



TIMBER
ACCELERATOR
HUB

Mass Timber: Challenges & Potential Solutions

Summary report of the ASBP's Timber Accelerator Hub



ASBP The Alliance
for Sustainable
Building Products

The Timber Accelerator Hub (TAH) was established by the ASBP, with support from Built by Nature, Timber Trade Federation and Swedish Wood



Orsman Road, Waugh Thistleton Architects.
Photo by Ed Reeve.



TIMBER ACCELERATOR HUB

A report exploring the primary challenges of fire safety, regulation and insurance for mass timber construction on the road to a nature-based transformation of the UK built environment sector. Presenting opportunities and solutions to overcome these challenges and unlock the wider uptake of mass timber products.

Author: Joe Giddings, Projects & Campaigns Director,
Timber Accelerator Hub - 2022

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Definitions

Mass Timber: This report is about mass timber; the group of engineered wood products comprised of multiple timber layers glued or fixed together to form solid structural elements.

Barriers & Challenges: The 'challenges' described in the report can be overcome by diligent and competent teams, so the term is preferred over the more restrictive term 'Barriers'.

Industry/Sector: Used as shorthand for 'construction industry' as a whole; to describe the sector responsible for 20% of the UK's carbon footprint through new buildings and infrastructure.

Potential Solutions: Our recommendations for systemic changes necessary to accelerate the use of mass timber.

Who For: This report is for those seeking understanding of the UK construction sector outlook for mass timber construction.

Not For: This report doesn't seek to provide project specific guidance for design professionals.

This report is endorsed by the following organisations



Wood for Good



*Dalston Lane, Waugh Thistleton Architects
Photo by Daniel Shearing.*





Foreword by Simon Corbey, Director, ASBP

It has been a pleasure to assist with the work of the Timber Accelerator Hub, generously funded by the Laudes Foundation, with support from TDUK, Wood Knowledge Wales and Swedish Wood.



It's such an essential and timely project and it has brought together a broad range of stakeholders from across the construction industry, all of which are working to overcome the barriers to mass timber construction in the UK. This project sits neatly alongside several workstreams here at the Alliance for Sustainable Building Products, such as our Natural Fibre Insulation Group and

Reducing Plastics in Construction Group and research projects such as 'Zero Avoidable Packaging', looking to reduce waste plastic from construction.

We got the green light for the Timber Accelerator Hub in November 2020, and we then convened the advisory committee, which met for the first time in January 2021 and my sincere thanks go out to all involved. We brought Joe Giddings in to be the Project Director in April 2021 and it feels since then that Joe has made tremendous amount of progress in a relatively short time, and we have built up trust and momentum within our ever-growing networks. We identified the main barriers to be insurance and regulatory and we have been working hard to overcome these complex and multi-faceted barriers, as you will see in the report.

It's been interesting to learn from colleagues in Germany and Canada about how their governments are supporting mass timber and timber in construction more generally and it's clear we are lagging some way behind here in the UK. Whilst we have made good progress, it is clear that there is still a lot of work still to do to enable mass timber construction to become normalised.

We identified the main barriers to be insurance and regulatory and we have been working hard to overcome these complex and multi-faceted barriers...

Project Partners

The Timber Accelerator Hub (TAH) was established by the ASBP, with funding from the Laudes Foundation, Timber Development UK and Swedish Wood, to work with a network of key construction industry stakeholders to investigate current barriers and explore potential solutions.

The project has been steered by a wider group of leading practitioners and experts drawn from a number of key partner organisations, in addition to the three outlined above, acting in an advisory capacity; Wood Knowledge Wales, Structural Timber Association, Cambridge Centre for Natural Material Innovation, Lendlease, Mass Timber Risk Consulting, Gallagher, Gardiner & Theobald, British Woodworking Federation & OFR Consultants.

We would like to thank all our partners for the time, expertise and energy given towards this project throughout the process.

'Phase 1' of the project, comprising the work described in this report, was carried out from November 2020 to February 2022.

This report benefits from the support of Built by Nature, a network and grant-making fund, founded by Laudes Foundation, with a mission to accelerate the timber building transformation in Europe and a vision of a built environment that works in unison with nature.

Find out more: www.builtbn.org

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Executive Summary

As the UK built environment sector seeks to transition towards greater use of timber and other bio-based materials to reduce the embodied carbon emissions of new buildings, major challenges are being experienced. These are leading developers, clients and their design and construction teams to turn back to more carbon intensive construction methods before the project starts on site.

The group of engineered solid wood products known in the UK as 'mass timber' demonstrate enormous potential for carbon reductions in major developments, due to their structural strength, versatility, lightness, high degrees of precision and low-carbon manufacturing. These attributes mean that mass timber products are technically suitable for structural use in medium and high-rise buildings, as demonstrated up to 24 storeys in Austria¹, 18 storeys in Norway² and Canada³, and 10 storeys here in the UK⁴.

Despite this potential, mass timber construction faces particularly acute challenges in the UK. These are significant enough to be stymying its wider uptake and following an early growth period which saw the successful completion of many mass timber buildings, there have been many reports that the advance of mass timber has ground to a halt in certain sectors, particularly residential.

The primary obstacles currently preventing the wider use of mass timber are shared across the industry, with three issues particularly being reported by private developers, Local Authorities and Government clients alike: Severe difficulties obtaining affordable construction and property insurance for mass timber buildings. A prohibitive regulatory environment precluding the use of combustible materials in certain building types. Prevailing uncertainty around the fire performance of mass timber causing doubt amongst industry stakeholders.

...mass timber construction faces particularly acute challenges in the UK. These are significant enough to be stymying its wider uptake.

Developers and their design teams might overcome one or more of these only to find the next obstacle insurmountable. The greatest challenge is currently insurance. Costs of insurance for a completed building using mass timber for its primary structure have been reported to be up to 800% higher than conventional construction methods. In some cases, insurers have opted to refuse cover.

The fact is that insurance providers' assessment of mass timber as a risk leads to disproportionate price increases for cover. Their concerns can be grouped into broad areas; susceptibility to fire and moisture damage, durability and repairability, concerns over quality of design and construction, and concerns over competency of professionals. There are several emerging and established solutions to these risks and competent design teams can demonstrate this. But at the time of writing unfavourable insurance market conditions persist.

The insurance sector has now been very clear about its concerns, with the RISCAuthority publishing a white paper on mass timber in February 2022.⁵ Engagement with the insurance sector towards a common approach to risk mitigation in mass timber buildings has tentatively begun. This should be top of the priority list for all stakeholders aspiring to reduce the carbon footprint of construction through an increase in mass timber products.

Aside from property protection, the Grenfell tragedy highlighted the tragic consequences of neglecting building safety. Given the scale of fatality witnessed in London in June 2017, the onus is well and truly on the timber industry, the wider construction industry and the Government to demonstrate clearly that this group of combustible products are safe to use.

To overcome concerns, the mantra in the coming years should be simple; test, test, test. Whilst some research is underway, test evidence often remains out of the public domain, having been produced on a project-by-project basis for a client. This can be enough for singular projects to gain approval, but this piecemeal approach will not overcome systemic barriers and negative perceptions. Industry-wide collaboration and coordination should be a priority to unlock mass timber for all.

The wider policy context has shifted dramatically since 2017 with the UK now legally committed to net zero emissions by 2050. The Government is well aware that to get there, the construction industry will need to dramatically reduce embodied carbon and there is now wide recognition that mass timber has an important role in this.

This demonstrates that despite the challenges, we've arrived at a moment of great opportunity and potential for mass timber construction in the UK: Ministers speak publicly about the need to reduce embodied carbon emissions; the Conservative MP Duncan Baker has introduced a private member's bill for embodied carbon regulation to Parliament; the Government has kickstarted a policy process to increase timber use; the UK's largest private developers are working together to unlock mass timber for their projects. And crucially, insurance brokers and underwriters are taking note and beginning to respond.

In the medium to long term, industry needs to work closely with Government towards the development of more advanced regulations, standards and statutory guidance documents that encourage mass timber construction whilst ensuring the highest degree of building safety and property protection in mass timber buildings. We're not there yet, but ultimately the ambition to mitigate constructions contribution to climate change will require us, somehow, move beyond the prohibitive regulatory environment we currently have. This report proposes a potential roadmap for this.

Casting our view further afield, there are many industry-led initiatives seeking to overcome the challenges outlined here. This report documents a thriving ecosystem of projects and organisations attempting to unlock mass timber construction. Over the past year, the TAH has coordinated some of these efforts through cross-industry working groups. Going forward, greater collaboration and coordination can really take advantage of this moment and generate further momentum towards the nature-based transformation of the UK built environment sector that we so need.

In conclusion, it seems clear that efforts to decarbonise the construction sector in the UK with natural materials, such as mass timber, are being stifled by an inability to overcome the twin challenges of gaining insurance & demonstrating fire safety. Anybody with an interest in mitigating the sector's impact on climate change should consider focussing on resolving these challenges, as a matter of priority.

Mass timber is an incredibly useful tool in the fight to mitigate climate change, but it is a tool which is currently unattainable for many. We must change this.



About the Author

This report was authored by Joe Giddings, Project Director of the Timber Accelerator Hub for the ASBP.

Prior to being appointed to this role in April 2021, Joe was a practicing project architect, working predominantly in the residential sector. Alongside this role, Joe is a coordinator of Architects Climate Action Network (ACAN), the organisation he co-founded in 2019 to address the climate emergency in the built environment sector. Joe has been a central coordinator of ACAN's campaign for the regulation of embodied carbon emissions.

¹HoHo, Vienna, Austria. Completed 2019. Project information available online from BuildUp EU. www.buildup.eu/en/practices/cases/hoho-vienna-first-city-office-built-timber-vienna

²Mjøstarnet, Mjøsa, Norway. Completed 2019. Project information available online from Moelven. www.moelven.com/mjostarnet

³Brock Commons, Vancouver, British Columbia. Completed 2017. Project information available online from ThinkWood. www.thinkwood.com/projects/brock-commons-tallwood-house

⁴Dalston Works, London, UK. Completed 2017. Project information available online from Waugh Thistleton. <https://waughthistleton.com/dalston-works>

⁵RISCAuthority, Insurance Challenges of Mass Timber. Available online: www.riscauthority.co.uk/news-and-features/insurance-challenges-of-massive-and-mass-timber-construction



Recommendations

Key Recommendations

- **Large scale testing** - Industry, Government and funding bodies should provide resource towards developing a more robust evidence base to address prevailing fire safety concerns, such as OFR's fully costed proposal, "Research questions on the path to mainstream adoption of mass timber in commercial construction."
- **Establish a common approach to risk mitigation** - Industry should establish engagement with the FPA & RISCAuthority, ideally through a 'neutral' organisation (i.e., not a timber body), towards the creation of a common approach to risk mitigation for mass timber buildings. (i.e., a 'mass timber playbook'). This guidance should be simple, visually based and suitable for clients, design teams and insurers. "How to mitigate risk and gain insurance for mass timber buildings"
- **Engagement with insurers** - Industry should scale up engagement with property insurance underwriters and risk assessors through Timber Accelerator Hub and Gallagher's 'Mass Timber Property Insurance Forum' to increase insurer confidence in mass timber through education and knowledge sharing.
- **Consistent standards** - Government should seek to provide clarity and consistency with regards to the position of mass timber construction in response to divergent standards, regulations and guidance and
- **Dedicated standards** – Government should consider creating dedicated standards and regulations to support the safe use of mass timber in all building types, including those taller than 18m.
- **Alternative Risk Transfer** - Developers should strongly consider establishing Alternative Risk Transfer vehicles, as is currently being explored by Lignum Risk Partners. Sometimes referred to as the 'Timber Construction Insurance Captive'.

