



Design Guide for Pick-up and Drop-off Points at Developments

Improving commuter experience and vehicular movement efficiency



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This guide is developed with research partners to propose design recommendations for building owners and professionals to facilitate the use of Pick-up and Drop-off Points by commuters, drivers and autonomous vehicles. The Land Transport Authority (LTA) and the Urban Redevelopment Authority (URA) shall not be held responsible for any loss, damage or injury that may be suffered by any person in connection with the recommendations in this guide.

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1. Foreword

The Land Transport Authority (LTA) and the Urban Redevelopment Authority (URA) are constantly exploring new ways to improve the public transport system and built environment. Pick-up and Drop-off Points (PUDOs) are busier due to the increasing usage of private hire vehicles (PHVs), and the gradual introduction of new vehicle types such as autonomous vehicles (AVs) could increase the environmental complexity.

These guidelines recommend best practices to enhance the commuter experience and reduce congestion at PUDO. They also include recommendations for developments aiming to design their PUDO for future AV deployment. We would like to thank our research partners, Technical University of Munich Asia, National University of Singapore and Nanyang Technological University, as well as our industry partners, ST Engineering and Motional, for working with us closely on this two-year research study. We would also like to express our gratitude to CapitaLand and SPH REIT for providing data on the PUDOs in their developments.

The design recommendations derived from the research findings have been compiled into this guide for building owners and industry professionals' easy reference. We hope that the industry will find the guide useful and provide expertise to further enhance the design guidelines.

This guide is complementary to the LTA Infrastructure Design Criteria and Standard Details of Road Elements. Pages 17 and 18 summarise the mandatory design requirements and recommendations in this guide.

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2. Design Recommendations

This guide provides recommendations that building owners and professionals can consider applying to new and existing PUDOs. The design of a PUDO is essential to:



Enhance the experience of commuters



Smoothen traffic flow



Facilitate interactions between commuters and different vehicles

WHAT ARE AVs?

AVs are vehicles that can sense their environment and move with little or no human intervention. AVs could be used for the transport of people and goods.

2.1 Design Principles for New PUDOs

2.1.1 PUDO Orientation



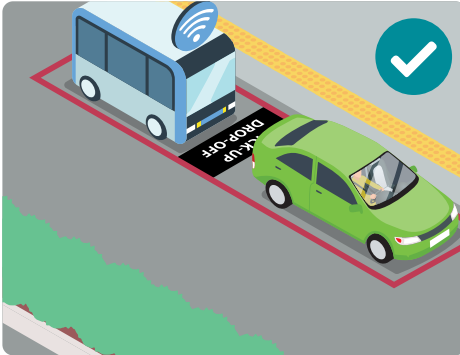
PUDOs should be designed for **left-side PUDO orientation**. This allows front seat passengers and commuters to alight safely along pedestrian pathways. For safety reasons, right-side PUDO orientation should be avoided, unless site constraints are challenging.



2.1.2 PUDO Approach



Where feasible, PUDOs should be designed with a **direct approach without requiring U-turns and to minimise any complex manoeuvres**. This helps to prevent disruption to traffic flow.



Direct approach for pick-up and drop-off without requiring U-turn.

2.1.3 Location of PUDO



PUDOs should be **located near building entrances and exits** for ease of access. PUDOs could also be **located away from the main carriageway** to prevent a traffic queue build up. One way is to site PUDO at basement levels of the development.

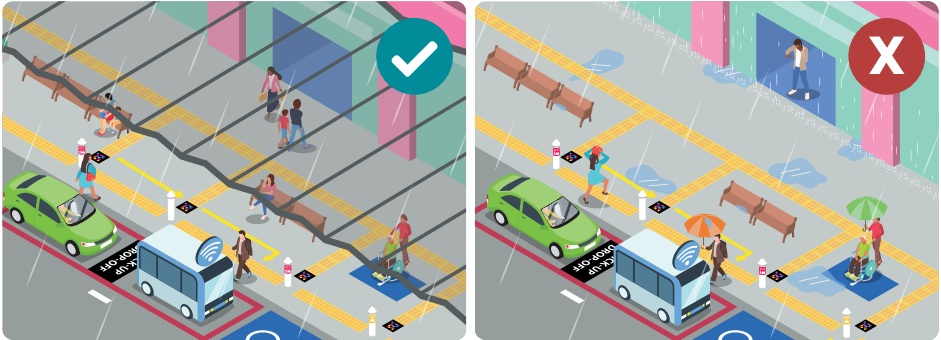


PUDOs should be sited near building entrances and exits.

