Field Performance Assessment of Geogrid- and Geocell-Reinforced Pavement on Weak Subgrade using LWD and Dynamic Field CBR Tests

Mohmmad Umar Rasool[1], Prasun Halder[2], and Riya Bhowmik[2]

[1]PhD Research Scholar, Department of Civil Engineering, Indian Institute of Technology, Jammu, India.

[2]Assistant Professor, Department of Civil Engineering, Indian Institute of Technology Jammu, India.

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Problem Statement

❖ The significant limitations identified in conventional pavement systems include frequent maintenance, repair requirements, durability issues, and the occurrence of rutting and potholes under repeated loading.

❖ Geosynthetic reinforcement provides an effective solution to enhance pavement strength and durability by improving load distribution, reducing rutting, and enabling thickness optimization, which in turn leads to lower maintenance needs and a longer pavement life.

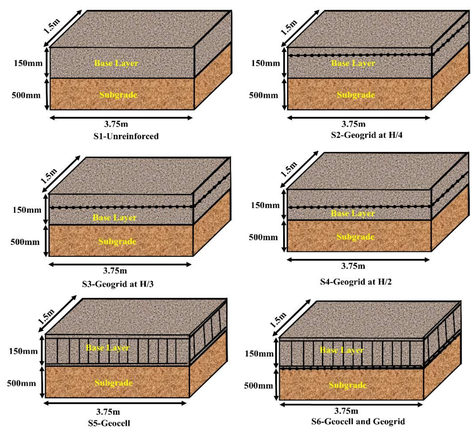
Objective

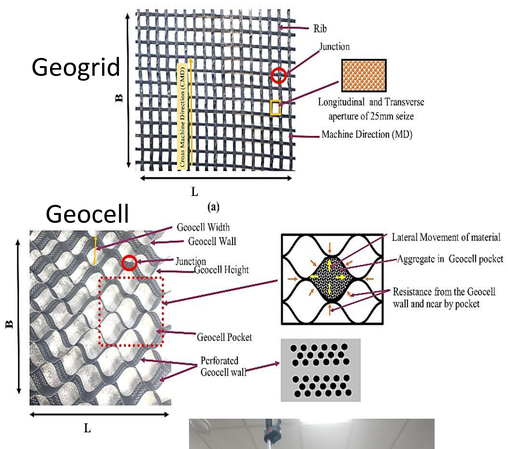
❖ To assess the performance of geosynthetic-reinforced pavement

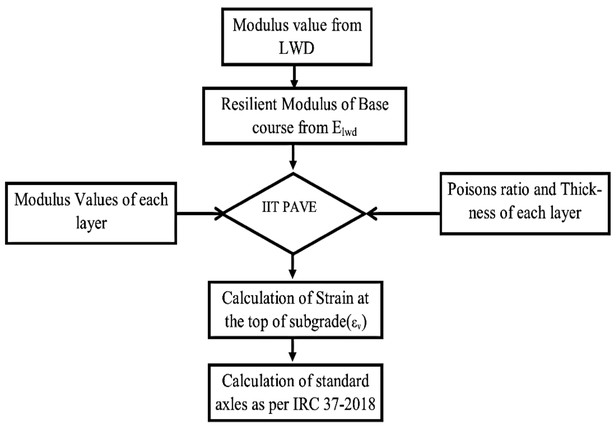
❖ To quantify the beneficial effects of geogrid and geocell reinforcement

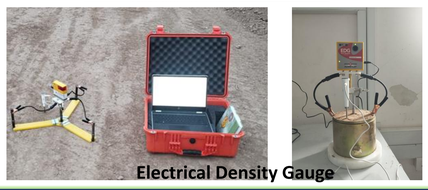
❖ To assess the economic viability of geosynthetic-reinforcement in base layer

