



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Interlocking Concrete Block Pavement (ICBP) commonly exhibits structural and premature failures such as rutting and local settlement. Over time, these surface depressions can exacerbate the issues, leading to joint widening, block cracking, block spalling, and edge failure. A primary cause of these surface layer failures can be the bedding layer which is designed as a non-structural component. This thin layer is subjected to a higher stress level than the base and is responsible for transferring vehicular stresses to the base.

Current construction practices and materials for ICBP are based on established guidelines with limited exploration into alternative methods, there is a need to develop a strengthening approach of the bedding layer by implementing geocell stabilisation. Existing geocells are unsuitable for stabilisation in the bedding layer due to its thin profile and specific location within the pavement structure. Hence, it is justified to explore the potential implementation of geocell technology customised to counter the specific stress conditions of the bedding layer. The confinement effect of the geocells must be sufficient to contain the stress, which is achieved by reducing cell opening size. However, the cell walls should not be placed too close together to avoid insufficient compaction of the infill material.

For investigation of confinement effect in the bedding layer, geocells with openings of 350 mm × 350 mm, 250 mm × 250 mm, and 150 mm × 150 mm, and 40 mm height, are manually sealed from HDPE sheet. The infill material is sand of a specified type and gradation. Both confined and unconfined bedding layers are compacted below the surface layer and on the base, overlying a subgrade and an embankment. A non-repetitive static plate load test is conducted on the surface layer, and pavement behavior is simulated using the finite element method (FEM). The influence on the structural capacity of the confined bedding layer is demonstrated by the increase in the modulus of improvement factor (MIF), calculated as the ratio of the simulated elastic modulus of confined bedding layers to that of unconfined bedding layers. The MIF for confined bedding layers with geocell openings of 350 mm × 350 mm, 250 mm × 250 mm, and 150 mm × 150 mm are found to be 5.09, 13.26, and 37.13, respectively.

Simplifying the analysis of the current pavement model, further investigation into micromechanical homogenisation of the surface layer suggests representing the composite layer consisting of blocks and jointing sand as a uniform, orthotropic elastic material.