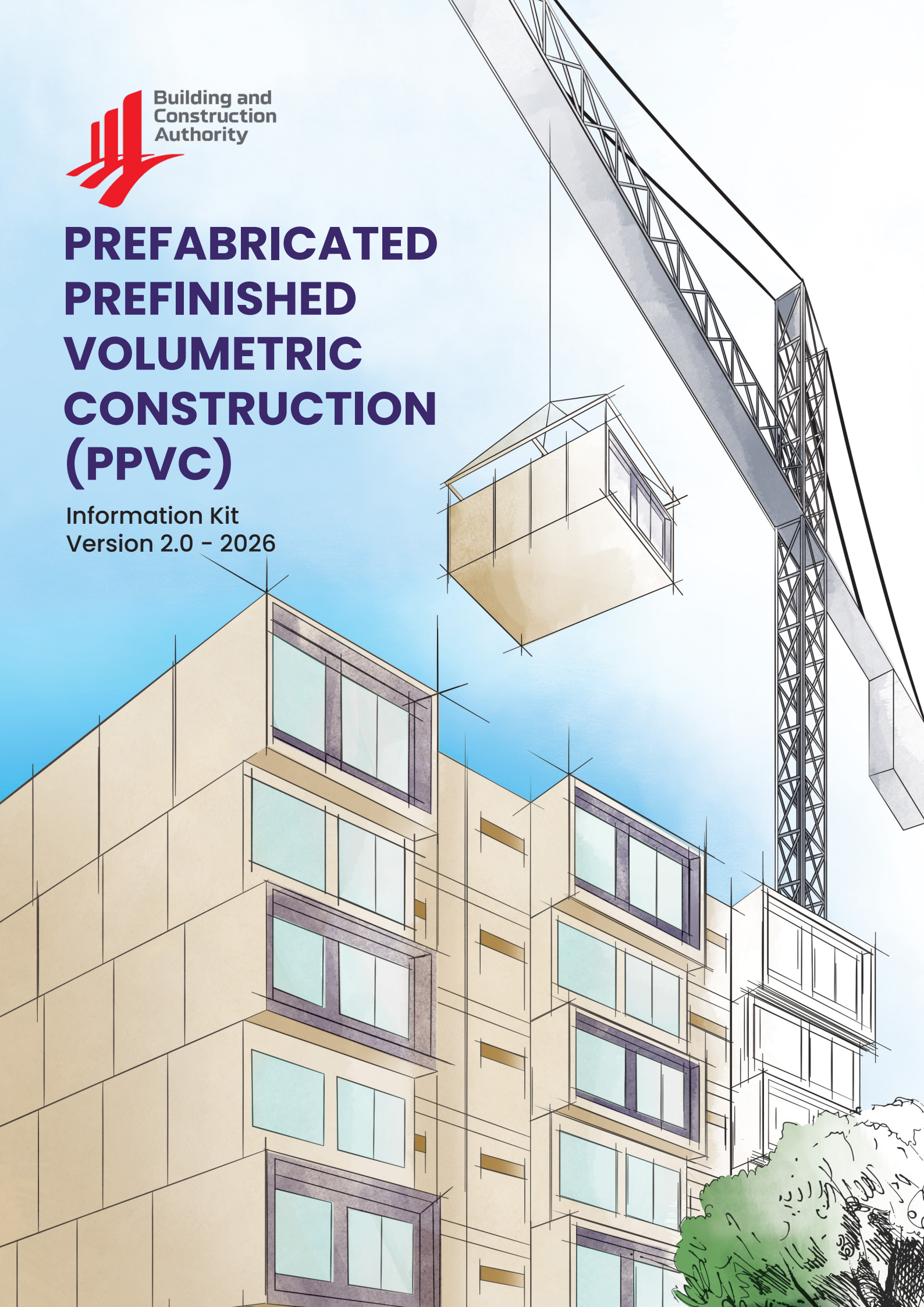




PREFABRICATED PREFINISHED VOLUMETRIC CONSTRUCTION (PPVC)

Information Kit
Version 2.0 – 2026



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1. INTRODUCTION

The 2nd version of the PPVC (Prefabricated Prefinished Volumetric Construction) Information Kit (2026) aims to: update industry on regulatory developments to PPVC, share the learning points and good practices from completed and ongoing PPVC projects, and serve as a guide with useful information on PPVC. This version will **update and supersede** the previous PPVC Information Kit revision 1 (Nov 2019).

Different sections of this kit may be more applicable to certain stakeholders. The table below summarises the contents and respective target audience.

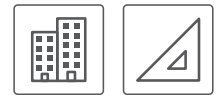
Content	 Developer	 Consultant	 Builder	 Precast/Fitting Out Specialist
2. Amendments to Rev 1 (2019)	✓	✓	✓	✓
3. Design	✓	✓		
4. Manufacturing			✓	✓
5. Construction Management			✓	✓
6. Regulation	✓	✓	✓	✓
7. Maintenance	✓		✓	
8. Useful Resources	✓	✓	✓	✓

2. HISTORY OF AMENDMENTS (to Rev 1, 2019 Information kit)



Brief description of changes	Revision date
Ver 2.0 (2026 Information Kit)	2026
a. Updated and supersedes Rev 1 – Section 2 (Design) under Ver 2.0 – Section 3	
b. Updated and supersedes Rev 1 – Section 3 (Manufacturing 3.1 to 3.4) under Ver 2.0 – Section 4	
c. Updated and supersedes Rev 1 – Section 4.3 (Suppliers of High-Capacity Cranes) under Ver 2.0 – Section 5	
d. Removed Rev 1 – Section 5 (Logistics)	
e. Updated and supersedes Rev 1 – Section 6.1 (Offsite Supervision) under Ver 2.0 – Section 6	
f. Updated and supersedes Rev 1 – Section 8 (Useful Resources) under Ver 2.0 – Section 8	

3. DESIGN



Designers shall make reference to the prevailing [Buildability Code of Practice \(COP\)](#) and/or addendums (if applicable), for the percentage (%) of total super-structural floor area to be constructed using PPVC method and the corresponding PPVC acceptance framework under the COP. In the calculation of the PPVC-GFA (%), designers are reminded to take into consideration the installation process (e.g. tower crane tie-backs affecting pre-finishing).