2.1.4 Sheltered PUDO



PUDOs should be designed with **sheltered access** to developments to shield commuters during inclement weather. A seamless and sheltered connection to nearby key nodes could also be provided for an enhanced pedestrian experience.



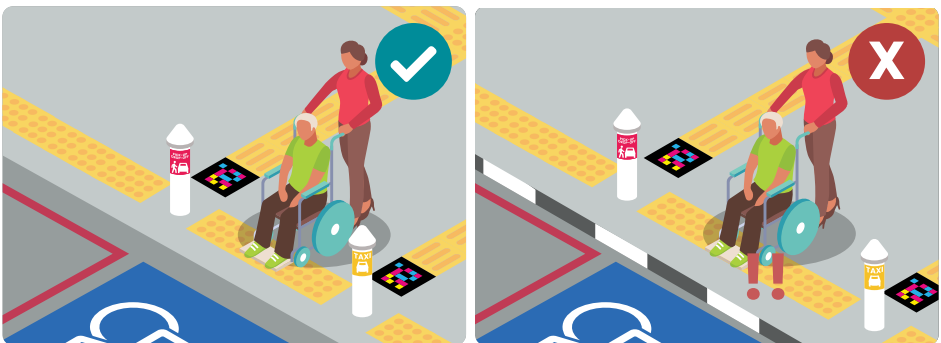
Fully sheltered PUDO provides a more comfortable commuting experience.

2.1.5 Accessible PUDO



PUDOs could be **kerb-less** so that wheelchair and personal mobility aid users can move seamlessly to and from developments.

Alternatively, for PUDOs with a kerb, a wheelchair ramp of 1,200mm in width could be constructed. Ramp travel depends on the height of the kerb, and the relief should be installed with reference to the Code on Accessibility in the Built Environment 2019.



Kerb-less PUDO allows for more seamless mobility.

2.2 Operational Design and Infrastructural Elements for New and Existing PUDOs

2.2.1 Hybrid Berth Layout



Berths designed with **clear markings** could guide drivers to follow the established path and driving conventions when using PUDOs.

Hybrid berth layout with **dedicated taxi stands and dedicated general PUDO berths** could be provided to facilitate different transportation services. The first berth in a PUDO could be dedicated for taxis while other berths could be dedicated for general pick-up and drop-off activities.

