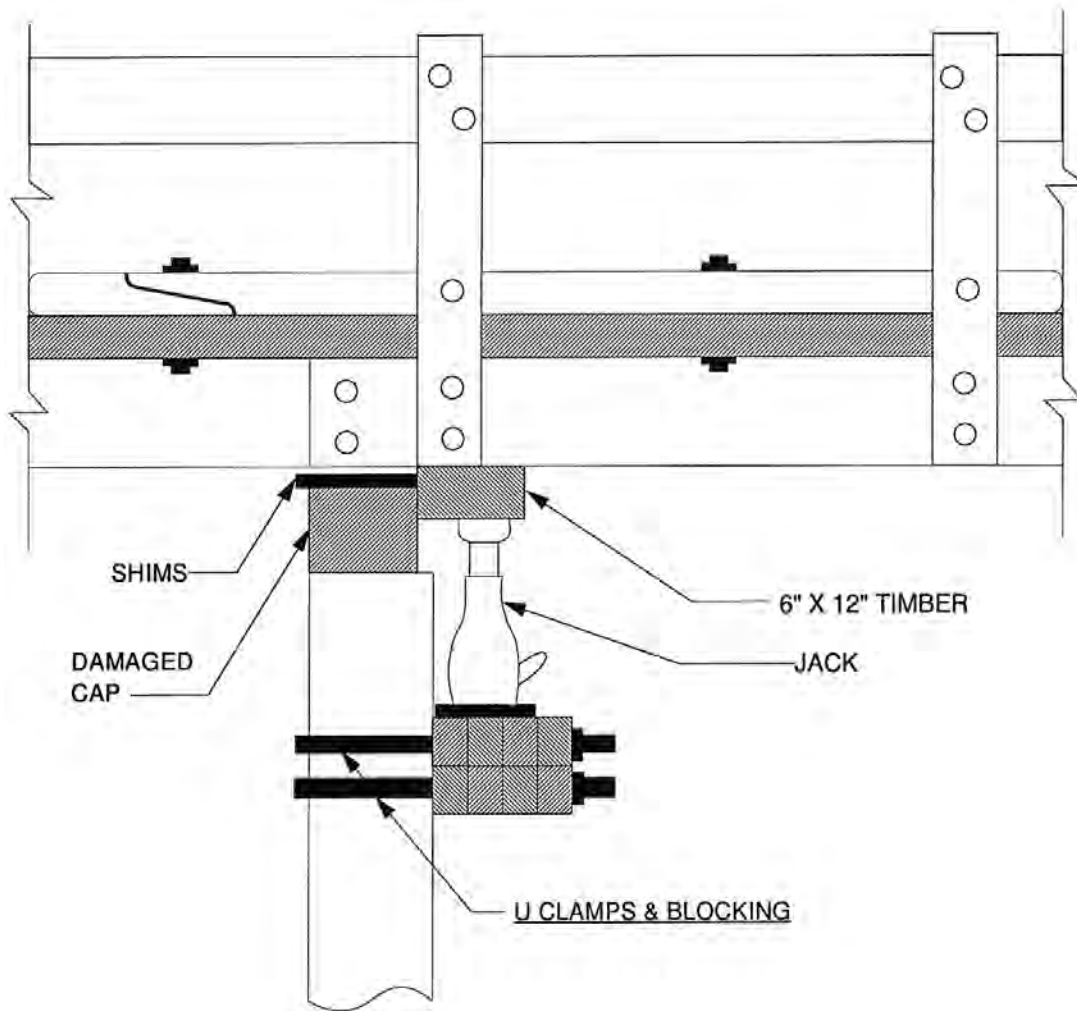
Repairing or replacing timber elements at any location within the work area. The work can include, but is not limited to, providing temporary supports for jacking; jacking all or a portion of the structure to gain access to the timber elements being repaired or replaced; removing or cutting fasteners, as required, to facilitate work; removing all or a portion of a deteriorated or damaged member; prefabricating a replacement element; treating cuts or holes with wood preservative; and refastening repaired or replaced element.

PROCEDURE DESCRIPTION - shim cap

1. Install U-Clamps and jacks, as shown.
2. Lift span approximately 1/2" higher than final elevation.
3. Cut shims 1/4" less than pile-cap gap and install. Use wood preservative.
4. Lower cap.
5. Toe nail shims.
6. Remove U-Clamps and jack.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	U-Clamps	As Required	Shims
3	Crew Members	As Required	Jacks	As Required	Wood Preservative
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.33 EA/HR		2 EA/DAY		12 MH/SY	



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: B744601

ACTIVITY TITLE: OTHER TIMBER MEMBERS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH MEMBER

PROCEDURE: STRENGTHEN EXISTING CAP

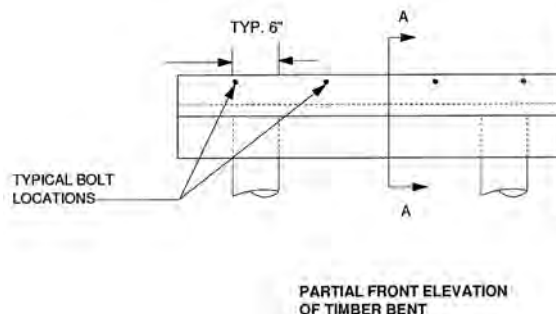
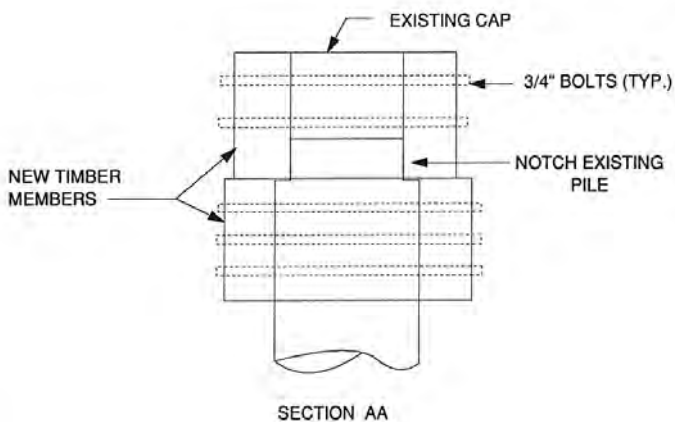
PROCEDURE DESCRIPTIONS

1. Notch existing pile if necessary.
2. Clamp new members as shown.
3. Drill bolt holes and treat with preservative.
4. Place bolts and tighten

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Power Drill	As Required	Shims
3	Crew Members	As Required	Clamps	As Required	Rings
				As Required	Bolts
				As Required	O.G. Washers
				As Required	Wood Preservative

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARDS
.33 EA/HR	2 EA/DAY	12 MH/SY



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: B744601

ACTIVITY TITLE: OTHER TIMBER MEMBERS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH MEMBER

PROCEDURE: REPLACE PILE

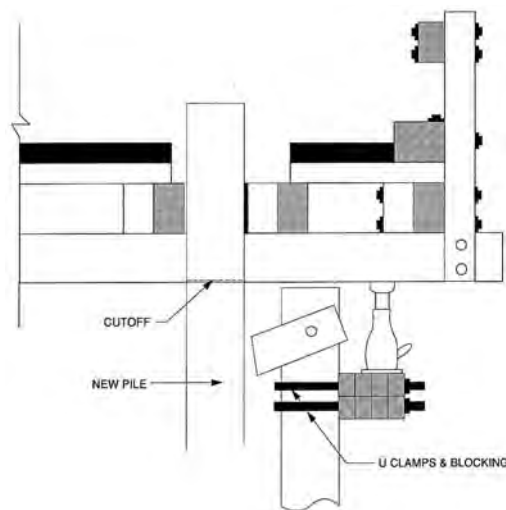
PROCEDURE DESCRIPTION

1. Cut through overlay and deck along center lines of adjacent stringers near pile to be replaced. Remove sufficient area of deck to permit pile to be driven.
2. Remove cross-bracing as necessary.
3. Drive pile at slight batter so it will be plumb when in final position.
4. Install U-Clamps and blocking on pile to be replaced as shown. Lift cap.
5. Cut new pile and pull into position under cap.
6. Install flashing and lower cap.
7. Remove existing pile and jack.
8. Install cross-bracing, deck, and overlay if appropriate.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Power Saw	As Required	Timber Pile
3	Crew Members	1	Pile Driver	As Required	Flashing
1	Special Crew Member (Operator)	1	Come Along	As Required	Crossbracing
		As Required	Jack, U-Clamps	As Required	Decking
		As Required	Blocking	As Required	Overlay Material
				As Required	WoodPreservative

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.33 EA/HR	2 EA/DAY	12 MH/SY



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: B744601

ACTIVITY TITLE: OTHER TIMBER MEMBERS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH MEMBER

PROCEDURE: REPLACE PILE SECTION

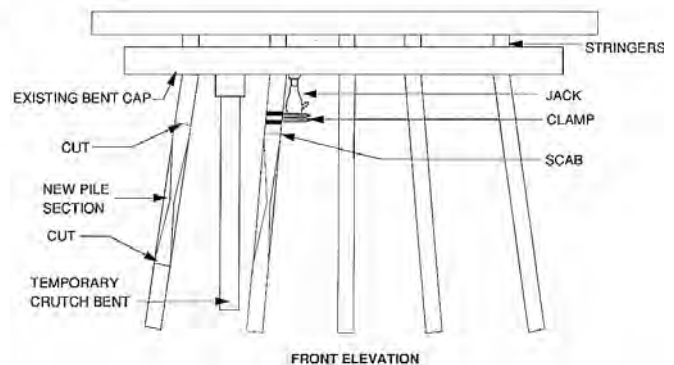
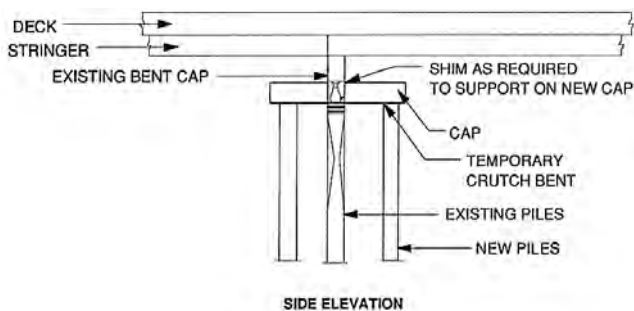
PROCEDURE DESCRIPTION

1. Install temporary crutch bent near pile to be partially replaced.
2. Install U-Clamps and jack on pile to be partially replaced. Lift cap.
3. Shim crutch bent to remove load from and lift span off of pile to be partially replaced.
4. Treat cut area with wood preservative.
5. Install replacement pile section and toe nail or use scabs if appropriate.
6. Remove crutch bent.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Power Saw	As Required	Temporary Bent
3	Crew Members		Jack(s)	As Required	Shims
			U-clamps	As Required	Wood Preservative
				As Required	Replacement Pile Section

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.33 EA/HR	2 EA/DAY	12 MH/SY



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: B744601

ACTIVITY TITLE: OTHER TIMBER MEMBERS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH MEMBER

PROCEDURE: REPLACE CROSS-BRACING

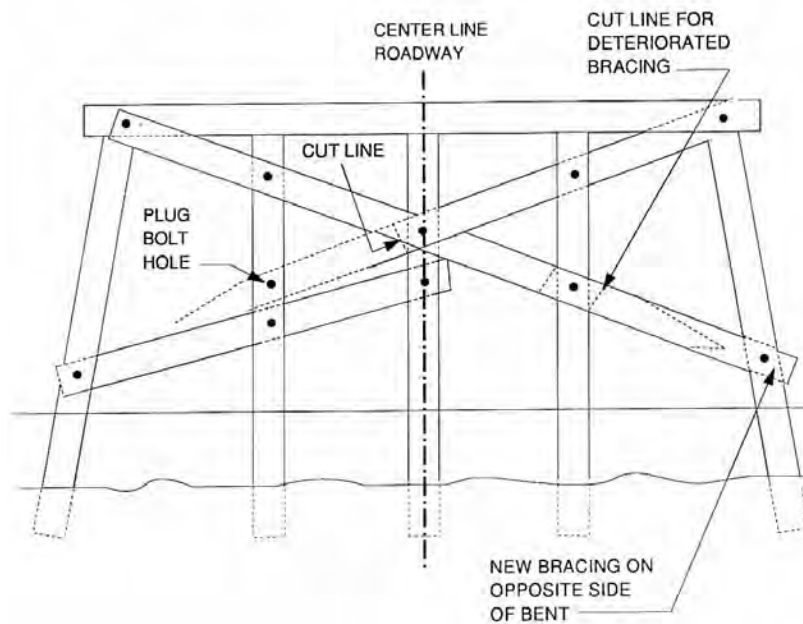
PROCEDURE DESCRIPTION

1. Remove deteriorated cross-bracing. Plug old bolt holes with caulk/grout.
2. Temporarily attach bracing to piles with galvanized nails. Nails should not interfere with bolt installation.
3. Drill and treat holes with wood preservative.
4. Place bolts, washers, and nuts. Tighten.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Power Drill	As Required	Crossbracing
3	Crew Members			As Required	Galvanized Nails
				As Required	Bolts, Washers and Nuts
				As Required	Wood Preservative
				As Required	Caulk/Grout

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.33 EA/HR	2 EA/DAY	12 MH/SY



Chapter 20: Steel

Table of Contents

7446-01	STRINGER (REPAIR/REPLACE)	20 - 3
7446-01	FLOORBEAM (REPAIR/REPLACE)	20 - 8
7446-01	GIRDER (REPAIR)	20 - 17
7446-01	DIAPHRAGM/LATERAL BRACING (REPAIR/REPLACE)	20 - 22
7446-01	REPAIR PROCEDURE FOR IMPACT AREAS	20 - 24
7446-02	UNCOATED WEATHERING STEEL - OTHER	20-26

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SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744602

ACTIVITY TITLE: STEEL STRINGER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: REPLACE SECTION (SUCH AS BEAM END)

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1060 - Painting Structural Steel
 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. When damage or deterioration is so severe that the structural capacity of a stringer is impaired, special traffic controls may be required on an emergency basis.

WORK AREA

All rolled beam steel stringers; their connections to bearings and floor beams which support them; areas of the deck directly adjacent to stringers requiring repair or replacement; and incidental items supported by and connected to stringers, such as diaphragms, cross frames and utility brackets.

ACTIVITY DESCRIPTION

Repairing and replacing all or portions of steel stringers. The work can include, but is not limited to, providing temporary supports for jacking; temporarily supporting or reducing loads carried by stringers either by jacking from below or using needle beams from above; disconnecting stringers from their supports or disconnecting incidental items supported by stringers by removing bolts or rivets or using oxyacetylene cutting torches; prefabricating replacement members or elements; drilling and reaming holes; grinding to provide the required finish or tolerances on steel surfaces; making minor repairs to decks within the work area; repairing or replacing incidental items within the work area; erecting replacement or repaired elements and incidental items, including installation of shear connectors, by welding or high tensile strength bolting; and preparing surfaces which have been damaged or left bare by the work, and applying a prime coat of paint. Report replacing all or portions of decks or major repairs to decks to appropriate activities such as Activity D744303, Concrete Deck (Repair), or Activity C744302, Open Steel Grid Deck (Repair/Replace).

PROCEDURE DESCRIPTION

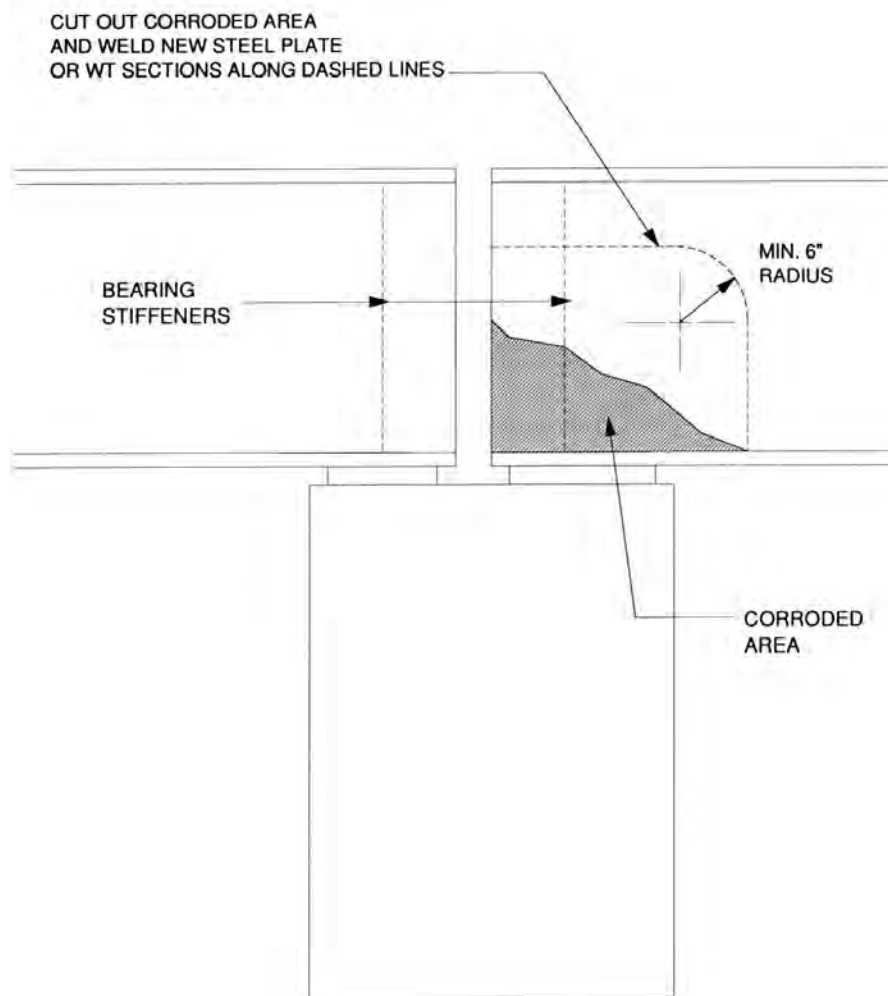
1. Modify superstructure to accept jacking loads, if necessary.
2. Construct temporary bent or install needle beam under sound portion of superstructure.
3. Lift superstructure.
4. Remove damaged or deteriorated section.
5. Weld new section into place using full penetration groove welds.
6. Lower member and check for distress.
7. Remove lifting devices.
8. Sandblast and apply prime coat paint.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	Jacks or Carrier	As Required	Temporary Bent
3	Crew Members		Beams	As Required	New Section
1	Special Crew Member (Certified Welder)	1	Sand Blaster	As Required	Prime Coat Paint
		1	Cutting Torch	As Required	Sand
		1	Welding Equip.		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.33 EA/HR	2 EA/DAY	18 MH/EA



Low Cost Bridge Repair

Steel Stringer End Connection



Stringer Support Bracket

PennDOT District 12-0

Westmoreland County

S.R. 993 over Brush Creek

Single span thru truss bridge, stringer ends repaired by installing steel support bracket.

Rehabilitation performed to avoid a weight limit posting.

Design: In-House by District Personnel

Construction: Westmoreland County
Maintenance Crew

Duration of Construction: 1 Week (3 man crew)

Maintenance and Protection of Traffic:

Lane closure over each stringer being repaired.

Cost: \$4,000 Material Cost

Stringer Support Bracket

Equipment List:

Temporary Traffic Control Devices

Grinder

Drill to install bolts in web of floor beam

Material List:

18 Steel Support Brackets fabricated by Dura-Bond Steel (Bid in DGS)

A325 Steel Bolts

Paint

Stringer Support Bracket

Steel support brackets and MPT designed in-house by District.

Steel support brackets fabricated by contractor.

Stringer Support Bracket

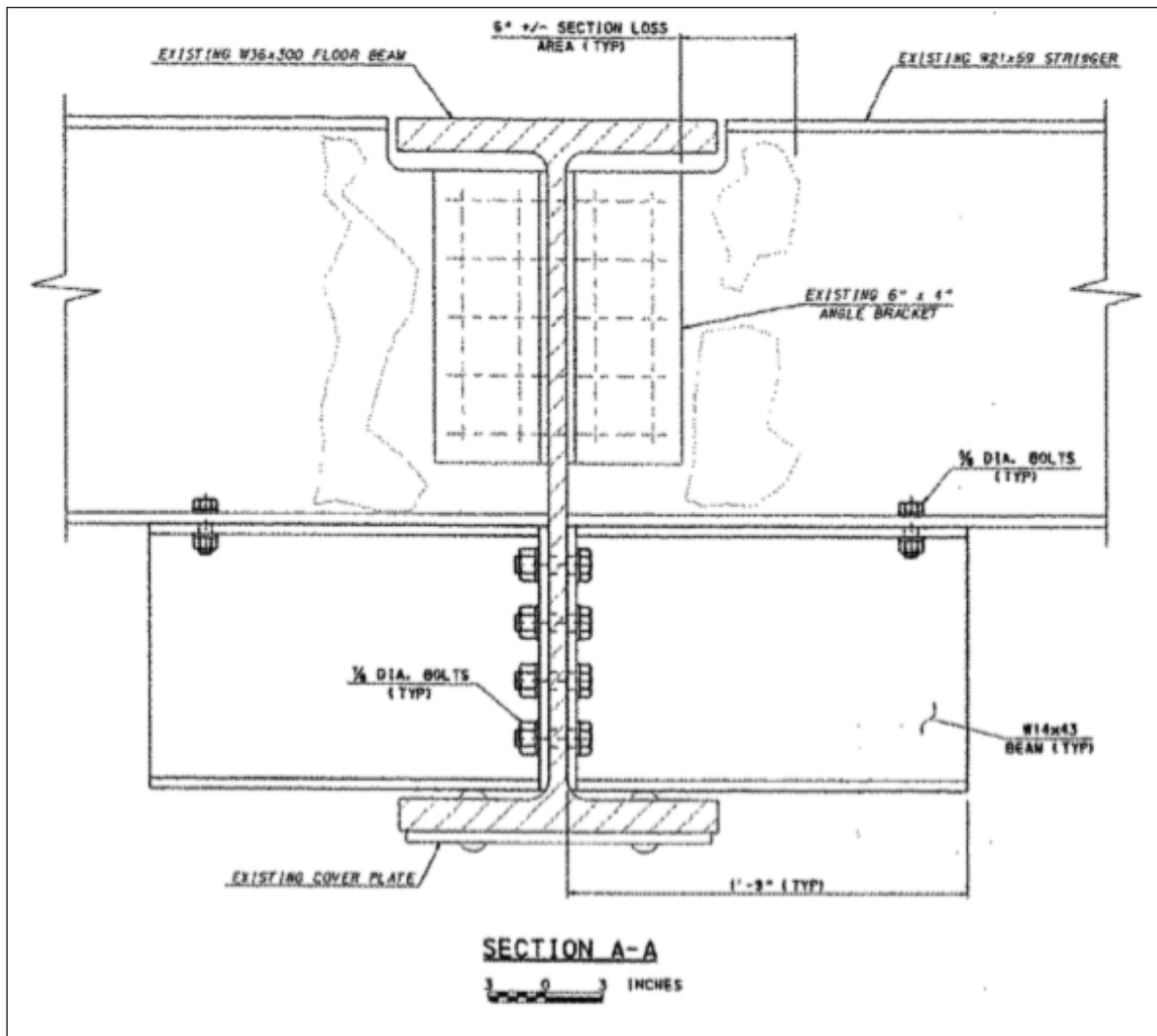
Lessons Learned:

(1) Original design would repair deficient stringers at 5 locations and reduce the bridge's effective width. This design did not consider that this would prevent access to the bridge from a private business with a driveway adjacent to the bridge.

(2) Maintenance forces proposed 4 additional locations to avoid reducing the bridge width. Additional expense and time was minimal and provided a reasonable and cost effective solution.

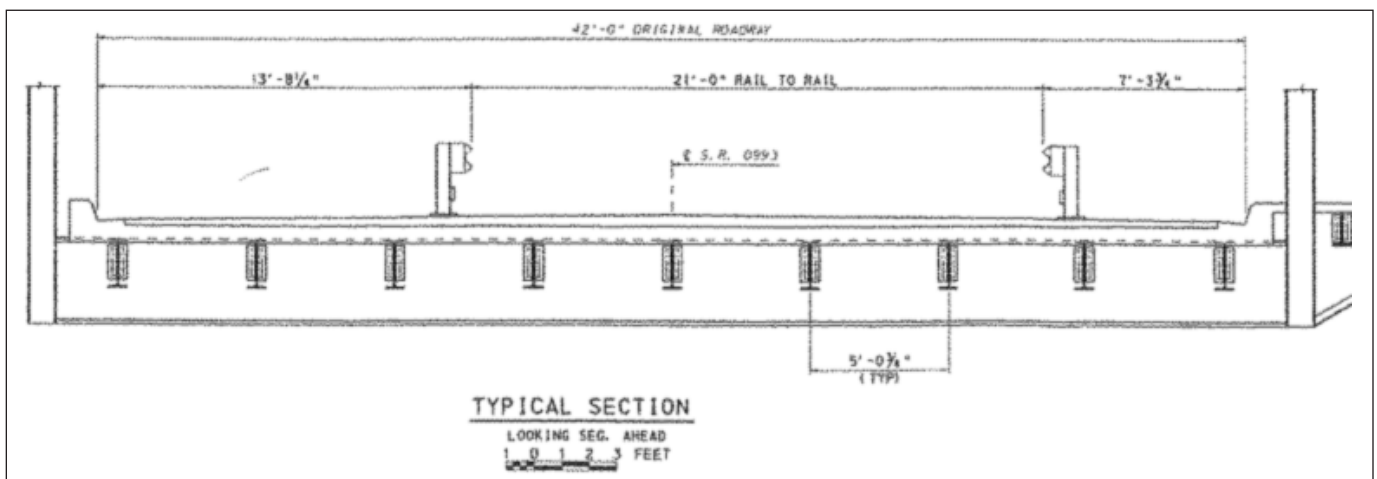


Stringer Support Bracket Plan and details by District.



Stringer Support Bracket Plan

Maintenance and Protection of Traffic



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744602

ACTIVITY TITLE: STEEL STRINGER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: REPLACE MEMBER

PROCEDURE DESCRIPTION

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Modify superstructure to accept jacking loads, if necessary. 2. Lift superstructure. 3. Disconnect member from structure and remove. 4. Modify structure to accept replacement member. 5. Install replacement member using high-strength bolts or welds. | <ol style="list-style-type: none"> 6. Remove jacks and check for distress. 7. Clean and paint. 8. Repair deck if necessary. <p>NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.</p> |
|---|--|

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	Welding Torch	1	Temporary Bent Replacement Members H.S. Bolts Prime Coat Paint Reinforcing Steel Concrete Mix Formwork
3	Crew Members	As Required	Jacks or Carriers	As Required	
1	Special Crew Member (Certified Welder)	1	Beams	As Required	
			Crane or Lift Equip.	As Required	
				As Required	

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.33 EA/HR	2 EA/DAY	18 MH/EA

SAP ASSEMBLY NUMBER: 711-7446-01**BMS Flex-Action:** B744602**ACTIVITY TITLE:** STEEL FLOORBEAM (REPAIR/REPLACE)**UNIT OF MEASUREMENT:** EACH FLOORBEAM**PROCEDURE:** REPLACE SECTION

REFERENCES

PennDOT Specifications (PUB 408)
Section 1060 - Painting Structural Steel
1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. When deterioration is so severe that the structural capacity of a floorbeam is impaired, special traffic controls may be required.

WORK AREA

All rolled beam and built-up, riveted or welded floorbeams, their connections to girders, chords or bearings; stringer connections to floorbeams; and areas of the deck directly adjacent to floorbeams requiring repair or replacement.

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of steel floorbeams. The work can include; but is not limited to, providing temporary supports for jacking; temporarily supporting the ends of floorbeams or the loads from stringers supported by floorbeams either by jacking from below or using needle beams from above; disconnecting floorbeams from their supports, or stringers from their beams by removing bolts or rivets or using oxy-acetylene cutting torches; prefabricating replacement members or elements; drilling and reaming holes; grinding to provide the required finish or tolerances on steel surfaces; making minor repairs to decks within the work area; erecting replacement or repaired elements and

incidental items in the work area by welding or high tensile strength bolting; and preparing surfaces which have been damaged or left bare by the work, and applying a prime coat of paint. In those areas where a floorbeam and one or more stringers supported by it are repaired or replaced at the same time, report the work of connecting repaired or replaced stringers to the floorbeam to Activity A744602, Steel Stringer (Repair/Replace).

PROCEDURE DESCRIPTION

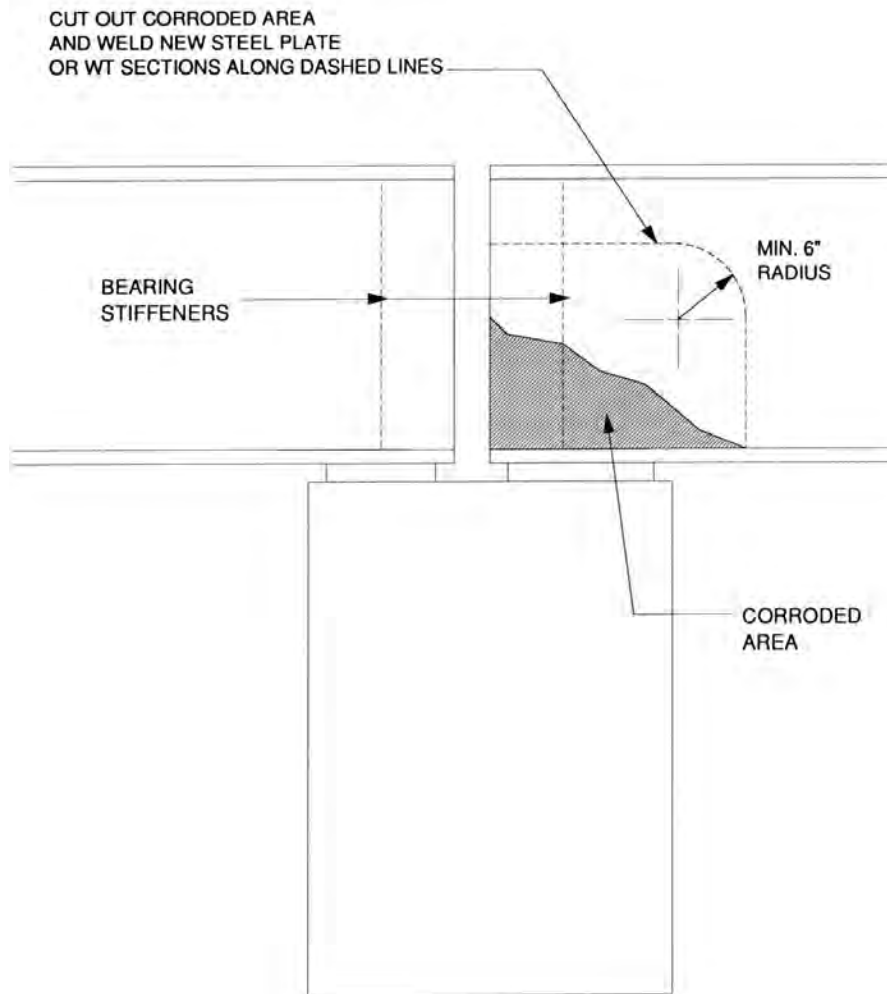
1. Modify superstructure to accept jacking loads, if necessary.
2. Construct temporary bent or install needle beam under sound portion of superstructure.
3. Lift superstructure.
4. Remove damaged or deteriorated section.
5. Weld new section into place using full penetration groove welds.
6. Lower member and check for distress
7. Remove lifting devices.
8. Clean and apply prime coat paint.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and the position of the weld required. Removing versus cleaning decayed area of beam will be determined by District Bridge Engineer.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	Jacks	As Required	Beam Sections
3	Crew Members	As Required	Carrier Beam	As Required	Paint
1	Special Crew Member (Certified Welder)	As Required	Beam		
		1	Cutting Torch		
		As Required	Welding Equip		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.33 EA/HR	2 EA/DAY	18 MH/EA



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: B744602

ACTIVITY TITLE: STEEL FLOORBEAM (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH FLOORBEAM

PROCEDURE: REPLACE MEMBER

PROCEDURE DESCRIPTION

1. Modify superstructure to accept jacking loads, if necessary.
2. Disconnect member from structure and remove.
3. Modify structure to accept replacement member.
4. Install replacement member using high-strength bolts or welds.
5. Remove jacks and check for distress.

6. Clean and paint.
7. Repair deck, if necessary.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and the position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Torch	1	Temporary Bent
3	Crew Members	As Required	Jacks or Carrier	1	Replacement
1	Special Crew Member (Operator)	1	Beam	As Required	Member
1	Special Crew Member (Certified Welder)			As Required	Prime Coat Paint
				As Required	Reinforcing Steel
				As Required	Concrete

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.05 EA/HR	33 EA/DAY	100 MH/EA

Steel Beam Replacement

Steel Stringer End Connection



Steel Beam Replacement

PennDOT District 5-0
 Schuylkill County
 S.R. 4008 over West Branch of Schuylkill River
 Single span steel girder bridge with steel grid deck.
 Replacement of Beam 3 (web deterioration). Repair of steel grid deck.
 Beam replaced without removing steel grid deck.



Design: In-House by District personnel
Construction: Schuylkill County Bridge Crew
Duration of Construction: 6 days
Maintenance and Protection of Traffic: Road Closure

Equipment List:

- Excavator
- Concrete Forms
- Concrete Saw
- Cutting torch
- Scaffold

Material List:

- Steel Beam
- Steel Reinforcement/Dowels
- Cement Concrete for Backwall



Steel Beam Replacement

Removal of deteriorated beam (cut in pieces for removal).
 Removal of approach roadway and backwall adjacent to beam.



Steel Beam Replacement

Installation of new beam and deck connections



Steel Beam Replacement

Repair backwall.

Patch approach roadway.



Steel Beam Repair



PennDOT District 2-0
Mifflin County
S.R. 1002 over Tributary to Honey Creek
Single span steel girder bridge with timber plank deck and bituminous overlay.

Plated beams to repair:

- Deteriorated webs at ends of beams
- Deteriorated flanges at midspan

Design: In-House by District personnel

Construction: Mifflin County Bridge Crew

Duration of Construction: 2 week s (May 2009)

Maintenance and Protection of Traffic: None required.

Cost: \$28,100

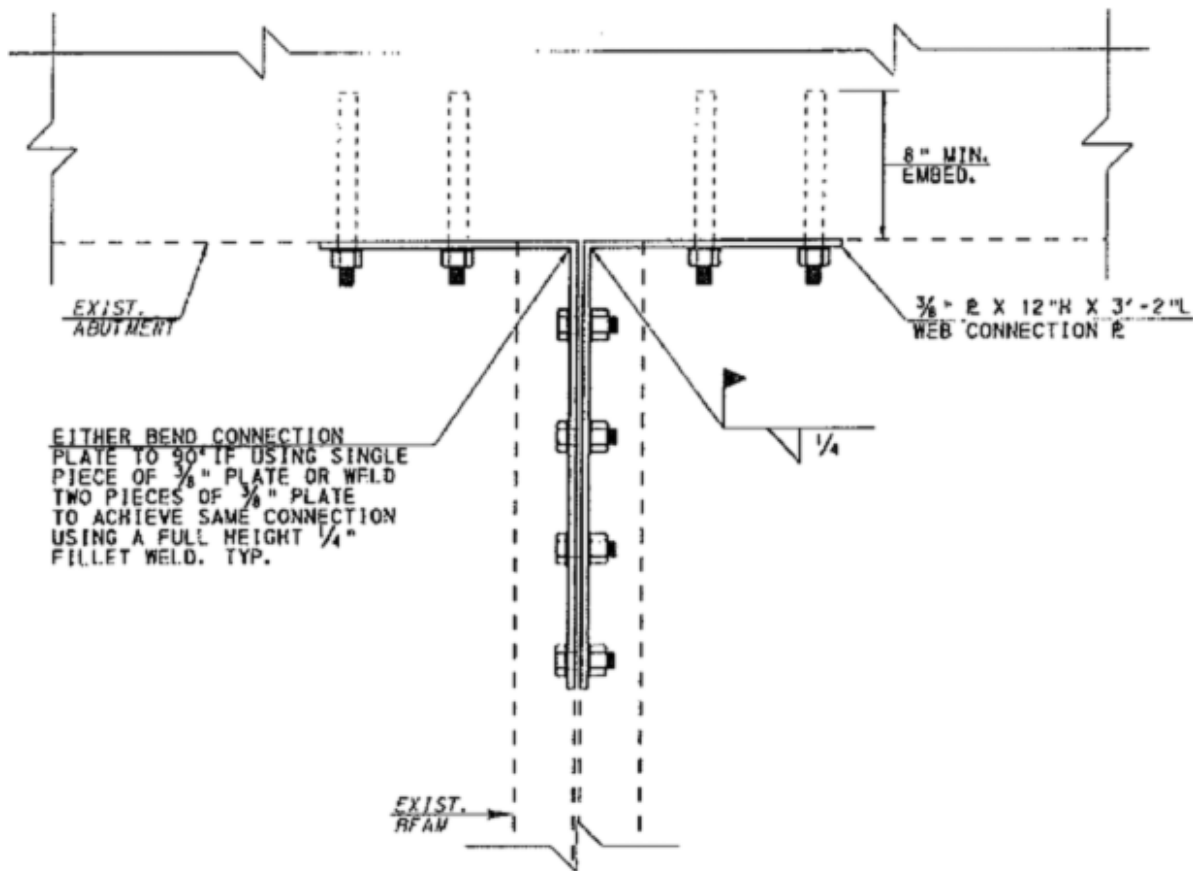
Equipment List:

Low profile magnetic drill

Material List:

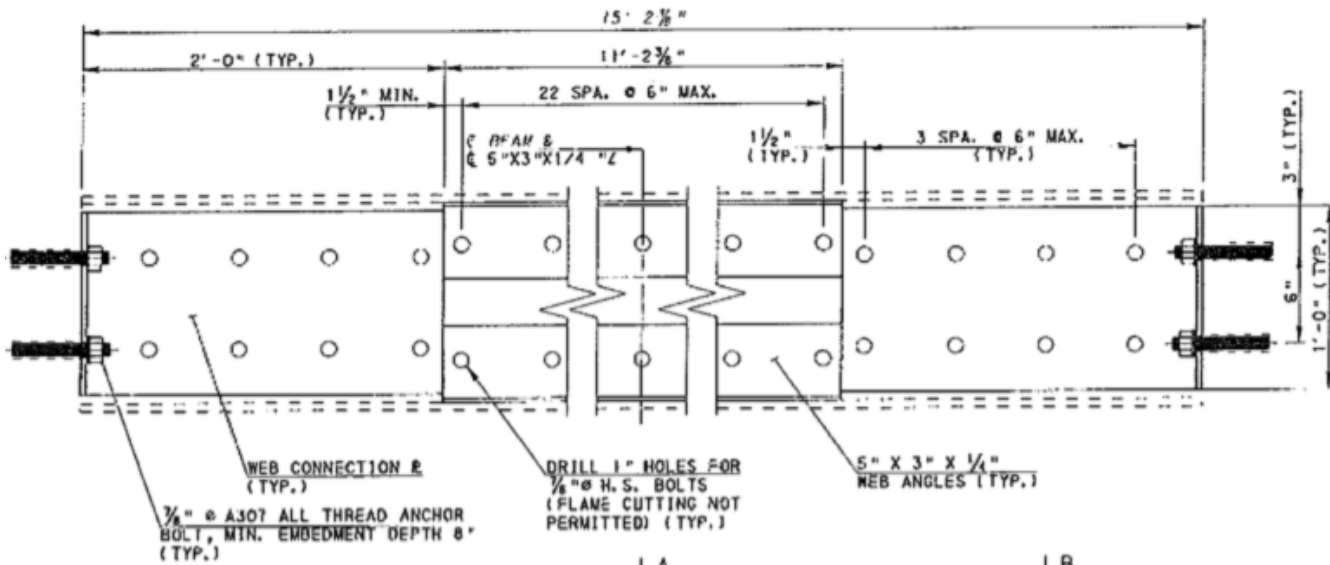
Fabricated steel and hardware





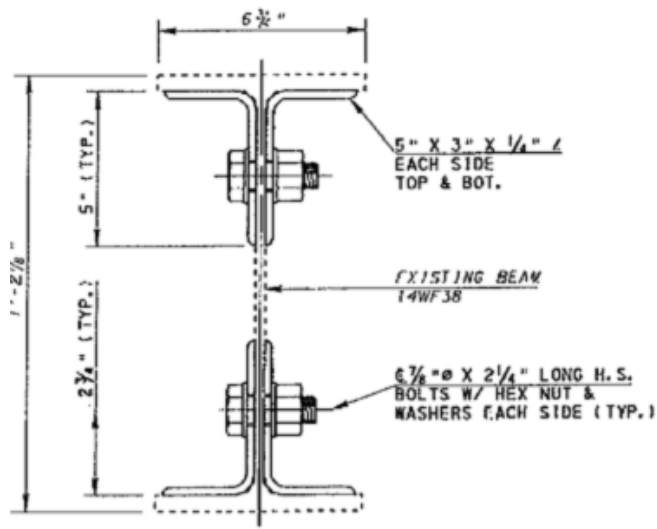
**PLAN
BEAM END CONNECTION PLATES**

NOT TO SCALE

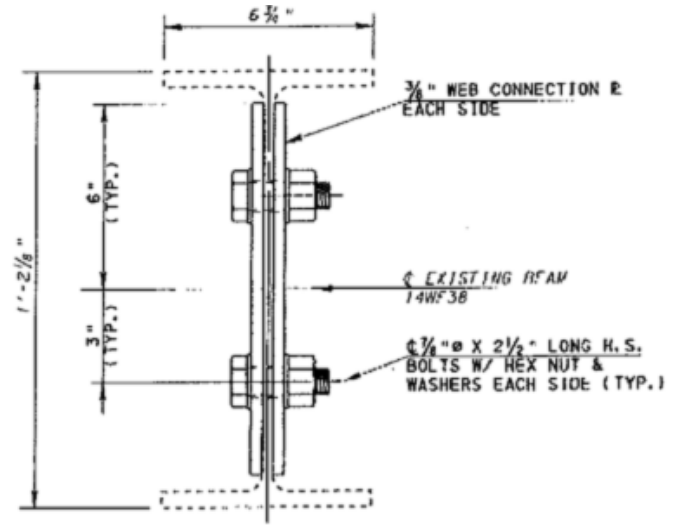


TYPICAL BEAM ELEVATION

NOT TO SCALE



SECTION A-A
NOT TO SCALE



SECTION B-B
NOT TO SCALE



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: C744602

ACTIVITY TITLE: STEEL GIRDER (REPAIR)

UNIT OF MEASUREMENT: EACH GIRDER

PROCEDURE: REPLACE SECTION

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1060 - Painting Structural Steel
 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. If damage or deterioration is sufficiently severe so that the structural capacity of a girder is impaired special traffic controls may be required on an emergency basis.