3.1 Design Principles to Achieve High Standardisation and Repeatability

PPVC standardisation must be undertaken in tandem with the unit/architectural layout design as early as possible. Early involvement of the multidisciplinary consultant team and precast specialists will be beneficial to the project.

A high level of repeatability may be achieved through the following design approaches:

- Rotational translation of the PPVC units (on plan, where applicable) to form the block layout. Note that mirroring creates handed-modules, which require a new set of moulds.
- Maximising the number of standard modules across unit types (i.e. standard bedroom module used across units).
- Massing the building from a set of standardised virtual PPVC modules (or Building Information Modelling objects).

A high level of repeatability and standardisation is able to benefit projects by offering economies of scale, leaner construction, supply chain efficiency and resilience, shortened construction time, and cost savings.

3.2 Usage of Building Information Modelling (BIM) for Services Coordination and Review

To ensure constructability and to minimise abortive works downstream, BIM should be utilised in the design development stages to coordinate and deconflict design requirements from the Architectural, Civil and Structural (C&S), and Mechanical Electrical and Plumbing (MEP) disciplines.

Due to the nature of PPVC design and construction (i.e. vertical stacking and stitching of individual modules together), designers must take into consideration the

possible reduction in building services spaces and coordinate the routing of Mechanical and Electrical (M&E) services within the PPVC unit and from common spaces (see **Figure 1**).

The use of a coordinated design BIM model can identify potential clashes and allow for early design intervention/provisions (e.g. structural openings for proposed Air-Conditioning and Mechanical Ventilation routing-ACMV) (see **Figure 2**).

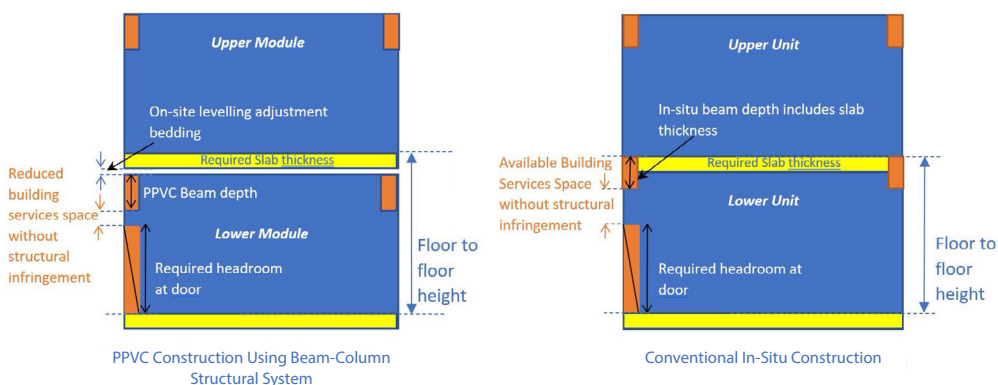


Figure 1: Illustration of possible reduction in building services space between a PPVC and Conventional In-situ Construction



Figure 2: Structural opening provision for ACMV routing in PPVC project.

3.3 Good PPVC Design/Detailing Practices

With the removal of the Building Innovation Panel (BIP) (In-Principle Acceptance, IPA) requirement for common PPVC systems (see **Section 6.2**), this section shares good BIP-PPVC design and detailing practices for the industry's reference. Project QPs are to seek for approval under the Building Plan and Structural Plan submission.

Structural Design Considerations

- a. Designers should translate the design intent for the horizontal and vertical PPVC connectivity into appropriate analytical modelling elements to estimate connection forces and building performance/behaviour. This includes selecting and detailing an appropriate connection system that fulfils this design intent (e.g. if two vertical elements are intended to perform and behave as a single composite element after stitching, the interface roughness of each individual element and its connection detail(s) must be able to achieve the force/stress transfer between materials). (For precast connection design, industry may reference Chapter 2 of the APCS Guidebook).

Waterproofing details at horizontal and vertical structural joints should make reference to the ["Good Industry Practices – Waterproofing for External Walls"](#) document. It is good practice to adopt at least three barriers/features to mitigate water ingress when developing and designing waterproofing details at these joints.

- b. Provide a method of draining water from the roof of PPVC modules during the transient stage to prevent water ingress and accumulation between the gaps of modules. Ensure that any trapped water is removed before structural grouting or stitching is carried out.
- c. Provide access panels or inspection holes to enable the inspection of key concealed structural elements, ensuring compliance with regular maintenance and structural inspections under building regulations. The method of inspection and inspection points should also be documented within the homeowner's user manual (e.g. sealed dead space between double slabs for six-sided PPVC systems).

Architectural Design Considerations

- a. Designers should consider PPVC modularisation when planning unit layouts and finishes (e.g. tile layout plans, door positions and carpentry must be reviewed in totality with the PPVC modules to prevent misalignment across the modules when pieced together).
- b. Designers should select finishes and materials that are durable and suitable for pre-finishing use in PPVC construction (i.e. hardy against deterioration and weathering effects). Proper protection or treatment to the finishes should be considered to ensure they are defect-free at handover.

