



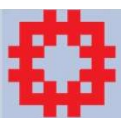
Hong Kong Housing Authority

Public Housing Construction – Innovation and Quality

Stephen K M LEUNG, JP
Deputy Director (Development & Construction)
Hong Kong Housing Authority

16 December 2022





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 - Small Unmanned Aircrafts (SUA) for Inspecting the Building Envelope



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Introduction

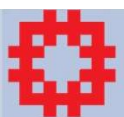
- *The **Hong Kong Housing Authority (HA)** was established in 1973 under the Housing Ordinance.*
- *The HA **plans, builds, manages and maintains** different types of public housing.*

Our Vision

To provide **affordable** rental housing to low-income families with housing needs, and to help low to middle-income families gain access to subsidised home ownership.

Our Mission

- To provide **affordable quality** housing, management, maintenance and other housing related services to meet the needs of our customers in a proactive and caring manner.
- To provide an **age-friendly** and **barrier-free** estate environment to address the needs of residents of different ages and physical ability.
- To ensure **cost-effective** and **rational** use of public resources in service delivery and allocation of housing assistance in an open and equitable manner.
- To maintain a **competent, dedicated and performance-oriented TEAM.**



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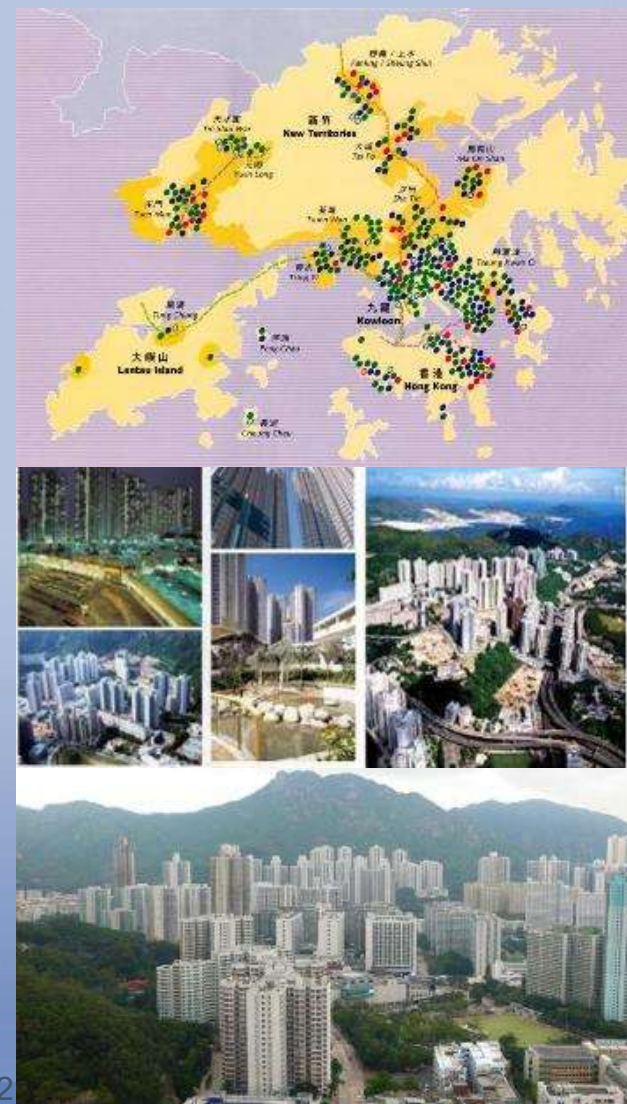
Introduction

Hong Kong Housing Authority's portfolio :

- A stock of around **819,000** PRH flats*
- Production estimate of about **360,000** new flats in the coming **10 years**

We need to build Smarter!

* Remarks : As at end September 2022



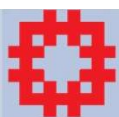


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Precast Construction in HA





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Precast Concrete Components (PCCs) in HA

Precast Construction Development in HA



1980s – 90s	2000 – 2017	2019 ~ NOW		
Planar precast	Volumetric Precast	Enhanced Precast		
 <p>Precast Staircase</p>  <p>Precast Facade</p>  <p>Semi-precast slab</p>	 <p>Volumetric Precast Bathroom</p>  <p>Precast Acoustic Balcony</p>  <p>Volumetric Precast Kitchen</p>	 <p>Semi-precast corridor slab</p> <th>Modular Integrated Construction</th> <td><p>MiC Mock up</p></td>	Modular Integrated Construction	 <p>MiC Mock up</p>



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Volumetric Precast Concrete Components (**V** PCCs) (with Finishes and BS Components starting *from 2000 onwards*)



Volumetric Precast Bathroom (VPB)



Volumetric Precast Kitchen (VPK)



Volumetric Acoustic Balcony



Lift Shaft



Staircase shaft



Water Tank



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Enhanced Precast Concrete Components (EPCCs) (from 2019 onwards)



