Minutes of TC218 Conference Call_Mar.20

MINUTE

Date of Meeting

Thursday March 12th, 2020

11:00 AM -12:00 PM Eastern Time - US & Canada (UTC-4)

Venue

Conference Call

Agenda:

1. Recap of the TC-R IGS meeting held in Barcelona - Jan. 2020

The International Geosynthetics Society Technical Committee on Soil Reinforcement (TC-R) hosted a 2-days workshop in Barcelona. 3 out of 4 topics included subjects familiar to TC218:

- **Reliability based design and analysis of geosynthetic reinforced structures** (chaired by Richard Bathurst)
- **Serviceability Limit States: analyses, design, specification** (chaired by Pietro Rimoldi and co-chaired by John Sankey)
- **Advancements, Developments and State of the Practice for International Codes for design of Reinforced Soil Structures** (chaired by Robert Lozano)

The Codes session included a talk by John Sankey where he promoted TC218 and summarized the findings of the Codes comparison document carried out by our Subcommittee 2.
Richard Bathurst provided a written summary of the outcome of his session on Reliability to be shared with the TC218 members (attached to this minute email).

2. Most recent news on next ISSMGE 2021 Sydney Conference planning

Based on the response received from TC218 members, the tentative program for the 20th ICSMGE Conference (Sydney, Sept. 2021) will include the following input:

State-of-the-Art Lectures

Suggested title of SOA lecture: Limit State Design for Mechanically Stabilized Earth

Recommended presenter: Dr. Dov Leschinsky, ADAMA Engineering

Name of the associated TC Honour Lecture (if relevant): TC218 will shift the honor lecture to our parallel session if the state-of-the art lecture for general conference is not accepted.

TC Parallel Session Themes

Suggested title of TC session: TC218 will conduct 2 tracks for our session

(1) Use of Solid Waste Backfills in Reinforced Fill Structures (MSE and RSS)

(2) Sustainability and Carbon Footprint for Reinforced Fill Structures

Honour lecture (if applicable):

Workshops

Draft title of workshop: Rail and Mining Applications Using MSE Wall Technology

Duration: 4 hours

Anticipated no. of attendees: 30

Other logistical matters:

Moreover, ISSMGE TOC Pierre Delage sent a request for potential speakers or contributors at the Conference. Richard Bathurst and Pietro Rimoldi offered their participation to speak on the subject of Reliability Analysis of Mechanically Stabilized Earth and Serviceability Limit States pertaining to MSE and RSS, respectively.

Any TC218 member who wish his name to be considered shall feel free to email John Sankey. We will collect proposals until Mar. 31st.

3. E-Exchange on Railroad Applications

With the purpose of keeping the conversation and activities engaging, it was proposed to start a new E-mail exchange on MSE wall performance for railway support between steel and geosynthetic reinforcement. Patricia Guerra will lead the exchange and she will send a proposed outline to the TC218 Board before organizing the exchange in April. The discussion will be again by email and the participants will probably have four weeks to contribute.

4. Coordination of a TC218 Special Issues for Case Histories

Ivan Puig Damians, our representative in the Editorial Board of the International Journal of Geoengineering Case Histories, communicated with our Chairman about the case history special issues task that has been requested on the TC218. CHs might be sourced from the material presented at the TC-R workshop in Barcelona and the previous one in 2018, in Munich.

The ISSMGE Journal requested a 3-month turnaround for the TC218 contribution, however more time was requested to complete this task.

Richard Bathurst, as one of the committee members for special editions, was able to provide further details and indicated that he could help our committee with the submission needs.

TC218 will probably organize an ad hoc subcommittee to help Ivan with this large task once more details will be provided by the Journal.

