

COMPANY
Gammon Construction Limited
Hong Kong Science and Technology Parks Corporation

PROJECT
Advanced Manufacturing Centre

LOCATION
Tseung Kwan O Industrial Estate, T.K.O.T.L. No. 39 & Ext. Thereto S.R. RP, S.B RP.

TYPE
New Building Construction, Manufacture Building

SCHEDULED TIME OF COMPLETION
Early 2022

A Full-cycle BIM implementation into construction digitization singularity

“Innovation is the key of staying competitive in the market. While full machine automation for replacing hard labour is still a long way, innovation and digitization can increase the productivity and help address the labour issue. In the years ahead, our vision is to transform Gammon by pushing back the boundaries of technology for the benefit of our clients and the construction industry at large. We thrive to become the Smart and Digital Contractor of Choice.”

– Sammy Lai

Director,
 Gammon Construction Limited

BIM PARTNERS

Wong Tung & Partners Limited
Meinhardt (C&S) Limited
Wong & Ouyang (Building Services) Limited

AUTODESK PRODUCTS USED

Autodesk® 3ds Max®
Autodesk® AutoCAD®
Autodesk® BIM 360®
Autodesk® Dynamo Studio
Autodesk® InfraWorks®
Autodesk® Navisworks® Manage
Autodesk® ReCap® Pro
Autodesk® Revit®
Autodesk® Vehicle Tracking



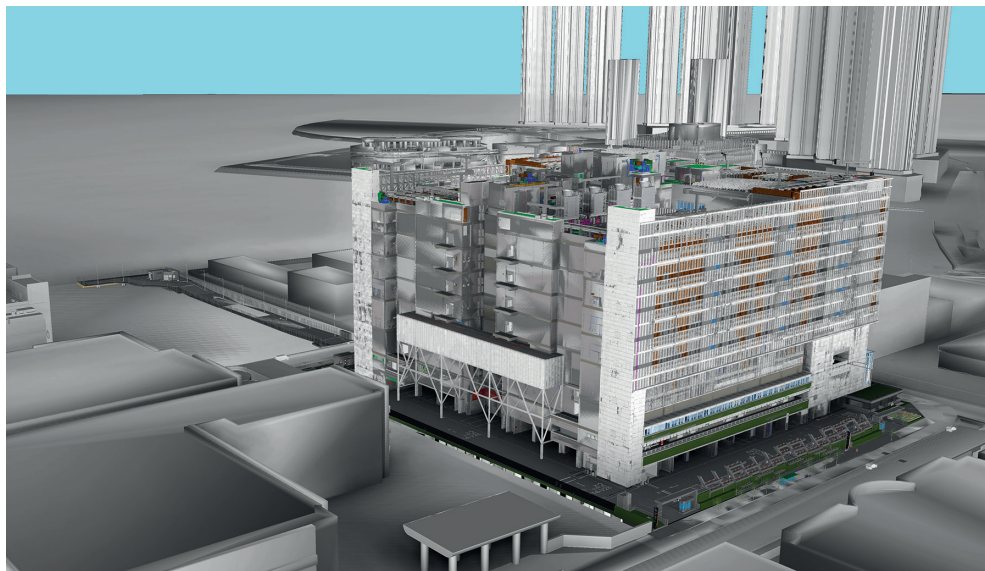
AMC is one of the first manufacture buildings to meet the industrial 4.0 standards. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation

Project overview

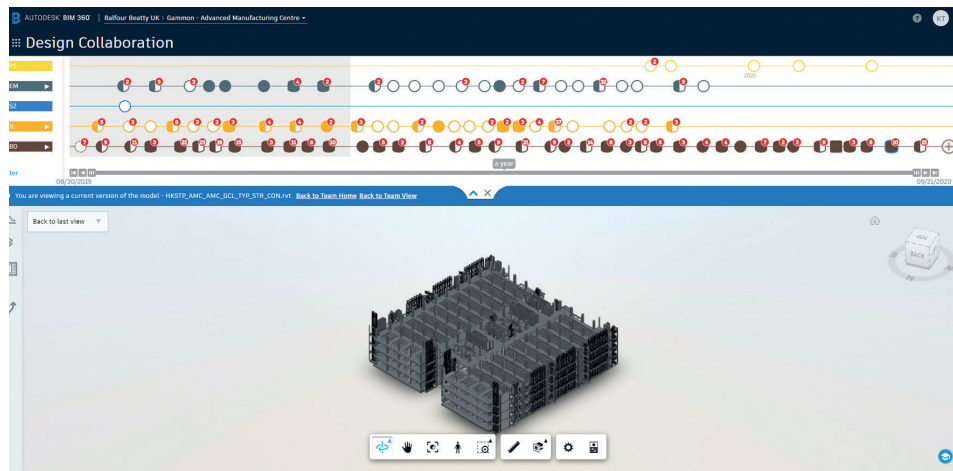
The Advanced Manufacturing Centre (AMC) in Tseung Kwan O Industrial Estate is one of the HKSTP's key initiatives for the re-industrialisation of Hong Kong. The 1.2 million-sq.ft. facility features superior design parameters in headroom, column-span, and structural loading capacity to provide an environment for big data processing, automated equipment, and advanced robotics, all of which support the drive towards Industry 4.0. AMC is a modern industrial premise suitable for smart production, with