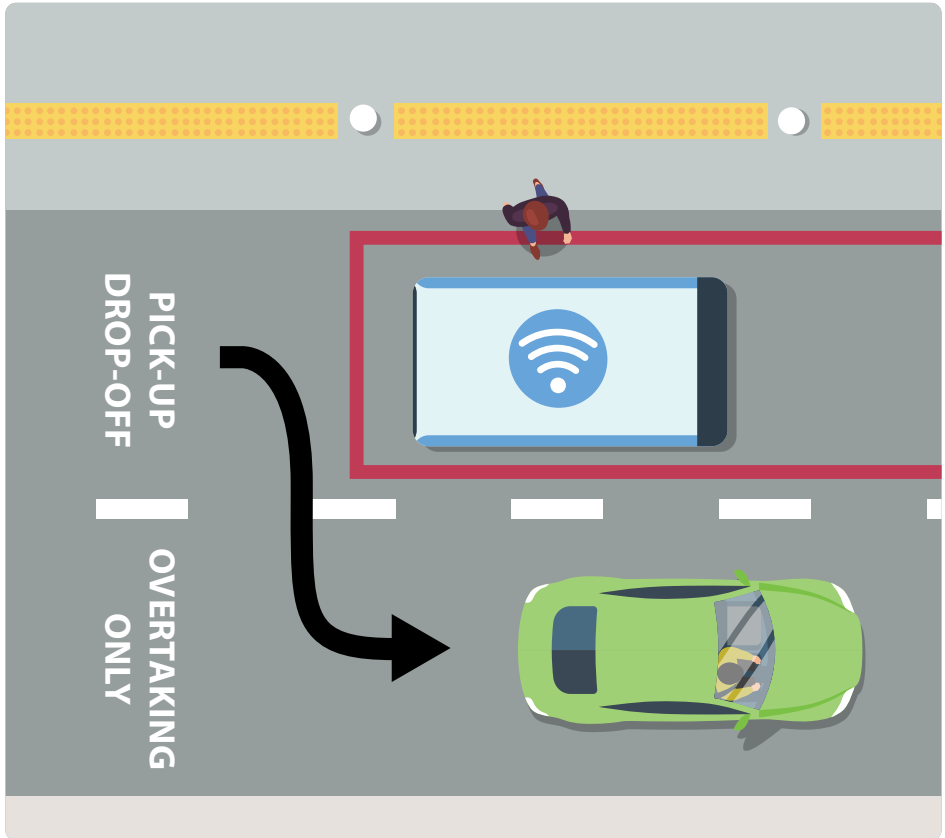


PUDO with differentiated berths for taxi and general pick-up and drop-off activities.

2.2.2 Segregated Carriageway and Lane Marking



At PUDOs segregated from the main carriageways, **the width of the PUDO should be wide enough to accommodate the vehicle-waiting lots and to allow overtaking.** This will facilitate traffic flow and minimise congestion as vehicles can move off once passengers have alighted. **Lane markings** such as “PICK-UP DROP OFF” and “OVERTAKING ONLY” could be provided to indicate the function of each lane.

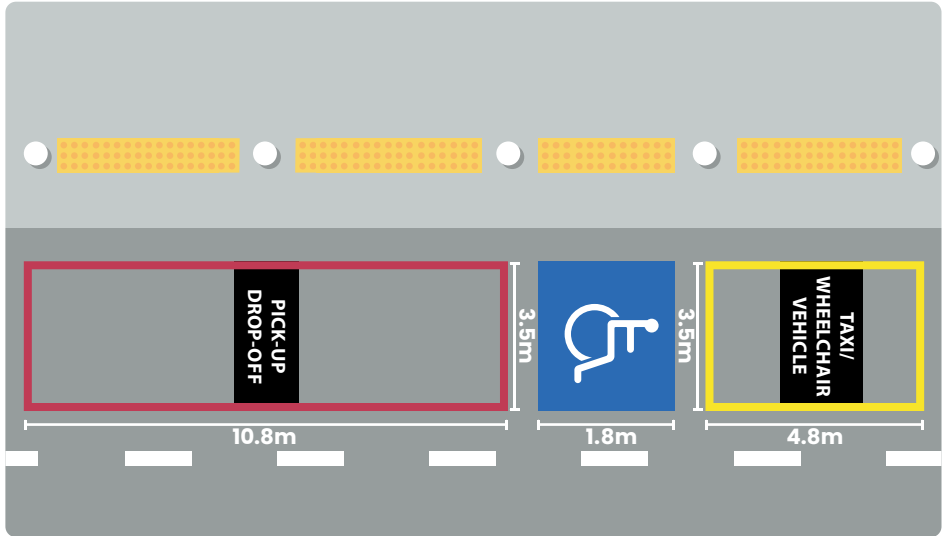


Segregated carriageways for overtaking, and for pick-up and drop-off.

2.2.3 Wheelchair User Boarding or Alighting Berth



In a PUDO, the first berth could also act as a **designated berth to facilitate the safe boarding and alighting of wheelchair users** who are commuting with a rear-entry vehicle.

