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Cold bending steel beams: A state-of the-art engineering solution that meets industry challenges

Antoine N Gergess

University of Balamand, Lebanon

Cold bending practice in the steel bridge industry is ambiguous. AASHTO allows cold straightening and cambering, but not curving. AASHTO's major concern is loss of fracture toughness (CVN) of the base metal and cracking of the weld due to fatigue. Alternatively, heat curving is widely used. Controversy in heat curving appeared as a recent study by Texas DOT on the effects of bending on the ductility of flange plates showed that when heat was applied to assist in the bending operation, particularly to reduce the bending forces, bridge fabricators have, on occasion, experienced the formation of cracks in the flange plate. Moreover, results showed that for heat-assisted bending operations, strain levels above 10 percent reduced the ductility and fracture toughness of the plate. Such controversy and unjustified reluctance for adopting cold bending for curving has jeopardized steel's competitive advantage in curved bridge applications, especially High Performance Steel (HPS) which demonstrates a high yield strength, high toughness and high formability in cold bending. An urgent need was therefore identified by steel fabricators to use cold bending for curving for efficiency, economy and time saving. A simple, versatile and cost-effective proprietary cold curving process was developed for this purpose and systematized by deriving closed-form solution that relate bending loads to curvatures. Its applicability and accuracy were verified based on comparisons with experimental results from a full-scale test girder. Visual inspection did not identify any localized damages, signs of distress or fracture which prove the legitimacy of cold bending within certain strain limits.

Biography

Antoine N Gergess has completed his PhD from the University of South Florida, Tampa, USA. Currently, he is the Dean of students and Professor of Civil Engineering at the University of Balamand, Lebanon and consultant for bridge design and construction in the UAE. He has published more than 25 papers in reputed journals and serves as the Secretary for the American Society of Civil Engineers (ASCE) Lebanon Group. He is a licensed professional engineer in Florida and Lebanon, an ASCE fellow and the recipient of the ASCE South Florida Section "Young Engineer" Award (1991).

Tony.Georges@balamand.edu.lb