BEARING CAPACITY AT THE PAVEMENT SIDE - THE NVF ANALYSIS METHOD

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Abstract
Traditional pavement bearing capacity analysis is based on an assumption of infinite geometry without any road edge; "geometric compatibility". This simplification leads to systematic under-dimensioned pavements at roads with narrow shoulders. The need for a model for analysis of bearing capacity at the road edge was pointed out by Nils Odemark already in 1956. As showed in the WAASHO Road Test in 1955, roads with weak edges exhibit fast deterioration, resulting in damages such as rutting, cracking and roughness in the outer (truck) wheel path. In Sweden, some 10 % of budgets for maintenance of paved roads are spent on repair of road edge deformations. For truckers, road edge damages on narrow roads bring serious risk for loss-of-control crashes. The crash type where most truck drivers are injured is the rollover. A high CoG makes heavy trucks prone to lateral forces, such as from roll-vibration at non-uniform road edge deformations. In the Nordic countries, over 1 000 truck rollovers occur every year. Roll-related lateral buffeting is particularly hazardous on ice-slippery surfaces, as it may cause the truck (or driver, by improper manoeuvring) to skid. Sustainable road edges require a relevant method for analysis of bearing capacity. Such a method has been in use in Denmark for decades. This method is based on classic geo-technological analysis as established by Terzaghi, and it has now been updated. The model shows that with regular 0.25 m shoulder, the outer wheel path may have as little as 45 % of the bearing capacity at the road centre. Sensitivity analysis shows that key factors are slope towards ditch, shoulder width, depth of ditch and pavement bearing capacity at the road centre. The method is currently being reviewed in the Norwegian Durable Roads programme, where achieving stable road edges have been given top priority. The insight from the sensitivity analysis has also made an immediate impact on the largest road reinforcement project ever in Sweden, the 157 km Pajala iron ore express road, a road that will be serving a 90 ton high-capacity truck every 7´th minute starting in 2013. The method for analysis of bearing capacity at the road edge is published as Nordic Road Association´s Report 04/2012.

Keywords: Bearing capacity analysis, pavement edge, edge slump, heavy goods vehicle, high centre-of-gravity, roll vibration, lateral force, slippery ice, skid crash.