

## **2016 STRUCTURES WORKSHOP MINUTES**

The 2016 Structures Workshop was held on April 26<sup>th</sup> in the Structures Management Unit Conference Room C in Raleigh, NC. Those in attendance included:

Tom Koch	State Structures Engineer
Kevin Bowen	State Bridge Construction Engineer
John Pilipchuk	State Geotechnical Engineer
Chris Peoples	State Materials Engineer
Glenn Mumford	State Roadway Design Engineer
Eric Williams	Assistant State Geotechnical Engineer
K. J. Kim	Assistant State Geotechnical Engineer
Matt Lauffer	Assistant State Hydraulics Engineer
Brian Hanks	Assistant State Structures Engineer
Rick Nelson	Assistant State Structures Engineer
Cameron Cochran	Bridge Construction Engineer
Aaron Earwood	Bridge Construction Engineer
Aaron Griffith	Bridge Construction Engineer
Corey McLamb	Bridge Construction Engineer
Johnny Metcalfe	Bridge Construction Engineer
Lee Puckett	Bridge Construction Engineer
Darin Waller	Bridge Construction Engineer
Dean Hardister	Geotechnical – Western Regional Operations Engineer
Chris Kreider	Geotechnical – Eastern Regional Operations Engineer
Scott Hidden	Geotechnical – Support Services Supervisor
Jack Cowsert	Materials and Tests – State Materials Quality Engineer
Randy Porter	Materials and Tests – Metals Engineer
Darren Scott	Materials and Tests – Structural Members Engineer
David Stark	Priority Projects – Project Engineer
Laura Sutton	Priority Projects – Project Executive
William Goodwin	Structures Management – Staff Engineer
Paul Lambert	Structures Management – Project Engineer
Dan Muller	Structures Management – Project Engineer
James Gaither	Structures Management – Engineering Supervisor
Madonna Rorie	Structures Management – Engineering Supervisor
David Snoke	Structures Management – Engineering Supervisor
Todd Garrison	Structures Management – Engineering Supervisor

The following topics were discussed:

### **WELCOME AND REVIEW OF 2015 STRUCTURES WORKSHOP MINUTES**

Mr. Koch opened the workshop with welcoming comments. His opening was followed by self-introductions by the representatives present at the workshop.

Mr. Muller briefly summarized each topic from the 2015 Structures Workshop minutes and progress of each topic was briefly discussed.

## **STRUCTURES MANAGEMENT TOPICS**

### **1) *Bridge Programming: Replacing Bridges at the “Head of the Stream”***

Mr. Muller discussed bridge replacement projects involving multiple bridges, including one or more load posted bridges. In some instances, the sequence of replacement involved equipment crossing load posted bridges in order to access the bridge under construction.

#### **Action Item:**

**In the future, Structures Management will include the Construction Unit on Division and Central BMIP distribution.**

### **2) *Utilization of Wisconsin Pour Sequence for Placement of Concrete Overlays***

Mr. Hanks discussed the possibility of using the Wisconsin pour sequence, typically used for concrete bridge decks, for concrete overlays on cored slab and box beam bridges with the intention of eliminating cracking. This technique was utilized on a few trial projects.

#### **Action Item:**

**No action required. It was decided that the overlay cracking was not a significant issue for the pour sequence to be necessary.**

### **3) *Conflicts Between Structures Management and Materials and Tests Pile Splice Detail***

Mr. Muller discussed the differences between the pile splice detail shown on Structures Management End Bent details and the Materials and Tests Welding Procedure Specification for H-piles. The differences include the location of back-gouging (along outside of flange versus inside of web) and the angle tolerance for flange and web beveling.

#### **Action Item:**

**Structures Management will revise the pile splice detail shown on the End Bent details to match that of Materials and Tests. Structures Management will also detail a welding access hole in the web portion of the pile. The revised SMU detail will be provided to Materials and Tests for review.**

### **4) *Material Requirements for Steel Falsework to Remain Permanently in Structure***

Mr. Hanks mentioned construction activities noticed at the Wilmington Bypass dual bridges over the Cape Fear River and the US-70 bridge over Gallants Channel in Beaufort, in which the falsework used to hold the soffit below each footing was composed of uncoated black steel. Typically falsework is temporary, however the falsework used at these locations will be permanently embedded into the cast-in-place concrete footings. Mr. Bowen and Mr. Peoples stated that stainless steel would be ideal for permanently embedded falsework in corrosive environments, and galvanized steel would be ideal for permanently embedded falsework elsewhere.

