

KaTRI Geotechnical Centrifuge

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Owner: Kajima Technical Research Institute (KaTRI), Kajima corporation

Location: Chofu-City, Tokyo, Japan

Introduction

KaTRI geotechnical centrifuge established in 1990 as the first centrifuge machine among Japanese construction companies. Subsequently, various centrifugal model tests have been conducted to deal with the domestic monumental and difficult projects: Haneda international airport, large depth tunnel excavation, offshore wind foundation, and so on. In 2002, KaTRI centrifuge Mark-2 was released, which was drastically improved in capacity and acceleration from Mark-1. In the upcoming 2024, KaTRI centrifuge Mark-3 is to be completed.



KaTRI centrifuge Mark-2

Key Technical Specifications

Beam Centrifuge	
Manufacturer	Hitachi Industrial Products, Ltd.
Year established	2002 (Mark-1: 1990)
Radius to base of platform	2.4m
Capacity	100g-tons
Bucket area	1.0 m(L) x 1.0 m(W) x 0.8m(H)
Major equipment	Shaking table Laminar shear box Inclined box Multiple loading system High-speed cameras

Shaking table

Shaking table with the electro-hydraulic servo vibration system accelerates in 1D-horizontal direction. The acceleration ability covers Japanese major seismic standards. In the case of static model tests, the table can be completely removed from platform.

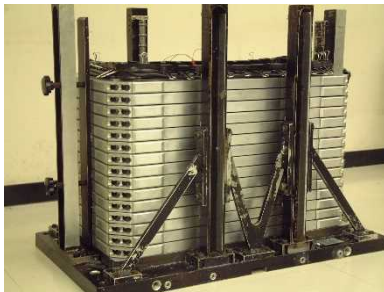


Shaking table

Shaking Table	
Table Size	0.7 m x 0.4 m
Max. Capacity	5 g-tons
Max. Velocity	100 cm/s
Max. Displacement	±3.0 mm
Frequency Range	10~400 Hz
Centrifugal Acceleration	25~100 g

Other equipments

- Laminar shear box
Use case) Verification of response displacement method²⁾
- Inclined box
Use case) Seismic stability of embankment slopes⁴⁾
- Multiple loading system
Use case) Foundation stability⁷⁾
- High-speed cameras



Laminar box



Inclined box



Multiple loading system

Key applications

- Soil-structure interaction, such as tunnel
- Tunnel excavation
- Large scale embankment, cut slope
- Reinforced soil structure
- Soil-pile interaction

Paper Examples

- 1) Igarashi, H. (2002): Centrifuge model test, Journal of the Japanese Society for Experimental Mechanics, Vol.2, No.4, pp.3-10.
- 2) Nagatani, H., Yamada, T., Igarashi, H., Takahashi, S. (2002): The cyclic shear response characteristics of parallel shield tunnels, 37th Japan National Conference on Geotechnical Engineering, pp.1777-1778. (In Japanese)

- 3) Igarashi, H., Sugihara, Y. (2000): A New evaluation method of earth pressure on multi-circular face shield tunnel based on centrifuge model tests, Proceedings of Japanese Society of Civil Engineers, Vol.51, No.652, pp.11-20. (In Japanese)
- 4) Mori, H., Arai, Y., Nagatani, H. (2002): Centrifuge static inclination model test on seismic stability of embankment slopes, 3rd International Conference on Landslides, Slope Stability & the safety of Infra-Structures, Singapore.
- 5) Zheng, J., Ohbo, N., Suzuki, K. Suzuki, R. (1995): Analysis of results of centrifuge tests on seismic behavior of embankment, First International Conference on Earthquake Geotechnical Engineering, pp.1069-1074.
- 6) Abe, H., Kitamotom, Y., Honda, M., Jinki, R. (1995): Prediction of the deformation of reinforced embankments by centrifuge experiments, Proc. International Symposium on Earth Reinforcement Practice, Fukuoka vol.1 pp.199-204.
- 7) Okamoto, M., Sasakura, T., Kobayashi, I., Igarashi, H. (2003): Application of centrifuge modelling test to an estimation of foundation stability, The foundation engineering and equipment, Vol.31, No.7, pp.54-57. (In Japanese)
- 8) Suzuki, Y., Adachi, N. (2010): Influence of Structure Base Slip on Structure Response during an Earthquake, Annual Report of Kajima Technical Research Institute, Vol.58, pp.1-6.
- 9) Sudo, Y., Hayashi, H., Kuroyanagi, M., Morimoto, I., Kokusho, T. (2005): Investigation of forces applied to piles due to liquefaction-induced lateral flow, Proceedings of Japanese Society of Civil Engineers, Vol.63, No.2, pp.467-486. (In Japanese)
- 10) Obara, T., Yoshida, T., Kawano, K., Morikawa, S., Ohno, S. (2011): Investigation of frost heave/ thaw subsidence prediction method applied to freezing method- centrifugal model frost heave experiment-, 66th Japan Society of Civil Engineers Annual Meeting, pp. 795-796. (In Japanese)
- 11) Nakamoto, S., Nasu, A., Nagatani, H., Kobayashi, T., Ohno, S. (2020): Centrifuge model tests for the double layered sheet pile, 55th Japan National Conference on Geotechnical Engineering, pp.22-8-3-04. (In Japanese)
- 12) Sasaoka, R., Kokusho, T., Fujisaki, K., Okamoto, M. and Togashi, N. (2019): Centrifuge Model Test on Seismic Behavior of Gravel contrasted with Sand, Japan Society of Civil Engineers Annual Meeting, CS14-19. (In Japanese)
- 13) Yamada, T. (2021): Study on quay's seismic performance applied with wide-grid lattice-type soil solidification, Deep Mixing Conference 2021.