



10 - Bridge Construction Concerns Substructure

PE/PS Workshop 2009

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Introduction

A bridge is made up of the following two components:

- Substructure
- Superstructure



Introduction (cont'd)

- SUBSTRUCTURE

- All of the components or elements of a bridge which support the superstructure.
 - Piling,
 - Footings,
 - Piers or Bents
 - Pile, Pier, or Bent Caps



Introduction (cont'd)

- SUPERSTRUCTURE

- The components of a bridge which support the deck or riding surface of the bridge as well as the loads applied to the deck.
 - Structural Members
 - Deck Slabs
 - Riding or Wearing Surface



Substructure

- Structure Excavation (*spec. 206*)
- Types:
 - Dry (spec. 206.04)
 - Wet (spec. 206.03)
 - Class X (spec. 206.02)
 - Unclassified (spec. 206.05)



Substructure (cont'd)

- Cofferdams (*spec. 206*)
 - Foundation Seal (*spec. 206.09*)
 - Lowering Footings
 - Limits of excavation
 - Dewatering
 - Cofferdam construction



Cofferdams



Substructure (cont'd)

- Foundation Types
 - Spread Footings (*spec. 206.08*)
 - Pile Foundations (*spec 701*)



Foundation Types

- Spread Footings
 - Test Borings
 - Soundings
 - Proof Testing of Rock



Foundation Types (cont'd)

- Piling Foundations

- Types of Piling

- H-pile (spec. 915.02)
 - Steel Pipe Piles (spec. 915.01)
 - Timber Piles (spec. 915.01(e) & 915.02(c))
 - Precast/Prestressed Concrete Piles
 - Sheet Piles



H-Piling



Piling

- Preliminary Work

- Field verify existing structures
- Analyze archived plans
- Look for notes on drawings/as-builts
- Look at soil borings to compare planned pile lengths estimated and soil material types



Piling (cont'd)

Preliminary Work (cont'd)

- Review pile load tables in contract to understand ton bearing requirements for project
- Review contract/project geotechnical report for results, findings, and recommendations



Piling (cont'd)

- Preliminary Work (cont'd)
 - Make sure that all falsework/shop drawings have been submitted and approved by a licensed engineer (Constr. Memo 09-01)
 - Check quantities that are planned for piling
 - Understand/recognize the types of piling to be driven and types of pile hammers used



Piling (cont'd)

- Preliminary Work (cont'd)
 - Make sure that the pile hammer information has been submitted and approved before starting the pile driving operation (spec 701.04(a))(Pile and Driving Equipment Data Form)(available on Department's website)



Pile Hammer Information



PILE AND DRIVING EQUIPMENT DATA FORM	
Des No.: _____	Structure Name and/or No.: _____
Contract No.: _____	Pile Driving Contractor or Subcontractor: _____
Project: _____	Piles driven by (Name): _____
County: _____	Values on this form are in: Imperial Metric units (circle one)
Hammer Components 	Hammer Manufacturer: _____ Model No.: _____ Hammer Type: _____ Serial No.: _____ Manufacturer's Maximum Rated Energy: _____ ft-lbs (Joules) Stroke at Maximum Rated Energy: _____ ft (meters) Range in Operating Energy: _____ to _____ ft-lbs (Joules) Range in Operating Stroke: _____ to _____ ft (meters) Ram Weight: _____ kips (kg) Modifications: _____ _____ _____
	Striker Plate Weight: _____ kips (N) Diameter: _____ in. (mm) Thickness: _____ in. (mm)
	Material #1 Material #2 (for composite cushion) Name: _____ Name: _____ Area: _____ in. ² (cm ²) Area: _____ in. ² (cm ²) Hammer Cushion Thickness/Plate: _____ in. (mm) Thickness/Plate: _____ in. (mm) No. of Plates: _____ No. of Plates: _____ Total Thickness of Hammer Cushion: _____ in. (mm)
	Helmet (Drive Head) Weight: _____ including inserts, kips (kN)
	Pile Cushion Pile Cushion Material: _____ Area: _____ in. ² (cm ²) Thickness/Sheet: _____ in. (mm) No. of Sheets: _____ Total Thickness of Pile Cushion: _____ in. (mm)
	Pile Pile Type: _____ Wall Thickness: _____ in. (mm) Taper: _____ Cross Sectional Area: _____ in. ² (cm ²) Weight/ft (m): _____ Ordered Length: _____ ft (m) Factored Design Soil Resistance, per pile: _____ tons (kN) Nominal Driving Resistance: _____ tons (kN) Driving Shoe/Closure Plate Description: _____ _____ _____
	Submitted By: _____ Date: _____ Telephone No.: _____ Fax No.: _____ Email Address: _____ INDOT PE/S: _____ Telephone No.: _____ Email Address: _____

Piling (cont'd)

- Preliminary Work (cont'd)
 - Review the 2008 Standard Specifications for information and pile driving preparation (spec 701;Driven Piling)
 - Make a pile driving calculation spreadsheet for the approved pile hammer being used (information taken from approved Pile and Driving Equipment Data Form)



Pile Driving Calc. Spreadsheet

INDIANA DEPARTMENT OF TRANSPORTATION - PILE DRIVING SPREAD SHEET

Column #1
 Ram Weight 2000 (lb)
 Energy @ stroke 12,000 (lb ft)

Column #2
 2000 (lb)
 20,000 (lb ft)

				R _u - corresponding to penetration/20 blows			
				DROP OR STROKE (H)			
PENTRATION LAST 20 BLOWS	PENTRATION LAST 20 BLOWS	N BLOWS PER FOOT	N BLOWS PER INCH OR 25mm	feet 6	meters 1.83	feet 10	meters 3.05
inches	mm	bpf		TONS	KN	TONS	KN
1.33	34	180	15.04	159	1412	219	1952
1.50	38	160	13.33	154	1367	213	1894
1.75	44	137	11.43	147	1310	205	1821
2.00	51	120	10.00	142	1261	197	1757
2.25	57	107	8.89	137	1217	191	1701
2.50	64	96	8.00	132	1178	185	1650
2.75	70	87	7.27	128	1143	180	1605
3.00	76	80	6.67	125	1110	176	1563
3.25	83	74	6.15	121	1081	171	1525
3.50	89	69	5.71	118	1053	167	1489
3.75	95	64	5.33	116	1028	164	1456
4.00	102	60	5.00	113	1004	160	1426
4.25	108	56	4.71	110	981	157	1397
4.50	114	53	4.44	108	960	154	1369
4.75	121	51	4.21	106	940	151	1343
5.00	127	48	4.00	104	921	148	1319
5.25	133	46	3.81	102	903	146	1296
5.50	140	44	3.64	100	886	143	1273
5.75	146	42	3.48	98	870	141	1252
6.00	152	40	3.33	96	854	138	1232
6.25	159	38	3.20	94	839	136	1212
6.50	165	37	3.08	93	824	134	1193
6.75	171	36	2.96	91	810	132	1175
7.00	178	34	2.86	90	797	130	1158



