SLGS NEWSLETTER

SRI LANKAN GEOTECHNICAL SOCIETY

A Member Society of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE)

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Message from the Editor

Dear Readers,

The Newsletter features two Geotechnical forums held in the months of January and February, 2022 via Zoom with the active participation of many members.

Five papers representing Sri Lankan Geotechnical Society (SLGS) have been accepted and will be presented in the 20th International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE 2022).

It is with great pleasure to inform that Dr. Ashani Ranathunga, a member of SLGS has won the Bright Spark Lecture Award in the International ICSMGE 2022 and she is invited to deliver a keynote lecture in the conference.

Dr. (Eng.) K. H. S. M. Sampath - Editor Newsletter

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Dr. Upul Atukorala
PhD, PEng
Principal Golder Associates Ltd.
(WSP Group of Companies),
Vancouver, British Columbia,
Canada

Geotechnical Design and Construction Challenges — A Canadian Jetty Reconstruction Project

Geotechnical Forum for the month of **January 2022** was conducted online via Zoom by Dr. Upul Atukorala, Principal Golder Associates Ltd.(WSP Group of Companies), Vancouver, British Columbia, Canada.

Dr. Upul Atukorala is a Principal and Senior Geotechnical Engineer in Golder Associates', Vancouver office. With 34 years of consulting experience, Dr. Upul is an industry-recognized specialist on ground response analysis and seismic design of earth structures, soil/structure interaction analysis under static and dynamic loads, and ground improvement methods to mitigate liquefaction.

The presentation covered a summary of some of the key design and construction challenges faced during the detailed design, site preparation and foundation installation phases of the project. The jetty is designed to withstand both tsunami forces and seismic forces while maintaining functionality. Typical results of soil-structure interaction analyses along with the details of foundation design and rock blasting criteria for offshore rock removal near heritage structures established for the project were discussed in the forum.

SLGS Virtual Geotechnical Forums by Dr. Nalin De Silva — February

Dr. Nalin de Silva
PhD. M.Eng. B.Sc (Eng), C.Eng. MIE(SL)
Senior Lecturer, Department of Civil Engineering, University of Moratuwa

Deep Excavation Best Practices

Geotechnical Forum for the month of **February 2022** was conducted online via Zoom by Dr. Nalin De. Silva, Lecturer, University of Moratuwa.

Dr. Nalin de Silva is serving as a senior lecturer attached to the Department of Civil Engineering, University of Moratuwa since 2009. With over 18 years of experience as a geotechnical engineer, Dr. De Silva is largely involved in the analysis and design of deep excavations and foundations in Sri Lanka.

This lecture covered an introduction to the construction and selection of different deep excavation support systems, different lateral support systems, general guidelines on the analysis and design, planning and design of ground water control systems, importance of monitoring during deep excavations and contingency plans to minimize the risk of unexpected failures.

Further, best practices for quality assurance and safety during the construction of deep excavations were also discussed during the session.

20th International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE 2022)

The 20th International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE 2022), to be held in Sydney, Australia, from May 1 to 5, 2022 in hybrid mood. The international conference is organized by the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) under the theme of "***A Geotechnical Discovery Downunder – Geotechnical Diversity Awaits You***".

ICSMGE 2022 will focus on the application of theory and the discovery that comes when world-class minds are focused on the geotechnical problems facing our world. The conference program and technical sessions reflect this emphasis on applications, and are designed to trigger collaboration, innovation and discovery from a diverse group of participants.

It is with great pleasure to inform that five papers representing the Sri Lankan Geotechnical Society (SLGS) have been accepted and will be presented in the international conference. The recorded presentations have already been submitted by the respective authors.

Further, Prof. Athula Kulathilaka, the past president of SLGS will attend the conference physically and present their findings, representing SLGS.

Details of the accepted five papers are as follows.

