MINUTES OF 2003 STRUCTURE WORKSHOP

The 2003 Structure Workshop was held on April 8th in the Bridge Maintenance Unit Conference Room in Raleigh. Those in attendance included:

Greg Perfetti	State Bridge Design Engineer
Paul Simon	FHWA Division Bridge Engineer
Lin Wiggins	State Bridge Maintenance Engineer
Njoroge Wainaina	State Geotechnical Engineer
Ron Hancock	State Bridge Construction Engineer
Cecil Jones	State Materials Engineer
Jay Bennett	State Roadway Engineer
Mohammed Mulla	State Soils and Foundations Engineer
Rodger Rochelle	State Research Engineer
Ricky Keith	Assistant State Bridge Design Engineer
Allen Raynor	Assistant State Bridge Design Engineer
Mike Robinson	Bridge Construction Engineer
Max Buchanan	Bridge Construction Engineer
Billy Trivette	Bridge Construction Engineer
Cameron Cochran	Bridge Construction Engineer
Rick Nelson	Bridge Construction Engineer
David Greene	Structural Members Engineer
Jack Cowsert	State Materials Quality Engineer
Chris Peoples	Materials and Tests Chemical Engineer
Victor Chao	Structure Design Engineer
Gichuru Muchane	Structure Design Engineer
Tom Koch	Structure Design Project Engineer
John Erwin	Structure Design Project Design Engineer
Scott Hidden	Soils and Foundations Engineer
Chris Kreider	Soils and Foundations Section Engineer
Nilesh Surti	Soils and Foundations Engineer
Jamey Batts	Soils and Foundations Section Engineer
Randy Turner	O.N.E.
Bill Goodwin	PDEA Bridge Replacement Unit Engineer
Don Moore	Geotechnical Consultant Coordinator
Don Idol	Bridge Maintenance Inspection Engineer
Ernesto Villalba	FHWA-NC
Emily Lawton	FHWA-NC
Brian Hunter	Materials and Tests Engineer
Owen Cordle	Materials and Tests Engineer
Andy Gay	Design Services Engineer

The following items of business were discussed:

1. INTRODUCTION:

Mr. Simon welcomed all in attendance and announced that there are several organizational changes within the design units that will occur in the near future. Most notably, Mr. Simon stated that the Geotechnical Unit and the Soils and Foundation Unit will merge to form one unit. In addition, Structure Design will merge current squads of a given Project Group into one larger design team. Mr. Simon also stated that consideration is being given to creating a design build team to handle the coordination of design build projects.

Mr. Simon also announced that two of the three recently submitted Innovative Bridge Research (IBRC) topics received federal funding. These included a one coat fast clad paint system to be used on three bridges in Wake County and FRP reinforcement in the bridge deck of a Macon County bridge replacement project.

2. ***OVERHANG FALSEWORK STANDARDIZATION :*** *(STRUCTURE DESIGN)*

Mr. Koch reported that in order to expedite the approval of overhang falsework submitted by the contractors, the Structure Design Unit is working to standardize overhang falsework designs. Mr. Erwin distributed a sample overhang falsework design table to the attendees. The table is designed so that the contractor can enter it with the overhang geometry of the structure and the screed load and calculate the maximum bracket and hanger spacing required. However, Mr. Erwin noted that the design tables only cover approximately 85% of all cases and there will be special geometries or loadings that fall outside the bounds of the tables. In these occurrences, the contractor will be required to design and submit the overhang falsework. Mr. Erwin stated that in the future a table similar to that distributed would be available for temporary steel diaphragm spacing. The temporary steel diaphragms will replace the 4”x4” timber struts that are currently used to prevent the exterior girder from rotating in response to the overhang loads.

Mr. Perfetti stated that the overhang falsework design tables will be included in the plans. Mr. Trivette questioned whether the contractor would still have to submit the design to the Structure Design office or would approval be granted in the field based on the design tables. Mr. Hancock stated that initially the contractor would still have to submit the design. However, in the future, designs could hopefully be approved in the field.