- c. Waterproofing drawings should be provided within wet areas. It is a good practice to provide a minimum 300mm "waterproofing upturn" and at least 150mm "waterproofing application" extending beyond the "wet area" into the adjacent "dry area".
- d. It is also a good practice to provide a minimum waterproofing layer of 1,800mm in height to the walls of the shower area within the In-Built Bathroom (IBB).

MEP Design Considerations

- a. Designers should indicate clearly on plans, the MEP works that are to be carried out on and offsite (in accordance with the PPVC acceptance framework).
- b. Designers should provide the method and details of on-site connection for MEP services between modules.
- c. Designers should consider the reach, working space and visibility for the installation of MEP services within ceiling spaces. Ensure that sufficient access panels are provided to facilitate the inspection, installation and maintenance of building services. The installation sequence of building services should also be taken into consideration when designing the routing and position of building services. Where possible, it is a good practice to design services for accessibility without affecting other services.
- d. For Cast-In MEP services, compliance tests should be carried out offsite to ensure they are free of defects and in working condition prior to delivery on site. The overall MEP system should be tested and commissioned one more time after completing the on-site connections.
- e. Sufficient access panels should be provided for the maintenance of vertical MEP stacks (e.g. IBB sanitary stacks). These access points should be taken from non-structural walls (such as drywalls) and from within the unit. This includes ceiling access points for the maintenance of "rodding eyes". These access points must be documented within the homeowner's manual.
- f. If a shallow floor trap is adopted within the IBB, designers must pre-consult and clear the design and product requirements with PUB, Singapore's national water agency.
- g. Coordinate with a structural engineer for the appropriate location of MEP penetrations/inserts/box-ups.

Homeowner's Manual

- a. Developers should provide a homeowner's manual of the PPVC upon completion and handover of the project. The minimum items to be provided within the manual can be found within Section 9.1.1 of the PPVC Guidebook.
- b. For IBBs, the manufacturer's label must be provided within the module and visible to homeowners. The location of the label must be indicated within the homeowner's manual. A sample and requirement of the manufacturer's label can be found at the following [link](#) or QR code.



3.4 Design and Detailing for Transient Loads/Stages

Contractual scopes and responsibilities of qualified persons (QPs) should be clearly defined in PPVC projects. If the permanent works QP and temporary works QP are independent, it is good practice to adopt an "RFA – Request For Approval" process within the project to circulate temporary stage-related PPVC design for review and record by the permanent works QP. The QP responsible for supervision works is to ensure that construction loads applied to the PPVC module and members are within the permissible limits of the approved construction drawings/calculations at all times (e.g. the stacking of construction material within the module during hoisting shall be designed for, if required).

Design

Designers of the steady-state PPVC system should consider the temporary and installation stage/process required for the PPVC construction. Some considerations include (but are not limited to):

- a. Review the load paths and transfers, and ensure that connections are strengthened with additional rebars where required for tower crane tie-backs to vertical PPVC elements and/or slabs, (where applicable). These elements must be able to support lateral tie forces without overstressing PPVC connections. Member sizes should be sufficient for these additional reinforcements to avoid rebar congestions, and comply with code requirements.
- b. The intended manner of lifting and impact of lifting forces and stresses on the end-state PPVC modules. PPVC modules should be designed rigid enough to withstand lifting and transportation stresses with minimal propping.
- c. The structural stability of free-standing modules during the installation stage (i.e. installation sequence) and the sequence of structural stitching/grouting or mechanical connection (if applicable) of the modules.

Quality Control of Detailing

The production of PPVC frames shall be done in a PAS (Precaster Accreditation Scheme) accredited facility. Developers are recommended to engage experienced specialist builders in precast concrete works with a high level of Quality Assurance and Quality Control (QA/QC).

The QP (supervision) appointed in relation to the project must carry out assessment of the QA/QC procedures put in place by the fabricator and to conduct regular visits/inspections of the yards. Some good practices to ensure the quality of PPVC production include:

- a. Arranging for mock-up inspection(s) of the PPVC fabrication (e.g. rebar congestion, accuracy of dowel/box-up provision, too many rebar sizes, quality of mould and finishing) early before commencing regular production (see **Figure 3** below).
- b. The QA/QC engineer from the specialist builder shall ensure that rebars required for each PPVC module are prepared and packed according to the bar bending schedule. The QA/QC engineer must also sign off on the bar bending schedules when they are transferred to the installation/production team. This ensures accountability of the rebars.
- c. Colour coding of rebars, or other identification systems, should be implemented to facilitate easy identification during installation and inspection.



Figure 3: Inspection prior to casting.

3.5 Using Design to Mitigate Common PPVC Issues

On top of the good practices to achieve alignment and site installation accuracy of PPVC modules (in PPVC Guidebook Chapters 7 and 8), the following additional measures may be adopted by designers and builders to improve alignment accuracy and avoid common pre-finishing defects (but not limited to):

Tile Lippage

- Designing a Precast/Cast In-Situ (CIS) unit corridor in between PPVC modules to allow for mitigation of minor levelling differences through the in-situ screed layer if required (see **Figure 4**).
- Trial assembly of PPVC modules in the off-site facility to facilitate QA/QC checks such as alignments, verticality of components, levels, flatness and structural gaps (between modules and joints) before delivery.
- Using digital and surveying tools to ascertain site levels before delivering and receiving the PPVC module from the yard.

