

# ADOT

## *Bridge Inspection*



## **BRIDGE INSPECTION GUIDELINES**

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

The Arizona Department of Transportation (ADOT) Bridge Inspection Guidelines are intended to describe bridge inspection procedures that must be followed in Arizona and to provide uniform interpretation of the various nationally available inspection and coding guides. These guidelines provide for consistency of bridge inspection throughout the state. Any deviation of these guidelines requires approval of the ADOT Bridge Inspection Program Manager.

The National Bridge Inspection Standards (NBIS) are published in the Code of Federal Regulations, 23 CFR 650, Subpart C. The NBIS set the national standard for the proper safety inspection and evaluation of bridges and applies to all structures defined as highway bridges located on all public roads. ADOT Bridge Inspection Guidelines detail Arizona's policies and procedures for safety inspection of in-service bridges.

These guidelines cover the majority of issues that may be encountered while performing and documenting a bridge inspection in Arizona; however, they are intended neither to be exhaustive nor to replace bridge inspection textbooks and manuals. Adhering to these guidelines does not relieve bridge inspection personnel from the responsibility of applying sound engineering principles and judgment throughout the bridge inspection process. In the event of conflicting information or requirements between these Guidelines and the NBIS, the NBIS will govern. If a conflict is discovered, please notify Bridge Inspection Program Manager immediately.

### **1.2 APPLICABLE REFERENCE MATERIALS**

The proper reference material to be used by the bridge inspection personnel must be the latest editions of the following:

- National Bridge Inspection Standards (NBIS), Code of Federal Regulations, Title 23, Part 650, Subpart C
- Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges (FHWA)
- Bridge Inspector's Reference Manual (FHWA)
- Inspection of Fracture Critical Bridge Members (FHWA)
- Culvert Inspection Manual (FHWA)
- Manual on Uniform Traffic Control Devices (FHWA)
- AASHTO LRFD Bridge Design Specifications
- AASHTO Manual for Bridge Evaluation
- AASHTO Manual for Bridge Element Inspection
- ADOT Safety Policies



### 1.3 ADOT BRIDGE INSPECTION SECTION

ADOT Bridge Inspection Section (BIS), an organizational unit within the Bridge Group, is responsible for bridge inspection program in Arizona. It employs in-house and consultant bridge inspection teams to perform safety bridge inspections on most of Arizona's publicly owned bridges. These include all of the bridges on the state highway system and the majority of the bridges that are owned or operated by Arizona Local Public Agencies (LPAs).

### 1.4 SELF INSPECTING LOCAL PUBLIC AGENCIES (LPAs)

Some LPAs perform their own bridge inspections. In order for a bridge owning LPA to conduct its own bridge inspections, whether through in-house or consultant inspectors, it must demonstrate that it complies with the NBIS. Also it must submit written documentation to ADOT Bridge Inspection Program Manager, detailing its bridge inspection program, quality control, and quality assurance procedures. The documentation will be reviewed by ADOT and the Federal Highway Administration (FHWA) for compliance with national and state requirements prior to granting approval. After the initial submission and approval of this documentation, it shall be updated by LPAs as needed and it will be reviewed at least once every five years by ADOT and the FHWA. If ADOT and the FHWA determine that a LPA is not in compliance with the NBIS and/or the state requirements, the bridge inspection program may be taken over by the state.

All LPAs performing their own bridge inspections shall submit annual electronic National Bridge Inventory records complying with FHWA reporting guidelines to the ADOT Bridge Inspection Program Manager. In addition, any LPA that performs its own bridge inspections without ADOT-provided bridge inspection software shall submit quarterly progress reports to the ADOT Bridge Inspection Program Manager. A sample quarterly progress report is included in Fig 1.4.

### 1.5 BRIDGE INVENTORY DATABASE

ADOT BIS maintains the bridge inventory database of all NBI qualified bridges and culverts except for Federal owned structures in Arizona. NBI qualified bridges and culverts in the state requiring inspection have a folder identified with the bridge structure number

#### 1.5.1 Structure Numbering System

Each structure, defined as a 'bridge' according to NBIS, has a unique identifying number assigned by the ADOT Bridge Inspection Section according to the group of numbers allotted to each ownership / maintenance responsibility as shown in table below:

**Table 1.5.1**

<b>Structure Number</b>	<b>Ownership / Maintenance Responsibility Category</b>
0001-2999	State jurisdiction bridges
3000-3999	Federal jurisdiction bridges
4000-7499	State jurisdiction culverts
7500-19999	Local Public Agency jurisdiction bridges and culverts
20000-29999	State jurisdiction bridges continued
30000-39999	State jurisdiction culverts continued
40000-989999	Reserved
990000 and above	Maricopa County non NBIS structures (N49: Structure Length<20 feet)

Structure Number Identification remains unique and permanent to each structure. Twin or parallel structures are numbered individually if there is an open median. The structure number will be retired only for structures totally removed, for one of the twin or parallel structures where the median is closed by subsequent construction or for transfer between state and local public agency jurisdiction. In that case, a new structure number must be assigned for the replacement or the transferred one. Transfer of structure's ownership / maintenance between local public agencies will not necessitate an assignment of a new structure number.

### **1.5.2 New Structure Number Request Procedures**

Inspector / Bridge Owner should request a new structure number for a new / replaced bridge by filling out Structure Number Request Form (See Fig 1.5.2). A new structure number is not required for a rehabilitated / widened structure.

**Fig. 1.4 – SAMPLE QUARTERLY PROGRESS REPORT FORM**

Transmittal of Quarterly Bridge Inspection Information to ADOT Bridge Inspection Section

Agency Name:			
Name of Person Providing Information:			
Date Information Provided:			
	Quarter	Year ----»	
Please highlight the quarter being updated	1	January 1st to March 31st	
	2	April 1st to June 30th	
	3	July 1st to September 30th	
	4	October 1st to December 31st	
			Comments:
No. of bridges inspected during the quarter:			
No. of culverts inspected during the quarter:			
No. of overdue bridge inspections at end of the quarter:			
No. of overdue culvert inspections at end of the quarter:			
No. of new NBI bridges added to the inventory during the quarter: <sup>a</sup>			
No. of new NBI culverts added to the inventory during the quarter: <sup>b</sup>			
No. of bridges deleted from the inventory during the quarter: <sup>c</sup>			
No. of culverts deleted from the inventory during the quarter: <sup>d</sup>			
No. of critical findings during the quarter: <sup>e</sup>			
Total no. of bridges in the inventory at the end of quarter:			
Total no. of culverts in the inventory at the end of quarter:			
Provide a list of structure numbers that correspond to the above fields:			
a:			
b:			
c:			
d:			
e:			
Please send the form electronically to =====> <a href="mailto:BridgeInfo@azdot.gov">BridgeInfo@azdot.gov</a>   Attention: Bridge Inspection Program Manager			
Alternatively mail to =====> ADOT Bridge Inspection Section, 205 South 17th Avenue, M/D 613E, Phoenix, AZ 85007			

Fig. 1.5.2 - Application for Structure Number Form



## Arizona Department of Transportation

Infrastructure Delivery and Operations Division  
 Bridge Inspection Section  
 205 South 17th Ave., Mail Drop 635E Phoenix, Arizona 85007-3212  
 Phone 602.712.8607 Fax 602.712.3056  
 E-mail Address: [vceleya@azdot.gov](mailto:vceleya@azdot.gov)

### APPLICATION FOR STRUCTURE NUMBERS

All structures conform to National Bridge Inspection Standards definition are required to have a structure number. The number (NBI Item 8 ~ Structure Number) will be assigned and monitored by the Bridge Management Section of ADOT to ensure that the assigned numbers for State, Local and Federal bridges are unique. Normally the number is retired and a new number is assigned when the structure is replaced. For newly design structures, apply for the structure number at the final structural design phase.

Instructions: **E-mail** or **FAX** this application to: **Verna Celeya**

Please provide the following data for each **new** structure:

Data Item	Description
Structure Name	
Culvert/RCB Dimensions	
Responsible Agency	
Feature Under Structure	
Road or Street on Structure	
Route Number	
Milepost	
Is it a twin/parallel structure?	YES <input type="checkbox"/> NO <input type="checkbox"/>
If YES, give clear distance between the two	
Year Built (or future est.)	
TRACS Number	
Project Number	
Project Station	
If there is an <b>existing structure</b> being replaced, provide the current structure number(s).	
Requested by:	Date:
FAX No.:	Phone No.:
E-Mail:	

Please provide the following data for each **new** structure:

Data Item	Description
Structure Name	
Culvert/RCB Dimensions	
Responsible Agency	
Feature Under Structure	
Road or Street on Structure	
Route Number	
Milepost	
Is it a twin/parallel structure?	YES <input type="checkbox"/> NO <input type="checkbox"/>
If YES, give clear distance between the two	
Year Built (or future est.)	
TRACS Number	
Project Number	
Project Station	
If there is an <b>existing structure</b> being replaced, provide the current structure number(s).	
Requested by:	Date:
FAX No.:	Phone No.:
E-Mail:	

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## **CHAPTER 2**

### **TYPES OF BRIDGE INSPECTION AND FREQUENCIES**

#### **2.1 INITIAL INSPECTIONS**

Initial Inspection is the first inspection of a new structure, that is, when it becomes part of the bridge inventory. The Initial Inspection is to include a coding of the analytical determination of load carrying capacity and scour critical determination. The purpose of the Initial Inspection is to verify the safety of a bridge, in accordance with the NBIS and Department standards, before it is put into service. It also serves to provide required inventory information of the as-built structure type, size, and location for Bridge Management System and National Bridge Inventory, and to document its structural and functional condition.

The inspection should be performed for each new structure after construction is essentially complete and before the bridge is put into service.

#### **2.2 ROUTINE INSPECTIONS**

Routine Inspections provide documentation of the existing physical and functional conditions of the structure. All changes to NBI items that have occurred since the previous inspection are also to be documented and updated. The purpose of routine inspections is to comply with NBIS and to satisfy the Department standards. The inspections are also served to determine the need for improvement, maintenance, and establishing or revising a weight restriction on the bridge, to ensure that the structure continues to satisfy present service and safety requirements and to identify and list concerns of future conditions. Load capacity analysis is reevaluated only if changes in structural conditions or pertinent site conditions have occurred since the previous analysis.

#### **2.3 SPECIAL / INTERIM INSPECTIONS**

Special Inspections as defined in the MBE are also called Interim Inspections in the state of Arizona. This inspection type is scheduled when

- The need to monitor a particular known or suspected deficiency between the routine inspections or the fracture critical inspections.
- The need to satisfy regular inspection frequency when the steel in-depth inspection could not be performed on the scheduled month due to the accessibility issue or other safety concerns.
- The need to optimize scheduling with other bridges in the same geographical area.
- The need to update the bridge condition rating after bridge rehabilitation before the scheduled routine inspection.

Bridges or culverts should be considered for an interim inspection if the NBI Superstructure, Substructure or Culvert code is equal to or less than 3.

The inspection interval may vary depending on the type of deficiency or the inspection situation. The inspection typically occurs between regularly scheduled inspections.

## **2.4 IN-DEPTH INSPECTIONS**

An in-depth inspection is a close-up, hands-on inspection of all steel members above the water or below the water level to identify any deficiency not readily detectable using but not limited to routine inspection procedures. The purpose of in-depth inspections is served to collect and document data to a sufficient detail needed to ascertain the physical condition of a bridge. This data may not be able to obtain during the routine inspections due to limited available resources and access. Non-destructive field tests and/or material tests may be performed to fully ascertain the existence of or the extent of any deficiency. The cracking of the main members and connection welds may be illustrated in sketches for better description and reporting. Load capacity analysis is reevaluated only if changes in structural conditions or pertinent site conditions have occurred since the previous analysis.

In-depth Inspections for Arizona bridges are currently scheduled for all the steel bridges in the entire bridge inventory of Arizona (State and LPAs) every 48 months due to the vulnerability and unpredictability of fatigue nature in steel.

An in-depth inspection that includes all elements of the structure will satisfy the NBIS and take the place of the routine inspection for that cycle.

## **2.5 FRACTURE CRITICAL INSPECTIONS**

Fracture Critical Bridges must have at least one fracture critical member (FCM) in order to be deemed as a fracture critical bridge. A FCM must meet the following three criteria:

- a) Must be steel
- b) Must be in tension
- c) The loss of the FCM would result in a partial or total loss of the structure

An important aspect of steel bridge inspection is the determination for potential fatigue and / or fracture. Fatigue cracks are developed at stresses well below the material's yield point stress. Fatigue and fracture can lead to premature and possibly sudden failure of a portion of the bridge or of the entire bridge.

Each bridge with FCM(s) must have an FCM Inspection Plan with an inspection field sheet attached made available to the Bridge Inspector. The plan must include highlighted locations of FCM with locations of the tension zone and typical fatigue prone details (E and E') listed in AASHTO fatigue prone categories in the member, discussion of bridge site location, access as well as traffic control, recommended methods of testing in FCMs and qualifications of inspector. The attached field inspection sheet(s) are prepared for recording notes / sketches of all the FCMs identified in the plan during inspection and the feedback comments after the inspection.

Fracture critical inspections must be scheduled within 24 month frequency in accordance with the NBIS.

FCM Inspection is required to have all steel members including FCMs and other bridge elements to be in-depth inspected in Arizona. It satisfies NBIS and takes the place of the In-Depth Inspection as well as the Routine Inspection for that cycle.



## **2.6 DAMAGE INSPECTIONS**

Damage Inspection is an unscheduled inspection to assess the structural damage resulting from environmental factors or human actions. Damage Inspections are performed following extreme weather-related events (major storm with flash flood), earthquakes, vandalism, and vehicular / train / plane traffic crashes, as requested by the District Maintenance Engineer.

For state bridges, the extent of damage and repair recommendations should be reported to the District Maintenance Engineer and Risk Management Section. When major damage has occurred, the inspectors will need to evaluate fractured or failed members, determine the extent of damage including the amount of section loss, take measurements for misalignment of members, check for any loss of foundation support, etc. The damage inspection report of the damage bridge will be in a special report format illustrated in an example in Fig 2.5.

The Damage Inspection is performed on as-needed basis. It does not require a complete bridge inspection and cannot be substituted for the routine inspection. Draft special inspection reports must be forwarded to Bridge Inspection Program Manager for review.

## **2.7 UNDERWATER INSPECTIONS**

The purpose of Underwater Inspections is to provide information on under water portions of a bridge to evaluate its overall safety and to assess the risk of failure due to scour.

During periods of low flow, underwater members will be inspected visually and by feel using probing rods, sounding lines, or other hand tools. When the physical condition of the substructure members or the integrity of their foundations cannot be determined using the probing tools due to high water, high flow, turbidity, etc., inspection by divers is required. New technology, including ground sensing radar, ultrasonic techniques, remote video recorders, and others are useful aids for underwater inspections of substructure foundations for limited situations.

Key information to be determined in every underwater inspection is the top of streambed relative to the elevation of the substructure foundations. Since scour can vary significantly from one end of a footing to the other, a single probing reading is not sufficient. Baseline streambed conditions should be established by waterway opening cross sections and by grid pattern of probing readings around the face of a substructure unit. The baseline information is essential for future monitoring and assessment. The current streambed conditions and changes since the last inspection are critical inputs to the bridge scour assessment.

Each bridge should have local benchmarks established near each substructure unit to enable inspectors to quickly and accurately determine the depth of adjacent scour. These benchmarks can be as simple as a painted line or PK survey nail driver into the wall in a place visible during high water. The location of these scour-monitoring benchmarks should be referenced in the inspection records and bridge file. Use previously established benchmarks when possible to provide a long-term record of scour conditions. If new benchmarks need to be established, provide conversion from new to old datum.

Underwater Inspections are required in water greater than 4 feet in a perennial stream (channel) at least once every 60 months.

## 2.8 INSPECTION FREQUENCY

Routine inspections for bridge structures are to be performed at regular intervals not to exceed 24 months. Routine inspections for culvert structures are to be performed at regular intervals not to exceed 48 months unless circumstances arise that will require the frequency to be reduced to 24 months.

In-depth inspections are to be performed at regular intervals not to exceed 48 months. It is to be scheduled at the same time the routine inspection is performed unless circumstances arise that will require the inspection date to be adjusted.

Fracture Critical Inspections are to be performed at regular intervals not to exceed 24 months.

Underwater Inspections are to be performed at regular intervals not to exceed 60 months.

Bridge inspection must be completed during the month in which the inspection is due. The due month is determined by the date of the previous inspection and the frequency for the inspection type.

If a bridge inspection cannot be completed in the month it is due then the inspection team leader must notify Bridge Inspection Program Manager, and document the reason for the delay in the inspection report.

Table 2.8 below shows a summary of normal inspection frequencies for the types of structure inspections.

**Table 2.8 - Normal frequencies of structure inspection types**

<b>Type of Inspection</b>	<b>Normal Frequency of Inspection in Months</b>
<b>Routine - Bridge</b>	<b>24</b>
<b>Routine - Culvert</b>	<b>48</b>
<b>In-Depth</b>	<b>48</b>
<b>Fracture Critical Member</b>	<b>24</b>
<b>Underwater</b>	<b>60</b>
<b>Damage / Special / Interim</b>	<b>N. A.</b>

**Figure 2.5 - Damage Inspection Form**

<b>ARIZONA DEPARTMENT OF TRANSPORTATION</b>		
<b>BRIDGE GROUP</b>		
<b>Special Bridge Inspection Report</b>		
Special Inspection Report Type: Damage		
Structure Number:	Route: MP:	
Structure Name:		
Inspected By:	Inspection Date:	
Agency: ADOT District:	Org. No.:	
		<b>P.E. Seal</b>
Incident description:		
Structure description:		
Damaged areas:		
Recommendations:		
Relevant photos of the damage locations are attached to the e-mail carrying this special report.		

## **CHAPTER 3**

### **BRIDGE INSPECTION PROCEDURES**

#### **3.1 INTRODUCTION**

All bridge inspections shall be performed in accordance with these guidelines and shall comply with the NBIS. Figure 3.1a displays a flowchart that details the bridge inspection process. The submittal package should include the following documents as described in Table 3.1 and in the order shown below:

- Bridge Inspection Cycle Form (Figure 3.1b)
- Summary of Bridges Inspected List (Figure 3.1c)
- Structure Inventory and Appraisal (SI&A) Report
- Inspection Report
- Repair Report (if applicable)
- List of Maintenance Items (if applicable)
- Vertical and Horizontal Clearance Diagram (if applicable)
- Channel Profile Diagram (if applicable)
- Sketches (if applicable)
- Inspection Photographs

#### **3.2 BRIDGE INSPECTION PLANNING**

Inspection personnel should contact ADOT district maintenance organizations or appropriate LPA personnel prior to inspecting bridges that are located within the jurisdiction of these entities. ADOT district maintenance organizations or LPA personnel should be encouraged to accompany the bridge inspection team during the field inspections. They could provide valuable information about on-going maintenance issues, flooding history, previous repair projects, and planned future projects. Moreover, in the case of LPAs, they may identify structures that need to be added or deleted from the NBI.

##### **3.2.1 Construction Zones and Traffic Restriction Review**

When planning bridge inspections, websites that display information on traffic restrictions caused by construction must be consulted. Inspection personnel must coordinate bridge inspection activities in construction zones with resident engineers.

##### **3.2.2 Traffic Control Plans**

When required, traffic control plans for bridge inspections should be prepared in consultation with ADOT District or LPA personnel. They must be submitted at least two weeks prior to the inspections and must be approved by the District or the LPA that have jurisdiction over the bridge. The approved traffic control plans should be sent to BIS for recordkeeping.

**Table 3.1 - Description and Purpose of Various Documents**

<b>Document name</b>	<b>Description</b>	<b>Purpose</b>
<b>Bridge Inspection Cycle Form</b>	Form with a reference number describing inspection of several structures by a given inspection team in a given time frame such as a week	Tracking of bridge inspection packet lifecycle (see section 3.5)
<b>Summary of Bridges Inspected List</b>	Listing of several structures inspected in a packet	Informs BIS of the task completed, repairs / maintenance items recommended and distribution of copies of the report to various stakeholders
<b>Structure Inventory and Appraisal (SI&amp;A) Report</b>	Form including all coded NBI items and Arizona Items	Quick review of all structure information in coded form
<b>Inspection Report</b>	Key part of inspection documents with element condition rating and notes	Review of all structure member conditions
<b>Repair Report</b>	List of applicable repairs recommended with assigned priorities	Informs the structure owner of the needed repair items and priorities.
<b>List of Maintenance Items</b>	List of applicable maintenance items recommended.	Informs District maintenance units / structure owners of the needed maintenances.
<b>Vertical and Horizontal Clearance Diagram</b>	A drawing of plan and elevation views of a bridge with vertical and horizontal clearance measurements provided for vehicular or RR traffic.	Advises Class C Permits and informs traveling public via posting of clearance signs
<b>Channel Profile Diagram</b>	This diagram graphically and numerically documents the cross-section profile underneath the bridge.	For bridge hydraulics or scour evaluation.
<b>Sketches</b>	Prepare whenever they are needed.	To better illustrate a condition encountered during the field inspection.
<b>Inspection Photographs</b>	Photos taken of the structure and its components during an inspection	The photos include some standard photos and others showing a defect supporting the inspection and repair/maintenance reports.

