



HKSTP InnoCell



Penny Bay Phase 3A



Pat Heung

Steel MIC Sytem In-principle Acceptance

优必

优必(上海)建筑科技有限公司



中集模块化建筑



Moderna Homes (HK) Limited



中國海龍建築科技有限公司
CHINA STATE HAILONG CONSTRUCTION TECHNOLOGY COMPANY LIMITED



Paul Y
保華建業
Paul Y. Engineering



Project
Excursion
Nov 2017



Desktop
Research
2017-18



Department
Enquiry
Nov 2017

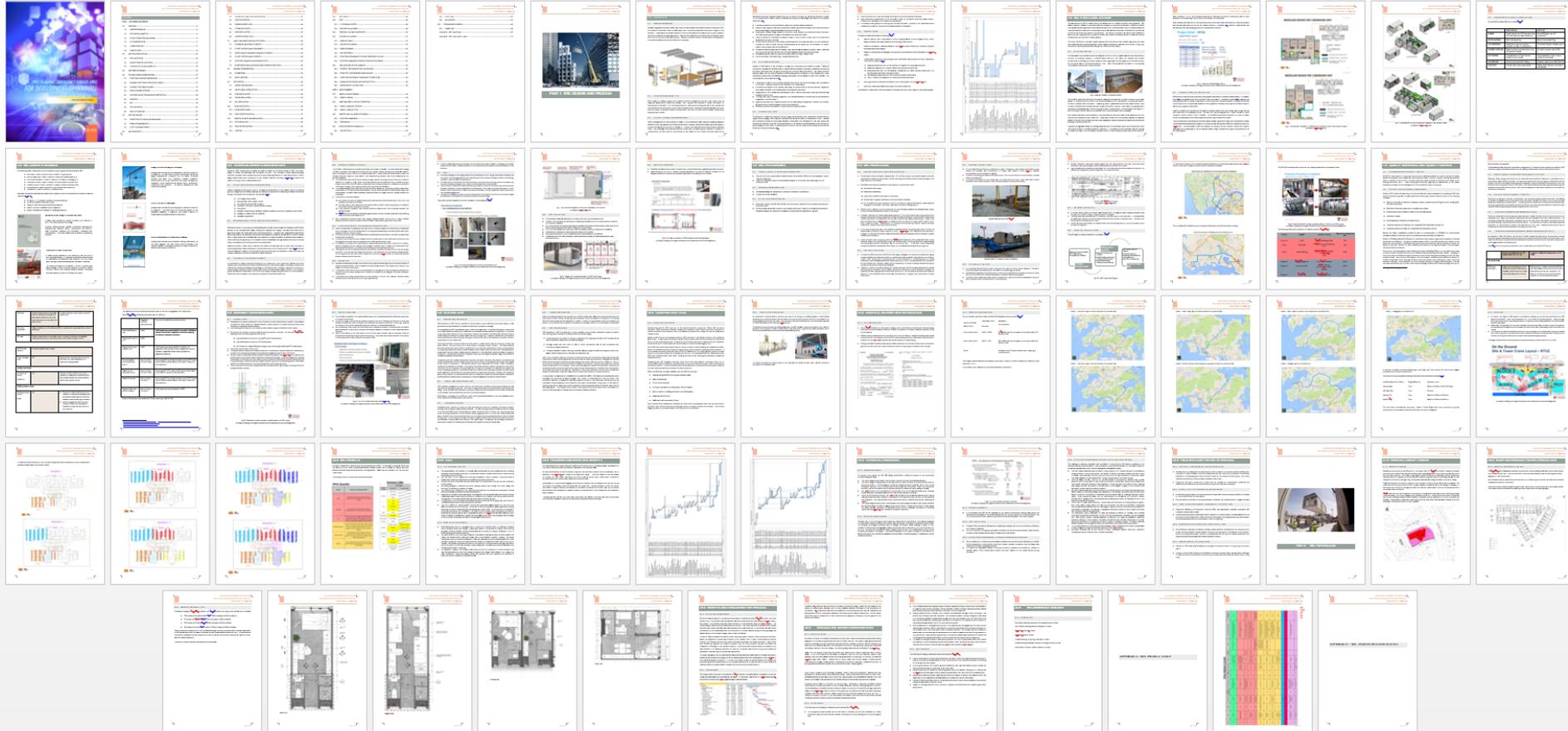


IPA Factory
Visit

InnoCell Project Delivery



Desktop Research Study (2017-18)



Design,
Material &
Supervision



Ground
Transport



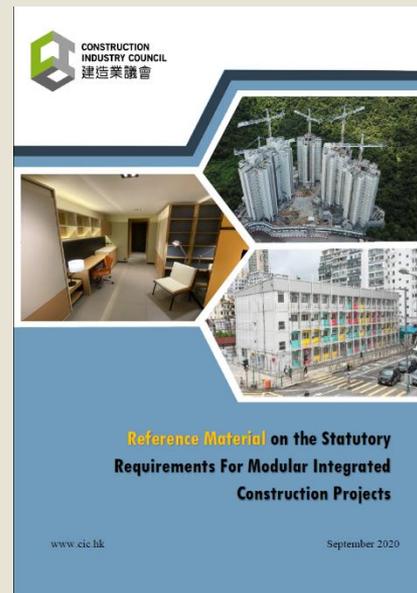
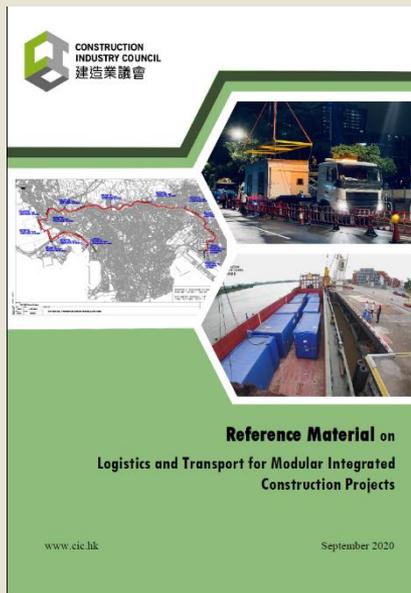
Module
Import



Landing
Pier



Department Enquiry November 2017



MIC Vendor Factory Visit (2018-19)

