ISSMGE TC201

Geotechnical Aspects of Dykes and Levees and Shore Protection

Newsletter July 2020

Dear TC201 members,

This is the eighteenth newsletter of the ISSMGE Technical Committee 201: Geotechnical Aspects of Dykes and Levees and Shore Protection. The intention of the newsletter is to keep all members informed on coming activities of our TC201 and the ISSMGE.

Cor Zwanenburg (Chairman TC201)
Norma Patricia López-Acosta (Secretary TC201)

1. TC201 Workshop during the 17th ECSMGE-2019 (Reykjavik, Iceland)

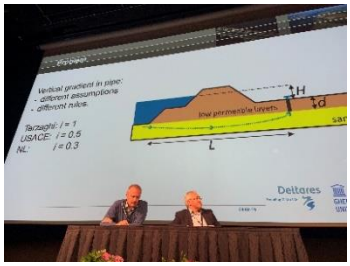
TC201 was given the opportunity to organize a workshop in advance of the Reykjavik conference. The workshop was held on Sunday September 1st, 2019, 13:00-16:00 h, location Harpa building. We had the following program:

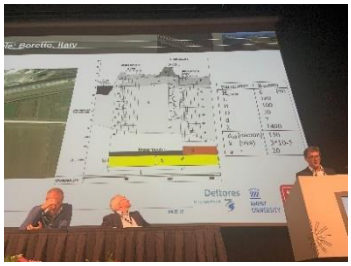
13:00-13:05	Introduction and welcome	Cor Zwanenburg
13:05-13:45	Large scale experiments with a coarse sand barrier as part of a multi-scale investigation of a novel remediation technique against backward erosion piping.	Ulrich Föster
13:45-14:30	I. Levees breaching scenarios and the different deterioration/damage mechanisms; link with failure modes analysis and risk analysis. II. Levee and dike survey using drones: the DIDRO project.	Rémy Tourment
14:30-15:15	The impact of the Eemdijk full-scale field test programme	Joost Breedeveld
15:15-16:00	Internal erosion of earth flood embankments	Jonathan Black

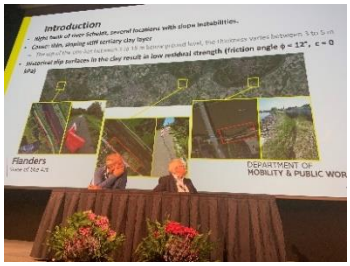
2. TC201 Session in the 17th ECSMGE-2019 (Reykjavik, Iceland)

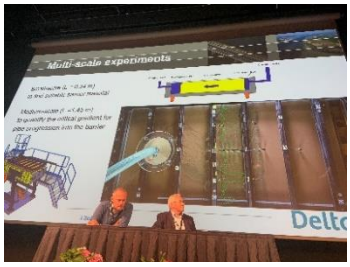
During the 17th European Conference on Soil Mechanics and Geotechnical Engineering, ECSMGE, Reykjavik, TC201 organized a session on dikes and levees. The organizing committee received about 37 papers that by the authors themselves were indicated to fall in the TC201 interest. We were very pleased with this number of papers. The Technical Discussion Session took place on Wednesday 4th September 2019, from 16:10 to 18:00 h, with the following program:

Last Name	Name	Country	Paper ID	Paper title
Van	Meindert	Netherlands	207	Overviewing geotechnical issues associated with levees and dams in Europe and USA.
Vincke	Leen	Belgium	261	Data management of dikes and levees in Flanders.
Bezuijen	Adam	Belgium	154	Head loss in vertical pipes of sand boils.
Cola	Simonetta	Italy	632	The application of the Boolean Stochastic Generation Method to model seepage under levees in heterogenous soils.
Breedeveld	Joost	Netherlands	399	The impact of the Eemdijk full-scale field test programme.
López-Acosta	Norma-Patricia	Mexico	622	Obtaining fragility curves on levees subjected to flooding.
De Vos	Leen	Belgium	316	Application of soilmix (CSM) in stiff clay for dike stabilization.
Förster	Ulrich	Netherlands	545	A coarse sand barrier as an alternative preventive measure against backward erosion piping.
Lengkeek	Henri John	Netherlands	456	Eemdijk full-scale field test program: sheet pile pull-over tests.
Ruggeri	Paolo	Italy	825	Failure of a massive geosynthetic-reinforced clay dyke for a waste disposal plant: investigation of the causes.









