

Lessons learnt from damage of reinforced concrete street houses of Taiwan during past earthquakes

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Street houses in Taiwan

- According to the Construction and Planning Agency of Taiwan, in average 38,000 street houses were built every year during 2006-2012.



Damage by the 1999 Chi-Chi Earthquake

- Many street houses were severely damaged in the first story along the street direction.

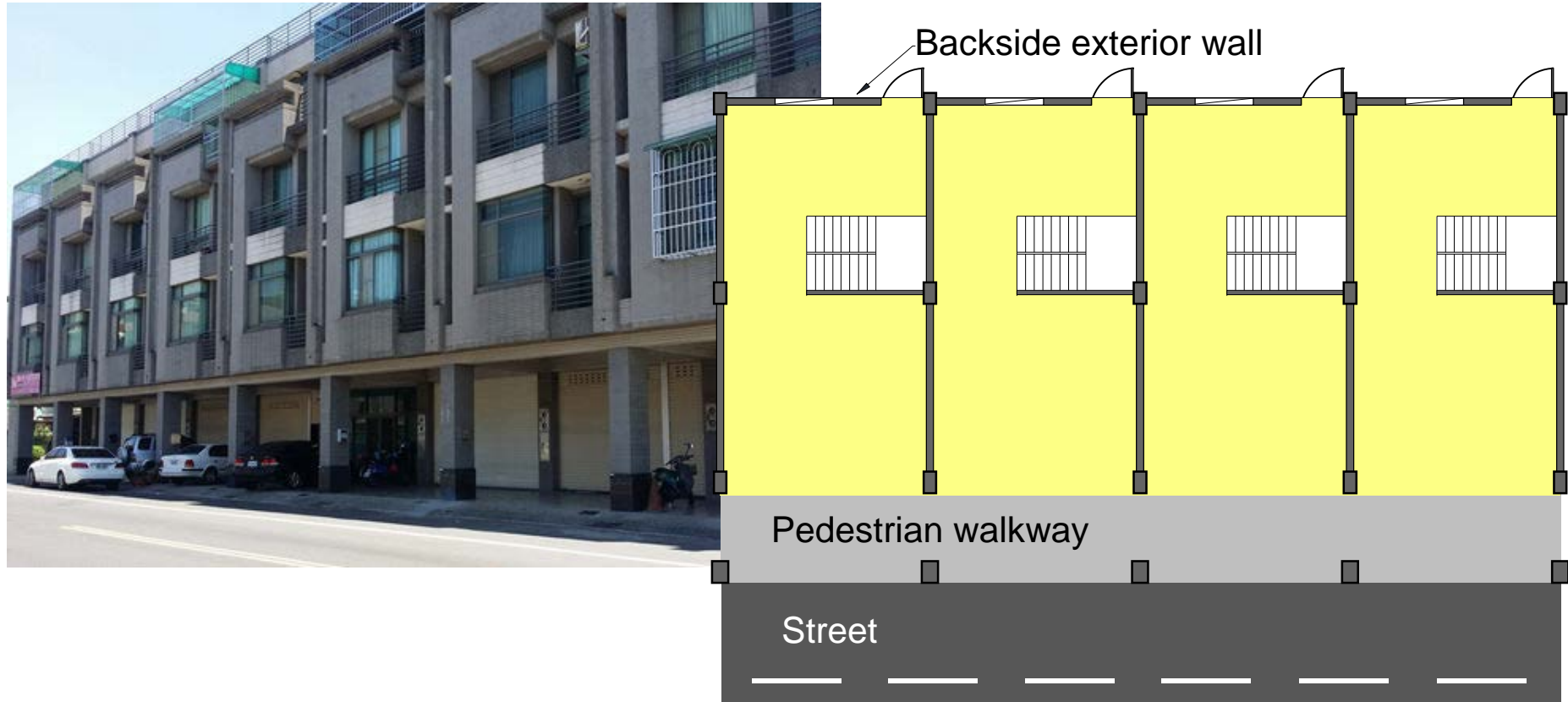


Damage by the 2016 Meinong Earthquake

- Still many street houses were damaged due to the weak first story.



Why are street houses of Taiwan easy to suffer weak story damage in the first story along the street direction



Plan view of the first story

- First story is often used for purposes such as living rooms, commercial use or parking lots.