Tonality Differences between Pre-Finished and On-Site Balance Tiles

- Use appropriate protective materials that prevent UV penetration (see **Section 5.3**).
- Conduct dry-lay and pre-lay at factory to sort out tile tonality issues and reserve sufficient tiles, from a given batch/stock, for the balance on-site tiling. The balanced tiles shall be properly tagged and protected from environment damage/exposure that can cause discoloration.
- Where natural stones are used for finishing, contractors may consider applying an appropriate impregnator to prevent surface stains and discoloration (see BCA's [Good Industry Practice Guide for Natural Stone Finishes](#)).
- Deliberate selection of finishes and tiling schemes may be used to address tonality-perceived issues, such as the deliberate use of colour variations or natural stones that are inherently different in tone and texture (see **Figure 5**).

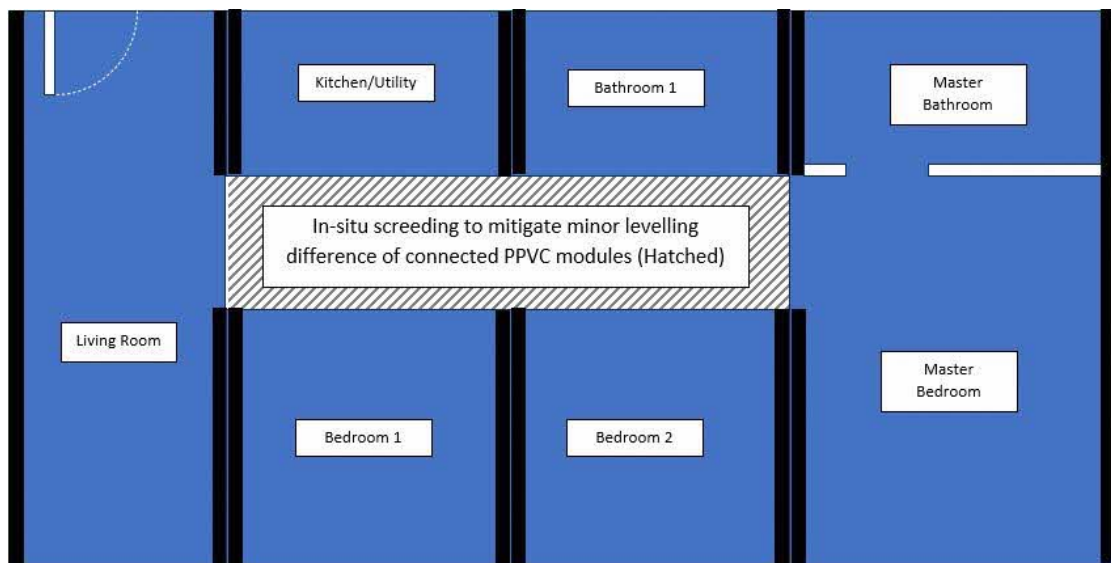


Figure 4: Illustration of in-situ screeding within PPVC unit corridor to mitigate minor level differences.

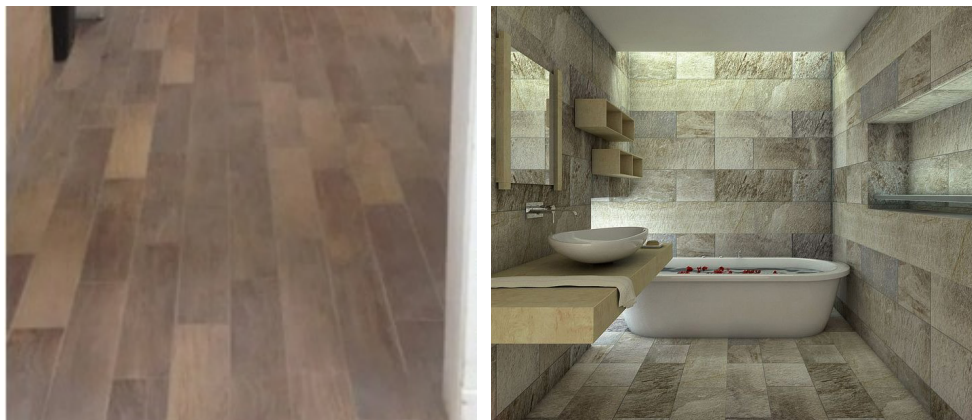


Figure 5: Illustrations of finishing choices with tone variations as acceptable solutions.

Pointing Misalignment between Pre-Finished and On-Site Balance Tiles

- Deliberate use of different finishes between interface/zones of pre-finished and balance on-site tiles to mitigate the alignment issue and reduce the need to

match the finishing materials. Aluminium trimming is commonly used/specified at the interface between different finishes, which may be used to break the visual layer and alignment between pointing (see **Figure 6**).



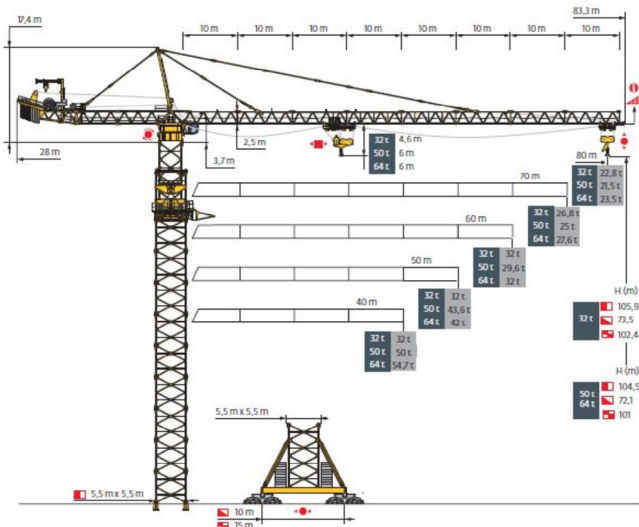
Figure 6: Use of different floor finishes to mitigate pointing alignment issues.

