ASCE Geo-Institute (G-I) 2021-2022 Virtual Speakers

Geosynthetics Technical Committee

Available Speakers for Virtual Chapter Meetings

Lessons learned from three failures

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Abstract: Three failures involving geosynthetics are described. Two were reinforced structures and the third was an unusual application: a turbidity curtain. As is true of most failures, each had multiple causes, but only the one with the turbidity curtain was due to the incorrect selection of the geotextile. Valuable lessons learned from each case are given.

Bio: Bob Holtz, Ph.D., P.E., D.GE., Dist. M. ASCE, Professor Emeritus of Civil Engineering at the University of Washington in Seattle, has also taught at Purdue and Cal State-Sacramento. He has worked for the Calif. Dept. of Water Resources, Swedish Geotechnical Institute, NRC-Canada, and as a consulting engineer in Chicago, Paris, and Milano. His research and publications are mostly on geosynthetics, soil improvement, foundations, and soil properties. He was President of IGS-NA from 1991-93 and a IGS Council Member, 1994-1998; he was also named an IGS Pioneer in 2006. He has given numerous short courses and lectures on geosynthetics engineering, both in US and abroad.

Geosynthetic Encased Columns as a Means of Soil Improvement

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Abstract: Significant investments are being made towards enhancing the transportation infrastructure. An inevitable consequence of the expansion of the network is the soft soil conditions encountered in the alignment. Geosynthetic encased columns (GEC) is a proven ground improvement technology which can be adapted as soil remediation technique for such conditions. In this presentation, first an introduction to the concept of GECs will be given. Then the recent advances in the academic research on the GECs will be elaborated. As it is known, earthquakes are one of the most devastating disasters and certainly also have a major effect on transportation infrastructure. In this presentation also results of shaking table tests to compare ordinary stone columns and GECs behavior under earthquake loading conditions will be presented. The brief recap of the state of the art on the geosynthetic encased columns including their earthquake behavior will be followed by case studies on three major projects where the site conditions and project requirements will be discussed. The significant benefits of geosynthetic encased columns in relation to project requirements will also be elaborated.

Bio: Professor Guler is currently an Adjunct Professor at the George Mason University, U.S.A. He served as a full Professor of Geotechnical Engineering at Bogazici University between 1989 and 2019. Dr. Guler has combined his academic experience to perform research and conduct multi-faceted geotechnical designs. His areas of expertise include pile foundations, slope stabilization, soil improvement and geotechnical earthquake engineering. He is particularly well known for his geosynthetic research and applications. He was an Elected Council Member of IGS (2012-2020), the Founding President of Turkish Chapter of IGS, is on the Editorial Board of the Journal “Geosynthetics International”, acts as the Convener of both WG2’s of ISO and CEN Technical Committees on Geosynthetics. He is an international Member of USA-TRB Geosynthetics Committee. He is board member of the Turkish National Committee of ISSMGE and member of ISSMGE TC218 on Reinforced Soil Structures. At Bogazici University he served as the Chairman of Civil Engineering Department (2004 – 2010), Director of Environmental Sciences Institute (1996-1999), Faculty Senate Member (1996-1999).

Accelerated Loading Testing to Evaluate the Performance of Geosynthetic Reinforced Flexible Pavement built over Weak Subgrade

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Abstract: This research study aims at evaluating the benefits of using geosynthetics to reinforce/ stabilize base aggregate layer/subgrade in pavements under repeated loading test conditions. For this purpose, six 80-ft. long and 13-ft. wide full-scale test lane sections were constructed, among which two sections were reinforced by one or two layers of triaxial geogrids, two sections were reinforced by one layer of high strength woven geotextile with different base layer thickness, and the remaining two sections were the control sections. The field test sections were instrumented by a variety of sensors to measure the load- and environment-associated pavement response and performance. Two series of tests, moving wheel load tests and cyclic plate load tests, were conducted to investigate the field performance of geosynthetic reinforced/stabilized paved roads and to identify the differences in pavement response to moving wheel and cyclic plate loads. In addition, six similar test sections were constructed inside a 6.5-ft. × 6.5-ft. × 5.5-ft. test box. The test box sections were also instrumented by a variety of sensors to measure the load-associated pavement response and performance. Laboratory cyclic plate load tests were then conducted. The results of accelerated load testing on the pavement test sections demonstrate the benefits of using geosynthetics in reducing the permanent deformation in the pavement structure. The adjusted traffic benefit ratio (TBRadj) associated with geosynthetic reinforcement can be increased up to 2.12 at a rut depth of 0.75 in. for pavement constructed using 18 in. thick base layer on top of weak subgrade soil using two layers of geogrid reinforcement. The inclusion of geosynthetics results in redistributing the applied load to a wider area, thus reducing the accumulated permanent deformation within the subgrade. The benefit of geosynthetics on reducing the maximum stress on top of subgrade is more appreciable at higher load levels. It was also found that the geosynthetics placed at the base-subgrade interface was able to improve the performance of both subgrade and base layers; by placing an additional layer of geogrid at the upper one-third of the base layer, the performance of the base layer was further enhanced. While geosynthetics showed appreciable benefit on reducing the permanent deformation of the subgrade layer, it showed less effect on the resilient properties of the subgrade layer. Drainage of the base layer

