FHWA Bridge Inspector’s Manual:  
Bridge Inspection Reporting

Course No: S05-015
Credit: 5 PDH

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Chapter 4
Bridge Inspection Reporting

Topic 4.1 Structure Inventory

4.1.1 Introduction
A good bridge inspection reporting system is essential to document bridge conditions and to protect the public’s safety and investment in bridge structures. It is, therefore, essential that bridge inspection data be clear, accurate, and complete, since it is an integral part of the lifelong record file of the bridge.

Because of the requirements that are fulfilled in accordance with the National Bridge Inspection Standards (NBIS), it is necessary to employ a uniform bridge inspection reporting system. A uniform reporting system is essential to evaluate the condition of a structure correctly and efficiently. It is a valuable aid in establishing maintenance priorities and replacement priorities, and in determining structure capacity and the cost of maintaining the nation’s bridges. Consequently, importance of the reporting system cannot be overemphasized. Success of any bridge inspection program is dependent upon its reporting system.

4.1.2 FHWA Structure Inventory, Appraisal and Condition Ratings
The FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation’s Bridges (FHWA Coding Guide) is used for defining the bridge inventory and the items to be used to collect information on the overall condition of the deck, superstructure, substructure, and channel. The data is reported to FHWA in accordance with the FHWA Coding Guide. It is not an inspection guide. Each state may use its own coding scheme, provided that the data is directly translatable into the format of the FHWA Coding Guide. In other words, the states are responsible for having the capability to obtain, store, and report certain information about bridges, for collection by FHWA as requested.

The Structure Inventory and Appraisal (SI&A) sheet is a tabulation of information that is submitted for each individual structure (see Figure 4.1.1).

For the small structures and culverts that are less than or equal to 20 feet, some states still collect the inventory information and generate a “local” database.

It is important to note that the SI&A sheet is not an inspection form. Rather, it is a summary sheet of bridge data required by the FHWA to effectively monitor and manage the National Bridge Inspection Program and the Highway Bridge Program.

Substitutes for the SI&A Sheet
There are suitable substitutes for the SI&A sheet. Some states simply reprint the federal form with the same items and item numbers. A few states have elaborate Bridge Management Systems (BMS) with different item numbers that collect all
the data listed on the SI&A form plus additional items not reported to the FHWA (see Figures 4.1.1 through 4.1.5).

**Data Entry Requirements**

For routine, in-depth, fracture critical member, underwater, damage and special inspections, the NBIS requires entry of the SI&A data into the State or Federal agency inventory within 90 days of the date of inspection for State or Federal agency bridges and within 180 days of the date of inspection for all other bridges.

For existing bridge modifications that alter previously recorded data and for new bridges, the NBIS requires entry of the SI&A data into the State or Federal agency inventory within 90 days after the completion of the work for State or Federal agency bridges and within 180 days after the completion of the work for all other bridges.

For changes in load restriction or closure status, the NBIS requires entry of the SI&A data into the State or Federal agency inventory within 90 days after the change in status of the structure for State or Federal agency bridges and within 180 days after the change in status of the structure for all other bridges.
## Structure Inventory and Appraisal Sheet

### IDENTIFICATION
- **State:** CA (California)
- **Struc Num:** 110013
- **Agency ID:** 110013
- ** Sufficiency Rating:** 96.8

### INSPECTION
- **Frequency:** 24 months
- **Inspection Date:** 12/23/1998
- **Next Inspection:** 12/23/1999
- **FC Frequency:** 90
- **FC Inspection Data:** NA
- **Next FC Inspection:** NA
- **LV Frequency:** 925
- **LV Inspection Data:** NA
- **Next LV Inspection:** NA
- **SI Frequency:** 930
- **SI Date:** NA
- **Next SI:** NA

### CLASSIFICATION
- **Highway System:** 104
- **Highway System Length:** 1.000 mi
- **NBI Length:** 1.000 mi
- **Functional Class:** 25
- **Roadway:** 0.5

### CONDITION
- **Deck:** 7.00 ft
- **Super:** 3.00 ft
- **Sub:** 3.00 ft
- **Channel:** 3.00 ft
- **Protected:** 3.00 ft

### LOAD RATING AND POSTING
- **Rating Method:** LRFD
- **Rating Method A:** LRFD
- **Rating Method B:** LRFD
- **Rating Method C:** LRFD
- **Rating Method D:** LRFD
- **Rating Method E:** LRFD
- **Rating Method F:** LRFD
- **Rating Method G:** LRFD
- **Rating Method H:** LRFD
- **Rating Method I:** LRFD
- **Rating Method J:** LRFD
- **Rating Method K:** LRFD
- **Rating Method L:** LRFD
- **Rating Method M:** LRFD
- **Rating Method N:** LRFD
- **Rating Method O:** LRFD
- **Rating Method P:** LRFD
- **Rating Method Q:** LRFD
- **Rating Method R:** LRFD
- **Rating Method S:** LRFD
- **Rating Method T:** LRFD
- **Rating Method U:** LRFD
- **Rating Method V:** LRFD
- **Rating Method W:** LRFD
- **Rating Method X:** LRFD
- **Rating Method Y:** LRFD
- **Rating Method Z:** LRFD
- **Rating Method AA:** LRFD
- **Rating Method AB:** LRFD
- **Rating Method AC:** LRFD
- **Rating Method AD:** LRFD
- **Rating Method AE:** LRFD
- **Rating Method AF:** LRFD
- **Rating Method AG:** LRFD
- **Rating Method AH:** LRFD
- **Rating Method AI:** LRFD
- **Rating Method AJ:** LRFD
- **Rating Method AK:** LRFD
- **Rating Method AL:** LRFD
- **Rating Method AM:** LRFD
- **Rating Method AN:** LRFD
- **Rating Method AO:** LRFD
- **Rating Method AP:** LRFD
- **Rating Method AQ:** LRFD
- **Rating Method AR:** LRFD
- **Rating Method AS:** LRFD
- **Rating Method AT:** LRFD
- **Rating Method AU:** LRFD
- **Rating Method AV:** LRFD
- **Rating Method AW:** LRFD
- **Rating Method AX:** LRFD
- **Rating MethodAY:** LRFD
- **Rating Method AZ:** LRFD
- **Rating Method BA:** LRFD
- **Rating Method BB:** LRFD
- **Rating Method BC:** LRFD
- **Rating Method BD:** LRFD
- **Rating Method BE:** LRFD
- **Rating Method BF:** LRFD
- **Rating Method BG:** LRFD
- **Rating Method BH:** LRFD
- **Rating Method BI:** LRFD
- **Rating Method BJ:** LRFD
- **Rating Method BK:** LRFD
- **Rating Method BL:** LRFD
- **Rating Method BM:** LRFD
- **Rating Method BN:** LRFD
- **Rating Method BO:** LRFD
- **Rating Method BP:** LRFD
- **Rating Method BQ:** LRFD
- **Rating Method BR:** LRFD
- **Rating Method BS:** LRFD
- **Rating Method BT:** LRFD
- **Rating Method BU:** LRFD
- **Rating Method BV:** LRFD
- **Rating Method BW:** LRFD
- **Rating Method BX:** LRFD
- **Rating Method BY:** LRFD
- **Rating Method BZ:** LRFD
- **Rating Method CA:** LRFD
- **Rating Method CB:** LRFD
- **Rating Method CC:** LRFD
- **Rating Method CD:** LRFD
- **Rating Method CE:** LRFD
- **Rating Method CF:** LRFD
- **Rating Method CG:** LRFD
- **Rating Method CH:** LRFD
- **Rating Method CI:** LRFD
- **Rating Method CJ:** LRFD
- **Rating Method CK:** LRFD
- **Rating Method CL:** LRFD
- **Rating Method CM:** LRFD
- **Rating Method CN:** LRFD
- **Rating Method CO:** LRFD
- **Rating Method CP:** LRFD
- **Rating Method CQ:** LRFD
- **Rating Method CR:** LRFD
- **Rating Method CS:** LRFD
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- **Rating Method CU:** LRFD
- **Rating Method CV:** LRFD
- **Rating Method CW:** LRFD
- **Rating Method CX:** LRFD
- **Rating Method CY:** LRFD
- **Rating Method CZ:** LRFD
- **Rating Method DA:** LRFD
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- **Rating Method DC:** LRFD
- **Rating Method DD:** LRFD
- **Rating Method DE:** LRFD
- **Rating Method DF:** LRFD
- **Rating Method DG:** LRFD
- **Rating Method DH:** LRFD
- **Rating Method DI:** LRFD
- **Rating Method DJ:** LRFD
- **Rating Method DK:** LRFD
- **Rating Method DL:** LRFD
- **Rating Method DM:** LRFD
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- **Rating Method DO:** LRFD
- **Rating Method DP:** LRFD
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- **Rating Method DY:** LRFD
- **Rating Method DZ:** LRFD
- **Rating Method EA:** LRFD
- **Rating Method EB:** LRFD
- **Rating Method EC:** LRFD
- **Rating Method ED:** LRFD
- **Rating Method EE:** LRFD
- **Rating Method EF:** LRFD
- **Rating Method EG:** LRFD
- **Rating Method EH:** LRFD
- **Rating Method EI:** LRFD
- **Rating Method EJ:** LRFD
- **Rating Method EK:** LRFD
- **Rating Method EL:** LRFD
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- **Rating Method FA:** LRFD
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- **Rating Method GL:** LRFD
- **Rating Method GM:** LRFD
- **Rating Method GN:** LRFD
- **Rating Method GO:** LRFD
- **Rating Method GP:** LRFD
- **Rating Method GQ:** LRFD
- **Rating Method GR:** LRFD
- **Rating Method GS:** LRFD
- **Rating Method GT:** LRFD
- **Rating Method GU:** LRFD
- **Rating Method GV:** LRFD
- **Rating Method GW:** LRFD
- **Rating Method GX:** LRFD
- **Rating Method GY:** LRFD
- **Rating Mode...
### Structure Inventory and Appraisal Sheet

<table>
<thead>
<tr>
<th>National Bridge Inventory</th>
<th>Structure Inventory and Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/15/94</td>
<td></td>
</tr>
</tbody>
</table>

#### IDENTIFICATION

<table>
<thead>
<tr>
<th>(1) State Name</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(8) Number Structure</td>
<td></td>
</tr>
<tr>
<td>(5) Inventory Route (On/Under)</td>
<td></td>
</tr>
<tr>
<td>(2) Highway Agency District</td>
<td></td>
</tr>
<tr>
<td>(3) County Code</td>
<td></td>
</tr>
<tr>
<td>(4) Place Code</td>
<td></td>
</tr>
<tr>
<td>(6) Features Intersected</td>
<td></td>
</tr>
<tr>
<td>(7) Facility Carried</td>
<td></td>
</tr>
<tr>
<td>(9) Location</td>
<td></td>
</tr>
<tr>
<td>(11) Milepoint/Kilometerpoint</td>
<td></td>
</tr>
<tr>
<td>(12) Base Highway Network</td>
<td>Code</td>
</tr>
<tr>
<td>(13) LRS Inventory Route &amp; Subroute</td>
<td></td>
</tr>
<tr>
<td>(17) Latitude</td>
<td>Deg Min Sec</td>
</tr>
<tr>
<td>(98) Border Bridge State Code</td>
<td></td>
</tr>
<tr>
<td>(99) Border Bridge Structure No.</td>
<td></td>
</tr>
</tbody>
</table>

#### STRUCTURE TYPE AND MATERIAL

| (43) Structure Type Main: Material | Type | Code |
| (44) Structure Type Appr: Material | Type | Code |
| (45) Number of Spans in Main Unit |      |
| (46) Number of Approach Spans |      |
| (107) Deck Structure Type | Code |
| (108) Wearing Surface / Protective System | A) Type of Wearing Surface | Code |
|                                               B) Type of Membrane | Code |
|                                               C) Type of Deck Protection | Code |

#### AGE AND SERVICE

| (27) Year Built |      |
| (106) Year Reconstructed |      |
| (42) Type of Service: On | Under | Code |
| (28) Lanes: On Structure | Under Structure |      |
| (29) Average Daily Traffic |      |
| (30) Year of ADT | (109) Truck ADT % |
| (19) Bypass, Detour Length |    |

#### GEOMETRIC DATA

| (48) Length of Maximum Span | M |
| (49) Structure Length | M |
| (50) Curb or Sidewalk: Left | M | Right | M |
| (51) Bridge roadway width curb to curb | M |
| (52) Deck width out to out | M |
| (32) Approach roadway width (w/shoulders) | M |
| (33) Bridge median | Code |
| (34) Skew: Deg | (35) Structure Flared |      |
| (10) Inventory Route Min Vert Clear | M |
| (67) Inventory Route Total Horiz Clear | M |
| (53) Min Vert Clear Over Bridge Row | M |
| (54) Min Vert Underclear Ref |      |
| (55) Min Lat Underclear RT Ref |      |
| (56) Min Lat Underclear LT Ref |      |

#### NAVIGATION DATA

| (38) Navigation Control | Code |
| (11) Pier Protection |      |
| (39) Navigation Vertical Clearance | M |
| (116) Vert-Lift Bridge NAV Min Vert Clear | M |
| (40) Navigation Horizontal Clearance | M |

#### SUFFICIENCY RATING

| Status |      |

#### CLASSIFICATION

| (112) NBIS Bridge Length |      |
| (104) Highway System |      |
| (26) Functional Class |      |
| (100) Defense Highway |      |
| (101) Parallel Structure |      |
| (102) Direction of Traffic |      |
| (103) Temporary Structure |      |
| (105) Federal Lands Highways |      |
| (110) Designated National Network |      |
| (20) Toll |      |
| (21) Maintain |      |
| (22) Owner |      |
| (37) Historical Significance |      |

#### CONDITION

| (58) Deck |      |
| (59) Superstructure |      |
| (60) Substructure |      |
| (61) Channel & Channel Protection |      |
| (62) Culverts |      |

#### LOAD RATING AND POSTING

| (31) Design Load |      |
| (63) Operating Rating Method |      |
| (64) Operating Rating |      |
| (65) Inventory Rating Method |      |
| (66) Inventory Rating |      |
| (70) Bridge Posting |      |
| (41) Structure Open, Posted or Closed | Description |      |

#### APPRAISAL

| (67) Structural Evaluation |      |
| (68) Deck Geometry |      |
| (69) Underclearances, Vertical & Horizontal |      |
| (71) Waterway Adequacy |      |
| (72) Approach Roadway Alignment |      |
| (36) Traffic Safety Features |      |
| (113) Scour Critical Bridges |      |

#### PROPOSED IMPROVEMENTS

| (75) Type of Work | Code |
| (76) Length of Structure Improvement | M |
| (94) Bridge Improvement Cost | $___,000 |
| (95) Improvements Cost | $___,000 |
| (96) Total Project Cost | $___,000 |
| (97) Year of Improvement Cost Estimate |      |
| (114) Future ADT |      |
| (115) Year of Future ADT |      |

#### INSPECTIONS

| (90) Inspection Date | (91) Frequency | MO |
| (92) Critical Feature Inspection | (93) CFI Date |      |
| A) Fracture Crit Detail | MO A |      |
| B) Underwater Insp | MO B |      |
| C) Other Special Insp | MO C |      |

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**Figure 4.1.2** Typical SI&A Sheet with NBI Data Only
Figure 4.1.3  Oregon Bridge Inspection Report with Element Level Data
CHAPTER 4: Bridge Inspection Reporting
TOPIC 4.1: Structure Inventory

<table>
<thead>
<tr>
<th>NBI Category</th>
<th>Appraisal NBI #</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scour</td>
<td>113</td>
<td>5 Stable w/ footing</td>
</tr>
<tr>
<td>Bridge Rail</td>
<td>36A</td>
<td>0 Substandard</td>
</tr>
<tr>
<td>Transitions</td>
<td>36B</td>
<td>0 Substandard</td>
</tr>
<tr>
<td>Approach Rail</td>
<td>36C</td>
<td>0 Substandard</td>
</tr>
<tr>
<td>Rail Ends</td>
<td>36D</td>
<td>0 Substandard</td>
</tr>
<tr>
<td>Structural</td>
<td>67</td>
<td>5 Above Min Tolerable</td>
</tr>
<tr>
<td>Deck</td>
<td>68</td>
<td>3 Intolerable - Correct</td>
</tr>
<tr>
<td>Clearance</td>
<td>69</td>
<td>N Not applicable (NBI)</td>
</tr>
<tr>
<td>Waterway</td>
<td>71</td>
<td>9 Above Desirable</td>
</tr>
<tr>
<td>Approach Alignment</td>
<td>72</td>
<td>8 Equal Desirable Crit</td>
</tr>
</tbody>
</table>

Remarks

P Conc Deck/Thin Ovl (18)
(6/09) Thin overlay overlaps one of the joints.

R/Conc Open Girdr (110)
Bl 5 girder 1 has exposed stirrups (6/09)

P/Stl Thru Truss/Bot (121)
(6/09) Lots of gasket materials (PVC) on steel joints below the dock.

P/Stl Thru Truss/Top (126)
(6/09) Missing rivets in SE splice at start of thru truss.

R/Conc Arch (144)
CONCRETE ARCH'S HAVE HORIZONTAL CRACKS - NEAR THE CENTER TOP ... (6/09) Steel exposed in spandrel column as well as cracks with efflor on arches. Cathodic Protection project underway @ South approach spans

R/Conc Floor Beam (155)
SOME OF THE CAPS, COLUMNS, HAVE CRACKS, SPALLS & EXPOSED REBAR

R/Conc Plar Wall (210)
(6/09) Bl 7 pier wall, S. ado, has corrosion cracking @ bottom of columns and determination.

R/Conc Cap (234)
MOST OF THE CAPS NEED WASHED... (6/09) Bent 7 cap has spalling w/exposed stirrup near column 2.

Open Expansion Joint (304)
MANY OF THE JOINTS EDGES ARE SPALLING..........ALL JOINTS ARE LEAKING.........JOINT AT MIDSAPAN HAS FAILED - PERCALL CORNER FAILED -
Other Joint (309)
[ none ]

Moveable Bearing (511)
(6/09) Verify total quantity of bearings after completion of cathodic protection.

Conc Bridge Railing (531)
Concrete rail being replaced in south approach spans (6/09)

Misc (900)
(6/09) Earthquake retrofit on S. end, bent 3, cables are tight

Fender System (994)
UW report states rating for elem. 994 as CS1-95%, CS2-3%, and CS3-2%

Notes

Inspection Notes
Reviewed for item #113, stays a T, jnr. user #152, 09-02-08. Tidal hydraulics study needed to determine seriousness and extent of possible scou during the flood of maximum scou potential. Tidal hydraulics study done by West Consultants, changed item 113 from T to 5, 01-11-11, jnr.

Figure 4.1.3 Oregon Bridge Inspection Report with Element Level Data (cont.)

