

Development of National Training for Bridge Maintenance

Western Bridge Engineers Seminar 2015

Session 5D

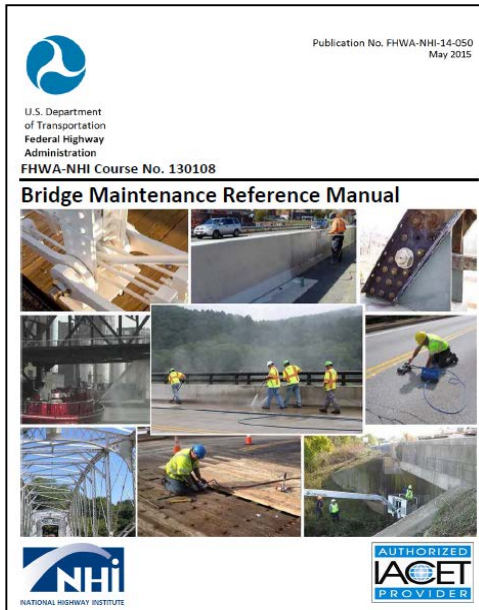
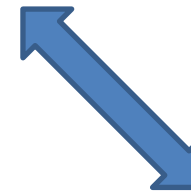
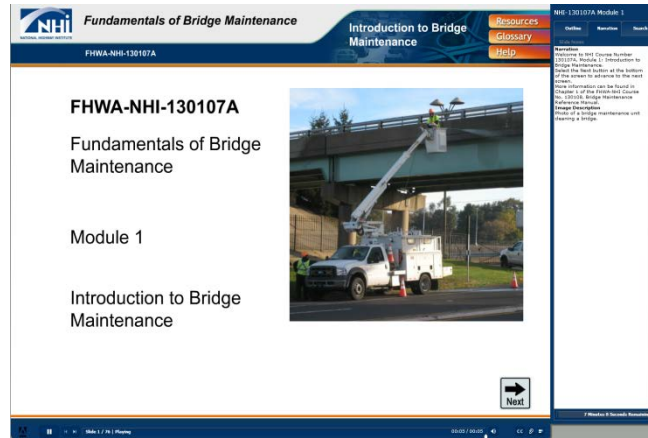
Eric Thorkildsen, PE

Greenman-Pedersen, Inc.

Presentation

- Sponsors of the Training
 - National Highway Institute (NHI)
 - *Training arm of Federal Highway (FHWA)*
- How to train bridge maintenance personnel
 - Adult Learning Techniques
- What have we developed
 - Reference Manual
 - Web Based Training
 - Instructor Led Training

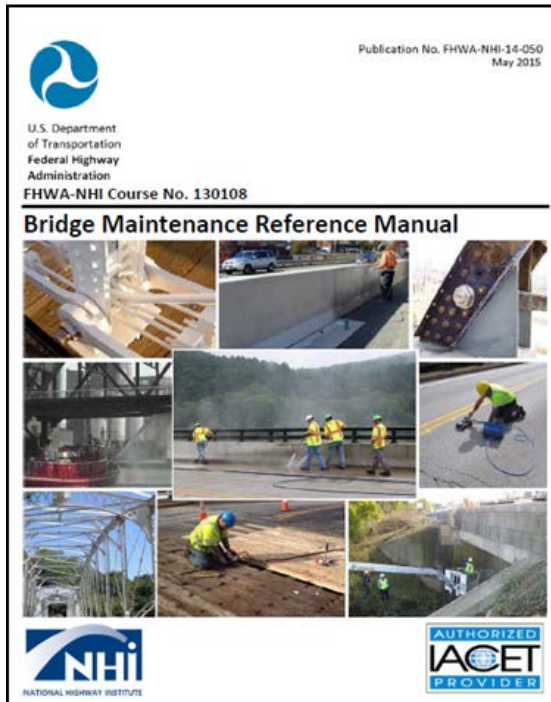
Bridge Maintenance Course



You are here

Reference Manual

- Over 1,000 pages
- 25 Chapters
- 22 Checklists
- Decision Aid Matrices



4. Sealing the concrete to prevent chloride intrusion

11.2 Preventive and Basic Maintenance of Steel Superstructures

Preventive maintenance of steel superstructures consists mainly of measures to clean to steel and protect the steel from corrosion. The preservation of steel involves protection from exposure to electrolytes, such as water or soil. When deicing salt is added to the electrolyte, there is a dramatic increase in the rate of corrosion of the structural steel.

Common protective coatings for steel superstructures are weathering steel, galvanizing, metalizing, and paint. Weathering steel is a type of steel that forms its own protective coating and theoretically does not need painting. However, many state highway departments have indicated poor performance from their bridges constructed with this type of steel. Therefore, members constructed from weathering steel should be monitored for excessive corrosion and be painted if necessary. Typical painting requirements are based on whether the steel is new or is to be repainted.



