GEOASIA Bulletin No.4

ALL SOILS ALL STATES ALL ROUND *GEO-ANALYSIS INTEGRATION*

For finding soil deformation and collapse in sandy, intermediate and clayey soils, and for static or dynamic interests

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Edited by *GEOASIA* Research Society Office

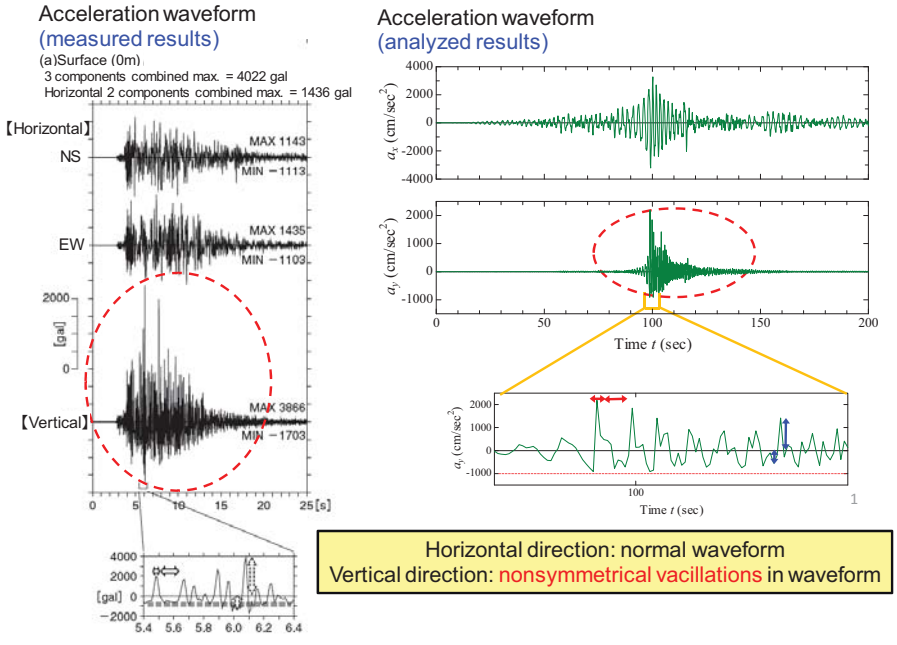
Furo-cho, Chikusa-ku, Nagoya, 464-8603, Japan TEL: +81-(0)52-789-3834

FAX: +81-(0)52-789-3836 E-mail: office@geoasia.jp URL: http://www.geoasia.jp

Message from the Society President

This is my fifth message as president since the founding of the ***GEOASIA*** Research Society in 2006, and the second since its registration last year as an incorporated society. This year again, I heartily thank all our members for their continuing support of the Society.

In 2010, the Society has had a succession of occasions to celebrate, from the spring on. One of these was winning the Japanese Geotechnical Society's 2009 Best Paper award with the work "Soil-Water Coupled Finite Deformation Analysis Based on a Rate-type Equation of Motion Incorporating SYS Cam-Clay Model" (Noda, Asaoka, Nakano. Soils and Foundations, Journal of the Japanese Geotechnical Society, Vol. 48, No. 6, pp. 771-790) which introduces the principal elements of the ***GEOASIA*** all-round geo-analysis technology. This paper had had to be kept under wraps for some time while the patent application was going through, but seeing it receive the award the moment it was published was naturally gratifying to us. The second cause for celebration, again for an activity at the heart of the ***GEOASIA*** Research Society's concerns, was the earning of the 2009 Certificate of the Minister of Education and Science (Scientific and Technological Research Category) for the project "Systematic Research for the Clarification of Static and Dynamic Soil Responses, Based on elasto-plastic Mechanics". To crown this distinction, I had the honor of being chosen as representative of the 43 recipients in this category and of going up to receive the Certificate in person. The ***GEOASIA*** geo-analysis technology is still only a tool in development, as will be touched on again in a moment, yet it is a pleasure and encouragement to see the recognition that it is earning and the way in which it is slowly but surely spreading its influence.