Supporting Recommendations

Timber Industry

- All existing large scale fire test evidence should be provided to the relevant regulatory authorities as a matter of priority, and the handing over of emerging evidence should be fast-tracked.
- To engage with the Institute of Fire Engineers, or other relevant professional body, to increase competency of the fire engineering profession to work with mass timber construction.
- To engage with RIBA & IStructE to upskill Architects and Structural Engineers through participatory 'mass timber working groups' to build confidence in the use of mass timber amongst professionals.

Government

- Consider publishing an approved 'route to compliance' for mass timber for buildings not subject to the 'combustible materials ban' in The Building Regulations.
- Further investigate the wider impacts that the combustible materials ban (above 18m) is having outside the scope of the ban itself, i.e., the impacts on the low-rise residential sector (below 18m).
- In the short term, consider providing funding for incremental project costs commonly incurred on mass timber projects, such as large-scale fire tests.

British Standards Institute

- Consider developing a new British Standard, suitable for testing external wall systems fixed back to a mass timber structure

Developers

- Consider open sourcing project-specific large scale fire testing data. Explore the potential for data sharing to reduce need for project-by-project testing.
- Consider adoption of digital approaches to risk management such as moisture monitoring and leak detection.

Insurers

- Unlock available cover and reduce premiums for mass timber buildings down to a comparable level to other structural systems by, for example, establishing facilities which pool available cover from multiple providers (using Chase Underwriting's Mass Timber Construction Insurance Facility as a model)
- Explore the creation of a mass timber insurance data pool (premiums & claims data of completed mass timber buildings)



*Orsman Road, Waugh Thistleton Architects.
Photo by Ed Reeve.*

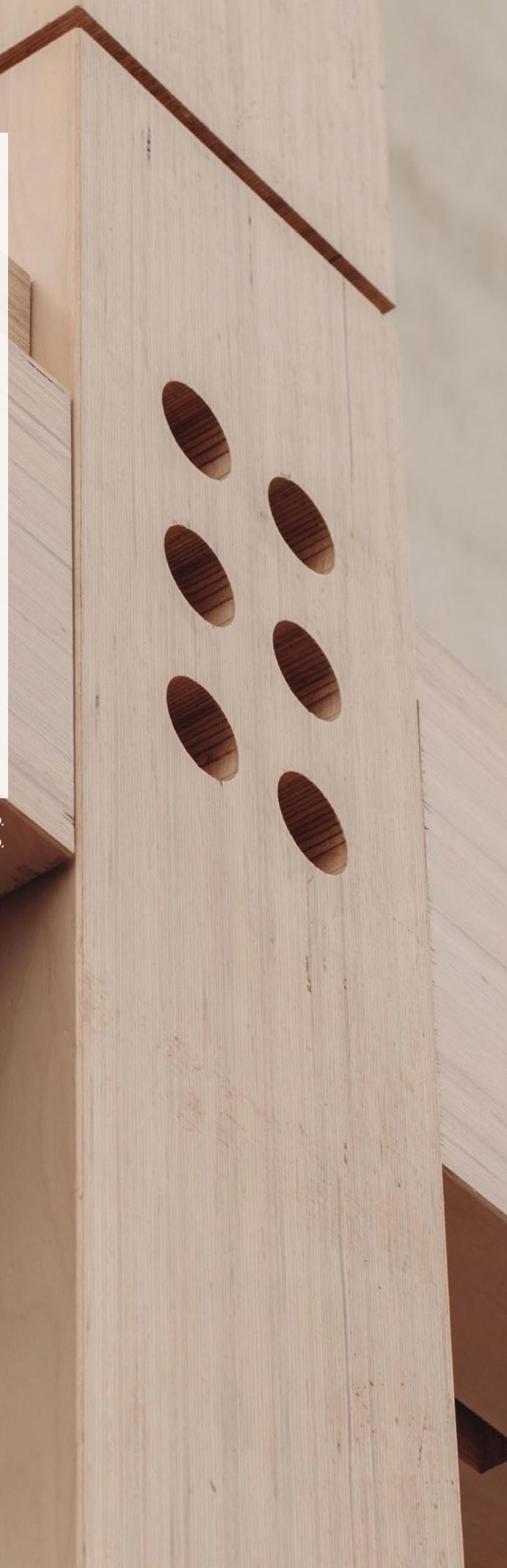
“

“To create places that are truly fit for the future we need to think and act in a fundamentally different way across the built environment sector.

We need to design innovatively to facilitate efficient assembly and disassembly of buildings, using a range of materials that can be used repeatedly, and ultimately recycled to eliminate waste. We must decarbonise ‘traditional’ materials such as concrete and steel, but we also need to accelerate the adoption of inherently low-carbon technologies such as engineered timber. And we need to collaborate, reflect and share lessons more proactively as we will only succeed if we learn together. The Timber Accelerator Hub plays a key role in facilitating this collaboration and shared learning.”

Mario Lara Ledermann, Lendlease

*B&W Building, Waugh Thistleton Architects for The Office Group.
Photo by The Office Group.*





Section 1

Introduction

The Timber Accelerator Hub was initiated in Autumn 2020 by ASBP in response to a significant shift in UK construction industry attitudes towards timber construction in the wake of the awful tragedy that unfolded on 14th June 2017 at Grenfell Tower.

The resulting changes in regulation of combustible materials in residential buildings, and the revelations of gross misconduct continuing to emerge from the Hackitt Review and Grenfell Inquiry, have challenged our perceptions of building safety. With the regulatory focus being placed on the combustibility of materials, the shockwaves from these events ran through to the insurance industry, resulting in reports of many mass timber projects being 'flipped' back to non-combustible concrete or steel.

Picking up on this trend amongst their wide client base, Gardiner & Theobald (G&T) organised a game-changing series of discussions, the 'Mass Timber Office Forum', drawing in most of UK's leading private developers to participate. Running for a year from Summer 2020, the forum revealed that insurance was now the key barrier to the uptake of mass timber construction in the UK commercial development sector.

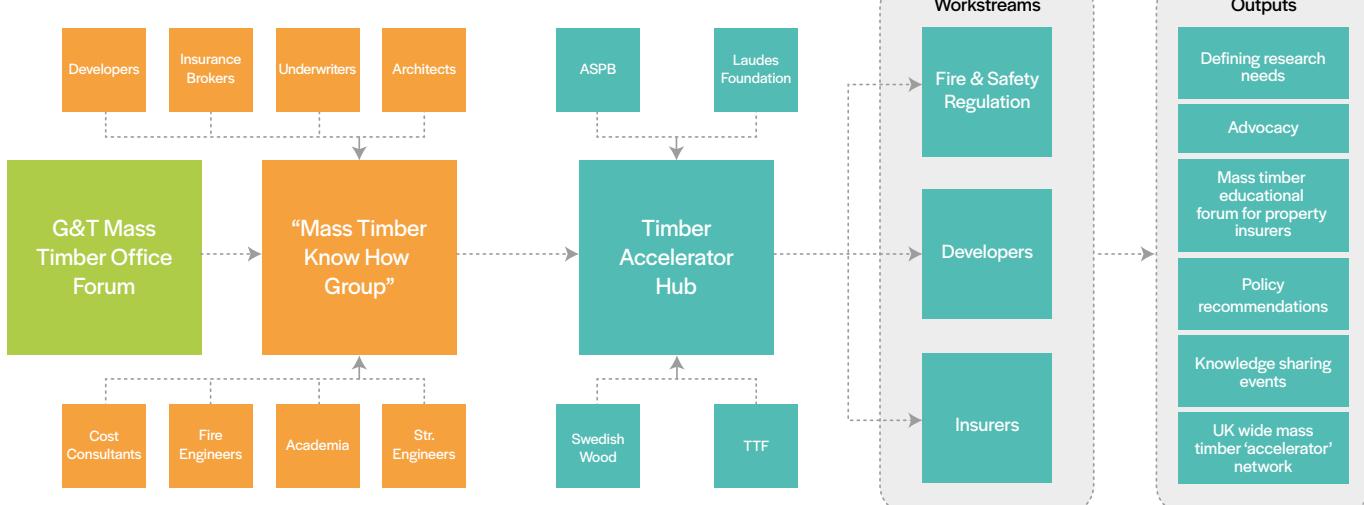
Emerging from this forum, several key stakeholders coalesced around an aim to translate these discussions into meaningful action towards solutions, and formed an informal group called the 'Mass Timber Know How Group' (MTKH). The MTKH agreed that funding was required to translate these conversations into action. ASBP were chosen to host the project and funding partners brought in. The Timber Accelerator Hub (TAH) was born.

Mass Timber Know How Group (MTKH)

Throughout 2021, the Timber Accelerator Hub helped coordinate monthly meetings of the informal MTKH group, a knowledge sharing group comprised of multiple stakeholders, from both demand and supply side, at the forefront of mass timber construction in the UK. The MTKH meetings were intended as a technical knowledge sharing exercise, a monthly snapshot of activity, with representatives joining from the following:

- Waugh Thistleton (Architecture)
- OFR Consultants (Fire)
- BM TRADA (Timber - Technical)
- Cambridge CNMI (Research)
- British Land (Developer)
- Lendlease (Developer)
- ASBP (Sustainability)
- Structural Timber Association (Timber - Technical)
- City of London Building Control (Authority)
- Elliott Wood (Structures)
- Gardiner & Theobald (Cost & Project Management)
- Stora Enso (Mass Timber Supply)
- Chase Underwriting (Insurance - Construction)
- Arup (Structures)
- Aviva (Insurance - Construction)
- Gallagher (Insurance Broker - Property)

Story of the project





Section 1

Timber Accelerator Hub (TAH)

The TAH set out to focus on the two primary challenges for mass timber construction in the UK; insurance and fire safety. A key objective for the TAH was to join industry leading research groups and help transfer research findings to the insurance industry.

The overarching aims of the project during the first phase of work:

- **To investigate** in detail the major challenges preventing the wider adoption of mass timber across the UK; insurance, fire performance and the regulatory environment.
- **To establish** the TAH as a network hub for key stakeholders to develop industry collaboration with the aim of overcoming these specific challenges.
- **To identify**, initiate or support key work required to overcome these challenges.

The TAH Network

The second aim listed above, to establish the TAH as a network hub, represents the method by which the TAH hoped to achieve progress: by convening a collaborative network.

Led by the ASBP, the TAH has coordinated several working groups. Some groups are communities of interest, bringing one type of stakeholder together into a forum, such as insurers or developers. These groups are useful as stakeholders experience common challenges specific to their professions. Other groups are comprised of multiple disciplines and intended for knowledge sharing from multiple perspectives. The TAH Steering Group for example brings together a representative cross section of industry - brokers, fire engineers, developers, structural engineers, quantity surveyor, sustainability experts, academia and timber associations.



CLT



LVL

The diagram below (Diagram 2) is an indicative representation of the wider mass timber ecosystem that the TAH sits within, aiming towards greater collaboration and coordination.

This Report

This report seeks to present the findings of this initial phase of work; a summary of our analysis of the two primary challenges for mass timber, and recommendations for potential solutions that would unlock its wider use, **in a safe and sustainable manner**.