**Factory
setup**

**Material
Sourcing**



**Logistics
Methods**

**Factory
Equipment**



**Command of
Hoisting
Technique**



**Module
Design Team**



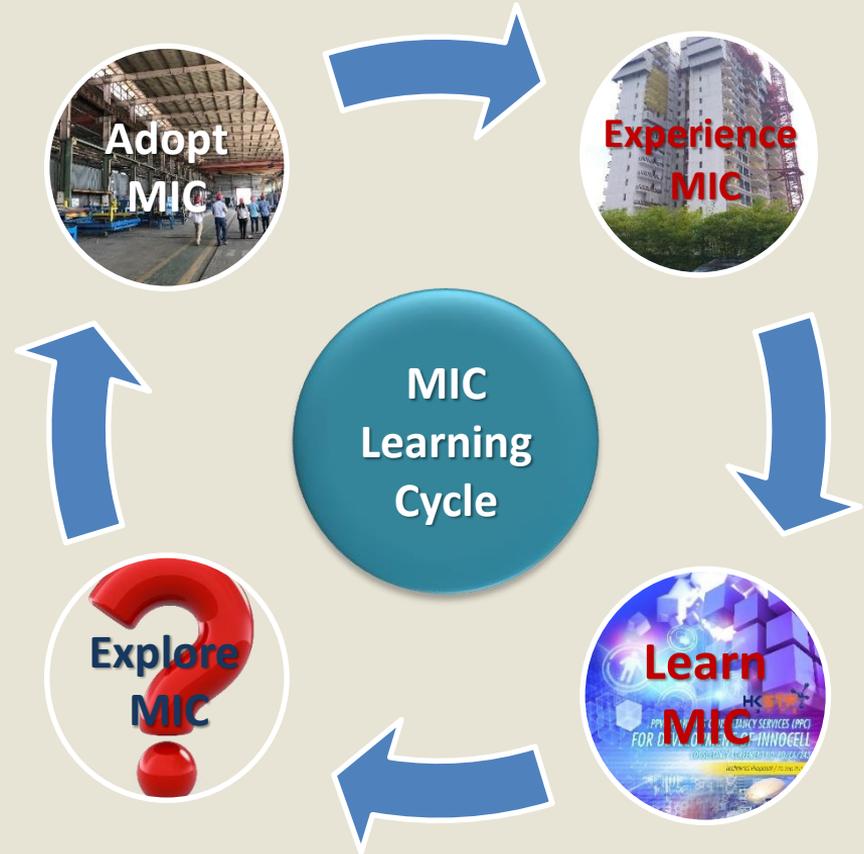
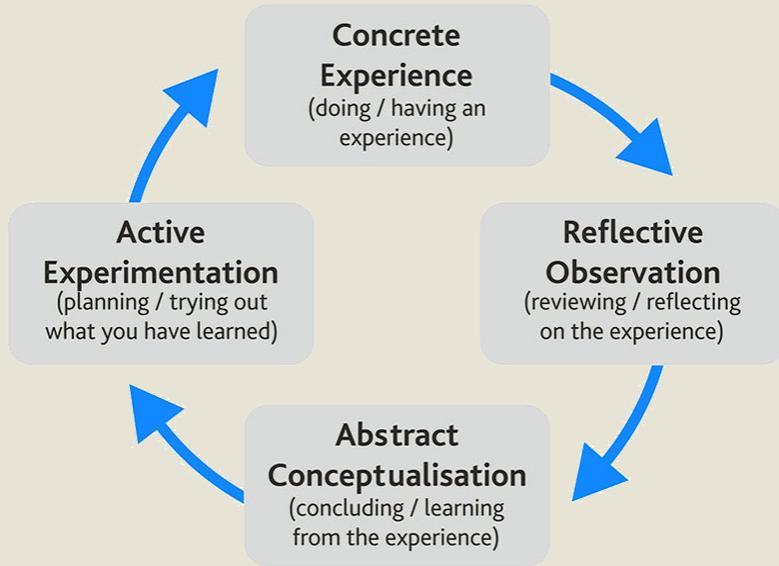
**Design
Details**

**Quality
Control**

**Factory
Capacity**

Kolb's learning Cycle

The Experiential Learning Cycle



Consultant Engagement Model

Common Model

Client Team



Authorised
Person A



Registered
Structural
Engineer A

Consultants
engaged by Client

Contractor Team



Authorised
Person B



Registered
Structural
Engineer B

Consultants engaged
by MIC Vendor

InnoCell Model

One Team



Authorised
Person



Registered
Structural
Engineer

Same Consultants
engaged by Client and
MIC Vendor

Roles and Responsibilities of Project AP RSE & Contractor's Designer

Model for other pilot projects

Client Team

Authorised Person
Registered Structural
Engineer



Project Consultants
engaged by Client but
only provide reference
design (MiC Ready/ Non
MiC) for tender

Contractor Team

AP & RSE Qualification
but not AP & RSE Duty



Designers engaged by
Contractor/ MIC Vendor
responsible for MiC Detail
Design only and Onward
Submission to Project AP RSE

InnoCell Model similar to conventional building projects

One Team

Authorised Person
Registered Structural
Engineer



Project Consultants engaged
by Client and responsible for
all MiC Detail Design &
Statutory Submission before
and after contract award

Contractor Designer responsible
for Contractor Design Portions
only, e.g. façade and temporary
work

InnoCell MIC Vendor Selection

7 nos. tenderers expressed interest

- Held Initial Discussion with each vendor
 - Vendor submit sample MIC Drawings
 - Fabricate and deliver MIC Prototype
 - Demonstrate Fabrication Capability
- 1) Manufacturing Programme
 - 2) Precedent Job Reference
 - 3) Pre-acceptance Approval



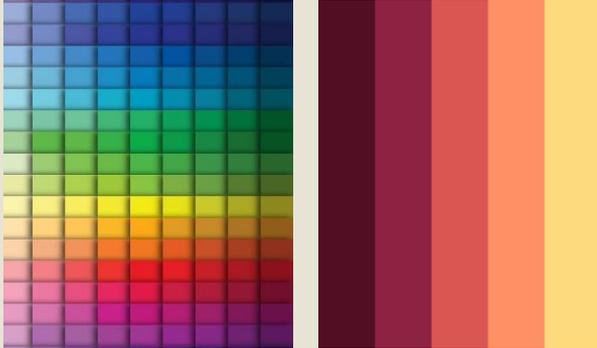
Developments Favoring MiC Construction



Space for Staging and Hoisting



Feasible Delivery Route



Economy of Scale



Future Alterations Manageable



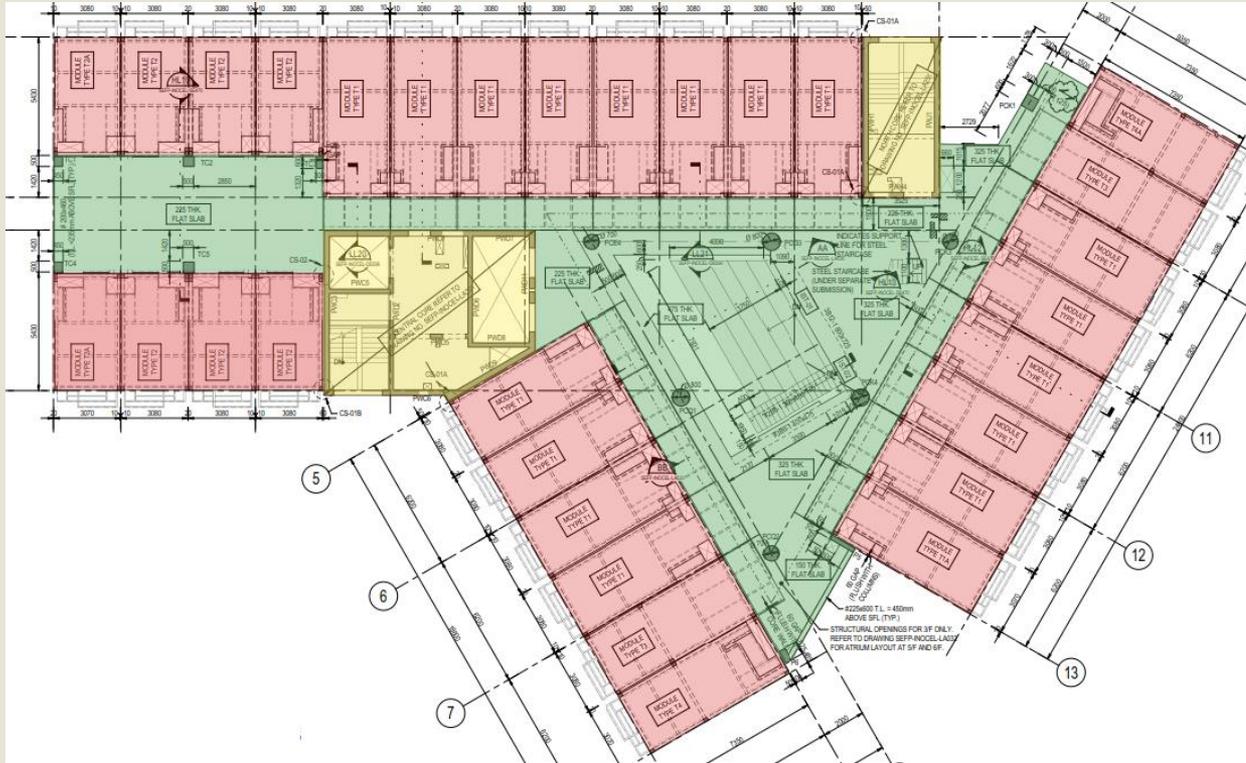
Planar Geometry

Hands-on experience from IPA and project submissions

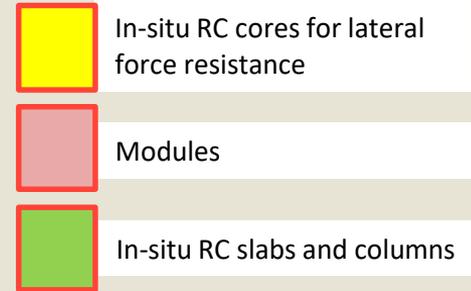
In line with PNAP ADV-36, major design considerations include:

- Structural system and design loads
- Vertical and lateral load transfer mechanism
- Structural stability
- Progressive collapse
- Corrosion protection
- Fire protection of structural elements
- Structural connections
- Design for temporary stages
- Workmanship requirements
- Specification

Structural System



- A stability structure independent of the MiC modules is necessary
- This layout shows a stability structure formed by two insitu rc cores and insitu rc slabs and columns

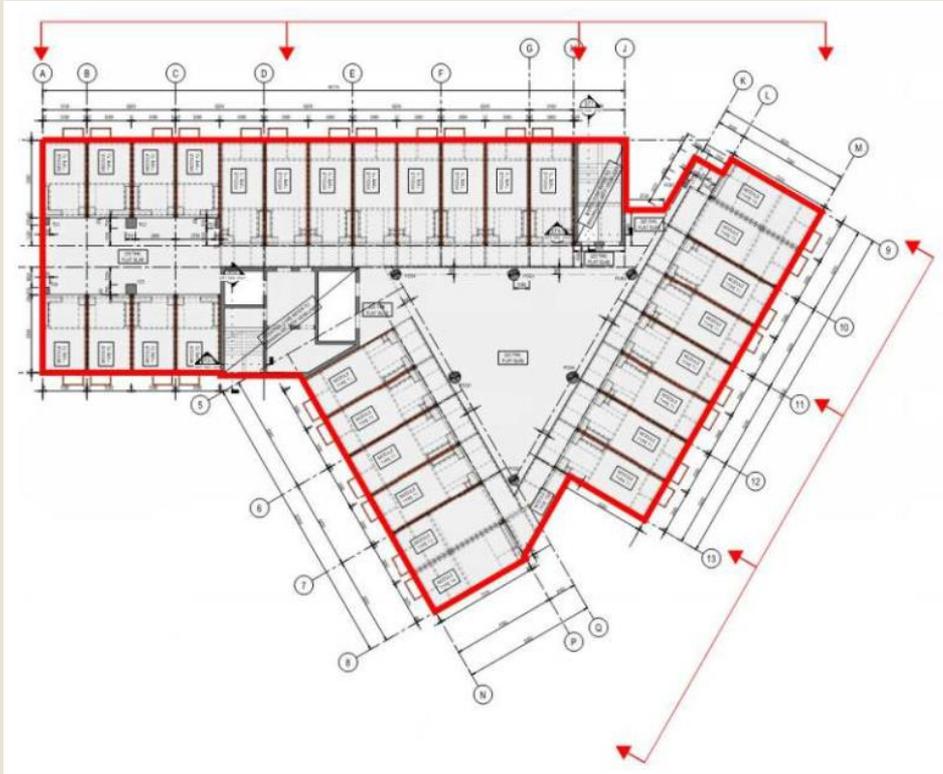


Structural Stability (Permanent Stage)

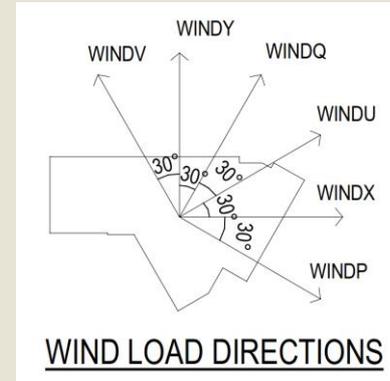


- For the structural analysis of the building, the floor elements within the cores are treated as rigid diaphragm, and the linking floor slabs are treated as semi-rigid diaphragm.

Design Loads (Wind Loads)



- Wind loads are transmitted from the façade to the stability system of the building (cores and linking floor slabs) via the modules.
- All the critical wind directions for the tower layout should be considered

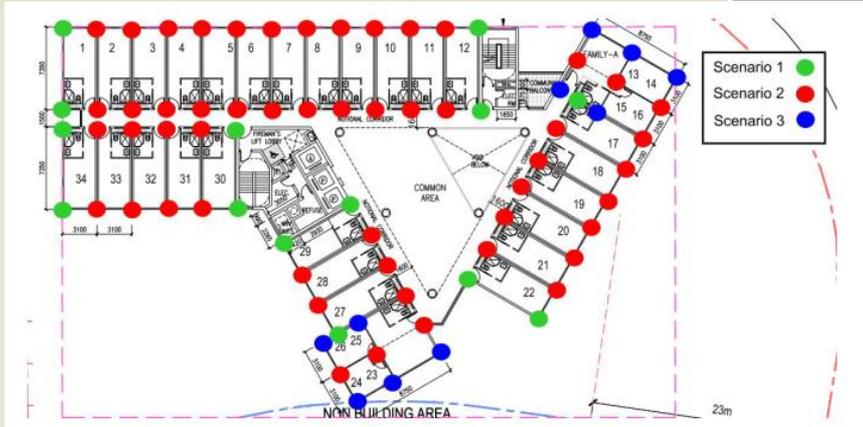


Progressive Collapse

Critical columns are removed for analyses of effects on stability for three scenarios

Table 4.3 - Partial load factors and combinations for extreme events

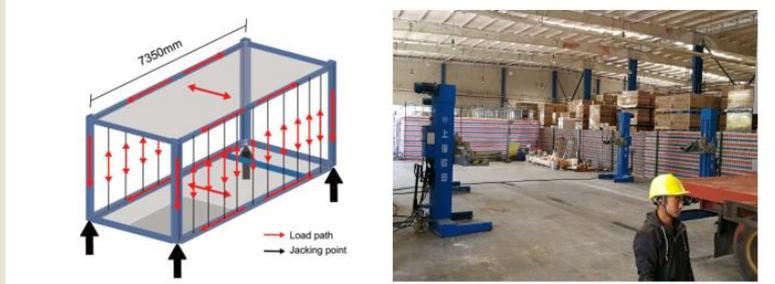
Load combination (including earth, water loading where present)	Load Type						
	Dead		Imposed		Earth and water	Wind	Extreme Event
	G_k		Q_k		S_n	W_k	A_k
	Adverse	Beneficial	Adverse	Beneficial			
1. dead, imposed and extreme event	1.05	1.0	0.35	0	1.05	-	1.0
2. dead, lateral and extreme event	1.05	1.0	-	-	1.05	0.35	1.0
3. dead, lateral, imposed and extreme event	1.05	1.0	0.35	0	1.05	0.35	1.0



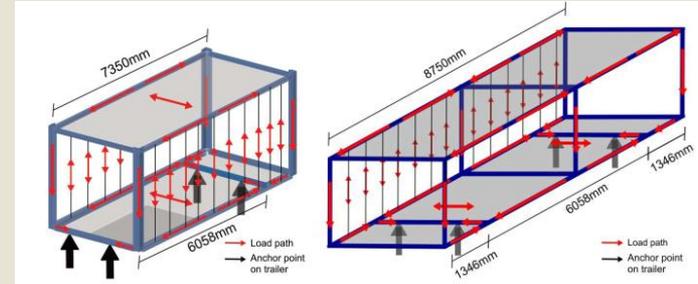
Load factors for accident cases

Column removal

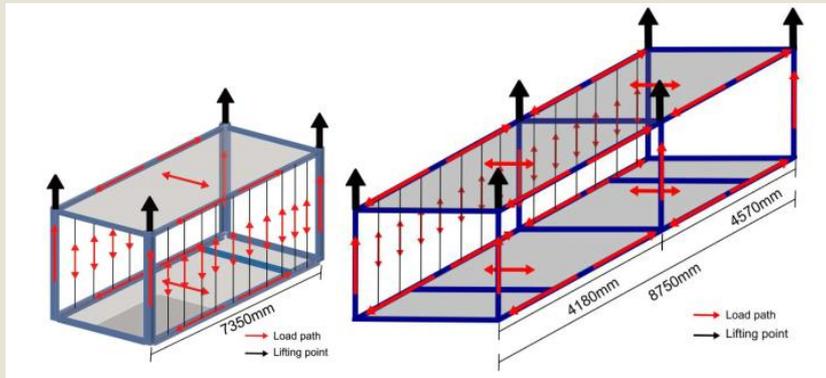
Structural Stability (Temporary Stages)



