

Tie-down details for repair of storm damaged roofs in south east Queensland

Tie and sheet roofs—Wind Classification to N3 (Maximum design gust wind speed 50m/s = old ‘W41N’)

Assessment of damage to framing

The assessment of damage to structural framing members should only be undertaken by a competent person such as a registered structural engineer or a licensed builder. Where damage has occurred to trussed roofs, any assessment should be undertaken in conjunction with a registered structural engineer. Some important areas to look for damage to structural framing include:

- cracked or broken members
- damaged truss plates
- loose joints and connections
- truss plates not firmly seated on timber
- gaps between support points and joints
- girder trusses (trusses that support other trusses).

Failure to correct these types of faults could severely affect the structural performance of the roof structure.

Other important issues

Pre-drilling timber

Timber in older buildings may be well seasoned and prone to splitting and splitting can weaken the connection. Timber should be pre-drilled to reduce the chance of splitting. The pre-drilled hole should be no greater than 80 per cent of the diameter of the fastener being used.

Split, decayed or insect damaged timber

If existing timber members are split or damaged by rot or insects, the member may be weakened and should be replaced.

Washer sizes

Bolt and coach screw connections will usually require washers. The following washer sizes are suggested:

- where an M10 bolt or coach screw is used—a 38 mm X 38 mm x2 mm washer is needed
- where an M12 bolt or coach screw is used—a 50 mm X 50 mm x3 mm washer is needed
- where an M16 bolt or coach screw is used—a 65 mm X 65 mm x5 mm washer is needed.

Introduction

The following simplified details are provided to assist builders and building certifiers in the repair or re-building of roofs damaged as a result of the storms in South East Queensland on 27 November 2014. The guidelines are not intended to cater for extensive building repairs where, due to the extent of damage, a building approval is required.

The details cover fixings from roof battens to top plates. Specific fixings for roof tiles and roof sheeting should be in accordance with the tile or sheeting manufacturers' specifications for a wind classification of N3.

If site conditions indicate that wind classification may be higher than N3, additional advice should be sought from a registered professional engineer for appropriate construction details.

The details provided are not intended to suggest that if roofs are repaired to this guide that the whole building or structure will have been brought up to a standard that complies with current building regulations.

Where extensive damage has occurred—such as wall damage, reconstruction or repair or rebuilding—this should be carried out in accordance with the current structural requirements of building regulations such as Australian Standard AS1684.2-2010, Residential timber-framed construction, Part 2: Non-Cyclonic Areas.

Simplified tie-down details for a limited range of building geometries, types and member spacings are provided in this guide. Reference should be made to AS 1684.2-2010 for more detailed tie-down design and information.

Procedure

Roof battens

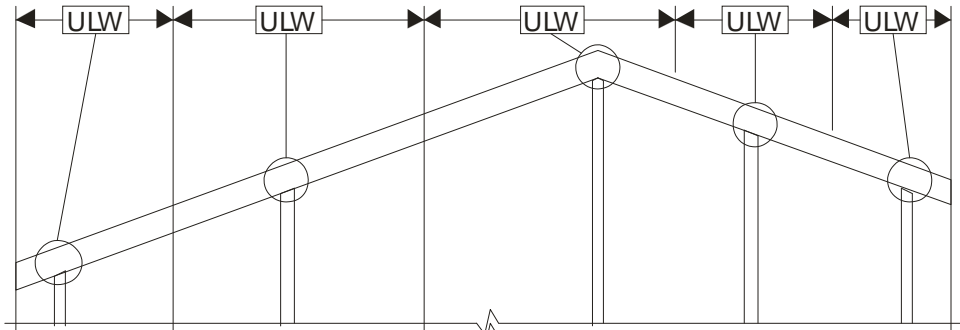
1. From Table 1, determine the uplift force on the batten to rafter or truss connection.
2. From Details sheet 1, determine an appropriate connection with strength equal to or greater than the uplift force determined from Table 1.