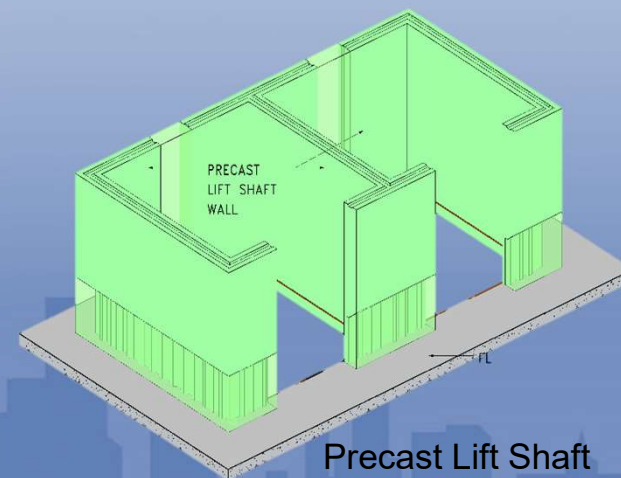
Enhanced Semi-precast
Corridor Slab



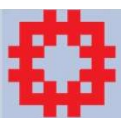
Enhanced Semi-precast Slab



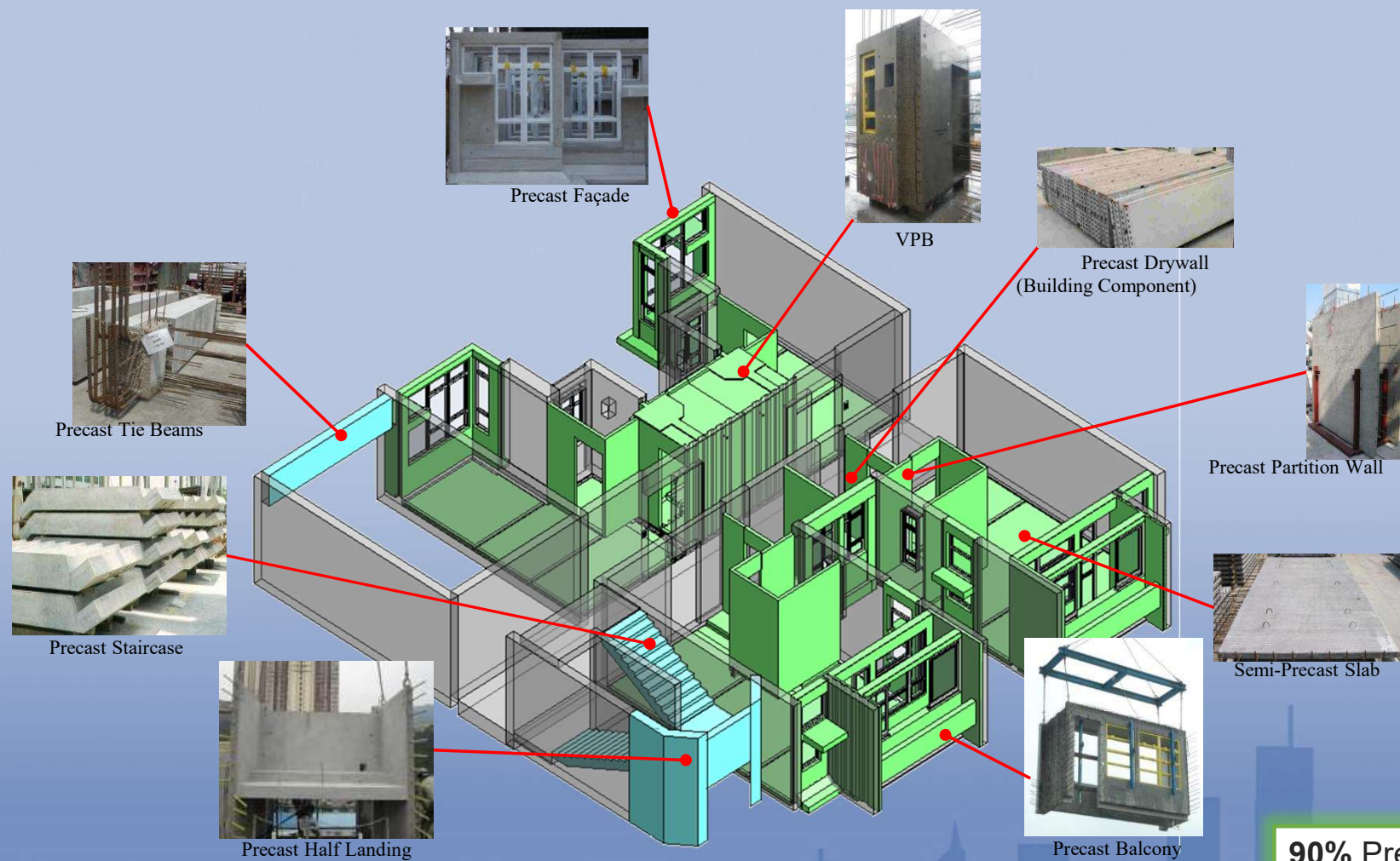
Precast Structural Wall



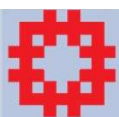
Precast Lift Shaft



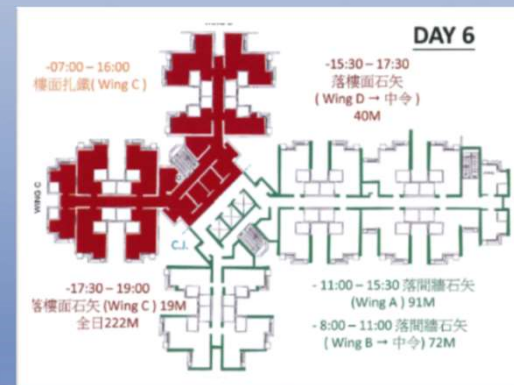
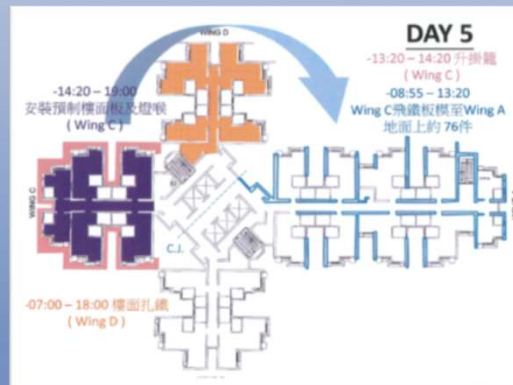
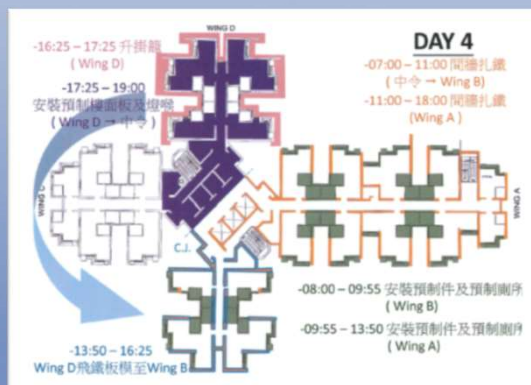
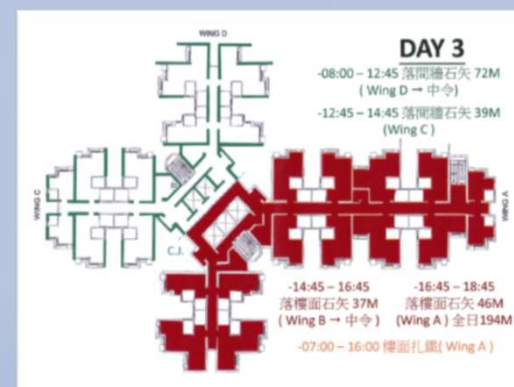
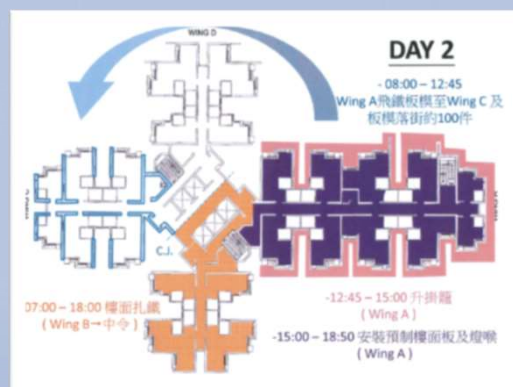
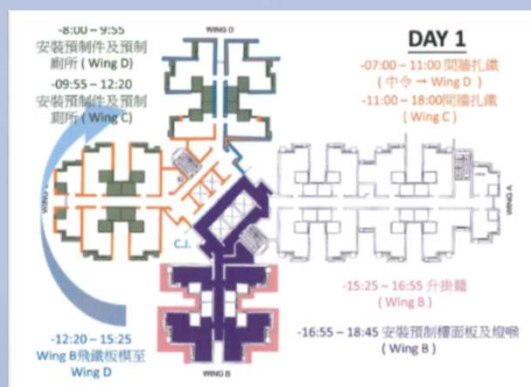
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90% Precast rate on plan



