Pondy bazaar, Chennai

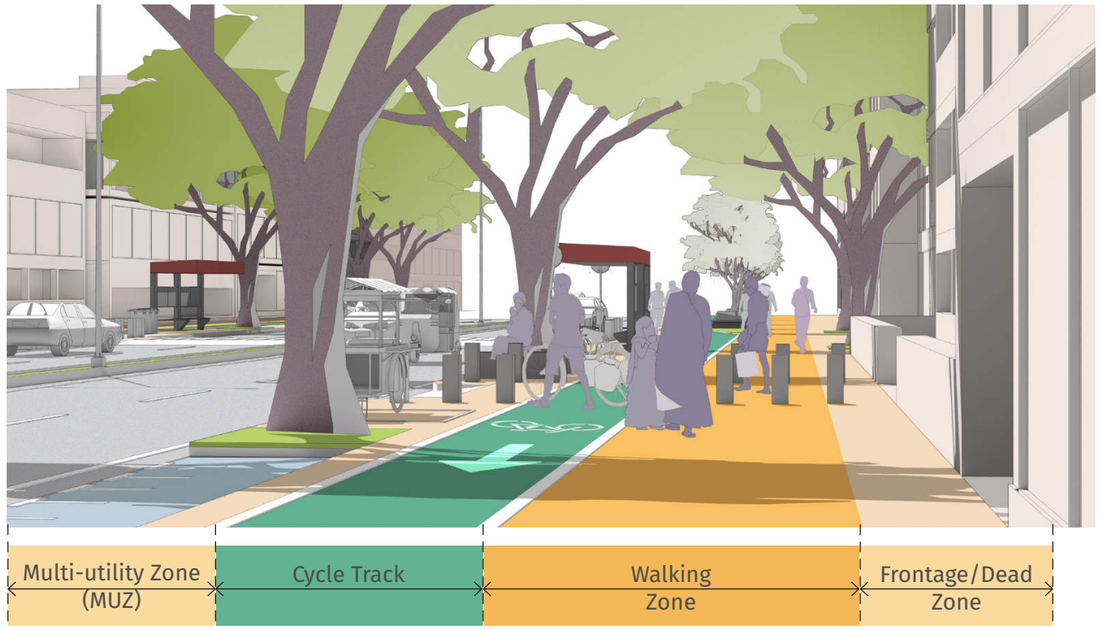
4

Street Design Elements

4.1 Footpaths
4.2 Cycle Tracks
4.3 Pedestrian Crossings
4.4 Traffic-calming Measures
4.5 Carriageways
4.6 Bus Priority Lanes
4.7 Service Lanes
4.8 Intersection/ Junction Design
4.9 Public Amenities
4.10 Street Furniture
4.11 Green and Landscape Strategy

4.1 Footpaths

Footpaths are vital to ensure people can walk safely and comfortably. Segregated footpaths enhance connectivity, improve safety and comfort, and ensure accessibility for all pedestrians, including people of all genders, ages, and abilities. They activate streets and boost businesses by providing places for people to walk, stop, sit, meet, talk, shop and eat.



4.1.1 Footpath Zones

Frontage/ Dead Zone

Space adjoining the property edge that acts as a buffer from the boundary wall and can accommodate any spill-over activities, such as a waiting crowd at shops. It allows for an unobstructed walking zone.

Walking Zone

Continuous level walking space, free of any obstructions, and ensuring a clear height of 2.4m above the finished level of the footpath throughout. Walking Zone includes Frontage One.

Multi-utility Zone (MUZ)

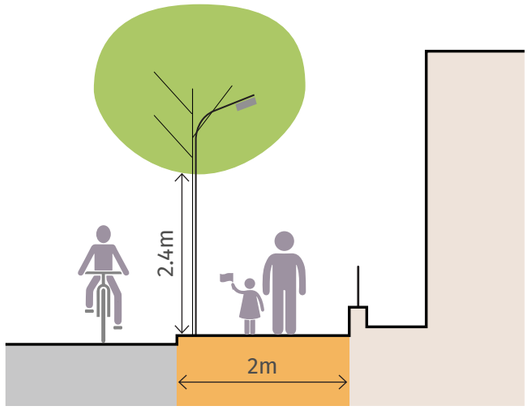
Space to provide facilities like street furniture, bus stops, IPT (Informal Public Transport) stands, landscape, children's play equipment, street signage, street lighting, telecom and electric boxes, on-street vending, on-street parking, and other public utilities.



Aundh-Ravet Road, PCMC

4.1.2 Width

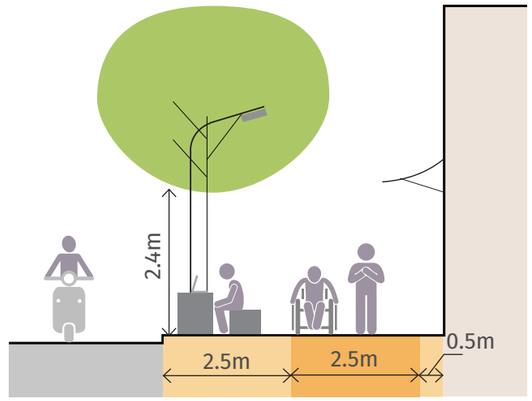
Streets are categorised as arterial, sub-arterial, collector, and local streets, and footpath widths shall be determined based on the street's land use. For example, commercial streets require wider footpaths than residential streets to support pedestrian movement and activities. For a comprehensive understanding of standards to follow based on land use, Right of Way (RoW), and street typologies, refer to Chapter 3—Street Design Templates.



Residential streets (For RoW ≥ 12m)

Walking zone	Minimum 2m

For RoWs ≤ 12m Refer Chapter 3.



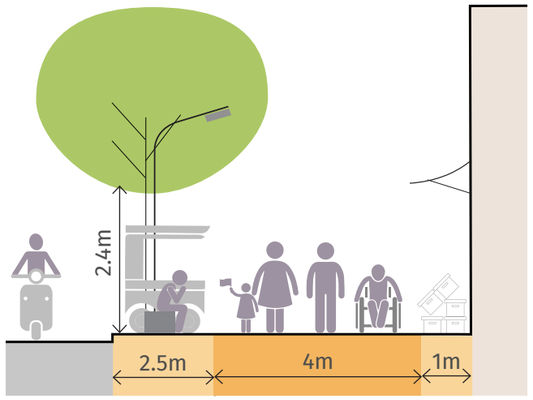
Commercial streets* (For RoW ≥ 18m)

Walking zone	Minimum 2m
Multi-utility Zone	Minimum 3m

*Streets with shop fronts and offices.

Local streets ≤6m RoW*

Streets with RoW ≤ 6m may be designed as shared streets. MUZ can be optional or provided as discontinuous patches.



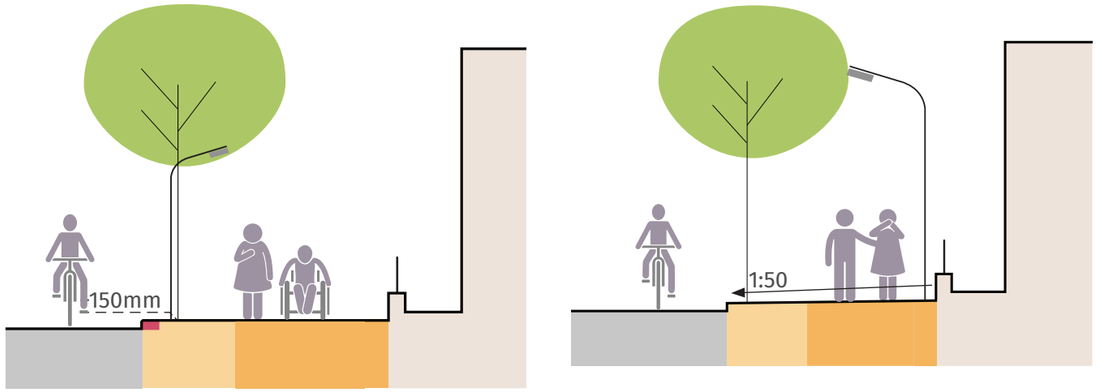
Transit and market streets

Areas such as markets, shopping streets, transit nodes, religious nodes, railway/metro stations, bus terminals, witness a high-intensity pedestrian footfall.

Walking zone	Minimum 2m
Multi-utility Zone	Minimum 3m

Based on the availability of alternate routes and RoW width, streets with high-intensity pedestrian footfall can be considered as pedestrian-only streets or pedestrian mall that allows only walking, cycling, and public transport.

4.1.3 Height and Gradient



Height

The top of the kerb should be 150mm high from the finished carriageway surface to prevent mounting of vehicles and ensure comfortable walking for all.

Gradient

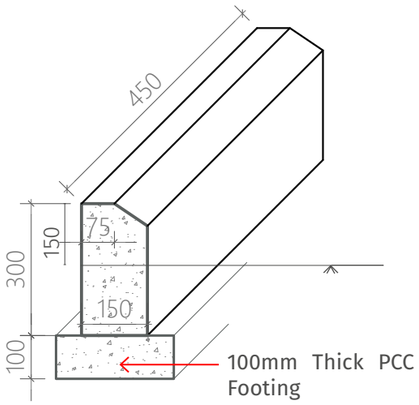
A gradient of 1:50* should be maintained for surface run-off.

*Footpath height to be 150mm at kerb edge

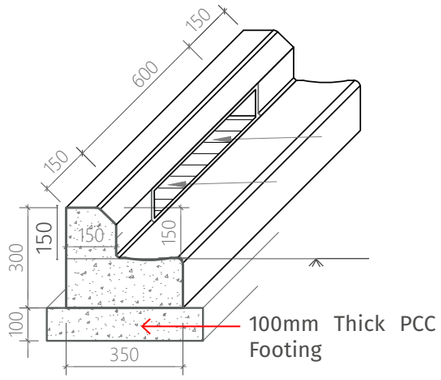
4.1.4 Kerb Details

The final finished height of the footpath is marked by placing kerb stones along the edge. Prefabricated kerb stones are generally preferred over traditional ones as they are stronger, easier to install, and have a uniform finish. The kerb shall be made of M30 grade concrete.

Saucer drains and openings to catchment pits should be laid along the footpath kerb to channelise and collect stormwater runoff. Saucer drains can also be provided along with the kerb stone as a single unit.

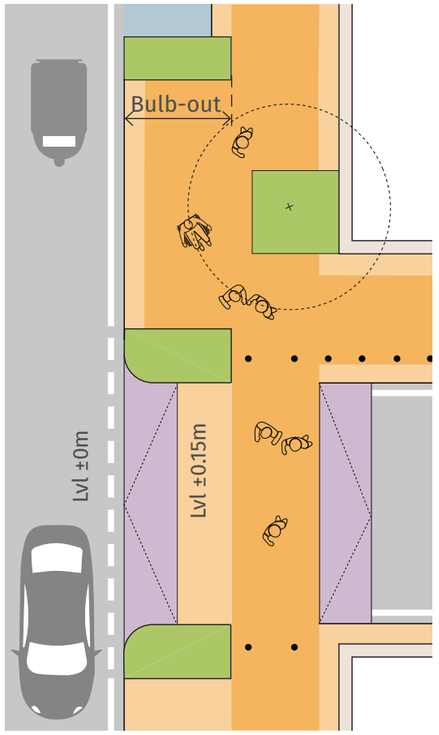


Typical 150mm thick kerb block



Typical kerb block with saucer drain

4.1.5 Continuity across Streets and Fixed Elements



When a footpath intersects with a perpendicular local street, the footpath should continue as a table-top with ramps for vehicle access.

Bulb-outs in MUZ

If there are permanent obstructions in the walking zone, a clear 2m wide walking zone should be maintained through bulb-outs in the MUZ.

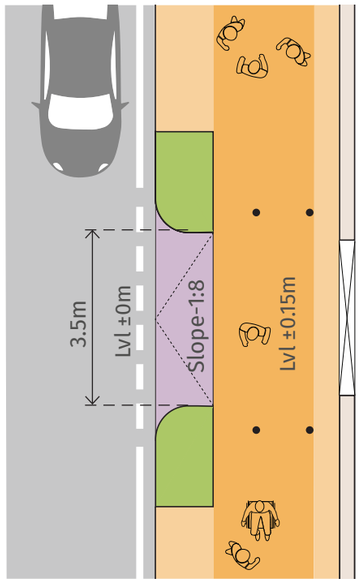


Footpath continuity maintained across local streets as table-tops in Ethiraj Salai, Chennai

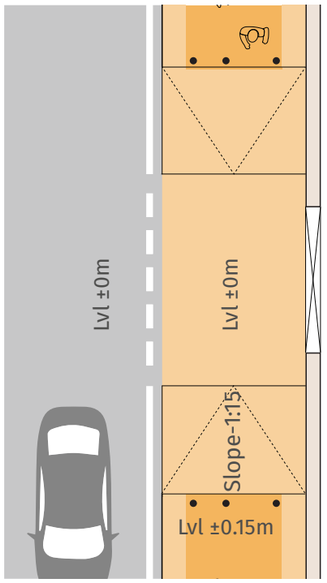


A clear wide footpath with vendors in MUZ in Smart Janpath, Bhubaneswar
Image Source - Elements Creative India

4.1.6 Continuity across Property Access



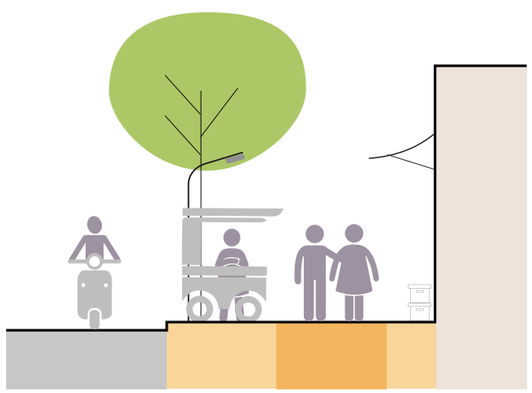
Streets with footpath > 2m
Vehicle access ramp should have a slope of 1:8, and should not be wider than 3.5m to avoid parking encroachment.



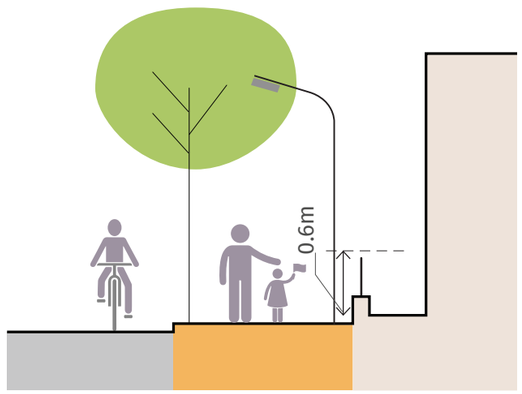
Streets with footpath ≤2m wide
Footpaths should slope down with a 1:15 gradient to accommodate property entrances.

4.1.7 Eyes on the Street

Street edges, featuring shop façades and vendors, or transparent boundary walls, contribute to a sense of safety. The 'eyes on the street' aspect offers informal urban surveillance, as illustrated in the figure below.



Public building-use

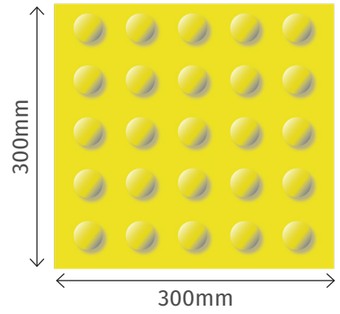


Private building-use

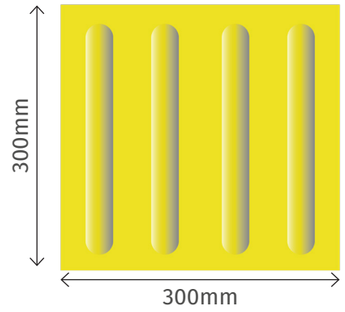
Compound walls should be discouraged for street edges having public building-use.

For public buildings, seating and interactive spaces that incorporate the compound wall should be considered rather than blank walls. These foster a more open and engaging environment, which enhance both the aesthetics and safety of the area.

4.1.8 Universally Accessible Streets



Blister tactile paving - Dot-type blocks indicate a warning signal



Directional tactile paving - Line-type blocks indicate the correct route to follow

Visually impaired pedestrians need guidance while walking to find their way, overcome obstacles, and cross safely. Tactile pavers should be laid 600mm away from the edge of any obstacle to avoid collision as shown in the figure.*

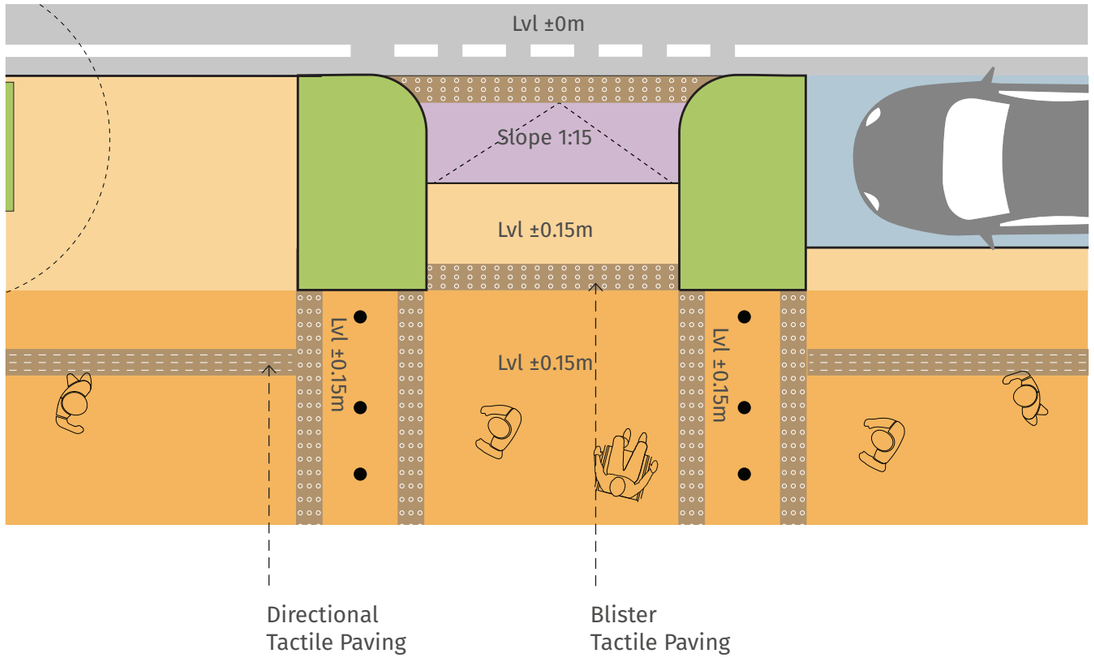
*Detail specification of tile design can be referred in IRC:SP:117

Surface material should be anti-skid such that any breaks in the surface (like drainage channels, expansion joints) are not more than 10mm wide.

Flared ramp



JM road, Pune. Image source - Oasis Designs Inc



4.1.9 Footpath on School Streets

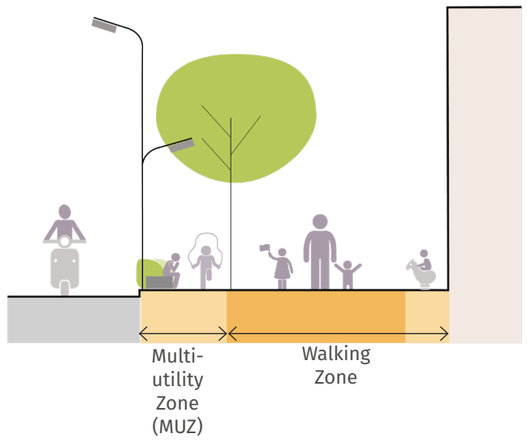
Since schools witness a large volume of children, the streets, especially the ones with the school entry/exit, should be designed to accommodate the large volume of pedestrian traffic, as follows:

Walking zone	Minimum 2m
Multi-utility Zone	Minimum 3m

Footpath in the school zone should include a 0.5m wide landscape buffer in the MUZ zone, along the kerb edge.

Footpath in the streets without the school entry /exit, and within the school zone, should be designed based on the street character and RoW.

Some of these streets, including the ones with the school entry/exit, can be designed as pedestrian-only streets that allows only walking, cycling and public transport. Refer Chapter 2.1 for more details.




Harrington Road, Chennai


West Avenue, Chennai

4.2 Cycle Tracks

The cycle is a core mode of urban transport. Cycles offer low-cost, pollution-free mobility and occupy only one-fifth of driving and parking space when compared to cars. Due to the lack of physical separation of motorised and non-motorised vehicles, cyclists face inconvenience and safety hazards from faster moving traffic. Therefore, the provision of safe and convenient cycling infrastructure is essential to attract new users.

Cycle tracks should be continuous, with smooth curves to ensure uninterrupted movement. They should be well-shaded and well-lit to enhance comfort and safety. Rather than being isolated segments, cycle tracks should be planned as a cohesive network for seamless connectivity across neighbourhoods. To create safe and efficient cycling infrastructure, the following key design principles must be followed to improve usability, prevent encroachment, and integrate seamlessly with urban streets.

- **Safety**: Physically separated infrastructure that ensures safe and conflict-free cycling.
- **Continuity**: A well-connected network that allows uninterrupted movement.
- **Directness**: Routes that provide efficient and convenient connectivity.
- **Comfort**: Design elements that enhance the cycling experience, including smooth surfaces, adequate width, and shade.
- **Accessibility**: Infrastructure that enables inclusive cycling for all, including people with disabilities.
- **Security**: Well-lit and naturally surveillance cycle tracks that enhance personal safety.
- **Visibility**: Clear signage, lighting, and markings that improve awareness and way finding.
- **Integration**: Seamless connections with public transport, pedestrian zones, and key destinations.

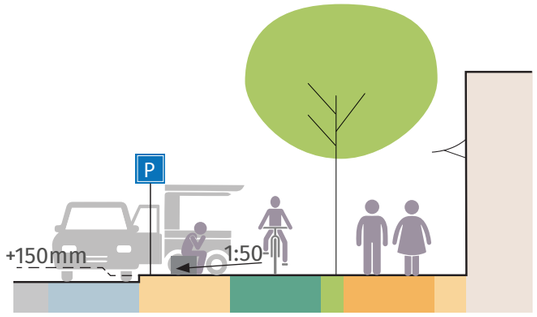


F. C. Road, Pune

4.2.1 Cycle Tracks and Cycle Lanes

Physically segregated cycle tracks

Physically segregated cycle tracks ensure safety and reduce the possibility of encroachment by moving motor vehicles and parking. These are recommended for streets with predominant speeds exceeding 30 km/h (typically streets with RoW ≥18m) to enhance cyclist safety.



At footpath level

Cycle tracks at footpath level are recommended to prevent encroachment by moving vehicles and parking.

Painted cycle lanes

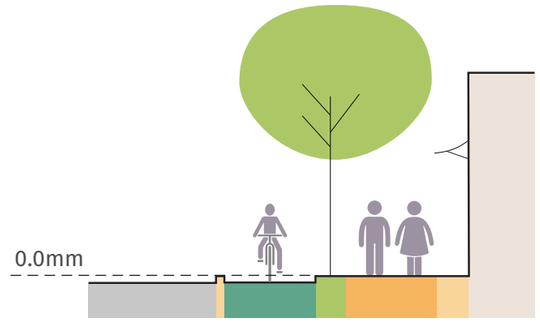
These can be provided while testing new designs on existing streets. However, painted cycle lanes that are not physically segregated or are at the same level as the carriageway are prone to encroachment by moving vehicles, vending, and parking. Therefore, parking and vending areas should be clearly demarcated to prevent such encroachments.



Painted Cycle Track in Chandigarh,
Image Source - Smart Commute Foundation

Buffer

In streets with parking along cycle track, a buffer of minimum 0.5m should be provided to protect the cyclists from dooring—a situation where a parked vehicle's door opens suddenly into the cyclist's path, causing a collision. In other cases, only a kerb (0.15m wide) may be used as a buffer to save space.



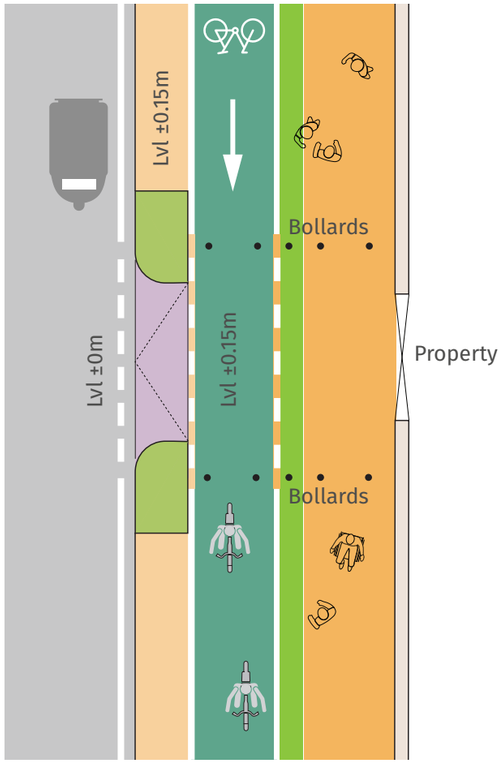
At carriageway level

Cycle tracks at road level have lower construction and maintenance costs, but they may not be universally accessible to wheelchair users when crossing from the sidewalk to the road due to the level difference.

Intersections and entrances

Cycle tracks should be clearly demarcated using paint and signage, especially at intersections and property entrances to deter motor vehicle encroachment. To prevent pedestrians from using cycle tracks, ensure there is a clear and unobstructed walking space.

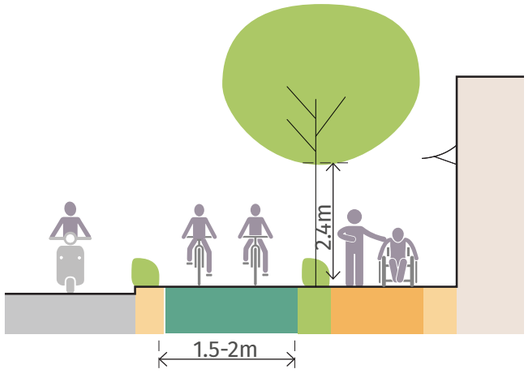
4.2.2 Continuity Across Property Entrances



At property entrances and intersections, the cycle track should continue at the same level and vehicle access should be provided by a ramp in the buffer, where possible.

Frequent change in the direction and location of cycle tracks should be avoided, unless absolutely necessary to accommodate public facilities, like vendors and bus stops.


Image Source - BRT_Delhi



Width

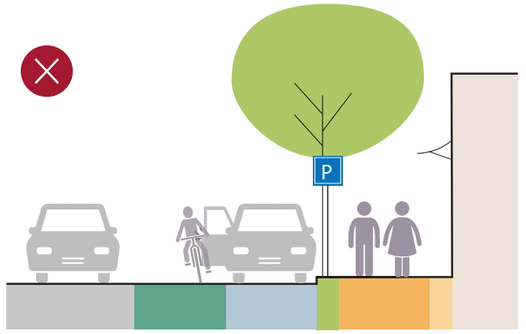
Cycle tracks should be minimum 2m wide for one-way movement and minimum 3m wide for two-way movement as per IRC. In Chennai's context, it is optimised to 1.5m for unidirectional single track.

Vertical clearance

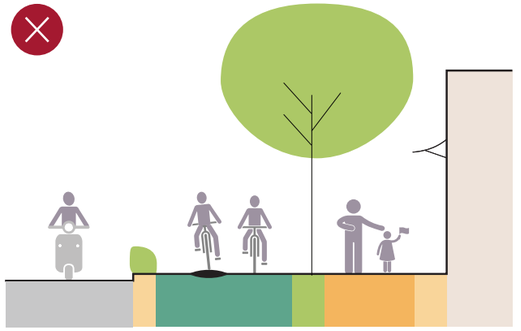
Vertical clearance of 2.4m should be maintained at all points.


Pashan Sus Road, Pune

4.2.3 Comfort and Safety



Cycle tracks should not be provided between parking and carriageway, as this could result in cyclists getting hit by dooring.



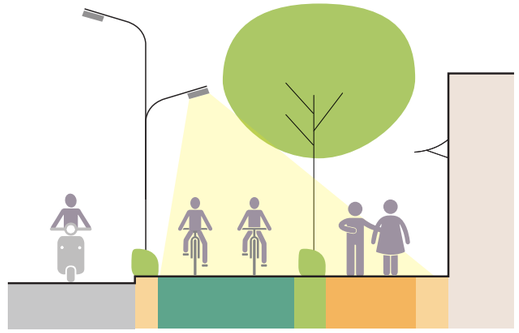
Surface

Cycle tracks should have an even surface free from undulations due to material or any level difference.



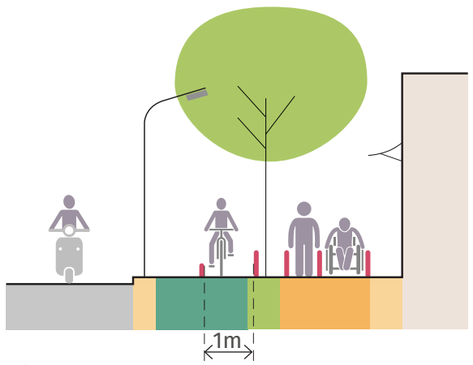
Shade

Continuous shade through tree cover should be provided to shelter cyclists from harsh weather.



Visibility

Cycle tracks should be well-lit and be clearly differentiated from footpath and carriageway. It is recommended to demarcate the cycle track through a coloured surface and lane markings.



Bollards

Bollards of height 0.2-0.4m with a clear spacing of 1.2m clear distance along the width of the cycle track can be provided to prevent three- and four-wheeler encroachment. Two-wheeler encroachment shall be avoided through enforcement.

Please note that closely spaced bollards can obstruct the movement of cyclists, force them to reduce the speed, thereby discouraging cyclists to use cycle tracks.

4.2.4 Markings and Surface Treatment

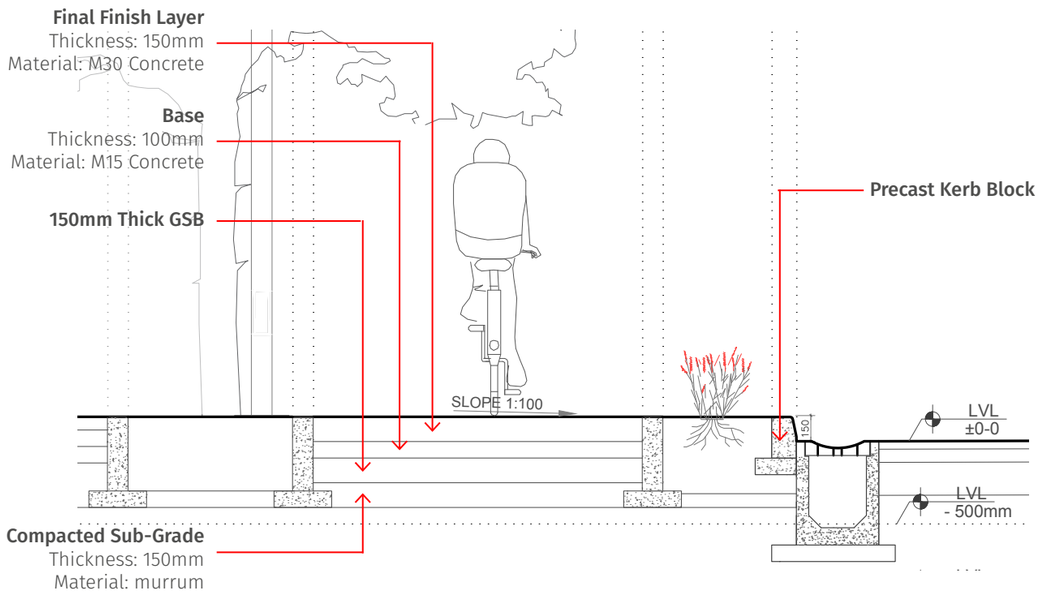
Markings and surface treatments enhance safety, visibility, and usability, serving a different purpose than the cycle track's base material. While materials like asphalt or concrete form the structural foundation, markings provide clear guidance, highlight hazards, and improve navigation, ensuring a safer and more intuitive cycling experience for users.

Refer Chapter 6 on materials for more information.



Paint Types	Easy to Apply	Low Cost	Long Lasting	Highly Visible	Easily Available	Application	Remarks
Thermoplastic Paint	✗	✗	✓	✓	✓	Lane marking, cycle logo	Available in limited colours ; Takes time and machinery to apply
Acrylic Distemper Paint	✓	✓	✗	✓	✓	Surface treatment	Does not need primer; Takes longer to dry
Floor Coat Emulsion Paint	✓	✗	✓	✗	✗	Surface treatment	
Water-based Epoxy Paint	✓	✓	✗	✗	✓	Surface treatment	Takes lesser time to dry
Aerosol Spray Paint	✓	✗	✓	✓	✓	Surface treatment, Cycle logo	Available in many colours

Table showing materials that can be used for surface treatment of cycle track



Cross section of cycle track

4.2.5 Cycle Tracks in School Streets

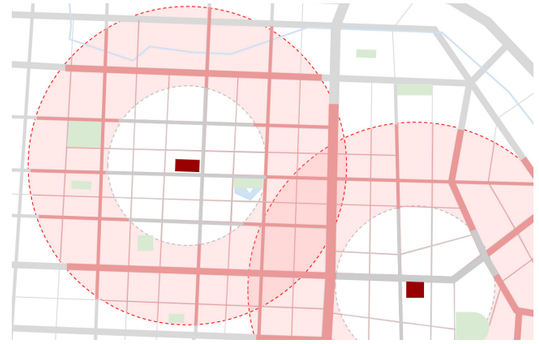
Between the ages of 6 and 17, children have the chance to expand their independent mobility to school through cycling, either with a parent or by themselves. To support and encourage this choice, it is imperative to provide dedicated cycle tracks and ensure adequate cycling infrastructure within school zones. To achieve a safe and accessible cycling environment for children, well-connected and continuous cycling networks should be planned and implemented, as opposed to the current disconnected and unusable segments of cycle tracks.

To accommodate a child cycling with a parent, segregated cycle tracks 1.5-2m wide (one-way) shall be provided within the school zone.

The placement of the cycle track must be at the kerb edge, or between the Walking Zone and MUZ based on the local context. The placement should factor in the safety of children.

In streets where provision of cycle tracks is not feasible, painted cycle lanes shall be provided. Painted cycle lanes must be combined with supportive traffic-calming measures to ensure lower speeds of motor vehicles.

Dedicated cycle signals shall be provided to ensure safety and improve confidence for children cycling, especially at intersections which witnesses high traffic volumes.



Cycle track between the MUZ and walking zone



Cycle track along the kerb edge



4.3 Pedestrian Crossings

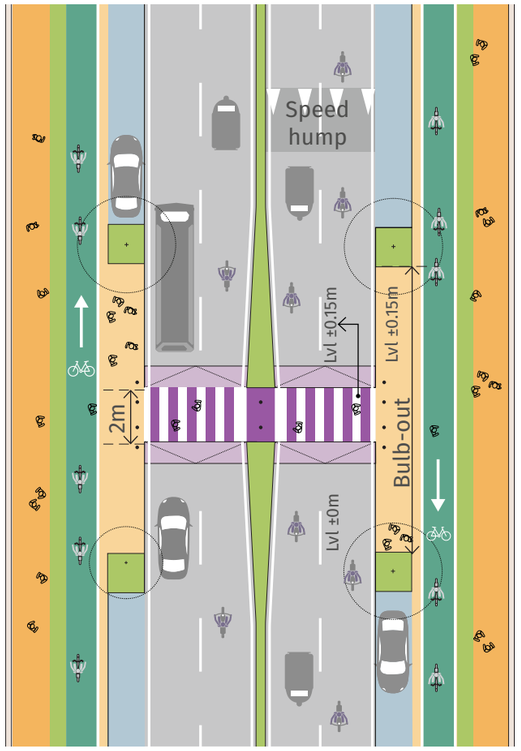
Well-designed mid-block and intersection crossings provide a safe and convenient way for pedestrians and cyclists to cross streets, discouraging them from risking their lives on urban streets.

Foot-over bridges or subways are often inconvenient and tend to become hotspots for crime and anti-social activities. Hence, pedestrian foot-over bridges should be considered only on urban expressways where vehicle speeds are above 60km/h.



DP & ITI Road, Pune
Image Source -Elements Creative India

4.3.1 Table-top Crossing



Location
Tabletop crossings are recommended to be provided at all unsignalised locations. They are also ideal for footpaths of narrow widths where providing ramps is not feasible.

Height
Tabletop crossings should be raised to the level of the adjacent footpath (maximum of 0.15m) with the vehicular ramps of 1:8 slope provides wheelchair access too.

Intervals **(as per NMT Guidance Document, 2016, MoHUA)**
Every 80-150m in commercial / mixed-use areas
Every 80-250m in residential areas

Width
At-least 2m wide and 4m in front of schools, hospitals, markets and other high footfall areas as per IRC:103

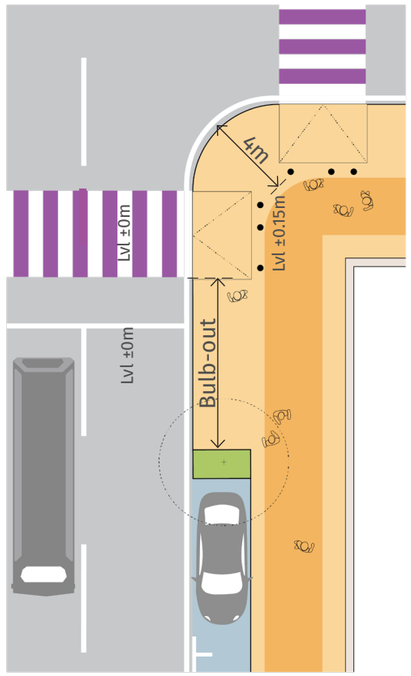
Bulb-outs
In case of a parking lane, bulb-outs should be provided to reduce the crossing distance.

Traffic-calming
It is recommended to provide speed hump at a distance (as per IRC:99) before the table-top crossing to slow down vehicle speed before table top.



Cobble stone paving on road before table top to slow down vehicle speed

4.3.2 Zebra Crossing with Ramps



Location
Zebra crossings are recommended at signalised crossings.

Height
Footpath should be ramped down (slope 1:15) to the level of the carriageway.

Width
At-least 2m of width should be provided.

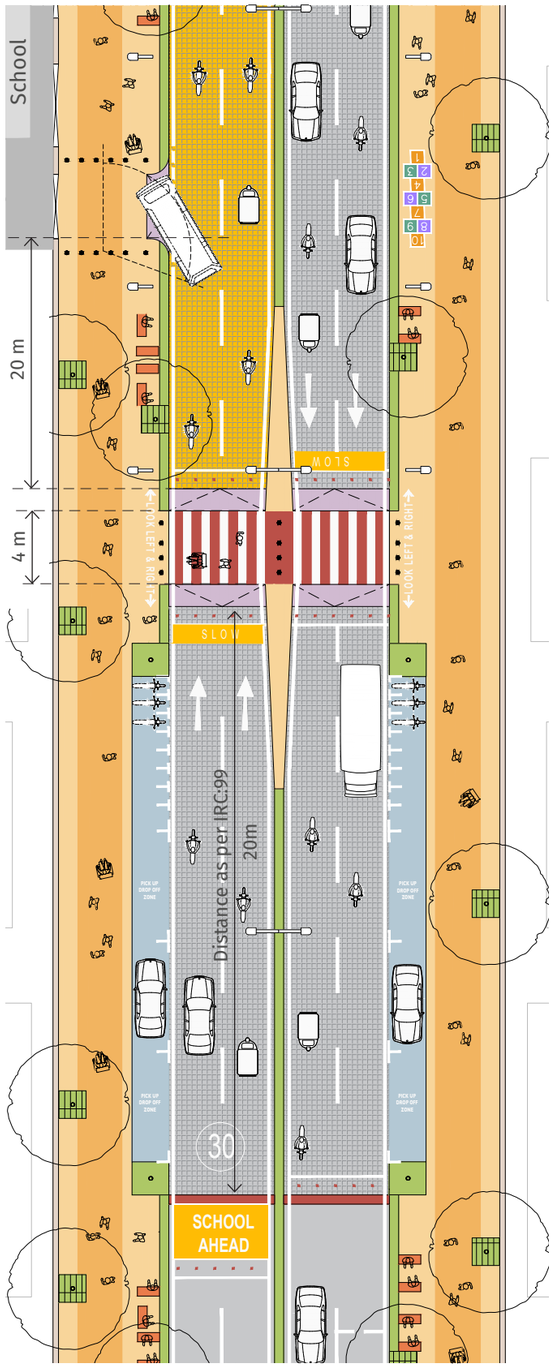
Turning radius
Small turning radius slows down vehicles and increases pedestrian safety while crossing.

Turning radii at intersections should be 4m on local and collector streets, and maximum 9m on arterial streets.

4.3.3 Pedestrian Crossing near Schools

Children have limited cognitive ability to navigate multi-directional traffic and they tend to cover shorter distances than adults. It is therefore important to ensure that crossings around school zones facilitate reduced crossing distances while helping the children focus on one direction of traffic.

Table-top Crossings



Raised crossings increase visibility and the potential for a vehicle to yield to a crossing child. Hence, a tabletop crossing should be provided in school zones as opposed to unsignalised zebra crossings.

Location
Table-top crossings should be provided at a distance of 30m on either side of the school entry/ exit, combined with the 'SLOW' road marking.

Width
A tabletop crossing should at least be 2m wide in front of schools.

Height
The tabletop should be 150mm high and must match the height of the footpath to ensure seamless movement of pedestrians.

Traffic-calming
Speed humps should be provided at a distance from speed table (as per IRC:99) for smooth reduction in motor vehicle speeds. The road marking 'SCHOOL AHEAD' should be combined with the speed humps.

Intervals
Table-top crossings should be provided at 80-150 m intervals, along the street with the school gate.

4.3.4 Pedestrian Grade Separators

Prioritise at-grade crossings

As per IRC:103–2012, at-grade pedestrian crossings are the preferred option. Foot over-bridges (FOBs) and subways should be considered only where at-grade solutions are not feasible due to very high traffic volumes or safety constraints.

Location
Entry structures should be placed within the Multi-utility Zone (MUZ) without obstructing the clear walkway. Maintain minimum clear widths as per IRC:103 for footpaths around entries.

Alignment

FOBs and subway entries should be placed on desire lines, directly aligned with pedestrian flow. Entries must connect seamlessly to continuous footpaths, without forcing detours or unsafe crossings.

Good sightlines should be ensured, avoiding blind spots or unsafe corners.

Universal Accessibility

Ramps, escalators or elevators should be provided at all FOBs and subway access points, as recommended in IRC:103. Tactile paving, handrails, non-slip surfaces, and adequate lighting should be ensured throughout.

Integration with public transport

FOB/subway landings should be located within 20–50 m of Metro/rail/bus station entries. FOB/Subway can be provided at multi-modal integration hubs.

Safety and surveillance

CCTV coverage, adequate lighting, and emergency call points should be integrated in and around entry points.

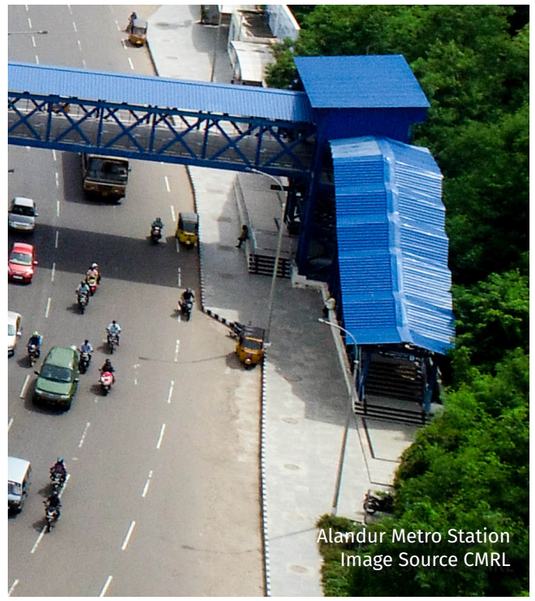
Parking and traffic management

No parking or loading zones should be permitted within 20–30 m of FOB/subway entries.

Maintenance and operations

Easy access for cleaning, maintenance, and drainage management. Road owning agencies will have to maintain the infrastructure.

Materials must be durable, low-maintenance, and weather-resistant as recommended in IRC:SP:90.


Alandur Metro Station
Image Source CMRL



Post Office Subway, Anna Salai, Chennai

4.3.5 Across Intersections

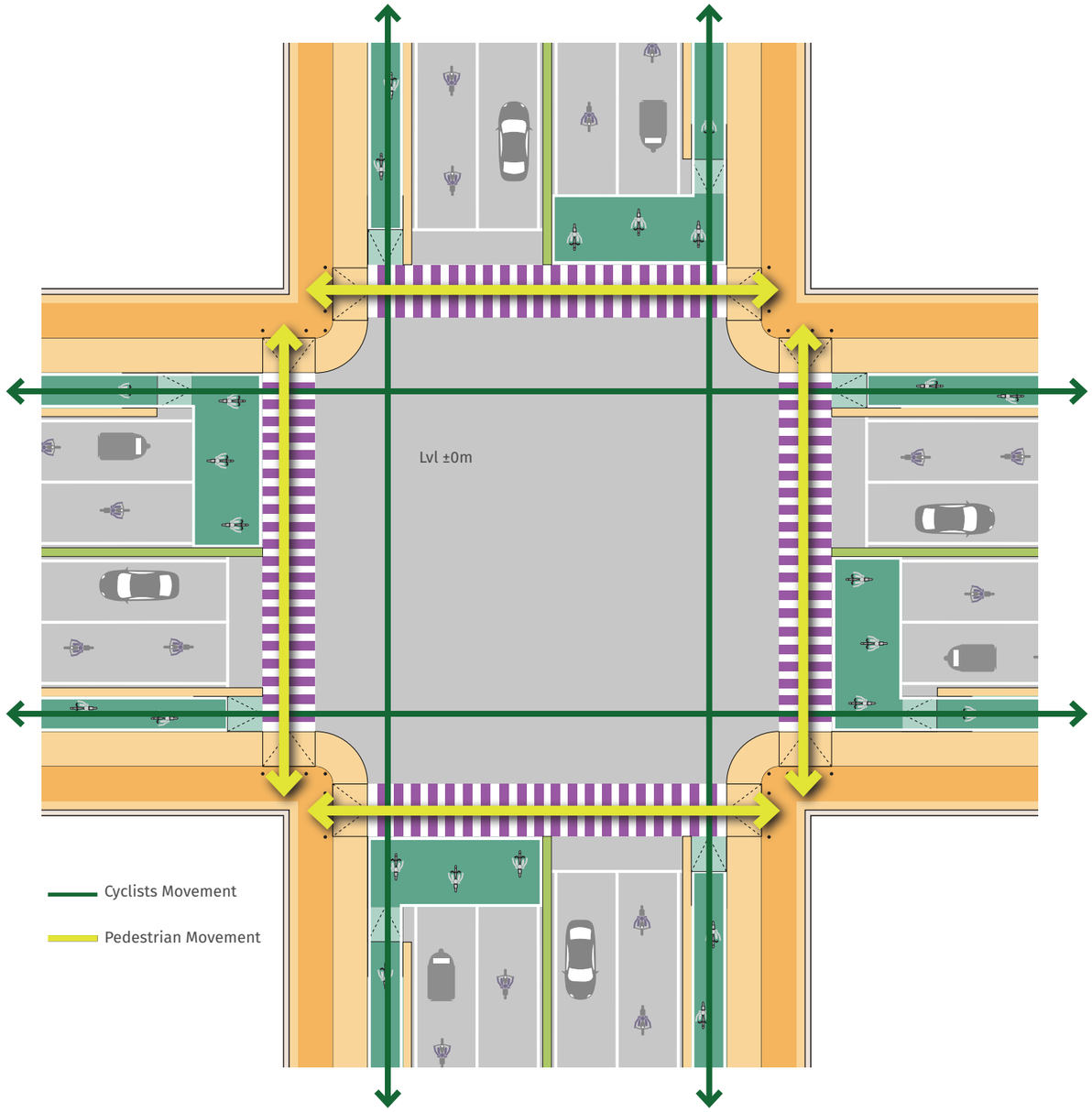
Streets with segregated cycle tracks

Continuity of cycle tracks should be maintained at intersections.
A cycle box should be added to allow cyclists to wait at the signals.

