Training Agenda
Local Bridge Conference
Bridge 101
Albany, New York
October 24, 2023

12:30 pm– 1:30 pm. NYSDOT Bridge Design Standards
Presenter: Harry White, NYSDOT

1:30 pm – 2:30 pm. Preliminary Bridge Engineering
Presenter: Joe Albert, NYSDOT

2:30 pm – 3:00 pm. Break

3:00 pm – 4:00 pm. Bridge Inventory
Presenter: Erica Westhuis, NYSDOT

4:00 pm – 5:00 pm. Bridge Inspection
Presenter: Mark Struzinsky, NYSDOT
Presenter Biography
Harry L. White 2\textsuperscript{nd}

Presenter: Harry L. White 2\textsuperscript{nd}, PE
Position/Title: Professional Engineer 4, NYSDOT

Harry White is the Director of the Structure Policy and Innovation Bureau for the New York State DOT Office of Structures. He previously led the NYSDOT Standards and Policies Unit, the NYSDOT Research and Development Bureau - Structures Unit, the NYSDOT Quality Assurance Chemistry Laboratories, and was a NYSDOT Structures Design Squad leader. He graduated from Union College in Schenectady, NY with a Bachelor of Science in Civil Engineering, and is a registered professional engineer in NY State.
LBC Bridge Engineering 101 Training

NYSDOT Bridge Design Standards

Harry White
Director
Structure Policy and Innovation Bureau

Contract Documents

- Contract Plans
- Standard Specifications for Construction and Materials
- Proposal
- Other Documents/Manuals Included by Reference
CONTRACT PLANS
Bridge Plan Organization

General Plan and Elevation
Typical Sections Profiles
Estimate of Quantities and Index of Drawings
General Notes
Boring Location Plan
General Subsurface Profile
Excavation and Embankment
Beginning Abutment Plan and Elevation
Beginning Abutment Details
Pier 1 Plan and Elevation
Pier 1 Details (Subsequent up-station piers shall be numbered sequentially and shall follow in order)
Ending Abutment Plan and Elevation
Ending Abutment Details
Bearings

This Listing is Found in Section 14.3 of the NYSDOT Bridge Manual

Bridge Plan Organization

Transverse Section
Framing Plan (Bridges with Steel Girders or Spread Prestressed Concrete Beams)
Beam Layout (Bridges with Adjacent Prestressed Beams)
Girder Details (Bridges with Steel Girders)
Beam Details (Bridges with Prestressed Concrete Beams)
Haunch Table
Superstructure Slab
Approach Slabs
Joint System
Barrier (Bridges with Concrete Barrier)
Railing (Bridges with Steel Railing)
Approach Drainage
Miscellaneous Details
Bar Bending Diagrams
Barlists
“Order of Precedence”

- The Contractor is bound by the requirements of the contract documents
- Where conflicts exist, there is an ‘Order of Precedence’
  - NYSDOT Standard Specifications for Construction and Material
  - Section 102-02 (§102-02)
    - Plans
    - Proposal - Special Notes
    - Proposal - Special Specifications
    - Standard Specifications
    - Standard Sheets
    - Base Line Data
Standard Specifications for Construction and Materials

- Volume 1
  - Section 100 - Contract Administration

- Volume 2
  - Section 200 – Earthwork
  - Section 300 - Bases and Subbases
  - Section 400 – Hot Mix Asphalt
  - Section 500 – Portland Cement Concrete
  - Section 550 – Structures

- Volume 3
  - Section 600 – Incidental Construction

- Volume 4
  - Section 700 – Materials and Manufacturing
Parts of a Specification

- Description
  - General Tasks the Contractor is Expected to Perform
- Materials
  - Description of required materials
  - Reference to Section 700 - Materials
- Construction Details
  - Specific tasks and expectation for proper completion
  - Specific restrictions on performing those tasks
- Method of Measurement
  - How the work will be measured for payment
- Basis of Payment
  - What is included the bid price

Referenced Documents

- Contract Requirements are Included by Referenced Documents:
  - NYSDOT Prestressed Concrete Construction Manual
  - NYSDOT Steel Construction Manual
  - NYSDOT Standard Sheets (NOT BD SHEETS)
- These Documents Contain requirements
Armorless Bridge Joint Example
Joint Specification

Approved List

Technical Services - Materials - Approved List
Joint Materials, Structural
Bridge Joint Components

Contracts for after January 1, 2021 may use any combination of an approved Joint Binder Material and an approved Joint Seal Material from the Approved List below:

Joint Binder Types (Item 507.62)
- Elastomeric Concrete (705-10A)
- Polymer Concrete (705-10B)
- MDC Joint Bases (705-50C)

Joint Seal Types (Item 507.63)
- Pressure-Closed-Cell Foam (705-04)
- Foam Supported Silicone (705-25)
- Preformed Seals (705-26)

Ammonium Bridge Joint Systems (705.65)
- No longer required for Contracts for after January 1, 2021. Options are still applicable as long as components are still approved.

Revised on: December 28, 2020
NOTE: All seals shall be Foam Supported Silicone Seals (705-23) meeting the requirements of 567.63. No other types of seal are permitted.

Proposal

- Project Title Sheet
- Contractor’s Bid Package Contents
  - Jurat/Bid Bond/DBE Commitment/Bid Survey/State Business/Itemized Proposal
- Required Contract Provisions
- Special Notes
  - Location Maps/Landscape Dev.
- Project Details
- Standard Specifications Revision
- Special Specifications
- Prevailing Wage Rates
Other Documents

Prestressed Concrete Construction Manual (ny.gov)
Prestressed Concrete Construction Manual

- Fabrication Requirements for Prestressed Concrete Components
- Shop Drawings
- Erection Drawings and Procedures
- Quality Control and Quality Assurance

Steel Construction Manual (ny.gov)
Steel Construction Manual

- Fabrication Requirements for Structural Steel
- Shop Drawing Submittals and Approvals
- Bolted Details
- Welded Details
- Welder Certification
- Shop Assembly Requirements
- Inspection Requirements – Visual, Ultrasonic, Radiograph, Magnetic Particle

NYSDOT Standard Sheets
Bridge Design Standards

- NYSDOT LRFD Bridge Design Specifications
  - This is a combination of:
    - AASHTO LRFD Bridge Design Specifications
    - NYSDOT ‘Blue Pages’
  - Used for Sizing Structural Elements

AASHTO Bridge Design Specifications (LRFD)
1.3 DESIGN PHILOSOPHY

1.3.5 Operational Importance

Delete the second paragraph and replace it with the following:

For the strength limit state:

\[ \eta = 1.05 \text{ for critical bridges}^* \]
\[ = 1.00 \text{ for essential and other bridges} \]

For all other limit states:

\[ \eta = 1.00 \]

*For definition of critical bridges, see Blue Page 3.10.5.
Manual for Condition Evaluation of Bridges

- Allowable Stress (ASR) and Load and Resistance Factor (LFR)

Manual for Bridge Evaluation

Load and Resistance Factor Rating (LRFR)

https://compass.astm.org/?fromLogin=true
New York State
DEPARTMENT OF TRANSPORTATION

BRIDGE MANUAL
2021

NYSDOT BRIDGE MANUAL

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<td>Section 23</td>
<td>Bridge Refinishing</td>
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Design
Section 1
Introduction

1.1 Purpose

This Bridge Manual has been prepared to provide policies and procedures required for bridge project development and bridge design for the New York State Department of Transportation (NYSDOT). This manual provides guidance for the decisions needed in developing a bridge project and includes the policies and standards that are required. This manual also provides commentary discussing sound bridge engineering practices and provides references to additional sources of information for bridge project development and bridge design.

The primary goal of this manual is to aid designers in ensuring that “quality” bridges are constructed. “Quality” bridges are safe, durable, economical, aesthetically pleasing, and environmentally sound.

Although this manual provides guidance on design procedures, many of the subjects presented only highlight design criteria and best practices. It is the responsibility of the designer to perform a complete structural analysis and produce a design that conforms to the current design standards and construction specifications presented in this manual in order to provide a safe, economical, and maintainable structure.

