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.
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.

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.

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.
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.

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.
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

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)
Gorgolewski M T, Grubb P J and Lawson R M
The Steel Construction Institute, 2001

Acoustic detailing for steel construction (P372)
Way A G J and Couchman G H
The Steel Construction Institute, 2008

Insulated render systems used with light steel framing (P343)
Wright C et al
The Steel Construction Institute, 2006

Energy efficient housing using light steel framing (P367)
Lawson R M and Francis K
The Steel Construction Institute, 2007

Building Design using Modules (P348)
Lawson R M
The Steel Construction Institute, 2007

Case studies on steel in residential buildings (P328)
The Steel Construction Institute, 2003

SmartLIFE - Lessons Learned (BRE Report BR500)
Cartwright P et al
IHS BRE Press, 2008

Sustainability of steel in housing and residential buildings (P370)
Lawson R M
The Steel Construction Institute, 2007

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