What To Look For

When performing maintenance on steel superstructures it is always good to see if anything does not look right. This includes:

- Impact damage to steel fascia girders. Generally the girder being twisted and bent from impact
- Severe corrosion and section loss
- Bent cross frame members indicating movement and buckling

11.2.1 Cleaning

Similar to concrete superstructures, the cleaning of steel superstructures is extremely important. Regular cleaning of the superstructure members is necessary to remove accumulation of sand, debris, bird droppings, and other harmful material by flushing with high-pressure water jet or compressed air, sweeping, or shoveling to remove build up. This is particularly critical in areas where there are likely to be chlorides in the debris or on surfaces, such as areas where salt is used for snow and ice control, and marine environments.

Part of the cleaning process should be the clearing of any drains and downspouts that could clog and inadvertently flood steel components. A simple modification such as extending the superstructure drain pipe 6 inches below the bottom flange of the girder is considered a preventive maintenance task.

11.2.1.1 Debris Removal

Traffic, pedestrians, animals and/or flooding cause superstructure debris. All debris should be removed for safety reasons and to prevent deterioration in areas where the debris accumulates and could trap moisture such as on flanges, diaphragms, gusset plates, etc. Steel bridges tend

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Suggested Procedure

Concrete Deck Repairs

“Suggested Procedures”

1. Identify the deck location to be repaired
2. Control traffic in accordance with traffic management plan
3. Hammer sound or chain area around the spall to identify and mark adjacent unsound concrete.
4. Sawcut to a depth of at least $\frac{3}{4}$ inch in a geometric pattern 1 inch outside the lines marked in the previous step.
5. Use a lightweight chipping gun to chip the concrete out between the edge of the spall and the sawcut lines. Remove the concrete to at least 1 inch below the top mat of reinforcing steel.
6. Use sand blasting equipment to remove any rust from exposed reinforcing steel.
7. Replace any missing steel with proper overlap lengths. Consult an engineer as necessary.
8. Remove any loose concrete material or other debris from inside the spalled area.
9. Wet the concrete in the spalled area and surrounding but do not allow standing water.
10. Mix rapid setting concrete and place concrete in the spalled area up to the surface of the surrounding deck.
11. Use a 2 by 4 or similar lumber to screed the newly placed concrete to the level of the surrounding deck.
12. Use a wet broom to provide a roughened surface in a transverse direction to traffic.
13. Use water and broom to clean the areas around the newly placed concrete.

Tips



What To Look For

When performing maintenance on steel superstructures it is always good to see if anything does not look right. This includes:

- Impact damage to steel fascia girders. Generally the girder being twisted and bent from impact
- Severe corrosion and section loss
- Bent cross frame members indicating movement and buckling



Recommendation

An air-entrained admixture is recommended for use in all concrete used in structures that are exposed to freezing temperatures



When to Call the Engineer

Concrete mix design and selection should be performed by an engineer or technician properly trained in concrete mix design and knowledgeable with the exposure environment, placement conditions and desired properties.

Web Based Training

- 8 Hours on-line
- Background Info
- 6 Modules

NHI NATIONAL HIGHWAY INSTITUTE

Fundamentals of Bridge Maintenance

Welcome & Introduction

Resources
Glossary
Help

FHWA-NHI-130107A

FHWA-NHI-130107A

Fundamentals of Bridge Maintenance

Module 0

Welcome and Introduction



Next

NHI NATIONAL HIGHWAY INSTITUTE

Fundamentals of Bridge Maintenance

Welcome & Introduction

Resources
Glossary
Help

FHWA-NHI-130107A

WBT Sequence

- Module 0: Welcome& Introduction

- Module 1: Introduction to Bridge Maintenance
- Module 2: Bridge Maintenance Management
- Module 3: Bridge Anatomy
- Module 4: Bridge Mechanics
- Module 5: Concrete Basics
- Module 6: Maintenance of Ancillary Items

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- Module 7: End of Course Assessment