4.1.6
# Chapter 4: Bridge Inspection Reporting

## Topic 4.1: Structure Inventory

### ARIZONA DEPARTMENT OF TRANSPORTATION

**BRIDGE GROUP**

### Structure Inventory & Appraisal

- **Structure Number:** 4023
- **Structure Name:** RC
- **Route:** 60 MP 58.85
- **Road Name:** US 60
- **Agency:** ADOT

#### Location Information
- **N1-State Code:** 049
- **N2-State Hwy District:** 88
- **N3-County Code:** 029
- **N4-Place Code:** 00000
- **N16-Latitude:** 33 deg 47.1 min
- **N17-Longitude:** 115 deg 36.5 min
- **N98-Border St Code - % Resp:** - 0
- **N99-Border Bridge Number:**

#### Inventory Route Data
- **N5-Inv Rte:** 1.2 000 000 0
- **N10-Inv Rte Min Vert Clr (feet):** 99.99
- **N11-Inv Rte Milepoint:** 56.85
- **N26-Functional Class:** 07
- **N29-Avg Daily Traffic:** 2417
- **N30-Year of ADOT:** 1998
- **N47-Inv Rte Tot Horiz Clr (feet):** 39
- **N100-Defense Hwy:** 0
- **N101-Parallel Bridge:** N
- **N102-Direction of Traffic:** 2
- **N104-Hwy System:** 0
- **N105-Percent Truck Traffic:** 46
- **N110-National Network:** 1
- **N114-Future ADOT:** 2427
- **N115-Year of Future ADT:** 2020
- **N200-Is N5 the Prnc. Rte?** Y

#### Responsibility
- **J21-Maint Responsibility:** 01
- **J22-Bridge Owner:** 01
- **J23-ADOT Org Number:** 8852
- **J24-Inspection Team Number:** 4
- **J25-Agency:** ADOT

#### Navigation
- **J38-Navigation Control:** 0
- **J39-Nav Vert Ctr (feet):** 0
- **J40-Nav Horiz Ctr (feet):** 0
- **J111-Nav Pier/Abut Prot:** 0
- **J116-Nav Min Vert Ctr (feet):** 0

#### General Data
- **J33-Bridge Median:** 0
- **J34-Skew:** 0
- **J35-Structure Flared:** 0
- **J37-Historical Significance:** 5
- **J107-Deck Str Type:** 1
- **J108-Wear Surf Prot System:** 6
- **J201-Wear Surf Thickness (inches):** 4

#### Dimensions
- **J32-Appr Rdw Width (feet):** 36
- **J34-Max Span Length (feet):** 10
- **J39-Structure Length (feet):** 32
- **J50a-Lt Curb/Swkr Width (feet):** 1
- **J50b-Rt Curb/Swkr Width (feet):** 1
- **J51-Br Width Curb-Curb (feet):** 39
- **J52-Deck Width Out-Out (feet):** 41.8
- **J112-NBI Br Length:** Y

#### Vertical and Horizontal Clearance
- **J53-Min Vert Over Clr (feet):** 99.99
- **J54-Min Vert Under Clr (feet):** N
- **J55-Min Lat Under Clr Rt (feet):** N 99.9
- **J56-Min Lat Under Clr Lt (feet):** N

#### Service Type, and Span Information
- **J42-Service Type:** 1.5
- **J43-Str Type, Main:** 2.19
- **J44-Str Type, App:** 0.00
- **J45-Number of Main Spans:** 3
- **J46-Number of App Spans:** 0

#### Condition Ratings
- **J58-Deck:** 8
- **J59-Elements:** N
- **J60-Substructure:** N
- **J61-Channel:** 7
- **J62-Curvat:** 7

#### Appraisal Ratings
- **J67-Struct Evaluation:** 7
- **J68-Deck Geometry:** 5
- **J59-Underclearance Rating:** N
- **J71-Waterway Adequacy:** 6
- **J72-Appr Rdw Align:** 8

#### Bridge Scour Data
- **J113-Scour Critical Rating:** 8
- **J202-Found Construction:** 0
- **J221-Scour Countermeasure:** 0

#### Load, Rate, and Post
- **J41-Design Load:** 5
- **J41-Open, Post, Close:** A
- **J63-Method Used for Oper. Rtg:** 5
- **J64-Operating Load Rtg:** 2 - 36
- **J65-Method Used for Inv. Rtg:** 5
- **J66-Inventory Load Rtg:** 2 - 36

#### Bridge Ratings
- **J70-Post Bridge Posting:** 5
- **J103-Str Designation:** A211-Post Load (Tons): 0
- **J22-Date of Load Rtg:**
- **J233-Post Load Vbl EB (ft-lb):** 0 - 0
- **J233-Post Load Vbl WB (ft-lb):** 0 - 0

#### Sufficiency Rating
- **J70-Speed Overload Rating:** 9.32

### General Comments

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Figure 4.1.4 Arizona Structural Inventory and Appraisal Sheet
### Chapter 4: Bridge Inspection Reporting

**Topic 4.1: Structure Inventory**

**Figure 4.1.5** Florida Structural Inventory and Appraisal Sheet
### CHAPTER 4: Bridge Inspection Reporting

**TOPIC 4.1: Structure Inventory**

**Figure 4.1.5** Florida Structural Inventory and Appraisal Sheet (Continued)

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**Structure ID: 520002**

**Structure Identification**
- Admin Area: Not located in area
- District (2): D3 - Chipley
- County (3): (52) Holmes
- Place Code (4): No city involved
- Location (9): 3.2 KM W OF BONIFAY
- Border Br St/Reg (98): Not Applicable
- Border Struct No (99): Share 0 %
- FIPS State/Region (1): Florida
  - Region 4-Atlanta
- NBIS Bridge Len (112): Meets NBIS Length
- Parallel Structure (101): No II bridge exists
- Temp. Structure (103): Not Applicable
- Owner (22): State Highway Agency
- Historic Signif. (37): Not eligible for NRHP

**Geometrics**
- Spans in Main Unit (45): 4
- Approach Spans (48): 0
- Length of Max Span (48): 9.843 ft
- Structure Length (49): 42.979 ft
- Deck Area 1 sq ft
- Structure Flared (35): No flare

**Age and Service**
- Year Built (27): 1964
- Year Reconstructed (105): -1
- Type of Service On (42a): Highway
- Under (42b): Waterway
- Fracture Critical Details: Not Applicable

**Navigation Data**
- Navigation Control (38): Permit Not Required
- Nav Vertical Clr (39): 0 ft
- Nav Horizontal Clr (40): 0 ft
- Min Vert Lift Clr (115): 0 ft
- Pier Protection (111): Not Applicable

**NBI Condition Rating**
- Sufficiency Rating: *99.5*
- Structural Eval (67): Above Min Criteria
- Deficiency: Not Deficient

**Minimum Vertical Clearance**
- Over Structure (53): 99.99 ft
- Under (reference) (54a): Feature not hwy or RR
  - Under (54b): 0 ft

**Load Rating**
- Design Load (31): M 13.5 (H 15)
- Rating Date: 08/08/1994 Initials JF
- Posting (70): At/Above Legal Loads

**Minimum Lateral Underclearance**
- Reference (55a): Feature not hwy or RR
  - Right Side (55b): 0 ft
  - Left Side (56): 0 ft

**6 Schedule**

**Current Inspection**
- Inspection Date: 01/06/2000
- Inspector MT338TK - Tom Klopfenstein
- Primary Type: Regular NBI
- Review Required: 

**Inspection Types Performed**
- NBI ✓ Element ✓ Fracture Critical 
  - Underwater
  - Other Special

**Next Inspection Date**
- Scheduled: NBI 01/06/2002
- Element: 01/06/2002
  - Fracture Critical
  - Underwater
  - Other Special

---

4.1.9
### CHAPTER 4: Bridge Inspection Reporting

TOPI 4.1: Structure Inventory

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**Figure 4.1.5**  Florida Structural Inventory and Appraisal Sheet (Continued)

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**Structure ID: 520002**

<table>
<thead>
<tr>
<th>Inspection Intervals</th>
<th>Required (92)</th>
<th>Frequency (92)</th>
<th>Last Date (93)</th>
<th>Inspection Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fracture Critical</td>
<td></td>
<td>mos</td>
<td></td>
<td>Crew Hours: 8</td>
</tr>
<tr>
<td>Underwater</td>
<td></td>
<td>mos</td>
<td></td>
<td>Flagger Hours: 0</td>
</tr>
<tr>
<td>Other Special</td>
<td></td>
<td>mos</td>
<td></td>
<td>Helper Hours: 0</td>
</tr>
<tr>
<td>NBI</td>
<td></td>
<td>24 mos (91)</td>
<td>01/06/2000</td>
<td>Snoopor Hours: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Special Crew Hours: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Special Equip Hours: 0</td>
</tr>
</tbody>
</table>

**5 Custom**

**General Bridge Information**
- Parallel Bridge Seq: [ ]
- Channel Depth: 0.328 ft
- Radio Frequency: -1
- Phone Number: (000) 000-0000
- Exception Date: [ ]
- Exception Type: Unknown

**Bridge Load Rating Information**
- Gvr. Span Length: 9.843 ft
- L-Rating Originating Design Plans
- Load Rating Date: 08/08/1994
- Method Calculation: AASHTO formula
- Load Dist. Factor: 0.168
- Impact Factor: 0
- Design Method: Load Factor
- Design Measure: English
- Recommended Single Unit: -1 tons
- Recommended Combination: -1 tons
- Recommended Tandem: -1 tons
- Single Unit Truck 2 Axles: 48.502 tons
- Single Unit Truck 3 Axles: 60.627 tons
- Single Unit Truck 4 Axles: 74.957 tons
- Combination Unit Truck 3 Axles: 79.366 tons
- Combination Unit Truck 4 Axles: 79.366 tons
- Combination Unit Truck 5 Axles: 87.093 tons
- Truck Trailer 6 Axles: 95.901 tons
- Posting Weight: tons
- Posting Single Unit: -1 tons
- Posting Combination Unit: -1 tons
- Posting Tandem Unit: -1 tons

**Bridge Scour and Storm Information**
- Pile Driving Record: Not Applicable
- Foundation Type: Foundation details
- Mode of Flow: Riverina
- Rating Scour Eval: Low Risk - Low
- Highest Scour Eval: Phase I completed
- Scour Recommended I: Stop scour evaluations
- Scour Recommended II: Unknown
- Scour Recommended III: Unknown
- Scour Elevation: -1 ft
- Action Elevation: -1 ft
- Storm Frequency: -1

**1 Condition**

**NBI Rating**
- Channel (81): No Deficiencies
- Deck (58): Not Applicable
- Superstructure (59): Not Applicable
- Substructure (60): Not Applicable
- Culvert (82): Minor Deterioration
- Waterway (71): 8 - Equal Desirable
- Unrepaired Spalls: -1 sq. ft.
- Review Required: [ ]

---

4.1.10
Some agencies furnish standardized sketch sheets and photo sheets to inspectors for report generation. Some agencies have developed their forms on software packages for use on portable computers (see Figures 4.1.6 and 4.1.7) or wearable computers (see Figures 4.1.8 and 4.1.9).
CHAPTER 4: Bridge Inspection Reporting

TOPIC 4.1: Structure Inventory

Figure 4.1.6  Portable Computer

Figure 4.1.7  Inspector Using Portable Computer
Figure 4.1.8  Wearable Computer with Case

Figure 4.1.9  Inspector Using Wearable Computer
The data and information required of states by the FHWA is listed in the *FHWA Coding Guide* and AASHTO *Manual for Bridge Evaluation*. It is important to note that several items listed in the *FHWA Coding Guide* apply to both the field and office personnel responsible for bridge inspections. The bridge inspector is typically not required to obtain the data for all the items during every inspection of a bridge. Once a bridge has been inventoried, the majority of the geometric and other inventory items will remain unchanged. The inspector is responsible for spot checking to see if inventoried items are consistent with observations at the bridge site.

### 4.1.3 Inventory Items

Inventory items pertain to a bridge’s characteristics. For the most part, these items are permanent characteristics, which only change when the bridge is altered in some way, such as reconstruction or load restriction. Inventory items include the following SI&A items:

- **Identification** – Identifies the structure using location codes and descriptions.
- **Structure Type and Material** – Categorizes the structure based on the material, design and construction, the number of spans, and wearing surface.
- **Age and Service** – Information showing when the structure was constructed or reconstructed, features the structure carries and crosses, and traffic information.
- **Geometric Data** – Includes pertinent structural dimensions.
- **Navigation Data** – Identifies the existence of navigation control, pier protection, and waterway clearance measurements.
- **Classification** – Classification of the structure and the facility carried by the structure are identified.
- **Load Rating and Posting** – Identifies the load capacity of the bridge and the current posting status. This item is subject to change as conditions change and is therefore not viewed as a "permanent" item.
- **Proposed Improvements** – Items for work proposed and estimated costs for all bridges eligible for funding from the Highway Bridge Program.
- **Inspection** – Includes latest inspection dates, designated frequency, and critical features requiring special inspections or special emphasis during inspection.

All inventory items are explained in the *FHWA Coding Guide*. Although inventory items are usually provided from previous reports, the inspector is responsible for verifying and updating the inventory data as needed. See Topic 4.2 for condition and appraisal rating items.
4.1.4
Condition and Appraisal Rating Items

Condition Rating Items

Condition ratings are used to describe the existing, in-place bridge as compared to the as-built condition. Condition ratings are typically coded by the inspector. Condition rating items include:

- Deck – Describes the overall condition rating of the deck. This condition of the surface/protective systems, joints, expansion devices, curbs, sidewalks, parapets, fascias, bridge rail and scuppers is not included in the rating, but the condition will be noted in the inspection form. Decks that are integral with the superstructure will be rated as a deck only and not influence the superstructure rating.
- Superstructure – Describes the physical condition of all the structural members. The condition of the bearings, joints, paint system, etc. will not be included in the rating except for extreme situations, but the condition will be noted in the inspection form. Superstructures that are integral with the deck will be rated as a superstructure only and not influence the deck rating.
- Substructure – Describes the physical condition of piers, abutments, piles, fenders, footings or other components.
- Channel and channel protection – Describes the physical condition that is associated with the flow of the water through the bridge which include the stream stability and the condition of the hydraulic countermeasures.
- Culvert – Evaluates the alignment, settlement, joints, structural condition, scour and any other of the items that may be associated with a culvert.

Appraisal Rating Items

Appraisal ratings are a judgment of a bridge component condition in comparison to current standards. Appraisal items are used to evaluate a bridge in relation to the level of service which it provides on the highway system of which it is a part. The structure will be compared to a new one which is built to current standards for that particular type of road. Appraisal rating items include:

- Structural Evaluation – Overall evaluation of the structure based on the lowest bridge component condition rating, excluding the deck, superstructure, substructure, channel and channel protection and culverts. This item is calculated by the FHWA Edit/Update program.
- Deck Geometry – Evaluates the curb-to-curb bridge roadway width and the minimum vertical clearance over the bridge roadway. This item is calculated by the FHWA Edit/Update program.
- Under-clearances, Vertical and Horizontal – The vertical and horizontal under-clearances from the through roadway under the structure to the superstructure or substructure units. This item is calculated by the FHWA Edit/Update program.
- Waterway Adequacy – Appraises waterway opening with respect to passage of flow under the bridge.
- Approach Roadway Alignment – Comparing the alignment of the bridge
approaches to the general highway alignment of the section of highway that the structure is on.

- Traffic Safety Features – Record information on bridge railings, transitions, approach guiderail, approach guiderail ends, so that evaluation of their adequacy can be made.
- Scour Critical Bridges – Identify the current status of the bridge regarding its vulnerability to scour.

**4.1.5 The Role of Inventory Items in Bridge Management Systems**

Inventory items are an important part of an owner’s Bridge Management System (BMS). Bridge owners use the inventory items to help plan inspection, maintenance, and reconstruction of their bridges, as well as classify their bridges. There have been times when there has been a problem on a particular bridge and the owners used the inventory items of that bridge to search for the same potential problems that might exist on other bridges.
### Chapter 4
#### Bridge Inspection Reporting

#### 4.2 Condition and Appraisal

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4.2.1 
**Introduction**

The reported condition of an element or component is an evaluation of its current physical state compared to what it was on the day it was built. Appraisal rating items are used to evaluate a bridge in relation to the level of service it provides on the highway system of which it is a part.

4.2.2 
**Condition Rating Items**

**Deck, Superstructure and Substructure**

Accurate assignment of condition ratings is dependent upon the bridge inspector’s ability to identify the bridge components and their elements. Bridge components are the major parts comprising a bridge including the deck, superstructure, and substructure. Bridge elements are individual members comprised of basic shapes and materials connected together to form bridge components.

The overall condition rating of bridge components is directly related to the physical deficiencies of bridge elements.

**Evaluating Elements**

The inspector is responsible for evaluating each element of each component and assigning to it a descriptive condition rating of “good,” “fair,” or “poor,” based on the physical deficiencies found on the individual element. The following guidelines are used in establishing an element’s condition rating:

- **Good** - element is limited to only minor problems.
- **Fair** - structural capacity of element is not affected by minor deterioration, section loss, spalling, cracking, or other deficiency.
- **Poor** - structural capacity of element is affected or jeopardized by advanced deterioration, section loss, spalling, cracking, or other deficiency.

To ensure a comprehensive inspection and as a part of the requirements of record keeping and documentation, an inspector is responsible for recording the location, type, size, quantity, and severity of deterioration and deficiencies for each element of a given component.

**Evaluating Components**

The following major components of bridges receive an overall Structure Inventory and Appraisal (SI&A) component condition rating:

- Item No. 58 – Deck
- Item No. 59 – Superstructure
- Item No. 60 – Substructure

**Component Condition Rating Guidelines**

NBI component condition ratings for deck, superstructure, or substructure components, in general, should reflect the overall condition of the component rather than localized conditions. This has been true for many years and is emphasized in the FHWA *Coding Guide* with the following wording:
Condition codes are properly used when they provide an overall characterization of the general condition of the entire component being rated. Conversely, they are improperly used if they attempt to describe localized or nominally occurring instances of deterioration or disrepair. Correct assignment of a condition code must, therefore, consider both the severity of the deterioration or disrepair and the extent to which it is widespread throughout the component being rated.

Although the FHWA Coding Guide states that it is improper to use the condition codes to describe localized instances of deterioration or disrepair, it also states that the inspector must consider both the severity and extent of the deterioration. With this in mind, there are occasions when a severe, localized condition affects the structural capacity of a component member. It is important to recognize that the coding applies to all primary members of a component. Therefore, localized conditions that impact the structural capacity of just one member can impact the overall performance of the entire component. The affect on structural capacity is dependent upon several factors including the type and extent of the deterioration, as well as the location along the member. An inspector may need to discuss the observed condition with an engineer to make this determination. When these situations occur, it is appropriate to assign a lower component condition rating for that component from a safety perspective and is in keeping with the intent of the National Bridge Inspection Program.

When these localized conditions are determined to be such that prompt action is needed and/or the overall component condition rating is affected, the conditions should also be addressed through the "critical findings" process that is identified in the NBIS regulation. The NBI component condition rating should be reviewed and appropriately adjusted once the critical finding has been addressed. This adjustment will depend on how the critical finding was addressed and how that action relates to the original rating rationale.

The coding of NBI condition items should be viewed as important, but secondary, to the recognition of and follow-up on critical findings.

Currently, states employ two approaches to coding condition items when localized areas of severe deterioration are encountered. Some will account for the severity of a localized area of deterioration by lowering the condition rating of an entire component. The component condition rating is adjusted after the deteriorated area is improved (i.e., rating may rise if physical improvements are made, or may stay the same if the bridge is posted for load restrictions and/or supported with temporary shoring). FHWA recognizes this approach when the severity of the localized deterioration affects the structural capacity of the component.

Other states “rate to the average” regardless of the severity of a localized area of deterioration. This approach relies heavily on ensuring that critical findings are addressed in a timely manner regardless of the component condition rating value. If the localized area of severe deterioration is not improved following the critical finding follow-up process, the component condition rating may need to be lowered to account for the severity of the deterioration if structural capacity is affected.

Either approach to coding the condition items results in the same ultimate outcome, i.e. critical inspection findings are addressed to ensure continued safe use
of the bridge and component condition ratings eventually reflect the overall condition of the component. If the approach is to consider both the severity and extent of a component’s deterioration in rating each component at the time of inspection (or up to 90 days after the inspection as required by the NBIS), there cannot be any assumptions about future improvements made to a localized area. Only if an improvement is made, the rating should then be raised as appropriate. If the improvement is made within 90 days of the inspection, there is no need to consider the localized deterioration in the rating.

The following general component condition rating guidelines (obtained from the 1995 edition of the FHWA Coding Guide) are to be used in the evaluation of the deck (Item 58), superstructure (Item 59), and substructure (Item 60):

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>NOT APPLICABLE</td>
</tr>
<tr>
<td>9</td>
<td>EXCELLENT CONDITION</td>
</tr>
<tr>
<td>8</td>
<td>VERY GOOD CONDITION - no problems noted.</td>
</tr>
<tr>
<td>7</td>
<td>GOOD CONDITION - some minor problems.</td>
</tr>
<tr>
<td>6</td>
<td>SATISFACTORY CONDITION - structural elements show some minor deterioration.</td>
</tr>
<tr>
<td>5</td>
<td>FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling, or scour.</td>
</tr>
<tr>
<td>4</td>
<td>POOR CONDITION - advanced section loss, deterioration, spalling, or scour.</td>
</tr>
<tr>
<td>3</td>
<td>SERIOUS CONDITION - loss of section, deterioration, spalling, or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.</td>
</tr>
<tr>
<td>2</td>
<td>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.</td>
</tr>
<tr>
<td>1</td>
<td>“IMMINENT” FAILURE CONDITION - major deterioration or section loss present in critical structural components, or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put bridge back in light service.</td>
</tr>
<tr>
<td>0</td>
<td>FAILED CONDITION - out of service; beyond corrective action.</td>
</tr>
</tbody>
</table>

The component condition rating guidelines presented above are general in nature and can be applied to all bridge components and material types.

Structural capacity is defined as the designed strength of the member. However, structural capacity is different than load-carrying capacity. Load-carrying capacity refers to the ability of the member to carry the legal loads of the highway system of which the bridge is a part. Therefore, a bridge could possibly have good structural capacity yet be load posted because it is unable to carry the legal loads.
A bridge’s load-carrying capacity is not to influence component condition ratings. The fact that a bridge was designed for less than current legal loads, and may even be posted, has no influence upon component condition ratings.

Component condition ratings are determined by applying condition descriptions, which are general in nature, covering a broad array of bridge components and material types. The inspector is responsible for being familiar with terminology concerning material types and associated deficiency to utilize condition descriptions for accurately assigning component condition ratings. The following illustrates several common deficiency terms found in condition descriptions and their associated material types:

- Section loss usually applies to steel members or reinforcing steel
- Fatigue crack applies to steel members
- Cracking/spalling usually are used to describe concrete
- Shear crack usually applies to concrete but may apply to timber as well
- Checks/splits applies to timber members
- Scour can apply to substructure

Establishing a link between material type and deficiency allows for accurate component condition ratings determined by utilizing condition descriptions for ratings 9 through 1 found in the general component condition rating guidelines.

Supplemental component condition rating guidelines, which may be developed by individual states, are intended to be used in addition to the FHWA Coding Guide to make it easier for the inspector to assign the most appropriate condition rating to the component being considered and improve uniformity.

Using the material and component specific supplemental rating guidelines (found in the 1995 edition of the FHWA Coding Guide) helps to clarify how each type of deficiency affects the component condition rating. Care has to be taken not to “pigeonhole” the rating based on only one word or phrase. The following is one suggested method for determining proper component condition ratings:

- Identify phrases that describe the component
- Read through the rating scale until encountering phrases that describe conditions that are more severe than what actually exists
- Be sure to read down the ratings list far enough
- Correct rating number then is one number higher

This procedure generally works with all of the component condition rating guidelines.
4.2.3
Channel and Channel Protection
Condition Ratings

General

For structures located over waterways, a Structure Inventory and Appraisal (SI&A) condition rating is provided for the channel and channel protection:

- Item No. 61 – Channel and Channel Protection

Overall Condition

This item describes the physical conditions associated with the flow of water through the bridge such as stream stability and the condition of the channel, riprap, slope protection, or stream control devices, including spur dikes. The inspector should be particularly concerned with visible signs of excessive water velocity which may cause undermining of slope protection, erosion of banks, and realignment of the stream. Accumulation of drift and debris on the superstructure and substructure should be noted on the inspection form but not included in the component condition rating of the superstructure and substructure.

