ISSMGE - TC201

Geotechnical Aspects of Dikes and Levees

Newsletter December 2017

Dear TC member,

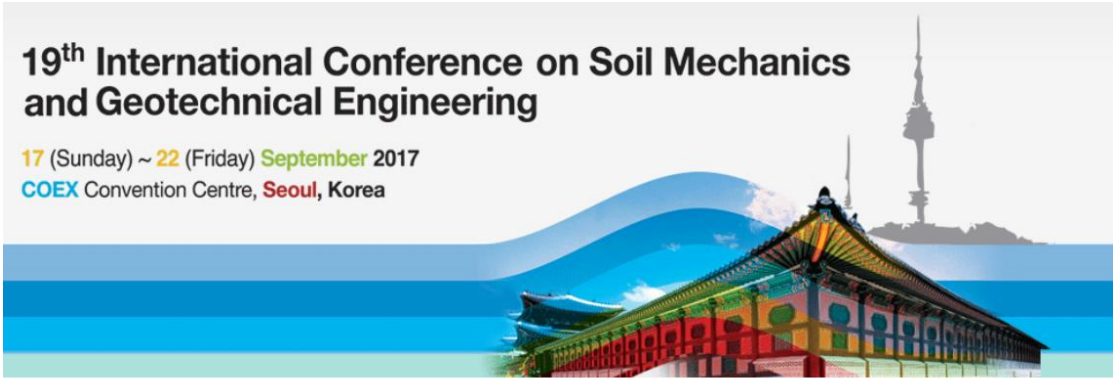
This is the fourteenth newsletter of the ISSMGE Technical Committee 201: geotechnical aspects of dikes and levees. The intention of the newsletter is to keep all members informed on coming activities of our TC and the ISSMGE.

Cor Zwanenburg (Chairman TC201)
Martin Pohl (Secretary TC201)

1. Workshop on seepage, London, August 31st – September 1st
On August 31 and Sept 1 a workshop on seepage induced instabilities was held at Imperial College London. A short impression of the workshop and discussion is presented in the appendices.

The presentations of the workshop can be downloaded from:
http://www.imperial.ac.uk/geotechnics/research/research-projects/seepage-induced-geotechnical-instability/seepage-workshop/.

2. TC201 session at the 19th ISSMGE conference in Seoul



The 19th ISSMGE conference was held in Seoul during September 17th to 22nd 2017. One session was dedicated to dikes and levees. In total 8 papers were selected for a presentation out of 13 submitted papers. In total an audience of 40 people visited the session. The presented topics showed a wide range of topics of interest for our working field.

The papers can be found on the ISSMGE website:https://www.issmge.org/publications/online-library, At this page a few items should be selected; for database one should select *International conference on Soil mechanics and Geotechnical engineering* for Conference, *19th conference on Soil mechanics and Geotechnical engineering (Seoul)* should be selected and finally for category *TC201* should be selected. The website will return the presented papers.

In total 11 papers were presented for which a TC201 member is author or co-author. These papers are listed in the attachment.

3. State of the Art versus State of Practice
The ISSMGE has taken the initiative to make an inventory of the state of the art, SOA versus the state of practice, SOP. TC201 also provided input for this inventory. The outcome of the

inventory was presented during the Seoul conference. A summary of the results is added to the newsletter.

The results gave an interesting view on the differences between state of the art and state of practice. Regarding the working field of TC201, the differences between SOA and SOP are felt very differently for the different respondents. For example, on the question on the cooperation between universities and industry, respondents answered in the range of non-existent to very intense. More details are given in the attachment.

