# ETHIOPIA URBAN STREET DESIGN MANUAL

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MINISTRY OF TRANSPORT AND LOGISTICS

ETHIOPIAN ROADS AUTHORITY

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# Contents


**1 Introduction ..... 1**

1.1. Principles of complete street design ..... 1

1.2. Scope and application of the manual ..... 6

1.3. Revision of the manual ..... 6

**2 Street network planning ..... 9**

2.1. Functions of a street network ..... 9

2.2. Street classification ..... 11

2.3. Network design ..... 14

2.4. Street orientation ..... 18

**3 Street elements ..... 21**

3.1. Footpaths ..... 22

3.2. Crossings ..... 29

3.3. Cycle tracks ..... 32

3.4. Riverside developments ..... 36

3.5. Bus rapid transit ..... 38

3.6. Bus and taxi stops ..... 41

3.7. Bus terminals ..... 44

3.8. Carriageways ..... 46

3.9. Medians ..... 48

3.10. Street trees and landscaping ..... 49

3.11. Vending ..... 52

3.12. Street lighting ..... 54

3.13. Street furniture ..... 56

3.14. Street signs and signals ..... 59

3.15. Public toilets ..... 62

3.16. Storm water ..... 63

3.17. Underground utilities ..... 66

3.18. Service lanes ..... 68

3.19. Parking ..... 69

3.20. Traffic calming ..... 71

3.21. Street enclosure ..... 73

4 Intersections ..... 75
4.1. Intersection typologies ..... 75
4.2. Intersection control ..... 76
4.3. Geometry ..... 77
5 Templates for street cross sections ..... 89
6 Planning and design process ..... 161
6.1. Preliminary study ..... 161
6.2. Stakeholder consultations ..... 161
6.3. Preparation of design TOR ..... 162
6.4. Data collection ..... 162
6.5. Street design preparation ..... 164
6.6. Integration ..... 165
6.7. Review and approval ..... 165
6.8. Tendering, contract award, administration, construction, and handover ..... 165
6.9. Operation and maintenance ..... 165
7 Appendices ..... 167
7.1. Height clearance and air rights ..... 167
7.2. Design vehicles ..... 168
7.3. Special streets ..... 169
7.4. Construction materials ..... 170
7.5. Colour coding and presentation ..... 172
8 References ..... 175
9 Definitions ..... 177

# Acronyms

| | |
|---|---|
| **AACRA** | Addis Ababa City Roads Authority |
| **AADT** | Annual average daily traffic |
| **BRT** | Bus rapid transit |
| **CS** | Collector Street |
| **ERA** | Ethiopian Roads Administration |
| **ISO** | International Organisation for Standardization |
| **LDP** | Local Development Plan |
| **LRT** | Light rail transit |
| **LS** | Local Street |
| **MOTL** | Ministry of Transport and Logistics |
| **MSE** | Micro and small-scale enterprises |
| **MUI** | Ministry of Urban and Infrastructure |
| **NDP** | Neighbourhood Development Plan |
| **NMT** | Non-motorised transport |
| **PAS** | Principal Arterial Street |
| **RFP** | Request for proposals |
| **SAS** | Sub-Arterial Street |
| **SWMP** | Storm water management plan |
| **TOD** | Transit-oriented development |
| **TOR** | Terms of reference |

# 1 Introduction

The Ethiopia Urban Street Design Manual is a comprehensive guide developed to address the pressing need for safer, more accessible, and more inclusive streets that cater to the growing urban population of Ethiopia. While previous manuals such as the Ethiopian Roads Administration's (ERA) Geometric Design Manual (2013), Addis Ababa City Roads Authority's (AACRA) Geometric Design Manual (2004), and Ministry of Urban Development and Housing's Street Design Standards for Urban Ethiopia (2017) have provided valuable insights and guidelines for designing good streets, there was a significant gap in the availability of a comprehensive guide that could be implemented nationally. Recognising this need, the manual brings together the best principles from these sources and updates them with the most recent concepts and international best practices to provide a complete urban street design framework.

This manual aims to serve as a valuable resource for all stakeholders involved in the planning, design, and implementation of urban streets in Ethiopia and address the need for safer, more accessible, and more inclusive streets that accommodate the needs of the country's growing urban population.

Active mobility and public transport are the dominant modes of transport in most Ethiopian cities. Consequently, urban street designs need to accommodate and reallocates street space to these modes. Streets not only ensure residents' mobility but also serve as a place for people to meet, interact, do business, and have fun. Streets make a city liveable, foster social and economic bonds, and bring people together. Decisions about how to allocate and design street space have a tremendous impact on quality of life.

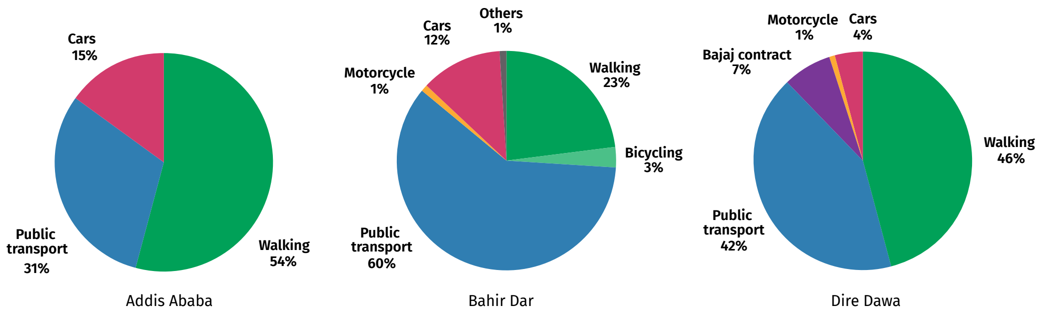



**Figure 1. Mode splits for cities in Ethiopia (World Bank, 2015; Bahir Dar City Administration, 2021; MobiliseYourCity, 2022).**

## 1.1. Principles of complete street design

Decisions about how to allocate and design street space have a tremendous impact on quality of life. Effective street designs ensure safety for all users, particularly pedestrians and cyclists, and facilitate efficient use of road space by prioritising public transport.

### 1.1.1. Designing for safety

In Ethiopia, more than 4,000 citizens lose their lives each year due to road traffic crashes. The economic, health, and social burden of the loss is immense (MOTL, 2021). Safe street design aims to encourage moderate vehicle speeds. Street designs that reduce motor vehicle speeds can significantly improve pedestrian safety since the likelihood of pedestrian death in a traffic collision increases dramatically when motor vehicle speeds rise above 30 km/h. A pedestrian has

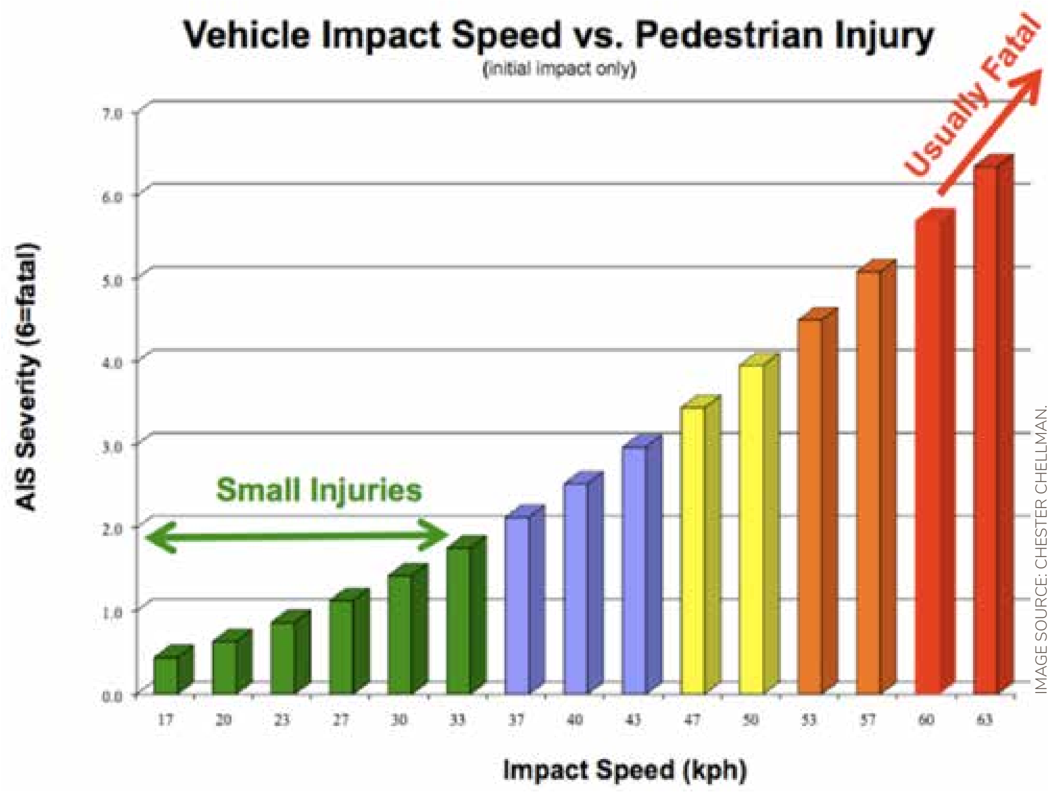



**Figure 2. Speed reduction is critical for safe pedestrian environments because the chance of pedestrian death in a collision increases dramatically when vehicle speeds exceed 30 km/h.**

a 90 percent chance of surviving being hit by a car travelling less than 30 km/h, but only a 50 percent chance of surviving impacts at 45 km/h. In addition to the risks associated with collisions, higher speeds also reduce the driver's field of view, thus affecting the driver's ability to respond to changing conditions in the roadway. At speeds below 30 km/h, it is much easier for drivers to see their surroundings and detect any potential conflicts with pedestrians, cyclists, or other motor vehicles.

The physical design of streets and the provision of footpaths, crossings, and other infrastructure is crucial to managing motor vehicle speeds and creating a safe walking and cycling environment. Accommodating non-motorised transport (NMT) modes safely involves the following basic techniques:

- Systematic traffic calming on smaller streets to reduce motor vehicle speeds and provide safe places for the mixing of pedestrians and other modes. Shared lanes can offer a safe space for pedestrians, cyclists, and motor vehicles to travel together if speeds are restricted to 15 km/h.
- For speeds up to 30 km/h, separate footpaths should be provided but cyclists can travel in the carriageway.
- Pedestrian and cycle infrastructure that is physically separated from motor vehicle traffic on larger streets, paired with traffic calming or traffic control to facilitate safe crossings.
- Speeds limits of up to 50 km/h are appropriate for urban streets.

### 1.1.2. Designing for efficiency

Streets are often designed to maximise the amount of space for motor vehicle movement. Yet vehicle movement and mobility are not one and the same. Mobility is about getting people to where they want to go, efficiently, conveniently, and safely. Mobility can be provided through high-quality, high-capacity public transport, which does not necessarily mean moving large numbers of vehicles.

While a road widening, flyover, or elevated highway may reduce congestion temporarily, the improvement is usually short-lived. The reason is simple: expanding the available road space initially increases speed and comfort and thereby encourages people to travel more often and take longer trips in private motor vehicles. More and more users take to the route until the wider road returns to its original level of congestion—but with significantly more vehicles stuck in traffic.

The government in turn may feel pressure to widen the road once again, but it is not possible to solve traffic jams by building larger and larger roads indefinitely. In fact, no city in the world has solved its mobility crisis by simply building more roads. On the contrary, some of the cities with the most elaborate road networks also have the worst congestion.

The only viable long-term solution for ensuring mobility is to build high-quality facilities for public transport and non-motorised transport. These modes can carry large numbers of passengers without an exponential increase in road space requirements. In most cases, an appropriate solution is bus rapid transit (BRT). A single BRT lane can carry 13,000 passengers per hour per direction (pphpd), and if passing lanes are added at stations, the capacity increases to 45,000 pphpd. The same lane can carry 800 cars per hour—only 1,200 to 1,600 persons at typical occupancy rates—assuming that the lane receives one half of the signal time at intersections.

There are solutions to traffic congestion too. The key to reducing congestion is lowering the number of vehicles on streets rather than increasing street widths to accommodate an ever-growing number of vehicles. This can be done through various means, including parking fees, congestion pricing, and other travel demand management tools. At a larger scale, compact, walkable transit-oriented development is the key to reducing congestion by keeping trip lengths short.

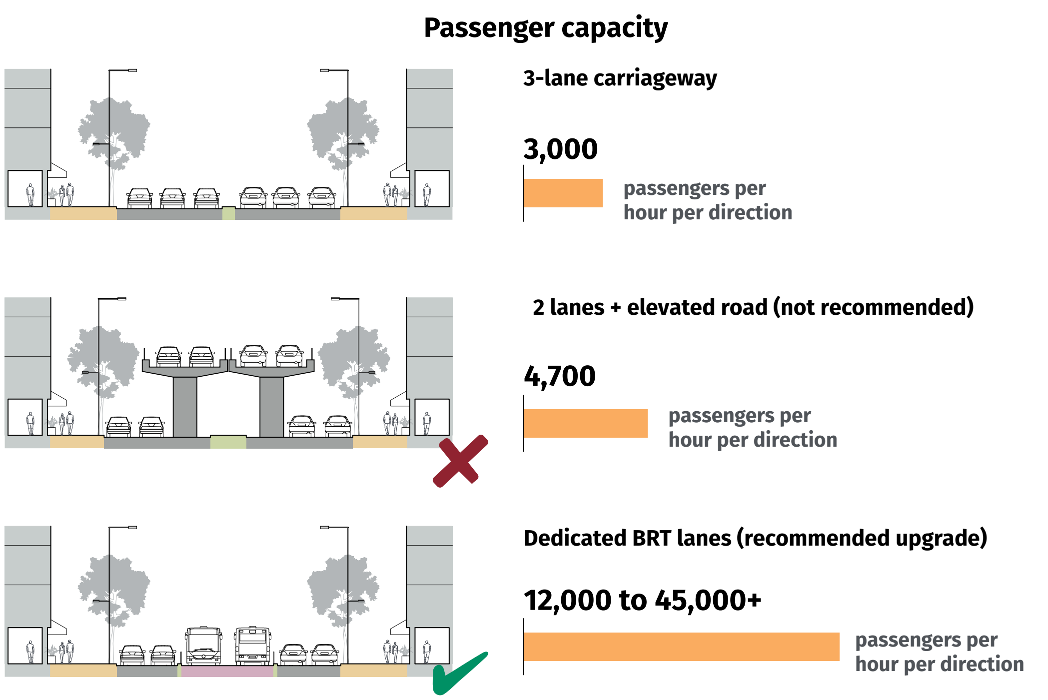



Figure 3. To maximise person-carrying capacity, streets should incorporate dedicated space for public transport and NMT.

**Figure 4. BRT can carry large numbers of passengers without an exponential increase in road space requirements.**

### 1.1.3. Universal access

Universal access is the concept of designing transport services and environments that as many people as possible can use, regardless of age or ability. Streets designed according to universal access principles accommodate assistive devices for particular groups of persons with disabilities.

In order to ensure that persons with disabilities can make complete journeys, needs should be accommodated at each step of the transport chain, from origin to destination. Accessibility to

**Figure 5. Streets need to meet universal access standards to ensure that everyone can access economic, social, and educational opportunities.**

transport is only as strong as its weakest link, so inclusive design must cover public passage, public transport stops and boarding, vehicle interiors, alighting, and passage to the final destination.

Streets designed according to universal access principles accommodate assistive devices for particular groups of persons with disabilities. An accessible environment has ample, well connected pedestrian facilities with unobstructed space for movement, consistent pavement surfaces, appropriately sloped ramps, and safe pedestrian crossings. Multiple elements of the streetscape must be designed in an integrated manner in order for the space to work. People with small children, people carrying heavy shopping or luggage, people with temporary accident injuries, and older people can all benefit from an inclusive transport environment.

### 1.1.4. Modal hierarchy

To promote safe, efficient designs, this manual uses modal hierarchies to inform design and operation decisions. The main modes include pedestrians, bicycles, public transport, personal vehicles, and freight. The default hierarchy for this manual is pedestrian > bicycle > public transport > freight > personal vehicles > personal vehicle parking.

### 1.1.5. Gender sensitive design

Until recently, transport planning has tended to take a "one-size-fits-all" approach, assuming that men and women will benefit equally from improvements in transport services. In reality, women and men have different expectations from a transport system and different perceptions of security. Thus, transport policies and plans need to respond to these differences.

An integrated and safe transport system provides access to education, work, health care, cultural, and other important activities that are crucial to women's participation in the society. The particular concern in the context of street design is the level of safety and security that female users experience. Inclusive designs help to improve the experiences of women and girls, making it easy to walk, cycle, or use public transport.

### 1.1.6. Child friendly streets

Streets should be safe and inviting for children and caregivers. Children have low perception of risks, and drivers cannot easily see children, making them some of the most vulnerable street users. It is therefore crucial that streets be designed with emphasis on children's safety. This can be

**Figure 6. Activities for children during a car-free event.**

achieved by providing ample footpaths, safe crossings, physically protected cycle tracks, and speed control features. Street designs can create a playful, inspiring, and educational environment through features such as wide walkways, landscaping, shade, artwork, seating, and play elements.

### 1.1.7. Streets as public and cultural spaces

Streets are urban spaces where people walk, talk, sit, trade, recreate, socialise, and do other activities. To be used as public spaces, streets need to have inclusive designs that create space for social activities and public gathering—not just mobility. Streets near churches, mosques, schools, universities, colleges, hospitals, administration offices, banks, and other destinations attracting large numbers of people shall have adequate space for pedestrian movement and interaction.

Ethiopia consists of a diverse population in terms of culture, religion, and ethnicity. Annually there are many celebrations in urban areas. Streets should have flexible designs that facilitate temporary pedestrianisation for use during festivals. Municipalities can select and adapt streets for art, performances, and similar activities. Urban plans can reserve parade or promenade streets with connectivity to existing public squares and parks. Street design also can enhance the character of historic districts in Ethiopian cities. As much as practicable, streets in historic cities shall be pedestrianised.

## 1.2. Scope and application of the manual

This manual covers the physical, environmental, socio-economic, technical, and management aspects of urban streets. The street design standards shall be applied in:

- The planning and design of new and existing streets in cities and rural centres in Ethiopia.
- Preparation of city development plans and subsequent street designs through City Development Plans or Structure Plans, Strategic Plans, Basic Plans, Sketch Plans, Neighborhood Development Plans, Urban Designs, and Block Designs.
- Retrofitting of streets based on local needs, including the design of safer intersections, improved walkways, introduction of mass rapid transit (e.g., BRT), cycling facilities, walkways, road safety improvements, and utilities.
- Monitoring and evaluation of urban street performance.

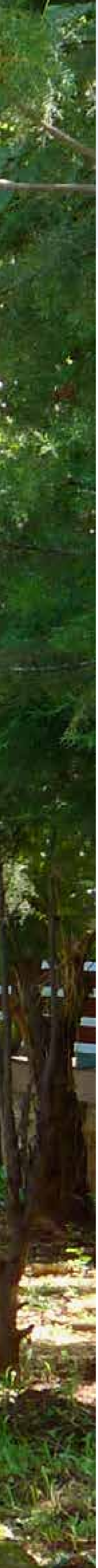
The main users of the manual include government officials, decision makers, individuals, developers, the community, utility and infrastructure agencies, authorities such as the Ethiopian Road Administration (ERA), the Addis Ababa City Roads Authority (AACRA), Ethiopian Electric Utility (ECU), and Ethiopian Telecommunication Corporation (ETC). Other users include institutions, community-based organisations (CBOs), non-governmental organisations (NGOs), and other actors engaged in planning, design, and implementation of street plans and designs.

## 1.3. Revision of the manual

The Ethiopia Urban Street Design Manual shall be updated every two years and revised every ten years based on future demand. The Ministry of Urban and Infrastructure (MUI) and the Ministry of Transport and Logistics (MoTL) shall align and update the street design standards based on current knowledge and global best practices.

ERA, MUI, and MoTL shall collect data and conduct a periodic evaluation of street design practices through stakeholder meetings, field visits, and review of literature. The revision process, which includes addressing identified problems, incorporating new standards and technologies, and disseminating the updated manual, will be carried out by MOTL and MUI in collaboration with private consultants, public/government institutions, NGOs, and international organisations.


**Figure 7. Street in Harar.**



# 2 Street network planning

Effective street networks provide connectivity for multiple users. Street networks should give priority to walking and cycling, which represent a plurality of trips and serve as the access modes for most public transport trips. Similarly, street networks should facilitate high-quality public transport to serve longer trips. Streets also need to support the movement of motorised traffic at moderate speeds.

## 2.1. Functions of a street network

The street network must support connectivity of multiple street users at multiple scales, including the following:

- Walking is key to urban life because it is a healthy and pollution-free form of mobility and recreation. Cities must have complete, safe, and publicly accessible pedestrian networks. Interconnected walking networks with short block lengths allow for short and direct routes through neighbourhoods. In general, blocks should be no larger than 100 m on a side. Such networks offer multiple routes to various destinations and make it convenient to walk and cycle to complete one’s daily commute and other errands. Frequent intersections contribute to slower vehicle speeds and greater pedestrian safety.
- For cycling to be safe and comfortable, major streets require cycle tracks that are physically separated from mixed traffic. Dedicated facilities are needed to encourage cycling among people of all ages and abilities. The cycling network should offer a dense set of routes serving all city areas and key destinations through the shortest possible routes. Specifically, all residents should be able to access dedicated cycle facilities near their homes.
- Public transport can move large numbers of people quickly and efficiently in urban areas. An effective public transport network should offer dedicated right-of-way services such as bus rapid transit (BRT) on high-demand corridors combined with a widespread network of local routes providing service across the metropolitan area. It is essential that street designs incorporate provision for public transport in order to avoid the need for costly retrofits. A typical street network supports public transport at intervals of 1 km.
- The network for motor vehicles should provide access to the urban area while ensuring safety and efficient movement for pedestrians, cyclists, and public transport. A well-connected motor vehicle network can reduce bottlenecks and congestion while managing vehicle speeds through the provision of frequent intersections. Streets also provide connectivity for freight vehicles, ensuring that freight movement does not compromise the safety of other road users.

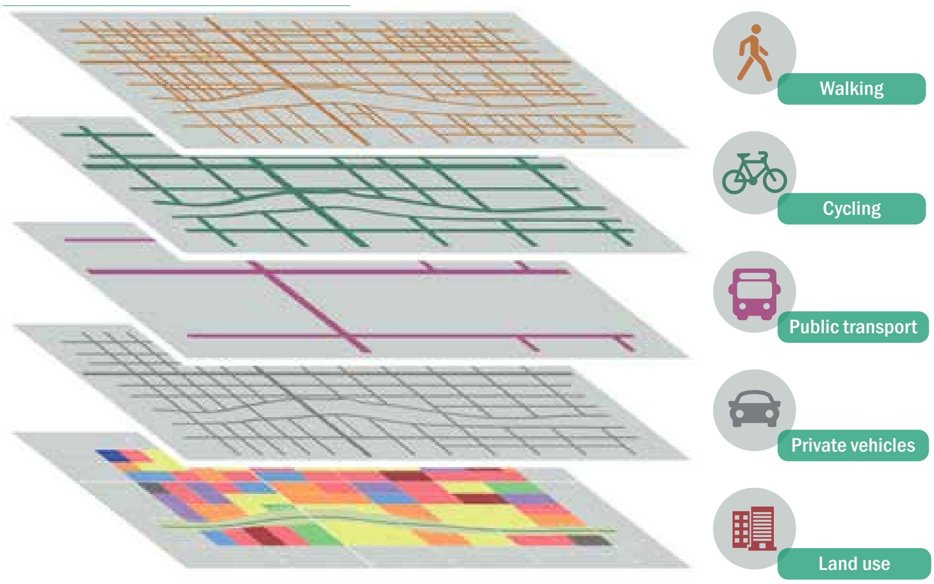



**Figure 8. Composition of street networks.**

A complete street that caters to all users can take on a variety of forms, depending on factors such as the available right-of-way, traffic volumes, street-side activities, and adjacent land uses. In general, smaller rights-of-way can function as slow shared spaces used by both pedestrians and vehicles. Street vending and social activities can also take place in the shared space. A narrow driving lane and other traffic calming elements help keep vehicle speeds low, so that vehicle movement remains compatible with the other uses. A larger street can cater to walking and stationary activities as well as through movement, but it often makes sense to differentiate the slow, shared zone from the mobility zone to ensure comfort and safety for pedestrians and stationary users. The cycle track, though part of the mobility zone, is also segregated from motor vehicle traffic.

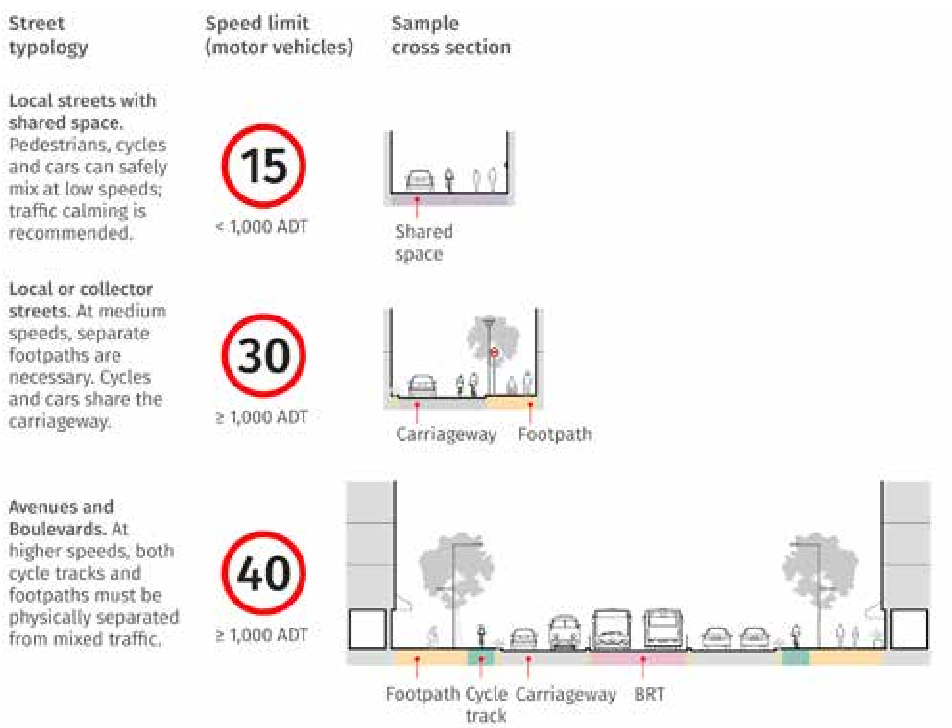



**Figure 9. All streets require safe space for NMT, whether in the form of shared space or dedicated footpaths and cycle tracks. Larger streets should prioritise public transport.**

## 2.2. Street classification

The traditional functional classification of streets assumed a trade-off between motor vehicle movement and speed on the one hand and local access on the other. In the Ethiopian context, streets of all sizes serve a variety of modes. It is imperative for street design to balance the need for pedestrian, cycle, public transport, freight, and private vehicle access, in addition to considerations related to the environment, historic site preservation, and socio-economic development.

The classification of streets is typically assigned at the urban planning stage based on socioeconomic characteristics, expected user volumes, existing and proposed land uses, topography, and location of streets. Following are the categories of streets adopted in this manual and their respective roles:

- **Principal Arterial Street / Boulevard (Wana Godana):** A major corridor incorporating reserved space for trunk public transport services in the form of BRT or dedicated bus lanes; dedicated space for cycling; and high-quality pedestrian space. Service lanes may be employed to manage access to adjacent land uses.
- **Sub-Arterial Street / Avenue (Melesetegna Godana):** A street with public transport access or priority; dedicated space for cycling; and footpaths.
- **Collector Street (Sebsabi Menged):** Street with optional public transport access; dedicated space for cycling or cycle access in a traffic calmed carriageway; and footpaths.
- **Local Street (Yewesete Leweset Menged):** Street with a slow-speed carriageway plus footpaths or a traffic calmed shared space where pedestrians, cyclists, and motor vehicles mix.

Note that the terminologies used to define the street typologies are for professional use. It is possible that the public naming of the streets will follow different conventions.

**Table 1. Street classification.**

| Street type | Amharic name | Characteristics | ROW | Max. vehicle speed |
|---|---|---|---|---|
| Principal Arterial Street/ Boulevard | Godana | Dedicated space for public transport (1+1 lanes), motor vehicle lanes (2+2 lanes), service lanes (optional), cycle tracks, and footpaths | 35-60 m | 50 km/h |
| Sub-Arterial Street/ Avenue | Melesetegna Godana | Dedicated space for public transport (1+1 lanes; optional) motor vehicle lanes (2+2 lanes), cycle tracks, and footpaths | 25-30 m | 40 km/h |
| Collector Street | Sebsabi Menged | Public transport service (optional), motor vehicle lanes (1+1 lanes), cycle tracks or cycles in traffic calmed motor vehicle lanes, and footpaths | 15-20 m | 30 km/h |
| Local Street | Yewesete Leweset Menged | Vehicle lanes and footpaths, or shared space. Cycles use traffic calmed motor vehicle lanes or shared space | 6-15 m | 10-15 km/h |

**Figure 10. Principal Arterial Street/Boulevard with LRT: Addis Ababa.**

**Figure 11. Sub-Arterial Street/Avenue: Abuare, Addis Ababa.**

**Figure 12. Collector Street: Hayahulet, Addis Ababa.**

**Figure 13. Local Street: Axum.**

## 2.3. Network design

Complete streets and networks have the power to create walkable communities where people are safe from traffic violence and have a lower greenhouse gas footprint. This section outlines a process to create a complete network that prioritises walking, cycling, and public transport. Motor vehicles are accommodated, but in a supportive role.

The typical street grids in use today are shown in Figure 11. Districts are outlined by arterial roads and highways. The district on the left is divided by a series of collectors, which are in turn sub-divided by a series of local streets. There is no hierarchy, even though the street classification suggests one. One can drive on any street in any direction. It is mono-modal with no regard for walking, cycling, or public transport. This network is a plumbing diagram for traffic. The district on the right is hierarchical. It funnels drivers from local streets to the arterials via collectors. While it is also mono-modal and auto-centric, there is no through traffic on smaller streets.

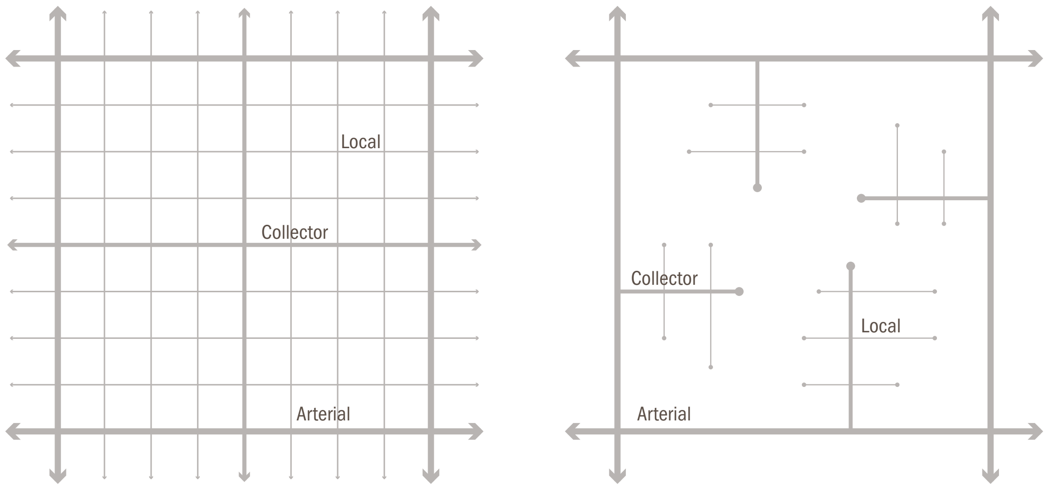



**Figure 14. Traditional mono-modal street grids for motor vehicle movement: typical non-hierarchical street grid (left) and typical hierarchical street grid (right)**

By contrast, the starting point of a complete network is public transport and walking. Public transport can move large numbers of people quickly and efficiently in urban areas. A well-connected street network enables public transport to operate within walking distance of all urban residents. Street networks should enable public transport services to operate with direct routing and minimal detours. High-demand corridors can incorporate dedicated right-of-way services such as BRT to enable buses to bypass the jam. On corridors with regular bus and public taxi services, street designs should provide convenient public transport access through shelters, signage, and safe pedestrian crossings.

Walking is a dominant mode in Ethiopian cities, and public transport trips also start and end on foot. As a healthy and pollution-free form of mobility and recreation, walking is key to urban life. Pedestrian networks must have complete, publicly accessible walkways where all destinations are connected to each other and protected from vehicle traffic.

Figure 12 shows two versions of a representative transit-oriented district. On the right is a rail-based system that does not follow the street network. On the left is a BRT system that plays the arterial street network. Both have a network of streets and paths that lead to the rapid transit stations. Both diagrams use a 5-minute (400 m) walking radius.

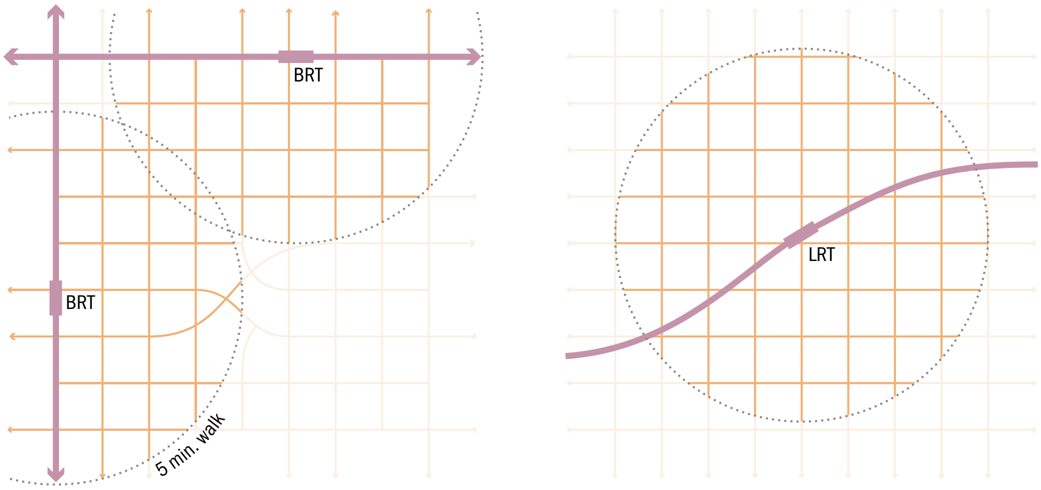



**Figure 15. Transit-oriented districts: BRT-based (left) and rail-based (right)**

Greenways, paths, and other non-motorised transport facilities play a key role in complete networks. Cycling offers low-cost, pollution-free mobility. For cycling to be safe and comfortable for people of all ages, cities should create complete cycle networks serving all city areas and key destinations through the shortest possible routes. The cycle network can include various types of facilities, including slow-speed neighbourhood streets, physically separated cycle tracks on major streets, and cycle paths running through parks and greenways. The cycle network should be integrated with public transport systems and pedestrian priority areas. Secure cycle parking should be available at destinations.

Figure 13 shows the greenway and cycle track components of a complete network. The left image illustrates how cycling facilities may or may not follow the grid. Aside from corridors on streets, the cycle network can follow a river or train tracks. On the right the greenways are overlaid on the Metro-based transit-oriented grid.

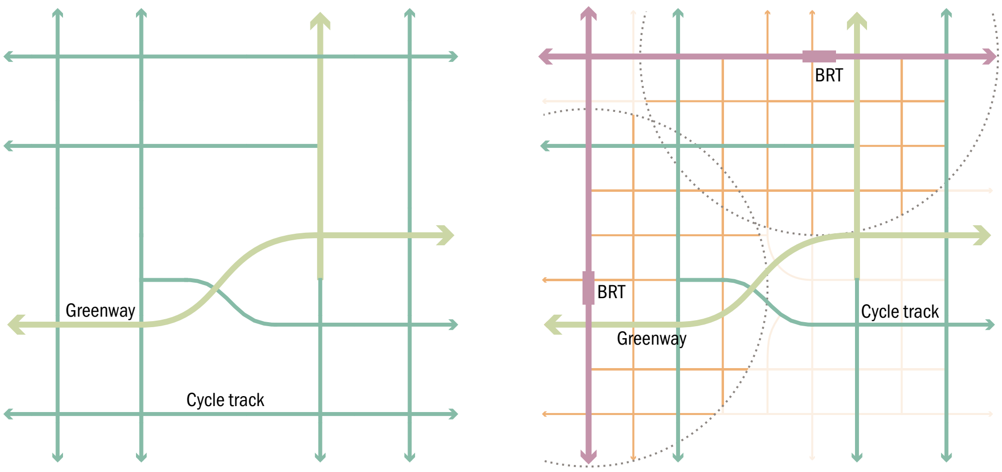



**Figure 16. Greenway components (left). Transit-oriented district with greenway (right)**

With the various components in hand, a composite network can be formed, as shown in Figure 14. The starting point is public transport—in this case a BRT system on a major arterial. Walkways and paths lead to the station and connect to other districts. Greenways and cycleways traverse and connect districts. Local and collector streets lead drivers to perimeter arterials. There is no through traffic.

Interconnected walking networks with short block lengths allow for short and direct routes through neighbourhoods. As shown in the right image, it will often be faster to walk or cycle within the district. The centre of the community is highly "green"—oriented towards walking, cycling, and public transport. Fine-grained networks offer multiple routes to various destinations and make it convenient to complete trips by foot or cycle. In areas where large blocks exist, redevelopment provides an opportunity to break up large blocks to improve pedestrian connectivity.

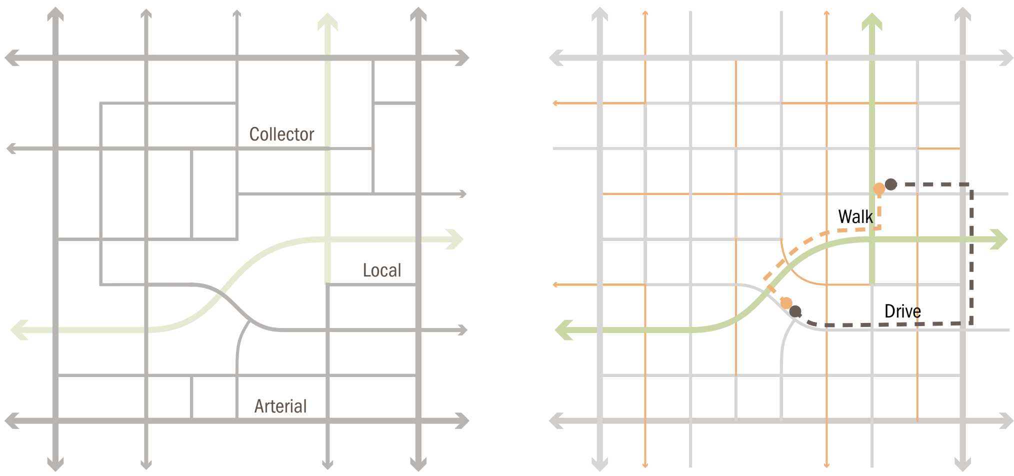



**Figure 17. Motor vehicle network (left). It is often faster to walk or cycle within the district (right)**

Complete networks accommodate motor vehicles, but in a supportive role. They are primarily for service and deliveries. Specific measures, including on-street parking systems and congestion charging, manage the overall use of personal motor vehicles. These measures should seek to cap the overall vehicle kilometres travelled by personal motor vehicles and limit the mode share of personal motor vehicles to 20 percent or less of trips.

The motorist network should provide access to the urban area while ensuring safety and efficient movement for pedestrians, cyclists, and public transport. A well-connected motor vehicle network can reduce bottlenecks and congestion. To ensure safety for all users, motor vehicle speeds must be managed carefully through traffic calming, appropriate street spacing, safe intersection designs, and automatic enforcement.

Finally, a complete, transit-oriented network can be formed, see Figure 15. The starting point is transit, in this case a surface-based system (red) such as an LRT or BRT passing through the district with a station at the centre. Everyone will be within a 5-minute walk of the station. Emanating out from the station is a principal walkway (yellow) - a promenade for people accessing the station, and also probably the signature street of the district. Walking spurs connect to this walkway and provide access to all blocks and surrounding districts. A greenway (yellow-green) passes through the district, potentially along a waterway. Cycleways provide high speed and comfortable passage for cyclists. Cycling infrastructure also extends the reach of the transit station. A network for drivers circumscribes the district but does not interrupt it. Access is provided to all blocks, but drivers are channelled to the surrounding arterials. Motor vehicles support the neighbourhood, but do not define it. This type of complete, transit-oriented district is reminiscent of many universities and other campuses.

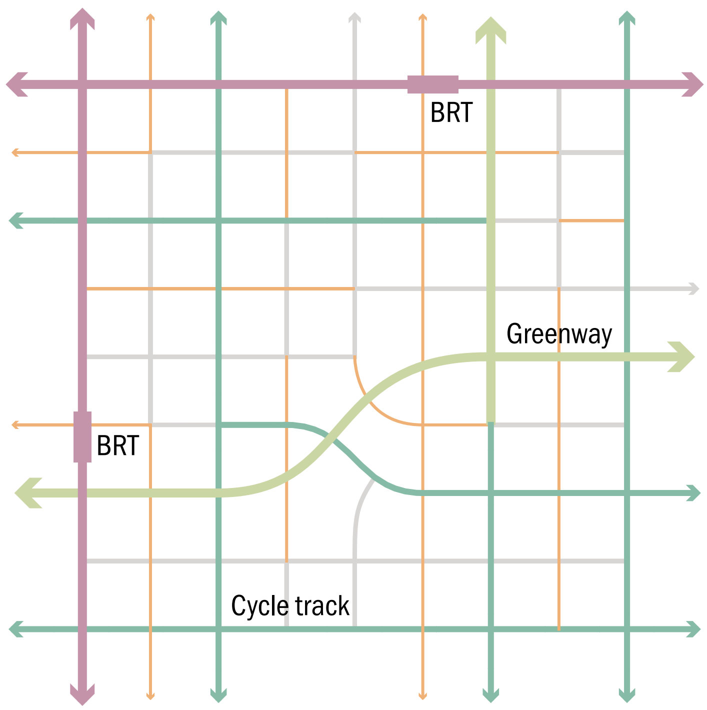



**Figure 18. Complete, transit-oriented network.**

The following table identifies the appropriate spacing for different street typologies. Aside from these standards, spacing shall be based on the land uses, location, topographic conditions, and other local factors. Street layouts should adopt the most economical and efficient street arrangement. The minimum size of a block in urban centres and associations/cooperatives shall be 30 m, while the minimum size of blocks for commerce, business, administration, service and manufacturing shall be 40 m. The maximum size of a block face is 100 m in order to ensure that the street network offers a fine-grained network of pedestrian paths.

**Table 2. Spacing of streets and facilities.**

| Type of street or facility | Classification | Spacing (m) |
|---|---|---|
| Public transport | Express stop/station | 600-800 |
| | Local stop/station | 300-500 |
| NMT | Cycleway | 150-200 |
| | Walking path | 20-40 |
| | Street crossing | 60-120 |
| Street (vehicle) | Principal Arterial Street | 1,000-1,500 |
| | Sub-Arterial Street | 250-500 |
| | Collector Street | 150-250 |
| | Local Street | 30-150 |

## 2.4. Street orientation

Ethiopia is located near the equator where there is overhead sun at noon and solar glare during the morning and afternoon in streets oriented east-west. Streets oriented toward the sun result in poor visibility for pedestrians and drivers and may contribute to traffic crashes. Similarly, streets oriented against prevailing wind direction are not comfortable for pedestrians and cyclists. In addition, urban streets in Ethiopia shall be oriented and designed to provide shade. Studies of micro-climatic conditions can inform the orientation of streets and the use of trees and other elements to counterbalance the effect of excessive solar radiation.

### DESIGN STANDARDS

- Streets shall be oriented at least 15° and preferably 30° from the east-west axis to avoid direct solar glare.
- Existing streets exposed to glare shall be modified by planting trees and allowing the construction of buildings and structures that can provide shade and protection against glare.
- The prevailing wind direction shall be considered in preparation of street layouts.

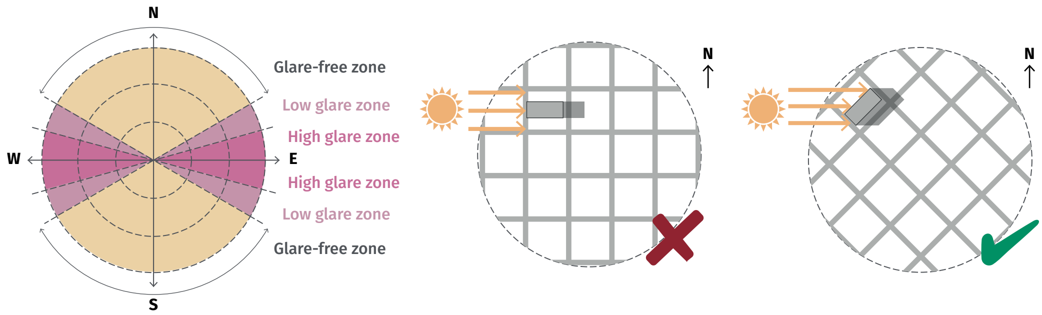



**Figure 19. Street orientation should avoid angles with maximum glare.**

**Figure 20. Street in Bahir Dar.**

# 3 Street elements

Street design elements are the various components of a street that accommodate or serve specific functions for various users, including pedestrians, cyclists, public transport riders, and car users. These elements require detailed planning and customisation to fit the local context. Achieving the right balance and placement of these elements can be challenging, as they all interact with one another. Even utility-oriented elements that are mainly located underground, such as utility boxes and manhole covers, can impact the usability of other elements, such as cycle tracks, footpaths, public transport infrastructure, and car lanes when they surface. Street elements play a crucial role in ensuring that all users can safely and efficiently travel through the street network. Therefore, it is essential to consider the interaction between all the street design elements to ensure that they work together seamlessly. The figure below shows the main street elements.

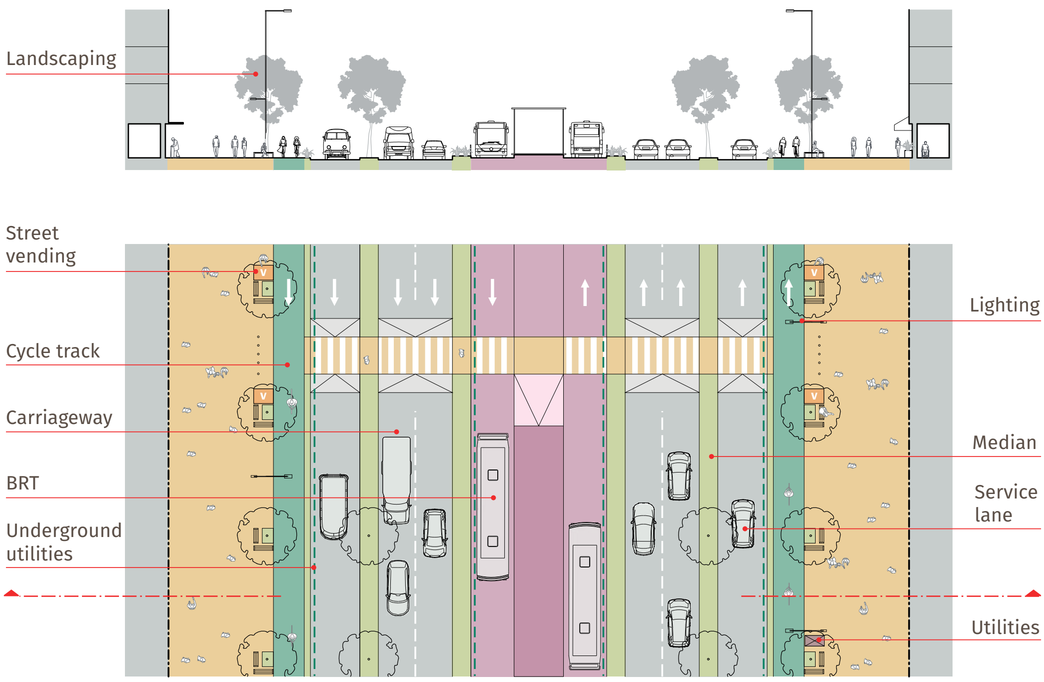



**Figure 21. Street design elements.**

## 3.1. Footpaths

Good footpaths promote safe and comfortable pedestrian mobility. As the primary public space in a city, they should be accessible to all users, regardless of age, gender, or special needs. Good walkways support outdoor activities and promote local economic growth.

Comfort, continuity, and safety are the governing criteria for the design and construction of pedestrian facilities. For this reason, the footpaths are divided into three main zones:

- **Pedestrian zone.** This zone provides continuous space for walking and should be clear of any obstructions. It should be at least 2 m wide.
- **Frontage zone.** Provides a buffer between street-side activities and the pedestrian zone. Next to a compound wall, the frontage zone can become a plantation strip.
- **Furniture zone.** This is a space for landscaping, furniture, lights, bus stops, signs, and private property access ramps.

Because interaction occurs between these zones, development of a cohesive design for the pedestrian realm is important. Design must consider the unique conditions associated with each zone as well as how the pedestrian realm interacts with other elements of the street, such as bicycle and transit facilities and junctions. Maintaining clear sight lines between pedestrians, bicyclists, and motorists in these areas of interaction is critical.

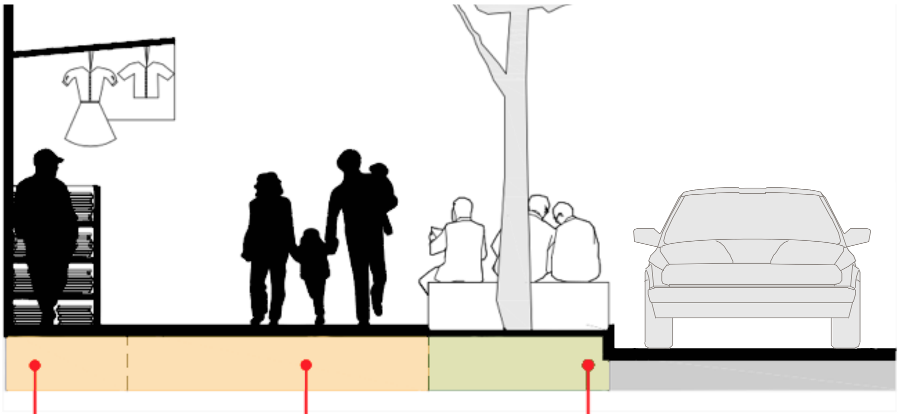
### DESIGN STANDARDS

- Minimum clear width of 2 m. For areas with high pedestrian volumes, wider footpaths should be provided.
- Elevation over the carriageway of +150 mm.
- Constant height at property entrances.
- Continuous shade through tree cover.
- No railings or barriers.
- Ramp slopes are no steeper than 1:10. Slopes of 1:12 are preferred.
- Cross slope no more than 2%.
- Tactile pavers for people with visual impairments.
- Bollards to prevent encroachments by cars. Bollards shall be 900 mm high and not more than 400 mm in diameter. A minimum width of 900 mm between at least one set of bollards is required for the passage of wheelchairs.

**Table 3. Footpath widths.**

| Street type | Footpath width (each side) (m) | Footpath share of ROW (%) |
|---|---|---|
| Principal Arterial Street/Boulevard | 4.0-10.0 | 20-30 |
| Sub-Arterial Street/Avenue | 3.0-5.0 | 25-30 |
| Collector Street | 3.0-4.5 | 30-40 |
| Local street | Shared street or 3.0 | 40-60 |


Figure 22. Footpaths designed per the zoning system provide uninterrupted walking space for pedestrians. The pedestrian zone should have at least 2 m of clear space.



**Frontage zone.** Provides a buffer between street-side activities and the pedestrian zone.

**Pedestrian zone.** Offers continuous clear space for walking. The clear width must be entirely free of obstructions.

**Furniture zone.** Contains trees, street lights, benches, utility boxes, and other potential obstructions.

Figure 23. Footpaths have distinct zones that serve separate purposes.

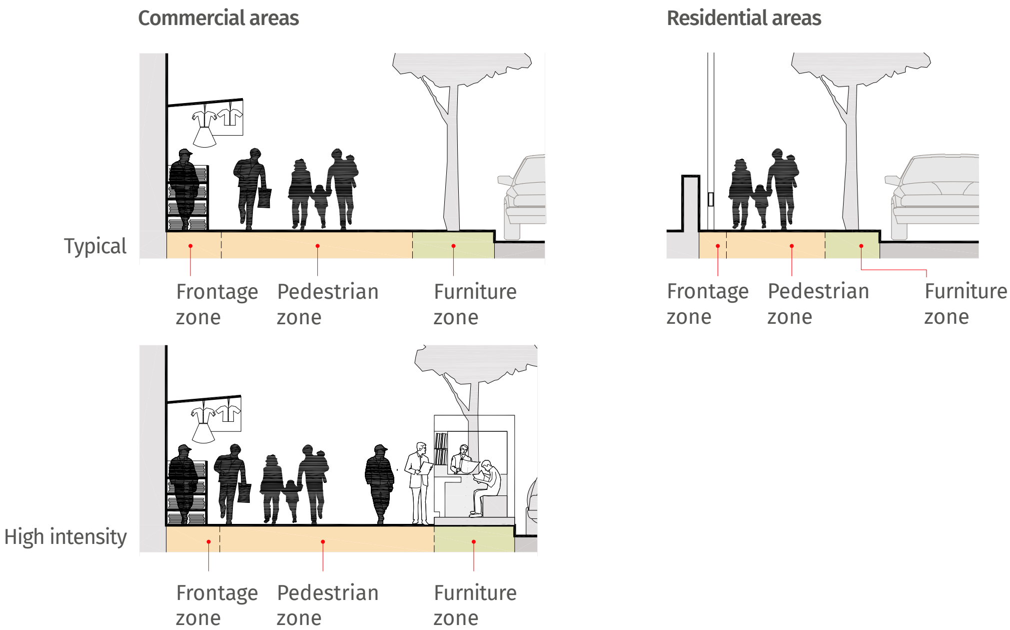



**Figure 24. For high intensity commercial areas, the furniture zone should be expanded. For residential areas, the frontage zone may be omitted. Wider footpaths are recommended in areas with large pedestrian volumes.**

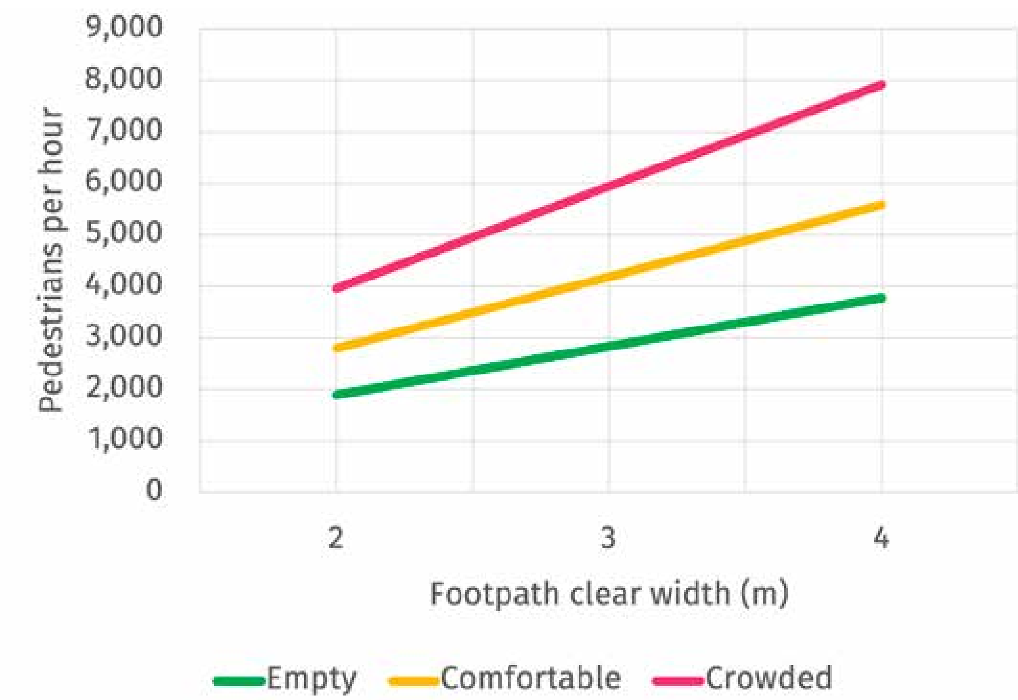



**Figure 25. Relationship between footpath width and capacity. The widths represent the unobstructed clear width.**

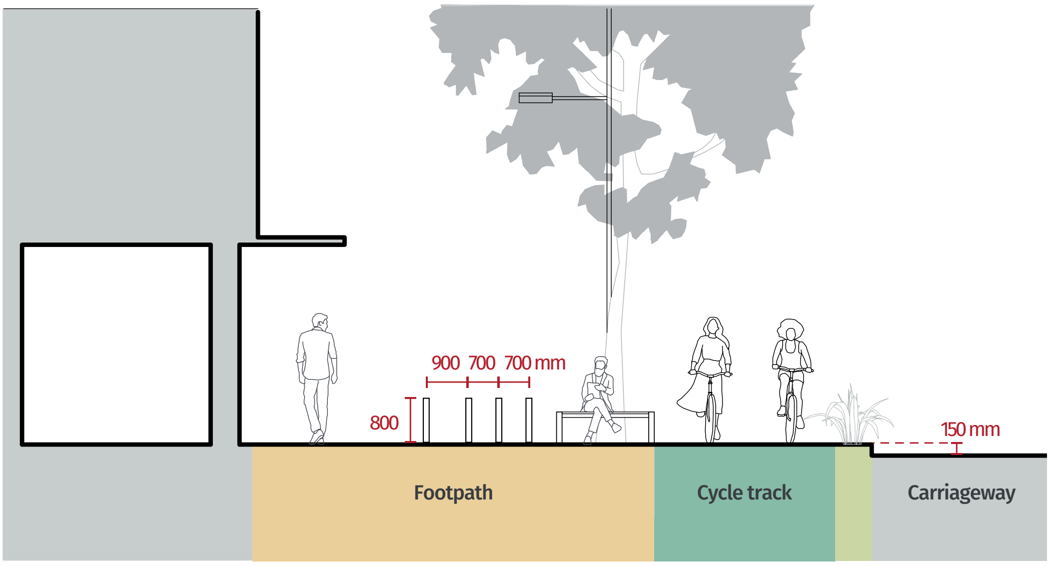
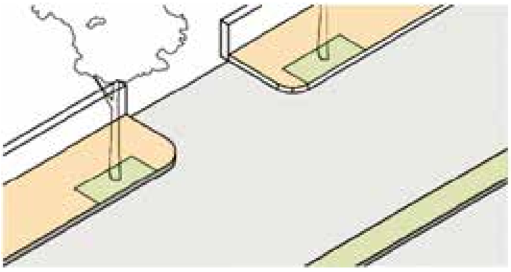



Figure 26. Footpath elements. Bollards should be installed to prevent vehicles from parking on footpaths, with spacing of 900 mm between at least one set of bollards to allow wheelchairs to pass. Footpaths should be raised +150 mm above the carriageway.

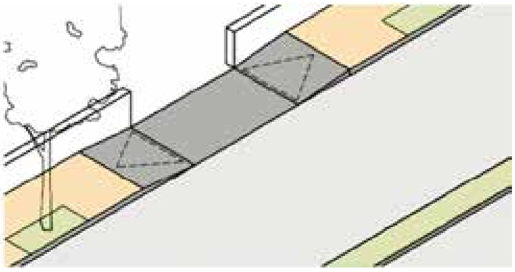
Figure 27. Bollards prevent vehicles from parking on footpaths.

Figure 28. Footpaths placed below the carriageway often experience water-logging. Footpaths should be raised +150 mm above the carriageway.

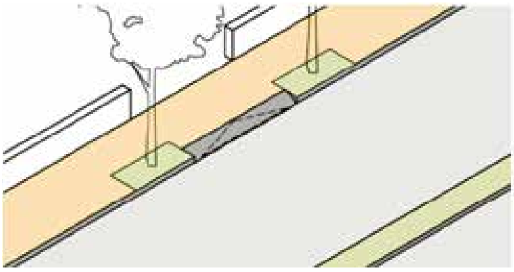

Figure 29. Footpaths should ramp down to the level of the carriageway, with a maximum ramp slope of 1:12.



Ending the footpath with abrupt curbs renders the footpath inaccessible for many pedestrians.



Lowering the entire footpath to the level of the carriageway is unacceptable as property entrances may become waterlogged.



Where required to provide the access to private properties, vehicle ramps should be provided in the furniture zone.

**Figure 30. Treatment of property entrances. Footpaths should remain at the same level at property entrances and small side streets, with ramps for vehicles, in order to improve convenience for pedestrians and maintain universal access.**


**Figure 31. Property entrance treament maintaining the footpath clear width at the same level.**

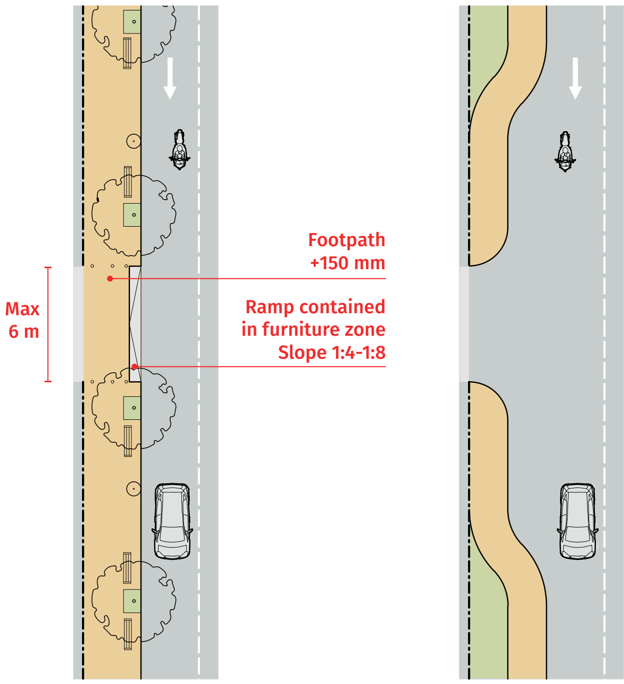



**Figure 32. To improve safety for pedestrians and cyclists, acceleration and deceleration lanes should not be used at property entrances on urban streets.**

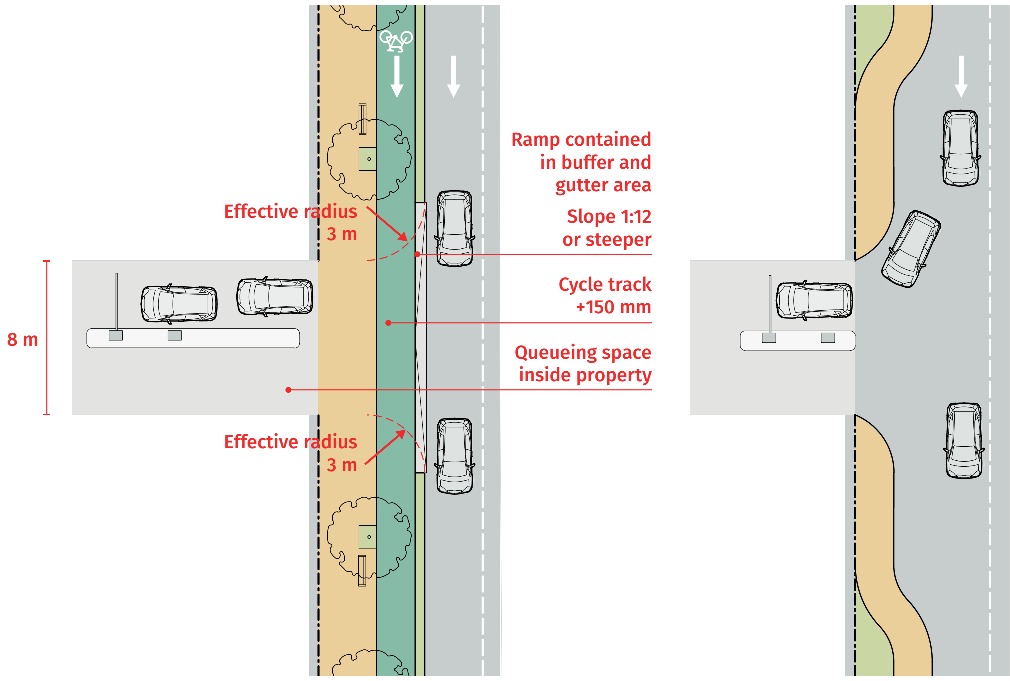



**Figure 33. Commercial entrances require sufficient queueing space inside the property for vehicles undergoing security checks.**

## 3.2. Crossings

Good crossings allow pedestrians and cyclists to cross busy streets safely and conveniently. A formal pedestrian crossing should be located wherever there is a concentrated need for people to cross the street (e.g., at a bus stop, at an entrance to a shopping mall, or where a path intersects the street). In busy commercial areas, crossings should be spaced at more frequent intervals.

At-grade crossings are superior to pedestrian footbridges or tunnels. Pedestrians dislike having to climb a stairway in order to cross the street, so they are likely to avoid it and cross at-grade as they please. This preference makes costly footbridges and tunnels an unwise use of limited resources.

### DESIGN STANDARDS

- Located at pedestrian desire lines.
- Signalised or raised to the level of the footpath to calm traffic. Footbridges and subways are to be avoided.
- For tabletop crossings, a height of +150 mm above the carriageway and ramps for vehicles with a slope of 1:8 to reduce vehicle speeds to 15 km/h.
- If a speed hump is used, the hump should be placed 5 m before the crossing.
- Drainage inlets should be provided upstream of the tabletop crossing to prevent water logging.
- Width of 5 m or equivalent to the adjacent footpath, whichever is larger.
- Bulb-outs in parking lanes to reduce the crossing distance.
- Where median fences are installed to prevent crossing, informal crossings in the form of breaks in the fencing should be provided wherever there is demand. The fence should be discontinued for the width of the pedestrian crossing in order to create a refuge island so that pedestrians do not spill over into the main carriageway. Fences should not be installed along footpaths.
- Refuge islands to provide spaces for pedestrians to wait before crossing the next stream of traffic.

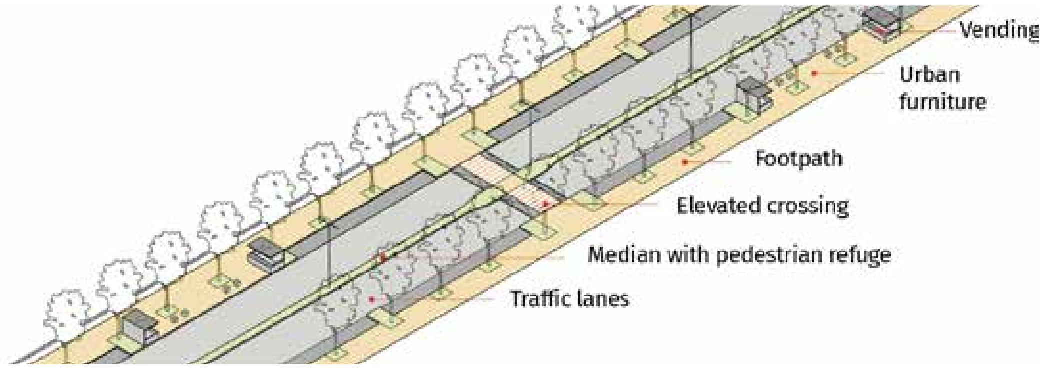



**Figure 34. Formal pedestrian crossings, in which pedestrians remain at the same level as the footpath (+150 mm) and vehicles pass over ramps, are required on major streets. Between formal crossings, hardscaped pedestrian refuge islands should be provided at intervals of approximately 50 m. At both formal and informal crossings, bulb-outs into the parking lane reduce the total crossing distance.**

Table 4. Maximum distance between median breaks.

| Street type | Maximum distance between median breaks (m) |
|---|---|
| Principal Arterial Street/Boulevard | 100 m |
| Principal Arterial Street with BRT | 200 m |
| Sub-Arterial Street/Avenue | 50 m |
| Collector Street | No median |
| Local Street | No median |

Figure 35. A tabletop crossing provides safe access to a BRT station.

## BEST TO AVOID: FOOTBRIDGES & SUBWAYS

In an attempt to increase motor vehicle speeds, at-grade pedestrian crossings are frequently replaced by footbridges. Since these facilities are inaccessible to many people, they should be avoided as much as possible. Grade-separated pedestrian crossings have numerous drawbacks:

- Increase in travel time. Footbridges lead to circuitous walking routes that typically increase travel distances and times, thereby discouraging walking. Pedestrians typically seek out short, direct routes to their destinations.
- Lack of universal access. Footbridges are often inaccessible and increase barriers to persons with disabilities, people carrying luggage, and parents with strollers. Extensive ramping may be installed to accommodate wheelchairs and bicyclists, but long crossing distances and steep slopes still discourage use.
- Obstructions on footpaths. Due to land constraints, footbridges can sometimes block footpaths. In order to accommodate both footbridges and footpaths, there might be need to acquire land outside the public right-of-way (ROW), which can be expensive.
- Prohibitive cost. Footbridges cost upwards of twenty times as much as at-grade crossings.
- Harassment and other crimes. The walking environment in grade separated facilities is generally poor and potentially unsafe with regard to sexual assault and other crimes, especially during night-time hours, since the facilities are by definition removed from street-level activity and the security it provides.
- Increased vehicle speeds. Grade separation also tends to increase motor vehicle speeds, further degrading the overall walking environment in the vicinity of the footbridge, especially for those who cross at grade.

## DESIGN STANDARDS

- Except where priority is being given to public transport, pedestrian footbridges and subways are to be avoided.
- For approval the following must be demonstrated: that the bridge or tunnel will add no more than 50 percent to the time it would take a person to cross the street at grade.