Piling (cont'd)

- Preliminary Work (cont'd)
 - Understand necessary paperwork that will need to be filled out for contract pile driving records (Form IC225)
 - Check all deliveries of piling for correct type, measurements, and manufacturers information (especially heat numbers)



Piling (cont'd)

- Foundation Piling
 - Types of piling used
 - Types of Pile Hammers (Spec. 701.04(b))
 - Gravity
 - Diesel
 - Hydraulic
 - Steam and Air
 - Vibratory



Diesel Pile Hammer



Pile Hammer Information



Piling (cont'd)

- Foundation Piling (cont'd)

- Pile Orientation

1. Battered (check w/ level & template)
2. Vertical (plumb) (check with level)

- Bearing and/or Refusal (Pile loads in Plans; Pile driving calculation sheet tables)(spec. 701.08)



Pile Orientation



Piling (cont'd)

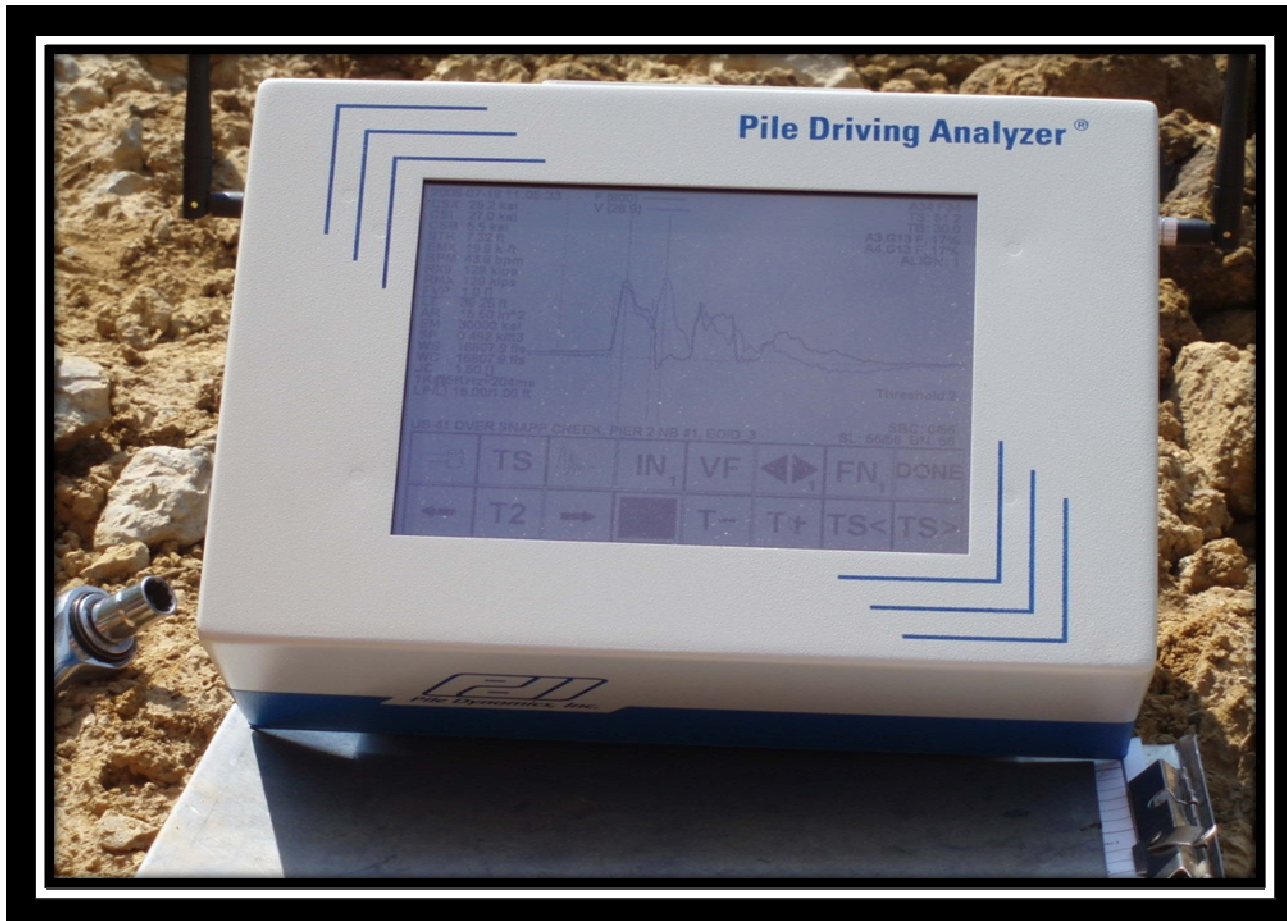
- Foundation Piling (cont'd)

- Testing Driven Piles (blow count versus pile capacity relationship)

1. Dynamic Pile Load Testing (spec. 701.06(c))
 1. Pile Driving Analysis Test
2. Static Load Testing (spec. 701.06(d))
 1. Pile Load Testing Types
 1. Lateral
 2. Tensile
 3. Compressive



Pile Driving Analyzer



Pile Driving Analyzer



Pile Driving Analyzer



Piling (cont'd)

- Foundation Piling (cont'd)

- Piles

- Marked at intervals of 1' from tip to butt end
 - Heat numbers marked at top and bottom of piles for recognition during driving
 - Splices and tips
 - H-Pile tips have specified weights for the size of pile being driven (spec 701.12)



Pile Markings



H-Pile Tip



Piling (cont'd)

- Foundation Piling (cont'd)
 - Goals to achieve
 - Bearing (minimum required)
 - Refusal
 - Pile tip elevation (minimum required)
 - Bearing and tip elevation
 - One continuous Operation (starting and stopping may distort results)



Piling (cont'd)

- Pile Driving Operation
 - After Excavation to planned bottom-of – footing
 - Dewater
 - Mark and layout locations of piles
 - Pile templates placed



Pile Layout Locations



Piling (cont'd)

