

# Bridge Maintenance Management for Florida Municipalities



Prepared By:  
Ralph Verrastro, PE and Rolando Corsa, PE


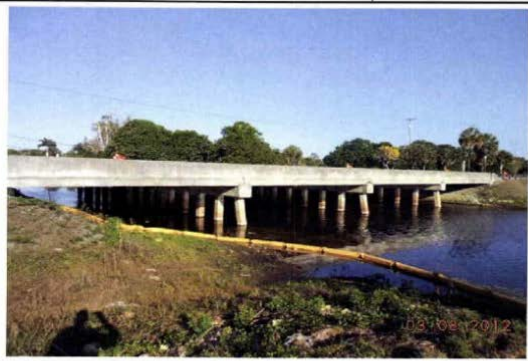

Prepared For:  
American Public Works Association – Florida Chapter (APWA)

# Agenda

- **Compile Bridge Records**
- **Organization of Bridge Records**
- **Bridge Life Definitions**
- **Bridge Project Type Definitions**
- **FDOT Bridge Inspection Program**
- **FDOT Bridge Inspection Reports (BIR)**
- **Funding Considerations**
- **Maintenance Program Tasks**
- **Bridge Typical Bridge Maintenance Repairs**
- **Bridge Structure Flood Emergency Training**

# Getting Started - Compile Bridge Records

- FDOT Bridge Inspection Reports (BIR)
- Correspondence from FDOT
- Original construction plans (As-built)
- Load rating calculations
- Original design calculations

BRIDGE INSPECTION REPORT		ICA								
	PREPARED FOR: FLORIDA DEPARTMENT OF TRANSPORTATION BRIDGE OWNER: COLLIER COUNTY	INSPECTED BY: <b>VOLKERT</b>								
BRIDGE NO. 030174	CONTENTS OF REPORT	INSPECTION DATE: 03/08/2012								
<table><tr><td>Pontis Report</td><td>U/W Inspection Report</td></tr><tr><td>CIDR</td><td>* Fracture Critical Data</td></tr><tr><td>Scour Elevation (Profile)</td><td>* Load Rating Analysis Summary</td></tr><tr><td>* Addendum (Element Notes &amp; Photos/Sketches)</td><td></td></tr></table> <p>*This section is not included in this report.</p>			Pontis Report	U/W Inspection Report	CIDR	* Fracture Critical Data	Scour Elevation (Profile)	* Load Rating Analysis Summary	* Addendum (Element Notes & Photos/Sketches)	
Pontis Report	U/W Inspection Report									
CIDR	* Fracture Critical Data									
Scour Elevation (Profile)	* Load Rating Analysis Summary									
* Addendum (Element Notes & Photos/Sketches)										
										
CR 951 OVER BIG CYPRESS BASIN CANAL		0.5MI NORTH OF I-75								
 <p>DeLorme Street Atlas USA® 2010</p> <p>Data use subject to license. © DeLorme, DeLorme Street Atlas USA® 2010. www.delorme.com</p> <p>MN (5.1" W)</p> <p>0 1000 2000 3000 4000 5000 Data Zoom 13-0</p>										

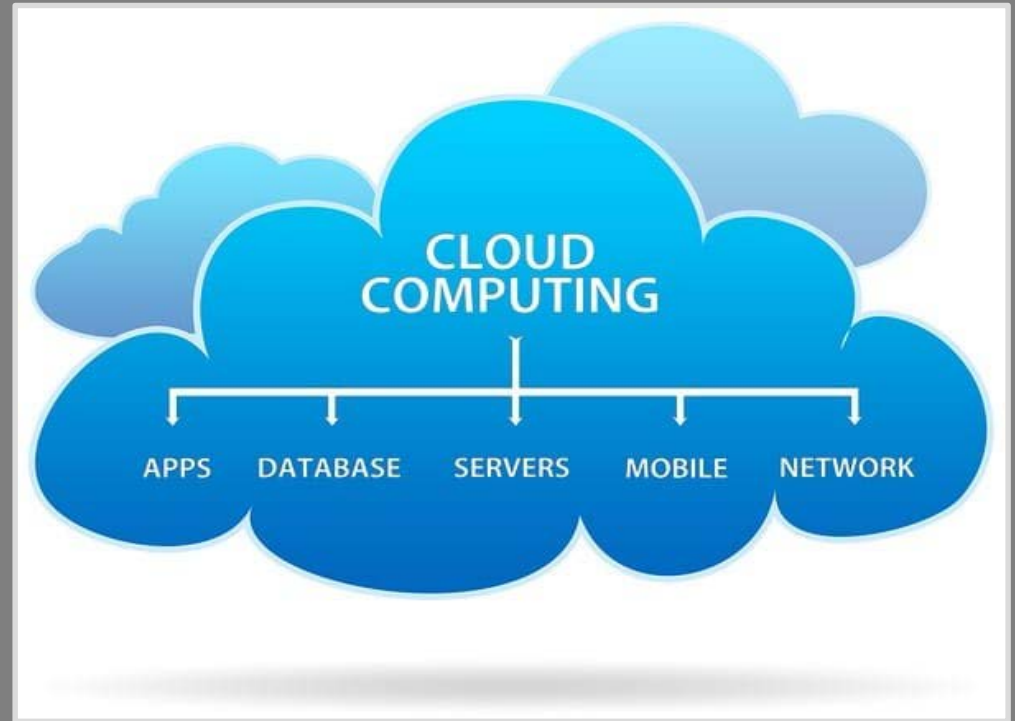
# Getting Started - Compile Bridge Records

- Geotechnical and Hydraulic Reports
- Bridge repair plans
- Bridge maintenance records
- Engineering studies and reports
- Accident (crash) reports



# Organization of Bridge Records

- File electronically on a local server or cloud based storage facility
- Pontis® Bridge Management System (used by FDOT)
- AASHTOWare
- Bridge Analyst
- Excel Spreadsheets – *recommended for municipalities*



# Organization of Bridge Records

- Other Searchable Data Base Programs
  - Oracle
  - Microsoft SQL Server
  - Microsoft Access
  - Amazon's Simple DB



# Bridge Life Definitions

(From the *Design Guide for Bridges for Service Life*)

- **SERVICE LIFE** - The time duration during which the bridge element, component, subsystem, or system provides the desired level of performance or functionality, with any required level of repair and/or maintenance.



# Bridge Life Definitions

(From the *Design Guide for Bridges for Service Life*)

- TARGET DESIGN SERVICE LIFE - The time duration during which the bridge element, component, subsystem, and system is expected to provide the desired function with a specified level of maintenance established at the design or retrofit stage.



# Bridge Life Definitions

(From the *Design Guide for Bridges for Service Life*)

- DESIGN LIFE - The period of time on which the statistical derivation of transient loads is based: 75 years for the current version of *AASHTO LRFD Bridge Design Specifications* (2018), hereafter referred to as *LRFD Specifications*.



# **Estimated Remaining Bridge Life**

## **(For Municipal Bridge Maintenance Programs)**

- The estimated remaining life for each bridge evaluated as part of a Bridge Maintenance Program is based on engineering judgment.
- Considers the original design life and anticipated time period when the bridge conditions may require emergency repairs to remain open to traffic.
- The estimated remaining bridge life may be related to concerns about 1 or 2 bridge components – e.g. deck, beams, scour, piles, etc.
- Upon completion of the recommended repairs, the estimated remaining bridge life should be extended usually for at least 10 or 20 years.