WORK AREA

All built-up girders, riveted or welded; their connections to floor beams, incidental items such as cross frames and bearings; and areas of the deck directly adjacent to girders requiring repair.

ACTIVITY DESCRIPTION

Repairing built-up steel girders by restoring or replacing damaged or deteriorated elements. The work can include, but is not limited to, providing temporary supports for jacking; modifying girders to accept jacking loads; temporarily supporting or reducing loads carried by girders by either jacking from below or using needle beams from above; disconnecting or removing elements from girders by removing bolts or rivets or using oxy-acetylene torches; repairing or prefabricating replacement elements; drilling and reaming holes; grinding to provide required finish or tolerances on steel surfaces; making minor repairs to decks within the work area; erecting repaired or replaced elements and incidental items by welding or high tensile strength bolting; and preparing surfaces damaged or left bare by the work and applying a prime coat of paint.

PROCEDURE DESCRIPTION

1. Modify superstructure to accept jacking loads, if necessary.
2. Construct temporary bent or install needle beam under sound portion of superstructure.
3. Lift superstructure.
4. Remove damaged or deteriorated section.
5. Weld new section into place using full penetration groove welds.
6. Lower member and check for distress.
7. Remove lifting devices.
8. Clean and apply prime coat paint.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	Jacks or Carrier	As Required	Temporary Bent
3	Crew Members	As Required	Beams	1	New Section
1	Special Crew Member (Certified Welder)	1	Welding Equip	As Required	Prime Coat Paint
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.17 EA/HR		1 EA/DAY		24 MH/EA	

Girder In-Fill



PennDOT District 1-0
 Crawford County
 S.R. 408 over Oil Creek (Hydetown, PA)
 Single span steel thru girder bridge
 (non-redundant steel tension member) with
 deteriorated and non-functional
 rocker nest. Replaced with laminated
 neoprene bearing pad.
 Infill of steel thru beams to protect against impact
 forces (preventive).

Design: In-House by District personnel

Construction: Crawford County Bridge Crew

Duration of Construction: 6 weeks

Maintenance and Protection of Traffic:
 Half-width construction with temporary signal.

Cost: \$25,000

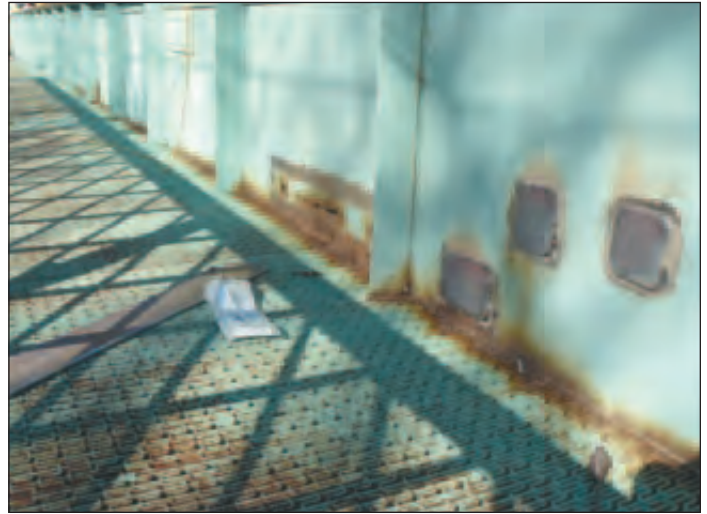
Equipment List:

- Hydraulic Jacks
- Timber Cribbing
- Concrete Forms
- Scaffold
- Welder

Material List:

- Class AA Cement Concrete
 (Lightweight is an option)
- Steel Reinforcement/Dowels
- Laminated Neoprene Bearing Pad
- Steel Anchor Bolts
- Steel Masonry Plate
- Steel Sole Plate

Girder In-Fill



Steel through-girder with structure mounted guiderail

Significant deterioration of girder web.



Completed In-Fill



Remember:

Check additional dead load on girder
Avoid transverse welds on non-redundant steel
tension members. Remove all rust and paint
because you cannot inspect beam after concrete
is placed.

If beams cannot support additional dead load,
other alternatives are available.



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: D744602

ACTIVITY TITLE: STEEL DIAPHRAGM/LATERAL BRACING (REPAIR/REPLACE)

UNIT OF MEASUREMENT: * EACH ITEM

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1060 - Painting Structural Steel
 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage.

WORK AREA

All steel diaphragms, cross frames, lateral bracing, and their connections to beams and girders.

***Special Measurement Note:** Diaphragms are usually composed of a single member such as a channel. In these cases the single member is considered as "one - each item" for measurement purposes. Cross frames are usually composed of at least four elements consisting of upper and lower members and cross members. All of these members together are considered as "one each item" for measurement purposes. Lateral systems may be composed of one or two members, and these may be discontinuous on multi-beam or girder bridges. One element, or two elements fastened together, spanning between connections without a break is considered "one each item" for measurement purposes.

ACTIVITY DESCRIPTION

Repairing or replacing all or part of the elements in structural steel diaphragms, cross frames or lateral bracing. The work can include, but is not limited to, disconnecting or removing elements by removing bolts or rivets or using oxy-acetylene cutting torches; straightening members by the application of heat and mechanical means; prefabricating replacement elements; repairing elements; drilling and reaming holes; erecting repaired or replaced elements by welding or high tensile strength bolting; and preparing surfaces damaged or left bare by the work and applying a prime coat of paint.

Cross frames and diaphragms are often connected to beam and girder stiffeners. Report the work of any necessary repairs to these stiffeners to this activity unless the beam or girder is being repaired at the same time. In that case, report the work to an appropriate activity that reflects the major effort, such as Activity A744602, Steel Stringer (Repair/Replace).

PROCEDURE DESCRIPTION

1. Modify superstructure to accept jacking loads, if necessary.
2. Construct temporary bent or install needle beam under sound portion of superstructure.
3. Lift superstructure, as necessary.
4. Remove damaged or deteriorated section or member.
5. Weld new section or member into place using full penetration groove welds.
6. Lower member and check for distress
7. Remove lifting devices.
8. Clean and apply prime coat paint.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	Jacks	As Required	Steel Shapes
3	Crew Members	As Required	Beams	As Required	Paint
1	Special Crew Member (Certified Welder)	As Required	Blocking	As Required	Paint
		As Required	Cutting Torch Welding Equipment		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.33 EA/HR		2 EA/DAY		18 MH/EA	

SAP ASSEMBLY NUMBER: 711-7446-01**BMS Flex-Action:** C744602**ACTIVITY TITLE:** REPAIR IMPACT DAMAGE TO STEEL GIRDER**UNIT OF MEASUREMENT:** EACH GIRDER**PROCEDURE:** GRIND IMPACT AREA

REFERENCES

PennDOT Specifications (PUB 408)

Section - 1060 - Painting Structural Steel

Section - 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on the need as indicated by inspection reports or reports of accidental damage. If fracture will occur due to subsequent impact then this corrective action will be done immediately.

WORK AREA

The impact are should be flared back to the material edge not less than 1 to 10 slope.

ACTIVITY DESCRIPTION

Repairing impact damage to steel girders requires very careful attention. Unless corrective measures are taken, fracture of the beam can occur due to impact at the original damage location or at any other point on the beam. The corrective measure to prevent fracture is to grind the impact damage to a smooth surface to eliminate stress riser and must be done prior to Heat-Straightening.

PROCEDURE DESCRIPTION

1. Grind impact area to bright metal to remove any irregularities and surface defects. Using a sanding disc, smooth area and round over edges. Finish grinding should be done parallel to the stress so this ensures that transverse grind marks are not present.
2. If the impact is within the proximity of a welded detail, the weld toes should be smoothed with a die grinder to ensure that no microcracks were introduced during the impact. Using a sanding disc, smooth the area and round over edges. Finish grinding should be done parallel to the stress so this ensures that transverse grind marks are not present.
3. The impact are should be faired back to the material edge at not less then a 1 to 10 slope.
4. The area should be thoroughly inspected, including any weld toes of details within the vicinity of the impact using ultrasonic or magnetic particle testing as appropriate for the detail.



ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As Required	Hand Grinder	As Required	Grind
1	Crew Members	As Required	Generator	1	Paint
		1		As Required	Test
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.17 SY/HR		1 EA/DAY		24 MH/EA	

SAP ASSEMBLY NUMBER: 711-7446-02**BMS Flex-Action:** E744602**ACTIVITY TITLE:** UNCOATED WEATHERING STEEL - OTHER**UNIT OF MEASUREMENT:** UWS MEMBER, EACH**PROCEDURE:** REPAIR SECTION

REFERENCES

PennDOT Specifications (PUB 408)

Section 705 – Joint Material

Section 1070 Painting Existing Structural Steel

Section 1071 Spot Painting Existing Structural Steel

Section 1105 Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. When damage or deterioration is so severe that the structural capacity of a UWS member is impaired, special traffic controls may be required on an emergency basis.

WORK AREA

All UWS members; their connections, areas of the deck directly adjacent to stringers requiring repair or replacement; and incidental items supported by and connected to UWS members, such as diaphragms, cross frames and utility brackets.

ACTIVITY DESCRIPTION

Repairing UWS members by sealing crevice locations or miscellaneous steel deterioration. The work can include, but is not limited to, providing temporary support for jacking; modifying UWS members to accept jacking loads; temporarily supporting or reducing loads carried by UWS members by either jacking from below or using needle beams from above; disconnecting or removing elements from UWS members by removing bolts or rivets or using oxy-acetylene torches; repairing or prefabricating replacement elements; drilling and reaming holes; grinding to provide required finish or tolerances on steel surfaces; repairing crevice locations; making minor repairs to decks within the work area; erecting repaired or replaced elements and incidental items by welding or high tensile strength bolting; and preparing surfaces damaged or left bare by the work and applying a coating system (as required).

Report replacing all or portions of decks or major repairs to decks to appropriate activities such as Activity D744303, Concrete Deck (Repair), or Activity C744602, Girder (Replace).

PROCEDURE DESCRIPTION

1. Remove any loose patina and dirt or debris.
2. Complete any miscellaneous steel repairs.
3. Apply penetrating sealer to displace moisture in crevice locations.
4. Caulk all edges around the crevice location with an approved compatible sealant (e.g., epoxy).
5. Stripe coat the crevice location with a compatible coating.

Chapter 21: Concrete Members

Table of Contents

7446-01	STRINGER (REPAIR/REPLACE)	21 - 3
7446-01	DIAPHRAGM (REPAIR/REPLACE)	21 - 10
7446-01	OTHER MEMBERS (REPAIR/REPLACE)	21 - 12

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SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744603

ACTIVITY TITLE: REINFORCED/PRESTRESSED CONCRETE STRINGER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1003 - Dowel Holes
 1080-Prestressed Concrete Bridge
 Superstructures
 1107 - Prestressed Concrete Bridge Beams

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage.

WORK AREA

All reinforced concrete stringers; all prestressed concrete stringers; areas of deck directly adjacent to reinforced concrete or prestressed concrete stringers requiring repair or replacement; and diaphragms framed into reinforced concrete or prestressed concrete stringers requiring repair or replacement.

ACTIVITY DESCRIPTION

Repairing or replacing reinforced concrete or prestressed concrete stringers. The work can include, but is not limited to, providing temporary supports for jacking; temporarily supporting the loads carried by the stringer either by jacking from below or using needle beams from above; temporarily applying loads to prestressed stringers; removing damaged or deteriorated concrete and reinforcing steel; drilling and grouting dowels of threaded inserts; constructing false work to support forms; constructing forms; installing reinforcing bars; placing concrete; and replacing prefabricated, prestressed stringers. Report the work of making minor repairs to the deck directly adjacent to a stringer being repaired or replaced, or the work of repairing or replacing diaphragms that frame into a stringer being repaired or replaced to this activity. Report repairs outside of the work area to other appropriate activities such as Activity D744303, Concrete Deck (Repair), or Activity B744603, Reinforced/Prestressed Concrete Diaphragm (Repair/Replace).

PROCEDURE DESCRIPTION

1. Remove all loose concrete from the damaged area and clean all areas where new concrete will be bonded.
2. Chip all cracks to a 2 inch deep V-Shaped groove.
3. Clean and repair any exposed reinforcing steel or prestress tendons.
4. Install forms to repair stringer to its original cross section.
5. Seal cracks in the stringer with epoxy and coat the contact surfaces of the existing concrete to be patched with an epoxy resin.
6. Place the new concrete while the epoxy resin is still wet.
7. Remove forms and finish surfaces.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	As Required	Concrete
3	Crew Members	1	Air Compressor with Hammer	As Required	Epoxy Mortar
		As Required	Access Equip.		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.17 EA/HR		1 EA/DAY		24 MH/EA	

SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744603

ACTIVITY TITLE: REINFORCED/PRESTRESSED CONCRETE STRINGER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: REPAIR PRESTRESSED STRINGER (POST-TENSIONING)

PROCEDURE DESCRIPTION

1. Drill 1-1/2 in. diameter holes through the web as shown to accommodate reinforcing steel to tie the new concrete together. These reinforcing bars are to be placed and grouted into the holes. Care must be exercised to avoid drilling through tendons or reinforcing bars.
2. Roughen and clean the surface of the concrete beams where the new concrete is to be bonded.
3. Install the post-tensioning ducts, reinforcing steel and the forming for the new concrete.
4. Cast the contact surfaces with an epoxy resin and place the new concrete while the epoxy is still tacky.
5. After the concrete has attained design strength, tension the strands to the specified load. The strands should be tensioned in a sequence to balance the load on each side of the flange.
6. Fill the post-tensioning ducts with grout.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	As Required	Concrete
3	Crew Members	2	Post-tensioning Jacks	As Required	Epoxy bonding material
		As Required	Access Equip	As Required	Post tensioning ducts
				As Required	Tendons

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 EA/HR	1 EA/DAY	24 MH/EA

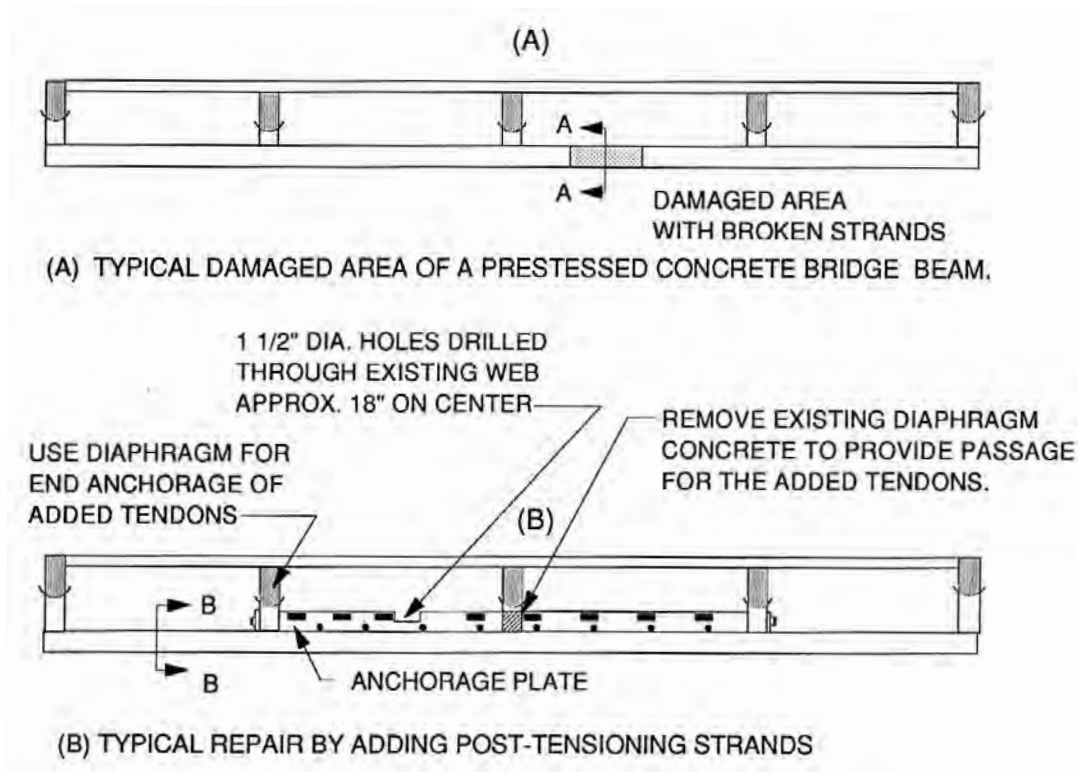
SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744603

ACTIVITY TITLE: REINFORCED/PRESTRESSED CONCRETE STRINGER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: REPAIR PRESTRESSED STRINGER (POST-TENSIONING)



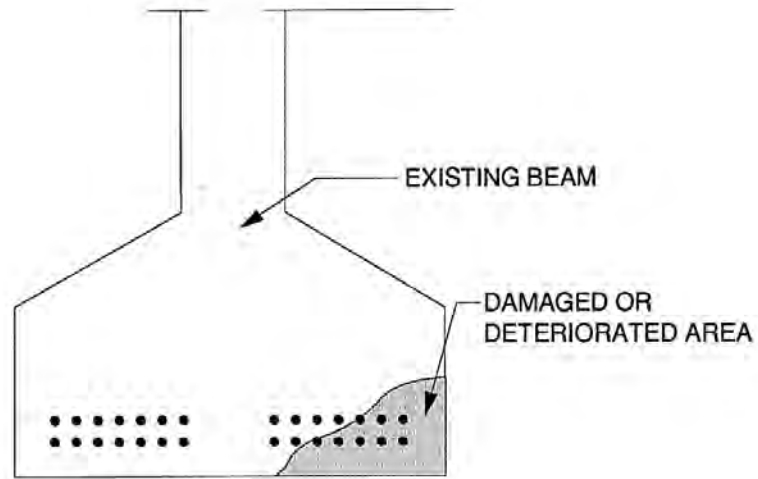
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BMS Flex-Action: A744603

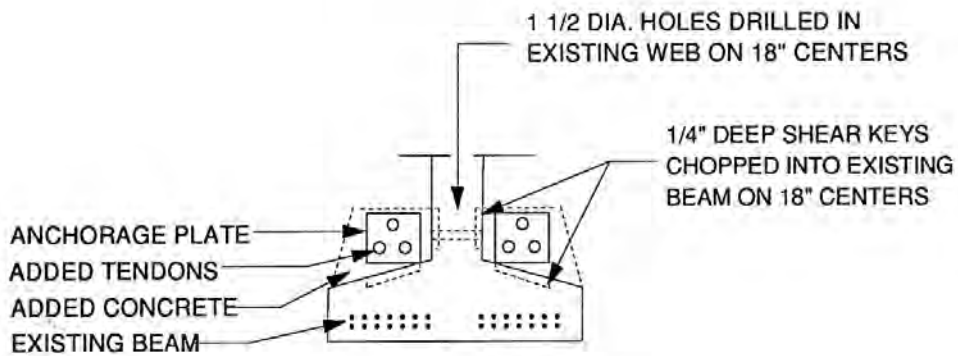
ACTIVITY TITLE: REINFORCED/PRESTRESSED CONCRETE STRINGER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: REPAIR PRESTRESSED STRINGER (POST-TENSIONING)



SECTION A A



SECTION B B

SECTIONS SHOWING DAMAGED AREA (A A) AND ADDED TENDONS TO STRENGTHEN THE BEAM (B B).

SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744603

ACTIVITY TITLE: REINFORCED/PRESTRESSED CONCRETE STRINGER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: REPAIR DISTRESSED AREAS OF CONCRETE BEAM ENDS

PROCEDURE DESCRIPTION

1. Where required, construct temporary bent for supporting jacks and blocking.
2. Place jacks and raise entire end of bridge a fraction of an inch. The lift should be only that required to insert a piece of sheet metal or other thin material used as a bond breaker for the new concrete.
3. Place the sheet metal bond breaker on the beam seat at the pier or abutment.
4. Above the deteriorated concrete to provide horizontal bearing surfaces between the new and old concrete.
5. Place new reinforcing steel and secure to the old reinforcing steel by welding. If weldability of the two steels is questionable, use low hydrogen electrodes and preheat the reinforcing bars. As an alternate to welding, the new reinforcement can be lapped with the old steel the amount of the development length.
6. Apply epoxy bonding compound to prepare the surfaces of sheared beam end, place the new concrete. A nonshrink additive should be used in the new concrete.
7. After concrete has reached sufficient strength, jack all beams simultaneously to the height needed to allow placement of elastomeric bearing pads.
8. Uniformly lower the entire end of the bridge. Check for possible distress in the repaired area.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.

Refer to: PUB 408, Section 1002

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor w/ chipping hammer	As Required	Concrete
3	Crew Members			As Required	Epoxy bonding material
1	Special Crew Member (Certified Welder)	1	Welding Equip	As Required	Reinforcing steel
		As Required	Jacks		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 EA/HR	1 EA/DAY	25 MH/EA

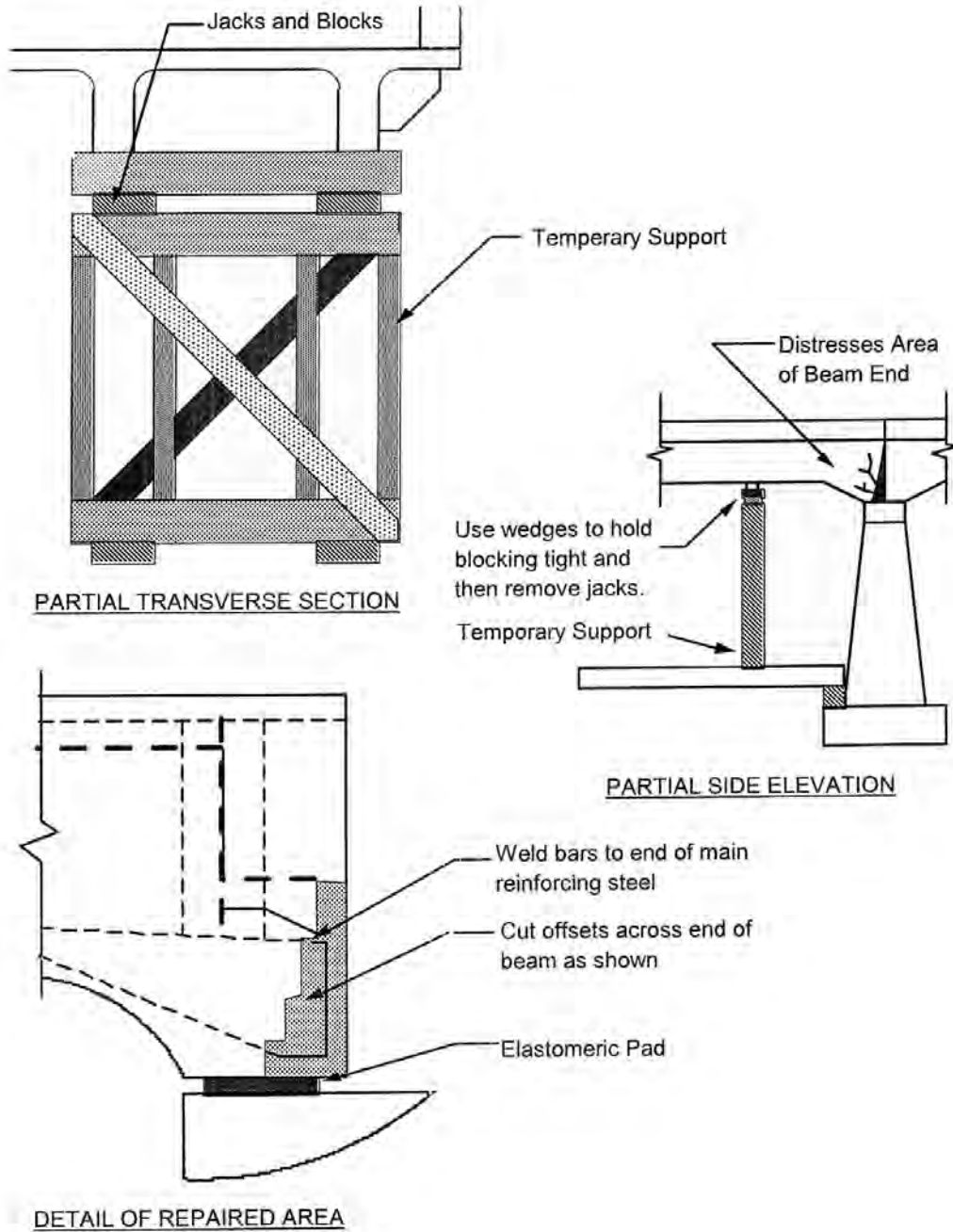
SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: A744603

ACTIVITY TITLE: REINFORCED/PRESTRESSED CONCRETE STRINGER (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH STRINGER

PROCEDURE: REPAIR DISTRESSED AREAS OF CONCRETE BEAM ENDS



SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: B744603

ACTIVITY TITLE: REINFORCED/PRESTRESSED CONCRETE DIAPHRAGM (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH DIAPHRAGM

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1003 - Dowel Holes
 1080 - Prestressed Concrete Bridge
 Superstructures

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage.

WORK AREA

All concrete diaphragms framed into reinforced concrete or prestressed concrete beams or girders; areas of the deck directly adjacent to concrete diaphragms requiring repair or replacement; areas of reinforced concrete at prestressed concrete beams or girders at and adjacent to diaphragms requiring repair or replacement.

ACTIVITY DESCRIPTION

Repairing or replacing concrete diaphragms framed into reinforced concrete or prestressed concrete beams or girders. The work can include, but is not limited to, removing damaged or deteriorated concrete and reinforcing steel; drilling, installing adhesive anchors or grouted dowels or threaded inserts; constructing false work or installing temporary hang-ers to support forms; constructing forms; installing reinforcing bars; and placing concrete. Report the work of making minor repairs to decks directly adjacent to diaphragms being repaired or replaced, or minor repairs and connections to stringers at and directly adjacent to diaphragms being repaired or replaced to this activity unless the diaphragms are framed into stringers undergoing major repair or replacement. In that case report all work to Activity A744603, Reinforced/Prestressed Concrete Stringer (Repair/Replace).

PROCEDURE DESCRIPTION

1. Remove damaged concrete using 15 lb. hammer.
2. Remove any damaged reinforcing steel.
3. If remaining steel reinforcement is too short (less than 18' embedded), adhesive anchors threaded inserts or grouted dowels must be used.
4. Drill holes appropriate for either adhesive anchors, threaded inserts or dowels and grout.
5. Install reinforcing steel.
6. Construct form work. Form work must be supported either by false work or temporary hangers.
7. Place concrete. If possible, a one and one half inch diameter vent hole vertically through the deck will facilitate concrete placement.
8. Remove formwork.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Hammer	As Required	Steel Reinforcemt
3	Crew Members	1	Concrete Drill	As Required	Concrete
				As Required	Threaded Insert
					Adhesive
					Anchors or
					Dowel & Grout

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1.7 SY/HR	1 EA/DAY	24 MH/EA

SAP ASSEMBLY NUMBER: 711-7446-01

BMS Flex-Action: C744603

ACTIVITY TITLE: REINFORCED/PRESTRESSED CONCRETE MEMBERS OTHER THAN STRINGER OR DIAPHRAGMS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: EACH MEMBER

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001- Cement Concrete Structures
 1003 -Dowel Holes
 1080 -Prestressed Concrete Bridge Superstructures
 1107 -Prestressed Concrete Bridge Beams

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage.

WORK AREA

All reinforced concrete or prestressed concrete superstructure members such as girders or floor beams, which are not included in the definitions of stringers or diaphragms; areas of the deck directly adjacent to such members; and connections of such members to stringers or diaphragms.

ACTIVITY DESCRIPTION

Repairing or replacing reinforced concrete or prestressed concrete superstructure members that are neither stringers nor diaphragms. The work can include, but is not limited to, removing damaged or deteriorated concrete and reinforcing steel; drilling and installing adhesive anchors, grouted dowels or threaded inserts; constructing false work; constructing forms; installing reinforcing steel; and placing concrete. Report the work of making minor repairs to decks in the work area and connecting to other members to this activity. Report concrete repairs outside of the work area to other appropriate activities such as Activity A744303, Concrete Deck (Repair), or Activity A744603, Reinforced/ Prestressed Concrete Stringer (Repair/ Replace).

PROCEDURE DESCRIPTION

1. Remove damaged concrete using a 15 lb. hammer.
2. Remove any damaged reinforcing steel.
3. If remaining steel reinforcement is too short, laps cannot be used. Therefore either threaded inserts or grouted dowels must be used.
4. Drill holes, as appropriate, for the adhesive anchors, threaded inserts or dowels and grout.
5. Form work support must be provided either by false work or temporary hangers.
6. Install reinforcing steel.
7. Construct Form work. Brace Form work.
8. Place concrete.
9. Remove Form work.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Hammer	As Required	Steel Reinforcement
3	Crew Members	1	Concrete Drill	As Required	Concrete
				As Required	Threaded Insert
				As Required	Adhesive Anchors
				As Required	or Dowels & Grout

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 EA/HR	1 EA/DAY	24 MH/EA

Chapter 22: Truss

Table of Contents

7447-01	MEMBERS (STRAIGHTEN/REPAIR/REPLACE)	22 - 3
7447-01	PORTAL (MODIFY)	22 - 29
7447-01	MEMBERS (TIGHTEN/FLAMESHORTEN)	22 - 31

NOTE: For all items in this Chapter - the details for all procedures must be furnished by the District Bridge Office and will only be accomplished by qualified personnel.

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SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: STRENGTHENING BOTTOM CHORD BY POST-TENSIONING

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1060 - Painting Structural Steel
 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or reports of accidental damage. Special traffic controls may be required when accidental damage impairs the structural capacity of the truss and during repair or replacement of members.

WORK AREA

All truss members - upper and lower chords, diagonals, verticals, and end posts; and their connections to other elements of a truss bridge such as floor beams, lateral bracing, and bearings.

* **Special Measurement Note:** Truss members may be composed of a single rolled shape, two or more eye-bars, or a combination of shapes, plates and bars. "Each member" is considered to be the complete member connecting two panel points, regardless of the number of elements of which it is composed.

ACTIVITY DESCRIPTION

Strengthening a truss member by adding parts such as angles or plates, or repairing a truss member by splicing existing elements and/or replacing parts, or completely replacing an entire member. The work can include, but is not limited to, providing temporary supports and jacking or other means of unloading truss members; removing parts of truss members or entire members by removing bolts or rivets or using oxy-acetylene cutting torches; prefabricating replacement elements or entire members; grinding to provide the required finish or tolerances on steel surfaces; drilling and reaming holes; erecting repaired or replaced members or elements by welding or high tensile strength bolting; and preparing surfaces damaged or left bare by the

work, and applying a prime coat of paint.

Report work on connections between truss members and members outside of the work area, such as lateral bracing, to this activity only if the work is limited to reconnections. When work involving the same connection is also being reported to another activity, such as Activity B744602, Steel Floor beam (Repair/Replace), report the connection work to that activity.

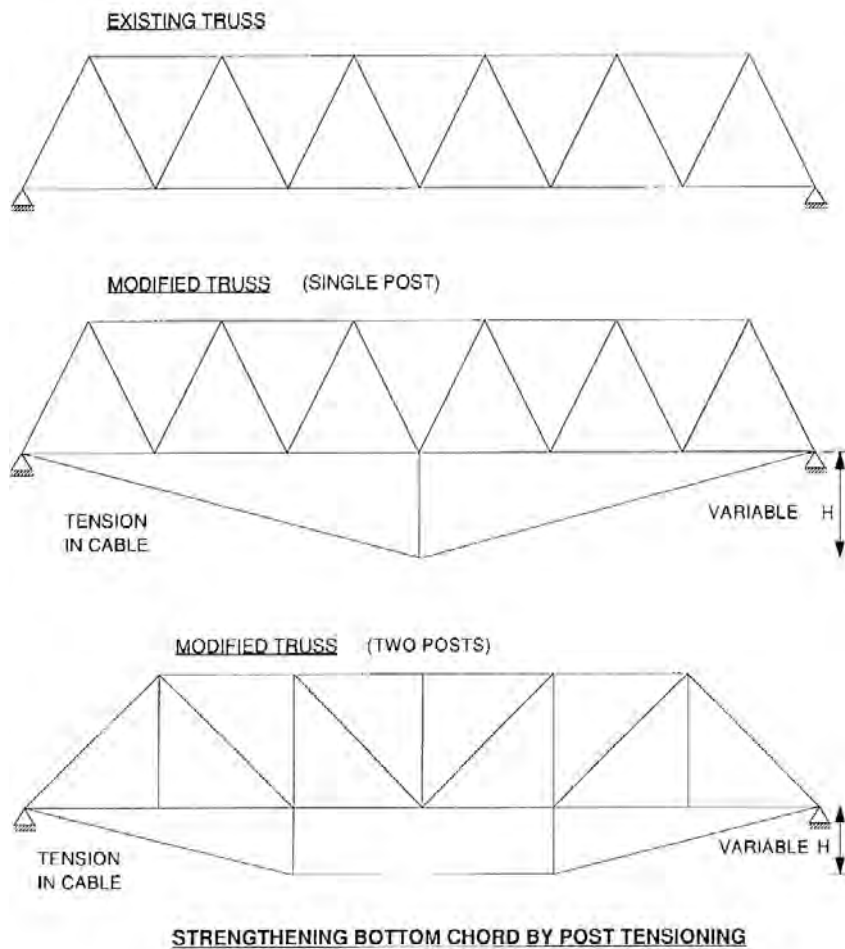
PROCEDURE DESCRIPTION

1. Position and install anchor connections.
2. Position and install posts.
3. String cable with turnbuckles.
4. Tension cables to desired force and permanently secure turnbuckle.
5. Clean and paint posts and turn buckles

NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1 3	Foreman Crew Members		No special equip required	As Required As Required As Required As Require	Posts (Braces) Cables Turnbuckles Paint
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.03 EA/HR		.2 EA/DAY		150 MH/EA	



NOTE: DIMENSIONS AND LOCATIONS POSTS AND OTHER COMPONENTS ARE TO BE FURNISHED BY THE DISTRICT BRIDGE ENGINEER.

SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: STRENGTHENING TOP CHORD

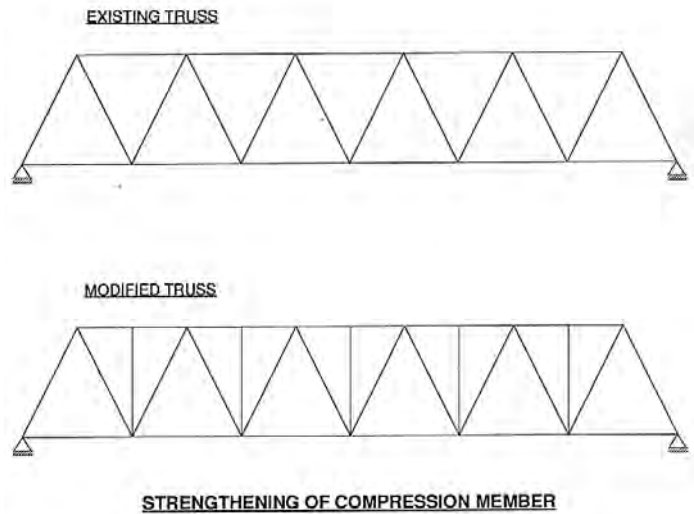
PROCEDURE DESCRIPTION

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Fabricate braces to proper length and drill holes in them. 2. Restrict traffic, as necessary, to provide work space. 3. Drill holes in chord and lower connection to match holes in brace. | <ol style="list-style-type: none"> 4. Attach braces with high strength bolts. 5. Clean and paint new members. <p>NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel.</p> |
|---|---|

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman		No special equip required	As Required	New Braces High Strength Bolts Paint
2	Crew Members			As Required	
				As Required	

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.03 EA/HR	.2EA/DAY	150 MH/EA



SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: STRENGTHEN ENTIRE BRIDGE CABLE SLING SUPPORT SYSTEM

PROCEDURE DESCRIPTION

1. Install anchorage devices adjacent to each abutment.
2. Suspend cables across channel each side of truss.
3. Attach cables to anchorage devices and to beams brackets, or other devices on the span.

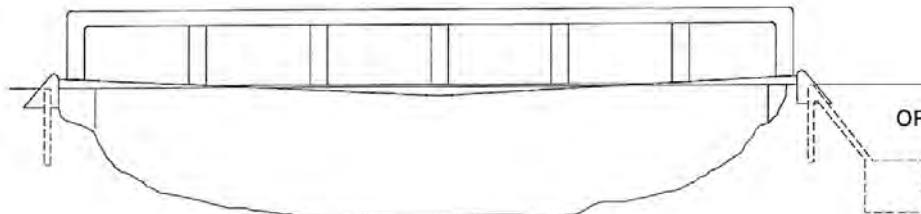
4. Adjust turnbuckles to tighten cable

NOTE: Details of this procedure should be furnished by the District Bridge Office and procedure should only be accomplished by qualified personnel.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Backhoe	As Required	Concrete
3	Crew Members			As Required	Anchors
1	Special Crew Member (Operator)			As Required	Cables
				As Required	Attachment Assemblies
				As Required	Turnbuckles

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.03 EA/HR	.2 EA/DAY	150 MH/EA



SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: STRENGTHEN ENTIRE BRIDGE CABLE-STAYED SUPPORT SYSTEM

PROCEDURE DESCRIPTION

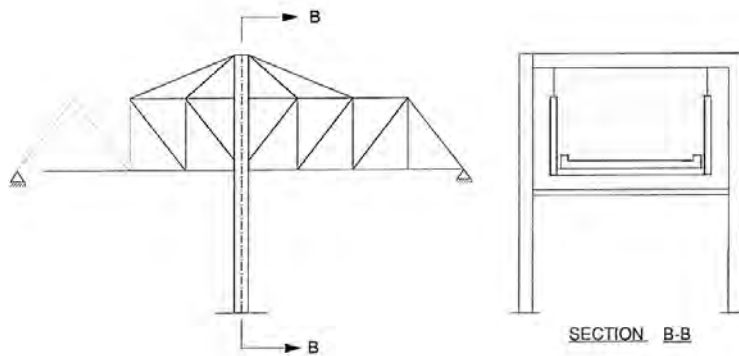
1. Excavate and prepare foundation for tower.
2. Erect tower.
3. Install cable attachment to the bridge.
4. Attach cables to bridge attachments and the tower.
5. Clean and paint tower.

NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel. Comply with applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation Districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Backhoe	As Required	Concrete (for footing)
3	Crew Members	1	Crane	As Required	Tower
1	Special Crew Member (Operator)			As Required	Cables
				As Required	Attachment Assemblies
				As Required	Turnbuckles
				As Required	Paint

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.03 EA/HR	.2 EA/DAY	150 MH/EA



SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: STRENGTHEN ENTIRE BRIDGE SHIFTING SUPPORTS

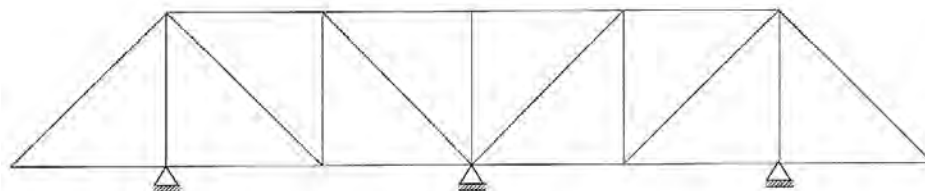
PROCEDURE DESCRIPTION

1. Excavate and prepare foundation.
2. Erect tower.
3. Modify existing bridge members, as required.
4. Install bearing.
5. Paint bearing.

NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel. Comply with applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation Districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Backhoe	As Required	Concrete
3	Crew Members	1	Crane	As Required	Tower
1	Special Crew Member (Operator)			As Required	Bearings
				As Required	Paint
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.03 EA/HR		.2 EA/DAY		150 MH/EA	



ADDED SUPPORT

SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: STRENGTHEN ENTIRE BRIDGE ADDITION OF SUPPORTS

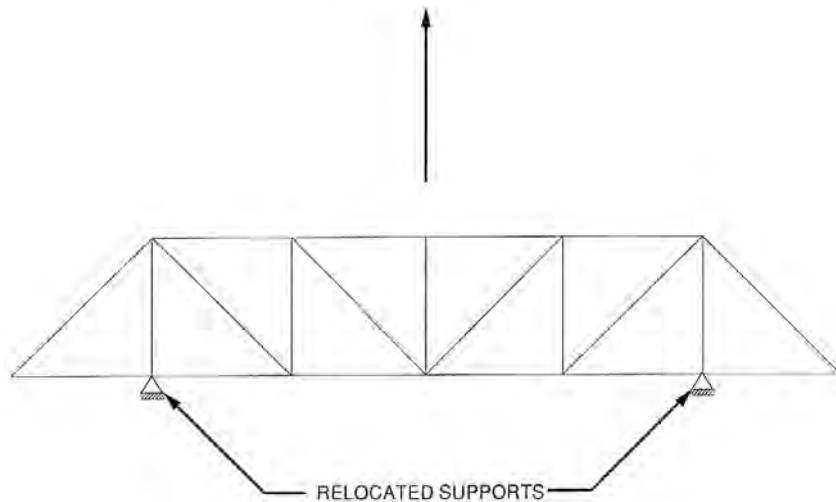
PROCEDURE DESCRIPTION

1. Excavate and prepare foundation.
2. Erect tower.
3. Modify existing bridge members, as required.
4. Install bearing.
5. Paint bearing.

NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Backhoe	As Required	Concrete
3	Crew Members	1	Crane	As Required	Tower
1	Special Crew Member (Operator)			As Required	Bearings
				As Required	Paint
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.03 EA/HR		.2 EA/DAY		150 MH/EA	



NOTE: DETAILS OF THIS PROCEDURE SHOULD BE FURNISHED BY THE DISTRICT BRIDGE OFFICE AND THE PROCEDURE SHOULD ONLY BE ACCOMPLISHED BY QUALIFIED PERSONNEL.

SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: STRENGTHEN ENTIRE BRIDGE METHOD OF SUBDIVISION

PROCEDURE DESCRIPTION

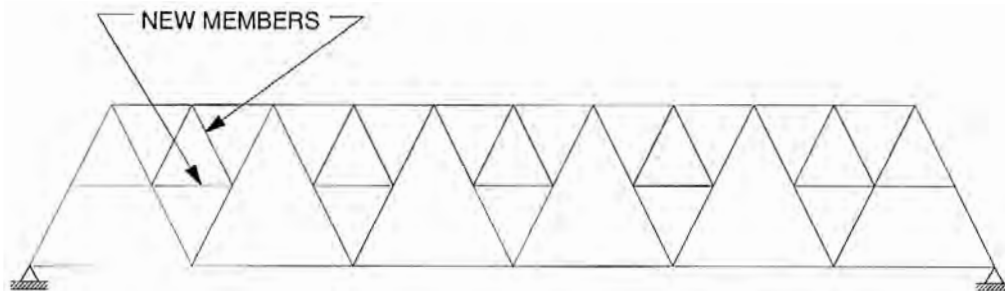
1. Add connections for new members.
2. Add new members.
3. Clean and paint new members.

NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1 3	Foreman Crew Members	1	Drill Reamer	As Required As Required As Required	H.S. Bolts New members Paint

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.03 EA/HR	.2 EA/DAY	150 MH/EA



SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: STRENGTHEN TRUSS CONNECTIONS AND BRACES

PROCEDURE DESCRIPTION

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Relieve load, as appropriate. 2. Disconnect members, if necessary, after relieving the load. Observe any precautions regarding leaving one piece of a two element member in place while repair is affected. 3. Clean and prepare surfaces for welding or anti-corrosion treatment. Cleaning for welding can often be at least partially completed in advance. 4. Position and align parts making use of clamps and pins, as applicable. 5. Weld the connections or fasten as otherwise designed ensuring at least the minimum weld is attained. | <ol style="list-style-type: none"> 6. Clean and inspect welds and apply protective coating to the area, as required. 7. Apply load to the repair. 8. Remove any lifting or dead load supporting equipment. <p>NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel. Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required.</p> |
|--|---|

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Cold Chisel	As Required	New Assemblies Paint
3	Crew Members	1	Welding	As Required	
1	Special Crew Member (Certified Welder)	1	Equip Lifting Equip Cable	As Required	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.03 EA/HR		.2 EA/DAY		150 MH/EA	

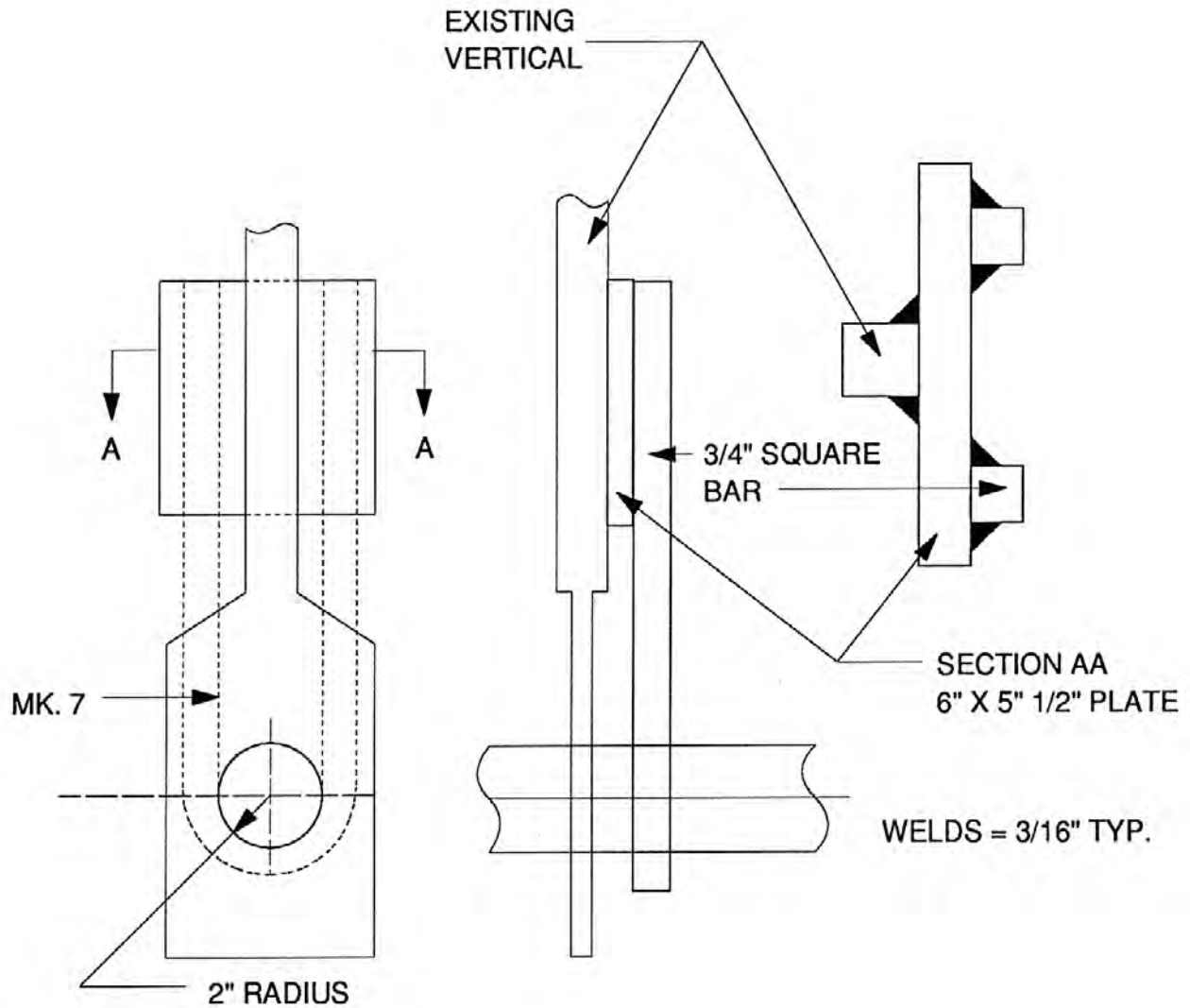
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BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: END VERTICAL



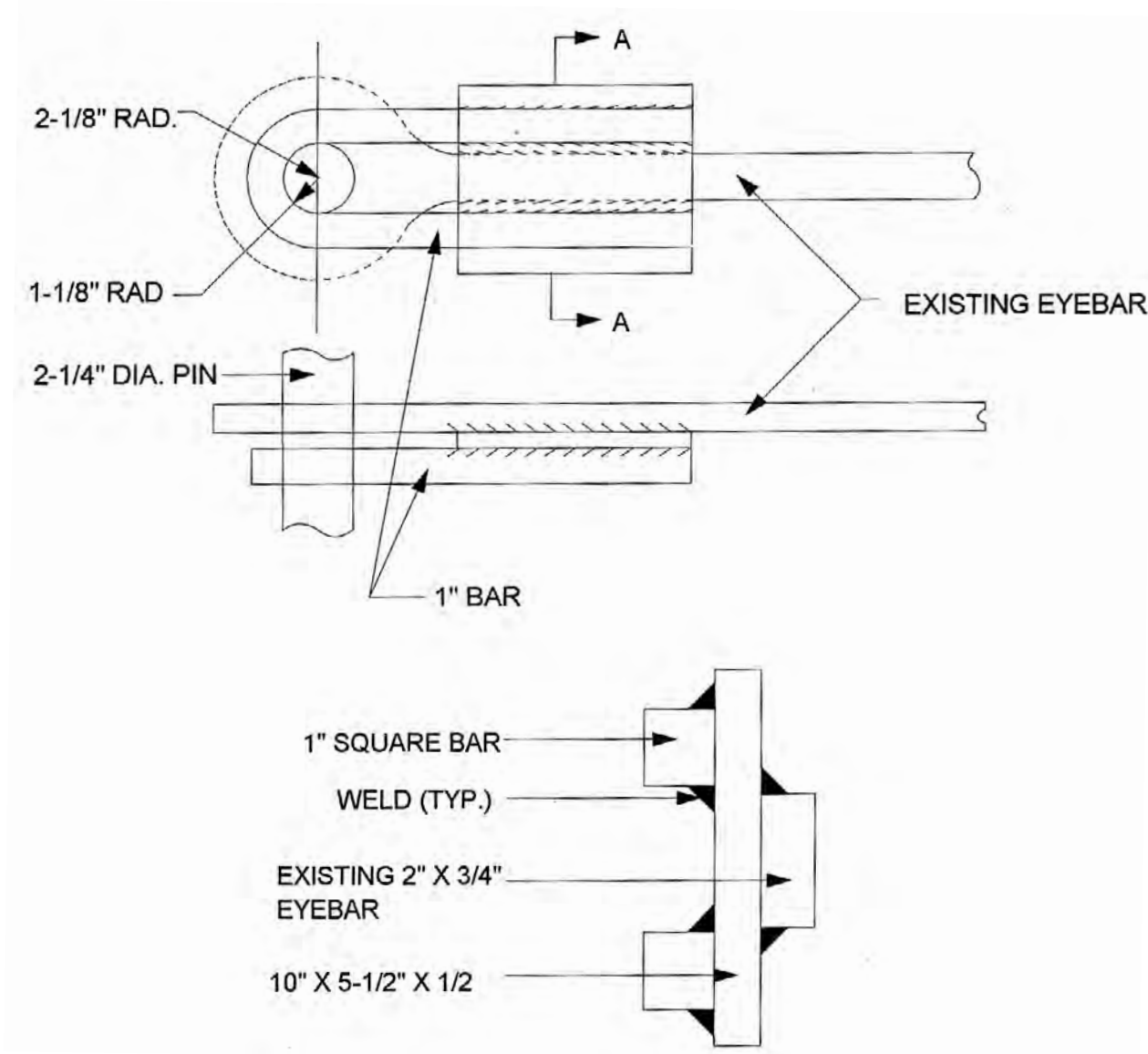
SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: EYEBAR AT PIN-ALTERNATE 1



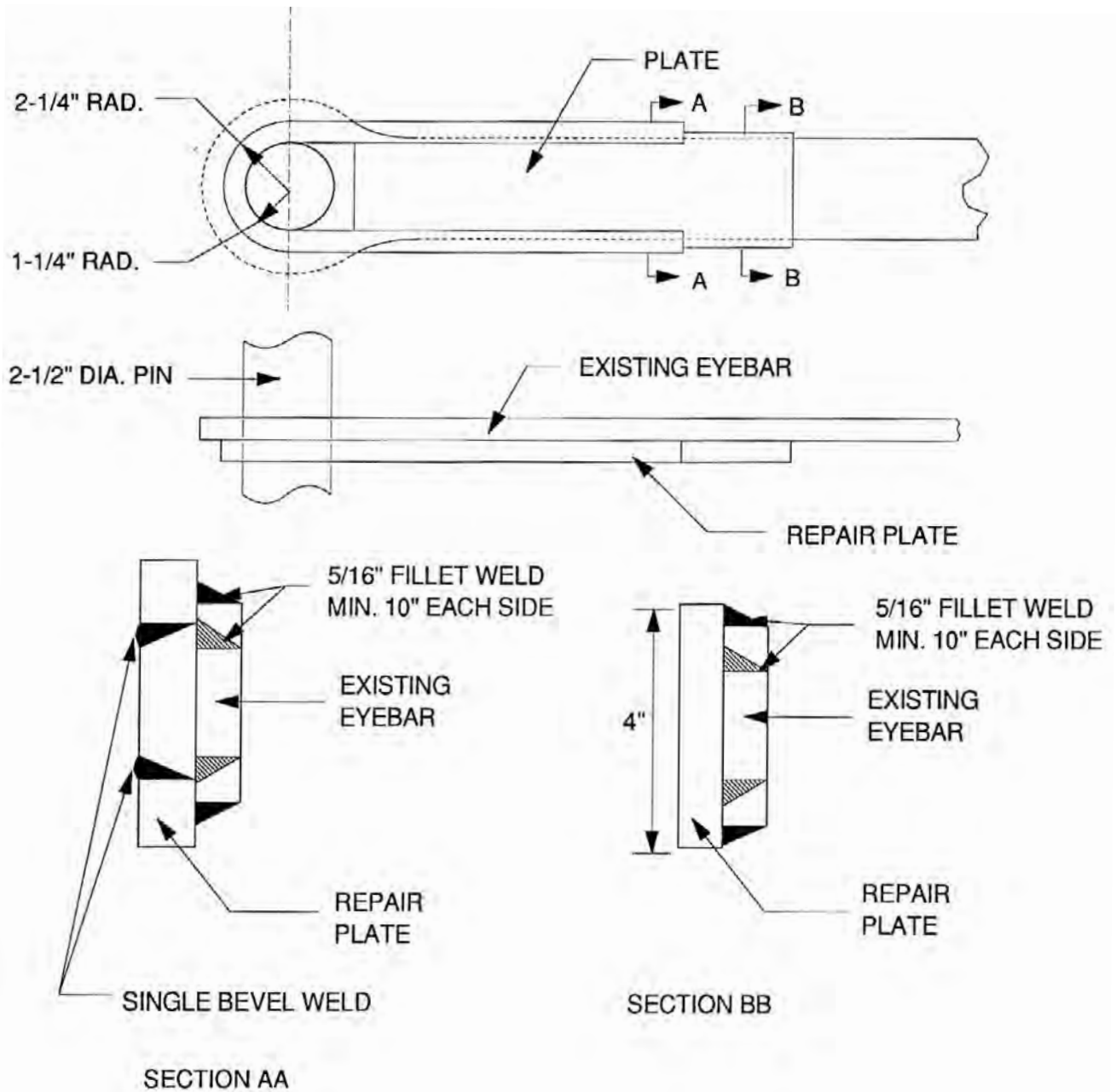
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BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: EYEBAR AT PIN-ALTERNATE 2



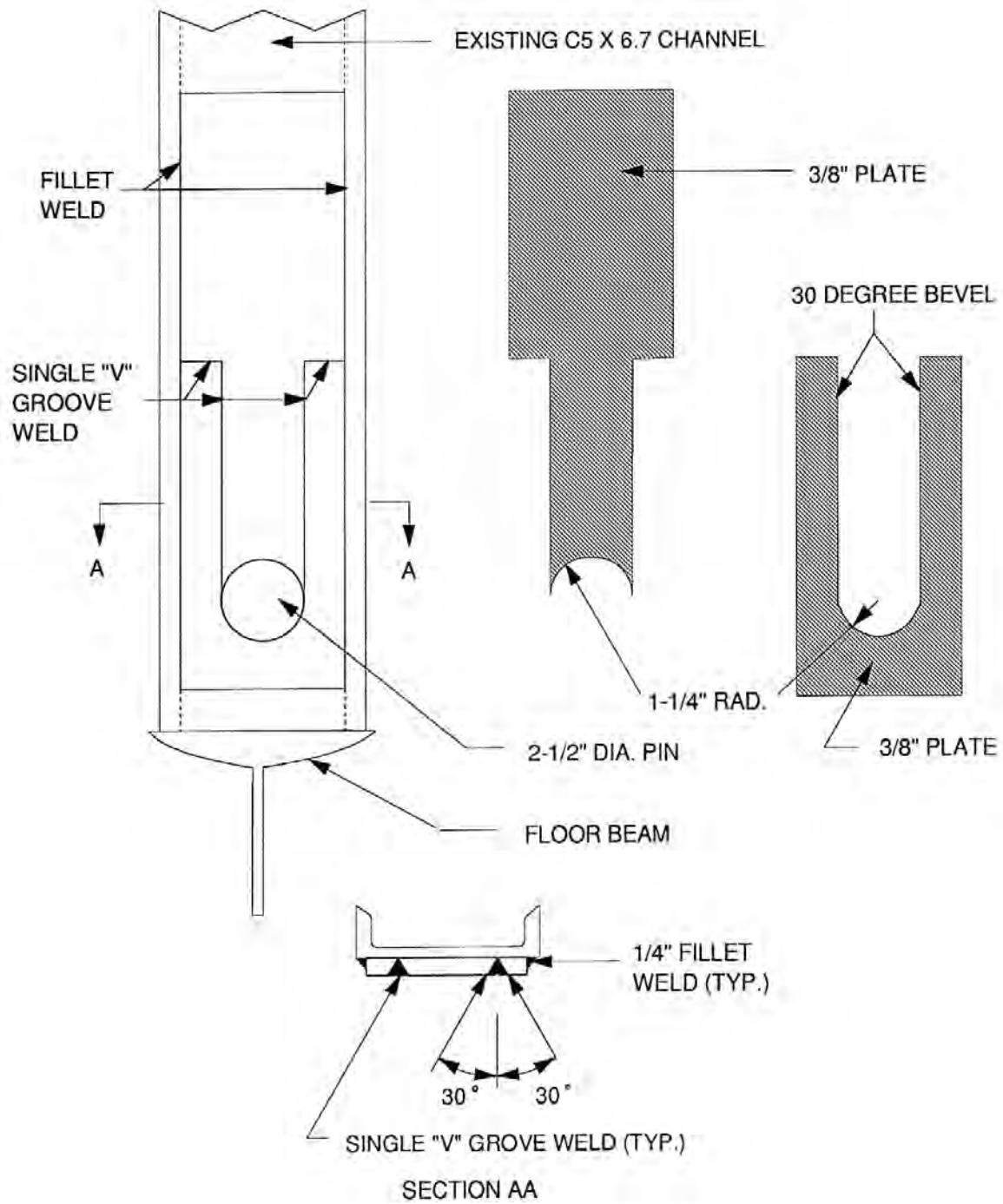
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BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: PIN PLATE



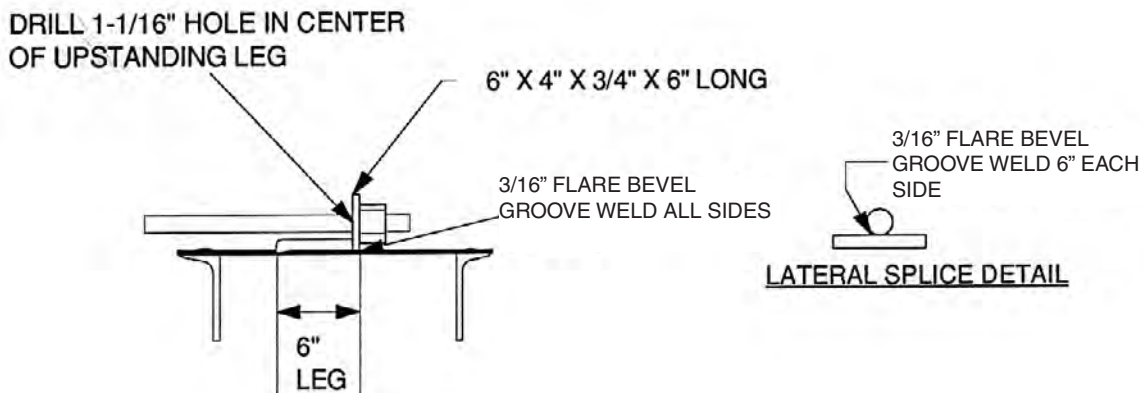
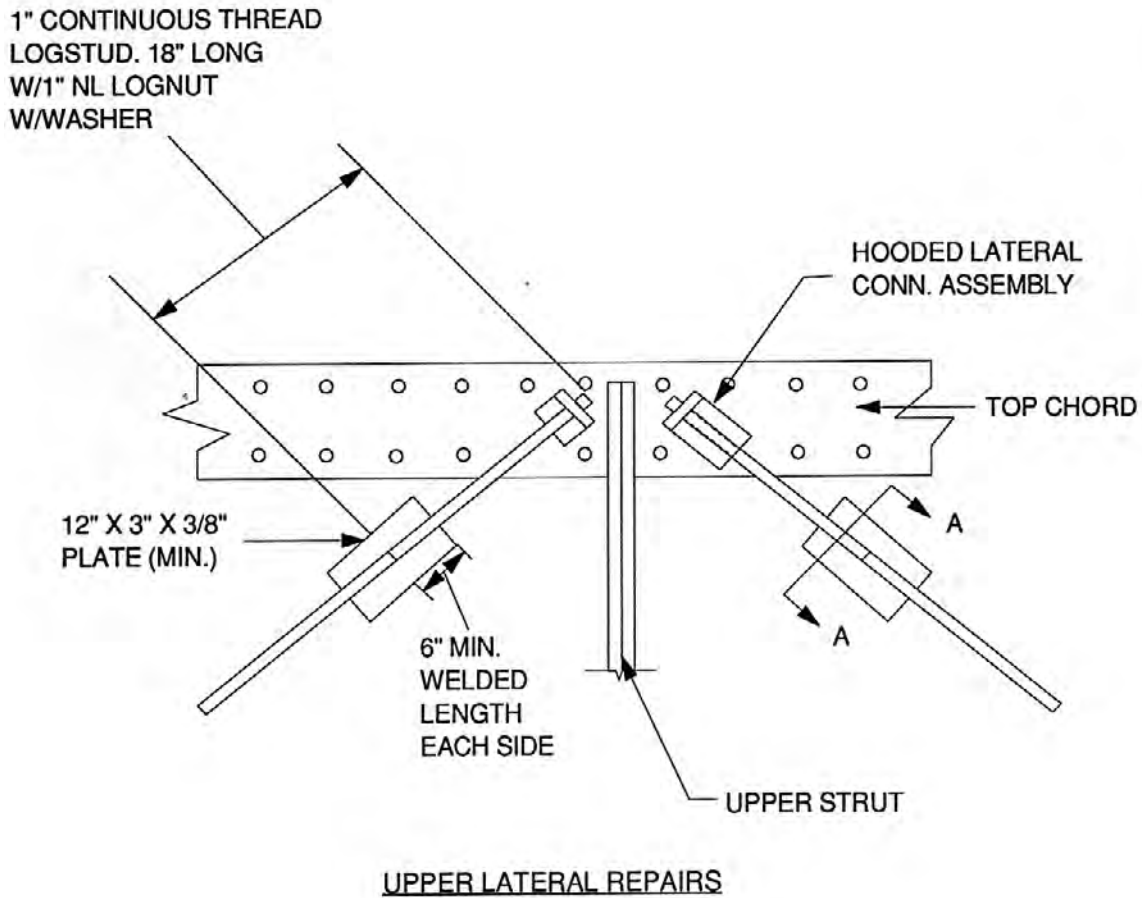
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BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: LATERAL CONNECTION



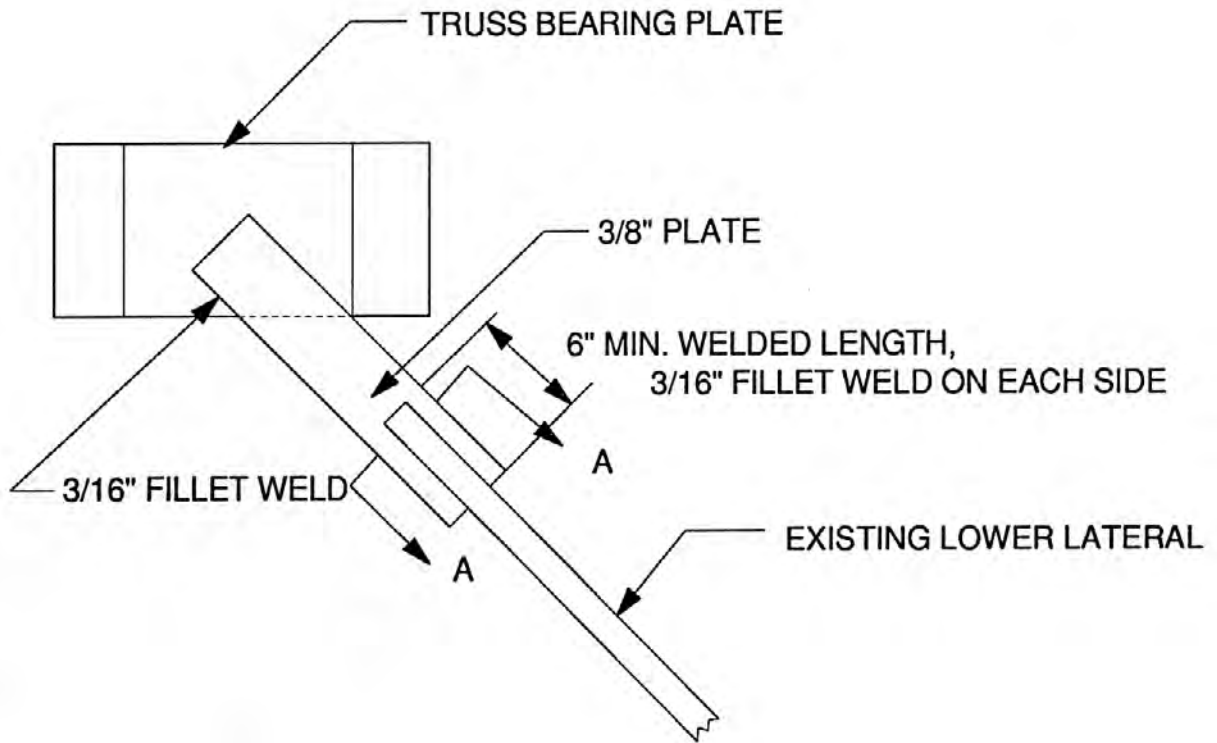
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BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: LOWER LATERAL



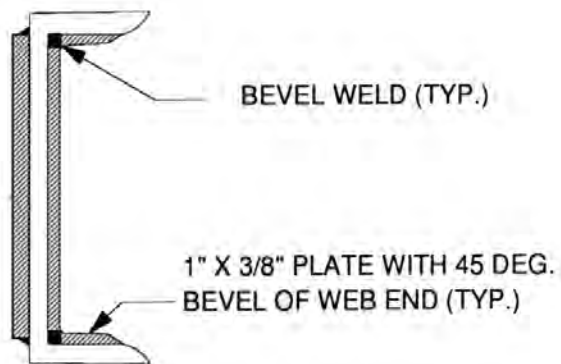
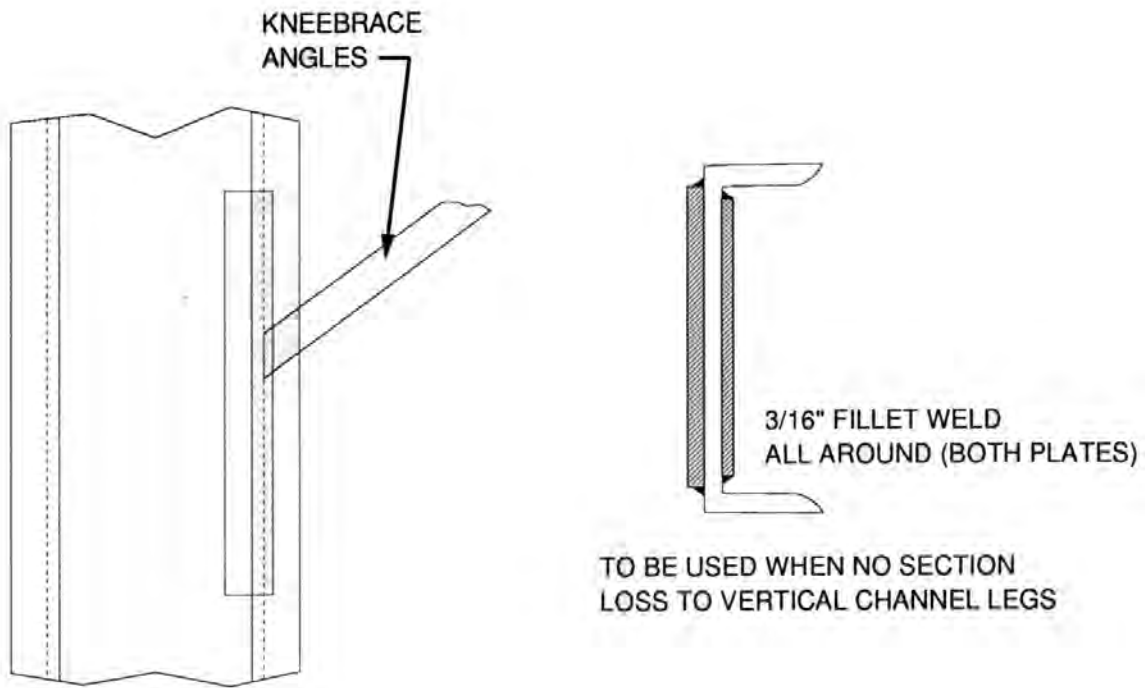
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BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: VERTICAL CHANNEL AT KNEEBRACE CONNECTION



SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPAIR BY SPICE PLATE

PROCEDURE DESCRIPTION

1. Bolt a side splice plate to the damaged member. Remove any rivet heads which interfere with the splice plate when the repair is near a connection.
2. If necessary, remove old tie plates or lacing bars from the two channels in the area of the crack to allow placement of the bottom tie plate. Some temporary lateral bracing may be required prior to completing the repair.
3. Bolt the bottom tie plate to the member.
4. Paint plate.

NOTE: Splice plates have been successfully attached using welds, but fatigue problems may result from welds where the structure experiences a high traffic volume. A bolted connection for the splice is preferable. Details of this procedure should be furnished by the District Bridge Office. The procedure should only be accomplished by qualified personnel.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Cold Chisel	2	Side Splice Plates
3	Crew Members	1	Power Drill	1	Bottom Plate
				As Required	Bolts & Nuts
				As Required	Paint
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.03 EA/HR		.2 EA/DAY		150 MH/EA	

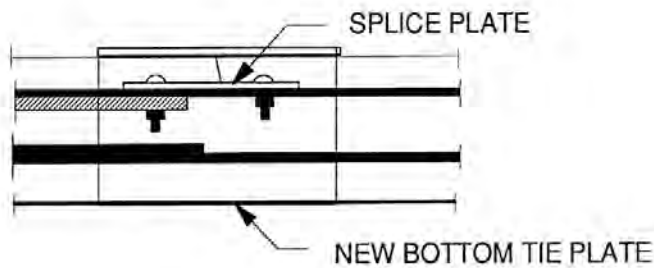
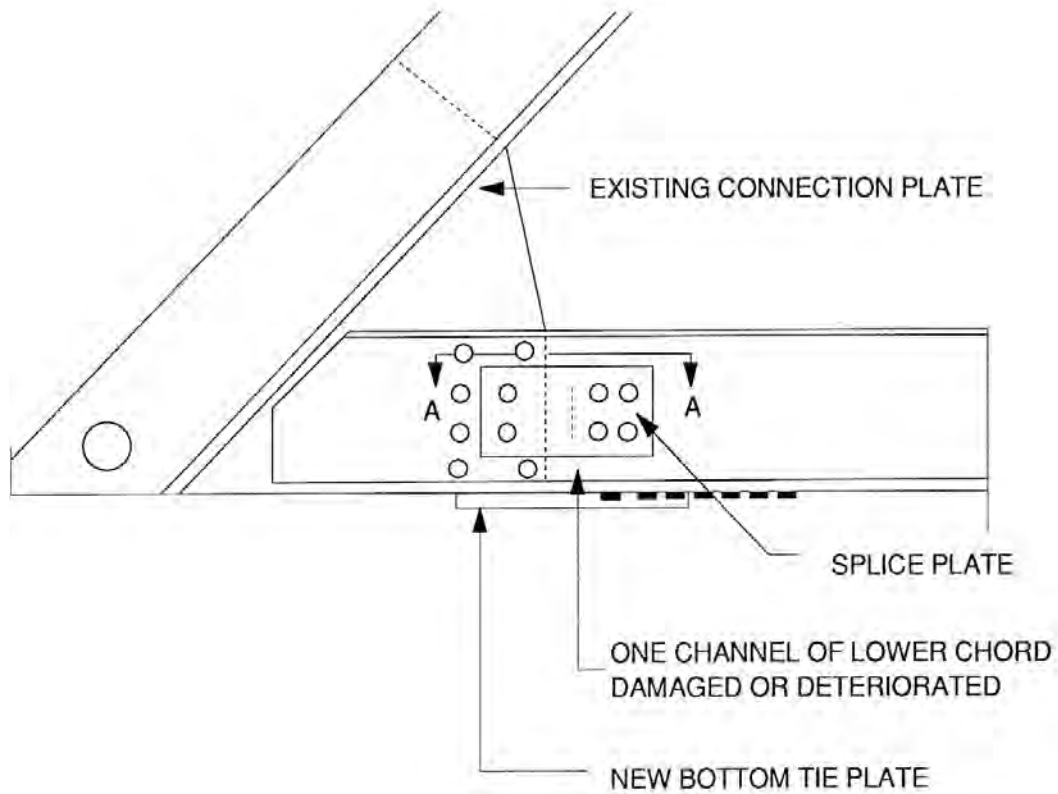
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BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPAIR BY SPICE PLATE



SECTION A-A

SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPLACE VERTICAL TENSION MEMBER

PROCEDURE DESCRIPTION

1. Install the wood blocking and WF beam on top chord to carry the cable sling.
2. Install a cable having the capacity to carry the maximum load in the vertical member being repaired over the WF beam and wood blocking.
3. Tighten the cable system to eliminate the dead load tensile force in the member being replaced.
4. If the member to be replaced is composed of angles, it can be repaired by first removing and replacing two of the angles, then removing and replacing the last two angles. The two angles removed first should be the weaker ones or as otherwise de-termined by the existing condition of the vertical member. If the member to be replaced is similar to

that shown in Section BB, first one channel is removed and replaced, then the other. If the entire member can be safely removed, it can be replaced with other type sections of equal strength. High strength bolts are used for connecting the new vertical members.

5. Install the batten plates or lacing bars at the required intervals along the vertical. Tighten the high strength bolts at all connections.
6. Paint the new component.
7. Remove cable slings and other temporary components and restore the bridge to normal traffic conditions.

NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Cable	1	WF Beam
3	Crew Members	1	Turnbuckle	As Required	Blocking
		As Required	Cable Clamps	As Required	Paints
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.03 EA/HR		.2 EA/DAY		150 MH/EA	

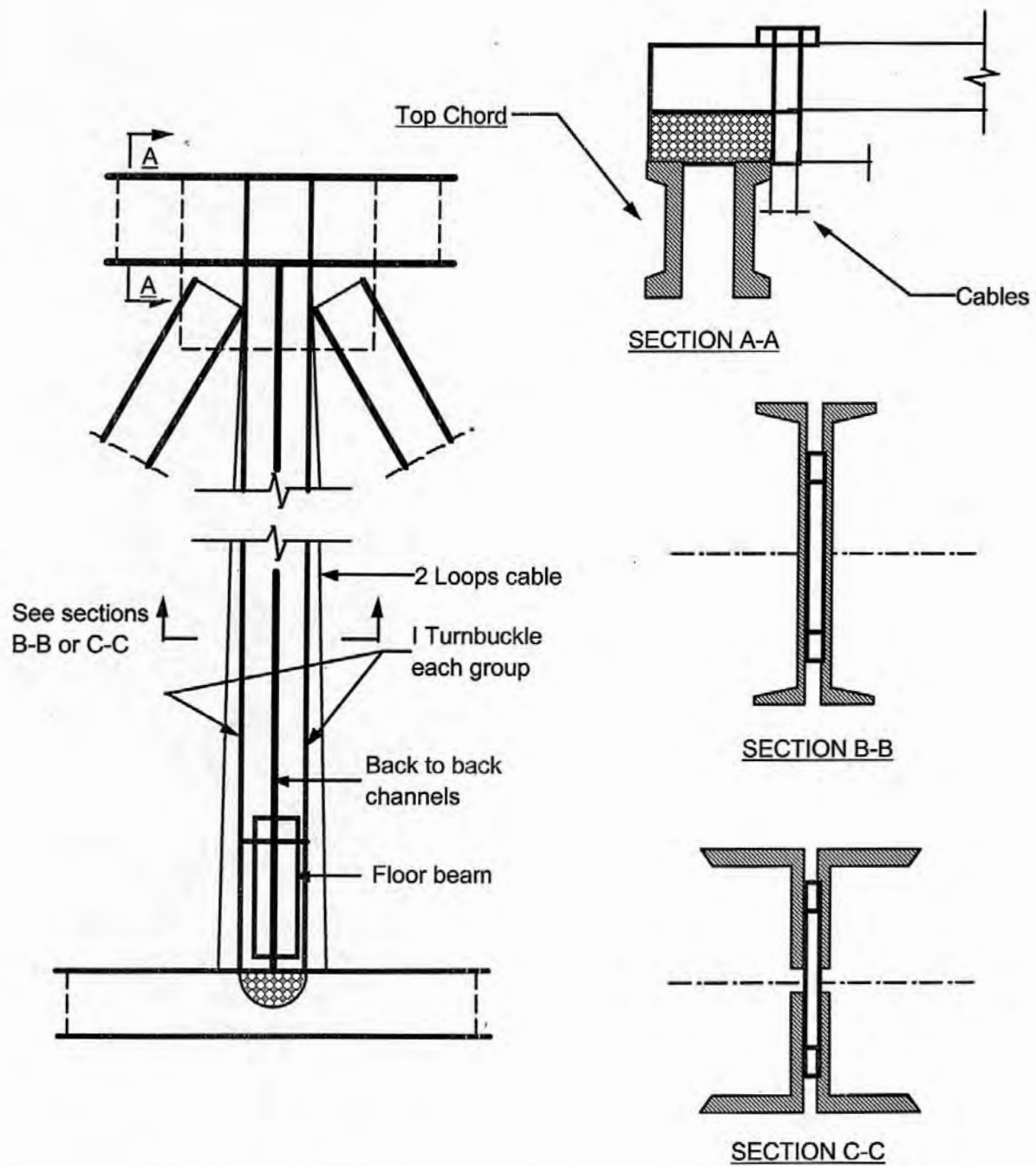
SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPLACE VERTICAL TENSION MEMBER



VERTICAL TENSILE MEMBER REPLACEMENT FOR RIVETED OR BOLTED CONNECTIONS

SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPLACE VERTICAL COMPRESSION MEMBER

PROCEDURE DESCRIPTION

1. Jack the temporary support until the designated load is reached. Place blocks and wedges that could hold the temporary support in position in the event of jack failure.
2. Remove rivets or bolts in gusset plates at bottom chord and top chord if entire member is to be replaced. If only a portion of a member is to be replaced, remove rivets or bolts in splice, if present, or cut member in preparation for new splice.
3. If a new splice is to be added, drill holes to template from holes in new member.
4. Install new member. Tighten the high strength bolts at all connections.
5. Remove any temporary blocks or wedges, unload jack, and remove jack and entire jack support system.
6. Paint new member.

NOTE: Details of this procedure should be furnished by the District Bridge Office and the procedure should only be accomplished by qualified personnel.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Jack	As Required	12"x12" tempoary support member
3	Crew Members	1	Cutting Torch		Jacking Blocks
1	Special Crew Member (Certified Welder)	1	Lifting Equip	As Required 1	Replacement Member
				As Required	Paint

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.03 EA/HR	.2 EA/DAY	150 MH/EA

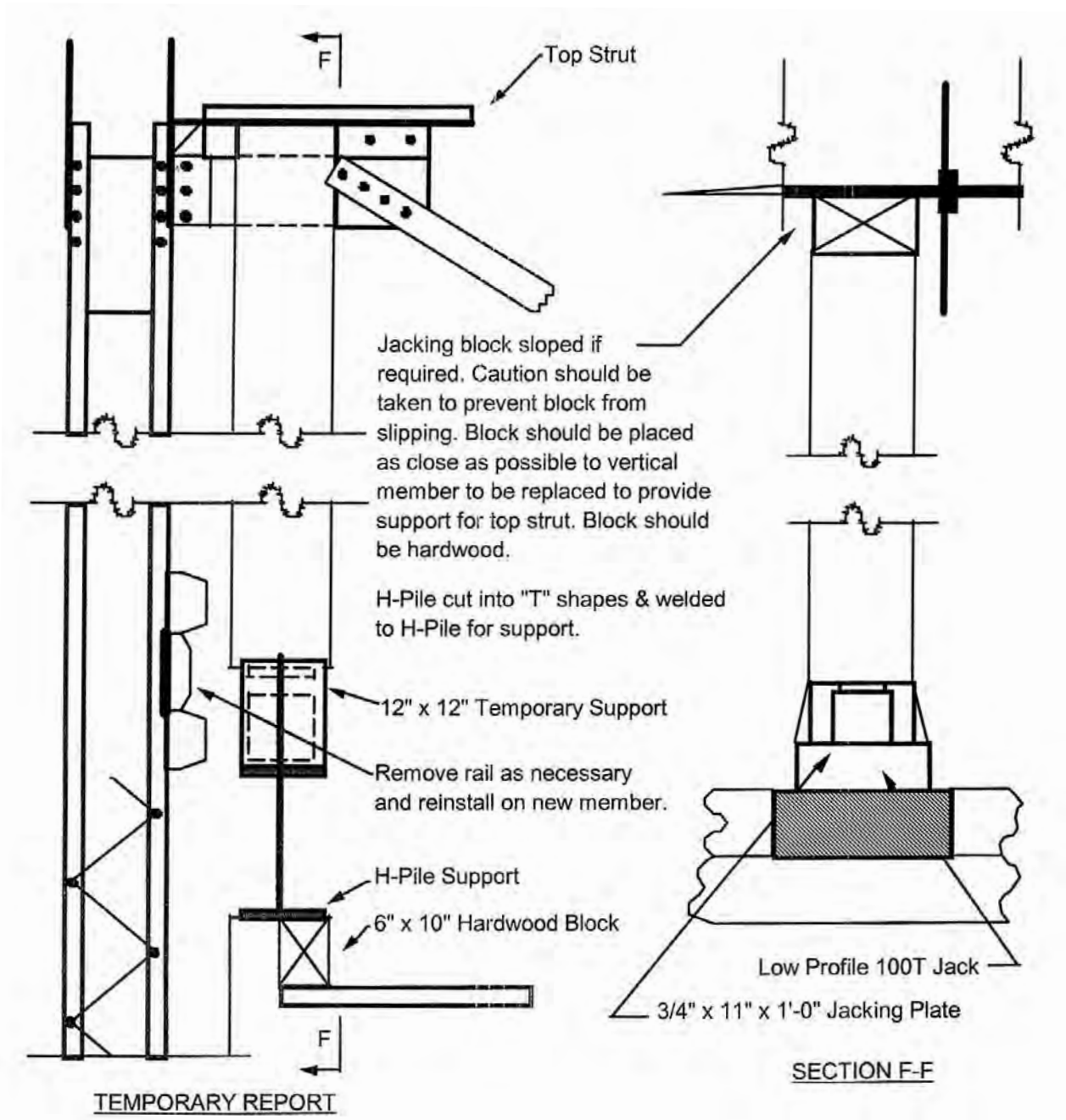
SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPLACE VERTICAL COMPRESSION MEMBER



SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPLACEMENT OF A TENSION DIAGONAL IN A RIGIDLY CONNECTED TRUSS

PROCEDURE DESCRIPTION

1. Restrict traffic to one lane on the opposite side of the bridge from the repair.
2. Cut and install the necessary wood blocking.
3. Install a cable having the capacity to carry the full dead load in the diagonal plus the live load distributed from the restricted traffic.
4. Tighten the cable system.
5. When the member to be replaced is composed of angles, Sec. AA, following sheet, it should be repaired by first removing and replacing two of the angles; then removing and replacing the last two angles. The two angles removed first should be the weaker ones or as otherwise determined by

the existing condition of the diagonal member. When the member is composed of channels, Sec. BB, following sheet, first one channel is removed and replaced, then the other. High strength bolts are used for connecting the new diagonal members.

