
 Discussion by Le-Wu Lu

570.14

Yes

LE-WU LU,⁸ A.M. ASCE. - The authors have presented a new solution to the load-carrying capacity of bow girders made of rigid-perfectly plastic material. In the development of the solution, a circular interaction relation(Eq.11) between bending and torsional moments was adopted. This interaction relation, proposed by J. Heyman⁴ in 1951 and used by subsequent investigators,^{6,7,9} is not theoretically correct. To determine an exact interaction curve for a given cross section, it is required to solve the nonlinear partial differential equation derived by G. H. Handelman,¹⁰ the solution of which is quite difficult. Due to the lack of an exact solution to this equation, the approximate circular interaction curve was therefore developed, from a lower bound consideration. Recently(1964) M. C. Steele¹¹ and E. O. Imegwu¹² succeeded in solving Handelman's equation and obtained numerical results for circular, square and triangular sections. Their results are summarized in Fig. 12.

^a December, 1963, by Kuang-Han Chu and Arthur Thelen (Proc. Paper 3726)

⁸ Research Asst. Prof. of Civil Engineering, Lehigh Univ., Bethlehem, Pennsylvania.

⁹ " The Plastic Theory of Plane-Curved Beams Loaded at Right Angles to Their Plane," by K. W. Johanson, Tech. Univ. of Denmark Bulletin No.3, 1954.

¹⁰ " A Variational Principle for a State of Combined Plastic Stress," by G. H. Handelman, Quarterly of Appl. Math., Vol.1, p.351, 1944.

¹¹ " The Plastic Bending and Twisting of Square Section Members," by M. C. Steele, Journal of Mech. and Phys. of Solids, Vol.3, p.156, 1954.

¹² " Plastic Flexure and Torsion," by E. O. Imegwu, Journal of Mech. and Phys. of Solids, Vol.8, p. 141, 1960.

It may be seen from this figure that the plastic interaction between bending and torsion is virtually independent of cross-sectional shape and that the theoretically computed points do not lie very close to the circular interaction curve. To remedy this situation, the writer had proposed a four-segment piecewise linear interaction relation which closely approximates the computed points.¹³ It is expected that theoretical solutions based on the more exact interaction curve would show better correlation with experimental results than that reported by N. S. Boulton and B. Boonsukha.⁷

¹³"Linearized Interaction Curves for Plastic Beams Under Combined Bending and Twisting," by Le-Wu Lu, Tech. Note, AIAA Journal, Vol.1, No.3, p.706, 1963.

3726
Discussion by
Legueta
3726

