Numerical analyses on mechanical performance of flat buried approach slab and soil deformation

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Abstract

The vulnerability problem of expansion joints could be fundamentally resolved using the concept of jointless bridges. The longitudinal deformation of the superstructure can be transferred to the backfill by using the approach slab. The flat buried approach slab (FBAS) has been used in many jointless bridges in European countries. In order to understand the mechanical performance of FBAS and soil deformation, a finite element model (FEM) was implemented in PLAXIS. Considering the friction between the FBAS and soil, the buried depth, the FBAS length and thickness as parameters, a parametric analysis was carried out. According to the obtained results and in order to reduce the soil deformation above the FBAS, it is suggested to increase the friction between the FBAS and sandy soil, and the buried depth of FBAS. Moreover, it should be paid attention to the vertical soil deformation and the concrete tensile stress of FBAS in pulling condition.

Keywords: jointless bridge; flat buried approach slab; finite element model; buried depth; soil deformation

1 Introduction

The life-cycle cost of jointless bridges is lower than that of bridges with expansion joints, because the jointless one is a monolithic structure without expansion joints and it's not necessary to do periodic inspection, maintenance and replacement of the joints [1-2]. In this bridge type, the imposed longitudinal deformation of the superstructure (u_{imp}) induced by the superstructure temperature variation, the creep and shrinkage deformations of concrete could be transferred to the substructure and backfill [3-5]. The approaching slab in jointless bridges should not only minimize the soil differential deformation, but also absorb the u_{imp} or transfer the u_{imp} to the backfill. The soil deformation above the approach slab may cause the cracks on

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