innovative design, provisions for flexible and highly automated production and distribution of products, and embedded services. By making high-value-added production facilities accessible to industries of various sizes, AMC facilitates the re-industrialisation of Hong Kong. AMC is under construction and is set to open in 2022.

Gammon Construction Limited is proud to be the contractor of this project. In parallel to supporting re-industrialisation in Hong Kong, we have also demonstrated industry changes promoted by the Government via



Coordination with a comprehensive BIM model including regional geography data. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation



Common Data Environment (CDE) ensuring information exchange wouldn't be misplaced. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation

Construction 2.0. These changes center on Innovation, Professionalisation, and Revitalisation: Building Information Modelling (BIM) is used in all levels, from design coordination to the supervision of different work trades. The 3D models and associated documents are hosted on a Common Data Environment (CDE) so that all stakeholders can access the most up to date information. BIM is also supporting Design for Manufacture and Assembly (DfMA) and Module integrated Construction (MiC), such as precast reinforced concrete construction and prefabrication of MEP systems. These modern methods of construction have significantly reduced onsite labour resources, safety risk for working at height, and construction time.

Commitment to construction digitalization

The 1.2 million square-foot multi-story industrial building is built to Industry 4.0 standards, and conceived to support high value-added production facilities accessible to industries of all sizes. The delivery of such a complicated project required construction digitalisation. The AMC construction team is committed to implementing BIM and various digital tools throughout the project.

A dedicated BIM team modernised the process and created thousands of prefabricated DfMA components for efficient construction. The development of mobile digital tools also greatly accelerated the adoption of the 3D BIM environment and digital delivery in the construction site.

CDE ensuring a single source of information

On this project, a Common Data Environment (CDE) was used with the sub-contractors. Design-related and specialty equipment contractors used the CDE to collaborate and produce a

federated 3D model. Each of the 3D models and the associated design updates interchange on Autodesk BIM 360. The adoption of the CDE has ensured information assets wouldn't be misplaced.

Full-cycle BIM

To further improve economy and safety, almost 75% of construction components were constructed with DfMA, MiMEP, and prefabrication. BIM took a big role in the anticipation and analysis of these construction elements. This included a 4D master programme, temporary works & safety design, design validation, logistic analysis, all the way to handover of as-built models and data for facility management.

Many different pieces of hardware were applied, such as laser scanners, drones and 360 cameras, as well as integrations with mobile phones. We reviewed and handpicked the most applicable BIM software to improve our delivery and meet the BIM requirements.

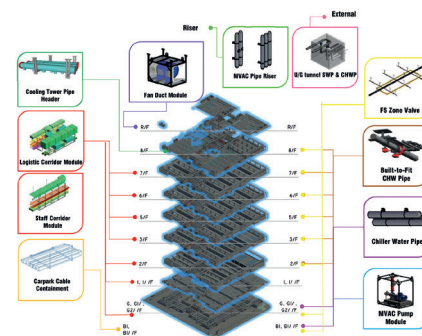
As the majority of MEP services were constructed by DfMA, once CSD / CBWD submissions were extracted from the 3D models, the BIM team would create DfMA shop-drawing on behalf of DfMA manufacturers. This significantly reduced the DfMA production timeframe.