**Figure 36. Pedestrian footbridges create longer routes, leading pedestrians to risk crossing at the shortest distance.**

## 3.3. Cycle tracks

On streets with faster speeds, cycle tracks can reduce conflicts between cycles and motor vehicles. Cycle tracks make it possible for even novice users to opt for cycling. Efficient cycle tracks are safe, convenient, continuous, and direct.

### DESIGN STANDARDS

- Physically separated from the carriageway as distinguished from painted cycle lanes, which offer little protection to cyclists.
- A minimum clear width of 2 m for one-way movement, and 3.0 m for two-way movement.
- Elevated +150 mm above the carriageway.
- Positioned between the footpath and carriageway. Provide a buffer of at least 0.5 m between the cycle track and carriageway. The buffer should be paved if it is adjacent to a parking lane. Increase the buffer to 0.75 m next to buildings, walls, etc.
- The buffer should be at least 0.5 m wide and should be paved if it is adjacent to a parking lane.
- Bollards to prevent encroachments by cars. One bollard placed in the middle of the cycle track, to allow for cyclists to pass on either side. Bollard spacing of 1.2 m.
- A smooth surface material—asphalt or concrete. Paver blocks are to be avoided.

**Table 5. Relationship between cycle track width and volume.**

| One-way volume (bicycles/hr) | Bidirectional volume (bicycles/hr) | Effective width (m)* |
|---:|---:|---:|
| < 150 | N/A | 2.0 |
| 150-750 | < 100 | 3.0 |
| > 750 | > 100 | 4.0 |

* Add 0.5 m where there are 10% or more tricycles or cargo bicycles.

**Table 6. Bicycle facility selection (adapted from NACTO, 2014).**

| Bicycle facility | Motor vehicle speed, 95th percentile | Motor vehicle volume, daily, both directions |
|---|---:|---:|
| Shared street | ≤ 15 km/h | - |
| Bicycle boulevard (bicycles in moderate-speed carriageway) | ≤ 30 km/h | < 2,000 and under 50 motor vehicles per hour, peak hour, peak direction |
| | ≤ 40 km/h | < 1,500 and under 50 motor vehicles per hour, peak hour, peak direction |
| Cycle track or protected bike lane | ≤ 40 km/h | ≥ 1,500 |
| | > 40 km/h | ≥ 1,500 |

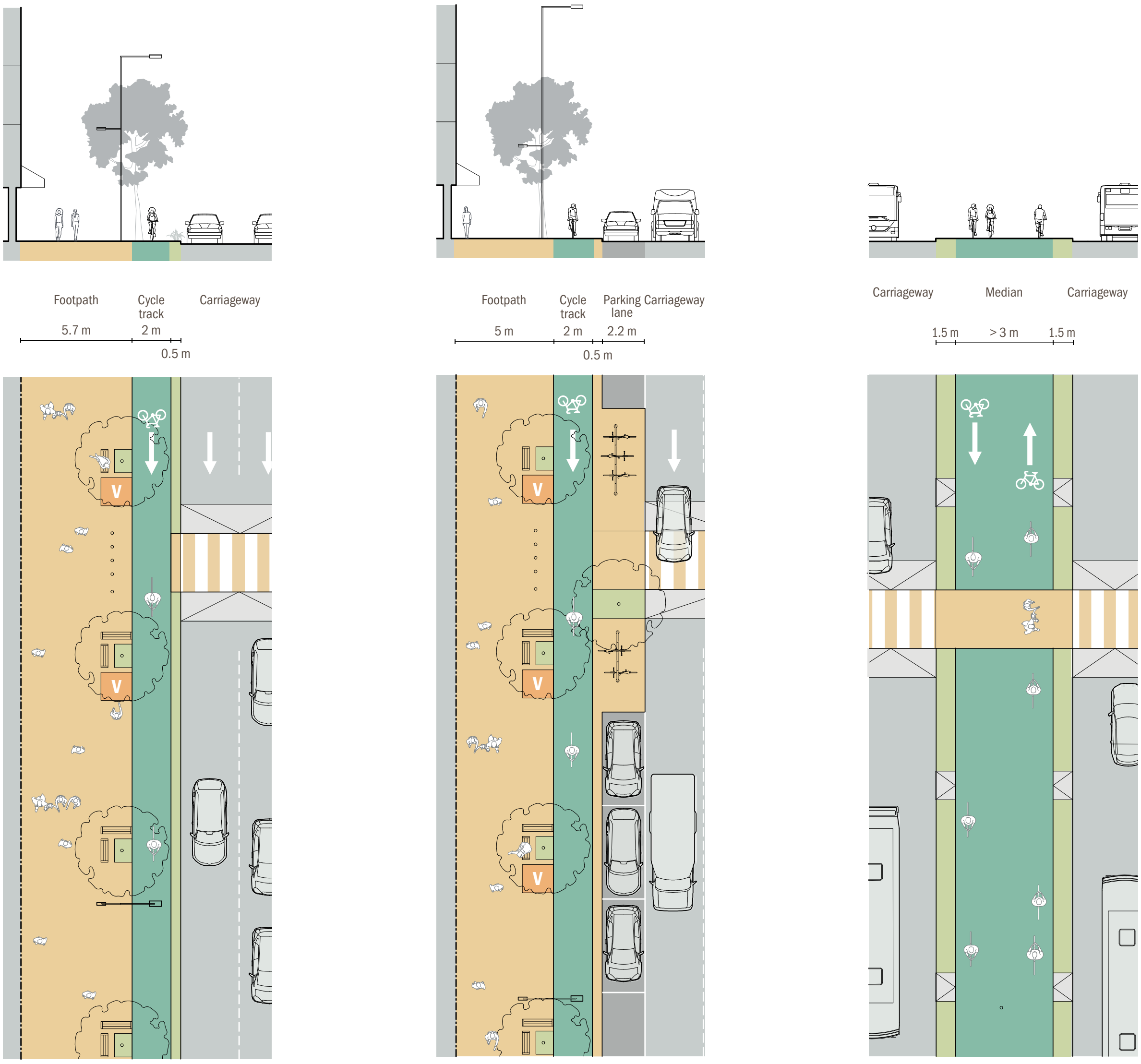



**Figure 37. For one-way movement, cycle tracks should have a width of 2 m plus a 0.5 m buffer next to the carriageway. The width should be increased to 3.0 m for two-way movement.**

Figure 38. Newly constructed cycle tracks should be physically separated from motor vehicle traffic and raised +150 mm above the carriageway.

Figure 39. Cycle track in Addis Ababa.

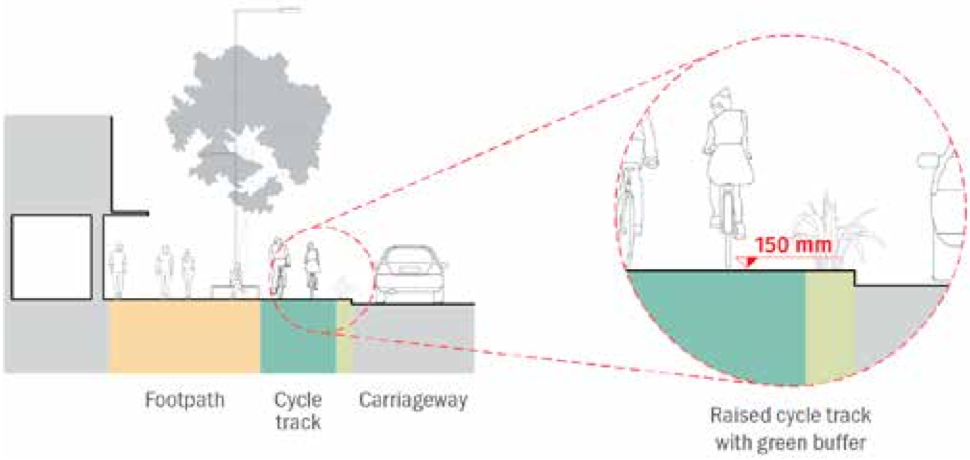



**Figure 40. Cycle tracks should be elevated +150 mm above the carriageway to allow for storm water runoff and prevent the accumulation of debris.**

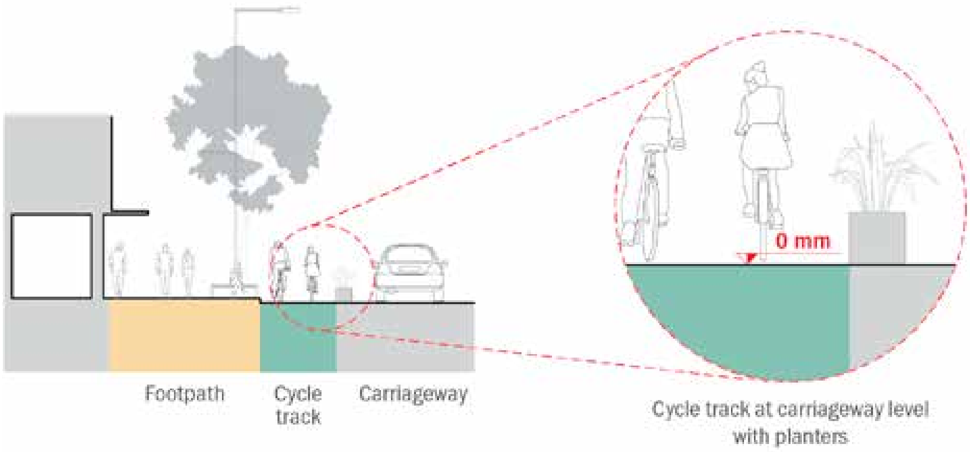



**Figure 41. A cycle track can be developed through the installation of planter boxes or kerbs within the existing carriageway space, provided that there is adequate drainage to prevent water-logging and accumulation of debris in the cycle track.**

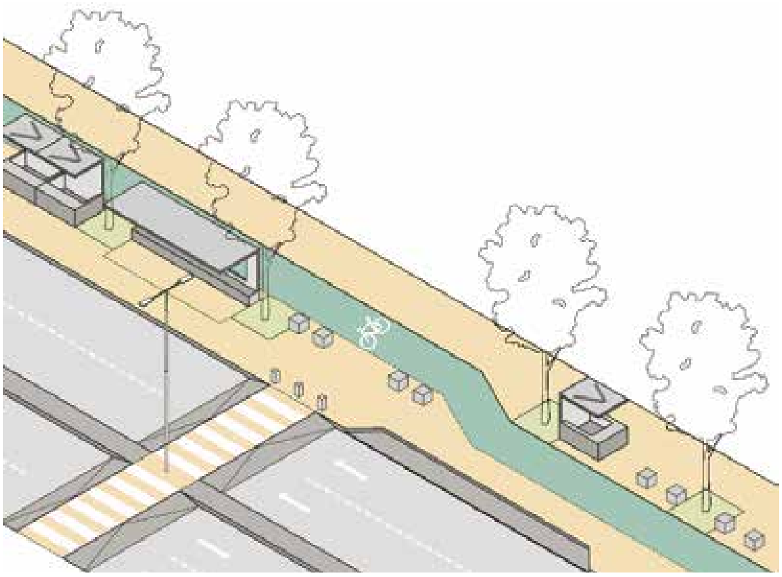


**Figure 42. Shift cycle tracks behind bus stops to create sufficient waiting area for passengers.**

## 3.4. Riverside developments

Riverside developments, also known as greenways, are multipurpose urban mobility corridors for cyclists and pedestrians with ample tree cover to provide shade. They offer continuous, safe, and unobstructed facilities for non-motorised traffic use, complementing the street network. Greenways can facilitate the reclamation of waterways and improve access to open spaces.

The typical components of a greenway network will include walking and cycling paths, facilities for passive recreation and sanitation, street furniture, and landscaping. The planning process for a riverside network should include from data collection on movement patterns, settlements, hydrology, water pollution, waste management, and ecological features. Individual riverside projects should link together to contribute to coherent walking and cycling networks.

### DESIGN STANDARDS

- Connectivity to existing pedestrian networks, cycle networks, and open spaces.
- Exclusive access for pedestrians and cyclists. Bollards to prevent encroachment by vehicles.
- Effective width of at least 3.0 m to serve as a shared space for pedestrians and cyclists. Increase effective width to 4.0 m where there are more than 25 people walking or 250 people cycling (both directions, per hour). Provide separate paths for each mode where there are more than 50 people walking or 500 people cycling (both directions, per hour).
- Tabletop crossings where the greenway crosses the street network.
- The treatment of the terrain slope should be as follows:
  - For slopes > 30%: conservation of forestry on sloping areas with perennial vegetation
  - For slopes of 15-30%: vegetable and fruit tree production on gentler slopes
  - For slopes up to 15%: recreational park development on gentler slopes
- Organised spaces for street vending.

**Figure 43. Greenways offer a pleasant environment for walking and cycling.**

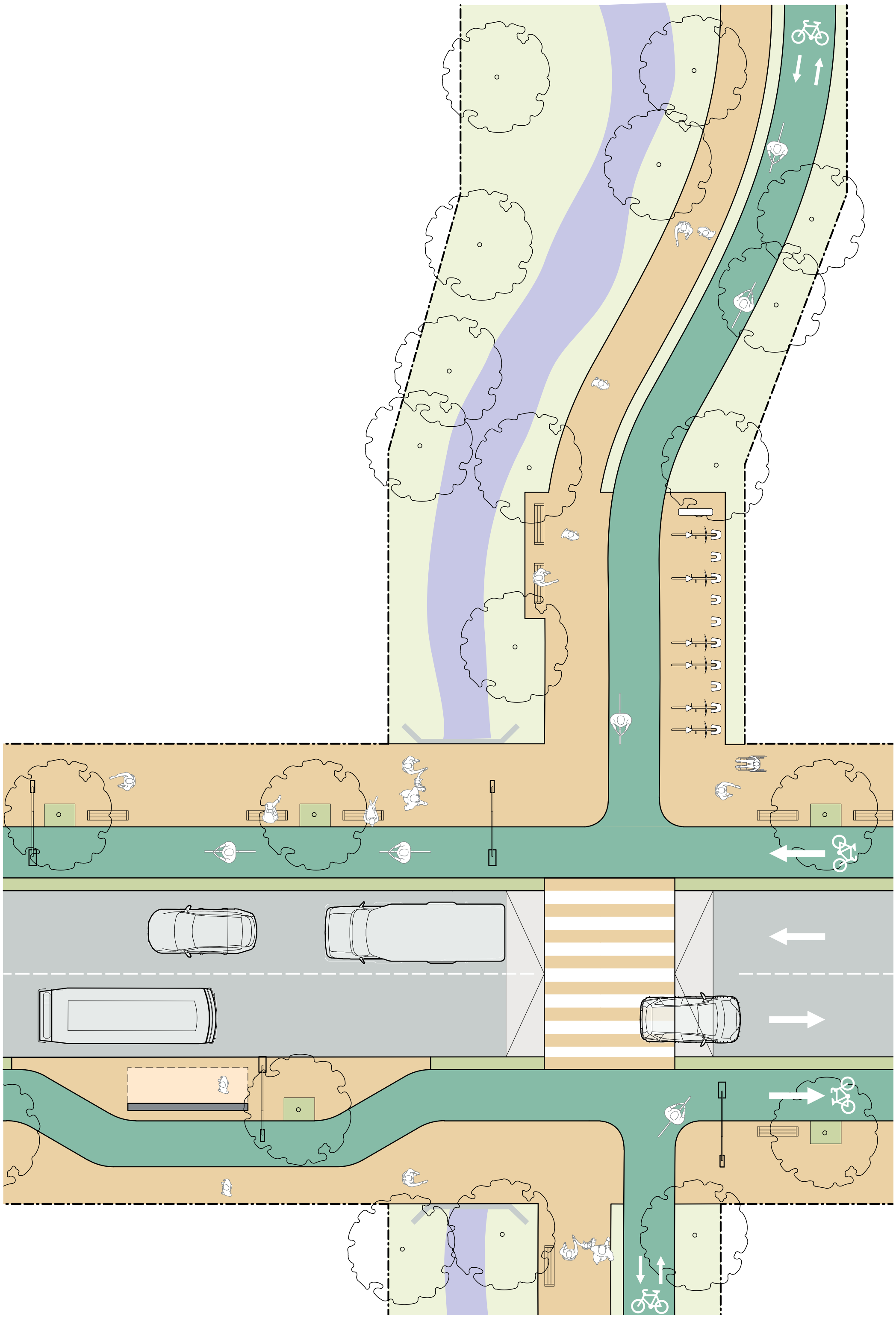


**Figure 44. Possible greenway configuration offering dedicated space for cyclists and pedestrians. At the interface with the street network, a wide, traffic calmed crossing ensures safe passage for greenway users.**

## 3.5. Bus rapid transit

As cities and urban centres grow, exclusive corridors for public transport can help increase the passenger carrying capacity of urban streets. Public transport lanes carry a large number of people with lower cost and time as compared to mixed traffic lanes. They also reduce expenditure on fuel, air pollution, and traffic congestion and are therefore more sustainable than wide roads devoted to personal motor vehicles.

Bus rapid transit (BRT) can offer high-capacity and high-quality public transport service at a fraction of the cost of rail systems. BRT can anchor transit-oriented development, facilitating compact, inclusive urban growth. Realising the advantages of BRT is a function of several design elements, including median-aligned dedicated BRT lanes, platform-level boarding, off-board fare collection, and intersection treatments. BRT also requires safe footpaths, cycle tracks, and crossings to enable convenient passenger access. Besides good physical design, successful implementation of BRT requires effective system management, operations planning, and traffic control.

### DESIGN STANDARDS

- Exclusive BRT lanes with a width of 3.5 m each direction must be provided in the centre of the street. The lanes should be separated from mixed traffic through a physical barrier.
- Centrally located BRT stations require a width of 4 m. Larger widths may be required if demand is high.
- Having the bus-station platform level with the bus floor is one of the most important ways of reducing boarding and alighting times per passenger. Passengers climbing even relatively minor steps can mean significant delay and an increase in safety hazards, particularly for the elderly, disabled, or people with suitcases or strollers.
- Safe pedestrian access should be provided via crosswalks elevated to the level of the footpath (e.g., +150 mm). At crossings, a 1 m pedestrian refuge between mixed traffic and a BRT lane is needed. At stations, the BRT lanes should be raised to +150 mm for the length of the station, with a ramp slope of 1:100 for buses, to match the level of the elevated crosswalks.
- To achieve capacities as high as those of metro systems, passing lanes, multiple sub-stops, and express services are required at BRT stations.
- Stations should be placed at least 40 m from intersection stop lines to allow sufficient space for bus and mixed traffic queues.
- Two-phase intersections to minimise delays for buses.
- Maximum grade of 5% for BRT lanes and 2% at stations.
- Cycle parking is needed at stations.
- For specific guidance on how to design centrally-located stations and other typologies, refer to the BRT Standard (ITDP, 2024).

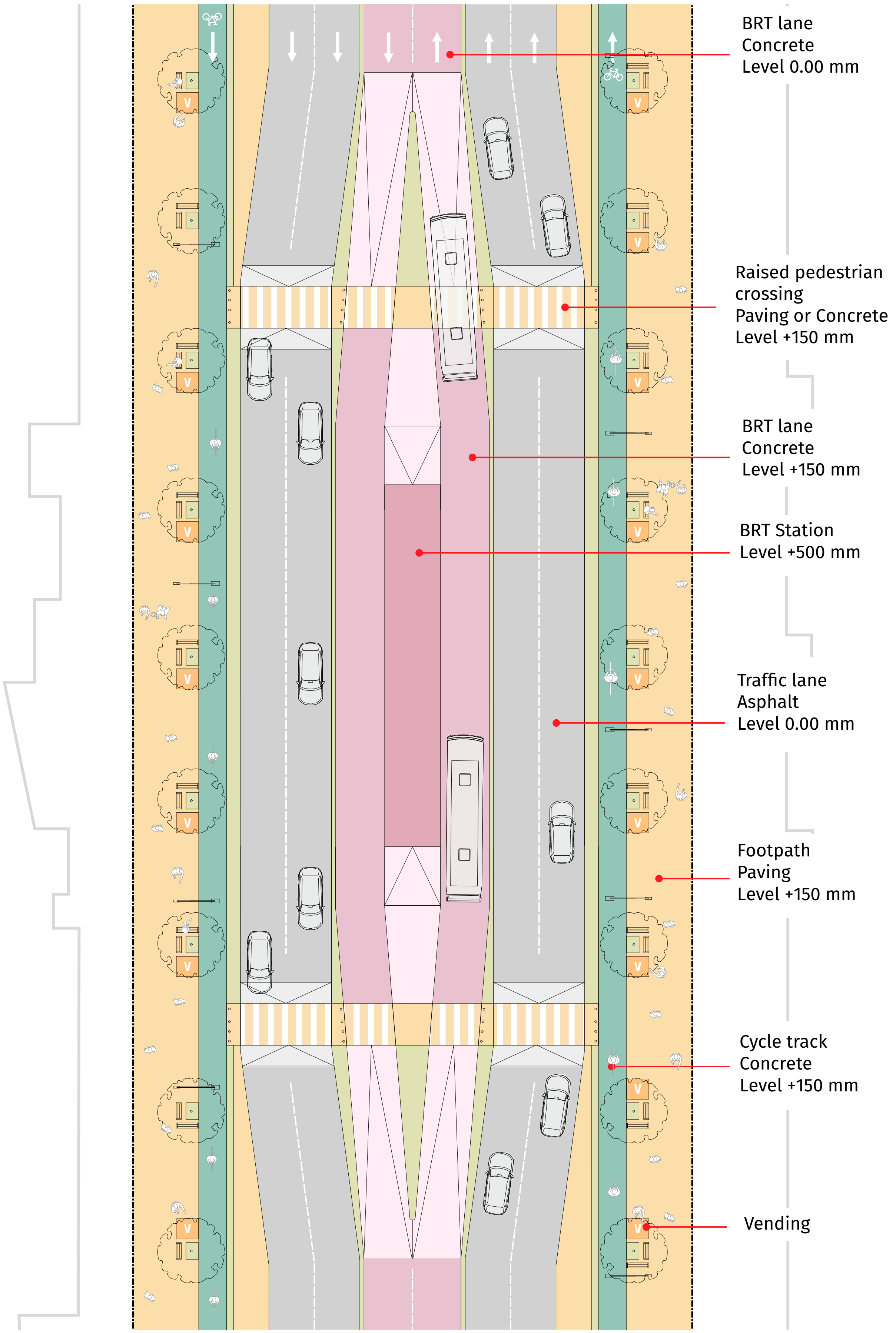



**Figure 45. BRT station and surrounding elements.**

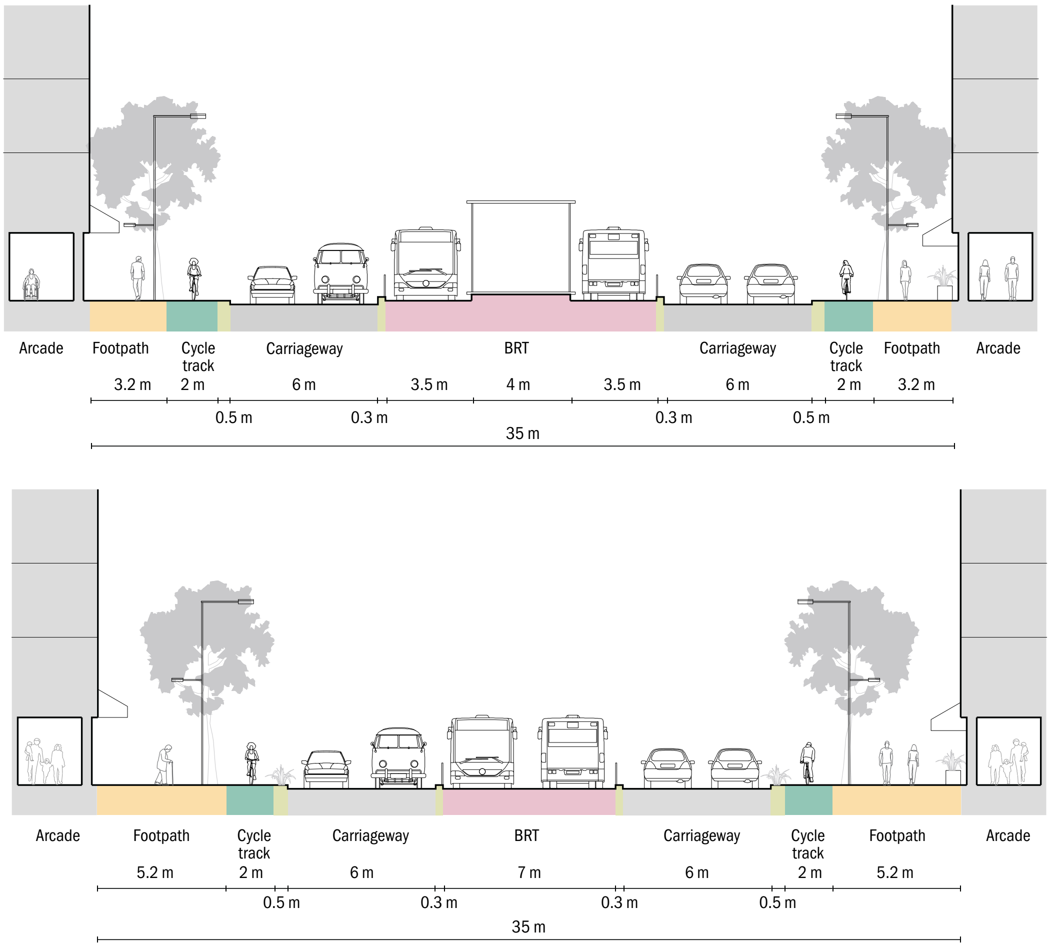



**Figure 46. A 35 m right-of-way can accommodate BRT along with footpaths, cycle tracks, on-street parking, and a local street carriageway. In order to accommodate the BRT station, the parking lanes are discontinued.**

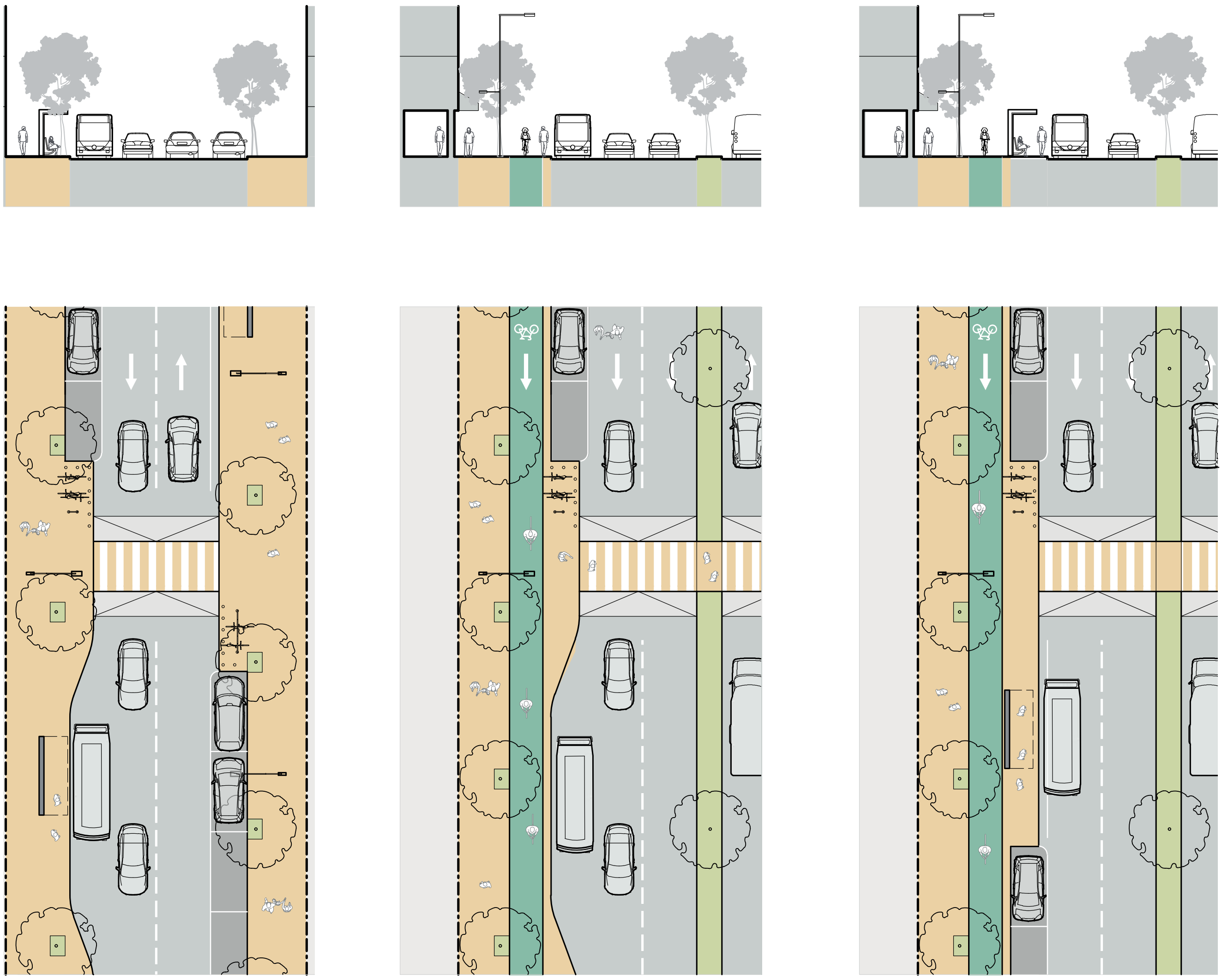
## 3.6. Bus and taxi stops

Well-designed bus and taxi stops offer a comfortable, weather-protected waiting area for public transport passengers while leaving clear space for pedestrian movement behind the shelter. The location of bus and taxi stops should be determined considering the land use, street network, and existing passenger behaviour.

Bus and taxi bays should be avoided because they increase travel times for public transport users and result in commuters standing in the street while waiting for the bus and taxi. However, bus and taxi bays may be warranted in some cases where public transport vehicles queue for long periods of time or on undivided carriageways.

### DESIGN STANDARDS

- On streets with two or more carriageway lanes per direction, bus stops should be placed adjacent to the bus's line of travel so that the bus does not need to pull over.
- On streets with one carriageway lane per direction or at terminal locations, the stop may incorporate a bus bay provided that there is sufficient clear space for walking behind the shelter. The width of the bus bay should be no more than 2.5 m.
- Bus stops require shelters with adequate lighting; protection from sun and rain; customer information; and clear, paved pedestrian access. Other amenities can include bicycle parking and trash receptacles.
- Cycle tracks should be routed behind bus shelters.
- Bus stops should be provided at intervals of 200-400 m.
- Bus stops may be placed at junctions or mid-block, depending on the route itinerary, transfer opportunities, and passenger origins and destinations. For bus stops near intersections, far side positioning is preferred.
- Eliminate driveways where they interfere with public transport operations.



On streets with two-way undivided carriageways, a bus bay may be provided if there is sufficient clear with for walking behind the shelter.

For carriageways with two or more lanes per direction, the bus stop should be placed on a bulbout in the parking lane so that buses do not need to pull over.

**Figure 47. Bus shelter placement should be compatible with non-motorised travel and facilitate efficient bus operations.**

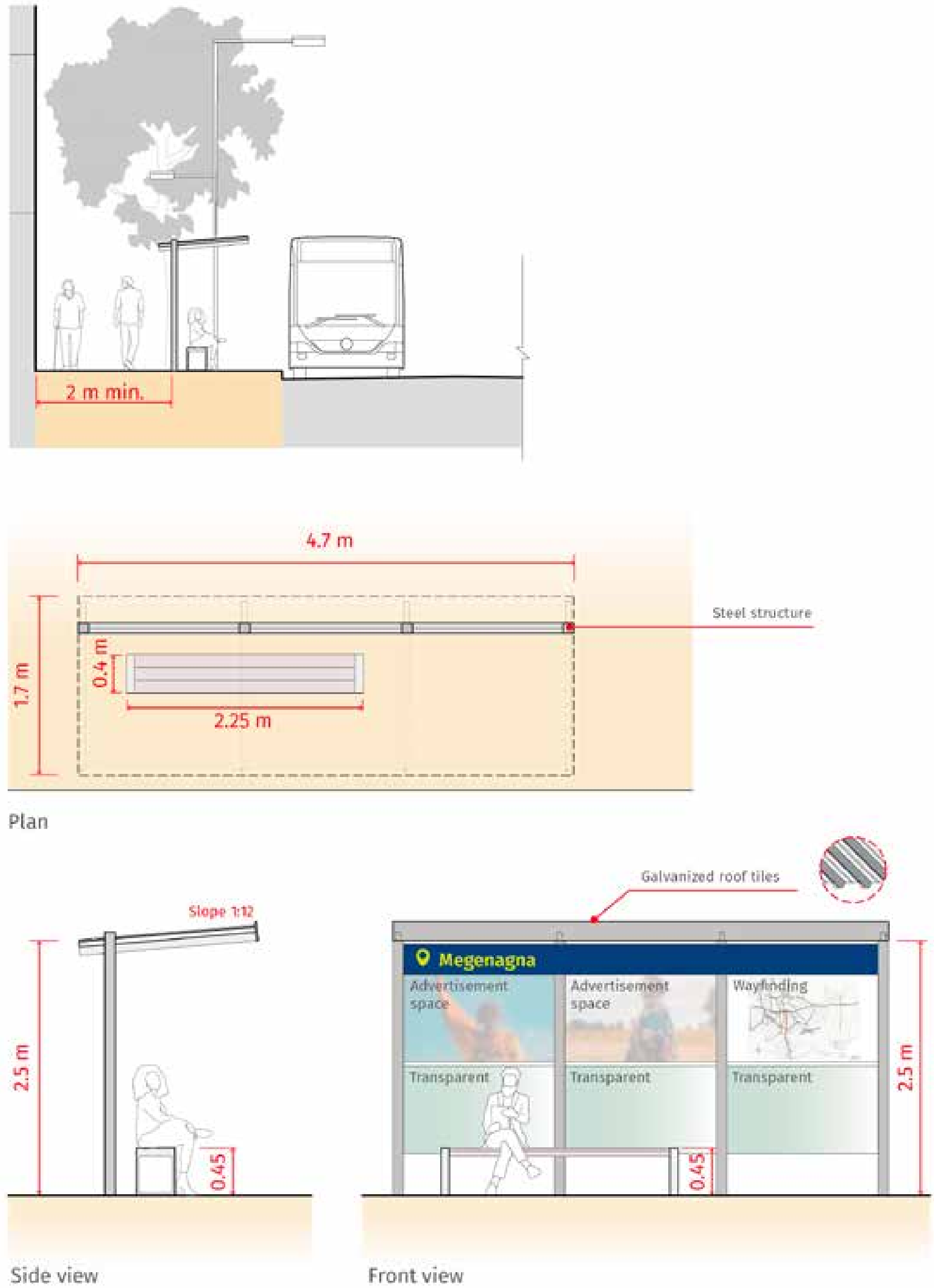



**Figure 48. A high-quality bus shelter offers rain protection and shade through opaque roof tiles. Open sides and transparent rear panels improve visibility. The shelter should include seating space and wayfinding information.**

## 3.7. Bus terminals

Bus terminals are the points where routes start or end, or stops with significant boarding-alighting activity. Terminals facilitate transfers from one route to another. Terminals also offer facilities such as public toilets and resting areas for bus crews.

### DESIGN STANDARDS

- Minimal walking distances and vertical displacement between platforms. Ensure that the entire facility offers universal access.
- Avoid bottlenecks. Provide wider spaces where different pedestrian streams intersect.
- Protection from sun and rain. Roofs should extend above the buses.
- Ample seating.
- Complete customer information, including real-time departure information.
- Adequate lighting to enhance safety and security for passengers.
- Public toilets with baby changing facilities.
- Organised vending kiosks.
- Cycle parking facilities.

**Figure 49. High-quality bus terminals offer protection from sun and rain, seating, and universal access.**

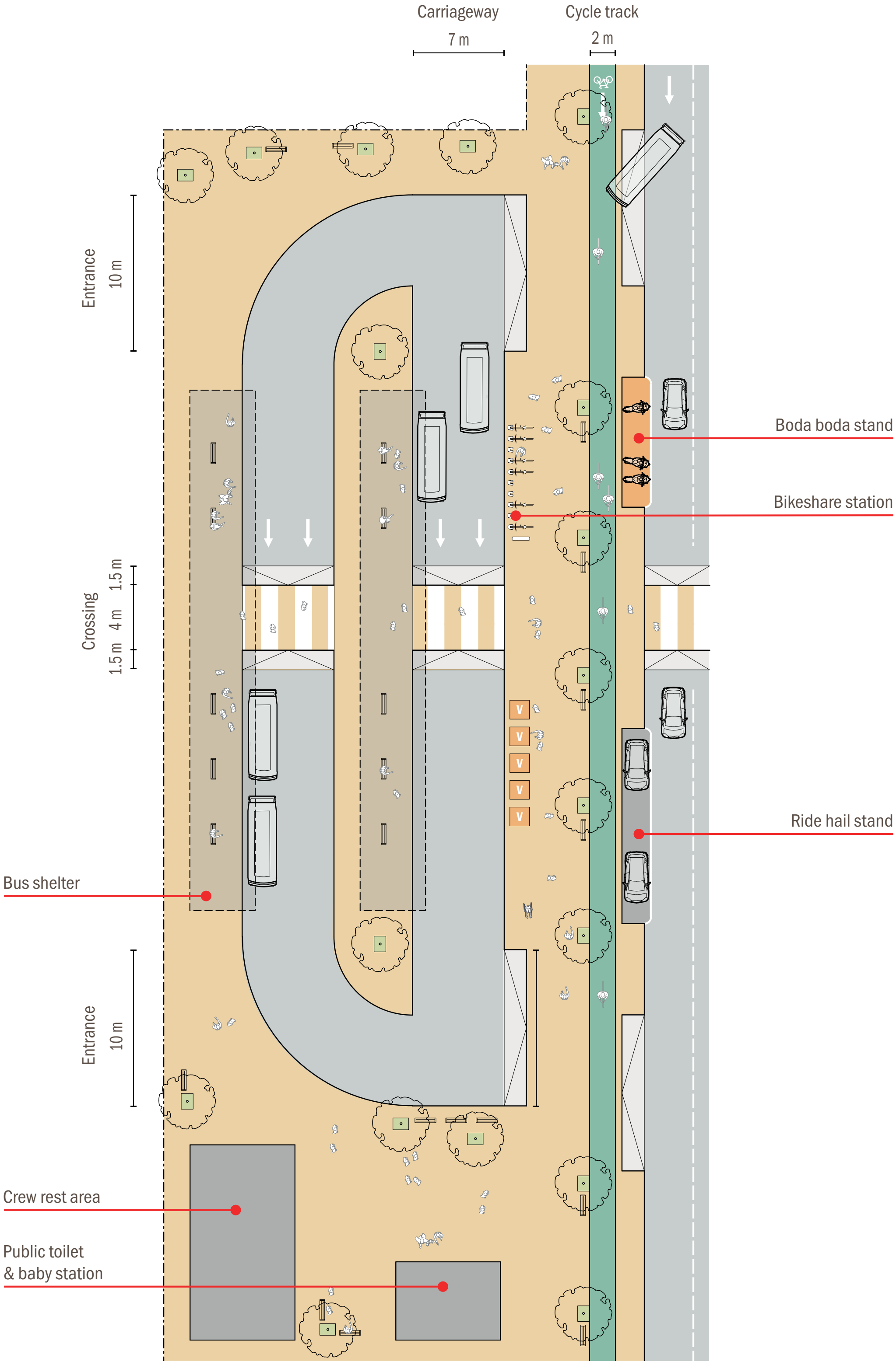



**Figure 50. Representative bus terminal layout.**

## 3.8. Carriageways

Street space should be allocated to the carriageway after adequate usable space has been reserved for walking, cycling, trees, public transport (including BRT if the street falls on the city's rapid transit network), and street vending. Otherwise, such activities will spill over onto the carriageway. Carriageway width is not determined by available ROW.

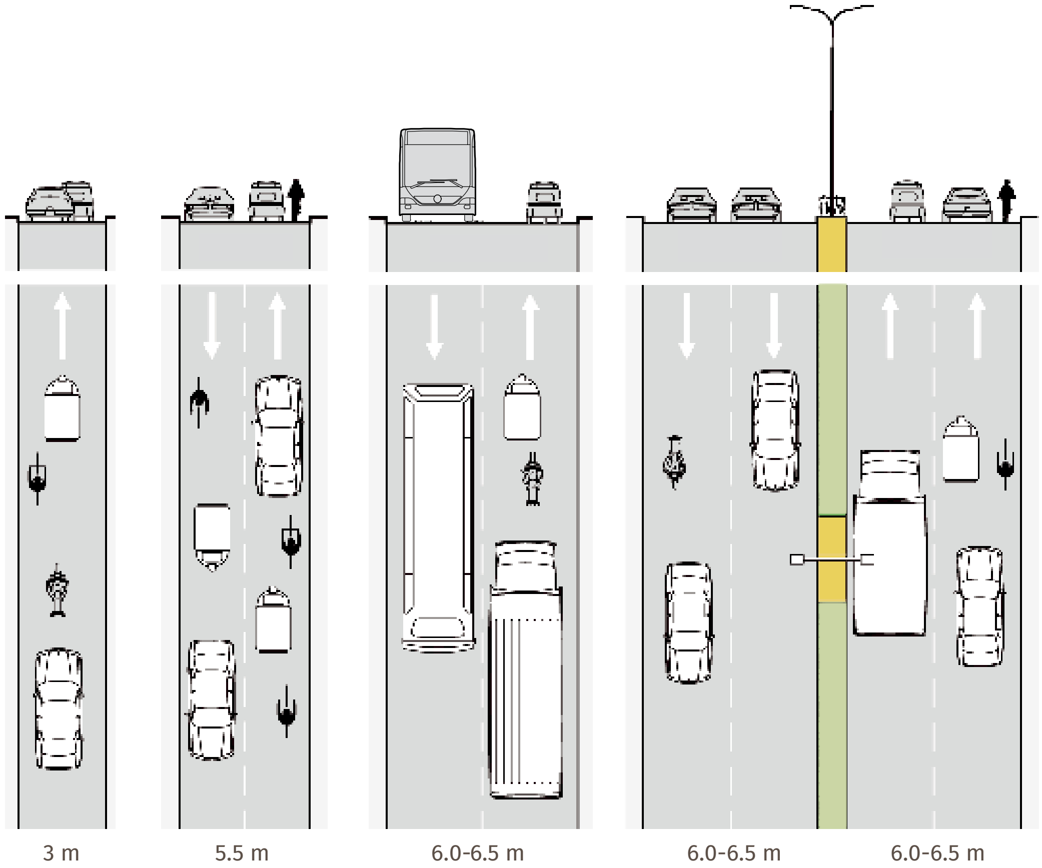
The carriageway should be designed for appropriate speeds suited to the street's role in the network. When carriageways become congested, they can no longer fulfil their role of providing for vehicle mobility. This can be addressed through parking pricing and other travel demand management measures to reduce the number of vehicles on the street. These measures reduce congestion, thereby improving conditions for the remaining users.

### DESIGN STANDARDS

- Width defined by the function of the street rather than the available right-of-way.
- On major streets, a width of 6.0-6.5 m for two lanes can accommodate large vehicles such as trucks and buses. Carriageways on urban streets should not be wider than three lanes or 9.0-9.75 m per direction. In industrial zones, a 3.5 m lane width is acceptable.
- Constant width, thereby ensuring the smooth flow of vehicles. The width should not increase on stretches where a wider right-of-way is temporarily available. Wider carriageway segments cause traffic jams where the width narrows again.
- Design speeds related to the street's function. Speeds can range from 10-15 km/h on local streets to 30 km/h on collector streets and 50 km/h on arterial streets.
- In the case of narrow, traffic-calmed streets, carriageways are replaced by shared space where motor vehicles, pedestrians, and cyclists coexist, with speeds no higher than 10-15 km/h.
- Superelevation is generally not used on low-speed (70 km/h or less) streets in unban areas. It negatively impacts drainage, footpaths, adjacent properties, intersections, and vehicle speed. Instead, streets are to be crowned with maximum 2.0% cross-slope (2.5% where there is heavy rain).
- Horizontal curves are designed to manage vehicle speeds (see Table 7). Ensure that the horizontal alignment does not result in narrow points in walking and cycling facilities.
- Vertical curves are to follow the natural grade of the land and/or match adjoining properties. Where vertical curves impact stopping sight distance, employ traffic calming to lower driver speed. For example, reducing speed from 50 to 30 km/h reduces stopping sight distance from 65 to 35 m (see Table 8) (AASHTO, 2018, Table 3-1).
- Maximum grade of 5%, except in cases of geographical constraints.

**Table 7. Minimum horizontal curve radius of streets (AASHTO, 2018, Table 3-13).**

| Speed (km/h) | Minimum horizontal curve radius (m) |
|---:|---:|
| ≤20 | 10 |
| 30 | 28 |
| 40 | 62 |
| 50 | 120 |




For a shared-street, the optimum width for a carriageway is 3 m for one-way movement and 5.5 m for two-way movement.

For local and collector streets that need to accommodate buses and trucks, the width of a two-way carriageway can vary between 6.5 and 7.0 m, depending on the volume of heavy vehicles.

In arterial streets, the optimum width of a two-lane carriageway is 6.0-6.5 m, and that of a three-lane carriageway, 9.0-9.75 m.

**Figure 51. Carriageway standards.**

**Table 8. Stopping sight distance (AASHTO, 2018, Table 3-1).**

| Street type | Speed (km/h) | Stopping sight distance (m) |
|---|---|---|
| Principal Arterial Street | 50 | 65 |
| Sub-Arterial Street | 40 | 50 |
| Collector Street | 30 | 35 |
| Local Street | 15 | 15 |

## 3.9. Medians

Medians can help streamline traffic and ensure safety on higher-speed streets where there is a risk of collisions involving left-turning traffic. In addition, they prevent speeding drivers from crossing into the opposing traffic lane. Medians also provide waiting space for pedestrians and shorten the distance of street crossings.

Medians that extend too far without any opportunities to cross, turn right, or make a U-turn make the other side inaccessible and unnecessarily increase the total distance travelled. They encourage vehicle movement on the wrong side, thereby compromising safety. Hence, the provision of breaks in a median at appropriate intervals is critical.

### DESIGN STANDARDS

- On an artery where the kerb-to-kerb carriageway width is 10 m or wider, a continuous median surmountable by pedestrians (maximum elevation 150 mm) is advised.
- If the curb-to-curb carriageway width is 11 m or narrower, periodic pedestrian refuges can enhance safety.
- In order for the median to function as a safe pedestrian refuge, a minimum width of 1 m should be provided. A cycle refuge should be 2 m wide.
- Guardrails and high kerbs are discouraged because they hinder pedestrian and cycle movement. They should be provided only on carriageways with a kerb-to-kerb width of 18 m or larger, with a break for pedestrian crossing every 50 m.
- Adjacent to BRT lanes, longer stretches of guardrail can be provided, with breaks at formal crossings (150–200 m).

**Figure 52. Medians offer a space for pedestrians to wait between streams of traffic.**

## 3.10. Street trees and landscaping

Landscaping improves the liveability of streets. It plays a functional role in providing shade to pedestrians, cyclists, vendors, and public transport passengers. Effective greening with street trees reduces the street temperature, making it comfortable for people to walk, cycle, or gather for social activities, even during summer afternoons. It also enhances the aesthetic qualities of streets. Trees also capture dust and remove glare. During storms, they reduce wind velocity. Additionally, trees can help reduce vehicle speeds by reducing the actual or the perceived width of a street. Landscaping can beautify a street, providing an umbrella canopy and adding colours, fragrances, and textures. A well-designed landscape promotes a sense of ownership among nearby residents or shop owners such that they contribute towards its upkeep. Finally, landscaping can incorporate fruit-bearing and medicinal or religious trees and shrubs.

### DESIGN STANDARDS

- Existing trees are to be retained in the course of street improvement projects.
- Every footpath should have a continuous tree line. Landscaping may extend into bulb-outs in the parking lane but a single tree line should be maintained in order to improve compatibility with underground utility lines. A continuous tree line is preferable to trees placed in the parking lane.
- Minimum distance between trees to provide continuous shade, depending on the individual trees' canopy size and shape. A typical interval is 6-10 m between trees.
- Tree pit locations should be coordinated with the position of street lights.
- For footpath widths equal or larger than 3.5 m, tree pits should have dimensions of at least 3.5 m by 1.5 m (a minimum of 5 $m^2$) to accommodate the trunk and root structure at full maturity. On narrower footpaths between 2 m and 3.5 m, 1 m by 3 m tree pits are acceptable and on tree-lined medians, a minimum 1 m width is recommended.
- Hume pipes can lower the level at which roots spread out, thereby reducing damage to road surfaces and utilities.
- Trees with high branching structures are preferable.
- Medium-height vegetation should be trimmed next to formal crossings to improve the visibility of pedestrians and cyclists.
- Indigenous species are preferable.

**Figure 53. Shaded streetscape in Dire Dawa.**

**Table 9. Preferred tree types per microclimatic condition.**

| Microclimatic condition | Pedestrian walkways | Medians |
|---|---|---|
| Kolla | Fine grained, dense leaved and canopied | Fine grained, dense leaved and canopied with shrubs and clinger |
| Woina Dega | Fine grained and dense, small and medium leaved<br>Deciduous with canopies | Fine grained and dense, small and medium leaved<br>Deciduous with canopies with shrubs and clinger |
| Dega | Coarse grained, small and medium leaved deciduous with canopies | Fine grained, small and medium leaved<br>Deciduous with canopies mixed with conical shaped trees, shrubs, and clinger. |
| Wurch | Coarse grained, small and medium leaved deciduous with canopies | Fine grained, small and medium leaved<br>Deciduous with canopies mixed with conical shaped trees, shrubs, and clinger. |
| Bereha | Fine grained and dense, small and medium leaved<br>Deciduous with canopies | |

**Table 10. Centre-to-centre spacing of street trees.**

| Location | Less than 6 m crown diameter | 6-9 m crown diameter | 9 m and above crown diameter |
|---|---|---|---|
| Footpaths | 6-8 m | 8-12 m | In city parks, along water bodies, reserved areas, as designed |
| Medians | 6-8 m | 8-12 m | - |
| Left over spaces outside the main cross section | As proposed in the urban or landscape design. | | |
| Greenway corridors | As proposed in the urban or landscape design. | | |

Table 11. Distance between trees and street elements.

| Street element | Minimum clearance (m) |
|---|---|
| Intersection | 8.0 |
| Street light pole | 3.0 |
| Underground water, electric, and telephone lines | 1.0 |
| Kerb | 0.3 |
| Building | 0.3 |

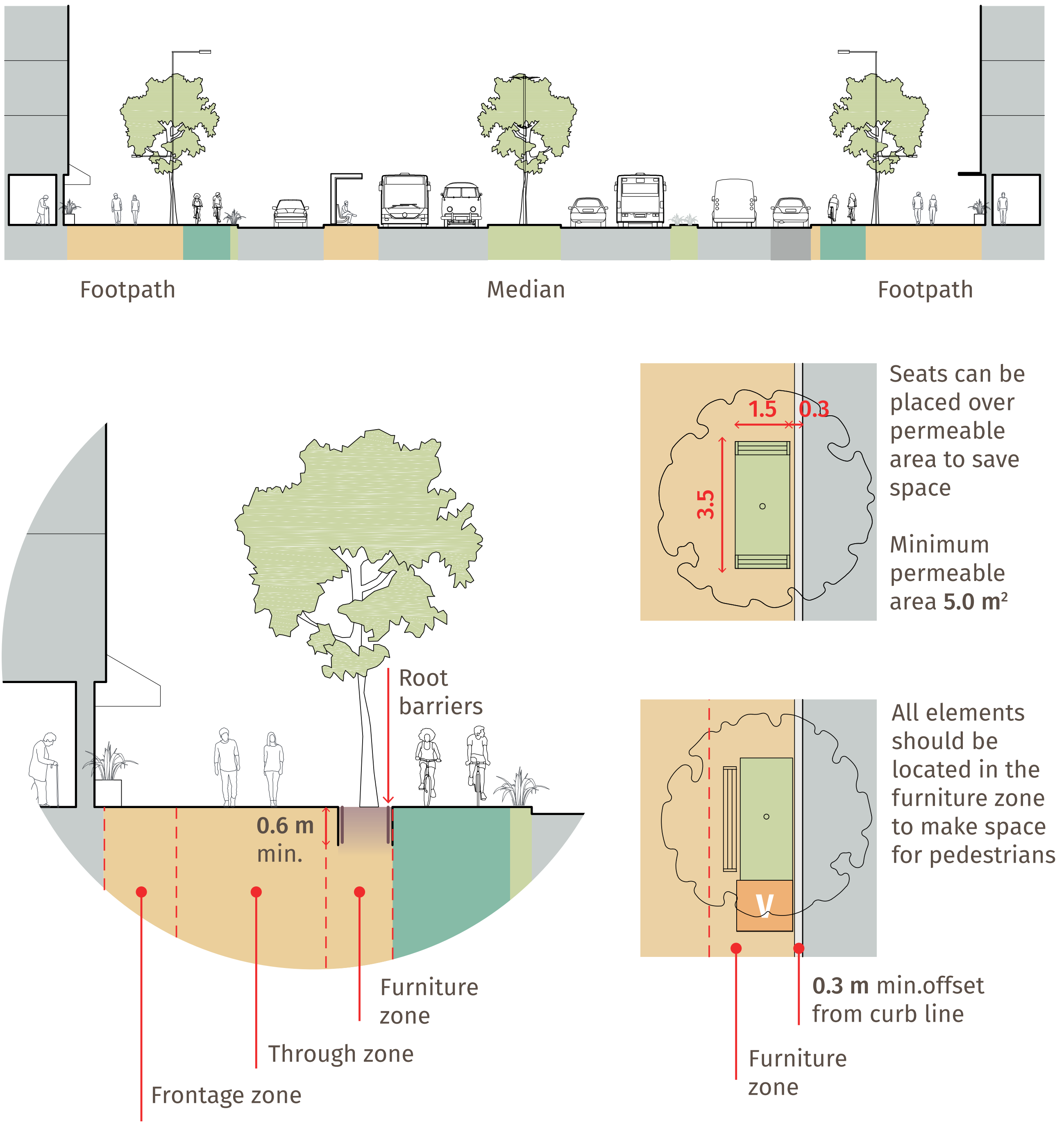



Figure 54. Position of trees in the cross section

## 3.11. Vending

Street vending provides essential goods and services to a wide range of population groups. It also makes public space safer by contributing "eyes on the street," particularly on streets lined with compound walls. Hence, it is important to provide improved and "formal" street vending areas, especially on major streets and near public transport nodes. Well located street vending reduces trip lengths by allowing people to shop on the way to other destinations. Spaces may be rented out to and managed by cooperatives.

### DESIGN STANDARDS

- Street vendors should be accommodated where there is demand for their goods and services—near major intersections, public transport stops, parks, and so on.
- Supporting infrastructure, such as cooperatively managed water taps, electricity points, trash bins, and public toilets, should be provided.
- Vending areas should be positioned so as to ensure the continuity of cycle tracks and footpaths. The furniture zone of the footpath or a bulbout in the parking lane are ideal locations for vending.
- The material used for the vending area should facilitate good drainage.

**Figure 55. Street vending offers access to essential goods.**

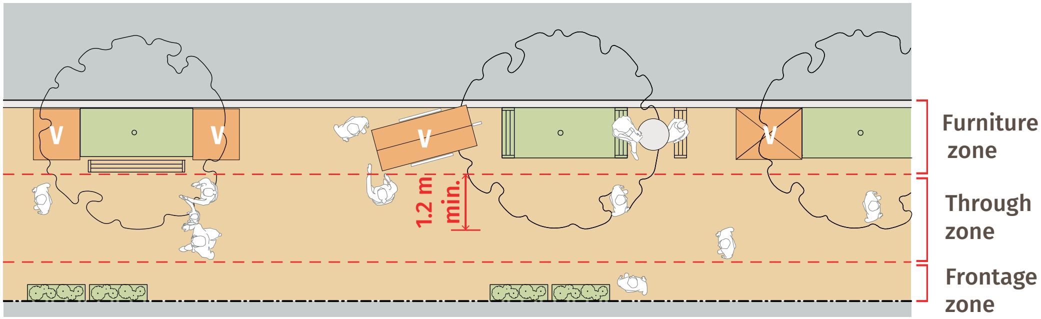



Figure 57. Street vending furniture and flexible typologies.

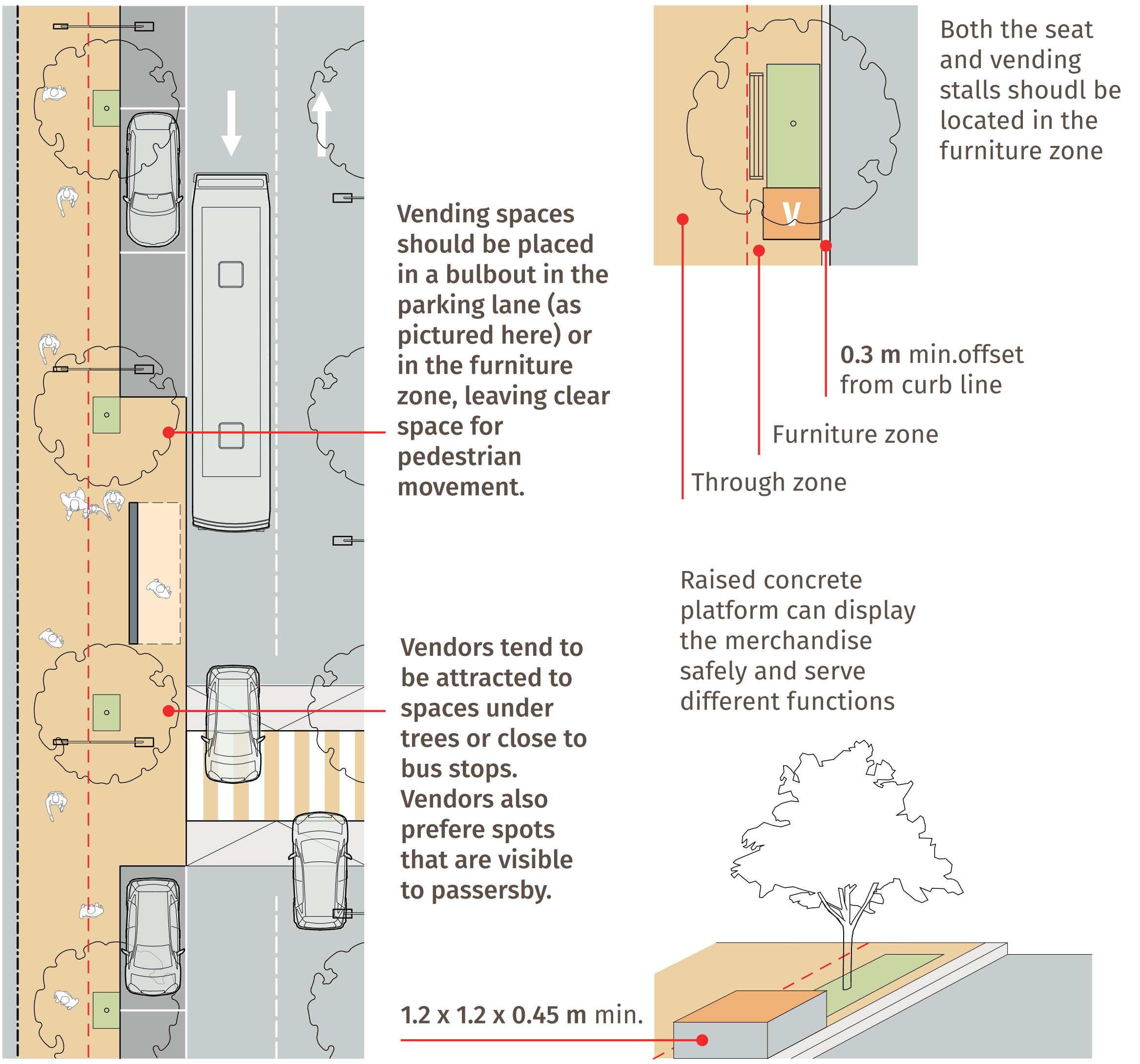



Figure 56. Street vending

## 3.12. Street lighting

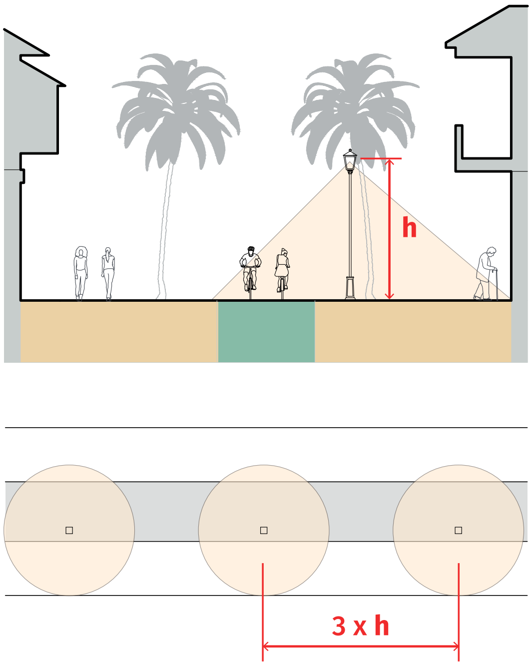
Well-designed street lighting enables motor vehicle drivers, cyclists, and pedestrians to move safely and comfortably by reducing the risk of traffic crashes and improving personal safety. From a traffic safety standpoint, street lighting is especially important in potential conflict points, such as intersections, driveways, and public transport stops. Additionally, lighting helps road users avoid potholes and missing drain covers. From a personal security standpoint, street lighting is essential for mitigating pedestrians' sense of isolation and reducing the risk of theft and sexual assault. Improved lighting is particularly important in isolated spaces such as under- and overpasses and walkways next to parks or blank façades.

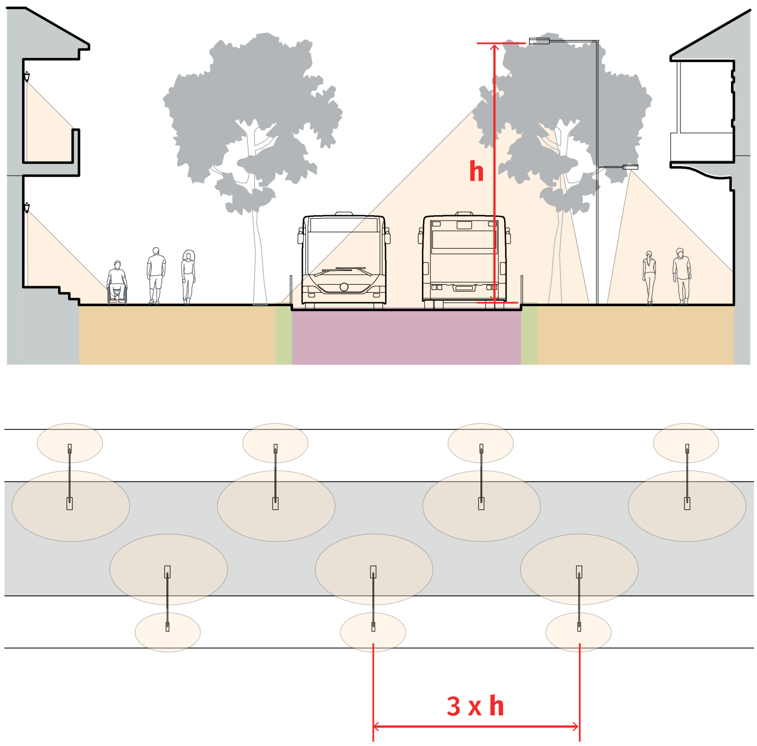
### DESIGN STANDARDS

- The spacing between two light poles should be approximately three times the height of the light fixture (see Table 12).
- Poles should be no higher than 12 m. Especially in residential areas, they should be significantly lower than 12 m to reduce undesirable illumination of private properties. Additional lighting should be provided at conflict points, such as intersections.
- The placement of street lighting should be coordinated with other street elements so that trees or advertisement boards do not impede proper illumination.
- The placement of street lighting can be at either side of the street and/or along the street median, or one-sided at local streets, as per Table 12. For the two-sided layouts, lights should be staggered so as to optimise costs, while still avoiding dark spots, especially for pedestrians.
- Street lights shall be powered by solar cells and use LED lamps.
- Lamps should offer sufficient lighting for motor vehicles and NMT areas. For all footpaths, pedestrian-scale lamps should be provided to increase illumination for pedestrians and also beautify urban spaces.

**Table 12. Light pole height and spacing options.**

| Street type | Street light position | Maximum spacing (m) | Height of street lights (m) |
|---|---|---|---|
| Principal Arterial Street | Street edge on both sides and double-sided in the median | 30 | 9-12 |
| Sub-Arterial Street | Two sides | 25 | 6-9 |
| Collector Street | Two sides | 20 | 6-9 |
| Local Street | One or two sides; pedestrian-scale lamps | 15 | 4-6 |




## Boulevard

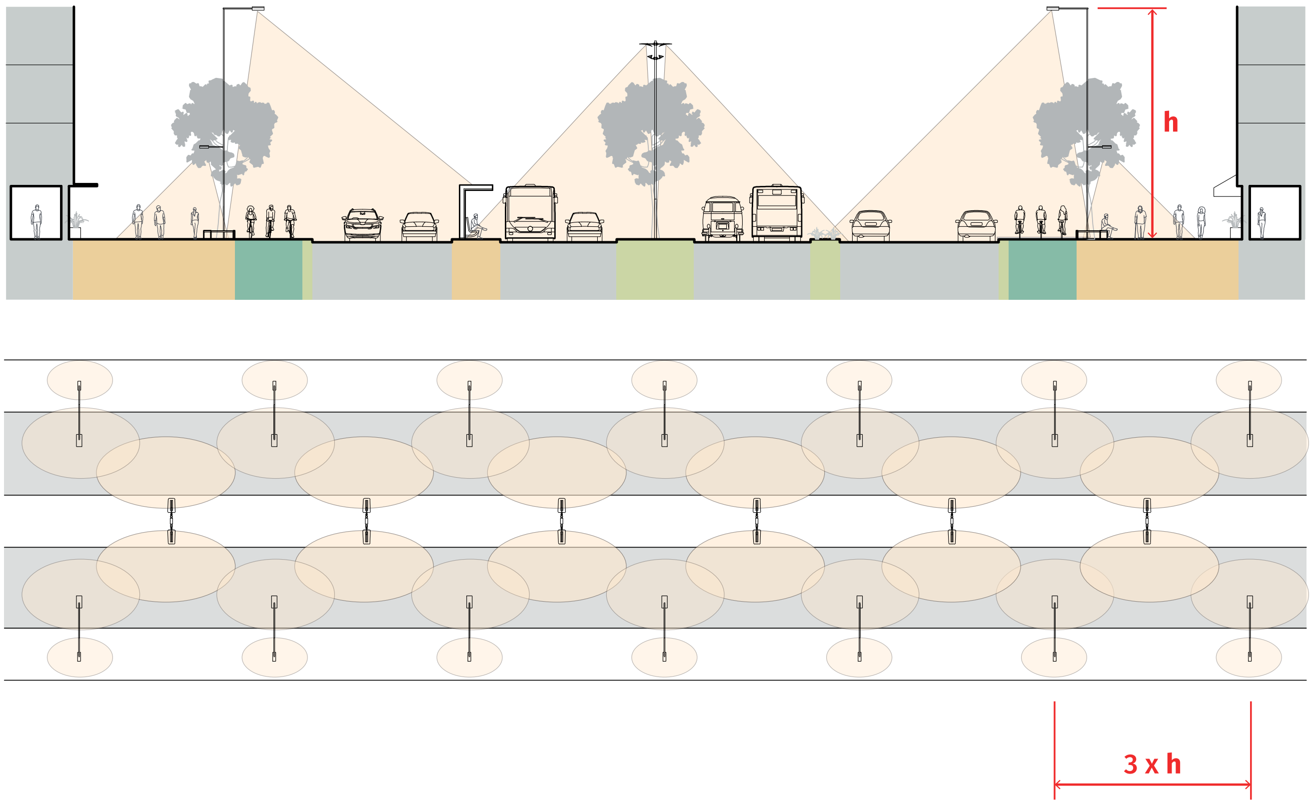



**Figure 58. These sections indicate how lights can be oriented to accommodate varying street widths and light post locations.**

## 3.13. Street furniture

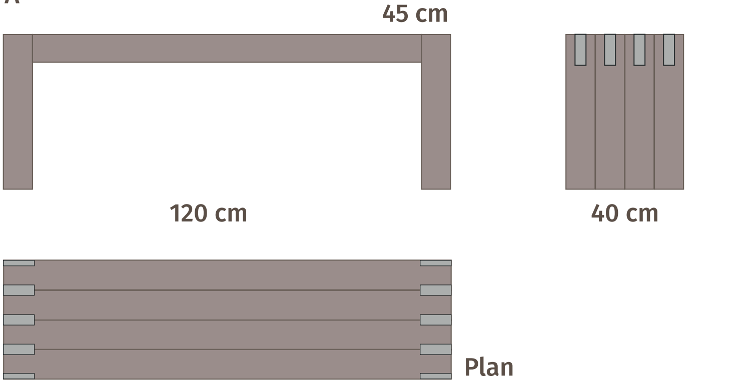
Street furniture provides people places to sit, rest, and interact with each other. Street furniture also includes services-related infrastructure, such as trash cans, street vending, toilets, and signage. When positioned on narrow shared streets, benches, tables, street vending spaces, and other furniture can also function as traffic calming elements. Vending stands, tables, roofs, and water taps can support the formalisation of street vending and promote better sanitary conditions. Finally, other street furniture, such as way-finding signs and bus stops, provides information.

