

RED-ACT Report

Real-time Earthquake Damage Assessment using City-scale Time-history analysis

May 18, M5.1 China Songyuan Earthquake

Research group of Xinzheng Lu at Tsinghua University (luxz@tsinghua.edu.cn)

First reported at 8:30, May 18, 2019 (Beijing Time, UTC +8)

Acknowledgments and Disclaimer

The authors are grateful for the data provided by **China Earthquake Network Center (CENC)**. This analysis is for research only. The actual damage resulting from the earthquake should be determined according to the site investigation.

Scientific background of this report can be found at:

http://www.luxinzheng.net/software/Real-Time_Report.pdf

1. Introduction to the earthquake event

At 06:24 18 May 2019 (Local Time, UTC +8), an **M 5.1 (CENC)** earthquake occurred in **China Songyuan**. The epicenter was located at **45.30N 124.80 E**, with a depth of **10.0 km**.

2. Recorded ground motions

9 ground motions near to epicenter of this earthquake were analyzed. The names and locations of the stations can be found Table 1. The maximal recorded peak ground acceleration (PGA) is **175 cm/s/s**. The corresponding response spectra in comparison with the design spectra specified in the Chinese Code for Seismic Design of Buildings are shown in Figure 1.

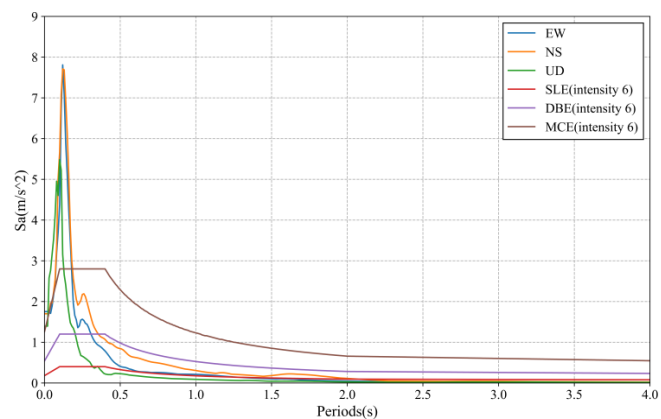


Figure 1 Response spectra of the recorded ground motions with maximal PGA

3. Damage analysis of the target region subjected to the recorded ground motions

Using the real-time ground motions obtained from the strong motion networks and the **city-scale nonlinear time-history analysis (see the Appendix of this report)**, the damage ratios of buildings located in different places can be obtained. The building damage distribution and the human uncomfotableness distribution near to different stations is shown in Figure 2 and Figure 3, respectively. These outcomes can provide a reference for post-earthquake rescue work.

