September 2020 Edition

# Commercial Design Manual for FASTFORM® Wall system

Think FASTER | Think SMARTER

FORMCRAFT Design Manual

*Leading Sustainable Construction*

© 2005-2020 Formcraft Pty Ltd.

# Design Manual Editions

**Current:**

September 2020 Edition - FastForm System

**Superceded:**

September 2019 Edition - FastForm System

August 2015 Edition - Vertical System

August 2014 Edition - Vertical System June

2014 Edition

March 2014 Edition

2013 Edition

Release N - Issued 1/3/2013

Release M - Issued1/6/2011

Older Editions

Please check www.formcraft.com.au regularly to ensure that you are using the most up-to-date edition.

# CONTENTS

THIS PAGE IS INTENTIONALLY
LEFT BLANK

# INTRODUCTION

# INTRODUCTION

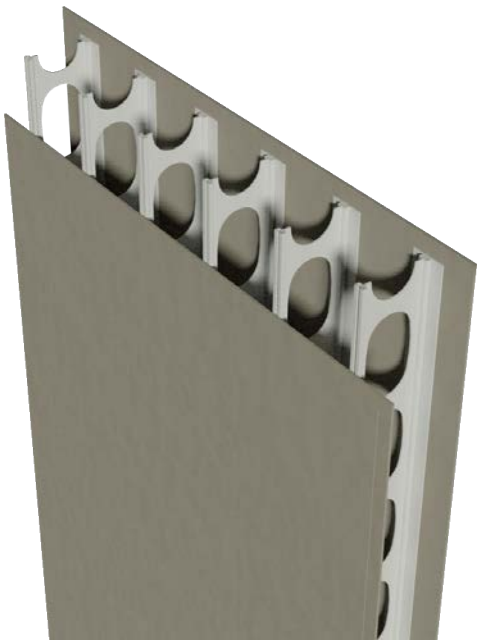
The FastForm® wall system is a permanent formwork system for insitu reinforced concrete structures that are fast, pre-finished and economical. FastForm® walls meet fire, acoustic, thermal and structural code requirements, while also offering a range of stylish finishes.

The structural capability of the product when filled with concrete makes it an ideal solution for the construction of buildings such as: Commercial offices, Mixed-use developments, Multi-unit apartments, Schools, Shopping centres, Prisons and Hotels.

The connectors can vary in width depending on the structural requirements for the project. The panels are stood in place, both vertical and horizontal reinforcement is placed as required and the wall is completed by filling the panels with concrete. Once complete, the walls act as reinforced concrete walls that comply with AS 3600 Concrete structures.

The FastForm® wall system wall system can utilise the following connection options:

1. FastForm Internal - Flat-packed fibre cement formwork with a PVC connection system for interior walls
2. FastForm External - Flat-packed fibre cement formwork with a galvanised or stainless steel connection system for non-combustible exterior wall applications.



**FastForm Internal**
Flat-packed Fibre Cement Panels with PVC connection system for internal walls.

**FastForm External**
Flat-packed Fibre Cement Panels with steel connection system for non-combustible external walls. Galvanised or stainless steel options.

This manual has been prepared to assist in the detailing of the FastForm® walling system. It provides a basis from which to work, but does not replace the services of professional consultants on specific projects.

Formcraft provides technical support throughout the design and construction process to ensure quality project outcomes.

## Advantages

FastForm® is a sustainable wall system that is fast to construct, provides a high level of structural capacity and creates a quiet comfortable interior environment.

## Speed/Cost Savings

Formcraft's advanced concrete forming technology also delivers proven savings in labour costs through its rapid construction technique. Pre-fabricated panel packs are delivered to site to suit your construction program.

The lightweight and flat packed design enables convenient on-site assembly and the panels are less expensive to transport, making them ideal for use in remote locations.

## Strength

Nothing rivals steel-reinforced concrete for strength and stability. Reinforced concrete walls are known to withstand much stronger weather conditions than other construction systems. Use of the FastForm® wall system results in a solid, stable and durable structure.

The high strength, thinner walls reduce the dead load on the structure. The walls act as deep beams and transfer walls, which reduce floor slab thickness and eliminates conventionally formed beams and columns.

## Strength

FastForm® walls allow architects and designers to create buildings that use fewer natural resources and provide ongoing energy savings for the project. FastForm® walls:

- Are manufactured to order and generate less wastage on the construction site than conventional methods.
- Maximise the amount of recycled material used in production of the product.
- Create structures that last longer and require less maintenance.

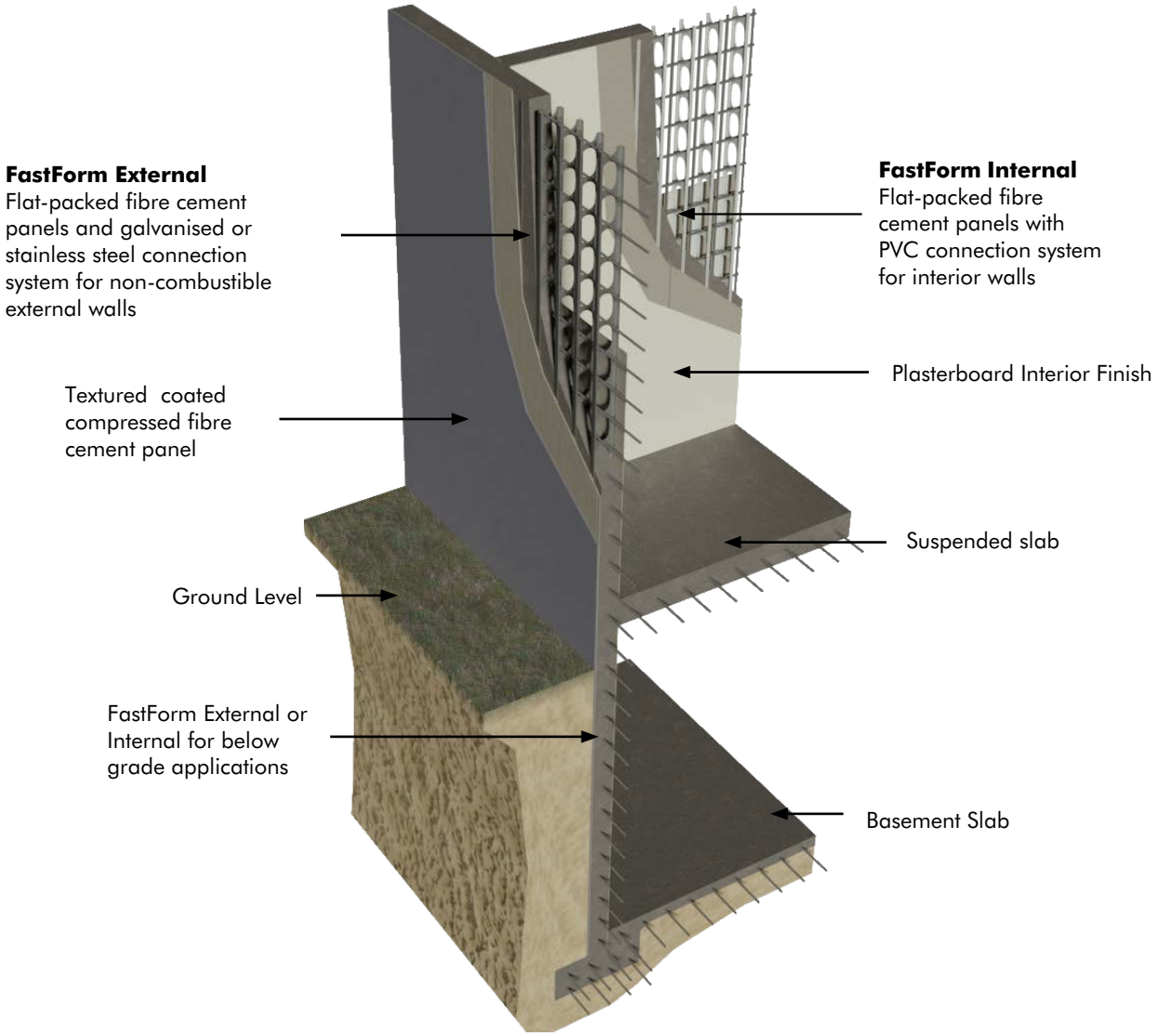
# FastForm® CHARACTERISTICS

The FastForm® panels are designed to function as the formwork for concrete walls. The formwork stays in place on the exterior and interior face of the wall assembly, and also serves as the substrate for exterior and interior finishing systems. When concrete is poured into the cavity between the formwork, a solid, flat, cast-in-place and steel-reinforced concrete wall is formed.

The concrete cavity thickness can be easily varied by using panel connectors of different widths to provide for different structural requirements.

FastForm® walls are used in commercial and residential construction for external and internal, load bearing, above grade and below grade walls. Specific applications include basement and under-croft walls, insulated exterior walls, inter-tenancy/party walls, sheer walls, stem walls and lift shaft and stairwell applications.

Product literature, technical information, CAD/BIM details, specifications and product samples are available upon request.






FORMCRAFT
Leading Sustainable Construction

Think FASTER | Think STRONGER | Think INSULATED | Think SMARTER | Think EFFICIENT

27 Amherst Street, Fremantle WA | 1800 FORMCRAFT | www.formcraft.com.au

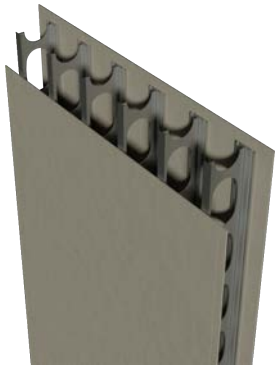
# FastForm® Wall Selection Guide

FastForm® Internal is a modular form that comprises 2 opposing compressed fibre cement panels with a PVC connection system. The pre-fabricated panels arrive to site flat packed and are easily assembled into forms by inserting PVC trusses between panels. This means that panels can be installed one at a time which vastly reduces the amount of crane time required for installation. The system also comprises an innovative joining strip which is used to join adjacent panels. This reduces the amount of fixings that are required to join panels together. The system also includes pre-fabricated corner and stop ends. The system is particularly well suited to any interior wall application that incudes inter-tenancy walls, lift shafts, stairwells, blade walls and columns.

