

NCDOT – PCI Joint Technical Committee Meeting

NCDOT, SMU – Large Conference Room

Thursday, July 12, 2018 (1:30 PM)

MINUTES

Attendees:

Gichuru Muchane	NCDOT – SMU	gmuchane@ncdot.gov
Dan Muller	NCDOT – SMU	dmuller@ncdot.gov
Trey Carroll	NCDOT – SMU	thcarroll1@ncdot.gov
James Bolden, Jr.	NCDOT – SMU	jlbolden@ncdot.gov
Cabell Garbee	NCDOT – M&T	cgarbee@ncdot.gov
Jason Poppe	NCDOT – M&T	jepoppe@ncdot.gov
Todd Whittington	NCDOT – M&T	twhittington@ncdot.gov
Aaron Earwood	NCDOT – CCU	aearwood@ncdot.gov
Peter Finsen	G/C PCI	peter.finsen@gcpci.org
Travis Overcash	Utility PS	utilityprecast@hotmail.com
J. R. Parimuha	Florence Concrete Products	jrparimuha@yahoo.com
Richard Potts	Standard Concrete Products	RichardPotts@standardconcrete.org
Reid Castrodale	Castrodale Engrg / G/C PCI	reid.castrodale@castrodaleengineering.com
Greg Lucier	NCSU – CFL	gwlucier@ncsu.edu

Reid Castrodale began the meeting at 1:40. Self-introductions were made by attendees.

1. Review Agenda

No revisions were made to the agenda distributed prior to the meeting.

2. Minutes of July 13, 2017 Meeting

Minutes were approved as distributed.

Assigned Tasks

As in the previous meeting, discussion of the following two items was combined:

3. Debonded Top Strands

4. Lateral Stability

Reid Castrodale briefly reviewed the agenda item that was passed at the recent AASHTO Committee on Bridges and Structures meeting related to both of these items [*copy of agenda item is attached*]. The LRFD Specifications will now require that stability be considered by designers.

NCDOT has not yet begun to develop a plan for how this change will be implemented. Trey Carroll recommended that this topic be discussed at the next G/C PCEF meeting, so its implementation can be coordinated between the states.

There was general discussion of some of the issues that will need to be included in any recommendation for implementation, such as the assumed location for lifting loops, debonding lengths, and criteria for the stability analysis. It was also noted that the status of PCI's lateral stability spreadsheet is not known. Reid Castrodale indicated that G/C PCI will develop proposed recommendations for analysis for lateral stability that will be distributed prior to the G/C PCEF meeting.

ACTION ITEM: G/C PCI will develop recommendations for assumptions to be used for stability calculations to be distributed prior to G/C PCEF meeting; add item to agenda for the G/C PCEF meeting.

5. Stressing Strands in Draped Position

Reid Castrodale mentioned that this item had been discussed during the Technical Committee meeting in 2017, but that there was no discussion or report of action in subsequent joint meetings. Richard Potts stated that PCI MNL-116 contains procedures for stressing strands through drape hardware including procedures to confirm that the draped strands are adequately stressed. Measuring elongation between two points marked on the strands allows the strain to be determined from which the stress and force can be computed to determine if the proper tension is present in the strands. Richard indicated that he prefers using 30 or 50 ft lengths for measuring elongations rather than the 20 ft length in the PCI procedure.

Reid Castrodale agreed to send Trey Carroll and Richard Potts the following items related to this topic that were distributed by email prior to the 2017 meeting:

- VDOT_2016_RB_Specs 405.04 PS w highlight (.pdf - 4 pgs)
- PCI MNL-116 Harped Strands (.pdf - 3 pgs)

The prestressers indicated that they prefer straight strand designs because of safety concerns for their workers. If draping is required, stressing strands in the draped position is preferred, again for safety concerns. One concern of prestressers is that most plants are not currently set up to stress strands from both ends, which the PCI MNL-116 procedures would require if the draped strands do not have the required stress at the dead end.

ACTION ITEM: Reid Castrodale will distribute items related to this topic to the committee.

6. Florida I-Beams (FIBs)

Trey Carroll reported that the Department was still working on developing standards for use of the Florida I-Beams (FIBs). Several design/build projects and one NCDOT project have already used the sections. For projects in NC, the strand pattern will have 2 columns in the web rather than the single column centered in the section which is the FDOT standard. The Department is currently only looking at using the 78-in.-deep sections or smaller as a standard but may consider the deeper sections in the future. They plan to develop standard reinforcement for the ends of the girders, similar to what is provided by FDOT.

Trey asked the prestressers who have had experience with FIBs to let him know if they had any comments on their use.

Reid Castrodale suggested that the Department should review the tables in the Structure Design Manual that indicate maximum spans or minimum structure depths for spans as new standard sections are being added.

