Standard Operating Procedure (SOP)
Geosynthetics Road Pavements in High Altitude

NMHS Project: Sustainable Road Pavements in High Altitude Regions Using Geosynthetics

PI- Dr. Gottumkkala Bharath, CRRI, Mathura Road, New Delhi

An adequate, long-lasting, and sustainable road network is critical in Himalayan areas for overall development while also meeting strategic needs. One of the major issues for high-altitude hill roads is a lack of good quality road construction materials, which forces the use of locally available materials that may not meet required standards. Engineers must use specialized techniques to effectively use local materials to alleviate such problems. The CSIR-CRRI initiated this project to investigate the improvement in performance of pavement layers of hill roads in high altitude regions built with locally available marginal materials when combined with geosynthetic materials.

Step 1: Site visit

Collecting information about site location, climatic conditions, topography, area connectivity and other relevant data.

Step 2: Collection of locally available materia

Identifying source of locally available marginal materials like tunnel muck, landslide debris, river bed material, local soil etc.

Step 3: Material characterization

The collected materials are subjected to geotechnical analysis for characterization of their engineering properties.

Step 4: Material selection for different pavement layers

The suitability and usage of the collected materials for different pavement layers is then decided based on their geotechnical and engineering properties.

Step 5: Planning trial combination with different Geosynthetic Material

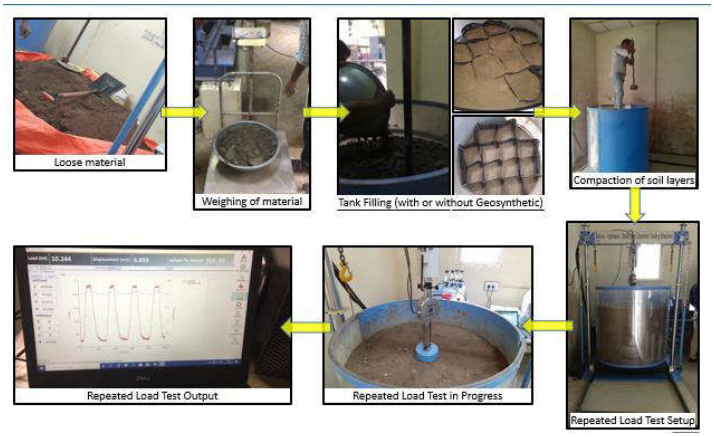
Based on previous studies and emphasized results, the proper selection for combination of different geosynthetic material and soil can be selectively chosen.

Step 6: Laboratory Model Evaluation

Large Size Tank can be used to model the pavement performance at laboratory scale. Different stages of preparing the Pavement Model inside the tank is shown in next figure.

Combination of **Geocell & Geogrid**

Geogrid placed on Subgrade



Step 7: Traffic simulation studies on Pavement Model

Different approaches and test procedures can be pursued for capturing performance improvement of the geosynthetic reinforced pavement models. Some of these studies can be – loaded wheel movement on top surface, repeated cyclic loads via plates, etc.

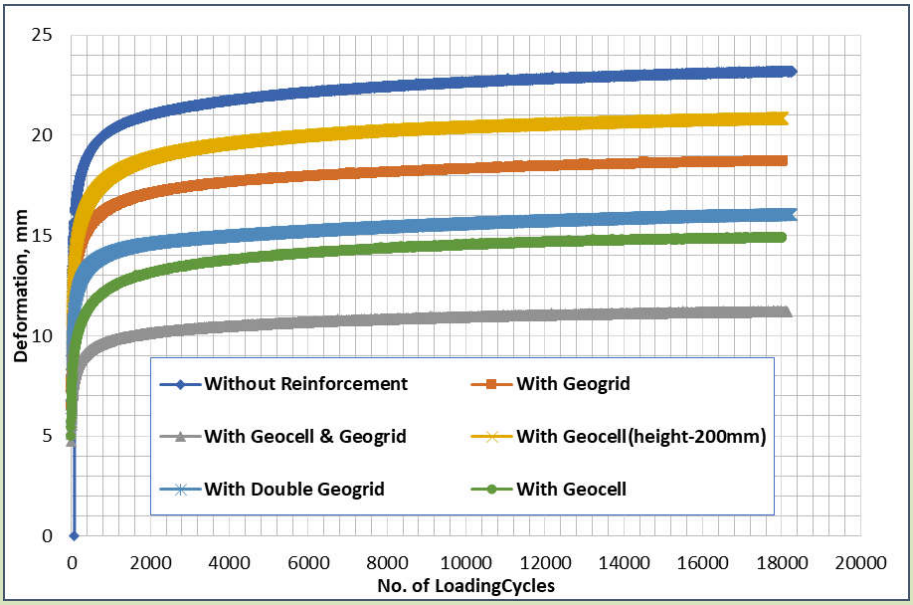
Based on loading conditions, different performance criterion can be proficiently selected. Some of them can be – measuring surface settlement (rutting behavior), measuring surface deflection (modulus study), measuring induced forces (stresses at strains) at different critical locations, etc.

Step 8: Capturing improvements (TBR or RDR)

The improvement in Pavement Performance can be analyzed in various terms like – Traffic Benefit Ratio (TBR), Rut Depth Reduction (RDR) factor, etc.

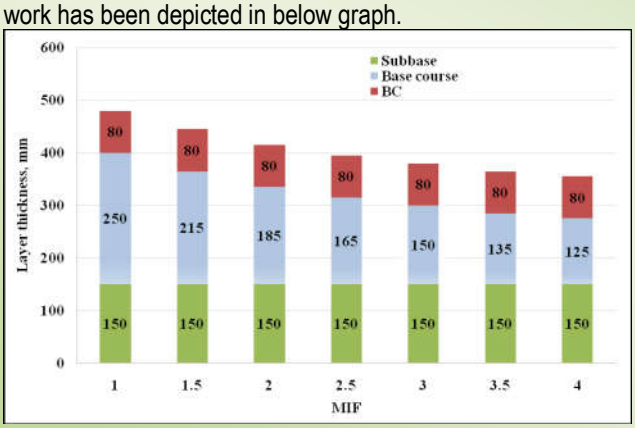
Step 9: Comparative Study

The test results obtained in terms of TBR and RDR can then further be used for comparative studies with respect to the unreinforced case and other reinforcement cases like (a) Geocell; (b) Geogrid; (c) Geocell plus Geogrid; (d) Double Geogrid, etc.



Step 10: Improvement Quantification in terms of MIF

The geosynthetic reinforced layer possesses higher modulus then the unreinforced ones. This increase in modulus and layer strength can be quantified in terms of Modulus Improvement Factor called MIF. This quantity is then further as an input for Reinforced Pavement Design and its Analysis. One such typical work has been depicted in below graph.



Reduction in Base Course Thickness with variation in MIF values

Step 11: Laying of Field Trial Section

Laying of Field Test Section with the selected combination of Geosynthetic materials based upon the laboratory based performance study.

Step 12: Performance Study

- Visual inspection to check for any signs of distress on pavement surface
- Structural Evaluation of the pavement using Benkelman Beam Deflection Method (BBD Survey) or Falling Weight Deflectometer Method (FWD Survey)
- Remaining Pavement Life will then be evaluated using BBD or FWD results; hence improvements/achievements in terms of Traffic Benefit Ratio can be established