Structural Engineers Must Bridge the Gap

By A. Christopher Cerino, P.E., F.SEI, DBIA

There have been many articles and discussions about the misconceptions between the public and the profession regarding the performance level of code-compliant buildings. Historically, Building Codes (and ASCE 7, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*) have focused on ensuring life safety. For hazards that do not offer much advanced warning (e.g., earthquakes, tsunamis, and tornadoes), a focus on life safety saves lives. Still, it is not sufficient to make communities resilient to these hazards. After an earthquake, for example, many buildings are tagged as needing substantial work before they are safe to enter, leaving communities displaced and distressed for long periods. Looking at ASCE 7 today, a practitioner sees many pages dedicated to the design of elements beyond the primary structural system, which may not tie as directly to life safety. These provisions, such as components and cladding wind loads, seismic anchorage of mechanical systems, and even flood loads, receive industry pushback when increases are proposed, with the most common objection being that this is "beyond life safety." While it is true that ASCE 7 says right in the title that it represents the *minimum* design loads, advocating for owners to go beyond the Code is often a hard sell. Designers should be having informed performance discussions with owners to decide if going beyond the Code is merited, but often recommendations are ignored or removed for cost reasons. But herein lies a fundamental problem – arguably, the majority of persons living and working in the structure are not part of that decision process and are unaware of the performance level of their building, which leaves communities vulnerable post-event.

This divergence is even more apparent as engineers discuss the possible ramifications of the changing climate to the defined hazards. Currently, ASCE 7 only looks backward in terms of hazard data. Certainly, factors of safety serve to alleviate major problems between the 6-year cycle of the Standard, when additional historic data is used to update considerations. The 2022 version of Chapter 5, which is still in the Supplement voting process, is the first to look *forward* for potential hazards, adding provisions for future relative sea-level change. While there are many projections for sea-level change, with a wide variation in impact, the Standard has cautiously proposed including only the historical change rate defined for the project site over the intended service life. While many consider this inadequate, this was the compromise to not push the envelope regarding what is considered necessary for life safety.

Today, some building owners are requesting a *resilient* building from their designers. While it is encouraging that this is becoming a common topic, there is little guidance on what this means and how to accomplish it. Are we striving for a building that is operational 3-days after the maximum considered earthquake? Is it a dry building after a 500-year flood in a coastal A-Zone? Is it an office with no broken windows or roof loss in a category 2 hurricane? The possibilities are endless, and the industry is looking for a champion for these project discussions. Traditionally, the architect has served as the master builder, directing the project criteria and holistic programming choices via their discussions with the owner. But in the field of resilience, which is rooted in the probabilities and performance of very different hazard types with future local projections, I do not think the architect should lead this charge. Structural engineers understand the mean recurrence intervals and probability associated with the load combinations provided in ASCE 7. In addition, ASCE is an industry leader in designer guidance on hazards and the changing climate and has dozens of additional resources to supplement the minimum load standard.

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When owners request a resilient building, they are not looking for a Code minimum design that simply allows people time to exit the structure safely but subsequently requires a complete rebuild. Instead, owners envision a building where most of the architectural façade or roofing system is intact, which is a function of the structural response of the system components and their connections. They are envisioning a building where the mechanical system needs only minor repairs for isolated sections to be up and running, also a function of the structural response of the system components and their connections. They envision a plumbing system with only minor ruptures leading to local repairs…you get the point. The gorilla glue that ties the entire discussion together is the structural engineer!

Building owners are looking to expand discussions on how to make their buildings more resilient, but the public is also demanding it because of the skyrocketing costs of annual damage and utter destruction to towns and cities worldwide. Whether this performance guidance belongs in ASCE 7 will be a long debate, but the guidance is needed, and structural engineers are the most equipped to fill this void. Structural engineers lament commoditized engineering fees and are striving to increase exposure via the We See Above and Beyond campaign (**weseeaboveandbeyond.com**), but here lies the opportunity of the new century. Today, many project organization charts now have a defined position titled "Resilience Lead." This position should always be filled by a Structural Engineer who is the most qualified to bridge the gap in the emerging realm of resilience performance. Become part of the discussion via firm organization and Code committees and help elevate the profession to meet the needs of an ever-changing hazard landscape.▪

A. Christopher Cerino is the Director of Structural Engineering in STV's New York office and a member of the NCSEA Board of Directors (anthony.cerino@stvinc.com).