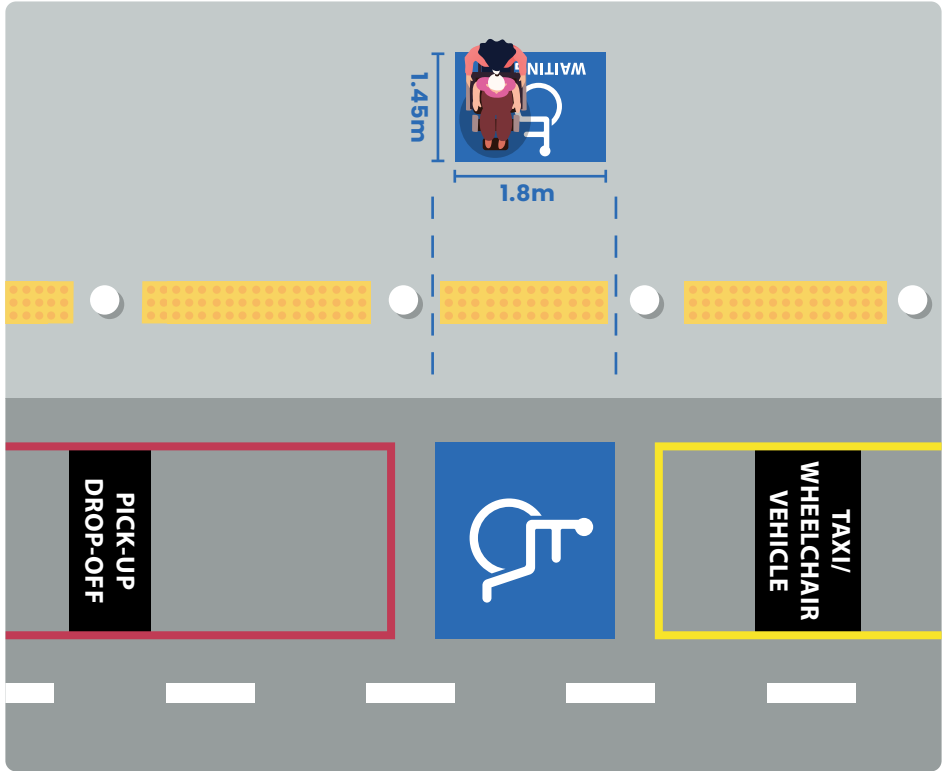


Designated berths and space allow wheelchair users to board and alight comfortably.

2.2.4 Wheelchair User Waiting Zone



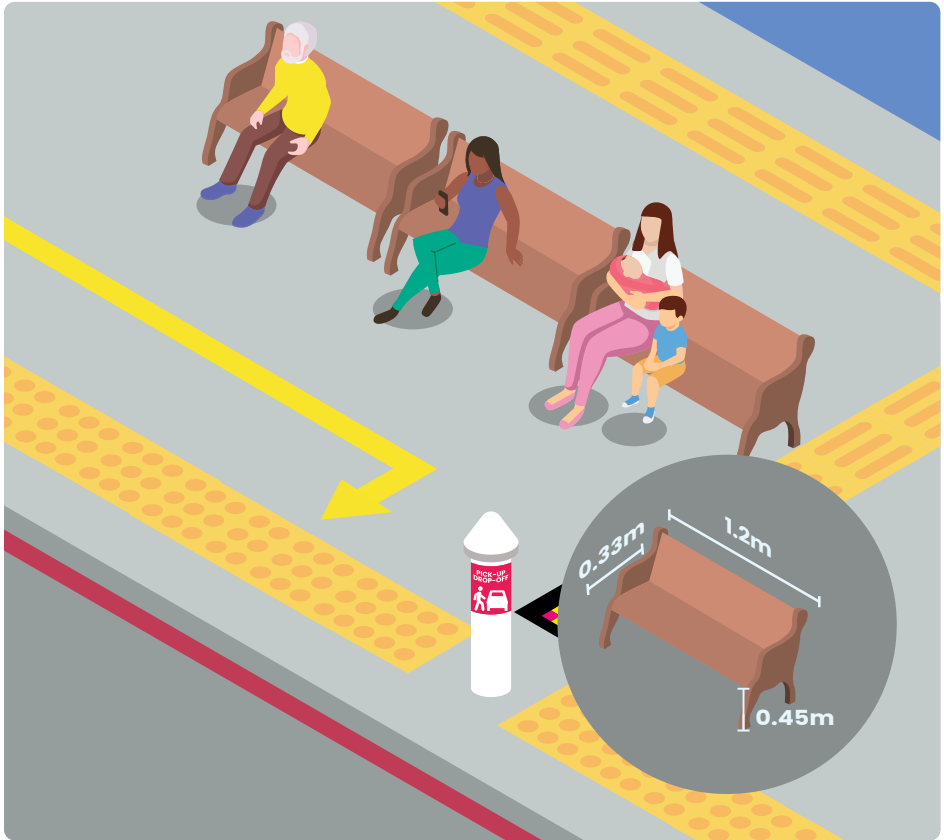
A **wheelchair user waiting zone** could be provided for easier navigation at PUDOs. The wheelchair user waiting zone should fit at least two wheelchairs. The waiting zone for wheelchair users should be aligned to the designated berth for wheelchair users.



