2014 STRUCTURES WORKSHOP MINUTES

The 2014 Structures Workshop was held on April 3rd in the Structures Management Unit Conference Room C in Raleigh, NC. Those in attendance included:

Greg Perfetti	State Structures Management Engineer
Earl Dubin	FHWA – Division Bridge Engineer
Kevin Bowen	State Bridge Construction Engineer
John Pilipchuk	State Geotechnical Engineer
Chris Peoples	State Materials Engineer
Jay Bennett	State Roadway Design Engineer
Brian Hanks	Assistant State Structures Management Engineer
Tom Koch	Assistant State Structures Management Engineer
Rick Nelson	Assistant State Structures Management Engineer
Eddie Bunn	Bridge Construction Engineer
Larry Carpenter	Bridge Construction Engineer
Cameron Cochran	Bridge Construction Engineer
Aaron Earwood	Bridge Construction Engineer
Lee Puckett	Bridge Construction Engineer
Dean Hardister	Geotechnical Western Regional Operations Engineer
Scott Hidden	Geotechnical Support Services Supervisor
K. J. Kim	Geotechnical Eastern Regional Manager
Stephen Morgan	Hydraulics Engineering Supervisor
Owen Cordle	Materials and Tests – Physical Testing Engineer
Jack Cowsert	Materials and Tests – State Materials Quality Engineer
Aaron Dacey	Materials and Tests – Coatings and Corrosion Engineer
Cabell Garbee	Materials and Tests – Field Operations Engineer
Trudy Mullins	Materials and Tests – Prestressed Concrete Engineer
Darren Scott	Materials and Tests – Structural Members Engineer
Bryan Kluchar	PDEA – Project Development Engineer Supervisor
Rasay Abadilla	Research and Development – Research Staff Engineer
Neil Mastin	Research and Development Manager
Glenn Mumford	Roadway Eastern Regional Engineer
Doug Taylor	Roadway Western Regional Engineer
Paul Lambert	Structures Management Project Engineer
Gichuru Muchane	Structures Management Project Engineer
Dan Muller	Structures Management Project Engineer
James Gaither	Structures Management Engineering Supervisor
Todd Garrison	Structures Management Engineering Supervisor
David Stark	Transportation Program Management – Project Executive

The following items of business were discussed:

1. STRUCTURES WORKSHOP WELCOME

Mr. Perfetti opened the workshop with welcoming comments and discussed the purpose of the meeting. He explained that the annual workshop continues to be an open forum to promote communication between representatives from each department to discuss issues of interest. His opening was followed by self-introductions by those representatives present at the workshop.

2. FHWA TOPICS

Mr. Dubin gave a presentation that focused on describing the MAP-21 federal transportation bill, reviewing the Bonner Bridge emergency procedures, and forming a Bridge Team to improve the North Carolina Bridge Program.

a) MAP-21

Mr. Dubin gave an overview of the MAP-21 (Moving Ahead for Progress in the 21st Century Act) federal transportation funding and policy bill which expires in October 2014. He explained that in the past, the national bridge program was investigated and funding was provided; as a result, improvement was expected but not always achieved. This created a need to monitor the outcomes of bridge improvement projects, such as safety and quality.

Mr. Dubin discussed the elements of the Transportation Performance Based Management, which include national goals, performance measures, targets, plans/reports, and special rules. The national goal is to maintain the Highway Infrastructure Asset System in a state of good repair. The purpose of the National Highway Performance Program is to establish performance measures for the condition of pavement and bridges. The targets of the program include determining the appropriateness of the performance measures and the cost-effectiveness and efficiency of transportation investments. The plan of the program involves collecting current and projected data; this information will be reported by asset management programs. The National Highway Performance Program will enforce special performance rules; for example, a percentage of 10% or more of total deck area of bridges on the NHS classified as structurally deficient for 3 consecutive years will be considered unacceptable. Mr. Dubin stated that North Carolina currently has about 8% deficient deck area.

