

DfMA Alliance Webinar Series – Transforming Construction with DfMA and MMC

Date: 19 June 2020

Topics and Speakers:

DfMA Journey in UK

- Presented by Dr John STEHLE
Structural Engineer at Advanced Science and Engineering Pty Ltd.

New Guidelines for Modern Methods of Construction_Handbook for the Design Modular Structures

- Presented by Prof. Ken McBRYDE
Architectural Physics, Adjunct Professor at the University of Sydney

Due to the limited time, our speakers were unable to answer all your questions during the live webinar. Therefore, we have summarized the most common questions, and you can now check out the answers below:

Questions & Answers:

1. How do we solve the water leakage and fire proof integrity problem at the joint of slab panels without insitu concrete?

Taking external precast panels as an example, selection of suitable joint sealant which is subject to movement and width of the joint; selection of gasket materials which is subject to the installation method and construction sequence; both play an important role in preventing water leakage. The fire resistant of joint fillers etc. should comply with local fire resistance requirements. Intumescent seals are available on the market. The maintenance aspects of such systems need to be considered carefully.

2. What is the view of the speakers of permanent formwork systems such as those used for concrete walls – internal and external applications?

There are two types of permanent formwork systems that can be used. One is where the permanent formwork contributes to the structure, the other type stays in place but does not provide structural strength. Both types are successfully used around the world for a wide range of applications. Precast double wall, which uses precast concrete biscuits as permanent formwork contributes to permanent strength, and I have experience using it for internal and external applications and even water-retaining applications. There are so many systems this answer could be very lengthy.

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3. Could you give us a few advantages / inconvenient between pre-cast and slip-forming?

The two systems are commonly used in building projects and could achieve different outcomes, which should be considered carefully. Their common advantages are labour saving and more efficient construction cycle. On the other hand, flexibility for late changes is reduced.

4. DfMA also considers the stage when the building is decommissioned? This is an environmental issue and the concern about cradle to cradle for materials / resources.

Yes, some solutions lend themselves better to deconstruction and re-use/recycling than others. This is an important consideration – i.e.: design also for disassembly. On the other hand, it may be better to focus on quality and durability for assets that require a long life.

5. Can the brickwork robot build sub-frames for tall brickwalls?

Depends on the models of your robot.

The system showed during the webinar is FastBrick (<https://www.fbr.com.au/>). It is believed that the system capabilities are evolving so please contact them for information on current capabilities.

6. Why did you call it MMC similar to the UK system of OSM?

MMC = Modern Methods of Construction, which is not confined to offsite methods. OSM = Offsite Manufacturing which is what it says.

7. Is “New Guidelines for Modern Methods of Construction_Handbook for the Design Modular Structures” a guideline only? Should it be linked to BCA/NCC?

It is currently only a guidance document. It is currently being adopted as an Australian Standard AS 4850. It is also being adopted by the Canadian Construction and Infrastructure Standards as a seed document for their Modular Construction Standards.

8. How do you download the book?

Please download the handbook from this link: <http://www.mccb.org.au/mccb>.

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9. Fire Engineers are having a ball. Most important consultant when talking about volumetric construction. Please elaborate on this issue.

Volumetric construction inherently involves dry joints between modules, cavities, etc. Once a volumetric system is fully developed and the details proven in terms of fire performance, then replication of the system should not involve fire engineers to such a significant extent where future applications are within the scope of the original approval regime.

10. Are there any different in DfMA between Singapore Scores and China Scores?

The two scoring systems are tailored for their own needs, which are very different. Singapore aims to reduce demand for workers on site, therefore, the higher the scores obtained in buildability and constructability means lesser workers is needed. China aims to improve its quality in construction by using more prefabricated construction methods. For more details, please refer to <https://www1.bca.gov.sg/docs/default-source/docs-corp-news-and-publications/publications/for-industry/buildability-series/cop2017.pdf> (Singapore) and <http://zfcxjst.gd.gov.cn/attachment/0/374/374273/2592317.pdf> (China).

11. What proportion of new build in offsite is embracing modern methods? Uptake in private residential?

In Australia the construction market is very competitive and innovative new systems do get tested out as builders seek competitive advantage, and the best systems gain popularity quite quickly. The regulatory regime has sometimes been a bit loose in the past, resulting in some poor quality construction taking place, particularly with regards to cladding systems. However, there are attempts underway to improve quality control with building codes being revised and insurance premiums driving greater conservatism.

12. DfMA method is based on tables and charts applicable to mechanical parts. When you use for structural components they have minimum section criteria and thickness. How can you implement DfMA for structural components?

Tables and charts do help facilitate the development of DFMA solutions. However, proper engineering assessments are required where any solution deviates from generic guidance. As such, engineering professionals need to be educated to ensure they understand DfMA systems well in order to be able to appraise them properly with respect to the project specific requirements.

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13. MMC covers all areas of construction including MEP services. Why do these elements always get left out of the design or get pushed to a sub-contractor for design and construct? There are experts in the industry that do these MEP systems through DfMA process.

It is due to many reasons, but not always the case. More educated construction professionals identify the opportunity to resolve MEP and integrate it better with the build process.

14. Has there been any Failed Modular, DfMA structural systems (possibly in the testing phase) which have been studied to distinguish critical elements in the design?

Yes, there has been. Unfortunately, knowledge sharing around failures is often poorly shared due to litigation or reputational reasons. It is important to engage with professionals who have experience and knowledge about potential pitfalls.

15. Connection details is very important for DfMA methods, how can we deal with the design issues for the connection point?

Connections cannot be an afterthought. It important to engage professionals that can provide appropriate details and in many cases this can influence the construction system selection process. BIM models help designers evaluate the visual quality of connections and their contribution to the character of the design.

16. How do the structure designers allow for provisions for modular E&M building services systems in the modular structures?

It important for traditional disciplines to get out of their pigeonhole and interact proactively with other designers and the supply chain, so that integrated solutions can be achieved to maximise the benefits of DfMA.

**17. How do you ensure assembly of modular construction within required tolerances?
Any technology used for quality assurance?**

BIM and 3D scanning are crucial tools to ensure accuracy during fabrication and assembly process. It also important to understand during the design phase what tolerances can be reliably achieved through the manufacturing and assembly phases. Mock-ups and prototypes can be very useful to understand the issues in advance before getting to site. Australian Standards also provide tolerances that designers can expect to achieve. It is important to specify achievable tolerances, and coordinate with adjacent materials. Designers need to discuss design intent with relevant suppliers in order to familiar.

18. Is the offsite market being fed with components manufactured in China or mainly from local manufacturing hubs? Is the local ecosystems growing?

Australia seems to be using many components from China, but in terms of precast and integrated building systems such as volumetric, there does not seem to be so much imported, but rather generally provided from local supply chain which is evolving and developing. Precast is probably generally too heavy to ship and volumetric too bulky, but perhaps more importantly, the design needs to be developed by teams in collaboration with many stakeholders which is perhaps difficult to influence remotely. Mass timber components are now also available in Australia and NZ. Previously we relied on supply from Europe.

19. Is there any chance to use robotic to reduce straining manual labour in precast factories?

Definitely robotic and automated technologies are available in the market, particularly in Europe. Some factories are more automated than others. With the use of BIM increasing, technology advancements and reducing cost of automation it seems to be a growing trend.

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