BOKU Vienna Geotechnical Centrifuge Centre

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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 BOKU Vienna Geotechnical Centrifuge Centre owns one beam geotechnical centrifuge, 3 m diameter (maximum acceleration 200 g) and a rainfall simulation device[1], a linear actuator, load cells, displacement transducer and strain gauges. Our experimental infrastructure is predominantly used for research purposes. On demand, we also offer highly-specialized consulting services to the industry. The centrifuge is currently (01.2023) located in the underground laboratory of the IGT. The centrifuge is operated from a separate control room (Figure 1). In the future, it will be moved to a newly built Civil Engineering and Natural Hazards department laboratory.

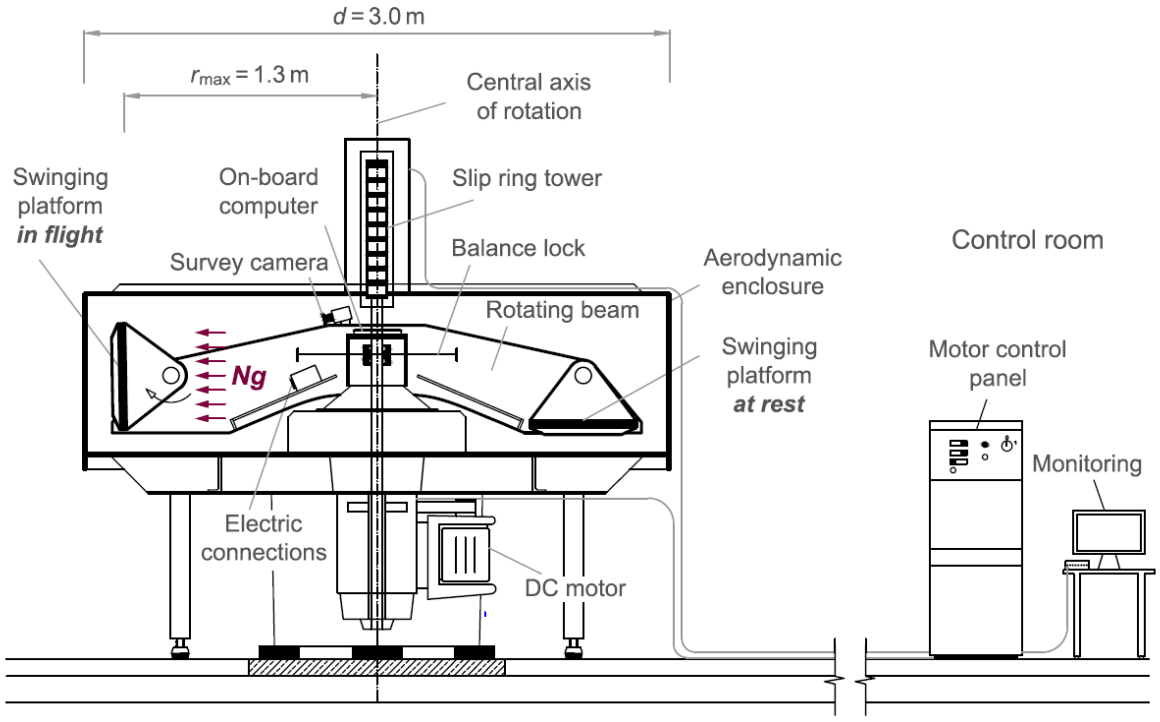

Figure 1. The BOKU Vienna Geotechnical Centrifuge Centre.

[1] Wang, S., Idinger, G. (2021) A device for rainfall simulation in geotechnical centrifuges. *Acta Geotechnica*. 16 (9), 2887-2898. doi: https://doi.org/10.1007/s11440-021-01186-w

Key Technical Specifications

Beam Centrifuge	
Manufacturer	TrioTech, California
Year established	1989 IGT
Radius to base of soil container	1.085 m
Capacity	10 gton (1 ton @110g, max G-level: 200g)
Bucket area	0.54 m x 0.56 m
Major equipment	Rainfall simulation device

The beam centrifuge was constructed by TrioTech in 1989 (Model 1231 Standard Heavy Duty). It consists of an arm supporting two swinging baskets, in which the model and the counterweight are installed (Figure 2). It is connected to the chamber with a bottom and a top bearing, ensuring higher stability of operation. Although the centrifuge is not brand new, it is an example of how existing equipment can be sustainably used for research.

With an effective diameter of 2.17 m, the centrifuge can be theoretically accelerated up to 200g. At 100g, the maximum load is 1 ton. The IGT centrifuge is the only one in Austria. A key advantage of the beam centrifuge is that the model can be installed upright (as in a drum centrifuge) thanks to the swinging basket that rotates progressively with the increase of the g-level. As a result, the model base is always perpendicular to the acceleration vector during flight. Each swinging basket has a platform of 0.54 x 0.56 m, where the soil container is placed. The setup offers the possibility of a soil container of up to 0.56 m height.

Figure 2. The BOKU Vienna Geotechnical Centrifuge.

Rain simulation device

Custom-designed for the TrioTech centrifuge, the rainfall device for initiating slope failure in a medium-sized centrifuge is simple, robust and affordable. An array of perforated hoses is placed close above the model slope surface to generate the raindrops. The rainfall intensity depends on the centrifuge acceleration and the flow rate of the water supply, which is controlled by the size and number of the tiny pinholes in the hose walls. The rainfall intensities that are tested range from 2.5–30 mm/h, covering the intensity range of moderate, heavy and torrential rainfall events. Model tests with rainfall-induced slope failure show that this system is capable of generating relatively uniform rainfall of wide intensities and leads to various patterns of slope failure (Figure 3).

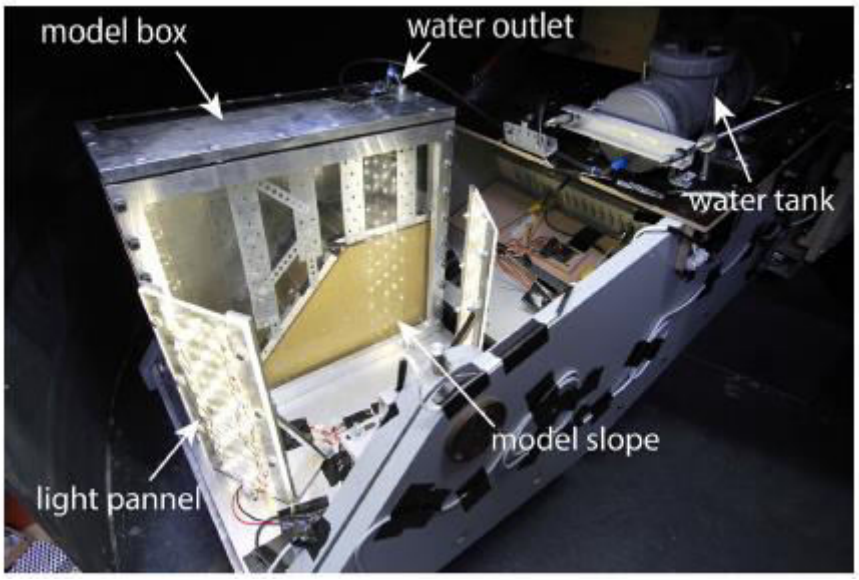

Figure 3. Rainfall simulation device. Water storage and distribution system.