

Fire test on light steel floor proves steel performs well in fire

Light steel frames are increasingly used worldwide in residential and hotel buildings of 6 to 8-storeys, primarily because of the speed of installation and productivity benefits of off-site manufacture.

This is also true in the UK where residential buildings of up to 11 storeys have been constructed using this technology. However, the increase in building height leads to longer required periods of fire resistance.

In view of this a full-scale loaded fire test was undertaken on a light steel floor at the Building Research Establishment in the UK (an equivalent organisation to BRANZ). The reason for this research was to develop generic fire design guidance for the light steel framing industry, as well as demonstrate the performance according to the more severe European standard.

The plan dimension of the test floor was 4.5 m x 3.5 m and supported an imposed load of 2.5 kPa plus its self-weight of 0.5 kPa. The floor consisted of 4.5 m span steel C-section joists spaced at 400 mm cross-centres, which were 200 mm deep with 63 mm wide flanges rolled from 1.6 mm thick steel equivalent to G350+Z275 steel supplied to AS 1397.

Initially, a mid-span deflection of 9 mm was measured when a 2.5 kPa imposed load was applied to the floor. During the first 80 minutes of the fire test, the increased deflection of the floor was less than 5 mm but, more importantly, the measured temperature in the steel joists remained at less than 100°C: so the joists would be essentially undamaged and re-usable, even after a severe fire.



View of the light steel floor under a load of 2.5 kPa at the end of the 90 minutes fire resistance test at BRE.

At 90 minutes, the joist temperature reached 280°C, which corresponded to a furnace temperature of over 1000°C. At this point, the deflection had only reached 30mm, which was well below the span/30 limit of 140 mm according to European Standard, the mean temperature of the upper surface was also less than 60°C, which was well within the 140°C limit for this fire test Standard. At the eventual failure at 92 minutes, the deflection was 230 mm due to the rapidly increasing steel temperature, which had reached approximately 600°C at this stage.

The fire resistance period of 90 minutes achieved in this test clearly demonstrates that light steel framing can satisfy some of the most demanding fire resistance periods required for multi-storey buildings. Moreover, the gypsum board that needs to be provided to the ceiling and wall faces to ensure satisfactory acoustic performance, also provides an

inherent fire resistance to this structural solution.

The information from this test can be used immediately by the light steel manufacturers to support their multi-storey design project work and development strategies.

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