National Vision of Non-Motorized Transport Infrastructure

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GLOSSARY

BMI	Body Mass Index
BPS	Badan Pusat Statistik / Central Bureau of Statistics
BRT	Bus Rapid Transit
CFD	Car-Free Day
DKI	Daerah Khusus Ibukota / Special Capital Region
ITDP	Institute for Transportation and Development Policy
LRT	Light Rail Transit
MRT	Mass Rapid Transit
NACTO	National Association of City Transportation Officials
NMT	Non-Motorized Transportation
PAUD	Pendidikan Anak Usia Dini / Early Childhood Education
PM	Particulate Matter
POI	Point of Interest
RDTR	Rencana Detail Tata Ruang / Rencana Detail Tata Ruang
Renstra	Rencana Strategis / Strategic Plan
RKPD	Rencana Kerja Pemerintah Daerah / Rencana Kerja Pemerintah Daerah
ROW	Right-of-Way
RPJMD	Rencana Pembangunan Jangka Menengah Daerah / Regional Medium Term Development Plan
RTBL	Rencana Tata Bangunan dan Lingkungan / Building and Environmental Plan
RTRW	Rencana Tata Ruang Wilayah / Spatial Plan
Tatralok	Tataran Transportasi Lokal / Local Transportation Level
TOD	Transit-Oriented Development
TPKPU	Tempat Perhentian Kendaraan Penumpang Umum / Bus Stop
UNEP	United Nations Environment Programme
ZoSS	Zona Selamat Sekolah / School Safety Zone

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OBJECTIVE

INTRODUCTION

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1.1 BACKGROUND

Non-Motorized Transport (NMT) is defined as any vehicle driven by human power. This includes walking, cycling, and other modes that do not use motorized power, such as horse carts and pedicabs. NMT is an important element in creating sustainable urban transportation systems that are environmentally friendly, safe, comfortable, efficient, and integrated across transportation modes.

Walking and cycling can be considered as efficient transport modes in terms of time and money saved, especially in urban areas where most of the trips made are short or medium-range. The availability of proper walking and cycling infrastructure to access transit points will in turn directly support the use of public transport.

Indonesia already has several rules and technical guidelines for NMT infrastructure development, especially to facilitate walking. Indeed, some city and regional governments have understood the importance in improving the use of NMT as the solution for a number of urban problems, such as pollution, traffic congestion, and high number of traffic accidents, which mainly occur in urban areas due to the high use of motorized vehicles. However, after several discussions with government officials, it emerged that city governments are facing issues in planning, designing, and implementing walking and cycling infrastructure. More specifically, they are having trouble determining priority locations, designing the NMT network, and adapting technical guidelines to suit their own unique urban characteristics.

To help cities improve and develop pedestrian and cyclist infrastructure, ITDP Indonesia worked with UNEP (United Nations Environment Programme) to publish a National Vision Non-Motorized Transport document as a practical guide for city governments planning and developing infrastructure for Non-Motorized Transport.

ITDP

Institute for Transportation Development Policy (ITDP) is a non-profit organization that works in cities worldwide in realizing a sustainable urban transit system as a way to cut greenhouse gas emissions and improve the quality of urban life. Founded in 1985, the Institute for Transportation and Development Policy (ITDP) has become a leading organization in the promotion of environmentally sustainable and equitable transportation policies and projects worldwide. ITDP Indonesia has been providing technical assistance to the provincial governments of DKI Jakarta, Medan, Semarang, and other cities for more than ten years on mass public transportation, parking systems and improving pedestrian infrastructure.

1.2 OBJECTIVE

This document is designed to both align the vision on improving the quality of NMT infrastructure and to be a practical guide to assist in planning and implementing NMT infrastructure for pedestrians and cyclists in the cities of Indonesia.

1.3 SCOPE OF THE GUIDELINE

In terms of vision, this document includes a brief discussion of the importance of improving the quality of NMT infrastructure and the pertinence of using NMT as an urban traffic solution. As a practical guide, the document incorporates elements and typology of road space design to help cities to realize that vision of improving the use of NMT. It illustrates this with success stories showing walking and cycling infrastructure development done by some cities in Indonesia and which can be adopted and adjusted to the particular needs and conditions of other cities.

**Note: This document may be updated at any time.*

1.4 GUIDELINE DRAFTING METHODOLOGY

Discussion with city authority and stakeholders

Field Observation

Survey

Case Study

Standard Setting

National Guidelines:
Minister of Public Works Regulation No. 3 of 2014 on Planning, Provisioning, and Utilizing Pedestrian Facility in Urban Areas • Ministry of Public Works and Housing Guidelines No. 02 of 2018 on Pedestrian Facility Planning • Minister of Transportation Regulation No. 67 of 2018 on Road Markings

International Guidelines:
ITDP TOD Standard 3.0 • ITDP Complete Street Design Workbook • NACTO Global Street Design Guide • NACTO Urban Bikeway Design Guide • AASHTO Guide for the Development of Bicycle Facilities • LTSA Cycle Network and Route Planning Guide • CROW Design Manual for Bicycle Traffic • Sustrans Handbook for Cycle-Friendly Design • Alta Planning+Design Creating Walkable and Bikeable Communities

PART 1

Non-Motorized Transport Vision in Urban Area

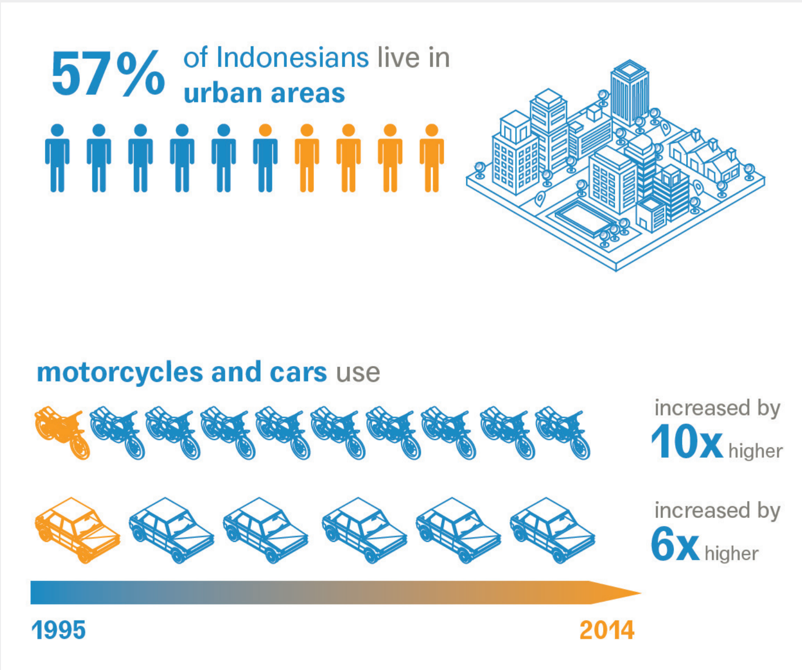
The first part of National Vision of NMT Facility covers the general concept of NMT and its pertinence as a solution for problems faced by urban areas in Indonesia. It also discusses the existing condition of NMT infrastructure in several urban areas of Indonesia to illustrate the urgency of developing acceptable facilities for pedestrians and cyclists.

2 NMT CONDITION IN INDONESIAN URBAN AREAS

2.1 DATA AND FACTS OF INDONESIAN URBAN AREAS

In 2019, 151 million (57%) Indonesian citizens lived in urban areas (World Bank, 2019). The growing urban population goes hand in hand with an increasing number of motorized vehicles: From 1995 to 2014, the number of cars increased six-fold while the number of motorcycles increased 10-fold in Indonesia (World Bank, 2019).

The rapidly growing motorcycle and car use in urban areas leads to urban issues such as pollution, traffic congestion, and a reduction in road safety. Below are some of the existing problems commonly faced by cities in Indonesia.



TRAFFIC SAFETY

From 2013 to 2017, traffic accidents in Indonesia increased by 0.77% a year. In 2017, there were 103,228 accidents with 30,568 fatalities (BPS, 2018).

HEALTH ISSUES

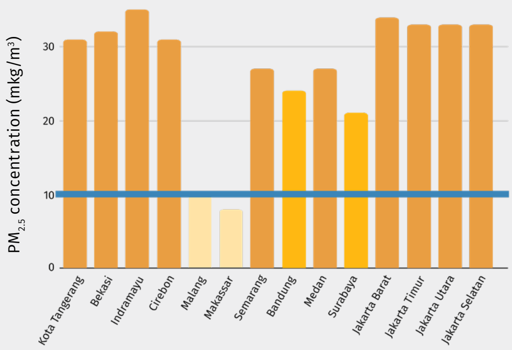
On average one in five Indonesians suffers from obesity, and the number is even higher in big city areas (Badan Penelitian dan Pengembangan Kesehatan, 2018).

SOCIAL GAP ISSUE

Motorized vehicles are inexpensive and easy to purchase, and many people buy one as a status symbol rather than because they need one. In Jakarta, the number of vehicle owners is greater than the population of Jakarta itself (Jakarta Smart City, 2018).

AIR POLLUTION

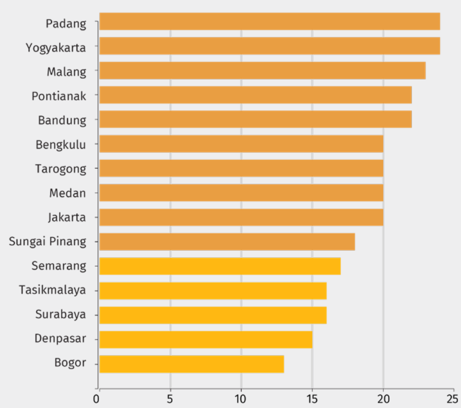
PM pollutant concentration in Indonesia doubled from 2013 to 2016 (Air Quality Life Index, 2019), and 80% of air pollution in urban areas is caused by motorized vehicles.



TRAFFIC CONGESTION

Congestion is all too common for most city dwellers in Indonesia. In fact, traffic congestion costs urban areas in Indonesia as much as 56 trillion rupiahs in fuel consumption and time wasted each year (World Bank, 2019).

Percentage of driving time spent in congestion



2.2 WALKING AND CYCLING BENEFITS

In the past, walking and cycling were the most common ways to get around in Indonesia, particularly for short trips such as going to school, to the office, for a picnic, or shopping. Today it's important to promote measures to increase the number of walking and cycling trips—they can be an integral element of urban transportation because they cost less other transport modes. With appropriate infrastructure and policies, walking and cycling may in fact offer the fastest traveling time for short trips. In addition to their efficiency, walking and cycling have the following benefits:

ENVIRONMENTAL SUSTAINABILITY

- Decrease in air and sound pollution.
- Increase in replanting and improved water management.
  Planting trees to provide shade for walkway and cycling lanes will improve cities' green landscape. Using permeable materials for sidewalks will also increase cities' water catchment areas.

TRANSPORT SYSTEM QUALITY

- Increasing public transport point accessibility (terminals, stations, stops).
  Based on the ITDP survey in Semarang, 60% of journeys to and 67% of journeys from Semarang BRT stops were done by walking. The popularity of walking to access the BRT stops implies that improvements of walking infrastructure can significantly increase public transport accessibility.
- Reducing traffic congestion.
- Reducing traffic accident numbers.
  Accident severity rate will increase in parallel to the speed of colliding vehicles. Reallocating some of the motorized vehicle road space to walking and cycling and implementing speed restrictions for motorized vehicles can directly improve road safety.

ECONOMIC ACTIVITY

- Increasing business and/or entrepreneurship opportunities.
- Increasing investment and area values on corridors through which pedestrians walk.
- Reducing daily transportation cost.

SOCIETAL HEALTH

- Improving physical health.
- Reducing mental and physical stress.

INCLUSIVITY

- Facilitating the mobility of all age, ability, and income groups, including vulnerable groups such as senior citizens, children, and people with disabilities.

SOCIAL INTERACTION

- Walking and cycling trips give more opportunities for social interaction.
- Pedestrian and cyclist spaces are parts of public space in urban areas. Improving those facilities will in turn improve the quality of public realms in cities.

2.3 CURRENT NMT-RELATED ISSUES

Based on field observation and interviews with a number of communities, the common problems faced by pedestrians and cyclists in various urban areas in Indonesia are as follows:

NON-NETWORK BASED

Jalan Guru Patimpus, Medan (2018)

Transport infrastructure should be designed to connect the initial location and destination of its user. However, sidewalks in urban areas in Indonesia are often built in sections instead of forming an integrated network of sidewalks. The lack of robust spatial planning and the fragmented construction of sidewalks means pedestrians often have to walk on roadways.

SECURITY AND SAFETY ISSUES

Jalan Pemuda, Semarang (2019)

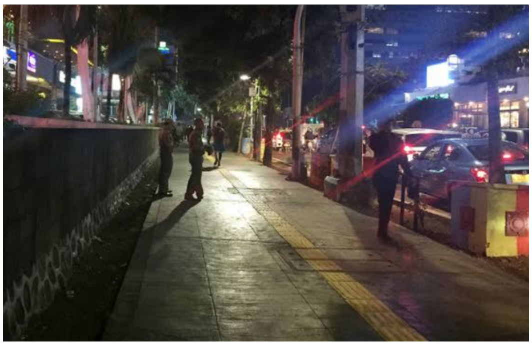
a. Lack of crossing facilities

Crossing facilities on roads or intersections such as zebra crossing are often long distances apart or sometimes nonexistent. This forces many pedestrians to cross the street directly—and dangerously—without using a crossing.

Jl. MT Haryono, Purbalingga (2017)

b. Use of design and materials that do not meet safety standards

Using ceramics makes sidewalk slippery when they are wet, increasing the risk of accidents, especially during rain. Inappropriate placement of supporting elements such as electrical poles, utilities like trash bins, and vegetation often block sidewalks.

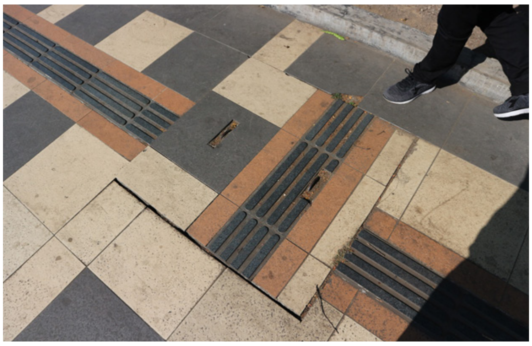


Jalan Wahid Hasyim, Jakarta (2019)

c. Poorly maintained existing facilities

Potholes or damaged surfaces and insufficient and poor lighting make journeys less convenient and more unsafe.

DIFFICULT ACCESSIBILITY FOR PEOPLE WITH DISABILITIES



Jalan Imam Bonjol, Semarang (2019)

Providing disability-friendly facilities for wheelchair users or visually impaired people has not been prioritized or even considered important yet. A few examples of the problem:

- Sidewalks are not wide enough to accommodate wheelchairs.
- Slopes that are too steep and lack of ramps to adjust for any height difference on surfaces.
- Nonexistent, insufficient, or inappropriate placement of tactile pavings.

LACK OF AWARENESS IN PRIORITIZING NMT USERS

Cipete Raya, Jakarta (2019)

Pedestrian infrastructure is often misused or abused by motorized vehicles—for instance, as vehicle parking spaces. Vehicles waiting on zebra crossing areas at intersections is a common problem, too. That causes problems for pedestrians because the vehicles take up space and do not stop or give them a chance to cross the road.

UNDERDEVELOPED CYCLING FACILITIES

Makassar (2019)

The bicycle is one eco-friendly mode of transport that is widely used in urban areas by many people, from school children and workers to street vendors. Yet bicycles have to share space with motorized vehicles, particularly on main roads. This has become a major safety issue, and that's the main obstacle to increasing bicycle use in urban areas in Indonesia.

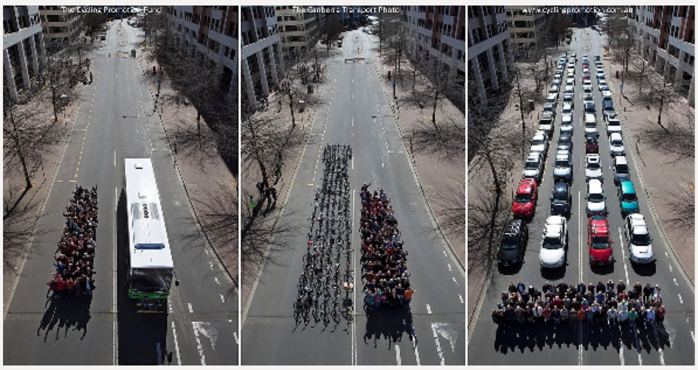
WHY DO URBAN AREAS NEED CYCLING SPACE?

1. Road space efficiency. A single road space can accommodate more bicycle users than car users and one car parking space can be used to park eight to 10 bicycles (Gallagher & Parkin, 2014).

2. Promotes the use of eco-friendly transport. Cycling uses only one-fifth of the energy used in walking.

3. Increases road traffic safety. Cycling infrastructures development in 12 big cities in U.S. has significantly reduced traffic accidents because car drivers have lowered their speed and become more careful on the road (Marshall & Ferenchak, 2019).

4. Improves health. Countries with the lowest Body Mass Index (BMI) levels are those which have high levels of walking and cycling. This shows that cycling as daily mode of transport can be utilized as an effective healthcare activity (Pucher et al., 2008).



Comparison of road space accommodation by using bus, bicycle and private cars for the same number of people (Cycling Promotion Fund, 2017)

3 VISIONS AND PRINCIPLES FOR PROVIDING NMT INFRASTRUCTURE

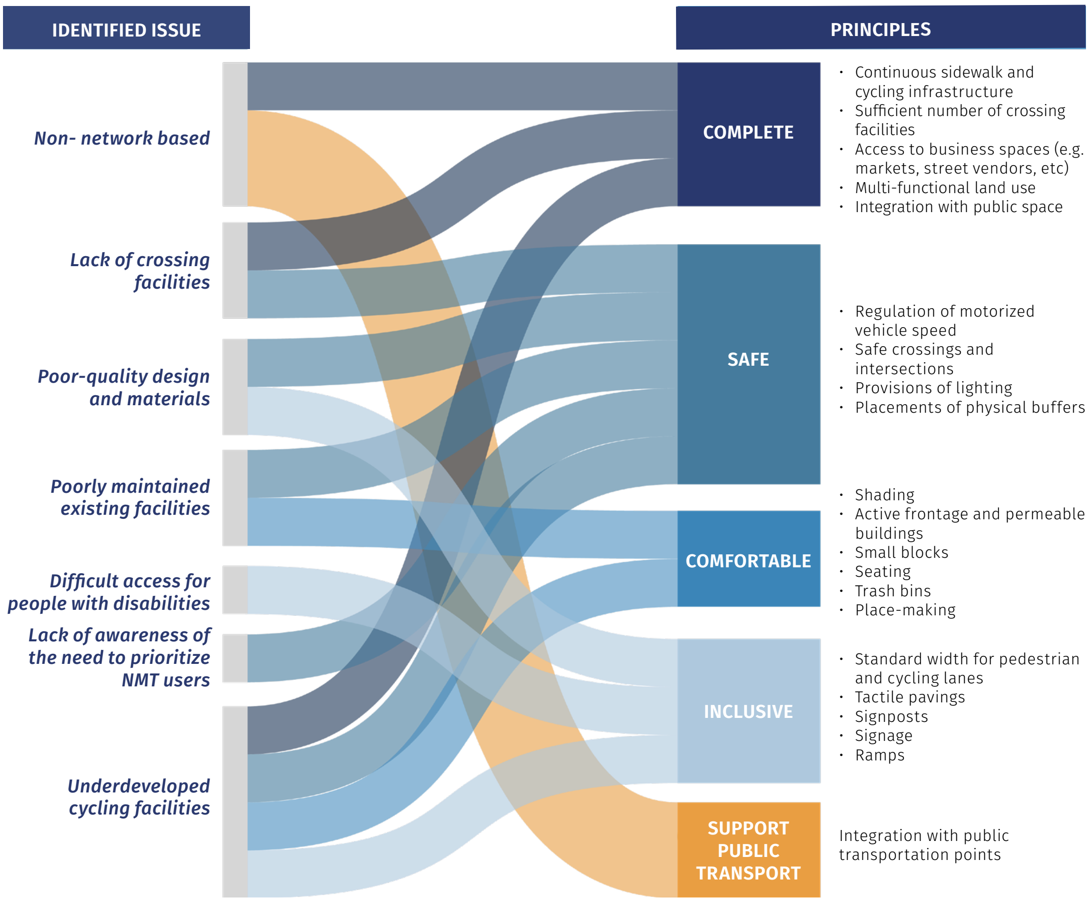
3.1 NMT VISION FOR INDONESIAN URBAN AREAS

Support for increasing pedestrian and cyclist numbers needs to be done comprehensively. In addition to creating policies and programs to support walking and cycling, infrastructure provision is also a crucial factor in boosting the numbers of pedestrians and cyclists.

The provision of NMT infrastructure should be based on a clear vision that sets out guidelines for long-term NMT development in a city. The first step in formulating the vision is analyzing existing issues and conditions faced by the city's citizens.

Based on the NMT-related issues identified in the previous section, the core vision in improving NMT usage in urban areas in Indonesia is:

Creating safe, comfortable, inclusive, and comprehensive walking and cycling space that supports public transport usage.



3.2 NMT FACILITIES PROVISION PRINCIPLES

1 COMPREHENSIVE

“Comprehensive” means building NMT and pedestrian network facilities that are continuous and also have integrated functions. Sidewalk networks and cycling lane routes need to be designed to make it easy for users to reach their destinations in the shortest distance possible. Walking and cycling will become attractive when destinations can be reached faster by walking or cycling than by driving a car.

KEY ELEMENTS:

- Continuous sidewalk and cycling infrastructure
- Sufficient number of crossing facilities
- Access to business spaces (e.g. markets, street vendors, etc)
- Multi-functional land use
- Integration with public space

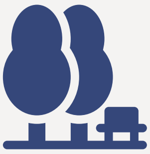
2 SAFE

Sidewalks and cycling lanes must be designed to ensure the safety and security of their users. The infrastructure should protect users from motor vehicle traffic or crime and meet safety requirements.

KEY ELEMENTS:

- Regulation of motorized vehicle speed
- Safe crossings and intersections
- Provisions of lighting
- Placements of physical buffers

3 COMFORTABLE



Comfortable walking and cycling space can encourage more people to walk and cycle longer and farther.

KEY ELEMENTS:

- Shading
- Active frontage and permeable buildings
- Small blocks
- Seating
- Trash bins
- Place-making

4 INCLUSIVE*

“Inclusive” means creating walking and cycling space that is easily accessible for people from every age-group, gender, and ability. This includes people with disabilities, women, children, and senior citizens.

** The official term used for this principle within the Indonesian public sector is "Gender Responsive"/"Responsif Gender", hence its usage in the Bahasa Indonesia version of this document*

KEY ELEMENTS:

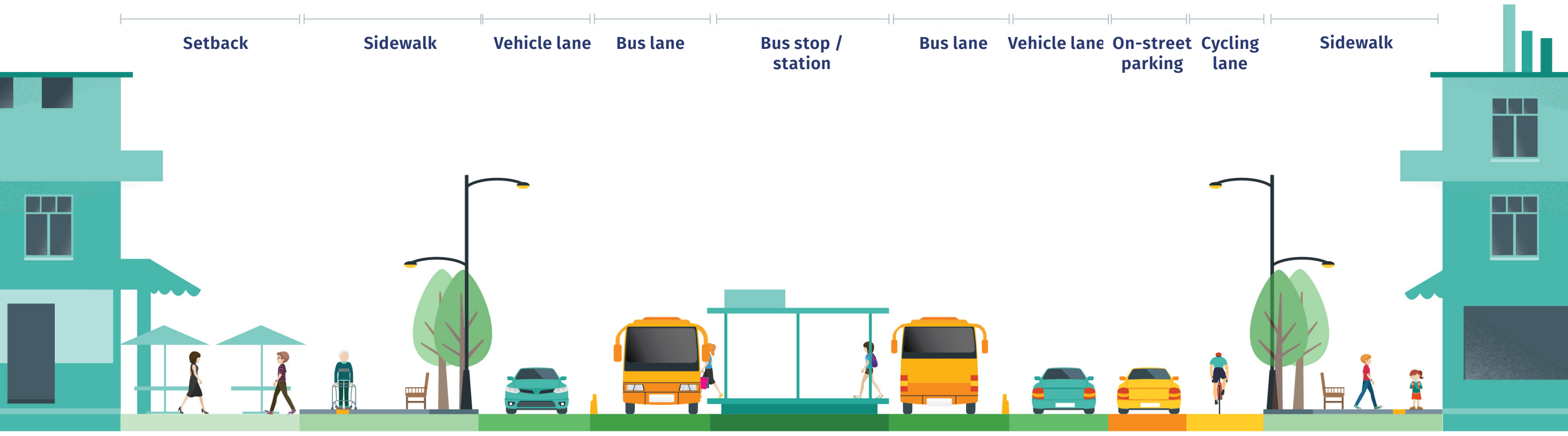
- Width dimension standard for pedestrian and cycling lanes
- Tactile pavings
- Wayfinding
- Signage
- Ramps

5 SUPPORT PUBLIC TRANSPORT

NMT facilities should be built to connect various land uses and activities to the city’s public transport system, thus encouraging the use of NMT

KEY ELEMENT:

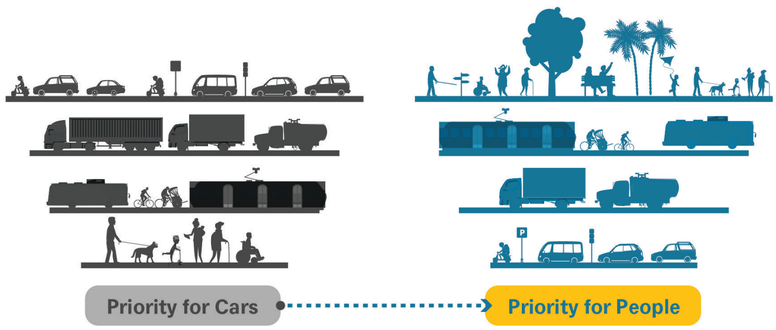
- Integration with public transport



Types of road users and road space division in complete street

3.3 COMPLETE STREET CONCEPT AND DIVISION OF ROAD SPACE

Providing pedestrian and cyclist infrastructure is inseparable from the concept of complete street infrastructure. That refers to a road that is accessible and can be used by every user, from pedestrian, cyclist, and driver to public transport user, and from every age-group and level of competency. It also encourages social and economic activities.



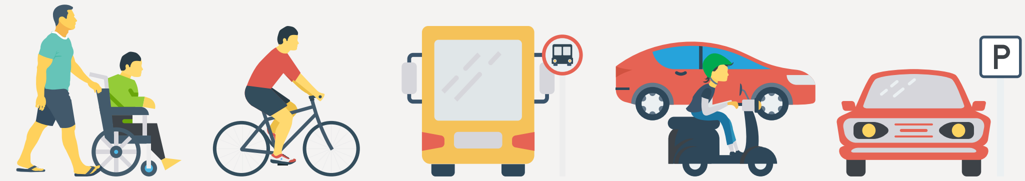
Roaduserspriorityinacomplete street

The current paradigm of providing and designing road space for vehicle movement should be shifted to providing space for mobility. Adopting this mind-set would ensure that limited road space in urban areas will be effectively designed for humans instead of for cars or motorcycles. The priority must be to build a comprehensive pedestrian, cyclist, and public space infrastructure and to place that above provisions for motorized vehicles.

ALL USERS

ALL AGES

ALL ABILITIES



1. Start by ensuring space is available for pedestrians
2. Give space to cyclists by prioritizing a cycling lane that is physically protected
3. Add space for public transport and its supporting facilities (stops)
4. Provide space for private vehicles (car, motorcycle, taxi, moto-taxi) with lane consistency principle
5. Can allocate remaining space for on-street parking.