Roof framing and trusses

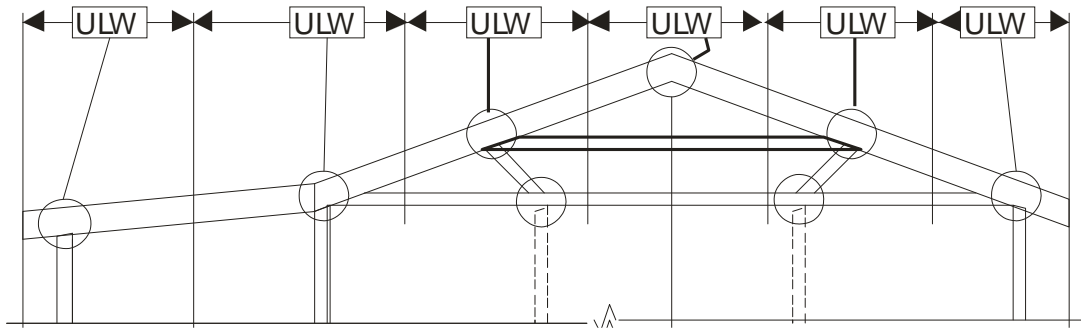
1. From Figure 1 determine the uplift load width (ULW) for the tie-down connection under consideration.
2. From Table 2, determine the uplift force on the connection under consideration.
3. From Details Sheets 2–4, determine an appropriate connection with strength equal to or greater than the uplift force determined from Table 2.

Figure 1—Roof uplift load width (ULW) for wind

(a) Roof beam construction



(b) Raftered roof construction



(c) Trussed roof construction

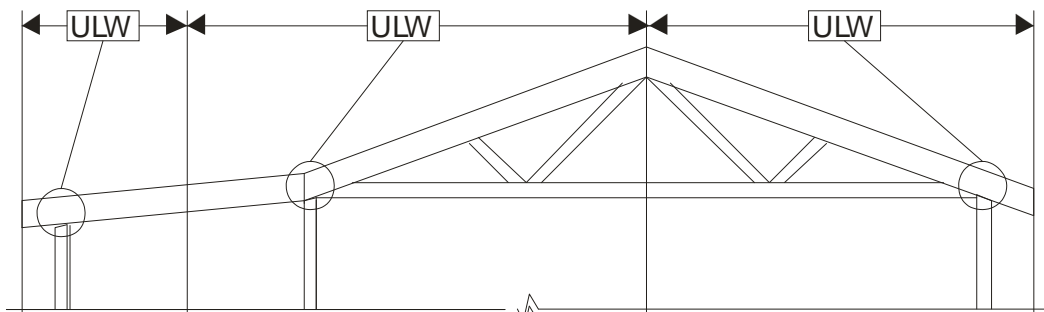


Table 1—Uplift forces on roof battens

Rafter or truss spacing (mm)	Batten spacing (mm)	Uplift force (kN)	
		Near edges	General area
Tile roofs			
600	330	0.50	0.23
900	330	0.75	0.35
Sheet roofs			
900	600	1.5	0.85
	900	2.3	1.20
1200	600	2.1	1.1
	900	3.1	1.7

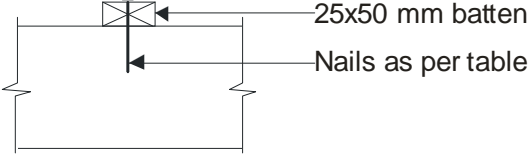
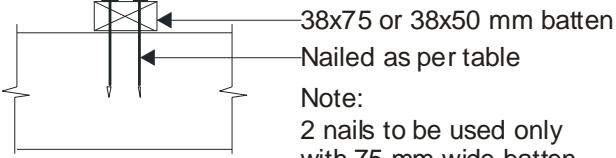
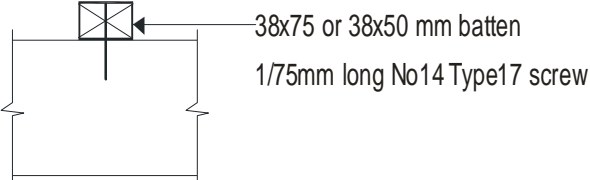
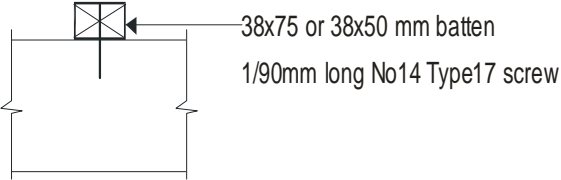
Note: Near edges applies to the batten closest to the ridge and the batten closest to the end of the eaves overhang and to the batten end connections at the gable or hip.

