

5.1 PROGRESSIVE COLLAPSE

Progressive collapse can be defined as collapse of all or a large part of a structure by failure or damage of a relatively small part of it.

The general services administration (GSA, 2003b) offers a somewhat more specific description of the phenomenon progressive collapse is a situation where local failure of a primary structural component leads to the collapse of adjoining member which in turn leads to additional collapse.

It has also been suggested that the degree of progressivity in a collapse be defined as the ratio of total collapsed area or volume to the area or volume damaged or destroyed directly by the triggering event.

Avoidance of progressive collapse.

- Progressive collapse occurs when a key member or member of a structure fail.
- The isolated failure of this key member or section then initiates a sequence of events, coursing failure of the entire structure
- Provides a solid exterior surface to meet blast resilience requirements. Minimizes cost to fix a damaged area compared to a steel framed building.
- Eliminates perimeter stell leading to greater interior space planning flexibility.

progressive collapse in abnormal loads.

In the assessment of a particular structure with regard to its collapse resistance, the following design criteria are of importance;

- a. Requirements
- b. Design objectives
- c. Design strategies
- d. Verification procedures

First the requirements, particularly the question if collapse resistance is necessary.

should he clarified. The necessity depends on the structure's significance with respect to the consequences of a collapse, including the immediate material and immaterial

losses but also indirect effects, e.g., the possible impairment of the infrastructure and of civil and national defense_ Another criterion for the determination of requirements is the structure's degree of Exposure to hazards of war, malicious action, and natural disasters. The exposure can be considered particularly high for public buildings, major bridges, and other lifeline structures, If collapse resistance is deemed necessary, the following design objectives must be specified:

1. Assumable extent of accidental circumstances
2. Assumable extent of initial local failure
3. Acceptable extent of collapse progression
4. Acceptable extent of damage to the remaining structure
5. Applicable load combinations and safety factors

The following design strategies to prevent progressive collapse are mentioned in the literature and have at least partially made their way into-the design codes:

- 1.High safety against local failure
 - 1.1. Specific local resistance of key elements (direct design)
 - 1.2. Non-structural protective measures (event control)
2. Design for load case 'local failure' (direct design)
 - 2.1. Alternate load paths
 - 2.2. Isolation by compartmentalization
3. Prescriptive design rules (indirect design)

These methods are further discussed in Section 4 below. The prediction of the structural behavior following a local failure requires suitable verification procedures. Accurate analysis will require a high degree of expertise and modeling effort. Thus, development and validation of simplified but admissible verification methods would be a worthwhile undertaking. The design criteria I. to IV. Listed above are to date only partially addressed in codes and guidelines. As far as applicable design criteria are not available in

codified form, they should be agreed upon by the contracting and other affected parties or established by the building authorities. It is anticipated that the design criteria can only partly be developed from first principles and reliability theory.

There will remain necessity for judgment and a decision-making process, most notably when stipulating the acceptable extent of collapse progression. On the other hand, the choices to be made here are relatively transparent—at least when compared to the choice of a safety index β so that an informed societal consensus is in principle possible (even when that consensus leads to the conclusion that certain kinds of structures should better not be built).

