



POLITECNICO
DI TORINO

Honors thesis

COURSE OF ARCHITECTURE FOR THE SUSTAINABILITY DESIGN

Abstract

**The anti-seismic capacity and enhancement of earthen
structures.**

Earthen architecture for the urban context of Bogotá, Colombia.

Tutor

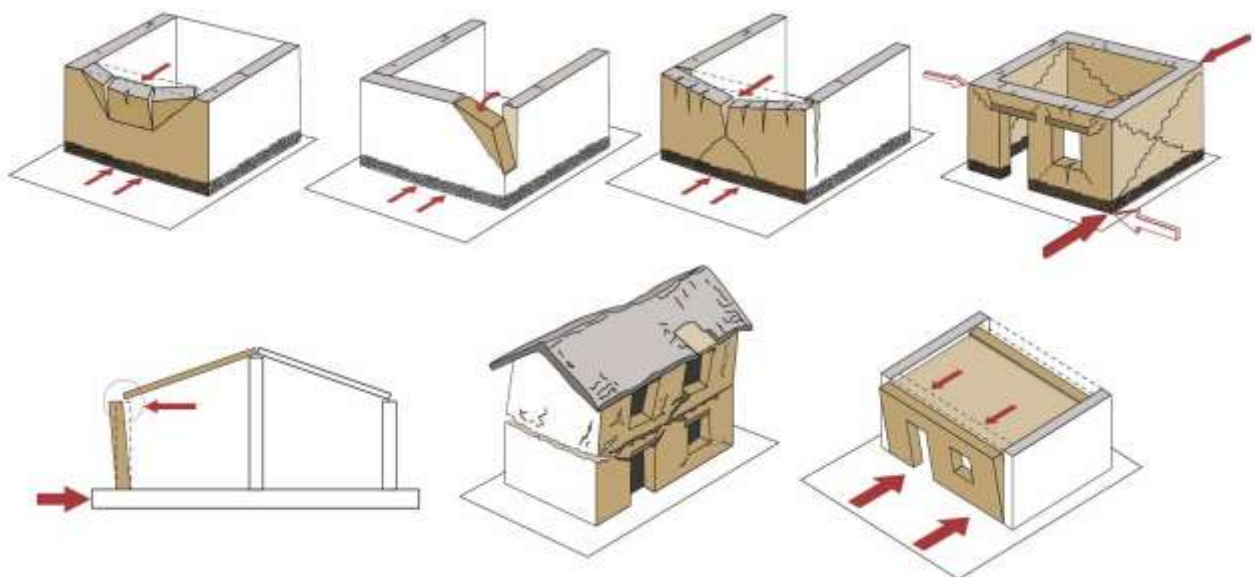
Francesca De Filippi; Roberto
Pennacchio; Luciana Restuccia.

by

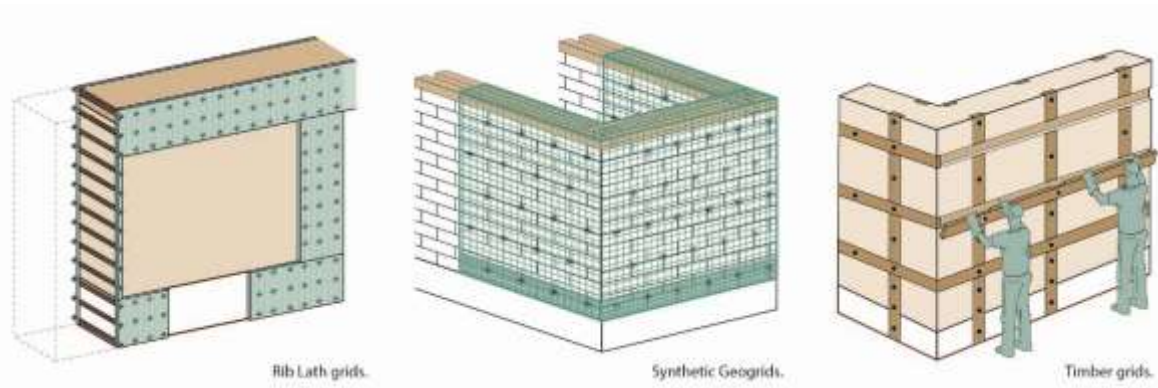
Santiago Torres Dueñas.

December 2018

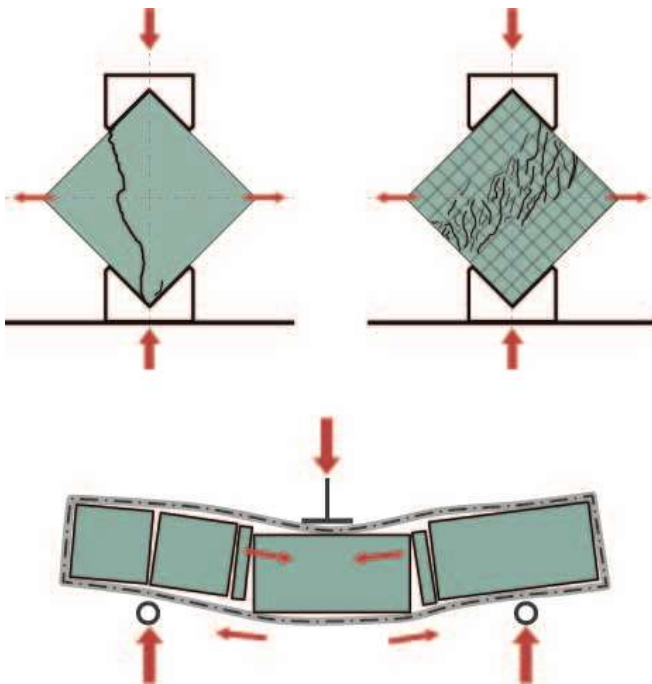
In consideration of the sustainable advantages of earthen construction, there is questioned the feasibility of an earthen building in the urban context of Bogotá, Colombia. Several aspects of earthen buildings and Bogotá's context are analyzed: the construction process of earthen buildings, the constructive regulations and earthen traditions in the country, and the geographical and socio-economic conditions in Bogotá. Hence is made a research on the main earthen techniques of the country: tapia (rammed earth), adobe, bahareque and CEB, their characteristics and construction processes are shortly described in order to find why these are not largely used in cities. In coherence to the seismic hazard of Colombia the investigation has special focus on the structural and anti-seismic capacity of earthen architecture, as an aspect that requires enhancement to enable earthen buildings to be constructed in Bogotá. Thus, the present document is proposed as a manual of anti-seismic solutions for earthen buildings. There are identified three main strategies to enhance the earthen buildings in seismic zones: the entire building behavior; the box-behavior of the structure; and the enhancing of load-bearing wall strengths. Furthermore than the appropriate constructive procedures, this investigation was deepened in the enclosing reinforcements for earthen load-bearing walls. Based on structural reinforcements for generic plasters and the mechanical enhancement of cementitious composites with micro inert biochar additive, here is proposed as technological innovation the experimental investigation to test an earthen plaster enriched with biochar additive (EPEB) expecting it can contribute to enhance the structure stability during earthquakes.



Failure mechanisms of earthen buildings.



Enclosing reinforcements.



Diagonal shear test &
Tree-point bending test.

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