# Bridge Project Type Definitions

- **Bridge Rehabilitation** includes strengthening a bridge to increase its load carrying capacity, deck replacement, deck rehabilitation, bridge widening or superstructure replacement, scour countermeasures, pile jacketing, etc.
- **Routine Bridge Maintenance** includes deck joint, deck, railing, superstructure, substructure, and channel maintenance and repair.
- **Bridge Replacement** involves the demolition of the existing bridge and the construction of a new bridge.

# FDOT Bridge Inspection Program

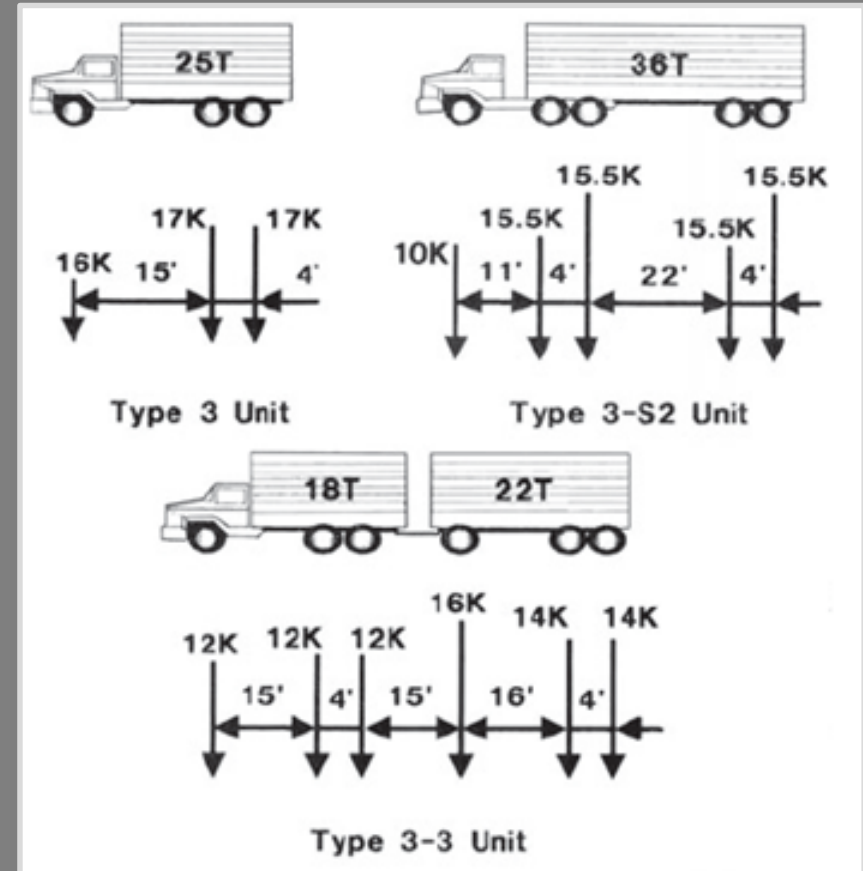
- Each bridge has a unique bridge number
- Inspections performed biennially by consultants working for FDOT
- Low condition ratings and posted bridges inspected every year
- Underwater inspections performed every 2 years
- Inventory information for each bridge in database



Bridge Number

# FDOT Bridge Inspection Program





- Load ratings performed for each bridge
- If no plans available, load ratings are approximate
- Updated when advanced deterioration is reported
- Updated when repairs are performed that increases dead loadings
- Operating ratings used to check for load posting on redundant structures



Load Rating Trucks

# FDOT Bridge Inspection Reports (BIR)

- The first 3 pages are an executive summary of the inspection and inventory data

FLORIDA DEPARTMENT OF TRANSPORTATION BRIDGE MANAGEMENT SYSTEM Inspection/CID Report with PDF attachment(s)		
<b>BRIDGE ID: 030139</b> <b>DISTRICT: 01 Bartow</b>		<b>PAGE: 2 OF 20</b> <b>INSPECTION DATE: 4/13/2011 AQAB</b>
BY: VOLKERT, INC. OWNER: 2 County Hwy Agency MAINTAINED BY: 2 County Hwy Agency STRUCTURE TYPE: 1 Reinforced Concrete - 01 Slab LOCATION: 6 MI EAST OF SR 29 SERVICE TYPE ON: 1 Highway SERV TYPE UND: 5 Waterway		STRUCTURE NAME: CR 846 OVER DRAINAGE CAN YEAR BUILT: 1948 SECTION NO.: 03 020 000 MP: 5.89 ROUTE: 00846 FACILITY CARRIED: CR-846 FEATURE INTERSECTED: DRAINAGE CANAL
<input type="checkbox"/> THIS BRIDGE CONTAINS FRACTURE CRITICAL COMPONENTS <input type="checkbox"/> THIS BRIDGE IS SCOUR CRITICAL <input type="checkbox"/> THIS REPORT IDENTIFIES DEFICIENCIES WHICH REQUIRE PROMPT CORRECTIVE ACTION <input checked="" type="checkbox"/> FUNCTIONALLY OBSOLETE <input type="checkbox"/> STRUCTURALLY DEFICIENT		
TYPE OF INSPECTION: Regular NBI DATE FIELD INSPECTION WAS PERFORMED: ABOVE WATER: 04/13/2011 UNDERWATER: 09/12/2001		
SMART FLAGS:	OVERALL NBI RATINGS:	
None	DECK: 7 Good SUPERSTRUCTURE: 7 Good SUBSTRUCTURE: 6 Satisfactory PERF. RATING: Good	CHANNEL: 6 Bank Slumping CULVERT: N N/A (NBI) SUFF. RATING: 63.8 HEALTH INDEX: 74.94
FIELD PERSONNEL / TITLE / NUMBER		INITIALS
McCutcheon, Thomas - Bridge Inspector (CBI #00416) (lead)		
Lynch, Matthew - Technician		
REVIEWING BRIDGE INSPECTION SUPERVISOR:		
Rucks, Edward - CBI (#00273) 		
CONFIRMING REGISTERED PROFESSIONAL ENGINEER:		
Teal, Daniel - PROJECT MANAGER (PE # 42097) VOLKERT, INC. 3409 W. LEMON STREET, STE 1 CERTIFICATE OF AUTHORIZATION NO 4641 TAMPA, FL 33609		
SIGNATURE: 		
DATE: JUN 02 2011		
<small>This report contains information relating to the physical security of a structure and depictions of the structure. This information is confidential and exempt from public inspection pursuant to sections 119.071(3)(a) and 119.071(3)(b), Florida Statutes. Only the cover page of this report may be inspected and copied.</small>		
REPORT ID: INSP005 (condensed)		PRINTED: 05/24/2011

# FDOT Bridge Inspection Reports (BIR)

- **Functionally obsolete** bridges are those that do not have adequate lane widths, shoulder widths, or vertical clearances to serve current traffic demand, or those that may be occasionally flooded.



# FDOT Bridge Inspection Reports (BIR)

- **Structurally deficient** means there are elements of the bridge that need to be monitored and/or repaired. The fact that a bridge is "structurally deficient" does not imply that it is likely to collapse or that it is unsafe. It means the bridge must be monitored, inspected and maintained. A structurally deficient bridge is one for which the deck (riding surface), the superstructure (supports immediately beneath the driving surface) or the substructure (foundation and supporting posts and piers) are rated in condition 4 or less.



# FDOT Bridge Inspection Reports (BIR)

- **Fracture-critical bridges** do not contain redundant supporting elements. This means that if those key supports fail, the bridge would be in danger of collapse. This does not mean the bridge is inherently unsafe, only that there is a lack of redundancy in its design.



# FDOT Bridge Inspection Reports (BIR)

- **Sufficiency ratings** were developed by the Federal Highway Administration to serve as a prioritization tool to allocate funds.
  - The rating varies from 0 percent (poor) to 100 percent (very good).
  - The formula considers structural adequacy, whether the bridge is functionally obsolete and level of service provided to the public.
  - The FDOT uses this rating for determining priorities for their construction program.