Table 2—Uplift forces on roof framing

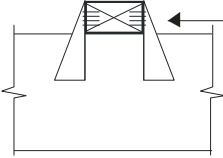
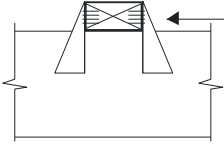
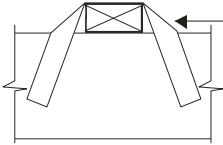
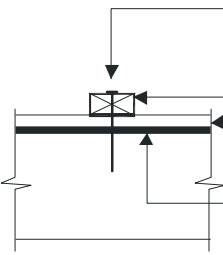
Uplift load width (mm)	Rafter or truss spacing (mm)	Uplift force (kN)
Tile roofs		
0 to 1500	600	0.84
	900	1.2
1501 to 3000	600	1.6
	900	2.5
3001 to 4500	600	2.5
	900	3.7
4501 to 6000	600	3.3
	900	5.0
Sheet roofs		
0 to 1500	900	1.8
	1200	2.3
1501 to 3000	900	3.5
	1200	4.7
3001 to 4500	900	5.3
	1200	7.1
4501 to 6000	900	7.1
	1200	9.5

Note: All timber to be hardwood, cypress or seasoned softwood.

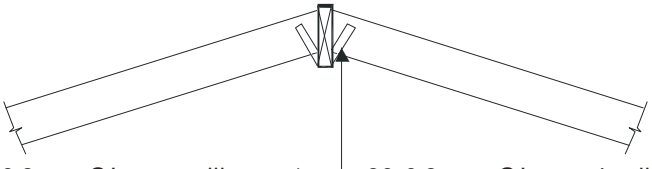
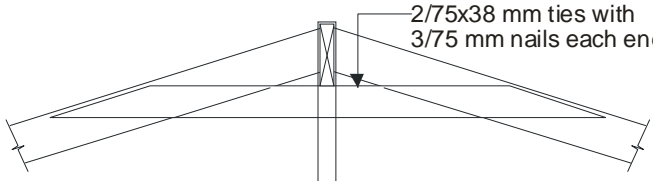
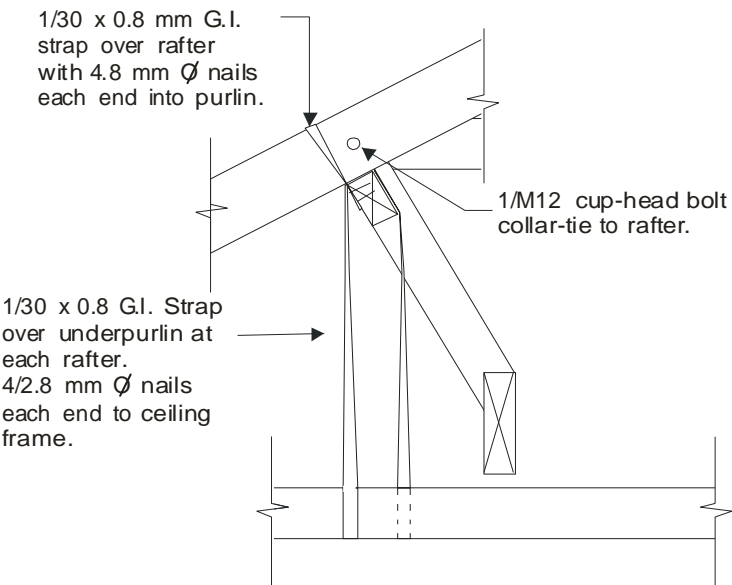
Detail sheet 1—Roof battens to rafters or trusses

Detail	Uplift capacity (kN)
<p>(i)</p>  <p>25x50 mm batten Nails as per table</p>	<p>1/65x2.8 dia nail 0.32 1/75x3.05 dia nail 0.43 1/75x3.05 dia deformed shank nail 0.85</p>
<p>(ii)</p>  <p>38x75 or 38x50 mm batten Nailed as per table Note: 2 nails to be used only with 75 mm wide batten</p>	<p>1/75x3.05 dia nail 0.32 2/75x3.05 dia nail 0.64 2/75x3.05 dia deformed shank nail 1.3</p>
<p>(iii)</p>  <p>38x75 or 38x50 mm batten 1/75mm long No14 Type17 screw</p>	<p>4.5</p>
<p>(iv)</p>  <p>38x75 or 38x50 mm batten 1/90mm long No14 Type17 screw</p>	<p>6.0</p>