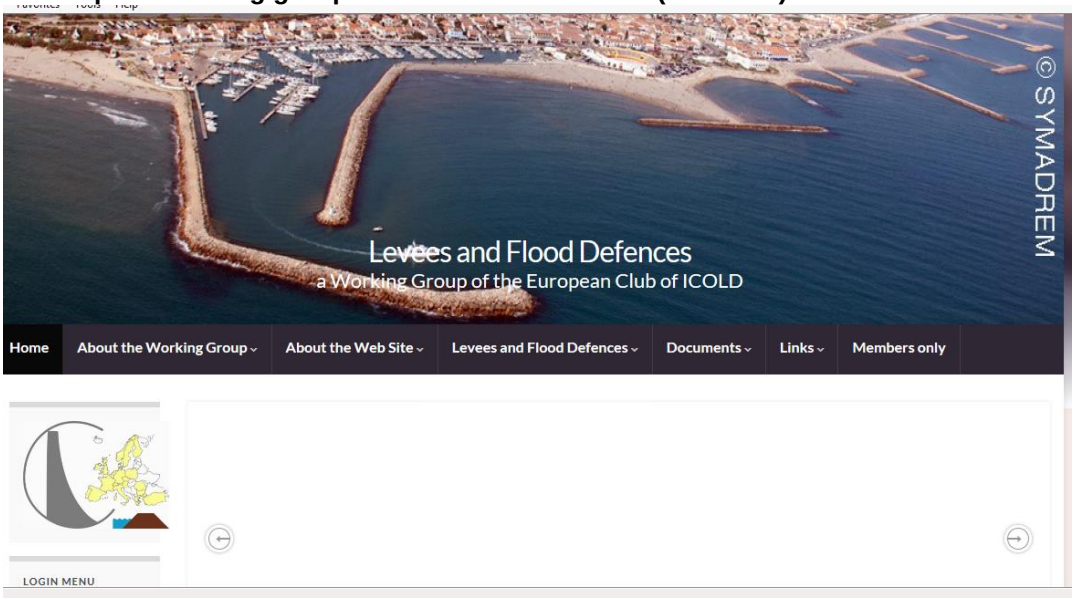
4. Committee meeting 2017

The 2017 committee meeting was held during the 19th ISSMGE conference in Seoul. The minutes of the meeting are added to the newsletter.

The next committee meeting will be held during the 17th European conference on Soil Mechanics and Geotechnical Engineering, ECSMGE, Rekjavik, September 1st - 6th 2019.

In the meeting it was decided to held a TC201 workshop during the 16th Pan American Conference on Soil Mechanics and Geotechnical Engineering, Canjun November 2019

5. European working group on levees under ICOLD (EUCOLD)

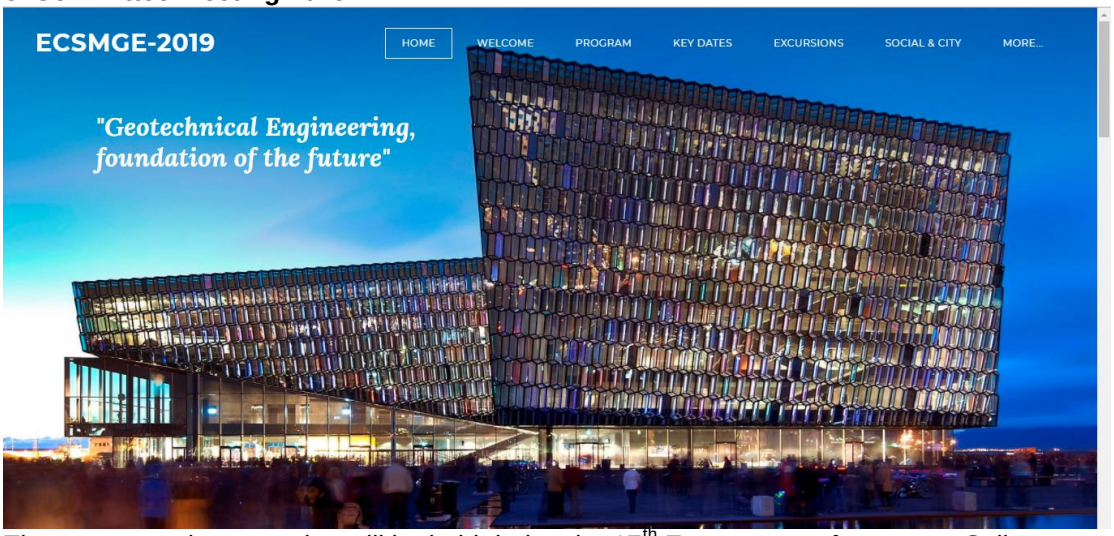


The European Levee Initiative has been launched. An important item will be the library/database of case histories, which also is presented in the workshop as the SAFElevee initiative-wg4. This initiative is supported by the European working group on levees under ICOLD (EUCOLD). TC201 has the intention to actively support this initiative and will encourage TC members to come forward with relevant cases. Visit the website http://lfd-eurcold.irstea.fr/ for more information.