Effectiveness of radial sub-horizontal drainage in improving the landslide stability: A case study on central highlands, Sri Lanka

Lilanka Kankanamge *(Geotechnical Engineering Division, National Building Research Organization, Colombo, Sri Lanka)*
Athula Kulathilaka *(Department of Civil Engineering, University of Moratuwa, Moratuwa, Sri Lanka)*
Manasi Wijerathna *(GHD Group Pty Ltd, Sydney, New South Wales, Australia)*

ABSTRACT: Slope instability, triggered by excessive rainfall is one of the common hazards that geotechnical engineers are challenged within tropical countries such as Sri Lanka. These slope failures are initiated in colluvial layers or planes of low shear strength in differently weathered zones in the thick soil overburden. Improvement of surface and subsurface drainage has proven to be effective in lowering the ground water table as well as preventing perched water table conditions. Badulusirigama Landslide in central highlands of Sri Lanka is an example for a slow moving long rotational slip that activates after heavy rainfall events. The landslide was rectified with more than 45 m long individual sub-horizontal drains that are arranged into a network of radial drainage groups at different elevations along the long sliding mass. This site is well equipped with monitoring instruments. The rectification measures were numerically simulated in 2D plane strain conditions to evaluate the improvement of the stability of the slope during the drains construction as well as in response to an actual critical rainfall event. The results indicate that the bottom up sequence of drainage construction is more rapid in improving the stability of a slope when compared to top down sequence of drainage construction. The results of the analysis revealed that with the critical rainfall of total 725 mm that spanned over 30 days with low initial intensities and a peak intensity of 216 mm/day after 24 days, an adequate factor of safety was maintained in the rectified slope throughout. There was a sharp reduction of FOS soon after the peak rainfall at 25th day but the slope could recover and the FOS restored as the rainfall intensity reduced.

Soft Peaty Clay stabilization in Sri Lanka: Sustainability via utilization of Secondary Raw Materials

Ashani Ranathunga & Athula Kulathilaka *(Department of Civil Engineering, University of Moratuwa, Sri Lanka)*

ABSTRACT: In situ deep mixing of soft peaty clay with a binder such as cement can improve strength and compressibility characteristics significantly in a short period of time. However, due to the higher cost and environmental impact for cement as the binder, reducing the cement content using secondary raw materials such as Calcium carbide residue (CCR) and Fly ash (FA) is needed and is focused on this study. Improvements in strength for various proportions of CCR, FA and cement were assessed by conducting unconsolidated undrained triaxial tests for short-term (28 days) and long-term (90 days) curing. Further, behaviour of compressibility was investigated by conducting loading, unloading, and preloading one-dimensional consolidation test on oedometer. Adding only cement has the best improvement while 10% CCR, 15% FA with 5% cement mixture showed the best results among other mixtures. The CCR fixation point was 30% and was independent with time. Further, moisture content of the soil plays a vital role in the strength improvement and having similar proportions for FA with CCR & cement mixtures provided better results. However, permitting pozzolanic reaction under an overburden stress can noticeably improve the strength & stiffness of peaty clay.

Structural mitigation of a deep-seated slow moving landslide along a major national road in Sri Lanka

Asiri Karunawardena *(National Building Research Organization, Director General, Sri Lanka)*

ABSTRACT: The government has implemented large-scale landslide mitigation works along the National roads in highland areas to avoid the frequent disturbance of the transport system due to the occurrence of landslides. The stabilization of Kahagolla land slide is one of the largest mitigation works carried out under the "Landslide Disaster Protection Project". This landslide was first identified in 1957 and creep movements have followed thereafter at different times affecting the road structure. Detailed field and laboratory investigations, Instrumentation and monitoring were performed to investigate the characteristics and the possible causes of the landslide. Stability analyses were carried out on the established landslide profile based on the above information and results indicate that some parts of the landslide are in a highly active stage. Also, analysis indicates that the main reason for landslide activation is the increase of ground water level and subsequent loss of slip surface strength. Based on the results of investigations and stability analysis, suitable combinations of countermeasures were selected by considering both the economic efficiency and the design requirements. The monitoring results up to date after implementing the mitigation measures, show acceptable stabilization of terrain.

