

UFRJ Centrifuge Modelling Multiuser Laboratory

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Introduction

The COPPE/UFRJ Centrifuge Modelling Multiuser Laboratory (LM2C) encompasses two geotechnical centrifuges, a 1.6 m diameter (60 gton capacity) mini-beam centrifuge and a 1.06 m diameter (90 gton capacity) mini-drum centrifuge and a variety of actuators, tool platforms, and highly specialized devices and sensors. Our experimental infrastructure is predominantly used for research and teaching purposes. On demand, we also offer highly-specialized consulting services to the industry.

Key Technical Specifications

Mini-Beam Centrifuge	
Manufacturer	Broadbent
Year established	2012
Radius to base of soil container	0.75 m
Capacity	60 gton
Bucket area	0.10 m x 0.30 m
Major equipment	2-Axis Actuator

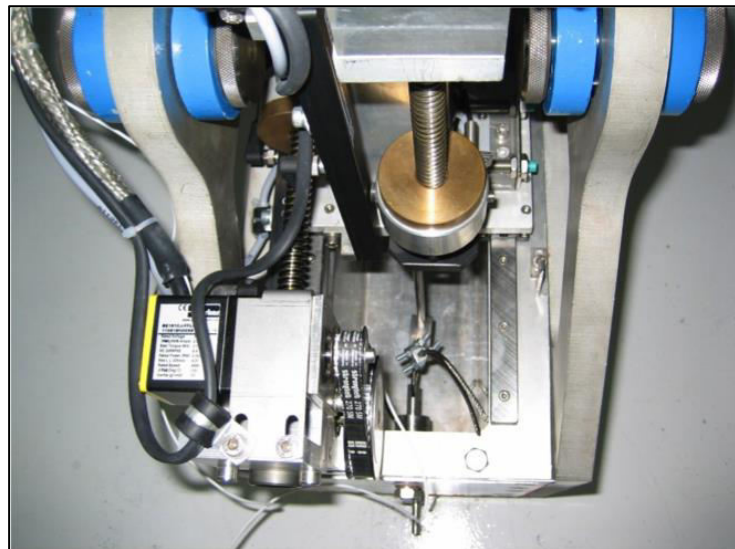
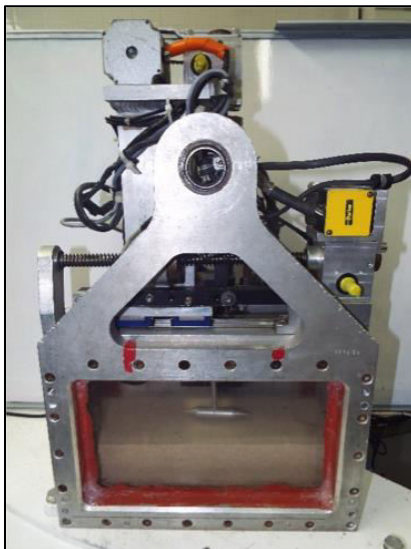
Mini-Drum Centrifuge	
Manufacturer	G-Max Scotland
Year established	1995
Radius to base of soil container	0.48 m
Capacity	90 gton
Channel dimensions	0.5 m x 0.25 m x 0.20 (Radius x H x D)
Major equipment	2-Axis Actuator

Beam Centrifuge

The beam centrifuge consists of an arm supporting two swings, in which the model and the counterweight are installed. The centrifuge was constructed by Broadbent and was commissioned in 2012 at LM2C, where it is under operation since then. With a diameter of 1.6 m, the centrifuge can be accelerated up to 300g carrying a payload of 0.2 tons. A key advantage of the beam centrifuge is that the model can be installed without 90° rotation (as in the drum centrifuge), thanks to the swing which rotates progressively with the increase of the g-level. As a result, the model base is always perpendicular to the acceleration vector. Each swing has a platform of 0.10 x 0.30 m, where the soil container is placed.



COPPE/UFRJ Mini-Beam Centrifuge at LM2C.



Mini-Beam centrifuge (a) container (b) 2-Axis Actuator.

Drum Centrifuge

The geotechnical drum centrifuge consists of a main channel, in which the model is built or placed, and a tool platform, where actuators and sensors can be mounted together with the data acquisition systems. With a diameter of 1.0 m, 0.25 m height and 0.20 m depth, the channel can be accelerated up to 200g carrying a payload of up to 0.45 tons. A key advantage of the drum centrifuge is that the entire channel can be filled with soil, creating a large model deposit in length. Smaller models can be tested using strongboxes, prepared outside and placed on the channel.

The rotation of the channel and the tool platform is provided by an external and an internal shaft, respectively. The tool platform spins together with the channel. Communication between the on-board computer and the control room is provided by sets of electrical slip rings. An additional slip ring is mounted on the tool platform over the internal shaft, allowing supply of water to the spinning model from an external source.



G-Max Scotland geotechnical drum centrifuge with two cylindrical strongboxes installed.

Besides the data acquisition system and the on-board computer, the tool platform is equipped with vertical and horizontal servo-electric actuators. The system allows actuation in 2 degrees of freedom (vertical and lateral). The actuators are equipped with load cells and laser displacement transducers to control and measure the results of the test. Depending on the specific needs of the test, different tool platforms are available, containing other types of actuators and instruments.

Auxiliary Equipment

The LM2C Laboratory also comprises an Adensometer and a Sand raining system. The Adensometer, produced by THOMAS BROADBENT & SONS LTD., allows preparing soil samples with pre-established tension and degree of consolidation for arm centrifuge testing. The sand raining system allows building sand layers with highly accurate specific relative densities, ideal for tests with sands.



(a) Adensometer (b) Sand raining system.