ACTION ITEM: Prestressers should contact Trey if they have encountered or foresee any issues with fabrication of the FIBs.

7. RFID Tag Placement

Jason Poppe had the original list of locations for tags that had been developed previously by the joint committee. No changes have been made to those previously agreed locations. The main requirement is that the tags should be placed 5 ft from the end of the element, except for cored slabs and box beams the tag can be placed between the dowel holes. For girders, it would be nice, but not required, to be able to see the tag from below.

Cabell Garbee reported that some changes to HICAMS are being made to address several issues. It seems that data collection and transfer is going pretty well.

At the joint committee meeting in March, it was suggested that a meeting was needed to work out data transfer issues between Titan and Idencia systems. It appears now that such a meeting may not be needed, as the interaction seems to be working better. Cabell indicated that the Department does not want the precasters to have to enter the same data separately for the two systems. Todd Whittington reported that Idencia is working toward having user meetings to see how the system is working. This is an idea from Tracy, who used to work on the HICAMS system for the Department.

ACTION ITEM: None.

8. Rubbing Girders

Jason Poppe reported that this issue was discussed in the staff meeting the previous day. The Department is interested in looking at the proposed GDOT procedure for rubbing girders.

The proposed GDOT procedure (per Jon Smith, GDOT) is as follows:

“GDOT proposes the following:

- Wet sack all the Girders as we are currently doing, making certain to be consistent with the mixing of the sack rub material.
- Leave the sack rub material on the Girders going forward with no rubbing off of the residual dust later.

This will eliminate the need to create the dust since the Producer won't have to rub the dried material residue as we currently do.

The DOT will get what we want (rub all areas to ensure any voids are filled) and the Producer gets what they want which is no dust generation.”

GDOT also asked producers for any feedback from this proposed procedure.

Richard Potts indicated that there are some photos that show the results of the proposed GDOT procedure. JR Parimuha reported that his plant often rubs girders more than required – they like the beams to look very good. Jason recommended that this be discussed at the upcoming G/C PCEF meeting, so the policy would be consistent between the states.

Peter Finsen indicated some comments received from Jeff White about direction from inspectors about rubbing girders. Cabell and Jason said that they would follow up.

G/C PCI offered to assist the Department in training for prestressed concrete inspectors. See discussion reported under new item below.

ACTION ITEM: G/C PCI will forward GDOT proposed procedure to NCDOT for review. [*included in minutes above*]; add this item to agenda for G/C PCEF meeting.

9. Future Prestressed Concrete Bridge Design Seminar

Several topics that would be good to discuss at the prestressed concrete bridge design seminar scheduled to be held in Raleigh on November 15 were discussed, including details for skewed cored slabs and box beams (see discussion reported under new item below) and a very brief mention of FIBs (no details should be given in seminar because Department standards are not expected to be finalized by the seminar). It was suggested that a follow up discussion be held at the G/C PCEF meeting.

ACTION ITEM: G/C PCI will contact ACEC to discuss further; G/C PCI will reach out to Carolinas AGC to try to get contractors involved; G/C PCI to have additional information on the agenda ready for NCDOT by the upcoming G/C PCEF meeting.

Other Items

10. Cored Slabs & Box Beams with Overlays – projecting bars for composite action

NCDOT reported that concrete overlays on box beams or cored slabs had delaminated in a few cases. The cause was not known. The Department was proposing use of bars extending out of the top surface of the elements to help ensure that delamination would not occur. Two possible details were discussed: L-bars and bars with 180 deg. hooks. Producers agreed that they preferred the L-bar detail. Use of a single bar crossing the section instead of two L-bars was discussed, but producers preferred the two L-bars. The bars could be spaced the same as sidewalk bars, which are spaced at 7 ft, but a spacing of 4 ft seemed more reasonable, and the bars would be located at stirrup locations. It was suggested that bars could be spaced at 4 ft but staggered between sides since having bars on both sides of the joint at the same location may not be necessary. It was noted that concrete overlays, which have a single mat of reinforcement, are only used on adjacent members for bridges on routes with higher ADTs and heavy truck traffic. It was reported that

contractors were concerned that protruding bars could be a problem for top-down construction where cranes are moved onto the spans. The question was raised regarding whether the bars would be epoxy coated. It is expected that they would since reinforcement in the overlay would be epoxy coated.

11. Barrier Rail Bars for Cored Slabs & Box Beams with Overlays – accommodating heavy super-elevation

NCDOT reported that some contractors had reported difficulties in placing barriers and obtaining the required side cover to reinforcement for cored slabs or box beams on a heavy super-elevation (which is uncommon). Richard Potts suggested that the bars could be moved in ½ in. to provide more cover. JR Parimuha cautioned against specifying bent bars because that would mean that a particular element could only be used on one side of the bridge, where they sometimes swap elements from one side to another to get better fit up for the overall bridge. It was suggested that a note and detail could be added that bars could be moved in to accommodate the tilt for super-elevations greater than 2%.