ICOLD will hold its annual conference in Vienna, July 1st to July 7th 2018. For this edition many papers on dikes and levees will be presented. More information on https://www.icoldaustria2018.com/home/

Our colleague and TC201 member Rémy Tourment is actively joining EUCOLD and can be reached for questions and suggestions for his website. (remy.tourment@irstea.fr)

6. Committee meeting 2019



The next committee meeting will be held during the 17th European conference on Soil Mechanics and Geotechnical Engineering, ECSMGE, Rekjavik, September 1st - 6th 2019, http://www.ecsmge-2019.com/

Please note that the deadline for submitting papers is **April 15th 2018.**

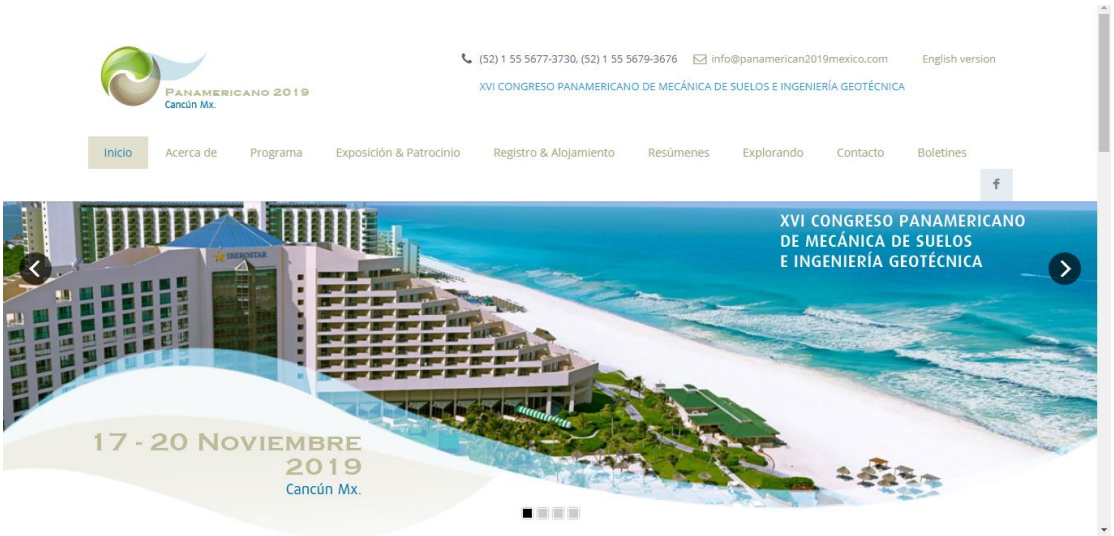
Details of the committee meeting will be announced later.

7. TC201 Session in the 17th ECSMGE 2019

During the 17th European Conference on Soil Mechanics and Geotechnical Engineering, ECSMGE, Reykjavik, TC201 has been giving the opportunity to organise session. This session will involve the papers submitted for the conference in the field of dikes and levees.

All TC201 members are encouraged to submit papers. Please note that the deadline for abstract submission is **April 15th 2018**

8 TC201 Workshop during the 16th Pan American Conference on Soil Mechanics and Geotechnical Engineering, Canjun November 2019



The workshop will be focused on the application of the International Levee Handbook in practice. Contact person for this workshop is Norma Patricia López Acosta; NLopezA@iingen.unam.mx

9. ISSMGE website

The ISSMGE has launched a new website. It provides a lot of useful information and is really worth visiting. However, for TC201 still little content can be found. We will be working on further improvement of the TC201 page. Members are encouraged to come forward with ideas and relevant content.

The archived webinars can be found on http://www.issmge.org/media/recorded-webinars
The TC members are encouraged to further promote watching the webinars.

10. Next Newsletter

The next newsletter will be send around at June 15th. Please provide all available information, like TC related publications, news, research, to the secretary Martin Pohl, martin.pohl@baw.de.

