



Stakeholder guide to structural insulated panels (SIPs)

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Foreword

The purpose of this paper is to provide the reader with sufficient information to better understand the use of timber in construction from a risk management perspective.

Structural timber construction is the most popular method of building in the developed world. It's currently used in over a quarter of all new houses in the UK and is becoming increasingly widespread in the commercial sector too. Its versatility and flexibility is seeing structural timber increasingly used in educational facilities, retail units of all sizes, healthcare and office blocks - in fact, any project where speed, economy without compromise and a lower carbon footprint are desirable.

There are two markets in the sector and it is important to appreciate that not one structural timber system is used in one type of application:

- Low and medium rise buildings
- High rise and complex buildings

There are also two distinct structural timber technologies, both of which have a significant contribution to carbon reduction and the drive to Net Zero 2050:

- Mass timber systems (the focus of this guidance)
- Lightweight timber systems

This guide focusses on Structural Insulated Panels (SIPs), a panelised building system that has been commonplace in the UK since the turn of the century.

The issue of climate change and the risks brought about the lack of clarity around combustible/durable materials (specifically structural timber) in construction are addressed herein.

For context, the guide addresses SIPs used as structural load-bearing elements and not timber cladding or timber building appendages, such as balconies.

It is vital when considering the risk associated with all construction materials that the design and product type has been fully considered and is suitable for its intended use. STA provide numerous guidance documents for structural timber construction to help clients and constructors alike to make those right decisions.

I very much hope the content of this report provides clarity as to why the construction industry stakeholder community can rely on structural timber systems, in particular SIPs, as a safe building method.

ANDREW CARPENTER

CEO Structural Timber Association





1) Defining structural insulated panels

Structural insulated panels (SIPs) are engineered, load-carrying, timber-based panel products that can be used in walls and roofs of residential and light commercial buildings. These lightweight panels combine the structural and thermal envelope of the building; they are manufactured off-site in a factory and shipped to the construction site, offering many advantages to the build programme. This panelised form of construction allows SIPs to be assembled to form highly airtight, energy-efficient building envelopes.

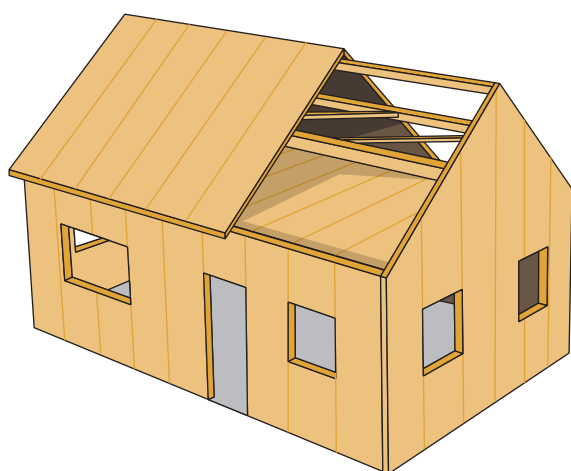


Fig 1: SIP wall and roof panels (illustrative purposes only)

Overall, it's a faster, more cost-effective and considerably more sustainable build method. As the environmental challenges of 21st century building become apparent, more and more builders, self-builders, architects and developers in all sectors are turning to the unique advantages of SIPs based structural timber.



Generally, SIPs are made by sandwiching a core of rigid foam insulation between two structural skins, though many different variations are included in the blanket definition. Typically, SIPs are commonly made using oriented strand board (OSB) as a facing material, with the most common insulating core materials being expanded polystyrene (EPS) or polyurethane foam (PUR).

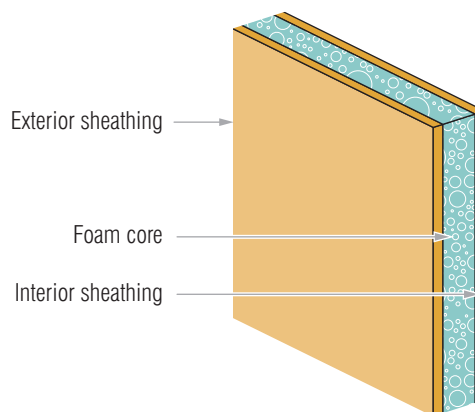


Fig 2: SIP panel composition

During production, EPS is fully-bonded with structural adhesive to the OSB skins, where PIR is mainly foamed between the OSB skins, which create the bond.