5. Short-term Committee goals

- Erol Güler reported on the Terminology subcommittee (Group 1).
  A draft report from input initially received was circulated before the videoconference. During the call comments were received on other terminology to be added. If Group 1 members wish to add additional new terms, they can email Erol, including the definition they would like to use. Moreover, suggestions were also given on the need to include references for the included terminology but Erol mentioned the difficulty in providing all sources. A caveat could be eventually added at the beginning of the Terminology report addressing general sourcing.
  A final draft of the document will be sent to the Board for review and distribution to membership.
- Dimitri Plantier is collecting responses for input to a table generated on the subject of good construction practice. The feedback from Group 3 volunteers is due by April 15th.
- The Subcommittee 2 on Code Interpretation has a table that was finalized and distributed. However, the table was kept open to add information on additional codes whenever available (e.g. South Africa, Japan, etc.)

6. Board Election

John Sankey indicated that he will step down as Chair of TC218 at the end of May 2020 and Jim Collin will step down as Vice Chairman at the same time. Giulia Lugli will be elevated to the Chairman position to serve out the remainder of a 4-year term ending in January 2021 and might extend 2 more years with the consent of ISSMGE.

A separate email will be sent to the membership about this topic.

7. Closure of the Conference call

Next conference call will be on Tuesday **June 9th, 2019 – 9 AM (UTC+9)** capturing mainly Asia/Australia.

Attendees at TC218 Committee Conference Call – Mar. 12th, 2020

Name	Company Name	Contact E-Mail	Country
John Sankey	Terre Armee	sankeyjohn2@gmail.com	USA
Jim Collin	Collin Group	jim@thecollingroup.com	USA
Giulia Lugli	Maccaferri	g.lugli@maccaferri.com	USA
Jennifer Nicks	FHWA	jennifer.nicks@dot.gov	USA
Jacek Kawalec	Tensar and Silesian University of Technology	kawalec@tensar.pl	Poland
Patricia Guerra	Geosynthetics Engineered Solutions	Patricia@geosyn.co.uk	UK
Pietro Rimoldi	Maccaferri	pietro.rimoldi@gmail.com	Italy
Oliver Detert	Huesker	detert@huesker.de	Germany
Richard Bathurst	Royal Military College	bathurst-r@rmc.ca	Canada
Shahriar Mirmirani	Reinforced Earth Company	smirmirani@recocanada.com	Canada
Erol Güler	Shannon & Wilson	SRB@shanwil.com	USA
Yuli	Tensar International	wliew@tensarcorp.com	USA
Mike Bernardi	Strata	mbernardi@geogrid.com	USA
Castorina Vieira	FEUP	cvieira@fe.up.pt	Portugal
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Riccardo Musella	Reinforced Earth Company	rmusella@reco.com.au	Australia

IGS TC-Soil Reinforcement – Reliability Session Report

20-21 January 2020, Barcelona Technical University (UPC), Barcelona, Spain

Chair: Professor Richard J. Bathurst

A call for session themes for the IGS TC-Soil Reinforcement workshop in Barcelona resulted in a session titled: RELIABILITY-BASED ANALYSIS AND DESIGN OF GEOSYNTHETIC REINFORCED STRUCTURES. This is a timely topic because the probabilistic approach (reliability-based design) for geotechnical foundations is gaining traction in Canada, the Netherlands, Japan and the USA. The case for reliability-based design has also been made in ISO2394:2015. Annex D: General principles on reliability for structures. International Organization for Standardization, Geneva, Switzerland. In the opening remarks to the session by the chair, Professor Bathurst, he explained that reliability-based design (RBD) can be fully probabilistic or simplified (semi-probabilistic). An example of the simplified approach used in the USA and Canada is calibration of load and resistance factor design (LRFD) limit states to a target probability of failure. RBD provides an alternative probabilistic appreciation of margins of safety and the accuracy of the load and resistance models that appear in simple limit state equations including those used for internal and external stability design of mechanically stabilized earth (MSE) walls. However, the session chair cautioned that reliability-based design should be viewed as a complementary approach to traditional (deterministic) working stress methods and LRFD approaches. He concluded by noting that the development and use of RBD for MSE walls is relatively new and it is for this reason that this session was developed.

Four presentations were given by the following IGS members: R.J. Bathurst, P. Rimoldi, Y. Miyata and P. Pezzano. A brief summary of each talk is reproduced below.

