

Fire resistance of composite beams with unfilled deck voids (AD076)

A series of fire tests on composite beams carried out in March 1990 has led to the development of interim design recommendations for the case where the voids created above the steel beam by the profiled decking are left unfilled. This is economically significant because void-filling can be a labour intensive and expensive activity. The research was intended to demonstrate the circumstances in which void fillers can be omitted, and the "trade-off" in terms of increased protection to the section.

The interim recommendations are given in AD077 below. These assume that fire protection materials are assessed on the basis of a limiting temperature of 550°C or, for some materials, 620°C. In some cases an increase in fire protection thickness is needed, based on the publication *Fire Protection for Structural Steel in Buildings (Revised 2nd Edition)* ASFPCM/SCI/FTSG. Alternatively, for board-type materials, an increase in the section factor of the member is more appropriate, as the thickness of these materials increases in discrete steps. The lower value given by the two methods may be used.

The recommendations apply to all composite beams comprising UB or UC sections. They do not apply to unusual structural forms such as stub girders or trusses, although an assessment based on these tests may be appropriate. An upper limit of 90 minutes fire resistance is made because of concerns about excessive heating of the upper flange and potential loss of strength of the shear connectors.

The information is presented more fully in the SCI Technical Report: *Fire Resistance of Composite Beams*. The research was sponsored by 15 organisations, including British Steel, Bovis Construction, and the principal fire protection and composite decking manufacturers.

Fire resistance of composite beams: interim recommendations (AD077)

Fire protection materials assessed on a limiting temperature of 550°C

- 1 (a) Composite or non-composite beams with filled voids, or with re-entrant profiled decking, for all fire resistance periods: recommendation, use the ASFPCM guidance* to determine the fire protection thickness based on the section factor for three-sided heating.
- (b) Composite beams with unfilled voids and with trapezoidal profiled decking.
 - i. 60 minutes fire resistance: recommendation, use ASFPCM guidance*.
 - ii. 90 minutes fire resistance: recommendation, use ASFPCM guidance*, but either add 10% to the thickness of fire protection or add 15% to the section factor for three-sided heating when determining the thickness of fire protection (this is more appropriate for board-type materials). The lower value given by the two methods may be used.
 - iii. 120 minutes or longer fire resistance: recommendation, fill the deck voids above the flange.
- (c) Non-composite beams with trapezoidal decking, for all fire resistance periods: recommendation, fill the deck voids above the flange.

Fire protection materials assessed on a limiting temperature of 620°C

- 2 (a) Composite or non-composite beams with filled voids or with re-entrant profiled decking, for all fire resistance periods: recommendation, use the ASFPCM guidance* to determine the fire protection thickness based on the section factor for three-sided heating.
- (b) Composite beams with unfilled voids and with trapezoidal profiled decking:
 - i. 60 minutes fire resistance: recommendation, use ASFPCM guidance*, but either add 20% to the thickness of fire protection, or add 30% to the section factor for three-sided heating when determining the thickness of fire protection (this is more appropriate for board-type materials). The lower value given by the two methods may be used.
 - ii. 90 minutes fire resistance: recommendation, use ASFPCM guidance*, but either add 30% to the thickness of fire protection or add 50% to the section factor for three-sided heating when determining the thickness of fire protection.
 - iii. 120 minutes or longer fire resistance: recommendation, fill the deck voids above the flange.
- (c) Non-composite beams with trapezoidal decking, for all fire resistance periods: recommendation, fill the deck voids above the flange.

**Fire Protection of Structural Steel in Buildings (Revised 2nd Edition) ASFPCM/SCI/FTSG, 1988.*