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Shaking Table System for Geotechnical Centrifuge

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EMERGING CONSTRUCTION TECHNOLOGIES

Civil - Construction Equipment & Methods

SHAKING TABLE SYSTEM FOR GEOTECHNICAL CENTRIFUGE

THE NEED

Because of the increasing constructions of large-scaled and important structures on soft grounds especially in bay area development, it has become very necessary to investigate the seismic ground behavior. One effective method of studying such behavior is to conduct shaking table tests under a centrifugal field using a model specified from the actual structure in accordance with the similarity law, so as to allow economic evaluation of alternative designs, investigation of complex problem areas, and validation of numerical methods with instrumented physical models.

FIGURE 1 SHAKING TABLE SYSTEM

THE TECHNOLOGY

The shaking table system for geotechnical centrifuge, which can simulate sinusoidal and real seismic waves under a centrifugal force of 50 times earth gravity, is capable of providing significant data for the seismic design of structures. The shaking table can accommodate test specimens up to 250kg under 50G condition, so it can be used to perform various types of ground shaking tests. Because the maximum excitation acceleration of the shaking table is 25G (i.e. 500 Gal in full scale prototype), it can simulate the response of ground during large earthquakes.

The available frequency range of the system is from 25 to 350Hz (corresponding prototype frequency is 0.5~7Hz), which covers the predominant frequency range of

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real earthquakes. The data acquisition system can simultaneously measure 48 channels of signals including acceleration, displacement, pore water pressure and earth pressure, etc.

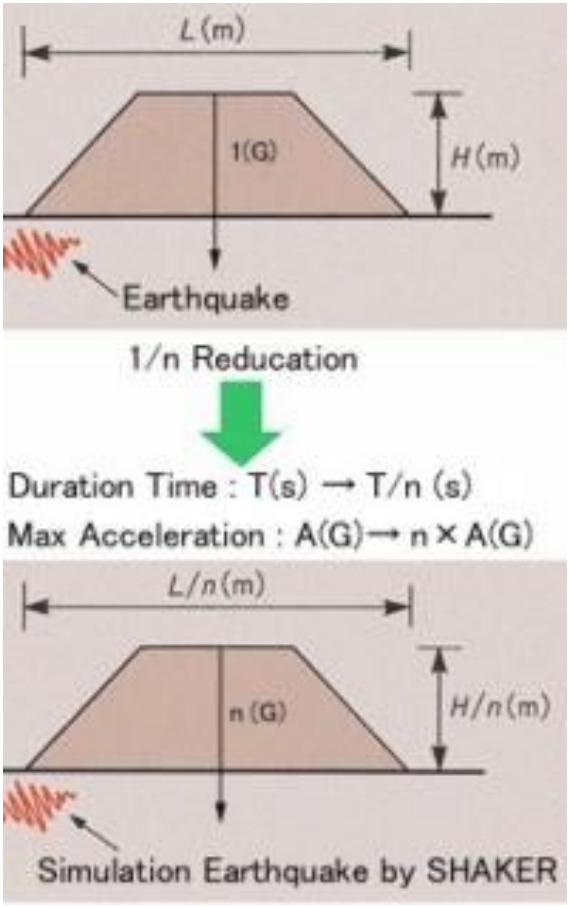

FIGURE 2 PRINCIPLE OF CENTRIFUGE MODELING TEST

THE BENEFITS

This technology can be applied following fields: 1) Investigation on the dynamic soil-structure(such as bridge foundation, tunnel, etc.) interaction. 2) Simulation of the response of liquefied ground. 3) Verification of liquefaction-resistant construction method. 4) Verification of the seismic stability of soil-structures.

STATUS

Direct application to specific engineering design historically has been reserved for large projects, which justify the time and expense involved. These have included, for example, offshore foundation design in the oil industry; large span bridge pier foundation design; seismic and non-seismic design of embankment dams; and seismic design of bridge foundations and waste disposal facilities. However, the frequency with which it is used by large design-construct firms internationally is increasing, especially in Japan. Together

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these trends point to its increased use in engineering design of difficult, unusual, or extreme geotechnical engineering design.

BARRIERS

Geotechnical centrifuge modeling is a highly specialized laboratory based technique. As such, it suffers from the traditional obstacles to moving research results into practice. For the engineer-contractor, this means developing an appreciation of the potential advantages derived from smarter geotechnical engineering, and being able to see different scenarios played out before construction; the visual nature of the modeling, enhanced by collection of soil and structural response data, however, makes the investment very attractive. For the researcher, this will require increased sensitivity and understanding of the practical needs of real construction, in terms of economics, response time, and the appropriateness of the end product delivered to the engineer-contractor.

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REVIEWERS

Peer reviewed as an emerging construction technology

DISCLAIMER

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