I-70 Overpass Beam Failure
Lakeview Drive Bridge

Washington County, PA

NHI Real Solutions Seminar ***July 2008***

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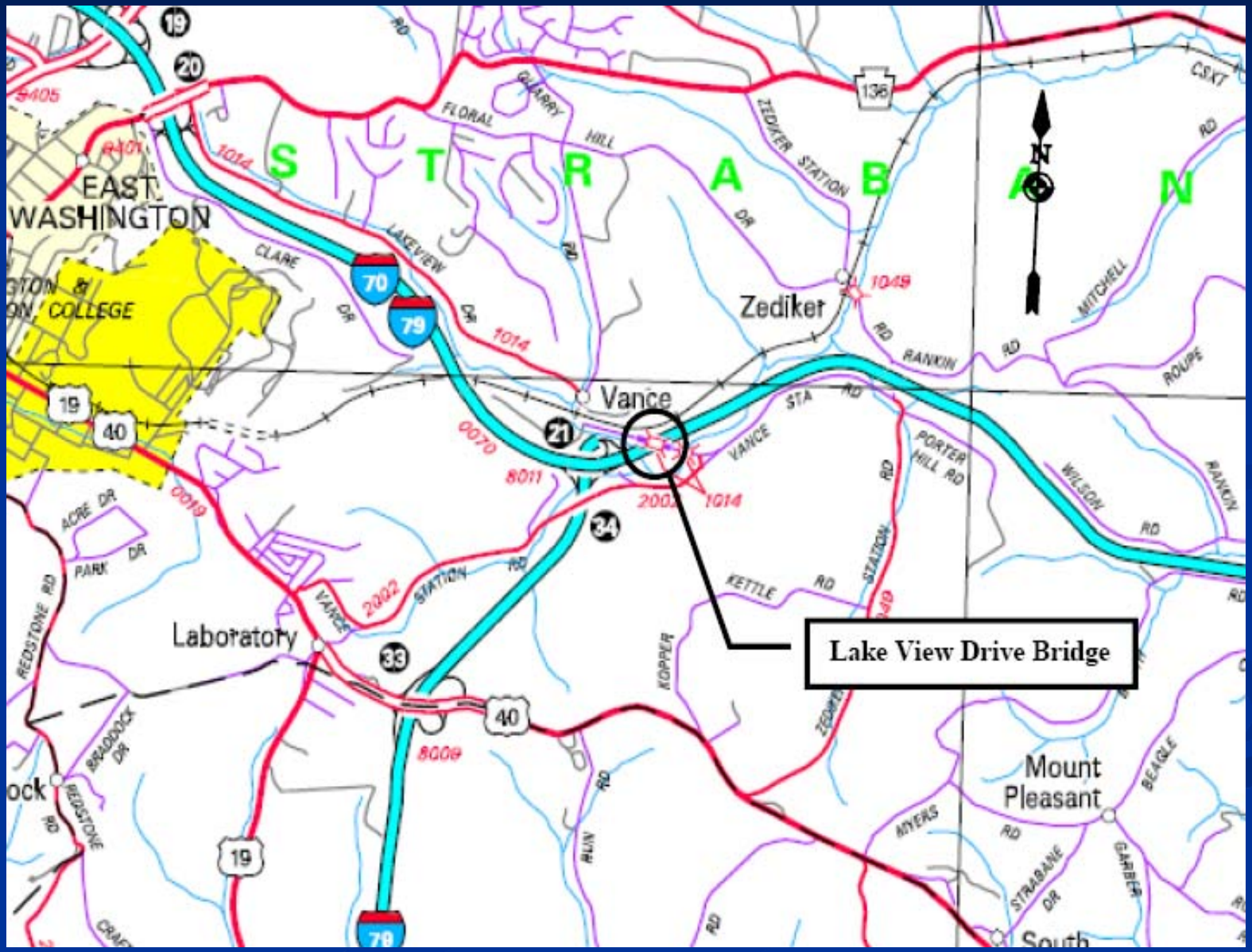
PENNDOT
Pennsylvania
Department of
Transportation

Learning Outcome

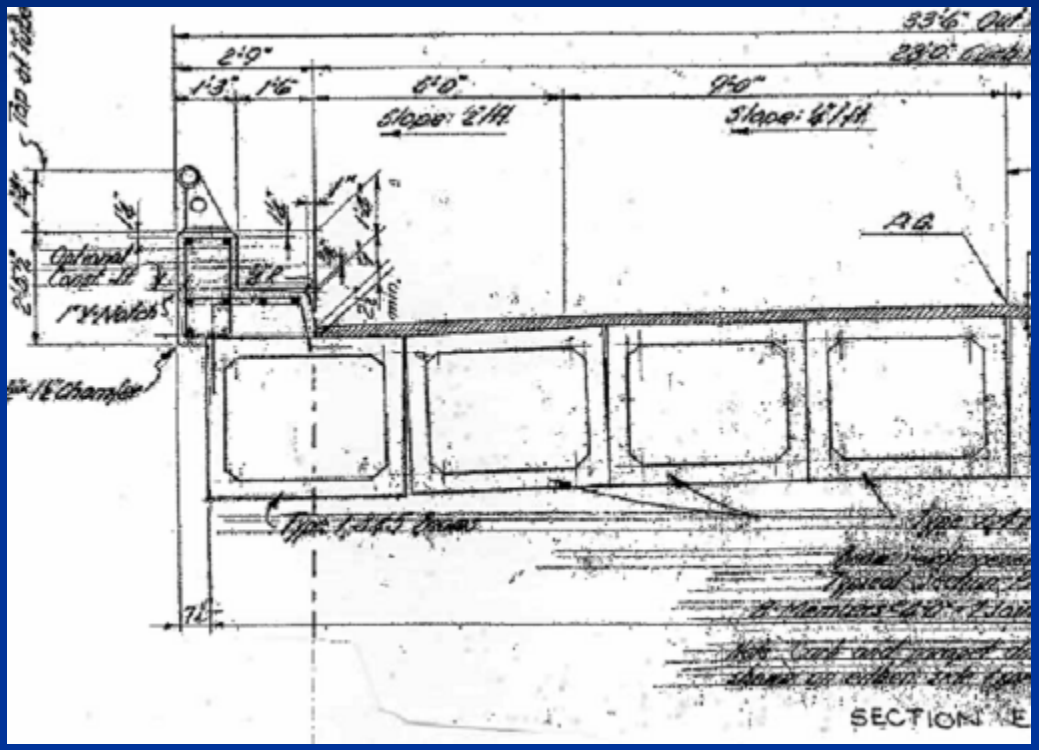
A. Assign an NBI rating to a prestressed, adjacent non-composite box beam superstructure using new rating guidelines