FastForm® External is a modular form that comprises 2 opposing compressed fibre cement panels with a metal connection system. The pre-fabricated panels arrive to site flat packed and are easily assembled into forms by inserting the steel trusses between panels and placing pre-fabricated corner and stop end modules. There are options for both galvanised and stainless steel connection systems. Stainless steel is generally used in coastal conditions to maximise corrosion resistance. The system is particularly well suited to any exterior wall applications and meets the new NCC requirements for non-combustible wall systems.

| Product | Areas Of Use | Product Code | Wall Thickness | Panel Inside Face | Concrete Cavity | Panel Outside Face | FRL | $R_w + C_{tr}$ | R-Value |
|---|---|---|---|---|---|---|---|---|---|
| **FastForm Internal**<br>• Flat packed materials<br>• Fibre cement panels<br>• PVC connection system | • Interior walls<br>• Intertenancy walls<br>• Lift shafts<br>• Blade walls | TT120-P | 120mm | 6mm Fibre Cement | 108mm | 6mm Fibre Cement | 120/120/120 | 47 | 0.25m2.K/W |
| | | TT162-P | 162mm | 6mm Fibre Cement | 150mm | 6mm Fibre Cement | 180/180/180 | 50 | 0.25m2.K/W |
| | | TT270-P | 270mm | 6mm Fibre Cement | 258mm | 6mm Fibre Cement | 240/240/240 | 57 | 0.25m2.K/W |
| **FastForm External**<br>• Flat packed materials<br>• Fibre cement panels<br>• Steel connection system (galvanised & stainless steel options) | • Non-combustible<br>• Non-corrosive (stainless steel option)<br>• Exterior walls | TT120-S | 120mm | 6mm Fibre Cement | 108mm | 6mm Fibre Cement | 120/120/120 | 47 | 0.25m2.K/W |
| | | TT150-S | 150mm | 6mm Fibre Cement | 138mm | 6mm Fibre Cement | 120/120/120 | 49 | 0.25m2.K/W |
| | | TT162-S | 162mm | 6mm Fibre Cement | 150mm | 6mm Fibre Cement | 180/180/180 | 50 | 0.25m2.K/W |
| | | TT262-S | 262mm | 6mm Fibre Cement | 250mm | 6mm Fibre Cement | 240/240/240 | 57 | 0.25m2.K/W |

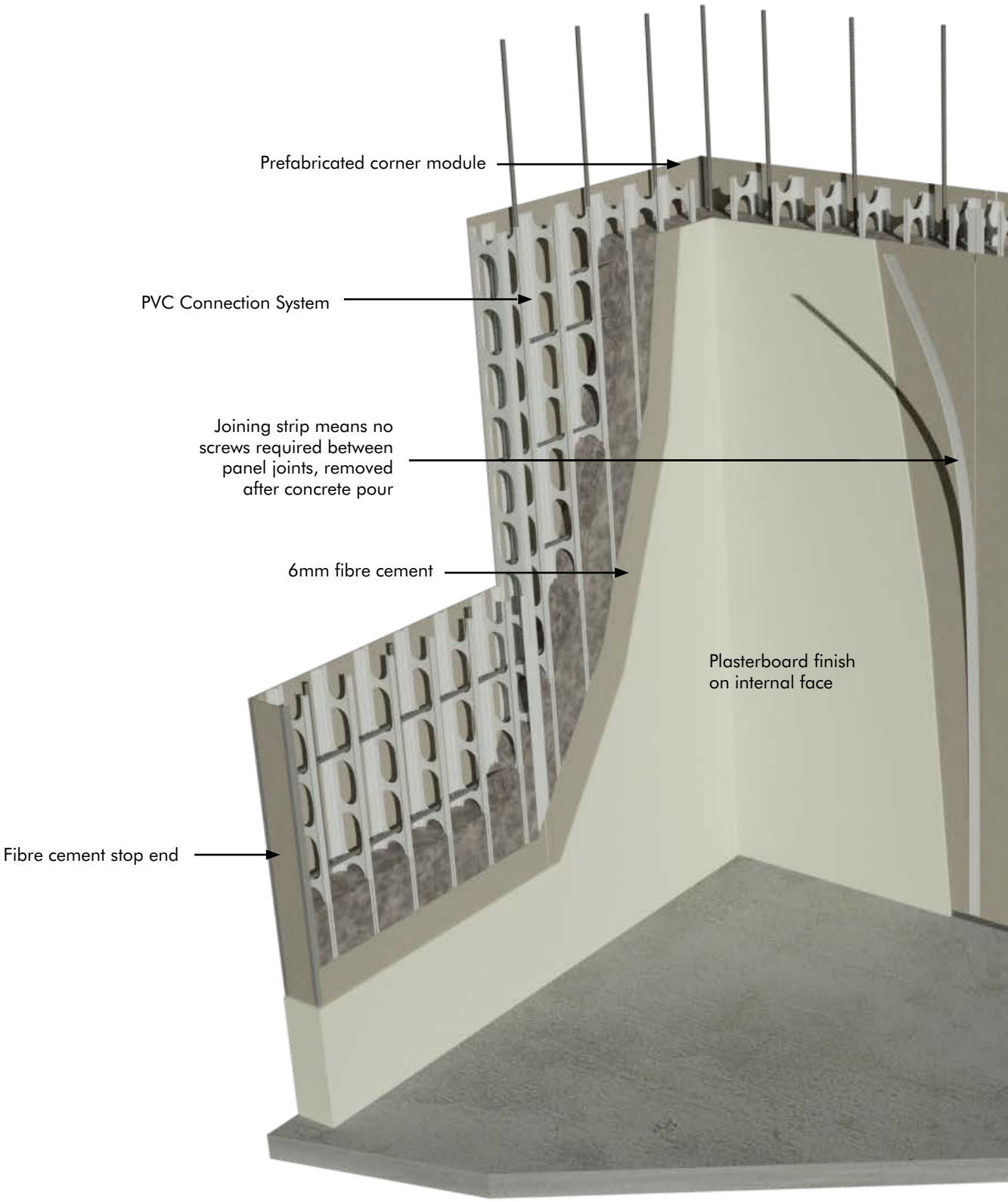
FastForm Internal



FastForm External

# FastForm® Typical Layout

## Illustrative Features of the FastForm Wall System



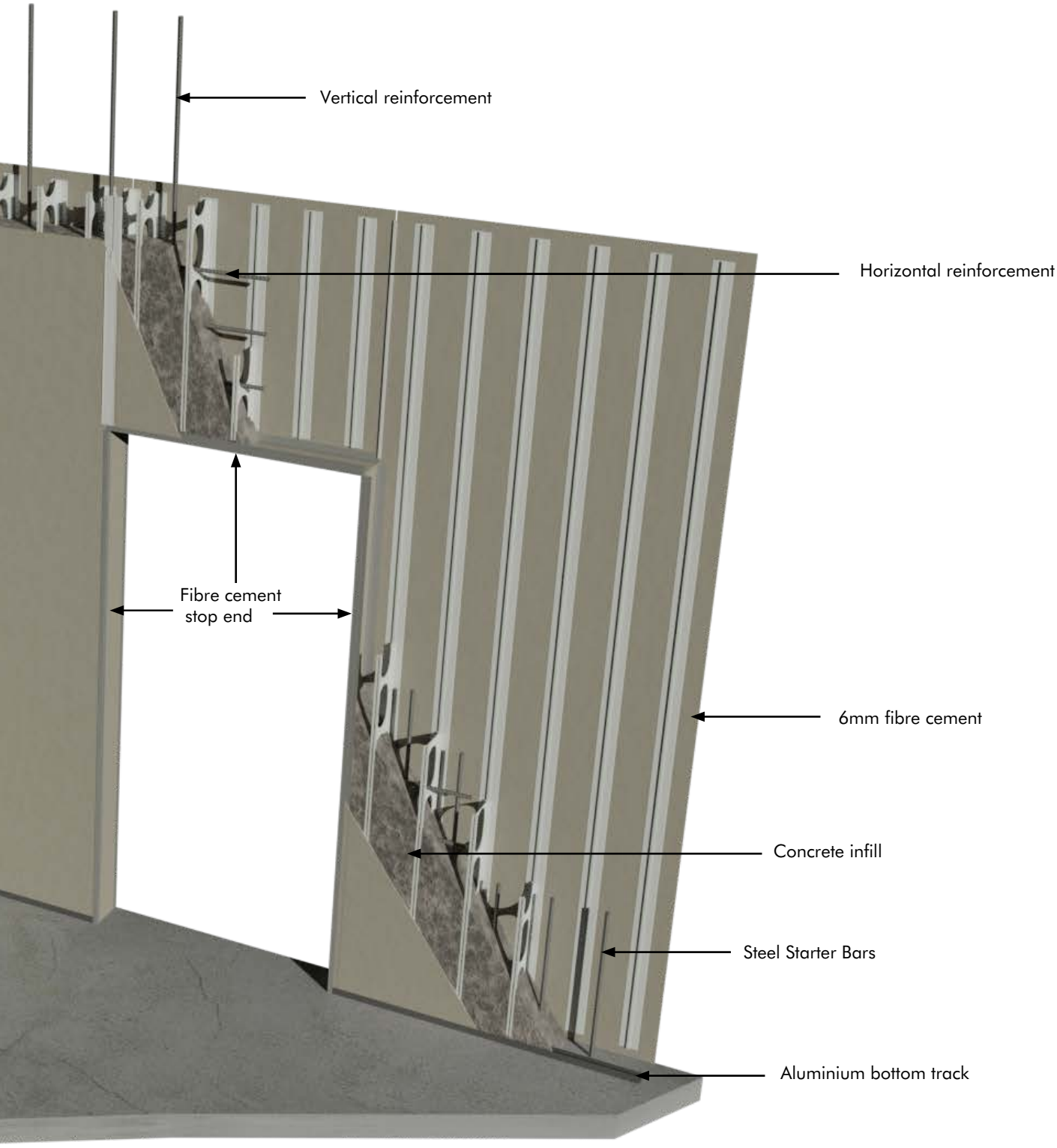



FORMCRAFT Leading Sustainable Construction

Think FASTER | Think STRONGER | Think INSULATED | Think SMARTER | Think EFFICIENT

27 Amherst Street, Fremantle WA | 1800 FORMCRAFT | www.formcraft.com.au

# FastForm® Typical Layout



# NOTES

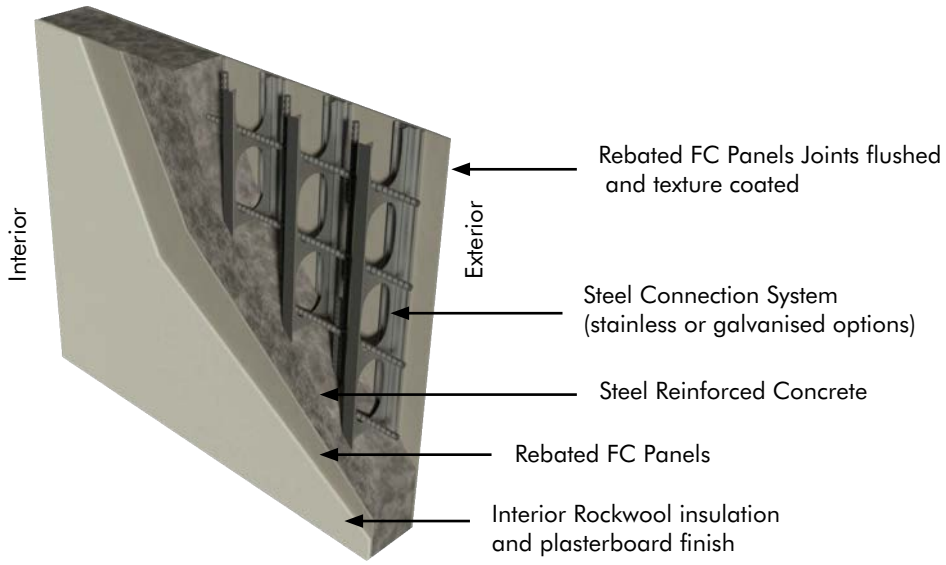
# APPLICATIONS

# FASTFORM® APPLICATIONS

## External Walls

BCA REQUIREMENTS

| CLASS OF BUILDING | REQUIRED FRL | BUILDING'S CLIMATE ZONE | REQUIRED R-VALUE | RECOMMENDED PRODUCT TO MEET REQUIREMENTS |
|---|---|---|---|---|
| 1 | N/A | 1, 2, 3 &5<br>4 & 6<br>7 & 8 | 1.4<br>1.7<br>2.3 | EE220<br>ET174<br>ET216 |
| 2 | 90/90/90 | 1, 2, 3 &5<br>4 & 6<br>7 & 8 | 1.4<br>1.7<br>2.3 | TT162-S |
| 5,7a &9 | 120/120/120 | 1, 2, 3 &5<br>4 & 6<br>7 & 8 | 1.4<br>1.7<br>2.3 | TT162-S |
| 6 | 180/180/180 | 1, 2, 3 &5<br>4 & 6<br>7 & 8 | 1.4<br>1.7<br>2.3 | TT162-S |
| 7b & 8 | 240/240/240 | 1, 2, 3 &5<br>4 & 6<br>7 & 8 | 1.4<br>1.7<br>2.3 | TT162-S |




