MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-539 (project 635) | August 2024

Field Evaluation of Geogrid-Reinforced Pavement Systems Over Soft Subgrades

the ISSUE

Pavement systems constructed over soft subgrades can be damaged by differential settlement and movement in the base and subbase layers, leading to shortened life span. Including geosynthetics into a pavement system over soft subgrades can improve performance and reduce the amount of sub-excavation required to construct roadways. A better understanding of how geosynthetics impact the performance of pavement systems is important for building sustainable and efficient roadway systems, especially in areas with soft subgrade materials.

the RESEARCH

The purpose of this research was to determine whether two geosynthetic materials – geogrid and geotextile – can be used to reduce the cost of structural pavement systems on major highways that are constructed on soft subgrades (soils that exist prior to highway construction).

A research section was built during construction of a major highway to compare the performance of four different geosynthetic-reinforced pavement systems – one without geosynthetics, one with geogrid only, and two with geogrid and geotextile.

Within each section, moisture and temperature sensors were placed within the soil layers, and sensors to measure the load carried by the geosynthetics were installed. A portable data acquisition system was used to record readings of all sensors during subsequent tests.

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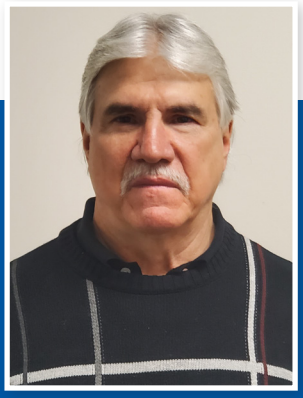

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Project Title

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the **RESEARCH** (cont.)

Prior to conducting any loading tests on the pavement systems, tests were conducted at selected locations along the test sections to estimate the stiffness of the subgrade prior to construction of the pavement system; and of subbase and base courses after each course was constructed. These tests were conducted every 50 feet along the roadway at two locations – near the middle of the roadway and near the edge of the roadway. After the base course was constructed throughout the research sections, two types of loading tests – weight from a loaded haul truck and specialized equipment that applied thousands of cyclic loads to simulate loads from real traffic – were performed on the surface of the base course at eight locations where sensors were located.

the **FINDINGS**

Due to variability in the test sections that occurred during construction – primarily substantial variations in thickness and density of the base and subbase courses – significant differences in stiffness occurred throughout each test section. Therefore, results of the study were mixed. During load tests, permanent deflections and loads carried by geosynthetics were very small. Significant correlations between stiffness of the base and subbase and measured strain in the geosynthetics were discovered. Significant correlations between a combination of strength of the geosynthetics and their depth in the pavement system, and load carried by the geosynthetics, were also found. Analyses of the geosynthetic benefits were inconclusive. Therefore, the effectiveness and cost benefit of the geosynthetics will be determined from the long-term performance of each test section using standard performance parameters such as roughness, rutting, and cracking that are routinely measured and calculated by the Utah Department of Transportation.

the **IMPACT**

Our understanding of the manner in which geogrids and geotextiles reinforce pavement systems has been greatly enhanced by this research. The data obtained from testing done on instrumentation installed within a real highway are invaluable to the profession, which in the past has relied primarily on data obtained from laboratory testing or smallscale field tests. This research has provided exposure to many aspects of the transportation field to one graduate student and one undergraduate student who have worked on this project.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1236

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.