6. Install the batten plates or lacing bars at the required intervals along the diagonal. Tighten the high strength bolts at all connections.
7. Paint the new components.
8. Remove cable slings and other temporary components and restore the bridge to normal traffic conditions.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Cutting Roch	As Required	Wood Blocking
3	Crew Members			As Required	Cables
1	Spreical Crew Member (Certified Welder)			As Required	Bolts & Nuts
				1	Replacement Member
				As Required	Paint

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.03 EA/HR	.2 EA/DAY	150 MH/EA

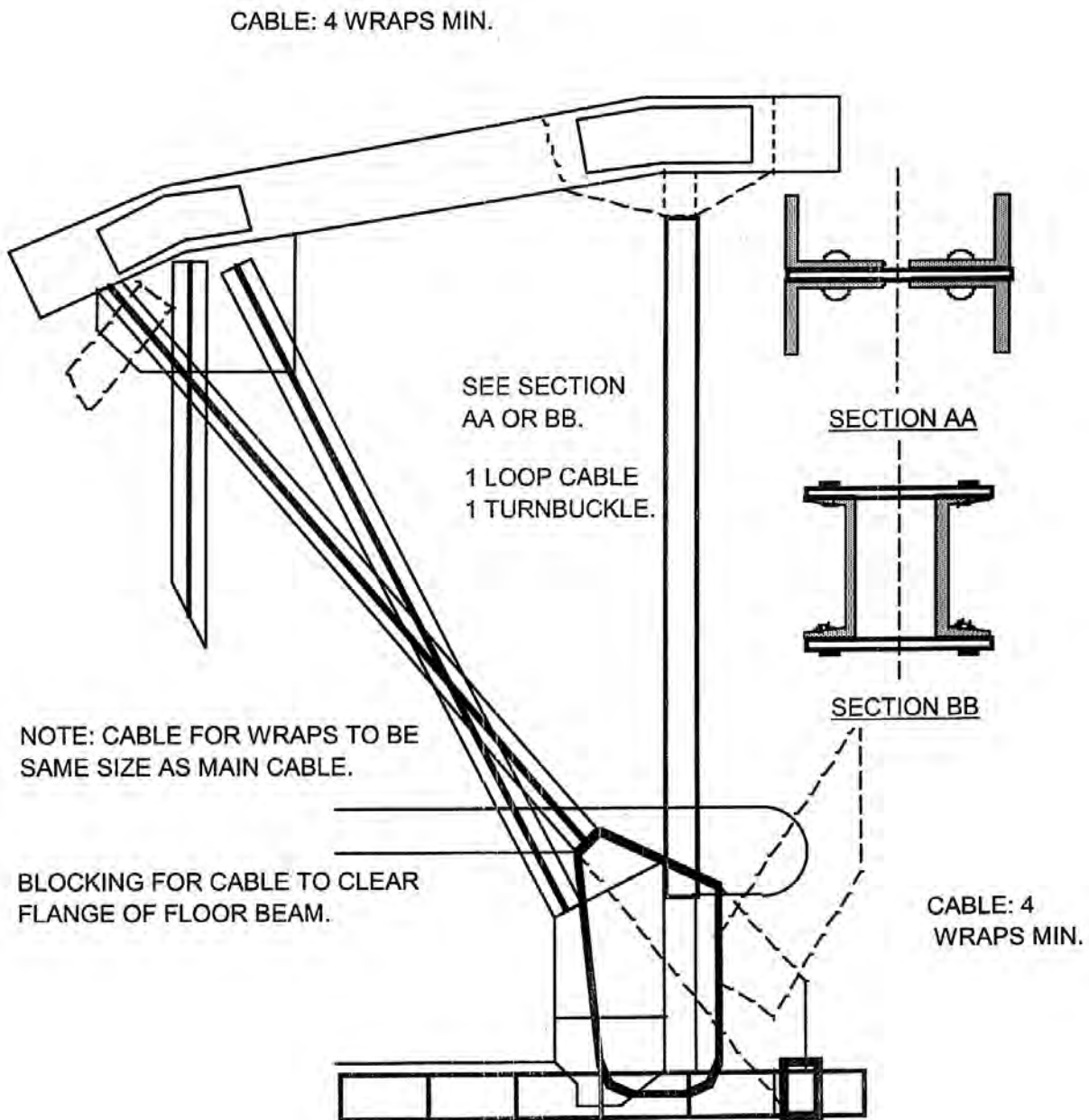
SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPLACEMENT OF A TENSION DIAGONAL IN A RIGIDLY CONNECTED TRUSS



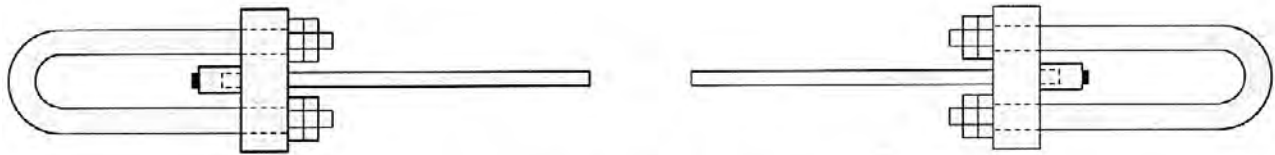
SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

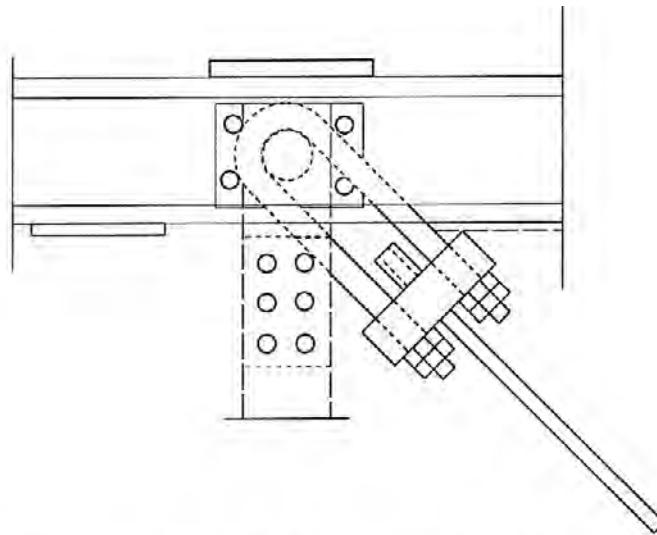
ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: REPLACEMENT OF A TENSION IN A RIGIDLY CONNECTED TRUSS



NEW DIAGONAL MEMBER



TRUSS DIAGONAL REPLACEMENT FOR PINNED END CONNECTIONS

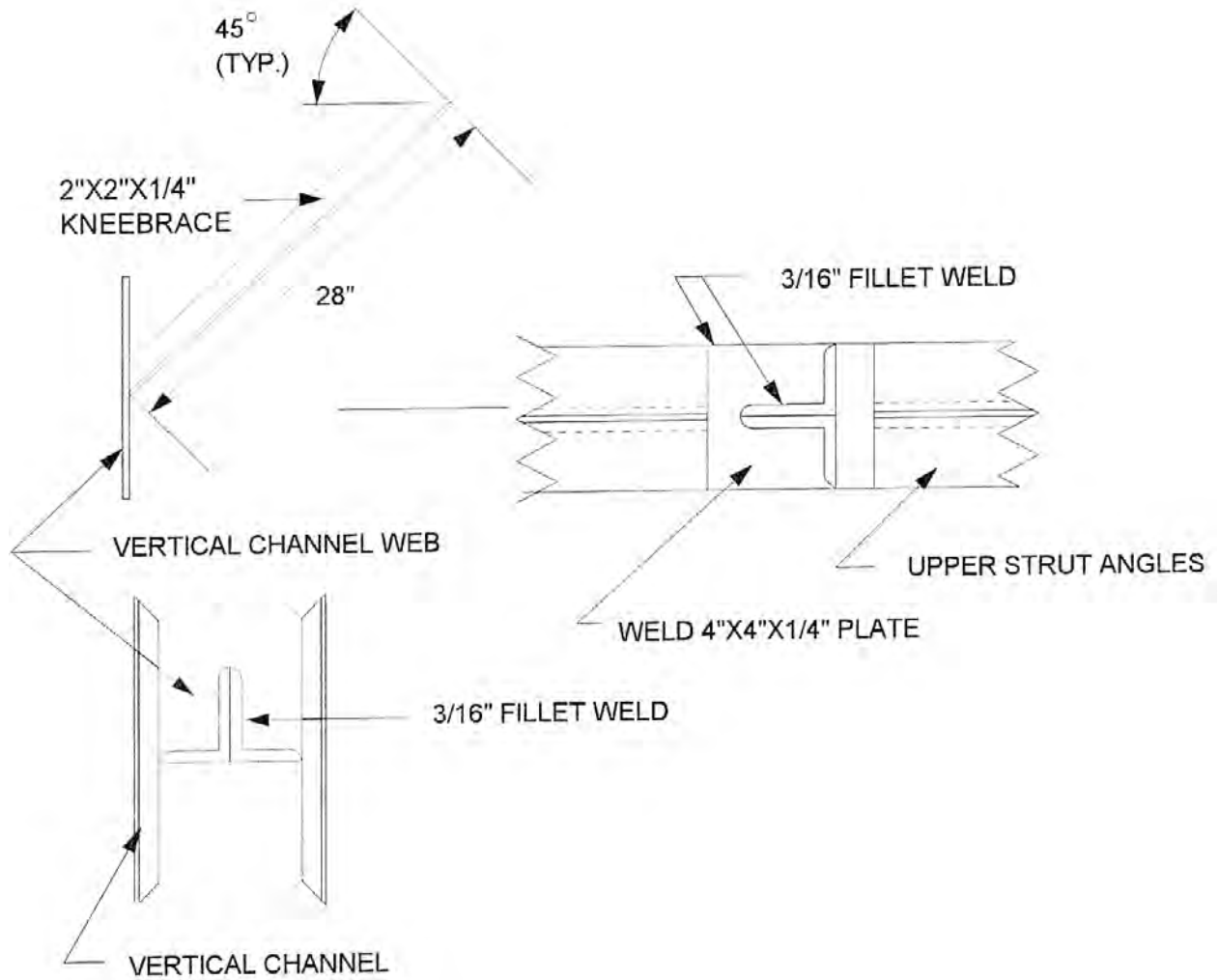
SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: A744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (STRENGTHEN/REPAIR/REPLACE)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: KNEEBRACE REPLACEMENT



SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: B744701

ACTIVITY TITLE: STEEL TRUSS PORTAL (MODIFY)

UNIT OF MEASUREMENT: STEEL TRUSS PORTAL (MODIFY)

PROCEDURE: REPLACEMENT OF A TENSION DIAGONAL IN A RIGIDLY CONNECTED TRUSS

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1060 - Painting Structural Steel
 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Reports of accidental damage to a portal or to the portal of another truss bridge in the same vicinity, which has a similar underclearance, should be considered as an indication that portal modification may be appropriate. WORK AREAs, their connections to end posts, and portions of other end posts affected by portal modifications.

ACTIVITY DESCRIPTION

Modifying portals of steel through truss Bridges to increase underclearance and/or to reduce the potential for damage to such bridges from over height loads. The work can include, but is not limited to, removing all or portions of the portal by removing bolts or rivets or using oxy-acetylene cutting torches; prefabricating parts or an entirely new portal; grinding to provide the required finish or tolerances on steel surfaces; drilling or reaming holes; erecting replacement or modified elements by welding or high tensile strength bolting; and preparing surfaces which have been damaged or left bare by the work, and applying a prime coat of paint. Minor modifications or repairs to end posts will usually be required as a result of making modifications to portals. Report such work with that reported under this activity. A separate report is not required.

PROCEDURE DESCRIPTION

Technique A

☞ Remove knee braces

Technique B

☞ Remove lower horizontal member and cut diagonals to new length.

☞ Replace horizontal member in new position and add no diagonals.

Technique C

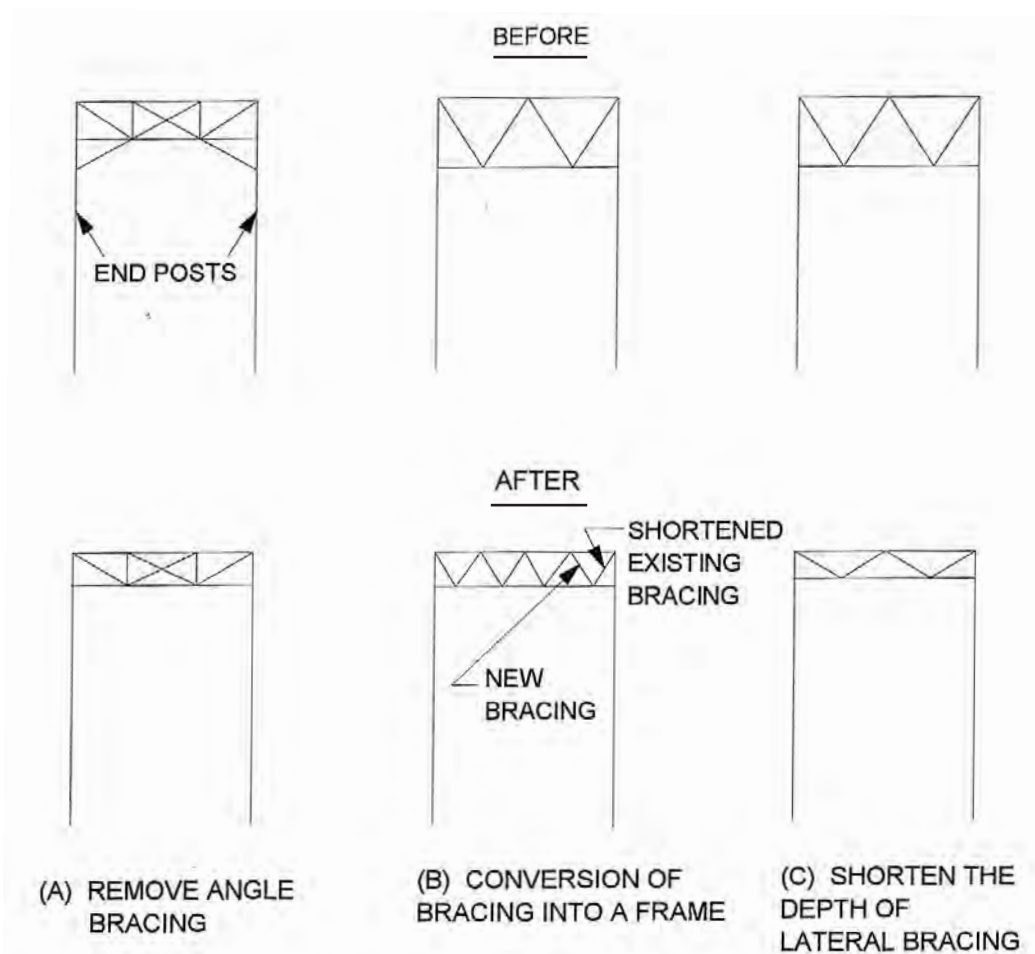
☞ Remove all portal bracing and install replacement members, which must be fabricated to fit between end posts

NOTE: The dimensions, locations, and installation or removal procedure for components shall be provided by the District Bridge Engineer. Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position of the weld required

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Cutting Torch	As Required	New Members
3	Crew Members	1	Power Drill	As Required	HS Bolts & Nuts
1	Special Crew Member (Certified Welder)	As Required	Access Equip	As Required	Paint

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.08 EA/HR	.5 EA/DAY	60 MH/EA



EXAMPLES OF PORTAL MODIFICATIONS

NOTE: THE DETAILS FOR REMOVAL OF EXISTING BRACING AND THE DIMENSIONS, LOCATION AND ATTACHMENT OF NEW BRACING ARE TO BE PROVIDED BY THE DISTRICT ENGINEER.

SAP ASSEMBLY NUMBER: 711-7447-01

BMS Flex-Action: C744701

ACTIVITY TITLE: STEEL TRUSS MEMBER (TIGHTEN/FLAME SHORTEN)

UNIT OF MEASUREMENT: *EACH MEMBER

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1060 - Painting Structural Steel
 1105 - Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections and the observation of tension members during the passage of live loads. Special traffic controls for both loadings and speed are required during the work of flame shortening.

WORK AREA

All eye-bar and rod truss tension members.

* **Special Measurement Note:** Truss tension members composed of eye-bars or rods usually consist of one or two elements but can be made up of more elements. "Each Member" is considered to be the complete member connecting two panel points regardless of the number of member elements which are tightened or flame shortened.

ACTIVITY DESCRIPTION

Tightening rod-turn buckle type tension members by adjusting turnbuckles, and flame shortening eye-bar type tension members by the application of controlled heat and mechanical force, to equalize stresses between tension members of two trusses or elements of single tension members. The work can include, but is not limited to, turning existing turnbuckles; removing paint; installing clamps; applying controlled heat using oxy-acetylene heating torches; applying mechanical force using clamps; measuring the increment of shortening; measuring the frequency of oscillation of paired members to insure that they are essentially equal; and preparing surfaces which have been damaged or left bare by the work, and applying a prime coat of paint.

PROCEDURE DESCRIPTION

1. Remove paint from the eye-bar in the area to be heated. Attach the upsetting clamp while supporting inclined eye-bars as necessary to remove sags.
2. Restrict traffic as necessary to control live loads on the span.
3. Heat the eye-bar to the proper temperature and shorten the bar by upsetting it with force applied by turning the screws of the upsetting clamp assembly.
4. Water quench the bar after it has sufficiently air cooled.
5. Determine the proper tension in the bar by measuring the vibration frequency.
6. Restore traffic on completion of the procedure.
7. Repaint as necessary.

NOTE: Details of this procedure should be furnished by the district bridge office and the procedure should only be accomplished by qualified personnel.

Chapter 23: Abutments, Wings, Piers

Table of Contents

7448-01	BACKWALL (REPAIR/REPLACE)	23 - 3
7448-02	ABUTMENTS (REPAIR)	23 - 7
7448-02	WING (REPAIR/REPLACE)	23 - 13
7448-02	PIER (REPAIR)	23 - 24
7448-03	FOOTING (UNDERPIN)	23 - 33
7450-01	MASONRY (REPOINT)	23 - 40
7451-01	ABUTMENT SLOPEWALL (REPAIR/REPLACE)	23 - 42
7451-01	ABUTMENT SLOPEWALL (CONSTRUCT NEW)	23 - 46
7332-01	INSTALLING WEEP HOLES IN EXISTING MSE WALLS	23 - 48

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SAP ASSEMBLY NUMBER: 711-7448-01

BMS Flex-Action: A744801

ACTIVITY TITLE: ABUTMENT BACKWALLS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes
 1017 - Pressure Mortar Painting and Surfacing

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

Abutment backwalls for the full width of the structure between abutment parapets, and to a depth sufficiently below the bridge seat elevation to permit the installation of dowels and/or the proper lapping of reinforcement bars. If more extensive repairs are required or if both backwalls and pedestals/seats are involved, report all work to Activity B744802, Abutments (Repair).

* **Special Measurement Note:** Cubic yards of concrete or masonry placed, not the deteriorated material removed.

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of concrete masonry backwalls. The work can include, but is not limited to, installing sheeting, if necessary, and excavating pavement and other roadway material behind backwalls to gain access to them; removing deteriorated or damaged concrete. reinforcing steel; or masonry; drilling and installing adhesive anchored or grouted dowels; installing reinforcing steel; constructing forms; placing concrete; replacing and pointing masonry elements; pressure grouting masonry; epoxy pressure grouting; and restoring all pavement and other roadway material behind the backwalls. In some instances removal of concrete in a backwall is primarily for the purpose of gaining access to anchorages for armored or modular dams, or making minor repairs to concrete

associated with deck joints and is within the defined work area for an activity involving deck joints. In these cases report all work to the appropriate activity, such as Activity D744102, Steel Dam Deck Joints (Repair/Rehabilitate), or Activity B744102, Compression Seal Deck Joints (Repair/ Rehabilitate).

PROCEDURE DESCRIPTION

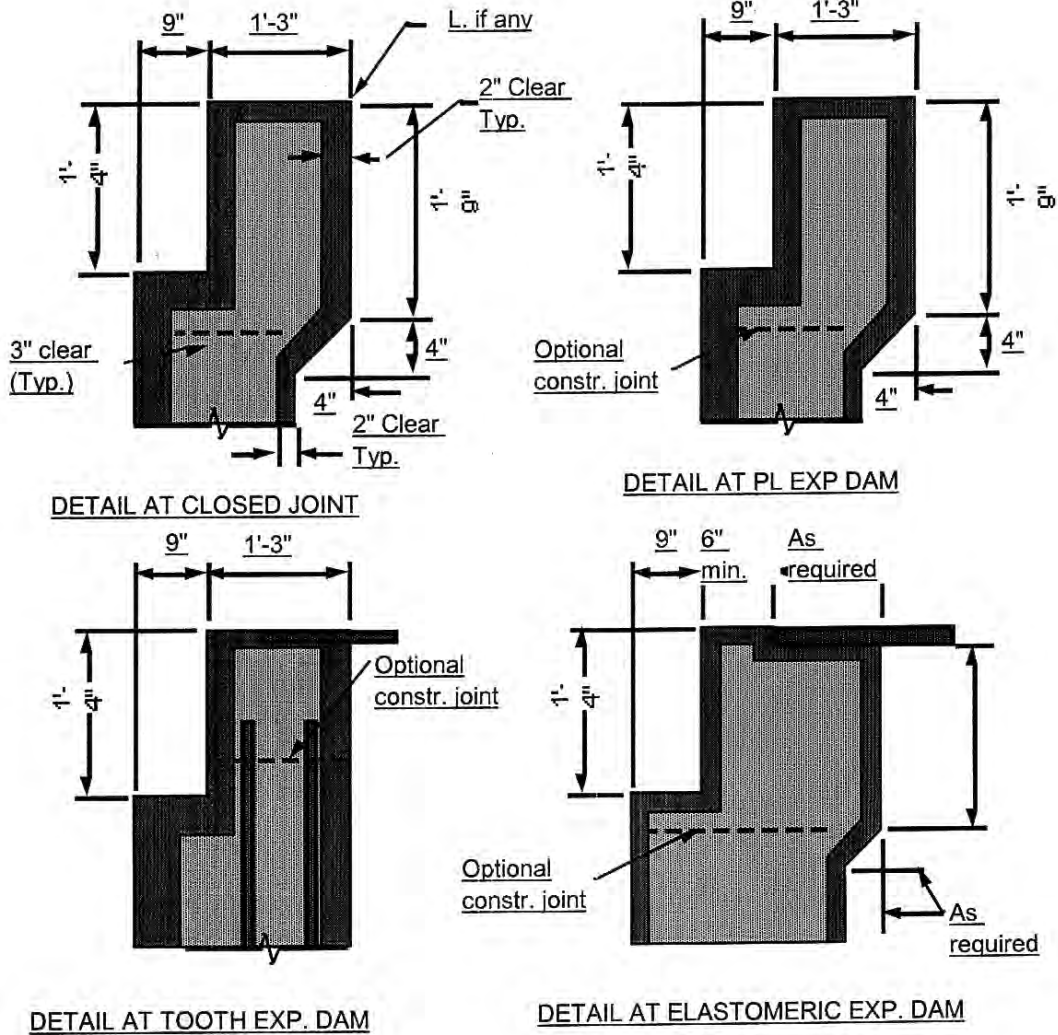
1. Temporarily tack weld the abutment side of steel armored joints, plate expansion dams, or toothed expansion dams to the deck side of the joint assembly.
2. Cut and excavate the approach slab or pavement to allow access to the backwall.
3. Remove deteriorated concrete or masonry and/or reinforcing bars from the backwall.
4. Place replacement reinforcing bars by tying them into existing bars in the abutment or by grouting dowel bars into the abutment.
5. Place forms for concrete.
6. Place and cure concrete. Insure concrete is placed beneath existing joints.
7. Remove forms and temporary tack welds on joints or dams.
8. Backfill and compact subgrade under the approach slab or pavement.
9. Patch the approach slab or pavement.

NOTE: Welding details for this repair should be furnished by the District Bridge Office and the welding should be accomplished by personnel certified for the type and position the weld required.

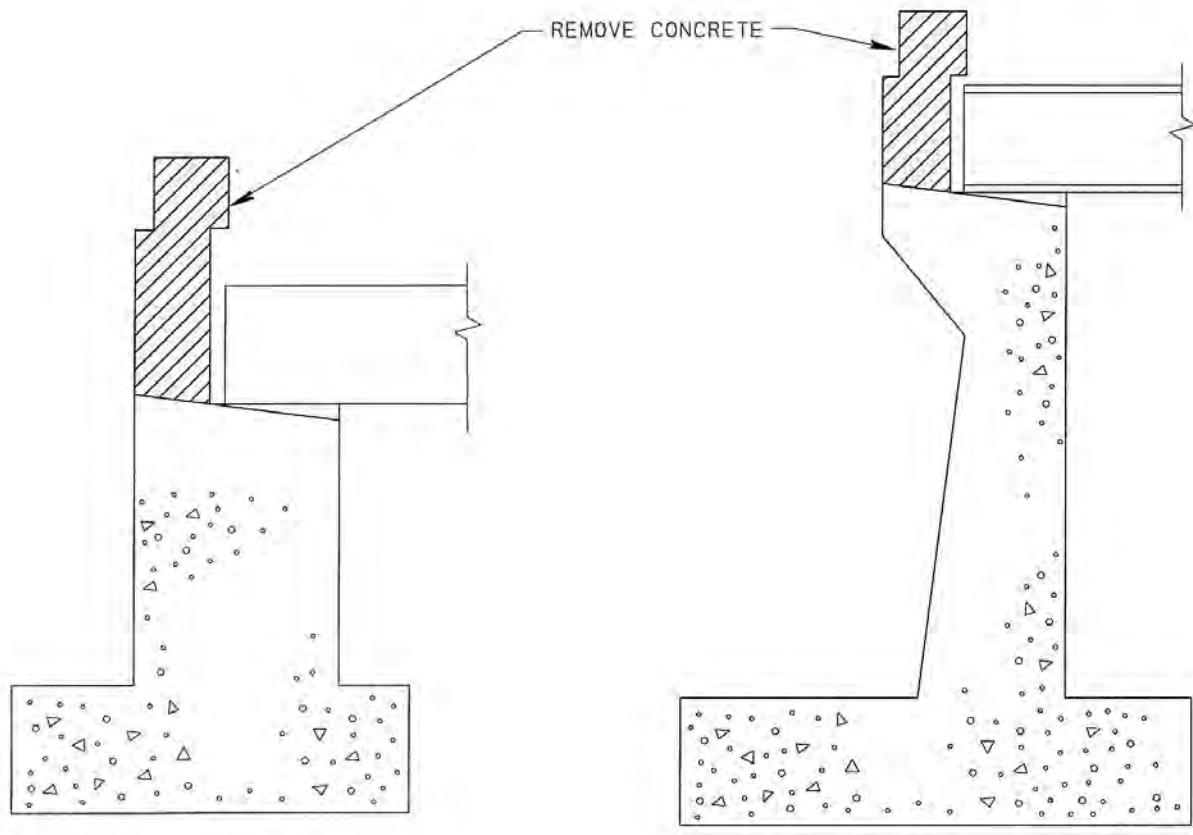
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Welding Equip	As Required	Reinforcing Steel
3	Crew Members	1	Concrete Mixer	1 C.Y.	Concrete
1	Special Crew Member (Certified Welder)	1	Backhoe or Gradall		
1	Special Crew Member (Operator)	1	Roller or Tamper		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.17 CY/HR		1 CY/DAY		36 MH/CY	

TYPICAL JOINT DETAILS



CROSS SECTIONS OF ABUTMENTS WITH BACKWALLS



TYPICAL TYPE 1 ABUTMENT
STUB

TYPICAL TYPE 2 ABUTMENT
CANTILEVER

SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: B744802

ACTIVITY TITLE: ABUTMENTS (REPAIR)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes
 1017 - Pressure Mortar Pointing and
 Surfacing

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

The breastwall and other portions of bridge abutments, except for wingwalls when only the wingwalls are involved. The wingwalls are included in the work area when both breastwalls and wings are being repaired at the same time.

* **Special Measurement Note:** Cubic yards of concrete or masonry placed, not deteriorated material removed.

ACTIVITY DESCRIPTION

Repairing all or portions of concrete or masonry abutments. The work can include, but is not limited to, installing sheeting when necessary and excavating material retained by or protecting the abutment; temporarily modifying superstructures to accept jacking loads; providing temporary supports for jacking; removing loads from abutments either by jacking from below or using needle beams from above; removing deteriorated or damaged concrete, reinforcing steel or masonry; drilling and installing dowels; installing reinforcing steel; constructing forms; placing concrete; replacing and pointing masonry elements; pressure grouting masonry; epoxy pressure grouting; and replacing excavated material.

When only the backwall or bridge pedestal/seats are involved, the work should not be reported under this activity. It should be reported under

appropriate activities for the work. When protective material such as riprap is excavated to gain access to the work, it should be replaced in conformance with work descriptions in appropriate activities, such as Activity B745301, Rock Protection. However, a separate report is not required, and the work should be reported under this activity.

PROCEDURE DESCRIPTION

1. Remove backfill or materials protecting or being retained by the abutment to gain access to the repair area.
2. Provide temporary supports for jacking or set up needle beams to remove loads from the abutment as required.
3. Remove loads from the abutment by jacking or using needle beams or removing portions or the entire span as necessary.
4. Remove deteriorated concrete or masonry and additional material as required to establish vertical and horizontal surfaces.
5. Place dowel bars, reinforcing steel and forms.
6. Apply bonding agent, place and cure concrete and remove forms.
7. Reload the abutment by removing jacks or needle beam or replacing the span.
8. Place and compact backfill and rock protection as required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Gradall or	1 C.Y.	Concrete Mixer Reinforcing Steel
3	Crew Members		Excavator	As Required.	
1	Special Crew Member (Certified Welder)	1	Concrete Mixer		
1	Special Crew Member (Operator)		Staging, needle beam, jacks or other equip to remove the load		
		1	Tamper or roller		
		1	Welding Equip		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.087 CY/HR		5 CY/DAY		60 MH/CY	

SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: B744802

ACTIVITY TITLE: ABUTMENTS (REPAIR)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: JACKET CONCRETE

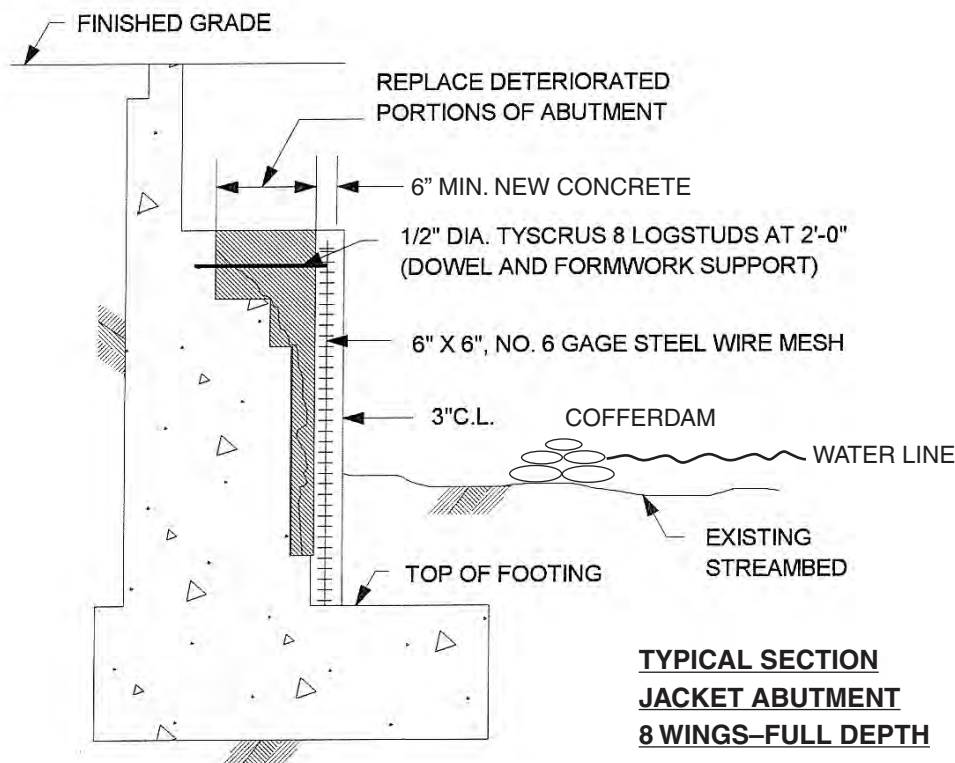
PROCEDURE DESCRIPTION

1. Remove deteriorated concrete and laitances by chipping and blast cleaning.
2. Drill and set tyscrus and lagstuds.
3. Set reinforcing steel and forms.
4. Just prior to placing concrete, apply epoxy bonding agent.
5. Place cement concrete, cure, remove forms, and provide erosion control.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Air Compressor	1 C.Y.	Concrete Mixer
3	Crew Members	1	Concrete Mixer	As Required	Reinforcing Steel

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
..08 CY/HR	.5 CY/DAY	60 MH/CY



SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: B744802

ACTIVITY TITLE: ABUTMENTS (REPAIR)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: L-SHAPED ABUTMENT JACKET (REPAIR) FOR STONE ABUTMENTS

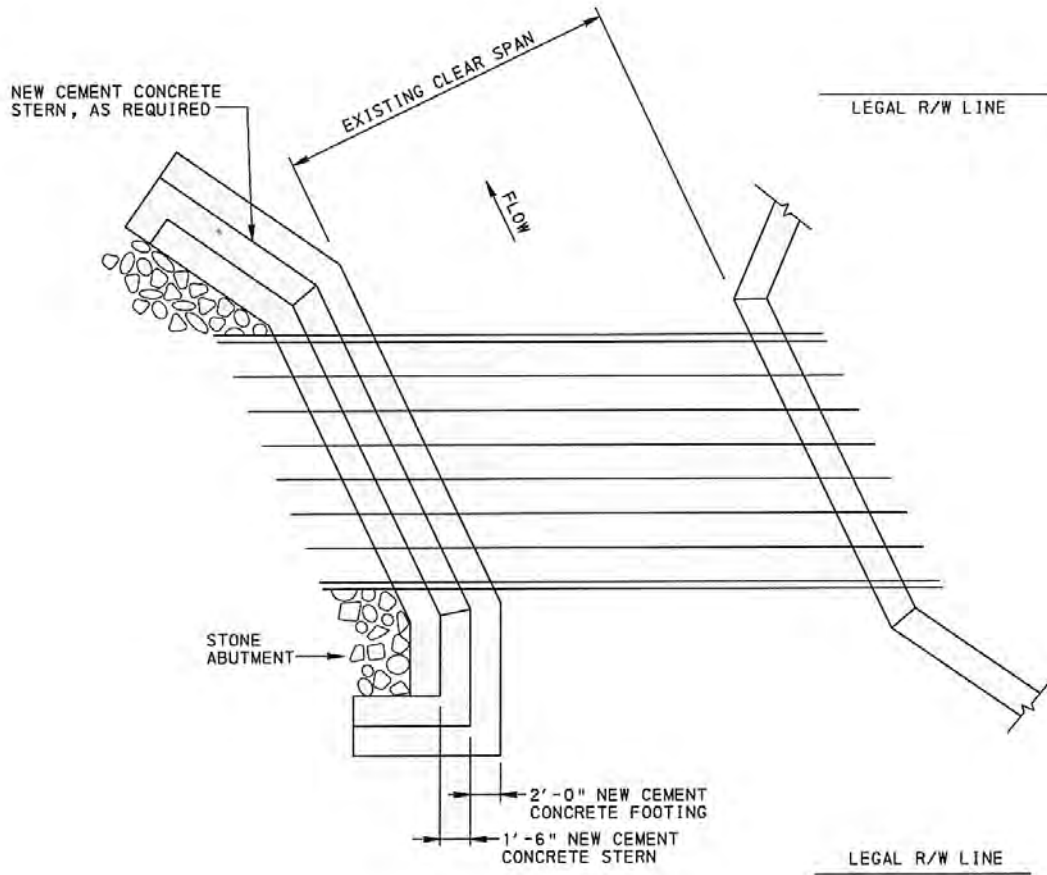
PROCEDURE DESCRIPTION

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Construct sandbag cofferdam and excavate for footing to sound material. 2. Clean existing stone that is to come in contact with new concrete. 3. Set dowels with non-shrink grout or approved adhesive in existing open stone joint at 24 in. horizontally and vertically with 1 ft-3 in. embedment length. 4. Set concrete forms and place concrete as required against existing stone abutment. Prior to placing concrete, apply epoxy bonding compound to stone that is to come in contact with new concrete. | <ol style="list-style-type: none"> 5. Place forms, reinforcing steel, and concrete for new abutment footing. 6. Place forms, reinforcing steel, and concrete for new abutment wall. 7. Remove loads from the existing abutment by jacking or using needle beams as necessary. 8. Install new bearings or move old bearings as necessary. Reload the newly jacketed abutment. 9. Remove formwork and the cofferdam. |
|--|---|

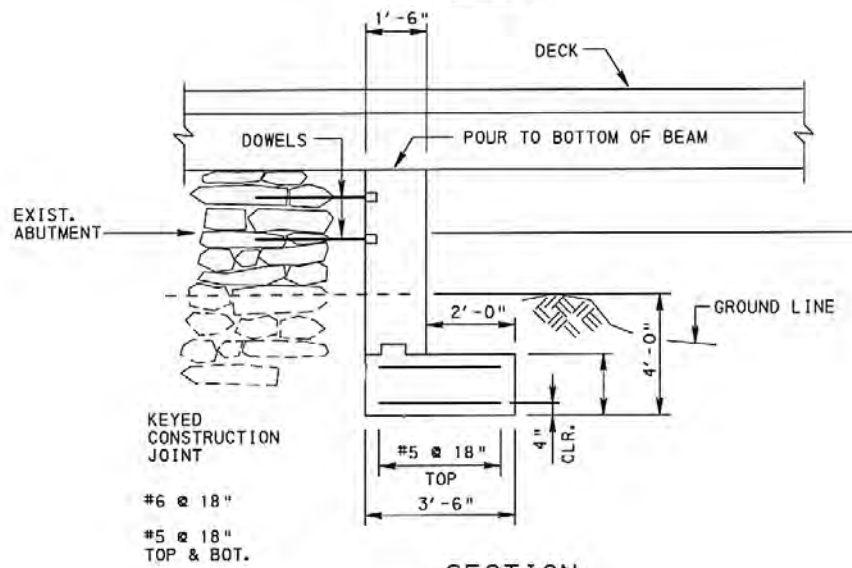
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1 3	Foreman Crew Members	1	Concrete Mixer	1 C.Y. As Required As Required	Concrete Reinforcing Steel Sandbags

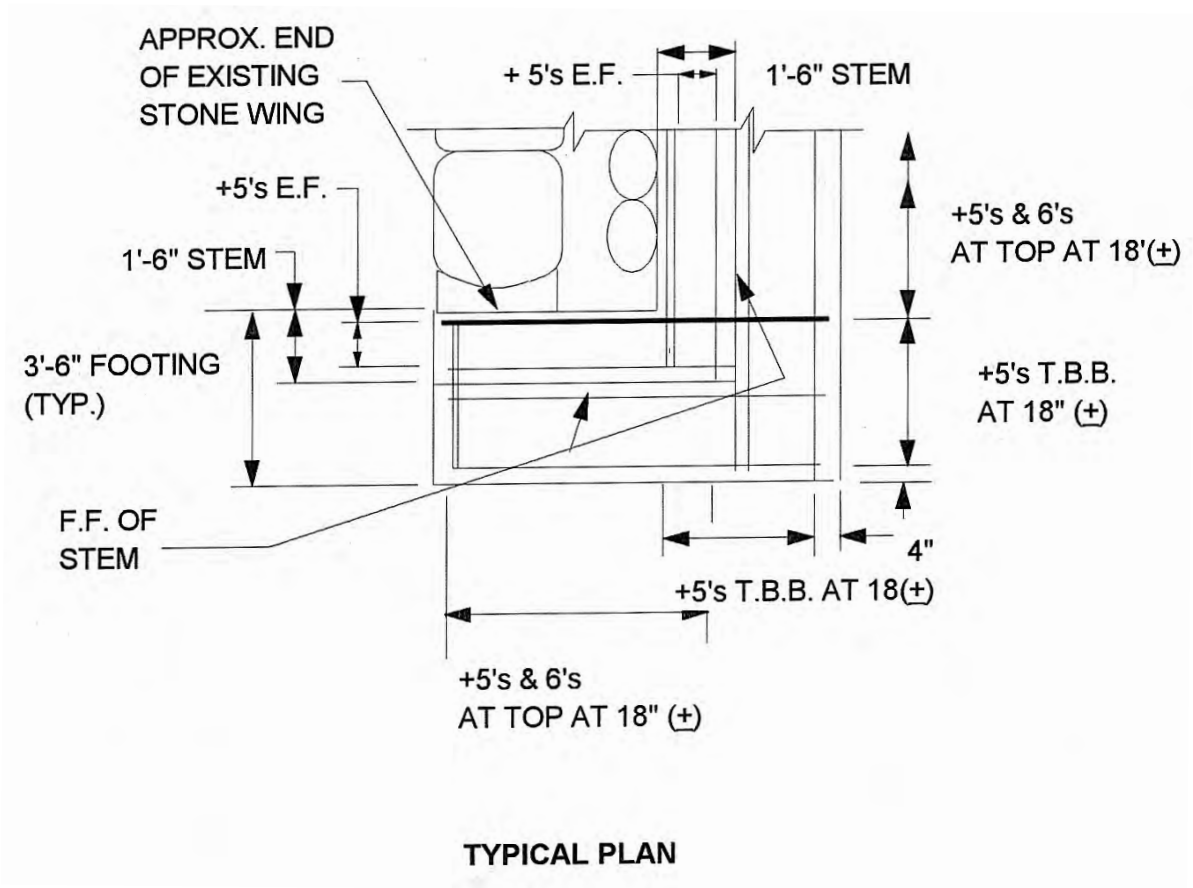
PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.08 CY/HR	.5 CY/DAY	60 MH/CY



PLAN



SECTION



SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: C744802

ACTIVITY TITLE: ABUTMENTS WINGWALLS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: EXTEND WINGWALLS WITH GABIONS

REFERENCES

PennDOT Specifications (PUB 408)

Section 626 - Gabions

675 - Random Stone Slope Wall

735 - Geotextiles

1001 - Cement Concrete Structures

1002 - Reinforcement Bars

1003 - Dowel Holes

1017 - Pressure Mortar Pointing and Surface

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

The full length and depth of abutment wingwalls from, and including, the abutments parapets to the end of the wingwalls.