Evaluate and code the condition in accordance with the previously described general component condition ratings, procedures to account for critical findings, and the following descriptive codes:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Not applicable. Use when bridge is not over a waterway (channel).</td>
</tr>
<tr>
<td>9</td>
<td>There are no noticeable or noteworthy deficiencies which affect the condition of the channel.</td>
</tr>
<tr>
<td>8</td>
<td>Banks are protected or well vegetated. River control devices such as spur dikes and embankment protection are not required or are in a stable condition.</td>
</tr>
<tr>
<td>7</td>
<td>Bank protection is in need of minor repairs. River control devices and embankment protection have a little minor deficiency. Banks and/or channel have minor amounts of drift.</td>
</tr>
<tr>
<td>6</td>
<td>Bank is beginning to slump. River control devices and embankment protection have widespread minor deficiency. There is minor streambed movement evident. Debris is restricting the channel slightly.</td>
</tr>
<tr>
<td>5</td>
<td>Bank protection is being eroded. River control devices and/or embankment have major deficiency. Trees and brush restrict the channel.</td>
</tr>
<tr>
<td>4</td>
<td>Bank and embankment protection is severely undermined. River control devices have severe deficiency. Large deposits of debris are in the channel.</td>
</tr>
<tr>
<td>3</td>
<td>Bank protection has failed. River control devices have been destroyed. Streambed aggradation, degradation, or lateral movement has changed the channel to now threaten the bridge and/or approach roadway.</td>
</tr>
<tr>
<td>2</td>
<td>The channel has changed to the extent the bridge is near a state of collapse.</td>
</tr>
<tr>
<td>1</td>
<td>Bridge closed because of channel failure. Corrective action may put bridge back in light service.</td>
</tr>
</tbody>
</table>
4.2.4 Culvert Condition Ratings

General

When assigning a culvert condition rating, all areas of the culvert and the possible effects on the overall structure are investigated. The inspector considers whether the component is functioning properly, whether it could pose a threat to safety or cause property damage, and whether it could cause more extensive damage if not repaired.

Evaluating Elements

Chapter 14 addresses the individual elements of various culverts. The overall component condition rating considers all of the elements which make up a culvert and are useful in establishing maintenance, rehabilitation, and replacement programs and priorities.

Although some of the individual elements of culverts are not directly considered in the FHWA Coding Guide, these supplemental items are useful in determining the overall culvert condition ratings. They may also be included as part of an agency's bridge management system.

Evaluating Components

In addition to the major components of bridges (deck, superstructure, and substructure), culverts also receive a Structure Inventory and Appraisal (SI&A) overall component condition rating:

- Item No. 62 – Culverts

Component Condition Rating Guidelines

This item evaluates the alignment, settlement, joints, structural condition, scour, and other items associated with culverts. The component condition rating code is intended to be an overall condition evaluation of the culvert. Integral wingwalls to the first construction or expansion joint are included in the evaluation.

Item 58 – Deck, Item 59 – Superstructure, and Item 60 – Substructure should be coded N for all culverts.

Evaluate and code the culvert condition in accordance with the previously described general component condition ratings, procedures to account for critical findings and the following descriptive codes:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Not applicable. Use if structure is not a culvert.</td>
</tr>
<tr>
<td>9</td>
<td>No deficiencies.</td>
</tr>
<tr>
<td>8</td>
<td>No noticeable or noteworthy deficiencies which affect the condition of the culvert. Insignificant scrape marks caused by drift.</td>
</tr>
<tr>
<td>7</td>
<td>Shrinkage cracks, light scaling, and insignificant spalling which does not expose reinforcing steel. Insignificant damage caused by drift with no misalignment and not requiring corrective action. Some minor scouring</td>
</tr>
</tbody>
</table>
has occurred near curtain walls, wingwalls, or pipes. Metal culverts have a smooth symmetrical curvature with superficial corrosion and no pitting.

6 Deterioration or initial disintegration, minor chloride contamination, cracking with some leaching, or spalls on concrete or masonry walls and slabs. Local minor scouring at curtain walls, wingwalls, or pipes. Metal culverts have a smooth curvature, non-symmetrical shape, significant corrosion, or moderate pitting.

5 Moderate to major deterioration or disintegration, extensive cracking and leaching, or spalls on concrete or masonry walls and slabs. Minor settlement or misalignment. Noticeable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection in one section, significant corrosion or deep pitting.

4 Large spalls, heavy scaling, wide cracks, considerable efflorescence, or opened construction joint permitting loss of backfill. Considerable settlement or misalignment. Considerable scouring or erosion at curtain walls, wingwalls, or pipes. Metal culverts have significant distortion and deflection throughout, extensive corrosion or deep pitting.

3 Any condition described in Code 4 but which is excessive in scope. Severe movement or differential settlement of the segments, or loss of fill. Holes may exist in walls or slabs. Integral wingwalls nearly severed from culvert. Severe scour or erosion at curtain walls, wingwalls, or pipes. Metal culverts have extreme distortion and deflection in one section, extensive corrosion, or deep pitting with scattered perforations.

2 Integral wingwalls collapsed, severe settlement of roadway due to loss of fill. Section of culvert may have failed and can no longer support embankment. Complete undermining at curtain walls and pipes. Corrective action required to maintain traffic. Metal culverts have extreme distortion and deflection throughout with extensive perforations due to corrosion.

1 Bridge closed. Corrective action may put bridge back in light service.

0 Bridge closed. Replacement necessary.

4.2.5 Appraisal Rating Items

The following SI&A items are known as appraisal rating items:

- Item No. 67 – Structural Evaluation
- Item No. 68 – Deck Geometry
- Item No. 69 – Underclearances, Vertical and Horizontal
- Item No. 71 – Waterway Adequacy
- Item No. 72 – Approach Roadway Alignment
- Item No. 36 – Safety Features
- Item No. 113 – Scour Critical Bridges

Appraisal rating items are used to evaluate a bridge in relation to the level of
service it provides on the highway system of which it is a part. The level of service for a bridge describes the function the bridge provides for the highway system carried by the bridge. The structure is compared to a new one that is built to current standards for that particular class of road. The exception is Item 72, Approach Roadway Alignment. Rather than comparing the alignment to current standards, it is compared to the general existing alignment of the roadway approaches to the bridge compared to the general highway.

The level of service goals used to appraise bridge adequacy vary depending on the highway functional classification, traffic volume, and other factors. The goals are set with the recognition that widely varying traffic needs exist throughout highway systems. Many bridges on local roads can adequately serve traffic needs with lower load capacity and geometric standards than would be necessary for bridges on heavily traveled main highways.

If national uniformity and consistency are to be achieved, similar structure, roadway, and vehicle characteristics are evaluated using identical standards. Therefore, tables and charts have been developed which are used to evaluate the appraisal rating items for all bridges submitted to the National Bridge Inventory, regardless of individual state criteria used to evaluate bridges.

The following general appraisal rating guidelines (obtained from the 1995 edition of the FHWA Coding Guide) are used to evaluate structural evaluation (Item 67), deck geometry (Item 68), underclearances (Item 69), waterway adequacy (Item 71) and approach roadway alignment (Item 72).

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Not applicable</td>
</tr>
<tr>
<td>9</td>
<td>Superior to present desirable criteria</td>
</tr>
<tr>
<td>8</td>
<td>Equal to present desirable criteria</td>
</tr>
<tr>
<td>7</td>
<td>Better than present minimum criteria</td>
</tr>
<tr>
<td>6</td>
<td>Equal to present minimum criteria</td>
</tr>
<tr>
<td>5</td>
<td>Somewhat better than minimum adequacy to tolerate being left in place as is</td>
</tr>
<tr>
<td>4</td>
<td>Meets minimum tolerable limits to be left in place as is</td>
</tr>
<tr>
<td>3</td>
<td>Basically intolerable, requiring high priority of corrective action</td>
</tr>
<tr>
<td>2</td>
<td>Basically intolerable, requiring high priority of replacement</td>
</tr>
<tr>
<td>1</td>
<td>This value of rating code not used</td>
</tr>
<tr>
<td>0</td>
<td>Bridge closed</td>
</tr>
</tbody>
</table>

The specific tables for Item 67 - Structural Evaluation, Item 68 - Deck Geometry, Item 69 - Underclearances, Vertical and Horizontal, Item 71 - Waterway Adequacy and Item 72 - Approach Roadway Alignment appear in the FHWA Coding Guide and are detailed enough that several states now program their computerized bridge management system to automatically calculate several of the appraisal rating items. Thus, some inspectors may not be responsible for coding these items. Inspectors may be asked to field verify the computed appraisal ratings.
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TOPIC 4.2: Condition and Appraisal

Item 67 - Structural Evaluation - The item description and procedures used to determine the Structural Evaluation Appraisal Rating are located in Item 67 of the FHWA Coding Guide. This item is coded by the FHWA Edit/Update program, not the inspector. The correct way to evaluate this item for bridges is to consider the following factors:

- The lowest rating dictated by Item 59 - Superstructure, Item 60 - Substructure or Comparison of Item 29 - ADT and Item 66 - Inventory Rating.
- For culverts, the lower of Item 62 - Culverts or Comparison of Item 29 - ADT and Item 66 - Inventory Rating.
- Appraisal codes of 3 or less can be achieved without the superstructure and substructure controlling with the comparison of Item 29 – ADT and Item 66 – Inventory rating

Item 68 - Deck Geometry - The deck geometry appraisal evaluates the curb to curb bridge roadway width and the minimum vertical clearance over the bridge roadway. This item is coded by determining two appraisal ratings, one for bridge roadway width and one for the minimum vertical clearance. The lower of these two is the appraisal rating. This item is coded by the FHWA Edit/Update program, not the inspector. The FHWA Coding Guide includes the following scenarios to choose from for the bridge roadway width appraisal:

- Bridges with two lanes carrying two-way traffic.
- Bridges with one lane carrying two-way traffic.
- All other two-way traffic situations.
- Bridges with one-way traffic.

Item 69 - Underclearances, Vertical and Horizontal - This item refers to the vertical and horizontal underclearances from the through roadway under the structure to the superstructure or substructure units. The item description and coding guidelines, which are located in Item 69 of the FHWA Coding Guide, are used to determine the Underclearance Appraisal Rating. This item is similar to Item 68 in that two different ratings are developed: one for vertical underclearance and one for horizontal underclearance. The lower of these two is the appraisal rating. This item is coded by the FHWA Edit/Update program, not the inspector.

Item 71 - Waterway Adequacy - Waterway adequacy is appraised with respect to passage of flow through the bridge. The rating is tied to flood frequencies and traffic delays. Appraisal ratings are assigned by the table contained in Item 71 of the FHWA Coding Guide and are based on the functional classification of the road carried by the structure, hydraulic and traffic data for the structure, and site conditions. This item is not coded by the FHWA Edit/Update program.

Item 72 - Approach Roadway Alignment – This appraisal is based on comparing the alignment of the bridge approaches to the general highway alignment of the section of roadway on which the structure is located. The rating guidelines are correctly applied by determining if the vertical or horizontal curvature of the bridge approaches differs from the section of highway the bridge is on, resulting in a reduction of vehicle operating speed to cross the bridge. This item is not coded by the FHWA Edit/Update program. The guidelines for FHWA Item 72, Appraisal or
Approach Roadway Alignment, are as follows:

- If no reduction in the operating speed of a vehicle is required compared to the highway, code Item 72 as an “8.”
- If only a very minor reduction in the operating speed of a vehicle is required compared to the highway, code Item 72 as a “6.”
- If a substantial reduction in the operating speed of a vehicle is required compared to the highway, code Item 72 as a “3.”

The following guidelines indicate a means of determining the difference between a minor reduction and substantial reduction of operating speed:

- Minor reduction in operating speed - ≤ 9 mph
- Substantial reduction in operating speed - ≥ 10 mph

The remaining codes between these general values are applied at the inspector’s discretion.

A narrow bridge does not affect the Approach Roadway Alignment Appraisal. The narrow bridge would be accounted for in Item 68, Deck Geometry.

Items affecting sight distance at the bridge, unrelated to vertical and horizontal curvature of the roadway, such as vegetation growth and substructure units of overpass structures do not affect the Approach Roadway Alignment Appraisal.

Item 36 - Traffic Safety Features - For structures on the National Highway System (NHS), this appraisal is based on comparing the traffic safety features in place at the bridge site to current national standards set by regulation, so that an evaluation of their adequacy can be made. For structures not on the National Highway System (NHS), the procedure is the same, however, it shall be the responsibility of the highway agency (state, county, local, or federal) to set standards. The item description and procedures used to determine the Traffic Safety Feature Appraisal Rating are located in Item 36 of the FHWA Coding Guide. The following are the traffic safety features to be coded:

- Bridge Railings
- Transitions
- Approach Guiderail
- Approach Guiderail Ends

Item 113 - Scour Critical Bridges – This item is used to identify the current status of the bridge regarding its vulnerability to scour. A scour critical bridge is one with abutment or pier foundations that are rated as unstable due to observed scour at the bridge site, or a scour potential as determined from a scour evaluation study including a scour analysis made by hydraulic, geotechnical, or structural engineers. The item description, procedures, and code descriptions are located in Item 113 of the FHWA Coding Guide.
4.2.6

Functionally Obsolete and Structurally Deficient

Definitions

A bridge is considered to be functionally obsolete if it has deck geometry, load carrying capacity, clearance or approach roadway alignment that no longer meets the criteria for the system of which the bridge is a part. Examples include bridges with inadequate lane widths or shoulder widths, insufficient vertical clearances to serve the traffic demand, or bridges that may be occasionally flooded.

Bridges are considered structurally deficient where significant load carrying elements are found to be in poor or worse condition due to deterioration and/or damage, or the adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to the point of causing intolerable traffic interruptions.

Any bridge classified as structurally deficient is excluded from the functionally obsolete category. Bridges that are structurally deficient and functionally obsolete are reported together as deficient bridges.

General Qualifications

In order to be considered for either the structurally deficient or functionally obsolete classification, a highway bridge must meet the following:

Structurally Deficient (SD) -

1. A condition rating of 4 or less for
   ▪ Item 58 - Deck; or
   ▪ Item 59 - Superstructures; or
   ▪ Item 60 - Substructures; or
   ▪ Item 62 - Culvert and Retaining Walls.\(^1\) or

2. An appraisal rating of 2 or less for
   ▪ Item 67 - Structural Evaluation; or
   ▪ Item 71 - Waterway Adequacy.\(^2\)

Functionally Obsolete (FO) -

1. An appraisal rating of 3 or less for
   ▪ Item 68 - Deck Geometry; or
   ▪ Item 69 - Underclearances;\(^\text{ (1) }\) or
   ▪ Item 72 - Approach Roadway Alignment. or

2. An appraisal rating of 3 for
   ▪ Item 67 - Structural Evaluation; or
   ▪ Item 71 - Waterway Adequacy.\(^2\)
Footnotes for structurally deficient and functionally obsolete:

(1) Item 62 applies only if the last digit of Item 43 (Structure Type) is coded 19.
(2) Item 71 applies only if the last digit of Item 42 (Type of Service) is coded 0, 5, 6, 7, 8 or 9.
(3) Item 69 applies only if the last digit of Item 42 is coded 0, 1, 2, 4, 6, 7 or 8.

4.2.7
Sufficiency Rating

Definition
Sufficiency rating (S.R.) is a calculated numeric value used to indicate the sufficiency of a bridge to remain in service. The rating is calculated using the sufficiency rating formula. Sufficiency rating is discussed in detail in Appendix B of the FHWA Coding Guide.

Sufficiency Rating Formula

\[
S.R. = S_1 + S_2 + S_3 - S_4
\]

\[
0 \leq S.R. \leq 100
\]

(entirely deficient) (entirely sufficient)

where:

\[
S_1 = 55\% \text{ max.; based on structural adequacy and safety (i.e., superstructure, substructure or culvert condition and load capacity).}
\]

\[
S_2 = 30\% \text{ max.; deals with serviceability and functional obsolescence (items such as deck condition, structural evaluation, deck geometry, underclearances, waterway adequacy, approach road alignment).}
\]

\[
S_3 = 15\% \text{ max.; concerns essentiality for public use (items such as detour length, average daily traffic, and STRAHNET (Strategic Highway Corridor Network).}
\]

\[
S_4 = 13\% \text{ max.; deals with special reductions based on detour length, traffic safety features, and structure type.}
\]

Twenty NBI items are used to calculate these four factors which therefore determine the sufficiency rating. Sufficiency rating is not normally calculated manually. Usually, it is included in the agency’s inventory computer program and is calculated automatically by the computer based upon the inventory data collected by the bridge inspector. The sufficiency rating is calculated by the FHWA Edit/Update program.

Uses
Sufficiency Rating (SR) is used by the federal and state agencies to determine the relative sufficiencies of all of the nation’s bridges. In the recent past, eligibility for federal funding with Highway Bridge Program funds has been determined by the following criteria:

\[
S.R. \leq 80 \quad \text{Eligible for rehabilitation}
\]
S.R. < 50 Eligible for replacement

Some states use the sufficiency rating as the basis for establishing priority for repair or replacement of bridges; the lower the rating, the higher the priority. Several states have developed specific bridge management procedures with priority guidelines for repair or replacement of bridges. By using these types of procedures, priority ratings can be established by considering the significance or impact of such level-of-service parameters as traffic volume and class of highway.
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<td>4.3.12</td>
</tr>
</tbody>
</table>
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**Topic 4.3 Introduction to Element Level Evaluation**

**4.3.1 Introduction**

Managers of large inventories of infrastructure assets need a tool to effectively manage these assets. For bridge data, element level inspection has been successfully used as a basis for data collection, performance measurement, resource allocation, and management decision support. Although component condition rating and reporting, as described in the FHWA *Coding Guide*, provides a consistent method for evaluation and reporting, the data is not comprehensive enough to support bridge preservation performance-based decision support.

The Pontis CoRe (Commonly Recognized) Element Report (June 1993), which is the basis of the AASHTO CoRe Element Guide, was prepared by technical working group representatives from California, Colorado, Minnesota, Oregon, Virginia, Washington, and the Federal Highway Administration. The Pontis CoRE Report explains the reasoning behind the selection of bridge items that require inspection for a successful Bridge Management System. Pontis is ‘bridge’ in Latin.

In 2010, the AASHTO Bridge Element Inspection Manual was developed to address improvements to the existing CoRe Element Guide. This reference manual was prepared by representatives from California, Idaho, Michigan, Montana, New York and FHWA to further enhance bridge management.

Significant changes from the existing CoRe Element Guide:

- All elements have four defined condition states having general descriptions (good, fair poor, and severe).
- Wearing surfaces have been separated from decks/slabs and protective coatings.
- Elements have been categorized as National Bridge Elements (NBEs) or Bridge Management Elements (BMEs), with provisions for custom agency developed elements.
- Multiple distress paths provide the ability to incorporate all defects within the overall element assessment.
- Smart Flags (Defect Flags) have been revised to identify the predominant distress.

**4.3.2 Element Level Inspection Development**

In developing a system for standardized data collection, the FHWA needed to look at the shortcomings of NBI (National Bridge Inventory) data. The problems with NBI data included:

- Each bridge is divided into only three major parts for condition assessment: deck, superstructure, substructure and culvert.
- The rating scale for these parts is 0-9 by severity of the deficiency, which does not indicate the extent of the deficiency.
The component condition ratings are based on subjective interpretation by the inspectors.

A system was developed which included a standardized description of bridge elements at a greater level of detail. The FHWA created a task force to revise the standards and created a manual called "Commonly Recognized (CoRe) Structural Elements". The AASHTO Guide for CoRe Element Manual defined each element, the unit of measurement, definitions of a set of 3-5 standardized condition states, and feasible actions for each condition state. The CoRe Element Manual was accepted as an official AASHTO manual in May 1995. Some states developed their own CoRe Element Manual based on the AASHTO Core Element Manual. Approximately 40 states perform element level inspection.

In 2010, the limitations of the CoRe Element Manual were again addressed. These problems included:

- Inconsistent number of condition states and descriptions between element types
- Inconsistent condition state definitions between agencies
- Limited distress path language defined within the condition states

The National Bridge Element and Bridge Management Element system provides multiple distress paths for each defined condition state. This allows for deficiencies to be identified within each overall element assessment. The AASHTO Guide Manual for Bridge Element Inspection defines each element, description, unit of measurement or quantity calculation, set of four standardized condition states, feasibility actions, element commentary, and element definitions. The AASHTO Guide Manual for Bridge Element Inspection, First Edition, 2011, was first published as an official manual in February 2011.
4.3.3
Element Level Rating Terminology

The AASHTO Guide Manual for Bridge Element Inspection, First Edition, 2011. (see Figure 4.3.1) provides a description of structural elements that are commonly used in highway bridge construction and encountered on bridge safety inspections.

The following terms are used to describe bridge element-level inspection:

- National Bridge Elements (NBEs) represent the primary structural components of bridges necessary to determine the overall condition and safety of primary load carrying members. They provide a uniform basis for data collection.
- Bridge Management Elements (BMEs) represent a recommended set of condition assessment language that may be modified to suit the agency's needs. Examples of these elements include expansion joints and seals, approach slabs, wearing surfaces, protective coatings and smart flags.
- Agency developed elements are customized elements that can be sub-sets of defined NBEs, sub-sets of BMEs, or elements that are independent of the defined AASHTO elements. Agency developed elements are used in addition to the NBEs and BMEs.
- Condition states describe the severity of the deficiencies in AASHTO Bridge Elements. All elements have four defined condition states having general descriptions of good, fair, poor, and severe. Condition State 1 (good) and Condition State 4 (severe).
- Environments are used to classify the operating conditions and the deterioration of the structure, which does not change due to maintenance work or deficiencies. Depending on the agency, inspectors may or may not be responsible for determining the environment.
- Sub-elements or sub-sets are divisions of NBEs or BMEs that are created to provide flexibility to track variations in cost or performance characteristics.
- Smart Flags or Defect Flags are BMEs and used when a specific condition exists, which may be described in the National Bridge Element condition state definitions. They inherit the same units of measure as the NBE or BME to which they are assigned.
- Feasible actions, as provided in the AASHTO Guide Manual for Bridge Element Inspection, are general actions to address deficiencies. Feasible actions are often further defined by agencies for each condition state. Agency procedures vary and some inspectors create work recommendations for feasible actions. The inspector may not be required to record feasible actions.
4.3.4 Basic Requirements of National Bridge Elements

In the development of National Bridge Elements, it was important that the specification must be generic. Different agencies have varying maintenance practices, funding mechanisms, policy concerns and terminology. However, the physical components of bridges and deterioration processes are not unique. Agencies must be able to customize the generic standard to satisfy their own purposes without sacrificing the benefits of a common standard. Any changes to elements could introduce incompatibility between agencies. For this reason, agencies cannot change the number of condition states and the intent of the condition state language.