### DESIGN STANDARDS

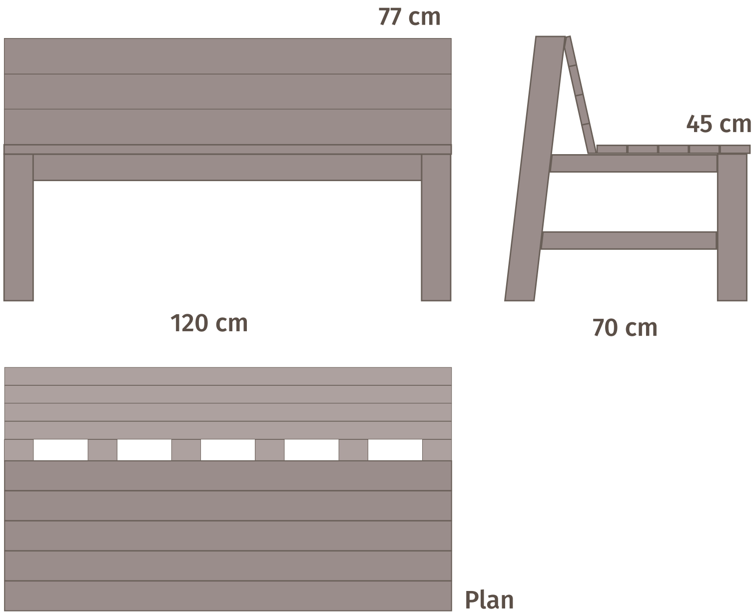
- Furniture and amenities should be located where they are likely to be used. Furniture is required in larger quantities in commercial hubs, market areas, crossroads, bus stops, BRT stations, and public buildings.
- Most street furniture, especially benches and tables, should be placed where it receives shade. Otherwise, it will become too hot to be used during the daytime.
- Furniture should be located where it does not obstruct through movement. Bulb-outs in parking lanes and street vending islands in shared streets are great places to install furniture. Similarly, a landscaping strip can be broken with street furniture on hardscaped spaces.
- On streets with large numbers of pedestrians and commercial activity—especially eateries—trash bins should be provided at regular intervals (i.e., every 20 m). On streets with lower pedestrian densities, trash bins can be provided according to adjacent land uses or street activity.
- Security cameras shall be fitted in important locations at a minimum height of 4.5 m on street light poles.
- On a 3 m wide footpath, furniture and amenities should be provided sparingly and in the tree line to maintain at least 2 m of clear space for walking.
- Bulb-outs in a parking lane can accommodate street furniture and amenities without compromising pedestrian mobility.
- A parking or service lane discontinued in the vicinity of a bus stop provides space for street vending and furniture.
- On a shared street, furniture can be placed on islands that double as traffic calming elements.

**Figure 59. Street furniture offers spaces to rest and interact.**

**Furniture**
**A**




**Furniture**
**B**




**Furniture placement**

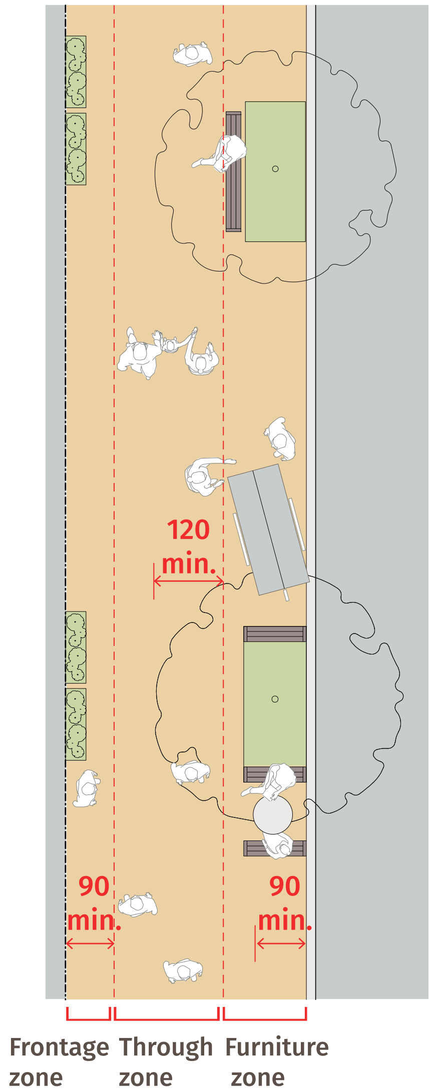



Figure 60. Dimensions and placement for seating.

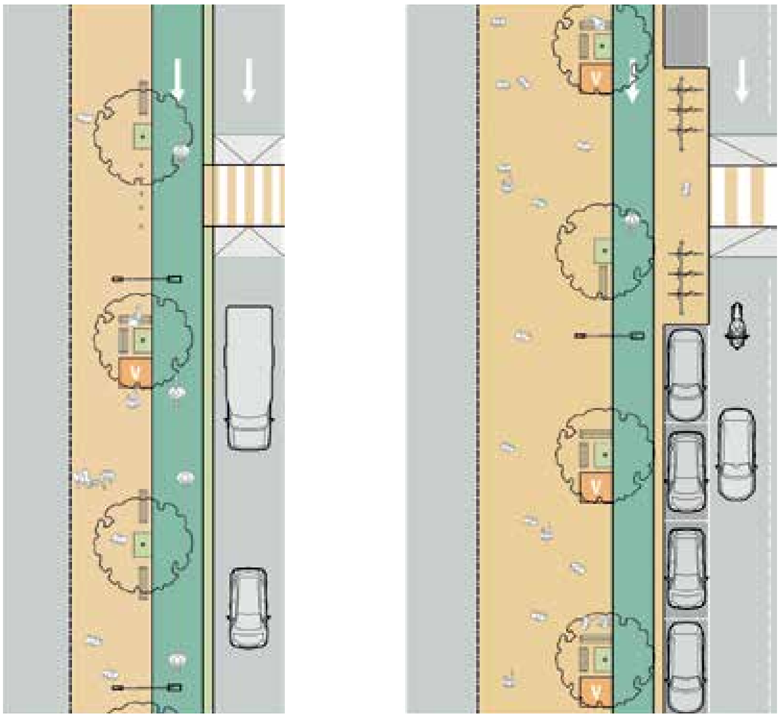


**Figure 61. Street furniture and other street design elements that are static (including utility boxes, street lighting, trees, and parking), need to be aligned in order to leave adequate clear width for the movement of pedestrians, cyclists, and motor vehicles.**

**Table 13. Standards for litter receptacles.**

| Element | Standard |
|---|---|
| Size | 400 mm x 400 mm, height 600-900 mm |
| Construction | Fixed |
| Mechanism | Fixed on a post, with the box above the ground on rotating hinges or other mechanism for easy waste removal |
| Location | At each pedestrian crossing, or with maximum spacing 150 m and 250 m in industrial areas |

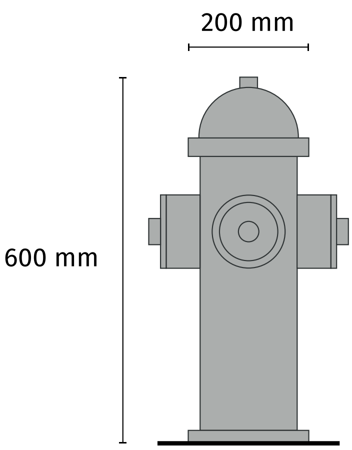



**Figure 62. Dimensions of a fire hydrant.**

## 3.14. Street signs and signals

Street signs and signals offer various types of information, including the following:

- Maximum speed limit for a given street.
- Directions to different destinations.
- Intersection operations.
- Kerb management policies, including parking, no-parking, and loading zones.
- Temporary street closures.

### DESIGN STANDARDS

- Glossy surface to improve legibility at night.
- Uniform typography with a sans serif typeface above a blue or green background. Where possible, use of symbols is preferred to facilitate understanding regardless of the user's linguistic background.
- Convenient position clearly visible to the target users. Signs must not be placed within 1 m of each other or clustered in one location.
- Traffic lights shall have a minimum height of 4.5 m shall be visible from at least 150 m.
- Traffic signs placed above pedestrian areas shall have clear height of 2.2 m up to the lower edge of the plate, spacing of at least 0.35 m from the edge of the kerb, and positioning limited to the furniture zone of the footpath.
- Tourist maps shall be posted in tourist interest areas such as historic areas, public transport stations, and popular public spaces.
- The clear height of advertisements shall be at least 2.5 m on walls and 3 m on poles.
- The duration of contracts for temporary advertisement boards shall not be more than 6 months. The owner or city administration shall remove the board within two weeks of notification of expiration of contract to the owner. The duration of contracts for permanent information boards or advertisements is 5 years.

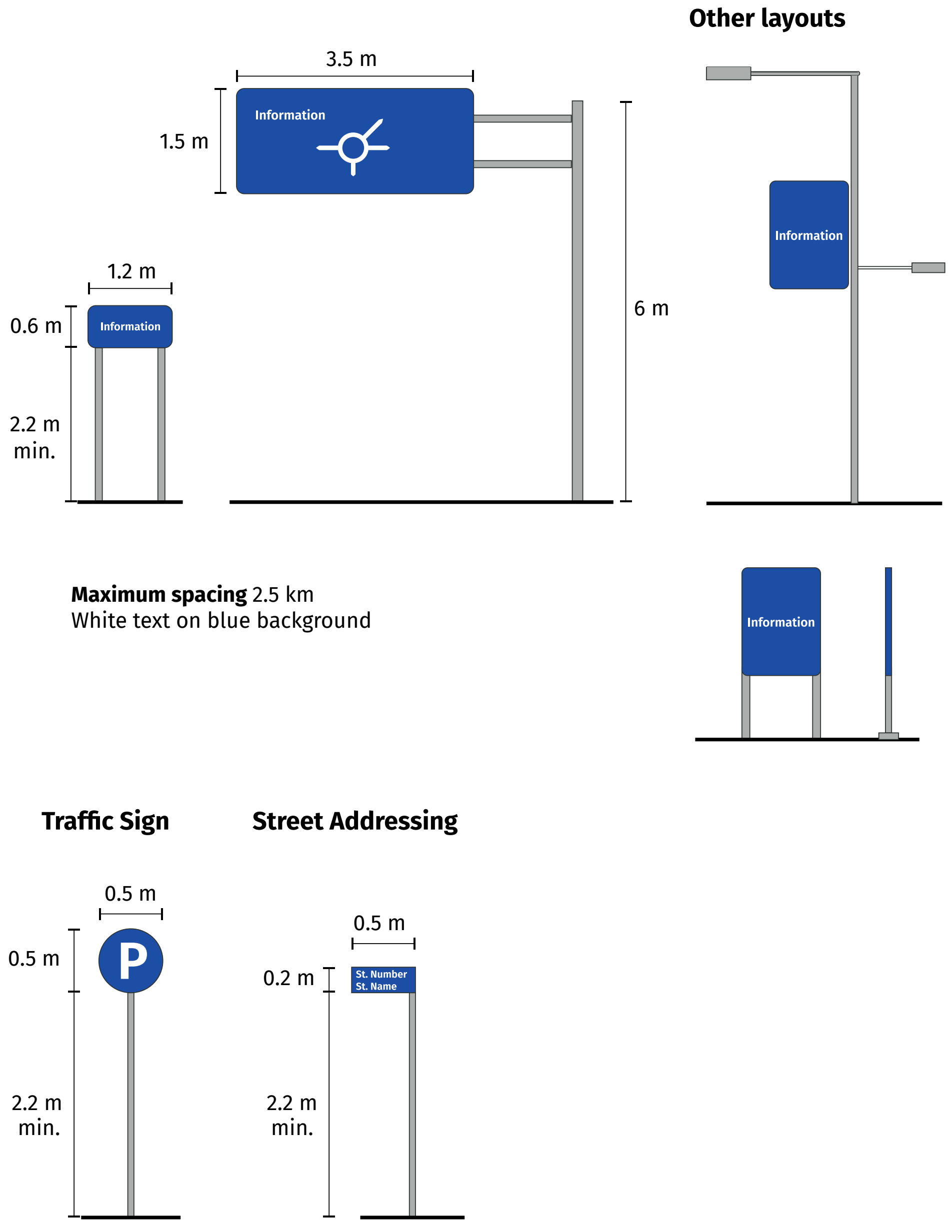



Figure 63. Traffic and street addressing signs.

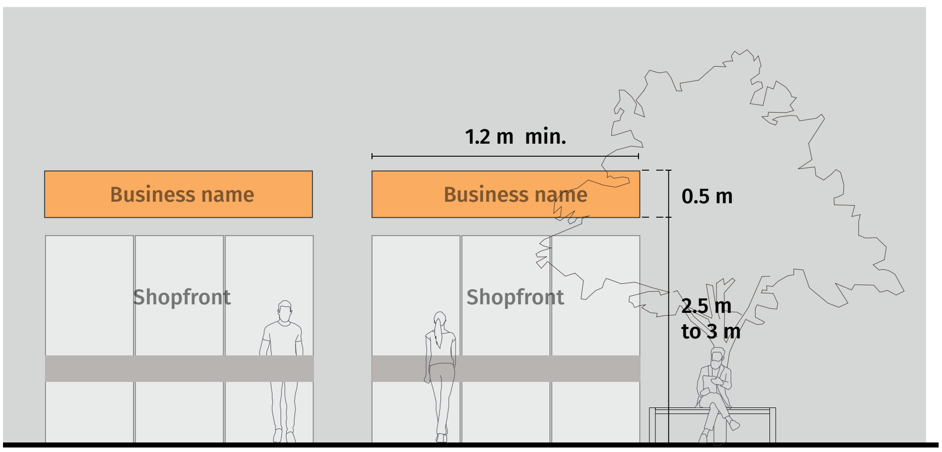
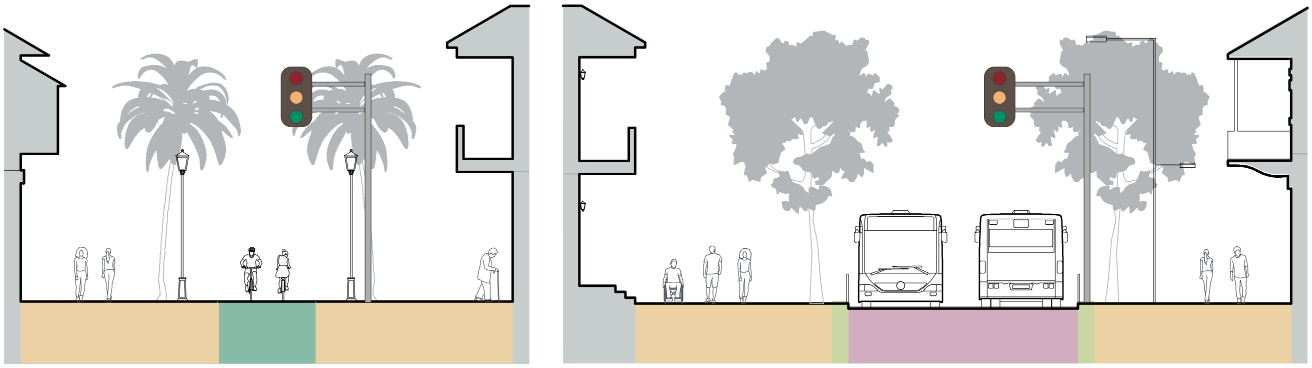
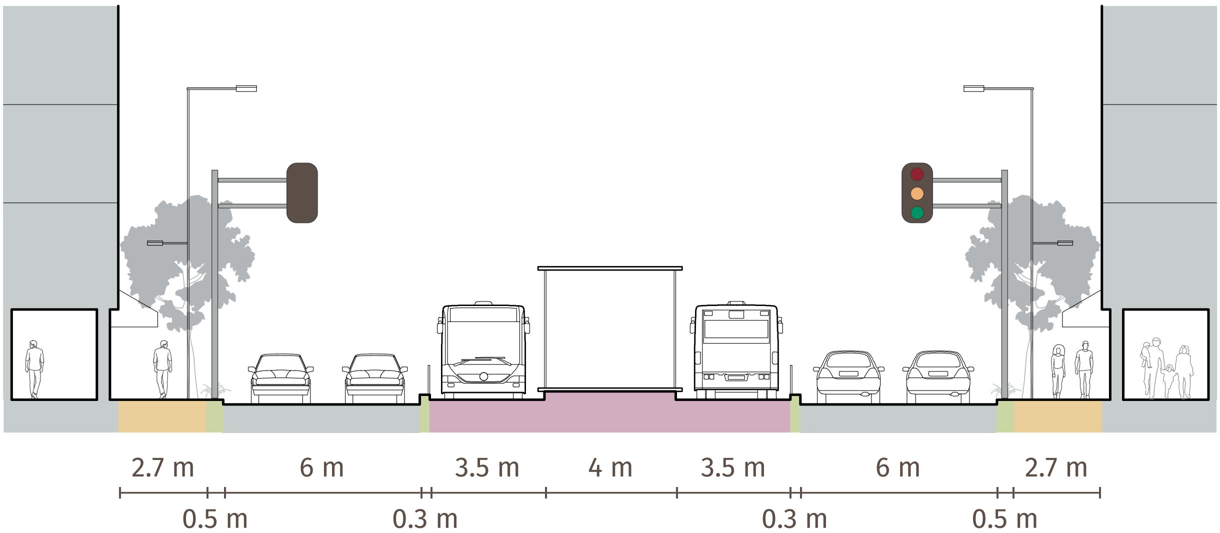



Figure 64. Shop signs.



## Avenue




## Boulevard

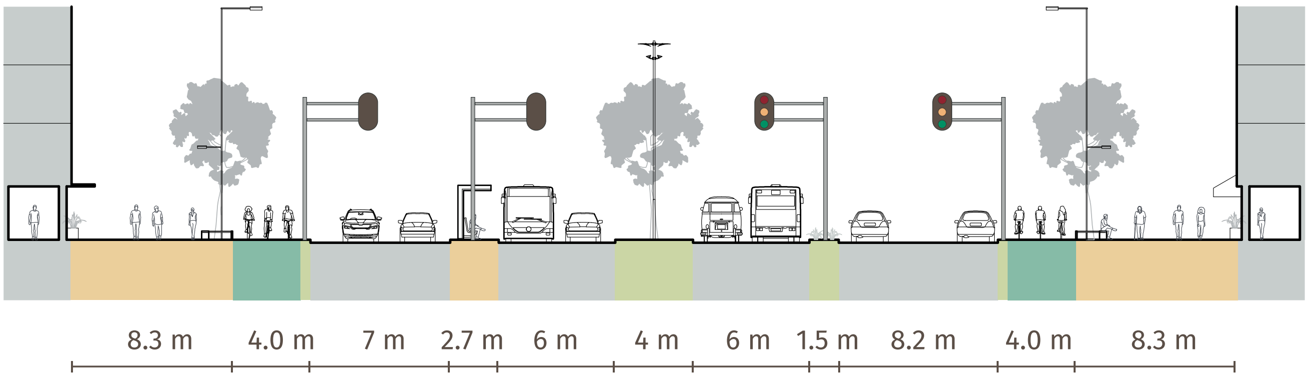



**Figure 65. Position of traffic signals.**

## 3.15. Public toilets

Public toilets contribute to the betterment of the urban environment and improve public health. The location of public toilets shall be determined in neighbourhood development plans, urban design plans, street designs, or block designs; and implemented in the construction and furnishing phase of streets. They can also be installed as part of street improvements. Public toilets can be run and managed through micro-scale enterprises to create employment opportunities. Potential funding sources include donations, sponsorships, and advertisements.

### DESIGN STANDARDS

- The minimum area to be allocated for public toilets is 50 sq m for a set of male and female stalls and 19.5 sq m for a standalone unisex stall. This includes the toilet facilities and a workstation for access control, collecting fares, supervision, and maintenance.
- Positioning at public transport stations, public spaces, and other busy locations.
- Hygienic, easy to clean, and attractive fixtures.
- Adequate cleaning to avoid foul smells.
- Universal access.

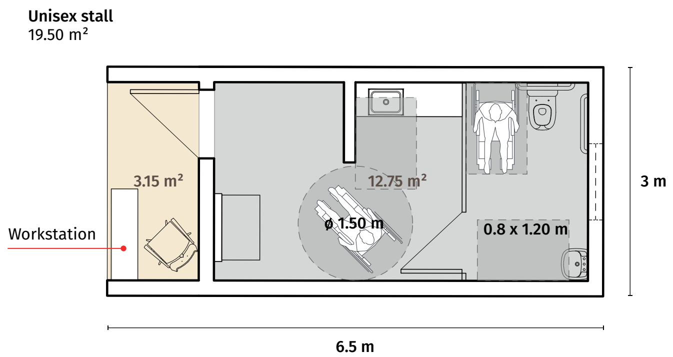



Figure 66. Public toilets: unisex stall with universal access.

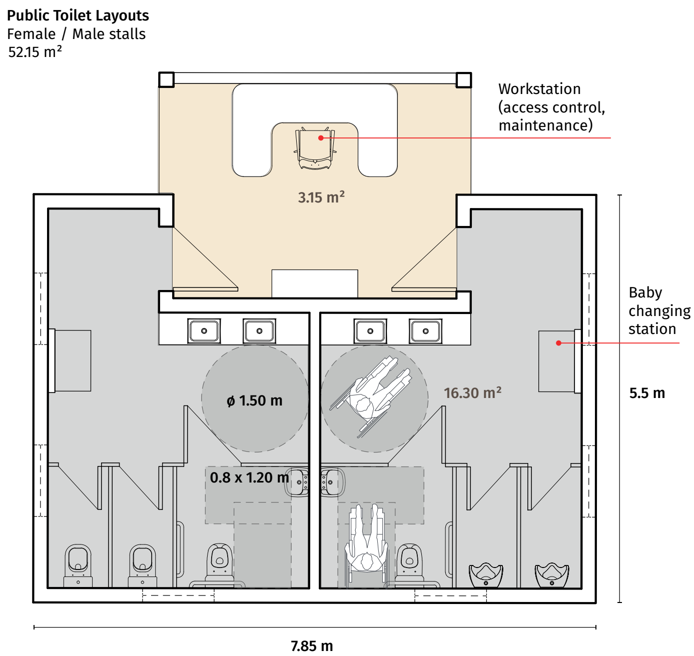



Figure 67. Public toilets: male and female stalls with universal access.

## 3.16. Storm water

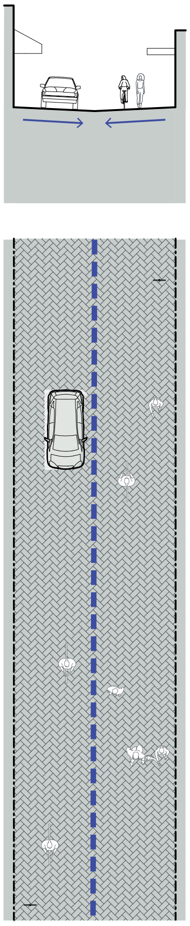
Adequate and efficient storm water drainage prevents water logging and erosion. Under-investment in storm water drainage results in major longitudinal storm water flows, which can erode the street surface. Deteriorated surfaces may cause crashes and thus imply costs beyond direct maintenance expenses.

In flooded areas, pedestrians and cyclists are forced to make their way through uncomfortable and potentially dangerous terrain hidden under the water's surface. After the water drains away, the remaining mud and debris act as a deterrent to walking and cycling.

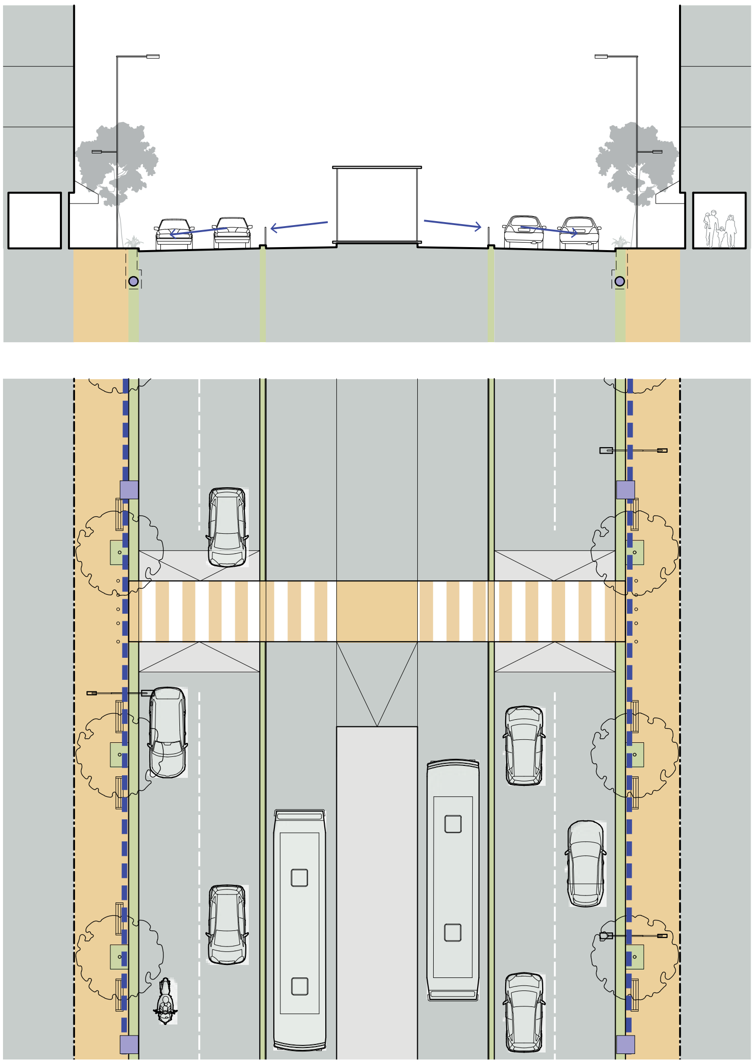
The design of many streets in Ethiopia places pedestrians and cyclists at the lowest point in the cross section, forcing them to wade through water and mud during the rainy season. Drains are often placed in an ad-hoc manner and are not levelled with the surrounding road surface. Open drain covers cause crashes and pose risks to pedestrians.

### DESIGN STANDARDS

- The lowest point in the cross section should occur on the carriageway. Cycle tracks, footpaths, bus stops, and street vending areas should be at a higher level.
- 1:50 camber for footpaths and cycle tracks.
- Drain surfaces should be at grade with the surrounding street surface unless provided in landscaped areas. Drain access points should be surfaced appropriately to avoid interrupting pedestrian and bicycle movement.
- Catch pits should be located at regular intervals, depending on their size and the catchment area, and at the lowest point of the street cross section. Gratings should be designed so that they do not catch cycle wheels.
- Drainage channels should be provided underground to maximise the area available for NMT.
- More environmentally benign approaches such as landscaped swales improve groundwater recharge, reduce storm water runoff, and improve the overall liveability of a street. Swales range in size from tree pits and landscaping strips to large low-lying neighborhood parks. Swales are most appropriate on wide rights-of-way with large areas of unused space, but not in constrained environments where they take away space from pedestrians, cyclists, and street vendors.
- The number of storm water lines in the cross-section should be minimised to keep construction and maintenance costs low. For example, an equal number of catch pits can be accommodated on two instead of four lines if they are placed strategically.
- Gratings should be designed so that they do not catch cycle wheels.




On a narrow and short street, underground piping is usually unnecessary. Instead, storm water can be carried off directly on the carriageway. The lowest elevation is at the centre of the street in order to maintain drier areas for pedestrians.




On wider streets with higher runoff, multiple storm water pipes may be desirable. In this example, the BRT lanes have one set of drains, while the carriageway lanes and footpaths drain into a second set of drainage lines.

**Figure 68. Storm water drainage arrangements.**

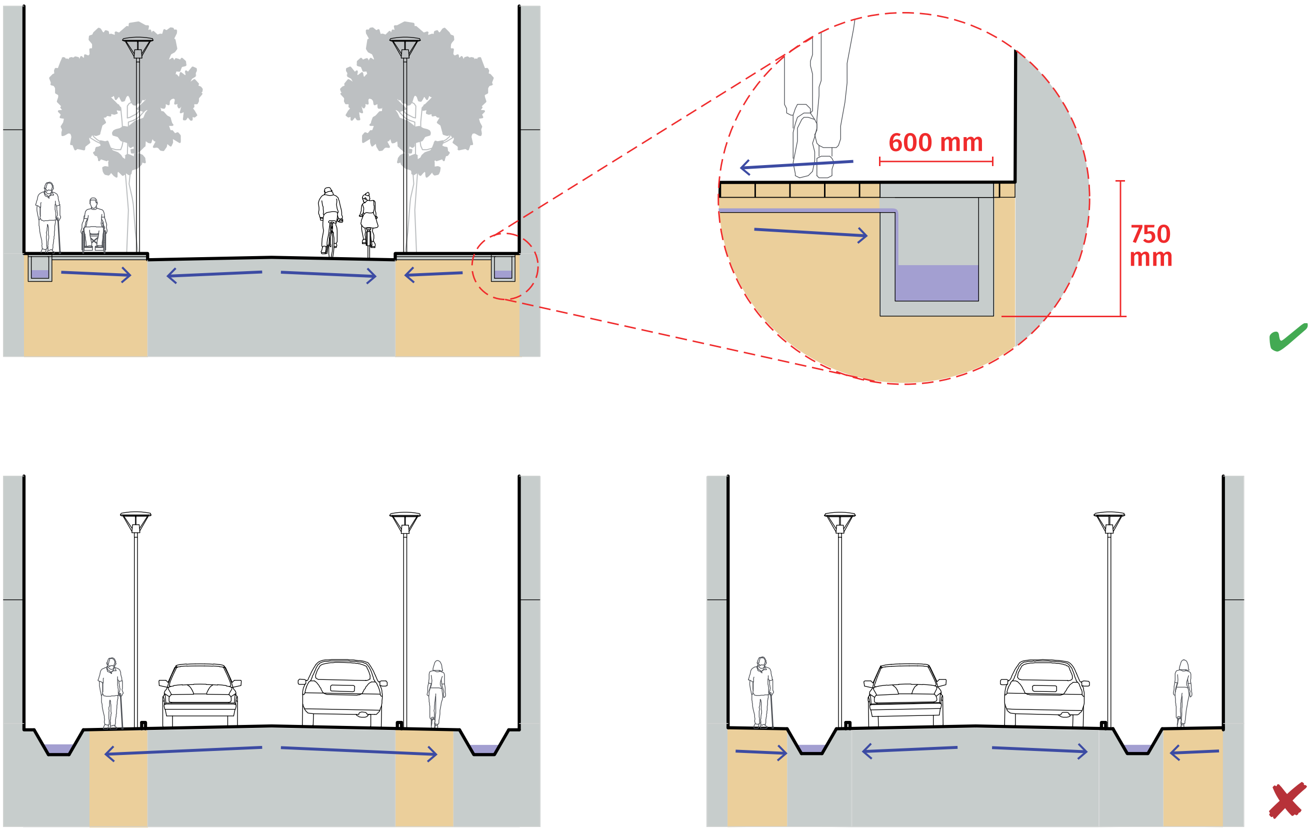



Figure 69. Footpaths should be raised above the level of the carriageway to prevent water logging. The drain should be placed on the outer edge of the footpath in order to make space for a tree line between the footpath and the carriageway. Drain covers increase the footpath width.

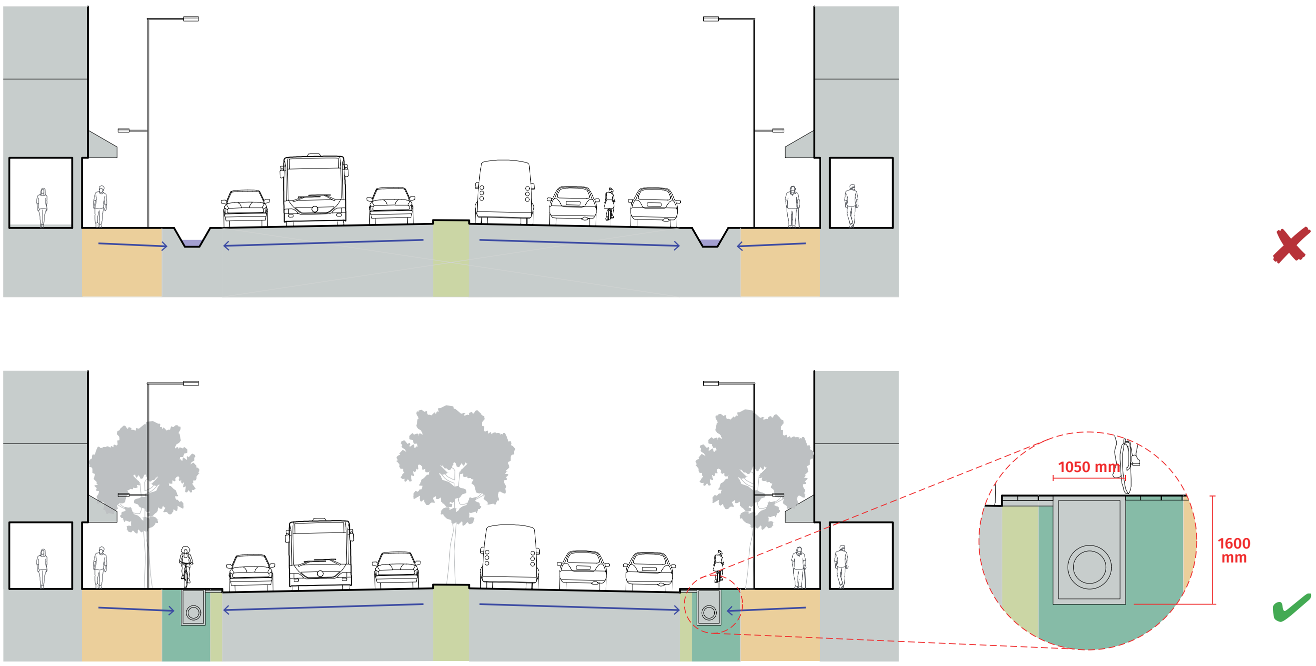



Figure 70. On collector and arterial streets, storm water should be carried underground to free up space for cycle tracks, wider footpaths, trees, and street furniture.

## 3.17. Underground utilities

Streets are the conduits for major services, including electricity, water, sewage, communication, and gas. The physical infrastructure may occur in the form of pipelines, telephone cables, fibre optic cables, ducts, and poles. Some utilities, such as telecommunications cables, require frequent access for expansion and maintenance.

### DESIGN STANDARDS

- Underground utilities are ideally placed under the walkway. Where this is not possible, underground utilities can be placed at the outer edge of the right-of-way or under the carriageway.
- Utility boxes should be sited in easements just off the right-of-way to reduce conflicts with pedestrian movement. Where this is not possible, utility boxes should be placed within parking or landscaping areas. If it is absolutely necessary to locate utility boxes on the footpath, a space of at least 2 m should be maintained for the through movement of pedestrians. Similarly, utility boxes should never constrain the width of a cycle track.
- Though it is possible to accommodate underground utilities even below a tree line, this may lead to the destruction of the trees and a deterioration in liveability if the utilities need to be uncovered.
- In order to minimise disruptions, utilities should be installed with proper maintenance infrastructure. For example, telecommunication lines should be placed in ducts that can be accessed at frequent service points.
- For information regarding the construction of utility lines, including pipe size and the location of utility ducts, please refer to the ERA Drainage and Utility Manual. This manual provides detailed guidelines and specifications for incorporating utility infrastructure into street designs.

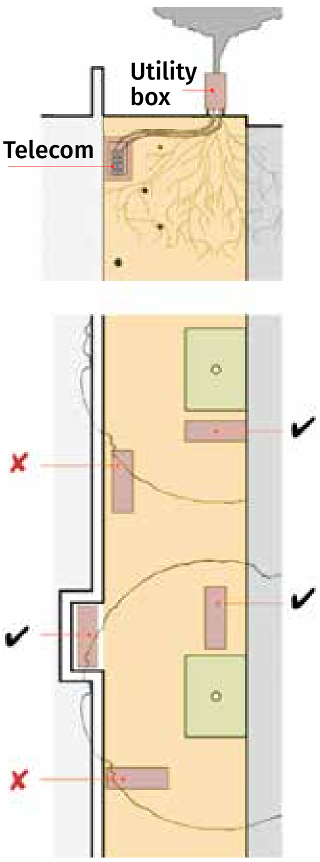



**Figure 71. Access boxes for underground utilities should not constrain the space needed for through movement. If it is not possible to place utility boxes on private easements, the ideal location is in line with tree pits, to avoid conflicts with pedestrian movements. If there is no way to avoid placing a utility box in the pedestrian movement zone, then it is essential to orient the box parallel to the street. Placing the box perpendicular to the street, where it stands directly in the way of pedestrians, is unacceptable.**

**Table 14. Standards for utilities.**

| Element | Diameter (m) | Placement |
|---|---|---|
| Storm water | 1.4 | Under cycle track or footpath |
| Electricity (up to 33 kV) | 0.8 | Under cycle track or footpath |
| Telecom | 0.8 | Under cycle track or footpath |
| Water supply | 0.5 | Buffer zone or under footpath |
| Sewer | 0.5 | Buffer zone or under footpath |
| High voltage electricity, trunk water line, trunk sewer | To be sized according to corridor specifications | Median |

Note: Applicable for all street types.

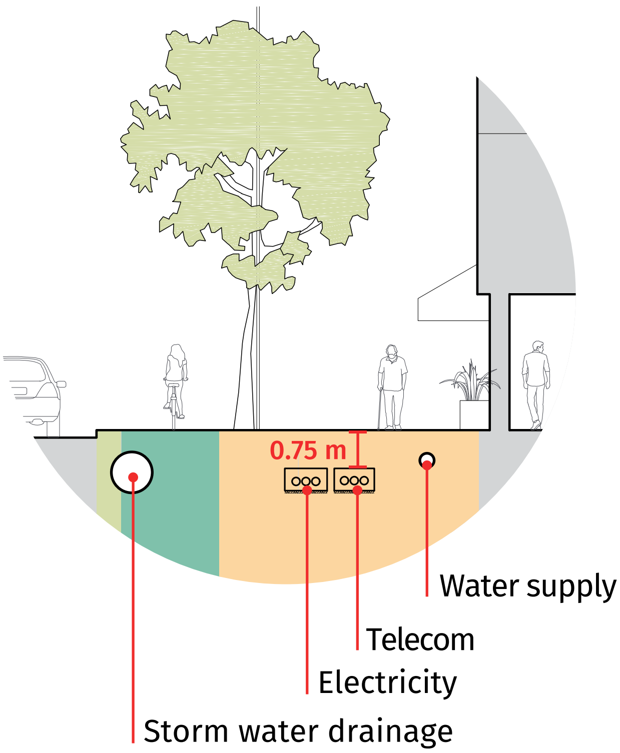



**Figure 72. Underground utility placement.**

# 3.18. Service lanes

Service lanes improve safety and throughput by segregating property access points and parking from the main carriageway. Service lanes can increase the mobility function of the main carriageway while also maintaining liveability for non-motorised road users. They also reduce interruptions in cycle tracks, and with reduced speeds because of traffic calming, service lanes can function as slow shared spaces.

Service lanes that are too wide encourage fast driving. In addition, wide service lanes invite encroachment by shops, parked vehicles, or street vendors. Therefore, moderate service lane widths are needed to ensure safe user behaviour. 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.

## DESIGN STANDARDS

- A service lane should be 3.0-3.5 m wide for a single lane and 5.5-6.0 m for two lanes.
- Service lanes should contain traffic calming elements to maintain safe driving speeds.
- Access into and out of a service lane should be provided via a ramped crossing over the footpath and cycle track, which continue at their original levels.
- A service lane need not be continuous, lest it become an alternative to the main road.

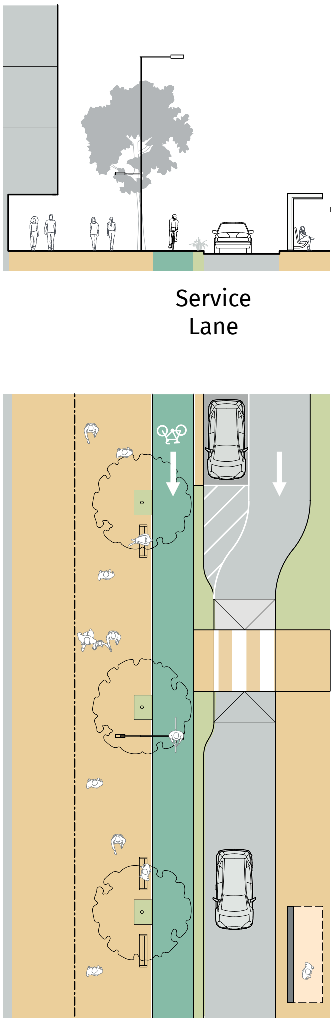



**Figure 73. Service lanes should be designed for slow-speed access to adjacent properties.**

## 3.19. Parking

In general, valuable street space should be used for wider walkways, trees, cycle tracks, cycle parking, vending, and social gathering space rather than parking. On-street parking may be allowed on streets where all the other requirements for public transport and active travel have been met.

### DESIGN STANDARDS

- On-street parking areas should be allotted after providing ample space for pedestrians, cyclists, trees, and street vending.
- Parallel parking layouts are preferred.
- Parking bay width of 2.0 m width for taxi stands and 2.2 m in commercial areas.
- Tree pits can be integrated in a parking stretch to provide shade. Otherwise, shaded street elements, such as footpaths, may be encroached by parked vehicles.
- Near intersections, parking lanes can be discontinued to reduce conflict and to give additional vehicle queueing space.
- Dedicated cycle parking should be provided at public transport stops and stations and in commercial districts.
- In contrast to mobility-oriented elements such as carriageways, cycle tracks, or footpaths, parking involves fewer design constraints as it does not require continuous linear space.

**Table 15. On-street parking layouts.**

| Angle (°) | Manoeuvring space width (m) | Parking space width (m) | Space per car (sq m) |
|---:|---:|---:|---:|
| 0 | 3.0 | 2.0-2.2 | 25 |
| 30 | 3.0 | 2.3 | 33 |
| 45 | 4.5 | 2.5 | 33 |
| 60 | 5.0 | 2.5 | 30 |
| 90 | 7.0 | 2.5 | 30 |

With regard to off-street parking, minimum parking requirements in zoning regulations and master plans compel developers to provide more parking spaces than necessary, leading to underutilisation of prime urban land that could be used for other higher priority uses such as housing, retail space, and office development. Off-street parking requirements often lead to the design of buildings with large car parks on the lower floors, making parking lots and structures the dominant feature in the urban environment. The presence of parking structures also hinders the development of active frontages that enhance street activity. Off-street parking drives up the cost of residential and commercial space, thereby hindering affordability.

To encourage the use of sustainable modes, Ethiopian cities should minimise the overall supply of off-street parking. Cities should eliminate minimum parking requirements. Developers would have the option of providing parking in some developments, but they would be able to create more affordable developments for households who do not own cars. Along corridors where frequent public transport is available, cities can establish parking maximums to encourage more productive use of well-located land and minimise congestion in dense city areas. Where there is a surplus of off-street parking, shared parking arrangements can enable new projects to secure some parking spaces for their occupants without increasing the overall parking supply. Under a shared parking arrangement, one building with excess parking spaces leases some of its spaces to another, thereby reducing the need to construct new parking.

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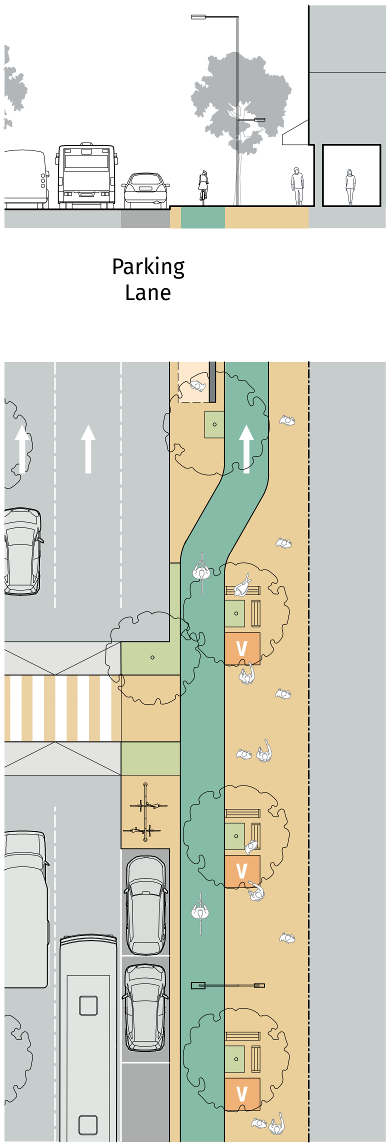



Bulbouts between parking areas provide space for street furniture, vending and to accommodate pedestrian refuges, reducing the crossing distance.

Cycle tracks next to parking lanes require a minimum 0.5 m buffer so that car doors do not open over the cycle track. This buffer should be hardscaped.

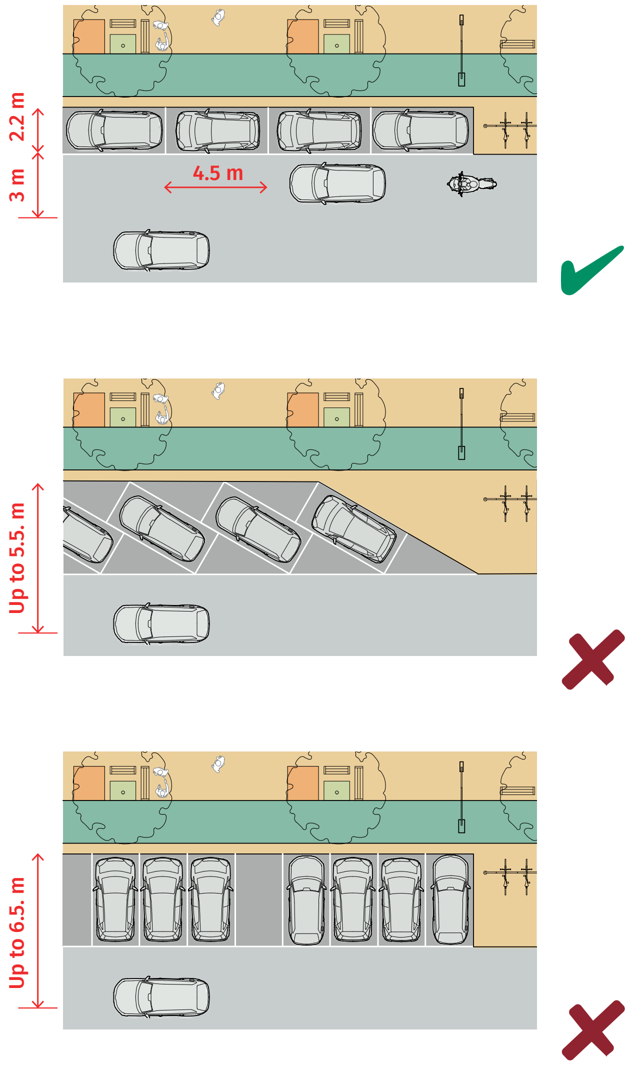



Figure 74. On-street parking layout.

Figure 75. Parallel parking for cars is the most efficient parking layout in terms of the number of vehicles relative to the area occupied. The same parking lane can be used as perpendicular parking for two-wheelers.

## 3.20. Traffic calming

Well-designed traffic calming elements ensure pedestrian and vehicle safety by reducing the speed and potentially also the volume of motor vehicles. The increased use of private vehicles necessitates traffic calming to ensure that streets remain safe for pedestrians and cyclists. Traffic calming elements are particularly important in places where large numbers of children are present, such as schools, parks, and residential areas. Some traffic calming elements, such as speed bumps and speed tables, are easy to implement, and can be deployed quickly as a solution to road safety challenges.

The effect of any traffic calming measure on all the road users should be carefully considered before they are installed. Some are unsuitable if large buses are part of the traffic stream; some are very harsh on bicycles, motorcycles and motorcycle taxis; and some are totally unsuitable when there is any animal drawn transport.

### DESIGN STANDARDS

- Traffic calming can take different forms depending on the context, and is most effective where two or more mechanisms are combined. Traffic calming can be applied near intersections or every 80-120 m in stretches where speeds need to be controlled, such as school zones (streets within 100 m of schools), residential areas, or locations with high foot traffic.
- Vertical-deflection devices include raised crossings, speed humps, and raised intersections.
- Speed humps should follow a sinusoidal shape to improve comfort for cyclists.
- Raised pedestrian crossings should match the level of the adjacent footpath—typically 150 mm. A flat top design is preferred, with allowances for drainage at the kerb. The critical dimension is the ramp slope:
  - 1:6 yields 10 km/h
  - 1:8 yields 15 km/h
  - 1:10 yields 20 km/h
  - 1:12 yields 25 km/h
  - 1:14 yields 30 km/h
- Rumble strips are uncomfortable for cyclists and should be avoided on urban streets.
- Horizontal-deflection devices include mini-roundabouts, chicanes, and islands. Design varies but the objective is to reduce speed to 10 km/h below the speed limit.

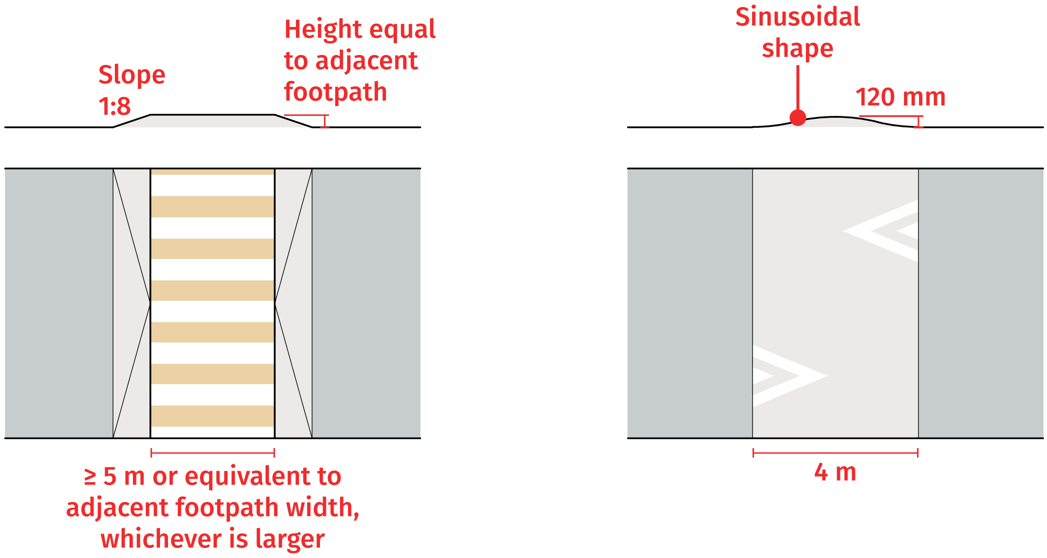



**Figure 76. Vertical deflection devices include raised crossings (left) and speed humps (right).**

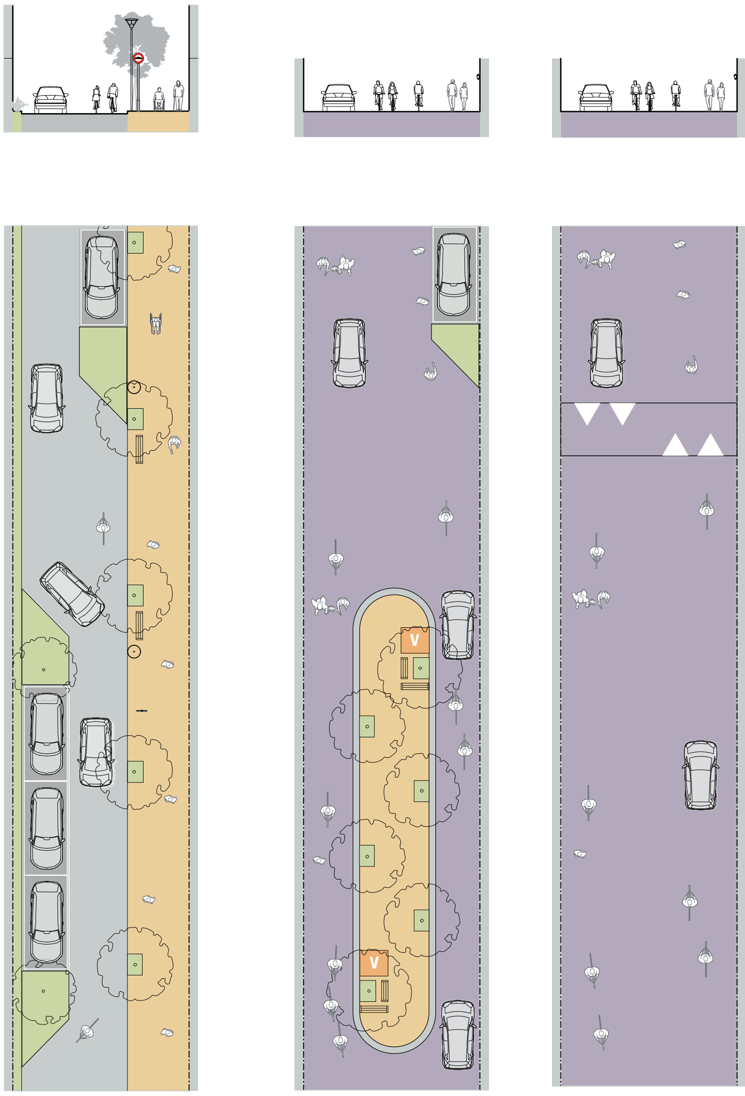



**Figure 77. Traffic calming options include horizontal displacement through a meandering carriageway (left) or shared space (middle) and vertical displacement in the form of a speed hump (right).**

## 3.21. Street enclosure

Streets are urban spaces, and the sense of enclosure can contribute to identity and character of the space. Street enclosure is influenced by the street width and height of adjacent buildings. The sense of enclosure is enhanced when structures follow a consistent build-to line.

### DESIGN STANDARDS

- The typical ratio of building height to the street right-of-way should be at least 1:3 and at most 2:1. This standard applies to the building's podium base. The design can incorporate a taller point tower behind the podium.
- Building setbacks shall be defined in accordance with federal, regional, and local regulations and specific urban design plans applicable at the site.
- Glazing of buildings shall not be reflective and hamper visibility for drivers and pedestrians.
- The floor finish level (FFL) of buildings shall not be lower than the level of adjoining street.

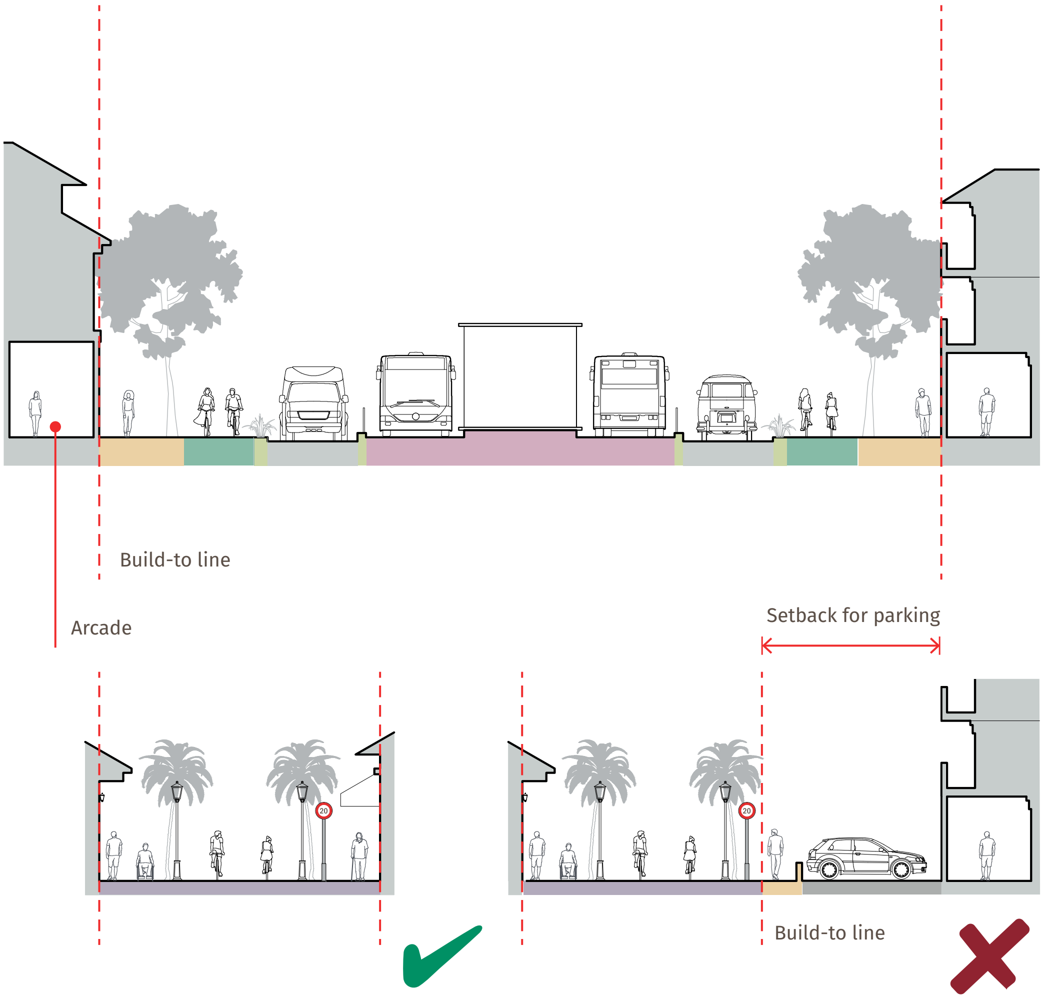
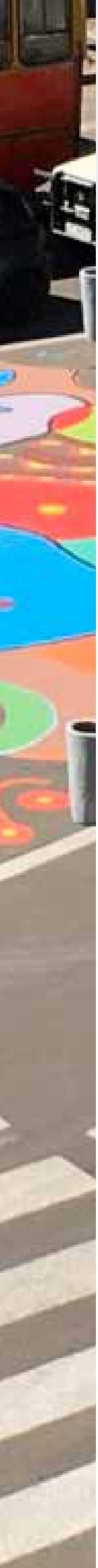



**Figure 78. Human-scaled streets with arcades and build-to lines**

Image source: GDCI



# 4 Intersections

Intersections are a key part of the urban landscape therefore shall be treated properly to maximise attractiveness, safety, and efficiency. Intersection design has undergone a fundamental shift over the past decades. What was once seen as simply an exercise in processing the highest number of vehicles has now been recast as an exercise in safety. Intersections, by definition, are points of conflict. Experience tells us that the best way to minimise the outcomes of those conflicts is through speed management—not by assigning priority as is traditionally done through traffic control devices. The quality of an intersection environment can vary significantly depending on turning radii, the presence of refuge islands, the continuity of cycle tracks, and other design features.

Intersections, rather than the standard section of a street, are the limiting factor in vehicle capacity. Therefore, intersection design needs to take into account the impact of design choices on mobility. However, this emphasis on mobility should not be confused with an emphasis on private motorised traffic. Instead, it may be desirable to design an intersection in such a way that prioritises throughput of public transport, cycles, and pedestrians.

## 4.1. Intersection typologies

Intersections can take a variety of forms depending on the level of pedestrian activity, bicycle traffic, vehicle volume, presence of BRT, and street cross sections:

- **Signalised intersections** are the preferred configuration for urban intersections of major streets with large volumes of pedestrians and cyclists. Signals manage movements on all legs of the intersection, providing crossing opportunities for pedestrians and cyclists.
- **Roundabouts** improve safety for vehicles by simplifying interactions at unsignalised intersections. However, they present challenges for pedestrians and cyclists because they increase the size of intersections and divert NMT movements from their desire lines. Roundabouts are warranted at locations with moderate traffic volumes: up to 15,000 annual average daily traffic (AADT) for a mini roundabout, 25,000 AADT for a single-lane roundabout, and 45,000 AADT for a two-lane roundabout. With higher volumes, roundabouts should be converted to compact signalised intersections without the central traffic circle to reduce delay for motor vehicle and NMT users alike. Roundabouts are acceptable in intersection retrofits but are not the preferred layout for new streets.
- **Squareabouts** are a means of managing right-turning traffic at large intersections while minimising signal cycle times. Squareabouts make the right-turn phase obsolete by creating left-turn queuing space within the intersection itself. Vehicles queue in this space during one phase and exit during the next phase. Squareabouts are a valuable option on BRT corridors. While BRT would require the addition of extra phases to a typical four-phase intersection, the squareabout accommodates all turning movements in only two phases.
- **Stop-controlled intersections** are appropriate for smaller intersections with low to moderate traffic volumes. Stop lines should be provided.
- **Mini roundabouts** are the safest type of intersection on smaller streets.
- **Grade separations** may be warranted if they prioritise NMT and public transport movement. All grade-separated facilities along planned BRT corridors should incorporate provision for BRT lanes and BRT turning movements at intersections.

For urban expansion areas, the type and size of intersections shall be proposed at the stage of urban plan preparation for all categories of urban centres. These proposals shall be followed in NDPs and urban design plans as well as in the geometric designs of streets.

**Table 16. Intersection typology by street classification.**

| | Signal | Roundabout | Mini-roundabout | All-way stop | 2-way stop or yield | All-way yield |
|---|---|---|---|---|---|---|
| PAS-PAS | Preferred | Acceptable | N/A | N/A | N/A | N/A |
| PAS-SAS | Preferred | Acceptable | N/A | N/A | N/A | N/A |
| SAS-SAS | Preferred | Acceptable | N/A | N/A | N/A | N/A |
| SAS-CS | Preferred | Acceptable | N/A | Acceptable | Acceptable | N/A |
| CS-CS | Preferred | Acceptable | Acceptable | Acceptable | Acceptable | Acceptable |
| CS-LS | N/A | N/A | Acceptable | Preferred | Acceptable | Acceptable |
| LS-LS | N/A | N/A | Acceptable | Preferred | Acceptable | Acceptable |

Adapted from Abu Dhabi Urban Planning Council (2017).

## 4.2. Intersection control

Intersection control mechanisms should facilitate safe transitions between the intersecting routes, which may have different traffic speeds. There are several possible sequences of signal phases for a given intersection. The optimal phasing design is determined by the relative volumes of the various movements taking place at an intersection. The physical layout of an intersection must be designed in conjunction with the signal phasing.

The simplification of signal cycles through the elimination of turning movements can help reduce delay at intersections, particularly along BRT corridors. As described later in this section, squareabouts combine straight and turning movements, allowing for a two-phase cycle. Signal cycles also can be simplified through changes at the network level. For example, a left turn can be substituted by three right turns.

### DESIGN STANDARDS

- Signal timing should be optimised according to traffic volumes on different legs of the intersection. Pedestrians should be given priority, followed by bicyclists, public transport, and other vehicles in that order. Streets climbing up slopes shall be given priority over other legs of an intersection.
- Provide leading pedestrian signals allowing pedestrians to begin crossing before the signals for vehicles along the same leg turn green.
- The minimum phase duration is determined by the time pedestrians need to cross the street, assuming a walking speed of 1 m/s.
- Adopt two-phase signal cycles and intersection designs along BRT corridors. Intersections where BRT corridors pass through roundabouts should be signalised.
- 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. For example, for four straight-plus-left phases, a clockwise sequence is preferred.
- Signalised intersections should be fitted with audible pedestrian signals in at least one local language and English.
- Traffic lights shall be located at both sides of the lanes entering the intersection, and also in the median on the opposite side of the intersection, as applicable.

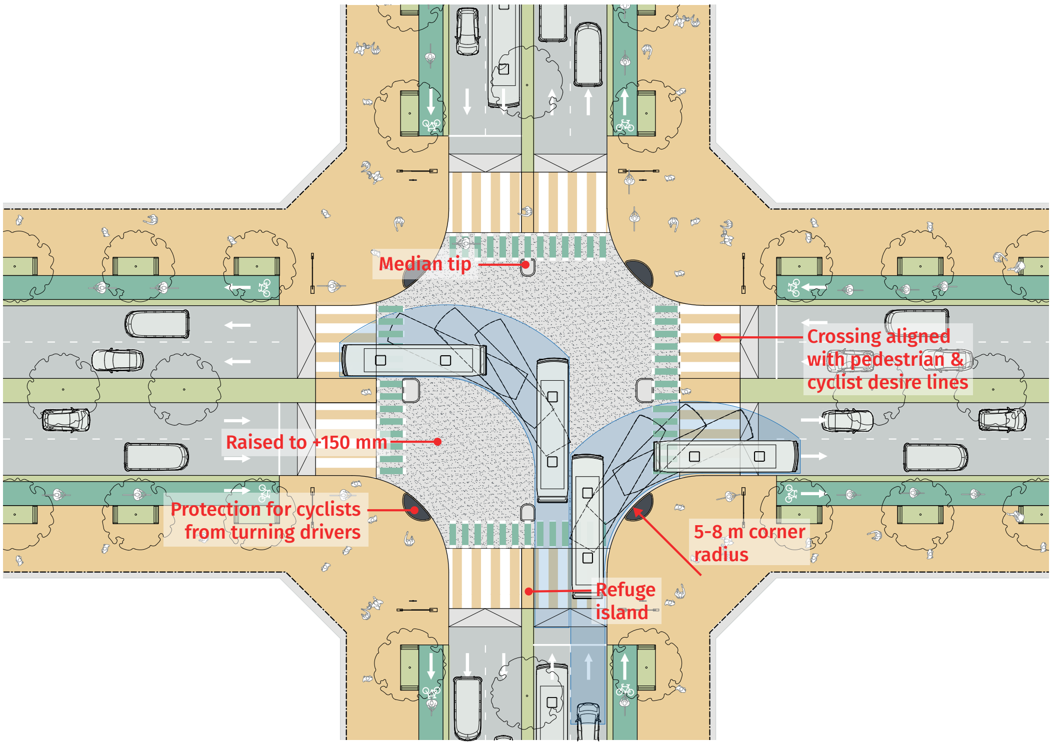



**Figure 79. Design elements for a signalised intersection.**

## 4.3. Geometry

The physical layout of an intersection must be designed in conjunction with the signal phasing. The layout is also influenced by the design vehicle, the kind of vehicle that predominantly uses a given street (as opposed to the control vehicle). The design vehicle should be as small as possible, typically a passenger car or small delivery van.

The choice of design vehicle is influenced by the functional classification of a street and by the proportions of the various types and sizes of vehicles expected to use the facility. The control vehicle, on the other hand, is the largest vehicle that is expected to operate on a given roadway segment at low frequencies. When control vehicles are making turns at an intersection, they can be allowed to encroach on the adjacent lanes to enable them to make a turning movement.

### 4.3.1. Crossings

Crosswalks delineate an area that is reserved for pedestrian movement while perpendicular traffic is stopped. Crossings should only be marked where vehicles are required to stop, such as at signalled intersections. At unsignalised intersections, painted crosswalks do not necessarily improve pedestrian safety unless accompanied by a physical measure such as a speed bump or speed table. At signalised intersections, stop lines for vehicles should be located prior to painted crosswalks. Since many drivers do not respect painted markings, stop lines require vigilant enforcement if the crosswalk is to remain free of queuing vehicles.

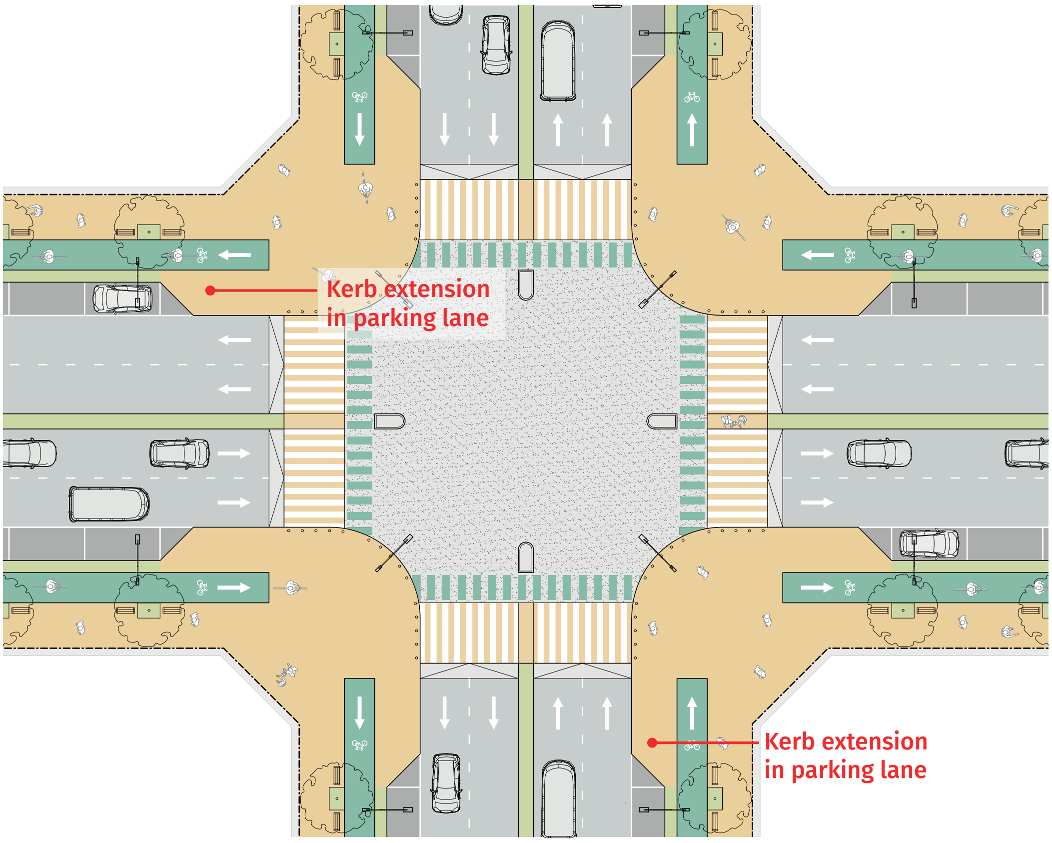



Figure 81. At an intersection of streets with parking lanes, kerb extensions in to the parking lanes reduce the crossing distance for pedestrians and cyclists.

