2010 Haiti Earthquake
Homes

Government Buildings
Schools

The 27 February 2010
South Central Chile
Earthquake
Engineered buildings

Santiago
Construction trend

Rene Lagos

Wall damage
Anchoring to concrete

Nonstructural
Christchurch 2010-2011

Darfield “aftershocks”

Focal Depth: ~5km
Epicenter: ~8km from CBD
Before

After
URM Damage - February

370 URM buildings in CBD
Ingham and Griffith, 2011

Life Safety

Outside ➔ Unsafe

Risk of fatalities outside building

Inside ➔ Safer?

Risk of fatalities inside buildings
(Ingham 2011)
Retrofit Strength vs Damage

Nonductile concrete

Ingham and Griffith, 2011
185 confirmed fatalities
- 115 in CTV building
- 18 in PGC building
- 42 in and around URM

Approximately 6500 injuries

Overall Structural Performance

CBD Tagging as of March 18 2011
RC Building Performance

Distribution of placards for concrete frame and wall buildings in CBD as of 12 June 2011

Critical Building Project

- ~40 “Critical buildings”
- Advise City on action to reduce hazard during State of Emergency.
  - Stabilize, Demolish, or Leave it for the owner?
Christchurch – One year after

Central Business District – Cordon (114 Square Blocks)
Tohoku, Japan 2011

Ground Acceleration Records

http://outreach.eri.u-tokyo.ac.jp/eqvolc/201103_tohoku/#tsunamiheight

Acceleration Time History (EW direction)
High-rise buildings
Performance of School Buildings; without Seismic Retrofit

Performance of School Buildings; with Seismic Retrofit Done
Peak Water Level Measurements

- Typical inundation depth from 10m to 20m
- Maximum runup of 38m and 40m

Tsunami Damage to Structures

- Overturned Koban (in Onagawa, RC, two-storied)
- Hotel partially intact (in Miyako, S, six-storied)
- Collapsed Building (in Rikuzen-takatata, RC, one-storied)
- Collapsed Railway Bridge (in Tanohata, RC)
- Collapsed Seawall (in Yamada, RC)
- Overturned Brick Wall (in Watari, Concrete Block)
Types of Debris

- Fire Truck in Otsuchi
- Power poles and tree trucks
- Failed seawall
- Debris damming

Map of World with Chile, NZ and Japan