To avoid this from happening, the bridge element guide manual provides the ability of an agency to add custom agency developed elements or modify recommended
Bridge Management Elements. It is possible for future National Bridge Elements or Bridge Management Elements to be added. These elements must be permanent, have clear distinction and be defined as concisely as possible. The guidelines for developing National Bridge Elements include:

- Each element must be a primary load carrying element
- Each element must have a unique functional role.
- Distinguish elements that have significantly different maintenance requirements.
- Distinguish elements that are measured in different ways for costing or inspection.
- Distinguish elements whose conditions are described in different ways.
- Each element must be significant from the standpoint of maintenance cost or functionality. This is why, for example, secondary members are omitted from the list of National Bridge Elements. The level of detail in data collection would be too large relative to the effect of these elements on decision making.
- Deterioration behavior and maintenance alternatives for the element must be sufficiently understood. This is why, for example, composite materials such as fiber reinforced polymer are excluded from the list of National Bridge Elements.
- If an element is more significant than other elements, its behavior or condition description is complex, the element may be subdivided into smaller elements. An example of this type of element would be a pin and hanger assembly.
- A formal definition of each element must be developed to clarify thinking.

One primary use of definitions is to establish a useful inventory. In the field, each element must be clearly identified, measured and counted economically. It is also important to describe element attributes, such as size, material, condition and serviceability, quantitatively. The commonality aspect of National Bridge Elements depends on having definitions that are widely understood and are stable over time. One major factor contributing to definitions being widely understood is NHI’s bridge inspection related training courses.

### 4.3.5 Bridge Element Identification

<table>
<thead>
<tr>
<th>National Bridge Elements</th>
<th>AASHTO National Bridge Elements describe primary load carrying members, including:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Girders</td>
</tr>
<tr>
<td></td>
<td>Trusses</td>
</tr>
<tr>
<td></td>
<td>Arches</td>
</tr>
<tr>
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<td>Cables</td>
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<tr>
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<td>Floorbeams</td>
</tr>
<tr>
<td></td>
<td>Stringers</td>
</tr>
</tbody>
</table>
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- Abutments
- Piers
- Pins and Hangers
- Culverts
- Bearings
- Railings
- Decks
- Slabs
- Gusset Plates
- Column/Piles
- Caps

See Figures 4.3.2 - 4.3.4 for a list of decks/slabs, superstructure, and substructure AASHTO National Bridge Elements.

**Figure 4.3.2** Decks/Slabs National Bridge Elements in the AASHTO Guide Manual for Bridge Element Inspection
Bridge Management Elements

AASHTO Bridge Management Elements represent a recommended condition assessment language that can be modified to suit the agency's needs. The following types of elements are defined as Bridge Management Elements:

- Joints
- Approach Slabs
- Wearing Surfaces
- Protective Systems
- Smart Flags (Defect Flags)
See Figures 4.3.5 - 4.3.6 for a list of decks/slabs and wearing surfaces and protection systems AASHTO Bridge Management Elements.

<table>
<thead>
<tr>
<th>Element</th>
<th>Units</th>
<th>Element Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joints</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strip Seal Expansion Joint</td>
<td>LENGTH</td>
<td>300</td>
</tr>
<tr>
<td>Pourable Joint Seal</td>
<td>LENGTH</td>
<td>301</td>
</tr>
<tr>
<td>Compression Joint Seal</td>
<td>LENGTH</td>
<td>302</td>
</tr>
<tr>
<td>Assembly Joint/Seal (modular)</td>
<td>LENGTH</td>
<td>303</td>
</tr>
<tr>
<td>Open Expansion Joint</td>
<td>LENGTH</td>
<td>304</td>
</tr>
<tr>
<td>Assembly Joint w/o Seal</td>
<td>LENGTH</td>
<td>305</td>
</tr>
<tr>
<td>Approach Slabs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P/S Concrete Approach Slab</td>
<td>AREA</td>
<td>320</td>
</tr>
<tr>
<td>Reinforced Concrete Approach Slab</td>
<td>AREA</td>
<td>321</td>
</tr>
</tbody>
</table>

AREA = square feet (square meter)
LENGTH= feet (meters)
EA = Each

**Figure 4.3.5** Decks/Slabs Bridge Management Elements in the AASHTO Guide Manual for Bridge Element Inspection

<table>
<thead>
<tr>
<th>Element</th>
<th>Units</th>
<th>Element Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protective Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wearing Surfaces</td>
<td>AREA</td>
<td>510</td>
</tr>
<tr>
<td>Steel Protective Coating</td>
<td>AREA</td>
<td>515</td>
</tr>
<tr>
<td>Deck/Slab Protection Systems</td>
<td>AREA</td>
<td>520</td>
</tr>
<tr>
<td>Concrete Protective Coating</td>
<td>AREA</td>
<td>521</td>
</tr>
</tbody>
</table>

AREA = square feet (square meter)

**Figure 4.3.6** Wearing Surfaces and Protective Systems in the AASHTO Guide Manual for Bridge Element Inspection
Defect Flags

Defect Flags are part of the Bridge Management Elements and are used to identify the predominant defect for that condition state. The severity of the deficiency is captured by coding the appropriate Defect Flag condition state. The NBI translator uses AASHTO element-level data that includes defect flag data to determine NBI component condition ratings.

Defect Flags inherit the units of the parent NBE or BME.

- **Steel Cracking/Fatigue:** This flag shall be used with steel elements to identify the predominant defect in a given condition state that is not corrosion.

- **Pack Rust:** This flag shall be used in conjunction with steel elements connection defects (including shapes in contact in built-up members) of steel bridges that are already showing signs of rust packing between plates.

- **Concrete Cracking:** This flag shall be used with concrete elements to identify the predominate defect in a given condition state that is not spalling or delaminations.

- **Concrete Efflorescence:** This flag shall be used with concrete elements to identify the predominate defect in a given condition state that is not spalling or delaminations.

- **Settlement:** This flag shall be used with all substructure and culvert elements to identify the predominate defect in a given condition state that is not material deterioration. The use of the flag is to identify the severity of the settlement.

- **Scour:** This flag shall be used with all substructure and culvert elements to identify the predominate defect in a given condition state that is not material deterioration. The use of the flag is to identify the severity of the scour.

- **Superstructure Traffic Impact:** This flag shall identify all traffic collisions with the superstructure. Application of the flag is in relation to the impact on the structures capacity to carry load.

- **Steel Section Loss:** This flag shall be used with steel elements to identify the predominate defect in a given condition state that is not corrosion. Setting this flag will identify the severity of section loss.

- **Steel Out-of-plane Compression Members:** This flag shall be used with steel truss or arch elements. The use of the flag shall denote any member that is not in plane with the panel (buckling). It shall be used to identify the predominate defect in a given condition state that is not material deterioration.

- **Deck Traffic Impact:** This flag shall identify all traffic collisions with the deck. Application of the flag is in relation to the impact on the structures capacity to carry load.
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Substructure Traffic Impact: This flag shall identify all traffic collisions with the substructure. Application of the flag is in relation to the impact on the structures capacity to carry load.

Barrel Distortion: This flag is to identify the severity of the culvert barrel distortion. Its use shall be with culverts only. This flag shall describe predominate culvert deterioration that is not attributed to material deterioration.

Agency Developed Elements

Agencies may develop sub-elements that use the same condition state definitions as their associated NBE or BME elements. This allows for more detailed element descriptions. They are a subset of the NBE or BME and allow a more detailed classification. They are often created to distinguish a different size, location or exposure.

- Fascia girders and interior girders can be examples of Sub-Elements.
- The ends of girders can be examples of Sub-Elements.

Agency developed elements fall into three main categories: subsets of NBES, BMEs, or elements that are independent of defined elements. Agency Developed Element guidelines are listed below:

**Agency Defined Subsets of NBEs**

For agency defined sub-sets of National Bridge Elements, the agency must be able to combine the sub-elements back together to form the original NBE element for NBI submission with the original condition state and element definition language.

**Agency Defined Subsets of BMEs**

For agency defined sub-sets of Bridge Management Elements, the agency is not required to combine the elements to form the original Bridge Management Elements since BMEs are not required for NBI submission. However, custom elements of this type must retain the original number of condition states using a good, fair, poor, severe description.

**Independent Agency Developed Elements**

For Agency Defined Elements that are not sub-sets of National Bridge Elements or Bridge Management Elements, the only requirement is the standardized number of condition states (four). These elements may include inventory items or specific aspects of the structure. Independent Agency Defined Elements may or may not include feasible actions, deficiency, or official condition state language.

Examples of potential independent agency developed elements include approach guardrail, approach guardrail ends, seismic retrofit components, tunnels, condition of drainage components or lighting fixtures, or ancillary items such as overhead signing structures.
4.3.6 Condition States

The scale of good-fair-poor-severe is not acceptable because these terms do not have precise definitions that can be observed in the field. It was decided to measure bridge condition on a single scale that reflects common processes for deterioration and the effect on serviceability. The general pattern for a Bridge Element having four condition status is as follows:

1. Good – No deterioration to minor deterioration
2. Fair – Minor to Moderate deterioration
3. Poor – Moderate to Severe deterioration
4. Severe – Beyond the limits established in condition state 3 and/or warrants a structural review to determine strength or serviceability of the element or bridge

Each of these levels of deterioration is called a condition state. The condition state methodology provides two types of information about a bridge element’s deterioration:

- Severity – characterized by precise definition of each condition state
- Extent – the distribution of the total element quantity among condition states

The severity is important for selection of a feasible and cost effective preservation treatment, and extent is important for cost estimation.

Assignment of quantities to condition states is determined from element definitions and element commentary for National Bridge Elements. Condition state definitions are guidelines to the bridge inspector for categorization of the severity of the deficiency. Element commentary represents additional considerations for the inspector during the collection of data. From this information, the inspector can complete the element level evaluation. Additionally, element level Smart Flags (Defect Flags) are used to describe a condition which is not included in the National Bridge Element or Bridge Management Element condition state language.

4.3.7 Feasible Actions

Feasible actions are those that an agency may take to remove the defect. They represent a set of responses that may be taken for an element based upon quantities within a given condition state. They also represent general guidance on agency preservation strategies and can be customized by each agency for each element and condition state.

A summary of feasible actions and associated condition states is given below. Depending on the element, some feasible actions/conditions states may not be available. Other feasible actions, such as "Do Nothing", are available for all elements and condition states. "Do Nothing" can be used for all the elements in condition states since the possibility of nothing that needs to be done due to the condition of the element being good or to be used if the condition of the bridge is
so severe, the bridge is closed and or there is a feasible action already taking place.

<table>
<thead>
<tr>
<th>Feasible Action</th>
<th>Condition State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Nothing</td>
<td>●</td>
</tr>
<tr>
<td>Protect</td>
<td>●</td>
</tr>
<tr>
<td>Preserve (for other culverts and other railings)</td>
<td>●</td>
</tr>
<tr>
<td>Repair</td>
<td>●</td>
</tr>
<tr>
<td>Rehab</td>
<td>●</td>
</tr>
<tr>
<td>Reset (for bearings only)</td>
<td>●</td>
</tr>
<tr>
<td>Replace</td>
<td>●</td>
</tr>
</tbody>
</table>

### 4.3.8 Environments

Element can exist in one of four environments, which describe different weather or operating conditions. The environments are important for deterioration models and prediction of future conditions. The four environments are defined in general terms as follows:

1. **Benign** – No environmental or operational conditions affecting deterioration
2. **Low** – Environmental or operational conditions create no adverse impacts, or are mitigated by past non-maintenance actions or highly effective protective systems
3. **Moderate** – Typical level of environmental or operational conditions influence on deterioration
4. **Severe** – Environmental or operational conditions factors contribute to more rapid deterioration. Protective systems are not in place or are ineffective

Environment policies are used for element level inspection and set by individual state agencies.

### 4.3.9 The Role of Element Level Data in Bridge Management Systems

An immediate application of Bridge Elements is the collection and analysis of performance data. It is essential that original data collection be as objective and repeatable as possible. This raw, objective data must be stored so that the analysis may be updated or improved at a later time. Bridge Elements must be usable to support management decision making. The large volume of raw data collected must be transformed into useful information. For this reason, the development of bridge Bridge Elements was heavily influenced by the parallel development of Pontis software and previous CoRe elements.
Condition state data provides quantitative data about the physical condition and performance of bridge elements. This data is also, the effects of treatment actions can be tracked over time. Element level data is an essential part of the following BMS functions. Element level inspections can track the effectiveness of action over time by showing the various condition states and how they may change over time after the bridge element is either repaired, replaced, or nothing would be done. Potential applications for agencies includes:

- Identification of bridge needs (replacement and preservation)
- Development and testing of new maintenance techniques
- Treatment selection policies
- Project priority setting and programming
- Budgeting
- Funding allocation
- Long-range planning
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# Abbreviations for Field Inspection Notes

- **Abut.** = Abutment
- **Adj.** = Adjacent
- **B.** = Bent
- **Btw.** = Between
- **Bot.** = Bottom
- **B.S.** = Both Sides
- **[** = Channel (Steel Shape)
- **cm** = Centimeter
- **Col.** = Column
- **Conc.** = Concrete
- **Cond.** = Condition
- **Conn.** = Connection
- **Cr.** = Crack
- **Delam.** = Delamination, Delaminated
- **Deter.** = Deterioration
- **Diag.** = Diagonal
- **Diam.** = Diameter
- **Diaph.** = Diaphragm
- **D.S.** = Downstream
- **E** = East
- **Eff.** = Efflorescence
- **Elev.** = Elevation
- **Exp.** = Expansion
- **F.B.** = Floorbeam
- **F.L.** = Full Length
- **Flg.** = Flange
- **F.S.** = Far Side
- **Ft.** = Feet
- **Gus.** = Gusset
- **H.L.** = Hairline
- **Horz.** = Horizontal
- **Hvy.** = Heavy
- **Int.** = Interior
- **Lac.** = Lacing
- **Lat.** = Lateral
- **Lat. Br.** = Lateral Brace
- **Lgth.** = Length
- **Low.** = Lower
- **Lt.** = Light
- **M** = Meters
- **Med.** = Medium
- **Mid.** = Middle
- **N** = North
- **No Vis. Def.** = No Visible Defects
- **N.S.** = Near Side
- **P** = Pier
- **Pl.** = Plate
- **S** = South
- **S.I.P.** = Stay-in-Place Forms
- **SF** = Square Feet
- **Stiff.** = Stiffener
- **Str.** = Stringer
- **T. Welds** = Tack Welds
- **Typ.** = Typical
- **U** = Upper
- **U.S.** = Upstream
- **Vert.** = Vertical
- **Vis.** = Visible
- **Vis. S.** = Visible Signs
- **W** = West
- **W =** Wide Flange (Steel Shape)
- **L =** Angle (Steel Shape)
Topic 4.4 Record Keeping and Documentation

4.4.1 Introduction

Bridge owners maintain a complete, accurate, and current record of each bridge under their jurisdiction. Such information relating directly to the inspection, design, performance and maintenance of the bridge is vital to the effective management of a population of bridges. Additionally, this information provides a record that may be important for repair, rehabilitation, or replacement of their assets.

The first section in this topic covers the critical components of the bridge record, while the remaining sections provide the inspector with guidance on how to thoroughly organize inspection data and produce an accurate and effective inspection report.

4.4.2 Bridge Records

Bridge records, or files, are used to maintain detailed, cumulative and up-to-date information on each structure. A thorough study of the available historical information can be extremely valuable in identifying possible critical areas of structural or hydraulic components and features.

The contents of any particular bridge file may vary depending upon the size and age of the structure, the functional classification of the road carried by the structure, and the informational needs of the agencies responsible for inspection and maintenance. The bridge file is not only a resource to the bridge owner, but also a resource to the inspector. The inspector will gain valuable insight into the bridge by being familiarized with it prior to the inspection. It is recommended that the following types of information be assembled when possible.

According to the AASHTO Manual for Bridge Evaluation, the bridge record includes the following information:

- Plans, including construction plans, shop and working drawings, and “as-built” drawings
- Specifications
- Correspondence
- Photographs
- Materials and tests, including material certification, material test data, and load test data
- Maintenance and repair history
- Coating history
- Accident records
- Posting
- Permit loads
- Flood and scour data
- Traffic data
- Inspection history
- Inspection requirements
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- Structure Inventory and Appraisal sheets
- Inventories and inspections
- Rating records

**Plans**

Construction, “as-built,” or shop and working plans are included in a bridge record. If plans are not available, determine the following types of construction information: date built; type of structure, including size, shape, and material; design capacity; and design service life. Hydraulic data is also assembled where available, including structure profile gradeline, elevation of inverts or footings, stream channel and water surface during normal and high flows, design storm frequency, drainage area, design discharge, date of design policy, flow conditions, limits of flood plain, type of energy dissipaters (if present), cut-off wall depth, channel alignment, and channel protection.

**Specifications**

The bridge record includes a complete copy of the technical specifications used to design and build the bridge. When a general specification was used, only the special provisions are included in the file. The edition and date of the general specifications are noted in the bridge record.

**Correspondence**

The bridge record includes any applicable letters, memorandums, and notices of project completion, construction diaries, telephone logs, and any other information directly concerning the bridge in chronological order.

**Photographs**

Photographs are used to supplement the inspection notes and sketches. A minimum of two photographs are included in the bridge record: a topside view of the bridge roadway and at least one elevation view of the bridge. Photographs showing major deficiencies or other features, such as utility attachments or channel alignment, also are included. Photographs that show load posting signs are also provided, if applicable.

**Photo Log**

Keep a photo log during the inspection. The photo log includes the date, photo number, and description of each photograph. It is best to be very specific when describing the photos (see Figure 4.4.1). Descriptions include both the location of the member and a brief description of any deficiencies.
Materials and Tests

Certificates for the type, grade, and quality of materials used in construction of the bridge are included in the bridge record. Examples include steel mill certificates, concrete delivery slips, and any other manufacturers' certificates. The certificates are retained in accordance with bridge owner policy and statute of limitations.

Reports for any non-destructive or laboratory testing either during or after construction are included. If any field load testing is performed, provide the reports in the bridge record.

Maintenance and Repair History

Information about repairs and rehabilitation activities are included in the bridge record. This chronological record includes details such as the date, project description, contractor, cost, contract number and any other related data. The types and amount of repairs performed at a bridge or culvert site can be extremely useful. For example, frequent roadway patching due to recurring settlement over a culvert or approach roadway for a bridge may indicate serious problems that are not readily apparent through a visual inspection of the structure.

Coating History

This information in the bridge record documents the surface protective coatings used, including surface preparation, application method, dry film paint thickness, types of paint, concrete and timber sealants, and other protective membranes.

Accident Records

Include details of accidents or damage to the bridge in the bridge record (see Figure 4.4.2). This information includes the date of the occurrence, description of the accident, member damage and repairs, and any investigative reports.
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4.4.4

Figure 4.4.2  Accident Involving Construction Equipment and a Bridge

Posting

Each bridge record includes load capacity calculations and any required posting arising from the load ratings. The summary of posting actions includes the date of posting and a description of the signing used (see Figure 4.4.3).

Figure 4.4.3  Posted Bridge

Permit Loads

A record of the most significant single-trip permit loads using the bridge are included in the bridge record. This information is to include any applicable documentation and calculations.

4.4.4
Flood and Scour Data

A chronological history of major flooding events are included for bridges over water (see Figure 4.4.4). This history includes the high water marks at the bridge site, scour evaluation, scour history, and any plan of action.

Traffic Data

When available, the bridge record contains a history of the variations in Average Daily Traffic (ADT) and Average Daily Truck Traffic (ADTT) including the frequency and types of vehicles using the bridge. ADT and ADTT are important factors in determining fatigue life and are monitored for each bridge and each traffic lane on the bridge. If available, weights of the vehicles using the bridge are also included in the bridge record.

Inspection History

Reports from previous inspections can be particularly useful in identifying specific locations that require special attention during an inspection. Information from earlier inspections can be compared against current conditions to estimate rates of deterioration and to help judge the seriousness of the problems detected and the anticipated remaining life of the structure.

