MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 23-498 (project 587) | August 2023

Forensic Evaluation of Geogrid-reinforced Flexible Pavement Sections on SR-10 Near Emery, Utah

the ISSUE

The geogrid-reinforced pavement system on the section of State Route 10 between Muddy Creek and Emery, Utah, experienced premature deterioration. Research was needed to understand the reasons for this deterioration and to develop an improved understanding of the significant influence that native subgrade and fill materials have on the performance of pavement systems constructed on soft subgrades and how geogrid can limit damage stemming from these materials.

the RESEARCH

The methodology used in the forensic investigation of the premature deterioration of State Route 10 between Muddy Creek and Emery, Utah, consisted of conducting field testing and sampling, analyzing pavement distress data and construction documents, and performing laboratory testing on samples obtained from the field. In the field, cyclic static plate load, falling weight deflectometer, cone penetration, and dynamic cone penetration tests were conducted. Samples of roadway pavement materials (asphalt, base, and subbase) and nearby soils used for fill beneath the pavement material in some locations were obtained and tested in the laboratory. In the laboratory, tests were conducted to determine the grain-size distribution, plasticity, wetting-induced expansiveness and collapsibility of the soils, and the stress-strain and flexibility characteristics of the asphaltic concrete. Pavement distress data analyzed included roughness, rutting, and cracking. Construction documents reviewed included technical drawings related to roadway alignment, embankment fill, culverts, daily construction records, and results from laboratory and field tests conducted for quality control. Statistical analyses of data were also undertaken.

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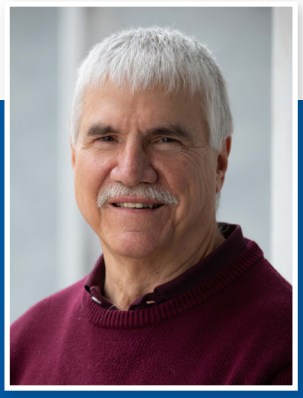

Lead Investigator(s)

Evert Lawton
University of Utah
lawton@civil.utah.edu

Co-Investigator(s)

Pedro Romero-Zambrana
University of Utah
pedro.romero@utah.edu

Research Assistant(s)

Henrik Burns, GRA, MS
Nadereh Adham, GRA, PhD

Project Title

Use of Geogrid in Pavement Systems to Provide Longer Service Life and Reduced Maintenance

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the FINDINGS

There was deep embankment fill beneath most of the southbound lane, but little or no embankment fill beneath most of the northbound lane. Most or all of the embankment fill was constructed from native soils taken from cut sections of the roadway, which were vulnerable to large changes in volume from loading and wetting.

The pavement system performed well with respect to cracking and rutting, but only adequately with respect to roughness in the northbound lane and poorly in the southbound lane. The poor roughness performance was likely caused by large settlement and heave within the embankment due to loading and wetting, resulting in undulations on the pavement surface. The presence of culverts underneath the roadway negatively affected the performance of the pavement system supporting the southbound lane. The geogrid performed well and prevented cracking in the asphalt-concrete layer despite large movements within the embankment and subgrade.

the IMPACT

A better understanding of the significant influence that native subgrade and fill materials have on the performance of pavement systems constructed on soft subgrades should result in roadway systems that will perform better and require less long-term maintenance than current practices allow.

Proving that the geogrid in this roadway system performed well and helped limit the damage that occurred to the roadway should result in the use of more geogrid-reinforced pavement systems in Utah and significant savings in the long-term cost of the pavement systems constructed using this technology. Recommendations are provided for suitable embankment fill material and pavement support materials, along with effective placement of geogrid and geotextile in pavement sections for future UDOT projects.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1137

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.