Reconnaissance Report

2016/02/06 Meinong Earthquake, Kaohsiung, Taiwan
Main damage area: Tainan

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2016/02/07
- **Epicenter:** 22.93N, 120.54E
- **Depth:** 16.7 km
- **Richter magnitude scale:** 6.4

(Courtesy of CWB, Taiwan)
Earthquake information

- Detailed information:
  Link to
  Central Weather Bureau, Taiwan

(Courtesy of CWB, Taiwan)
Earthquake information

- Maximum PGA at Caoling, Yunlin (120.68E, 23.60N)

(Courtesy of CWB, Taiwan)
Earthquake information

- Yongkang dist., Tainan (area with the collapsed residential building)

永康（TAI1）震度：5 級

地震資訊
發震時間：2016/02/06 03:57:27
震央位置：東經120.54度，北緯22.93度
深度：16.7公里，芮氏規模：6.4

測站資訊
測站Site: TAI1
測站時間：2016/02/06 03:57:15
測站位置：東經120.24度，北緯23.04度
震央距：33.34公里，方位角：111.87度

(Courtesy of CWB, Taiwan)
Earthquake information

- Downtown area, Tainan City

![Earthquake Graph]

(Courtesy of CWB, Taiwan)
Earthquake information

☆ : Main shock
● : Aftershocks
☆☆ : Main shock of Jiasian EQ, 2010/03/04

Courtesy of NCREE Taiwan (link to pdf file)
General damage situation (preliminary)

- **Buildings**
  
  Collapse: not more than 10 RC buildings, several URM buildings
  
  Inclined due to soil liquefaction: several RC buildings close to Yansuei River
  
  Moderate damage: no accurate number yet but not many
  
  - Most of the buildings look intact. The damaged buildings scatter in the east area of Tainan (Yongkang, Sinhua, Rende, Gueiren, Guanmiao, Yujing, Shanshang)

- **Casualties (2016/02/07)**
  
  24 deaths (22 in the collapse residential building)
  
  121 missing
  
  About 400 injuries
Collapsed Buildings

- King’s Town Bank
  Hsinhua (23.036588, 120.300981)

10 stories with 1-story basement
About 20 years old
1F-3F collapsed and inclined to the street side

1F-3F: Bank and office
Above 4F: rental suites
(not occupied so no casualties reported)
Collapsed Buildings

- King’s Town Bank
Collapsed Buildings

- King’s Town Bank

Before earthquake from Google street view
Collapsed Buildings

- King’s Town Bank

Before earthquake from Google street view

Possibly soft ground floor
Collapsed Buildings

- King’s Town Bank
Collapsed Buildings

- **Weiguan building** - **Yongkang** (23.005026, 120.261198)
Weiguan building

16 stories with 1-story basement
About 16 years old
Collapsed and overturned to the street side

1F-2F: commercial (big electronic store)
Above 3F: residential
Collapsed Buildings

- Weiguan building
  Before earthquake from Google street view
Collapsed Buildings

- Weiguan building
Collapsed Buildings

- Weiguan building
Collapsed Buildings

- Weiguan building
  - It seems there were no walls at the base floor
Collapsed Buildings
Collapsed Buildings

- Weiguan building

Failure at the steel coupler?
Collapsed Building

- Weiguan building

90-degree bend hooks were allowed to use before Chi-Chi earthquake. However the hooks drew the attention of the public opinion and is blamed for the collapse.
Collapsed Buildings

- **Weiguan building**

Used oil tanks cast in the concrete were used as inside formwork of non-structural façade to reduce the weight. Some local media mistook this for jerry-building.
Collapsed Buildings

- Weiguan building

An interactive rough 3D model was built by Dept. of Geomatics, NCKU with photo taken by drones. [click here](#)
Collapsed Buildings

- **Street Building**
  - Rende (22.989977, 120.267316)

3 stories +1-story rooftop additions
37 years old
Collapse at the ground floor

The upper stories were intact. It was demolished for safety reason.
Collapsed Buildings

- Street Building
Collapsed Buildings

- Street Building

The 2+1F buildings at the left side were built at the same time and they are intact.
Collapsed Buildings

- Street Building

The intact neighbor buildings are lower and have partially confined masonry panels (behind the closet and adjacent to the stairs) at the base floor.
Collapsed Buildings

- **Tachi Market**
  Tainan City (22.962476, 120.229978)

4 stories
About 31 years old
Collapse at the ground floor

1F: market
Above 2F: residence
Collapsed Buildings

- Tachi Market - Soft ground floor
Collapsed Buildings

- **Tachi Market**
  - The building (left) next to the market was mildly damaged.
Collapsed Buildings

- **Tachi Market** - The building arcade was originally cantilevered. Columns were added at the corner at 2013.
Collapsed Buildings

- **Tachi Market**
  - The column bases and the original cantilever beam ends were damaged.

Hinged connection
Collapsed Buildings

- Shanshang Market
  Shanshang (23.102771, 120.354864)

2 stories
About 30 years old
Collapse at the ground floor

1F: market
2F: residence
Collapsed Buildings

- Shanshang Market
Collapsed Buildings

- Shanshang Market
3 stories
About 30 years old
Moderate damage

- Shear cracks appeared on almost every column at 1F and some at 2F
- Ceilings and shelves damaged
Damaged Buildings

- Shanshang District Office
Damaged Buildings

- Shanshang District Office
Intact Buildings

- **Shanshang Junior High School**
  Shanshang (23.103836, 120.357748) (close to the Shanshang market)

3 stories
30-50 years old
(built in several periods)
no damage
Intact Buildings

- Shanshang Junior High School

Standard plan with cantilever corridor and larger span. Similar buildings have been found severely damaged or collapsed in Chi-Chi earthquake, but....
Intact Buildings

- Shanshang Junior High School

The building has partially confined masonry wing-walls in the back frame. This is also the reason that it rated a high score in the preliminary seismic evaluation and has not been put in the waiting list for retrofit.