- Pile Driving Operation (cont'd)

- Pile Driving

- Pile hammer needs to maintain consistent speeds (blow per minute rate) and energy output (ft-lbs/blow) during operation
 - Hammer has free-fall
 - Head of pile is not crushed or damaged (spec.701.10)
 - Penetration rate is at a uniform rate
 - No sensible bounce to pile after the blow (spec. 701.09(c))



Pile Driving



Piling (cont'd)

- Pile Driving Operation (cont'd)

- Pile Inspector's Duties

- Make sure that piles are being driven plumb or on specified batter, as planned
 - Record length of pile, type of pile, heat number, and location for each pile driven
 - See that contractor is taking sufficient readings on piles during driving operation
 - Observe and record penetration rate and counts per blow for each pile



Pile Driving



Pile Driving



Piling (cont'd)

- Pile Driving Operation (cont'd)
 - Pile Inspector's Duties (cont'd)
 - Pile cut-offs (spec. 701.13)
 - Record cut-off lengths, heat numbers, and locations, as the cut-offs may be re-used as splices
 - Splices (spec. 701.11)
 - Record information
 - See that welding is performed properly and by a certified welder



Pile Cut-Offs



Piling (cont'd)

- Pile Driving Operation
 - Pile Inspector's Duties (cont'd)
 - Make sure that heaved material between the piles has been removed and the planned bottom-of-footing elevation has been restored



Piling (cont'd)

- Pile Driving Operation (cont'd)
 - Pile Inspector's Duties (cont'd)
 - Record information on IC225 (Pile Driving Record)
 - Locations of piles
 - Lengths of piles
 - Heat Numbers
 - Types of piles
 - Measurements (lengths of pay, cut-offs, & splices)
 - Drawing on back of pile locations, as driven in field



Pile Driving Record (IC225)

INDIANA DEPARTMENT OF TRANSPORTATION
PILE DRIVING RECORD

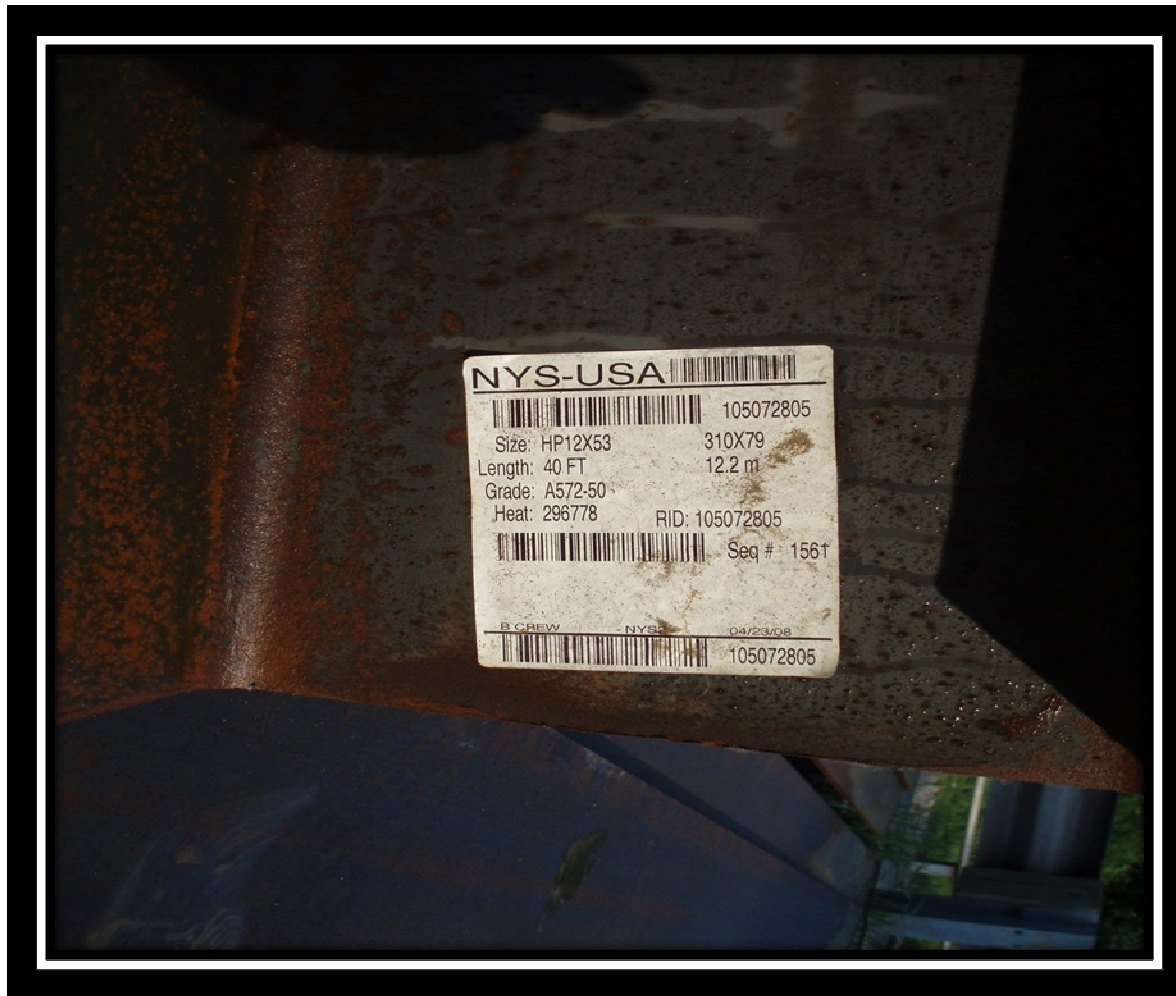
CONTRACT NO.: _____ DATE: _____
 JOB LOCATION: _____
 PILE TYPE: _____ LENGTH: _____ BENT/PIER NO.: _____ PILE NO.: _____
 HAMMER: _____ ENERGY/BLOW: _____ OPERATING RATE: _____
 TOTAL LENGTH IN LEADS: _____ LENGTH CUTOFF: _____ PILE CUTOFF ELEV.: _____
 DESIGN NO.: _____ DESIGN BREAKING: _____ SAFETY FACTOR: _____
 WEATHER: _____ TEMP.: _____ START TIME: _____ STOP TIME: _____

