Assessment of the Structural Safety of the Schiphol Railway Tunnel

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Abstract

The planned extension of the parking garage P1 in the centre of Schiphol Airport, in which a third storey would be build on top of the existing two, demanded a reassessment of the Schiphol Railway Tunnel underneath it. The assessment was based on the Eurocodes, on the Dutch standard NEN 8700 and on the Dutch guideline RBK. The major goal was to avoid or minimize strengthening measures. This is achieved by minimizing the calculated construction forces, by using 3D FEM plate models, by accurately determining the load from the parking garage and using the adjusted load factors for the safety level "Reconstruction". Also the capacity of the construction elements was calculated as accurately as possible. Additional design shear capacity was gained using the benefits of the RBK, of the haunches and thickenings. The ULS was reviewed and strengthening measures were designed, mainly to locally increase the shear capacity.

Keywords: tunnel, assessment, structural safety, shear capacity, strengthening.

1 Introduction

The Schiphol Railway Tunnel is 5,8 km long and consists of two tubes, both containing two tracks. The first tube was completed in 1981, the second one in 2001. Halfway, the two tubes are combined over a 550 m stretch to form the station area with six tracks and three platforms. This is also where the parking garage P1 is situated (52°18'27"N 4°45'32.5"E, see online map services), built partly on top of the two separate tubes and partly on the combined tubes, over a total length of 320 m. Due to the local circumstances, each of the 25 concerned segments has different characteristics and dimensions, making it necessary to assess several segments of the tunnel. In this paper segment Q8 is used only. Figure 1 shows one of the 3D finite element models: tube 1 is situated on the left (= south side) and tube 2 is situated on the right (= north side). In tube 1 steel grade B400 was used, tube 2 was built with steel grade B500.

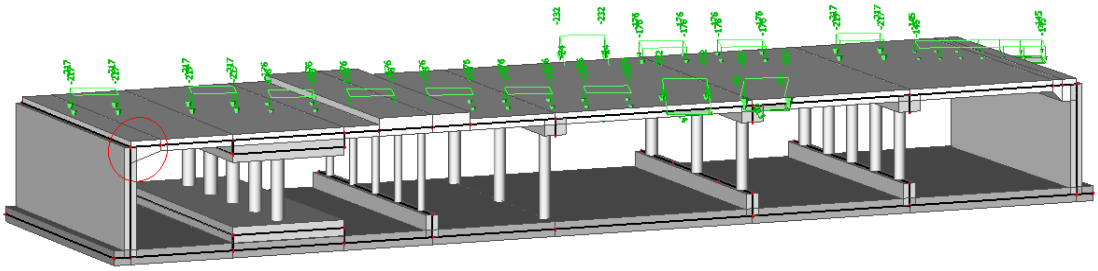

Figure 1. Segment Q8, finite element model with load P1 and cross-section roof

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