ISSMGE TC211 Ground Improvement

Report on the recent and upcoming TC211 activities

April 2018

Noël Huybrechts
BBRI & KU Leuven
Chairman

Jérôme Racinais
Menard group
Vice-chairman

Nicolas Denies
BBRI
Secretary

Update on the ISSMGE TC211 activities – April 2018

Period 2013 - 2017 with principal theme: "Design, Quality Control and Quality Assurance for GI works"

1. TC211 Workshop in Edinburgh (September 15th 2015) – Progress in QC/QA for GI works

XVI ECSMGE 2015
13-17 September 2015 - Edinburgh

Antonio Viana Da Fonseca (Portugal)
Design, Quality Control and Quality Assurance

Richard Jewell (UK) and **Nicolai Volkov** (Russia)
In-situ test and ground improvement in permafrost

Henk Van De Graaf (Netherlands)
Quality control of ground improvement by *in-situ* and laboratory testing

Jerome Racinais (France)
Calibration of rigid inclusion parameters based on pressuremeter test results

Jimmy Wehr (Germany)

Real-time quality monitoring and result verification by static and dynamic trial loading of piles in marine clay

Wim Maekelberg (Belgium)
GI techniques applied for the new railway construction works in Mechelen, Belgium

TC 211 WORKSHOP – Progress in QC/QA for GI works

Presentations available on the TC website

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e-Book available via the TC website

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Presentations available on the TC website

1. Development of Deep Soil Mixing Technique for Earth Retention in Malaysia by Raju V.R. et al.
2. Artificial Ground Freezing to Remediate the Construction of a Shaft of a Water Supply System in Bueno Aires, Argentina by Lancellotta G. et al.
3. Lightweight Fill to Reduce Settlement on Bridge Approach Embankments Treated with Vibro Stones Columns by Chwee A.Y.L. and E.G. Balakrishnan
4. Design and Construction of Ground Improvements to Mitigate Liquefaction, a Case History from MacKays to Peka Peka Expressway, New Zealand by Robins, P and T. Pervan
5. Pilot tests on methods to form working platform on very soft clay by Guo W.
6. Ground Improvement for Tanks by Hamidi B. and S. Varaksin
7. Recent Advancements in the Application of Vaccuum Pressure for Consolidating Soft Soil by Zhong R., Indraratna B. and C. Rujikiatkamjorn
8. Twenty years of CMC successful application by Racinais J., Thomas B. and R. Ong

To purchase the proceedings of the 19th Southeast Asian Geotechnical Conference, kindly email to andrita@iemasb.com or serena@iem.org.my

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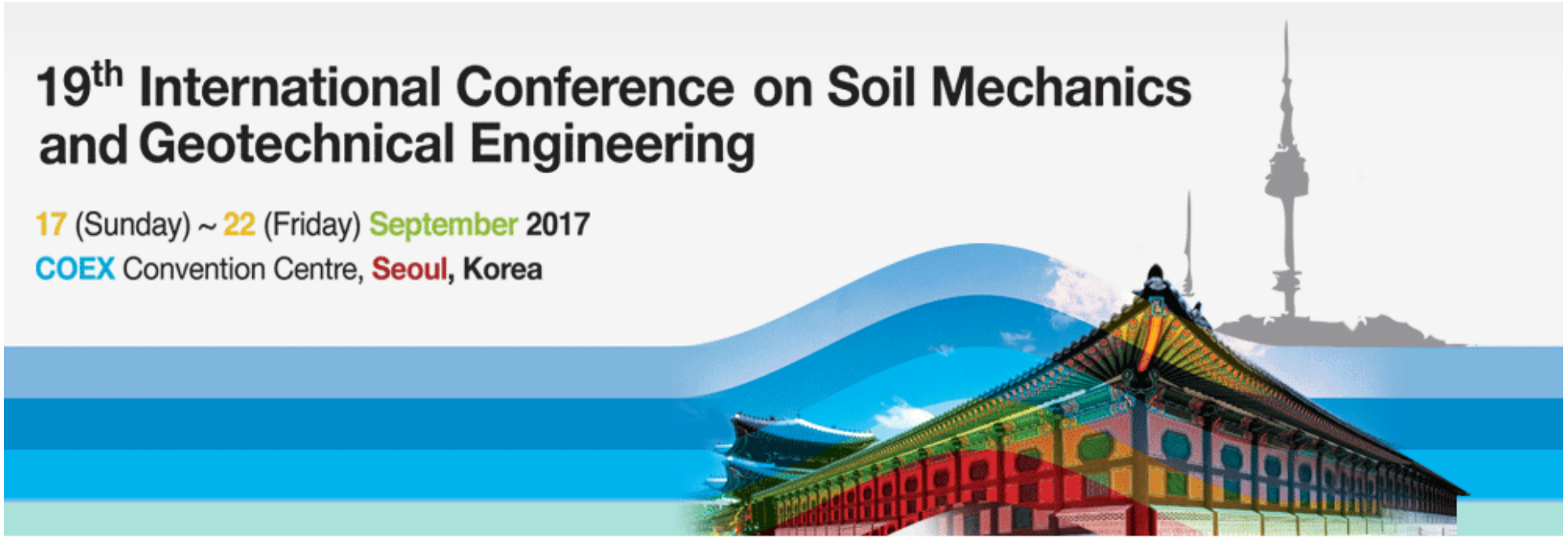
4. **TC211 ACTIVITIES IN SEOUL 2017**



