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Administrative Report: TC 38 – Soil-Structure Interaction

Compte rendu sur la CT-38

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ABSTRACT

The Administrative report presents main activities of TC38 "Soil-Structure Interaction" during the period of 2005-2009. The main task of TC38 is to produce Guidelines on Soil-Structure Interaction by 2013. An important step towards this goal is collection and analyses of well documented case histories submitted by TC38 members.

RÉSUMÉ

Le rapport administratif présente les activités principales de TC38 "Interaction sol-structure" pendant 2005-2009. L'objectif essentiel du TC 38 est composition des instructions générales de l'interaction sol-structure à 2013. La partie importante de ce processus est recherche et analyse des antécédents documentés soumis par les membres du comité.

1 COMPOSITION OF TC38

Chair:

Professor Vladimir Ulitsky (Russia)

Secretary:

Dr. Michael Lisyuk (Russia)

Host Member Society:

Russian Society for Soil Mechanics, Geotechnical and Foundation Engineering (RSSMGFE)

Core Members:

Prof. W. Van Impe (Belgium)

Dr Werner Bilfinger (Brazil)

Dr John Christian (USA)

Max Ervin (Australia)

Prof. K. Ishihara (Japan)

Prof. R. Katzenbach (Germany)

Prof. Tim Newson (Canada)

Dr. C. Shashkin (Russia)

Members:

Eng. Altin Bidaj (Albania)

Prof. Maotian Luan (China)

Dr Huanbei Liu (China)

Mr Nikifor Petrovic (Croatia)

I.K. Cisse (CTGA)

Dr Jan Zalesky (Czech & Slovak)

Kari Avellan (Finland)

Dr J. Lorincz (Hungary)

Dr V. Balakumar (India)

Prof. M. Jamiolkowsky (Italy)

Dr Assadollah Noorzad (Iran)

Dr E. Utenov (Kazakhstan)

G. Sultanov (Kazakhstan)

Prof. M. Topolnicki (Poland)

Nuno Guerra (Portugal)

Manuel António de Matos Fernandes (Portugal)

Prof. Nicoleta Radulescu (Romania)

Prof. Zaven Ter-Martirosyan (Russia)

Dr Mark Webb (South Africa)

Dr Eduard Vorster (South Africa)

Dr Mehmet Berilgen (Turkey)

Dr. Yasser El-Mossallamy (Egypt)

Dr. Rufat Bulut (USA)

C. Gilbert (France)

2 TERMS OF REFERENCE

1. To promote co-operation and expertise exchange within the area of soil-structure interaction amongst the leading research and design institutes and universities world-wide as well as amongst the largest contractors with the objective to enhance overall engineering and research expertise within this area.

2. To identify examples of well-documented case histories involving soil-structure interaction.

3. To analyse the case histories using various soil-structure interaction models and to compare the results with the real observations.

4. To serve as an organizational support in promoting and advancement of new calculation methods in soil-structure interaction, as well as in development of related interactive monitoring and application of the observational method with possibility of adjusting design decisions during the construction process.

5. To organize workshops and conferences on soil-structure interaction, and further inclusion of related sections into international (regional) scientific geotechnical conferences. To report on the results of its activities at these conferences.

6. To prepare a guide giving recommendations for practitioners' approach to soil-structure interaction problems.

3 ACTIVITIES INITIATED

Scientific programme for the second term of TC38 work was developed. This programme will be sent to all core members and members of TC38 for discussion. After discussion and im-

improvements/corrections the programme will be presented at the meeting of TC38 members in Alexandria, Egypt, on 4 October 2009, before the XVII ICSMGE.

Submission and analysis of case histories involving soil-structure interaction

The following case histories have been submitted and analyzed by TC38 members:

1. M. Ervin. Remedial piling and settlement. Twin residential towers.

This case history deals with a challenge during the redevelopment of a major inner city riverbank, including the construction of several residential towers and a number of other structures. Two of the towers experienced problems during installation of their piled foundations that may have led to increased settlements if left unremediated. This work describes the foundation problems that arose and the methods used to assess the potential settlement of the towers. On the basis of these estimates additional piling works were required for one of the towers. Settlement monitoring was carried out during construction.

2. V. Ulitsky, C. Shashkin, M. Lisyuk. Development of settlements of buildings founded on soft soils in Saint Petersburg.

The presented work includes 14 case histories of settlements development in time for residential buildings. In the first part of this case the specifics of soil behavior of soft clays in St. Petersburg are presented. Methods of soft soils properties determination are described. In the second parts the observational data on the settlement development in time for 14 buildings as well as the building parameters and loads are given. The number of floors for the considered buildings is from 4 to 17, the period of settlement measurement is from 1 to 37 years.

3. W. Van Impe. Case history on the embankments on soft soil in underwater conditions.

This work is a part of a book "On the design, construction and monitoring of embankments on soft soil in underwater conditions" (authors W. Van Impe, R.D. Verastegui Flores), which was published in St. Petersburg in 2007 in Russian language.

4. Yasser El-Mossallamy. Performance of deep excavation in overconsolidated clay: Case History – Japan Center, Frankfurt, Germany.