On August 31 and Sept 1 a workshop on seepage induced instabilities was held at Imperial College London. The workshop was organized in conjunction with the British Geotechnical Association and the British Dam Society. The workshop was also supported by three technical committees of the International Society for Soil Mechanics and Geotechnical Engineering: TC 105 Geo-Mechanics from Micro to Macro, TC 201 Dikes and Levees, and TC 213 Scour and Erosion. The workshop was organized to launch the EPSRC funded collaboration between Imperial College London, the University of Sheffield entitled "Particle-Scale Investigation of Seepage Induced Geotechnical Instability", and the EPSRC provided financial support for the workshop. There were 48 participants including representatives from consulting engineers, dam owners and academics.

The first session of the workshop focussed on UK practice. The first speaker, Rob Gilbert from ARUP, reminded us all how international UK practice is, describing case histories of dams in Myanmar, Mauritius and Sudan. Dr Toby Roberts from WJ Groundwater presented a number of dewatering case histories and discussed some of the issues associated with filter selection for dewatering wells. Dr Chris Menkiti from GCG presented some case histories from the Warsaw Metro. Dr. Menkiti also highlighted the problem of sea borne transport of mineral ores; instabilities associated with this material have resulted in the loss of a number of large ships in recent years.

The second session of the workshop was loosely based around a consideration of design guidance and codes. The first speaker was Dr Brian Simpson from ARUP, who has been involved in a working group looking at seepage related issues in EC7. Dr Philip Smith from Royal Haskoning DHV spoke about his experience with UK levees (flood embankments) and introduced the Levee Handbook. Dr Bernard Odenwald provided a German perspective, while Mr. Rod Bridle introduced the ICOLD Bulletin 164 on Internal Erosion.

The second day of the workshop was research orientated. In the first session, there was a focus on international experimental research, with presentations from Prof Jonathan Fannin (University of British Columbia, Canada), Dr Didier Marot (University of Nantes, France) and Prof Akihiro Takahashi (Tokyo Institute of Technology, Japan). The final session of the workshop outlined UK research, and started with a presentation from Dr Philippe Sentenac (Strathclyde) on field monitoring of internal erosion in flood embankments. Finally, the joint Sheffield – Imperial research project team gave presentations on transparent soil and discrete element modelling.

Key points from the workshop were:

- There was a repeated theme in the industrial presentations of the need to understand both the geology of sites as well as the history of human intervention at sites, whether the site is an existing levee or a new deep excavation in an urban environment. Dr Smith and Dr Odenwald highlighted that failures are also often observed at irregularities (transitions) or junctions with structures intercepting levees.

- There is scope for new technologies to help us better understand site conditions: Dr Philip Smith from Royal Haskoning DHV highlighted the ability of LIDAR to help identify old meanders and old drainage channels. Dr Sentenec discussed the use of geophysics, focussing on electrical resistivity tomography and describing use of this technology on flood embankments in France.

- The risk posed to dams and flood embankments by internal erosion was highlighted. Considering the performance of embankments in England since 2007, Dr Smith highlighted that the particular threats to UK levees are seepage, internal erosion and uplift; however,

with extreme floods such as those in the winter of 2015/2016 overtopping is also an issue. He noted that these mechanisms pose a greater risk to levees than slope stability failures.

- Dr Simpson pointed out that factoring water pressure under using an EC7 approach can lead to impossible situations.

- Dr Smith highlighted the fact that despite the significance of levees, in contrast to dams, there is less legislation and inspection. Dr Smith pointed out that these structures are vulnerable as they were typically not designed to particular standards and are often constructed on poor ground; their fragility is typically not apparent. To emphasize how fragile these structures can be, Dr Smith showed a video of a US Corps of Engineers experiment in which a full-scale levee on silty sand failed only 15 minutes after the development of a pipe beneath the levee.

- Mr. Bridle explained that the ICOLD bulletin on internal erosion is very useful to engineers seeking to understand the mechanics of internal erosion; notably they define the four mechanisms, suffusion, backward erosion, contact erosion and concentrated leak erosion. He highlighted that each mechanism can fundamentally be considered as a load – resistance problem. He pointed out that the challenge is to estimate the hydraulic forces causing erosion in vulnerable soils.

