



International Society for Soil Mechanics and Geotechnical Engineering

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A Note from TC303 (Floods) Chairman Professor Susumu Iai

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The Technical Committee 303 addresses the issues on "Coastal and River Disaster Mitigation and Rehabilitation". As a chairman of this TC, I am pleased to write this short note addressed to ISSMGE members.

Global sustainability is the greatest long term challenge of our time. The breadth of disciplines that need to work together and the long duration over which action must be coordinated is unprecedented in the history of engineering. In geotechnical engineering and earthquake geotechnics in particular, we are unused to the challenge of working with other disciplines to address such problems, which have been far removed from our daily practice to date.

Apart from the geotechnical engineering and earthquake geotechnics, sustainability may be more clearly defined when we try to define the inverse concept of the sustainability: i.e. unsustainability. The TVs and newspapers reported a few years ago incidents of a parent(s) killing his or her own children and a child killing his or her own parent(s) in Japan. Self centered attitude for fulfilling his or her own needs, commonly found in human minds, may be the primary triggering mechanism to those abnormal incidents. Given that the common elements of human minds are the cause of these incidents, our future society might accept these incidents just as daily routine incidents. Ultimately, our future society will be heading into an unstable society that will eventually collapse.

United Nations Brundtland commission published Our Common Future in 1987, in which, "sustainable development" is defined as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The next generations cannot express their strong opinions against the current generations because the next generations have not yet been born or fully grown up. If the current generation uses up all the natural environment and energy, there will be no sustainable society.



A Note from TC303 (Floods) Chairman (Continued)

Professor Susumu Iai

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Let us try to answer a question “what is the most fundamental and important strategy towards achieving the sustainable society?” The answer to this question is obvious to Mr. Ryusho Kobayashi, a Buddhism priest, Enryaku-ji temple, Mount Hiei, Kyoto (Open symposium, Kyoto University, 2007). “The most fundamental and important strategy is a mind revolution from the current self centered demand and take-away attitude to a returning and give-away attitude with gratitude.” Mr. Kobayashi follows his lecture and strikes the mind of the audience; “go back to your home and look at your face. Your face is not made instantaneously but has been formed through a long and cumulative process of your life over years. If your mind revolution has been continuing to aim at achieving the returning and give-away attitude, your face will certainly look radiant.”

Back to the engineering, an initial, bold step towards approaching this challenging subject from the discipline of geotechnical engineering and earthquake geotechnics was taken through the fourteen contributions by world leading experts. A special seminar was held in Kyoto, Japan, hosted by the Kyoto Sustainability Initiative, from January 12-14, 2010, which brought a number of experts together to discuss the opportunities for geotechnical engineering and earthquake geotechnics as we face up to this global challenge. The seminar generated intensive and stimulating discussions on a wide range of topics from the purely technical to government policy. Following the seminar, each of the experts was invited to set down their thoughts, from which a book entitled “Geotechnics and earthquake geotechnics towards global sustainability” has been prepared.

TC303 organized an international gathering under the name of Kyoto Seminar in 2010. A book was published (Iai, 2011) and I made a statement therein as what follows; “*Soil in one form or another covers most of the surface of the planet, and yet soil mechanics as such does not seem to be a big factor in global sustainability. The subjects covered by the international experts include an overview of global sustainability, geotechnical challenges in counteracting natural hazards, the role of geotechnical engineering in creating a low carbon society, world heritage, lifelines in megacities, coastal protection, exploring non-gravity geotechnics, designing for sustainability and more. We hope that these contributions from the Kyoto Seminar 2010 will stimulate debate over the role of geotechnics in achieving a more sustainable future for the world.*”

The compilation and editing of the conference publication coincided with the initial phase of activities of TC303 of ISSMGE created for the period 2009-2013 under the wider theme of ‘Impact on Society’. TC303 continues the work of the former TC39 ‘Geotechnical Engineering for Coastal Disaster Mitigation and Rehabilitation’, which was focused on tsunami risk following the 2004 Sumatra earthquake in Indonesia. The editing of the publication reflected the activities of TC303 (for details of TC303, refer to <https://sites.google.com/site/tc303issmge/home>).

