

Thermo-mechanical analysis of the white-topping slab with long-term monitoring data

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KEYWORDS: *Thermal analysis, elastic thermo-mechanics, coupled FEA, long-term monitoring.*

White-topping represents a pavement rehabilitation technique with a thin cement concrete overlay. The paper summarizes thermo-mechanical analysis of a single slab $1750 \times 2000 \times 140$ mm over deteriorated asphalt concrete pavement [1]. A non-stationary heat transport is weakly coupled with elastic material model, supplemented with constant mechanical elements to capture slab warping. The results show that traffic loading solely acting on the slab induces principal tensile stresses of up to 2.4 MPa. Summer characteristic thermal cycle induces up to 1.6 MPa (see Fig. 1). The combination of temperature cycles with traffic yields up to 4.1 MPa, indicating cracking, concrete softening and fatigue phenomena.

The monitored data over five years comprised six pairs of vibrating wire strain gauges, twelve thermal gauges, ambient air temperature, solar radiation and three inductive gages monitoring concrete separation from underlying asphalt concrete. Unsymmetrical temperature differences across the thickness were measured and simulated, owing to much higher heat flow from solar radiation than from night cooling. After four years, moisture-induced warping seems already stabilized at the curvature of 2.5 km^{-1} . Continuous separation of the slab from asphalt concrete has been measured and stabilized at a gap of 0.3 mm after two years. The experimental data served for calibration and successful validation of the thermo-mechanical model.

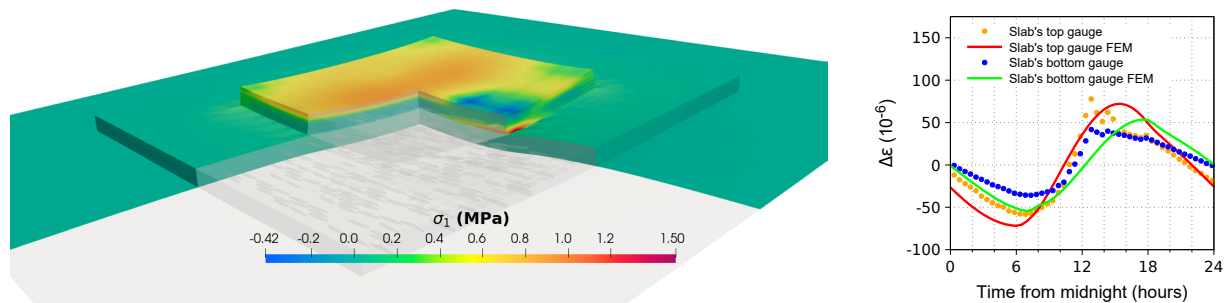


Figure 1. Thermo-mechanical analysis (left) and strain validation during summer cycles (right).

ACKNOWLEDGEMENT: The research was co-funded by the European Union under the project INODIN, no. CZ.02.01.01/00/23_020/0008487 and from the Czech Science Foundation under the project number 25-15501S.

[1] B. Slánský, L. Vysloužil, P. Bijok, V.Šmilauer, R. Hela, R., *The First Whitetopping in the Czech Republic*, National Report of the 6th FiB Congress, Oslo, 2022.