Program language in BIM

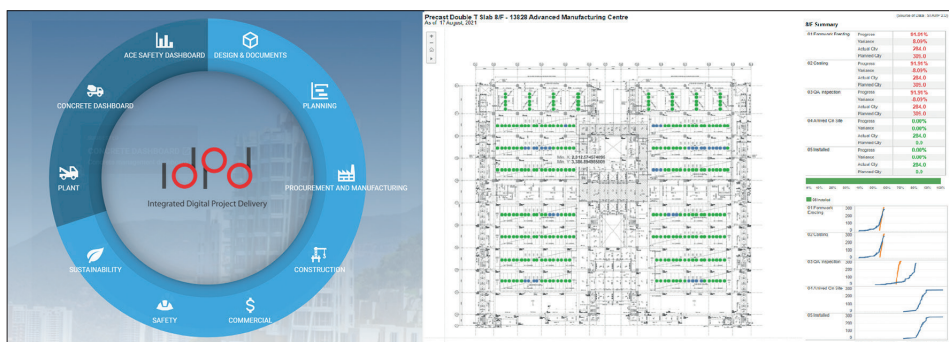
Gammon has self developed a web interface called Integrated Digital Project Delivery (IDPD), which is a central hub for all digital information on their projects. The backbone of IDPD is an API "data-hooking", which can be connected to any database, regardless of data from the construction site, or database from the client's system. All information forms a singular dashboard to report the most current status on-demand.

Gammon also has skills in using "Dynamo" and API to create Revit & Navisworks plug-ins. Unlike proprietary software, our tools are customised to suit the needs in the Hong Kong construction industry and our internal processes.

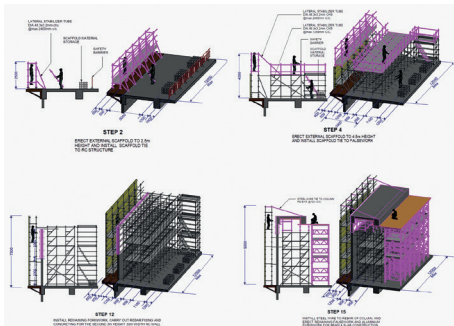
For AMC, there are many machines capable to do complex movements and joint articulation. These issues can be challenging to analyze in typical BIM software, so we developed solutions with game engines. This took traditional BIM data to the next level and the results



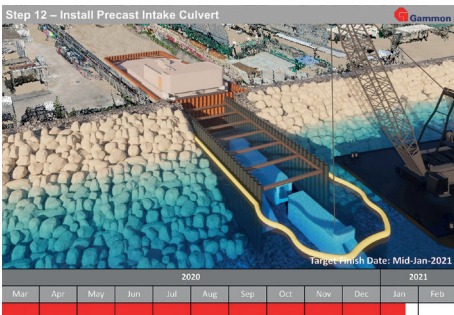
BIM team created shop drawings for 5000+ DfMA components. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation



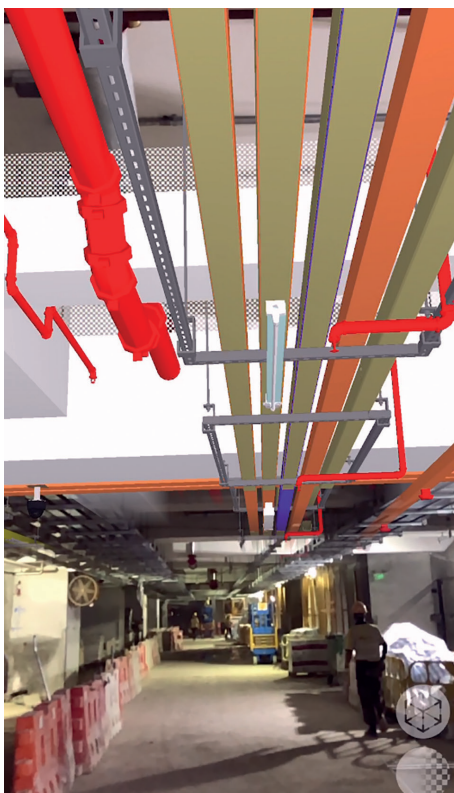
IDPD web interface helps construction teams receive updates on-demand. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation



3D modeling helped scaffolding/ temporary works design and submission. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation



4D programme simulation helped the installation of the seawater plumb house. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation



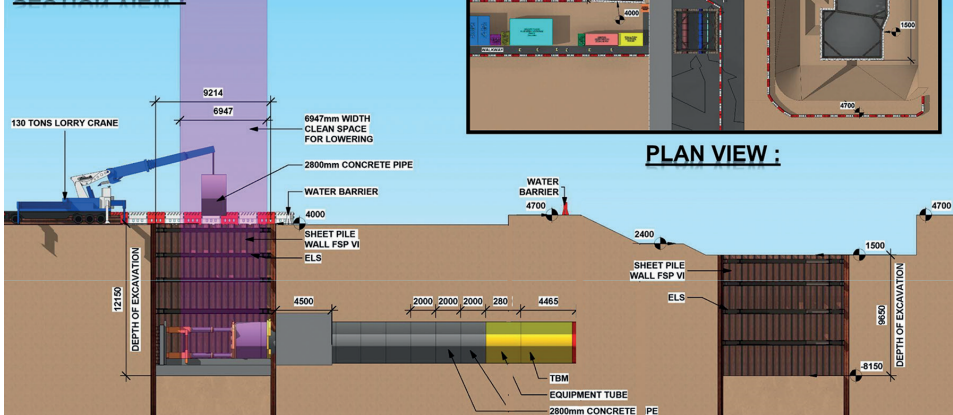
AR technology had helped the BIM adoption on the construction site. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation

Proposed Pipe Jacking For Seawater District Cooling System Along Chun Yat Street And C5,C6



PIPE JACKING SITE #1
SEQ #15
PIPE JACKING

SECTION VIEW :



BIM helped the construction site's layout planning to further enhance safety standards. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation

were able to be illustrated in the form of "Mixed Reality" on any mobile device.

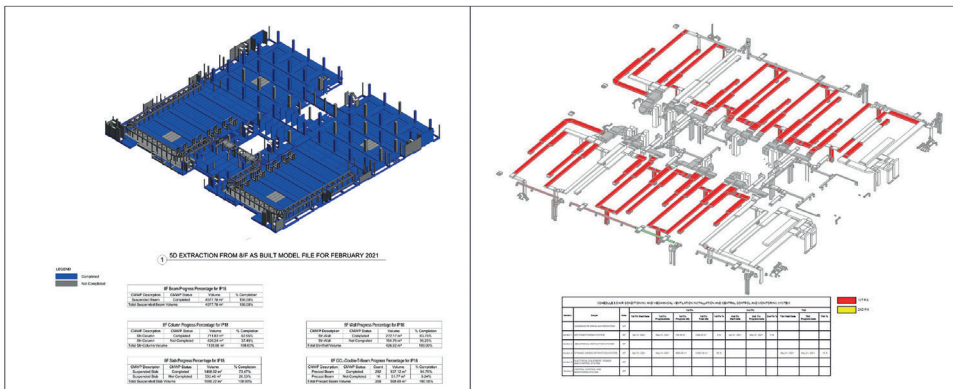
BIM 5D for interim payment

The contract required Gammon to use BIM to support monthly interim payment applications. This required the expertise of both the BIM and the commercial teams to collaborate on solutions. As well as correctly recording quantities in the BIM models, we developed a workflow that considered ever-changing site conditions.

The statuses needed for the 5D model to include updates from the construction team, as well as from data held in the

digital tools which have been used from the beginning of the project. For example, the interim payment team could review the latest status of works in the IDPD dashboards, check design against the 3D models and verify actual site conditions using 360 photography.

As a result, the 5D BIM model helped with discussing quantities between parties. Since BIM models were being updated to reflect the construction condition, as-built updates were taking place alongside the 5D payment applications every month. This meant the as-built has been produced iteratively, making it more efficient to handover the final BIM model.



5D BIM interim payment helped all parties to agree on the quantities. Image Courtesy of Gammon Construction Limited and Hong Kong Science and Technology Parks Corporation



AMC is a state-of-the-art manufacturing facility with combination of aesthetic design.
Image Courtesy of Architectural Services Department, HKSAR Government

About Gammon Construction Limited

Gammon Construction, headquartered in Hong Kong, is a 50/50 joint venture between Balfour Beatty, a leading international infrastructure group, and Jardine Matheson, the Asian-based conglomerate. Gammon has a reputation for delivering high-quality projects throughout China and Southeast Asia. The company's integrated business focuses on civil, building, foundations, electrical and mechanical, facades and interiors works and design, and the construction services division provides considerable plant and steel fabrication and concrete production capabilities. Gammon has a strong building and information modelling department and a digital entity dedicated to furthering the commercial opportunities of the innovations.

About Hong Kong Science and Technology Parks Corporation

Hong Kong Science and Technology Parks Corporation (HKSTP) plays a pivotal role in re-industrialisation. The goal is to support innovation and technology-driven re-industrialisation by providing the land resources, suitable multi-storey industrial spaces, and an innovation and technology community to facilitate the development of new industrial operations in the Industrial Estates. The Advanced Manufacturing Centre at Tseung Kwan O Industrial Estate is one of the facilities supporting smart manufacturing in Hong Kong.