Mr. Robinson asked if it would be possible for large bridges to have the overhang falsework designs included in the plans when let. Mr. Perfetti and Mr. Hancock agreed that this was a good idea and would be considered on a case by case basis.

3. ASPHALT ON APPROACH SLABS: *(STRUCTURE DESIGN)*

Mr. Koch stated that with the design of integral abutment details and the addition of the reinforced approach fill, questions had arisen whether the asphalt on the approach slab was still necessary from a maintenance point of view. Mr. Hancock stated that he had recently polled the Division Construction Engineers with this question and that the consensus was that the detail should be left as is with asphalt on the approach slab.

Mr. Hancock stated that for integral bridges the asphalt on the approach slab should be included if the specific bridge site has the potential for long term settlement. If not, the asphalt on the approach slab is unnecessary.

Mr. Koch questioned if the reinforced approach fill actually prevented the settling of the approach slab. Mr. Hancock responded that the reinforced approach fill mainly prevented washout of the backfill material from under the end bent but was not a deterrent to long term settlement.

Mr. Robinson asked if the reinforced approach fill was being detailed on every structure. Mr. Mulla stated that for some cored slabs and cut sections the reinforced earth fill was not detailed. *After some discussion, it was agreed upon by the attendees that for the small addition in price the reinforced approach slab should be detailed on all structures. The Soils and Foundation Unit agreed to implement this change.*

Mr. Erwin distributed integral abutment/approach slab details to the attendees for comments. Mr. Trivette asked if the subbase could be detailed as concrete in the plans for integral bridges and the option for stone or asphalt subbase be eliminated. Mr. Hancock stated that consideration should be given to this so that the base and the lower portion of the sleeper slab could be poured monolithically. Mr. Wiggins stated that if the concrete subbase and sleeper slab were to be poured together, reinforcement should be detailed in the subbase so that it would not separate from the sleeper slab.

Mr. Koch stated that for integral bridges the approach slab would probably increase from 12’ to 20’-25’ in length. Mr. Trivette warned that this addition of length to the approach slab would necessitate a change in screeding methods for the contractor. In addition, elevations would be required on the sleeper slab in order to verify that the grade was correctly set.

Mr. Perfetti asked if the concrete subbase needed to be extended beyond the sleeper slab as is currently detailed in the approach slab standards. Mr. Hancock stated that if the subbase is poured monolithically with the lower portion of the sleeper slab then the extension of the subbase was not necessary. However, Mr. Hancock stated that the reinforced approach fill needed to be extended a minimum of 5’ beyond the sleeper slab to insure good drainage under the sleeper slab. *Structure Design committed to considering and investigating all suggestions in preparing final details.*

4. CSL TUBES AND TESTING: *(STRUCTURE DESIGN)*

Mr. Perfetti stated that over the past year the Department has spent approximately $250,000 in CSL tubes and testing and questioned if there was enough benefit to warrant continued placement of tubes in every drilled pier. Mr. Mulla replied that when the contractor knows that there is a possibility that the drilled pier may be tested then the quality of the shaft is always improved. Therefore, since the piers cannot be visually inspected, CSL testing is a great benefit to insure quality drilled piers. Mr. Perfetti asked if the CSL tubes and testing could be incidental to the drilled shaft. Mr. Surti stated that the tubes could be incidental to the drilled pier but the testing should be an individual pay item since the quantity was unknown.

Mr. Mulla stated that the Soils and Foundation Unit was considering buying the testing equipment and performing the test themselves. Mr. Hancock agreed that this was a good idea and stated that the test should be ran sporadically or when a problem in the drilled pier was perceived.

