Closure to Discussion by Kenneth B. Bondy concering "Monitoring Secondary Moments of Continuous Unbonded Post-Tensioned Concrete Beams," Kyungmin Kim and Thomas H.-K. Kang, PTI Journal, December 2018, pp. 5-16

BY KYUNGMIN KIM AND THOMAS H.-K. KANG WITH CONTRIBUTION FROM HYEONGYEOP SHIN AND BYEONGUK AHN, SEOUL NATIONAL UNIVERSITY FOR INDEPENDENT DETAILED ANALYTICAL CALCULATIONS

POST-TENSIONING INSTITUTE ®

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Closure to Discussion by Kenneth B. Bondy concering "*Monitoring Secondary Moments of Continuous Unbonded Post-Tensioned Concrete Beams*," Kyungmin Kim and Thomas H.-K. Kang, *PTI Journal*, December 2018, pp. 5-16

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First, the authors express gratitude for the discusser's interest in the paper, whom the authors recognize for his achievements in post-tensioning. The second author is particularly proud of being a recipient of the Kenneth B. Bondy Award for Most Meritorious Technical Paper. The authors' responses to comments are as follows.

The third conclusion reached in the original paper was that "the measured total actuator load exceeded the plastic capacity of the whole member calculated through plastic analysis theory, where nominal moment strengths were assumed to be reached at all critical sections," even though assessed secondary moments were 10 times larger than normally calculated, and "unlike the existing postulation, the bending resistance at the interior support location seemed to be achieved from a combination of two different mechanisms: by internal beam moment resistance and by hold-down force induced by the post-tensioning." Thus, "conventional sectional analysis does not seem to be appropriate for indeterminate unbonded PT structures."

In the authors' paper, recently accepted for publication in *ACI Structural Journal* (Kim and Kang 2019), this was confirmed as shown in Fig. D1 and D2. In addition, four similar specimens (D3H, D3L, D4H, and D4L) with 2400 MPa (350 ksi) tendons were also investigated in the ACI paper.

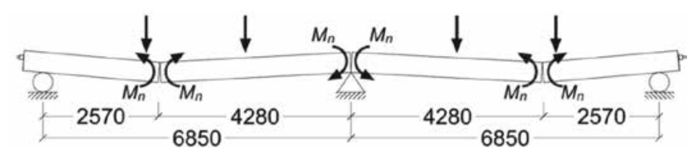

Fig. D1—Plastic hinge model (adapted from Kim and Kang 2019). (Note: Units in mm; 1 mm = 0.039 in.)

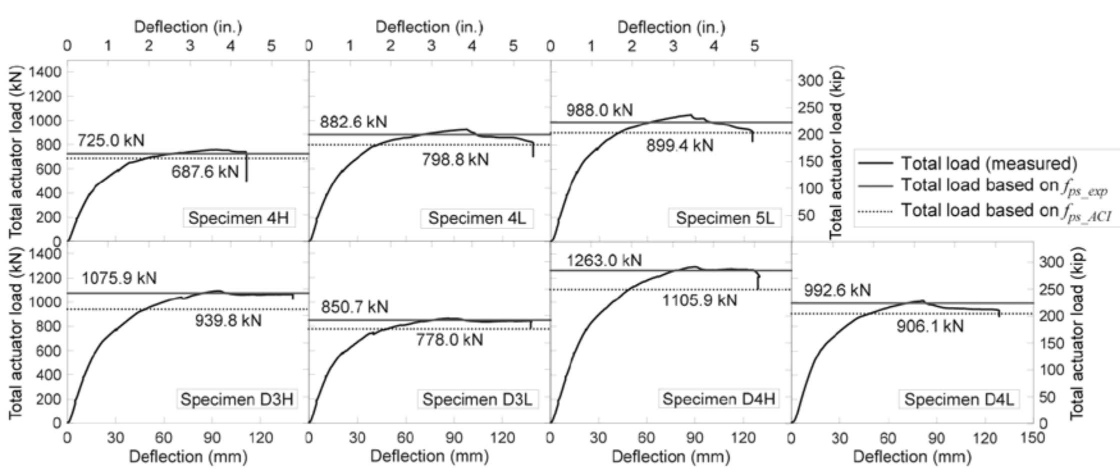

Fig. D2—Load-deflection curves (adapted from Kim and Kang 2019).

