Effect of steel diaphragms on girder performance of simply supported T-girder bridges with wide girder spacing

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Abstract

A promising system for accelerated bridge construction is the simply supported T-girder bridge with wide girder spacing and steel diaphragms. However, the influence of steel diaphragms on this system is unclear. A space grillage model was presented to conduct a parametric study. Three forms of the number of steel diaphragms were considered: with three diaphragms, with two end diaphragms only, and without diaphragm. It is found that the reduction of the number of steel diaphragms reduces the stresses of girders under dead load; under eccentric vehicle load, the removal of steel diaphragms changes the load transfer coefficient and leads to uneven load distribution. However, under load combination conditions, the removal of steel diaphragms has a modest positive effect of reducing stress and deflection envelop values for girders and can bring the most adverse situation of each girder closer.

Keywords: assembled T-girder bridge; space grillage model; diaphragm; main girder performance.

1 Introduction

With the development of accelerated construction, a promising system is proposed, which is the simply supported T-girder bridge with wide girder spacing and steel diaphragms. This type of bridge allows girders prefabricated in the shop and the adjacent girders connected on field by longitudinal wet joints as well as steel diaphragms. However, the installation of steel diaphragms causes inconvenience, and the influence of the diaphragms on the performance of each girder is unclear. Lungui Li et al [1] investigated the effect of intermediate diaphragms on the deflections and flexural strains of girders at the midspan of decked bulb-tee bridges and recommended one intermediate diaphragm at midspan be used. Tedesco et al [2] showed that the removal of diaphragms has only a modest effect on the response of the bridge while reducing the maximum negative bending moment of the slab, leading to improved deck performance through the finite element method. Tanya Green et al [3] analysed the effect on the overall stiffness and deflection of main girders at different inter-section angles between the intermediate diaphragm and the main girder by considering the effects of temperature differences, bearings, and other

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