3.6 Consideration of Tower Crane Position Early in Block Layout Design to Facilitate Construction Productivity at Installation Stage

During the design development phase, designers should consider the weight of PPVC modules and position of tower cranes (TCs) when developing the block layout (see **Figure 7**). This will help to maximise the efficiency of the TC usage on site and avoid overlapping crane working zones caused by cranes positioned too close to each other. Overlapping crane

working zones is typically detrimental to productivity and results in idling of TCs.

Designers should consult TC suppliers or builders early to determine the position of the TC, which is dependent on crane lifting capacities and allowable tip-loads. Designers may refer to the PPVC Guidebook (Section 2.5) on the various types of lifting machinery as a guide.



4. MANUFACTURING



4.1 List of Firms

Below is the list of firms with PPVC project references and, firms that have [In-Principle Acceptances \(IPA\)](#) for their PPVC systems for use in Singapore projects.

- **Prefabricators with ongoing PPVC projects:**
Refer to Section 4.3.

- **Firms with IPA Certificates:**
Please refer to this [link](#)¹ or QR code.



4.2 Steel Mould Fabricators

Steel is used to fabricate moulds to withstand the wear and tear from handling and repeated use, and to achieve high-quality precast concrete products. Conventional and flexible 3D moulds are shown in Figures 8 and 9 below.

Concrete PPVC modules can be produced using:

- 3D Mould for Volumetric Production**
Besides the conventional 3D mould, the 3D flexible mould can be re-configured and re-used multiple times for varying PPVC shell dimensions.
- 2D Mould for Panelised PPVC System**
2D precast panels are assembled together using mechanical connection to form PPVC modules (more information in Section 4.4).

3D PPVC moulds can be conventional or flexible (see **Figures 8 and 9**). For PPVC mould fabricators or suppliers, you may refer to the BCA directory of specialist builders (Precaster and Structural Steelwork).

- **Specialist Builder (Precaster):**
Please refer to this [link](#) or QR code.



- **Specialist Builder (Structural Steelwork):**
Please refer to this [link](#) or QR code.



Figure 8: Conventional 3D mould.



Figure 9: 3D flexible mould.

¹Link provides the list of firms with IPA that applied through the Building Innovation Panel (BIP). As IPA is no longer required for PPVC adoption (see Chapter 6.2), there are firms that may not be included in this list. QPs shall ensure the PPVC designs (from other IPA systems or non-IPA systems) meet the acceptance framework and suitability for adoption in their projects.

4.3 Assessments to Ensure Quality Standards

To ensure quality standards of PPVC modules, quality assessments are carried out both in factory and on site.

Item	Link
Precaster Accreditation Scheme (PAS) / Structural Steel Fabricators' Accreditation Scheme (SSFAS) For production facilities producing PPVC shell – PAS for concrete shell production and SSFAS for steel shell production.	 To find out more about PAS, please refer to this link or QR code.  To find out more about SSFAS, please refer to this link or QR code.
Manufacturer Accreditation Scheme (MAS) For production facilities carrying out PPVC fitting out works.	 To find out more about MAS, please refer to this link or QR code.
CONQUAS Assesses the quality of workmanship in fit-out and on-site works.	 To find out more about CONQUAS, please refer to this link or QR code.
BCA Quality Mark Assesses the internal finishes and fit-out works (i.e. floor and wall finishes, wardrobes, electrical switches etc.), and water tightness of newly completed dwelling unit in a project.	 To find out more about the BCA Quality Mark, please refer to this link or QR code.

4.4 2D to 3D PPVC Production Methods

3D PPVC frames may be constructed and joint from 2D Panels (see **Figure 10**) using a jig/frame with adjustable props. Currently, automated technology (APPS) is available for 2D precast concrete panel production. It improves productivity, quality and resilience of the precast supply chain for projects and consumers. The use of automation for advanced manufacturing also offers cost savings through the reduction of material waste and rework rates arising from poor quality control and workmanship.

2D to 3D construction methods reduce the need for complex 3D moulds and transportation restrictions of completed 3D frames, especially when assembled near the site. However, they require production space for the 2D panel stitching works and additional quality control of the secondary assembly operation.



Figure 10: Use of jig/frame with adjustable props for 2D panel assembly. (Photo courtesy of Chip Eng Seng Contractors (1988) Pte Ltd)

Design of panel stitching and selection of location(s) for 2D panelised PPVC frames

Where possible, designers should consider:

- Locating the stitching joint between panels, away from the external facade (to eliminate risk of water ingress from the building's external into the PPVC module).
- Locating the stitching joint in a manner that minimises the complexity and amount of formwork/falsework required for the stitching operation (e.g. away from right-angled bends).
- Minimising reliance on post waterproofing works (e.g. backer rods and waterproofing sealants) in their stitching details. Secondary operation waterproofing works are dependent on workmanship quality and are subjected to weathering degradation in the long term.
- Adopting good practices to minimise and/or limit cracks at concrete cold joints (e.g. adopting sufficient bond transfer between concretes cast at different times, using suitable and approved waterstops, providing mesh/reinforcement to control crack widths or controlling the length of concrete pour to minimise the development of concrete stresses/cracks).

This is illustrated in **Figure 11**.