Bridge Detail (BD) Sheets

- Historical Standard Sheets
  - Bridge Design and Detail (BDD) Sheets
  - Guideline Drawing (GLD) Sheets
- Bridge Detail (BD) Sheets
  - Shows level of detail shown on the contract plans
  - Some details may be copied/pasted, but all require review
  - Few are intended as ‘Insert Sheets’
    - Multi-Rotational Bearings (EP/EL/EB Bearings have fill-in tables)
    - Railings
    - Barriers
    - Transitions
    - Miscellaneous (Scuppers, Waterstops, Curbs, Pile Details, etc.)
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<td>Aplishments</td>
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<td>Approach Drainage</td>
<td>04/29/20</td>
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<td>Bearings</td>
<td>10/06/14</td>
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<td>Precast Culverts</td>
<td>02/09/21</td>
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<td>EE</td>
<td>Excavation and Embankment</td>
<td>02/09/21</td>
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<td>FD.E</td>
<td>Snow and Pedestrian Fencing</td>
<td>7/14/16</td>
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<td>ID.E</td>
<td>Integral Abutments</td>
<td>6/30/10</td>
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<tr>
<td>JT</td>
<td>Joint Joints and Modular Joints</td>
<td>9/02/20</td>
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<td>MS.E</td>
<td>Miscellaneous</td>
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<td>OS</td>
<td>Overhead Sign Structures</td>
<td>3/01/17</td>
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<td>PC.E</td>
<td>Prestressed Concrete Beams and Slab Units</td>
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<td>PR.E</td>
<td>Piers</td>
<td>12/03/16</td>
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<td>RT.E</td>
<td>Concrete Traffic Barriers</td>
<td>12/03/14</td>
</tr>
<tr>
<td>NL.E</td>
<td>Rail for Low Volume Bridges</td>
<td>5/01/98</td>
</tr>
<tr>
<td>RP.E</td>
<td>Bicycle and Pedestrian Railings</td>
<td>12/23/16</td>
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<tr>
<td>RB.E</td>
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<td>RU.E</td>
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Standards Unit

Eric Lantzy, Unit Leader
Duane Carpenter, Specifications
Jim Ross, Engineering
Gary Ruth, Detailing
Project Development Manual

- Project Scoping
- Project Design Phases
- Environmental Requirements
- Public Involvement
### Bridge Inspection Manual

**Department of Transportation**

**BRIDGE INSPECTION MANUAL**

March 2017

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New users need to fill out the form given at the link below in order to access EAM (formerly BDIS), which contains Bridge Inventory Data and inspection reports. They should apply for access to all the Regions with Role 24 - "Structures Data Look Up".

CADD Standards

- Chapter 14 of the NYSDOT Bridge Manual
- Chapter 20 of the Highway Design Manual – CADD Standards and Procedures
- Appendix 14 of the Project Development Manual
Comprehensive Asset Management/Capital Investment (CAM/CI)

- [http://gisweb/html5viewer/?viewer=camci](http://gisweb/html5viewer/?viewer=camci)

EI/EB/ED Search Utility (ny.gov)
Other Standards

- NYSDOT Bridge Safety Assurance Vulnerability Manuals
- AASHTO Guide Specifications for Design of Pedestrian Bridges
- American Railway Engineering and Maintenance of Way Association (AREMA)

PDH Question 1

Which of the following takes the precedence when there are conflicts in requirements:

1) Standard Sheets
2) Notes on Contract Plans
3) NYSDOT Standard Specification
4) BD Sheets
PDH Question 1

Which of the following takes the precedence when there are conflicts in requirements:

1) Standard Sheets
2) Notes on Contract Plans
3) NYSDOT Standard Specification
4) BD Sheets

PDH Question 2

A NYSDOT Approved List tells the Contractor what information?

1) Acceptable installation techniques for a given item/material
2) Products that are acceptable to NYSDOT, listed in order of preference
3) Listing of suppliers that have been shown to supply quality materials.
4) Products that are acceptable to NYSDOT, listed in no specific order
PDH Question 2

A NYSDOT Approved List tells the Contractor what information?

1) Acceptable installation techniques for a given item/material
2) Products that are acceptable to NYSDOT, listed in order of preference
3) Listing of suppliers that have been shown to supply quality materials.
4) **Products that are acceptable to NYSDOT, listed in no specific order**

PDH Question 3

All NYSDOT Bridge Detail Sheets are intended to be inserted into a Contract Plan set.

1) True
2) False
PDH Question 3

All NYSDOT Bridge Detail Sheets are intended to be inserted into a Contract Plan set.

1) True  
2) False

PDH Question 4

The order of the details in a set of bridge plans is a matter of preference for the designer.

1) True  
2) False
PDH Question 4

The order of the details in a set of bridge plans is a matter of preference for the designer.

1) True*
2) False

* While technically true, it is a terrible idea. All bridge plans should follow the order outlined in the NYSDOT Bridge Manual to avoid confusion and to make for easy reading and review. Bridge plans sent to Main Office for review will be rejected for not following the proper order.

PDH Question 5

Material and Manufacturing specifications can be found in which section of the NYSDOT Standard Specifications?

1) Section 100
2) Section 300
3) Section 500
4) Section 700
5) All of the Above
PDH Question 5

Material and Manufacturing specifications can be found in which section of the NYSDOT Standard Specifications?

1) Section 100  
2) Section 300  
3) Section 500  
4) **Section 700**  
5) All of the Above

Questions?
Thank You For Your Attention!
Presenter Biography
Joe Albert

Presenter: Joe Albert, P.E.
Position/Title: Professional Engineer 2 (Structures), NYSDOT

Joe Albert is a Project Engineer for the Structures Design Bureau within the NYSDOT Office of Structures. He oversees the final design of new and replacement bridge projects, as well as rehabilitations, throughout New York State. He has also been involved in many accelerated design and construction bridge projects, including emergency repairs. Joe has over 10 years of bridge design experience in both the public and private sector as a designer, squad leader, and project engineer. He graduated from SUNY Buffalo with a Bachelor of Science in Civil Engineering and is a registered Professional Engineer in the State of NY.
Joe Albert, P.E.
NYSDOT
Project Engineer, Structures Design Bureau

Joseph Albert, P.E.
SUNY Buffalo – BS Civil Engineering, 2011.

Worked in the private sector for 5 years

Obtained NYS Professional Engineering License, 2016

Employed by NYSDOT November 2016-Present

Project Engineer, Structures Design Bureau
Presentation Objectives

1. Explain the scoping process, purpose and objectives, design criteria (including site data), and preliminary site layout, per BM Section 3.
2. Explain the process of using engineering judgement to produce feasible alternatives and ultimately selecting the “best” alternative.
3. Show potential ways to balance superstructure and substructure costs.
4. Discuss coordination between multiple disciplines in order to not just economize the structure, but the cost of the entire project.

Bridge Scoping Activities

- Team Building: Interdisciplinary project team put together to identify critical issues, project requirements and to develop solutions that all are in concurrence with. Make sure to schedule meetings on a regular interval.
- Informed Decision Making: Understanding the project goals and objectives → Determination of reasonable alternatives for the project during Phases I-IV and for the bridge type during final design.
- Documentation: Design Approval Documents (DAD) – 5 different formats (see bridge manual)
## Purpose and Objectives

- Determining the project’s purpose and objectives, guidance can be found in the Project Development Manual (https://www.dot.ny.gov/divisions/engineering/design/dqab/pd
m)
- Rehab. Vs. Replacement worksheet (Section 19 of BM) will assist the project developer in deciding whether to replace or rehabilitate the structure.

## Design Criteria

### Site Data

- The key to laying out and delivering a new or replacement bridge project is obtaining accurate and timely site data.

- *Site data review should not be taken lightly,* this is the designer’s opportunity to identify issues that may end up delaying our submissions down the road. A little time up front can save a lot of time down the road!
Site Data Package

- Provides the designer with the information required to select a Structure for a specific site.
- Site Data Package consists of 2 parts:
  - Bridge Data Sheet – Part 1 – Bridge Data Sheet
  - Bridge Data Sheet – Part 2 – Hydraulic Assessment Form
- The Region prepares and assembles the Site Data Package (SDP) or oversees its preparation by a Consultant.
Site Data – Part 2

Hydraulic Analysis Form

- Hydraulic analysis to determine an adequate opening (BM 3.2.3.1)
  - A minimum of 2'-0" of freeboard for the projected Q0 is required for the proposed structure. **The freeboard shall be measured at the lowest point of the superstructure between the two edges of the bottom angle for all structures.**

Hydraulic Table

Temporary Bridge

Slope Protection

*Be sure to coordinate with either Regional Hydraulics or MO Hydraulics as soon as possible to make sure they get involved early and offer input.*
Site Data – Part 2
Hydraulic Assessment Form

For all projects where the bridge crosses water, a Hydraulic data table is required on the General Plan and Elevation drawing.

