Causes of Excessive Detensioning Stresses in the Northeast Extreme Tee (NEXT) Beams

The following comments relate to "Causes of Excessive Detensioning Stresses in the Northeast Extreme Tee (NEXT) Beams,"[1] by Mauricio Diaz Arancibia and Pinar Okumus, which appeared in the May–June 2017 issue of *PCI Journal*.

We are both members of the PCI Northeast Bridge Technical Committee, which was responsible for the development of the northeast extreme tee (NEXT) beam. This active committee consists of representatives from New England Departments of Transportation and New York, regional producers, and several consultants. The development of the NEXT beam was one of our major accomplishments as a committee. The popularity of this section, which is now being used in many states beyond New England, speaks volumes to the quality of the design and its simplicity, durability, and versatility. Our committee continues to develop better details and other variations on this section.

We greatly appreciate the study into end cracking on certain forms of the NEXT beam. The study was very good and identified the most likely causes for the longitudinal cracking in the top flanges. The study has confirmed our suspicion that the cracking was due to uneven liftoff of the stems after detensioning and large skew angles. It is important to supplement this article with a little history and recommendations for management of these cracks.

The most common crack is a longitudinal crack located just inside the face of the stem on obtuse corners of skewed NEXT F beams. This crack is somewhat common in these beams but rare in NEXT D beams, as the authors also concluded in their research. Based on the producer's experience with double-tee beams, our committee had predicted the potential of this crack before the first beam was cast. We included details for supplemental reinforcement in this region in our typical details and also investigated fiber-reinforced polymer reinforcement. Our committee also developed repair procedures for the crack. Supplemental crack control reinforcement is intended to intercept a crack and keep the width of the crack reasonable. Crack control reinforcement will not eliminate the potential for a crack.

The important point in this discussion is an understanding of the nature of this crack and what it means to the service life of the section. The top flange of a NEXT F beam is a "form" that is intended to support the wet-cast concrete of the deck. It is not considered to be part of the structural deck; therefore, this crack should not be considered to be detrimental to the performance of the beam or the deck. The standard repair procedure that has been developed for this crack is based on providing a bridge that is as durable as an uncracked section. In short, this crack is expected and can be managed as any crack in a precast concrete beam that is repaired according to PCI-recommended repair guidelines.[2] Serviceability requirements in AASHTO[3] allow for certain width cracks in concrete elements, even in severe exposure locations. More information on the management of this crack can be found in our committee's document "Bridge Member Repair Guidelines" at http://www.pcine.org/index.cfm/resources/bridge/Specification_and_Guidelines.[4]

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1. Diaz Arancibia, Mauricio, and Pinar Okumus. 2017. "Causes of Excessive Detensioning Stresses in the Northeast Extreme Tee (NEXT) Beams." *PCI Journal* 62 (3): 31–45.
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3. AASHTO (American Association of State Highway and Transportation Officials). 2014. *AASHTO LRFD Bridge Design Specifications*. 7th edition. Washington, DC: AASHTO.
4. PCI Northeast Technical Committee. 2012. "Bridge Member Repair Guidelines." PCINER-01-BMRG. Belmont, MA: PCI Northeast.

Authors' response

We would like to thank Michael Culmo and Rita Seraderian for their interest in our study. The firsthand information they provide on the development of the northeast extreme tee (NEXT) beam and observations and management of flange cracking adds significant value to our study. We agree with their comments that the possibility of cracking does not take away from the popularity of these beams. In fact, our study was motivated by the popularity of NEXT beams for accelerated bridge construction in our region. We recognize that cracking can be managed by the standard repair procedures detailed in the "Bridge Member Repair Guidelines" of the PCI Northeast Bridge Technical Committee,[1] that cracking can be allowed to a certain extent, and that not all beams have cracks. The goal of our study[2] was to advance knowledge on reasons behind cracking, which may lead to design or production details that can reduce or eliminate detensioning cracks. We are pleased to hear that the findings of our study regarding uneven supports and skew angles align with the observations of the PCI Northeast Bridge Technical Committee and hope that they can be useful for the committee's continuing efforts to develop better details for this important product.

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1. PCI Northeast Technical Committee. 2012. "Bridge Member Repair Guidelines." Report PCINER-01-BMRG. Belmont, MA: PCI Northeast.
2. Diaz Arancibia, Mauricio, and Pinar Okumus. 2017. "Causes of Excessive Detensioning Stresses in the Northeast Extreme Tee (NEXT) Beams." *PCI Journal* 62 (3): 31–45.

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