Streets without segregated cycle tracks

In case of narrow streets where segregated cycle tracks are not provided, the intersection can be raised to reduce the traffic speeds and enhance safety for cyclists.

Pedestrian crossings should be located at all corners of the intersection, such that there is minimum deviation from the path of the walking zone.



4.3.6 Intersections near School Zones

Within a school zone, table-top crossings with pedestrian access ramps should be provided across all unsignalised arms of the intersection. This increases visibility and the potential for a vehicle to yield to a crossing child.

Signalised street junctions shall be designed with zebra-crossings.

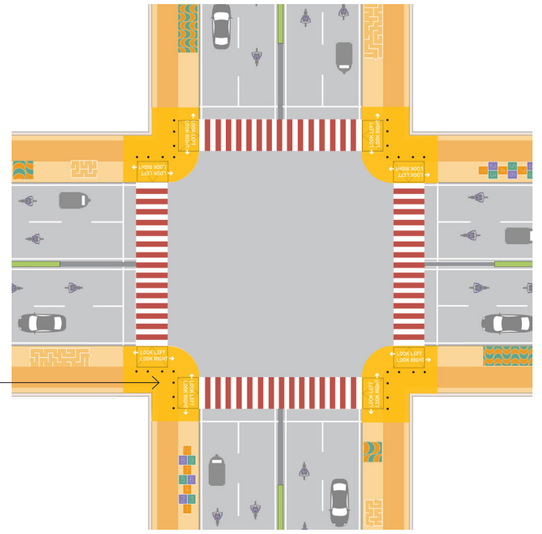
Appropriate signage and road markings should be provided around the intersections.

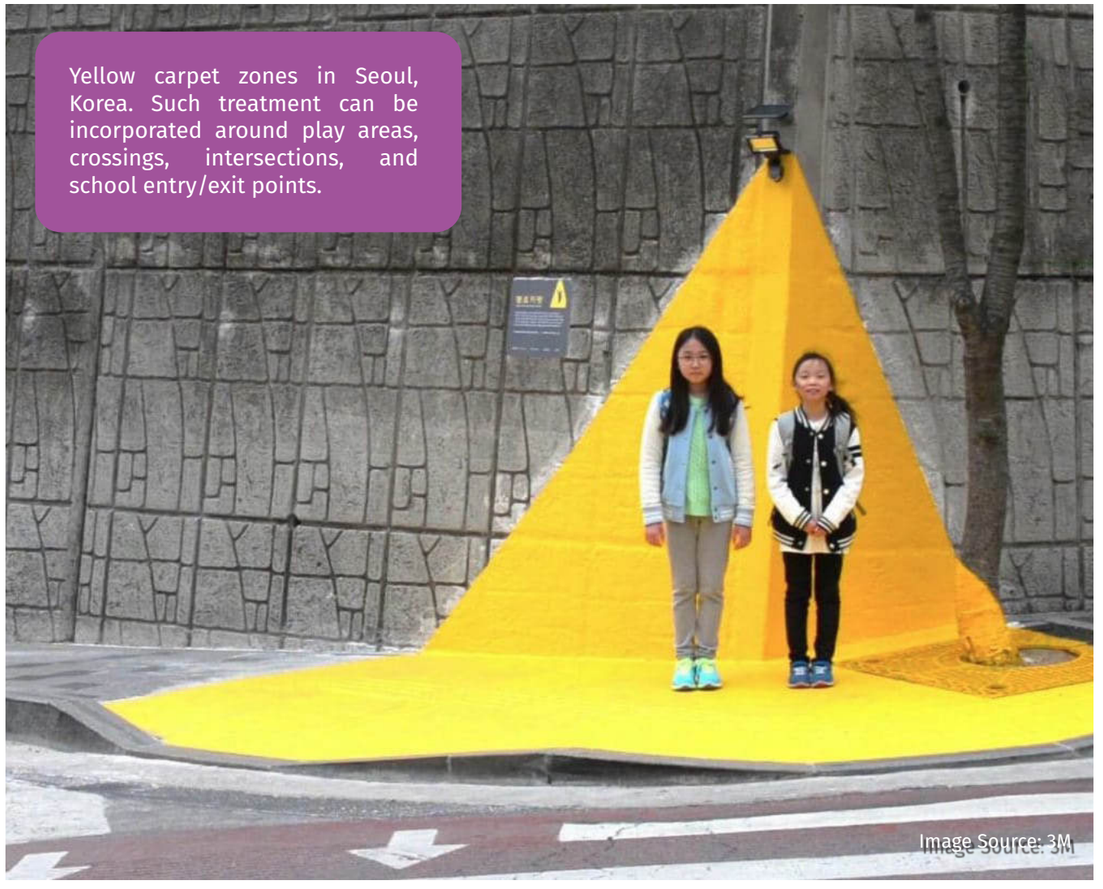
Intersections should be designed in accordance with the guidelines specified in Chapter 4 of this document.

Yellow Carpet Zones at Intersections

To alert vehicle drivers to slow down and to make children more visible to the drivers, the street corners around intersections can be painted in yellow.

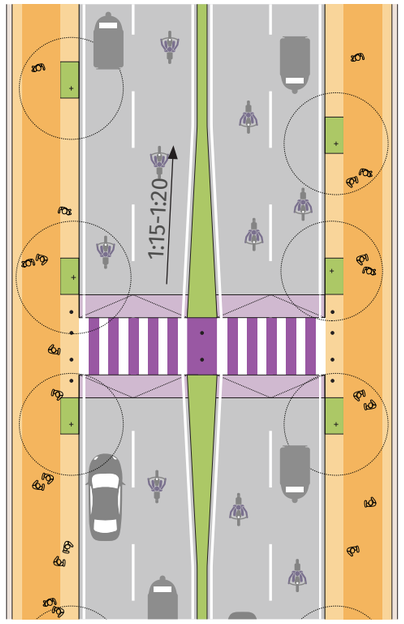
Signalised intersection in a school zone





4.3.7 Median and Pedestrian Refuge

Medians reduce conflict between opposite directions of traffic and channelise vehicular movement in high traffic volume streets. Pedestrian refuges or refuge islands support comfortable crossing and safety of pedestrians at large intersections, by providing an intermediate resting point and breaking the crossing length into shorter segments. The unused carriageway space at intersections should be converted to pedestrian refuge for safe crossing and efficient vehicle throughput. Refuge islands should be free of landscaping and fencing to ensure usability.

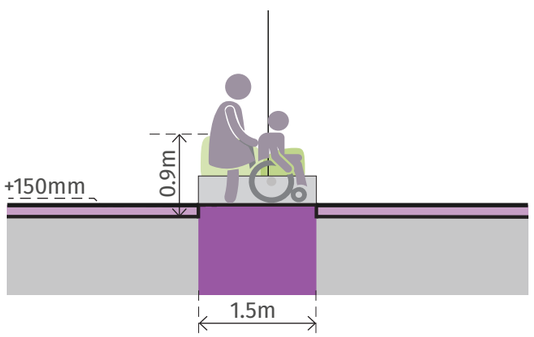


Criteria for median
Streets with more than two lanes in each direction should have a median.

Break in the median
A break in the median should be provided at regular intervals for pedestrian crossings: every 80-150m along commercial/mixed use streets, and 80-250m along residential streets. The frequency can be adjusted based on site conditions.

Median width
Medians should be of uniform width of 1.2m.
Where a pedestrian refuge needs to be added, a gradual variation in median width of 1:15-1:20 should be provided as shown in the diagram.

Landscape
Bushes should be trimmed to ensure visibility. Drought-tolerant, low maintenance native species that are capable of storm water filtration should be planted on the medians.



Pedestrian refuge width
For a safe and inclusive pedestrian refuge that accommodates strollers, wheelchairs, and cycles, it should have a minimum width of 1.5m. The refuge island shall be at the level of carriageway to ensure access to wheelchair and free from any landscaping.

Bollards
Bollards should be placed in the refuge to prevent motor vehicles from turning.

(Details present later in the chapter)


Smart Janpath, Bhubaneswar.
Image Source - Elements Creative India

4.3.8 Median and Median Refuge near School Zones


Harrington Road, Chennai

To help children focus on one-directional traffic and to reduce their exposure time to traffic while crossing, streets in school zones should be designed with a continuous median, with refuge islands based on the number of lanes and street width.

In order to accommodate people with strollers, wheelchairs, cycles; a minimum 1.5m x 2.4m pedestrian refuge shall be provided.

Bollards can be placed in the refuge to prevent motor vehicles from turning while ensuring it does not obstruct the movement of persons on wheelchair and cyclists.

The table-top crossing is not at the same level as the footpath, 3rd Avenue, Besant Nagar, Chennai

Table-top crossing is at the same level as the refuge island and the footpath, DP Road, Pune

4.3.9 Mid-Block U-Turns

To improve traffic flow and reduce congestion, Madurai has introduced, mid-block U-turns across key corridors.

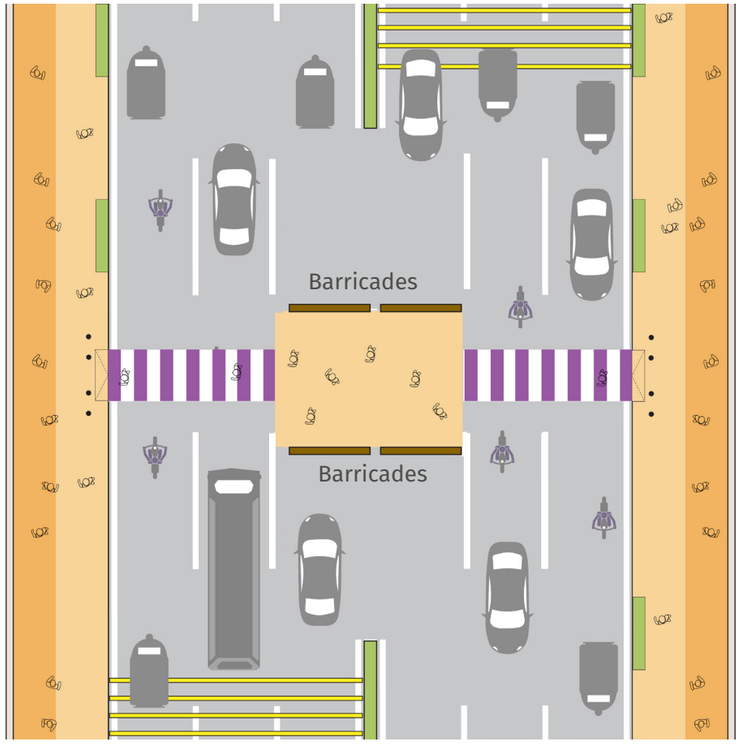
While signal-free U-turns may help ease vehicular congestion and reduce travel time, pedestrian safety at mid-block crossings poses a challenge that needs to be overcome.



U-turn in CIT Nagar , Chennai.
Image Source: Greater Chennai Traffic Police

Signal-free stretches can only work if drivers are courteous enough to allow pedestrians to cross. To ensure safety and comfort of pedestrians while maintaining efficient vehicular flow, additional design features should be integrated to the crossing.

The below mentioned example provides temporary solutions for the temporary U-turn interventions currently being implemented. It is recommended that the city implements permanent design solutions, as outlined in this document, to ensure all street users feel safe and comfortable while using the street



Conceptual representation of mid-block crossing

Space for pedestrians (zebra crossing, pedestrian refuge islands) shall be provided at the mid-block.

Pedestrian signals should be provided at the crossing to ensure pedestrians have sufficient time to cross. For signal timings and phasing, refer to Chapter 4.8.

Traffic-calming elements such as rumble strips and speed humps shall be provided before the mid- block u-turns to reduce vehicle speed as they approach the mid-block.

Signage and road markings should emphasise pedestrian priority at designated crossings to promote compliance.

4.4 Traffic-Calming Measures

Traffic-calming features decrease vehicle speeds, reducing the likelihood of fatalities and severe injuries from accidents. They also create safer conditions for pedestrians and cyclists sharing the road with motor vehicles, especially when separate footpaths and cycle tracks are unavailable.

Traffic-calming measures are recommended where pedestrian-vehicle conflicts are expected to occur.

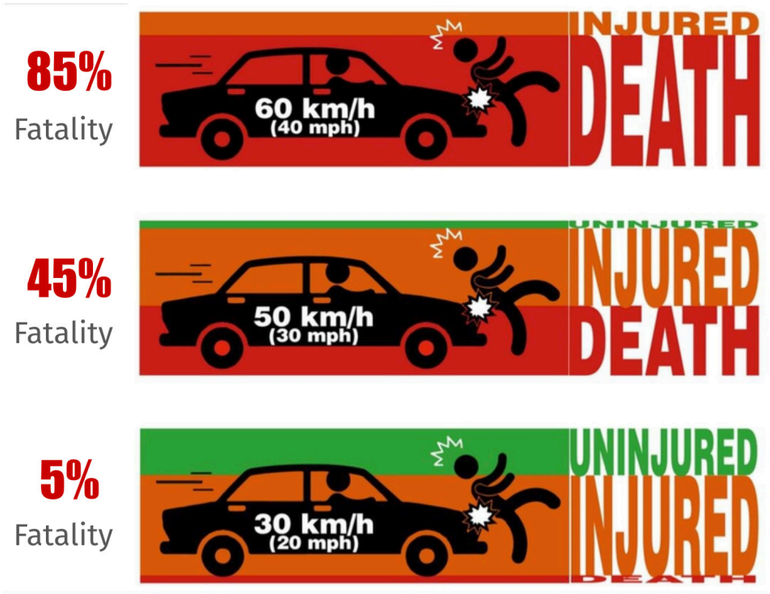
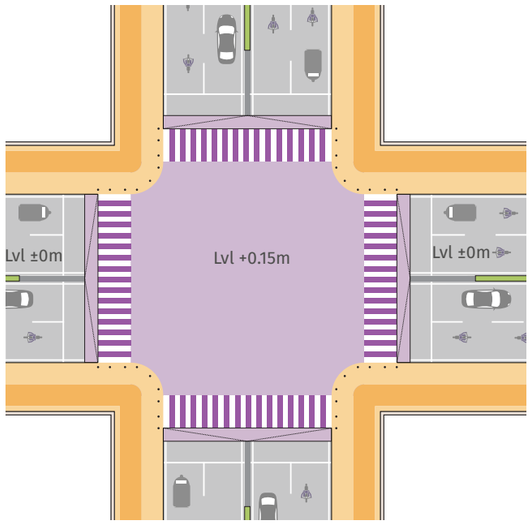


Image Source: Copenhagenize

4.4.1 Vertical Displacement

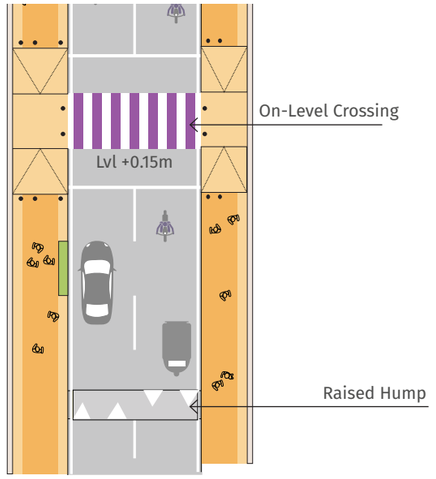
Vertical displacement includes raised junctions, speed humps, speed bumps, speed tables, and speed cushions.



Raised junctions
Elevated platform encourages motorists to slow down, promoting safer road interactions and minimising the risk of accidents.

The raised nature of these junctions provides a visual cue to drivers, reinforcing the need for caution in specific areas.

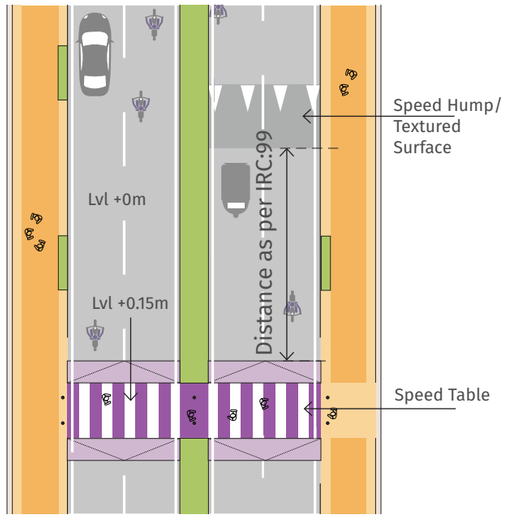
Material difference on the carriageway (like cobble-stone paving) can be provided up-to a distance of 10-20 m from the speed tables to slow down traffic and ensure pedestrian safety.



Speed humps
Speed humps are cast-in-situ in the carriageway and provide a smooth reduction in motor vehicle speeds.

Location criteria
Speed humps can be provided on local and collector streets. Steep speed humps may lead to discomfort for drivers.

These should be located at a distance (as per IRC:99) from pedestrian crossing.



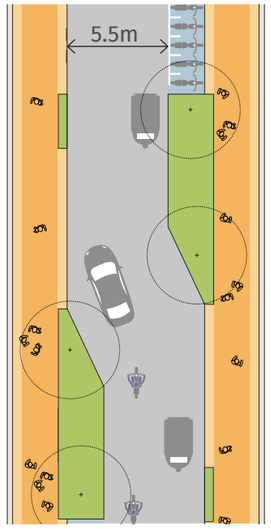
Speed tables
Speed table (also known as table-top crossing) is a crossing raised at the level of footpath, that extends to the full width of the carriageway.

Speed humps should be provided at a suitable distance from speed table (as per IRC:99) for smooth reduction in motor vehicle speeds.

Location criteria
Speed tables should be provided on arterial and collector streets at:
- Unsignalised junctions
- Mid-block crossings with frequent pedestrian movement

Refer IRC:99 for design standards of speed table on bus routes.

4.4.2 Horizontal Displacement



Chicane

Chicanes (designed curves on the road that can be used for traffic-calming) combined with temporary/ permanent barriers in the carriageway can be provided on local streets to slow down vehicles. They should be combined with retro-reflective hazard markers.



4.4.3 Traffic-Calming Measures in School Zones

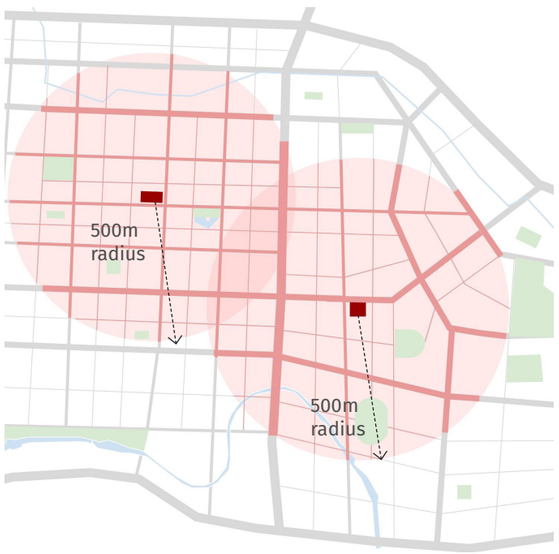
Children are susceptible to various risks when they navigate road traffic, especially speeding vehicles. The risk of severe injury and fatality increases exponentially with speed and the impact will be even worse for a child.

Hence a safer speed limit (15 to 30 kmph) is recommended in school zones where Vulnerable Road Users (VRUs)—young and elderly pedestrians and cyclists—share the carriageway space with vehicles. This also helps alleviate the inherent fears of traffic among parents and caregivers, and can potentially lead to an increase in independent mobility of children through active transportation.



Aundh D. P. Road, Pune

Location and Design



All streets within the school zone (500m around the school) should be designed to ensure vehicles drive within the safe speed limits—15kmph to 30kmph—as mentioned in IRC SP: 32.

Traffic calming elements and sufficient speed signage can be incorporated to achieve this.

Refer Chapter 4.4 for more information on traffic-calming measures.

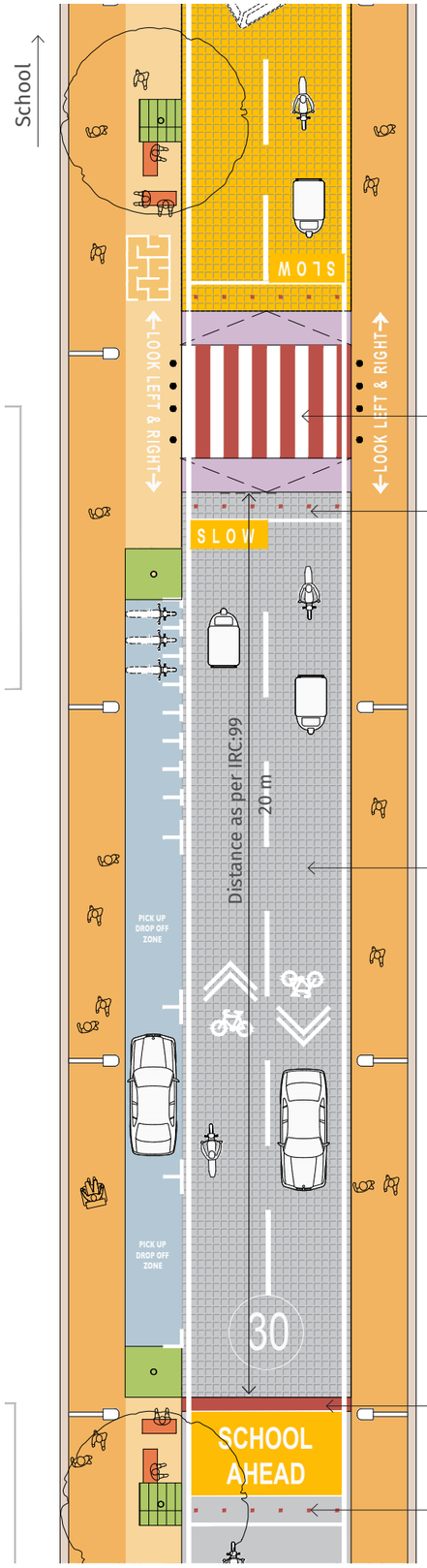


Table-top with speed bump and cat-eyes

To ensure vehicles stay within the safe speed limit, streets in the school zone, at frequent intervals, shall be designed with a combination of traffic-calming elements such as:

- Speed tables
- Speed humps
- Speed bumps
- Chicanes
- Cat eyes
- Rumble strips
- Material-difference (like cobble-stone paving / paver blocks)

Speed Table / Table-Top Crossing

Cat Eyes

Material Difference

This can be provided 100 m on either side of the school entry / exit gate. This helps with the automatic reduction of vehicular speeds due to higher frictional resistance offered by the paving material.

Materials like cobble-stones and paver blocks can be used. In cases where this is not possible, rumble strips shall be provided 100 m on either side of the school entry / exit gate.

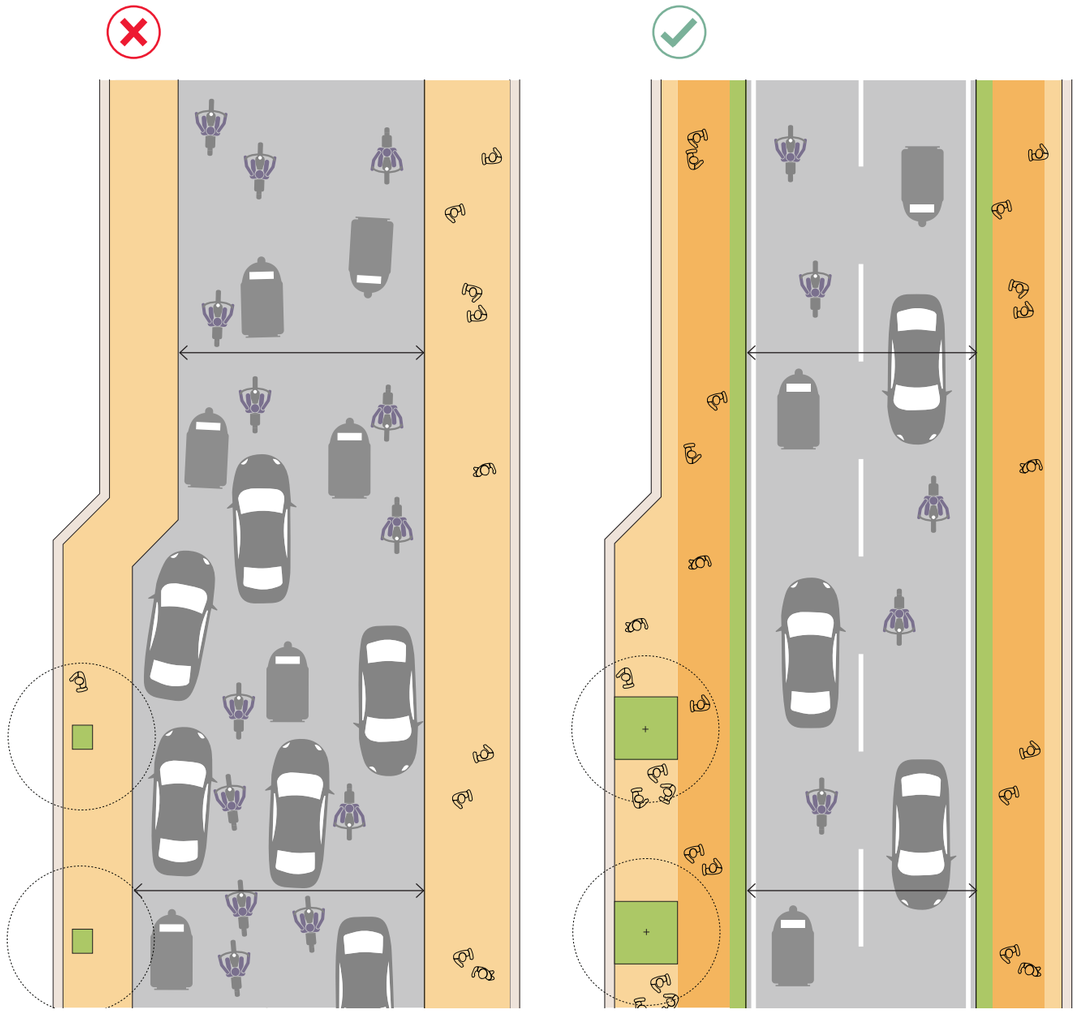
Speed Bump

Cat Eyes

4.5 Carriageways

The purpose of a carriageway is to enable seamless movement of vehicular traffic. A consistent width must be maintained throughout the street length to avoid bottlenecks. A carriageway can be designed for appropriate speeds based on the function of streets in the city network.*

4.5.1 Design



The carriageway width should not increase in portions where a wider RoW is temporarily available. Bottlenecks lead to congestion and traffic jams.

*Refer Table 1: Street elements and their presence on arterial, sub-arterial, collector and local streets

4.5.2 Carriageway Width

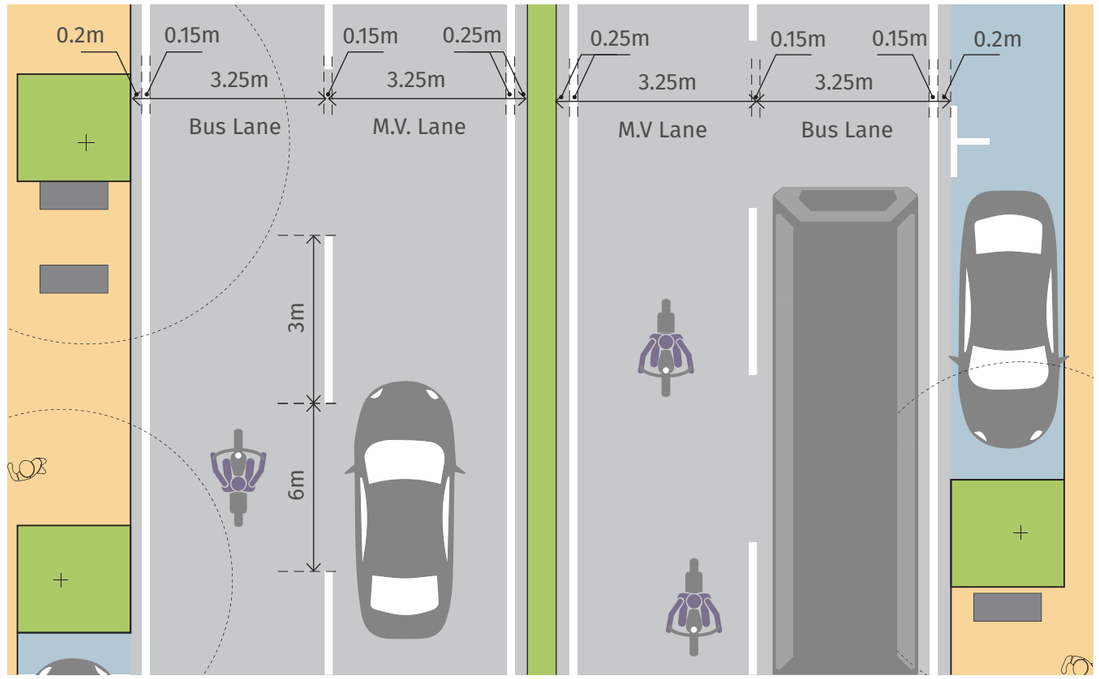
The table below shows the recommended carriageway widths for each road type. These are contextualised for Madurai, based on IRC:86-2018.

Number of lanes	Width of Carriageway			
	Arterial Roads (RoW 45m, 60m)	Sub-Arterial Roads (RoW 30m, 36m)	Collector Roads (RoW 18m, 24m)	Local Roads (RoW 9m, 12m)
Single lane with raised kerbs	3.5m	3.25m	3.25m	3m
2-lane with raised kerbs	7.5m (0.5m of shyness near median)	7m (0.5m of shyness near median)	6.5m	6m
4-lane with raised kerbs	15m with median (0.5m of shyness near median)	14m with median (0.5m of shyness near median)	13m with median	NA

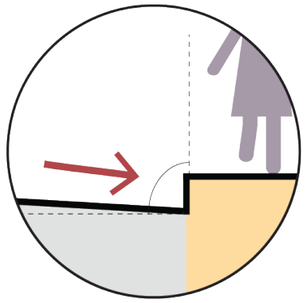
The minimum width of an urban road without kerb should be 5.5 m including allowances for a stalled vehicle and pedestrian movement.

4.5.3 Lane Width

Road lane marking on the carriageway is a crucial aspect of traffic management, enhancing safety and guiding motorists effectively. These markings, including lane dividers and symbols, play a vital role in maintaining organised and efficient traffic flow on roads.

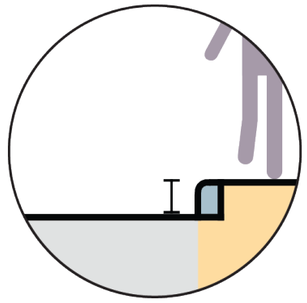


4.5.4 Carriageway Principles



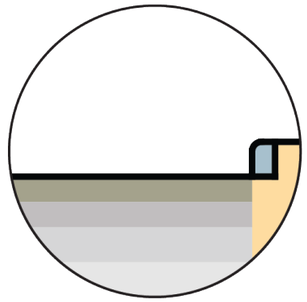
Drainage

The carriageway should have a proper longitudinal gradient (minimum 0.3 %) and a camber (slight concave curvature on the road) of 1.5 to 2.5 % to allow for surface runoff.



Surface

The carriageway should have an even surface, with a level difference of 150mm between the top coat of the carriageway and the kerb.



Construction in layers

The carriageway should have a compacted sub-grade with solid base and strengthened surface.

4.5.5 Construction in Layers

The carriageway layers are mentioned below in the order of top most to the bottom most layer. Refer IRC 250:2013 for more information.

Carriageway Layers (Top to bottom layers)	Depth of Carriageway Layer			
	Arterial Roads (RoW 45m, 60m)	Sub-Arterial Roads (RoW 30m, 36m)	Collector Roads (RoW 18m, 24m)	Local Roads (RoW 9m, 12m)
Surface Layer Bituminous Concrete (BC)	40-50mm	40-50mm	40mm	30mm
Intermediate Layer Dense Bituminous macadam (DBM)	Refer IRC 81: 2022, 37:2018 for calculation reference based on soil bearing capacity and traffic axle load.			
Intermediate Layer Metalling followed by tac coat				
Base Layer Wet mix macadam (WMM)				
Sub Base Granular sub base				
Sub Grade				
Earthwork Excavation				

Refer IRC 58: 2015 for Rigid Pavement Roads.



Pondy Bazaar, Chennai
Image Source - Elements Creative India

4.6 Bus Priority Lanes

A Bus Priority Lane (BPL) is a designated lane on carriageway reserved primarily for buses to help them move faster and more reliably than general traffic. By giving buses dedicated or preferential space, these lanes reduce delays caused by congestion, improve travel time consistency, and make public transport more efficient and attractive.Bus lanes can break the vicious cycle of private transport dependence by maintaining competitive travel times and reliable scheduling in road-based public transport.

Bus lanes are of two types – Kerb side bus lanes and Median bus lanes. Considering Madurai's context, kerb-side bus lanes are recommended. Refer to IRC 70: 2017

Bus priority can take different forms:

- Exclusive lanes: Only buses are allowed at all times
- Time-based lanes: Reserved for buses during peak hours
- Shared priority: Buses with other modes like shared IPT (not recommended)

Challenges

- **Traffic heterogeneity:** Managing high volumes of mixed traffic often leads to encroachment into bus lanes, reducing their effectiveness.
- **Operational gaps:** Limited system management, inefficient operations planning, and frequent property access points disrupt lane continuity and performance.
- **Access and safety:** Inadequate pedestrian crossings and poor integration with walking and cycling infrastructure create barriers to safe bus stop access.
- **Weak enforcement:** Inconsistent enforcement allows misuse by private vehicles and intersection blockages, affecting bus reliability.

4.6.1 Design

Right of Way (RoW):
BPLs are recommended for RoW of 36 m and above.

Lane width:
A dedicated lane width of 3.5 m should be maintained,

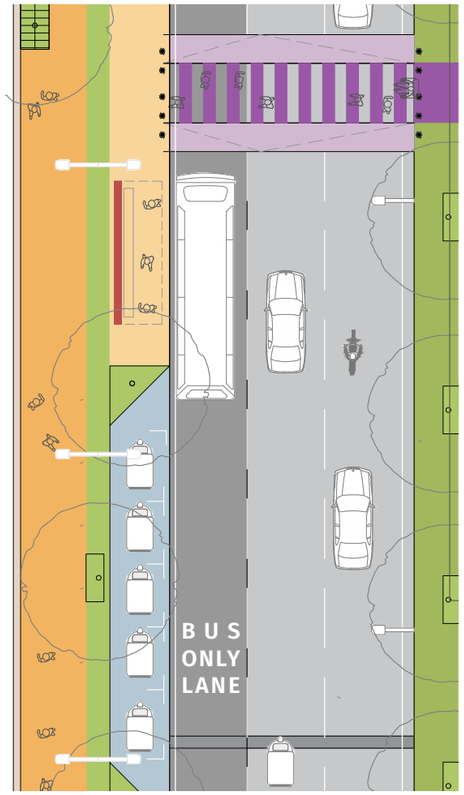
Bus stop:
Bus stops are provided at the kerb edge in MUZ

Pedestrian crossing:
Safe pedestrian crossings must be provided near bus stops

Lane demarcation:
BPLs should be clearly defined through physical segregation or road markings, depending on RoW

Signal priority:
Buses should be supported with priority at intersections through dedicated signal systems.

Continuity of lane and access management
Continuous uninterrupted BPL stretches with minimal disruptions from property entrances and side streets through controlled access design.





Bengaluru
Source: FILE PHOTO

4.7 **Service Lanes**

Service lanes can increase the mobility function of the main carriageway while also maintaining comfort for non-motorised road users. Well-designed service lanes improve safety by segregating property access points and parking from the main carriageway. They are useful in high-speed corridors such as arterial and sub-arterial roads, and at-grade urban expressways. Service lanes should be designed for slow speeds and should have a designated entry and exit, to avoid becoming treated as another carriageway lane.

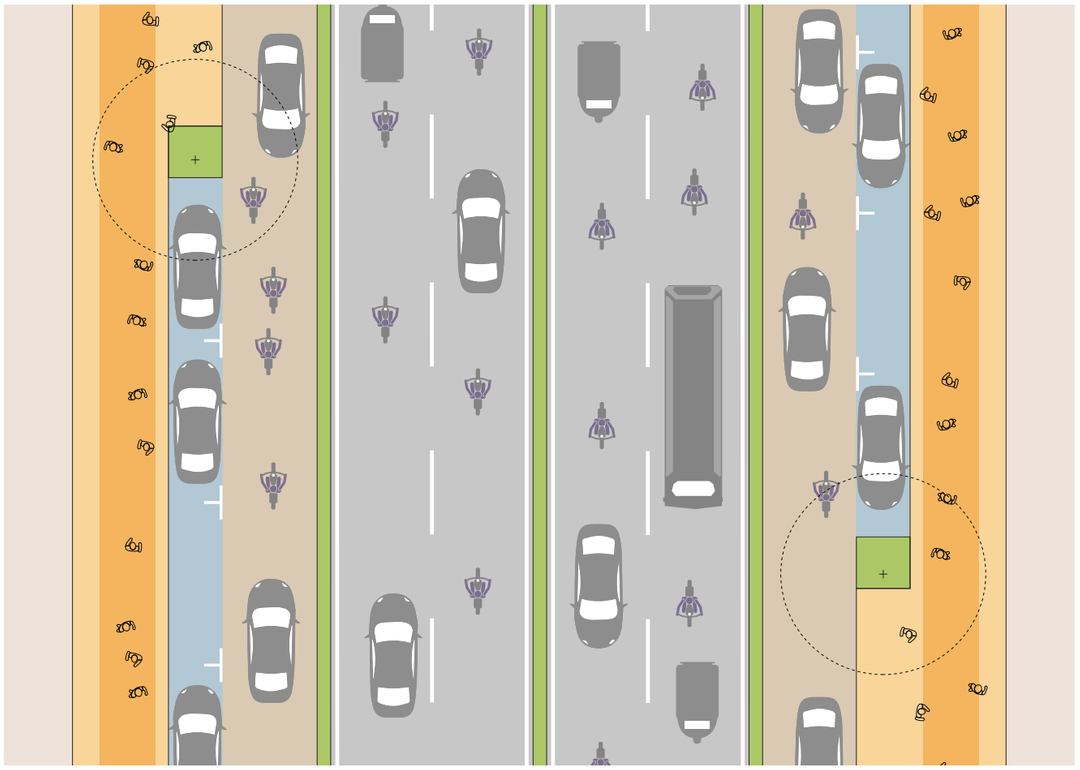
4.7.1 Criteria for Service Lane

A service lane can be considered on a high volume arterial streets (RoW >45m) or in sub-arterial street if one or both of the following criteria are met:

i. Frequency of property entrances is more than once every 15 m
ii. There is active public building use along the edges

A service lane should be 5.5m on each side as per demand and recommendation.

Access into and out of a service lane should be provided via a table-top crossing to ensure the footpath and cycle track continue at their original levels.



Service lanes that are too wide encourage fast driving, thus defeating one of the primary roles of service lanes: to provide safe pedestrian space. In particular, it is difficult to maintain priority for pedestrians on service lanes that are wide enough for two-way car movements. In addition, wide service lanes invite encroachment by shops, parked vehicles, or street vendors.



OMR, Chennai Image Source: X: @Chennai Updates

4.8 Intersection/ Junction Design

The quality of an intersection can vary significantly, depending on the turning radii, the continuity of footpaths and cycle tracks and other design features. In addition to prioritising the movement of pedestrians, cyclists and public transit, the intersection design should be designed for low vehicular speeds. This section covers the basic elements of intersection design, which can help achieve the above vision. (Refer IRC 92:2017)

4.8.1 Turning Radius and Left Turn Pockets

Turning radius is relevant in the context of designing street corners and left turn pockets. Larger vehicles require more space in order to take a turn, and hence intersection design must factor these in.

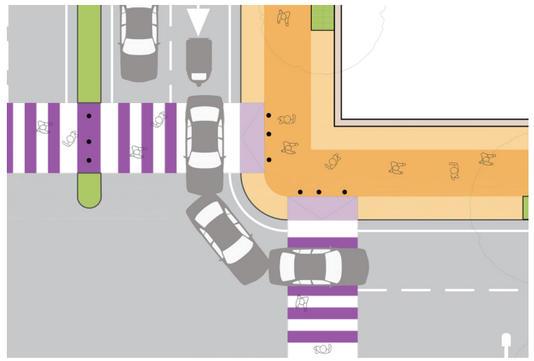
Design of turning radius

Larger turning radii encourages faster vehicle speeds. Hence, tighter corners are preferred as they improve pedestrian and cyclist safety.

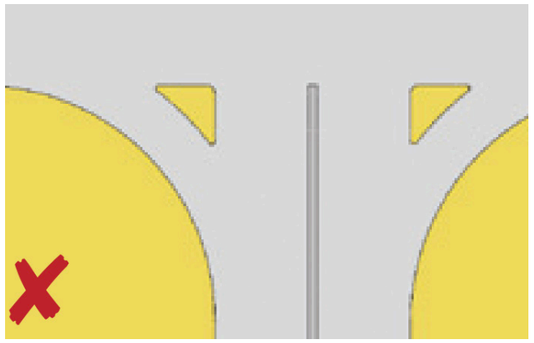
For local streets that cater to light vehicles, the turning radius should be 4m.

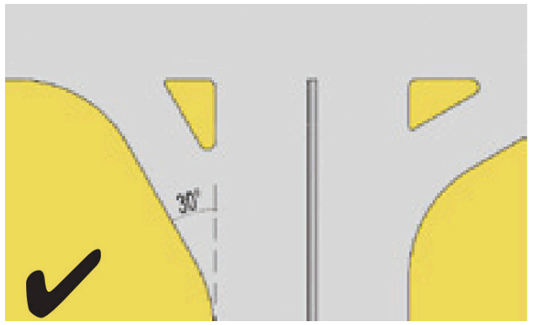
The turning radius for streets that accommodate buses and trucks (Bus Route Roads) shall be 9m.

Intersection angles of 90° should be maintained for optimal safety and visibility.



Turning radius for smaller vehicles





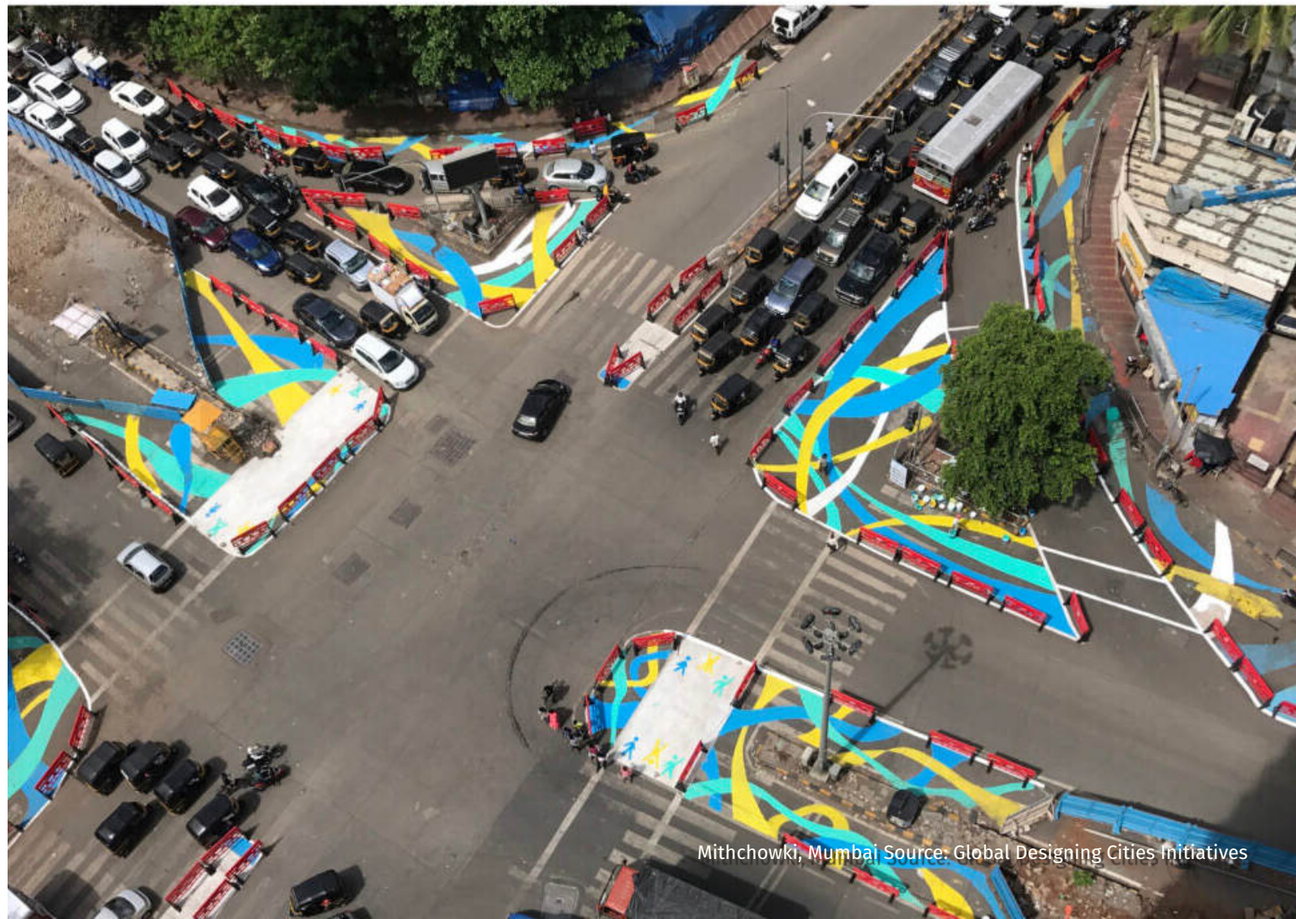
Left turn pockets

Left turn pockets can increase junction capacity by allowing vehicles to make free left turns. However, if not designed appropriately, they can compromise pedestrian safety.

