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Summer semester

Editor : Anil Bhandari

Geotechnical Society Newsletter

KU Geotechnical Society

The KU Geotechnical Society was founded in September, 2007 at the University of Kansas.

President: Xiaoming Yang

Vice president: Anil Bhandari

President Elect: Matthew Charles Pierson

Advisor: Prof. Jie Han

Members: All current and past graduates and undergraduates in geotechnical engineering

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Matthew, our new president, full in action.



We play together; faculty and students.



Team work !!!

BBQ at Clinton Lake !

Continuing the tradition of celebrating the end-of-semester party, KU Geotechnical Society arranged a BBQ at the Clinton Lake with students, faculty members, staffs, and their spouses/ friends. A weather alert was released earlier that day of possible storms so everyone wondered if we had made the right decision to call for outing. This is particularly true, especially in Lawrence, with weather so unpredictable, but there we went, it was our day; with no storm, no scorching sun, but a wonderful breezy day which was good for an outdoor activity - we did not miss any opportunity to play volleyball and frisbee!

In conjunction of the outing, the BBQ was also meant to celebrate the handover of KU geotechnical society to our new officers. Matthew Charles Pierson will be leading the society on a capacity of a president for the coming year. He was caught by our photographer while playing frisbee/flying disc in a vibrant, energetic, and always in action mode!

Special points of interest:

- Capacity of pile-founded bridges under scoured conditions.
- DEM analysis of geotextile-soil interaction under wheel loading.
- Remediation of sinkhole problem in Karst terrains by using geosynthetics over drilled shaft.

TRB Best Paper Award



From left to right : Prof. D. Goodings, Chair of TRB Soil Mechanics Section; Mr. Xiaoming Yang, , Dr. Robert L. Parsons, Mr. Robert Henthorne, and Dr. Jie Han.

The Ph.D. student, Xiaoming Yang, and two faculty members, Drs. Jie Han and Robert L. Parsons at Department of Civil, Environmental, and Architectural Engineering at the University of Kansas with Mr. Robert Henthorne, the Chief Geologist at Kansas Department of Transportation (KDOT) have recently won the first Transportation Research Board (TRB) Soil Mechanics Section Best Paper Award. The paper entitled “Resistance factors for drilled shafts in weak rocks based on O-cell test data” is to address one of the emerging geotechnical problems in bridge design using the AASHTO Load Resistance Factor Design (LRFD) Bridge Design Specifications, which is mandatorily required by all US Departments of Transportation for federally funded projects from October 2007. This study was sponsored by the KDOT KTran Research Program. This TRB Best Paper was the only paper selected

and awarded by the Soil Mechanics Section among 68 submitted papers at the 87th TRB Annual Meeting in DC from Jan. 13-17, 2008. It is also the first time for the Soil Mechanics Section to give out the TRB Soil Mechanics Section Best Paper Award in its long history.

Research Highlights

Capacity of pile-founded bridges under scoured conditions



Bridge scour

Scour is a natural phenomenon caused by erosion or removal of streambed or bank material from bridge foundations due to flowing water. Literature has shown that most bridge failures are caused by scour of riverbeds. Capacity of pile-founded bridges may be reduced under scoured conditions. This problem is highly complex and requires multidisciplinary knowledge combining Geotechnical, Structural, and Hydraulic engineering. A means to quickly evaluate these situations is required by the KDOT. The objective of this research is to develop a tool for the analysis of bridges that have been or may be damaged from scour/flood

events. Literature review clearly shows that the behavior of scoured piles is important to the safety of bridges and requires more systematic investigation in future research. Prof. Caroline R. Bennett, Prof. Robert L. Parsons, Prof. Jie Han are the investigator of this study, and Dr. Fayun Liang is actively working on this research.

“The scour problem is highly complex and is a multidisciplinary area combining Geotechnical, Structural, and Hydraulic engineering.”

Research Highlights (cont'd)

DEM analysis of geotextile-soil interaction under wheel loading

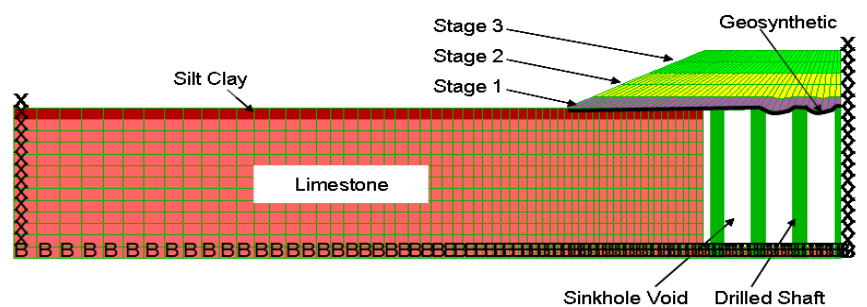
The use of geosynthetic above subgrade or within base course has demonstrated their success in reducing rut depth and prolonging pavement life. Experimental studies showed that geosynthetics can minimize the movement of particles in the base course. A new performance-based method was developed by the KU Geotechnical group to modify an Asphalt Pavement Analyzer (APA) that measures the rut depth of the geosynthetic reinforced base for a desired number of wheel passes to evaluate the geosynthetic-soil interaction. In this study, numerical software-Particle Flow Code (PFC) 2D, which is based on discrete element modeling (DEM) of micromechanics, was used to simulate this performance-based test to investigate the geotextile-soil interaction. The analysis was focused on the effect of