<table>
<thead>
<tr>
<th>HYDRAULIC DATA</th>
<th>Minimum Channel Elevation</th>
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<tbody>
<tr>
<td>Drainage Area = ______ (sq. miles)</td>
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<tr>
<td>Recurrence Interval (yrs.)</td>
<td>100 50</td>
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<tr>
<td>Peak discharge (ft/s)</td>
<td></td>
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<tr>
<td>High Water Elevation @ Pt. of Max. Backwater</td>
<td>Existing Proposed</td>
</tr>
<tr>
<td>Avg. Velocity Thru Structure (ft/s)</td>
<td></td>
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<tr>
<td>Scour Analysis:</td>
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<tr>
<td>Begin Abutment</td>
<td></td>
</tr>
<tr>
<td>Pier</td>
<td></td>
</tr>
<tr>
<td>End Abutment</td>
<td></td>
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</table>

Scour depth is measured from minimum channel elevation.
Advanced Preliminary Package

Size, Type, Location

- Advanced Preliminary Package consists of the following:
  - Advance Preliminary Plans (also see Appendix 3E of BM)
  - General Plan & Elevation
  - Typical Sections
  - Staging Sections
  - Profile
  - Structure Justification Report (SJR)
  - Preliminary Cost Estimate (PEW’s or itemized)
  - Superstructure Selection Table

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Advanced Preliminary Package

The Process

- Regardless of who the bridge designer is (MOS, Region, or consultant), the preliminary process is required for all new, replacement, and superstructure widenings/replacement bridge projects.
- If the preliminary process is waived for rehabilitations, this will be noted in the signed BRJR.
Advanced Preliminary Package

The Process

1. Submit Advanced Preliminary Package for comments to stakeholders (Region, MOS, metals, concrete, construction, and any other regional groups involved).

2. Work with G.E.B. and Hydraulics.

3. G.E.B. will provide preliminary foundation recommendations.

4. Once signature is obtained by DCES, be sure to post to ProjectWise and to alert all stakeholders that the preliminary has been signed.

5. Submit revised package for signature (include checklist, comment resolution form, preliminary foundation recommendations, and stamped HRR).

6. Hydraulics will provide a stamped HRR.

7. Once signature is obtained by DCES, be sure to post to ProjectWise and to alert all stakeholders that the preliminary has been signed.

Advanced Preliminary Package

SJR

NYSDOT Bridge Manual

Structure Justification Report

Appendix 3F

Structure Justification Report

Structure Justification Report

EXISTING AND PROPOSED BRIDGE DATA:

OPERATIONAL CLASSIFICATION: (Critical, Essential, or Other Bridge)

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<th>NO. OF SPANS</th>
<th>SPAN LENGTH</th>
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<th>SUBSTRUCTURE</th>
<th>M.I.D.E.T.</th>
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<td>UTILITIES</td>
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<td>PROJECT AND SITE CONDITIONS</td>
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<td>INNOVATIVE OR UNUSUAL FEATURES</td>
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<th>EXISTING YEAR BUILT</th>
<th>PROPOSED</th>
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# Advanced Preliminary Package

**PEW's**

### Preliminary Cost Estimate for SHW and Replacement Bridges

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<th>Item</th>
<th>Description</th>
<th>Cost ($MM)</th>
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<tr>
<td>2. <strong>Proposed Type</strong></td>
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<tr>
<td>3. <strong>Number of Span(s)</strong></td>
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<td>[Enter cost]</td>
</tr>
<tr>
<td>4. <strong>Length of Span(s)</strong></td>
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<td>[Enter cost]</td>
</tr>
<tr>
<td>5. <strong>Superstructure Type</strong></td>
<td>[Enter type]</td>
<td>[Enter cost]</td>
</tr>
<tr>
<td>6. <strong>Abutment Type</strong></td>
<td>[Enter type]</td>
<td>[Enter cost]</td>
</tr>
<tr>
<td>7. <strong>Foundation Type</strong></td>
<td>[Enter type]</td>
<td>[Enter cost]</td>
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### Additional Details

- **Can incorporate metalizing or galvanizing here**
- **Region will provide**

---

**Notes:**

- Ensure all components are accounted for.
- Cross-reference with regional availability.

---

**Advanced Preliminary Package**

**PEW's**

- [Diagram of bridge structure]

- **Bridge Geometry Formulas & Equations for Calculating**

  - Shoulder Break Length: \( L = \sqrt{D + 2H} \)
  - Shoulder Break, Lanes: \( (D + 2H) / 2 \) for (Lanes) **Calculations**

---

**Diagram:**

- [Diagram of bridge structure with measurements]

- **Distance from shoulder angle point to toe of rail:**

---

**Department of Transportation**

**Date:** [Enter date]
## Advanced Preliminary Package
### Superstructure Selection Table

| Superstructure Type | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 | 300 | 310 | 320 | 330 | 340 | 350 | 360 | 370 | 380 | 390 | 400 |
|---------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Steel Beam | 3.4 | 4.5 | 5.6 | 6.7 | 7.8 | 8.9 | 9.0 | 10.1 | 11.2 | 12.3 | 13.4 | 14.5 | 15.6 | 16.7 | 17.8 | 18.9 | 20.0 | 21.1 | 22.2 | 23.3 | 24.4 | 25.5 | 26.6 | 27.7 | 28.8 | 29.9 | 31.0 | 32.1 | 33.2 | 34.3 | 35.4 | 36.5 | 37.6 | 38.7 | 39.8 | 40.9 | 42.0 |
| Reinforced Concrete Beam | 4.9 | 6.0 | 7.1 | 8.2 | 9.3 | 10.4 | 11.5 | 12.6 | 13.7 | 14.8 | 15.9 | 17.0 | 18.1 | 19.2 | 20.3 | 21.4 | 22.5 | 23.6 | 24.7 | 25.8 | 26.9 | 28.0 | 29.1 | 30.2 | 31.3 | 32.4 | 33.5 | 34.6 | 35.7 | 36.8 | 37.9 | 39.0 | 40.1 | 41.2 | 42.3 | 43.4 | 44.5 |
| Prestressed Concrete Beam | 7.4 | 8.5 | 9.6 | 10.7 | 11.8 | 12.9 | 14.0 | 15.1 | 16.2 | 17.3 | 18.4 | 19.5 | 20.6 | 21.7 | 22.8 | 23.9 | 25.0 | 26.1 | 27.2 | 28.3 | 29.4 | 30.5 | 31.6 | 32.7 | 33.8 | 34.9 | 36.0 | 37.1 | 38.2 | 39.3 | 40.4 | 41.5 | 42.6 | 43.7 | 44.8 | 45.9 | 47.0 |

## Advanced Preliminary Package
### Allowable Span Length Table

| Superstructure Type | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 170 | 180 | 190 | 200 | 210 | 220 | 230 | 240 | 250 | 260 | 270 | 280 | 290 | 300 | 310 | 320 | 330 | 340 | 350 | 360 | 370 | 380 | 390 | 400 |
|---------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Beam | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 |
| Post Tension Beam | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 |
| Truss | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.7 | 1.8 | 1.9 | 2.0 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 | 2.7 | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 | 3.7 | 3.8 | 3.9 | 4.0 | 4.1 | 4.2 |

---

Denotes Allowable Structure Type for Given Span

Denotes Structure Type Requires Justification for Given Span
# Advanced Preliminary Package