This report will focus on mass timber, a group of products facing particularly acute challenges, although it is believed that the learning is applicable to other nature-based products and systems.

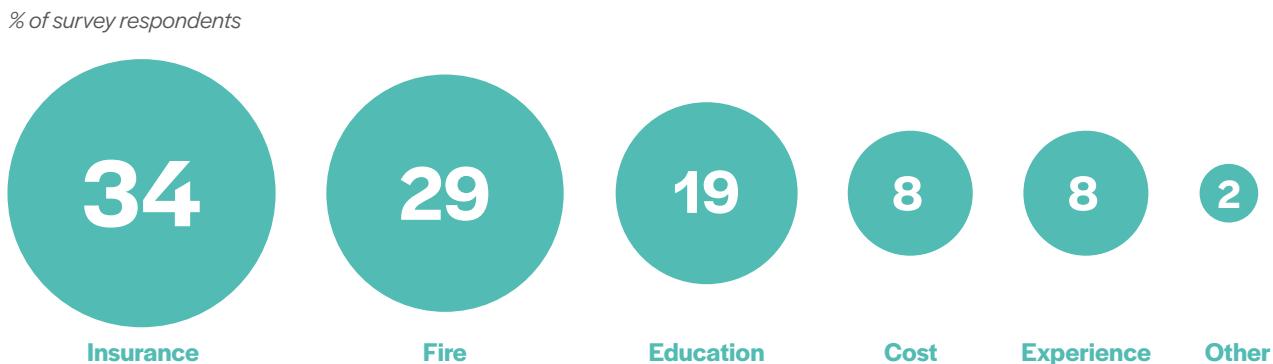
'Mass timber' is the name given to the family of engineered wood products that comprise multiple pieces of timber that are layered, or laminated, into solid wood elements for structural application. Mass timber includes Cross Laminated Timber (CLT), Glue Laminated Timber (Glulam), Laminated Veneer Lumber (LVL) and Dowell Laminated Timber (Brettstapl or DLT).

Due to their strength, precision, lightness and durability, these products are most suitable for use in medium and high-rise buildings, with the potential to replace the predominant structural materials in this scale of construction, steel and concrete, both of which are more carbon intensive in their production.

LVL and CLT are two of the most commonly used mass timber products

Images from Stora Enso

What do you think is the greatest barrier to the uptake of mass timber offices?



Graphic taken from "Mass Timber Office Forum Summary Whitepaper" Gardiner & Theobald 2021

The carbon reduction benefit has been identified as the main driver to the adoption of mass timber in buildings. This report does not intend to detail these carbon benefits, as this topic has been explored extensively elsewhere. For further information regarding timber's role in tackling the climate crisis, see publications from the Centre for Natural Material Innovation⁶ or Forestry and Land Scotland.⁷ For up-to-date embodied carbon factors of mass timber products, refer to the December 2021 article by IStructE comparing EPDs from all the major European producers of mass timber.⁸

Mass timber products can be used for the entire structure of a building, or in a 'hybrid' or 'mixed' structural system. A 'hybrid' structure uses a combination of mass timber and other materials throughout a structural system; CLT floor slabs within a steel frame, for example. A 'mixed' structure is one where two or more structural systems are used in tandem; A concrete stair core and ground floor combined with a Glulam post and beam frame with CLT floors, for example. The 'challenges' we speak about here are experienced when using any one of these types of structure.

Nor does this report attempt a sweeping 'barrier analysis' for mass timber construction. Instead, we focus on the two primary challenges for mass timber construction: 1) construction and property insurance and 2) fire safety & regulation. We recognise that there are further challenges widely reported, experienced at every stage of design and construction: cost and supply, professional indemnity insurance and education. Whilst vitally important, these are not explored here. Readers are encouraged to look at G&T Mass Timber Office Forum Summary Whitepaper which provides valuable insight.⁹

The TAH set out to focus on the two primary challenges for mass timber construction in the UK; insurance and fire safety.

⁶ Centre for Natural Material Innovation, University of Cambridge, www.cnmi.org.uk

⁷ Forestry & Land Scotland, Scottish Government, <https://forestryandland.gov.scot/what-we-do/timber-industry/timber-and-the-climate>

⁸ IStructE, Mass Timber Embodied Carbon Factors <https://shop.istructe.org/resources/blog/mass-timber-embodied-carbon-factors/>

⁹ Gardiner https://marketintel.gardiner.com/uploads/GTs-Mass-Timber-Office-Forum_Summary-Whitepaper.pdf



Section 1

Wider policy context – Net Zero

In the 5 years since 2017, the wider policy context to mass timber construction has shifted dramatically. Much greater emphasis is now placed on addressing the climate emergency and mitigating the impact of construction. It is now almost universally recognised that the sector must rapidly decarbonise the construction of new buildings, and several landmark policies have set the direction of travel, towards an increase in the use of wood products in construction, such as mass timber:

In 2019 – UK commits to a legally binding target of net zero emissions by 2050.¹⁰

In 2020 – The UK Government’s official advisory body, the Climate Change Committee, recommends to “rapidly scale up the levels of wood used in construction and support the assessment and benchmarking of whole-life carbon in buildings.”¹¹

In 2021 – The UK hosts COP26. The Government publishes its Net Zero Strategy in the run up to the conference, unveiling its long-term plan to achieve net zero emissions by 2050. The strategy commits the UK to “develop a policy roadmap to increase the use of timber in construction in England.”¹²

In 2022 – Three Government departments (DEFRA, BEIS, DLUHC) set up a ‘Timber in Construction’ policy working group to act upon the commitments in the Net Zero Strategy. The group is due to report to ministers in late 2022, with external stakeholder input helping guide a policy roadmap.

Further Information

Some of the initiatives named here are detailed elsewhere in the report.

Page 13 - Mass Timber Know How Group

Page 13 - G&T Mass Timber Office Forum

Page 25 - STA CLT Special Interest Group

Page 25 - UK Fire Hub

Page 26 - OFR Research Questions

Page 36 - Mass Timber Property Insurance Forum

Page 13 - TAH Developers Working Group

Page 37 - Alternative Risk Transfer Vehicle

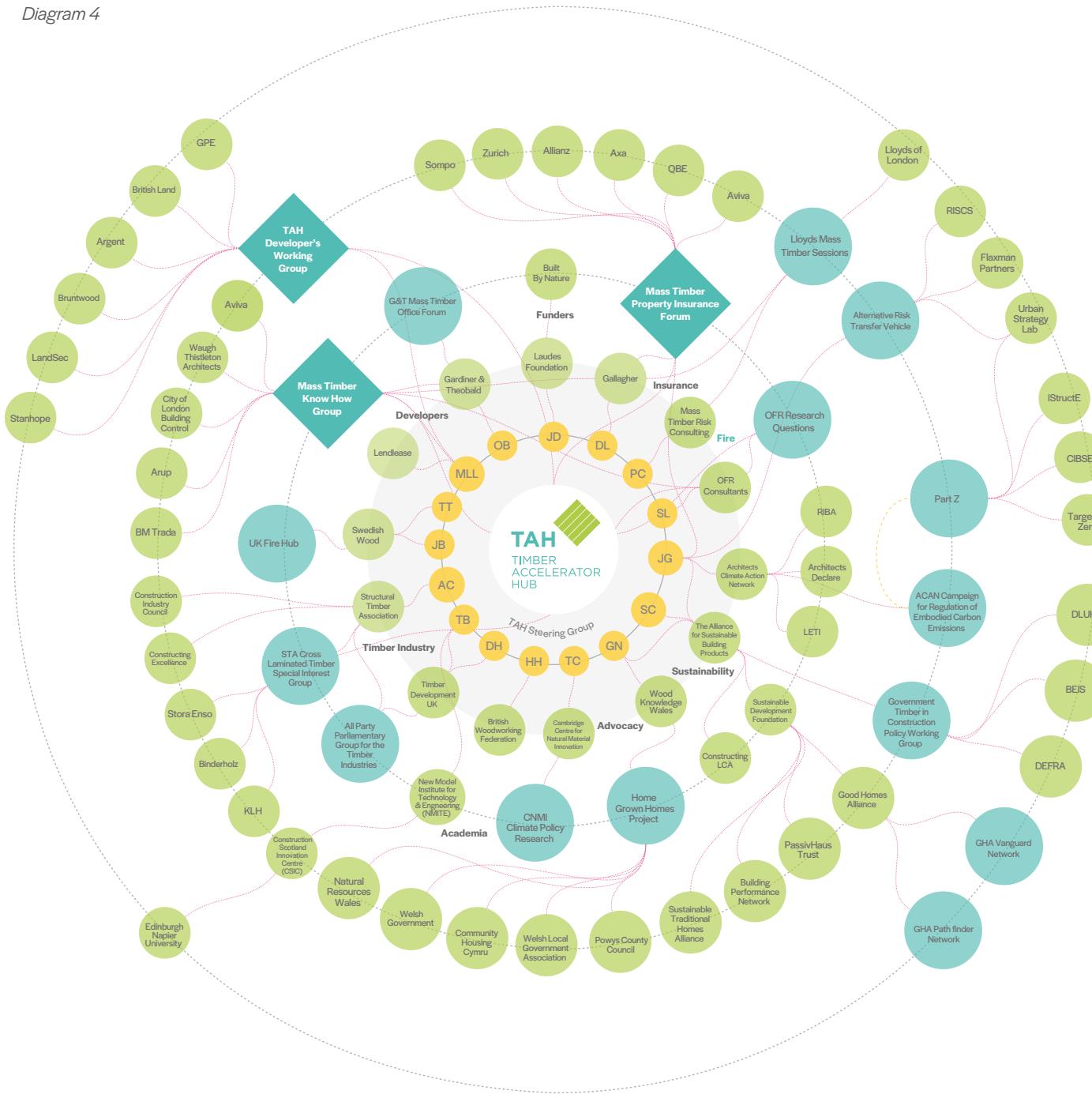
Page 16 - Gov. Timber in Construction Policy Group

¹⁰ [www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-netzero-emissions-law](http://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law)

¹¹ www.theccc.org.uk/publication/reducing-uk-emissions-2020-progress-report-to-parliament

¹² www.gov.uk/government/publications/net-zero-strategy

Diagram 4

**Stakeholder Mapping Key**

- Yellow circle: Individual
- Green circle: Organisation
- Teal circle: Initiative
- Teal diamond: Key TAH Activity

Stakeholder Mapping

This map is an illustrative representation of the wider ecosystem of organisations and initiatives that the TAH sits within.

This diagram is indicative only. Inclusion of an organisation in this diagram does not indicate a relationship, formal or otherwise, between the TAH and that organisation.

“

“It appears there is currently a lack of confidence in certain elements of the construction industry generally, but especially towards mass timber construction. At the vanguard of the construction industry, however, there are extremely competent and visionary developers, designers and contractors who want to achieve net-zero in a safe and sustainable way.

The question is whether there is enough time to let this knowledge cascade down to the whole industry, or whether a catalyst is needed. In my view, industry and government need to show courage and willingness to invest otherwise the industry will flounder in its critical pursuit of net zero. The obvious answer is to develop a rapid and extensive research programme to better understand innovative building materials and methods.”