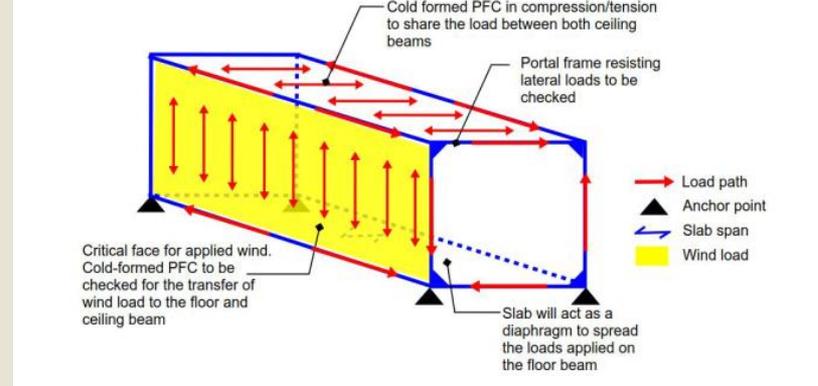
Factory Support Condition



Road Transportation Condition



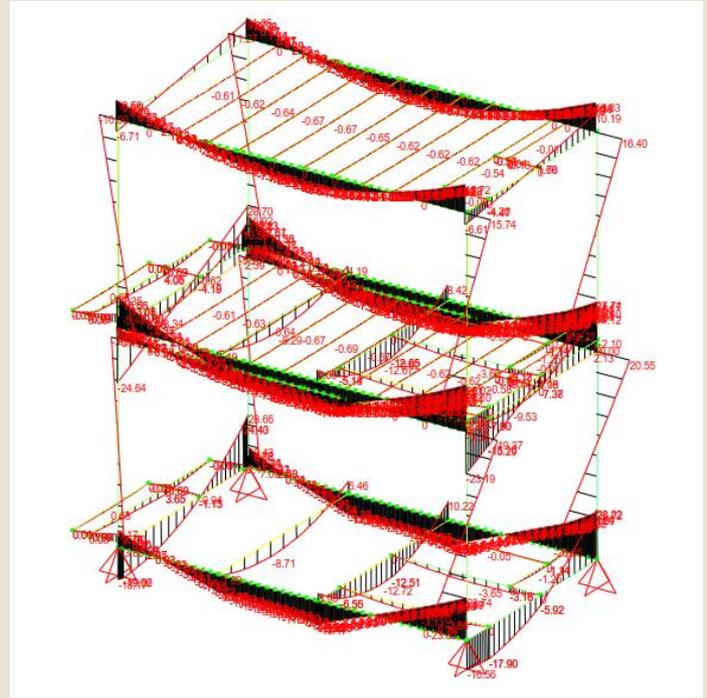
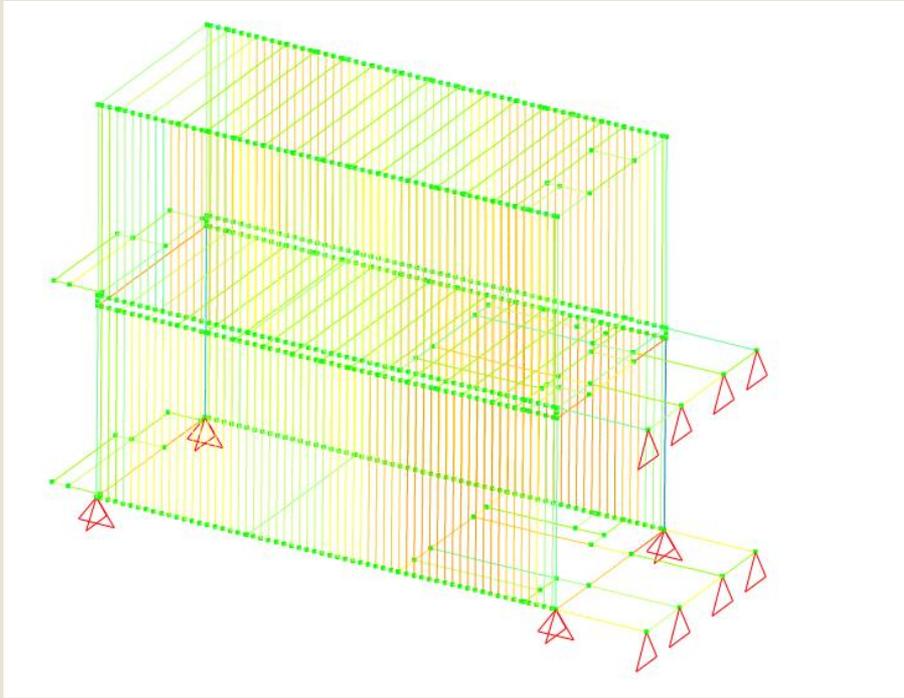
Lifting Condition



Lateral Stability due to Wind Load

Structural Stability (Temporary Stages)

All temporary conditions of the modules are analysed to ensure the integrity of the units is maintained.

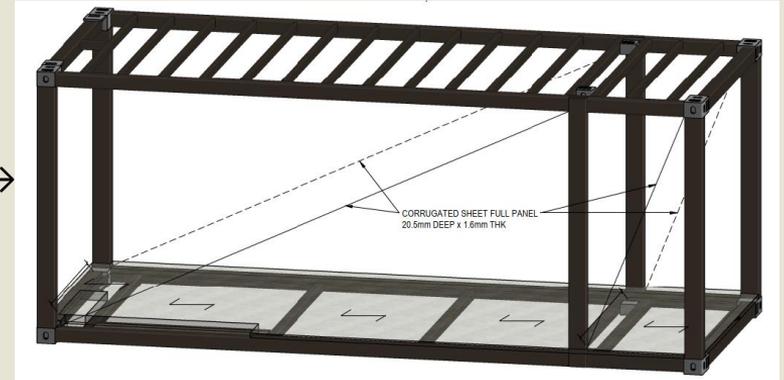


Design Changes after IPA Granted

Non-system changes are allowed:

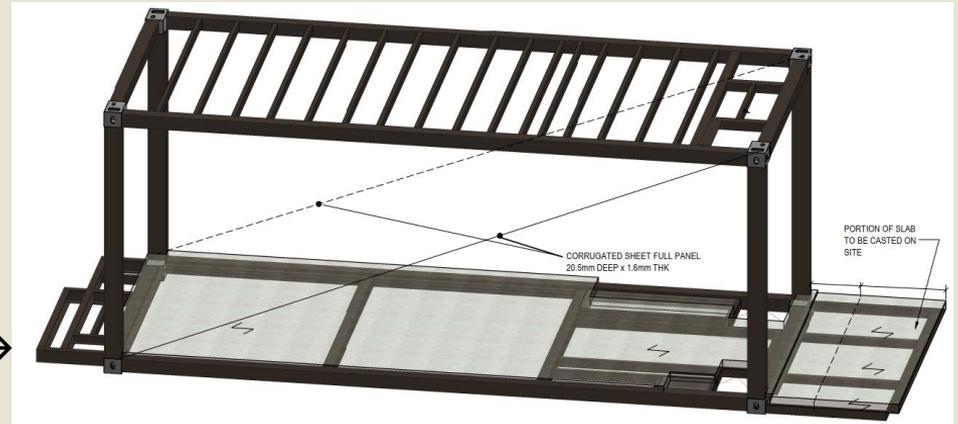
- Member size
- Module dimensions
- Slab thickness
- Addition / removal of members
- Openings

Layout accepted in IPA →



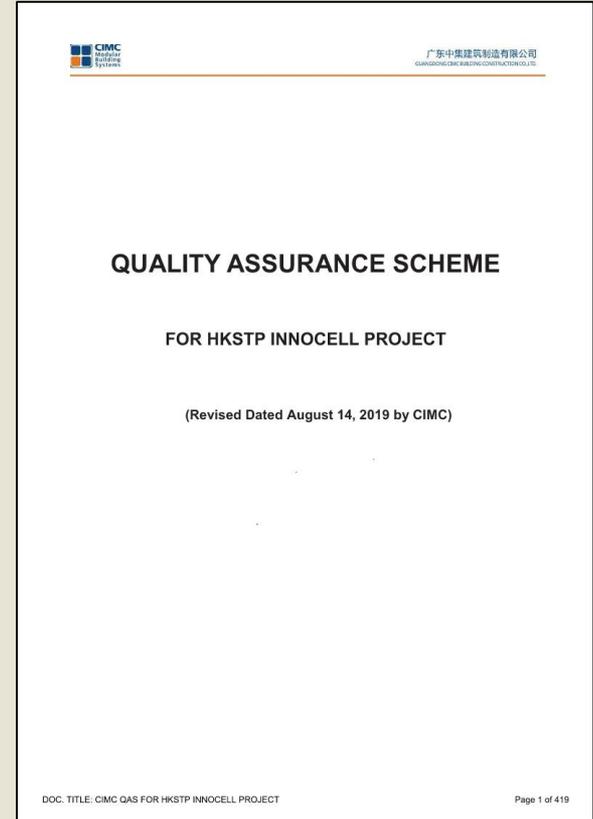
Compare superstructure submission to IPA version and provide justification for differences. No IPA “amendment” or resubmission is required.