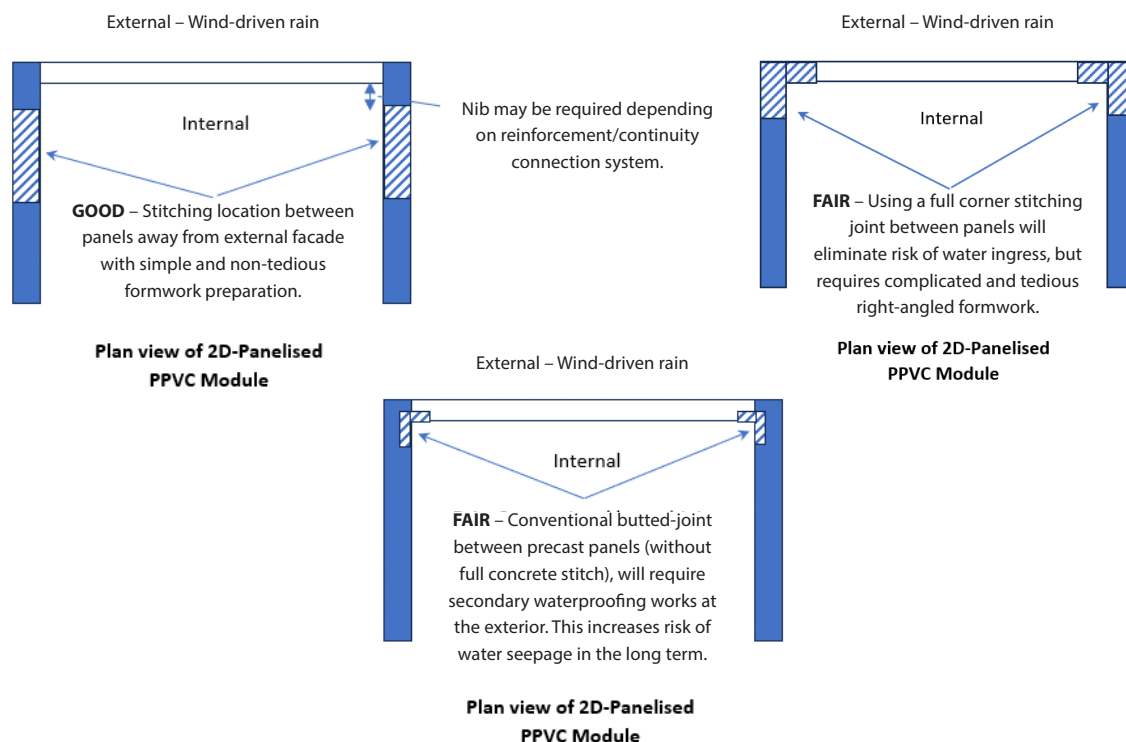


Figure 11: Illustrations of stitching locations for 2D panelised PPVC frames.

Quality Control for Verticality and 2D Panel Stitching

Adjustable props should be used to secure the top and bottom of 2D panels. The following guidelines should also be adhered to:

- Fitting of adjustable guide bars to the base mould to simulate positions of continuity bars/connectors.
- Adopting an adjustable jig/frame that allows propping and adjustment to the top and bottom of the 2D panels prior to casting.
- QA/QC checks for dimensional tolerance and verticality of the erected 2D panels should be carried out in accordance with approved method statements with the help of levels, laser guides or surveying instruments.
- Coordinate precast shop drawings to ensure adequate surface treatment and reinforcement anchorages or lap length, enabling good quality structural stitching of the 2D panels.

As illustrated in **Figure 12**.



Figure 12: Adjustable props to secure the top and bottom of 2D panels.

4.5 Adoption of R&A Solutions for Fitting Out

Robotic and automation solutions can benefit PPVC fitting-out production by: increasing productivity, improving quality assurance, resource efficiency and safety at off-site factories.

If you require additional clarification or consultation, do send your enquiries through the email listed in Section 8 of this information kit.

4.6 Miscellaneous Good Practices

To ensure quality standards and productivity of PPVC module production, some good practices adopted by the industry during manufacturing include:

A Ensuring proper labelling and regular maintenance of moulds, including removing old mortar and checking for warping and excessive deflection during casting.

B Using of “soft demoulding” process with adjustable inner forms and/or sufficient form oil or mould release agents to prevent damage during demoulding.

C Checking that the joints and edges of the mould, bolts, stoppers, tie rods, side props and rubber seals are intact and properly secured to prevent grout loss during casting.

D Ensuring that cast-in items are properly secured, with tack welding carried out where necessary.

E Rechecking the level of the base mould before casting, where applicable, as it may be affected by preparatory works.

F Adopting “concreting inspection” points along external 3D moulds to ensure consistent concrete flow and coverage during casting (see **Figure 13**).



Figure 13: “Concreting inspection” point for 3D PPVC casting on external mould.

G Carrying out non-destructive testing (NDT) at selected points on completed modules, especially where there are visible casting defects, such as honeycombing and grout leaks. Recognising that such defects may indicate reinforcement congestion, which should be resolved through shop drawings prior to fabrication. Focus NDT sampling on these precast areas to ensure concrete uniformity.

H Addressing non-uniform concreting identified during sampling by decongesting reinforcement through design adjustments and/or refining the approved concrete mix until the desired strength, performance and casting consistency are achieved. This may involve adjusting the maximum aggregate size and the ratio and quantity of coarse and fine aggregates or admixtures to improve flowability. Avoiding post-grouting patching or repair works, as these are unproductive.

5.CONSTRUCTION MANAGEMENT



5.1 Payment Arrangements

Payment terms for PPVC projects can be tailored to suit off-site PPVC work processes. Common practices adopted for public and private sector projects are:

Public Sector PPVC Projects

Under the Public Sector Standard Conditions of Contract (PSSCOC), Option Module D provides for advance payment of 20% of the total PPVC costs, subject to a maximum 10% of the total construction contract sum.

Private Sector PPVC Projects

Advance Payment

- Advance payment quantum (%) is pegged against the total PPVC cost; and
- Advance payment is released upon receipt of a Banker's Guarantee by the contractor.

