

Project Title: Optimum Construction Procedure, Sequence, and Assembly of MiC Modules

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Project Outline:

Hong Kong is a dynamic international financial centre with a population of 7.35 million (GovHK-b 2016), most of whom live and work in high-rise buildings. There are about 50,000 buildings in Hong Kong, about 8,000 of which are owned and managed by the Government. Major part of these buildings were built more than thirty years ago. One third of the Hong Kong population live in about 789,300 public rental housing (PRH) units in which the private sector is responsible for running the other two thirds, i.e. 1.5 million units (GovHK-a 2016). The Buildings Department (BD), the Housing Authority (HA), and the Architectural Services Department (ArchSD) all strive for a safe and healthy built environment in Hong Kong (HA 2016 & 2018). The HA, in its annual report 2017-18, announced that increasing the housing supply becomes urgent priority to the Government. The HA targeted to build 460,000 units in the coming ten years in order to reduce the gap between supply and demand in housing (HA 2018). This target is very challenging without the wide adoption of innovative construction solutions, such as prefabricated / precast components and Modular Integrated Construction (MiC). The prefabricated / precast components of buildings were implemented in Hong Kong in the past two decades. Such building components were built in a factory and transferred to the construction site for installation. This technology helped much the housing industry in Hong Kong for the last period. However, it suffered from several challenges, i.e. limited site conditions, poor stakeholder communication, and other technical aspects. In addition, the implementation of prefabricated / precast components in building construction did not cope with the demand from the Hong Kong population and residents.

Therefore, the need arise by the Hong Kong government and industry to adopt the concept of complete building modules, which is called Modular Integrated Construction (MiC). The MiC is a promising technology that will expedite the construction of building units, minimize interference

to the adjacent services, facilities and businesses, as well as improve productivity and safety. However, the use of MiC modules also poses many challenges, particularly in Hong Kong weather conditions and environment, which add more challenges to the design of MiC module connections, the construction sequence, and the optimal crane location. There is a need therefore to design the optimum construction procedure(s), sequence, and assembly of MiC modules for various building shapes and number of floors in Hong Kong.

The proposed research will also support the technological development of MiC, which is the 7th theme of CNERC. It will advance the capabilities of the PolyU CNERC to effectively and efficiently run the MiC projects in collaboration with the construction industry in Hong Kong. It will assist in positioning the CNERC as a hub for MiC expertise and development in Hong Kong and worldwide.

Research Objectives:

The objectives of the proposed research are as follows:

- 1. Assess crane productivity for MiC modules.*
- 2. Design the optimum construction procedure(s), sequence, and assembly of MiC modules.*
- 3. Develop a BIM-based 4D model for the construction sequence of MiC assembled modules.*

Expected Deliverables:

1. Literature review on MiC
2. Simulation-based productivity model of MiC modules
3. Optimization model for the sequence of MiC modules
4. 4D BIM-based model for the optimum sequence of MiC modules