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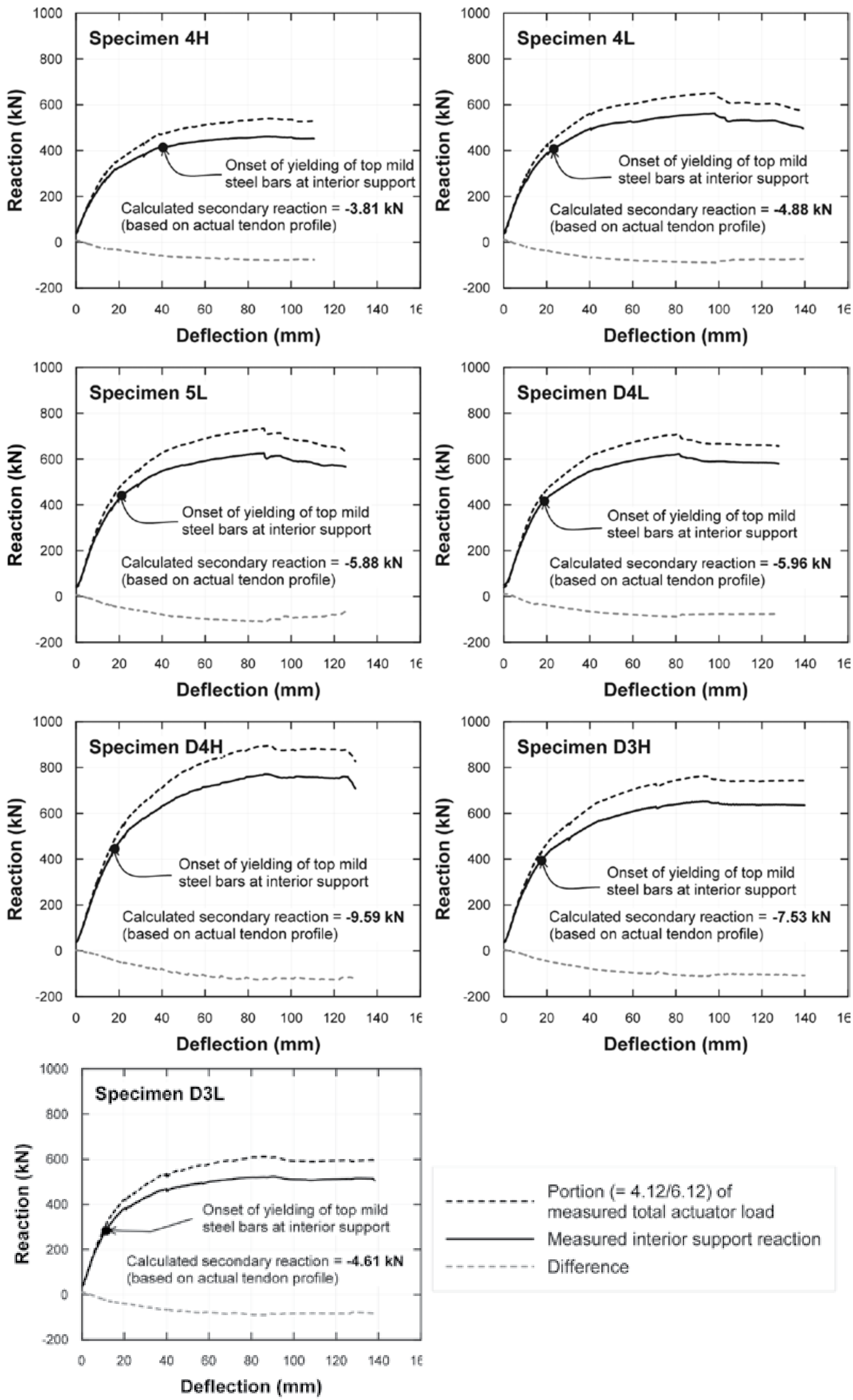

Fig. D3—Support reaction data from all specimens. (Note: 1 kN = 0.225 kip.)