Action Item(s):

None

b) Bonner Bridge Emergency Procedures

Mr. Dubin discussed the importance of identifying the protocols and procedures to safely reopen the Bonner Bridge in a timely manner if the bridge is closed again in the future. He stated that owners of scour-critical bridges are federally required to have an emergency plan of action. He also stated that a small group should be created to identify the needs of the department, gather and interpret scour data, ensure the safety of personnel during emergency conditions, establish a protocol to promptly reopen the bridge, satisfy public demands, and manage political pressure. He also stated that a task force should be created to develop a plan of action flow chart to improve the emergency process. He emphasized the need to determine a time period after a storm event that would ensure the safety of boats with sonar equipment to monitor the scour below the bridge.

Action Item(s):

None

c) Bridge Team

Mr. Dubin discussed the need to create a Bridge Team consisting of members from different departments that would meet regularly to resolve issues and discuss opportunities to enhance the Bridge Program in North Carolina. He gave an example of a Bridge Team goal; to have a certain percent (to be determined) of the bridges in North Carolina with a sufficiency rating greater than 80 by a certain year (to be determined). The Bridge Team would be responsible for providing

planning opportunities, such as Accelerated Bridge Construction and Greenway systems, improving the efficiency of bridge designs, and accounting for construction, maintenance, and inspection.

Action Item(s):

Based on need, Structures Management will collaborate with the other units and create work groups to discuss topics, develop policies, and resolve issues related to bridges. For example, there are a number of retaining walls issues that have been discussed over the years with no resolution; SMU will take advantage of this opportunity to collaborate with Geotechnical, Roadway, and Construction (and possible others) to make progress towards resolving these issues.

3. RESEARCH AND DEVELOPMENT TOPICS

Mr. Abadilla presented ongoing research projects in North Carolina. He stated that there are currently 8 in-progress research projects and 2 recently completed projects. Of these 10 projects, 4 are Structures/Construction projects, 2 are Structures projects, 3 are Structures/Geotechnical projects, and 1 is a Bridge Management project.

a) Structures/Construction Research Projects (In-Progress)

One of the in-progress Structures/Construction research projects involves the assessment of deteriorated cored slab units from Carteret County bridge numbers 150035 and 150039. Forensic investigation of these units is to be performed (field and lab tests) to determine the residual capacity of the units.

The other in-progress Structures/Construction project involves the use of CFRP prestressing strands and GFRP shear reinforcement in cored slab units.

b) Structures Research Projects (In-Progress)

One of the in-progress Structures research projects involves quantifying the corrosive potential of de-icing and anti-icing solutions to steel and concrete bridge components through field and lab tests.

The other in-progress Structures project involves the analysis of truck load distribution in North Carolina through a database of axle loads.

c) Structures/Geotechnical Research Projects (In-Progress)

One of the in-progress Structures/Geotechnical research projects involves the design of temporary slopes and excavations in North Carolina residual soils.

Another project involves the determination of vertical resistance for sheet pile abutments.

Another project involves the development of a database to document walls adjacent to bridges to create a retaining wall inventory and assessment system.

d) Bridge Management Research Projects (In-Progress)

The in-progress Bridge Management research project involves the revision and/or updating of bridge deterioration models and the determination of bridge user costs for the NCDOT BMS (Bridge Management System).

e) Structures/Construction Research Projects (Completed)

One of the completed Structures/Construction research projects involves the durability of bridge decks with light weight concrete. The final report for this research includes findings on chloride contents on the surface of bridge decks and the diffusion of chlorides into bridge decks; these findings can assist with decisions regarding the use of deicers. The report also includes a list of bridges in which the chloride contents in the bridge decks exceeded the corrosion thresholds and/or the replacement levels. The surface resistivity measurements may provide insight into the durability performance of bridge deck mixtures.

The other completed Structures/Construction research project involves crack-free mass concrete footings on bridges in coastal environments. The results of the project include recommendations for additions and revisions to the current NCDOT mass concrete specifications. The recommendations include dividing mass concrete structures into two categories: "typical" and "massive" mass concrete. "Massive" mass concrete is defined as a structure with a minimum dimension of 14 feet.