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Training Delivery Method

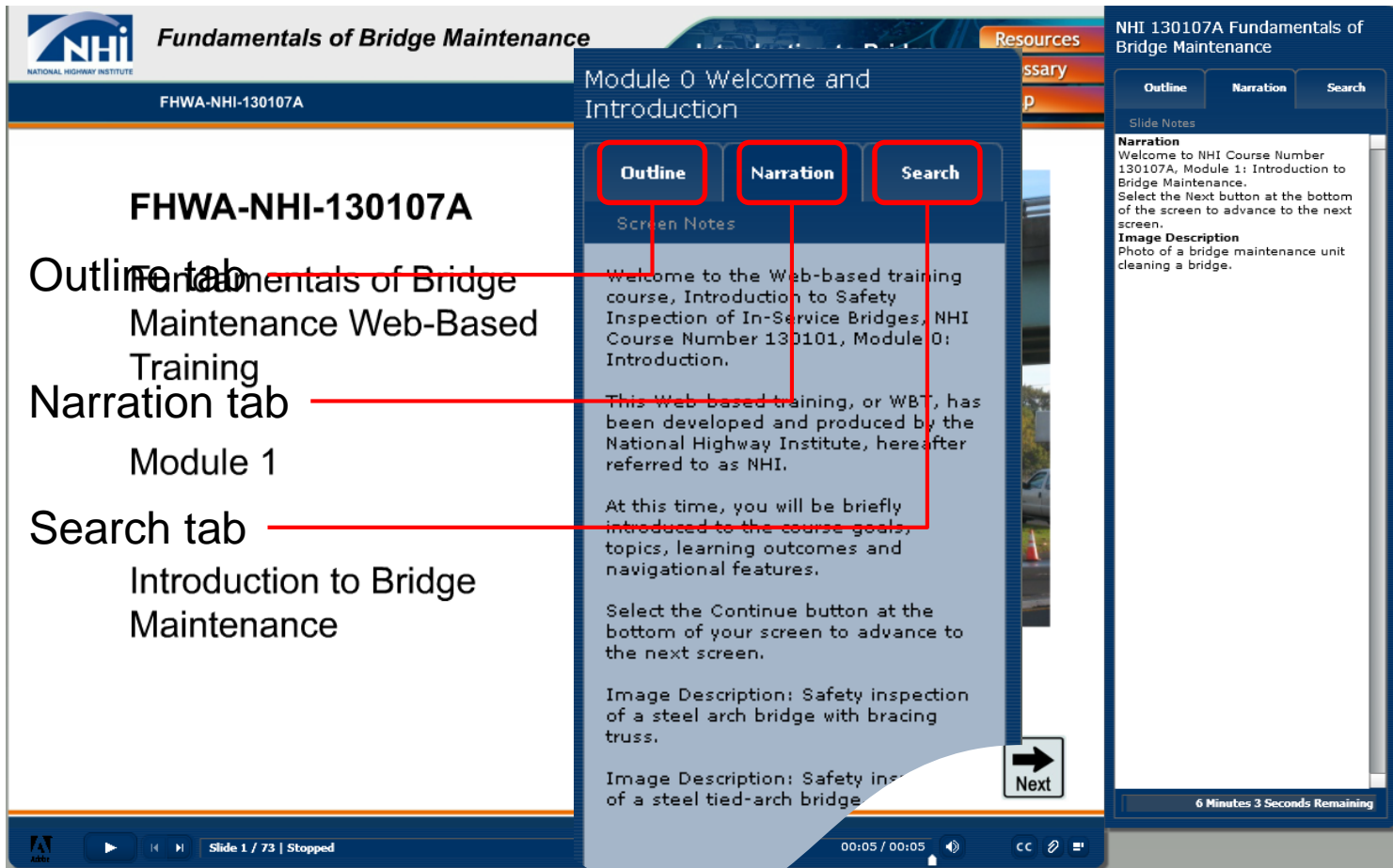
Web-based training:

- Self-paced, web-based course that is designed for you to progress at own pace
- Learning system will remember your progress and allow training to resume at any time without losing your position
- Review previously completed topics at any time
- Audio component is available or can be muted and narrative read on your own.
- Other Web-based training courses are available from NHI:

<http://www.nhi.fhwa.dot.gov>



Navigational Features: Adobe Presenter



The screenshot displays the Adobe Presenter interface for the course "Fundamentals of Bridge Maintenance". The main content area shows the title "FHWA-NHI-130107A" and "Fundamentals of Bridge Maintenance Web-Based Training". A central overlay window titled "Module 0 Welcome and Introduction" contains three tabs: "Outline", "Narration", and "Search". The "Outline" tab is selected, showing a list of screen notes. The "Narration" tab is also visible, showing a text block. The "Search" tab is also visible. The interface includes a "Next" button at the bottom right of the overlay. The main content area also has a "Next" button at the bottom right. The bottom of the screen shows a progress bar and a "Slide 1 / 73 | Stopped" indicator.

Outline tab
Fundamentals of Bridge Maintenance Web-Based Training

Narration tab
Module 1

Search tab
Introduction to Bridge Maintenance

Module 0 Welcome and Introduction

Outline

Narration

Search

Screen Notes

Welcome to the Web-based training course, Introduction to Safety Inspection of In-Service Bridges, NHI Course Number 130101, Module 0: Introduction.

This Web-based training, or WBT, has been developed and produced by the National Highway Institute, hereafter referred to as NHI.

At this time, you will be briefly introduced to the course goals, topics, learning outcomes and navigational features.

Select the Continue button at the bottom of your screen to advance to the next screen.

Image Description: Safety inspection of a steel arch bridge with bracing truss.

Image Description: Safety inspection of a steel tied-arch bridge.

Next

NHI 130107A Fundamentals of Bridge Maintenance

Outline

Narration

Search

Slide Notes

Narration
Welcome to NHI Course Number 130107A, Module 1: Introduction to Bridge Maintenance.
Select the Next button at the bottom of the screen to advance to the next screen.

Image Description
Photo of a bridge maintenance unit cleaning a bridge.

6 Minutes 3 Seconds Remaining

Slide 1 / 73 | Stopped

00:05 / 00:05



FHWA-NHI-130107A

FHWA-NHI-130107A

Fundamentals of Bridge Maintenance

Module 2

Bridge Maintenance Management



Module Learning Outcomes

Upon completion of this module, you will be able to:

- Review basic requirements for bridge inspections according to the National Bridge Inspection Standards and the AASHTO Element Level Inspection Guide
- Summarize the general concept of bridge management systems and the activities associated with these systems
- Review the various steps and activities involved in the proper planning and implementation of bridge maintenance program activities
- Discuss commonly used contracting bridge maintenance methods
- Describe the principles of quality assurance and quality control measures used in bridge maintenance.




