EERI VERT Chiapas Earthquake

Performance of Buildings in Guatemala

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CONRED - Earthquake Damage Report

- Affected regions:
  - Huehuetenango (Color in map: red)
  - Quetzaltenango (Color in map: blue)
  - Quiché (Color in map: blue)
  - San Marcos (Color in map: red)
  - Sololá (Color in map: blue)
  - Suchitepéquez (Color in map: blue)
  - Totonicapán (Color in map: blue)

- Damages
  - 18,810 affected persons.
  - 4 injured persons.
  - 677 houses with some damage.
  - 887 houses with moderate damage.
  - 1,006 houses with severe damage.
  - 12 roads affected.
  - 2 bridges damaged.
  - 25 buildings affected.
  - 10 churches affected.
  - A tsunami alert was issued.

https://conred.gob.gt/site/index.php
In Guatemala City, the earthquake was felt by most of the population but no significant damages were reported.

Most of the regions affected by the earthquake have been affected by at least 4 significant Seismic events in the past 5 years which are the following:

- 2,012 - San Marcos, M = 7.4
- 2,014 - San Marcos, M = 6.9
- 2,017 - San Marcos, M = 6.9
- 2,017 - Escuintla, M = 6.8

Most structures collapsed due to poor construction. Traditional constructions are made of adobe, or “clay bricks” which have shown poor Seismic response in the past events.

In general, the construction industry in the affected regions is informal and undeveloped.
Overview of topic and how it affected various regions

- Over 21 thousand affected in Guatemala: One of the most affected areas is Huehuetenango including 9 buildings, 3 churches and a school. (http://www.prensalibre.com/ciudades/guatemala/mas-de-21-mil-afectados-ha-dejado-el-terremoto-en-guatemala)
- 33 schools, 10 churches and 25 buildings damaged in Guatemala. The National Coordinator for Hazard Reduction (CONRED in Spanish) is still evaluating the damages in Huehuetenango and San Marcos, both neighboring the Mexican border with Guatemala. (http://noticieros.televisa.com/ultimas-noticias/internacional/2017-09-11/suman-mas-21300-damnificados-guatemala-sismo-mexico/)
- Damages are focused on the departments of Quetzaltenango, Quiché, San Marcos, Suchitepéquez, Totonicapán and Huehuetenango being the latter the most affected. Reports of collapsed buildings in Tacaná (https://elperiodico.com.gt/nacion/2017/09/08/desolador-panorama-por-danos-causados-por-terremoto-de-7-7-grados-en-el-occidente/)
- The Municipality of Tacaná has counted 8 houses at high risk, 182 with severe damages, 20 with minor and 44 with moderate damage. https://elperiodico.com.gt/nacion/2017/09/08/tacana-es-uno-de-los-poblados-marquenses-mas-golpeados-por-el-terremoto-de-anoche/
Overview of topic and how it affected various regions

• Key facilities affected: Retalhuleu Departamental Palace (previously damaged suffered further damage)

Overview of topic and how it affected various regions

• Facilities affected: Damaged Parish in San Marcos

http://www.prensalibre.com/ciudades/guatemala/mas-de-21-mil-afectados-ha-dejado-el-terremoto-en-guatemala

Overview of topic and how it affected various regions

• Facilities affected: Buildings damaged in Tacaná of San Marcos, Guatemala.

Overview of topic and how it affected various regions

• Facilities affected: Buildings damaged in Tacaná, Guatemala.

http://lahora.gt/mas-18-mil-afectados-terremoto-del-pasado-jueves/#prettyPhoto
Quetzaltenango

Moderate damage in historic building.

Collapse of poor quality construction.

http://www.prenslibre.com/guatemala/comunitario/fuerte-sismo-sacude-guatemala
Quiché

 Collapse of poor quality construction.

http://www.prens libre.com/guatemala/comunitario/fuerte-sismo-sacude-guatemala
Huehuetenango

Cracks in old building.

http://www.prensalibre.com/guatemala/comunitario/fuerte-sismo-sacude-guatemala
San Marcos

Collapsed wall

Collapsed wall

San Marcos

Most Affected Area - Tacaná
San Marcos – Tacaná

 Severly damaged building.

 Severly damaged building.

San Marcos – Tacaná

Collapsed front wall.

Damages in old church
San Marcos – Tacaná

Collapsed Wall in house.


Broken windows in church.
San Marcos – Tacaná

Damages on interior walls.


Damages on exterior Wall of house
Questions that a reconnaissance team could look into

• Performance of the most common building types in Guatemala and failure patterns
• Common structural and construction deficiencies of buildings in Guatemala
• Adoption and implementation of building code in Guatemala
• Review of building code in Guatemala—Technical Limitations and Recommendations if any
• What are the lessons to be learnt in the aftermath of this earthquake?
• Does Guatemala require that buildings be designed considering high seismic forces?
- Are there retrofit guidelines for buildings in Guatemala?
- Were there any retrofitted buildings affected? How did they perform?
- Which building types did better? Height, structural systems, material types, age, etc.
- Are there any signs of soil amplification? Local site effects on damage severity of building?
Links to media articles discussing the topic


https://twitter.com/CRGuatemalteca/status/906040289009303552