

SIMPSON

Strong-Tie

®

RACKING SOLUTIONS FOR TIMBER FRAMED BUILDINGS



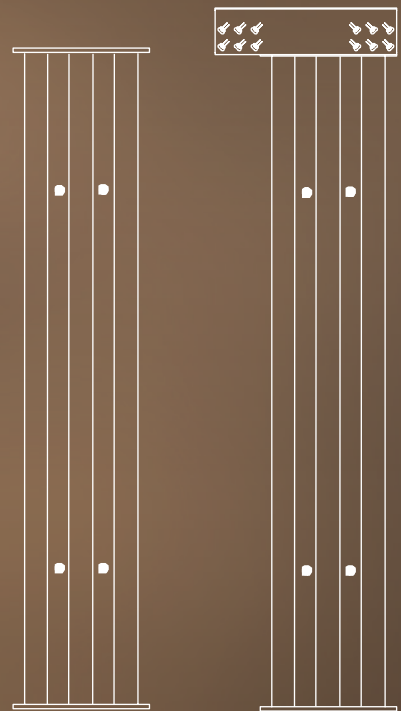
$$R_{design} = \frac{R_k \times K_{mod}}{\gamma_M}$$

$$K_{dens} = (pK/350)^2$$



SIMPSON
Strong-Tie

$$K_{dens} = (pK/350)^2$$



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Introduction

Overcoming the Challenge of Racking Resistance in Timber Structures with Large Openings

Typically, a timber frame building is subjected to wind loads which result in racking, overturning and sliding forces being exerted against it.

For engineers and designers working with timber frame structures it is becoming increasingly difficult to provide sufficient racking resistance, particularly in buildings with large openings and very little wall in the front and rear elevations.

The Strong-Portal™ range from Simpson Strong-Tie® includes the Steel Strong-Portal and Steel Strong-Wall which have been developed to provide improved resistance to racking forces and to help overcome the design challenges presented in such cases.

These new systems can be used in external or internal walls depending on the racking requirement and available wall space.

About Simpson Strong-Tie®

Testing Innovation and Performance

Our state-of-the-art laboratory facilities are constantly testing new and existing products to provide you with the best connecting and anchoring solutions, including the information you need in order to design with, and properly install our products.

Technical Approvals

The fact that we extensively test our connectors gives you the reassurance that they will perform in the toughest conditions. We strive to ensure that our products are compliant with the latest European requirements for construction products. Details of the relevant European standards can be found on the individual product pages

Customer Support

The quality and variety of our product lines gives engineers and builders more freedom to design flexibly while offering reliable and proven performance. In addition, customers can count on our UK technical support centre, a team of experienced field representatives and a suite of training programmes.

Performance Values

The permissible values published within this document have been determined in accordance with BS5268-2..

Materials & Durability

Unless otherwise stated the connectors listed in this document are manufactured from S250 carbon steel with a pre-galvanised coating of Z275 in accordance with EN10346:2009.

Technical Support

Call: +44(0)1827 255600

Fax: +44(0)1827 255616

Email: uktechnical@strongtie.com



Design Guide

Design Guidelines

Applications:

The racking solutions described in this document can be used in the following situations within a building to resist racking loads.

- Around openings such as garages, patio doors and bay windows.
- Narrow piers.
- Internal walls.
- External walls

Wall Thickness

The Steel Strong-Wall can be used in conjunction with either 89mm or 140mm deep stud walls (and any thickness in between).

The Steel Strong-Portal panel can be used in walls with a minimum stud thickness of 140mm.

Racking Resistance

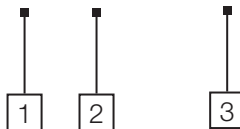
The graph opposite shows the performance values for the complete range of products.



Item Codes Explained

The item code shown below follows a convention indicating dimensions.
Example shown SSP300/2400:

SSP 300 / 2400



1 Product Type: SSP for Steel Strong-Portal or SSW for Steel Strong-Wall.

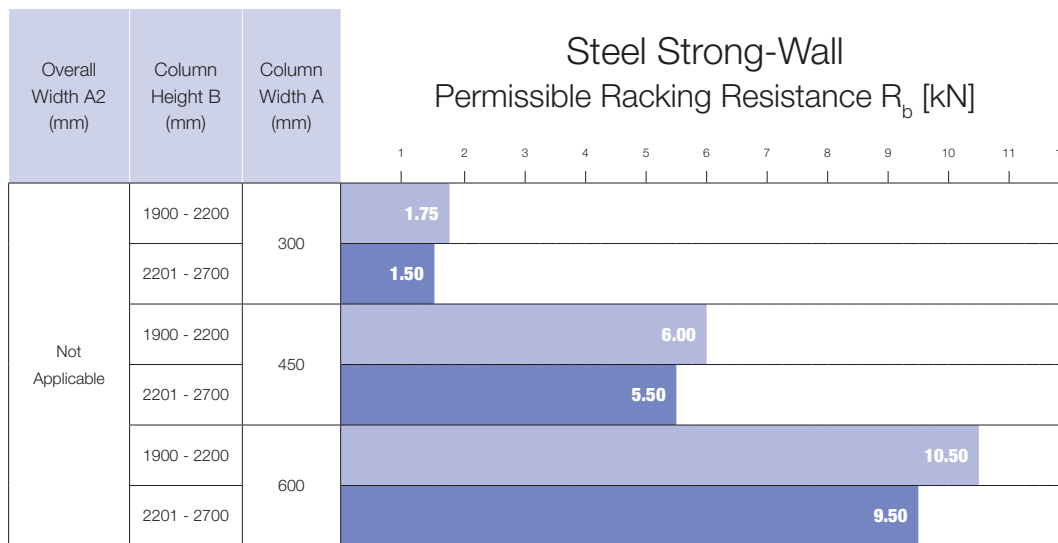
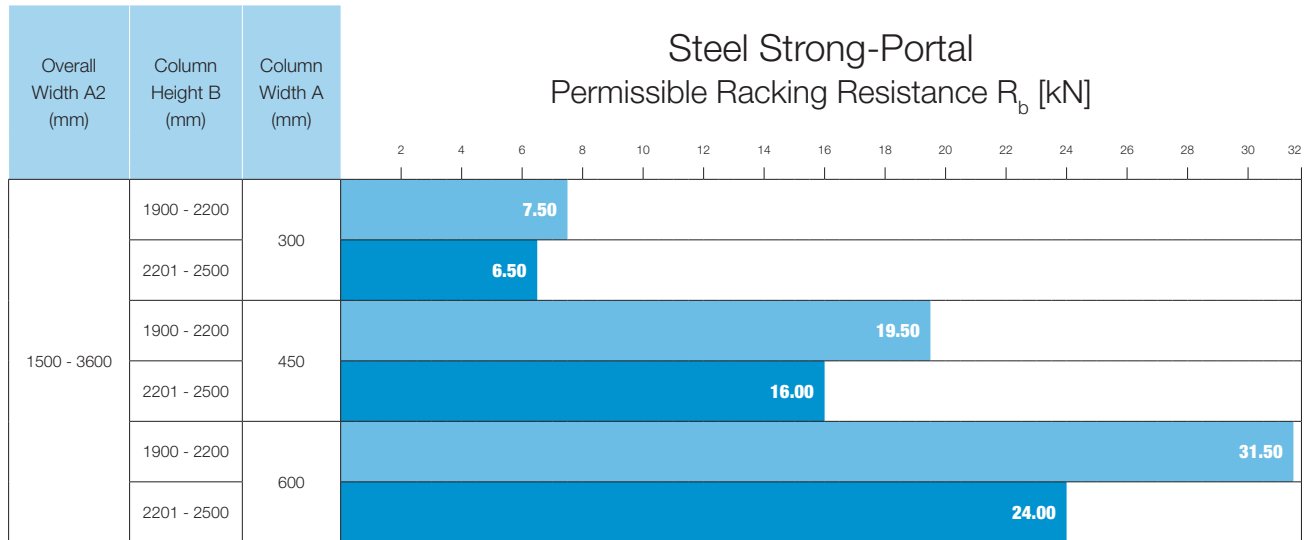
2 Column width 'A': 300mm, 450mm or 600mm.