Module Introduction

This module contains the following lessons:

- Lesson 1: Bridge Inspections
- Lesson 2: Maintenance Management Systems (MMS) and Bridge Management Systems (BMS)
- Lesson 3: Bridge Maintenance Planning and Scheduling
- Lesson 4: Contracting Methods
- Lesson 5: QA/QC Practices

During each lesson, knowledge checks are provided to test your understanding of the material presented.



This module will take approximately
80 minutes to complete.



Match the following types of contracts with their correct description.

Type of Contract

Description

b Method-Based

a. Uses standard plan details and a universal specification activities that are covered under the contract

c Directed

b. Agency defines how the work will be done

d Performance-Based

c. Contractors bid by submitting unit prices for each of the identified bid items

a Job Order Contract

d. Agency defines expected outcomes from the work

[Do you need to review contracts? Select this link to return to that section of the lesson or select the Next button to continue.](#)



Instructor Led Training

- 4 Days
- 7 Modules
- Lecture
- Hands On Activities
- Adult Learning

NHI-130108 Bridge Maintenance

...

Module 1:
General Bridge Maintenance Concepts
and Special Considerations

Lesson 1:
Bridge Maintenance Concepts

• 1:1-1

Importance of Bridge Maintenance



- Spend **\$50 million** to replace a bridge or **\$1 million** to get 5 more years out of it?



• 1:1-5

NHI-130108

Bridge Maintenance

...

Module 3:

Maintenance and Preservation Techniques
for Special Deck Elements and Features

Lesson 1:

Maintenance and Preservation
Techniques for Expansion Joints



Learning Outcomes

- Explain the purpose and significance of expansion joints
- Identify common types of expansion joints
- Identify expansion joint components
- Recognize common expansion joint defects

Purpose of Expansion Joints

- Provide a gap for bridge movement
 - Expansion
 - Contraction
 - Rotation
- Provide a smooth riding surface
 - Approach roadway to a bridge deck, or
 - Between adjoining segments of a bridge deck



Expansion Joint Locations

- Located above piers, abutments, pin & hangers, or on a sleeper slab
- Typically placed transverse; but, may also be longitudinal on bridge decks greater than 100 feet wide

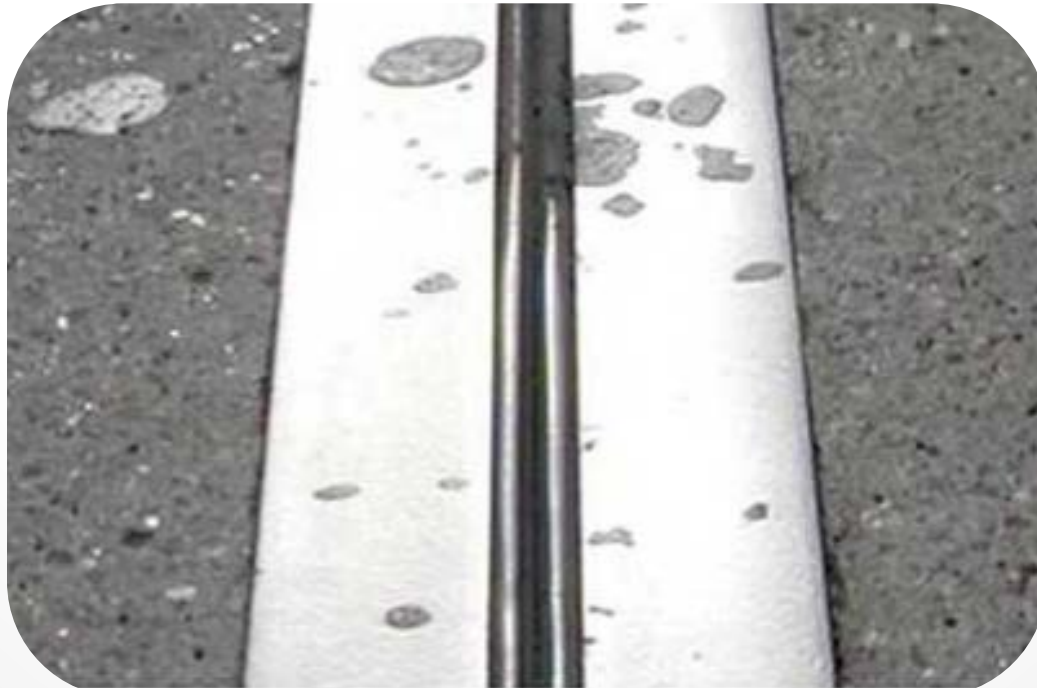


Categories of Bridge Joints

- Closed expansion joints
 - Provides a smooth riding surface over the gap
 - Protects the portion of the bridge directly below the opening
- Open expansion joints
 - Used in older bridges, but now are very rare
 - Allowed drainage to flow through the joint and down onto bridge components below
 - Relied upon drainage troughs below the joints to protect the bridge beneath from debris and water
- Fixed joints
 - Do not have a gap or opening
 - Are NOT expansion joints, and do not provide for movement