# FDOT Bridge Inspection Reports (BIR)

- Some factors that reduce the SR that are not related to the condition of the bridge include:
  - Load posted bridges
  - Low load rating ( $RF < 1$ )
  - Long detour length or no off site detour
  - High ADT
  - Poor geometry – bridge close to an intersection



# FDOT Bridge Inspection Reports (BIR)

- Ignore the **Health Index** rating number on the FDOT reports



# FDOT Bridge Inspection Reports (BIR)

- **Scour critical** bridges are susceptible to damage from scour of the soils that support the bridge foundations. These bridges need to be closely monitored during flood events.



# FDOT Bridge Inspection Reports (BIR)

- Condition rating definitions vary depending on the bridge element. The following table summarizes the general condition rating definitions used in the BIR:

N - NOT APPLICABLE

9 - EXCELLENT CONDITION

8 - VERY GOOD CONDITION - no problems noted.

7 - GOOD CONDITION - some minor problems.

6 - SATISFACTORY CONDITION - structural elements show some minor deterioration.

5 - FAIR CONDITION - all primary structural elements are sound but may have minor section loss, cracking, spalling or scour.

4 - POOR CONDITION - advanced section loss, deterioration, spalling or scour.

3 - SERIOUS CONDITION - loss of section, deterioration, spalling or scour have seriously affected primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.

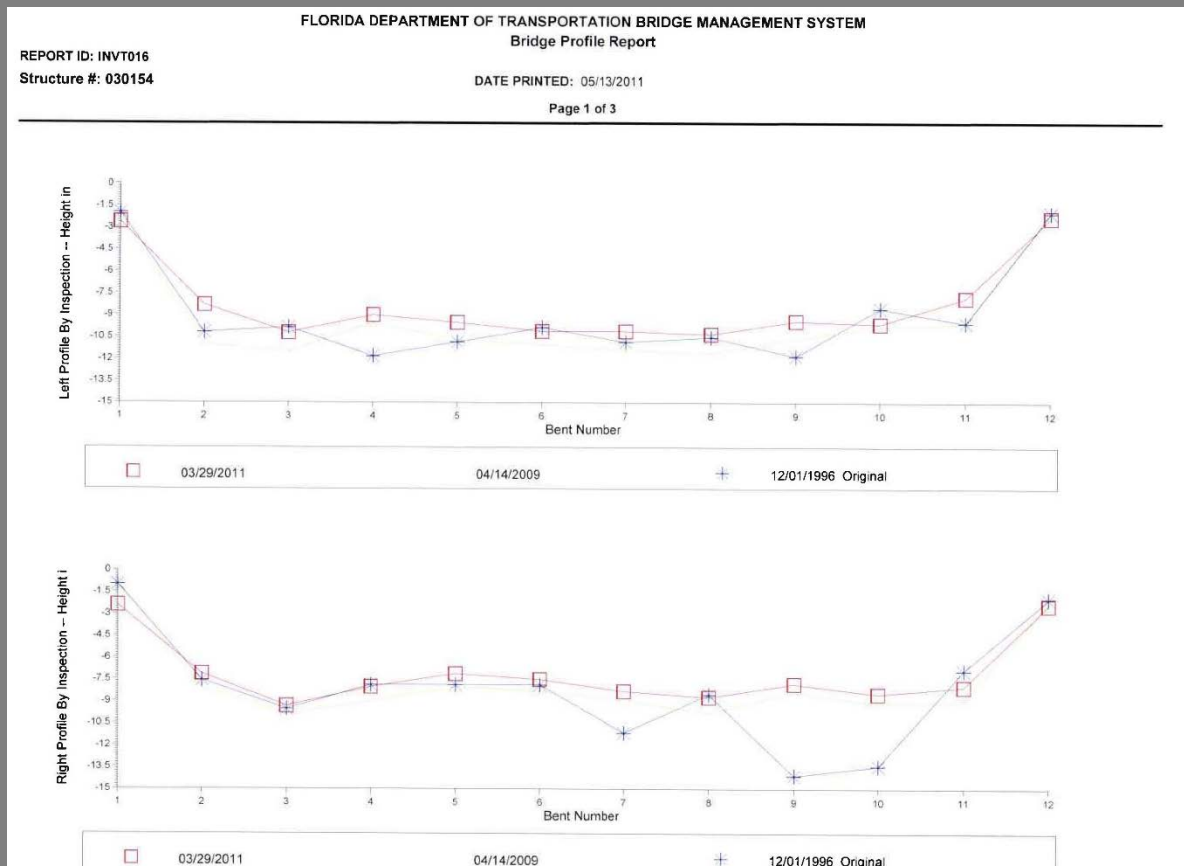
2 - CRITICAL CONDITION - advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.

1 - "IMMINENT" FAILURE CONDITION - major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.

0 - FAILED CONDITION - out of service - beyond corrective action.

# FDOT Bridge Inspection Reports (BIR)

- **Bridge Profile Report** – tracks the drop line measurements from a fixed datum level to the bottom of channel to monitor scour of stream bed over time.



# FDOT Bridge Inspection Reports (BIR)

- **Comprehensive Report Summary** – these pages are near the back of the report and provides a summary of the load ratings, general repair recommendations, approximate repair quantities, etc.

FLORIDA DEPARTMENT OF TRANSPORTATION  
BRIDGE MANAGEMENT SYSTEM  
Inspection/CID/Bridge Profile Report with PDF attachment(s)  
COMPREHENSIVE

REPORT ID: INVT001A  
Structure ID: 030122

Page 15 of 19  
02/18/2011

DATE PRINTED:

Elements

Inspection Date: 1/6/2011 OWHP

Span Id	Elem/Env	Description	Qty1	%1	Qty2	%2	Qty3	%3	Qty4	%4	Qty5	%5	T Qty
0	38/4	Bare Concrete Slab	0	-	9450	100	0	-	0	-	0	-	9450 sf.
<b>Notes</b> Note: There is one 4-1/2in. utility pipe along the west side of structure and two steel sleeves attached to the deck underside in each span. Anchorage type is unknown.													
CS2: DECK TOP: The deck surface has intermittent longitudinal cracks up to 1/16in. wide. The deck top also has diagonal cracks up to 1/32in. wide and map cracking up to 1/32in. wide at the centerline of Span 2.													
DECK UNDERSIDE: Span 6 has a spill from a core sample 12in. x 12in. x 2in., 3ft. north of Bent 6 cap.													
0	301/4	Pourable Joint Seal	363	87.9	50	12.1	0	-	0	-	0	-	413 lf.
<b>Notes</b> CS2: The abutment expansion joints are deteriorated within the travel lanes.													
0	331/4	Conc Bridge Railing	441	98.22	0	-	8	1.78	0	-	0	-	449 lf.
<b>Notes</b> CS3: Bridge rail Posts 2-2 right and 3-3 left have spalls with exposed painted steel up to 9in. x 8in. x 2in. Refer to Photo 1. REPAIR The top rail Section 2-2 right has cracking with corrosion staining. DECREASE Refer to Photo 2. REPAIR CORRECTIVE ACTION TAKEN: Several areas of the corrosion on the rail section and post have been epoxy injected.													
0	204/4	P/S Conc Column	39	97.5	1	2.5	0	-	0	-	0	-	40 ea.
<b>Notes</b> CS1: Bent 2 piling have graffiti painted on their faces. The painted graffiti on the piling is not visible from the roadway. The following was noted by the underwater inspectors: CS2: Pile 3-3 west face has a 12in. x 1/32in. vertical crack with no corrosion bleed out at the top of the marine growth.													
0	215/4	R/Conc Abutment	89	100	0	-	0	-	0	-	0	-	89 lf.
<b>Notes</b> Note: There is a 9in. utility pipe along the west side of the structure and steel angle bracing attached to both abutments. Anchorage type is unknown.													
0	234/4	R/Conc Cap	338	100	0	-	0	-	0	-	0	-	338 lf.
<b>Notes</b> Note: There is a 9in. utility pipe along the west side of the structure and steel angle bracing attached to the intermediate bent caps. Anchorage type is unknown.													
0	396/4	Other Abut Slope Pro	1932	50.42	1800	46.97	100	2.61	0	-	0	-	3832 sf.
<b>Notes</b> Note: This element represents the rip rap bags slope protection at both abutments and at the four corners of the structure. CS2: There are trees rooted in the radii of the south slope. INCREASE Refer to Photo 3. CS3: Abutment 1 slope protection has an area of missing, displaced and undermined rip rap bags, 10ft. x 10ft. x 4ft. of penetration at the toe between Piles 2-2 and 2-3. INCREASE Refer to Photo 4. REPAIR													
0	290/4	Channel	1	100	0	-	0	-	0	-	0	-	1 ea.
<b>Notes</b>													

