

REFLECTIONS ON THE PRESENT STATE OF ISSMGE AND GEOTECHNICAL ENGINEERING IN NORTH AMERICA

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ABSTRACT

On the occasion of the 75th anniversary of the International Society for Soil Mechanics and Geotechnical Engineering and of the 14th Pan-American Conference on Soil Mechanics and Geotechnical Engineering held in Toronto, Canada, some reflections on the present state of ISSMGE and Geotechnical Engineering in North America are presented.

RESUMEN

Con motivo del 75^{avo} aniversario de la Sociedad Internacional de Mecánica de Suelos e Ingeniería Geotécnica y del 14^{avo} Congreso Panamericano de Mecánica de Suelos e Ingeniería Geotécnica celebrado en Toronto, Canada, se presentan algunas reflexiones sobre el estado actual de la SIMSIG y de la Ingeniería Geotécnica en America del Norte.

1 INTRODUCTION

ISSMGE is now a respectable 75 years old lady, with the magic power of renewing herself constantly thanks to the inflow of new young members and to the reluctant fading away of old warriors. An anniversary is always a good time for reflection. It is an appropriate occasion to look back to the past but also to assess the present in order to prepare the future.

The author of this short contribution has the privilege to be ISSMGE Vice-President for North-America, since the end of 2009. During this period, he has had the opportunity to appreciate the buoyant energy of the Member Societies of the region and the enthusiasm and creativity of their individual members. It is thus with a great pleasure that he accepted to prepare these reflections on the present state of ISSMGE in North America.

2 THE NORTH AMERICAN REGION

2.1 Member countries of the region

The North American region includes only three member countries: Canada, USA and Mexico, a small number when compared to other regions such as South America, Asia and Europe. The individual membership in the ISSMGE represents however close to 20% of the grand total membership (approximately 19,000) of all Member Societies around the globe. It has already been pointed out in the past that the impact of the three votes of the region (out of 86 countries) in the major issues under consideration on the floor at ISSMGE Council meetings is far from proportionate to the number of individual members and their fee contributions.

The three member societies of the region are extremely active and have a strong presence and influence in the engineering community and in the society

in general in their respective country as well as internationally.

2.2 Activities of member countries

Detailed information regarding the activities of each of the three Member Societies of the region can be found on their excellent individual web sites:

Canadian Geotechnical Society (CGS, Canada): www.cgs.ca
Geoinstitute (GI, USA): www.geoinstitute.org
Sociedad Mexicana de Ingeniería Geotécnica (SMIG, Mexico): www.smms.org.mx

A summary of the highlights of the activities of the North American Region during the last two years, originally included in the minutes of the ISSMGE Council meeting is reproduced below:

- Canadian Geotechnical Society

Presidents during the period: Michel Aubertin, Bryan Watts

Annual Conferences:

62nd Canadian Geotechnical Conference &
10th Joint CGS/IAH-CNC Groundwater Conference
September 20-24, 2009
Halifax, Nova Scotia

63rd Canadian Geotechnical Conference &
6th Canadian Permafrost Conference
September 12-16, 2010
Calgary, Alberta

Other important technical events:

13th International Seminar on paste and thickened tailings
May 3-9, 2010
Toronto, Ontario

15th Annual contaminated and hazardous waste site management course theory, practice & outdoor field demonstrations
May 3-7, 2010
Toronto, Ontario

World Tunnel Congress 2010 (ITA): Tunnel Vision Towards 2020
May 14-20, 2010
Vancouver, British Columbia

The Second IASTED International Conference on Environmental Management and Engineering
July 15 – 17, 2010
Banff, Alberta

3rd Canadian Young Geotechnical Engineers and Geoscientists Conference
September 16-18, 2010
Bayshore Inn, Waterton Lakes, Alberta

Second International Conference on Oil Sands Tailings,
December 5-8, 2010
Edmonton, Alberta

- GeolInstitute, USA

President during the period: Edward Kavazanjian Jr., Larry P. Jedele.

Annual Conferences:

Geo Florida 2010 Conference
February 20-24, 2010
West Palm Beach, Florida, USA

Geo-Frontiers 2011 Conference
March 13-16, 2011
Advances in Geotechnical Engineering
Dallas, Texas, USA

Other important technical events:

Earth Retention Conference 3
August 1- 4, 2010
Bellevue, Washington

5th International Conference on Scour and Erosion (ICSE-5)
November 7-10, 2010
San Francisco, California

GeoRisk 2011
Geotechnical Risk Assessment and Management,
June 26-28, 2011
Atlanta, Georgia.

Co-sponsored events:

35th Annual Conference on Deep Foundations
October 12-15, 2010
Renaissance Hollywood, California

International Symposium on Testing and Specification of Recycled Materials for Sustainable Geotechnical Construction
February 02-04, 2011
Baltimore, Maryland

- **Sociedad Mexicana de Ingeniería Geotécnica**, (Mexican Society of Geotechnical Engineering), Mexico

Presidents during the period: Walter Paniagua, Juan de Dios Alemán.