geotextile location and packing density of particles on the rut depth of geotextile-reinforced bases. A similar approach can be used to evaluate geogrid-soil interaction. The results and phenomena from the numerical analysis are discussed and compared with experimental data. The behavior of unreinforced and geotextile-reinforced bases is captured qualitatively by DEM for medium dense particle assembly as compared with the experimental data. It is observed that the geotextile helped distribute contact forces to a wider area. Prof. Jie Han is the principal investigator of this study and the graduate student, Anil Bhandari, is working on this project.

Remediation of sinkhole problem in Karst terrains by using geo-synthetics over drilled shaft

This research focused on a new method to remedy a common sinkhole problem in karst terrains using geosynthetics over drilled shafts to support an embankment. Numerical analysis using FLAC^{2D} software was conducted to verify the effectiveness of this method. In the numerical analysis, foundation soil, rock, and a drilled shaft wall were assumed to be elastic while embankment fill was assumed to be linearly elastic-perfectly plastic with a Mohr-Coulomb failure criterion. A geosynthetic layer above the drilled shaft wall was modeled



A plain strain numerical model using FLAC^{2D}.

using cable elements. The construction of the embankment was simulated in three stages. The numerical results include the settlement at the base of the embankment, the tension in the geosynthetic layer, and the axial force in the drilled shaft. A parametric study was conducted to investigate the effects of the void size and the tensile stiffness of geosynthetic. The numerical analysis demonstrated that this proposed method could be effective in maintaining the stability of the embankment over the sinkhole. This research outlined a preliminary study using geosynthetics and drilled shafts to mitigate the embankment over a small sinkhole. Further study is under way to investigate embankments over large sinkholes with multiple drilled shaft walls. Fei Wang, a visiting Ph.D. student from China, is working on this project under Prof. Jie Han.

Graduated Student Joins Industry

Mr. Harihar Shiwakoti earned his master degree in December 2007. While in KU, he conducted research on “Development of a rapid test to determine moisture sensitivity of HMA (Superpave) mixtures”. He describes his time at KU and his job experience as:

“I started my graduate studies (Master’s in Civil Engineering) in KU in Fall 2006 with specialization in geotechnical engineering. One and half years in KU were a short

but sweet learning period for me. Very supportive and cooperative professors, enthusiastic friends and helpful lab management made my experience a memorable one. Since January 2008, I joined the Office of Geotechnical Design in the California Department of Transportation (Caltrans). Coming from the plains of Midwest to the mountains and beaches of west coast has been a change for me; although, the basics of geotechnical science are same

everywhere. I feel that the courses I took in KU, and lots of interactive research meetings have been real assets for me to deal with the real world situations in site investigation, analysis of results and data, geotechnical design and report writing on a daily basis. I am proud to be a member of KU Geotechnical Society Alumni. I know where to turn at whenever I need any information and help about any geotechnical issues”.

Invited Distinguished Lecture



Faculty, students, and practicing engineers from industry join the extramural lecture.

Prof. D. T. Bergado, from Asian Institute of Technology, Thailand was invited to give a distinguished lecture “Behavior of stiffened deep cement mixing piles in soft Bangkok clay” on 7th March 2008.

KU geotechnical society had the pleasure of hosting Professor D. T. Bergado, who delivered an extramural lecture on the topic “Behavior of stiffened deep cement mixing piles in soft Bangkok clay”. His lecture mainly focused on the existing problems of deep cement mixing piles and the stiffening technique to remediate the problems. The graduate students as well as practicing engineers from the industry, who attended his lecture, were benefitted from the outstanding research in this topic that spanned from laboratory tests, field tests to numerical modeling.

Prof. Bergado is a Geotechnical Engineering Professor in School of Engineering and Technology at Asian Institute of Technology, Thailand. He has been in AIT since 1982. He is an internationally well-known expert in ground improvement, geosynthetics, geotechnical disaster mitigation, and probabilistic/numerical methods in geotechnical engineering, etc. He obtained his civil (geotechnical) engineering doctoral degree from Utah State University in 1982 as a full bright exchange scholar.