Action Item(s):

Structures Management will review the research project and consider the recommendations for modification of the current NCDOT specifications for mass concrete.

f) Other Research Projects

Mr. Abadilla displayed a list of other research projects completed in the last ten years. He also provided a link to the Research and Analysis website (https://connect.ncdot.gov/projects/planning/Pages/ResearchAnalysis.aspx) which includes a link to Search Research Projects. This feature allows the user to perform a refined search for research projects.

4. STRUCTURES MANAGEMENT TOPICS

a) Nonconformance Reports for Prestressed Members

Materials and Tests noted that nonconformance reports (NCR's) for prestressed concrete girders are generally not sent to the Bridge Construction Engineers, especially if the girders only have low-strength problems or a couple of vertical cracks. However, the Bridge Construction Engineers requested to be notified if the vertical cracks in a girder are expected to get larger or if any web-splitting cracks exist that may cause damage to the girder; some of these issues could be resolved in the field. Also, the BCE's noted that if the girders are damaged in-transit, the bridge inspector on the project should be notified when the girders arrive at the site.

Action Item(s):

In the future, when submitting an NCR to the bridge inspector on a project, Materials and Tests will also provide the NCR to the appropriate Bridge Construction Engineer.

b) Overhang Falsework Inserts in Cored Slabs and Box Beams

Construction requested that threaded inserts be provided in the exterior units of cored slabs and box beams for concrete rails that are not slip-formed (such as a concrete curb for a 3-bar rail with sidewalk or a classic barrier rail) and for concrete rails that have aesthetic form-liners. Threaded rods can be installed into the inserts and used to support falsework to allow construction workers access to the exterior sides of the bridge.

Action Item(s):

Structures Management will coordinate with Construction to develop a policy on the appropriate use of the inserts.

c) Total Dead Load Fit-up for Steel Girders

Currently, some bridge contract plans require steel girder fabricators to detail diaphragm members and connections for full dead load fit-up, for straight and curved steel girders. National research is underway which will provide insight on the type of fit-up (no load fit-up, steel dead load fit-up, or total dead load fit-up) that is acceptable for various ranges of span lengths and skews.

Action Item(s):

Upon completion of the research, Structures Management and Construction will coordinate to develop a steel girder fit-up policy.

5. CONSTRUCTION TOPICS

a) Bridges with Sidewalk Tying to Roadway without Sidewalk

Construction addressed the condition when a sidewalk is built on a bridge and approach slab, but not on the roadway adjacent to the approach slab. A drainage box is typically located 6 feet to 8 feet away from the approach slab and at the edge of roadway. However, the gutterline of the sidewalk does not line up with the drainage box, and the drainage box is not as wide as the sidewalk. Therefore, a concrete transition, both in width and height, is required to join the sidewalk and the drainage box.

Action Item(s):

Roadway will further investigate this issue.

b) Vertical Curves on Skewed Bridges

Construction addressed the difficulties of using a concrete truss screed machine for bridge decks with vertical curves and skews. Also, when a normal crown section is required on a bridge with a skew, the difficulties are amplified.

Action Item(s):

Structures Management and Roadway will coordinate and discuss options to alleviate constructability issues related to alignment, such as combinations of severe skew with crowned section, variable superelevation with crowned section, and severe skew with vertical curve. In some situations, a constant superelevation could be used instead of a normal crown. Also, severe skews can sometimes be mitigated without drastically increasing bridge length. Structures Management will include language in the Design Manual to discourage details that cause constructability issues.

c) Reference Lines on Staged-Constructed Bridges

Construction reported that occasionally, for staged-constructed bridges, the control line is in a location that cannot be referenced during the latter part of construction. For example, the control line for a bridge was located under a permanent traffic barrier that was built during the first stage of construction. Therefore, for the second stage of construction, the control line was not available for reference.

Action Item(s):

Structures Management and Roadway will coordinate to ensure that the control line on stage-constructed bridges is located such that it can be referenced during all stages of construction.

d) Expansion Joint Seals on Staged-Constructed Bridges

Construction reported that for staged-constructed bridges that require expansion joint seals, the premolded neoprene gland is not installed until after the final stage of construction is completed. Temporary pads are commonly installed in place of the neoprene gland during early construction stages.