On July 22nd 2009, the Mexican Society for Soil Mechanics changed its name to Mexican Society for Geotechnical Engineering (Sociedad Mexicana de Ingeniería Geotécnica).

Biennial Conference:

25th National Meeting of Soil Mechanics and Geotechnical Engineering and 20th Nabor Carrillo Lecture (Lecturer: Enrique Santoyo Villa)
November 11-13, 2010
Acapulco, Guerrero, Mexico

Other important technical events:

International Symposium: Technologies and foundation systems for the twentieth Century
December 3-4, 2009
Mexico City

Symposium on tunnels and tunnel shafts in soils and rocks
February 25-26, 2010
Mexico City

Geosynthetics: Present and perspectives in Mexico
March 10-12, 2010
Mexico City

SMIG also organized a number of short courses and special activities. It published an excellent commemorative volume on the history of Soil Mechanics in Mexico untitled: "El Siglo de la Mecánica de Suelos (Soil Mechanics' century)".

On January 20th 2011, SMIG organized in Mexico City a Special Symposium to honor the memory of the late Prof. Leonardo Zeevaert, with participation, among other personalities, of Jean-Louis Briaud, and William Van Impe, respectively President and former President of ISSMGE.

2.3 International relations

During the period, formal international relations between the three member countries were encouraged. Contacts were however established mostly in an informal manner taking advantage of personal relations. Typical were the lectures given in Mexico by Jorge Zornberg (GI, USA) on *Geotextiles* and by Serge Leroueil (Canada) on *Compacted soils*.

An agreement of cooperation was signed between GI (USA) and SMIG (Mexico) on October 7th, 2009 in Alexandria, Egypt. To follow up on this agreement, Juan de Dios Alemán, SMIG President, and G. Auvinet, ISSMGE VP for North America, were invited to attend the GI board of governors meeting in Dallas (March 12th 2011). A proposal to organize a joint technical event in 2012 on "Geotechnical Hazards" is being evaluated.

G. Auvinet was also kindly invited to attend the board of governors meeting of CGS in Calgary, on September 12th, 2010.

An important international event for both regions of the American continent is the Pan-American Conference. The conference technical program will enhance opportunities for interaction between academics, practitioners, designers, contractors and owners from North, Central and South America. This will be accomplished through a combination of invited speakers for plenary sessions, including keynote presentations (Casagrande Lecture and the R.M. Hardy Lecture), specialist technical breakout sessions and exhibits. There will also be poster sessions, panel discussions, short courses/workshops and technical tours.

The Casagrande Lecturer will be Dr. Kerry Rowe (Queen's University).

To promote a wide participation in this conference a special meeting of the Pan-American Committee took place in Gramado, Brazil (during COBRAMSEG2010, August 17-22) with participation of delegates from 15 member countries. Professor Giovanni Cascante, co-chair of the 14th PCSMGE organizing committee, presented the advances in the Toronto Conference organization. President of ISSMGE, Jean-Louis Briaud and Past President Pedro Seco y Pinto, attended this meeting. The North American region was represented by Giovanni Cascante (Canada), Robert Holtz (USA), Walter Paniagua and G. Auvinet (Mexico).

To foster participation of members of all countries of the continent, including some that may not be able to attend the Conference, and respecting a tradition inherited from previous Pan-American Conferences, the Organizing Committee kindly agreed to include all accepted papers in the Proceedings, opening a "proceedings-only" option. However, only duly registered members by July 2011 will be considered for oral and poster presentations.

3 PRESENT TRENDS IN SOIL MECHANICS AND GEOTECHNICAL ENGINEERING IN NORTH AMERICA

To assess the health, as well as any potential weakness, of Soil Mechanics and Geotechnical Engineering in the region, a review of the main topics treated during recent Conferences or published in well known regional and international journals can be helpful.

The topics covered by ISSMGE technical committees of the region are also indicative of the themes that are in the front line of geotechnical research and engineering practice in North America:

Fundamentals:

TC102 Ground Property Characterization from in-situ tests (hosted by USA).

Applications:

TC 206 Interactive Geotechnical design (Canada)

TC 208 Stability of Natural Slopes (Canada)

TC 209 Offshore Geotechnics (USA)

TC 214 Foundation Engineering for Difficult Soft Soil Conditions (Mexico)

Among the most recurrent topics dealt with geotechnical conferences and journals, the following should be mentioned:

Geotechnical testing.

The classical approach consisting of sampling and laboratory testing for defining soils properties to be taken into account in design is more than ever being challenged by *in situ* testing. This trend presents evident advantages since it can help shortening the duration of geotechnical surveys and avoiding the problem of disturbance of soil samples. However, these advantages should not be overblown and used as a justification to reduce the cost of geotechnical surveys. An adequate balance between *in situ* and laboratory testing should always been looked for, especially in the case of soft soils.