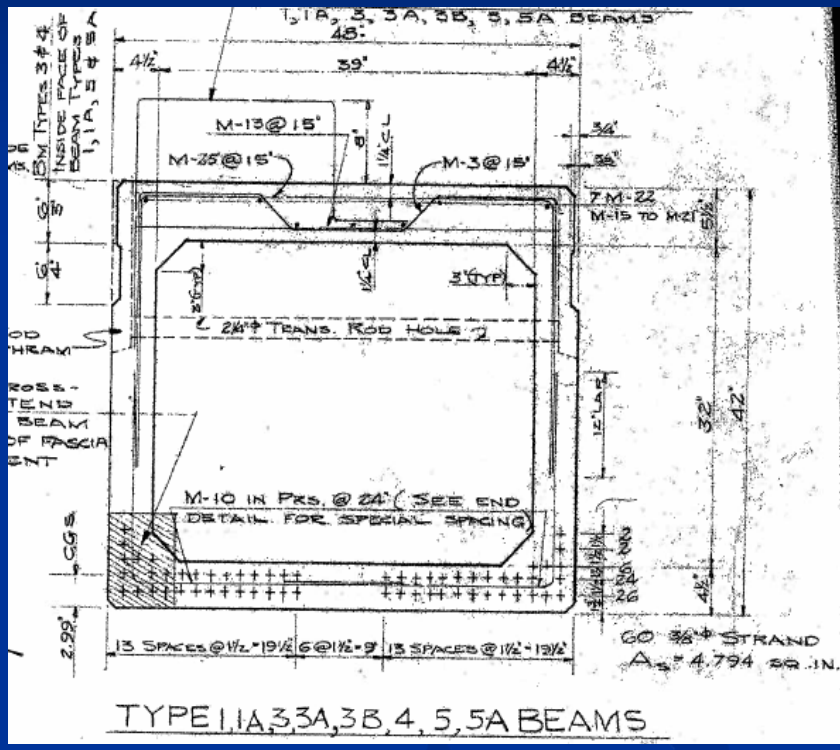
Rating Guidelines

Location Map



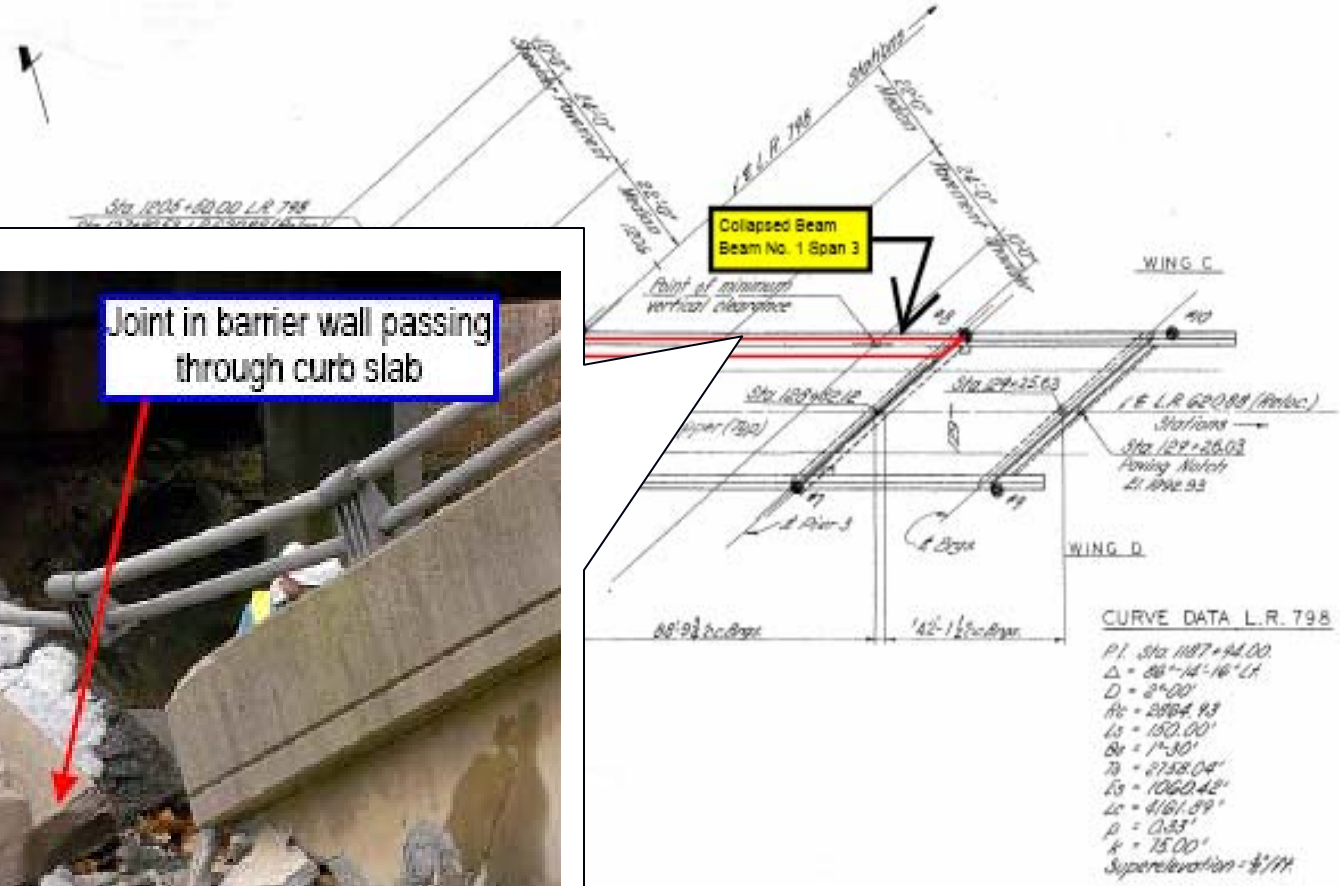
Bridge Cross Section





Non-composite

Bridge Plan View




ARMLIFT

Forensic Inspection and Evaluation

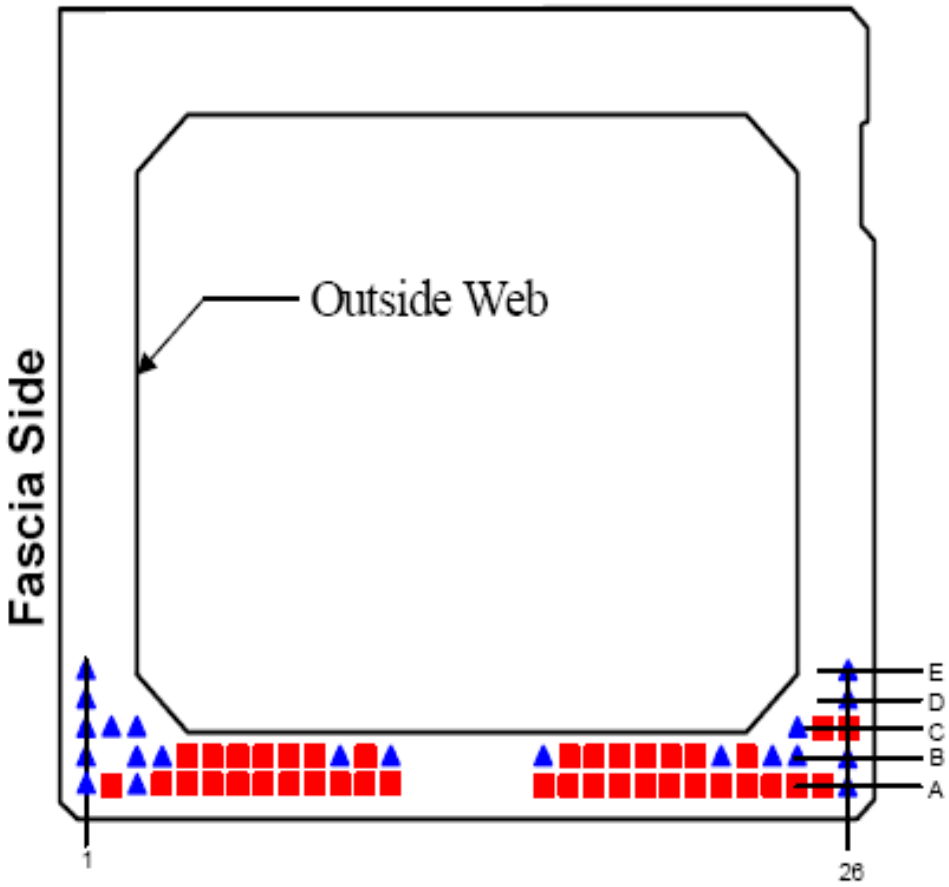
Field Inspection and Forensic Investigation
of the
SR 1014 Lake View Drive Bridge
over
Interstate 70

Final Report

Prepared By:
Baker
Michael Baker Jr. Inc.

- Re-opening I-70 WB
- Safety of other similar bridges in PA

Forensic Evaluation of Materials



More Evaluation and Testing

ATLSS

LEHIGH UNIVERSITY

PENNDOT Project 3900023623

Forensic Evaluation of Prestressed Box Beams from the Lake View Drive over I-70 Bridge

DRAFT REPORT

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August 2006

ATLSS REPORT NO. 06-13

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PENNDOT

PITT Report CEIST-33
FHWA-PA-2006-008-EMG001

Submitted to Pennsylvania Department of Transportation

Full-scale Testing Program on De-commissioned Girders from the Lake View Drive Bridge

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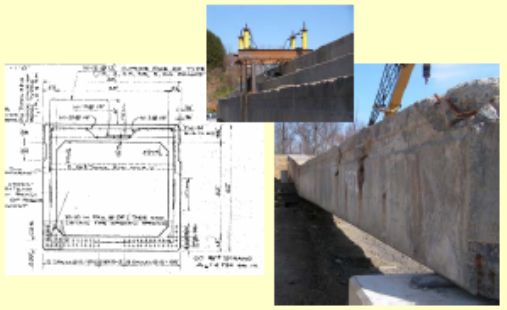
August 2006



school of engineering
civil and environmental engineering
structural engineering and mechanics