Milestone Payment

- Fixed instalments based on milestones completed; and
- For payment of off-site works, the contractor will provide a performance bond to the developer.

Private residential PPVC projects typically adopt the milestone payment method. The most common schedule for milestone payment is:

Completion Milestones	% of Payment
PPVC shell offsite	30
PPVC finishes offsite	30
Onsite installation	40

5.2 Suppliers of High Capacity Cranes

As PPVC modules are heavy (about 25 to 40 tonnes), generally, high-capacity tower cranes (HCTCs) are used for PPVC projects. HCTCs generally refers to TCs with lifting capacity of at least 30 tonnes at 30 metres.

For a list of possible HCTC suppliers in Singapore, you may refer to the list of approved crane contractors on the Ministry of Manpower's website.

HCTC suppliers

Please refer to this [link](#) or QR code.



5.3 Protection of Modules

Protection is provided to prevent potential damages to modules and installed internal finishes and fittings during delivery, storage and lifting activities.



Canvas sheet for module exteriors.



Bubble wrap for interior fittings (i.e. wash basin).



Self-adhesive plastic wraps for internal finishes (i.e. tiles).



Spray-on protective film for interior finishes.



PPVC module wrapped with canvas sheets prior to delivery.



Cardboard wrapping to protect sanitary fixtures.



White PVC corrugated sheets for tiles/flooring protection.

5.4 Adoption of Digital Solutions to Manage Production, Inventory and Logistics

Digital solutions should be used to augment the PPVC project lifecycle. There is a wide variety of digital tools that can help PPVC projects reap benefits such as better production and logistics planning and tracking, reduction in re-works and construction waste, improve efficiency and mitigate possible budget overruns.

For more information on various digital tools that you may adopt for your projects, refer to the [link](#).

If you require additional clarification or consultation, do send your enquiries through the email listed in Section 8 of this information kit.

5.5 Material Selection and Tests (Good Practice from BIP Framework)

With the removal of the BIP-IPA requirement for common PPVC systems (see Section 6.2), this section shares the various tests and performance requirements recommended for: (i) panel boards, and (ii) lightweight concrete panels², used as floors and walls for the IBB areas of the PPVC.

The list of tests and passing criteria may be found in Appendices C and D (see **Figure 14**) of the BIP-PPVC checklist or in the [link](#) provided.

Appendix D : Test Reports for Lightweight Concrete Panels used as wall and floor of PBUs

Product Name	
Manufacturer	
Concrete Mix Raw Materials (for used in different proportion)	
Grade of concrete	
Density of concrete (kg/m ³)	

Instructions

- Unless otherwise stated, please conduct and submit test reports according to the test standards listed below.
- All test reports shall be the original or certified true copies issued by local or overseas laboratories accredited to ISO/IEC 17025, SAC (SINGAPORE) and SAC (MILITARY) within last 5 years.
- The manufacturer of the lightweight concrete panels used in the PBU system shall establish a Quality Management System certified according to EN ISO 9001.

S/N	Test Standard	Criteria
A Strength Performance		
1	S482:2003	To achieve a grade of Medium (M20) and above.
B Fire Safety* and Thermal Properties		
2	BS 476:1-2:2002 and BS 476:2:2002	As per the Section 3.15.19 of the Code of Practice for Fire Protection in Buildings 2018 available on the SCDF website.
3	BS EN 45545-2:2013+A1:2015	Fire classification of construction products and building elements on flame spread and smoke density.

*The tests required for fire safety may vary according to the type and composition of lightweight concrete. As such, please be advised to consult SCDF on the necessary tests to be conducted. The consultation can be facilitated by the PBU screening panel secretariat after the submission of application.

Appendix C : Test Reports for Panel Boards used as wall and floor of PBUs

Product Name	
Manufacturer	
Type of Board	
Density (kg/m ³)	

Instructions

- Unless otherwise stated, please conduct and submit test reports according to the test standards listed below.
- All test reports shall be the original or certified true copies issued by local or overseas laboratories accredited to ISO/IEC 17025, SAC (SINGAPORE) and SAC (MILITARY) within last 5 years.
- The manufacturer of panel boards used in the PBU system shall establish a Quality Management System certified according to EN ISO 9001.

S/N	Test Standard	Criteria/Remarks
A Strength Performance		
1	S482:2003	To achieve a grade of Medium (M20) and above.
B Thermal Properties		
2	BS 476: Part 21:1987*	Fire tests on building materials and structures. *Only applicable for single slab PBU system.
3	BS 476: Part 22:1987*	Fire tests on building materials and structures. *Only applicable for PBU wall system which is also used as party wall or compartment wall.
4	BS 476: Part 4: 2020	Fire tests on building materials and structures. Non-combustibility test for materials.
5	BS EN 13501-1:2017+A1:2018	Fire classification of construction products and building elements on flame spread and smoke density.
C Acoustic Properties		
6	ASTM E911:2003	Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements.
D Green Label and Mold Resistance		

Figure 14: Cover pages of Appendices C and D

² Refer to the definition provided in the prevailing version of the Buildability COP.

5.6 Supply Chain Management

As PPVC construction involves off-site casting of the frames, fitting-out and temporary storage, this section shares the important considerations for the supply chain management of PPVC projects.

Estimation of Land Space/Needs

The sizing for factory space is dependent on the following parameters:

- Peak site-installation cycle time (according to programme needs)
- Storage space required for 2D panels (for panelised PPVC frame construction) / 3D moulds and turning tables and fitting-out materials
- Time required for panelised PPVC construction / 3D frame casting and demoulding and fitting-out
- Module dimensions (width, length and height)
- Working space between modules
- Gantry crane/equipment working spaces
- Vehicular delivery routes (i.e. turning radius for long vehicles) for construction materials/supplies
- If the supply of modules is from off-shore facilities, do plan for sufficient stock to ensure precast supply resilience. It is a good practice to maintain a buffer precast stock of a few floors or according to the client's requirement.