FEET	TOTAL PEN. IN 20 BLOWS	TONS	REMARKS	FEET	TOTAL PEN. IN 20 BLOWS	TONS	REMARKS
0.0 - 1.0				32.0 - 33.0			
1.0 - 2.0				33.0 - 34.0			
2.0 - 3.0				34.0 - 35.0			
3.0 - 4.0				35.0 - 36.0			
4.0 - 5.0				36.0 - 37.0			
5.0 - 6.0				37.0 - 38.0			
6.0 - 7.0				38.0 - 39.0			
7.0 - 8.0				39.0 - 40.0			
8.0 - 9.0				40.0 - 41.0			
9.0 - 10.0				41.0 - 42.0			
10.0 - 11.0				42.0 - 43.0			
11.0 - 12.0				43.0 - 44.0			
12.0 - 13.0				44.0 - 45.0			
13.0 - 14.0				45.0 - 46.0			
14.0 - 15.0				46.0 - 47.0			
15.0 - 16.0				47.0 - 48.0			
16.0 - 17.0				48.0 - 49.0			
17.0 - 18.0				49.0 - 50.0			
18.0 - 19.0				50.0 - 51.0			
19.0 - 20.0				51.0 - 52.0			
20.0 - 21.0				52.0 - 53.0			
21.0 - 22.0				53.0 - 54.0			
22.0 - 23.0				54.0 - 55.0			
23.0 - 24.0				55.0 - 56.0			
24.0 - 25.0				56.0 - 57.0			
25.0 - 26.0				57.0 - 58.0			
26.0 - 27.0				58.0 - 59.0			
27.0 - 28.0				59.0 - 60.0			
28.0 - 29.0				60.0 - 61.0			
29.0 - 30.0				61.0 - 62.0			
30.0 - 31.0				62.0 - 63.0			
31.0 - 32.0				63.0 - 64.0			

PILE INFORMATION: _____ TOTALS: _____
 MIN. PILE TIP ELEV.: _____ TOTALS TO DATE: _____
 MANUFACTURER'S HEAT NO.: _____ BEARING REQUIRED (ULT. LOAD): _____
 PILE TOE ATTACHMENTS: _____ SIGNATURE: _____



Pile Information



Foundation Construction

- Footings

- Formwork (spec. 702.13)

- Measured for correct dimensions and proper layout location, as specified in plans

- Re-steel (spec. 703)

- Check for correct type, size, and lengths
 - Check for correct placement and proper tying of bars



Footing



Foundation (cont'd)

- Footings (cont'd)
 - Concrete Pour (spec. 702)
 - See that approved mix design and correct mix type is used
 - Perform concrete tests, as required
 - See that proper concrete equipment is used
 - See that proper pour rates are met
 - See that proper curing procedures are performed and met



References

- Manual of Steel Construction
 - Pile materials, shapes, and sizes
 - Welding symbols and references
- 2008 Indiana Design Manual
- INDOT Design Memorandums
 - 08-15 (Min. Pile Length and Integral End Bents)



References (cont'd)

- INDOT Special Provisions
 - 104-C-139 (Geotechnical Evaluation Report)
 - 701-B-068 (Bitumen Coating for Piles)
 - 701-B-132 (Pile Driving)
 - 701-B-154 (Oversized Pre-Drilled Pile Holes & Bentonite Grout for Reduction of Pile Downdrag)
 - 701-B-078 Delete & Incorporate into 701



References (cont'd)

- INDOT Supplemental Specs. (cont'd)
 - 701-B-154 (Oversized Pre-Drilled Pile Holes and Bentonite Grout for Reduction)
- INDOT Construction Memorandums
 - 09-01 (Shop Drawing and Falsework Review Procedures)
 - 06-19 (Clarification of Requirements for Concrete Mix Design)



References (cont'd)

- INDOT Standard Drawings
 - E701-BPIL-02 (Reinf. Conc. Pile Details)
 - E701-BPIL-04 (Splicing Pile Shells in the Field)
 - E701-BPIL-05 (Steel H-Pile Splice Procedure)
 - E701-BPIL-06 (Alternate Steel H-Pile Splices)



References (cont'd)

- ASTM's
 - AWS D 1.5
 - ASTM A 27/A 27M
 - ASTM A 36/A 36M
 - ASTM A 572/A 572M
 - ASTM A 588/A 588M
 - ASTM A 690/A 690M



References (cont'd)

- ASTM's (cont'd)
 - ASTM D 1143/D 1143M
 - ASTM D 3689
 - ASTM D 3966
 - ASTM D 4945
- Installation Specification for Driven Piles (PDCA Spec. 103-07; August 2007; Pile Driving Contractors Association)



References (cont'd)

- INDOT Geotechnical Manual (2008 Edition; Bridge Foundation Analysis)
- INDOT General Instructions for Bridge Structure Analysis (July 2007)



References (cont'd)

- Websites

- Pile Driving

- www.fhwa.dot.gov
 - www.usace.army.mil
 - www.pilebuck.com
 - www.timberpilingcouncil.org
 - www.artikel-software.com
 - www.rebar.ecn.purdue.edu/jrtp/PileDriving.htm
 - www.petra.ac.id/kts06/papers/28-KTS-GE-07.pdf



References (cont'd)

- Websites (cont'd)
 - Pile Driving (cont'd)
 - www.lowery.tamu.edu
 - www.nhi.fhwa.dot.gov/training
 - www.hmc-us.com
 - www.piledrivers.org
 - www.iceusa.com
 - www.hammersteel.com
 - www.mktpileman.com



References (cont'd)

- Websites (cont'd)
 - Pile driving (cont'd)
 - www.abi-group.com (Delmag Hammers)
 - www.pilespecs.com
 - www.pileco.com
 - www.apevibro.com
 - www.conmac.com
 - www.nor-trade.com (ICE Hammers)



References (cont'd)

- Websites (cont'd)
 - Pile Driving (cont'd)
 - www.vulcanhammer.net
 - www.pile.com (Pile Testing Information)
 - www.pdi.com (PDA Testing)
 - www.vibropile.com
 - www.cse.polyu.edu.hk/~ctpile/ptest/p-dlt/p-dlt.html



References (cont'd)

- Websites (cont'd)

- Bridge Links

- www.fhwa.dot.gov/index.html
 - www.bridgepros.com/home.htm
 - www.asbi-assoc.org
 - www.co.multnomah.or.us/bridge/bridge_types/bridge_types.htm
 - www.tfhrc.gov/index.html



References (cont'd)

- Websites (cont'd)

- Bridge Links (cont'd)