For more details, see Chapter 4.

### **3.2.3 Record Drawing Updates**

Bridge inspectors should gather all missing bridge documentation such as record drawings for existing and new structures and determine if any structure was retrofitted, repaired or rehabilitated and include project plans in the bridge file. The plan information on the inside cover of the inspection folder should be updated accordingly. If the structure was replaced, a new folder and a set of plans must be obtained, in addition to the request for a new structure number as well as retiring the replaced structure.

### **3.2.4 Railroad Permits**

Prior to inspecting bridges which carry or cross over railroad tracks, a permit may need to be obtained from the railroad company. For routine inspections, ADOT has obtained a systemic permit from railroad companies to inspect those bridges. Bridge inspectors should check the availability of such permits. In general, when the bridge carries the railroad tracks, the railroad company would be the bridge owner (NBI item N22 = 27). When the bridge spans over the railroad tracks, both ownership and maintenance responsibility belong to the state or the LPA, and NBI items N21 and N22 should be coded accordingly.

### **3.2.5 Canal Bridge Inspection**

Inspections of canal bridges are best performed during canal dry out periods. Inspection personnel should contact the canal owner for these periods prior to inspections and strive to schedule inspections of canal bridges during dry out periods.

### **3.2.6 Border Bridges**

Jointly owned border bridges with California, City of Needles, and Nevada are inspected by Caltrans or NDOT under the terms of Intergovernmental Agreements between Arizona and these entities. Inspection reports and data must be obtained and documented in Arizona bridge inventory.

### **3.2.7 Safety Compliance**

It is imperative that bridge inspection personnel, whether ADOT or consultants, comply with all of ADOT safety policies at all times including but not limited to, wearing hard hats, steel toed boots and safety vests.



### 3.3 FIELD INSPECTION

During a Field Inspection, team members should adhere to the following:

- Remain within the limits of the right of way.
- When specifying traffic directions on the state highway system, the highway's cardinal direction should always be used instead of the compass direction. For example, I-10 from Phoenix to Tucson is EB (cardinal) direction although actually it is in north to south compass direction.

Compass directions should be used when specifying all locations other than the state highway system.

- In the event of the discovery of a new structure that qualifies for the NBIS, inspection personnel should perform an initial inspection of that structure while in the field. Afterwards, the BIS office technician should be informed of existence of the new structure. A new structure number will be assigned and a skeleton record will be created in the database. At this point, the inspection team shall update the database with the information gathered in the field and generate all necessary inspection documents.
- When inspecting a structure with no record drawings, inspection personnel should prepare elevation, plan, and cross-section details for conducting a load rating analysis in addition to obtaining all required NBI information.
- The inspector must alert Bridge Inspection Program Manager whenever a bridge element has deteriorated or has been damaged to an extent where a new load rating must be performed. A review of Load Rating Report could provide valuable information about critical bridge elements and locations. An increase in overlay thickness could also justify the need for a new load rating. See Figure 3.3 for Load Rating Summary Sheet.
- In the event that a scour plan of action (POA) does not reflect field current conditions, the inspector must alert Bridge Inspection Program Manager. See Appendix B for a sample POA.

### 3.4 CHARACTERIZATION OF CONCRETE DETERIORATION

Use the following terms, which are found in the FHWA Bridge Inspector's Reference Manual, when describing crack width, scaling or spalling of concrete elements:

#### **Crack Widths:**

Describing cracks should include length, width, location, and intensity (few, numerous, etc.). To maintain consistency, it is essential to document crack width in the inspection notes using the following table:

**Table 3.4.1 – Crack Size in Reinforced / Pre-stressed Concrete**

Crack Size	Crack Width, inches - Reinforced	Crack Width, inches - Pre-Stressed
Insignificant	<0.012	<0.004
Moderate	0.012 - 0.05	0.004 - 0.009
Wide	>0.05	>0.009

#### **Concrete Scaling:**

Scaling is the condition of concrete with gradual and continuing loss of mortar and aggregate over an area due to the chemical breakdown of the cement bond. Scaling is classified according to the following table:

**Table 3.4.2 – Concrete Scaling Categories**

Scaling	Loss Depth, inches	Description
Light/Minor	1/4	surface exposure of coarse aggregates
Medium	1/4 to 1/2	mortar loss between the coarse aggregates
Heavy	1/2 - 1	clearly exposed coarse aggregates
Severe	>1	reinforcing steel is usually exposed

#### **Concrete Spalling and Pop-out:**

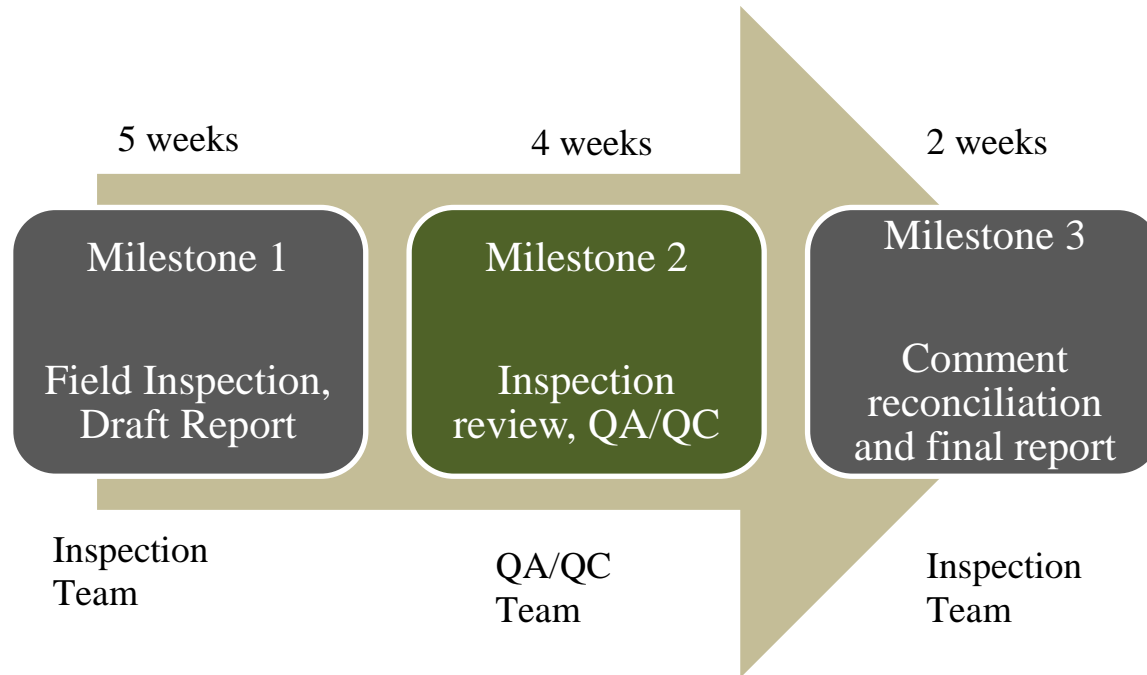
A Spall is a circular or oval depression in concrete caused by separation of a portion of the concrete surface. A Pop-out is usually a funnel-shaped cavity found in a horizontal concrete surface that occurs after a near-surface aggregate particle has expanded, then fractured. Spalls and Pop-outs are classified in the following table:

**Table 3.4.3 Concrete Spalling and Pop-out**

Defect	Depth, inches	Diameter, inches
Pop-out	Near surface	From <0.5 to several
Spalling - Small	1/4	≤6
Spalling - Large	1/4 to 1/2	>6

### 3.5 BRIDGE INSPECTION LIFECYCLE

When planning an inspection, inspection teams shall assemble bridges into packets. The lifecycle of a packet consists of the following milestones:



The completion of the field inspection of the first bridge in a packet marks the beginning of the 11-week lifecycle of a bridge inspection packet. This lifecycle procedure applies to all inspections, whether performed by in-house staff or consultants, and shall be observed unless an exemption is granted by Bridge Inspection Program Manager.

### 3.6 CRITICAL FINDINGS

#### 3.6.1 Definition, Purpose and Reporting Responsibilities

Critical Findings are defined as a structural or safety related deficiency that is discovered during a routine, in-depth or fracture critical bridge inspection which requires immediate follow-up inspection or action of the bridge. The main purpose of Critical Finding is to bring those deficiencies to the attention of responsible parties and cause actions are undertaken immediately to restore service on that bridge or safeguard the travelling public using it.

It is the responsibility of the bridge inspector to note, evaluate, and notify. It is the responsibility of the bridge owner to respond, protect the public and fix the deficiency in a proper and timely manner. The bridge owner must notify FHWA of the situation and actions taken to resolve problems including monitoring of the critical findings. The bridge owner, if a self-inspecting LPA, must inform ADOT of such findings and monitoring or actions taken to remedy the situation. The bridge owner must also periodically update FHWA of the progress made until the deficiency is removed.

### 3.6.2 Critical Finding Applicability

Critical findings shall be issued when, as a minimum but not limited by one of the following conditions exists:

**For a bridge or a culvert:**

- a. A partial or complete bridge collapse
- b. Structural or other defects posing a definite and immediate public safety hazard
- c. A condition rating of 2 or less for NBI item 61 (*channel and bank protection*)
- d. An appraisal item 113 (*scour critical*) rating of 2 or less
- e. A load rating (NBI item 66) of less than 3 tons

**For a bridge:**

- f. A condition rating of 2 or less for any of the following bridge components: NBI items 58 (*deck*), 59 (*superstructure*), and 60 (*substructure*)

**For a culvert:**

- g. A condition rating of 2 or less for culvert component 62

These conditions may require closure or partial closure of a bridge for the immediate follow-up measures to be taken.

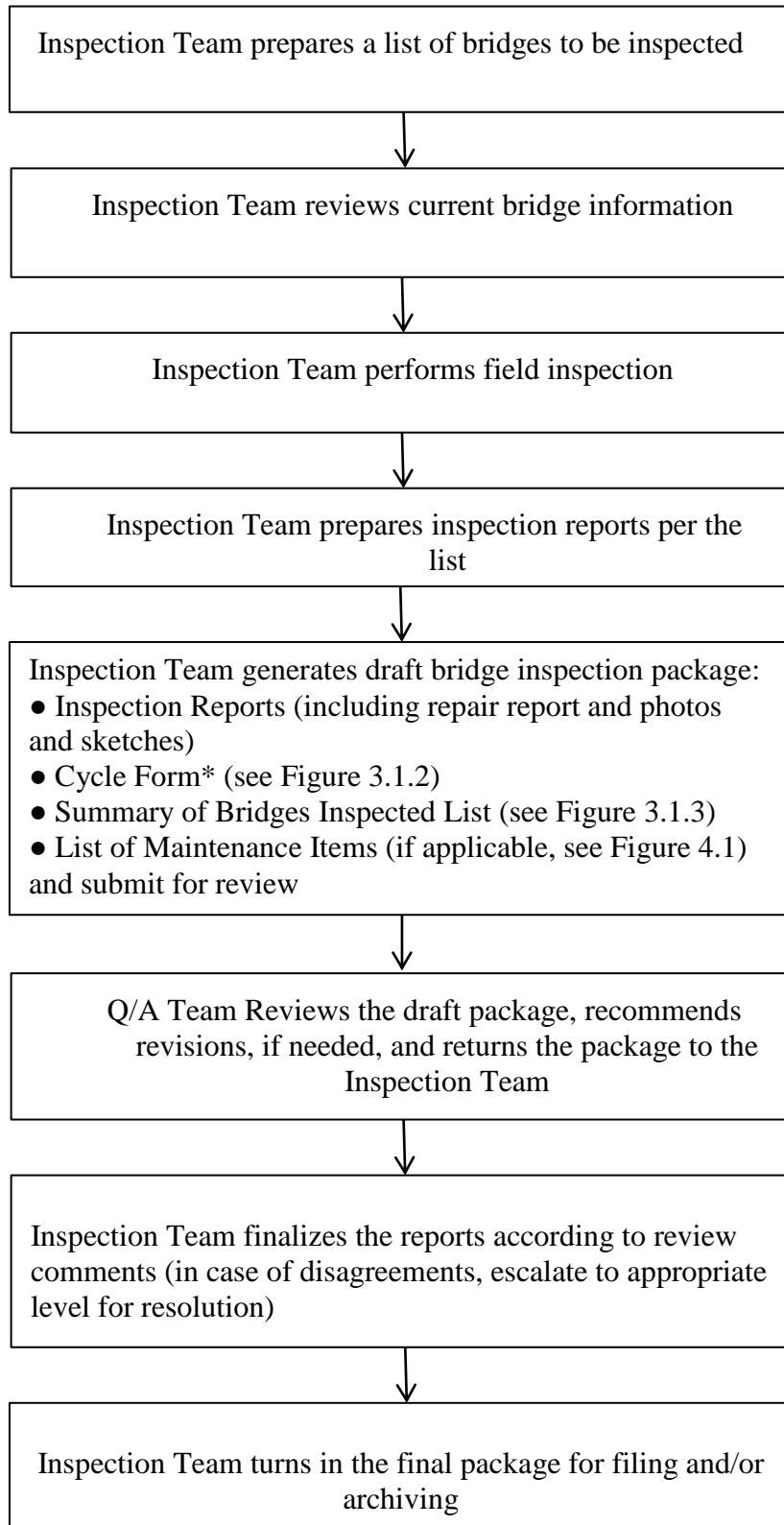
### 3.6.3 Critical Finding Procedures

1. The inspector discovering the critical finding shall immediately report the finding to Bridge Inspection Program Manager and notify responsible ADOT Maintenance District or bridge owner to immediately close the bridge or partially barricade the bridge, pending a closer inspection results.
2. The inspector shall complete the bridge damage inspection report describing the critical findings and submit a copy to Bridge Inspection Program Manager and responsible Maintenance District or bridge owner within 48 hours of the findings.

## 3.7 COMPLEX BRIDGES

The National Bridge Inspection Standards (NBIS) defines complex bridges as movable, suspension, cable stayed, and other bridges with unusual characteristics. There aren't any Complex Bridges in Arizona at current time.

**Figure 3.1a – ADOT Bridge Inspection Flowchart**



\*Cycle Forms shall always be prepared by ADOT staff.

Figure 3.1b – Bridge Inspection Cycle Form

<b>BRIDGE INSPECTION CYCLE</b>			
TEAM: <input style="width: 50px;" type="text"/>	MAINT ORG: <input style="width: 50px;" type="text"/>	PACKET NUMBER: <input style="width: 50px;" type="text"/>	
ROUTE NUMBER: <input style="width: 50px;" type="text"/>		NO. OF FILES IN PACKET: <input style="width: 50px;" type="text"/>	
Begin MP <input style="width: 50px;" type="text"/>	End MP: <input style="width: 50px;" type="text"/>	AGENCY NAME: <input style="width: 100px;" type="text"/>	
<div style="display: flex; justify-content: space-between;"> <span>Check here if this is a partial local agency packet: <input type="checkbox"/></span> <span>Check here if location map included: <input type="checkbox"/></span> </div>			
<b>PHASE I</b>			
1. FILE CHECK OUT DATE: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
<b>PHASE II</b>			
2. FIELD INSPECTION DONE: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
3. FILE ASSEMBLY, PHOTOS DONE: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
4. FORWARD PACKET FOR REVIEW: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
<b>PHASE III</b>			
5. REVIEW COMPLETION DATE: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
6. RETURN TO TEAM FOR CORRECTIONS: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
7. TEAM REVISIONS COMPLETION DATE: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
<b>PHASE IV</b>			
8. RETURN FILES TO FILE SYSTEM: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
9. PREPARE TRANSMITTALS: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
10. TRANSMIT REPORTS TO CUSTOMER: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
<b>PHASE V</b>			
11. ADD TO BG-IDMS: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
12. REVIEW OF BG-IDMS DOCUMENTS ADDED: <input style="width: 100px;" type="text"/>		BY: <input style="width: 100px;" type="text"/>	
<b>REMARKS:</b>			

Notes:

1. Cycle Forms and Summary of Bridges Inspected Lists should list the same bridges.
2. Each Cycle Form should contain bridges owned by only one Agency. For State Bridges, Cycle Forms should be generated by single Maintenance Organization number and bridges should be listed in Remarks section by ascending milepost order. Local Agency bridges will be listed in Remarks section in sequential order of bridge number. Cycle Forms will be created by in-house teams having responsibility over the region where the bridges are located. Generally, no more than 15 bridges should be listed on one Cycle Form (this also applies to Summary of Bridges Inspected List).
3. Initial Inspections should not be mixed with other inspections and are commonly listed in a separate Cycle Form.
4. Remarks of Cycle Form should contain the type of inspection and the name of the inspectors.



### Figure 3.1c – Summary of Bridges Inspected List

<b>NOTE:</b> State bridges: List structures by MP order, only one route per ORG. Local Agency bridges: List structures by structure number order.		<b>Summary of Bridges Inspected</b>										% Reviewed: _____	
<b>Packet Number:</b> _____		<b>NOTE: If N113 is ≤ 3, Copy to BHS/If settlement at approach slab/abutment ≥ ½", Copy to BGS</b>											
Str. Number	Structure Name	Inspection Date	Rt	MP	Reviewed?	Number of Repair Recon- mendations	Items Maintenance	Number of	Copy to Signs	Copy to		Copy to BIS Leader	Copy to BMS
										BHS	BGS		

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

Structure Number: \_\_\_\_\_

SI&A \_\_\_\_\_ Photos \_\_\_\_\_

Insp. \_\_\_\_\_ Profile \_\_\_\_\_

Repair \_\_\_\_\_ Clearance \_\_\_\_\_

F:\Forms\Summary of Bridges Inspected-2017

Revised 05.12.2017

Notes:

1. Place a check mark in the “Reviewed?” box if the structure is selected for review.
2. Place a check mark in “Copy to Signs” when a repair recommendation relates to traffic signs, such as vertical clearance, weight limit signs, or other signs attached to an ADOT bridge.
3. Place a check mark in “Copy to BHS” or “Copy to BGS” when a repair recommendation/maintenance item relates to scour/head cut,  $N113 \leq 3$ , etc. or approach slab/deck settling  $\geq \frac{1}{2}$ ”, respectively.
4. Place a check mark in “Copy to BIS Leader” if:
  - a. An overall condition rating is being modified by two points or is 4 or less.
  - b. A structure lost or gained a SD or FO classification.
  - c. Change to inspection frequency (NBI item N91).
  - d. A structure is closed or replaced (retired).
  - e. A scour critical structure without a POA in the bridge file.
  - f. It is an initial inspection.
  - g. A major repair is recommended.
5. Place a check mark in “Copy to BMS” when a load rating analysis is needed.

