

# Benefits of Light Steel Framing in Rapid Dry Envelope

In multi-storey framed construction, it is now common practice to use light steel infill walls to create a Rapid Dry Envelope to support the external cladding, and to act as separating or compartment walls between different parts of the building. The use of light steel infill walls may be applied to any type of framed construction in steel or concrete. Light weight, speed and ease of installation are important constructional benefits.

## SPEED OF INSTALLATION

Rapid installation of the light steel infill walls creates a weather-tight envelope allowing other activities within the building to proceed much earlier than would be possible with blockwork infills. Fewer materials and less labour time on site are required, and the process is 'dry' so that shrinkage and other drying-out problems are eliminated. Time savings of over two weeks per floor are readily achievable.

## LIGHT STEEL PRE-FABRICATED OR C SECTION ASSEMBLIES

Light steel framing consists of either pre-fabricated wall panels, or assemblies of site installed C sections that are designed to span vertically between the floors. As external walls, they are designed to resist wind loading on the façades, and to support lightweight cladding materials. Masonry is supported directly by the primary structure or foundations.

## ACOUSTIC PERFORMANCE AND FIRE RESISTANCE

As external walls, or as internal separating or compartment walls, the light steel framing components promote good acoustic insulation and fire resistance properties. This is easily achieved by using two or more layers of fire-resistant plasterboard, or in some cases by using double layer infill walls between dwellings, or individual occupancies.

## LIGHT WEIGHT

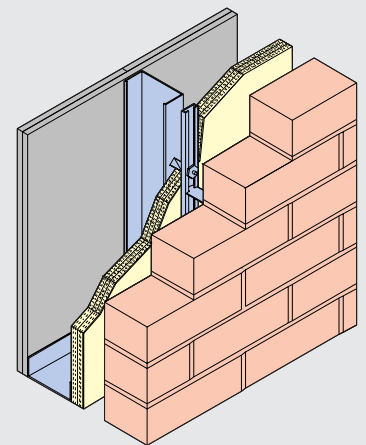
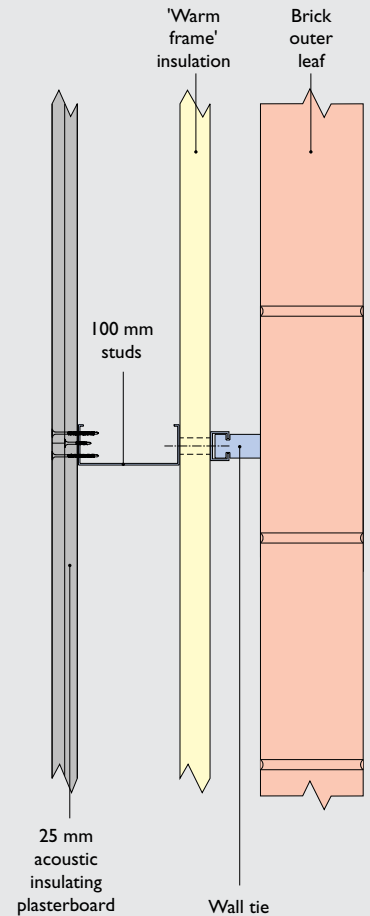
Light steel infill walls are much thinner than conventional blockwork and do not apply heavy line loads to the floor. This is often crucial in refurbishment applications where the quality of the original floor construction is not sufficient to resist heavy loads.

## DESIGN VERSATILITY

In PFI hospitals and other similar applications, light steel infill walls have important benefits by being relocatable as demand for space changes during the life of the building. Tall, thin walls can be designed with good performance characteristics. For example, in cinemas and theatres, walls up to 7 m high can be designed. The same technology is used for both external and internal walls.

## THERMAL INSULATION

A high level of thermal insulation is provided by a variety of foam insulation boards that attach externally to the studs to create a 'warm frame'. The external insulation can provide temporary weather protection, and allows for rapid fit-out and early servicing.