## Importance Factors

### Table 3-5

<table>
<thead>
<tr>
<th>Selection Criteria</th>
<th>Project Specific Condition</th>
<th>Recommended Importance Factor</th>
<th>Commentary</th>
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<tbody>
<tr>
<td><strong>Vertical Curve Profile</strong></td>
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<tr>
<td>Tangent to Horizontal Curve</td>
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<td>Cannot be accommodated by a varying thickness.</td>
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<tr>
<td>Moderate Vertical Curve</td>
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<td>Default value.</td>
</tr>
<tr>
<td>Extreme Vertical Curve</td>
<td></td>
<td>1</td>
<td>Includes any sag curve.</td>
</tr>
<tr>
<td><strong>Horizontality of Horizontal Curve</strong></td>
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<td></td>
</tr>
<tr>
<td>Tangent to Horizontal Curve</td>
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<td>2</td>
<td>Cannot be accommodated by a varying thickness.</td>
</tr>
<tr>
<td>Moderate Horizontal Curve</td>
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<td>1.5</td>
<td>Default value. Includes horizontal arcs with a curve.</td>
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<tr>
<td>Extreme Horizontal Curve</td>
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<td>Includes a single horizontal arc.</td>
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<tr>
<td><strong>Excessive Cross-Sections</strong></td>
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<tr>
<td>Superelevation &gt; 3%</td>
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<td>0.25% Superelevation &gt; 1%</td>
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<td><strong>Data Accumulation</strong></td>
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<tr>
<td>Not a Bridge Crossing</td>
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<td>Default value.</td>
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<tr>
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<td>Operations Requirement</td>
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</table>

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### Appendix 3C

**Project Monitor Sheet**

**Project Monitor (Target Dates)**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Off-Set</th>
<th>Design Height (ft-0&quot;&quot;)</th>
<th>C.G. Offset</th>
<th>Design Height (ft-0&quot;&quot;)</th>
<th>Design Height (ft-0&quot;&quot;)</th>
<th>Design Height (ft-0&quot;&quot;)</th>
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<th>Off-Set</th>
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<td>C.G. Offset</td>
<td>Design Height (ft-0&quot;&quot;)</td>
<td>Design Height (ft-0&quot;&quot;)</td>
<td>Design Height (ft-0&quot;&quot;)</td>
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<td>40 to 90 yrs.</td>
<td>30 yrs.</td>
<td>0 to 90 yrs.</td>
<td>30 yrs.</td>
<td>0 to 90 yrs.</td>
<td>30 yrs.</td>
<td>0 to 90 yrs.</td>
<td>30 yrs.</td>
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</tbody>
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**Programmed**

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<th>Design Height (ft-0&quot;&quot;)</th>
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<th>Design Height (ft-0&quot;&quot;)</th>
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<tbody>
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<td>C.G. Offset</td>
<td>Design Height (ft-0&quot;&quot;)</td>
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<td>Off-Set</td>
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<tr>
<td>30 yrs.</td>
<td>40 to 90 yrs.</td>
<td>30 yrs.</td>
<td>0 to 90 yrs.</td>
<td>30 yrs.</td>
<td>0 to 90 yrs.</td>
<td>30 yrs.</td>
<td>0 to 90 yrs.</td>
<td>30 yrs.</td>
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**Completed**

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<th>Design Height (ft-0&quot;&quot;)</th>
<th>Off-Set</th>
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<tbody>
<tr>
<td><strong>Total</strong></td>
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<td>Design Height (ft-0&quot;&quot;)</td>
<td>C.G. Offset</td>
<td>Design Height (ft-0&quot;&quot;)</td>
<td>Design Height (ft-0&quot;&quot;)</td>
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<td>Off-Set</td>
</tr>
<tr>
<td>30 yrs.</td>
<td>40 to 90 yrs.</td>
<td>30 yrs.</td>
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<td>30 yrs.</td>
<td>0 to 90 yrs.</td>
<td>30 yrs.</td>
<td>0 to 90 yrs.</td>
<td>30 yrs.</td>
</tr>
</tbody>
</table>
Site Layout
Substructure Considerations

- Option #1 – Integral Abutments
  - Criteria for use can be found in Section 11.2.1

Site Layout
Substructure Considerations

- Option #2 – Semi-Integral Abutments
  - Criteria for use can be found in Section 11.2.2
Site Layout

Substructure Considerations

- Option #3 – Conventional Abutments with jointless details

Site Layout

Finding the balance within

- When laying out substructures, span length vs. substructure height should be considered. For example, slightly increasing the span length may allow you to use an integral abutment rather than a semi-integral abutment. The savings on the substructure choice will normally outweigh the additional superstructure costs.

- Placement of the Pier in a multi-span superstructure can also be optimized to create a balanced span configuration which will optimize the superstructure design.
Site Layout

Finding the balance within
Site Layout

Finding the balance within

Site Layout

Making peace with Others

- Sometimes coordination with Highway Design, Geotech, Construction, hydraulics, etc. may help lower the overall cost of the project even if it adds a little cost to the bridge share.
If a job is staged, be sure to try to limit your abutment height. You may end up with a longer span but limiting the height of the abutment will also limit the height of the staging wall. Some staging walls can become very expensive. This could be the difference between a tied back soldier pile lagging wall and sheeting.
Site Layout

Making peace with Others – Geotech

Common Terminology

GRSS – Geosynthetic Reinforced Soil System Wall
- Designer provides retained height and general site conditions to GEB and GEB will design and provide designer with parameters and notes to put into plans.

Sheeting/Braced Excavation
- Designer provides retained height to GEB and GEB will provide designer with minimum section modulus for sheeting. If the sheeting needs to be braced within a cell, typically the designer will design the struts and bracing and GEB will design the sheeting.
Site Layout
Making peace with Others – Geotech
Common Terminology

Solider Pile Lagging Wall
• Designer provides retained height and general site conditions to GEB and GEB will design and provide pile size and lagging size.
Site Layout
Making peace with Others – Geotech
Common Terminology
Solid Pile Lagging Wall
Site Layout

Making peace with Others – Geotech

Common Terminology

Soldier Pile Lagging Wall
Site Layout

Making peace with Others – Geotech

Terminology

Soil Nail Wall
• Designer provides GEB with loads and GEB designs the soil nail wall.

Rockery Wall
• Designer provides GEB with retained height and GEB provides rock sizes and construction details.
Site Layout

Making peace with Others – Geotech

Terminology

Rockery Wall

Hydraulic Considerations:
- Increasing the span length is not always the most economical way to increase hydraulic opening. Work with hydraulics and highway design to try and find the sweet spot between a raise in grade and an increased span length.

Common terminology:
- Ordinary High Water (OHW) – Water surface elevation for the mean annual flood, recurrence interval of 2.33 years.
- Ordinary Water (OW) – Highest surface water elevation likely to be encountered during on construction season.
- Design High Water (DHW) – Q_{50}, flood flow having a recurrence interval of 50 years.
- Scour Elevation – Calculated elevation at which the stream bed material will erode to.
Hydraulic Model – Existing Condition (12 Hour)

Route 28 & 212 Inundated

Hurricane Irene August 2011
Hydraulic Model – Proposed Condition (12 Hour)

Route 28 & 212 Passable

Proof of Concept
Site Layout

Making peace with Others – Highway Design

Highway Design Considerations:

- If there is an opportunity to raise the profile on a bridge to achieve desired vertical clearances, work with Highway Design to find the sweet spot between the highway work and the girder design. An uneconomical beam design can lead to large cost increases where it may be possible to get a minimal raise in profile. Remember 2” in the bridge world is different than 2” in the highway world.

Site Layout

Making peace with Others - Construction

Construction Considerations:

- It may be a small added cost to the project at first but something to think about is facilitating future work. Example of this might be increasing the width of the pier cap at the top to facilitate a future bearing replacement.
Summary and Conclusions

- Scoping → Site Data → Site Layout → Advanced Preliminary → Signed Preliminary
- Every single one of these tasks requires coordination. Coordination and communication is crucial to any phase of any project!
- Preliminary engineering is just as much an art as it is a science. Newer engineers should rely on the experience of their supervisors and ask questions as to why a certain bridge is in its configuration.
- Spend the time up front and it will pay off down the road, not just economically but also with simplifying your design and construction.

PDH QUESTIONS

1.) What is the first option for abutment type?

A. Conventional Abutment
B. Integral Abutment
C. Semi-Integral Abutment
D. Stub Abutment
2.) Which of the following is **NOT** included in a preliminary package?

