Lintel Design Guidance for Masonry Veneer

Main image: Firth Industries. Image below: Klinker Profi.

Introduction

Openings in a masonry veneer wall require a lintel to span across and support the veneer above. Viewed as a secondary structural component, a lintel's role is to uphold the masonry that forms an arch over the opening. It accomplishes this by dispersing the vertical load of the masonry, away from the opening and towards its sides.

This guide provides insights on the variety of lintels available and the design methodology for brick veneer lintels.

Only masonry veneers fixed to a base structure, typically using veneer ties are covered. Structural masonry construction, which is almost always reinforced and concrete filled masonry, is not included.

Definition

A 'lintel' is a beam component engineered to bear a section of a wall that contains an opening. For running bond masonry, the forces borne by the lintel can be visualised as a triangular arrangement of units above it, as the bonding of the wall induces an arching effect over the opening. Figure 1 illustrates how the load is distributed to lintels.

Where the veneer is constructed using stack bonding, the arching effect is not applicable, and all the masonry above the lintel is assumed to be supported by it.

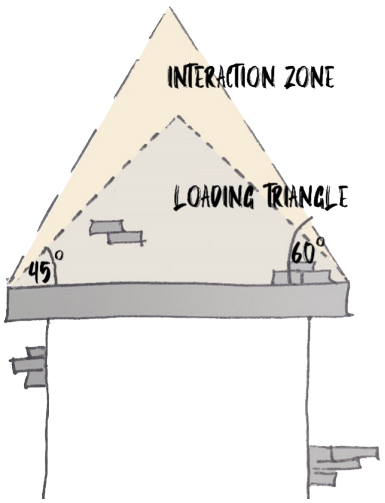

Figure 1. Load distribution of running bond masonry to a veneer lintel.

Image: Klinker Profi.

Detailing

Masonry veneer lintels are typically steel angle sections (EA or UA) embedded in the veneer. Other solutions include steel shelves fixed to primary structural elements, or precast concrete lintels. Steel shelves fixed to primary structure beams are Specific Engineering Design (SED) and are not covered by this guide. Precast concrete lintels are not common and are not covered by this guide.

Steel angles work by embedding within the veneer, bearing on the blockwork at either side of an opening. The angle has strength in bending, supporting the cladding across the opening.

Corrosion, or rusting, is a concern with steel lintels exposed to the elements, with corrosion being unsightly and ultimately reducing the section strength. Treatment of the steel must be carefully considered at the design stage.

Steel Lintel Dimensions

Steel lintels for masonry veneer are detailed in Appendix E of *NZS 4229:2013* and the *New Zealand concrete masonry manual,* Section 5.5. These solutions, when applied correctly, are considered to comply with the *New Zealand building code (NZBC)*. Solutions outside of the requirements specified in these documents are SED must be specified by a suitably qualified Structural Engineer.

This guide only considers solutions that do not require SED.

Either side of an opening in a veneer, a minimum 230 mm length of wall is required as a supporting jamb. The steel angle is embedded into the mortar line at the opening head with at least 100 mm seating for opening spans up 2000 mm width. Opening spans exceeding 2000 mm require a 200 mm seating for the steel angle.

For running bond masonry, Table 7 of CCANZ CP01:2022 details the angle sections required for various thickness of veneers, the lintel span, and height of veneer supported.

For stack bond masonry, Table 13.2 of the *New Zealand concrete masonry manual* Section 5.5 details the angle sections required. Stack bond lintels are larger than the equivalent running bond lintels because stack bond veneer does not form a natural arch action in the same way that running bond does.

Veneer Thickness

When determining the correct lintel size, first determine the veneer to be used. Lintels are provided for veneer of a width of between 70 mm and 90 mm. The masonry units may be solid or hollow.

Maximum Height of Veneer Supported

The height of veneer supported is the height of masonry above the opening. Typically, this height will extend from the opening further up to the roof or a parapet.

In some situations, a shelf angle may be provided to support the veneer at each floor level with a physical gap provided between the masonry at the top of the lower floor and the shelf above. For this scenario the masonry height is taken from the opening to the gap.

Where the masonry has a sloped profile above the opening, the veneer height should be taken as the maximum (i.e. worst-case scenario).

Three columns are provided in the tables – veneer heights up to 350 mm, between 350 mm and 700 mm, and between 700 mm and 2000 mm. For openings with veneer height above the opening of more than 2000 mm, specific engineering design is required.