3 Height 'B' in mm.

Performance Value Summary

Racking Resistance Performance Values

Determined in accordance with BS5262-2



Please Note

Several products can be used together to give increased performance. For example:

$$2 \times \text{SSW300/2200} = 2 \times 1.75 = 3.5\text{kN}$$

$$2 \times \text{SSP450/2500} = 2 \times 16.00 = 32\text{kN}$$

- SSW300/2200 = Steel Strong-Wall, 300mm width, 2200mm height.
- SSP450/2500 = Steel Strong-Portal, 450mm width column, 2500mm opening height.

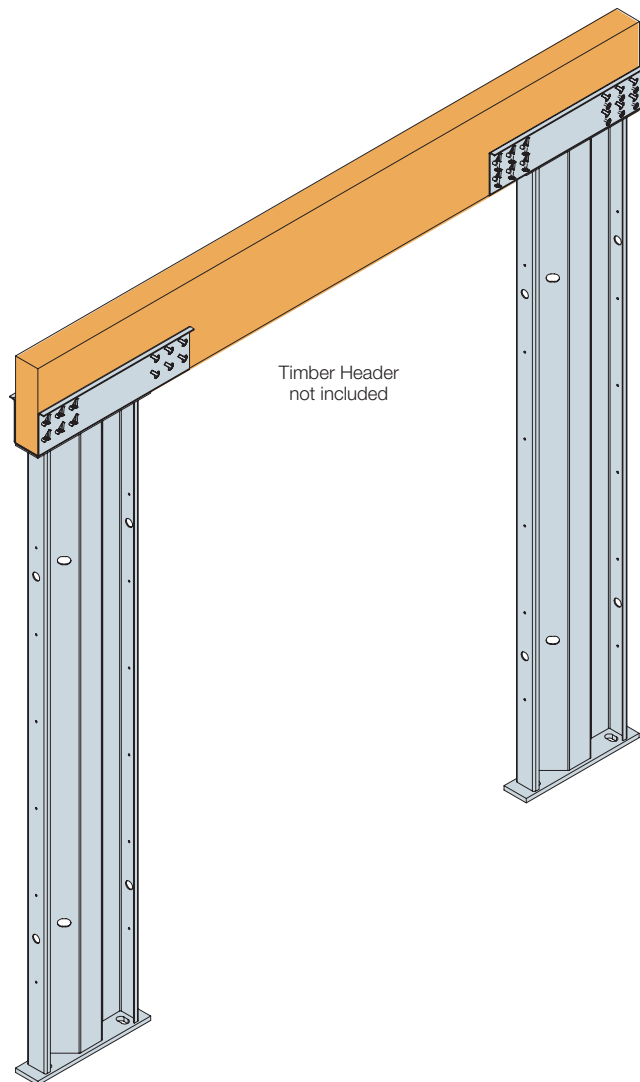
For further information, please contact Simpson Strong-Tie® technical support on 01827 255600.

About Steel Strong-Portal

Developed to offer enhanced racking resistance in timber structures, Steel Strong-Portal™ is available in a range of heights and widths to suit various sizes of opening and can be delivered directly to site or our customers' facility.

Key Benefits

- Easily integrated with existing timber frame designs.
- Secured directly to foundation and adjacent timber frame panels.
- Easy to handle - no need for cranes or mechanical handling equipment.
- No additional framework required - simple connection to adjacent elements.
- All fixings and adhesives required for installation provided.



Materials

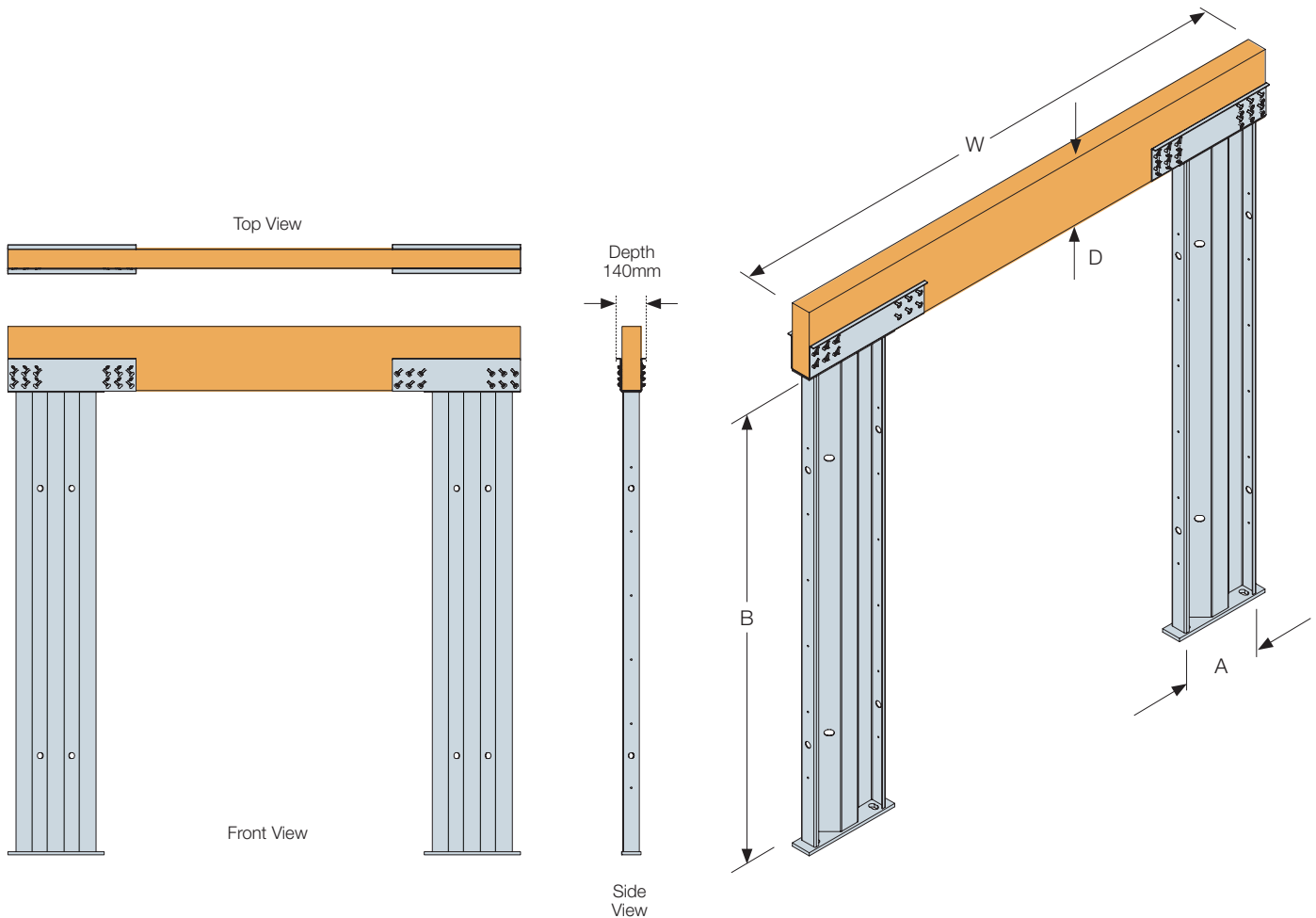
Steel Strong-Portal:	Galvanised mild steel - Z275
AT-HP Adhesive:	Styrene free, methacrylate resin
Threaded Rods:	Grade 8.8 carbon steel, zinc plated
Nuts and Washers:	Carbon steel, zinc plated
Screws:	ESCR8.0X120 and SDS 25112

Steel Strong-Portal Performance Values

Product Range & Performance Values for use with BS 5268-2 Design Methods

Item Code	Column Width (A) mm	Overall Width Range (W) mm	Column Height Range (B) mm	Header Depth (D) mm	Permissible Loads (kN)		Anchor Loads at Max Permissible Racking Load ⁽³⁾ (kN)	
					Racking R_b	Axial	Tension	Shear
SSP300	300	1500 - 3600	1900 - 2200	315	7.5	15.0	9.5	1.875
			2201 - 2500		6.5		8.5	1.625
SSP450	450		1900 - 2200		19.5	25.0	25.0	4.875
			2201 - 2500		16.0		20.5	4.000
SSP600	600	1900 - 2200	31.5	30.0	40.0	7.875		
		2201 - 2500	24.0		30.5	6.000		

1. Fasteners and anchors are supplied with Steel Strong-Portal™.
2. R_b is the racking resistance determined from tests carried out in accordance to BS EN 594:2011
3. It is the responsibility of the building engineer/designer to ensure the foundation and hold down anchors can take the applied tension and compression loads.
4. It is recommended to use either Glulam or LVL as the head timber. Width = 90mm and height = 315mm.
5. Axial loads have been determined when maximum racking load is being applied. Designer responsible for structure to consider the section of timber header required to resist vertical loads.



