Key Laboratory of Geotechnical Mechanics and Engineering of the Ministry of Water Resources

Director: Prof. Dr. Bo HU
Manager: Bo LI
Contact: Bo LI
Website: http://www.crsri.cn/
Owner: Changjiang River Scientific Research Institute
Location: Wuhan, China

Introduction

Physical modelling is indispensable to derive insights on the key factors affecting the performance of geotechnical systems, to properly validate numerical models, and to evaluate the efficiency of innovative solutions (proof-of-concept). The Changjiang River Scientific Research Institute encompasses two geotechnical centrifuges, a 6 m diameter (180 gton capacity, built in 1983) beam centrifuge and a 3.75 m diameter (200 gton capacity, built in 2008) beam centrifuge. The new geotechnical centrifuge is equipped with a earthquake simulator, a three-direction movable manipulator equipment, a rainfall and water level change simulation device. Our experimental infrastructure is predominantly used for research and we also offer highly-specialized consulting services to the industry.

Changjiang River Scientific Research Institute

Key Technical Spefications

Beam Centrifuge	
Manufacturer	China Academy of Engineering Physics
Year established	2008
Radius to base of soil container	3.75m
Capacity	200 gton (2 tons @100g, max G-level: 200g)
Bucket area	1.2 m x 1.0 m
Major equipment	Earthquake simulator (capacity 0.3 tons @50g) Dropping device for loose particles in a centrifugal field Three-direction movable manipulator equipment Rainfall and water level change simulation device

Beam Centrifuge

The beam centrifuge consists of an arm supporting two swings, in which the model and the counterweight are installed. It is connected to the chamber with a bottom and a top bearing, ensuring higher stability of operation. The centrifuge is not brand new, but rather an example of how existing

equipment can be reused for research. There are two centrifuges in CRSRI, one was built by ourselves in 1983 and out of service rightnow, the other one in use was built in 2008.

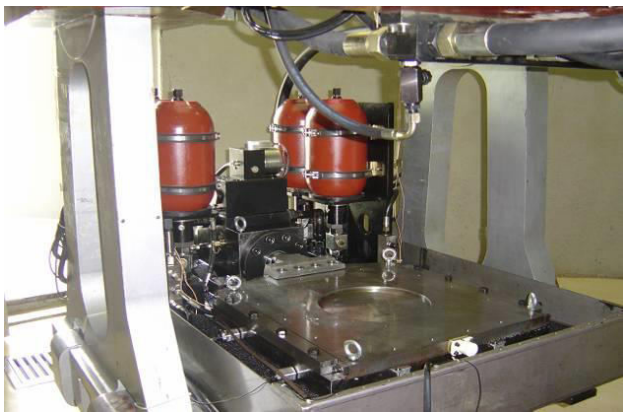
CKY-180 geotechnical centrifuge at Changjiang River Scientific Research Institute（1983，out of svervice）

CKY-200 geotechnical centrifuge at Changjiang River Scientific Research Institute(2008, in use)

With an effective diameter of 7.5 m, the CKY-200 centrifuge can be accelerated up to 200g carrying a payload of 1 tons (or equivalently 2tons at 100g). The dropping device for loose particles can carried 200kg material at 100g. This device can simulate the construction of horizontal and vertical blocking methods. The horizontal polishing density obtained from centrifugal test provides a basis for conducting physical and mechanical tests. The research results have also been applied to the cofferdams of water conservancy projects such as the Three Gorges, Baihetan, Datongxia, and Nianpanshan.

Earthquake Simulator

Custom-designed for the CKY-200 centrifuge, the earthquake simulator is capable of delivering horizontal seismic ground motions of any target waveform (including recorded and artificial motions) at up to 20 g peak ground acceleration on packages of up to 300 kg over a wide frequency band, at a maximum centrifugal acceleration of 50g.



The earthquake simulator on the centrifuge basket.

The laminar box used in this study consists of 25 stacked rings, which are made of hollow aluminum alloy to minimize the payload mass. The inner dimensions of the box are 700mm length by 3500mm width by 600mm height. A membrane, 1 mm thick, was used to create a water-tight containment for the saturated sand or clay deposit in the shear box. The laminar box with stacked rings was proposed to simulate the flexible boundary conditions, and rigid boundary conditions while these rings were fixed.