PCI Mid-Atlantic + PCI Northeast

Bridge Design Seminar – April 13, 2021 – Q&A

Means and Methods		
No.	Questions	Responses
1	Bottom flange ties only at ends of girders?	Since the meaning of the question is not clear two responses are provided: (1) The more likely meaning is related to the confinement reinforcement in the bottom flange. While some owners require confinement bars for the full length of a girder, the LRFD specifications only require confinement bars at the end regions of the girders. (2) The second meaning is that side forms require under-ties that pass beneath the soffit forms hold the two side forms in place at the bottom. Top ties are also provided to keep the top of the forms in place. These ties are required for the full length of the girder.
2	What is the purpose of the bearing plate if the prestressed beam is being supported by a rubber pad? For example, for a prestressed beam with an integral abutment. Is the bearing plate necessary in this case?	A bearing plate is typically required if the bearing plate connects to a sole plate when anchor bolts are used for superelevation or to serve as a mechanism for lateral restraint. Bearing plates are often preferred by fabricators to protect the ends of the girders because spalling is a concern when girders camber and slide during detensioning. A bearing plate is a good practice in all cases with larger skews as it reduces the likelihood of spalls at the end of the beam during detensioning or when the beam begins to camber and bear on the ends alone. In a situation like an integral abutment, a bearing plate is not required, but would still be helpful to prevent spalling during detensioning.
3	When the concrete is poured in the forms how can we ensure there are no potential cold joints? Since you will be going back and forth to fill the full height of the girder? On site construction projects, OPSS indicate that an old joint is considered after 20 minutes interruption in the concrete pour operation. Is this accurate or is this more for shallow structures like a bridge deck or overlay?	Typically when concrete is placed into a form in a precast plant, it is placed continuously or as close to continuously as possible, so that no cold joints form. (Also, not normally a back & forth motion) But more importantly, anytime new concrete is placed on existing concrete, care needs to be taken to watch the flow of the concrete and assure the new concrete is mixing with the existing concrete. And if it is not mixing well together, the simple solution is to use a vibrator or a rod to mix the two layers of concrete.
4	How do you avoid segregation of the aggregate when vibrating, especially with the congested reinforcing? It seems like you would have excessive aggregate at the bottom and center of	A proper SCC (Self-Consolidating Concrete) concrete mix is designed to suspend the aggregate and provide a uniform aggregate distribution across the entire depth of the cross section. There are pouring techniques used at the ends of beams that help provide a uniform aggregate distribution, but overall, a good SCC mix has no segregation. Tests are performed during mix development to assess the ability of the mix to pass through rebar in a

	the forms with little or no aggregate at the top and outside of the reinforcing cage.	beam; another approach is to pour a trial section of girder then cut the end off and visually inspect the aggregate distribution to assure there is an equal distribution of aggregate per area of the cross section. A conventional concrete mix design with a higher slump may also be used with appropriate means and methods.
		Materials
1	What time duration is needed before raking top flange ¼" for composite behavior?	A lot of conditions affect this duration such as the set time of the mix, concrete temperature, and air temperature. On a typical pour, it is likely 15 to 30 mins after the top of the beam is screeded off.
2	What is typical f'ci and can use 7,200 psi?	Typical release is approx. 80% of the f'c. We use 8 & 10ksi for most of our bridge mixes so the release for these is 6.4 & 8ksi. 80% is a good rule of thumb but f'ci should be driven by the design and it is good practice to specify what is required for the design rounded up to the nearest 100 psi. Release strength does not need to be a function of 28 day strength. Designers should recognize that release strength is a very important, driving parameter for casting efficiency for the producer. In many cases the release strength for a 10ksi, 28 day strength could be only 6.4 ksi with no impact to the final strength of the product. For this type of design, debonded top strands are often utilized to reduce stresses at the end of the girders to allow lifting and handling. This will be covered in session 2 and 3.
3	Did you ever use corrosion inhibitor with concrete at any project specially roadways?	Corrosion inhibitor has been used on bridge products. We not aware of its use on roadways. Corrosion inhibitor has been used on bridge deck panels or NEXT beams which may be subjected to direct traffic without an overlay.
4	What are some lessons that have been learned so far from the design and fabrication of CFRP strand (vs. steel strand) prestressed and post-tensioned members?	Two lessons come to mind. The first is that fabrication of girders using CFRP strands is generally more challenging because stressing of the material, which has a greater notch sensitivity than steel, affects how that type of strands can be gripped. The second issue is that the strand is elastic until failure, so there is no yield point and therefore no plasticity. While this differs from the behavior of conventional strand, the significantly greater ultimate strength of CFRP strand makes it possible to achieve safe designs using a different approach from designs using conventional strand. A guide specification is now available. Several recent articles on this subject have been published in both *ASPIRE*, PCI and ACI journals and publications.
5	I design with PennDOT DM-4 criteria and for f'ci what range is considered when i use f'c for final of per DM-4 of 8,000 psi?	If f'c is 8ksi, f'ci typically is approx. 80% of f'c or 6.4 ksi. However, if a lower initial strength will work, designers are encouraged to specify the lowest compressive strength that will satisfy the design requirements. This will allow the girders to be detensioned at the earliest possible time.