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Period 2013 - 2017 with principal theme: "Design, Quality Control and Quality Assurance for GI works"

4. TC211 ACTIVITIES IN SEOUL 2017

Organization of the 4 Discussion Sessions dedicated to GI works on September 20 and 21:

Session 1 dedicated to the GI works without admixtures and inclusions,

Sessions 2 and 3 dedicated to the GI works with admixtures and inclusions,

Session 4 dedicated to GI works with grouting type admixtures.

according to the GI categories of the SoA Report of our TC.

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Pe … r GI works”

ICSMGE Alexandria 2009

17TH International Conference on Soil Mechanics & Geotechnical Engineering

State of the Art Report

Construction Processes
Procédés de Construction

Jian Chu
Nanyang Technological University, Singapore
Serge Varaksin
Menard, France
Ulrich Klotz
Zublin International GmbH, Germany
Patrick Mengé
Dredging International n.v., DEME, Belgium

NOTA : TC 17 meeting ground improvement – 07/10/2009
Website : www.bbri.be/go/tc17

Table 1. Classification of ground improvement methods adopted by TC17

Category	Method	Principle
A. Ground improvement without admixtures in non-cohesive soils or fill materials	A1. Dynamic compaction	Densification of granular soil by dropping a heavy weight from air onto ground.
	A2. Vibrocompaction	Densification of granular soil using a vibratory probe inserted into ground.
	A3. Explosive compaction	Shock waves and vibrations are generated by blasting to cause granular soil ground to settle through liquefaction or compaction.
	A4. Electric pulse compaction	Densification of granular soil using the shock waves and energy generated by electric pulse under ultra-high voltage.
	A5. Surface compaction (including rapid impact compaction).	Compaction of fill or ground at the surface or shallow depth using a variety of compaction machines.
B. Ground improvement without admixtures in cohesive soils (also see Table 4)	B1. Replacement/displacement (including load reduction using light weight materials)	Remove bad soil by excavation or displacement and replace it by good soil or rocks. Some light weight materials may be used as backfill to reduce the load or earth pressure.
	B2. Preloading using fill (including the use of vertical drains)	Fill is applied and removed to pre-consolidate compressible soil so that its compressibility will be much reduced when future loads are applied.
	B3. Preloading using vacuum (including combined fill and vacuum)	Vacuum pressure of up to 90 kPa is used to pre-consolidate compressible soil so that its compressibility will be much reduced when future loads are applied.
	B4. Dynamic consolidation with enhanced drainage (including the use of vacuum)	Similar to dynamic compaction except vertical or horizontal drains (or together with vacuum) are used to dissipate pore pressures generated in soil during compaction.
	B5. Electro-osmosis or electro-kinetic consolidation	DC current causes water in soil or solutions to flow from anodes to cathodes which are installed in soil.
	B6. Thermal stabilisation using heating or freezing	Change the physical or mechanical properties of soil permanently or temporarily by heating or freezing the soil.
	B7. Hydro-blasting compaction	Collapsible soil (loess) is compacted by a combined wetting and deep explosion action along a borehole.
	C1. Vibro-replacement or stone columns	Holes jetted into soft fine-grained soil and backfilled with densely compacted gravel or sand to form columns.
C. Ground improvement with admixtures or inclusions	C2. Dynamic replacement	Aggregates are driven into soil by high energy dynamic impact to form columns. The backfill can be either sand, gravel, stones or demolition debris.
	C3. Sand compaction piles	Sand is fed into ground through a casing pipe and compacted by either vibration, dynamic impact, or static excitation to form columns.
	C4. Geotextile confined columns	Sand is fed into a closed bottom geotextile lined cylindrical hole to form a column.
