Learning From Full-Scale Testing of a Rubble House

Jacob T. David; Peyton Lingle; Jeffrey Lytle; William Lotz; Fatih Oncul, Ph.D
www.spsu.edu/rubble-house :: rubble-house@spsu.edu

1. Overview

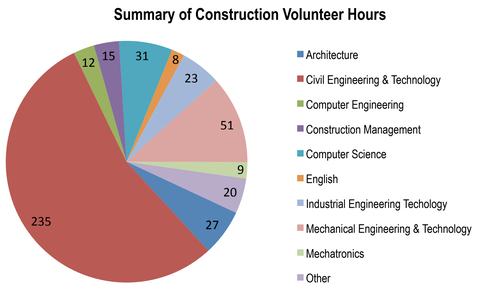
- The 2010 earthquake in Haiti killed over 300,000 people, and left thousands of families homeless and tons of rubble in urban areas.
- In response to this tragedy, replacement houses are being built by NGOs using welded wire baskets and rubble as an immediate and inexpensive solution for the needy.
- In August 2011, Southern Polytechnic State University and Conscience International initiated a research study to understand the seismic resistance of rubble houses.
- A 14' wide, 20' long and 8' tall rubble house was built on SPSU campus, and then subjected to a series of static loads.
- The project depended on voluntary collaboration; over 600 labor hours was spent between students, faculty, and sponsors for construction.

2. Objectives

- Create a student-centered environment to support research and apply learned knowledge to real-life problems
- Increase students' sensitivity to community issues; promote volunteerism
- Promote team-based learning and interdisciplinary collaboration
- Test and evaluate construction techniques on a full scale Rubble House

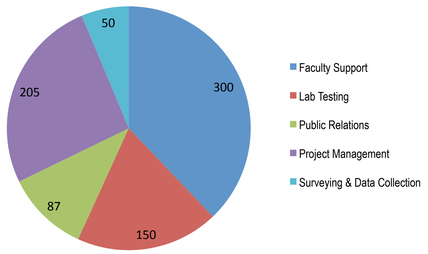
3. Participation

Total: 431 Hours



Grand Total: 1223 Hours

Total: 792 Hours



4. Construction

3 Days
Preparing/Pouring
Foundation

5 Days
Making Wire
Basket Walls

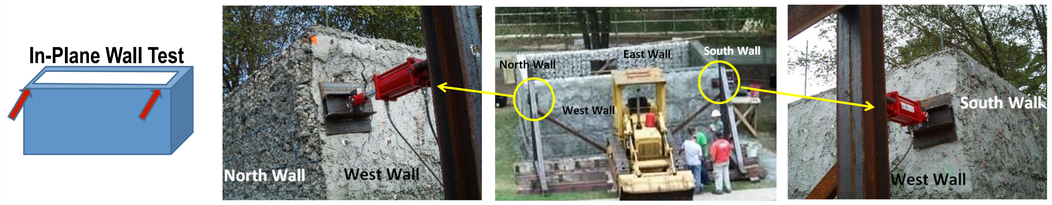
12 Days
Filling Wire Baskets
with Loose Rubble

4 Days
Applying Cement
Wall Finish

5. Field Tests On SPSU Campus

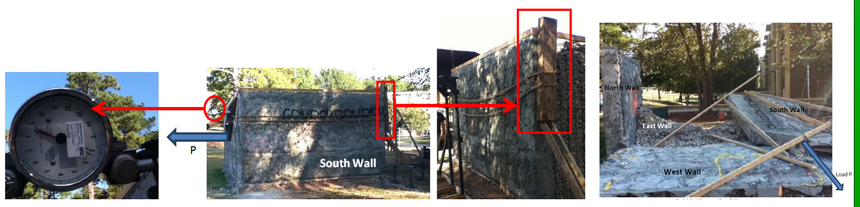
Three field tests were conducted to assess mechanical behavior of rubble walls under static loads. Measurements were taken using displacement gauges, total stations, and 3-D point cloud laser scanner.

In-Plane Wall Test



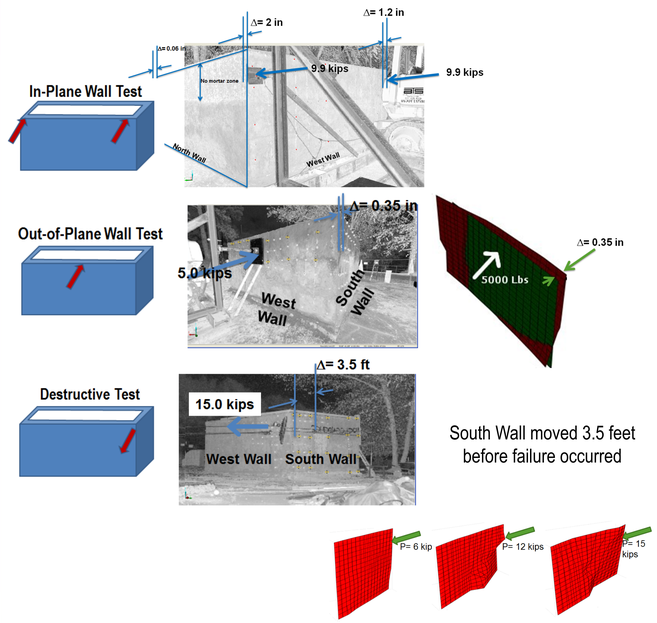
Out-of-Plane Wall Test

Destructive Test



6. Results

Displacements were measured at varying load increments. The diagrams below display images acquired by the point cloud scanner, along with maximum deflection measured for each field test.



South Wall moved 3.5 feet before failure occurred

7. Conclusions & Future Plans

- Surveys indicate students involved were able to develop and apply skills learned in the classroom to the field, while helping the community. Further activities are being planned to engage more students and faculty.
- The rubble house demonstrated great resistance and ductility against applied static loads (more than anticipated seismic loads), proving to be a viable solution for low-income residents in earthquake stricken areas.
- Full-scale shake table tests are strongly recommended to verify seismic resistance of rubble houses as a future study.

Core Team Members

SPSU Faculty:
Fatih Oncul, Ph.D, Asst. Professor
Wasim Barham, Ph.D, Asst. Professor
Metin Oguzmert, Ph.D, Asst. Professor
Pavan Meadati, Ph.D, Asst. Professor
John Lee, RLS, Lecturer
Daniel Branham, RLS, Lecturer

SPSU Administration:
Ruston Hunt, Ph.D, Dean
Steve Kitchen, Senior Director

Field Supervisor:
Jeremy Holloman, Conscience International, Inc.

SPSU Students:
Jacob T. David (CET)
Jeffrey Lytle (CET)
William Lotz (CET)
Chance Dennis (CET)
Teona Edwards (CET)
Christian Bougoullion (CE)
Peyton Lingle (CE)
Bri Mason (CS)

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