Another new challenge posed to our daily practice is the aspect of combined hazards. State-of-the-art geotechnical earthquake engineering is typically based on site-by-site detailed analysis. However, directly applying cutting edge earthquake engineering is difficult for a long coastal protection line.

A Note from TC303 (Floods) Chairman (Continued)

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Thus, a new methodology should be developed; an example, which has been developed via the collective efforts of the author and their associates, has been adopted for coastal areas in Japan and is briefly reviewed below.

The seismic performance of geotechnical structures, which extend over 70 km of coastline along the Osaka Bay area, is evaluated (Fig. 1). The northern part of the coastal protection line is slightly inland from the sea, whereas the southern part of the coastal protection line is directly exposed to the sea. Geotechnical conditions along the coastal protection line were compiled based on boring data, which was originally obtained at 100 to 500 m intervals for the construction of the Hanshin Bay Area Highway.

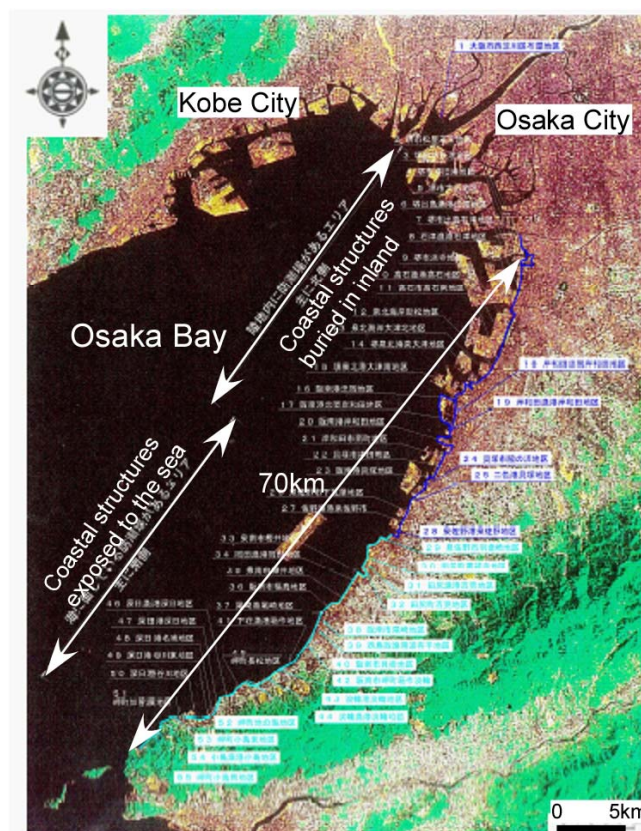


Fig. 1. Investigated coastal protection line for Osaka Bay Area, Japan.

The primary objective of this assessment was to avoid combined hazards such as those that occurred during the 2004 Sumatra, Indonesia, earthquake (Fig. 2). The performance grades of the coastal structures reflect the consequences of failure and were based on importance categorized by land use and the elevation of the ground relative to the sea level. Highly industrialized zones with low ground water level are assigned the highest performance requirements for protection of the coastal zone.

Instead of performing effective stress analysis on a site-by-site basis, a set of design charts has been developed based on a comprehensive set of parametric studies on embankments and gravity structures. The design charts are incorporated into a spreadsheet format. Required input data are (1) the basic parameters defining the cross section of the structures, (2) geotechnical conditions as represented by the SPT N-values, and (3) earthquake data represented by the wave form, peak ground acceleration, or distance and magnitude from the seismic source. These design charts can conveniently and efficiently assess the vulnerability of coastal geotechnical structures that extend a long distance such as tens of kilometers over variable geotechnical and structural conditions.

A Note from TC303 (Floods) Chairman (Continued)

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The results of the seismic assessment of the coastal protection line in the Osaka Bay Area are compiled in terms of the settlements of the coastal protection facilities due to earthquake shaking. The areas with smaller margin to the acceptable level of settlements are not robust against the expected effect of Tsunami. The assessment successfully indicated the areas less likely to protect the land from a tsunami and must be strengthened or improved in preparation.



Fig. 2. Coastal area of Banda Aceh, Indonesia, before (above) and after (below) the Indian Ocean-Sumatra earthquake of 2004 (after Quickbird).

Reference

Iai, S (ed.) (2011): Geotechnics and Earthquake Geotechnics towards Global Sustainability, Springer