Proceedings of the 16th International Conference on Soil Mechanics and Geotechnical Engineering

doi:10.3233/978-1-61499-656-9-3467

Report of TC3 - Geotechnics of pavements

Rapport du TC3 - Géotechnique des chaussées

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ABSTRACT

The Technical Committee 3 (TC3), "Geotechnics of Pavements", of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) is charged with promoting and enhancing professional activities in geotechnical, pavement and rail track engineering in areas related with geotechnical aspects in design, construction, strengthening and monitoring. This report provides a brief summary of the TC3 activities during the period 2001 – 2005.

RÉSUMÉ

Le Comité Technique 3 (TC3), Géotechnique des Chaussées, de la Société Internationale de Mécanique des Sols et de la Géotechnique (SIMSG) est chargé d'encourager et d'échanger les activités professionnelles d'ingénierie dans les domaines des routes et des chemins de fer en rapport avec les aspects géotechniques du dimensionnement, de la construction, du renforcement et de l'observation de ces ouvrages. Ce rapport décrit sommairement les activités du TC3 pendant la période de 2001-2005.

1 TERMS OF REFERENCE OF TC3

The terms of reference of TC3 for the period 2001 – 2005 were agreed upon by the Core Members in June 2002.

The terms of reference intent to promote co-operation and exchange of information and knowledge about the geotechnical aspects in design, construction, strengthening and monitoring of pavements and rail tracks. For these purposes the following topics were selected.

1. Geotechnical aspects related to foundation layers of pavements and rail tracks (Guidelines to promote the use of mechanistic approach in design).
2. Earth structures in pavement and railway construction (Guidelines and promote the use of processed materials and continuous compaction control).
3. Strengthening and reinforcement of pavements and rail tracks (Inventory and Guidelines to design).
4. Subsurface sensing for transportation infrastructure condition diagnostics (Synthesize the knowledge about current state of the art techniques).

It was also an objective to cooperate actively with other technical committees whose field of activity involves important questions related to pavements and rail tracks, for example, TC5, TC6, TC 8, TC 9 and TC17.

These goals intent to be disseminated through TC3-sponsored sessions on Geotechnics of pavements and rail tracks at ISSMGE international and regional conferences on soil mechanics and geotechnical engineering, and through special geotechnical, geoenvironmental and unsaturated soils conferences on pavements and rail tracks.

2 MEMBERS OF TC3

2.1 *Core Members*

The core members of TC3 during 2001 – 2005 are listed in Table 1.

Table 1 Core Members of TC3 during 2001-2005

Name	Country
A. GOMES CORREIA (Chair)	Portugal
Dietmar ADAM (Secretary)	Austria
Alain QUIBEL	France
Tuncer EDIL	USA
Hans RATHMAYER	Finland
Yoshitsugu MOMOYA	Japan

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2.2 *Members*

The regular members of TC3 during 2001 – 2005 are listed in Table 2.

Table 2 Regular Members of TC3 during 2001-2005

Name	Country
J.C. VERBRUGGE	Belgium
W. HAEGEMAN	Belgium
Liedi L. BERNUCCI	Brasil
Ahmed SHALABY	Canada
Marius ROY (2002-2004)	Canada
Pauli KOLISOJA	Finland
Andreas LOIZOS	Greece
Miklos KOVÁCS	Hungary
T. BOROMISSZA	Hungary
D.N. SINGH	India
Valerio MELE	Italy
Pierpaolo FANTINI	Italy
Nobuyuki YOSHIDA	Japan
B.B. TELTAEV	Kazakhstan
Eduardo FORTUNATO	Portugal
V. D. KAZARNOVSKY	Russia
Ana PETKOVSEK	Slovenia
Jose Luis GARCIA DE LA OLIVA	Spain
Hai Sui YU	United Kingdom

3 TC3 ACTIVITIES DURING 2001 – 2005

3.1 *Website*

The activities of TC3 in the period 2001 – 2005 are described on the TC3 web site: http://www.geoforum.org/tc3.

3.2 *Meetings*

Prior to the 16th ICSMGE in Osaka, 4 TC3 meetings held in this period:

- Technical University of Lisbon (IST/DEC), Lisbon, Portugal, 2 June 2002 (during the International Conference on "Bearing Capacity of Roads, Railways and Airfields" – BCRA'02).
- Laboratoire Central des Ponts et Chaussées, Paris, France, 13 December 2002.
- Technical University of Prague, Prague, 27 August 2003 (during the 13th European Conference on Soil Mechanics and Geotechnical Engineering).
- National Technical University of Athens, 16 December 2004 (with participation of the President of ISSMGE (2001-2005), Prof. W. Van Impe).

The final meeting of the TC3 held at Osaka, Japan, during the 16th ICSMGE in 14th September 2005.