Icons made by DinosoftLabs from www.flaticon.com

Completestreetimplementation in road space design

PART 2

Pedestrian And Cyclist Infrastructure Development In Urban Areas

The second part of the NMT National Vision document discusses the practical measures that should be taken to create safe, comfortable, comprehensive, and inclusive pedestrian and cyclist infrastructure. As a design guideline, this section provides the standard requirement of pedestrian and cyclist facilities as well design typologies that can be adopted accordingly to fit a city's unique requirements.

4 BASIC PRINCIPLES OF NMT INFRASTRUCTURE PLANNING AND DEVELOPMENT

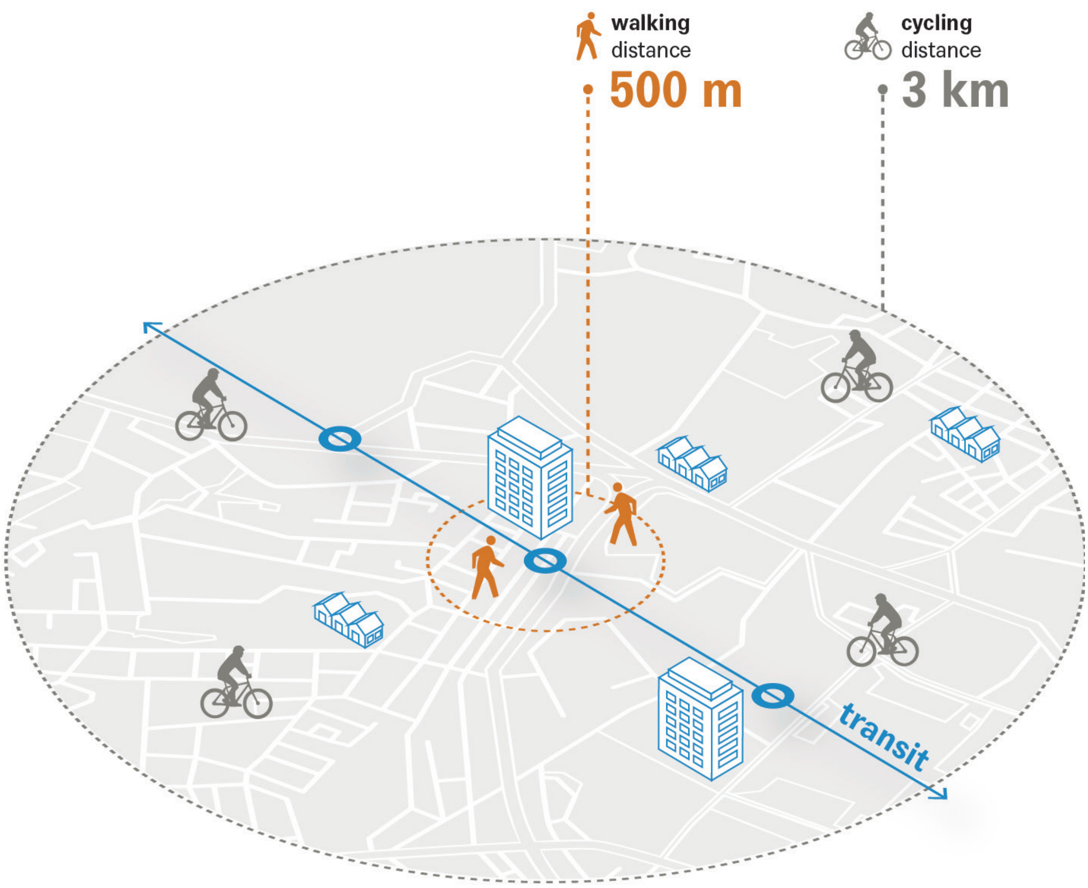
NMT facility development, particularly pedestrian and cycling infrastructure that is comprehensive, safe, comfortable, inclusive, and integrated with public transport, needs to be based on the understanding of pedestrian and cyclist characteristics.

Some basic characteristics that must be considered are comfortable distances that can be reached by walking and cycling, factors that influence people's behavior while cycling or walking, and also standard requirements of space in designing pedestrian and cyclist facilities.

4.1 DISTANCE, SPEED, AND SPACE REQUIREMENT

A. DISTANCE

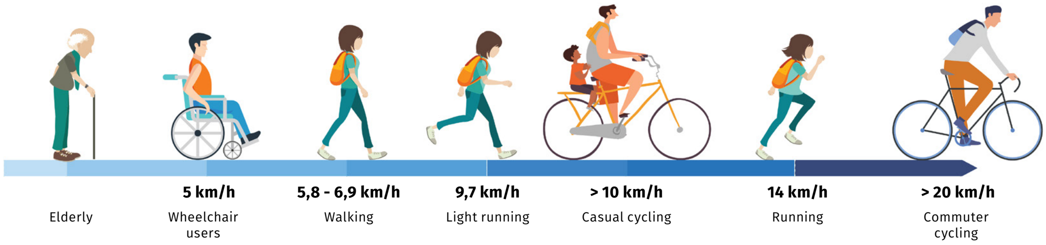
The comfortable distance is 500 meters maximum for pedestrians or 3 kilometers for beginner cyclists. Transit points like bus stops must be placed accordingly to connect the journeys. However, frequent hot weather can shorten the comfortable walking distance to 400 meters, and if pedestrians are carrying heavy goods, that further limits the desirable walking distance to 300 meters. Shade, such as trees or man-made shelters, as well as attractive surroundings such as active frontages can encourage people to walk or cycle farther.



Comfortablewalkingandcycling distance

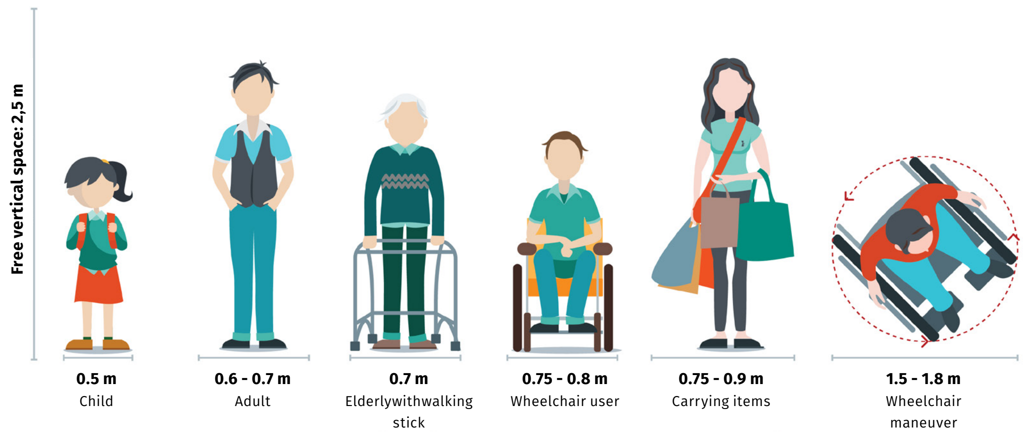
B. SPEED

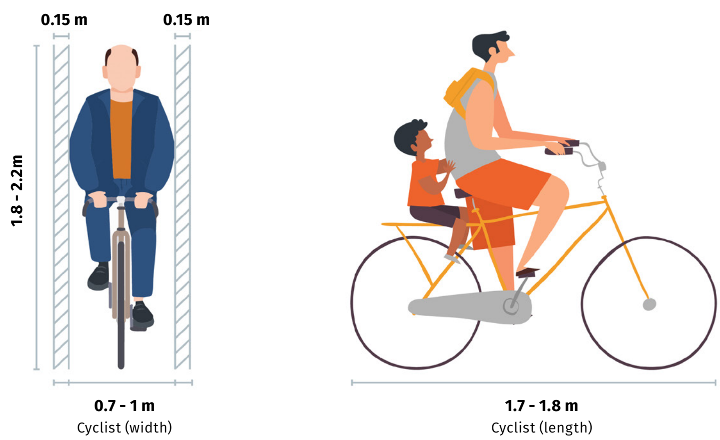
Users travel at various speeds, which means that extra space should be designed into the infrastructure to allow faster people to pass slower ones.



Various speeds to be accommodated in pedestrian infrastructure

C. SPACE REQUIREMENT





Space requirement of various users of NMT facilities

4.2 UNDERSTANDING CYCLISTS

When a city is about to build a non-motorized transportation infrastructure, it must tackle the planning and construction of pedestrian and cyclist facilities in a comprehensive and integrated manner so it functions optimally.

In cities in Indonesia, however, cycling lanes are often an afterthought in road space design. This results in a suboptimal design of cycling lane, such as by only adding cycling lane markings on an existing road space without considering the space requirement of cyclists.

Design principles and requirements for pedestrian infrastructure are discussed in detail under *Regulation of Ministry of Public Works and Housing No. 03, 2014 on The Guidelines of Planning, Providing, and Utilizing of Means and Infrastructure Network for Pedestrian in Urban Area* and the *Circular of Ministry of Public Works and Housing No. 02, 2018 on The Guidelines of Technical Planning for Pedestrian Facility*. However, national guideline documents that include detailed information about cycling infrastructure design are still scarce. This subsection is included to fill the gap and to provide basic information to understand the needs of cyclists prior to designing cycling infrastructure.

4.2.1 CHARACTERISTICS OF A CYCLIST

Some factors that need to be considered in the design of cyclist infrastructure are (Godefrooij et al, 2009; Sustrans, 2014):

1 Bicycle are capable of relatively high speed and needs space for maneuvering

The width and geometrical design of the bicycle lane should able to accommodate bicycles' speed and space requirements. For example, a bicycle lane should be separated from space for pedestrians, who move more slowly. Bicycles also need maneuvering space to make turns or stop at intersections.

2 Cycling requires human power

Just like pedestrians, cyclists are generally reluctant to travel a longer route because of detours. Cycling infrastructure should be designed to minimize the energy that cyclists need to expend. Therefore it is important to avoid steep inclines or a lack of ramps when there is height difference on sections of the cycling lane—in other words, anything that requires the cyclist to get off their bike or to slow down.

3 Cyclists are directly exposed to their surroundings

Cyclists do not have physical protection as car drivers do, which makes them highly vulnerable if there is a collision with a motor vehicle. Moreover, cyclists are also exposed to weather, so they need protection from direct sunlight or rain.

4 Varieties of cyclists

The design should accommodate a variety of cyclists, such as groups of beginners and vulnerable cyclists, like children.

5 Cycling as social activity.

Cycling is often a group activity, so if the bike lane is wide enough, groups can use it, such as parents cycling with their children.

4.2.2 FIVE PRINCIPLES OF CYCLING FACILITY

1. SAFETY

PROVIDE PHYSICAL PROTECTION

Add protection for bicycle lanes especially on routes with high mobility or speed

MATCH STANDARD DIMENSIONS

Design bicycle lane that meets safety standard

INTERSECTION DESIGN

Design intersections that minimize conflicts with other road users

TRAFFIC CALMING

Reduce motor vehicle speed, particularly on local streets and in residential areas

2. CONTINUITY

AVOID LONG DETOURS

Design quicker and shorter routes compared to those for motor vehicles

PRIORITIZING CYCLISTS

Give priority to cyclists, especially at crossings and intersections

3. COHESIVENESS

CONNECTING ORIGINS AND DESTINATIONS

Make routes that are continuous and connect cyclists' starting point and destination

CONSISTENT DESIGN

Use consistent and clear designs and markers that make navigation easy

SUPPORTING FACILITY PROVISION

Provide bicycle parking spaces in destinations and public transport points

4. COMFORT

ANTI-SLIP AND EVEN SURFACE

Use anti-slip and durable materials

SUFFICIENT WIDTH

Provide space to overtake or to cycle in pairs/group

AVOIDING STEEP INCLINES AND HAIRPIN CURVES

Design route that enables cyclists to move with ease

ROUTINE MAINTENANCE

Maintain the condition of the bicycle lane so it stays smooth and doesn't get flooded

5. ATTRACTIVENESS

INTEGRATED WITH ACTIVITY CENTERS

Designing routes that go through city activity centers, public parks or other public spaces

AVOID UNDESIRABLE AREAS

Designing routes that avoid remote places or areas with a high crime rate

ATTRACTIVE AND HARMONIOUS DESIGN

Create a design that enhances the aesthets of the surroundings

WHICH PRINCIPLES NEED TO BE PRIORITIZED AT THE START OF THE DEVELOPMENT OF BICYCLE LANES?

Safety, Route Continuity, Cohesiveness, Comfort and Attractiveness are the five basic principles that must be fulfilled in developing proper cycling infrastructure. These five principles were originally formulated in the *Design Manual for Bicycle Traffic* (CROW, 2017), a guideline for bicycle infrastructure development in the Netherlands, a country famous for successfully developing cycling culture by providing very high-quality infrastructure.

However, it is unavoidable that in the early stage of cycling infrastructure development some principles may have to be compromised in order to fulfill others. For example, if a road has a high volume of vehicles, fast traffic, or congested intersections and traffic engineering measures or intersection reconstruction seem impossible, then the route for the bicycle lane could be created a bit farther away for safety. Nevertheless, planning for the shortest possible route should be included in the longer-term plan of cycling infrastructure development.

The primary function of the proposed cycling network should determine how to prioritize principles, such as whether it will be a commuting route or one for recreational cycling (PRESTO, 2007).

Commuting Route

1. SAFETY
2. ROUTE CONTINUITY
3. COHESIVENESS
4. COMFORT
5. ATTRACTIVENESS

Recreational Route

1. SAFETY
2. ATTRACTIVENESS
3. COHESIVENESS
4. COMFORT
5. ROUTE CONTINUITY

5 DESIGN PREPARATION

Some preparations should be made before starting to design the NMT infrastructure in urban areas. These include existing conditions analysis, institutional framework identification, and city-level NMT vision and target formulation.

5.1 ANALYSIS OF EXISTING CONDITIONS

In order to improve a city's NMT system, we first should understand what needs to be addressed and improved. An inventory of baseline data should be collected, including current infrastructure conditions, NMT usage level and user behavior, existing policies, and existing development plans.

5.1.1 ANALYZING EXISTING POLICIES AND DEVELOPMENT PLANS

Inventorizing of policy and development plan is done by analyzing planning documents and existing regulations in each administrative area.

Related Document	Parts that need to be studied
1. **RPJMD** (Rencana Pembangunan Jangka Menengah Daerah) 2. **Renstra** (Rencana Strategis) Perangkat Daerah 3. **RKPD** (Rencana Kerja Pemerintah Daerah) 4. **RTRW** (Rencana Tata Ruang Wilayah) 5. **RDTR** (Rencana Detail Tata Ruang) 6. **RTBL** (Rencana Tata Bangunan dan Lingkungan) 7. **Tatralok** (Tataran Transportasi Lokal) 8. **Regional regulation** 9. **Mayor regulation**	1. **To what extent the documents have regulated the development of NMT infrastructure?** 2. **How do the planning documents affect the development of NMT infrastructure, whether directly on indirectly?** For example, NMT infrastructure development can be prioritized on planned activity center locations. 3. **The policy gap** in related to the development of NMT facility.

5.1.2 ANALYZING CURRENT NMT CONDITIONS

Inventorizing existing conditions should be done to understand the urgency, actual user needs, and identify prioritized locations for NMT development in cities. Some aspects which should be analyzed are:

1. NMT USAGE

1. The number of pedestrian and cyclist in some road space.
2. Local residents percentage that use NMT as daily mode of transport.

2. NMT INFRASTRUCTURE CONDITION

1. The length, location and condition of existing pedestrian and/or cyclist facility.
2. The percentage of street length that has been equipped by sidewalks that meet accessibility standard.
3. Number of transit points (stations, terminals and stops) that are connected with sidewalks or bicycle network which meet accesibility standard.
4. The percentage of school that is connected with sidewalks and bicycle network that meet accesibility standard.

3. NMT ISSUES

1. Number of accidents and accident locations which involving pedestrian, cyclist or other NMT.
2. Present issues faced by pedestrian, cyclist and other NMT users.

5.2 FORMULATION OF VISION, TARGET AND LOCAL PROGRAM RELATED TO NON-MOTORIZED TRANSPORT

Vision

How should the conditions be for walking, cycling, and other NMT mode usage?

Vision example:
Create a complete, safe, comfortable, and inclusive walking and cycling space that supports the use of public transportation

Objective

What should be achieved?

Objective examples:
- Improve the accessiblity of public transportation by walking or cycling
- Reduce the rate of pedestrian and cyclist accidents
- Create accessible pedestrian infrastructure
- Create an NMT network that connects origins and destinations

Target

To what extent must these objectives be achieved?

Targets should be:
Specific
Measurable
Achievable
Relevant
Time-bound

Target examples:
- 50% of bus stops are accessible from sidewalks and/or cycling lanes that meet accessibility standards in 2020
- The number of accidents involving NMT users decreases by 50% in 2020
- 75% of urban road length is equipped with sidewalks/ cycling lanes in 2020

Program

What should be done?

Program examples:
- Prioritize the construction and improvement of pedestrian and cyclist infrastructure within 500 m radius of bus stops
- Build protected cycling lanes on main roads and intersections

As a first step, there should be a vision that illustrates the condition for walking, cycling, or other NMT use that achieves desired and also a clear and measurable target to set for that vision.

Based on general issues commonly faced by pedestrians and cyclists in urban areas in Indonesia, the component of national vision should cover the principles of comprehensive, safe, comfortable, inclusive, and supportive public transport use. This vision foundation can be adopted by city governments but also can be adapted to fit specific issues or the wishes of pedestrians and other local NMT users.

It is recommended that cities develop a **local NMT masterplan document** to ensure comprehensive planning of NMT infrastructure. The vision, objectives, targets, and programs will be included in the city's NMT masterplan document, which will be the basis for medium- to long-term development of NMT facilities.

CRITERIA OF A GREAT VISION

1. **Describes the desirable conditions of NMT clearly** (particularly those of pedestrian and cyclist).
2. **It is based on real NMT issues** that are present and need to be tackled.
3. **It is able to serve as a clear guideline** for formulating goals, programs and achievable targets.

5.3 CONDUCT PUBLIC CONSULTATION FORUMS

A public consultation forum is held to engage the community or local community in identifying issues and expectations regarding the standard of non-motorized transportation trips. The forum can be through discussion sessions, workshops, surveys, or public hearings.

Public involvement process in each stage of NMT infrastructure development stage (adapted from GIZ, 2016)

Further information on holding public consultation forums can be found in the *Minister of Administrative and Bureaucratic Reform Regulation No. 16 of 2017* concerning Guidelines for Organizing a Public Consultation Forum Within Public Service Provider Unit

1. Pre-construction

Stakeholders

Between local public institutions:
- Mayor
- House of representatives
- Government agencies

Inter-public institutions:
- National government
- Provincial government
- City government

Engagement methods
- Discussions and presentations
- Pre construction meeting
- Focused group discussion
- Classroom discussion

Stakeholders

Citizens
- District, sub-district, neighborhood communities
- Other communities (e.g. NMT, children, and disabled advocacy groups and communities

Other communities
- Land owners
- Business owners

Engagement methods
- Focused group discussion
- Survey
- Public hearing
- Campaigns and publications

Outputs
- Regulations/decree regarding NMT development
- Pedestrian and cycling network master plan
- Detailed engineering drawing
- Project budget plan
- Annual city budget plan (RAPBD) which contains NMT project budget

2. Construction

Stakeholders
- Public institutions
- Citizens
- Other communities

Engagement methods
- Public hearing

3. Post-construction

Stakeholders
- Public institutions
- Citizens
- Other communities

Engagement methods
- Campaigns and publications

Execution of collaborative planning process in Sunter Jaya, Jakarta

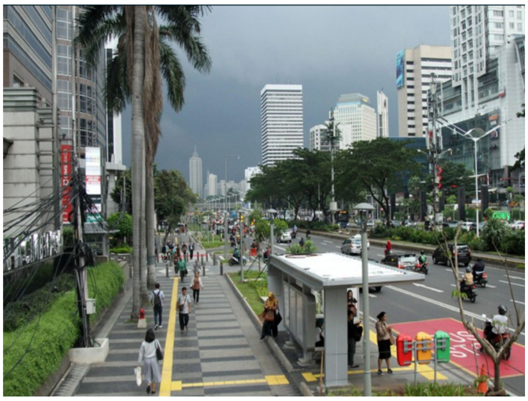
6 PLANNING FOR NMT NETWORK

Based on *Regulation No. 22 of 2009 Section 25 Article 1 about Traffic and Public Transport*, parts of the infrastructure for pedestrians, cyclists, and people with disabilities are considered road elements that should be provided and utilized in public roads. Therefore, providing pedestrian and cyclist infrastructure cannot be separated from road development and construction.

However, there are still sections of road in urban areas of Indonesia that are not sufficiently equipped for pedestrians and/or cyclists. One question that often arises is how to prioritize the location of pedestrian and cyclist developments or improvements in a specific area, given the limited resources. This chapter will discuss some approaches to help determine the best location.

Three key aspects of pedestrian and cyclist network planning are:

Network based
Continuous, connecting origins and destinations



Integrated with public transport points

Connects city activity or economic centers

Visual representation of data in the form of map or diagram can help people to understand the data more easily and clearly.

Below are some basic data collected in network design and area determination for development priority (Alta Planning+Design, 2012):

Location and condition of existing pedestrian and cyclist facility

Activity center points

Points of Interest and land functions zoning

Public transport transit points

Terminals, stations, bus stops, and the amount of passenger that get on/off in said transit points.

Physical obstacles to walking or other NMT modes

River, inclines, rail road, toll road.

Road network map and related data

Road classification, road width and space, number of lanes, average speed and planning, vehicles volume

The amount of pedestrian and cyclists on number of road segments

Demographic data

Population dispersion based on group age, gender and income and job location dispersion.

Accident rates and locations of pedestrians and cyclists

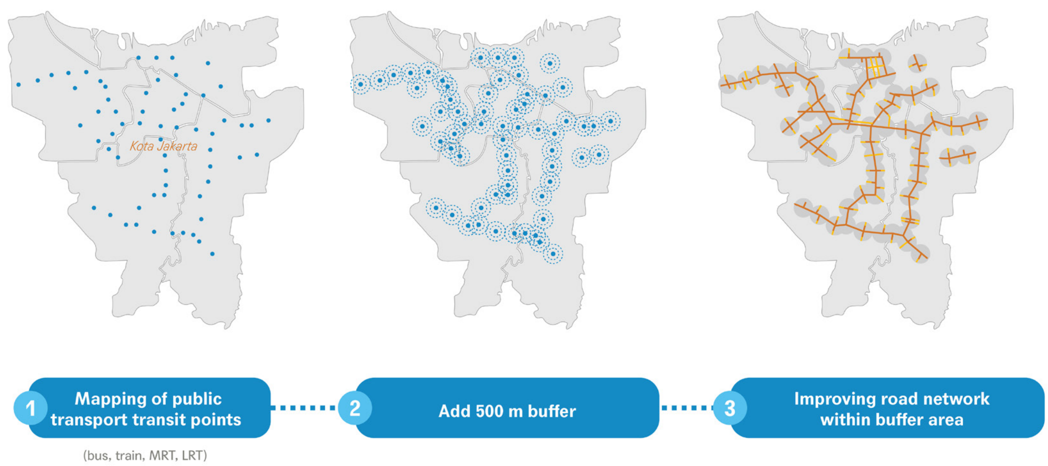
These are mapped Points of Interest:

- **Housing Area** Housing complex and apartments
- **Transit Points** Train station, bus terminal, and bus stops
- **School and University Buildings** School safety zone
- **Office and Industry Center**
- **Shopping and Recreation Center** Old towns, halls, markets, malls, city parks, and other tourism spot.
- **Public Facility** Government buildings, hospitals, places of worship
- **Sport Facility** Stadium

6.1 PEDESTRIAN NETWORK DESIGN BASED ON TRANSIT POINTS

Pedestrian infrastructure that helps people to access public transport points in Jakarta, Indonesia (above)

The first step in determining priority locations for the development or improvement of pedestrian infrastructure is prioritizing integration with public transport points. Locations surrounding public transport points can be perfect for starting to develop a pedestrian network. Improving the quality of sidewalks that directly access the available transit points helps make walking the most attractive mode of transport for reaching public transport points.

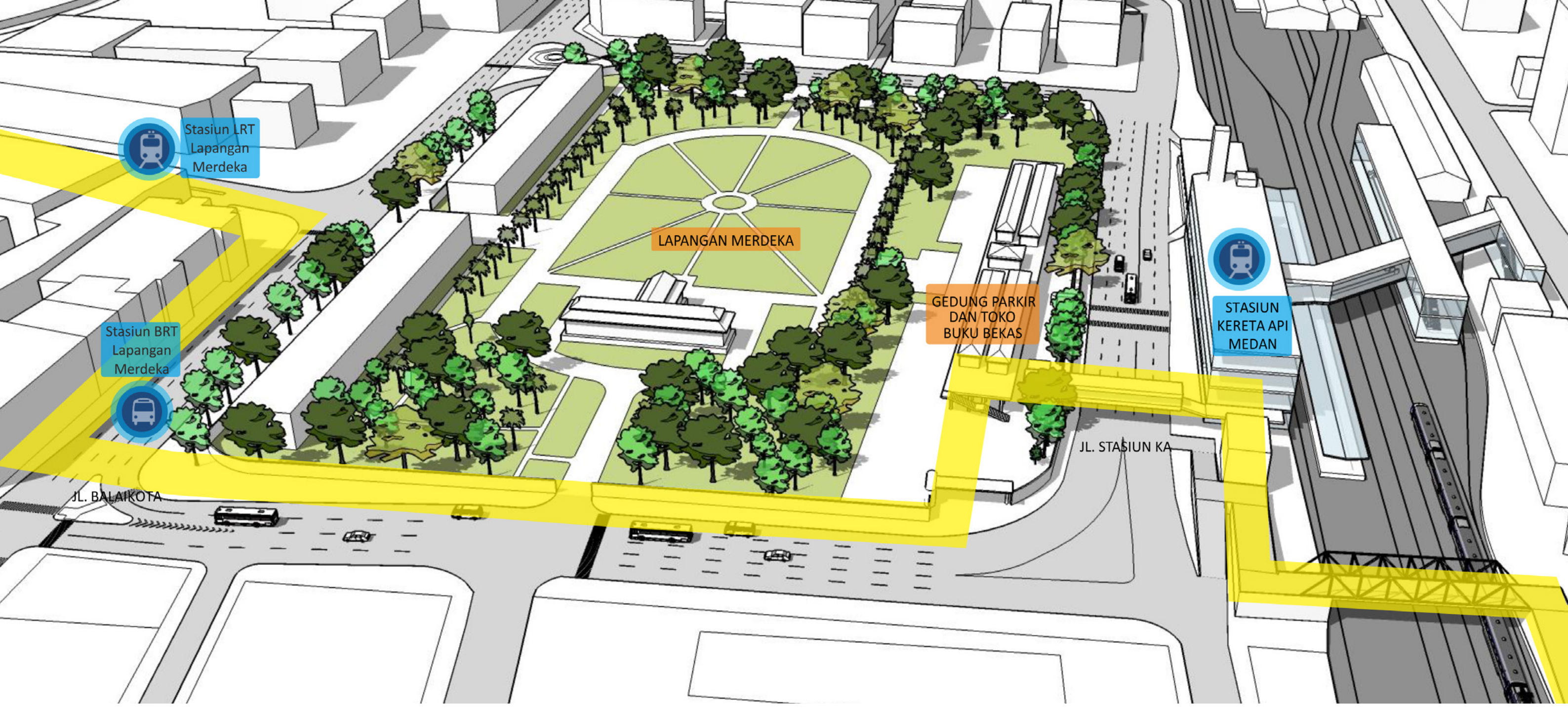


APPLICABLE IN:

Urban areas in Indonesia that already have a developed (preferably mass) public transport system with predetermined routes and stopping points such as bus stops, terminals, or stations.