Traditionally, left turn lanes have been designed with a circular geometry. However, such a design is unsafe for pedestrians because it allows for fast vehicle movements.

The preferred design incorporates a 30° angle of approach. Since vehicles enter the outgoing arm at a more abrupt angle, they are compelled to reduce their speeds.

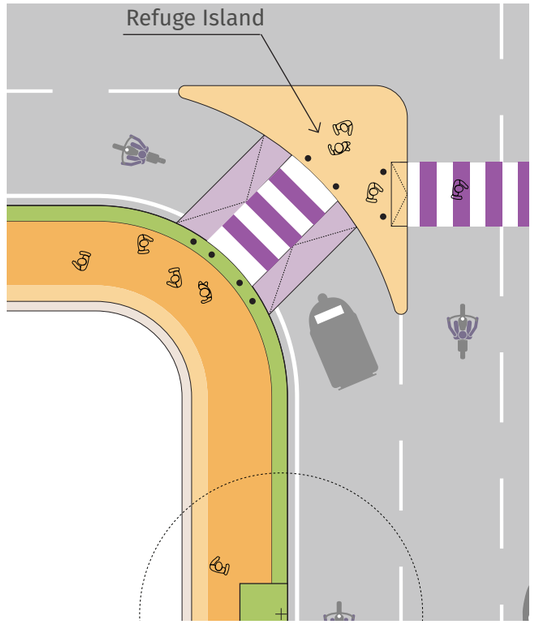




Mithchowki, Mumbai Source: Global Designing Cities Initiatives

4.8.2 Refuge Islands

The design of street corners and turning lanes must account for the turning radius, especially for larger vehicles that require more space to manoeuvre. At intersections, the unused triangular spaces created by turning lanes (known as channelisers) should be re-purposed as pedestrian refuges, since they often go unused by vehicles and accumulate debris. Properly designed channelisers improve safety by providing pedestrians with protected waiting areas while ensuring smooth turning movements for all vehicle types.



Location

Refuge islands should be provided at intersections where pedestrians have to cross more than two lanes of traffic in succession. These islands can also act as channelisers of traffic.

Height

Refuge islands should be at the same level as the footpath.

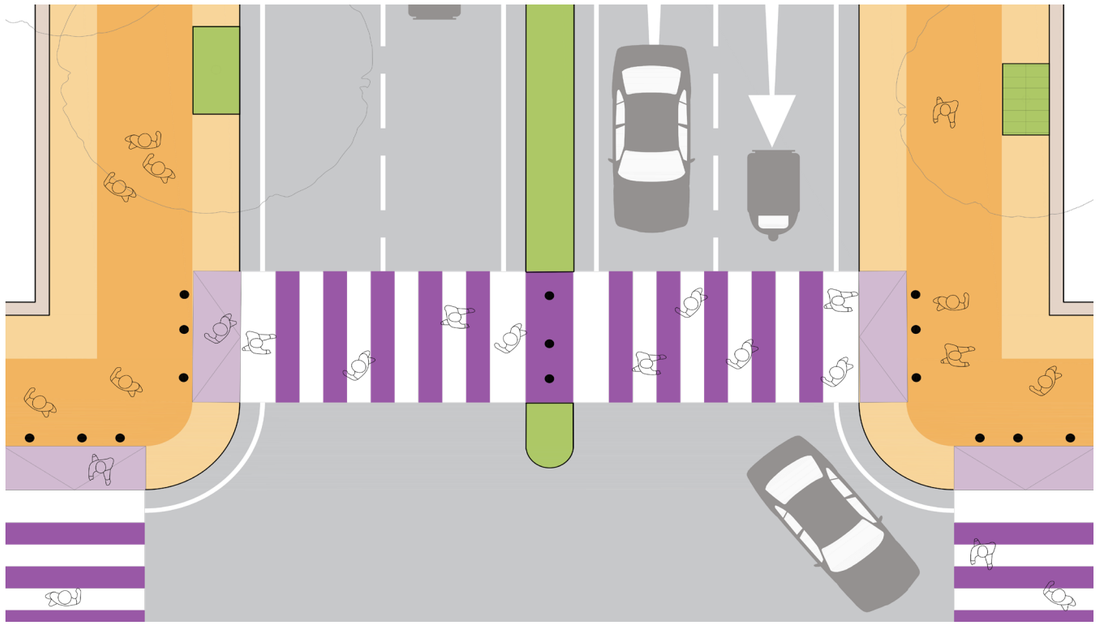
Tabletop crossings must be provided between the footpath and the refuge islands for safer crossing.

Refuge islands should be highlighted by reflective bollards. Light poles and signage, if any, should not obstruct pedestrians' movement and vision.


Chandigarh

4.8.3 Pedestrian Crossings

Crossings denote areas for pedestrian movement while perpendicular traffic is stopped. Pedestrian crossings can be painted (without additional measures) at signalised intersections. At unsignalised intersections, painted cross-walks need to be accompanied by a physical measure such as a speed bump or speed table.



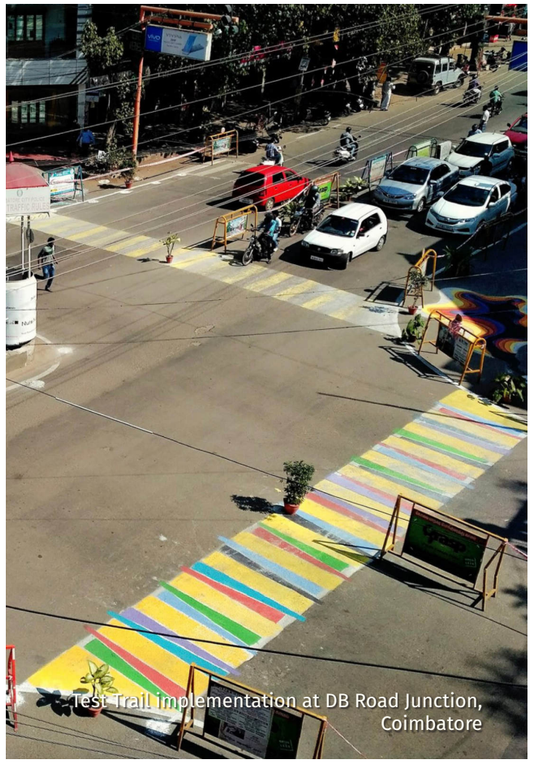
At-least 2m of width should be provided for the pedestrian crossing. Along arterial and sub-arterial streets, 3-4m wide pedestrian crossings can be provided.

Pedestrian refuge width

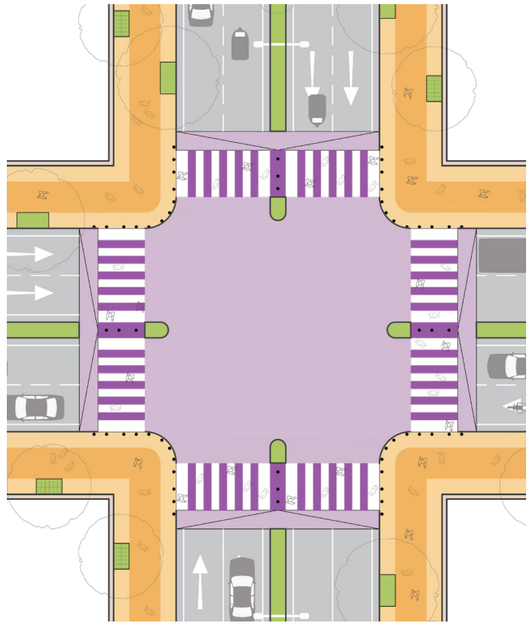
For a safe and inclusive pedestrian refuge, for people with strollers, wheelchair, cycles; a minimum 1.5m width of refuge should be provided. The refuge island should be at the level of carriageway to ensure universal access, and should be free from any landscaping.

Bollards

Bollards should be placed in the refuge to prevent motor vehicles from turning.


Test Trail implementation at DB Road Junction, Coimbatore

4.8.4 Other Elements



Levels

The level of the carriageway at intersections and pedestrian crossings can be raised to that of the footpath or cycle track, through the use of ramps, in order to improve safety and convenience for pedestrians.

Unsignalised intersections shall be raised since pedestrian safety is not ensured by any other means. If raising the intersection prevents adequate vehicle throughput, then ramps should be installed at least on left turn pockets.

Signalised intersections can be raised if warranted by safety concerns.

Bollards

Bollards help define refuge islands and other pedestrian spaces and prevent vehicles from driving over these spaces. Bollards are especially helpful when a pedestrian area is at the same level as the surrounding road surface.



Ramps provided at left turns to ensure pedestrian safety in Wardha Road, Nagpur

4.8.5 Traffic Signals

Type of signals

Fixed time signals
- Operate on a preset cycle with fixed green, amber, and red durations.
- Best for intersections with consistent traffic flow and no major fluctuations.

Traffic actuated signals
- Adjust timings based on real-time traffic conditions using sensors.
- Suitable for intersections with variable traffic demand.

Pedestrian signals
- Provide dedicated crossing time for pedestrians.
- Include walk (green), don't walk (red), and flashing red for clearance time.

Flashing signals
- Used at low-traffic intersections or for cautionary purposes.
- Typically flashing amber (proceed with caution) or flashing red (stop and proceed when safe).

Manual signals
- Controlled by traffic police using hand signals or temporary lights.
- Used in case of signal failure, special events, or emergencies.

Pelican signals
- Pedestrian-activated signals that stop traffic only when a pedestrian presses a button.

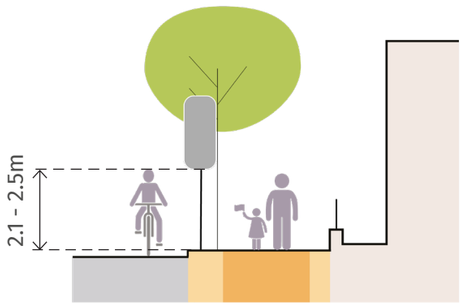
Signal placement criteria

Consider putting a signal at the crossing if:
- Pedestrians have to wait more than 45 seconds to cross the street.
- Traffic speed increases from 40 km/h for 2-lane undivided road, 60 km/h for 4-lane divided road and 80kmph for 6-lane divided road.
- It is recommended to put signal at crossing on 6-lane divided street or one-way street with more than two lanes (as it is difficult to cross more than two lanes)
- Audio signals should be installed at entry, exit and important movement junctions such as entrance lobby, lift, stairways, escalators, etc.

Refer IRC: 103-2022 for more information.

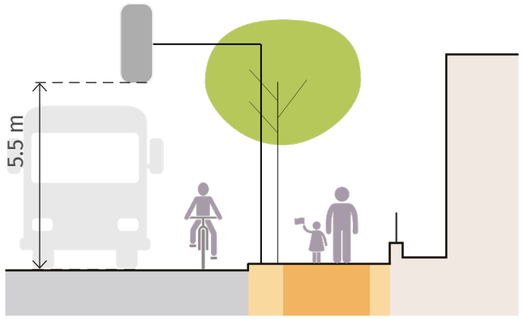


Vehicular Traffic Signals in Chennai

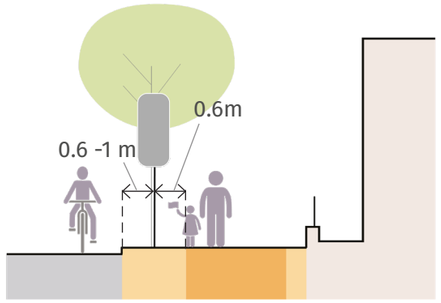


Height and positioning

The bottom of the signal housing should be at a height of 2.1 to 2.5 m above the finished footpath level.



For signals suspended over the street, the height must be 5.5 m above the road surface.



Lateral placement

Signals should be positioned between 600 mm and 1 m from the edge of the carriageway to avoid obstruction and ensure visibility.

Pit size of pole foundation

The foundation of the poles should be 900mm x 900mm wide with a depth of 1050mm.

The poles should be embedded in an M200 concrete box, that is placed with a minimum 300 mm below ground and 300 mm above ground.



Pelican signals in Bengaluru
Image Source: Indiamart



Pedestrian and cyclist signals in Chandigarh

Considerations for Persons with Disabilities

- All visual signage and information should be supplemented with audio announcements and digital displays.
- Pedestrian traffic lights should be provided with clearly audible signals for the benefit of pedestrians with visual impairments.
- Acoustic devices should be installed on a pole at the point of origin of crossing and not at the point of destination. In noisy areas, any spoken information should be repeated at least once. Audible traffic signals should operate at least 15dB over the prevailing sound level, with a maximum of 140dB.
- The installation of two adjacent acoustic devices such as beepers is not recommended in order to avoid disorientation.
- Acoustical signals encourage safer crossing behaviour among children as well.

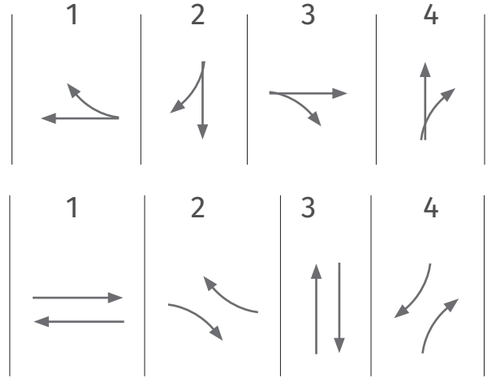
Refer IRC: SP: 117-2018 for more information.

Signal phasing

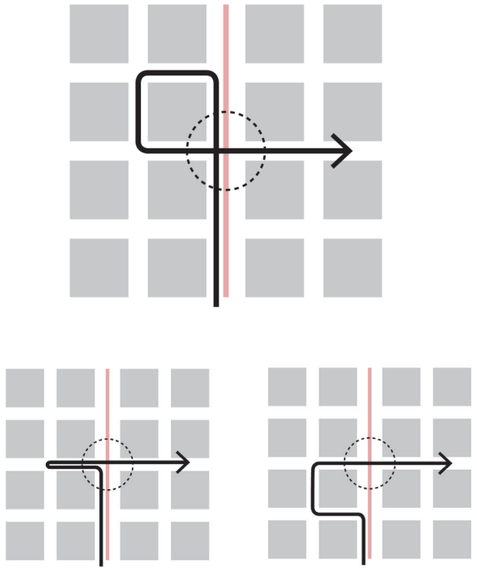
The physical layout of an intersection must be designed in conjunction with the signal phasing.

There are generally several possible sequences of signal phases. The optimal phasing design is determined by the relative volumes of the various movements taking place at an intersection.

For example, the diagram on right shows two standard phasing plans for a four-arm junction. (The diagrams assume that left turns are uncontrolled and can occur during any phase.) Phasing sequences ensure that the final vehicles from each phase are in a different part of the junction from the starting vehicles in the next phase.



Two of the possible signal phasing options for a typical four-arm intersection alternately combine or separate the right turning and straight movements



The simplification of signal cycles through the elimination of turning movements can help reduce delay at intersections, particularly along BRT corridors.

Signal cycles also can be simplified through changes at the network level. For example, a right turn can be substituted by three left turns (as shown in the diagram on the left).

In order to reduce intersection delay along a BRT corridor, intersections can be simplified by prohibiting right turns across the BRT corridor. Vehicles can still make the right turn at the circled junction by turning left three times and then crossing perpendicular to the corridor. Two additional options are indicated below. In the diagram at left, the turn is accomplished through a left turn followed by a U-turn. In the diagram at right, vehicles make two right turns at less critical junctions away from the BRT corridor.

Determining of cycle lengths and green period signalling

To calculate how long the pedestrian green light should last

- Divide the width of the road (in meters) by 1.2 meters per second (average walking speed). On streets with high movement of children and the elderly (such as schools, hospitals, public parks and markets), it is recommended to consider a walking speed of 0.45 m/s.
- Add 7 seconds for pedestrians' reaction time.
- The total is the green signal duration for pedestrians.

Things to note

- The total signal cycle time should be a multiple of 5 seconds.
- If it's not, round it up to the next multiple of 5.
- The cycle length (waiting time when it is red) should not exceed 120 seconds for smooth traffic flow.

4.8.6 Roundabouts and Rotaries

Roundabouts and rotaries are a signal-free solution to enhance intersection safety and efficiency. By consolidating conflict points and enforcing natural speed reduction through geometric deflection, they significantly reduce severe crashes—particularly high-risk right-angle collisions common in unsignalised intersections.

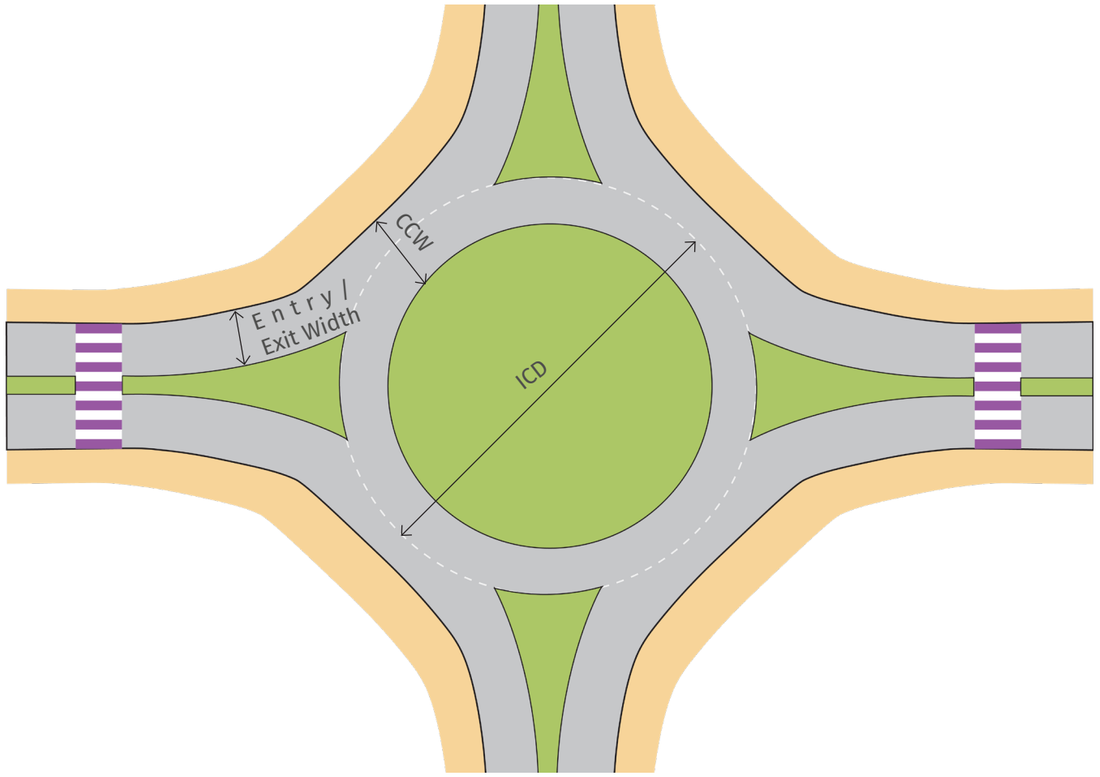
In small intersections, the roundabout as well as the islands in the centre of the four street arms may be constructed with truck aprons (see image on right) that are surmountable by trucks and buses, but not by cars and two-wheelers. Such a design accommodates the larger turning radius of heavy vehicles while maintaining a smaller turning radius for other vehicles. (Refer IRC 92:2017)

Roundabout	Rotary
Smaller in size, recommended for minor intersections	Larger in size, recommended for larger intersections
Enforces lower speeds (<40 km/h)	Higher speeds are permissible (>40 km/h)
Based on yield-at-entry principle (self regulating movement of vehicles)	Based on weaving behaviour between entering traffic from the approach road and the circulating stream
No pedestrian activity on central island	Pedestrian crossing to and from the central island is permissible



Khandoba Junction in Pimpri Chinchwad designed as a multi-lane round

Design of roundabouts and rotaries



Parameter	Roundabout		Rotary
	Single-lane Roundabout	Multi-lane Roundabout	
Inscribed Circle Diameter (ICD)	28 – 40 m	40 – 70 m	> 70 m
Entry / Exit Width	Same as CCW (Min 6m)	9 – 12 m	12 – 15 m (0.5 to 0.75 times the approach width)
Circulatory Carriageway Width (CCW)	12 – 8 m	1 – 1.2 times entry width	
Lane Configuration	1 lane	2-3 lanes	>3 lanes

Pedestrian and cyclist crossings and refuge islands shall be provided even in the case of a roundabout or a rotary, ensuring safe crossing of pedestrians and cyclists at the intersection. This will ensure continuity of infrastructure for pedestrians and cyclists, making it a comfortable experience for them (Refer IRC: 65-2017 for more details on roundabouts and rotary design).

4.8.7 At-grade Treatment for Grade Separators

Pedestrian continuity

- Continuous, obstruction-free footpaths should be provided on both sides of the carriageway beneath grade separators.
- Pedestrian crossings should be provided at-grade along natural desire lines at regular intervals.
- Pedestrians should not be forced to take long detours or rely solely on grade-separated facilities.
- Signalised or raised pedestrian crossings should be introduced where traffic volumes are high.
- All pedestrian infrastructure should be universally accessible, including provision of ramps, tactile paving, and adequate widths.

Intersections

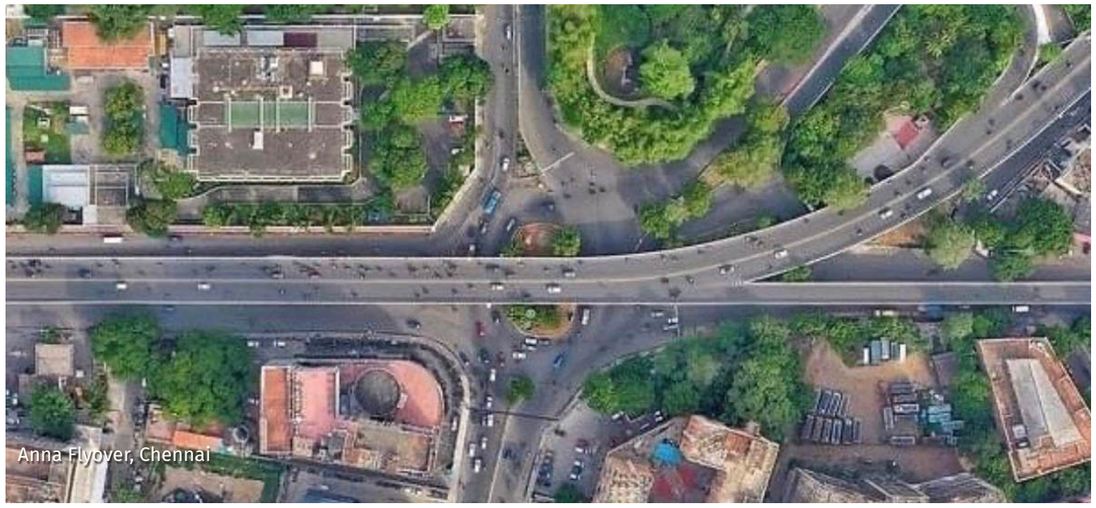
- Intersections beneath or adjacent to grade separators should be designed as complete intersections, ensuring safe movement for all users.
- Pedestrian crossings should be provided on all arms of the intersection, with refuge islands where crossing widths are large.
- Signalisation should be introduced where warranted to manage conflicts between movements.
- Slip lanes should be encouraged in arterial and sub-arterial roads; where provided, they should include raised pedestrian crossings and tight corner radii.
- Adequate sight distances should be maintained for all users at intersections.
- Public transport stops should be integrated without obstructing pedestrian movement.

Developments below grade separators example: Palanganatham flyover.

- Adequate lighting should be provided to eliminate dark and unsafe areas.
- Turning radii at junctions beneath grade separators should be minimised to reduce vehicular speeds.
- Safe pedestrian crossing shall be ensured to access the developments below grade separator.
- If play spaces are designed below the grade separator, necessary safety measures are to be taken
- Proper drainage systems should be incorporated to prevent waterlogging.

Traffic management and circulation

- A clear hierarchy of movement should be established, with through traffic prioritised on the grade separator and local traffic managed at-grade.
- Entry and exit ramps should be designed to minimise conflict points and avoid weaving movements near intersections.
- Adequate merging and diverging lengths should be provided for smooth traffic flow.
- Traffic calming measures should be incorporated at-grade to reduce vehicle speeds.
- Road signage and lane markings should be provided to guide traffic and improve lane discipline.
- Safe and direct access should be ensured for pedestrians and public transport users.



Anna Flyover, Chennai

4.8.8 At-grade Treatment for Interchanges

Pedestrian continuity

- Safe and direct pedestrian routes should be provided across and around interchanges, aligned with natural desire lines.
- Frequent, at-grade pedestrian crossings should be provided with appropriate traffic control measures.
- Pedestrian facilities should be well-lit, visible, and designed to enhance safety and comfort.

Access control management

- Access points should be limited and clearly defined to reduce conflicts and improve safety.
- Informal and unsafe access points should be restricted through design interventions.
- Medians, channelisers, and barriers should be used to guide vehicular and pedestrian movements.
- Pedestrian crossings should be provided only at designated, safe locations.

Circulation and traffic management plan

- Traffic circulation should be simplified to reduce conflicts and improve legibility for all users.
- Local and through traffic movements should be clearly segregated.
- Dedicated turning lanes should be provided to streamline vehicular movements.
- Multimodal integration should be ensured through provision of bus bays, intermediate public transport stands, and pick-up and drop-off areas.
- Wayfinding signage should be provided to guide users through the interchange.

Safety issues

- Speed management measures such as raised crossings, rumble strips, and reduced turning radii should be incorporated.
- Continuous street lighting should be provided across all at-grade areas.
- Road markings and signage should be clear, visible, and regularly maintained.
- Guardrails and pedestrian barriers should be used judiciously to enhance safety without restricting movement.
- Surveillance and emergency access provisions should be incorporated where required.



Kathipara Interchange, Chennai

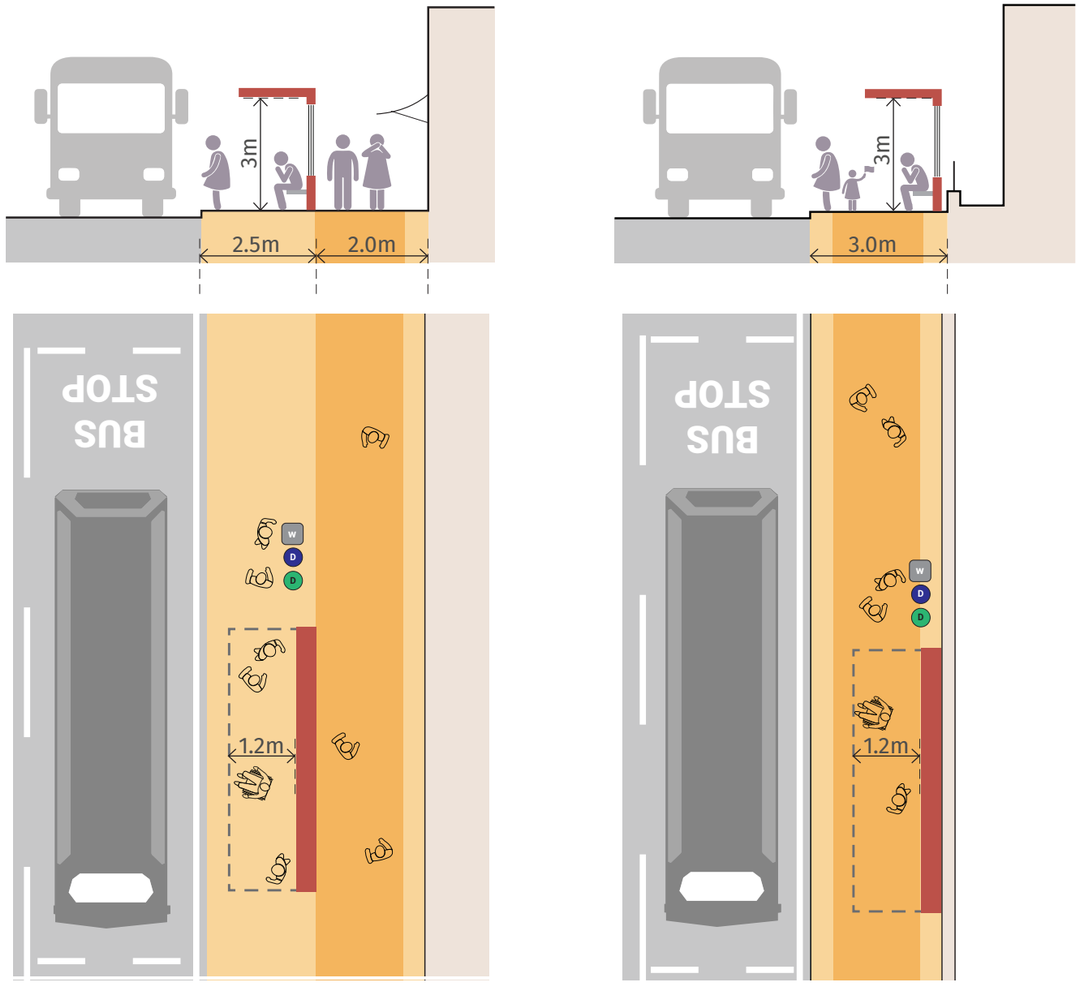
4.9 Public Amenities

Pondy Bazaar, Pedestrian Plaza, Chennai

4.9.1 Bus Stops

Bus stops provide safe and comfortable waiting spaces. They should be located such that they are easy to identify and do not obstruct the walking zone. Bus stops should be oriented such that buses can pull-over in their original path and do not need to get into a niche (bus bay), thus ensuring smooth movement of traffic. A typical bus stop shelter should be **9m x 2.5m** in size. The length of the bus stop should be determined based on the number of buses and expected volume of buses using the stop. For seamless multi-modal integration, relocate the existing bus stops wherever necessary to the nearest public transport interchange options. Ensure the placement of new bus shelters in closer proximity to other modes of public transport.

4.9.1.1 Location



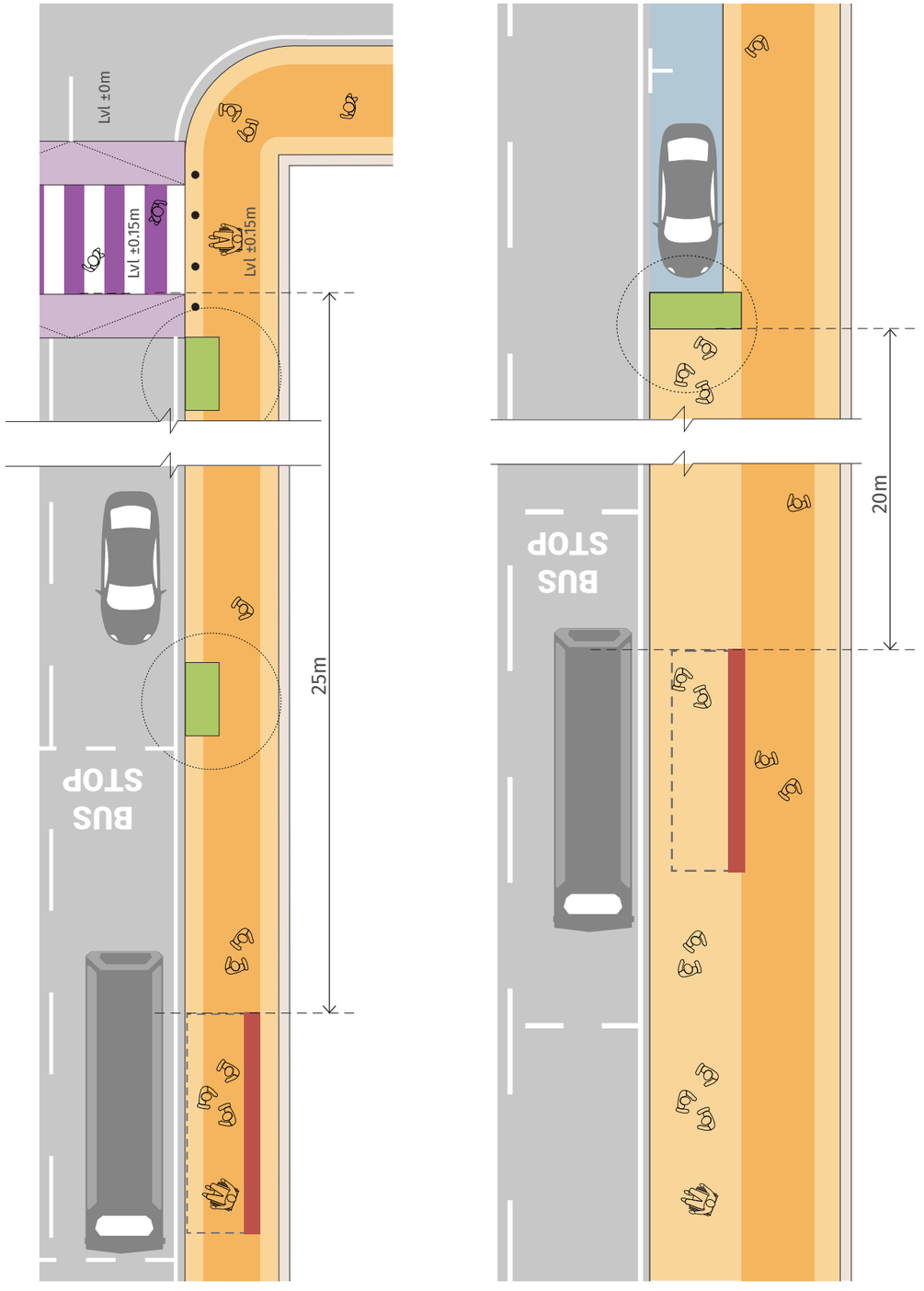
Footpaths >4.5m wide

For footpaths > 4.5m wide, bus stops should be in the MUZ.

Footpaths <4.5m wide

For footpaths < 4.5m wide, bus stops should be pushed to the wall to ensure sufficient space in the front for walking zone.

4.9.1.2 Distance from Junctions and Parking



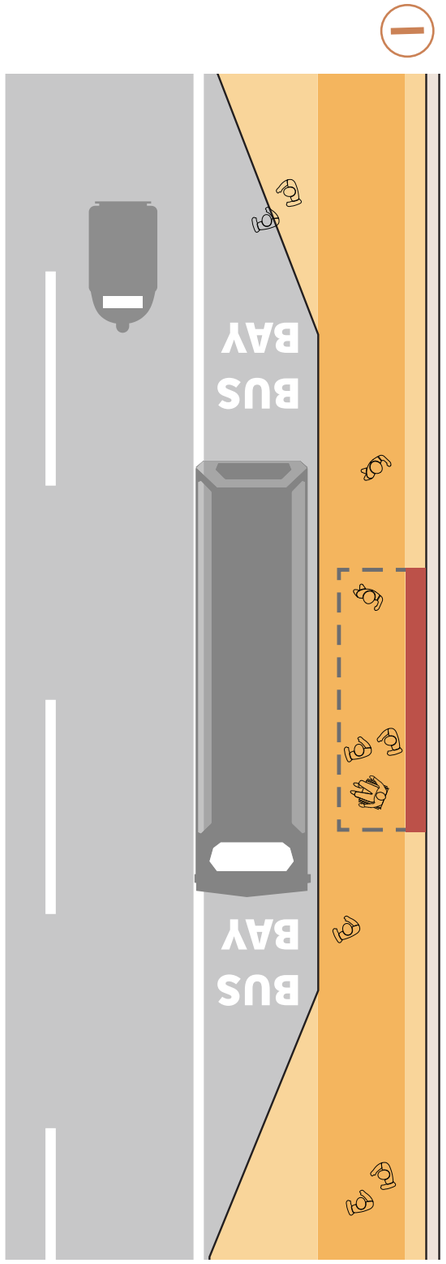
Distance from junction

Bus stops should be located 25m from junctions with safe pedestrian crossings at the intersection.

Distance from parking bay

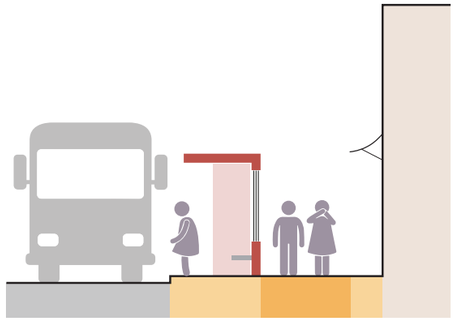
There should be no parking 20m before and after the bus stop to allow space for vendors, signage, and other needs.

4.9.1.3 Bus Bay Design



Bus bay

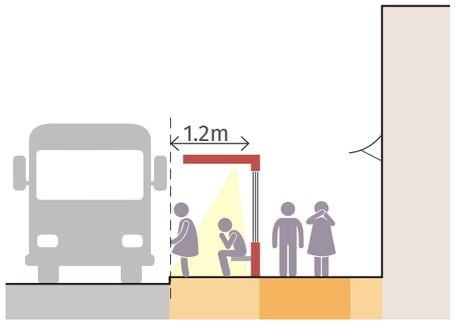
Bus bays should generally be avoided on urban streets because they make it difficult for buses to merge back into traffic, especially in areas with slow-moving but high-volume traffic. Additionally, bus bays are often misused for parking, obstructing bus operations. However, bus bays can be provided primarily on high-speed routes such as urban expressways and highways, based on the context.



Accessibility

Bus stops should be easy to locate, and should display information maps, up-to-date route number, direction of travel, major stops and helpine numbers. These information boards should be perpendicular to pedestrian movement on footpaths greater than 4.5m wide, and parallel to pedestrian movement on footpaths less than 4.5m wide.

Bus stops should be at the same level as footpaths, and railings should not be provided along the kerb edge, as they obstruct the alighting path. If the bus stop platform is at a different level than the adjacent footpath, a ramp should be provided to ensure seamless access for boarding and alighting.



Comfort and safety

There should be sufficient shade (permanent roofing is recommended) and light with a clear waiting space of 1.2m wide in front of the shelter,. Seating should be provided to ensure comfort.

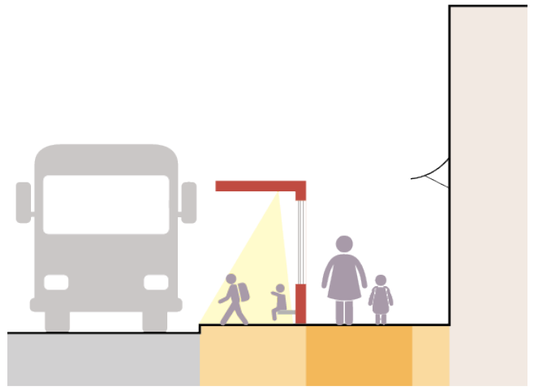
The back panel of the bus stop should be transparent to ensure safety.

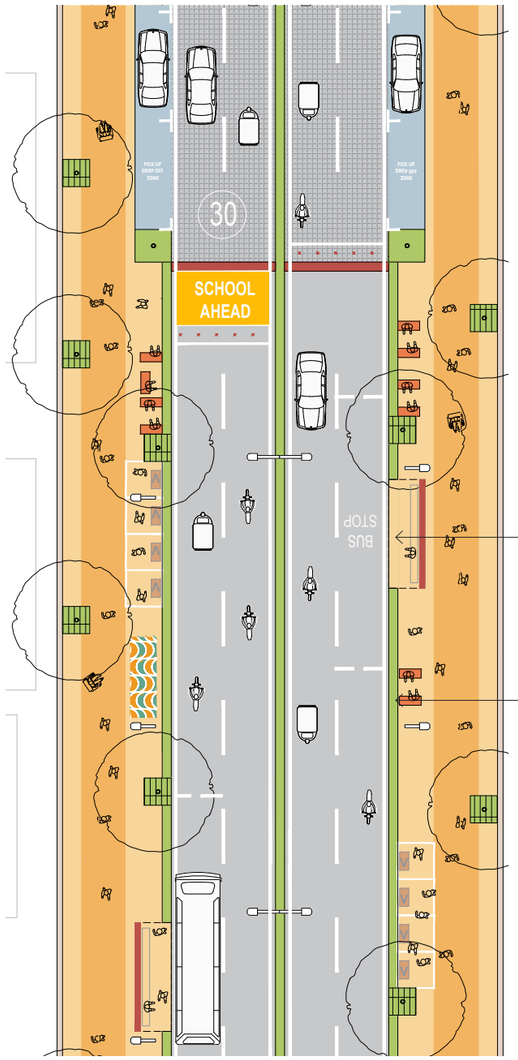
Material and slope for water drain

Bus bays shall be constructed with paver blocks or concrete finish with camber towards carriageway.

4.9.1.4 Transit Station Design in School Zones

Seating at transit stops should prioritise providing rest spaces for children and caregivers. Child height seating shall be provided across all transit stops within school zones.





Transit stops must be designed with cycle racks, trash cans and other facilities around school zones.

Interactive play elements

Transit stops must be designed to incorporate child friendly ‘pause and play’ spaces where children can rest, play and learn. Colour, artwork, puzzles and games on the floor and walls of such waiting spaces including street furniture can invite children to engage and play.

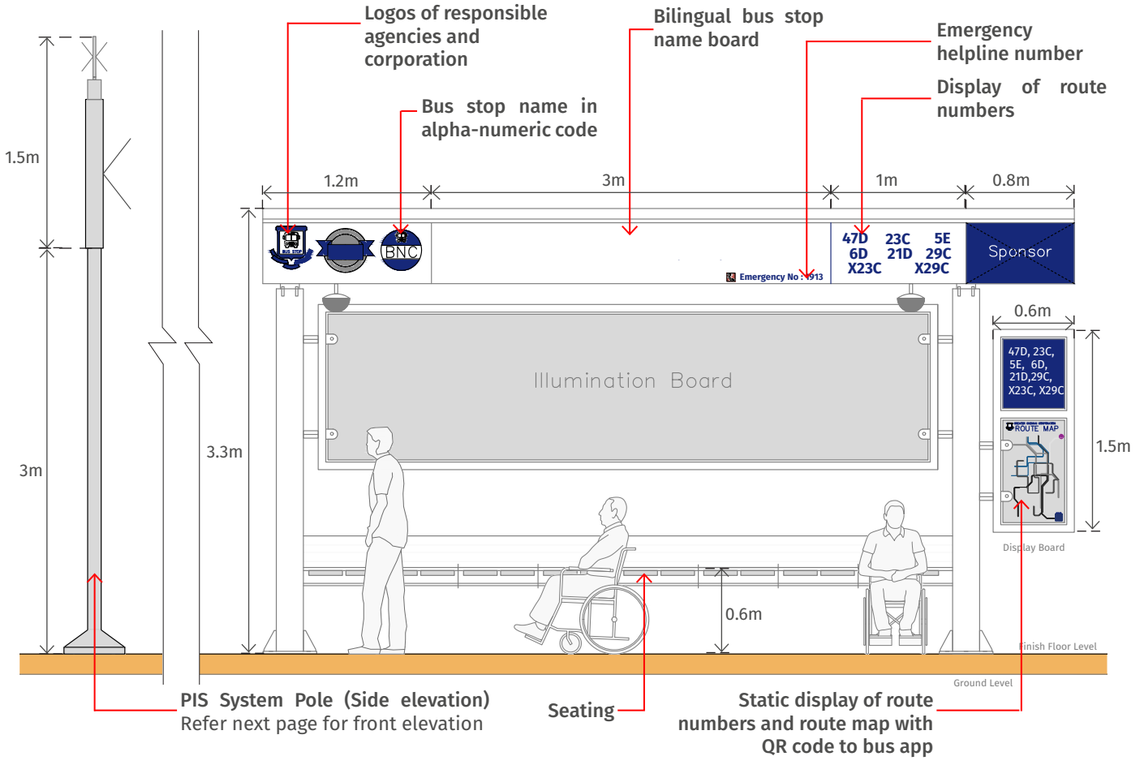
Bus Stop

Public Bicycle Sharing Station / Cycle Parking

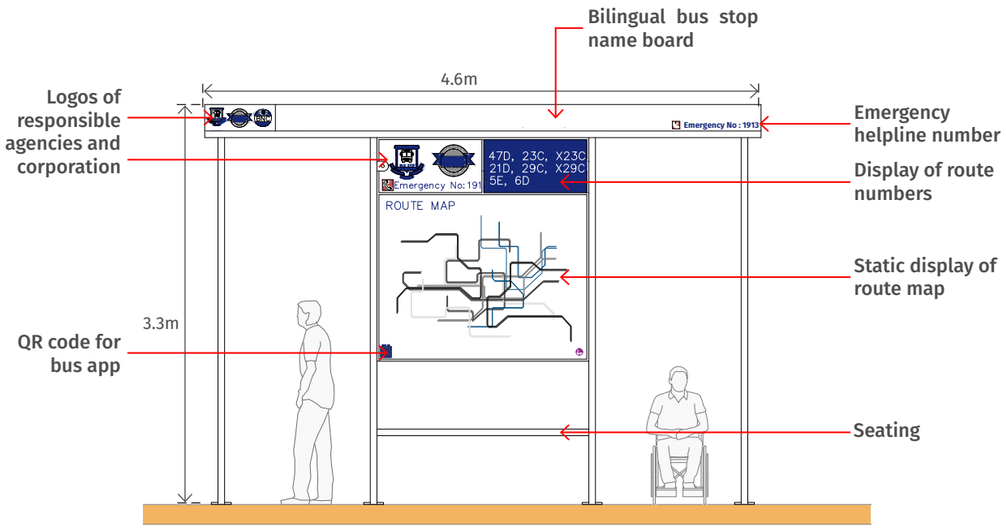
Public bicycle sharing stations or cycle parking should be located at a preferable frequency of 300m, close to the cycle tracks in the MUZ.