This report contains information relating to the physical security of a structure and depictions of the structure. This information is confidential and exempt from public inspection pursuant to sections 119.071(3)(a) and 119.071(3)(b), Florida Statutes. Only the cover page of this report may be inspected and copied.

# Funding Considerations

- The typical approach for funding bridge repair and replacement is the use of a combination of local and FDOT funds.
  - There are limited federal funds available to local municipalities for bridge replacement through the FDOT.
  - These funds are allocated by the FDOT based on the statewide bridge replacement ranking formula listing which is influenced heavily by the Sufficiency Rating.



# Funding Considerations

- Federal and state funds are typically not available for rehabilitation of local bridges.
- Conduct annual meetings with FDOT District staff to keep on top of opportunities for funding
- Maintain close relationships with local MPO
- Establish relationships with neighboring municipalities for partnering opportunities



# Bridge Maintenance Program Tasks

- Compile a listing of all the bridges in an Excel spreadsheet that includes the bridge number, feature carried, feature crossed, year built, date of most recent FDOT inspection and sufficiency rating.
  - Consider adding other inventory data for each bridge in this spreadsheet such as number of spans, total length, superstructure rating, substructure rating, deck rating, age, detour length, AADT, structural deficiency, obsolescence, scour critical, etc.
  - This will allow you to search the spreadsheet data on the bridges and develop lists based on these factors.




# Bridge Maintenance Program Tasks

- Sort the bridges in the spreadsheet based on the Sufficiency Rating and summarize the list from lowest to highest. Depending on budget constraints, consideration may be given to including a subset of the bridges to be included in the initial Bridge Maintenance Program based on this priority listing.
- Review copies of the available past FDOT inspection reports, inventory data, load rating calculations and record drawings for each bridge to be considered.



# Bridge Maintenance Program Tasks

- Perform an inspection of the bridges and complete a field report checklist.
- Review the condition ratings for each element to confirm agreement.
- Document general bridge conditions, obtain measurements, and identify structural deficiencies and operational characteristics.
- A sample copy of a report form is attached.



### BRIDGE INVESTIGATION CHECKLIST

Bridge Reference #: <u>52</u> BIN #: <u>#030158</u> Feature Carried: <u>CR 858</u> Feature Crossed: <u>Obie Canal</u>	Date: <u>1/28/2014</u> Team Leader: <u>RV</u> Assistant Team Leader: <u>RC</u>
--	--

Record Plans Available? <u>n</u> <small>y/n</small> DOT Ratings Evaluted (Separate Form) <u>y</u> <small>y/n</small>	If No, Relevant Dimensions Recorded? <u>y</u> <small>y/n</small> Discrepancies Documented? <u>y</u> <small>y/n</small>
---	---

**APPROACH GEOMETRY NOTES**

Orientation: Invented south to north.

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**APPROACH RAIL TYPE**

Begin Approach: Guardrail with concrete posts  
 End Approach: Guardrail with concrete posts

<b>ACCESS</b> Inspection Access Restrictions? <u>n</u> <small>y/n</small> Construction Restrictions? <u>n</u> <small>y/n</small> Staged Construction Restrictions? <u>n</u> <small>y/n</small> Vertical Underclearance Restrictions? <u>n</u> <small>y/n</small> Vertical Overclearance Restrictions? <u>y</u> <small>y/n</small>	<b>REMARKS</b> <u>Power lines west of bridge.</u>
--	--

<b>STREAM</b> Stream Constriction @ Bridge? <u>n</u> <small>y/n</small> Stream Deposition? <u>n</u> <small>y/n</small> Stream Scour Concerns: <u>n</u> <small>y/n</small> Stream Geometry Concerns: <u>n</u> <small>y/n</small>	<b>REMARKS</b> 
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<b>UTILITIES</b> Electric: <u>OH</u> Telephone: CATV: Natural Gas: Other Fuel: Municipal Water: Others:	<b>UG or OH</b> OH      	<b>OWNER</b>       	<b>REMARKS</b> <u>West of structure.</u>
--	---	--	---

<b>MISCELLANEOUS</b> Driveways: <u>n</u> <small>y/n</small> Intersections: <u>n</u> <small>y/n</small> Evidence of Pedestrians: <u>n</u> <small>y/n</small> Traffic Signals: <u>n</u> <small>y/n</small> Railroads: <u>n</u> <small>y/n</small> Bike Routes: <u>n</u> <small>y/n</small> Structures: <u>n</u> <small>y/n</small> Adjacent Culverts: <u>y</u> <small>y/n</small> Adjacent Parking: <u>y</u> <small>y/n</small> Speed Restrictions: <u>y</u> <small>y/n</small>	<b>REMARKS</b> <u>45 mph</u>
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**SPECIAL CONSIDERATIONS**

All the deficiencies noted in the previous inspection report, dated 2/12/13, remain. The bridge was not posted at the time of our inspection.

# Bridge Maintenance Program Tasks



*YES!* There are alligators out there!!

# Bridge Maintenance Program Tasks

- Perform a review to confirm the accuracy of the Sufficiency Rating (SR) provided by FDOT. We have provided a copy of a spreadsheet that may be used to calculate the SR independently from the FDOT's calculations. If a discrepancy is found, it should be reported to FDOT.