This chronological record of inspections performed on the bridge includes the date and type of inspection. The initial inspection report is included in the bridge record. Earthquake data, fracture critical member information, deck evaluations, and corrosion studies are also included when available.
Inspection Requirements

Inspections are planned and prepared for by taking into account needed access, inspection equipment, structural details, inspection methods, and the required qualifications of inspection personnel. In addition, the National Bridge Inspection Standards require that written inspection procedures for specific types of more complex inspections (fracture critical, underwater, and complex bridges) be developed to address those items that need to be communicated to an inspection team leader to ensure a successful bridge inspection. Section 4 of the AASHTO MBE has general considerations regarding inspection plans. An owner may have general overall inspection procedures in their bridge inspection manual that address common aspects of these more complex inspections, however, each bridge will have written inspection procedures specific to each bridge which address items unique to each bridge. The following items are to be addressed for each of these types of bridge inspections, either in the bridge specific inspection procedures, or by referring to general inspection procedures (typically in an agency's bridge inspection manual):

- Identify each of the critical members to be inspected (fracture critical elements, past repairs, underwater elements, complex features, fatigue prone details, scour countermeasures, etc.) on plan sheets, drawings or sketches
- Identify special access needs or equipment necessary to gain the access required to inspect the features (under bridge inspection trucks, man lifts, traveler system, climbing, etc.)
- Describe the inspection method(s) and frequency to be used for the elements. For example, “Visually inspect all identified FCMs at arm’s length for cracks, deterioration, missing bolts, loose connections, broken welds… using PT to verify the existence of suspected cracks.”
- Address required proximity to details, such as “arm’s length”
- Identify special qualifications required of inspection personnel by the program manager, if any (successfully passed fracture critical course, certified electrician for movable bridge electrical components, qualified bridge inspection diver, etc., may be possible qualifications)

Other items that may be addressed depending on each unique situation might include:

- Special contacting procedures prior to inspection (Coast Guard, security, operations personnel, etc.)
- Safety concerns (snakes, bats, etc.)
- Best time of year to inspect the bridge (lake draw down, canal dry time, snow, ice, bird nesting seasons, etc.)
- Anything else the program manager wants the inspection team leader to be aware of in preparation for the inspection

Any special requirements to ensure inspector and public safety, including a traffic management plan, are also included.
### Structure Inventory and Appraisal Sheets
A chronological record of SI&A forms used by the bridge owner is included in the bridge record. Refer to Topic 4.1 for a complete description of SI&A sample form.

### Inventories and Inspections
Inspection reports are included as part of the bridge record. This information includes the results of all inventories and bridge inspections and can include construction or repair activities.

#### Bridge Inspection Forms
Many bridge owners have standard inspection forms. These forms are used for each bridge in their system and give the inspector a checklist of items that are to be reviewed. Another benefit of standardized forms is that it organizes bridge reports into a consistent format (see Figures 4.4.5 and 4.4.24 that are located at the end of this topic).
<table>
<thead>
<tr>
<th>Milepost</th>
<th>List of Elements</th>
<th>Associated Smart (Defect) Flag</th>
<th>Associated Protection Systems</th>
<th>Quantity</th>
<th>Units</th>
<th>CS 1</th>
<th>CS 2</th>
<th>CS 3</th>
<th>CS 4</th>
</tr>
</thead>
<tbody>
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</table>

*Figure 4.4.5*  Element Level Example Inspection Form
Rating Records

A complete record of the determination of the bridge’s load-carrying capacity is included in the bridge record (see Figure 4.4.6). This information will include the design load to indicate the live load the bridge was designed for, the analysis methods used to determine the inventory and operating ratings, and the inventory and operating ratings for the bridge. The capacity calculations will be signed and dated by the individual who determined them, together with any assumptions used.

![Figure 4.4.6 Example Load Rating Summary Sheet](Image)

Figure 4.4.6  Example Load Rating Summary Sheet
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Post or restrict the bridge in accordance with the AASHTO *Manual for Bridge Evaluation* or in accordance with State law, when the maximum unrestricted legal loads or State routine permit loads exceed that allowed under the operating rating or equivalent rating factor.

### 4.4.3 Methods of Inspection Documentation

**Traditional**

Note all signs of distress and deterioration with sufficient precision so that future inspectors can readily make a comparison of conditions. The most commonly used method for record keeping is pencil and paper. The inspector writes findings on forms, sketches, and notebooks (see Figure 4.4.7). This method is extremely flexible in that the inspector can draw whatever configurations are necessary to best describe and document deficiencies.

![Inspector Taking Notes](image)

**Figure 4.4.7** Inspector Taking Notes

**Electronic Data Collection**

Another method of record keeping is electronic data collection (see Figure 4.4.8). This technology provides a significant advantage in a number of areas. With all the bridge data available at the site, the inspector can retrieve and edit previous records and save them as current inspection data. This not only saves time but eliminates the need for reentering data. Also, it eliminates errors that can occur when transferring the inspector’s field notes to the computer back at the office. Electronic data collection provides a logical and systematic sequence of inspection, ensuring that no bridge elements are overlooked. It also allows the inspector to compare the current deficiencies with previous reports and note if any deterioration has gotten worse.

4.4.10
4.4.4 Inspection Report Documentation

While the inspection of small bridges usually only requires the use of the standard inspection form, the inspection of large or complex bridges requires the use of an inspection file, in addition to any standard inspection forms. The inspection file contains:

- Standard nomenclature and abbreviations for the elements of members and the components made up of these members
- Sketches of elements or members showing typical and deteriorated conditions (some of these can be pre-made to allow more expediency during the inspection)
- A standard notation system for indicating the condition of the elements or members
- A log or index for photographs
- Brief narrative descriptions of general and component conditions

When the above, detailed file format is selected for recording bridge inspection results, the information is to be recorded systematically. However, many bridge owners differ significantly in their required format. Most of the above information, if not provided on the inspection report, is available in the bridge record.

Element Identification

Identify the elements by the type of material, construction method, and the function that each element or member performs.

Some examples of elements or members and their abbreviations:

- Multi-beam (B1 – B6)
- Deck or slab
- Stringer (S1 – S4)
- Floorbeam (FB0 – FB15)
### Structure Site Orientation

Structure site orientation is normally established according to highway direction of inventory, mile markers, segments, or stationing. It is important that the orientation of each bridge be clearly established. The following are some examples:

- I79, Milepost 155.28 NB
- SR0019 Segment 05010
- Union Township, Alpha Drive, Station 109+05

### Bridge Member Orientation

When describing bridge members, it is important to clearly identify the specific element or member that has the deficiency. The following are some examples to orient bridge members:

- Substructure units (e.g., Abutment 1 and Pier 3) (see Figure 4.4.9).
- Floorbeam ends are identified by left/right looking in the direction of inventory or north/south or east/west designations.
- Sides of members can be identified by direction (e.g., “south side of Floorbeam 2” or “northeast elevation of Beam 4”).
- Span numbers and bay numbers to identify general areas on the bridge (see Figure 4.4.9).
- Individual beams or stringers left to right, looking in the direction of inventory (see Figure 4.4.10).
- Upstream or downstream designations can be assigned to structures over waterways (e.g., “upstream truss”, “downstream girder”, or “upstream arch”) (see Figure 4.4.11).
- For truss elements, identify the member with joint designations and specify if it is an upstream/downstream or north/south truss (see Figure 4.4.12). Number floorbeams in accordance with the panel point numbers.

If the orientation used during the inspection differs in any way with that used in existing documents, clearly state these differences in the inspection notes.
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Figure 4.4.9  Sample Span Numbering Scheme

Figure 4.4.10  Sample Typical Section Numbering Scheme

Figure 4.4.11  Sample Structure Orientation Sketch
4.4.14

**Figure 4.4.12** Sample Truss Numbering Scheme

**Element Dimensions**

Document sufficient dimensions to establish the size or cross section and other pertinent dimensions of elements. These include:

- Deck elements: length, width, and thickness
- Superstructure elements (beam, girder, floorbeam, stringer, and truss member): length, depth, width, flanges, and webs (see Figures 4.4.13 and 4.4.14)
- Substructure elements (abutment, columns and caps): width and depth (for rectangular shapes), diameter (for round columns), length, spacing, and pile batter and spacing (for pile bents)

**Figure 4.4.13** Steel Superstructure Dimensions
Exact member dimensions are required to determine section properties used to calculate a load-rating analysis.
**Inspection Notes and Sketches**

In most cases, it will be possible to insert reproductions of portions of the plans in the inspection notes. However, in some instances, sketches will have to be drawn. The inspector may be able to pre-draw the sketches in the office and fill them out in the field (see Figures 4.4.15 through 4.4.17).

**Figure 4.4.15** Framing Plan
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Figure 4.4.16  Girder Elevation

Figure 4.4.17  Typical Prepared Culvert Sketches
The first sketch in the field inspection notes normally portrays the general layout of the bridge and site information, illustrating the structure plan and elevation data (see Figures 4.4.18 and 4.4.19). The immediate area, the stream or terrain obstacle layout, major utilities, and any other pertinent details are also included.

**Figure 4.4.18** Sample General Plan Sketch

**Figure 4.4.19** Sample General Elevation Sketch

**Deficiency Identification** Identify material deficiencies as presented in Topic 6.1 – Timber, Topic 6.2 – Concrete, Topic 6.3 – Steel, Topic 6.5 – Masonry.

The exact location, severity and extent of deficiencies are used to determine the capacity of the bridge in its current condition.
Deficiency Qualification  Describe the seriousness of a deficiency. For example:

- Crack sizes – record lengths, widths, and depth
- Section loss – record the remaining section dimensions (when reporting section loss, it is important to document the section remaining rather than trying to estimate the percentage of section loss)
- Deformation – record the amount of misalignment

Deficiency Quantification  Describe the quantity of a deficiency. For example:

- Spalling – 2 feet x 3 feet x 2 inches deep
- Scaling – 4 feet high by full abutment width
- Delamination – 1 foot x 6 inches
- Decay – 2 feet x 2 feet x 3 inches deep

Deficiency Location  The exact position of the deficiency on the element or member is required if load capacity analysis is to be performed. For example:

- Left side of web, top half, 3 feet from north bearing
- Top of top flange, from 3 feet to 6 feet west of Pier 2

The accuracy of the load capacity analysis depends on precise location information for deficiencies:

- Bending moment – Maximum positive moment occurs at or near midspan. Maximum negative moment occurs at the intermediate supports if the structure is continuous.
- Shear/bearing – Shear is maximum at or near the supports. Bearing is maximum at the supports.
- Axial compression members – The capacity of the member to resist compressive forces is reduced by any deformation or change in cross section. The potential capacity reduction is not dependent on where on the member the deficiency is located. All segments are critical.
- Axial tension members – These members experience a reduction in capacity through loss of section or from cracking. As with the axial compressive members, tensile members are equally susceptible regardless of the location of the deficiency.
- Combinations – While axial members are critical at all locations, it is not always apparent which members are loaded only in an axial direction. In fact, due to the dead load of the member itself, most are not. Other factors can also contribute to bending forces that will create varying moments, shears, compression, and tension areas within a member that is primarily axial. Because of this, identify the exact position of the deficiencies in all members using reference points, regardless of the forces acting on the member.

Locating a deficiency may include tying it to an established permanent reference. Avoid using references that can change over time.
Some examples of proper referencing include:

- 7 feet-3 inches from fixed bearing on Beam 3 at Abutment 1
- 3 feet-1 inch from west corner of Abutment 2
- 2 feet-6 inches below bridge seat on south face of Column 1, Pier 2

Reference points to avoid, since these locations vary between inspections:

- Expansion rocker faces
- Ground levels, especially those that may be exposed to water
- Water levels

When documenting the deficiency locations on the deck, include the condition of deck and haunch, expansion joints, construction joints, curbs, sidewalks, parapets, and railings with the deck sketches (see Figure 4.4.20).

![Image of a bridge with annotations](image.png)

Figure 4.4.20 Sample Deck Inspection Notes
When documenting the deficiency location of the superstructure, sketch the superstructure units in plan view and elevation, or cross section if necessary. Items to be inspected include bearings, main-supporting longitudinal members, floorbeams, stringers, bracing, and diaphragms (see Figure 4.4.21).

Figure 4.4.21  Sample Superstructure Inspection Notes
Include sketches or drawings to describe the condition of each substructure unit (see Figure 4.4.22). In many cases, it is sufficient to draw typical units that identify the principal elements and deficiencies of the substructure. Identify each element of the substructure unit so that they can be cross referenced to the notes or sketches. Items to be identified include piling, footings, vertical supports, lateral bracing of members, and caps.

**Figure 4.4.22  Sample Substructure Inspection Notes**

Include sketches or drawings to describe the condition of the channel (see Figure 4.4.23). Streambed materials, alignment, condition of the banks, and the condition of the bottom of the waterway (including scour holes) are included in the sketch.

**Figure 4.4.23  Sample Channel Inspection Notes**

**Summary of Findings**

Report all deficiencies, no matter how minor they may seem. Be as descriptive as necessary to report not only the severity of the deficiency but the location as well. This will be described in further detail later in this topic. When reporting deficiencies, be objective and do not use terms such as “dangerous” or “hazardous”.

4.4.22
CHAPTER 4: Bridge Inspection Reporting System
TOPIC 4.4: Record Keeping and Documentation

Example Inspection Form – PennDOT Form D-450

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**Structure Description**

- FHWA Facility Carried:
- Features Intersected:
- Location:
- Roadway Name:
- City/Borough Name:

**Structure Type**

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<td>4 - Vertical Clearance On</td>
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This document includes structure safety inspection information that is confidential pursuant to 65 P.S. §661 et seq., 75 PA. C.S. §3754 and 23 U.S.C. §409 and may not be disclosed or used in litigation.

Figure 4.4.24 Example Inspection Form – PennDOT Form D-450
### CHAPTER 4: Bridge Inspection Reporting System

**TOPIC 4.4: Record Keeping and Documentation**

**Figure 4.4.24** Example Inspection Form – PennDOT Form D-450 (continued)
### CHAPTER 4: Bridge Inspection Reporting System

#### TOPIC 4.4: Record Keeping and Documentation

#### Figure 4.4.24 Example Inspection Form – PennDOT Form D-450 (continued)
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Figure 4.4.24  Example Inspection Form – PennDOT Form D-450 (continued)
### CHAPTER 4: Bridge Inspection Reporting System

#### TOPIC 4.4: Record Keeping and Documentation

**4.4.27 Figure 4.4.24**  Example Inspection Form – PennDOT Form D-450 (continued)
### Figure 4.4.24  Example Inspection Form – PennDOT Form D-450 (continued)
Figure 4.4.24  Example Inspection Form – PennDOT Form D-450 (continued)
4.4.30

Figure 4.4.24  Example Inspection Form – PennDOT Form D-450 (continued)
### UNDERWATER INSPECTION

**Form G**

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---

**Figure 4.4.24** Example Inspection Form – PennDOT Form D-450 (continued)
### Underwater Inspection

**Form G**

**Pennsylvania Department of Transportation**

**Figure 4.4.24** Example Inspection Form – PennDOT Form D-450 (continued)

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**Underclearance**

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### Figure 4.4.24  Example Inspection Form – PennDOT Form D-450 (continued)

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**Top Slab:**

Barrel:

**Floor/Paving:**

Headwall:

Wings:

**Settlement:**

Debris:
### Figure 4.4.24  Example Inspection Form – PennDOT Form D-450 (continued)
### Figure 4.4.24  Example Inspection Form – PennDOT Form D-450 (continued)
### Chapter 4: Bridge Inspection Reporting System

**Topic 4.4: Record Keeping and Documentation**

#### 4.4.36

**Figure 4.4.24**  Example Inspection Form – PennDOT Form D-450 (continued)
### CHAPTER 4: Bridge Inspection Reporting System

#### TOPIC 4.4: Record Keeping and Documentation

4.4.37

#### Figure 4.4.24  Example Inspection Form – PennDOT Form D-450 (continued)
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### Table of Contents

**Chapter 4**
Bridge Inspection Reporting

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<tr>
<td>4.5.1</td>
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4.5.1 Definition

A critical finding are a structural or safety related deficiency that requires immediate follow-up inspection or action.

A structure related deficiencies can interrupt the load path, not allowing loads to be transferred as designed. This can cause surrounding elements to become overstressed or unstable, potentially leading to partial or total collapse of the structure. Critical findings may also be non-structural deficiencies which jeopardize the safety of motorists or pedestrians.

4.5.2 Procedures

As stated in the NBIS regulations, each state or federal agency is required to "establish a statewide procedure to assure that critical findings are addressed in a timely manner." Although specific procedures vary among agencies, general steps must be taken to assure that critical findings are identified and resolved as quickly and efficiently as possible. The viable options available are permanently repair, temporarily repair or restrict loads on the bridge.

Currently, states employ two approaches to coding condition items when localized areas of severe deterioration are encountered. Some will account for the severity of a localized area of deterioration by lowering the condition rating of an entire component. The component condition rating is adjusted after the deteriorated area is improved (i.e., rating may rise if physical improvements are made, or may stay the same if the bridge is posted for load restrictions and/or supported with temporary shoring). FHWA recognizes this approach when the severity of the localized deterioration affects the load-carrying capacity of the component.

Other states rate to the general condition regardless of the severity of a localized area of deterioration. This approach relies heavily on ensuring that critical findings are addressed in a timely manner regardless of the component condition rating value. If the localized area of severe deterioration is not improved following the critical finding follow-up process, the component rating may need to be lowered to account for the severity of the deterioration if structural capacity is affected.

Either approach to coding the condition items results in the same ultimate outcome, i.e. critical inspection findings are addressed to allow continued safe use of the bridge. Component ratings eventually reflect the overall condition of the component. If the approach is to consider both the severity and extent of a component’s deterioration in rating each component at the time of inspection (or up to 90 days after the inspection as required by the NBIS), there cannot be any assumptions about future improvements made to a localized area. Only if an improvement is made, the rating should then be raised as appropriate. If the improvement is made within 90 days of the inspection, there is no need to consider the localized deterioration in the rating.
Critical findings / critical follow-up report categorical contents with the documented status:

1. Bridges that have critical findings in the process of being addressed.
2. Bridges with work scheduled but not started yet.
3. Bridges that have no plan in the works.
4. Critical Finding is scour related.

**Procedures for Inspectors**

Upon identifying a potential critical finding, immediately report the deficiency to the appropriate agency official, bridge owner, or governing authority. For most agencies, a verbal notification is required soon after identifying the potential critical deficiency.

In addition to a verbal notification, agencies require immediate written notification of the potential critical finding. This notification is often presented in a standardized hardcopy or electronic format (see Figures 4.5.1 and 4.5.2), and is submitted soon after the verbal notification for most agencies. The written notification serves to document the critical finding by describing the extent of the deficiency complete with notes, photographs, sketches and drawings, measurements, possible causes, and recommendations for repair. Temporary actions may also be taken at this time to safeguard the public until proper repairs can be completed. These actions may include:

- Load posting
- Traffic restrictions from the damaged area
- Speed restrictions
- Temporary lane closure
- Temporary shoring
- Complete bridge closure

After submittal of the written report, the finding will be assessed and the severity determined along with a proposed repair strategy or plan of action. In accordance with NBIS regulations, the agency is also required to notify the FHWA of the critical finding. Public works officials or law enforcement may also be contacted as needed.
Missouri Department of Transportation
Critical Inspection Finding
State System

Bridge __________ District ________ County ____________ Route __________ AADT ________
Location __________________________________________________ ____________________
Inspector ___________________________ Inspection Date ___________


Inspector’s Immediate Recommendations:

☐ Immediate Closure Required ☐ Immediate Blocking/Shoring Required
☐ Reduce traffic to one lane. ☐ Carry traffic on [ ] NB [ ] SB [ ] EB [ ] WB lane
☐ Other:

Immediate Notification: ☐ State BM Engr ☐ Supv Bridge Insp Engr ☐

MoDOT Action Plan by Bridge Maintenance and the District: ____________________________ Date: ___________

Follow-up Actions: ____________________________ Completion Date: ___________

Figure 4.5.1 Missouri DOT Critical Inspection Finding Form
Agencies establish priority maintenance procedures and prioritization criteria to help facilitate maintenance work plan strategies. Most agency systems utilize between three and five different prioritization levels ranging from general housekeeping and routine repairs to critical findings requiring immediate action. Examples of agency priority maintenance procedures are listed below in the order of most critical to least critical, with a description of each level.

**Figure 4.5.2** Washington State DOT "Critical Damage - Bridge Repair Report"
CHAPTER 4: Bridge Inspection Reporting
TOPIC 4.5: Critical Findings

Oregon Department of Transportation (ODOT)

- "Significant" – Severe deficiency to a primary bridge element that requires complete or partial closure of the bridge, or an immediate load restriction of the bridge.
- "Critical" – Serious deficiency to a primary bridge element that needs repair to prevent the bridge from being load posted.
- "Urgent" – Traffic safety related concern that does not jeopardize the reliability of the transportation system, protection of public investments, or maintenance of legal federal mandates.
- "Routine/Schedule" – Minor to moderate deficiency to a primary bridge element or moderate to major deficiency to a secondary element.
- "Monitor" – Non-structural housekeeping repairs such as cleaning the deck and drainage systems.

North Carolina Department of Transportation (NCDOT)

- "Critical Finding" – Severe deficiency to a primary bridge element that could cause partial or complete collapse or a safety feature deficiency that may jeopardize the safety of the public.
- "Priority Maintenance need" – Serious deficiency that may lead to load posting and/or bridge closures if left untreated.
- "Routine Maintenance need" – Minor to moderate deficiencies to primary or secondary bridge elements or non-structural housekeeping repairs such as cleaning the deck and drainage systems.

Pennsylvania Department of Transportation (PennDOT)

- "0 – Critical" – Severe deficiency to a primary bridge element that could directly or indirectly cause partial or complete structure collapse or a safety feature deficiency that may result in loss of vehicle operator control or failure to contain errant vehicles on the bridge deck.
- "1 – High Priority" – Serious deficiency to a primary bridge element that may lead to load posting and/or bridge closures. If left untreated, the deficiency may also jeopardize public safety.
- "2 – Priority" – Advanced deficiency on a primary bridge element or appurtenance that if left untreated, may lead to continuing deterioration, load posting, or partial or complete bridge closures.
- "3 – Schedule" – Minor deficiency to a primary bridge element or appurtenance that may continue to deteriorate if lead untreated.
- "4 – Program" – Note-worthy problem on a primary bridge element, secondary element, or appurtenance that may lead to a documentation-worthy deficiency if left untreated.
- "5 – Routine" – Non-structural housekeeping maintenance that may lead to deterioration of primary and secondary structural members if left untreated.