Sam Liptrott, Director, OFR Consultants



Stora Enso, factory floor





Section 2

Mass Timber, Fire Safety & Regulation

2.1 Introduction

This section is about mass timber, fire safety and the regulations. It will outline how, rightly or wrongly, the UK's regulatory environment is currently precluding the use of mass timber in many residential buildings. In addition, it will identify a series of mounting challenges that clients face when seeking to demonstrate fire safety of mass timber buildings, regardless of whether they are explicitly impacted by the prohibitive residential regulations, standards and guidance.

It should be stated from the outset that there are no regulatory barriers to using mass timber in commercial, educational or cultural projects, these are strictly limited to the residential sector. Whilst these other building typologies are affected by the ripple effects from the residential sector, they are not explicitly impacted by the regulations outlined here.

We might wrongly classify these obstacles and challenges as 'teething problems' being experienced as the industry shifts towards the greater use of mass timber to decarbonise construction projects. We might then expect that these problems will be 'ironed out' on a project-by-project basis, as we gradually improve understanding and competence with regards to mass timber.

However, the issues highlighted are systemic in their nature, to do with the rules and perceptions that apply across the whole industry, rather than being confined to any individual project. As such they are proving to be insurmountable for many developers, particularly as more and more are approaching mass timber for the first time. Furthermore, regulatory barriers are increasing in number, not decreasing, gradually eating away at the parts of a building in which the mass timber is permitted, and in turn feeding negative perceptions still held by many.

This cocktail of prohibitive regulations and the wider perceptions they feed is a major barrier to the use of all types of timber. To overcome this and create a professional environment and regulatory landscape that supports the design and construction of safe mass timber buildings, will require a concerted collaborative effort right across industry and Government.

2.2 Background

In the UK, there has been an increased focus on building safety in the years since 2017. The Hackitt Review (concluded in 2018) and The Grenfell Tower Inquiry (still ongoing) have highlighted systemic malpractices and poor standards within the construction industry, as well as identifying considerable shortcomings of the UK's building standards framework. Changes to The Building Regulations have been made several times in recent years to address these shortcomings.

The way that buildings are designed and constructed, the materials that are used in their construction, have come under greater scrutiny as the industry adapts. Within the design professions at least this is leading to an improved culture with greater focus being given to building safety.

Given this backdrop mass timber products have faced a significant challenge, across all building typologies, due to the combustibility of the material and the relative lack of know-how across the design and construction sectors, when compared with construction methods that use concrete and steel frame structural systems. Due to the common and widespread usage of concrete and steel systems, there exists a greater understanding of their fire performance. When it comes to demonstrating fire safety in the UK, mass timber is playing catch-up, as is to be expected by an innovative product.

Faced with a tragedy of the scale of the Grenfell fire, the political priority has been on tightening rules to guarantee protection of life in new buildings. At the time of writing, the Grenfell Tower inquiry continues to reveal how the regulations had been watered down to the point of catastrophic failure.¹³ The need to act swiftly necessitated the introduction of blunt policy instruments, outlined below, that introduced a ban on the use of all combustible materials in external walls of high-rise residential buildings. This initial ban led to a cascading series of similar changes to various standards and regulations.

The concerns are not limited to residential typologies. Turning to commercial buildings, in 2014 a large fire in a nearly completed Glaxo Smith Klein laboratory, built with a Glulam structure, resulted in a total loss and is still cited by insurers as a reason to justify a higher risk profile, and increased cost of insurance premium, for this and other types of mass timber construction.

¹³ BBC, The Grenfell Tower Inquiry Podcast, "Episode 186 - Ministry of Housing, Communities and Local Government". Available Online. www.bbc.co.uk/programmes/p0bsltr2



Section 2

Mass Timber, Fire Safety & Regulation (cont.)

2.3 Prohibitive Regulations and Standards

The events of Grenfell fire, the ensuing Hackitt Review, and the ongoing Grenfell Inquiry have led to the implementation of several measures that directly preclude the use of timber in some circumstances. It is important to note that these measures have only been applied in relation to certain residential buildings, therefore the regulatory landscape still provides huge opportunity for mass timber schemes. There are no restrictions on most types of building, including educational, commercial, industrial and any residential building outside of London that does not exceed 18m. Residential schemes with a floor at least 18m above ground level, and affordable housing schemes of any height in London, are subject to several restrictions which are outlined below.

2018 The Building Regulations

- In November 2018 amendments to The Building Regulations¹⁴ were made by the Government in order to ban the use of combustible materials (Class A1, A2-s1 or d0) in any part of the external wall of buildings with a floor at least 18m above ground level that contain residential accommodation.¹⁵
- This piece of legislation rules out the use of any combustible material anywhere in the external wall build-up of residential buildings with a floor above 18m.
- This amendment is made through primary legislation, i.e., via parliament, directly amending Regulation 7 (Materials and workmanship) of The Building Regulations 2010, rather than through amendments to guidance such as the Approved Documents.
- The requirement contains a list of exemptions including window frames, membranes & cavity trays amongst other items. The list of exemptions does not include any type of structural timber.
- Government held a further consultation, yet to be concluded, about further changes to this regulation.¹⁶

There are no restrictions on most types of building...

¹⁴ The Building (Amendment) Regulations 2018 – accessible online www.legislation.gov.uk/uksi/2018/1230/regulation/2/made

¹⁵ CIBSE, Technical Note: The Government Ban On Combustible Materials in High Rise Residential Buildings www.cibsejournal.com/technical/technical-note-the-government-ban-on-combustible-materials-in-high-rise-residential-buildings

¹⁶ In January 2020, the Government held a public consultation on further amendments to The Building Regulations proposing to lower the height threshold for the ban on combustible materials in external walls to 11m. The consultation also proposed to include further building typologies within the list of 'relevant buildings', such as hotels and hostels. The results of the consultation are yet to be published (at the time of writing in February 2022).

¹⁷ Greater London Authority, Affordable Homes Programme Funding Guidance 2021-2026 www.london.gov.uk/sites/default/files/301120_homes_for_londoners_funding_guidance-acc1.pdf

¹⁸ Cundall, 'BS 9991:2021 draft is out for consultation' www.cundall.com/ideas/blog/bs-99912021-draft-is-out-for-consultation

2020 Greater London Authority Affordable Homes Programme 2021-2026

- In November 2020, the GLA released the Affordable Homes Programme Funding Guidance for the period of 2021 to 2026.¹⁷ The guidance states that for residential schemes receiving funding from the scheme, "no combustible materials may be used in the external walls of all homes and buildings, regardless of their height."
- This signifies a major extension of the combustible materials ban previously implemented through amendments to The Building Regulations
- In order to justify this deviation from The Building Regulations, the guidance states that "the need to move away from arbitrary height thresholds" is demonstrated by the occurrence of "several damaging fires in blocks below 18 metres."
- This requirement rules out the use of any type of structural timber in any part of the external wall of residential buildings in the capital receiving this GLA funding.

2021 British Standard 9991¹⁸

- In September 2021 the British Standards Institution published a consultation on the draft of a new BS 9991. This is the standard that covers "fire safety in the design, management and use of residential buildings". The draft new standard introduced a clause that '*precludes the use of timber*' for any loadbearing element, within internal or external walls, in 'single stair' residential buildings with a floor above 18m.

The lack of consensus or clarity inherent in the divergent nature of these measures creates uncertainty across the industry. Implicit in the deviation between these various standards, is the message that “*timber is unsafe*”. Given this context, clients bringing forward any type of residential building, regardless of height or scale, seem reluctant to propose mass timber due to its combustibility. This is unfortunate, as there is a body of evidence demonstrating how mass timber performs in fire and how to mitigate risk, which shall be explored later.

Furthermore, whilst these measures are, for now, technically limited to residential buildings, the negative perception of all types of timber created by this series of measures has ‘bled’ out from the affected building types. A much larger range of building types, including schools and offices, are being impacted by this regulatory uncertainty.

Underpinning all of this are the findings of the Independent Review of Building Regulations and Fire Safety, carried out in the wake of the Grenfell fire and led by Dame Judith Hackitt, as presented in her final report, ‘Building a Safer Future’.¹⁹ Hackitt outlines the ‘system failure’ which led to the tragic events of June 14th, 2017; inadequate regulatory oversight and enforcement coupled with ignorance and indifference towards building safety. Considering this ‘race to the bottom’, Hackitt suggests a number of preventative measures to provide higher levels of protection for inhabitants of taller residential buildings. These layers of protection include suggestions such as “the use of sprinklers” and “the use of non-combustible materials throughout the building.”

It is important to note however, that elsewhere in the report Hackitt suggests the target for new regulatory measures should be high rise residential buildings of 10 or more storeys. Furthermore, Hackitt’s Final Report explicitly calls out the tendency of the industry to rely on prescriptive measures and recommends that any regulatory measures should be ‘truly outcomes based rather than based on prescriptive measures.’ Finally, Hackitt spoke out on Radio 4 in November 2020, when asked about wood specifically, again encouraging the adoption of better risk management practices through design rather than the use of prescriptive measures such as bans; “As long as things are designed in such a way that there is no risk of fire spread from the use of materials.... this all about preserving life safety. Ensuring that the whole building is safe.”

The contradictions at play here, between expert advice and measures introduced, suggest that the regulatory challenge for mass timber can be partly attributed to a combination of negative perceptions, adherence to a precautionary principle and the political nature of decision making.



Cobalt Place, Eurban. Photo by David Grandorge.

However, the evidence base suggesting mass timber is safe in high rise residential buildings appears not currently sufficient, or the evidence hasn’t been communicated well enough, for political decisions in its favour. Added to this, the Government justification (MHCLG) for the ban, in 2018, felt that the impact was negligible; *“Currently the number of projects above 18 m in height where load bearing structural timber elements are used remains relatively small. The effect of the ban on the use of engineered timber remains limited in the short term.”*

In the intervening period, political momentum has been steadily mounting behind increased use of timber in construction, see recent Net Zero Strategy, but there remains much work to be done to build a convincing political case for mass timber specifically as a strategic tool in the fight against the climate crisis, before it will be warranted special attention with regards to the regulations.

...there is a body of evidence demonstrating how mass timber performs in fire and how to mitigate risk.

¹⁹ Dame Judith Hackitt, for HM Gov, Building A Safer Future, accessed online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/707785/Building_a_Safer_Future_-_web.pdf



Section 2

Mass Timber, Fire Safety & Regulation (cont.)

This report will now go on to explore problems with testing regimes for external wall systems, before moving on to look at wider impacts outside the scope of the measures outlined here.

Potential Solutions

Industry

- Provide significant investment to develop a more robust evidence base to address prevailing safety concerns.
- Provide existing evidence to the government to seek an exemption for this form of construction from the ban.
- Focus resources on developing relationships with relevant Government departments, Government Ministers & MPs.
- Develop closer ties with regulatory authorities such as the British Standards Institute.

Government

- Provide clarity and consistency on the position of mass timber in construction, in direct response to divergent standards, regulations and statutory guidance.
- Create an agreed ‘route to compliance’ for mass timber with regards to the combustible materials ban set out in The Building Regulations.
- Create statutory guidance to support the safe use of mass timber in buildings taller than 18m.

2.4 Problems With Fire Testing Regimes

There has been some critique of the existing UK testing regimes for external wall systems. This critique is mostly aimed at BS 8414, “Fire performance of external cladding systems - Test method for non-loadbearing external cladding systems”, which has two parts, 8414-1 for systems fixed back to a structural steel frame & 8414-2 for systems fixed back to masonry. It seems clear that a new standard is required for the testing of systems fixed back to mass timber substrates.