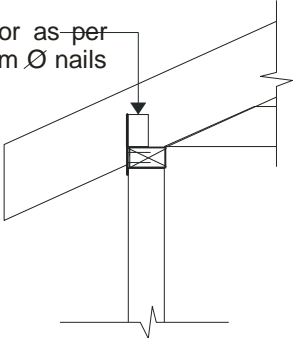
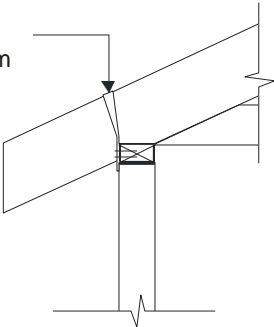
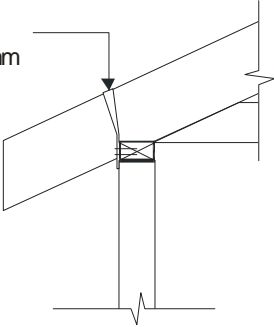
Detail sheet 1—Roof battens to rafters or trusses (cont'd)

Detail	Uplift capacity (kN)
<p>(v)</p>  <p>1/Framing anchor 4/2.8 mm dia. nails to each leg</p>	<p>3.5</p>
<p>(vi)</p>  <p>2/Framing anchors either side of batten 4/2.8 mm dia. nails to each leg</p>	<p>5.9</p>
<p>(vii)</p>  <p>30x0.8 mm G.I. strap with 3/2.8 mm Ø nails each end of strap</p>	<p>4.7</p>
<p>(viii)</p>  <p>1/90mm long No 14 Type 17 Screw</p> <p>38x50/75 mm wide batten</p> <p>25x50 mm counter batten</p> <p>6 mm lining</p>	<p>2.6</p>

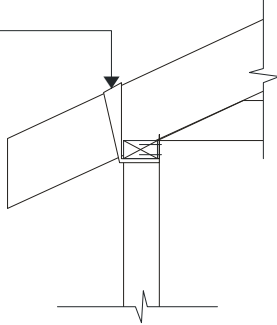
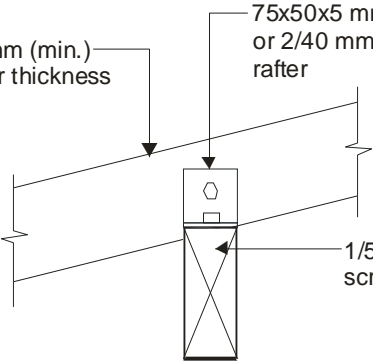
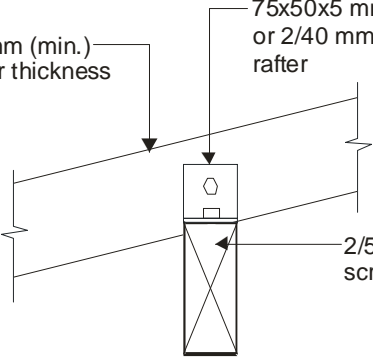
**Detail sheet 2—Rafters to rafters at ridge, rafter to underpurlins
and to ceiling/wall frame**

Detail	Uplift capacity (kN)
<p>(ix)</p>  <p>30x0.8 mm G.I. strap ceiling frame or tied down to internal walls or external walls at gable ends →</p> <p>→ 30x0.8 mm G.I. strap 4 nails each end</p>	<p>4.7</p>
<p>(x)</p>  <p>2/75x38 mm ties with 3/75 mm nails each end</p> <p>30x0.8 mm G.I. strap tied down to ceiling frame or internal walls or external walls at gable ends →</p>	<p>4.7</p>
<p>(xi)</p>  <p>1/30 x 0.8 mm G.I. strap over rafter with 4.8 mm \varnothing nails each end into purlin.</p> <p>1/M12 cup-head bolt collar-tie to rafter.</p> <p>1/30 x 0.8 G.I. Strap over underpurlin at each rafter. 4/2.8 mm \varnothing nails each end to ceiling frame.</p>	<p>5.9</p> <p>(13 if underpurlin is tied down to wall studs or floor frame with a looped strap or M10 bolt)</p>