Materials and Methodology



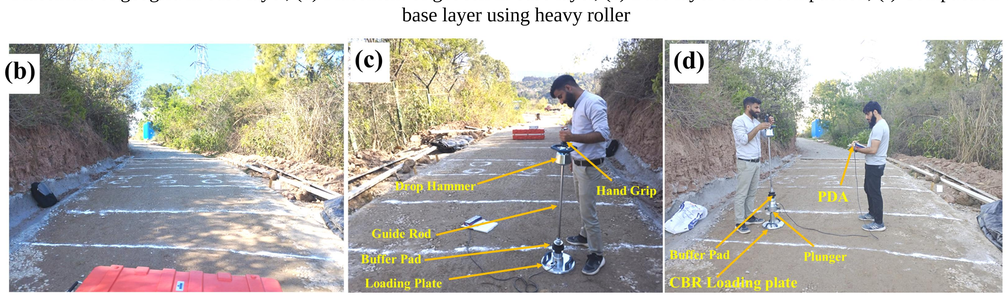






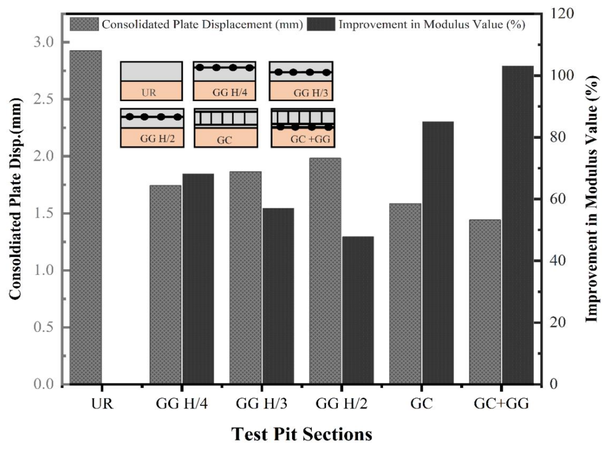
Road Construction and Field Tests

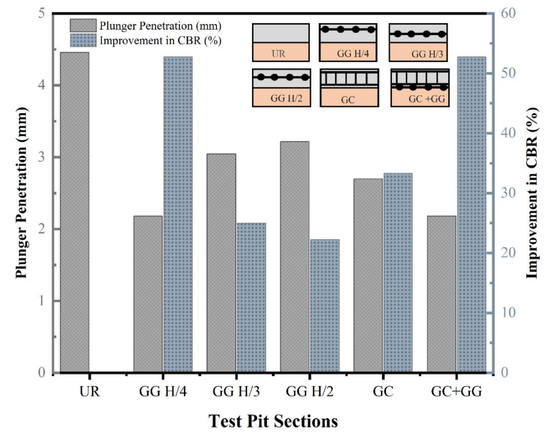
Construction sequence of test pit section: (a) Original subgrade condition, (b) Compaction of subgrade using roller, (c) Placement of geogrid in base layer, (d) Placement of geocell in base layer, (e) Base layer before compaction, (f) Compaction of base layer using heavy roller

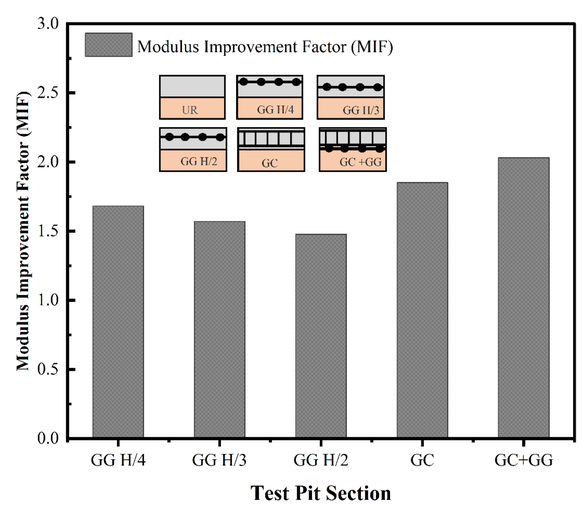


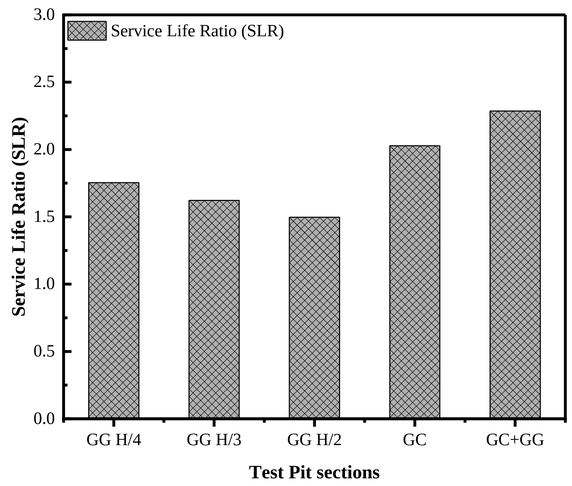
LWD and Field CBR tests on field: (a) Compaction of base layer, (b) Marking of exact test locations, (c) LWD Testing, (d) Field CBR testing