#### **Action Item:**

**Structures Management will revise the Falsework and Formwork Project Special Provision to require falsework permanently embedded in cast-in-place concrete be stainless steel in corrosive environments and galvanized steel elsewhere. SMU will also add this requirement in the corrosive plan notes.**

5) **Consolidation of Concrete at Bundled Rebar in Reinforced Concrete Columns**

The Construction Unit discussed concrete consolidation at the reinforcing steel splice locations near column and drilled shaft interfaces. The Construction Unit proposed the use of staggered mechanical couplers as a potential solution. However, Structures Management mentioned that the size of mechanical couplers may result in the same consolidation problems as lap splices.

Action Item:

Structures Management will investigate reinforcement clearance requirements in the AASHTO LRFD Bridge Design Specifications. SMU will also discuss the possibility of requiring larger column diameters if adequate clearance between reinforcing steel bars at splice locations is not provided.

6) **U-4444AB Site Review**

a. **Wingwall Lengths**

The Construction Unit discussed instances in which wingwalls appeared to be too short in length. The slope protection between the berm in front of the end bent cap and the tip of the wingwall was steep and potentially treacherous.

Action Item:

Structures Management will investigate the slope protection details and wing length calculations for these situations.

b. **Median Strips**

The Construction Unit discussed the current detail for median strips adjacent to joints. The detail shows the strip with the same opening as the joint opening in the bridge deck. However, this results in the strip extending over the elastomeric concrete breakout for foam joint seals or the hold-down plates for expansion joint seals.

Action Item:

Structures Management previously developed a proposed revision to Design Manual Figure 6-19 to show a 1-inch clearance between the edge of elastomeric concrete breakout or hold-down plate and the edge of the median strip. As a result of this increased opening in the strip, Structures Management will provide the Hydraulics Unit with the proposed detail to solicit their opinion on the effect of hydraulic spread.

c. **Prestressed Girder Buildups for Crest Vertical Curves**

The Construction Unit noted situations in which stirrups extending out of the tops of prestressed concrete girders did not penetrate the deck due to the crest vertical curve.

Action Item:

Structures Management will add language to the Design Manual to require stirrups to extend into the deck. In some situations, stirrups may require variable extension heights in order to adequately penetrate the deck.

### 7) ***Bridge Rails on Bicycle Routes***

Mr. Hanks discussed the recent transition from using Two Bar Metal Rails to Vertical Concrete Barrier Rails on bicycle routes. The Two Bar Metal Rail, which is 54-inches in height, was previously considered the preferred rail for bridges on bicycle routes. However, according to AASHTO, a 42-inch barrier rail is considered adequate for bicycles except in certain conditions. These conditions include steep downgrades, sharp curves, narrow shoulder widths, and high cross-winds.

*Action Item:*

*Structures Management will revise the Design Manual to clarify the rail required for bicycle routes.*

## **MATERIALS AND TESTS TOPICS**

### 1) ***Miscellaneous Steel Fabricators***

Mr. Scott discussed instances of Contractors selecting steel fabricators not on the approved Producer/Supplier List. These situations typically involved miscellaneous steel members. When the fabricators submit shop drawings for review, Materials and Tests inspectors are pressured to ensure that the fabricators are adequately certified for the work and not delay project schedule.

*Action Item:*

*Structures Management will ensure that special Project Special Provisions involving miscellaneous steel fabrication refer to Section 1072 of the Standard Specifications. Section 1072-1 Part (A) addresses the use of steel fabricators on the NCDOT Approved Structural Steel Fabricators List and the requirement of AISC certification if necessary.*

### 2) ***Update on Metallization PSP Revision***

Mr. Porter discussed the revision of the current Project Special Provision for Thermal Sprayed Coatings (Metallization). The PSP will be condensed to cover basic information regarding metallization and to address basis of payment. Materials and Tests is developing a program (technical document) to cover specific information such as coating thicknesses, manufacturer recommendations, facility quality control measures, fabrication requirements, and field metallization allowances.