On a personal note, I retired from Nagoya University in March, and since April have been engaged as senior research advisor at the Association for the Development of Earthquake Prediction (reg. foundation). I owe this move to the efforts of Professor Yoshihiro Sawada, who is also advisor to the ***GEOASIA*** Research Society. Shortly afterwards, my term as President of the Japanese Geotechnical Society came safely to an end at the annual general meeting on May 27, and the day after that I was invited to give my valedictory lecture marking my retirement from the university. After the lecture, I was treated to a heartwarming commemorative farewell dinner at a large hotel in the city; I hear that the event was partly supported by the ***GEOASIA*** Research Society. My sincere thanks.

It was moving to see so many people there – as many as 300, including members of this Society. But to be honest, I spent a good deal of time beforehand – I do not exaggerate much if I say nearly a year – pondering over what to say in this last lecture. What is the aim that this all-round geo-analysis technology ***GEOASIA*** ought to be setting itself? By posing that question afresh, would I be able to come up with a new insight and to put it across in an understandable manner? For a naturally slow head like mine, this made for quite a grueling year.

It was my worthy friend, and a fellow member of this Society, Osamu Kusakabe, who told me once that a theory is just a prediction of the existence of some unknown phenomenon. A particular instance of this was a question raised by Dr. Yoshihiro Sawada: In the Iwate-Miyagi Nairiku Earthquake, what could account for the bulges in the ground and the nonsymmetrical vacillations of the vertical seismic motion observed in West-Ichinoseki. Thanks to the efforts of Society members Toshihiro Takaine and Shotaro Yamada, a way was found to tie up these two things into an account that had a shape to it. To recompense their efforts, I should like to include diagrams of their results in this issue.

There must still be plenty of geomechanical phenomena that we know very little about. There are certainly still unknowns in the changes that occur after earthquakes, and it is one of my wishes for ***GEOASIA*** that it should work as a discovery tool in this area. There is still a prevalent general outlook in the world of geotechnology that "there is no need for difficult mechanics when it comes to design." But where is the virtue in designing things in ignorance of the facts? My hope is that by working together we can find ways to overturn this baleful "general outlook," and then set out boldly in quest of real advances.

Let me end by wishing all members success in their projects and activities.

Akira Asaoka,
Senior research advisor, the Association for the Development of Earthquake Prediction (reg. foundation);
Emeritus professor, Nagoya University

Report of awards earned using the *GEOASIA* geo-analysis technology

The three following awards were gained in the academic year 2009 for research achievements making use of the ***GEOASIA*** geo-analysis technology.

【*2009 Best Paper award of the Japanese Geotechnical Society*】
Noda T., Asaoka A. and Nakano, M. (2008): Soil-Water Coupled Finite Deformation Analysis Based on a Rate-type Equation of Motion Incorporating SYS Cam-Clay Model (Soils and Foundations, Journal of the Japanese Geotechnical Society, Vol.48, No.6, pp.771-790)

【*2009 Certificate of the Minister of Education and Science (Scientific and Technological Research Category)* 】
Asaoka A., Nakano M., Noda T. and Nakai K.: Systematic Research for the Clarification of Static and Dynamic Soil Responses, Based on Elastoplastic Mechanics.

Awarding ceremony;
Certificate of the Minister of Education and Science
(April 13, 2010)

【*Best Paper Award in ASCE 2010 (Geotechnical Special Publication No.201)* 】
Noda, T., Asaoka, A. and Nakai, K. (2010): Modeling and seismic response analysis of a reclaimed artificial ground, Proceedings of GeoShanghai 2010, pp.294-299.

① Settlement related to the raising of underground and its influence on the surrounding ground

The effects of settlement on the surrounding ground as an after-result of the raising of underground water were investigated under axially symmetrical conditions using a two-dimensional numerical analysis. With an embankment load, there is a possibility of large-scale settlement, as compared with a ground on which no embankment is placed. Irrespective of whether there is an embankment load or not, the area of settlement (the radius of influence) will be more extensive when the permeability of the soil is low.