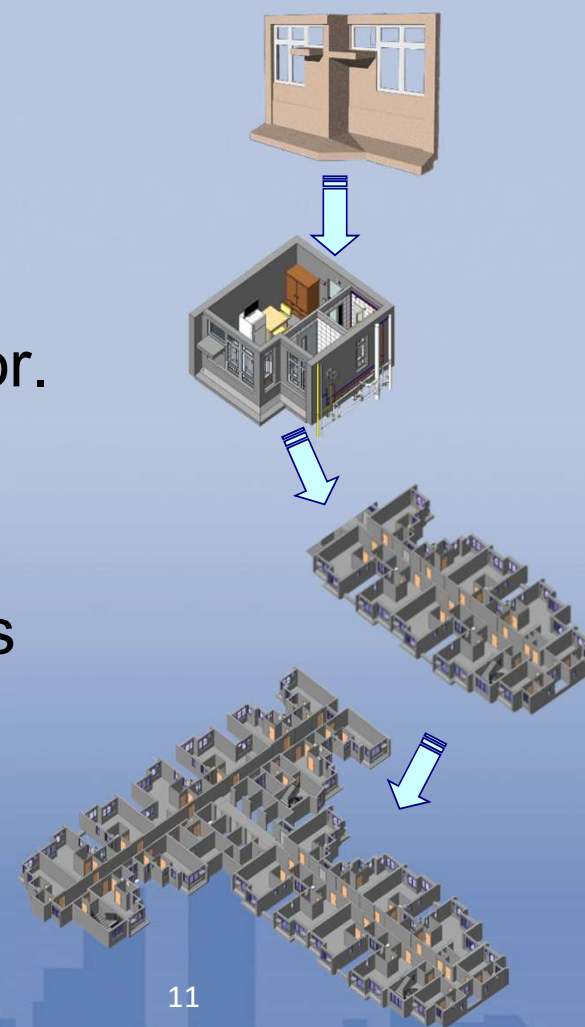
6-day Construction Cycle using Precast Concrete Construction

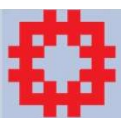




Advantages of Prefabrication

- a) **Improve Quality**: Fair face off-form finishes with paint to exterior and tiles/paint to interior.
- b) **Environmental Friendliness**: Reduce use of Timber Formwork
- c) **Safety**: Reduce Wet Trades & Labour forces and Working at Height





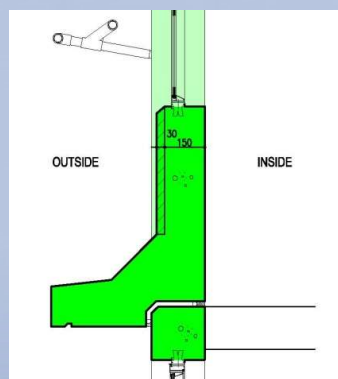
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Water Tightness

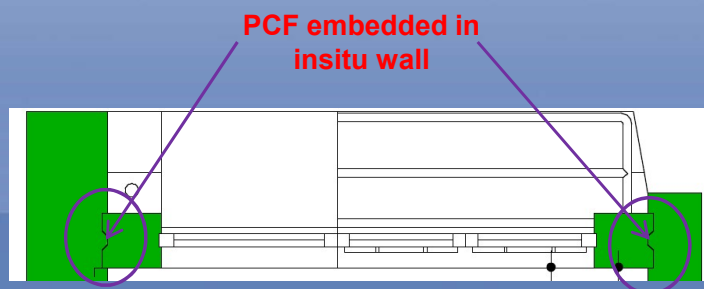
(Joint between Precast Façade & Building)