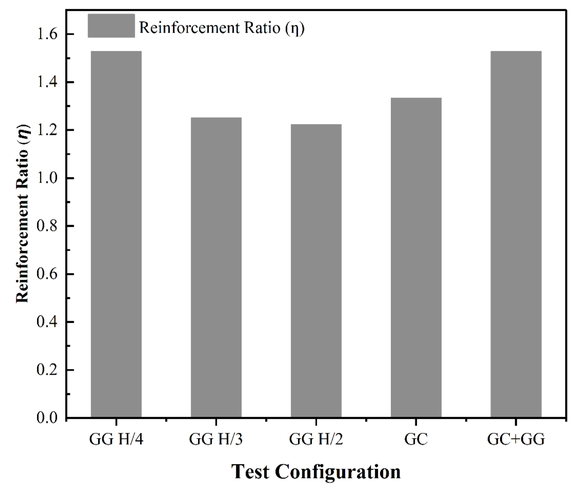
Results

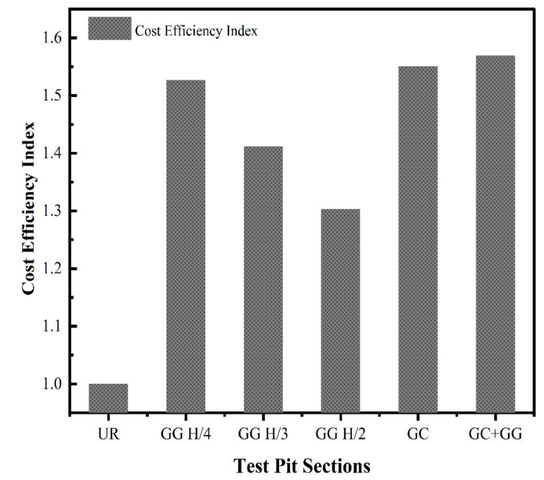












Conclusions

❖ Geosynthetic reinforcement substantially improves base layer performance. Both LWD and CBR tests indicated that geogrid placed at H/4 depth is most effective among single-layer geogrid configurations, while deeper placements showed reduced efficiency.

❖ The dual reinforcement system (Geocell + Geogrid) provides the best pavement performance, achieving the highest service life ratio (SLR = 2.29) and modulus improvement factor (MIF = 2.03) due to the combined benefits of vertical confinement and tensile reinforcement. Geocell alone also performs strongly (SLR = 2.03, MIF = 1.85, and RF =1.53), outperforming geogrid-only sections.

❖ Specifically, the GG at H/4 and GC+GG configurations were 53% and 57% more economically efficient than the unreinforced section, respectively, highlighting their effectiveness in improving the base layer.

Fundings

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Publications

❖**Rasool, U.M.,** Halder, P., and Bhowmik, R. (2024) “Effect of geogrid reinforcement in improving the soaked and unsoaked CBR values of local subgrade soil," *in Proceeding Indian Geotechnical Conference (IGC-2024)**. (Paper ID: 334)***

❖Choudhury, A., **Rasool, U.M.,** Halder, P., and Bhowmik, R. (2024) "Improvement in Subgrade CBR Values of Low-Volume Unpaved Rural Roads Using Geogrids: Experimental Investigation," *in Proceeding IYGEC.* ***(Paper ID:160)***

❖ **Rasool, U.M.,** Halder, P., and Bhowmik, R. (2025) "Assessment of Embodied Carbon in Geosynthetic-Reinforced Flexible Pavements: Experimental Insights into Carbon Footprint and Cost Implications ,” *in Proceeding Indian Geotechnical Conference (IGC-2025)**. (Paper ID: 382)***

For more details: 2023rce1004@iitjammu.ac.in