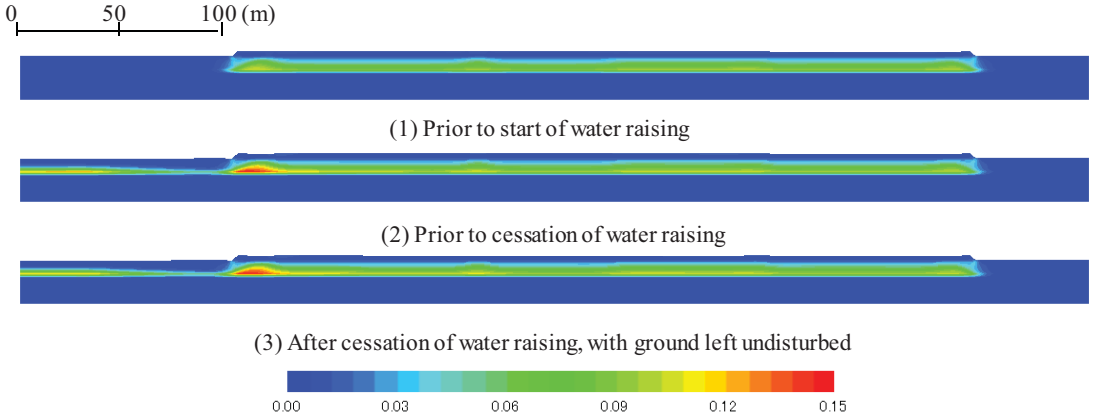


Fig. 1 Shear strain distributions after post-seismic consolidation

② Prediction of embankment-related settlement in an ultra-soft ground containing peat

An attempt was made to simulate large-scale deformation behavior associated with an embankment load, and also to predict future behavior, in a ground including approx. 50m of ultra-soft sediment layers containing peat. In addition to the settlement behavior directly under the center of the embankment, quantitative simulations were also made of measured results obtained for uplift in the ground surface and for pore water pressure levels.

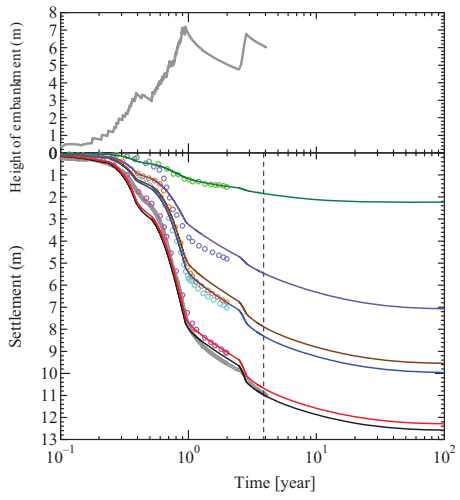


Fig. 3 Past settlement simulations and future predictions

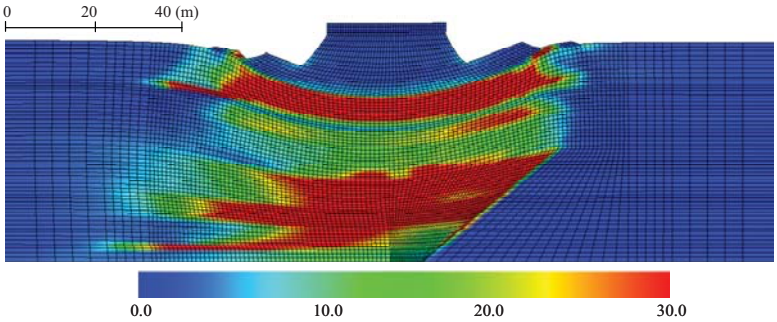


Fig. 4. Shear strain distributions in the ground (after consolidation)

③ Analysis of the seismic response of a soft alluvial clay ground bearing a coastal defense installation such as a breakwater

An analysis was carried out of the seismic response of the seabed ground under a coastal defense installation, in a case where the ground consisted of a thick layer of soft alluvial clay. It was shown that with such large and lop-sided load acting on this soft clay layer, there is a risk of ground disturbance as a result of the repeated shear stresses occurring during an earthquake, and of large-scale settlement in the period during and after the earthquake.