4.9.1.5 Information Panel Design

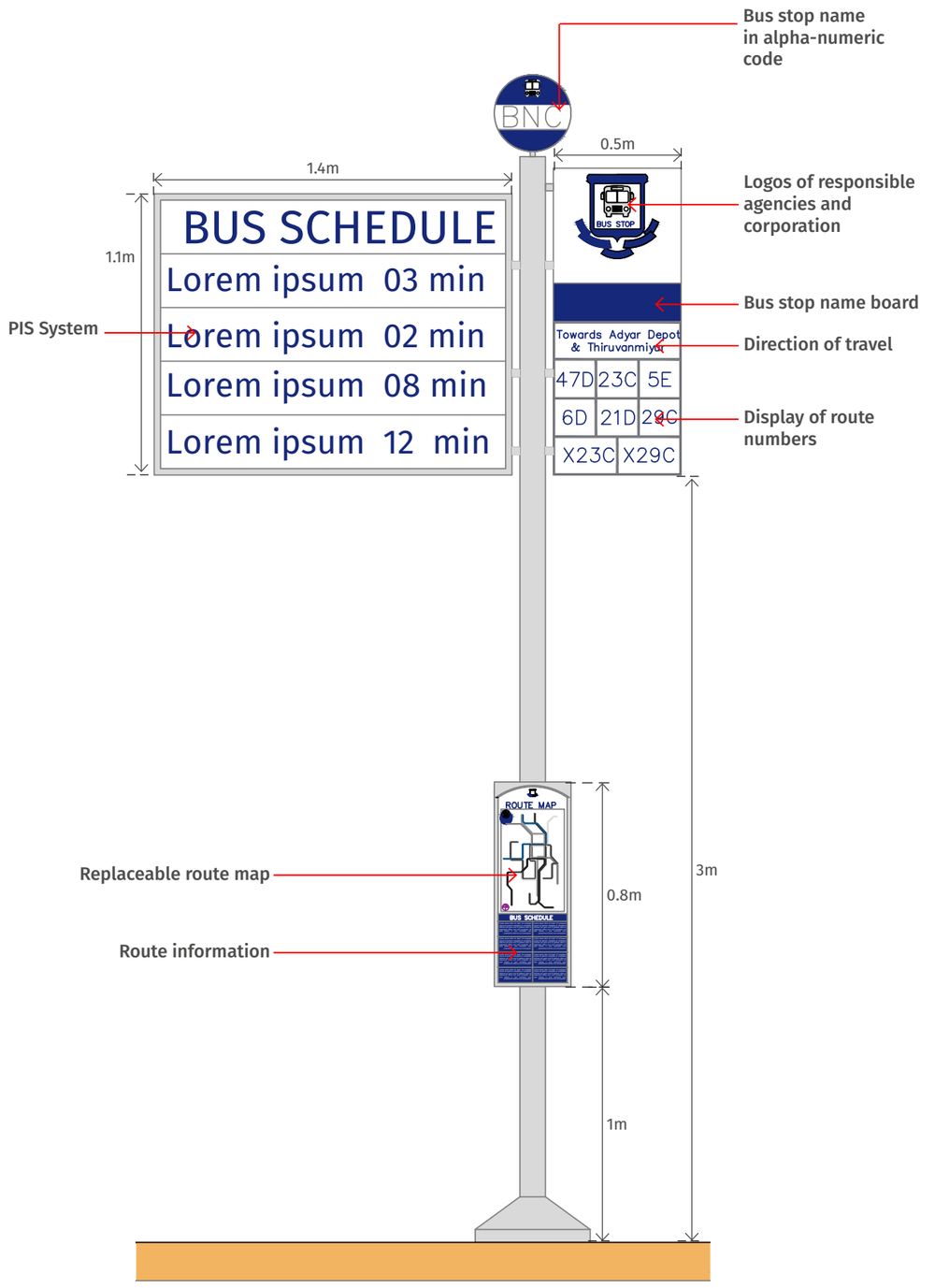
All bus stops, regardless of type (2-pole, 2-pole+panel, 3-pole), should have unique alpha-numeric codes with lat-long identification, standardised information panels displaying the bus stop name, bus numbers, and a route map. Integrating a Passenger Information System (PIS) ensures real-time updates, improving accessibility and reducing confusion for commuters.



Typical elevation of bus stop with information panels



Typical elevation of bus stop on narrow footpaths (<4.5m width) with information panels



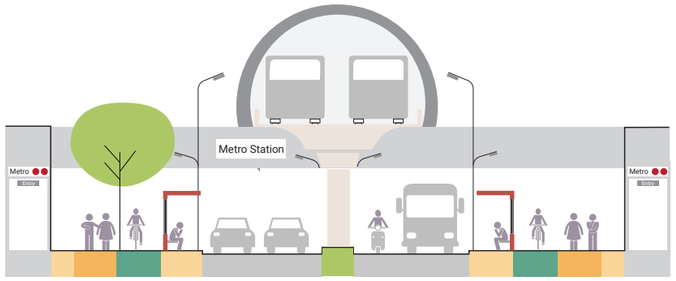
Front elevation of PIS System Pole

4.9.2 Metro/ Rail Station Entry and Exits

Seamless integration of Metro and rail station entries/exits with footpaths is essential to ensure safe, direct, and barrier-free access for commuters. Well-designed pedestrian connections reduce transfer time, improve station visibility, and encourage public transport use by making first- and last-mile movement comfortable and intuitive. Continuous footpaths, safe crossings, wayfinding, and universal accessibility at station frontages are critical to achieving a truly integrated transit network.

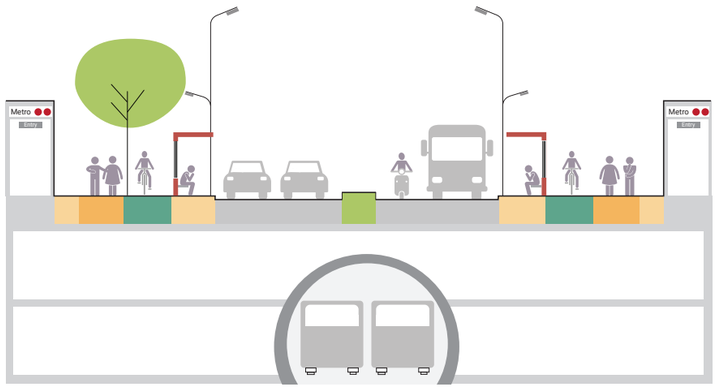
4.9.2.1 Elevated Stations

- Direct, barrier-free connections should be provided through staircases, escalators or elevators to the footpath without requiring road crossings.
- Landing areas should be placed in the frontage or MUZ without obstructing walking zones.
- Shaded waiting space and clear wayfinding should be provided at the base of stairways.
- Elevator access should be universally accessible and located close to the main pedestrian flow.



4.9.2.2 Underground Stations

- Entries/exits should be positioned to maximise street visibility and provide short, direct routes to major pedestrian desire lines.
- Avoid placing station shafts within the clear pedestrian zone; integrate them within the frontage zone.
- Ensure sufficient lighting, CCTV coverage, and clear directional signage at entry plazas.
- Provide safe, signalised or raised crossings if entries open directly onto busy intersections.



Location of station access

Station entries/exits should open directly onto continuous, obstruction-free footpaths with a minimum of 2-4m of clear walkway. Avoid placing access points behind parking lots, compound walls, or discontinuous sidewalks.

Integration with bus stops

Bus stops should be located within 50m of station access to ensure seamless transfers.

Direct, safe and shaded pedestrian links should be provided between the station and the bus stop.

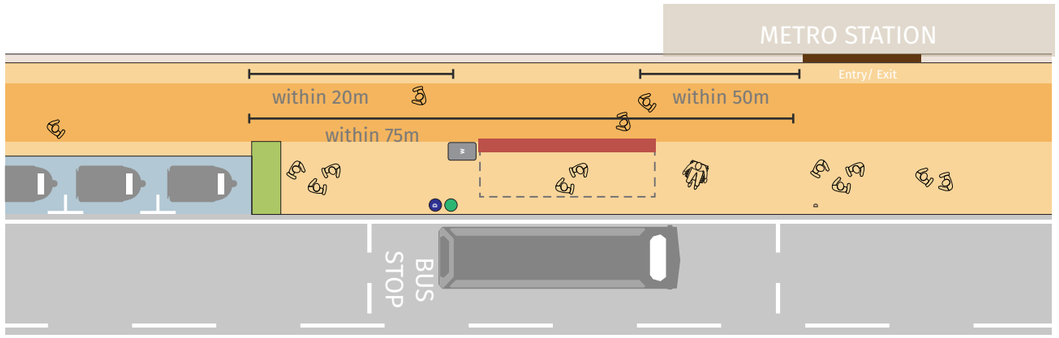
The bus stop placement should not obstruct walking zones or sightlines.

Integration with IPT bays

IPT bays (autos, share autos, taxis) must be designated within 75 m of station entries/exits to support last-mile access.

Bays should be designed to avoid spillover onto the pedestrian zone or carriageway.

Clear signage and markings should be provided to manage queuing and prevent encroachment.



Parking restrictions and pick-up and drop-off bays

- No on-street parking should be permitted within 100 m of Metro station entrances/exits to maintain visibility, safety, and free pedestrian flow.
- On-street parking provided beyond 100m can be used for pick-up and drop-off activities.
- A no-fee cushion time (approved by the parking policy) should apply for pick-up and drop-off activities to allow smooth short-duration stops.
- Bays should be well-marked, channelised, and supported with signage to prevent misuse or long-duration waiting.

Wayfinding and visibility

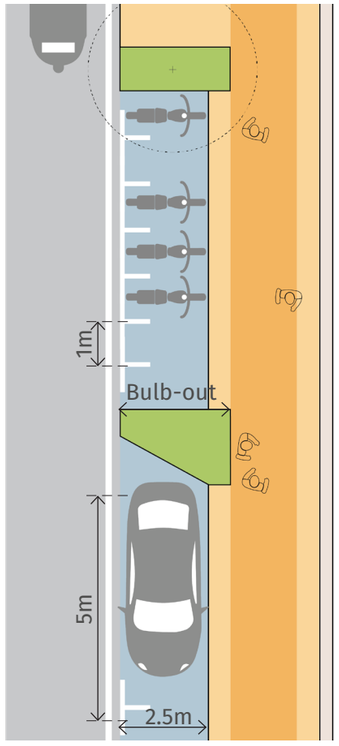
- Clear, consistent wayfinding signage should link station entries to bus stops, IPT bays and nearby landmarks.
- Wayfinding signs should be installed at street level indicating Entry A/Entry B/Entry C.
- Clear sightlines should be maintained by removing obstructions near station frontage.

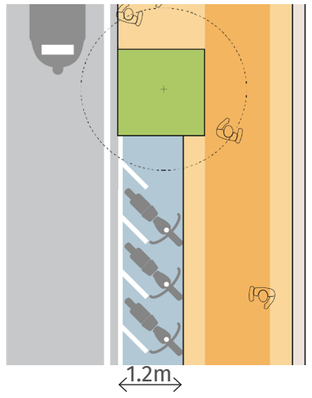


4.9.3 On-street Parking

On-street parking is a sub-optimal use of limited street space. On-street parking, if provided, should move to off-street locations to ensure that the limited street space is prioritised to move people efficiently and allow people to sit, play and socialise. On-street parking should be clearly designated, limited and priced. Pricing manages the parking demand and enforcement ensures discipline.

4.9.3.1 Design





Orientation

Parallel parking is recommended for four-wheelers on streets where parking is essential. It saves the precious street space for public use and allows flexibility to accommodate perpendicular two-wheeler parking as well.

Bulb-outs in Parking bays

A maximum of five continuous car parking spaces should be provided while designing parking bays. The bays should be designed with bulb-outs to accommodate pedestrian lights, utility boxes, and street furniture without interruption.

Dedicated cycle and auto rickshaw parking should be provided at public transport stops and stations and in commercial areas, to facilitate multi-modal integration. A maximum of eight autos shall be accommodated in a parking bay.

Kerb edge

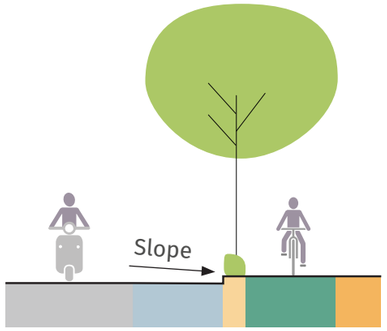
The kerb edge should be positioned at a 45-degree angle to accommodate sufficient space of manoeuvring .

Narrow streets

On narrow streets with high demand for two wheeler parking, angular parking bays (1.2-1.5 m wide) are recommended.

Pick-up and drop-off

Designated parking bays may serve as pick-up and drop-off zones. The no-fee cushion time permitted under the Parking Policy allows short, quick stops without charges, ensuring smooth passenger movement while preventing long-duration parking.



Surface

The area allotted for parking should have a clean and levelled surface, free from water logging with proper drainage facilities.

Visibility

Each parking bay should be clearly defined and marked to avoid haphazard parking. Appropriate parking signage giving information on timings, vehicle type parking and price should be provided.*

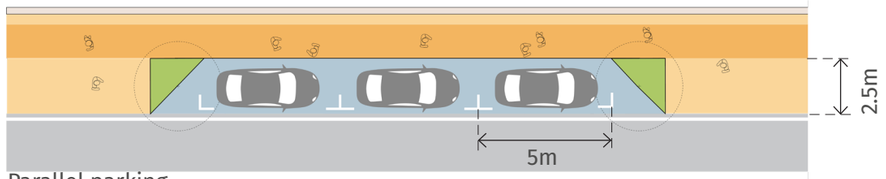
*Parking signage and markings should be provided as per IRC:67 and IRC:35 respectively.

Parking Space Dimensions

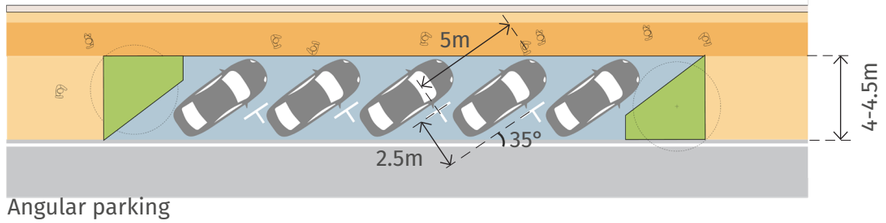
Vehicle Type	Parking bay Dimensions
Car	5m x 2.5m
2-wheeler	2m x 1m
Cycle	2m X 0.5m*
Auto-rickshaw, e-rickshaw	3m X 1.5 - 2m
Cycle-rickshaw	2.5m x 1m
Light Commercial Vehicle	5.5m x 2.5m

* 2-wheeler zone of size 5m x 2m can be demarcated to accommodate 5-6 two-wheelers or cycles.

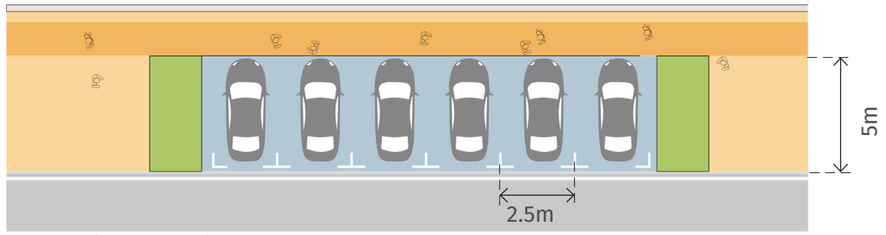
4.9.3.2 Orientation and Manoeuvring Distances



Parallel parking



Angular parking



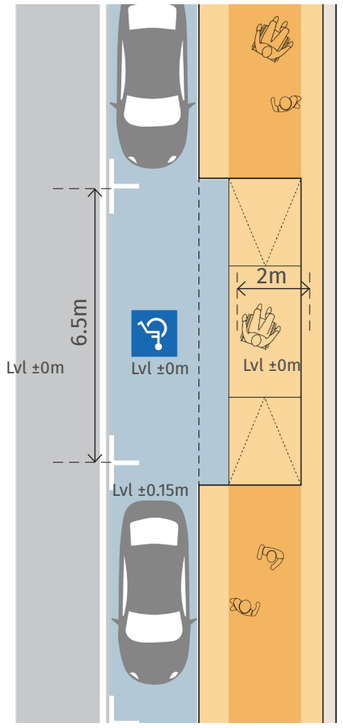
Perpendicular parking

4.9.3.3 Parking Distances and Restrictions

Parking Rules	Buffer Dimension	Context
No Parking	Within 50m	From major junctions
	Within 15-20m	From minor junctions
	Within 30m in areas where 30m buffer is not feasible, it can be provided at 10m distance	From school entry/exit gates
	Within 50m	From mass transit hubs
	Within 20m	From bus stops
	Within 100m	From public off-street parking facility
	Property entrances	
Parking Restrictions Parking shall be discouraged. In case of high demand, parking shall be optimised to minimum requirements.	On arterial roads and Bus Route Roads	
	Accommodating demand on local streets	
Parking Mandates	Within 75m	IPT parking - near transit hubs
	Every 100-150m of street	Cycle parking
	Every 500m of street length	Electric charging stations with 4W and 2W slots

*Refer IRC 70 for more details.

4.9.3.4 Accessible Parking Bays



It is recommended to provide wheelchair accessible parking spaces in off-street locations. On-street accessible parking space numbers should be provided in discussion with the local stakeholders, ensuring the continuity of walking zone.*

Where provided, on-street accessible parking bays must be clearly demarcated with signage and have access to ramps as shown in the figure.

*Refer IRC:SP:117 for more details.

4.9.3.5 EV Charging



It is recommended to provide charging points in off-street locations, ensuring the street space is used for short-term parking only.

In general, on-street charging point should be discouraged. However, in exceptional cases, wherever excess space in MUZ is available fast chargers can be accommodated abutting the on-street parking.

Iconic Road, Surat
Image Source - Streets Compendium, SCM

4.9.3.6 Park & Ride Facilities

Preferred location

Park & Ride entry/exit points should be placed on secondary or side streets rather than the main station access road If located on the primary road, they should be positioned at least 30–50 m away from pedestrian entry/exit points.

Smooth vehicular circulation

Dedicated turning lanes or channelised access should be provided to prevent spillover onto the main carriageway. Entries should be avoided near junction, with at least a 50 m setback from intersections.



Thirumangalam Metro Station, Anna Nagar, Chennai
Image Source - CMRL

4.9.3.7 Parking Allocation in School Zone

Due to their small size, children tend to remain in the blind spot of vehicles (cars, trucks, SUVs, vans and buses), making them invisible users of streets. Parked vehicles obstruct the line of sight for both drivers and pedestrians, making it difficult for drivers to see children crossing the road and for children to see approaching vehicles. Hence, managing parking around schools is critical to ensure the safety of school children.

Location and design



Any street with a school entry/exit should not be designed with on-street parking for a distance of 30m on either side of the entry/exit, on both sides of the street.

In areas where 30m buffer is not feasible, on-street parking can be demarcated at a distance of 10m from the school entry / exit.

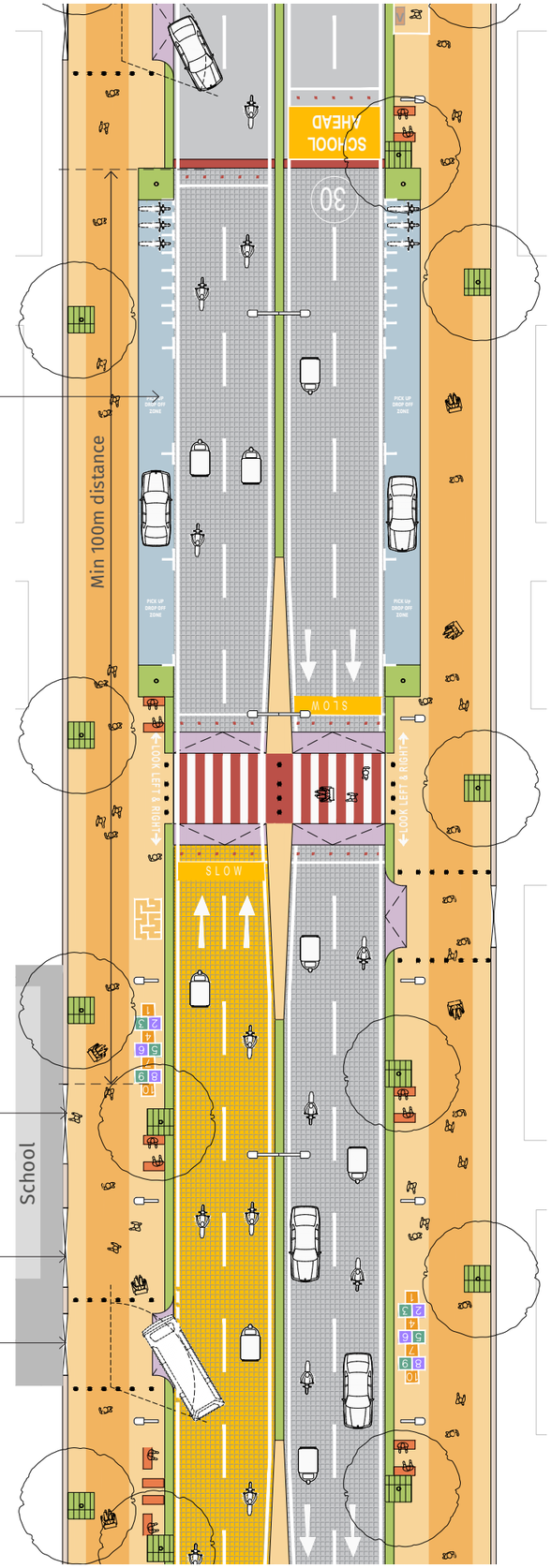
Parking for cycles, and school buses should be provided within the school premises. If the school has space constraints, off-street parking facilities, in the vicinity of the school should be identified.

- School
- School Zone
- 30m stretch around schools
- Streets where on-street parking is permissible



Harrington Road, Chennai

On-street parking on the streets within the school zone should follow the guidelines mentioned in Chapter 4.9.3



4.9.3.8 Pick-up and Drop-off Zones in School Zone

In India, only 12% of school trips are estimated to be made using private transport*. But this causes significant congestion and chaotic parking around schools, further making school zones unsafe and polluted. A pick-up and drop-off zone is a space on the street, identified at a walkable distance that is dedicated to the loading and unloading of students by private motor vehicles or school buses. These are no-parking zones which facilitate temporary waiting of vehicles. Such zones provide a safe spot for children to be picked up or dropped at school.

* Household Social Consumption on Education in India, 2018, Ministry of Statistics and Programme Implementation

Location and Design



Pick-up and drop-off activities shall be accommodated at multiple locations in streets within the school zone.

These streets can restrict vehicular access around school start and end times, and should be designed with continuous and safe footpath, as mentioned in Chapter 2.1.

Any street with a school entry/exit should not permit pick-up / drop-off activities for a distance of 30m on either side of the entry/exit, on both sides of the street. In areas where 30m buffer is not feasible, pick-up / drop-off zones can be demarcated at a distance of 10m from the school entry / exit.

- School
- School Zone
- 30m stretch around schools
- Street stretch where pick-up / drop-off is permissible

Pick-up / Drop-off for school buses and vans

School buses and vans carry a large volume of children. It is important to ensure these vehicles do not park on the carriageway for picking-up / dropping-off school children.

It is recommended that pick-up / drop-off for school buses/vans be provided within the school premises to ensure safe loading and unloading of children.

If the school has space constraints, off-street parking facilities, located within the school zone may be identified for picking up and dropping off school children.



School van dropping children in front of the school gate, leading to traffic congestion on the street, Avvai Shanmugam Salai, Chennai

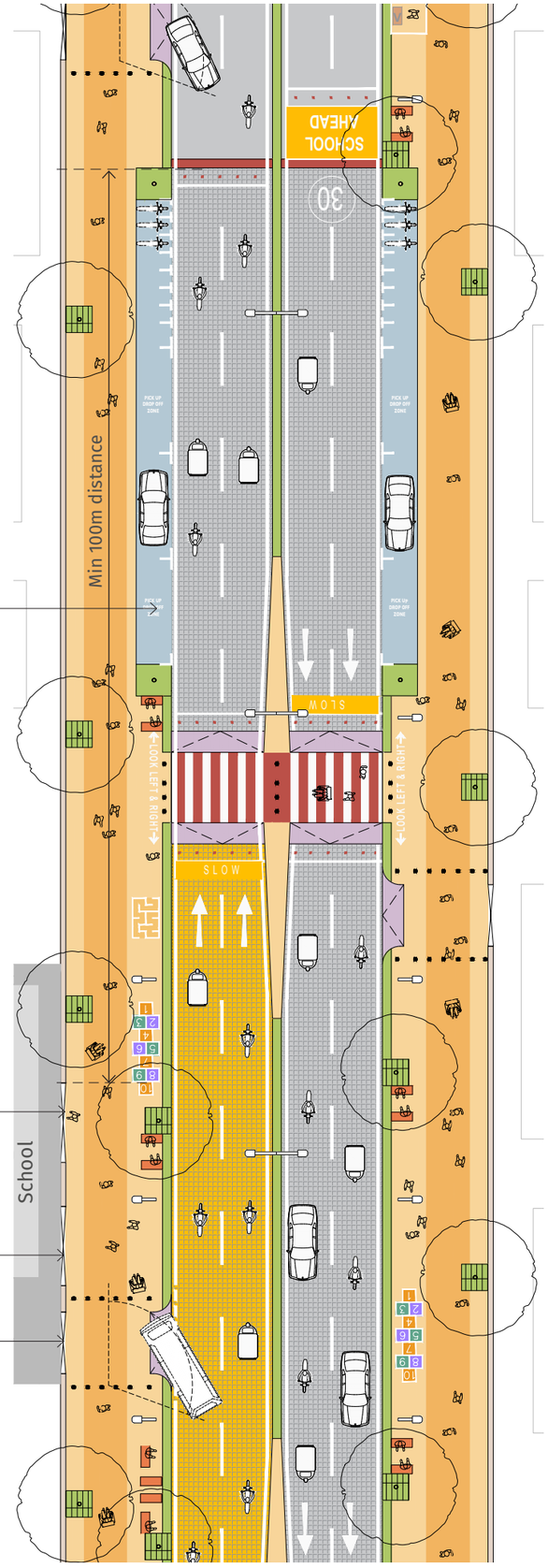
Pick-up / Drop-off for private vehicles

The pick-up / drop-off points for the private motor vehicles shall be accommodated in the on-street parking provisions, provided at a distance of 30m on either side of the entry/exit, on both sides of the street.

These provisions shall facilitate safe loading and unloading of students directly onto the footpath.

Except the pick-up / drop-off hours, these bays shall be used as public on-street parking facilities.

Parking bays shall be provided for a maximum of 30m along the school streets.



On-street pick-up / drop-off for school buses and vans

In cases where school buses and vans are unable to provide parking within the campus or identify off-street locations for pick-up / drop-off, the on-street parking facilities shall prioritise pick-up / drop-off for the school buses and vans.

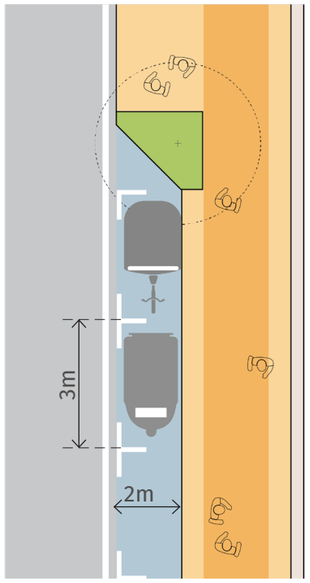
School buses and van pick-up / drop off shall be provided on the same side of the street as the school to ensure less interaction between students and vehicles.

4.9.4 Auto/ IPT Bays

Above-ground electrical utilities—street lights, transformers, and electric poles—are integral to safe and functional streets. Their placement must ensure well-lit pathways, avoid obstructing footpaths, and maintain adequate clear zones for pedestrian movement. In street design, coordinating these utilities early in the layout helps prevent clutter, improves accessibility, and supports efficient maintenance while keeping the streetscape visually organised and safe.

4.9.4.1 Intermediate Public Transport (IPT)

IPT stands should preferably be located 50m before and after bus stops and 75m before and after other transit stations. All recommendations for location near intersections, bus stops remain same as for other on-street parking. IPT stands should also be located at places of high footfall - especially near hospitals and commercial areas.



Orientation

IPT stands should accommodate parallely parked auto-rickshaws to ensure ease of manoeuvring and to occupy less space.

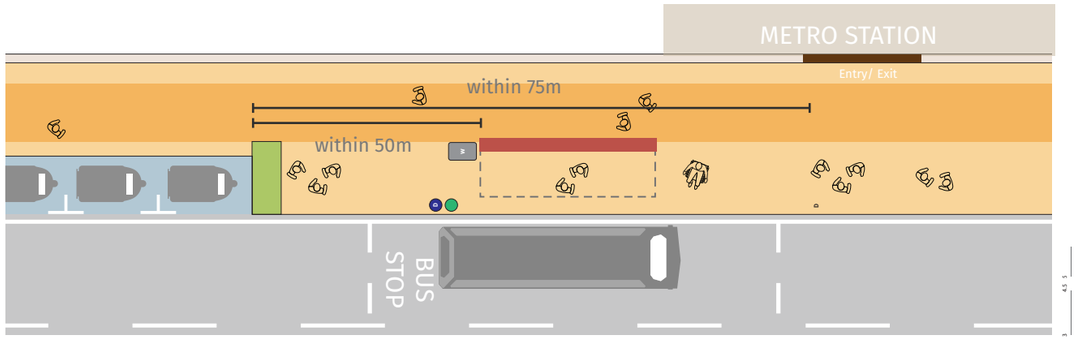
Clear signage for IPT markings highlighting the maximum capacity for autos should be provided.

A minimum of five and a maximum of eight parking spaces for IPT should be provided in one parking zone.

Kerb edge

The kerb edge shall be positioned at a 45-degree angle to accommodate sufficient space for manoeuvring .

Integration with public transport modes





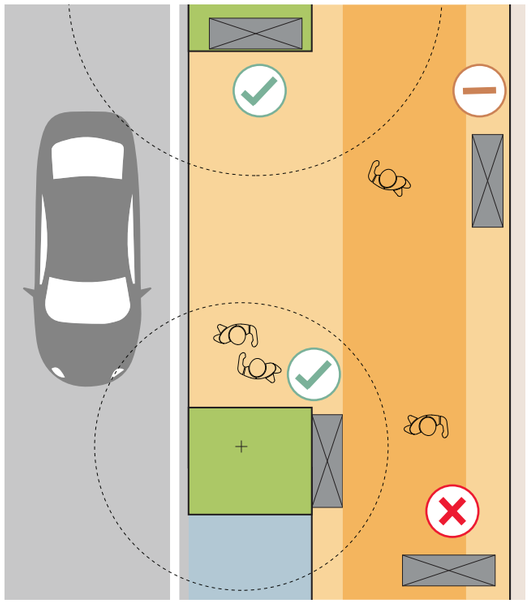
Alandur Metro Station - IPT Integration
Image Source: CMRL

4.9.5 Electrical: Above Ground

Above-ground electrical utilities—transformers, pillar boxes and electric poles—are integral to safe and functional streets. Their placement must ensure well-lit pathways, avoid obstructing footpaths, and maintain adequate clear zones for pedestrian movement.

In general, above-ground electrical utilities should be located off-street—within public spaces, private property, OSR (Open Space Reservation) land. Planning authorities like DTCP and ULBs should ensure this.

4.9.5.1 Electrical: Utility Boxes and Transformer



Utility boxes

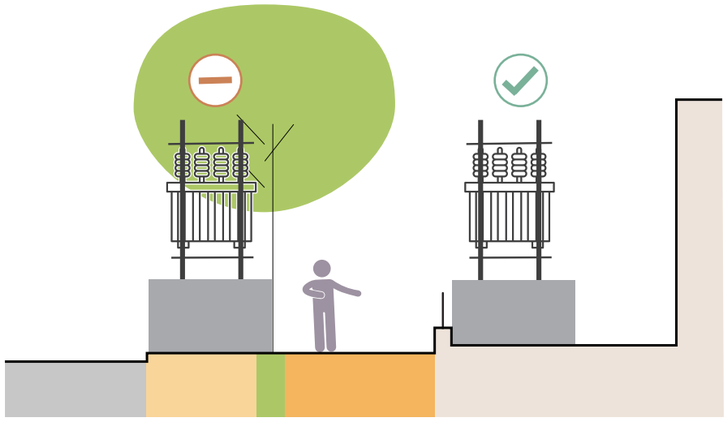
Utility boxes should be located in the frontage or MUZ, where available. They should be placed ensuring that there is no physical and visual obstruction in the walking zone and along street edges.

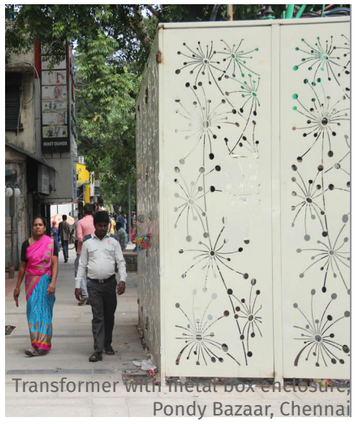
Adequate planning is necessary to ensure utility boxes do not disrupt the flow of pedestrian movement.

Utility boxes should not constrain the width of a cycle track.

Transformer

Transformers must not be placed within the clear pedestrian zone. They should be positioned in the frontage zone or Multi-utility Zone (MUZ), where available, to avoid physical and visual obstructions Placement should ensure that sightlines at junctions, building entrances, and crossings remain clear, and the pedestrian flow is not disrupted. **Traditional bulky transformers should be replaced with compact, modern, low-footprint units to reduce obstruction and improve overall efficiency.**





Transformer with metal box enclosure, Pondy Bazaar, Chennai

4.9.5.2 Electrical: Electrical Poles

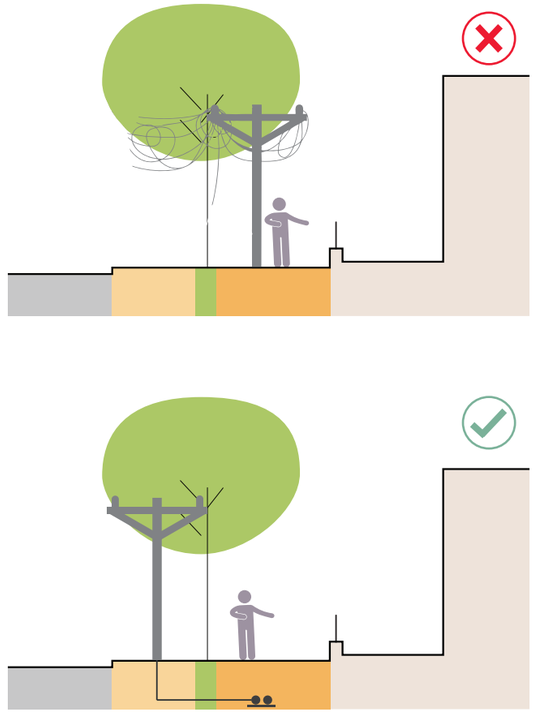
Location
Poles should be placed only in the frontage or MUZ, ensuring they do not encroach into the 2 m clear pedestrian zone.

Dimensions and clearances
A distance of 0.5–0.75 m should be maintained from the footpath edge and ensure 3.0 m vertical clearance over footpaths and 5.5 m over carriageways.

Pole height and spacing
7–10 m poles should be used, spaced 30–50 m apart based on lighting and utility needs.

Overhead wires
Ensure wires maintain required safety clearances and do not sag or obstruct movement along the street edge.

Modernisation
Overhead networks should be replaced with underground cabling or compact utility poles where possible, to reduce visual and physical clutter.reduce visual and physical clutter.



4.9.5.3 Camera and Signal Controller

Camera poles:
Camera poles must be installed within the MUZ or median based on requirement. CCTV/ APNR cameras should be placed at a height of 6–8 m on lighting or utility poles, with clear sight lines covering junctions, crossings, and high-activity zones, ensuring they do not obstruct the pedestrian clear path.

Local Processing Units (LPU):
One LPU is required for every three cameras and should be placed within the MUZ.
Where MUZ space is not available, the LPU may be placed at the kerb edge but must not obstruct the clear pedestrian walkway.

Network Video Recorder (NVR) and UPS Cabinet:
NVR units and accompanying UPS cabinets must only be located within the MUZ zone, ensuring they do not interfere with walking paths or utilities.

Signal controller and NVR placement
Signal controllers, along with NVR and UPS cabinets, should be installed near junctions within the MUZ. Their placement must not obstruct the clear pedestrian walkway, maintain adequate sightlines, and avoid creating any visual hindrance in the streetscape.



Ambal Nagar, Chennai

All cameras must be connected to a reliable electrical power source, and their output feeds should be routed to the Police ICCC through dedicated telecom ducts integrated within the utility corridor.

Other Public Amenities

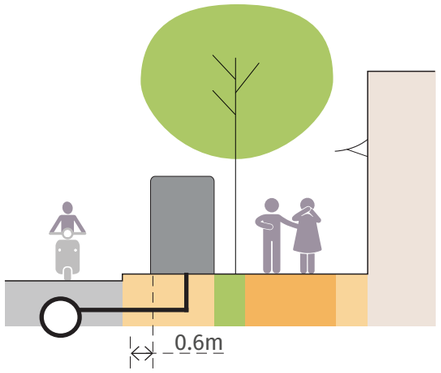
Public amenities such as dustbins, toilets, drinking water kiosks, police booths, and PBS stations are essential for making streets functional and people-friendly. When integrated seamlessly into the Multi-utility Zone, they support comfort, safety, hygiene, and sustainable mobility—without obstructing the pedestrian zone. Thoughtful placement, compact designs, and coordination with utilities ensure these elements blend into the streetscape, enhancing walkability and overall street experience.

4.9.6 Public Toilets

It is recommended that public toilets should be provided in off-street locations, ensuring accessibility and safety for all users.

However, if it is provided as on-street, it should be placed at a minimum of 0.6m clear distance from the kerb edge with a minimum of 2m clear walking zone in front of it. Regular maintenance should be done to ensure clean environment.

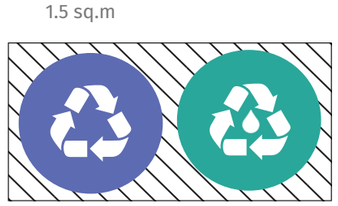
*Refer IRC:SP:117 for detailed design.





Paris, France

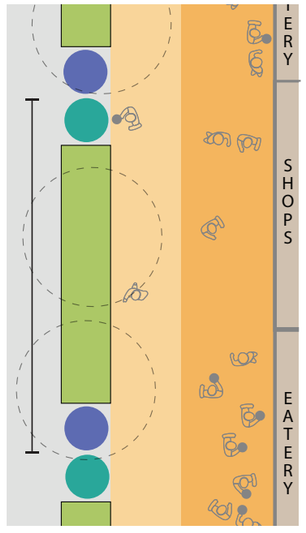
4.9.7 Garbage Bins

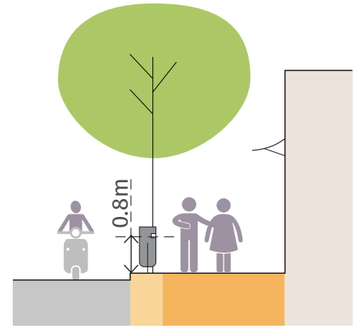


Size

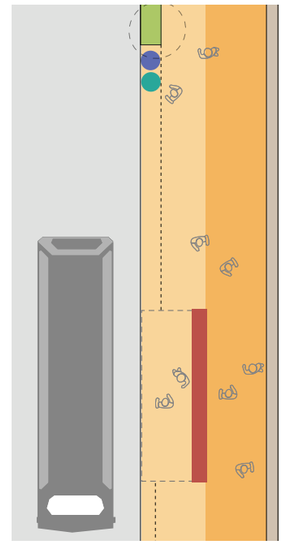
Separate bins should be provided for wet and recyclable waste in the MUZ; total space allocated should not exceed 1.5 sq.m., at a preferable frequency of 50-75m.

All commercial establishments, eateries and hotels should have their own garbage bins and should not place them on the street/ footpath. The waste has to be handed over to the waste collection team of ULB.





Opening of the bins should preferably be at a height of 0.8m from the finished floor level.



Adjacent activity

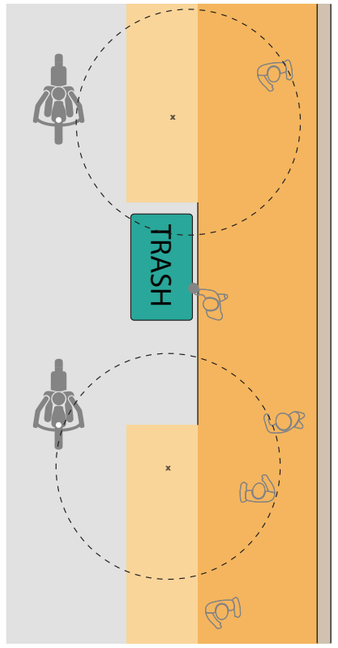
Dustbins should be provided at regular intervals according to adjacent land uses and activity.

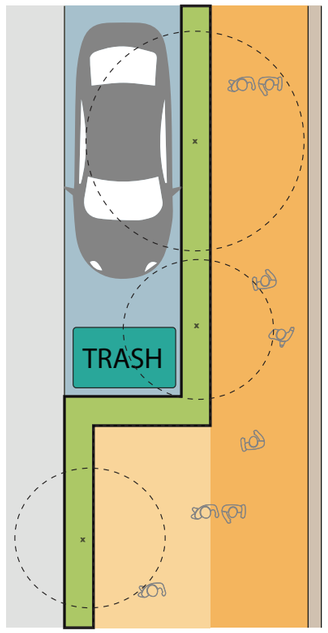
Location

Dustbins should be placed near all transit stations, parking and vending areas owing to the high people activity expected there.


CG Road, Ahmedabad

Dumpster Bins





Niches

Garbage containers should be placed in niches (1 m x 3 m per container) in the MUZ for easy lifting.

In parking bays

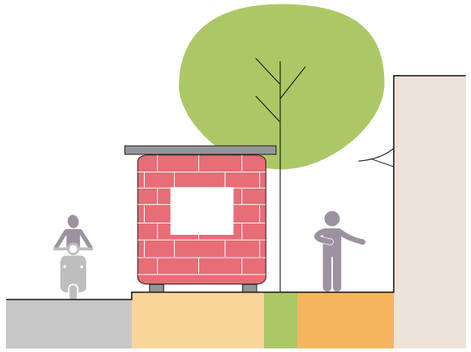
Garbage containers can also be placed within parking bays.

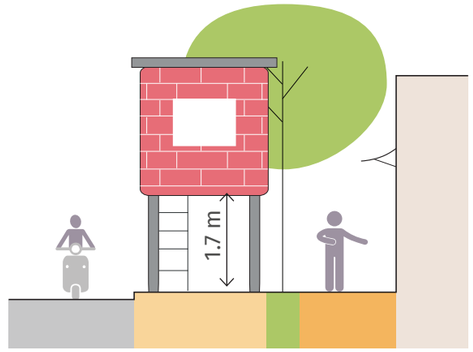


Harrington Road, Chennai

4.9.8 Police Booths

Locate police booths at key junctions or high-footfall areas, ideally located on Multi-utility Zone. The booth can also be dsigned with stilt with a clear height of 1.7m.



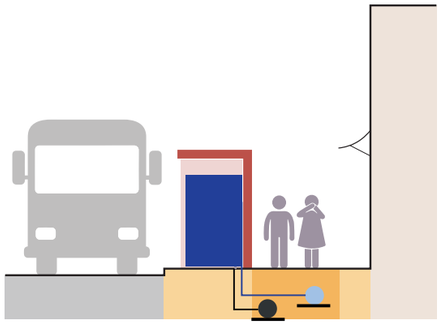


4.9.9 Drinking Water Kiosks

A drinking water stand-alone unit, typically 0.6–1.0 m wide with a shallow depth of 0.4–0.6 m, integrated within the MUZ.

It should be placed near bus stops, parks, playgrounds, markets, or other high-footfall public spaces, ensuring the 2 m clear pedestrian zone remains unobstructed.

The facility must have a direct piped water connection, drainage, and power supply for a small in-line RO or filtration system.

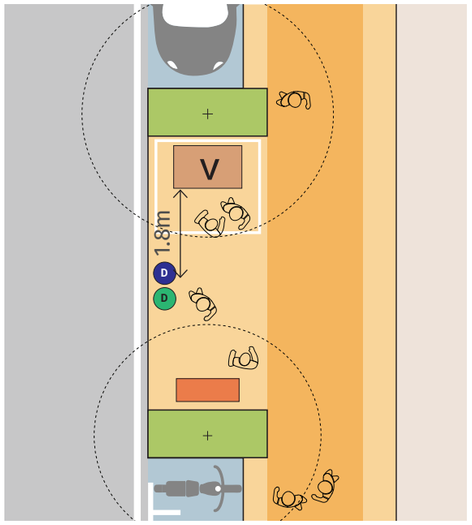




Water ATM, KK Nagar

4.9.10 Street Vending

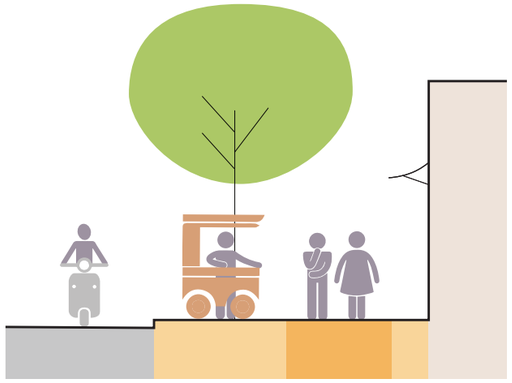
Street vending provides for an important social space and serves as a form of security for those walking on the street, especially women. The National Street Vendors Act, 2014 makes it mandatory to accommodate vending areas in street design, ensuring provisions for spillover. A spatial plan for street vending can be formulated, contributing to enhanced personal security through the presence of street vendors.[3]



Design

A typical vendor space of 1.8m x 1.8m (including spillover space) should be clearly demarcated in the MUZ.

Public amenities like water taps, electricity points, and dustbins should be provided accordingly. [3]



Location

Street vending activity should be located in the MUZ to avoid any obstruction in the walking zone.

Demarcated vending spaces should be provided where there is an existing demand, especially near high footfall zones.



Vendor obstructs the walking zone in K K Nagar, Chennai

A Vending Management Plan, informed by periodic surveys, certification of vendors, and designation of special vending and no-vending zones in the city, shall be prepared. These shall be created as a series of local area plans. This is primarily because vendors already exist and cannot be displaced too far off from their current locations, and different streets in a region will have different capacities for vending zones. This can be assessed only at the neighbourhood level.

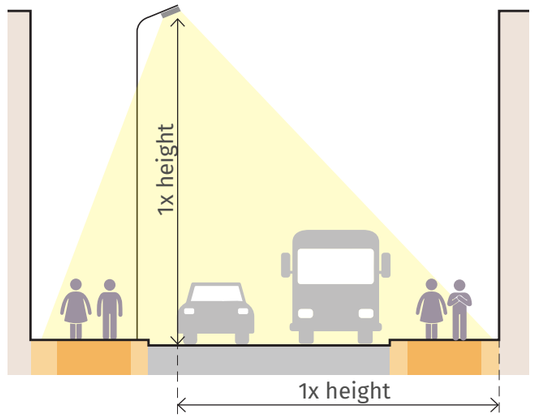
A clear wide footpath with vendors in MUZ in Smart Janpath, Bhubaneshwar
Image Source - Elements Creative India



4.10 Street Furniture

4.10.1 Street Lights

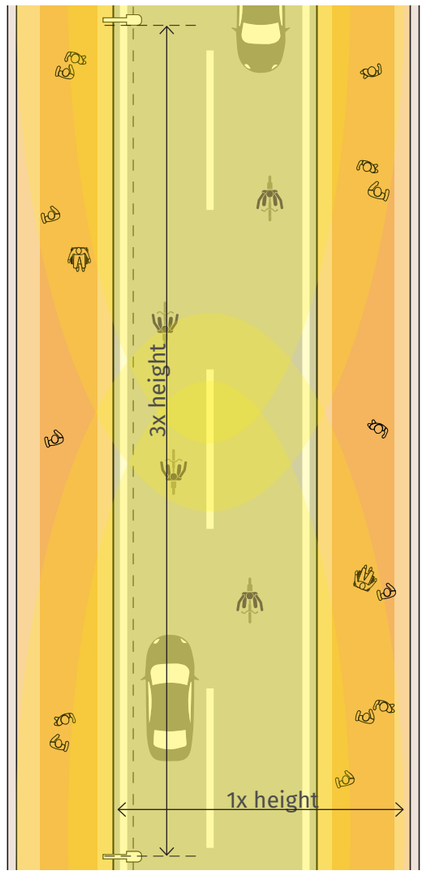
Street lighting is a critical element of street design that ensures safety, accessibility, and comfort after dark. Well-designed lighting improves visibility for all road users, reduces crashes, enhances personal security—especially for women and vulnerable users—and supports social and economic activity by extending the usable hours of streets. Beyond functionality, good street lighting also improves the overall quality and inclusiveness of public spaces.

