Hydro-Geotechnical Centrifuge PARI Mark II-R

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Introduction

Centrifuge modelling is a technique for reproducing a prototype scale structure with a physical scale model. PARI's centrifuge machine has a 312 g-tonne capacity, achieving a maximum centrifugal acceleration of 113g at 3.8 m radius. This machine has a shaking table, a wave flume, and a high-speed camera. Large numbers of model tests have been carried out on the centrifuge over more than 40 years.

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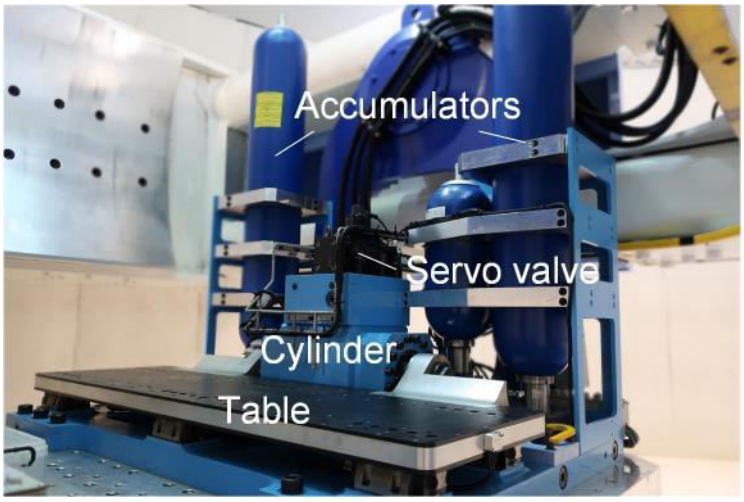
Key Technical Specifications

Beam Centrifuge	
Manufacturer	Sumitomo Metals (Currently, Nippon Steel Railway Technology)
Year established	1994 (1st centrifuge Mark I was established in 1980)
Radius to base of platform	3.8 m
Capacity	312 gton (2.76 tons @113g, max G-level: 113g)
Bucket area	1.7 m x 1.6 m
Major equipment	Shaking table (capacity 386kN @100g)
	Wave flume (Piston type)
	Dam-break tsunami simulator
	Vertical and horizontal loading devices
	Embankment simulator
	Grout injection machine
	Measuring instruments (static: 58ch, dynamic: 70ch)
	High-speed cameras (3 units) / Imaging devices

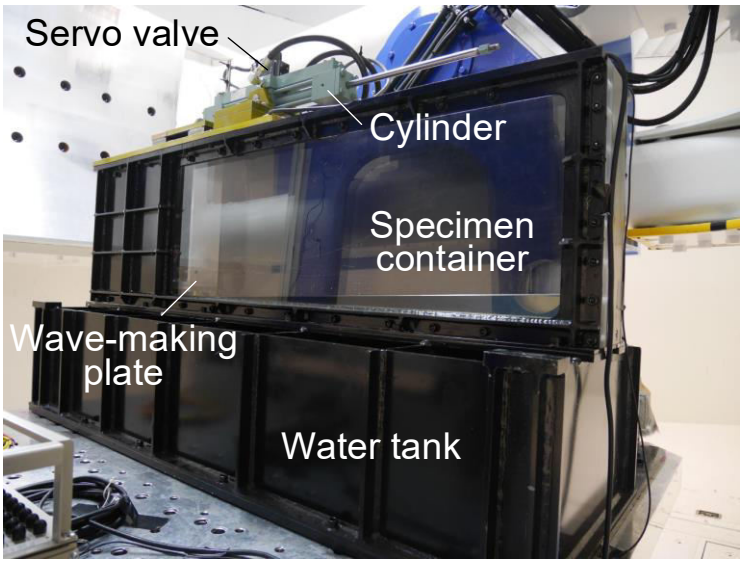
Shaking table

This high-power shaking table was manufactured to simulate huge earthquakes that can occur in Japan. The cylinder is mounted on the side of the table to provide a low and wide table. For static model testing where the platform is used extensively, it is a unit-type shaking table that can be removed in its entirety.



Wave flume

This is a wave generator and channel unit that can perform wave model tests in a centrifuge. The stability of structure and ground against waves can be investigated. It is equipped with a water flow device to control the water level in a narrow channel.



Paper Examples

Details of the centrifuge machine:

Terashi, M. (1985): Development of PHRI Geotechnical Centrifuge and its Application, Report of the Port and Harbour Research Institute, Vol. 24, No. 3, pp. 73-122.

Kitazume, M. and Miyajima, S. (1995): Development of PHRI Mark II Geotechnical Centrifuge, Technical Note of the Port and Harbour Research Institute, No. 817, 33p.

Takahashi, H., Fujii, N., Morikawa, Y., and Takano, D. (2019): Development of hydro-geotechnical centrifuge PARI Mark II-R, Technical Note of the Port and Airport Research Institute, No. 1353, 27p.

Shaking table:

Takahashi, H., Takahashi, N., Morikawa, Y., Towhata, I., and Takano, D. (2016): Efficacy of pile-type improvement against lateral flow of liquefied ground, Géotechnique, Vol. 66, Issue 8, pp. 617-626.

Takahashi, H., Fujii, N., and Sassa, S. (2020): Centrifuge model tests of earthquake-induced submarine landslide, International Journal of Physical Modelling in Geotechnics, Vol. 20, Issue 4, pp. 254-266.

Wave flume:

Takahashi, H., Morikawa, Y., and Kashima, H. (2019): Centrifuge modelling of breaking waves and seashore ground, International Journal of Physical Modelling in Geotechnics, Vol. 19, Issue 3, pp. 115-127.

Takahashi, H., Zdravković, L., Tsiampousi, A., and Mori, N. (2022): Destabilisation of seawall ground by ocean waves, Géotechnique. (Ahead of print)

Dam-break tsunami simulator:

Takahashi, H., Sassa, S., Morikawa, Y., Takano, D., and Maruyama, K. (2014): Stability of caisson-type breakwater foundation under tsunami-induced seepage, Soils and Foundations, Vol. 54, Issue 4, pp. 789-805.

Takahashi, H., Morikawa, Y., Mori, N., and Yasuda, T. (2019): Collapse of concrete-covered levee under composite effect of overflow and seepage, Soils and Foundations, Vol. 59, Issue. 6, pp. 1787-1799.

Vertical and horizontal loading devices:

Takahashi, H. (2021): Stability of composite-type breakwaters reinforced by rubble embankment, Soils and Foundations, Vol. 61, Issue 2, pp. 318-334.

Embankment simulator:

Kitazume, M. and Maruyama, K.(2006): External stability of group column type deep mixing improved ground under embankment loading, Soils and Foundations, Vol. 46, Issue 3, pp. 323-340.

Grout injection machine:

Nishimura, S., Takehana, K., Morikawa, Y., and Takahashi, H. (2011): Experimental study of stress changes due to compaction grouting, Soils and Foundations, Vol. 51, Issue 6, pp. 1037-1049.