3. Committee meeting 2019 (Reykjavik, Iceland)

The last committee meeting was held on Monday 2 September 2019 (starting at 18:15 h, first floor Harpa building) during the 17th European conference on Soil Mechanics and Geotechnical Engineering (ECSMGE-2019) in Reykjavik, Iceland.

In this meeting, it was decided that there would be a change in secretary. Martin Pohl indicated that he wanted to stop his TC activities and Norma Patricia López-Acosta was willing to take over. The official change was in February 2020.

Back left: **Cor Zwanenburg** (Chairman TC201), Right: **Martin Pohl** (Past Secretary TC201)
Front left: **Norma Patricia López-Acosta** (Secretary TC201), Right: **Meindert Van** (Past Chairman TC201)

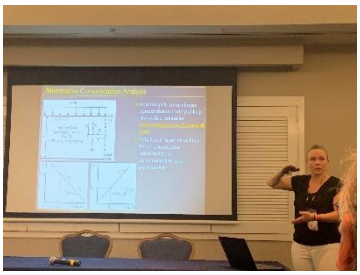
4. TC201 Workshop during the XVI PCSMGE-2019 (Cancun, Mexico)

TC201 organized a workshop during the XVI Panamerican conference on Soil Mechanics and Geotechnical Engineering in Cancun, Mexico. The workshop took place on Wednesday November 20th, 2019 in room Coral, from 10:15 to 16:15 h, with the following program:

10:15-11:20	Short introduction to the TC 201 Workshop	Cor Zwanenburg
10:20-10:45	Small dams: some case histories.	Ivan Vanícek
10:45-11:10	The International Levee Handbook.	Cor Zwanenburg (in Maureen Corcoran's absence)
11:10-11:35	Experimental testing on levees.	Anne Lemnitzer
11:35-11:45	Questions	
	Coffee Break and Lunch	
14:45-15:10	Geomembrane sealing systems for the construction of new embankment dams.	Pascual Perazzo
15:10-15:35	Lessons learned from full-scale tests.	Cor Zwanenburg
15:35-16:00	Risk assessment on levees subjected to flooding through fragility curves.	Norma Patricia López Acosta
16:00-16:15	Questions	


Cor Zwanenburg (Introduction)


Cor Zwanenburg (The International Levee Handbook)


Anne Lemnitzer


Cor Zwanenburg, Patricia López-Acosta and Anne Lemnitzer


Pascual Perazzo


Ivan Vanícek

5. New TC201 members

The Hungarian Geotechnical Society has nominated three members to TC201 (since January 17, 2020):

Corresponding member:
László Nagy lacinagy@mail.bme.hu

Nominated members:
Edina Koch koche@sze.hu
Emoke Imre imreemok@hotmail.com

Similarly, the Chinese member Society has nominated the following two members (since May 27, 2020):

Nominated members:
Xu Li Jianhong Zhang
Jian Ji Jianhong Zhang

We warmly welcome all these new TC201 members.

6. TC201 events during 2020

(a) Initiative on joined document on failure paths for water retaining structures

A concept outline of the report is in preparation. After the summer, this concept will be shared with the entire TC201, along with a brief questionnaire to ask for input on the different components of the report. Please contact *Rémy Tourment* (remy.tourment@irstea.fr) or *Esther Rosenbrand* (Esther.Rosenbrand@deltares.nl) if you want to contribute. Based on the input from the TC, the inventories will be completed and the report will be presented at the 20th ICSMGE in Sydney 2021.

The purpose of design, assessment and maintenance of levees and embankments is to avoid a breach and flooding. Flooding happens when a sequence of events occurs that cause damage, deterioration and/or failure of one or more components of the levee and ends by a breach in the levee. Such a sequence of events is called a failure path. Failure paths are the result of an analysis in order to identify the possible mechanisms by which a levee may fail and to identify which characteristics of the levee and its environment influence the occurrence of these. Failure paths can be constructed based on event tree analysis or fault tree analysis or forensic analysis of actual failures. Assessment of the probability of occurrence of each event in the failure path can be used to assess the probability of failure of the levee as a whole. Besides assessment, failure path analysis can also be used for design, and also to devise an effective a maintenance protocol and emergency response measures.

ISSMGE TC201[1] is working on a report on the use of failure paths, failure trees, event trees, fault trees and bowtie trees for levees around the world. This report inventories examples of failure paths and application of failure analysis for levees and embankments. Failure paths that are constructed based on case histories are one important component of the report. An inventory of case histories is made in order to identify critical failure mechanisms or combinations of mechanisms that commonly lead to failure.

