

China School Collapses – What Should We Think?



New York Times map of towns (red dots) that lost at least one school, with overlay of fault zone (orange box) from the USGS and ground acceleration (green dot) reported by IRSN.

The death of thousands of children due to the collapse of their school buildings during the Sichuan Earthquake is a tragedy beyond words. We must demand to know what happened, as part of our grieving, as an acknowledgement of the value of lost futures and in our efforts to prevent yet another such tragedy.

Newspapers are full of anecdotes, speculations and recriminations. But so far, I have read few, if any, analyses that have given me any sense of what went wrong. While the collapse of school buildings is unacceptable under any circumstances, I still want to know whether they failed under heavy or moderate shaking, and whether they were better or worse built than other buildings in the area.

I gain some insight from this map of school collapses

recently published by the *New York Times*¹. I am struck by the linearity of the pattern of towns in which the schools were located. When I overlay the fault zone² (orange box), the proximity of most of the collapsed schools to the fault becomes apparent.

This was a truly large earthquake – magnitude 7.9. Fault displacements exceeded 10 meters. The fault zone ruptured for at least 200 kilometers, causing a wide swath of land (within and near the orange box) to shake – and shake severely. This assertion is supported by a report³ of a peak acceleration of 25% the force of gravity at a distance of 70 km from the epicenter. While this is only a moderate level of shaking, it is consistent with much higher levels, perhaps exceeding the force of gravity, within the fault zone itself. Even the best engineered, constructed and maintained buildings would be at risk of severe damage under these circumstances.

But the best engineered, constructed and maintained buildings should not be at risk for catastrophic collapse. The goal is for them to survive the earthquake more-or-less intact, even if they are so badly damaged that they must be torn down afterward.

If Chinese schools were houses-of-cards poised to topple down with the slightest trembling of the ground, then the map would show collapses in the heavily-populated regions east of the fault zone, around Chengdu, where the level of shaking was more moderate, but still significant. Yet the map shows none. So my preliminary conclusion is that most of the schools that collapsed experienced severe shaking.

This acknowledgement does not necessarily absolve anyone of responsibility. After all, this was known to be a seismically active region in which severe shaking was to be expected. But it should, in my opinion, move the focus of the debate away from the reasons for individual collapses (notwithstanding allegations of corruption, shoddy construction, etc.) and towards the broader issue of ensuring earthquake safety in a seismically active zone.

Focus on long-term safety is especially important given the rapid pace of building in China that is being driven by its unprecedented economic expansion. Choices – if only implicit – are being made now with consequences that will affect schoolchildren for decades to come.

¹ Chinese Are Left to Ask Why Schools Crumbled, Jim Yardley, Jake Hooker and Andrew C. Revkin, *NY Times*, May 25, 2008.

² Poster of the Eastern Sichuan, China Earthquake of 12 May 2008 - Magnitude 7.9, US Geological Survey, http://earthquake.usgs.gov/eqcenter/eqarchives/poster/2008/20080512_image.php, 2008.

³ Earthquake in Sichuan (China), Report by Seismic Risk Assessment Bureau of the Institut de Radioprotection et de Surete Nucleair (IRSN, Paris, France), www.irsn.org/document/site_1/fckfiles/File/Internet/Actualites/IRSN_Earthquake-in-Sichuan.pdf