4.5.5
Bridge Closing Procedure

In some situations, the bridge may need to be closed until the critical finding can be repaired. The decision to close the bridge may result from the nature of the critical finding upon initial discovery, an unacceptable timeframe in which the repairs are scheduled to be completed, or agency policy on critical findings.

For situations recommending closure of the bridge by the bridge inspector and/or bridge maintenance supervisor, follow established State or Federal Agency procedures. Examples of acceptable procedures include:

- Contact the Bridge Maintenance Supervisor about the recommended closing.
- Contact the Bridge Engineer about the recommended closing.
- If both the Bridge Maintenance Supervisor and Bridge Engineer are unavailable, contact the District or Division office about the recommended closing.

4.5.3 Examples of Critical Findings

FHWA guidance for a follow-up may include a procedure where the State promptly submits to the Division office a copy of inspection reports or recommendations for all on-system and off-system bridges that meet the following criteria:

1. Bridges with recommendations for immediate work on fracture critical members;
2. Bridges with recommendations for immediate correction of scour or hydraulic problems;
3. Bridges with condition ratings of 3 or less for the superstructure or substructure or appraisal ratings of 3 or less for waterway adequacy; and
4. Bridges with recommendations for immediate work to prevent substantial reduction in the safe load capacity.

Source: http://www.fhwa.dot.gov/bridge/0650csup.cfm

Many state agencies publish examples of critical findings for bridge inspectors. It should be noted that these lists are not all-inclusive or comprehensive and should only be used as guidance in determining whether or not a deficiency is a critical finding.

The critical findings listed below are organized by material type and application. These deficiencies represent excerpts obtained from several agencies' critical finding documentation.

Timber

The following deficiencies represent examples of critical findings for timber:

- Through-loss in deck planks and broken planks in danger of breaking through.
- Primary structural members with collision damage that compromises the structural capacity (including severe section loss, full length horizontal cracking, and section loss to truss compression members producing
member buckling or severe flexural cracking).

- Primary structural members with multiple open cracks in high stress regions or crushing/decay that may lead to superstructure settlement.
- Crushed or broken nailer boards or broken joists.
- Piles and pier caps that have loss of bearing capacity or soil retention through crushing, decay, or insect damage.
- Substructure units with severe scour and undermining of the substructure foundation causing instability.

**Concrete**

The following deficiencies represent examples of critical findings for concrete:

- Section loss (thru-hole) subject to enlargement by traffic or deep spalls with exposed rebar in danger of holing through, creating a safety hazard to passing traffic.
- Prestressed girder with spalling and broken strands or 100% deterioration at critical high stress areas.
- Non-composite prestressed adjacent box beams with serious deterioration and existing strand loss, loss of camber or torsional cracking.
- Reinforced concrete girder or pier cap with spalling and broken main rebar or 100% deterioration, with more than one bar affected at the same location in the girder.
- Reinforced or prestressed concrete girder bearing area resulting in loss of bearing area and making girder subject to settlement.
- Reinforced concrete columns with spalling and rebar section loss causing the column to be subject to failure.
- Primary structural members with collision damage that compromises the structural capacity (including severed prestressing tendons, reinforcing steel that results in flexural cracking and negative beam camber, pier shafts, and columns).
- Concrete pier column or cap with significant structural cracking that is supporting a fracture critical bridge or fracture critical component.
- Falling concrete or concrete that is delaminated or partially detached and anticipated to fall, presenting a safety hazard to under-passing motorists and/or pedestrians.
- Bearing seats that are severely deteriorated or undermined.
- Sidewalk structural supports or walking surface with damage or deterioration presenting a hazardous condition to pedestrians.
- Substructure units with severe scour and undermining of the substructure foundation causing instability.
The following deficiencies represent examples of critical findings for steel:

- Steel members with deteriorated areas that have failed in buckling, crippling, more than 10% of the connectors in a connection are missing, etc., or which makes failure likely in the near future.
- Secondary structural members (diaphragms, bracing, etc.) with extensive section loss.
- Fracture critical members subjected to impact damage including gouging or tearing, perpendicular stress cracks in either the base metal or weld metal, parallel stress cracks resulting from out-of-plane distortions or poor weld details, and severe corrosion in girder flanges, webs, in truss members, or in gusset plates.
- Primary structural members with collision damage that compromises the structural capacity (including fractures, large gouges, significant twisting/kinking of beams, and section loss to truss compression members producing member buckling or severe flexural cracking).
- Primary structural member (non-FCM member) with a completely fractured tension member due to fatigue or vehicular collision.
- Pin and hanger systems in fracture critical members with severe deterioration or severe accumulation of debris or rust packing.
- Bottom flange cover plates with cracked welds at the end of a partial length welded cover plate for a steel multi-girder or steel floorbeam.
- Substructure units with severe scour and undermining of the substructure foundation causing instability.

The following deficiencies represent examples of critical findings for traffic safety features:

- Bridge railing (bridge parapets, median barriers, or structure-mounted guardrail) with damage or deterioration that may prevent containment and/or redirection of errant vehicles traveling at the posted speed limit.
- Pedestrian railing that is missing or detached, allowing a pedestrian to fall off the structure.
- Guardrail connections to bridge railing, concrete barrier rebar, or guardrail that is detached and in close proximity or projecting into traffic with potential for impact.

The following deficiencies represent examples of critical findings for signs and lighting:

- Load posting or vertical clearance signs that are missing, damaged, improperly located, or visually obstructed including relevant advance warning signs.
- Signs, traffic signals, or strain poles presenting a safety hazard to passing motorists and/or pedestrians due to extensively damaged, split or buckled sections, or with cracked welds at either pole/base connections or
member/member connections.

- Sign, traffic signal, or strain pole 4-bolt base plate connections with one or more loose nuts presenting a safety hazard to passing motorists and/or pedestrians.
- Signs with deteriorated or missing panel connectors, allowing sign to "flop" under wind loading that present a safety hazard to passing motorists and/or pedestrians.
- Lighting fixtures with split sections, buckled sections, significant section loss, and/or cracked welds at the pole/base connection that present a safety hazard to passing motorists and/or pedestrians.

Other

The following deficiencies represent other examples of critical findings:

- Expansion joints that are deteriorated, damaged, or loose which may present a safety hazard to passing traffic.
- Rocker bearings that are critically tilted either exceeding the acceptable amount of tilt or bearing on the outer one-quarter width of the rocker.
- Excessive debris and/or sediment buildup at the hydraulic opening for scour critical bridges or other bridges with unknown foundations.

4.5.4 Example Plans of Action

As previously mentioned, a statewide or Federal agency wide procedure must be established to assure that critical findings are addressed in a timely manner. The appropriate actions to be used for repair or mitigation of the critical finding must be quickly identified and efficiently carried out. The FHWA must be periodically notified of the actions that have been taken to resolve or monitor critical findings. It is the responsibility of Bridge Owners to implement procedures for addressing critical deficiencies including:

- Immediate critical deficiency reporting steps
- Emergency notification of police and the public
- Rapid evaluation of the deficiencies
- Rapid implementation of corrective or protective actions
- A tracking system to ensure adequate follow-up
- Provisions for identifying other bridges with similar structural details for follow-up inspections

Some agencies have very strict timeframes (3 to 7 calendar days) for developing and accepting plans of action. For circumstances involving immediate attention or a more detailed solution, it may be necessary to begin addressing the critical finding (through permanent or temporary work) prior to the 100% development and acceptance of the plan of action. Example plans of action are given below for Pennsylvania DOT (Figure 4.5.3) and Washington State DOT (Figure 4.5.4).
**Figure 4.5.3** Pennsylvania DOT Critical and High Priority Maintenance Items – Flowchart for Plan of Action
CHAPTER 4: Bridge Inspection Reporting
TOPIC 4.5: Critical Findings

Figure 4.5.4  Washington State DOT Flowchart for Field Inspection Procedure
After the plan of action has been accepted, recommended repair work will then be performed and completed within a few days up to several weeks, depending on the individual agency's regulations. A post-repair report will be generated documenting all necessary work done to address the critical finding and the date of completion. A follow-up inspection will also be conducted to assess the condition of the repairs. The FHWA will be notified of the repair and post-repair progress.
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Bridge Inspection Reporting

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Topic 4.6  The Inspection Report

4.6.1  Introduction
The purpose of the bridge inspection reporting system is to have trained and experienced personnel record objective observations of all elements of a bridge and to make logical deductions and conclusions from their observations.

The bridge inspection report represents a systematic inventory of the current or existing condition of all bridge members and their possible future weaknesses. Moreover, bridge reports form the basis of quantifying the manpower, equipment, materials, and funds that are necessary to maintain the integrity of the structure.

A bridge inspection is not complete until an inspection report is finalized. The bridge inspection report documents all signs of distress and deterioration with sufficient precision so that future inspectors can readily make a comparison of condition. Bridge owners normally set the format to be used when preparing a bridge inspection report. A complete inspection report contains several parts, as outlined in this topic. A sample bridge inspection report is presented in Appendix A. Inspection reports are prepared for special inspections, which are conducted for checking a specific item where a problem or change may be anticipated. Even if no changes are evident, reports are still generated for each type of bridge inspection. Some bridge owners also request a special bridge inspection and report when planning a major rehabilitation.

4.6.2  Basic Components of a Comprehensive In-Depth Bridge Inspection Report

Table of Contents
The table of contents presents the general headings and topics of the inspection report in an orderly manner so that individual sections of the report can be found with ease. It generally follows the title page, and individual sections are listed with their corresponding starting page number.

Location Map
A map is normally included with a scale large enough to positively locate the structure. The bridge is clearly marked and labeled, and the map has a north arrow to aid with orientation. Some agencies may choose to use GPS coordinates or latitude/longitude descriptions.

Bridge Description and History
The bridge description and history section of the report contains all pertinent data concerning the design, construction, and service of the bridge. The type of superstructure will generally be given first, followed by the type of abutments and piers or bents, along with their foundations. If data is available, indicate the type of foundation soil, maximum bearing pressures, and deep foundation capacities. The type of deck is also indicated.

The history of the bridge is from a structural standpoint and is developed from information obtained from design, construction and rehabilitation plans, previous inspection reports, maintenance records, discussions with maintenance crews and
local residents, and any other available source that offers pertinent information. Typical items included in the history narrative are:

- Historical flood frequencies and high water marks
- Maintenance measures and repairs
- Chronological record of conditions (in order to help determine a rate of deterioration of all bridge components and the channel). The agency establishes criteria for the number of bridge inspections kept on file.
- Reference drawings
- Photos, which would consist of a typical approach photograph showing the approach roadway, bridge and any load restriction signs, as well as an elevation/profile photograph showing upstream/downstream of the bridge. Other photographs, such as those conveying the condition of the bridge and its components, would be found in the Appendix or in the Inspection Results section of the inspection report.

**Design Data**

The design information includes a description of the following:

- Skew angle
- Number and length of spans
- Span type and material
- Total length
- Bridge width
- Deck structure type
- Wearing surface
- Deck protection and membrane
- Sidewalks
- Railing and median
- Year constructed/reconstructed
- Number of traffic lanes
- Design live loading
- Waterway
- Other features intersected
- Clearances
- Encroachments
- Alignment

**Construction Data**

The construction history of the bridge includes the date it was originally built, as well as the dates and descriptions of any repairs or reconstruction projects. State what plans are available, where they are filed, and whether they are “design”, “as-built”, or “rehabilitation” drawings.

**Service Data**

The average daily traffic (ADT) count and the average daily truck traffic (ADTT) count are included, along with the date of record. This information is updated approximately every five years. Other service data to consider includes the year of ADT and ADTT, facility carried, functional classification, and bypass detour length and map. In addition, environmental conditions that may have an effect on the bridge, such as salt spray, industrial gases, bird droppings, and ship and railroad traffic, are noted in the report.

**Executive Summary**

The executive summary is a narrative presentation summarizing the inspection and analysis findings in regard to the qualitative condition and the load capacity of the bridge, along with an overview of recommendations. A typical executive summary identifies the bridge (e.g., name, number, and location) and the date of inspection. The executive summary presents any high priority repair items.
CHAPTER 4: Bridge Inspection Reporting

TOPIC 4.6: The Inspection Report

**Inspection Procedures**

The procedures used to inspect the bridge are documented in the inspection report. In most instances, it is advantageous to inspect structures in the same sequence as the load path (i.e., the deck first, then the superstructure, and finally the substructure). This manual is organized and presented for that sequence.

Many inspections cannot follow this sequence due to traffic and lane-closure restrictions. It is useful to document whatever sequence was used during the inspection. This information will be useful in planning future inspections and will also serve as a checklist to make sure that all elements and components were inspected. The following information is typically included:

- Equipment required (e.g., hammers and plumb bobs)
- Access equipment (e.g., rigging, ladders, and free climbing)
- Access vehicles (e.g., inspection cranes and bucket trucks)
- Traffic restrictions (e.g., lane closures, flagmen, and hours of operation)
- Permits required (e.g., railroad and Coast Guard)
- Inspection methods (e.g., visual, physical or advanced)
- Personnel (e.g., by name and classification)
- Special equipment (e.g., material testing and underwater inspection)
- Deviations from “hands-on” inspection of all areas
- Time required for inspection
- Channel profiles, cross sections and scour criticality

When structure plans are not in the bridge records and a load rating has not been calculated, it may be necessary to obtain field measurements to assist in the calculation of the load capacity of the structure.

**Inspection Results**

Provide narrative descriptions of the conditions both quantitative and qualitative, indicating the locations and the extent of the affected areas. Use agency-approved forms consistent with similar inspections. Note all signs of distress, failure, or defects with sufficient precision so that a deterioration rate can be determined. This is very important for determining estimated remaining life and an optimal preservation strategy. Take photographs in the field to show deficiencies and cross reference in the report or on forms where deficiencies are noted. Supplement written notes with sketches and photos to show location and physical characteristics of deficiencies, including a known object in the photograph for scale reference.

Note any load, speed, or traffic restrictions on the bridge. Indicate if the signs are missing or damaged. Take approach roadway photograph to confirm placement of load posting signs that includes the approach roadway, bridge and sign. Check for advanced warning signs. Include information about high water marks and unusual loadings. Note the weather conditions such as temperature, rain, or snow. Note all work or repairs to the bridge since last inspection. Verify or obtain new dimensions when improvement work has altered the structure. New streambed profiles and cross sections are taken to detect scour, channel migration, or channel aggradation and degradation. Note any channel restrictions (e.g. debris) that could impact stream flow and increase scour potential. State the seriousness and amount of all deficiencies at the bridge site.
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TOPIC 4.6: The Inspection Report

**Load Rating Summary**
A summary of any load capacity rating analysis that has been performed is included in the report. The summary is presented in a table or chart. Governing load ratings are shown for both inventory and operating levels for all types of loadings used in the analysis. Identify the governing member for each rating. The governing member is the one that has the lowest capacity for a given type of loading.

For example, in a girder-floorbeam-stringer structure, Stringer three in Bay five may have the lowest capacity for carrying HS20 trucks, compared to all other stringers, floorbeams, or girders. The HS20 inventory and operating ratings for this stringer is reported, and it would be identified as the governing member.

**Conclusions and Recommendations**
A good inspection report explains in detail the type, severity and extent of any deficiency found on the bridge and points out any deviations or modifications that are contrary to the “as-built” construction plans. The depth of the report is consistent with the importance of the deficiencies. Not all deficiencies are of equal importance. For example, a crack in a prestressed concrete box beam which allows water to enter the beam is much more serious than a vertical crack in an abutment backwall or a spall in a corner of a slopewall.

The inspector’s experience and judgment are called upon when interpreting inspection results and arriving at reasonable and practical conclusions. Improper and misinformed conclusions will lead to improper recommendations. The inspector may need to play the role of a detective to conclude why, how, or when certain deficiencies occurred. Seek advice from more experienced personnel when you cannot confidently interpret the inspection findings.

The recommendations made by the inspector constitute the “focal point” of the operation of inspecting, recording, and reporting. The inspector reviews previous inspection recommendations and identifies any recommendations that have not been addressed, particularly if urgent. A thorough, well-documented inspection is essential for making informed and practical recommendations to correct or preclude bridge deficiencies.

All recommendations for preservation work, load rating, postings, and further inspection are included in this portion of the inspection report. Carefully consider the benefits to be derived from completing recommended work and the consequences if the work is not completed. List, in order of greatest urgency, any work that is necessary to maintain structural integrity and public safety. Recommendations concerning work are typically classified between three to five distinct prioritization levels, which range from the most severe or significant (critical) to a maintenance item that is considered routine or may only require monitoring (non-critical). The specific prioritization levels are set forth by each bridge-owning agency. Examples of agency priority maintenance procedures are listed in Topic 4.5.2.

The inspector decides whether a deficiency is a critical finding and needs immediate action using agency procedures. Usually this is easily determined, but occasionally the experience and judgment of a professional engineer may be required to reach a proper decision. A large hole through the deck of a bridge obviously needs attention, and a recommendation for immediate action is in order. Communicate the critical finding immediately and document actions taken in the
report. By contrast, a slightly deteriorated bridge bearing may not be critical. A condition such as this would appropriately call for a recommendation for a preservation action.

Typically, most work recommendations submitted by the bridge inspector will be in the category of non-critical work. The recommended work is carefully described in the report along with a cost estimate.

If not already described in the executive summary, the conclusions and recommendations section of the report summarizes the following:

- Overall condition
- Major deficiencies
- Load-carrying capacity
- Recommendations for:
  - Further inspection
  - Maintenance
  - Repairs
  - Painting
  - Posting
  - Rehabilitation
  - Replacement

Some state and local agencies designate separate personnel, not the inspector in the field, to prepare recommendations and cost estimates.

Report Appendices

To achieve maximum effectiveness of the inspection report, the report appendices contain any back-up information used to substantiate the inspector’s findings, conclusions and recommendations. Typically, the appendices include photographs, drawings and sketches, and inspection forms (see Topic 4.4 for record keeping and documentation). Appendices may also include copies of any field notes used and specialist reports (e.g., underwater, nondestructive evaluation (NDE), and survey), or these documents may be referenced in the report. A load capacity rating analysis of the structure may also be incorporated into the report appendices. It is important to have the inspection report and all supplemental information, including report appendices, accurate with clear and concise descriptions or explanations.

Photographs

Photographs are a great asset to anyone reviewing reports on bridge structures. It is recommended that pictures be taken of any problem areas. Take pictures even if you think you can explain it completely in writing. It is better to take several photographs that may be considered unessential than to omit a photograph that could cause misinterpretation or misunderstanding of the report. At least two general photographs of every structure are provided in the appendix. One of these depicts the structure from the roadway, while the other photo is a view of the side elevation (see Figures 4.6.1 and 4.6.2). Captions are provided for each photograph. Photographs are numbered so that they can be referred to in the body of the report. Sketches may also be a substitute for missing as-built plans.
Figure 4.6.1  Near Approach - Toward Bridge

Figure 4.6.2  Downstream Elevation
Drawings and Sketches

Sketches and drawings needed to illustrate and clarify conditions of structural elements or serve as as-built plans are included or referenced. Sketches may be able to convey information not readily identified in a photograph (i.e., remaining web thickness). Original drawings are very helpful during future investigations with determining the progression of defects and to help determine any changes and their magnitude. Drafting-quality plans and sketches, sufficient to indicate the layout of the bridge and bridge site, may be included as an appendix.

Some reports combine photographs and sketches or text boxes together to accurately describe and document a particular deficiency.

Inspection Forms

The inspection forms contain the actual field notes, as well as the numerical condition and appraisal ratings by the inspector. The inspection forms are normally signed by the inspection team leader. A complete SI&A form or equivalent is included in the appendix. Compare previous inspection forms to current conditions for inventory data accuracy.

Load Capacity Analysis

A load rating analysis is performed on the structure to determine the load-carrying capacity of the bridge. It includes the investigation of primary load-carrying members of the bridge. Such analysis is normally performed by engineers in the office, not by the inspector. Also, not all inspections require a new load rating analysis. A new load rating analysis is performed if the condition of the primary members has changed considerably since the last inspection. The report also includes recommendations for a new load rating analysis when maintenance or improvement work, change in strength of members, or dead load has altered the condition or capacity of the structure.

Field Inspection Notes

Include the original notes taken by the inspectors in the field or photocopies thereof in the appendix section of the report. The original field notes are source documents and as such are typically included in the bridge record.

Underwater Inspection Report

If an underwater inspection of the substructure has been performed, a separate report is usually prepared by the dive team. If applicable, include the underwater inspection report in the appendix or cross-reference the location of the report.

Material Testing Results

Material testing may be performed on a structure in order to determine the strength and properties of an unknown or suspect material. Include the testing lab’s report in the appendix.
### 4.6.3 Basic Components of a Comprehensive Routine Inspection Report

#### Location Map
A map with a scale may be included to help positively locate the structure. Some agencies may choose to use GPS coordinates or latitude/longitude descriptions to supplement or replace the location map.

#### Inspection Procedures
The procedures used to inspect the bridge may be documented in the inspection report. For inspection reports that include the inspection procedures, it is advantageous to inspect structures in the same sequence as the load path (i.e., the deck first, then the superstructure, and finally the substructure).

As with in-depth inspections, some routine inspections cannot follow this sequence due to traffic and lane-closure restrictions. Therefore, it is useful to document whatever sequence was used during the inspection. This information will be useful in planning future inspections and will also serve as a checklist to make sure that all elements and components were inspected. The following information is typically included:

- Equipment required (e.g., hammers and plumb bobs)
- Access equipment (e.g., rigging, ladders, and free climbing)
- Access vehicles (e.g., inspection cranes and bucket trucks)
- Traffic restrictions (e.g., lane closures, flagmen, and hours of operation)
- Permits required (e.g., railroad and Coast Guard)
- Inspection methods (e.g., visual, physical or advanced)
- Personnel (e.g., by name and classification)
- Special equipment (e.g., material testing and underwater inspection)
- Deviations from “hands-on” inspection of all areas
- Time required for inspection
- Channel profiles, cross sections and scour criticality

When structure plans are not in the bridge records and a load rating has not been calculated, it may be necessary to obtain field measurements to assist in the calculation of the load capacity of the structure.