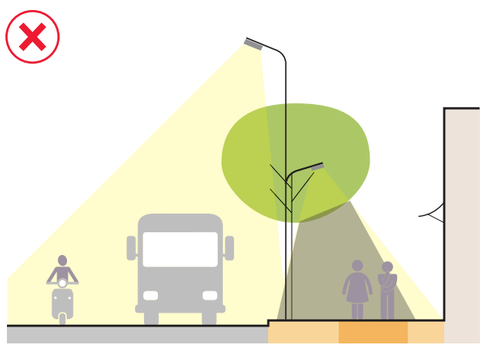


Light fixtures

LED light fixtures are recommended for low energy consumption. Warm white LED light is preferred. 25-30 lux levels of lighting should be available on the footpath as per IRC 103.

Street lights should be placed in a way to illuminate the street surface, minimising glare and light pollution.





Landscape and lighting

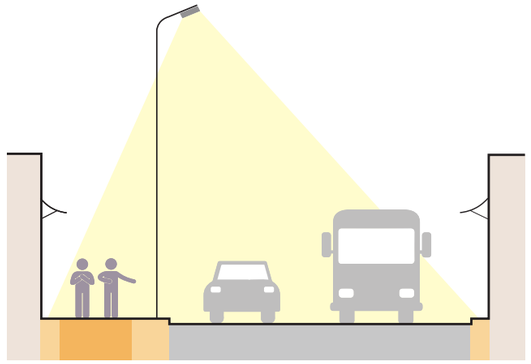
An integrated plan of street lights and trees should be prepared to avoid any obstruction to street light.

Height

Light poles should be no higher than 12m so as to avoid undesirable illumination of private properties.

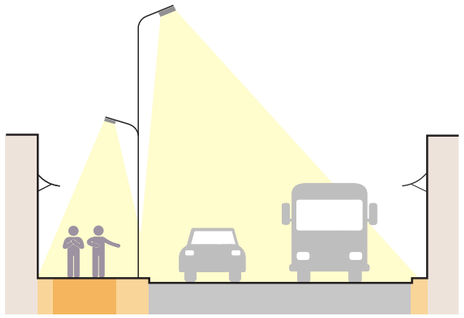
Spacing

Spacing between two light poles should be about three times the height of the fixtures to ensure full coverage.



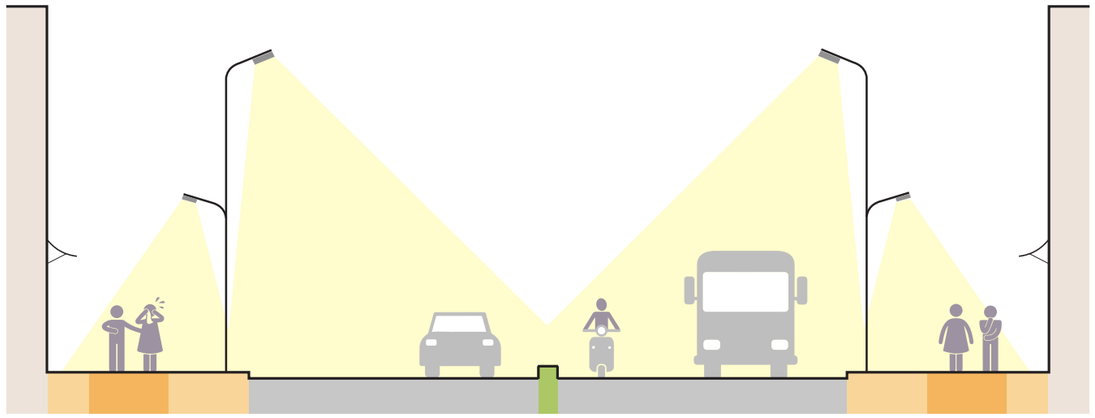
Placement on RoW ≤ 12m

A single light in the MUZ can be used if it Illuminates the entire RoW.



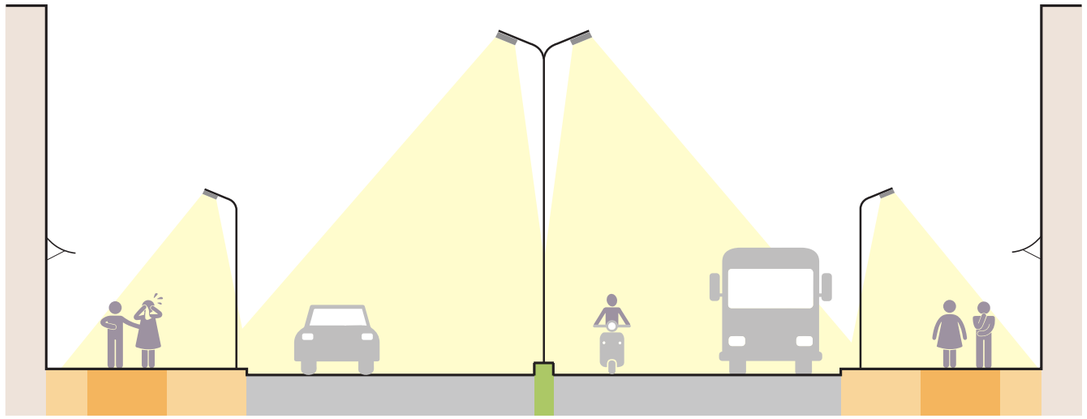
Placement on RoW ≤ 12m

Else, a pedestrian light should be fixed at a lower level to illuminate the entire edge.



Placement on wide streets

Pedestrian and street lights can be combined in a single pole in the MUZ to avoid clutter, provided there is proper illumination.



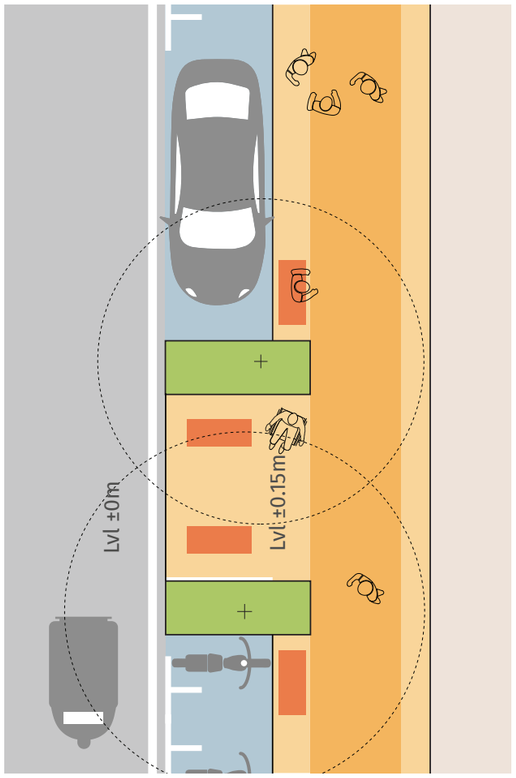
Median poles can be used for the carriageway and pedestrian lights should be provided separately.

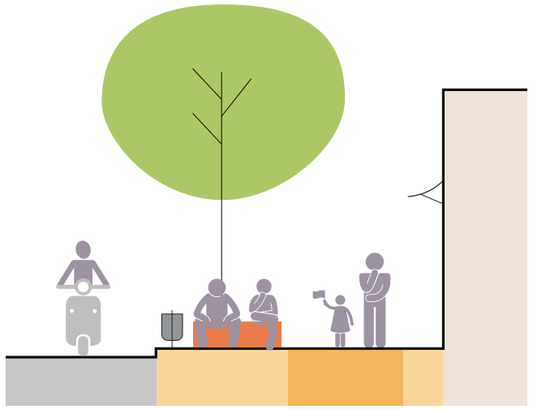
*These guidelines are generic recommendations. A lighting consultant may be engaged to contextualise these, determine the necessary lux levels, and develop detailed designs.

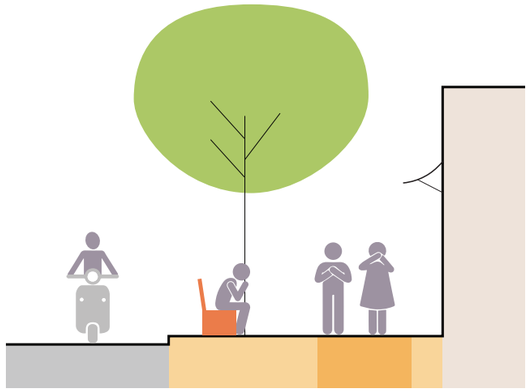
4.10.2 Seatings

Seating is an essential element of inclusive street design, providing rest points for all users—especially the elderly, children, caregivers, and people with disabilities. Well-placed seaters enhance comfort, encourage longer stays, support social interaction, and make streets more welcoming and walkable. Integrating seating at regular intervals, particularly near transit stops, crossings, parks, and commercial areas, improves overall public realm usability and promotes active mobility.

4.10.2.1 Seating







Orientation

Streets with wide MUZ (>1.5m) can have a group seating layout perpendicular to the direction of pedestrian movement.

Streets with narrow MUZ (<1.5m) can have a linear seating layout along the direction of pedestrian movement.

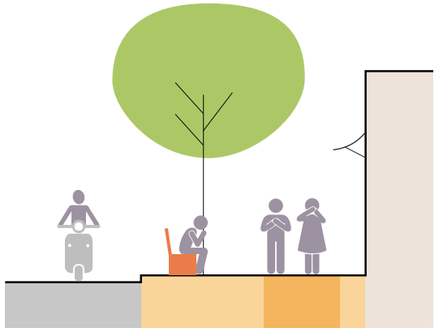
Design

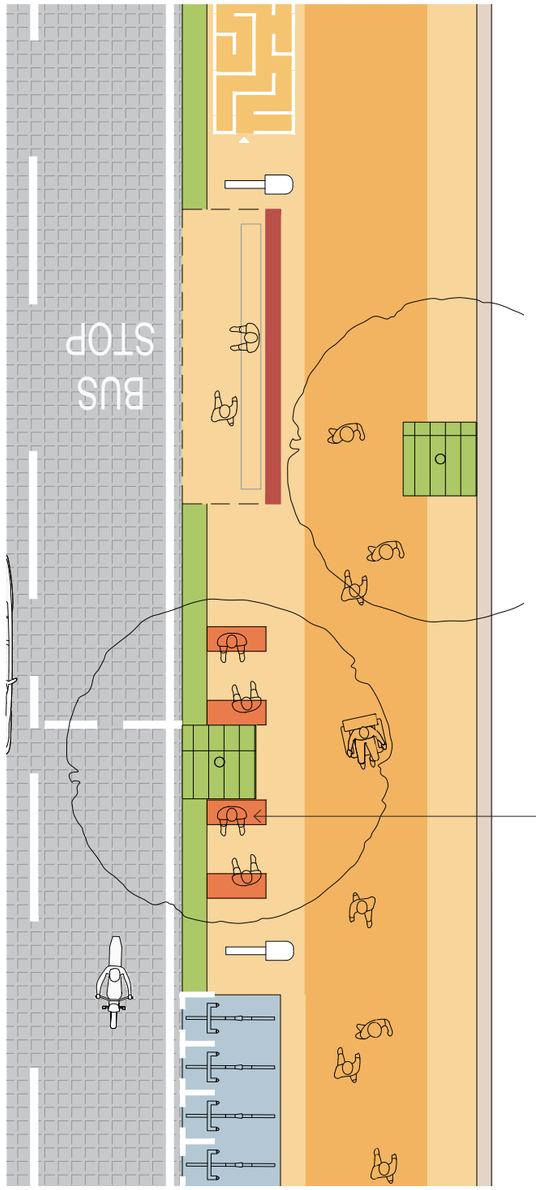
Seats may have a backrest and armrest.
Height and depth of seats should be 450mm (excluding backrest). They should be well shaded either natural or built.

Seating in School Zones

To ensure comfortable and accessible seating for children, the height of seating along the streets in school zones shall be 0.5m. These must be located in the MUZ to avoid obstruction in the walking zone.

To facilitate frequent pause and rest spaces for children, seating must be provided every 50–100m along streets within the school zone.



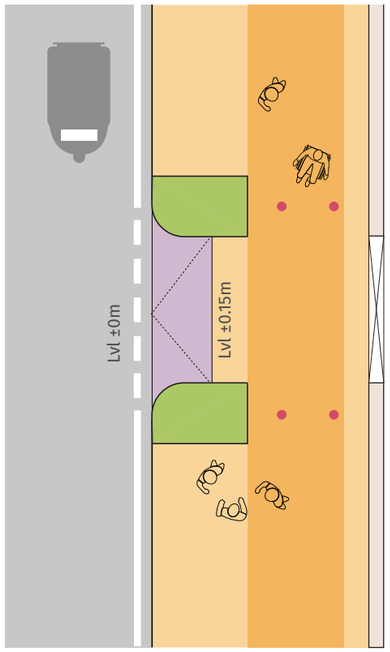


Seating clusters along the streets must be designed near transit stops, play areas, and street corners within the school zone and must include space for caregivers, wheelchairs and strollers.

Seating must be well-shaded, and can be designed with different forms, shapes and colours to invite children for play.

4.10.3 Bollards

Bollards are essential for defining pedestrian-only spaces, protecting footpaths from illegal parking and encroachment, and enhancing safety near crossings, school zones, transit hubs, and high-footfall areas. They guide vehicle movement, reinforce traffic-calming measures, and help maintain clear, unobstructed walking zones. Properly spaced, high-visibility bollards improve streetscape organisation while ensuring pedestrian comfort and safety.



Location

Bollards should be provided at locations where vehicle encroachment is possible, such as property entrances, pedestrian median refuge, and table-top crossings.

Height

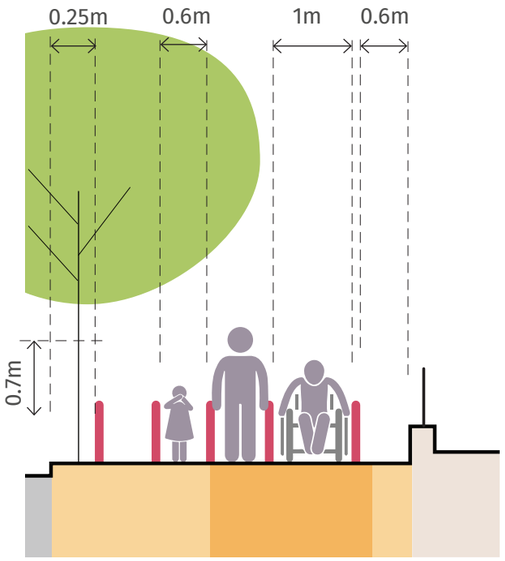
Bollard on footpaths should have a minimum height of 0.7m.

Spacing

The clear width for footpaths should be 0.6m, and 1m width for wheelchair access should be provided near the building edge as per IRC 103:2022. The bollards in the outer edges should be placed 0.25m away from the footpath's kerb edge, and 0.6m away from the building edge to ensure proper fixing.

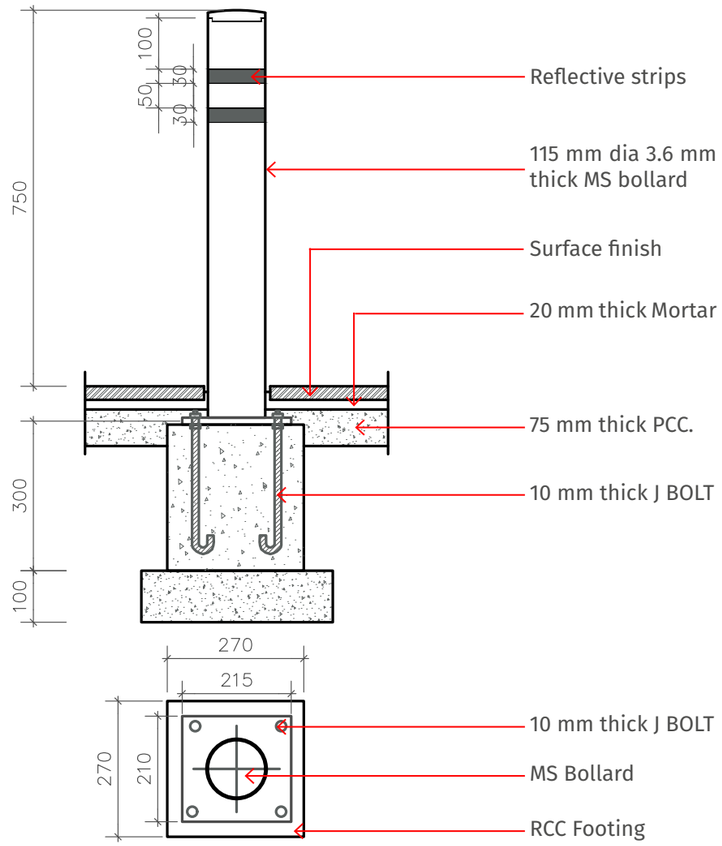
Reflective tapes

Bollards that are over 1m tall should be identifiable by using contrasting colours, and reflective tapes as per IRC:103.




Reflective tapes on bollards at Binny road, Chennai

Cross section of a bollard




Steps involved in the construction of bollards



4.10.4 Railings

Railings help channel pedestrian movement at high-conflict zones—such as near schools, transit hubs, and busy intersections—by preventing unsafe mid-block crossings and guiding people toward designated crossing points. They enhance safety at curves or locations with poor visibility and offer edge protection along drains or level differences. Railings should be used sparingly, placed only where essential, and designed to be transparent, unobtrusive, and consistent with the streetscape.

Location

Railings should be avoided on streets, as they obstruct access on and off the footpath. This obstruction can impede pedestrian movement and compromise safety by limiting the ease of entry and exit.

Placement

Railings may be provided near schools. They should be located 0.25m away from the footpath edge and should have a height of 0.7m. This safety measure helps protect pedestrians, especially children, by preventing accidental falls onto the road.



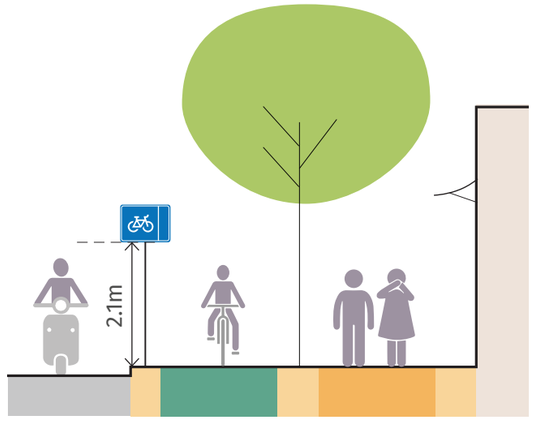
Encroachment along the railing in Anna Salai, Chennai



Railing along the bus stop hinders the access to buses in P. H. Road, Chennai

4.10.5 Pedestrian and Cyclist Signage

Pedestrian and cyclist signage plays a key role in improving safety, wayfinding, and ease of movement on streets. Clear, visible, and well-placed signs help users navigate routes, identify crossings, cycle tracks, and destinations, and understand right-of-way, especially at junctions and conflict points. Consistent signage supports inclusive street use, reduces confusion for all users, and encourages walking and cycling by making streets more legible and comfortable.



Location

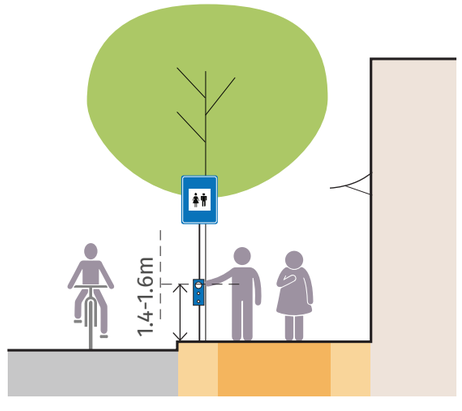
Signage should be located at 0.25m from the kerb edge with minimum 2.1 m vertical clearance from the finished footpath level to the bottom of the signage board.

Multiple informatory signs can be combined on a single pole to reduce clutter.

All signage shall adhere to the specifications mentioned in IRC: 67 - 2021



J. M. Road, Pune



Braille signage

Braille sign boards* should be located between 1.4-1.6m from finished footpath level.

*For signage design details, please refer to IRC:SP:117



Sir Thyagaraya Road, Chennai

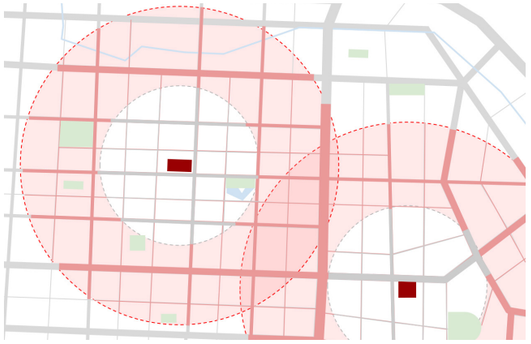
Orientation

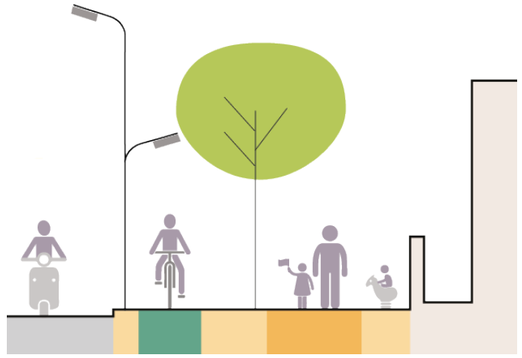
Signage should be placed perpendicular to the line of traffic, on the left side of the road with clear visibility.

4.10.6 Play Spaces and Public Art Installations

Streets hold immense potential as more than just passageways. Streets, especially around schools, can become spaces that foster inspiration, learning, and most importantly nurture play for children—a crucial aspect of their growth that promotes physical activity, motor skills, socialization, and creativity. It is important that these streets are carefully designed to nurture these qualities in children.

4.10.6.1 Play spaces





Play equipment and play spaces shall be located in the MUZ or in the Frontage zone depending on the availability of space, context and factoring in the safety of children. If located in the MUZ closer to the kerb, a landscape buffer shall be provided.

These shall be located under well-shaded spaces with sufficient seating around. The play space must be programmed at regular intervals to ensure it does not lead to overcrowding of children in one location.



JM Road, Pune



Interactive play elements painted along school routes as part of a tactical trial, Dehradun
Image Source: Dehradun Smart City

Footpath and abutting compound walls shall be designed with interactive murals, puzzles, games and other artwork to make the space vibrant and fun for children.

Brighter colours and fun patterns can be incorporated with traffic-calming measures. The design shall be such that children are not encouraged to stop on the streets and the colours are not distracting to the drivers.



Murals along the compound walls of properties leading up to the school, Surat
Image Source: The Urban Lab Foundation

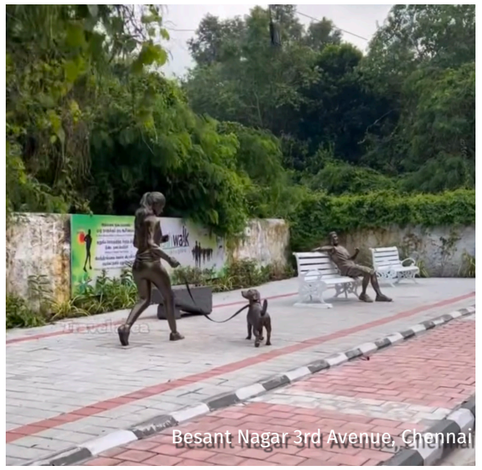
4.10.6.2 Public Art

Location
Recommended to be placed at public plazas, landmark junctions, wider RoW streets, and iconic corridors in MUZ

Design and Integration
Use durable, low-maintenance, context-sensitive artworks that do not protrude into pedestrian movement or disrupt sight lines.

Safety
Ensure installations pose no trip hazards or visibility obstructions.

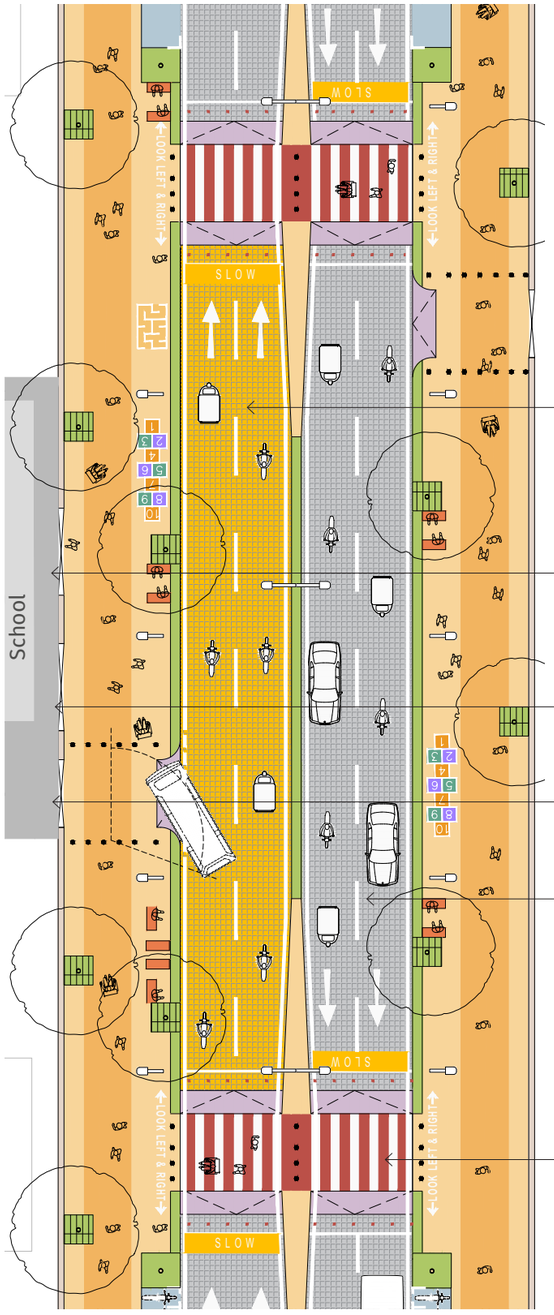
Community Engagement
Involve local artists and **c**ommunity groups to create context-relevant, inclusive art.



Besant Nagar 3rd Avenue, Chennai

4.10.7 School Entry and Exits

School entries and exits are the areas that become congested and chaotic, especially around school start and end times. These pose a significant safety risk if not designed correctly. These entries and exits should aim for zero vehicle-pedestrian conflicts, and should prioritise safe movement of children in and out of the school premises.



Schools shall provide separate entries and exits for pedestrian and vehicular access.

It is recommended that, wherever feasible, schools be designed with multiple entry / exit points, to reduce conflicts between different street users. This enables channelising vehicular and pedestrian traffic in and around school zones more effectively.

It is recommended that be school entries and exits be placed on collector and local streets than the arterial streets, if the plot allows for it.

Delineating School Property

It is recommended that the carriageway be painted yellow, where the school property starts and ends. This helps draws the attention of motorists by making children more visible.

Textured Surface for Traffic-Calming

To ensure safer speeds around school entries and exits, materials like cobble-stone, paver blocks, or rumble strips can be provided on the carriageway, 100 m on either side of the school entry / exit gate.

IRC: 32 specifies the 100m length as the School Access Zone

Speed table / Table-top crossing

To facilitate easy crossing and clear demarcation of pick-up and drop-off zones around schools, speed table / table-top crossings shall be provided at a distance of 30m on either side of the entry/exit, on both sides of the street.



Lack of continuous and wide Footpath in front of the school entry/exit, Avvai Shanmugam Salai, Chennai


School street designed with wide, multiple entries/exits and with continuous Footpath, Sir Thyagaraya road, Chennai

Pick-up/drop-off activities should not be permissible in front of the school entry/exit. This is to ensure that overcrowding of children near the entry/exit does not happen, ensuring lesser conflict with the traffic.

Bollards with chains or low height railing should be provided on either side of the school entry / exit for up to 30m distance.

In areas where 30m buffer is not feasible, the bollards can be provided up to a distance of 10m from the school entry / exit.


Bollards with low-height railing, Harrington Road, Chennai

4.11 Green and Landscape Strategy

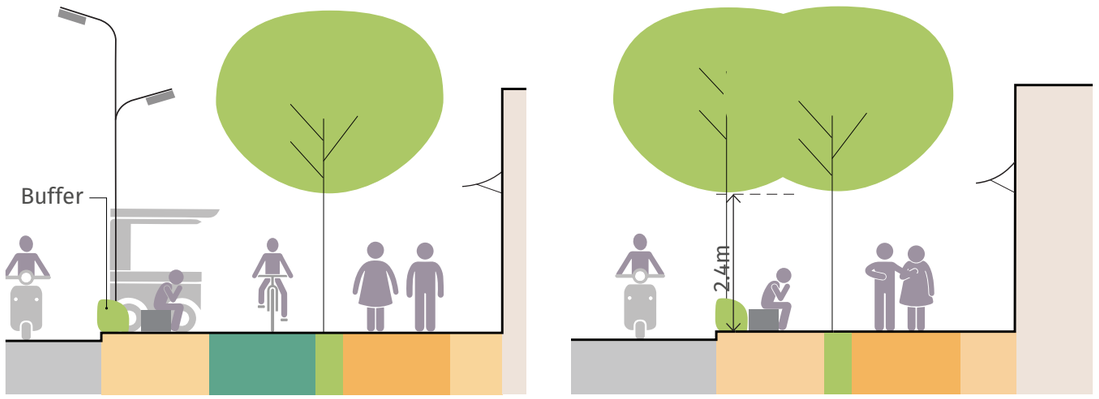
4.11 Tree Corridor and Tree Pits

Landscape enhances user comfort through shade, improves street aesthetics, and supports sustainable drainage by directing storm water into tree pits and planted areas. Shrubs should be used only where sufficient walking space is available. Existing trees must be preserved, and new species selected based on local climate. The placement of street lights, signage, and trees should be coordinated to avoid blocking lighting or wayfinding. Horticulture experts can be consulted for context-appropriate detailing. Refer IRC: SP 119, IRC: SP 50, and IRC: SP 42 for additional guidance.



Tree pits along the road, Ring Road, Delhi. Image Source - Oasis Designs Inc

4.11.1 Location and Vertical Clearance



Tree Corridor
(1m for small canopy trees and 1.5m for large canopy trees)
Landscape elements should be placed in the tree corridor and in MUZ where utility is not an obstruction, to serve shade for walking, cycling, seating, vending, and other activities.

Trees and low-height shrubs can be used as a buffer between various modes of transport.

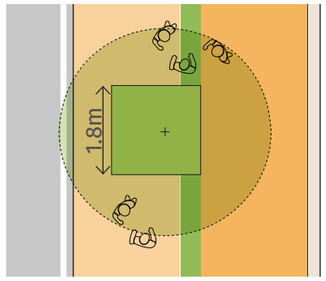
Vertical clearance
For safe pedestrian movement, vertical clearance of 2.4m should be maintained from the finished footpath level. Regular pruning should be done to ensure foliage doesn't block street light and signage.

4.11.2 Tree Pits

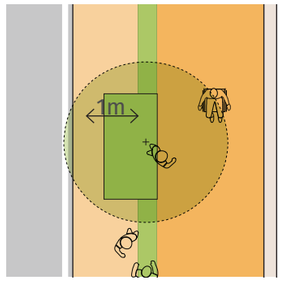

Raised tree pits along the road, T.Nagar, Chennai

As per IRC:SP:119-2018, the centre-to-centre distance between tree trunks shall be >15m for large trees, >10m for medium trees, and >6m for small trees.

However, the distance can be adjusted based on the canopy size to ensure continuous shade.



Tree pit dimension for large trees



Tree pit dimension for medium trees

As per IRC:SP:119-2018, size of the tree pits should be at least 3.3 sq.m to accommodate roots at full maturity.

This can be achieved keeping minimum of 1.8m as one dimension for large trees or minimum 1m internal dimension for medium height trees.

The dimension for the tree pit should also be decided based on the diameter of the tree trunk.

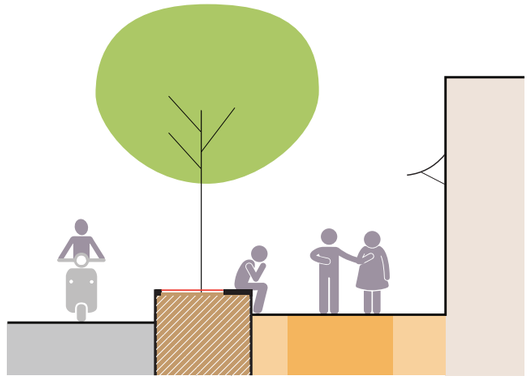
Diameter of tree trunk	Minimum size of tree grate (in m)
Upto 0.15 m	0.6 X 0.6
Upto 0.3 m	0.75 X 0.75
	1 X 1
Upto 0.9 m	1.5 X 1.5
Upto 1.2 m	2 X 2



Tree grating

Surmountable tree gratings in level with the finished footpath surface should be used to ensure appropriate width of the walking zone, for narrow streets and when retaining existing trees.

The grating gaps should be perpendicular to the movement of wheelchairs, with contrasting colour bands along the edges for accessibility.

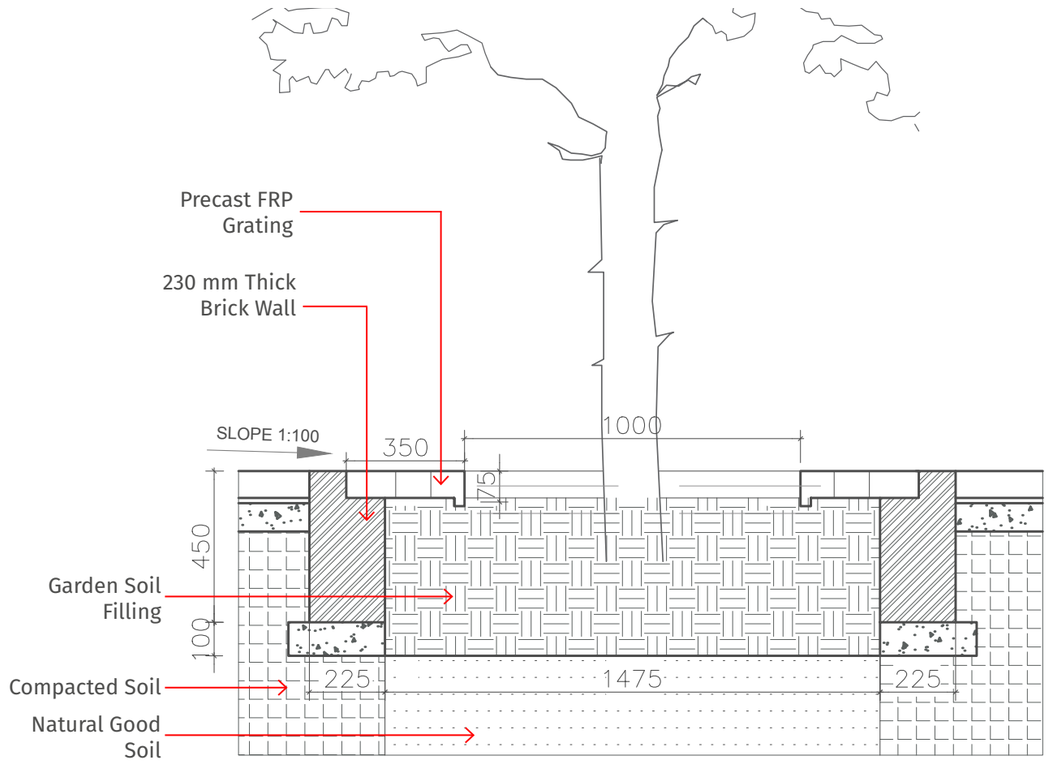


Raised tree pits

Tree pits raised to the height of a standard seating may be provided around trees with exposed roots, ensuring provision for water percolation.

Tree pits should be located in the MUZ, ensuring there is no obstruction to the walking zone.

Cross section of a tree pit

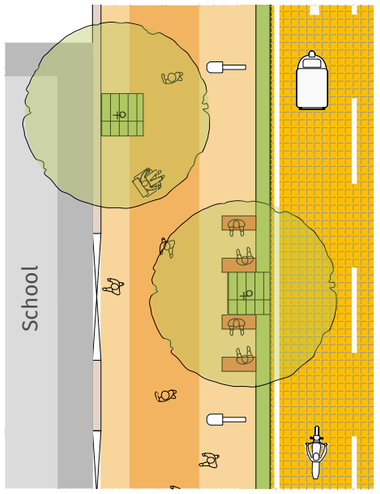




4.11.3 Landscape around School Zones

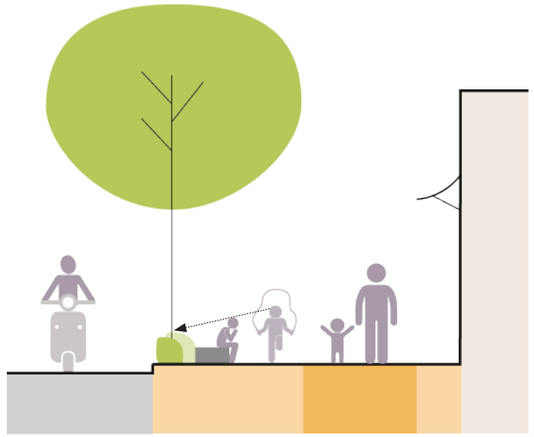
Trees and greenery improves a child's brain development, motor skills and enables creative play behaviour. They also serve as a buffer from the vehicular air and noise pollution and hence are of utmost importance around school zones.

Location and design



Footpath in the school zone shall include a 0.5m wide landscape buffer in the MUZ, along the kerb edge.

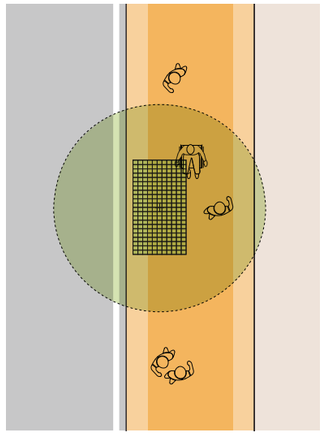
Seating and play areas along streets must be designed close to trees to ensure sufficient shade for children.



Children's heights and eye levels must be considered when choosing plant species around school zones to ensure that children can see the vehicles and vice-versa.

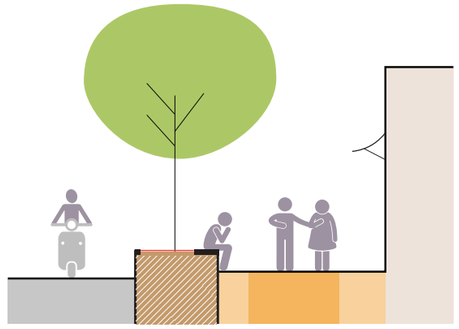

Harrington Road, Chennai


Pondy Bazaar, Chennai



Streets must be designed with planters and walkable tree pits to maximise space for walking.

Walkable tree pits must be made using permeable materials and should be a minimum of 1.5 m by 1.5 m in size, while allowing for an accessible clear footpath.



In school zones, tree pits raised to the height of a standard seating may be provided around trees with exposed roots.

Tree species

The selection of tree species for Madurai's streets should be based on the available RoW to ensure proper growth, minimal maintenance, and maximum environmental benefits. The table below provides recommended tree species categorised by RoW width, prioritising native and well-adapted species for urban resilience and ease of maintenance. To ensure better tree growth, saplings planted should be atleast 3-4 years old.

Street RoW	Recommended Tree Species	Remarks
Local Roads (RoW <15m)	Putranjiva roxburghii (Putranjeevi) Bauhinia purpurea (Mantharai) Ixora pavetta (Chulundu)	Compact trees with non-invasive roots, ideal for narrow streets
Collector Roads (RoW 30-15m)	Thespesia populnea (Poovarasu) Calophyllum inophyllum (Punnai) Barringtonia acutangula (Neer Kadambu) Pongamia pinnata (Punga maram)	Hardy trees suitable for medium-width streets and coastal resilience
Sub-Arterial Roads (RoW 45-30m)	Terminalia catappa (Natvadumai / Naatu Badaam) Pongamia pinnata (Punga maram) Lagerstroemia reginae (Poo Maruthu) Saraca asoca (Asokam)	Medium to large trees with shade and flowering benefits
Arterial Roads (RoW 60-45m)	Ficus religiosa (Arasa maram) Albizia lebbeck (Vaagai) Terminalia arjuna (Neer Marudhu) Dalbergia lanceolaria (Erigei)	Large canopy trees providing extensive shade, suitable for road medians and wide open spaces

Other tree species can be used based on the specific street context, space availability, and environmental conditions.

Preference should be given to native species as they are better adapted to local soil, climate, and require minimal maintenance.

Trees should be selected to avoid obstruction to pedestrian movement and prevent damage to footpaths and underground utilities.

At least 100 trees shall be planted, per planting row, per side within one kilometre distance, as per IRC:SP:119

Right of Way	Minimum no. of trees/km
<35m	200
35-45m	300
46-60m	500
61-120m	700

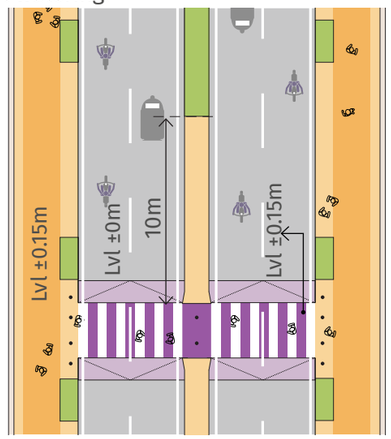
Refer street template of 18m RoW representing tree corridor and 24m RoW representing integrating tree corridor and footpath

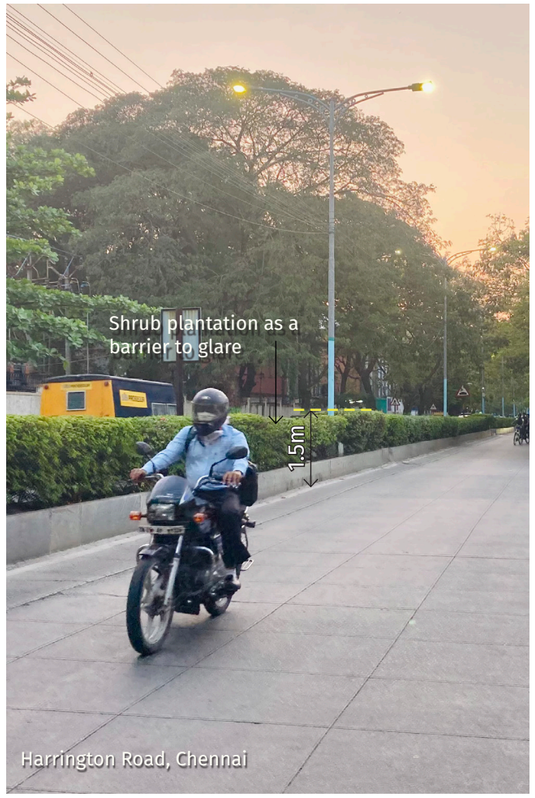


Well-shaded footpaths in Pondy Bazaar, Chennai

4.11.4 Tree Plantation at Medians and Traffic Islands

To sustain green spaces, methods such as drip irrigation and underground tanks can be employed for efficient watering.





Harrington Road, Chennai

At medians

At mid block crossings, shrub plantations should be discouraged within 10m from the pedestrian refuge to improve visibility for pedestrians, especially children.

Shrubs up to 1.5m in height should be planted in medians to minimise headlight glare from the opposite direction. When the available clear width of landscaped area in a median is more than 1m, a row of small or medium trees can be planted.

Traffic islands

Plantation in traffic islands should be avoided. In areas with a low water table, roundabouts can include bio swales and detention ponds. Dense clumps of large shrubs or low-branching trees should be avoided to maintain visibility across the carriageway.

In larger traffic islands, high-branching, well-pruned trees can be planted, ensuring a clear height of 4.5m from the carriageway level.



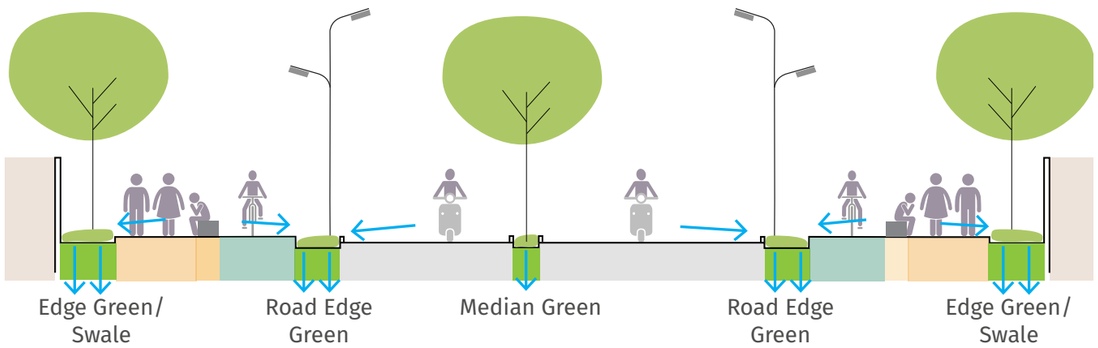
Palanganatham, Madurai

4.11.5 Natural Storm Water Management

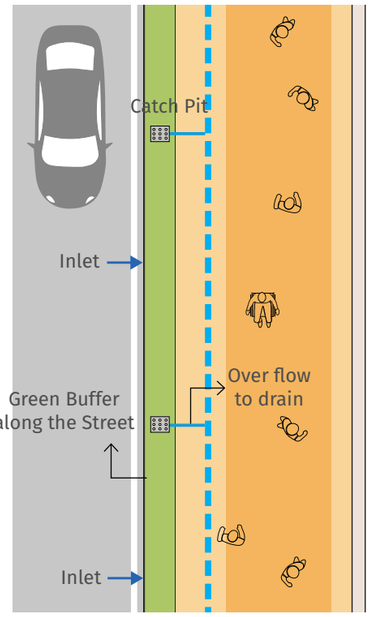
Effective storm water management on streets is crucial to prevent flooding, safeguard water quality, and ensure the overall resilience of urban infrastructure.