2.2.5 Benches with Arm Rest and Back Rest



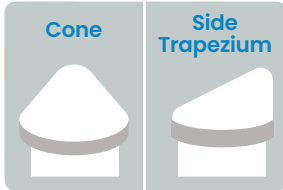
For a comfortable waiting experience for commuters, **benches should be provided**. For enhanced comfort level, full arm rest and back rest could be provided for all benches.



2.2.6 Non-mirrored Finish Bollard with Cone or Side Trapezium Top



The first bollard and last bollard of every berth could have a 'Taxi Stand' or 'PUDO' sign with the **relevant colours to mark out the different zones** at the PUDO. This will improve wayfinding at PUDOs.



Bollards of up to 1,000mm height could be **constructed in non-mirrored finish** with **cone or side trapezium top** instead of a rounded top. Bollards should also be constructed 600mm away from the road edge or kerb.



AV-FRIENDLY FEATURE

Mirrored or shiny surfaces on bollards may reflect too much light into Light Detection and Ranging (LiDAR) and camera sensors installed on AVs. To avoid this, reflective strips could be used on bollards instead.

2.2.7 Kerb Marking Using Tactiles



Yellow tactiles could also function as kerb markings, to remind commuters to keep a safe distance from oncoming traffic. It could be accompanied by a safety message such as 'Wait behind the yellow line'.



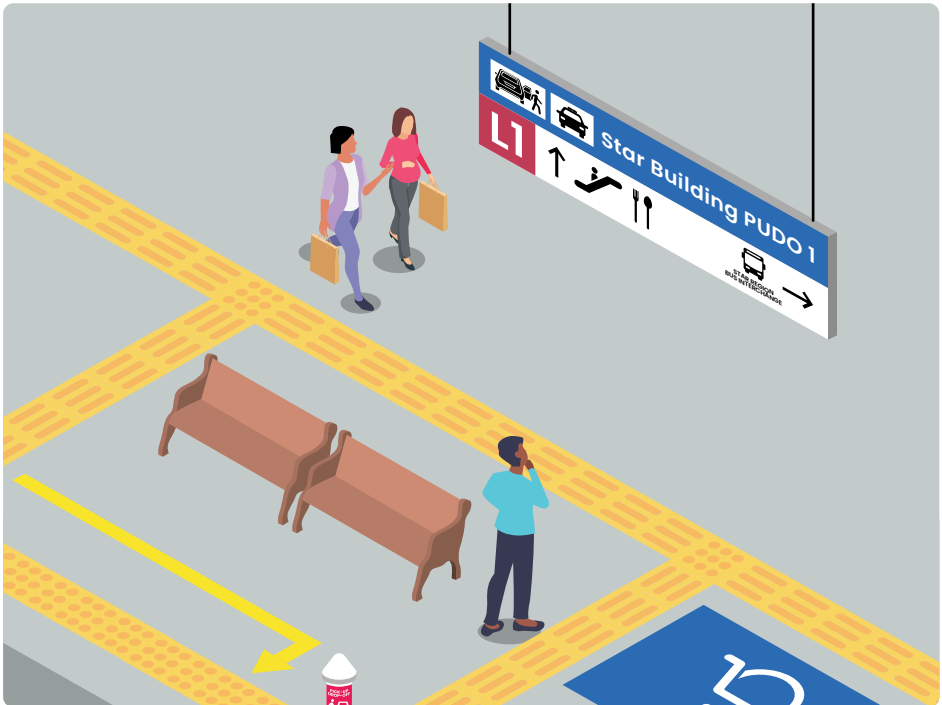
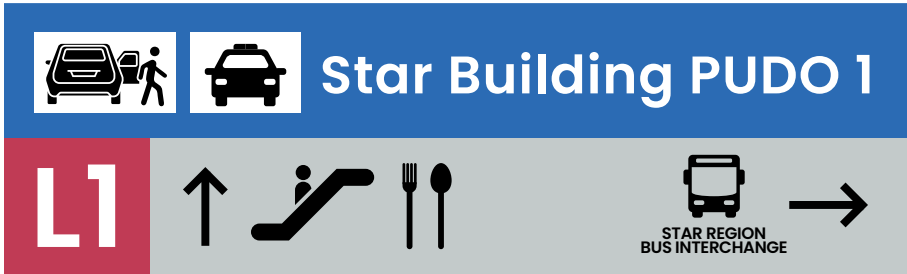
AV-FRIENDLY FEATURE