**Fig. 3.3 – SAMPLE OF LOAD RATING REPORT**

**ARIZONA DEPARTMENT OF TRANSPORTATION  
BRIDGE GROUP  
Bridge Technical Section**

**Bridge Rating Report**



**I. General Information**

Structure No.	<b>515</b>	Structure Name:	<b>Fine Wash Bridge</b>	Rated By:	<b>Masudur Rahman, PE</b>
Route:	<b>US70</b>	Location:	<b>34.60 mi W of Jct US191</b>	Date of Rating:	<b>03/03/09</b>
Mile Post:	<b>304.85</b>	Owner:	<b>ADOT</b>	QA/QC By:	<b>M. Amin Islam, Ph.D., P.E.</b>
District:	<b>Safford</b>	Year Built:	<b>1932</b>	Date of QA/QC	<b>03/31/09</b>
County:	<b>Graham</b>	Year of Reconst.:	<b>1958</b>		

**II. Rating Data**

Structure Length:	<b>112 feet</b>	Deck/Slab Thickness:	<b>17.50 inches</b>
Structure Type, Main:	<b>1 01; Concrete Slab</b>	Deck Concrete Strength:	<b>2.50 ksi</b>
Original Design Vehicle:	<b>HS20-44</b>	Deck Reinforcing Steel:	<b>40.00 ksi</b>
Rating Vehicle:	<b>HS20-44</b>	Prestress Strands:	<b>NA</b>

Rating Method	Inventory Rating				Operating Rating			
	Factor	NBI Code N66	Location from Begin of Str. (feet)	Limit State	Factor	NBI Code N64	Location from Begin of Str. (feet)	Limit State
LFD	0.93	2 - 33	11.00	Ult. Moment	1.55	2 - 56	11.00	Ult. Moment
ASD		2-17	From BMS File			2-35	From BMS File	

**III Computer Program**

Software Used: **Virtis 6.0.0**      Data Base File: **VirtisBridges9\_60.db**      Structure Model ID: **515**

**IV. Comments**

AC Overlay: 5 inches;

Bridge Span Configuration: **5 Spans: 5 @ 22' - 0**

## **CHAPTER 4**

### **BRIDGE INSPECTION DOCUMENTS**

Bridge Inspection Documents must be written using appropriate technical terminology. They should not contain abbreviated text. Inspectors' personal notebooks may contain those abbreviations; however, inspectors should refrain from using any abbreviation in all formal documents that is associated with the bridge inspection. Common acronyms may be used.

The following bridge inspection documents are normally produced as a result of an inspection:

- Structure Inventory and Appraisal (SI&A) Report
- Inspection Report
- Inspection Photographs
- Repair Report (if applicable)
- List of Maintenance Items (if applicable), see Figure 4.1
- Vertical and Horizontal Clearance Diagram (if applicable)
- Channel Profile Diagram (if applicable)
- Sketches (if applicable)

A description of each of the above documents follows. In addition, a sample of each of these documents is included in Appendix A.

#### **4.1 STRUCTURE INVENTORY AND APPRAISAL (SI&A) REPORT**

The SI&A document is a collection of bridge data that includes a large portion of the fields which constitute the NBI items. ADOT customized this NBIS required report by grouping like data together and adding Arizona Agency Items to it.

##### **4.1.1 General Requirements**

- When a dropdown list is provided within the inspection software, the user shall select the appropriate entry from the list. In the event that the list is missing an appropriate entry, the user shall notify the database administrator, in BMS, so that the list would be updated accordingly.
- NBI items N13a and N13b, LRS Inventory Route and Sub-route, are globally populated by the database administrator.
- When coding NBI item N28a (lanes on), count and record lanes that carry actual traffic only. A temporarily closed lane, i.e., for construction purposes, shall be counted. Lanes that are not in use, including median lanes, shall not be counted.
- Arizona item A207 (inspection quarter field) shall not be altered. Arizona item A228 (next inspection due date) should be equal to NBI item N90 (current inspection date) plus NBI item N91 (inspection frequency).

- Arizona item A235 must only be set to “Active” after the initial inspection has been reviewed and finalized.
- During the initial inspection of a structure that was replaced, Arizona item A300 must contain a reference to the number of the retired (replaced) structure. Also, prior to designating the replaced structure as “Retired” under Arizona item A235, item A300 must contain a reference to the new structure number.

#### **4.1.2 Data to be updated by Bridge Management Section (BMS)**

- Inventory – NBI and Agency Items
  - NBI item N31, Design Load
  - NBI item N63, Method Used for Operating Rating
  - NBI item N64, Operating Load Rating
  - NBI item N65, Method Used for Inventory Rating
  - NBI item N66, Inventory Load Rating
  - NBI item N70, Bridge Posting
  - Arizona item A222, Load Rating Date and Initials

#### **4.1.3 Data to be updated by Bridge Hydraulics Section (BHS)**

- Appraisal
  - NBI item N113, Scour Critical
- Inventory – Agency Items
  - Arizona item A221abc, Scour Countermeasure (Flow-Floor-Bank)

#### **4.1.4 Common Data Entry Errors**

- NBI item N5d, Inventory Route Number, is a 5-digit long numerical field and should start with leading zeros as needed. For example, use “00008” for I-8, “00010” for I-10, “00089” for 89A, “00101” for Loop 101, etc.
- Proposed Project Information, NBI items N75a, N75b, N76, N94, N95, N96 and N97, must be coded for any structure with a Sufficiency Rating of 80 or less; NBI item N97 shall indicate a date within 8 years from the current inspection year. Otherwise, the inspector must update this item.
- When a required posted weight limit sign is missing, NBI item N41 (structure open, posted, or closed traffic) shall be coded as “B”. A new repair recommendation to replace the missing sign should be created.

NBI item N49, Structure Length, should be 20 feet or greater when NBI item N112 (NBIS bridge length) is coded “Long enough”.

## **4.2 INSPECTION REPORT**

### **4.2.1 General Requirements**

The Bridge Inspection Report documents all of the observations that are made during the field inspection. Bridge inspection reports must be sealed and signed by a certified NBIS bridge inspection team leader who is a Professional Engineer licensed in civil or structural engineering by Arizona Board of Technical Registration.

### **4.2.2 NBI Bridge Condition Ratings**

Condition Ratings shall be assigned based on the overall condition of the bridge element and not on a localized area. Any one point increase or decrease in condition ratings should be documented in the related element notes section. Element quantities and condition states must be updated accordingly, to maintain consistency between the two rating methods.

Inspection personnel should consult with a Bridge Inspection Program Manager whenever a condition rating is being modified by two points or more.

The Bridge Inspection Program Manager must be notified when an overall condition rating is 4 or less.

When bridge elements are not visible, inspectors should maintain previously documented condition ratings unless actions were taken to improve the condition of the element since the last inspection. Those actions must be documented in the inspection report and bridge file. A note clarifying that the element is not visible or accessible should also be added. A common example is when a bridge deck is asphalt overlaid since the last inspection.

The condition rating of 9 should only be used when describing excellent element conditions for newly built structures.

### **4.2.3 Sufficiency Ratings**

Appropriate justification is needed in the event that:

1. The sufficiency rating significantly changes;
2. The structure is no longer classified as structurally deficient or functionally obsolete; or
3. The structure gains a structurally deficient or functionally obsolete classification.

### **4.2.4 Orientation and Elements Numbering**

Piers and spans are usually numbered sequentially in the direction of increasing stations. Note that the first substructure element is referred to as abutment number 1 followed by piers numbered from 1 to the last pier ending in the last substructure element, abutment number 2. Therefore, span number 1 located between abutment number 1 and pier number 1 and span number 2 located between pier number 1 and pier number 2 and so on. Girders are numbered from left to right while looking towards increasing stations. This information should be consistent with record drawings.

The inspector should note that some existing bridge inspection documentation may not have

followed the convention stated above. In those cases, bridge inspectors should follow the existing convention for numbering abutments, piers, spans and girders to maintain consistency with past inspections. However, this inconsistency should be documented in the report for future reference.

#### **4.2.5 Structure Component Rating**

Additional guidance is provided below when documenting structure components.

##### **4.2.5.1 Deck**

- NBI item N58, Deck Condition Rating, shall be based on the deck top and the deck undersurface condition. The condition of asphalt or other type of overlays at the deck top should not be considered in the rating. Also, N58 coding should not be influenced by the condition of sidewalks, bridge railings, or deck joints.
- For culvert structures (NBI item N43b = 19), Deck Condition Rating, NBI item N58, shall always be “N”, regardless of fill height.
- NBI item N108 (Wearing Surface / Protective System), Arizona item A201 (Wearing Surface Thickness), and the inspection element protection items, such as Element 510, must be coded consistently. If applicable, inspection personnel should verify the measurement of the overlay thickness in the field. These items also apply to culverts with fill height < 2’.
- The condition of joints between approach slabs and roadway pavement should be documented under the joint element notes section.
- Deck Condition Rating of 4 or less should trigger a repair recommendation.

##### **4.2.5.2 Superstructure**

- For slab bridges, Superstructure Condition Rating (NBI item N59) shall match Deck Condition Rating (NBI item N58).
- Overhead cable lines crossing over the structure should be documented under the inspection notes section. If applicable, the coding of NBI items N10 and N53, Minimum Vertical Clearance items, must be in accordance with the existence of such overhead utilities.
- Pre-stressed concrete and reinforced concrete voided slabs /adjacent box beams or box girders shall be inventoried under elements 104 & 105 respectively. Reinforced concrete top flange (Element 16) shall be coded additionally for the top flange where traffic rides directly on the structural element regardless of the wearing surface or protection system used. See Figures 4.2.5.2a and 4.2.5.2b.

Pre-stressed concrete segmental box girders shall be inventoried under element 104. Pre-stressed concrete top flange (Element 15) shall be coded additionally for the top flange where traffic rides directly on the structural element regardless of the wearing surface or protection system used.



#### **4.2.5.3 Substructure**

- Reinforced concrete abutment length (Element 215) shall be inventoried excluding any integral wing walls. See Figure 4.2.5.3.
- For non-waterway bridges, if the abutment slopes are armored, they shall be evaluated as slope protection. For waterway bridges, armored slope protection shall be evaluated as bank protection.

#### **4.2.5.4 Waterway**

- If scour around pier or abutment is discovered during the inspection, the inspector should notify Bridge Hydraulics Section by checking the “Copy to BHS” box on Summary of Bridges Inspected List, See Fig 3.1c. Therefore, any repair recommendation should be deferred to BHS and only a maintenance item should be recommended by the inspector. Bridge Hydraulics Section will determine whether the coding of NBI item N113 needs to be changed and prioritize any needed remedial actions.
- For all Scour Critical Structures (NBI item N113 = 3), the inspector should review the scour Plan of Action (POA). Bridge Inspection Program Manager shall be notified immediately in the event that a copy of the POA is missing from the bridge file or the POA needs to be updated.
- Comments relating to channel stability should refer to the comparison of current and historical measurements as documented on channel profile diagrams.

#### **4.2.5.5 Roadway**

- Erosion caused by roadway drainage must be documented. If it is significant, BHS should be notified.
- Settlement of approach slab must be documented. If it is equal or over ½ inch, BGS, Bridge Geotechnical Sections should be notified.
- Measured vertical under clearances must be shown on the vertical and horizontal clearance diagram. The minimum vertical under clearance, in each driving direction, must be noted under the inspection notes section.

#### **4.2.5.6 Culverts**

- NBI item N58 (Deck Condition Rating) shall always be coded as “N”.
- NBI item N36a, b, c, d, (Railings and Rail Transition / Approach Rail) should be coded as “N” unless the fill height is less than 2 feet.
- Culverts’ structure length, NBI item N49, should be measured parallel to the roadway centerline, regardless of the skew of the headwalls. The measurement should be made between the inside faces of the exterior end walls.

- NBI items N50a, N50b, N51, and N52, should be set to “0” unless the fill height is less than 2 feet.

#### 4.2.6 Contents of Inspection Notes and Element Notes of AASHTOWare BrM

There are two types of note sections in AASHTOWare BrM for bridge inspectors to record the inspection observations made for each structure. One type of note section is Element Notes, and the other type is Inspection Notes.

Element Notes are a note section that is limited to a 4000-character length dedicated to condition states of each element based on observations and measurements in the field. Each element also can be documented for several potential defects and protection sub-elements, and each of them has its own note section of 4000-character length. Inspectors should accurately describe the element and concisely record the necessary information so that it leads to a proper evaluation of condition states of the element.

Inspection Notes is a note section that is limited to a 4000-character length, which includes specified items not covered by the Element Notes.

The specified items in Inspection Notes for **Bridges** are as follows:

1. Additional notes for deck, superstructure and substructure
  - Describe main and approach span superstructures, main and secondary members if applicable.
  - Describe substructure wing walls and slope protection.
  - List utility attachments, if applicable.
2. Waterway notes
  - Describe channel/bank protection condition and flow direction.
  - Describe scour countermeasures, such as aprons, flumes, dikes, etc., if applicable.
3. Roadway / Safety notes
  - List traffic signs, such as speed limit sign, weight limit sign, vertical clearance sign, etc.
  - Include vertical clearance measurement notes if applicable.
4. Miscellaneous notes
  - Describe the number and status of previous repair recommendations, and the number of current recommended repairs when it is applicable.
  - Describe the number and status of previous maintenance items, and the number of current recommended maintenance items when it is applicable.
  - For steel in-depth / fracture critical inspections, describe the access method, traffic control type and specialized equipment used.
  - List Photos taken for the inspection report.

The specified items in Inspection Notes for **Culverts** are as follows:

1. Additional notes for the culvert structure
  - Describe wing walls, headwalls, if applicable.
  - List utility attachments, if applicable.
2. Waterway notes
  - Describe channel/bank protection condition and flow direction.
  - Describe scour countermeasures, such as aprons, flumes, dikes, etc., if applicable.
  - Describe Inlet and outlet percent openings, and high water mark measurement below ceiling at inlet.
3. Roadway / Safety notes
  - List traffic signs, such as speed limit sign, weight limit sign, etc.
4. Miscellaneous notes
  - Describe the number and status of previous repair recommendations, and the number of current recommended repairs when it is applicable.
  - Describe the number and status of previous maintenance items, and the number of current recommended maintenance items when it is applicable.
  - List Photos taken for the inspection report.

#### 4.2.7 Bridge Element Condition States

All bridge AASHTO elements are provided with a list of potential defects. In addition, protective systems such as asphaltic concrete on concrete deck, cathodic protection of rebar, and paint/oxide on steel elements are introduced as "sub-elements" with their own potential defects and condition state ratings.

The description of condition states for all elements, "sub-elements" and defects are provided in the following table:

Condition State	Description
1	Good
2	Fair
3	Poor
4	Severe

The condition ratings of all applicable NBI items or components are shown in the following table with their descriptions:

Condition Rating	Description
9	Excellent
8	Very Good
7	Good
6	Satisfactory
5	Fair
4	Poor
3	Serious
2	Critical

1	Imminent Failure
0	Failed
N	Not Applicable

Rating of bridge element condition states should be according to current AASHTO Manual for Bridge Element Inspection, and to the extent possible, be consistent with NBI item Condition Ratings.

### 4.3 REPAIR REPORT / LIST OF MAINTENANCE ITEMS

Repair recommendations should only be issued for valid and practical items that need to be repaired. Inspection personnel should keep in mind that they are performing safety inspection of bridges / culverts, and that repair recommendations that qualify under this criterion should be issued. Therefore, a repair recommendation to patch a spall that does not affect the structural integrity of a given bridge element should not be made. Likewise, a repair recommendation dealing with aesthetic treatment should not be made. Both of these examples should be noted as observations in the appropriate inspection notes section of the inspection report.

A repair recommendation should not be created for the following maintenance items:

- Protruding joint angles\*
- Drainage grates, manhole and junction box covers\*
- Tree branches, vegetation, or other obstruction protruding over bridge decks\*
- Exposed wires, cables, etc.\*
- Approach slab settlements
- Potholes in roadway approach or on bridge decks
- Joints between approach roadway and approach slabs
- Missing joint seals
- Damage to chain link and pedestrian fences
- Minor concrete spalls on bridge elements
- Damage to roadway drainage appurtenances
- Clogged drains
- Damage to roadway approach guardrail and end treatment
- Minor damage to bridge railings
- Cleaning debris around bearings
- Lighting fixtures, utility lines or casings
- Bird netting damage
- Cleaning of channel debris, vegetation growth, sediments, etc.
- Cleaning debris and sedimentation from culverts
- Graffiti removal
- Weed removal
- Irrigation system repair
- Minor erosion
- Minor damage to bank protection elements such as rail-banks, gabions, etc.

\* This item may require immediate maintenance personnel notification depending on field conditions.

Maintenance items such as the ones listed above should be summarized in the List of Maintenance Items form. An example of this form is included in Appendix A. This list provides maintenance personnel with a summary of the maintenance items so that a thorough reading of the inspection report is not required. These maintenance items shall be also listed under the Inspection Notes section of the inspection report.

The inspector should consult with Bridge Inspection Program Manager prior to issuing a repair recommendation with a high repair task priority. In the event that the bridge must be closed, the inspector should contact the appropriate District or Local Agency depending on structure ownership. Then Bridge Inspection Program Manager should be informed.

Previously issued repair recommendations that were not implemented and are in accordance with these guidelines should be repeated. The inspector should not refer back to previous recommendations; instead new repair recommendations corresponding to the current inspection must be created.

#### **4.4 CLEARANCE DIAGRAM**

The clearance diagram shall graphically and numerically document lateral and vertical clearance measurements, locations, and posted vertical clearance signs. Measurements should be coded in the database in feet including decimal points; for example, 16.5 would be the correct coding for a 16'-6" measurement.

The following should be adhered to when preparing clearance diagrams:

- Vertical clearances shall be measured from items attached to the superstructure such as lights and signs if they result in lower vertical clearances. If measurements were copied from record drawings, the inspector must document same with a note below the diagram.
- Lateral under-clearance should be measured from edge of travel lane to:
  - The face of a rigid obstruction such as pier column or wall, abutment wall, faces of concrete barrier/parapet for relatively flat ground.
  - The toe of slopes steeper than 1:3.
- When updating previous measurements, and in the event those are different, the inspector should cross-out the existing value and write the updated value next to it. If certain measurements cannot be taken due to inaccessibility or other reasons, previous values should be transferred to the new diagram and should be clearly labeled.
- The inspector should create a new clearance diagram whenever the existing diagram becomes crowded or difficult to read.

#### **4.5 VERTICAL CLEARANCE SIGN**

Vertical Clearance Signs are required if the measured minimum vertical clearance is equal or less than 16'-3". A repair recommendation should be created stating that a vertical clearance sign is needed and specifying the clearance as the measurement minus 3". The 3 inch is a buffer zone accounting for vehicle bounce.

When a new Vertical Clearance Sign measurement conflicts with an existing posted sign, the inspector should consult with Bridge Inspection Program Manager prior to issuing a repair recommendation.

When a Vertical Clearance Sign is required for a structure that spans over both traffic directions, one of the two following cases shall apply:

1. No raised median: posted signs in both direction of traffic should reflect the same minimum vertical clearance.
2. Raised median: each direction of traffic may have a different vertical clearance sign.

Posting a Vertical Clearance Sign, where two or more structures are located along the same road in parallel and close to each other is governed by the lowest vertical clearance measurements amongst the structures. In this case, the inspector must clearly document the structure that controls the vertical clearance on all structures diagrams, and address this fact in the inspection notes section. It may be noted that in case of several parallel structures, a vertical clearance sign may be posted on a structure not because it has the lowest vertical clearance, but due to its location at one end of the parallel structures.

#### **4.6 CHANNEL PROFILE DIAGRAM**

This diagram shall graphically and numerically document the cross-section profile underneath the bridge. The diagram is not required for concrete lined channels.

The following should be adhered to when preparing channel diagrams:

- The inspector should make every effort to maintain up to five successive inspection records of the same points on the same sheet to allow for a better understanding of changes in the channel profile over time.
- Vertical measurements under bridge should be taken at intervals of quarter spans and should be from the lowest member of the superstructure to the channel bottom. For spans shorter than 40 feet, the inspector may omit quarter and three-quarter point measurements.
- If measurement is not possible under the bridge usually due to inaccessibility, inspectors can measure from the top of the deck by subtracting the depth of the superstructure from the measured value.
- Typically, these measurements should be taken at the upstream or downstream side of the bridge, depending on the condition of channel in the field, and the chosen side should be noted on the diagram. It is important to consistently take measurements on the same side of the bridge for a better understanding of changes in the channel profile over time.

The inspector should create a new Channel Profile Diagram whenever the existing diagram becomes difficult to read or has no space to record new profile measurements.

## **4.7 SKETCHES**

Sketches should be prepared whenever they are needed to better illustrate a condition encountered during the field inspection. A field condition that cannot be appropriately documented with photographs and written observations would require a sketch to be generated. An example of a needed sketch is when the inspector is trying to report deteriorated areas of a bridge deck. A sketch could delineate and show dimensions of all affected areas. Another situation that may require a sketch is collision damage to a girder. A sketch could show location of multiple damaged areas.

Appendix A has an example of an inspection sketch.

## **4.8 INSPECTION PHOTOGRAPHS**

### **4.8.1 General**

Photographs shall be obtained identifying the bridge roadway (Roadway ID), bridge elevation (Elevation ID), typical deck top condition (including culverts with less than 2 feet of fill height), typical soffit condition, typical expansion or hinge joints if applicable, bridge elements requiring repair or maintenance, and any additional necessary features (such as weight limit signs, vertical clearance signs, etc.). The first five photographs are referred to as the standard required photographs for all bridges.