“Pre-fixing Method” to improve quality of construction

- ✓ PCF to be installed prior to the casting of supporting shear walls
- ✓ PCF joins effectively with structural wall by embedding starter bars in in-situ concrete
- ✓ Better in waterproofing



Façade Bottom
Joint Details





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Use of Environmentally Friendly Materials

- Cement production alone account for 8% of global CO₂ emissions.
- To reduce the CO₂ emission by using less cement in concrete in support to meet government's 2050 carbon neutrality target, HA had required in the specification for the use of environmentally friendly construction materials:
 - ✓ **35%** use of Ground Granulated Blastfurnace Slag (GGBS) is mandated for precast façade, staircase, refuse chute, partition wall and concrete panel
 - ✓ **35%** use of Pulverised Fuel Ash (PFA) is mandated for all foundation works (e.g. piles, tie beams, footings), and **25%** use of PFA for other in-situ concrete elements
- We had embarked on a study to ascertain the viability of extending the use of GGBS to foundation elements





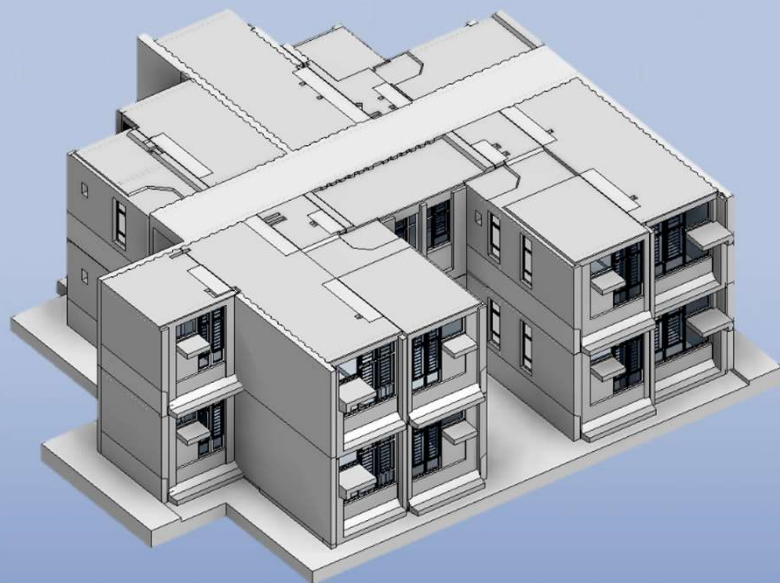
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Modular Integrated Construction (MiC)



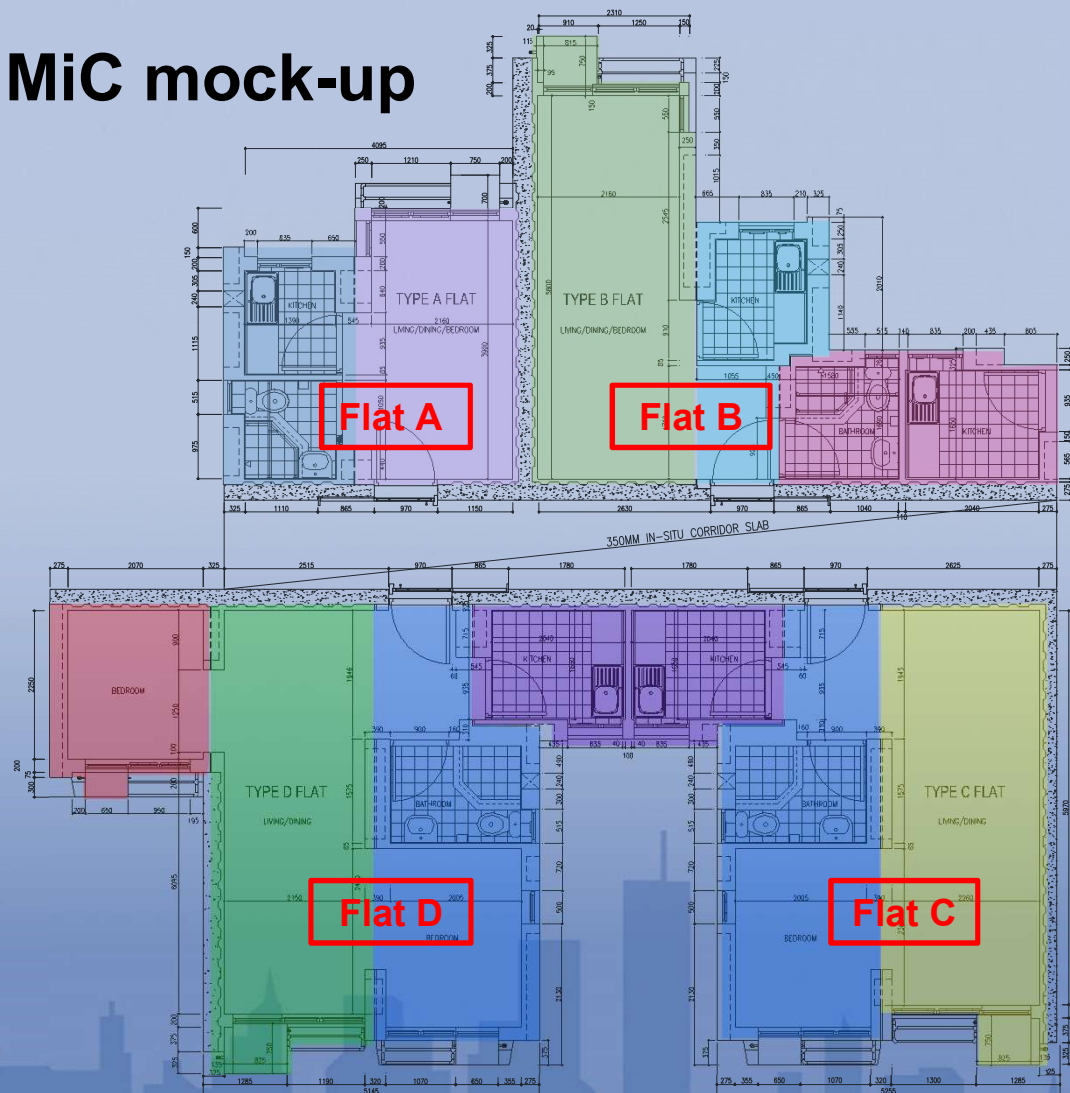
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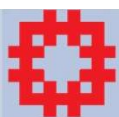
MiC Mock Up