Material Properties

Tested concrete and prestressing strands met the design criteria

Concrete Strength f'_c

Design:
5900 psi

Measured:
6200 psi min
8400 psi max

Strand Strength F_y

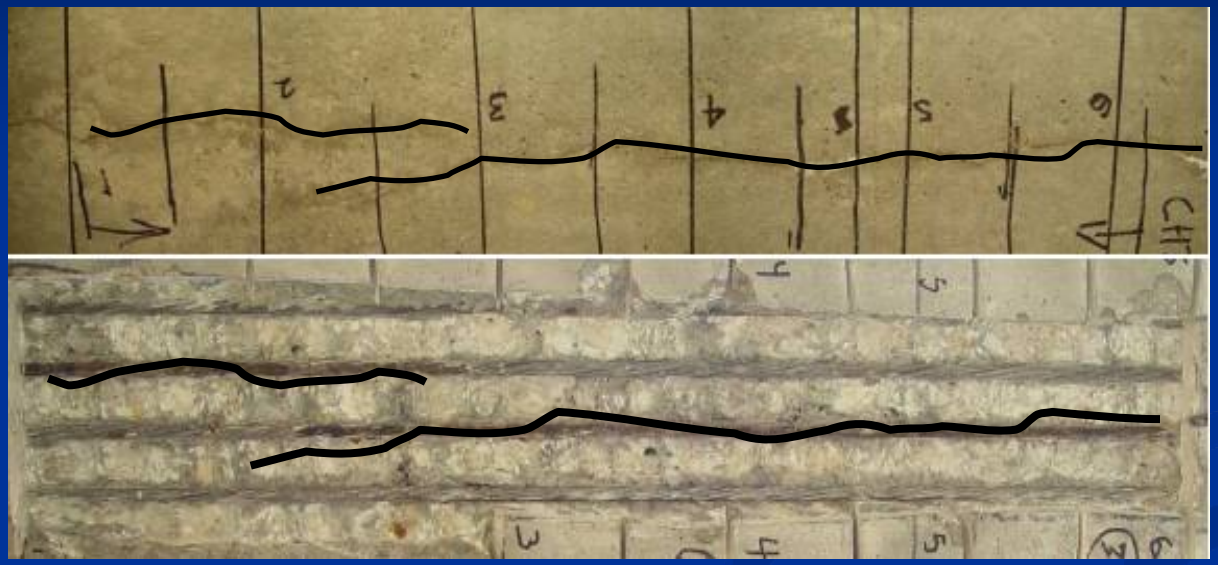
Design:
250 ksi

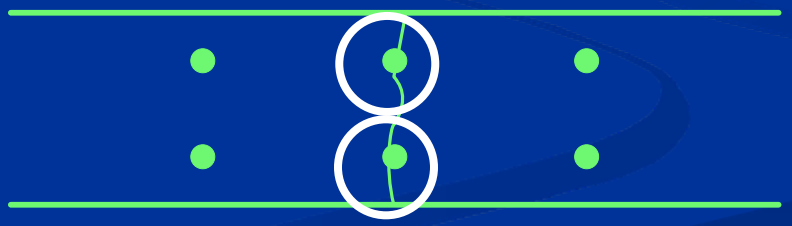
Measured:
276.6 ksi

Unforeseen Fabrication Problems

- Bottom flange thickness
- Bottom concrete cover
- Wall thickness
- Lateral post-tensioning tie rods and shear keys
- Vent holes and drain holes
- Prestress Loss

Correlation of Surface and Strand Conditions

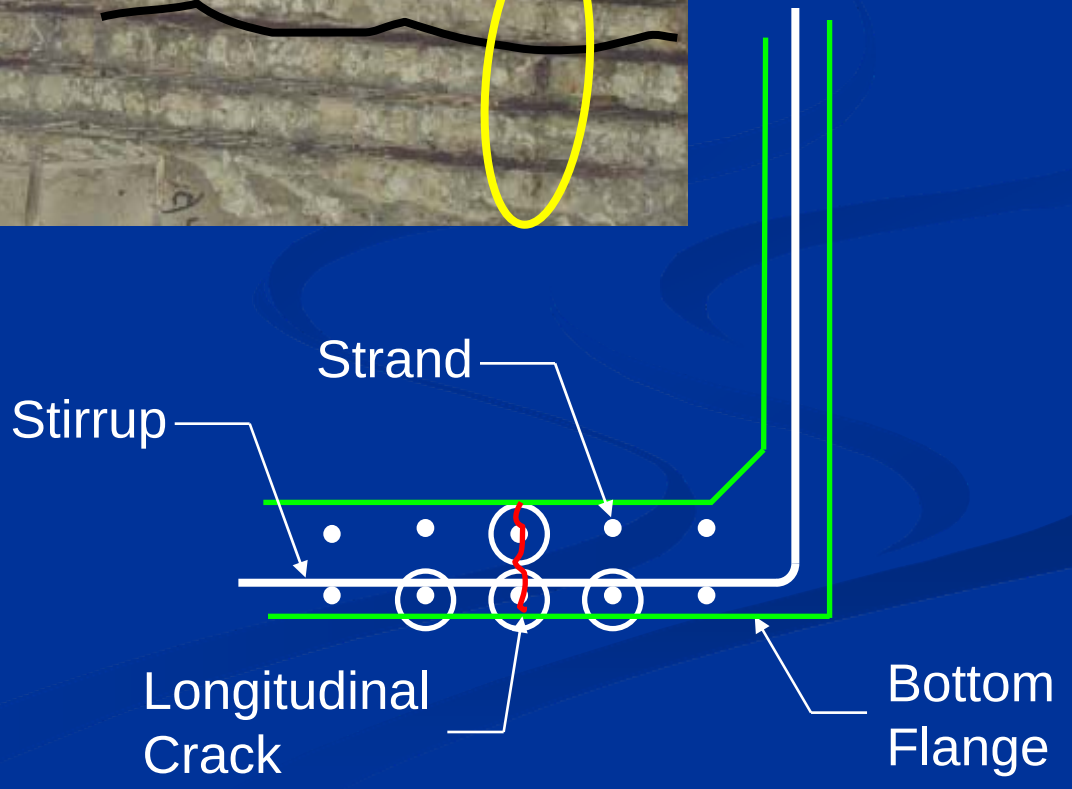




Bottom Flange

Longitudinal Crack

Correlation of Surface and Strand Conditions (continued)



