



## **OVERVIEW**

The  $M_w7.9$  earthquake in Wenchuan, China on 12 May 2008 was catastrophic in terms of lives lost and buildings destroyed or damaged: 69,185 people killed, 374,171 injured, 18,467 still listed as missing. More than 7.79 million houses were destroyed, and 24.5 million damaged. Some villages have few to no buildings that remain standing.

**Permanent ground displacement and strong shaking appear to have contributed to heavy damage and partial collapse of the bridge near Gao Yuan.**

Observations were made by Dr. Elizabeth Hausler during a field reconnaissance to the earthquake-affected area between 15 and 24 June 2008. Dr. Hausler's visit to Sichuan was coordinated through the 10 + 10 Strategic Partnership between the University of California system and 10 universities in China. This report is one in a series of observations on residential buildings and bridges.

Dr. Hausler is a graduate of the civil engineering program at University of California, Berkeley and the Founder and CEO of Build Change, an international non-profit engineering company that designs and trains builders and homeowners to build earthquake resistant houses in developing countries. See [www.buildchange.org](http://www.buildchange.org) and contact [elizabeth@buildchange.org](mailto:elizabeth@buildchange.org). Comments, questions, and additional observations are welcome.

The visit was made possible by Dr. Gretchen Kalonji on the UC side and Profs. Guan Ping and Tang Ya on the Sichuan University side. Dr. Hausler was hosted by Prof. Li Bixiong, the director of the civil engineering department at Sichuan University. Kind assistance from all parties, including several students at Sichuan University, is greatly appreciated.

*Exact positions are not available. Upon learning that visitors had been detained for traveling with GPS units in China, I opted to leave my GPS unit in left luggage at Jakarta airport. More detailed location information is available upon request.*



*Fig 1. Collapsed middle span of reinforced concrete bridge at Gao Yuan, looking south. IMG0490.*



*Fig 2. Tourist Map of Gao Yuan, note location of retaining wall and road heave near pink dot, pathway buckling to the east along the yellow road. IMG0509.*

**Permanent Ground Displacement**

Permanent ground displacement, in the form of extension of a stone masonry retaining wall, heave in the adjacent road, and buckling in pathway, were located near Gao Yuan Bridge. It is possible that these features line up along an E-W trending line. More detailed surveying is needed. The compression of the pathway shown in Fig. X was in a N-S direction.



*Fig 3.* Extension of retaining wall along Chengxiang Road, Gao Yuan Village, looking roughly southeast. Note road has been filled in. IMG0502



*Fig 4.* Heave along Chengxiang Road, Gao Yuan Village, looking roughly northeast. IMG0503



*Fig 5.* Permanent ground displacement along pathway. IMG0511



*Fig 6.* Permanent ground displacement along pathway IMG0514



*Fig 7.* Buckling pathway pavement due to compression, of roughly 1m. Looking west. IMG0520



*Fig 8.* Permanent ground displacement along pathway, looking south IMG0525



### Gao Yuan Bridge

This roughly north-south spanning concrete bridge had one collapsed section. The northmost deck shifted into the north abutment and to the west. This extension appears to have contributed to the collapse.



*Fig 9.* Gao Yuan bridge looking west from temporary footbridge. IMG0458



*Fig 10.* Gao Yuan bridge looking west, note displacement of north deck to the north. IMG0461



*Fig 11.* North abutment from the east. Note deck has moved north (or abutment moved south). IMG0463



*Fig 12.* North abutment from the west. Note deck has moved west (or abutment moved east). IMG0476



*Fig 13.* North deck, north end. Note displacement to the north and west. IMG0478



*Fig 14.* North deck, south end. Note deck has displaced to the north. IMG0479



*Fig 15.* Heave and buckling of road on north abutment., looking south. IMG0483



*Fig 16.* Displacement of north roadway over north deck, looking west. IMG0488