

Dragages Singapore IDD for PPVC projects – Experience & Learning Points

BOUYGUES

ovation

Dragages, A PPVC Pioneer In Singapore

2014



Steel PPVC System 10-storey hotel, 252 PPVC modules

2016

Woodlands Nursing Home



Hybrid PPVC System 9-storey nursing home, 343 PPVC modules

2016



Concrete PPVC System 40-storey residential (505 units), 1866 PPVC modules

2019

BCA Academy Phase 2



PPVC / APCS / PDV / MET

7-storey zero energy building (MET) 16-storey super low energy building (PPVC, APCS and PDV)

2017

Park Colonial



Concrete PPVC System 6 blocks, 14-15-16-storey apartments (837 units), 2514 PPVC modules

2019

The M @ Middle Road



Concrete PPVC System 4 blocks, 20-storey 522 units

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2018

Perumal Road



Concrete PPVC System 1 tower 23-storey residential (116 units) 1 tower 18-storey service apartment (240 units) 680 PPVC modules

2018

Garden Residences



Concrete PPVC System 5 blocks, 15-storey apartments (613 units), 2012 PPVC modules

Production steps of a PPVC module

<u>Stage 1 – Carcass Fabrication</u>



Panel fabrication / casting



3D Module after casting



Module ready for delivery

<u>Stage 2 – Fit Out Installation</u>



Module arrangement



Fit out works





Module ready for delivery

Stage 3 – Site Installation



Preparation for Transfer Slab





Lifting process





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PPVC Module is installed



1. At Design Stage

IDD for PPVC projects – Experience and Learning Points





Concept to Schematic Design 50%



The M

Level 1 Block 1

Situation

- Layout frozen at 95% due to early WP & BP process
- PPVC fabricator / Main Contractor not involved at early design stage





PPVC vendor / Main Contractor is involved.

- PPVC demarcation layout;
- Integration of the construction tolerances to the design;
- Coordination of all cast in parts (plumbing, electrical conduits...);
- Optimization of the 65% PPVC score for efficiency of the process;
- Fully coordinated module.







PPVC vendor / Main Contractor is involved.

- PPVC demarcation layout;
- Integration of the construction tolerances to the design;
- Coordination of all cast in parts (plumbing, electrical conduits...);
- Optimization of the 65% PPVC score for efficiency of the process;
- Fully coordinated module.

But because of late involvement,

• Non-typical details







Total = 1,866 PPVC modules 48 type of PPVC Modules 26 sets of PPVC moulds Park Colonial Total = 2,514 PPVC modules 172 type of PPVC Modules 39 sets of PPVC moulds PPVC vendor / Main Contractor is involved.

- PPVC demarcation layout;
- Integration of the construction tolerances to the design;
- Coordination of all cast in parts (plumbing, electrical conduits...);
- Optimization of the 65% PPVC score for efficiency of the process;
- Fully coordinated module.

But because of late involvement,

• Lack of standardization (too many type of modules and moulds).





PPVC vendor / Main Contractor is involved.

- PPVC demarcation layout;
- Integration of the construction tolerances to the design;
- Coordination of all cast in parts (plumbing, electrical conduits...);
- Optimization of the 65% PPVC score for efficiency of the process;
- Fully coordinated module.

But because of late involvement,

- PPVC design need to be tweaked to fully align with regulatory and design requirements. Example:
 - □ Stair Case Shelter specific design for the walls
 - □ Fire requirement from floor to floor
 - □ Façade features & city grids



Drawing Submission And Issuance / Model Sharing



Situation

• Digital tools available to fully manage design digitally

<u>But</u>

• Paper-based shop drawing review & approval is still preferred by some industry stakeholders





Learning Points & proposed solutions (Design Stage)

PPVC principles not fully applied to get full benefits of time, productivity and cost saving



Lack of standardization of modules leading to inefficiency in fabrication



Paper-based shop drawing review & approval is still preferred by some industry stakeholders



Adjust the architectural design requirements to take into account PPVC specificities. Key to involve PPVC suppliers early at Design Stage

Creation of a DfMA Digital Design Database as an object library to help consultants, developers select suitable PPVC design

Digital tools are available. More a mindset change than technology issue.



2. At Fabrication / Construction Stage

IDD for PPVC projects – Experience and Learning Points





Project Site And Factories

DIGITAL TOOL FOR H&S, QA/QC AND PRODUCTION FOLLOW-UP













- 1. Safety During Construction
- 2. Defect Management During Construction
 - 3. Defect Management During Handover
 - 4. PPVC Production Management
- 5. Real Time fabrication progress tracking
 - 6. Data Analytics





Project Site And Factories

AVERAGE OF 50 TASKS PER MODULES ARE TRACKED, STATUS UPDATED IN REAL TIME



Project Site And Factories

DEFECT – DATA ANALYTICS





Not just one project but 2 likely 3



3 centers of production instead of 1 (factory, fit-out and site)

Increase of coordination issues

Aside with ICPH, most of precast works done in Malaysia.

 Vulnerability in case of MCO, border closure. Precasters can consider domestic production and/or diversify to Batam, Bintan and Karimun (BBK)"



Lean Management & Collaborative tools



DIGITAL LEAN MANAGEMENT TOOLS BETWEEN MULTIPLE SITES (PPVC YARD + FIT-OUT FACTORY + SITE) TO ENHANCE COORDINATION



- 1. Review outstanding short-term actions
- 2. Review the daily activities vs plan
- 3. Clarify activities for the following day
- 4. Review any potential forthcoming issues
- 5. Put on the activity tracker the number of deliverables done the day before





RE / RTO Virtual Inspection?



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Learning Points & proposed solutions (Production Stage)

3 centers of production (factory, fit-out and site) instead of 1 => increase of coordination issues



To implement Collaborative / production planning tools based on lean management principles

Limited RE resources from QPs to sign off inspection. Remote inspection not yet fully implemented.



To benchmark against other sectors for digitalization of quality inspections and identify the right digital tools.