Previously recommended repairs that were completed since the last inspection should also be documented through photographs.

Inspection personnel must not include excessive number of photographs in the inspection reports. For example, a single typical photograph of similar cracks would suffice.

### **4.8.2 Guidance for Inspection Photographs**

- 1.** Inspection personnel should strive to obtain the best possible photographs with utmost clarity and exposure.
- 2.** With the exception of standard required photos, other photographs should not be included unless they are being referenced in the inspection report.
- 3.** When taking a photograph documenting the roadway or the elevation, it is useful to select an opposite direction to the previous inspection photograph.
- 4.** Roadway photographs should clearly show all lanes on the structure wearing surface. If there are two directions of travel, then the photograph should show both directions on the structure. For unusually wide structures, a separate photograph for each direction of travel may be taken instead and appropriately labeled.
- 5.** Inspectors should not refer to photographs taken during previous inspections. Instead, new photographs should be taken.
- 6.** Whenever an element requires repair, a photograph should be taken and referred to in the text of the repair recommendation as well as the inspection report.

7. If the structure is posted for weight limit signs, vertical clearance signs or other restrictions, include photographs from both approaches showing said restrictions.
8. Whenever a previously suggested repair is complete, a photograph must be taken to document said completion. In addition, the inspector should document said completion with a statement in the inspection report.
9. A list of all photographs that were taken during the inspection shall be included as a last item under the inspection notes section of the inspection report. The list should be sequential and should contain the description of each photograph.

#### **4.8.3 Digital Photograph Naming Convention**

All photograph file names must contain 24 digits/characters plus “.jpg”. The first 5 digits should indicate the structure number including leading zeros (type the number “0” not the letter “O”). The 7th through 16th digits should indicate the inspection date. The 24th digit should distinctly identify each photograph for that inspection by using sequential letters of the alphabet (Type “a”, “b”, “c”, etc...). Utilize category INSPECTION option from Multimedia – Context of BrM software for linking photographs to a given inspection date.

Examples:

- During the December 18th, 2014 inspection of structure number 1280 (4 digits), five photographs were taken. The five file names should be:
  - 01280-2014-12-18-Photo-a.jpg
  - 01280-2014-12-18-Photo-b.jpg
  - 01280-2014-12-18-Photo-c.jpg
  - 01280-2014-12-18-Photo-d.jpg
  - 01280-2014-12-18-Photo-e.jpg.
- During the April 15<sup>th</sup>, 2015 inspection of structure number 25 (2 digits), three photographs were taken. The three file names should be:
  - 00025-2015-04-15-Photo-a.jpg
  - 00025-2015-04-15-Photo-b.jpg
  - 00025-2015-04-15-Photo-c.jpg.
- During the June 10<sup>th</sup>, 2015 inspection of structure number 20001 (5 digits), four photographs were taken. The four file names should be:
  - 20001-2015-06-10-Photo-a.jpg
  - 20001-2015-06-10-Photo-b.jpg
  - 20001-2015-06-10-Photo-c.jpg
  - 20001-2015-06-10-Photo-d.jpg.



#### **4.8.4 Other Naming Conventions for Documents stored in BrM**

All file names must contain first 16 digits/characters of digital photograph naming convention (structure number plus date) plus category plus “.pdf”. This assumes all these documents are saved as a pdf file. Do not use underline character ( \_ ) for dash (-).

##### **4.8.4.1 Category INSPECTION option from Multimedia in BrM software**

This is intended for documents belonging to a particular inspection date. See the following example of documents and their related naming conventions:

For January 14<sup>th</sup>, 2015 inspection of structure #869:

- Camera location sketch was prepared. The file name should be:  
00869-2015-01-14-Sketch.pdf
- Channel profile was prepared. The file name should be:  
00869-2015-01-14-Channel Profile.pdf
- Clearance Diagram was prepared. The file name should be:  
00869-2015-01-14-Clearance Diagram.pdf
- Report supplement was prepared. The file name should be:  
00869-2015-01-14-Report Supplement.pdf
- Miscellaneous (any document other than above). The file name should be:  
00869-2015-01-14-Miscellaneous.pdf

##### **4.8.4.2 Category BRIDGE option from Multimedia in BrM software**

This is intended for documents belonging to the life of a bridge. See the following example of documents and their related naming conventions:

For May 10<sup>th</sup>, 2010 inspection of structure number 869:

- Construction Plans were prepared. The file name should be:  
00869-2010-05-10-Plans-Record Drawing-Original Construction.pdf
- Bridge Load Rating Summary was prepared. The file name should be:  
00869-2010-05-10-Load Rating.pdf
- Fracture Critical Inspection Procedure was prepared. The file name should be:  
00869-2010-05-10-Fracture Critical Procedure.pdf
- Plan of Action for Scour Vulnerable Bridges was prepared. The file name should be:  
00869-2010-05-10-POA for Scour.pdf
- Miscellaneous (any document other than above). The file name should be:  
00869-2010-05-10-Miscellaneous.pdf

**Figure 4.1 – List of Maintenance Items**

**Arizona Department of Transportation  
Bridge Group  
List of Maintenance Items**

<b>Str. No.</b>	<b>Structure Name</b>	<b>Rt.</b>	<b>MP</b>	<b>Description of Maintenance Items</b>

<b>District/LPA:</b>		<b>Org. Number:</b>		<b>Packet Number:</b>	
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<b>Inspected by:</b>		<b>Date:</b>	
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## Procedure for Some Superstructure and Substructure Elements

### Superstructure

- Pre-stressed concrete and reinforced concrete voided slabs shall be inventoried under elements 104 & 105 respectively. Reinforced concrete top flange (Element 16) shall be coded where traffic rides directly on the structural element regardless of the wearing surface or protection system used.

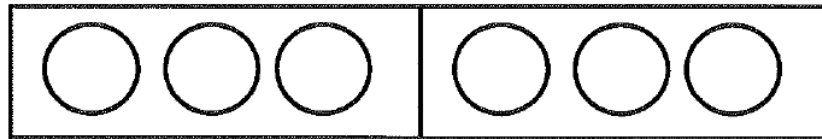


Figure 4.2.5.2a - Reinforced Concrete / Pre-stressed Concrete Voids Slab

- Reinforced Concrete Top flange (Element 16) shall be coded for all pre-stressed & RC concrete girders where traffic rides directly on the structural element regardless of the wearing surface or protection system used. Pre-stressed Concrete Top flange (Element 15) shall be coded only for segmental pre-stressed concrete girders.

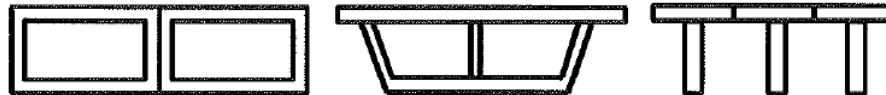


Figure 4.2.5.2b - Reinforced Concrete / Pre-stressed Concrete Girders

### Substructure

- Reinforced concrete abutment (Element 215) length shall be inventoried without wingwalls regardless of connection type (integral or jointed).

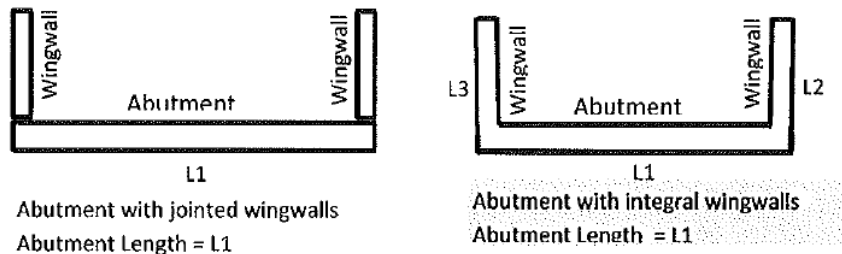


Figure 4.2.5.3 - Reinforced Concrete Abutment Walls & Wingwalls

## **CHAPTER 5**

### **QUALITY CONTROL AND QUALITY ASSURANCE**

#### **5.1 INTRODUCTION**

Quality Control and Quality Assurance are integrated into all aspects of bridge inspection. They contain the essential requirements to demonstrate that care, skill, and diligence is used in the preparation of bridge inspection report.

The quality of the bridge inspection program will be controlled through regularly scheduled training workshops, random office review of inspection documents, independent and concurrent field review of inspections, and independent field inspection conducted specifically for calibration purposes. In addition, the FHWA conducts an annual review of the bridge inspection program.

#### **5.2 QUALITY CONTROL ENGINEER / QUALITY ASSURANCE ENGINEER**

The quality control engineer's responsibilities include but not limited to the review of the inspection reports, review of inspection methods in field, and performing quality assurance work. Quality control engineer should not be the same person as the team leader being reviewed. Quality control engineer should have extensive experience in the bridge safety inspection area and should be familiar with inspection procedures and requirements.

The quality assurance engineer is responsible for ensuring that the defined quality control procedures are enforced.

#### **5.3 REVIEW SELECTION ON INSPECTION DOCUMENTS**

Independent office review of bridge inspection documents will be performed to enhance quality assurance. Quality control engineers must select at least 10% of each packet of bridges to be reviewed. All inspection packets shall be reviewed regardless of bridge ownership and whether ADOT personnel or consultants performed the inspections. The following are some of the criteria that shall be used when selecting inspections to be reviewed:

- Initial Bridge Inspections
- Bridges designated as Structurally Deficient
- Bridges with Fracture Critical Members
- Bridges with one or more condition rating that changed by 2 points or more
- Change in sufficiency rating prefix (i.e., from blank to S or F, or vice versa)
- Change in vertical or horizontal clearance that may affect NBI items
- Bridges in need of changing vertical clearance signs
- Bridge inspections that include repair recommendations

#### **5.4 REVIEW INSPECTION DOCUMENTS**

Quality control engineers shall indicate on the draft inspection report any incorrect coding and corrections found. In case of on-call consultants, quality control engineers shall summarize findings from the reviews into a document, and return the document to the inspectors for

correction. See the example in Figure 5.4. Quality control engineers shall summarize findings from the review, and assist the bridge inspection program manager in developing a training plan which will ensure these errors will not be repeated.

The quality control engineer's review includes but not limited to the following:

1. Overall review of the inspection report to ensure that the correct structure is identified. This includes a check that correct bridge has been identified through examination of information such as structure number, structure name, route, mile post, and location. Further detail review should assure all required information has been entered correctly in accordance with the FHWA coding Guide. This review includes but not limited to a check those proper coding conventions, formats, correct significant digits and units have been used.
2. Check the condition ratings of items 58 through 62 for consistency with the element ratings. The element inputs should be reviewed for accuracy, including elements numbers, units and quantities under different condition states.
3. Check all photographs and/or sketches for proper cross referencing to the inspection report.
4. Check consistency of information between the current inspection report and pervious inspection reports, load rating report, plan of action, and/or the fracture critical inspection plan/field sheet, if applicable.
5. Review all items in the SI&A to check they have been properly and correctly entered.
6. Check the inventory data on the SI&A against the record drawing to ensure that the data is consistent.

## **5.5 REVIEW COMMENT CORRECTION**

Bridge inspection personnel are reminded that assuring quality during their field inspection and throughout their documentation is their responsibility.

The independent office review of bridge inspections is provided to maintain consistency throughout the state and shall not replace the due diligence that an inspector must exercise while performing and documenting each bridge inspection.

Review corrections should be implemented prior to sealing and signing reports. Inspection personnel should strive to maintain objectivity and factual reporting of field observations. While some relevant comments with professional judgment are desirable and made to pinpoint source of a potential problem area, subjective reporting and editorializing of review comments are not acceptable.

Special attention should be accorded to pattern errors. Since the review may not entail every inspection report in a submitted packet, some errors may be repeated in non- reviewed reports. Therefore, the inspector must correct non-reviewed reports for similar types of comments.

## **5.6 FIELD INSPECTION REVIEW**

At least once every year, the Bridge Inspection Program Manager and the quality control engineer should randomly choose at least five structures to review in the field for each inspection team. The composition of these structures shall represent a cross-section of bridge types inspected.

The quality control engineer shall keep a logbook of the dates, review team, and Bridge Inspection Quality Assurance Review Form (See Figure 5.6) and shall have the logbook available to present to FHWA on the occasion of FHWA annual review.

## **5.7 TRAINING WORKSHOP**

To minimize common mistakes and omissions from structure inspections, at least once every year, Bridge Inspection Program Manager should establish a training workshop to all bridge inspection personnel by utilizing the training plan developed in consultation with quality control engineers.

The plan should address concerns and not be limited to the following:

- Changes to the coding guide
- Changes to the element coding
- Changes to the bridge management software
- Changes to structures inspection scheduling
- Common errors or problems occurring due to inspectors' inputs or the software

The Training Workshop should include inspectors' views and observations in the field which may help to improve quality of the inspection reports.

Figure 5.4 - On-call consultant review comments

### RETURNED FOR CORRECTIONS

Team No.	4	Inspection Week	7/2/15	Packet No.	7313
Review Comments By & Date	HS	7/7/15	Date Returned to Team	7/7/15	
Corrections Completed By			Date Returned to Office		
Local Government	City of Yuma		Maintenance ORG No.		
Route		Milepost	To	No. of Files	1

**GENERAL NOTE:** While inspecting structures, please remember to take photo for each repair item and refer to the photo when preparing inspection reports.

Structure No.	COMMENTS
8533	<p><b>SI &amp; A</b> None</p> <p><b>Inspection Report:</b> <u>Comments above elements</u> Comment 3, 1st sentence: No evidence of testing of pins provided other than noting it was tested (when and by who not documented). See general note above. Comment 3, 2nd sentence: one new repair if abutment undermining is counted. Comment 8: Refer to maintenance item. Previous inspection maintenance item (removing debris from lower chord of deck truss) is not mentioned.</p> <p><u>Comments for Elements</u> FCM should be identified. Element 161: Refer to the pin tests if they were done for this inspection. Element 215, Comment 3: Since abutment is away from the river flow, it is preferred that its undermining does get described as erosion and not scour. Last sentence refers to a repair item which is not seen in the repair</p>

Figure 5.6 – Bridge Inspection Quality Assurance Review Form

Bridge Inspection Quality Assurance Review																								
Agency <b>ADOT</b>		Str No. <b>771</b>		Str Name <b>Pinal Air Park Tr UP</b>		Route		QA Date		Milepost		232.02												
Inspection Team <b>PB: MM &amp; QN</b>		Inspection Date		QA Review Team		9/8/2014		10 Letter																
Bridge Inventory Item		Inspection Team		QA Review Team		Element		Condition State (Inspect)		Element		Condition State (QA Review)												
#	Description	Units	Team	#	Description	Qty	Units	1	2	3	4	5	#	Description	Qty	Units	1	2	3	4				
N19	Detour Length	mi	12	✓	12	Concrete Deck - Bare	1 EA	0	0	0	1	0	12	Re Concrete Deck	8785 SF	0	0	8785	0					
N28	Lanes On/Under	#/#	2/7	✓	107	Painted Steel Open Girder/Beam	991 LF	968	10	13	0	0	107	Steel Open Girder/Beam	991 LF	968	10	13	0					
N10	Inv Rte Vert Cir	ft	99.99	✓	205	Column or Pile	12 EA	11	1	0	0	0	205	Re Conc Column	12 EA	11	1	0	0					
N29	Avg Daily Traffic	#	500	✓	304	Open Expansion Joint	73 LF	64	9	0	0	0	304	Open Expansion Joint	73 LF	64	9	0	0					
N108	Wear Surf Prot Sys	###	100	✓	311	Moveable Bearing	8 EA	8	0	0	0	0	311	Moveable Bearing	8 EA	8	0	0	0					
A201	Wear Surf Thick	in	0	✓	313	Fixed Bearing	12 EA	12	0	0	0	0	313	Fixed Bearing	12 EA	12	0	0	0					
N53	Min Vert Over Cir	ft	99.99	✓	330	Metal Bridge Railing - Uncoated	496 LF	496	0	0	0	0	330	Metal Bridge Railing	496 LF	496	0	0	0					
N54	Min Vert Under Cir	ft	H16.24	✓	356	Steel - Fatigue	1 EA	1	0	0	0	0												
N55	Min Lat Under Cir Rt	ft	H5.5	✓	358	Deck Cracking	1 EA	0	0	1	0	0												
N56	Min Lat Under Cir Lt	ft	15	✓	362	Traffic Impact	1 EA	0	1	0	0	0												
N43	Str Type, Main	###	402	✓																				
N44	Str Type, Appr	###	000	✓																				
N58	Deck	CR	4	✓																				
N59	Superstructure	CR	5	✓																				
N60	Substructure	CR	7	✓																				
N61	Channel	CR	N	✓																				
N62	Culvert	CR	N	✓																				
N36	Traffic Safety Features	####	1111	✓																				
N113	Scour Critical Rating	AR	N	✓																				
N41	Open, Post, Close	#	A	✓																				
N64	Operating Load Rtg	tons	2-54	✓																				
N70	Bridge Posting	#	5	✓																				
A233	Posted Vert Cir Pos	ft-in	0-0	✓																				
A233	Posted Vert Cir Neg	ft-in	0-0	✓																				
N91	Insp Freq	mo	24	✓																				
QA Review Evaluation															QA Review Comments									
[X] Complies with established QC Procedures. No noted findings.															Inspection was reported through ABIS. Elements should be updated via BRM in next inspection.									
[ ] Complies with established QC Procedures. Minor findings noted.															W-beam flush with concrete curb under steel baluster.									
[ ] Does not comply with established QC procedures. Major findings noted.																								
[ ] Does not comply with established QC procedures. Critical findings noted.																								
Signature _____ Date _____															Signature _____ Date _____									
Signature _____ Date _____															Signature _____ Date _____									



## **APPENDIX A – SAMPLE OF BRIDGE INSPECTION DOCUMENTS**

This appendix contains samples of the following bridge inspection documents:

- Structure Inventory and Appraisal (SI&A) Report
- Repair Report
- Bridge Maintenance Report
- Inspection Report
- Vertical and Horizontal Clearance Diagram
- Channel Profile Diagram
- Sketches
- Inspection Photographs

These samples are provided to maintain consistency between inspection teams. They are not meant to restrict the individuality of each bridge inspection. They are intended to be used as guidance for a typical inspection of a typical Arizona bridge. Some of these documents were created for illustration purposes and are not based on actual inspections. Not all examples are related to the same bridge