Action Item(s):

Structures Management and Construction will investigate options of expansion joint seal installation procedures for stage-constructed bridges. Any traffic control sequences that are needed for joint installation will be required to be shown as splice locations in the working drawings. In addition, Structures Management will investigate options for detailing a temporary membrane to be used until the neoprene gland is installed.

e) Neoprene or Polyurethane Sealant on Expansion Joint Seals

Currently, the Structures Management standard for expansion joint seal details specifies the use of neoprene sealant. However, Construction stated that there is not a neoprene sealant product provided on the Approved Product List. Furthermore, the Project Special Provision for Expansion Joint Seals does not provided criteria for the neoprene sealant. Construction has entertained the use of polyurethane sealant (Black Jack), but is concerned that neoprene has superior bonding properties and resistance to oil than polyurethane.

Action Item(s):

Structures Management, Construction, and Materials and Tests will revise the Project Special Provision for Expansion Joint Seals to include criteria for the neoprene sealant that is specified on the Expansion Joint Seal Details standard.

f) Threaded Holes in EJS Hold-down Plates

Construction addressed the difficulty of placing the steel hold-down plates on the base angles in expansion joint seal openings; workers commonly injure their fingers during placement due to the tight fit. Construction recommended that threaded holes be provided by the fabricators in the hold-down plates. Threaded bolts could be inserted in the holes and used to lift the plates and ease the placement of the plates in the joint openings.

Action Item(s):

Structures Management, Construction, and Materials and Tests will investigate the revision of the Expansion Joint Seal Details standard to include a requirement in the installation procedure for fabricators to provide threaded holes in the hold-down plates. The standard will specify the hole diameter, depth, and spacing. The hold-down plates are 4 inches wide, 1½ inches thick (maximum), and 12 feet long (maximum). Therefore, the maximum plate weight is 245 pounds. For a 12 foot plate with 4 bolts spaced at 3 feet (with 1.5 feet distance from each end of plate to bolts), the required weight for lifting per bolt location is 61.25 pounds. Standards from PennDOT are also available and will be reviewed for example.

g) Construction Joint in Approach Slab for Expansion Joint Seals and Modular Joints

Construction reported that when concrete is poured for approach slabs containing expansion joint seals and modular joints, the base angle of the joint tends to uplift. Construction proposed that a construction joint should be provided in the approach slab similar to that provided in the deck, located 2.5 feet from the centerline of the joint.

Action Item(s):

Structures Management and Construction will investigate possible revisions to the Expansion Joint Seal Details standard to include a section showing an end bent, with the bridge deck on one side and the approach slab on the other. A construction joint will be shown 2.5 feet from the centerline of the joint in the deck and in the approach slab.

h) Cored Slabs with Excessive Asphalt Wearing Surfaces

Construction addressed the issue of slip-forming barrier rails on cored slab bridges with excessive asphalt wearing surfaces. Typically, the maximum height of the slip-forms for rails is 48 inches. Therefore, for a barrier rail that is 42 inches above the top of wearing surface elevation at the inside rail face, the maximum depth of asphalt is 6 inches to allow the use of slip-forms. If the depth of asphalt at the inside rail face is greater than 6 inches, the contractor is required to hand-pour the rail.

Action Item(s):

No action is required. For typical cored slab bridges, the asphalt wearing surface depth at the inside rail face will be less than 6 inches. This will especially be the case when the refined method for predicting camber for prestressed members is implemented, in which required camber is reduced.

i) Exterior Cored Slab Uplift

Construction reported that there have been some instances of exterior cored slab units lifting off the bearing pads during post-tensioning of the units.

Action Item(s):

Structures Management and Construction will investigate possible reasons for the exterior cored slab units lifting off the bearings during post-tensioning. One possible solution discussed is to partially post-tension the units, pour grout into the shear keys between the units, and then fully tighten the post-tensioning.

j) Shear Key Grout

Construction expressed the need for specific categories for grout on the Approved Product List. Various classes of grout should be included depending on the specific use, such as grout for structural applications and grout for geotechnical applications. Specifically for cored slab and box beam shear keys, Construction mentioned the use of epoxy grout.