STEPS:

1. Map of public transport transit points (bus stops, terminals, stations).
2. Place buffers within 500 m of the identified transit points that cover areas that can be reached by a 10-minute walk.
3. Improve the existing road network within buffer area to accommodate pedestrians.
4. Prioritize transit points with highest ridership for the early phases of development.



6.2 PEDESTRIAN NETWORK DESIGN BASED ON ACTIVITY CENTERS

Illustration of high-quality pedestrian infrastructure to reach city activity center in Medan, Indonesia (above)

If a city does not yet have a mass public transport system, priority can be given to areas around the city's activity centers by identifying activity points such as city halls, city parks, or the city's old town.
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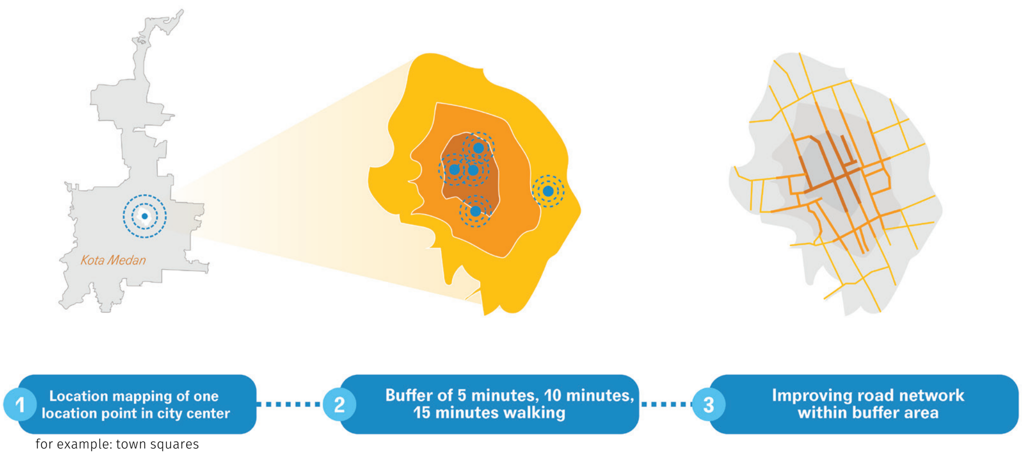
6.2.1 FOR CITIES WITH ONE ACTIVITY CENTER



APPLICABLE IN:

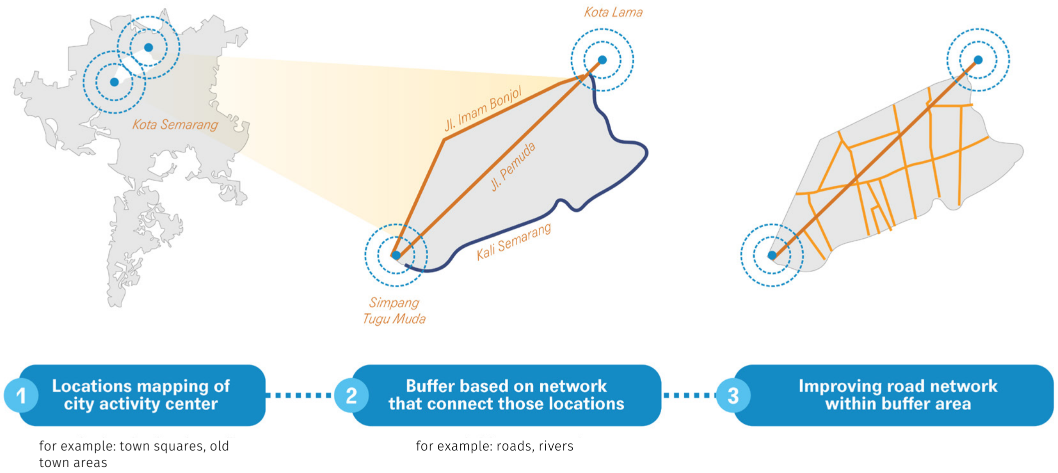
Cities that have only one significant activity center, such as city square or city park.

STEPS:

1. Determine one point of city activity center (hall or city park).
2. Determine buffers based on 5 minutes, 10 minutes, and 15 minutes of walking. Buffer determination method:
   - a. Walk from starting point (activity center location) to the north
   - b. Make note of stopping points after 5 minutes, 10 minutes, and 15 minutes of walking
   - c. Repeat steps A and B from starting point to the south, west, and east
   - d. Connect noted points to create buffer for each section of journey.
3. Development starts from the prioritized location inside the 5 minutes walking buffer, then it continues on to the 10 minutes walking area and so on.

6.2.2 FOR CITIES WITH MORE THAN ONE ACTIVITY CENTER

Illustration of pedestrian infrastructurethatconnectscity activity centers in Semarang, Indonesia



APPLICABLE IN:

Cities that have several activity centers or a main economic corridor.

STEPS:

1. Determine the location of city activity centers such as halls, old towns, and so on.
2. Create buffers based on physical edges surrounding those locations, such as a road or river.
3. Develop pedestrian infrastructure starting from roads within buffer areas

6.3 NMT NETWORK DESIGN BASED ON SCHOOLS

Pedestrian-andcyclist-friendly area around schools

Walking, cycling, or using public transport is the most common way for most students to get to school in Indonesia, especially those from lower classes. This is possible because trips from home to school tend to be short compared to the average distance from home to office.

Regulation of Land Transport 2018 about School Safety Zone (ZoSS) specifies prioritizing safety for pedestrians by restricting vehicle speed; prohibiting on-street parking; and providing crossings in school areas. ZoSS needs to be equipped with safe pedestrian and cyclist infrastructure.

APPLICABLE IN:

Any city

STEPS:

1. Identify school locations, prioritizing early-childhood education centers (PAUD), elementary schools, and middle schools.

   Aspects to consider in determining priority schools:

   a. The number of students in the school
   b. The number of traffic accident reports around the school's surrounding areas

2. Create linear buffer with 150 m length on left and right side of school (based on ZoSS criteria) and mark it as Priority Area 1.
3. Identify transit points and housing areas that can be reached within 10 minutes walking or 500 m radius and mark them as Priority Area 2.
4. Development is done from within Priority Area 1 to Priority Area 2.

6.4 NMT NETWORK DESIGN BASED ON RESIDENTIAL AREAS

NMT-friendlyresidentialareain Makassar, Indonesia (above)

One way to encourage urban residents to start using public transport or NMT modes is by increasing the safety and comfort of walking and NMT use around where they live. This approach needs to use participative and collaborative planning and a design process that involves local residents, because they are most of the users of the road space.

Vulnerable groups such as children, women, and people with disabilities mostly walk and cycle to reach activity spots near their houses or to access public transport stops. Therefore, these vulnerable groups should be involved in the design process so the resulting infrastructure can effectively accommodate their needs.

The success of implementing a NMT network in a housing area relies greatly on the commitment of the local residents to maintain the infrastructure and to enforce rules and regulations that have been agreed, such as not allowing any motorized vehicles not owned by local residents to pass through the residential streets.

APPLICABLE IN:

Housing area

STEPS:

1. Determine location and hold meeting with local community leaders.

   Determine priority housing location to develop NMT facilities based on:

   a. Proximity to public transport transit point
   b. Residents' willingness to participate in the planning and design process

2. Identify issues that impact every group in the resident community through discussion, interview, field survey, and travel diary.
3. Map area and issues, along with data analysis.
4. Conduct public hearings on the design and development plans.
5. Implement development by including the local residents or communities.

The planning process in a residential area can be seen in the diagram below:

1 approach

early stage meeting to establish network with societal organization and local community

2 issue identification

data collecting through interview, observation and perception discussion especially with vulnerable group

3 mapping

area and issue mapping participatively and issue confirmation

4 idea & recommendation

public discussion of area planning and designing with community

5 implementation

area arrangements by related local work unit which involving local residents (e.g: community service).

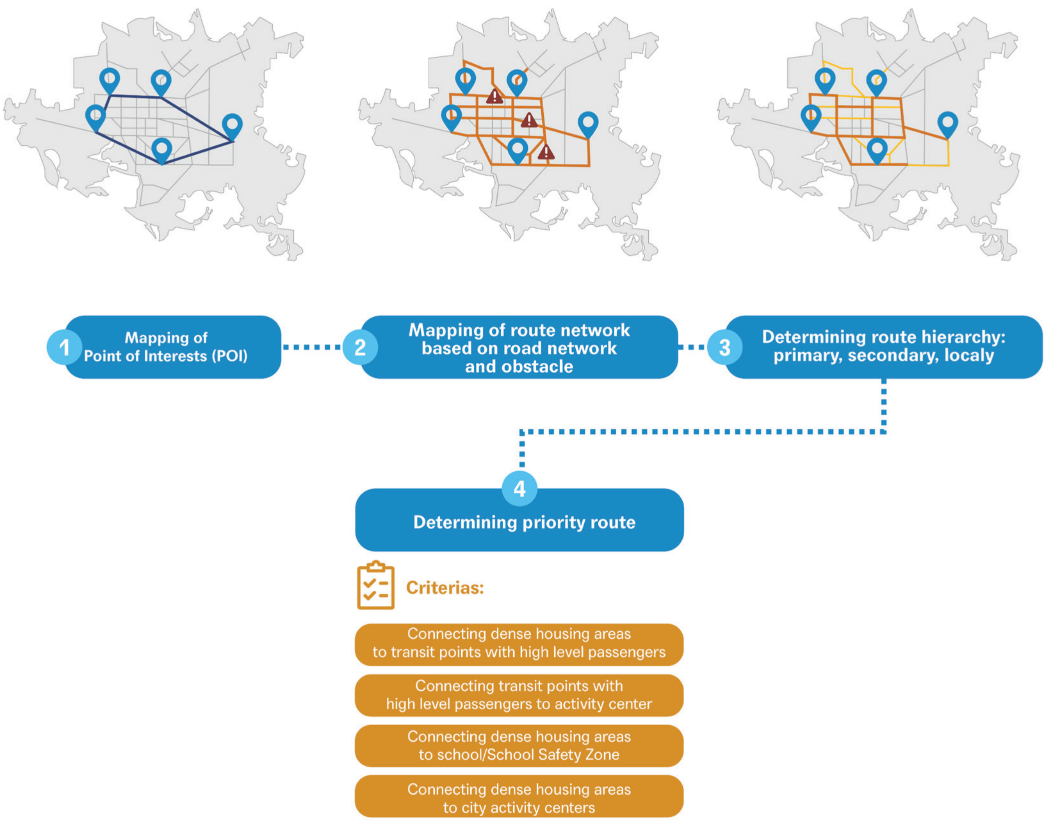
Local residents' involvementisnecessaryat every step to encourage a sense of belonging toward the development of NMT infrastructure.

6.5 BICYCLE NETWORK DESIGN

Safe and convenient cycling infrastructure that can be used by every age and income group in Tokyo, Japan.

As discussed in Chapter 6, the characteristics and requirements of cyclists are different to those of pedestrians. Cyclists can travel farther than pedestrians, which means bicycle lane network design should be done on a more strategic level by mapping bicycle lane routes at city scale.

Bicycle lane networks in an urban area should be designed comprehensively based on safety principles, route continuity, and cohesiveness. In other words, a city bicycle route network should allow cyclists to reach activity centers or public transport points safely, easily, and quickly.



Below are the steps that need to be taken in planning a bicycle network and route (Godefrooij et al., 2009; LTSA, 2004; GIZ & SUTP, 2016):

1 Establish the goals of cycling network development

Strategic goals at the city level will become a guideline for future network development. Examples of strategic goals in cycling network development include:

- Increasing accessibility of public transit points by bicycle
- Developing child-friendly city by connecting housing areas and schools to pedestrian and cycling lanes
- Increasing connectivity between housing areas and city activity centers

2 Identify the origins and destinations of travelers

A bicycle lane network should connect residents' travel origins and destinations. Generally, bicycle trips go from housing areas to city activity centers or transit points. Therefore, these tasks must be done:

- **Map land use.** As a first step, RTRW and RDTR documents can be used to generally map city residents' travel origins and destinations.
- **Map trip origins and destinations.** These points should be identified to map main activity points or points of interest (POI) in the area.

3 Identify the level of importance of each identified POIs

The level of importance on each POI can be identified by predicting the potential number of bicycle users at the POIs. Indicators that can be used to prioritize origins and destinations that should be connected by the cycling network are:

Types of activity center point	Indicator
Housing area	Number of residents per income group
Office area	Number of occupations
School / University	Number of students
Shopping area	Size of shopping space
Public transport point (terminal/station/bus stop)	Number of passengers

The identified main origin and destination points should then be connected by desire lines.

4 Identify potential routes for cycling

Three identification methods can be used for determining the routes:

- The shortest routes that connect identified origin and destination points from step 3.
- Data of traffic and cycling volume. If there have not been many cyclists in one area, traffic volume data can be used, assuming that the number of potential cyclists in a road segment is proportionally aligned with existing traffic on that road segment.
- Cyclists testimonials. Surveys, interviews, or workshops can be conducted with local bicycle communities to collect data about the routes they often use.

5 Identify obstacles on the potential routes

An initial phase of cycling infrastructure development in Jakarta, Indonesia (above)

Identify obstacles such as:

- Topography (inclines, rivers and etc.)
- Road segments with dense vehicle volumes (especially trucks and busses)
- Wide and crowded intersections
- One-way streets
- Areas considered unsafe by pedestrians and cyclists
- Other obstacles that can hinder cycling journeys

6 Design a complete cycling network and the necessary supporting facilities on a city/regional scale.

Make a map of the bicycle network based on the results of the data analysis from steps 2 to 5, with a hierarchy as follows:

- **Primary Route:** Connects primary activity center points, dense housing areas, and primary public transport points with a design speed of 30 km/h (to accommodate high-speed commuter cyclists)
- **Secondary Route:** Connects primary routes and secondary activity center points
- **Access Route:** Cycling lanes on local street to access primary or secondary routes

7 Determining development priority segments.

In most cases, a cycling network is developed gradually. Some criteria can be used to determine the initial routes based on the determined goals of cycling network provision in each city (as in Step 1).

It should be noted that the proposed priority routes are just the first steps toward a dense city-wide cycling network. In the long term, a city cycling network has to cover as much area as possible, with a maximum distance of 250 m between routes (CROW, 2017). The following criteria can be used for determining priority routes, based on the predetermined cycling network goals:

Route prioritization criteria	Notes
a. Transit based: 1. Connecting dense housing area to public transport points with high number of passengers 2. Connecting public transport points with high number of passengers to activity centers (office/shoppping area/ public facilities)	*1. Can be the main priority in cities with a developed mass transport system* *2. There should be supporting facilities to enable intermodality at public transport points, such as bicycle parking facility or bike-sharing*
b. School based: Connecting residential areas around schools with the school areas/School Safety Zones	*1. Safety aspects should be made the utmost priority in designing a cycling network for schools* *2. Under 6 km should be considered the optimal journey distance by cycling*
c. City activity based: Connecting dense housing area with city activity centers	*It should be considered that the optimal journey distance by cycling is under 6 km*

7 DESIGN FOR PEDESTRIAN AND CYCLIST INFRASTRUCTURE

7.1 Pedestrian Infrastructure

7.2 Cycling Infrastructure

7.3 Supporting Infrastructure

7.1 PEDESTRIAN INFRASTRUCTURE

MULTI-UTILITY ZONE

With a minimum width of 0.6 m (should be adjusted based on the type of street furniture installed) or 1.5 m if it is a green lane.

PEDESTRIAN ZONE

With a minimum width of 1.5 m to accommodate two pedestrians passing each other, or a minimum width of 1.8 m to accommodate wheelchair movement.

BUILDING FRONTAGE ZONE

With a minimum width of 0.75 m (should be adjusted based on building functions and the presence/ absence of sidewalk commercial space).

Pedestrian infrastructure comprises several elements aside from the pedestrian zone, as can be seen above. Appropriate provision and placement of those elements is needed for a sidewalk to function well for every user. The good practices that should be applied in designing pedestrian infrastructure are elaborated in the following pages.

7.1.1 CONTINUOUS SIDEWALK

DESIGN CONCEPT

1. Provide obstacle-free moving space with a minimum width of 1.5 meters (a minimum of 1.8 meters is recommended to accommodate passing wheelchair users).
2. Ensure it is uninterrupted by driveway lane, road furniture, or other objects.
3. Provide ramps for any height difference on the pedestrian path.

A. Space requirement for pedestrian infrastructure

Width of pedestrian zone

Minimum-width calculation formula:

$$W = V/35 + N$$

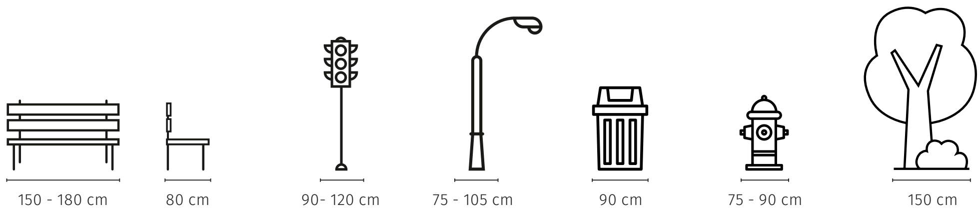
W minimum width of pedestrian zone (m)
V two-way pedestrian volume (person/min/m)
N additional width (m) with values described on the table below:

N (m)	Two-way pedestrian volume	Location example
1,5	> 33 person/min/meter	Market, terminal
1,0	16-33 person/min/meter	Shopping areas besides market
0,5	< 16 person/min/meter	Other areas

Space allocation guideline for pedestrian zone

Land use	Recommended width	Minimum width
Housing	**2,75 m**	1,6 m
Office	**3 m**	2 m
Industry	**3 m**	2 m
School	**3 m**	2 m
Station/terminal/bus stop	**3 m**	2 m
Commercial area	**3 m**	2 m

Space allocation guideline for multi-utility zone

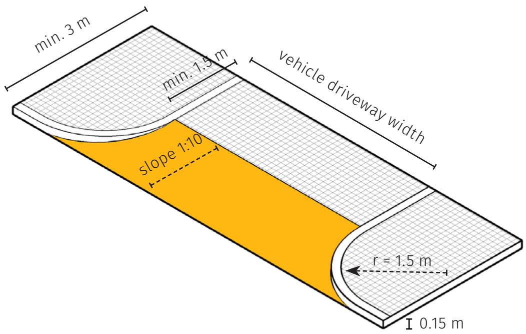


An example of pedestrian lane interrupted by road furniture (left)

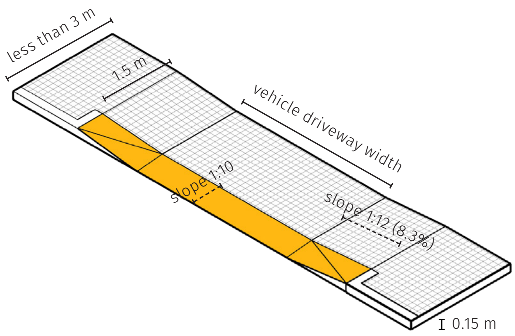
An example of effective space of pedestrian lane with sufficient width (right)

B. Driveway design for continuous sidewalk

Discontinued sidewalks at driveways is one of the most common problems found in pedestrian infrastructure design. Sidewalks should have a consistent height at driveways to ensure continuity. Continuous sidewalk design at driveways will give priority to and improve safety for pedestrians by forcing motorized vehicles to slow down when accessing the driveways.



Alternative 1 For min. 3 m-wide sidewalks



Alternative 2 For less than 3 m-wide sidewalks

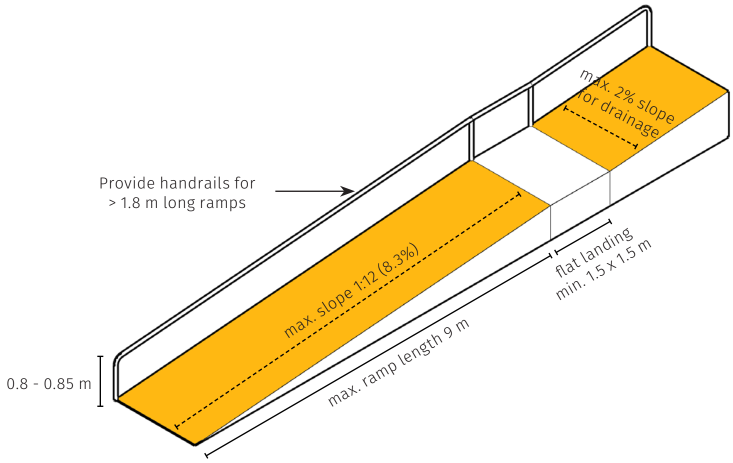
Example of pedestrian lane discontinued at driveway (top left)

Good examples of driveway design in Jakarta (top right), Osaka, Japan (bottom left), Bogota,Colombia(bottomright).

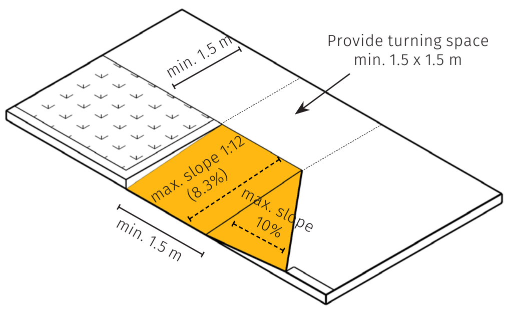
C. Mandatory provision of ramps

Ramps are mandatory when there is a height difference on sidewalks to create an inclusive walking environment that can be easily accessed by users of different abilities. The recommended maximum inclination of the ramp to allow people in wheelchairs to move independently is 1:12 (8.3%). A level surface to rest should also be provided, with a minimum length of 1.2 m for every 9 m of ramp.

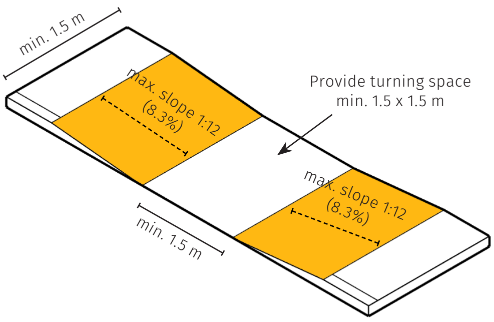
Maximum inclination of ramps



Curb ramp design guideline at midblocks

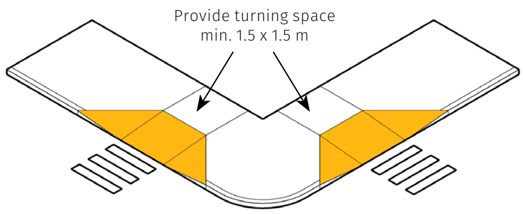


Alternative 1 Perpendicular curb ramp

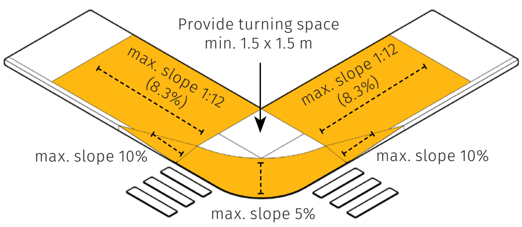


Alternative 2 Parallel curb ramp

Curb ramp design guideline at intersection



Alternative 1 Ramps on each side



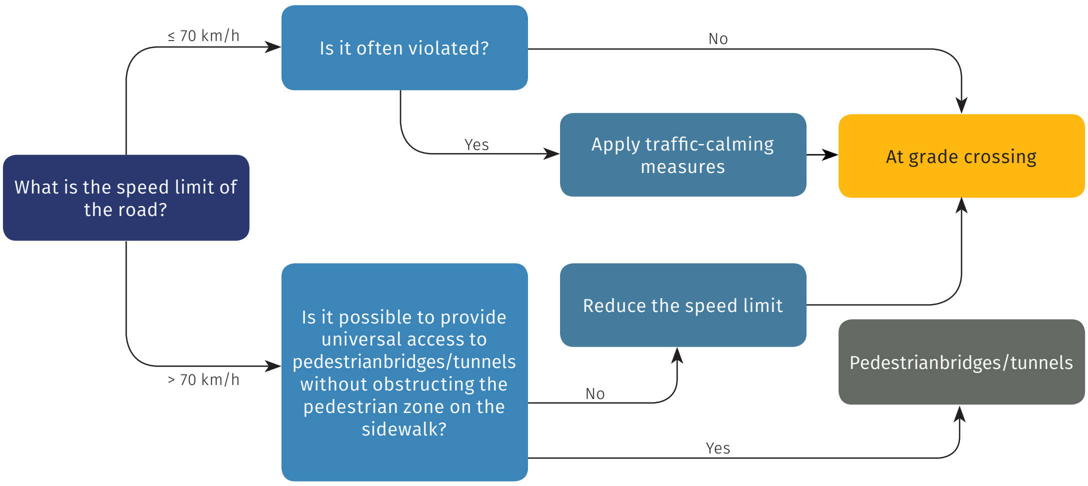
Alternative 2 Depressed corner

7.1.2 PROVIDE CROSSINGS THAT PRIORITIZE PEDESTRIANS

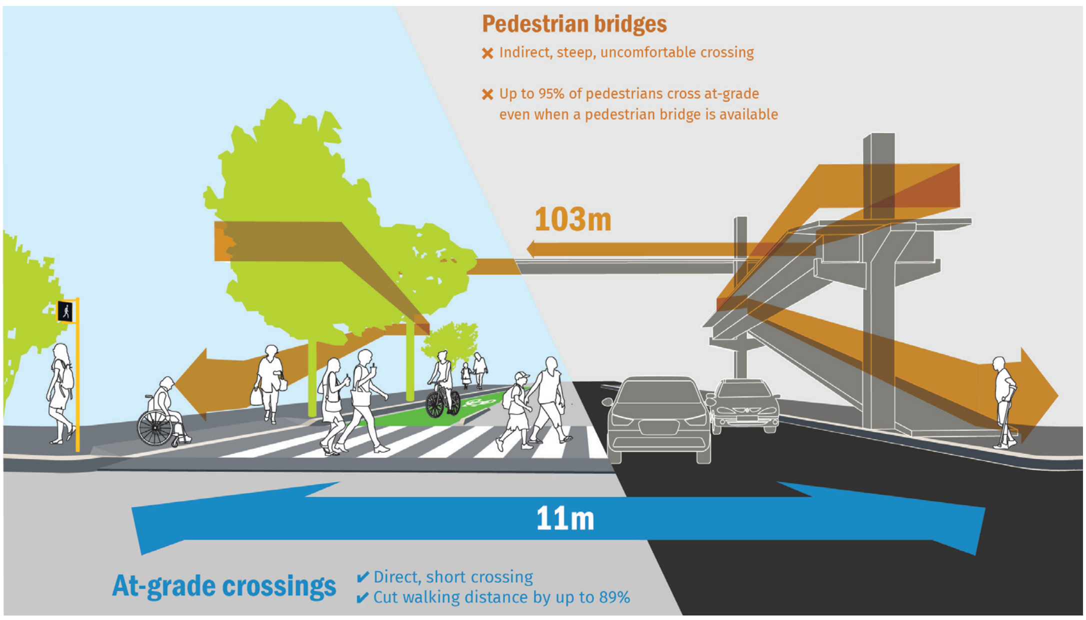
DESIGN CONCEPT

1. Clearly mark with a minimum mark width of 2.5 meters.
2. Make the crossing distance as short as possible.
3. Provide ramps to accommodate access for people with disabilities.
4. Place at every foot of the intersection or at midblocks with a maximum of 80 to 100 meters distance from other crossing points.
5. Provide refuge island that can accommodate people with disabilities on roads that have more than two lanes.

