

Technical Information Sheet ED012

Light Steel Framed Housing

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Housing and residential building is an important market for light steel framing and modular construction. These technologies are appropriate because of the speed of construction, improved quality and the high level of sustainability that is achieved through off-site manufacture.

Key benefits

The benefits of light steel framing and modular construction in housing are:

- Speed of construction (up to 30% faster than traditional methods of house construction)
- Excellent performance characteristics e.g. acoustic and thermal insulation.
- High level of quality control, accuracy and freedom from shrinkage reducing call-back for defects.
- Light weight for use on poor ground, with reduced foundation requirements.
- Minimum disturbance to the locality during construction due to reduced number of deliveries.
- Waste recycling in manufacture and reduction of on-site waste.
- Compliance with Code for Sustainable Homes.
- Room in the roof systems can be constructed without difficulty.
- Can easily be extended and modified internally in the future.

Applications in housing

Light steel framing is widely used in housing, particularly in urban projects or where there is an economic benefit for speed of construction. The off-site nature of the manufacturing process also improves quality and minimises waste, which is important when satisfying the Code for Sustainable Homes. Light weight is an important requirement to minimise the loads on the foundations.

The various design issues related to compliance with the Building Regulations, including structural design, acoustic and thermal insulation, are presented in the SCI publications: *Building Design using Cold Formed Steel: Residential Buildings* (P301).

This technical information sheet reviews the basic principles of design using light steel framing in the following housing types:

- Private and social housing
- Housing associated with mixed use developments
- Key worker accommodation
- Care homes and sheltered housing
- Extensions to existing houses e.g. creation of habitable roof space.



Town houses at Accordia, Cambridge
(Image courtesy of Metek UK and
Alison Brooks Associates)



Code Level 5 houses at Bicester, Oxon
(Image courtesy of Fusion Building Systems)



Two storey light steel housing
(Image courtesy of Kingspan Profiles & Sections)

Light Steel Framing

In housing, light steel framing generally comprises pre-fabricated wall panels, floor joists and roof trusses. Three storey town houses often require design of an 'open' roofing system in light steel framing.

Form of construction

Light steel framing comprises galvanized C sections in the wall panels, and either deeper C sections or lattice joists in the floors. Spans of up to 6 m can be achieved, which can eliminate internal load-bearing walls and therefore lead to flexibility in internal space planning.



Figure 1 Three storey housing in Basingstoke
(Image courtesy of Ayrshire Framing)

The pre-fabricated wall panels are typically storey-high (i.e. 2.4 to 2.7 m) and up to 4 m long, depending on transportation and lifting. A house can be constructed from as little as 12 wall panels, and the panels for up to four houses can be delivered on one lorry.

The floors can be installed in the form of floor cassettes of up to 3 m width, or as individual joists. An example of light steel framed housing is illustrated in Figure 2.

Application

Private and social housing up to four storeys, especially town houses or houses built on a podium level in mixed use applications.

Technical details

Light steel framed housing is manufactured from a series of panels, including the floor cassettes. The walls transfer vertical loads and provide stability to the building. The light steel walls typically use 70 to 100 mm deep C sections in steel thicknesses of 1.2 to 1.6 mm.



Figure 2 Light steel framing in housing
(Image courtesy of BW Industries)

The wall panels can be built with integral K or X-bracing to provide stability and with integral lintels for openings up to 3 m wide. Wall capacities of up to 50 kN/m are readily achieved.

The floor joists are typically 150 or 250 mm deep, also in steel thicknesses of 1.2 to 1.6 mm. Generally, they are supported by a Z section that is placed over the wall panel, see Figure 3. Alternatively, factory-fabricated floor cassettes can be bolted directly to the wall studs, see Figure 4. The floor depth is in the range of 200 to 300 mm.

Strip steel used in the cold rolling process is supplied in grades of S280 to S450 (i.e. 280 to 450 N/mm² yield strength), and is galvanized (zinc coated) to give a high level of protection and a design life in excess of 200 years (see SCI P262 for further details).

Habitable roof space can be created using light steel framing either by purlins spanning between cross-walls or by 'open' roof trusses. Housing with an open roof system using lattice purlins is shown in Figure 5.



Figure 3 Floor joists supported on Z section placed over the wall panel
(Image courtesy of BW Industries)

Technical Solutions

Cladding

Various forms of cladding may be used, such as brickwork, rainscreen cladding, insulated render and board materials. Lightweight cladding often requires the use of a sheathing board, which adds to the shear resistance of the walls.