The core materials are responsible for providing thermal insulation, counteracting shear and transverse forces, and resisting moisture penetration. The insulating core also reduces the overall panel weight.



2) Risks and mitigation

As with any construction material, good design, manufacture and assemble are key. In many cases the suitability of application of any building material can be gained from the confirmation of a BBA certificate; SIPs are no exception. As a factory fabricated construction product, it is straightforward to apply good manufacturing management controls such as those in ISO 9001-2015. However, to be assured of the quality of the final assembly it is critical that competency, from design/engineering through to installation, is qualified in some way.

In recognition of this requirement and in line with the requirements of the Building Standards Review ^(R1) following from the Dame Judith Hackitt review of Grenfell Tower, the Structural Timber Association ^(R2) implemented its own competency scheme, which is mandated for all members to comply with.

Competency

STA Assure has been developed to provide evidence of excellence in the structural timber industry; from design, to manufacture and installation. The scheme, which includes an independent audit, recognises the accreditations and standards held by our individual member companies. The robust assessment process ensures that design and production processes and quality controls are in line with customer's expectations for consistent, high levels of quality.



The member appraisal also includes a Site Safe audit, validating CDM compliance and Health & Safety Executive requirements for the protection and registration of timber structures during construction.

This scheme has received formal recognition from many of the industry's leading structural warranty and building control bodies: LABC Warranty, Premier Guarantee, Protek Warranty, Build-Zone Warranty, Self-Build Zone Warranty and ABC+ Warranty - as well as the Health and Safety Executive, the National Fire Chief Council (NFCC) and CIREG.

STA Site Safe

This programme specifically requires all members to follow a prescriptive process of registering sites under construction with the local fire chief and to comply with the requirements to mitigate fire risks during construction. ^(R3)

Whether designers, manufacturers or structural timber erectors, STA members are supported through education and training to ensure they continue to deliver a highly-skilled, quality service to their clients.

Training schemes are developed to validate the existing skills and competencies of experienced structural timber professionals, whilst raising the skill levels of young entrants to the industry. STA's commitment to education and training is acknowledged and applauded by industry stakeholders and clients alike.

Structural timber training schemes and initiatives include:

- Erector competency scheme
- Erector workbooks - Skills, Practical and Health & Safety
- Design workbooks - Skills, Practical and Health & Safety
- Manufacturer workbooks - Skills, Practical and Health & Safety
- Timber frame apprenticeships
- Factory tours
- Events and seminars.

STA Assure is just one (but very important reason) to choose to work with an STA member, regardless of the size and scale of the finished project, but the benefits go much further:

- STA members adhere to the highest standards of technical excellence
- Homes and buildings are manufactured in a factory environment to strict auditable quality standards
- STA members have access to the latest in education, skills training and technical support
- They adopt good environmental principles, with products from well-managed sustainable sources.





3) SIPs longevity

Once known as a novel building material SIPs is now recognised as mainstream, and whilst it is difficult to establish precisely how many homes have been constructed using SIPs, its use is increasing across all housing types.



Following the 2003 announcement by the Department of the Deputy Prime Minister to both incentivise modern methods of construction in the Affordable Housing sectors and drive better energy efficiency, the SIPs industry in the UK began to form. This included the formation of the UK SIPS Association (now part of the Structural Timber Association) to bring together the SIPs industry, to both maintain the highest possible quality standards and to embark of a comprehensive testing programme for structural integrity and fire resilience.

The UK was late to the SIPs market, which was led by the North American market dating back to the fifties. There are 15 members of STA operating in the SIPs market. With a collectively declared turnover in excess of £50m, projects range from large education contracts to homes in the self-build market and affordable markets.

Many of those members have BBA certification for their systems which qualifies longevity as an expected life of 60 years minimum.

An example of text relating to longevity taken from Innovare BBA Cert 08/S040 and Kingspan TEK 02/S029. Note that Certified SIPs have been available in the UK since 2000.

Durability

Provided the installation remains watertight, the SIPs will have a 60-year minimum service life provided they are protected from damage by the external and internal finishes.