New Training for Prestressed Concrete Inspectors

It was agreed that training for inspectors would be good, and that it could be held in conjunction with the seminar in November. It could involve as many as 40, including consultants. All of the inspectors cannot be pulled in from the plants for the training, so it was suggested that it could be conducted as a webinar. Cabell indicated that they had done some similar training for precast items in which they worked through photos of products and issues encountered. Cabell also stated that a “hands on” course would be nice, but that there are no plants close enough to Raleigh to make that practical. It was agreed that there would be further discussion at the G/C PCEF meeting.

ACTION ITEM: G/C PCI will continue to explore with NCDOT options for inspector training; further discussions will occur at the G/C PCEF meeting.

New Bearing Details for ≥ 30 deg. Skews for Cored Slabs and Box Beams

Producers reported seeing a few projects with 45 deg. skews, which are not in the standard details. Only one project was known to the Department. It was pointed out that such skews do not sit on bearings well and may rock. Richard Potts pointed out that the grade also affects how well beams sit on bearings, with the low end having the worst conditions.

ACTION ITEM: Reid Castrodale will check PCI Northeast website to see if they have details that can be distributed to the committee.

New Availability of Prestressed Elements

Dan Muller raised the questions of lead times for delivery of prestressed concrete elements that had been raised by contractors. Others pointed out that there had been a joint meeting in April with AGC and PCI to discuss that issue. The issue remains on the AGC agenda. It was suggested that the problem can be especially difficult with design/build contracts, where the contractors can plan their schedules to improve efficiency when several bridges are bundled, but if they only release one

bridge at a time to the prestresser, the prestressers are not able to also improve efficiency. The ability to efficiently produce product is especially important since neighboring states are also increasing their programs, so all plants are busy. Aaron Earwood indicated that he is working to educate the Division offices about this issue. It was requested that the Department provide a published program that would allow producers to plan ahead as they see the future demand in the program. Currently, only the central office program is listed on the NCDOT website. The Divisions are being encouraged to also publish information on their programs.

ACTION ITEM: NCDOT agreed to review their contracts to make sure the schedules allow reasonable lead times for production of prestressed girders.

Informational Items

New NCSU Research Concept

Greg Lucier briefly presented a concept to the group that he is considering as a submittal to NCDOT as a research proposal. It would be to use a several-inch-deep layer of UHPC in the bottom of cored slabs to provide corrosion protection for the strands. The remainder of the cross-section would be filled with conventional concrete. The group seemed to think that the idea may have some potential as long as the conventional concrete could be placed without displacing the UHPC.

12. Update on Status of Bridge Program

No update was given. The Department expects the same level of funding for bridge projects next year.

13. PCEF Meeting – August 16, 2018 – SCDOT

The next NCDOT / PCI Joint Meeting will be held on Nov. 16, 2017 at the MTU.

The meeting was adjourned at 3:45.

Attachment:

- **2018 AASHTO Bridge Committee Agenda Item: WAI 193** - Designing for stability of precast-prestressed bridge girders during handling and transportation [*as received from a member of T-10. Final version of ballot distributed to states for voting may be formatted differently but should have same content*]

2018 AASHTO BRIDGE COMMITTEE AGENDA ITEM: WAI 193

SUBJECT: Designing for stability of precast-prestressed bridge girders during handling and transportation

TECHNICAL COMMITTEE: T-10

<input checked="" type="checkbox"/> REVISION	<input type="checkbox"/> ADDITION	<input type="checkbox"/> NEW DOCUMENT
<input checked="" type="checkbox"/> DESIGN SPEC	<input type="checkbox"/> CONSTRUCTION SPEC	<input type="checkbox"/> MOVABLE SPEC
<input type="checkbox"/> MANUAL FOR BRIDGE	<input type="checkbox"/> SEISMIC GUIDE SPEC	<input type="checkbox"/> MANUAL BRIDGE
ELEMENT INSP		
EVALUATION	<input type="checkbox"/> OTHER	

DATE PREPARED: 5/10/2010

DATE REVISED: 2/22/2018

ITEM INFORMATION

Item #1

Revise the following Article:

5.5.4.3—Stability

The structure as a whole and its components shall be designed to resist sliding, overturning, uplift and buckling. Effects of eccentricity of loads shall be considered in the analysis and design.

Buckling and stability of precast members during handling, transportation, and erection shall be investigated.

Add the following Commentary:

C5.5.4.3

Stability during handling, transportation, and erection can govern the design of precast, prestressed girders. Precast members should be designed such that safe storage, handling, and erection can be accomplished by the contractor. This consideration does not make the designer responsible for the contractor's means and methods for construction, as discussed in 2.5.3.