Layout approved in →
Superstructure



Quality Assurance Scheme (QAS) and Qualified Supervision

- AP/RSE to verify supplier's capability of module fabrication
- Important to recognize scope of work undertaken by different factories, trades and sub-contractors
- QAS to be submitted and must satisfy BD for IPA to be approved
- For project stage, QAS should be submitted at least 14 days before commencement of fabrication in factory
- AP/RSE should plan carefully for the qualified supervision of a MiC project since it is likely to involve T3 and T5 personnel for away-base supervision.



Planning and Coordination

- Planning and programming are important aspects of MiC for reaping its benefits
- Topography and site location study
- Cranage arrangement
- Transportation arrangement
- Temporary storage arrangement



Bad planning leads to galvanized coating to be removed for bracket welding

- A successful MiC project relies on good coordination
- Important for key personnel to understand fabrication details of all trades
- Example: welding of façade brackets to galvanized main frame (mindset of on-site vs off-site installation not applicable)

Monthly Audit Reports

- A monthly audit report has to be submitted to the BD for MiC projects
- Coordination with the Contractor & sub-contractors is important
- It reflects on the quality checks done
- It also keep document checks in shape

Summary of Audit

The following items are checked in the audit checking. Video Record of Inspection is attached in Appendix A.

	Item	S / NS	Remark
(1)	TCP check	S	
(2)	Finishing workmanship	S	
	Setting-out checking	S	
	Shipping preparation works checking	S	

Summary of Audit in Documentation

Items	Observation
- BD approval Drawings	In order
- BD accepted Quality Assurance Scheme	In order
- Inspection logbook	In order
- Record on concrete production	In order
- Inspection form	In order
- Welding test report	In order
- Shear stud bending test report	In order
- Concrete cube test report	In order

Summary of Audit in Prefabrication

Production Procedure	Conclusion	Acceptance Criteria / items to be inspected
Structural Steel		
- Size and dimension	Satisfactory	Mil Certificate and dimension measurement
- Welding	Satisfactory	VT, UT and MPI by laboratory
- Galvanizing	Satisfactory	Measurement of coating thickness
- Shear stud installation	Not inspected	Visual Test and Bend Test by laboratory
Steel Reinforced Bar		
- Size, pattern, fixing and layout of the steel reinforcing bars	Satisfactory	Refers to approval drawings

Inspection and Test Plan (ITP)

- An ITP should be designed like a complete summary of acceptance criteria
- Advisable to be more comprehensive than BD requirements for QA Scheme

香港科技園 InnoCell - Structural MIC Prefabrication Inspection and Test Summary Plan						 協興工程有限公司 HIPHING ENGINEERING CO LTD <small>新創建築集團成員 Member of NWS Holdings</small>		 CIMC Modular Building Systems		Date: 28 June 2019	
ITP Document No.: ITP-S-MIC-001	Revision: 5	Timing	Type of Inspection	Specification / Reference Documents	Acceptance Criteria	CIMC R	Inspection Requirement ZP R	HH R	RSE Rep. R	AP Rep. R	Remarks
1.0	Acceptance of ITP	Review & check prior to Works	Approved Submission Form	ITP-S-MIC-001	ITP reviewed by all parties and accepted to use in Project						
2.0	Documentation review										
2.1	Shop Drawing / Fabrication Drawing	Review & check prior to Works	Review	Approved Submission Form	Ensure all drawings are at Construction Issue	R	R	R	R	R	
2.2	Workshop Work Method Statement	Review & check prior to Works	Review	Approved Submission Form, ADV-36 PS.S1 - CL5.4	The method statements to be submitted by the Contractor shall: - describe the methods of design, construction and/or manufacture and installation proposed for all normal activities associated with the relevant part or phase of the Works; - detail any special activities or processes required or proposed for the relevant part or phase of the Works; - identify the amount and nature of the Contractor's equipment and temporary Works which the Contractor proposes to use; - describe the supervision policy which the Contractor proposes to follow, particularly with regard to the work of Sub-Contractors of any tier; - contain sufficient information to enable the Architect to understand and appraise the Contractor's plan for the execution of the Works and for the control of the quality of the Works; - contain details for traffic management and/or road closures if required; and - include other relevant information.	W/R	W/R	W/R	W/R	R	
2.3	Proposed Testing Laboratory / Fabrication Factory - Welding Test, Material Test, Concrete Cube Test, Rebar Test, etc. - Factory of MIC Fabrication/ Galvanization / Heat Soak Treatment / Façade Fabrication, etc.	Review & check prior to Works	Review	Approved Submission Form	Ensure Proposed laboratory are HOKLAS / CNAS Lab or MRA Partners Factories are under ISO9000 or equivalent	W/R	W/R	W/R	W/R	R	
2.4	Material against material submission schedule - Structural Steel, Welding Consumable, Aluminum, Steel reinforcement, Concrete, others Accessories, etc.	Review & check prior to Works	Review	Approved Submission Form	As per corresponding requirement	W/R	W/R	W/R	W/R	R	
2.5	Other Document Submission - Welding Procedure and Welder Test Certificate, Calibration Report of the Heat Soak Treatment Oven, Material Supplier Information, etc.	Review & check prior to Works	Review	Approved Submission Form	As per corresponding requirement	W/R	W/R	W/R	W/R	R	
3.0	Prefabrication of Façade (Curtain Wall + Cladding)										
3.1	Material Verification and Pre-treatment										
a	Structural Steel Delivery - Hot-rolled Steel Section - Hot-finished Hollow Steel Section	Each Batch / Upon Delivery	Measure and Visual inspection	PS.S2, BS EN 10025-1:2004 PS.S2, BS EN 10210-1:2006	- Straightness of Section by Visual Inspection - Mill certificate of steel Grade comply with approved drawings - Measure Dimension of Section comply with Section Table - Condition of Steel for Fabrication is not to be more heavily pitted or rusted than Grade C of Swedish Standard SIS 05 59 00 - Material Tolerances Clause 15.1 to 15.9 of HKCSUS Laboratory Testing Procedure - Required Tensile Strength and Elongation percentage - Chemical Composition	-	A1	W2	W3	W3	
b	Structural Steel Sampling	Upon Delivery ADV-36: One specimen for every 40tonnes of each section or plates of same thickness from the same cast to be	Laboratory Test	BS EN ISO 6892-1:2016, BS EN 10002-1:2001		-	A1	W2	W3	W3	

Digitization

- Including inspection forms, test reports and drawings
- Avoiding document loss
- Enhancing traceability
- Improving transparency
- Environmentally friendly

HK Science Park InnoCell Development
Hong Kong Science and Technology Parks
5/F, Building 5E,
5 Science Park East Ave,
Science Park
Shatin China (Hong Kong)



MAIL TYPE	MAIL NUMBER	REFERENCE NUMBER
Inspection Record	WSP(Str)-INSPREC-001492	HHEXQ-RI-002915

Re: PD/WC/213/RISC/STR/W/1384

From	Mr Ken Cheng - WSP Hong Kong Ltd.
▶ To (2)	Mr Simon Kwok - HIP HING ENGINEERING (+1 more...)
▶ Cc (9)	H.E. Wendy Fan - HIP HING ENGINEERING (+8 more...)
Sent	Wednesday, October 7, 2020 4:13:46 PM HKT (GMT +08:00)
Status	N/A

