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## **ASSESSMENT REPORT**

concerning

The Ability of Masonry Walls Consisting of  
Aerated and Aggregate Concrete Blocks  
in Conjunction with Wi Columns  
Wi Beams and Wi Troughs to Provide Fire  
Resistance in Accordance with the  
Requirements of BS EN 1996-1-2: 2005  
(including the National Annex)

### **Wembley Innovation Limited**

Unit 5 Fourth Way  
Wembley  
HA9 0LH  
United Kingdom

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## 1. SUMMARY

- 1.1 This report presents an appraisal of the expected fire resistance performance of loadbearing and non-loadbearing masonry walls constructed from aerated or aggregate concrete blocks, in relation to the requirements of BS EN 1996-1-2: 2005 (including the National Annex).
- 1.2 The report also considers the fire resistance performance of Wi Columns and Wi Beams and Wi Troughs when used in masonry walls constructed from Wi Slot Blocks, aerated or aggregate concrete blocks.
- 1.3 It is expected that single leaf masonry walls made from Wi Slot Blocks without additional surface finishes and constructed in accordance with BS EN 1996-1-1; 2005 (including the National Annex) would be expected to provide fire resistance periods in terms of the performance criteria defined in BE EN 1996-1-2: 2005 (including the National Annex) when exposed to fire from either side separately, as shown in the Table 1. It is expected that perforations of the masonry walls, will be assessed for fire protection requirements to ensure the protected perforations achieve a satisfactory level of fire protection in line with the required duration of the wall construction.

Table 1

Maximum fire resistance period – up to minutes	Loadbearing Class REI				Non-loadbearing Class EI			
	Wi Slot Block Thickness mm to minutes				Wi Slot Block Thickness mm			
	100	140	190	215	100	140	190	215
30	√	√	√	√	√	√	√	√
60	√	√	√	√	√	√	√	√
90	√	√	√	√	√	√	√	√
120	√	√	√	√	√	√	√	√
180	x	√	√	√	√	√	√	√
240	x	x	√	√	√	√	√	√

√ denotes meets performance criteria. x denotes performance criteria not met.

- 1.4 It is acceptable to incorporate Wi Columns and Wi Beams and Wi Troughs into Wi Slot Block and aerated and aggregate concrete blocks walls of a similar fire rating and maintain the fire resistance performance given in Table 1.
- 1.5 UL is an accredited Notified Body (Number 0843) to the European Construction Products Directive 89/106/EEC (CPD). This enables us to assess fire-resistance products to applicable EN standards and issue the CE Certificate of conformity. For a list of our full accreditations for testing please see UKAS schedule 5772 and for Certifications please see UKAS schedule 4705.

## 2. Assumptions

- 2.1 It is assumed that the walls will be constructed with the mortar beds and perpends fully filled with mortar. It is assumed that the construction of the walls complies with the requirements of BS EN 1996-1-1: 2005 (including the National Annex).

- 2.2** This report assumes that non-loadbearing walls carry no load other than their own weight and edge restraint and that the load for loadbearing walls does not exceed the maximum permissible design stresses in terms of BS EN 1996-1-1: 2005 (including the National Annex).
- 2.3** It is expected that perforations of the masonry walls, will be assessed for fire protection requirements to ensure the protected perforations achieve a satisfactory level of fire protection in line with the required duration of the wall construction.

### 3. Proposals

- 3.1** It is proposed to provide a range of loadbearing and non-loadbearing, concrete blockwork walls constructed from Wi Slot Blocks and aerated or aggregate concrete blocks used in conjunction with Wi Columns, Wi Beams and Wi Troughs.
- 3.2** The walls are required to provide fire resistance period up to 240 minutes by satisfying the requirements on BS EN 1996-1-2 (including the National Annex).