At-grade crossings should be built instead of pedestrian bridges or tunnels whenever possible. Pedestrian bridges and tunnels will lengthen crossing distance and hinder access for people with disabilities. In cases where pedestrian bridges or tunnels are the only options, ramps or elevators should be provided so they are easily accessible to people with disabilities.



Guideline for crossing types



Comparison of an at-grade crossingwithapedestrianbridge

Types of at-grade crossing

ZEBRA CROSSING

Location Intersection or road with 2 lanes or less

Speed limit Less than 70km/h (or less than 40km/h if not equipped by traffic lights)

Vehicle volume Low – high

Pedestrian volume Low – high

Can be provided with traffic-calming measures such as speed humps with a distance of 5 to 10 meters from the zebra crossing.

ZEBRA CROSSING WITH ISLANDS

Location Intersection or road with more than 2 lanes

Speed limit Less than 70km/h (or less than 40km/h if it is not equipped by traffic lights)

Vehicle volume Medium

Pedestrian volume Low – high

Refugee island should be a minimum of 1.2 m wide so pedestrians can stop safely for a moment to see traffic conditions.

DIAGONAL CROSSING

Location Intersection

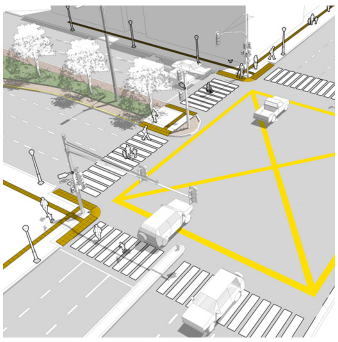
Speed limit Less than 70km/h

Vehicle volume Medium – high

Pedestrian volume High

Pedestrian is given a dedicated phase in an intersection to allow them to cross in any direction. A spacious waiting area on the corners of intersection is necessary to accommodate the high number of pedestrians waiting to cross.

PELICAN CROSSING



Location Intersection or road with more than 2 lanes

Speed limit Less than 70 km/h

Vehicle volume Low – high

Pedestrian volume Low – high

A minimum of 7 to 40 seconds for green light is needed for 12.5 m-wide roads, but that can be extended to 60 seconds on roads with high pedestrian volume. The crossing can have buttons to activate pedestrian phase.

PEDESTRIAN PLATFORM

Location Intersection or midblock at local road with less than 2 lanes or commercial area or school area

Speed limit 30km/h or less

Vehicle volume Medium – high

Pedestrian volume Medium – high

Crossing is made at the same height as the sidewalk to give priority to pedestrians and force vehicles to slow down.

BULB-OUT

Location Road with on-street parking

Speed limit 30km/h or less

Vehicle volume Low – medium

Pedestrian volume Low – medium

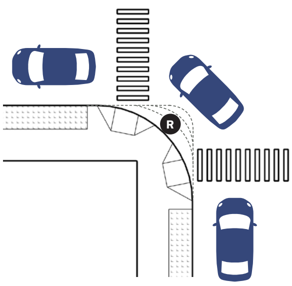
Crossing distance can be shortened by repurposing 1 or 2 parking spaces to extend the pedestrian area.

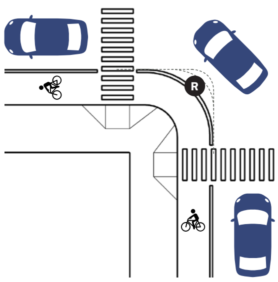
7.1.3 PEDESTRIAN-FRIENDLY INTERSECTIONS

DESIGN CONCEPT

1. Provide a waiting space for pedestrians to wait before crossing.
2. Make crossing distance as short as possible.
3. Minimize corner radii to add space for pedestrians and to reduce vehicle speed when turning.
4. Provide pedestrian refuge islands for wide crossing (more than two lanes).

A. Tighter curb radii

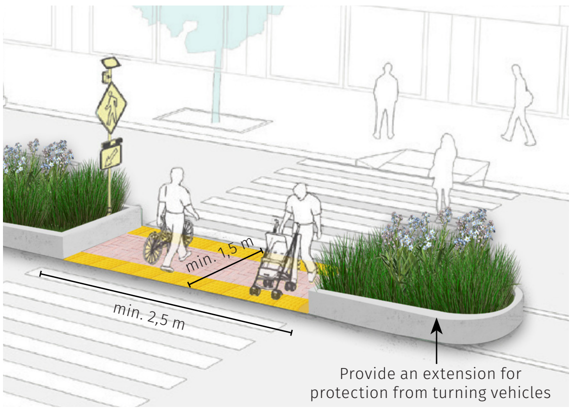




R (m)	Street types
3	Neighbourhood streets intersecting
6	All other street types except freight network
7.5	Minor - minor truck streets intersecting
9	Major - major truck streets intersecting

https://streetsillustrated.seattle.gov/design-standards/intersections/

B. Pedestrian refuge island



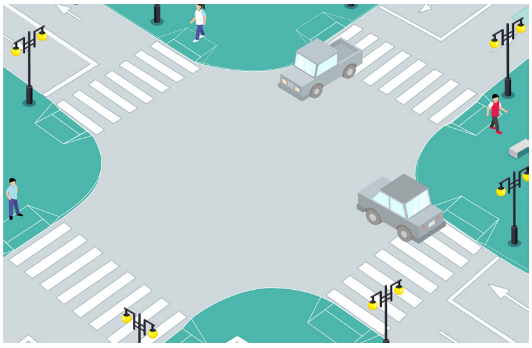
Example of pedestrian refuge islandatanintersectioninTokyo, Japan

Illustration of intersection improvement in Medan, Indonesia

C. Pedestrian space expansion at intersection

Sidewalk extension or pedestrian space expansion can reduce crossing distance and increase safety for pedestrians who cross the intersection. Pedestrian space at intersections can be expanded as follows:

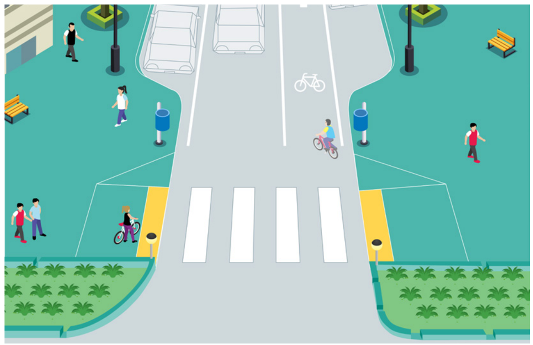
MINIMIZE CORNER RADII



Minimizing intersection radius so vehicles can slow down while making a turn and crossing distance is reduced.

- *minimize crossing distance*
- *reduce vehicle turning speed*

BULB-OUT



Transforming on-street parking segments at intersection into pedestrian space extension. Used if there is on-street parking near the intersection.

- *minimize crossing distance*
- *increase visibility of pedestrian crossing the road*
- *provide more space for waiting and street furnitures*

SLIP LANE REMOVAL

Left-turn lane increases accident risk for crossing pedestrians because car or motorcycle drivers tend not to give priority for pedestrians to cross. If an intersection already has such a lane, the recommendation is to repurpose the lane as pedestrian space.

- *minimize crossing distance*
- *increase visibility of pedestrian crossing the road*
- *provide more space for waiting and street furnitures*
- *give priority to pedestrian*

SLIP LANE WITH WAITING STALL

When left-turn lane is really needed (for example: if bigger turning radius is needed for bus), zebra cross and crossing islands should be added. Special lane geometry should be designed to increase pedestrian visibility.

- *minimize crossing distance*
- *increase visibility of pedestrian crossing the road*

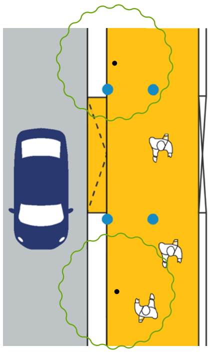
7.1.4 APPROPRIATE PLACEMENT OF BOLLARDS

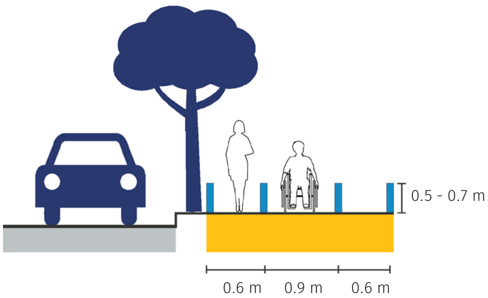
DESIGN CONCEPT

1. Should be functional enough to restrict motor vehicle from entering sidewalk without hindering access for pedestrians and people with wheelchairs

Bollards can be placed on shared areas between pedestrians and vehicles such as driveways, intersection, and crossing. Bollards placement should not disrupt pedestrian space, tactile pavings, or bicycle lanes (if any).

Bollards with reflective strip mustbeplacedoneachdriveway and ramp to prevent cars and motorcycles parking on or misusing the pedestrian area



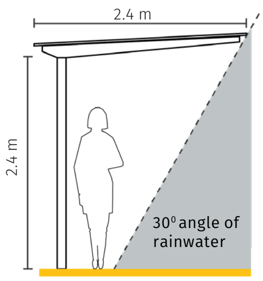


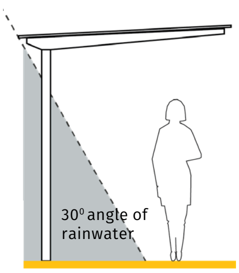
7.1.5 SHADED WALKING SPACE

DESIGN CONCEPT

1. Provide sufficient protection from direct sun light and rain, with a preferable minimum width of 2.4 meters
2. Take into account the effective height of pedestrian space (minimum 2.4 meters)
3. Take into account the effective width of pedestrian space (minimum 1.5 meters)

Protection from direct sun and rain is especially needed in tropical countries such as Indonesia. Shading can be from trees or man-made shelters, canopies, or building roofs. Shading is ideally made continuous along the sidewalk or at least in areas with a high volume of pedestrians.





Left: The shading facility must considerthe angle ofrainwater

Right, top: A shaded sidewalk in Kuala Lumpur, Malaysia (source: Karl Fjellstorm, Far East Mobility)

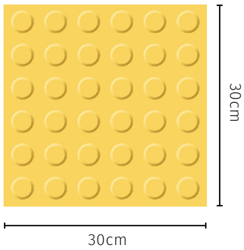
Right, bottom: A shaded sidewalk in Semarang, Indonesia

7.1.6 APPROPRIATE INSTALLMENT OF TACTILE PAVINGS

DESIGN CONCEPT

1. Should be in as straight a line as possible so it can be followed easily.
2. Choice of tactile paving pattern and placement should be made based on accessibility standards.

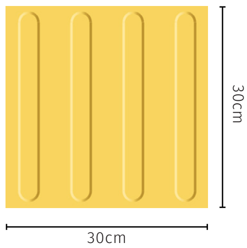
Tactile pavings are placed on the sidewalk to help people with visual impairment. Below are the two types of tactile pavings and their usage based on their raised mark patterns:



Type 1. Dots / Domes

Function: Warning

Locations:
1. Ramps
2. Stairs
3. Crossings
4. Bus stops

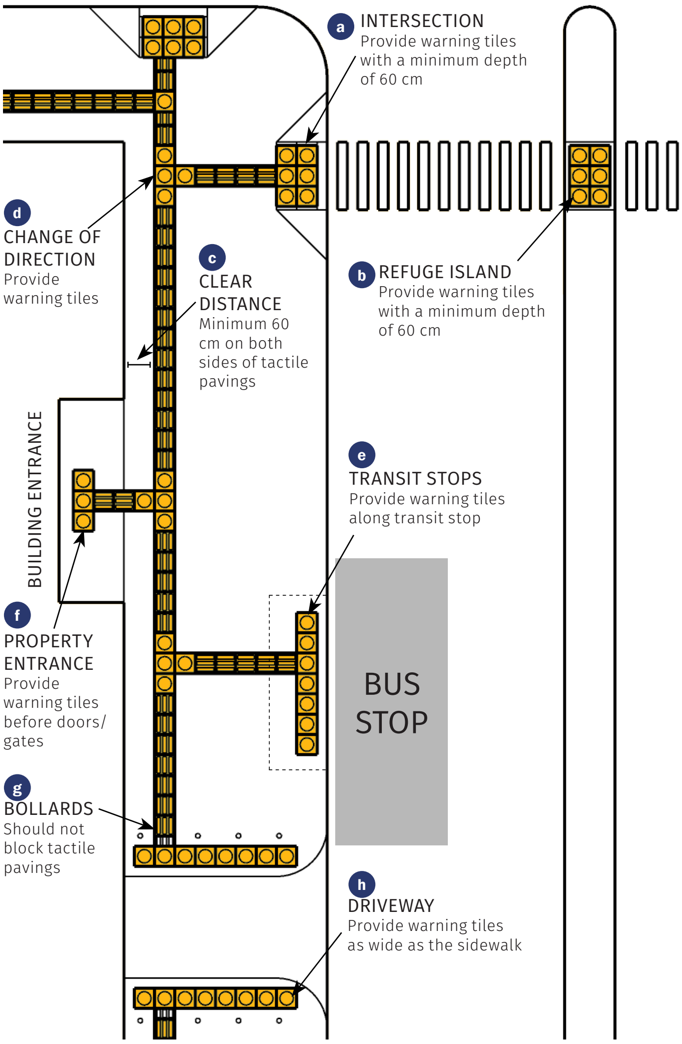


Type 2. Lines

Function: Direction/guide

Locations:
Along sidewalks, with minimum of 60 cm of empty space on both left and right side (wider for lane with higher pedestrian volume)

Illustration of tactile paving placement at intersections (source: NZ Transport Agency), along sidewalks, and at transit stops(source:KarlFjellstorm,Far East BRT)



AT INTERSECTIONS

CONTINUOUS ALONG SIDEWALKS

AT TRANSIT STOPS

7.1.7 SURFACE MATERIAL

DESIGN CONCEPT

1. Use material that is durable and easy to maintain.
2. Use nonslippery material, with a coefficient of friction > 0.55.
3. Use materials that minimize sunlight reflection or light reflection when the surface is wet.
4. Use a color and texture that contrasts with the adjacent carriageway.

Left: Ceramic tiles will get slippery when wet and can be dangerous to walk on

Right: A sidewalk with nonslippery concrete paving blocks in Jakarta, Indonesia

Examples of sidewalk surface material:

CONCRETE

Concrete sidewalk in Tangerang Selatan, Indonesia

Concrete sidewalk with paver patterns in New York, U.S. (source: New York City Department of Transportation, 2015)

Location Any sidewalk (recommended as the default choice of sidewalk material)

Advantages

Durable (40–80 years), relatively low cost, provide sturdy base for street furniture or signage, can be modified to conform with desired colors or patterns

General specifications

- Reinforcement: Wire mesh or steel reinforcement
- Thickness: 13 cm (default), 15 cm (on driveways), 18 cm (on driveways that accommodate heavy vehicles)
- Equipped with tooled or saw-cut joints, with a maximum distance betwen joints 24-30 times the thickness of the concrete, a maximum joint width of 5 mm, and a joint depth of 1/3 of the thickness of the concrete, to control cracks
- Equipped with certain finishings to increase its coefficient of friction (e.g. broom finish)

Left: Broom finishing to increase surface friction (source: Wikihow)

Right: Circular pattern on a sloping concrete sidewalk in Tokyo, Japan

PAVING BLOCKS

Textured concrete paving blocks in Tokyo, Japan

Location Any sidewalk with < 5% slope

Advantages Permeable, easier to replace when damaged than concrete

Disadvantages Requires regular maintenance; can easily become uneven (e.g., due to the growth of tree roots), making it dangerous for pedestrians and wheelchair users

General specifications

Should be equipped with a filtration layer (gravel and sand) below the pavement. The layer should be located 60 cm above groundwater table

References used in this section include the Street Design Manual (NYC Department of Transportation, 2015), A Guide for Maintaining Pedestrian Facility (FHWA, 2013), NYDOT Standard Specifications (NYDOT, 2019)

GRANITE

Granite pavers in Tokyo, Japan

Location Sidewalks in special areas (such as historic area)

Advantages Adds aesthetic value and design coherence in historic areas

Disadvantages High installation costs, cannot withstand heavy loads

General specifications

- Minimum thickness of 7.5 cm
- Use a nonslippery surface finishing (coefficient of friction > 0.55)

RUBBER PAVERS

Rubber pavers on a sidewalk (source: Steven Petric, stevenpetric.com)

Location Sidewalks with concerns of root upheaval

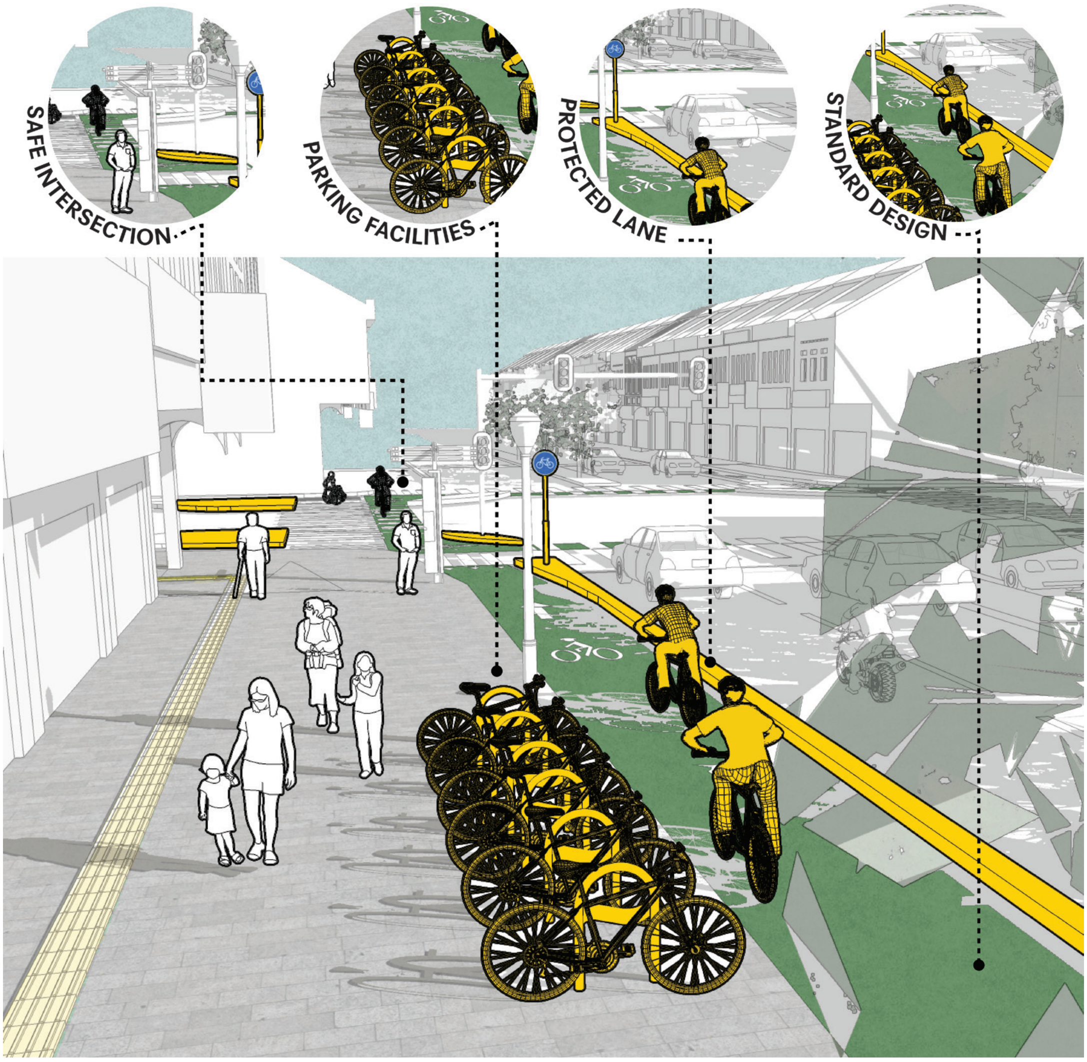
Advantages Thinner and more flexible than other materials, which allows more room for tree root growth; can be installed and replaced easily

Disadvantages Requires routine maintenance; higher installation costs

General specifications

Must be free of harmful chemicals to prevent soil pollution

7.2 CYCLING INFRASTRUCTURE



Good practices to be applied in designing cycling infrastructure are as follows:

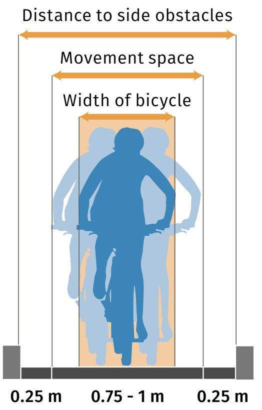
- **MEET STANDARD DIMENSIONS AND COMFORTABLE WIDTH**
- **CONSISTENT DESIGN FOR EASY COMPREHENSION**
- **PROVIDE PHYSICAL PROTECTION**
- **PROVIDE PARKING FACILITIES**
- **INTERSECTIONS THAT MINIMALIZED CONFLICTS**
- **ANTI-SLIP AND EVEN SURFACE**

7.2.1 MEET STANDARD DIMENSIONS AND ALLOW FOR COMFORTABLE WIDTH

DESIGN CONCEPT

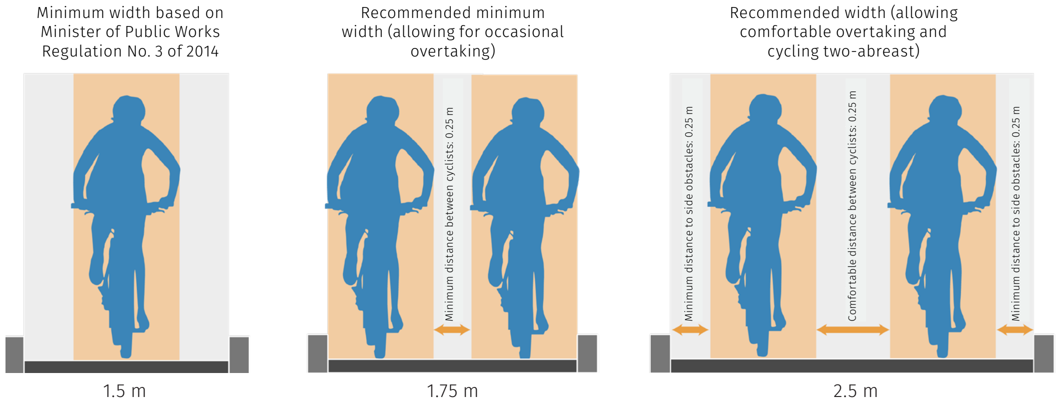
1. Has net width of 1.75 to 2 meters for one-way or minimum of 2.5 meters for two-way lane. In limited space, bicycle lane can be made 1.5 meters wide, but this reduces the possibility for cyclists to overtake or cycle side-by-side.
2. Provide ramps when there is an elevation change.

Cyclist space requirements



No	Component	Definition	Dimension	Notes
1	Bicycle width	Width needed by bicycle on idle	0.7 m	For bicycle in general, bicycle with modifications are not included.
2	Movement space	Width needed to move left and right to stabilize bicycle movement	0.75-1 m	Wider in low speed
3	Distance between cyclists	Extra width needed for two cyclists to cycling side by side with comfort	0.5 m	Wider in crowded lane
4	Distance to side obstacles	Minimum distance between bicycle and side obstacles (curb, fence, elevation difference, wall, etc.)	0.2 m	Side obstacle height < 15 cm
			0.25 m	Side obstacle height 15-60 cm
			0.5 m	Side obsstacle height > 60 cm
5	Net height	Vertical space that free of obstacles, counted from bicycle lane surface	2,3 m	Minimum signage height
			2.5 m	Minimum height of canopy/tunnel

Recommended cycling lane width



Ideal inclinations for cycling ramps

Inclination	Maximum inclination length
2%	250 m
5%	100 m
7%	30 m

After the maximum inclination length is reached, a flat surface with a minimum length of 25 meters should be provided to allow cyclists to rest (CROW, 2017)

7.2.2 PROVIDE PHYSICAL PROTECTION

DESIGN CONCEPT

1 Whenever possible and appropriate, physical protection should be provided to separate cycling lane from motorized traffic.

A bicycle lane network can include several types of bicycle lane based on the existing traffic situation on that road. Possible types of cycling lanes include:

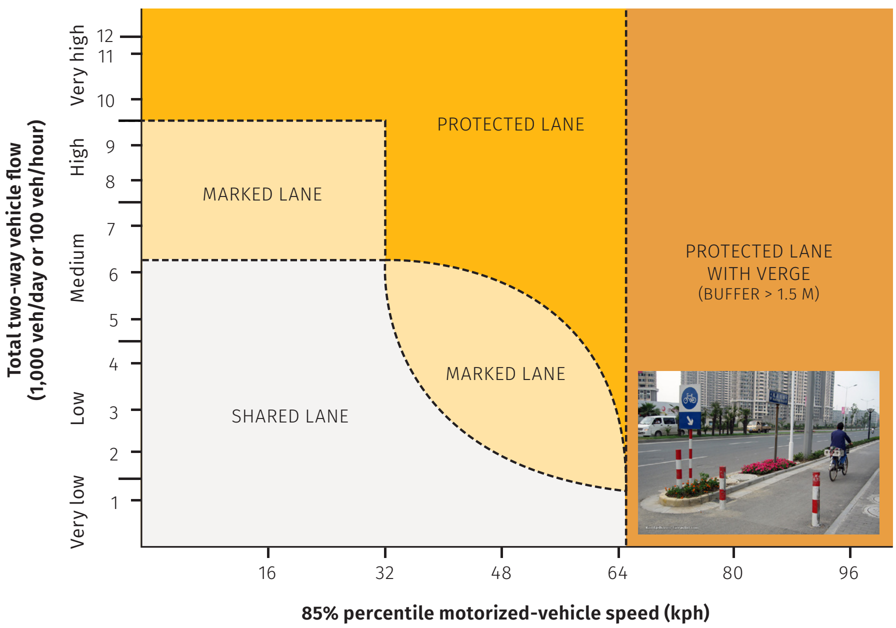
Shared lane	Protected lane separated from motorized traffic	Protected lane separated from motorized traffic and pedestrian
		
Cyclists share the road with motorized vehicles but have a higher priority as road users (only for local and low-traffic-density roads)	Provision of cycling lane on sidewalks with a minimum width of 5 m (need separation by color, material, or verge)	Equipped with physical separator to separate cyclists from motorized traffic

Safety | Space | Cost →

A. Choosing separation type

Cycling infrastructure type guideline (adapted from Sustrans, 2014)

Protected lane with verge in Wuxi, China (right, source: Karl Fjellstorm, Far East Mobility)



Big cities in Indonesia are known for their dense traffic. Based on cases found in Jakarta and in Pune, India, which also has a high number of motorcycles, marked lanes are very vulnerable to misuse by motorized vehicles, which pass through them or park. For that reason, we strongly recommend making protected cycling lanes the primary choice in urban areas, with the exception of local streets with low traffic.

