3 SIPS
TECHNICAL BULLETIN

STRUCTURAL
TIMBER ASSOCIATION
Building solutions in timber

Acoustics

This Technical Bulletin is intended to provide the reader with introductory information on using structural insulated panels for construction.

Structural insulated panels (SIPs) are prefabricated, high performance, lightweight, building panels that can be used in floors, walls and roofs for residential and commercial buildings. A SIP consists of two high density facings, typically Orientated Strand Board (OSB) which are bonded on both sides of a low density, cellular foam core.

The panels are typically made by sandwiching a core of rigid foam plastic insulation which is bonded to the two structural skins. A strong, structural bond between the three layers is essential to the load bearing ability of the SIP so that high loads can be transmitted by the relatively light units reducing the use of internal studding. SIP walls can bear considerable vertical and horizontal loads with reduced internal studding.

The load carried by the SIP is transferred to ground by the OSB skins, held in position by the fully bonded insulation core.

In the UK structural insulated panels are available with a number of different insulation cores; expanded polystyrene (EPS), extruded polystyrene (XPS), polyisocyanate (PIR) and polyurethane (PUR). In all cases the skins are typically OSB although there is increasing research into other forms of load bearing materials.

SIPs are manufactured under closely controlled factory conditions and can be custom designed for each application. The result is a building system that is extremely strong, energy efficient and cost effective. Strict quality control procedures are implemented in the manufacture of SIPs to ensure quality and consistency of panels. In terms of strength and resistance to fire there is little difference between the different core materials - both forms of manufacture will comply with the Building Regulations.

In all cases it is the insulation core that provides excellent thermal properties due to the limited amount of timber studs required. Equally air permeability due to the large format nature of the supplied panels is much lower than traditional construction due to the small number of joints in the structure.

There are two fundamental applications for SIPs; full structural and infill for a concrete, steel or engineered timber frame. In all cases the product will be engineered for load bearing capability, racking resistance and wind loading in accordance with the test results obtained by STA members.

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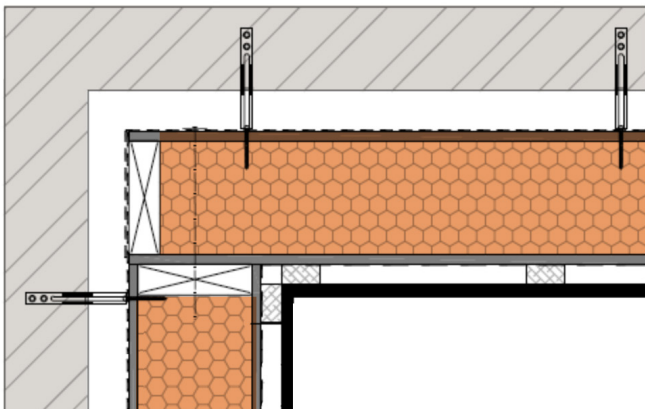

Walls

External walls

There are no specific requirements for the sound insulation performance of external walls within National Building Regulations. Normally the acoustic performance of an external wall is only considered when a significant external noise source is present, e.g. a building is being constructed near a busy road, rail line or airport.

If this is the case, the ultimate performance of the external facade would be dictated by the level of prevailing ambient noise. In the majority of cases, the window units and any trickle ventilators will be the dominant source of noise ingress into a building.

A SIP, much like timber studwork, relies on the mass and continuity of plasterboard linings to provide the majority of the sound insulation performance. If the sound insulation performance of the wall needs to be improved, the use of acoustic rated plasterboard in multiple layers is normal. An acoustic consultant would need to be involved to determine specification and performance requirements.

Internal walls

Building Regulations specify airborne sound insulation performance targets for internal walls. These targets vary depending on which area of the UK the site is located in. The airborne sound insulation targets are expressed as Airborne Sound Reduction (Rw) and is based on laboratory test data. These walls are not subject to pre-completion sound insulation testing on site.

Intermediate walls in SIP buildings are normally formed using timber studwork and lined with plasterboard. Plasterboard manufacturer's test data should be consulted for wall specifications and performance, although regulation requirements are normally achievable with one layer of plasterboard (15 mm) to either side of timber studs with mineral wool insulation between.

Party walls

Building Regulations vary across the UK, but they all specify an airborne sound insulation performance target for separating/party/compartment walls. The targets are expressed as Standardised Weighted Level Difference (DnT,w) and depending on local regulations may or may not include a correction for low frequency performance (DnT,w + Ctr). These are pre-completion testing performance criteria and subject to on site testing. As with internal walls, party walls in SIP buildings are normally formed using timber studwork and lined with layers of plasterboard.

Typically these walls would consist of two independent 90mm deep studwork frames separated by a 50mm wide cavity. Acoustic insulation is installed between the studs, and then the wall is lined on each room face with two layers of plasterboard. The timber studwork frames may or may not be sheathed for structural reasons.

These types of wall, although lightweight in their nature, are actually capable of outperforming many masonry party walls. Onsite testing has shown that these types of wall generally achieve airborne sound insulation test results some 10 dB better than Building Regulations minimum standards.

