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Earthquake Reconnaissance

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Outline

• General Earthquake Information

• Some Observations
  – Chengdu
  – Dujiangyan
  – Xiaoyudong
  – Hanwang
  – Pintong

• Lesson Learned
Magnitude: 8.0 (7.9 USGS)
Fault Rupture: ~300 km x 30 km
Surface Displacement: 5m (v), 4.8m (h)
Largest Recorded PGA: 0.65g
Death: ~70,000
Missing: ~20,000
Injured: ~380,000
Economic loss: ~$450B

The map is from CEA website (http://www.ceagov.cn:99/)
The Felt Areas of the Wenchuan M8.0 Earthquake

2008年5月12日四川省汶川县发生8.0级地震，多个省市有震感

Epicenter

Felt Areas

Strongly Felt Areas

1,000 miles
Peak Ground Acceleration (E-W component) of Wenchuan M8.0 Earthquake

CEA website (http://www.cea.gov.cn:99/, no contour value was given)

* The contour values were estimated and may not be accurate.
Central fault

Frontal fault

Chengdu
Fault distance: 50~60 km, no damage
Central fault
Frontal fault
Dujiangyan
90% buildings damaged
102 buildings collapsed

Tourist City

Dujiangyan-Irrigation system, built 2,000 years ago
Collapsed building in Dujiangyan
Collapsed building in Dujiangyan
Damaged police station (new) in Dujiangyan
Damaged new hotel in Dujiangyan
Juyuan Middle School (300+ students were killed)
Zhipingpu Dam, built in 2005

Water level before earthquake
Luo Yu Zheng is crying for the losses of her son (Tao Liang killed at Juyuan MS) and house.

Results from the natural + manmade disasters

Juyuan MS survivor
Guo Tao (16)

Juyuan MS victim
Tao Liang (16)
Dangerous road
Damaged bridge

Lateral spreading
High Plateau Village

Houses with minor damage

Collapsed house

“the best house – good construction quality”
Collapsed and severe damaged houses in this area
Surface rupture

Bridge collapsed

Rupture
This may be the reason

House with some damage

Rupture
Collapsed school buildings
Collapsed school buildings
Collapsed school buildings
Family lunch on top of ruptured fault

Fault rupture

Minor damage
100+ students were killed

Collapsed school buildings
50+ students were killed in the Pintong ES. 40+ students were killed in the Fault area.
Massive landslide

Fault rupture

less damage (lower plate)

More damage (upper plate)
No damage to this house (about 50 m from the rupture)
Large landslide

Buried house

House
60+ people were buried
Earthquake science is the base for seismic hazard assessment and mitigation.
Lesson 2 – Design Ground Motion

Recurrence interval: 2,000 – 5,000 years

Building damage
1. Under design
2. Quality of construction

How about PGA with 5 and 2% PE in 50 yrs.?
Lesson 3 – Induced (secondary) hazards

Secondary Hazard
1. Landslide/Rock fall
2. Ground Motion Amp.
3. Liquefaction (reported)

Town of Hanwang
100% buildings damaged
Lesson 4 – Mitigation Works

Not necessary expensive
Not design for 0.6g PGA or larger
Thank you!