**TT162-S Wall Model**

FASTFORM WALL ALTERNATIVES

| Wall Model | Concrete Thickness | Wall Thickness | Fire Resistance | Acoustic Rating | Thermal Resistance |
|---|---|---|---|---|---|
| | | | FRL | $R_w + C_{tr}$ | R-Value |
| TT120-S | 108mm | 120mm | 120/120/120 | 46 | 0.25m2.K/W |
| TT150-S | 138mm | 150mm | 120/120/120 | 49 | 0.25m2.K/W |
| TT162-S | 150mm | 162mm | 180/180/180 | 50 | 0.25m2.K/W |
| TT262-S | 250mm | 262mm | 240/240/240 | 57 | 0.25m2.K/W |



FORMCRAFT Leading Sustainable Construction

Think FASTER | Think STRONGER | Think INSULATED | Think SMARTER | Think EFFICIENT

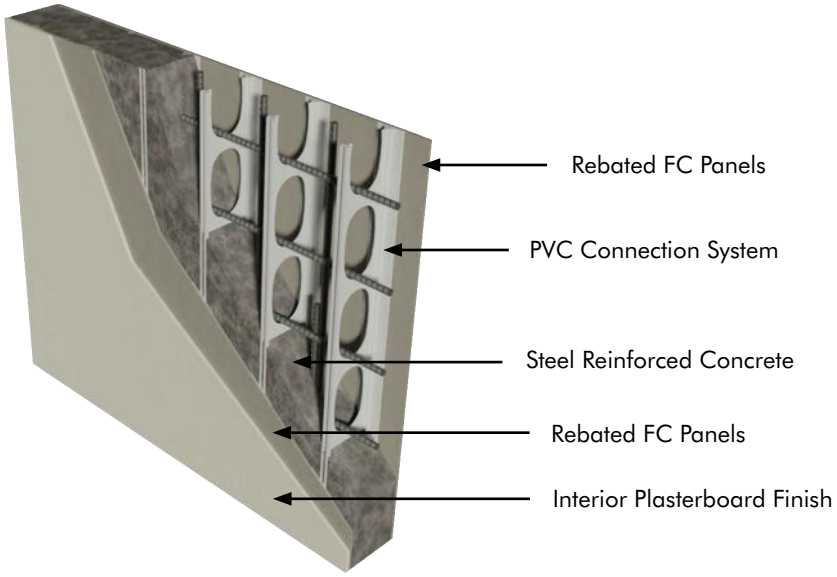
27 Amherst Street, Fremantle WA | 1800 FORMCRAFT | www.formcraft.com.au

## Inter-Tenancy Walls

Description: Walls separating sole occupancy units.

BCA REQUIREMENTS

| WALL USE | REQUIRED FRL | REQUIRED $R_w + C_{tr}$ | REQUIRED $D_{n,T,w} + C_{tr}$ | RECOMMENDED PRODUCT |
|---|---|---|---|---|
| Habitable to Habitable | 90/90/90 | 50 | N/A | TT162-P |
| Habitable to Wet Area | 90/90/90 | 50 | 45 | TT162-P |
| Wet Area to Wet Area | 90/90/90 | 50 | 45 | TT162-P |




**TT162-P Wall Model**

FASTFORM WALL ALTERNATIVES

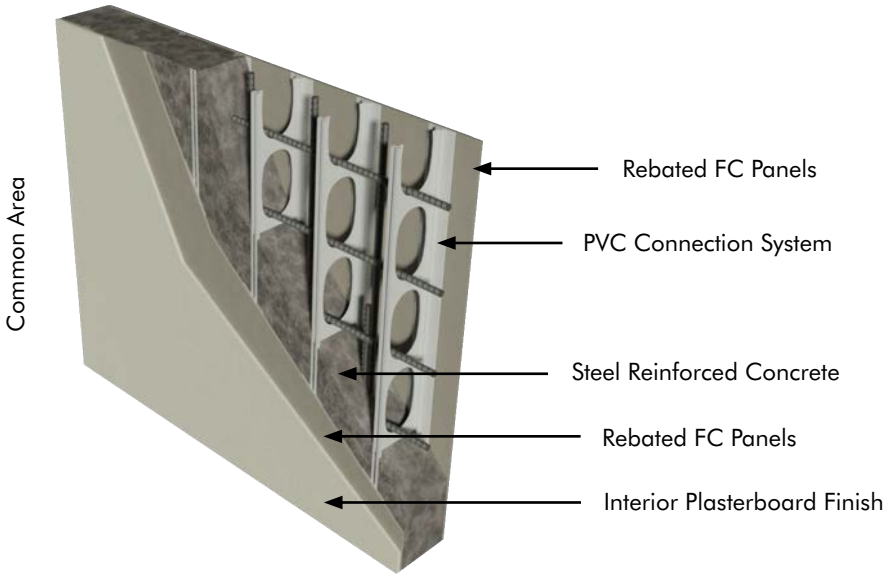
| Wall Model | Concrete Thickness | Wall Thickness | Fire Resistance FRL | Acoustic Rating $R_w + C_{tr}$ | Thermal Resistance R-Value |
|---|---|---|---|---|---|
| TT162-P<br>TT270-P | 150mm<br>258mm | 162mm<br>270mm | 180/180/180<br>240/240/240 | 50<br>57 | 0.25m2.K/W<br>0.25m2.K/W |
| TT162-S<br>TT262-S | 150mm<br>250mm | 162mm<br>262mm | 180/180/180<br>240/240/240 | 50<br>57 | 0.25m2.K/W<br>0.25m2.K/W |

## Lift, Stairwell & Service Shafts

Description: Walls separating shafts from common areas or sole occupancy units.

BCA REQUIREMENTS

| WALL USE | REQUIRED FRL | REQUIRED $R_w + C_{tr}$ | REQUIRED $D_{n,T,w} + C_{tr}$ | RECOMMENDED PRODUCT |
|---|---|---|---|---|
| Lift Shaft | 90/90/90 | N/A | N/A | TT162-P |
| Stairwell Shaft | 90/90/90 | N/A | N/A | TT162-P |
| Service Shaft | 90/90/90 | 25/40 | N/A | TT162-P |




**TT162-P Wall Model**

FASTFORM WALL ALTERNATIVES

| Wall Model | Concrete Thickness | Wall Thickness | Fire Resistance FRL | Acoustic Rating $R_w + C_{tr}$ | Thermal Resistance R-Value |
|---|---|---|---|---|---|
| TT162-P<br>TT270-P | 150mm<br>258mm | 162mm<br>270mm | 180/180/180<br>240/240/240 | 50<br>57 | 0.25m2.K/W<br>0.25m2.K/W |
| TT162-S<br>TT262-S | 150mm<br>250mm | 162mm<br>262mm | 180/180/180<br>240/240/240 | 50<br>57 | 0.25m2.K/W<br>0.25m2.K/W |



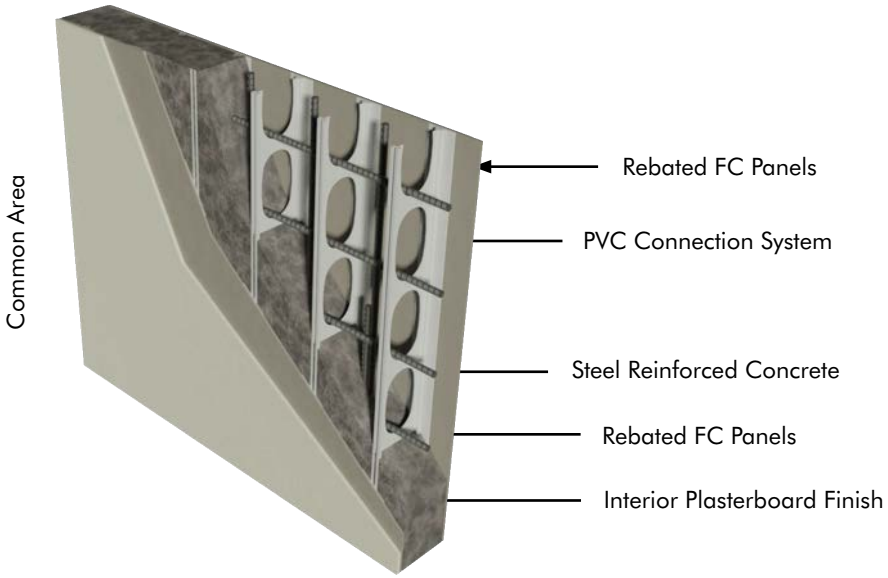
FORMCRAFT Leading Sustainable Construction
Think FASTER | Think STRONGER | Think INSULATED | Think SMARTER | Think EFFICIENT
27 Amherst Street, Fremantle WA | 1800 FORMCRAFT | www.formcraft.com.au

## Retaining & Basement Walls

Description: Walls to retain earth or similar. eg Basements, etc.

