



## ***Subject: Disproportionate Collapse***

### ***What is Disproportionate Collapse?***

Disproportionate collapse is the inability of a building to withstand collapse disproportionate to its use in the event of limited accidental damage or failure to part of the structure. In such a situation the majority of the building or subsequent floors and structural walls will need to have the ability to retain the majority of their structural integrity should a localised area of the structure be damaged and can not therefore be relied upon for structural support.

### ***Approved Document A3 2004:***

Section 3 of approved document A (Reducing the Sensitivity of the Building to Disproportionate Collapse in the Event of an Accident), states: *'The requirement will be met by adopting the following approach for ensuring that the building is sufficiently robust to sustain a limited extent of damage or failure, depending on the class of the building'*.

Unlike the previous incarnation of this document the 2004 edition very specifically categorises the buildings in the following classes:

#### Class 1

- Houses not exceeding 4 Storeys
- Agricultural Buildings
- Buildings into which people rarely go, provided no part of the building is closer to another building, or area where people go, than a distance of 1.5 times the building height

#### Class 2A

- 5 storey single occupancy houses
- Hotels not exceeding 4 storeys
- Flats, apartments and other residential buildings not exceeding 4 storeys
- Offices not exceeding 4 storeys
- Industrial buildings not exceeding 3 storeys
- Retailing premises not exceeding 3 storeys of less than 2000m<sup>2</sup> floor area in each storey
- Single storey educational buildings
- All buildings not exceeding 2 storeys to which members of the public are admitted and which contain floor areas not exceeding 2000m<sup>2</sup> at each storey



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#### Class 2B

- Hotels, flats, apartments and other residential buildings greater than 4 storeys but not exceeding 15 storeys
- Educational buildings greater than 1 storey but not exceeding 15 storeys
- Retailing premises greater than 3 storeys but not exceeding 15 storeys
- Hospitals not exceeding 3 storeys
- Offices greater than 4 storeys but not exceeding 15 storeys
- All buildings to which members of the public are admitted which contain floor areas exceeding 2000m<sup>2</sup> but less than 5000m<sup>2</sup> at each storey
- Car parking not exceeding 6 storeys

#### Class 3

- All buildings defined above as Class 2A and 2B that exceed the limits on area and/or number of storeys
- Grandstands accommodating more than 5000 spectators
- Buildings containing hazardous substances and/or processes

### **Interpretation of A3**

All building regulations are guidance documents and are not set in stone. Approved Document A3 makes a lot of reference to framed buildings in the sense of concrete or steel framed buildings, not timber frame or SIP's. This means that interpretation of the regulations in the context of A3 when using SIP's is not completely clear. The guidance that is most applicable is that the area at risk of collapse is limited to 15% of the floor area of that storey or 70m<sup>2</sup>, whichever is the less, and does not extend further than the immediate adjacent storeys.

**Class 1 Buildings.** With the above in mind all buildings in class 1 are satisfied as they only need to demonstrate compliance with A1 (Loading), which is demonstrated in the BBA certificate, and A2 (Ground Movement) which is the responsibility of the project engineer to design the foundations so that they can accommodate the loadings from the TEK panel.

**Class 2A Buildings.** Approved Document A3 requires all class 2A buildings are provided with effective horizontal ties, or effective anchorage of suspended floors to walls. Tim Studer, Kingspan TEK structural engineer, detailed in a previous bulletin that:

1 Vertical loads are resisted by the proprietary steel hangers connecting floor joists to the wall.

2 Horizontal loads are resisted by the 22mm OSB deck extending across the full width of the wall so that it is "sandwiched" between the upper and lower wall assemblies. Large screw fixings pass through the timber plate at the base of the upper wall panel, through the deck and into the timber plate at the top of the lower panel.

3 Load in the plane of the floor or walls are transferred to adjacent members by shear loads in the fixings identified above.

**Class 2B Buildings.** Class 2B buildings which include Educational buildings greater than 1 storey in height and Hospitals of any size would need further appraisal and may be best suited to framed constructions.



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**Conclusion:**

All Class 1 buildings can be considered for use with TEK panels as they are not subject to evidence of provisions of disproportionate collapse. Many Class 2A buildings can be considered as suitable for use with TEK (subject to the limitations of the BBA certificate and structural Calculations). Most Class 2B buildings, as stated above, would be best put forward as a framed building.

As with ALL projects being considered for use with The TEK Building System, the full guidance of the companies Structural Engineer (or nominated person) should be sought before fully committing the company to any project not specifically covered within our latest accreditation documents, e.g. BBA / BM Trada / IAB / zulassung.

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