Key Inspection Requirements

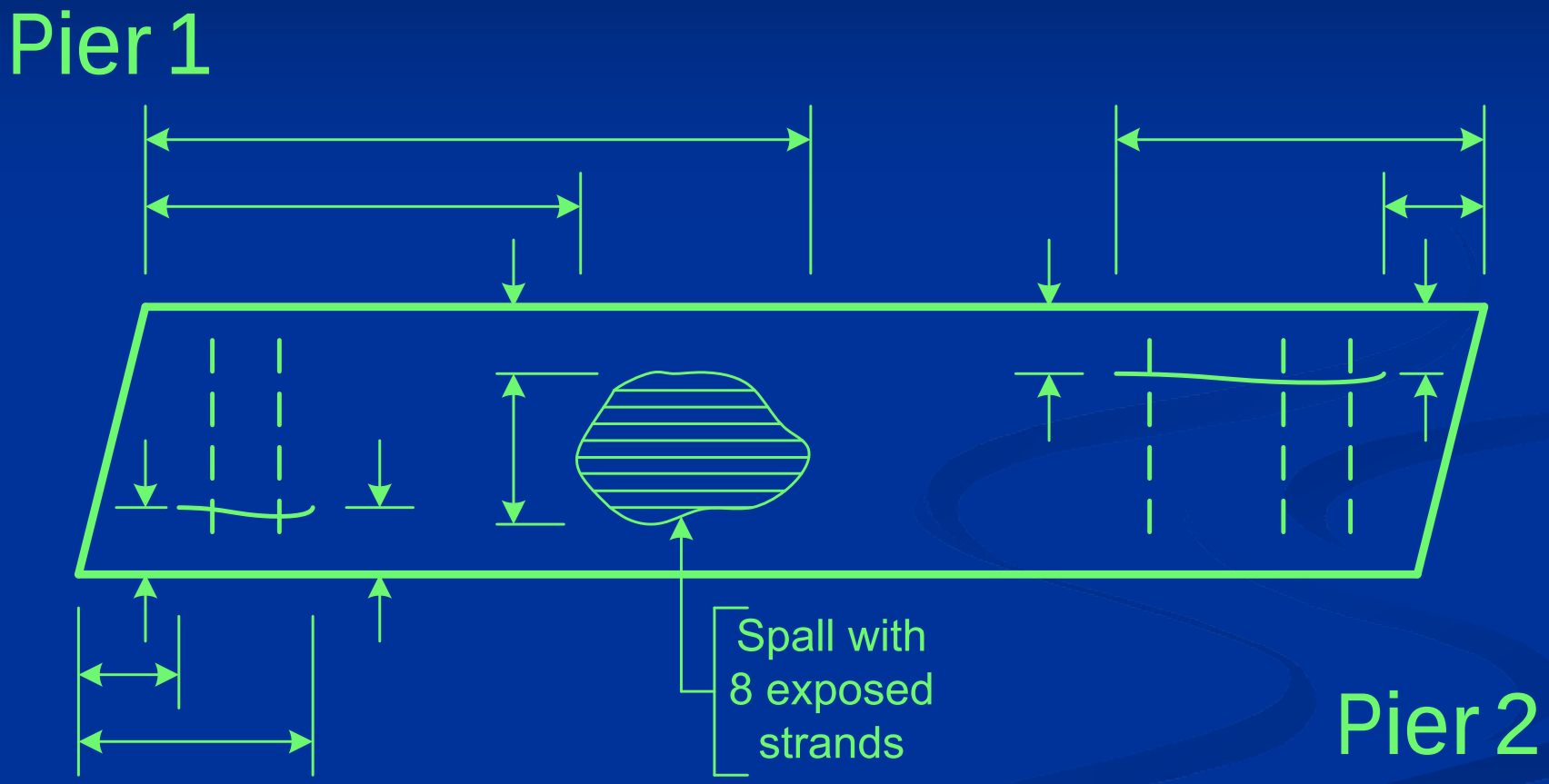
1. Document exposed strands
2. Document cracking patterns
3. Define strand corrosion
4. Measure camber
5. Investigate Independent Beam Action
6. Evaluate barrier and barrier connection
7. Clear clogged drain holes