BCA REQUIREMENTS

| WALL USE | REQUIRED FRL | REQUIRED $R_w + C_{tr}$ | REQUIRED $D_{n,T,w} + C_{tr}$ | RECOMMENDED PRODUCT |
|---|---|---|---|---|
| Retaining Wall | Varied according to application | N/A | N/A | TT162-P |




**TT162-P Wall Model**

FASTFORM WALL ALTERNATIVES

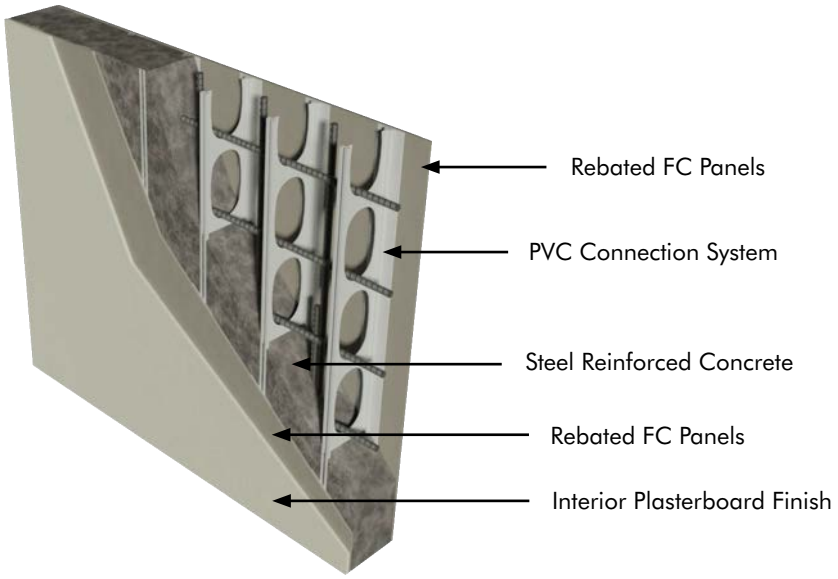
| Wall Model | Concrete Thickness | Wall Thickness | Fire Resistance FRL | Acoustic Rating $R_w + C_{tr}$ | Thermal Resistance R-Value |
|---|---|---|---|---|---|
| TT162-P<br>TT270-P | 150mm<br>258mm | 162mm<br>270mm | 180/180/180<br>240/240/240 | 50<br>57 | 0.25m2.K/W<br>0.25m2.K/W |
| TT162-S<br>TT262-S | 150mm<br>250mm | 162mm<br>262mm | 180/180/180<br>240/240/240 | 50<br>57 | 0.25m2.K/W<br>0.25m2.K/W |

## Corridor Walls

Description: Walls separating sole occupancy units from common areas and stair shafts.

BCA REQUIREMENTS

| WALL USE | REQUIRED FRL | REQUIRED $R_w + C_{tr}$ | REQUIRED $D_{n,T,w} + C_{tr}$ | RECOMMENDED PRODUCT |
|---|---|---|---|---|
| Common Area Separation | 90/90/90 | N/A | N/A | TT120-P |
| Stair Shaft Separation | 90/90/90 | N/A | N/A | TT162-P |




**TT162-P Wall Model**

FASTFORM WALL ALTERNATIVES

| Wall Model | Concrete Thickness | Wall Thickness | Fire Resistance FRL | Acoustic Rating $R_w + C_{tr}$ | Thermal Resistance R-Value |
|---|---|---|---|---|---|
| TT120-P | 108mm | 120mm | 120/120/120 | 46 | 0.25m2.K/W |
| TT162-P | 150mm | 162mm | 180/180/180 | 50 | 0.25m2.K/W |
| TT270-P | 258mm | 270mm | 240/240/240 | 57 | 0.25m2.K/W |
| TT120-S | 108mm | 120mm | 120/120/120 | 46 | 0.25m2.K/W |
| TT150-S | 138mm | 150mm | 120/120/120 | 49 | 0.25m2.K/W |
| TT162-S | 150mm | 162mm | 180/180/180 | 50 | 0.25m2.K/W |
| TT262-S | 250mm | 262mm | 240/240/240 | 57 | 0.25m2.K/W |



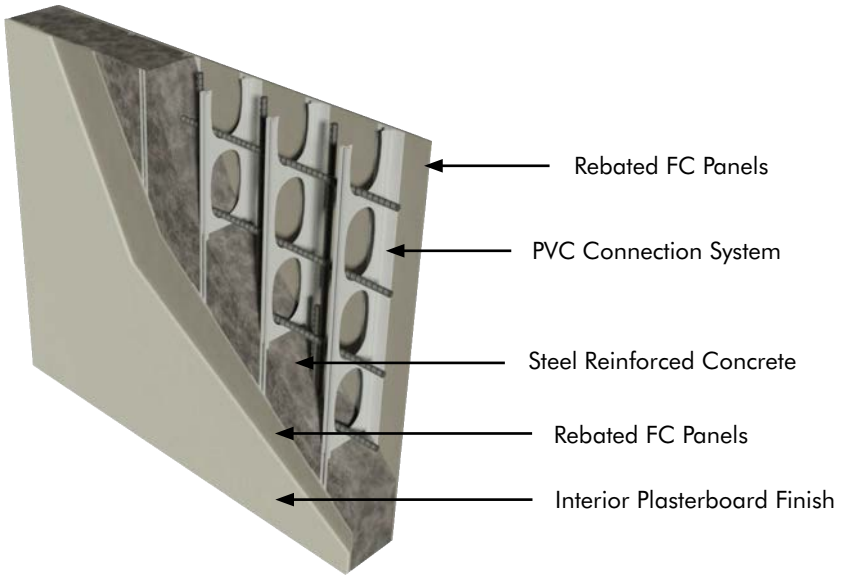
FORMCRAFT Leading Sustainable Construction
Think FASTER | Think STRONGER | Think INSULATED | Think SMARTER | Think EFFICIENT
27 Amherst Street, Fremantle WA | 1800 FORMCRAFT | www.formcraft.com.au

## Blade Walls

Description: Independant wall typically of achitectural or structural significance.

BCA REQUIREMENTS

| WALL USE | REQUIRED FRL | REQUIRED $R_w + C_{tr}$ | REQUIRED $D_{n,T,w} + C_{tr}$ | RECOMMENDED PRODUCT |
|---|---|---|---|---|
| Blade Wall | Varied according to application | N/A | N/A | TT162.. |




**TT162-P Wall Model**

FASTFORM WALL ALTERNATIVES

| Wall Model | Concrete Thickness | Wall Thickness | Fire Resistance | Acoustic Rating | Thermal Resistance |
|---|---|---|---|---|---|
| | | | FRL | $R_w + C_{tr}$ | R-Value |
| TT120-P | 108mm | 120mm | 120/120/120 | 46 | 0.25m2.K/W |
| TT162-P | 150mm | 162mm | 180/180/180 | 50 | 0.25m2.K/W |
| TT270-P | 258mm | 270mm | 240/240/240 | 57 | 0.25m2.K/W |
| TT120-S | 108mm | 120mm | 120/120/120 | 46 | 0.25m2.K/W |
| TT150-S | 138mm | 150mm | 120/120/120 | 49 | 0.25m2.K/W |
| TT162-S | 150mm | 162mm | 180/180/180 | 50 | 0.25m2.K/W |
| TT262-S | 250mm | 262mm | 240/240/240 | 57 | 0.25m2.K/W |

# NOTES

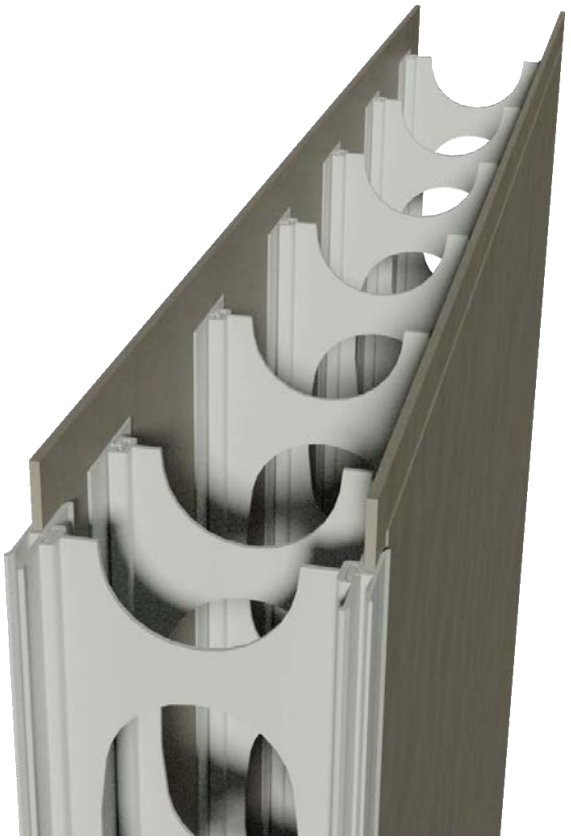
# ARCHITECTURAL

# FastForm® Panel Types & Finishes

## FastForm® Internal

## THE NEXT GENERATION SYSTEM FOR COMMERCIAL CONSTRUCTION

Panels used for the FastForm® Internal system are 6mm thick and 3600mm long by 1200mm wide. Face-plates are adhered inside the 6mm panels at 200mm horizontal centres and joined via a Truss connector. Corner joins are supported by a propriety corner brace during pouring. The FastForm® Internal system also uses an additional inter-panel Joining Truss connector with an FC Joining Strip at each end to connect adjacent panels, prevent concrete leakage and reducing the amount of screw fixing required during panel installation. The FC Joining Strip is removed before flushing the fibre cement panel joints by simply peeling of the external strip.



## FastForm Internal Product Components

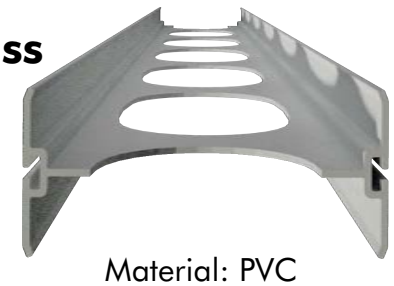
### Truss

Product Code:
TR108
TR150
TR188
TR250

Material: PVC

### Joining Truss

Product Code:
JT108
JT150
JT188
JT250



Material: PVC

### Bottom Track

Product Code:
BT

Material:
Aluminium

### Corner Profile

Product Code:
CPT

Material:
Aluminium

### FC Joining Strip

Product Code:
FCJS

Material:
PVC



FORMCRAFT
Leading Sustainable Construction



27 Amherst Street, Fremantle WA | 1800 FORMCRAFT | www.formcraft.com.au

## Exterior Finishes

Typical exterior finishes are:

1. Rebated FC panels with flushed joints and textured render
2. Cladding systems able to be fixed to D_qrDmpk® walls.

**Rebated FC flushed and beaded ready for rendering**

**Acrylic render system applied to panels**

## Interior Finishes

The most common and cost effective interior finishing material used is plasterboard. Plasterboard can be applied directly to D_qrDmpkě u_jjq sqgle amltclrgml_j bpwu_jj qapcuq

It is recommended that plasterboard is applied to internal FormPro® fibre cement walls to give a high level of internal finish.

**Interior EPS Panels with screw fixed plasterboard**

This can be achieve by one of three methods;

1. Discontinuous stud wall – used when impact sound abatement is required for inter-tenancy walls.
2. Plasterboard on battens – is used when there is a high level of service reticulation required in that section of walling.
3. Direct stick plasterboard – is used internally to achieve a high level of finish.

## Level of Finish

The quality of the finish on walls depends on the straightness of walls, and the quality of the finishing system and the amount of glancing light projected on the wall surface. It is essential for designers and builders to determine the level of finish required before construction commences, otherwise it may not be possible to attain the desired finish level without extensive corrective measures. Generally FastForm® walls achieve Level 4 finish (as determined by AS2589.1) which is +/- 6mm tolerance across an 1800mm plane.

### Glancing light

Glancing light is where the light from an artificial or natural source is nearly parallel to the surface. This condition exaggerates vertical joints and other imperfections making them more obvious. It is recommended designers give consideration to the level of finish required and eliminate potential problems due to glancing light.