### 4. Details of Components

- 4.1** Wi Slot Blocks are manufactured from lightweight aggregates to form a medium density (dry density 1450kg/m<sup>3</sup>) concrete block nominally 440mm long by 215mm high. The blocks comply with the specification of EN 771-3 and have specially designed vertical slots and end grooves. The blocks are supplied in nominal thicknesses of 100mm, 140mm, 190mm and 215mm.
- 4.2** Wi Columns are designed to be integrated in walls composed of aggregate concrete blocks to provide resistance to lateral forces e.g. wind loading. Briefly, the columns are constructed from hollow concrete blocks infilled with C40 grade structural concrete which contains H16 steel reinforcing bars that extend the height of the wall. There are two bars per column. See Figure 1 for typical details
- 4.3** Wi Beams are designed to be integrated in walls composed of aggregate concrete blocks to provide horizontal support as a number of separate courses throughout the height of the wall. Wi Troughs are designed to act as lintels above openings. Wi Beams and Troughs briefly consist of horizontal concrete 'troughs' filled with C40 grade structural concrete reinforced with H16 steel bars. See Figures 2 and 3 for typical details.

### 5. Assessed Performance of Masonry Walls

- 5.1** BS EN 1996-1-2 provides methods whereby masonry walls may be designed to provide various periods of the fire resistance. One such method relates to tabulated data which may be used to derive a fire resistance classification for a wall design depending upon the composition of the wall and whether it is required to be loadbearing or non-loadbearing.
- 5.2** Fire resistance classifications for walls are designed by the letters R, E and I. These are performance requirements and are briefly summarised as follows;
- R relates to the loadbearing capability - structural stability under load
  - E relates to integrity - the formation of through gaps (above a specified size) or flaming on the unexposed face.

- I relates to thermal insulation – limitations in the temperature of the unexposed face to prevent fire spread by heat transfer.

**5.3** As walls can be both a structural element (loadbearing ) and a separating element preventing fire spread from one side to the other the following classifications are used in this report:

- Loadbearing walls: REIxxx
- Non-loadbearing walls: EIxxx  
where xxx is the performance expressed in minutes.

**5.4** Wi Slot Blocks are considered to fall within the category of dense and lightweight aggregate masonry and are Group 1 units since the void content is <25% and the dry density (1450kg/m<sup>3</sup>) is between 400 and 1700kg/m<sup>3</sup>. Therefore walls constructed with these blocks may be deemed to provide fire resistance performances in accordance with Table NA.3.8 for loadbearing walls and Table NA.3.7 for non-loadbearing walls listed in BS EN 1996-1-2 (National Annex).

**5.5** In accordance with the tables the performances for walls composed of Wi Slot Blocks without applied finishes are deemed appropriate as given in Table 2:

Table 2

Maximum fire resistance period – up to minutes	Loadbearing Class REI				Non-loadbearing Class EI			
	Wi Slot Block Thickness mm to minutes				Wi Slot Block Thickness mm			
	100	140	190	215	100	140	190	215
30	√	√	√	√	√	√	√	√
60	√	√	√	√	√	√	√	√
90	√	√	√	√	√	√	√	√
120	√	√	√	√	√	√	√	√
180	x	√	√	√	√	√	√	√
240	x	x	√	√	√	√	√	√

√ denotes meets performance criteria. x denotes performance criteria not met.

## 6. Assessed Performance of Wi Columns, Wi Beams and Wi Troughs

- 6.1** Wi Slot Block and aerated or aggregate concrete block walls may include Wi Columns, Wi Beams and Wi Troughs therefore it is important that the introduction of these components does not adversely affect the deemed performance of the walls.
- 6.2** In the case of Wi Troughs acting as lintels e.g. above a door the performance of the lintel is considered in isolation i.e. does not consider the construction below and exposure to one face only.
- 6.3** It is considered unlikely that the inclusion of these elements will diminish the deemed integrity and insulation performance of both loaded and non-loadbearing walls (EI) for the following reasons:

- These elements are an integral part of the wall and are effectively tied to it and will therefore tend to act in unison, consequently they would be expected to perform in a similar manner.
- They are infilled with reinforced concrete and will be of at least the same thickness as the wall therefore similar levels of insulation performance could be expected.
- In addition, the concrete infill when heated is likely to gradually produce water which will have a cooling effect.

