Our Experience in Dealing with Disasters: Are We Prepared?

By Nabil Hourani, PE, Sr. Geotechnical Engineer, HNTB Corporation and Charles Sacre, PE, Sr. Principal Professional, Kleinfelder

Natural and man-made disasters have a huge impact on people as they abruptly find themselves shouldering losses, devastation and death. The authors—geotechnical and structural engineers—have seen closely the remnants of the August 2005 Hurricane Katrina (the Hurricane) in New Orleans, Louisiana, and the July 2006 War in Lebanon (the War). Both caused so much suffering to fellow human beings. In this article based on our experience, we have confined our findings to the engineering aspects of disaster in an attempt to raise more consciousness in the future for such unexpected events.

From the Hurricane, investigation of the Ninth Ward (Photo 1) was a humbling experience. A complete silence of what was before the nine-foot flooding, a lively neighborhood where "shotgun houses"—12 feet wide by 40-60 feet long single story—lined the roadways on each side. Rare were the residents who came back. Mold in walls, floors and furniture and total destruction of utilities disrupted the lives of families who left everything behind. Very little could be salvaged from the structures as it was necessary to replace major components such as timber studs and joists, wall and floor panels, and columns down to foundations. Without immediate help, waiting for work would deprive the families of income needed to survive.

It took fifteen months to hire a manager for the recovery efforts in New Orleans. Coordination at such a large scale of disaster appeared at the time to be a daunting task for any government to organize the recovery.

From the War (Photo 2), the authors had investigated the damage from the data available from various international and national sources. Damages to infrastructure included 97 bridges, several power plants, utilities and water treatment plants, schools, neighborhoods, roadways, retaining walls, earth structures, radar and telecommunication installations. An 800 square mile area including many cities and towns were disrupted and a 400,000 population had to relocate to escape bombardment.

The authors prepared and proposed an emergency plan of action to tackle the bridges and highways that included three parts: 1) Emergency field survey and data collection; 2) Road map for reconstruction, with the potential approval of the government authorities and financial institutions; and 3) Implementation. Massive human and financial aid came from the national and international communities, private banks and businesses, the US Aid, the European Community, and the Middle Eastern countries. In a span of eighteen months most of the bridges and roads were open to traffic.

Our role was limited to supporting the authorities by providing technical training to the Ministry of Public Works engineers and inspectors, on roadway/wall/bridge investigations and damage assessment for rehabilitation and upgrades.

Looking at more recent disasters, the news is harsh. It was reported from Southeast Asia: "Power and communication outages are rampant in parts of the Philippines after Super Typhoon Haiyan, with sustained winds of 195 mph, slammed into the country. Thousands of people were killed, homes/buildings were blown apart, landslides moved mud down mountains, and severe damage was caused to infrastructure, property and crops, in what is being called one of the most powerful storms ever recorded."

In the US and in particular in New England, we have experienced during the last two years, higher more frequent and more intense natural events, such as storms, floods, and earthquakes.

Photo 1: Hurricane Damage in the Ninth Ward, New Orleans

Photo 2: Damage from the 2006 War in Lebanon

We can still remember the effects of the year 2012: the Northeast and Great-Lakes winter blizzard which damaged utilities and transportation elements, Hurricane Isaac in the southern states that produced 34 Tornadoes, the summer wildfires and drought forces that fractured roadways and structures, and finally Hurricane Sandy which devastated coastal properties along the Atlantic states.

Recently, we may have been preparing and planning for some man-made disasters, such as

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industrial accidents, terrorism attacks, and hostilities. But, are we considering natural disasters and their effects on our design and construction of civil engineering projects?

Natural Disasters (Hurricanes/Typhoons/Cyclones, Flooding, Earthquakes, Volcanoes, Tsunamis, Wild-land Fires, etc.) are connected to the earth and the solar system's large and complex dynamism, but also to our human activities. While we can do little about the former, we can modify and alter the latter.

Following are suggested actions, which are open for discussion in the engineering community:

- Be aware of and depict the Environmental, Geographical, Economical, and Societal factors of disasters.
- Educate people, both in government and private, about these natural processes and their impacts.
- Participate in pre- and post-disaster missions in the US and around the world.
- Adapt our structures to climate change (work around Nature's forces not always against them).
- Implement building materials and systems which are more portable, easily installed, and flexible.
- Use simulation technologies to improve design and construction (3-D models, virtual environment, etc.).

Ultimately, our response to a disaster is the final test of the long-term planning and process that we have put together. Obviously, many obstacles exist against both pre- and post-disaster work, including technical (uncertainties in assessment and modeling, availability of communications and computers), logistical (adequate equipment and access to remote/mountainous areas), financial (initial and long-term costs), political, and administrative (bureaucracy, corruption, and distrust).

The World Road Association (PIARC) has published a report titled "Risks Associated with Natural Disasters, Climate Change, Man-Made Disasters and Security Threats" (2013 R12EN). The document presents a user guide to evaluate the risks associated with all hazards, practical techniques for managing risks associated with natural disasters (such as heavy rainfall, earthquakes, forest fires), case studies used to mitigate or reduce risks associated with hazards, and a proposed Risk Management Toolbox. Other reports about Katrina and Sandy, and reports by FEMA and other institutions, and by the City of Boston are resources for engineers to prepare themselves and be able to plan and advise on solutions for infrastructure recovery and rehabilitation.

The authors recognize however good news from the disasters that we have witnessed and participated on a voluntary basis, be it after the Hurricane or the War, during field investigations and missions. Our most significant lessons learned are the following:

- The most dominant factor in recovery was the resiliency (*the ability to recover quickly from setbacks*) of the affected population and systems.
- A combined public/private initiative but with one agency in-charge led to a very efficient, cooperative and aggressive program of recovery and reconstruction of damaged/destroyed roads and bridges.

If we need to implement resiliency against and after major disasters, we must prepare ourselves and be ready to mitigate risks and safeguard within reasonable probabilities our institutions and communities. It is our responsibility as engineers to be active participants in this endeavor to protect our society.