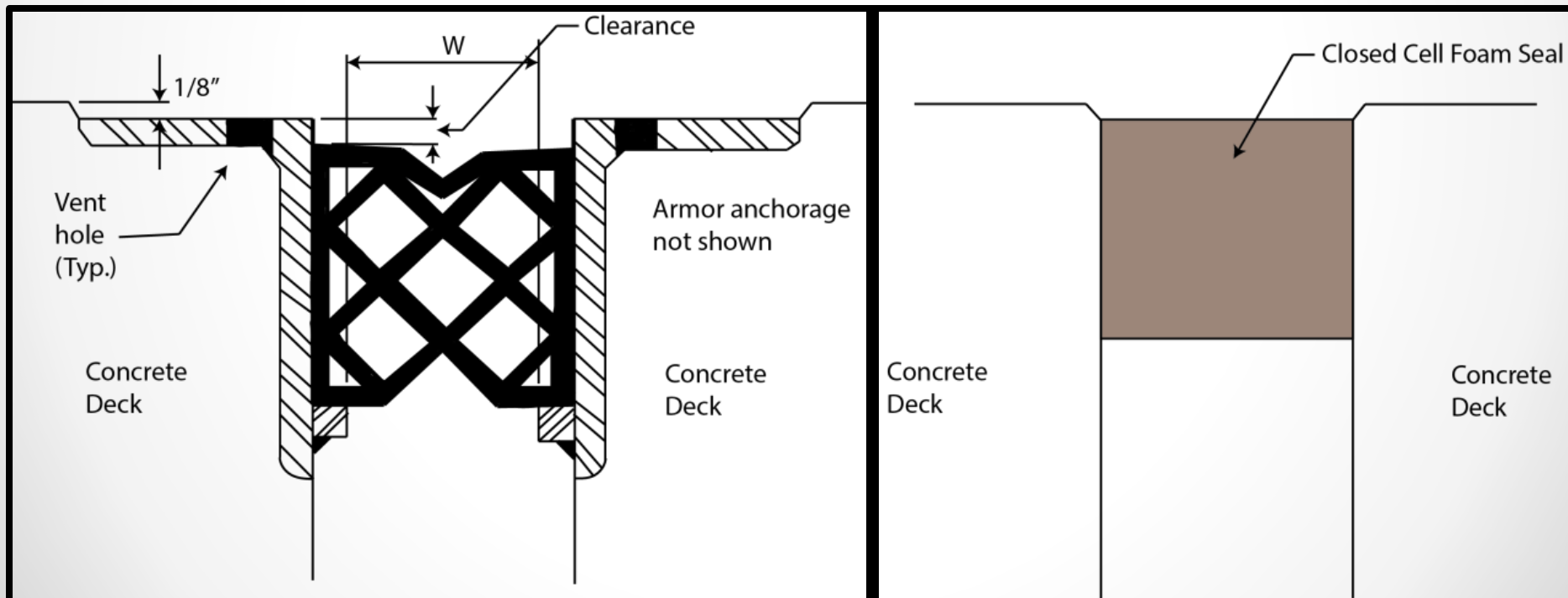
Compression Joint Seal

- Relies on compression to maintain water tightness
- Is inserted into the joint using lubricants which may also serve as adhesives



