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CELEBRATING THE DESIGNERS OF THE WORLD AROUND US

IMPROVING NEW YORK CITY'S DRINKING
WATER AT THE SOURCE
MONITORING THE OLD FORT LANDSLIDE
IN BRITISH COLUMBIA
GUIDON'S GROUNDBREAKING HEADQUARTERS
TIMBER MAKES A (MASS)IVE COMEBACK



PUERTO RICO: EARTHQUAKE DISASTER AT A CROSS ROAD

H. Kit Miyamoto, Ph.D., S.E.

enter. The earthquake and its aftershocks were moderate compared to other recent earthquakes globally, but social impact is huge. What's known as ground acceleration at the epicenter was 50 percent of gravity – the equivalent to something we expect in seismic regions like California or Japan.

The earthquake damaged about 10 to 20 percent of buildings in affected towns. Many were concrete residential buildings. The building code here is the latest version of International Building Code and the education and licensing system is similar to what we have in California. Unfortunately, it is estimated that only about half of all residential buildings ever received valid construction permits. Many houses sit on slender columns without proper steel reinforcement or walls. Since the weather is usually great, these common areas are used for BBQ parties, gatherings or as parking. But seismic engineers know this as a deadly construction type called soft story construction. It is the weakest link of the structure. Most of the collapsed structures here in Puerto Rico had soft stories. There are still more than 150,000 of these dangerous buildings standing on this island.

More than a quarter of the schools in the earthquake-hit area are damaged and one collapsed. Most of the damaged schools were built prior to 1987 when the building code was updated with proper seismic provisions. They are all concrete structures with non-ductile construction. It was fortunate that the earthquake happened during school holidays, otherwise we would have lost a few hundred students.

Back in January, when we met municipalities, there were lot of confusion. After all, it was the first earthquake in more than a century. The island was totally unprepared even though they experience large hurricanes often. Unfortunately, earthquake disasters are completely different from hurricanes. Before hurricanes hit, there is a warning, and there's a beginning and end. Not for earthquakes. Aftershocks are still rumbling here on a daily base and it is March. Anyone can see water, roof, or window damage caused by hurricanes, but cracks caused by earthquakes are mysterious. Even for engineers, it can be hard to judge if it is superficial or deeper structural damage. This uncertainty is causing deep anxiety and social unrest.

I must say the government and municipalities are acting decisively. There were more than 8,000 displaced people in tent cities and more than 10,000 buildings damaged in January. When our team arrived in January, they were just establishing rapid damage assessment system. Just eight weeks later, 80 percent of buildings have been assessed with proper damage assessment systems. I recently visited some of the displacement camps and noticed how they have emptied. Fortunately, Rental Housing Assistance vouchers decompressed the camps to less than 600 people. Most families have relocated to rented housing, apartments and hotels.

I must say the response was one of the best I have witnessed. I know how government was slow for devastating Hurricane Maria a couple years ago, but I can see that municipalities and government learned a lot from these failures and doing the best they can this time.

But this is only the beginning of disaster recovery. Still, there are great challenges ahead. We need to deal with 10,000 to 20,000 damaged residential buildings and repair the heritage buildings. These buildings are a part of the history and culture of these communities.

The usual quick solution is to demolish these buildings as fast as possible. Unfortunately, FEMA funds are geared toward this destructive approach. This must be avoided at all cost. The majority of these houses can be repaired and retrofitted per the International Building Code at a fraction of cost and timeline of total demolition and reconstruction. Once the buildings are taken down, it will take years for the city to come back. There are numerous examples of this from Italy to New Zealand. There are always grand plans to reconstruct the city to the grander state, but it often ends up with empty parking lots. It is very difficult to bring back private investment with too many empty lots as neighbors. Quick and excessive demotion will kill future investment and the city.

Luckily, there is a solution to avoid this tragedy. Each damaged building can be examined for repairability and retrofit. This can be done fairly rapidly by using latest technology. This engineering analysis will determine the future of this country.

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