*Action Item:*

*Materials and Tests will continue to revise the current PSP and develop the new program for metallization.*

### 3) ***Discussion of the Nonconformance Report Policy***

Mr. Peoples discussed the ongoing efforts of developing NCR's for prestressed concrete girders. Currently, inspection of girders at precast concrete plants and creation of NCR's to record issues is a significant time demand for Materials and Tests. When NCR's are issued, producers submit repair details and procedures that are typically approved. Girders with pre-detensioning vertical web cracks that close after detensioning are typically approved. Rarely do issues result in girder rejection.

Action Item:

Structures Management and Materials and Tests will further discuss the current NCR policy and procedures.

**4) Follow-Up on Girders with Noted Vertical Cracks in Nonconformance Reports**

Mr. Peoples discussed vertical cracks that develop in prestressed concrete girder webs prior to detensioning of strands. These cracks are mapped and incorporated into NCR's. If the cracks close after detensioning, the girders are typically accepted for use on bridge projects. Mr. Peoples asked if girders containing NCR-accepted cracks were ever inspected after several years of service to evaluate the condition of the cracks.

Action Item:

Structures Management and Materials and Tests will further discuss evaluating in-service girders with pre-detensioning vertical cracks reported in NCR's.

**CONSTRUCTION TOPICS**

**1) Gaps at Roadway Ends of Integral End Bent Approach Slabs**

Mr. Puckett discussed issues with cracking in the asphalt at roadway ends of approach slabs for bridges with integral end bents. He suggested that asphalt above the beveled end of the approach slab creates a crack and that a vertical joint between the approach slab and roadway flexible pavement is a possible solution. He noted that at some bridge sites the issue was resolved by removing the cracked asphalt, cutting out the beveled end of the approach slab, and placing elastomeric concrete in the cut out area to create a non-beveled approach slab end.

Action Item:

Structures Management and Construction will continue to discuss the issue and possible solutions.

**2) Certification Requirements for Drilled Shaft Permanent Casings**

Mr. Puckett discussed instances where Contractors have used permanent steel casings for drilled shafts without the necessary certification for the casings. He mentioned that there is also a discrepancy between the Standard Specifications and HiCAMS regarding the required type of certification for casings. In order to inform Contractors when permanent steel casings are required on a project and to avoid construction delays, Mr. Puckett suggested permanent steel casings be incorporated into the pay item for drilled shafts.

Action Item:

Construction and Materials and Tests will continue to discuss the issue.

**3) Approach Fill Detail for Outlet Pipes Below Water Surface Elevations**

Mr. McLamb discussed instances where drainage pipes in approach fills were installed below the water surface elevation or in a hole below grade. He asked if the pipe could either be eliminated or installed above the water level for those cases.

Action Item:

Structures Management, Geotechnical, Hydraulics, Roadway, and Construction will discuss in the Wall Workgroup, particularly during discussions regarding revisions to approach fill details.

**4) Deck Sealing Requirements**

Mr. Earwood discussed the Standard Specifications requirement to seal concrete decks with exposed aggregate. He mentioned that deck sealant is not required after diamond grinding, in which aggregate may be exposed in the top of the deck. Mr. Nelson stated that Silane would be the preferred type of sealant for this application.

Action Item:

Structures Management and Construction will continue to discuss deck sealants.

**5) Temporary Expansion Joint Seal Gland for Stage-Construction**

Construction and Structures Management discussed expansion joint seals on stage-constructed bridges. During previous discussions, it was agreed to use a temporary gland in the first stage(s) of construction to be removed and replaced with a permanent gland in the final stage. Also, Structures Management should coordinate with Traffic Control when this sequence of gland installation is required.

Action Item:

Structures Management will revise the Design Manual to include stage-construction requirements for the expansion joint seal gland for the first stage(s) and to coordinate with Traffic Control regarding the removal of the temporary gland and installation of the final gland.

**6) Additional Reinforcing Steel in 3-Bar Metal Rail Curbs**

Mr. Earwood discussed issues with notable cracking in Three Bar Metal Rail curb sections.