This case history deals with a deep excavation pit of about 16 m was required to build the basements and underground car parks of the Japan building. The foundation of both the main tower and the side basements could be constructed without settlement joints applying a piled raft foundation. The author presents a finite element analysis to model the behavior of the pit excavation coupling both hydraulic and deformation calculations, as well as the results of the measurements of displacements the excavation support walls, vertical displacements beside the pit excavation, earth and water pressure distributions acting on the pit excavation support walls.

5. T. Newson and M. Kanungo. Buried reinforced concrete box culvert.

A buried reinforced concrete box culvert was constructed in 1982 at the Texas A & M University Research and Extension Center. The project was concerned with the design of culverts for shallow fills less than 2.44 m. The objective was to compare the measured data with the design pressures and develop an improved method of predicting earth pressures on box culverts due to both dead and live loads. The culvert was instrumented with twenty earth pressure cells on the top and side slabs, and with six resistance strain gauges on the tensile reinforcing steel in the top slab.

After completing analysis of the case histories there will be a continuous work on preparation of a guide giving recommendations for practitioners' approach to soil-structure interaction problems. In such a way, the guide will be based on the results of computations and comparison with the observational data on behavior of real building and structures.

4 ACTIVITIES COMPLETED

– Participation in XIII Danube-European Conference on Geotechnical Engineering, Ljubljana, Slovenia. 29-31 May 2006. Discussion Session 4 "Soil-structure interaction under static and dynamic loading", Keynote lecture "Basic regularities of soil-structure interaction" was delivered by C. Shashkin. Lecture "Reconstruction of historical cities" (V. Ulitsky and M. Lisyuk) was delivered by M. Lisyuk. The lecture included soil-structure interaction issues when dealing with the preservation and reconstruction of historical monuments and urban areas development.

– Meeting of members of TC 38 (XIII Danube European conference in Ljubljana, 28-31 May 2006).

Following the proposals of the core members prof. W. Van Impe and prof. M. Jamiolkowski, at this meeting a very important decision has been made to concentrate the activity of TC38 on analyses of well documented case histories. The results of calculations using various soil-structure interaction models must be compared with the results of real observations. After obtaining the calculation results it is planned to discuss and calibrate methods of soil-structure interaction calculation. Core members agreed to submit well documented case histories including the observation data for analysis.

It was also decided that the ultimate goal of the TC38 work is to produce a guide giving recommendations for practitioners' approach to soil-structure interaction problems.

– Workshop "Basics of soil-structure interaction. Soil characterization and determination of soil parameters for use in soil-structure interaction analysis" (8-9 September 2006 – Saint Petersburg, 12-13 September 2006 – Ghent).

On 8 September prof. K. Ishihara made a presentation of the book "Soil behaviour in earthquake engineering" in Russian. The book has been published in Russia by agreement with the Oxford University Press publishers. Prof. K. Ishihara also delivered a presentation "Performance of Piles with slab-constrained caps undergoing lateral flow due to liquefaction".

On 9 September prof. M. Jamiolkowski delivered two presentations: "Design parameters for sands from cone penetration tests" and "Safeguarding Venice lagoon against high tides". Prof. M. Jamiolkowski also made a short presentation on construction of a new metro line under the historical centre of Rome.

On 13 September prof. W. Van Impe delivered his lecture on "Usefulness/relevance of advanced soil parameter testing & research" in Ghent University for the audience of 47 participants from Russia, Ukraine, and Kazakhstan.

Also presentations on advanced in-situ and laboratory soil testing have been delivered by Dr. P. Van Impe, D. Verastegui, G. Van Alboom, and L. Areas. The modern laboratory and in-situ equipment as well as the testing methods have been demonstrated.

– Workshop "Use of soil-structure interaction principles for design of high-rise buildings" (14 May 2007 – Saint Petersburg, 17-18 May, Shanghai).

Saint Petersburg: presentation by prof. V. Ulitsky, Dr. C. Shashkin, and Dr. M. Lisyuk on the challenges of high-rise and underground construction in Saint Petersburg.

Presentations by T. Kettle, J Patterson, F. Nikandrov (RMJM UK, Scotland) on the basics on architectural and structural

design of high-rise buildings taking Moscow-City and Gazprom-City towers as examples.

Shanghai – Presentation of the work on design and construction of high-rise buildings in Shanghai by Mr. Hu Yuyin, leader of the Shanghai Construction Group (SCG). Visit to the construction site of Shanghai World Financial Center (492 m high, 101 floors).