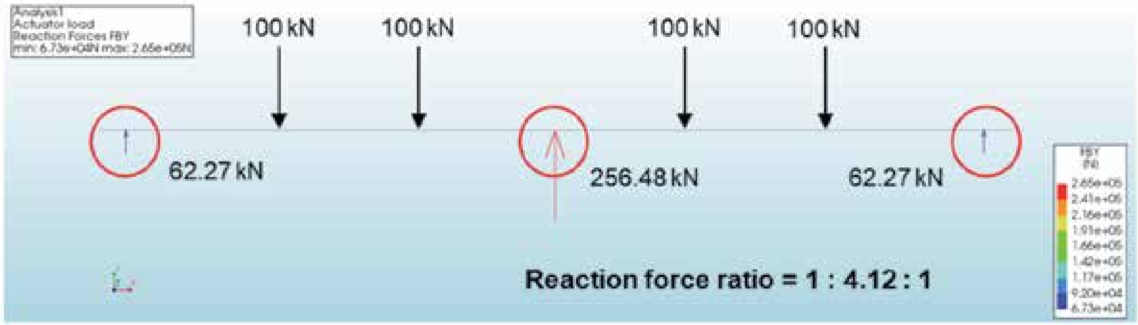

Fig. D4—Elastic analysis of indeterminate beam. (Note: 1 kN = 0.225 kip.)

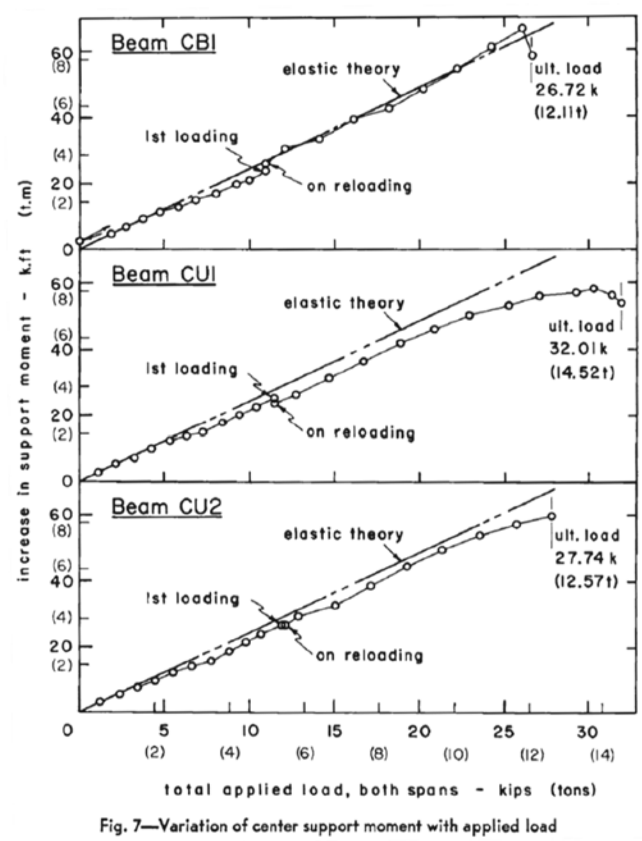

Fig. D5—Support moment (adapted from Mattock et al. 1971a).

Figure 10 of the original paper is re-plotted using the original data in Fig. D3, along with the data of the other specimens D3H, D3L, D4H, and D4L. The load cell installed at the interior support was checked using a universal testing machine before and after the beam testing, so the interior support reaction histories are correct for all seven specimens. The black dashed line is obtained from the total applied load multiplied by (4.12/6.12). This ratio is from the elastic analysis as shown in Fig. D4, and is expected to be the same until plastic moment is reached. The difference (hold-down force) is also plotted. Under internal bending moment resistance mechanism, the secondary reaction force (hold-down force) is unexplainable.

The authors would like to stress that the secondary reaction was very small with self-weight only before the external loading was applied, which is consistent with the calculated secondary reaction (–9.59 to –3.81 kN [–2.16 to –0.86 kip]). However, secondary reaction appeared to increase significantly as the loading increased.

Within the figures, negative value means downward direction (pulling reaction).

In regard to Mattock's research (Mattock et al. 1971a, b), the authors do not have the full University of Washington report by Yamazaki, Kattula, and Mattock. As such, it is unclear to the authors as to how center support moment was obtained according to Mattock et al.'s ACI papers (1971a, b) and depicted in Fig. 7 therein (refer to Fig. D5 herein). The authors believe that this was not measured center support "reaction," but center support moment derived based on other information, because no center reaction histories were provided.

As to analytical secondary moments in the original paper, calculations based on the conventional indirect method were checked and rechecked with detailed procedures reproduced in the Appendix (https://www.post-tensioning.org/publications/ptijournal.aspx).

REFERENCES

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