Research Meetings and Presentations

The KU Geotechnical Group held research meetings almost every two weeks. The topics of the presentations are provided below:

January 28, 2008: Welcome and Introduction

Behavior of rammed aggregate piers considering installation effects, Dr. Jeff Chen

February 4: Research overview, Prof. Anil Misra

February 18: Micromechanical analysis of geosynthetic reinforced base under wheel loading, Anil Bhandari

February 25: Micromechanics based imperfect interface model and its application to wave propagation, Orestes Marangos

March 7: Statistical analysis of load capacities of drilled shafts using O-Cell test data, Xiaoming Yang

Consolidation calculation of soft ground improved by T-shape deep mixed columns, Lei Chen

March 24: Behavior of scoured piles – Literature review, Dr. Frank Liang

April 7: Update on MSE wall research, Mathew Pierson

Numerical Analysis of Embankments Supported by Geosynthetics over Drilled Shafts in Karst Terrains, Fei Wang

April 21: Experimental study of geosynthetic-reinforced bases, Sanat Pokharel

Numerical analysis of geosynthetic-reinforced bases, Xiaoming Yang

May 5: Reological characteristics of jointed rock masses with high in-situ stress, Andy Li

Containment of hazardous materials by deep mixing, Lei Chen



Dr. Jeff Chen is giving his presentation



Dr. Frank Liang is giving his presentation

Trip to New Orleans, Louisiana for GEOCONGRESS 2008



KU Geotechnical Group at the Geopier booth with Dr. Kord Wissmann (president of Geopier) and his colleagues at GeoCongress Exhibition

KU Geotechnical group made a distinctive participation in the ASCE GeoCongress held in New Orleans from 9th to 12th March 2008. There were 11 participants from KU that included one visiting scholar and three PhD students from China. The KU participants presented papers, shared knowledge and had the opportunity to learn about the recent trends in research and development in the field of geotechnical engineering. The Peck lecture on “Case History of an Embankment on Soft Ground” by Dr. Tien H. Wu and the Terzaghi Lecture on “Criteria for Granular and Geotextile Filters” by Dr. J. P. Giroud were true highlights of this conference. The exhibition by more than 60 different geotechnical companies was a great opportunity to our team to learn about the state of geotechnical practice.

There were total 9 technical papers from KU Geotechnical group. The papers and the presenters are listed below:

Paper

Evaluation of Surface Infiltration Rate of Permeable Sidewalks under Rainfall.

Critical Height of a Deep Mixed Column-Supported Embankment under an Undrained Condition.

Stability of Levees over Soft Soil Improved by Deep Mixing Technology.

An Approach to Estimate the Optimum Depth of Floating Type Columns for Embankment Stability.

Laboratory Model Study on Densification of Hydraulically-Filled Fine Sands by Vibro-compaction.

Statistical Analysis of O-Cell Test Data for Nominal Load Capacities of Drilled Shafts .

Consolidation Calculation of Soft Ground Improved by T-shape Deep Mixing Columns.

One-Dimension Consolidation of Double-Layered Foundation with Two-Level Load.

Service Limit State Design of Deep Foundations Using a "t-z" Model Approach.

Presenter

Dr. Jie Han

Dr. Jie Han

Dr. Jie Han

Dr. Jie Han

Dr. Jie Han

Mr. Xiaoming Yang

Ms. Lei Chen

Mr. Fei Wang

Dr. Roberts Lance*

* Co-author of Prof. Anil Misra.

The trip to New Orleans was unique and memorable experience for all of us. The funds from the National Science Foundation as part of Prof. Jie Han's research project, Geopier Foundation Company, and the Department of Civil, Environmental, and Architectural Engineering at KU covered our conference registrations, hotels, and travel expenses. The experience for a total of 30 hours long drive to and from Lawrence to New Orleans in the Great Plains, along Missouri and Mississippi rivers and crossing the 24 miles long lake Pontchartrain causeway would remain in the memory for a long time to come for us from different parts of the world and even for the residents of Kansas about the visit to the city where birds can fly below the sea level. The visit to the French Quarters, downtown, and the lively life at Bourbon Street were some other things to remember. Civil Engineers going to New Orleans would always be interested to see the levees, embankments, and the situation aftermath Katrina. We could manage to take a brief tour to the Katrina disaster area and have first hand information about the disaster and rehabilitation work. Thanks Matthew for an excellent drive and overall management of the tour.

Trip to New Orleans, Louisiana for GEOCONGRESS 2008 (Cont'd)

Here are what some of the KU Geotech group members have to say about the trip:

Fei Wang: "The GeoCongress conference made me think about the different ideas of my research. I enjoyed not only the technical things but also the beautiful landscape over there."

Lei Chen: "It was definitely a wonderful trip. I was glad to be there, meeting so many famous professors and learning a lot from them, having so much fun with my group mates which I will never forget."

Justine Clay: "The trip to New Orleans was an impressive experience. We were able to expand our engineering knowledge at the conference, as well as experiencing the culture of an amazing city such as New Orleans."



KU Geotechnical Group with the Terzaghi Lecturer, Dr. J.P. Giroud at GeoCongress

Acknowledgment of Sponsorship

The members of the KU Geotechnical Society would like to express their sincere appreciations to the following sponsors since January 2008:

1. Geopier Foundation Company – A Grand Sponsor
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Olathe, KS 66062

The above sponsors have made our students possible to attend the ASCE GeoCongress and local geotechnical conferences/seminars.



Support KU Geotechnical Society

The KU Geotechnical Society would greatly appreciate the industry's continuous support. All contributions will be used to support the activities of the Society and students to participate in national and local conferences. Please contact: Matthew Charles Pierson, (matthewp@ku.edu) for any contributions.