- www.soinc.eezway.com/bridge/index.htm
 - www.pghbridges.com
 - www.bridgepros.com/learning_center/index.html (Bridge Glossary)
 - www.tfhrc.gov/index.html
 - www.nabro.unl.edu
 - www.bridgesite.com/softwarelinks.htm



References (cont'd)

- Websites (cont'd)

- Bridge Links (cont'd)

- www.openhere.com/science/architecture/buildings-and-projects
 - www.itl.acns.nwu.edu/links/bridges.html
 - www.aci-int.org/general/home.asp
 - www.uscg.mil/hq/g-o/g-opt/g-opt.htm



Piers or Bents

- Interior Piers/Bents
 - Hammerhead Piers



Piers or Bents

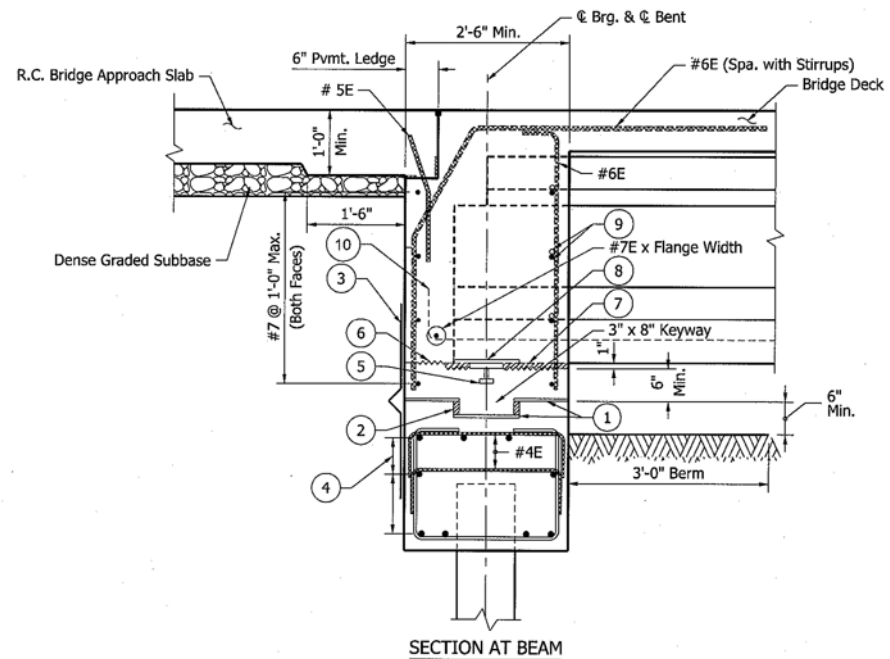
- Frame Bent



Piers or Bents

■ End Bents

- Semi-Integral
- Used on bridge rehabilitation projects



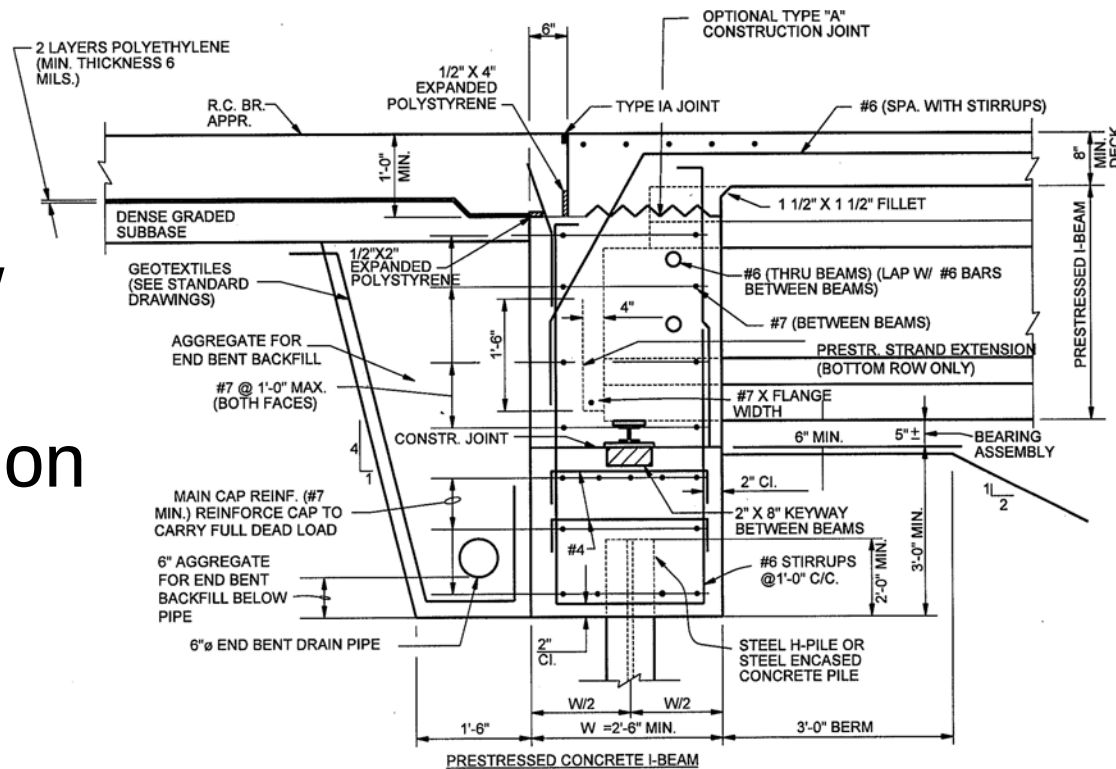
SUGGESTED SEMI-INTEGRAL END BENT DETAILS
(Method 1)

Figure 67-1 C (1)
(Page 1 of 4)



Piers or Bents

- Integral
- Used on most new bridge construction



SUGGESTED INTEGRAL END BENT DETAILS
(Beams Attached to Concrete Cap, Method B)



General

■ Formwork

- Check dimensions against plans
- Should be:
 - clean and mortar tight
 - sturdy and properly braced
 - properly aligned
 - chamfer exposed edges (*spec 702.13*)
 - grades checked using construction engineering



General

■ Reinforcing Bars

- Approval of bars – covered under a certified sampling program
- Bars in proper place, proper orientation, and alignment
- Proper bar splices and splice length (*spec 703*)
- Proper clearances (clear cover) from bottom, sides, and top of forms
- Reinforcing held securely in place
- Epoxy coating clean, in good shape, and covered (*spec 703*)



General

- Concrete Placement
 - Check that required Class A, B, or C is being used. (*spec 702.02*)
 - Check Frequency Manual for required tests
 - Place concrete close to its final location. Do not move by vibrating.
 - Place concrete in 1 ft to 2 ft lifts and vibrate from one lift into another to minimize cold joints
 - Vibrate properly. Excessive vibration causes segregation



Piers or Bents

- Most likely need falsework
- Make sure top of cap grades have been checked
- Ensure that the concrete is vibrated properly
- Use tremies on pours where concrete will be dropped >5 ft. (*spec 702.20*)
- Pour rates are important to avoid cold joints
- Bench marks should be transferred to the cap



Substructure

Questions ????