Diagram of Key Dimensions

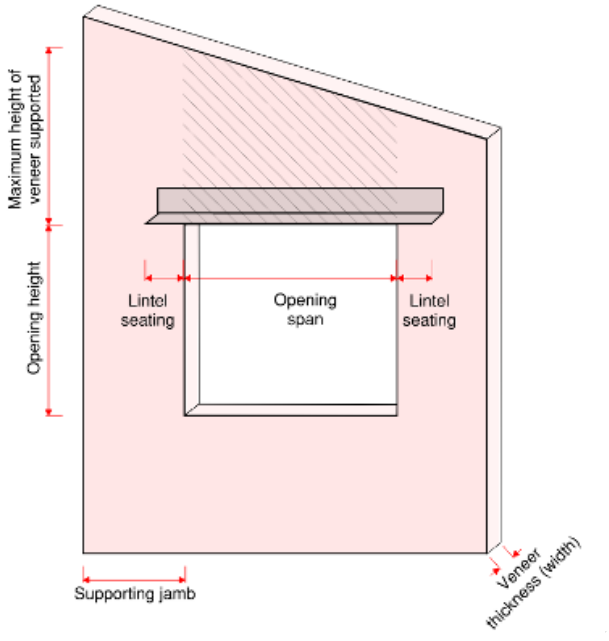

Figure 2. Illustrative diagram of key dimensions.

Maximum Opening Span

The opening span, or lintel span, is the clear distance between the masonry jambs either side of the opening. Steel angle sections are specified for maximum spans of 2000 mm, rising in 500 mm increments up to a maximum of 4800 mm.

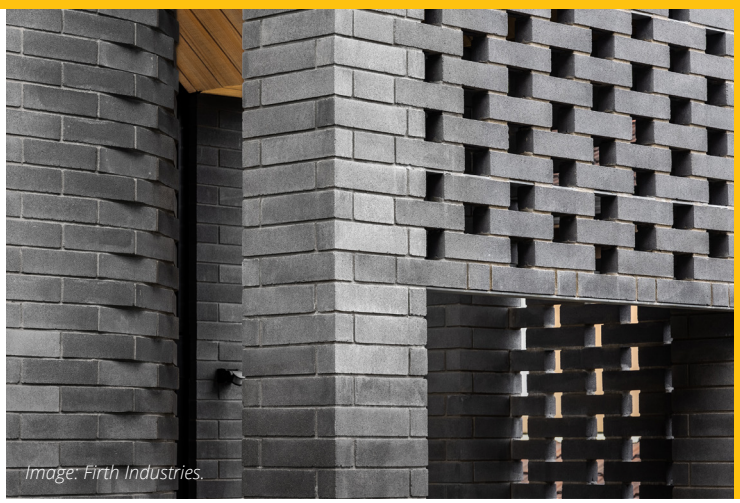

Image: Firth Industries.

Maximum Opening Height

The maximum height of an opening in a veneer is 5650 mm. It is recommended that a structural engineer be consulted where the opening height exceeds 4000 mm.

Design Criteria

The lintels in the table are specified to have a maximum deflection of the least of 10 mm or span over 360 (L/360). This will prevent undue deformation of the veneer, and subsequent cracking.

Veneer ties should be added to the second row of mortar (or a maximum of 200 mm) above the opening.

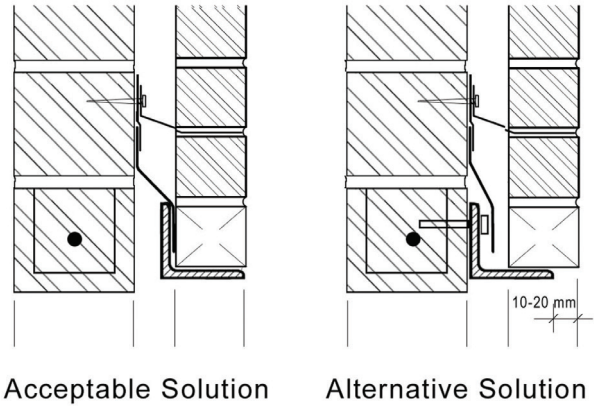

Figure 3. Veneer lintel.

NZBC, E2/AS1, acceptable solution for lintel bar, provides a method where the angle spans the brick from one side to the other as shown in Figure 3.

The lintel should be kept either solely in the brick (acceptable solution) or the structural wall (alternative solution) but not both.

An alternative solution for lintel bars involves the angle being attached directly to the structural wall, as shown in Figure 3. It is required that the veneer sits on the lintel at least by 2/3^{rds} of the veneer thickness and the maximum overhang of the bricks shall be 25 mm.