Mr. Perfetti stated there was concern with placing the black steel tubes in drilled piers in a corrosive environment. When black steel is in contact with epoxy coated steel, a macrocell is often times formed and accelerated corrosion can be anticipated. Mr. Perfetti stated that black steel is never allowed in footings cast in a corrosive environments and therefore it is inconsistent to allow black steel pipes in drilled piers. Therefore, allowing black steel pipes in drilled piers is somewhat contradictory. Mr. Greene suggested that the steel tubes be galvanized but after some discussion it was deemed too expensive. Mr. Hidden suggested that the steel tubes be cut off a certain distance below the column or footing to prevent corrosion. Mr. Perfetti agreed that this was probably the best solution and would be considered on a case by case basis.

5. PRECAST CULVERTS: *(FHWA)*

Mr. Villalba stated that on a recent stream crossing project, a long detour was required to replace the structure in place, the contract time was over one year and a bridge was chosen as the preferred alternative. However, in the planning documents, the option of a culvert was never mentioned. Mr. Villalba stated that the use of culverts should be considered and mentioned within the planning documents. A culvert could have been constructed in half the time as the bridge in this particular situation yet it appeared from the planning document that this alternative was never a consideration. Mr. Goodwin responded that the agencies prefer bridges to culverts due to the culvert's impact to the stream. However, the agencies do consider ways to lessen the project time when considering alternatives.

Mr. Wiggins stated that replacements completed by the Bridge Maintenance Unit are typically faster than commercially let contracts and questioned whether the contract

times for the TIP projects needed to be shortened. Mr. Bennett stated that many issues are considered when establishing contract times. Moratoriums, spring/fall construction seasons, and school schedules are a few of many that have to be considered. Mr. Bennett stated the original goal was to accommodate all of these schedules and conclude with a reasonable contract time. Mr. Hancock stated that any additional coordination between Units to more accurately estimate contract times would be beneficial.

6. HYDRAULIC GRATES: *(FHWA)*

Mr. Villalba stated that at the 2002 Spring Field Review a proposal was made to establish a committee to review NCDOT standard hydraulic grates and to design a grate that was traffic and bicycle safe as well as hydraulically efficient. Mr. Villalba questioned if this committee had been established. *After no comments, Mr. Jones stated that the Materials and Tests Unit would establish this committee in the near future.*

7. OTHER FHWA ITEMS: *(FHWA)*

Mr. Villalba stated that the following new concepts were being implemented between the Units:

- Aesthetics Policy: The Structure Design Unit, Research Unit and PDEA were establishing an aesthetics policy to be considered on certain structure projects.
- LRFD Design: The Structure Design Unit and the Soils and Foundations Unit will soon be designing several projects under the AASHTO LRFD design methodologies.
- Self-Compacting Concrete: The Materials and Tests Unit is organizing a workshop on SCC on June 26-27 that will be open to all Units.

8. PLANNING AND ENVIRONMENTAL ISSUES: *(PDEA)*

Mr. Goodwin stated that the planning stages of a project have become a multidisciplinary effort. Most agencies are now concerned with both the demolition of the existing bridge and the construction of the new structure. Therefore, PDEA will need input from the Construction Unit early in the planning process as well as during the permit application process. Mr. Moore stated that the Geotechnical Units also needed to be involved with PDEA in scheduling site investigations without violating permit restrictions. Mr. Moore stated that better communication between the Geotechnical Unit and PDEA regarding the issue of permits would be beneficial.

Mr. Perfetti asked if prefabricated bridge components were being considered by PDEA in order to minimize temporary impacts. Mr. Turner stated that prefabricated bridge elements as well as culverts need to be presented to the agencies as options that will decrease construction times.

Mr. Turner gave a brief summary on requirements within PDEA in determining the bridge length of structures spanning environmentally sensitive areas. Step 2A in the Merger01 process requires a biologist to visit the site and assess the limits of the wetland. Subsequently, the bridge length is determined based on minimum impacts to the designated wetland. Therefore, the bridge will typically be increased in length to minimize the impacts that the roadway embankment may incur on the sensitive area. Therefore, PDEA will make recommendations in some cases for bridge length not based on any hydraulic data but only in order to span the wetland and minimize impacts. In addition, off-site detours are utilized so that a structure can be replaced "in-place" in order to minimize impacts to the environment.

