

DISCUSSION



Adjacent box-beam bridges

The following comments relate to “Simplified Transverse Post-tensioning Construction and Maintenance of Adjacent Box Girders,”¹ by Jenna Hansen, Kromel Hanna, and Maher K. Tadros, and “Transverse Post-tensioning Arrangement for Side-by-Side Box-Beam Bridges,”² by Nabil F. Grace, Elin A. Jensen, and Mena R. Bebawy, both of which were published in the Spring 2012 issue of *PCI Journal*.

Readers should be aware of the following two reports that are available on the same topic as the two publications: *PCI State-of-the-Practice Report of Precast/Prestressed Adjacent Box Beam Bridges*³ and the Transportation Research Board’s National Cooperative Highway Research Program (NCHRP) Synthesis 393, *Adjacent Precast Concrete Box Beam Bridges: Connection Details*.⁴ An abbreviated version of the NCHRP document was published in the Winter 2011 *PCI Journal*.⁵

The first paper states that *PCI Bridge Design Manual*⁶ section 8.9, “Transverse Design of Adjacent Box Beam Bridges,” is based on a procedure proposed by El-Remaily et al.⁷ This statement is true of the second edition of the manual. The third edition⁸ uses the procedure proposed by Hanna et al.⁹

In the appendix of the first paper, the SI equivalent of 283 psi should be 1951 kPa.

Figure 1 compares the range of transverse forces using the proposed design procedures in each paper with those reported in the second reference listed above. The Grace et al. data are based on spans from 50 to 124 ft (15 to 37.8 m) with widths from 25 to 90 ft (7.6 to 27 m), a newly constructed slab, and the recommended number of diaphragms. The Hansen et al. data are based on Fig. 3 of their paper. Clearly the

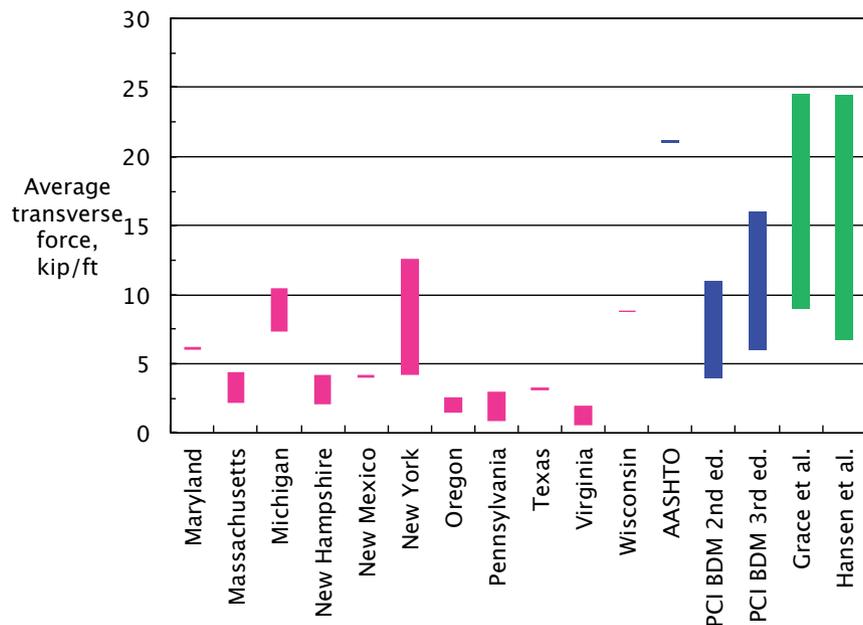


Figure 1. Comparison of proposed methods with other specifications.
 Note: PCI BDM = *PCI Bridge Design Manual*.

range of posttensioning forces is similar for both methods but is much higher than used by most state departments of transportation.

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Authors' responses

The authors greatly appreciate Henry Russell's comments and his contribution to the subject. Thanks for the correction of the stress conversion to SI units. Russell correctly points out that most state highway agencies do not provide adequate transverse posttensioning. We are glad that the paper by Grace, Jensen, and Bebawy recommends similarly high values for the transverse posttensioning levels. We agree with their conclusion that the level of the required posttensioning increases with bridge width.

We would like to take this opportunity to emphasize several issues:

Applying the posttensioning before the longitudinal joint between box beams is grouted is not an acceptable practice, even though it may be more convenient than grouting and then posttensioning. It is important to have the grout subjected to enough precompression to overcome the tension from additional loads on the bridge deck, mainly the effects of truck loads.

We believe that a composite cast-in-place topping, while helpful, is not necessary and is contrary to the concept of accelerated bridge construction. Top and bottom transverse posttensioning as shown in our paper, when calculated properly, will adequately account for the transverse bending and eliminate the potential for longitudinal cracking without need for a composite topping.

We believe that internal diaphragms are not only unnecessary but may even be harmful. It has been common practice in most of the United States not to use concrete diaphragms for I-girder bridges unless the span is relatively long. Some of the spans without intermediate diaphragms are as long as 150 ft (46 m) and the I-girder spacing as wide as 12 ft (3.7 m). When internal diaphragms are eliminated from box-beam production, the product is simpler and weighs less. Moreover, eliminating internal diaphragms allows for possible internal attachment of utilities and for use of inspection cameras and similar maintenance activities. On the bridge, when top and bottom transverse posttensioning is introduced, the adjacent webs are integrated into one and the top and bottom flanges act in transverse flexure and attract lower torsional moments.

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The authors would like to thank Henry Russell for his interest in the work and for his comments. The authors also would like to acknowledge both references highlighted by Russell as well as other investigations that have been performed and recently published addressing this topic.^{5,10}

The authors agree that the recommended transverse posttensioning force from the design charts provided in the paper is significantly greater than the current state of practice.

At the same time, readers should be aware that most state agencies do not have design guidelines for the transverse posttensioning force, and according to the survey performed by Russell,⁵ “Eighty-one percent of states and 89% of the respondents to the survey stated that they did not make any design calculations to determine the amount of transverse ties between box beams.”

Furthermore, it is important to highlight that the design charts in this paper were developed for southeast Michigan conditions by including the effects of both thermal and traffic loading. The environmental conditions at the bridge location should, therefore, be considered when determining the appropriate level for transverse posttensioning force.

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COMMENTS?

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