3.3 *TC3 dissemination activities*

The achievement of TC3 in this period was the development of items 1, 2 and 3 of the terms of reference. Priority was decided in these fields in detriment of item 4. The most significant works were:

(1) Emphasis on the geotechnical aspects related to foundation layers of pavements and rail tracks promoting the use of mechanistic approach in design. This was done in the following events:

Workshop on pavement engineering from a geotechnical perspective, Quebec City, Canada, 24 October 2004. This was organised in connection with the 57th Canadian Geotechnical Conference "Geo-engineeering for society and its environment" of the "Société canadienne de géotechnique - Région Est du Québec", (published in CD-ROM by the CGS/SCG-AIH-CNC, Quebec, Canada, 2004). The CD-ROM contents are presented in Appendix1. For this workshop experts in pavement engineering were invited.

International seminar on geotechnics of pavements and railway design and construction, Athens, Greece, 16-17 December 2004 (published by Millpress in book and CD-ROM: Gomes Correia & Loizos, 2004). This was organized under the auspices of: ISSMGE, TC3 of ISSMGE, National Technical University of Athens and Hellenic Society for Soil Mechanics and Foundation Engineering. For this seminar experts in pavement and railway engineering were invited.

Workshop on Geotechnical aspects related to foundation layers of pavements and rail tracks, Osaka, Japan, 13th September 2005 (selected contributions in printing by Taylor & Francis (Balkema): Gomes Correia, Momoya & Tatsuoka, 2006). The table of contents of the workshop is presented in Appendix 2. In this workshop participated and contributed the chairmen of TC6 & TC8. These contributions were related with the environmental effects, mainly the effect of relative humidity on the deformation and strength of granular aggregates and frost and thaw of road and railway structures.

(2) Earth structures in pavement and railway construction. This covers the use of processed materials (non conventional materials on road construction), in-situ evaluation of material stiffness and continuous compaction control. Important work was done related with the promotion of the use of processed materials through an international inventory and with two forums of discussion materialized in two events:

Workshop on the use of processed materials in pavements and transportation earthworks, Prague, 24 August 2003 (selected contributions in Gomes Correia, Momoya & Tatsuoka, 2006). The contents of the workshop are presented in Appendix 3.

Seminar on promoting the use of waste materials in geotechnical works, Guimarães, Portugal, 15 March 2004 (Gomes Correia et al., 2004; papers in English, French and Portuguese). The seminar was organised by the Portuguese Geotechnical Society (SPG) with the cooperation of the University of Minho and the National Laboratory of Civil Engineering, with the participation of TC3 & TC5 of the ISSMGE. This seminar emphasis the Portuguese actions in promoting the re-use of waste materials. Selected papers are in Gomes Correia, Momoya & Tatsuoka (2006), in particular the contribution of the TC5 chairman dealing with the contamination problems related to the re-use of waste materials in geotechnical works.

Other important TC3 contributions in this item (2) concern innovative methods and technologies in earthworks, promoting intelligent compaction - deep and near surface in layers - (in Gomes Correia & Loizos, 2004) and continuous compaction control. In this last context an international pre-standard was prepared during TC3 activities and published in Gomes Correia, Momoya & Tatsuoka (2006).

(3) Strengthening and reinforcement of pavements. This incorporate foundation reinforcement (in Gomes Correia & Loizos, 2004), and share the development work for reinforcement of pavements and structures in the COST 348 REIPAS action (in Gomes Correia, Momoya & Tatsuoka, 2006). This COST action is taking a step towards practicable guidelines for the structural design and execution of reinforced pavements and road sub-bases and to reach a consensus on the methods to determine relevant material parameters essential for analysing or predicting the behaviour of the reinforced structures. Design approaches developed either for the utilization of geosynthetic reinforcement materials or for the utilisation of steel grids are referred.

3.4 *Liaison with other groups*

TC3 has established liaison with following groups:

- TC5, TC6 & TC8 of the ISSMGE.
- COST 348 REIPAS: Reinforcement of pavements with steel meshes and geosynthetics.

4 FUTURE ACTIVITIES AND RECOMMENDATIONS

The following activities are still on-going in TC3:

- *Participation on the XIII Danube-European Conference on Geotechnical Engineering - Active geotechnical design in infrastructure development, Ljubljana, Slovenia, 29-31 May 2006* (www.danube-conference2006.si).
- *First International Congress on Geotechnical Engineering for Transportation Infrastructures,University of Nottingham, UK, in early 2008*. The concept of this series of congresses was agreed in Athens meeting with the approval of Prof. Van Impe, which stresses the importance that this new and important conference should be organized and held under the umbrella of the ISSMGE. Moreover, the interplay of sister Societies, and TCs should be aimed, especially TC5, TC6, TC8, TC9, TC10, and TC17 should contribute. The place to be held the first Congress was decided by TC3 members in Osaka meeting.