Acquisition/Options for Factory Space

PPVC builders/manufacturers are encouraged to source early for factory space. The various options for sourcing land include:

- Temporary Occupation Licence for land through the Singapore Land Authority (SLA) or Government Procurement Entities
- Rental of manufacturing facilities from JTC Corporation (lessee market)
- Land bidding of SLA-allocated land plots for long-term facilities
- Open market rental / co-sharing of manufacturing facilities from builders/precasters

Provisions for Off-Site Facilities

Off-site facilities used to produce PPVC modules shall be sheltered. The planning of the factory layout and location of construction activities should be carefully considered to co-locate synergistic trades/processes that promote lean manufacturing (i.e. reduction of waste³ from the manufacturing process). Some important considerations for the off-site facility include:

- Working load and number of gantry crane(s) to achieve production cycle
- The heights of the roof and gantry crane are affected by:
 - The need to account for elevated module storage off the factory floor, necessitated by fitting-out activities
 - Module height
 - Height of protruding continuity connectors, from modules (if any)
 - Overhead lifting clearance with presence of module stock on the shop floor

Transportation Options/Methods

For modules produced in off-shore facilities and are to be delivered directly to the site, please check that there is an alternative delivery route. Although the adoption of a Just-in-Time (JIT) construction method can help minimise the need for local off-site storage space, it can be disrupted by unprecedented traffic conditions along its delivery route and adversely affect construction schedules. Alternative modes of transportation (e.g. by sea) can be considered to reduce the risk of delays through the causeway or other land routes. Designers and builders may also plan for non-critical construction design/processes to alleviate risks arising from logistical delays. Examples of non-critical design in PPVC include minimising the use of connection details that are dependent on module installation sequence.



³ Activities or processes that do not generate value.

6. REGULATIONS



6.1 Supervision of PPVC Construction Works

This section updates the industry on the recent regulations and circulars related to the supervision of PPVC construction and production. Notwithstanding, the industry is reminded to stay abreast and comply with all prevailing supervision requirements that may be published before or after the time of this information kit. These include:

- a. Requirements for submission of site supervision plans and reference templates**
 - Circular No.: APPBCA-2021-05
- b. On-site sampling of PPVC modules**
 - Circular No.: APPBCA-2022-16
- c. Requirements for remote supervision**
 - Circular No.: APPBCA-2021-19

For more information on supervision requirements, refer to the following [link](#).

6.2 Updates on PPVC-IPA Requirements and PPVC Acceptance Framework

With the PPVC ecosystem now in place, BCA will streamline the regulatory clearance process by removing the requirement for projects to only use PPVC systems that have obtained an IPA. In line with the above, the BIP will stop accepting common PPVC systems for evaluation with effect from 1 April 2023. These changes shall apply to projects submitting for planning permission on or after 1 April 2023.

However, all projects are still required to comply with the prevailing Buildability COP requirements. These include using PPVC fabrication facilities that are accredited under the PAS and MAS.

For more information, please refer to the [link](#) or Circular No.: APPBCA-2023-01.



6.3 Compliance with Technical Height Control Limits and PPVC Government Land Sales (PPVC-GLS) Requirement

The industry is reminded to comply with Technical Height Control Limits (referenced as AMSL in metres) specified within the Technical Conditions of Tender (TCOTs) for their project/development and PPVC-GFA requirements under the prevailing Buildability COP.

These conditions shall be considered in tandem, early during the design development phase and designed for compliance. Designers and builders are also reminded to consider and comply with the Technical Height Control requirements during the construction phase, early in the project.

Advisory on compliance with CAAS and RSAF Technical height controls at all times.

- Circular No.: APPBCA-2023-10

Projects QPs and developers are recommended to carry out early pre-consultation on the Technical Height Control Limits and PPVC-GFA requirements with the respective agencies (if necessary).



6.4 Oversized Vehicle Movement (OVM)

The Land Transport Authority (LTA) traffic regulatory requirements are applicable to oversized vehicles transporting all types of goods.

OVM Regime	Parameters
Travel with permit and Auxiliary Police Force (APF) escort	a. Width more than 3.4 m; or b. Height more than 4.5 m; or c. Weight more than 80 tonnes.
Permitted travel time for OVM without APF	Permitted travel time for OVM with APF
a. 9.30 a.m. to 5.00 p.m.; and b. 7.00 p.m. to 7.30 a.m.	a. 7.00 p.m. to 5.00 a.m. on all roads except expressways; and b. 11.00 p.m. to 5.00 a.m. on expressways.

Please refer to the LTA PROMPT [website](#) for the latest requirements on OVM.

7. MAINTENANCE



It is a good practice for developers and contractors to provide a homeowner user manual upon completing the project. Homeowners shall inform the MCST of the works to be carried out during renovations. If the renovation works involve hacking, similar to conventional building design, due diligence should be carried out to ensure that key structural elements are not damaged. Homeowners should engage a qualified person to ensure compliance with the building control requirements.

As per the Urban Redevelopment Authority's Controller of Housing requirements, the developer should inform the purchasers about the use of PPVC, in the Option-To-Purchase form, Sale and Purchase Agreement form, sales brochures and any other marketing materials.

You may refer to the PPVC Guidebook (Section 8 – Useful Resources) (Chapter 9.1.1) for a list of information (non-exhaustive) that is recommended to be included into the homeowner's manual.

8. USEFUL RESOURCES



[PPVC Guidebook](#)



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