BEGINNER'S GUIDE TO Structural Insulated Panels

SIPs have become a popular option with selfbuilders because of the many benefits they offer.

WHAT ARE SIPS?

Structural insulated panels (SIPs) are a pre-engineered building system. They form a strong, lightweight structure which is fast to erect, thanks to the large components, and offers extremely good thermal performance. The panels consist of two parallel faces – usually oriented strand board (OSB) – sandwiching a rigid core of polyurethane, polyisocyanurate, or polystyrene foam. Other variations of facing materials and cores exist, but these are the most common in the UK.

OSB is manufactured in wide mats from cross-oriented layers of thin, rectangular wooden strips compressed and bonded together with wax and resin adhesives. All of the mainstream UK suppliers use OSB/3, which complies with the British Standard for structural integrity. The resulting panels are lightweight, quick to erect and free from problems of compression, shrinkage and cold bridging.

The nature of the stressed skin panel makes it exceptionally strong, and high levels of insulation can be achieved in thinner wall thicknesses than other forms of construction. SIPs can provide a fast way of building very efficient walls which require no additional frame or skeleton to support them.

Captions captions



HOW ARE THEY USED?

SIPs can be used as the inner skin of a cavity wall, as a selfsupporting single skin structural wall in place of timber frame or blocks, and as a pre-insulated roofing structure, and may be used in floors, walls and roofs for residential, industrial and commercial applications, creating ecologically friendly and energy-efficient buildings. They are suitable for new builds and home extensions, and are commonly used for garden buildings and garages, as well as making ideal infill panels for other structures, such as oak, steel or concrete frames.

Due to the unique way that structural insulated panels work they are perfectly suited for roof construction for new builds, extensions and replacement roofs. They arrive precut, with insulation already fitted, and span from wall to ridge beam – usually without any further support. This means that the roof space can be left completely open to be used as further accommodation, storage or as a vaulted ceiling.

SIPs are very flexible and can be used with any external cladding, including brick, render, weatherboarding or aluminium. They can also be roofed with slates, tiles or metal coverings. Internally the panels can be finished with plasterboard and a









skim coating (with service cavities where needed) so that wet trades, together with build times, are kept to a minimum.

THE PROCESS

Architects and designers are increasingly aware of SIPs and should be able to modify designs to suit the system. Ideally, choose a CAD designer who has relevant experience of working with SIPs and understands the structural implications of a panel system, or use a package company which can provide a design and SIPs-build service.

The panels are custom designed for each project and cut to order, including door and window openings. They can also include service ducting, which makes wiring extremely easy but does mean that the electrical layout will need to be planned at an early stage. Alternatively services may be run through internal partition walls, with wiring



passing through the cavity between the panel and internal plasterboard, or through a double layer of plasterboard.

Once the designs have been used by the manufacturer to produce the required panels these will then be erected on site – often by the same company. A few SIPs companies offer a full-build package, while others rely on the selfbuilder or project manager to take responsibility for the foundations and fitting out stages. SIPs must be protected from the elements, and should not be stored in direct contact with the ground.

Most foundations are suitable, but the slab should be accurate and level within the acceptable tolerance. On-site access should be available for a suitable crane or telescopic handler if required. Panels are placed over a sole plate and joined together by either timber or OSB splines located in pre-formed rebates within the core. A top plate is then fitted and joints are glued and nailed. Care should be taken to seal the joints properly, following the manufacturer's recommendations.

THE BENEFITS

As a method of construction SIPs offer high levels of insulation, structural strength and air tightness, with thinner wall sections. They also increase the available roof space, thanks to their truss-free construction, enabling rooms to be created in the roof. This can provide an additional 25 per cent of floor space at no additional cost.

By combining the stages of conventional timber frame construction – framing, sheathing and insulation – into a single unit, a structure can be erected much faster and with less specialised labour. This can mean lower labour and loan expenses and quicker occupancy. A crew of two with no special equipment can easily install smaller panels, while larger panels can be quickly erected with the use of a crane.

Structural insulated panels are relatively lightweight at approximately 18 to 25kg/sqm, so the foundation specification may be reduced. Being fabricated off-site in a factory they can be delivered pre-cut and pre-insulated, and the shell of a typical house can be erected within a matter of days. They are not dependent on good site conditions and the quick speed of erection can have significant savings on skip hire and scaffolding costs. Their size also makes them less likely to be stolen from site than more conventional building materials – a problem which has sadly become a relatively common occurrence.

The OSB creates a continuous surface onto which radiators, kitchen cabinets and light fittings may be easily fixed with little or no additional support, and the OSB and insulation core are resistant to attack by mould and microbes and provide no food value to vermin. Because there is no service cavity the walls have a very solid sound when struck, and the jointing techniques used in SIPs buildings mean that the sound transmittance through the joints is reduced, which helps to reduce sound transfer between rooms.

COSTS

SIPs are generally viewed as costing slightly more than standard timber frame construction, because the insulation is already installed in SIPs panels. When comparing like-for-like a SIPs build will usually cost about one per cent more than a traditional build, but increased build speed, reduced waste, less manpower and a reduction in site machinery help to offset this extra expense, and the energy saving benefits should also be taken into account.

ENERGY EFFICIENCY

UKSIPS and the Structural Timber Association (formerly the UKTFA) have joined forces, and their website structural timber.co.uk offers technical information about SIPs, as well as links to suppliers and erectors.

