


2.8. Lessons from Pisco Earthquake in August, 2007 (Hiroto KATO)

ペルー太平洋岸地震の教訓 (加藤博人)

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Lessons from Pisco Earthquake in August, 2007

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References

Some photos used in this presentation are quoted from the following references.

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- Ricardo Proaño, Luis Quiroz, Sebastian Schmidt, Jenny Taira, Miguel Estrada, Patricia Gibu, Audry Camacho, Dandy Roca, Rafael Salinas, Francisco Ríos, Matthias Wild, Markus Englemer, Eduardo Arellano, Carlos Zavala, Leslie Chang, Lourdes Cardenas, Inspeccion Preliminar a la Zona de Desastre Sismo del 15 de Agosto del 2007, CISMID, UNI (be called CISMID 3 for short)
- Jörgen Johansson, Paola Mayorca, Tatiana Torres and Edwin Leon, A Reconnaissance Report on The Pisco, Peru Earthquake of August 15, 2007 by JSCE, JAEE and University of Tokyo with the collaboration of CISMID, UNI (be called Johansson, et al. for short)

Observed Typical Failure Patterns on RC and CM Structures

Typical failure patterns on **RC and confined/
infilled masonry wall structures** were similar to
those of previous earthquake damages.

- damage in upper story
- damage/collapse in intermediate story
- collapse in first story
- torsional failure
- shear failure on short column
- failure of beam-column joint
- destruction of masonry wall out-of-plane
- Problem/ inadequate structural design and construction works

Damage of Confined Masonry Structures



(San Clemente)

from Johansson, et al.



(Pisico Pueblo)



(Chincha Alta)

damage in intermediate story

from CISMID 1

Damage of Confined Masonry Structures



Close-up View of beam-column joint



Back View



Front View

Destroyed building due to the torsional vibration by eccentricity of stiffness (Pisco)

from Johansson, et al.

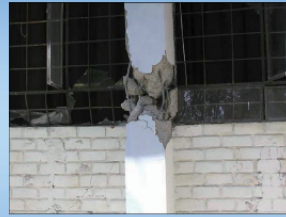
Damage of Confined Masonry Structures



Columns in the 1st floor are not aligned with the columns in the 2nd floor. One of the columns is interrupted in the 2nd floor. (Molinos, Ica)

from Johansson, et al.

Damage of RC Frame Structure with Infilled Masonry Wall



shear failure of short column with spandrel wall

from Johansson, et al.

Confined Masonry and RC Structures



from CISMID 3

no damage



no damage

New RC building with proper size of column and beam, in addition structural slit between column and spandrel wall

These examples prove the validity of the current design regulations.

- NTE E.030 Seismic design code (latest revision 2003)
- NTE E.060 Reinforced concrete (latest revision 1989)
- NTE E.070 Masonry (latest revision 2006)

Observed Typical Failure Patterns on Adobe Constructions

- complete collapse
weak materials, without reinforcement and flexible slab/roof, etc.
- out-of-plane destruction of masonry wall
without reinforcement, insufficient connection to column
- to build an inadequate extension

Damage of Adobe Structures



(Pisco)



(Pisco Pueblo)



(Chincha)



(Ica)

from CISMID 1

Damage of Adobe Structures



Adobe house with plaster spalling and corner destruction (San Luis, Canete)



Collapsed adobe house (Nuevo Monterrico, Canete)



from Johansson, et al.

Subjects for Earthquake Disaster Mitigation

- ✓ Seismic Evaluation for Existing Buildings
- ✓ Seismic Rehabilitation/Retrofit of Vulnerable Buildings
- ✓ Education to Citizens
- ✓ Disseminate the knowledge of disaster prevention to large earthquakes
- ✓ Awareness of earthquake disasters to citizen