Steel Strong-Portal Installation

General Information

- The Steel Strong-Portal column should be fixed directly to the concrete foundation.
DO NOT sit the Steel Strong-Portal on a timber sole plate.
- A DPC is required between the Steel Strong-Portal column and the concrete foundation.
- The concrete foundation should be designed by the engineer responsible for the structure to accommodate the hold down anchors and resist the applied loads.
- Refer to page 16 for foundation requirements.

Equipment Required for Installation

- 1 off 22mm (SSP300) or 28mm (SSP450/SSP600) masonry drill, min. 300mm long.
- 1 off Dust Brush (item code BR17/30).*
- 1 off Dust Pump (item code PUMP).*
- 1 off Resin Dispensing Gun (item code DT380).*
- 1 off 30mm (SSP300) or 36mm (SSP450/SSP600) A/F, Long Length Socket
- 1 off Torque Wrench (min. capacity 150Nm (SSP300) or 200Nm (SSP450/SSP600).
- 1 off SDS ¼ Hex Drive (SDSD3/8-RB).*
- 1 off T30 drive bit (included).

* Available from Simpson Strong-Tie, call 01827 255600 for prices.

Steel Strong-Portal Installation Step 1

1a - Position the first Steel Strong-Portal column on top of the foundations in the required position, ensuring the correct orientation of the column with the fixing holes facing internally. Mark the foundation through the holes.

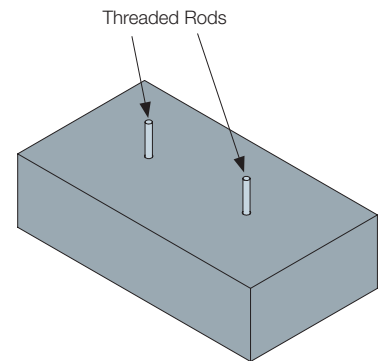
1b - Drill vertical holes to the stated diameter and depth:

SSP300	= Ø22mm x 160mm
SSP450	= Ø28mm x 160mm
SSP600	= Ø28mm x 200mm

1c - Ensure the holes are cleaned thoroughly using a pump and brush.

1d - Install the anchor bolts supplied: AT-HP resin with LMAS threaded rods:

SSP300	= M20 x 210mm
SSP450	= M24 x 210mm
SSP600	= M24 x 250mm



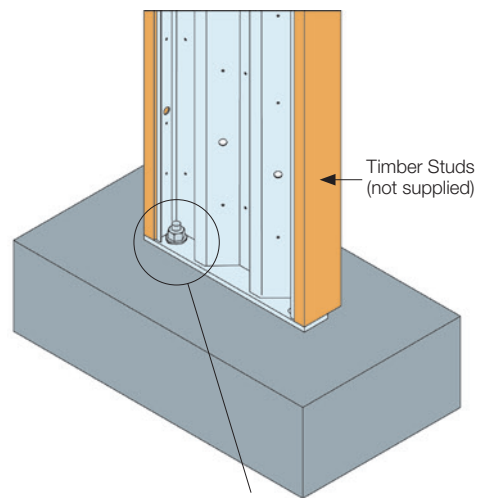
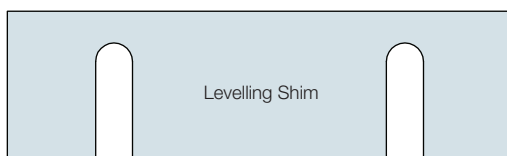
Steel Strong-Portal Installation Step 2

2a - Position the Steel Strong-Portal column over the anchor bolt rods and level by using steel shims and structural grout if required. Plumb and, where necessary, provide temporary bracing, which can be adjacent timber frame panels if already installed.

2b - Install nuts and washers and tighten by hand. Once the AT-HP resin has cured (see cartridge label for cure times) tighten the nut to the recommended torque (M20: 150 Nm torque, using torque wrench with a 30mm socket. M24: 200 Nm torque, 36mm socket). Do not over-tighten nuts as this may lead to premature failure.

2c - It is recommended to fix timber studs to the outside of the column. These can be fixed in place using the SDS25112 screws supplied.

Note: Where necessary to aid levelling of the column, steel shims are available to order in widths 300, 450 and 600mm and thicknesses 1, 2 and 3.5mm. Contact Simpson Strong-Tie for details.



WARNING: DO NOT USE AN IMPACT WRENCH TO TIGHTEN NUTS.

Steel Strong-Portal Installation

Steel Strong-Portal Installation Step 3

3a - Place the timber header (not supplied) between the left hand (LH) and right hand (RH) columns. It is recommended to use either Glulam or LVL structural timber for the header. See performance table for minimum size.

3b - Connect the timber header to the column using the ESCR screws provided via the angled holes in the header connection shoe (Fig 3b1). Ensure that the angle between the header and column is 90° (Fig. 3b2) and that there is no gap between the bottom of the header and the section of the column (Fig. 3b3).

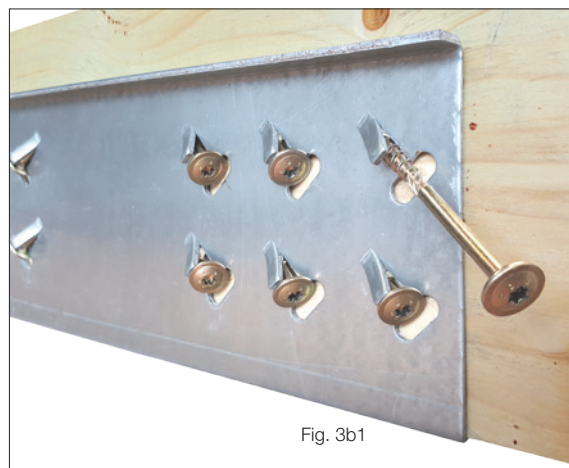
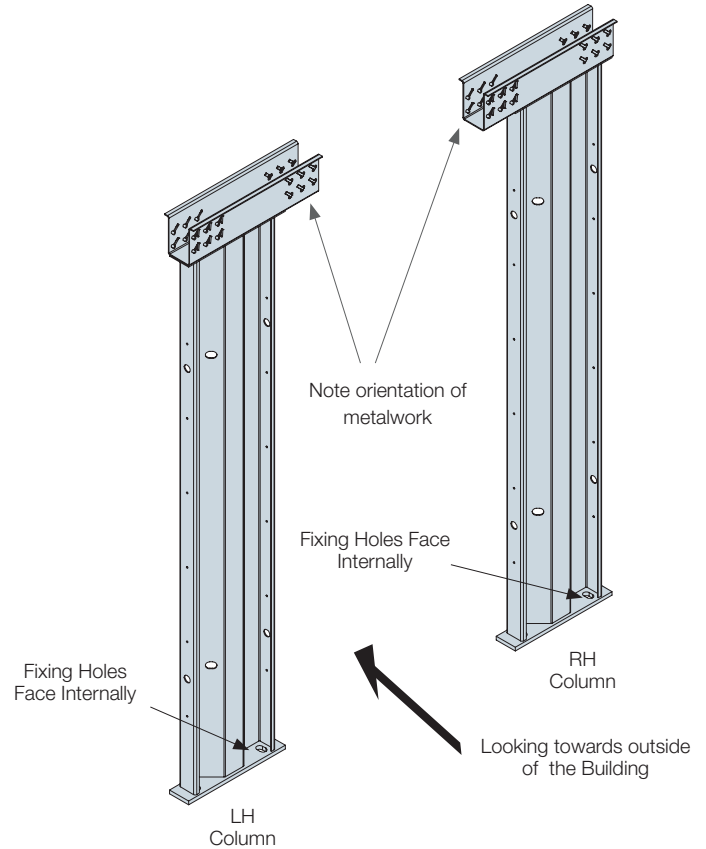
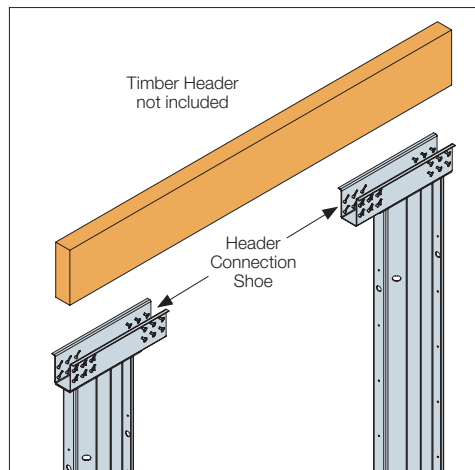