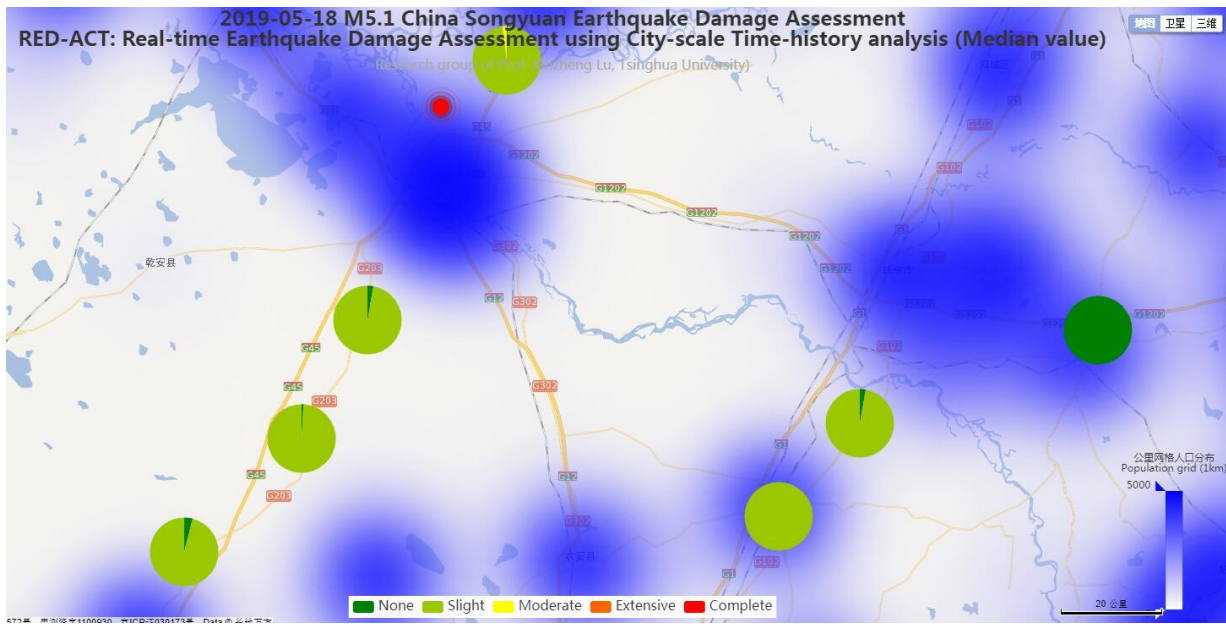


Figure 2 Damage ratio distribution of the buildings near to different stations

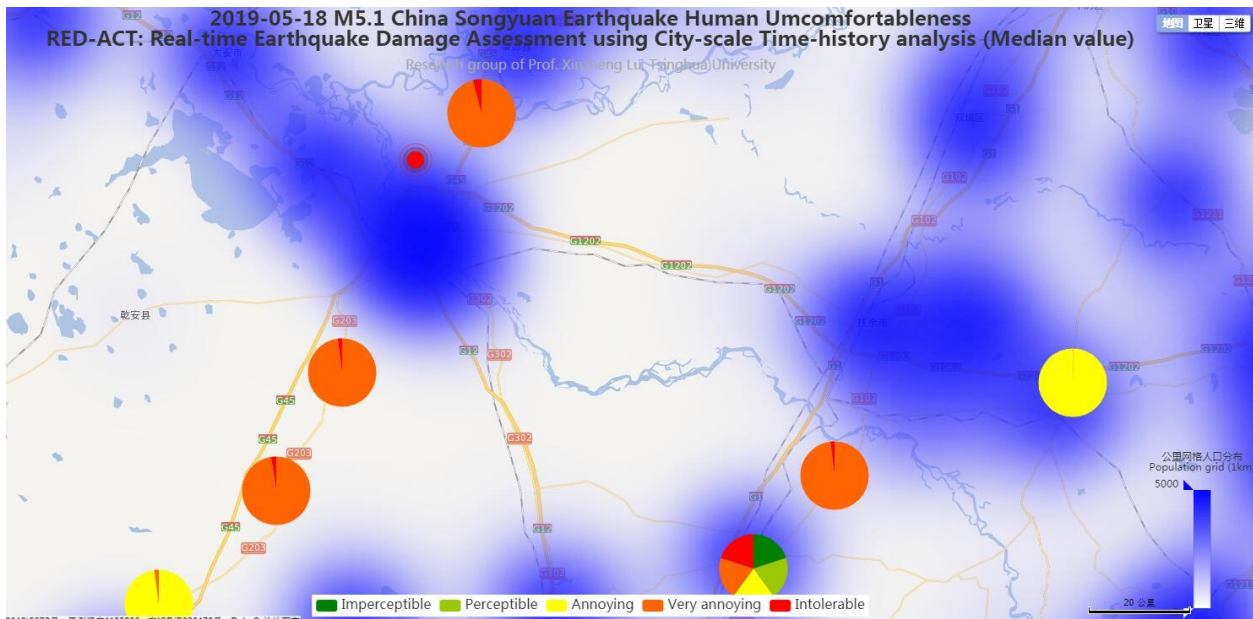
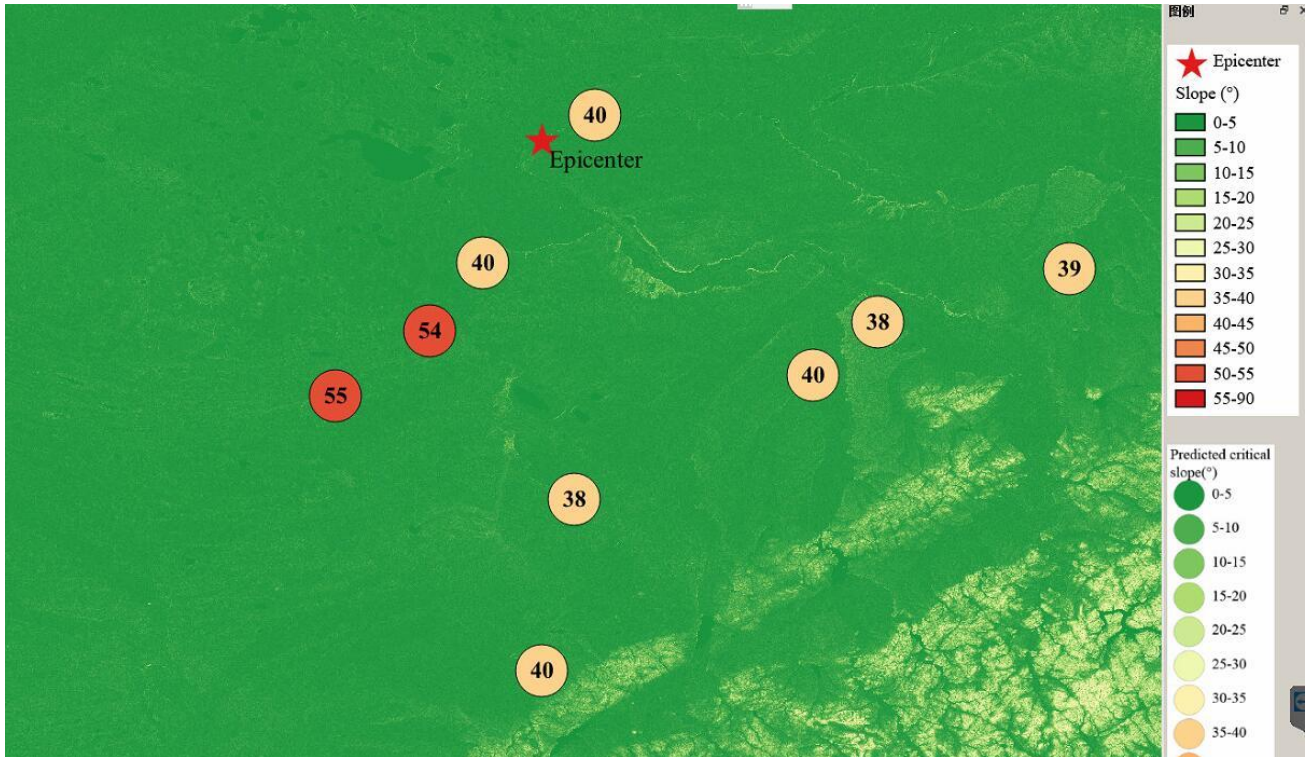