▼ DETAILS

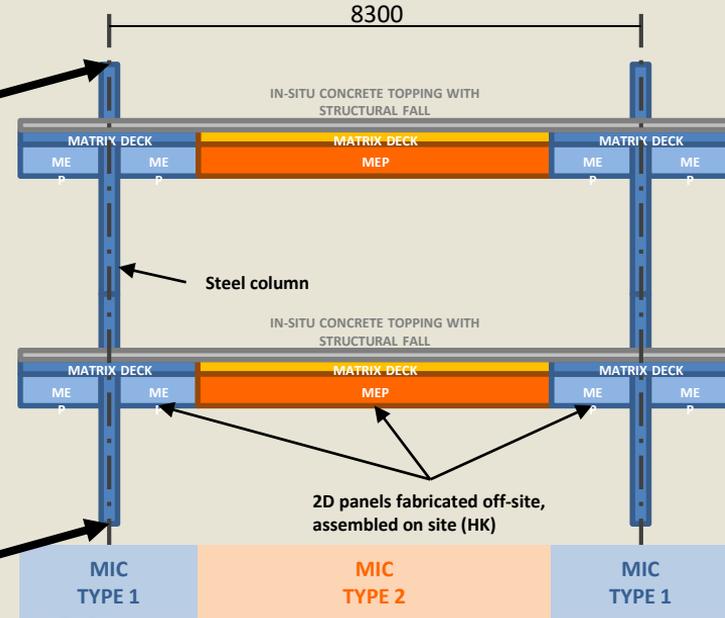
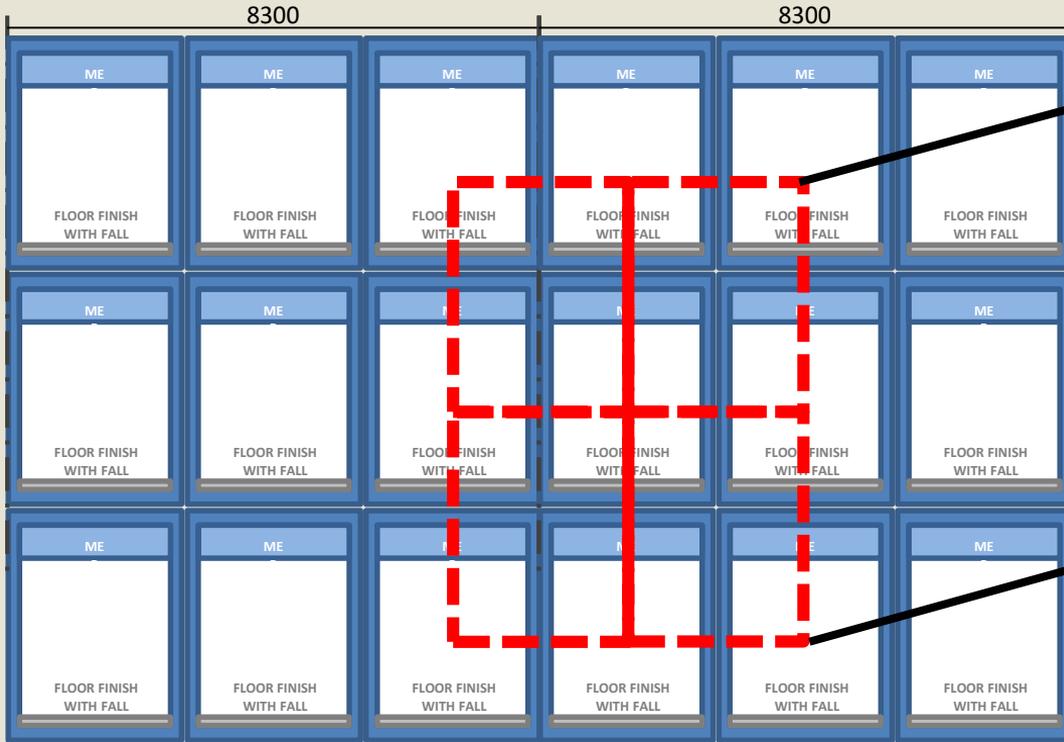
Trade	STR
Inspection Type	W
Inspection Ref.	PD/WC/213/RISC/STR/W/1384
Inspection Date	9/28/20
Inspection Time	4:30 PM
Permission	(1) Notice of no objection, the stated description of works was completed in compliance with the specified requirement
Comments	
Approval for works proposed	is given



INNOVATIVE “MADE IN HK” 2-STAGE MIC / DFMA CONSTRUCTION

CONVENTIONAL MIC

“MADE IN HK” 2 STAGE MIC



INEFFICIENT DESIGN – double column, beam, slab, wall and joints



COMPROMISED clear headroom

Promote innovative “Hong Kong Made Mic” construction technology



OPTIMISED for transportation – combination of offsite MiC and on-site DfMa, make it feasible for long span usages



EFFICIENT DESIGN – eliminates double structure and reduces number of joints and on-site installation & construction time

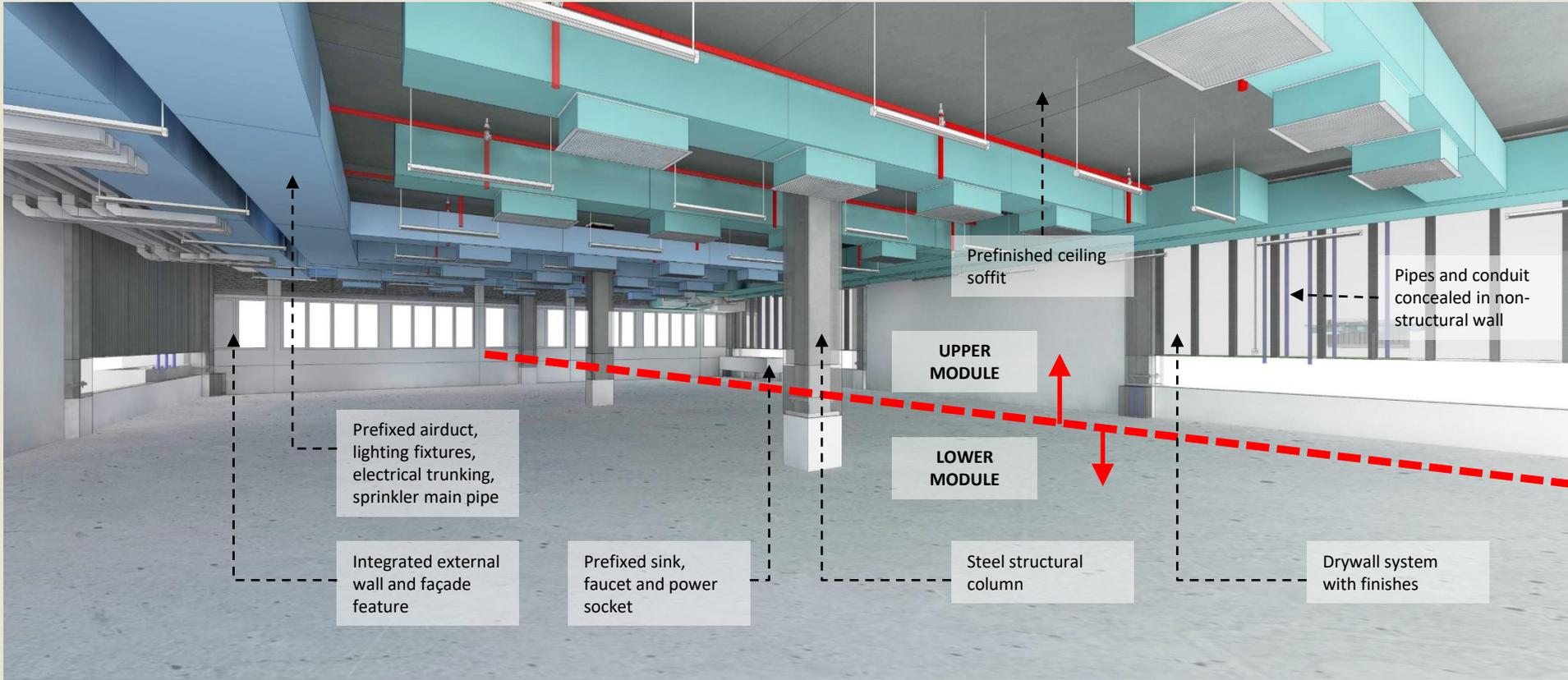


MAXIMISE offsite construction benefits. It would reduce approximate 292,00m3 of waste which is generated from the formwork works.