9. CONCRETE COMPRESSION CYLINDERS: *(MATERIALS AND TESTS)*

Mr. Jones displayed a concrete compression cylinder that had been incorrectly made. Mr. Jones stated that the Materials and Tests Unit was receiving more and more incorrectly made cylinders from the field and asked the Construction Engineers to encourage inspectors to make quality cylinders.

Mr. Robinson inquired about the status of the compression cylinder storage and transport facilities. Mr. Jones stated that a purchase order for transit facilities had been received and the facilities would be distributed with a document detailing handling and curing procedures for contractors in the near future.

10. METALLIZING JOINT ARMORS *(MATERIALS AND TESTS)*

Mr. Greene stated that metallizing the back of the steel angle in the area of the studs is very difficult and asked if the standard could be revised to require metallization on the exposed surfaces only. Mr. Perfetti stated that the existing standard notes do not require the studs to be metallized. Mr. Greene stated that the area around the studs was also difficult to metallize and questioned if the angle could be galvanized. Mr. Perfetti stated that the heat on the angle during the hot dip galvanizing process could warp the angle. Mr. Simon also stated that the corners of the angles needed to be metallized and that the corners often get overlooked when the specification requires metallizing exposed surfaces only. After some discussion, it was concluded that the current specification is adequate.

Mr. Trivette stated that with structures on heavy skews and vertical curves the angle is very hard to set at grade. In fact, often times the angle does not match the grade, creating a bump at the joint. Mr. Trivette stated that if the angle was required to be field welded, the correct grade of the angle could be more easily achieved. *Mr. Perfetti stated that the Structure Design Unit would investigate the possibility of not splice welding the angle.*

11. CORROSION INHIBITOR ACCEPTANCE: *(MATERIALS AND TESTS)*

Mr. Peoples distributed a draft copy of a special provision for Calcium Nitrite Corrosion Inhibitor for prestressed members and asked that comments on the draft be made to Jack Cowsert. Mr. Hancock asked if there would be a special provision for Corrosion Inhibitors for cast-in-place members. Mr. Peoples stated that the intention was to release this provision for prestressed members and then progress into cast-in-place members.

12. DESIGN BUILD PLAN DISTRIBUTION: *(MATERIALS AND TESTS)*

Mr. Greene stated that the Materials and Tests Unit had not been receiving plans for design build projects. The Unit typically receives two sets of roadway plans and four sets of structure plans. Mr. Greene stated that precast concrete inspectors are trying to inspect members without any plans. Mr. Gay stated that for ongoing projects, Scott Blevins of Design Services needs to be contacted for plan requests. For future projects, a scope of work needs to be written by the Materials and Tests Unit and given to Mr. Gay for inclusion in the contract.

13. LEAD ABATEMENT: *(MATERIALS AND TESTS)*

Mr. Peoples stated that there is some confusion with the inspection responsibilities of lead abatement projects. Mr. Peoples stated that the specification requires the contractor to be quality control certified. Therefore, the inspector only needs to perform quality assurance inspections which would not require the inspector to be on the project at all times. In recent projects, the contracted certified inspector has been on the project maintaining traffic control and performing other miscellaneous inspection work creating unnecessary cost for the Department. Mr. Peoples stated that the Construction Offices needed to monitor the time of these inspectors. Mr. Hancock stated that verbiage should be put in the specification stating limits on the amount of time the contracted inspector should be onsite and their scope of work.

Mr. Buchanan stated that for design/build projects, consideration should be given to adding painting to the scope of work on existing bridges within the project limits.