20th International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE 2022)

Effect of Degree of Saturation on Pullout Resistance

Nadeej Priyankara & Arnold Fernando *(Department of Civil & Environmental Engineering, University of Ruhuna, Sri Lanka)*

ABSTRACT: Soil nailing is a technique which is used to reinforce and strengthen the existing ground conditions. This is done by installation of closely spaced, passive, structural inclusions known as nail into the soil and these nails helps to improve the overall shear strength of soil. Among the factors influencing the soil-nail pullout resistance, the degree of saturation (S_r) of the soil is an important factor, especially for permanent soil-nail structures. As such, in this research study, the effect of degree of saturation on pullout resistance was studied by conducting a series of laboratory pullout tests using a laboratory pullout box. Especially designed water proof cap was used to apply back water pressure to saturate the soil within the pullout box. Variation of earth pressures close to the grouted nail were observed during the tests. It was evident from the test results that higher the degree of saturation of soil, lower the pullout resistance. Maximum pullout resistance was observed when the degree of saturation is near the optimum moisture content of the soil. When the soil is sufficiently dry, lower pullout resistance was observed due to low bond strength between grout surface and surrounding dry soil.

Applicability of coal bottom ash for the rehabilitation of clay mines: Potential as a backfill material

Sivaraman Suloshini, Ashani Ranathunga, Athula Kulathilaka & Buddhika Gunawardana
(Department of Civil Engineering, University of Moratuwa, Sri Lanka)

ABSTRACT: The higher cost associated with the restoration of clay mines and shortage of suitable filling materials have created many abandoned clay mines in Sri Lanka, which leads to many environmental and health issues. Coal bottom ash (CBA) generated during the coal combustion process as a by-product is a potential fill material. Currently, most of the CBA is open dumped into nearby lands creating environmental pollution and utilizing CBA as a fill material for clay mine restoration will be a suitable solution for these problems. Therefore, main objective of this study is to investigate the applicability of CBA as a partial or full replacement of the existing fill materials for clay mine rehabilitation. CBA produced from Lakvijaya coal power plant, Sri Lanka was used and the basic properties, shear strength parameters, compressibility characteristics and heavy metal leachability of CBA were investigated. According to results, CBA behaves as a poorly graded and non-cohesive material with a friction angle of 35°. Further, CBA can be considered as a free draining material with low compressibility. The highly porous structure of CBA caused a lower dry density (975 kg/m^3). However, it can be improved using 10 – 25% of soil to CBA. Further, the leachability potential of trace metals in CBA does not exceed the allowable limits. Thus, CBA would be a suitable fill material for clay mines restoration or similar uses.

Bright Spark Lecture Award won by Dr. Ashani Ranathunga

It is with great pleasure to announce that a SLGS member, Dr. Ashani Ranathunga has won the Bright Spark Lecture Award in the 20th International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE 2022).

The Bright Spark Lecture Award was established by Professor Charles Ng, president of ISSMGE to promote young members of the ISSMGE to play a major role in various international and regional conferences. Recipients of this award are invited to give a keynote lecture at ISSMGE conferences.

The Young Member Presidential Group (YMPG) in collaboration with the Local Organising Committee for the ICSMGE has announced the winners of the Bright Spark Lecture Award to two very distinguished engineers: Dr. Ashani Ranathunga (Sri Lanka) and Dr. Brendon Bradley (New Zealand). They are both invited to give keynote lectures at the Sydney ICSMGE in May 2022.

Dr Ashani Ranathunga was a Lecturer at The University of Moratuwa, Sri Lanka. Her interest for Geotechnical Engineering started during her undergraduate studies with the analysis of the 450-year-old Galle Fort rampart that survived the 2004 tsunami. She graduated with First Class Honours from The University of Ruhuna, Sri Lanka in 2013 and obtained her PhD from Monash University, Australia in 2017.

Her postgraduate studies focused on the long-term safe storage of CO_2 in deep coal seams with enhanced coalbed methane recovery. She has worked with state-of-the-art instruments from micro- to macro-scale related to CO_2 sequestration. She has been awarded the Best PhD Thesis Award by the Department of Civil Engineering at Monash University together with the postgraduate publication award for the candidate with an excellent publication record for the year 2017.

Since joining the Department of Civil Engineering at University of Moratuwa, she has made a significant contribution to the development of the undergraduate programme and research of the department. Her current research focuses on ground improvement, CO_2 sequestration and waste products for soil amendments.