- Prof Fannin explained that in seeking to improve understanding of internal erosion in embankment dams there is a need for both data completeness and model completeness.

- Prof Marot proposed that in assessing suffusion (one form of internal erosion) the power expended by the seepage force should be considered.

- Presentations from Dr E. Bowman (Sheffield) and dir. T. Shire (Glasgow) demonstrated the power of transparent soil and discrete element modelling to examine the fundamentals of seepage-induced instabilities.

- Recent guidelines and resources for practicing engineers were highlighted including The International Levee Handbook, ICOLD Bulletin 164 on Internal Erosion, the German BAW Codes of Practice.

Selected presentations from the workshop are available at http://www.imperial.ac.uk/geotechnics/research/research-projects/seepage-induced-geotechnical-instability/seepage-workshop/. For further information, contact Prof Catherine O'Sullivan (cath.osullivan@imperial.ac.uk).

Report on findings ISSMGE survey on SoP - SoA

TC201 Geotechnical aspects of dikes and levees and shore protection

dr. C. Zwanenburg, August, 2017

Introduction

In the period of 2016 – 2017 the TOC of the ISSMGE has organized a survey to determine the gap between practice and theory in the geotechnical profession. The survey is based on a series of questions prepared by the different technical committees of the ISSMGE. In this way relevant questions were put forward for each of the geotechnical working fields. The results of the survey are collected in a spreadsheet (Survey_data_for_TCs_30_5_2017.xls). This report summarizes and analyses the answers received on the questions put forward by TC 201, Geotechnical aspects of Dikes, levees and shore protection.

Hot Topics and Relevant Questions

The survey questions were raised based on identified hot topics for each of the TC working fields. For TC 201 the main hot topic is the availability of codes or guidelines on stability assessment of water retaining structures. From geotechnical point of view, there is a difference between the stability assessment of existing structures, which might be in active use for a long period and designing new water retaining structures. Related to the codes and guidelines is the availability of calculation tools to conduct the analysis prescribed by the different codes.

Due to their nature, codes and guidelines do not reflect the latest state of the art in their profession; it takes time before new developments are sufficiently grown to be included in guidelines or codes. Codes and guidelines can be seen as a reflection of the state of practice, SOP. The state of the art, SOA, is beyond the SOP. When there is a small gap between the practitioners and researchers, new ideas and developments should lead to (regular) updates of the existing codes and guidelines. The practitioners should then be confronted by updates of codes and guidelines and introduction of new, accompanying software, relevant for their work. Researchers would find reflections of their recent work in the new updates.

For TC201, the considerations above have led to the following questions:

Q35: In the region(s) where you are active, what are the design codes for designing dykes and levees?

Q36: Are the status of dykes and levees regularly checked in the regions where you are active? If so, do these checks consider several failure mechanisms (e.g. crest height, stability, piping), or only crest height?

Q37: Which calculation tools and experience based methods do you generally use in designing dykes and levees? Are more advanced tools available? Is the sophistication of calculation tools in line with the sophistication in parameter assessment?

Q38: In the region where you are active, are there universities where consequences of climate change, including actions and preparations, are studied? If so, how is the industry connected to academic research?

Q39: What, in your opinion, has been the input of academic research to design of dykes and levees in the last five years?

Results

In total 11 persons have filled out the TC 201 part of the questionnaire, however not everybody has given an answer to all questions and sub questions, leading to a total number of 74 responses.

Question Q35 results in a pallet of different codes in which the USACE guidelines and the Eurocode are regularly mentioned. Besides these two, local codes, Dutch, German, French and Belgian codes are mentioned.

It is remarkable that the International Levee Handbook, IHL, (CIRIA 2013) is not mentioned by any of the respondents. The International Levee Handbook is recently published by CIRIA to create a practical, worldwide applicable, guideline in dike design and stability assessment for existing dikes and levees. Apparently the IHL is not yet a generally accepted document in the working field.

Answers to Question Q36 show the differences in sophistication in dealing with the safety of existing structures. The answers differ from no checks to visual inspection only to safety calculations for all failure mechanisms.