**10 - Bridge Construction Concerns
Superstructure & Miscellaneous
PE/PS Workshop 2009**

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Tom Carrow, P.E. Gary Kreutzjans

Introduction

A bridge is made up of the following two components:

- SUBSTRUCTURE
- SUPERSTRUCTURE



Introduction (cont'd)

- SUPERSTRUCTURE

- The components of a bridge which support the deck or riding surface of the bridge as well as the loads applied to the deck.
 - Structural Members
 - Deck Slabs
 - Riding or Wearing Surface



Structural Members

- Structural Steel
 - Rolled beams
 - Girders
- Concrete
 - Box beams, I-beams
 - Bulb-T beams
 - Concrete tubs
- Concrete Slabs
 - The slab is it's own structural member



Structural Steel & Concrete Members

- Fabricated off-site
- Shop QA Inspection performed by either INDOT or consultant to INDOT
 - Ensures strict control of manufacturing and curing
- Shop drawings
- The members should be inspected when they arrive



Structural Steel

- *Spec 711*
- Main Members or Primary Members
 - Rolled Beams
 - W-shapes
 - Minimal shop welding, mostly cutting & drilling holes
 - Girders
 - Built from plates
 - Significant shop welding



Structural Steel (cont'd)

- Secondary Members
 - Cross Frames
 - Typically angles and plates that are welded together.



Structural Steel (cont'd)

■ Diaphragms

- Now Channel sections are almost exclusively used. Attached to main member with bolted angles. No longer welded to main member.



Structural Steel (cont'd)

- Jacking Frames
 - Typically a “Beefier” or “Heavy Duty” channel or S-section located at the end bent and sometimes at interior bents/piers.
 - Used to enable the bridge to be raised in order to work on bearings or other components.
 - Less common today due to preference for semi-integral and integral end bents.





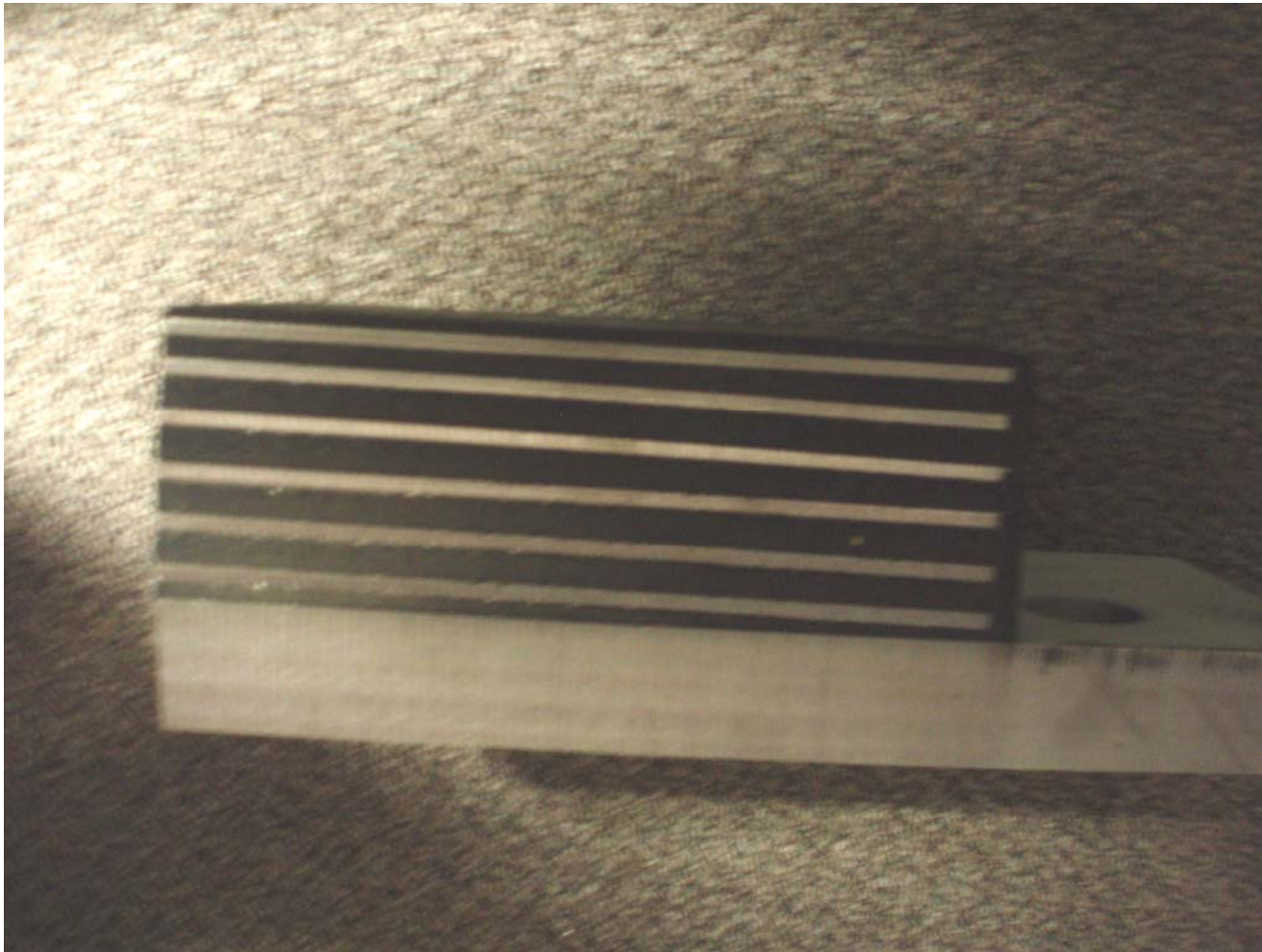
Jacking Frame



Structural Steel (cont'd)

- Bearing Assemblies
 - Shoes or Rockers
 - Fabricated from steel
 - Elastomeric Bearing Pads
 - Fabricated from steel plates sandwiched between an elastomer. They may need to be field sampled if a sample was not previously obtained.