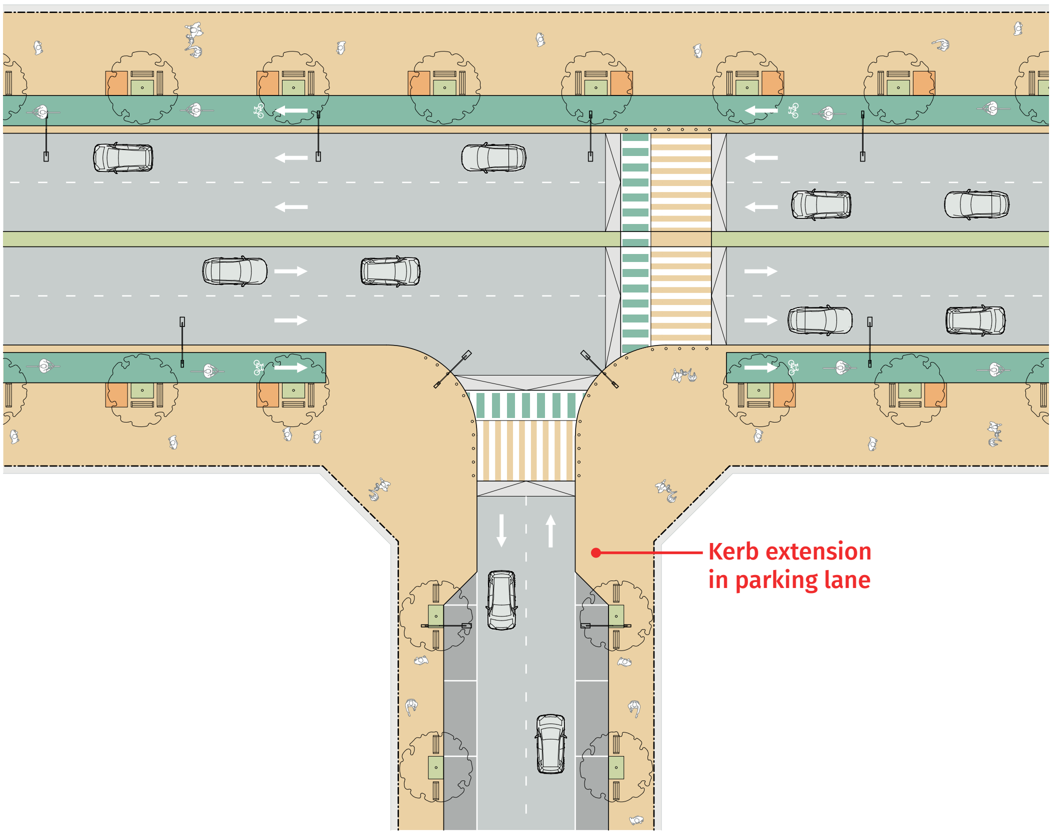



Figure 80. At an intersection with a minor street, a tabletop crossing maintains continuity for pedestrians and cyclists. Kerb extensions in the parking lanes reduce the crossing distance.

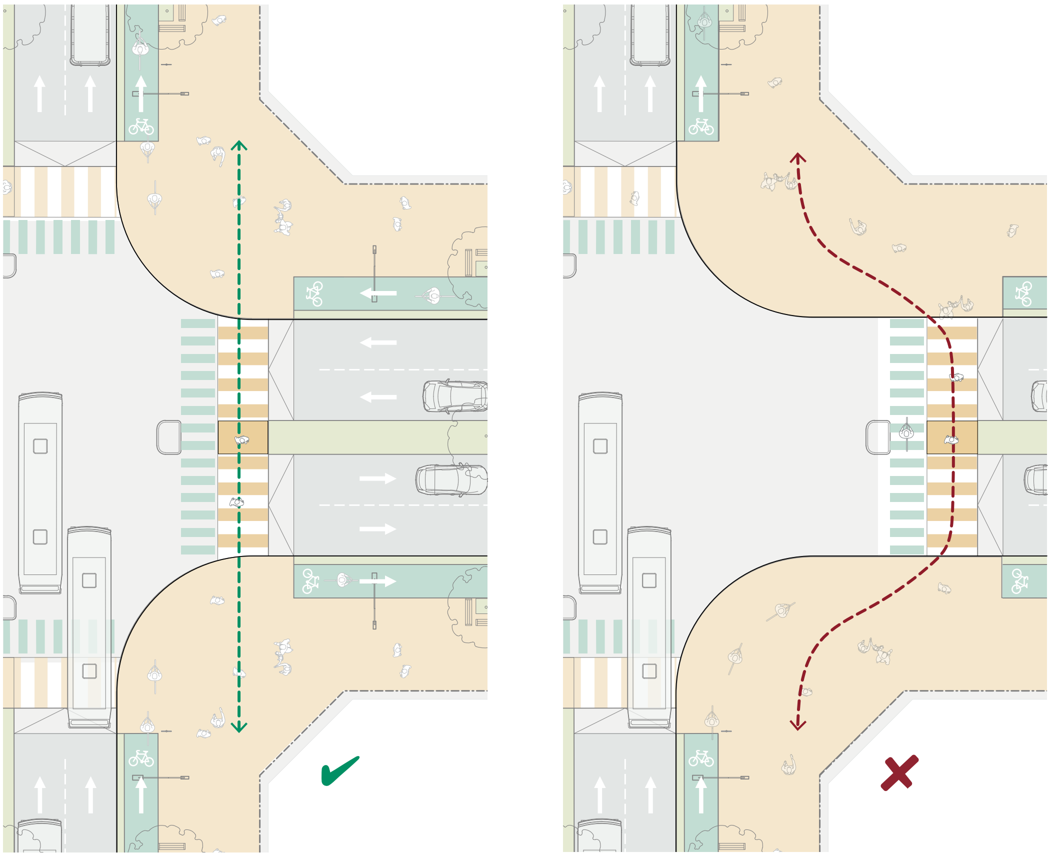


**Figure 82. Pedestrian crossings at intersections should be located such that there is minimum deviation from the path of travel defined by the pedestrian zone in the footpath.**

### DESIGN STANDARDS

- Zebra crossings on all legs of all signalised intersections.
- 5 m wide pedestrian crossings (3 m minimum) and 2 m wide cycle track crossings.
- Pedestrian crossings aligned with desire lines. People will cross the street using the shortest route, so it is best to accommodate movements along desire lines. Align crossing elements (zebra crossings, median refuges, and kerb ramps) in a straight line and maintain the same width.
- Raised crosswalks (tabletop crossings) at +150 mm at unsignalised zebra crossings. This applies to crossings of smaller streets along a corridor, slip lanes, and elsewhere. Signalised crossings may be raised as well. The entire intersection may be raised.
- Kerb extensions into parking lanes to reduce the crossing distance.
- Provide bicycle facilities through intersections. Protect cyclists from drivers, especially turning drivers. Direct cyclists through pedestrian areas. Include slow, shared zones where modes and directions interact.

## 4.3.2. Refuge islands and medians

Pedestrian refuge islands separate conflicts, so pedestrians can judge whether it is safe to cross by looking at and analysing fewer travel lanes and directions of traffic at a time. Tall, bushy plants should be avoided in medians because they obstruct pedestrian visibility. In the case of triangular islands adjacent to free left turn lanes, the island must remain free of landscaping and fencing in order to serve as a refuge for pedestrians.

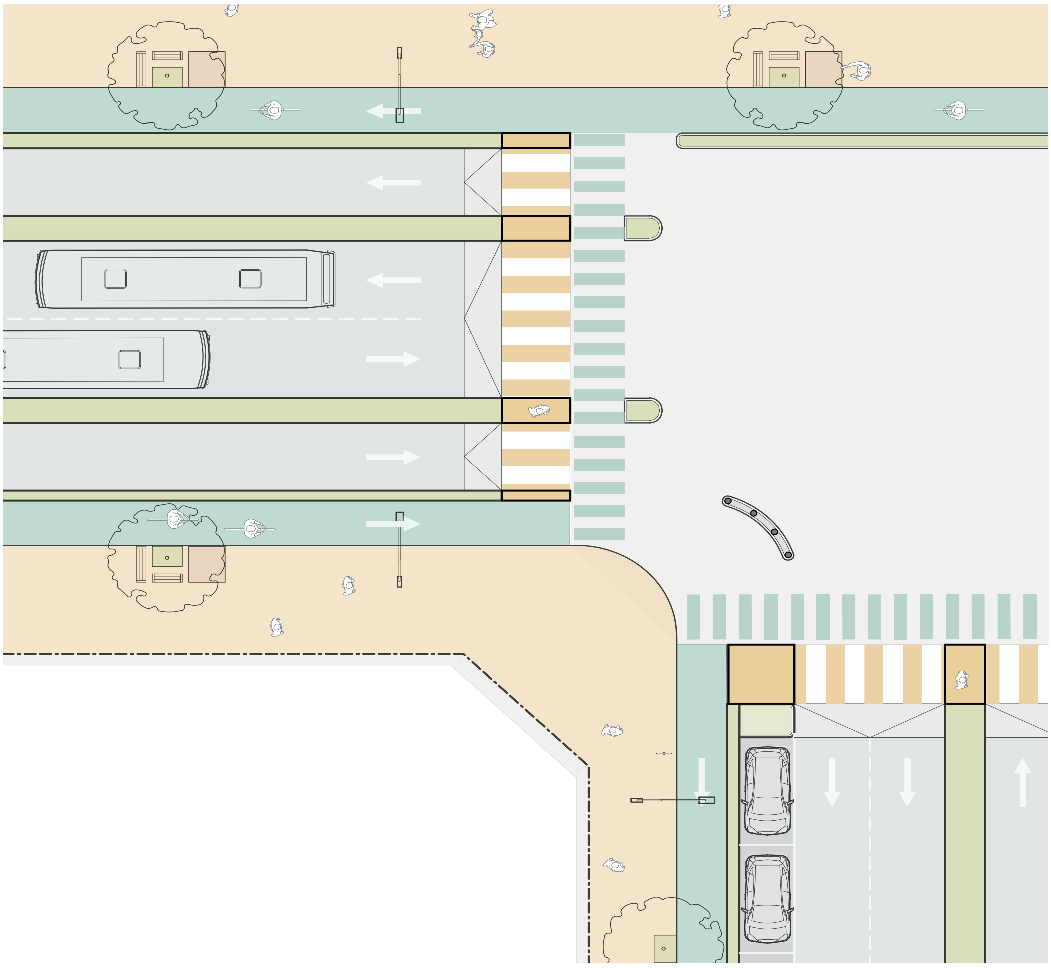


Figure 84. Pedestrian refuge islands and medians improve safety by allowing pedestrians to cross different streams of traffic in separate stages.

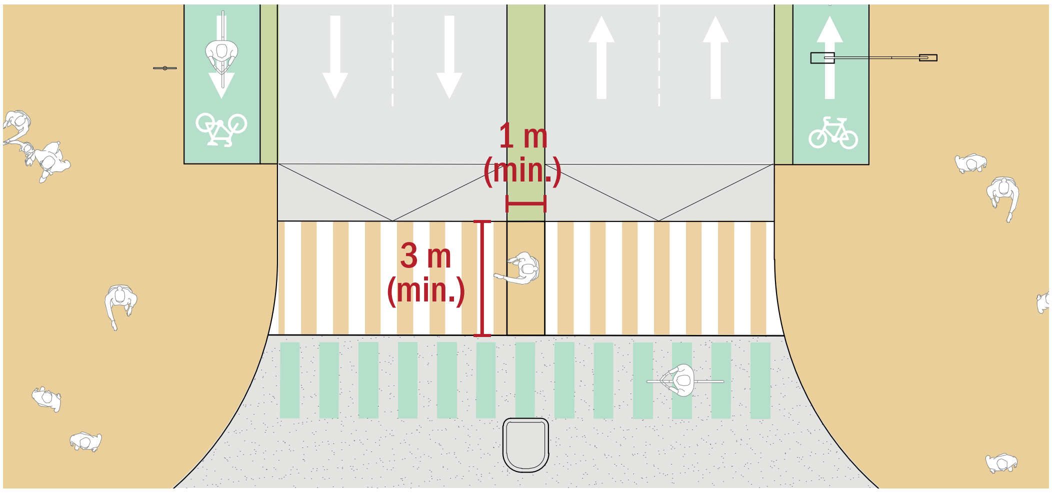



Figure 83. Pedestrian refuge island dimensions.

DESIGN STANDARDS

- Pedestrian refuge islands separate conflicts, so pedestrians can judge whether it is safe to cross by looking at and analysing fewer travel lanes and directions of traffic at a time. Provide refuge islands where there are more than three lanes total to cross.
- "Median tips" where there is a zebra crossing and a median at an intersection.
- Stop lines perpendicular to the travel lane and set back at least 3 m from the zebra crossings.
- Tall, bushy plants should be avoided immediately adjacent to refuge islands because they obstruct pedestrian visibility. In the case of triangular islands adjacent to free right turn lanes, the island must remain free of landscaping and fencing in order to serve as a refuge for pedestrians.
- At least 1 m wide and 3 m long, matching the width of the corresponding crosswalk.

## 4.3.3. Turning radius

The concept of the 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, so intersection designs need to take into account the size of vehicles that are expected to pass through an intersection.

Since larger turning radii encourage faster vehicle speeds, tighter corners are preferred because they improve safety for pedestrians and cyclists. For local streets that cater to light vehicles, as well as intersections of major streets with local streets, a 4 m kerb radius is appropriate.

While larger streets need to take into account the turning radius requirements of buses and trucks, it should be noted that the effective turning radius is often much larger than the radius of the built kerb. The design of the kerb should assume that trucks and buses make the largest turn possible. If the exit leg has more than two lanes, a smaller kerb radius is possible because the sweeping path of a large vehicle can pass through the available lanes.

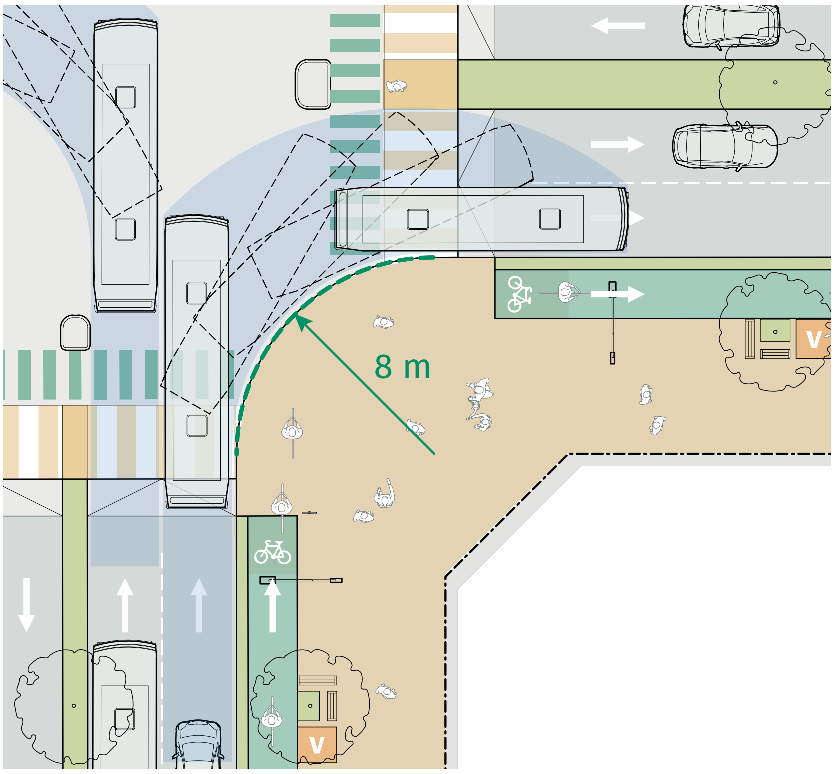



**Figure 85. An intersection should be sized to minimise pedestrian crossing distances while accommodating left turns of a design vehicle.**

### DESIGN STANDARDS

- Kerb radii as per Table 17 and Table 18.
- Protected configuration of the cycle track at locations where vehicles turn.

**Table 17. Recommended kerb radii (m) by intersection typology.**

| | PAS | SAS | CS | LS |
|---|---|---|---|---|
| PAS | 8.0 | | | |
| SAS | 8.0 | 6.5 | | |
| CS | 6.5 | 6.5 | 4.0 | |
| LS | 4.0 | 4.0 | 4.0 | ≤ 2.0 |

Note: The radius can be smaller if the exit leg has more than two lanes.

**Table 18. Recommended kerb radii (m) by intersection typology: streets in industrial areas.**

| | PAS | SAS | CS | LS |
|---|---|---|---|---|
| PAS | 13.7 | | | |
| SAS | 12.8 | 7.3 | | |
| CS | 7.3 | 7.3 | 6.5 | |
| LS | 6.5 | 4.0 | 4.0 | ≤ 4.0 |

Note: The radius can be smaller if the exit leg has more than two lanes.

## 4.3.4. Right turn pockets

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

The design should assume that a large vehicle completes the turn in the outermost lane of the exit arm but may enter the central lane while completing the turn. Otherwise, the right turn pocket becomes so large that smaller vehicles are able to travel at full speed around the corner. Right turn pockets can be used where the free right turns are crucial, but should be deemed an exceptional measure since pedestrian movements are not as direct in this layout.

### DESIGN STANDARDS

- 30° angle of approach to encourage moderate vehicle speeds, with a 20 m entry radius and 8 m exit radius.
- 3 m vehicle lane.
- Tabletop crossing for pedestrians and cyclists, with ramps for vehicles.

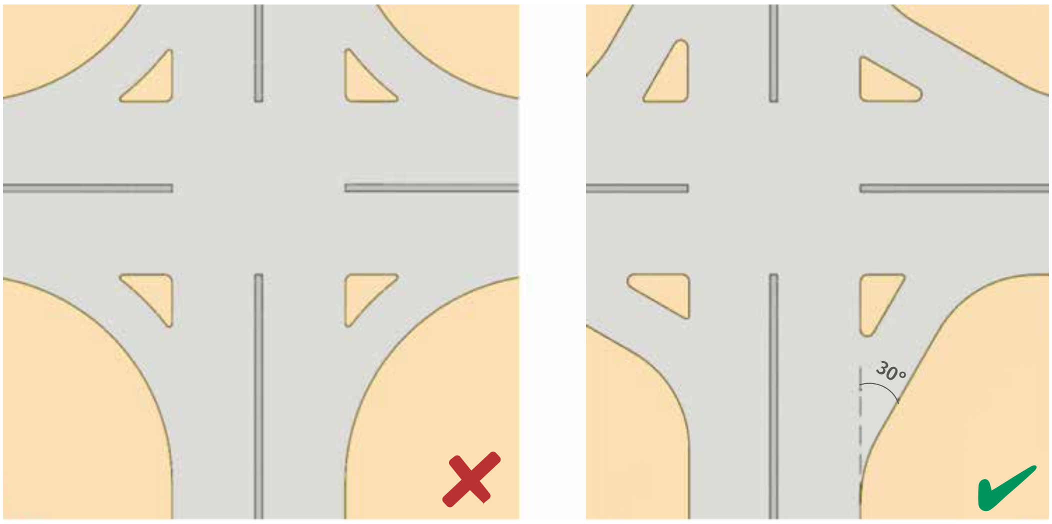



**Figure 86. An intersection should be sized to minimise pedestrian crossing distances while accommodating left turns of a design vehicle.**

## 4.3.5. 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. Possible shapes range from slender posts to larger and heavier obstacles that can double as seats. A minimum width of 815 mm is required for the passage of wheelchairs. At entrances to cycle tracks, a wider opening is preferred.

### DESIGN STANDARDS

- A minimum width of 900 mm between at least one set of bollards is required for the passage of wheelchairs at pedestrian crossings.
- At entrances to cycle tracks, 1.2 m is preferred between bollards. A width of 1.5 m is required for 3-wheelers and trailers.
- Bollard height of 900 mm.

## 4.3.6. Roundabouts

Roundabouts can improve safety for vehicles at unsignalised intersections with moderate vehicle volumes. They are common in locations with historical landmarks. Roundabouts increase walking and cycling distances and should be avoided where NMT volumes are high. Roundabouts need to include safety elements for pedestrians and cyclists. The cycle track should be protected from motorised traffic in the roundabout through the provision of a buffer zone. Since roundabouts are unsignalised, pedestrian and cycle crossings should be raised to the level of the footpath, with ramps for vehicles.

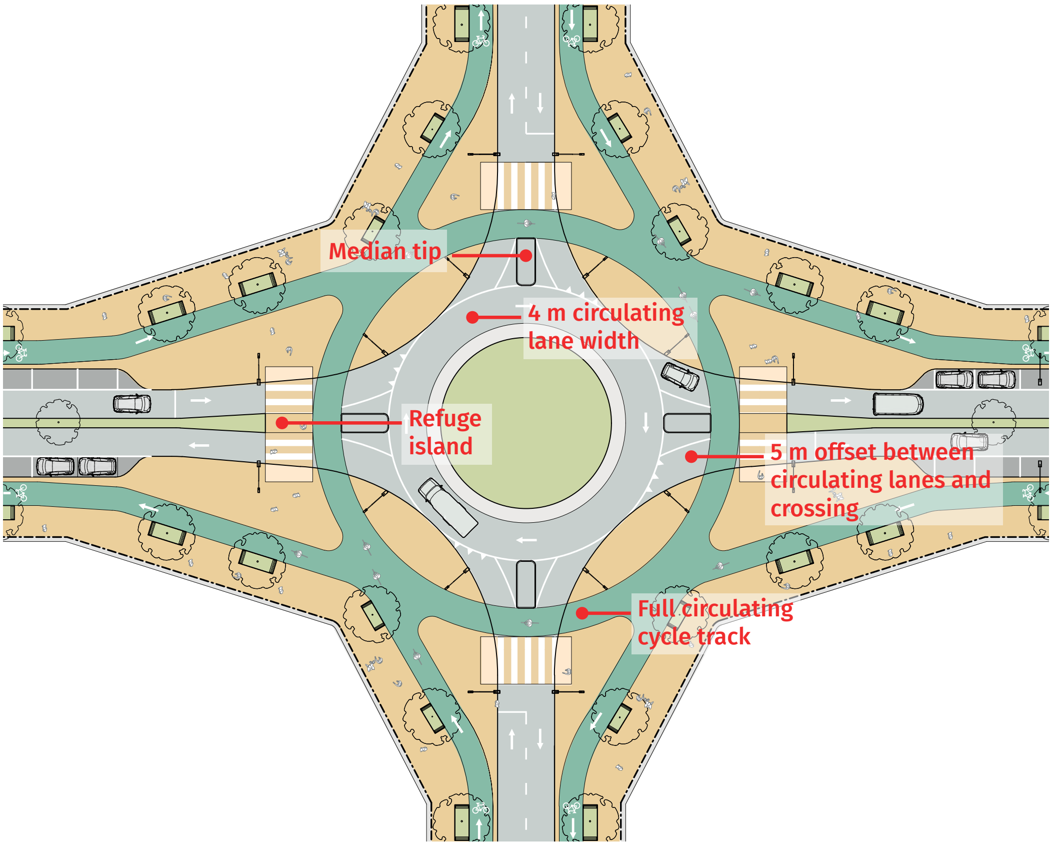



Figure 87. Design elements for a single-lane roundabout.

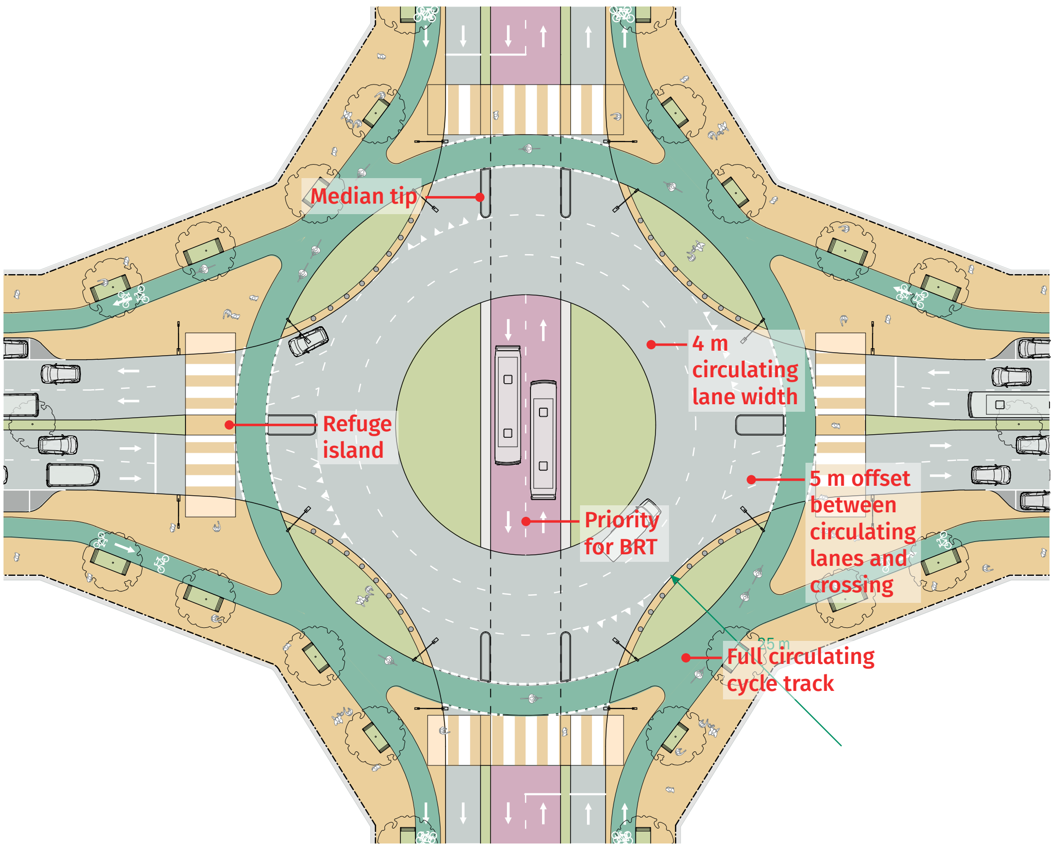



Figure 88. Design elements for a two-lane roundabout with BRT.

### DESIGN STANDARDS

- Streets should be laid out to intersect at right angles.
- No more than two approach lanes per direction. If there are three or more lanes, use a signalised intersection design.
- Adopt a maximum of 2 lanes circulating the roundabout.
- Circulating lane width of 4 m.
- 5 m offset between the circulating lanes and the crossing to allow a vehicle to stop for pedestrians and cyclists on the exit leg without blocking the roundabout.
- The maximum intersection grade allowable for the vehicle lanes rotating around the island is 2 percent.
- Raised pedestrian and cycle crossings at +150 mm.
- Roundabouts can be applied in areas where the volume of pedestrians is low and where there is sufficient space to accommodate vehicle and NMT elements in the roundabout design.
- Locations where BRT and LRT corridors cross roundabouts shall be signalised.
- Signs shall not be placed in roundabout islands.

**Table 19. Roundabout dimensions (adapted from FHWA, 2000).**

| Design element | Mini roundabout (LS-LS) | Urban compact (CS-CS, CS-LS) | Urban single lane (CS-CS, CS-LS) | Urban double lane (CS-SAS, SAS-SAS, SAS-PAS, PAS-PAS) |
|---|---|---|---|---|
| Max. entry speed (km/h) | 25 | 25 | 40 | 50 |
| Max. number of entering lanes per approach | 1 | 1 | 1 | 2 |
| Roundabout inscribed circle diameter (m) | 13-25 | 25-30 | 30-40 | 45-55 |
| Typical daily service volume on 4-leg roundabouts (vehicles/day) | 10,000 | 15,000 | 20,000 | 20,000 |

## 4.3.7. Intersections with BRT

BRT intersections should be designed to operate with two-phase signal cycles, reducing delays for buses and mixed traffic alike. Turns along BRT corridors can be managed through the following approaches:

- Two-phase signal cycles combine straight-bound BRT and mixed traffic movement. Left turns are accomplished through the network (e.g., three right turns).
- Signalised U-turns allow vehicles to reach the opposite side of the corridor. They also accommodate right turning vehicles (e.g., a right turn plus a U-turn).
- Squareabouts make the left-turn phase obsolete by creating left-turn queuing space within the intersection itself. Vehicles queue in this space during one phase and exit during the next phase. BRT buses merge with the mixed traffic when moving around the central island.

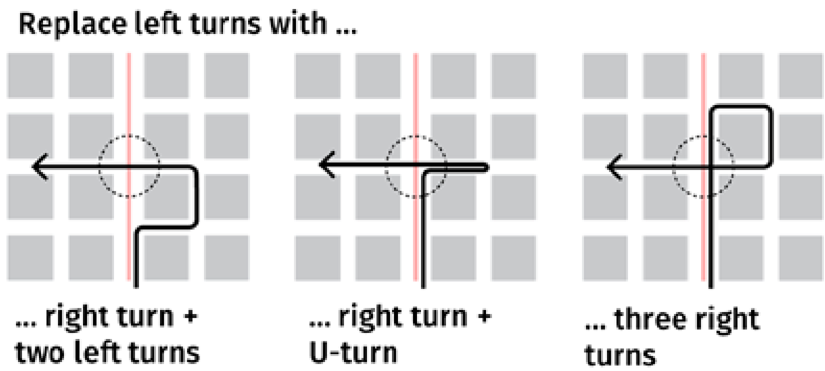



Figure 89. Alternatives to left turns across BRT c

## DESIGN STANDARDS

- Adopt two-phase signals at BRT intersections. Eliminate mixed traffic left turns across the BRT lanes. Additional phases may be provided where BRT buses themselves need to turn.
- In squareabout intersections, size the queueing space per expected turn volumes. Use corner radii of 8 m for the central island.
- Position U-turn lanes on the outer side of the carriageway to improve visibility of turning vehicles for bus drivers and allow for an adequate U-turn radius.


Figure 90. Signage indicating alternate mixed traffic circulation at a two-phase BRT intersection.

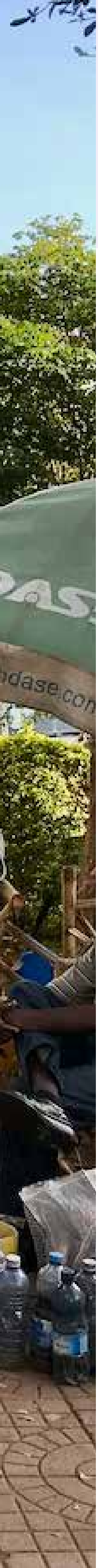
## 4.3.8. Grade separation

In general, urban intersections should be at grade in order to avoid disrupting the urban fabric, public space, and socioeconomic activities. Grade separation is not justified solely to facilitate vehicle flow, as it can lead to increased traffic and higher speeds on the overpass, which in turn can decrease safety.

However, there are cases where grade separation may be justified, such as in the construction of a BRT-only flyover to prioritize BRT buses, an NMT-only bridge or tunnel to connect parks and greenways, or in situations where there are already changes in elevation that pedestrians and cyclists are accustomed to navigating.

### DESIGN STANDARDS

- Intersections in urban areas shall have at-grade intersections so as not to disrupt the urban fabric, space, and socioeconomic activities.
- Grade separations should prioritise public transport and NMT.
- The clear height under the grade separator shall be at least 5.5 m.



# 5 Templates for street cross sections

This section provides a collection of street templates to show how street elements can be combined to provide varying degrees of liveability and mobility. Each template contains a ground plan and a cross section. If the template's cross section changes, such as in case of a meandering street or a BRT corridor, the standard provides more than one cross section.

**Table 20. Elements in standard cross sections: streets in mixed use areas.**

| | Street element width (m) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Street type | ROW (m) | Footpath | Cycle track | Median/buffer | Parking | Service lane | Median | Shared space | Carriageway | BRT median | BRT lane |
| Local street | 6 | | | | | | | 6.0 | | | |
| | 8 | | | | | | | 8.0 | | | |
| | 10 | | | 0.5 | | | | | 6.0 | | |
| | 10 | | | | | | | 10.0 | | | |
| Collector street | 15 | 3.0 | 2.5 | 0.5 | | | | | 6.0 | | |
| | 15 | 3.4 | | | 2.2 | | | | 6.0 | | |
| | 20 | 4.3 | 2.0 | 0.5 | | | | | 6.5 | | |
| | 20 | 5.0 | | | | | | | | | 3.5 |
| Sub-Arterial Street | 25 | 3.5 | 2.0 | 0.5 | | | | | 6.0 | | |
| | 25 | 5.2 | | | | | | | 3.5 | 0.3 | 3.5 |
| | 30 | 3.8 | 2.0 | 0.5 | 2.2 | | | | 6.0 | | |
| | 30 | 4.7 | | 0.5 | | | | | 6.0 | 0.3 | 3.5 |
| Principal arterial street | 35 | 5.3 | 2.0 | 0.5 | 2.2 | | 0.5 | | 6.0 | | |
| | 45 | 6.0 | 2.0 | 0.5 | | | | | 9.0 | 1.5 | 3.5 |
| | 50 | 5.0 | 2.0 | 0.5 | 2.2 | 4.0 | 1.5 | | 6.0 | 0.3 | 3.5 |
| | 60 | 5.8 | 3.0 | 0.5 | 2.2 | 4.0 | 1.5 | | 6.0 | | |
| | 60 | 7.8 | 3.0 | 0.5 | 2.2 | 4.0 | 1.5 | | 6.0 | 1.5 | 3.5 |

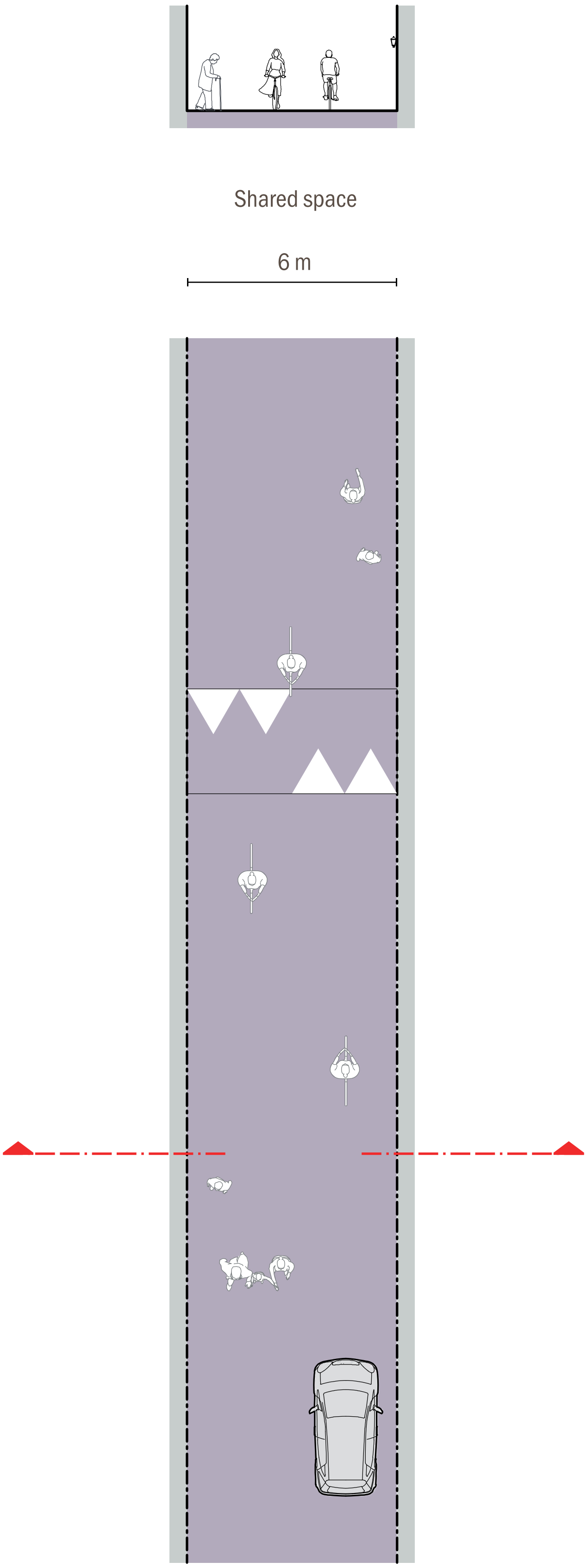
Table 21. Elements in standard cross sections: streets in historical areas.

| Street type | Street element width (m) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROW (m) | Footpath | Cycle track | Median/buffer | Parking | Service lane | Median | Shared space | Carriageway | BRT median | BRT lane |
| Local Street | 6 | | | | | | | 6.0 | | | |
| | 8 | | | | | | | 8.0 | | | |
| | 10 | 10.0 | | | | | | | | | |
| Collector Street | 15 | 6.0 | 3.0 | | | | | | | | |
| | 20 | 6.0 | | | | | | | | 0.5 | 3.5 |
| | 20 | 4.0 | 2.5 | 0.5 | | | | | 6.0 | | |
| Sub-Arterial Street | 25 | 6.0 | 2.5 | 0.5 | | | | | 3.5 | | |
| | 25 | 6.2 | 2.5 | | | | | | | 0.3 | 3.5 |
| | 30 | 8.5 | 2.5 | 0.5 | | | | | 3.5 | | |
| | 30 | 4.5 | 2.0 | 0.5 | | | | | 3.5 | 1.0 | 3.5 |

Table 22. Elements in standard cross sections: streets in industrial areas.

| Street type | Street element width (m) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | ROW (m) | Footpath | Cycle track | Median/buffer | Parking | Service lane | Median | Shared space | Carriageway | BRT median | BRT lane |
| Local Street | 10 | 3.0 | | | | | | | 4.0 | | |
| Collector Street | 15 | 4.0 | | | | | | | 7.0 | | |
| | 20 | 4.0 | | | 2.5 | | | | 7.0 | | |
| | 20 | 4.0 | 2.0 | 0.5 | | | | | 7.0 | | |
| Sub-Arterial Street | 25 | 4.0 | 2.0 | 0.5 | 2.5 | | | | 7.0 | | |
| | 30 | 5.0 | 2.0 | 0.5 | | | | | 7.0 | | |
| | 30 | 5.0 | | | 2.5 | | | | 7.0 | | |
| Principal Arterial Street | 35 | 5.3 | 2.0 | 0.5 | 2.2 | | | | 7.0 | | |
| | 40 | 6.0 | 2.0 | 0.5 | | | | | 7.0 | 1.0 | 3.5 |
| | 45 | 4.5 | 2.0 | 0.5 | | | | | 10.5 | 1.5 | 3.5 |
| | 50 | 5.7 | 2.0 | 0.5 | 2.5 | | | | 10.5 | | |
| | 60 | 6.7 | 3.0 | 1.5 | 2.5 | 4.0 | 1.5 | | 7.0 | | |

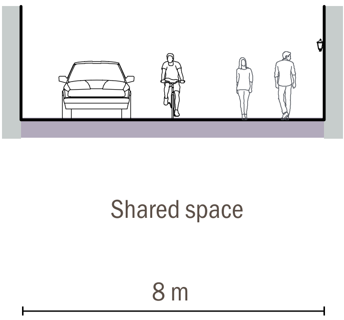
# 6 m
## Local Street
## Mixed use

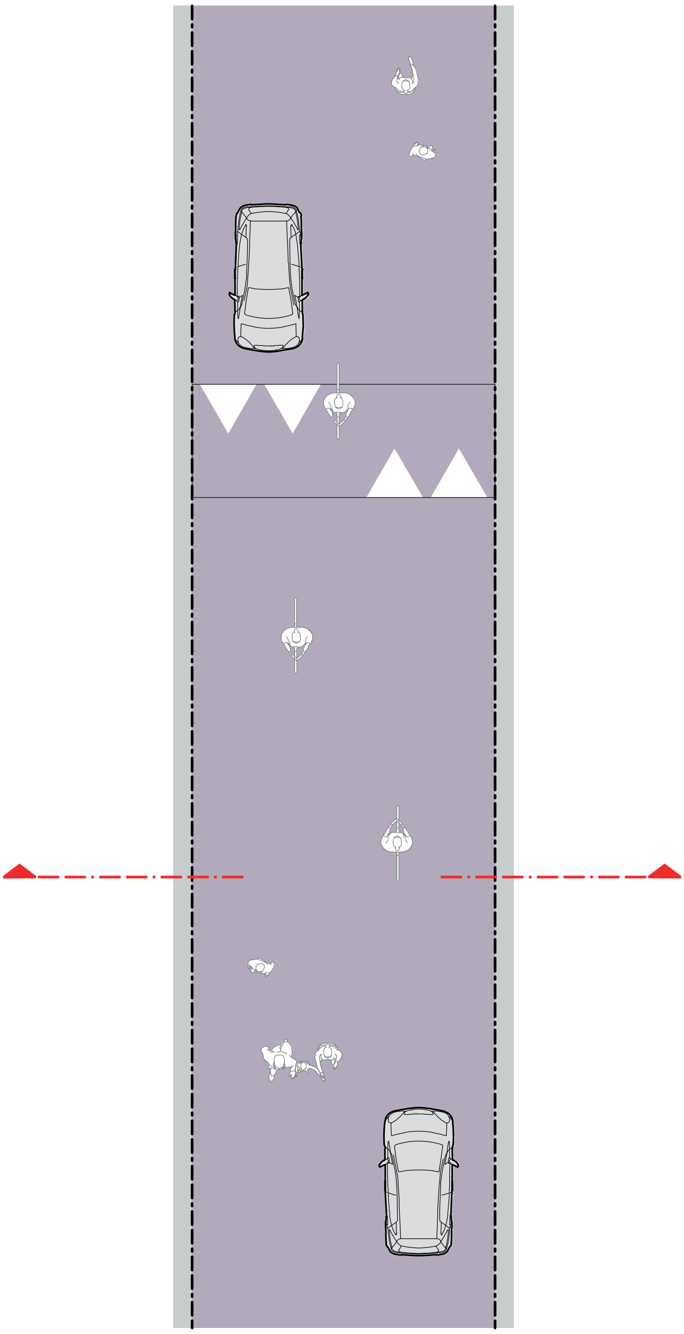


# 8 m

Local
Street (A)

Mixed use

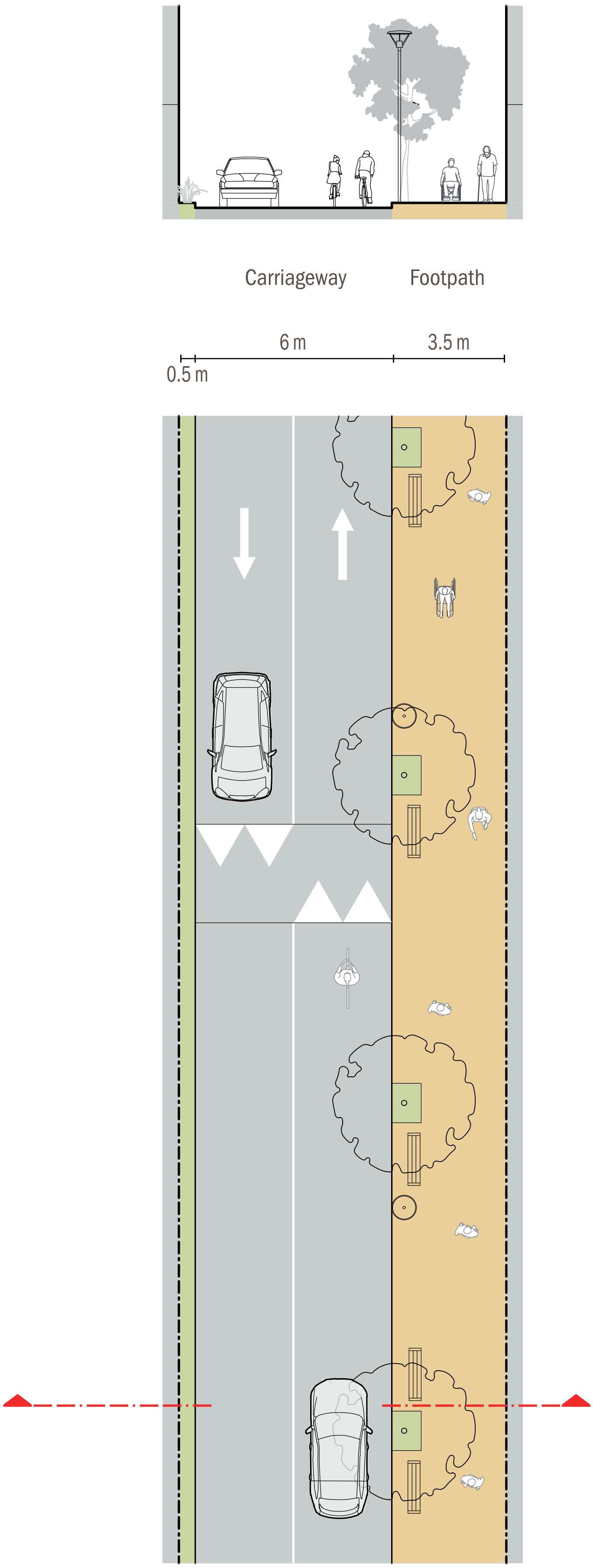


# 10 m

## Local Street (A)

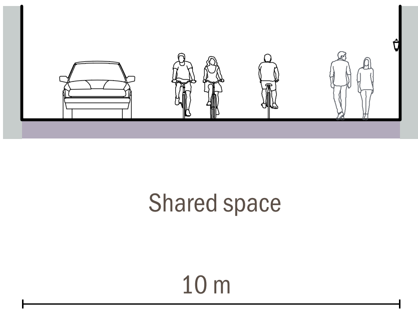
## Mixed use

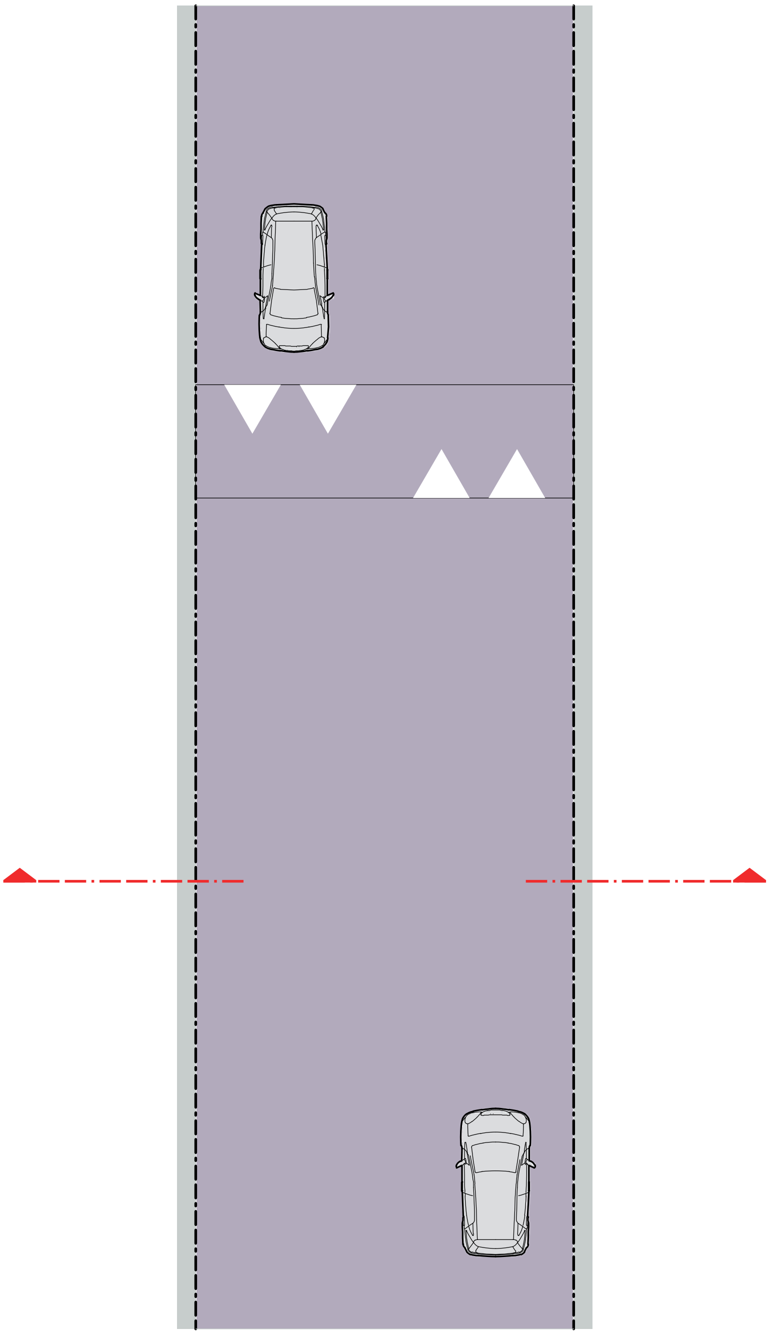


# 10 m

## Local Street (B)

## Mixed use

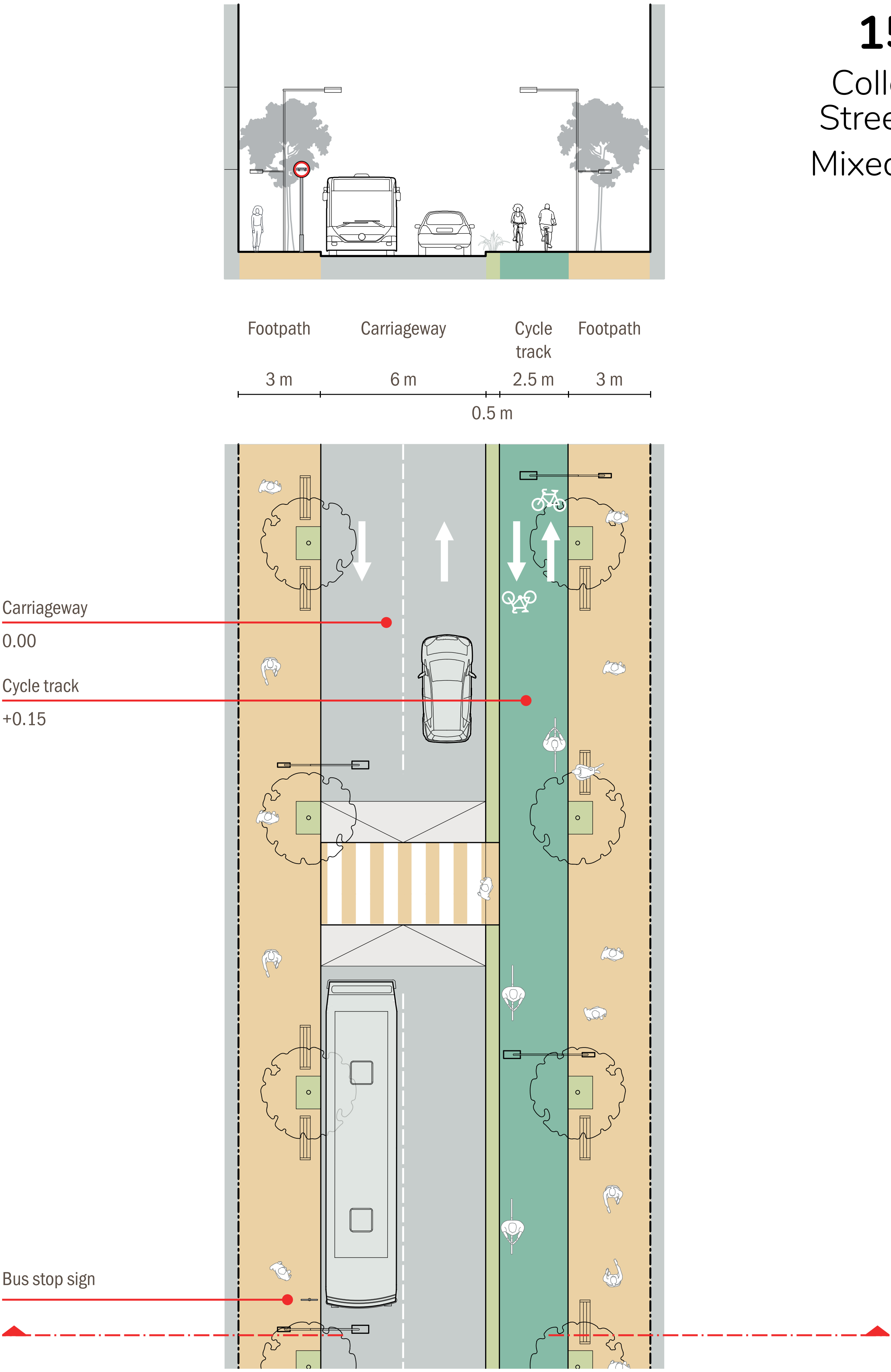


# 15 m

Collector Street (A)

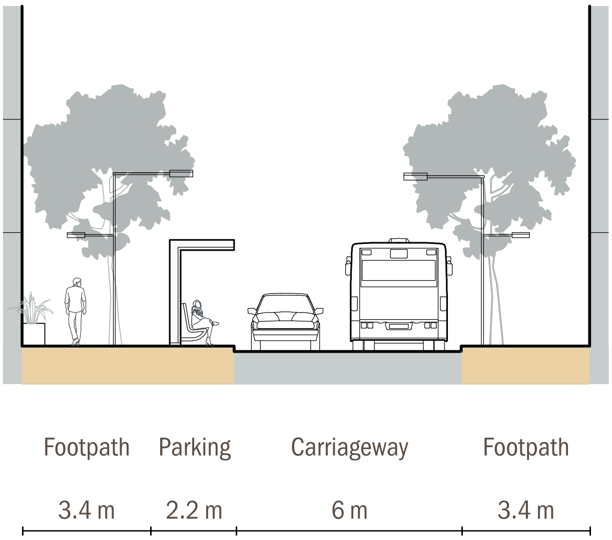
Mixed use

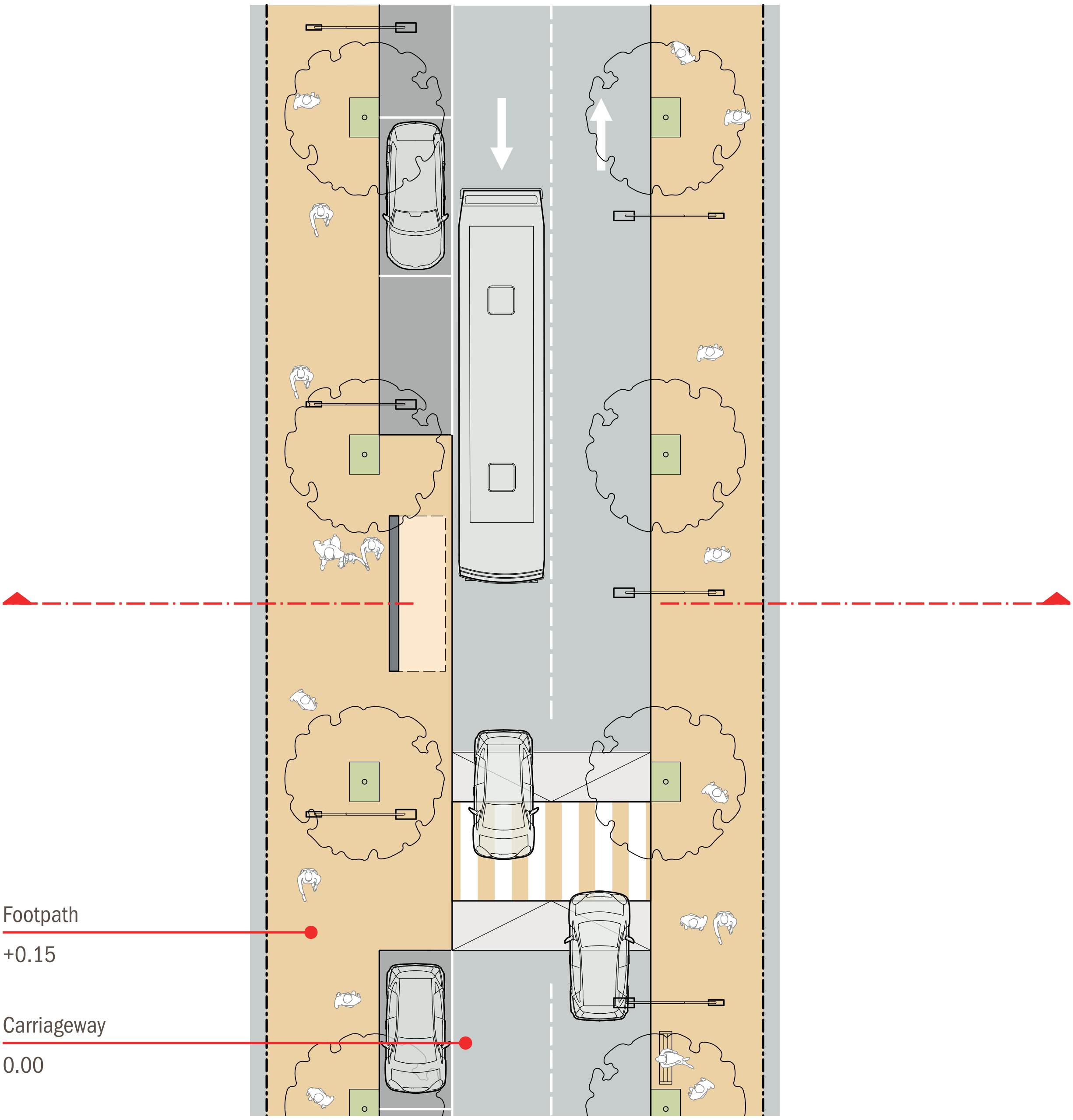


# 15 m

## Collector Street (B)

## Mixed use

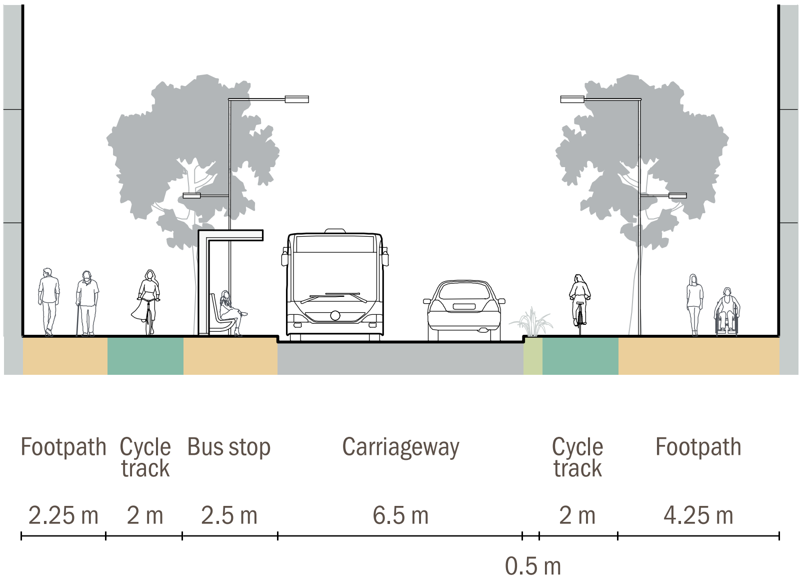


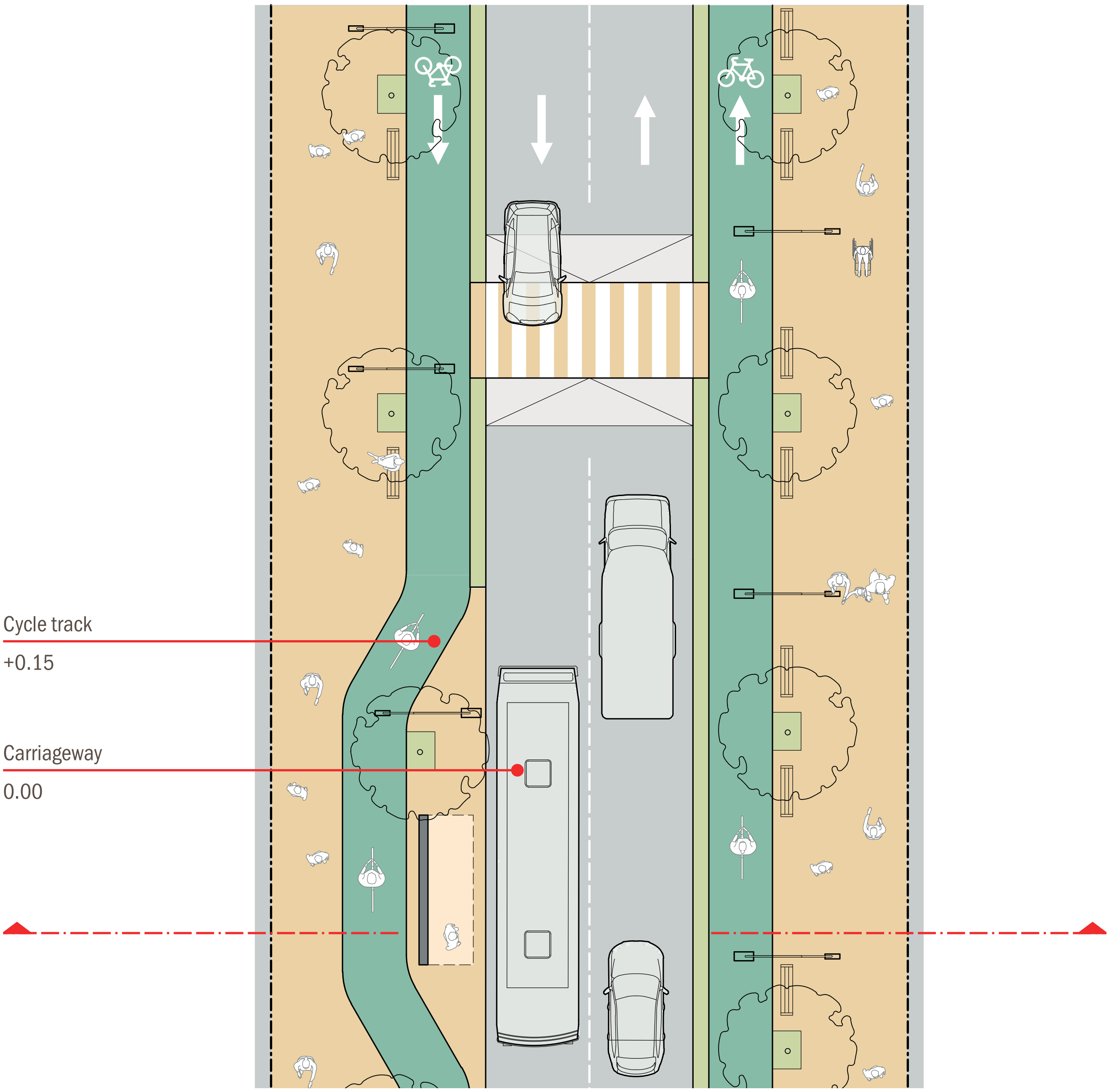



# 20 m

## Collector Street (A)

## Mixed use

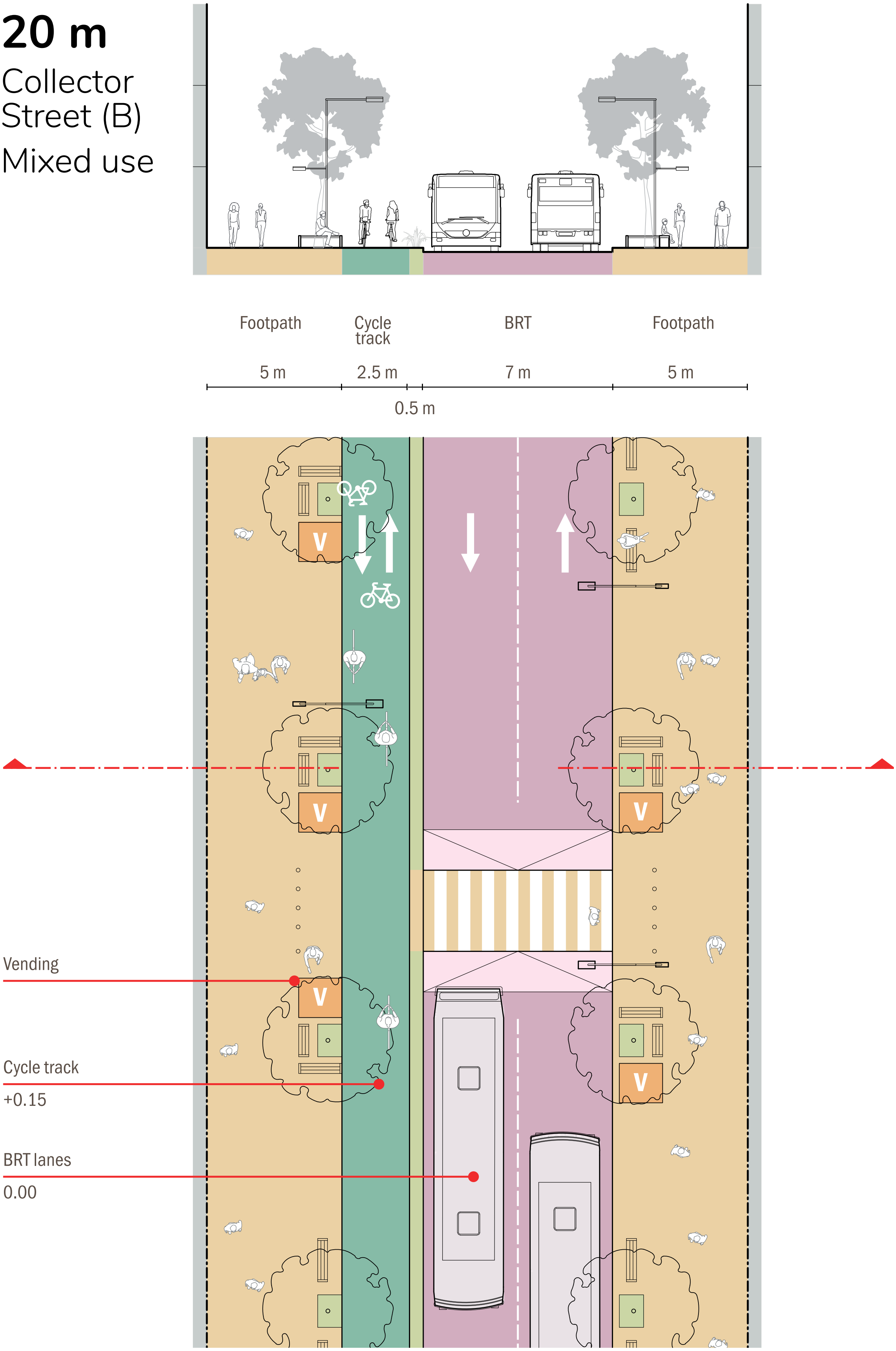


# 20 m

Collector Street (B)