**6.4** The Wi Columns, Wi Beams and Wi Troughs contain C40 structural grade concrete and are reinforced with H16 steel bars consequently it is considered reasonable to seek guidance concerning the likely fire performance of these components by reference to BS EN 1992-1-1:2004+A1:2014.

**6.5** This document provides simplified tabulated data for designing concrete construction for fire resistance and although not directly related to the Wi components since these are integral within the wall does provide guidance for concrete construction such as walls.

**6.6** Generally, the ability of loadbearing concrete structure to maintain stability under fire conditions can be related to the cover or protection provided to the steel reinforcing. In principle the surrounding concrete needs to limit the temperature of the steel so that it maintains its structural capability for the specified period.

**6.7** BS EN 1992-1-1:2004+A1:2014 refers to concrete walls with reinforcement and various types of concrete including lightweight and dense aggregate consequently the performance of the concrete core of the Wi components may be evaluated using the data from this table.

**6.8** In the case of the Wi components the minimum cover to the reinforcing of the thinnest component (100mm) is 42mm and from the tables the maximum cover requirement for up to 240 minutes is 25mm suggesting that the reinforcing bars of the Wi components are adequately protected. Any variation of the standard Wi Column, Wi Column and Wi trough elements should ensure that a minimum cover of 25 mm is maintained (see figure 4 &5).

**6.9** Consequently, it is considered unlikely that the inclusion of these components will diminish the structural stability (R) performance of the walls as listed in Table 1. The fire-rated performance of Wi Columns, Wi Beams and Wi Troughs will apply with alternative aerated or aggregate concrete blocks, which have a similar performance to Wi Slot Blocks.

## **7. Conclusions**

**7.1** This report presents an appraisal of the expected fire resistance performance of loadbearing and non-loadbearing masonry walls constructed from aerated or aggregate concrete blocks, in relation to the requirements of BS EN 1996-1-2: 2005 (including the National Annex).

**7.2** The report also considers the fire resistance performance of Wi Columns and Wi Beams and Wi Troughs when used in masonry walls constructed from aerated or aggregate concrete blocks.

**7.3** It can be concluded that unperforated single leaf masonry walls made from Wi Slot Blocks without additional surface finishes and constructed in accordance with BS EN 1996-1-1 (including the National Annex) would be expected to provide fire resistance periods in terms of



the performance criteria defined in BE EN 1996-1-2: 2005 (including the National Annex) when exposed to fire from either side separately, as shown in the Table 3.

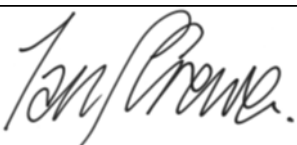

Table 3

Maximum fire resistance period – up to minutes	Loadbearing Class REI				Non-loadbearing Class EI			
	Wi Slot Block Thickness mm to minutes				Wi Slot Block Thickness mm			
	100	140	190	215	100	140	190	215
30	√	√	√	√	√	√	√	√
60	√	√	√	√	√	√	√	√
90	√	√	√	√	√	√	√	√
120	√	√	√	√	√	√	√	√
180	x	√	√	√	√	√	√	√
240	x	x	√	√	√	√	√	√

√ denotes meets performance criteria. x denotes performance criteria not met.

- 7.4** It is acceptable to incorporate Wi Columns and Wi Beams and Wi Troughs into Wi Slot Block walls and maintain the fire resistance performance given in Table 1:

## 8. Signatories

Report by:	Reviewed By
	
I J Crewe* Senior Project Engineer	S G Baker* Staff Engineer
Buildings and Life Safety Technology Division	Buildings and Life Safety Technology Division

\*For and on behalf of UL LLC.

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## 9. References

- 9.1** NA to BS EN 1996-1-2: 2005 UK National Annex to Eurocode 6: Design of masonry structures - Part 1-2: General Rules – structural fire design.
- 9.2** NA to BS EN 1996-1-1: 2005 UK National Annex to Eurocode 6: Design of masonry structures - Part 1-1: General rules for reinforced and unreinforced masonry structures.
- 9.3** BS EN 1992-1-1: Eurocode 2: Design of concrete structures. General rules and rules for buildings
- 9.4** BS EN 771-3 Specification of masonry units – Aggregate concrete.