1. Document Exposed Strands

Collision Damage

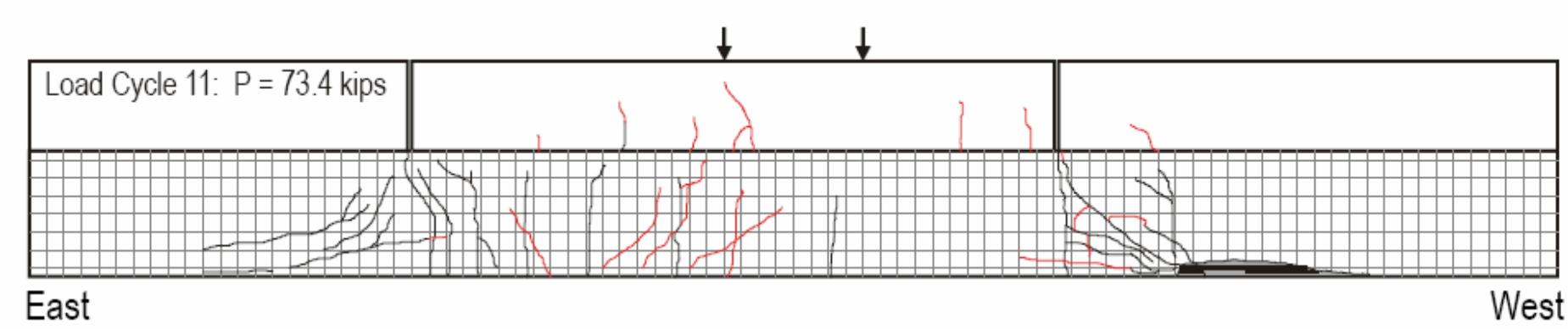
Corrosion Damage

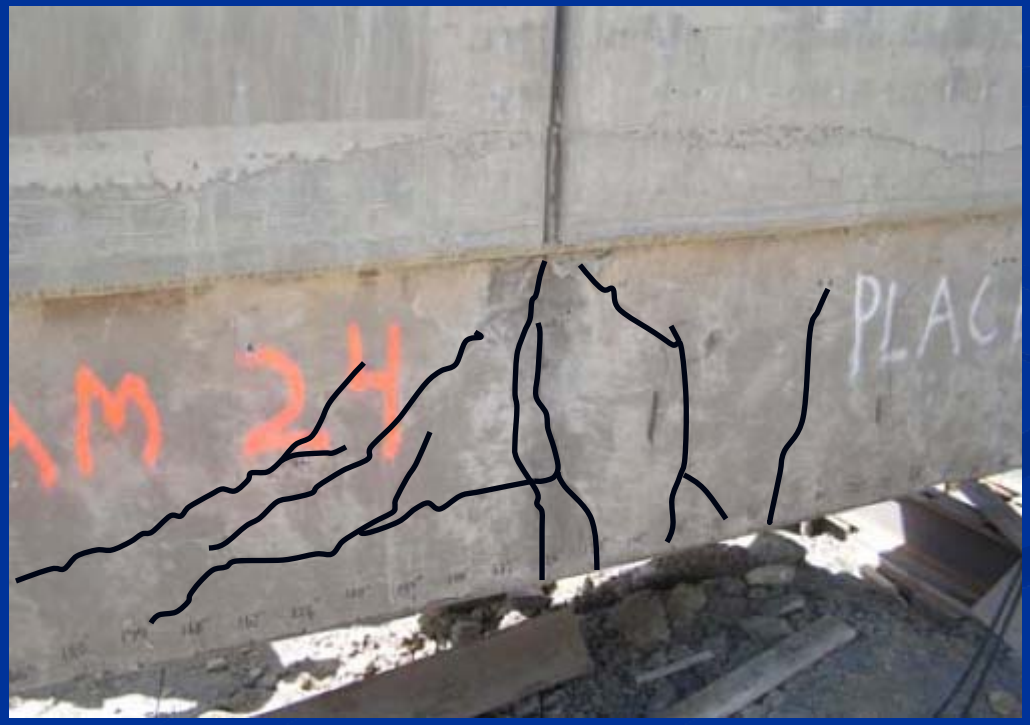
2. Document Cracking Patterns



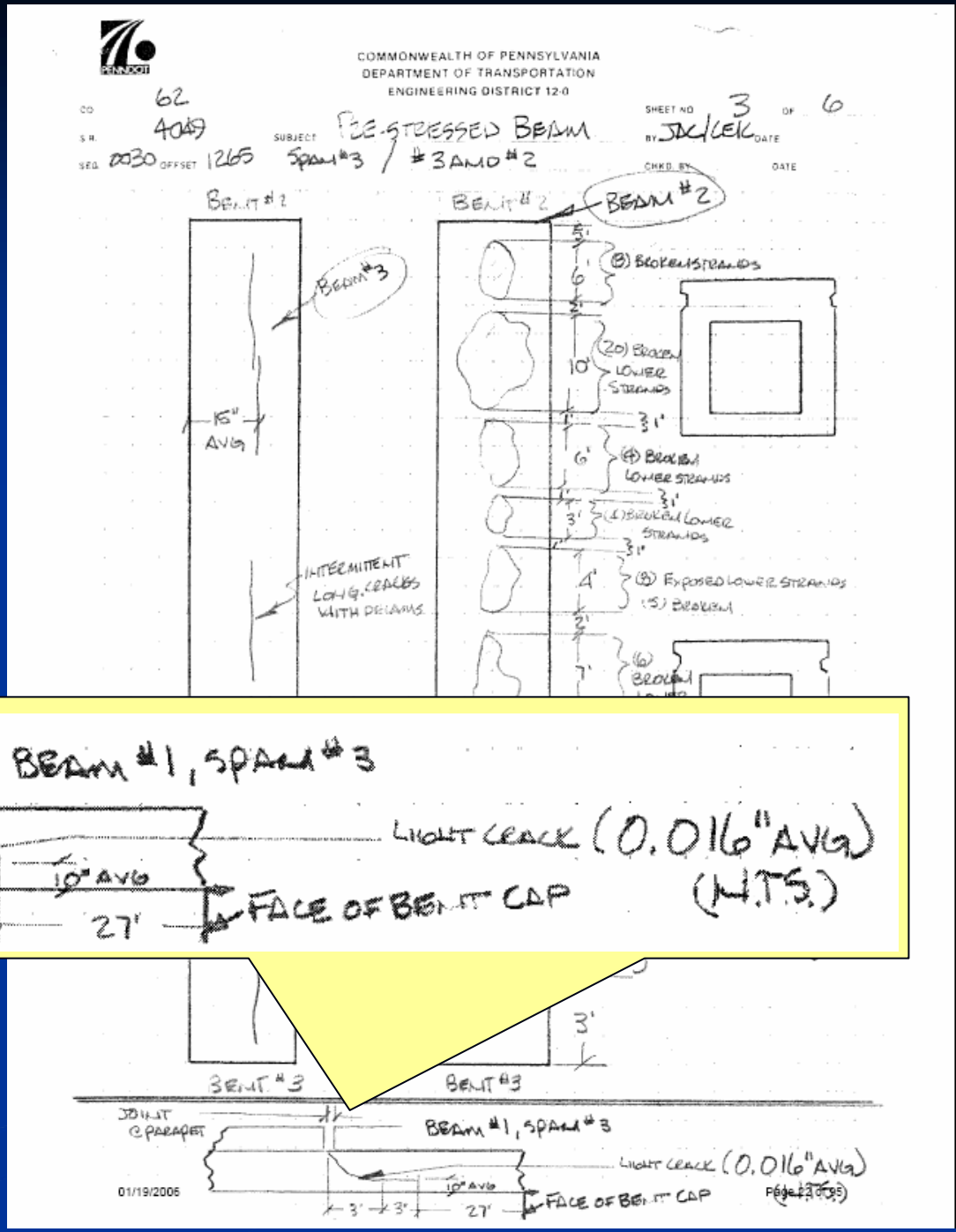
Span 1, Beam 6

Cracking Near Barrier Joints

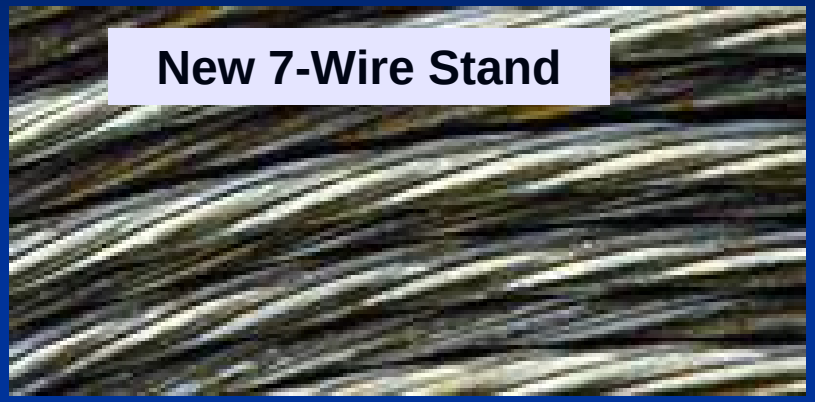


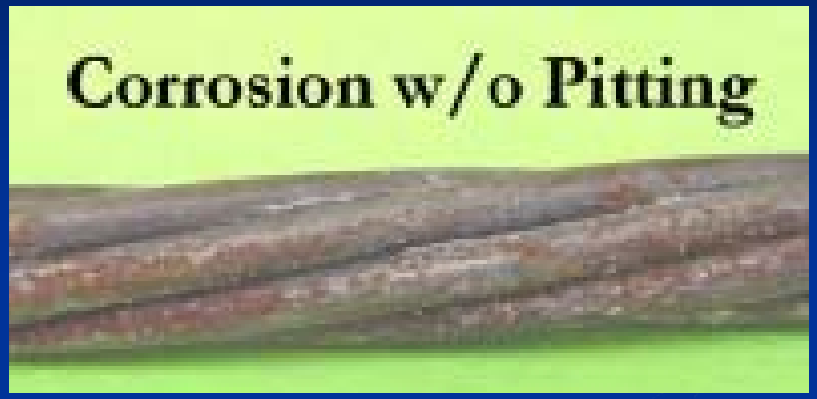


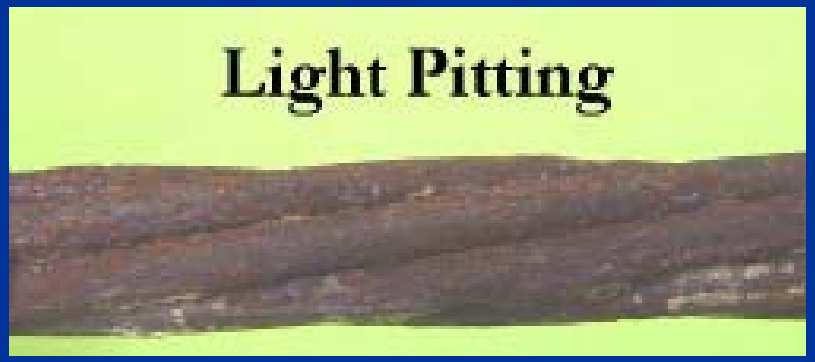
Cracking Near Barrier Joints



3. Define Strand Corrosion

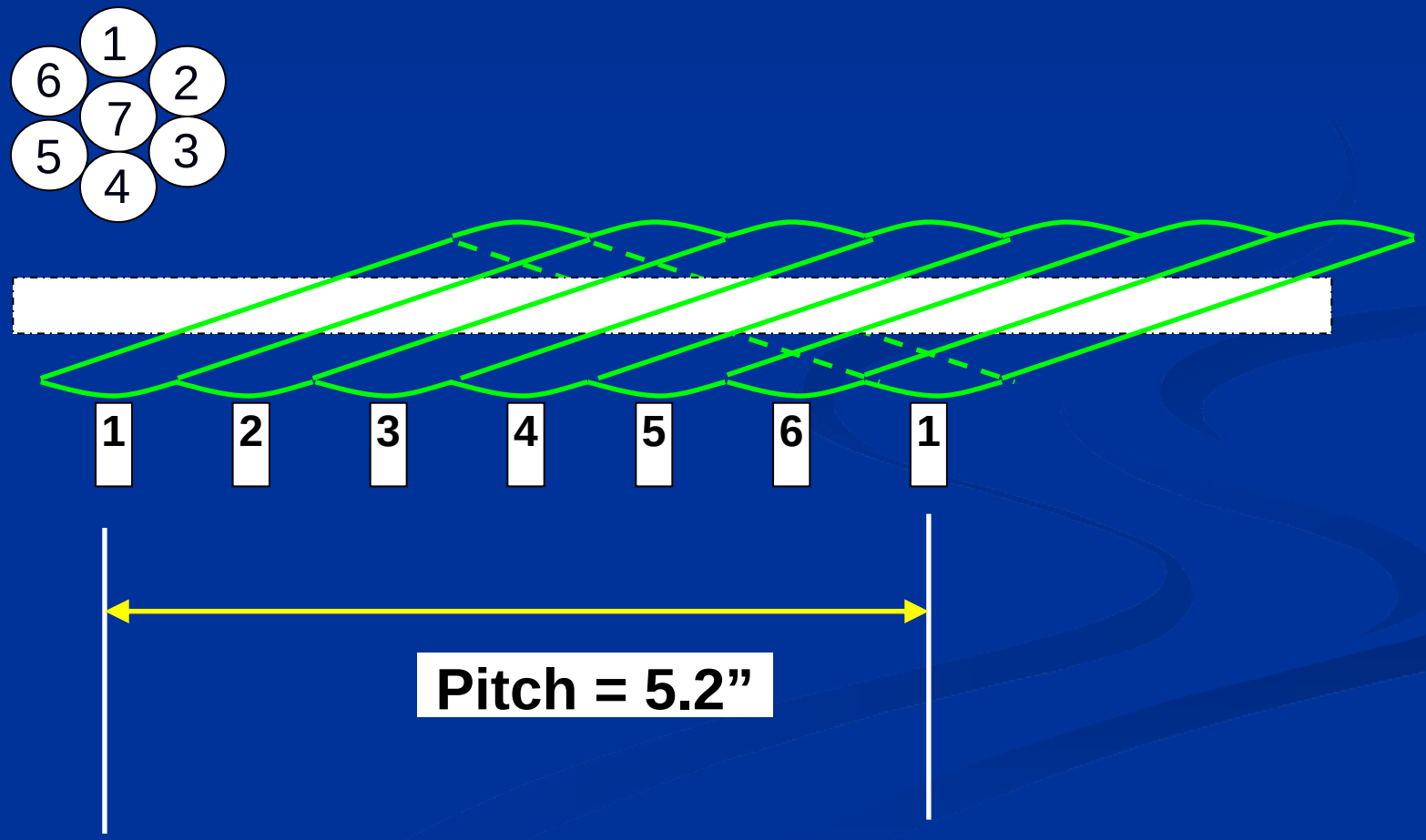




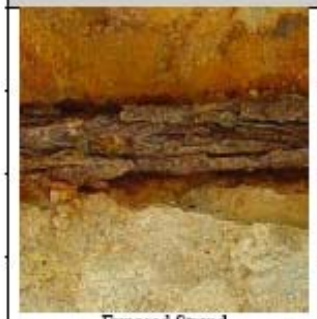


Strand Pitch

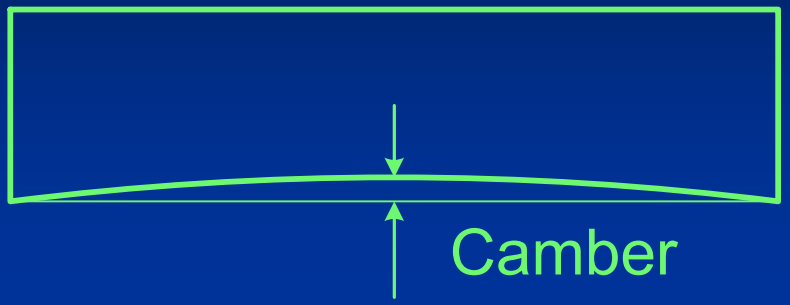
7-wire Strand cross-section



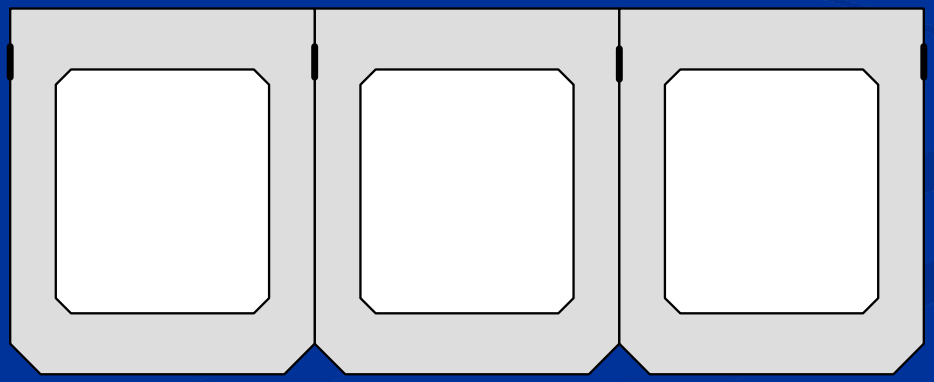
Corrosion Evaluation "Hand Out"

External Surface Condition	Strand Condition (In-situ)	Strand Condition (Removed)	Region Shown	Wire Condition	Average Condition
 Exposed Strand			5A between section 6 & 7 Strand D	Missing 3	# samples 9
				w/ Corrosion 4	w/ Corrosion 4
				Pitted -	Pitted -
				Heavily Pitted 4	Heavily Pitted 2.2
 Heavy Efflorescence w/ Rust			3B between section 1 & 2 Strand E	Missing 0	# samples 1
				Corrosion 6	w/ Corrosion 6
				Pitted 0	Pitted 0
				Heavily Pitted 6	Heavily Pitted 6
 Heavy Efflorescence			3B between section 4 & 5 Strand E	Missing 0	# samples 1
				Corrosion 6	w/ Corrosion 6
				Pitted 0	Pitted 0
				Heavily Pitted 6	Heavily Pitted 6

4. Measure Camber



5. Investigate Independent Beam Action