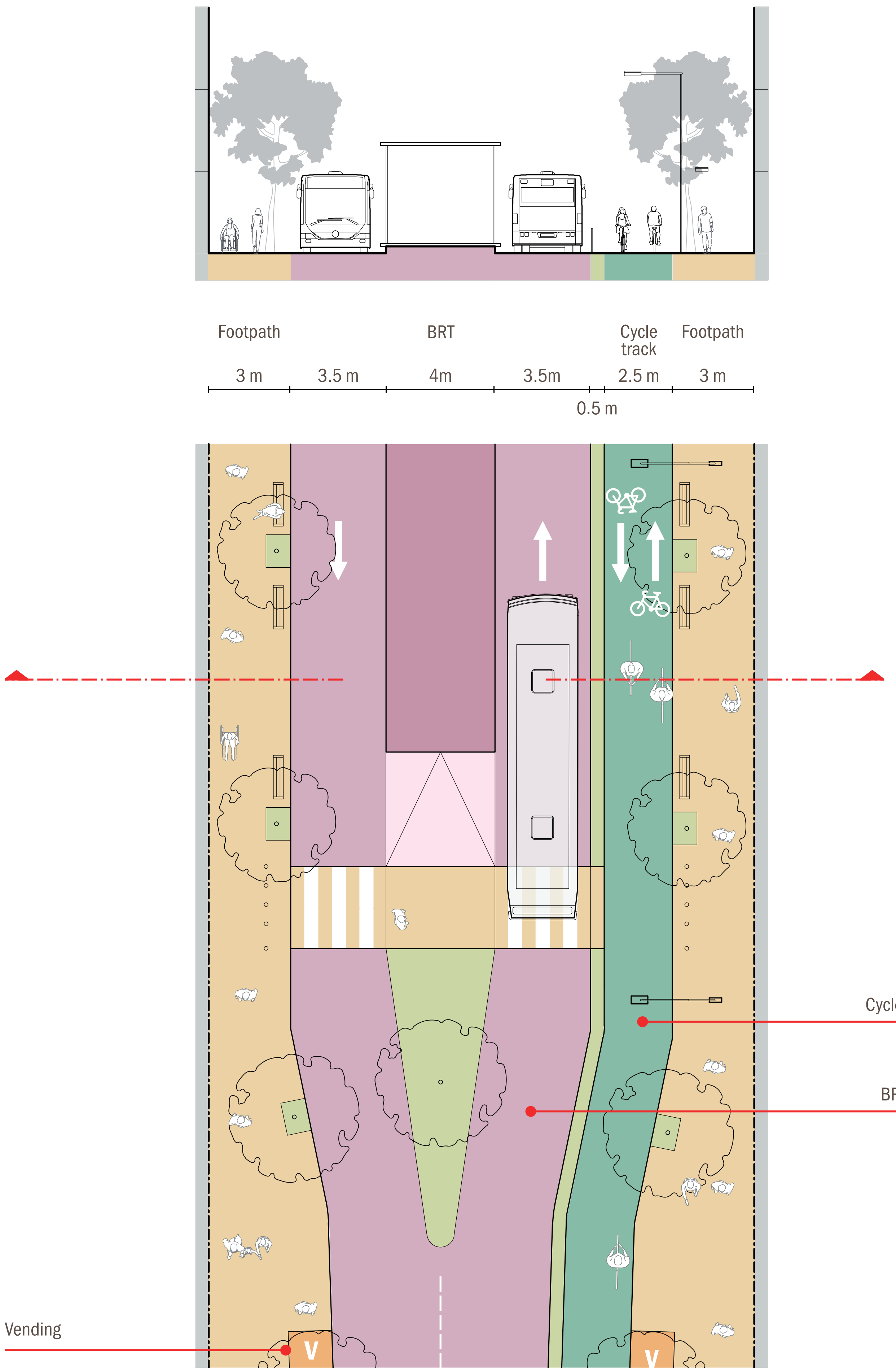
Mixed use



# 20 m

Collector Street (B) on station

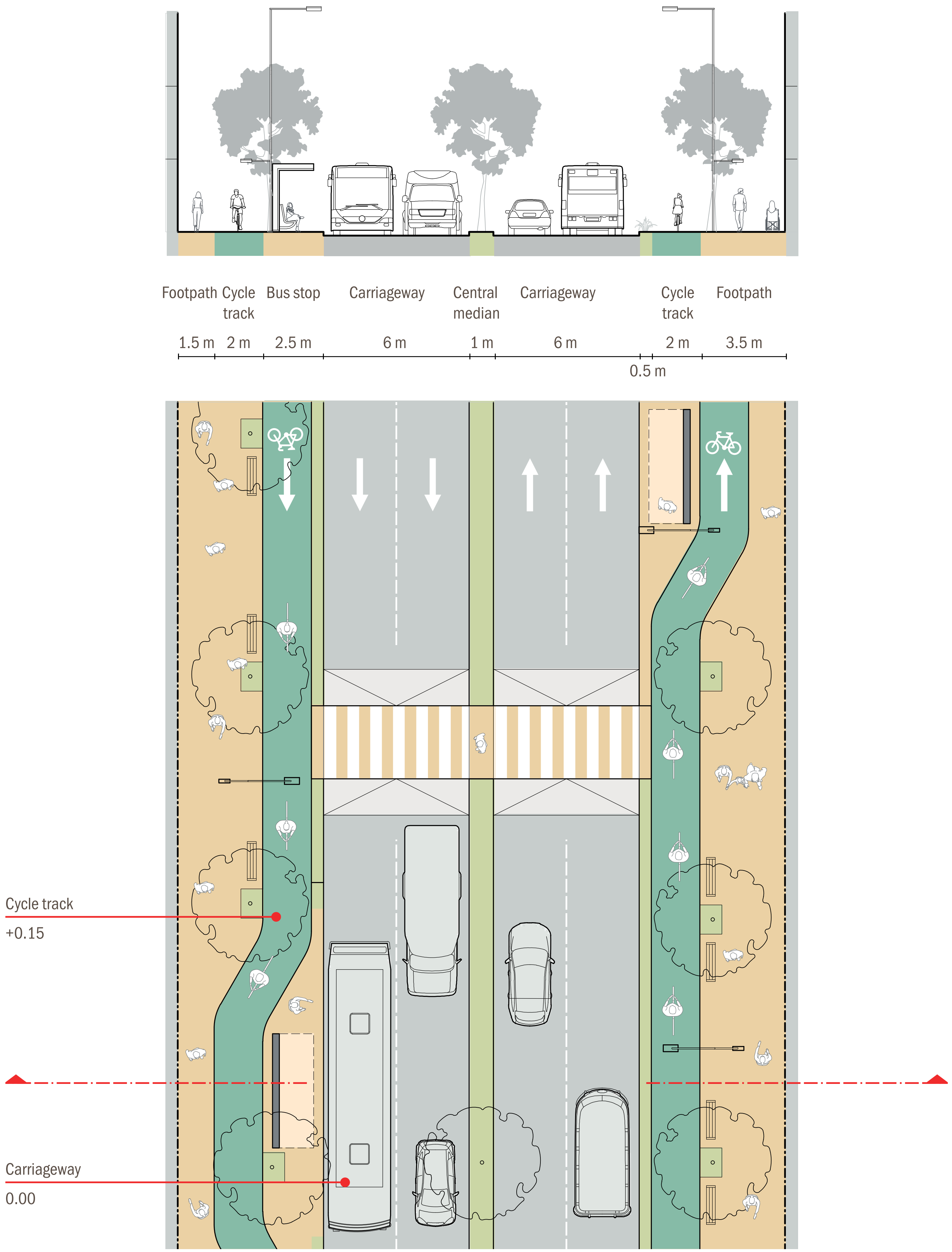
Mixed use



# 25 m

Sub-Arterial
Street (A)

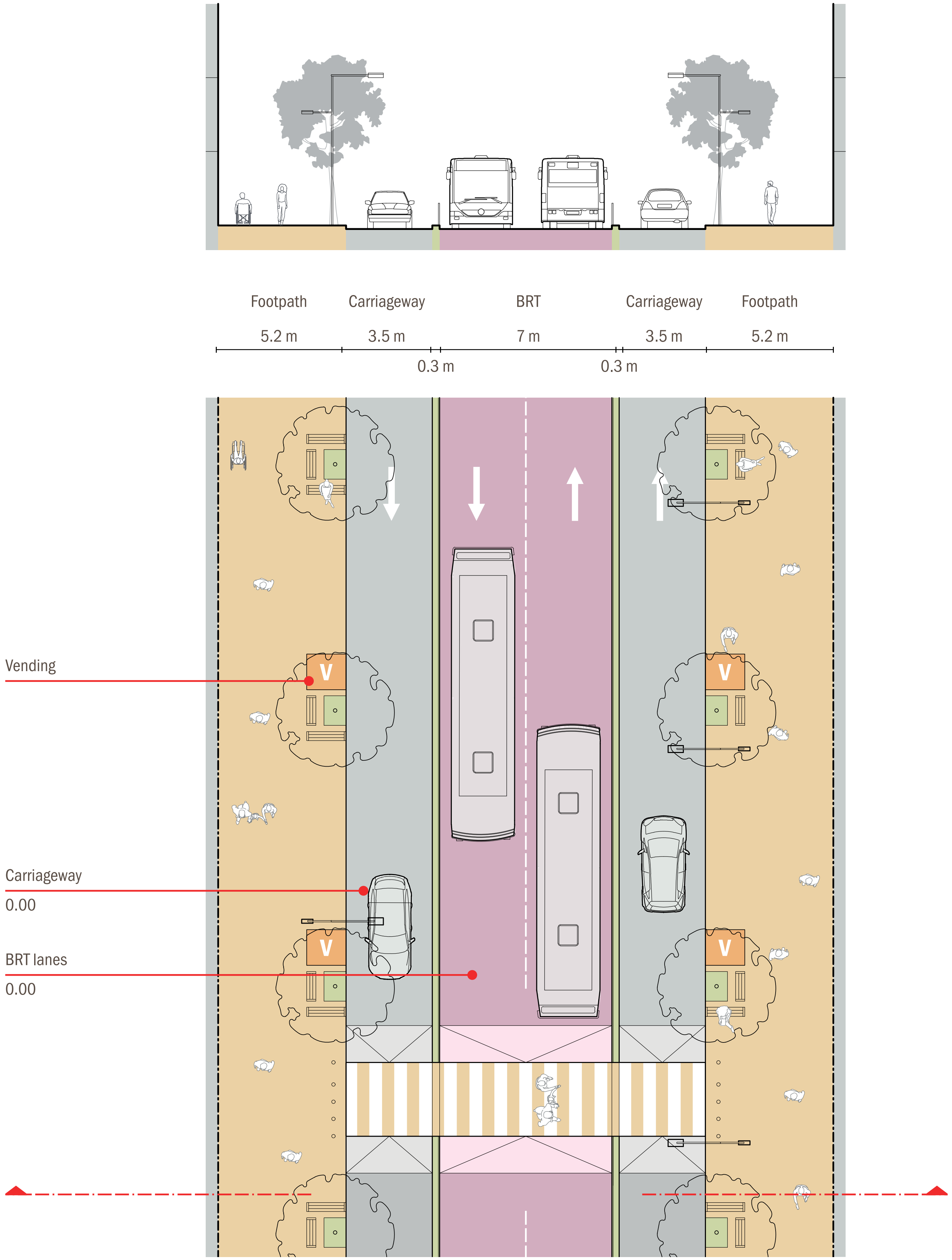
Mixed use



# 25 m

Sub-Arterial Street (B)

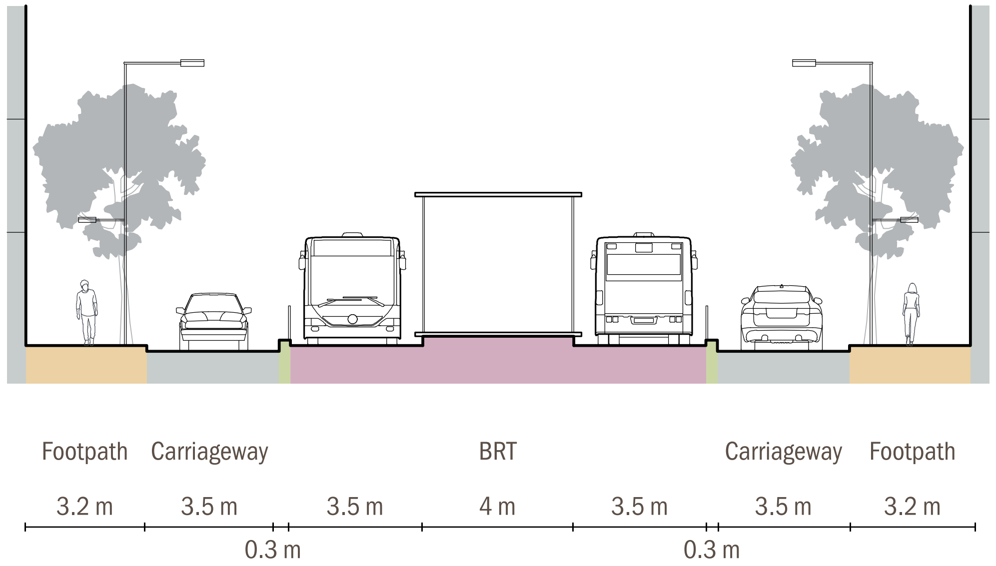
Mixed use

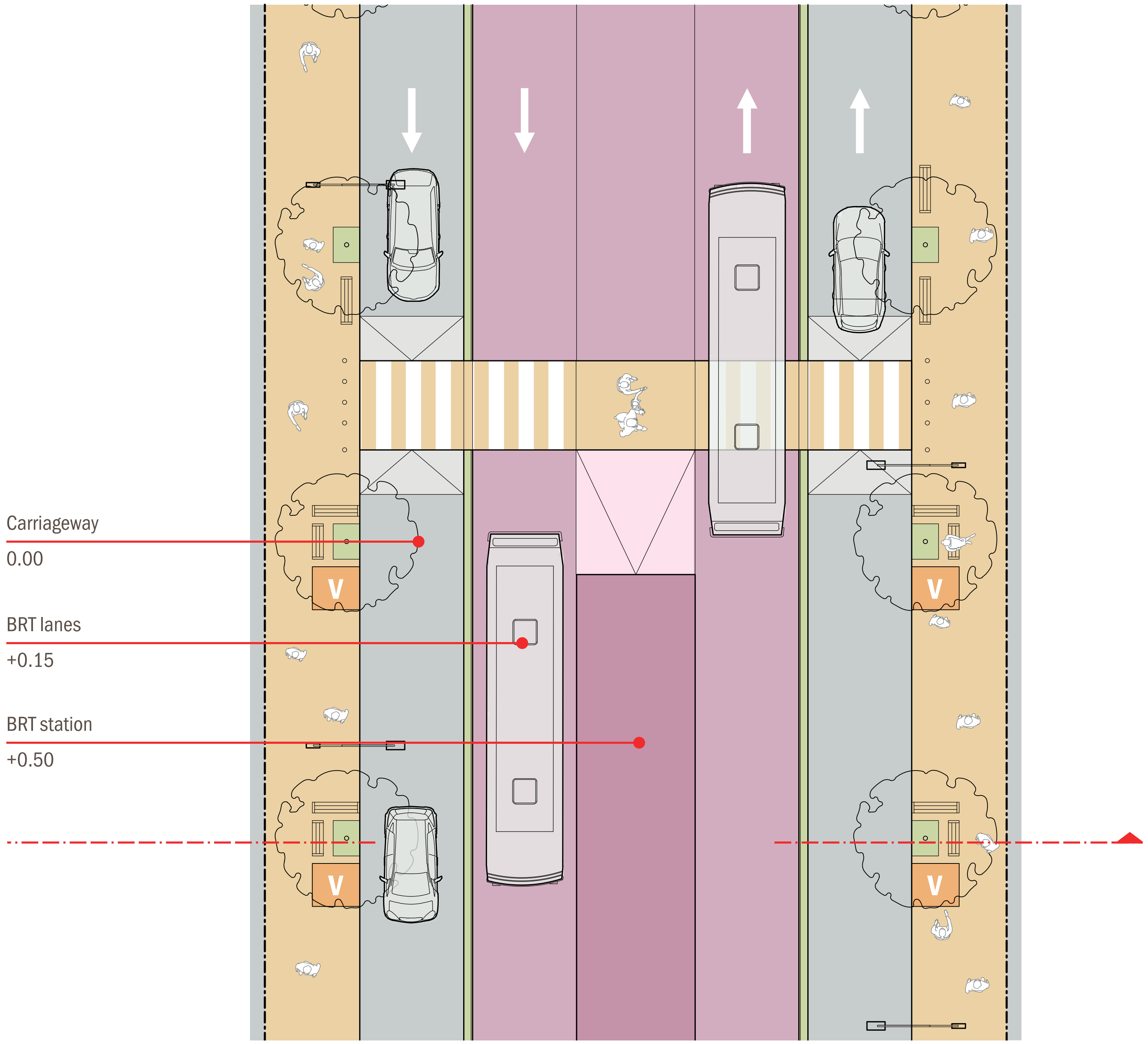


# 25 m

Sub-Arterial Street (B) on station

Mixed use

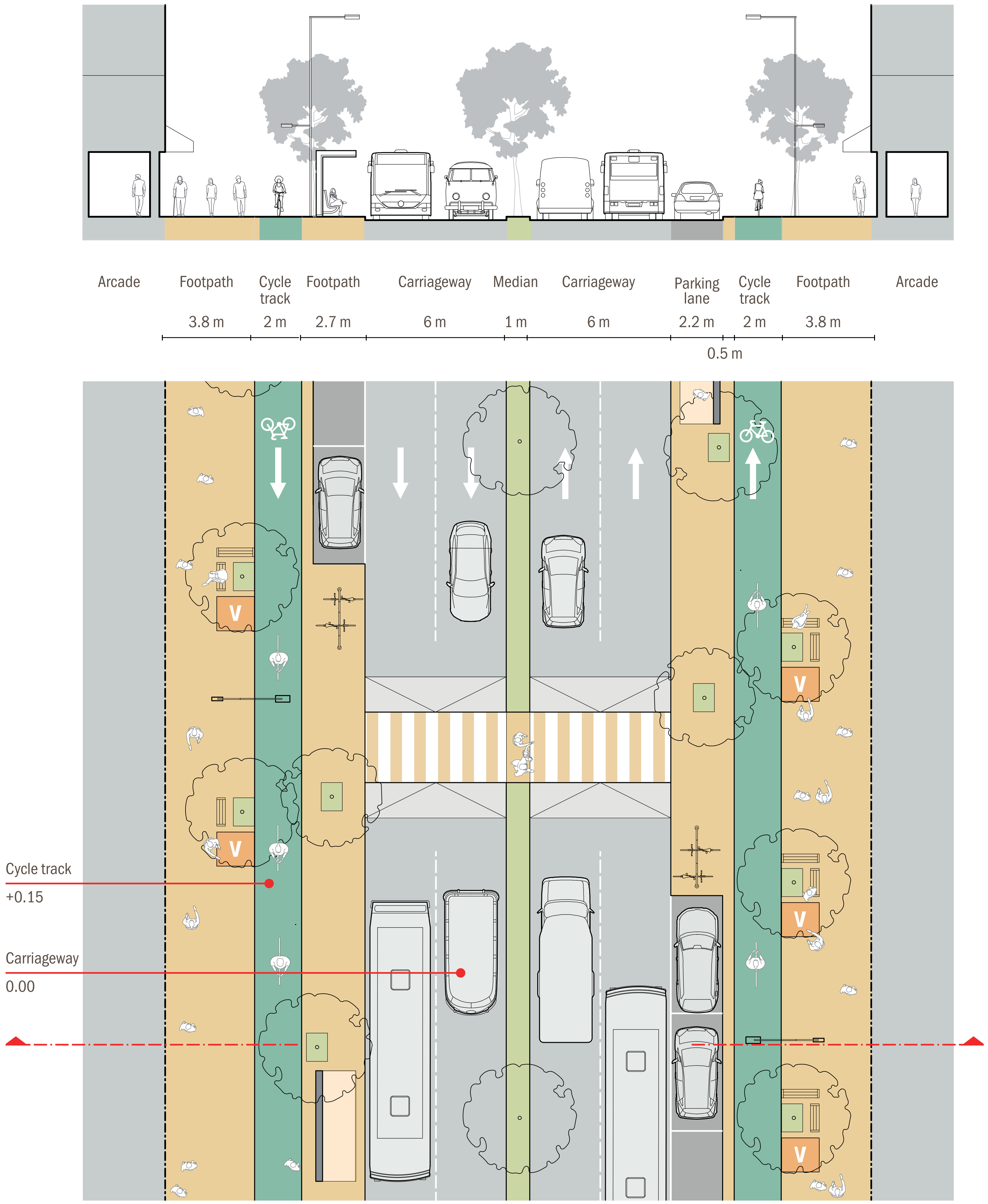


# 30 m

Sub-Arterial Street (A)

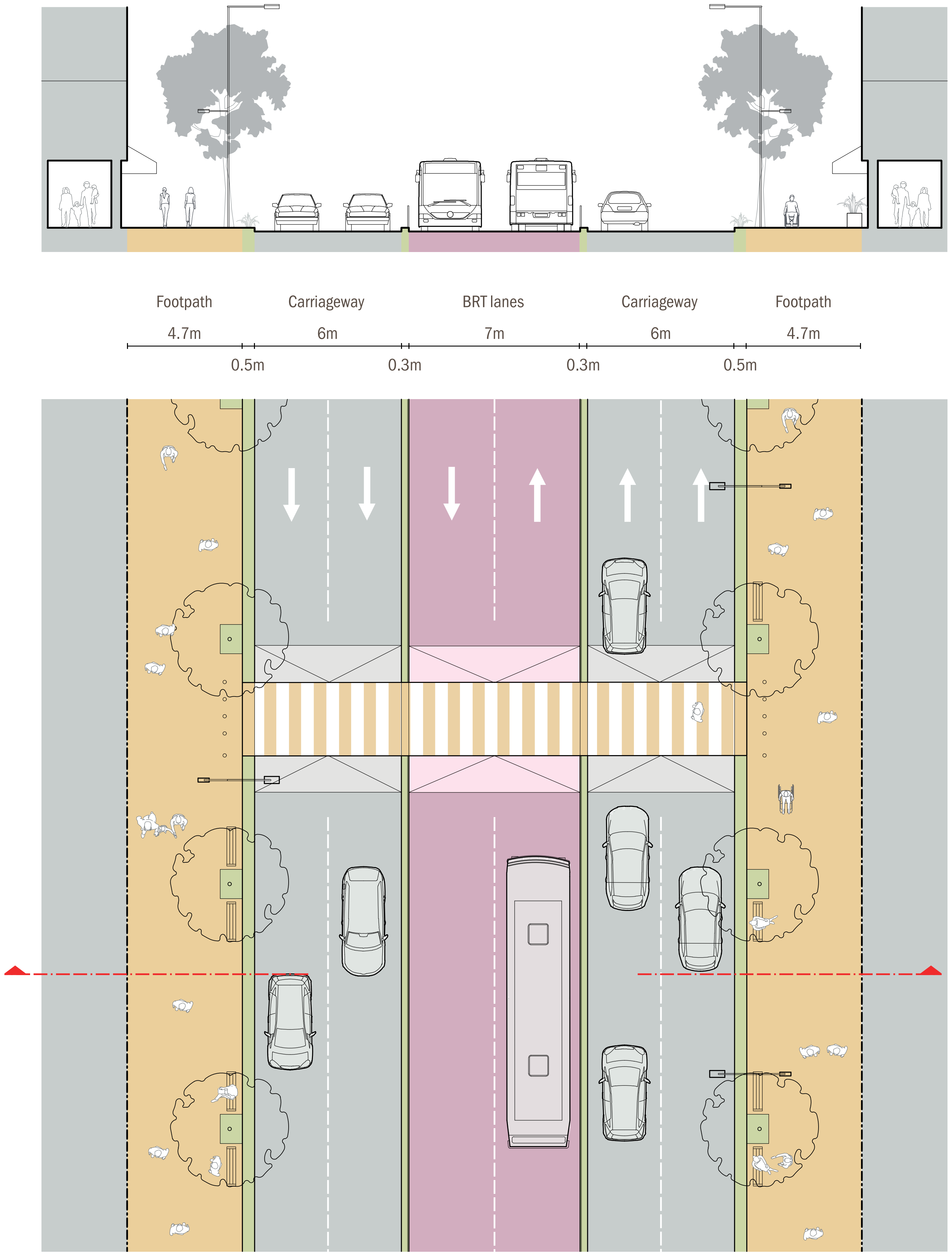
Mixed use



# 30 m

Sub-Arterial
Street (B)

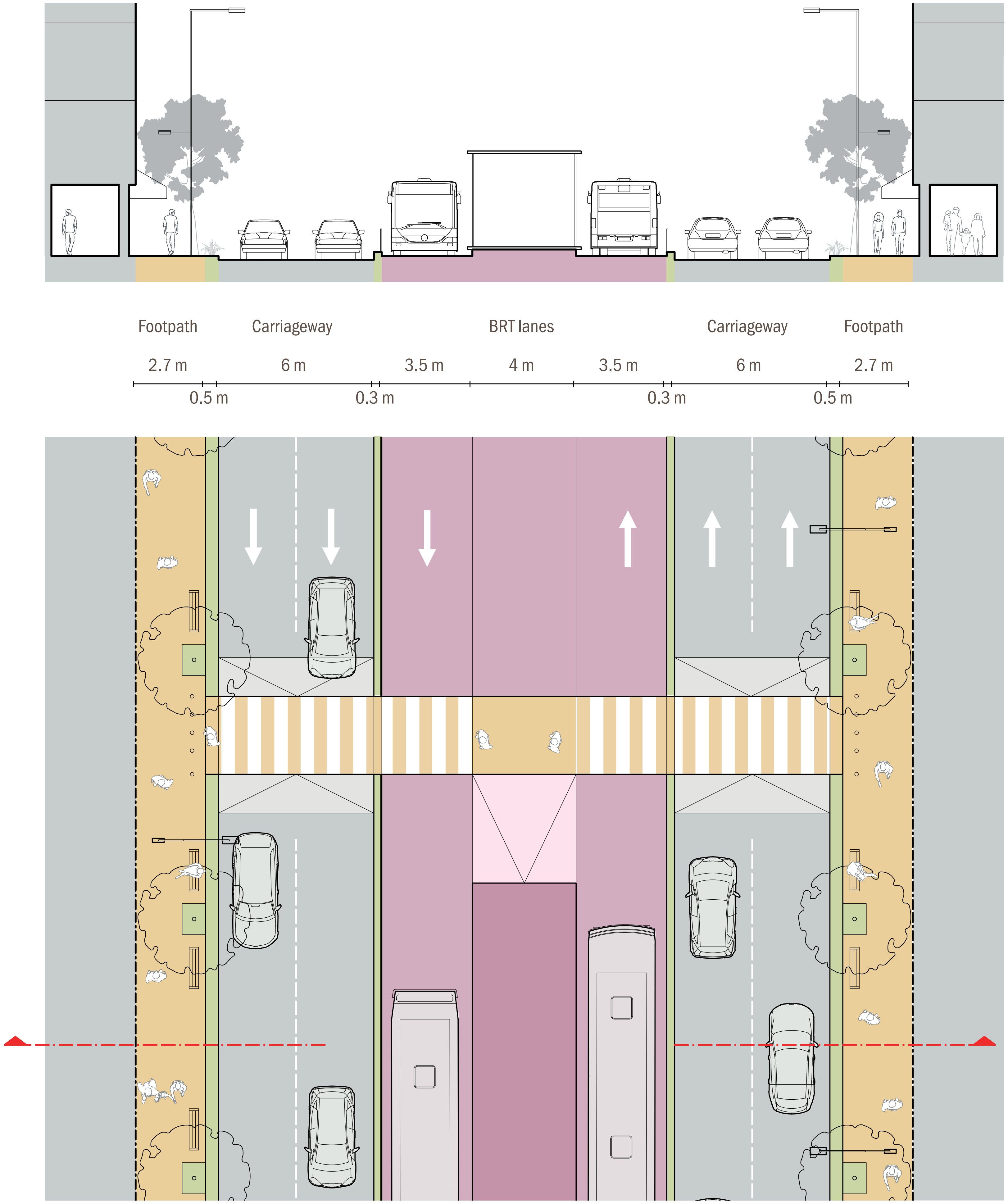
Mixed use



# 30 m

Sub-Arterial Street (B) on station

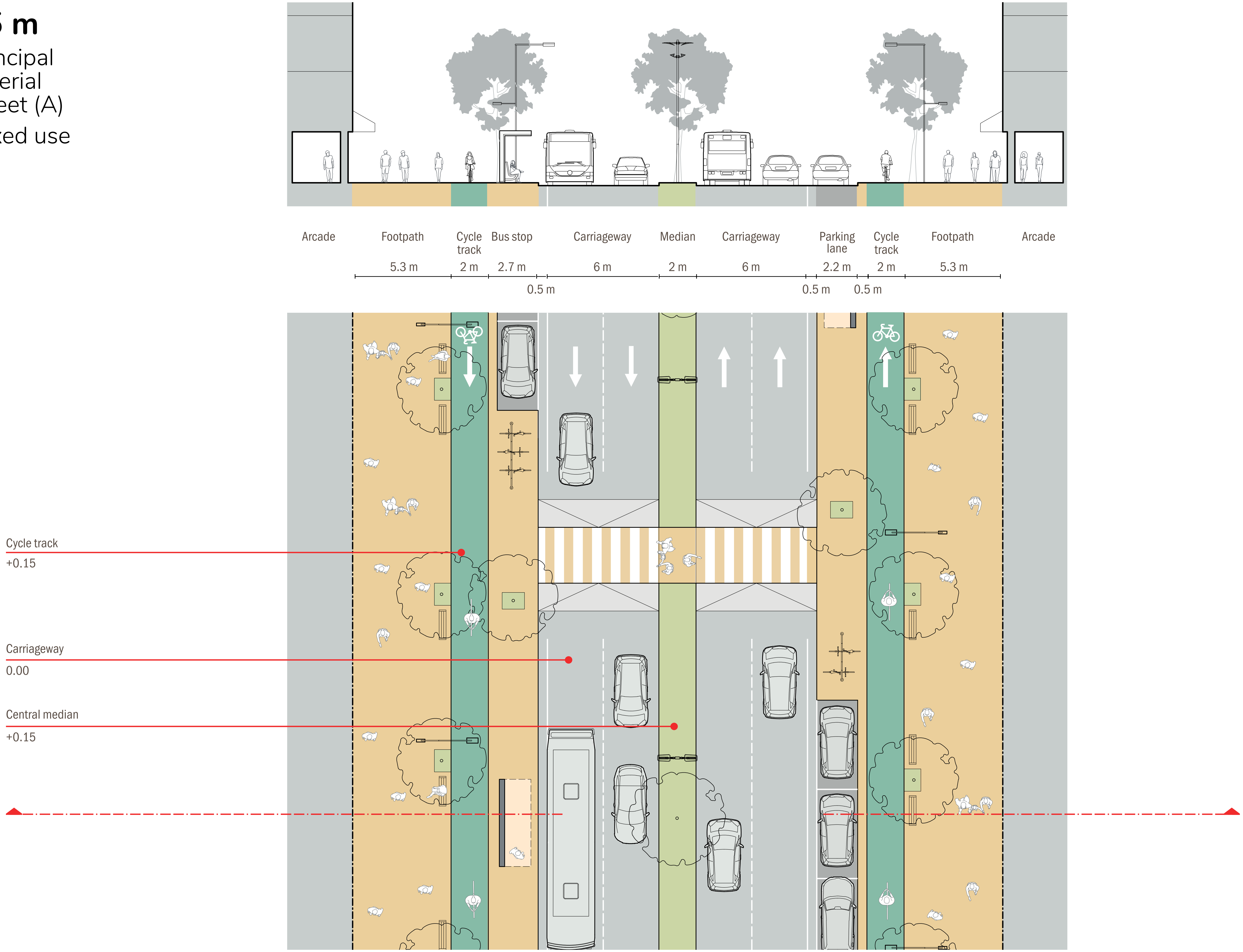
Mixed use



# 35 m

Principal Arterial Street (A)

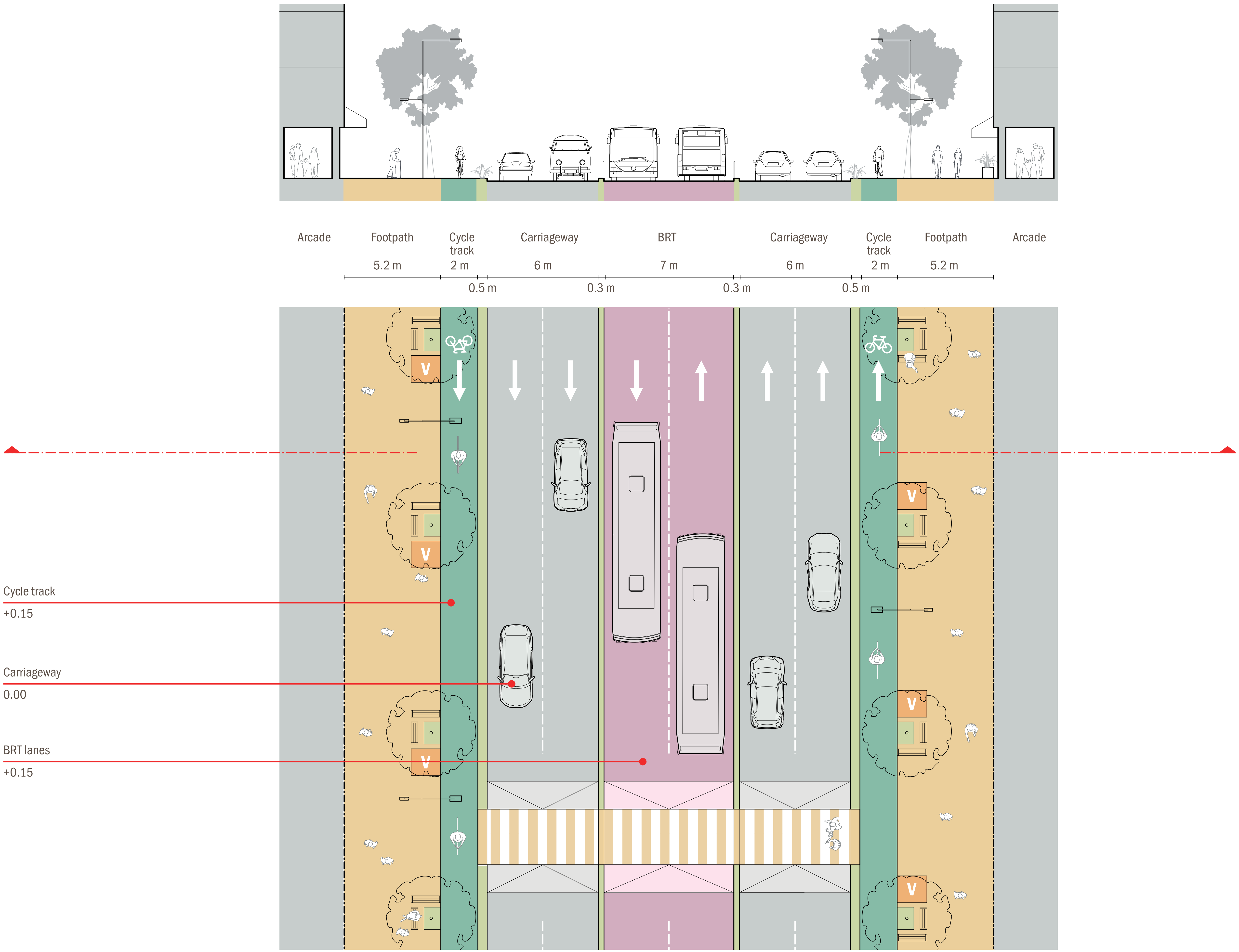
Mixed use



# 35 m

Principal Arterial Street (B)

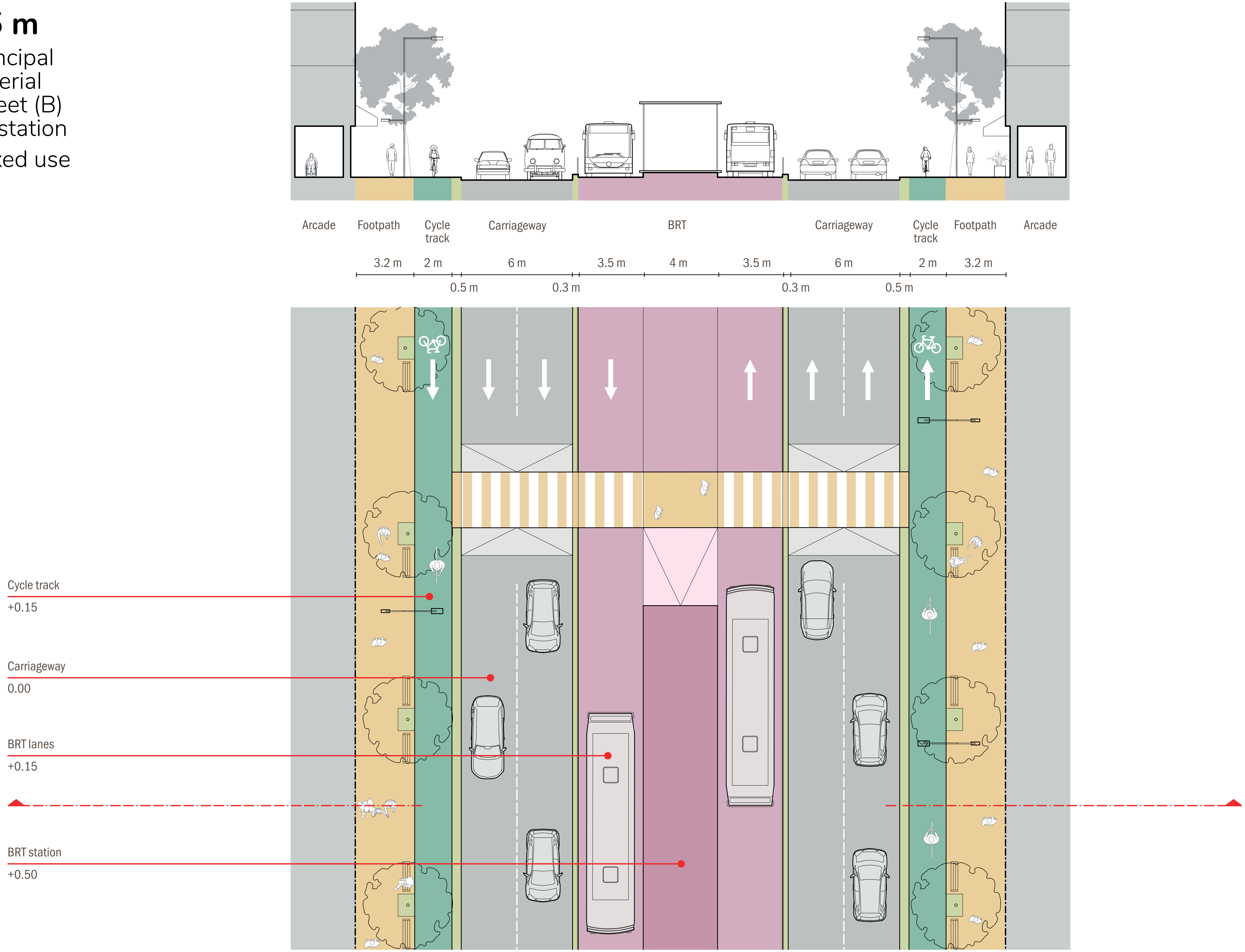
Mixed use



# 35 m

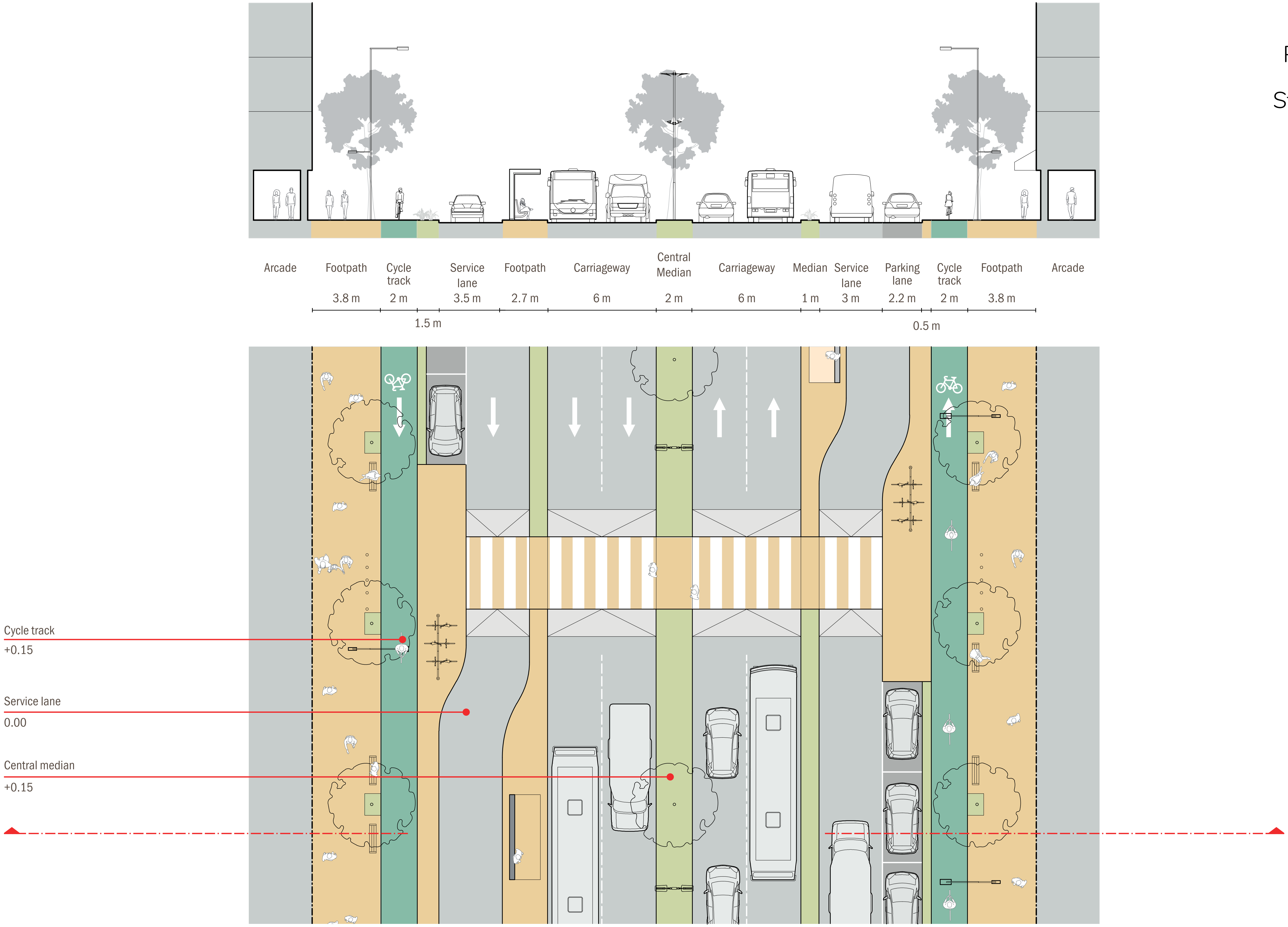
Principal Arterial Street (B) on station

Mixed use



# 40 m

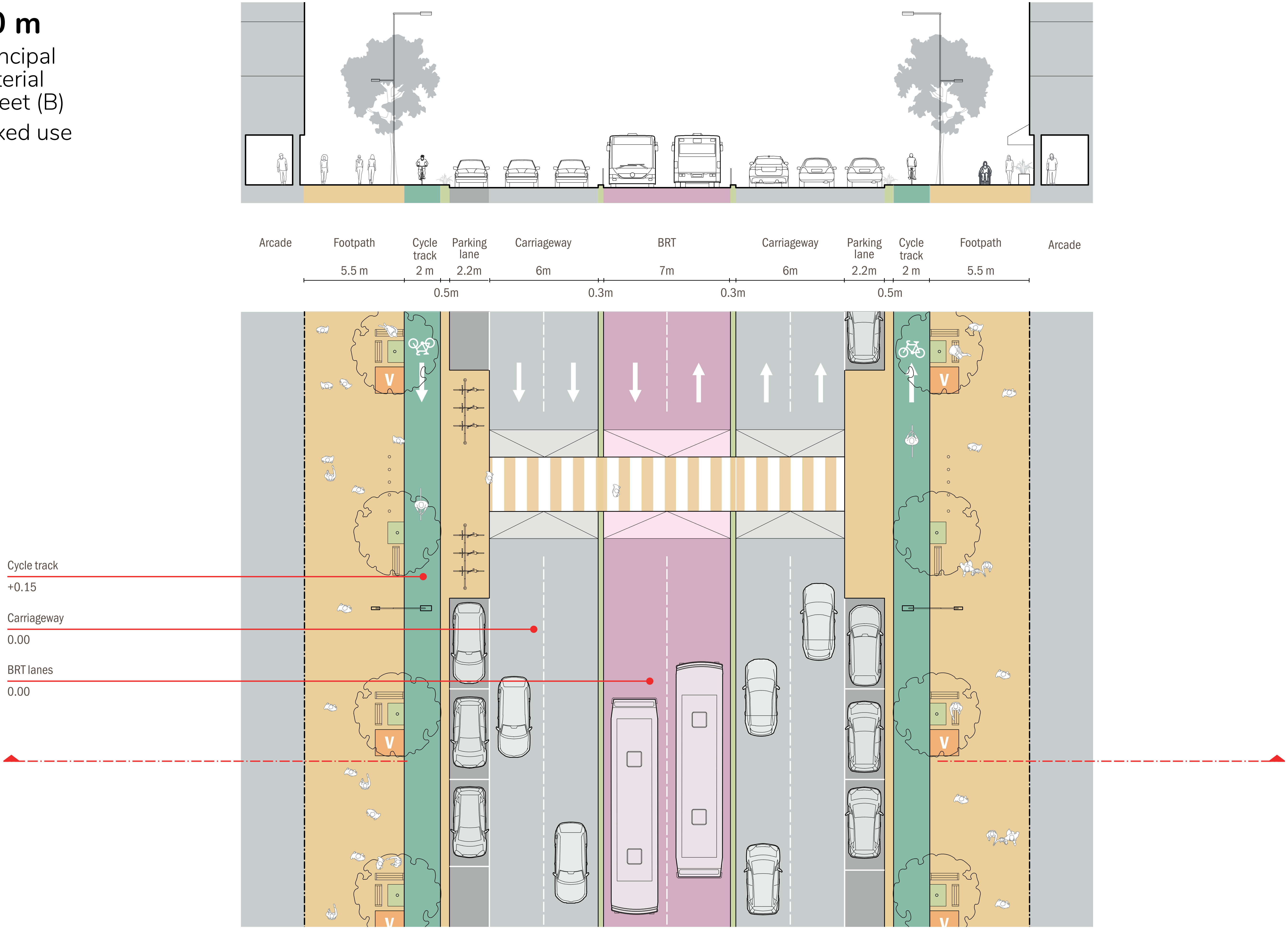
Principal Arterial Street (A)



# 40 m

Principal Arterial Street (B)

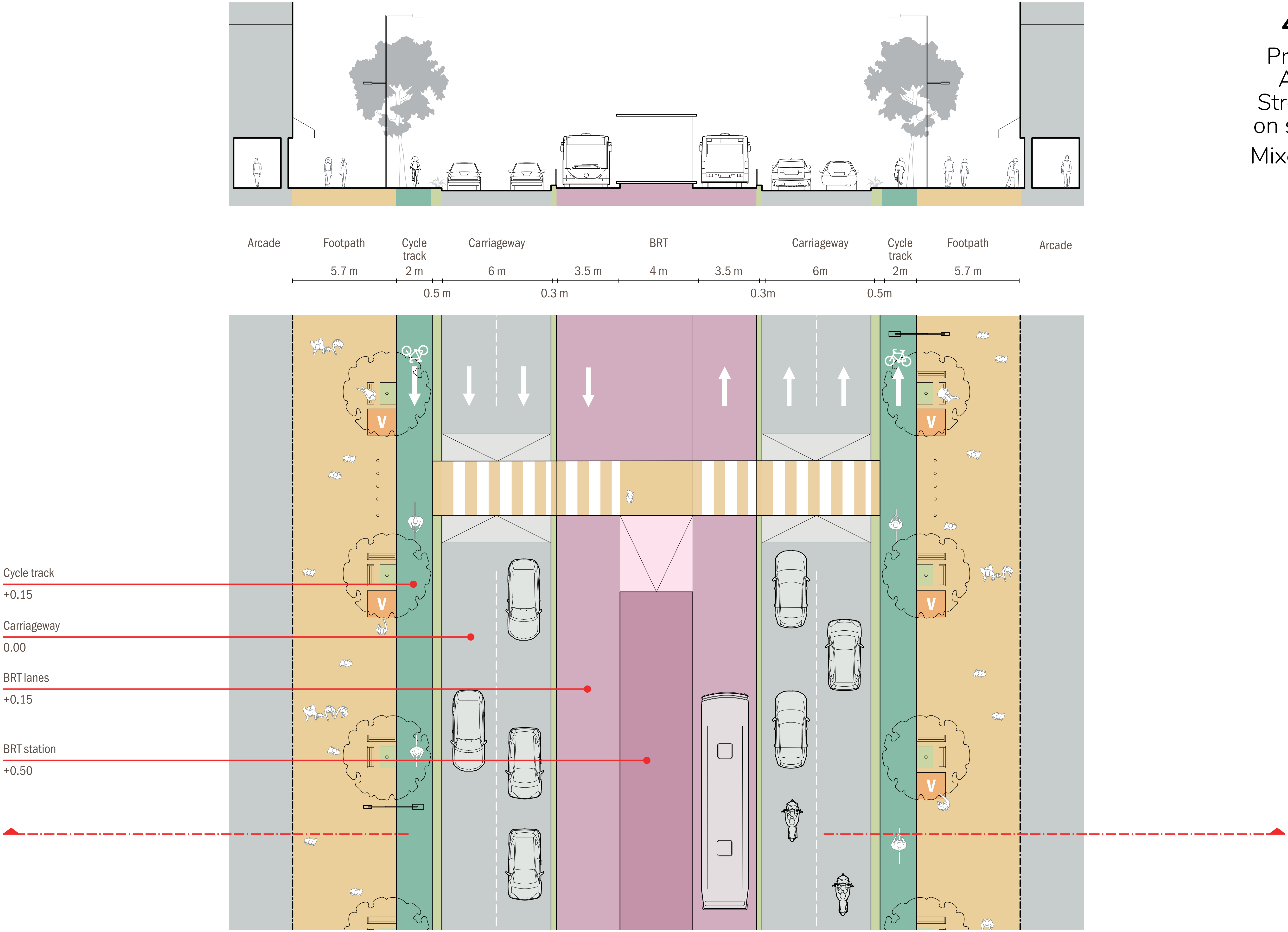
Mixed use



# 40 m

## Principal Arterial Street (B) on station

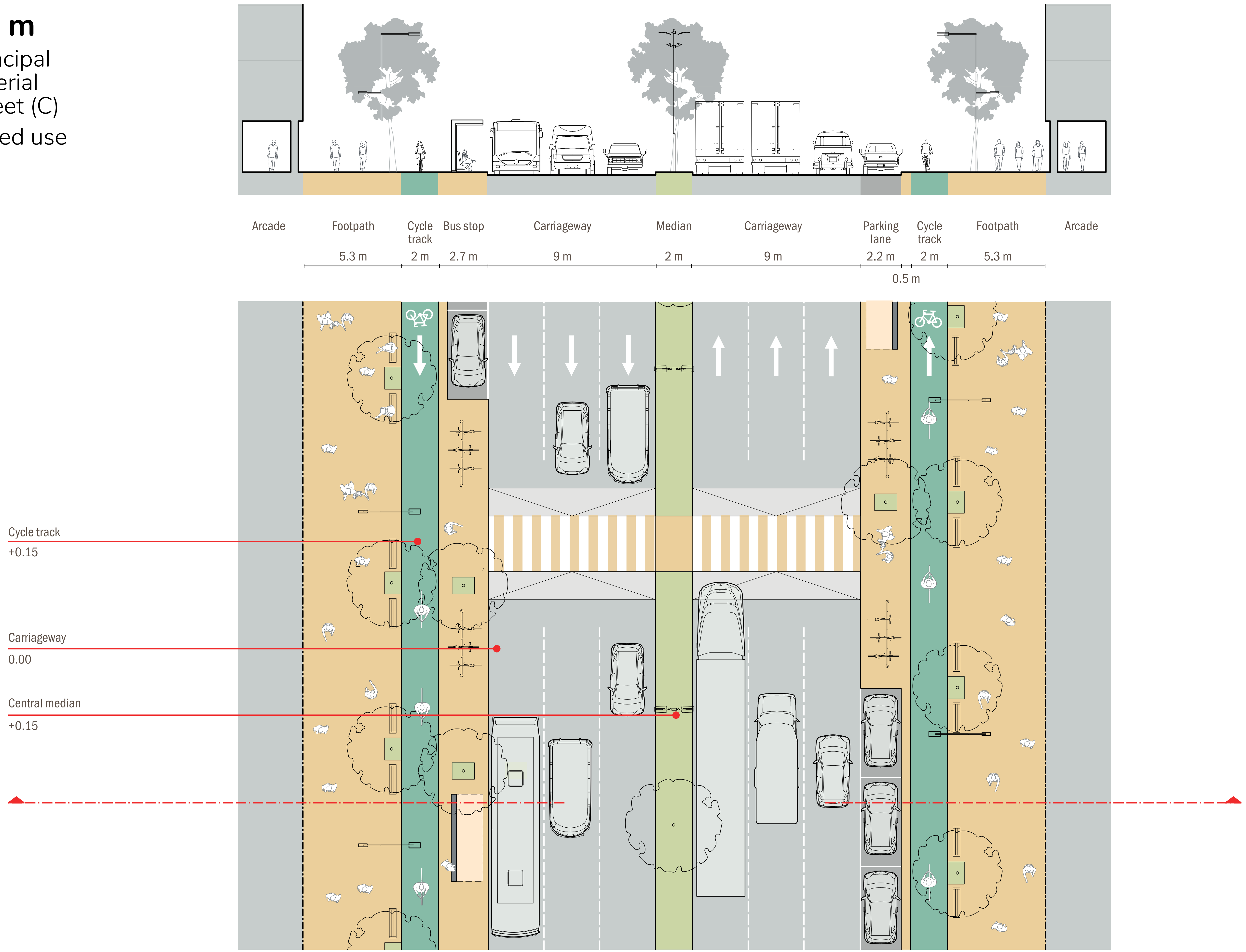
## Mixed use



# 40 m

## Principal Arterial Street (C)

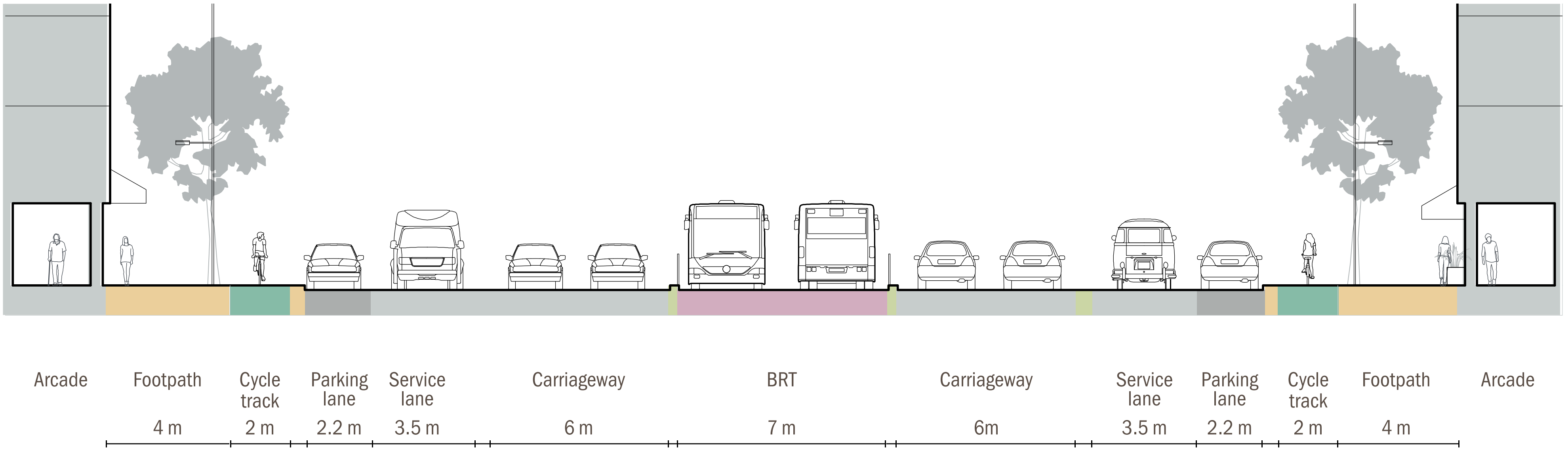
## Mixed use

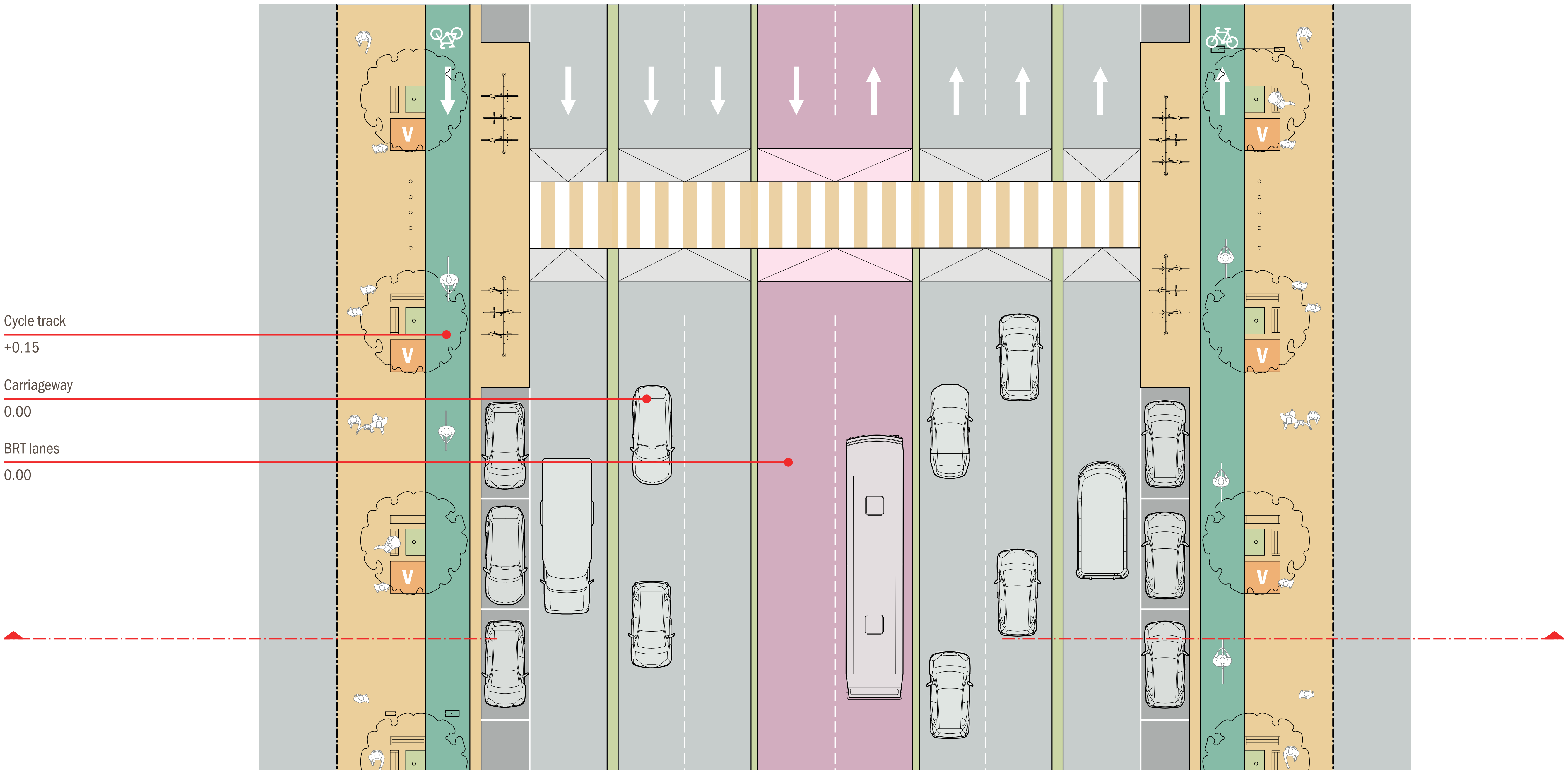


# 45 m

Principal Arterial Street (A)

Mixed use

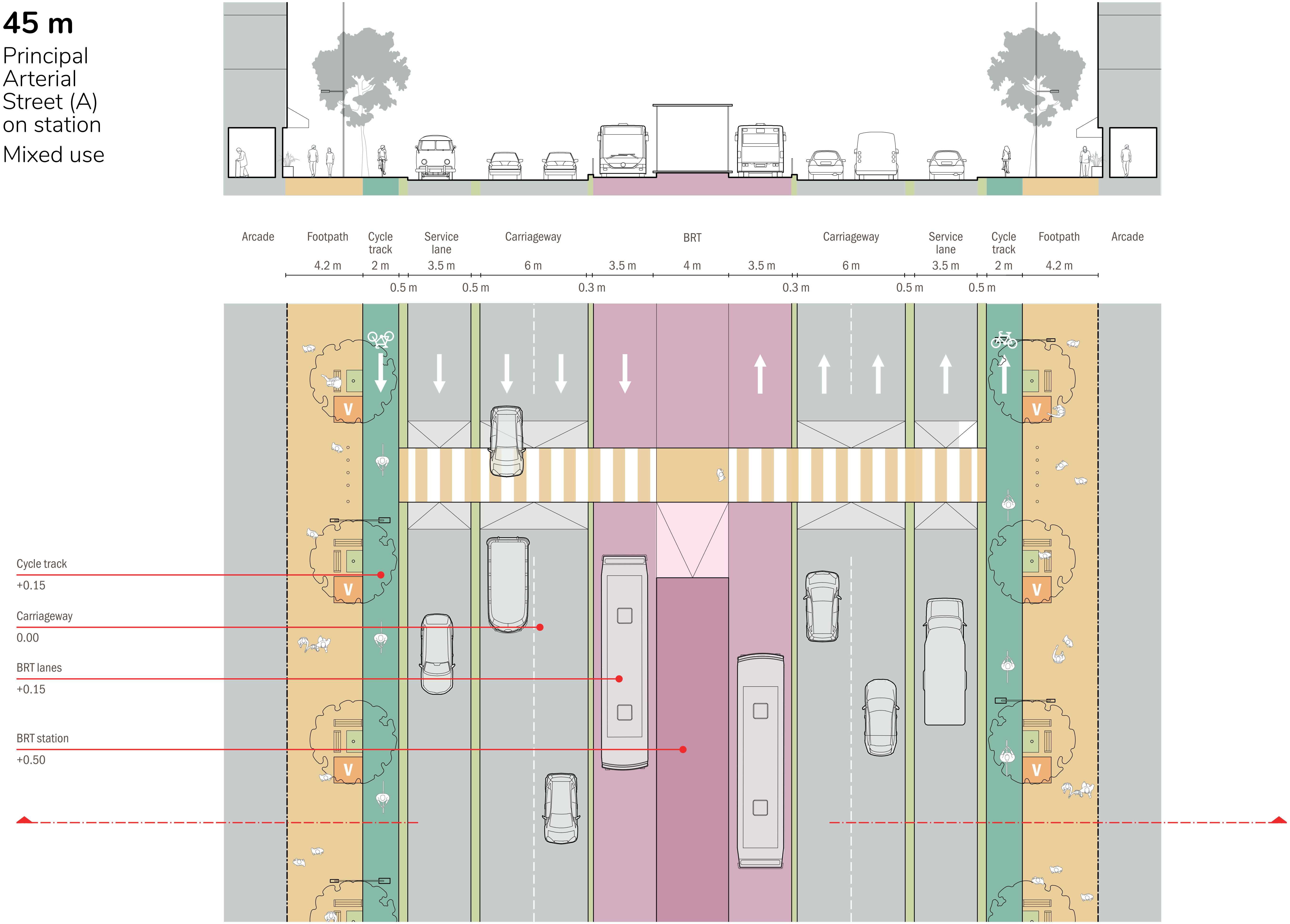


# 45 m

Principal Arterial Street (A) on station

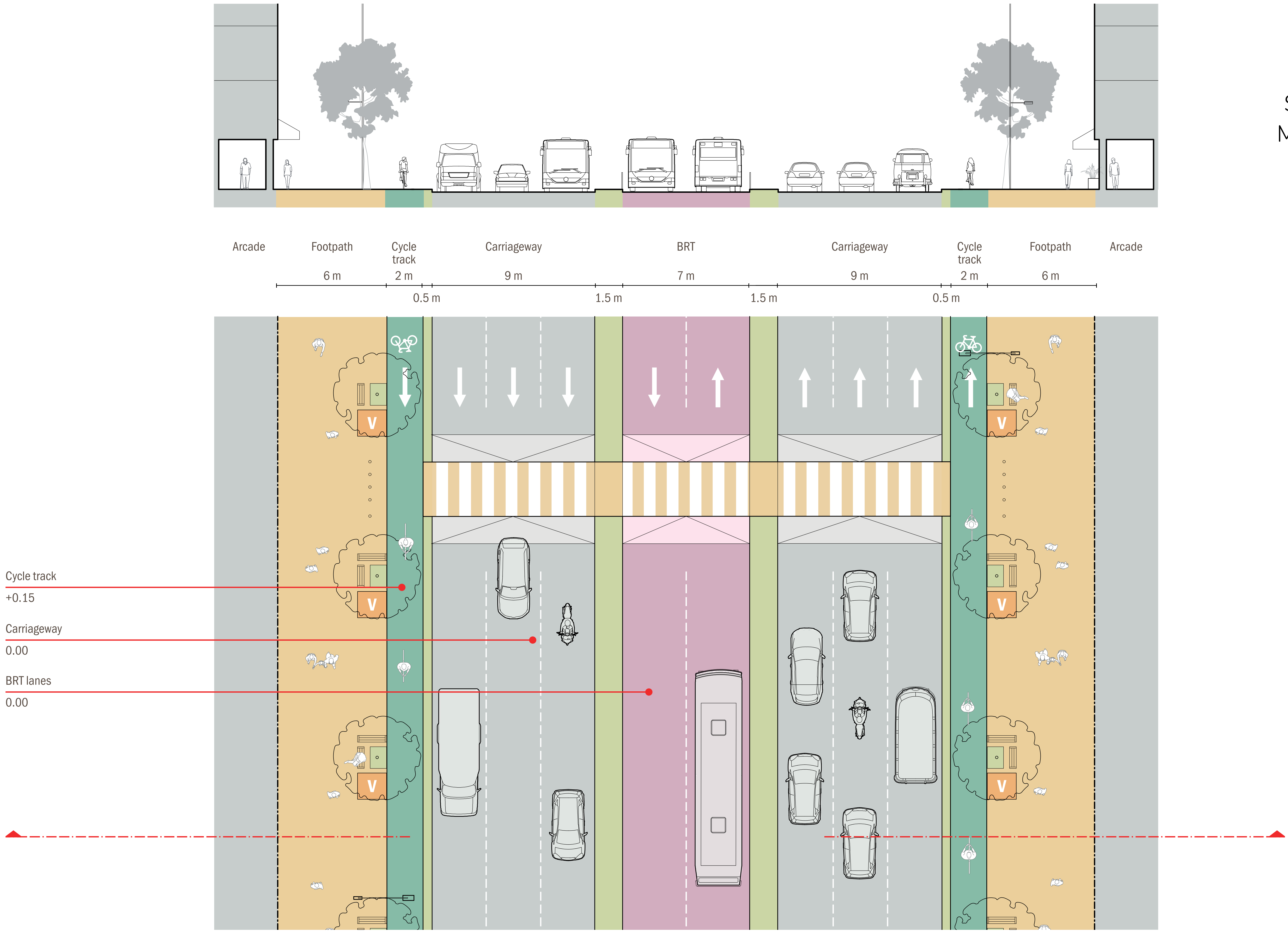
Mixed use



# 45 m

Principal Arterial Street (B)