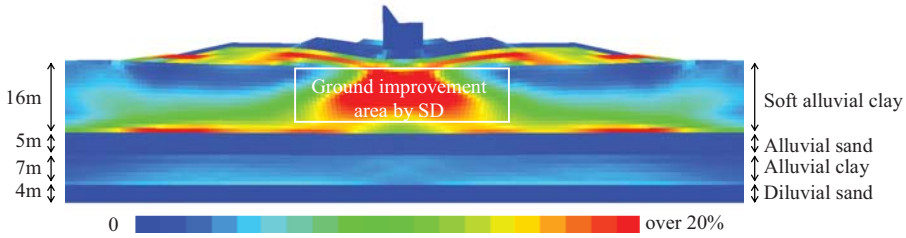


Fig. 4 Shear strain distributions in the 30 years

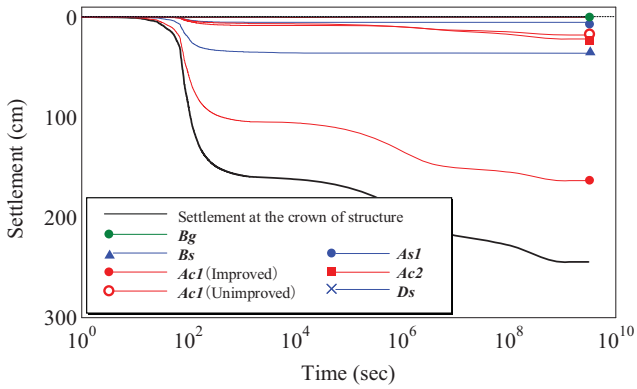


Fig. 5 Amount of settlement in each of the layers following the earthquake immediately under the structure

④ Investigation of the effects of static press-in sand compaction on surrounding structures, making use of 3-dimensional analysis

The process of creating a sand pile was modeled and analyzed under 3-dimensional conditions. Findings were obtained regarding distance decay in the displacements produced by the press-in static compaction operation in the surface and underground levels of the surrounding sand ground, and also regarding the variations in the characteristics of the ground reaction (soil pressure) affecting adjacent structures depending on the distance from the press-in site (sand pile).

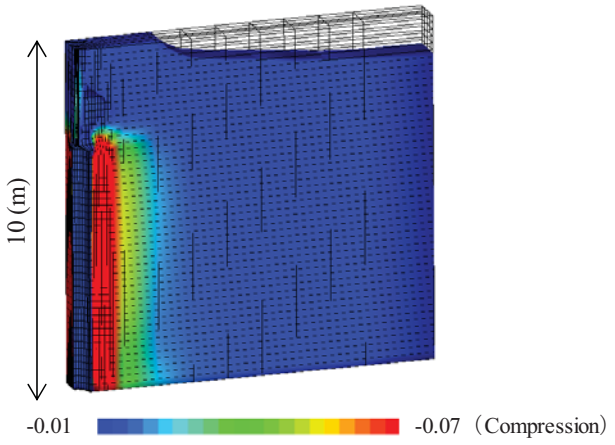


Fig. 6 Change in the void ratio (following diameter expansion)

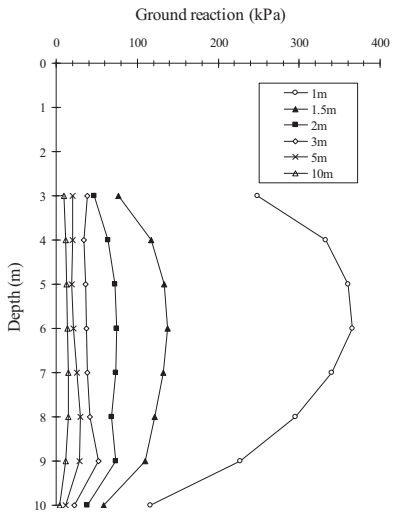


Fig. 7 Distance dependence of ground reaction

Principal publications etc. in Academic Year 2009 (including the first half of AY 2010)

Academic papers:

【*Soils and Foundations*】

① Co-seismic and post-seismic behavior of an alternately layered sand-clay ground and embankment system accompanied by soil disturbance, Vol.49, No.5 pp.739-756.

② Proposal of a simple method for judging naturally deposited clay grounds exhibiting large long-term settlement due to embankment loading, Vol.50, No.1, pp.109-122.

③ Predictive simulation of deformation and failure of peat-calcareous soil layered ground due to multistage test embankment loading, Vol.50, No.2, pp.245-260.

【*Japanese Geotechnical Journal*】

① A study of settlements of the backfill ground around a rigid structure during an earthquake by centrifuge tests and by a FE simulation, Vol.5, No.1, pp.45-59.

② Effects of water contents on compression curves in remolded samples, Vol.5, No.1, pp.81-87.