Fig. 3b1: Note how the screws are installed into the guided slots at an angle into the timber header.

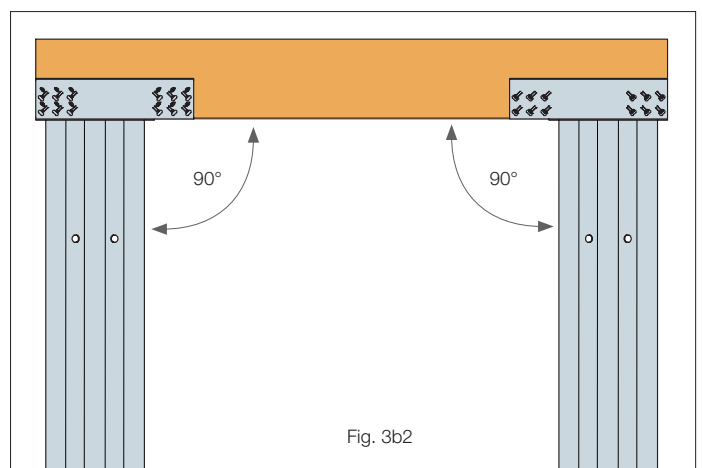
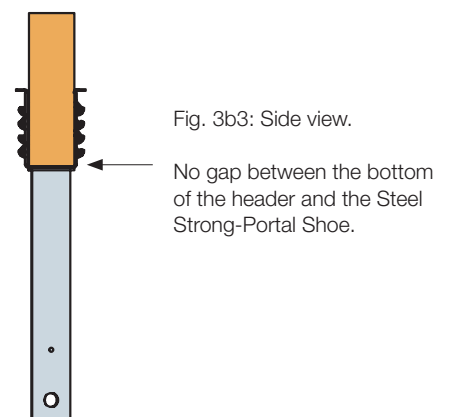


Fig. 3b2: Ensure right angled connection of timber header (not supplied) and Steel Strong-Portal columns.

Below: Steel Strong-Portal Shoe with all screws installed into the guided slots. Example shows LH column, arrow indicates direction to RH column.



About Steel Strong-Wall

The Steel Strong-Wall is a corrugated steel panel which is designed to be fixed directly to the concrete foundations of a building, within the external or internal wall, via a bolted connection.

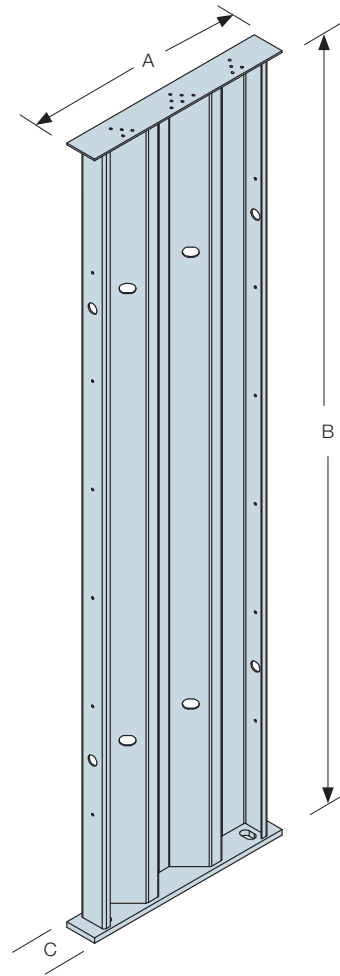
Being relatively small in width the Steel Strong-Wall™ can be used in areas where only small sections of wall are available, offering significantly higher racking resistance than the equivalent sized standard timber frame wall panel.

Key Benefits

- Available in three widths: 300mm, 450mm and 600mm.
- Available height ranges: 1900mm to 2700mm.
- At only 89mm wide, it can be fitted into standard 89mm and 140mm deep timber frame panels.
- All fixings and adhesives required for installation are included.

Materials

Steel Strong-Wall™: Galvanised mild steel
 SDS Screws: Hot dip galvanised, carbon steel
 AT-HP Adhesive: Styrene free, methacrylate resin
 Threaded Rods: Grade 5.8 carbon steel, zinc plated
 Nuts and Washers: Carbon steel, zinc plated



Product Range & Performance Values for use in BS 5268-2 Design Methods

Model Number				Foundation Anchors		Fasteners to Top Rail ⁽¹⁾	Permissible Loads (kN)		Anchor Loads at Max Permissible Racking Load ⁽³⁾ (kN)	
	Width (A)	Column Height Range (B)	Depth (C)	Qty	Diameter (mm)	Qty	Racking R _b ⁽²⁾	Axial	Tension	Shear
SSW300	300	1900 - 2200	89	2	20	4	1.75	15.00	T = 7.697 x R _b	F / 2
		2201 - 2700					1.50		T = 5.360 x R _b	
SSW450	450	1900 - 2200		2	24	10	6.00	22.50	T = 5.297 x R _b	
		2201 - 2700					5.50		T = 2.704 x R _b	
SSW600	600	1900 - 2200		2	24	14	10.50	30.00	T = 2.812 x R _b	
		2201 - 2700					9.50		T = 3.722 x R _b	

1. Fasteners are supplied with the Steel Strong-Wall™ panel. Item code: SDS25312 - Ø6.35mm x 89mm long.
2. R_b is the test racking resistance determined from tests carried out in accordance to BS EN 594:2011.
3. It is the responsibility of the building engineer/designer to ensure the foundation and hold down anchors can take the applied 'tension' and 'compression' loads. Please see separate section for generic foundation detail examples.
4. F refers to applied racking load.
5. The allowable axial load is to be determined in accordance with EN1993-1-1, with the corresponding applied racking load.
6. Axial loads have been determined with corresponding maximum racking load.

Steel Strong-Wall Installation

General Information

- The Steel Strong-Wall should be fixed directly to the concrete foundation.
DO NOT sit the Steel Strong-Wall on a timber sole plate.
- A DPC is required between the Steel Strong-Wall™ panel and the concrete foundation.
- The concrete foundation should be designed by the engineer responsible for the structure to accommodate the hold down anchors and resist the applied loads.
- Refer to page 16 for foundation requirements.

Equipment Required for Installation

- 1 off 22mm (SSW300) or 28mm (SSW450/SSW600) masonry drill, min. 300mm long.
- 1 off Dust Brush (item code BR17/30).*
- 1 off Dust Pump (item code PUMP).*
- 1 off Resin Dispensing Gun (item code DT380).*
- 1 off 30mm (SSW300) or 36mm (SSW450/SSW600) A/F, Long Length Socket
- 1 off Torque Wrench (min. capacity 150Nm (SSW300) or 200Nm (SSW450/SSW600).
- 1 off SDS ¼ Hex Drive (SDSD3/8-RB).*

* Available from Simpson Strong-Tie, call 01827 255600 for prices.

