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DURABILITY APPRAISAL OF CAVITY WALL TIE

1. INTRODUCTION

Les Boulton & Associates Ltd (LBA) was requested to review the documentation provided by Eagle Wire Products Ltd in order to carry out an assessment of the durability of a new galvanised steel cavity wall tie. The evaluation was required to assess whether the materials employed in manufacture of the Eagle Wire "Short" and "Long" Brick Ties, would meet a fifty year life as set out in Clause B2 "Durability" of the New Zealand Building Code. The evaluation of the durability of the wall tie was to be in accordance with the NZBC Verification Method B2/VM1, Clause 1.1 - In Service History.

2. DESCRIPTION OF THE CAVITY WALL TIE

The Short and Long Brick Ties manufactured by Eagle Wire products Ltd are shown schematically in Appendices 1 and 2. They are both identical in manufacture and materials of fabrication except that the length of the tie at the mortar end of the 'Short' and 'Long' Ties are 85 mm and 116 mm, respectively. The metal wall ties are intended to connect masonry veneer to a timber frame as provided in NZS 3604 -1990; "Light Timber Frame Buildings".

Eagle Wire Products brick veneer wall ties are manufactured from cold-rolled carbon steel strip to produce the two sizes of components shown in the drawings, both of which are 25mm wide X 1.8mm thick. The cold rolled carbon steel coil is manufactured to JIS G3141 -1990; "Cold Rolled Carbon Steel Sheets and Strip". The wall ties are fabricated by pressing and all sharp edges and corners are removed after manufacture. The ties are hot-dip galvanised to comply with NZS/AS1650-1989; "Hot-Dipped Galvanised Coatings on Ferrous Articles".

The 40 mm self-drilling screw that attaches the wall tie to the timber frame is mechanically galvanised and the zinc coating complies with ASTM B695-91;

“Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel” (Appendix 3).

The screw specification is:

12g X 40 mm, Hexagonal Head;
Mechanically Galvanised Screw to Class 40
(ASTM B695 -91) with minimum 40µm zinc
coating thickness.

The screw complies with the requirements for *Corrosion Resistance Class 3*, in NZS/AS 3566-1990; “Screws-Self Drilling-For the Building and Construction Industries” (Amendment No.1; 1990).

3. DISCUSSION

A review of the International Literature has shown that a United Kingdom study¹ on the service performance of cavity wall ties concluded that zinc on galvanised steel ties may be lost (due to corrosion) in the wall cavity at a rate of up to 10 g/m² per annum of service life. This corrosion rate depends greatly on the actual environment in the wall cavity. The rate may be more or less, depending upon the prevailing conditions at the location where the building is constructed. The same study suggests that corrosion rates of the galvanising on ties embedded in the mortar indicates expected losses of zinc in the range 7-11 g/m² per annum.

A study of galvanised steel wall ties recovered from old brick veneer houses in Auckland (>50 years old) revealed that in the severe marine Auckland environment the corrosion rate was probably considerably less than the figures obtained from the UK². Nevertheless, the zinc coating weight of the galvanised steel wall tie needs to be greater than approximately 450 g/m² in order to allow for the event that a corrosion rate in the cavity, or in the cement mortar, approaching 7-10 g/m² may be approached. It is considered that this zinc corrosion rate represents a worst case situation and the structural integrity of the tie will still remain intact even if the steel tie is showing evidence of ‘red rust’. In fact, in the New Zealand study, the galvanised wire ties that did fail in service were located in the wall cavities of a 65 year old brick veneer home situated about 1.5 km from the sea. Furthermore, the old cavity ties examined were only fabricated from No.8 SWG fencing wire.

The most corrosion-prone location on a metal tie in the wall cavity appears to be at the mortar-cavity interface. This effect was revealed in the Auckland study and the damage was mostly due to localised crevice corrosion. With a thick, wide wall tie (25 mm X 1.8 mm) the likely long term damage due to

¹ J.F.A.Moore, “The Performance of Cavity Wall Ties”, Building Research Establishment, CP3/81, United Kingdom, 1981.

² “Durability of Cavity Wall Ties”, Report No.17516.00, Industrial Research Ltd, 1994.

crevice corrosion attack on the galvanised steel at the mortar-cavity interface will be greatly diminished.

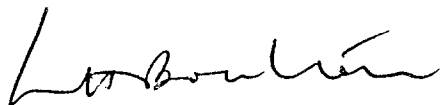
The Eagle Wire galvanised steel wall ties are manufactured from cold-rolled carbon steel strip to JIS G3141 -1990. The mechanical properties of the steel are given in this Standard and the carbon steel employed is suitable for zinc hot-dip galvanising. The ties are hot-dip galvanised to NZS/AS 1650 -1989 and the average zinc coating weight is in excess of 500 g/m² of zinc, as determined by the weight loss chemical analysis method, BS 442 -1982. The ties will be fixed to the interior timber frame with Class 3 mechanically galvanised screws of which only the head will be exposed in the cavity. The remainder of the screw will be embedded in the timber frame.

4. CONCLUSIONS

After studying the available information and assessing the materials chosen by Eagle Wire Products Limited for the manufacture of the cavity wall ties, it is considered that the components will meet the durability requirements for a fifty (50) year life under verification method B2/VM1 of the Building Code, Durability Clause B2.3.

5. ATTACHMENTS: Appendices 1-3.

Report prepared by:



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