	C5. Rigid inclusions (or composite foundation, also see Table 5)	Use of piles, rigid or semi-rigid bodies or columns which are either premade or formed in-situ to strengthen soft ground.
	C6. Geosynthetic reinforced column or pile supported embankment	Use of piles, rigid or semi-rigid columns/inclusions and geosynthetic girds to enhance the stability and reduce the settlement of embankments.
	C7. Microbial methods	Use of microbial materials to modify soil to increase its strength or reduce its permeability.
	C8 Other methods	Unconventional methods, such as formation of sand piles using blasting and the use of bamboo, timber and other natural products.
D. Ground improvement with grouting type admixtures	D1. Particulate grouting	Grout granular soil or cavities or fissures in soil or rock by injecting cement or other particulate grouts to either increase the strength or reduce the permeability of soil or ground.
	D2. Chemical grouting	Solutions of two or more chemicals react in soil pores to form a gel or a solid precipitate to either increase the strength or reduce the permeability of soil or ground.
	D3. Mixing methods (including premixing or deep mixing)	Treat the weak soil by mixing it with cement, lime, or other binders in-situ using a mixing machine or before placement
	D4. Jet grouting	High speed jets at depth erode the soil and inject grout to form columns or panels
	D5. Compaction grouting	Very stiff, mortar-like grout is injected into discrete soil zones and remains in a homogenous mass so as to densify loose soil or lift settled ground.
	D6. Compensation grouting	Medium to high viscosity particulate suspensions is injected into the ground between a subsurface excavation and a structure in order to negate or reduce settlement of the structure due to ongoing excavation.
E. Earth reinforcement	E1. Geosynthetics or mechanically stabilised earth (MSE)	Use of the tensile strength of various steel or geosynthetic materials to enhance the shear strength of soil and stability of roads, foundations, embankments, slopes, or retaining walls.
	E2. Ground anchors or soil nails	Use of the tensile strength of embedded nails or anchors to enhance the stability of slopes or retaining walls.
	E3. Biological methods using vegetation	Use of the roots of vegetation for stability of slopes.

Classification of the GI methods

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Session 1 dedicated to the GI works without admixtures and inclusions,

Sessions 2 and 3 dedicated to the GI works with admixtures and inclusions,

Session 4 dedicated to GI works with grouting type admixtures.

according to the GI categories of the SoA Report of our TC.

+ GENERAL REPORT of the papers by Noël Huybrechts, Nicolas Denies, Jeroen Dijkstra, Cholachat Rujikiatkamjorn, Jérôme Racinais & Almer van der Stoel

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+ Organization of a common TC211-TC218 Workshop on Sept. 20 on the topic of "MSE Walls and Reinforced Soil Slopes"

Update on the ISSMGE TC211 activities – April 2018

SESSION 1 – 9:00 to 10:30 (duration = 90 minutes)

Provisional title of the presentation or topic	NAME OF THE SPEAKER	COMPANY	COUNTRY	Duration (minutes)
Introduction to the TC211 activities	Noël Huybrechts – chairman TC211	Belgian Building Research Institute	Belgium	10 minutes
Introduction to the TC218 activities Presentation of the new TC218	John Sankey – chairman TC218	Terre Armée	USA	10 minutes
PRESENTATION 1 *Overview of MSE Wall & Anchor Solutions*	John Sankey	Terre Armée	USA	20 minutes
PRESENTATION 2 *Mining Applications of MSE Walls*	Gary Power	The Reinforced Earth Company	Australia	20 minutes
PRESENTATION 3 *Use of Polymeric Geogrids in Structures with Non-Standard Reinforced Fills*	Chaido Doulala-Rigby (Yuli)	Tensar International Ltd	UK	20 minutes
DISCUSSION/QUESTIONS				10 minutes

Update on the ISSMGE TC211 activities – April 2018

SESSION 2 – 11:00 to 12:30 (duration = 90 minutes)