* **Special Measurement Note:** Cubic yards of concrete or masonry placed, not deteriorated material removed.

ACTIVITY DESCRIPTION

Repairing all or portions of concrete or masonry abutments. The work can include, but is not limited to, installing sheeting when necessary and excavating material retained by or protecting the wingwall; removing deteriorated or damaged concrete, reinforcing steel or masonry; drilling and installing dowels; installing reinforcing steel; constructing forms; placing concrete; replacing and pointing masonry elements; pressure grouting masonry; epoxy pressure grouting; and replacing excavated material.

When protective material such as riprap is excavated to gain access to the work, it should be replaced in conformance with work descriptions in appropriate activities, such as Activity B745301, Rock Protection. However, a separate report is not required, and the work should be reported under

this activity. When wingwalls are being repaired at the same time as breastwalls, a separate report under this activity is not required, and all work should be reported under Activity C744802.

PROCEDURE DESCRIPTION

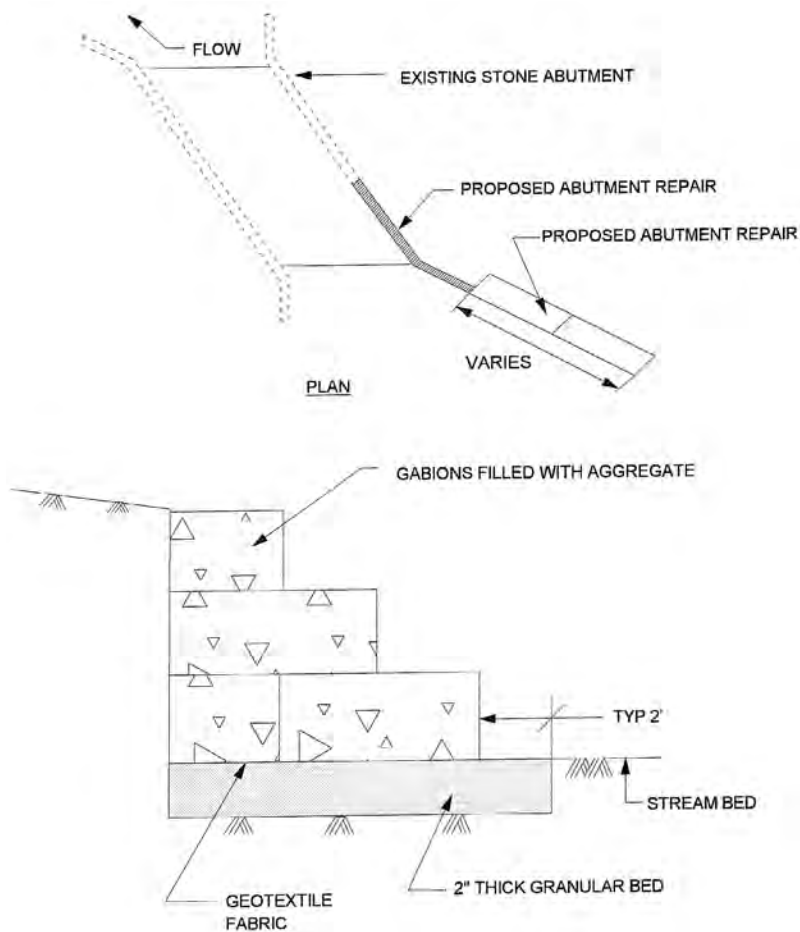
1. Excavate and remove all unsuitable material below the wingwall extension.
2. As required, replace unsuitable material with acceptable granular material and thoroughly compact the entire foundation to a firm, even surface.
3. Place specified geotextile fabric or place cement concrete pad.
4. Assemble, bind, join, and place gabions.
5. Fill Type A gabions by hand or small power equipment, with specified aggregate.
6. As specified, secure lid to sides, ends, and diaphragms using connecting wire.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

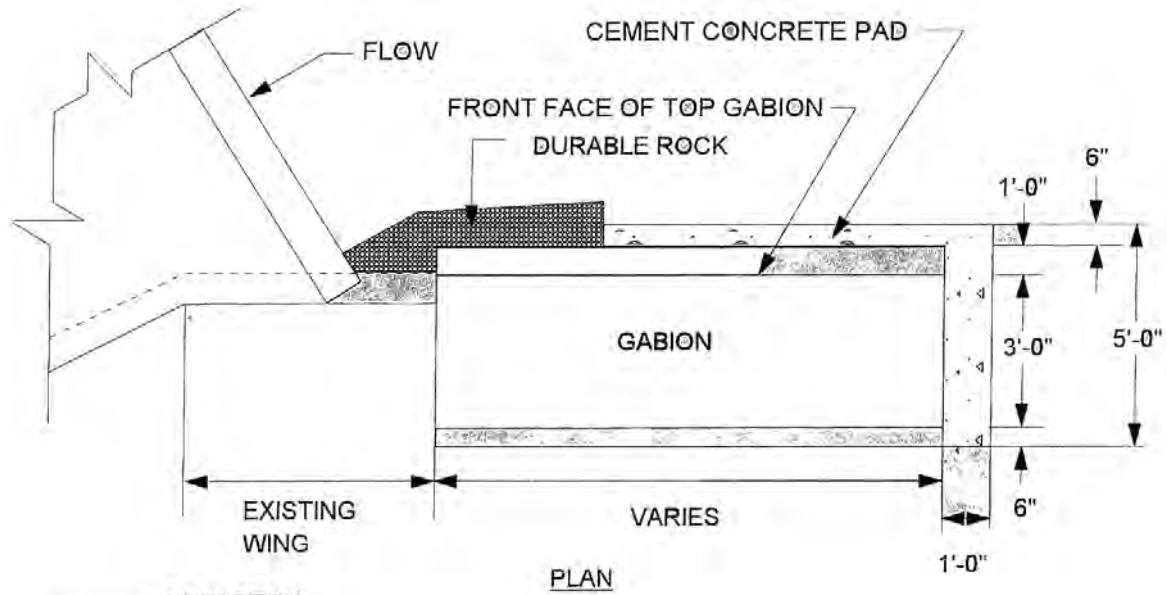
LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Gradall or Backhoe	1 C.Y.	Stone for gabions
3	Crew Members			As Required	Gabion basket and ties
1	Special Crew member (Operator)	1	Concrete Mixer (for concrete pad)	As Required	Geotextile fabric (for granular bed)
		1	Tamper or Roller	As Required	Aggregate for base
		1	Sweeper	As Required	Water

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.67 CY/HR	4 CY/DAY	6 MH/CY

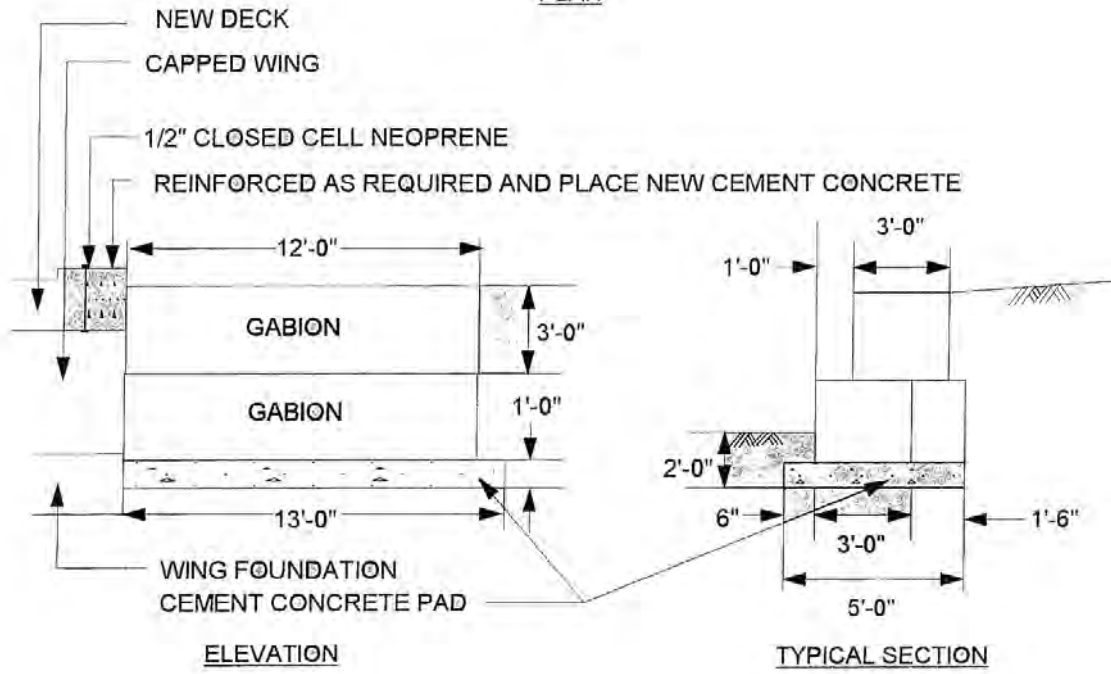


WINGWALL CROSS-SECTION

TYPICAL GABIONS WITH CONCRETE PAD



PLAN



ELEVATION

TYPICAL SECTION

SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: C744802

ACTIVITY TITLE: ABUTMENTS WINGWALLS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: REPLACE CONCRETE WINGWALLS

PROCEDURE DESCRIPTION

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Remove existing wingwalls and excavate to sound material. 2. Clean all concrete that is to come in contact with new concrete. Chip and clean existing concrete to remove any unsound material and laitances. 3. Drill and set dowels. 4. Set forms, reinforcing steel and place concrete. Just prior to placing concrete, | <p>apply epoxy bonding compound to all existing cleaned concrete that is to come in contact with fresh new concrete.</p> <ol style="list-style-type: none"> 5. Prior to placing concrete, provide for adequately reinforced weep holes. 6. Backfill adequately cured concrete wingwalls. Suitable filter shall be provided for weep holes. 7. Provide scour protection. |
|---|--|

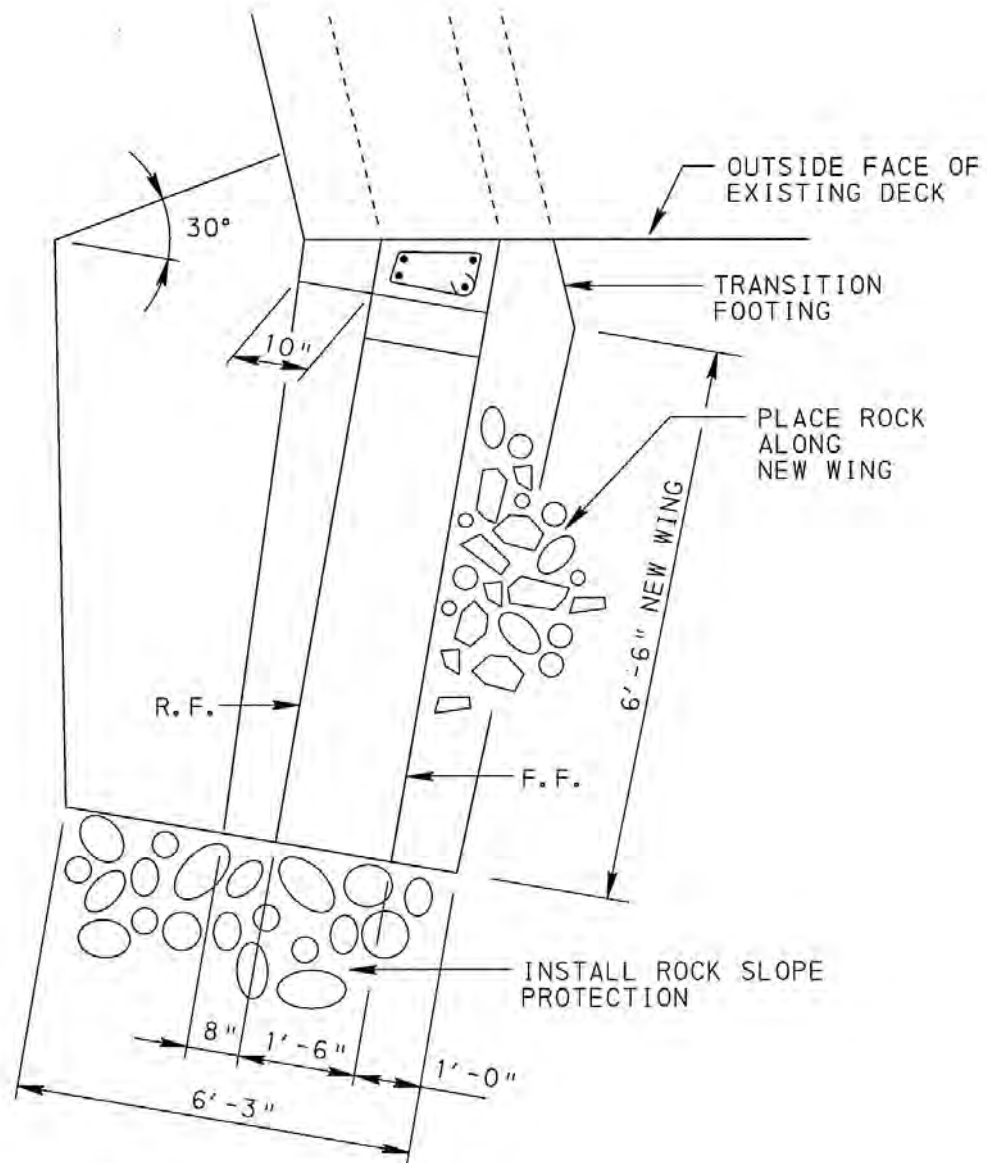
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Gradall or	1 C.Y.	Concrete Reinforcing Steel Stone for scour protections
3	Crew Members		Backhoe	As Required	
1	Special Crew member (Operator)	1	Concrete Mixer	1 C.Y.	

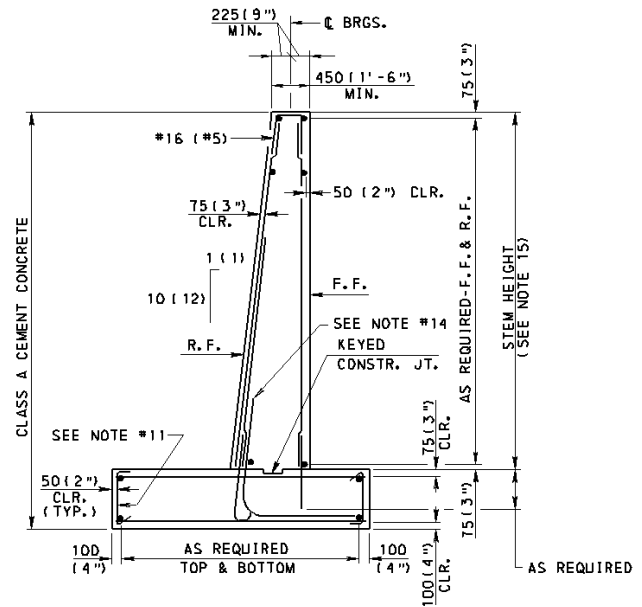
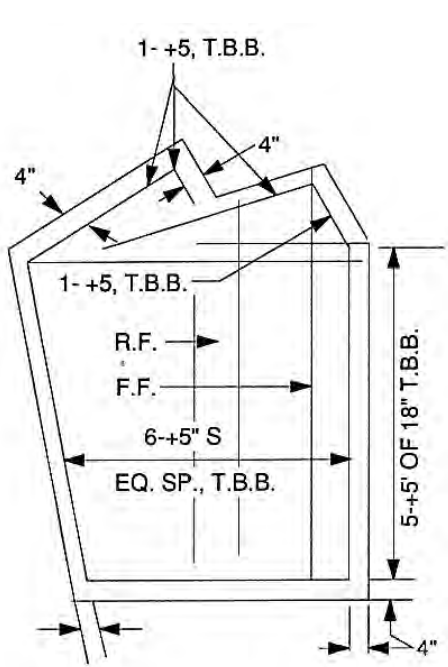
PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.67 CY/HR	4 CY/DAY	6 MH/CY

NOTE: Exact dimensions, rebar size, and rebar spacing to be furnished by District Bridge Office.

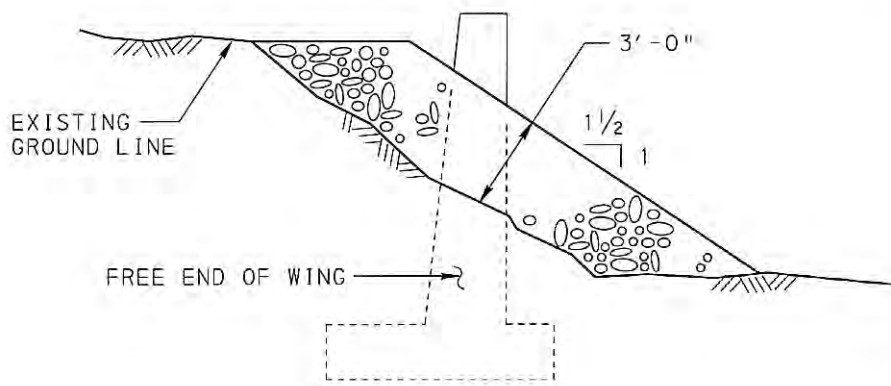
ROCK SLOPE PROTECTION



ROCK SLOPE PROTECTION



TYPICAL SECTION WITHOUT BACKWALL
 (WITH OR WITHOUT BATTER)



ELEVATIONS

SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: C744802

ACTIVITY TITLE: ABUTMENTS WINGWALLS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: REPAIR BROKEN OR DETERIORATED CONCRETE WINGWALLS

PROCEDURE DESCRIPTION

1. Excavate as required to set dowels and forms.
2. Remove all fractured or deteriorated concrete to sound concrete by chipping, and blast to remove laitances.
3. Drill and set form anchor bolts and dowels. Dowels are to be placed a minimum of 9 in. into sound concrete and set with non-shrink grout or approved adhesive, 18 in. on center, front and back.
4. Cross-lace reinforcing bars as shown and set forms.
5. Just prior to placing concrete, apply epoxy bonding agent to all existing concrete that is to come into contact with new concrete.
6. Cure concrete until concrete has developed sufficient strength to resist the imposed lateral pressures before backfilling with granular material.
7. Backfill and provide erosion protection as necessary.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	1 C.Y.	Concrete Mixer
2	Crew Members	1	Gradall or	As Required	Reinforcing Steel
1	Special Crew member (Operator)		Backhoe		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.67 CY/HR	4 CY/DAY	6 MH/CY

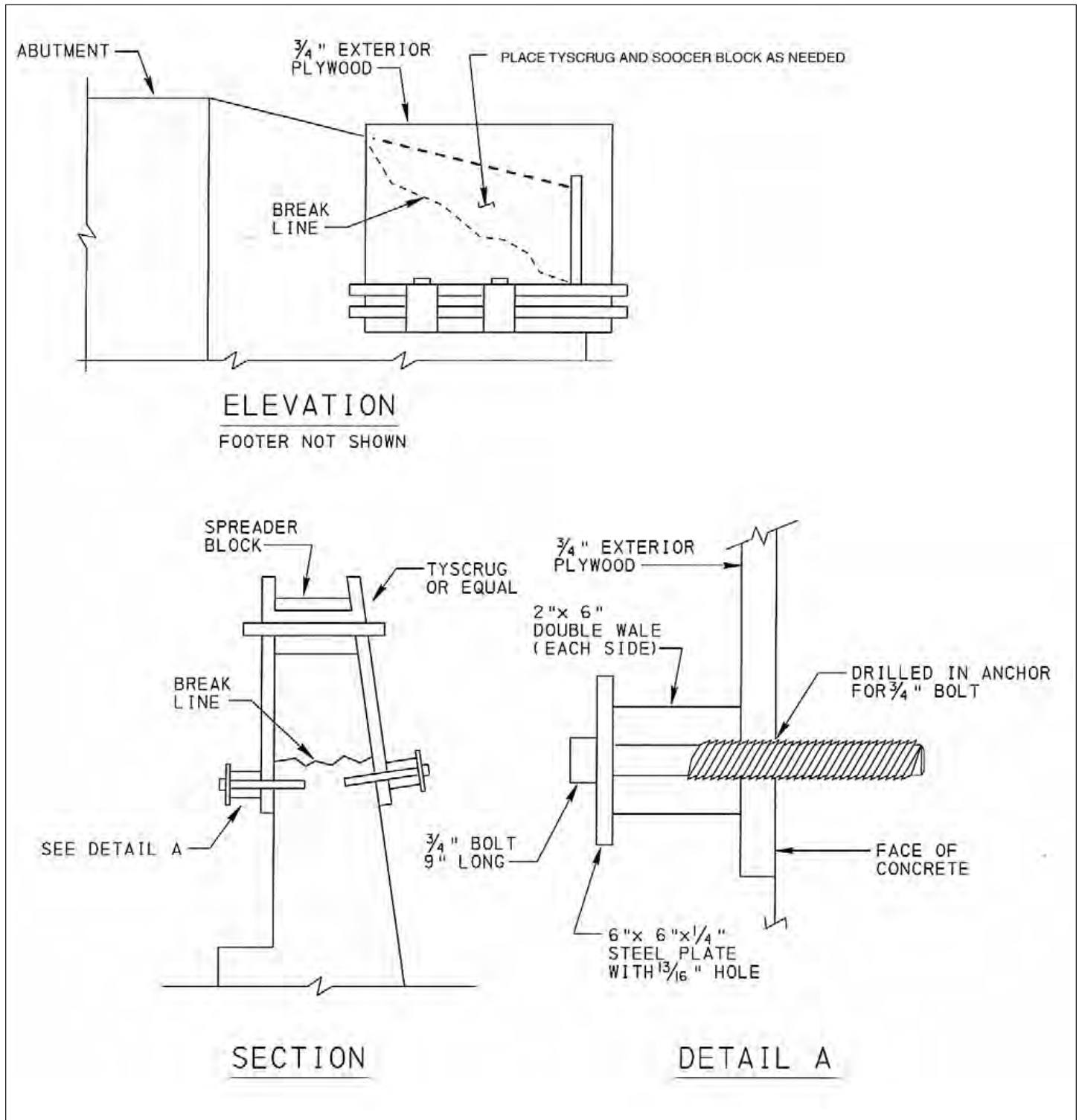
SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: C744802

ACTIVITY TITLE: ABUTMENTS WINGWALLS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: REPAIR BROKEN OR DETERIORATED CONCRETE WINGWALLS



SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: C744802

ACTIVITY TITLE: ABUTMENTS WINGWALLS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

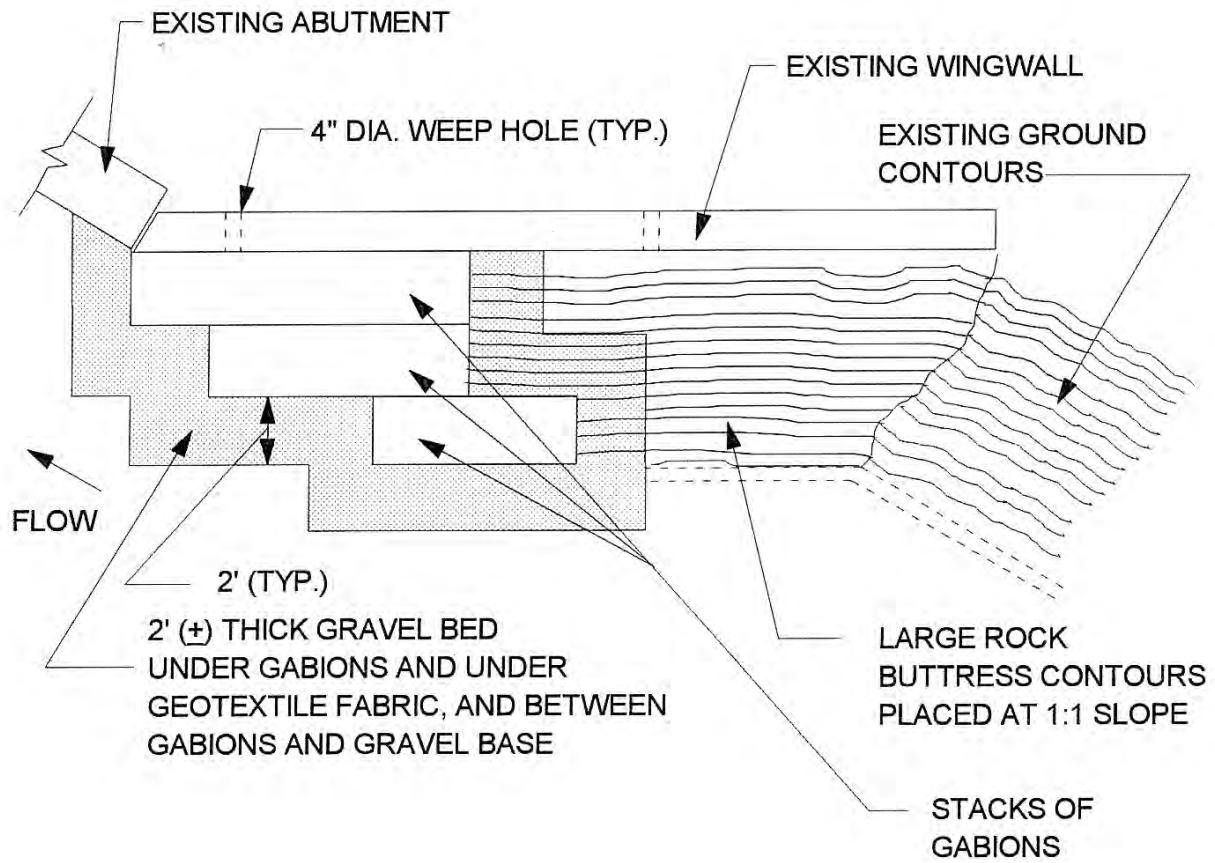
PROCEDURE: STABILIZE EXISTING WINGWALLS WITH GABIONS OR PRECAST CONCRETE BLOCK

PROCEDURE DESCRIPTION

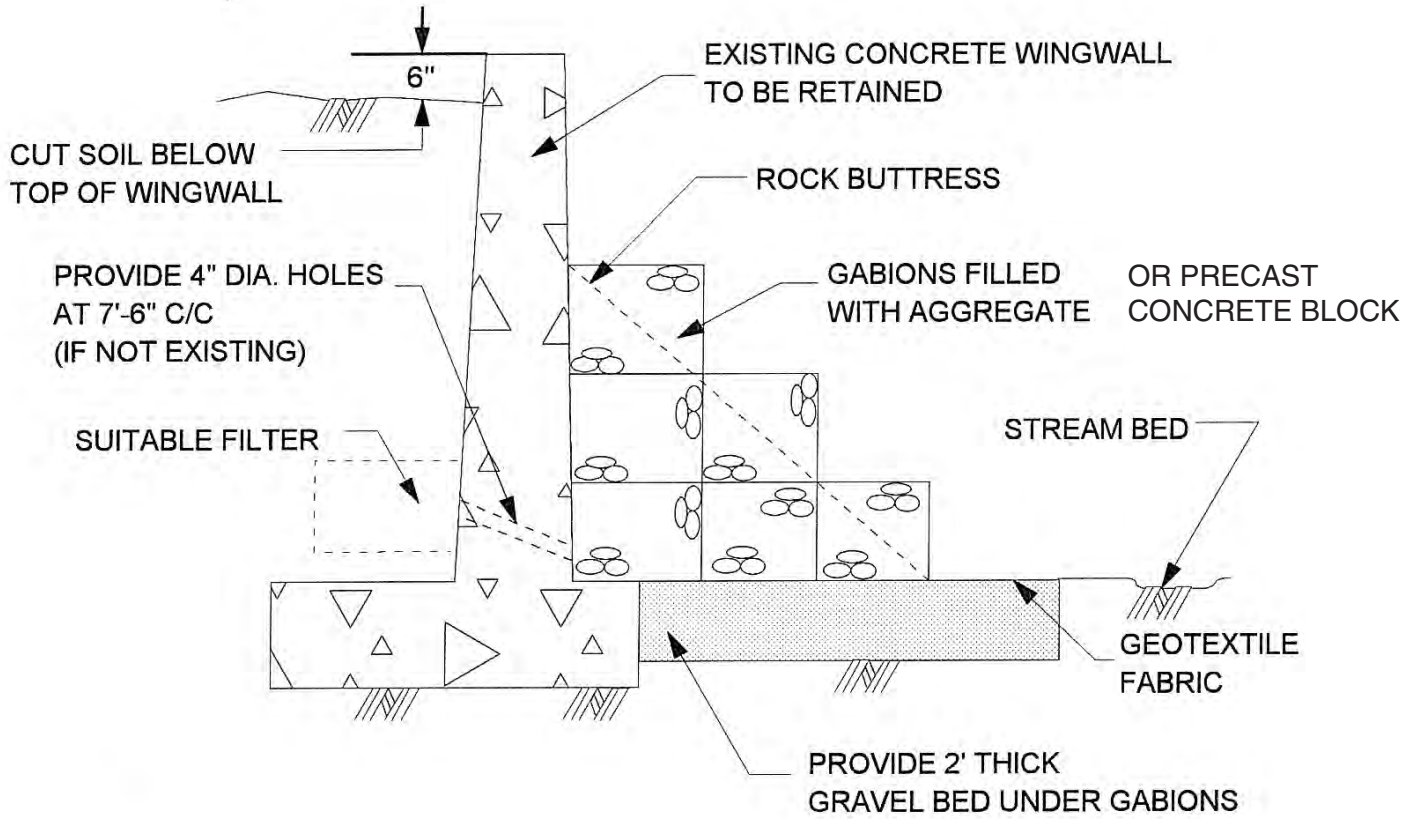
- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Excavate and remove all unsuitable material below the face of wingwall to be retained or stabilized. 2. As required, replace unsuitable material with acceptable granular material and thoroughly compact the entire foundation to a firm, even surface. 3. Place specified geotextile fabric or place cement concrete pad. 4. Assemble, bind, join, and place gabions. 5. Fill Type A gabions by hand, and Type B gabions by hand or small power equipment, with specified aggregate. | <ol style="list-style-type: none"> 6. As specified, secure lid to sides, ends, and diaphragms using connecting wire. 7. Place specified large rock buttress at a one-to-one slope. <p>NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.</p> |
|---|---|

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Gradall or backhoe	1 C.Y.	Stone for gabions
2	Crew Members			As Required	Gabion basket and ties
1	Special Crew member (Operator)	1	Concrete Mixer	As Required	Geotextile fabric (for granular bed)
				As Required	Aggregate for base
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.67 CY/HR		4 CY/DAY		6 MH/CY	



PLAN



WINGWALL CROSS-SECTION

SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: D744802

ACTIVITY TITLE: PIERS (REPAIR)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes
 1017 - Pressure Mortar Pointing and Surfacing

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

All portions of all types of concrete or masonry piers. Work on timber piles or bents is not included within this work area and should be reported to Activity B744601, Other Timber Members (Repair/Replace).

* **Special Measurement Note:** Cubic yards of concrete or masonry placed, not deteriorated material removed.

ACTIVITY DESCRIPTION

Repairing all or portions of concrete or masonry piers. The work can include, but is not limited to, installing sheeting when necessary and excavating material temporarily modifying superstructures to accept jacking loads, providing temporary supports for jacking; removing loads from piers either by jacking from below or using needle beams from above; removing dowels; installing reinforcing steel; constructing forms; placing concrete; replacing and pointing masonry elements; pressure grouting masonry; epoxy pressure grouting; and replacing excavated material.

When only the bridge pedestals/seats are involved, the work should not be reported under this activity, but should be reported under Activity D744503, Bearing Pedestal/Seat (Reconstruct). When protective material such as riprap is excavated to gain access to the work, it should be replaced in conformance with work descriptions in appropriate activities, the work should be reported under this activity.

PROCEDURE DESCRIPTION

1. Saw cut the boundaries of the deteriorated concrete to be removed to a depth of 3/4".
2. Remove deteriorated concrete by chipping with light power tools.
3. Blast clean exposed reinforcing bars of all rust and foreign materials. Replace deteriorated bar sections as necessary.
4. Place reinforcing mesh as necessary.
5. Blast clean the existing concrete to be patched to remove loose concrete chips and laitances.
6. Place forms, coat existing concrete surfaced with epoxy bonding agent, and place concrete.
7. Remove forms and finish surfaces after concrete has cured.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	1	Concrete
3	Crew Members	1	Welding Equip	As Required	Reinforcing Steel
1	Special Crew member (Certified Welder)	1	Scaffolding or lifting equip		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 CY/HR	1 CY/DAY	30 MH/CY

SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: D744802

ACTIVITY TITLE: PIERS (REPAIR)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: REPAIR DETERIORATED CONCRETE PILE

PROCEDURE DESCRIPTION

1. Remove deteriorated concrete from existing piles.
2. Clean existing reinforcing steel and replace any steel as required.
3. Install new mesh reinforcing cage around pile. Use spacers to keep the form in the proper position.
4. Place forming jacket around pile and seal the bottom of form against pile surface.
5. Pump concrete into the form through the opening at the top. Finish the concrete at the top of the form.

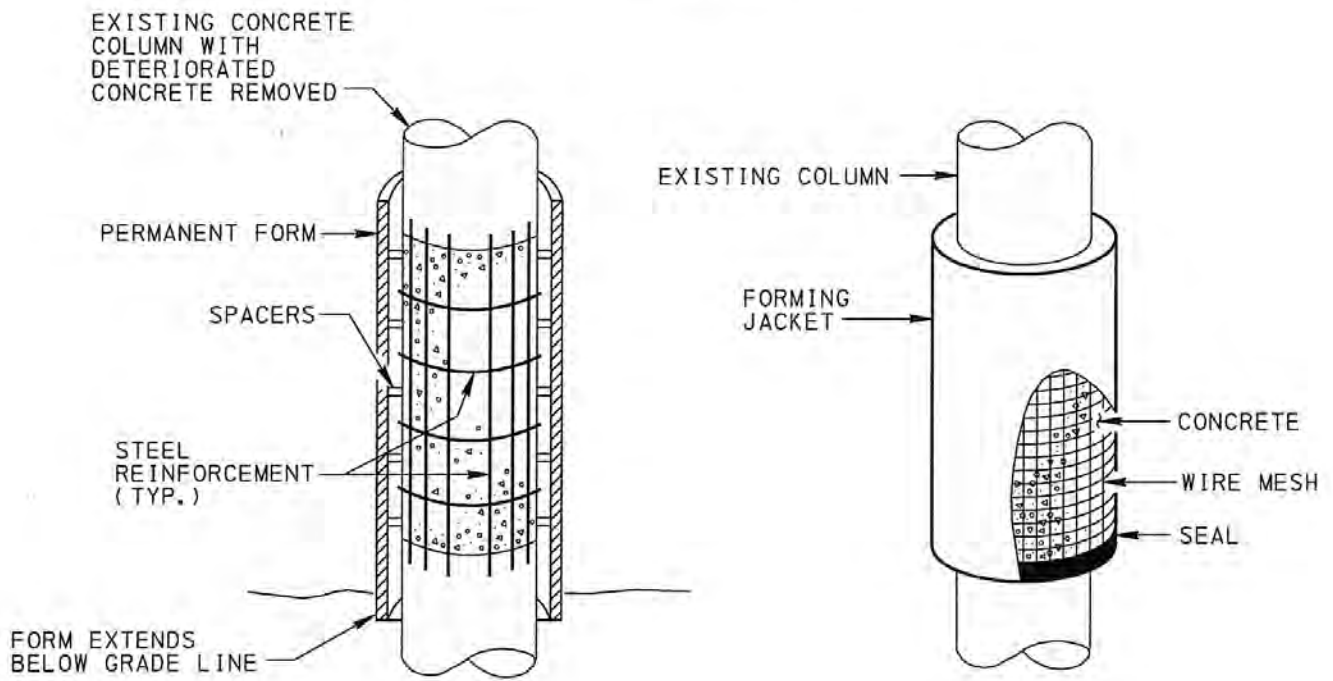
NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

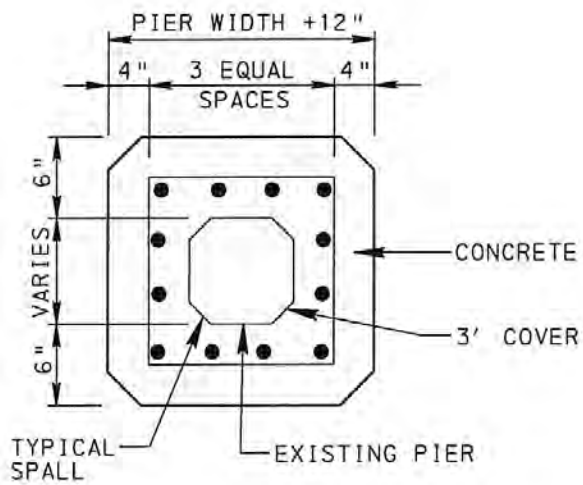
LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	1 C.Y.	Concrete
2	Crew Members		welding	As Required	Reinforcing Steel
1	Special Crew member (Certified Welder)	1	Equipment		and steel mesh
		1	Access Equip	1 Each	Forming jacket

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 CY/HR	1 CY/DAY	30 MH/CY

TYPICAL ROUND PILE



TYPICAL SQUARE PILE



PLAN

SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: D744802

ACTIVITY TITLE: PIERS (REPAIR)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: EPOXY GROUTED REINFORCEMENT FOR REPAIR OF CRACKED HAMMER HEAD PIERS

PROCEDURE DESCRIPTION

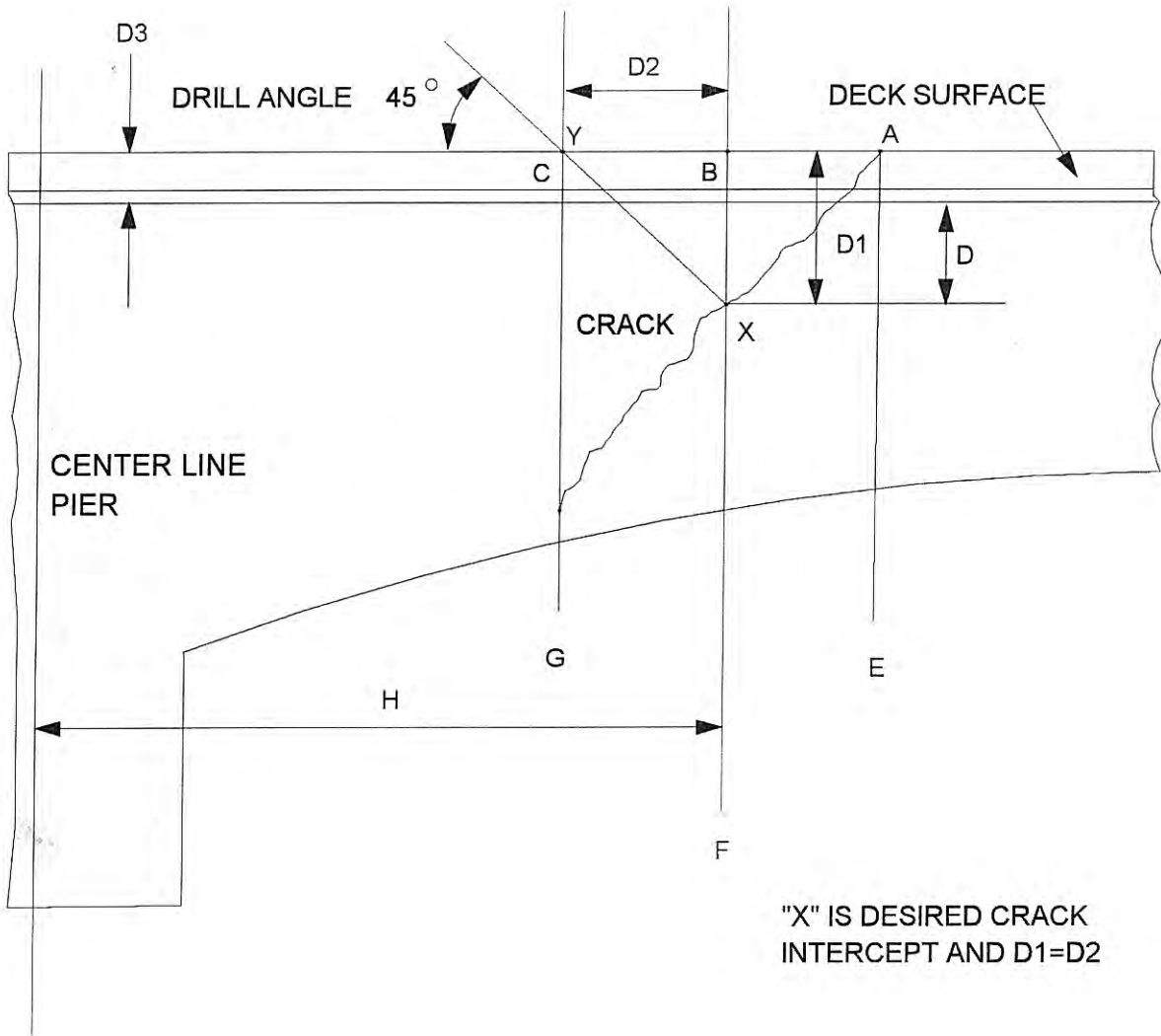
- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Clean crack of all loose concrete and laitances. 2. Seal crack with epoxy grout. 3. Drill holes perpendicular to the crack place. 4. Inject epoxy grout into the drill holes under low pressure. | <ol style="list-style-type: none"> 5. Place the rebars into the drill holes. 6. Clean any excess grout. <p>NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.</p> |
|--|---|

ACTIVITY REQUIREMENTS

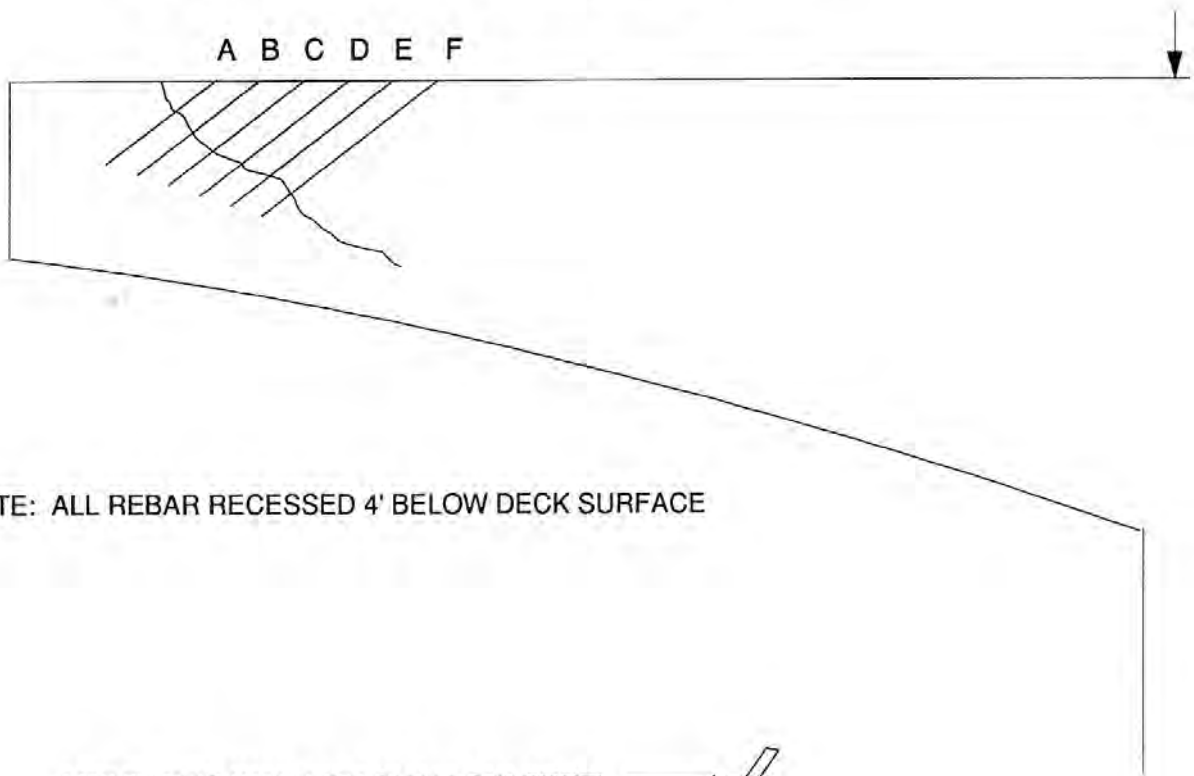
LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Injection equip	As Required	Epoxy Grout
3	Crew Members	1	Concrete Drill	As Required	No. 4 Reinforcing Steel
		As Required	Access Equip		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 CY/HR	1 CY/DAY	30 MH/CY

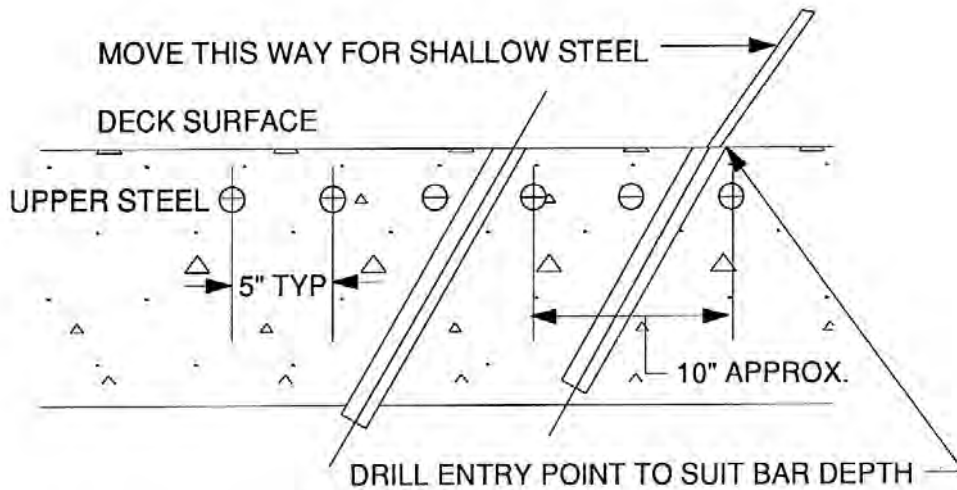
METHOD USED TO LOCATE INTERCEPTS AND DRILL ENTRY POINTS



GEOMETRY TO ESTABLISH DRILL ENTRY POINTS



NOTE: ALL REBAR RECESSED 4' BELOW DECK SURFACE



NOTE: ENTRY POINT MUST BE ADJUSTED TO CLEAR UPPER STEEL.