Street houses that survived strong earthquakes (1)

- This building survived likely due to **stronger columns in the first story along the street direction.**



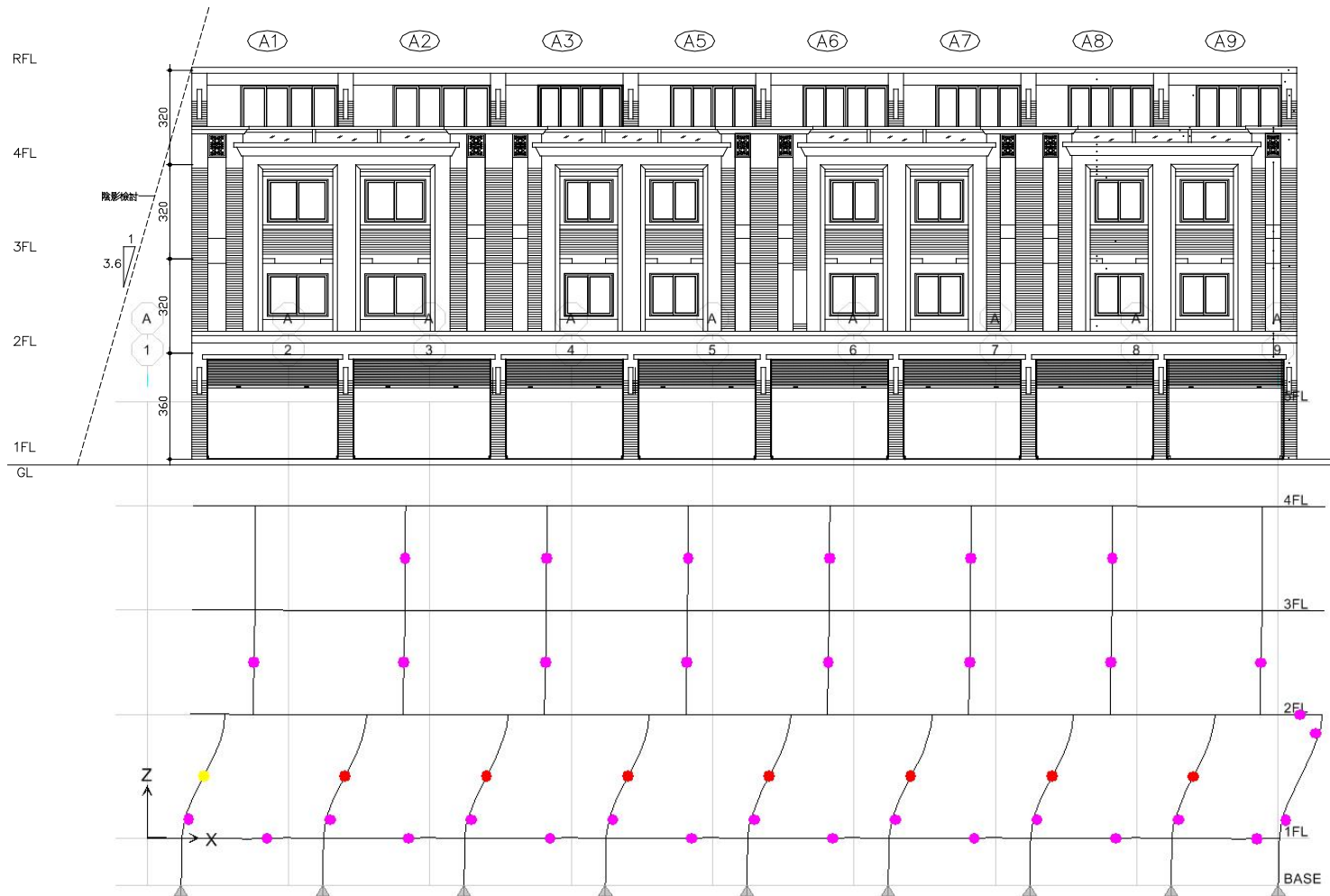
Street houses that survived strong earthquakes (2)

- This building survived likely due to **stronger walls in the first story along the street directions.**



Modern street houses: an example built around 2010

- Still suffered weak first story **because walls with openings were not included in the weak story check.**



Some thoughts

- It has been 18 years since 1999 Chi-Chi earthquake, the weak story still exists.
- One reason is that structural engineers usually ignore the strength contribution of walls with opening in the weak story check.
- The Taiwanese code for RC structures does provide methods to calculate the strength of walls with openings, although not clear.
- Perhaps we need to make some design examples for structural engineers.