#### Inspection Results
The results of the inspection are documented within the inspection forms. Narrative descriptions of the conditions are typically not included for routine inspection reports. As with in-depth inspections, use agency-approved forms consistent with similar inspections. Note all signs of distress, failure, or defects with sufficient precision so that a deterioration rate can be determined. This is very important for determining estimated remaining life and an optimal preservation strategy. Take photographs in the field to show deficiencies and cross reference in the report or on forms where deficiencies are noted. Supplement written notes with sketches and photos to show location and physical characteristics of deficiencies, including a known object in the photograph for scale reference.
Note any load, speed, or traffic restrictions on the bridge. Indicate if the signs are missing or damaged. Take approach roadway photograph to confirm placement of load posting signs that includes the approach roadway, bridge and sign. Check for advanced warning signs. Include information about high water marks and unusual loadings. Note the weather conditions such as temperature, rain, or snow. Note all work or repairs to the bridge since last inspection. Verify or obtain new dimensions when improvement work has altered the structure. New streambed profiles and cross sections are taken to detect scour, channel migration, or channel aggradation and degradation. Note any channel restrictions (e.g. debris) that could impact stream flow and increase scour potential. State the seriousness and amount of all deficiencies at the bridge site.

**Load Rating Summary**

For routine inspections, a load rating may be conducted. If performed, a load rating summary is included in the report and may also be included on the inspection forms. The summary is presented in a table or chart. Governing load ratings are shown for both inventory and operating levels for all types of loadings used in the analysis. Identify the governing member for each rating. The governing member is the one that has the lowest capacity for a given type of loading.

**Conclusions**

A routine inspection report may or may not contain conclusions of the inspection. If conclusions are included, explain in detail the type, severity and extent of any deficiency found on the bridge and point out any deviations or modifications that are contrary to the “as-built” construction plans. The depth of the report is consistent with the importance of the deficiencies. Not all deficiencies are of equal importance.

The inspector’s experience and judgment are called upon when interpreting inspection results and arriving at reasonable and practical conclusions. Improper and misinformed conclusions will lead to improper recommendations. The inspector may need to play the role of a detective to conclude why, how, or when certain deficiencies occurred. Seek advice from more experienced personnel when you cannot confidently interpret the inspection findings.

**Recommendations**

Recommendations are made by the inspector that constitutes the “focal point” of the operation of inspecting, recording, and reporting. The inspector reviews previous inspection recommendations and identifies any recommendations that have not been addressed, particularly if urgent. A thorough, well-documented inspection is essential for making informed and practical recommendations to correct or preclude bridge deficiencies.

All recommendations for preservation work, load rating, postings, and further inspection are included in this portion of the inspection report. Carefully consider the benefits to be derived from completing recommended work and the consequences if the work is not completed. List, in order of greatest urgency, any work that is necessary to maintain structural integrity and public safety. Recommendations concerning work are typically classified between three to five distinct prioritization levels, which range from the most severe or significant (critical) to a maintenance item that is considered routine or may only require monitoring (non-critical). The specific prioritization levels are set forth by each bridge-owning agency. Examples of agency priority maintenance procedures are...
The inspector decides whether a deficiency is a critical finding and needs immediate action using agency procedures. Usually this is easily determined, but occasionally the experience and judgment of a professional engineer may be required to reach a proper decision. A large hole through the deck of a bridge obviously needs attention, and a recommendation for immediate action is in order. Communicate the critical finding immediately and document actions taken in the report. By contrast, a slightly deteriorated bridge bearing may not be critical. A condition such as this would appropriately call for a recommendation for a preservation action.

Typically, most work recommendations submitted by the bridge inspector will be in the category of non-critical work. The recommended work is carefully described in the report along with a cost estimate.

The recommendations section of the report summarizes the following:

- Further inspection
- Maintenance
- Repairs
- Painting
- Posting
- Rehabilitation
- Replacement

Some state and local agencies designate separate personnel, not the inspector in the field, to prepare recommendations and cost estimates.

**Report Appendices**

To achieve maximum effectiveness of the inspection report, the report appendices contain any back-up information used to substantiate the inspector’s findings, conclusions (if included) and recommendations. Typically, the appendices include photographs, drawings and sketches, and inspection forms. See Topic 4.4 for record keeping and documentation. Note that for routine inspections, inspection forms comprise the report, itself. Appendices may also include copies of any field notes used and specialist reports (e.g., underwater, nondestructive evaluation (NDE), and survey), or these documents may be referenced in the report. Although typically not conducted for routine inspections, a load capacity rating analysis of the structure may also be incorporated into the report appendices if performed. It is important to have the inspection report and all supplemental information, including report appendices, accurate with clear and concise descriptions or explanations.

**Photographs**

Photographs are a great asset to anyone reviewing reports on bridge structures. It is recommended that pictures be taken of any problem areas. Take pictures even if you think you can explain it completely in writing. It is better to take several photographs that may be considered unessential than to omit a photograph that could cause misinterpretation or misunderstanding of the report. At least two general photographs of every structure are provided in the appendix. One of these depicts the structure from the roadway, while the other photo is a view of the side.
elevation (see Figures 4.6.1 and 4.6.2). Captions are provided for each photograph. Photographs are numbered so that they can be referred to in the body of the report. Sketches may also be a substitute for missing as-built plans.

**Drawings and Sketches**

Sketches and drawings needed to illustrate and clarify conditions of structural elements or serve as as-built plans are included or referenced. Sketches may be able to convey information not readily identified in a photograph (i.e., remaining web thickness). Original drawings are very helpful during future investigations with determining the progression of defects and to help determine any changes and their magnitude. Drafting-quality plans and sketches, sufficient to indicate the layout of the bridge and bridge site, may be included as an appendix.

Some reports combine photographs and sketches or text boxes together to accurately describe and document a particular deficiency.

**Inspection Forms**

The inspection forms comprise the actual routine inspection report and contain the field notes, as well as the numerical condition and appraisal ratings by the inspector. The inspection forms are normally signed by the inspection team leader. A complete SI&A form or equivalent is included in the appendix. Compare previous inspection forms to current conditions for inventory data accuracy.

**Load Capacity Analysis**

A load rating analysis may or may not be performed on the structure to determine the load-carrying capacity of the bridge. For routine inspections without a load capacity analysis, the results of the previous load capacity analysis are typically included in the report. If a load capacity analysis is performed, it is normally performed by engineers in the office, not by the inspector, and represents an investigation of primary load-carrying members of the bridge. A new load rating analysis is performed if the condition of the primary members has changed considerably since the last inspection. The report also includes recommendations for a new load rating analysis when maintenance or improvement work, change in strength of members, or dead load has altered the condition or capacity of the structure.

**Field Inspection Notes**

Include the original notes taken by the inspectors in the field or photocopies thereof in the appendix section of the report. The original field notes are source documents and as such are typically included in the bridge record.

**Underwater Inspection Report**

If an underwater inspection of the substructure has been performed, the summary of findings of the underwater inspection report (typically prepared by the dive team) is usually included in the appendix or cross-referenced to another location of the report.
4.6.4

Importance of the Inspection Report

Source of Information

A well-prepared report will not only provide information on existing bridge and bridge site conditions, but it also becomes an excellent reference source for future inspections, comparative analyses, and bridge study projects. Any conditions that are suspicious but unclear are reported in a factual manner, avoiding speculation. Terms such as “hazardous” or “dangerous” are subjective and are not used in the inspection report or inspection documentation that may be included in the appendix. Further action on such reports will be determined after review and consultation by experienced personnel.

Legal Document

In preparing an inspection report, keep in mind that bridge funding may be allocated or repairs designed based on this information. Furthermore, the inspection report is a legal record which may form an important element in future litigation. The language used in reports needs to be clear and concise and, in the interest of uniformity, care needs to be taken to avoid ambiguity of meaning. The information contained in reports is obtained from field investigations, supplemented by reference to “as-built” or “field-checked” plans. The source of all information contained in a report needs to be clearly stated.

Some state agencies require inspection reports to be signed, dated and sealed by a professional engineer before accepting them. Other state agencies require inspection reports to be signed and dated by the inspection team leader. The AASHTO MBE states (per Article 2.2) that "the components of data entered in a bridge record should be dated and include the signature of the individual responsible for the data presented.” No undocumented alterations are allowed to the report once it is accepted. Some inspectors retain copies of their reports for their personal files in the interest of self-protection if there is any litigation.

Critical Findings

Critical findings are documented in the inspection report. However, the inspection report does not provide guidance for the follow-up to critical findings - the inspector does not wait for the inspection report to communicate and take action on critical findings. Instead, the follow-up to critical findings is a separate procedure that is immediately communicated with action taken on the critical findings, in accordance with the requirements of the NBIS. Agency procedures are established to assure that critical findings are addressed in a timely manner. In many instances when the critical finding exists, a plan of action is established and the deficiency is addressed prior to the formal submittal of the inspection report.

The FHWA is periodically notified of the actions taken to resolve or monitor critical findings. Advanced inspection methods for one or more elements may be recommended. The report provides information which may lead to decisions to limit the use of a bridge or close it to traffic; any bridge which the inspection has revealed to be a potential public safety concern.

Maintenance

Another purpose of the inspection report is to provide useful information about the needs and effectiveness of preservation activities. An active preservation program is vital to the long-term structural integrity of a bridge. The inspection report enables bridge preservation to be programmed more effectively through early
detection of structural deficiencies, therefore minimizing more costly future work and inconvenience to the traveling public.

**Load Rating Analysis**

When an inspection reveals deficiencies that may affect the load-carrying capacity of the structure, the findings need to be reviewed by an engineer to determine if a revised load rating analysis is required. A new load rating analysis is performed to determine the safe load capacity for the current condition. It may then be necessary to restrict loads crossing the bridge so that its safe load capacity is not exceeded. It is important that the revised load-carrying capacity (load rating) analysis become part of the bridge record.

**Bridge Management**

Another purpose of the inspection report is analysis by the bridge owners and the FHWA of the SI&A data. The intent of the analysis is to aid in the decisions for allocating and prioritizing funding.

Another important purpose of the inspection report is the data the report provides for use by the owner in managing the bridge asset. The data provided in the inspection report is important for the identification, prioritization, budgeting and programming of bridge preservation, improvement and replacement work. On a national level the data is used for reporting to Congress on the condition and performance of the Nation's bridges and for determining current and future estimates of funding needs. Furthermore, the data is used to: classify bridges according to serviceability, safety, and essentiality for public use; assign each a priority for replacement or rehabilitation; and determine the cost of replacing each such bridge with a comparable facility or of rehabilitating such bridge.

**4.6.5 Quality**

The accuracy and uniformity of information collected and recorded is vital for the management of an owner’s bridges for preservation, improvement and replacement, and, most importantly, public safety. Quality cannot be taken for granted. The responsibility of ensuring quality bridge inspections rests with each bridge owner and the inspection team. Two phrases are frequently used when discussing quality; they are quality control and quality assurance.

NBIS regulations require each state to assure that systematic quality control (QC) and quality assurance (QA) procedures are being used to maintain a high degree of accuracy and consistency in the inspection program. Include periodic field review of inspection teams, periodic bridge inspection refresher training for program managers and team leaders, and independent review of inspection reports and computations.

The AASHTO MBE provides guidance for the implementation of appropriate quality control and quality assurance procedures. Quality control procedures include the "use of checklists to ensure uniformity and completeness, the review of reports and computations by a person other than the originating individual, and the periodic field review of inspection teams and their work." Quality assurance procedures include the "overall review of the inspection and rating program to ascertain that the results meet or exceed the standards established" by the bridge-owning agency.

Follow state-wide or agency-wide QC/QA procedures for a higher degree of accuracy and consistency in the inspection program.
See Topic 1.3 for a detailed description of quality control and quality assurance.
Appendix A

Sample Inspection Report
PORT AUTHORITY OF ALLEGHENY COUNTY
PITTSBURGH, PENNSYLVANIA

REPORT ON THE
NBIS INSPECTION
OF
CHARTIERS CREEK BRIDGE

BMS No. 02 7421 0000 9061

Submitted By:

Michael Baker Jr., Inc.
100 Airside Drive
Coraopolis, Pennsylvania
15108

September, 2011
STRUCTURE B.M.S. NUMBER: 02 7421 0000 9061
BRIDGE NAME: Chartiers Creek Bridge
LOCATION: Crafton, Pennsylvania
INSPECTION DATE: June 23, 2011
INSPECTED BY: Michael Baker Jr., Inc.
               Patrick A. Leach, P.E.
               Charles L. Molnar
PREPARED FOR: Port Authority of Allegheny County
PREPARED BY: Michael Baker Jr., Inc.
               Written By: Joseph E. Salvadori, E.I.T.
               Reviewed By: Raymond A. Hartle, P.E.
PORT AUTHORITY AGREEMENT NUMBER: 11-08
OWNER OF BRIDGE: Port Authority of Allegheny County
COST INFORMATION:
                  Inspection & Report $4,662.00
                  Rigging $2,340.00
                  Traffic Control $ 0
                  Railroad $ 0
                  Insurance $ 0
DATE SUBMITTED: (Seal removed for BIRM)
TABLE OF CONTENTS

I Location Map

II Introduction

III Inspection Findings
   - Inspection Summary
   - Photographs
   - Drawings (Note – Drawings for this structure are not included in this example.)
   - Forms D-450’s

IV Structural Analysis

V Recommendations And Cost Estimate

VI Appendix
   - BMS Forms D-491’s (Note – Not included in this example.)
Chartiers Creek Bridge

Location Map
(No Scale)
REPORT ON THE INITIAL NBIS INSPECTION OF CHARTIERS CREEK BRIDGE
PORT AUTHORITY OF ALLEGHENY COUNTY

II. INTRODUCTION:

• Location
Located in the Borough of Crafton, the Chartiers Creek Bridge carries two (2) lanes of the Port Authority of Allegheny County’s West Busway over Chartiers Creek, and the Pittsburgh Industrial Railroad, Inc.

• Year Built
The approximate date of the original construction of the Chartiers Creek Bridge is 1948. The structure was built by the Pennsylvania Railroad Company. Rehabilitation was completed in July 1997.

• Load Posting
None required.

• Description
The Chartiers Creek Bridge is a three (3) span, non-composite, riveted and bolted built-up plate girder bridge with a total length of 253’-11” (see photo no. 1). The 3 spans consist of one (1) main simple span 124’-0”, one (1) simple south end span 55’-3”, and one (1) simple north end span 68’-3” long. The span lengths are measured between centerline of bearings. The skew angle measured between the centerline of the abutment and West Busway is 90°. There are AT&T conduits mounted under the deck, and light poles mounted on top of the concrete parapets (see photo no.’s 8 & 2, respectively).
Chartiers Creek Bridge

The superstructure consists of four girders spaced at 7’-0” – 6’-0” – 7’-0” on centers, are laterally restrained with angle cross framing, and support an 8 1/2” reinforced concrete deck. The deck thickness includes a 1/2” integral-wearing surface. The deck measures 28’-0” between the reinforced concrete parapets present on both sides of the structure. Galvanized stay-in-place deck forms are present on the underside of the deck (see photo no. 8).

Span 1 girders are made up of a 5’-11” deep by 1/2” thick web plates, and 18” wide by 3/4” thick top and bottom flange plates (see photo no. 8). The main span consists of a 10’- 4 1/2” deep by 1/2” thick web plate, and top and bottom flange plates varying from 20” wide by 7/8” thick, to 20” wide by 1” thick (see photo no. 9). Span 3 girders are made up of a 6’- 10 1/2” deep by 1/2” thick web plate, and 18” wide by 3/4” and 7/8” thick top and bottom flange plates (see photo no. 10). New knee brackets, bolted to the fascia girders, measure 4’-9” wide, from the centerline of existing fascia girders to the centerline of the new W24x55 fascia stringers, with 1/2” thick web plates, and 6” wide by 1/2” thick top and bottom flange plates (see photo no. 4). Lateral bracing and diaphragms consist of angles, and angle x-bracing, respectively. Laminated elastomeric bearing pads are present at the girder ends.

The main span vertical underclearance, from the existing concrete channel bottom, at the centerline of the railroad measures 60’-9” and 36’-7” in span 1.

Gravity type substructures consist of a combination of original stone construction with newly constructed reinforced concrete abutment backwalls and pier caps (see photo no.’s 4 to 7).
III. INSPECTION FINDINGS:

Michael Baker Jr., Inc. performed this initial inspection, which follows NBIS procedures, on June 23, 2011, via a UB-40 underbridge inspection crane. In general, the structure was in good condition with a few minor problems. Several conduits at the south abutment and in span 1 have severely buckled segments, and broken couplers and/or adapters (see photo no.’s 12 & 13). In addition, a conduit in span 3 is split and leaking water (see photo no. 14). These problems are due to the junction boxes being allowed to fill with rainwater during construction.

**Approach**
The north and south approach roadway and slabs are newly constructed with no deficiencies noted.

**Deck**
No deficiencies noted – new construction (see photo no. 11). All PennDOT Type 1 scuppers are in excellent condition. A few scuppers exhibit minor debris accumulation but are fully functional (see photo no. 15). Random hairline (< 0.01”) shrinkage cracks along the length of the concrete parapets are present (see photo no. 16). Deck expansion joints consist of strip seals in good condition with minor debris accumulation (see photo no. 17).

**Superstructure**
The superstructure has no visible structural deficiencies. Girders, fascia stringers, knee brackets, and lateral bracing are newly painted. The paint shows no visual defects, but the girders and bracing exhibit evidence of prior minor section loss and member pitting. Fascia stringers and knee brackets are in new condition with no deficiencies noted (see photo no. 4). Diaphragms are in good condition, but show areas of freckled surface rust under the broken
Conduit in span 1. Approximately 50% of lateral bracing connections between girders 3 & 4, in span 2, were not painted with final paint coat (see photo no. 18). Laminated elastomeric bearing pads are functioning properly with no problems noted.

**Substructure**

The north and south abutments are in good condition, with a few minor problems noted. Both abutments have newly constructed reinforced concrete backwalls, bridge seats, and wingwalls with no visual deficiencies noted (see photo no.’s 4 & 5). The stem tops consist of new reinforced concrete construction, also with no visual deficiencies noted, and are attached to the existing stone masonry bases. Some locations of the stone masonry show minor cracking and loosening of mortar.

Piers 1 & 2 are in good condition with minor cracking and loosening of mortar on the existing stone masonry portion of the stems. The bridge seats, caps, and stem tops are newly constructed reinforced concrete with no visual deficiencies noted (see photo no.’s 6 & 7).
Chartiers Creek Bridge

Photo No. 1       General Elevation (Upstream)

Photo No.2       South Approach (near)
Chartiers Creek Bridge

Photo No.3  North Approach (far)

Photo No.4  South Abutment (near) - Elevation
Chartiers Creek Bridge

Photo No.5  North Abutment (far) - Elevation

Photo No.6  Pier 1 - North Face (Looking South)
Chartiers Creek Bridge

Photo No.7  Pier 2 - North Face (Looking South), note electrical lines

Photo No.8  General Underside View – Span 1
Chartiers Creek Bridge

Photo No. 9  General Underside View – Span 2

Photo No. 10  General Underside View – Span 3
Chartiers Creek Bridge

Photo No. 11  General Deck View

Photo No. 12  Conduit, Span 1 – note longitudinal crack/split
Chartiers Creek Bridge

Photo No. 13  Conduit and Couplers, Span 1 – note bend in conduit, and coupler separation

Photo No. 14  Conduit, Span 3 – note conduit is split and leaking water
Chartiers Creek Bridge

Photo No. 15   Typical PennDOT Type 1 Scupper

Photo No.16   Typical parapet crack
Chartiers Creek Bridge

Photo No. 17  Strip Seal at North Abutment (typ.) – note minor debris accumulation

Photo No. 18  Lateral bracing connection between beam #3 and #4, in span 2 – note no final paint coat, and rust freckles
IV. **STRUCTURAL ANALYSIS:**

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<tr>
<th>LOAD FACTOR</th>
<th>H</th>
<th>HS</th>
<th>ML</th>
<th>P</th>
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<tbody>
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<td>115</td>
<td>159</td>
<td>152</td>
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<tr>
<td>Inventory w/ F.W.S</td>
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<td>155</td>
<td>148</td>
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<tr>
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<td>265</td>
<td>253</td>
<td>346</td>
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<tr>
<td>Operating w/ F.W.S</td>
<td>187</td>
<td>259</td>
<td>247</td>
<td>338</td>
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</table>

Note: 1) Critical rating is for a beam controlled by shear in span 3
2) Due to no analysis being performed as part of the inspection, the above table is reproduced from contract drawings.

V. **RECOMMENDATIONS AND COST ESTIMATE:**

**Repairs**

<table>
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<tr>
<th>Item</th>
<th>Estimated Quantity</th>
<th>Unit Cost</th>
<th>Total Cost</th>
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<tbody>
<tr>
<td>Drain junction boxes, and conduits filled with water. Repair bent conduits, and broken couplers/adapters.</td>
<td>N/A</td>
<td>Lump Sum</td>
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<td>Paint locations requiring final paint coat between girders 3 &amp; 4 in span 2.</td>
<td>20 SF</td>
<td>Lump Sum</td>
<td>$1,500.00</td>
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**TOTAL COST $9,000.00**

Note: The above costs are only for the items listed and do not include additional costs which would be incurred when the work is performed, such as mobilization, maintenance and traffic protection, engineering, etc.
### Bridge Management System

**Site Data**

- **Structure Type (Dept.)**: STL. RIVETED I-BEAM
- **Main Over**: CHARTIERS CREEK
- **Approach Over**: CHARTIERS CREEK

**Inspection Date**

- **Inspector**: E06 06 23 00
- **Headed by**: E12 MICH AEL BAKER JR.