BS 8414 has come under wider criticism. In a report from Judith Schulz, Jim Glockling & others titled ‘Critical Appraisal of the UK’s Regulatory Regime for Combustible Facades²⁰ multiple shortcomings were highlighted; *“As the vehicle for allowing combustible products on tall buildings, the test does not specify the extent of cavity barrier deployment, while ignoring features present in real buildings, such as windows, vents or other openings, despite a test rig height of more than 8 m.”*

The report goes on, presenting a litany of errors, coming to a damning conclusion *“There is no direct connection between the façade system in the test and the actual façade system the results deem compliant.”*

In her 2019 report to the Grenfell Inquiry, outlining interim recommendations, Arup’s Dr Barbara Lane²¹ called for an “immediate moratorium” on the use of 8414 – until the standard is updated to “include window openings and other relevant fixtures and fittings.” An amendment to BS 8414 was made the following year, 2020, appears not to incorporate such an update, although it is unclear whether Dr Lane’s concerns were considered.

Regardless, for mass timber to be considered for use in external wall systems of high-rise residential buildings, it will be necessary to have in place a robust testing regime for such systems to allow a significant body of evidence to be produced demonstrating safety.

Potential Solutions

Government & British Standards Institute

- Consider developing a new British Standard, suitable for testing external wall systems fixed back to mass timber substrates, to sit alongside the existing BS 8414

²⁰ Judith Schulz, Darren Kent, Tony Crimi, Jim L. D. Glockling & T. Richard Hull - ‘Critical Appraisal of the UK’s Regulatory Regime for Combustible Facades <https://link.springer.com/article/10.1007/s10694-020-00993-z>

²¹ Dr Barbara Lane, “Grenfell Tower fire safety investigation: Interim Recommendations” – Accessible online at <https://assets.grenfelltowerinquiry.org.uk/Dr%20Barbara%20Lane%27s%20report%20on%20interim%20recommendations%20BLAI00000001.pdf>

2.5 Wider industry impacts

Simply put, mass timber has faced a challenge across all typologies due to the combustibility of the material and heightened awareness of the risks, both real and perceived, that are associated with the use of combustible materials for the primary structure of a building.

To illustrate this point, one leading fire engineer recounted a meeting in early 2022 with a major insurer to discuss property insurance for a central London commercial project (i.e., Unaffected by the combustible materials ban) approximately £100m in value. The insurer's opening question was "*is the CLT combustible?*", to which the engineer answered "yes". The response from the insurer was short and to the point, essentially "*we are not interested*". Following this meeting, the instruction from the developer to the design team was to work up a steel & concrete alternative.

Further evidence that mass timber's combustibility is having a prohibitive effect outside the scope of the combustible materials ban itself, was found in the educational sector. Educational buildings are not currently included in the combustibles ban. However, a project architect at a leading sustainability driven architectural practice told of how two new 2-storey schools in Scotland were forced to turn from glulam frame to steel frame at technical design stage. The client was asked by building control and the fire brigade to carry out multiple large scale fire tests of key details. The architect reported that the high costs of the tests (approximately £100k each) coupled with a lack of capacity at the testing facility (leading to a potentially significant delay), led the client to make the decision to switch to a steel frame.

This is a common story. Developers are requested to carry out project specific large scale fire testing incurring significant incremental costs vs other materials. Testing capacity in the UK appears to be lacking. Further investigation should be considered. We feel that further qualitative evidence should be gathered from the residential sector, through a listening exercise focusing on a range of clients (Local Authorities, Housing Associations & Private Developers) to build further detailed understanding of the wider impact that negative perceptions are having, outside the scope of the ban, i.e., under 18m.

Potential Solutions

Industry

- Further investigate impacts of the combustible materials ban on the residential sector, outside the scope of the ban itself

Developers

- Facilitate open sharing of project-specific large scale fire testing data. Explore the potential for data sharing to reduce need for project-by-project testing

Government & British Standards Institute

- Provide funding for incremental project costs
- Increase UK testing capacity



Stora Enso, factory floor



Section 2

Mass Timber, Fire Safety & Regulation (cont.)

2.6 Competency

Earlier this report claimed there was a *relative* lack of know-how across the design and construction sectors with regards to designing mass timber buildings, when compared with construction methods that use concrete and steel frame structural systems. Nowhere is this more apparent than in the field of fire engineering.

To begin to understand why it's important to note that in relation to The Building Regulations, mass timber is a novel building material; buildings with a mass timber structure are not currently considered a "common building type" by professionals. This means they need a more detailed approach, based upon an in-depth understanding of the fire dynamics in this type of construction. In some ways, this may provide an opportunity for mass timber to drive an adoption of higher building standards. Sam Liptrott, leading fire engineer of timber buildings and Director of OFR Fire Consultants, explained why at an oral evidence session of the Environmental Audit Committee in November 2021, saying "*the level of care and attention that gets applied to timber buildings, because it is recognised as a novel building type, is far more and in far more detail than in a steel and concrete.*" Elaborating further on how this might drive higher quality, Liptrott suggests "*the move to novel building materials gives us more control over the quality of the construction and results in higher quality buildings... because people care more.*"

However, there is a distinct lack of competent professionals that hold this knowledge. The Structural Timber Association summed up the predicament succinctly in Volume 6 of their Fire Safety in Use: "*The fire safety design of mass timber buildings is a specialised area requiring specific knowledge and relevant experience in the fields of, for example, combustion, fire dynamics, heat transfer and structural response. Such expertise is not widely held by a large quantum of fire safety professionals.*"

This was backed up by Sam Liptrott, later in the oral evidence session of the Environmental Audit Committee: "*The issue we have with [mass] timber is there is a relative paucity of competence when it comes to the ability to design and build in [mass] timber.*" And writing in the journal The Developer, Steve Webb, structural engineer and director of Webb Yates, described how in his experience many fire engineers simply have an '*aversion to timber*',²² in his experience.

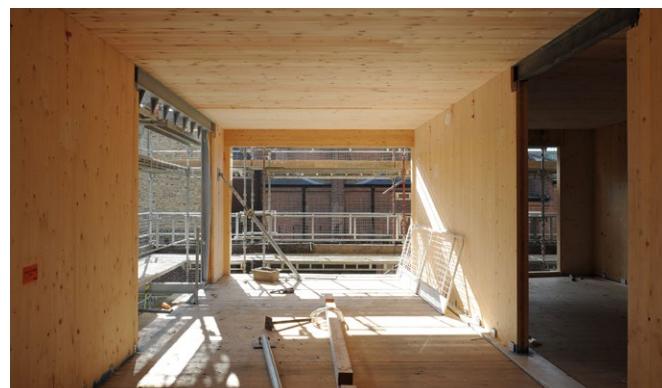
Further evidence along these lines was given by Professor José L. Torero, Professor Civil Engineering and Head of the Department of Civil, Environmental and Geomatic Engineering at University College London, during the Gardiner & Theobald 'Mass Timber Office Forum':²³ "this is a very complex problem, and therefore requires highly competent individuals that must deliver the solution. The solution is not trivial, with other materials you might have simpler approaches that are accessible to a large number of people, whereas with [mass] timber the approaches are always complex and require a lot of detail. The knowledge is simply accessible to a very small number of people."

In addition, through mostly anecdotal evidence, a shortage of skills has been highlighted within other key professions, Architects & Structural Engineers, both of which are instrumental as the specifiers of materials. This point requires further investigation.

Potential Solutions

Industry

- Engage with academic institutions, such as UCL & Edinburgh, the Institute of Fire Engineers, or another relevant professional body, to dramatically increase competency amongst the fire engineering profession
- Engage with RIBA & IStructE to establish 'timber working groups' for Architects & Structural Engineers



Cobalt Place, Eurban. Photo by David Grandorge.

²² Steve Webb, 'The Trouble with Timber, What's Stopping the Switch to Wood?' in The Developer www.thedeveloperlive/opinion/opinion/the-trouble-with-timber-whats-stopping-the-switch-to-wood

²³ G&T Mass Timber Office Forum – full series available on YouTube: www.youtube.com/playlist?list=PLrFwHvNZGkkFtYl2f8IMEYT7JpMwWl7Kn

2.7 Current Understanding

Despite the challenges laid out previously, there is a great deal known about the performance of structural timber in fires. There is a good level of understanding of effects such as charring, so-called ‘self-extinguishment’ or ‘burn out’, delamination and pyrolysis. Professor José L. Torero summarized this to the same Mass Timber Office Forum session; “*we know an enormous amount about timber behaviour, timber has been studied since the 1920s. We understand quite well how adhesives work, we understand quite well how delamination works, we understand quite well how self-extinguishment can be managed. All that information is there.*”

There are many measures that are known to reduce the risks associated with fires in timber buildings, such as compartmentation, ventilation, encapsulation of timber elements, limiting exposed CLT surfaces, using concrete for ground floor structure, installing sprinklers, and using a non-combustible external wall build up. This is not however a simple shopping list of measures, a highly competent fire engineer should always be appointed, and on large and complex buildings, it is recommended to appoint a second fire engineer to ‘peer review’ the work of the primary consultant.

Given that this is a complex topic, and not the author’s area of expertise, further reading is recommended:

OFR Fire Consultants, through the Structural Timber Association Special Interest Group (STA SIG) on CLT, undertook a comprehensive literature review of existing results of large-scale fire testing. The resulting document presents a good overview of current knowledge and can be accessed publicly on the STA website.²⁴

The STA have also produced guidance on how current understanding of fire performance relates to the Building Regulations, in the “Structural timber buildings fire safety in use guidance Volume 6 - Mass timber structures”, also accessible online.²⁵

Another good source of information comes from the Research Institute of Sweden (RISE)²⁶ who have multiple research projects towards the fire safe implementation of mass timber in tall buildings, such as their ongoing ‘Glue Line Integrity’ in Fire tests.

2.8 Current Ongoing Research

In addition to current understanding there are several initiatives aiming to build knowledge or develop designs that respond to current regulation. These are outlined in brief below. It is hoped that the findings of some of these initiatives will help further the implementation of fire-safe timber buildings.

a. New Model Home – Waugh Thistleton Architects with UCL and others. The New Model Building, to be published early 2022, provides an approved solution for residential buildings up to 18m. The design features a non-combustible external wall build up and will create a suite of standard details that can be adopted by others. The practice has sought the approval of a national warranty provider, and following publication intends to set about seeking approval for a New Model Building up to 30m.

b. Structural Timber Association CLT Special Interest Group – Mentioned above, the group is undertaking a series of large-scale fire tests, underway currently in Poland, looking at a range of compartment sizes in residential and commercial typologies, with several treatments applied. Results will be reviewed and published later this year

c. RISE Glue Line Integrity in Fire testing - Large scale fire testing by RISE, examining the behaviour of various glues in CLT when exposed to fire.

d. Arup – Recently carried out some in-house large scale fire testing in France, examining the behaviour of HBX glue in CLT when exposed to fire. It is unclear however whether the results will be suitable for use by the wider industry.

e. UK Fire Hub Website – developed by Swedish Wood, and led by Julie Bregulla, previously of BRE, this will be a repository of peer-reviewed fire performance information relating to timber, both mass timber and timber frame. Intended to be a comprehensive resource that contains all known scientific results. Will not include speculative or other non-peer-reviewed information.

Despite the challenges laid out previously, there is a great deal known about the performance of mass timber in fires.

