RAPIDWALL®

ENGINEERING DESIGN GUIDELINES

COTTAGE CONSTRUCTION

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1. FOUNDATION DESIGN

Foundations for cottage construction, using Rapidwall® as the main walling material, shall be designed based on an equivalent type of construction determined from Table 3.1 of the Australian Standard AS 2870. In applying this standard it is recommended that Rapidwall® construction be considered as *articulated masonry veneer* when founded on sites of classifications A or S and as *masonry veneer* on all other site classifications.

2. VERTICAL ARTICULATION JOINTS

Vertical articulation joints shall be incorporated Rapidwall® cottage construction as necessary to control and limit the effects of wall movements caused by differential foundation movement, structural and/or thermal effects. However based on experience and testing it is recommended that the following general guidelines be adopted in detailing a cottage design:-

- For the Rapidwall® not filled with concrete, panels can be installed in lengths up to 12 metres but external walls should have vertical control joints, cut on-site if appropriate, into lengths not exceeding eight metres. Such control joints should not be placed on either side of window and door openings.
- For Rapidwall® filled with concrete and dowelled to a concrete floor or foundation in accordance with the detailed guidelines, panels can be installed in lengths up to 12 metres without control joints. Providing lintel reinforcement is designed and used in accordance with the guidelines, control joints may be placed adjacent to window and door opening. When cutting vertical control joints on site, which is recommended, they should be cut after the concrete has been placed and set in the Rapidwall® cells and the cuts should be through the 13 mm face only. Providing the cuts on either side of the wall are within the same Rapidwall® cell, they need not be opposite each other. Including the bases of Rapidwall® on a foundation, seal all control joints after applying any surface sealants and finishes.

3. ROOF TIE-DOWNS

Roof tie-downs must be designed based on the uplift wind forces calculated in accordance with AS/NZS1170 part 2, 2002. Providing the following conditions are satisfied, for normal cottage construction the simplified design tables provided in this section may be used. In other conditions a specific tie-down design is best completed by a suitably qualified professional structural engineer.

Conditions:

- Rapidwall® used without concrete filling;
- Applicable only to regions A, B and C as specified by AS/NZS1170.2, 2002;
- Average wind recurrence interval: 500 years;
- Terrain category 3, building height h≤10m;
- Outside local topographic zone of hills, ridges and escarpments;
- Roof slope $\alpha \geq 15°$;
- Roof area $\geq 100m^2$;
- External walls fully enclosed and without significant openings (except region C);
- Applicable only to regular rectangular shaped houses (or combination of rectangles) with roof trusses supported by two end walls.

Table 3.1 Tie down design provision for region A

		Tie down provision						
Roof truss span (m)		3	5	7	9	11	13	15
Roof self-Weight (kg/m^2)	15	FT@1.5	FT@1.5	FT@1.25	FT@1	FT@1	FT@0.75	FT@0.75
	25	WT@1.5	FT@1.5	FT@1.25	FT@1	FT@1	FT@1	FT@0.75
	35	WT@1.5	FT@1.5	FT@1.5	FT@1.25	FT@1	FT@1	FT@1
	45	WT@1.5	FT@1.5	FT@1.5	FT@1.25	FT@1.25	FT@1	FT@1
	55	WT@1.5	WT@1.5	FT@1.5	FT@1.5	FT@1.5	FT@1.25	FT@1.25
	65	WT@1.5	WT@1.5	WT@1.5	FT@1.5	FT@1.5	FT@1.5	FT@1.5
	75	WT@1.5	WT@1.5	WT@1.5	WT@1.5	WT@1.5	FT@1.5	FT@1.5
	90	NA	NA	NA	NA	NA	NA	NA

Table 3.2 Tie down design provision for region B

		Tie down provision						
Roof truss span (m)		3	5	7	9	11	13	15
Roof self-weight (kg/m^2)	15	FT@1.5	FT@1	FT@1	FT@0.75	FT@0.75	FT@0.75	FT@0.5
	25	FT@1.5	FT@1.25	FT@1	FT@0.75	FT@0.75	FT@0.75	FT@0.75
	35	FT@1.5	FT@1.25	FT@1	FT@1	FT@0.75	FT@0.75	FT@0.75
	45	FT@1.5	FT@1.25	FT@1	FT@1	FT@0.75	FT@0.75	FT@0.75
	55	FT@1.5	FT@1.5	FT@1.25	FT@1	FT@1	FT@0.75	FT@0.75
	65	WT@1.5	FT@1.5	FT@1.25	FT@1	FT@1	FT@1	FT@0.75
	75	WT@1.5	FT@1.5	FT@1.5	FT@1.25	FT@1	FT@1	FT@1
	90	WT@1.5	WT@1.5	FT@1.5	FT@1.5	FT@1.25	FT@1.25	FT@1

Table 3.3 Tie down design provision for region C

Roof truss span (m)		3	5~9	11~15
Roof self-weight (kg/m^2)	15~90	FT@0.25	FT@0.25	FT@0.25

Notes:

- NA denotes that no tie down is needed
- FT denotes Foundation Tie that shall be anchored into foundation
- WT denotes Wall Tie that is tied into the ribs of the wall
- The number follows '@' denotes the spacing of ties in meters
- Details of tie down shall be provided in accordance with typical details
- For information, typical roof weights may be found from Table 3.4. However, it is the responsibility of the designer to calculate the roof weight of their specific structure.
- In region C, one foundation tie shall be provided using at least a R12 bar. In all other cases, one foundation tie may be provided by smaller single R6 bar.