## BRIDGE GROUP

## Structure Inventory and Appraisal

Structure Number : 00814 Structure Name : Chambers TI UP

Feature Under : I-40

Route : 40 MP : 333.41 Road Name : US 191 Agency: ADOT

Location : @ Jct US 191

LOCATION INFORMATION			DIMENSIONS			PROPOSED IMPROVEMENTS		
N1-State Code :	049		N32:Appr Rdwy Width (feet):	30		N75-Type of Work:		
N2-State Hwy District :	Northeast		N48-Max Span Length (feet):	76		N76-Length of Str Imp (feet):	0	
N3-County Code :	001		N49-Structure Length (feet):	245		N94-Br Improv Cost (x1000):	\$0	
N4-Place Code :	00000		N50a-Lt Curb/Swlrk Width (feet):	0.0		N95-Rdwy Improv Cost (x1000):	\$0	
N16-Latitude:	35 Deg 11 Min 25.31 Sec		N50b-Rt Curb/Swlrk Width (feet):	0.0		N96-Total Project Cost (x1000):	\$0	
N17-Longitude :	109 Deg 26 Min 9.42 Sec		N51-Br Width Curb-Curb (feet):	30.3		N97-Year of Cost Estimate:		
N98-Border St Code - % Resp:			N52-Deck Width Out-Out (feet):	33.2				
N99-Border Bridge Number:			N112-NBIS Br Length?	Y				
INVENTORY ROUTE DATA			VERTICAL & HORIZONTAL CLEARANCE			CONSTRUCTION PROJECT DATA		
N19-Detour Length (miles):	12		N53-Min Vert Over Clr (feet):	99.99		N27-Year Built:	1966	
N20-Toll:	3		N54-Min Vert Under Clr (feet):	H	16.29	N106-Year of Reconstruction:	2013	
ROADWAY RECORD	ON	UNDER	N55-Min Lat Under Clr Rt (feet):	H	9.5	A204-Orig Project Number:	I-40-5(30)	
N5-Inv Rte: 1 2 1 00191 0	2	1 00040 0	N56-Min Lat Under Clr Lt (feet):	38.0		A205-Orig Project Station:	1384+30.15	
N28-Lanes:	2	4.00				A223-TRACS Number:		
N10-Inv Rte Min Vert Clr (feet):	99.99	16.56				A225-Deck Area (sq. feet):	8134	
N11-Inv Rte Milepoint:	375.33	333.41	SERVICE, TYPE, and SPAN INFORMATION			INSPECTION		
N26-Functional Class:	07	01	N42-Service Type:	6	1	N90-Inspection Date:	07/19/2016	
N29-Avg Daily Traffic:	1025	15697	N43-Str Type, Main:	4	2	N91-Insp Freq (months):	24	
N30-Year of ADT:	2015	2015	N44-Str Type, Appr:	0	0	A207-Inspection Quarter:	3	
N47-Inv Rte Tot Horiz Clr (feet):	30.3	72.50	N45-Number of Main Spans:	4		Inspection Type:	Routine	
N100-Defense Hwy:	0	1	N46-Number of Appr Spans:	0		A228-Next Insp Date:	July 2018	
N101-Parallel Bridge:	N		CONDITION RATINGS			CRITICAL FEATURES		
N102-Direction of Traffic:	2	2	N58-Deck:	7		N92A-Fracture Critical:	N	
N104-Hwy System:	0	1	N59-Superstructure:	8		N92B-Underwater Insp:	N	
N109-Percent Truck Traffic:	11	43	N60-Substructure:	7		N92C-Special Insp:	N	
N110-National Truck Network:	0	1	N61-Channel:	N		N93A-Date Fract Crit Insp:		
N114-Future ADT:	1035	15707	N62-Culvert:	N		N93B-Date Underwater Insp:		
N115-Year of Future ADT:	2036	2036	APPRAISAL RATINGS			N93C-Date Spec Insp:		
A200-Is N5 the Princ. Rte?	N	Y	N67-Struct Evaluation:	7		A234-Steel In-Depth Insp Freq(months):	48	
			N68-Deck Geometry:	5		CULVERT INFORMATION		
			N69-Underclearance Rtg:	3		A217-Culv Barrel Height(feet):	0	
			N71-Waterway Adequacy:	N		A218-Culv Length (feet):	0	
			N72-Appr Rdw Align:	8		A219-Culv Fill Height (feet):	0	
			N36-Traffic Safety Features:	1	N N N	BRIDGE RAILING		
			BRIDGE SCOUR DATA			A206a,b,c-		
			N113-Scour Critical Rtg:	N		Bridge Rail Type,	911	
			A202-Foundation Type:	66		Geometric Conform, and		
			A220-Found Embed (feet):	0		Structural Conform:		
			A221-Scour Countermeasure:			SUFFICIENCY RATING		
			LOAD, RATE, and POST			Sufficiency Rating:	F	90.20
			N31-Design Loading:	A		A300 - GENERAL COMMENTS		
			N41-Open, Post, Close:	A		Superstructure and deck replaced in 2013.		
			N63-Method Used for Oper. Rtg:	1				
			N64-Operating Load Rtg/Factor:	88				
			N65-Method Used for Inv. Rtg:	1				
			N66-Inventory Load Rtg/Factor:	52				
			N70-Bridge Posting:	5				
			N103-Temp Str Designation:					
			A211-Posted Limit (Tons):					
			A222-Date of Load Rtg:	10/01/2014				
			A233-Posted Vert Clr NB/EB (ft-in):	0-0				
			A233-Posted Vert Clr SB/WB (ft-in):	0-0				

RESPONSIBILITY		
N21-Maint Responsibility:	01	
N22-Bridge Owner:	01	
A203-ADOT Org Number:	5236	
A229-Agency:	ADOT	

NAVIGATION		
N38-Navigation Control:	N	
N39-Nav Vert clr (feet):	0.00	
N40-Nav Horiz Clr (feet):	0.00	
N111-Nav Pier/Abut Prot:		
N116-Nav Min Vert Clr (feet):		

GENERAL DATA		
N33-Bridge Median:	0	
N34-Skew:	0	
N35-Structure Flared:	0	
N37-Historical Significance:	5	
N107-Deck Str Type:	1	
N108-Wear Surf Prot System:	1	0 1
A201-Wear Surf Thickness (inches)	0	

## BRIDGE GROUP

## Bridge Repair Report

Structure Number :	00814	Structure Name :	Chambers TI UP	Inspected by :	
Route :	40	Road Name :	US 191	Inspection Type:	Routine
MP :	333.41	Agency :	ADOT	Inspection Date :	Tuesday, July 19, 2016
ADOT District:	Northeast	District Org:	5236	Next Insp. Due By :	July 2018

**Work Candidate ID:** 00814-RAPX-080216-C5F0A57B1CE0**Action:** 1013 Bearings-Reset**Estimated Quantity:****Estimated Cost:****A212 - Repair Priority:** 3**A216 - Actual Completion Cost**

\$

**A215 - Completion Date:**

Reinstall bearing pad for Beam 4 at south abutment.

## BRIDGE GROUP

## Bridge Maintenance Report

Structure Number :	00596	Structure Name :	Wilmot Rd TI OP EB	Inspected by :	
Route :	10	Road Name :	I-10 EB	Inspection Type:	Routine
MP :	269.36	Agency :	ADOT	Inspection Date :	Thursday, January 11, 2018
ADOT District:	Southcentral	District Org:	5391	Next Insp. Due By :	January 2020

<b>Work Candidate ID:</b>	7F08953-A93C-012418-7ABF93C29C	<b>A216 - Actual Completion Cost</b>	\$
<b>Action:</b>	1029 Deck-Patch spalls->Deck-Repair (Potholes)		
<b>Estimated Quantity:</b>		<b>A215 - Completion Date:</b>	
<b>Estimated Cost:</b>	\$0.00		
<b>A212 - Repair Priority:</b>	3		

Patch deck spalls until deck is rehabilitated.

<b>Work Candidate ID:</b>	7F08953-A93C-012418-49A6DFF28B	<b>A216 - Actual Completion Cost</b>	\$
<b>Action:</b>	1070 Substructure-Patch spalls		
<b>Estimated Quantity:</b>		<b>A215 - Completion Date:</b>	
<b>Estimated Cost:</b>	\$0.00		
<b>A212 - Repair Priority:</b>	3		

Repair damaged slope paving at southwest and southeast corners.

## BRIDGE GROUP

## Inspection Report

Structure No.: <b>00814</b>	Structure Name: <b>Chambers TI UP</b>	Inspected by : <span style="background-color: black; color: black;">[REDACTED]</span>
Route : <b>40</b>	Road Name: <b>US 191</b>	Inspection Type: <b>Routine</b>
MP : <b>333.41</b>	Agency: <b>ADOT</b>	Inspection Date : <b>Tuesday, July 19, 2016</b>
ADOT District: <b>Northeast</b>	District Org: <b>5236</b>	Next Insp. Due By : <b>July 2018</b>

## NBI Condition Ratings

N58 Deck :	7 Good	N61 Channel:	N N/A (NBI)
N59 Superstructure :	8 Very Good	N62 Culvert :	N N/A (NBI)
N60 Substructure :	7 Good		

## Appraisal Ratings

N67 Structural Evaluation:	7 Above Min Criteria	N71 Waterway Adequacy:	N Not applicable
N68 Deck Geometry:	5 Above Tolerable	N72 Approach Roadway Align.:	8 Equal Desirable Crit
N69 Vert. & Horiz. Clearances:	3 Intolerable - Correct	N113 Scour Critical:	N Not Over Waterway

## Inspection Notes

## Roadway/Safety:

- Two-lane AC roadway has a few narrow to medium transverse and longitudinal cracks. Transitions are level.
- Fills are in good condition.
- Concrete barrier is at all 4 corners of bridge and has a few large spalls and vehicle scuff marks.
- Minimum measured vertical underclearances = 16.39' (WB) and 16.29' (EB). Therefore, posting of vertical clearance is not required, per current ADOT signing policy.
- 'US 191' signs are on exterior beams. Object markers are at both ends of Pier 2 column. Traffic / directional signs are at both ends of bridge, on top.

## Superstructure:

- Steel channel diaphragms (bolted to stiffeners) are at abutments, piers and intermediate span locations. Diaphragms are in very good condition.

## Substructure:

- Concrete slope paving at both abutments has narrow to medium horizontal and vertical cracks of moderate density (some sealed) and a few patches.

## Miscellaneous Inspection Notes:

- The one repair recommended in the previous inspection was not completed and is repeated. See repair report. No new repairs are recommended.
- No previous maintenance items to verify and no new maintenance items are recommended.
- Photos:
  - Roadway ID, looking S
  - Elevation ID, looking W
  - Deck top
  - Deck bottom
  - Joint, typ.
  - Beam 4 bearing pad, S abut.

Element No.	Element Description	Quantity	Units	Env.	Condition State			
					1	2	3	4
12	Re Concrete Deck	8134	sq feet	2	7634	500	0	0
1. Deck top has a few hairline transverse and random cracks. 2. Deck bottom has hairline transverse cracks of light density, a few with efflorescence on overhangs.								
107	Steel Opn Girder/Beam	974	feet	2	974	0	0	0
1. Description: 4- W36x160 rolled steel beams, 4 continuous spans. 2. Spans are numbered north to south and beams east to west, in accordance with plans. 3. Since this is a routine inspection, not all comments made in the last In-depth inspection were verified. However, they are retained and may be updated during the next In-depth inspection. Refer to inspection dated 10/1/14 for most recent In-depth inspection notes. 4. There are no fracture critical members on this structure. Fatigue prone details include welded vertical stiffeners and cover plates over piers. 5. Beams are in good condition.								
	515 Steel Protective Coating	8561	sq feet	2	8561	0	0	0
1. Description: Tan paint (no lead).								
205	Re Conc Column	3	each	2	3	0	0	0
1. Description: Reinforced concrete columns on CIP YN-16 piles. 2. Pier columns have minor hairline vertical cracks.								
215	Re Conc Abutment	66	feet	2	66	0	0	0
1. Description: Reinforced concrete stubs on CIP YN-16 piles. 2. Abutments are in good condition. Backwalls have light to moderate scaling and hairline random cracks.								

## BRIDGE GROUP

## Inspection Report

Structure No. : **00814**      Structure Name : **Chambers TI UP**      Inspected by : XXXXXXXXXX  
 Route : **40**      Road Name : **US 191**      Inspection Type: **Routine**  
 MP : **333.41**      Agency : **ADOT**      Inspection Date : **Tuesday, July 19, 2016**  
 ADOT District: **Northeast**      District Org: **5236**      Next Insp. Due By : **July 2018**

Element No.	Element Description	Quantity	Units	Env.	Condition State			
					1	2	3	4
234	Re Conc Pier Cap	85	feet	2	85	0	0	0
1. Description: Reinforced concrete hammerhead pier caps. 2. Pier caps have minor hairline vertical cracks.								
302	Compressn Joint Seal	56	feet	2	56	0	0	0
1. Description: Compression seal joints at abutments. 2. Joint openings at 90 deg. F: N abut. = 1-1/2" (E), 1-3/8" (W); S abut. = 1-3/8" (E), 1-1/2" (W). Joints are partially filled with debris.								
310	Elastomeric Bearing	16	each	2	15	0	1	0
1. Description: Elastomeric bearing pads at abutments and Piers 1 and 3. 2. Bearing pads are in new condition. Bearing pad for Beam 4 at south abutment has partially moved out from under beam. Approximately 58% of pad is still in contact with sole plate. See Photo 'f' and repair report.								
313	Fixed Bearing	4	each	2	4	0	0	0
1. Description: Fixed steel bearings at Pier 2.								
515	Steel Protective Coating	4	sq feet	2	4	0	0	0
1. Description: Tan paint.								
321	Re Conc Approach Slab	420	sq feet	2	420	0	0	0
1. Approach slabs have a few hairline to narrow longitudinal cracks.								
331	Re Conc Bridge Railing	490	feet	2	490	0	0	0
1. Description: 34" F-Shaped concrete barrier, both sides of bridge.								

# ARIZONA DEPARTMENT OF TRANSPORTATION

## BRIDGE GROUP SUPPLEMENTAL PAGE TO BRIDGE INSPECTION REPORT VERTICAL & HORIZONTAL CLEARANCE DIAGRAM

STRUCTURE NAME

CHAMBERS TI UP

STRUCTURE NO.

814

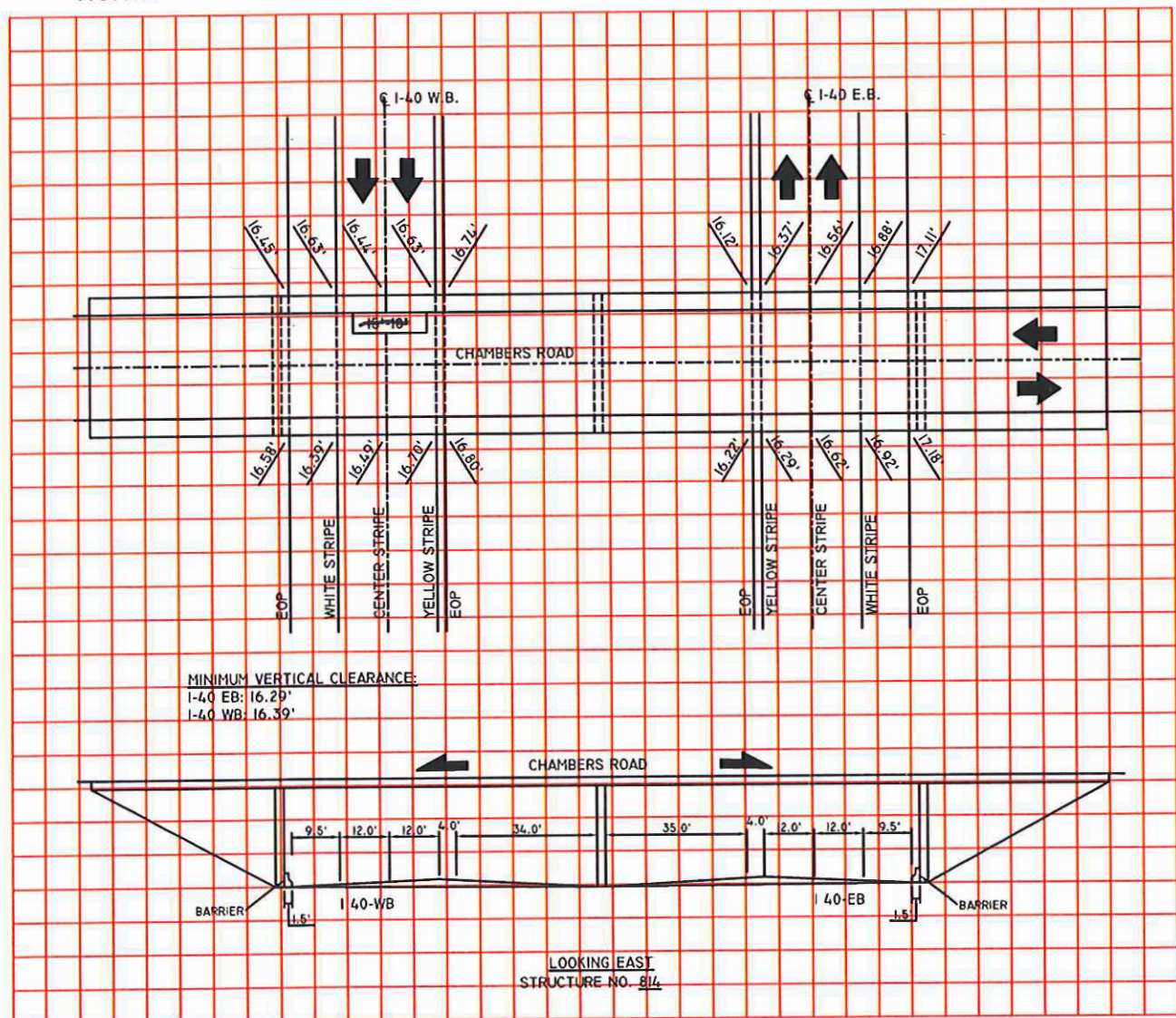
LOCATION I-40  
ROUTE

333.41  
MILEPOST



NORTH

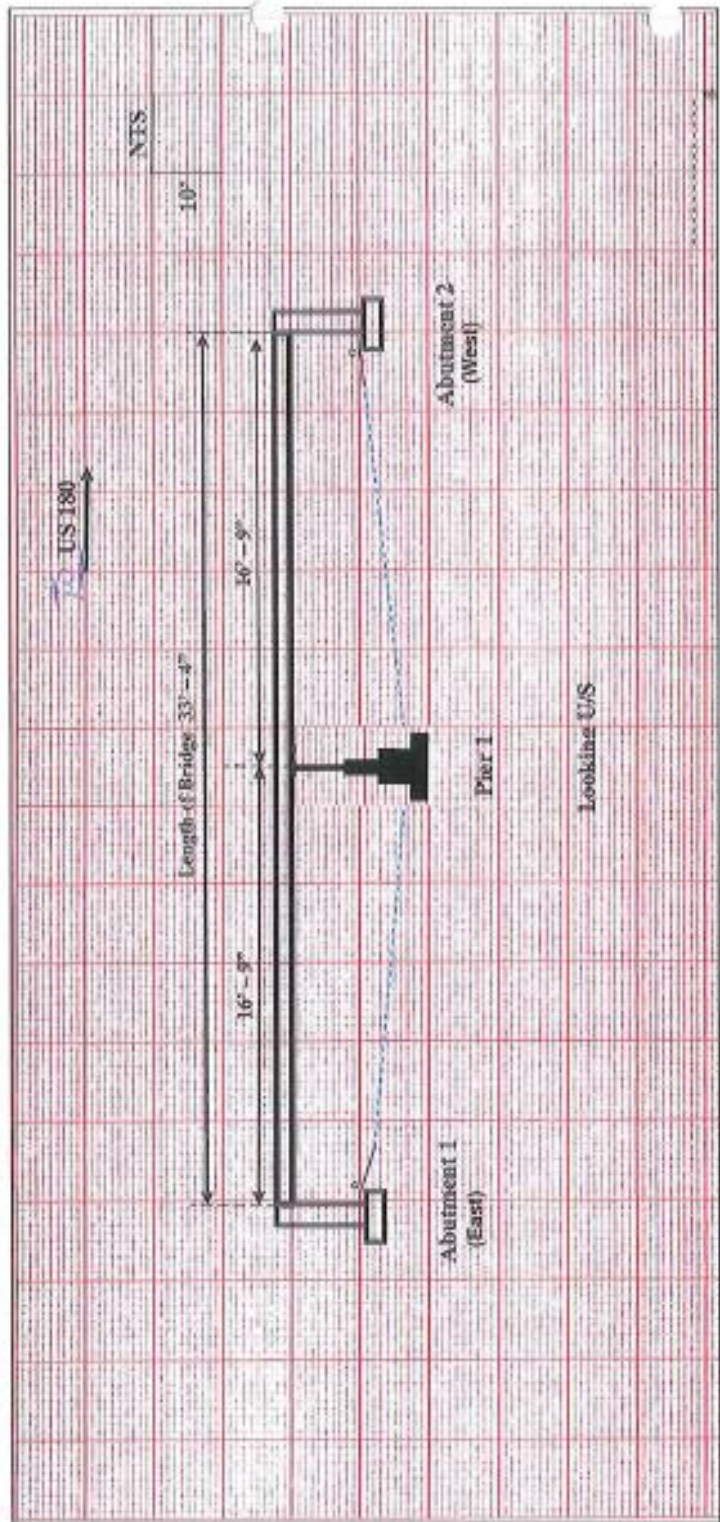
INSPECTION	23	24			
DATE	10/11/14	7/19/16	7-13-16		
INITIAL					
NEW/REVISED DIAGRAM	REV.	NSC			





Channel Profile Diagram

Name of Structure: Little Colorado River Br.  
Structure No. 8777  
Location: Route MP Springville Globe