Steel Strong-Wall Installation Step 1

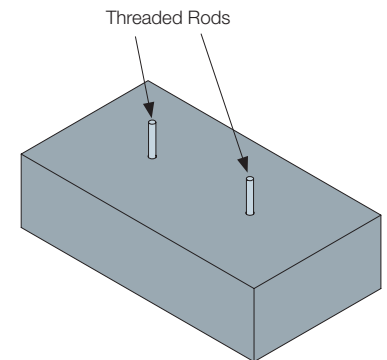
1a - Position the Steel Strong-Wall on top of the foundations in the required position, ensuring the correct orientation of the wall, with the fixing holes facing internally. Mark the foundation through the holes.

1b - Drill vertical holes to the stated diameter and depth:

SSW300	= Ø22mm x 160mm
SSW450 & SSW600	= Ø28mm x 160mm

1c - Ensure the holes are cleaned thoroughly .

1d - Install the anchor bolts supplied: AT-HP resin with M20 X 210 threaded rod for SSW300 and M24 X 210 threaded rod for SSW450 and SSW600.



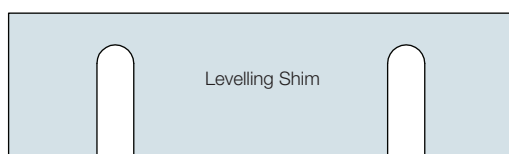
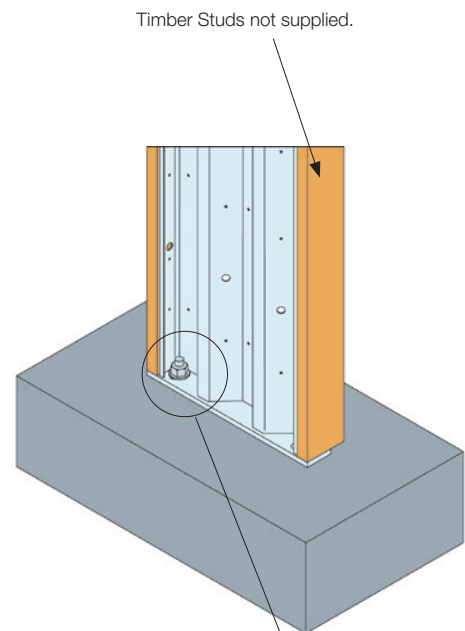
Steel Strong-Wall Installation Step 2

2a - Position the Steel Strong-Wall™ over the anchor bolt rods and level by using steel shims and structural grout if required. Plumb and where necessary, provide temporary bracing, which can be adjacent timber frame panels if already installed.

2b - Install nuts and washers and tighten by hand. Once the AT-HP resin has cured (see cartridge label for cure times) tighten the nut to the recommended torque (M20: 150 Nm torque, using torque wrench with a 30mm socket. M24: 200 Nm torque, 36mm socket). Do not over-tighten nuts as this may lead to premature failure.

2c - Attach vertical timber studs to both sides of the Steel Strong-Wall using the short SDS screws provided.

Note: Where necessary to aid levelling of the wall, steel shims are available to order in widths 300, 450 and 600mm and thicknesses 1, 2 and 3.5mm. Contact Simpson Strong-Tie for details.



Steel Strong-Wall

Steel Strong-Wall Installation Step 3

3a - The Steel Strong-Wall™ can be secured to the adjacent timber frame wall panels using SDW22300 screws (not supplied), installed from the timber frame side as shown in fig. 3a. the spacing of the SDW screws is to be determined by the engineer responsible for the design structure.

Lateral Capacity of SDW22300 Screw:

BS 5268: 0.9kN (short term)

Based on 38mm thick C16 timber frame and 38mm thick Steel Strong-Wall™ stud.

Alternate fastening specification shall be in accordance to engineers instructions.

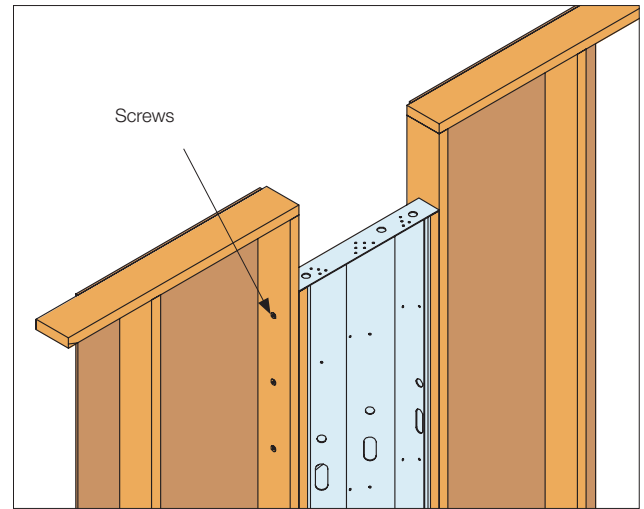


Fig. 3a

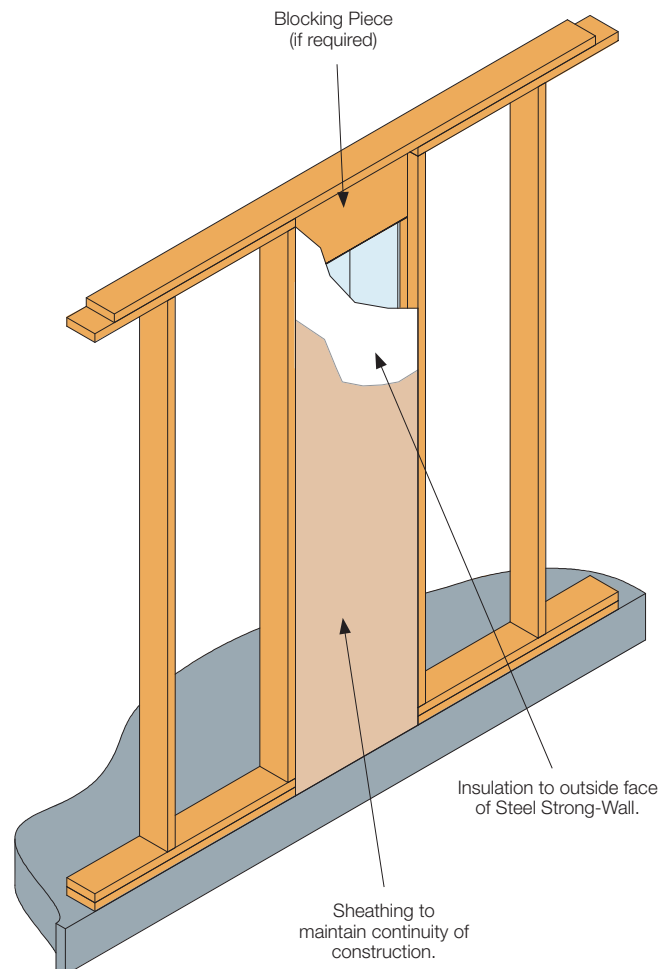
Steel Strong-Wall Installation Step 4

4a - Connect the top of the Steel Strong-Wall™ to the timber frame structure through the pre-drilled holes in the top plate with the long SDS screws provided. If required, as a height make-up piece, a single solid timber packer (typically LVL) should be inserted between the top of the Steel Strong-Wall™ and the timber frame structure.

4b - Install the head binder over timber frame and the Steel Strong-Wall™.

4c - Install insulation on the outer face of the Steel Strong-Wall™ panel and close off the panel by installing sheathing to the face of the timber studs - thus maintaining continuity in the timber frame construction.

Sheathing to be installed with fasteners in accordance with engineers instructions.