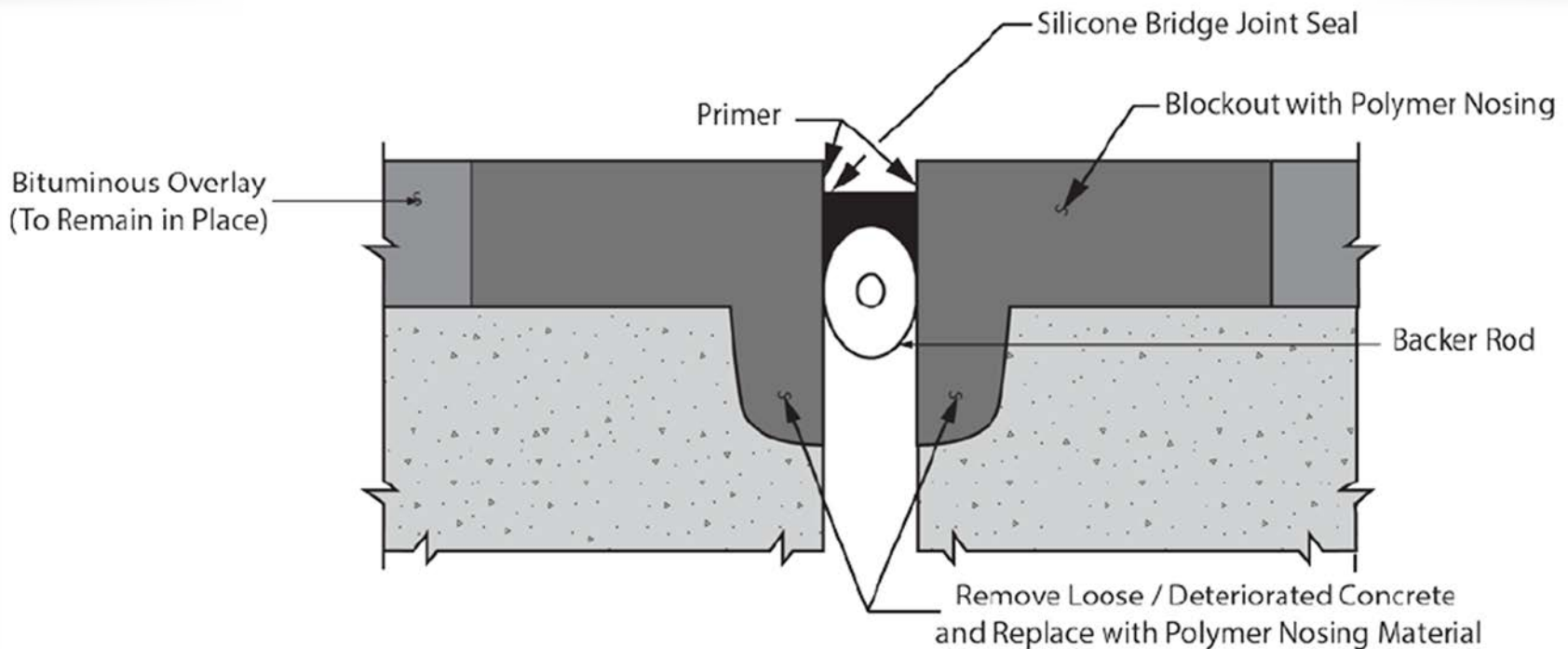
Compression Joint Seal (cont.)

- Two types:
 - Open cell
 - Closed cell foam



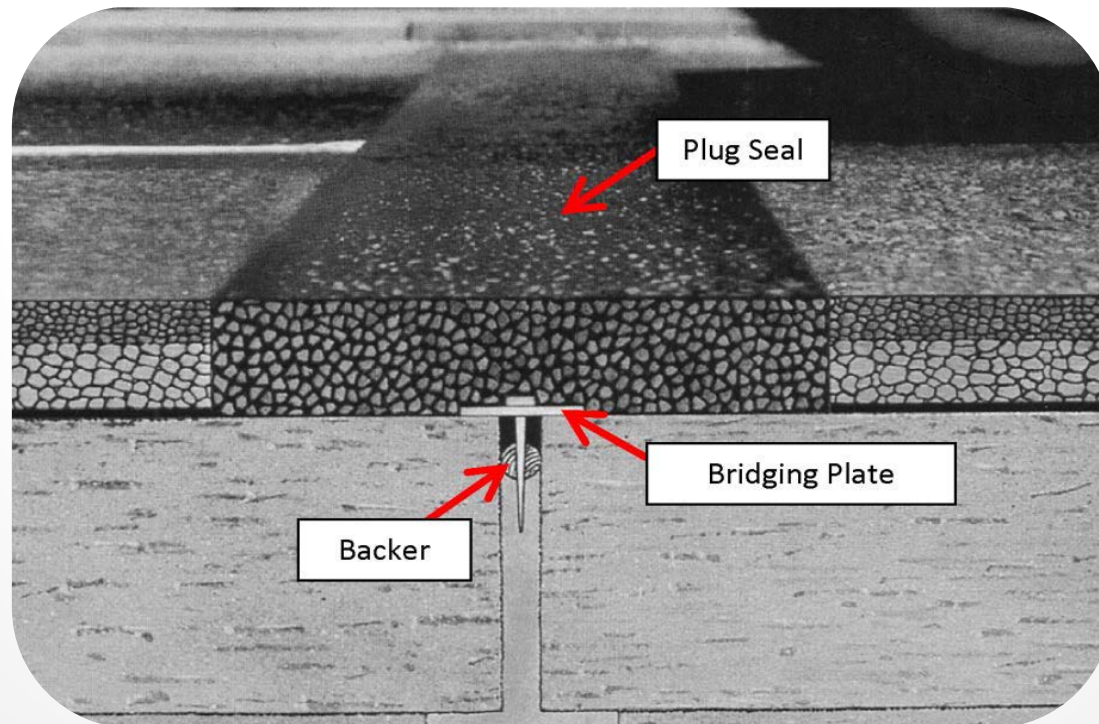
Pourable Joint Seal

- Made of a self-leveling, rapidly curing silicone material
- Headers are typically elastomeric concrete

