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PLASTIC ANALYSIS OF CIRCULAR BALCONY GIRDERS

Discussion by Le-Wu Lu

LE-WU LU, 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. Heyman in 1951 and used by subsequent investigators, 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, 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. Steele and E. O. Imegwu succeeded in solving Handelman’s equation and obtained numerical results for circular, square and triangular sections. Their results are summarized in Fig. 12.
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. 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. 

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