ABSTRACT

The development of the high-speed railway line presents challenges due to limited expertise in its construction and operation. Engineers often face the condition of lines that must pass through areas with soft soil. Because of its low stiffness, soft soil can cause track deflection, resulting in excessive deflection owing to train weight and speed. One of the factors that must be considered is the dynamic load arising from the train's speed. As the train speed gets closer to the critical speed, the amplitude of the stresses and deformations in the soil increases due to the increased train speed. This study will calculate the overal induced load generated by Indonesian high speed train as well as investigate the influence of implementing asphaltic-reinforced ballasted track and Geogrid-reinforced ballasted track on track static and dynamic response.

This study was conducted using pseudo-analysis modeling approach using Plaxis 3D. The track refers to ballasted track design of the Jakarta-Bandung High Speed Train with the induced dynamic load from the CR400AF train moving at 360 kph calculated using dynamic amplification factor equation from several previous research. Other required data regarding track elements refer to the result of soil investigation in Bandung, west java with approximation based on the CPT interpretation for each soil layer and relevant literature. This research will focus on increasing the track modulus on the superstructure with reinforcing ballast layer. Three models of ballasted track will be modelled: unreinforced ballasted track, asphalt-reinforced ballasted track, and Geogrid-reinforced ballasted track.

The simulation result indicates that the non-reinforced track model experienced the greatest deflection of 4.425 mm while the deflection of the asphalt-reinforced ballast track is 3.886 mm and for the Geogrid-reinforced ballast track is 2.849 mm. The asphalt reinforcement method can reduce the deflection by 12% while the geogrid reinforcement by 35.6 %. Based on the modelling results, it is found that Geogrid-reinforced ballast provides increased track stiffness and better load distribution, followed by asphaltic-reinforced ballasted track, as evidenced by the reduction in deflection and reduction in subgrade stress.

Keywords: Dynamic load, asphaltic-reinforced ballast, Geogrid-reinforced ballast, subgrade stress, track deflection, static response, dynamic response, finite element model.