SAP ASSEMBLY NUMBER: 711-7448-02

BMS Flex-Action: D744802

ACTIVITY TITLE: PIERS (REPAIR)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: POST TENSIONING OF CRACKED HAMMER HEAD PIERS

PROCEDURE DESCRIPTION

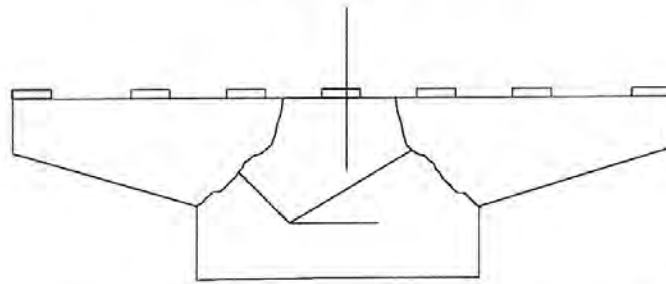
1. Erect all intermediate supports and anchorage assembly at one end of pier cap. Locate existing stirrups and horizontal steel in pier cap prior to installing expansion bolts for the supports.
2. Insert corrugated pipes with pre-grouted thread-bars inside to the intermediate supports or the pier cap.
3. Erect the smooth PVC pipes with threadbars inside to the intermediate supports or the pier cap.
4. Erect anchorage assembly at other end of pier cap.
5. Add anchor plates with steel tubes to both assemblies, pack tubes with plastic corrosion inhibitor and add anchor units on both ends.
6. Initially post-tension all threadbars to 10 kips in order to seat the post-tensioning system on the pier cap.
7. Epoxy inject all cracks in the pier cap.
8. After the injected epoxy has hardened, post-tension the system to the required load per bar.
9. Install sealing caps with plastic corrosion inhibitor and plastic nuts.

ACTIVITY REQUIREMENTS

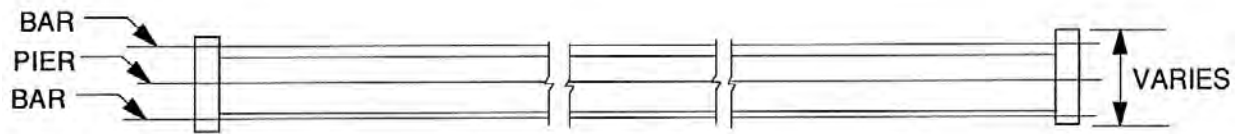
LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Jack	C.Y.	Epoxy Grout
3	Crew Members	1	Epoxy Injecting Equip	As Required	Post-Tensioning Bars as Fittings
		As Required	Access Equip		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 CY/HR	1 CY/DAY	30 MH/CY

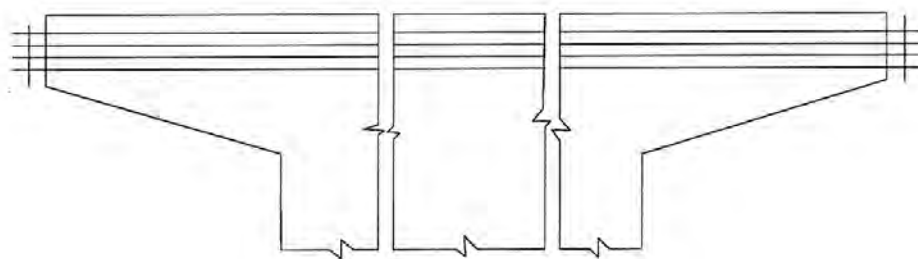
CRACK LOCATION DETAIL



ENTRY PORTS TO BE PLACED AT 6" CENTERS FOR INJECTION OF EPOXY BONDING MATERIAL.



PLAN



ELEVATION

SAP ASSEMBLY NUMBER: 711-7448-03

BMS Flex-Action: E744803

ACTIVITY TITLE: FOOTING (UNDERPIN)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or special inspections conducted because of rapid run-off resulting from unusually high water.

WORK AREA

All footings on all substructures units; abutments, wingwalls, piers, and sufficient area adjacent to them to allow for any necessary excavation and the placing of water control devices.

ACTIVITY DESCRIPTION

Underpinning concrete or masonry footing with concrete or pumped grout. The work can include, but its not limited to, excavating material; installing sheeting or other water control devices such as bagged concrete riprap or nylon tubes filled with pumped grout; erecting temporary supports to permit the removal of unsatisfactory material; constructing forms; drilling and grouting dowels; placing reinforcing steel; placing concrete or pumping grout; and replacing excavated material. When protective material such as riprap is excavated to gain access to the work area, it should be replaced in conformance with work description in appropriate activities, such as Activity B745301, Rock protection. However, a separate report is not required, and the work should be reported under this activity.

PROCEDURE DESCRIPTION

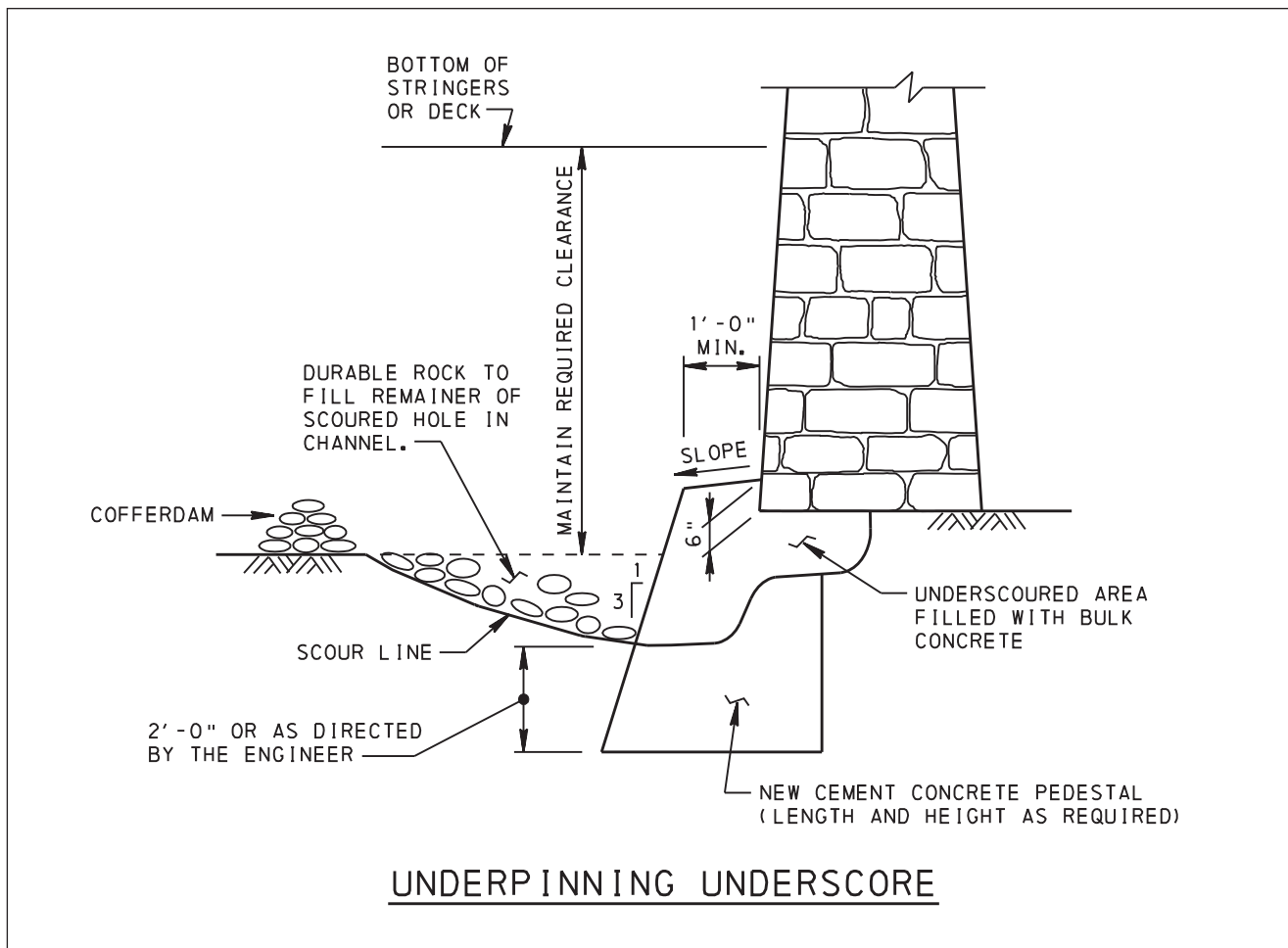
1. Construct sandbag cofferdam to an elevation above the water level or divert stream using temporary pipes.
2. Clean all exposed concrete of marine growth and remove loose or deteriorated concrete.
3. Excavate as required to sound material.
4. Drill required dowel holes, set and install dowels, set additional reinforcing, and place forms.
5. Place form work 6" higher than the bottom of the foundation to ensure the cement concrete fills the scour area and supports the foundations properly.
6. Remove forms and protect against continued stream bed erosion with gabions or stone riprap.

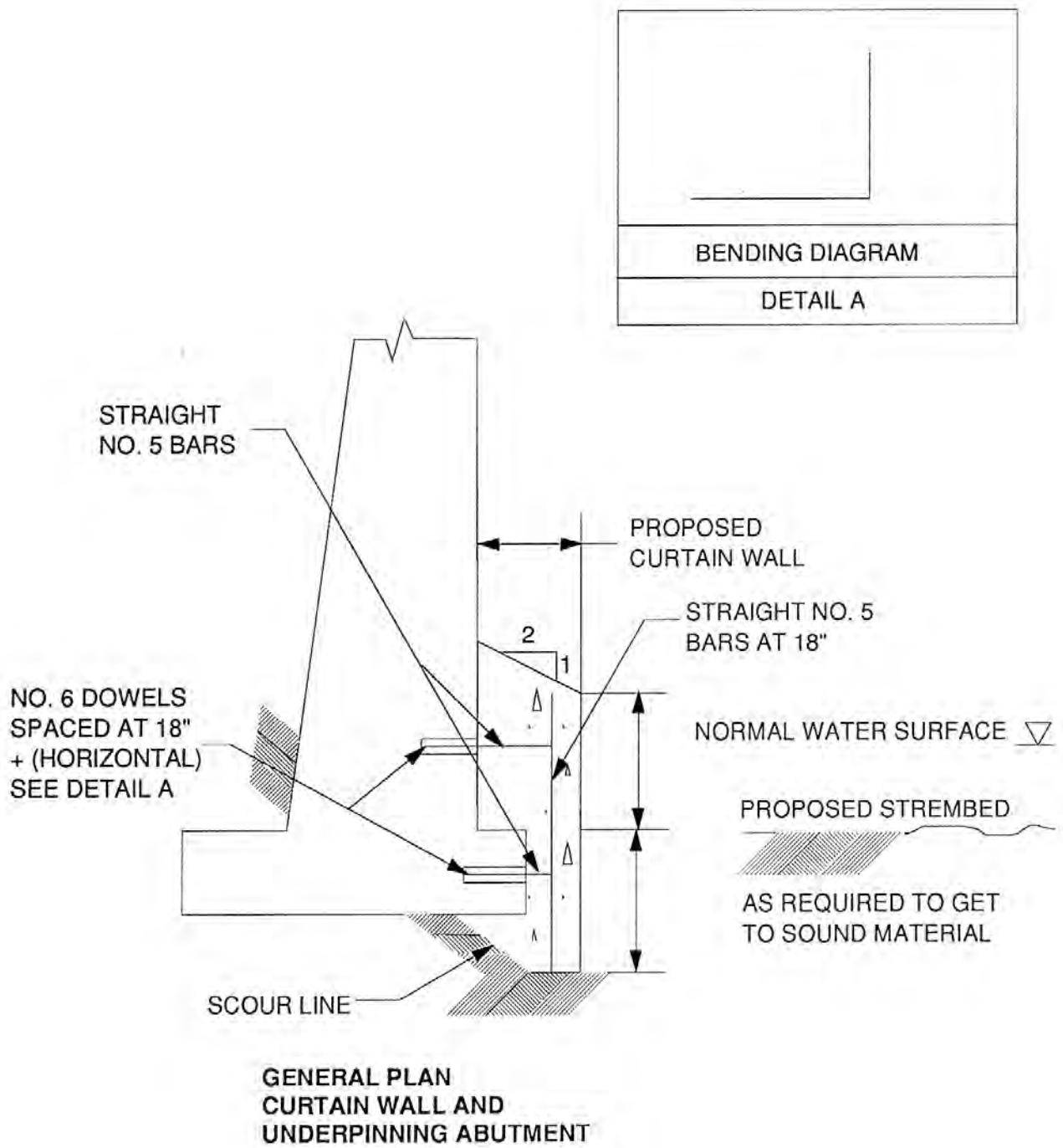
NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	1 C.Y.	Concrete
3	Crew Members	1	Gradall or backhoe		
1	Special Crew Member (Operator)				

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.133 CY/HR	2 CY/DAY	12 MH/CY





Underpinning



PennDOT District 5-0
 Monroe County
 S.R. 3018 over Kettle Creek
 Single span reinforced concrete slab bridge with
 undermining at far abutment

Underpinning

Design: In-House by District personnel

Construction: Monroe County Bridge Crew

Duration of Construction: 1 weeks

Maintenance and Protection of Traffic: Road
 Closure

Cost: \$29,585



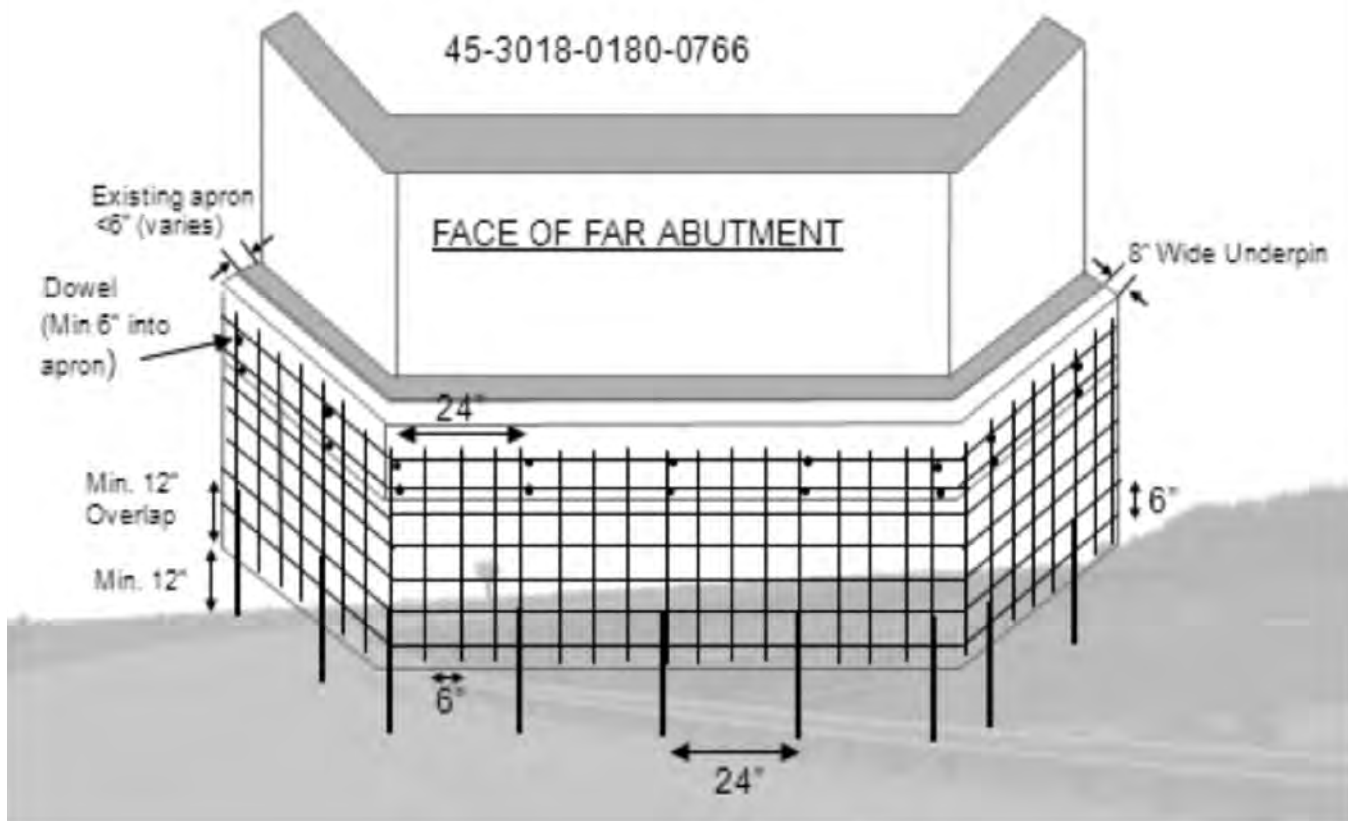
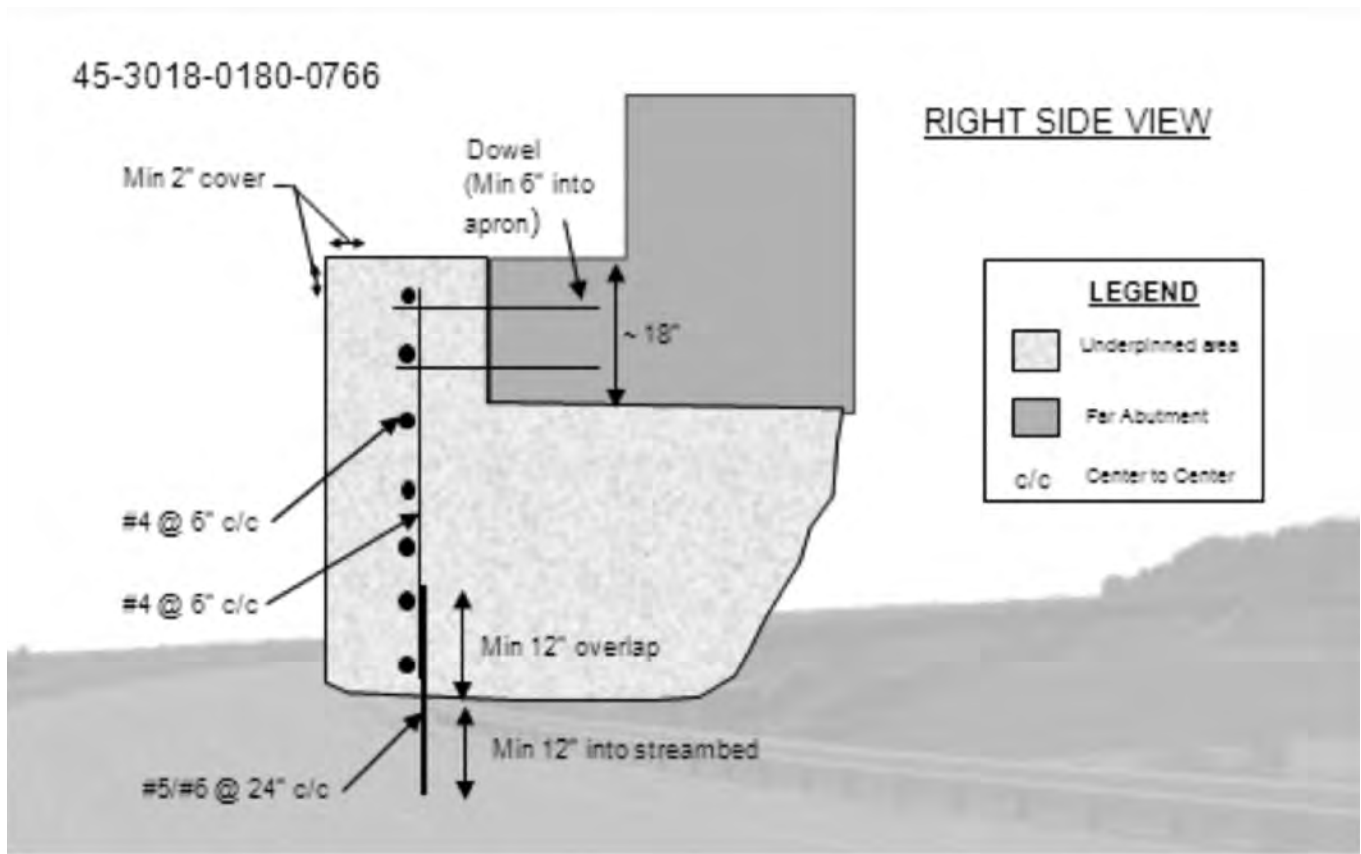
Equipment List:

- Concrete Forms
- Excavator
- Pumps/E&S Control Measures

Material List:

- HDPE Pipes
- Steel Reinforcement/Dowels
- Cement Concrete





Underpinning



Diversion of stream flow utilized through HDPE Pipes. Installation of other E&S Control measures.



Installation of steel dowels, Concrete Forms, and Placement of new Concrete.



Lessons Learned:

- 1) Dewatering was biggest challenge.
- 2) Scour problem was larger than anticipated.
Be prepared to make field adjustments.

SAP ASSEMBLY NUMBER: 711-7448-03

BMS Flex-Action: E744803

ACTIVITY TITLE: FOOTING (UNDERPIN)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE OR MASONRY

PROCEDURE: UNDERPIN USING TREMIE CONCRETE

PROCEDURE DESCRIPTION

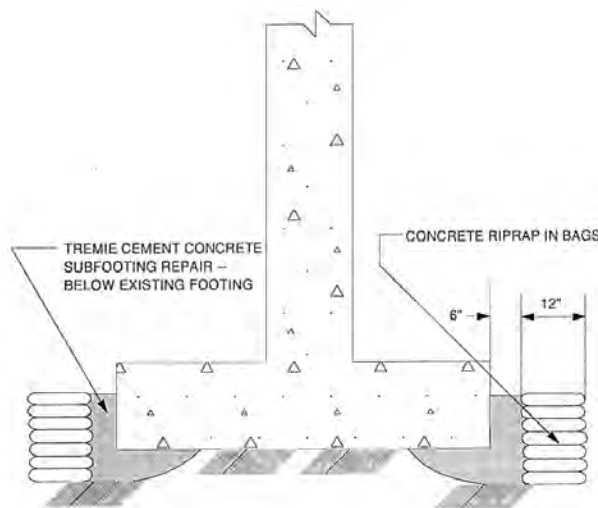
1. Clean all exposed concrete of marine growth and remove loose or deteriorated concrete.
- 2.. Excavate as required to sound material.
3. Place concrete riprap bags around scour area. Where the scoured-out material is fine-grained, a filter should be placed prior to placing the riprap.
- 4.. Pump or tremie concrete into damaged area.
5. Protect against continued stream bed erosion as required by rebuilding stream bed with properly designed riprap or by paving the stream bed.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	1	Concrete
2	Crew Members	1	Gradall or backhoe		
1	Special Crew Member (Operator)				

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.33 CY/HR	2 CY/DAY	12 MH/CY



SAP ASSEMBLY NUMBER: 711-7448-04**BMS Flex-Action:** F744804**ACTIVITY TITLE:** MASONRY (REPOINT)**UNIT OF MEASUREMENT:** CUBIC YARDS OF MASONRY**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1017 - Pressure Mortar Pointing and
Surfacing

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Work should not be scheduled when there is any possibility of freezing temperatures.

WORK AREA

All masonry substructure units; abutments, wingwalls and piers, and sufficient area adjacent to them to allow for any necessary excavation and the placing of water control devices.

ACTIVITY DESCRIPTION

Pointing and repointing masonry elements is substructure units with mortar. The work can include, but is not limited to, excavating materials; installing sheeting or other water control devices such as bagged concrete riprap; removal of deteriorated concrete with hand or power tools; cleaning surfaces to be mortared with high pressure water, air-blasting or sand-blasting, as appropriate and necessary; mixing mortar and mortaring prepared joints.

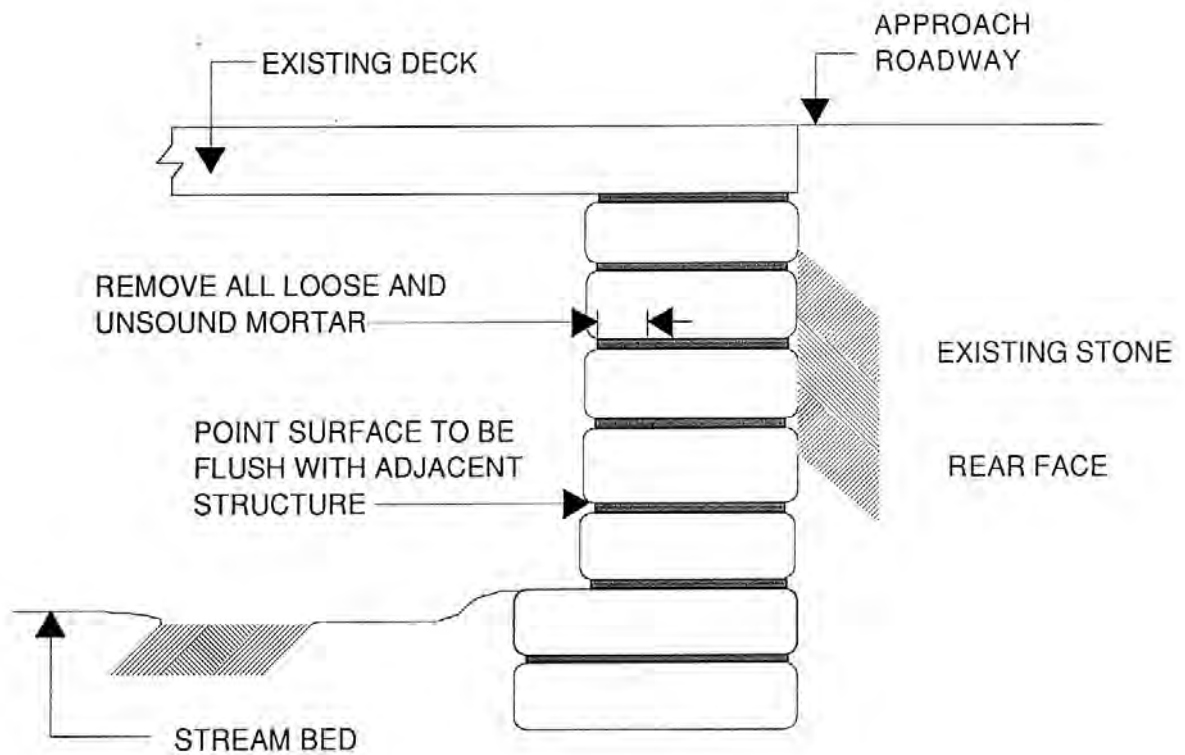
When protective material such as riprap is excavated to gain access to the work, it should be replaced in conformance with work descriptions in appropriate activities, such as Activity B745301, Rock Protection. However, a separate report is not required, and the work should be reported under this activity.

PROCEDURE DESCRIPTION

1. Thoroughly clean masonry joints of all loose and unsound mortar and foreign material.
2. Saturate the joint surfaces with clean water before applying mortar.
3. Fill all the voids with mortar, making the surface flush with the adjacent face of the structure.
- 4.. Cure all new mortar with wet burlap or clear curing compound.
5. Clean the face of the masonry.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1 3	Foreman Crew Members	1	Pressure Grouting Equip	As Required	Mortar
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
CU/HR		CU/DAY		CU/CY	



NOTE: IF WEEPHOLES ARE NOT PRESENT THEN DRILL OPENINGS FOR PLACEMENT OF WEEPHOLE PIPES OR LEAVE SEVERAL OPENINGS TO RELIEVE HYDRAULIC PRESSURE.

SAP ASSEMBLY NUMBER: 711-7451-01

BMS Flex-Action: A745101

ACTIVITY TITLE: ABUTMENT SLOPEWALL (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *SQUARE YARDS OF ABUTMENTS SLOPEWALL

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 673 - Precast Cement Concrete Block
 Slopewall, Cast-in-Place Cement
 Concrete Slab Slopewall
 674 - Stone Slopewalls
 675 - Random Stone Slopewall
 1001 - Cement Concrete Structures

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. If the bridge is a water crossing, the work can usually be done most conveniently during the middle to late summer season when water levels are normally low.

WORK AREA

The entire area of existing slopewalls and sufficient additional area to permit any necessary excavation and installation of cutoff or toe walls.

***Special Measurement Note:** Square yards of slopewall surface repaired or replaced, not removed.

ACTIVITY DESCRIPTION

Repairing or replacing portions of an existing slopewall, composed of the same materials. The work can include, but is not limited to, installing sheeting or other water control devices; excavating material; removing deteriorated or damaged concrete masonry units; constructing forms; grading surfaces and installing aggregate and/or geotextiles; placing reinforcing steel; placing concrete; laying concrete blocks or stones; and mortaring joints. If an entire slopewall is removed and replaced with a slopewall composed of a different material, all work should be reported under Activity A745102, Abutment Slopewall

(Construct New).

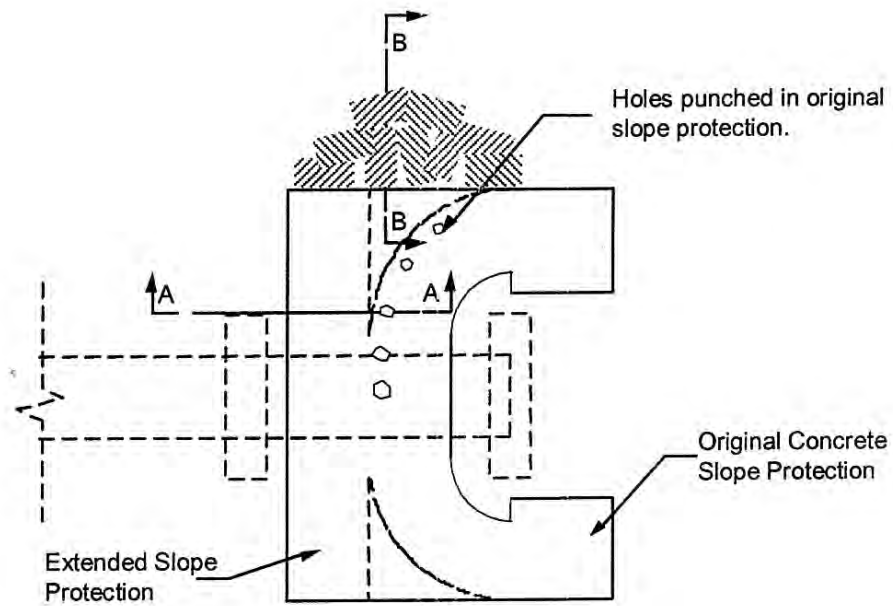
PROCEDURE DESCRIPTION

1. Excavate for a new end wall around toe of slope to extend to below scour line or to solid rock.
2. Set up forms for end wall and place concrete.
3. Fill voids in existing sound slope protection by removing sections of protection and filling voids with crushed stone.
4. Grade and place bedding for slope wall extension.
5. Replace damaged sections, sections removed to fill voids with concrete, and place extension.
6. Fill voids in embankment and protect slopes adjacent to stone protection with large stone riprap.

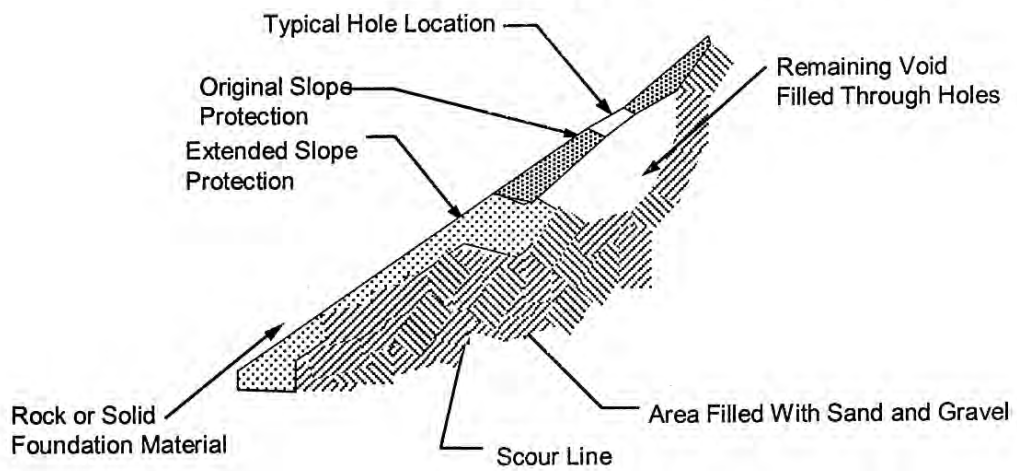
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Gradall or backhoe	.012 CY	Concrete and/or concrete blocks
2	Crew Members				
1	Special Crew Member (Operator)	1	Air compressor and Jack Hammer	As Required	Joint sealing material
		1	Concrete Mixer	As Required	Sand and fine aggregate
				As Required	Large aggregate stone for riprap
				As Required	Reinforcing Steel
					1SY Geotextiles

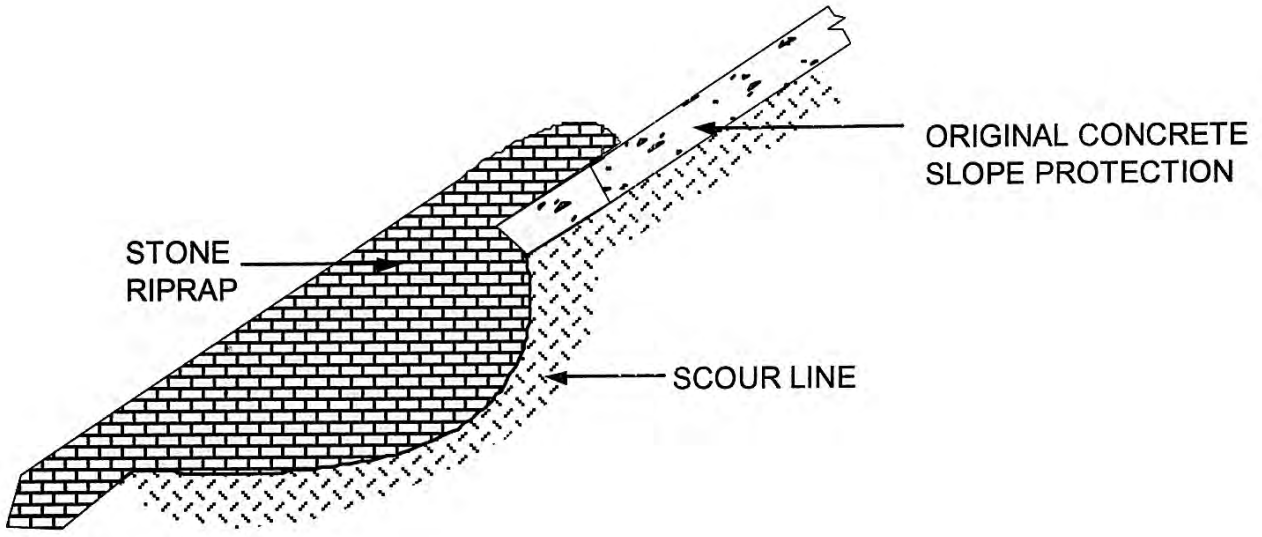
PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.4 SY/HR	25 SY/DAY	1 MH/SY



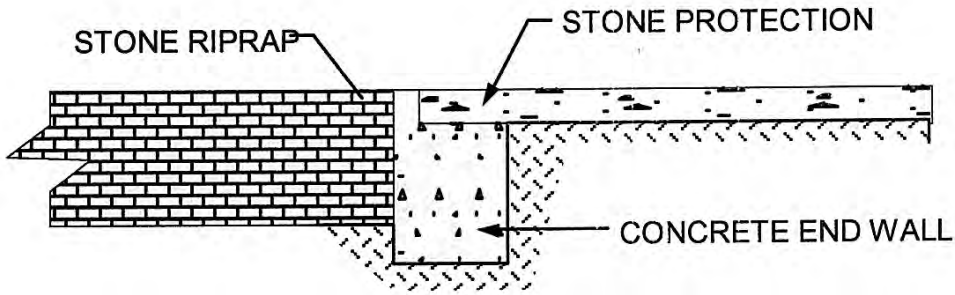
PLAN VIEW OF CONCRETE SLOPE PROTECTION



SECTION A-A



PROFILE



SECTION B-B

SAP ASSEMBLY NUMBER: 711-7451-01

BMS Flex-Action: B745102

ACTIVITY TITLE: ABUTMENT SLOPEWALL (CONSTRUCT NEW)

UNIT OF MEASUREMENT: *SQUARE YARDS OF ABUTMENTS SLOPEWALL

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 673 - Precast Cement Concrete Block
 Slopewall, Cast-in-Place Cement
 Concrete Slab Slopewall
 674 - Stone Slopewalls
 675 - Random Stone Slopewall
 1001 - Cement Concrete Structures

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. If the bridge is a water crossing, the work can usually be done most conveniently during the middle to late summer season when water levels are normally low.

WORK AREA

The filled area in front of a stub or semi-stub abutment extending from a line drawn perpendicular to the centerline of the bridge from the end of one wing to a similar line drawn from the other wing between the abutment structure at the top and the stream bed or shoulder depending upon whether the structure is a water crossing or an overpass at the bottom (see sketch).

ACTIVITY DESCRIPTION

Constructing new precast cement concrete block, cast-in-place cement concrete slab, stone or random stone abutment slope walls within the work area. The work can include, but is not limited to, installing sheeting or other water control devices; excavating material; removing deteriorated or damaged concrete masonry units; constructing forms; grading surfaces and installing aggregate and/or geotextiles; placing reinforcing steel; placing concrete; laying concrete blocks or stones; and mortaring joints.

Similar work on the bridge approaches back of the described work area should not be reported under this activity, but should be reported to appropriate highway maintenance activities.

