



SEI Pre-Standard and Commentary on Disproportionate Collapse:

Part I—Risk and Applicability Determination for Disproportionate Collapse

Kirk MARCHAND

Managing Principal
Protection Engineering
Consultants
Dripping Springs, TX,
USA
kmarchand@protection-consultants.com

Eric WILLIAMSON

Associate Professor
The University of Texas at
Austin
Austin, TX, USA
ewilliamson@mail.utexas.edu

David STEVENS

Senior Principal
Protection Engineering
Consultants
Spring Branch, TX, USA
dstevens@protection-consultants.com

Summary

Guidance in EN 1990 and EN 1991 provides preliminary guidance for determination of appropriate design approaches for mitigation of progressive collapse. This preliminary guidance is somewhat devoid of detail with respect to applicability and analysis. It also does not lend itself well to consensus based professional and industry approaches extant in the US. The SEI Progressive Collapse Standards and Guidance Committee is developing guidance more applicable to the US approach, and has developed preliminary recommendations for risk determination and mitigation strategy applicability.

Keywords: progressive collapse, disproportionate collapse, risk determination, extraordinary loads, robustness.

1. Introduction

The Structural Engineering Institute (SEI) Progressive Collapse Standards and Guidance Committee has determined that a design pre-standard and commentary for disproportionate collapse mitigation will have two components: 1) a risk determination approach that leads the developer, owner, or building official to a determination of the prescriptive or performance based structural measures to be employed, and 2) engineering approaches for the inclusion of these structural measures. The engineering approaches would be selected or “triggered” based on risk and would have two parts; a) a robustness standard that is a function of risk and offers prescriptive measures to be employed and b) a comprehensive performance-based approach that is also a function of risk, but that bases design measures employed on pre-determined and identified actions or combinations of actions.

2. Proposed mitigation approaches and “triggers” for new construction

The mitigation approaches proposed by the SEI committee will provide options for mitigation based on the availability of risk and consequence information where events (actions) and consequences are identified and calculated. If that information is not available, minimum loads for events are provided and acceptable consequences are prescribed. Figure 1 illustrates the proposed approach.

The applicability of these approaches to various building structures can be defined based on ASCE7 occupancy guidelines as recently modified and proposed for use in the latest DoD/GSA guidance on progressive collapse mitigation. Again, it is envisioned that this approach would be applied only as required by local ordinance. Consequences can be defined with a number of metrics, but ultimately are categorized with two main factors: level of occupancy and building function/criticality. This philosophy is reflected in the occupancy categories and their definitions in the table below. The original form of this table in ASCE 7 is used in US building practice for defining importance factors for seismic, wind, and snow design, for application in government, military, civilian and commercial construction.

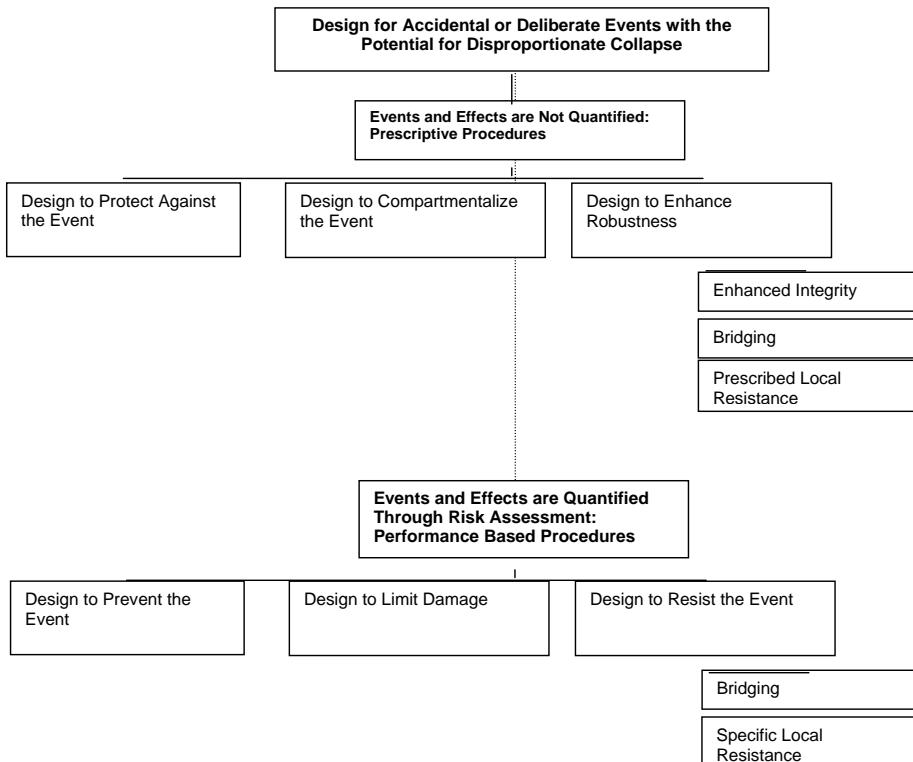


Figure 1. Proposed SEI Approaches for Disproportionate Collapse Mitigation

The occupancy table, combined with proposed mitigation approaches uses building categories according to occupancy and function in a way that would facilitate requirements for strategies or measures for progressive collapse mitigation of increasing rigor. For example:

- Class I may have *no special requirements* for mitigating collapse,
- Class II may require prescribed or risk and consequence based “enhanced robustness” or protection *or* compartmentalization,
- Class III may require prescribed or risk and consequence based enhanced robustness with higher prescriptive/performance requirements *but would not allow alternatively providing protection or compartmentalization*,
- Class IV may require a risk assessment to determine threats/actions and may allow any combination of protection *or* compartmentalization *or* bridging *or* specific local resistance,
- Class V may require a risk assessment to determine threats/actions and may permit mitigation schemes including bridging and specific local resistance *but may not allow alternative designs using protection or compartmentalization*.

These are preliminary ideas, but serve to suggest that a logical framework could be developed.

3. Final SEI product

The goal of the SEI effort is to produce a consensus document; one that has been fully “vetted” by the academic, design professional, constructor and materials communities. While the intention is to have the pre-standard included in building codes by reference, it will be up to local municipalities and governments to determine its mandatory application through statute.