A. General Plan and Elevation  
B. Typical Section  
C. Profile  
D. Framing Plan

3.) At what location is Hydraulic freeboard measured?

A. The lowest point of the superstructure at the Abutment  
B. The lowest point of the superstructure at the Pier  
C. The lowest point of the superstructure between the two edges of the bottom angle
PDH QUESTIONS

4.) Typically, Soldier Pile Lagging Walls are cheaper than driven Sheeting
   
   A. True
   B. False

PDH QUESTIONS

5.) A bridge project can be completed without coordination with other offices

   A. True
   B. False
Questions?
Presenter Biography
Erica Westhuis

Presenter: Erica Westhuis

Erica Westhuis is the Structures Data Services Unit Manager and is responsible for maintaining the inventory and inspection information for the structural assets of the Department, including bridges, large culverts, and overhead sign structures. She is also Project Manager for the Structure Manager System of the Enterprise Asset Management System and co-chair of the Statewide Structures Management Team. She has been with the Office of Structures since she started at NYSDOT in 1994. She worked in the Structures Design Bureau for eleven years, first as a bridge designer and then as a Design Squad Leader. Prior to her current assignment she spent five years as a Liaison Engineer for Bridge Inspection and six years as the Technical Assistant to the Deputy Chief Engineer - Structures. She graduated from Rensselaer Polytechnic Institute in Troy, NY in 1992 with a Bachelor of Science in Civil Engineering and is a licensed professional engineer in New York State.
Topics

• What is Inventory
• Summary of Assets
• Inventory Layout
  • Demo of System Navigation
• Flow of Data
• Procedures for Inventory Process
• Federal and State Reporting
Topics

• Bridge Management
• Example Queries
• Maps and Apps
• Frequent Issues
• Specifications for the National Bridge Inventory (SNBI)
• Going Forward

Bridge Data Services Unit

Erica Westhuis
• Unit Manager, EAM – SMS Project Manager

Heather Petticrew
• Inventory Quality Assurance, SMS support,
  General Inventory issues

Binod Shah
• GIS Coordinator, Location data for Bridges, LC and OSS, LRS data management
What is Inventory

Bridge, Large Culvert and OSS inventory is comprised of multiple datasets in one comprehensive inventory and inspection software application:

“Enterprise Asset Management Program – Structure Manager System” or SMS

(formerly known as BDIS – Bridge Data Information System however it was expanded to include all structural assets owned by NYSDOT)

What is Inventory

• Over 200 inventory items describing the type of structure, geometry, feature carried, feature crossed and individual elements that make up the structure
• All inspection rating values – NBI ratings and AASHTO Element ratings
• Critical Findings (flags)
• Posting Information (Loads and Vertical Clearances)
What is Inventory

- Vulnerability determinations and ratings
- Load Rating values
- Work History
- Location Information
- Standard photos
- Diving and Fathometer reports
- Etc.

Summary of Assets

- Total number of each asset managed in the system:
  - 19,992 Bridges (includes state, local, authority highway bridges and some pedestrian and railroad bridges)
  - 8,062 Large Culverts – NYSDOT-Owned
  - 4,809 Overhead Sign Structures – NYSDOT-Owned
  - Additional assets – Retaining Walls, Noise Barriers (maintained by others in the Department)
## Typical Workload Summary

- Average number of inventories processed:
  - ~10,000 Bridges
  - ~2,000 Culverts
  - ~350 Posting workflow events
  - ~100 BIN and CIN Assignments
  - ~80 Deletions

---

## So what are we calling this system now?

- Technically its Structure Manager System or SMS
- BDIS was used during the build of the system
- EAMP is the entire suite of all modules
So what are we calling this system now?

Inventory Layout
EAM - SMS Demo
Always a scary proposition to do a live demo but let’s cross our fingers and see what I can show you…

Flow of Data
- Inventory
- Inspection
- Load Rating
- Vulnerabilities
- GIS/LRS
- Highway Data
- Historic Bridges
- Railroad Information
- MMS

Uploaded by data owners or system jobs

• SMS

Used by other systems
- HOOCS
- Bridge Data Reports
- FHWA
- Graber Report
- GASB
- NYSDOT Bridge Data
- Open Data Bridge Data
- GIS Web Services
- Maps and Apps

Automated processes
**Procedure for Inventory Process**

1. Request an Identification Number (if needed)

2. For replacement structures – can copy an existing record
   a. Retains functional class, AADT, political unit etc.
   b. **NEW RECORD:**
   c. Confirm all old values are gone from Work History, Standard Photos, Content Library
      i. Enter new information for Feature Carried, Feature Crossed and Span Inventory
      ii. Verify and correct all other tabs and values

3. For new structures, the entire record will need information

4. Location verification and Maps are generated

5. Quality Control and Quality Assurance approvals

6. System job adds to Inspection Manager

7. Highway Data is populated

• **DO NOT OVERWRITE EXISTING INVENTORY RECORD WITH NEW STRUCTURE’S DATA**
New Standard Maps

Order for New Structures

- Construction about to begin on existing bridge
  ➢ Closed Bridge Report submitted

- Bridge is demolished
  ➢ Deletion Report submitted

- New bridge is built and opened to traffic
  ➢ New record in inventory
Postings and Vertical Clearances

- Closed, reopened, load posting, vertical clearance postings, temporary structures:
  - Timeliness is CRITICAL
  - Used in HOOCS – Automated Highway Oversized Overweight Credentialling System
  - Use the Posting Values or CODES as required

* Full instructions can be found online in our Inventory Manual

Deletions and Abandonments

- Abandoned structures should be RARE
  - Must not cross a travel way
    - Highway
    - Railroad
    - Bike path or pedestrian walkway
  - Deleted structures must be fully removed before deletion
Federal Reporting Values

- FHWA Condition Status uses the lowest value of the 4 NBI ratings:
  - “Good” = Greater than or equal to 7
  - “Fair” = 5 or 6
  - “Poor” = Less than or equal to 4
State Reporting Values

- Translated Condition Rating:
  - Conversion of AASHTO Element values to NYSDOT Condition Rating

- General Recommendation:
  - Direct assessment from Inspector on NYSDOT 1 to 7 Scale

- Weighted NBI value:
  - Similar to former NYSDOT Condition Rating but using NBI ratings

Bridge Management

- Deterioration models
- Global trends statewide
- Performance of new materials or items
- Development of candidates for rehabilitation or replacement in capital program
- Performance measures, assessments and goals for bridge populations
- TAMP – Transportation Asset Management Plan

Bridge Inventory

New York State has 17,542 highway bridges totaling 144,132,000 square feet of deck area, as shown in Table 2.5. The table also shows the same inventory broken down by count.

<table>
<thead>
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<th>Highway System</th>
<th>NYSDOT (Deck Area*)</th>
<th>NYSAA (Deck Area)</th>
<th>Others (Deck Area)</th>
<th>Sub-total (Deck Area)</th>
<th>NYSDOT (Count)</th>
<th>NYSAA (Count)</th>
<th>Others (Count)</th>
<th>Sub-total (Count)</th>
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<td>11.8</td>
<td>9.3</td>
<td>39.7</td>
<td>1,743</td>
<td>446</td>
<td>113</td>
<td>2,302</td>
</tr>
<tr>
<td>Non-Interstate NHS</td>
<td>30.6</td>
<td>12.2</td>
<td>16.4</td>
<td>65.2</td>
<td>2,299</td>
<td>62</td>
<td>570</td>
<td>3,121</td>
</tr>
<tr>
<td>Total NHS</td>
<td>61.0</td>
<td>24.0</td>
<td>25.7</td>
<td>96.8</td>
<td>4,042</td>
<td>505</td>
<td>683</td>
<td>5,302</td>
</tr>
<tr>
<td>Non-Federal Aid Illegal</td>
<td>16.1</td>
<td>1.5</td>
<td>10.6</td>
<td>28.2</td>
<td>2,663</td>
<td>147</td>
<td>1,035</td>
<td>4,747</td>
</tr>
<tr>
<td>Total Federal Aid Eligible</td>
<td>77.1</td>
<td>13.6</td>
<td>36.2</td>
<td>126.9</td>
<td>7,002</td>
<td>655</td>
<td>2,618</td>
<td>10,280</td>
</tr>
<tr>
<td>Non-Federal Aid Eligible</td>
<td>3.2</td>
<td>0.9</td>
<td>13.1</td>
<td>17.2</td>
<td>533</td>
<td>113</td>
<td>6,666</td>
<td>7,262</td>
</tr>
<tr>
<td>Total Statewide</td>
<td>80.3</td>
<td>14.5</td>
<td>49.3</td>
<td>144.1</td>
<td>7,506</td>
<td>768</td>
<td>9,554</td>
<td>17,542</td>
</tr>
</tbody>
</table>

