

# **RED-ACT Report**

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

## 2019-04-14 M3.0 Beijing Huairou Earthquake

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#### Acknowledgments and Disclaimer

The authors are grateful for the data provided by China Earthquake Networks Center. 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 12:47 14 Apr 2019 (Local Time, UTC +8), an M 3.0 earthquake occurred in Beijing Huairou. The epicenter was located at 116.39 40.34, with a depth of 19.0 km.

### 2. Recorded ground motions

75 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 0.19 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 uncomfortableness 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

No.	Station Name	Longitude	Latitude
1	C0001	40.04	116.52
2	CIQ	39.79	116.57
3	DHC	39.86	116.11
4	F0001	40.08	116.24
5	F0002	40.00	116.26
6	F0004	40.01	116.34
7	FHY	39.62	116.69
8	JIZ	40.00	116.56
9	K0001	40.25	116.13
10	LBP	40.57	116.21
11	LLM	40.63	116.64
12	M0001	40.79	116.74
13	M0002	40.74	116.64
14	M0004	40.78	116.50
15	M0006	40.27	116.53
16	M0007	40.60	116.60
17	M0008	40.41	116.51
18	M0009	40.38	116.67
19	M0010	40.51	116.66
20	MAF	40.05	117.00
21	MIY	40.47	116.83
22	N0001	40.10	117.11
23	N0002	40.12	117.17
24	N0003	40.15	117.04
25	N0004	40.28	117.06
26	N0005	40.34	117.14
27	N0006	40.18	117.00
28	N0007	40.28	117.12
29	NKY	39.69	115.97
30	NLS	40.21	116.65
31	P0002	40.60	117.10
32	P0003	40.42	116.94
33	P0004	40.33	116.85
34	Q0001	40.65	116.18
35	Q0002	40.55	116.08
36	Q0003	40.58	115.92
37	Q0004	40.44	115.79
38	Q0005	40.55	116.00
39	Q0006	40.37	116.10
40	Q0007	40.43	116.06
41	Q0008	40.36	115.93

Table 1 Names and locations of the strong motion stations

42	Q0009	40.70	116.39
43	Q0010	40.53	116.22
44	Q0011	40.46	115.97
45	Q0012	40.50	115.81
46	Q0013	40.57	116.21
47	SSL	40.25	116.23
48	TIT	39.89	116.41
49	XBZ	40.34	115.97
50	XIJ	39.83	116.88
51	Y0001	40.21	116.66
52	YAZ	40.15	116.83
53	ZHT	39.96	115.68
54	CHC	40.91	115.84
55	FEN	41.22	116.62
56	G0062	40.21	115.84
57	G0063	40.54	115.43
58	G0064	40.26	115.54
59	G0066	40.39	115.60
60	G0067	40.17	115.51
61	G0068	40.38	115.50
62	G0069	40.33	115.80
63	G0070	40.17	115.61
64	G0071	40.30	115.92
65	G0073	40.37	115.70
66	G0074	40.48	115.55
67	G0075	40.22	115.74
68	G0076	40.47	115.66
69	G0077	40.30	115.66
70	G0082	40.22	115.39
71	G0093	40.30	115.44
72	BAD	39.73	117.28
73	EWZ	39.40	117.37
74	HBT	39.58	117.13
75	WUQ	39.45	116.96