Example – Running Bond

For an opening span of 2750 mm, with 70 mm thick veneer, and a height above the opening of 1250 mm, requires a 125 x 75 x 8 angle.

Concrete NZ. *CCANZ CP 01:2022 Code of practice for weathertight concrete and concrete masonry construction.* **Table 7.**

Table 7	Veneer lintel table – steel angles					
Maximum lintel span (mm)	Veneer thickness 70 mm			Veneer thickness 90 mm		
	Maximum veneer height supported			Maximum veneer height supported		
	350 mm	700 mm	2000 mm	350 mm	700 mm	2000 mm
2000	80 x 80 x 8	80 x 80 x 8	80 x 80 x 8	90 x 90 x 8	90 x 90 x 8	90 x 90 x 8
2500	80 x 80 x 8	80 x 80 x 8	90 x 90 x 8	90 x 90 x 8	90 x 90 x 8	90 x 90 x 10
3000	90 x 90 x 8	90 x 90 x 8	125 x 75 x 8	90 x 90 x 8	90 x 90 x 8	90 x 90 x 10
3500	90 x 90 x 8	90 x 90 x 8	125 x 75 x 8	90 x 90 x 8	90 x 90 x 10	125 x 75 x 10
4000	90 x 90 x 8	125 x 75 x 8	125 x 75 x 10	90 x 90 x 10	125 x 75 x 8	150 x 90 x 10
4500	125 x 75 x 8	125 x 75 x 10	–	125 x 75 x 8	125 x 75 x 10	–
4800	125 x 75 x 8	125 x 75 x 10	–	125 x 75 x 8	125 x 75 x 10	–

Example – Stack Bond

For an opening span of 2750 mm, with 70 mm thick veneer, and a height above the opening of 1250 mm, requires a 150 x 90 x 10 UA.

New Zealand concrete masonry manual: 5.5 Veneer – Stack bond. **Table 13.2.**

Table 13.2	Stack veneer lintel table – steel angles					
Maximum lintel span (mm)	Veneer thickness 70 mm			Veneer thickness 90 mm		
	Maximum veneer height supported			Maximum veneer height supported		
	350 mm	700 mm	2000 mm	350 mm	700 mm	2000 mm
2000	80 x 80 x 8	80 x 80 x 8	125 x 75 x 8	90 x 90 x 8	90 x 90 x 8	125 x 75 x 8
2500	80 x 80 x 8	80 x 80 x 8	125 x 75 x 8	90 x 90 x 8	90 x 90 x 10	150 x 90 x 10
3000	90 x 90 x 8	125 x 75 x 8	150 x 90 x 10	90 x 90 x 10	125 x 75 x 8	–
3500	125 x 75 x 8	125 x 75 x 8	–	125 x 75 x 8	125 x 75 x 10	–
4000	125 x 75 x 8	150 x 90 x 10	–	125 x 75 x 8	150 x 90 x 10	–
4500	125 x 75 x 10	150 x 90 x 10	–	150 x 90 x 10	–	–
4800	150 x 90 x 10	–	–	150 x 90 x 10	–	–

Lintel Orientation

Uneven Angle (UA) lintels are to be installed so the long angle leg is vertical.

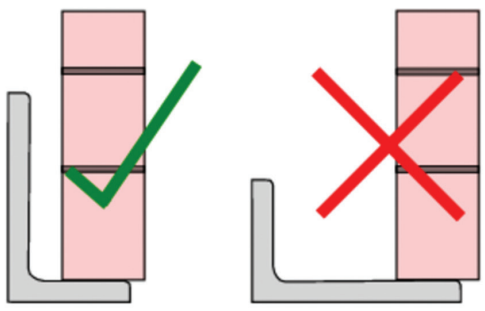

Figure 4. Correct orientation of UA (Uneven Angle) lintels.