²⁴ Structural Timber Association CLT Special Interest Group, Information Zone, www.structuraltimber.co.uk/sectors/clt-special-interest-group/information-zone

²⁵ Structural Timber Association, Structural timber buildings fire safety in use guidance Volume 6 - Mass timber structures www.structuraltimber.co.uk/assets/STA_Vol_6_Fire_Safety_Mass_Timber_Compliance_Oct_2020_v1.1.pdf

²⁶ Research Institute of Sweden www.ri.se/en/what-we-do/projects/fire-safe-implementation-of-mass-timber-in-tall-buildings



Section 2

Mass Timber, Fire Safety & Regulation (cont.)

2.9 Further Research Requirements

Whilst there is a good level of understanding of how mass timber performs in certain applications, with further work underway to increase that understanding, it is felt by leading fire engineers that significant further research and testing is required to demonstrate its fire safety. Through dialogue with the Mass Timber Know How group, several areas have been outlined by OFR Consultants with the intention *“to identify and convey key fire safety issues that are considered barriers to the widespread and mainstream adoption of mass timber in commercial premises.”* This has been worked up into a fully costed research proposal outline in the box below.

Listed here are the areas highlighted by OFR as requiring further research.

- A compliance roadmap
- Enclosure fire dynamics
- Glue-line integrity failure (GLIF) or ‘delamination’
- Self-extinguishment
- Standardising CLT
- External fire spread
- Internal fire spread via linings
- Fire brigade intervention
- Passive fire protection (PFP)
- Connections – between elements in both hybrid and all-timber structures
- Encapsulation performance
- Automatic fire suppression system performance
- Buildability and real building details

...it is felt by leading fire engineers that significant further research and testing is required to demonstrate mass timber's fire safety.

Potential Solution – in depth

Initiative Title: Research questions on the path to mainstream adoption of mass timber in commercial construction: outline research proposal

Project Team (indicative):

- OFR Consultants – Lead partner
- University College London – research support
- University of Edinburgh – research support
- Heyne Tillet Steel – rig structural design and detailing
- Hybrid Structures – rig procurement, installation & demolition.
- Stora Enso – engineered timber supply
- ITB – fire testing laboratory
- Henkel – adhesive supply and input; and
- Fermacell – dry lining supplier / specialist

What is it?

A fully costed research proposal for research, including large scale fire testing, with a view towards creating “a sufficient body of research to mitigate key fire safety concerns and, in the process, create a logical, evidence-based pathway, for the wider acceptance of mass timber

in commercial buildings.” Looking in detail at myriad real-world circumstances i.e., Column interfaces w/ beams, CLT walls and floors, pipe holes and other penetrations, the effects of weathering.

Why is this work important?

This workstream aims for the low hanging fruit: mainstream adoption of mass timber in commercial premises, i.e., those of predominantly retail and office use. The research aims towards an insurable building typology for commercial use.

Commercial typologies are not restricted by regulation, & the level of ambition is much higher and complex with commercial, looking towards 10-15 stories. Timber becomes the thing that unlocks viability in less-valuable outskirts.

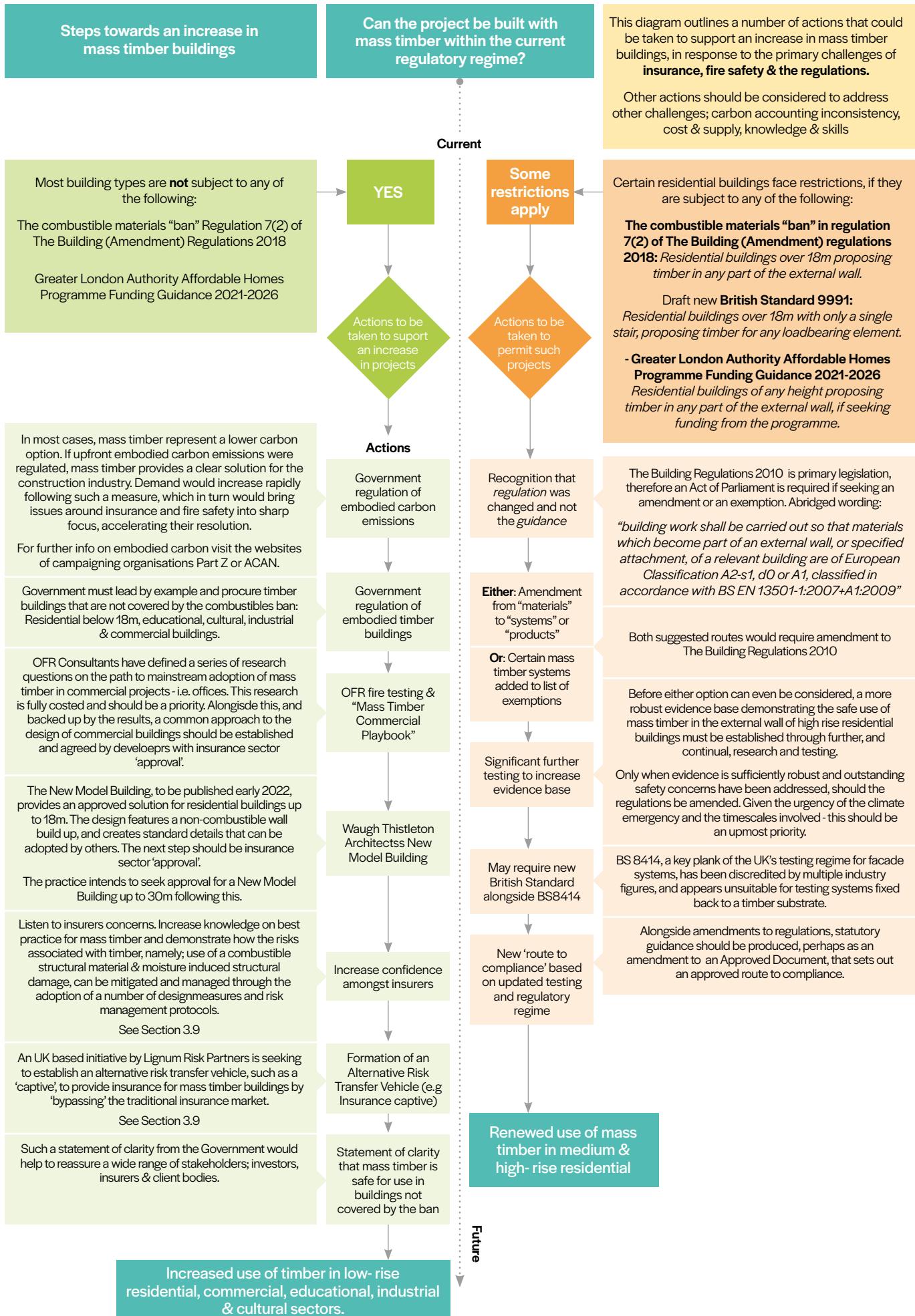
What will the outputs be?

All outcomes from the programme will be made available through an appropriate body. This is envisaged as a dedicated web platform / archive / wiki.

Total Cost - £1,400,000 + VAT.

In-kind support (materials & construction) - £420,000 + VAT.

Residual remaining to be funded - £980,000 + VAT.



“

The London insurance market is undoubtedly going through a hard market cycle, having enjoyed 10 to 15 years of favourable trading conditions. The result is a “flight to safety,” meaning that trying to bring “new” technologies and products to insurers in the current market cycle is significantly more challenging, and mass timber sits firmly in this category.

Couple the above with a number of years in succession where insurers have made losses in the construction and property sectors, and rapidly introducing the large-scale adoption of mass timber creates understandable concern.

That being said, huge progress has already been made, and the solutions are becoming clearer all the time; with quality, clear and open communication being at the heart.

Dominic Lion, Associate Director - Real Estate, AJ Gallagher

*B&W Building, Waugh Thistleton Architects for
The Office Group. Photo by The Office Group.*





Section 3

Construction & Property Insurance

3.1 Introduction

This section is about the significant challenges faced by developers when seeking insurance for developments that use mass timber within the primary structural system of a building. Significant increases in premium rates, and in extreme scenarios a lack of availability of cover, for buildings using mass timber, are currently precluding its use in many cases. For the purposes of this report, we shall be focusing on Construction (whilst the project is on site) and Property (post-completion) Insurance. This includes latent defects, material damage, and business interruption insurance. This report doesn't seek to address the challenges around obtaining Professional Indemnity Insurance.

The following section refers not only to fire risks but begins to talk about moisture too. The perils of water and fire are of equal concern to insurers.

Some major projects are succeeding to gain both construction and property insurance – demonstrating that it is possible to design and build an insurable building that incorporates mass timber. It's worth reiterating at this point: as long as risks are mitigated in the right way, insurance will be available. However, there are several challenges, which this report will go on to outline now.

Significant increases in premium rates, and in extreme scenarios a lack of availability of cover, for buildings using mass timber, are currently precluding its use in many cases.

3.2 Background

Post 2008 the global insurance market received large levels of capital investment which both increased the appetite of existing insurers but also saw an influx of new insurers into the market. This increase in available capacity and a relatively benign loss environment meant that the cost of insurance fell dramatically, and policy coverage widened from 2010 leading to the soft market commentators refer to.

The softening of the market meant that premium income fell as coverage naturally widened due to positive competitive market dynamics. However, these softening dynamics meant that incurred losses were more acutely felt. Many long-established markets could, or were prepared to, ride out this market cycle but many of the new entrants, without longstanding books of business, chose to withdraw from the market.

The combination of capacity withdrawal and the need to return underwriting books to profit has meant that since 2018 the market has seen significant rate increases, a dramatic restriction in policy coverage and a **strong reluctance to provide cover for more volatile or challenging risks**. This is known as a hardening, or hard, market.

As of February 2022, many of the markets that remain are still working towards achieving profitability; the wider claims context and general global economic market dynamics mean that the insurance market remains in the middle of hard market cycle and may do so for some time to come.



Section 3

Construction & Property Insurance (cont.)

3.3 Where are we now?

The Grenfell fire, the following cladding scandal and the ‘ban’ on combustible materials in the external walls of new residential developments over a certain height, explored in the first section of this report, has had a significant effect on the Property insurance market.

In the context of timber buildings, fire risk is referred to as a “known unknown” and has had to be priced into property insurance policies for all buildings, regardless of type. In some cases, this has led to renewal prices increasing between 5 and 10-fold, or in extreme cases the non-availability of cover.

Whilst fire losses are relatively rare, water damage claims have been rising rapidly in recent years for all buildings. Whilst risk management practices are improving around water monitoring and leak detection, there is still some way to go until we see widespread adoption of these property protection measures.

Given the background and the current context, the availability of insurance has become a major barrier to the adoption of mass timber in developments.

In conversation with head of development at one of the country’s leading private property developers, we learnt that 6 of their developments had recently been ‘flipped’ from a mass timber or hybrid frame to concrete or steel, due to the lack of available property insurance. These developments were all of a commercial typology, therefore not impacted by prohibitive regulation. This experience was shared by a wider group of the UK’s largest private developers.

We also spoke to a government client, working on a regional school building programme of £1.3bn in value. The desired option was to use a Glue Laminated timber frame, driven by sustainability concerns. Despite this intention, their insurance broker had advised them that insurance premiums for the completed assets, would likely be 300% higher due to the use of timber. Owing to the fiduciary obligations of this public client, this increase was enough to preclude the use of timber.

The availability of insurance has become a major barrier to the adoption of mass timber in developments.