* Millions of square feet.
Life Cycle Planning

Preventive Maintenance

Preservation

Rehabilitation

Bridge Replacement

Current and Projected Bridge Conditions

Figure 7.8 Bridge condition by deck area—$200M average annual spending.
Example Queries
Every time there is an issue with a bridge – anywhere – we need an accurate list of NYS bridges to check:

- How many bridges cross the Canal?
- What bridges need a Post Seismic Inspection?
- How many bridges have Rocker Bearings
- How many bridges have Weathering Steel?
- How many closed or abandoned bridges are there? On the state system?
- What’s the lowest VC we have? Crossing a state highway?
- How many structures have a current L1LR?
- How many grasshopper structures are in NYS?
- How many scour critical bridges in Region 8?
- How many tied arches do we have?
- How many RR bridges does NYSDOT own?
Maps and Apps – Internal to NYSDOT

Maps and Apps – Publicly Available
Frequent Issues - Vertical Clearance

Vertical Clearance - On

**Minimum VC** – this is the measurement if you are driving ON the Feature Carried – F1.

What is the VC above the roadway? In this case, there is no restriction – code “99”
Vertical Clearance – “Under”

Minimum VC – this is the measurement if you are driving on the FEATURE CROSSED – F2.

What is the VC above the roadway?
• For this field – the bridge (F1) should be the obstruction.

Over and Under
**Vertical Clearance – “Over”**

Minimum VC – this is the measurement if you are driving on the FEATURE CROSSED – F3.

What is the VC above the roadway? For this field – you are the top of the stack. The VC should be 99.

Back to our Feature Carried: FEATURE CROSSED – F3 is the obstruction now.

---

**Vertical Clearance - On**

- This was an example for the BIN in the middle – “BIN A”

- If everything is done correctly:

  - The Feature Carried VC for BIN A should match the Feature Crossed VC for BIN B in BIN B’s inventory.
Frequent Issues - Culvert Clarification

**Span Length for Culverts:**
- Along the centerline of the roadway ("diameter" of the pipe)

**Barrel Length:**
- This field was added to determine structures that need confined space entry during inspection. Also added to try to eliminate confusion with "span length" vs "bridge length".

---

**Large Culvert Span Criteria and Measurements**

- Span - Minimum 5 ft perpendicular along centerline of pipe
- Span - Maximum 20 ft along centerline of roadway
Frequent FHWA Item Issues

GTMS 19 – Culvert

• Don’t change the GTMS back and forth
  • Important for historic trends and deterioration curves
  • Important for NBI coding – and condition indexes

• NBI values vs. GTMS Type

• SMS (BDIS) Error Check – checks against ACTIVE INVENTORY, not the current edits you are doing

One more note on Culverts

GTMS for 5 to 20ft Structures – aka Large Culverts:

• This is NOT automatically GTMS-19

• Code based on the type of structure – It’s not GTMS 19 just because it’s in the Large Culvert Program / Module

• Check GTMS and Design Type for proper coding
Inventory Unit Tips & Guidance

Work History – Do not change historic information

Milepoint – not a critical value as we move to LRS

Photos – standard photos should not be covered in snow

NEVER EDIT THE ACTUAL BRIDGE IDENTIFICATION NUMBER!!

Specifications for the National Bridge Inventory - SNBI

Out with the old and in with the new... 😊
Benefits of Current System

Many of the “new” fields required by FHWA actually exist already in our system!

- Needs:
  - Some additional fields needed
  - Some additional codes needed in existing fields
  - Complete reconfiguration of the actual file coding itself
  - More info to come… Going to be a long 4 years of implementation…

Going Forward

- Rail Data to be populated with work from Passenger and Freight
  - New BINs and edits to existing BINs (starting with RRxxxxx)
  - No impact on our work (hopefully)

- Updated Manual and Forms to be issued

- SNBI changes to be implemented – All changes due in March 2026
  - Scheduling
  - Additional codes
  - Additional fields
**Going Forward**

- Continue work on GIS and Linear Reference System
  - Large Culverts all in LRS as authoritative data source
  - Bridges 75% complete in LRS
  - OSS to be added to LRS after LC and Bridges

- Automate all Structure Data on internal and external websites
  - Provide consistency and real time data as appropriate

**PDH Question #1**

.Inventory is used in Bridge Management for:

A. Deterioration models  
B. Performance of innovative items  
C. Development of candidates for replacement  
D. All of the above
PDH Question #2

When are the SNBI requirements due in the Federal File?
- March 2026

PDH Question #3

How is the Vertical Clearance recorded for each Feature?
- A. Measured below the road
- B. Measured from curb to curb
- C. Measured above the Feature being inventoried
- D. We don’t record Vertical Clearances
**PDH Question #4**

True or False: All large culverts are GTMS 19.

- FALSE

**PDH Question #5**

FHWA Condition Status of “Poor” means…

- A. The bridge has a flag.
- B. The bridge’s lowest NBI rating is “4”.
- C. The bridge is posted for load.
- D. The bridge has no money.
Helpdesk Contacts

For issues with the program, email:
  • fixit@its.ny.gov
  • nataliya.shahab@its.ny.gov
  • erica.westhuis@dot.ny.gov or mark.struzinsky@dot.ny.gov or any other NYSDOT manager that would be related to the topic
  • Please put EAM/BDIS in the subject line

For User Account Issues email BDISaccts@dot.ny.gov
  • Password resets, locked accounts, security roles etc..

The End
Presenter Biography
Mark Struzinsky

Mark Struzinsky, P.E.

Mr. Mark Struzinsky is a licensed Professional Engineer with 24 years of bridge design and inspection experience. He graduated with honors earning a Bachelor of Science Civil Engineering degree from SUNY Buffalo in 1998, immediately after which he began his career with the NYS Department of Transportation’s Main Office Structures Division. His design experience includes bridges ranging in complexity from single span box culverts to multi-span interchanges. For several years he supervised a bridge design squad. Currently, he is the NYSDOT Main Office Bridge & Tunnel Inspection Unit Head and Structure Management Assistant Bureau Director. He is responsible for the statewide oversight of the inspection programs, which includes ensuring regulatory compliance, funding procurement, and inspection technical guidance. He is the Editor-in-Chief of the 2014, 2016, and 2017 editions of the NYSDOT Bridge Inspection Manual.
A little about me...
• SUNY Buffalo Class 1998
• Started with Main Office DOT May 1998
• PE since 2003
• Bridge Design 12 years
  • Squad Boss 4 years
• Bridge Inspection since 2010
  • Liaison doing QA review & Contract Negotiation
  • Chief Editor/Writer of last 3 editions of Bridge Inspection Manual
• Unit Head since 2018
• Assistant Bureau Director since June 2022
Outline and Learning Objectives

I. Bridge Definition

II. Quick History of NYSDOT Bridge Inspection Program

III. Inspection Planning

IV. The Rating System

V. Condition Flags

VI. The Inspection Report

VII. SMS (aka ‘BDIS’ and ‘EAM’) and the BIN Folder

I. What span defines a ‘bridge’ per FHWA?

• Bridge span > 20 feet; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.

• Large Culvert 5’ > span > 20’ (See BIM Appendix N)
II. A Quick History of NYSDOT Bridge Inspection Program
   A. Purpose?
   B. What are the goals of the Program?
   C. When was it created?
   D. How has the Bridge Inspection Program evolved since inception?