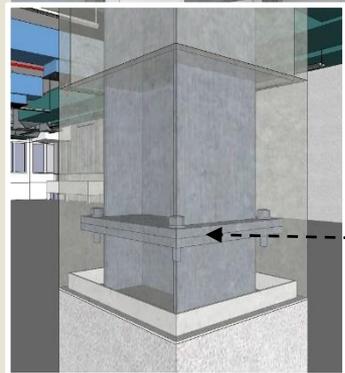
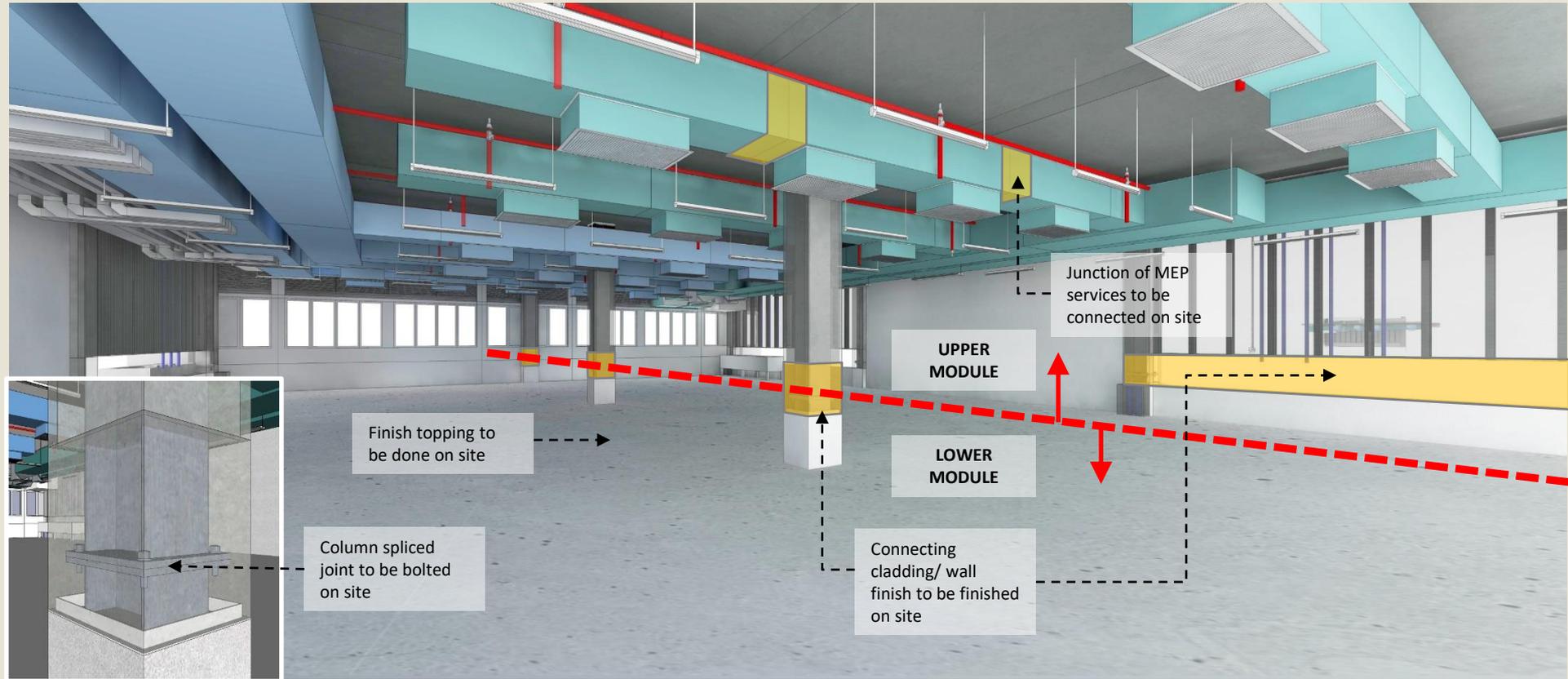


