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Advances on shear strength and behavior of bridge girders with steel corrugated webs

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This paper provides the recent advances related to the shear strength and behavior of bridge girders with steel corrugated webs. The real behavior at the juncture between the corrugated web and flanges of bridge girders is studied using elastic bifurcation buckling analyses using ABAQUS software. The results obviously indicated that when the flanges are rigid enough ($t_f / t_w \geq 3.0$), the girder segments exhibit shear failure mechanisms and the realistic support condition at the juncture is nearly fixed. Hence, a new interactive shear buckling strength formula is proposed for the case of fixed juncture. The shear strength of bridge girders with corrugated webs (BGCWs) using the realistic initial imperfection amplitudes is investigated. The models are well verified using available experimental results. It is found that stocky corrugated webs cannot practically reach the yield shear strength. However, among the strengths using the proposed interactive shear buckling strength formula, the one adopting Sause and Braxtan equation is found to be the most suitable. On the other hand, the existing literature on bridge girders with steel corrugated webs (BGCWs) is focused on prismatic girders i.e., with constant depth. To the authors' best knowledge, no work has been done on the shear stability of tapered BGCWs although they have been increasingly used in bridges in recent years. Webs in different typologies of tapered girders with steel corrugated webs are investigated. Accordingly, the critical shear buckling stress (τ_{cr}) of the corrugated webs of tapered BGCWs is evaluated and it is found that predicting τ_{cr} values for the tapered webs based on prismatic web calculations is not accurate. Therefore, critical buckling stresses for the tapered webs are proposed based on the stresses of prismatic webs, with different equation for each typology. The paper is, then, extended to investigate the non-linear shear strengths of the BGCWs. The available design shear strength formulas for prismatic girders are compared with the FE shear strengths of the tapered BGCWs. Based on these comparisons, design strengths for different tapered BGCWs cases are suggested.

Biography

Mostafa Fahmi Hassanein has completed his PhD from Tanta University, Egypt. He is currently an Associate Professor of Structural Engineering at the Department of Structural Engineering at the same University. He has published 26 papers in international journals. He has served as a reviewer for different reputed journals and conferences. He was also invited to the 8th European Solid Mechanics Conference (ESMC), Graz, Austria, 2012 as an "Invited Speaker". Recently, he has awarded the "State's Incentive Award in the Engineering Sciences" in 2015 from the Academy of Scientific Research and Technology, Egypt.

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