B. Examples of physical separators and their additional space

Some examples of physical separators (source: Karl Fjellstorm, Far East Mobility)

GREEN STRIP (MIN. 1.5 M)

CONCRETE CURB (MIN. 0.2-0.4 M)

BOLLARDS (MIN. 0.2 - 0.4 M)

ARMADILLO (MIN. 0.2 M)

C. Separation at roads with on-street parking

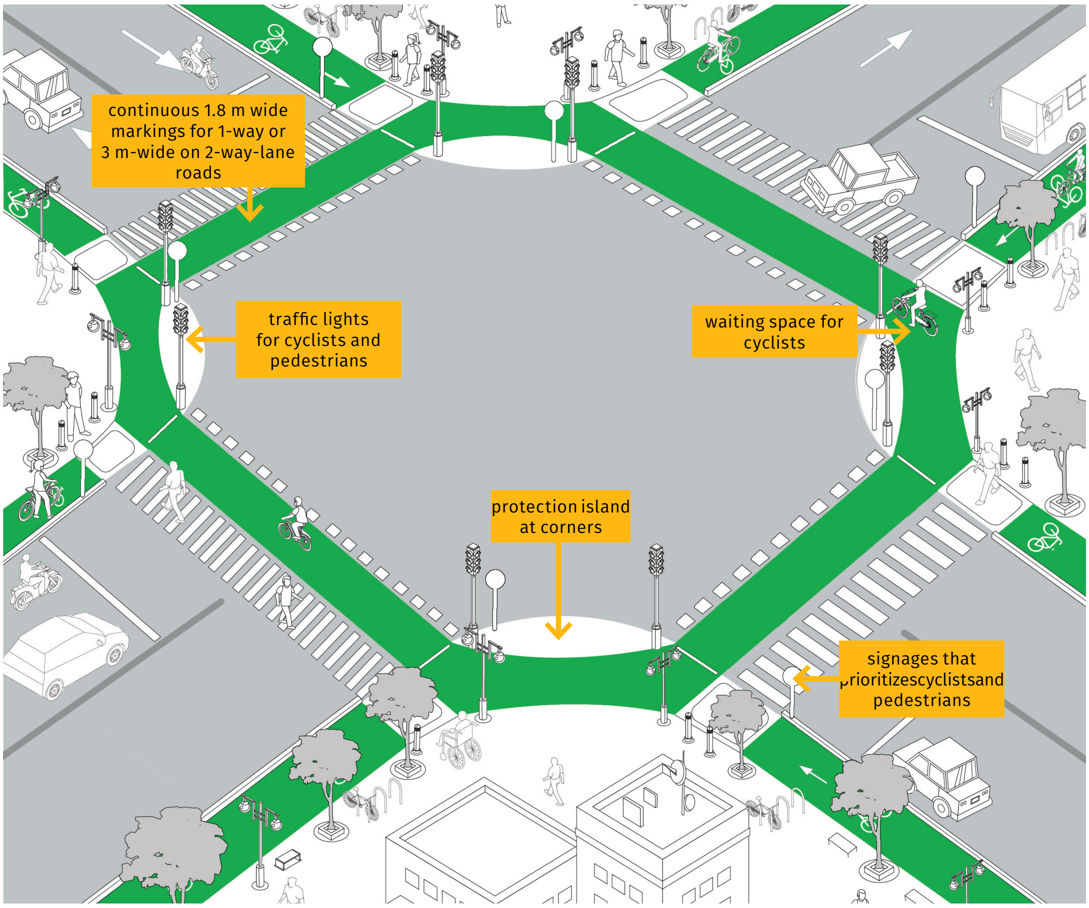
For safety, a cycling lane adjacent to on-street parking needs to be separated with a buffer that can accommodate a car door opening without obstructing the cycling path of cyclists (min. 0.5 m).

Widerbufferadjacenttoparking space in New York, U.S. and Rotterdam, the Netherlands (source:KarlFjellstorm,FarEast Mobility)

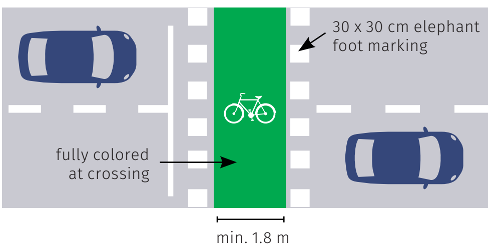
7.2.3 INTERSECTIONS AND CROSSINGS THAT MINIMALIZE CONFLICT

DESIGN CONCEPT

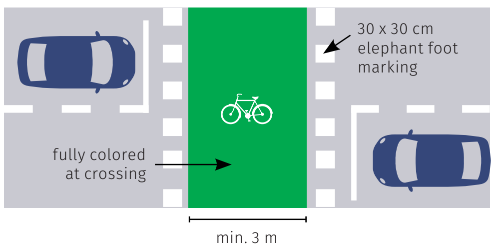
1. Provide waiting space for cyclists before crossing.
2. Mark with continuous 1.8-meter-wide markings for one-way or three meters for two-way lane.
3. Provide protected islands at intersection corners.
4. Place traffic lights for cyclists and pedestrians
5. Provide signages that shows priority for cyclists and pedestrians



A. Crossing marking on one-way roads



B. Crossing marking on two-way roads



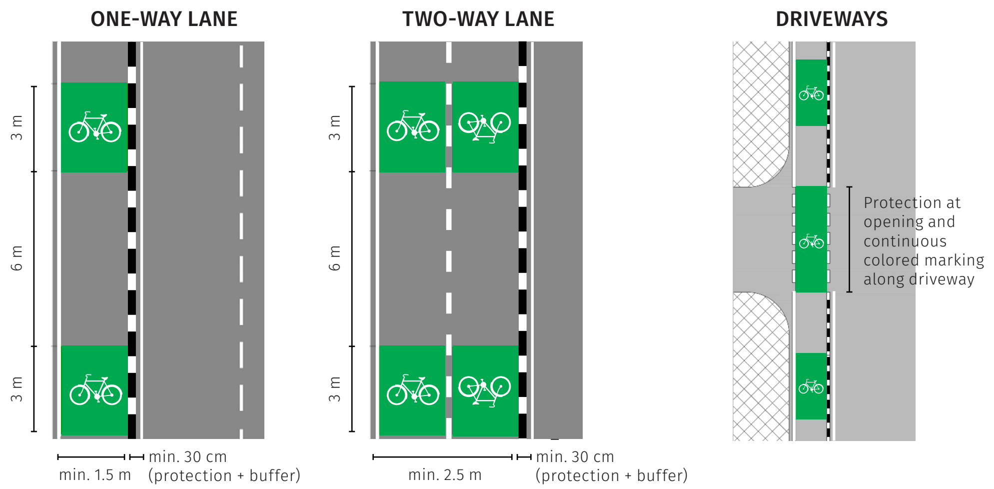
7.2.4 CONSISTENT DESIGN FOR EASY COMPREHENSION

DESIGN CONCEPT

1. Place markings with bicycle symbols on bicycle lane every 100 meters or at least on every bicycle lane opening (e.g., after intersections or driveways).
2. If cycling lanes within a city or an area are colored, that color should be consistent.
3. Provide signage and wayfinding signs or maps for cyclists

A. Cycling lane marking

Further information on road markings can be found in the Minister of Transportation Regulation No. 67 of 2018



B. Signage for cyclists

Further information on traffic signs can be found in the Minister of Transportation Regulation No. 13 of 2014

DEDICATED CYCLING LANE SIGN

Location

- At start of every dedicated cycling lane
- Every 250 m along dedicated cycling lanes

CAREFUL OF CYCLISTS SIGN

Location

- At start of every shared cycling lane
- Every 100 m along shared cycling lanes
- At intersections
- On any road sections where there is a high volume of cyclists

YIELD SIGN

Location

At every intersection, for motorized vehicles to yield for cyclists to pass

7.2.5 PROVIDING BICYCLE PARKING FACILITIES

DESIGN CONCEPT

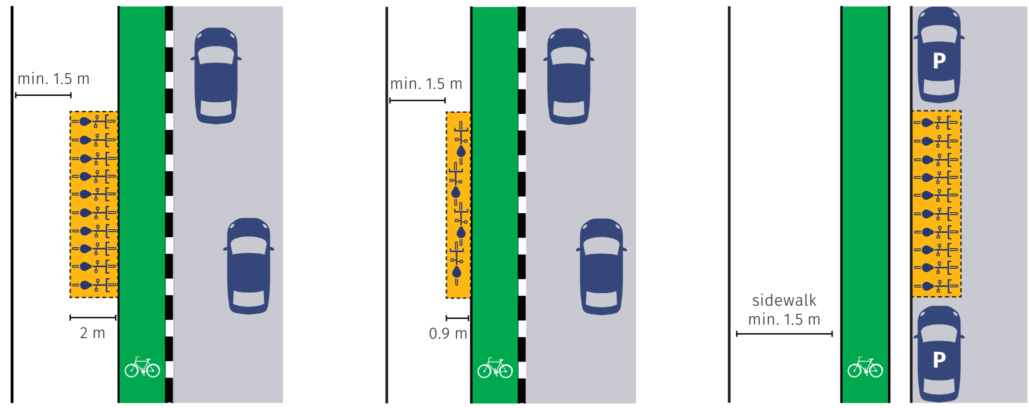
1. Should be placed as close as possible to building access door/bus stop/destination area.
2. Place appropriately, so they don't disrupt the movement of pedestrians and cyclists.
3. Place in highly visible areas, equipped with sufficient lighting to provide safety.
4. Mark clearly
5. Provide shade over bicycle parking area if possible.

All cycling trips have three steps, which are:
1. Keeping bicycle at house
2. Riding bicycle on bicycle lane network
3. Bicycle parking at destination

This means that safe, accessible parking spaces are required to establish a complete cycling infrastructure.

A. Parking location alternatives

PERPENDICULAR AT SIDEWALK	ALONG SIDEWALK	AT ON-STREET PARKING



B. Parking provision

Land use	Bicycle parking provision
Housing	1 parking space per 6 dwelling units
Commercial, office, industry, health and medical care	
1,000 m^2 < GFA < 3,000 m^2	10 parking spaces
3,000 m^2 < GFA < 15,000 m^2	1 parking space per 300 m^2 floor area
15,000 m^2 < GFA	1 parking space per 300 m^2 floor area for floor area up to 15,000 m^2, and 1 parking space for every subsequent 1,000 m^2 floor area
Place of Worship	1 parking space per 300 m^2 floor area for floor area up to 15,000 m^2, and 1 parking space for every subsequent 1,000 m^2 floor area
Civic and Community Institution, Sports and Recreation	
1,000 m^2 < GFA < 3,000 m^2	20 parking spaces
3,000 m^2 < GFA < 15,000 m^2	1 parking space per 100 m^2 floor area
15,000 m^2 < GFA	1 parking space per 150 m^2 floor area for floor area up to 15,000 m^2, and 1 parking space for every subsequent 500 m^2 floor area

Source: Walking and Cycling Design Guide (Land Transport Authority Singapore, 2018)

Left: Clearly marked bicycle parking area in Osaka, Japan (source:KarlFjellstorm,FarEast Mobility)

Right: A bicycle parking area adjacent to a subway station in Tokyo, Japan

7.2.6 ANTI-SLIP AND EVEN SURFACE

DESIGN CONCEPT

1. Use materials that are durable and easy to maintain, such as asphalt or concrete.
2. Materials must not be slippery, with a coefficient of friction > 0.55.
3. Ensure that any manhole covers are level to the surface of the cycling lane.
4. Ensure that any manhole steel gratings are perpendicular to the direction of the cycling lane.

Left: Pigmented asphalt for a cyclinglaneinGuangzhou,China (source:KarlFjellstorm,FarEast Mobility)

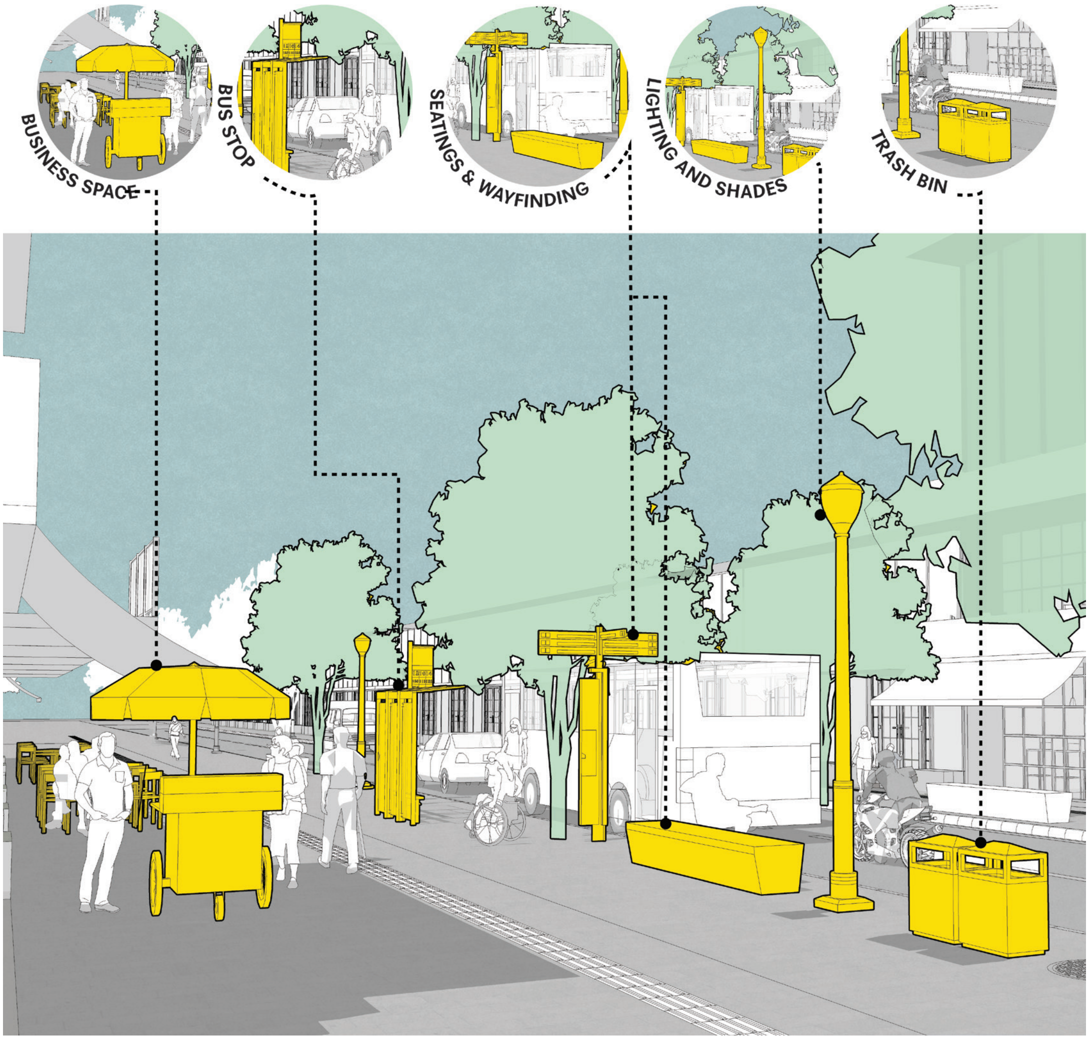
Right: Cycling lanes marked withgreencoldplasticpaintand white thermoplastic paint in Jakarta, Indonesia

Left: Steel gratings that are parallel to the direction of cycling lane, which are dangerous to cycle on

Right:Appropriateinstallationof steel grating (perpendicular to the direction of cycling lane)

7.3 SUPPORTING INFRASTRUCTURE

Infrastructure elements that support NMT are illustrated in the following picture.



7.3.1 BUS STOPS

DESIGN CONCEPT

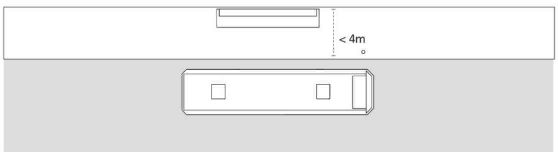
1. Must be universally accessible from sidewalks or other pedestrian paths.
2. Provide ramp if there is any height difference.
3. Bus stops placement:
   - On 4-meter-wide (or more) sidewalks: Place on the curb edge, still providing a clear pedestrian zone with a minimum width of 2 meters.
   - On less than 4-meter-wide sidewalks: Place adjacent to building/property line.
4. Provide bicycle parking facility to accommodate intermodality whenever possible

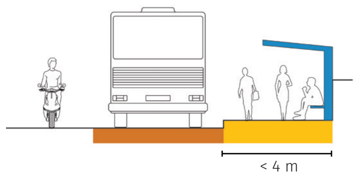
Bus stops should be designed to facilitate easy transfers between public transport and NMT. The design also should minimalize conflict between pedestrians, cyclists, and passengers who get on/off the bus, people waiting for a bus, and the bus itself.

Bus stop elements that should be provided are:
1. Shading that protects the waiting area with a minimum width of 3 m and net height of 2.4 m
2. Seating
3. Bus stop signage
4. Information panels (bus schedule and routes)
5. Physical protection (e.g., bollards)

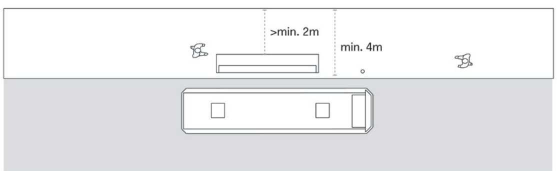
Bus stop design alternatives

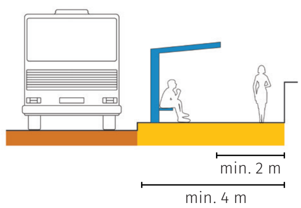
a **Sidewalk under 4 meters wide**



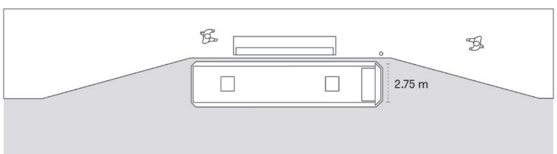


b **Sidewalk more than 4 meters wide**





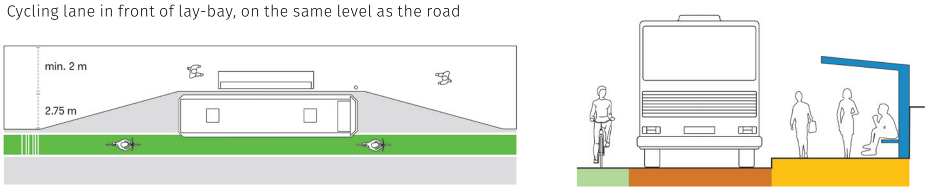
c **Sidewalk with lay-bay**



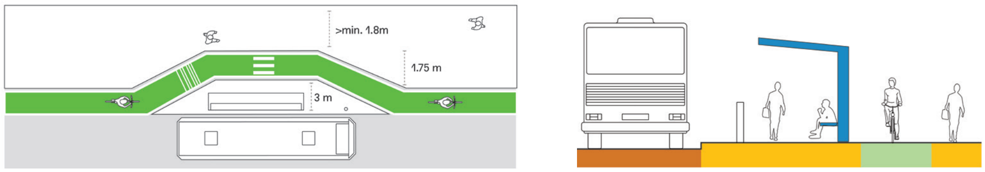
Bus stop design with cycling lane

a Cycling lane in front of bus stop, on the same level as the road

b Cycling lane in front of lay-bay, on the same level as the road



c Cycling lane behind the bus stop (for routes with high bus frequency)



7.3.2 TRASH BINS

DESIGN CONCEPT

1. Place every 20 meters, at every intersection or crossing, and near transit points, e.g., bus stops
2. Place in multi-utility zone so they don’t disrupt the pedestrian zone.

Cleanliness is one of the important factors in creating comfortable pedestrian and cyclist infrastructure. Sidewalks that are clean and free of bad odors create a good walking setting. Trash cans must also be well managed to achieve a clean and comfortable walking space.

Left: Trash bin placement in themulti-utilityzoneinJakarta, Indonesia

7.3.3 VEGETATION

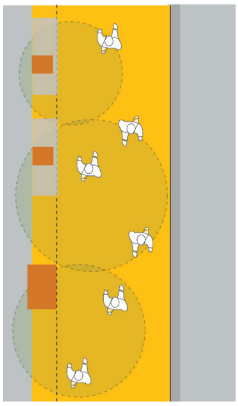
DESIGN CONCEPT

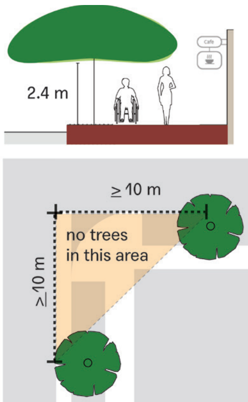
1. Place shade vegetation so it does not disrupt pedestrian movement.
2. Choose shade vegetation that has a wide canopy.
3. Make sure shade vegetation does not block street lighting.
4. Space shade vegetation at distances that provide continuous shading.
5. Whenever possible, development of new cyclist and pedestrian infrastructure should preserve existing trees.

Further information can be found in the Minister of Public Works Regulation No. 05/PRT/M/2012 concerning Guidelines for Planting Trees in Road Network Systems

Placement of vegetations

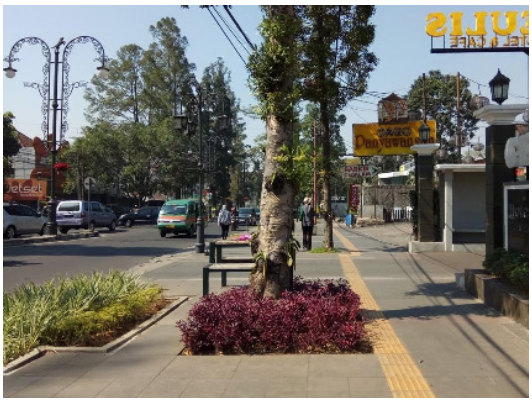
1. On a green strip between pedestrian lane and motor vehicle lane.
2. On a green strip between pedestrian lane and cyclist lane.
3. Placed as tree pits in multi-utility zone.
    a. Elevated tree pits are preferable whenever space permits, since they can function as seating, with minimum size of 1.8 by 1.8 meters or 1.25 by 2 meters to accommodate root growth.
    b. In a limited space, tree pits can be covered by steel grating, which should be on the same level as the sidewalk surface.





Left: Diagram of vegetation placement on sidewalks

Right: Appropriate placement of vegetation in Wonosobo, Indonesia



Left: Adequate open surface provision for root growth on a sidewalk in Bandung, Indonesia

Right: An example of steel grating to cover a tree pit in Wonosobo, Indonesia

7.3.4 LIGHTING

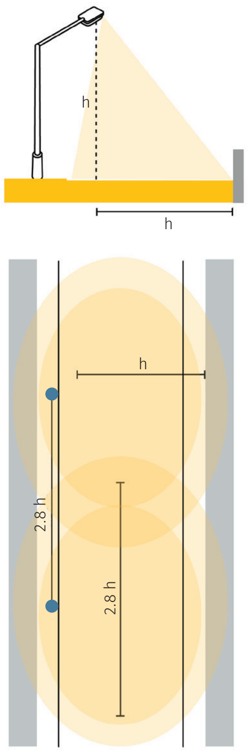
DESIGN CONCEPT

1. Streetlamps should be spaced at distances of three times their height to provide continuous lighting on sidewalks
2. Streetlamp poles should be placed in multi-utility zone so they do not disrupt pedestrian

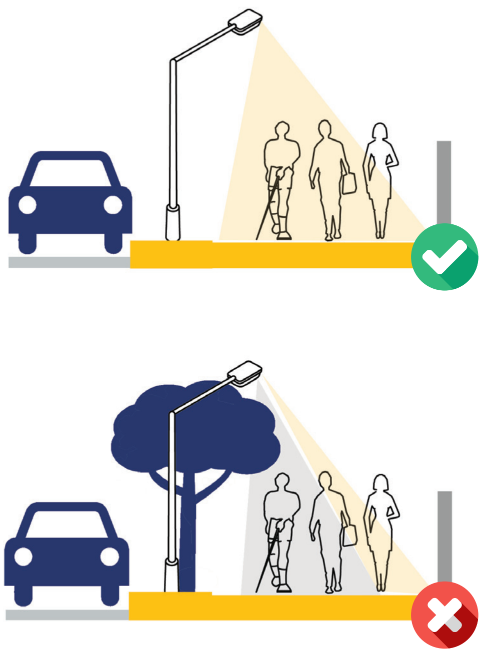
More information about lighting utilities installment can be found in Transportation Minister Regulation No. 27/2018.

Lighting is one of the important elements to create safe pedestrian and cyclist infrastructure. Sufficient lighting will reduce the risk of crime, reinvigorate pedestrian space, and give visibility for pedestrians and cyclists at night.

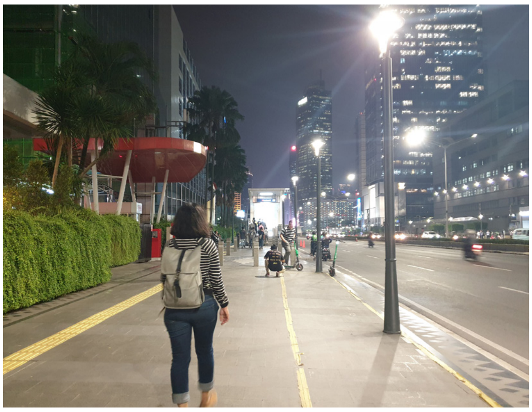
Left: Streetlamp placement guideline



Right:Lightingfromstreetlamps should not be obstructed by sidewalk trees



Well-litsidewalksinJakarta(left) and Medan (right)

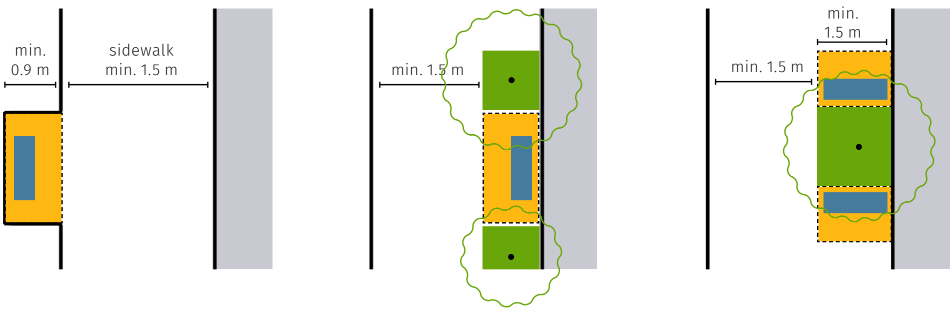


7.3.5 SEATINGS

DESIGN CONCEPT

1. Seating should not obstruct pedestrian zone (keep its minimum width to 1.5 meters).
2. Do not place seating at building entrance/exit.
3. Equip seating with shade (tree or man-made shelters).
4. Seating placement should be prioritized on crowded sidewalks, such as those near parks or commercial areas. On sidewalk segments with a high level of activity, seating should be placed every 10 to 20 meters.
5. Use durable materials such as metal or concrete.

Seating facility placement examples



Left: Tree pit as a seating area (source: ITDP India)

Right: Appropriately placed new seating that does not obstruct pedestrian zone, in Jakarta, Indonesia

Left: Vegetation-shaded seatings in Wonosobo, Indonesia

Right: Seatings with canopies at a bus stop in Jakarta, Indonesia

7.3.6 BUSINESS SPACE

DESIGN CONCEPT

1. Space can be made for formal small-business activity while still providing effective free space for pedestrians with a minimum width of 1.8 meters.
2. Trash cans should be placed near business space.
3. Should be equipped with supporting infrastructure, like electricity and water.
4. Markings can be placed as a clear visual separator of a permitted business space.

Providing space for street vendors or other businesses on sidewalks is indeed a subject of much debate. On one hand, inappropriate placement and design of street vendors can disrupt the pedestrian zone. Issues of cleanliness and aesthetic values are often cited by opponents of the provision. Some shop buildings or restaurants were found to expand their selling area to the sidewalk or in front of their buildings.

Yet, on the other hand, business activities from street vendors increase the liveliness of sidewalks. There are small shops or trade carts or just trade stalls scattered in various corners of the city. Some are mobile, some are temporary stalls, and some are semipermanent (some cases have even turned into permanent buildings). Appropriate placement of street vendors can be the key to accommodating both the businesses and the pedestrians.