Figure 3 Human uncomfortableness distribution near to different stations

4. Earthquake-induced landslide of the target region subjected to the recorded ground motions

According to local topographic data, lithology data and ground motion records, the distribution of earthquake-induced landslide near to different stations under the different proportions of the landslide slab thickness that is saturated can be calculated, as shown in Figure 4. The basemap shows the distribution of the local slope. The number in the circle represents the critical slope of the landslide. The earthquake-induced landslide tends to occur with a higher probability when the slope near the station is larger than this threshold value.



(a) The proportion of the landslide slab thickness that is saturated equals 0%



(b) The proportion of the landslide slab thickness that is saturated equals 50%



(c) The proportion of the landslide slab thickness that is saturated equals 90%
 Figure 4 Distribution of earthquake-induced landslide near to different stations

Scientific background of this report can be found at: http://www.luxinzheng.net/software/Real-Time_Report.pdf

Table 1 Names and locations of the strong motion stations

No.	Station Name	Longitude	Latitude
1	22BDT	124.6	44.89
2	22DHT	125.72	44.51
3	22DSJ	124.1	44.44
4	22FHT	124.98	45.39
5	22GZL	124.8	43.51
6	22SGT	124.91	44.09
7	22SHJ	125.94	44.69
8	22WLT	124.42	44.66
9	22YST	126.59	44.87