Answers to Question Q37 results indicate that analytical calculation tools dominate the state of practice. Finite element methods are mentioned as the more advanced calculation tools available. One respondent mentions that more advanced calculation tools have no meaning without a better understanding of the geotechnical characteristics of dyke or levee sections.

Opinions differ on the question if the sophistication of the calculation tools is in line with the sophistication in parameter assessment. Although not clearly stated, it is to be expected that the respondents who stated that the levels of sophistication are out of line, feel that the calculation tools are more advanced than the parameter assessment.

Answers to Question Q38 show a large range of academic involvement, from no to poorly, in kind involvement and participation in BSc & MSc finals. This result might indicate that cooperation between industry and academia depends on individual contacts between academic staff and practitioners. As a consequence some respondents might experience a strong cooperation between industry and academia while others do not.

Answers to Question Q39 give an overview of present day research topics. Although one respondent indicates that the input of academic research to design of dikes and levees in the last five years has been non- existent, the other respondents mention topics that can be summarized by 3D modeling and constitutive modeling.

General

Ten percent of the total number of respondents has indicated to be interested in TC201, which shows the relevance of TC 201. TC 201 forms a network by which industry and academia are linked. The responses to question Q38 and Q37 indicate the relevance of such a network. Since some respondents feel a clear interaction, while others don't, there is a need for TC 201 to further strengthen the bonds between industry and academia. This will be done by continuing organizing

sessions and workshops during conferences on topics that in the interest of both industry and academia.

The geographical origin of the respondents is only available for the entire survey and not specifically for the respondents of the TC201 part of the questionnaire. Based on the received answers it seems that the respondents of the TC201 part of the questionnaire are mainly from Europe / North America. A focus point for TC201 for the coming years is to further widen the active network. TC201 already has an active input from South America, besides Europe and North America. For the coming years the intention is to further increase the input from Asian countries.

For future surveys it would be interesting to have more respondents. Preferably the respondents should be better divided over the different continents. For future surveys, TC201 could play a more active role in mobilizing respondents. Preferably the respondents should be encouraged to answer all the questions. Now some respondents have answered only some questions.

The following papers were authored or co-authored by a TC201 member:

The Development of a Large Diameter Sampler
Développement d'un échantillonneur de large diamètre
Cor Zwanenburg

Influence of the unsaturated soil property functions on numerical analyses of saturated and unsaturated waterflow in embankments
Influence des fonctions des propriétés du sol non saturées sur les analyses numérique du flux d'eau saturée et non saturée dans les digues
Norma Patricia López-Acosta, José Alfredo Mendoza Promotor

Geotechnical challenges in the design of the new Lueneburg lock next to the existing ship lift
Défis géotechniques à relever dans la conception de la nouvelle écluse de Lunebourg à proximité de l'actuel ascenseur à bateaux
Ulf Matthiesen, Martin Pohl, Roland Rother, Sascha Henke

Retaining structures and underpinning solutions for three excavations at Rosa Araújo Street, in Lisbon, Portugal
Solutions de Soutènement et de Reprise en Sous - Oeuvre pour trois excavations à la Rue Rosa Araújo, à Lisbonne,Portugal
Alexandre Pinto, Ana Pereira

FPM41 high rise building in central Lisbon: innovative solutions for a deep and complex excavation
FPM41 bâtiment à grand hauteur au centre Lisbonne: solutions innovantes pour une excavation profonde et complexe
Alexandre Pinto, Catarina Fartaria, Xavier Pita, Rui Tomásio

Soil parameters governing mechanical properties of coral gravel soils
Paramètres de sol gouvernant des propriétés mécaniques des sols de gravier corallien
Yoichi Watabe, Takashi Kanek, Shinji Sassa

Shear and Interface shear strengths of calcareous sand
Résistance au cisaillement et à l'interface du sable calciere
Pham Huu Ha Giang, Wim Haegeman, Peter van Impe, Willem van Impe, Patrick Menge

The effect of weathering process to determination of residual shear strength of clay shale with triaxial multi stage system
L'effet du processus de résistance aux intempéries sur la détermination de la résistance au cisaillement résiduel du schiste argileux avec un système triaxial à plusieurs étages
Idrus M. Atalas, Ramli Nazir, Masyhur IrsyamPintor T. Simatupang

