

# GG189-14

## Table 302.1, 503.2 (New)

**Proponent:** Tien Peng, National Ready Mixed Concrete Association, representing National Ready Mixed Concrete Association (tpeng@nrmca.org); Martha VanGeem, Consulting Engineer, representing self; Jason Krohn, Precast/Prestressed Concrete Institute, representing Precast/Prestressed Concrete Institute (jkrohn@pci.org); Stephen Szoke, Portland Cement Association, representing Portland Cement Association (sszoke@cement.org)

**Revise as follows:**

**302.1 Requirements determined by the jurisdiction.** The jurisdiction shall indicate the following information in Table 302.1 for inclusion in its code adopting ordinance:

1. The jurisdiction shall indicate whether requirements for residential buildings, as indicated in Exception 1 to Section 101.3, are applicable by selecting “Yes” or “No” in Table 302.1. Where “Yes” is selected, the provisions of ICC 700 shall apply and the remainder of this code shall not apply.
2. Where the jurisdiction requires enhanced energy performance for buildings designed on a performance basis, the jurisdiction shall indicate a zEPI of 46 or less in Table 302.1 for each occupancy required to have enhanced energy performance.
3. Where “Yes” or “No” boxes are provided, the jurisdiction shall check the box to indicate “Yes” where that section is to be enforced as a mandatory requirement in the jurisdiction, or “No” where that section is not to be enforced as a mandatory requirement in the jurisdiction.

**TABLE 302.1  
REQUIREMENTS DETERMINED BY THE JURISDICTION**

Section	Section Title or Description and Directives	Jurisdictional Requirements	
<b>CHAPTER 5. MATERIAL RESOURCE CONSERVATION AND EFFICIENCY</b>			
503.1	Minimum percentage of waste material diverted from landfills	<input type="checkbox"/> 50% <input type="checkbox"/> 60% <input type="checkbox"/> 75%	
503.2	Resilient design and construction	<input type="checkbox"/> Yes	<input type="checkbox"/> No

*(Portions of table not shown remain unchanged.)*

**Add new text as follows:**

**503.2 Resilient Design and Construction.** Where this section is indicated to be applicable in Table 302.1, the project building shall be designed to resist hazards above the minimum requirements in the International Building Code including fire, snow, wind, floods, earthquake, hail and other natural or man-made hazards to reduce the environmental impacts associated with extracting, processing, transporting and installing materials for repairing, replacing or retrofitting a building after a disaster. The requirements of this section shall be performed in accordance with the following:

1. Reduced environmental impacts from disaster resilient design for natural and man-made hazards shall be demonstrated through whole-building life cycle assessment of the project building. To meet this requirement, two buildings shall be designed; a reference building and project building, and life cycle assessment shall be performed on each building. The reference building shall be designed to the minimum requirements of this code and the minimum loads and hazards of the International Building Code and the project building shall be designed to a higher level of loads and hazards. Taking into account the probability of the buildings being subjected to project building loads and hazards over a 75-year life of the buildings, damage to the buildings and the

- environmental impact of repairing, replacing and retrofitting the buildings shall be estimated and these impacts shall be included in the life cycle assessment.
2. The life cycle assessment shall conform to the requirements of ISO 14044.
  3. The life cycle assessment shall demonstrate that the building project achieves not less than a 5-percent improvement in environmental performance for global warming potential and at least 4 of the following impact measures, as compared to a reference design of similar usable floor area, function, materials and configuration that meets the minimum requirements of this code and the requirements of the International Building Code.
    - 3.1. Acidification potential.
    - 3.2. Eutrophication potential.
    - 3.3. Ozone depletion potential.
    - 3.4. Smog potential.
    - 3.5. Depletion of non-renewable energy resources.
    - 3.6. Depletion of non-renewable material resources.
    - 3.7. Use of renewable material resource.
    - 3.8. Use of renewable primary energy.
    - 3.9. Consumption of freshwater.
    - 3.10. Hazardous waste.
    - 3.11. Non-hazardous waste.
    - 3.12. Impact(s) and potential impact(s) on biodiversity.
    - 3.13. Toxicity related to human health, the environment or both.
  4. The reference and project buildings shall utilize the same life cycle assessment tool.
  5. The life cycle assessment tool shall be approved by the code official.
  6. Building operational energy shall be included.
  7. Building process loads shall be permitted to be included.
  8. Maintenance and replacement schedules and actions for components shall be included in the assessment.
  9. The full life cycle, from resource extraction to demolition and disposal, including but not limited to, onsite construction, maintenance and replacement, relocation and reconfiguration, and material and product embodied acquisition, process and transportation energy, shall be assessed.
  10. The complete building envelope, structural elements, inclusive of footings and foundations, and interior walls, floors and ceilings, including interior and exterior finishes, shall be assessed to the extent that data are available for the materials being analyzed in the selected life cycle assessment tool.