BRIDGE SUFFICIENCY RATING CALCULATION					
County /City:	Collier	Bridge ID:	34056	FHWA No.:	
Structural Adequacy & Safety - S1 (max.) is 55%					
Item 59. Superstructure Rating	=	N			
Item 60. Substructure Rating	=	N			
Item 62. Culvert Rating	=	6			
Item 66. Inventory Rating	=	235			(MUST START WITH "2")
The calculated allowance for Structural Adequacy and Safety (S1)				=	54.7222
Serviceability and Functional Obsolescence - S2 (max.) is 30%					
Item 58. Deck Condition Rating	=	N			
Item 67. Structural Condition Rating	=	5			
Item 68. Deck Geometry Rating	=	N			
Item 69. Underclearance Rating	=	N			
Item 71. Waterway Adequacy Rating	=	8			
Item 72. Approach Alignment Rating	=	9			
Allowance for Serviceability -J (max.) is 13% =				1	
Item 28. Lanes on Structure	=	3			
Item 29. ADT on Structure	=	1556			
Item 51. Roadway width - curb to curb	=	34			
Item 43. Main Structure Type	=	119			
Item 32. Approach Roadway Width	=	34			
Item 100. Is this a defense road (Y/N)	=	N			
Item 53. Vertical Clearance	=	9999			
The calculated allowance for Serviceability and Obsolescence (S2)				=	14
Essentiality for Public Use - S3 (max.) = 15%					
Item 19. Detour Length	=	99			
The calculated allowance for Essentiality for Public Use - S3				=	0.710141701
Special Reduction - only used if S1+S2+S3>=50%					
Item 36. Traffic Safety	=	1010			
The allowance for Special Reductions (S4)				=	5.999902232
SUFFICIENCY RATING SUMMARY					
Item					
Structural Adequacy and Safety	-	S1=	54.7222		
Serviceability & Functional Obsolescence	-	S2=	14		
Essentiality for Public Use	-	S3=	0.7101417		
Special Reductions	-	S4=	5.9999022		
Sufficiency Rating (S1 + S2 + S3 - S4 )				=	63

3/7/2018

6:58 AM

# Bridge Maintenance Program Tasks

- Establish recommendations for additional testing and/or detailed structural analyses that may include:
  - Update the load rating
  - Bridge deck evaluation
  - Substructure concrete evaluation



# Bridge Maintenance Program Tasks

- Non-destructive testing
  - Delamination surveys
  - Ground Penetrating Radar (GPR) scans
  - Magnetic particle testing



# Bridge Maintenance Program Tasks

- Destructive testing
  - Extract cores for visual examination
  - Conduct a concrete removal sampling survey

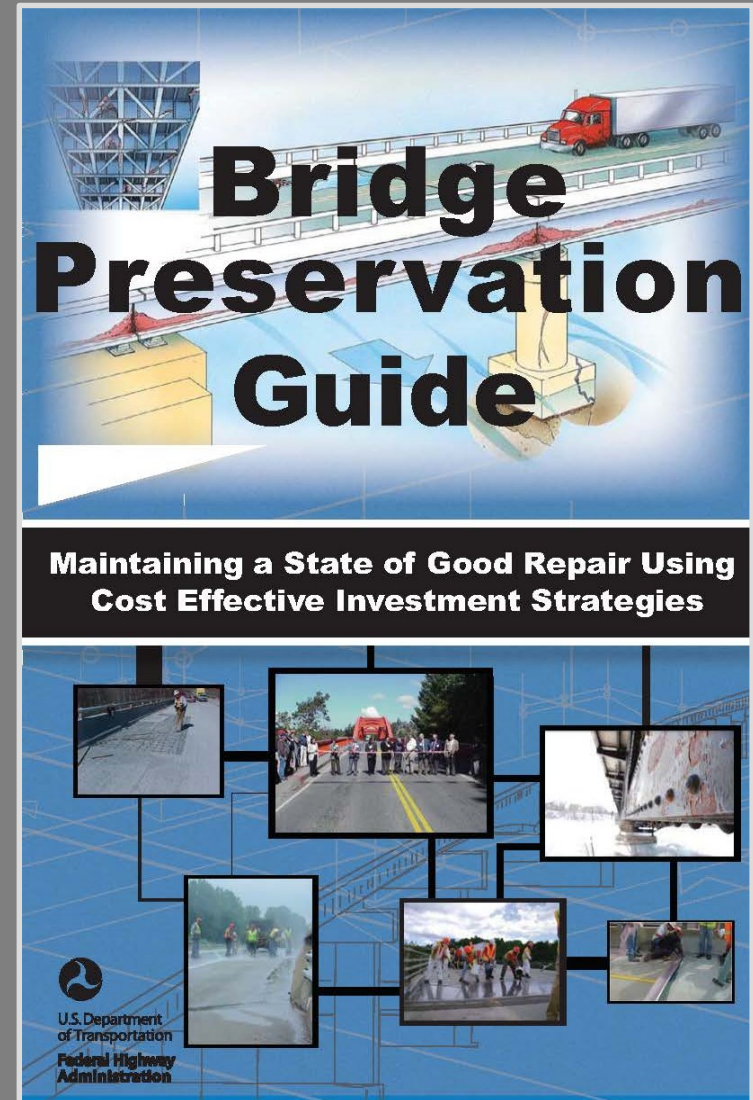


# Bridge Maintenance Program Tasks

- Laboratory testing
  - Compression
  - Petrographic analysis
  - Chloride content
  - pH testing
  - Alkali-silica reaction testing
  - Carbonation testing

# Bridge Maintenance Program Tasks

- Provide recommendations for routine, periodic or preventative maintenance for each bridge.



# Bridge Maintenance Program Tasks

- Determine feasible alternatives for bridge rehabilitation which may include bridge widening.
- Determine the feasible alternatives for replacement.



# Bridge Maintenance Program Tasks


- Estimate the costs for construction, engineering and construction inspection for the routine maintenance repairs, feasible rehabilitation alternatives and feasible replacement alternatives. A copy of a sample spreadsheet is provided.

28-Jan-14

Project No. N/A

County: Collier

Description: Bridge #52 (030158)






ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT COST	COST PER ITEM
Total					
0101-1	Mobilization	1	LS	\$ 25,000.00	\$ 25,000
0102-1	Maintenance of traffic	1	LS	\$ 10,000.00	\$ 10,000
0104-12	Staked turbidity barrier - Nyl. Reinf. PVC	120	LF	\$ 15.00	\$ 1,800
0350-78	Cleaning & sealing ran. Cracks	400	LF	\$ 5.00	\$ 2,000
0401-70-1	Restore Spalled Areas, Epoxy	10	CF	\$ 1,200.00	\$ 12,000
0457-1-22	Std. Integral Pile Jkt., Str., 16 to 30	180	LF	\$ 1,000.00	\$ 180,000
0458-1-21	Bridge deck expansion Jnt., Rehab, Poured	424	LF	\$ 70.00	\$ 29,680
20% Contingency					\$ 52,096
TOTAL:					\$ 312,576

# Bridge Maintenance Program Tasks

- Sort the bridges into 4 categories:
  - **Bridge Replacement** – These bridges should be replaced in the next 5 to 10 years.
  - **Bridge Rehabilitation** – These bridges require major comprehensive maintenance repairs.
  - **Bridge Maintenance** – These bridges will require routine maintenance within the next 5 to 10 years.
  - **Do Nothing** – These bridges will not require any investment for the next 10 years.

# Bridge Maintenance Program Tasks

- Prepare individual bridge reports. A sample report format is provided.

 <b>Collier County Bridge Study (Phase 4)</b> 	
<b>BRIDGE:</b> CR 858 over OBIE CANAL	
<b>BRIDGE REFERENCE NO. 52</b>	<b>BRIDGE ID 030158</b>
<b>SITE DESCRIPTION:</b> <ul style="list-style-type: none"><li>• Span and Skew: 60'-0" (4 spans at 15'-0"), No skew</li><li>• Superstructure: Reinforced concrete slab units</li><li>• No. of Lanes: 2</li><li>• Substructure: Concrete caps on timber piles</li><li>• Year built: 1953 (61 years old)</li><li>• Bridge Width: 25'-8" out-to-out</li><li>• Curb to Curb Width: 24'-0"</li><li>• ADT: 110</li><li>• The original design live load for this bridge is H15</li></ul>	
	
<b>EXISTING CONDITIONS:</b> <ul style="list-style-type: none"><li>• Sufficiency Rating: 79.2</li><li>• Deficient Elements:<ul style="list-style-type: none"><li>a. Various spalls on the curbs, deck underside, bent caps, guardrail posts and joint headers.</li><li>b. Various cracks on top and underside of deck and approach slabs.</li><li>c. Various joint adhesion failures.</li><li>d. Lateral misalignment of spans 2 and 3.</li><li>e. Timber pile deficiencies, including decay, checks and shakes.</li><li>f. Guardrail on approach roadway and bridge does not meet standards.</li></ul></li><li>• Bridge was not posted at the time of our inspection. Although the bridge width of 24' curb to curb is less than 32'-1" minimum required to avoid "functionally obsolete" classification, the current ADT of 110 is less than 5,000, therefore not functionally obsolete. (per FHWA)</li></ul>	

CR 858 OVER OBIE CANAL (030158) Page 1 of 4

# Bridge Maintenance Program Tasks



## Collier County Bridge Study (Phase 4)



### ALTERNATIVES:

**1. Null (Do Nothing)**

- Not recommended.

