Nullifire Australia
Unit 4/15 Flinders Pde North Lakes Q 4509
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SC902 Technical Advisory Note

Plasterboard Cladding in Close Proximity to Intumescent Coated Structural Steel

Introduction

In steel framed buildings it is quite common for load bearing steelwork to be incorporated into composite walls that are clad with plasterboard. This raises the question of how to fire protect the steelwork without significantly increasing the thickness of the wall, which is generally the case if multiple layers of a fire rated plasterboard have to be used.

If the steelwork was fire protected using an intumescent coating, the concern has been that the plasterboard passing across the face (not fixed directly to) of the coated structural will interfere with the expansion of the intumescent thus affecting fire performance. This situation could be encountered with both beams and columns with the plasterboard running either parallel or perpendicular to the flanges. A test was needed to determine if the encased intumescent coated steel remained adequately protected.

Summary

The concerns are centered on the possibility that the plasterboard will restrict the expansion of the intumescent before it falls away, leaving an unprotected area. The sooner the plasterboard falls away, the less chance there is of this happening. For beams, the plasterboard lies in the horizontal position, where gravity will have the most effect. In the case of columns, the plasterboard is in a vertical orientation – a position in which it can support its own weight more adequately. Consequently, beams are the least likely to be influenced as the plasterboard will collapse or bend away from the steel earlier in a fire event. Thus, it was decided that testing plasterboard encased columns would be the more severe testing scenario.

Testing Considerations

Columns will generally have two possible arrangements, as shown in Figure 1. The plasterboard could run either parallel or perpendicular to the flanges. In the perpendicular position the plasterboard only touches at the flange tips, leaving a large amount of space for the intumescent to expand into. The parallel position has the potential to restrict expansion all down the face of the flanges thus possibly resulting in a much greater effect.

Taken together, these two considerations suggest that a column with plasterboard fixed in the parallel orientation suffers the greatest chance of a negative reaction with regards to fire performance. In considering the most common construction scenario that would be encountered, it was decided to test the single layer of plasterboard configuration.

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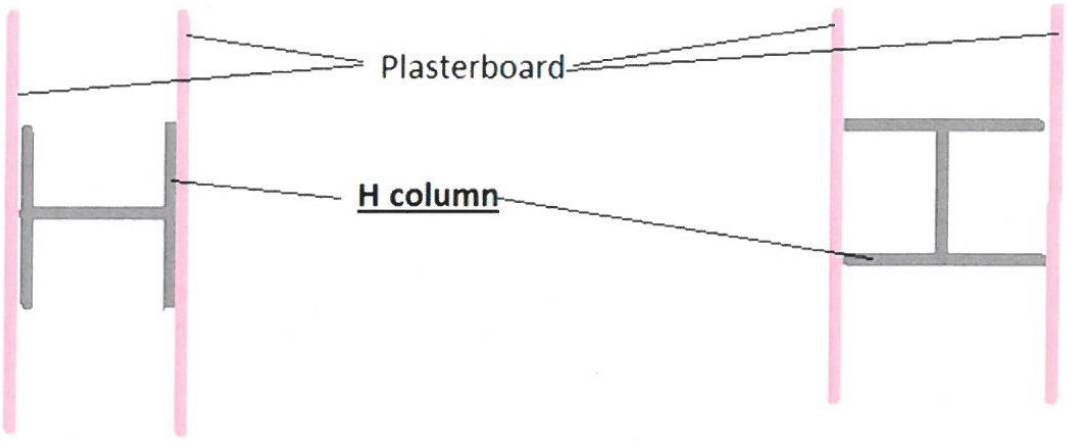


Figure 1.

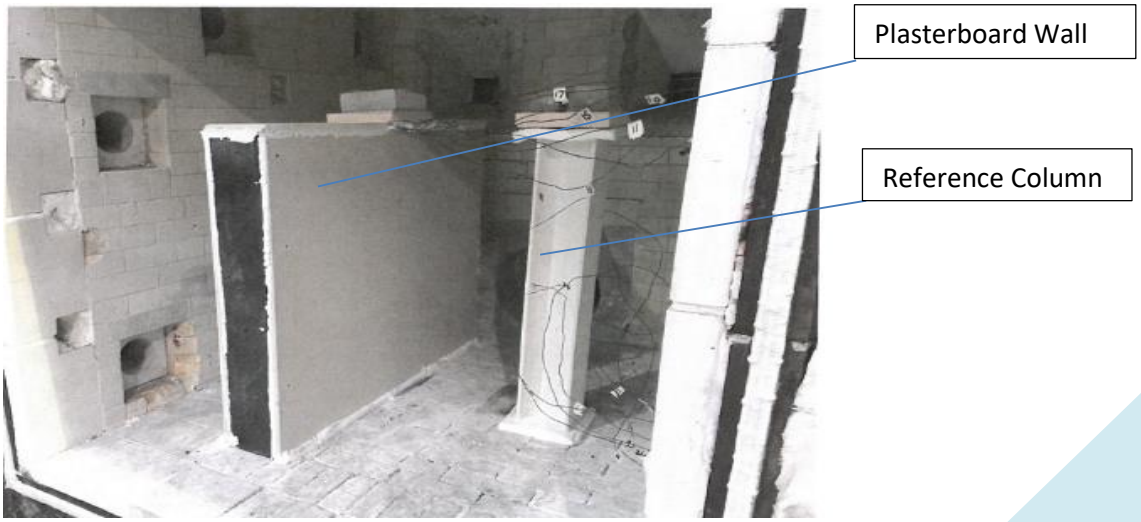
Testing Methodology

Two 150mm diameter x 1mtr high I section columns, of Hp/A 300 designation, were coated with Nullifire SC 900 Series intumescent basecoat being applied to all faces of the steel to achieve a Dry Film Thickness (DFT) of between 2.274 and 2.395mm. BRANZ Fire Assment Report FAR 3997 detailing compliance of Nullifire SC900 Series in accordance with Australian Standards AS1530.4-2005 and AS4100-(13381-8:2010) method designates a DFT of 2.32mm for a 1 hour FRL (60/-/-) at a critical steel temperature of 500°C.

One column was encased with 15mm thick standard plasterboard (non-fire rated) in a 1.2mtr long double sided wall construction with the board running parallel to the flange faces. The board was anchored (screw fixed) to a pair of supporting pillars made from Thermalite Shield block at either end. The plasterboard was run hard up against the column, but was not mechanically fixed to it.

The second column which is used as a reference was placed along side the centrally positioned wall section in the furnace and fire tested according to the methods of the EN13381-8 standard.

Furnace Setup



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Testing

The plasterboard wall started to show signs of damage at 30 mins and by 40 mins was deflecting significantly. By 55 mins both plasterboard wall faces had collapsed but the encased column was still largely black indicating that it had not absorbed as much heat. After 1 hour the free standing column had reached 550°C, but the encased column had only reached 430°C.

Conclusions

The test indicated that the plasterboard encasement did not degrade fire performance but rather, improved it. This test does indicate that we can use the standard product loading tables for Nullifire SC902 with encased sections for both columns and beams. The main proviso is that the plasterboard can not be mechanically fixed directly to the protected steelwork.