Structural insulated panels come into their own when it comes to complying with Part L of the Building Regulations. U-values range between 0.27w/m²k and 0.1w/m²k for a panel thickness of between 100mm and 250mm.

Any heating system is suitable for a SIPs house, but may need to be downsized due to the air-tightness and efficiency of the building. The panels are also ideally suited for more innovative and energy efficient systems such as air source heat pumps, and the airtight nature of SIPs construction means that mechanical ventilation is strongly recommended

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FAQs

John Langley, director of SIPs specialist JML Contracts, answers some frequently asked questions

Why SIPs?

SIPs are at the forefront of a radical change in building design and technology. This high-performance building system has unique insulating properties, allowing them to be airtight and draft free, which in turn will dramatically reduce heating bills and increase living spaces. This makes them an excellent choice for passive or close to passive builds.

SIPs offer better thermal efficiencies than standard timber frame kits and are becoming more popular in challenging build locations. They are far quicker to erect than traditional building methods and the pre-cut, fabricated panels greatly reduce installation time.

SIPs are also very suited to complicated buildings that require a lot of additional structure/steelwork. The panels themselves, as well as offering low U-values, have inherent structural strength which allows the saving of expensive steelwork and other additional structural costs that other forms of construction would need.

How does this system compare financially against other timber frame alternatives? Building in SIPs gives you exceptional thermal performance and U-values and in turn dramatically reduces your heating and energy bills. To build two identical houses side by side, one SIP and one timber frame, the actual build costs would be the same. However, once built, the performance of the SIP home would be substantially better than it's equivalent

and the running costs would be considerably less.

How does SIPs compare structurally to timber frame?

Once completed, SIP structures form a shell up to seven times stronger than conventional timber frame constructions. Their structures also increase habitable roof space as, unlike timber frame kits, they do not require roof trusses. This means that builds which are perhaps one and a half storeys in height will benefit hugely as clients will achieve considerably higher ceiling height.

If I am considering using SIPs, when should I speak to my SIPs supplier?

The earlier the better really. If you are considering SIPs, ideally you need to speak to your SIPs supplier as soon as you can. A lot of SIPs suppliers will have their own in-house architect who will have experience and specialise in SIPs building techniques. However, if you already have planning permission on existing drawings, it's still possible to build in SIPs.





CASE STUDY ARN costs of a Scottish farmhouse.

SIPs have helped to lower the heating



n 80-year old farmhouse in rural Perthshire, may not convey images of well-insulated, cosy living. However, for building contractors John and Katie Langley, doubling the size of their home using structural insulated panels has meant they have more than enough room for their three sons, and no complaints of the house being cold - even with the unpredictable Scottish weather.

COSY

The two-storey extension took the house from 180sqm to 360sqm to include a large kitchen/diner, a downstairs lavatory and cloakroom, laundry room, boot room - essential for country living with three sons - two double bedrooms and ensuite, and a master bedroom and dressing room.

Originally John and Katie thought about doing it in stages but with the cost of putting down the foundations, they felt that they might as well do the whole lot at once.

The extension took a year to build from start to finish and partly thanks to the SIPs construction, has created spaces



KITCHEN

Handmade Kitchens Direct produced this to Katie's design The mantle and island were painted by Carte Blanche to create a distressed look.

BACK HALL Katie's joiner

produced the tongue and groove panelling and installed limestone floor tiles to create a traditional look.

FIREPLACE

John built the fire surround with stone from Katie's parents' old house.

BEDROOMS

The master and boys bedrooms are in the new extension to take advantage of the warmth. BATHROOM

The main

bathroom has lots of storage.









CONTACTS

Builders, including supply and erection of SIPs JML Contracts Ltd: jmlcontracts.co.uk Kitchen cabinetry and oak worktops Handmade Kitchens:handmadekitchens-direct.co.uk Aga Range Cooker Centre: rangecookercentre.co.uk Paint effects on Aga hood and distressed finish on island Decorate Scotland: decoratescotland.blogspot.co.uk Electrician Halley Electrics: halleyelectrics.co.uk Oak flooring British Hardwoods: britishhardwoods.co.uk Flagstones Stonell: stonell.com Paint Paintandpaperlibrary: paintandpaperlibrary.com Curtains and fabrics Mulberry: mulberry.com Carpets The Mill Shop: themillshopnewtyle.co.uk Bathroom wall and floor tiles Mandarin Stone: mandarinstone.co.uk / Bathroom sanitary ware Bathstore bathstore.com. The Bathroom Company: thebathroomcompany.co.uk

that are so much warmer than the rest of the house. The family notices such a difference that they don't use the older part of the farmhouse as much now, as the temperature change is considerable. All the family bedrooms are in the new extension with the spare rooms relegated to the original part of the house!

Despite underfloor heating being installed throughout the downstairs part of the extension it has never been turned on. The heating bills have shrunk dramatically and with an Aga heating much of the kitchen-diner, windows are often opened to let the heat out The added benefits that their SIPs extension has brought to family life are huge. Not just from a warmth and space perspective, but also the flexibility the extension has allowed them. "I love the fact I my boot room and cloakroom are all at the back door so the kids can dump their kit there and avoid dragging it all through the house or coming into the kitchen to drop it all!," says Katie.

"The luxury of the extra space downstairs and spare rooms for guests has been brilliant. It has meant we now throw a lot more parties!"