Purpose & Goals of Bridge Inspection - UCBI § 165.1

- To serve, protect and preserve the health, safety and welfare of the public.
- To provide for a program of comprehensive bridge management, inspection, and maintenance.
- To improve knowledge of the condition of bridges and provide for prioritization of bridges in need of maintenance, rehabilitation and replacement.
- To provide a mechanism for historical predictions, assessment of bridge performance and deterioration, evaluation of effectiveness of preventive maintenance, and determination for increased scheduling of bridge maintenance.
Program Creation and Evolution

1. 1930’s the NYSDOT appears to have been inspecting bridges sporadically
2. 1967 Silver Bridge collapse motivated creation of Federal standards
   - Single eye bar in suspension chain failed
   - 46 died

3. 1971 National Bridge Inspection Standards (NBIS) were publicized
4. 1970’s NYS establishes the Bridge Inventory and Inspection System (BIIS)
   - System setup to rate condition of state bridges
   - 1 (failed) through 7 (new) rating scale

5. 1977 NYS Law requires inspection of bridges on local roads
   - Inspected by local owner prior to this

6. 1982 NYS bridge inspection moved from Maintenance Division to Structures Division

7. 1987 I-90 over Schoharie Creek Bridge collapse (10 died)
Program Creation and Evolution

8. 1988 NYS Legislature passed - State Chapter 781 Laws of 1988 (“Graber Bill”) required NYSDOT to established the Uniform Code of Bridge Inspection (UCBI)

9. NYSDOT Bridge Inspection Manual (BIM)
   • Dates to 1982
   • BIM provides the policy/instructions to per UCBI
   • Recent Editions 2014, 2016 & 2017
   • Working on 2024 Edition

10. January 2016 AASHTO element rating system replaces NYSDOT 1 thru 7 rating

11. June 8, 2022 – new:
   • National Bridge Inspection Standards (NBIS)
   • Specification for the National Bridge Inventory (SNBI)
   • Currently evaluating for implementation in 2024 BIM

III. Inspection Planning

A. Inspection Manuals
B. Inspection Cycle
   • Bridge
   • Large Culvert
C. Types of Inspection
**Bridge Inspection Manuals**

- **AASHTO Manual for Bridge Element Inspection (MBEI)**
  - National Bridge Elements (NBE)
  - Bridge Management Elements (BME)

- **NYSDOT Bridge Inspection Manual (BIM)**
  - NYSDOT specific inspection policy and guidance
  - Agency Defined Elements (ADE)
  - Supplemented by Technical Advisories (TAs)

- **NYSDOT Bridge and Large Culvert Inventory Manual**
  - What/how to document bridge features and other data

- **FHWA Bridge Inspector’s Reference Manual (BIRM)**
  - What/how to inspect.

- **Many others…. (see BIM Section 1)**

**Inspection Cycle**

- **Highway Bridges**
  - **Biennial** (every 2 years) maximum inspection interval
  - **Annual** (interim) inspection if:
    - Active/Inactive Structural (Red or Yellow) Flag
    - Posted for load (exception: R-Posting and ‘errant’ postings)
    - General Recommendation of 3 or less
      (More on Gen. Rec. later in presentation)
    - In future - Select NBI items ≤ 3
**Inspection Cycle**

- **Substructure Unit (SSU)** under highway bridges
  - Portions inaccessible by topside inspection team
  - **60 Month** maximum inspection interval
  - **24 Month** inspection if General Rec. of 3
  - **Annual** inspection if
    - Active/Inactive Structural (Red or Yellow) Flag
    - General Recommendation of 1 or 2
    - Frequency as directed by Inspection Manager or RHE
    - In future - Select NBI items ≤ 3

**Inspection Cycle**

- **Pedestrian/Bicycle Bridges**
  - **Biennial** inspection of NYSDOT owned ped/bicycle bridges
  - **Annual** (interim) inspection same as highway bridges
  - NYSDOT may elect to inspect non-NYSDOT owned ped/bicycle bridges through formal agreement with owner; otherwise, owner is responsible
**Inspection Cycle**

- **Railroad Bridges**
  - Span > 10 feet located at such a depth that it is affected by live loads.
  - Annual inspection required per Feds.
  - NYSDOT inspects State-owned and a few of RR-owned
  - RR owners send NYSDOT letter certifying they performed annual inspections

**Inspection Cycle**

- **Large Culverts (not ‘bridge’ inspection)** – NYSDOT mandated, BIM Appx. N
  i. Gen. Rec. = 7, 6 or 5 inspected at **48 months**.
  ii. Gen. Rec. = 4 or 3 inspected at **24 months**.
  iii. Gen. Rec. = 2 or 1 inspected at **12 months**.
  iv. Active/inactive Red Flags or active Yellow Flags inspected at **12 months**.
**Types of Bridge Inspection**

- General Bridge Inspection
- General Diving (SSU) Inspection
- Special Inspection In-Lieu of (SILO) Interim Inspection
- Special Inspection
- Damage Inspection (new for 2024)
  - Flood, seismic, bridge hit, other
- None Due to Construction

---

**IV. The Rating System**

A. What are AASHTO Elements?

B. How are AASHTO Elements Quantified?

C. What is the Rating Scale and what do the Ratings Represent?

D. What are Element Defects?

E. What are Non-Structural Condition Observations?
Types of Elements

National Bridge Elements – NBE

• Primary structural load carrying members
  • Decks, Railings, Superstructure, Bearings, Substructure, Culverts

• Defined in MBEI

• BIM provides additional guidance

Types of Elements

Bridge Management Elements – BME

• Elements pertinent to long-term durability
  • Joints, Approach Slabs, Wearing Surface and Protective Systems (Paint)

• Defined in MBEI

• BIM provides additional guidance
Types of Elements

Agency Defined Elements – ADE

• Custom NYSDOT elements
• Defined in BIM

All Elements are [functional] specific
**Most Elements are** material **specific**

- Railing Example:
  - NBE 330 - Metal Bridge Rail
  - NBE 332 - Timber Bridge Railing
  - NBE 334 - Masonry Bridge Railing
  - NBE 331 - R.C. Bridge Railing
  - NBE 333 - Other Bridge Railing

**Condition States assessed by Quantity**

- Bearings/Ped./Col. - ‘Each’ bearing assessed separately
- Multi Girder/Cap – all linear ‘Feet’ assessed separately
- Deck – every “Square Foot” assessed separately

See MBEI for further detail on determining element quantity.
• AASHTO Manual for Bridge Element Inspection
  • Defines Condition State rating of
    • 1-Good,
    • 2-Fair,
    • 3-Poor, and
    • 4-Severe

• NYSDOT Bridge Inspection Manual
  • Defines Condition State rating of
    • 5-Unknown
  • Defines ADE CS 1 thru 4

**What is the Rating Scale and what do the Ratings Represent**

- **CS-1 “Good”**
  - No deterioration.
  - Insignificant deterioration requires no repair or maintenance.
  - Repaired to the full capacity & expected life.

- **CS-2 “Fair”**
  - Minor deficiencies that signify progressing deterioration.
  - May need preventive maintenance.
  - Repaired but not equal to the original.
• **CS-3 “Poor”**
  - Advanced deterioration.
  - Does not warrant structural review.
  - May need preventative maintenance or repair.

• **CS-4 “Severe”**
  - Warrants a structural review for strength or serviceability
  - Review indicates strength or serviceability impact
    - (example: bridge posted for load)
  - No longer effective for its intended purpose.
    - (example: sidewalk closed due to extensive tripping hazards/spalling)

• **NYSDOT CS-5 “Unknown” (new guidance coming in 2024)**
  - Element concealed from view
    - Example: Buried Footings and Piles
  - Can’t access for inspection
    - Example: Closed Vault
  - Stage construction
    - Portions closed to highway traffic
Still With Me?