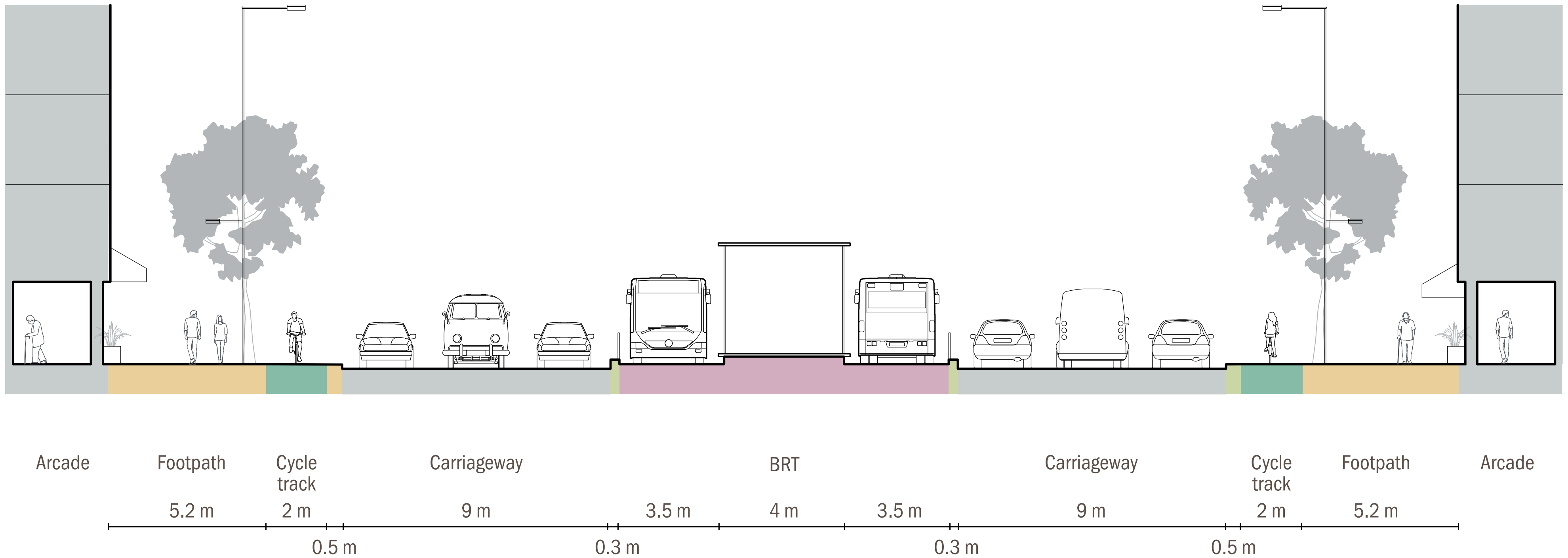
Mixed use

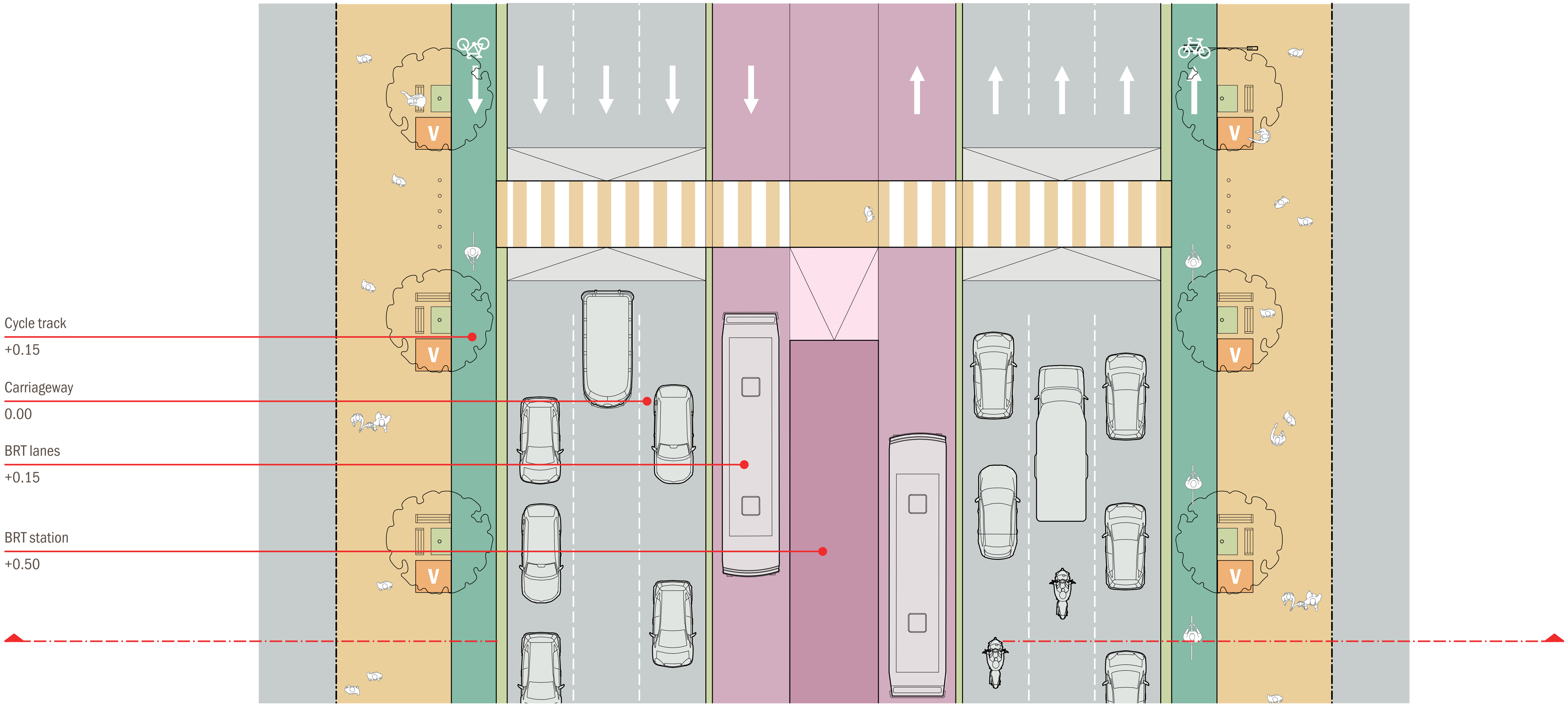


# 45 m

Principal Arterial Street (B) on station

Mixed use

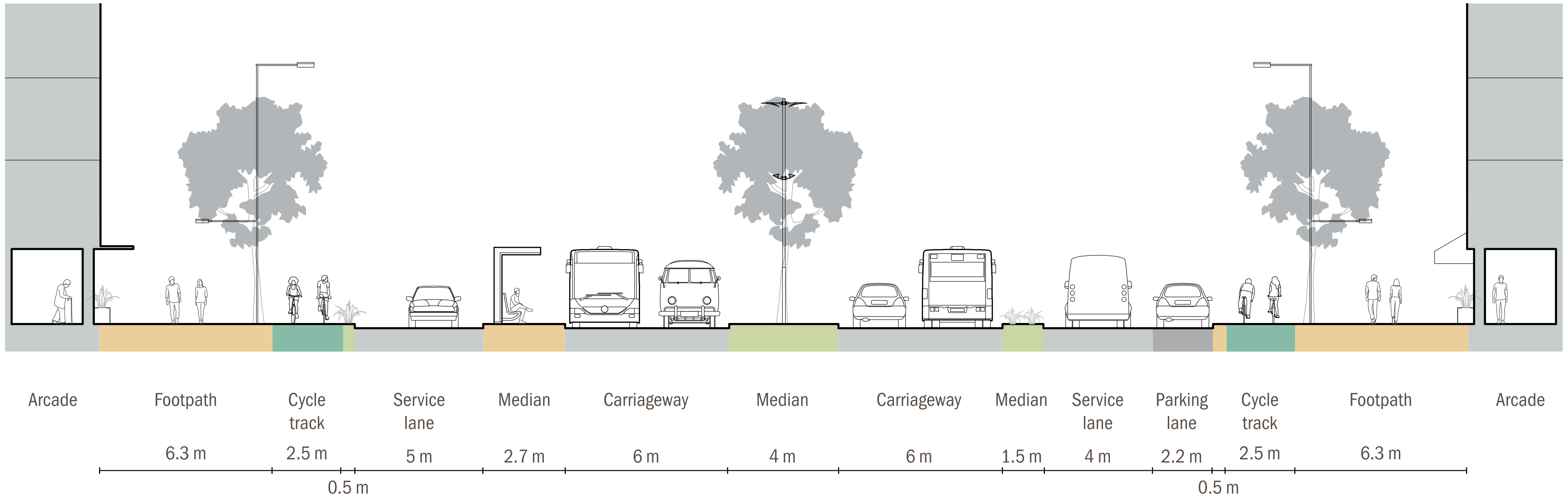


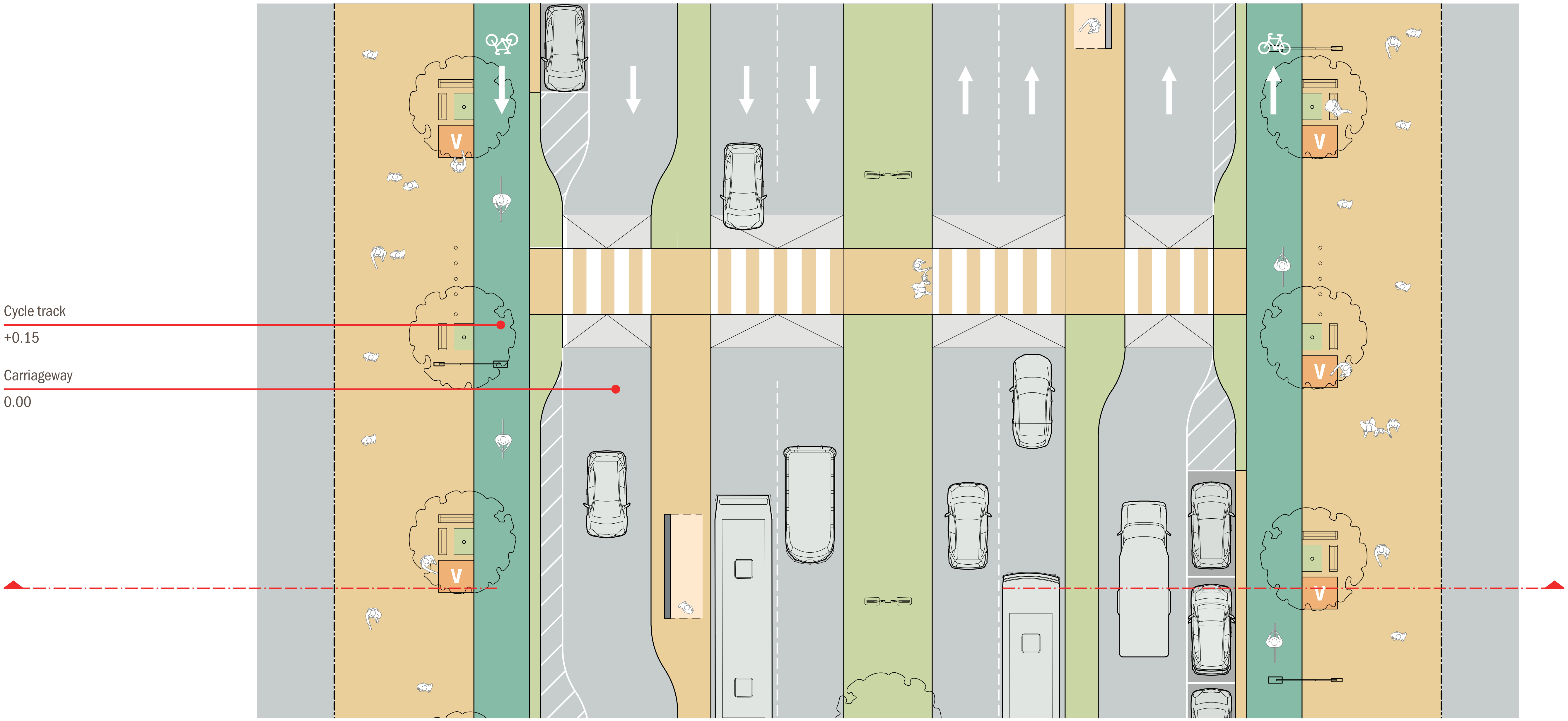



# 50 m

Principal Arterial Street (A)

Mixed use

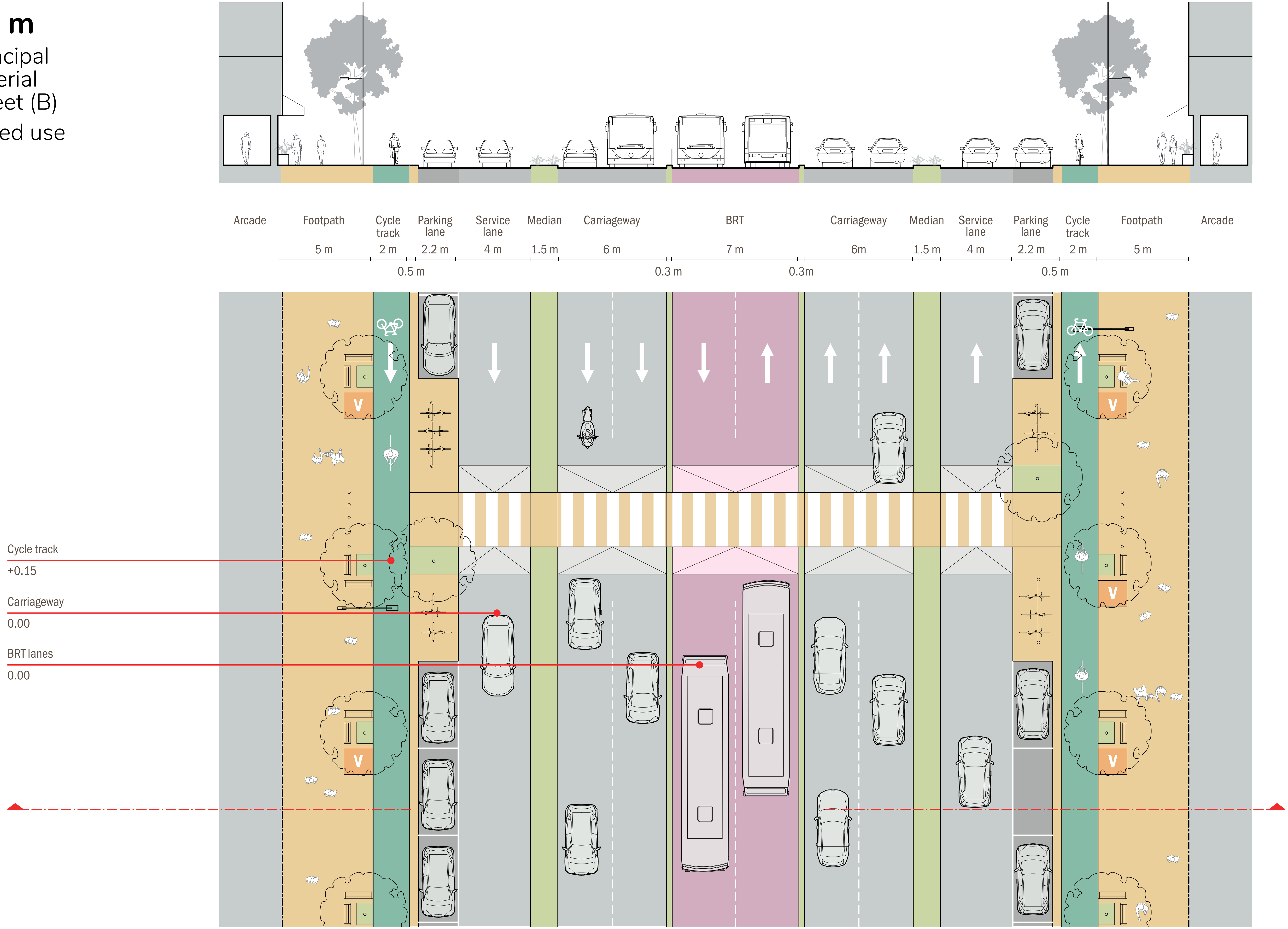


# 50 m

Principal Arterial Street (B)

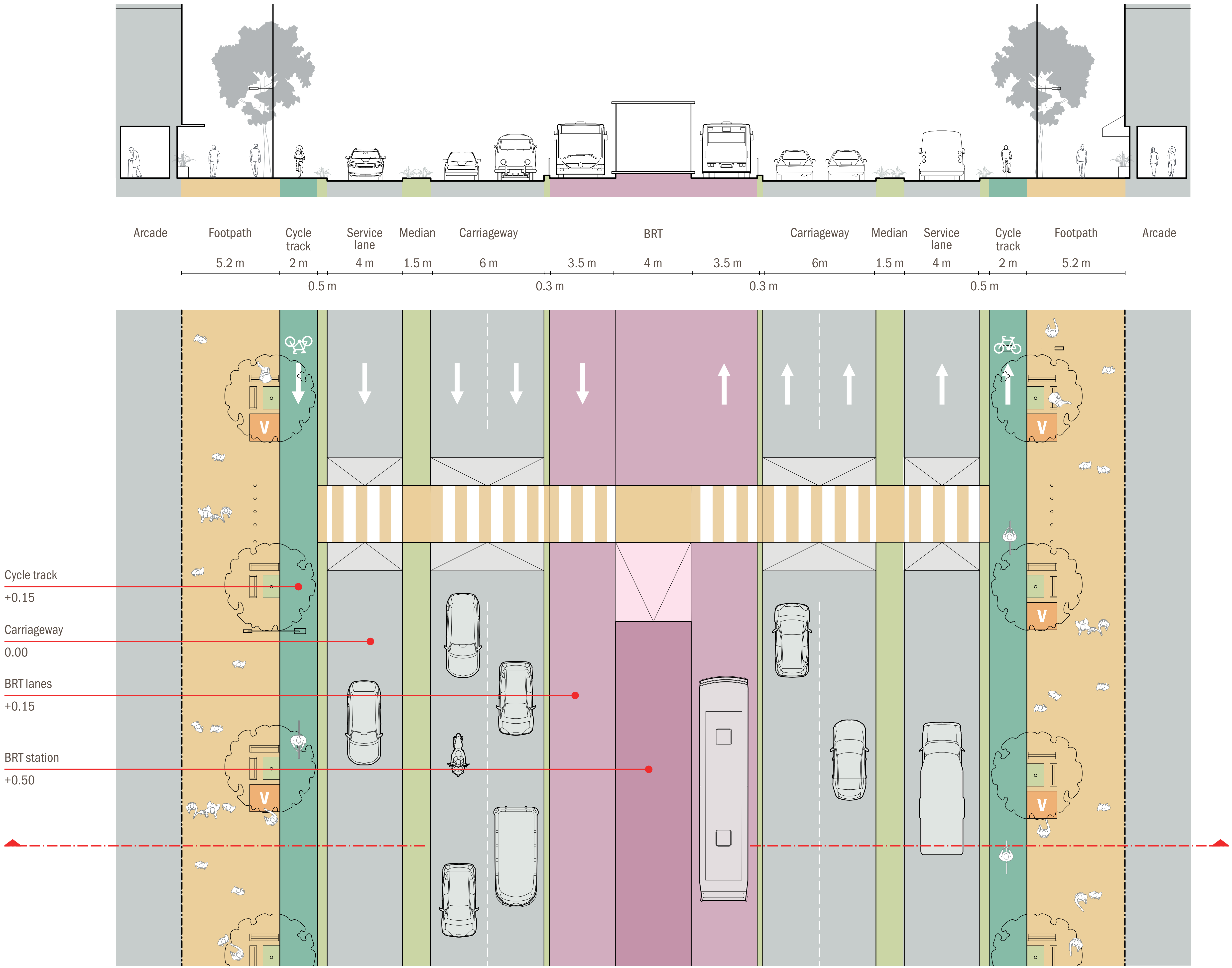
Mixed use



# 50 m

Principal Arterial Street (B) on station

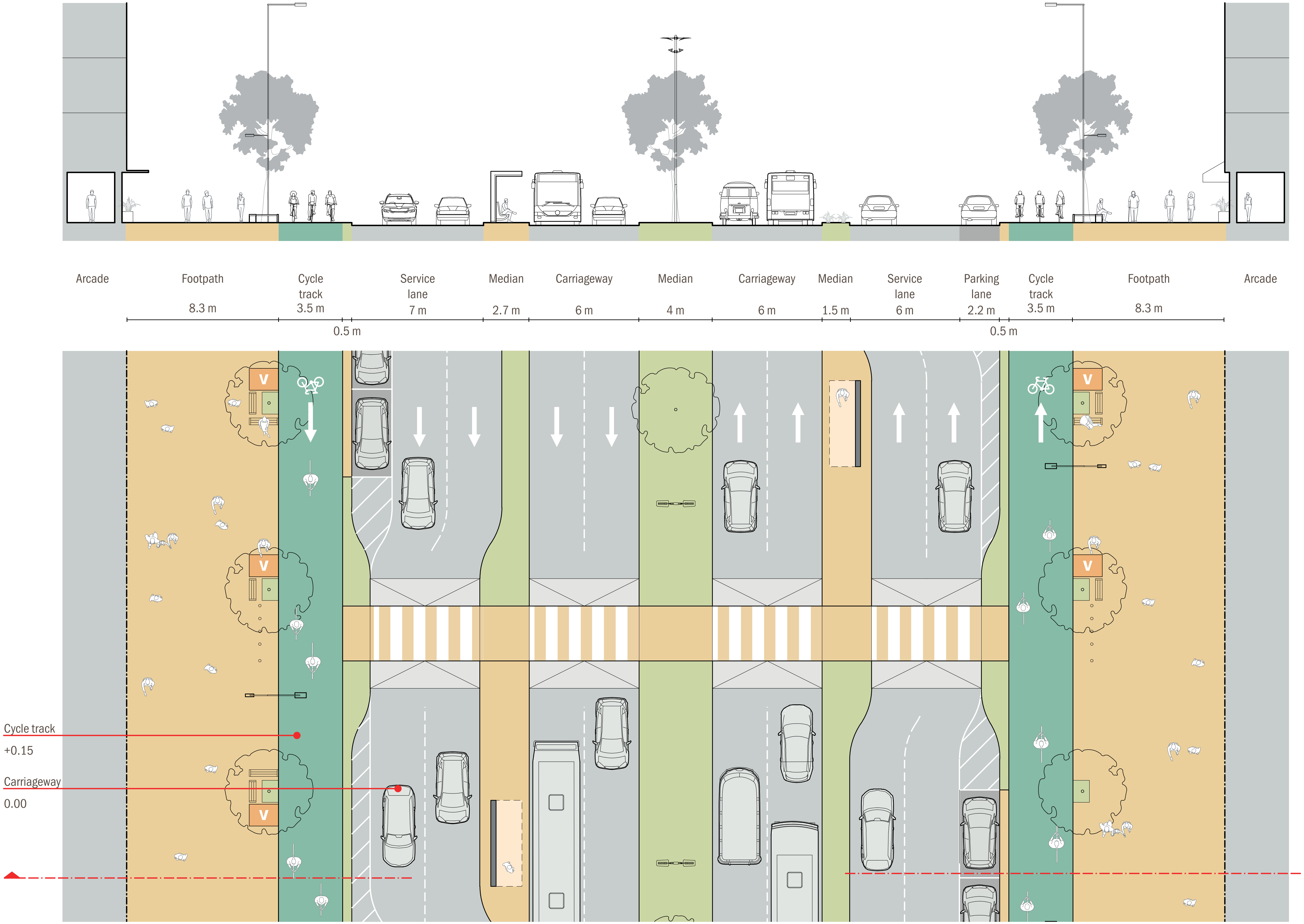
Mixed use



# 60 m

Principal Arterial Street (A)

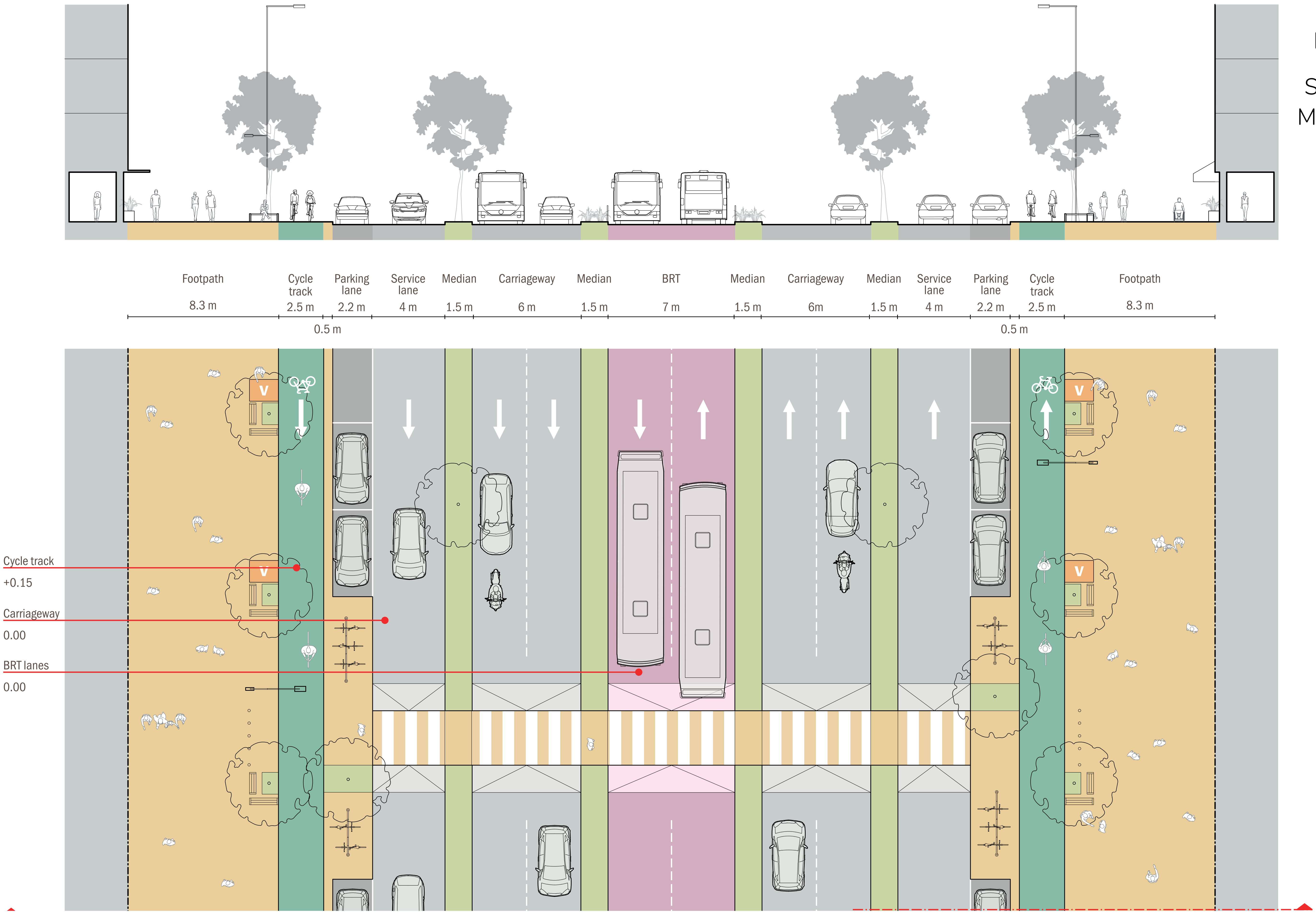
Mixed use



# 60 m

Principal Arterial Street (B)

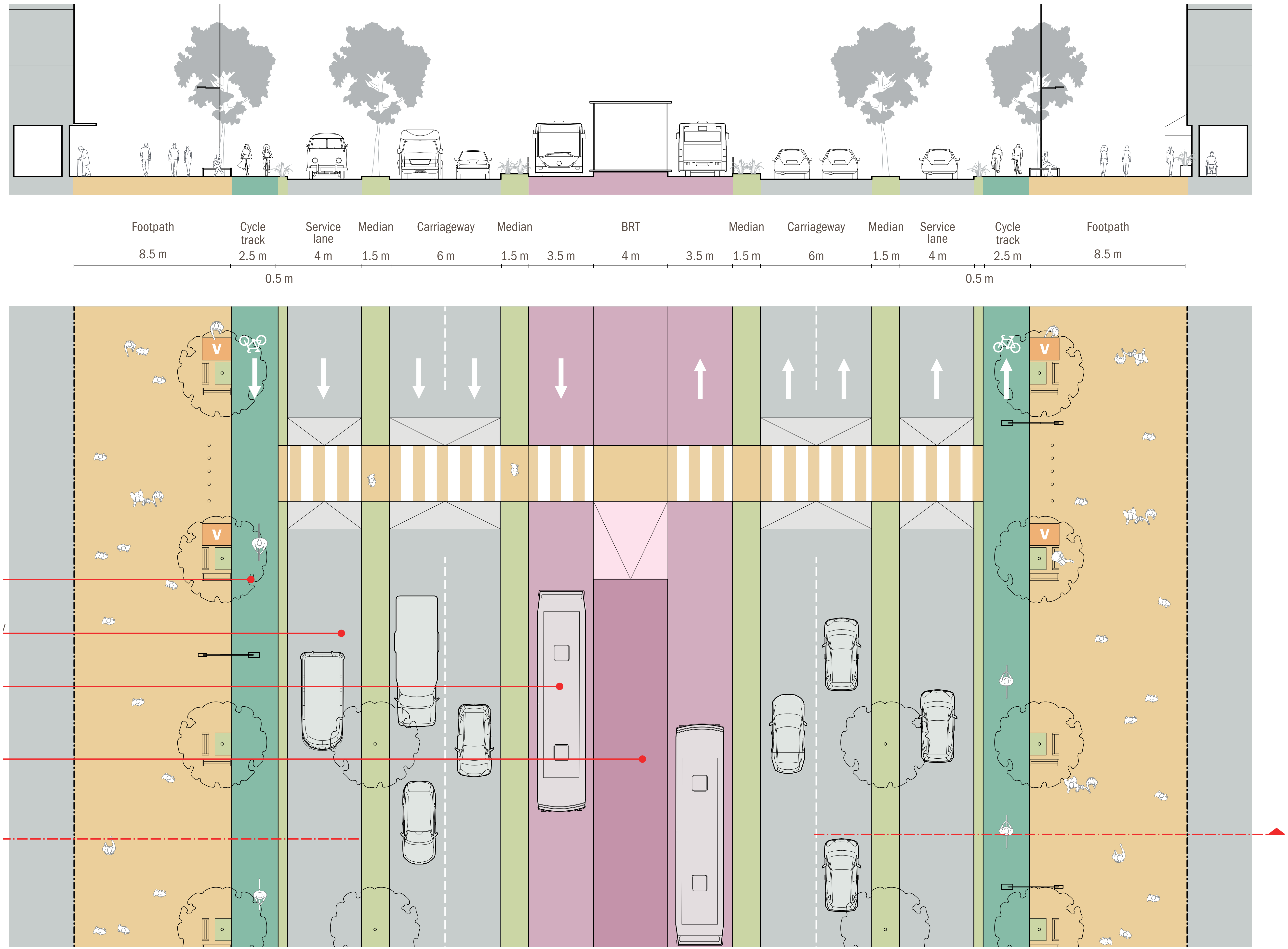
Mixed use



# 60 m

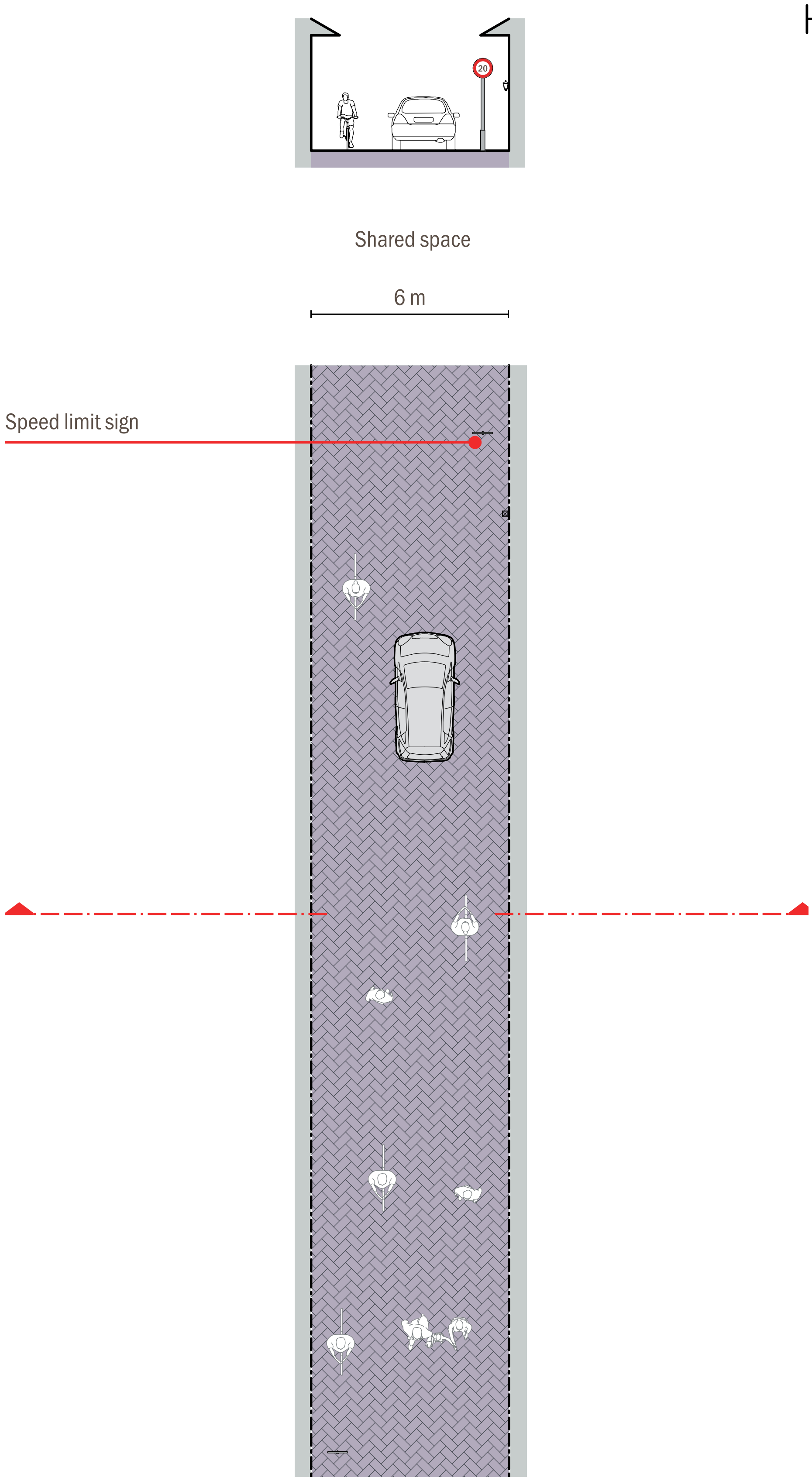
Principal Arterial Street (B) on station

Mixed use



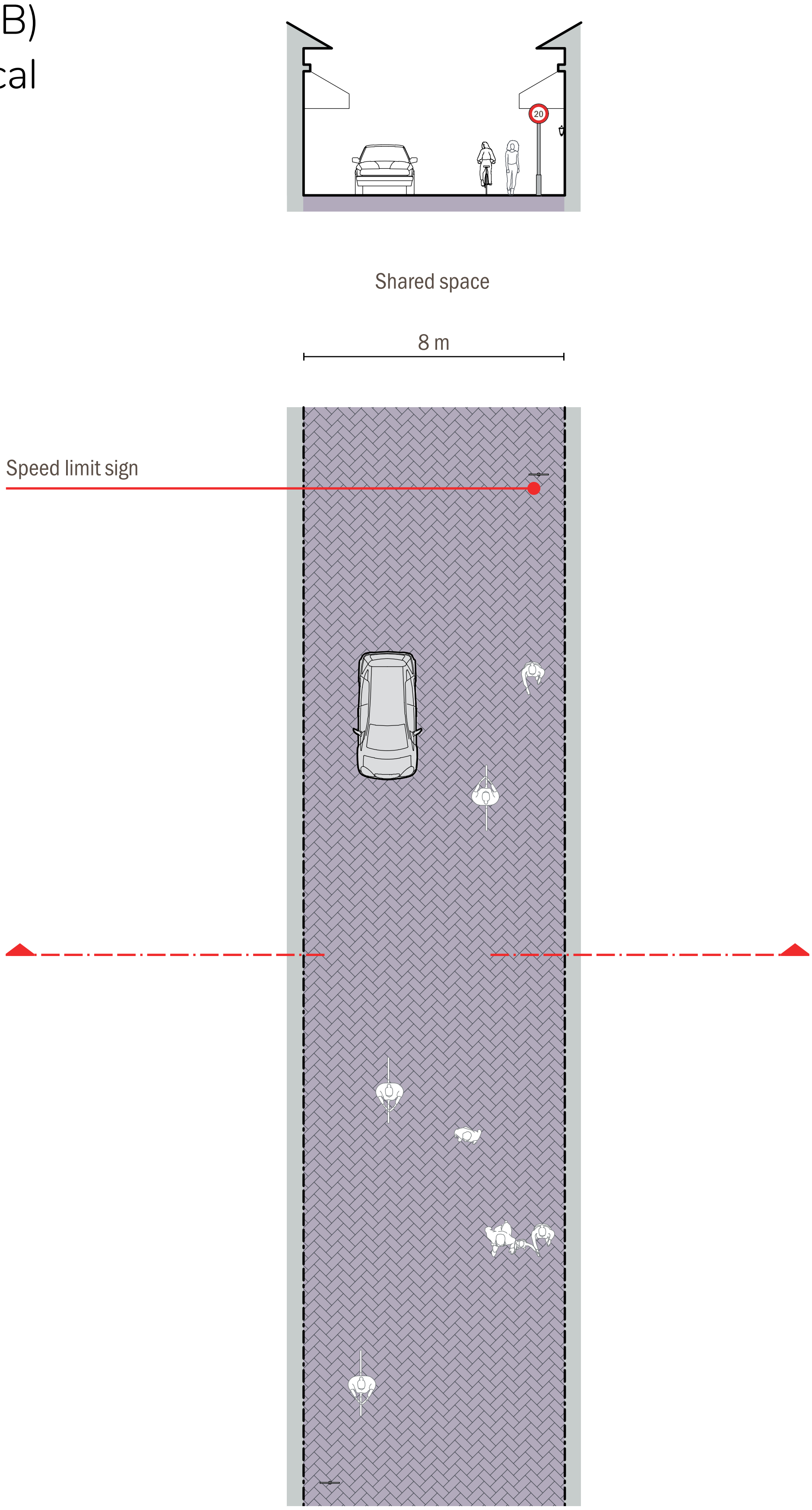
# 6 m

## Local Street (B)
## Historical



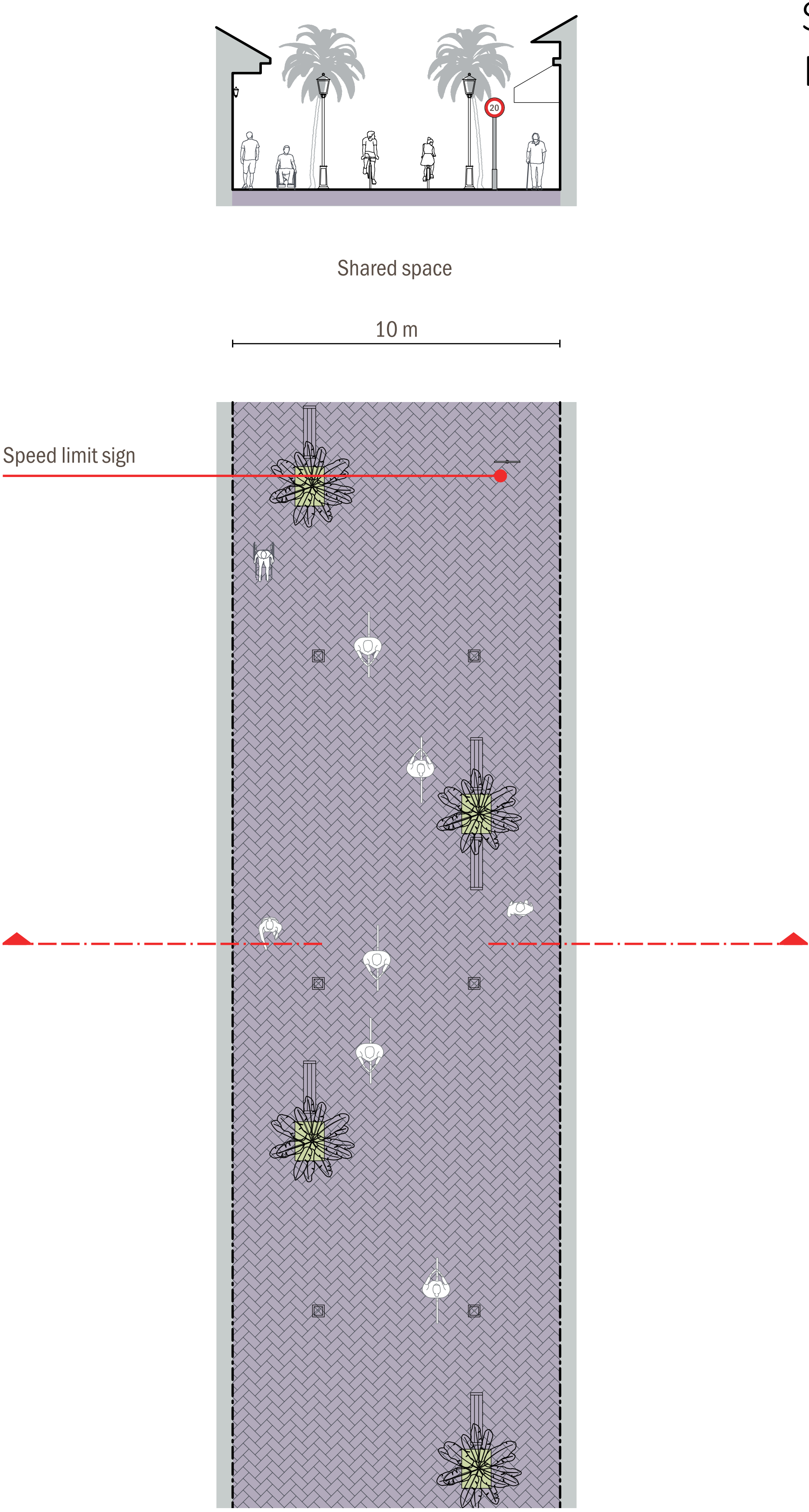
# 8 m

## Local Street (B) Historical



# 10 m

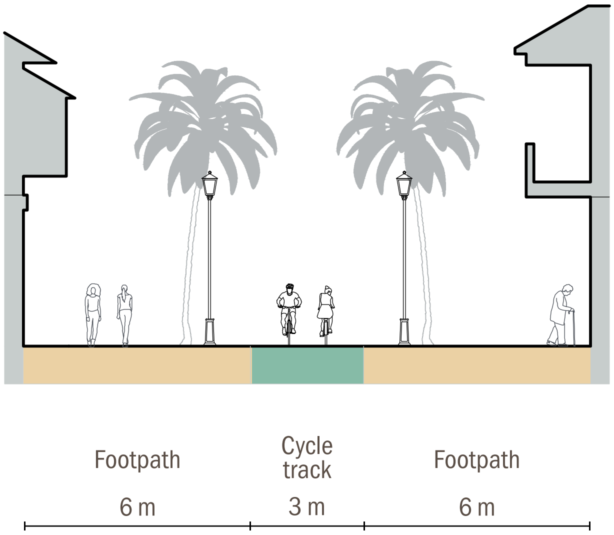
Local
Street (C)
Historical

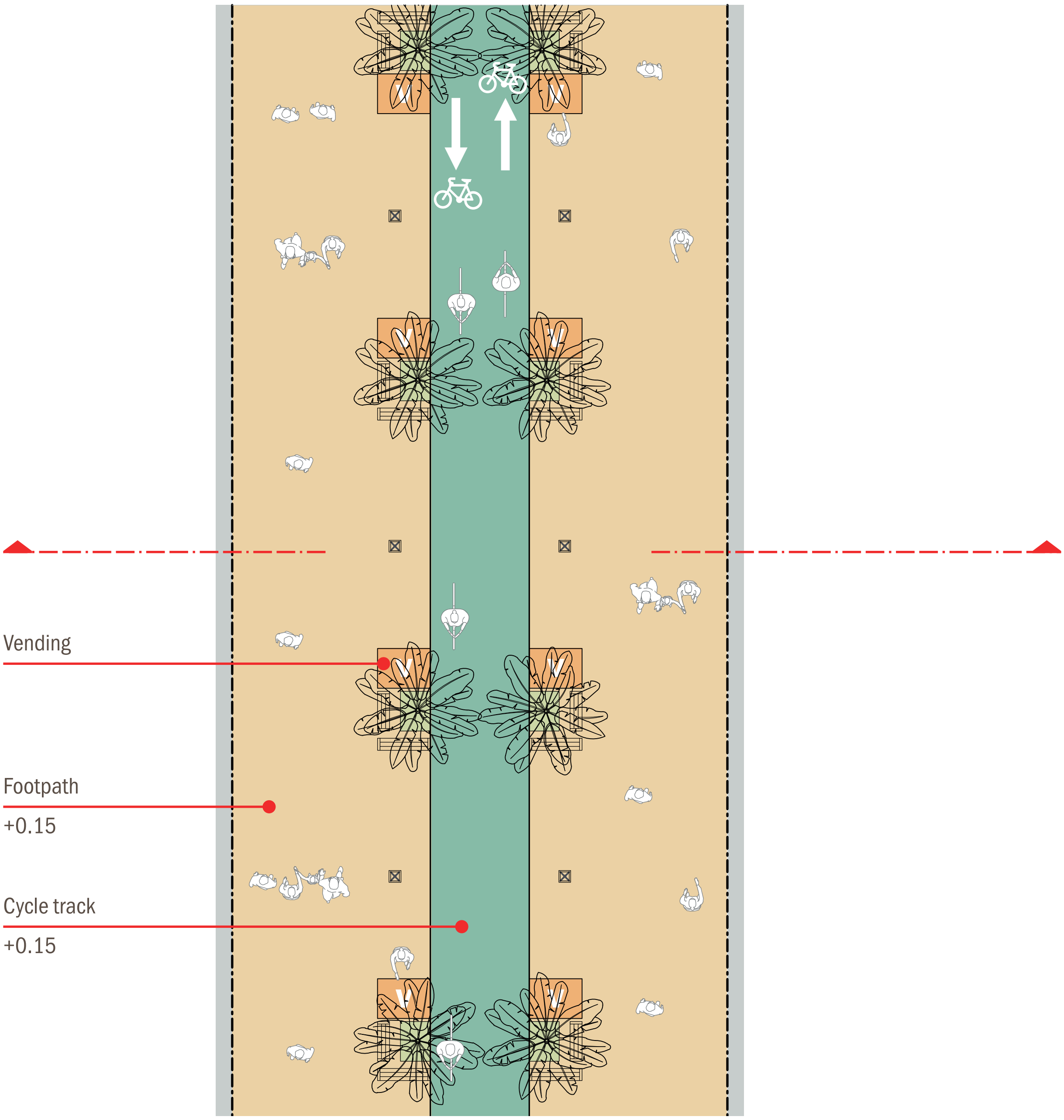


# 15 m

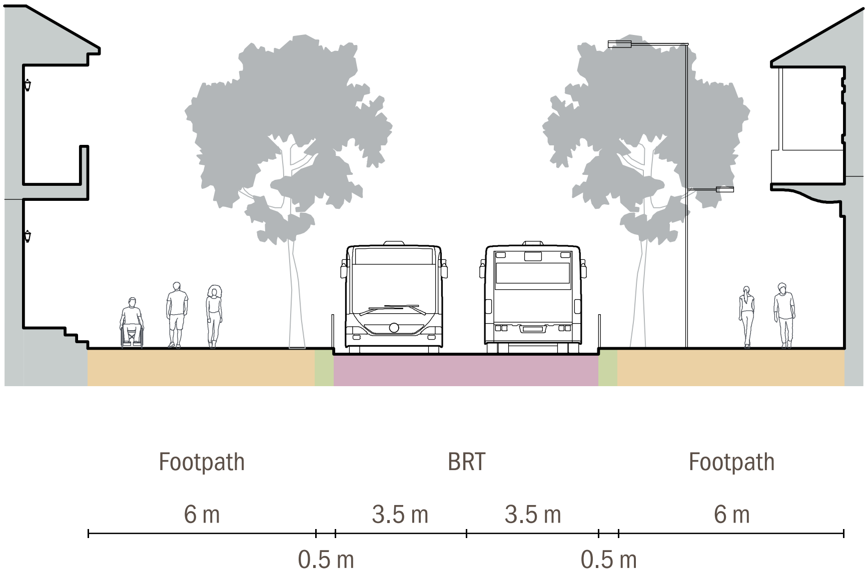
Collector Street (C)

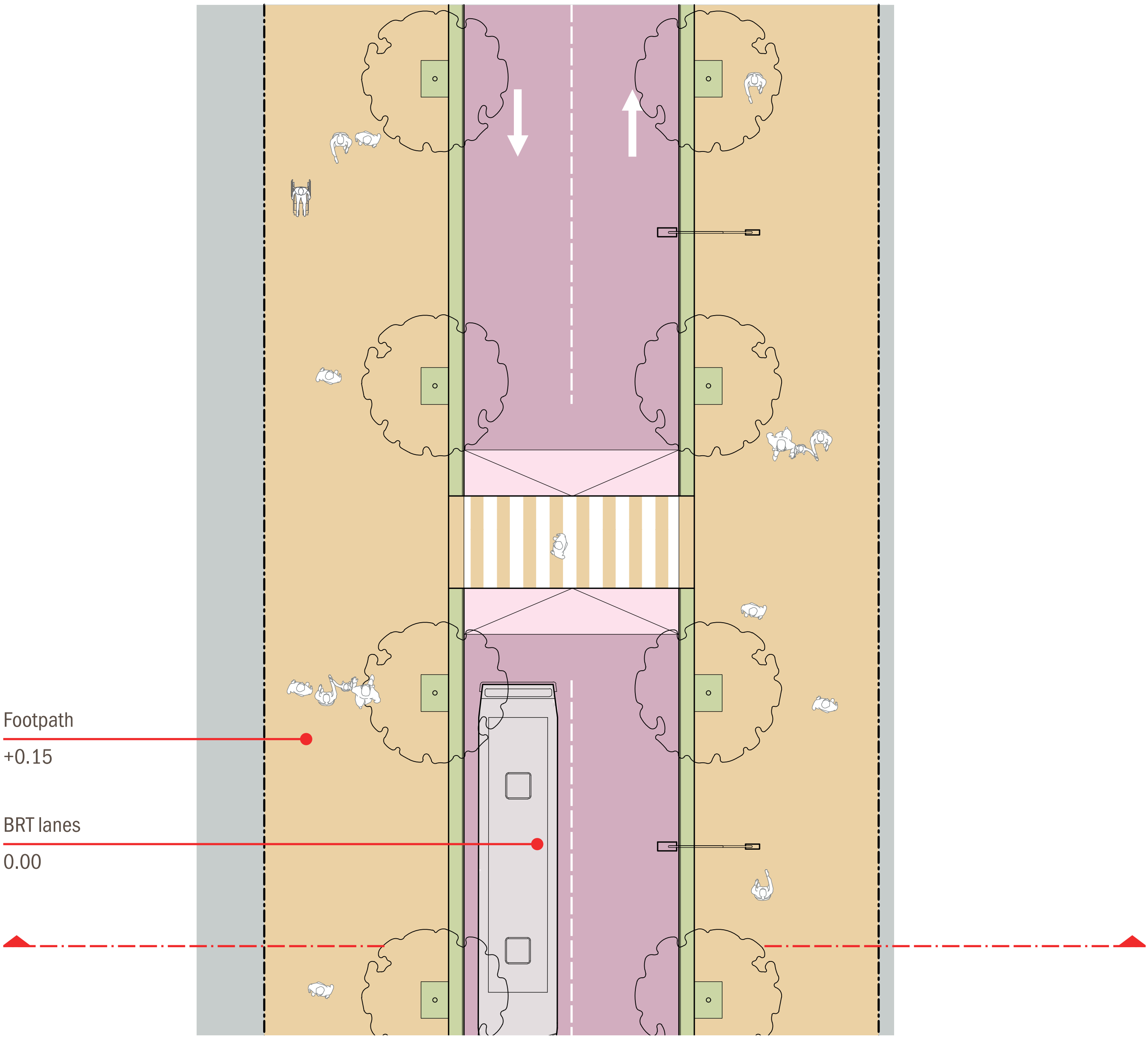
Historical



# 20 m
## Collector Street (C) Historical

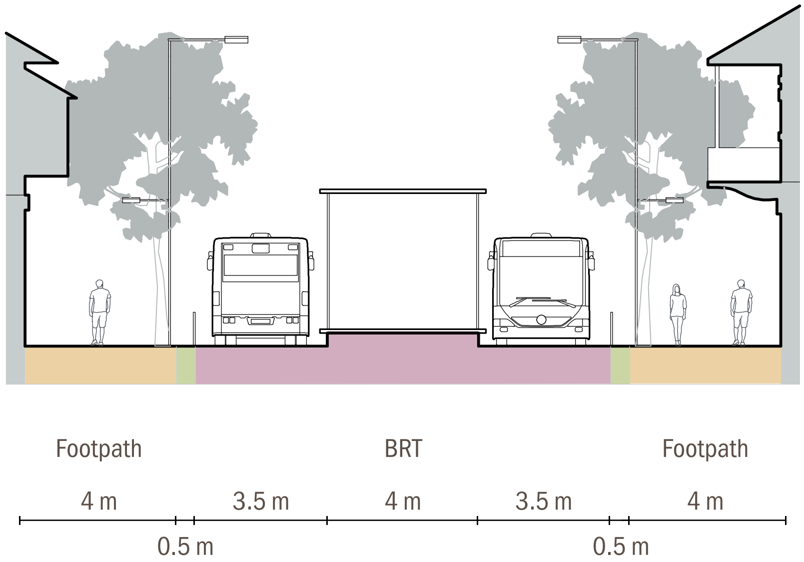


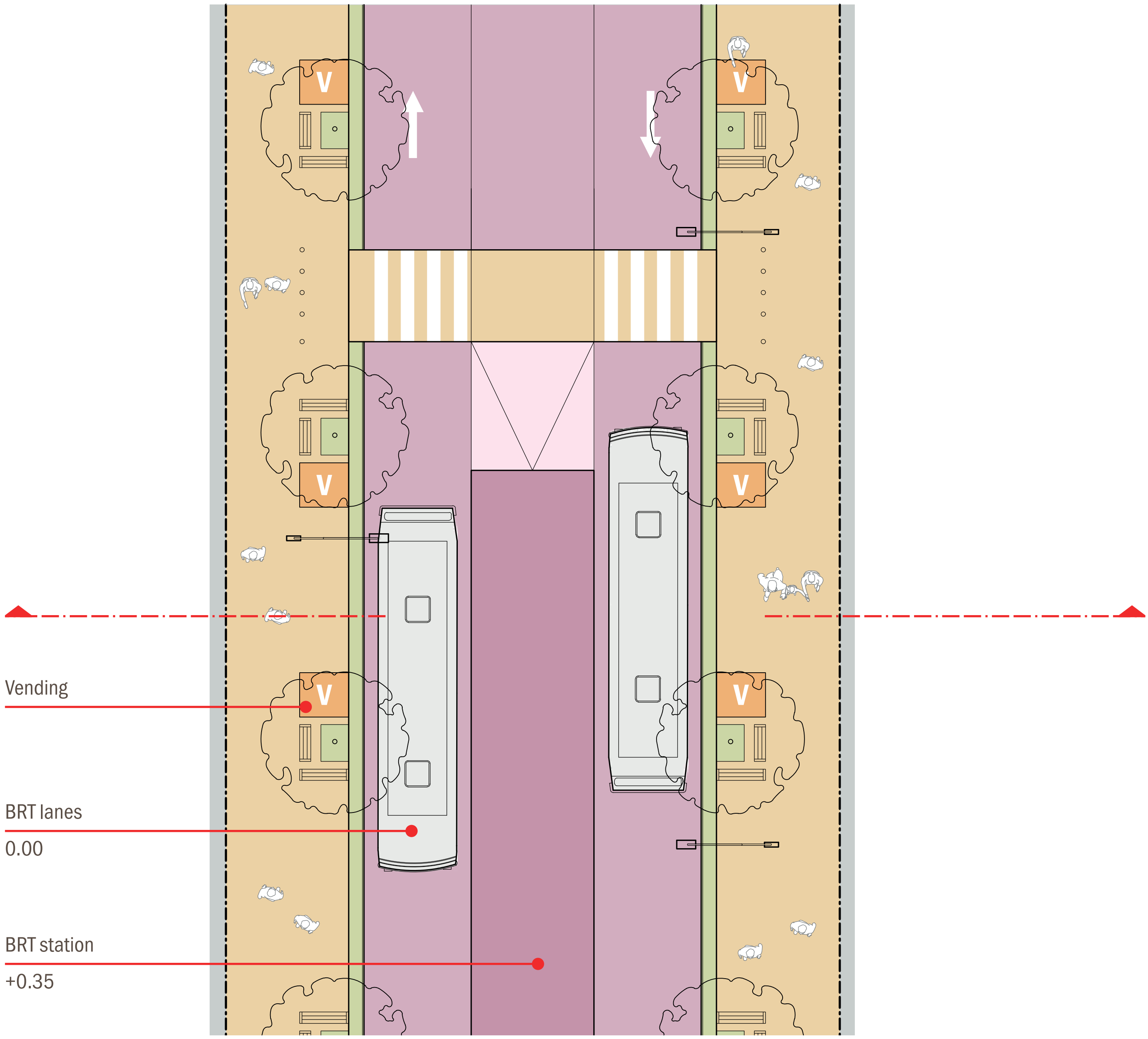



# 20 m

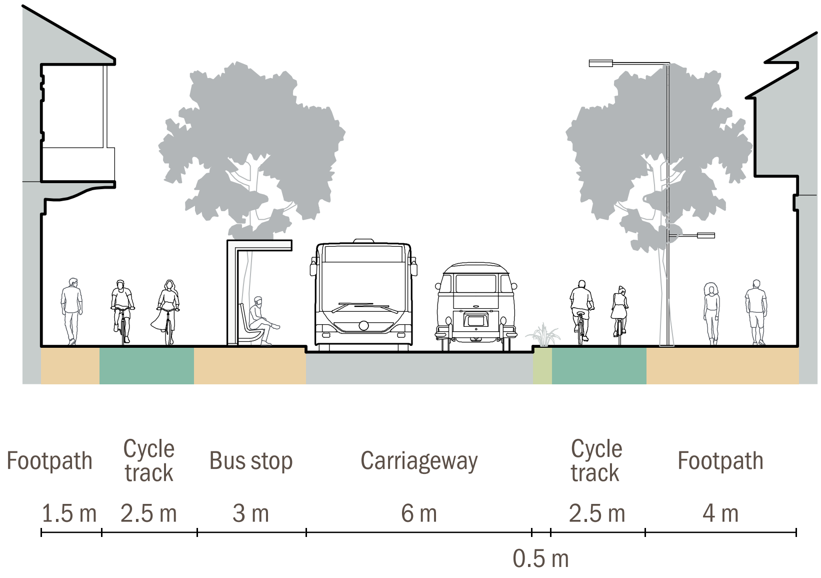
Collector Street (C) on station

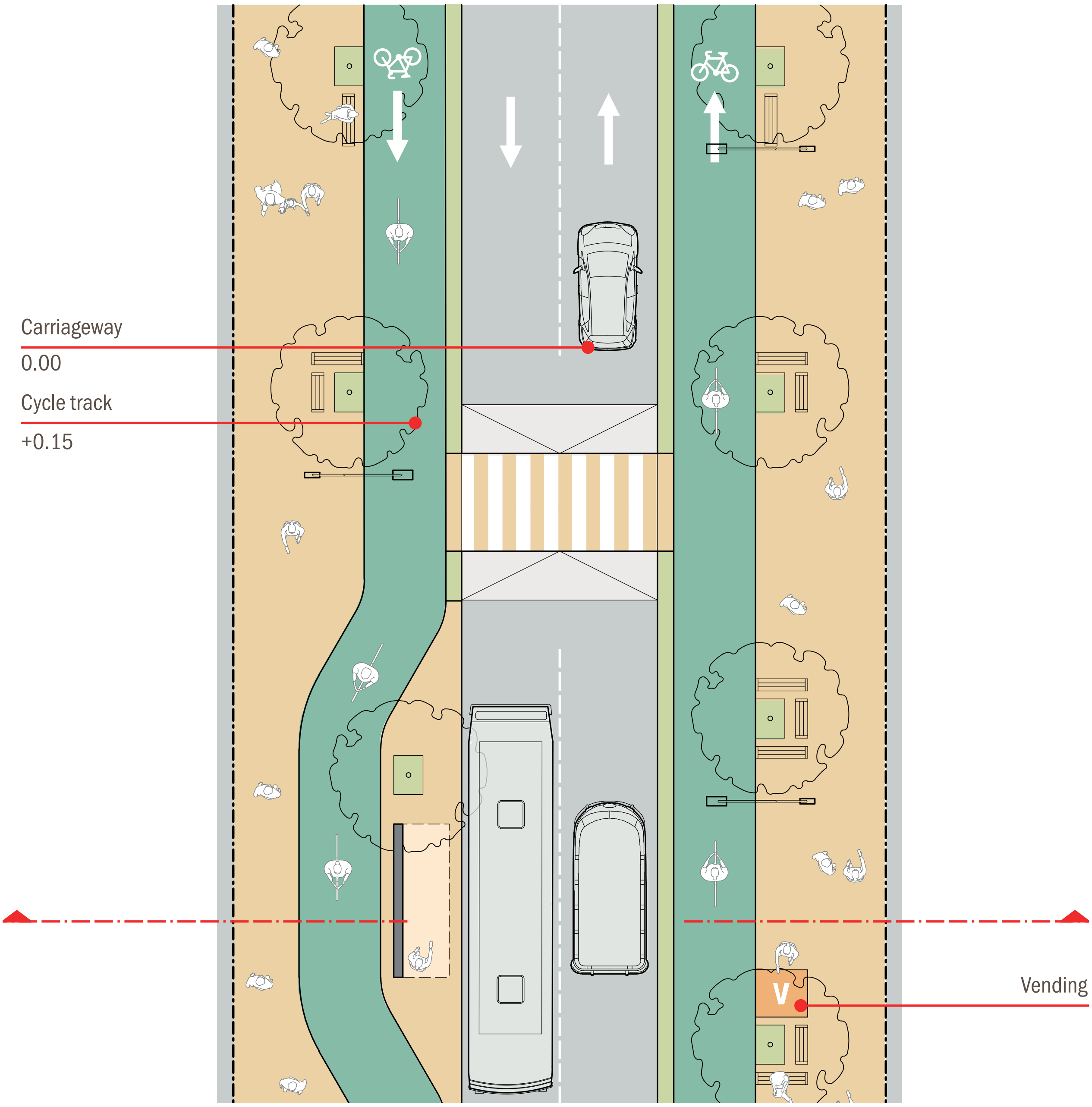
Historical



# 20 m
## Collector Street (D) Historical

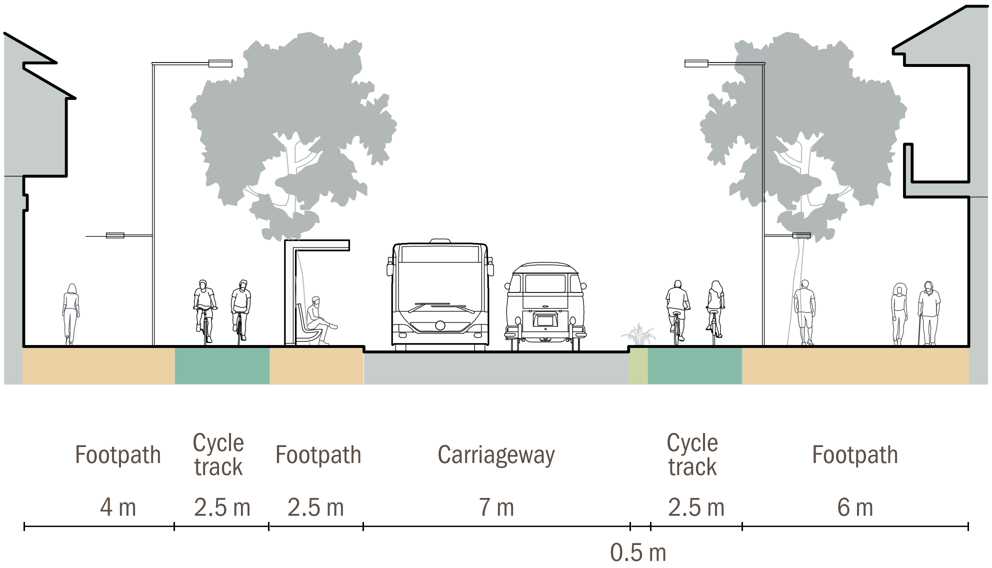


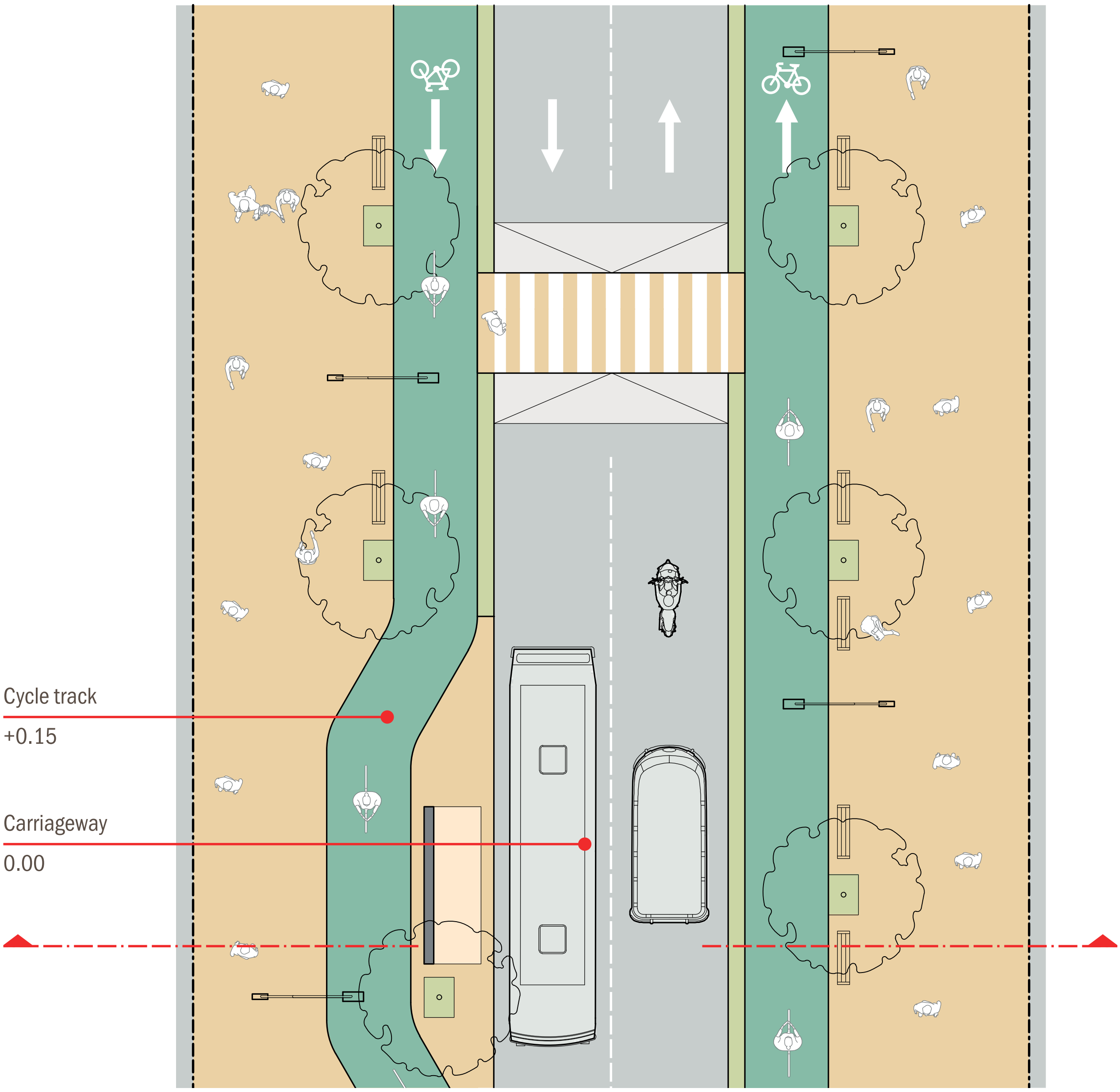



# 25 m

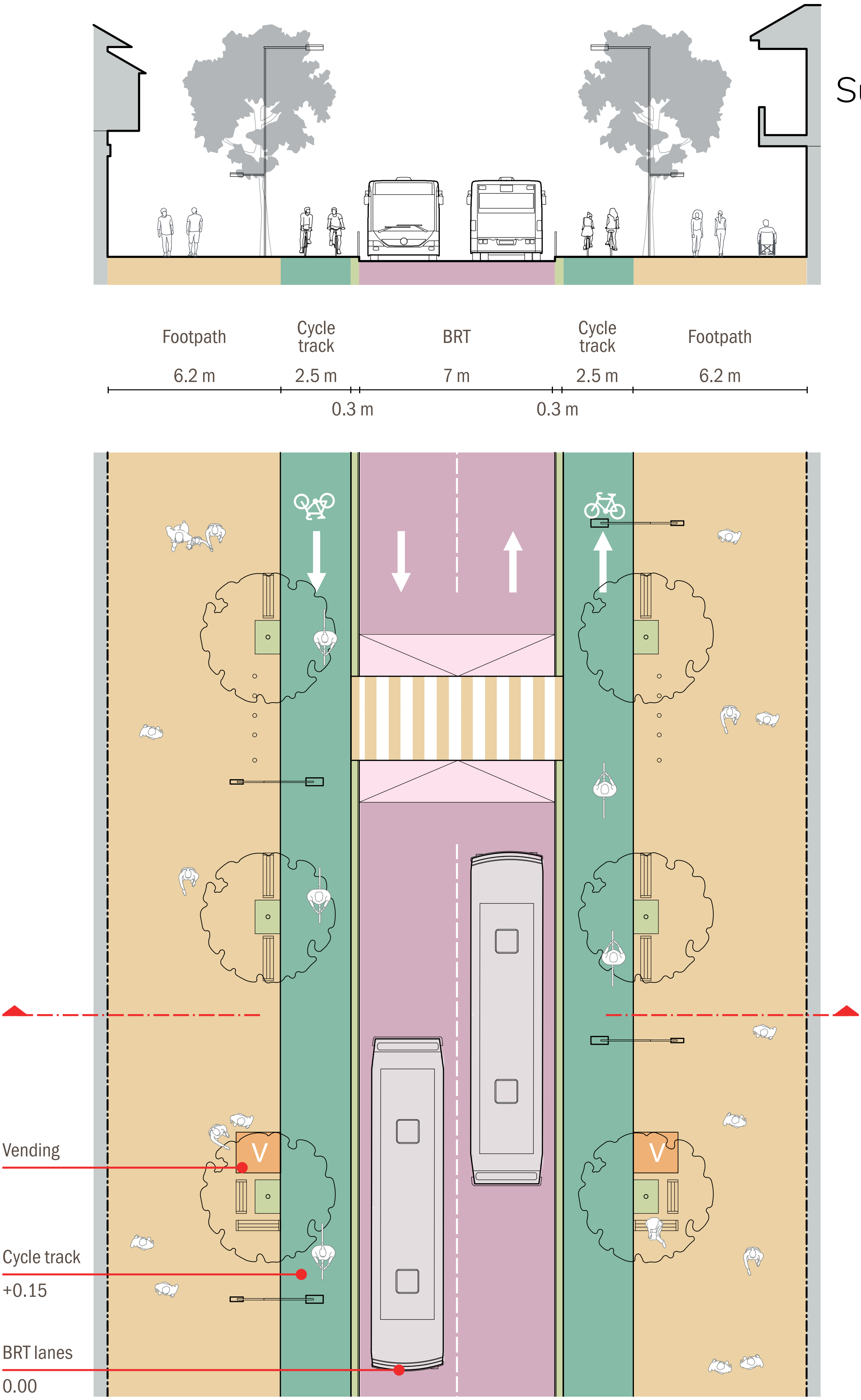
## Sub-Arterial Street (C)