Action Item:

Structures Management will revise the Three Bar Metal Rail details to include reinforcement in the curb section.

**7) Location of Joints in Sidewalks and Parapets**

Mr. Earwood discussed issues with notable cracking in Three Bar Metal Rail sidewalks. He shared that on some bridges the Contractor placed grooved contraction joints in the sidewalk at each post location, which seemed helpful to control the cracking.

Action Item:

Structures Management will revise the plan note listed in the Design Manual regarding sidewalks to require grooved contraction joints at each centerline rail post location.

**8) 28-Day Compressive Strength Test Requirements for Grout for Structures**

Mr. Earwood discussed the Grout for Structures Project Special Provision, which states that the compressive strength of grout shall be determined from test results at 28 days. Mr. Hidden stated that the recently revised Grout Specifications do not have a 28-day strength requirement for Type III grout, which is considered grout for structures. Mr. Earwood suggested the PSP be revised to require a more practical 7-day strength instead of 28, similar to that of latex modified concrete.

Action Item:

Structures Management will compare the Grout for Structures PSP to the Grout Specifications, discuss the strength requirements, and revise the PSP as needed.

## **9) Railroad Issues**

Mr. Earwood discussed several issues that often occur on projects involving railroad structures. Railroad authorities commonly inform Construction about requirements that are not addressed in project special provisions or contracts, often times after construction has begun. Some of these requirements include but may not be limited to the following: maximum concrete drop of 10 feet for drilled shafts, turn-of-nut installation method for bolts, 150% capacity for temporary bents used for girder erection, exclusion of tubular scaffolding for temporary bents, limitation of 2 girders supported on temporary bents at one time, standard penetration tests (SPT's) on all drilled shafts, and horizontal clearances from crane loads.

### Action Item:

Structures Management and Construction will further discuss and identify issues. Structures Management will send the railroad project special provision to Construction for them to review and revise, ensuring that the PSP either directly addresses the issues or refers to a railroad provision that addresses the issues.

## **10) Washout under Deck Drains**

Mr. Earwood discussed some projects with issues under deck drains adjacent to the end bents. The drainage onto the rip rap caused erosion of the earth material under the geotextile fabric followed by collapse of the rip rap stone. He proposed an increase in the required minimum distance from end bents to the first deck drains. He also proposed using smaller stones (perhaps Class B rip rap) on top of and in between the Class II rip rap stones, using a thicker and more durable geotextile fabric under the rip rap, or using a double layer of geotextile fabric.

### Action Item:

Structures Management and Hydraulics will discuss the proposed options of drain locations, mixture of smaller and larger rip rap, thicker geotextile material, and double layer of geotextile material.

## **11) Skidmore Test for Steel Diaphragms on Concrete Girders**

Mr. Earwood discussed the possibility of eliminating the Skidmore bolt test requirement for steel diaphragms for concrete girders, since these members are not considered critical for concrete girders.

### Action Item:

Structures Management will add a plan note excluding the Skidmore test requirement to the standard drawing detailing steel diaphragms for concrete girders.

## **12) Maximum of 55,000 Pounds for Skidmore Test**

Mr. Earwood discussed that a Materials and Tests document lists a maximum 55,000 pound tension load for the Skidmore test, but the Standard Specifications do not address a maximum tension load.

### Action Item:

Construction and Materials and Tests will further discuss and add the maximum tension load to the Standard Specifications.

### **13) Post-Tensioning for Proper Bearing of Exterior Cored Slabs/Box Beams**

The topic was thoroughly discussed in the review of the 2015 Structures Workshop minutes and therefore was not discussed again.

#### Action Item:

Structures Management will revise the Design Manual to include a note regarding uplift of exterior cored slab and box beam units during post-tensioning. The note will instruct the Contractor to release the post-tensioning strand until the exterior units return to full contact with the bearing pads and fill the shear keys between the exterior and adjacent interior units prior to resuming post-tensioning.

### **14) Post-Tensioning on Skewed Cored Slab/Box Beam Bridges**

Mr. Earwood discussed instances where skewed post-tensioning strands were jacked normal to the exterior cored slab or box beam face. He explained that jacking the strands along the skew is preferred and that beveled steel plates can be used against the jacking frame to accomplish this.