- Workshop and meeting of members of TC 38 (XIV European Conference SMGE (24-28 September 2007, Madrid). Workshop on soil-structure interaction took place on 23 September 2007. The main topic of the workshop was to present and compare the results of the computations of the case histories presented by the members of TC 38. Case histories have been presented by W. Van Impe, C. Shashkin, M. Jamiolkowski and V. Fioravante. After discussions it was decided to continue with the analysis of the case histories for calibration of soil-structure interaction calculation methods and, ultimately, producing a guide with recommendations for soil-structure interaction problems, as was agreed in the meeting in Ljubljana in 2006.
- General report at the XIV European Conference SMGE (24-28 September 2007, Madrid). The title of the report “Foundation in urban areas. Codes and standards”. The report included a section on soil-structure interaction. Authors: V. Ulitsky, A. Shashkin, and M. Lisyuk.
- Invited lecture at the scientific workshop “Theory and practice of soil-structure interaction” (8-9 October 2007, Istanbul). Lecture “Use of soil-structure interaction approach in design of buildings” (authors: V. Ulitsky, C. Shashkin, M. Lisyuk) was delivered by M. Lisyuk.
- Participation of TC 38 members in the Touring lectures in Indonesia on Soil-Structure Interaction (17-19 October 2007, Jakarta) following the invitation of ISSMGE President prof. P. Sêco e Pinto. Three lecturers participated in the Touring lecture P. Sêco e Pinto, M. Madhav, and M. Lisyuk. Lectures by V. Ulitsky and M. Lisyuk “Preservation and Reconstruction of Historical Monuments with Account of Soil-Structure Interaction” and “Soil-Structure Interaction of underground structures in soft soils”. Lectures by M. Lisyuk, C. Shashkin “Basic Regularities of Soil-Structure Interaction” and “Soil-Structure Interaction: Case histories”. All these lectures were delivered by M. Lisyuk. The lectures were published in the Proceedings of the workshop.
- International geotechnical conference “Development of cities and geotechnical engineering” (Saint Petersburg, 17-19 June 2008). The conference was organized jointly by TC38 and TC41 with participation of TC 32 and TC4. ISSMGE Board meeting was held before the conference on 16 June. ISSMGE Board members participated in the conference. Session on Soil-Structure interaction was held at the conference. Totally 55 papers were submitted to Session on Soil-Structure interaction. On the plenary session and the session on Soil-Structure interaction invited lectures and reports were delivered by TC38 members: V. Ulitsky, W. Van Impe, R. Katzenbach, C. Shashkin, Max Ervin, Yasser El-Mossallamy, and Kari Avellan. Also, Invited lectures were delivered by TC41 Chair A. Negro and TC4 Chair T. Kokucho.

The proceedings of the conference include 4 volumes (2 volumes in English and 2 volumes in Russian).



Fig. 1. International geotechnical conference “Development of cities and geotechnical engineering” (Saint Petersburg, 17-19 June 2008). Session 1 on Soil-Structure Interaction was held in the historical Imperial Hall of St. Petersburg State Transport University

- Meeting of TC38 members (Saint Petersburg, June 18, 2008). The meeting was attended by TC 38 members – participants of the International geotechnical conference “Development of cities and geotechnical engineering” (Saint Petersburg, 17-19 June 2008), and Secretary General ISSMGE Neil Taylor. Some submitted case histories have been discussed. It was pointed out that there are some uncertainties in the result of the analysis of most case histories. These uncertainties are caused mostly by insufficient data on soil properties, presented in the case histories. It was decided to pay much closer attention to subsoil properties and to obtain for analysis the actual stress-strain curves of the tested soils. V. Ulitsky asked Yasser El-Mossallamy to present more detailed data on soil properties for his deep excavation case history. It was also decided to continue with the analysis of the case histories to produce a guide with recommendations for practitioners’ approach to soil-structure interaction problems.
- Workshop on preservation on preservation of historical monuments with account of soil-structure interaction “Our Heritage and Science” (Saint Petersburg, 17 April 18, 2009). The workshop was organized under the auspices of TC38 and St. Petersburg City Committee for Preservation of Historical monuments. The reports included the case histories of preservation and reconstruction of Constantinovsky palace, Summer theatre in Kamenny Island, and other case histories.

5 ACTIVITIES IN HAND AND TO BE COMPLETED WITHIN 1 YEAR

International workshop on using new geotechnical technologies and soil-structure interaction (Saint Petersburg, 17 May, 2009). The lectures will be given by Mr. E.F. Ischebeck and A. Junker (Germany) – “New developments in anchor piles technology” and M. Bogdanov (Russia) – “Site characterization for big constructional projects”.

Meeting of TC38 members in Alexandria, Egypt, on 4 October 2009, before the XVII ICSMGE. During this meeting future work of TC38 and preparation of the guidelines for soil-structure interaction will be discussed.

International geotechnical conference “Geotechnical challenges in Megacities” (Moscow, Russia, 6-10 June 2010). This conference is organized by NIIOSP Institute (Moscow) and TC38 “Soil-structure Interaction” jointly with TC28 “Underground Construction in Soft Ground”, TC32 “Engineering Practice of Risk Assessment and Management”, and TC 41 “Megacities”.

Meeting of members of TC38 is planned during this conference.

Conference topics are:

- Construction in restrained urban areas (Foundations for high-rise buildings, Deep excavations, retaining structures, diaphragm walls, Tunnels for underground transport infrastructures, etc.)
- Preservation of existing structures taking into account soil-structure interaction (Effect of new buildings and constructions on underground structures, Effect of new structures on existing buildings, etc)
- Urban environmental geotechnics: (Geofailures and risk assessment, Construction on contaminated soils, Preservation of hydrogeological situation, Improved soils, etc).