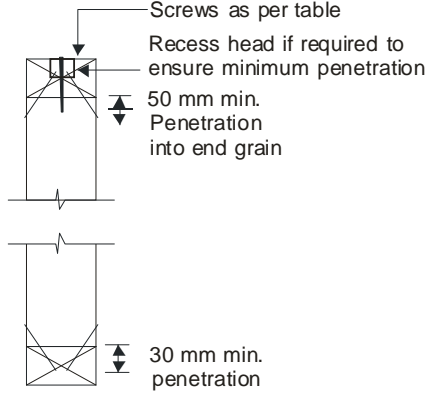
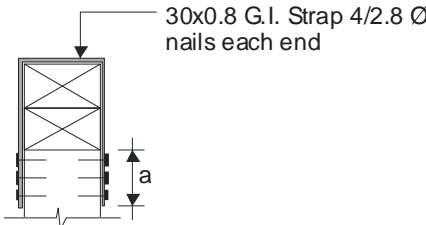
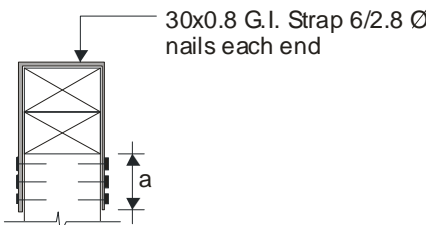
Detail sheet 3—Rafters/trusses to top plate or wall frame

Detail	Uplift capacity (kN)
<p>(xii)</p> <p>Framing anchor as per table, 4/2.8 mm Ø nails to each end</p> 	<p>1/Framing anchor 3.5</p> <p>2/Framing anchors 5.9</p>
<p>(xiii)</p> <p>1/30x0.8 mm G.I. Strap with 3/2.8mm dia nails each end</p> 	<p>4.7</p>
<p>(xiv)</p> <p>2/30x0.8 mm G.I. Straps with 3/2.8mm dia nails each end</p> 	<p>8.4</p>

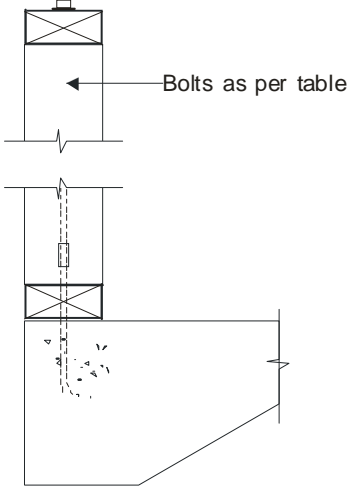
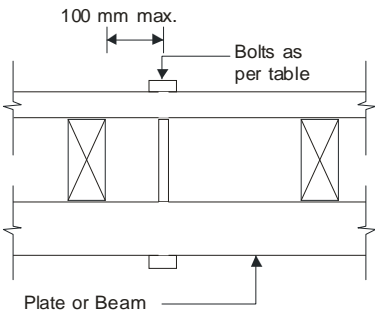
Detail sheet 3—Rafters/trusses to top plate or wall frame (cont'd)

Detail	Uplift capacity (kN)
<p>(xv)</p> <p>30x0.8 mm G.I. Looped strap with 4/2.8mm Ø nails each end</p> 	<p>13</p>
<p>(xvi)</p> <p>35 mm (min.) rafter thickness</p> <p>75x50x5 mm MS angle with 1/M10 bolt or 2/40 mm No14 Type17 screws to rafter</p> <p>1/50 mm No14 Type17 screw to top plate or beam</p> 	<p>4.2</p>
<p>(xvii)</p> <p>35 mm (min.) rafter thickness</p> <p>75x50x5 mm MS angle with 1/M10 bolt or 2/40 mm No14 Type17 screws to rafter</p> <p>2/50 mm No14 Type17 screws to top plate or beam</p> 	<p>5.1</p>

Detail sheet 4—Top plates to studs and general connections

Detail	Uplift capacity (kN)
<p>(xviii)</p>  <p>Screws as per table Recess head if required to ensure minimum penetration 50 mm min. Penetration into end grain</p> <p>30 mm min. penetration</p>	<p>No 14 Type 17 screw or M10 coach screw</p> <p>3.6</p>
<p>(ixx)</p>  <p>30x0.8 G.I. Strap 4/2.8 Ø nails each end</p> <p>a</p>	<p>5.9</p>
<p>(xx)</p>  <p>30x0.8 G.I. Strap 6/2.8 Ø nails each end</p> <p>a</p>	<p>8.4</p>

Detail sheet 4—Top plates to studs and general connections (cont'd)

Detail	Uplift capacity (kN)
<p>(xxi)</p> 	<p>M10–15 M12–20 M16–35</p>
<p>(xxii)</p> 	<p>M10 cup head–10 M12 cup head–12 M12 Bolt/Rod–20</p>