Acoustic performance

Separating floors and walls, achieve excellent airborne and impact sound reductions. Airborne sound reductions of over 52 dB (with low frequency correction factor), are achieved, which are up 5 to 10 dB better than in Part E of the current Building Regulations. Impact sound transmissions are also low (< 30 dB). A concrete screed can be introduced, although this adds to the floor weight.

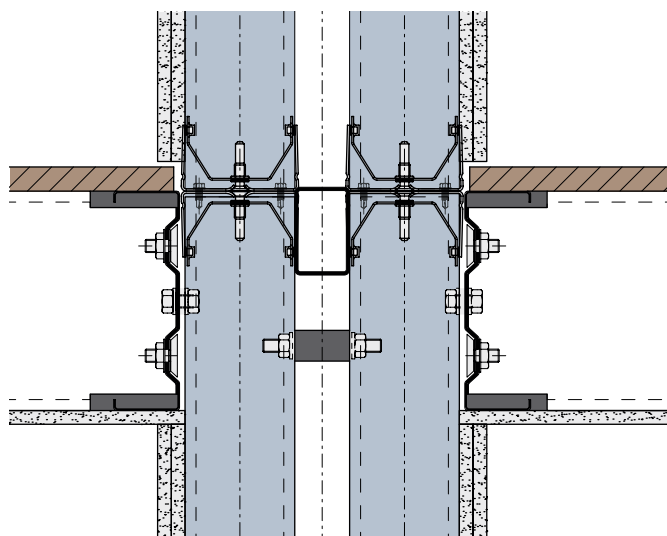


Figure 4 Light steel separating wall between houses with floor cassettes bolted to the studs

Thermal insulation

Thermal insulation is characterised by the heat loss per unit area of façade (i.e. U value). Low U values of less than 0.2 W/m²°C can be achieved by placing insulation boards of 70 to 100 mm thickness outside the light steel structure supplemented by mineral wool between the C sections, as shown in Figure 6. Excellent air-tightness can be achieved by external sheathing boards or by internal continuous membranes, where practical.

Services

Openings can be formed for services at regular positions within floor joists, as shown in Figure 7.



Figure 5 Light steel framing with open roof trusses in town housing
(Image courtesy of Metek Building Systems)

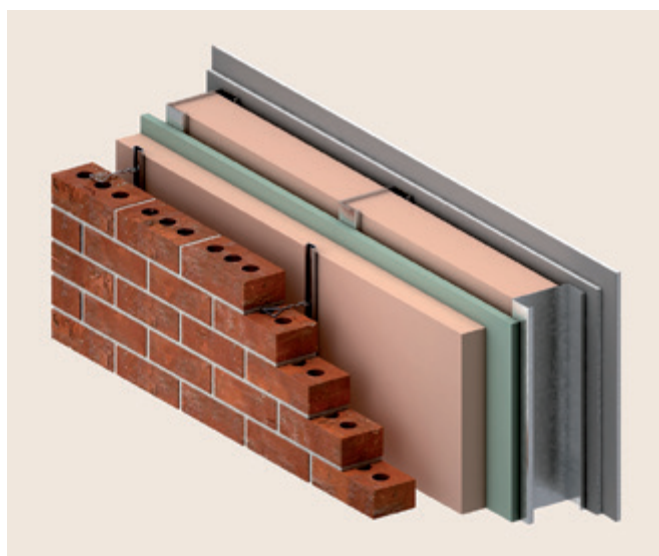


Figure 6 Brick cladding attached to light steel walls
(Image courtesy of BW Industries)



Figure 7 Openings for services in floor joists
(Image courtesy of Fusion Building Systems)

Sources of Information

Other technical information sheets

The following technical information sheets provide further guidance about light steel construction.

- ED010: Light Steel Solutions for All Applications
- ED011: Light Steel Residential Buildings
- ED013: Light Steel Infill Walls
- ED014: Light Steel Modular construction
- ED015: Acoustic Performance of Light Steel Construction
- ED016: Fire Safety of Light Steel Construction

Manufacturers

The following manufacturers are active in the light steel and modular construction sector and may be contacted for further information.

Ayrshire Metal Products Ltd - www.ayrshire.co.uk

BW Industries Ltd - www.bw-industries.co.uk

Fusion Building Systems - www.fusionbuild.com

Kingspan Profiles & Sections - www.kingspanprofiles.com

Metek UK Ltd - www.metek.co.uk



Figure 8 Light steel housing in Cambridge used in the BRE Smart-Life assessment project
(Image courtesy of Fusion Building Systems)

Bibliography

The following publications may be referred to for more information on light steel framing and modular construction.

Building design using cold formed steel sections: Residential buildings (P301)

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The Steel Construction Institute, 2003

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IHS BRE Press, 2008

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