Elastomeric Bearing Pad



Structural Steel (cont'd)

- Miscellaneous Items
 - High Strength Bolts, Nuts, and Washers: sampled and tested during fabrication. ASTM A325
 - Splice Plates: fabricated from plate stock. Flange and Web splice plates are used.
 - Shop Painting: Unless otherwise specified in the contract, steel should only be primed. The remaining painting is done in the field.



Structural Steel (cont'd)

- Erection of Structural Steel
 - Pre-Erection Meeting
 - Used to discuss the plan for erecting main members
 - If underpassing road, closure times and duration of closure should be discussed.
 - Bearing Assemblies
 - Review Plan Notes
 - *Spec 711.60*, 50% of holes shall be filled with bolts at time of erection.



Structural Steel (cont'd)

- Erection of Structural Steel (cont'd)
 - Drift pins only used to draw the parts into position and not to enlarge or distort holes.
 - Contact surfaces (under splices, etc...) must be free of oil, laquer, grease, or rust inhibitor.
- Adjustments
 - Check alignment, adjust splices, etc... prior to tightening bolts.



Structural Steel (cont'd)

- Bolting Splices
 - Proper tension required.
 - Installation to be per AASHTO Bridge Specs
 - Check using bolt tension indicating device
- Stud connectors
 - Should be shipped Must be installed in field.





Steel Members set in place



Concrete Members

- Bearing Assemblies
 - Elastomeric
 - Steel sections
 - Nothing



Concrete Members

■ Erection

- Lift by approved lifting devices only, as shown on the plans or shop drawings.
- If not placed on piers/bents directly from the truck, store in an upright position at all times. Each beam end must be supported at the centerline of bearing.
- When placing, shift beams only while held free of supports by lifting devices.



Concrete Members

- Erection (cont'd)
 - Do not grout dowel holes nor place concrete for floor, diaphragms, or shear keys prior to complete documentation of acceptance of members and bearing pads.
 - Heavy equipment may be operated on members only if approved in writing.



Concrete Members

- Secondary Members
 - Concrete Cast-in Place Diaphragms
 - Steel Diaphragms



Concrete Members

- General Problems

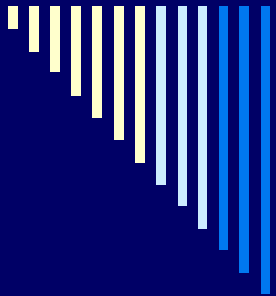
- Excess Camber

- Camber/screeds should be checked after setting beams.
 - Screed shots should be compared with screed elevations provided. If differences, contact designer of record for new screeds.
 - If the camber exceeds that shown on the plans by more than $\pm 1"$, the Manager of Structural Services should be contacted. In no circumstance should the deck be thickened without prior approval.





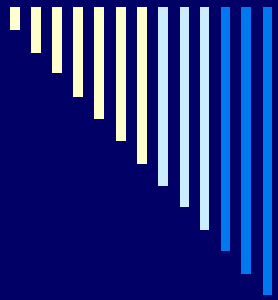
Concrete Beams set in place



PE/PS Workshop

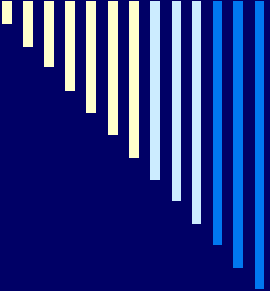
Bridge Construction – The Deck Pour





The Deck Pour

- QC/QA and High Performance
- Standard Deck Mixes
- The Day Before the Pour
- The Day of the Pour
- After the Pour

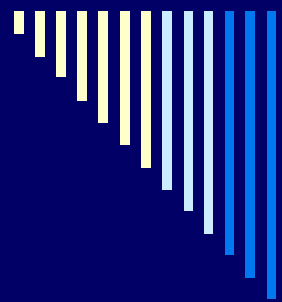


QC/QA and High Performance

Before the Pour

- ❑ Assure proper testing equipment
- ❑ Trial Batch
- ❑ Predetermine number of lot and subplot samples and their locations on the deck.





All Bridges

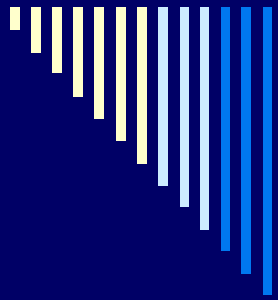
Before the Pour



- ❑ Submittals for forms and falsework approved
- ❑ Pour sequence approved
- ❑ Screed elevations checked
- ❑ Read the specs, dude!

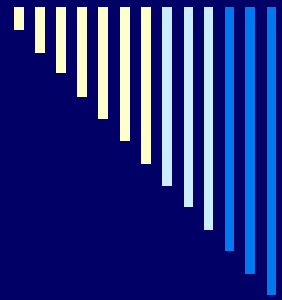
Preparing for the pour





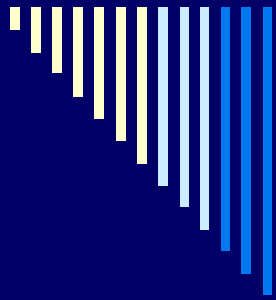
Do some checks...

- ☐ SIP's secure, lapped correctly?
- ☐ No welds on top flanges except where permitted (steel beams)
- ☐ Chamfer strips and drip beads?
- ☐ Shear studs (number, location, weld quality)
- ☐ Bolts tightened, torque checked (steel structures)?
- ☐ Deck drains installed?
- ☐ Forms secure (copings, diaphragms)?



All Bridges





Watch those rodbusters!

