**Wan Cheuk Lam, Nelson**

BSc(Hons) MHKIBIM MHKICBIM

Mr. Nelson Wan Cheuk-Lam has over 7 years of experience on digital transformation and integrate construction ideas with BIM. Currently working as a Deputy BIM Manager in a mega scale design and build data Center project at Gammon Construction Limited. He joined the company at 2017, and obtained HKIBIM , HKICBIM in 2019. He is a young leader to drive full BIM implementation with LOD500, demonstrating DfMA approach in BIM throughout project life cycle.

Nelson also lead his team to deliver from design to as-built by BIM. Expertise on maximising benefit of BIM at manufacturing and procurement from a contractor aspect.

Digitalization of Design for Manufacturing and Assembly (DfMA)
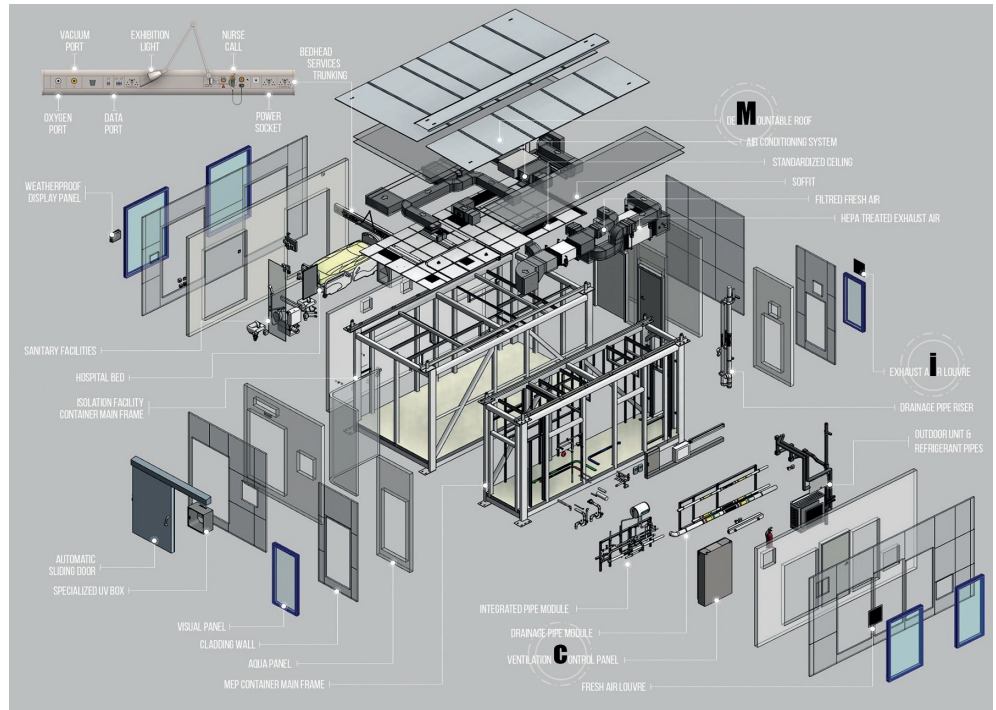
Digitalization of Design for Manufacture and Assembly (DfMA)
Image Courtesy of Gammon Engineering & Construction Company Limited

Digitalization and automation of routine works in construction industry has recently been a hot topic. It has always been a challenge in the construction field where relies a lot of traditional thinking and norms on site. However, with the government and Construction Industry Council support, Building Information Modelling (BIM) has taken a great leap in the past 5 years. As a tool able to generate and manage digital representations of physical and information, it also can innovatively integrate with traditional Manufacture and Assembly and form a whole new project life cycle, called DfMA (Design for Manufacture and Assembly) as an innovative digitalize solution.