**Weather Conditions**

- Temp: 84
- MOSTLY SUNNY

**Bridge Signing Verification**

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<th>BMS Item</th>
<th>Type of Sign</th>
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<th>Near Advance</th>
<th>Bridge Site</th>
<th>Far Advance</th>
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<tr>
<td>D15</td>
<td>Bridge Weight Limit</td>
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<tr>
<td>D15</td>
<td>Except Combination</td>
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<td>B22/B23</td>
<td>Vert. Clearance - Und</td>
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<td>Hazard Clearance</td>
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<td>Other</td>
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</table>

**Vert. Clear. Sign**

- **On Feature**: B01 = [ ] B31 = [ ]
- **Under Feature**: B01 = [ ] B31 = [ ]

**E26 Underclearance Appraisal**

- Controlling: Lateral 12'-2" Vertical 36'-7"

**E28 Approach Alignment**

- NO SPEED REDUCTION. GOOD SIGHT DISTANCE.

**E15 Approach Roadway**

- NEW PAVEMENT GOOD CONDITION.

- **Pavement**: GOOD
- **Drainage**: GOOD (ALL NEW CONSTRUCTION)
- **Shoelands**: GOOD

**E14 Approach Slab**

- NEW CONSTRUCTION.

- **Bump at Bridge**: Yes [x] No [ ]

**E19 Relief Joint**

- 1
Bridge Data

For Non-State Roadways

For State highways, data from RMS will be used

Deck Geometry 6

Deck Wearing Surface 9 NEW CONSTRUCTION (CONCRETE INTEGRAL)

Wearing Surface Type 101 C10A Wearing Surface Thickness 0.5

Deck 9

Estimated Spall or Delamination %

Est. Chloride Content

Top EXCELLENT CONDITION - NEW CONSTRUCTION.

Underside STAY IN PLACE FORMS (NO RUSTING NOTED) GALVANIZED AND IN GOOD CONDITION.

Exp. Joint No. 4 C22 Exp Jt Types M B G

GOOD CONDITION - SOME MINOR DIRT BUILD UP. (STRIP SEALS)

Deck Drainage GOOD - SOME SCUPPERS HAVE DEBRIS BUT NOT IN THE DOWNSPOUT.

Superstructure 7

See Sheet for Additional Details. Form 491-J attached for FCM details Yes No

Girders / Beams GOOD CONDITION - SUPERSTRUCTURE HAS BEEN RECONSTRUCTED FOR NEW BUSWAY BRIDGE. NEW PAINT/COATING OVER PREVIOUS Pitting/MORE SECTION LOSS. ALSO, SOME AREAS OVER LIGHT SURFACE RUST ON BOTTOM FLANGE. (THROUGHOUT)

Floorbeams N/A

Stingers NEW (FASCIA STRINGERS) W24 X 55 EXCELLENT CONDITION.

Diaphragms GOOD CONDITION. FEW AREAS OF FRECKLED SURFACE RUST UNDER BROKEN CONDUIT IN SPAN 1.

Truss Members N/A

Portals / Bracing FEW AREAS OF FRECKLED SURFACE RUST UNDER BROKEN CONDUIT IN SPAN 1. SEVERAL AREAS BETWEEN G3 AND G4 IN SPAN 2 WERE NOT PAINTED WITH FINAL COAT.

Bearings GOOD CONDITION. (LAMINATED ELASTOMERIC)

Drainage System (Below Deck) EXCELLENT CONDITION. (TYPE 1 SCUPPERS)
### Abutment Data

#### NAB - Near Abutment (Use same notation as W09)
- **Backwall:** GOOD CONDITION - NEW CONSTRUCTION.
- **Bridge Seats:** GOOD CONDITION - NEW CONSTRUCTION. VERY MINOR DEBRIS.
- **Cheekwalls:**
- **Stem:** GOOD CONDITION - NEW CONCRETE CONSTRUCTION AT TOP ON EXISTING STONE MASONRY BASE. SOME LOCATIONS HAVE MINOR CRACKING AND LOOSENING OF MORTAR.
- **Wings:** GOOD CONDITION - NEW CONSTRUCTION.
- **Footing:** NOT VISIBLE.
- **Piles:** NOT VISIBLE.
- **Scour / Undermine:** No

#### FAB - Far Abutment (Use same notation as W09)
- **Backwall:** GOOD CONDITION - NEW CONSTRUCTION.
- **Bridge Seats:** GOOD CONDITION - NEW CONSTRUCTION. MINOR DEBRIS.
- **Cheekwalls:**
- **Stem:** GOOD CONDITION - SAME AS NEAR ABUTMENT.
- **Wings:** GOOD CONDITION - NEW CONSTRUCTION.
- **Footing:** NOT VISIBLE.
- **Piles:** NOT VISIBLE.
- **Scour / Undermine:** No

---

#### Embankment/Wall
- **Slope-Wall:** GOOD CONDITION - HEAVY VEGETATION.
- **Wall Drainage:**

#### Settlement
- **None Noted.**
Substructure (Cont.)

Pier / Bert Number 1 [Use same notation as W09]

Bridge Seats GOOD CONDITION - NEW CONSTRUCTION.

Caps GOOD CONDITION - NEW CONSTRUCTION.

Cheekwalls

Columns/Stems GOOD CONDITION - NEW CONSTRUCTION ON TOP OF EXISTING STONE MASONRY BASE. MINOR CRACKING AND LOOSE MORTAR.

Footings NOT VISIBLE.

Piles NOT VISIBLE.

Scour / Undermine Yes No X

See Details on Form Sheet

NOT IN CHANNEL - CHANNEL IS CONCRETE LINED.

Settlement NONE NOTED.

Pier / BERT Number 2 [Use same notation as W09]

Bridge Seats GOOD CONDITION - NEW CONSTRUCTION.

Caps GOOD CONDITION - NEW CONSTRUCTION.

Cheekwalls

Columns/Stems GOOD CONDITION - SAME AS PIER 1.

Footings NOT VISIBLE.

Piles NOT VISIBLE.

Scour / Undermine Yes No X

See Details on Form Sheet

CHANNEL IS CONCRETE LINED.

Settlement NONE NOTED.
**Waterway Data**

**BRIDGE MANAGEMENT SYSTEM**

**BRIDGE INSPECTION REPORT**

---

**U.W. Inspection Date**

### Inspection Type

- **W02**: N
- **W02-A**: [Blank]
- **W03**: [Blank]
- **W04**: [Blank]

### Weather Conditions

**Weather Conditions**

**Name of Consultant and/or Inspectors**

**Hired by**

**Inspection Cost**

**Scour Critical Rating**

- **E29A**: W06 [Blank]
- [Blank] Observed Scour
- [Blank] Scour Calculation

**No. of Units Inspected**

**Streambed Material**

- **W07**: C 8

**Channel**

- **E21**: Channel/Channel Protection - Cond. Rating [Blank] Details on Sheet

**Channel**

**CONCRETE LINED CHANNEL.**

---

**Banks**

**GOOD CONDITION - HEAVY VEGETATION.**

**Streambed Movements**

**NONE NOTED.**

**Debris, Vegetation**

**SOME DEBRIS IN CHANNEL.**

**River (Stream) Control Devices**

**N/A**

**Embankment / Streambed Controls**

**N/A**

**Drift, Other**

**NONE NOTED.**

---

**Waterway Adequacy**

- **E27**: 9

**Risk of Overtopping**

- **Remote**: [Blank]
- **Slight**: [Blank]
- **Occasional**: [Blank]
- **Frequent**: [Blank]

**Traffic Delay**

- **Insignificant**: [Blank]
- **Significant**: [Blank]
- **Severe**: [Blank]

**B18 - Functional Class.**

---

**High Water Mark**

**ELEV:** [Blank]

**DATE (mm/yyyy):** [Blank]

- [Blank] New HW Mark
- [Blank] HW since last inspection

---

**W09**

- **Substructure Unit**: [Blank]
- **Foundation Type**: [Blank]

**W10**

- **Foundation Type**: [Blank]

**W11**

- **Depth**: [Blank]

**W11-A**

- **Observed Scour Rating**: [Blank]

**W11-B**

- **U.W. Inspect. Performed**: [Blank]

**W11-C**

- **Observed Depth**: [Blank]

**W11-D**

- **Counter-Measures**: [Blank]

**W11-F**

- **Counter-Measures**: [Blank]

**Findings:**

**ABUTMENT OUT OF FLOOD PLANE.**

---

**W09**

- **Substructure Unit**: [Blank]

**W10**

- **Foundation Type**: [Blank]

**W11**

- **Depth**: [Blank]

**W11-A**

- **Observed Scour Rating**: [Blank]

**W11-B**

- **U.W. Inspect. Performed**: [Blank]

**W11-C**

- **Observed Depth**: [Blank]

**W11-D**

- **Counter-Measures**: [Blank]

**W11-F**

- **Counter-Measures**: [Blank]

**Findings:**
Findings: ABUTMENT OUT OF FLOOD PLANE.
**OBSERVED SCOUR RATING GUIDE**

<table>
<thead>
<tr>
<th>Rating</th>
<th>ITEM NUMBER</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
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<tbody>
<tr>
<td>Rating</td>
<td></td>
<td>Change Since Last</td>
<td>Scour</td>
<td>Debris</td>
<td>Substructure</td>
<td>Opening Adequacy</td>
<td>Sediment</td>
<td>Alignment</td>
<td>Velocity/ Stream</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inspection</td>
<td>Hole</td>
<td>Potential</td>
<td>Scourability</td>
<td>Channel</td>
<td></td>
<td></td>
<td>Slope</td>
<td></td>
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<tr>
<td>9</td>
<td>None</td>
<td>None</td>
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<td>None</td>
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<td>None</td>
<td>Good</td>
<td>Low</td>
<td>9</td>
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<tr>
<td>8</td>
<td>Minor</td>
<td>Minor</td>
<td>Minor</td>
<td>Minor</td>
<td>Minor</td>
<td>Fair</td>
<td>Minor</td>
<td>Good</td>
<td>Low</td>
<td>8</td>
<td></td>
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<tr>
<td>7</td>
<td>Minor</td>
<td>Advanced</td>
<td>Medium*</td>
<td>Medium*</td>
<td>Medium*</td>
<td>Fair</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>7</td>
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<td>6</td>
<td>Minor</td>
<td>Advanced</td>
<td>High*</td>
<td>A5</td>
<td>Fair</td>
<td>High</td>
<td>Medium</td>
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<td>Medium</td>
<td>6</td>
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<td>5</td>
<td>Medium*</td>
<td>Advanced</td>
<td>High*</td>
<td>A5</td>
<td>Fair</td>
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<td>High</td>
<td>High</td>
<td>5</td>
<td></td>
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<tr>
<td>4</td>
<td>Medium*</td>
<td>Serious*</td>
<td>High</td>
<td>A4*</td>
<td>Poor*</td>
<td>High</td>
<td>Poor*</td>
<td>High</td>
<td>Low</td>
<td>4</td>
<td></td>
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<tr>
<td>3</td>
<td>High*</td>
<td>Serious*</td>
<td>Present</td>
<td>Overlap*</td>
<td>High</td>
<td>Poor*</td>
<td>High</td>
<td>Poor</td>
<td>High</td>
<td>3</td>
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**NOTES:**
- Rating considerations given in highest to lowest level of importance from left to right.
- * If an item is so marked, it cannot be given a higher ranking.
- C = Effective Countermeasures
- P = Pile Supported Substructures
- * Based on competent rock and no problems exist.

**DETERMINATION OF RATING FOR BMS ITEM**

<table>
<thead>
<tr>
<th>Substructure Unit</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<tbody>
<tr>
<td></td>
<td>Change Since Last Inspection</td>
<td>Scour Hole</td>
<td>Debris Potential</td>
<td>Scourability</td>
<td>Opening Adequacy of Channel</td>
<td>Sediment</td>
<td>Alignment</td>
<td>Velocity/ Stream Slope</td>
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<tr>
<td>P02</td>
<td>9</td>
<td>8</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>7</td>
<td>9</td>
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</table>

If Underwater Inspection only

Signatures and Date:
### Bridge 2 Data

**Paint Condition**: VERY GOOD - RECENTLY REPAINTED.

**Fascias**: VERY GOOD - NEW.

**Splash Zone; Truss/Girder**: 

**Bearing**: VERY GOOD.

**Other**: 

---

<table>
<thead>
<tr>
<th>E23</th>
<th>Est. Remaining Life</th>
<th>BMS to Calculate Yes/No</th>
<th>3</th>
<th>4</th>
<th>Comments</th>
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<table>
<thead>
<tr>
<th>Recalculate IR/OR:</th>
<th>Yes</th>
<th>Due to:</th>
<th>Deterioration</th>
<th>New Wearing Surf.</th>
<th>Other</th>
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<td>No</td>
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<td>Previous Rating Dated</td>
<td>is still valid</td>
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<th>E30</th>
<th>Inventory Rating</th>
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<th>9</th>
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<th>E32</th>
<th>Rate Meth</th>
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<th>S</th>
<th>E33</th>
<th>Typ Mem</th>
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<th>AASHTO</th>
<th>E37</th>
<th>Spec</th>
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<th>4</th>
<th>E38</th>
<th>Manual</th>
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<thead>
<tr>
<th>E29</th>
<th>Bridge Post</th>
<th>9</th>
<th>CONTROLLING:</th>
<th>H</th>
<th>HS</th>
<th>ML-80</th>
<th>X</th>
<th>Engineering Judgement</th>
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<tr>
<th>E24</th>
<th>Structural Condition Appraisal</th>
<th>7</th>
<th>Based upon</th>
<th>Table 1</th>
<th>E27.ADT</th>
<th>E30.RO</th>
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<table>
<thead>
<tr>
<th>E01</th>
<th>Next Insp. Freq.</th>
<th>2</th>
<th>4</th>
<th>E03</th>
<th>Equip. Next Insp.</th>
<th>B</th>
<th>SNOOPER TRUCK (UB-40)</th>
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<table>
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<tr>
<th>E04</th>
<th>Spec. Insp. Type</th>
<th>E05</th>
<th>By Date</th>
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<table>
<thead>
<tr>
<th>Is bridge over water?</th>
<th>X</th>
<th>Yes.</th>
</tr>
</thead>
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---

**Notes**: ONE SPAN IS OVER WATER AND ONE SPAN IS OVER RAILROAD.

HAD RAILROAD REPRESENTATIVE ON SITE. CREW WAS OUT OF SPAN 1 (RR LOCATION) BY TIME REQUIRED. (9 A.M.)

INSPECTION WAS FIRST ON NEWLY CONSTRUCTED BUSWAY BRIDGE WHICH USED AN EXISTING RR BRIDGE. CONDUITS ON BRIDGE WERE BUSTED AT ADAPTERS AT ABUTMENT 1. ALSO, ONE EXPANSION COUPLER WAS BROKEN AND NEEDED REPLACED. SEVERAL CONDUIT SEGMENTS IN SPAN 1 WERE SEVERELY BUCKLED AND NEEDED REPLACED.

---

**Signatures and Date**: PATRICK LEACH, P.E. - 6/23/11
CHARLES MOLNAR - 6/23/11
## Maintenance Needs Data

### Approach/Waywork Item # Location Quantity PR DUC
- **Pavement/Fetch/Raise**: R07AMRT LNLRLFR SV
- **Pavement Reels/T (Rep/Replace)**: R07JFLR LNLRLFR SV
- **Shoulders (Rep/Reconsit)**: R07JLDR LNLRLFR SV
- **Drainage-O’Brien Bridge (Improve)**: R07JKRAN LNLRLFR EA
- **GRTEnd (Rep/Rep/Imp)**: R07JQERL LNLRLFR EA
- **Load Limit Signs (Replace)**: R07JXSGN LNLRLFR EA
- **Clearance Signs (Replace)**: R07JXSGN LNLRLFR EA
- **Cut Brush to Clear Signs**: R07JXSGN LNLRLFR EA
- **Approach Stair (Replace)**: A07JX30 LNLRLFR EY

### Cleaning/Flush Item # Location Quantity PR DUC
- **Deck Cleaning**: A07JX301 -- EB
- **Scuppers/Down Spouting**: B07JX301 123456 EA
- **Bearings/Seating**: C07JX302 123456 EB
- **Steel Horizontal Surface**: D07JX302 123456 EB

### Deck Item # Location Quantity PR DUC
- **Bitum Deck Surf (Rep/Rep)**: B07JX401 123456 SV
- **Timber Deck**: B07JX402 123456 EB
- **Open Steel Grid (Rep/Rep)**: C07JX402 123456 EB
- **Concrete Deck (Rep)**: D07JX403 123456 SB
- **Concrete Sidewalk (Rep)**: E07JX403 123456 SB
- **Concrete Curb/Parapet (Rep)**: F07JX403 123456 SB

### Deck Joints/Expansion Joints Item # Location Quantity PR DUC
- **repair/Restore**: A07JX301 123456 UF
- **Compression Seal (Rep/Rehab)**: B07JX402 123456 UF
- **Modular Cam (Rep/Rehab)**: C07JX402 123456 UF
- **Steel Dam (Rep/Rehab)**: D07JX402 123456 UF
- **Other Types (Rep/Rehab)**: E07JX402 123456 UF

### Bridge Railings/Parapets Item # Location Quantity PR DUC
- **Bridg Railings/Parapet (Rep/Rep)**: R07JX402 123456 UF
- **Structurator (Rep/Rep)**: R07JX402 123456 UF
- **Pierhead (Rep)**: R07JX402 123456 UF
- **Medinm Barrier (Rep/Rep)**: R07JX402 123456 UF

### Deck Drainage Item # Location Quantity PR DUC
- **Scupper Grade (Replc)**: D07JX402 123456 EA
- **Drain/Scupper (Install)**: B07JX402 123456 EA

### Bearings Item # Location Quantity PR DUC
- **Lubricate**: A07JX301 123456 UF
- **Steel (Rep/Rehab)**: A07JX401 123456 UF

### Steel Item # Location Quantity PR DUC
- **Stringer (Rep/Rep)**: A07JX402 123456 EA
- **Floorbeam (Rep/Rep)**: B07JX402 123456 EA
- **Girdler (Rep)**: C07JX402 123456 EA
- **Graph_lat (Rep/Rep)**: D07JX402 123456 EA

### Reinf. PS/PS, PC, and PT Concrete Item # Location Quantity PR DUC
- **Stringer (Rep/Rep)**: A07JX403 123456 EA
- **Pipebeam (Rep/Rep)**: B07JX403 123456 EA
- **Other Membrs (Rep/Rep)**: C07JX403 123456 EA

### Truss Item # Location Quantity PR DUC
- **Members (Strengthen/Rep)**: A07JX404 123456 EA
- **Portal (Modify)**: B07JX404 123456 EA
- **Members (Tighten/Flame/shorten)**: C07JX404 123456 EA

### Painting Item # Location Quantity PR DUC
- **Superstructure - Spot**: A07JX405 123456 EB
- **Substructure - Full**: B07JX405 123456 SB

### Abutment - Wings - Piers Item # Location Quantity PR DUC
- **Backwall (Rep/Rep)**: A07JX406 123456 EA
- **Abutments (Rep)**: B07JX406 123456 EA
- **Wing (Rep/Rep)**: C07JX406 123456 EA
- **Piers (Rep)**: D07JX406 123456 EA
- **Footing (Underpin)**: E07JX406 123456 EA
- **Masonry (Rep)**: F07JX406 123456 EA
- **Abut Stopwall**
- **Abut Stopwall (Construct New)**: B07JX406 123456 EA
- **Pile Repair**: A07JX406 123456 EA

### Scour - Erosion Control Item # Location Quantity PR DUC
- **Streambed Fencing (Rep/Constr)**: A07JX407 123456 EA
- **Rock Protection**: B07JX407 123456 EA
- **Scour Hole (Backfill)**: C07JX407 123456 EA
- **Stream Deflector (Rep/Constr)**: D07JX407 123456 EA
- **Vegetation/Debris (Remove)**: E07JX407 123456 EA
- **Deposition (Remove)**: F07JX407 123456 EA

### Culvert Item # Location Quantity PR DUC
- **Heave Wall (Wings (Rep/Rep)**: A07JX408 123456 EA
- **Apron/Outlet Wall (Rep/Rep)**: B07JX408 123456 EA
- **Barrel (Rep)**: C07JX408 123456 EA

### FOR COMPLETION BY REVIEW ENGINEER

1. **Apply Protective Coating**
2. **Deck/Parapet/Sidewalk**
3. **Substructure**
4. **Construct Temporary Support Pier**
5. **Piper/Curvet Crossing**
6. **Bridge**

### MAJOR IMPROVEMENT NEEDS

<table>
<thead>
<tr>
<th>F01</th>
<th>Year Needed</th>
<th>F02</th>
<th>Type Work</th>
<th>F04</th>
<th>Improvement Length</th>
<th>F05</th>
<th>F06</th>
<th>F08/F09</th>
<th>F10</th>
<th>Future ADT</th>
</tr>
</thead>
</table>

**Reviewed By:**

*By:* 

**PR - PRIORITY CODE:***

- **0:** Prompt action required (Inform Bridge Engineer before updating BMS)
- **1:** High Priority, as soon as work can be scheduled
- **2:** Priority, review work plan, adjust schedule if needed
- **3:** Add to scheduled work
- **4:** Routine structural, can be delayed until funds are available
- **5:** Routine non-structural, can be delayed until programmed
Note: The Appendix section for this report is not included here. The BMS 491 Forms for PENNDOT are that state’s version of the FHWA SI&A sheet with additional state items. The documents included in the report are typically red marked revisions to the file copy and reflect changes identified during the inspection.
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