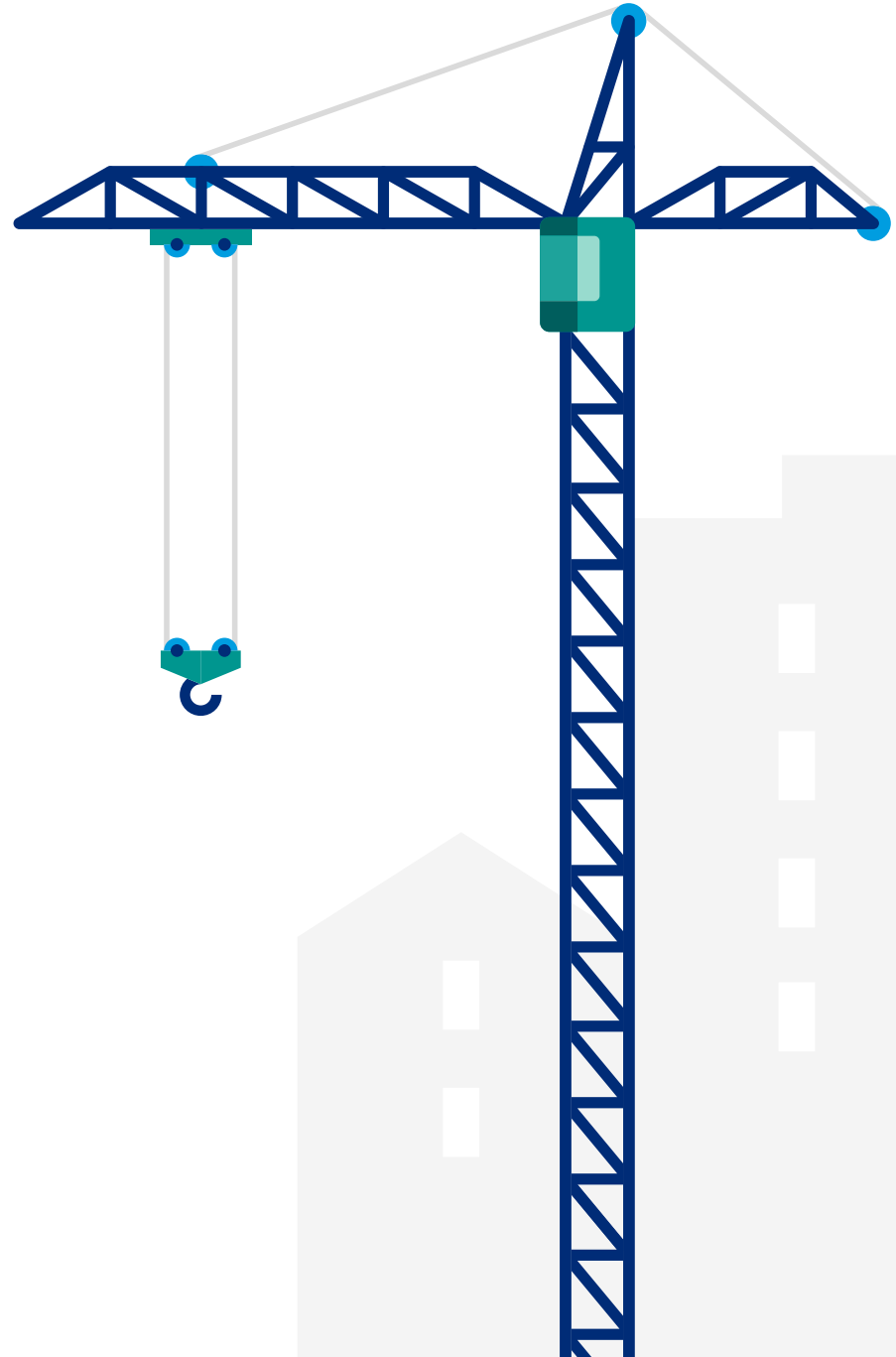
Marsh

Marsh Specialty

The risk profile of modern methods of construction



A Marsh Specialty collaboration with the Centre for Sustainable Development, Department of Engineering (University of Cambridge)

