SM19S_12046

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Beam Theory for Analysis of Girders with Corrugated Steel Webs

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Prestressed concrete girder with corrugated steel webs is a new concrete-steel composite structural element that has been recently utilized in highway bridges in France and Japan. In the girders, considerable shear deformation in the webs and large relative longitudinal displacement of the upper and lower flanges are anticipated. This incurs warping in the cross section of the girder and invalidates the assumption on plane section remaining plane in the classical beam bending theories. In this study, an extended shear deformable beam bending theory for analysis of the girders is derived. The theory is basing on two displacement fields and the assumption on zero longitudinal stiffness of the corrugated steel webs. Numerical example on a box-section cantilever by the theory shows good prediction comparing with the classical beam theories. The theory is also capable to predict the shear lag phenomenon in the webs of the girder.

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