- 2 storeys / 4 Types of Modular Flats
- Total 8 flats (22 modules)
- Fabricated in 惠州

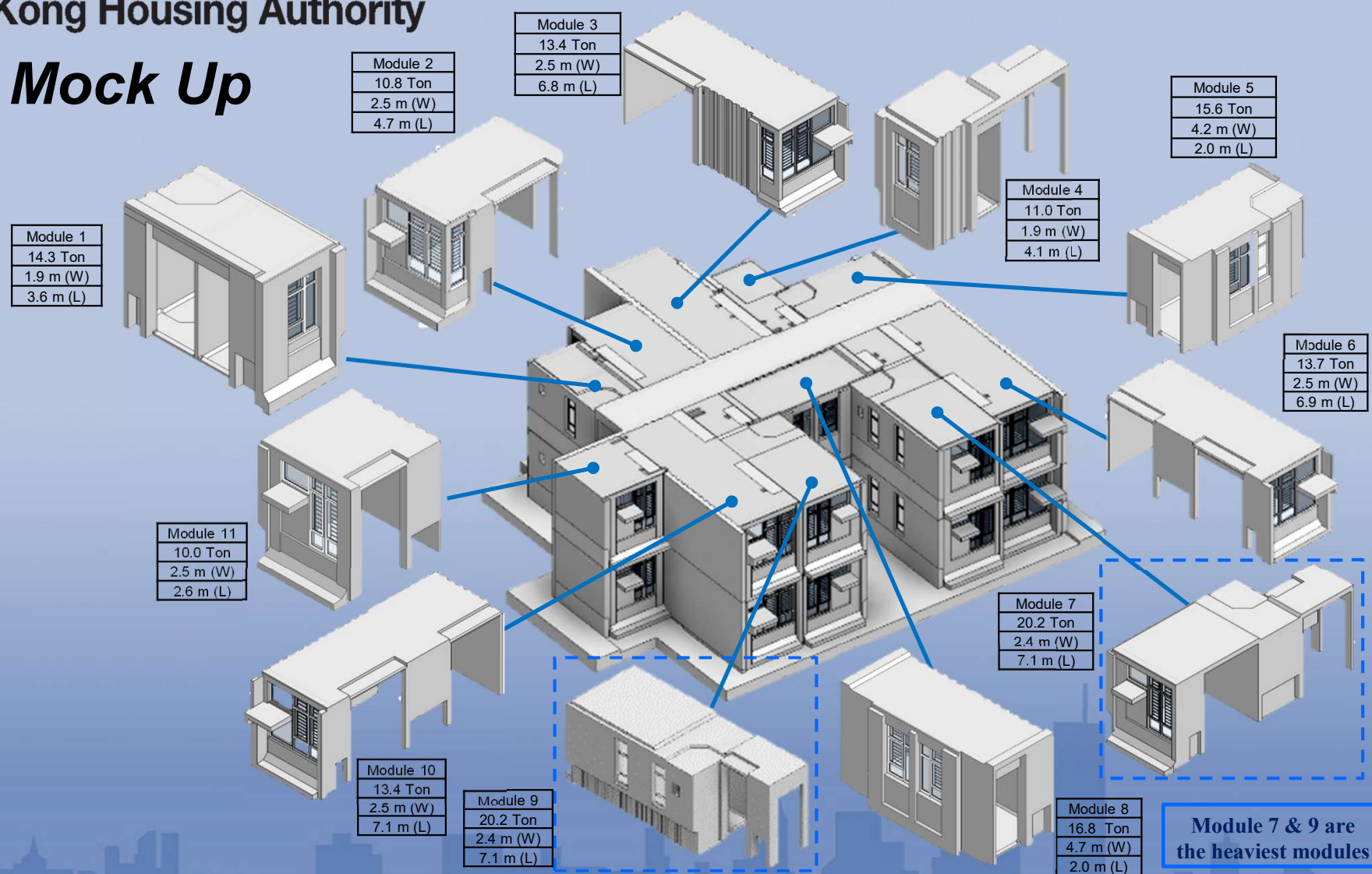
MiC mock-up





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MiC Mock Up



Note: All modules are NOT more than the transportation limit of 2.5m width

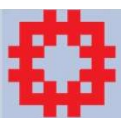


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MiC Mock Up

- Commencement -
9 / 2020
Completion -
12 / 2020
- Assessment of –
 - **buildability**
 - **workmanship**
 - **quality control**
 - **joint integrity**





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MiC Mock Up



- Completed in Dec 2020





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1st Batch HA MiC Projects

(1) Tung Chung Area 99

- One MiC block of 12 storeys
- To demonstrate the **productivity, cost-effectiveness** of MiC



(2) Anderson Road Quarry Site R2-6 & R2-7

- **Three MiC blocks**
 - Two blocks at R2-6
 - One block at R2-7
- Good **benchmark for cost and time comparison** with other nearby similar scale non-MiC projects



(3) Tak Tin Street, Lam Tin

- One MiC block of 33 storeys
- To demonstrate the logistic arrangement in **very congested area** with busy traffic





2022 Policy Address –

1st five-year period (2023/24 -2027/28)

- All projects adopt the Design for Manufacture and Assembly (DfMA), with the adoption of the MiC approach in suitable projects.

