ABSTRACT

The difference in track stiffness at track transitions creates issues such as rapid degradation, track geometry disruption, ballast flying, wheel/rail force amplification, and bearing failure. Excessive plastic settlement could occur from wheel/rail force amplification and bearing failure. This excessive plastic settlement degrades the track geometry, necessitating costltry maintenance modifications regularly. Approach block is one mitigation measure that has been used to mitigate the track's superstructure and substructure. Soil improvement is a viable approach to minimise the difference in track displacement during train movement through the transition zone. Geosynthetics have shown to be an efficient method of soil improvement. Geosynthetic materials in different forms, such as geogrid, geotextile, geocell, and geonet, are utilised for subgrade stabilisation. The influence of geotextile reinforcement on track vertical displacement and track stiffness at the transition zone was investigated in this study.

Using Plaxis 3D software, the finite element method is applied to investigate the track model. The mechanical properties of the track's materials were derived from a literature review, previous research, and applicable standards. In the transition zone, geotextile reinforcement was applied in the approach block. Five geotextile reinforcements with varying spacing and layer number were analysed to determine track displacement and stiffness. The load was simulated using a train load that moved at 50 m/s.

Overall, in all reinforced condition, the track displacement is reduced, the largest reduction of track displacement occurs in var 1 condition with 20,8% reduction. Moreover, the geotextile reinforcement provides gradual displacement change in the transition zone. The track displacement along the reinforced location (at 25-35 meter) is lower compared to unreinforced one. The reduction of the track displacement is evidence that the track stiffness is improved. Using BOEF method, the track stiffness and track modulus can be determined using the track displacement data. Overall, the track stiffness is improved by 26% on var 1 condition compared to the unreinforced one.

Keywords: Transtion zone, geotextile reinforcement, finite element mehod, track stiffnes, track displacement