Action Item(s):

Structures Management, Geotechnical, and the Product Evaluation department will discuss the addition of various classes of grout on the Approved Product List. Structures Management and Materials and Tests will investigate the benefits of epoxy grout for structural applications.

k) MSE Abutment Walls / Stone under Approach Slabs

When MSE walls are detailed in front of end bent caps, instead of reinforced approach fill that is typically used below approach slabs, the fill is detailed below the approach slab and above the bottom of the cap as follows. For a certain distance behind the backwall, depending on the required length of the lateral straps, a rectangular section of reinforcing stone is detailed. For the remaining length to the end of the approach slab and beyond, regular soil fill would be used. The contact area between the stone and the soil is detailed as a vertical face. Construction addressed the impracticality of achieving a vertical face while backfilling. Typically, for the remaining distance to the end of the approach slab or beyond, the backfill is installed at approximately a 1½:1 slope.

Action Item(s):

Structures Management and Geotechnical will discuss the development of a policy and details for the requirement of the reinforcing stone backfill under the entire length of approach slabs when MSE walls are used. Details and revisions will be discussed with Construction.

l) HP 12x53 Piles with High Bearing Capacity

Construction reported difficulties driving HP 12x53 piles with high bearing capacities. While driving the piles with excessive hammer forces, the tops of the piles are being damaged to the extent to where the contractor is required to cut off the tops of the piles and splice new pile segments before driving is continued. In some cases, this cutting and splicing procedure is required multiple times before the piles are driven to the required depth.

Action Item(s):

Geotechnical will discuss further and explore the option of increasing the pile size to an HP 14x73 when the bearing capacity of an HP 12x53 approaches a certain magnitude (to be determined).

m) Controlling Pile Overruns

Construction addressed the issue of driving piles in muck material. In some instances, because of the difficulty in determining the pile capacity in these soil conditions, the total lengths of the piles required to achieve adequate bearing while driving are twice as long as the design lengths that were delivered to the site. Also, Construction mentioned that for accelerated construction, the pile lengths are estimated based on risk, which can be extremely different from the required pile lengths based on actual soil conditions.

Action Item(s):

The Geotechnical unit will investigate pile overrun issues further. In addition, Structures Management and Geotechnical will investigate the possibility of requiring pile galvanization based on the minimum pile tip elevation.

n) Drilled Pier Permanent Steel Casing Sizes

Construction reported a particular situation which occurred in the western part of North Carolina. The contractor chose to use a permanent steel casing with the same diameter as the drilled shaft. While drilling the hole for the shaft, the contractor did not encounter rock. As a result, the contractor had to lengthen the shaft and extend the casing; he wanted compensation for this additional material.

Action Item(s):

Structures Management and Construction will investigate further.

6. MATERIALS AND TESTS TOPICS

a) Elastomeric Concrete Testing and Qualifications

Materials and Tests reported that a 100% pass rate for the required testing of elastomeric concrete samples was achieved in 2013 and 2014. Currently, the Project Special Provision for Elastomeric Concrete requires the following minimum field sampling: six 2 inch cube molds and three 3 inch x 6 inch cylinders on each day of elastomeric concrete production. Materials and Tests proposed lessening the number of required samples as a result of the testing success rate. Construction discussed potential problems with the elastomeric concrete mixture. Construction stated that any problems would most likely be related to moisture; if the aggregate used in the mixture is wet or if the bucket used to mix the ingredients contains any water, swelling can occur in the mixture causing an inferior final product.

Action Item(s):

For the time being, Construction proposed to not change the current sampling requirements, especially when elastomeric concrete mixing and sampling is performed during cold weather. Construction will further discuss the possibility of reducing the quantity of required test samples.

b) Drilled Shaft Sampling for Signs and Noise Walls

For drilled shafts used for signs and noise walls, the contractor is responsible for testing the concrete in each shaft. However, Materials and Tests reported that contractors have discovered a work-around within the HiCAMS database to avoid concrete sampling for these shafts.

Action Item(s):

Materials and Tests will fix the work-around in HiCAMS so that contractors must sample drilled shaft concrete as required.

c) SRW Block Inspection

Materials and Tests reported that the SRW (Segmental Retaining Wall) blocks that are typically used on roadway projects are similar to those used for private and/or residential retaining walls; these can be obtained from most home improvement stores. These blocks are not generally durable enough to satisfy AASHTO requirements for quality inspection.