### Internal finishing for rebated FC panels

It is recommended that internal walls are over-sheeted by one of 3 methods - Direct stick plasterboard, Batten and Sheet or Discontinuous Stud Wall. It is important that the procedure from the chosen manufacturer must be followed.

### External coating for Rebated FC panels

It is recommended for external walls that an external textured render system be applied. It is important that the procedure from the chosen manufacturer must be followed. Good preparation of the panels using a skim coat over the entire wall surface by applicator is critical to achieving quality finishes.

The procedure is as follows;

1. Screw holes or any other high points in the wall should be sanded or grinded back to provide a flat surface.
2. Panel joints should be primed and taped with a fibre glass mesh.
3. Jointing compound is applied by trowel to the panel joints.
4. Complete panel surface should be rendered with one or more coats to a thickness of 4-10mm to provide a flat surface.
5. The top coat should be a minimum be 2–3 mm thick trowel-on system and be designed to perform as a water resistant membrane.

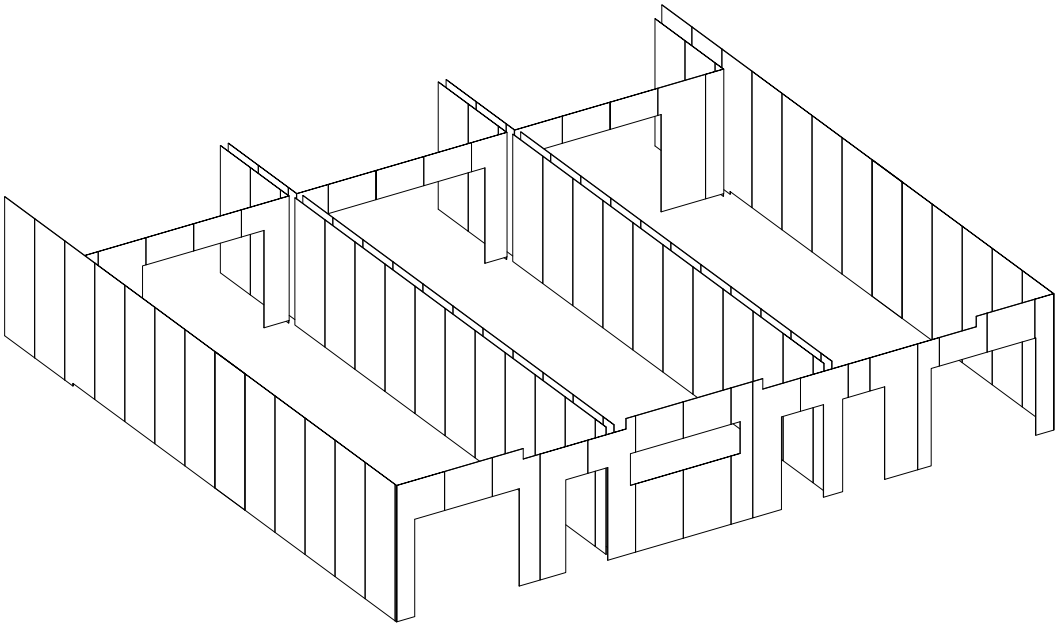
### Suppliers

The main suppliers of texture coating materials are;

| | |
|---|---|
| Rockcote | Ph. 1800 267 737 |
| Wattyl | Ph. 13 21 01 |
| Dulux | Ph. 13 23 77 |
| Taubmans | Ph. 13 16 86 |

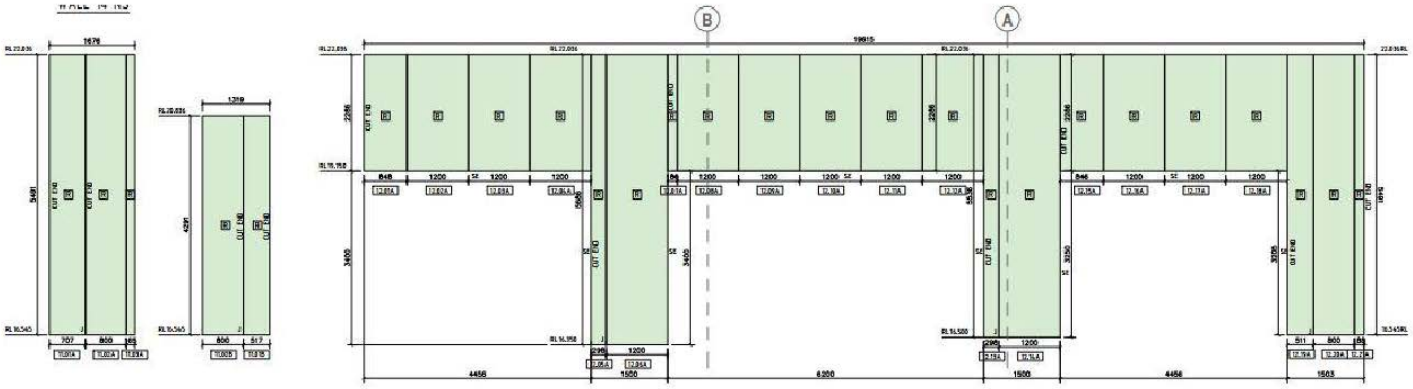
## Panelisation for the FastForm® Wall System

A major feature of the FastForm® system is the ability to pre-cut the fibre cement panels to dramatically reduce installation times. Each panel is shop drawn and labelled for easy onsite identification to assist installation.



**Panelised Floor of Example Development**

Formcraft produces detailed shop drawings for each project before customising each wall so that it is precisely prepared ready for assembly before it arrives on site. Because of this on-site waste is dramatically reduced.



**Shopdrawing example ready for production**

## Doors and Windows

Door and window frames may be placed as close to a corner as needed as long as the wall is structurally adequate. A 400mm offset works best. It is necessary to allow enough wall space for proper functioning of the door or window. The spacing between two or more doors or windows is determined by the need for the structural design to allow for adequate steel reinforcement placement.

Formcraft manufactures a fibre cemnt stop end solution that provides for an easy means of fixing doors and windows. Formcraft recommends double glazed windows and doors to maintain optimal energy efficiency.

**Stop Ends can be used to exclude concrete from door and window openings**

Most windows and door frames can be installed into the openings according to the design by utilising the FastForm® stop end system to line the opening. The door and window frames are then trim fitted to the stopend which has concrete directly behind the 6mm fibre cement panel.

With hinged doors, the orientation of the hinge must be considered due to the thickness of the wall in comparison to the door. Exterior hinged doors that are hung to the FastForm® wall should be installed so that the hinge is flush with the inside wall.

## Electrical, Mechanical and Plumbing

Since the FastForm® wall ultimately becomes a solid concrete wall, the electrical, mechanical and plumbing penetrations through the wall must be carefully pre-planned. Penetrations are easily accommodated before the concrete is placed by installing conduits through the wall. Examples of items that would need penetrations include exterior lighting, vents, and the main utility box.

**Installation of wall box in fibre cement panels**

## Other Floor Systems

FastForm® walls are versatile and are fully capable of being integrated with a variety of other floor systems including:

- Conventional Slab
- Bondek Slab
- Post Tension Slab
- Light Frame Floor

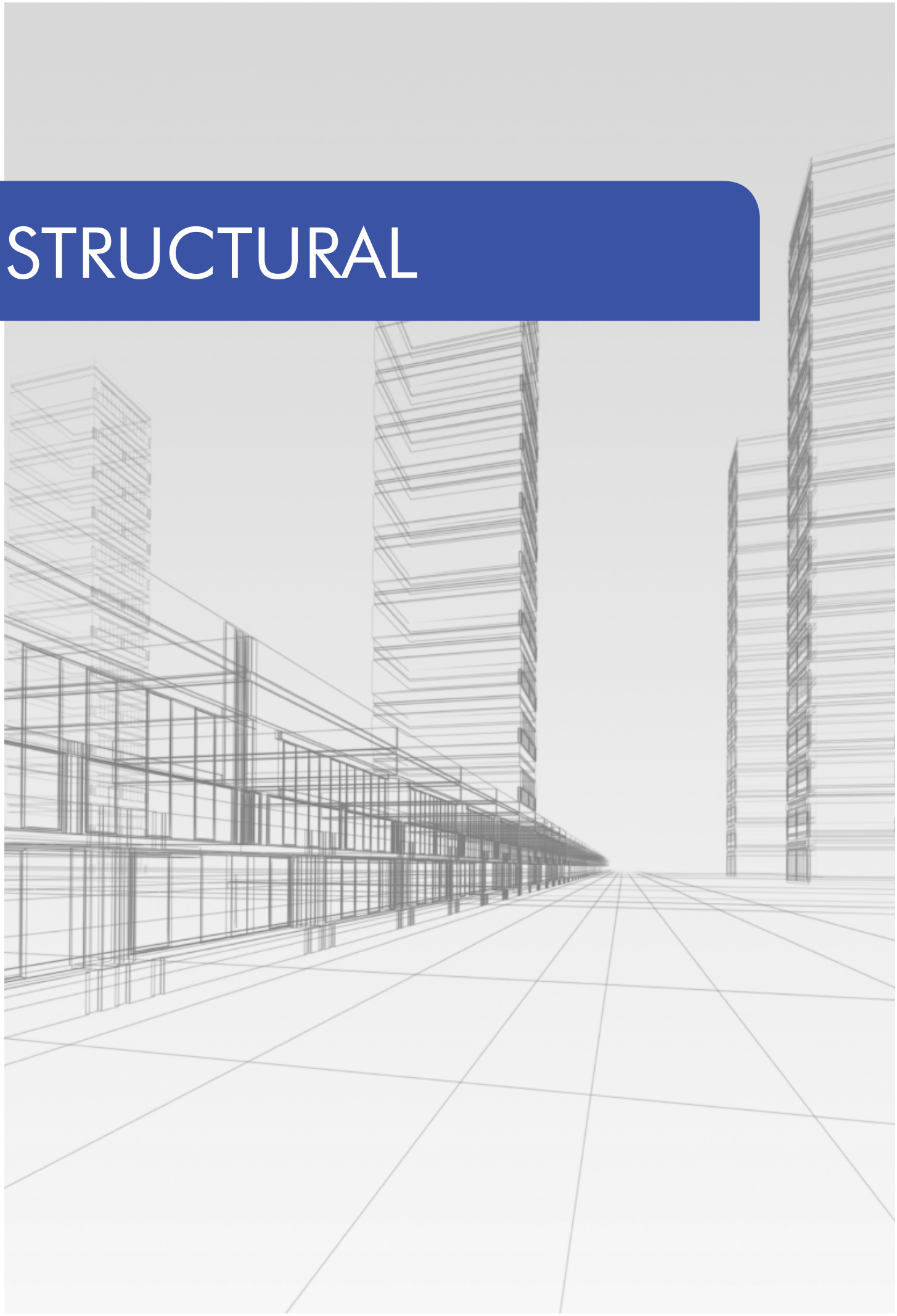
## BIM Software

Formcraft realises the importance of software in the design of buildings and so can provide product details and models in the following formats;

- AutoCAD
- DWG
- Revit
- PDF

# NOTES

# STRUCTURAL



## Vertical Load Capacity

The vertical load design capacit y ( $\phi N_u$) for the various wall thicknesses, wall heights and support conditions are shown in the following Charts.