Microscopic investigation of progressive changes of pore water distribution in shear band of unsaturated sand under trixial compression
Caractérisation microscopique de l'évolution de la distribution de l'eau dans l'espace poral des bandes de cisaillement d'un sable non saturé sous chargement triaxial
Ryunosuke Kido, Yosuke Higo, Simon Salager

Use of remote-sensing deformation monitoring for the assesment of levee section performance limit state

Utilisation de la télédétection pour l'évaluation de l'état limite de la performance de la section des digues

Victoria Bennet, Chung Nguyen, Tarek Abdoun, Amr Helal, Mohammed Gabr, Cathleen Jones, Davis Bekaert Joel Dudas

Piled raft foundation design: a method to consider interaction effects

Dimentionnement d'un radier sur pieux: une méthode pour considérer les effets d'interaction

Dang Dinh Chung Ngyuen, Victoria Bennet, Tarek Abdoun, Dong-Soo Kim, Seong-Bae Jo

Minutes: Seoul meeting ISSMGE TC201: Geotechnical aspects of dikes and levees
Venue: 19th ISSMGE conference Seoul, Korea
Date: September 21st 2017

Attendants:
Patricia Lopez Acosta, National University of Mexico, Mexico
Martin Pohl, Bundesanstalt für Wasserbau, Germany
Meindert Van, Deltares, The Netherlands
Cor Zwanenburg, Deltares, The Netherlands

1) Opening (15:15u)
The chairman Cor Zwanenburg opens the meeting and welcomes the attendants.

2) Minutes last meeting
- accepted -

3) Information on the discussion session during the ICSMGE 2017 on Sep 21st Session 5
For the first time the TC201 had a session during the ICSMGE. Previous requests were unsuccessful.
40-50 participants joined the TC201-session with extensive discussions.
8 papers were selected for presentation, 14 papers were related to the TC201 topics.

For having a session at the next conference will be tried again. The members are encouraged to contribute by presentations.

4) Report on findings ISSMGE survey on SoP – SoA in respect to TC201
The aim of the survey is to bring academics and industry together. Therefore each TC could formulate three questions for the survey. The findings of the survey are attached to the minutes.

5) Future development
TC201 will chair a session during the ECSMGE Reykjavik Sept 2019. Therefore it is important to have sufficient papers in the field of dikes and levees submitted for the conference. All TC201 members are encouraged to submit abstracts. Please note that the deadline for abstract submission is April 15th 2018.

A TC-workshop will be prepared for the XVI Panamerican Conference Cancun, Mexico, Nov 2019. It shall last half a day to a full day during the period 17-11-2019. Exact day and time will be announced later. Further details are as follows:

TC201 Workshop: "From fundamentals to applications and guidelines"
Workshop Coordinator: Norma Patricia LÓPEZ-ACOSTA
Chair TC201: Cor Zwanenburg
Secretary TC201: Martin Pohl

	Technical topic
1.	The International Levee Handbook
2.	Codes and standards
3.	Case-Histories
4.	Evaluation of instability
5.	Experimental tests

A data base with case histories exists in ICOLD: https://www.tudelft.nl/citg/over-faculteit/afdelingen/hydraulic-engineering/sections/hydraulic-structures-and-flood-risk/research/safelevee/
2 phds are currently filling the data base with data from reports.

6) ISSMGE: TOC report

The ISSMGE TOC report, prepared for the Seoul conference 2017, indicated that the number of TC201 activities have been low. TC201 has the ambition to be an active TC and thus the intention to change the image of the TC for the next TOC report which will be reported over 4 year.

It was discussed how to achieve the improvement. The minutes, point 5, already discuss two TC201 related events in 2019. Also, the TC website will be improved at the start of 2018. Furthermore, TC201 will be actively seeking cooperation with others TC's and ICOLD working groups.

It is discussed if TC201 wants to start an honour lecture. Cor Zwanenburg will find out what requirements are for starting an honour lecture.

7) Any other business
The question was raised about TOC members and corresponding members. It is explained that there is no longer a difference between TOC members and other members. Corresponding members are members only take part in the mailing to be informed.

8) Closing(16:30u)
Cor Zwanenburg closes the meeting.