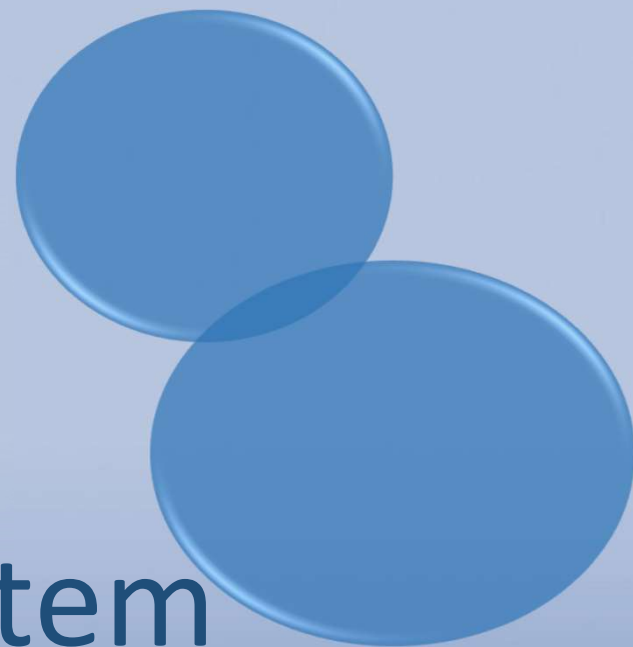
2nd five-year period (2028/29 -2032/33)

- No less than 50% of the projects will adopt the MiC approach



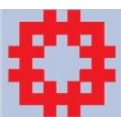


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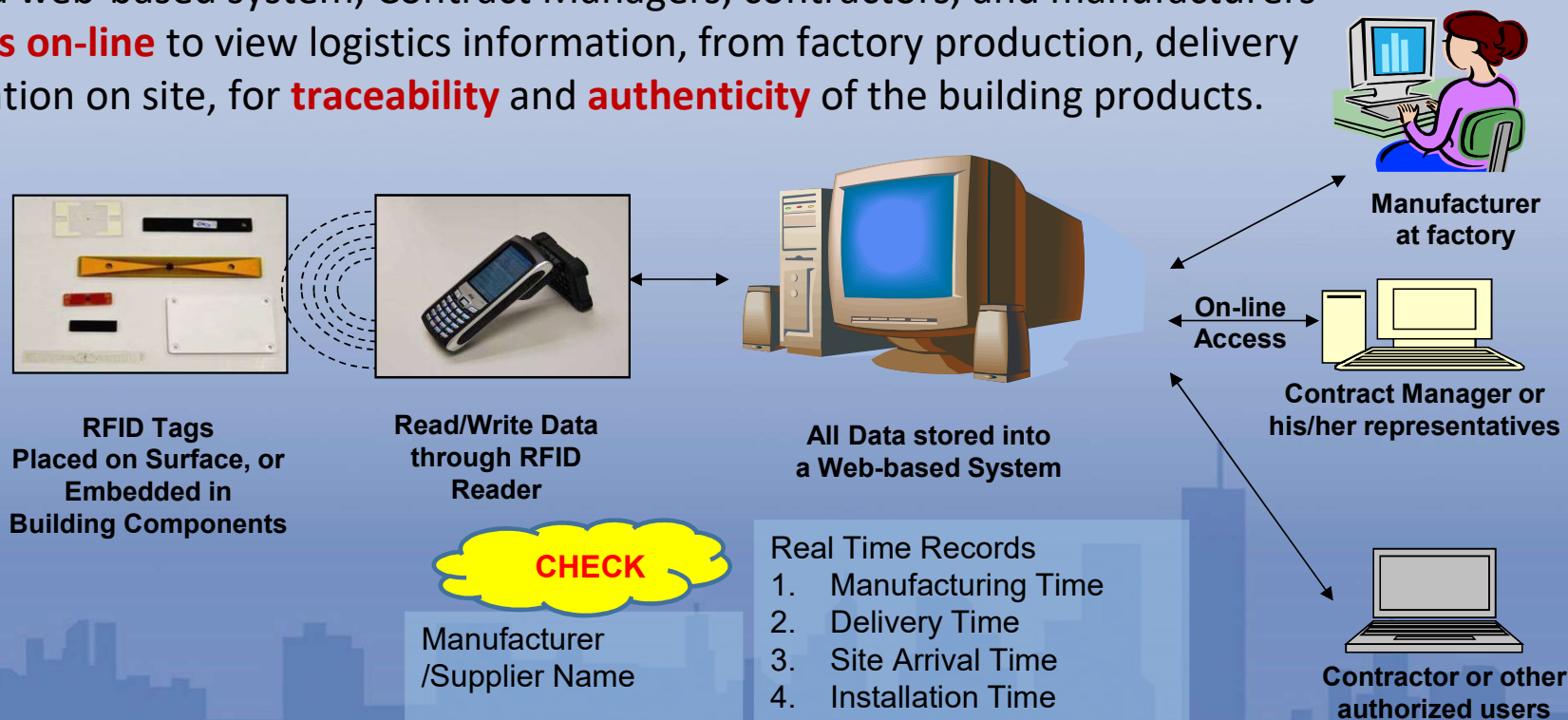
Smart Quality Control System





Radio Frequency Identification (RFID)

- RFID technology consists of a reader and a tag. RFID tag has a built-in antenna and a chip. The reader is used to transmit radio frequency energy, which stimulates the chip operation through the antenna to read data.
- Through a web-based system, Contract Managers, contractors, and manufacturers can **access on-line** to view logistics information, from factory production, delivery to installation on site, for **traceability** and **authenticity** of the building products.