The design capacities have been calculated in accordance with AS 3600 Clause 11.4 SIMPLIFIED DESIGN METHOD FOR BRACED WALLS SUBJECT TO VERTICAL FORCES ONLY, as follows:

Design axial compressive strength = $\phi N_u$ (kN/m)

**where:**

$\phi$ = 0.6

$N_u$ = the ultimate strength (kN/m)
= $(tw - 1.2e - 2e_a)0.6\, f'_c\, 10^3$

$t_w$ = Wall concrete thickness (m)
= overall thickness – 0.012

e = the eccentricity of the load (m)
= 0 for continuous floor slab
(adopt 0.05 $t_w$ as minimum)
= 0.166 $t_w$ for discontinuous floor slab

$e_a$ = additional eccentricity (m)
= $H^2_{we}/(2500\, t_w)$

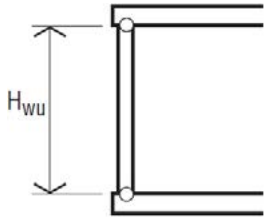
$H_{we}$ = the effective height of wall (m)
= 0.75 $H_{wu}$ where wall restrained against rotation top and bottom by floors
= 1.0 $H_{wu}$ where wall not rotationally restrained top and bottom

$H_{we}/t_w$ = 30 max. when $N^* > 0.03\, f'_c\, Ag$
= 50 max. when $N^* \leq 0.03\, f'_c\, Ag$

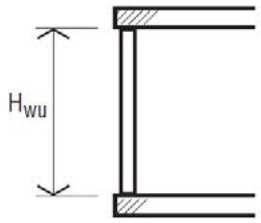
$H_{wu}$ = Unsupported height of wall (m)

$f'_c$ = Concrete compressive strength (MPa)

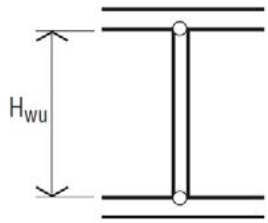
NOTE: Charts have been calculated for infill concrete strengths of 25 MPa and 32 MPa. Where other concrete strengths are used, the capacities will change proportionally.



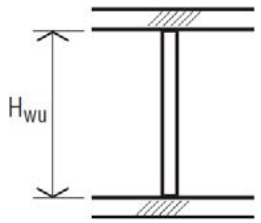
Floor Continuous
Wall Rotationally Restrained



Floor Continuous
Wall Rotationally Unrestrained



Floor Discontinuous
Wall Rotationally Restrained



Floor Discontinuous
Wall Rotationally Unrestrained

## Lateral Load Capacity

The capacity of a wall subjected to a lateral load (wind or earthquake) is given in the chart on the following page.

It has been calculated on the basis of a simply-supported beam spanning vertically between floor supports, with central reinforcement @ 400 mm centres and concrete strength 25 MPa, refer chart on following page. Capacities are given for N12 and N16 vertical reinforcement. Higher capacities can be achieved by increasing the size of the vertical reinforcement.

The capacity is given by the formula:

Design Capacity, $w = 8\phi M_u / L^2$ (kPa)

**where:**

$M_u = f_{sy}\, d\, A_{st} \left[ 1 - \dfrac{0.6\, A_{st}\, f_{sy}\, 10^{-6}}{f'_c\, b\, d} \right] 10^{-3}$ (kN.m/m)

$\phi$ = 0.8

L = Design span for bending (m)
= Height between floors

b = Design width (m)
= 1.0

d = Depth to tensile reinf orcement (m)
= $t_w/2$

$t_w$ = Wall concrete thickness (m)
= Overall wall thickness - 0.012

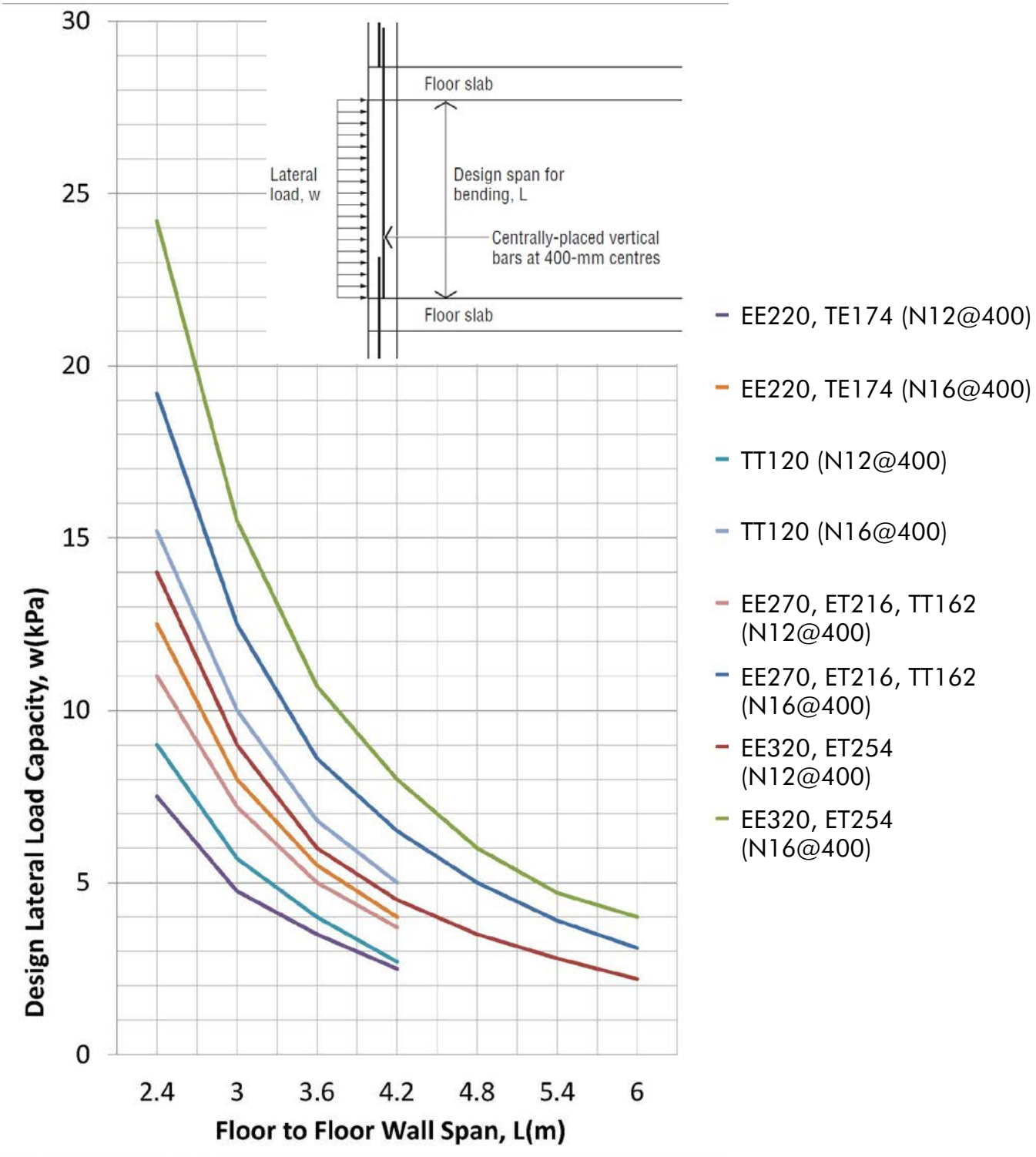
$A_{st}$ = Area of vertical reinforcement ($mm^2$)

$f'_c$ = Concrete compressive strength (MPa)

$f_{sy}$ = Yield strength of reinforcement (MPa)

# LATERAL LOAD CAPACITY

## Design Lateral Load Capacity
## Vertical Reinforcement






FORMCRAFT
Leading Sustainable Construction
Think FASTER | Think STRONGER | Think INSULATED | Think SMARTER | Think EFFICIENT
27 Amherst Street, Fremantle WA | 1800 FORMCRAFT | www.formcraft.com.au

## Racking Resitance

When a wall is subjected to racking forces, it can fail by either overturning of the wall or shear through the length of the wall. The wall capacity is therefore limited by the lesser value of overturning or shear.

**Wall Overturning**

The resistance to overturning of the wall is controlled by wall thickness and length, concrete strength and the amount and strength of tiedown reinforcement. In addition, weight of the wall as well as any other applied loads will help to resist overturning. The overturning is calculated in accordance with the assumptions contained in AS 3600 Clause 8.1.2.1 Combined bending and axial force. The following formula has been used:

$$V=\frac{\phi\left[(f_{sy}\,A_{st}\,10^{-3}+w\,L_w)d\left\{1-\frac{0.6(f_{sy}\,A_{st}\,10^{-3}+w\,L^w)}{t_w\,d\,f'_c\,10^3}\right\}-w\,L_w\left\{d-\frac{L_w}{2}\right\}\right]}{H_w}$$

**where:**

| | | | |
|---|---|---|---|
| $V$ | = Design overturning resistance | (kN) |
| $\phi$ | = Strength reduction factor for shear | |
| | = 0.7 (adopt shear value) | |
| $f_{sy}$ | = Yield strength of reinforcement | (MPa) |
| $f'_c$ | = Concrete compressive strength | (MPa) |
| $A_{st}$ | = Area of tiedown reinf. in tension | ($mm^2$) |
| | = Reinf. area over half wall length | |
| $w$ | = Total Vertical load on wall | (kN/m) |
| | = $w_s + w_{sw}$ | |
| $w_s$ | = Superimposed permanent load (PL) | (kN/m) |
| $w_{sw}$ | = Self-weight of wall (SW) | (kN/m) |
| $d$ | = Distance from the compression face (end of wall) to the centroid of tensile reinforcement | (m) |
| $H_w$ | = Wall height | (m) |
| $L_w$ | = Wall length | (m) |
| $t_w$ | = Concrete thickness | (m) |
| | = Overall wall thickness – 0.012 | |

The overturning capacities shown in the Racking Resistance chart have been calculated for the TE174 walls with concrete strength 25 MPa and tiedown rods N12@ 400 mm centres. Two sets of design curves are given covering two load cases. One set of curves is for a UPL of 0 kN/m and the second set is for a UPL of 100 kN/m. Where a UPL is between these values, the overturning capacity can be obtained by interpolation. Increases in wall size or concrete strength will only give marginally higher strength.