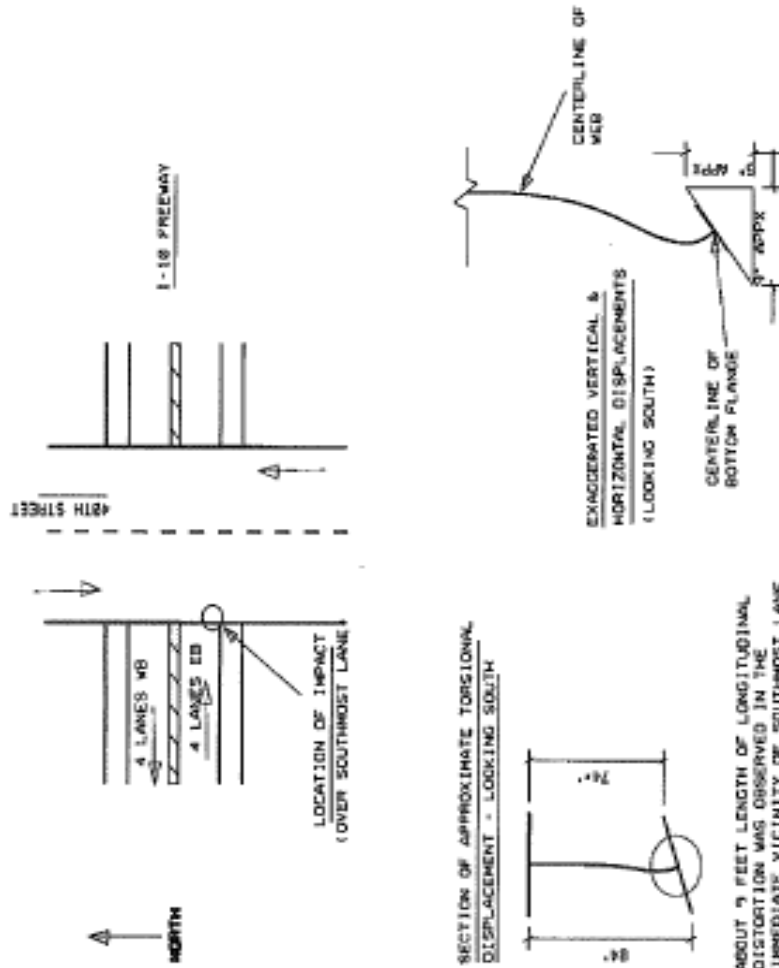


Inspection No.	Inspection Date	Inspector's Initial	Channel Profile Location (US or D/S)	Depth at Abut. 'A1' face or at Support, 'P' (RHS)	Depth at 1/4 span	Depth at mid span	Depth at 1/4 span	Depth at the right side of Support 'P-1'	Depth at the left side of Support 'P-1'	Water	Water
17	5/13/14		D/S	9.50'							
18	9/23/14		D/S	9.50'							



## An Example of a sketch

### DAMAGE TO EASTMOST STEEL GIRDER AND ASSOCIATED ELEMENTS (STRUCTURE -2190 AT I-10 AND 40TH STREET) ELEMENTS NOT TO SCALE



**BRIDGE GROUP**

## Bridge Inspection Photographs

Structure Number :	<b>00814</b>	Structure Name :	<b>Chambers TI UP</b>	Inspected by :	
Route :	<b>40</b>	Road Name :	<b>US 191</b>	Inspection Type:	<b>Routine</b>
MP :	<b>333.41</b>	Agency :	<b>ADOT</b>	Inspection Date :	<b>Tuesday, July 19, 2016</b>
ADOT District:	<b>Northeast</b>	District Org:	<b>5236</b>	Next Insp. Due By :	<b>07/19/2018</b>



File Name : 00814-2016-07-19-Photo-a.jpg

Description : Roadway ID, looking S

**BRIDGE GROUP**

## Bridge Inspection Photographs

Structure Number :	<b>00814</b>	Structure Name :	<b>Chambers TI UP</b>	Inspected by :	
Route :	<b>40</b>	Road Name :	<b>US 191</b>	Inspection Type:	<b>Routine</b>
MP :	<b>333.41</b>	Agency :	<b>ADOT</b>	Inspection Date :	<b>Tuesday, July 19, 2016</b>
ADOT District:	<b>Northeast</b>	District Org:	<b>5236</b>	Next Insp. Due By :	<b>07/19/2018</b>



File Name : 00814-2016-07-19-Photo-b.jpg

Description : Elevation ID, looking W

**BRIDGE GROUP**

## Bridge Inspection Photographs

Structure Number :	<b>00814</b>	Structure Name :	<b>Chambers TI UP</b>	Inspected by :	<b>[REDACTED]</b>
Route :	<b>40</b>	Road Name :	<b>US 191</b>	Inspection Type:	<b>Routine</b>
MP :	<b>333.41</b>	Agency :	<b>ADOT</b>	Inspection Date :	<b>Tuesday, July 19, 2016</b>
ADOT District:	<b>Northeast</b>	District Org:	<b>5236</b>	Next Insp. Due By :	<b>07/19/2018</b>



File Name : 00814-2016-07-19-Photo-c.jpg

Description : Deck top



**BRIDGE GROUP**

## Bridge Inspection Photographs

Structure Number :	<b>00814</b>	Structure Name :	<b>Chambers TI UP</b>	Inspected by :	<b>[REDACTED]</b>
Route :	<b>40</b>	Road Name :	<b>US 191</b>	Inspection Type:	<b>Routine</b>
MP :	<b>333.41</b>	Agency :	<b>ADOT</b>	Inspection Date :	<b>Tuesday, July 19, 2016</b>
ADOT District:	<b>Northeast</b>	District Org:	<b>5236</b>	Next Insp. Due By :	<b>07/19/2018</b>



File Name : 00814-2016-07-19-Photo-d.jpg

Description : Deck bottom

**BRIDGE GROUP**

## Bridge Inspection Photographs

Structure Number :	<b>00814</b>	Structure Name :	<b>Chambers TI UP</b>	Inspected by :	<b>[REDACTED]</b>
Route :	<b>40</b>	Road Name :	<b>US 191</b>	Inspection Type:	<b>Routine</b>
MP :	<b>333.41</b>	Agency :	<b>ADOT</b>	Inspection Date :	<b>Tuesday, July 19, 2016</b>
ADOT District:	<b>Northeast</b>	District Org:	<b>5236</b>	Next Insp. Due By :	<b>07/19/2018</b>



File Name : 00814-2016-07-19-Photo-e.jpg

Description : Joint, typ.

**BRIDGE GROUP**

## Bridge Inspection Photographs

Structure Number :	<b>00814</b>	Structure Name :	<b>Chambers TI UP</b>	Inspected by :	<b>[REDACTED]</b>
Route :	<b>40</b>	Road Name :	<b>US 191</b>	Inspection Type:	<b>Routine</b>
MP :	<b>333.41</b>	Agency :	<b>ADOT</b>	Inspection Date :	<b>Tuesday, July 19, 2016</b>
ADOT District:	<b>Northeast</b>	District Org:	<b>5236</b>	Next Insp. Due By :	<b>07/19/2018</b>



File Name : 00814-2016-07-19-Photo-f.jpg

Description : Beam 4 bearing pad, S abut.

## PLAN OF ACTION FOR SCOUR VULNERABLE BRIDGES- BRIDGE HYDRAULICS SECTION

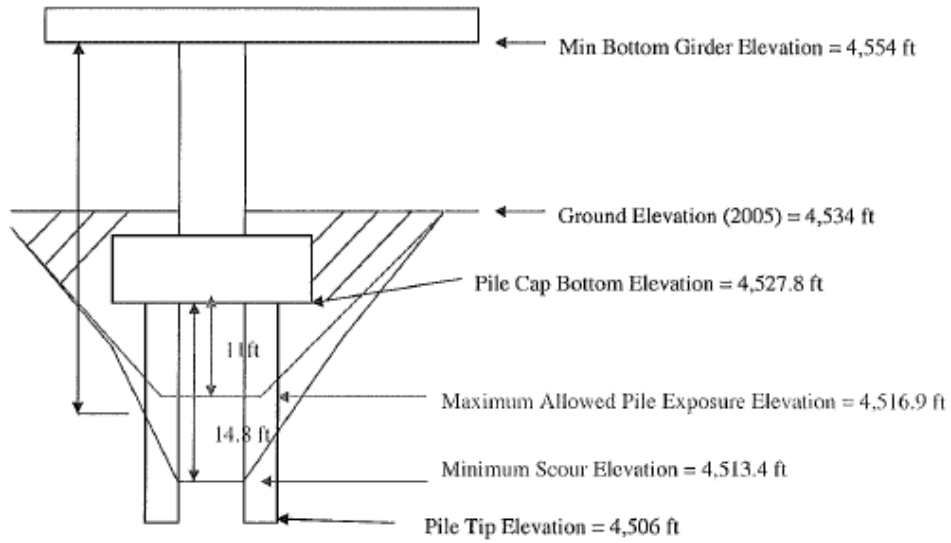
Approved By: ..... Date.....

- 8/29/2008



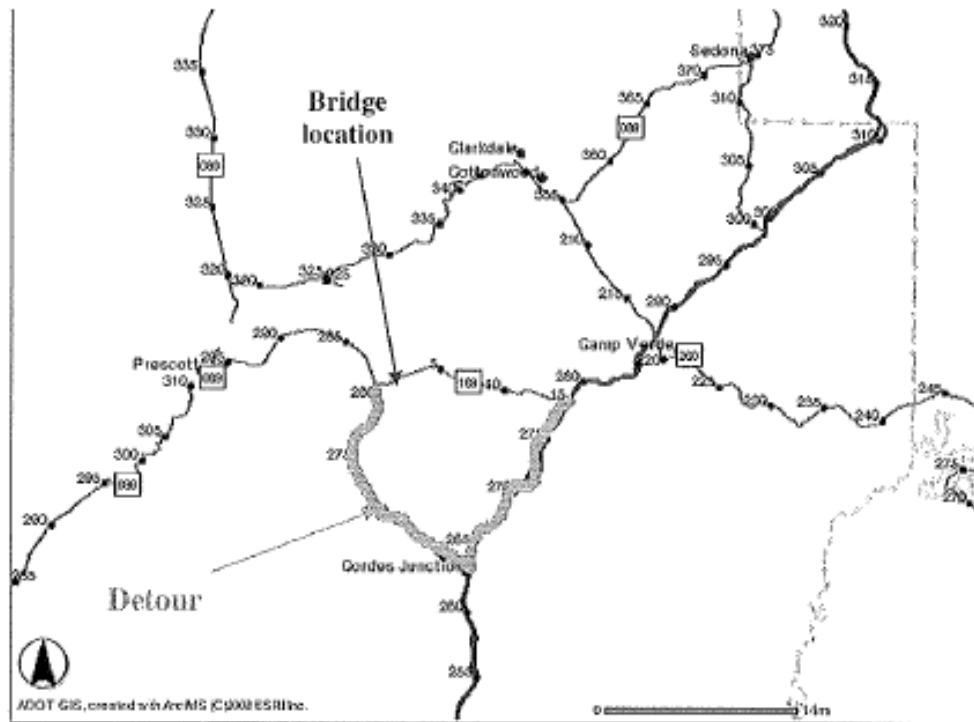
Str. No.: 1371

Minimum scour elevation shown below is based on the 50 year storm event.



8/29/2008

**Detour Map for structure 1371**  
**Milepost 0.25**  
**SR 169**



## **APPENDIX C – FRACTURE CRITICAL DOCUMENTS:**

**1. Inspection Plan**

**2. Field Sheets**

**3. Drawings**

## **Fracture Critical Members In-Depth Inspection Plan**

Structure #: 10597

Bridge Name: Hereford Rd Bridge

Route: Cochise County

Facility Carried: Hereford Road

Location: 8.3 mi East of SR 92

### **Bridge Description**

Hereford Road Bridge has three simple spans of steel through pony trusses with a concrete deck supported by multiple steel rolled stringers and floor beams attached to the truss bottom chords.

### **Fracture Critical Members**

1. Tension members of the north and south steel trusses in span 1, 2, & 3.
2. Floor beams in span 1, 2, & 3.

### **Members and Details that require Inspection**

Spans and panel points are numbered from west to east. Span 1 and 3 are numbered with bottom chords from L1 to L11 and top chords from U2 to U10. Span 2 is numbered with bottom chords from L1 to L17 and top chords from U2 to U16.

SPAN	FRACTURE CRITICAL MEMBERS	INSPECTION METHODS USED	INSPECTION COMPLETED	
			Yes	No
All Spans	Tension stress areas in the floor beams at panel points	VT/PT		
<b>NORTH &amp; SOUTH TRUSSES</b>				
Span 1	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11	VT/PT		
Span 1	Diagonal members: U2-L3, U4-L5, U8-L7, U10-L9	VT/PT		
Span 2	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11, L11-L13, L13-L15, L15-L17	VT/PT		
Span 2	Diagonal members: U2-L3, U4-L5, U6-L7, U8-L9, U10-L9, U12-L11, U14-L13, U16-L15	VT/PT		
Span 3	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11	VT/PT		
Span 3	Diagonal members: U2-L3, U4-L5, U8-L7, U10-L9	VT/PT		
Note: The tension stresses are distributed over the member cross sections as follows: - Bottom flange and lower 1/2 of the web of steel floor beams in the positive moment regions - Top flange and upper 1/2 of the web of steel floor beams in the negative moment regions - The engineer shall choose PT for FCM inspection whereas VT is not applicable.				

# ADOT Bridge Group

## Inspection Methods

### 1. Visual Inspection (VT)

Visual inspections will be conducted in accordance with NBIS Code of Federal Regulation 23 CFR Part 650, The inspection procedure recommendation in the FHWA NHI 03-001 "Bridge Inspection Reference Manual," 2006 and AASHTO "Manual for Condition Evaluation of Bridges," 1994, second edition and the "Inspection of Fracture Critical Bridge Members" FHWA Report No. FHWA-IP-86-26 will be followed. These inspections shall be hands-on with the inspector being within arm length of the component. Critical areas shall be specially cleaned prior to the inspections and additional lighting and magnification shall be used.

### 2. Liquid (Dye) Penetrant Testing (PT)

The testing will be performed by a Certified ASNT Level II inspector from a selected ADOT qualified on-call inspection company in accordance to ANSI/ASNT Testing Specifications. Refer also to: *Inspection of Fracture Critical Bridge Members*, FHWA Report No. IP-86-26.

## Special inspection Needs

### 1. Inspection Access Method Discussion

The bridge spans over Hereford River on Hereford Road in Cochise County with a narrow single-lane roadway and no shoulders. The channel is relatively flat and has spread wider than the center span. The low-flow channel runs through the center span west of the east pier. The berm on either side of the low-flow is approximately 15' from the lowers truss chords which are about 25' above the water surface of the low-flow. The truss members above deck can be inspected with bucket truck, ladders or ropes. Lower truss chords and floor beams can be reached by ladders or ropes. Temporary bridge closure may be required if bucket truck is used.

### 2. Traffic Control Plan

The selected ADOT qualified on-call inspection company shall coordinate with Cochise County.

### 3. Equipment

The selected ADOT qualified on-call inspection company shall equip with the tools necessary to perform the In-depth inspection for this bridge.

Revised by: \_\_\_\_\_

██████████

Date: \_\_\_\_\_

Revised by: \_\_\_\_\_

██████████

Date: \_\_\_\_\_

Approved by: \_\_\_\_\_

██████████

Date: \_\_\_\_\_

Structure No. 10597

## **Fracture Critical Members In-Depth Inspection**

### **Field Sheet**

Structure #: 10597  
 Bridge Name: Hereford Rd Bridge  
 Route: Cochise County  
 Facility Carried: Hereford Road  
 Location: 8.3 mi East of SR 92

#### **Bridge Description**

Hereford Road Bridge has three simple spans of steel through pony trusses with a concrete deck supported by multiple steel rolled stringers and floor beams attached to the truss bottom chords.

**Fracture Critical Members** (see FCM Plan and Drawings in bridge file)

1. Tension members of the north and south steel trusses in span 1, 2, & 3.
2. Floor beams in span 1, 2, & 3.

#### **Members and Details that require Inspection**

-Spans and panel points are numbered from west to east. Span 1 and 3 are numbered with bottom chords from L1 to L11 and top chords from U2 to U10. Span 2 is numbered with bottom chords from L1 to L17 and top chords from U2 to U16.

-Inspection methods listed are required for that member. Any other method(s) used in conjunction with these should be noted.

SPAN	FRACTURE CRITICAL MEMBERS	INSPECTION METHODS USED	INSPECTION COMPLETED	
			Yes	No
All Spans	Tension stress areas in the floor beams at panel points	VT/PT		
<u>Comments:</u>				
<b>NORTH TRUSSES</b>				
Span 1	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11	VT/PT		
<u>Comments:</u>				
Span 1	Diagonal members: U2-L3, U4-L5, U8-L7, U10-L9	VT/PT		
<u>Comments:</u>				
Span 2	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11, L11-L13, L13-L15, L15-L17	VT/PT		
<u>Comments:</u>				

SPAN	FRACTURE CRITICAL MEMBERS	INSPECTION METHODS USED	INSPECTION COMPLETED	
			Yes	No
Span 2	Diagonal members: U2-L3, U4-L5, U6-L7, U8-L9, U10-L9, U12-L11, U14-L13, U16-L15	VT/PT		
<u>Comments:</u>				
Span 3	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11	VT/PT		
<u>Comments:</u>				
Span 3	Diagonal members: U2-L3, U4-L5, U8-L7, U10-L9	VT/PT		
<u>Comments:</u>				
<b>SOUTH TRUSSES</b>				
Span 1	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11	VT/PT		
<u>Comments:</u>				
Span 1	Diagonal members: U2-L3, U4-L5, U8-L7, U10-L9	VT/PT		
<u>Comments:</u>				
Span 2	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11, L11-L13, L13-L15, L15-L17	VT/PT		
<u>Comments:</u>				
Span 2	Diagonal members: U2-L3, U4-L5, U6-L7, U8-L9, U10-L9, U12-L11, U14-L13, U16-L15	VT/PT		
<u>Comments:</u>				
Span 3	Lower chord members: L1-L3, L3-L5, L5-L7, L7-L9, L9-L11	VT/PT		
<u>Comments:</u>				
Span 3	Diagonal members: U2-L3, U4-L5, U8-L7, U10-L9	VT/PT		

Comments:

-VT = Visual Inspection Test; PT = Dye Penetrant Test;

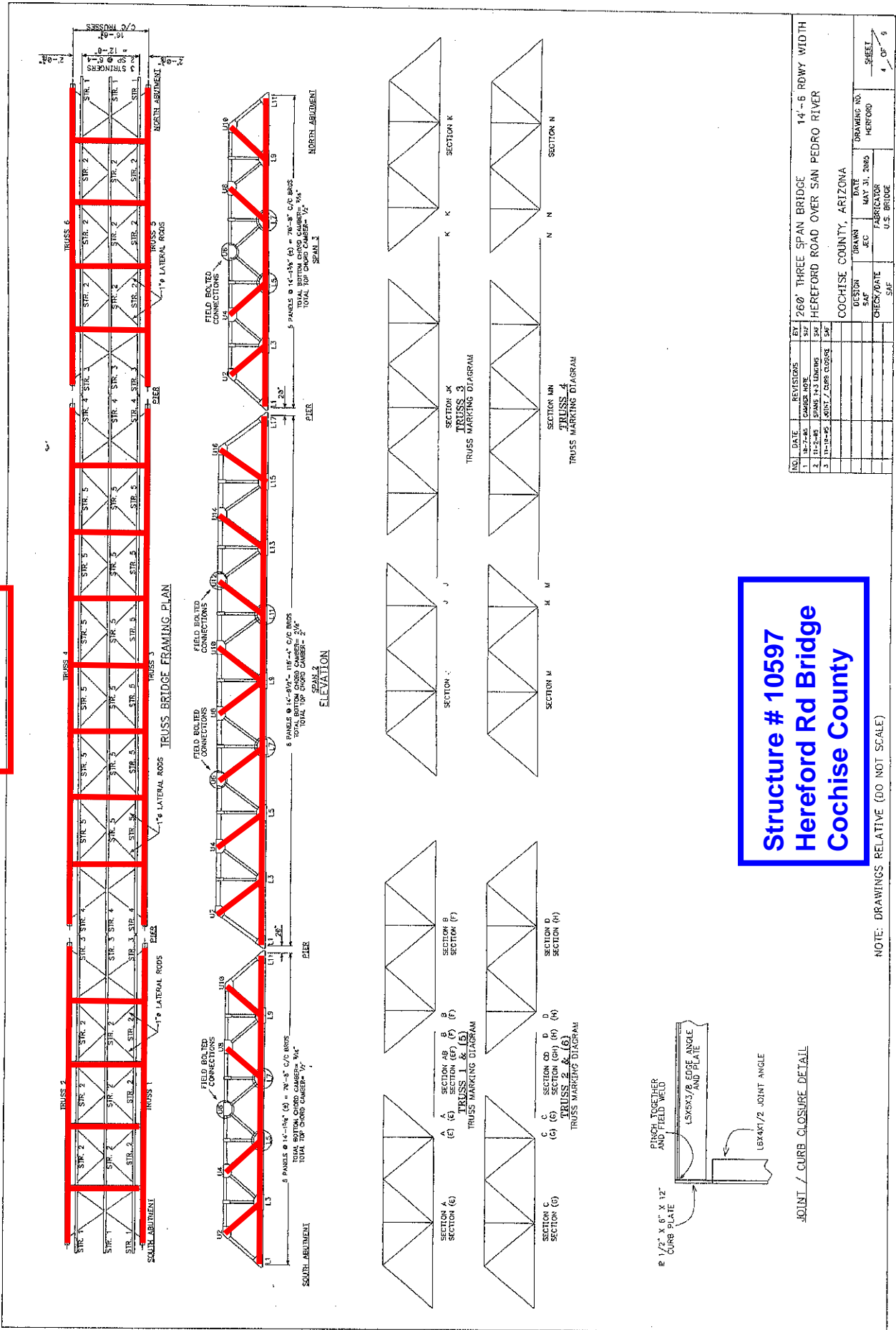
Note: The tension stresses are distributed over the member cross sections as follows:

- Bottom flange and lower 1/2 of the web of steel floor beams in the positive moment regions
- Top flange and upper 1/2 of the web of steel floor beams in the negative moment regions
- The engineer shall choose PT for FCM inspection whereas VT is not applicable.