## Historical



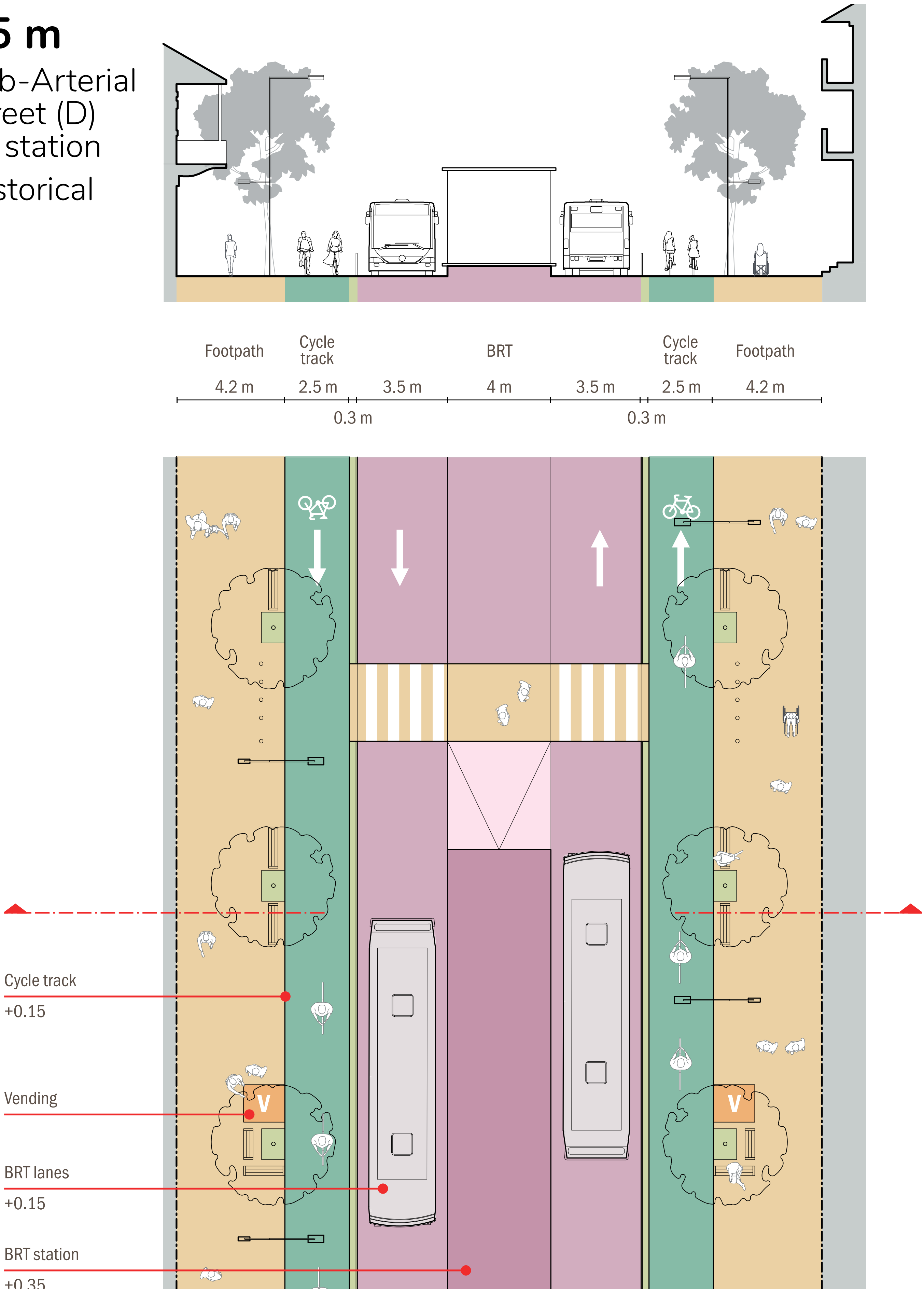



# 25 m
## Sub-Arterial Street (D) Historical



# 25 m

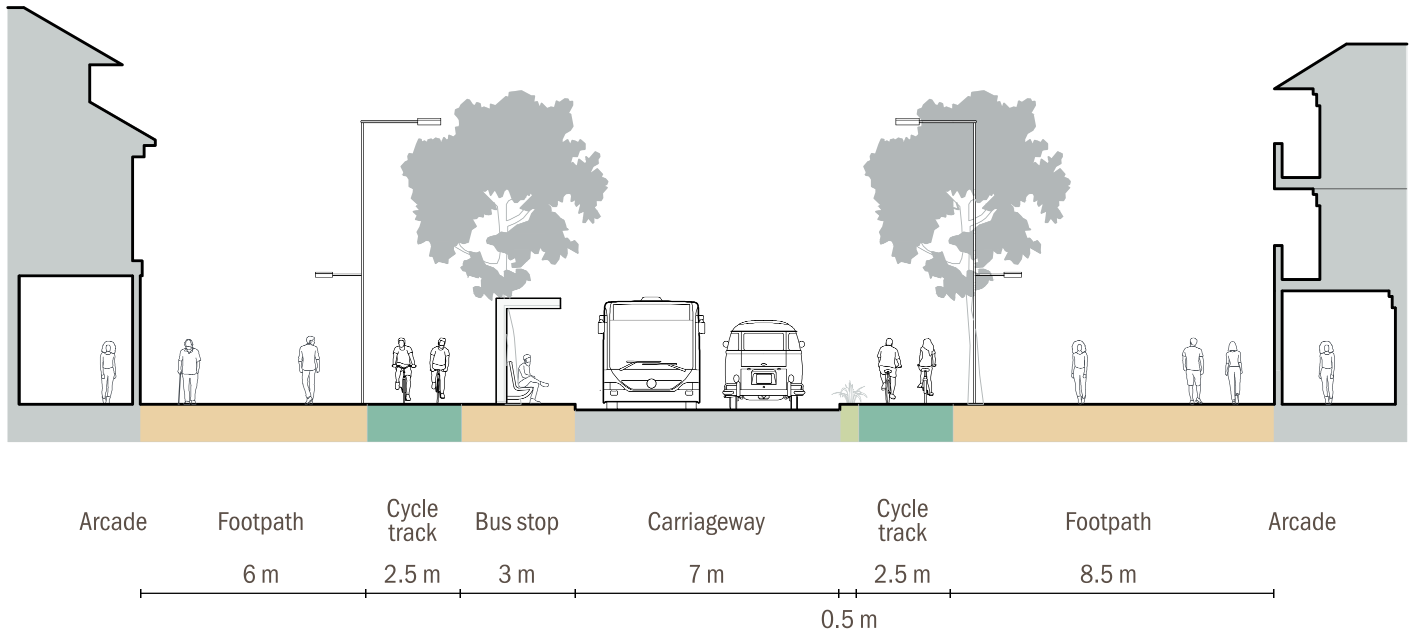
## Sub-Arterial Street (D) on station Historical

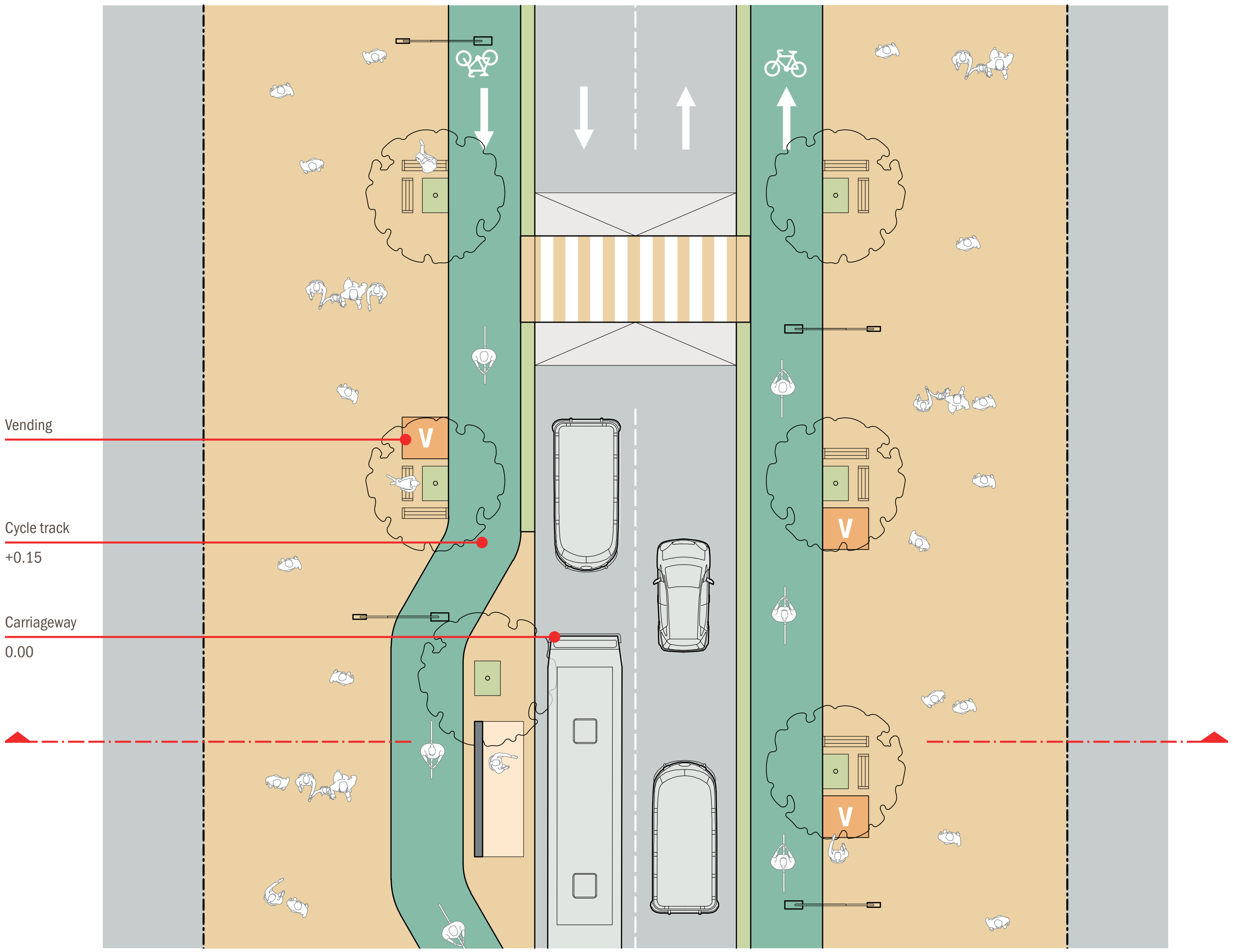


# 30 m

## Sub-Arterial Street (C)

## Historical

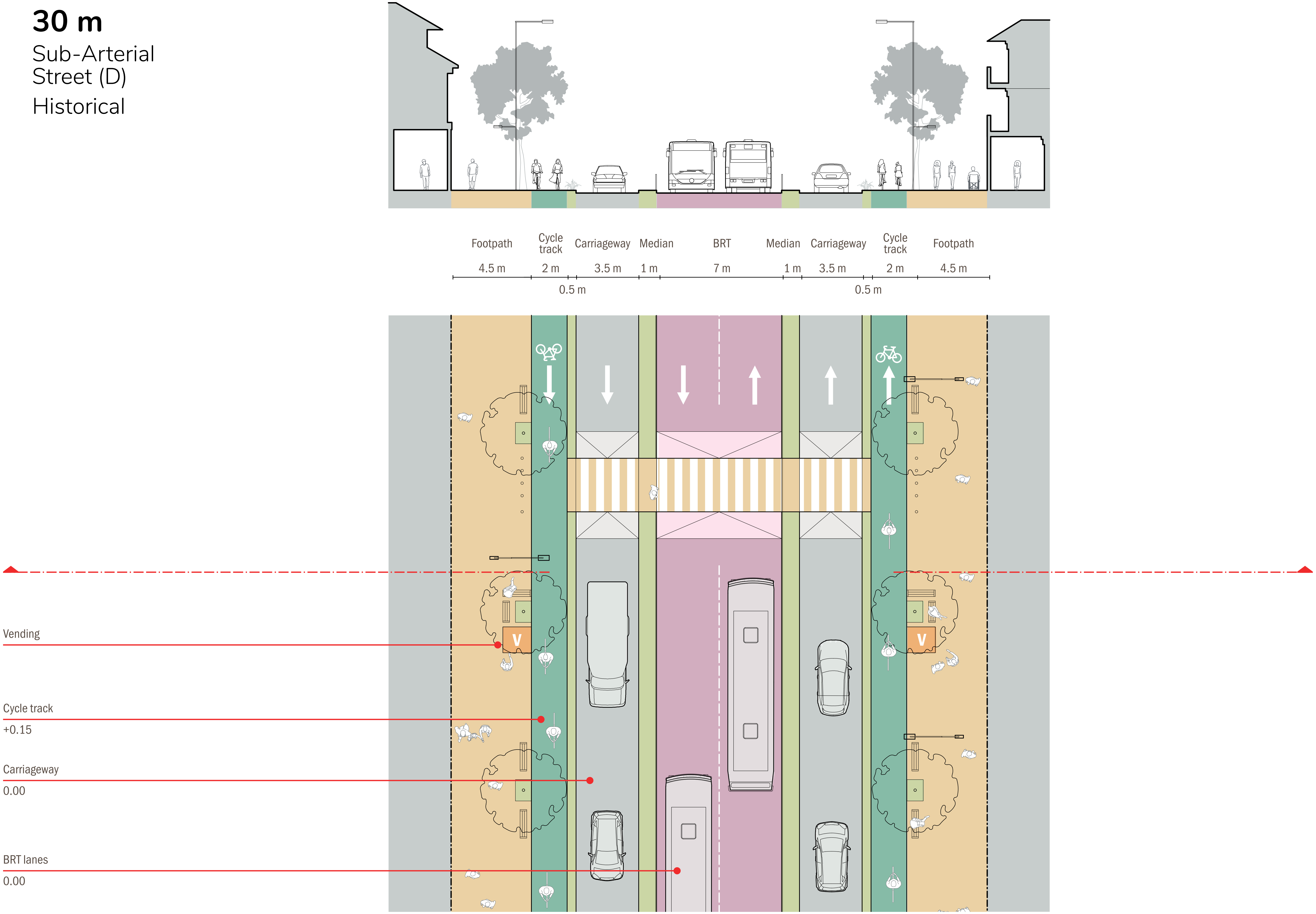


# 30 m

Sub-Arterial Street (D)

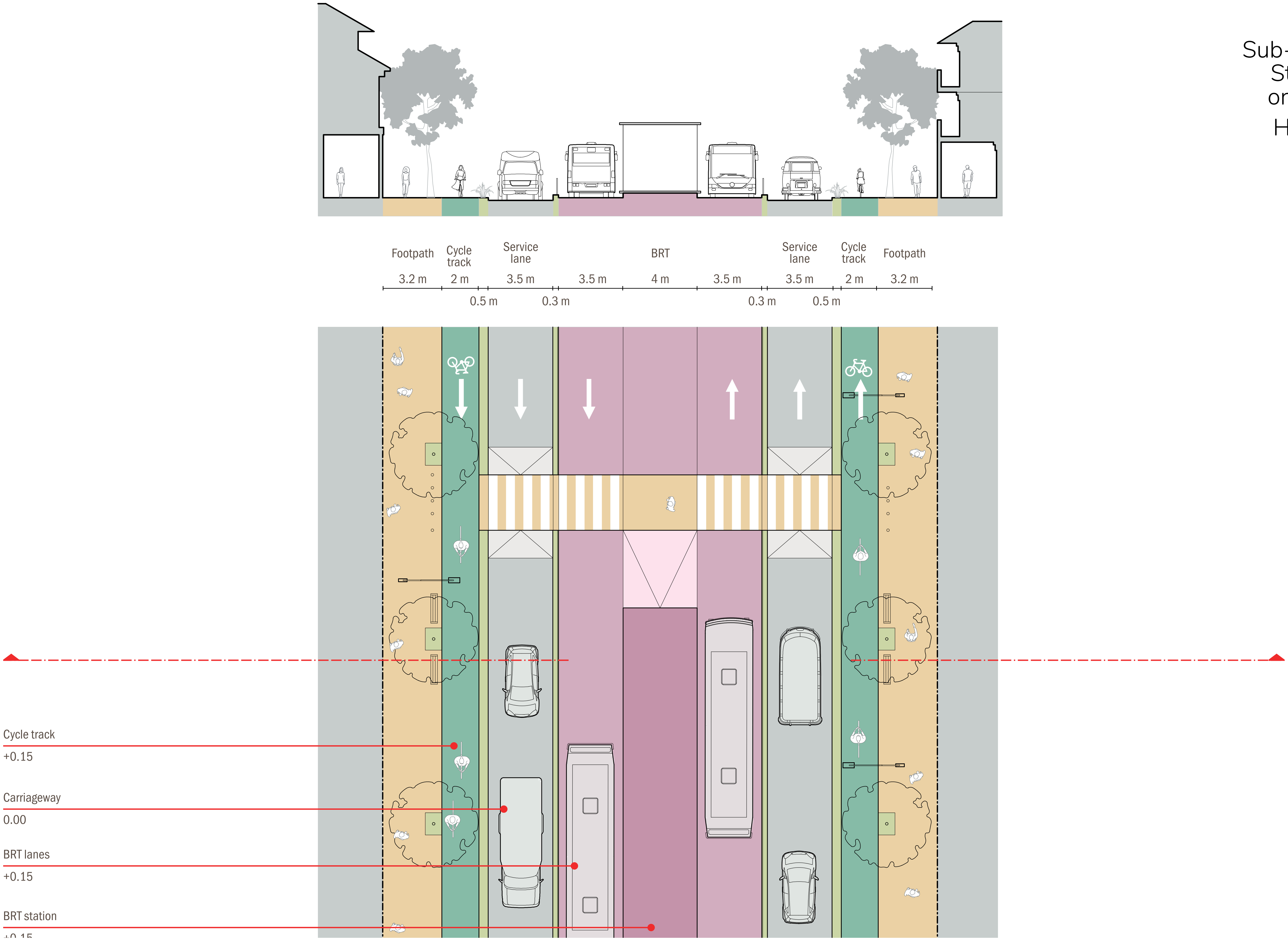
Historical



# 30 m

Sub-Arterial Street (D) on station

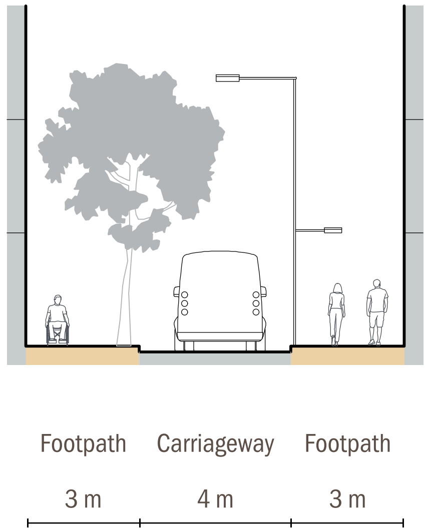
Historical

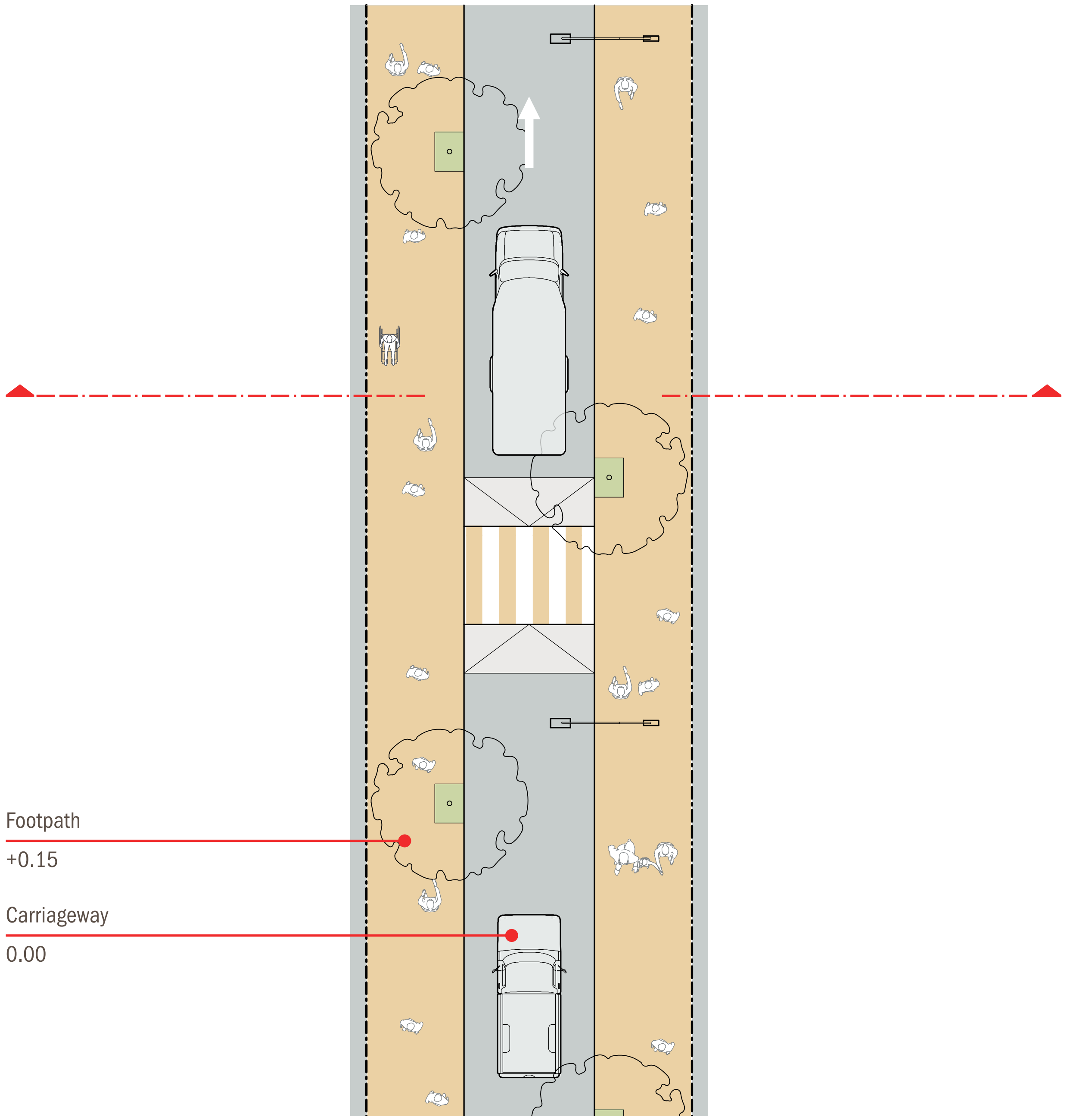


# 10 m

Local
Street (D)

Industrial



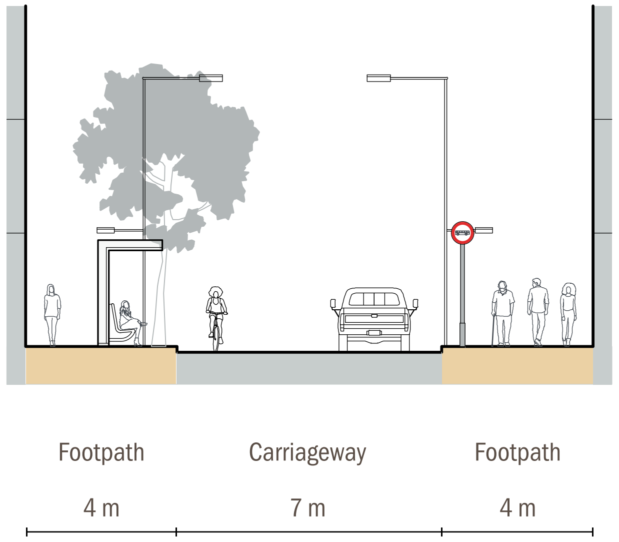



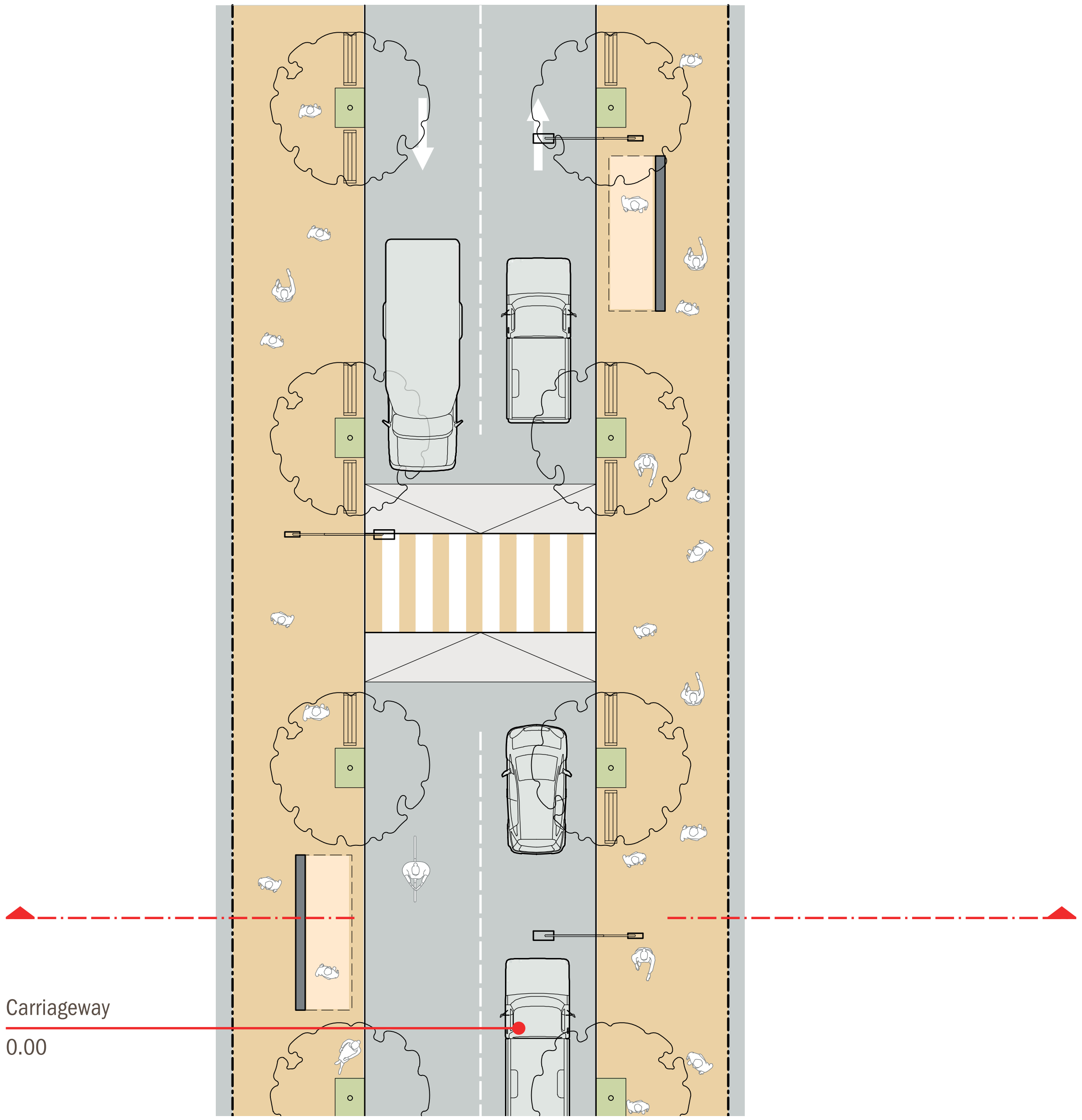
# 15 m

Collector Street (D)

Industrial

ERA jurisdiction



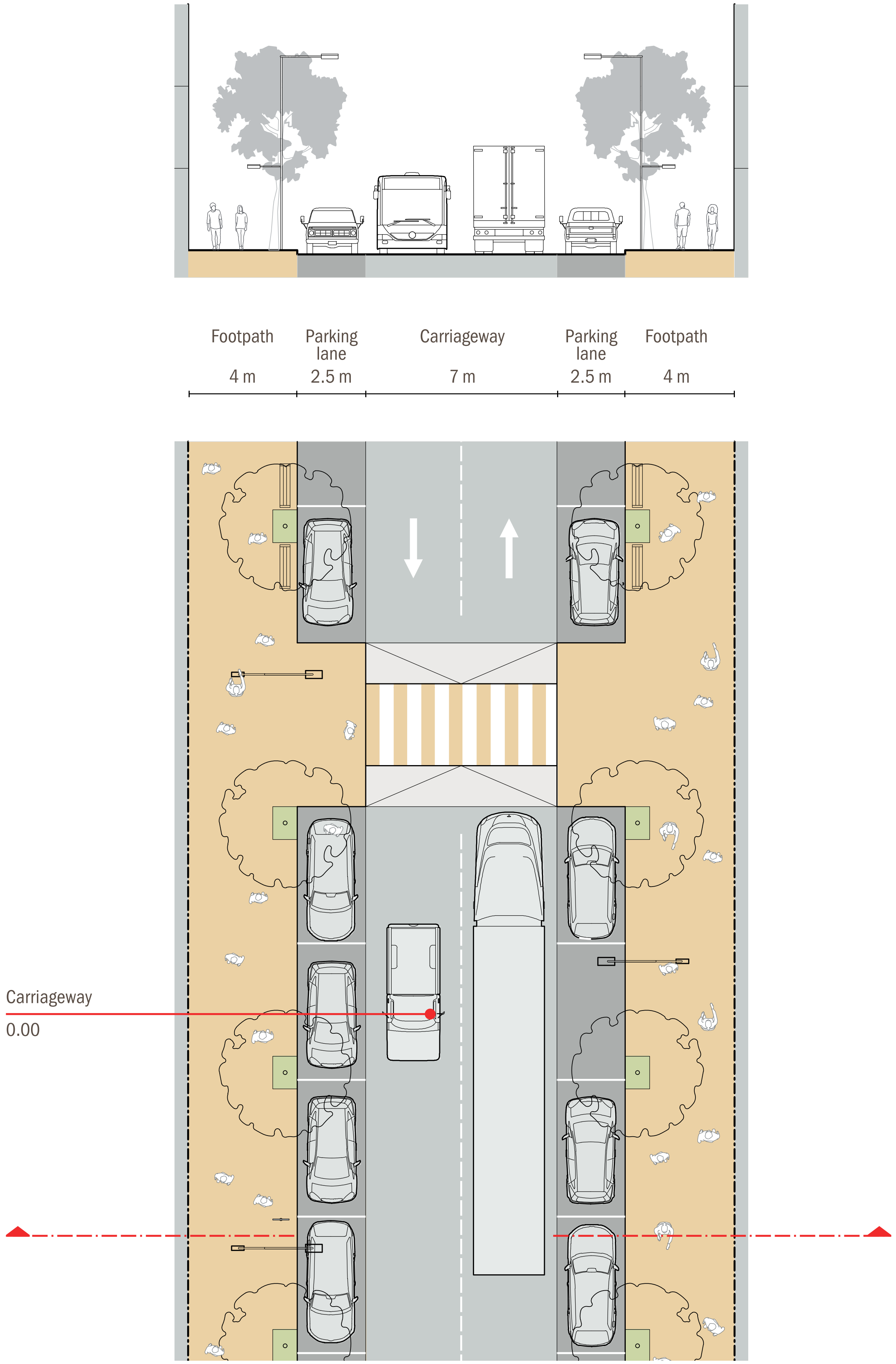



# 20 m

Collector Street (E)

Industrial

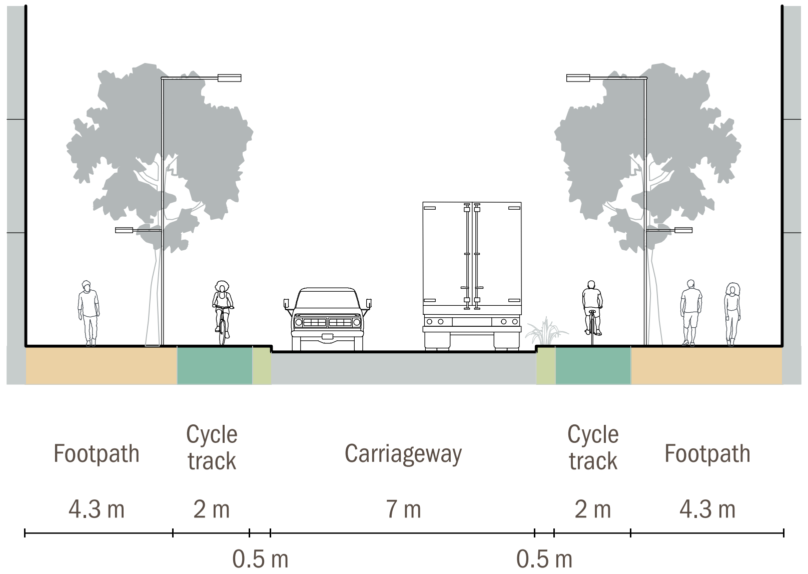
ERA jurisdiction

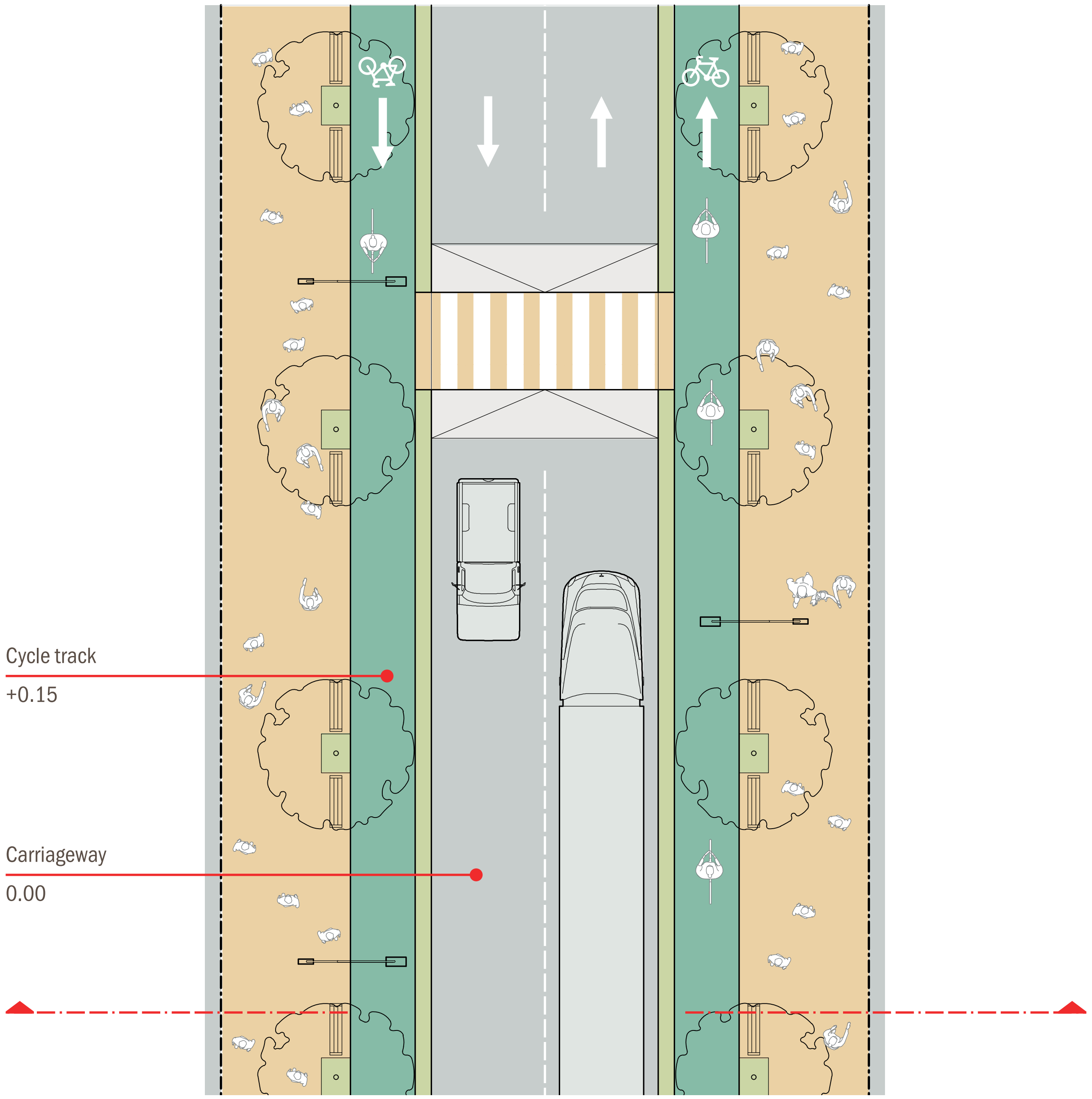


# 20 m

Collector Street (F)

Industrial



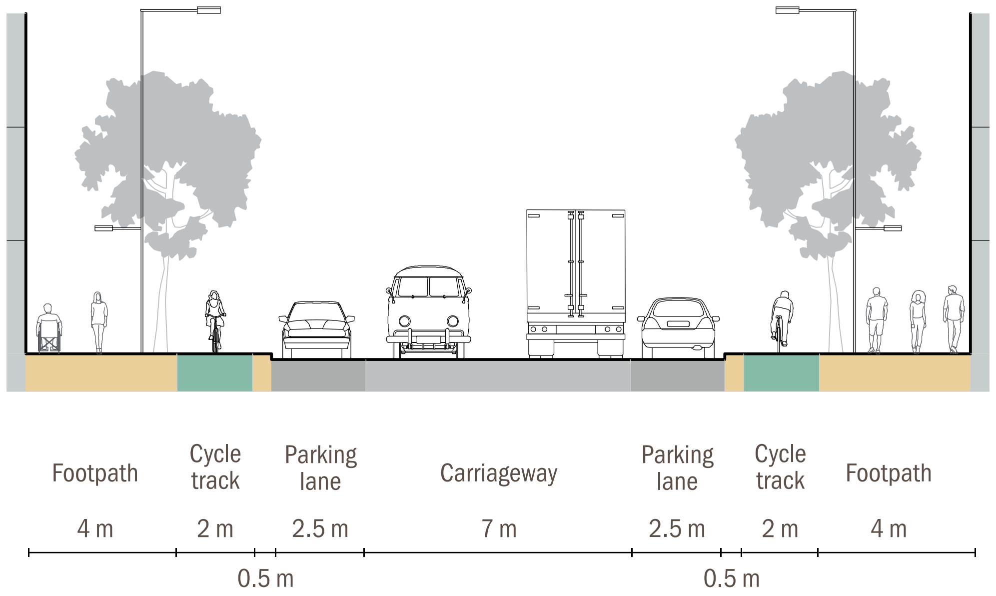



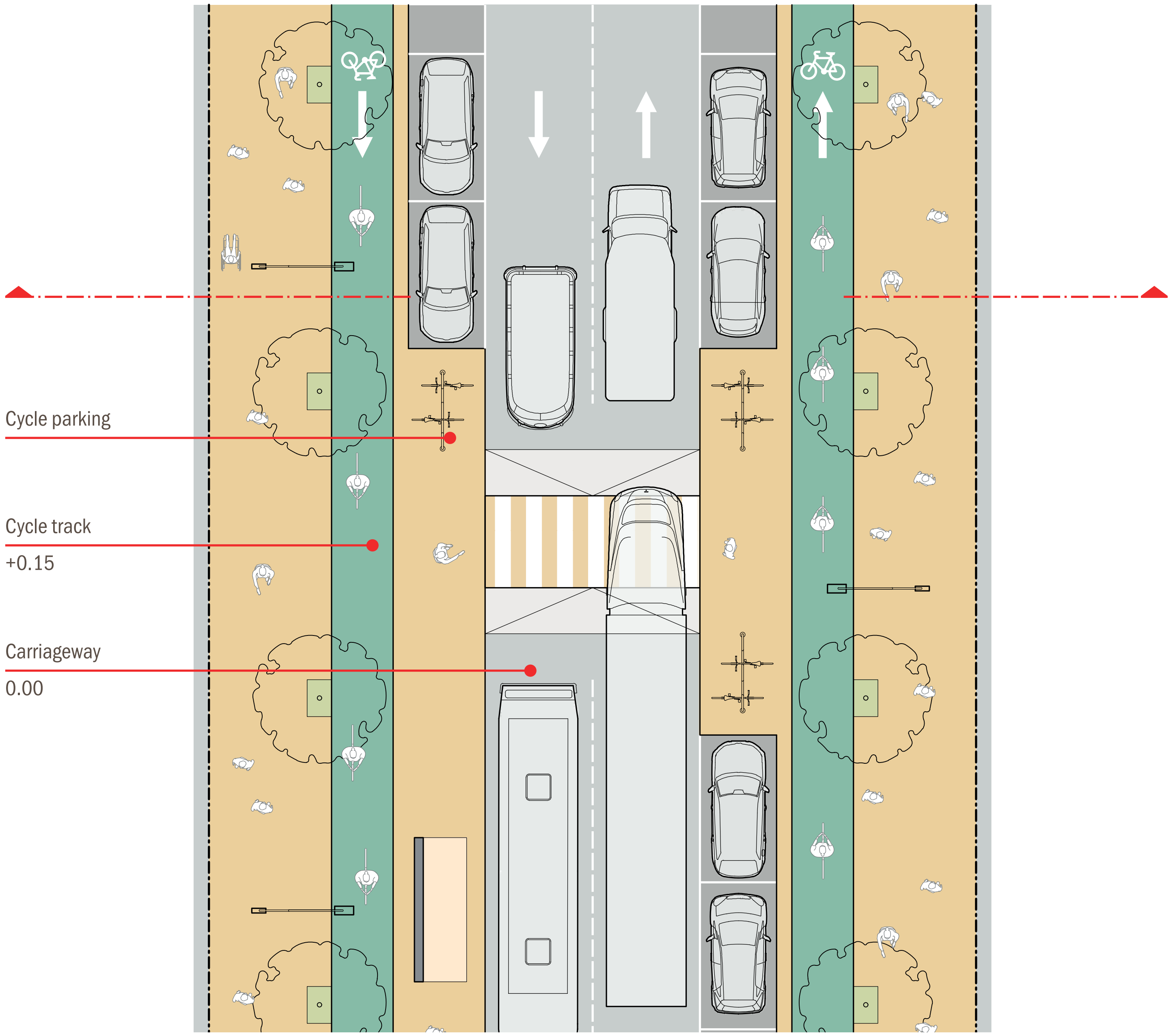
# 25 m

Sub-Arterial Street (E)

Industrial

ERA jurisdiction

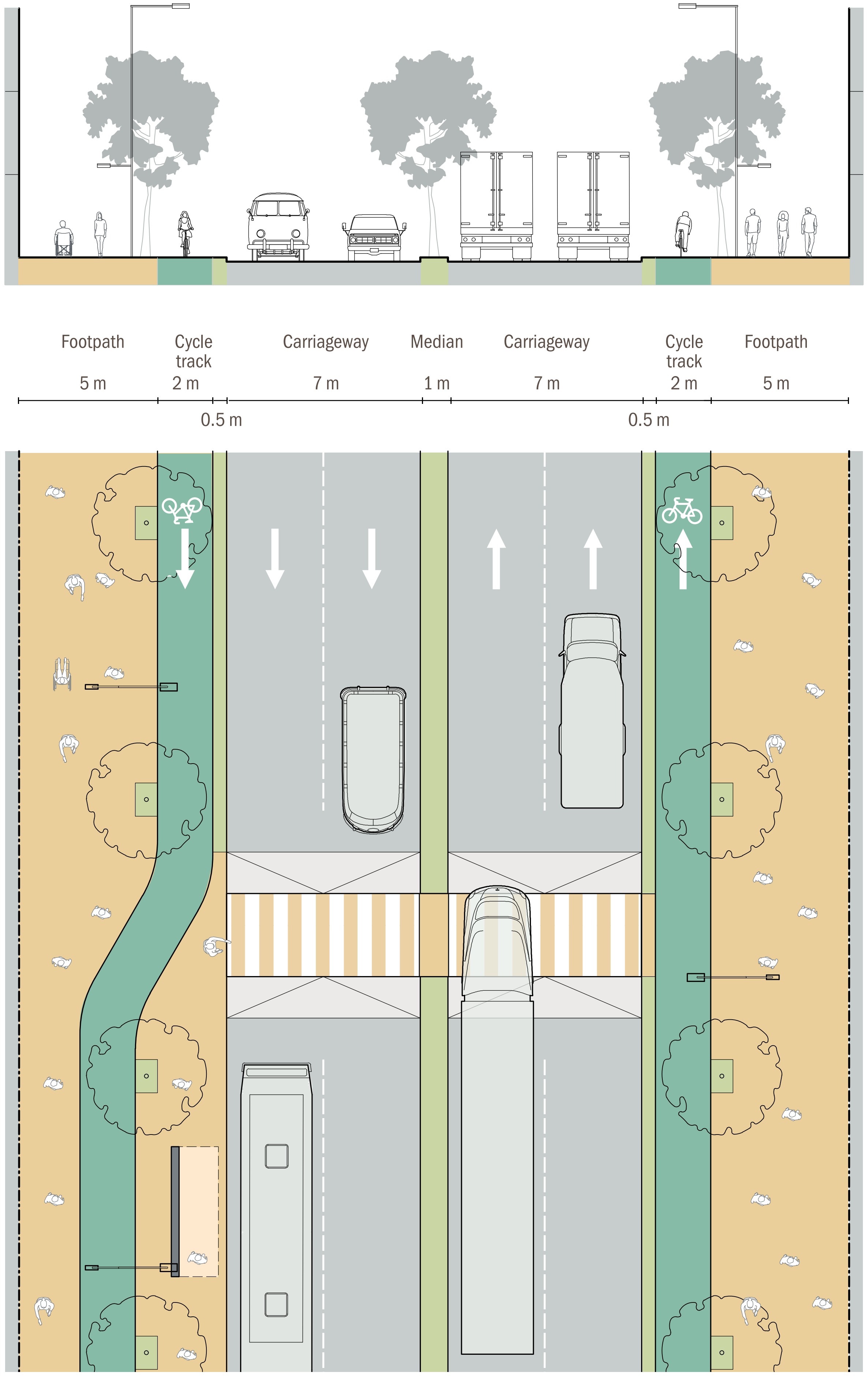


# 30 m

Principal Arterial Street (E)

Industrial

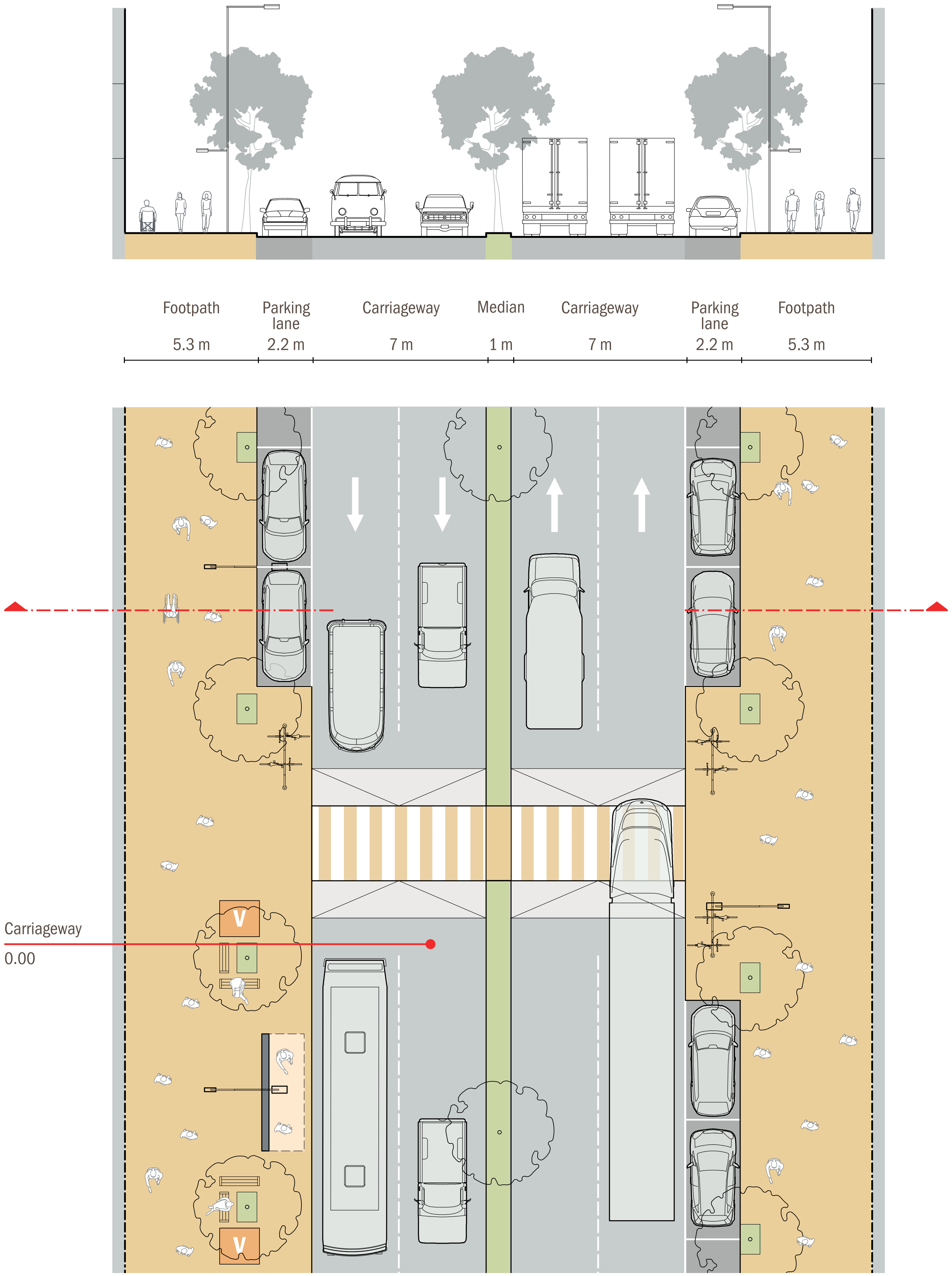


# 30 m

Sub-Arterial Street (F)

Industrial

ERA jurisdiction

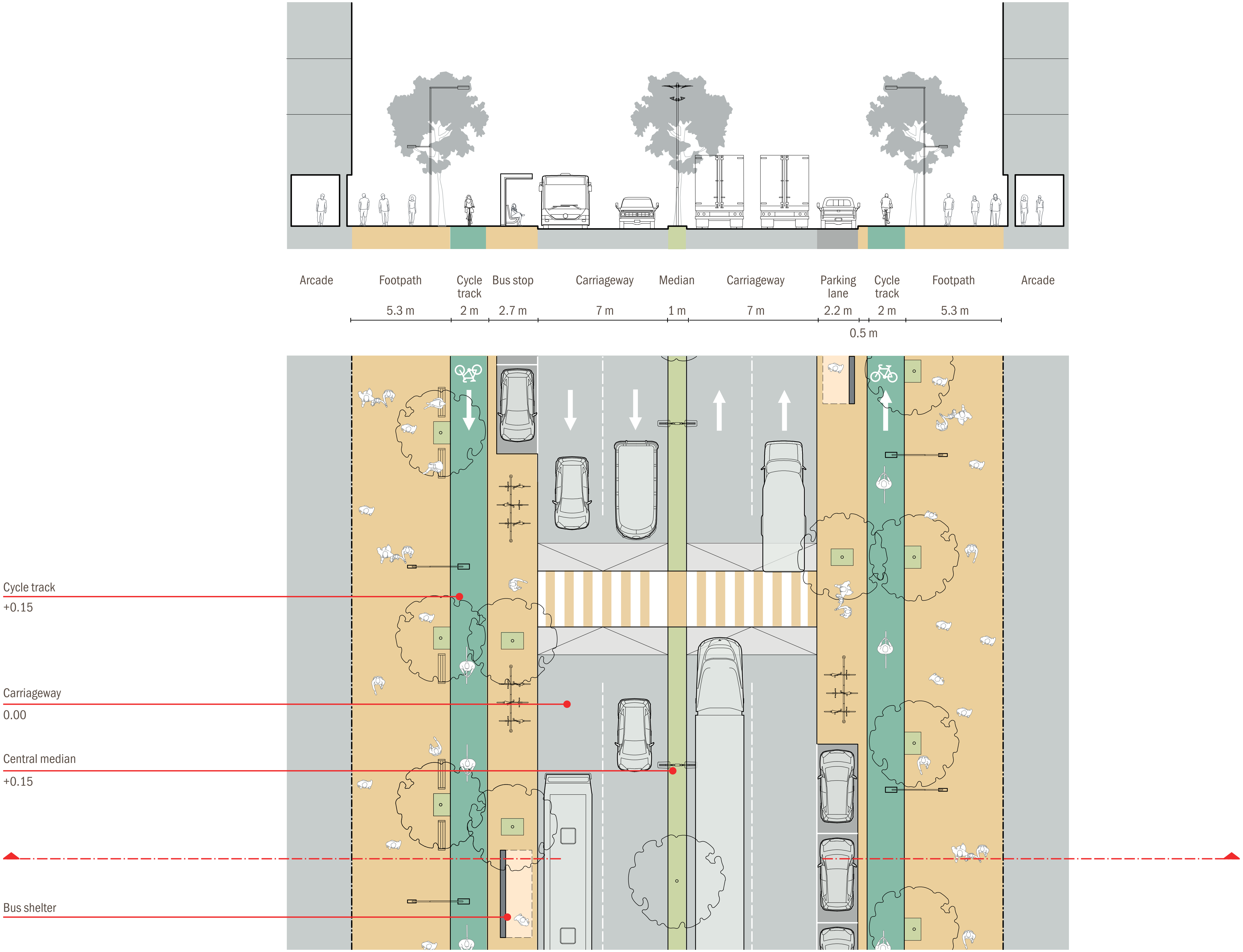


# 35 m

Principal Arterial Street (C)

Industrial

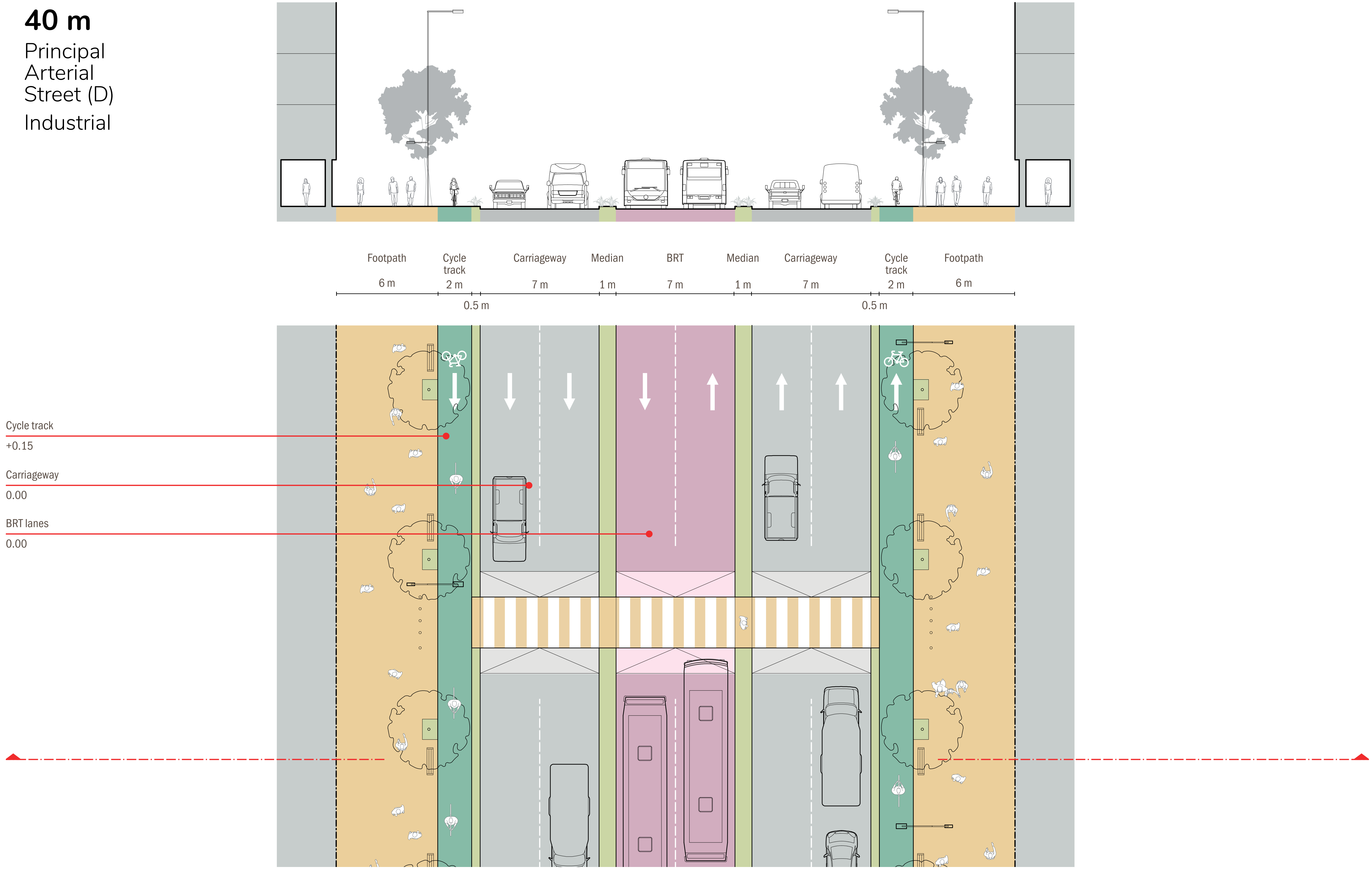
ERA jurisdiction



# 40 m

Principal Arterial Street (D)

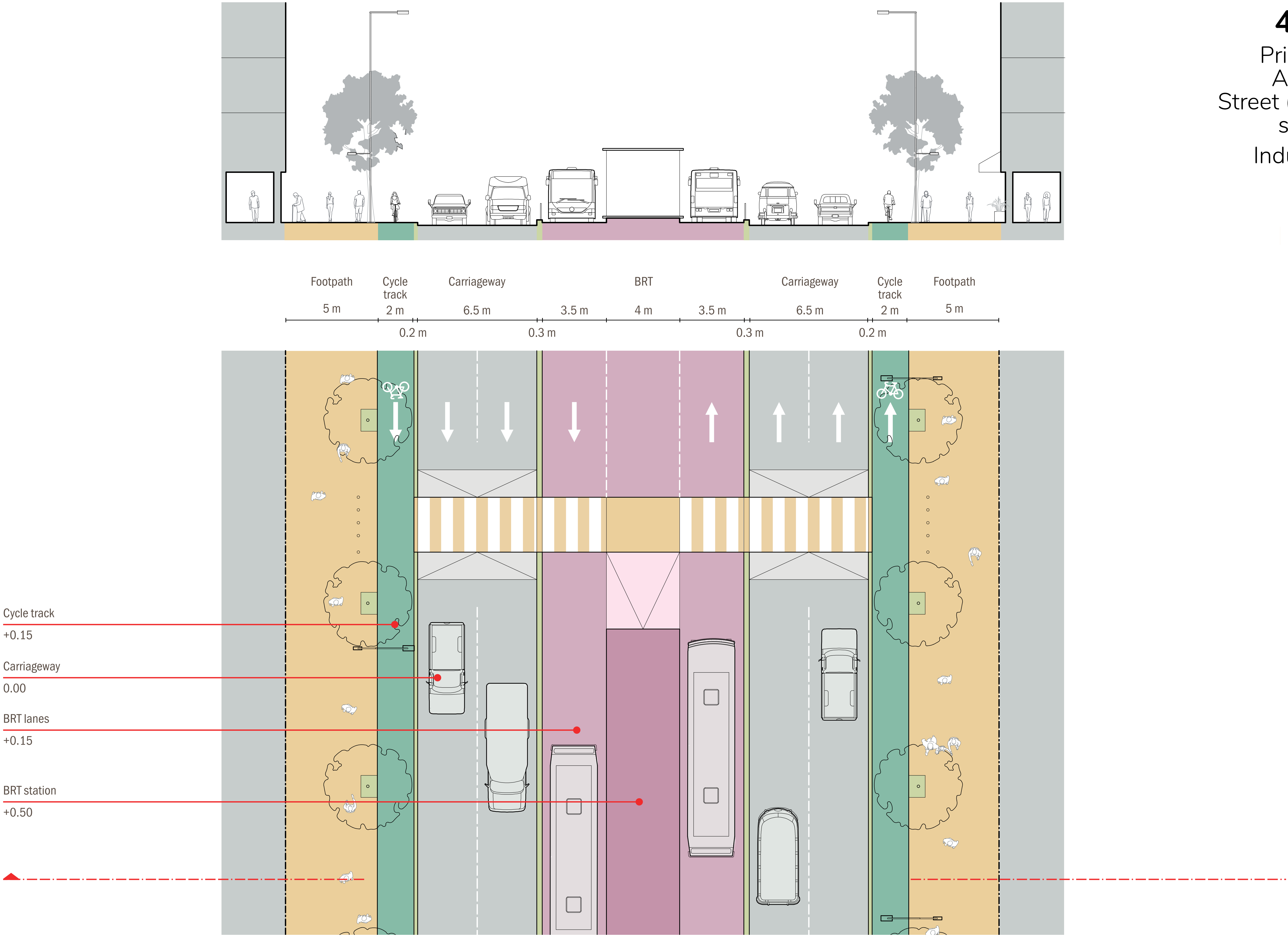
Industrial



# 40 m

Principal Arterial Street (D) on station

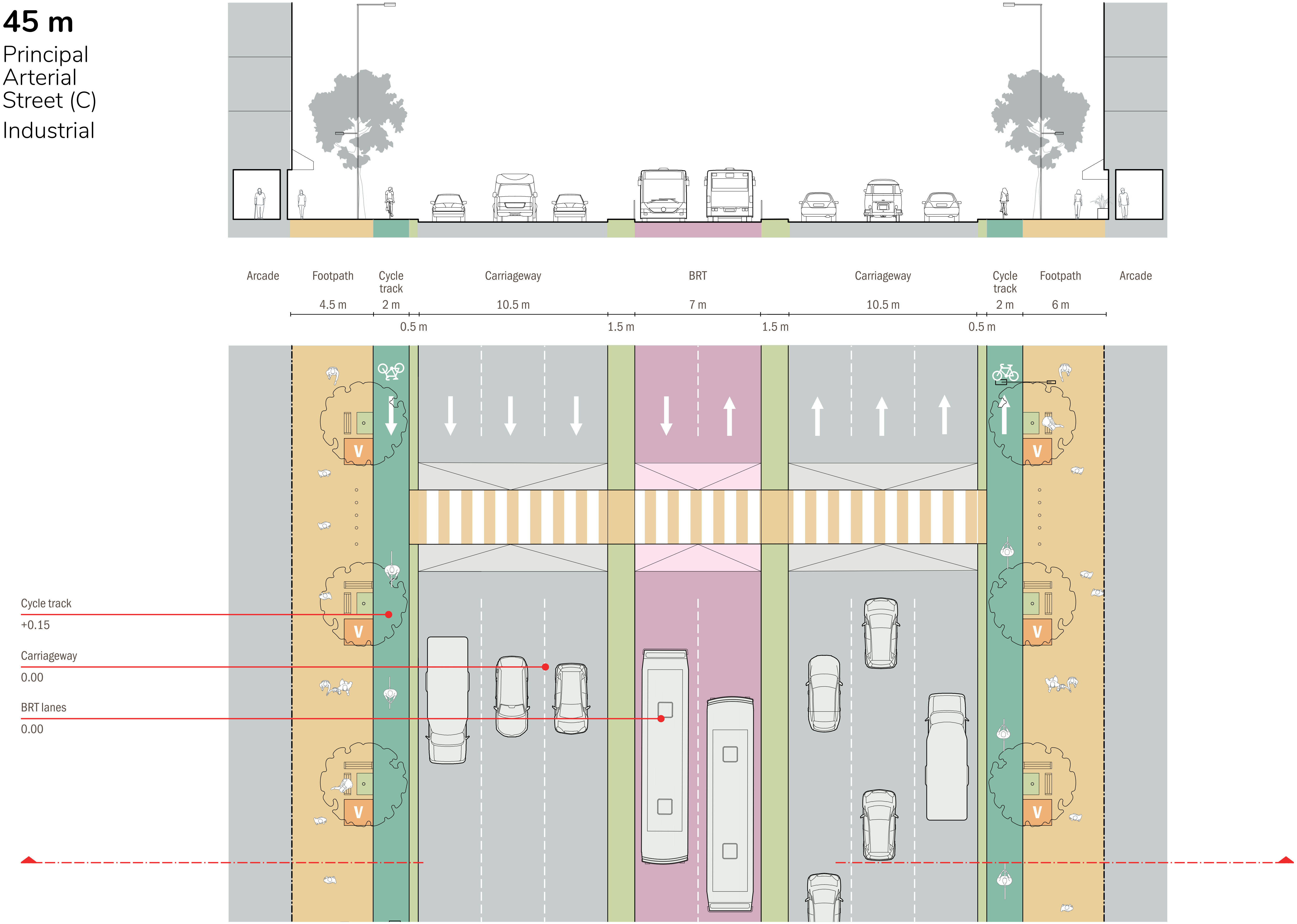
Industrial



# 45 m

Principal Arterial Street (C)

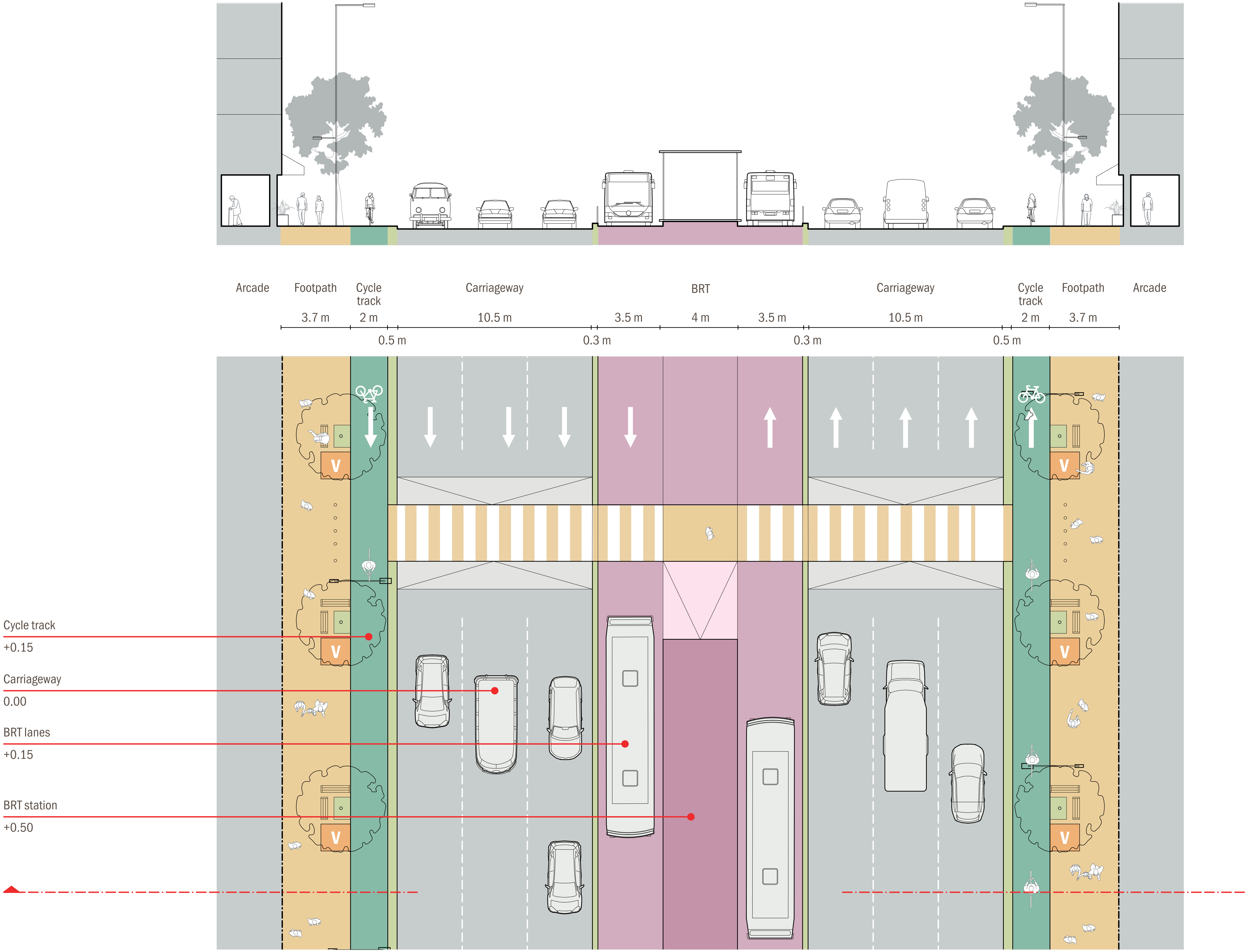
Industrial



# 45 m

Principal Arterial Street (C) on station

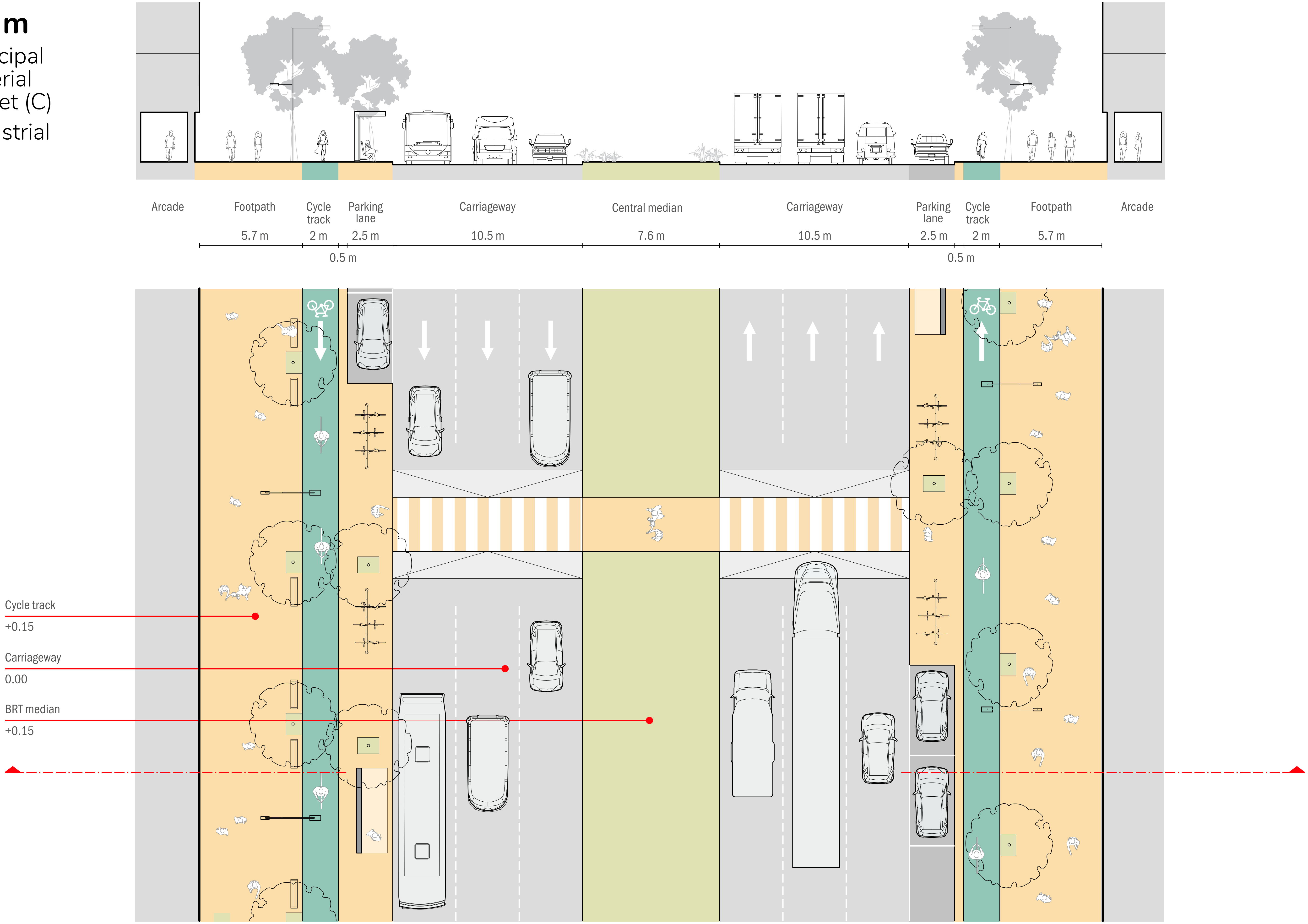
Industrial



# 50 m

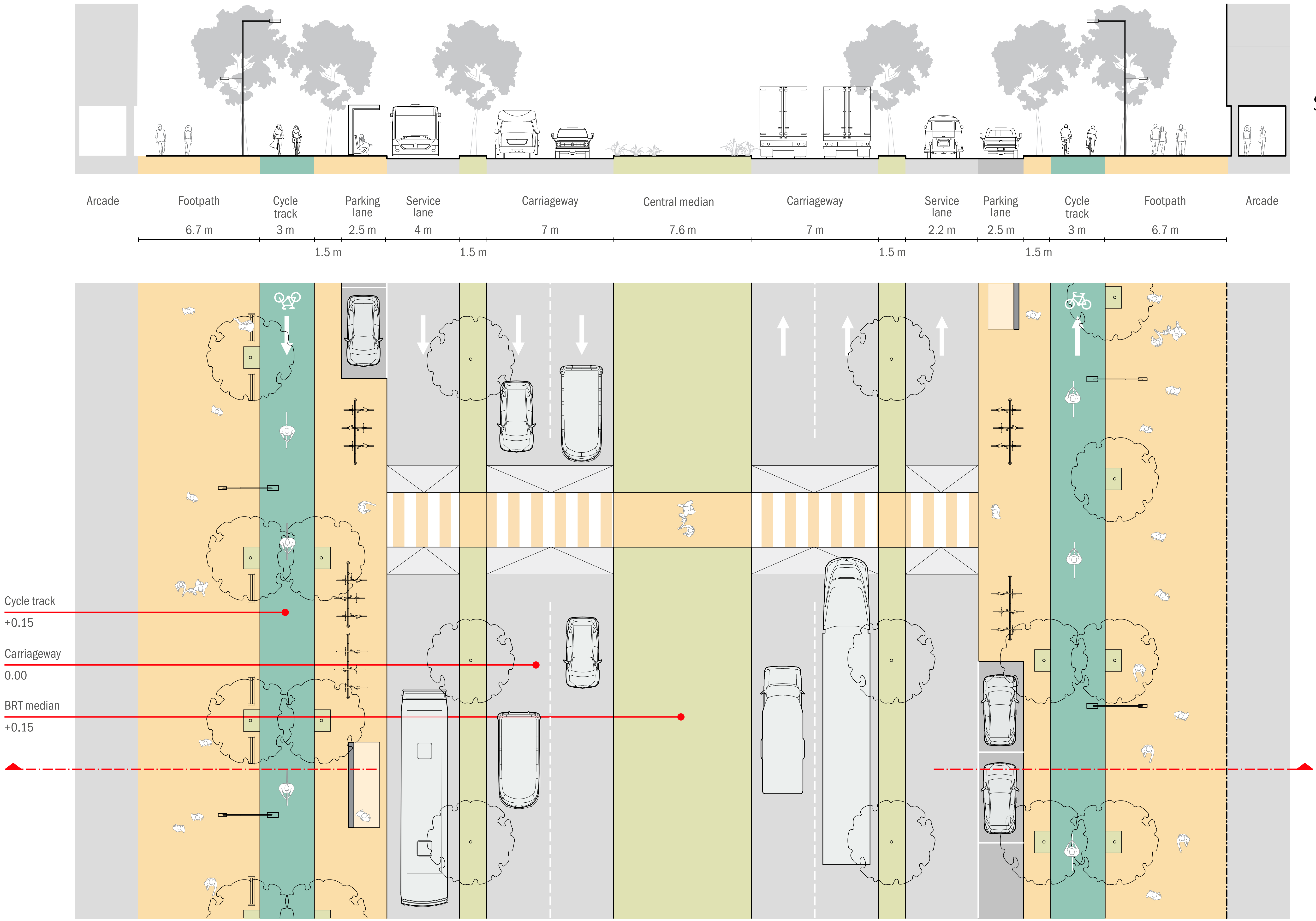
Principal Arterial Street (C)