Figure 1- Typical Details of the Wi Column

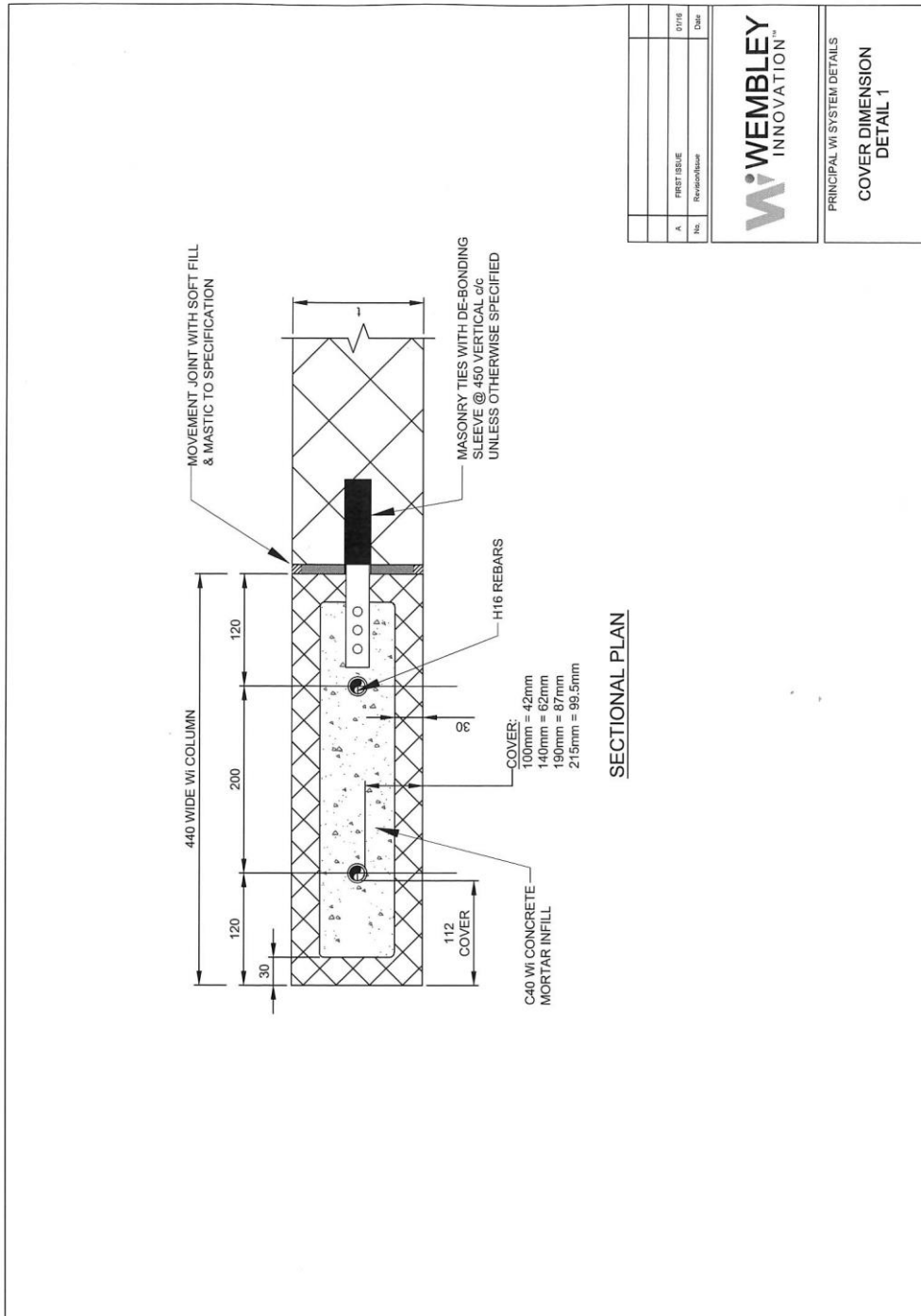




Figure 2- Typical Details