# Derivation of Displacements of Soil Layer Compositions Induced by Means of Wheel Overruns Using Laser Scanning Point Clouds

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**SUMMARY**

High-resolution acquisition techniques such as terrestrial laser scanning have a great potential for determining displacements of soil layer compositions, as already demonstrated in a number of studies in lab and under field conditions.

In this paper, a specific test rig is used to determine the serviceability and enables the determination of the effects of wheel overruns with wheel loads of up to 10 tons on any soil layer compositions (bound, unbound, reinforced, unreinforced) with a thickness of up to 1 m.

The laboratory-based investigations using the test rig are observed by means of a terrestrial laser scanner. In a first set-up, two representative 3d point clouds are captured: one before starting the wheel overruns to have a non-deformed zero epoch and a second after finishing the wheel overruns to have a mainly vertical deformed epoch. Both 3d point clouds are referenced in a local laboratory coordinate systems, which consequently allows for the calculation of a difference point cloud by means of, e.g., the M3C2 algorithm. Our aim is the B-spline-based approximation of the epochs to yield the mainly vertical displacements. For a given raster B-spline curves will be approximated in driving direction of the wheel as well as in the perpendicular direction. This allows to determine the displacements values. In particular for the driving direction a validation with classical track depth measurements will be performed. Besides the displacements, other descriptive parameters such as the roughness of the soil might be obtained by this approach.

For future work, the 3d point cloud acquisition will be performed more frequently after a specific number of wheel overruns to yield a time series of 3d point clouds and obtain a multi-temporal approximation to visualize the displacements over time.