#### Action Item:

Structures Management will add a note requiring post-tensioning strands jacked along the skew to the standard drawings detailing cored slabs and box beams.

### **15) Plug Joint Discussion for Cored Slab/Box Beam Bridges**

Mr. Earwood discussed the possibility of adding details and pay items for plug joints to cored slab and box beam project contracts. He explained that plug joints are commonly installed in place of foam joint seals during rehabilitation of cored slab or box beam bridges. Construction also proposed foam joints being replaced by plug joints as the standard joint type for cored slabs and box beams, even at fixed interior bent locations.

#### Action Item:

Structures Management and Construction will further discuss the use of plug joints internally and with Divisions. Structures Management will investigate details from other states that use plug joints.

### **16) Barrier Rail Brace Reinforcement**

Mr. McLamb discussed instances where additional reinforcing steel was used to cross-brace the typical longitudinal and transverse reinforcing steel in F-shape and Vertical concrete barrier rails. The bracing steel was added to prevent the typical steel from twisting out of alignment during rail slip-forming. Mr. McLamb suggested that the bracing steel be added to standard barrier rail details. However, Mr. Hanks explained that the rails have been approved by FHWA as detailed and that adding reinforcement would require resubmittal to FHWA for review and approval.

#### Action Item:

Structures Management will discuss the possibility of creating a plan note allowing Contractors the option to add bracing reinforcement to prevent racking of typical barrier rail reinforcement during slip-forming.



**17) Permit Modifications for Temporary Causeways**

Mr. Puckett discussed Division 9 and 11 projects in which temporary causeways were permitted and detailed, but the Contractor elected not to use the causeway. He stated that based on his experience, if a Contractor needs to build a temporary causeway on a project, applying for a permit modification during the construction phase and omitting the causeway from the plans is easier and quicker than obtaining a permit during the planning phase and detailing the causeway on the plans.

Action Item:

Construction will further discuss the topic, review the Temporary Access PSP, and potentially revise the PSP to address permit modifications for temporary causeways.

**18) Grout Pots in Fixed Bents on Wide Bridges**

Mr. Waller discussed difficulties with anchor bolts and disc bearing assemblies aligning with steel girder bottom flanges at fixed bearing locations on wide bridges. He proposed grout cans at fixed bearing locations similar to those at expansion bearing locations to allow for some tolerance in anchor bolt placement, perhaps even regardless of bridge width.

Action Item:

Structures Management will discuss detailing grout cans at fixed disc bearing locations similar to those at expansion disc bearing locations.

**19) Skew Bar Kit in Specifications**

Mr. Earwood discussed the possibility of revising the Standard Specifications to require a special kit for screeds to accommodate skewed and/or crowned bridges.

Action Item:

Construction will further discuss the topic and potentially propose a revision to the Standard Specifications.

**20) Specifications for Preferred Screeds**

Mr. Earwood noted that the Standard Specifications require mechanically operated screeds and the Specifications needs to require screeds be self-propelled as well. He also stated that certain types of screeds should be disallowed in the Specifications.

Action Item:

Construction will further discuss the topic and potentially propose a revision to the Standard Specifications.

**21) Revision of Standard Specifications for Placing Load on Structure Members**

Mr. Bowen noted that the Standard Specifications should include more specific loading scenarios. He mentioned the following example: for a footing, a minimum concrete strength (to be specified) should be obtained before backfill material can be placed around the footing.

Action Item:

Construction will review the current section of the Standard Specifications for Placing Load on Structure Members and propose a revision to include more specific loading scenarios and strength requirements.

## **SPRING FIELD REVIEW ITINERARY**

Prior to the Structures Workshop, Mr. Muller and the Bridge Construction Engineers discussed possible bridge sites to visit on the Spring Field Review trip. Structures Management prepared a map including all of the suggested bridge locations in the western and central parts of North Carolina. Following the workshop, Mr. Muller and the Bridge Construction Engineers reviewed this map and discussed potential routes for the trip. Structures Management and the BCE's will continue to discuss bridge sites and routes to finalize the trip, which will be scheduled for mid-May (specific dates to be determined).