of the Wi Beam

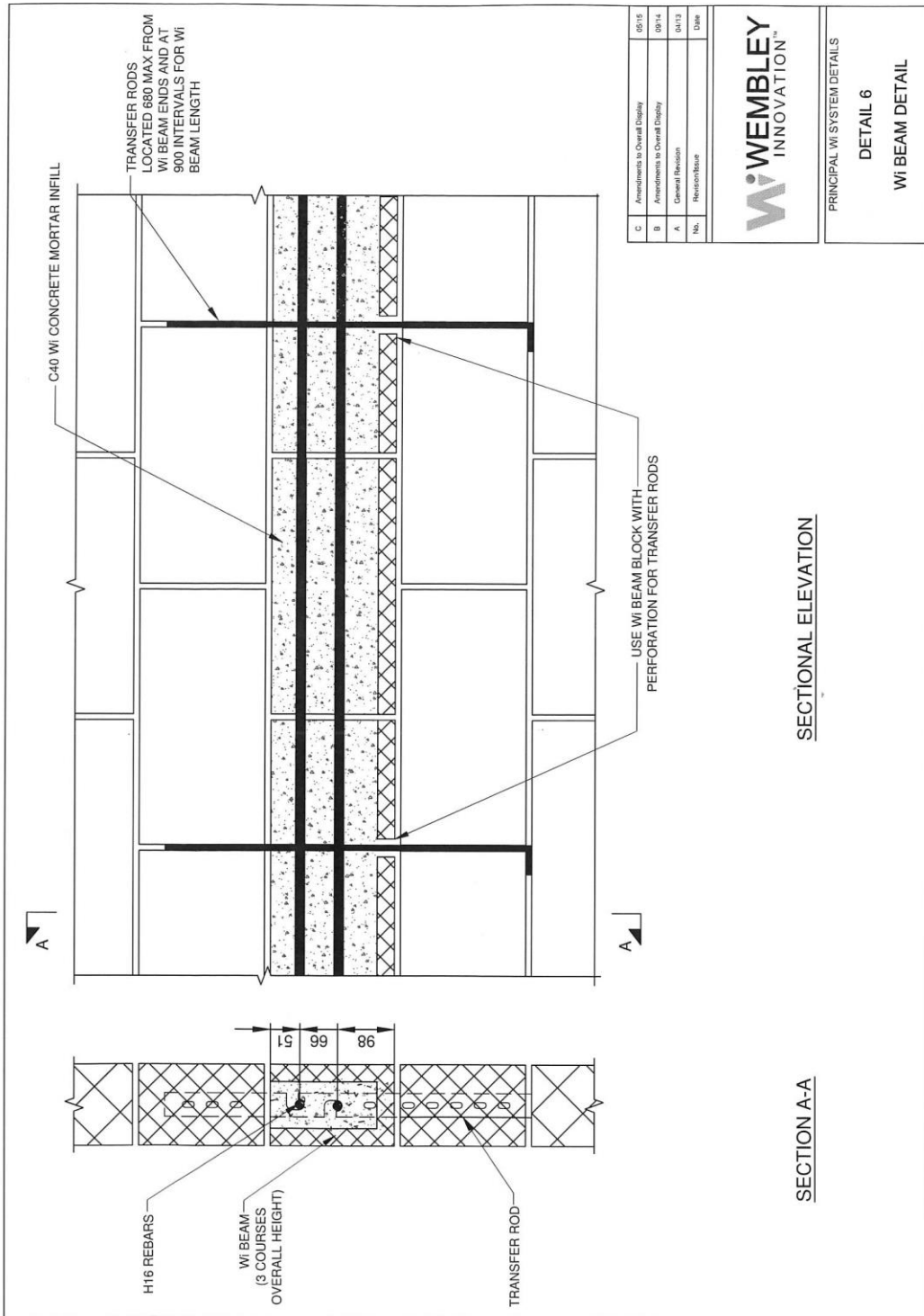
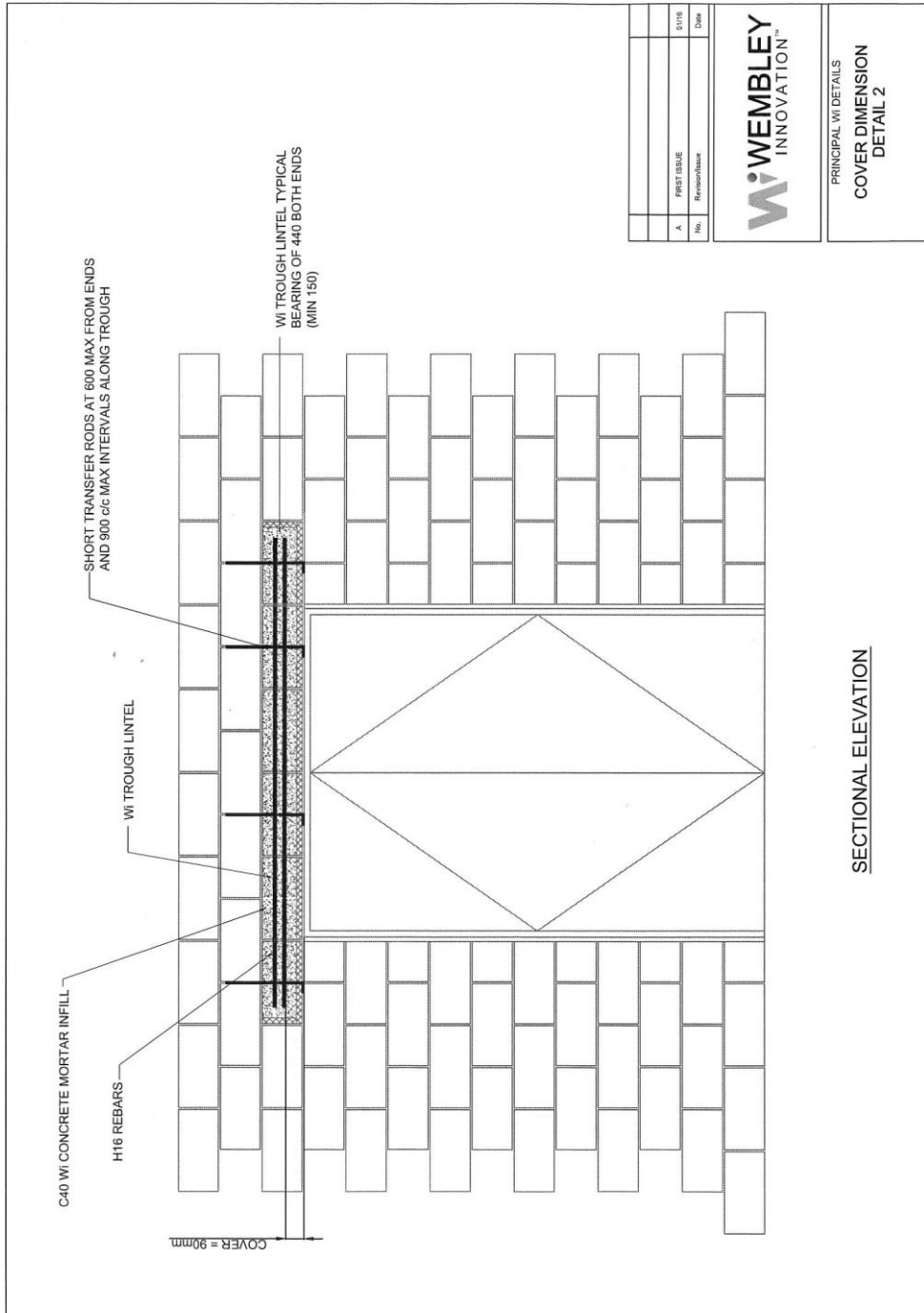