**2. Bridge Rehabilitation:**

- Repair existing deficient elements.
- Scope of Work: Includes patching of all spalls, sealing of all cracks, jacketing of existing timber piles.
- This work can be completed using staged construction, alternating one way using a temporary traffic signal to maintain a one-way traffic operation or using flaggers if the work is completed at night.

**3. Bridge Widening:**

- Not recommended.

**4. Bridge Replacement:**

- Recommended.

### BUDGET ESTIMATES FOR ALTERNATIVES:

Alternative	Construction	Design	Inspection	Total
2 – Bridge Rehabilitation	\$315,000	\$45,000	\$30,000	<b>\$390,000</b>
3 – Bridge Widening	N/A	N/A	N/A	<b>N/A</b>
4 – Bridge Replacement (Recommended)	\$615,000	\$90,000	\$60,000	<b>\$765,000</b>

# Bridge Maintenance Program Tasks



## Collier County Bridge Study (Phase 4)



Timber piles



Timber piles



Timber piles



Approach roadway

# Bridge Maintenance Program Tasks



## Collier County Bridge Study (Phase 4)



### RECOMMENDATIONS:

1. We recommend the replacement alternative due the advanced deteriorated conditions and relatively high cost to repair. It was also only designed for H15 loading.
2. The current estimated life of the bridge if no repairs are completed is 10 years.
3. If improvements were planned for CR 858 within the next 10 years, we would recommend the Null Alternative for now and plan to replace the bridge when the roadway is improved.
4. Widening is not recommended. The bridge is sufficiently wide for current ADT values.
5. The detour length is approximately 30 miles. The bridge replacement would need to be performed in phases to maintain traffic using temporary traffic signals with an alternating one way traffic pattern or using a temporary detour bridge. The temporary detour bridge is most likely the most economical approach since this canal is almost dry in the winter.

# Bridge Maintenance Program Tasks

Evaluate the following factors related to each bridge and prepare a priority listing for each of the 4 work categories.

- Structurally deficient – high priority
- Scour critical – high priority
- Functionally obsolete – priority depends on other factors
- Estimated remaining service life and potential for emergency repairs
- Traffic control alternatives

# Bridge Maintenance Program Tasks

- Traffic control alternatives
  - New bridge on adjacent alignment
  - Phased construction
  - Temporary detour bridge
  - Offsite detour



# Bridge Maintenance Program Tasks

- Average annual daily traffic (AADT)
- Time required for permitting, design, right-of-way, bidding, and construction
- Planned roadway improvement projects



# Bridge Maintenance Program Tasks

- Accident history
  - Numerous accidents – higher priority
  - No accidents – lower priority even if functionally obsolete



# Bridge Maintenance Program Tasks

- Cost – where can you get the most “bang for the buck”
- Politics



# Bridge Maintenance Program Tasks

- Prepare a draft Bridge Program Study Report
  - Summarize the findings of the study including recommendations for a multi-year bridge improvement program
  - Include maintenance repairs and capital improvements.
  - Identify which bridges should be included in the FDOT work program
  - Identify bridges better suited to local funding.
  - Copies of sample spreadsheet tables are provided.

# Bridge Maintenance Program Tasks



## COLLIER COUNTY BRIDGE PROGRAM STUDY (IN ORDER OF RECOMMENDED SEQUENCE)

Bridge Reference Nos.	Bridge	Year Built	ADT	*Estimated Life (Years)	Sufficiency Rating	Estimated Construction Cost	Estimated Design & CEI Cost	Estimated Total Project Cost
6** (030177)	Vanderbilt Dr. over Little Horse Pass	1964	11500	5	56.7	\$1,405,000	\$350,500	<b>\$1,755,000</b>
19** (030178)	Vanderbilt Dr. over Canal	1964	15000	5	81.2	\$515,000	\$130,000	<b>\$645,000</b>
8 (030136)	CR 846 over Drainage Canal	1948	4635	10	61.2	\$661,000	\$166,000	<b>\$827,000</b>
1 (030154)	CR 858 over Okaloacoochee Slough	1951	1440	10	45.2	\$2,080,000	\$525,000	<b>\$2,605,000</b>
2 (030155)	CR 858 over Okaloacoochee Slough	1951	1000	10	48.9	\$1,545,000	\$385,000	<b>\$1,930,000</b>
3 (030156)	CR 858 over Okaloacoochee Slough	1951	1000	10	48.9	\$745,000	\$185,000	<b>\$930,000</b>
32 (030153)	CR 858 over Okaloacoochee Slough	1951	1070	10	68.1	\$765,000	\$190,000	<b>\$955,000</b>
52 (030158)	CR 858 over Obie Canal	1953	110	10	79.2	\$615,000	\$150,000	<b>\$765,000</b>

# Bridge Maintenance Program Tasks

- Communicate the Plan
  - Conduct a meeting with the municipality's political leaders
  - Review the bridge program findings
  - Recommend an annual funding amount
  - Recommend a time frame for the initial bridge maintenance program
  - Gain acceptance for a guaranteed annual funding level for 10 years.



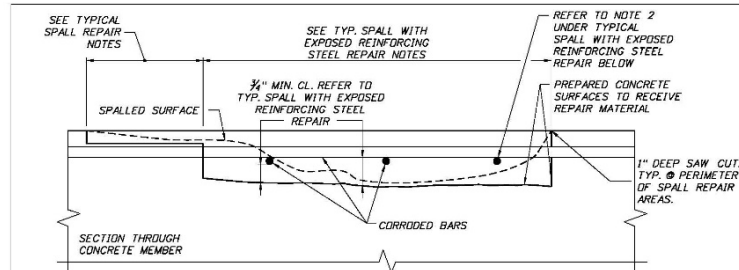
# Bridge Maintenance Program Tasks

- Develop a specific bridge maintenance and replacement program based on the approved local funding (consider a separate list for FDOT funding)

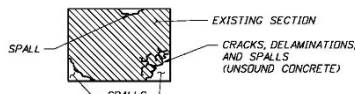


# Typical Bridge Maintenance Repairs

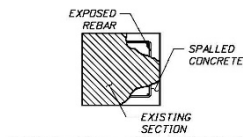
## Concrete patching repairs



**CONCRETE SPALL REPAIR DETAIL**  
APPLICABLE TO HORIZONTAL, VERTICAL, AND OVERHEAD LOCATIONS



**TYPICAL DELAMINATIONS AND SPALLS**



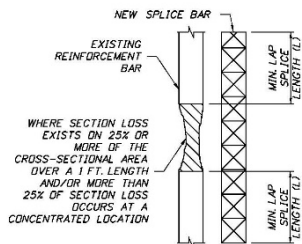
**TYPICAL SPALL WITH EXPOSED REBARS**

REBAR SIZE	LAP SPlice LENGTH
3	12 INCHES
4	16 INCHES
5	20 INCHES
6	24 INCHES
7	33 INCHES
8	43 INCHES
9	54 INCHES
10	68 INCHES
11	84 INCHES

**MIN. SPlice LENGTHS (L)**

### SIMPLE PATCH CONFIGURATION

AT CORNER LOCATIONS PROVIDE RIGHT ANGLE CUTS. PATCH CONFIGURATIONS SHALL BE KEPT AS SIMPLE AS POSSIBLE. INDIVIDUAL REPAIR AREAS WITHIN 2 FEET SHALL BE JOINED AT THE DIRECTION OF THE ENGINEER.