6. Evaluate Barrier and Barrier Connection

7. Clear Clogged Drain Holes

Rev 02/06

NOTE: The following table supplements the Condition Rating Codes for prestessed concrete adjacent box beam superstructures (Item E18 only)

Superstructure Condition Rating Guidelines for Non-Composite Prestressed Concrete Adjacent Box Beams

Condition Rating	Percent # strands exposed (single beam)	Other Deterioration of P/S Concrete Beams	
9 - Excellent	0%		No cracks, stains or spalls
8 - Very Good	0%		No cracks, stains or spalls
7 - Good	0%		Map cracks and miscellaneous hairline cracks
3 - Serious	15-20%	Spalls	Spalls/delaminations, >25%
		Transverse cracks	Open flexure cracks in bot. Flange
		Web cracks	Vert. or diag. cracks in P/S beam near open jts. in barrier
		Camber	Sagging/Loss of camber
		Transverse Tendons	Broken or missing
5 - Fair		Spalls	Spalls/delaminations, <15%
		Transverse cracks	None
		Longitudinal cracks	Hairline longitudinal cracks in bottom flange
		Longitudinal Joints	Leakage at joints with light efflorescence
		Transverse Tendons	Broken or missing
2 - Critical	>20%	All	Any cond. worse than detailed above

The “Aftermath”

PennDOT’s State Owned Adjacent Box Beam Bridges

As of May 2006	Bridge Count	CLOSED	Load Posted	Restricted
Over Highways	20	3	0	0
Over Streams	778	1	11	15
Grand Totals	798	4	11	15

Participant Exercise

Prestressed Non-Composite Adjacent Box Beam Rating