- *Issue of a Journal on Geotechnics for Transport Infrastructures.* This was proposed in Athens meeting and approved by Prof. Van Impe, who points out that it should be a journal under the umbrella of the ISSMGE.

The Core Members and active Members of TC3 strongly recommend that TC3 committee continued in the period 2005 – 2009.

REFERENCES

Gomes Correia et al. (2004). *Seminar on Promoting the use of waste materials in geotechnical Works* (Gomes Correia et al. eds). Portuguese Geotechnical Society.

Gomes Correia & Loizos (2004). *Geotechnics in pavement and railway design and construction* (A. Gomes Correia & A. Loizos eds.). Millpress, Rotterdam (Book & CD-Rom).

Gomes Correia, Momoya & Tatsuoka (2006). *Geotechnics aspects and processed materials in design and construction of pavement and rail track* (A. Gomes Correia, Y. Momoya & F. Tatsuoka eds.). A.A. Balkema Publishers / Taylor and Francis, The Netherlands.

APPENDIX 1

Workshop on pavement engineering from a geotechnical perspective, Quebec City, Canada, 24 October 2004.

- Pavement design with an emphasis on constitutive material laws, by *A. Gomes Correia*;
- Pavement design with respect to permanent deformation, by *P. Hornych*;
- Stress rotations due to moving wheel loads and their effects on pavement materials characterization, by *E. Tutumluer*;
- Yield Loci of base course materials and their significance for test standards, by *J.-M. Konrad*;
- Pavement performance modelling and damage prediction, by *A. Molenaar;*
- Assessment of the hydraulic characteristics of unsaturated base-course materials: a practical method for pavement engineers, by *Jean Côté*;
- Hydro-mechanical pavement response in early spring thaw, by *J.-M. Konrad, M. Lebeau, D. Nguyen.*

APPENDIX 2

Workshop on geotechnical aspects related to foundation layers of pavements and rail tracks, Osaka, Japan, September 13, 2005.

(1) Pavement and rail track foundations

- Soil mechanics aspects in pavement and rail track foundations, by *A. Gomes Correia;*
- The effect of relative humidity on the deformation and strength of granular aggregates, by *E. Alons;*
- Frost design method for road and railway structures. State of the art in France, by *S. C. Mauduit,*
- Frost heave design of pavements, by *S. Saarelainen (TC8 chairman);*
- Long-term dynamic response of ballasted track under high speed railway load, by *A. Kaynia & D. Clouteau (presented by A. Moderassi);*
- Shakedown theory and its application to pavement analysis and design, by *H. S. Yu;*
- Influence of impact load on base course and subgrade by circulation, by *Y. Shioi, T. Sakai.*

(2) Continuous compaction control

- Roller-integrated continuous compaction control (CCC), by *D. Adam.*

(3) Reinforcement of pavement

- Reinforcement of pavements with steel meshes and geosynthetics, by *H. Rathmayer.*

(4) Influence of considering principal stress rotation in modeling and how it affects pavement and rail track performance.

- Effects of continuous principal stress axis rotation on the deformation characteristics of sand under traffic loads, by *Y. Momoya, K.Watanabe, E.Sekine, M.Tateyama, M. Shinoda, F. Tatsuoka;*
- Development and performance evaluation of multi-ring shear apparatus, by *T. Ishikawa, S. Miura, E. Sekine;*
- Development of rut depth prediction model considering deformation of asphalt layer and subgrade, by *T. Kanai, S. Higashi, K. Matsui, K. Himeno.*

APPENDIX 3

Workshop on the use of processed materials in pavements and transportation earthworks, Prague, 24 August 2003.

- An international inventory of the use of processed materials, by *A. Gomes Correia*;
- Present state of utilisation of processed material in pavement surface and base-course in Japan, by *Nobuyuki Yoshida;*
- Portuguese actions to promote the use of processed materials in geotechnical applications, by *E. Fortunato;*
- Engineering approach to environmental aspects, by *Alain Quibel;*
- Engineering approach to geotechnical aspects. Physical and mechanical properties, by *D. Adam*;
- Relationship of laboratory resilient modulus to back-calculated elastic moduli from large-scale experiments and FWD tests on granular materials model , by *Tuncer Edil;*
- Functional requirements and long-term performance, by *Alain Quibel*;
- Application of crushed concrete for mechanical stabilization to railway embankment, by *Yoshitsugu Momoya;*
- Measurements to improve "in situ" material performance, by *H. Rathmayer;*
- Assessment of leaching of heavy metals from fly ash stabilized roadway subgrade, by *Tuncer Edil;*
- Government policies, regulations and practices, by *Alain Quibel and Tuncer Edil.*