Industrial



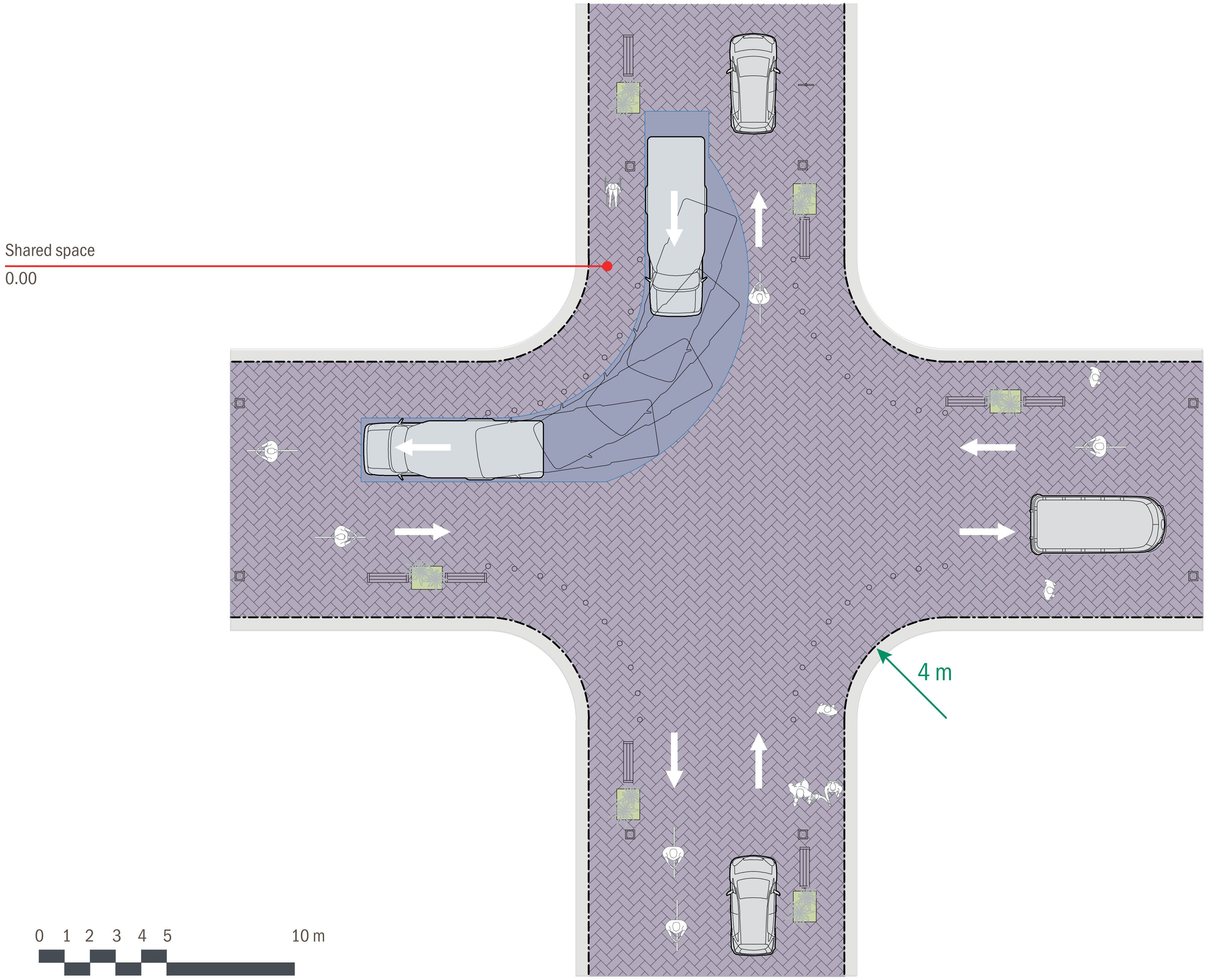
# 60 m

## Principal Arterial Street (C) Industrial



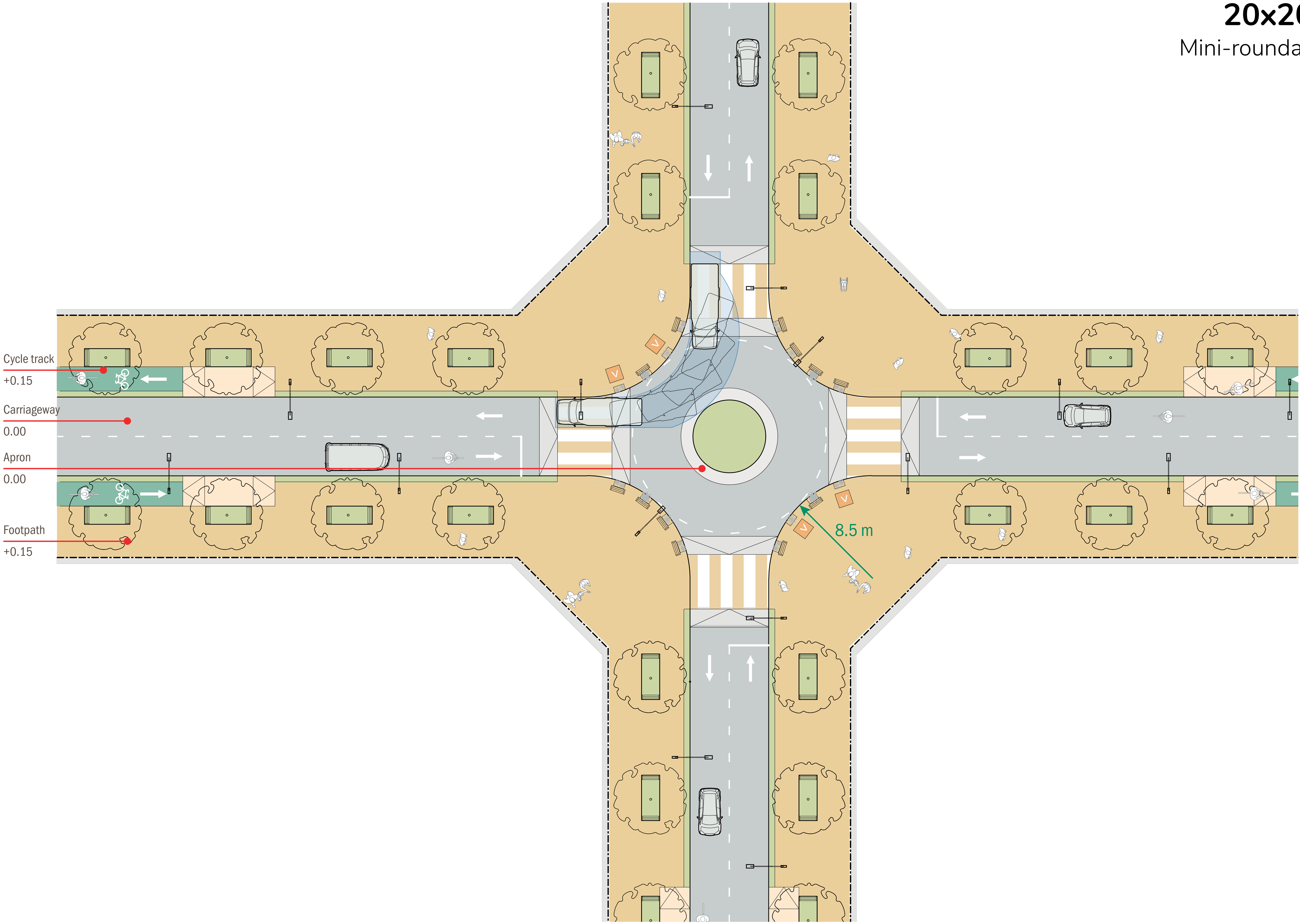
# 10x10 m

## Shared space intersection



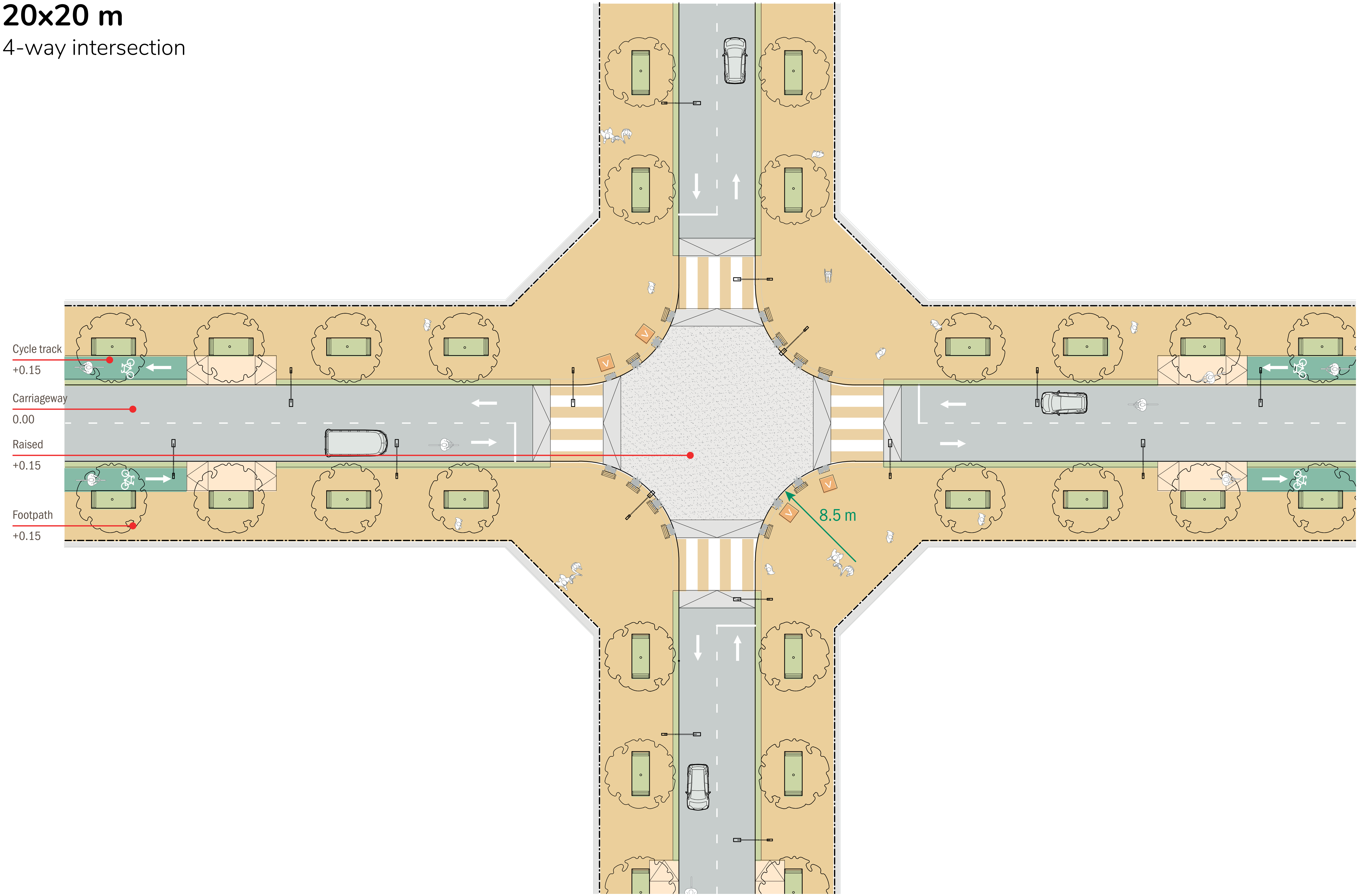
# 20x20 m

Mini-roundabout



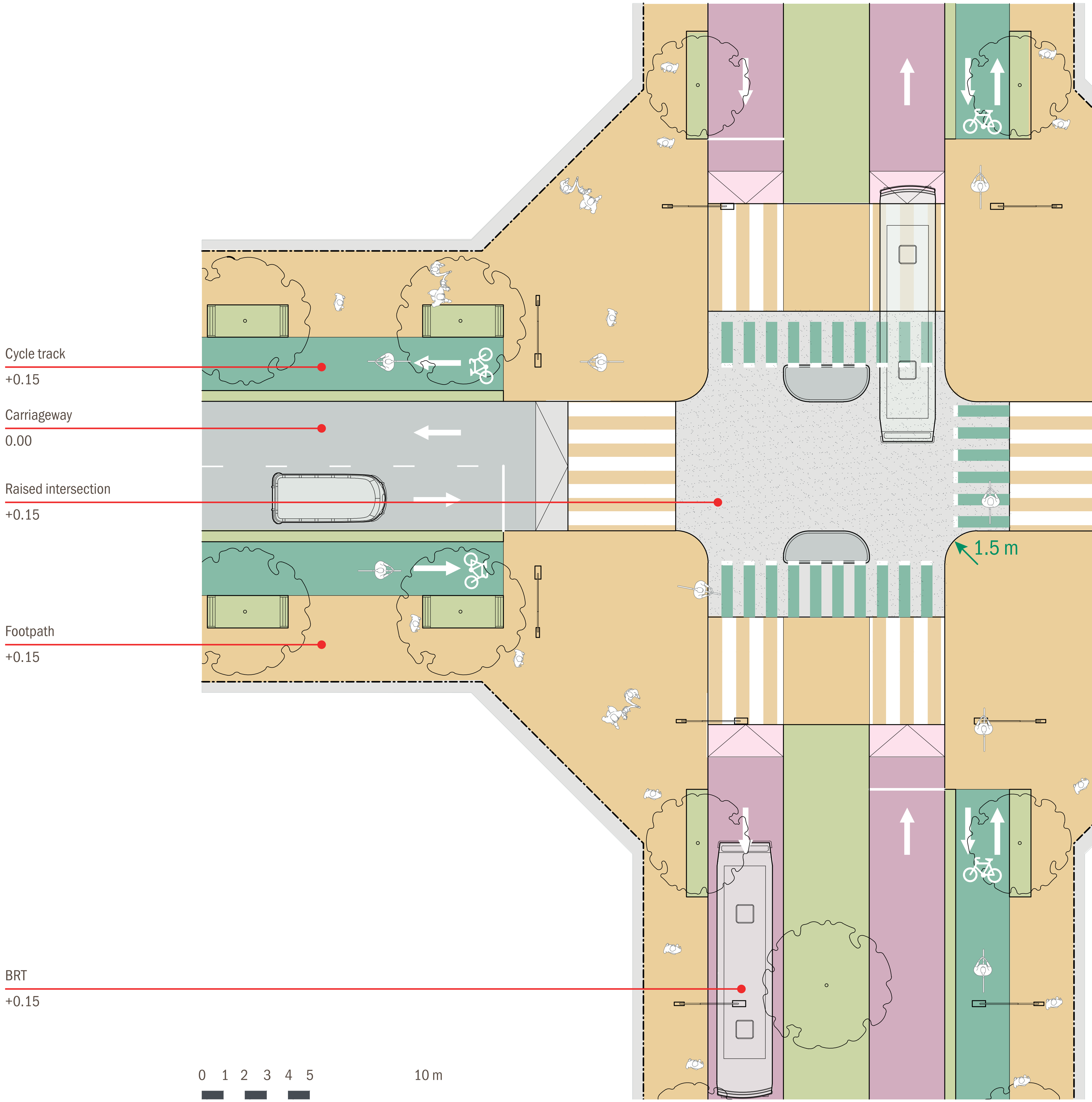
# 20x20 m

## 4-way intersection



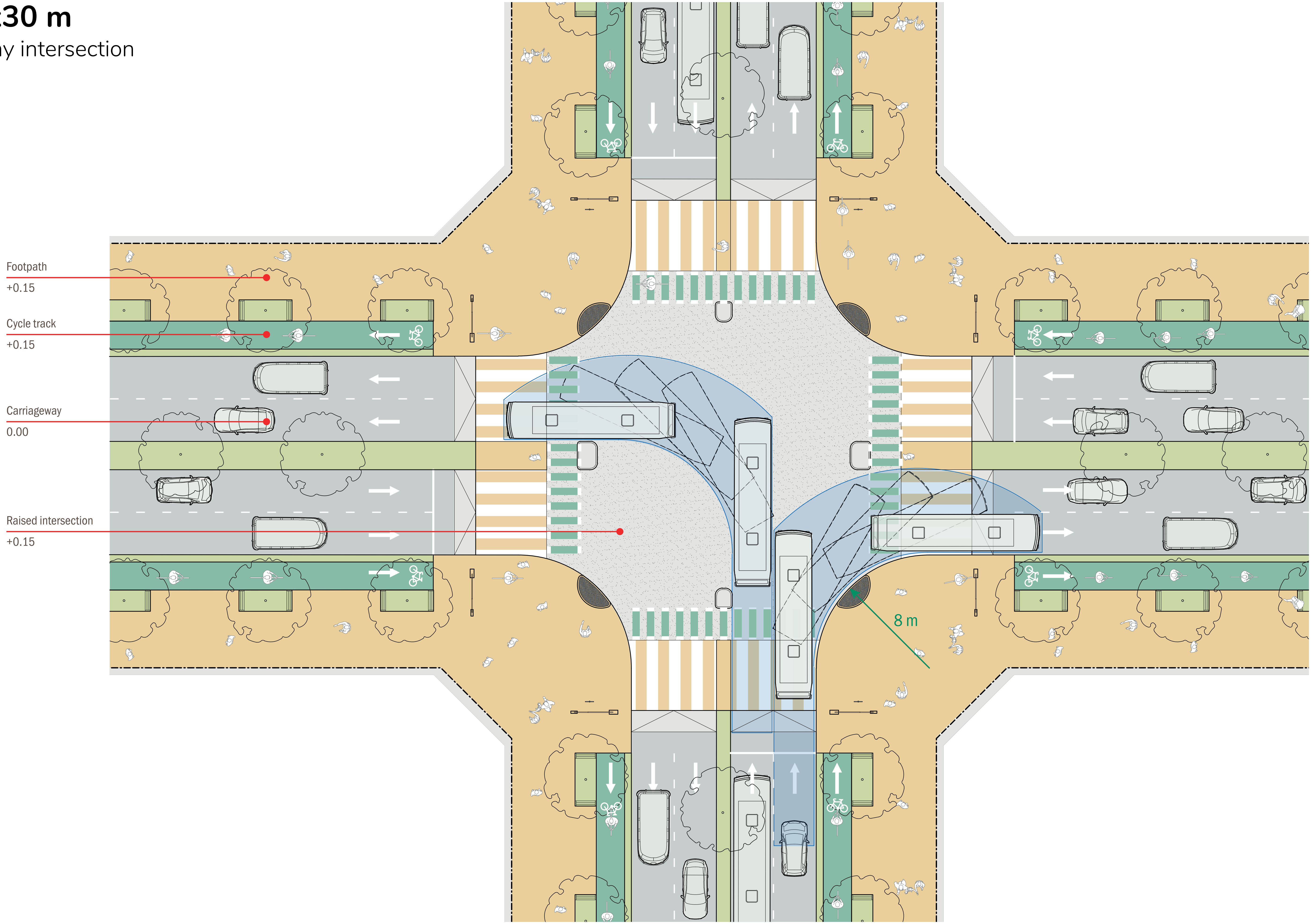
# 20x20 m

4-way intersection BRT



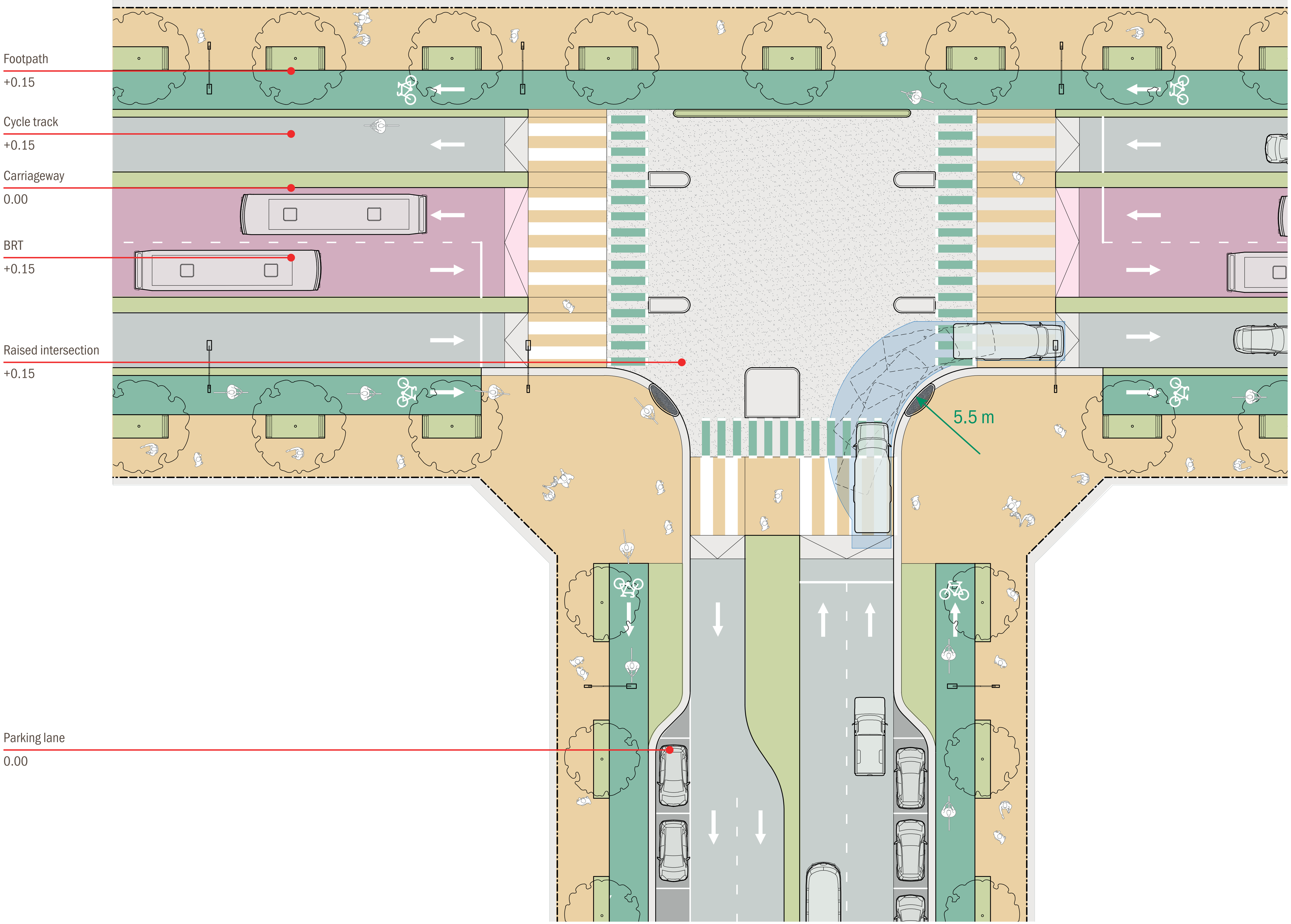
# 30x30 m

4-way intersection

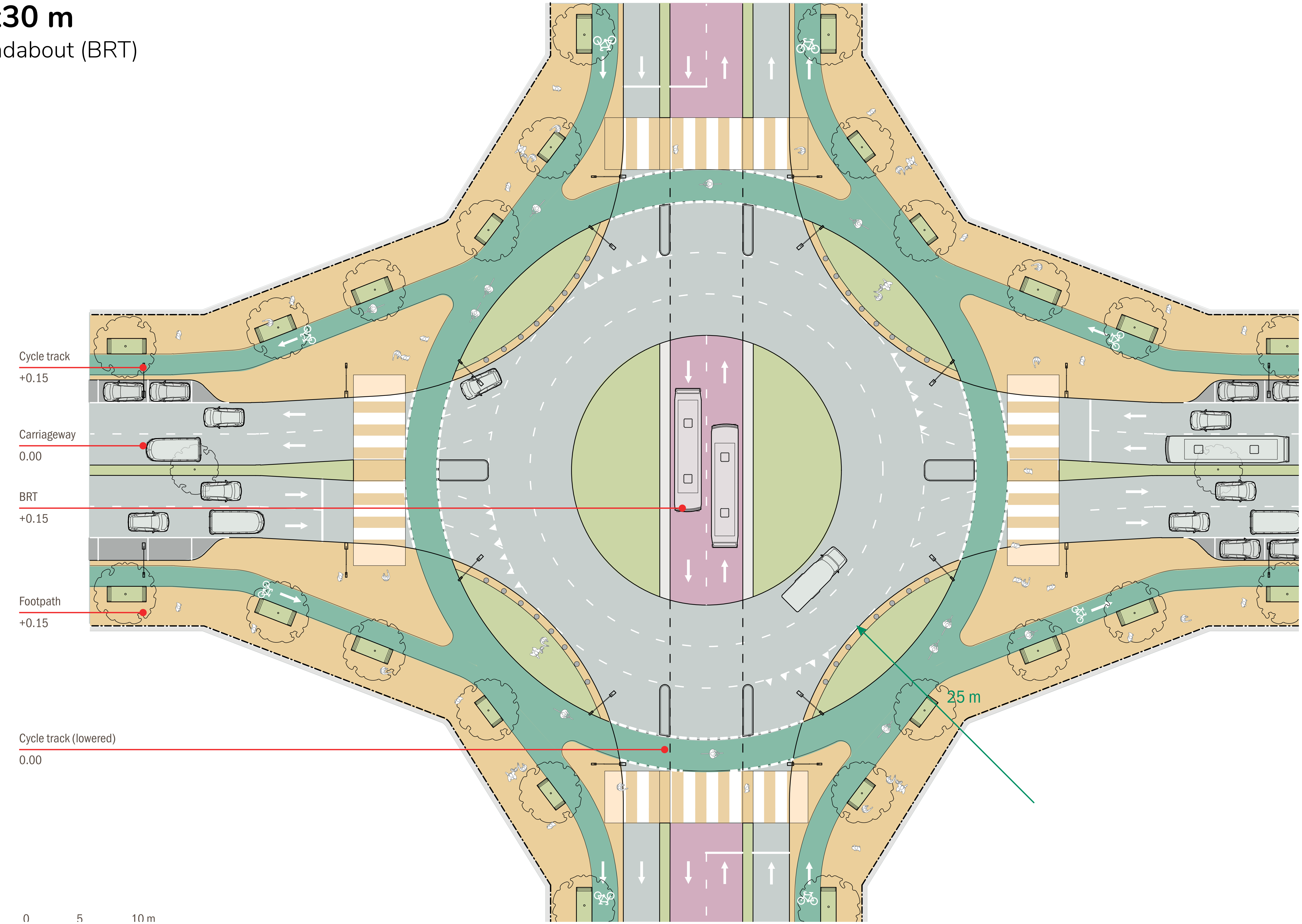


# 20x20 m

4-way intersection BRT

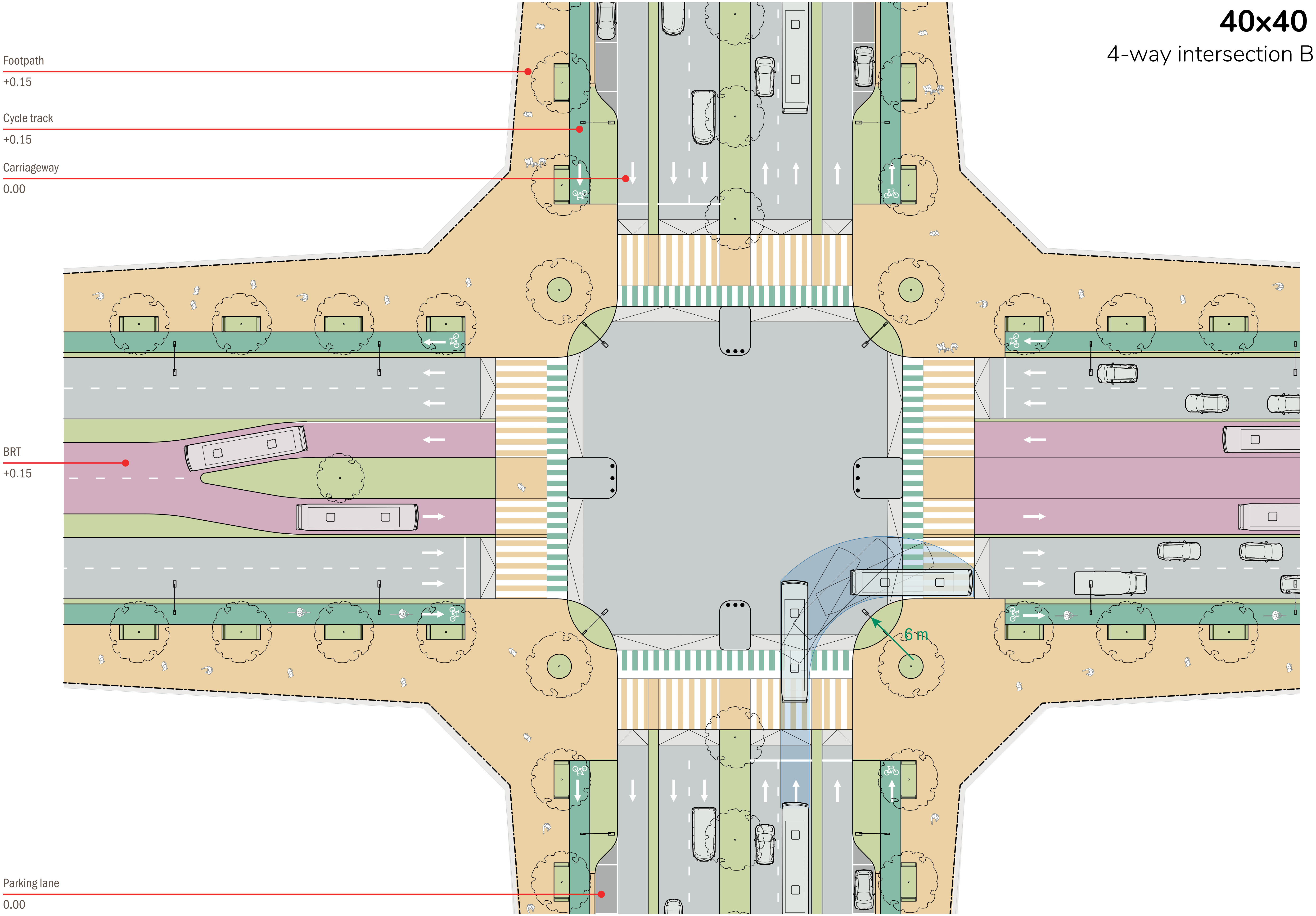


# 30x30 m
## Roundabout (BRT)



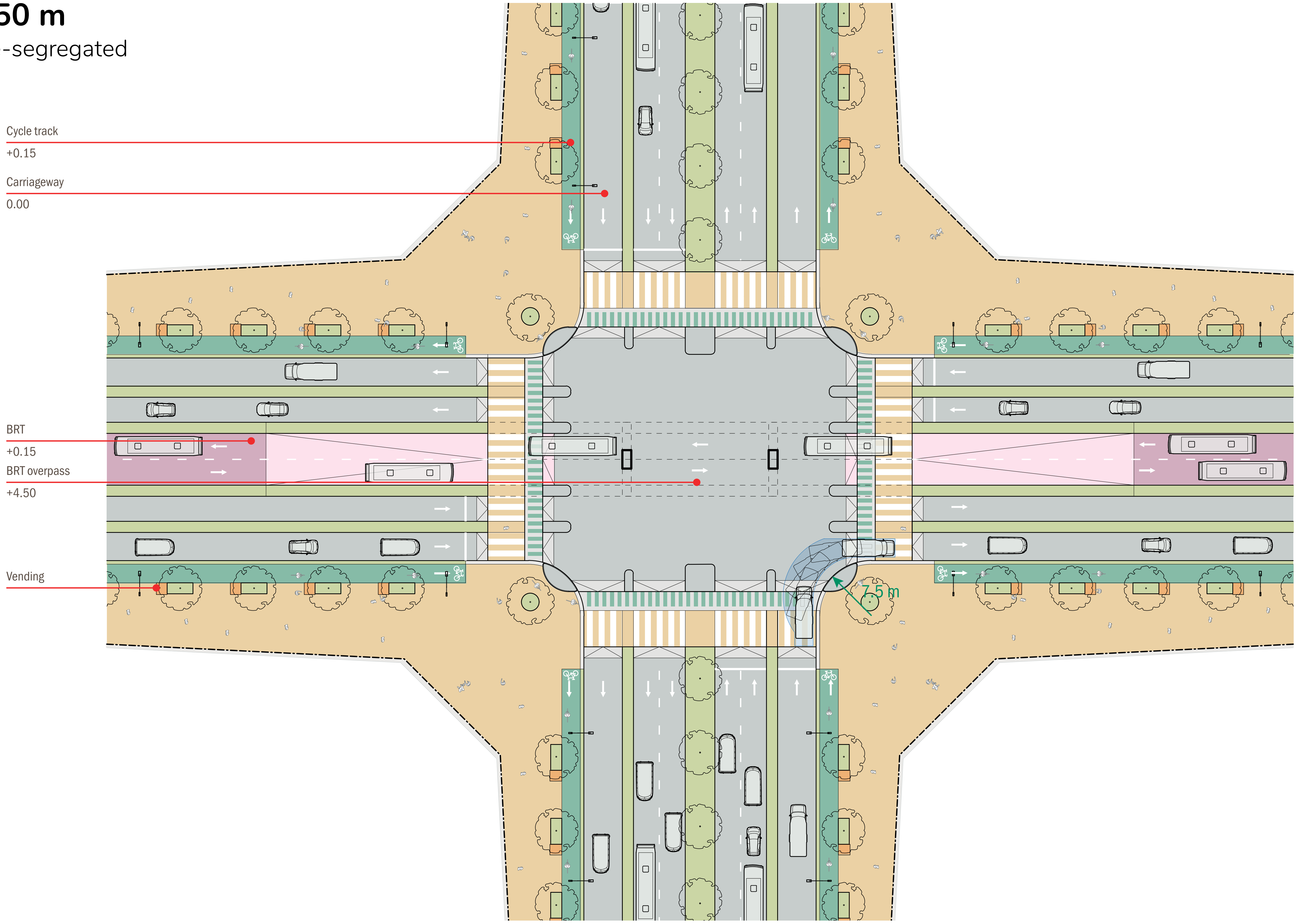
# 40x40 m

4-way intersection BRT



# 50x50 m

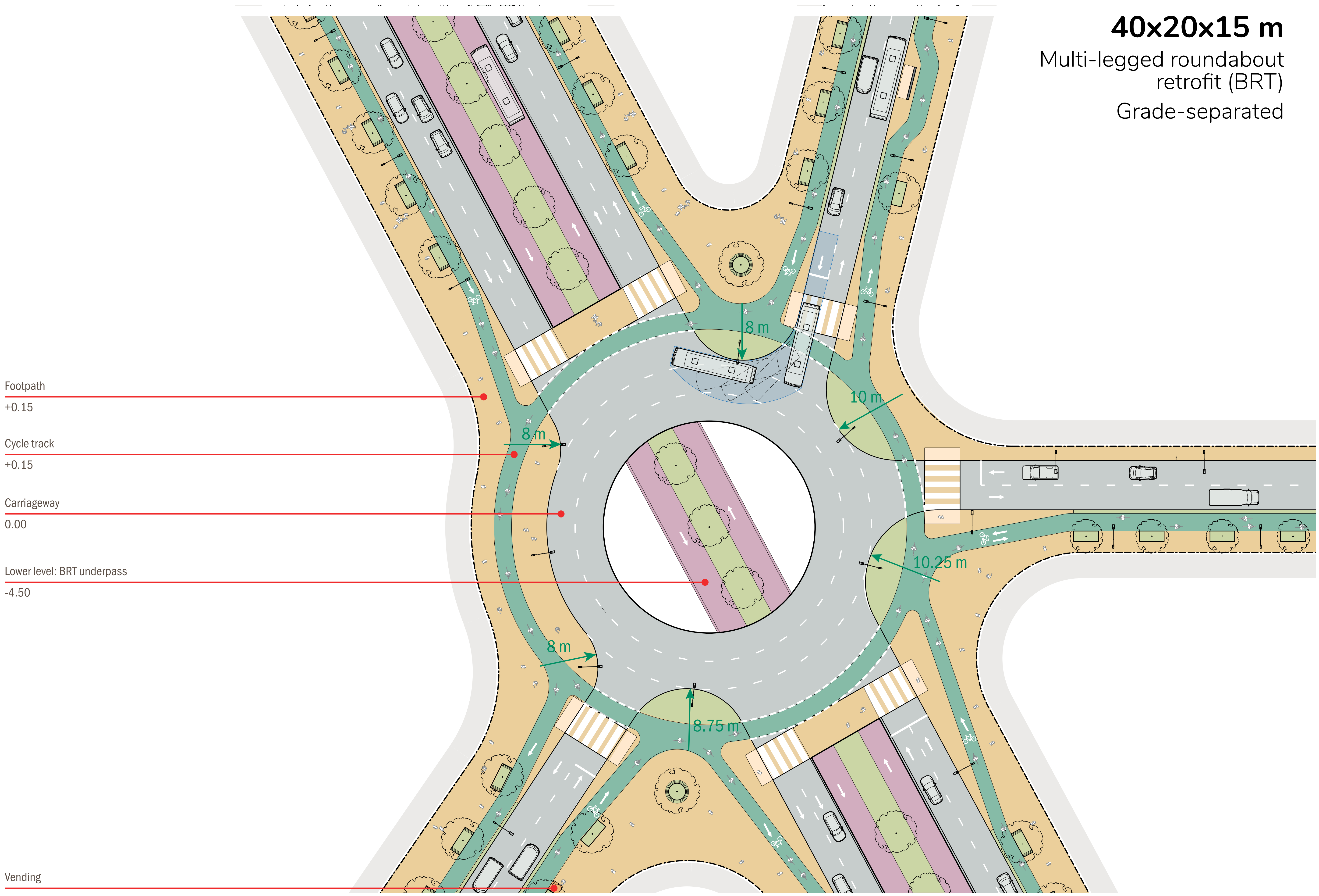
## Grade-segregated



# 40x20x15 m

Multi-legged roundabout retrofit (BRT)

Grade-separated

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# 6 Planning and design process

Street network planning shall be done as part of structure plan, strategic plan, basic plan, or sketch plan preparation of urban and rural centres. These plans shall incorporate the provisions of proper street planning standards.

The selection of streets for development shall be done in accordance with phasing defined in urban plans, strategies, and programmes developed and adapted by city administrations, municipalities, regional authorities, or federal authorities as applicable. In some cases, need assessment could be carried out to identify and justify the selection of streets for development and improvement. The design of streets shall be grounded in existing urban plans.

The design and implementation process shall have the following steps.

## 6.1. Preliminary study

The process of data collection, analysis, and preparation of reports is crucial for facilitating discussion and building consensus among government organisations, utility agencies, stakeholders, developers, and the community. The preliminary analysis will cover the analysis of existing street uses, street length, ROW, classification, number of properties to be affected, preliminary cost estimate, period of implementation, and contribution expected from stakeholders.

## 6.2. Stakeholder consultations

Public participation aims at promoting transparency in decision making, facilitating public awareness, promoting public ownership of projects, and encouraging collaboration in governance processes. Public participation is, therefore, a key step in the street design process. The project team should inform the stakeholders of the planned developments and to seek their input into the designs. It is important to engage all key stakeholders including:

- Ministry of Transport and Logistics
- Ministry of Urban and Infrastructure
- Ethiopian Road Administration
- Ethiopian Road Safety and Insurance Fund Service
- Ethiopia Environmental Protection Authority
- Public transport operators
- Street vendors
- Business community
- Persons with disabilities
- Donor agencies and development partners
- NGOs in the transport sector
- Utility providers (e.g., water, electricity, telecommunications)

This step includes development of a vision and documentation of steps to be taken by the city administration, utility agencies, stakeholders and the community. The project proponents negotiate with the stakeholders and reach consensus on the preferred approach.

## 6.3. Preparation of design TOR

This step involves using the background information gathered in the first step above as well as the outcomes from the stakeholder consultations to prepare a terms of reference for the hiring of design consultants. The implementing agency then issues the tender, completes the selection process, and issues a contract to the selected consultant. The consultant then works with the implementing agency on the following activities. As an alternative, the implementing agency could prepare the designs in-house.

## 6.4. Data collection

At the onset of the design process, it is key that the designer consult relevant government agencies and gather data about street conditions. Such information may include the following:

- **City vision.** It is useful to have a brainstorming session with key city officials to understand their vision for the city. A workshop can be held to explore the best suited options to achieve the city vision while at the same time aiming for a comfortable, safe and user-friendly street environment.
- **Review of existing transport and land use plans.** The designer is required to compile spatial information on existing transport plans, including BRT networks, cycle networks, pedestrian networks, and pedestrian zones. The designer should also identify transport system goals that are stated in these reports.
- **Topographic survey.** The purpose of a topographic survey is to collect data on the project site including all the existing features (see next page). The designer should supplement the topographic survey with information on underground utility networks obtained from the client.
- **Underground utility survey.** It is necessary to conduct detailed surveys of underground utilities to establish the location of specific utility lines and determine whether relocation is necessary. These utilities may include lines for telecommunication, electricity, natural gas, water, and sewage.
- **Survey of land uses.** The designer should compile land use information to help inform street design decisions. A land use survey must be carried out for every building in the study area. The land use analysis should note important activity generators, such as shopping areas, theatres, and housing developments. All land use data should be recorded using a GIS platform.
- **Existing NMT condition survey.** Key to designing a quality and effective non-motorised transport (NMT) network is to have an in-depth understanding of the existing walking and


**Figure 91. Topographic survey drawing.**

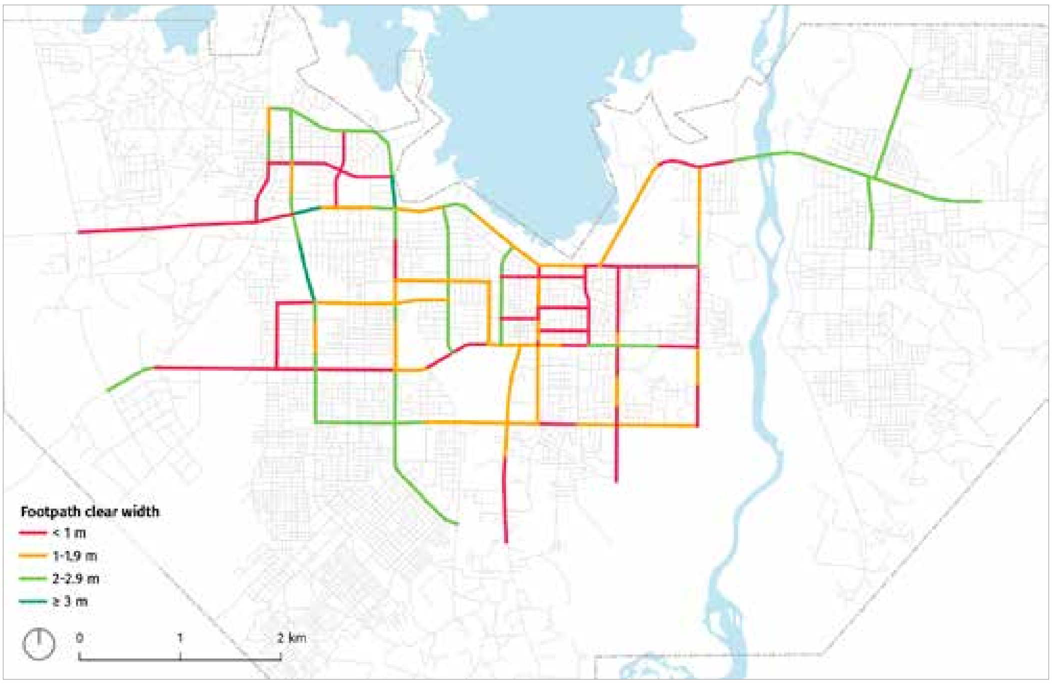


**Figure 92. Footpath clear width data from NMT condition survey.**

cycling environment, and the extent to which it provides safe, convenient access for NMT users. Street conditions can be captured using the smartphone application. The app allows a surveyor to record street characteristics and remotely upload the information to an online spreadsheet. The data from these surveys are then cleaned, mapped, and analysed to inform preliminary interventions along the surveyed streets.

- **Survey of NMT user movements.** Information on NMT volumes on each street can help inform the design and sizing of pedestrian and cycle facilities. There are range applications available online which can be used for NMT counts, including Device Magic and Multiple Counter. NMT surveys should be disaggregated by gender, age, and disability.
- **Traffic counts.** Data obtained through a traffic survey is necessary for intersection design and signal timing optimisation. The traffic survey quantifies vehicle movements, including non-motorised user movements. Traffic surveys should be conducted during peak periods when motorised traffic is and demand for space are highest. Counts can be conducted manually on site or by video recording using cameras. The count should be categorised by vehicle type.
- **Data on national and regional roads.** MUI, ERA, and regional agencies can provide information on national and regional roads, which should be integrated with the proposed urban street network per local urban plans. Similarly, data on roads connecting urban areas to the rural kebeles in the hinterland areas shall be collected from existing situation studies.
- **Parking survey.** In most urban areas, parking appears crowded and chaotic in some areas, creating the impression of an overall shortage, yet there could be several unused parking spaces within reasonable walking distance. A parking survey reveals such imbalances, and appropriate measures can be included in the street design to improve parking efficiency on the street. A parking survey seeks to quantify current parking patterns in the project area by collecting data on the existing parking capacity and demand. Three types of surveys should be carried out:
  - **Parking inventory survey:** The first step involves recording the number of parking spaces in on-street and off-street facilities.
  - **Occupancy survey:** The second step involves counting the number of vehicles parked on each street segment or off-street parking facility over the course of the day. These counts can be used along with the supply data to calculate occupancy rates.
  - **Turnover survey:** Turnover data can help determine what types of users are parking in a particular facility (e.g., all-day parking by office-goers, short-term parking by shoppers, etc.).

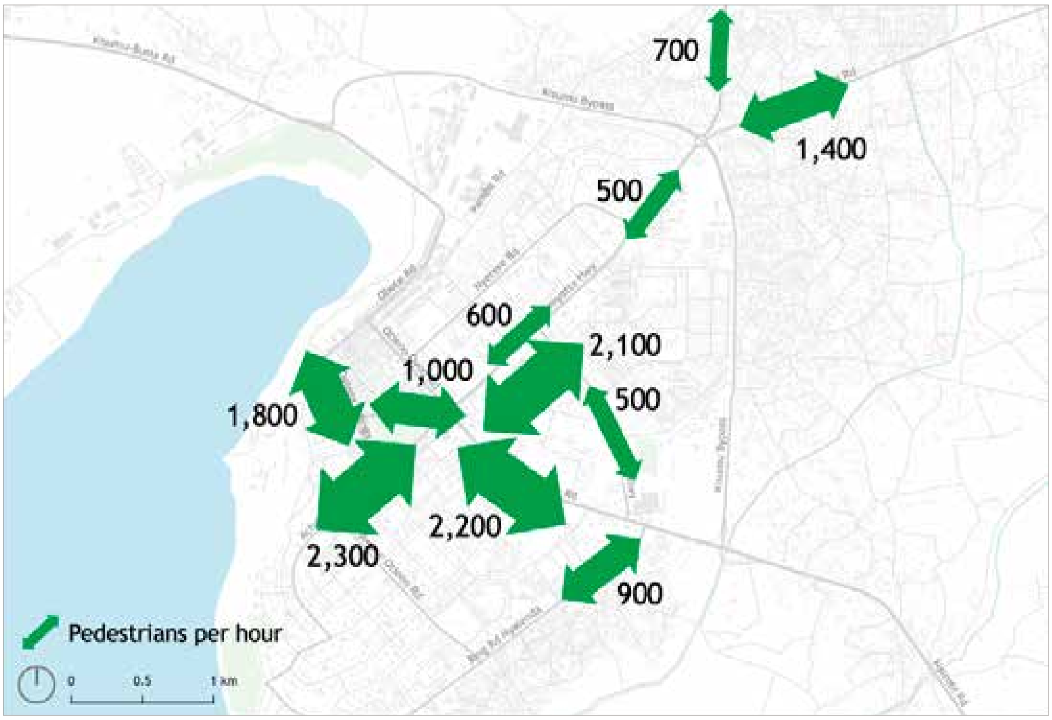


**Figure 93. Pedestrian volume counts.**

- **Street vending and related activities survey.** The designer must document existing vending activity, including the type of vending and the physical typology of the vending structure (i.e., permanent or temporary structure). The location and characteristics of each vendor should be recorded using GIS. The survey also should capture social gathering spaces in the study area. This information will inform the placement of street furniture and other elements in the final design.
- **Analysis of crash data.** The designer should obtain data from the police on traffic crashes over the past 3 years. The crash location, type, and users involved (i.e., pedestrian, cyclist, two-wheeler, car, bus, etc.) should be mapped using a GIS platform. This information will enable the designer to identify major traffic safety "black spots" and suggest traffic calming, intersection modifications, and other interventions to improve safety for vulnerable street users.
- **Right-of-way.** City management or relevant road authorities may be in a position to provide the available right-of-way (ROW) widths. In addition, maps showing precise, geocoded locations of the public right-of-way may be obtained.
- **Documentation of public transport.** To document existing public transport routes and services, data on the public transport services within the project area should be collected and mapped. All paratransit and bus stops within the project area also should be mapped. The designer should gather additional information on planned public transport projects within the project area from relevant bodies.
- **Consultation with utility providers**. Any existing utilities within the project area should be identified during the early stages of design. Utility providers may have information on existing utility networks. Discussions with relevant utility providers should be held to agree on any necessary relocations or on the installation of a service duct. It is advisable to maintain communication with the providers as the design progresses and also during project implementation. The designer should obtain any necessary approvals from utility providers for planned relocations.

## 6.5. Street design preparation

Next, the consultant prepares the complete design of the selected street/s based on street design standards and the TOR. The street design preparation includes at least three sub-steps: draft designs, draft final designs, and final designs. The first two sub-steps shall be followed by review, evaluation, and comments on the respective outputs from a diverse set of stakeholders. The final design shall address the comments on the draft and draft final outputs. The team of professionals preparing the designs shall consist of architects, landscape architects/planners' urban planners/designers, engineers, environmentalists, sociologists, economists, and consultants of different categories as applicable.

## 6.6. Integration

This step includes preparation of plans for integration of activities and provision of financing support among the local government, utility providing agencies, and the community. This step shall include detailing the contribution of each stakeholder and preparing a breakdown of funding sources and phasing of release.

## 6.7. Review and approval

The design of streets shall be approved by city administration and/or municipality before proceeding to construction. Urban centres can seek design review assistance from regional and federal institutions, consultants or other bodies as applicable. The designs shall be accompanied with plans of actions, financing, funding sources, and budgets. Required street plans, drawings, and reports as applicable shall be submitted to the city administration and municipality for approval. The city administration and municipality shall have the right to reject or approve the design submitted for approval. The rejected designs shall be returned together with the reasons for the rejection. If designs could be improved comments shall be given to the designers.

## 6.8. Tendering, contract award, administration, construction, and handover

The construction of streets shall be carried out in accordance with the approved and adopted designs.

## 6.9. Operation and maintenance

Streets are valuable public property. To give sustainable services they have to be managed properly and protected from improper use and abuse. Therefore, they have to be administered and also owned by a public body with clear mandates. City administrations and municipalities shall manage the operation and maintenance of urban streets.

Streets shall be maintained regularly every two years and also as required when damage occurs. If damage is caused by crashes or actions of users, those who caused the damage shall be made accountable and cover the cost of maintenance. The required regulation and working procedure shall be defined and enforced. There is a need to support high-quality construction and maintenance of streets by establishing an infrastructure budgeting system and an urban infrastructure fund (MUDH, 2014).


Coca-Cola

# 7 Appendices

## 7.1. Height clearance and air rights

Vehicles have different heights and require corresponding clearances to pass safely under built structures. Defining and enforcing appropriate height clearance in streets is essential to protect people and property from crashes. Streets requiring grade separated infrastructure shall be defined in urban plans. The height clearance shall be detailed in the Neighbourhood Development Plan (NDP), urban design, and geometric designs of streets and implemented accordingly. Arcades shall be detailed in the urban design and NDPs and shall be used and treated as part of the public ROW in the latter case.

### DESIGN STANDARDS

- Minimum clearance as defined in Table 23.

**Table 23. Standards for height clearance.**

| Street element | Minimum clearance (m) |
|---|---|
| Grade separated intersections | 5.5 |
| Arcades (out of ROW) | 3.5 |
| Buildings over public ROW | 7.5 |
| LRT with overhead power supply | 6.5 |
| LRT without overhead power supply | 5.5 |

**Figure 94. Split underpass with provision for BRT.**

## 7.2. Design vehicles

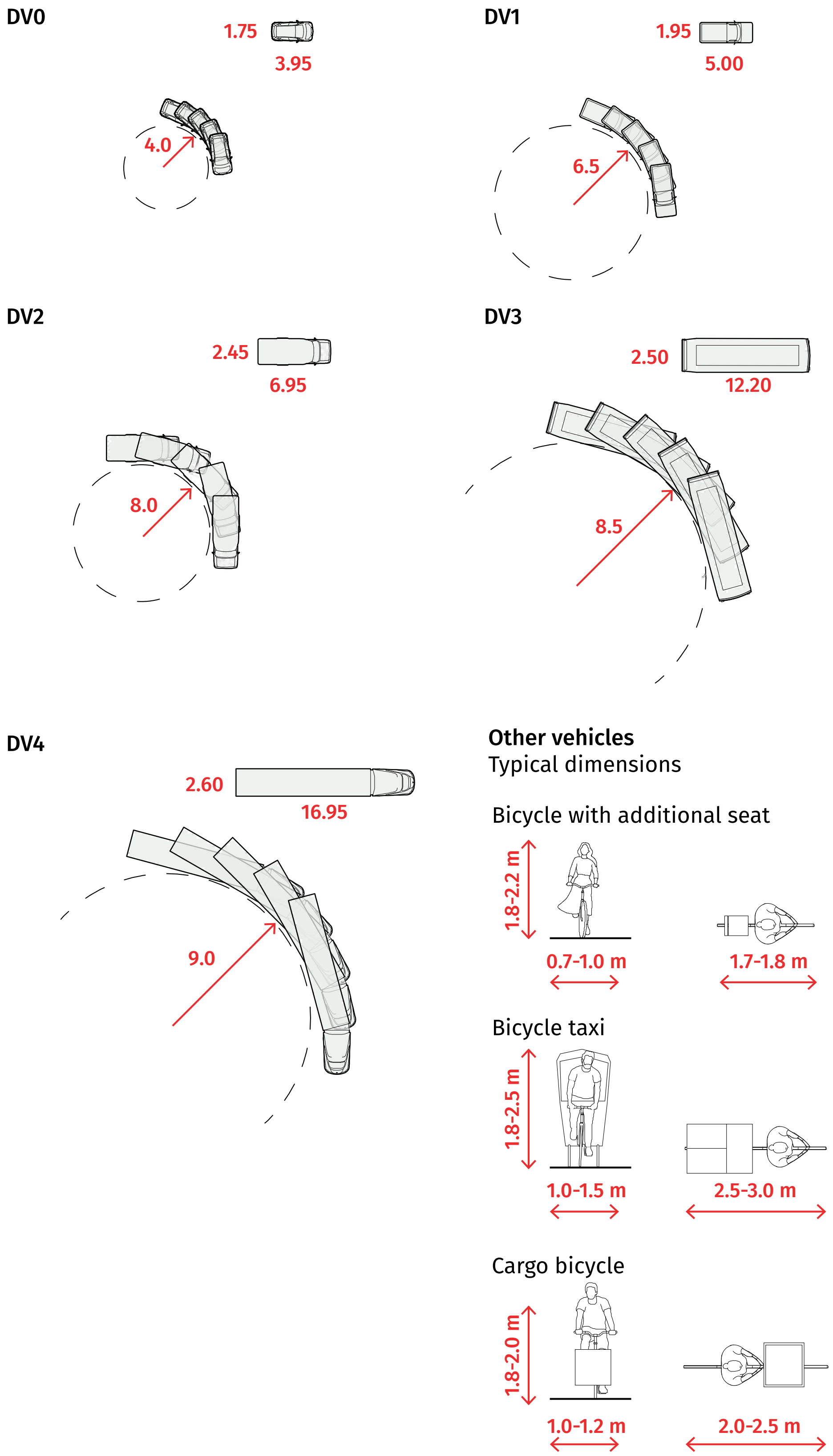


Figure 95. Design vehicle dimensions and turning radii (AASHTO, 2018).

## 7.3. Special streets

In addition to the typical streets presented in this manual, urban centres consist of streets serving special purposes. These streets shall be integrated with the overall street network.

### 7.3.1. Pedestrian streets

Municipalities are urged to designate streets for pedestrians and cyclists to ease traffic congestion, promote socioeconomic development, or and improve the quality of public space.

#### DESIGN STANDARDS

- Access for pedestrians and cyclists.
- Physical elements to prevent entry by motor vehicles.
- Shade and street furniture elements.
- Organised spaces for street vending.

### 7.3.2. Cul-de-sacs

#### DESIGN STANDARDS

- The length of a cul-de-sac street shall not be more than 120 m.
- The radius of turning shall be enough for private cars (DV0) and minibuses (DV2).
- Width shall be a minimum of 6 m for shared streets and 10 m for others.
- At the end of the cul-de-sac, it is preferable to provide pedestrian and cyclist connections to the nearest street to reduce travel distances for NMT users.

### 7.3.3. Alley streets

Alley streets provide private rear access to buildings to facilitate freight and parking access while improving the pedestrian environment.

#### DESIGN STANDARDS

- Minimum ROW of 2 m for NMT access; minimum ROW of 6 m for vehicle access.
- Adequate lighting for night-time security.
- Orient utility entrances for buildings toward the alley in order to improve continuity of pedestrian and cyclists facilities on the main block face.

### 7.3.4. Streets linking rural and urban areas

The design of streets linking rural or peri-urban areas to urban centres should anticipate urban expansion and reserve space for walking, cycling, and public transport facilities.

**DESIGN STANDARDS**

- Major peri-urban streets that enter the urban area and have the potential of becoming Principal Arterial Streets should have a ROW of at least 40 m.
- All the street design elements shall apply on these streets. The design may reserve space for future public transport facilities (e.g., median BRT lanes).

### 7.3.5. Streets for cattle

Secondary and tertiary urban centres shall have streets for cattle entering the urban area from at least the main supply direction.

**DESIGN STANDARDS**

- At least one street along the main cattle supply route.
- Minimum ROW of 7.5 m.
- Streets near water bodies shall be located at least 15 m away from the respective water bodies.

## 7.4. Construction materials

Construction materials affect the aesthetics, usage, durability, and sustainability of urban streets. The selection of appropriate construction materials shall be based on consideration of the street function and loads along with the material strength, durability, cost, aesthetics, and maintenance needs.

There is strong experience of using local materials in street construction, namely the use of cobblestones for Local Streets. Micro-scale enterprises have good experience in the excavation of rocks from quarries, transport of rocks to sites of production, production of cobblestones, and construction methods.

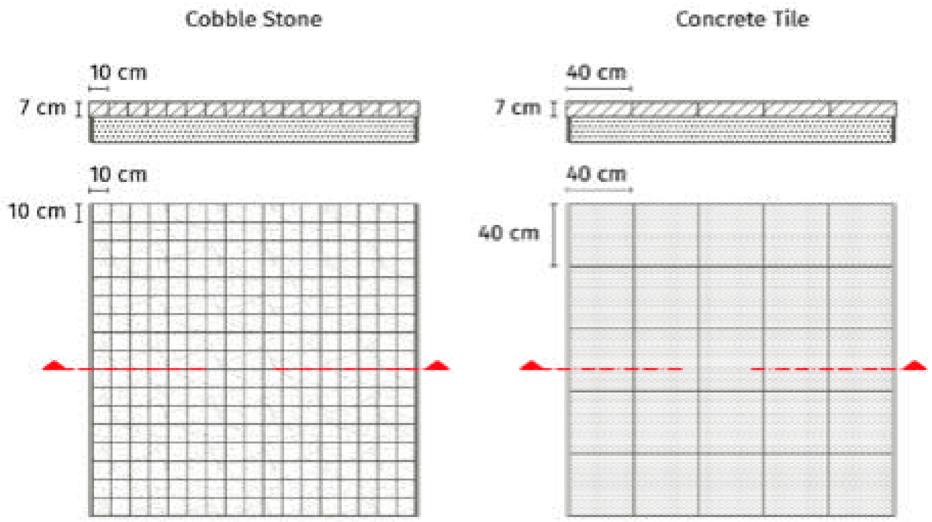


**Figure 96. Walkway construction materials and arrangement**

**Figure 97. Tactile paving.**

## DESIGN STANDARDS

- **Walkways:** Concrete is a popular material for walkways because it is durable and requires minimal maintenance. Other materials such as pavers and cobble stones allow for storm water percolation. Footpath materials should be strong and durable. The surface should not be slippery in the rain. Yellow tactile tiles should be included to provide guidance to persons with visual impairments.
- **Cycle tracks:** Asphalt is a common material for cycle tracks because it provides a smooth surface for cyclists. Concrete can also be used, but it tends to be more expensive. Some cities use coloured pavement to distinguish cycle tracks from other street elements.
- **BRT:** On BRT corridors, the bus lanes are to be constructed in reinforced concrete at stations and intersections. At other locations, use of reinforced concrete is preferred.
- **Carriageways:** Construction material of carriageways or vehicle lanes for all streets except local streets shall be concrete asphalt (class C:35) or high-grade multi-layered asphalt concrete, with a potential for upgrading to concrete asphalt over time. For local streets, semi-dressed, dressed or cobblestone, concrete tiles, on compacted and multi-layered aggregate base with strength enough to carry the load of vehicles for daily use and trucks in case of emergency and delivery of goods.
- **Concrete buffer**: The buffer between the cycle track and carriageway need to include a greenery space for grass and shrub ad surrounded by concrete element
- **Other urban street elements:** Street furniture, such as benches, trash cans, and bike racks, can be constructed using materials such as metal, concrete, or wood. Street lighting can be constructed using metal poles and fixtures, with LED bulbs for energy efficiency.

## 7.5. Colour coding and presentation

In structure, strategic, basic, and sketch plans street network maps showing layout, functional classification, ROW, and network maps shall be presented in the colours indicated below. The street network plans shall include cross section designs. At the stage of NHD, urban designs, and block designs, the layouts shall show the detailed arrangement of street elements.

**Table 24. Colour and line coding for street network plans and land use maps.**

| Street type | Colour | Line weight |
|---|---|---|
| Principal Arterial Street | Red | 0.25 |
| Sub-Arterial Street | Blue | 0.20 |
| Collector Street | Green | 0.18 |
| Local Street | Magenta | 0.18 |
| Mass rapid transit | White | 0.18 |

**Figure 98. Shaded walkway in Addis Ababa.**

**Figure 99. Street in Addis Ababa.**

# 8 References


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# 9 Definitions

**Access**: ability to reach social and economic opportunities, measured in terms of the time, money, comfort, and safety that is associated with reaching such opportunities.

**Annual average daily traffic (AADT):** the average daily number of vehicles travelling a street calculated by summing the total number of vehicles traveling on the same street within a year and dividing by the total number of days in the year.

**At-grade intersection:** an intersection or junction where streets join or cross at the same level.

**Basic plan:** a long-term urban plan that is prepared for category four and five small towns for 5-10 years planning period at the urban level (MUDC, 2014).

**Bollard:** post used to mark, delineate, or partition streets, walkways, cycle tracks, and urban spaces.

**Bus rapid transit (BRT):** High quality bus-based mass rapid transit system that delivers fast, comfortable, reliable, and cost-effective urban mobility through the provision of segregated right-of-way infrastructure, rapid and frequent operations, and excellence in marketing and customer service.

**City Block Design:** is urban design prepared for a city block based on Neighborhood Development Plan and urban design and is the basic unit forming the urban fabric showing where streets and buildings shall be laid (MUDC, 2014).

**Complete street:** a street that are designed for all users, including pedestrians, cyclists, public transport passengers, and personal motor vehicles, as well as street vending, trees, street furniture, and other elements.

**Coverage of streets:** the area occupied by streets divided by the total area of an urban centre.

**Cul-de-sac:** a dead-end local street.

**Floor finish level (FFL):** height of the surface of the ground floor of a building.

**Grade-separated intersection**: an intersection where streets intersect at different heights.

**Kerb extension or bulb-out:** part of street cross section where the vehicular lanes narrow to shorten the distance and time required for pedestrian crossings.

**Kerb:** the edge of a carriageway built of concrete or stone or other material higher than the level of vehicular lanes, separating the NMT zone from the vehicle zone.

**Mobility:** conditions under which an individual is capable of moving in the urban environment.

**Mode share:** the share of total trips carried out by a particular mode of urban transport, including walking, cycling, bus, paratransit, rail, two-wheeler, or car.

**Motorway or toll road:** streets designed to carry traffic in fast and unobstructed lanes, sometimes adjoined with service lanes or streets.

**Non-motorised transport (NMT):** Human-powered transport such as walking and cycling.

**Public transport (PT):** Shared passenger vehicles that are publicly available for multiple users. In this document, the term “public transport” is used to refer to MRT, paratransit, and formal road-based public transport services.

**Right-of-way (ROW):** The width of the street, taken from the compound wall/property edge on one side of the street to the compound wall/property edge on the other side of the street.

**Sustainable transport modes:** Compared with personal motor vehicles, sustainable transport modes consume the least amount of street space and fuel per person-km and also entail lower infrastructure costs: walking, cycling, and public transport (including a regular bus service as well as MRT systems).

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