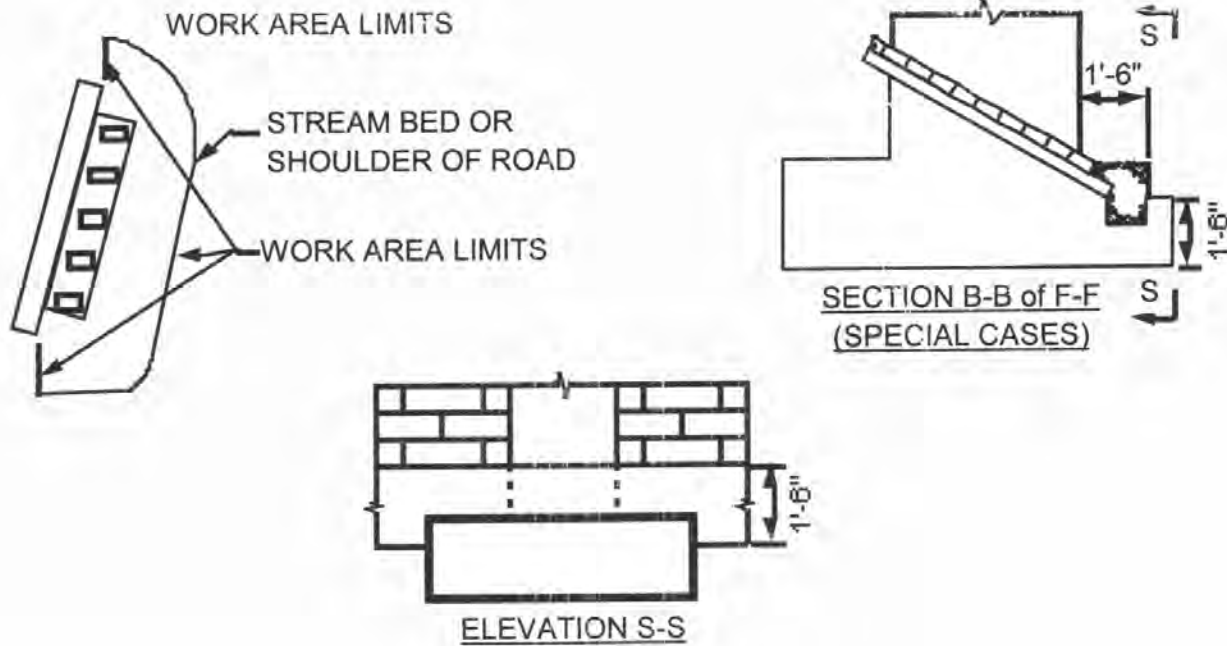
PROCEDURE DESCRIPTION

1. Remove existing deteriorated abutment slopewall.
2. Regrade slope and place sand and geotextiles as required for precast cement concrete blocks or stone.
3. Place forms and concrete, precast concrete blocks, or stones.
4. Construct cut-off and toe walls.
5. Seal joints as required.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Gradall or backhoe	1 CY	Concrete
2	Crew Members			As Required	Concrete blocks
1	Special Crew Member (Operator)	1	Concrete Mixer	As Required	Reinforcing Steel
		1	Jack Hammer	As Required	Geotextiles
				As Required	Aggregate

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
4 SY/HR	25 SY/DAY	1 MH/SY



SAP ASSEMBLY NUMBER: 711-7332-01

BMS Flex-Action: RTWALLR

ACTIVITY TITLE: INSTALL WEEP HOLES IN EXISTING MSE WALLS

UNIT OF MEASUREMENT: EACH WEEP HOLE

PROCEDURE: DRILL WEEP HOLES IN EXISTING MSE WALLS

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1060 – Painting Structural Steel
 1105 – Fabricated Structural Steel

SCHEDULING CONSIDERATIONS

The following conditions of MSE walls should determine the priority in scheduling work: a) MSE wall slightly bulging or in distress, b) Anticipated higher probability of water accumulation behind the MSE wall

WORK AREA

Drill weep holes in existing MSE walls, except in cases where bridge and approaches (for at least 500 feet at each end) are entirely in fill sections. Where MSE wall slightly bulging or in distress and or anticipated higher probability of water accumulation behind the MSE wall.

ACTIVITY DESCRIPTION

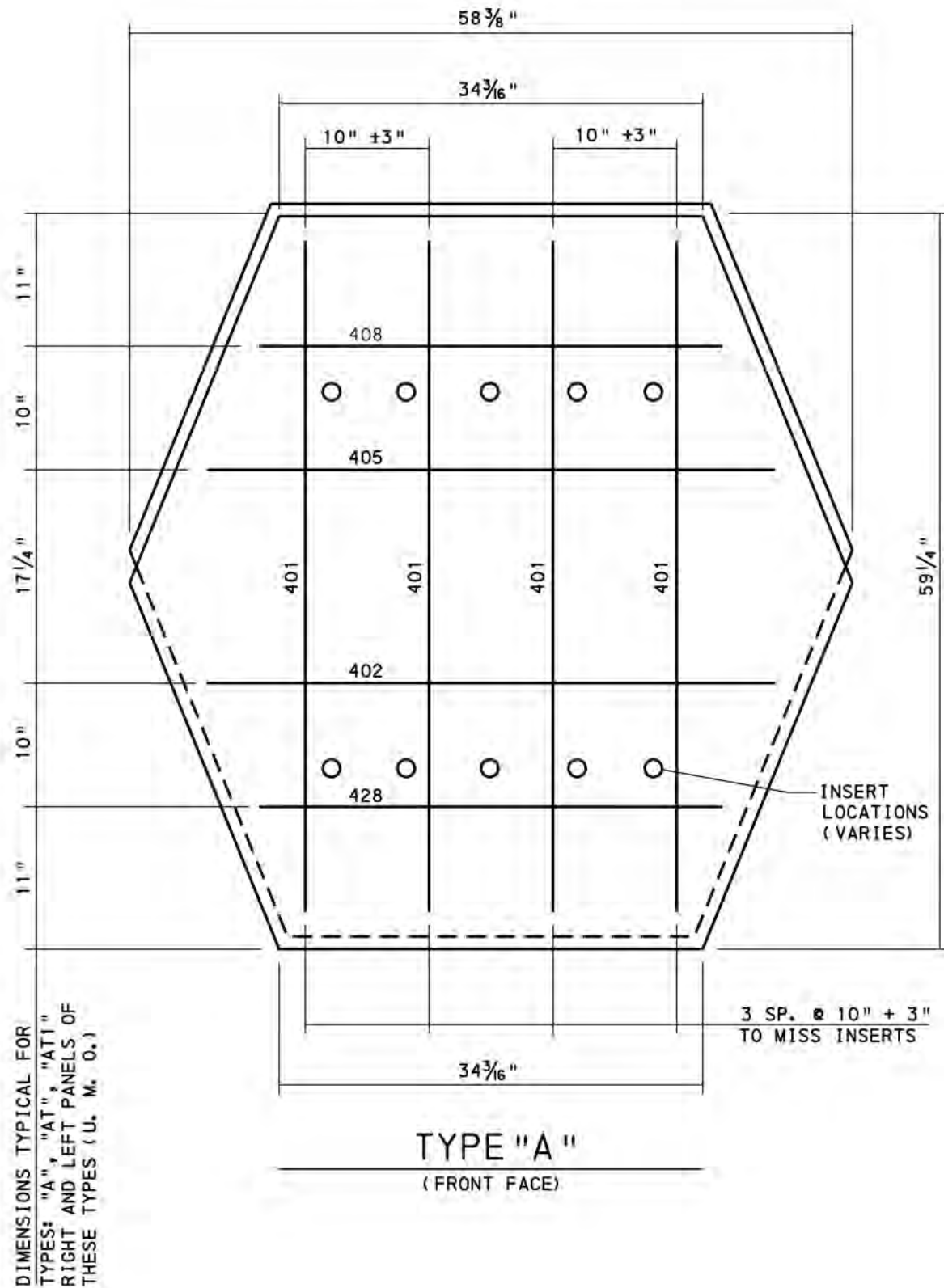
Locate anchors/inserts to avoid drilling into them. Drill weep holes spaced 5 to 10 feet apart in distressed areas. Install casing and secure it.

PROCEDURE DESCRIPTION

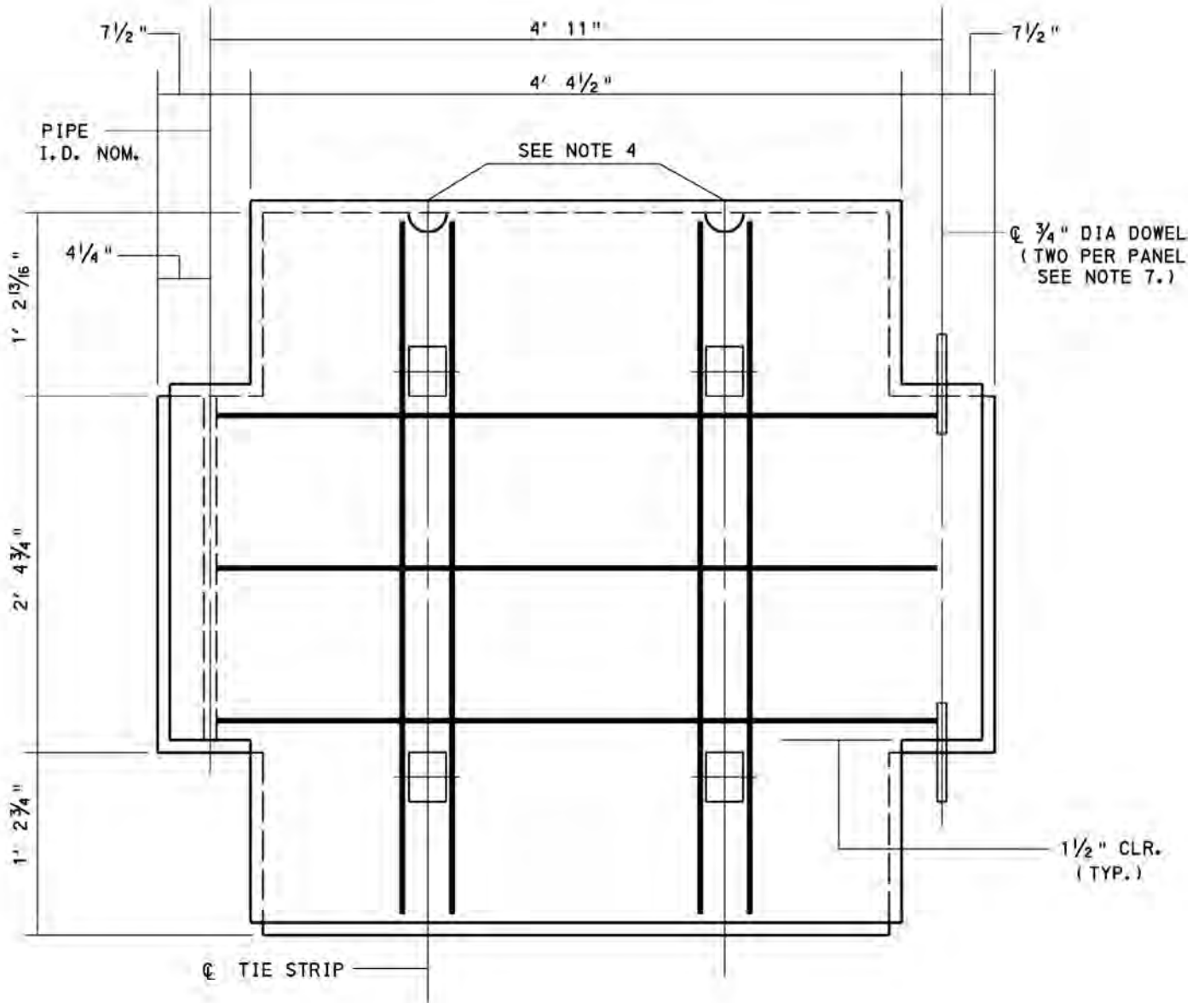
- 1) Drill weep holes in existing MSE walls, except in cases where bridge and approaches (for at least 500 feet) are entirely in fill condition, as follows:
 - a) Location of horizontal and vertical reinforcements on each panel.
 - b) Location of anchorages or connector inserts on each panel. VSL walls have two sets wire mesh connector inserts on each panel. Reinforced Earth RE walls could have two to ten tie strips per panel, depending on panel size.
 - c) Weep holes (2" diameter minimum or 4" diameter maximum) are to be installed at 5' to 10' horizontal intervals and in areas of obvious distress, bulge and water stains in the existing MSE wall panels 1'-0 minimum above the finished ground line. Wider weep hole spacing may be used if deemed appropriate. Note that the closer spacing is prescribed due the presence of 15% fine (passing the No. 200 sieve) aggregates
 - d) Holes may be drilled through the panel joint. The joint at the selected drilling location should first be filled with a fast-setting cement patching material (such as set-45). Then carbide-faced drill bit can be used to make weep hole.
 - e) For holes not in joints, use a pachometer to verify and locate the steel bars and anchor/connector inserts in the panel. The drilled hole should be a minimum of 2" away from any horizontal or vertical reinforcing bars and 6" away from any anchorage/connector location.
- 2) Drill through the panels with a heavy duty electrically operated rotary/impact drill, such as TE-72 Hilti drill set in the rotary and impact mode. Use a 3" carbide tipped bit (for 2" well casing) or a 5" carbide bit (for a 4" well casing). In a 7" to 8" thick wall panel, the desired hole will have to be drilled incrementally, using a 1/2 " cold chisel to chip away the complete portion of the desired hole.
 - 3) Upon completion of the desired hole, use a 19" and/or 27" hilti flat chisel, with drill in impact mode to loosen structure backfill to desired depth. Clean out loose material as necessary with a clean-out hole fabricated to fit into hole. Collect backfill samples and place in waterproof containers for laboratory testing, as required.
 - 4) View inside cavity and measure for required length of wall casing so it is flush with panel face. Drill a near vertical hole in the panel for placement of a nail to secure casing in the flush position with the wall panel. Wrap and tape a piece of geotextile to the deep end of the well casing, Insert the well casing and place plastic nail through the drilled hole in well casing matching the hole in the panel. Caulk annular space between well casing and the drilled hole in panel.

Equipment Needed	Hand Tools and Accessories
1- Hilti TE-72 Electrically operated Drill or equivalent	Plastic electricians tape
1- Hilti 3" (F-BK 318-12) or (G-BK 5-17) carbide tipped single piece core bit	Geotextile
1- 19" flat chisel - Hilti	2 lb Hammer
1- 27" flat chisel - Hilti	1/2" cold chisel for chipping out cored wall sections of panel (2" at a time)
1- 1/4" or 3/8" carbide tipped bit Hilti	Duct tape
1- Generator with extension cords as required	Cut steel nails or round grooved masonry nails
1- Power drill for 1/4" bit (hammer type)	Caulking gun w/ caulk cartridges
1- Pachometer for locating steel in the panels	Ball of heavy duty twine or rope
5 foot lengths on 2" or 4" well casing with 0.02 slits (Acker drill Co.)	plastic bucket, for lowering supplies
1- Clean-out rod (Hoe) for removing loosened wall backfill	plastic pint containers and lids for samples or heavy duty plastic bags
	Tape measure or ruler
	Flashlight or trouble light
	Crayon makers

RETAINED EARTH WALL PANEL



REINFORCED EARTH WALL PANEL



PANEL TYPE "A"

WITH R4 REINFORCEMENT
FRONT VIEW

Chapter 24: Culverts

Table of Contents

7452-01	HEADWALL/WINGS (REPAIR/REPLACE)	24 - 3
7452-01	APRON/CUTOFF WALL (REPAIR/REPLACE)	24 - 6
7452-01	BARREL (REPAIR)	24 - 8
7452-02	BARREL (SHOTCRETE REPAIR)	24-10

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SAP ASSEMBLY NUMBER: 711-7452-01

BMS Flex-Action: A745201

ACTIVITY TITLE: CULVERT HEADWALL/WINGS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *SQUARE YARDS OF CULVERT HEADWALLS OR WINGWALLS

PROCEDURE: REPAIR

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections.

WORK AREA

The full length and depth of masonry and concrete headwalls and wingwalls of culverts identified by the Department as having the minimum dimensions to qualify as being considered a bridge as per the Bridge Management System. These are identified as having the last two digits of 31 or 32 in the structure type code (6A29).

* **Work Measurement Note:** Square yards of either the front face or back face repaired or replaced, or both in those cases where a single replacement or repair involves both faces.

ACTIVITY DESCRIPTION

Repairing or replacing all or portions of concrete or masonry headwalls or wingwalls. The work can include, but is not limited to , installing sheeting, when necessary, and excavating material retained by or protecting the headwall or wingwall, removing deteriorated or damaged concrete, reinforcing steel; constructing forms, placing concrete, replacing and pointing masonry elements, pressure grouting masonry, epoxy pressure grouting, and replacing excavated material.

When roadway embankment or protective material such as riprap is excavated to gain access to the work, it should be replaced in conformance with standard highway maintenance procedures or with work descriptions in appropriate activities, such as Activity B745301, Rock Protection, as

applicable. However, separate reports are not required, and all the work should be reported under this activity.

PROCEDURE DESCRIPTION

1. Install siltation devices.
2. Excavate as required to set dowels and forms.
3. Remove all fractured or deteriorated concrete to sound concrete by chipping, and blast clean to remove laitances.
4. Drill and set form anchor bolts and dowels. Dowels are to be placed a minimum of 9 inches. Into sound concrete and set with non-shrink grout, or approved adhesive, 18 in. on center, front and back.
5. Cross-lace bars and set forms.
6. Just prior to placing concrete, apply epoxy bonding agent to all existing concrete that is to come into contact with new concrete.
7. Cure concrete until concrete has developed sufficient strength to resist the imposed lateral pressures before backfilling with granular material.
8. Remove siltation devices.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	As Required	Concrete Mix
3	Crew Members	1	Gradall or Backhoe	As Required	Reinforcing Steel
1	1 Special Crew Member (Operator)			As Required	Formwork
				As Required	Siltation Devices
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
1.7 SY/HR		10 SY/DAY		3 MH/SY	

SAP ASSEMBLY NUMBER: 711-7452-01

BMS Flex-Action: A745201

ACTIVITY TITLE: CULVERT HEADWALL/WINGS (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *SQUARE YARDS OF CULVERT HEADWALLS OR WINGWALLS

PROCEDURE: REPLACE

PROCEDURE DESCRIPTION

1. Install siltation devices.
2. Install sluices or other water diversion devices.
3. Remove existing wingwalls and/or headwall and excavate to sound material.
4. Clean all concrete that will be in contact with new concrete. Chip and blast-clean existing concrete to remove any unsound material and laitance.
5. Drill holes and set dowels with non-shrink grout or approved adhesive.
6. Prior to placing concrete, provide for adequately reinforced weep holes.
7. Set forms and reinforcing steel and place concrete. Just prior to placing concrete, apply epoxy bonding compound to all existing cleaned concrete that is to come in contact with fresh new concrete.
8. Backfill adequately cured concrete, wingwalls. Suitable filter shall be provided for weep holes.
9. Provide scour protection for wings.
10. Remove siltation devices.
11. Remove sluices or other water diversion devices.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Concrete Mixer	As Required	Concrete Mix
3	Crew Members	1	Gradall or Backhoe	As Required	Reinforcing Steel
1	1 Special Crew Member (Operator)			As Required	Riprap
				As Required	Siltation Devices

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1.7 SY/HR	10 SY/DAY	3 MH/SY

SAP ASSEMBLY NUMBER: 711-7452-01

BMS Flex-Action: B745202

ACTIVITY TITLE: CULVERT APRON/CUTOFF WALL (REPAIR/REPLACE)

UNIT OF MEASUREMENT: *SQUARE YARDS OF APRON CUTOFF WALL

PROCEDURE: GENERAL REPLACEMENT

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Work can be most efficiently performed during periods of low water which are most likely to occur during late summer or early fall.

WORK AREA

The entire width and length of existing masonry and concrete aprons and cutoff walls of culverts identified by the Department as having the minimum dimensions to qualify as being considered a bridge identified in the Bridge Management System. These are identified as having the last two digits of 31 or 32 in the structure type code, (6A29).

* **Special Measurement Note:** Square yards measured horizontally for aprons and vertically for cutoff walls.

ACTIVITY DESCRIPTION

Repairing and replacing all or portions of existing culvert cement concrete or masonry aprons and cutoff walls. The work can include, but is not limited to, constructing sluices or providing other means to conduct water through the structure and to protect the work and freshly placed concrete from flowing water; driving sheeting; removing deteriorated masonry units, mortar concrete, and reinforcing steel; excavating material to the required dimensions; placing and compacting suitable base material; drilling and installing dowels; constructing forms; placing and tying reinforcing steel; placing concrete; placing and

pointing masonry units; and backfilling.

PROCEDURE DESCRIPTION

1. Install siltation devices.
2. Construct sluices or other devices to divert stream.
3. Remove deteriorated masonry.
4. Excavate unsuitable material.
5. Place and compact base material.
6. Drill holes and set dowels with non-shrink grout or approved adhesive.
7. Construct formwork.
8. Place reinforcing steel.
9. Place concrete. Just prior to placing concrete, apply epoxy bonding agent to all existing concrete that is come into contact with new concrete.
10. Remove formwork.
11. Remove sluices and siltation devices.
12. Grade Streambed.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Backhoe	As Required	Concrete
3	Crew Members	1	Drill	As Required	Reinforcing Steel
1	Special Crew Member (Operator)			As Required	Epoxy
				As Required	Dowels
				As Required	Base Material
				As Required	Backfill
				As Required	Sluice Material
				As Required	Siltation Devices

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1.3 SY/HR	8 SY/DAY	3.75 MH/SY

SAP ASSEMBLY NUMBER: 711-7452-01

BMS Flex-Action: C745203

ACTIVITY TITLE: CULVERT BARREL (REPAIR)

UNIT OF MEASUREMENT: *SQUARE YARDS OF CULVERT BARREL

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1002 - Reinforcement Bars
 1003 - Dowel Holes
 1017 - Pressure Mortar Pointing and Surfacing

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Work can be most efficiently performed during periods of low water which are most likely to occur during late summer or early fall.

WORK AREA

The full length and width of masonry and concrete culvert barrels of culverts identified by the Department as having the minimum dimensions to qualify as being considered a bridge identified in the Bridge Management System. These are identified as having the last two digit of 31 or 32 in the structure type code, (6A29). In addition any area required to install flow control devices which are needed to facilitate the work.

* **Work Measurement Note:** Square yards of either the inside face or outside face repaired, or both in those cases where a single repair involves both faces.

ACTIVITY DESCRIPTION

Repairing all or portions of concrete or masonry culvert barrel. The work can include, but is not limited to, constructing sluices or providing other means to control water flow through the culvert so the work can be accomplished; driving sheeting; excavating material; removing deteriorated concrete, reinforcing steel or masonry; epoxy pressure grouting; and replacing excavated material.

When roadway embankment or pavement is excavated to gain access to the work, it should be replaced in conformance with standard highway maintenance procedures. Separate reports are not required, however, and all work should be reported under this activity.

PROCEDURE DESCRIPTION

1. Install siltation devices.
2. Construct sluices or other devices to divert stream.
3. Remove deteriorated masonry.
4. Drill holes and set dowels with non-shrink grout or approved adhesive.
5. Construct formwork.
6. Place reinforcing steel.
7. Place concrete. Just prior to placing concrete, apply epoxy bonding agent to all existing concrete that is to come in contact with new concrete.
8. Replace, repair and point masonry elements.
9. Pressure inject any cracks with epoxy cement.
10. Remove sluices.
11. Remove siltation devices.
12. Backfill, if necessary.

NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Backhoe	As Required	Concrete
3	Crew Members	1	Drill	As Required	Reinforcing Steel
1	Special Crew Member (Operator)	1	Pressure Injection Equip	As Required	Epoxy Cement
				As Required	Dowels
				As Required	Backfill
				As Required	Sluice Material
				As Required	Siltation Devices
				As Required	Grout

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 SY/HR	1 SY/DAY	30 MH/SY

SAP ASSEMBLY NUMBER: 711-7452-02

BMS Flex-Action: C745204

ACTIVITY TITLE: METAL ARCH CULVERT BARREL STRUCTURAL SHOTCRETE (REPAIR)

UNIT OF MEASUREMENT: *SQUARE YARDS OF CULVERT BARREL

PROCEDURE: GENERAL PROCEDURE

REFERENCES

- PennDOT Specifications (PUB 408)
- Section 709 - Steel Welded Wire Fabric
- Section 1002 - Reinforcement Bars
- Section 1043 - Shotcrete

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Work can be most efficiently performed during periods of low water which are most likely to occur during late summer or early fall.

WORK AREA

The full length and width of metal arch culvert barrels identified by the Department as having the minimum dimensions to qualify as being considered a bridge identified in the Bridge Management System. These are identified as having the last two digit of 35 in the structure type code, (6A29). In addition any area required to install flow control devices which are needed to facilitate the work.

* **Work Measurement Note:** Square yards of the inside face of the corrugated metal arch culvert.

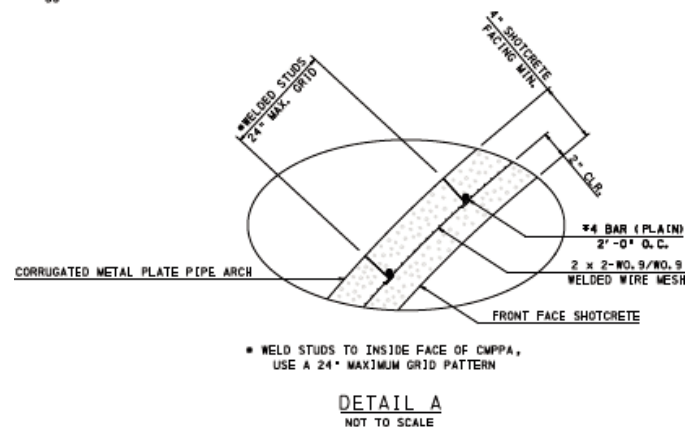
ACTIVITY DESCRIPTION

Repairing all or portions of corrugated metal arch culvert barrel. The work can include, but is not limited to, constructing sluices or providing other means to control water flow through the culvert so the work can be accomplished; removing all foreign matter from all metal surfaces receiving welded connections; arc gun welding steel studs to the existing arch, installing steel reinforcement bars and welded wire mesh fabric reinforcement, and applying shotcrete facing to the inside of the metal arch culvert barrel.

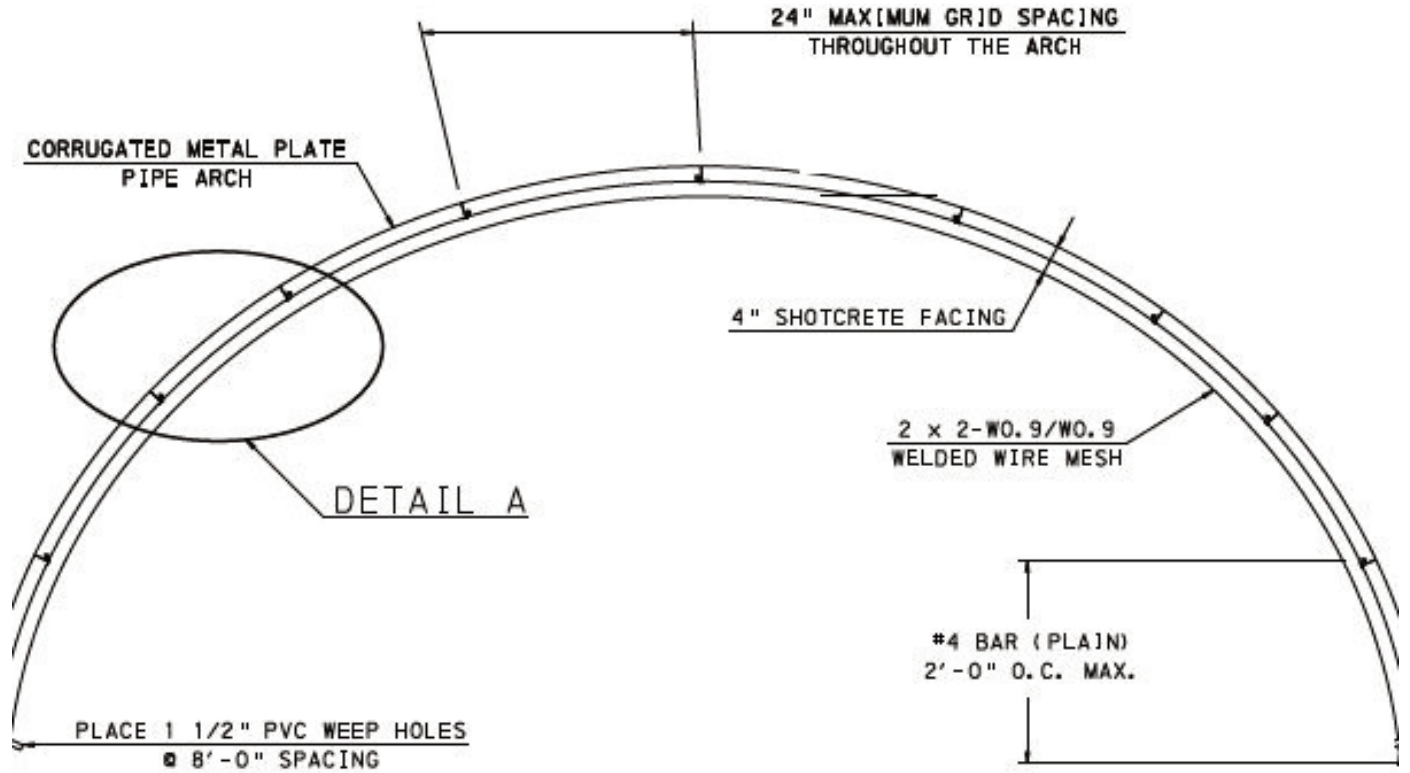
When roadway embankment or pavement is excavated to gain access to the work, it should be replaced in conformance with standard highway maintenance procedures. Separate reports are not required, however, and all work should be reported under this activity.

PROCEDURE DESCRIPTION

1. Install siltation and all E & S devices.
2. Construct sluices or other devices to divert stream. Maintain dewatering operations at all times.
3. Remove and dispose of any loose scale rust from the inside of the existing metal arch culvert.
4. Install steel studs by arc welding gun process to the culvert on a 24"x24" maximum square grid pattern. Attach the No. 4 reinforcing bars to the steel studs.
5. Attach doubled 4"x4" 8 gauge welded wire mesh reinforcement mats (to form a maximum 2" x 2" opening).
6. Spray a 4" thickness of shotcrete facing to the inside of the metal arch culvert. Hand finish to a uniform smooth finish. Dewatering operations will have to be maintained for a minimum of 24 hours to ensure the shotcrete has sufficient time to harden; before allowing stream to return through the arch.



NOTE: Comply with all applicable permit and procedural requirements of the Department of Environmental Resources, Pennsylvania Fish Commission and local Conservation districts in accomplishing this procedure.



GENERAL CONCEPT
TYPICAL SECTION

N.T.S.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Metal Arc Welder	As Required	Shotcrete
5	Crew Members	1	Shotcrete Equip	As Required	Reinforcement Bar
1	Special Crew Member (Operator)	1	Misc. Hand Tools	As Required	Sluice Material
				As Required	Siltation Devices
					Steel Welded
					Wire Mesh
					Reinforcement

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
.17 SY/HR	1 SY/DAY	30 MH/SY

Chapter 25: Erosion Control

Table of Contents

7453-01	STREAMBED PAVING (REPAIR/CONSTRUCT).....	25 - 3
7453-01	PAVING METAL BOTTOM PIPES, ARCHES, AND CULVERTS	25 - 5
7453-01	ROCK PROTECTION - DUMPED RIP RAP	25 - 7
7453-01	ROCK PROTECTION - GABION BASKETS	25 - 9
7453-01	STREAM DEFLECTOR (REPAIR/CONSTRUCT)	25 - 10
7453-02	SCOUR HOLE (BACKFILL)	25 - 12
7453-03	VEGETATION/DEBRIS (REMOVE)	25 - 14
7453-03	DEPOSITION (REMOVE)	25 - 16

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SAP ASSEMBLY NUMBER: 711-7453-01

BMS Flex-Action: A745301

ACTIVITY TITLE: STREAMBED PAVING (REPAIR/CONSTRUCT)

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE STREAMBED PAVING

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 667 - Cement Concrete Paving for
 Streambed
 1003 - Dowel Holes
 BD 632M (For fish passage baffles)

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections and/or changes in stream flow or conditions that increase the potential for scour problems. Work can be most efficiently performed during periods of low water, which are likely to occur during later summer and early fall. Be aware of any seasonal environmental restrictions.

WORK AREA

The entire width and breath of existing paved streambed areas or areas indicated on plans for new streambed paving, plus sufficient additional space to allow for required excavation and for the construction of sluices or other means to conduct water through the structure during the paving operation.

* **SPECIAL MEASUREMENT NOTE:** Cubic yards of concrete placed (not removed or repaired).

ACTIVITY DESCRIPTION

Repairing existing areas of cement concrete streambed paving or constructing new cement concrete streambed paving in accordance with plans prepared for the work. The work can include, but is not limited to, constructing sluices or installing sheeting or providing other means to conduct water through the structure and to protect the work area and freshly placed concrete from flowing water; removing deteriorated concrete, reinforcing steel and unsuitable material below the bottom of the paving; excavating material to the required dimensions to depress the culvert floor 1 foot below stream bed; placing and compacting suitable base material; drilling and grouting dowels; constructing forms; placing and tying reinforcing steel; placing concrete and concrete fish passage baffles; saw cutting concrete; and placing preformed joint filler.

When protective material such as riprap is excavated to gain access to the work, it should be replaced in conformance with work descriptions in appropriate activities, such as Activity B745301, Rock Protection. However, a separate report is not required, and the work should be reported under this activity.

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies
2. Divert upstream flow with a sump or dam and pump water via conduit to the other side of the culvert. This dewatering scheme will be part of the overall E & S approval. Refer to PUB 464.
3. Clean out debris and silt as required.
4. Construct reinforced paving to a depth of 12", as needed, and place riprap at the outlet end as needed. Do not finish off concrete, leave the surface rough to allow turbulent flows and depositions.
5. Allow concrete to harden (enough to walk on), install concrete fish passage baffles in accordance with BD-632M or as per PFBC/DEP direction, flush concrete with stream water and pump upland until pH level is below 9. Measure pH with a calibrated meter and not pH paper. Upland discharge will preclude any reentry of water into the stream and any erosion effects.
6. Remove sump or dams and restore stream flow. Seed and mulch as required following approved E & S Controls.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Excavation Equip	1 CY	Concrete
3	Crew Members	1	Drill	As Required	Siltation Devices
1	Special Crew Member (Operator)		Concrete Saw	As Required	Backfill
				As Required	Dowels
				As Required	Reinforcing Steel
				As Required	Joint Filler
					Material

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1 CY/HR	6 CY/DAY	5 MH/CY

SAP ASSEMBLY NUMBER: 711-7453-01

BMS Flex-Action: A745301

ACTIVITY TITLE: PAVING METAL BOTTOM PIPES, ARCHES, AND CULVERTS

UNIT OF MEASUREMENT: *CUBIC YARDS OF CONCRETE PAVING

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 667 - Cement Concrete Paving for
 Streambeds
 1003 - Dowel Holes
 BD 632M

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections and/or changes in stream flow or conditions that increase the potential for scour problems. Work can be most efficiently performed during periods of low water, which are likely to occur during later summer and early fall. Be aware of any seasonal environmental restrictions.

WORK AREA

The entire width and breadth of existing paved streambed areas or areas indicated on plans for new streambed paving, plus sufficient additional space to allow for required excavation and for the construction of sluices or other means to conduct water through the structure during the paving operation.

* **SPECIAL MEASUREMENT NOTE:** Cubic yards of concrete placed (not removed or repaired).

ACTIVITY DESCRIPTION

Repairing existing areas of cement concrete streambed paving or constructing new cement concrete streambed paving in accordance with plans prepared for the work. The work can include, but is not limited to, constructing sluices or installing sheeting or providing other means to conduct water through the structure and to protect the work area and freshly placed concrete from flowing water; removing deteriorated concrete, reinforcing steel and unsuitable material below the bottom of the paving; excavating material to the required dimensions; to depress the culvert floor 1 foot below streambed; placing and compacting suitable base material; drilling and grouting dowels; constructing forms; placing and tying reinforcing steel; placing concrete; concrete fish passage baffles; saw cutting concrete; and placing

preformed joint filler.

When protective material such as riprap is excavated to gain access to the work, it should be replaced in conformance with work descriptions in appropriate activities, such as Activity B745301, Rock Protection. However, a separate report is not required, and the work should be reported under this activity.

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies
2. Divert upstream flow with a sump or dam and pump water via conduit to the other side of the culvert. This dewatering scheme will be part of the overall E & S approval. Refer to PUB 464.
3. Clean out debris and silt as required.
4. Construct reinforced paving to a depth of 6" to 8", as needed, and place riprap at the outlet end as needed. Do not finish off concrete, leave the surface rough to allow turbulent flows and depositions.
5. Install concrete fish passage baffles in accordance with BD-632M or as per PFBC/DEP direction.
6. Allow concrete to harden (enough to walk on), flush concrete with stream water and pump upland until pH level is below 9. Measure pH with a calibrated meter and not pH paper. Upland discharge will preclude any reentry of water into the stream and any erosion effects.
7. Remove sump or dams and restore stream flow. Seed and mulch as required, following approved E & S Controls.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Excavation Equip	1 CY	Concrete
3	Crew Members	1	Drill	As Required	Siltation Devices
1	Special Crew Member (Operator)	1	Concrete Saw	As Required	Backfill
				As Required	Dowels
				As Required	Reinforcing Steel
				As Required	Joint Filler Material

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1 CY/HR	6 CY/DAY	5 MH/CY

SAP ASSEMBLY NUMBER: 711-7453-01

BMS Flex-Action: B745301

ACTIVITY TITLE: ROCK PROTECTION

UNIT OF MEASUREMENT: *CUBIC YARDS OF ROCK PROTECTION

PROCEDURE: DUMPED RIPRAP

REFERENCES

PennDOT Specifications (PUB 408)

Section 626 - Gabions

674 - Stone Slope Walls

850 - Rock Lining

DM 4 Chapter 7

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections and/or changes in stream flow or conditions that increase the potential for scour problems. Be aware of any seasonal environmental restrictions.

WORK AREA

All areas at and adjacent to bridge substructure units that are subject to scour and require rock protection.

ACTIVITY DESCRIPTION

Restoring existing rock protection by relocating existing rock and placing additional rock as required, or placing new rock protection at and adjacent to bridge substructure units. The work can include, but is not limited to, removing dislocated existing rock; preparing surface by excavating unsuitable material, backfilling, placing material, and grading surface; placing geotextiles; placing gabion baskets; and placing rock either directly on geotextiles and prepared; choking the tops of Riprap placed in a streambed with streambed material.

The minimum size of stone in rock protection should be based on a maximum anticipated velocity of water per DM 4 Chapter 7 section PP 7.2.5.

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies.
2. Install siltation devices.
3. Prepare foundation by removing unsuitable base material if required.
4. Backfill with suitable base material if required.
5. Place geotextiles if appropriate.
6. Place Riprap of the size specified by dumping to depth specified.
7. Choke with streambed material if required.
8. Remove siltation devices.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Excavation Equip	1 CY	Riprap
3	Crew Members				
1	Special Crew Member (Operator)	2	Rock Stick		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1 CY/HR	6 CY/DAY	5 MH/CY

SAP ASSEMBLY NUMBER: 711-7453-01

BMS Flex-Action: B745301

ACTIVITY TITLE: ROCK PROTECTION

UNIT OF MEASUREMENT: *CUBIC YARDS OF ROCK PROTECTION

PROCEDURE: GABION BASKETS

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies.
2. Install siltation devices.
3. Excavate and remove all unsuitable material below the face of the wingwall to be retained or stabilized.
4. As required, replace unsuitable material with an acceptable granular material and thoroughly compact the entire foundation to a firm, even surface.
5. Place specified geotextile fabric or place cement concrete pad.
6. Assemble, bind, join, and place gabions.
7. Fill Type A gabions by hand, or with small power equipment, using specified aggregate.
8. As specified, secure lid to sides, ends, and diaphragms using connecting wire.
9. Place the specified large rock buttress at a one-to-one slope.
10. Remove siltation devices.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Excavation Equip	1 CY	Aggregates or Large Rocks
3	Crew Members			As Required	Siltation Screens
1	Special Crew Member (Operator)			As Required	Backfill
				As Required	Gabions
				As Required	Geotextile Fabric

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1 CY/HR	6 CY/DAY	5 MH/CY

SAP ASSEMBLY NUMBER: 711-7453-01**BMS Flex-Action:** D745302**ACTIVITY TITLE:** STREAM DEFLECTOR (REPAIR/CONSTRUCT)**UNIT OF MEASUREMENT:** CUBIC YARDS**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)

Section 206 - Embankment

626 - Gabions

850 - Rock Lining

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections and/or hydraulic evaluations. Work can be most efficiently performed during periods of low water which are most likely to occur during later summer or early fall. Be aware of any seasonal environmental restrictions.

WORK AREA

Areas of stream banks adjacent to bridges at existing stream deflectors or as shown on the plan for new stream deflectors.

ACTIVITY DESCRIPTION

Repairing existing or constructing new stream deflectors. The work can include, but is not limited to, removing displaced existing embankment protection material; excavating unsuitable material; driving sheet piling; and placing embankment protection materials.

When appropriate portions of the work shall be performed in accordance with other pertinent activities such as Activity B745301, Rock Protection, or Activity ECREMDP, Deposition (remove), but separate activity reports are not required and all work should be reported under this activity.

