TU Wien
Faculty of Civil and Environmental Engineering
Institute of Structural Engineering
Research Unit Mechanics and Structural Dynamics
Karlsplatz 13 | E212-03 | 1040 Vienna | Austria
www.tuwien.at/cee/tragkonstruktionen/bmdyn

Master's Thesis

Experimental Investigation of Failure Mechanisms in a Novel Interlocking Plastic Block System

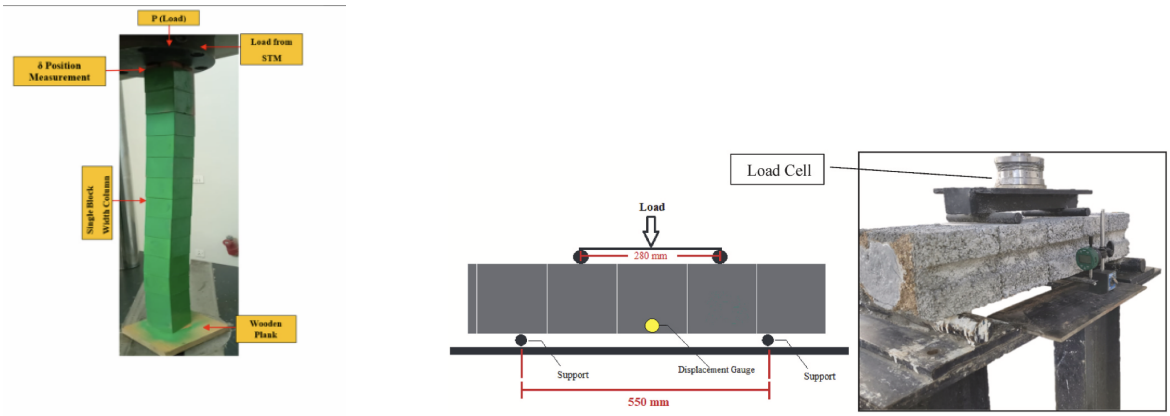
Motivation

Amid increasing pressures for sustainability, circularity, and cost-effective solutions, innovative construction techniques are becoming ever more significant. One notable example is a patented modular plastic building system that, similar to a large-scale interlocking brick concept, uses a plug-in connection method, enabling both rapid assembly and straightforward disassembly for subsequent reuse. Furthermore, the hollow cores of the blocks can be filled with concrete and reinforced, allowing the system to be flexibly tailored to diverse structural and architectural demands. This combination of reversibility and versatility represents a major advantage over conventional construction approaches and unlocks new possibilities for sustainable, resource-efficient building.

Due to its plug-in connection principle, the mechanical behavior of this system is expected to differ fundamentally from conventional masonry construction. Rather than exhibiting purely monolithic or purely masonry-like failure, the system is anticipated to show a transitional behavior between these two extremes, governed by the interaction between individual blocks and their interlocking connections. Understanding these failure mechanisms under static loading conditions is therefore a key prerequisite for any future structural assessment. This master's thesis offers the opportunity to contribute directly to the experimental characterization of an innovative, patented product and to develop simplified analytical models that capture its essential mechanical behavior.

Tasks

- Experimental investigation of failure modes of individual blocks and block assemblies under static loading conditions, including compressive, flexural, and shear configurations
- Identification and classification of governing failure mechanisms, with particular focus on the transitional behavior between monolithic and masonry-like failure due to the interlocking connection system
- Testing of beam-type configurations to study flexural failure and of panel-type arrangements to investigate shear failure behavior
- Development of simplified analytical models to describe and predict the observed mechanical behavior, based on the experimental results and material properties provided by the manufacturer



(a) Interlocking plastic block system (Adnan et al. 2022, doi:10.3390/buildings12122257).

(b) Flexural test on lightweight interlocking blocks (Hosseinzadeh et al. 2025, doi:10.1016/j.jobe.2025.113699).

Figure 1: Examples of interlocking block construction systems.

Prerequisites

An interest in laboratory testing and basic knowledge of structural mechanics are required. Knowledge of materials science and analytical modeling methods is an advantage.

Supervisors

Univ.Prof. Dr.-Ing. Francesca Taddei, francesca.taddei@tuwien.ac.at
Univ.Ass. Alexis-Michael Eilers, M.Sc, alexis-michael.eilers@tuwien.ac.at

Start

Available immediately.