6	For P/S beams that have draped strands, are there any limitations for the force resisted by the hold down device/anchor? Also, are there any limitations for the total hold down force? For example, we have seen a requirement where the total hold down force must be equal to or less than 75% of the girder self-weight.	Most fabricators will have a hold down force limit. Typically, this is dealt with by breaking the one hold down location into two or more to stay under the fabricators limit (usually this is done by the fabricator and not by the designer). Yes, there is a limit on the total hold down force. If the force is too high, meaning too many strands are deflected, you can suspend the beam from the strands and that is not a good situation (beam wants to raise up off the bed which is a major safety concern). General standard practice is to design with straight strands and use debonding to control stresses at the ends. Using debonding tends to reduce end stress cracks more than draping. If a debonding pattern is unattainable based on the limits of AASHTO or the specifications, drape the minimum number of strands required to meet the criteria.
	BIM	
1	Was Tekla used for all of those 3D models? Was that produced by the designer or the fabricator? Please elaborate on the information that was provided in the 3D model that was useful for the fabricator. Were shop drawings or installation drawings produced from the 3D model?	Tekla was used for all the models shown, and the models were produced by the fabricator. The information provided by the model is vast, some if it includes: piece weights, piece volumes, rebar shapes, quantities, weights, all information on a per piece basis or however you want to break it up. Scheduling can be done and a piece list can be produced. Once the model is complete, reports can be generated to pull whatever information is wanted from the model. All shop drawings and installation drawings were produced from the model. It is also possible to use the model in the plant or field and not have to generate the 2d drawings if desired.
2	What percentage of projects are using BIM for layout of all rebar? At percentage of the bridge structure needs to be designed as precast before you start seeing a net gain to make a BIM model?	We layout all rebar in all our models. The time investment into 3D modeling is extensive and should not be underestimated but the positive output is far greater than you may think. It takes a leader with a strong computer knowledge and someone that likes the challenge to make something work cause there will be many bumps in the road, trying to figure it out and make it work for you. We use 3D BIM on all the products we produce, even individual beams; and have experienced net gains in plant constructability, information, drawing quality and consistency.

	GENERAL	
1	With precast foundations, how do you ensure full and or uniform bearing?	If the subgrade bearing surface is aggregate, contractors have different methods of ensuring optimum compaction and a high standard of care for the final grading. More often, the subgrade system is prepared low, and either with shim stacks or levelling devices, precast foundations are set to proper elevations and flowable concrete is pumped through openings in the foundation until it flows out all sides ensuring full and uniform bearing.
2	What is the typical variation in camber for precast girders? 0.05 inches / 1 in of camber?	This varies based on the prestress force to design the element. The more prestress the potential for higher camber. PCI MNL-135 Tolerance Manual addresses Camber Variation from the Design Camber. You should also speak to the fabricator about camber and the anticipated variation. It is good to provide details that allow variation in camber to be addressed in construction.
3	Do precasters have any objections to the use of fibers in the precast decks and beams?	No objections, just question if necessary, because depending on the type of fibers, it may get expensive; or if the question is referring to fiber as a replacement for other forms of traditional reinforcement, no objection.
4	Will there be preliminary charts added to ch 6 for the NEXT E-beam and voided slabs?	PCI Northeast has provided preliminary design charts for NEXT F, E, and D sections in the 2nd Edition **NORTHEAST EXTREME TEE (NEXT) BEAM GUIDE DETAILS.** These can be downloaded for free on www.pcine.org under Bridge Technical Resources.
	Girder Repairs / Fabrication Issues	
1	As a bridge inspector I see a lot of prestressed beams voided slabs and also boxes that have the end corners cracked and spalled. I assume it is being caused by the stresses - how important is this? I know in some ways it may push the stress blocks out the beams.	Spalls at on the bottom corners at ends of prestressed beams or boxes are usually caused by camber and sliding at detensioning as discussed in an earlier response. This is more likely to be a problem when beam ends are skewed. These small spalls can be easily repaired. Please review the following resources for additional guidance. PCI Website – www.pci.org Look in bookstore. Manual for the Evaluation and Repair of Precast, Prestressed Concrete Bridge Products, 1st Edition (MNL-137-06). PCINE website – www.pcine.org Look under Technical Resources/Bridge Resources for the free guideline published in January 2018: Resolution of Non-Conformances in Precast Concrete Bridge Elements (7.16 MB PDF File)