Furthermore, at the industry-leading ‘Mass Timber Office Forum’, convened by cost consultants Gardiner & Theobald throughout 2020 & 2021, more than 100 participants, representing many of the UK’s most prominent private developers, identified ‘insurance’ as being the greatest barrier to the use of mass timber.

All the given examples are from commercial and educational typologies, which both have a lower risk profile than residential.

3.4 What solutions presently exist for Construction Insurance?

It is important to note that Construction Insurance for mass timber buildings, which covers projects whilst on-site, is available, but insurers are very variable in their appetite and client/risk selection. Here we are referring to the following use classes/type; commercial, retail, educational, leisure and light industrial (warehouses). Private residential projects and large-scale multi-dwelling developments should be considered separately.

Chase Underwriting International have recently launched a UK Mass Timber Construction Insurance Facility for projects between £10-£200m. Chase have responded to the current situation with the announcement of a facility which fills the gap in the UK construction insurance market with an equitable policy that matches the needs of developers wanting to utilize mass timber products in their projects. This facility is supported by multiple insurers each taking on just a small slice of the risk, with Chase Underwriting the managing agent.

Above £60m the projects tend to be of a hybrid nature. Insurance is available for these albeit more difficult to place. Hybrid structures are seen by insurers as a better risk than pure timber.

Regardless of size and nature of the project, an experienced broker must be used, and insurers must be engaged very early on in the planning of the project, ideally at RIBA Stage 2.

Risk management is the essential theme around the successful purchase of construction insurance. The Structural Timber Association’s “16 Steps to Fire Safety on Construction Sites” is a useful guidance document and provides a touchpoint for insurers.²⁷

²⁷ Structural Timber Association, ‘16 Steps to Fire Safety’. Available online from: www.structurtimber.co.uk/library

Auftrags-Nr.: MP06453
Bauvorhaben: The Black & White Building
Bauteilnummer: A1_C-E/4_W07
Oberfläche/Qualität: 140mm LENO IndiNordSi abge
LKW-Nummer: 2



Orsman Road, Waugh Thistleton Architects.
Photo by Ed Reeve.

3.5 What solutions presently exist for Property Insurance?

Currently there is no commonality or facility available for either mass timber or hybrid properties. Availability of insurance is extremely variable. Finding Property Insurance has been reported to be considerably more challenging.

Success partly depends upon who your broker is. We have worked closely with brokers from Gallagher & Marsh to understand market conditions, two of the firms with experience in securing insurance for mass timber buildings. An example of the approach taken by brokers to simplify the process for developers and design teams, can be found in Marsh's pamphlet "*Building with cross laminated timber: information required by insurers.*"²⁸ This document outlines a series of questions that will be asked by underwriters, and acts as a checklist for developers. There is an opportunity for new guidance here, to help further simplify the process.

Brokers have reported that most underwriters will rely upon information produced by the RISCAuthority and The Fire Protection Association (FPA). Another example highlighting the information that insurers will require is the 'IQ 6' questionnaire developed through the RISCAuthority and published by the FPA, titled "Building System Questionnaire for Massive Timber System use in high-rise applications."²⁹ The document comprises 32 pages of questions and requests for test evidence, to demonstrate properties ranging from lamination strength following submersion in water to the relative structural performance of different glue types used in the mass timber.

Whilst it is recognised that much of the information requested is important to ensure protection of the building, it remains unclear if underwriters and risk assessors can interpret the wide breadth of information the questionnaire calls for. However, clients and their design teams should consider consulting both questionnaires to understand the information and approach required by insurers.

Perhaps part of the problem for insurers is that there is too great a variation in projects coming forward, without corresponding performance data to be able to accurately assess the risk. Developers should consider moving towards a common approach to design and risk mitigation in mass timber buildings, establishing standardised designs that respond to insurers concerns, above and beyond Building Regulations requirements. This has been discussed in the TAH's Developer's Working Group.

Potential Solution

Industry

- Engage with the FPA & RISCAuthority, ideally through a 'neutral' organisation i.e., not a timber trade body, towards the creation of a common approach for insurable mass timber buildings i.e., "a mass timber playbook" or "common risk mitigation rules"

Insurance sector

- The insurance sector should consider creating 'Mass Timber Property Insurance' facilities which pool available insurance from multiple providers, using Chase Underwriting's construction facility as a model.
- Brokers should consider developing clear guidance for developers on how to approach property insurance.

²⁸ Marsh, "Building with Cross Laminated Timber" www.marsh.com/uk/industries/real-estate/insights/building-cross-laminated-timber-insurance-considerations.html

²⁹ IQ 6 Questionnaire, RISCAuthority & Fire Protection Association



Section 3

Construction & Property Insurance (cont.)

3.6 Insurance industry perspective

Apart from broader market dynamics, why is it difficult to gain insurance for mass timber? Earlier this year, an insurance industry white paper was published setting out exactly why. What is clear from the report,³⁰ published by RISCAuthority and the Fire Protection Association, is that insurance is in fact available, but only if risks are adequately managed.

Insurance is all about risk; but the insurer's appetite and available capacity for any project rests primarily upon an assessment of all aspects of the design, the likely financial impact of any water or fire damage event, and the preventative & protective measures in place.

Given wood's susceptibility to both fire and water damage, it follows that insurers foresee higher maximum losses and price as such. For property underwriters, there are fewer built assets upon which they can base their risk assessment.

A broker recently described an ongoing 'epidemic' of water damage claims, in all types of construction. RISCAuthority echo this, stating "Escape of Water alone is the greatest category of loss in the domestic and residential sector – greater than fire and security combined." Water ingress, pooling, flooding or sprinkler leakage, all create more concern for insurers if any type of timber is involved.

The RISC Authority report makes clear that they feel the UK's Building Regulations have "little relevance or impact" when it comes to the insurance of mass timber buildings, that regulatory minimums are not adequate from a property protection perspective.

Insurance is all about risk; but the insurer's appetite and available capacity for any project rests primarily upon an assessment of all aspects of the design, the likely financial impact of any water or fire damage event, and the preventative and protective measures in place.

Looking more broadly, insurance providers' assessment of mass timber as a risk is based on several factors. These can be grouped into broad areas of concern; fire performance, moisture, durability, repairability, concerns over quality of design and construction, and concerns over competency. Several the most frequently mentioned problems are outlined below.

- There is a significant lack of performance data specific to mass timber buildings (how buildings fare in a loss event and how they have been repaired) by which insurers can price risk and dictate premium levels.
- In the absence of the ability to accurately assess the Probable Maximum Loss, insurers must therefore assume (and price) for a total property loss in the event of a fire.
- Similarly, insurers estimated maximum losses for escape-of-water claims are higher for mass timber.
- Perception of risk exposure is poor (i.e., "timber burns") and the data to counter this perception hasn't been sufficient to date.
- Still a high level of avoidable claims on traditional buildings giving insurers a lack of confidence in ability of all but the very best to implement effective risk management on construction sites – i.e., the contractors have a role to play.
- A misjudged assumption that the fire brigade will allow a total property loss after life has been saved.³¹
- An increase in losses in general across all classes of construction, but particularly from escape-of-water claims (all construction types).
- Lack of data or specific project reports about the repairability of mass timber in the case of water or fire damage.
- Lack of certification and accreditation for trades which are deemed more of a risk on mass timber construction sites.
- Design teams approaching insurers too late – early mitigation steps not taken.
- Insurers looking for best in class design but finding limited experience of design partners.
- Lack of insurance industry trust in UK construction/property sectors generally in wake of the Hackitt Review and Grenfell inquiry.

These factors combine to result in increased costs of insurance, and in some cases a resistance to provide even basic cover for all-timber and hybrid mass timber buildings, notwithstanding a select few cases. This is despite the fact that the additional risks associated with mass timber can be managed and mitigated through high levels of competency in design and construction.

However, for the first time, the RISCAuthority paper also sets out specific design features, both desirable and undesirable, that will affect the risk profile of a building. Some of these are highlighted below.

³⁰ RISCAuthority & FPA, "Insurance Challenges of Mass Timber Construction" www.riscauthority.co.uk/news-and-features/insurance-challenges-of-massive-and-mass-timber-construction

³¹ The assumption that the fire service will allow for total property loss in the event of a fire in a mass timber building is here characterised as misjudged or incorrect. It is the author's understanding that the fire service has a duty under the Fire and Rescue Services Act to protect life and property in the event of a fire. Every effort would be made to minimise fire damage where possible. Therefore, it is incorrect to suggest fire and rescue services would 'allow' the total loss of any building, as some in the insurance sector have been.

3.7 Mitigating Risk in Mass Timber Buildings

It's entirely possible to build large mass timber buildings within the current landscape, as some are demonstrating, but for the project to gain insurance however, it will require the adoption of enhanced approaches to risk mitigation and management. Premium rates and availability of cover essentially rely upon a risk assessment of the project (by underwriters & risk assessors). It is about getting the right information to the right insurer. The risk profile is affected by the design.

Whether it's daily site visits or hourly water patrols, undertaking project specific fire testing or appointing two sets of consultants to peer review each other's designs, there are several things that developers and design teams can do to reduce the risk profile of a project. The approach will be different for each project and should be arrived at through third-party negotiations with Building Control authorities, the Fire Service, and insurance providers.

Developers could consider the adoption of the following measures. This list is indicative, not conclusive, and expert advice should always be sought from an experienced team of consultants, the insurance broker, an experienced contractor and a relevant industry body such as the Structural Timber Association.

- Appoint a competent and demonstrably experienced design team – ideally using consultants that have worked with mass timber systems previously
- Engage early on with the insurance broker and providers – ideally at RIBA Stage 2
- Adopt a 'belts-and-braces' approach to Fire Safety
 - Early appointment of an experienced Fire Consultant
 - Consider appointing a second fire consultant – to peer review the design
 - Consider that large scale fire tests may be required
 - Pay particular attention to combustible voids, particularly risers; consider full encapsulation or complete fill with non-combustible insulation
 - Avoid green walls
 - Consider hybrid structures
 - Include fire suppression (sprinklers)

Engage early on with the insurance broker and providers – ideally at RIBA Stage 2

- Adopt enhanced risk management protocols
 - Consider use of a digital twin – with the possibility to record on-site photographs of all details as built and link these back to a BIM model of the building for continued management of the property post-completion.
 - Apply the Golden Thread principle to information management
- Design a durable structure
 - Introduce a pitch to the roof if using solid CLT – or consider switching to an alternative roof construction if flat roof is required.
 - Include details such as drainage holes to allow passage of water through the wood in high-risk areas.
 - Consider avoiding CLT for balcony or walkway construction.
- Consider a 'mixed' structure – using concrete for the structural material of the ground floor and core
- Adopt early warning systems in the completed building
 - Consider installing moisture sensors within the mass timber in high-risk locations
 - Install leak detection systems in wet zones as a bare minimum
- Appoint a competent and experienced contractor
- Protect the structure on-site
 - Develop a rigorous water management plan with the contractor – follow timber industry guidance around keeping wood dry.
 - Protect the structure from moisture ingress using factory-applied coatings and on-site coverings.

Potential Solutions

Industry

- Commission production of readily understandable, visually based, guidance for clients & design teams "How to approach insurance for mass timber buildings"
- Establish standard 'pre-approved' details for mass timber construction that answer insurers concerns



Section 3

Construction & Property Insurance (cont.)

3.8 Risk Management

Several new approaches to risk management, some utilising latest digital technology, are being brought forward, which could help increase insurer confidence in mass timber buildings.