【*Journal of Applied Mechanics JSCE*】

① Seismic/post seismic response analysis of loose sandy ground improved with partial solidification, Vol.13, pp.443-452.

② Simulation of reclaimed ground composed of dredged soil for two kinds of earthquake ground motions with different spectral characteristics, Vol.13, pp.453-462.

【*GeoShanghai 2010* (Shanghai, China, June 3-5, 2010)】

① Numerical analysis on co- and post-seismic behavior of sandy/clayey soil ground improved by sand compaction pile method, pp.218-224.

② Modeling and seismic response analysis of a reclaimed artificial ground, pp.294-299.

③ Soil-water coupled finite deformation analysis of seismic deformation and failure of embankment on horizontal and inclined ground, pp.139-144.

④ Different failure modes of a clay foundation-embankment system corresponding to different incident seismic waves, pp.125-130.

⑤ Mechanical behavior of compacted geomaterial changed from the dredged soil in Nagoya port by mixing with some stabilizers, pp.149-154.

【*WCCM/APCOM 2010* (Sydney, Australia, July19-23, 2010)】

Seismic response analysis of an artificial reclaimed ground constructed on naturally deposited soils, on CD, No.012107.

International conferences:

【*Urban Geotechnic*s (Incheon, Korea, September 2009)】

Aiming at All Soils All States All Round Geo-analysis Integration (Invited lecture)

【*Japan-China Geotechnical Symposiu*m (Okinawa, Japan, April 12-14, 2010)】

① Reproduction of a reclaimed ground considering its construction history and evaluation of its seismic behavior by using a soil-water coupled analysis, pp.174-179.

② Seismic stability assessment of a lightweight structure on sandy/clayey foundations, pp.564-571.

【*IWS- Brisbane2010* (Brisbane, Australia, Aug. 26-27, 2010)】

① Aiming at “All Soils All States All Round Geo-analysis Integration” (Special lecture) .

② Undrained shear behavior of dredged soil treated by cement.

③ Seismic stability assessment of a steel plate built-up column sited on a liquefiable soft ground.

Domestic conferences:

【*64rd Japan Society of Civil Engineers 2009Annual Meeting* (Fukuoka, September 2009) 】43papers.
【*46th Japan National conference on Geotechnical Engineering* (Ehime, August 2010) 】11papers.
【*15th Conference of the Japan Society for Computational Engineering and Science* (Fukuoka, May 2010) 】
Seismic response analysis of alluvial ground on which a large structure was sited, pp.973-974.

Invited lectures:

【*Vietnam, Geotechnical Day* (Vietnam, Hanoi, June 18, 2010】】
Akira Asaoka: Aiming at ALL SOILS ALL STATES ALL ROUND GEO-ANALYSIS INTEGRATION

Main Forthcoming Activities in 2010

In addition to the submission of academic papers to journals such as *Soils and Foundations*, research efforts planned for the coming year include presentations at international conferences such as the 14th Asian Regional Conference on Soil Mechanics and Geotechnical Engineering (Hong Kong, China, May 23). We also hope to extend surveying and research activities making use of the ***GEOASIA*** analysis technology so as to take in international fields as well as domestic Japanese ones.

As part of our members' schedule of activities this year, a program of workshops, external lectures and addresses is being planned to make a broader public acquainted with the ***GEOASIA*** analytical technology and to train new ***GEOASIA*** MASTERs. If any member or reader has wishes or topic proposals in this area, please contact the Research Society Office. Efforts are also being put into renewing the Society's homepage, exhibiting at company booths, the insertion of publicity articles in publications, and other advertising activities. Finally, the Society is supporting the publication of Professor Asaoka's textbooks on geomechanics and geotechnology.

Editorial Afterword

The Society President, Professor Asaoka, retired in March from Nagoya University. The administrative work for the Research Society will continue to be performed in the Nagoya University office as hitherto, but there are also plans to expand activities in the future through Professor Asaoka's new Tokyo base, the Association for the Development of Earthquake Prediction. As these changes begin, we ask for the continued support of all of our members.

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Bulletin No. 4 Issued August 9, 2010 Edited by *GEOASIA* Research Society Office TEL:+81(0)52-789-3834 E-mail:office@geoasia.jp