Adopting common data environment (CDE) to enhance efficiency for collaboration with different project stakeholders in design and construction stage. Designers, engineers, subcontractors, quantity surveyors and manufacturers would then be able to collaborate the concept together to design installation which would be tailor made to the building to suit for installation challenges, in order to achieve better safety and quality on the outcome. The accuracy of the BIM model would also require to a certain level of detail in order to mimic the actual site situation, in order to facilitate the virtual way to build, as well to avoid unnecessary design and coordinate fault on production.
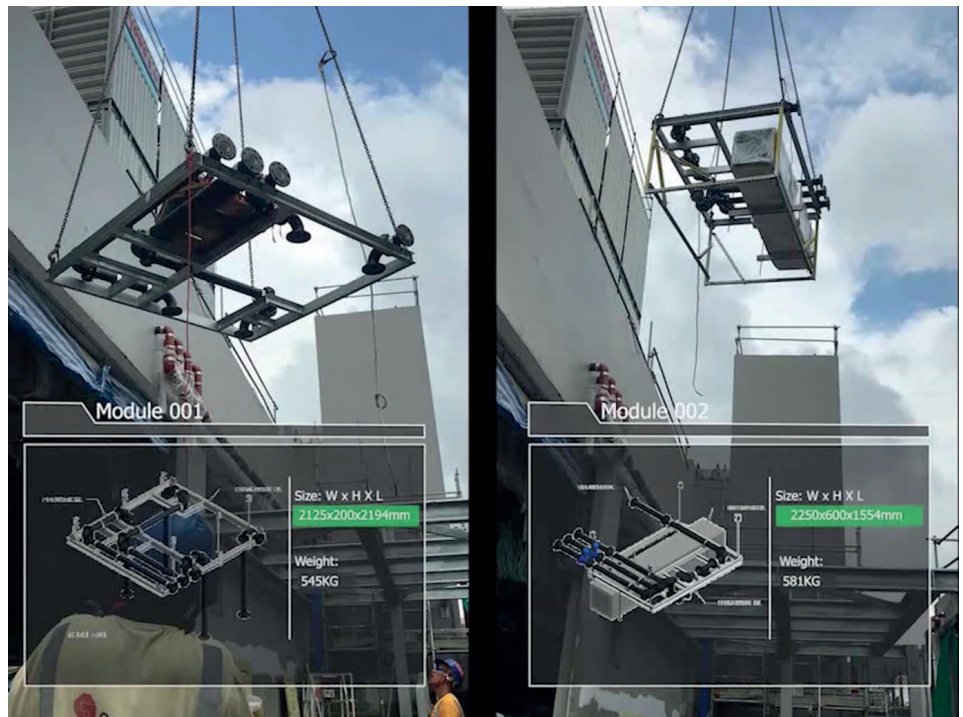
Battling against the traditional mindset of using 2D drawings with 3D BIM model is always one of the most challenging task to overcome. While engineers and supervisors demand 2D drawings in various location of the site which is the most practical means to carry out works on site with dimension and clear indication, there always have people want to find shortcuts on generating 2D drawings without using the common data environment under BIM platform. Here on this project, we established a stringent workflow control of drawings to site, as well aligning the operational team and subcontractors, for all 2D drawings even the manufacturing drawings at factory shall all be derived from BIM. Not only that, the as-built BIM requirement has always required to be at

BIM Design Review Meeting
Image Courtesy of Gammon Engineering & Construction Company Limited

Delivery of DfMA
Image Courtesy of Gammon Engineering & Construction Company Limited

the LOD500 which at the end of the day if BIM is not being followed, it would be all parties to suffer but not just the BIM team to as-built back the whole model. This mindset has been implemented to all team members on day one, facilitating all the factory works able to be coordinated under a BIM environment, read by the factory, manufacture the modules off site, and install on site in one goal. The project execution has been so clearly tied together on first day of execution, where all stake holders truly have the mindsets to understand and willing to execute the coordination and design in a virtual way via BIM then to actual site installation, as one team together from main contractor and the MEP contractor, in order to strife for a win-win situation. A lot of time were spent throughout the project life cycle together with the project in charge to educate this concept together with client, designer, subcontractor, engineer and manufacturer.

Not only that, the detail for fabrication drawings would be much higher

compare to traditional shop drawings in DfMA approach. Not only the module itself, clear indication on maintenance, connection details, overall configuration would also be a critical demand on generating fabrication drawings for DfMA in order to suit actual site installation. Clear supporting details would be required in order to make installation work, regardless it is not a requirement under LOD500 not a requirement under specifications, the BIM model has to be on a very high level of accuracy containing information

of each components under the BIM environment. To tackle this challenge, we set up a separate team solely developing Revit Family under the autodesk software capacity and build up our own data base. We also make use of these family to animate the method statements of different DfMA component installation to ensure it works on site.

The examples of this job and our experience pioneered the possibility of how far the concept of DfMA can go with the aid of autodesk software. From this we also develop a few other examples for project further evolving to Modular Integrated Construction (MiC). The experiences also being shared across within the company and set as a norm for upcoming Gammon project adopting DfMA, facilitating elimination of hot works, and demanding a higher quality of installation with a shorter site construction period. The outcome of this project has been demonstrated to different stake holders in the industry at different technical site visits, as well as a case sharing in order to support recent government initiation to DfMA and MiC with the help of Autodesk software.
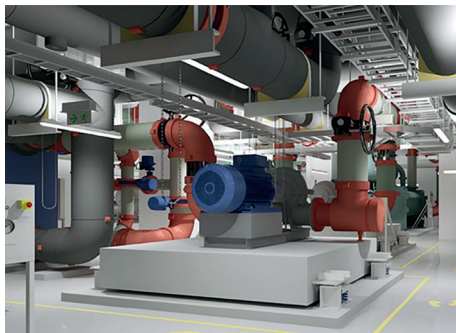
Digitalization of Modular Plant Room
Image Courtesy of Gammon Engineering & Construction Company Limited

DfMA of Factory Quality Assurance
Image Courtesy of Gammon Engineering & Construction Company Limited

Digital Fabrication of DfMA
Image Courtesy of Gammon Engineering & Construction Company Limited

BIM As-Built Verification
Image Courtesy of Gammon Engineering & Construction Company Limited