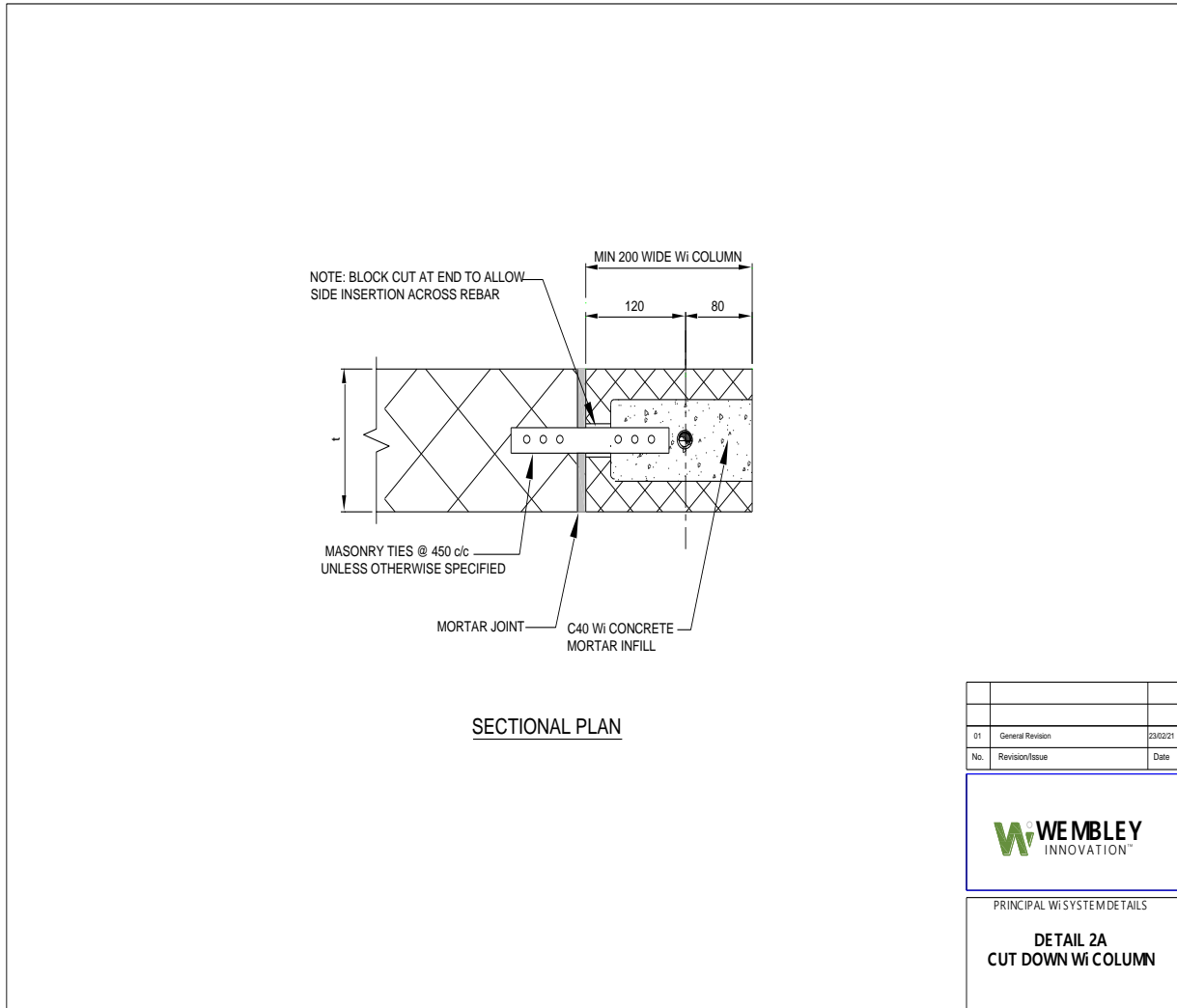




Figure 3 – Typical Details of the Wi Trough (Lintel)



**Figure 4 – Typical Details of a non-standard Wi Column**



**Figure 5 – Typical Details of a non-standard Wi Beam/Wi Trough Lintel**