A snapshot of STA members' activity in the SIPs market (not all STA members manufacturing and supplying SIPs responded to this request) suggests in the last 10 years, a conservative estimate as to the numbers of building types are:

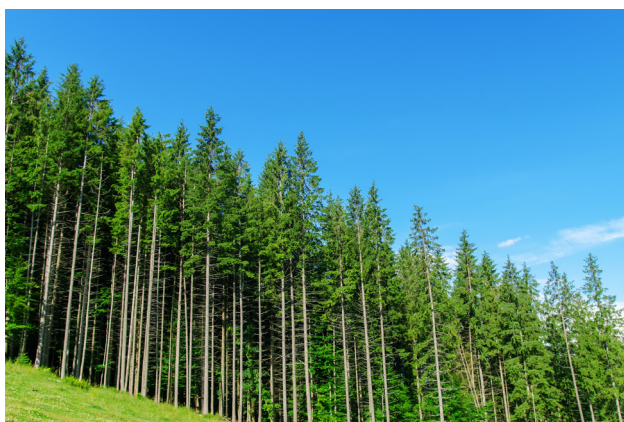
- Homes - more than 8000 completed, from affordable housing schemes of multiple units to single private dwellings
- Schools - over 3400 complete schools or additional classrooms
- Hotels - over 60 of various sizes
- Other - home office garden rooms are a growing sector.



4) SIPs and the built environment

Timber, as part of the circular economy, is the safest and most effective carbon store.

Currently, the construction industry represents around 10% of total UK carbon emissions and directly contributes to a further 47%. As a result, the industry finds itself in a position of great responsibility and influence with regards to the nation's climate change efforts.



As trees grow, they naturally absorb carbon, which continues to be stored when the material is transformed into structural timber products. Timber absorbs and stores more carbon than it emits during processing and installation. Engineered timber solutions act as an effective carbon store when used as part of a building. When the building has reached the end of its use, this stored carbon can either be re-used as fuel or will naturally filter back into the soil. By comparison, the use of concrete and steel within construction leads to considerably more energy and carbon usage.

More information can be found at www.timefortimber.org

To this end, a report published by Chatham House (Making Concrete Change: June 2018) shows that cement is the source of 4-8% of total global carbon dioxide emissions. Conversely, more carbon dioxide is absorbed and stored within timber products than is emitted during its harvesting process, manufacturing and transportation combined.

When used instead of other building materials, a single cubic metre of timber will save around 0.8 tonnes of carbon dioxide emissions. With such strong green credentials, it's clear to see why so many organisations are embracing timber. Not only does the material provide strength and aesthetic beauty, but offers an effective solution in battling climate change.

Recognising this, the French government recently announced new sustainability legislation to help make the country carbon-neutral by 2050. The new law, which becomes enforceable in 2022, will mandate that all new public buildings in France are built from at least 50% timber, or other natural materials.

SIPs are recognised as a construction product that reduces the energy consumption of buildings in use. SIPs have been commonplace in the development and construction of homes to PassiveHaus standards since before 2004.

This is accomplished due to the intrinsic nature of each panel being fully insulated, unlike a typical traditional build where heat loss from non-insulated elements of the structure is common. Furthermore, factory manufacturer panels are close tolerance and high quality to reduce the amount of heat loss through air leakage at poor-fitting junctions.



5) References

(R1) Structural Timber and the Building Safety Review 2020

Extracted from the Building Safety Review, the following statement makes clear the need for the construction supply chain to be able to demonstrate competency. STA Assure is at the heart of the delivery of quality structural timber systems.

Clause 6: Facilitating improvement in competence of industry and building inspectors

Effect

160 Clause 6 states that the Building Safety Regulator must provide assistance and encouragement to persons in the built environment industry and to registered building inspectors to facilitate improvement of competence of organisations and individuals in the industry, or members of the profession.

Background

161 This is a new provision. The independent review recognised competence as an area where improvement was needed across the built environment sector.

Example 1: Functions in relation to industry competence

Under this duty the Building Safety Regulator may undertake activities such as setting the strategic direction of the competence committee (see Clause 10) to increase competence within the built environment industry, carrying out research and analysis, convening working groups, developing a communications strategy and other activities which support this duty. For example, the Building Safety Regulator may use the insights it gains into the competence levels within the built environment industry to focus the Committee's activities on areas where additional work is most needed and can have the most impact.

The Building Safety Regulator can also develop and implement a communications plan with the industry competence committee to encourage industry's use of the competence frameworks and to highlight the legal requirements regarding competence.

The Building Safety Regulator may work with the competence committee to share its insights from reviewing Gateway two applications containing evidence of the competence of the Principal Contractor and Principal Designer, to improve the guidance to industry.