A. Space requirement for business space

Below are two elements of business space that need to be accommodated in the design:

1. The space needed for physical elements of business space, e.g., tables and chairs, carts, stalls, or kiosks.
2. Extra space for the movement of buyers and sellers.

B. Regulated aspects in business space

1. Types of permitted business.
2. Requirements of business permits and supervision.
3. Time limit and scheduling of the use of business space (e.g., allowed only during car-free days or on weekends and holidays)
4. Other regulations and rules related to business space provision.

C. Restriction of motorized vehicles

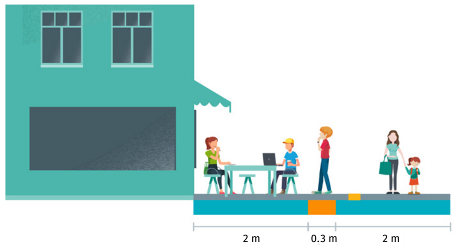
On roads with high commercial activity, restricting access for motor vehicles can be considered so the particular road can be only accessed by pedestrians and cyclists. Another option is a shared street that allows motor vehicles to pass through with a speed limit of 15 km/h.

Sidewalk division between marketplace and pedestrians in Amsterdam, the Netherlands (source: Karl Fjellstrom, Far East Mobility)

D. Types of sidewalk businesses
Space for different businesses and their dimensions are as follows:

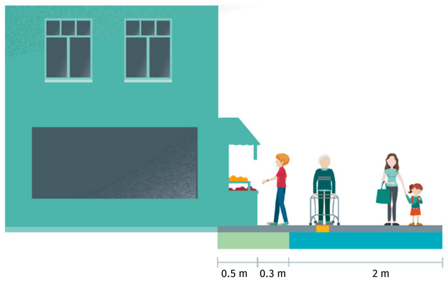
SIDEWALK CAFE

Some urban sidewalk spaces can also be designed by adding a café or restaurant expansion from existing buildings. The addition of a café on the ground floor can activate the face of the building as well as the area. This type of activity requires at least 1 meter of space and the maximum width required is 4 meters. This activity should not interfere with pedestrians' free space with a width of at least 2 meters, or the space can be adjusted according to pedestrian volume.



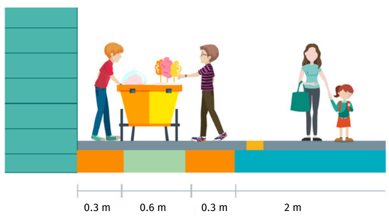
SIDEWALK SHOP

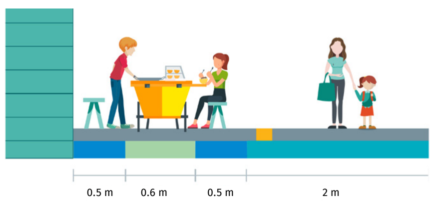
Some stores, such as book, clothing, or fruit and vegetable shops, often use the area in front of their store to place display products or discounted items as well as information and promotions. The area permitted for this store runoff is 0.5 meter for goods and 0.3 meter for lanes of people looking at goods. This can be done if after deducting 0.8 meter for the sidewalk shop there is still at least 2 meters of pedestrian free space, depending on the pedestrian volume.



SMALL SHOP AND CART

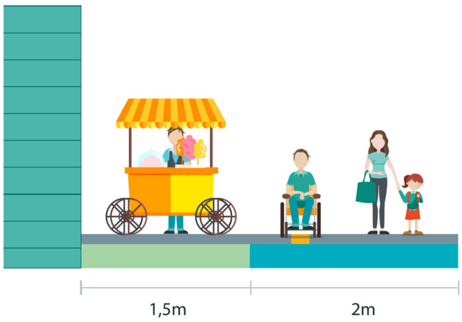
Other business spaces that can be found in sidewalk spaces are carts and small merchant shops. The majority of food traders use carts or small kiosks to sell on the sidewalk. Some provide chairs and some do not. The space needed for this activity is at least 1.2 meters or a maximum of 2 meters. Provision of space for this activity must still leave room to walk at least 2 meters.





FOOD TRUCKS AND MOBILE VENDORS

Some types of businesses in Indonesian cities are traders who use cars or modified vehicles more recently known as food trucks. In addition to cars, mobile traders or businesspeople include hawkers, herbalists, drink sellers with bicycles, traveling tailors, and so on. For mobile sellers, there is no need to provide a special space on the sidewalk. Provision of space for food trucks or traders with cars is done in the on-street parking space that has been provided, with restrictions and/or time management. Another option is providing a space parallel with on-street parking space. Turning parking spaces into activity spaces can also create "parklets."



Sidewalk division for marketplace in Frankfurt, Germany

Space for businesses can be allocated in line with the physical quantities available, but arrangements can also be made based on time of use. One space can be used by two or three different activities at different times. Setting up the operational time of the business can complete the division of space for businesses and business licensing, and it can also be used to supervise how the business space is used. This also applies when road space is used for different at certain times, such as Car Free Day (CFD).

7.3.7 WAYFINDING

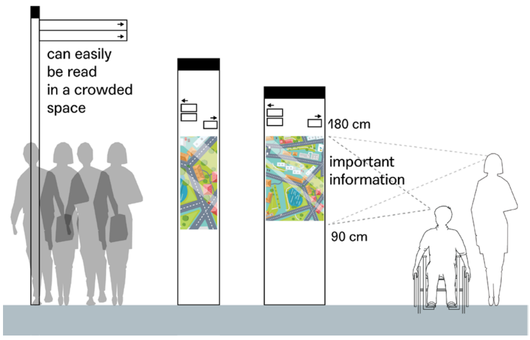
DESIGN CONCEPT

1. Show information of spatial orientation where the person stands, informing the way and distances to transit points and nearby public facilities.
2. Can be a stand-alone board or attached to electrical or lighting installation.
3. Build in a strategic location, such as bus stop, station, public space, and commercial areas, with 5 to 10 minutes of walking distance between signs.
4. Install 8 to 10 meters from the intersection to give spatial orientation for the people who are about to cross.
5. Make sure signage is legible for all users.

Good walking infrastructure must provide sufficient information for anyone who passes it. Wayfinding can directly give pedestrians multi-modal transit information. Access to wayfinding makes people feel more comfortable and secure because they know their current position and information about the surrounding area, too. They can also find out how far they are from the nearest transit point.

The shape and size of the wayfinding can be varied according to the size of the local community. The information must be easily spotted, and the type and size of letters in wayfinding must be clearly legible. The choice of language, graphic design, and maps must be universally understood, because they will be read by local people, workers, commuters, and tourists. In a better design, good wayfinding can accommodate the needs of blind people by providing information in braille that is placed in strategic places such as shelters, stations, and commercial areas.

Wayfinding in Frankfurt



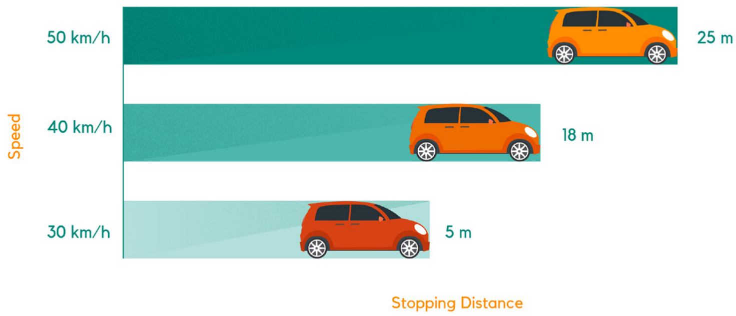
Wayfinding in Bandung

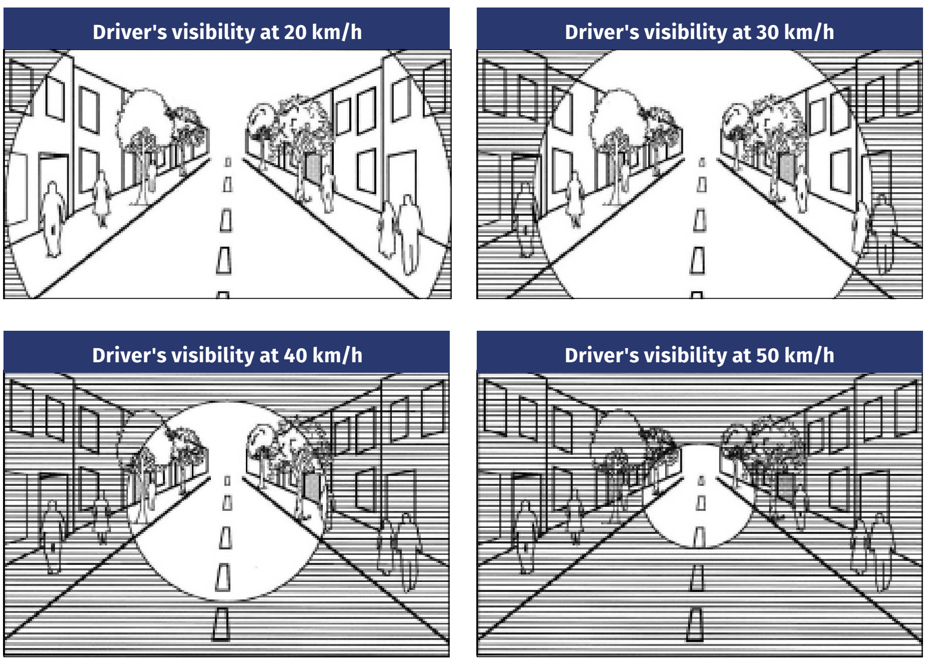
Braille wayfinding in Harajuku Station, Japan

7.3.8 TRAFFIC CALMING

Setting and limiting the speed of vehicles in each road lane can help make walking safe for most people. Vehicle speed is related to stopping distance, breadth of view, and the level of injury that can be caused by it. Several studies (Pasanen 1993, DETR 1998, Rosen and Sanders 2009, and Tefft 2011) show that there is a relationship between vehicle speed and pedestrian death risk in urban areas in developed cities. Vehicles traveling at less than 20 km/h can cause 0–1% risk of pedestrian death, while vehicles with speeds of 40 km/h can cause a 25% risk of pedestrian death. The risk of death is 60% when people are run over by a vehicle traveling at 50 km/hour. Above 70km/h, the risk of death increases to 100%.

The relation between vehicle speed and the accident risks can be explained by the two diagrams below. The first diagram shows that the higher the vehicle speed, the farther the distance it needs to come to a stop. Also, as shown in the second diagram, the visibility span of a driver will drastically decrease with the increase of vehicle speed. When driving fast, the driver will not be able to clearly notice the activities of people in the adjacent walking space, which further increases the risk of accidents.





To increase the safety of all road users, speed reduction (whether by lowering the speed limit or installing traffic- calming devices on roads to enforce compliance with regulated speed limit) is often desirable.

A. PHYSICAL TRAFFIC CALMING

Left: Rubber speed bump (source: www.speedbumpsandhumps.com)

Middle: Asphalt speed hump (source: www.roadwayservices.com.au)

Right: Speed table to prioritize cyclists (source: Karl Fjellstrom, Far East Mobility)

SPEED BUMP

Location Parking area and residential streets (less than 10km/h operational speed)

SPEED HUMP

Location Local and residential streets (less than 20km/h operational speed)

SPEED TABLE

Location Collector, local, and residential streets; crossings (raised crossing or intersection)

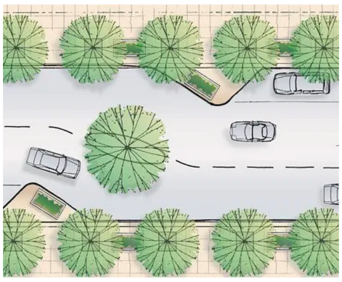
Left: Chicane illustration (source: San Francisco Better Streets)

Middle: Paver rumble strip (source: NACTO)

Right: Median widening in Gold Coast, Australia (source: Karl Fjellstrom, Far East Mobility)

Further information about traffic calming measures can be found in Transportation Minister Regulation No. 82/2018.

CHICANE



Location Low-volume residential streets with speeding issues

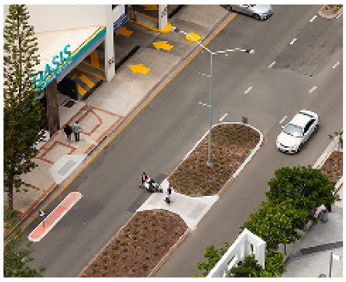
Chicanes can be achieved by alternating vehicle parking spaces or installing curb extensions

RUMBLE STRIPS/OTHER SURFACE TREATMENTS

Location Collector, local and residential streets; or combined with speed table

Aside from thermoplastic markings, a strip of uneven surface material can be applied to reduce vehicle speed

ROAD NARROWING



Location Any road

Can be done by widening the median or sidewalk, installing curb extensions, or adding on-street parking spots

B. VISUAL TRAFFIC CALMING

In some cases, residents do not want a physical traffic-calming device although there is a need to reduce traffic speed on the street. This is the case, for example, in narrow residential streets in which the main speed-limit violators are nonresidents or through traffic—the residents might object to the use of speed humps or bumps since they also become obstacles for the residents, especially when they are cycling or carrying heavy loads to their houses. As an alternative, visual traffic-calming measures can be used.

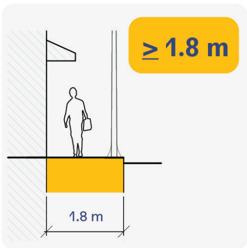
Left: Visual sidewalk in Tokyo, Japan (source: thetokyofilesurbandesign.wordpress.com)

Right: 3D street markings in Singapore (source: LTA)

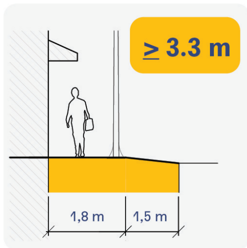
8 DESIGN GUIDELINE

8.1 TYPICAL SPACE REQUIREMENTS

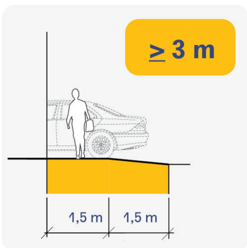
Below are the guidelines for minimum space requirements for pedestrian and cyclist infrastructure on each side of the road:



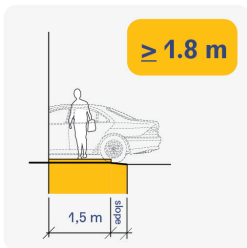
Space requirement for sidewalks



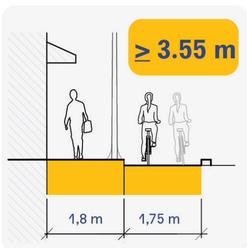
Space requirement for sidewalks with ramps for pedestrians



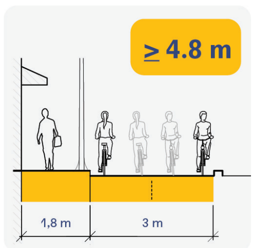
Space requirement for sidewalks with ramps for driveway (1st Alternative)



Space requirement for sidewalk with ramps for driveway (2nd Alternative)



Space requirement for sidewalk and one-way bicycle lane



Space requirement for sidewalk and two-way bicycle lane

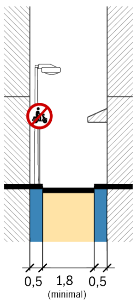
8.2 EXAMPLES FOR STREET DESIGN

Below are examples of pedestrian- and cyclist-friendly street design with various right of ways (ROWs) that are commonly found in cities in Indonesia.

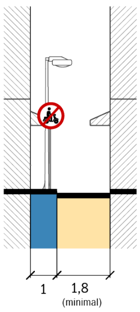
Note:
If there is no exact match of ROW, it is possible implement other designs made for smaller ROWs and use the remaining space as pedestrian sidewalk.

ROW < 5 METERS

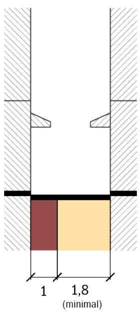
Variant 1. Shared street with buffers on both sides designated for potted plants, signage and other road furniture



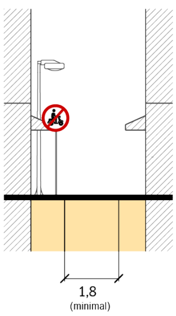
Variant 2. Shared street with a buffer on one side designated for potted plants, signage and other road furniture



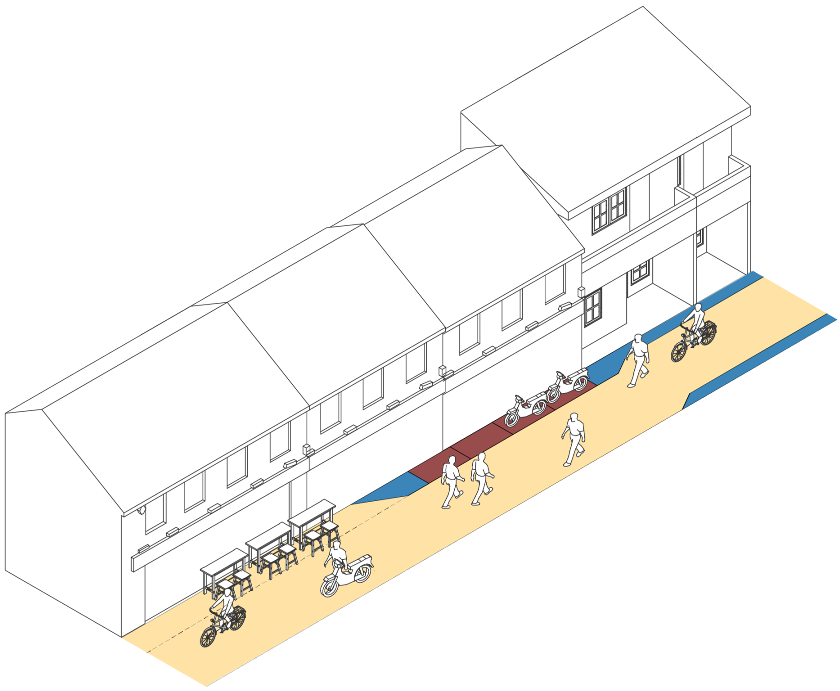
Variant 3. Shared street with motorcycle parking spaces



Variant 4. Shared street for business space on both sides or one side should allocate a minimum of 1.8 m-wide space for pedestrian zone



Narrow streets (alleys) are considered as shared streets that should prioritize the safety of pedestrians and cyclists. Limiting motorized vehicle use can increase the level of safety and comfort of the alleys in residential areas, as well as increasing the economic value and stimulating economic activity in commercial areas.



CREATING PEDESTRIAN-FRIENDLY ALLEYS

Left:Apedestrian-friendlyalley in a housing area in Makassar, Indonesia

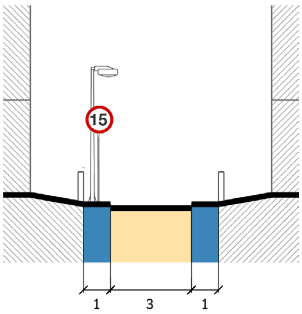
Right:Apedestrian-friendlyalley in a commercial area in Kyoto, Japan(source:KarlFjellstrom,Far East BRT)

Small alleys often not only accommodate pedestrian mobility but also act as a social space. In residential areas, groups of women, children, young adults, and older people are the active users of the space, as they spend a lot of time socializing and doing daily activities there. Therefore, a safe space is needed to accommodate these various activities, especially for vulnerable groups of users.

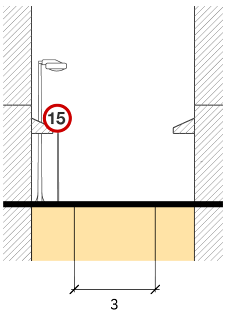
A community-driven approach can be used to create a more pedestrian-friendly street, as people will have a stronger sense of ownership of the space. Local residents often already have their own initiatives to improve street safety through signage, road markings and paintings, speed bumps, and even banning motorized vehicles from passing through during certain times. It is important to maintain the locals' sense of ownership by creating an inclusive codesign process where they can develop a consensus on the alley design and what kind of rules should be implemented (e.g., alley pedestrianization on Sunday, prohibiting on-street parking).

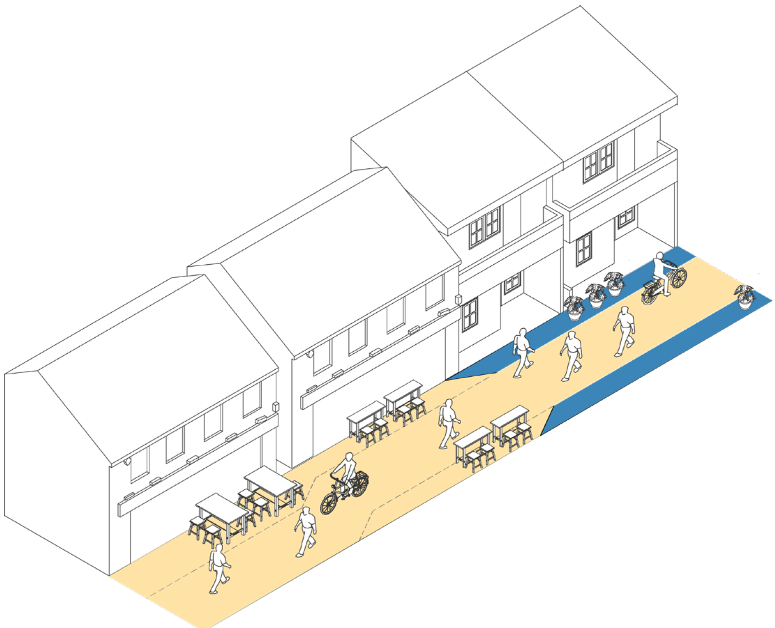
ROW 5 METERS

Variant 1. Shared street with buffers on both sides designated for potted plants, signage and other road furniture



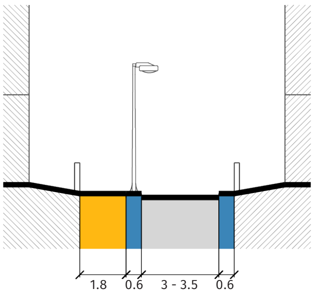
Variant 2. Shared street with 2 m business space



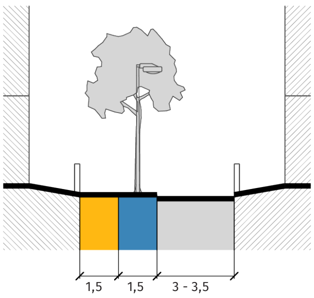


ROW 6 METERS

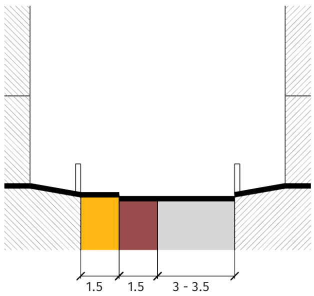
Variant 1. Sidewalk on one side of the road with space for road furniture or potted plants on both sides of the road



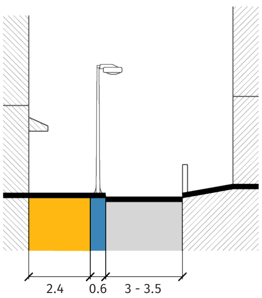
Variant 2a. Sidewalk and shade vegetations on one side of the road (Note: Needs to be combined with Variant 3 to accommodate users with special needs)



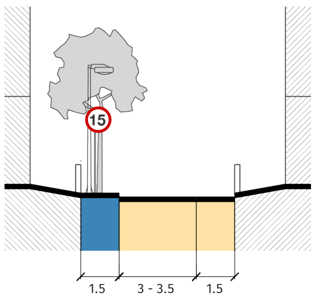
Variant 2b. Sidewalk on one side of the road with space for diagonal motorcycle parking



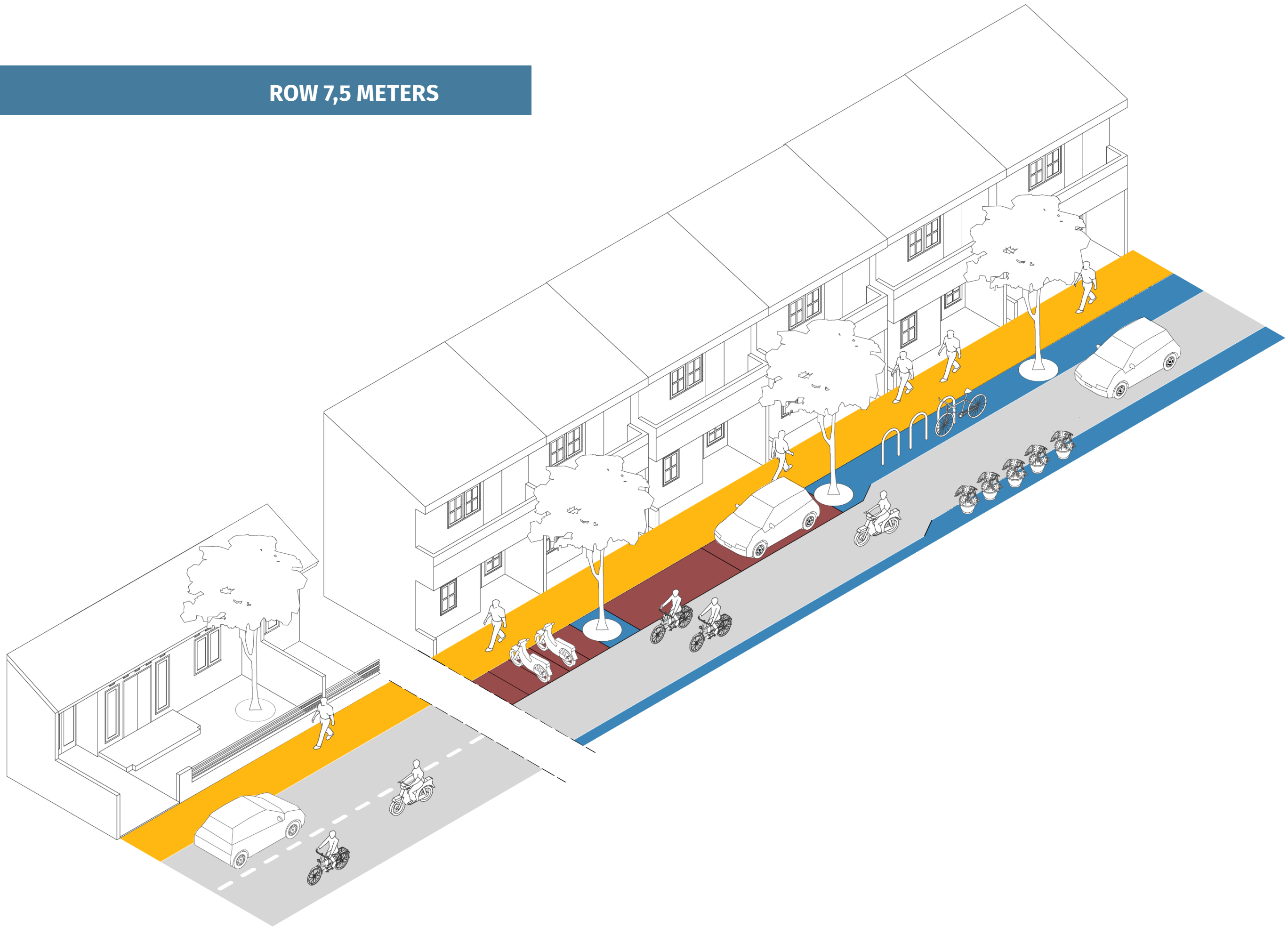
Variant 3. Sidewalk on one side of the street with space for street furniture



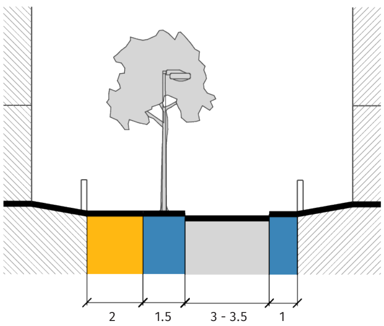
Variant 4. Shared street with street furniture space on one side of the road