Table 3.4 Self-weight of typical roofs

Roof type	Roof mass allowed (kN/m^2)
Sheet roof	25
Sheet roof and ceiling	40
Tile roof	75
Tile roof and ceiling	90

4. VERTICAL LOAD BEARING CAPACITY OF WALLS

The unfilled Rapidwall® panels generally have more than sufficient axial load capacity to support point loads from roof structures in normal cottage construction. Calculations are not required for a tiled roof point load applied on top of a Rapidwall® panel wall where the tributary area is less than nine (9) square metres. This is equivalent to a load from a 15m span truss at 1.2m centres supporting a tiled roof. When this maximum tributary area is exceeded, specific calculation should be made to check the load bearing capacity to satisfy the following: -

- A maximum allowable local bearing of $\phi P_u = 13.2$ kN for point load applied onto the top of the wall via a 120mm wide × 45 mm thick timber plate; or
- A maximum allowable local bearing of $\phi P_u = 20$ kN for point load applied onto the top of the wall via a 120mm wide × 45 mm thick timber plate plus a 150PFC capping channel;
- The minimum spacing of 600mm between point loads; and
- A maximum uniform bearing capacity of $\phi p_u = 66$ kN/m.

5. LATERAL WIND PRESSURE ON WALLS

The Rapidwall® panels have significant flexural capacity to resist gust wind pressure on the wall in region A and B. The full height (2.85m) wall without opening and supported on its top and bottom can resist a maximum ultimate pressure of 1.6kPa without cracking, which is sufficient for cottage construction satisfying the design assumptions provided in Section 3 for region A and B. For region C, every cavity in the wall shall be filled with concrete and a R12 reinforcing bar at the centre of the concrete cell. This R12 bar as specified in Table 3.3 is sufficient to resist both the wind pressure on the wall as well as the uplifting tie down.

When the conditions in Section 3 are not satisfied, detailed calculations by a qualified professional engineer shall be exercised to check the out-of-plane bending in accordance with engineering principals provided in the first part of the design guidelines.

6. LINTELS

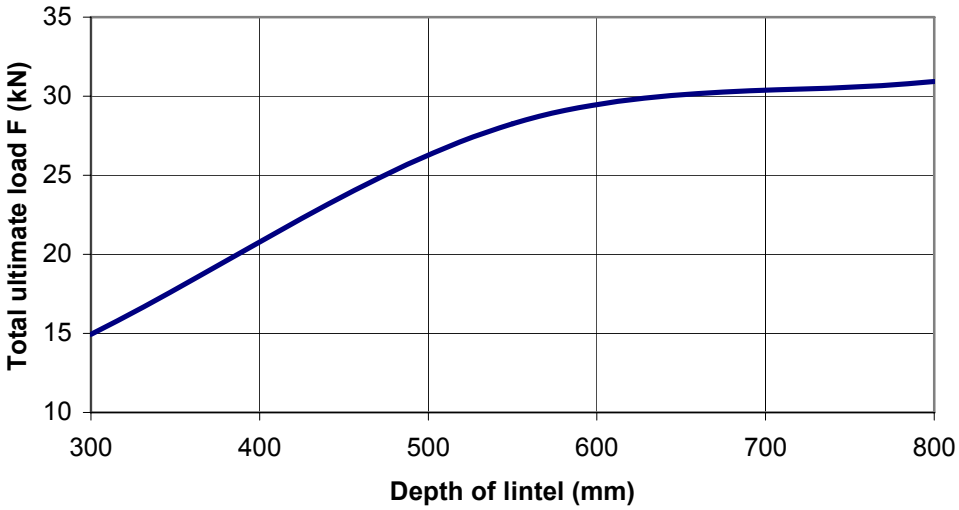
That part of a Rapidwall® panel above a door or window opening must be designed as a lintel. Concrete filled lintels shall be designed by a qualified professional engineer in accordance with the design principals provided in the first part of these design guidelines. Due to the creep characteristics of Rapidwall®, for lintels without reinforced concrete infill it is generally not advisable for them to be designed to support substantial superimposed loads, other than self weight, over a long period of time. However deep lintels, with aspect ratios (depth to span) greater than one [1.0], can be used as structural members to support self-weight as well as superimposed dead and live loads in accordance with Table 6.1.

The total ultimate load *P* given in the table shall be calculated in accordance with Eq.3.1:

$$F = 1.25G + 1.5Q \qquad (3.1)$$

where G and Q are the total dead and live load on the span, respectively.

Table 6.1 Design table for deep unfilled lintels



If the load on the lintel is point load, local crushing check shall also be undertaken in accordance with Section 4.