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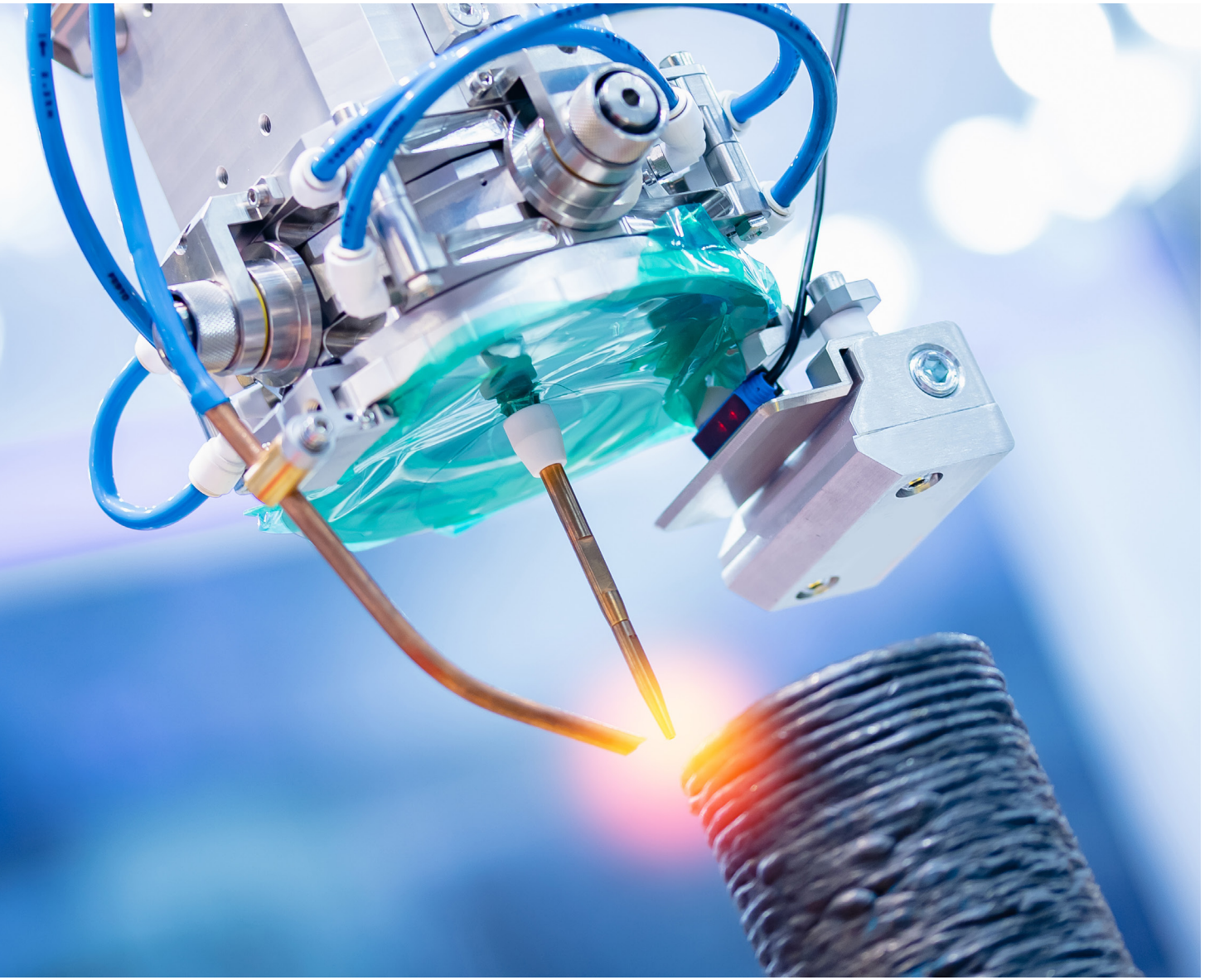

Accelerating change

The construction industry is responsible for almost 40% of energy and process-related emissions (International Energy Agency, 2019). Increasingly organizations are looking to modern methods of construction (MMC) to reduce their environmental impact, as well as improve efficiencies and costs associated with projects.

To help accelerate the adoption of MMC, Marsh engaged with students undertaking the MPhil in Engineering for Sustainable Development to develop an alternative risk assessment framework to support insurers' ability to identify and evaluate the risk attributes specific to MMC.

The insurance industry is a key stakeholder to accelerating change and forward thinking markets will be key supporters of driving positive change in the built environment.

A panacea for the construction industry?

The term MMC covers a range of offsite manufacturing and onsite techniques and it has different meanings in different sectors and jurisdictions.

For simplification purposes, MMC can be split into seven categories (Ministry of Housing, Communities & Local Government, 2019):

- **Category 1:** Volumetric modular, for example, 3D primary structural systems.
- **Category 2:** Panelized systems in 2D, such as cross-laminated timber (CLT) panels, cold formed steel panels, and timber cassette panels.
- **Category 3:** Mass timber structural elements (including glulam and laminated veneer timber), steel, and precast concrete elements.
- **Category 4:** 3D printing of structural/non-structural elements.
- **Category 5:** Bathroom/kitchen pods, mechanical and electrical assemblies, and solid cladding systems.
- **Category 6:** Large format cladding systems.
- **Category 7:** Sacrificial temporary works, use of building information modeling, and site robotics.

Considering our clients' needs, and in order to address some of insurers' greatest concerns, the project was structured to explore two MMC technologies: modular construction and CLT.

MMC offer multiple benefits that support organizations' efforts to align to the United Nations Sustainable Development Goals (SDGs) such as: reduced production and logistical emissions (SDG 9, 13), reduced waste (SDG 12), and accelerated construction of affordable housing (SDG 10, 11).

Modular construction is a process in which construction takes place off-site, under controlled conditions, using the same materials and designs, as well as the codes and standards used in conventionally built facilities. The "modules" are then put together on-site.