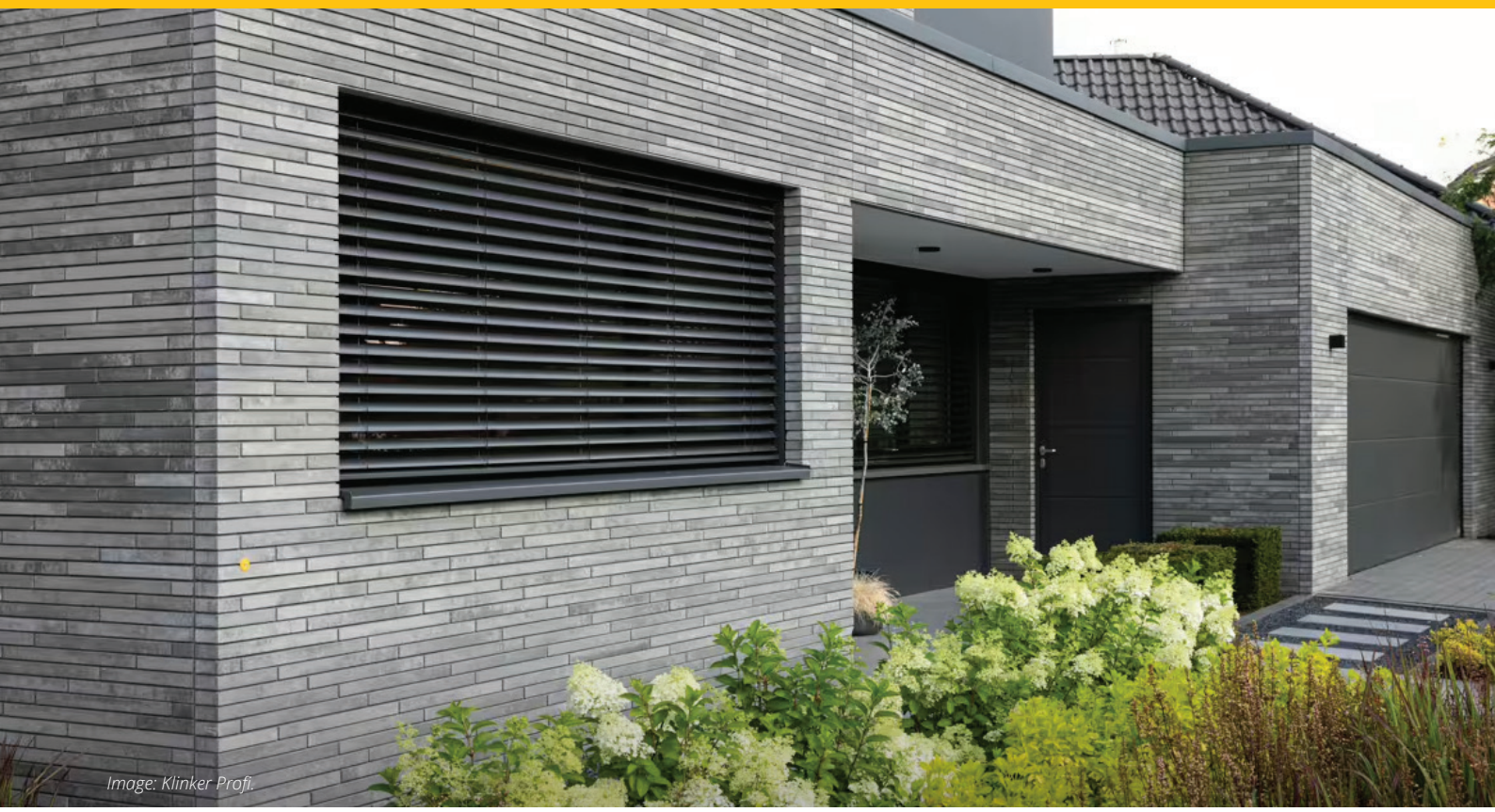

Image: Klinker Profi.

Corrosion Protection

To prevent undue corrosion, steel angles must be galvanised mild steel or be stainless steel, depending on the exposure zone. For all New Zealand exposure zones suitable systems are either

- Grades 316, 316L or 304 stainless steel, or
- Hot dipped galvanising with a coating thickness of at least 600 grams per metre square with an additional duplex coating.

In most parts of the country (away from the ocean), the duplex coating for the galvanised may be omitted.

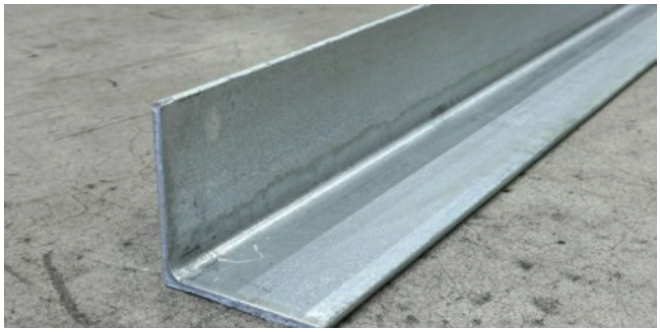

Figure 5. A typical galvanised steel lintel.

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