Value-Benefits of Light Steel Frames as Infill Walls	Applications
Lightweight walls do not overload the existing structure	Roof-top extensions
Internal fit-out can progress rapidly	Apartments
Internal walls can be relocated	Hospitals
Light steel does not contribute to fire load	Offices
Light steel is robust to impact and damage	Education
Thinner walls can be constructed	Refurbishment
Light steel walls possess excellent acoustic insulation	Cinemas

# Technical Aspects

## WIND LOADS

Light steel external walls resist wind loading of up to 1.5 kN/m<sup>2</sup>. These pressures may occur in tall buildings, or at corners due to local wind pressure.

Typically 100 mm C section studs are used at 400 mm centres, which can span 3 to 4 m between floors. In regions of high wind pressure, or for taller walls, 150 mm C studs may be used.



## ACOUSTIC INSULATION

Light steel infill walls can achieve excellent acoustic insulation of 65 dB+ when using double layers of plasterboard and insulating quilt between the studs. In cinemas, tall separating walls often use light steel framing in double skins for optimum acoustic insulation.



## FIRE RESISTANCE

Fire resistance periods of up to 120 minutes can be achieved using multiple layers of fire resistant plasterboard.

The same board material may be used as fire protection to steel beams and columns.



## THERMAL INSULATION

External insulation creates a warm frame. U-values of less than 0.4 W/m<sup>2</sup>°C can be achieved by single layers of insulation, and 0.2 W/m<sup>2</sup>°C can be achieved by two layers of insulation. It is also possible to place insulation between the studs, depending on the building's use, but the majority of the insulation should be external in order to avoid 'cold bridging'. Brick or blockwork is attached through vertical runners screw fixed to the studs.



## CLADDING SUPPORTS

Light steel external walls support lightweight cladding by fixing directly through the insulation. Masonry cladding should be supported by the primary frame for buildings of over 4 storeys high. It is tied back to the frame using vertical channels in which the wall ties are located. Masonry may be ground-supported for walls up to 12 m high.



## SCI PUBLICATIONS

### BUILDING DESIGN USING COLD FORMED STEEL SECTIONS:

Acoustic Insulation (P128)

Fire Protection (P129)

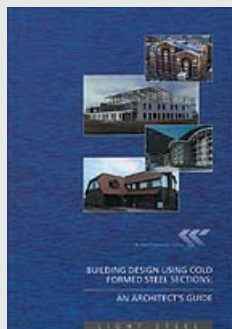
Construction Detailing and Practice (P165)

Over-cladding of Existing Buildings using Light Steel (P247)

Case Studies on Light Steel Framing (P176)

Durability of Light Steel Framing in Residential Buildings (P262)

An Architect's Guide (P130)



## SOURCES OF INFORMATION AND SUPPLIERS

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# Recent Applications using Rapid Dry Envelope

A Rapid Dry Envelope can be created using light steel infill walls, which are fast to install, lightweight, and achieve early enclosure of the building so that internal fit-out can start without delay. The cladding can be attached later as it is off the 'critical path' of the construction operation.

The same technology may be applied to both new-build and renovation. Light steel infill walls are insulated and dry-lined, and are weatherproof during construction.

The same details may also be applied to internal separating walls, especially between apartments or occupancies, where a high degree of acoustic insulation is required. The following projects illustrate the principle and benefits of a Rapid Dry Envelope using light steel framing.

Light steel framing has the following attributes for use as infill walls:

## SUSTAINABLE CONSTRUCTION

- ✓ Energy efficiency
- ✓ Efficient materials use
- ✓ Minimises waste
- ✓ Ability to be recycled
- ✓ Future adaptability
- ✓ Long life product
- ✓ Minimum disruption

## RE-THINKING CONSTRUCTION

- ✓ Reduced costs
- ✓ Reduced time on site
- ✓ Increased productivity
- ✓ Certainty of budget and time
- ✓ Reduced wastage
- ✓ Safer construction
- ✓ Higher quality



Infill walls used in Cumberland Hospital.

## Cumberland Hospital

This large PFI-funded hospital in Carlisle used Knauf infill walling because of the value-benefits that it offered to the Carlisle Hospitals NHS Trusts as client. The 33,000 m<sup>2</sup> project consists of four separate but linked buildings and was opened in July 2000.

The primary structure is a steel framework and a composite floor slab using steel decking.



The client wished to have flexibility of internal planning and 'dry' construction, which the light steel infill wall construction offered.