When commuters stand too close to the kerb or lean on bollards, they may be classified as an obstruction. As a safety feature, the AV may stop and not resume driving. Kerb markings will remind users to keep a safe distance away from traffic.

2.2.8 Wayfinding Signage

















There should be **clear directional signage** to entrances of nearby developments, and directions to surrounding key transport nodes and landmarks. Where there are multiple PUDO's within the development, the name of each PUDO should be clearly displayed.



3. Summary

This guide should be read together with the LTA Infrastructure Design Criteria (IDC) and the Standard Details of Road Elements (SDRE). The full compilation of mandatory and recommended elements is included in the checklist below.

Element	Mandatory	Recommended
Design Principles for New PUDOs		
 2.1.1 PUDO Orientation		✓
 2.1.2 PUDO Approach		✓
 2.1.3 Location of PUDO		✓
 2.1.4 Sheltered PUDO		✓ Sheltered PUDO and sheltered connection to nearby key nodes could be provided.
 2.1.5 Accessible PUDO		✓
Operational Design and Infrastructural Elements for Existing PUDOs		
 2.2.1 Hybrid Berth Layout	✓ Consult Taxi Service on number of taxi bays to provide. Refer to IDC Volume C Chapter 1, Clause 1.3.1.1.	✓ Dedicated taxi stand and a dedicated berth for PUDO could be provided.
 2.2.2 Segregated Carriageway with Lane Marking		✓
 2.2.3 Wheelchair User Boarding or Alighting Berth		✓

Element	Mandatory	Recommended
Operational Design and Infrastructural Elements for Existing PUDOs		
 <p>2.2.4 Wheelchair Users Waiting Zone</p>	✓	✓
 <p>2.2.5 Benches with arm rest and back rest</p>	<p style="text-align: center;">✓</p> <p>At least two benches should be provided, and at least a third of the bench to be fitted with arm rest.</p> <p>Refer to IDC Volume C Chapter 1, Clause 1.3.2.2.</p>	<p style="text-align: center;">✓</p> <p>Benches could be fitted with arm rest for each seat and a full back rest.</p> <p>Priority seats could be provided.</p>
 <p>2.2.6 Non-mirrored finish bollard with cone or side trapezium top of height 1,000mm and relief on the first and last bollards of each berth to mark out different zones in PUDO</p>	<p style="text-align: center;">✓</p> <p>Bollards of height 1,000mm should be constructed 600mm away from road edge, when a road kerb is not provided.</p> <p>Refer to IDC Volume C Chapter 1, Clause 1.3.2.3.</p>	<p style="text-align: center;">✓</p> <p>Bollards with non-mirrored finish could be constructed.</p> <p>First and last bollards of each berth could be marked with relief and colour-coded.</p>
 <p>2.2.7 Kerb marking using tactiles to keep people away from the kerb</p>		✓
 <p>2.2.8 Wayfinding signage to nearby nodes and landmarks</p>		✓
 <p>2.2.9 Tactile wayfinding for visually impaired users with ArUco or Navilens graphic</p>	<p style="text-align: center;">✓</p> <p>Tactile tile provision shall comply with the prevailing Code on Accessibility in the Built Environment.</p>	✓

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