**Reason:** The consequences of natural disasters have become increasingly real, personal and devastating. In 2012, there were 11 natural disasters costing \$1 billion or more in damage, making 2012 the second highest year with billion-dollar disasters [i]. Now, with the world's attention on the Philippines after Typhoon Haiyan, communities must rethink the way we build to meet the challenge of natural or man-made disasters. Globally, insurers lost at least \$108 billion on disasters in 2011 and \$77 billion in 2012 [iii]. Reinsurer Swiss Re Ltd. said that 2011 was the second-worst year in the insurance industry's history. Only 2005, with Hurricane Katrina and other major storms, were more costly [iii]. However, most of the increased disaster losses cannot be attributed to an increased occurrence of hazards. Frequency of major US hurricane landfalls has remained constant in the last 60 years [iv], and the trend of strong to violent tornadoes (F3+) has, in fact, decreased since 1954 [v].

Buildings, when designed to minimum code requirements, are intended to experience controlled damage and provide minimum life safety. Therefore even if the building must be demolished or significantly repaired after a major earthquake, hurricane, tornado, fire or flood, it has met the intent of the code. For projects in high-risk areas, this minimal level of performance results in significant additional material impacts following a major natural or man-made event.

As a society, we have placed a great deal of emphasis on recycling rates and carbon footprints. It is ironic that we are surprisingly willing to invest considerable amounts of upfront capital for a building that achieves a modest savings in energy efficiency, yet we are completely satisfied if the structure meets only the code minimum requirements for seismic or wind load and is significantly damaged during these events. A sustainable building should be designed to sustain minimal damage due to natural disasters such as hurricanes, tornadoes, earthquakes, flooding and fire. Otherwise, the environmental, economic and societal burden of our built environment could be overwhelming. A building that requires frequent repair and maintenance or complete replacement after disasters would result in unnecessary cost, from both private and public sources, and environmental burdens including the energy, waste and emissions due to disposal, repair and replacement.

It doesn't make sense to design a modern building, commercial or residential, to meet the green code requirements that could be easily destroyed as a result of a hurricane, earthquake or other force of nature. That would mean that all of the green technology and strategies used in the building would go to the landfill. What is the point of installing low flush toilets in a home to conserve water if it ends up in a landfill after a tornado blows through?

Therefore, this proposal provides a performance pathway to demonstrate the environmental impact reduction through resilient design and construction. To meet the requirements of this section, the two designs shall be documented in separate life cycle assessment models, and the material quantities of the structural and non-structural materials over the 75-year building life shall be compared. The assessment shall demonstrate a reduction in life cycle impacts over the buildings lifetime including the impacts of repair and replacement. This section is similar to section 303.1 of this code on Whole Building Life Cycle Assessment except in this case the design is increased over and above the minimum requirements of the IgCC and the IBC such that the project building will resist minimum design loads and other requirements with lower damage than it would otherwise experience during a natural or man-made event.

It is apparent that there needs to be significant shift in how we address natural disasters, moving away from the traditional focus on response and recovery toward emphasis on resiliency, that is, preventive actions to reduce the effects of a natural hazard. The goal of this requirement is to protect the building and its contents in addition to protecting the occupants, resulting in improved performance over the building life reducing environmental, societal and economic burdens of the building.

**Bibliography:**

[i] National Oceanic and Atmospheric Administration (NOAA) National Climate Data Center. 2011. <http://www.ncdc.noaa.gov/billions>. Accessed October 2013

[ii] Masters, J. 2011. "2011's Billion-Dollar Disasters: Is climate Change to Blame?" Weatherwise, March-April 2012, <http://www.weatherwise.org/Archives/Back%20Issues/2012/MarchApril%202012/dollar-disaster-s-full.html>.

[iii] Swiss Re website. News Release, 27 March 2013, Zurich. [http://www.swissre.com/media/news\\_releases/nr\\_20130327\\_sigma\\_natcat\\_2012.html](http://www.swissre.com/media/news_releases/nr_20130327_sigma_natcat_2012.html). Accessed October 2013

[iv] Weinkle, J., et. al. July 2012. "Historical Global Tropical Cyclone Landfalls" [http://sciencepolicy.colorado.edu/admin/publication\\_files/2012.04.pdf](http://sciencepolicy.colorado.edu/admin/publication_files/2012.04.pdf)

[v] National Oceanic and Atmospheric Administration (NOAA) National Climate Data Center. 2013. "U.S. Tornado Climatology", <http://www.ncdc.noaa.gov/oa/climate/severeweather/tornadoes.html>. Updated May 17, 2013

**Cost Impact:** Will increase the cost of construction

Will have an impact on initial cost in material selection and design. However, will have a positive cost impact resulting from improved performance over the building life.

---

GG189-14 : 503.2 (NEW)-PENG790