Additional Comments/Observations:



— = FCM



## APPENDIX D – CRITICAL FINDINGS PROCEDURE

**Date:**

**Memorandum #:**

There are four key components that comprise the critical findings procedure which are as follows:

- 1) **Description: Definition, Purpose and Classification**
- 2) **Starter, Trigger and Notification Process**
- 3) **Activities & Reporting**
- 4) **Close-out & Reporting**

### **Description: Definition, Purpose and Classification**

#### **Definition:**

Federal Regulations (23 CFR 650, Subpart C) defines a critical finding as “A structural or safety-related deficiency that requires immediate follow-up inspection or action.”

ADOT further defines the deficiency as discovery of a bridge component, visually or by rating evaluation, of such severity that might critically threaten public safety and structural stability leading to partial or full closure of the structure.

#### **Purpose:**

The purpose of establishing the Critical Findings process is to bring those bridge deficiencies to the attention of responsible parties. Responsible parties then take action in a timely manner to restore service on the bridge and safeguard the traveling public using it. Federal regulations require critical findings to be reported to FHWA

**Classification:** Critical Findings are classified, based on levels of severity, as described below and then summarized in Table 1:

**1 - Urgent** (Color: Red) - Structural deficiency of primary structural bridge element which threatens the integrity of the structure as a whole.

- Bridge is closed and immediate action required.
- This may require bridge replacement or major rehabilitation.

**2 - Restrictive** (Color: Orange) - Structural deficiency that affects load postings and/or establishes restrictions.

- Bridge restricted ASAP.
- This may require lane or shoulder closures and/or load restrictions; analysis and recommendations done immediately.

**3 - Serious** (Color: Yellow) - Does not immediately jeopardize the bridge or the traveling public.

- No restrictions required.

**Table 1- Summary of Severity Classification**

<b>Severity</b>	<b>Color Designation</b>	<b>Immediate Action (s)</b>
Urgent	Red	Bridge Closure
Restrictive	Orange	Bridge Restriction
Serious	Yellow	None

### **Starter, Trigger and Notification Process**

**Starter:** Any of the following persons may initiate the notification process:

- ADOT Bridge Inspectors,
- ADOT District Personnel,
- LPA Personnel
- Member of Public

**Trigger:** Any observation of the field conditions or examination of records by the Starter, as described below, shall justify a critical finding notification:

A. Field observations:

- A partial or complete bridge collapse
- Structural or other defects posing a definite and immediate public safety hazard
- Severe scour deficiencies
- Extreme deterioration of primary structural element(s)
- Other safety deficiencies caused by earth movement, natural disaster, traffic impact, etc.

B. Examination of various bridge or culvert inspection documents warrant granting any of the following NBI ratings:

- A. NBI item 113 - Scour Rating, an **Appraisal Rating** of 2 or less
- B. NBI item 66 (inventory load rating) of less than 3 tons.
- C. Following NBI items - A **Condition Rating** of 2 or less:
  - NBI item 58 (deck)
  - NBI item 59 (superstructure)
  - NBI item 60 (substructure)
  - NBI item 61 (channel and bank protection)
  - NBI item 62 (culvert)

### **Notification Process:**

The Starter will immediately contact the appropriate ADOT District Engineer (DE) or the bridge owner, thus beginning the notification process. The ADOT DE or the bridge owner, in turn, shall contact the Bridge Group Bridge Preservation Program Manager (BPPM).

The ADOT Bridge Management Section Leader (BMSL) will assume the lead role in the notification process once he/she has been notified. The primary method of contact will be phone/e-mail notification and a required follow-up e-mail to properly document circumstances. See Exhibit A at the end of this document for the entire notification process.

The Critical Findings Report will document the entire notification process by including description of incident and action plan (any immediate, short-term and long-term plans going forward). Initial communication with Bridge Group shall be documented on the Critical Findings Report.

This Report can be found on the ADOT Bridge Group website (<http://www.azdot.gov/business/engineering-and-construction/bridge>) under "Critical Findings Report" topic.

## **Activities & Reporting**

### **Initial Activities & Reporting:**

Once ADOT DE or the bridge owner is made aware of the problem, a decision should be made by him or her on how to control the traffic over and under bridge in order to keep public safe and safely assess the damage. Technical staff (ADOT District Engineer or Local Public Agency Engineer) will perform the initial assessment in order to determine if the damages could be assessed locally or need further inspection.

Inspection of ADOT structures and those Local Public Agencies utilizing ADOT is done by Bridge Management Section (BMS) inspectors. Inspection of self-inspecting Local Public Agencies is conducted by their own resources.

Once the site inspection is complete and a related report is prepared by the inspector (s), indicating a case of Critical Finding, the inspection report will be defined as Initial Inspection-CF. Initial Inspection-CF will often start as a damage inspection following an initial assessment. But it is plausible to occur during any regularly scheduled inspection or random observation.

A check list of possible follow-up activities is reviewed at this point. The list should have activity check boxes associated with the inspection and confirmation of the Critical Finding. By checking these boxes, the inspector will be required to submit a Critical Findings report.

At this stage, Critical Finding report will be filled out only for the portions of the report titled "Part1-Critical Finding by inspector" and "Part 2-Action Plan by bridge owner".

### **Typical information required at this point includes the following:**

- Basic bridge location Information
- Date and time of Incident or observation (if known)
- Written and thorough narrative documentation -supplemented with pictures
- Incident duration and any associated traffic restrictions imposed
- Classification of Critical Finding
- Inspector(s) name(s)
- Action Plans (short-term and initial long-term activities) and follow-ups

Short-Term Follow Up: Action means a plan is in place and sufficient countermeasures have been implemented to restore light service or to fortify closures in order to ensure public safety.

Initial Long-Term Action Plan: Countermeasures have been planned to be implemented to restore the structure to its full capacity and ensure public safety.

- A Long-Term Action Plan for the structure shall also be established at this time.

### **Intermediate - Final Activities & Reporting:**

These activities occur after the initial Inspection-CF is submitted. It covers any action, such as Short-Term Follow-Up actions and finalized Long-Term Action Plan and relaying the information between all parties involved.

Critical Finding report at this stage will include, "Part1-Initial Inspection-CF" and "Part 2-Initial Actions", all completed or active parts of mitigation plans, including Short-Term Follow-Up actions and final Long-Term Action Plan steps. As a minimum, an interim report should be filled out for completion of Short-Term Follow-Up and Long-Term Actions in a timely manner.

### **Close-Out & Reporting**

The close-out inspection is the inspection performed after Short-Term Follow-Up actions and Long-Term Action Plan have been completed and no structural or safety issues pending.

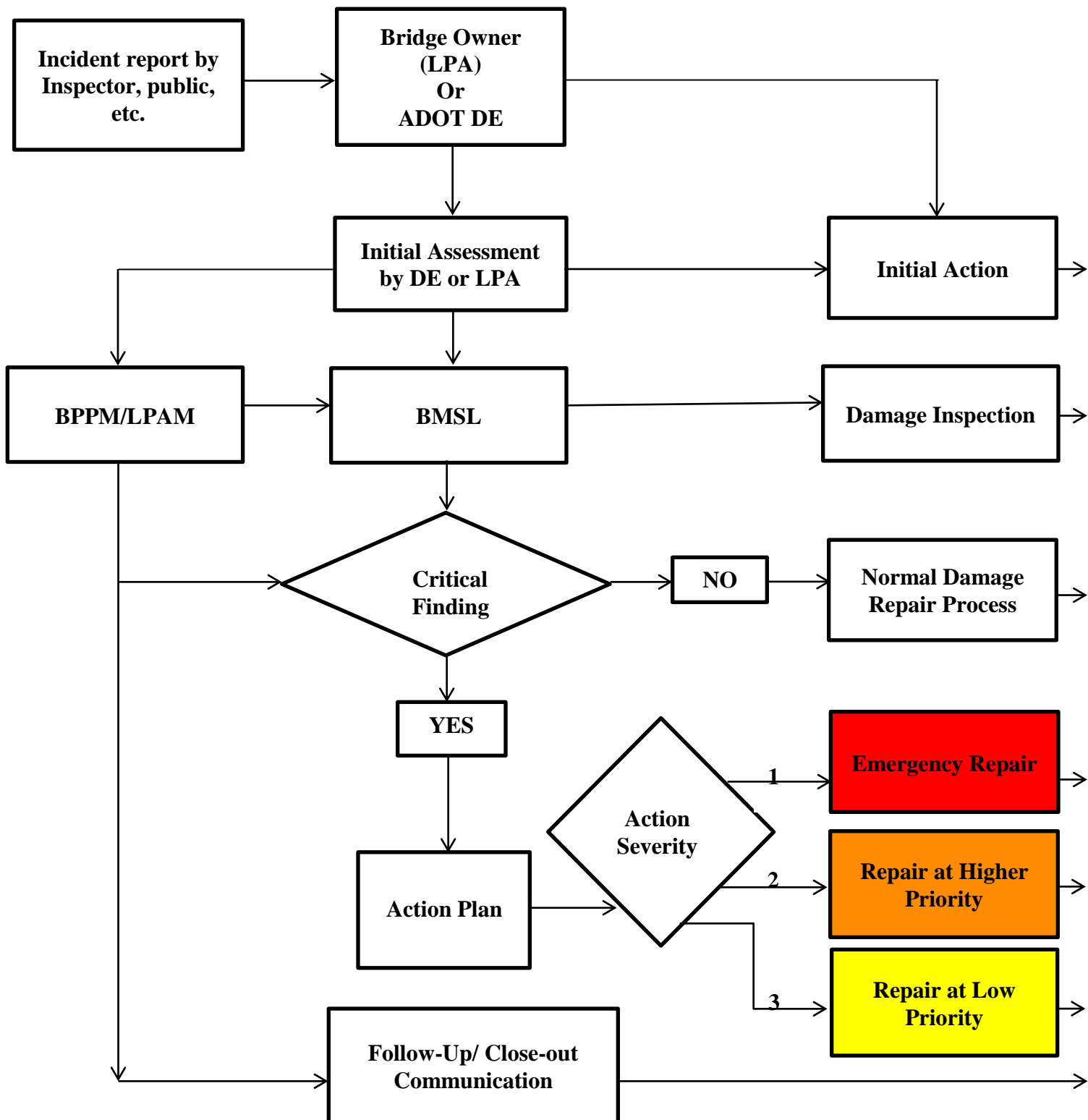
There may be several Interim steps and inspections ending with close-out inspections. Along with this closeout inspection, there should be an associated Critical Finding Activity. By checking this activity, the inspector will be required to submit a final Critical Findings Report. At this stage, the report should be filled out in its entirety. When this inspection document is e-mailed to all the interested parties, the case of Critical Finding will be considered closed.

Typical information required at this point includes the following:

- Description of Short-Term Follow-Up Actions & final Long-Term Action Plan
- Photo documentation to confirm Follow-up Actions have been addressed and/or implemented
- Date Follow-up Actions were completed

## Exhibit A - Abbreviations and Critical Finding Process

- **ADOT DE** - ADOT District Engineer
- **LPA** - Local Public Agency representative
- **BPPM** - Bridge Preservation Program Manager
- **LPAM** - ADOT Local Public Agency Manager
- **BMSL** - ADOT Bridge Management Section Leader



**APPENDIX E – CRITICAL FINDING REPORT**

**Authority**

Under Code of Federal Regulations (23 CFR 650, Subpart C), Critical Finding is a structural or safety related deficiency that requires immediate follow-up inspection or action.

**Part 1. Critical Finding/ Recommendations:**

**(To be filled by the inspection team)**

Structure ID Number:	Structure Name:
Location:	Inspection Team:
Previous Inspection Date:	Next Inspection Date (if not this inspection):

Significance:

**DESCRIBE HOW YOU WERE INFORMED OF CRITICAL FINDING IF NOT DURING A PLANNED INSPECTION**

**DESCRIBE GENERAL BRIDGE INFORMATION, CRITICAL FINDING(S) AND  
ATTACH PHOTOS/SKETCHES**

**Responsible parties to be kept notified:**

- ☐
- ☐
- ☐
- ☐

☐ FHWA - Arizona Division



## **Part 2. Describe action plan:**

**(To be filled by the owner)**

Describe specific steps of the action plan, include dates and responsible person for each action, responsible parties to be notified

### **Responsible parties to be notified:**

- ☐ State Bridge Engineer
- ☐ Bridge Preservation Manager
- ☐ Bridge Design Manager
- ☐ District Engineer
- ☐ FHWA - Arizona Division

### **Part 3. Action plan steps**

**(To be filled by the owner)**

Type of action/ repair, date of action/ repair, responsible party, company/organization  
Updated information after Action Plan

#### **Responsible parties to be notified:**

- ☐
- ☐
- ☐
- ☐

☐ FHWA - Arizona Division

## **Part 4. Periodic Update of Action Plan**

**(To be filled by the owner)**

Type of each step of action/ repair, date of action/ repair, responsible party, company/organization

### **Responsible parties to be notified:**

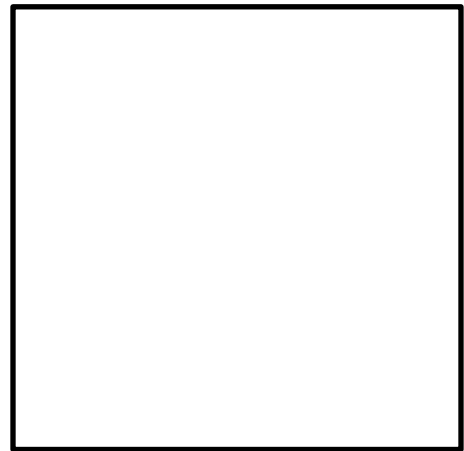
- ☐
- ☐
- ☐
- ☐

☐ FHWA - Arizona Division

## Part 5. Post repair update and closure

**(To be filled by the owner or its representative - to be signed and sealed by a Civil P.E. registered in Arizona)**

Certification of completion of work, compliance with the intended design information and readiness of the bridge for receiving full capacity public and commercial transportation



Seal, Date and Expiration Date

### Responsible parties to be notified:

- ☐
- ☐
- ☐
- ☐

☐ FHWA - Arizona Division

## APPENDIX F – ARIZONA ITEMS

Item No.	Item Name	Page
200	Principal Route location	82
201	Wearing Surface thickness	83
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211	Posted Limit	93
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# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/22/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Principal Route Location**

AZ ITEM NO. 200

## DESCRIPTION

A one-digit field to indicate the location of the principal route in cases where the bridge has highway routes passing underneath.

**FIELD TYPE:** Yes/No

## BACKGROUND

In the early development of bridge records in our predecessor agency the Arizona Highway Department, all records were based on the concept of "principal route" and "other route". Highway features located by principal route is still a standard for the Agency. In cases where two routes intersect at a bridge and routes pass over and under the bridge, a means is needed to identify which route is the principal route.

## PROCEDURES

If the bridge has two records, determine which record contains the principal route. Code "Y" (Yes) in the record containing the Principal Route, and code "N" (No) in the record containing the non-principal or other route.

The Principal Route is determined by the following order of route importance: Interstate highway, U.S. highway, state highway, county highway, city street, others. If two or more intersecting routes are of the same hierarchy, the lower route number will be considered the principal route.

## EXAMPLES

1. Principal route on the structure, with no route under the structure - i.e., bridge or culvert over waterway; bridge over railroad. Code Item 200 = Y
2. Principal route on the bridge, with lower hierarchy route under the bridge - i.e., highway overpass.  
For record where Item 5a = 1 Code Y  
For record where Item 5a = 2 Code N
3. Lower hierarchy route on the bridge, with principal route under the bridge - i.e., highway underpass.  
For record where Item 5a = 1 Code N  
For record where Item 5a = 2 Code Y
4. No route on the bridge with principal route under the bridge - i.e., pedestrian or railroad structure over the roadway.  
Code Item 200 = Y  
(Code Item 5a = 2)

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/20/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Wearing Surface Thickness**

AZ ITEM NO. 201

## DESCRIPTION

A two-digit field, indicating the thickness of the overlay, **usually asphaltic concrete**, that has been applied to the structural deck either at original construction or subsequently.

FIELD TYPE: Numeric

## PROCEDURES

Use the average thickness shown on contract plans, if available, and check by field measuring at deck drains or by measuring at deck drains or by measuring down from known height of curb.

Thickness is recorded to the nearest inch, and includes all material from driving surface to structure deck surface.

Verify recorded data on each biennial inspection.

**If no overlay is present, leave this item blank**

**For the culvert structures not at grade, leave this item blank.**

Refer to Item 108 - Wearing Surface/Protection System for additional information and cross-reference.

Code the thickness to the nearest inch.

## EXAMPLES:

Bridge deck has a measured **AC overlay of 2.75"**.

Code: 3

Bridge deck has a measured AC overlay of 12.2 inches.

Code: 12

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 05/23/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Foundation Type**

AZ ITEM NO. **202**

## DESCRIPTION

A two-digit field, the first digit of which identifies the type of abutment foundation and the second digit identifies the type of pier foundation.

## PROCEDURES

The information should be taken from the contract plans or by field investigation of the foundation material.

If two or more types of abutment foundations are present, record the lower number in the first digit.

If two or more types of pier foundations are present, record the lower number in the second digit. Leave the second digit blank for single-span bridges

Leave this item blank for the reinforced concrete box culverts, bridge culverts, and pipe or pipe arch culverts.

## CODING

FIRST DIGIT ABUTMENT FOUNDATION		SECOND DIGIT PIER FOUNDATION	
1	spread on uncemented soil	1	spread on uncemented soil
2	spread on cemented soil	2	spread on uncemented soil
3	spread on bedrock	3	spread on bedrock
4	steel H piles	4	steel H piles
5	C-I-P- pipe shell piles	5	C-I-P pipe shell piles
6	C-I-P fluted shell piles	6	C-I-P fluted shell piles
7	precast concrete piles	7	precast concrete piles
8	timber piles	8	timber piles
9	drilled shaft or caisson	9	drilled shaft or caisson
0	Other and unknown foundation	0	Other and unknown foundation

## EXAMPLE

Abutments on timber piling and pier spread footings on cemented soil. Code 82



# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 05/23/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **District Maintenance ORG**

AZ ITEM NO. **203**

## DESCRIPTION

A four-digit field to identify the District Maintenance Organization (ORG) who has maintenance responsibility for the structure.

This item applies to State-maintained structures only.

## PROCEDURES

The ORG number is taken from the ORG Boundary Log published by the Arizona Department of Transportation, Highways Division, Maintenance Group. In the Log each ORG number consists of four digits representing the engineering district and the maintenance section. The first two digits represent the District and the last two digits represent the individual Maintenance ORG.

## CODING

A structure is located in the Prescott District on U.S. Route 60, at milepost 71.53. From the Log, the structure falls in the milepost range of 49.57 to 74.45.

Given ORG number = 8852 (Wickenburg Maintenance)

Leave blank when not applicable.

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 05/23/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Original Project Number**

AZ ITEM NO. **204**

## DESCRIPTION

A eighteen-digit field to identify the project number under which the original construction of the structure was carried out.

