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Lessons of Gujarat's Bhuj Earthquake:

Could Karachi Be Next?

by

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The earthquake disaster on 26 January of this year in Gujarat resulted in the loss of tens of thousands of lives and hundreds of thousands more injured. Official estimates of economic losses approach 5 billion U.S. dollars, but the actual figure may ultimately be much larger. The government of India estimates 40 million people in 8000 villages were affected. First priorities in coping with this disaster was the rescue of victims who survived in air pockets of collapsed buildings, and relief for those who escaped serious injury but needed clean water, food, medicine, and temporary shelter. The outpouring of rescue and humanitarian assistance from the international community and Pakistan was commendable and reassuring.

But while human rescue and relief were quite properly the immediate response, there are longer-term lessons to take from this disaster. Initial Indian estimates of the fatalities quickly climbed from 5,000 to over 10,000 -- already devastating, but within days again doubled to today's official estimate of over 20,000, a number that seems conservative.. Can human disasters on this scale be minimized? Are even more massive ones waiting in the wings?

In Ahmedabad, more than 300 kilometers from the epicenter, modern but poorly built high-rise buildings collapsed, killing hundreds. Much of the town of Bhuj near the epicenter, and whole villages and smaller towns in the Kutch district bordering Pakistan were flattened.

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The tectonic fault that produced this quake, which registered a massive 7.7 on the Richter scale, is part of a complex system of geologic faults that run northwest in Gujarat through the marshy Rann of Kutch, where it produced a magnitude 7.6 quake in 1819, and into Pakistan. While concealed under the loose sediments of the Indus delta, this system of faults appears to continue to the west, passing through the metropolitan area of Karachi and extending into the Arabian Sea, where it intersects another system of faults associated with a major tectonic boundary that has produced devastating earthquakes as far north as Quetta in the past. Together these fault systems have produced historically large earthquakes within a hundred miles of Karachi, notably in the Pab Range, Thatta, and Jhimpir areas. Although Karachi itself has only experienced moderate earthquakes in the last century, it has grown in size from less than half a million to a sprawling mercantile city of upwards of 12 million inhabitants since the last significant earthquake. It is Pakistan's largest and most cosmopolitan metropolis, but also its largest concentration of shanty towns.

Karachi sits very near to a geologic triple junction - the point where three tectonic plates meet. While the dynamics of the fault systems near Karachi are poorly understood, the dangers are clear. Three types of fault systems intersect in the general vicinity – a subduction zone, a transform boundary, and an ancient rift system that appears to have been reactivated. Each produces a distinct type of ground motion with an associated hazard risk that under the right circumstances could conceivably annihilate hundreds of thousands of Karachi inhabitants and cause incalculable damage to the infrastructure. An earthquake of similar magnitude to Gujarat's occurring in the ocean off of Karachi could rival the effects of nuclear weapons. Focused offshore, it could generate a Tsunami traveling inland suddenly to engulf that city's most densely populated areas, where innumerable dwellings and places of business of shoddy construction are crammed together on sandy flatlands just a few feet above sea level. Buildings on this type of sediment would also be particularly susceptible to shaking during an onshore event.

How methodical relief and rehabilitation could be brought to bear after such a catastrophe is difficult to imagine, unless far-reaching emergency response measures are prepared for and rehearsed in advance.

This natural geological danger to a congested metropolis is not without its national security and military implications as well. Now that India and Pakistan confront each other with nuclear weapon capabilities and worry about escalatory military scenarios, it is conceivable that a large earthquake offshore could be misinterpreted as a nuclear detonation

Even if suspicions of offshore nuclear detonations were quickly disproved by foreign as well as Pakistani seismic readings and sampling of air and water for radiation byproducts – as surely would occur within two or three days – the crippling of Pakistan's largest city by this catastrophe, tying down a significant part of the Army to maintain order and provide physical relief, would be a source of anxiety to defense planners.

While preventing earthquakes or even predicting their timing and size is not feasible, much can be done to anticipate and ameliorate their effects by planning for emergencies. This includes identifying logistical requirements, training and drilling first responders, earmarking hospitals and their procedures, stockpiling kits for water purification along with rations and medicine, and engineering redundancy into power and communication links. Longer term measures would also involve more stringent standards and controls on the construction of multi-floor buildings and vital water and power infrastructure, and even evacuation plans that could be implemented given sufficient warning.

Outlining the areas most vulnerable to earthquake damage and doing the basic science needed to anticipate probable damage and possible mitigation strategies are also critical to effective emergency response. This, in fact, is where the foundation of planning response must begin, and where the initial steps are quite economical. Most existing hazard maps show Karachi to be only moderately susceptible to earthquakes or tsunamis, a premise that needs reexamination, along with the conventional wisdom that the Gujarat quake was an anomalous "intraplate" event, or any notion that by releasing strain it has reduced the risk in nearby areas closer to plate boundaries, such as Karachi. Geological mapping of the entire region needs to be done in far more detail and a modern system of geodetic instrumentation should be installed to measure movement along the faults.

Other geologically active zones of South Asia need to be reassessed as well, notably Islamabad-Rawalpindi – where the federal government of Pakistan sits near a major plate bounding fault that produced an earthquake which destroyed the ancient city of Taxila; Quetta which has been devastated by earthquakes in the recent past and is swelling with refugees; the entire earthquake-prone Himalyan front; and densely populated, coastal Dhaka, which adjoins a seismic zone that, according to some models, could be subject to exceptionally powerful, ground motion-producing forces.

Scientific collaboration on this subject could be of great benefit to both India and Pakistan, forming specialized but nonetheless important channels of confidence-building, and providing the data needed to support both effective emergency planning and measures to reduce the vulnerability of the region as a whole. The response of western governments to this tragedy has already resulted in scientific cooperation with India on an unprecedented scale. Expansion of this effort to include adjoining and other at risk areas of Pakistan, particularly by leading U.S. seismic risk analysts, could be of immense scientific and humanitarian benefit, not to mention a means of reengagement in the region in a constructive and nonaligned manner.