**LAP LENGTH DETAIL**

### EXPOSED REINFORCING STEEL NOTES

1. REMOVE RUST FROM EXPOSED REINFORCING STEEL BY ABRADING TO "WHITE METAL CONDITION" AND PREPARE SURFACES IN ACCORDANCE WITH ICRI TECHNICAL GUIDE 03730 "GUIDE FOR SURFACE PREPARATION" OF DETERIORATED CONCRETE RESULTING FROM REINFORCING STEEL CORROSION.
2. WHERE EXISTING REINFORCING STEEL HAS GREATER THAN 25% LOSS IN CROSS-SECTIONAL AREA DUE TO CORROSIVE DETERIORATION OR DAMAGE, SUPPLEMENT REINFORCING WITH ADDITIONAL REINFORCING AS SHOWN IN THE LAP LENGTH DETAIL, AND MIN. SPlice LENGTHS.

### CONCRETE REMOVAL AND SURFACE PREPARATION NOTES

1. REMOVE ALL UNSOUND CONCRETE AND PREPARE SURFACES FOR REPAIR IN ACCORDANCE WITH ICRI TECHNICAL GUIDELINES 03730 "GUIDE FOR SURFACE PREPARATION" OF DETERIORATED CONCRETE RESULTING FROM REINFORCING STEEL CORROSION.
2. ALL REPAIR AREAS SHALL HAVE SQUARE EDGES AROUND THE PERIMETER OF THE SPALL DEFINED BY 1/4" DEEP SAW CUT LINES. CHIP THE REPAIR EDGES CLEAN TO FORM 45 TO 90 DEGREE CORNERS ALONG THE EDGES AND CORNERS OF THE REPAIR AREA THE DEPTH OF THE CHIPPED EDGE SHALL BE 1/4" OR GREATER. FEATHERED EDGES WILL NOT BE ACCEPTABLE.
3. REMOVE UNSOUND CONCRETE USING MECHANICAL ABRASION, BUT DO NOT USE EXCESSIVE FORCE, WHICH MAY CAUSE MICRO-FRACTURING OF THE SOUND CONCRETE. REMOVE CONCRETE BEHIND BARS TO 1/4" MINIMUM. PHASED REPAIRS MAY BE NECESSARY.
4. CARE SHALL BE TAKEN TO AVOID DAMAGING THE EXISTING REINFORCEMENT.
5. PREPARED SURFACES SHALL BE INTENTIONALLY ROUGHENED TO A MINIMUM PROFILE OF 1/4" TO PROVIDE MECHANICAL LOCK FOR THE REPAIR.
6. CONCRETE SURFACES SHALL BE STRUCTURALLY SOUND AND FREE OF BOND INHIBITING SURFACES.
7. WHERE THE BOND BETWEEN EXISTING CONCRETE AND REINFORCEMENT HAS BEEN DESTROYED OR WHERE MORE THAN HALF THE DIAMETER OF THE BAR IS EXPOSED TO A DEPTH THAT WILL PERMIT THE CONCRETE MORTAR TO BOND TO THE ENTIRE PERIPHERY OF THE BAR, PROVIDE A MINIMUM DEPTH BEHIND THE REINFORCEMENT OF 1/4" FOR THIS PURPOSE.
8. APPLY A TYPE A EPOXY COMPOUND IN ACCORDANCE WITH SECTION 926 OF THE SPECIFICATION TO THE EXISTING CONCRETE SURFACES PRIOR TO PLACING THE FRESH REPAIR MATERIAL.

### CONCRETE SPALL REPAIR NOTES

1. RESTORE CONCRETE SURFACES USING APPROVED MATERIALS IN ACCORDANCE WITH SECTION 926 OR SECTION 930 OF THE SPECIFICATIONS.
2. FOR SPALLS WITH AN AVERAGE DEPTH OF 1" OR LESS, REPAIR USING A TYPE F-1 OR TYPE F-2 EPOXY REPAIR MORTAR, FOR SPALLS WITH AN AVERAGE DEPTH GREATER THAN 1", REPAIR USING A RAPID HARDENING CONCRETE MORTAR.
3. SELECT MATERIALS SUITABLE FOR APPLICATION INCLUDING ORIENTATION (I.E.G. HORIZONTAL, VERTICAL OR OVERHEAD APPLICATION) AND THICKNESS.
4. MIX, PLACE AND CURE REPAIR MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.
5. FINISH REPAIR MATERIALS FLUSH WITH THE ORIGINAL CONCRETE SURFACE (U.N.D.). THE SURFACE FINISH SHALL MEET THE REQUIREMENTS FOR A GENERAL SURFACE FINISH PER SECTION 400 OF THE SPECIFICATIONS.
6. COMPLETION OF CLEANING OPERATIONS AND REPAIR SHALL OCCUR WITHIN THE SAME DAY AND SHALL NOT EXCEED THE BONDING AGENT WINDOW OF APPLICATION.
7. THE CONTRACTOR SHALL SAW-CUT 1" AT THE AREA OF THE DAMAGED CONCRETE. THE CONCRETE SHALL BE REMOVED FROM 1/4" TO 1" DEPTH BEHIND THE REINFORCING BAR BY MECHANICAL MEANS. THE CONTRACTOR SHALL NOT DAMAGE THE EXISTING REINFORCING.

### GENERAL NOTE:

DEFICIENCIES SHOWN ARE FOR ILLUSTRATION ONLY. ALL DIMENSIONS ARE APPROXIMATE. IN THE PRESENCE OF THE ENGINEER, THE CONTRACTOR SHALL CLEARLY OUTLINE ALL AREAS IN NEED OF REPAIR WITH AN APPROVED PAINT OR MARKER PRIOR TO DEMOLITION. NO DEMOLITION OF ANY AREA OR MEMBER OF THE BRIDGE SHALL BE PERFORMED UNTIL THE CONTRACTOR RECEIVES APPROVAL FROM THE ENGINEER. INFORM THE ENGINEER IF A REMOVAL AREA EXCEEDS HALF THE THICKNESS OF THE SECTION.

