

Penetration and survival of riparian tree roots in compacted coarse gravel mixtures

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Root growth and penetration of riparian trees along paved cycling paths and service roads of rivers causes often traffic safety problems. Damages occur mostly on street surfaces with thin asphalt layers and especially in the upper part of the pavement structure. The maintainers of these roads are faced with frequent and high annual repair costs in order to guarantee traffic safety and pleasant cycling conditions.

Analyses of the dominating process mechanisms demonstrated that mainly the naturally growing pioneer vegetation along rivers is responsible for the asphalt damages caused by their constant and rapid growth. The investigations of the root growth characteristics showed that tree roots mostly penetrate the road structure between the gravel sublayer and the asphalt because of the high compaction of the layer itself.

In a second step of the research project the influence of different gravel size mixtures on the root penetration and survival are analysed. Coarse gravel size mixtures with the lowest possible fine granular fraction are supposed to inhibit root growth due to the mechanical impedance and air pruning of roots. Furthermore coarse gravel size mixtures could influence the presence of condensate formed at the underside of the asphalt layer.

Therefore seven different compositions of matrix stone gravel size mixtures (0/32, 4/32, 8/32, 16/32, 0/64, 8/64 hydraulic bound mixture and 16/64) as sublayer material were tested in a small scale experimental set-up. Wooden boxes with a dimension of 1x1.5x0.5 m and 0.5x0.5x0.5 m were used as frames for the different matrix stone mixtures. On one side the boxes were delimited to the surrounding soil with a steel mesh followed by a wire mesh and a geotextile. Boxes were located in an 80 cm deep hole on a 30 cm thick drainage layer. Willow and poplar cuttings were planted laterally to the root penetrable side of the boxes. Large boxes were filled and compacted with 6 different gravel size mixtures (all but 4/32) and covered by a 10 cm thick concrete layer, small boxes were filled and compacted with 6 gravel size mixtures (all but hydraulic bound mixture) up to the top of the boxes. In total 18 large boxes and 36 small boxes were constructed.

Six month after planting the cuttings, above- and below-ground biomass was analysed for the first 6 large boxes and the first 12 small boxes. Soil moisture conditions were also analysed by 21 soil-moisture sensors (3 in each large box and 3 in the surrounding soil) in order to detect different soil moisture conditions throughout time. First results showed that after six months a slightly increase of root biomass production was detected in the finer gravel size mixtures.