(R2) Structural Timber Association – an introduction

Representing over 800 members across the structural timber industry and associated supply chain, the Structural Timber Association (STA) has an objective to enhance quality, drive product innovation through technical guidance and research together with growing the market for structural engineered timber systems.



The membership consists of full manufacturing members for timber frame, structural insulated panels and cross-laminated timber technologies, designers, installer/erectors, supply chain (suppliers into the structural timber industry) and associate members consisting of academics and governing bodies.

Many of these bodies are contributing to the ongoing programme 'raising the bar' in structural timber quality and competency.

The market for structural timber is defined into two distinct risk profiles, SIPs is predominantly used in first:

1. Low and medium rise buildings
2. High rise and complex buildings.



5) References continued.../

(R3) Site Safe policy

The award-winning Site Safe policy applies to all structural timber building system members, including manufacturers, fabricators, contractors and installers who work with principal contractors. Members are audited to ensure they are achieving the functional requirements of the Site Safe policy for sites under construction. Both the policy and the audit process have been developed over many years to support members; by following the policy they can engage with customers and assure the best project outcomes.

Included in this Site Safe activity is a commitment to follow the STA 16 Step programme (see Fig1). Designed to mitigate the risk of fires during construction, it requires the registration of every STA member construction project with the National Fire Chief Council (NFCC).



PHASE	RESPONSIBILITY AND ACTION	EXAMPLE
Design	Principal Designer and Design team Action Consider the fire risk in the choice of building location, materials and process of build. STA 16 Steps numbers 1,2,3	Adjust location of the building; adopt fire robust timber solutions on sensitive sites. Undertake / commission a concept or full off the site fire risk assessment.
Tender	Principal Designer and Design team Action Include the risk mitigation concepts for the constructor to fulfill. STA 16 Steps numbers 1,2,3	Provide a concept or full off the site risk mitigation risk assessment report. STA site safe policy actions. STA 16 Steps compliance for the construction phase.
Construction: pre-site start	Principal Contractors and subcontractors Action Check that Steps 1 to 3 have been completed and follow or commission additional detailed fire risk assessment PLUS STA 16 Steps numbers 4-7	Appoint fire safety coordinator and create fire safety plan. Appoint STA site safe companies.
Construction: during construction	Principal Contractors and subcontractors Action Review Steps 4 to 7 for compliance PLUS STA 16 Steps numbers 8-16	Fire hazard and warning procedures implemented. STA site safe checks.
Practical completion	End of construction fire prevention	

Fig 3: STA Site Safe risk assessment



6) Conclusion

The following matrix is a summary of the activity carried out by STA in the pursuit of 'Raising the Bar', aligned with the Dame Judith Hackitt review.

STA ACTIVITY	WHY WE DO IT	IMPACT
STA Assure	Evidence that STA members are competent and capable	People
Timber Frame Competency Awards scheme	Ensures members are trained to use best practice guidance	People
Design and Engineering workbooks	Ensures members are trained to use best practice guidance	People
NVQ/SVQ	Ensures members are trained to use best practice guidance	People
CLT fire testing	Structural timber is easy to specify, backed by empirical data on performance	Product
Timber frame fire testing	Structural timber is easy to specify, backed by empirical data on performance	Product
SIPs fire testing	Structural timber is easy to specify, backed by empirical data on performance	Product
Guidance and technical notes	Aligns standards and guidelines to ensure consistent and usable best practice guidance	Process
Site Safe registration process	Ensures all structural timber projects are registered, prior to commencement, with the local fire officer	Process
STA 16 Steps	Ensures all structural timber projects under construction are protected against the spread of fire	Process
Time for timber campaign	Provides context to the role timber has in construction and climate change	Promotion

Fig 4: Association activity

STA are fully committed to driving change in the construction industry through market-leading initiatives such as STA Assure and Site Safe Programmes. By focussing on the four pillars below stakeholders can be assured that by using STA members in the delivery of SIPs buildings, the quality will be best in class.

People = training Product

Product = best practice

Process = audit check

Promotion = wider education

It is vital when considering risk associated with all/any construction material that the design and product type has been fully considered as suitable for the purpose in which its use is intended. STA provide numerous guidance documents for SIPs construction that can be issued as a reference point.

The combination of STA Membership and a SIPs construction that has been fully tested to both British and European standards provides both quality and certainty of outcome and longevity.



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