PRESENTATION 4 *Hybrid reinforced soil structures with primary and secondary reinforcement for high walls and slopes*	Pietro Rimoldi	Maccaferri	Italy	20 minutes
PRESENTATION 5 *Seismic Considerations for Reinforced Soil Slopes and MSE Walls*	Yoshihisa Miyata	National Defense Academy	Japan	20 minutes
PRESENTATION 6 *Special Solutions with Geosynthetic MSE Walls*	Oliver Detert	Huesker	Germany	20 minutes
PRESENTATION 7 *Earth Pressure Distribution in the Facing Area of Geogrid Reinforced Earth Structures – Field Measurements and Design Practice*	Kent P. von Maubeuge	NAUE GmbH & Co. KG	Germany	20 minutes
DISCUSSION/QUESTIONS				10 minutes

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+ Organization of a common TC211-TC218 Workshop on Sept. 20 on the topic of

"MSE Walls and Reinforced Soil Slopes"

+ Organization of the 4th Louis Ménard Lecture on the topic of

"Advancing the State-of-the-Art in Soft Soil Stabilisation

- From Conceptual Fundamentals to Field Applications"

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Previous Louis Ménard Lectures

Jean-Louis Briaud (18th ICSMGE, Paris 2013)

Patrick Mengé (IS-GI Brussels, 2012)

Clyde N. Baker (ISP-5, Paris 2005)

4th Louis Ménard Lecture on the topic of

"Advancing the State-of-the-Art in Soft Soil Stabilisation

- From Conceptual Fundamentals to Field Applications"

by Prof. Buddhima Indraratna (University of Wollongong)

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+ strong collaborations with

- The DEEP FOUNDATIONS INSTITUTE – DFI

For this conference, TC211 members were actively participating with presentations of Abir Al-Tabbaa, Antonio Alberto Correia, Nicolas Denies, Stefan Larsson, Mitsuo Nozu, Michał Topolnicki…

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- The ETC 3 (European Technical Committee 3 – Piles)

SIMSG ISSMGE
ETC3 - Piles

GBMS BGGG
Belgian Member Society of ISSMGE

Design of Piles in Europe
How did Eurocode 7 change daily practice?

International Symposium
28 and 29 April 2016, Leuven, Belgium

co-organized by our Chairman, Noël Huybrechts and focusing on the design of pile foundations in Europe

Special keynote lecture written by our TC 211 members: S. Varaksin, B. Hamidi, N. Huybrechts and N. Denies: "Ground improvement vs. pile foundations?" highlighting the fundamental differences between the design of pile foundations and the design of rigid inclusions including (or not) a load transfer platform

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- the TC102 In situ testing (cf. Workshop Edinburgh with the keynote of Antonio Viana da Fonseca, the Chairman of the TC102)

- the new TC 218 – Reinforced fills (cf. common Workshop TC211-TC218 organized in Seoul 2017)

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+ participations to dedicated publications

