3rd International Conference on Steel & Structure
11-12 December 2018
Olympic Hotel, Tehran, Iran

Fatigue Behavior of Shear Connectors in Steel-Concrete Beams with Partial Interaction

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Abstract

Fatigue is one of the main limit states in the design of bridges. Because bridges are subject to cyclic loads such as vehicle traffic and because the ratio of dead to live load is relatively low in these structures, bridges have a high sensitivity to fatigue failure. Regardless of the type of materials used in the bridge, fatigue failures are brittle and can occur in stress levels much lower than the yield stress. More specifically, fatigue failure of shear connectors leads to a significant reduction in stiffness of beams and ductility as well as a significant increase in deflection and finally bridge failure. There has been a lot of research conducted on the fatigue behavior of shear connectors in fully-composite beams. However, there is little research and data on how shear connectors perform in partially-composite beams fatigue-wise. The application of partially-composite beams in bridges has recently increased because the shear connectors are no longer distributed evenly along the beam but rather, they are installed and concentrated wherever they are needed. In this paper, the methods of evaluating fatigue life of shear connectors in fully-composite beams are investigated, and these methods are extended to partially-composite beams based on the available experimental data and partial-interaction theory. The results of this study show that checking fatigue based on slip range or strain range instead of the conventional stress range approach lead to more accurate equations with better correlation and smaller error.

Keywords:
Fatigue, *Bridge*, *Strengthening*, *Steel*, *Shear Connector*

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