Evaluation of Connection Flexibility in a Road Bridge

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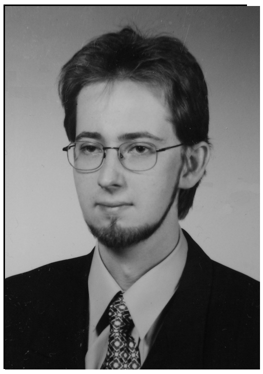

Summary

Shear studs used commonly in steel-concrete composite bridges may not assure full interaction of a steel beam and a concrete slab [1]. This problem is indicated in researches conducted on composite bridges. Using values such as deflections and shear slips in steel-concrete interface for estimation of connection flexibility in bridge structures seems to be ineffective in this case. In the paper authors' own indices used for identification of the flexibility of connection, based on values of strains in steel beams, are proposed. The results if in-situ tests of a steel-concrete composite road bridge, under live static and movable loads are presented. The results give some remarks on local changes of connection flexibility in the bridge, due to live loads.

Keywords: steel-concrete composite bridge; in-situ tests; flexibility of connection; strains; partial interaction

1. Coefficients of connection flexibility

Basic test of a steel-concrete connection with use of shear studs is the push-out test. It allows to estimate stiffness of a single connector, defined as the ratio of the shear force T, to the plate displacement in relation to the steel beam flange δ (shear slip). It is expressed by the following equation

$$c_z = \frac{T}{\delta} \quad . \tag{1}$$

Because the total stiffness of the connection of the girder on length *b* results from *n* connectors of a stiffness c_z, we can use the following equation

$$C_z = \frac{n \cdot c_z}{b} \quad . \tag{2}$$

Along the length of the span, density of shear studs usually changes according to the envelope of the vertical force, thus $C_z = C_z(x)$. The value of the parameter C_z is considerably influenced by the number of cyclic loads [2] for the tested connection, therefore it changes with succeeding load cycles. In in-situ tests of steel-concrete composite bridges, flexibility of the connection may be estimated on the basis of strains measurement. Index of connection flexibility, defined [3, 4] on the basis of the strain difference along the steel-concrete interface $\varepsilon_{ac} = \varepsilon_{ag} - \varepsilon_{cd}$, related to the strain ε_{ag}, on the top flange of a steel girder (Fig. 1), is expressed by

$$\beta = \frac{\varepsilon_{ac}}{\varepsilon_{ag}} = \frac{\varepsilon_{ag} - \varepsilon_{cd}}{\varepsilon_{ag}} \, . \tag{3}$$

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