

# Editorial | *The Japan Tohoku Tsunami*

*Learning from Disaster*

By Gary Chock, S.E.



The ASCE-Structural Engineering Institute Tohoku Tsunami Reconnaissance Team visited Japan in mid-April to examine tsunami effects to buildings, bridges, and coastal protective structures within the inundation zone along over 150 miles of coastline. In the August and October issues of STRUCTURE®, we reported on some of our observations and findings on the effects of the March 11, 2011 Tohoku Tsunami, generated by the Great East Japan Earthquake of Moment Magnitude ( $M_w$ ) 9.0. Our objective every day was to operate as a mobile failure analysis investigative team to capture as much documentable evidence as daylight permitted. The results of that intense work on the ground, combined with further independent research and collaboration with Japanese researchers, will soon be available from the ASCE Structural Engineering Institute as a 350-page monograph, *Tohoku Japan Tsunami of March 11, 2011 – Performance of Structures*. This comprehensive report will bring forward factual information and numerous photographs on the following topics:

- The Great East Japan Earthquake and Tohoku Tsunami
- Pre-Survey Preparatory Research
- Tsunami Warning and Evacuation
- Flow Velocity Characteristics
- Debris Loading
- Building Performance
- Bridge Performance
- Breakwaters
- Seawalls and Tsunami Gates
- Quays and Wharves
- Scour Effects
- Other Structures
- Failure Mode Analyses
- Initial Recovery Efforts
- Recommendations for Tsunami Mitigation, Future Post-Tsunami Surveys, and Research Needs

I would offer the comment that it has been particularly gratifying to see the results of the failure mode analysis – hydrodynamic loading formulation arising from laboratory research appear to be working quite well in predicting observed structural effects. Looking forward, the case studies from this reconnaissance and others will be highly beneficial to the present efforts to develop and validate a modern set of tsunami criteria and loading provisions for the U.S. The ASCE 7 Subcommittee on Tsunami Loads and Effects has nearly 30 members working on this effort. Recent research in developing quantifiable measures of the reliability against collapse inherent in current seismic design methodologies should also provide a framework for tsunami design criteria. For this to someday successfully save lives in addition to mitigating the level of physical destruction, there is also a need for greater evacuation preparation along the Pacific coast. Robust tall buildings can serve as intuitively recognized refuges and, in seismic zones where a level of structural reserve capacity is typically provided, that may be quite economically achievable. However, in proximity of subduction zones, we may need to determine the expected seismic performance level of buildings and essential facilities prior to the onset of tsunami inundation.

From another perspective, in looking back at the experiences since March, I have been struck by the differences in media treatment of the earthquake disaster between the United States and Japan. Unfortunately, as an engineer I found the coverage from the U.S. mainstream 24/7 televised media too often to be factually shallow,

confusing, primarily emotive and generally disinclined to attempt to present numerical data and unable to provide useful summary analyses. Somehow, despite repetitive opportunities, it never seemed to improve in content or accuracy. Before we made our first survey in April of this year, I had replied to a media question that our greatest challenge was to remain focused and on task in the midst of the great expanse of destruction. Unfortunately, it was the U.S. mass media itself that quickly lost discipline in covering the extent of the tsunami devastation, and in failing to follow the societal and economic issues inherent in Japan's desire to reconstruct with improved mitigation against tsunami rather than just rebuilding as it was. This makes engineering investigations essential not only as a means of documenting perishable data, but also as a means of conveying the full impact of disasters on communities.

On the other hand, English versions of NHK and Japanese print media and various websites (including the Japan Society of Civil Engineers) provided abundant, regularly updated detailed information, as well as offering a greater selection of unabbreviated videos of the tsunami that were very insightful. Rather than emphasizing some aspiring celebrity-newscaster's face and ad-hoc commentary as we seem to do in the States, the Japanese reports primarily emphasized actual footage of the disaster and informative content from the field. These were often accompanied by illustrative maps of geography and presented diagrams of infrastructure or failure modes. How could that information possibly be considered boring? The present style of U.S. broadcast journalism coverage generally does the American public a disservice on critical events with societal issues of primary concern to the engineer; that is, the risk of natural hazards, explanations of their effects using quantifiable systems of reference, and to what extent engineered systems and emergency response plans have performed to their criteria and sometimes beyond.

It may well be that disciplined practitioners of engineering and the physical sciences are now a counter-culture resource, one that still values formulating hypothesis from facts and remaining open to changing a technological approach based on new data or better insight. We go out to the construction site to validate constructability, and so, too, we visit the research community and disaster sites to validate our design methods. For structural engineers, this cycle of research and development, practical application to the built environment, and learning from natural disasters and technological failures is fundamental to the integrity of our profession. This mode of technical merit-based discernment is also part of a much-needed philosophical counter-weight for society. Why not answer questions first from our perspective without watering it down, thereby forcing a follow-up and deeper explanation of the engineering approach? Then, perhaps, we can deliberately strive to inject content-rich responses to such questions facing society and, when necessary, more bluntly demand that broadcast reporting and journalists provide the technological knowledge the public needs and deserves. American society should be challenged also to learn something meaningful from disasters. ■

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