Site Characterization. Variability and uncertainty

Oversimplified assumptions regarding homogeneity of soils tend to be substituted by explicit consideration of soil heterogeneity. Spatial variability can be idealized recurring to mathematical models such as random fields and be taken explicitly into account in analyses by analytical or numerical methods. Variability is now recognized as the main source of uncertainty in geotechnical engineering although other factors such as limited representativity of laboratory or field tests must also be taken into account.

Management of Geotechnical data

Geographical Information Systems have proven to be useful to collect, display and process large amount of geotechnical data. An important work is being achieved in most countries on the elaboration of risks maps including detailed geotechnical zoning.

Physical and numerical modeling

Simultaneous approaches combining physical and numerical models based on different constitutive laws are now commonly used, at least for large projects. Powerful available commercial softwares allow sophisticated analyses of complex sequential construction procedures. The danger may lie for geotechnical engineers in trying to adapt their analyses to the available commercial softwares and not the other way around. Better interaction between soil and structural scientists and engineers is also evidently required to correct the simplistic assumptions regarding the soil behavior found in most popular commercial structural softwares.

Geohazards

Many classic soil mechanics problems, such as landslides, soil erosion, ground subsidence, soil fracturing and behavior of natural or artificial geotechnical structures in seismic conditions are now being classified as *geohazards*. This has been helpful to attract the attention of responsible authorities towards geotechnical problems.

Reliability and risk analysis

Taking into account explicitly variability and uncertainty in Geotechnical engineering makes it possible to perform risk analysis but also to assess the probability of good behavior of geotechnical structures, i.e. their reliability (Reliability is of course a more popular concept than its complement to unity: the probability of failure). Many engineers still don't feel comfortable with explicit consideration of probability in geotechnical design, but they tend to accept it in an implicit form as in limit state and load and resistance factor design (LRFD).

Ground improvement

Much more than in the past, geotechnical engineers' strategy now frequently consists of improving poor soils rather than accepting their properties and taking them into account as such in geotechnical design. When the soil bearing capacity is inadequate it is improved or substituted by a more competent material. New improvement techniques are constantly being developed. Bio improvement is one the most recent stabilization techniques.

New concepts in foundations

A blurring frontier now exists between deep foundations and soil improvement methods as in the case of rigid inclusions. The concept of Energy foundations combining the mechanical function of foundations with an efficient management of energy is fascinating and will certainly be developed further in the future.

Geoenvironmental engineering

Geoenvironmental preoccupations have had a considerable impact on the geotechnical profession. Geotechnical engineering has come up with many practical solutions for site remediation, construction of sustainable barriers, reuse of dredged sediments and bio waste to cite just a few topics. At some point, in the

1990's, it looked like attention to geoenvironmental problems would become the main business of geotechnical engineers. This has not completely materialized, but this type of problem still represents a significant percentage of their activity.

Sustainability

Quantitative benefits of sustainable construction using recycled materials have attracted a lot of attention. Life cycle analysis (LCA) and life-cycle cost analysis (LCCA) are being performed to quantify the benefits of green construction in geotechnical applications. Concepts of sustainability will certainly be soon introduced into geotechnical engineering standards and practices.

Land subsidence

Land subsidence is a problem affecting an increasing number of cities. A foremost example is the case of Mexico City but many other problematic cases have been identified in the North America region. The associated phenomena, especially soil fracturing, are taking worrying proportions and this will certainly be an important subject for geotechnical engineers in the coming years.

Geosynthetics

New synthetics materials are taking an important place in geotechnical practice. The merits and limitations of these materials are now well established. A healthy equilibrium is being reached between promotion by manufacturers of these products and reasoned and critical appraisal of their actual usefulness by geotechnical engineers.

Underground structures

A large part of the future development of many cities will take place in their subsoil. Tunnels are increasingly necessary for drainage, transports and many other uses. The challenges met to build intricate underground networks are requiring and will require participation of Geotechnical engineers.

Offshore engineering

With the increasing exploitation of oil fields in deep sea, new sophisticated techniques are being developed for geotechnical surveys in these difficult conditions. This is one of the most challenging areas of the profession.

Geoeducation

Diffusion of Soil Mechanics and Geotechnical Engineering principles and techniques is fostered in this very moment by fast developing new communication techniques. Internet is an unlimited source of information. *Webinars* on geotechnical subjects are being organized and will soon be an important part of the educational process. Furthermore, the development of *Geoworld*, a new social network for geotechnical engineers will certainly improve considerably the flow of data and opinions. A collective brain is being created that will profoundly modify Geotechnical Engineering research, education and practice.

A large number of topics could be added to the above list. Some of them are still vying to be accepted as

significant contributions to Geotechnical Practice. This is the case of some sophisticated approach such as Micromechanics studies on soils or soft computing applications. The importance of basic research on this kind of topics should however be recognized since future progress may depend on them.

4. FINAL COMMENTARY

The brief overview presented shows that Soil Mechanics and Geotechnical Engineering in North America is a buoyant many-faceted specialty. Its brilliant and creative activities in the present are a guarantee of a promising future.

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