14. TIE BACK WALLS: *(MATERIALS AND TESTS)*

Mr. Greene stated that the Standard Specifications require shop welding for the tie back reinforcement connection to the piles in tie back walls. However, the majority of the time the contractor is allowed to perform the welding in the field. Mr. Greene stated his concerns that the welded connection is an integral part of the wall design and the field inspectors were not qualified to inspect such a weld. After some discussion on the quality of welds, performance specifications, and sample testing, it

was decided that the existing specification be reinforced by adding a note to the plans emphasizing that the connections are to be shop welded. *Under Mr. Hancock's suggestion, the Soils and Foundation Unit agreed to place a note on the plans emphasizing that the anchor reinforcement must be shop welded to the pile.*

15. COATING ENDS OF WEATHERING STEEL GIRDERS *(SOILS AND FOUNDATIONS)*

Mr. Greene asked if it was a great benefit to coat the ends of weathering steel girders since it was a somewhat costly item. Mr. Simon stated that there was great benefit in coating the end of the girders because inevitably expansion joints degrade and leak over time causing the end of the girder to rust. Mr. Simon stated that unless jointless bridges were designed, all weathering steel structures on the National Highway System should be coated on the ends.

16. RESEARCH TOPICS: *(RESEARCH AND ANALYSIS)*

Mr. Rochelle updated the attendees on the recently funded research topics for FY2004. The funded research topics can be viewed at http://www.ncdot.org/planning/development/research/ once all contracts are executed in June 2003.

17. EXPANSION JOINT TOUR: *(RESEARCH AND ANALYSIS)*

Mr. Rochelle presented the attendees with a draft copy of the final research report of the expansion joint tour in October. On the tour, members of the expansion joint committee visited various structure sites throughout the State focusing on the performance of joint types as well as elastomeric concrete. *Mr. Rochelle requested comments to be returned within the next month.*

18. JOINT ISSUES: *(CONSTRUCTION)*

Mr. Trivette stated that evazote joints in sawed concrete should no longer be specified especially in staged construction. Mr. Trivette stated that the stage I traffic destroys the edges of the sawed concrete as well as the joint by the time traffic is opened to stage II. Mr. Hancock stated that the expansion joint committee concluded not to allow sawed joints. Instead, blockouts for elastomeric concrete around the evazote joint would be required.

Mr. Buchanan asked if there were any current testing requirements for elastomeric concrete. Mr. Hancock stated that the specification sets criteria for a cube test which verifies the compression strength of the concrete. Mr. Hancock stated that further tests or research was needed to determine other material properties such as bonding with the seal and armor as well as elongation of the elastomeric concrete. Mr. Rochelle stated that a technical assistance agreement was available for such research.

The Materials and Tests Unit, the Structure Design Unit, and the Construction Unit all agreed to draft the technical assistance proposal.

19. CULVERT CONSTRUCTION ISSUES: *(CONSTRUCTION)*

Mr. Trivette stated that on multibarrel culverts with staged construction, the contractor usually requests to change the staging sequence that is shown in the plans. The contractor then submits his change to the permitting agencies and receives permission. The Contractor typically denies the Department's request for a credit in these cases, stating that the proposed staging was included in their bid. Mr. Trivette asked if the plans or specifications could be revised in order to eliminate this debate. Mr. Bennett stated that an exact construction sequence is necessary for initial permitting of the project. Therefore, even though there may be alternatives, the permitted construction sequence must be shown in the plans. Mr. Hancock stated that a note should be added to the plans giving the contractor the option to propose an alternative construction sequence that must be permitted by the agencies. Mr. Hancock stated that in addition, a lump sum pay item to cover channel diversion instead should be created instead of various pay items. *Structure Design committed to presenting this idea at the next AGC/DOT meeting for comments from the contractors.*

Mr. Trivette also stated that on three sided culvert projects the Geotechnical borings are only taken along the centerline of the culvert. In many cases, the rock line drops over the length of the footing and thus the contractor is forced to pour a subfooting. Consequently, there is no pay item to account for this quantity of additional reinforcement and concrete. *Structure Design committed to requesting more soundings from the Geotechnical Unit for three-sided culverts.*