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

REVISIONS				STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION				STANDARD CONCRETE SPALL REPAIR DETAILS	SHEET NO.
DATE	DESCRIPTION	DATE	DESCRIPTION	ROAD NO.	COUNTY	FINANCIAL PROJECT ID			
				--	COLLIER	--			--

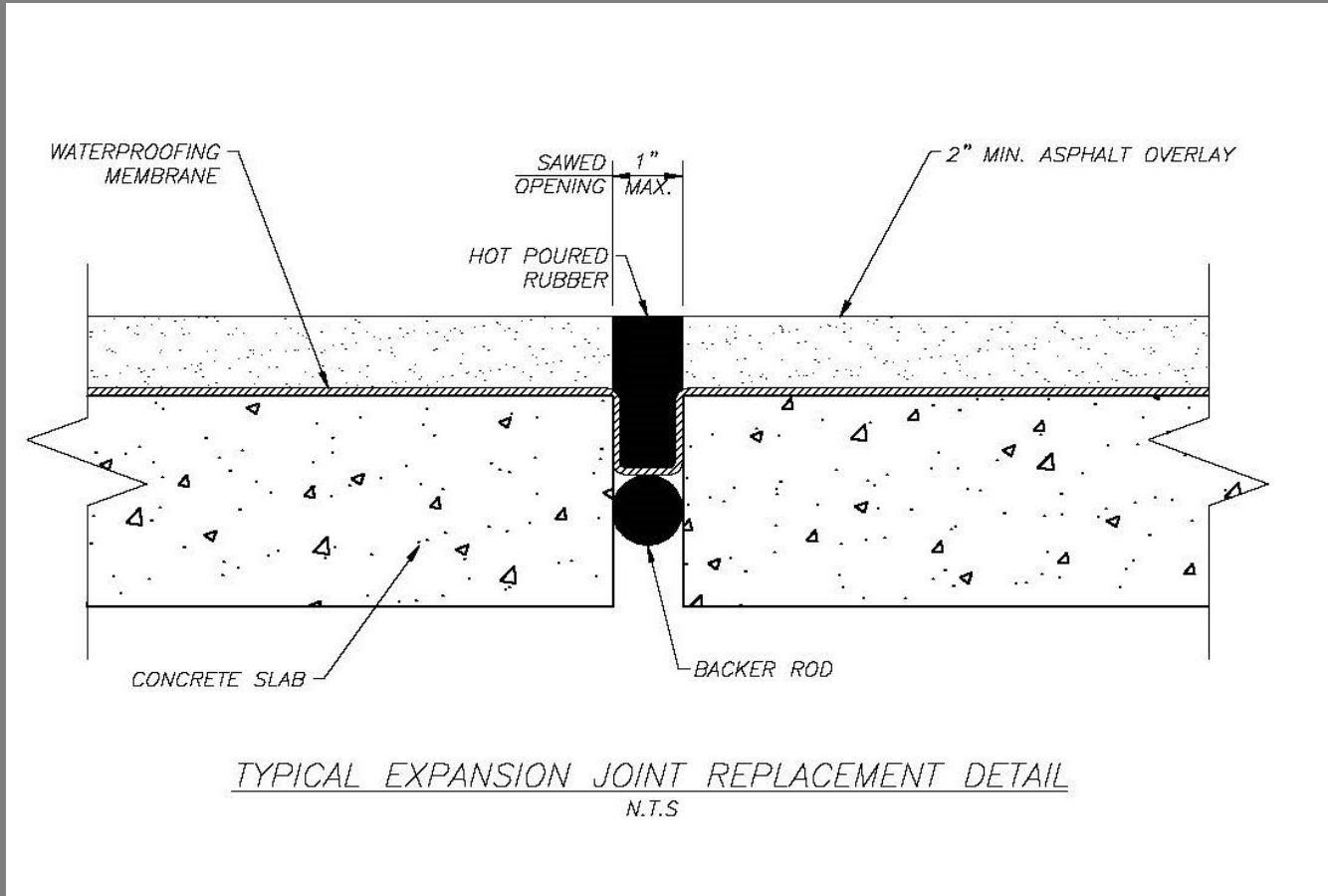
# Typical Bridge Maintenance Repairs

- Concrete patching repairs



# Typical Bridge Maintenance Repairs

- Expansion joint replacement



# Typical Bridge Maintenance Repairs

- Expansion joint replacement



# Typical Bridge Maintenance Repairs

- Wearing surface repairs
  - Concrete overlay



# Typical Bridge Maintenance Repairs

- Asphalt with waterproofing membrane



# Typical Bridge Maintenance Repairs

- Structural and non-structural cathodic protection pile jackets



# Typical Bridge Maintenance Repairs

- Bridge railing replacements



# Typical Bridge Maintenance Repairs

- Bridge railing replacements



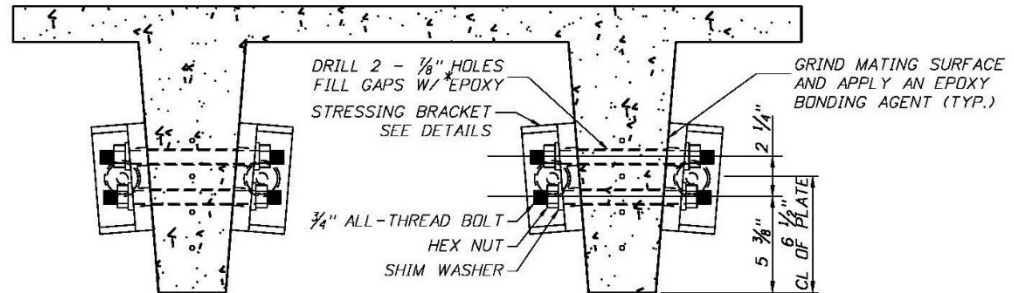
# Typical Bridge Maintenance Repairs

- Beam strengthening



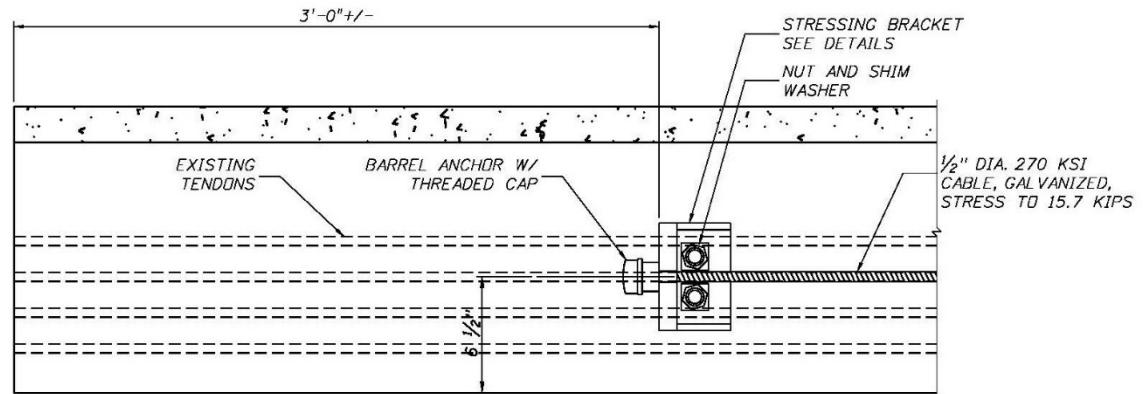
# Typical Bridge Maintenance Repairs

- Beam strengthening



\*ADHESIVE BONDING SYSTEM FOR STRUCTURAL  
APPLICATIONS PER SECTION 937 - TYPE HV.

DETAIL A - STRESSING BRACKET END VIEW  
(CORROSION PROTECTION NOT SHOWN FOR CLARITY)



DETAIL B - STRESSING BRACKET SIDE VIEW

# Typical Bridge Maintenance Repairs

- Beam strengthening



# Typical Bridge Maintenance Repairs

- Maintenance, cleaning and painting



# Typical Bridge Maintenance Repairs

- Maintenance, cleaning and painting



# Typical Bridge Maintenance Repairs

- Maintenance, cleaning and painting



# Typical Bridge Maintenance Repairs

- Rip rap repairs



# Typical Bridge Maintenance Repairs

- Rip rap repairs



# Typical Bridge Maintenance Repairs

- Rip rap repairs



# Flood Emergency Training

- **Bridge Structure Flood Emergency Training**
  - Municipal Flood Warning Action Plans
  - Emergency Response Considerations
  - Bridge Scour Basics
  - Bridge Types, Components and Detail
  - Bridge Flood Warning Report – sample report provided
  - Inspections performed by Public Works staff

# Flood Emergency Training



# Flood Emergency Training



# Flood Emergency Training





**BRIDGING  
SOLUTIONS**

# QUESTIONS???