• Each material has unique defects. Example:

<table>
<thead>
<tr>
<th>#</th>
<th>Defect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>Corrosion</td>
</tr>
<tr>
<td>1010</td>
<td>Cracking</td>
</tr>
<tr>
<td>1020</td>
<td>Connection</td>
</tr>
<tr>
<td>1900</td>
<td>Distortion</td>
</tr>
<tr>
<td>4000</td>
<td>Settlement</td>
</tr>
<tr>
<td>6000</td>
<td>Scour</td>
</tr>
<tr>
<td>7000</td>
<td>Damage</td>
</tr>
</tbody>
</table>
Each material has unique defects. Example:

**Defects – Reinforced Concrete (RC)**

<table>
<thead>
<tr>
<th>#</th>
<th>Defect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1080</td>
<td>Delamination / Spall / Patched Area</td>
</tr>
<tr>
<td>1090</td>
<td>Exposed Rebar</td>
</tr>
<tr>
<td>1120</td>
<td>Efflorescence / Rust Staining</td>
</tr>
<tr>
<td>1130</td>
<td>Cracking (RC)</td>
</tr>
<tr>
<td>1190</td>
<td>Abrasion / Wear (PSC/RC)</td>
</tr>
<tr>
<td>1900</td>
<td>Distortion</td>
</tr>
<tr>
<td>4000</td>
<td>Settlement</td>
</tr>
<tr>
<td>6000</td>
<td>Scour</td>
</tr>
<tr>
<td>7000</td>
<td>Damage</td>
</tr>
</tbody>
</table>

**Defect 1130—Cracking (RC and Other)**

<table>
<thead>
<tr>
<th>Condition State 1</th>
<th></th>
<th>Condition State 2</th>
<th></th>
<th>Condition State 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient cracks or moderate-width cracks that have been sealed.</td>
<td>Unsealed moderate width cracks or unsealed moderate pattern (map) cracking.</td>
<td>Wide cracks or heavy pattern (map) cracking.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width less than 0.012 in.</td>
<td>Width 0.012–0.05 in.</td>
<td>Width greater than 0.05 in.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Boundary Image CS 1–2

Boundary Image CS 2–3
**Defects**

- Defects are used to identify Condition State (CS) quantities.
- ‘Worst of’ overlapping defects controls.

---

**Condition State Definitions: Element 12 - RC Deck**

<table>
<thead>
<tr>
<th>Defect</th>
<th>CS 1</th>
<th>CS 2</th>
<th>CS 3</th>
<th>CS 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delamination / Spall / Patched Area (1080)</td>
<td>None</td>
<td>Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.</td>
<td>Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.</td>
<td>The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review.</td>
</tr>
<tr>
<td>Exposed Rebar (1090)</td>
<td>None</td>
<td>Present without measurable section loss.</td>
<td>Present with measurable section loss, but does not warrant structural review.</td>
<td>Does Not Require Comment &amp; Photo</td>
</tr>
</tbody>
</table>

---

**Quantifying Defects**

<table>
<thead>
<tr>
<th>Defect</th>
<th>CS 1</th>
<th>CS 2</th>
<th>CS 3</th>
<th>CS 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delamination / Spall / Patched Area (1080)</td>
<td>None</td>
<td>Delaminated. Spall 1 in. or less deep or 6 in. or less in diameter. Patched area that is sound.</td>
<td>Spall greater than 1 in. deep or greater than 6 in. diameter. Patched area that is unsound or showing distress. Does not warrant structural review.</td>
<td>The condition warrants a structural review to determine the effect on strength or serviceability of the element or bridge; OR a structural review.</td>
</tr>
<tr>
<td>Exposed Rebar (1090)</td>
<td>None</td>
<td>Present without measurable section loss.</td>
<td>Present with measurable section loss, but does not warrant structural review.</td>
<td>Does Not Require Comment &amp; Photo</td>
</tr>
<tr>
<td>Efflorescence / Rust Staining (1120)</td>
<td>None</td>
<td>Surface white without build-up or leaching without rust staining.</td>
<td>Heavy build-up with rust staining.</td>
<td>Requires Comment &amp; Photo</td>
</tr>
<tr>
<td>Cracking (1130)</td>
<td>Insignificant cracks or moderate width cracks that have been sealed.</td>
<td>Unsealed moderate width cracks or cracks of moderate pattern (map) cracking.</td>
<td>Wide cracks or heavy pattern (map) cracking.</td>
<td></td>
</tr>
</tbody>
</table>

**Total Quantity**

<table>
<thead>
<tr>
<th>Unit</th>
<th>CS-1</th>
<th>CS-2</th>
<th>CS-3</th>
<th>CS-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft²</td>
<td>798</td>
<td>199</td>
<td>599</td>
<td>599</td>
</tr>
</tbody>
</table>
Non-Structural Condition Observation (NSCO)

NSCO Definition per BIM Section 5

- may become a danger to vehicular or pedestrian traffic before the next anticipated inspection date, but poses no danger of structural failure or collapse, or
- require remediation to maintain bridge durability, and
- do not duplicate safety flag PIA or structural flag conditions

NSCOs are recorded for conditions within the bridge limits

- Approximately to end of approach slab or railing transition

***New guidance – Issue Safety PIA if may become a danger to vehicular or pedestrian traffic in 120 days

NSCO’s can Include

- Approach
  - Drainage
  - Embankment
  - Settlement
  - Erosion
  - Pavement
  - Railing

- Drainage
  - Scuppers,
  - Downspouts
  - Joint Troughs
  - Etc...
NSCO’s can Include

• Fencing
  • Pedestrian
  • Snow

• Attachments
  • Lighting
  • Fascia Mounted Signs
  • Utilities & Their Supports

NSCO’s can Include

• Bridge Cleaning
  • Bridge Seats
  • Pier Caps
  • Superstructure
  • Deck

• Other
  • Discretion of Inspection Team Leader
V. Condition Flags

- Appendix B - NYSDOT Bridge Inspection Manual (BIM)
- Google “Hypothetical Flagging Examples”

- **Structural**
  - **Yellow** - Let’s keep an eye on it (no response required)
  - **Red** - Let’s take action (6-week response)
  - **Red PIA** - NEEDS IMMEDIATE ATTENTION! (24-hour response)

- **Non-Structural** (but could be part of a structural component: loose deck concrete)
  - **Safety PIA** - NEEDS IMMEDIATE ATTENTION! (24-hour response)

---

Flag Examples

Contract bearings on a warm day, section loss, many others!
VI. The Inspection Report

A. How are the Inspections Documented?

B. Review Process

How are the Inspections Documented

- BIM Section 2B – The Inspection Report
  - Elements, quantities and conditions states
  - Notes
  - Condition Photos
  - Sketches
  - Standard Photos
- Structure Management System (SMS)
  - a.k.a. Enterprise Asset Manager (EAM)
  - a.k.a. Bridge Data Information System (BDIS)
Review/Approval Process

Inspection Team Completes Inspection and Sends in Report

To QC Engineer For QC Review and if OK To M.O. For QA Review

M.O. QA Review
If No Comments = Report is Finalized
If Errors or Omissions = Report is Returned to TL for Revisions

VII. SMS and the BIN Folder

SMS

Hover over title for tool tip

Double click paper clip for attachment
**BIN Folder**

- See BIM Section 2C.3 for full description:
  - 6 years of inspection reports (bridge/dive/fathometer)
  - Bridge plans/sketches
  - Level 1 and 2 load rating summaries
  - Pertinent correspondences (closures, agreements, other)
    - Flag correspondences subfolder
  - Element quantity calculations
- Stored in Regions/Shared with Consultants

---

**Time for a little…**

![Q&A骰子](image)
PDH Question 1
A bridge as defined by FHWA is:
  a. a custom-made replacement tooth or teeth that fill the space where one or more teeth are missing.
  b. a span > 20 feet between under-copings of abutments or spring lines of arches.
  c. a span > 20 between the extreme ends of openings for multiple boxes; it may also include multiple pipes, where the clear distance between openings is less than half of the smaller contiguous opening.
  d. B and C

PDH Question 2
What manual defines the National Bridge Elements’ condition state rating scale?
  a. FHWA Bridge Inspectors Reference Manual
  b. AASHTO Manual for Bridge Element Inspection
  c. AASHTO Manual for Element Condition Assessment
  d. Minimalist Guide to Ensuring the Safety of the Traveling Public
PDH Question 3
Which of the following unit is not used to measure an element quantity?
   a. Each
   b. Feet
   c. Square foot
   d. Cubic foot  Answer

PDH Question 4
Assignment of CS-4 to an element is appropriate when:
   a. A structural review is warranted
   b. A review indicates strength or serviceability impacted
   c. A and B  Answer
PDH Question 5
A NSCO is not

a. A condition that may become a danger to vehicular or pedestrian traffic before the next anticipated inspection date, but poses no danger of structural failure or collapse

b. A condition requires remediation to maintain bridge durability

c. A condition that duplicates safety flag PIA or structural flag conditions