has important effect on the performance of pavement structures for both unreinforced and reinforced lane sections.

The life-cycle cost analysis (LCCA) demonstrated the cost savings of using geosynthetics in pavement as compared to the unreinforced/untreated sections. However, compared to the 12-in. cement/lime treated subgrade with cement stabilized base pavement section, the LCCA showed it is more cost effective to use geosynthetics for base thickness less than 12 in. (or < 15 in. of unreinforced aggregate base). The cost benefit becomes close for base thickness > 12 in. between using a single geosynthetic layer and 12-in. cement/lime treated subgrade with cement stabilized base. Moreover, the cost benefit of using double geogrid layers exceeds the cost savings of 12-in. treated subgrade with cement stabilized base.

A Case Study on Instrumenting and Monitoring of In-Service Geosynthetic Reinforced - Soil Integrated Bridge System (GRS-IBS) and Finite Element Parametric Study

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Abstract: The FHWA has been promoting the GRS-IBS technology for bridge abutments through the EveryDay Counts (EDC) initiative. To realize the potential benefits of using GRS-IBS abutments in Louisiana, the Department of Transportation and Development (DOTD) built GRS-IBS abutmentfor two bridges at Creek and Maree Michel in Vermilion Parish, which provide the opportunity toexamine the performance and stability of GRS-IBS abutments with respect to local materials andsoil conditions. An instrumentation plan was developed to monitor the short-term and long-term behavior of the in-service GRS-IBS abutment at Maree Michel Bridge. This presentation will cover the detailed instrumentation plan, results of performance monitoring of the GRS-IBS at Maree Michel Bridge, and the results of finite element parametric study on the effect of different variables and parameters contributing to the performance of GRS-IBS abutment. Measurements from the instrumentation provided valuable information on the performance of GRS-IBS abutments. The FHWA design of GRS-IBS abutments was verified and calibrated based on the collected data from the instrumentation measurements. Furthermore, the long-term monitoring provides the measurements needed to examine the performance, durability and long-term stabilityof the GRS-IBS abutments constructed over Louisiana subsurface soil, under the live traffic load and adverse weather conditions in Louisiana. The monitoring program consisted of measuring bridge deformations, settlement, strains along the reinforcement, vertical and horizontal stresses within abutment, and pore water pressure. Measurements from the instrumentations provide valuable information to evaluate the design procedure and performance of GRS-IBS bridges. Theinstrumentation readings showed that the magnitude and distribution of strains alongreinforcements vary with depth. The locus of maximum strains in the abutment varied by surchargeload and time that did not corresponds to the $(45 + \phi/2)$ line, especially after the placement of steelgirders. A comparison was made between the measured and theoretical value

of thrust forces on the facing wall showed that the predicted loads by the bin pressure theory were close to the measured loads in the lower level of abutment. However, the bin pressure theory under predicted the thrust loads in the upper layers with reduced reinforcement spacing.

2D and 3D finite elements (FE) models using PLAXIS 2016 program were developed to evaluate the performance of GRS abutment at Maree Michel Bridge. Then, a 2D FE parametric study was conducted to evaluate the effect of different variables and parameters on the performance of the GRS-IBS under service loading, in terms of lateral displacement of facing, settlement of RSF, maximum strain distribution along the reinforcement, lateral facing pressure, and location of possible failure locus. The FE results showed that that the abutment height, span length, reinforcement spacing, S_V, and reinforcement stiffness have significant effect on the performance of the GRS-IBS. The effect of reinforcement spacing has higher influence than the reinforcement stiffness for the same reinforcement ratio (stiffness/ spacing) due to the composite behavior of closely reinforced soil.