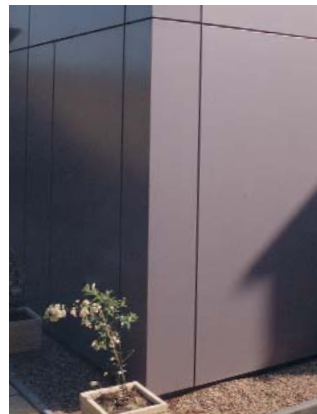
The design was complicated by the need for large window openings, which would have made the use of block and brickwork extremely difficult. The internal partitions were also designed by Knauf as part of their contract with Amec.

## Multiplex Cinema Projects

Modern multiplex cinemas often use light steel external walls and internal separating walls to provide early enclosure for following trades and also to achieve excellent acoustic insulation.

The 5 to 6 m tall walls use 150 mm to 200 mm deep C section studs vertically between the floors without additional support. Sound reductions of over 70 dB are achieved in cinemas by use of double skin walls and insulating quilt between them.

The same technology is applied to both external and internal walls.



## Management College, Leamington Spa

The Ashorne Hill Management College used the Terrapin Matrex system, and light steel infill walls manufactured as pre-fabricated panels by Corus Framing.

The external cladding uses a storey-high steel cassette system which is fixed through the external insulation to the light steel infill walls.



Acoustic insulation between the wall studs.



## Colchester Hospital

Metsec's SFS system was used on the external infill walls to a 4-storey composite frame at Colchester Hospital. The infill walls had many window openings and supported the brick cladding through thick insulation, which would not have been achievable in blockwork. The creation of a rapid dry envelope enabled fit-out to proceed without delay.



Infill walls used in Colchester Hospital.



Penthouse apartments at White House, Waterloo.

## Penthouse Roof-top Extension

Twenty-four penthouse apartments have been added to the former Shell Downstream building at Waterloo, London by a roof-top extension in light steel framing. In a joint project between Fairview New Homes, Frogmore Estates and Galliard Homes, light steel internal partitioning was also used in the refurbishment of the existing concrete framed building.

Metsec Framing was awarded the £1.8 million contract to design, manufacture and install the superstructure of the two storey roof-top extension. The main benefit was the light weight of the construction, which avoided over-loading the original roof. The external walls consisted of 100 mm C sections, external insulation, and stone cladding tied to the wall studs.



Skyline Plaza, London.

## Skyline Plaza, London

A redundant 11-storey concrete framed building, constructed in 1962, has been converted into 130 luxury apartments using light steel infill and separating walls. Contractor St George chose light steel framing for both the external and internal walls because of its speed of installation and light weight.

Further factors influencing the choice were the need to design the façade to achieve a U-value of 0.35 W/m<sup>2</sup>C, and a sound reduction of 55 dB from the noisy traffic in the adjacent Commercial Road, East London. These criteria were met by the construction details provided by Ayrshire Framing and Lafarge.





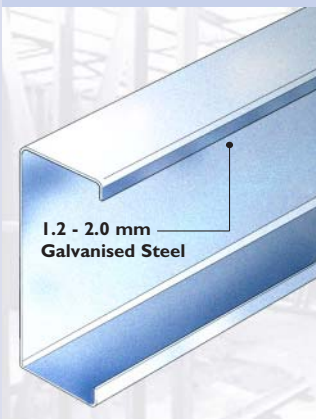
# Construction Notes



Light steel framing used in infill walls consists of 70 mm to 150 mm deep C sections that are cold rolled from galvanized steel strip of 1.2 to 2 mm thickness. The galvanizing (zinc layer) provides excellent durability.

Wall panels can be pre-fabricated as storey-high units or, more often, are site assembled from components. The second approach is often the only solution in renovation applications where tolerances in the original construction have to be accommodated.

COLD ROLLED  
C SECTION



The infill walls consist of a bottom 'track' attached to the floor and a top 'track' attached to the underside of the floor above. The top track allows for sliding of the vertical studs and height adjustment.

This movement is essential in concrete frames, where 1 or 2 mm shortening of the concrete structure per floor can occur over time.

The vertical studs are designed to span 3 to 4.5 m between floors, and to resist transverse wind or other loads in bending.

One or two layers of 'fire-resistant' plasterboard to the internal face provide for up to 60 minutes fire resistance.