Cross-laminated timber (CLT) is a large-scale, prefabricated, solid engineered wood panel that consists of several layers of kiln-dried lumber boards stacked in alternating directions, bonded with structural adhesives, and pressed to form a solid, straight, rectangular panel.

Understanding MMC risks

Insurers use historical data to quantify and evaluate risk. But as with any new technology, there is limited loss data for MMC, making it harder for insurers to understand trends and quantify potential risks. Generally, this has resulted in a cautious, conservative approach to underwriting projects that use these MMC.

As a result, clients are finding it more challenging to insure projects incorporating the use of these innovative processes or products, which in turn poses a significant challenge for MMC adoption.

In the absence of this data, the first objective of the project was to build an understanding of risk factors relating to MMCs. To do so, the MPhil project team facilitated a series of interviews and workshops with stakeholders from the construction industry — contractors and developers, construction insurers, lawyers, loss adjustors, and Marsh specialists.

During this consultation, participants identified risks within each phase of an MMC project. They included:

Design

Rigid designs inhibit design modifications later in the project when manufacturing and construction errors are recognized.

Manufacturing

Mass production of pre-manufactured components means that defects could result in the need to reproduce a large volume of impacted components.

Transportation

Offsite construction extends to supply chains, which makes the arrival timing of pre-constructed material more critical.

Construction

Assembling pre-constructed materials with manufacturing defects requires specialized labor that may not be available on-site at the time of installation. Additionally, fire and water risks increase prior to protection systems being enabled.

Operations

There is potential for increased restitution costs when using MMC technology to rectify issues post-construction.

Focusing on modular construction and cross-laminated timber, stakeholder discussions led to the development of the below risk prioritization matrix.

MMC	High priority	Medium priority	Low priority
Modular	Skills shortage when repair is required and in interconnecting pods	Material transportation damage	Fire and water damage that may occur in operations
	Quality control during manufacturing	Storage damage	
	Incremental damage	Rigid design that limits supplier used	
	Supplier availability		
CLT	Fire protection	Replicated defects	Offloading damage
	Leak/damp detection	Quality control standards during manufacturing phase	
	Rigid design and lack of building standards	Limited suppliers	
	Skills shortage when repair is required		
	Supply chain risk		

Implementing a standardized framework

When describing current practices for evaluating these MMC risks, the majority of insurers interviewed stated they used judgment-based risk assessments. However, in the absence of a clearly documented methodology, insurance buyers may not fully understand insurers' needs, which may curtail their ability to improve insurers' confidence in MMC projects.

To enhance information sharing and risk perception, the MPhil project team proposed a standardized and consistent framework to remove ambiguity and variability. **The framework is based on the principles illustrated on the right.**

The consultation highlighted how MMC challenges extend beyond technological risks to include organizational and supply chain challenges, as well as sectoral barriers. Hence the risk framework focuses on each of these three risk lenses.

The technological component of the framework qualitatively compares the MMC's risk relative to a traditional technology, using a task and hazard analysis to identify risk differences, before associating a relative qualitative score to the risk. Organizational and supply chain risks are then assessed using a structured qualitative framework that aids communication with clients procuring construction insurance.

Other project recommendations included third party assurance schemes, risk data sharing across the sector, and sustainability assessments. Marsh Specialty is currently working with stakeholders across the construction industry on these initiatives.

FRAMEWORK

1 Repeatable

A standardized process is agreed across the industry, based on shared 'best practices' coming out of the individualized judgment-based decisions currently taking place.

2 Auditable

Documenting the repeatable process creates an audit trail and enables organizations to validate their risk decisions.

3 Transparent

Promoting clear communication between insurers and contractors to understand expectations under a common risk assessment approach.

4 Evolutionary

As data emerges, or an assessment fails, the auditable trail allows decisions to be critiqued, shortfalls recognized, and the process to develop and evolve.

Looking ahead

Greater collaboration between stakeholders will result in a better understanding of the process, products, risks, and mitigations related to MMC. Particularly in the absence of years of loss data, it should help improve insurers' perception of and comfort in underwriting a range of MMC risks.

Following on from the study, Marsh is working to convene a group of project stakeholders to further develop the proposed risk framework. This group will also examine the viability of other project recommendations, including third party assurance schemes, risk data sharing across the sector, and sustainability assessments.

About Marsh

Marsh is the world's leading insurance broker and risk advisor. With around 45,000 colleagues operating in more than 130 countries, Marsh serves commercial and individual clients with data-driven risk solutions and advisory services. Marsh is a business of Marsh McLennan (NYSE: MMC), the world's leading professional services firm in the areas of risk, strategy and people. With annual revenue over $20 billion, Marsh McLennan helps clients navigate an increasingly dynamic and complex environment through four market-leading businesses: Marsh, Guy Carpenter, Mercer and Oliver Wyman. For more information, visit mmc.com, follow us on LinkedIn and Twitter or subscribe to BRINK.