A simple approach for probabilistic internal stability analysis and design of reinforced soil walls

Richard J. Bathurst, GeoEngineering Centre at Queen's-RMC, Kingston, Ontario, Canada

The lecture explained the basics of probabilistic analysis and design for internal stability limit states for mechanically stabilized earth (MSE) walls using the example of geogrid reinforced soil walls. The general approach uses a closed-form solution for reliability index which is easily implemented in a spreadsheet and thus eliminates the need for Monte Carlo simulation. A novel feature of the formulation is that it includes uncertainty in the choice of nominal values [which is consistent with the notion of level of understanding that appears in the Canadian Highway Bridge Design Code] and the underlying accuracy of the load and resistance models that appear in each limit state equation using bias statistics. The lecture demonstrated how bias statistics for tensile load and pullout model accuracy can be gathered from load measurements recorded from instrumented walls and found in laboratory pullout box test databases. The concepts are general and can be applied to any soil-structure interaction problem which can be expressed by a simple linear limit state performance function and for which bias statistics are available. The lecture concluded with an example of the calculation of the probabilistic margin of safety against failure of the reinforcement tensile strength limit state for all reinforcement layers in a wall using the AASHTO Simplified Method and the recently adopted AASHTO Stiffness Method in the USA. The calculations were performed for an actual instrumented and monitored production MSE wall constructed in the USA.

Reliability analysis of external stability of geosynthetic reinforced soil retaining walls

Pietro Rimoldi, Consultant, Milano, Italy

This lecture was complementary to the previous lecture because it focused on reliability analysis and design for external stability limit states of MSE walls. The external limit states considered in the lecture were sliding, overturning, and bearing capacity. The lecture reviewed the link between probability of failure and reliability index (β) and linked these concepts to Eurocode 0 (EN 1990:2002) Annex C. Closed-form solutions for the three external limit states were first presented and then soil friction angle and unit weight parameters identified as stochastic variables with normal (Gaussian) distributions and statistical characteristics defined by mean and standard deviation (or COV). Monte Carlo simulation was explained in which multiple calculations for each limit state are performed with each calculation using randomly sampled values from the distributions above. The probability of failure is computed as the fraction of the total number of calculations that fail to satisfy the limit state function. These calculations can be performed using an EXCEL spreadsheet. The influence of the COV of soil parameters and different deterministic reinforcement lengths on the probability that a limit state is not satisfied was illustrated. The lecture showed that reducing the COV of soil parameters through better project investigation can lead to cost savings.

Reliability analysis of geogrid pullout capacity

Yoshihisa Miyata, National Defense Academy, Japan

The first speaker introduced the notion of model error as a contribution to probability of failure (or reliability index) in reliability analyses. This talk expanded on this idea by focusing on the calculation of model error (bias) for geogrid pullout capacity in the pullout limit state for internal limit states for MSE walls. The talk covered current pullout design models used in Japan, the collection of pullout test data used to quantify pullout model error, the interpretation of pullout load tests in Japan, the accuracy of current pullout models used in Japan, and a proposal for an improved pullout model. The paper shows that the current pullout model used in Japan is excessively conservative by a factor of 1.35 *on average* and COV of bias values of 38%. The proposed new model is much better with mean bias of 1 and COV of bias values of 26%. Furthermore, there is no statistically significant correlation between model error (bias) and predicted pullout capacity. While the lecture focused on reliability of geogrid pullout models using physical test measurements, the general approach to quantify model error is applicable to other limit states where physical measurements are available for both load and resistance parameters.

First order reliability method for reinforced soil walls

Pietro Pezzano, Officine Maccaferri, Italy

In this lecture, internal and external limit states for MSE walls were examined within a probabilistic framework. The margin of safety was expressed as reliability index (β) and its calculation demonstrated using the well-known first-order reliability method (FORM) approximation. The probability of failure for five different limit states for a typical reinforced soil wall and expressed using formulations found in BS8009 was demonstrated. The calculations were easily carried out using an EXCEL spreadsheet application that is freely available.

Following the four presentations there was a lively collegial discussion between the speakers and the audience.

Prepared by
Richard J. Bathurst
IGS Past-President