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Radio Frequency Identification (RFID)

RFID Application in building components:

- Precast Façade/ Precast Balcony Units
- Aluminium Window
- Timber Door
- Metal Gateset
- Volumetric Precast Bathroom (VPB)
- Volumetric Precast Kitchen (VPK)
- Modular Integrated Construction (MiC) Unit

Benefits

- Unique Identification
- Improve Traceability
- Enhance Data Management
- Real time Monitoring
- Minimize human errors
- Streamline the Work Flow



Aluminium Window



Precast Facade



Metal Gateset



Volumetric Precast Bathroom

Precast Facades



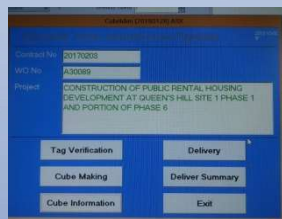
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Radio Frequency Identification (RFID)

(1) Initialization



(2) Registration



(3) Record off-site time



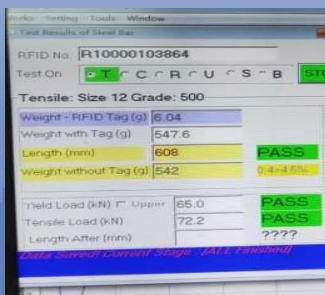
(4) Measurements



(5) Test



(6) Results upload to RFID system automatically





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DCSMS

Development and Construction Site Mobile System

DCSMS - Background

DCSMS

Development and Construction Site Mobile System

發展及建築
工地流動系統



香港房屋委員會
Hong Kong Housing Authority



Digital Works Supervision System (DWSS) For DEVB Works


- The Development Bureau had issued a Technical Circular to promulgate the use of DWSS in certain public works tendered on or after 1 April 2020



香港特別行政區政府
The Government of the Hong Kong Special Administrative Region

**政府總部
發展局
工務科**

香港政府總部大樓 2 樓
政府總部西翼 18 樓



**Works Branch
Development Bureau
Government Secretariat**

18/F, West Wing,
Central Government Offices,
2 Tin Mau Avenue, Tsim
Hong Kong

Ref : DEVB(PSGO)/38/2
Group : 5

27 March 2020

Development Bureau
Technical Circular (Works) No. 3/2020
Digital Works Supervision System

Scope

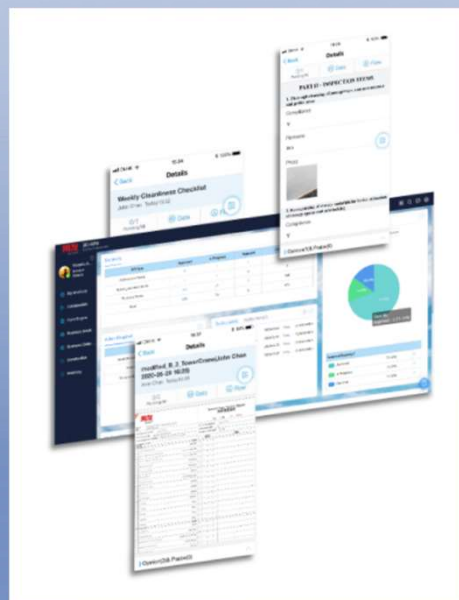
This Circular sets out the policy and requirements on the adoption of the Digital Works Supervision System (DWSS) in capital works contracts under the Capital Works Programme, with pre-tender estimate exceeding \$300 million and to be tendered on or after 1 April 2020.

Effective Date

2. This Circular takes immediate effect.

Effect on Existing Circulars and Circular Memoranda

3. This Circular shall be read in conjunction with ETWB TC(W) No. 12/2004.



INSPECTION REQUEST FORM

Date: 07 May 2020

Contract No.: 1A

Kiewit Town, Kowloon

Latex Submission

Ref: No. 05-001(2020)

Rev: _____

This is a non-technical / non-substantive

signature request to

(a) Location of Work Project Name: <u>Phase II Bridge Rd</u>	Date & Time
(b) Work to be Inspected Inspection of <u>APC</u>	08 May 2020 10:17
(c) Work Proposed and Acceptance of Work	07 May 2020 10:17
(d) Remarks: If it is a substantive issue (not confined to above but important)	Yes / No
REQUESTED BY: <u>11/10</u>	TIME: 10:17
DESIGNATION: <u>Human Administration</u>	DATE: 07 May 2020
Reviewed by: TIME: 10:20	DATE: 07 May 2020
Field in: <u>ASST</u>	SIGNED: _____
Field in: <u>ASST</u>	SIGNED: _____
Field in: <u>ASST</u>	DATE: 07 May 2020

Field in: ASST (This address has been inspected. Permission is hereby not proposed work submitted in (b) above is not "not good" for the following reasons:

(a) Not in compliance with APC & 10:17

(b) Not in compliance with APC & 10:17

(c) Not in compliance with APC & 10:17

(d) Not in compliance with APC & 10:17

This is a non-technical / non-substantive signature request to

Form is returned to the Contractor at once below

SIGNED: <u>11/10</u>	TIME: 10:45
DESIGNATION: <u>Human Administration</u>	DATE: 07 May 2020
COUNTERSIGNED: <u>Human Administration</u>	DATE: 07 May 2020
COUNTERSIGNED: <u>Human Administration</u>	DATE: 07 May 2020
Reviewed on behalf of Contractor by: <u>Human Administration</u>	TIME: 10:54
SIGNED: <u>11/10</u>	DATE: 07 May 2020

Note: If a substantive request by Inspected Engineer may be required to return below