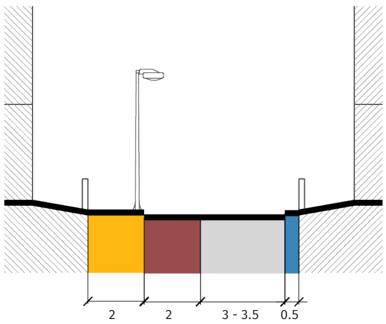
ROW 7,5 METERS



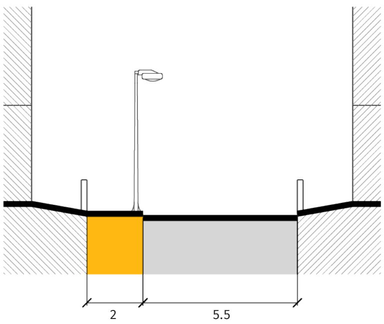
Variant 1a. Sidewalk on one side of the road with space for shade vegetation on one side and road furniture on both sides. The smaller road furniture space can be used for signage, streetlamps, or potted plants

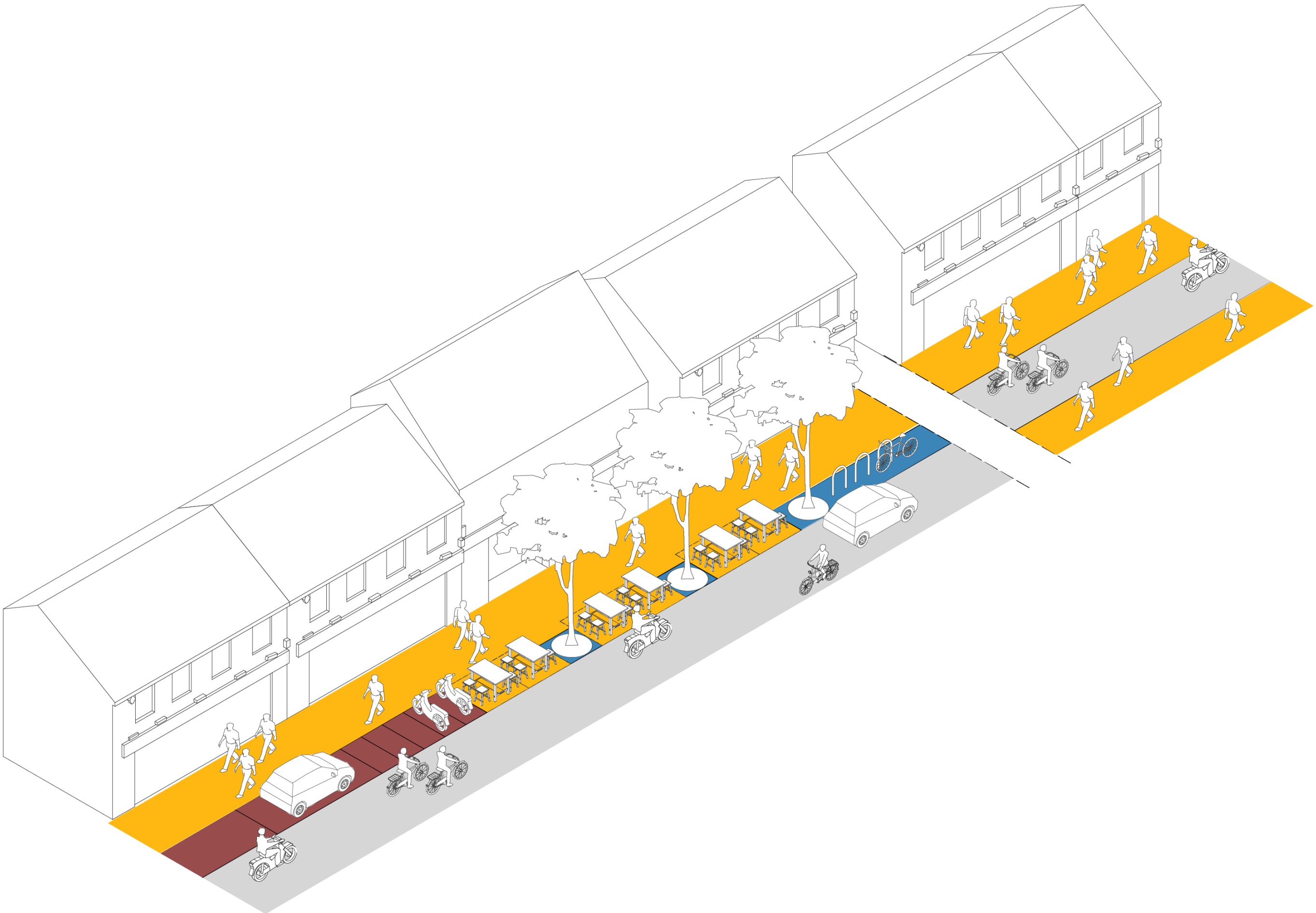


Variant 1b. In some sections, parking space can be provided yet interspersed by space for road furniture and shade vegetation. The smaller road furniture space can be used for signage, streetlamps, or potted plants

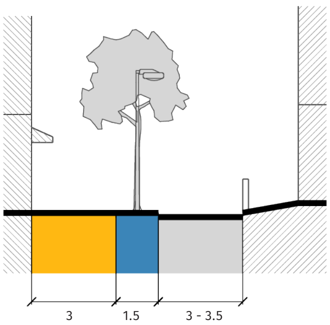


Variant 2. Two-way street with sidewalk on one side of the road

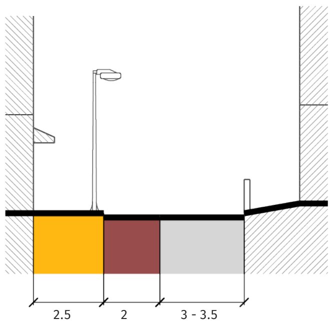




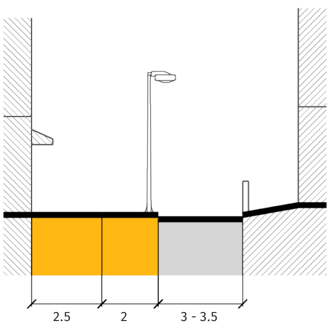
Variant 3a. Sidewalk on one side of the road with shade vegetation and road furniture space. This variant fits well on street with one active commercial side



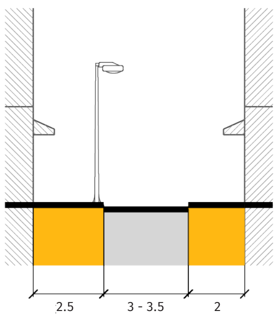
Variant 3b. On a few segments, space for parking can be provided



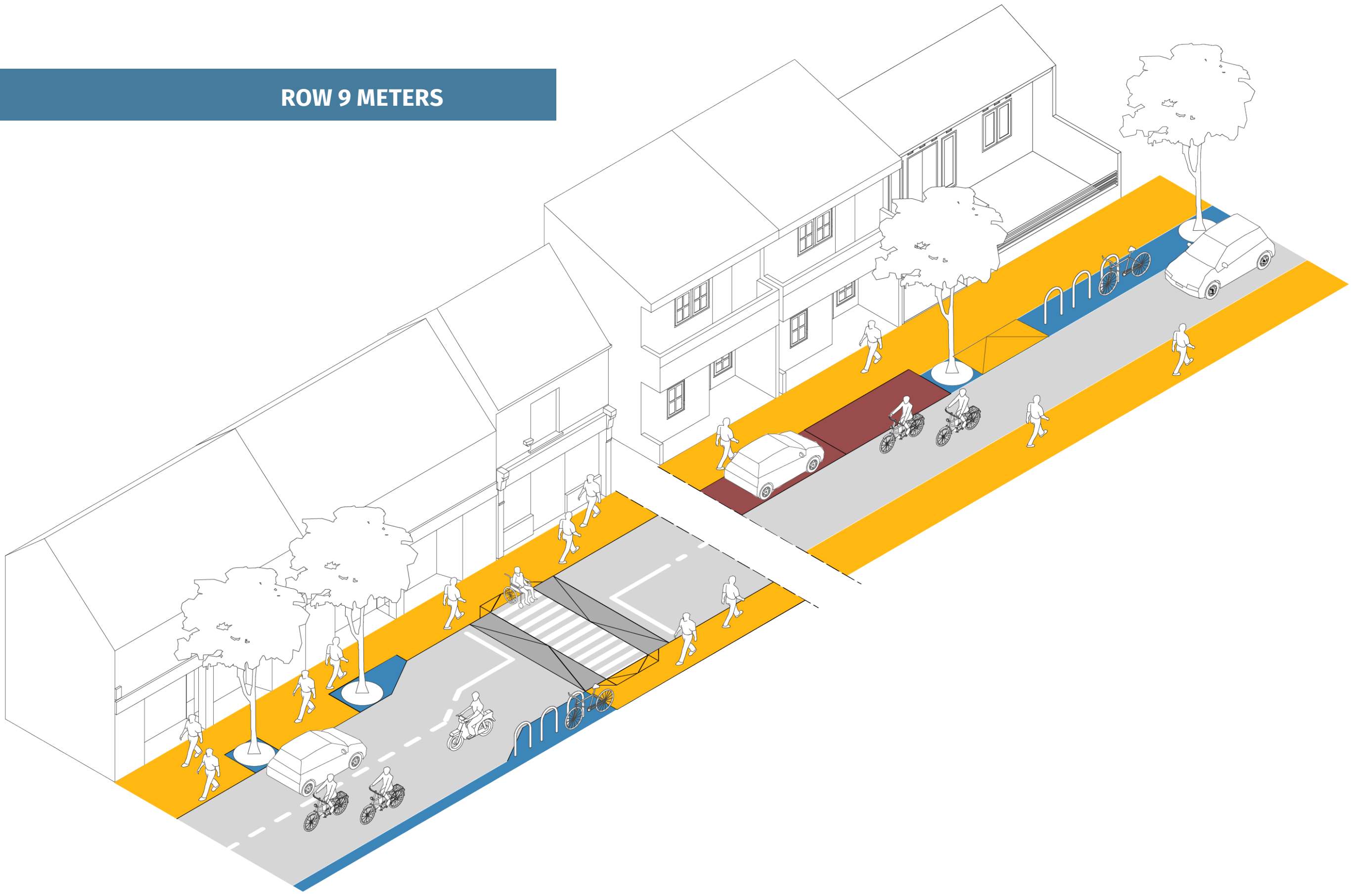
Variant 3c. This variant can be applied to provide business space while still guaranteeing sufficient space for pedestrians



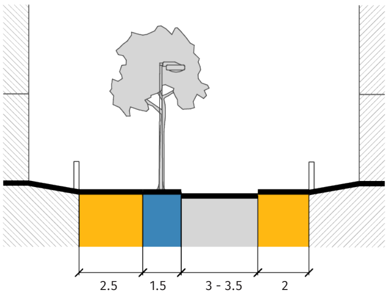
Variant 4. Sidewalks on two sides for street with two active commercial sides



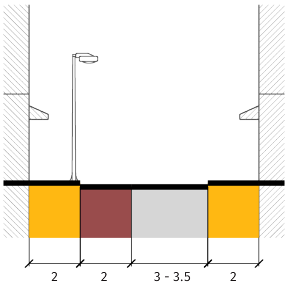
ROW 9 METERS



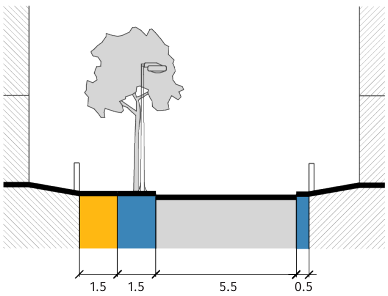
Variant 1a. Sidewalk on both sides of the road with space for shade vegetation and road furniture



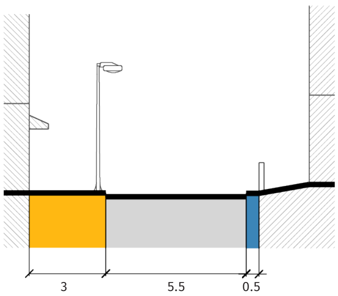
Variant 1b. In some sections, parking space can be accommodated and interspersed by space for shade vegetation



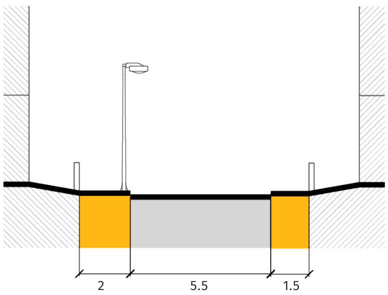
Variant 2a. Sidewalk on one side of the road with space for shade vegetation and road furniture. The smaller road furniture space can be used for signage, streetlamps, or potted plant



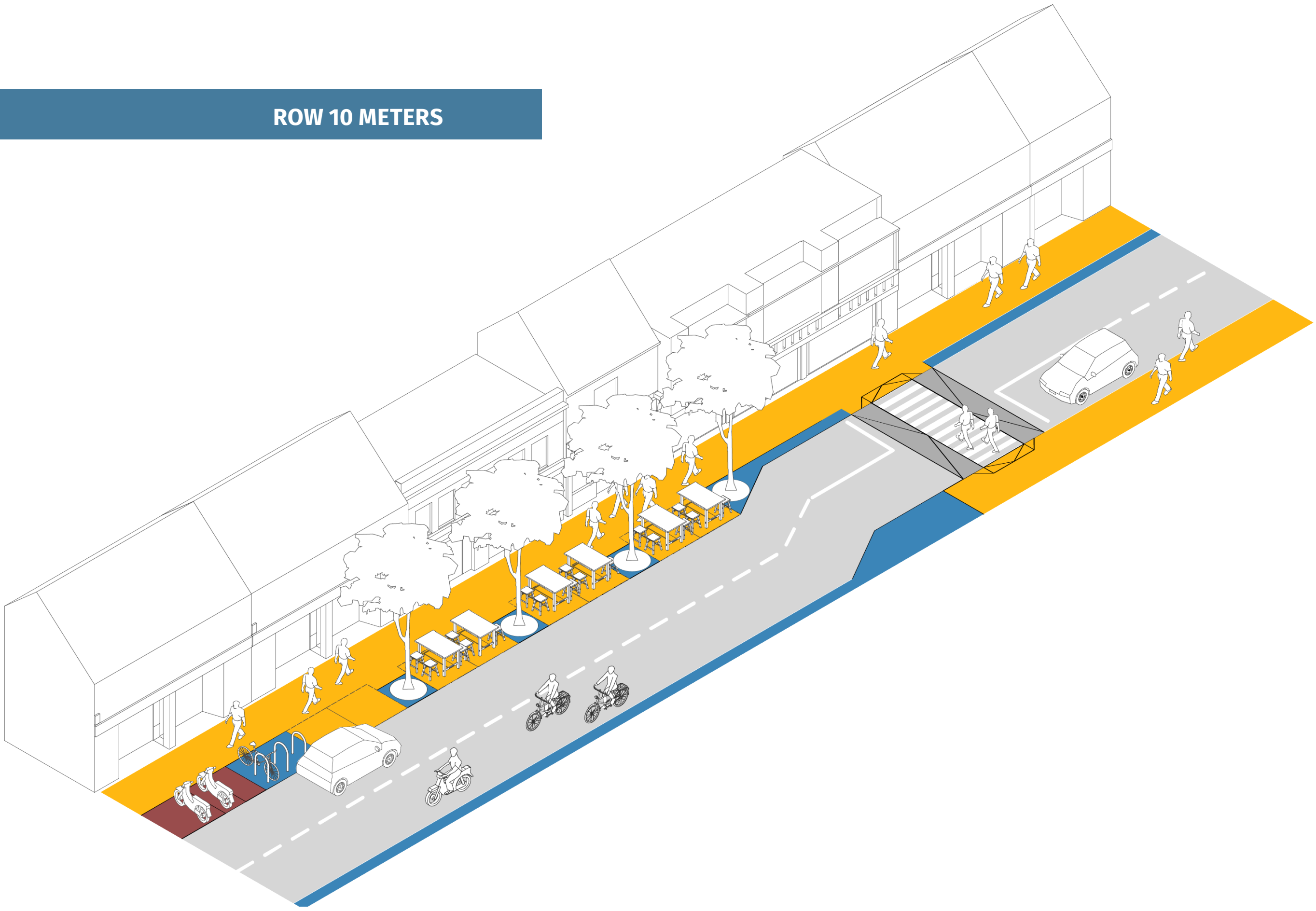
Variant 2b. On a street with one active commercial side, a spacious sidewalk can be provided on that particularly active side



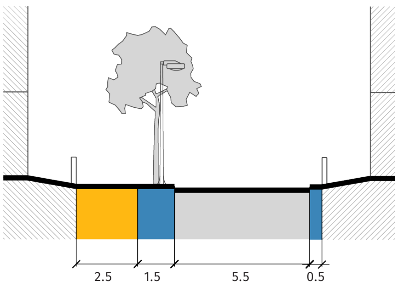
Variant 3. Sidewalk on both sides of the street with 2 active commercial sides. Streetlamps or other utilities can be placed on the bigger part of the sidewalk. This example can be used on a street that already has good shade from building canopies on commercial area, or from trees on private areas on both sides of housing area



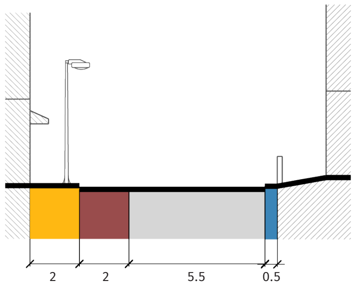
ROW 10 METERS



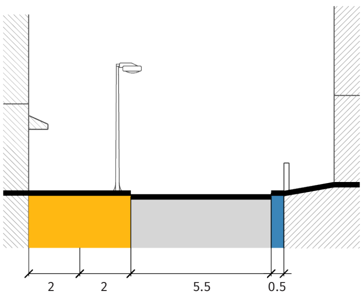
Variant 1a. Sidewalk on one active side of the road with space for shade vegetation and road furniture



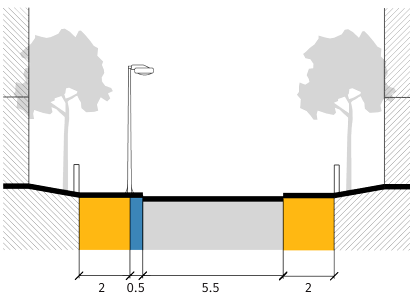
Variant 1b. In some sections, parking space can be accommodated, interspersed with spaces for shade vegetation



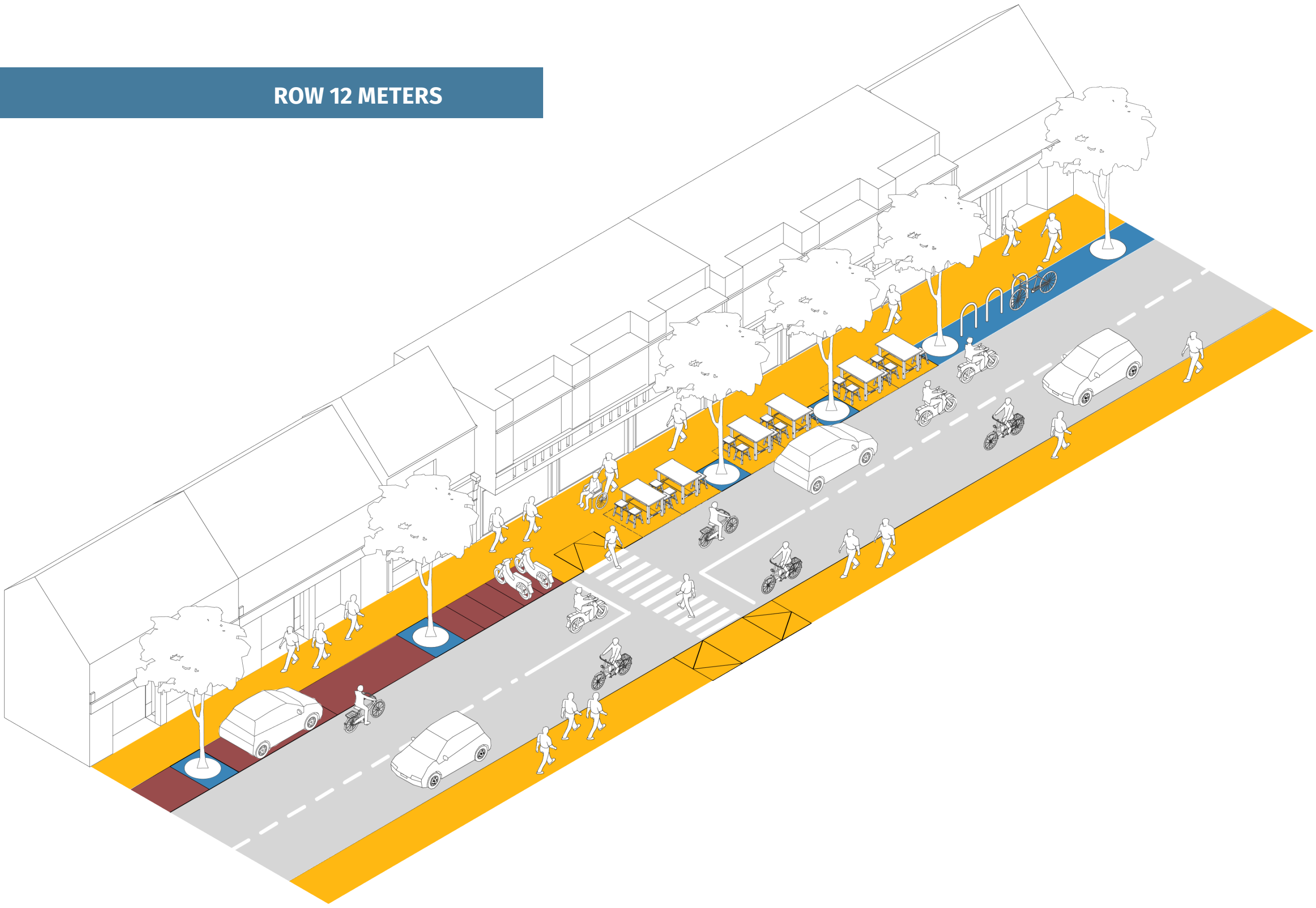
Variant 1c. In some sections, business space can be provided, particularly on areas with active commercial activity



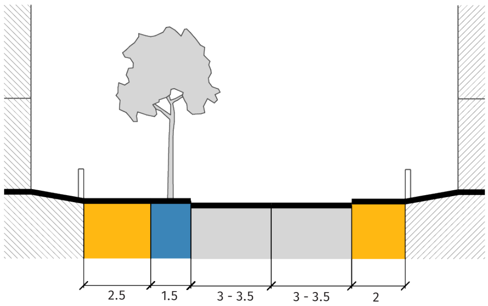
Variant 2. Sidewalks on both sides of the road with space for road furniture. This example can be applied on streets with existing shade from building canopies in commercial areas or from vegetation in private areas on both sides of housing area



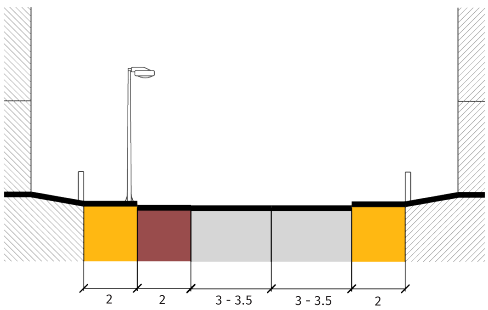
ROW 12 METERS



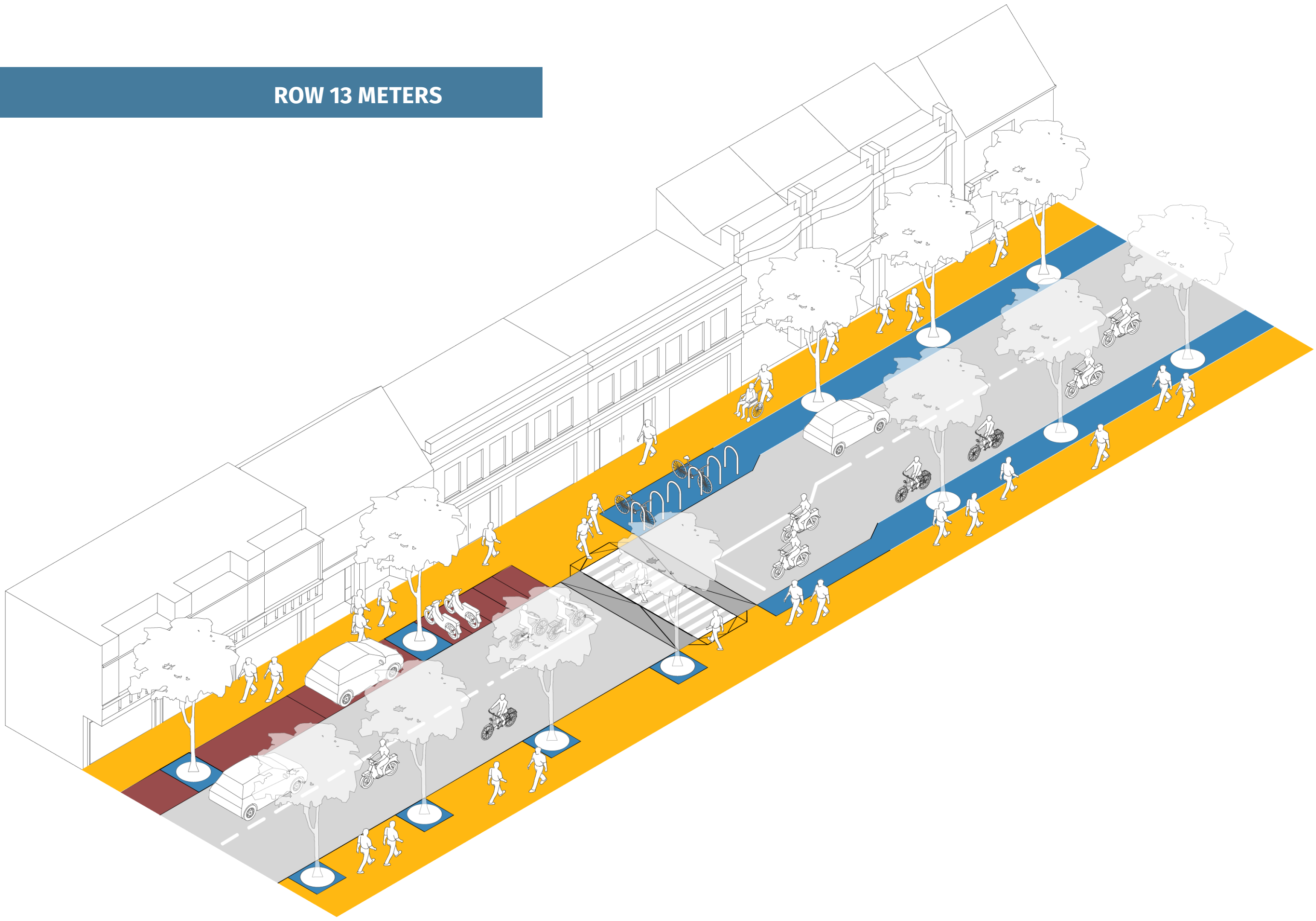
Variant 1. Sidewalks on both sides of the road with space for shade vegetation and road furniture. Can be interspersed with 2 m-wide business spaces



