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)
  - Suchitepequez (Color in map: blue)
  - Tococapán (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](https://conred.gob.gt/site/index.php)
Some Important Points

● 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](http://www.prensalibre.com/ciudades/guatemala/mas-de-21-mil-afectados-ha-dejado-el-terremoto-en-guatemala))
- 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/](https://elperiodico.com.gt/nacion/2017/09/08/desolador-panorama-por-danos-causados-por-terremoto-de-7-7-grados-en-el-occidente/))
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.prensalibre.com/guatemala/comunitario/fuerte-sismo-sacude-guatemala
Quiché

Collapse of poor quality construction.

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

Cracks in old building.

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

Landslide on road (reported the next day)
San Marcos

Collapsed wall

Collapsed wall

San Marcos

Most Affected Area - Tacaná
San Marcos – Tacaná

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