AT-HP Chemical Anchor System

AT-HP - High Performance Resin

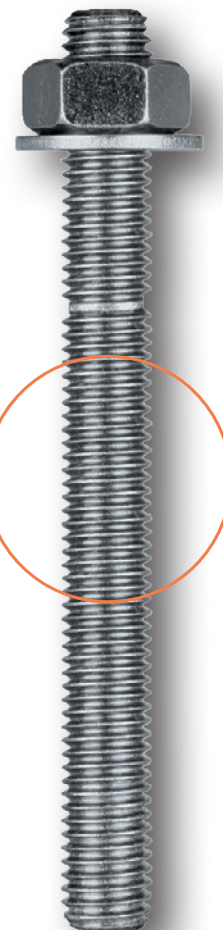
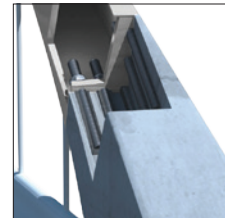
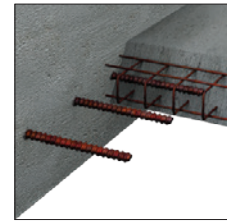
AT-HPBN280-UK Methacrylate resin for threaded rod and rebar

AT-HP is a styrene free methacrylate resin suitable for threaded rod and rebar into concrete and threaded rod into masonry.

Easy to dispense and fast curing, specially designed for structural fixings and construction uses.

Changes colour as it cures: Starting out blue, it changes to grey as it cures. Once it is completely grey it is safe to use the installed rod as intended.

- ETA approved for threaded rod and rebar installations.
- Changes colour as it cures.
- Fast curing.
- Low odour.
- Non-flammable.



AT-HP Chemical Anchor System

AT-HP™ (item code AT-HPBN280-UK) is a styrene free methacrylate resin suitable for high performance fixing applications of threaded rod into concrete. Easy to dispense and fast curing, specially designed for structural fixings and technical construction sites.

Benefits

- Changes colour as it cures. Once it turns grey, the anchor fixing is cured sufficiently to beign loading.
- Fast curing.
- Low Odour.
- Non-flammable.
- ETA Approved (ETA-11-0151)

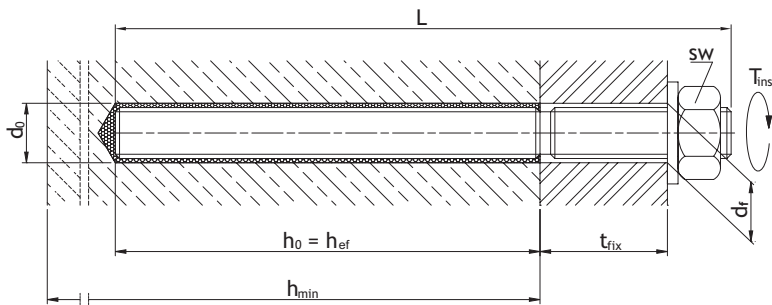
Product Summary

Product Family	Anchor Ø	Anchor Length	Drill Hole Ø	Drill Hole Depth	Clearance Hole Ø	Width Across Flats	Installation Torque
	d - (mm)	L - (mm)	d ₀ - (mm)	h ₀ - (mm)	d _f - (mm)	sw - (mm)	T _{inst} - (Nm)
SSP300	M20	210	22	160	22	30	150
SSP450	M24	210	28	160	28	36	200
SSP600	M24	250	28	200	28	36	200
SSW300	M20	210	22	160	22	30	150
SSW450	M24	210	28	160	28	36	200
SSW600	M24	210	28	160	28	36	200

Curing Schedule

Temperature of Anchorage Base	Working Time t _{gel}	Curing Time t _{cure}
-5°C	45 min	9 h
0°C	15 min	4 h
+5°C	12 min	1 h 30 min
+10°C	9 min	60 min
+20°C	4 min	30 min
+30°C	1 min	20 min

Note: Temperature of the resin is ≥ 5°.



Spacings, Edge Distances and Member Thickness (mm)

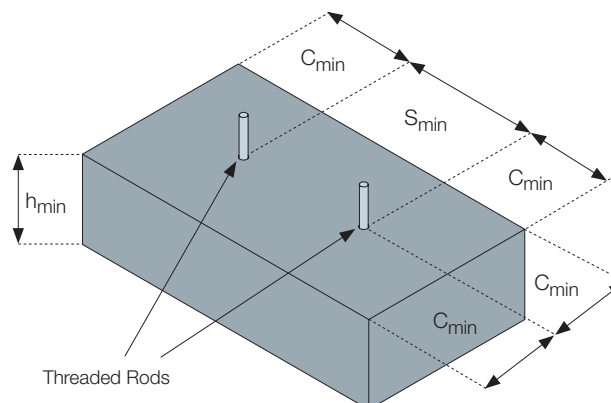
Product	SSP300	SSP450	SSP600	SSW300	SSW450	SSW600
Thread Diameter	M20	M24	M24	M20	M24	M24
Effective Embedment Depth (h _{ef})	160	160	200	160	160	160
Minimum Spacing (S _{min})	173	310	464	173	310	464
Minimum Edge Distance (C _{min})	100	180	265	110	190	210
Minimum Member Thickness (h _{min})	260	260	300	260	260	260

Recommended Hole Cleaning Sequence

Hole Cleaning Recommended Sequence
Blow Twice
+ Brush Twice
+ Blow Twice
+ Brush Twice
+ Blow Twice

Dimensions shown above are purely to ensure the anchors perform. It is the responsibility of the foundation/building engineer to design the foundation to resist all loads and moments imposed by the structure and Steel Strong-Portal™ or Steel Strong-Wall™.

Guide to Spacings, Edge Distances



Thermal Performance

Thermal Performance

The thermal performance of the Steel Strong-Portal and Steel Strong-Wall has been independently assessed by TRADA Technology Ltd for the stated insulation options shown in Fi.1. Typical construction detail as per table below.

Insulation Description and Position	Overall Insulation Thickness (mm)	Insulation Lambda (W/mK)	Wall U-Value (W/m2K)
Celotex GA3000 on outside face of Steel Strong-Wall™	50	0.023	0.36
Kingspan TW55 on outside face Steel Strong-Wall™	50	0.023	0.36
Steico Flex on outside face of Steel Strong-Wall™	50	0.038	0.42
Knauf Earthwool on outside face of Steel Strong-Wall™	50	0.032	0.40
Celotex GA300 on outside face of Steel Strong-Wall™ + cavity fill	100	0.023	0.23
Kingspan TW55 on outside face Steel Strong-Wall™ + cavity fill	100	0.023	0.22