**Wall Shear**

The shear strength through the wall is controlled by wall thickness and length, concrete strength and amount and strength of reinforcement. The shear capacity is calculated in accordance with AS 3600 Clause 11.5.3. Strength in shear, as follows:

$$\mathbf{V_u = \phi(V_{uc} + V_{us})}$$

**When** $H_w/L_w < 1.3$

$$V_{uc} = \left[ 0.66 \sqrt{f'_c} - 0.21 \frac{H_w}{L_w} \sqrt{f'_c} \right] 0.8\, L_w\, t_w\, 10^3$$

**When** $1.3 \le H_w/L_w < 1.83$

$$V_{uc} = \left[ 0.05 \sqrt{f'_c} + \frac{0.1 \sqrt{f'_c}}{\left[ \frac{H_w}{L_w} - 1 \right]} \right] 0.8\, L_w\, t_w\, 10^3$$

**When** $H_w/L_w \ge 1.83$

$$V_{uc} = [0.17 \sqrt{f'_c}]0.8\, L_w\, t_w\, 10^3$$

$$V_{us} = \frac{A_s}{s} f_{sy}\, 0.8\, L_w\, 10^3$$

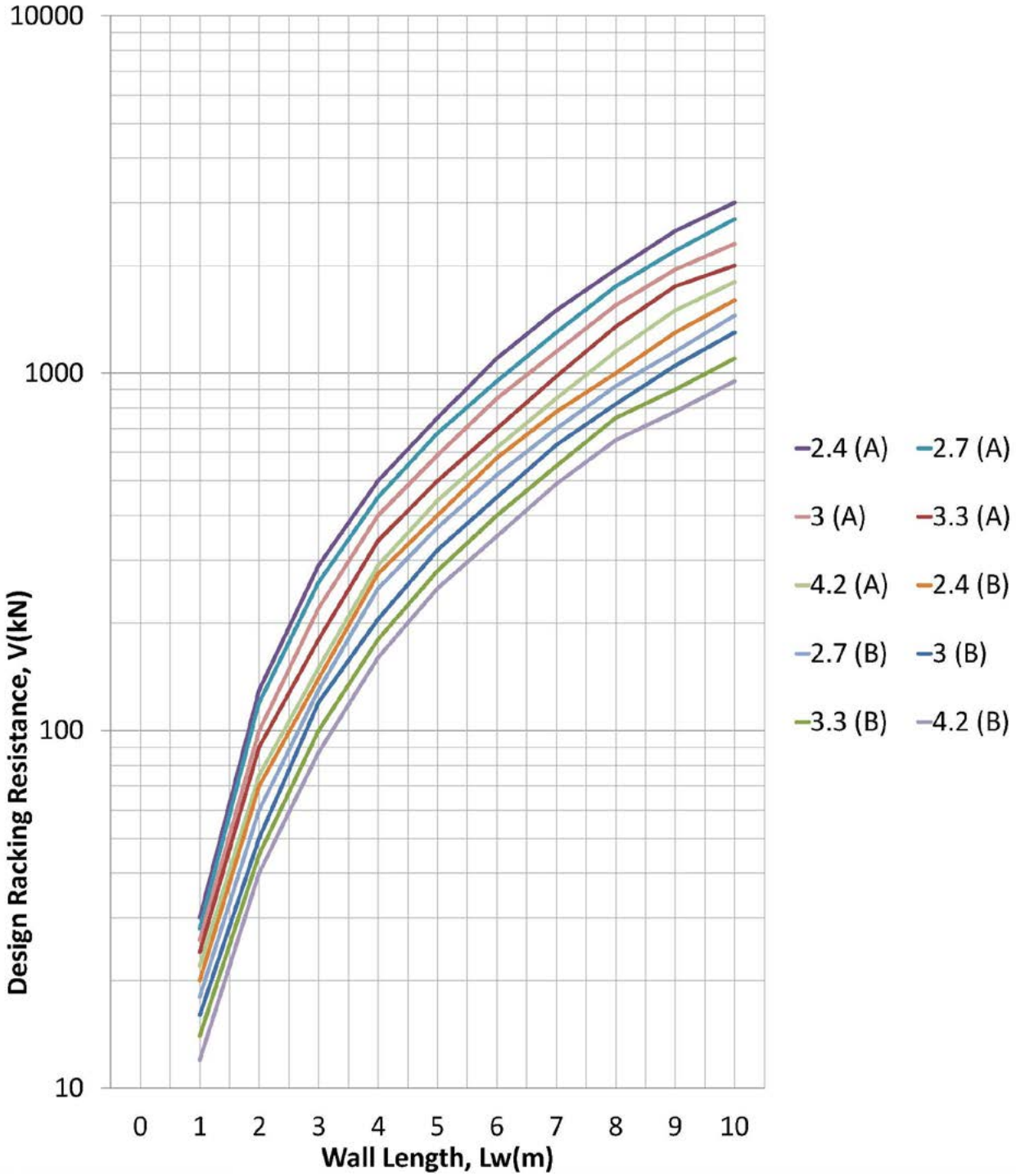
**where:**

| | | |
|---|---|---|
| $V_u$ | = Design strength in shear | (kN) |
| $V_{uc}$ | = Shear strength without reinf. | (kN) |
| $V_{us}$ | = Contribution to shear strength by reinforcement | (kN) |
| $\phi$ | = Strength reduction factor for shear | |
| | = 0.7 | |
| $f'_c$ | = Concrete compressive strength | (MPa) |
| $f_{sy}$ | = Yield strength of reinforcement | (MPa) |
| $A_s$ | = Area of vertical and horizontal reinforcing bars | ($mm^2$) |
| s | = Spacing of vertical and horizontal reinforcing bars | (mm) |
| $H_w$ | = Wall height | (m) |
| $L_w$ | = Wall length | (m) |
| $t_w$ | = Wall concrete thickness | (m) |
| | = Overall thickness – 0.012 | |

The shear capacity given in the following chart have been calculated for the TE174 wall with concrete strength 25 MPa and N12 bars @ 400 mm centres. Increases in wall size, concrete strength or einforcement will give proportionally higher shear strength.

**Racking Resistance**
The racking resistance given in the following chart is the lesser of the shear and overturning values. Except for long and heavily-loaded walls, the value of racking resistance is limited by overturning.

Wall Overturning use AS3600 clause 8.1.2.1 - Combined Bending and Axial Force
Wall Shear use AS3600 clause 11.5.3 - Strength in Shear



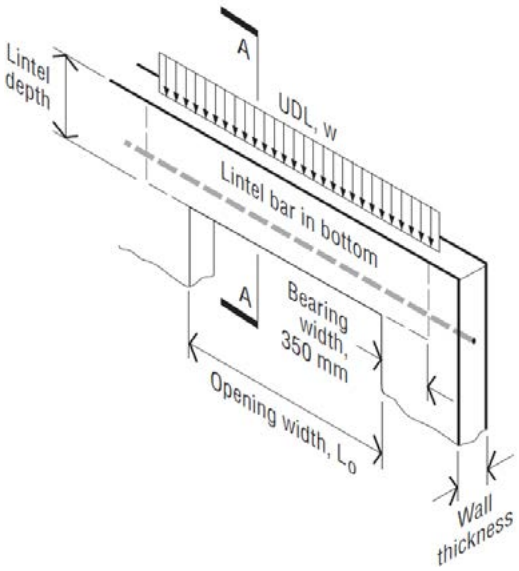
## Lintel Capacity

The design lintel capacity is the lesser of the strength in flexure or in shear. Deflection must also be checked to ensure that serviceability limits are not exceeded.

The design capacities given have been calculated on the basis of simply supported beams using concrete strength of 25 MPa and the details shown in the image below.

**Flexural Capacity**
The capacity in flexure is calculated for a simply-supported beam using the following formula:

Design Capacity, $w = 8 \phi M_u / L^2$ (kN/m)




**where:**

$$M_u = f_{sy}\, d\, A_{st} \left[ 1 - \frac{0.6\, A_{st}\, f_{sy}\, 10^{-6}}{f'_c\, b\, d} \right] 10^{-3} \quad \text{(kN.m)}$$

$\phi$ = 0.8

L = Design span for flexure (m)
= $L_o$ + 0.35

$L_o$ = Opening width (m)

b = Thickness (m)
= Overall wall thickness – 0.012

d = Depth to tensile reinf orcement (m)

$A_{st}$ = Area of tensile reinforcement ($mm^2$)

$$\geq 0.22\, b\, d \left[ \frac{d + 50}{d} \right]^2 \frac{f'_{ct}}{f_{sy}}$$

$f'_c$ = Concrete compressive strength (MPa)

$f'_{ct}$ = Concrete flexural tensile strength
= $0.6\sqrt{f'_c}$ (MPa)

$f_{sy}$ = Yield strength of reinforcement (MPa)

**Assumptions**

- Simply-supported beam
- Bearing width = 350mm
- Design span for flexure,
  L = Opening width + 0.35 (m)
- Design span for shear,
  L = Opening width - 2d (m)
- No vertical shear reinforcement


FORMCRAFT Leading Sustainable Construction
Think FASTER | Think STRONGER | Think INSULATED | Think SMARTER | Think EFFICIENT
27 Amherst Street, Fremantle WA | 1800 FORMCRAFT | www.formcraft.com.au

# NOTES

# NOTES

# PERFORMANCE

# PERFORMANCE & BCA COMPLIANCE

FastForm® and FormPro® walls have been evaluated for compliance with the following Australian Standards and BCA codes

## Australian Standards

- AS.3600 Concrete structures
- AS.1366 EPS
- AS.3610 Formwork for concrete
- AS.3700 Masonry structures

## BCA Requirements

- Volume 1 - Class 2 to 9 Buildings
- Volume 2 - Class 1 & Class 10 Buildings - Housing Provisions
- Part 1.1.1.2 Alpine Areas
- Part 3.1.3 Termite Risk Management
- Part 3.3.2 Reinforced Masonry
- Part 3.3.4 Weatherproofing of Masonry
- Part 3.6.2 Glazing Sizes & Installation
- Part 3.7 Fire Safety
- Part 3.8.1.5 Protection of walls in wet areas
- Part 3.8.6 Sound Insulation
- Part 3.10.1 Cyclonic Areas
- Part 3.10.1 High Wind Areas

## Tests Conducted on FC Material as per AS2908

| Test Description | Value |
|---|---|
| Water Absorption | 16.22% |
| Flexural Strength | 16Mp |
| Dimensional Stability – Thermal & Humid Aging | 0.52% |
| Density | 1613kg/$m^3$ |
| Dimensions | +- 2mm |
| Flame Test to AS1530.2 | Pass |
| Flame Test to AS1530.3 | |
| - Structural Adequacy | 219 minutes |
| - Integrity | 219 minutes |
| - Insulation | 149 minutes |

## Tests Conducted on EPS Material

| Test Description | Value |
|---|---|
| Water Absorption | 0.18% |
| Water Vapour Permeance | 94.0ng/Pa-s-$m^2$ |
| Compressive Strength | 165kPa |
| Flexural Strength | 365kPa |
| Dimensional Stability – Thermal & Humid Aging | 0.5% |
| Density | 27.5kg/$m^3$ |
| Dimensions | +- 3mm |
| Limiting Oxygen Index | 29.1% |
| Formaldehyde Emission | No formaldehyde detected |
| Fungi Resistance | No fungal growth detected |
| Flame Spread Rating | < 25 |
| Smoke Developed Rating | < 450 |