For embankment assessment and design, it is common to consider failure mechanisms such as external erosion, internal erosion and sliding collapse, and failure paths have been derived based on theory for such mechanisms. An example is the failure path for the internal erosion mechanism of backward erosion piping, which is shown below. Failure paths derived based on theory can differ in the level of detail of the steps that are included, these differences often reflect differences in the level of knowledge that is available regarding the failure path. Therefore, an inventory is also made of the use of such 'theoretical' failure paths derived for such specific 'failure modes'. An inventory of these paths therefore aids in identifying best practice, as well as knowledge gaps.

[1] https://www.issmge.org/committees/technical-committees/applications/dykes-and-levees-

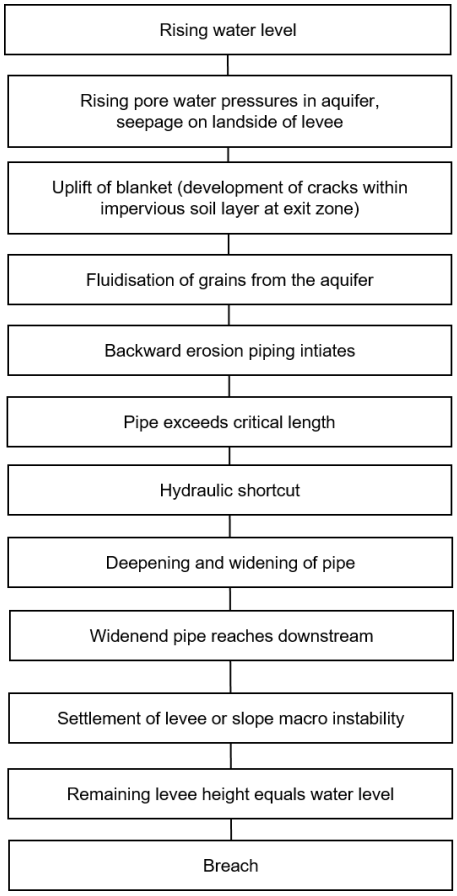


Figure 1. Example of a theoretical failure path for the internal erosion mechanism of backward erosion piping.

A limitation in many failure paths oriented in detail at specific mechanisms is that the relation to other events or mechanisms that may occur simultaneously and affect these is often missed. Therefore, failure trees, which are a collection of failure paths which also show relations between mechanisms, form an important part of the report.

(b) Conferences FLOODrisk2020 and ISC6

TC201 has planned a nice agreement between the four TCs of ICOLD and ISSMGE on both embankment dams and levees (ISSMGE TC201 and TC210, ICOLD TC-E and TC-LE) to organize a common workshop in Budapest, as a side event to the two conferences FLOODrisk2020 and ISC6. The tentative title is "*Geophysical and geotechnical investigations for flood mitigation dams and levees*". Originally, the FLOODrisk2020 was scheduled for September 2020, however the organizing committee has monitored the COVID-19 pandemic, for some time, and it has been decided to postpone FLOODrisk2020 until 21st-25th June 2021.

(c) TC201 Course as part of the ISSMGE Virtual University

Recently, the ISSMGE has announced the launch of its Virtual University (VU) Platform, a new part of ISSMGE's cyber-infrastructure (see http://virtualuniversity.issmge.org/). The objective of the Virtual University is to provide open-source, high quality technical and educational content that can be used by engineers of practice and graduate students initially all around the world and it will be extended to undergraduate students at a later stage. The Virtual University includes, free courses, webinars, as well as short educational videos. Each course consists of several webinars or lectures (4 to 5 per course, with total approximate duration of 5 hours).

TC201 has taken the initiative to set-up a course on dike technology (water retaining structures). A course should contain at least from four to five webinars. Each webinar should have a duration of approximately 45 minutes. The idea is to have one general webinar on dikes and levees including nomenclature, safety standards, general overview of failure mechanisms, design guidelines, etc. The other webinars should discuss the state-of-the-art knowledge on the individual failure mechanisms.

The webinars will be produced during the summer of 2020. The course (the complete set of webinars) is intended to be launched at the end of 2020. TC201 members who are interested to join the development of the webinars are encouraged to contact Cor.Zwanenburg@deltares.nl

7. Next TC201 Newsletter

The next newsletter will be sent in December. Please provide all available information, like TC related publications, academic papers, news, research, among others, to the Secretary TC201 *Norma Patricia López-Acosta*, nlopeza@iingen.unam.mx