Analysis of Shear Demands near the Steel-Concrete Interface in Composite Bridge Girders Having Varied Stud Pitch, Girder Depth, and Span Length

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Abstract

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The center-to-center spacing, or pitch, between headed shear studs in composite bridge girders is currently limited to 24 inches; however, research into shear stud performance at larger spacings indicates that an increase in the pitch limit from 24 to 48 inches may be justified. As shear stud pitch increases, and as studs are grouped into clusters, the applicability of existing shear demand equations (based on continuous shear flow assumptions) may no longer be valid. This paper investigates shear demands in embedded studs of composite bridge girders through a parametric finite element study, examining the effect of shear stud pitch, girder depth, and girder span on resulting stud demands. A total of 24 detailed finite element models are analyzed using the commercial software ABAQUS and consider 4 different shear stud pitches, 3 different girder depths, and 2 different span lengths. Results indicate that the current American Association of State Highway Transportation Officials (AASHTO) shear flow estimations do not accurately capture demands on stud clusters having center-to-center spacing greater than 24 inches. In stud clusters spaced at 36 and 48 inches, the AASHTO shear flow prediction equation consistently under predicted forces found in the outer-most rows of each stud cluster. A new design method and updated formulation for predicting stud demands at larger spacings is presented.

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