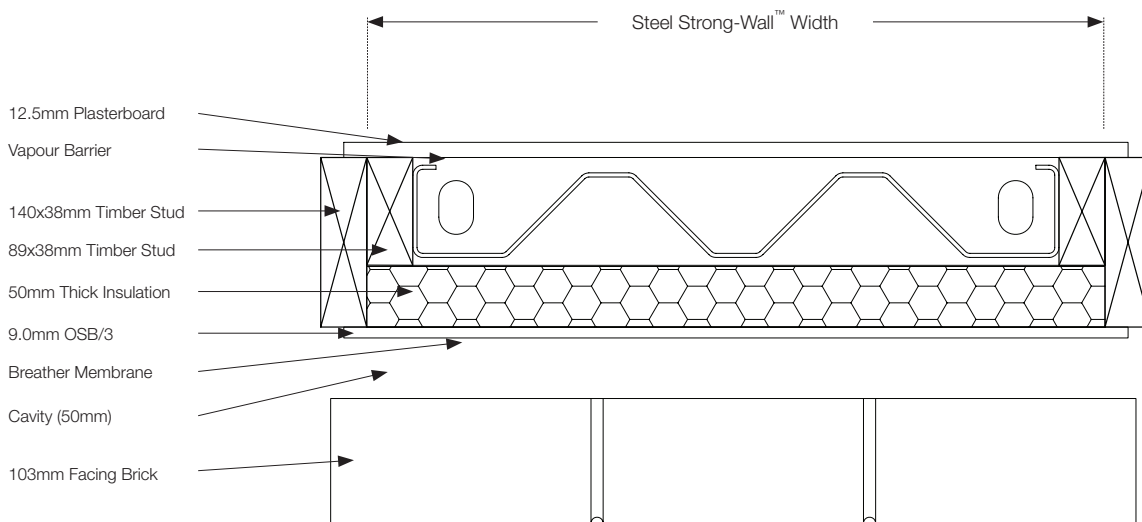
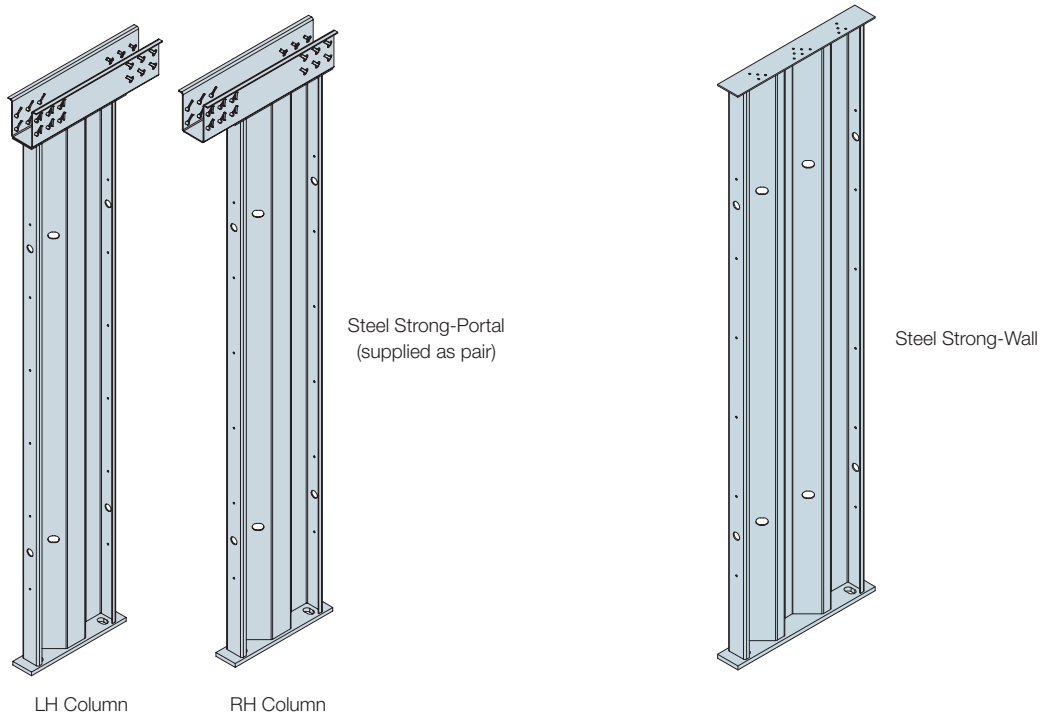


Fig.1 Typical Construction Detail



Steel Strong-Portal and Steel Strong-Wall Foundation Details

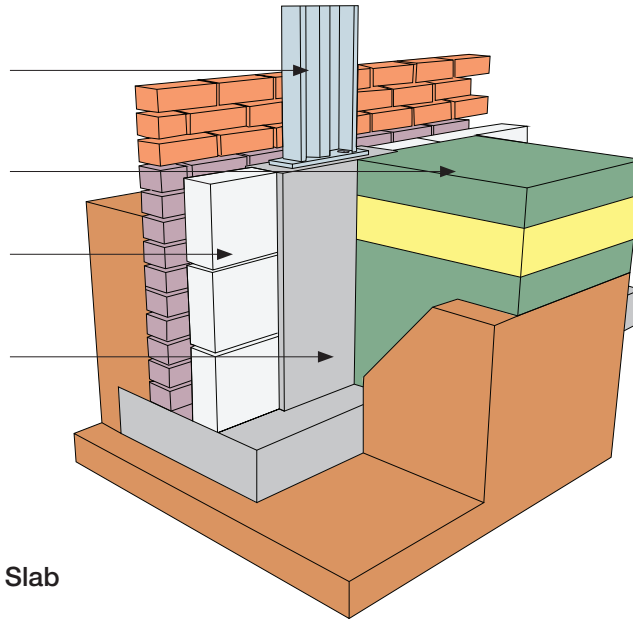
Strip Foundations with Ground Supported Floor Slab (also applicable to Steel Strong-Wall™)

Steel Strong-Portal column or Steel Strong-Wall

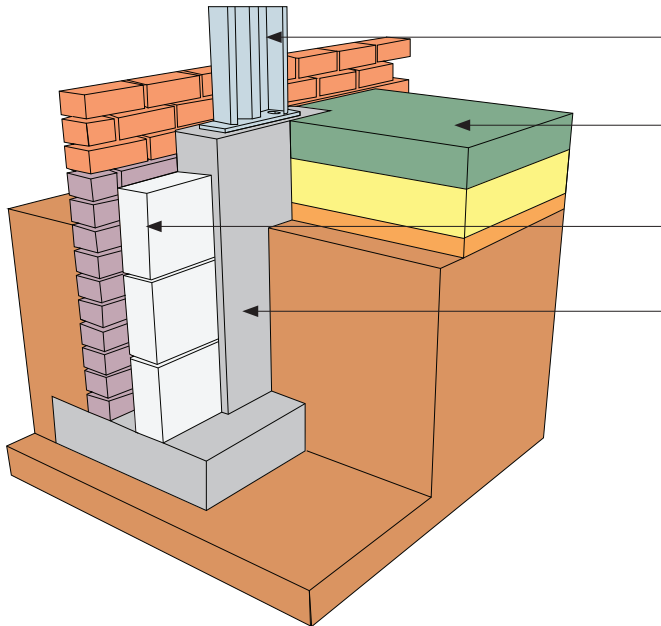
Floor (designed by others)

Brick and block work as per the engineering details.

Concrete Pier, cast to the required floor height and reinforced/connected to the strip foundation (designed by engineer responsible for the foundations).



Strip Foundations with Suspended Floor Slab



Steel Strong-Portal column or Steel Strong-Wall

Floor (designed by others)

Brick and block work as per the engineering details.

Concrete Pier, cast to the required floor height and reinforced/connected to the trench fill foundation for fixed base design.

No reinforcement/connection is required for pinned base design (designed by engineer responsible for the foundations).

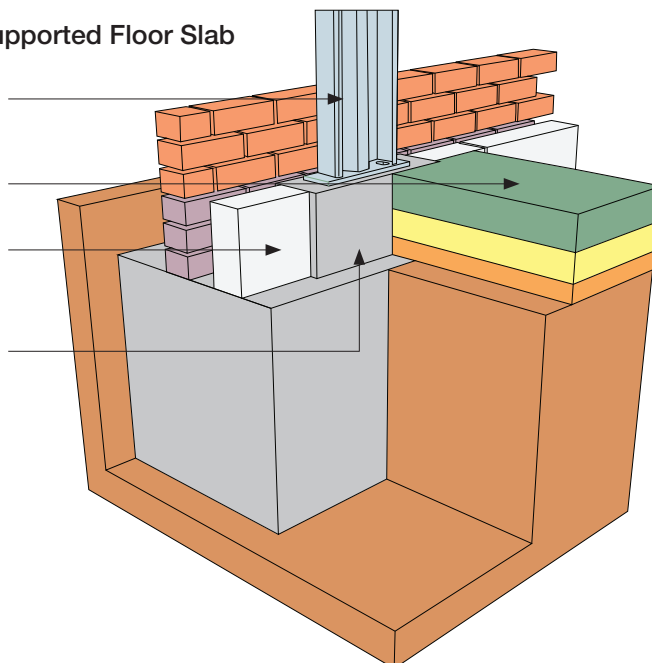
Trench Fill Foundations with Ground Supported Floor Slab

Steel Strong-Portal column or Steel Strong-Wall

Floor (designed by others)

Brick and block work as per the engineering details.