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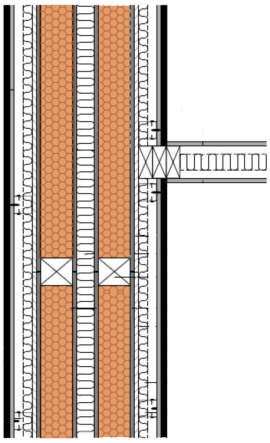

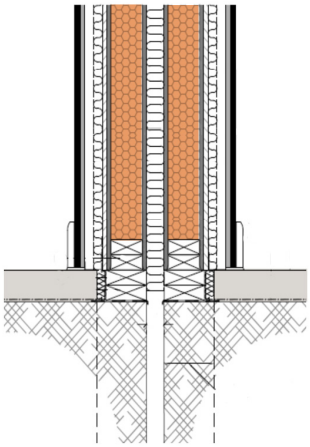

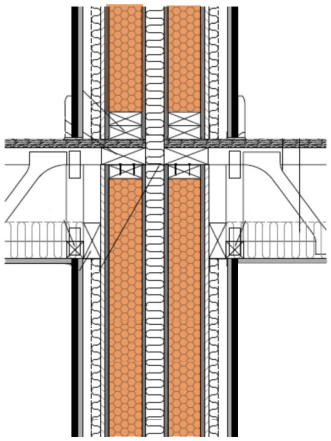

Currently, generic SIP structures are not covered for use with Robust Details timber studwork party walls, and as such on site pre-completion sound insulation testing would need to be carried out to verify the performance. Product manufacturers may have specific approval for their systems.

Alternatively, SIPs can be used to form the two leafs of the party wall. These types of wall have not been subject to exhausting testing, as with timber studwork walls, and so onsite testing would be required to verify performance.

A typical specification would be two independent SIP wall leafs separated by a cavity, usually 50mm. The SIP walls would then be lined on each room face with two or more layers of plasterboard fixed onto timber battens to form a service void.

Floors

Intermediate floors

Building Regulations specify airborne sound insulation performance targets for intermediate floors. These targets vary depending on which area of the UK the site is located in. The airborne sound insulation targets are expressed as Airborne Sound Reduction (Rw) and is based on laboratory test data. These floors are not subject to pre-completion sound insulation testing on site.

Intermediate floors in SIP buildings would normally be of timber joist construction and are typically identical in makeup to the floors used in timber framed or masonry buildings. A normal specification would be solid or engineered timber floor joists overlaid with a 22mm chipboard deck, 100mm mineral wool between joists and a ceiling of one layer of 15mm plasterboard. Plasterboard manufacturer's test data should be consulted for floor specifications and performance.

Party floors

Building Regulations vary across the UK, but they all specify an airborne sound insulation and impact sound transmission performance target for separating/party/compartment floors.

The airborne sound insulation targets are expressed as Standardised Weighted Level Difference (DnT,w) and depending on local regulations may or may not include a correction for low frequency performance (DnT,w + Ctr). These are pre-completion testing performance criteria and subject to on site testing.

The impact sound transmission performance targets are expressed as Standardised Weighted Impact Sound Pressure Level (LnT,w). These are pre-completion testing performance criteria and subject to on site testing.

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Party floors are generally of timber joist construction, although pre-cast concrete floor systems can be used. Timber joisted floors would usually consist of solid or engineered timber floor joists overlaid with a structural floor deck and an acoustic floating floor system. A number of acoustic floating floor options exist, but the most common system uses timber and foam resilient battens overlaid with 19 mm plasterboard plank and 22 mm chipboard. Ceilings are normally formed by the use of two or more layers of plasterboard fixed to the underside of the floor joists with the use of acoustic resilient bars.

These types of floor, although lightweight in their nature, normally perform at least as well as masonry party floors. On-site testing has shown that these types of floor generally achieve airborne and impact sound insulation test results some 5 to 10 dB better than Building Regulations minimum standards.

Concrete floor systems would usually consist of hollow core pre-cast concrete planks, overlaid with a resilient layer and screed, with a plasterboard ceiling supported on a metal framing system.

Roof

There are no specific requirements for the sound insulation performance of roofs within National Building Regulations. Normally the acoustic performance of a roof is only considered when a significant external noise source is present, e.g. a building is being constructed near a busy road, rail line or airport, or rain noise may be an issue.

As with most lightweight building systems, the use of multiple layers of plasterboard can help to reduce noise transmission to the rooms below. An acoustic consultant would need to be involved to determine specification andperformance requirements.

Definitions and explanations

Rw
Is a laboratory measurement of Airborne Sound Reduction.

DnT,w
Is a site measurement of Standardised Weighted Level Difference (airborne sound insulation performance). This figure cannot be directly compared to Rw values. Typically an Rw is 5 to10dB higher than the performance of a product/system when tested on site (DnT,w)

LnT,w
Is a site measurement of Standardised Weighted Sound Transmission (impact sound insulation performance).

Ctr
Is a low frequency correction factor that may be applied to the DnT,w performance measured on site.