Lateral bending stability analysis should be based on the "Recommended Practice for Lateral Stability of Precast, Prestressed Concrete Bridge

Girders”, Precast Concrete Institute, Publication CB-02-16-E. A detailed design example is presented in Seguirant, Brice, and Khaleghi, (2009).

Item #2

Add the following Article:

5.9.4.5 Temporary Strands

Temporary top strands may be used to control tensile stresses in precast prestressed girders during handling and transportation. These strands may be pretensioned or post-tensioned prior to lifting the girder from the casting bed or post-tensioned prior to transportation of the girder. Detensioning of temporary strands shall be shown in the construction sequence and typically occurs after the girders are securely braced and before construction of intermediate concrete diaphragms, if applicable.

Pretensioned temporary strands are debonded over the center portion of the girder. If pretensioned, the development length, measured from the end of the debonded zone, shall be determined as described in 5.9.4.3.3 No other provisions of 5.9.4.3.3 apply to temporary strands.

Debonded temporary strands shall be symmetrically distributed about the centerline of the member.

Debonded lengths of pairs of temporary strands that are symmetrically positioned about the centerline of the member shall be equal.

The effects of temporary strands must be considered when calculating camber and loss of prestress

C5.9.4.5 Temporary Strands

The stability of slender precast concrete girders is improved when lifting and transportation support points are moved away from the ends of the girder. The consequence of having a shorter span between support points is reduced dead load stresses to balance the stresses due to pretensioning and thus excessive tensile stresses in the top flange and compressive stresses in the bottom flange may develop. Temporary strands placed in the top flange of the girder reduce stresses and reduce the required concrete compressive strength at prestress transfer. Temporary strands in the top flange balance a portion of the primary prestressing and reduce camber and camber growth due to creep.

Temporary top strands reduce the effectiveness of the permanent prestressing. Therefore, detensioning of the temporary top strands is typically recommended. Access to pretensioned temporary top strands is typically provided through pockets in the top surface of the top flange. Detensioning must occur before the temporary strands become inaccessible.

Casting deck concrete and installation of precast deck panels will typically cover temporary top strand access points in the top flange.

Detensioning of the temporary top strands results in an upward deflection of the girder. Typically, temporary top strands are detensioned one girder at a time. This results in a differential deflection between adjacent girders that can crack intermediate concrete diaphragms, if present. To mitigate this issue, temporary strands should be detensioned after the girders are securely braced, but before intermediate concrete diaphragms are placed.

Sleeves used for debonding should be of sufficient inside diameter to mitigate binding of the strand during detensioning. Experience has shown that sleeves with inside diameter $\frac{3}{16}$ " to $\frac{1}{4}$ " larger than the strand diameter provide sufficient annular space. Access pockets should be protected to prevent water intrusion into the sleeves. Water in the sleeves can freeze and result in longitudinal cracking in the top flange that mirrors the location of the sleeves. Access pockets should be immediately patched and sealed after detensioning.

Item #3

Revise the following Article:

5.12.3.2—Precast Beams

C5.12.3.2.1

AASHTO LRFD Bridge Construction Specifications places the responsibility on the Contractor to provide adequate devices and methods for the safe storage, handling, erection, and temporary bracing of precast members. However, these preservice conditions may govern and should be considered in the design, as discussed in 2.5.3.

Item #4

Add the following to Article 5.15:

S. J. Seguirant, Brice, R., and B. Khaleghi, "Design optimization for fabrication of pretensioned concrete bridge girders: An example problem", PCI JOURNAL Vol. 54, No. 4, Fall 2009, pp 73-111

"Recommended Practice for Lateral Stability of Precast, Prestressed Concrete Bridge Girders", Precast/Prestressed Concrete Institute, Publication CB-02-16-E

OTHER AFFECTED ARTICLES

None

BACKGROUND

The spans of pretensioned girders have been steadily increasing over the past decade. Record or near record breaking spans have been design and constructed in Washington, Nebraska, and Florida. These spans have been in excess of 200 ft. The stability of long span pretensioned girders is a serious concern and should not be ignored by the design engineer. Accommodations for stability often govern the girder design.

The use of temporary strands is a common design accommodation for shipping and handling of precast girders. The effect of temporary strands should not be ignored in design. These strands could be pretensioned or post-tensioned depending to the producers' capability and girder types.

ANTICIPATED EFFECT ON BRIDGES

Improved safety and constructability

REFERENCES

S. J. Seguirant, Brice, R., and B. Khaleghi, "Design optimization for fabrication of pretensioned concrete bridge girders: An example problem", PCI JOURNAL Vol. 54, No. 4, Fall 2009, pp 73-111

"Recommended Practice for Lateral Stability of Precast, Prestressed Concrete Bridge Girders", Precast/Prestressed Concrete Institute, Publication CB-02-16-E

Lead State: WA
Industry: PCI
FHWA