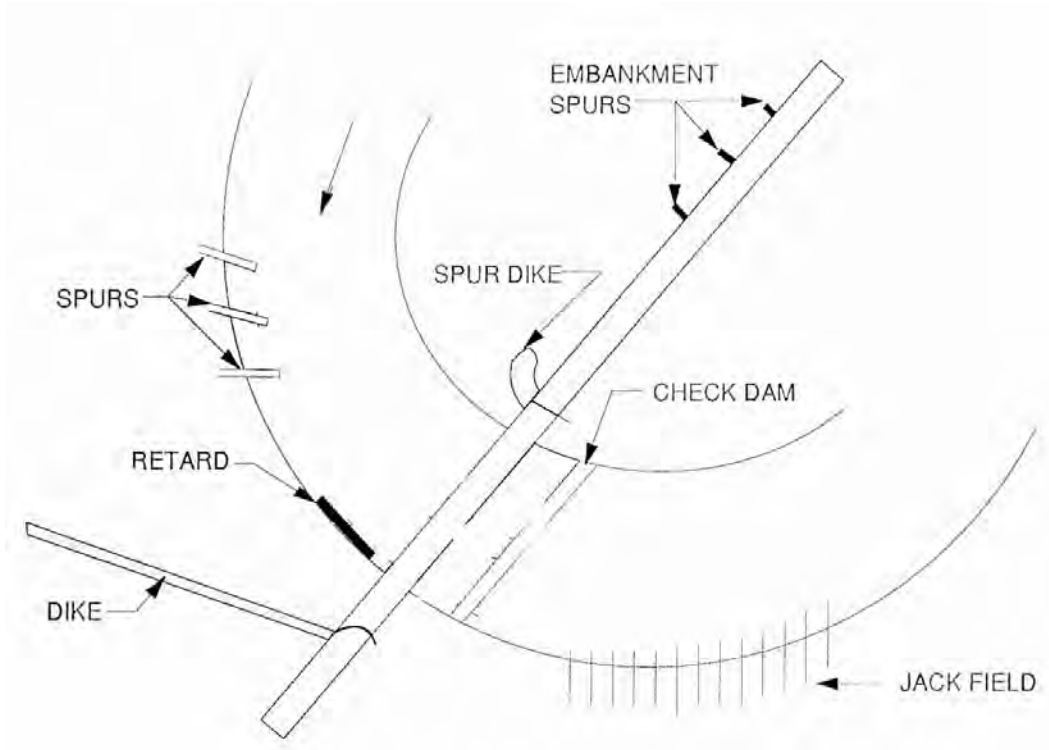
PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies.
2. Install siltation devices.
3. Remove displaced existing embankment protection material and dispose of properly.
4. Excavate unsuitable material and dispose of properly.
5. Drive piling as shown on plans.
6. Place and compact suitable material.
7. Place geotechnical fabric.
8. Place embankment protection material.
9. Remove siltation devices.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Excavation Equip	1 CY	Embankment Protection Material Sheeting Geotextile Fabric
3	Crew Members	1	Pile Driver	As Required	
2	Special Crew Members (Operators)	1	Crane	As Required	

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
1 CY/HR	6 CY/DAY	6 MH/CY



SAP ASSEMBLY NUMBER: 711-7453-01**BMS Flex-Action:** C745301**ACTIVITY TITLE:** SCOUR HOLE**UNIT OF MEASUREMENT:** *CUBIC YARDS OF BACKFILL**PROCEDURE:** EXCAVATE AND FILL

REFERENCES

PennDOT Specifications (PUB 408)
Section 703 - Aggregates
(PUB 23 and PUB 238)

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections. Inspections in addition to regularly scheduled inspections may be appropriate following unusually high water, particularly in areas where scourable material is present and where scour holes previously occurred. Be aware of any seasonal environmental restrictions.

WORK AREA

All areas of stream beds at and adjacent to substructure units where scour holes are present and cause potential hazard to a bridge.

***SPECIAL MEASUREMENT NOTE:** Cubic yards of material placed, not excavated.

ACTIVITY DESCRIPTION

Filling scour holes at and adjacent to substructure units with scour resistant material, typically large riprap. The work can include, but is not limited to, excavation of silt or other highly scourable material naturally deposited in scour holes.

Allied work such as the removal of debris that is a contributing cause to the formation of a scour hole and the placing of heavy rock around a pier to prevent a scour hole from becoming a hazard to a pier should be reported under appropriate activities such as Activity B745301, Rock Protection, and

Activity ECREMVG, Vegetation/Debris (Remove).

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies.
2. Install siltation devices.
3. Excavate highly scourable material and dispose of properly.
4. Place scour resistant material, choke with streambed material if required.
5. Remove siltation devices.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Excavation Equip	1 CY	Scour Resistant
3	Crew Members	1	Rock Stick		Material
2	Special Crew Member (Operators)			As Required	Siltation Devices

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
2 CY/HR	12 CY/DAY	2.5 MH/CY

SAP ASSEMBLY NUMBER: 711-7453-03**BMS Flex-Action:** ECREMVG**ACTIVITY TITLE:** VEGETATION/DEBRIS (REMOVE)**UNIT OF MEASUREMENT:** CUBIC YARDS OF VEGETATION OR DEBRIS REMOVED**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

None

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or as reported by bridge maintenance personnel. Debris is likely to collect at substructure units during a period of high water to help reduce scour problems. Be aware of any seasonal environmental restrictions.

WORK AREA

Areas around substructure units where debris has collected, and areas of stream beds and banks adjacent to the structure under State control where standing vegetation impedes stream flow or might become dislodged and cause hazardous conditions in the future.

ACTIVITY DESCRIPTION

Removing and disposing of vegetation and debris which is growing or has collected in the work area. The work can include, but is not limited to, removing debris collected around substructure units by manual and/or mechanically assisted means; cutting down and removing growing vegetation; loading material in truck; and disposing of material at an approved dumping location.

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies.
2. Remove debris collected around substructure.
3. Remove vegetation from stream banks and the streambed as permitted.
4. Dispose of debris and vegetation properly.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Chain Saw		(None)
3	Crew Members	As Required	Bush Ax		
1	Special Crew Member	1	Excavation Equip		
	(Operators)	1	Winch or Pulling Equip		

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
3.3 CY/HR	20 CY/DAY	1.5 MH/CY

SAP ASSEMBLY NUMBER: 711-7453-03**BMS Flex-Action:** ECREMDP**ACTIVITY TITLE:** DEPOSITION (REMOVE)**UNIT OF MEASUREMENT:** CUBIC YARDS OF DEPOSITED MATERIAL REMOVED**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

None

SCHEDULING CONSIDERATIONS

Based on need as indicated by bridge inspections or as reported by bridge maintenance personnel. Material deposited during periods of high water especially if the material is deposited in a manner that will change the direction or velocity of the flow increasing the possibility of scour. Be aware of any seasonal environmental restrictions.

WORK AREA

Streambeds and banks at and adjacent to bridge substructure units where excess material has been deposited that reduces the hydraulic efficiency of the structure.

ACTIVITY DESCRIPTION

Excavating and disposing of soil, clay silt, sand, gravel or rock that has been deposited in streambeds and on stream banks at and adjacent to bridge substructure units. The work can include, but is not limited to, excavating deposited material; grading streambeds and banks; loading material in trucks; and disposing of material at approved dumping locations.

If the deposition of material has been initiated because of a collection of debris or vegetation, the debris and vegetation should be removed in accordance with Activity ECREMVG, Vegetation/Debris (Remove), but separate activity reports are not necessary. All required work is to be reported under this activity.

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies.
2. Install siltation devices.
3. Excavate deposition as permitted and dispose of properly.
4. Grade streambed and banks, if required.
5. Remove siltation devices.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	As req'd	Excavation Equip	As Required	Silt Barrier
2	Crew Members				
2	Special Crew Member (Operators)				

PRODUCTION UNITS/HOURS	PLANNING UNITS	PERFORMANCE STANDARD
4 CY/HR	24 CY/DAY	1.25 MH/CY

Chapter 26: Construct Temporary

Table of Contents

7454-01	SUPPORT BENT	26 - 3
7454-01	PIPES.....	26 - 11
7454-01	BRIDGE.....	26 - 13

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SAP ASSEMBLY NUMBER: 711-7454-01

BMS Flex-Action: A745401

ACTIVITY TITLE: CONSTRUCT TEMPORARY SUPPORT BENT

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 1001 - Cement Concrete Structures
 1005 - Piles
 1031 - Timber Structures

SCHEDULING CONSIDERATIONS

Based on need as indicated by evaluations of bridge inspection reports and other pertinent data by the Review Engineer.

WORK AREA

All areas shown on plans as required for installation of temporary support bents, placing of equipment, access to the work, and portions of existing superstructures or substructures at end adjacent to the bents.

ACTIVITY DESCRIPTION

Constructing temporary bents to support superstructures or substructures as indicated on the plans provided by the Department for the work. The work can include, but is not limited to, driving piles; excavating material; installing structural steel; cutting, drilling and erecting timber members; and modifying existing superstructures or substructures to accept attachments to the bents or loads imposed by them.

Work under this activity is intended to temporarily support or strengthen structures to eliminate or raise posting limits, to allow the passage of overweight permit vehicles, to protect the bridge and the public using it pending structure rehabilitation or replacement, or for a similar specific primary purpose. Work to provide temporary supports or jacking platforms so that a maintenance activity such as Activity D744802, Piers (repair), can be performed should be reported to that activity and not to this activity.

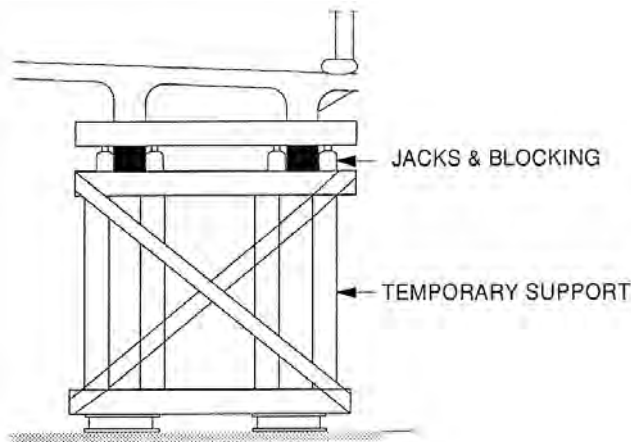
PROCEDURE DESCRIPTION

1. Obtain necessary permits
2. Modify structure to accept new load distribution if necessary.
3. Prepare foundation for temporary bent or drive piles depending on bent type selected.
4. Construct bent.
5. Jack superstructure (depending on type of support being installed).
6. Block and shim as necessary.
7. Remove jacks and check for distress.

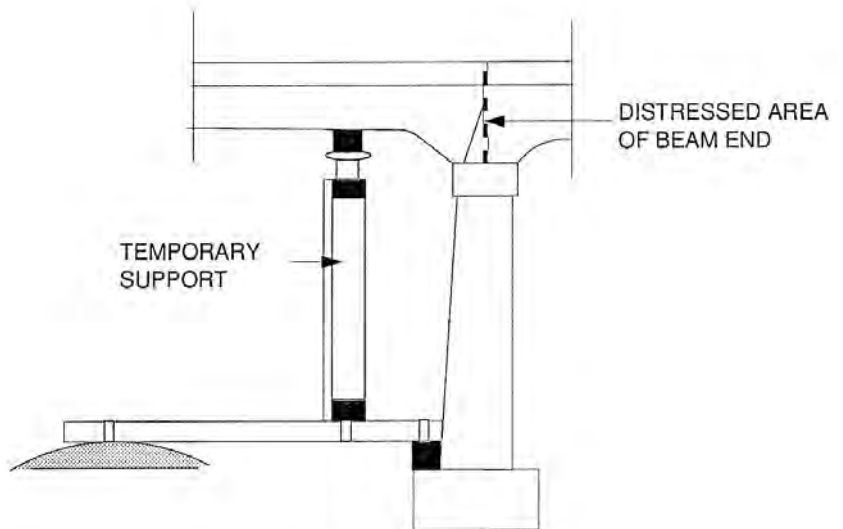
ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Crane	1 Each	Temporary Bent Blocking Shims
3	Crew Members	1	Pile Driver with Jack	As Required	
1	Special Crew Member (Operator)			As Required	
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.03 BEA/HR		30 EA/DAY		.6 MH/EA	

ALTERNATE NO. 1

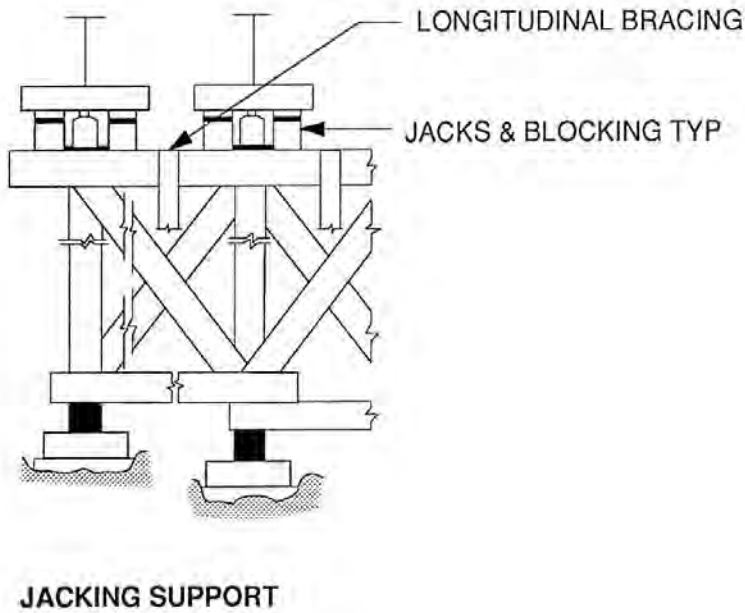
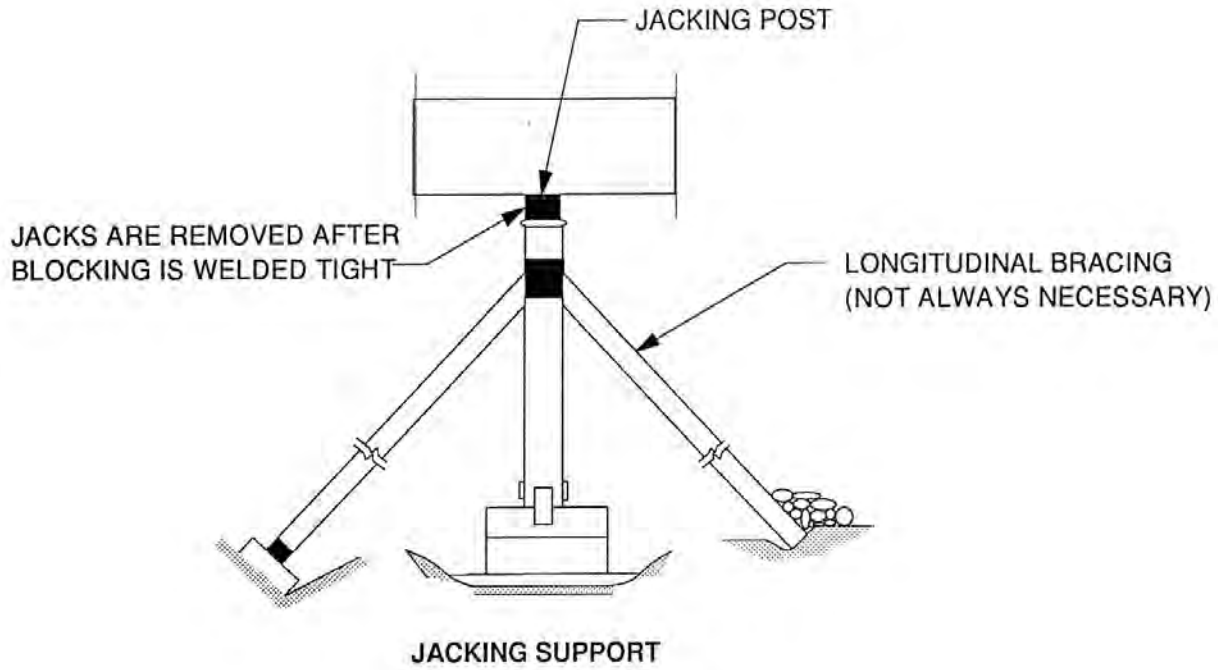


PARTIAL TRANSVERSE SECTION

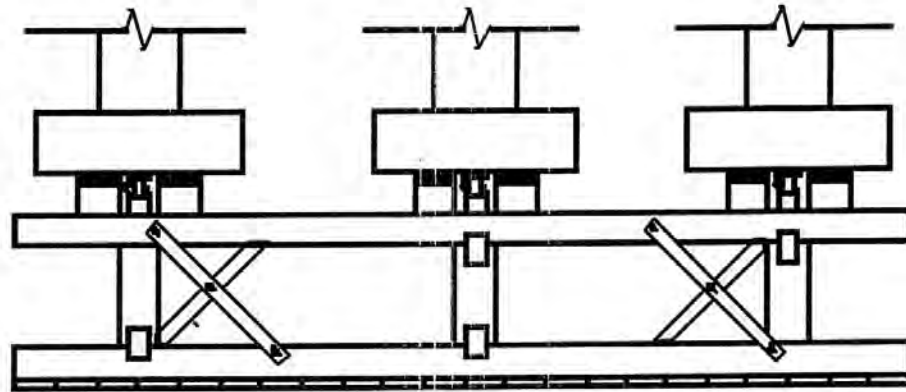


PARTIAL SIDE ELEVATION

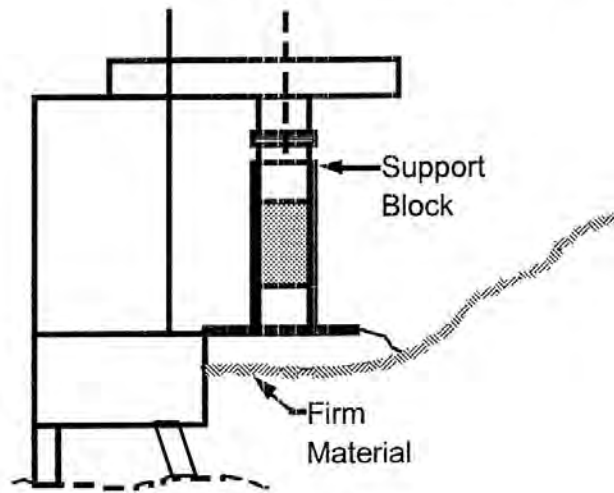
ALTERNATE NO. 2



ALTERNATE NO. 3

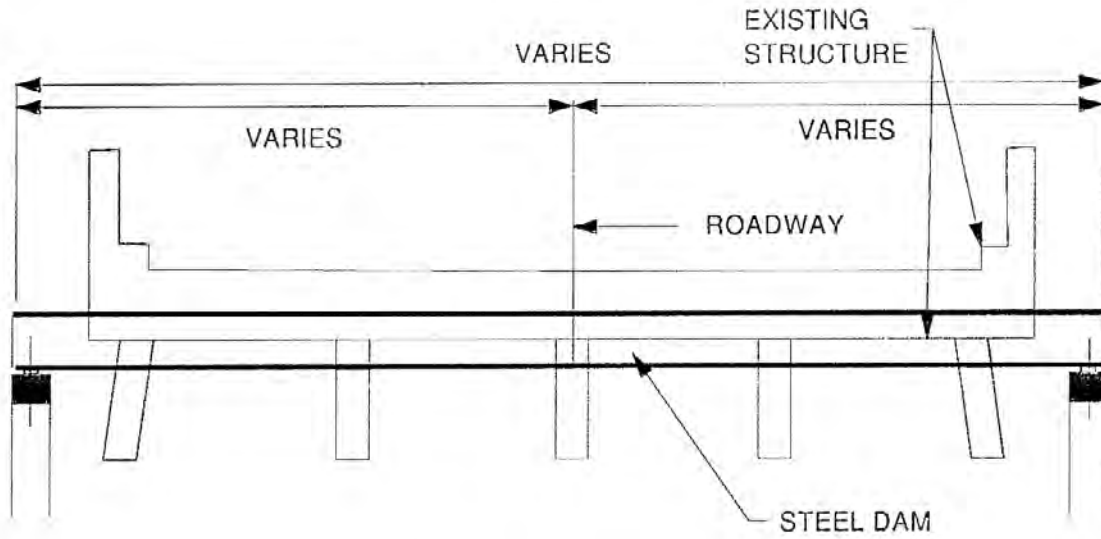


Details of Temporary Bent



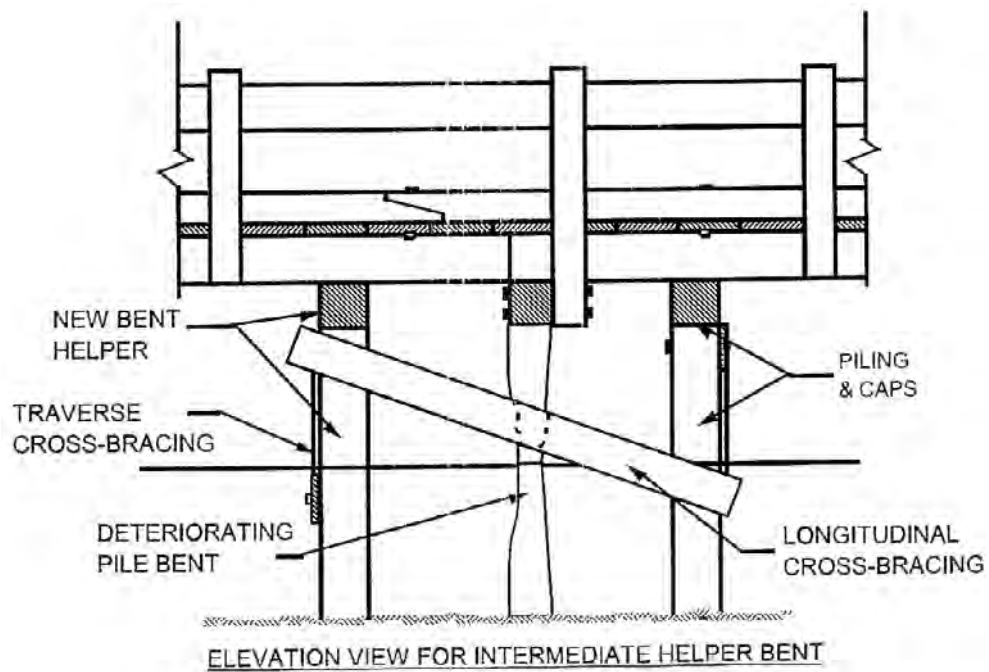
SECTION A-A

ALTERNATE NO. 4



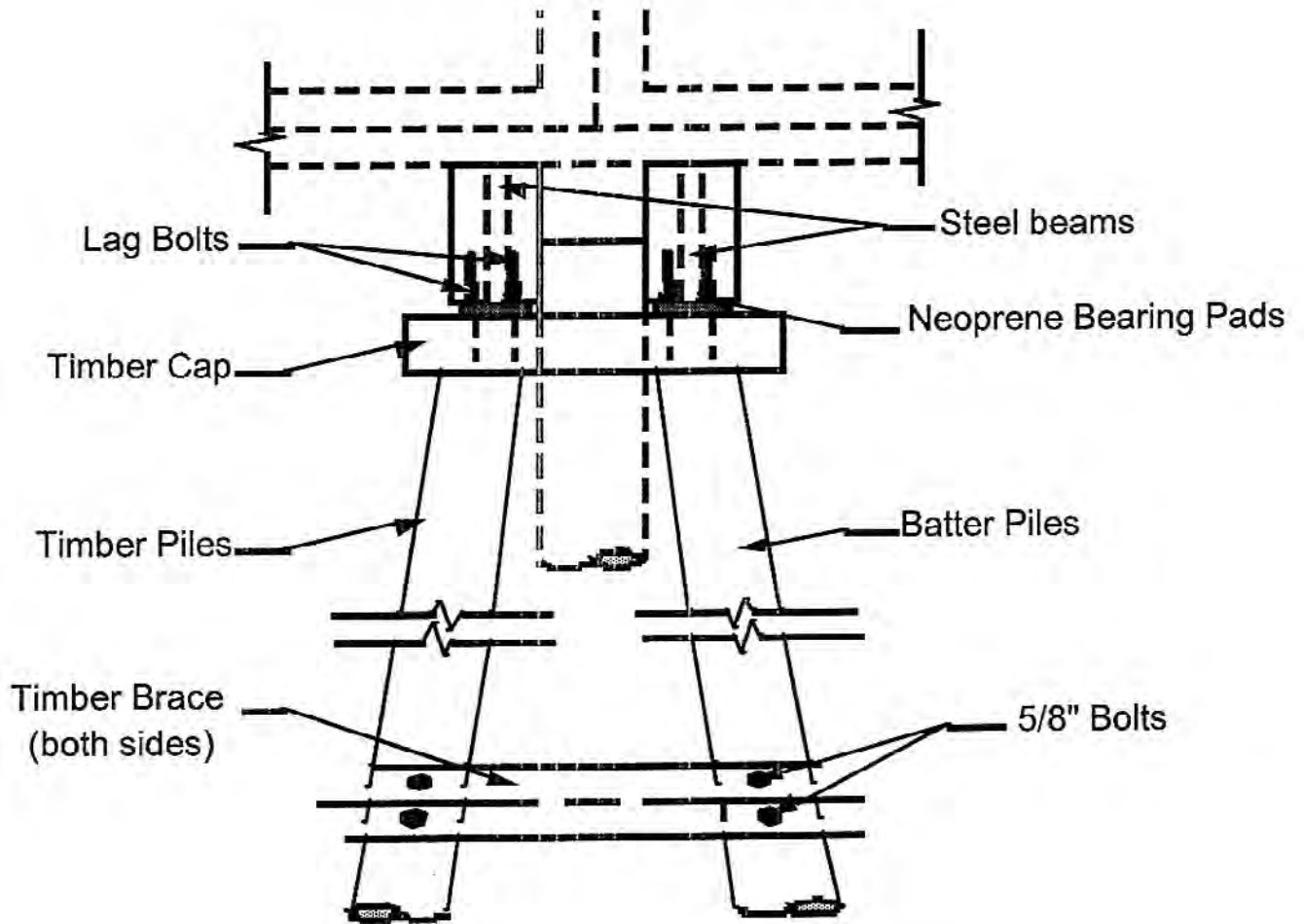
ELEVATION VIEW

ALTERNATE NO. 5

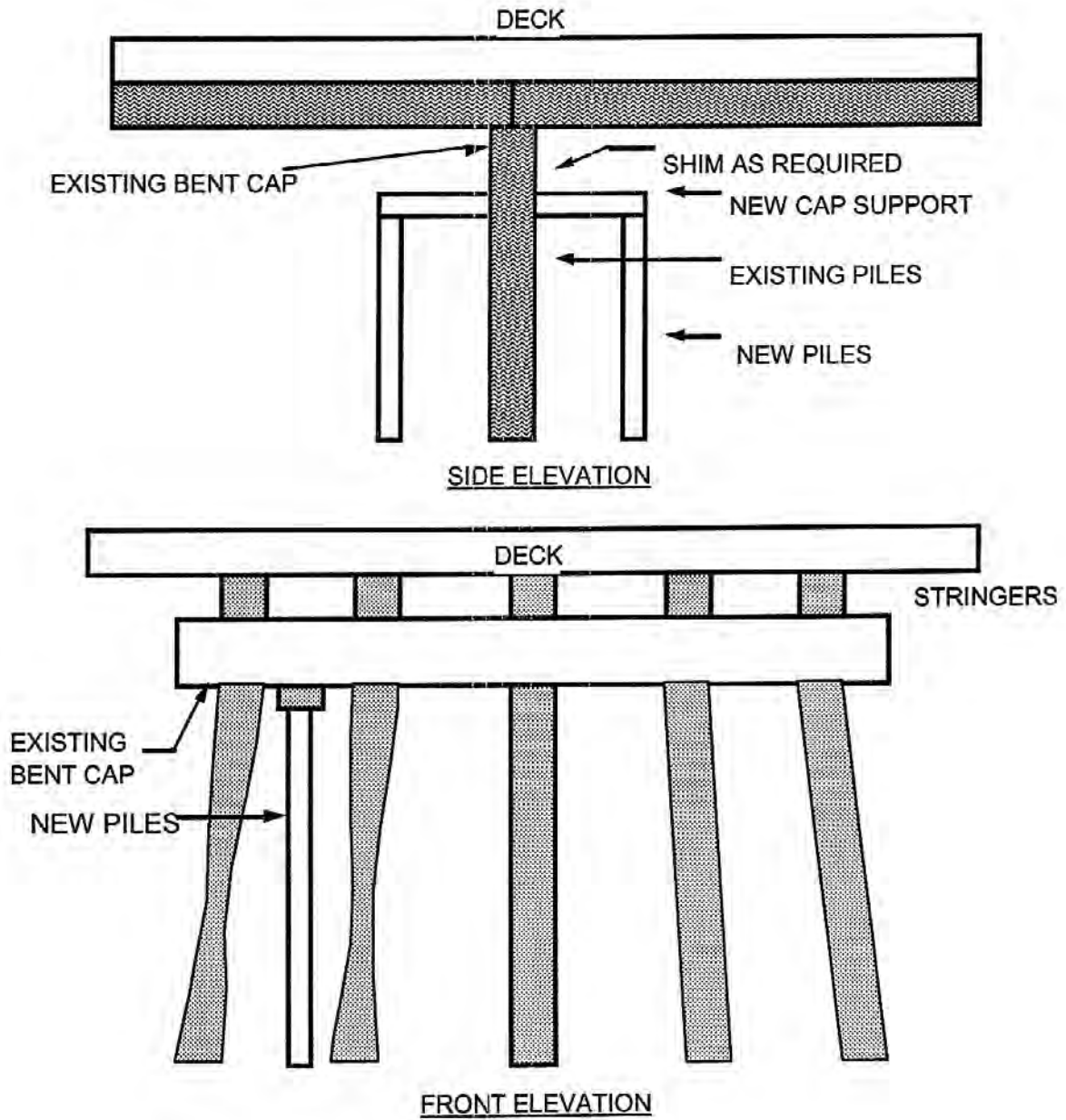


ELEVATION VIEW FOR INTERMEDIATE HELPER BENT

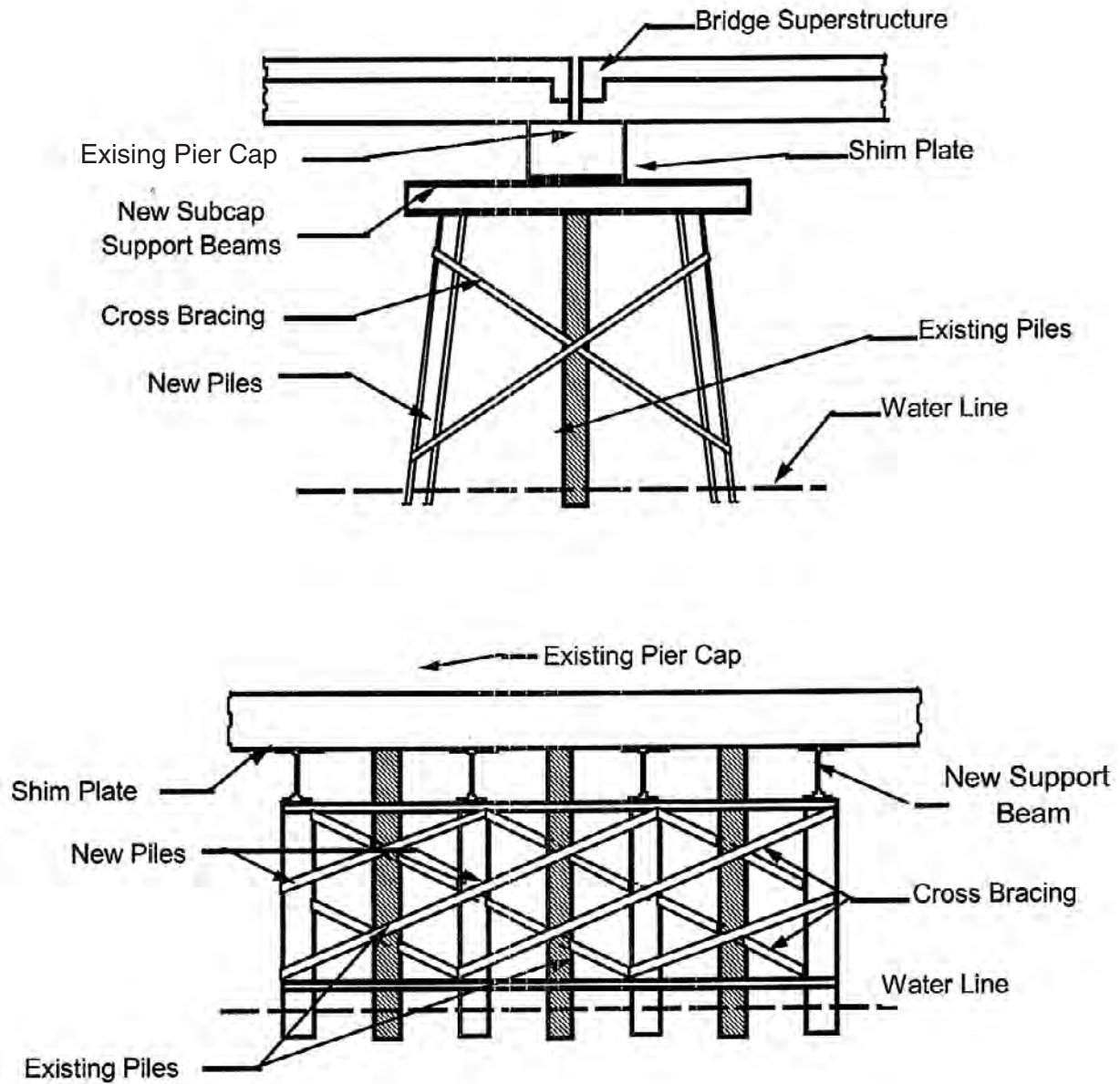
ALTERNATE NO. 6



ALTERNATE NO. 7



ALTERNATE NO. 8



SAP ASSEMBLY NUMBER: 711-7454-01

BMS Flex-Action: B745401

ACTIVITY TITLE: CONSTRUCT TEMPORARY PIPES

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 601 - Pipe Culverts
603 - Metal Plate Culverts

SCHEDULING CONSIDERATIONS

Based on need as indicated by evaluation of bridge inspection reports and other pertinent data by the Review Engineer. Pipes can be installed most conveniently during periods of low water which are likely to occur during later summer and early fall. Be aware of an seasonal environmental restrictions.

WORK AREA

All areas shown on plans as necessary for the installation of pipes and the embankments in which they are placed.

ACTIVITY DESCRIPTION

Placing of temporary pipes in temporary embankments to divert traffic from an existing structure (so-called _go-arounds_) or placing of temporary pipes in an existing embankment to divert water from an existing structure. The work can include, but is not limited to, excavating material; placing pipe; bolting structural plate pipe sections together; installing bands, or other means to connect pipe sections; placing and compacting embankment material; placing embankment protection material; and installing guide rail.

Any necessary earthwork and other associated work should be done in accordance with the requirements of the appropriate highway maintenance activities, but should be charged to this activity. Work under this activity is intended to raise posting limits, to protect a bridge and the public using it pending structure rehabilitation or replacement, or for a similar primary purpose. If a maintenance activity such as Activity E744803, Footing (Underpin), is being performed and a pipe is used to temporarily contain or direct the flow of water under the bridge, the work should be reported to that activity rather than to this new one.

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies.
2. Install siltation devices.
3. Construct approach fills.
4. Excavate, if necessary.
5. Prepare the bedding material.
6. Install Pipe.
7. Backfill.
8. Place pavement.
9. Install Guiderail.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Excavation Equip	As Required	Fill Material
2	Crew Members				Bedding Material
2	Special Crew Member (Operators)	1	Paver		Bridge / Pipe Components
		1	Post Driver	As Required	Pavements
		1	Crane	As Required	Guardrail
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
.08 BR/HR		5 BR/DAY		60 MH	

SAP ASSEMBLY NUMBER: 711-7454-01

BMS Flex-Action: C745401

ACTIVITY TITLE: CONSTRUCT TEMPORARY BRIDGE

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 903 - Temporary Bridge and Approaches
 1001- Cement Concrete Structures

SCHEDULING CONSIDERATIONS

Based on need as indicated by evaluation of bridge inspection reports and other pertinent data by the Review Engineer. Be aware of any seasonal environmental restrictions.

WORK AREA

All areas shown on plans as necessary for the erection of a temporary bridge and its approaches.

ACTIVITY DESCRIPTION

Constructing temporary bridges and approaches in accordance with plans furnished by the Department. The work can include, but is not limited to, excavating material; driving piles; installing sheeting or other devices to control the flow of water; constructing forms; placing reinforcing steel; placing concrete; cutting, drilling and erecting timber members; erecting structural steel members; and placing embankments and performing associated work. Any necessary earthwork and other associated work should be done in accordance with the requirements of the appropriate highway maintenance activities, but should be charged to this activity.

PROCEDURE DESCRIPTION

1. Obtain necessary permits / clearances from environmental agencies.
2. Install siltation devices.
3. Construct approach fills.
4. Excavate, drive piles, place caps, install bulkheads, set beams, place deck, and attach rails as necessary to construct temporary bridge.
5. Backfill and finish grading approaches.
6. Place pavement.
7. Install Guiderail

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1 3	Foreman Crew Members	1	Concrete Mixer	As Required As Required	Reinforced Steel Concrete
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
2.3 EA/HR		14 EA/DAY		2.2 MH/EA	

Chapter 27: Miscellaneous Bridge Activities

Table of Contents

7459-01	BRIDGE MAINTENANCE	27 - 3
7459-01	PROTECTIVE COATINGS DECK/PARAPET/SIDEWALK	27 - 4
7459-01	PROTECTIVE COATINGS STRUCTURES	27 - 6

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SAP ASSEMBLY NUMBER: 711-7459-01

BMS Flex-Action: None

ACTIVITY TITLE: BRIDGE MAINTENANCE

UNIT OF MEASUREMENT: EACH BRIDGE

PROCEDURE: GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
 Section 504 Pavement Relief Joint
 511 Pressure Relief Joint (4")
 1000 Structures
 Standards for Roadway Construction (PUB 72)
 RC – 24 Pavement Relief Joint

SCHEDULING CONSIDERATIONS:

Based on need as indicated by bridge inspections. Work is limited to those areas of bridges and structures classified as non-structural activities.

WORK AREA:

Entire Structure including approaches. Includes Pavement Relief Joints, Pressure Relief Joints, Covered Bridge Roof, Covered Bridge Siding and any other non-structural element activity not covered by a specific activity code.

ACTIVITY DESCRIPTION

Repair or replacement of any nonstructural element of a bridge or bridge approach. Activity will vary based on need. Bridge Maintenance, Other is not a catch-all and is only intended for those non-structural activities not covered under any other specific activity title

PROCEDURE DESCRIPTION

Repair or replacement of any nonstructural element of a bridge or bridge approach elements as directed by the County Manager or District Bridge Engineer. All work should be in accordance with (pub. 408).

NOTE: Obtain approval from the Pennsylvania State museum commission prior to beginning work on any covered bridge and/or Historical Structure. Refer to BMS 5E04.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1 As Required	Foreman Crew Members	As Required	To be determined based on need	As Required	To be determined based on need
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
VARIES		VARIES		VARIES	

SAP ASSEMBLY NUMBER: 711-7459-01**BMS Flex-Action:** A743401**ACTIVITY TITLE:** APPLY PROTECTIVE COATING DECK/PARAPETS/SIDEWALKS**UNIT OF MEASUREMENT:** EACH BRIDGE**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 503 - Protective Coating for Cement
Concrete Pavement
1019 - Protective Coating for Reinforced
Concrete Surfaces

SCHEDULING CONSIDERATIONS

Requirement for application determined by District Bridge Engineer based on conditions or circumstances at specific structures, established cycles for reapplication, and/or absorption tests. Temperature and moisture restrictions are relatively rigid for applying concrete coating materials and work schedules should take these into account.

WORK AREA

Bridge deck, parapets and sidewalks, and other portions of the bridge super structure designated by the Review Engineer for the application of protective coatings. Cleaning, reported under Activity B743101, Clean/Flush Scupper/Down-spouting or C743102, Clean/Flush Bearing/Bearing Seat as applicable.

ACTIVITY DESCRIPTION

Applying a two-component epoxy-resin system or other protective coating as approved and designate for such use by the Department to elements in the work area. The work can include, but is not limited to, thoroughly cleaning the surfaces to be coated to eliminate potential bond-inhibiting matter by sweeping, flushing, drying, and etching and/or sand blasting; and applying the coating by brush, roller or spray.

PROCEDURE DESCRIPTION

1. Clean surface to be coated of all grease, laitances, and all foreign material by water blasting and scrubbing with a stiff bristle brush. Surfaces judged to be unsound shall be removed to a depth judged sound by sand blasting and water blasting.
2. Surface shall be completely dry prior to coating. Temperature shall be above 50OF.
3. Apply coating according to manufacturer's specifications.
4. Successive coats shall not be applied until preceding coats have become dry to the touch.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Water-Blaster	As Required	Coating
3	Crew Members	1	Sand Blaster brushes		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
100 SY/HR		600 SY/DAY		.04 MH/SY	

SAP ASSEMBLY NUMBER: 711-7459-01**BMS Flex-Action:** B743401**ACTIVITY TITLE:** APPLY PROTECTIVE COATING SUBSTRUCTURE**UNIT OF MEASUREMENT:** EACH BRIDGE**PROCEDURE:** GENERAL PROCEDURE

REFERENCES

PennDOT Specifications (PUB 408)
Section 1019 - Protective Coating for Reinforced
Concrete Surfaces

SCHEDULING CONSIDERATIONS

Requirement for application determined by District Bridge Engineer based on conditions or circumstances at specific structures. Temperature and moisture restrictions are relatively rigid for applying concrete coating materials and work schedules should take these into account.

WORK AREA

Abutments, pier caps, endwalls and other unsubmerged portions of bridge substructures designated by the Review Engineer for the application of protective coatings. Cleaning, reported under Activity B743101, Clean/Flush Scupper/ Downspouting or C743102, Clean/Flush Bearing/ Bearing Seat as applicable.

ACTIVITY DESCRIPTION

Applying a two-component epoxy-resin system or other protective coating as approved and designate for such use by the Department to substructure elements in the work area. The work can include, but is not limited to, thoroughly cleaning the surfaces to be coated to eliminate potential bond-inhibiting matter by sweeping, flushing, drying, and etching and/or sand blasting; and applying the coating by brush, roller or spray.

PROCEDURE DESCRIPTION

1. Clean surface to be coated of all grease, laitances, and all foreign material by water blasting and scrubbing with a stiff bristle brush. Surfaces judged to be unsound shall be removed to a depth judged sound by sand blasting and water blasting.
2. Surface shall be completely dry prior to coating. Temperature shall be above 50°F.
3. Apply coating according to manufacturer's specifications.
4. Successive coats shall not be applied until preceding coats have become dry to the touch.

ACTIVITY REQUIREMENTS

LABOR		EQUIPMENT		MATERIAL	
NUMBER	CLASSIFICATION	NUMBER	TYPE	AMOUNT	DESCRIPTION
1	Foreman	1	Water-Blaster	As Required	Coating
3	Crew Members	1	Sand-Blaster		
		2	Brushes		
PRODUCTION UNITS/HOURS		PLANNING UNITS		PERFORMANCE STANDARD	
50 SY/HR		300 SY/DAY		08 MH/SY	

