21st International Conference **ENGINEERING MECHANICS 2015**
Svratka, Czech Republic, May 11 –14, 2015
Paper **#109, pp. 180–181**

# Reliability of Approach Slabs and Modelling of Transition Zones of Bridges

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**Keywords:** approach slab, elastic support, modelling of interaction

**Abstract:** The approach slab is the structural member of transition zones, which compensates a different settlement of bridge abutment and a road embankment. The main reason of different settlement is the consolidation of soil under the slab and the abutment. The geometry of approach slab, its length and the thickness is defined on the basis of differential settlement of embankment and the abutment. The static behaviour of slab is defined as a slab on elastic soil. The reinforced concrete slab is supported with the line rigid support on the one edge, and the rest of slab area interacts with the soil. The civil engineers design the reinforcement in those slabs based on the simplified structural scheme, without considering the elastic area support. This scheme is the simple supported slab on the both ends**.**

The paper is dealing with the comparing of different structural models of the reinforced concrete approach slabs. The complex models of transition zones with the brick elements of the soil and the interaction with the reinforced concrete slab with the soil embankment are compared with the simplified models used by civil engineers. The analysis was performed on the transition zone of highway bridge from Slovakia based on its geometry and the subsoil consistence. The approach slab has length of 6.0 m and is 10.15 m wide. The thickness of slab is 350 mm. The height of embankment behind the abutment is 9.5 m. As an alternative 250 and 350 mm thickness of the slab was analysed.

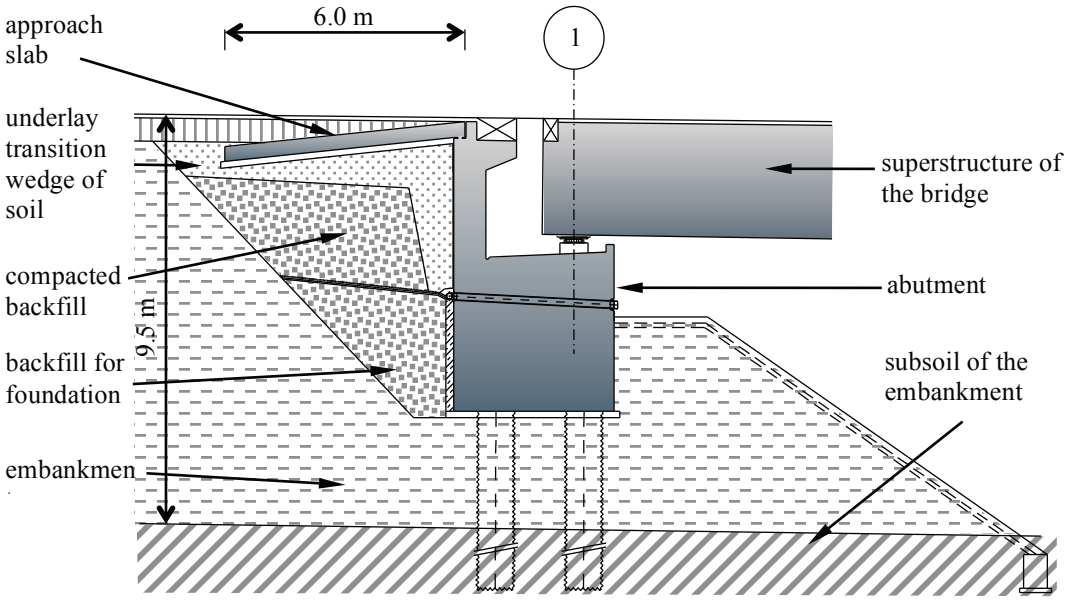


Fig. 1: Analysed approach slab of the bridge on the highway road

What is the reliability and the safety of using simplified models shows the parametric studies, where the results of different soil stiffness and the thickness of slab for various structural models are

compared. The structural models were divided into 2 groups. With the constant stiffness of subsoil under the approach slab and linearly changing stiffness along the slab length. The linearly decreasing stiffness from the maximum value on the free end to the minimum on the edge that is supported by the abutment. This should simulate the void that may develop below the slab caused by the erosion of embankment or by water percolation and the infiltration. The reference model to compare with, was the simple supported slab on the both ends.

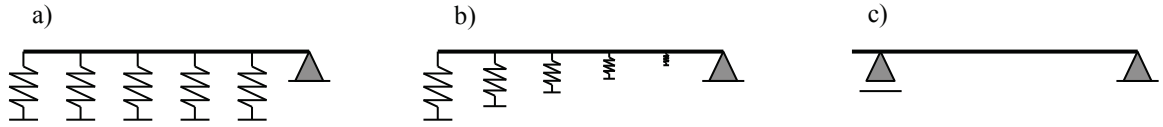


Fig. 2: The alternatives of models of approach slab (right edge – connection with abutment, left edge – free end of approach slab)

The selected models of soil for analysis were: single parameter Winkler model, two-parameters Winkler-Pasternak model, iterative procedure for obtaining soil resistance coefficient via Soil-In from SCIA Engineer and 3D finite soil elements model with Sofistik software.
The backfill for transition zone is in the most cases sand or sand-gravel compacted soil. For the analysis was chosen 8 representative values of stiffness parameters from gravel G1-GW to G5-GC and sand from S1-SW to S3-SF.

The loads of construction was based on STN EN 1991-2/NA. Selected load model was LM1 with a coefficient $\gamma_{Qi}$ and $\gamma_{q1}$ equals 0.9. The most loaded lane was placed on the edge of approach slab. The areas of tandem of wheels was enlarged according to the 30° angle of force redistribution to 1.2 x 1.2 m. The analysis of models is based on the maximum bending moment of the approach slab. Therefore the vehicle was placed in the middle of the slab.

The reason for the analysis of design reliability of approach slab was the conservative structural scheme of approach slab as simply supported slab on the both ends. Also the effect of consideration of void creation in transition zone, which could cause a significant loss of soil material under the slab. The paper tries also assess ability of real usage of these complex calculations in practise in the terms of time difficulty, effectivity and the reliability of design of approach slabs.

**Acknowledgement:** This work was supported by the Slovak Research and Development Agency under the contract No APVV–0442-12.

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