## PROCEDURES

The original project number should be obtained from the contract plans. When the plans are not available for State administered project, the Project Control Section should be contacted to obtain the necessary information. The local owner agency should supply the Project Number for project administered by them.

## CODING

Coding should be left justified with unused positions left blank.

Project Number   IR - I - 10 - 5(40)      IR - 10 - 5 ( 4 0 ) \_\_\_\_\_

Leave blank when unknown.

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 05/23/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: Station-Principal Route

AZ ITEM NO. 205

## DESCRIPTION

A nine-digit field representing the construction route station of a structure for the principal route according to the system hierarchy.

## PROCEDURES

Determine the station for the structure from the contract plans. If plans are not available, leave this item blank.

For the structures carrying the principal route, record the Beginning Bridge station shown on the location sheet of the bridge plans. If the only bridge station shown is at the center of the structure, then the beginning bridge station should be computed and recorded.

For the structures with principal route passing under, record the station of the point of intersection between the principal route under and the construction centerline of the structure.

The beginning of the bridge is considered to be at the fill face of the backwall and should be used when plans are available or the position can easily be determined in the field. This item should be coordinated with Item 49.

The data in the nine-digit field should be right justified, with unused positions left blank. Do not include the plus sign and decimal point. The entry of the data may start out left justified, and the program will right justify upon execution of entry.

## CODING

Construction station: 825 + 32.67

Enter as follows: 8253267   Data as stored:   8253267

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/21/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Bridge Rail Type**

AZ ITEM NO. 206

## DESCRIPTION

A three-digit field representing the type of rail on the bridge or box culvert at grade.

## PROCEDURES

Record the rail type from the plans when available and verify from field inspection for changes.

For culverts at grade, where the height of fill is normally one foot or less and the curbs and/or rails delineate the roadway, record the rail type; otherwise leave blank.

Determine the geometric characteristics of the rail element and record all geometric features suitable for evaluating conformance to standards.

Determine the structural adequacy of the rail, using current AASHTO Standard Specification for Highway Bridges.

If the bridges has more than one type of rail record the data for all types but code data for the least adequate system.

## CODING

First Digit - Rail Type: X\_\_

Code

0	None
1	H-2-1
2	H-3-1
3	Single rail with parapet
4	Concrete (other than concrete barrier)
5	Baluster (Aluminum or Steel)
6	Special steel (including curb-mounted guardrail)
7	Timber
8	Thrie-beam retrofit
9	Concrete barrier
Blank	Culvert not at grade

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/21/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Bridge Rail Type**

AZ ITEM NO. **206**

## CODING

Second Digit - Geometric Conformance        X  

Code

0      The existing bridge rail does not conform to current AASHTO geometric requirements.

1      The existing bridge rail conforms to current AASHTO geometric requirements.

Third Digit - Structural Conformance        X  

Code

0      The existing bridge rail does not conform to current AASHTO structural requirements.

1      The existing bridge rail conforms to current AASHTO structural requirements.

AASHTO conformance for typical standards:

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/21/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Inspection Quarter**

AZ ITEM NO. 207

## DESCRIPTION

A one-digit field representing the quarter in which the structure is scheduled for a regular interval inspection.

**FIELD TYPE:** Text

## PROCEDURES

The inspection quarter for a new structure is generally determined by assigning and keeping the quarter consistent with other nearby structures in the same geographic area.

## CODING

MONTHS			INSP. QUARTER	CODE
(EVEN YEAR)				
01,	02,	03	1	1
04,	05,	06	2	2
07,	08,	09	3	3
10,	11,	12	4	4
(ODD YEAR)				
01,	02	03	1	5
04,	05,	06	2	6
07,	08,	09	3	7
10,	11,	12	4	8

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/22/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Structure Name**

AZ ITEM NO. **209**

## DESCRIPTION

A twenty-digit field to record the name of the structure.

## PROCEDURES

The Bridge Group assigns the structure name to new State Bridges. The culverts with named waterway underneath, should be given the structure name of the waterway with appropriate suffixes such as RCB, CMP, etc. For unnamed waterways underneath, simply code structure name as RCB, CMP, etc. The names for local government structures can be derived as above or by using local official maps.

The name should have "OP" or "UP" as suffix depending upon whether the Principal Route is on or under the structure respectively. A traffic interchange will have "TI" as part of the name. The name of overpass with one-way traffic should have a directional suffix in it. Other commonly used names may be added in parentheses provided enough space is available.

### Bridge - (BR)

This term is usually reserved for the structure over waterways or canyons.

### Overpass - (OP)

A structure carrying the principal route over a roadway, railroad, or pedestrian crossing.

### Underpass - (UP)

A structure where the principal route passes under a highway, railroad or pedestrian crossing.

### Traffic Interchange - (TI)

An OP or UP is also called TI if on and off ramps are provided to the intersecting roadways.

### Viaduct

A structure carrying a roadway over various features such as streets, waterways, railroads. The use of the name is optional.

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/22/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Structure Name**

AZ ITEM NO. **209**

## Tunnel

A structure carrying a roadway through a topographical barrier.

## **CODING**

Structure name coding should be left justified, using any combination of alphabetic, numeric, special characters and blanks.

## **EXAMPLES:**

BLACK\_CANYN\_TI\_OP\_NB

CANYON\_DIABLO\_RCB\_\_\_

CMP\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Abbreviations to be used for culvert type:

RCB	-	Reinforced concrete box
RCBC	-	Reinforced concrete bridge culvert
RCP	-	Reinforced concrete pipe
RCPA	-	Reinforced concrete pipe arch
RCA	-	Reinforced concrete arch
CMP	-	Corrugated metal pipe
CMPA	-	Corrugated metal pipe arch
SPP	-	Structural plate pipe
SPPA	-	Structural plate pipe arch
SPA	-	Structural plate arch



# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 07/06/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Posted Limit**

AZ ITEM NO. 211

## DESCRIPTION

A two-digit field indicating the actual posted weight restriction in gross tons.

## FIELD TYPE

Numeric

## PROCEDURES

A Posted Weight Limit is required for all structures not capable of carrying Arizona legal loads as determined by the structural analysis.

A concrete structure need not be posted for the restricted loading when it has been carrying normal traffic for an appreciable length of time and shows no distress.

No structure will be limited to a weight restriction of less than three (3) tons. A bridge should be closed if not capable of carrying three (3) tons.

If this item is coded, then NBI Item 41 must be coded "P" (posted) or "K" (closed), and NBI Item 70 must be less than 5.

New or revised regulatory signing shall conform to the requirements of the Manual on Uniform Traffic Control Devices for Streets and Highways.

Code the posted weight limit in gross tons. The value to be coded shall be the rating for the Type 3 vehicle.

If no weight restriction is posted, leave this item blank.

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 07/06/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Repair Priority**

AZ ITEM NO. **212**

## DESCRIPTION

A one-digit field to indicate repair scheduling requirements.

## PROCEDURES

If more than one repair recommendation is made on a report, the repair work requiring the highest Repair Priority should be noted on the Structure Inspection Report. Individual repair priorities are noted on the Structure Repair Report.

TYPE OF ACTION	CODE
Immediate action required	1
Repair work to take priority over routine work	2
Repair work that can be scheduled	3
No repairs - may require special attention	4
No action is required	5

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/27/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Culvert Barrel Height**

AZ ITEM NO. **217**

## DESCRIPTION

A two-digit field indicating the height of culvert barrel to the nearest foot.

## PROCEDURES

The culvert barrel height can be taken from the plans and verified in the field. If plans are not available, the measurement must be determined in the field to the nearest foot.

For multiple-barrel culverts with varying heights, record the smallest height. For different barrel heights at inlet and outlet, record the smallest height.

Record the data on the Culvert Inspection Report.

This item is to be left blank for circular pipe culverts, and when not applicable.

Code a two-digit number indicating the culvert barrel height, to the nearest foot. It should be right justified.

## EXAMPLES

Culvert Barrel Height Code -

10 feet	<u>1</u> <u>0</u>
6 feet	<u>0</u> <u>6</u>

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/27/94

REVISION: DRAFT

ISSUED BY Bridge Management Section

ITEM NAME: Culvert Barrel Length

AZ ITEM NO. 218

## DESCRIPTION

A four-digit field indicating the length of culvert barrel to the nearest foot.

## PROCEDURES

The culvert barrel height can be taken from the plans and verified in the field. If plans are not available, the measurement must be determined. The length should be measured to the nearest foot, from face of headwall to face of headwall, along the centerline of the culvert.

For multiple-barrel culverts with varying lengths, record the minimum length.

Record the data on the Culvert Inspection Report.

Code a four-digit number indicating the culvert barrel length, to the nearest foot. It should be right justified.

Leave blank when not applicable.

## EXAMPLES

The barrel length of a box culvert is 46' - 7".

Code     47

An EB RCB, 65' long is extended 7' on the right and 54' through the median to a WB RCB, 66' long, which is extended 8' on the left.

New barrel length = 65' + 7' + 54' + 66' + 8' = 200'

Code  200

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 06/27/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: Culvert Fill Height

AZ ITEM NO. 219

## DESCRIPTION

A three-digit field indicating the maximum fill height in feet over the culvert, measured from the top surface of the fill or pavement to the top surface of the culvert.

## PROCEDURES

The maximum fill height over the culvert should be obtained from the plans and verified in the field. Measure the maximum fill height in the field when the plans are not available.

For culverts with no fill, code zeros. For all other cases, code actual maximum fill height to the nearest foot.

Leave blank when not applicable.

Coding should be right justified.

## EXAMPLES

<u>Culvert Fill Height</u>	<u>Code</u>
8 feet	<u>  </u> 8
123 feet	<u>1</u> <u>2</u> <u>3</u>

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 07/12/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Foundation Embedment**

AZ ITEM NO. **220**

## DESCRIPTION

A two-digit field to indicate the depth, below the thalweg (lowest flowline elevation in the channel), of the bottom of the highest substructure footing or highest piling tip. For single span structures, give the information for the most vulnerable abutment.

## PROCEDURES

The purpose of this item is to develop data for scour studies, and to provide a very generalized indication of scour vulnerability. The substructure unit selected to represent the data, for the bridge as a whole, should be that unit or group of units that appears to represent the foundation most susceptible to scour.

Determine the elevation of the highest footings, either in the channel or directly adjacent, from plans. Establish flow line elevation by measurement, then calculate the embedment depth.

Code no less than 0 1 for any substructure. For abutment foundations that are above the low stream bed elevation, and are selected to represent the bridge's most vulnerable foundation, Code 0 1.

Code 9 9 for embedments exceeding 100'.

Leave blank for any structure not crossing a waterway, and for all culverts.

## EXAMPLES

Distance from flow line elevation to the bottom of the highest vulnerable pier footing = 6.8 ft. Code 0 7

Distance from the highest pile tip elevation to the flow line = 109 ft. Code 9 9

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 07/18/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Scour Countermeasures**

AZ ITEM NO. **221**

## DESCRIPTION

A three-digit field to identify the existing types of channel control and bank protection features at this site.

## PROCEDURES

Record the existing types of scour countermeasures from plans when available and verify from field inspection. Leave blank when not applicable.

## CODING

First Digit - Flow Control

X\_\_

CODE	TYPE
0	None
1	Spur Dikes
2	Concrete check dam
3	Wire tied riprap & rail check dam
4	Outlet drop structure
5	Groins or training dikes
6	Retard
7	A combination of the above
9	Other

Second Digit - Floor Protection   X  

Third Digit - Bank Protection   X  

TYPE	CODE	TYPE
No Protection	0	No Protection
Concrete floor	1	Concrete slope paving
Soil cement floor	2	Soil cement
Wire tied riprap floor	3	Rail bank
Dumped rock floor	4	Grouted rock
Wire tied pier pads	5	Dumped rock riprap
Aprons	6	Wire tied rock, (Gabions)
A combination of the above	7	A combination of the above
Grouted rock	8	Masonry
Other	9	Other

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 07/18/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Date of Load Rating**

AZ ITEM NO. 222

## DESCRIPTION

An eight-digit field to indicate the last date the structure was analyzed for load capacity.

**FIELD TYPE:** Date

## PROCEDURES

Code month, day and year of the date the structure was last analyzed. If unknown, leave blank.

## EXAMPLE

This structure was last analyzed for load capacity on October 15, 1986.

Code: 10/15/86



# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 07/18/94

REVISION: *DRAFT*

ISSUED BY Bridge Management Section

ITEM NAME: TRACS Number

AZ ITEM NO. 223

## DESCRIPTION

An eight-digit field to identify the TRACS Number.

## PROCEDURES

Enter the number used to reference data in TRACS, which included The Project Number, The Sub-Project and Phase. Leave blank if unknown or not applicable.

## EXAMPLE

TRACS Number: H325003C

Code: H325003C

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 08/08/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Total Deck Area**

AZ ITEM NO. **225**

## DESCRIPTION

A six-digit field to indicate the total deck area of the bridge.

**FIELD TYPE:** Numeric

## PROCEDURES

The total deck area is usually the product of the width of the bridge out-to-out from NBI Item No. 52 and the bridge length from NBI Item No. 49. If the bridge has a variable width due to ramp flares, or other reasons for a non-prismatic shape, the area needs to be calculated using the variable out-to-out surface width from bridge end to bridge end.

## CODING

Code the area to the nearest square foot.

## EXAMPLE

NBI Item 52 is 30.3 ft. and NBI Item 49 is 46 ft.  
Calculate:  $30.3 \times 49 = 1487.7$  sq. ft.

Code: 1488

## EXAMPLE

A bridge has a taper at one end to provide for an entrance ramp. The bridge is nominally 45.17 feet out to out and the last 220 feet of the structure flares out from 45.17 feet to 60.17 feet. The bridge is 455 feet long overall.

Calculate:  $45.17 \times 455 = 20552.35$  sq. ft.  
 $(60.17 - 45.17) \times 1/2 \times 220 = 1650.00$  sq. ft.  
Total = 22202.35 sq. ft.

Code: 22202

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 07/26/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: Next Inspection Due Date

AZ ITEM NO. 228

## DESCRIPTION

A three-digit field which indicates the quarter of the year and the year of the next inspection due date.

## PROCEDURES

Record the quarter and year of the next scheduled inspection due date.

## EXAMPLE

The next inspection for this structure will be during July 1996.

Code: 396

The next inspection for this structure will be during November 1997

Code: 497

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 08/01/94

REVISION: 03/12/96

ISSUED BY Bridge Management Section

ITEM NAME: Agency

AZ ITEM NO. 229

## DESCRIPTION

An eighteen-digit field to identify the actual name of the agency responsible for maintenance of the structure.

## PROCEDURES

Record the name of the agency that has responsibility for the maintenance of the bridge, and as a result would also have responsibility for inspecting the structure. In general this is the same agency that is being considered for coding in NBI Item No. 21, and may not be the owner of the bridge.

## CODING

The coding must match the names listed below under Agency so that the exact name can be used in queries.

AGENCY	SBIS CODE
<i>ADOT</i>	<i>AZ</i>
<i>AZ STATE PARKS</i>	<i>AZ</i>
APACHE CO	AP
COCHISE CO	CH
COCONINO CO	CN
GILA CO	GI
GRAHAM CO	GH
GREENLEE CO	GE
LA PAZ CO	LA
MARICOPA CO	MA
MOHAVE CO	MO
NAVAJO CO	NA
PIMA CO	PM
PINAL CO	PN
SANTA CRUZ CO	SC
YAVAPAI CO	YV
YUMA CO	YU

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 08/01/94

REVISION: 03/12/96

ISSUED BY Bridge Management Section

ITEM NAME: Agency

AZ ITEM NO. 229

AGENCY	SBIS CODE
APACHE JCT	AJ
AVONDALE	AV
BISBEE	BB
BUCKEYE	BY
CAMP VERDE	CV
CHANDLER	CD
CLARKDALE	CK
CLIFTON	CF
COOLIDGE	CL
COTTONWOOD	CW
EAGAR	EG
FLAGSTAFF	FS
FLORENCE	FC
FOUNTAIN HILLS	FH
GILA BEND	GB
GILBERT	GT
GLENDALE	GN
GLOBE	GL
GOODYEAR	GY
KINGMAN	KM
LAKE HAVASU	LH
MARANA	MR
MESA	MS
MIAMI	MI
NOGALES	NG
ORO VALLEY	OV
PAGE	PG
PARADISE VALLEY	PV
PAYSON	PY
PEORIA	PE
PHOENIX	PX
PINETOP-LAKESIDE	PL
PRESCOTT	PT
SAFFORD	SF
SCOTTSDALE	SD
SEDONA	SE

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 08/01/94

REVISION: 03/12/96

ISSUED BY Bridge Management Section

ITEM NAME: Agency

AZ ITEM NO. 229

AGENCY	SBIS CODE
SIERRA VISTA	SV
SPRINGERVILLE	SP
SUPERIOR	SR
SURPRISE	SS
TEMPE	TM
TOLLESON	TL
TUCSON	TN
WELLTON	WT
WILLIAMS	WL
WINKELMAN	WK
WINSLOW	WN
YUMA CITY	YM
BIA COCOPAH	
BIA COLORADO RIV	
BIA FT APACHE	
BIA FT YUMA	
BIA GILA RIVER	
BIA HOPI	
BIA HULAPAI	
BIA PAPAGO (Tohono O'Odham)	
BIA SAN CARLOS	
BLM	
NATL PARK SERVICE	
NAVAJO TRIBE	
US BUREC	
US BUREC CAWCD	
USAF DAVIS-MONTHAN	
USFS APACHE-SIT	
USFS COCONINO	
USFS CORONADO	
USFS KAIBAB	
USFS PRESCOTT	
USFS TONTO	
VETERANS ADMIN	

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 11/21/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Principal Route Number**

AZ ITEM NO. **230**

## DESCRIPTION

A four digit field to indicate the route number of the principal route for each bridge.

**FIELD TYPE:** Numeric

## BACKGROUND

A simplified directly readable route number is needed for report identifications, sorting and record keeping. NBI Item 5 is too complex a number to handle this requirement effectively.

## PROCEDURES

Record the numeric portion of the Principal Route number for each bridge. The Principal Route is determined by the following order of route importance: Interstate Highway, U. S. Highway, State Highway, County Highway, City Street, local. If two or more intersecting routes are of the same hierarchy, the lower route number will be considered the principal route.

## EXAMPLES

Interstate 8	Code 8
State 40B	Code 40
US 89A	Code 89
US 191	Code 191
Interstate 40 over Interstate 17	Code 17

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 11/21/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Principal Route Letter**

AZ ITEM NO. 231

## DESCRIPTION

A one digit field to identify the text modifier for Principal Routes.

**FIELD TYPE:** Text

## PROCEDURES

Record the alpha portion of the route number associated with each route. Do not include the general hierarchy designation such as "I" for Interstate or "U" for U.S. Highway. Record only the modifier as follows.

- A - Alternate
- B - Business
- L - Loop
- S - Spur
- T - Temporary or Truck

Leave Blank for those routes without a modifier.

## EXAMPLES

US 89 A	Code: A
State Route 40B	Code: B
Interstate 10	Code: Leave blank
Temp 191	Code: T



# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 11/21/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Principal Route Milepost**

AZ ITEM NO. **232**

## DESCRIPTION

A seven digit field to indicate the principal route milepost location of the bridge.

**FIELD TYPE** Numeric general, precision = 3 digits.

## PROCEDURES

Record the milepost associated with the principal route for the applicable bridge. For bridges carrying the principal route code the milepost at the beginning of the bridge. For bridges with the principal route under, code the milepost at the intersection of the centerlines of the routes.

**CROSS REFERENCE:** NBI Item No. 11

## CODING

Code the number to the nearest 1/1000th of a mile and enter as a decimal number.

**EXAMPLE** 123.456

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 11/21/94

REVISION: ***DRAFT***

ISSUED BY Bridge Management Section

ITEM NAME: **Structure Status**

*AZ* ITEM NO. 235

## DESCRIPTION

N – New Structure

A – Active Structure

R – Retired Structure

# BRIDGE INVENTORY STANDARDS

ISSUE DATE: 07/18/94

REVISION: **DRAFT**

ISSUED BY Bridge Management Section

ITEM NAME: **Comments**

AZ ITEM NO. 300

## DESCRIPTION

A 40-character field, alphanumeric area to be used for coding significant information about the structure such as completion of previously recommended maintenance repairs, corresponding structure numbers used by Federal agencies, etc.

Normally this item will remain blank.