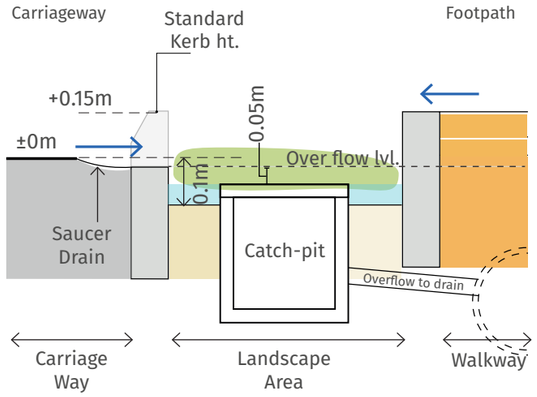
Bioswales along the road on Ring Road, Delhi. Image Source – Oasis Designs Inc



Kerb side detail



Refer IRC:SP:50-2013



Road edge green with catch pit

Catch pits provided in adjacent green strip allows extra water to go to nearby drain through underlay pipe.

The pit's manhole cover should be minimum 0.1m above the soil bed and 0.05m lower than the road level.

Water filtration

It involves strategically planting vegetation alongside roads to capture and filter storm water runoff. The green buffer serves as a natural filter, trapping pollutants and promoting infiltration, thus enhancing water quality and mitigating the adverse effects of urban runoff on local ecosystems.

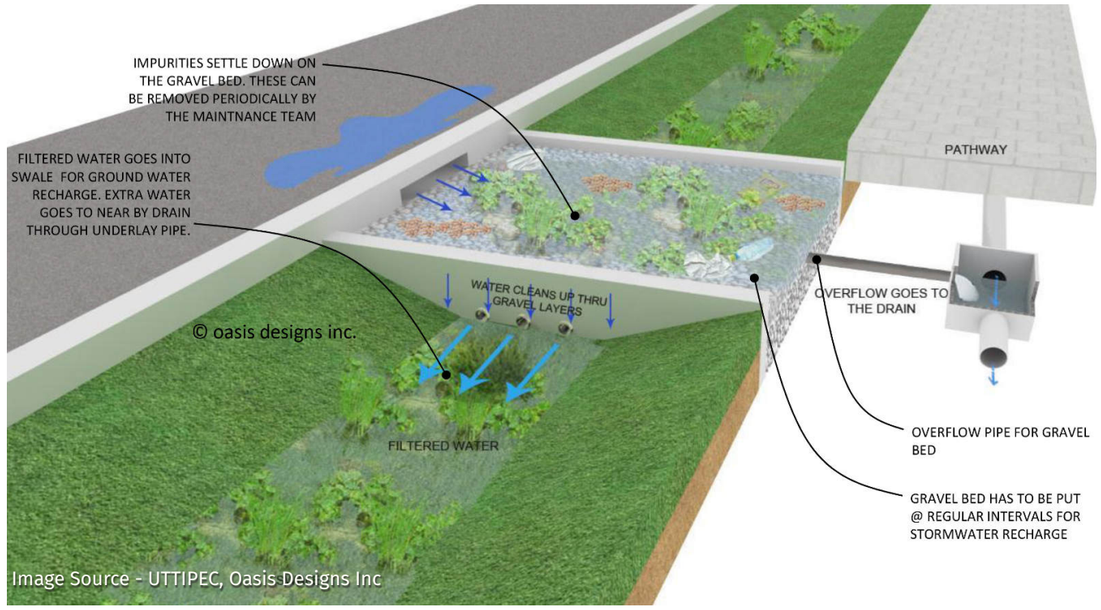
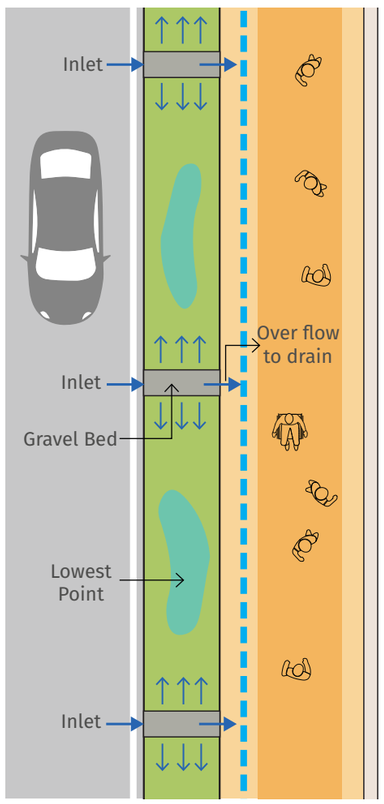


Image Source - UTTIPEC, Oasis Designs Inc



Swale

A swale is a shallow, vegetated depression to manage storm water runoff, promoting infiltration and reducing erosion.

Rainwater flows into the gravel trench, where it gets filtered. The filtered water then goes into the swale. Any excess water from the swale flows into the drain beneath the pathway.

It can be implemented alongside streets, parking lots, landscaped buffers or wide green spaces.

The width of the swale should not be less than 0.9m and depth should be 0.6m with an ideal slope ratio of 2-5%.

Refer section 2.1.5. on utilities for other storm water management solutions.

5

Underground Utilities

5.1. Utility Corridor

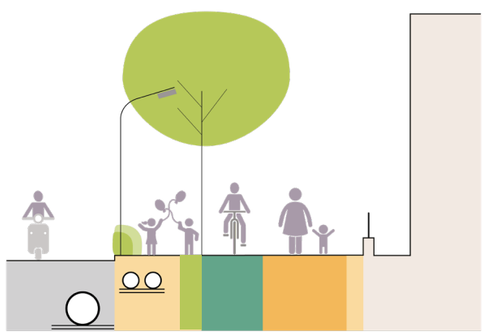
5.2. Storm Water Drain

5.3. Standardised RoW with Utility Placements

5.4. Contextualising Road and Street Template

5.1 Utility Corridor

Underground utilities shall be planned as an integrated network. For underground of water supply, sewer and storm water drain network, existing contour levels should be taken into account. Each utility department shall prepare a coordinated five year utility network plan. In greenfield areas, utilities shall be implemented as per the recommended guidelines, while in brownfield areas, coordinated design and utility integration shall address existing site constraints. This system of utility allocation shall be adopted in all cases, with sizes and depths varying based on on-site conditions, demand and road hierachy.





Ducts

Ducts are long-lasting casing pipes (RCC/HDPE/GI) which carry utility lines, and are buried directly in the ground on a PCC bed/compacted soil layer, eliminating the need for a concrete passage.

Trenches

Trenches are built underground to carry utility lines, covered with an in-situ concrete slab or precast concrete covers. Precast trenches are preferable considering faster construction and quality.

Aspects	Duct	Trench	Duct vs Trench
Type			Generally ducts are recommended over trenches. In case of SWD, they have less friction, better flow and easy to install. In exceptional cases, trenches may be adopted.
Cost			The laying of ducts costs only 30-35% as that of the construction of trenches.* ** Tender SURE Specifications for Urban Roads Execution*
Time			Ducts require less time for execution than trenches.
Flexibility			Ducts provide greater flexibility and can be manoeuvred around trees and obstructions.
Sustainability			Ducts are more environmentally sustainable compared to trenches, as trenches use cement concrete for construction, prevent rain water percolation, and obstruct growth of tree roots.



Ducts in DP Road, Pune

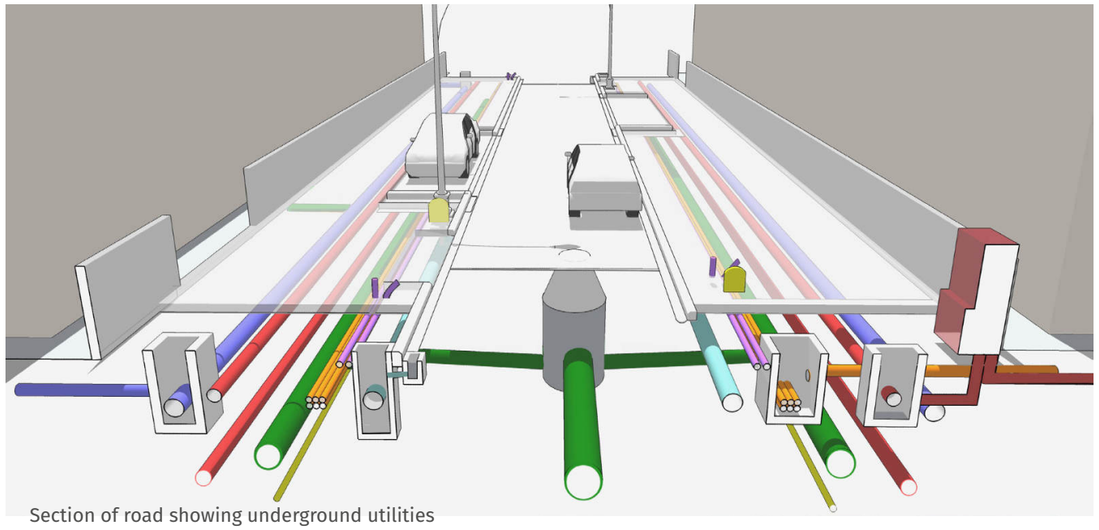


Trench implementation works in Pondy Bazaar, Chennai

Ducts are recommended for all underground utilities, given that manholes are located at regular intervals. They offer advantages such as streamlined installation, ease of maintenance, reduced visual clutter, and enhanced safety by consolidating multiple services within a shared infrastructure.

MEP experts should be consulted to ensure appropriate details suitable for local context.
Refer IRC:SP:98 for more details.

The image below is representative depicting a road section highlighting the placement of underground utilities, accompanied by a table detailing the specifications of each utility.



Section of road showing underground utilities

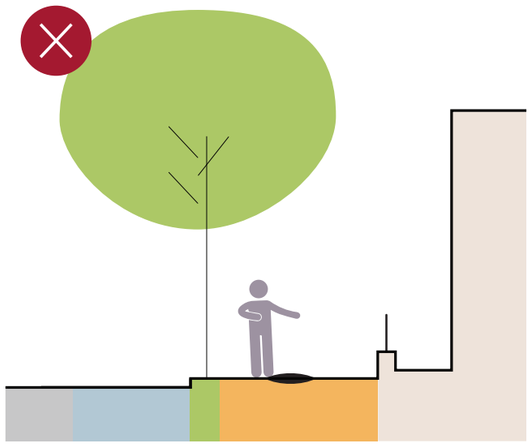
Category	Water		Electricity			Street Lights
Utility pipe*	Rider	Main	Low-tension	High-tension	Excessive HT	At median
Duct material*	MS/DIP	MS/DIP	HDPE DWC	RCC-NP3	RCC-NP3	HDPE
Duct size (dia)*	0.1-1.0m	1.2/1.6m	0.15m-0.3m	0.3m-0.45m	0.3m-0.45m	0.3m
Service laying depth from FRL*	2m-4m	3m-6m	0.8m-1m	1.5m-2m	1.8-2.0m	0.3m

Category	Sewage		Telecommunications		Storm Water	Additional Ducts
Utility pipe	Rider sewer	Trunk sewer (under median)	Copper cables	Optic fibres OFC	Main	Future additions
Duct material	RCC Hume Pipe	RCC Hume Pipe	HDPE	HDPE	RCC-NP3	HDPE
Duct size (dia)	0.25-0.8m	0.8m	0.45m	0.45	0.9-1.5m	0.15m
Service laying depth from FRL	3m-7.5m		0.45m		0.9m-1.2m	

Distance between electric cables and OFC
Vertical - 1m
Horizontal - 1m

Distance between electric cables and water supply lines HT/LT
Vertical - 1m
Horizontal - 1m

MEP experts should be consulted to ensure appropriate details suitable for local context.
*** Details are furnished by the utility departments (CMWSSB, TNEB, ULB, and Telecom Representative) and the same applies for Madurai. Refer IRC:98 for more detaiL**



Manholes

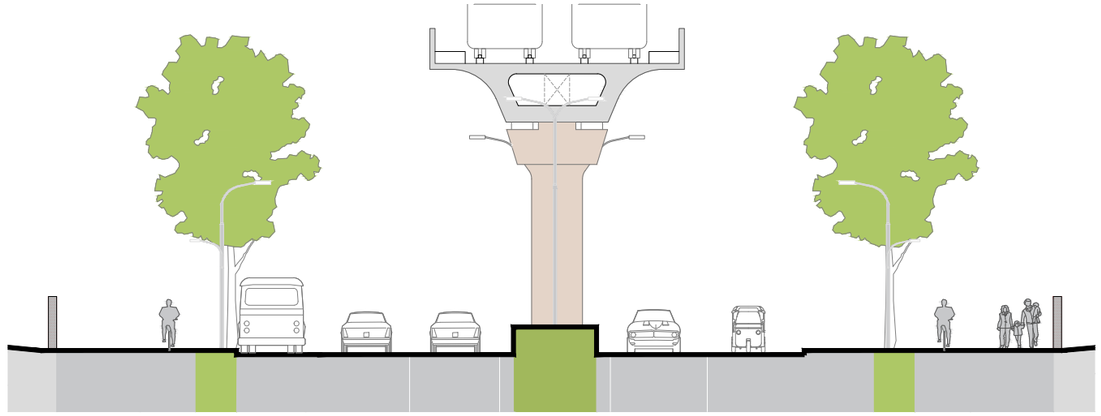
In cases, where manhole covers have to be located in the footpath, cycle track, MUZ or carriageway, they should be at the same level as the finished surface of the respective zone as shown in below figure.

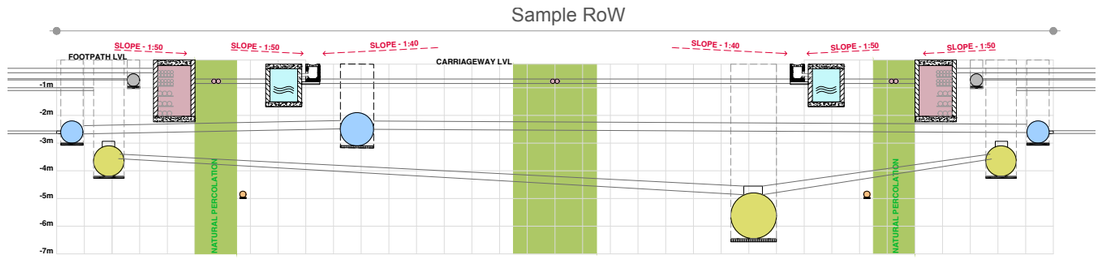
Service drop

The service drop shall be for all services which will greatly reduce hardship to service providers, service receivers and road authority.

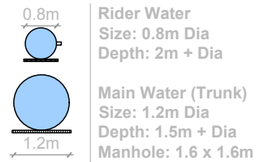


Raj Bhavan Road, Bengaluru. Image Source : Elements Creative India





Illustrative Sample of RoW with Utility Placements



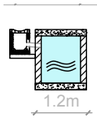
Rider Water
Size: 0.8m Dia
Depth: 2m + Dia

Main Water (Trunk)
Size: 1.2m Dia
Depth: 1.5m + Dia
Manhole: 1.6 x 1.6m



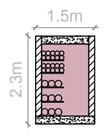
Rider Sewer
Size: 1m Dia
Depth: 3m + Dia

Main Sewer (Trunk)
Size: 1.6m + Dia
Depth: 5m + Dia
Manhole: 2m x 2m



Storm Water Drain
Silt Trap
Size: 0.6 (w) x 0.5m(d)
Manhole: 1.6 x 1.6m

SWD Size: 1.2m x 1.2m
Depth: 1m + dia



Electricity Trench
Size: 1.5m (w) x 2.3m (d)
Provisions: LT, HT, EHT
Depth: 0 + 2.3m



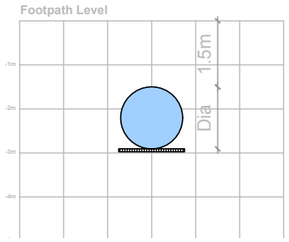
Telecom
Size: 0.45m Dia
7 core of 40mm dia each
Depth: 0-1m + Dia



Gas
Size: 0.25m Dia
Depth: 4.5m + Dia

Placement of duct depth

Each utility shall be placed at a minimum specified depth to avoid conflicts with other utility lines and street elements. The following illustration explains how to interpret the minimum depth requirements across different Right-of-Way (RoW) sections. In reality, existing contour shall determine the actual depth.



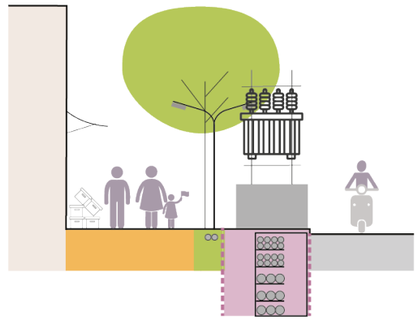
'Dia' refers to the respective diameter or size of the pipe, determined based on demand requirements.

Note:

1. For brownfield development, existing utilities on each street should be assessed prior to implementation, and the proposed concept should be customised accordingly based on existing condition.
2. For streets carrying multiple main or utility lines, the minimum required depth should be specified to ensure accommodation of all utilities.
3. Utility continuity across railway tracks, rivers, or grade separators should be assessed on a case-by-case basis, with underground connections preferred wherever feasible.
4. Utilities should be planned and resolved at the network level. Manholes at junctions should be avoided, and solutions should be developed on a case-by-case basis, considering the available road hierarchy and site conditions.
5. The proposed concept should incur huge capital investment (~80-90% more than existing practise) during implementation, but will be beneficial when lifecycle cost and road cut cost is considered.

5.2.1 Electrical

Electrical lines include low, high and excessive high tension cables which carry power to properties and transformers respectively, overhead cables, connections to street lights, surveillance cameras, and utility boxes/RMU units.



Location

Both underground and above-ground electrical utilities should be placed along the kerbside or in the MUZ.

Type of utilities

Above-ground: transformer, street light, utility box, pillar box, mini-pillar box

Below-ground: LT, HT, EHT Lines

Bundling of cables

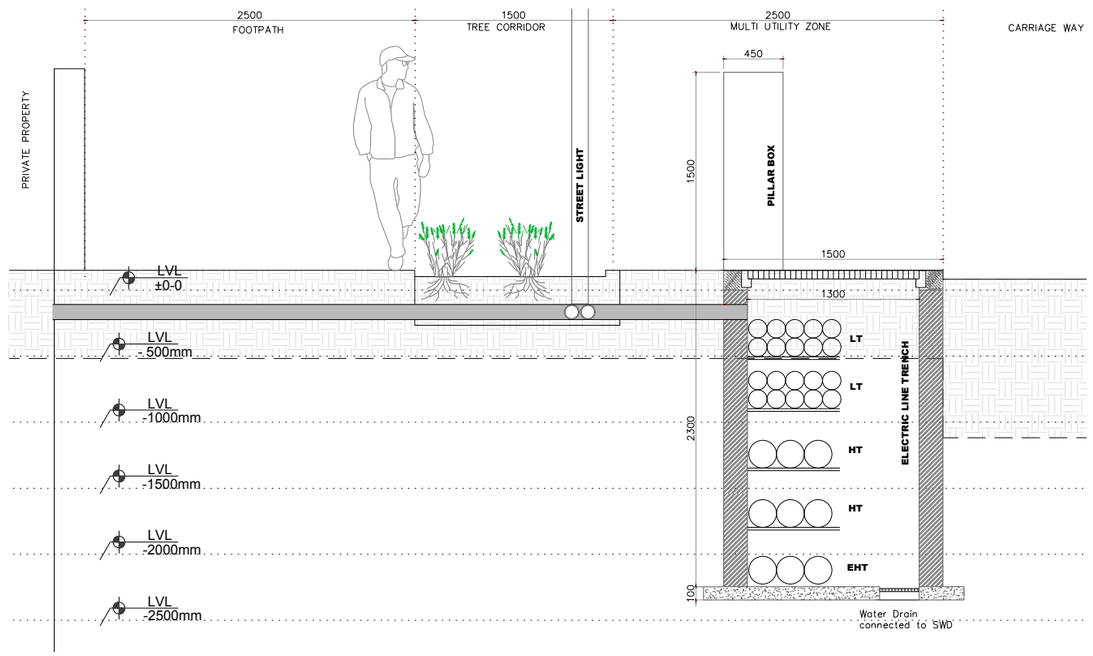
Cables for street lights, surveillance cameras,etc. should be small enough to be bundled and buried through ducts in the planter zone at the edge of the footpath, eliminating the need for manholes and deep digging. Overhead electrical cables should be avoided.

Other allied provisions

Electrical connections for on-street EV charging infrastructure, advertisement boards, or other allied provisions should be drawn from the recommended utility trench. Such provisions should be permitted only within the MUZ.

Chamber details

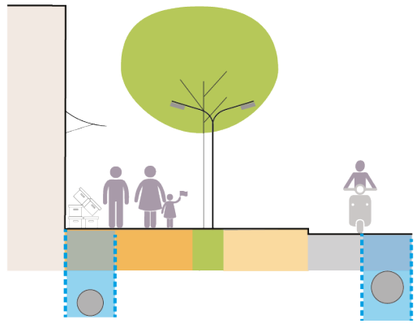
It is recommended to provide an inspection chamber at every 30m interval for a size of 0.6 x 0.6m



Typical cross section across electrical trench

5.1.2 Water Supply

Water supply lines carry potable water under pressure, and run on natural contour using gravitational force. Chambers with control valves are generally provided before connecting the main supply to adjacent properties. Additional connections can be made in future from these control chambers.



Location

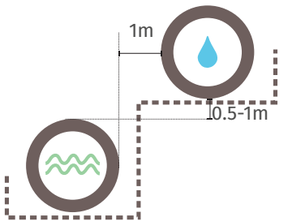
Rider lines should be provided next to property edge and main lines, pumping mains shall be provided close to median under carriageway

Type of utilities

Transmission lines: Pumping mains
Distribution lines: Rider and mains

Chamber details

It is recommended to provide an inspection chamber with a valve, sized 0.6m x 0.6m. These should be provided at an interval of every 50m for rider lines and 100m for main lines.

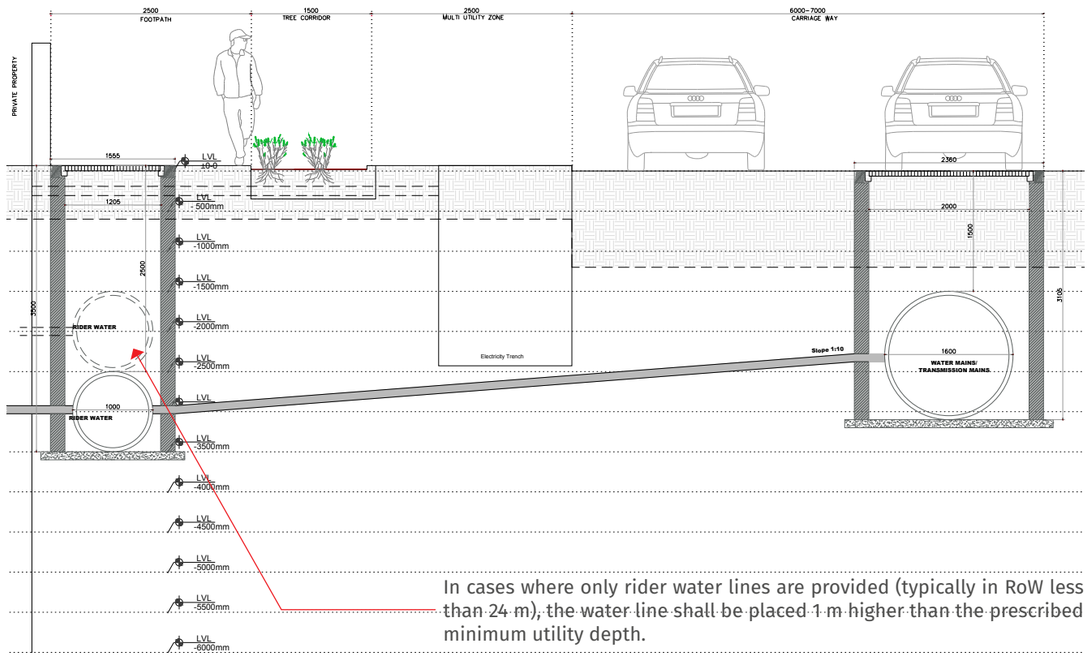


Ductile Iron (DI) pipes are typically used.

Relation to Sewer Line

Horizontal clearance of 1 m should be maintained between the water and sewer lines to avoid contamination of the water line in case of leakage.

In case of lack of space, the water line should be placed above the sewer line with vertical 0.5 m-1 m.



In cases where only rider water lines are provided (typically in RoW less than 24 m), the water line shall be placed 1 m higher than the prescribed minimum utility depth.

Typical cross section across water supply duct through inspection chamber

5.1.3 Sewerage

Sewer lines convey greywater and blackwater from residential and industrial sources. The system comprises main trunk lines and connecting rider lines. All property connections shall connect through manholes (machine holes) and not directly to the pipeline, with each machine hole serving approximately 6–8 connections.

Sewer and drainage lines operate on gravitational flow and should be aligned parallel to the road centreline to ensure efficient functioning and maintenance.

Location

Trunk sewer lines should be located below the carriageway. Rider sewer lines should be located below the footpath.

Rider sewer lines should not be laid above water line, in order to avoid contamination of potable water with sewage water in case of a pipe burst.



New connections can be made to the rider sewer, as it can have multiple such connections.

Double Walled Corrugated pipes are typically used.

Type of utilities

Transmission lines: Pumping Mains and Sewer Mains
Collection Lines: Rider Sewer

Above Ground: Lift stations (should be provided in MUZ where ever required

Chamber details

It is recommended to provide an inspection chamber at every 30m interval for a size of 0.6 x 0.6m for rider lines and at 100m interval for main line

Typical cross section across Sewerage Duct through Machine Hole

5.1.4 Telecommunications

Telecom lines include CATV/VI cables, optical fibre cables, conventional copper cables key sections, and connections for surveillance and security units. Common manholes should be provided for lines run by both public and private telecom operators, such that the ducts are not disturbed during maintenance. Overhanging cables should not be permitted.

Location

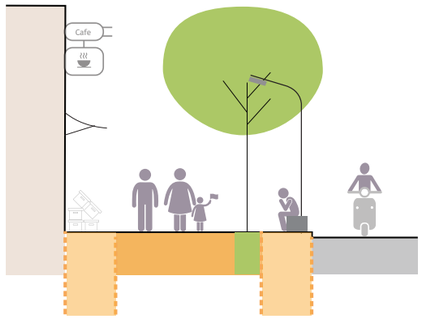
The lines should be placed along the property edge or kerbside, so that utility boxes can be placed at the edge without obstructing the footpath.

Copper telecom cables should not be placed close to electric cables to avoid electrical interference due to induced voltage. A minimum distance of 1-1.2 m should be provided between the two to avoid magnetic induction. (in case of conventional copper cables).

Stacking of ducts

Lines run by government and private operators can be run through 7 core pipe, and accessed through a single manhole.

High Density Poly Ethylene (HDPE) Pipes are typically used.



Type of utilities

Underground: Tranmission lines and Fibre Optic Access Termination (FAT) box
Above Ground: Distribution box (FMS)

Chamber details

It is recommended to provide an inspection chamber at every 150-200m interval for a size of 0.3 x 0.3m. If the road has many interseections points, then a chamber needs to be provided near every intersection.

Typical cross section across sewerage duct through machine hole

5.1.5 Gas

Gas mains and other ducts carrying combustible material should have clear visible markers above the ground. These markers should denote the type, location and date of installation with emergency contact numbers. The guidelines for these utilities should be strictly followed under expert supervision.





Other guidelines

Consolidation

In case of lack of adequate space, dry utilities (for eg, telecommunication and electricity) can be consolidated and stacked together to minimise the space occupied. Permissions from respective agencies must be obtained before consolidation. Manholes must be provided at regular intervals for ease of access and maintenance. Common manholes can be used for government and private connections with proper stacking of utilities.

Abandoned lines

Abandoned ducts and trenches should be reused or consolidated if duplicate or defunct lines are discovered during utility mapping. On-site engineers and the respective utility agencies should be contacted for re-routing. The decision to reuse or retrofit existing lines should be taken by the engineers based on their conditions and cost-effectiveness.

Future demand

Additional empty ducts should be provided which can be used in the future for new connections or different utilities avoiding the need for unnecessary excavation.

Identification system

Identification systems for underground utilities and crossings on the footpath should be established. These may be in the form of colour coded chamber covers or other similar marks which will make it easier to locate later. MMC shall prepare an SOP or adopt an SOP approved by state for identification system.



Network of underground utilities at different levels in DP Road, Pune

5.2 Storm Water Drains

Stormwater drains must be designed as an integrated network (contour based storm water cluster) from collection to discharge points, aligned with the existing natural contours to ensure efficient flow and minimise flooding. The on-ground network should prioritise sustainable drainage principles and incorporate the following components:

- **Filtration:** Bioswales, catch pits, and other natural/engineered filtration features can remove sediments and pollutants at the source.
- **Conveyance:** Well-designed ducts and channels can guide stormwater safely through the network, respecting topography to maintain natural flow paths.
- **Infiltration:** Groundwater recharge pits and porous surfaces should be integrated to increase infiltration and reduce surface run-off.
- **Retention:** Retention tanks should be included to temporarily store stormwater and release it gradually, supporting water security and minimising peak flow loads.
- **Detention:** Detention reservoirs help manage excess run-off during heavy rainfall and mitigate downstream flooding.

The final discharge point of the stormwater drain should always include a filtration or treatment system to ensure only clean water enters natural waterbodies or reservoirs.

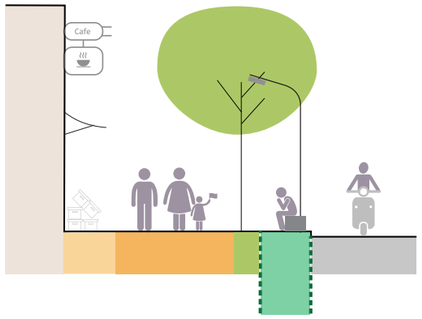
*For detailed guidelines, please refer to IRC-SP-50 2013 - Guidelines on urban drainage

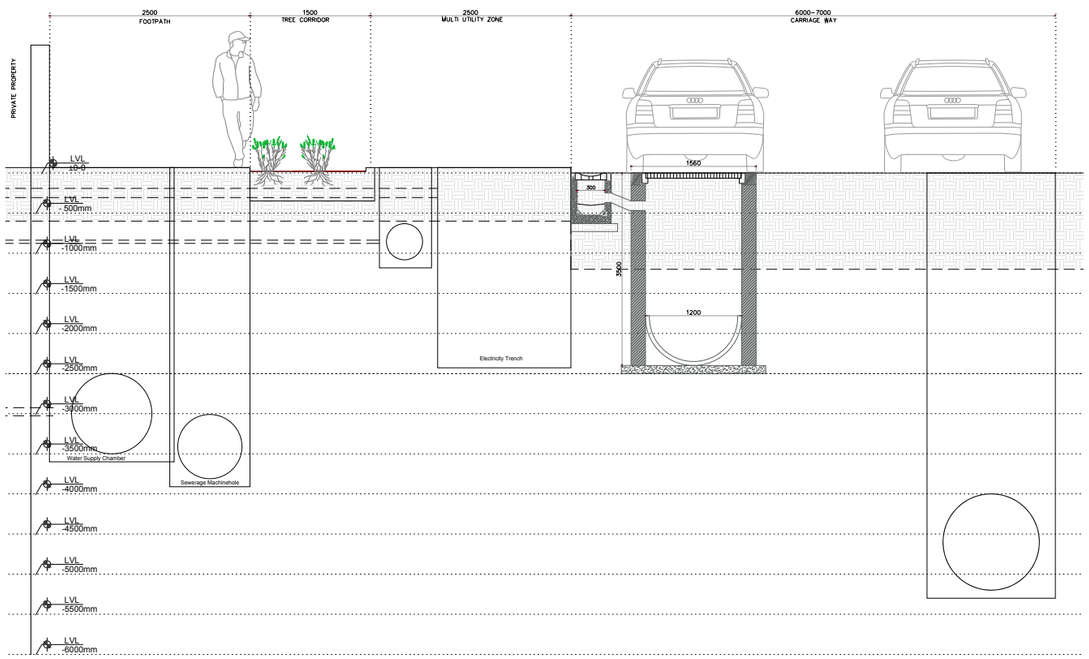
Location

They should be located along the carriageway edge with silt catch pits at regular intervals. These should not be provided at the property edge.

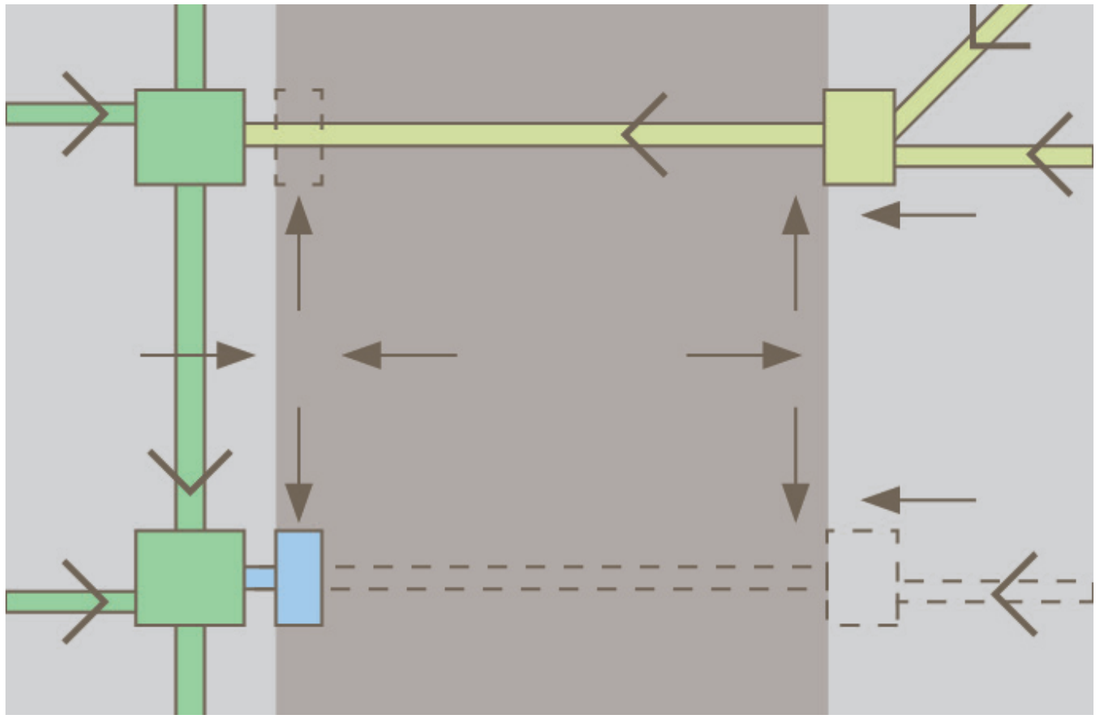
Connections

Connections from other utilities to properties can be easily made over ducts, making them advantageous over conventional trenches. Illegal sewer connections into storm water drain are prevented when ducts are used instead of trenches.





The size of the storm water drain should be considered as per design requirements considering the surface run-off, catchment area, etc.



Storm water drainage network diagram

Storm water manhole

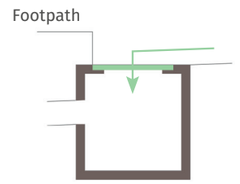
Storm water manholes collect water from the adjacent properties through ducts and from catchpits. They can have kerb-inlets on the surface to collect runoff water, removing the need for separate catchpits. Manholes are to be designed to withstand respective vehicular load in case of motorable drains proposed on carriageways.

Catchment pit

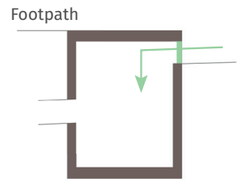
Catchment pits collect surface runoff from the carriageway, sidewalk, and private properties. The longitudinal and transverse gradient of the surface should be maintained as mentioned in IRC-SP-50 2013 (Guidelines on Urban Drainage) which recommends cross slopes of 2-2.5% for travel lanes.

Storm water from the road flows along the saucer drain (along the kerb) into the catchment pit through inlets. Catchment or catch pits should be designed such that silt is collected in the chamber through sand/gravel filters before the water flows into the main storm water drain.

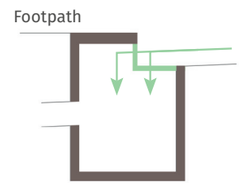
The depth of the catch pit can vary from 450-600 mm, with a width of approximately 300mm. Catchment pits should be located at the lowest point of the street cross-section and at regular intervals decided by their size, average rainfall, and the catchment area.



Catchpits Inlet



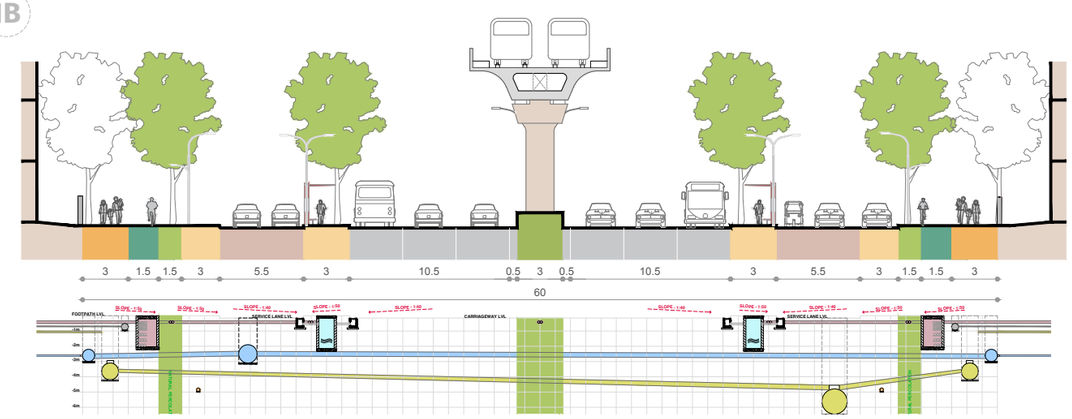
Kerb inlet



Combination inlet

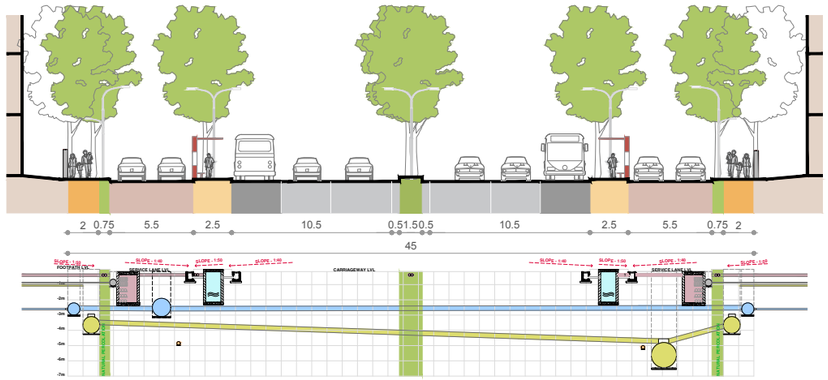
Types of catchment pit openings

1B



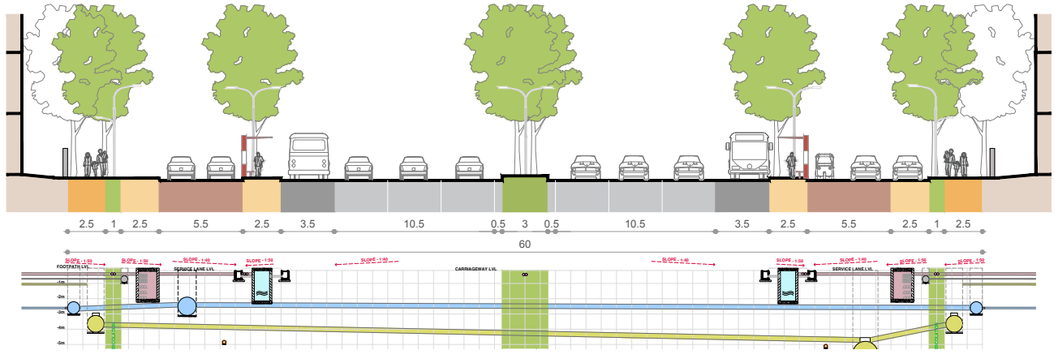
Arterial Road - 60m - With Metro

1C



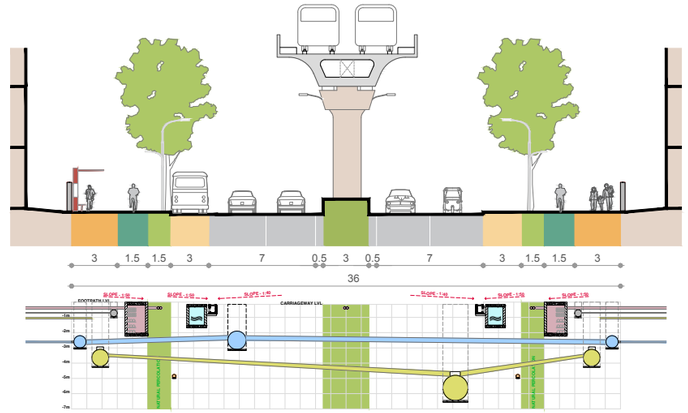
Arterial Road - 45m - With Bus Priority Lane

1A



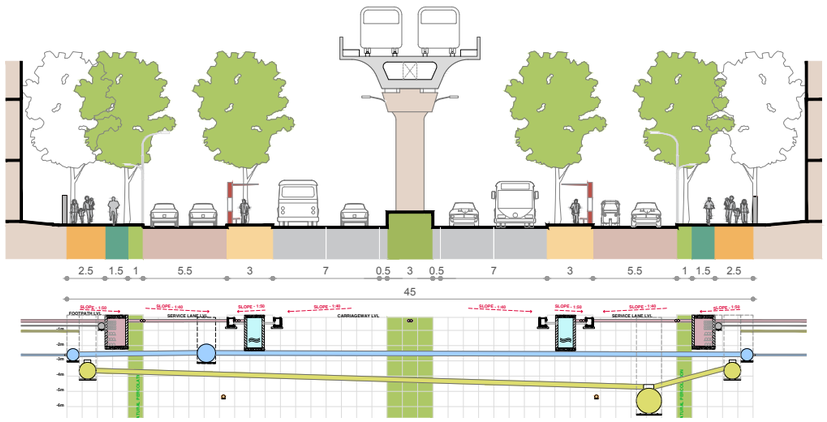
Arterial Road - 60m - With Bus Priority Lane

2B



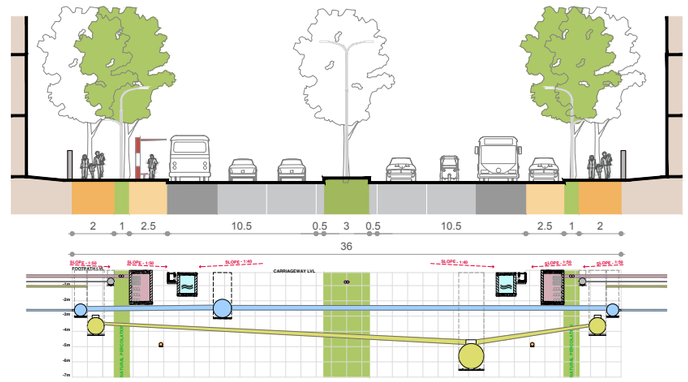
Sub Arterial Road - 36m - With Metro

1D



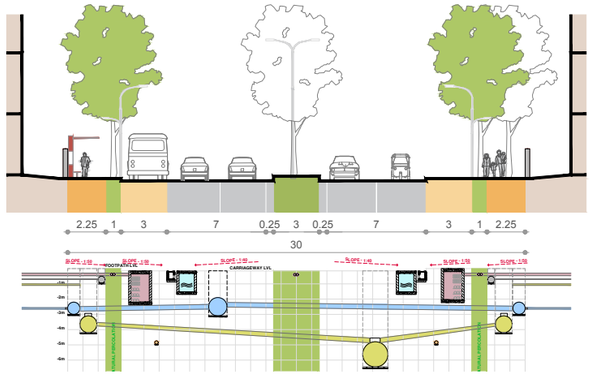
Arterial Road - 45m - With Metro

2A



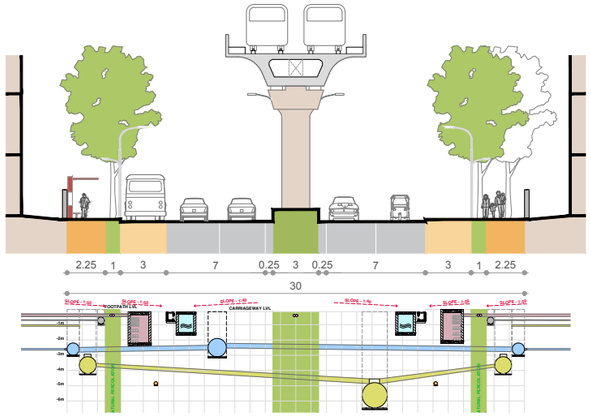
Sub Arterial Road - 36m - With Bus Priority Lane

2D



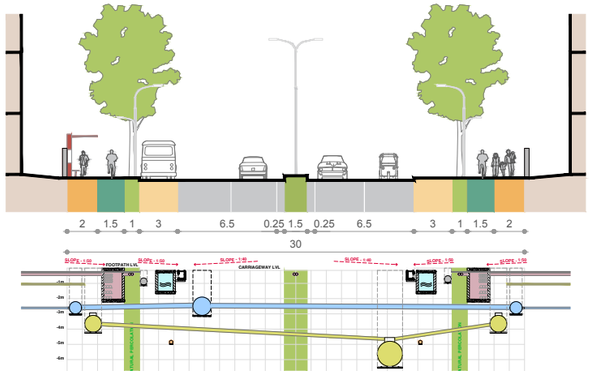
Sub-Arterial Road - 30m - Without Metro

2C



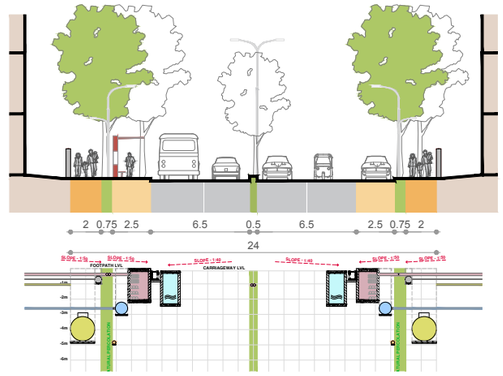
Sub-Arterial Road - 30m - With Metro

2E



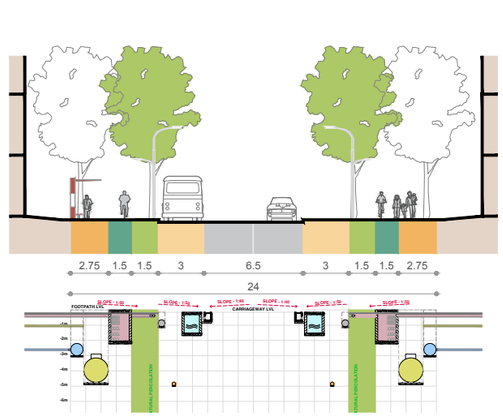
Sub-Arterial Road - 30m - With Cycle Track

3A



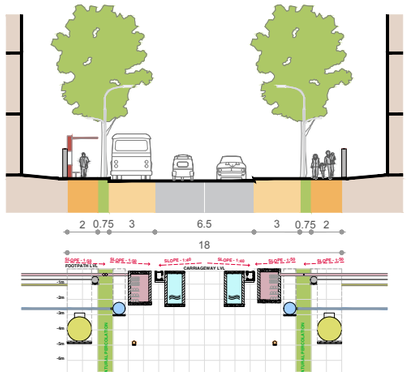
Collector Road - 24m - With 4 lanes

3B



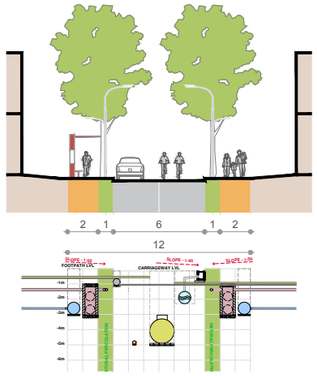
Collector Street - 24m - With 2 lanes

3C



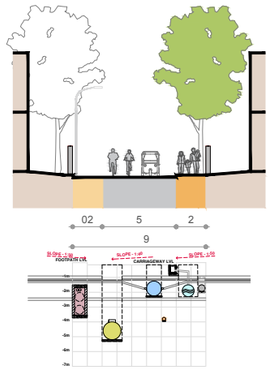
Collector Street - 18m

4A



Local Street - 12m

4B



Local Street - 9m



Underconstruction Mc Road Chennai - Under Ground Utility Management

Streamlined Above-ground Utilities at KNK Road, Chennai

5.4 Contextualising Road and Street Template

Standard street design templates provide a useful framework for street planning, but their effective application requires adaptation to on-ground realities. Variations in right-of-way, land use, user behaviour, and physical constraints must inform the design process. Contextualising templates ensures that proposed interventions are responsive to the existing street conditions, resulting in safer, more inclusive, and functional streetscapes.