- The 'Golden Thread.' First called for by Dame Judith Hackitt. Summarised by Buro Happold as "*a golden thread of information is an accurate, up-to-date record of all data required to maintain and operate a built asset.*"³³ Employing the principle will lead to higher quality buildings and greater oversight on all aspects of design and construction.
- Digital Twins. A digital twin is a virtual representation of a physical asset. Applied to buildings, they could help to more rigorously log as-built details and monitor maintenance and repairs over time.
- Digital moisture monitoring. An array of technology can be installed to closely monitor for water ingress and escape-of-water. These include moisture sensors embedded into the mass timber, leak detection systems, automatic shut off valves & notification systems to asset managers.

Potential Solutions

Industry

- Accelerate adoption of enhanced approaches to risk management including digitally based early warning systems

3.9 Emerging Solutions

The following are initiatives that presently exist to try and overcome the significant challenge of insuring mass timber assets. Here I've included a summary of what the initiative is, what the benefits are, as well as any drawbacks or gaps that remain.

i. Chase Underwriting International - Mass Timber Construction Insurance Facility

A product for mass timber commercial projects of £10-£200m value, providing Construction All Risks insurance. This is a risk management lead product supported by multiple insurers. This is a facility that is available now, with developers encouraged to contact Philip Callow at Chase through their appointed broker.

- ✓ Fills a gap in construction insurance market.
- ✓ Immediate solution for eligible projects – as it is already available.
- ✓ Chase report that up to £200m in value can be covered through the facility
- ✗ There is no equivalent facility for Property Insurance (insurance of completed buildings)
- ✗ Premiums will be higher than with more conventional materials

ii. Mass Timber Property Insurance Forum

An educational and knowledge sharing forum that was initiated by Dominic Lion, Real Estate Broker at Gallagher and is now being jointly run with the Timber Accelerator Hub. The intention is simple, to increase confidence amongst property insurance underwriters by increasing understanding and knowledge of mass timber products, which are relatively new to much of the market. The first forum was held in April 2021, with 2 further sessions held in 2021. The first session of 2022 took place in February. The topics for these are outlined below.

- a. **April 2021.** "How to safely design a high-rise mass timber building – A Case Study on Dalston Lane". Presentations from Andrew Waugh and David Lomax, Waugh Thistleton Architects, and Alan Dowdall & Gavin White, Ramboll.
- b. **July 2021.** "Fire safety in mass timber buildings; risk, spread and extinguishment". Presentation from Sam Liptrott, OFR Consultants.
- c. **October 2021.** "Repairability of mass timber structures". Presentation from Phillip Zumbrunnen and Jonathan Fovargue, Eurban.
- iv. **January 2022.** "Durability of mass timber structures". Presentations from Andrew Lawrence, ARUP and Sarah Wakley, Leaksafe.

Direct engagement such as this aims to increase confidence, unlock available cover, and reduce premiums for mass timber buildings to a comparable level to other structural systems. The TAH is in discussions with Waugh Thistleton and others working towards an in-person insurance summit.

- ✓ Direct engagement with property insurance underwriters
- ✓ Large and engaged audience
- ✓ Opportunity to listen directly to the concerns of underwriters
- ✓ Opportunity to present and communicate best practice in mass timber design and increase understanding of this stakeholder group
- ✓ Provides a conduit to communicate latest large scale fire test data to insurers as it becomes available

³³ Buro Happold, "How the Golden Thread of Information Will Impact Our Clients" www.burohappold.com/articles/how-the-golden-thread-of-information-will-impact-our-clients

iii Alternative Risk Transfer Solution by Lignum Risk Partners

An ongoing attempt to set up an 'Alternative Risk Transfer' insurance vehicle, such as a 'captive' insurer, for mass timber buildings, developed by Tim Den Dekker, Oliver Schofield and Roger Flaxman. A captive is an insurance entity created and owned by one or several industrial / commercial entities, established to provide insurance cover for risks of the owners. This could bypass the traditional insurance market and provide a solution for members.

This is a proven solution to analogous situations in which insurance has been unavailable through the traditional market. Wren Association provides PI insurance for architects through such a vehicle, after premiums for PI were heavily inflated in the late C20th, leading to the collapse of several firms.

- ✓ Captives are a viable proven alternative to the traditional insurance market
- ✓ Would deliver long term committed stable insurance protection
- ✓ Would provide a circle of confidence from improved risk management and minimum standards
- ✓ Would create a community of trust and cooperation
- ✗ Could potentially leave large sections of the industry without a solution, as it may act as a member's club
- ✗ May take some time to fully develop

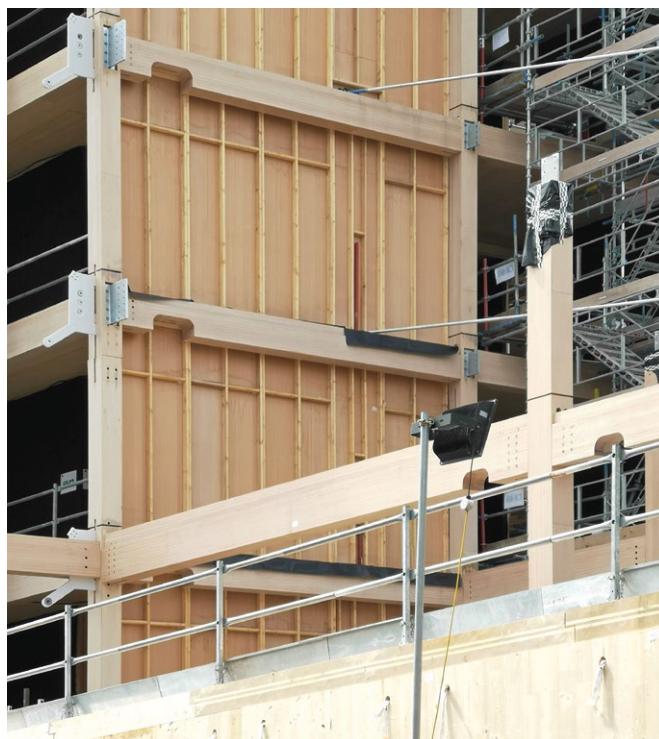


Photo: Waugh Thistleton Architects

3.10 Insurance: a look at further ideas that have been discussed

i. Mass Timber Commercial Playbook

Aim: To inform the design of Glulam/CLT/Hybrid offices - primarily from an insurance perspective. OFR's experience shows design of mass timber offices converges on a set of principles which are standard. This could be presented in a white paper, with testing to back it up, following which engagement should be sought with the ABI, FPA and others to agree such an approach for insurable mass timber commercial buildings.

ii. Enhanced risk management on sites through greater certification & accreditation of trades

Certain trades such as Hot Works are a greater risk to mass timber structures. In some countries such trades have more stringent certification & accreditation schemes. This may help increase confidence in UK construction sector.

iii. Government backed re-insurer for mass timber buildings

On the basis that timber must form part of Government's net-zero strategy, a Gov backed reinsurer could be formed along the lines of Flood RE (flood damage) or Pool RE (terrorism). Whilst included here, this idea has been discredited as mass timber's insurability doesn't represent the same kind of existential risk as terrorism or flooding.

iv. Data sharing initiative

Pooling available insurance data on mass timber buildings that exist to create a larger data set that could be drawn upon by insurers.

Potential Solutions

Industry

- Continue engagement and education of insurance industry through Timber Accelerator Hub & Gallagher's 'Mass Timber Property Insurance Forum'

Developers

- Developers should strongly consider establishing Alternative Risk Transfer vehicles, as is currently being explored by several companies. Sometimes referred to as the "Timber Construction Industry Captive"

Insurers

- Explore the creation of a mass timber insurance data pool (premiums & claims data of completed mass timber buildings)



Conclusion

Mass timber is an incredibly useful tool in the fight to mitigate climate change, but it is a tool which is currently unattainable for some.

Following 5 years of setbacks for mass timber in the UK, set out here in some detail, there is now a huge amount of progress being made right across the industry towards the resolution of some of these challenges, the widespread adoption of mass timber, and a nature-based transformation of the built environment.

This report has set out several potential solutions, peppered throughout the document. Some of these have been agreed by a number of stakeholders as key recommendations and are collated towards the front of the report. These include points to be actioned by the Government, the construction industry, the timber industry and the insurance sector in unison.

The Timber Accelerator Hub has demonstrated that the solutions exist in a network based, collaborative and coordinated approach. There are other examples of how such an approach can achieve huge success, that haven't been explored here. Readers are pointed towards the network of housing providers, local authorities, suppliers, architects and contractors created by Woodknowledge Wales.

This report makes it clear that there is a big role for Government. Following the publication of the UK's Net Zero Strategy, three UK Government departments have initiated a policy process to increase timber in construction. This is a sign of positive things to come.

However, as a final note to this report, readers are again directed towards the work of regional Governments, in British Columbia & Baden-Württemberg, both of which have established state programs to support mass timber construction. These examples, in Wales, Canada & Germany, provide us a model to overcome the challenges set out in this report in a coordinated way. They are models we should follow.

Regional Government Programs

Mass Timber Demonstration Program, British Columbia, Canada

The Mass Timber Demonstration Program (MTDP) in British Columbia provides funding for incremental costs in the design and construction of buildings that demonstrate emerging or new mass timber or mass timber hybrid building systems and construction processes. Additionally, the program will share any lessons learned, results, and research findings to help support future mass timber projects in the province. A number of projects have been built using mass timber as a result.

Holzbau Offensive, Baden-Württemberg, Germany

The state-led timber construction offensive provides funding and support for mass timber within this province of Germany. Practical support, training and information, research and funding are provided by the state Government to help more projects get off the ground. The program has yielded stunning results in the form of high-quality mass timber buildings throughout the state.

Footnotes

The findings of this report were derived from stakeholder engagement with individuals from a wide array of organisations. Inclusion of an organisation on this list by no means represents an endorsement of the content of this report by that organisation. This list is included for indicative purposes of our methodology only.

ADP	Chase Underwriting	HTA	Quattro Design
AHMM	City of London Building Control	IGBC	RIBA
Alliance for Sustainable Products	Climatewise	Igloo	Rock Townsend
Architype	CSIC	Kiss House	STA
Argent	DEFRA	KLH	Stanhope
Arup	dRMM	Landsec	Stewart Milne
Aviva	Edinburgh Napier	Laudes Foundation	Stora Enso
Bailey Partnership	Elliott Wood	Leaksafe	Stride Treglown
Better Buildings Partnership	Engenuiti	Lendlease	Structural Timber Association
BGY	Eurban	Lignum Risk Partners	Swedish Wood
BK Structures	Gallagher	Lloyds Futureset	TDUK
BM Trada	Gardiner & Theobald	London Fire Brigade	UKGBC
British Land	Glenn Howells	Marsh	Waugh Thistleton
Bruntwood	Grain Architecture	Mass Timber Risk Consulting	Welsh Government
BSW Group	Great Portland Estates	Mawson Kerr	Whitby Wood
Built By Nature	Grosvenor	Milner Associates	Woodknowledge Wales
Cambridge CNMI	Hawkins Brown	NMITE	
CEI Bois	Haworth Tompkins	OFR Consultants	
Change Building	Heyne Tillett Steel	PLP	



TIMBER
ACCELERATOR
HUB



The Timber Accelerator Hub (TAH) was established by the ASBP, with support from Built By Nature, Timber Trade Federation and Swedish Wood