- ❑ Protect epoxy coating per SS 703
- ❑ All steel should be Grade 60
- ❑ Store bars above ground on supports
- ❑ Check size and number of bars to assure they are per plan
- ❑ Tie mats securely; 33%-50% tied and tie down every 6 feet
- ❑ Hint: check for extra bars lying around
- ❑ Bars get marred sometimes; get cut for deck drain installation – repaint with epoxy paint

The Day Before the Pour

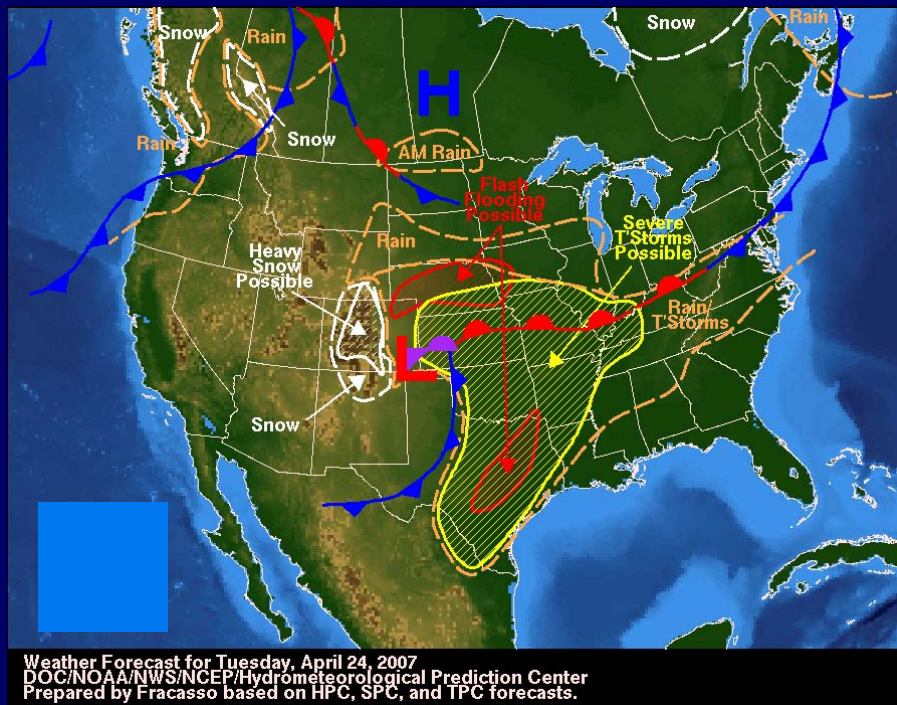


- ❑ Dry run finish machine
- ❑ Does contractor have sufficient materials on hand?
- ❑ Final cleaning of deck and formed areas
- ❑ Will you need additional help?
- ❑ Set up testing station for acceptance/job control testing

The Day Before the Pour



The Day Of the Pour



- ❑ Arrive early!
- ❑ Check the weather
- ❑ Did the contractor make all corrections directed during the dry run?

Be careful with that 'crete



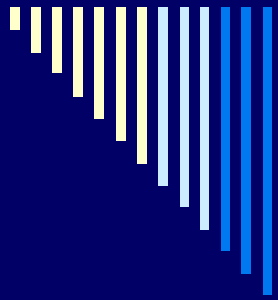
During the Pour

OK



NOT OK



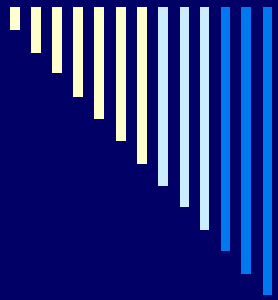


Do some more checks...

- ❑ Sample at point of placement (before vibration)
- ❑ Laborers clean their tools on the mat – bad!
- ❑ Should have plywood decking down to carry slick-line, wheelbarrows, generators, etc.
- ❑ Hydraulic oil, fuel leaks

During the Pour





During the pour

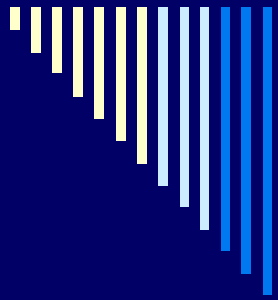
- ❑ Evaporative retardant – use it if needed
- ❑ Curing materials – quickly after tining
- ❑ Construction joint inside barrier wall steel
- ❑ Keep an eye on forms and falsework
- ❑ Finishers tossing extra mud overboard

During the Pour



During & After the Pour



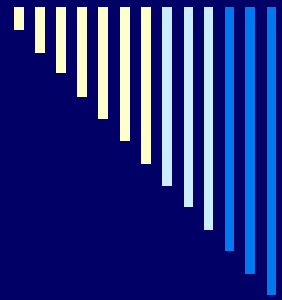


After the pour

- ❑ Take care of the specimens
- ❑ Read the specs on this stuff too, dude!
- ❑ [Cold weather] Heat a minimum of 6 full days (702.11)
- ❑ Wet cure a minimum of 7 full days (702.22)
- ❑ Sealers per manufacturer's recommendations.
- ❑ Make sure the right specimens are broken at the right time

What not to do!





What not to do!



Painting - General

- Spec 619 has been revised. It is a RSP (619-B-177) that will be incorporated into 2010 spec book.
<http://www.in.gov/dot/div/contracts/standards/rsp/sep07/sep07.htm>
- INDOT uses a three coat painting system (*spec 619.09*) for painting most structures.
- Contractor must submit and get approval of a QCP prior to beginning painting.



Painting

- Unless stated in QCP and approved, no painting between November 15 and following April 1.
- There are temperature and humidity restrictions for painting.
- Generally steel structural members on new bridges, including weathering steel members are primed in the shop and the remaining two coats are field applied.



Painting – Existing Steel

- Existing Steel to be cleaned & painted
 - If job advertized as non-hazardous and presence of hazardous materials confirmed, Contractor shall stop work and take additional measures. (*spec 619.07*)
 - The blasting waste generated must be sampled and sent to a lab to check for presence of hazardous materials.
 - EPA ID must be obtained from IDEM Land Quality Office



Sealing

- *Spec 709*; clear & epoxy penetrating
- Pier/Bent caps, front face of mudwalls, concrete barrier railing, concrete bridge railing, and other surfaces as indicated on the plans.
- Material from INDOT approved list. Available on website.



Small Structures

- Three Sided Culverts and Bridges (*spec 723*)
 - A bridge if span length >20 ft, otherwise a small structure.
- Four Sided (or Box) Culverts (*spec 714*)
 - Generally have spans less than 20 ft.
- Only Certified Precast Concrete Producers can supply
- Can be arch or flat topped. Check plans.



Small Structures (cont'd)

- Designed by the manufacturer or his representative.
- Shop drawings and calculations are required.
- Designer of record reviews submittals.



Small Structures (cont'd)

- Specifications cover the construction of footings and pedestals.
- Lift sections by handling devices or holes only.
- Maintain tight joints and alignment
- Use Masonite or steel shims between footing and segments to maintain gap for mortar.



Small Structures (cont'd)

- Check piece marks and keep in correct order.
- All butt joints must be waterproofed.
- Place backfill material in specified lifts.
- Flowable backfill required when less than a minimum of cover is available.



Superstructure

Questions ????