Action Item(s):

Materials and Tests will investigate the need to have production data for SRW units.

d) Seal Coating for Thermal Sprayed Coatings (Metallization)

Mr. Dacey gave a presentation on seal coatings for thermal sprayed coatings. He listed the following governing specifications: Society of Protective Coatings (SSPC), American Welding Society (AWS), and National Association of Corrosion Engineers (NACE). He explained that the sealer is a thin paint coat (about 1.5 mils thick) that is more durable than a typical liquid coating. The sealer is absorbed into the thermal sprayed coating pores and extends the service life of the coating, especially for members that are in acidic or alkaline environments, that are frequently exposed to saltwater or freshwater, and that require additional resistance to abrasion. Mr. Dacey stated that Materials and Tests will continue to review research studies, collaborate

with the industry, and monitor for revisions to material specifications to provide NCDOT with a superior selection of sealers.

Action Item(s):

Materials and Tests and the Product Evaluation department will discuss the addition of various types of seal coats on the Approved Product List, such as low viscosity penetrating sealers, high solids epoxy sealers, and other top coats.

e) Approval Process for Concrete Coatings

Mr. Dacey gave a presentation on the approval process for concrete coatings. He listed several required and desired applications of concrete coatings: to reduce permeability, cover graffiti, decorate visible surfaces, and enhance slip resistance of drivable surfaces. He also listed several considerations of coating new and existing concrete members: curing of concrete, soundness of concrete, repairing damaged areas, treating surface irregularities, cleaning surface contaminants, and moisture in concrete. He discussed the plan directed by the Governor and Secretary to improve the aesthetics of bridges at high impact locations and displayed pictures of example projects where concrete bridge superstructure and substructure elements were painted for visual effects. Materials and Tests have worked with multiple Divisions to recommend products for use on specific projects and to draft specifications for concrete coatings.

Action Item(s):

Materials and Tests and the Product Evaluation department will discuss the addition of various concrete coating products on the Approved Product List.

7. GEOTECHNICAL TOPICS

a) Geosynthetic Reinforced Soil

The Geotechnical unit reported that they are seeking projects to use geosynthetic reinforced soil as a trial. On previous projects, there were scour problems that prevented the use of this soil.

Action Item(s):

FHWA, Geotechnical, and Structures Management will continue to search for a pilot bridge project which would be ideal for geosynthetic reinforced soil.

b) Wall Alignment / Wall versus Slope under Bridges

The Geotechnical unit expressed the need for guidance and criteria for the use of MSE walls or abutment walls instead of concrete slope protection on bridge projects.

Action Item(s):

Structures Management will collaborate with Geotechnical, Roadway, Construction, and Hydraulics to form a work group. The purpose of the group will be to discuss and develop criteria for MSE walls, as well as to determine MSE wall alignment, geometry and other details.

8. HYDRAULICS TOPICS

FEMA and MOA Required As-Built Documentation

Hydraulics discussed bridge and culvert projects involving FEMA-regulated stream crossings. As part of the FEMA approval process, the as-built plans must be documented within 6 months of project completion. A Structures Management policy memo was released on July 8, 2011 that directed bridge plan producers to provide an area for a PE seal on the first sheet of the General

Drawing to certify the plans as as-built. Recently, at the request of Hydraulics, the policy memo was revised to require an area for a PE seal on the culvert plan sheets showing the centerline culvert profile and the culvert section/elevation views to certify the plans as as-built.

Action Item(s):

Structures Management will finalize the revised policy memo and release.

9. SPRING FIELD REVIEW ITINERARY

Prior to the Structures Workshop, Mr. Muller solicited suggestions from Construction for possible bridge sites of interest. Structures Management prepared a map of North Carolina that depicted all of the suggested bridge locations. Mr. Muller presented this map and gave a brief description of each site to the Construction and Geotechnical representatives present at the workshop that will be attending the Spring Field Review trip. The discussions on each site will be considered to generate the trip itinerary following the workshop. The trip will take place in early May (specific dates to be determined).