NBI Rating

- There are delaminations and spalls throughout and several longitudinal cracks up to 1/8” wide. Beam 2 has 30% of its area spalled or delaminated and 7 out of 54 (13%) strands exposed.

Rating = 3, Serious

Rating Reasoning

SOL 431-06-03

Rating: 4

6-15%
Strands Exposed
(single beam)

Rating: 3

Spalls/Delaminations
>25%

Composite Prestressed Concrete Adjacent Box Beams

			Other Deterioration of P/S Concrete Beams
			No cracks, stains or spalls
			No cracks, stains or spalls
			Map cracks and miscellaneous hairline cracks
		Spalls	Minor spalls/delaminations, <5%
		Cr	
		S	
		nsve	
		gitud	
		ngitu	
		S	
		Transve	
		Longitud	
		Longitu	
		Transverse Tendons	vily rusted
		Web cracks	Initi rt. or diag. cracks in P/S beam near open jts. rrier (< 3" length)
3 - Serious	15-20%	Spalls	Spalls/delamin ations, >25%
		Transverse cracks	Open flexure cracks in bot. Flange
		Web cracks	Vert. or diag. cracks in P/S beam near open jts. in barrier
		Camber	Sagging/Loss of camber
		Transverse Tendons	Broken or missing
2 - Critical	>20%	All	Any cond. worse than detailed above




Learning Outcome

A. Assign a NBI rating to a prestressed, adjacent non-composite box beam superstructure using new rating guidelines

I-70 Overpass Beam Failure
Lakeview Drive Bridge

Washington County, PA

Any Questions

Thank You!!

Raymond A. Hartle, P.E.

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