Concrete Pier, cast to the required floor height and reinforced/connected to the trench fill foundation for fixed base design. No reinforcement/connection is required for pinned base design (designed by engineer responsible for the foundations).



Steel Strong-Portal and Steel Strong-Wall Foundation Details

Raft Foundations and Floor Slab

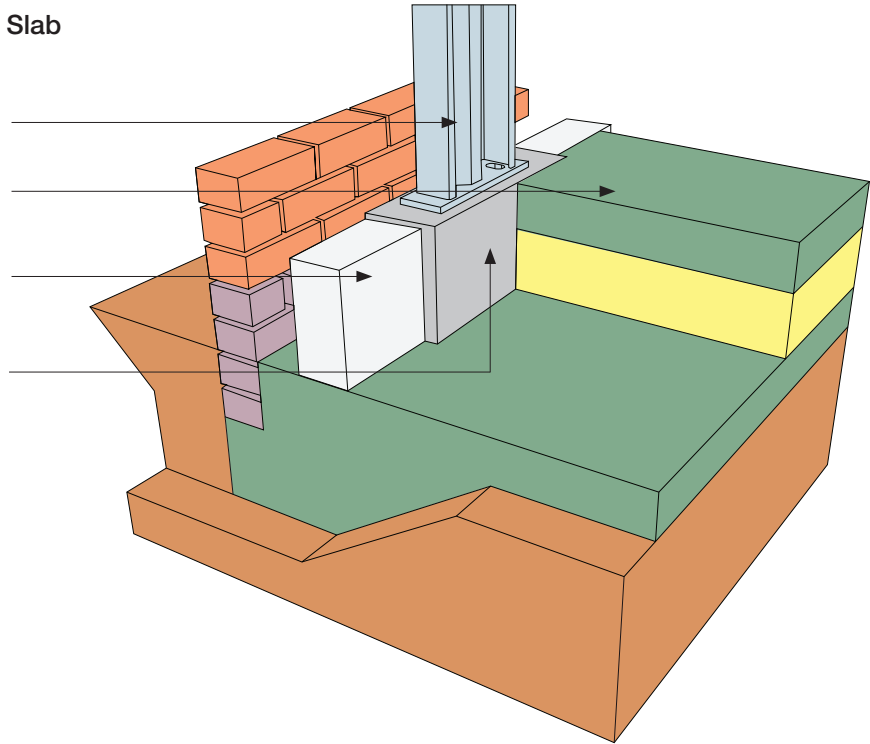
Steel Strong-Portal column or
Steel Strong-Wall

Floor (designed by others)

Brick and block work as per the
engineering details.

Concrete Pier, cast to the required
floor height and reinforced/
connected to the trench fill
foundation for fixed base design.

No reinforcement/connection is
required for pinned base design
(designed by engineer responsible
for the foundations).



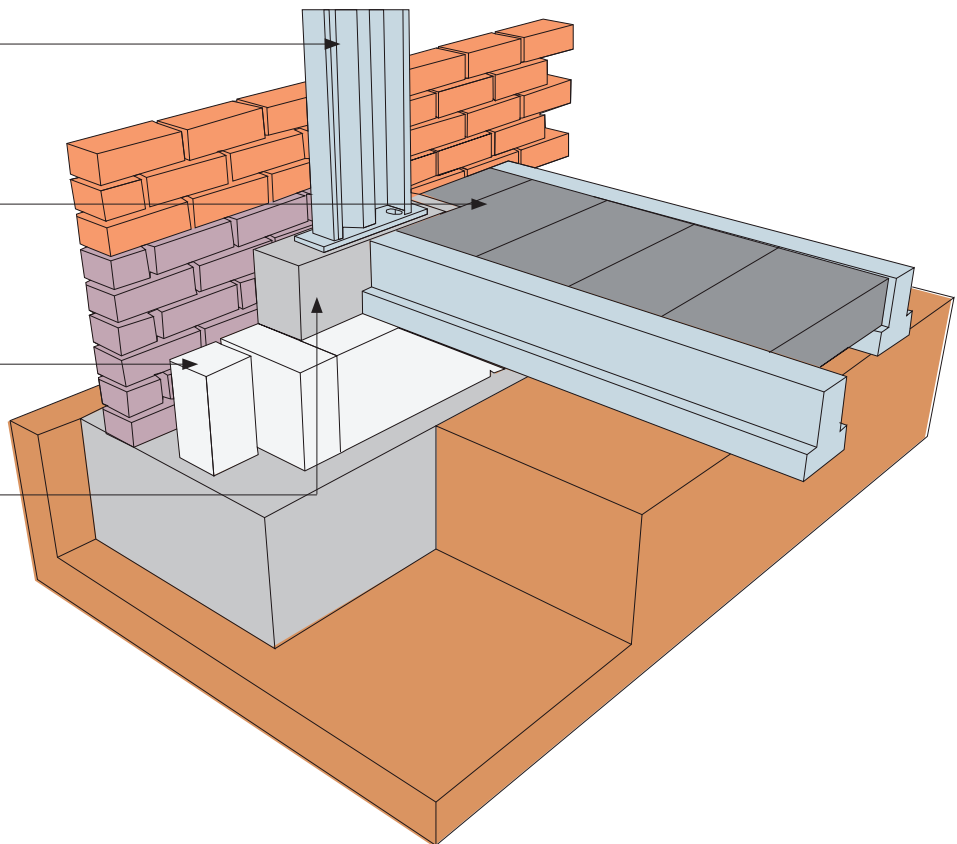
Strip or Trench Fill Foundations with Precast Concrete Beam and Block Floor

Steel Strong-Portal column or
Steel Strong-Wall

Beam and Block Floor
(designed by others)

Brick and block work
as per the engineering
details.

Concrete Pier, cast to the
required floor height and
reinforced/connected to
the trench fill foundation
for fixed base design. No
reinforcement/connection
is required for pinned
base design (designed by
engineer responsible for the
foundations).



Racking Solutions



Fast Technical Support and Advice

For the best technical support and practical advice, contact our Technical Support Team. To help us to help you, try and have the following information to hand:

- Which Simpson Strong-Tie® product are you using?
- What is your load requirement?
- What is the supported member's width and height?
- What is the supporting member's width and height?
- What is the supporting member's material and application?

Call +44(0)1827 255600 or fax +44(0)1827 255616 or email: uktechnical@strongtie.com

Visit us at: www.strongtie.co.uk

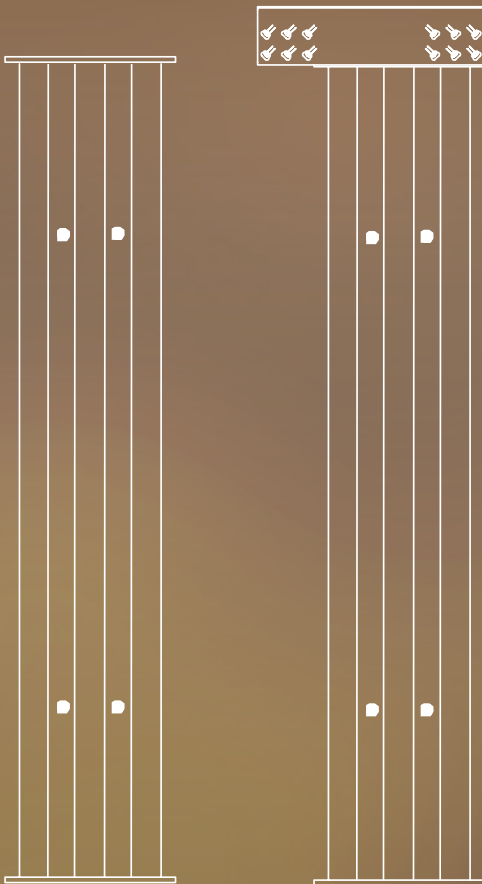
For product Information, 3D Cad Models, Installation Videos, DoP documentation and much more, visit our website at www.strongtie.co.uk. For the latest updates and industry news, follow us on twitter @strongtieUK or at facebook.com/strongtieUK.



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