INNOVATIVE LIGHT-WEIGHT FLAT SLAB SYSTEM reduce weight and maximize headroom

WORKSHOP TYPICAL BAY ARRANGEMENT

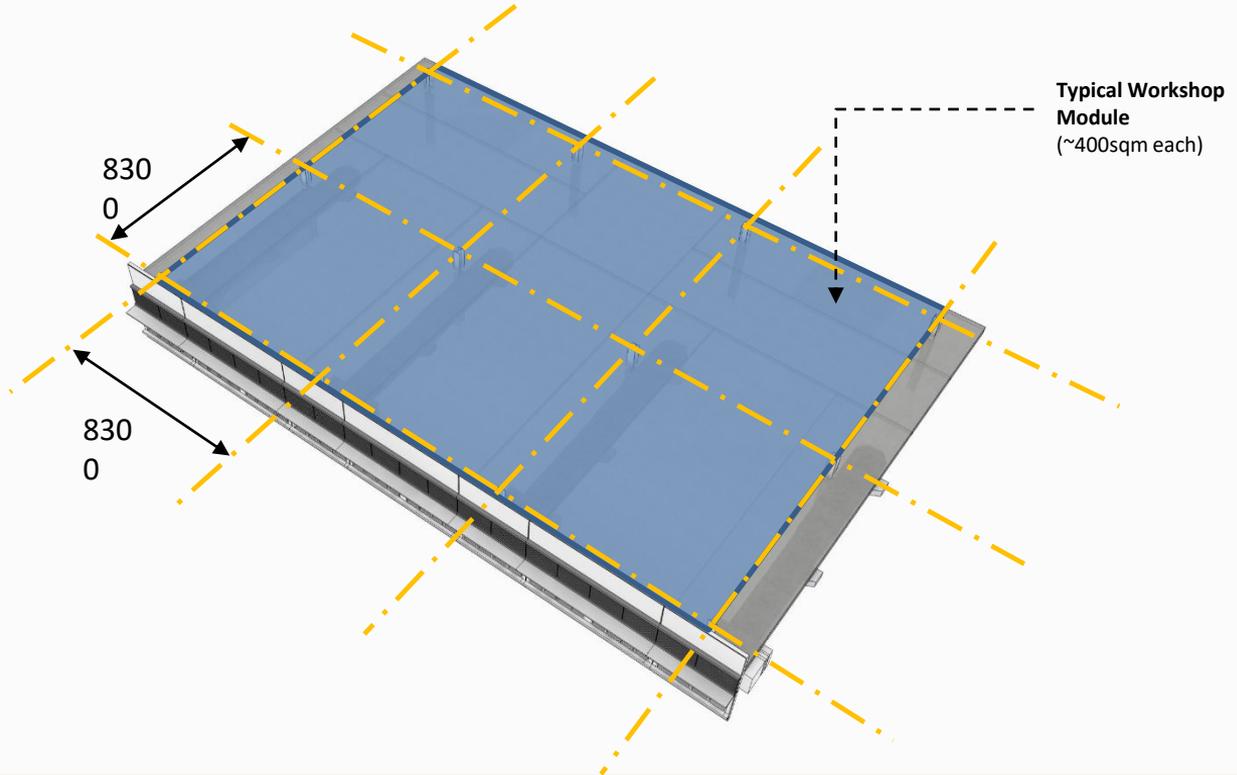


WORKSHOP TYPICAL BAY ARRANGEMENT

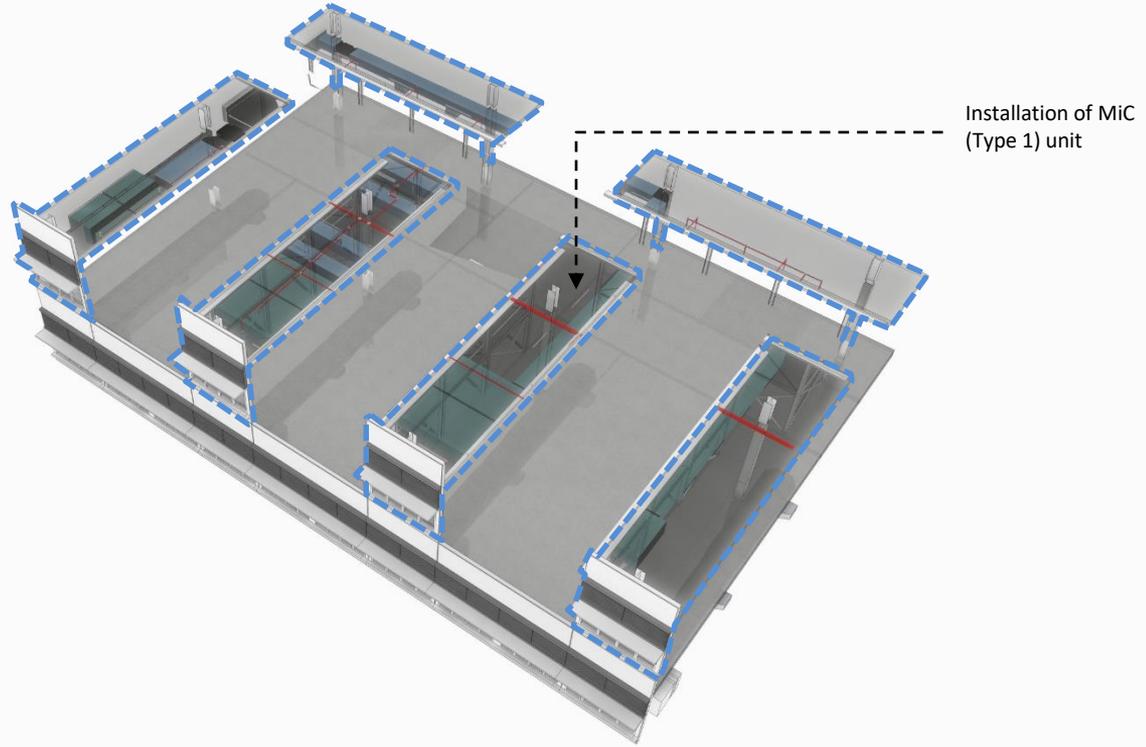


Column detail

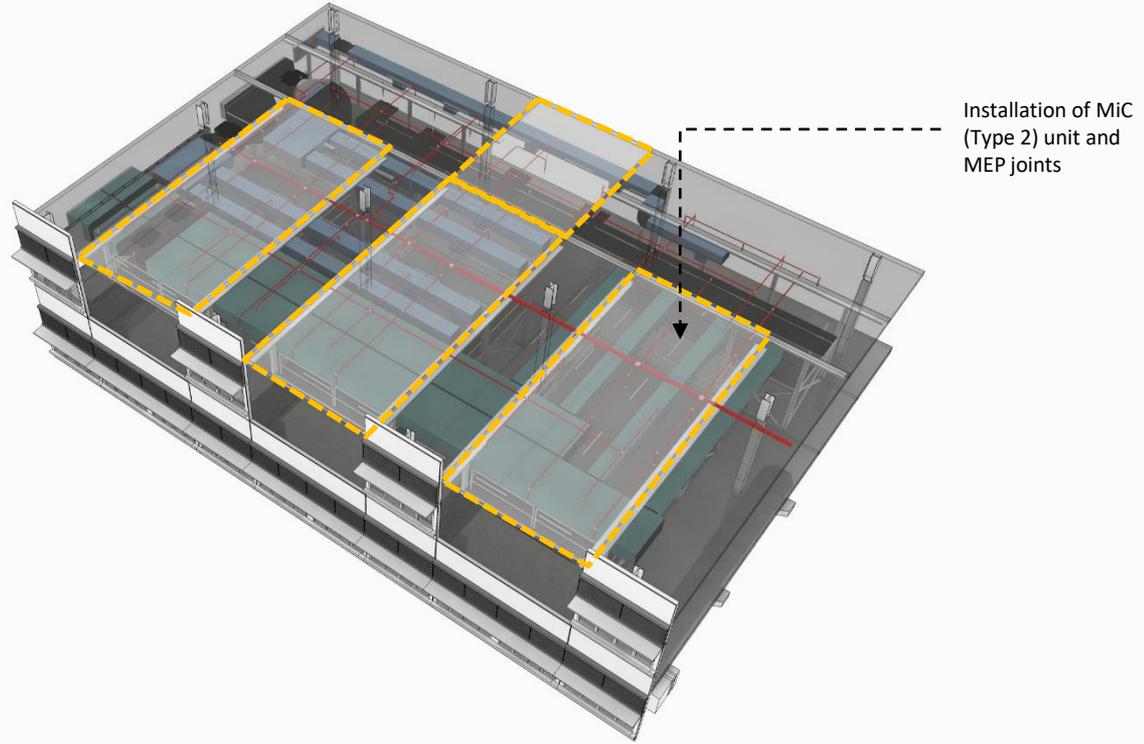
WORKSHOP TYPICAL BAY ARRANGEMENT



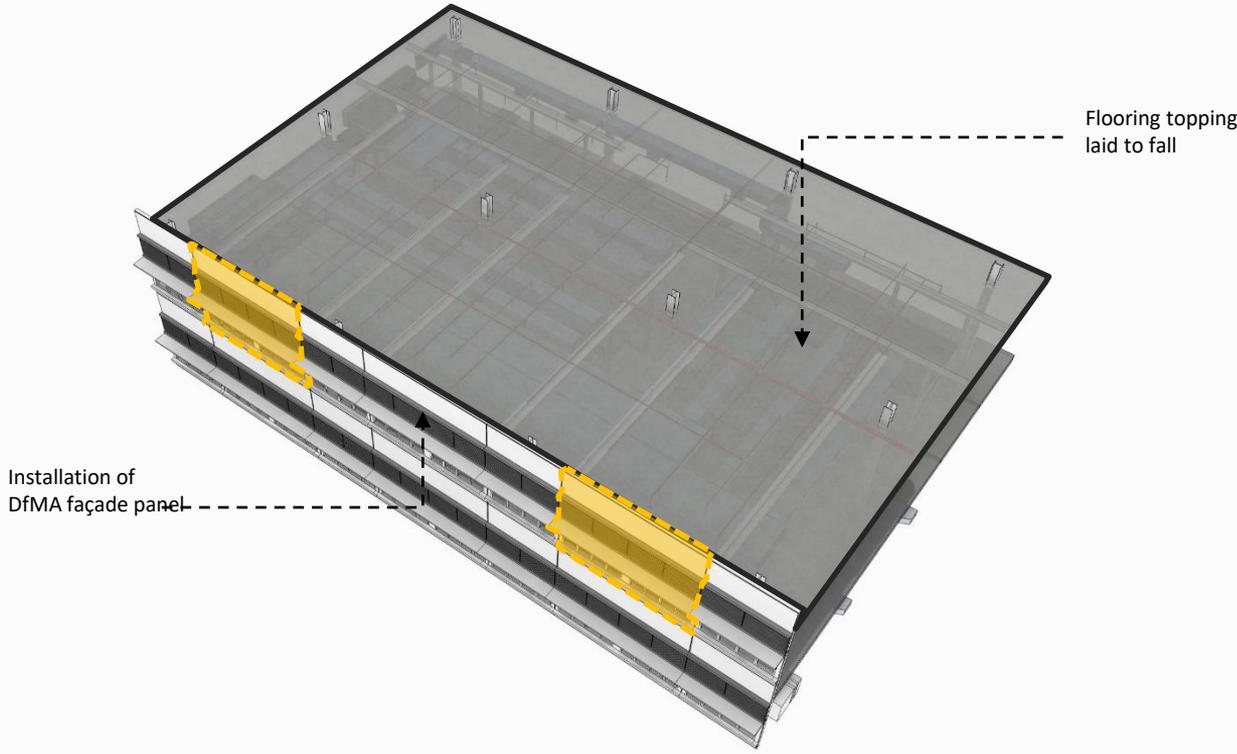
WORKSHOP TYPICAL BAY ARRANGEMENT



WORKSHOP TYPICAL BAY ARRANGEMENT



WORKSHOP TYPICAL BAY ARRANGEMENT



Flooring topping
laid to fall

Installation of
DfMA façade panel

THANK YOU

