

SIPs for faster construction

Building systems that include higher levels of prefabrication and off-site manufacture are potential solutions to New Zealand's urgent housing need. Current research will give a better overall understanding of the performance of SIPs in New Zealand.

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QUALITY HOUSING that can be built quickly and affordably is in high demand in Aotearoa New Zealand.

Structural insulated panels (SIPs) can be prefabricated and assembled quickly on site for walls, roofs and floors. They are sandwich panels made of two face layers and an insulating inner core manufactured in a factory that can be joined together either off site or on site to increase construction speed and reduce overall building cost.

Because they are made in a factory, the production can be more easily controlled, resulting in greater consistency, quality and performance for these systems.

Different SIP types

The face and core layers of SIPs can be made of different materials. Timber, metal and cement-based boards are commonly used ➤



Timber-based SIP walls during building construction.

as face layers. Typical core materials are polymer foams, such as expanded polystyrene, polyurethane or polyisocyanurate, although other materials can also be used.

Polystyrene blocks are joined to face layers using an adhesive, whereas polyurethane and polyisocyanurate are injected between the face layers as a liquid and self-adhere as they expand in place between the panels. SIPs can be made to different thicknesses and lengths depending on insulation and structural requirements.

Benefits of different SIP types

Different SIP systems have different advantages and disadvantages depending on the construction project and its requirements. A potential drawback of SIPs is the embodied carbon associated with the use of polymer-based foams as a core component. Examples exist overseas of SIPs and similar panellised systems that use alternative core materials (for example, bio-based materials), but these do not seem to be widely used in New Zealand.

The manufacturing of steel-skinned SIPs is well established in New Zealand because of their long history of use in commercial cold store applications. Steel-skinned SIPs are also used for residential construction, where benefits have been cited as availability, cost and a simple construction process. Steel-skinned SIPs can provide a weathertight system without the need for additional external or internal linings, although internal moisture and acoustic performance must be managed.

SIPs with timber-based panel face layers are the most common type of SIP used in residential construction overseas. Oriented strand board (OSB) or similar engineered wood panels are a common timber-based face layer for SIPs. In New Zealand, timber-based SIPs offer familiarity with our traditional building materials and methods as well as being easy to assemble and modify.

In recent years, magnesium oxide (MgO) boards have gained popularity as sheeting materials in the construction industry, including as face layers in SIPs. MgO boards are usually made from an MgO cement along with lightweight filler materials and reinforcing glass fibre mesh.

One benefit of MgO boards is their fire resistance, which, combined with their low density, has made them desirable for lightweight, off-site manufactured construction systems. Currently, there is no standardised way of producing MgO boards, which means there is potential variability in the performance of the different boards that are available for use in New Zealand.

Prefabrication options

SIPs can be made to custom sizes and shapes to meet the needs of each construction project. Once the SIP face layers and core are joined together, they are typically stacked ready for transportation to site.

In SIPs used as walls, window and door openings are prepared during the manufacturing process so that the SIPs arrive on site ready to assemble and without the need to be modified. Depending on the technical details

of each SIP system, manufacturers may also add connections and enclose exposed edges before the panels are finalised.

SIPs are one of many types of prefabricated building systems being used more frequently in New Zealand to help provide more high-quality housing quickly. SIPs can be assembled into larger sections off site - for example, wall sections or 3D modules - which make for even quicker on-site assembly and less crane time.

Timber-based SIPs can also be integrated easily with light timber-frame construction and other types of timber construction to develop hybrid systems for optimal efficiency across a range of building applications.

BRANZ research activity

BRANZ research on SIPs aims to understand how SIPs perform in New Zealand's climate and during earthquake and fire events. The initial focus of our research has been on SIPs with timber panel face layers, and we have tested systems with different timber-based panels and different core materials.

The project is funded by the Building Research Levy and EQC and will give the New Zealand building industry a better overall understanding of the performance of SIPs. A sound knowledge of SIPs in a New Zealand context will support the development of a simplified consenting process for buildings constructed with SIPs. ◀

For more ▶ For further information about the project and to watch progress videos from the project team, visit the BRANZ website at www.branz.co.nz/materials-research/sips/.