Rev. 5, 27 Feb 2018

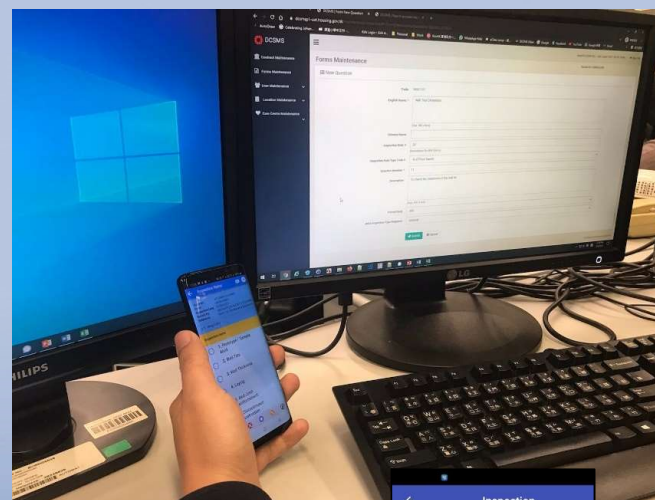
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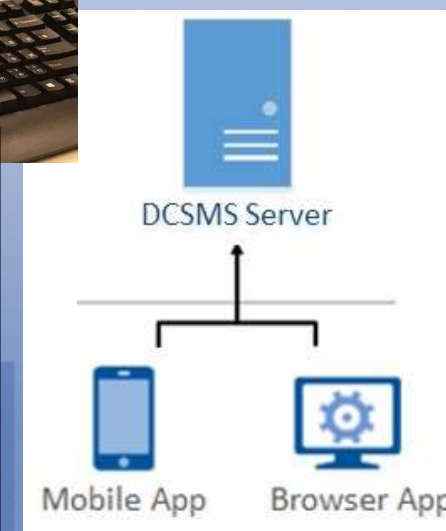
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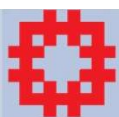
DCSMS – Why we go our own way?

- Tailor-made to Public Housing Construction Process and Housing Authority Inspection Procedures
- Can be Customized to Integrate with In-house and External Applications
- System and Forms can be Readily Updated by In-house Professional and IT Staff
- All Data Saved on our Secured Servers
- Unified Format of Data Storage to facilitate Data Exchange with BIM Models
- Can be Expanded to Cover Further Aspects

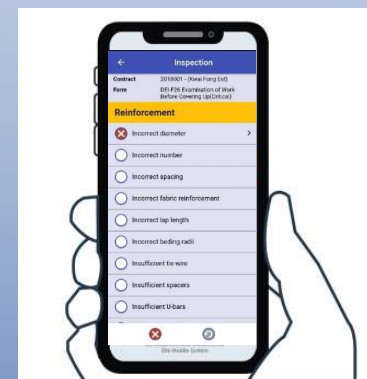
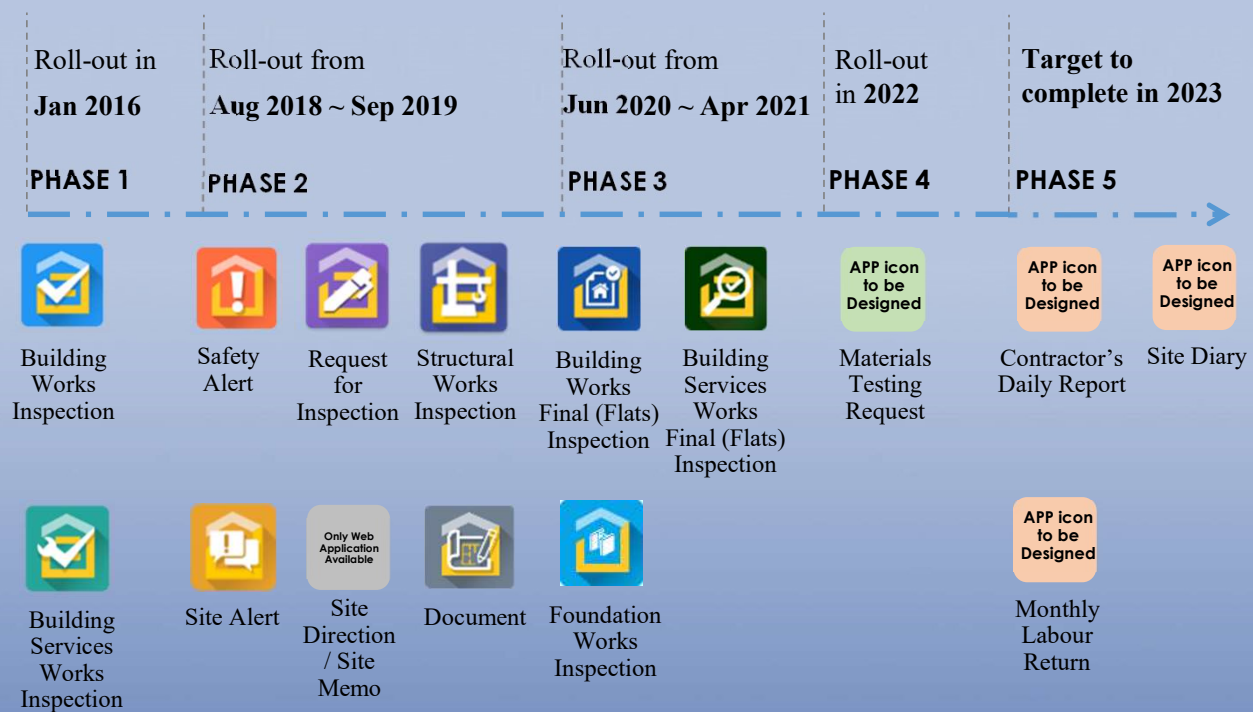


Reinforcement			
<input checked="" type="checkbox"/>	Incorrect diameter		
<input type="checkbox"/>	Incorrect number		
<input type="checkbox"/>	Incorrect spacing		
<input type="checkbox"/>	Incorrect fabric reinforcement		
<input type="checkbox"/>	Incorrect lap length		
<input type="checkbox"/>	Incorrect bedding radii		
<input type="checkbox"/>	Insufficient tie wire		
<input type="checkbox"/>	Insufficient spacers		
<input type="checkbox"/>	Insufficient U-bars		





DCSMS – Development Timeline





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Small Unmanned Aircraft (SUA) for Inspecting the Building Envelope

- Current common use of SUA for non-construction application
- More accurate, safe, efficient and productive for inspection





Small Unmanned Aircraft (SUA) for Inspecting the Building Envelope

- Approved by Civil Aviation Department (CAD)
- Scan building external condition in a safe distance with high resolution data acquisition; and
- Apply Artificial Intelligence to detect defects with locations shown on the BIM/GIS model.





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Thank You