Existing Condition - Scenario 1



Varying RoW

The RoW varies between 12–15 m and includes a central median. The absence of lane markings allows up to four lanes of traffic to flow informally, with the carriageway on each side of the median ranging from 6 to 7 m in width.



Absence of NMT infrastructure

The street lacks footpaths. A 0.5 to 0.8 m wide storm water drain runs along the property edge at carriageway level, offering only a vague spatial cue for pedestrian use.



Property ramps: An Obstruction to footpaths

In certain stretches, the storm water drain is laid at a slope, functioning as a ramp for property access. In other segments, it is interrupted by steps leading directly to residences, breaking pedestrian continuity.



High informal vendor activities

The street experiences high vending activity at different times of the day. With no designated vending zones, vendors use the footpaths and also spill onto the carriageway. This forces pedestrians to walk on the carriageway, putting them in direct conflict with fast-moving vehicles.

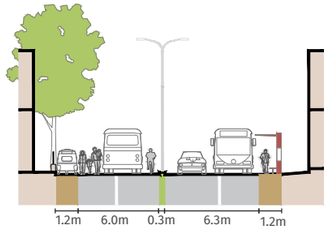


Haphazard illegal parking

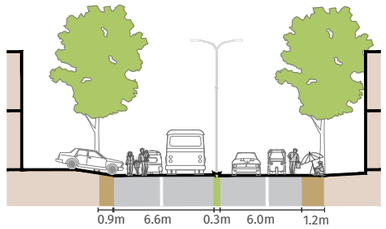
Illegal parking is also common, especially in front of commercial units and vending areas, further reducing the available walking and vending space further increasing pedestrian-vehicle conflicts.

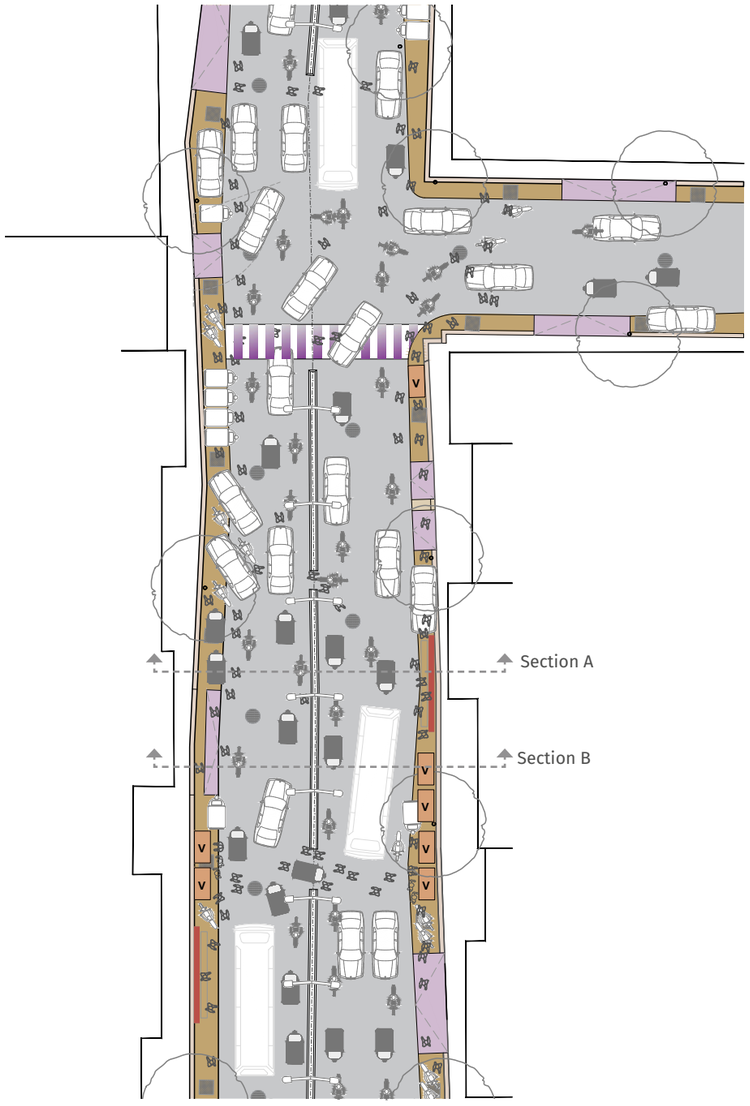
Existing Condition

Section A



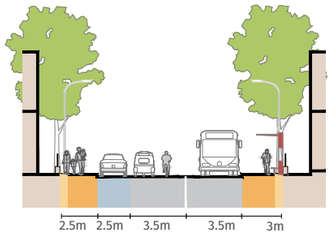
Section B



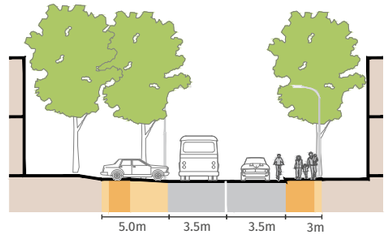


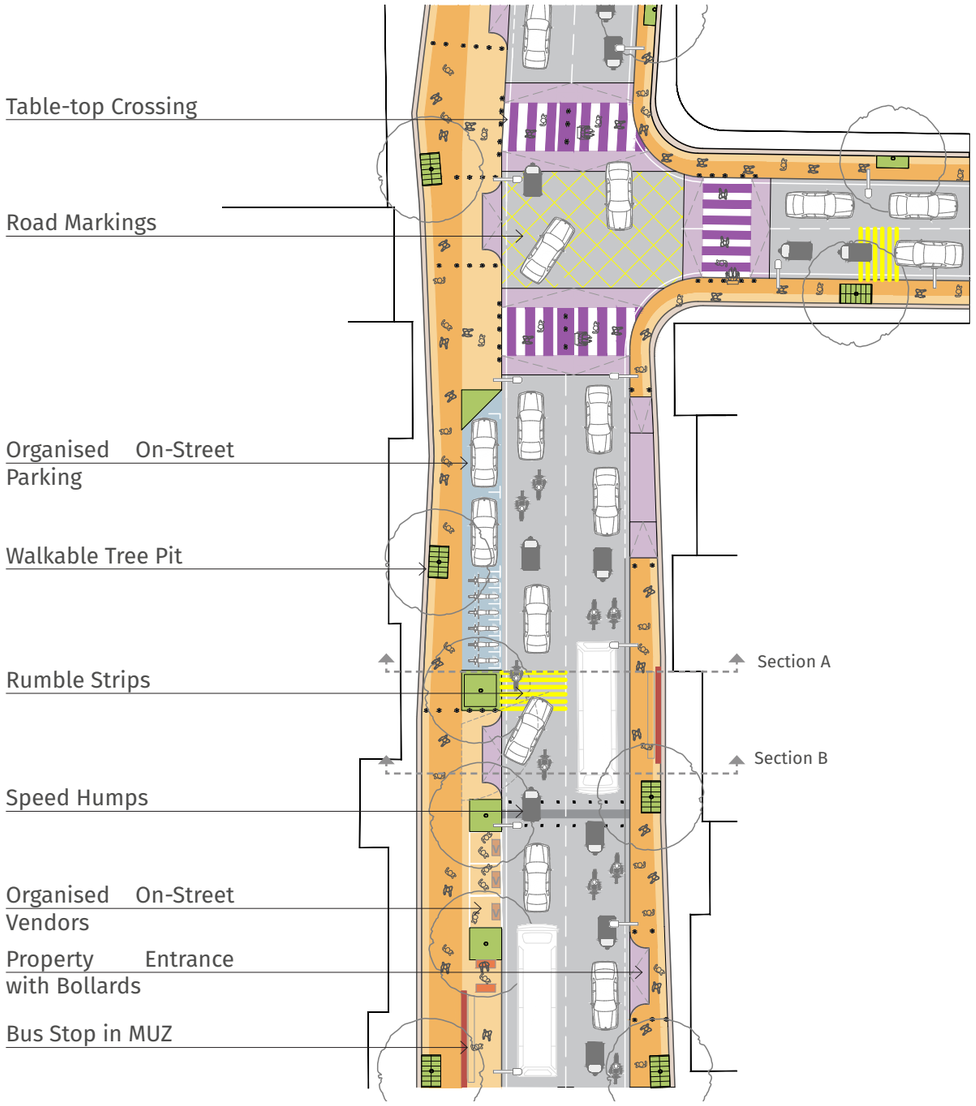
Proposed Solution

Section A



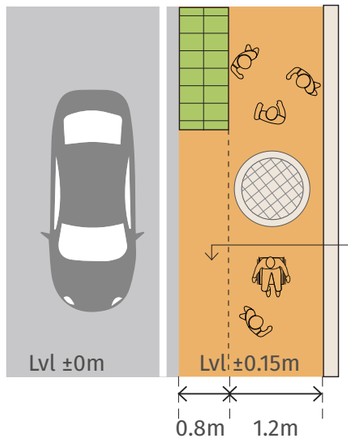
Section B

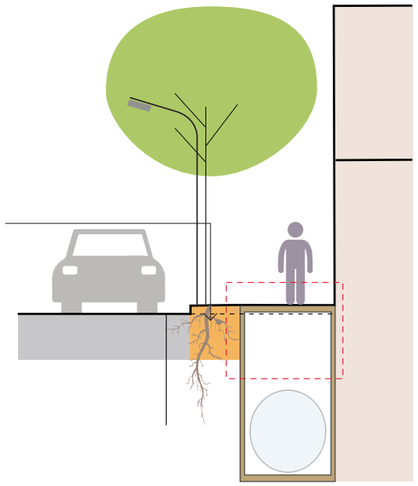




Ensuring Continuous Footpaths of 2m

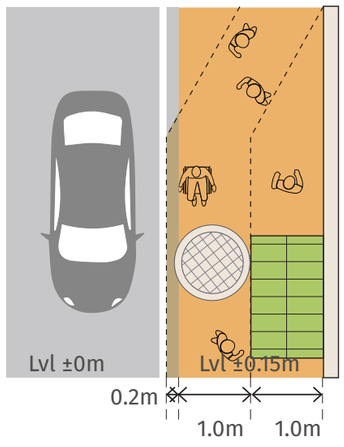
If a tree is present along the kerb edge, a walkable tree pit should be provided (0.8m width and 1.2m length), to ensure unobstructed pedestrian movement.

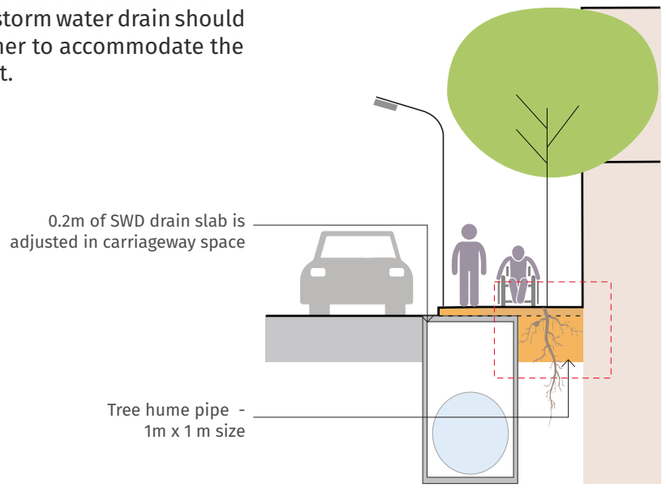




*Refer Chapter 4 & 5 for more details

In cases where the tree is present along the property edge, a walkable tree pit should be provided to ensure unobstructed pedestrian movement. In such cases the storm water drain should be designed in the below depicted manner to accommodate the landscape and the pedestrian movement.

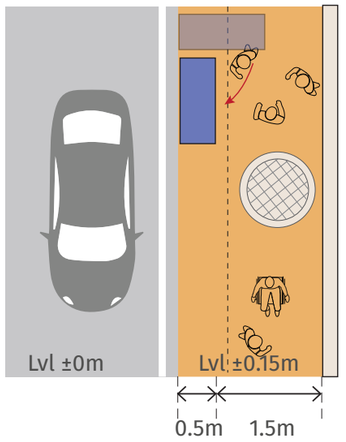


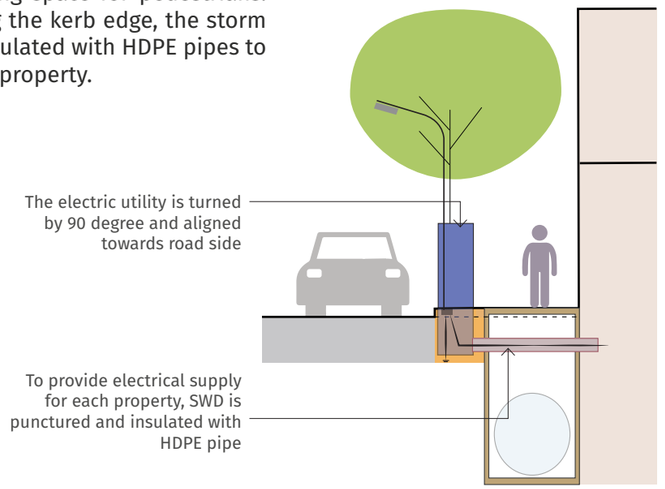


*Refer Chapter 4 & 5 for more details

Above-Ground Utility Strategies

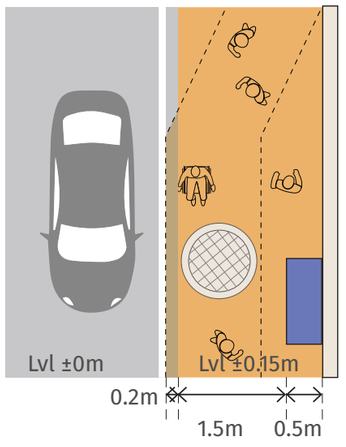
In the proposed scenario, the utility boxes are made parallel to the footpath in order to ensure clear walking space for pedestrians. Since the utility boxes are present along the kerb edge, the storm water drain should be punctured and insulated with HDPE pipes to run the necessary utilities to the private property.

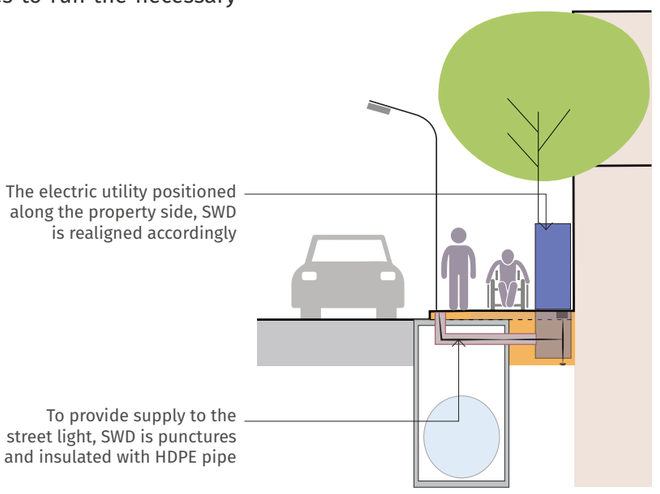




*Refer Chapter 4 & 5 for more details

In the proposed scenario, the storm water drain should be punctured and insulated with HDPE pipes to run the necessary utilities.

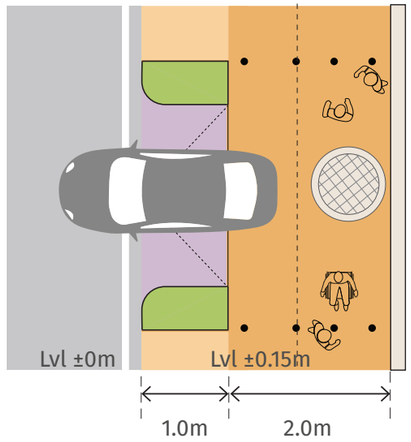


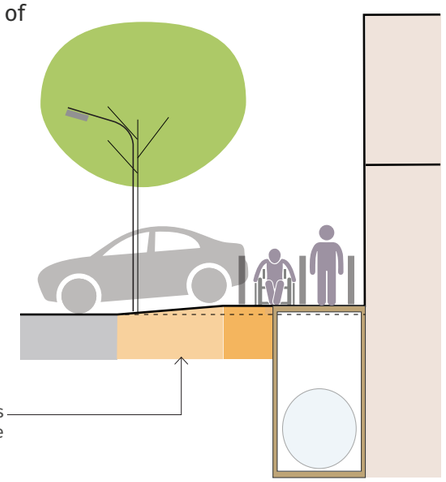


*Refer Chapter 4 & 5 for more details

Property Access Ramps

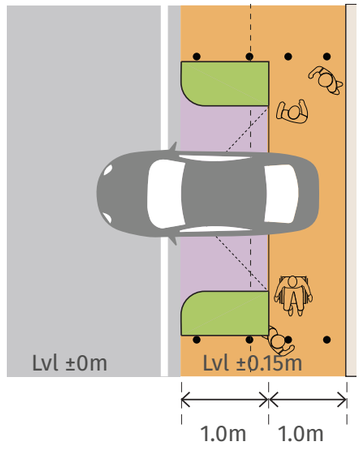
Property access ramps should be provided wherever necessary. In this instance, due to the availability of space, the property ramp is provided in the MUZ, ensuring a clear walking space of 2m for pedestrians.

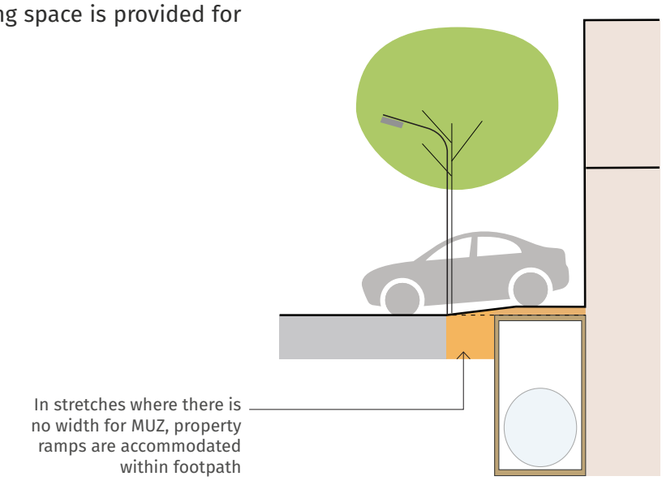




*Refer Chapter 4 & 5 for more details

In the absence of a MUZ (due to lack of space), the property ramp should be accounted within the private property. In instances where this is not possible, the ramps should be accounted for within the walking space. While this is not an ideal scenario, care must be taken to ensure that walking space is provided for pedestrians.



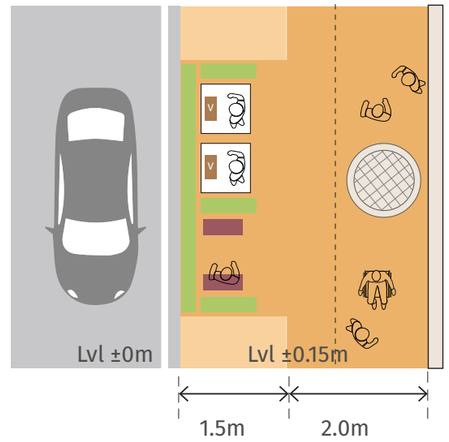


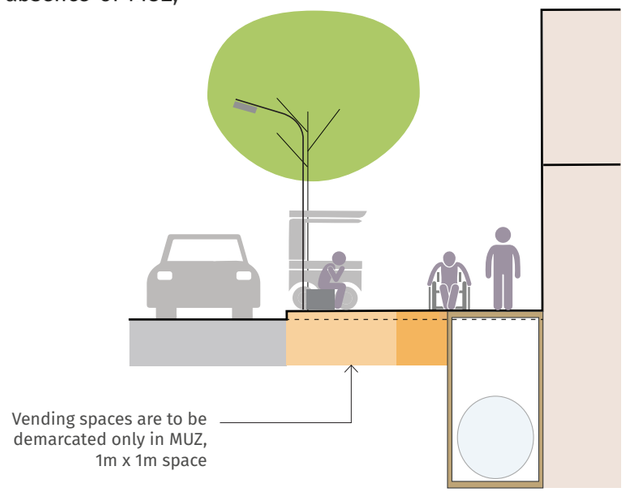
*Refer Chapter 4 & 5 for more details

Refer scenario 2 for other design solutions for ramp treatment.

Accommodating Vending and Parking in MUZ

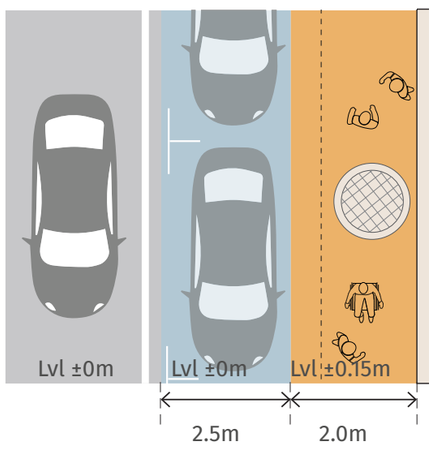
Vending spaces should be provided only in the MUZ, to ensure clear walking space for pedestrians. In the absence of MUZ, vending spaces should not be provided.

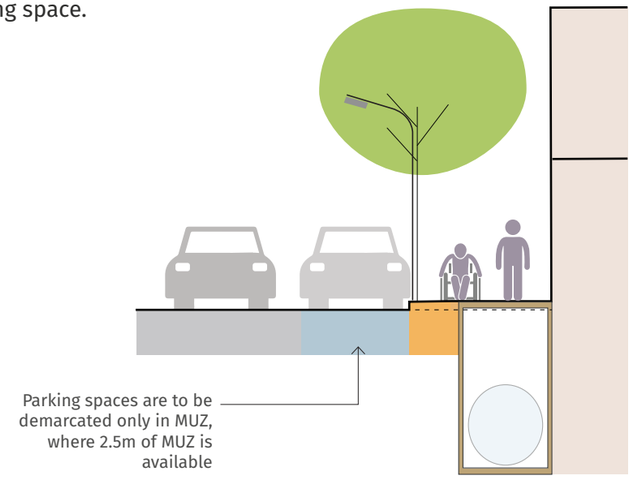




*Refer Chapter 4 & 5 for more details

Parking should be provided only in the MUZ, to ensure clear walking space for pedestrians. In the absence of MUZ, parking should not be provided. In cases where limited space is available for the MUZ, parallel parking orientation should be provided, without compromising on pedestrian walking space.

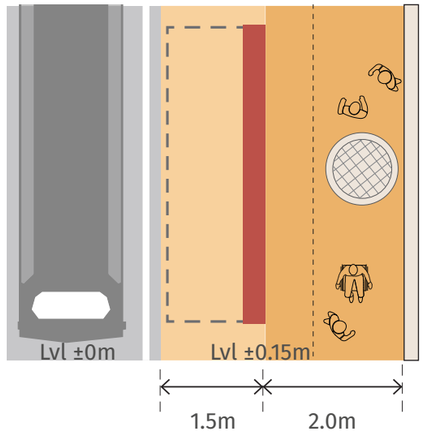


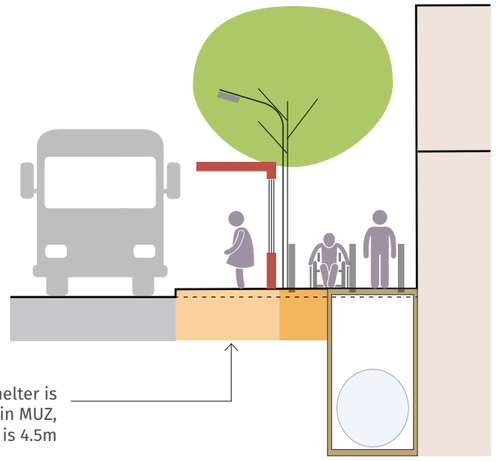


*Refer Chapter 4 & 5 for more details

Incorporating Bus Shelter with Streets

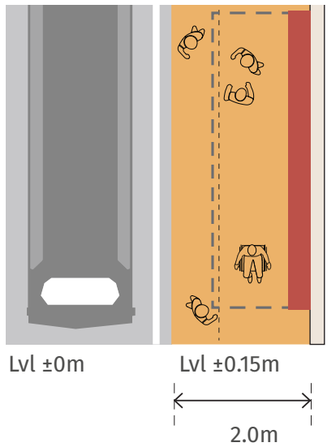
In locations where the space for footpaths >4.5m, the bus stop should be provided in the MUZ, with a clear walking space behind the bus stop.

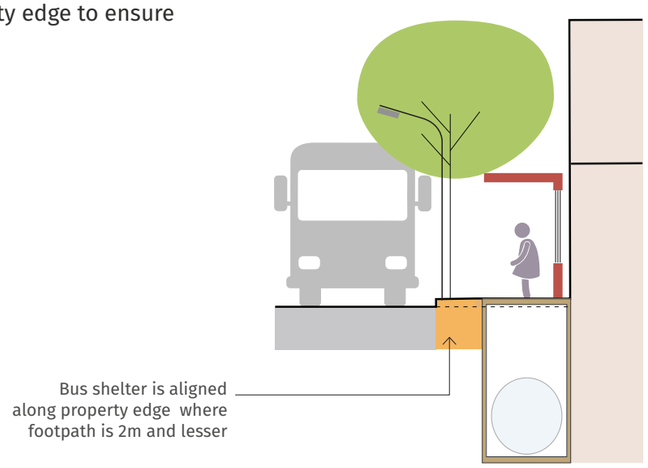




*Refer Chapter 4 & 5 for more details

In locations where the space for footpaths <4.5m, the bus stop should be provided along the property edge to ensure sufficient walking space for pedestrians.

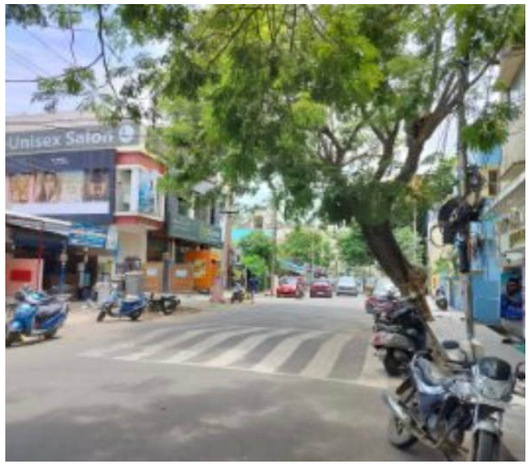




*Refer Chapter 4 & 5 for more details



Existing Condition - Scenario 2



Lack of street space demarcation

The street has a RoW of 12 m. The carriageway typically accommodates two lanes of traffic, but lacks centerline markings. On-street parking is common, especially in front of commercial establishments. The street is predominantly commercial with some residences in between.



Property ramps obstructing footpaths

In certain stretches, the storm water drain is laid at a slope, functioning as a ramp for property access. In other segments, it is interrupted by steps leading directly to residences, breaking pedestrian continuity.



Pedestrian inaccessibility concerns

There are no footpaths. A 0.5 to 0.8 m wide storm water drain runs along the property edge at a height of 0.6 to 1 m above the carriageway. This elevation makes it difficult for pedestrians to use the drain as a walking space, despite the drain offering segregation from traffic.



Absence of NMT infrastructure

In some segments, neither footpaths nor drains are present. Pedestrian access to shops is directly from the carriageway via steps or ramps, reducing the already limited walking space and causing frequent encroachments.



Grand Southern Trunk Road, Pallavaram Source: ITDP India

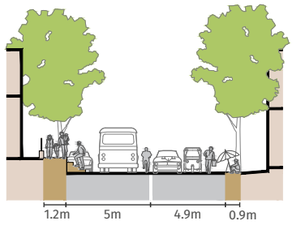


High storm water drains

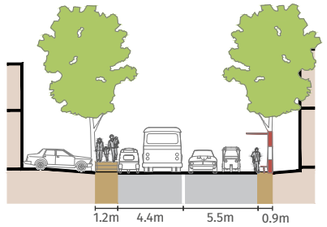
Where the 1 m high storm water drain exists, accessing stores requires two sets of steps—one over the drain and another into the shop. Store signage and equipment often encroach upon both the drain and carriageway, severely limiting pedestrian movement.

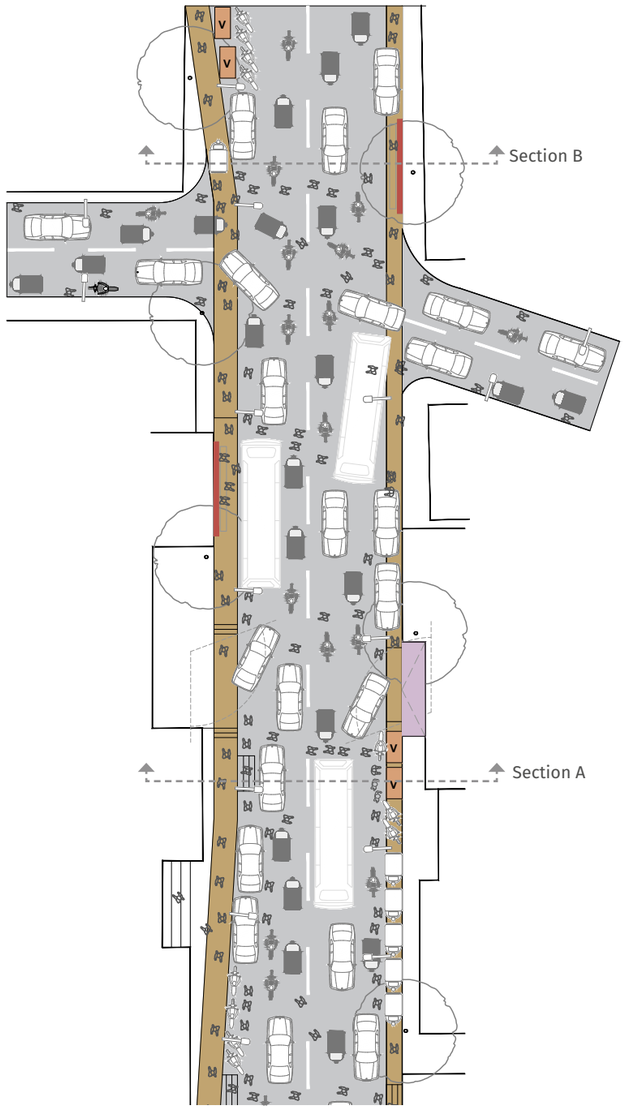
Existing Condition

Section A



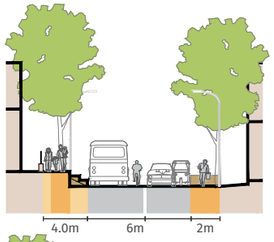
Section B



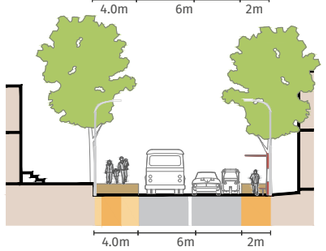


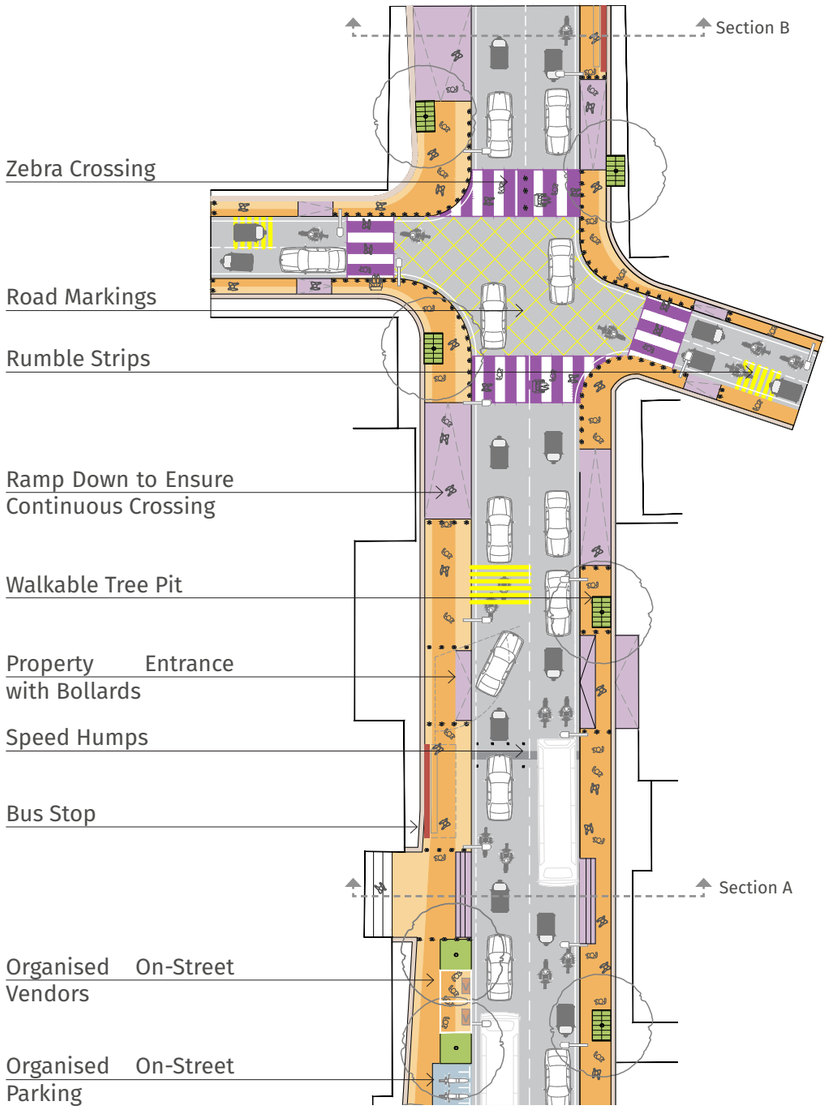
Proposed Solution

Section A



Section B

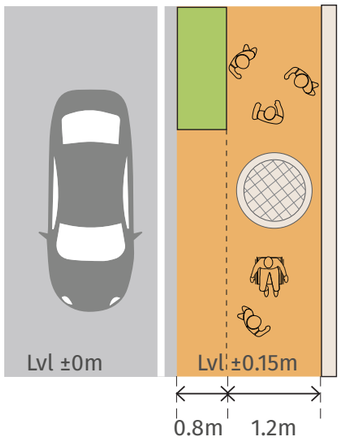


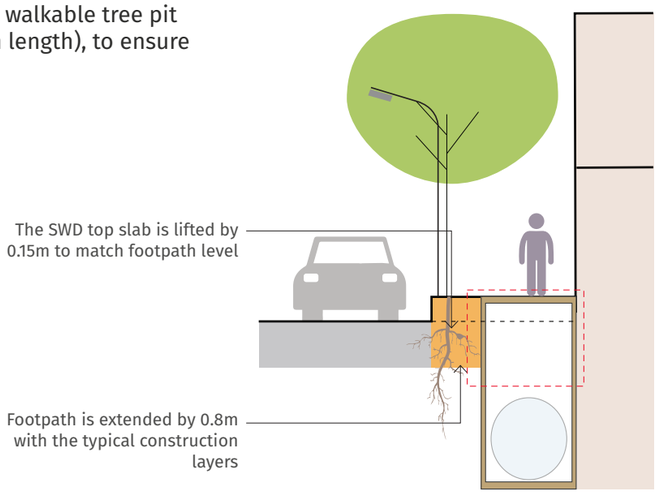


Note: Storm water drains should be designed with a finished top height of 0.15 meters. The required carrying capacity must be planned accordingly within this height constraint. The solutions provided under Scenario 2 apply only in cases where the top slab height of the storm water drain cannot be reduced. If the storm water drain height can be limited to 0.15 m, please refer to Scenario 1 for appropriate contextual solutions.

Ensuring Continuous Footpath of Minimum 2m

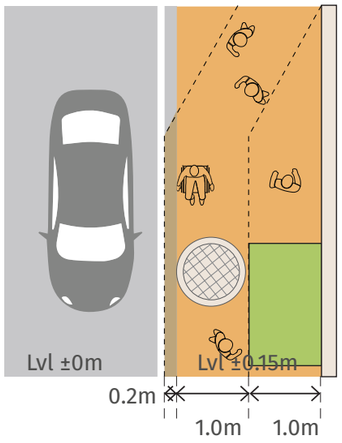
If a tree is present along the kerb edge, a walkable tree pit should be provided (0.8m width and 1.2m length), to ensure unobstructed pedestrian movement.

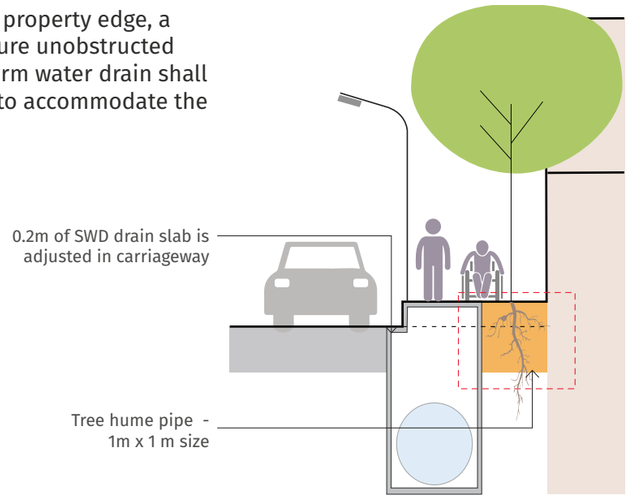




*Refer Chapter 4 & 5 for more details

In cases where the tree is present along the property edge, a walkable tree pit should be provided to ensure unobstructed pedestrian movement. In such cases the storm water drain shall be designed in the below depicted manner to accommodate the landscape and the pedestrian movement.

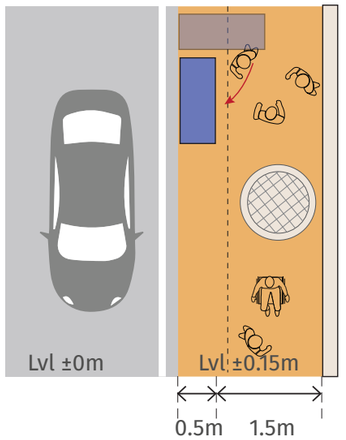


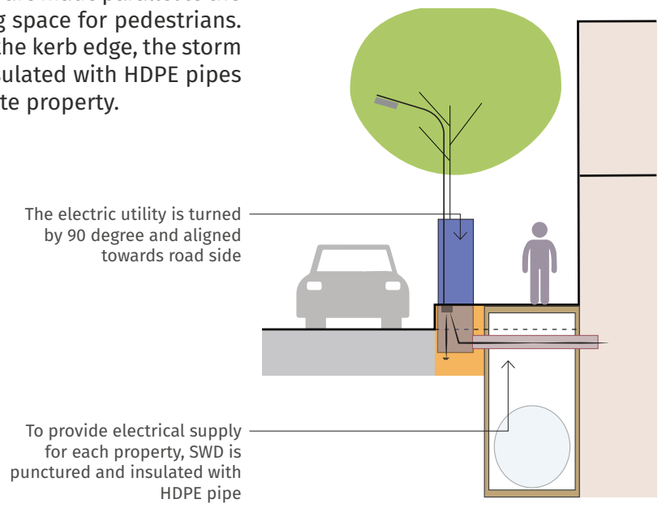


*Refer Chapter 4 & 5 for more details

Above-Ground Utility Strategies

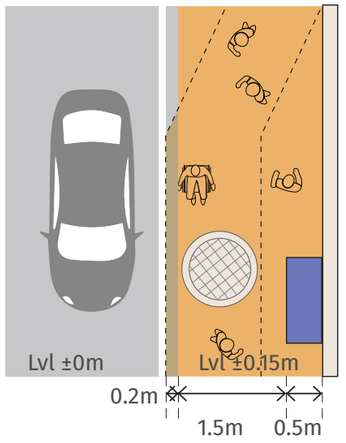
In the proposed scenario, the utility boxes are made parallel to the footpath in order to ensure clear walking space for pedestrians. Since the utility boxes are present along the kerb edge, the storm water drain should be punctured and insulated with HDPE pipes to run the necessary utilities to the private property.

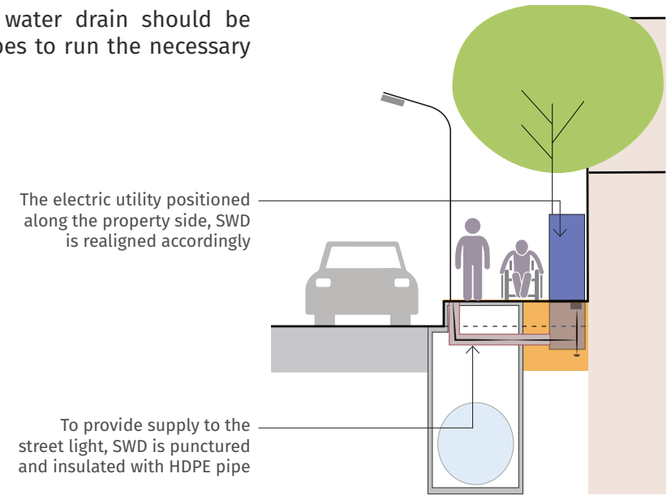




*Refer Chapter 4 & 5 for more details

In the proposed scenario, the storm water drain should be punctured and insulated with HDPE pipes to run the necessary utilities.

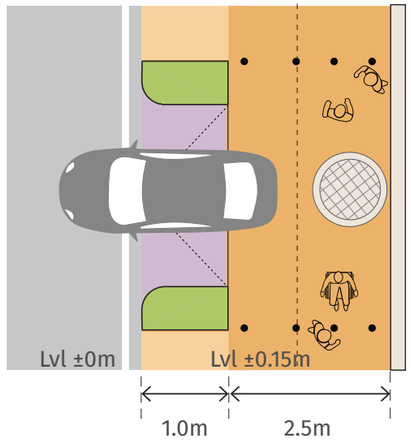


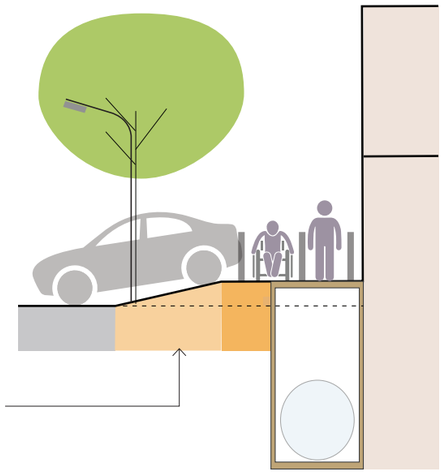


*Refer Chapter 4 & 5 for more details

Property Access Vehicular Ramps

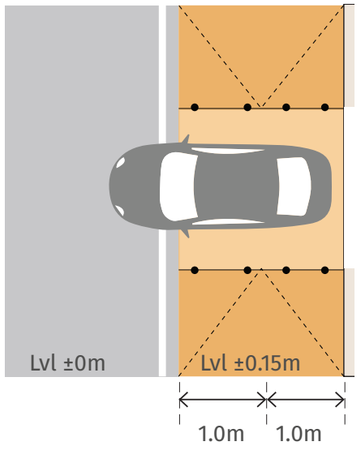
Property access ramps should be provided wherever necessary. In the instance below, due to the availability of space, the property ramp is provided in the MUZ, ensuring a clear walking space of 2m for pedestrians.

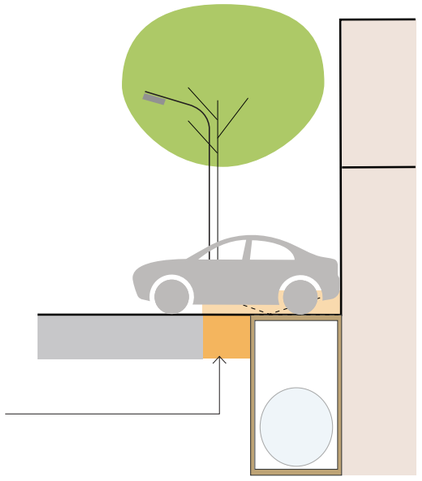




*Refer Chapter 4 & 5 for more details

In the absence of a MUZ (due to lack of space), the property ramp should be accounted within the private property. In instances where this is not possible, as shown below, the ramps are accounted for within the walking space. While this is not an ideal scenario, care must be taken to ensure that walking space is provided for pedestrians.