## Tests Conducted on PVC Web

| Test Description | Value |
|---|---|
| Flammability | Flame Front Distance = 100mm<br>Avg. Linear Burn Rate = 17.9mm/min |
| Average Lateral Fastener Resistance | 1.63kN |
| Average Withdrawal Fastener Resistance | 0.75kN |
| Shear Strength | 26.1MPa |
| Average Tensile Strength | 3.75kN |

## Fire Resistance Rating - BRANZ Fire Test FAR3116

| Wall type | FRR rating |
|---|---|
| EE220 model | 90/90/90 |
| EE270 model | 180/180/180 |
| EE320 model | 240/240/240 |

## Fire Assessment Report - BRANZ Fire Test FC11356-001

Assessment report on FastForm® and FormPro® walls to AS: 3600:2001. Walls were found to be compliant.

| Model | Wall Thickness | Concrete | External Material | FRL |
|---|---|---|---|---|
| EE220 | 220mm | 100mm | 60mm EPS/60mm EPS | 90/90/90 |
| EE270 | 270mm | 150mm | 60mm EPS/60mm EPS | 180/180/180 |
| EE320 | 320mm | 200mm | 60mm EPS/60mm EPS | 240/240/240 |
| TE174 | 174mm | 108mm | 6mm FC/60mm EPS | 90/90/90 |
| TE216 | 216mm | 150mm | 6mm FC/60mm EPS | 180/180/180 |
| TE254 | 254mm | 188mm | 6mm FC/60mm EPS | 240/240/240 |
| TT120-P/S | 120mm | 108mm | 6mm FC/6mm FC | 120/120/120 |
| TT150-S | 150mm | 138mm | 6mm FC/6mm FC | 120/120/120 |
| TT162-P/S | 162mm | 150mm | 6mm FC/6mm FC | 180/180/180 |
| TT262-S | 262mm | 250mm | 6mm FC/6mm FC | 240/240/240 |

## BRANZ Fire Test FI 3672 to ISO 9705

BCA 2006 Specification C1.10a Clause 3 and Specification A2.4 Clause 4

Plasterboard lined Formcraft wall system

**Result:**
Group 1 classification – Does not reach flash over during Test

## Determination of the Airborne Sound Insulation

VIPAC Technical report W-09-0084-TNT-840103-0

| **Wall Type** | **$R_w + C_{tr}$** |
|---|---|
| EE220 model | 56 |
| EE270 model | 59 |
| EE320 model | 62 |

## Determination of the Wall Impact Sound Rating

VIPAC Technical report W-09-0084-TNT-840103-0

| **Wall Type** | **$L_{n,w}$** |
|---|---|
| EE220 model | 48 |
| EE270 model | 51 |
| EE320 model | 54 |

## Field Sound Transmission Loss Performance

| **Wall Type** | **$D_{nT,w} + C_{tr}$** |
|---|---|
| TE216 | 47 |

## Thermal Performance Calculations (R-Value)

**General assumptions:**

- Thermal conductivity for Concrete at density 2850 Kg/m3 = 1.44 W/mK
- Thermal Conductivity for EPS at density of 26 Kg/m3 and 23°C = 0.0376 W/mK
- Thermal conductivity of Plasterboard = 0.173 W/mK
- 3.4m/s wind and surface emittance = 0.9

**Non-Concrete R-value contribution - (thickness (m)/k)**

| | | |
|---|---|---|
| Outside air | | = 0.044 |
| 60mm EPS | = 0.060 / 0.0376 | = 1.596 |
| 6mm Fibre Cement | = 0.006 / 0.173 | = 0.034 |
| 10mm Plasterboard | = 0.010 / 0.173 | = 0.057 |
| Inside air | | = 0.12 |
| EE Wall Non-Concrete Contribution (Total) | | = 3.413 |
| TE Wall Non-Concrete Contribution (Total) | | = 1.863 |
| TT Wall Non-Concrete Contribution (Total) | | = 0.260 |

**Concrete R-value contribution - (thickness (m)/k)**

| | | |
|---|---|---|
| EE220 (100mm conc.) | = 0.100 / 1.44 | = 0.144 |
| EE270 (150mm conc.) | = 0.150 / 1.44 | = 0.216 |
| EE320 (200mm conc.) | = 0.200 / 1.44 | = 0.288 |
| TE174 (108mm conc.) | = 0.108 / 1.44 | = 0.078 |
| TE216(150mm conc.) | = 0.150 / 1.44 | = 0.094 |
| TE254(188mm conc.) | = 0.188 / 1.44 | = 0.111 |
| TT120 (108mm conc.) | = 0.108 / 1.44 | = 0.059 |
| TT162 (150mm conc.) | = 0.150/ 1.44 | = 0.085 |

## Thermal Performance Values

| Product Line | Wall Model | Total Wall Thickness | Concrete Thickness | Concrete R–value | Total R-Value |
|---|---|---|---|---|---|
| FormPro® | EE220 | 220mm | 100mm | 0.144 | 3.557 |
| FormPro® | EE270 | 270mm | 150mm | 0.216 | 3.629 |
| FormPro® | EE320 | 320mm | 200mm | 0.288 | 3.701 |
| FormPro® | TE174 | 174mm | 108mm | 0.078 | 1.941 |
| FormPro® | TE216 | 216mm | 150mm | 0.096 | 1.959 |
| FormPro® | TE254 | 254mm | 188mm | 0.113 | 1.976 |
| FastForm® | TT120 | 120mm | 108mm | 0.086 | 0.342 |
| FastForm® | TT162 | 162mm | 150mm | 0.104 | 0.360 |

# NOTES

# FAQ

# FREQUENTLY ASKED QUESTIONS

## What is the Formcraft Construction System?

The Formcraft construction system is a permanent concrete forming system that can be used for load bearing concrete walls and suspended slabs for above or below ground applications.

## What can I build with FastForm® and FormPro®?

FastForm® FormPro® is a permanent formwork for walls. Typical applications are residential buildings, commercial buildings, factories, warehouses, shopping centres, basement walls, party walls and retaining walls.

## Does FastForm® and FormPro® comply with the requirements of the BCA?

Yes. The system complies with all structural engineering, fire rating, acoustic and energy efficiency requirements and has been tested by NATA accredited laboratories.

## What are the standard module dimensions ?

FastForm® and FormPro® forms are available in a variety of wall thicknesses and configurations. Please refer to product selection guide.

## Why would I use FastForm® of FormPro® rather than other walling systems?

- The best walling system for below ground conditions.
- Lighter (10 kg/m2), no cranage required, ideal for constructions with access difficulties.
- Easier and faster to install even by non-skilled labour.
- Incorporates insulation and ability to easily chase for service reticulation and for easy plasterboard screw fixing.
- Can be used as deep beams and footings to eliminate costly transfer structures.

## How can I maximise the benefits of FormPro®?

FormPro® is a modular system and its benefits can be maximised by dimensioning wall lengths and heights to suit FormPro® modules, which will achieve significant cost savings. See FormPro® Design Guide.

## Is FastForm® and FormPro® safer to build with than other wall systems?

FastForm® FormPro® System Safety Benefits

- Lighter- Minimise risk of back injury.
- Quicker- Reduce the time exposed to an activity or risk.
- No stripping of formwork- Eliminates a high risk activity.
- No sharp edges- Reduce risk of cuts.
- Installed by hand and rechargeable power tools- Eliminates the risk of electrocution by using 240V leads.

## Is FastForm® and FormPro® faster to build with than other wall systems ?

Yes. Significantly, due to the following:

- 5 kg for each 1200 x 600mm FormPro® module, lightweight, easier and faster to handle.
- Reduces the number of trades normally required.
- Eliminates the need for masonry trades.
- Service trades can easily chase into EPS panel with hot knife
- FastForm® and FormPro® eliminates need for floor slab edge boards.
- FastForm® and FormPro® is not affected by wet weather conditions.
- Significantly reduces the time possibly lost at construction sites due to accidents, access and cranage related issues.
- All of the above benefits equate to fewer workers and amenities on site, which means less time and lower cost.

## How do I brace the FastForm® and FormPro® walls?

The base of the forms are restrained by C channel which also establish the location of the walls. We recommend using a proprietary Formcraft bracing system which are screw fixed into the embedded face plates at min 1200mm centers. See FastForm® and FormPro® Construction Manuals

## What is the concrete mix used?

The minimum 20 MPa for normal grade concrete with compressive strength at 28 days is recommended with 120mm slump and 10mm aggregate sizes. Higher MPa concrete is sometimes specified for high strength applications.

# FREQUENTLY ASKED QUESTIONS

## What kind of concrete pump should be used?

The use of boom pump with a reduction to a 50mm hose is especially recommended.

## How are electrical and plumbing services installed into FormPro® walls?

FormPro® usually has a 60mm internal EPS panel and service chase can be easily and neatly cut into the EPS with a hotknife which can accommodate electrical, hydraulic and communication needs.

## How are windows installed into FormPro® walls?

Any type of window system can be installed into the proprietary subframe. The subframe is used to exclude concrete from the openings and provides a waterproofing fin within the opening to prevent wind driven water penetration to the interior of the building.

## What are the advantages of the system in multi-level construction?

- The formwork system doubles as the insulating element of the walls.
- The only difference is that all or some exterior, party and corridor walls are employed as load bearing elements. Internal partition walls of sole occupancy units are the only lightweight walls.
- Formcraft walls can be employed as deep beams thus resulting in substantially cheaper transfer slabs than in conventional frame systems.
- Formcraft walls support slabs rather than being supported by slabs, thus resulting in lower cost floor slabs.
- The walls and slabs are all made from the same material, i.e. concrete. This homogeneity achieves similar behaviour of both slabs and walls.
- Formcraft walls constructed with concrete slabs require one trade only.

## Does Formcraft provide technical assistance?

Yes. Comprehensive technical backup is available for architects, engineers, and construction workers. Please see Support.

- This Design Manual has been prepared to assist Architects & Engineers designing with the FastForm® wall system. Although every care has been taken in developing this manual, it is the responsibility of the user to ensure that its use is appropriate and exercise their own judgement in applying the information.
- The engineering of the structure of any building using FastForm® walls should only be undertaken by suitably qualified and experienced engineers/consultants. The full responsibility for the engineering and structural design, Certification of Compliance with all relevant Australian Standards, BCA and any other statutory requirements at Local, State and Federal levels rest with the project engineer/project consultants.
- Similarly, provisions and detail for installation of, including but not limited to; services; waterproofing; glazing; flashing; fixings or other, are to the builder's specification and/or relative project consultant. Formcraft has provided generic detail throughout this manual for illustrative purposes only. Formcraft does not warrant the adequacy of this detail or accept liability for any loss incurred should the user adopt these details without review or consultation with a appropriate industry consultant.
- Please check with Formcraft that you have the latest version as the manual may be updated from time to time and certain details may change.
- Formcraft reserves the right to change specifications without notice.
- Design Manual is a guide only. The project Engineer must be consulted for all final requirements.

**Copyright**

© 2005-2020 Formcraft Pty Ltd. No part of this publication may be reproduced in any form or by any means without prior written permission from Formcraft Pty Ltd. All right reserved.

# FORMCRAFT

*Leading Sustainable Construction*

Think FASTER | Think STRONGER | Think INSULATED

© 2005-2020 Formcraft Pty Ltd.