20. ACCESS ISSUES: *(CONSTRUCTION)*

Mr. Hancock stated that design engineers should consider access to the site and constructability when choosing a superstructure type. In many cases, especially stream crossings, contractors are not allowed temporary access in the water for construction and therefore erecting heavy concrete girders is difficult. Steel plate girders would be preferable for construction and should be considered in some cases. *Mr. Perfetti stated that this information would be presented at the next Structure Design Unit Project Engineer's Meeting.*

21. JETTING: *(SOILS AND FOUNDATIONS)*

Mr. Mulla stated that currently the Standard Specifications allow jetting of piles as an option even though the environmental agencies have restricted the use of jetting to

certain areas. Mr. Mulla stated that a draft specification had been written to restrict the use of jetting. The final copy will be released when a current research project is completed and suggested jetting pressures to be included in the specification are determined. *After some discussion, it was decided that the Soils and Foundations Unit would provide a note in the foundation recommendations stating whether jetting is allowed.*

22. CONSTRUCTION OVER RAILROADS: *(CONSTRUCTION)*

Mr. Hancock stated that in several bridge replacement projects over railroads, the existing embankment was approximately 1:1 or steeper. When the bridge replacement design is completed, the end bents are usually set back at a 1.5:1 or flatter slope. As a result, a vertical embankment parallel to the centerline of the bridge is required to tie the end bent slope to the existing embankment. Therefore, the Construction Unit has to request a supplemental wall design to hold back the soil. *Mr. Perfetti stated that this problem would be presented at the next Structure Design Unit Project Engineers meeting and he would request the Project Engineers be cognizant of this issue.*

23. POURING SEQUENCES: *(CONSTRUCTION)*

Mr. Robinson stated that in several instances the contractor had requested to deviate from the pouring sequence shown on the plans for continuous for live load concrete superstructure bridges. The contractor typically asked to place a construction joint four feet each side of the bent centerline. Subsequently, the contractor proposes to pour all the positive moment areas in the first pour and then return and pour the negative moment sections last. Mr. Trivette asked if this method could be detailed on the plans. *Structure Design committed to showing this method as an optional pouring method on the plans in the future.*

24. CLASS I FINISH: *(CONSTRUCTION)*

Mr. Hancock stated that some poured elements might warrant a Class I finish, in particular, the Texas Classic Rail. After some discussion of the finish of other bridge elements, *Structure Design committed to investigating the possibility of requiring Class I finish or Tex-cote for certain bridge elements.*

25. DRY POURING OF DRILLED PIERS: *(CONSTRUCTION)*

Mr. Buchanan stated that there were issues in the field as to when a dry pour was permitted. Mr. Mulla stated that in the drilled pier inspection manual there was a formula that calculated the amount of concrete head vs. static head required to use a dry pour. Mr. Buchanan stated that whenever the difference between the water elevation and the top of shaft elevation is greater than 30’-35’ a wet pour should be required. However, this requirement puts the burden on the inspector to accurately

gage the water elevation. *After some discussion it was decided that the Soils and Foundation Unit would revise the specification to require a wet pour if the water in the shaft was rising 12"/hour or there was over 25' of static head in the shaft.*

26. OTHER

- The Soils and Foundation Unit requested that the information for whether the bridge is located in a corrosive area be stated on the preliminary plans. *The Structure Design Unit committed to specify whether or not the bridge is located in a corrosive area on the preliminary plans.*
- Mr. Buchanan stated that the culvert foundation conditioning material is typically under-computed by 50%. *The Structure Design Unit committed to revising their method of estimating this quantity.*
- Mr. Buchanan stated that the minimum bridge grade of 0.3% is too low and asked that consideration be given to increasing the minimum to 0.5% or higher.