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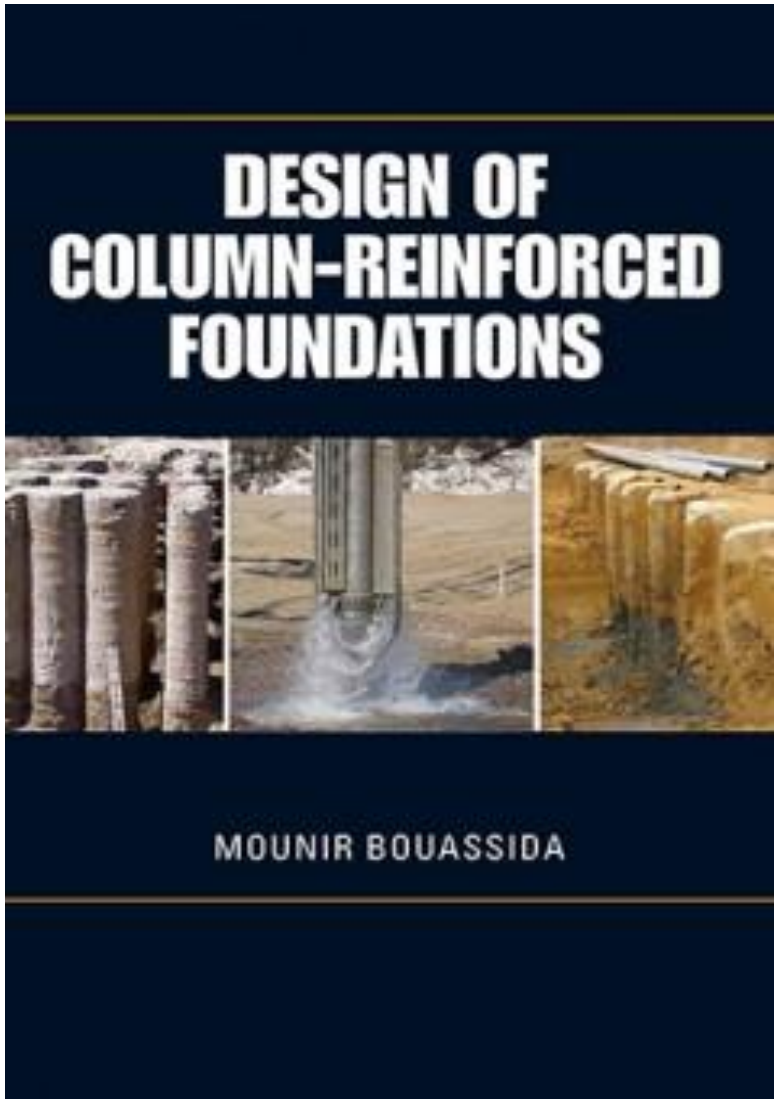
Dutch handbook Soil mix walls
– Design and Execution
- soon available in English !!!
- Last review in progress
- Taylor and Francis publisher



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Period 2017 - 2021 introducing a new principal theme:

"Innovations in design, execution and QA/QC of Ground Improvement works"

<u>new BOARD of the TC211:</u>

Chair: Noël Huybrechts (Belgium Building Research Institute – BBRI and KU Leuven – Belgium)
Vice Chair: Jérôme Racinais (Menard group, France)

Secretary: Nicolas Denies (Belgium Building Research Institute - BBRI – Belgium)

Members nominated by the Chair:

1. **B. Hamidi (Menard, Australia)**
2. **Michał Topolnicki (Keller group, Poland)**
3. **S. Varaksin (Apageo, France)**
4. **To be confirmed**

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Period 2017 - 2021:

“Innovations”

new Terms of reference of the TC211:

1. Launch of a **new TC211 website** – more information will be sent to the TC members in the near future
2. Abandoning the Newsletters for a **more dynamic way of communication** (short and more regular)
3. Participate by **dedicated workshops** in the international conferences **inviting TC members to contribute** to the knowledge and develop the addressed themes
4. **Promote the activities and the links with other organizations or TC’s (in particular the Deep Foundations Institute – DFI, the EFFC, the TC 102 – In situ testing and the new TC218 – Reinforced fills)**
5. Introduce a **new principal theme** for the period:

   “Innovations in design, execution and QA/QC of Ground Improvement works”
6. **Organize two main TC211 WORKSHOPS at the ECSMGE Reykjavik 2019 and ICSMGE Sydney 2021** based on the new principal theme **“Innovations”**
7. **Organize the next Louis Ménard Lecture in Sydney 2021**
8. The board currently studies the opportunity to organize a **new International Symposium IS-GI Brussels**

Period 2017 - 2021:

COMING SOON - The TC211 will be in Rome:

DFI-EFFC International Conference on Deep Foundations and Ground Improvement: *Urbanization and Infrastructure Development-Future Challenges*

June 05, 2018 - June 08, 2018
Sapienza University
Rome, Italy

Period 2017 - 2021:

COMING SOON - The TC211 will be in Rome:

http://www.dfi.org/dfieventlp.asp?13310

https://www.regonline.com/builder/site/default.aspx?EventID=2088920

Session Keynote Lecturers

Maurice Bottiau
SESSION:
Deep Foundation Technologies

Alessandro Flora
SESSION:
Ground Modification Technologies

Noel Huybrechts
SESSION:
Ground Modification Technologies

Giuseppi Lunardi
SESSION:
Design and Modeling Criteria

Alessandro Mandolini
SESSION:
Design and Modeling Criteria

Massimo Mucci
SESSION:
Project Information Management System (PIMS)

Giovanni Vaciago
SESSION:
Contracts and Geotechnical Investigation

Giulia Viggiani
SESSION:
Deep Foundation Technologies