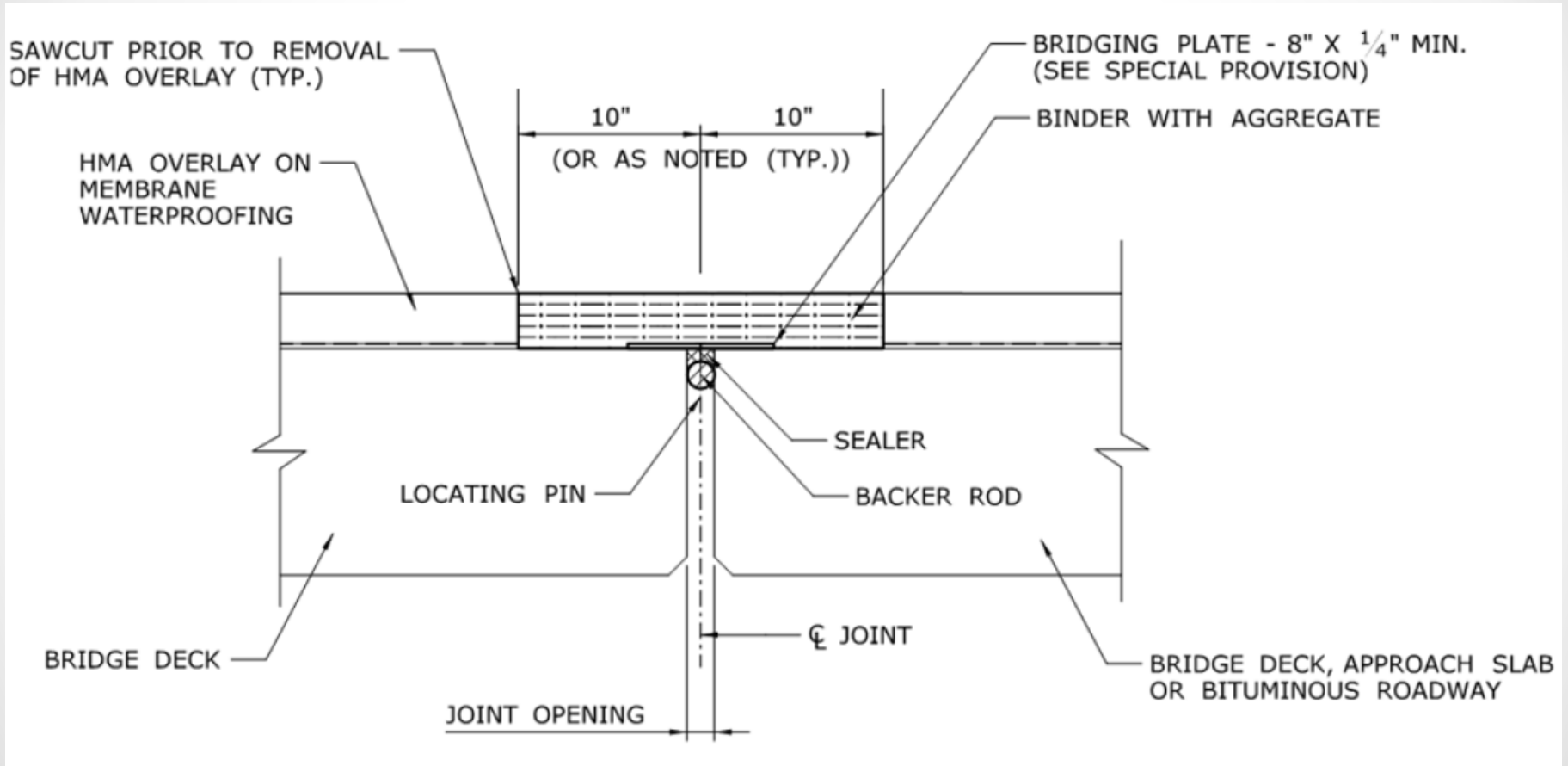


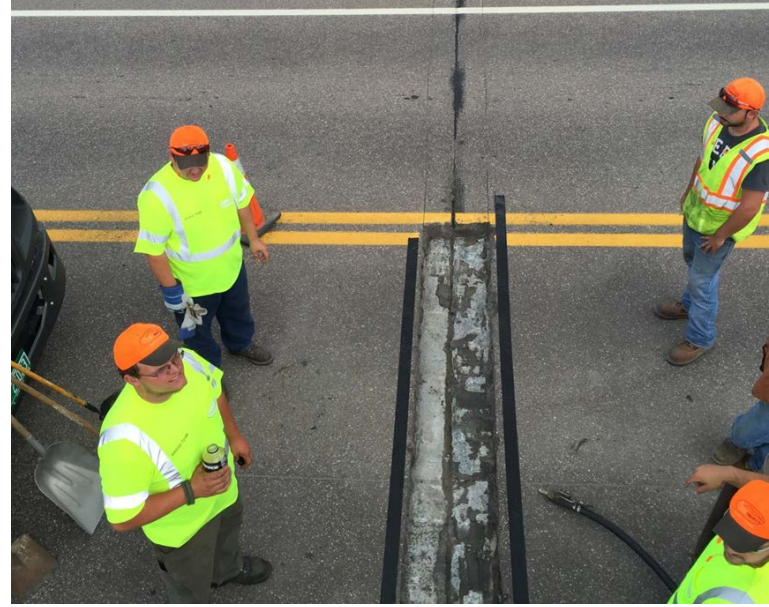
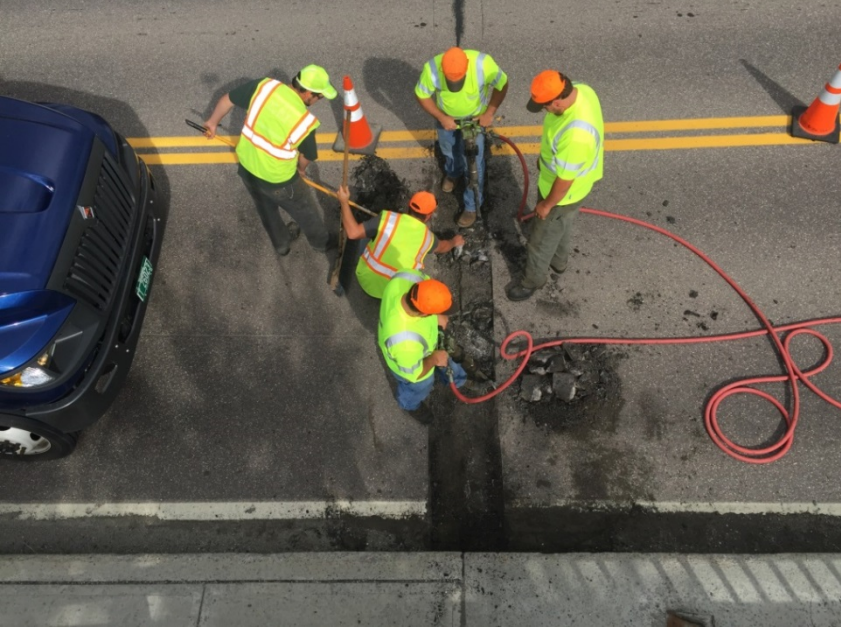
Asphaltic Plug Seal

- Used with asphalt overlays
- Specially formulated asphaltic binder mixed with aggregate that forms the road surface above the joint

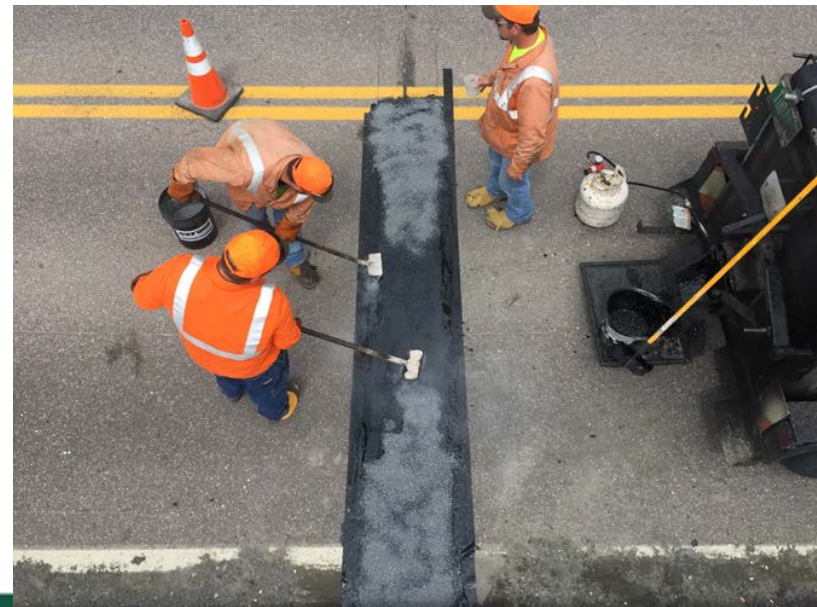


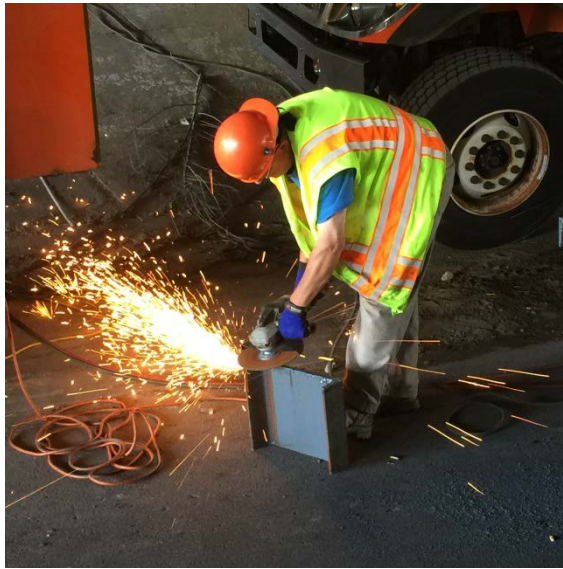
Asphaltic Plug Seal (cont.)





Asphalt Joint





Action









Epoxy Overlay





Healer Sealer





Deck Prep



Equipment



Schedule

- Reference Manual Fall 2015
- Web Based Training Winter 2015/2016
- Instructor Led Training Spring 2016

Thank You

Please select the "X" in the upper right hand corner of your screen to close this window and return to the course curriculum.