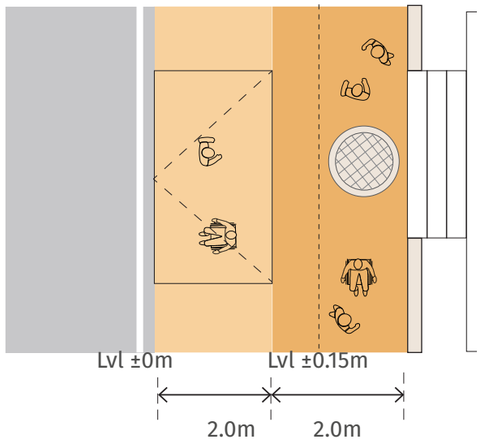


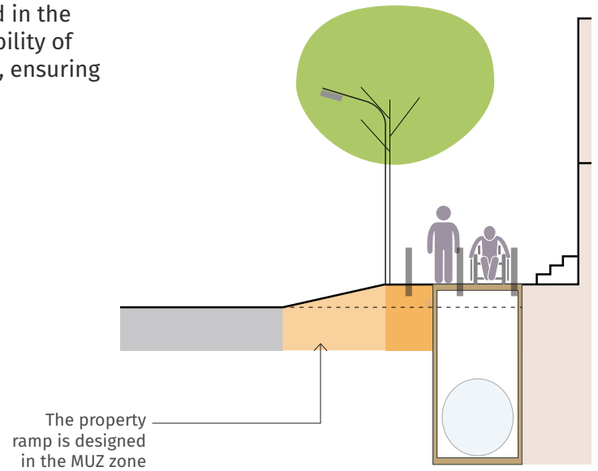


*Refer Chapter 4 & 5 for more details

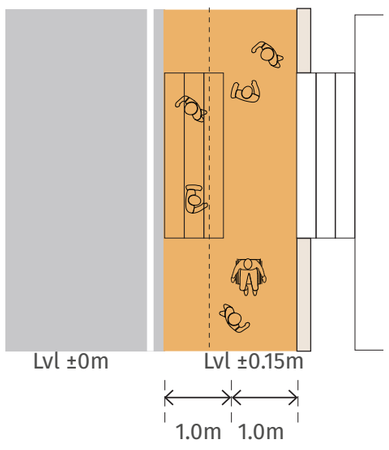
Property Access Pedestrian Stepped Entry

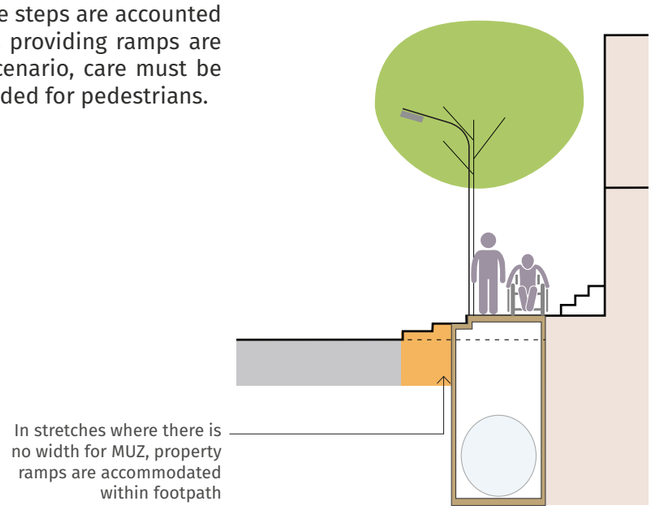
Access to the property should be accommodated in the private space. In this instance, due to the availability of space, the property ramp is provided in the MUZ, ensuring a clear walking space of 2m for pedestrians.





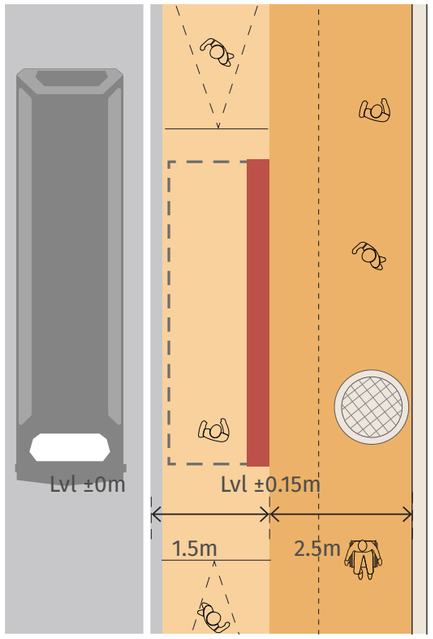
In the absence of a MUZ (due to lack of space), the stepped access to the footpath should be provided and the steps are accounted for within the walking space. In instances providing ramps are not possible. While this is not an ideal scenario, care must be taken to ensure that walking space is provided for pedestrians.

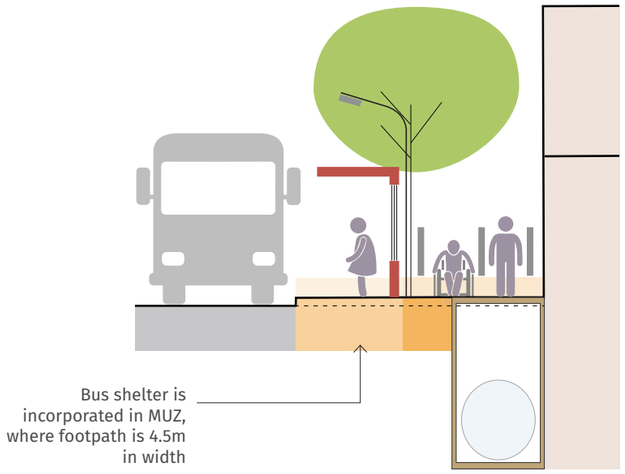




Incorporating Bus Shelter with Streets

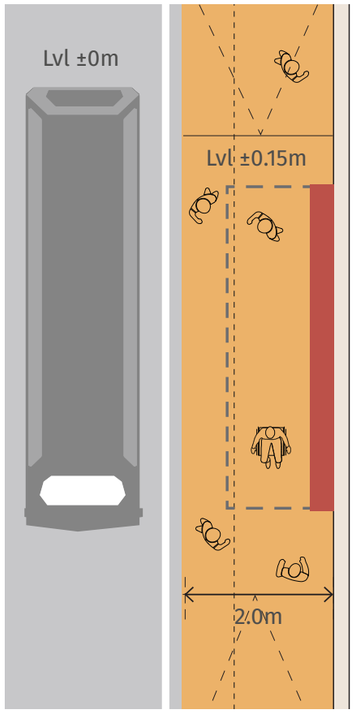
In locations where the space for footpaths greater than 4.5m, the bus stop should be provided in the MUZ, with a clear walking space behind the bus stop.

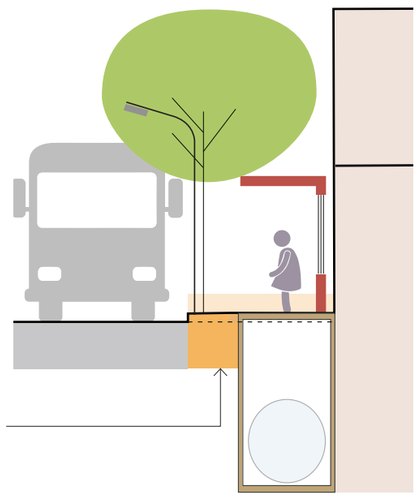




*Refer Chapter 4 & 5 for more details

In locations where the space for footpaths is less than 4.5m, the bus stop should be provided along the property edge to ensure sufficient walking space for pedestrians.

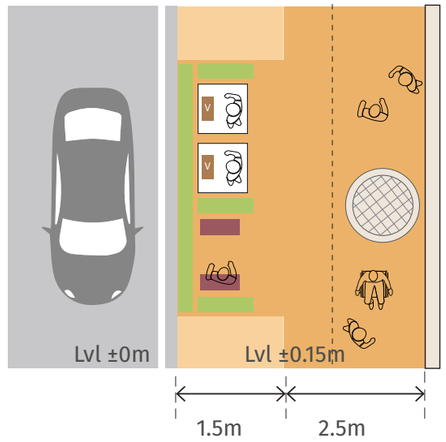


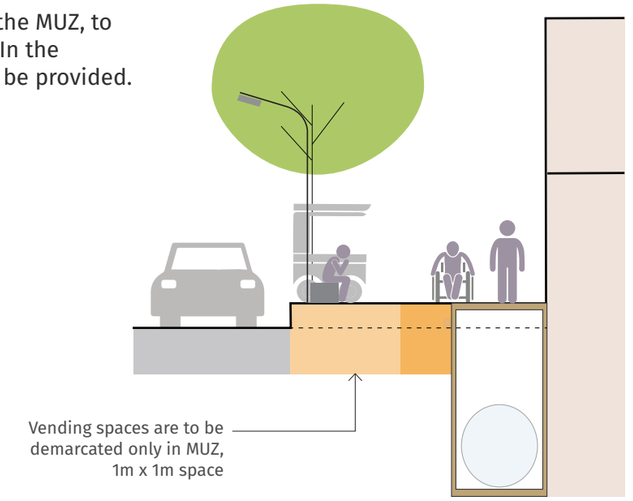


*Refer Chapter 4 & 5 for more details

Accommodating Vending and Parking in MUZ

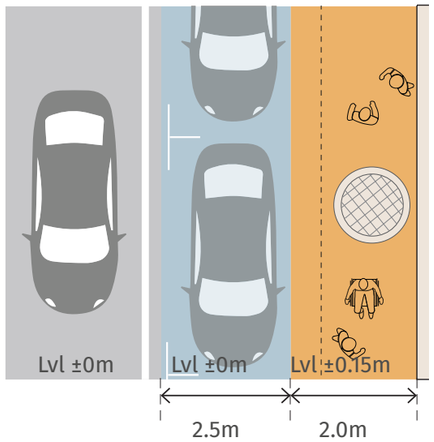
Vending spaces should be provided only in the MUZ, to ensure clear walking space for pedestrians. In the absence of MUZ, vending spaces should not be provided.

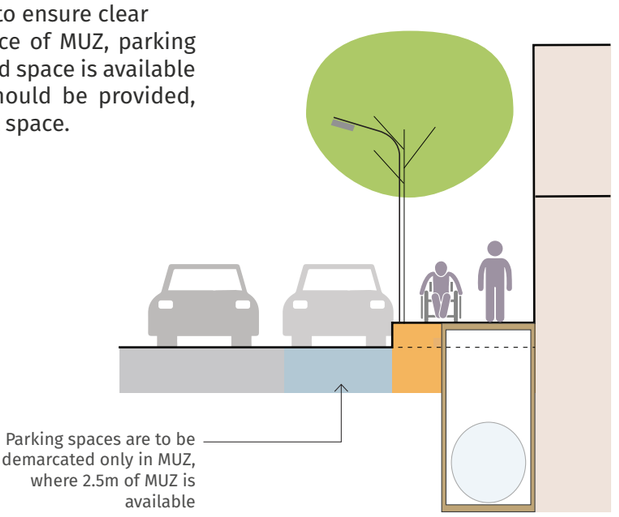




*Refer Chapter 4 & 5 for more details

Parking should be provided only in the MUZ, to ensure clear walking space for pedestrians. In the absence of MUZ, parking should not be provided. In cases where limited space is available for the MUZ, parallel parking orientation should be provided, without compromising on pedestrian walking space.





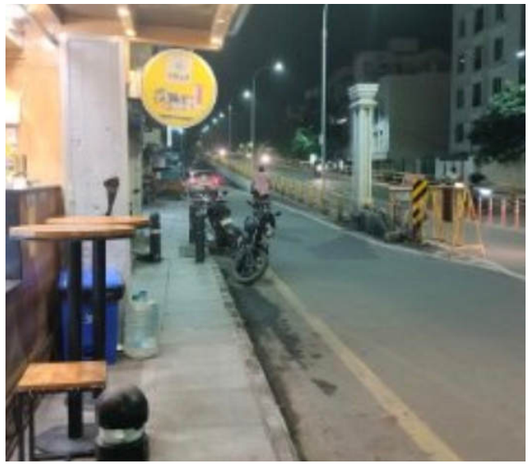
*Refer Chapter 4 & 5 for more details

Existing Condition - Scenario 3



Lack of pedestrian space

The street includes a flyover, with a 1 m wide footpath provided on either side at ground level for pedestrian access. The narrow width makes it difficult for pedestrians to walk side by side. The street is especially restrictive for persons with disabilities.



Commercial spillover on footpath

The already limited footpath is frequently encroached upon by shops and vending activities, forcing pedestrians to step onto the carriageway and navigate through traffic.



Encroached below-the-flyover spaces

The space beneath the flyover is primarily used for vehicular U-turns and parking. This often results in chaotic traffic movement and congestion on either side of the flyover, making the environment below unsafe and uncomfortable for pedestrians, especially when crossing.



Undesigned junctions under the flyovers

A four-arm junction lies beneath the flyover. One of the perpendicular arms includes a central median but lacks pedestrian refuge islands. This makes street crossing difficult and unsafe, particularly during peak traffic hours.

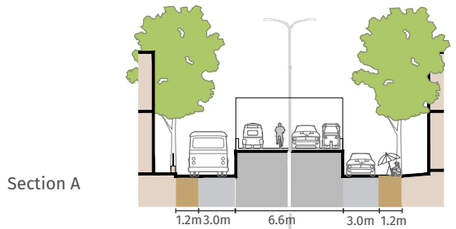

Grand Southern Trunk Road, Pallavaram Source: ITDP India

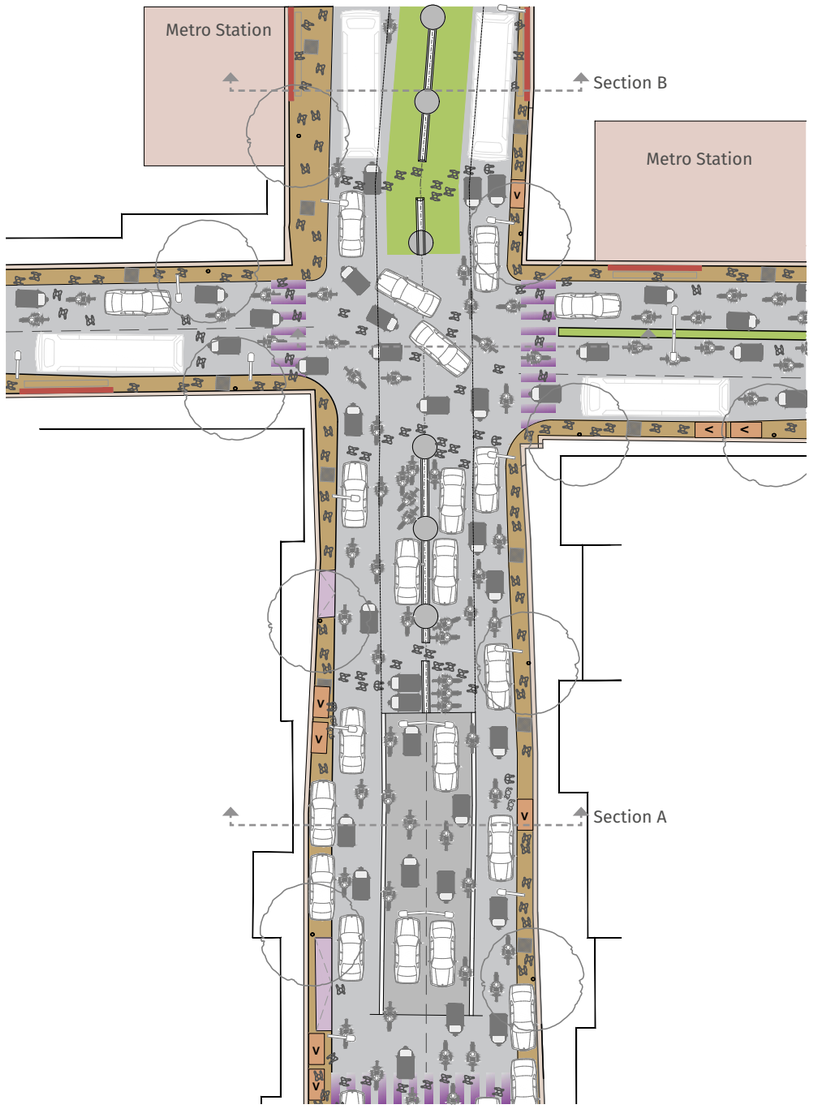


Unsafe first and last mile access

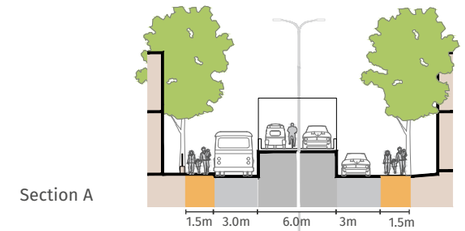
An under-ground metro station is located adjacent to the flyover. The footpath is limited in width and sees significant pedestrian use due to the volume of people accessing the metro. The lack of adequate walking space and safe crossing points creates an unsafe environment for commuters moving between the metro, bus stops, and nearby commercial areas.

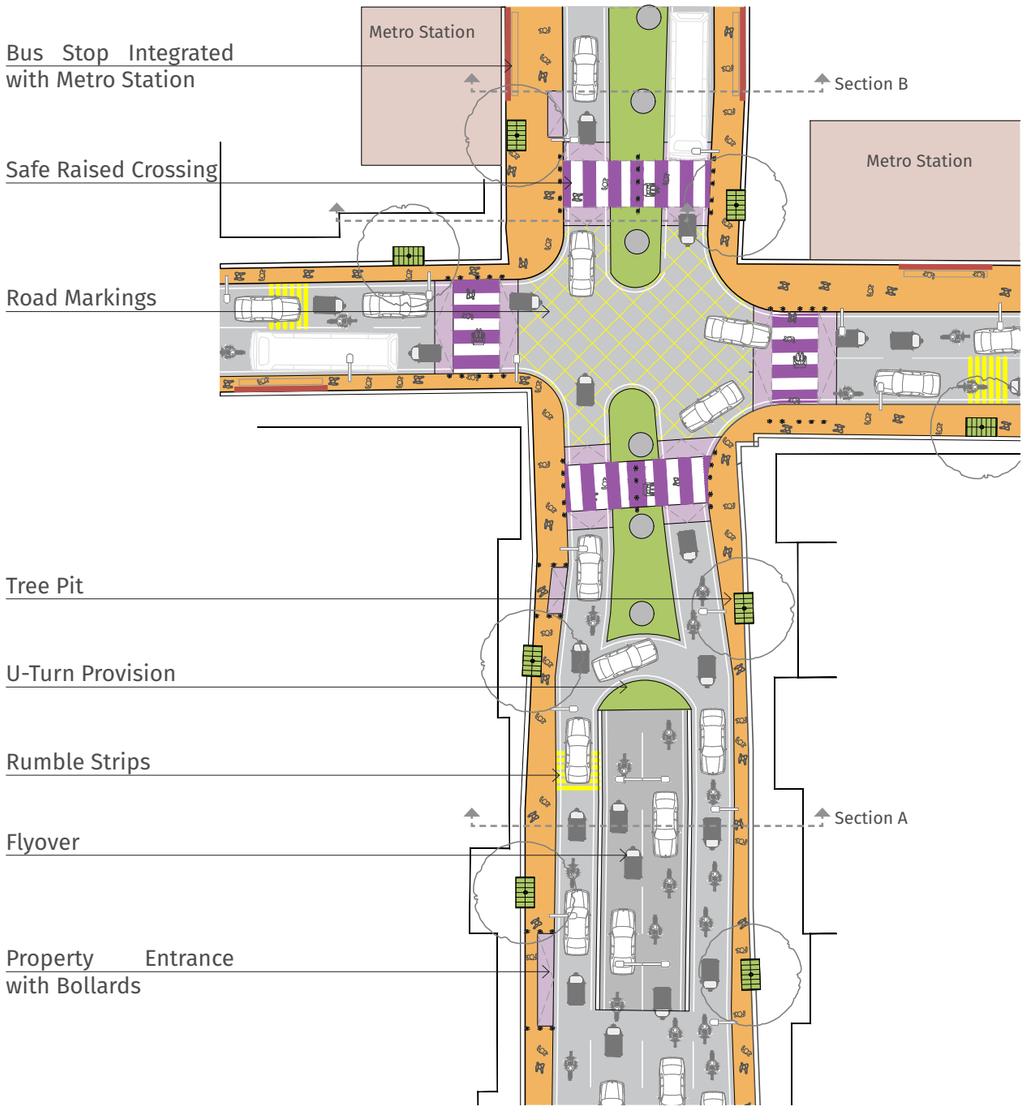
Existing Condition





Proposed Solution





J. M. Road, Pune

6

Material Palette

6.1. Materials

6.1 Materials

Materials play an important role in deciding the usability of design. Good materials go hand-in-hand with the design and help achieve the intended purpose of various street elements. Material selection should be an on-going process through the different stages of design. To ensure appropriate budget allocation and longevity of street elements, it is important to select materials that are durable and easy to maintain.



Aundh D. P. Road, Pune

Materials used in the streets should be:

- Easy to install
- Easy to procure
- Durable
- Cost-effective in maintenance
- Easy to clean
- Easy to dismantle and repair
- Highly resistant to vandalism
- Slip resistant

6.1.1 Flooring Finish

There are three types of flooring finish:
- Unit paving: Natural stone
- Unit paving: Manufactured
- Cast-in-situ

Flooring finish should be selected such that it is adaptable to different weather conditions and suitable as per universal accessibility requirements.


Aundh D. P. Road, Pune

6.1.1.1 Unit paving: Natural stone


S. M. Street, Kozhikode

Stone blocks

Pros
- Highly durable, less prone to weathering; 80mm thick stone blocks can be used for bearing vehicular load as well
- Can be laid in variety of design patterns
- Easy to dismantle for future repairs

Cons
- Expensive; heavy to transport
- Results in uneven surface and sinking if sub-base is not prepared with care
- Prone to dismantling if kerbs are not installed properly

Application
On carriageways for slowing traffic, landscaped zones, shared streets, at entries for gates and ramps; avoided on footpath due to its highly undulated surface



Harrington Road, Chennai

Stone slabs/tiles

Pros
- Thicker slabs are durable; less prone to weathering
- Can also be used as cladding or seating to compliment the pavement finish

Cons
- Expensive and heavy
- Thinner slabs prone to breakage if mishandled or dropped
- Labour-intensive to install
- Slippery during rains if polished
- Results in uneven surface and sinking if sub-base is not prepared with care

Application
Sandblasted/leather finished stone on footpath - generally in select projects; not recommended on cycle tracks and load-bearing areas.

Cement tiles

Pros
- Cost-effective
- Lighter than stone tiles, stone/concrete pavers
- Available in different textures, colours, designs, patterns, and shapes

Cons
- Prone to breakage if mishandled or dropped
- More labour-intensive to install than PCC finish
- Slippery during rains if without anti-skid studs
- Results in uneven surface and sinking if the base is not prepared with care
- Prone to dismantling if moisture retains in the surface

Application
On footpaths, especially tactile flooring; not recommended on parking bays and cycle tracks.



6.1.1.2 Unit paving: Manufactured

Concrete blocks

Pros
- Variety of sizes, colours, and patterns available
- Cost-effective
- Easier to install than stone slabs
- Anti-skid due to rough surface

Cons
- Results in uneven surface and sinking if the base is not prepared with care
- Un-chamfered edges may lead to chipping of blocks
- May become pigmented and slippery due to growth of moss on constant exposure to water

Application
On footpaths, parking bays, and carriageways to control speed; not recommended on cycle tracks.


J.M Road, Pune


J. M. Road, Pune

Permeable concrete blocks

Pros
- Offers a porous surface that enables water percolation
- Variety of sizes, colours, and patterns available
- Cost-effective
- Easier to install
- Anti-skid due to rough surface

Cons
- Improper composition of the material can result in loss of durability
- Requires regular cleaning to avoid blockage due to oil and dust
- Results in uneven surface and sinking if the base is not strong and stable

Application
On footpaths, parking spots, plazas.


Pinjala Subramaniam Street, Chennai

Interlocking tiles

Pros
- Variety of sizes, colours, and patterns available
- Cost-effective
- Easier to install than stone slabs
- Anti-skid due to rough surface
- Easy to replace few tiles without removing all

Cons
- Results in uneven surface and sinking if the base is not prepared with care
- More labour-intensive to install than PCC finish
- Prone to dismantling if moisture retains in the surface
- May become pigmented and slippery due to growth of moss on constant exposure to water

Application
On footpaths and parking bays; not recommended on cycle tracks.

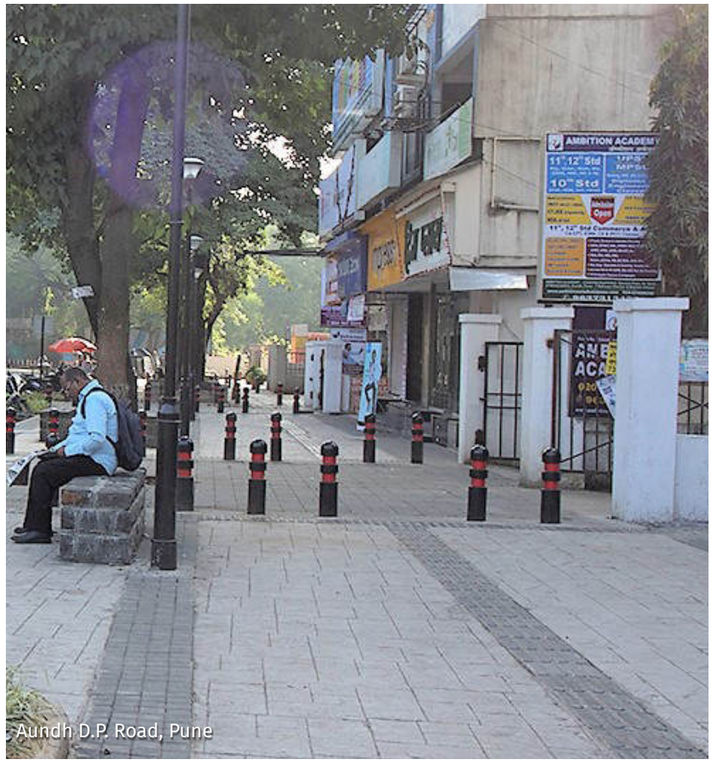
6.1.1.3 Cast-in-situ

PCC stamped concrete

Pros
- Variety of stencils available
- Monolithic surface; does not start dismantling like pavers
- Uniform finish
- Easy to clean and maintain

Cons
- Stamping too deep may disrupt wheelchair movement
- Expansion joints should be provided to prevent cracking
- Has to be demolished in case of future repairs of underground utilities
- Need additional care during curing to avoid paw-prints

Application
On footpaths, landscaping, plazas; intricate stencils not recommended for cycle track.


Aundh D.P. Road, Pune


J. M. Road, Pune

Rubberised floor finish

Pros
- EPDM rubber surface helps in impact absorption
- Reduces the risk of permanent injury by cushioning the fall
- Highly durable, less prone to weathering
- Offers permeability
- Available as tiles, easy to install

Cons
- Comparatively expensive
- Seams are prone to vandalism and staining

Application
In play areas for children, on the footpaths.

6.1.2 Cycle Track

The two of the most widely used materials for cycle tracks:
- Asphalt
- Concrete

When selecting materials for cycle tracks, factors such as climate, maintenance, and traffic load, play a major role. Cycle tracks should be colored to make them visually distinct from other street elements, ensuring clear visibility and safety for all road users.


F. C. Road, Pune

PCC Pigmented Concrete

Pros
- Adds colour to the street
- Can be combined with other finishes for variations in design
- Relatively quick to install
- Monolithic surface; does not start dismantling like pavers
- Uniform finish
- Easy to clean and maintain

Cons
- Colour wears off with time resulting in a dull look
- Expansion joints should be provided to prevent cracking
- Has to be demolished in case of future repairs of underground utilities
- Need additional care during curing to avoid paw-prints

Application
Generally used to differentiate between functions for instance pigmented concrete on cycle track.

PCC broom finish

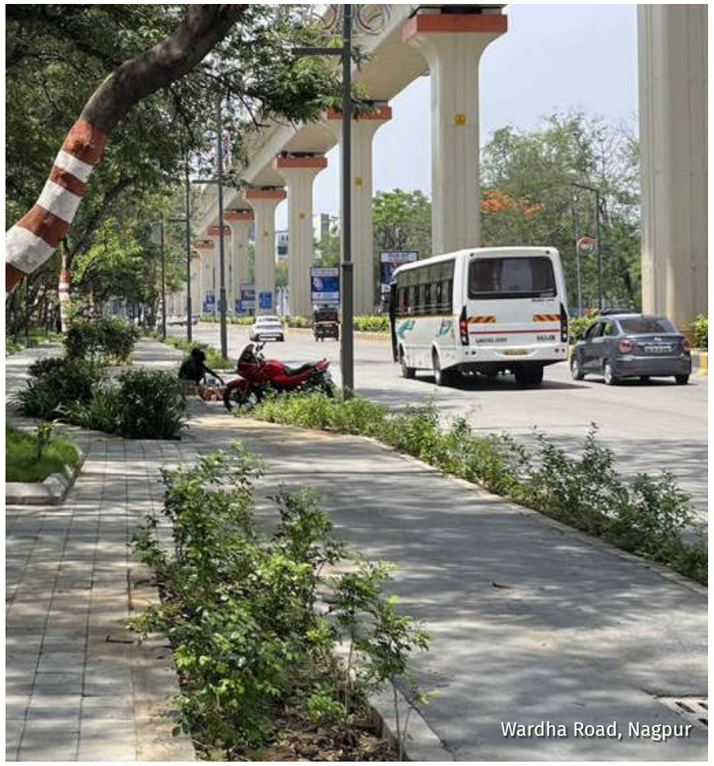
Pros
- Relatively quick to install
- Grooves provide sufficient grip
- Cheaper than other PCC finishes
- Monolithic surface; does not start dismantling like pavers
- Uniform finish

Cons
- Finish has to be even to avoid poor cycling experience
- Looks fairly plain
- Expansion joints should be provided to prevent cracking
- Has to be demolished in case of future repairs of underground utilities
- Need additional care during curing to avoid paw-prints

Application
On footpaths, cycle tracks, parking bays, and carriageways.


F. C. Road, Pune


Cycle Track in Pune


Wardha Road, Nagpur

Asphalt

Pros
- Smooth surface, providing a comfortable ride for cyclists
- Quick to install and cost-effective compared to concrete
- Flexible, reducing the risk of cracking under minor ground movements
- Easy to repair and maintain

Cons
- Less durable in extreme weather conditions (e.g., softens in heat, cracks in cold)
- Requires regular maintenance, especially in high-traffic areas
- Non-permeable, which can lead to water logging during heavy rains


Linear Garden Road, Pimpri Chinchwad

Concrete (M30)

Pros
- Highly durable and long-lasting, suitable for heavy traffic and high-load areas
- Resistant to weathering, including heat and UV radiation
- Low maintenance once installed
- Can be textured or colored for better visibility and aesthetics

Cons
- Higher initial cost and longer installation time
- Rigid surface can be uncomfortable for cyclists in case of falls
- Prone to cracking if not designed properly (e.g., lack of expansion joints)
- Non-permeable, requiring proper drainage systems

6.1.3 Bollards

There are four preferred types of materials used for bollards:
- Pigmented RCC
- Stone
- Galvanised iron
- Stainless steel

Bollard material should be robust for easy maintenance especially owing to high numbers.



Harrington Road, Chennai



S. M. Street, Kozhikode

Pigmented RCC

Pros
- Pigment added to concrete mixture results in homogeneity, as opposed to painted bollard
- Cost-effective
- Lighter than stone bollards, making it easier to handle
- Can be cast in different shapes as per design

Cons
- Tends to chip off with time
- Lighter colours fade off with time leading to dull look


Harrington Road, Chennai

Stone

Pros
- Durable

Cons
- Tends to break at the grooves
- Expensive

Galvanised iron

Pros
- Cost-effective compared to stone bollards
- Lighter than stone bollards, making it easier to handle
- Can be fabricated in different shapes as per design

Cons
- Paint tends to chip off
- More expensive than RCC bollards

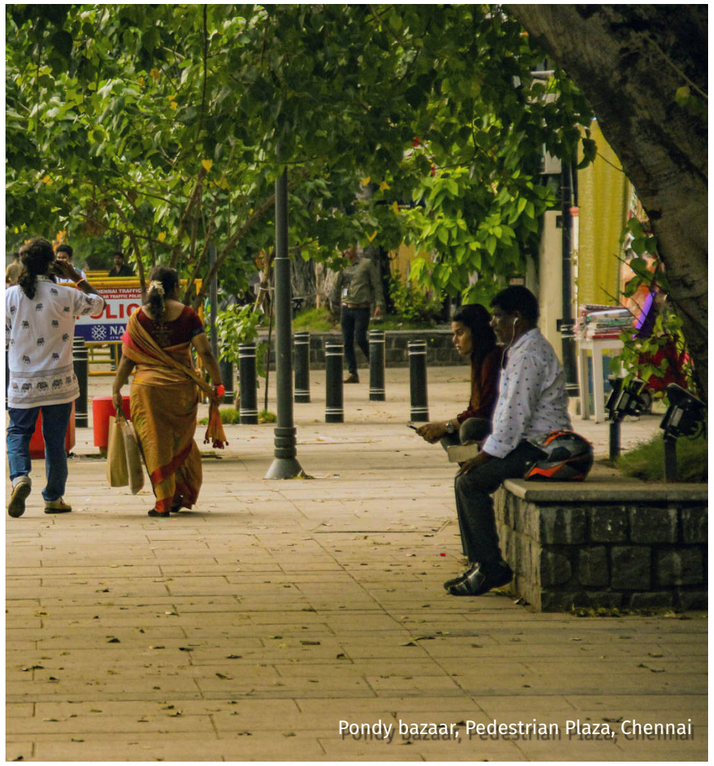

Church Street, Bengaluru

Stainless steel

Pros
- Cost-effective compared to stone bollards
- Lighter than stone bollards, making it easier to handle
- Easy to clean and maintain due to smooth surface

Cons
- Limited in shape - generally available only as pipes
- Less aesthetic as compared to other types of bollards


Source: Wikimedia Commons


Pondy bazaar, Pedestrian Plaza, Chennai

Stone

Pros
- Highly durable, less prone to weathering
- Does not chip away easily

Cons
- Expensive
- Labour-intensive to install

6.1.4 Seating

There are four preferred types of seating materials:
- Stone
- Precast concrete
- Metal
- Fibre reinforced polymers

Seating material should be selected such that it provides comfort in all weather conditions.


J. M. Road, Pune


Pondy bazaar, Pedestrian Plaza, Chennai

Precast concrete

Pros
- Cost-effective
- Can be cast in different shapes as per design
- Pigmented concrete mixture results in homogeneity, as opposed to painted seats

Cons
- Tends to chip off with time
- If painted, colour chips off with time

Metal

Pros
- Can be fabricated with varying degrees of ornamentation; highly suited for traditional design themes
- Durable
- Less prone to weathering

Cons
- Becomes easily hot or cold depending on outside temperature, making it uncomfortable to use
- Hard and not comfortable to use for long; preferred to avoid squatters
- Paint tends to chip off
- Rusts with time
- Prone to theft

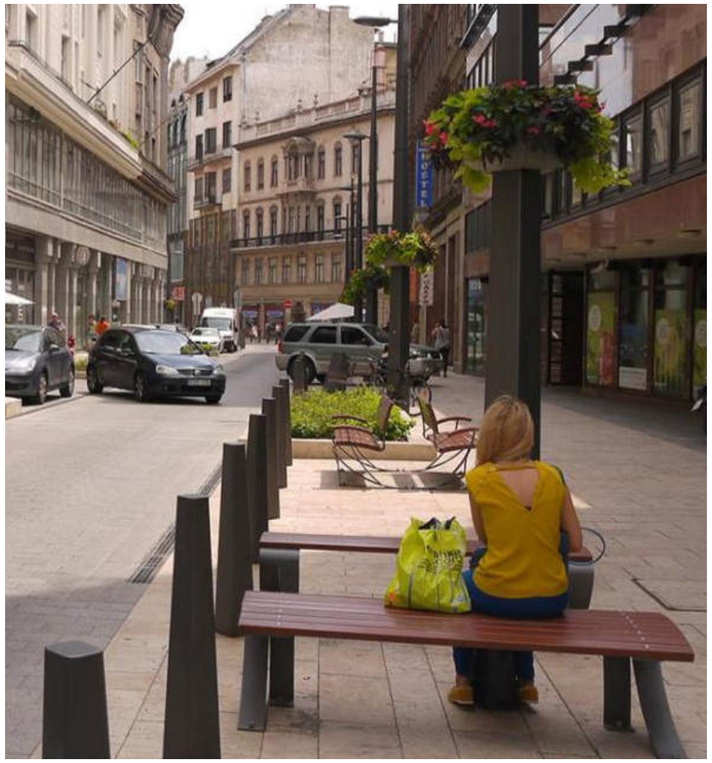


Source: Wikimedia Commons

Fibre reinforced polymers (FRP)

Pros
- Can be cast in different shapes as per design
- Pigment added to FRP mixture results in homogeneity, as opposed to painted seats
- Can be made translucent, providing for embedded lighting options
- Durable, being plastic in nature

Cons
- Expensive
- Relatively difficult to source, owing to fewer FRP vendors dealing with seating



6.1.5 Schedule of Rates

Schedule of Rates (SoR) provides standardised unit rates for materials, labour, and construction activities issued by the government or ULB.

Key challenges and considerations when revising SoR and designing streets

- **Missing proposed design elements in SOR:**Aat times, Standard SoR items do not reflect the materials, detailing, or quality requirements of proposed street designs, leading to compromises or cost distortions.
- **Incorporating new materials and technologies:** Emerging elements such as modular pavers, compact utilities, smart poles, or advanced drainage systems require new rate items and specifications that are not yet included in current SoR lists.
- **Dynamic vs static rate structures:** Street design elements evolve quickly, while SoRs are updated annually, causing delays in adoption of innovative solutions and forcing reliance on non-scheduled items.
- **Institutional coordination:** Effective revision requires alignment between multiple agencies—ULBs, Highways, utilities—so that common specifications and compatible rate items can be applied across projects.
- **Capacity building:** Engineers, planners, and procurement teams need orientation on new materials, construction techniques, and quality benchmarks to ensure correct interpretation and implementation of updated SoR items.

Estimating costs for non-SoR items

When a design element is not listed in the existing Schedule of Rates (SoR), its cost must be established through transparent and consistent market assessment:

- Collect a minimum of three quotations from authorised vendors or contractors to determine a realistic market rate.
- Document specifications clearly (material type, size, finish, installation method) to ensure comparable quotes.
- Use the average or the most reasonable quote—based on quality, warranty, and compliance—to estimate project costs.
- Submit these rates for approval as Non-Schedule Items (NSI) during DPR preparation or tendering.
- Recommend incorporation into the next SoR revision if the item is recurrent or essential, ensuring it becomes a standard approved item for future projects.

Recommended frequency of revision

- Annual major revision – once every year (mandatory)
- Mid-year minor corrections – once in 6 months (if market rates fluctuate >5–10%)
- Special revisions whenever new materials or tech are introduced, IRC standards or city street guidelines change, or when there is a change in policy mandates like green infrastructure and accessibility.

From SoR to BOQ: How it works

- BOQ (Bill of Quantities) uses these SoR items to calculate project-specific quantities and costs based on the approved street design and drawings.
- Designers and estimators map each design element's construction items (for example, earthwork excavation for footpaths, cutting bituminous concrete/cement concrete surface etc) to the closest relevant SoR item.
- If an element is not available in the SoR, it is added as a Non-SoR/NSI item, with rates determined as mentioned above.

The BOQ then lists the following: Item description (as per SoR/NSI); Unit (sqm, rmt, nos., etc.); Quantity (from drawings); Rate (from SoR or NSI); and Amount (Quantity × Rate).

The final BOQ becomes the foundation for tendering, budgeting, and contract execution, ensuring transparency and uniformity.



Chennai

7

Resource and References

References

Indian Roads Congress Guidelines [1]

The Indian Roads Congress (IRC) was set up by the Government of India in consultation with the State Governments in December, 1934 and is a registered society under the Registration of Society Act.

Following are the documents referred for this publication:

1. IRC:35-2015 Code of Practice for Road Markings
2. IRC:70-2017 Guidelines on Regulation and Control of Mixed Traffic in Urban Areas (First Revision)
3. IRC:86-2018 Geometric Design Standards for Urban Roads and Streets (First Revision)
4. IRC:92-2017 Guidelines for the Design of Interchanges in Urban Areas (First Revision)
5. IRC:98-2011 Guidelines on Accommodation of Utility Services on Roads in Urban Areas (Second Revision)
6. IRC:99-2018 Guidelines for Traffic-Calming Measures in Urban and Rural Areas (First Revision)
7. IRC:SP:12-2015 Guidelines for Parking Facilities in Urban Roads' (First Revision)
8. IRC:SP:50-2013 Guidelines on Urban Drainage (First Revision)
9. IRC:67-2022 Code of Practice for Road Signs (Fourth Revision)
10. IRC:SP-110-2017 Application of Intelligent Transport System for Urban Roads
11. IRC:SP:111-2017 Capacity Building of Road Agencies In Charge of Implementation of Road Projects in Urban Areas
12. IRC:SP:117-2018 Manual on Universal Accessibility for Urban Roads and Streets
13. IRC:SP:118-2018 Manual for Planning and Development of Urban Roads and Streets
14. IRC:SP:119-2018 Manual of Planting and Landscaping of Urban Roads
15. IRC:SP:128-2020 Guidelines for Urban Road Manual
16. IRC:103-2022 Guidelines for Pedestrian Facilities (Second Revision)
17. IRC:11-2015 Recommended Practice for the Design and Layout of Cycle Tracks (First Revision)
18. IRC:SP-88- 2019 Manual on Road Safety Audit (First Revision)
19. Morth 250-2013 Specification for Road and Bridge Works
20. IRC: 65: 2017 Guidelines for Planning and Design of Roundabouts
21. IRC:SP: 32 Road Safety Manual For Schools
22. IRC: SP: 42 Guideline for Road Drainage
23. IRC SP 90: 2010 Manual for Grade Separator and Elevated Structures
24. IRS 37: 2018 Guidelines for the Design of Flexible Pavements (Fourth Revision)
25. IRC 58: 2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision)

Harmonised Guidelines and Standards for Universal Accessibility in India 2021 [2]

The Harmonised Guidelines 2021 intend to be used as a reference for various stakeholders of built environment including the State Governments, the Development Authorities, the Planning Organisations, and Private Sector. The Harmonised Guidelines for Universal Accessibility shares a vision for a universally accessible and inclusive India.

The Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014 [3]

Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014 is an Act of the Parliament of India. This Act was drafted with the legislative intent of protecting the livelihood rights of street vendors as well as regulating street vending through demarcation of vending zones and laying out conditions/restrictions for street vending.

Motor Vehicles Act [4]

The Motor Vehicles Act, 1988 is an Act of the Parliament of India, which regulates all aspects of road transport vehicles. The Act came into force from 1 July 1989.

The Act provides in detail, the legislative provisions regarding licensing of drivers/ conductors, registration of motor vehicles, control of motor vehicles through permits, special provisions relating to State Transport Undertakings, traffic regulation, insurance, liability, offences, and penalties, etc.

Disabilities Act [5]

The Rights of Persons with Disabilities Act fulfils the obligations to the United National Convention on the Rights of Persons with Disabilities (UNCRPD), to which India is a signatory.

The guidelines, prepared by the Ministry of Urban Development are comprehensive guidelines, inclusive of all provisions updated and harmonised to act as an easy reference to Practitioner's Guide for Barrier Free Designs.

The National Urban Transport Policy (April 2006) [6]

It was approved by the Government of India to tackle urban mobility issues. It provides for integrated land use and transport plans in cities, coordinated planning for urban transport, people oriented equitable allocation of road space, capital support in the form of equity participation and/or viability gap funding, innovative financing, dedicated urban transport funds, NMT, car restraint measures, clean fuel and vehicle technology, private sector participation, and pilot projects in cities to establish models of best practices.

UTTIPEC Guidelines for Street Design [7]

As per the recommendations of National Urban Transport Policy, DDA, Delhi has notified Unified Traffic and Transportation Infrastructure (Plg. and Engg.) Centre (UTTIPEC) to enhance mobility, reduce congestion, and to promote traffic safety by adopting standard transport planning practices.

Recently UTTIPEC has published street design guidelines to promote sustainable transportation system in the city of Delhi.

Global Street Design Guide, NACTO [8]

Originally a program of NACTO, the Global Designing Cities Initiative (GDCI) was founded in 2014 by Janette Sadik-Khan, operating under the guidance of Director Skye Duncan.
The Global Street Design Guide is supporting practitioners to redefine the role of streets in cities around the world. Created with the input of experts from 72 cities in 42 countries, the Guide offers technical details to inform street design that prioritises pedestrians, cyclists, and transit riders.

The Sponge Handbook: Chennai [9]

The Sponge Handbook: Chennai is designed to be a guiding document to align regional planning priorities and neighbourhood planning processes with the hydrological cycle of Chennai's basins.
The handbook uses the Buckingham Canal area to demonstrate how the Sponge Basin framework can lead to the re-imagination of urban neighbourhoods, transit stations, open spaces, streets, and the rejuvenation of multi-functional infrastructures like the canal itself.

Streets for Pandemic Response and Recovery NACTO [10]

This resource aggregates and synthesizes emerging practices in transportation and street design in response to the COVID-19 pandemic. It highlights cities' current efforts to re-organize streets to best manage this crisis and support economic recovery. This evolving resource is not a comprehensive list of options, nor is it calibrated for the needs of a specific community; every city should assess local context and need, as well as the trajectory of the pandemic in the community, to inform a response and implementation strategy.

Urban Street Design Guidelines [11]

Pune has developed 'Urban Street Design Guidelines' to ensure that appropriate street types and design elements are implemented to create better streets for people. The Urban Street Design Guidelines give an overview of various elements that go into designing streets making them universally accessible, and also provide standard templates for different sizes and uses of streets. It provides a mandate for PMC engineers and planners for designing and executing streets to meet local needs, avoiding a one-size-fits-all approach.

Street Design Guidelines for Bhubaneswar, 2021 [12]

The Street Design Guidelines for Bhubaneswar intend to provide a step-by-step approach to formulating a Complete Street. Designing for Complete Streets is an exercise that acknowledges the needs and limitations of each user group and their interaction with the others. This manual gives guidelines regarding the designing of street for appropriate allocation of spaces and general specifications for various elements of the street. It is recommended to refer to IRC guidelines for technical engineering aspects regarding technology and construction procedure.

Designing Streets for Kids

This document by the Global Designing Cities Initiative, captures international best practices, strategies, programs, and policies that cities worldwide have used to design spaces that enable children of all ages and abilities to utilise cities' most abundant asset – streets. The guide includes design recommendations and case studies that highlight streets that are safe, enjoyable, and inspirational for children and caregivers.

Building Neighbourhoods to Thrive In - Design Guidelines

The Bernard van Leer Foundation (BvLF), the Ministry of Housing and Urban Affairs and the National Institute for Urban Affairs in India, and BDP, one of Europe's largest interdisciplinary design-led firms have compiled a series of five publications that will help Smart Cities in India to create infant, toddler and caregiver (ITC)-friendly neighbourhoods. This document looks at key features of pedestrian-oriented public spaces and offers insights into what ITCs need from those features.

Integrating Safety into Road Design

This global document published by the World Bank provides guidance on safety-related issues for street design in urban and rural settings, especially for low and middle-income countries (LMICs) around the world. Referencing this document will help the reader understand the nuances of road safety and how these can be applied in the context of school zones.



West Avenue, Chennai