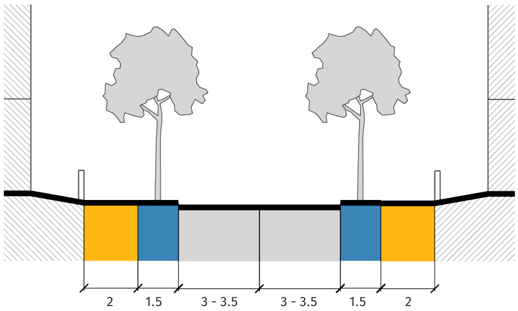
Variant 2. If needed, space for parking can be accommodated and also interspersed with space for shade vegetation and road furniture



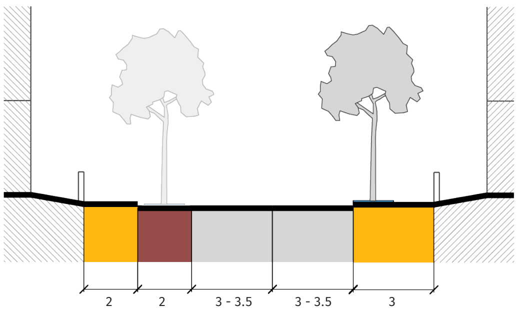
ROW 13 METERS



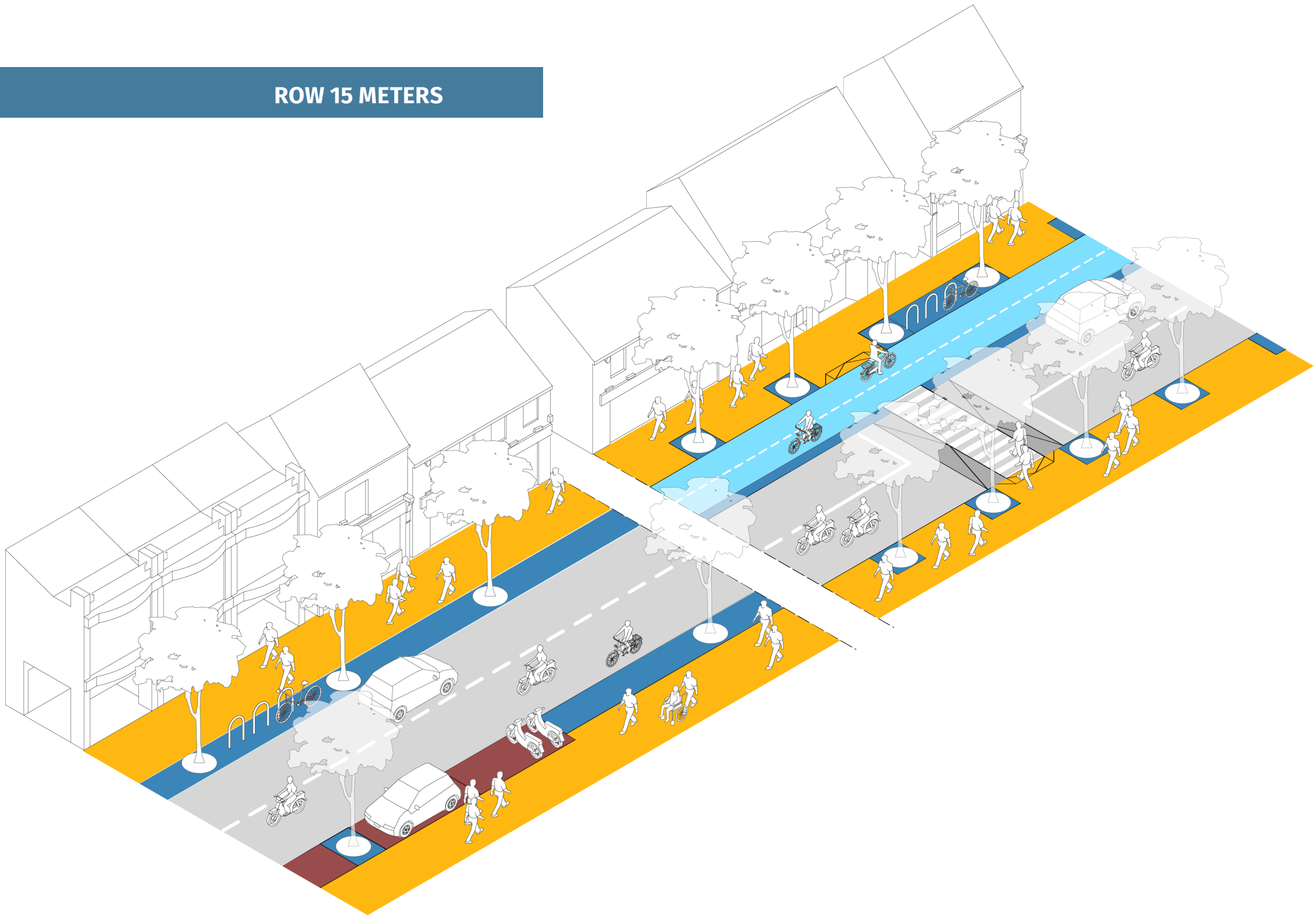
Variant 1. Sidewalks on both sides of the street with space for shade vegetation and road furniture



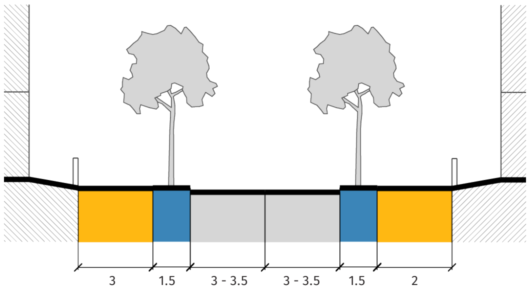
Variant 2. If needed, space for parking can be provided, interspersed with space for road furniture and shade vegetation



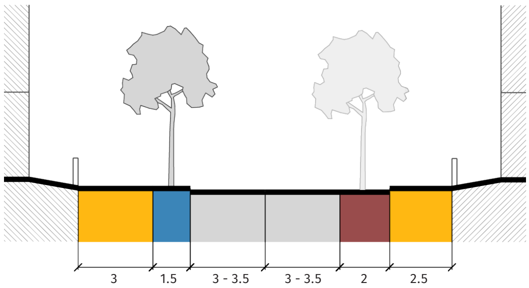
ROW 15 METERS



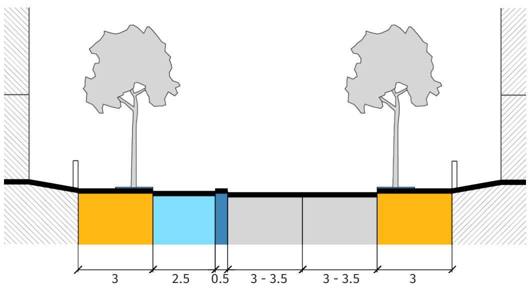
Variant 1. Sidewalks 3 meters wide to accommodate pedestrians on both sides of the road with space for road furniture and shade vegetation



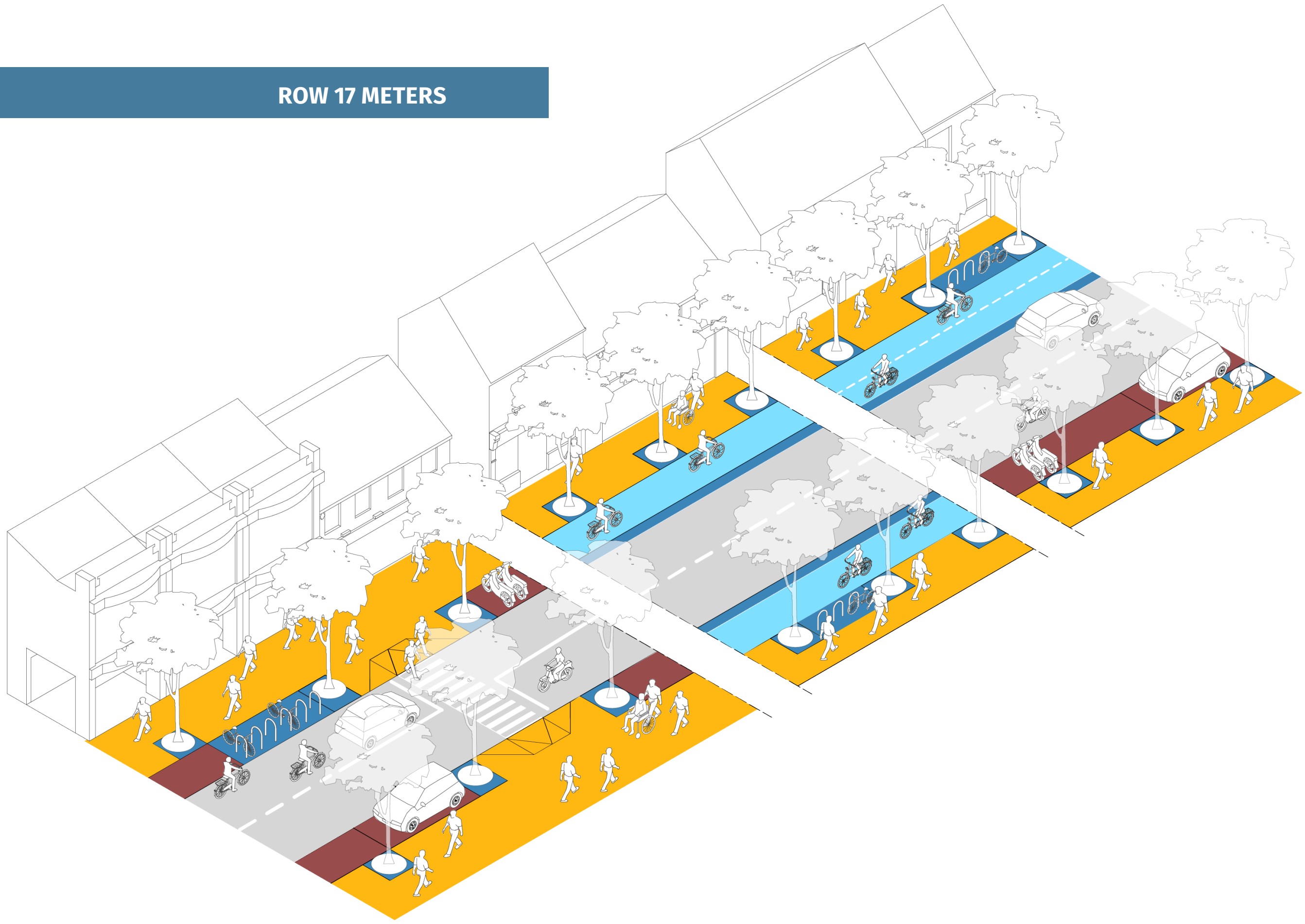
Variant 2. If needed, spaces for parking can be provided in particular sections, interspersed with space for road furniture and shade vegetation



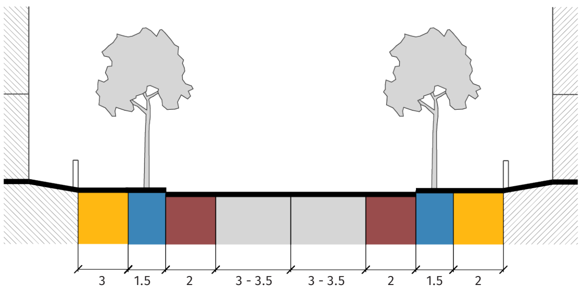
Variant 3. On street 15 meters wide, two-way cycling lane can be provided on one side of the road



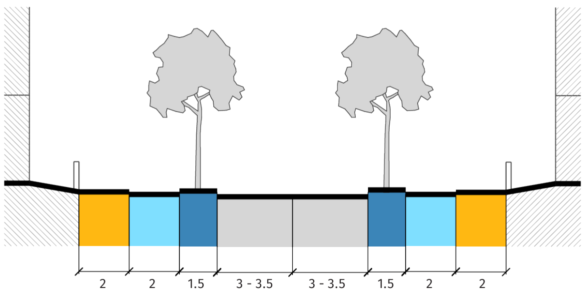
ROW 17 METERS



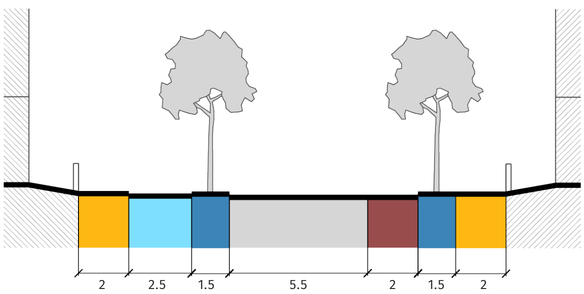
Variant 1. Sidewalks 2 to 3.5 meters wide to accommodate pedestrians on both sides of the road, with space for road furniture and shade vegetation



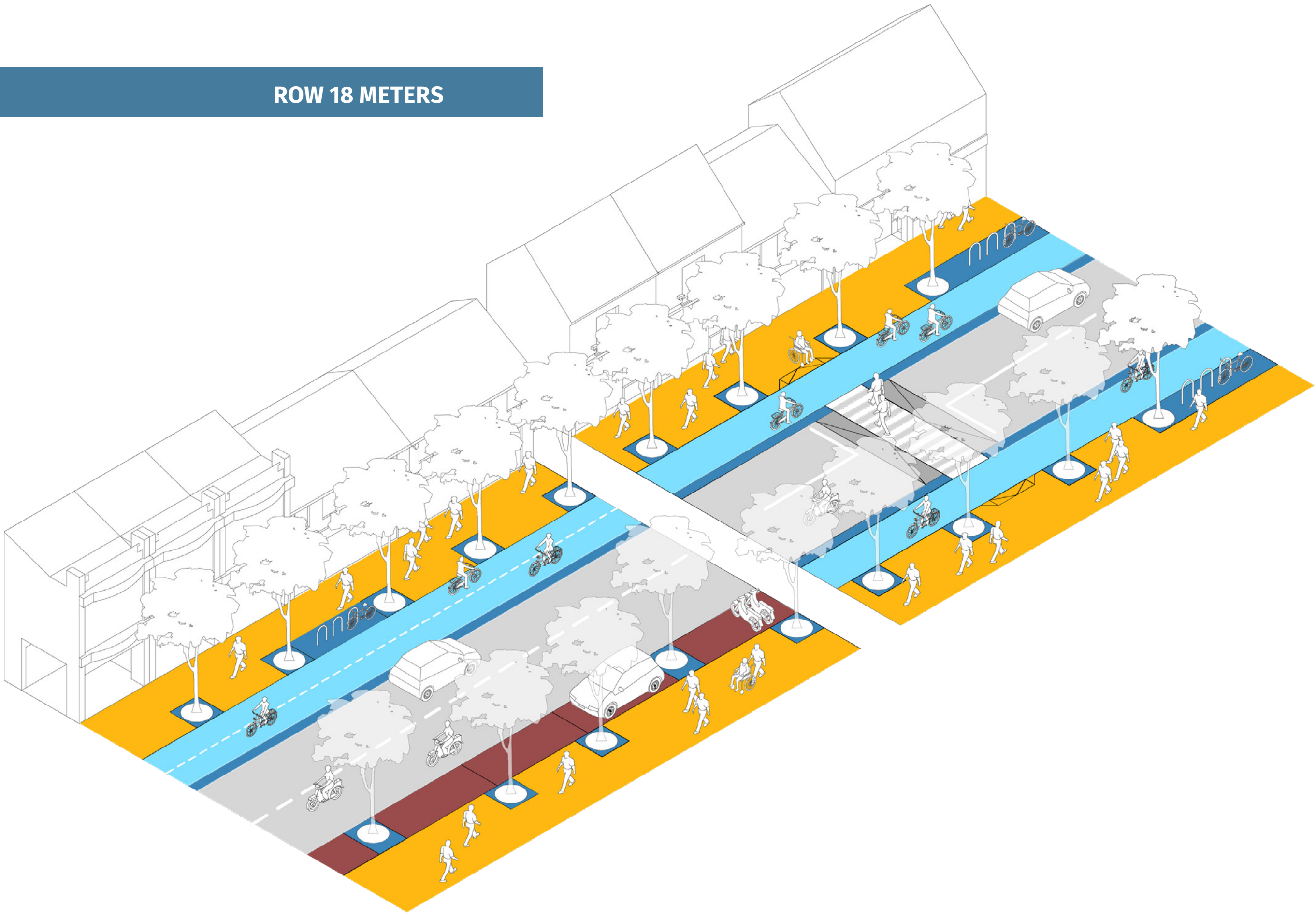
Variant 2. On streets 17 meters wide, two-way bicycle lanes can be provided on each side of the road



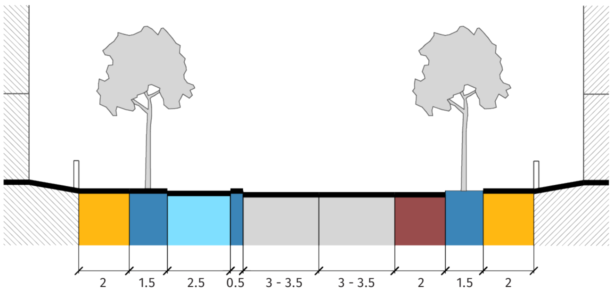
Variant 3. If needed, spaces for parking can be provided by replacing the two-way bicycle lanes to be on one side of the road



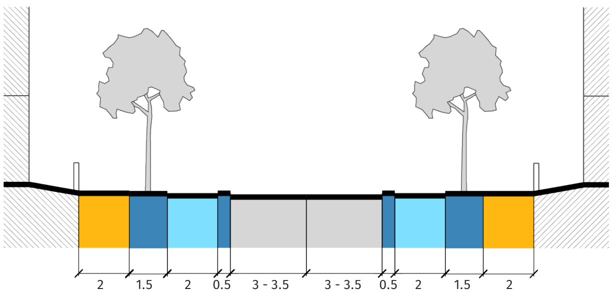
ROW 18 METERS

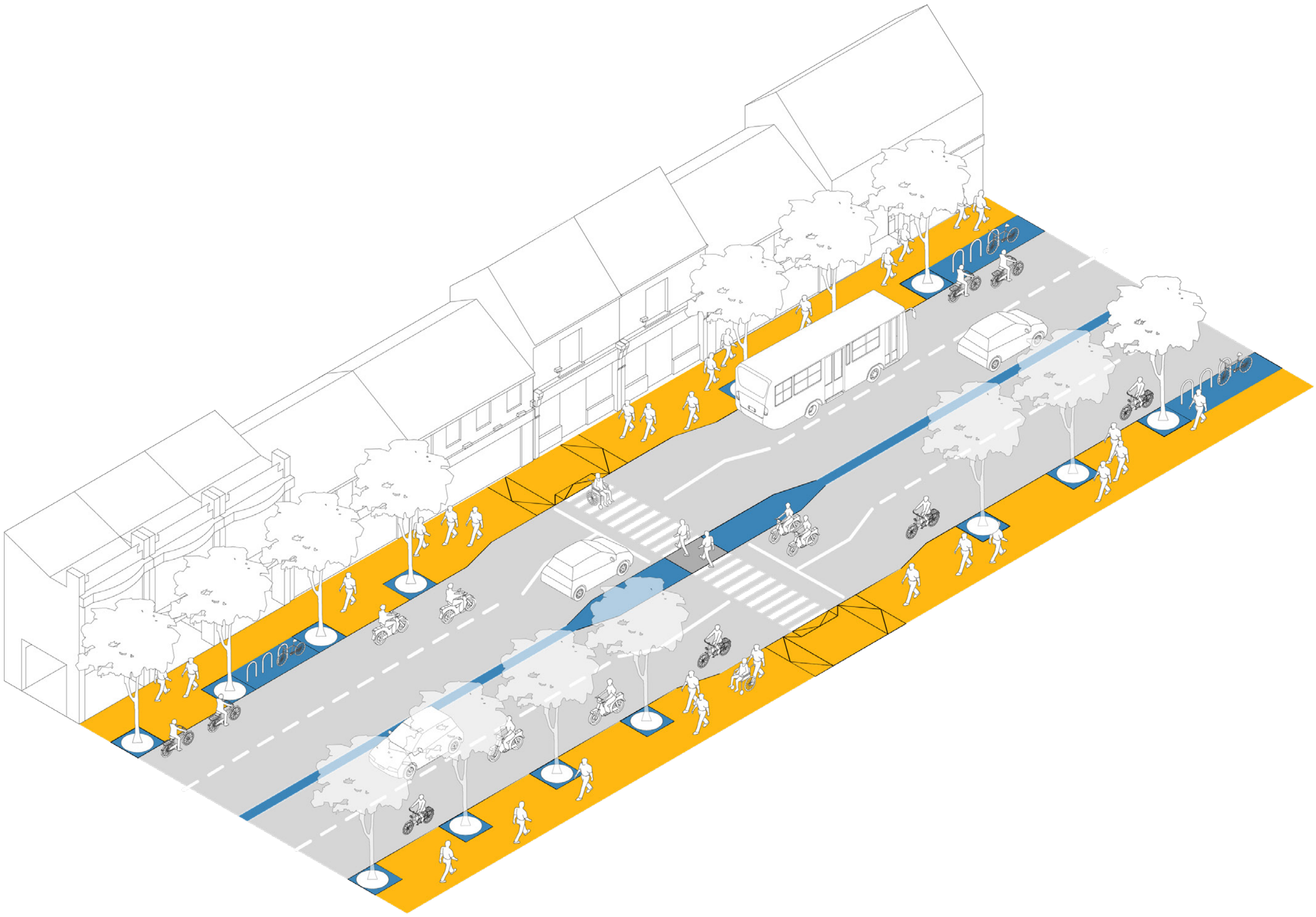


Variant 1. Two-way bicycle lanes can be provided along with space for shade vegetation and road furniture on one side of the road and space for parking on the other side

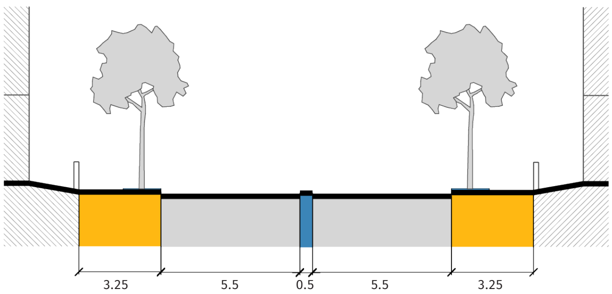


Variant 2. Streets equipped with one-way bicycle lane on both sides of the road

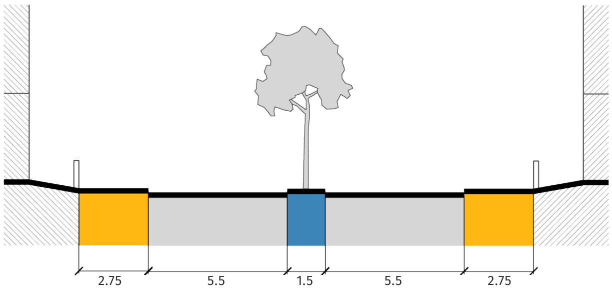




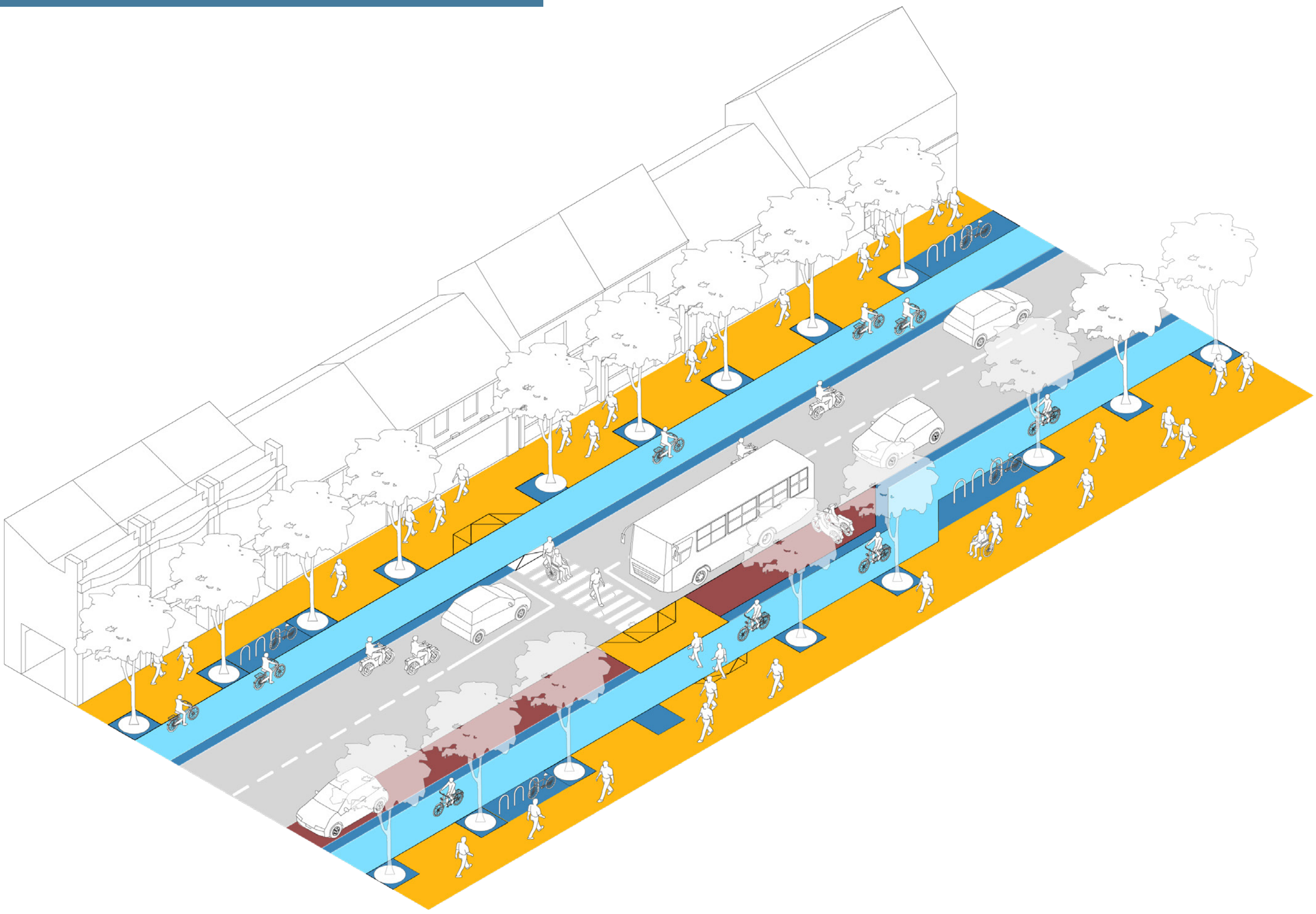
Variant 3a. On streets 18 meters wide, four lanes can be provided on two-way street while still providing accessible sidewalks. Road furniture can be placed In between tree pits. Sections with crossings should be combined with Variant 3b



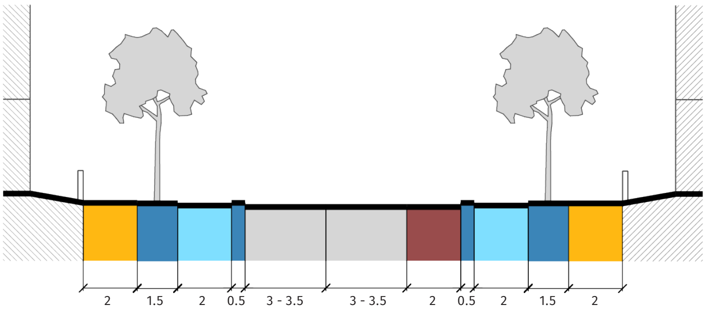
Variant 3b. For segments with crossings, the median should be widened to a minimum of 1.5 meters to accommodate pedestrian refuge island

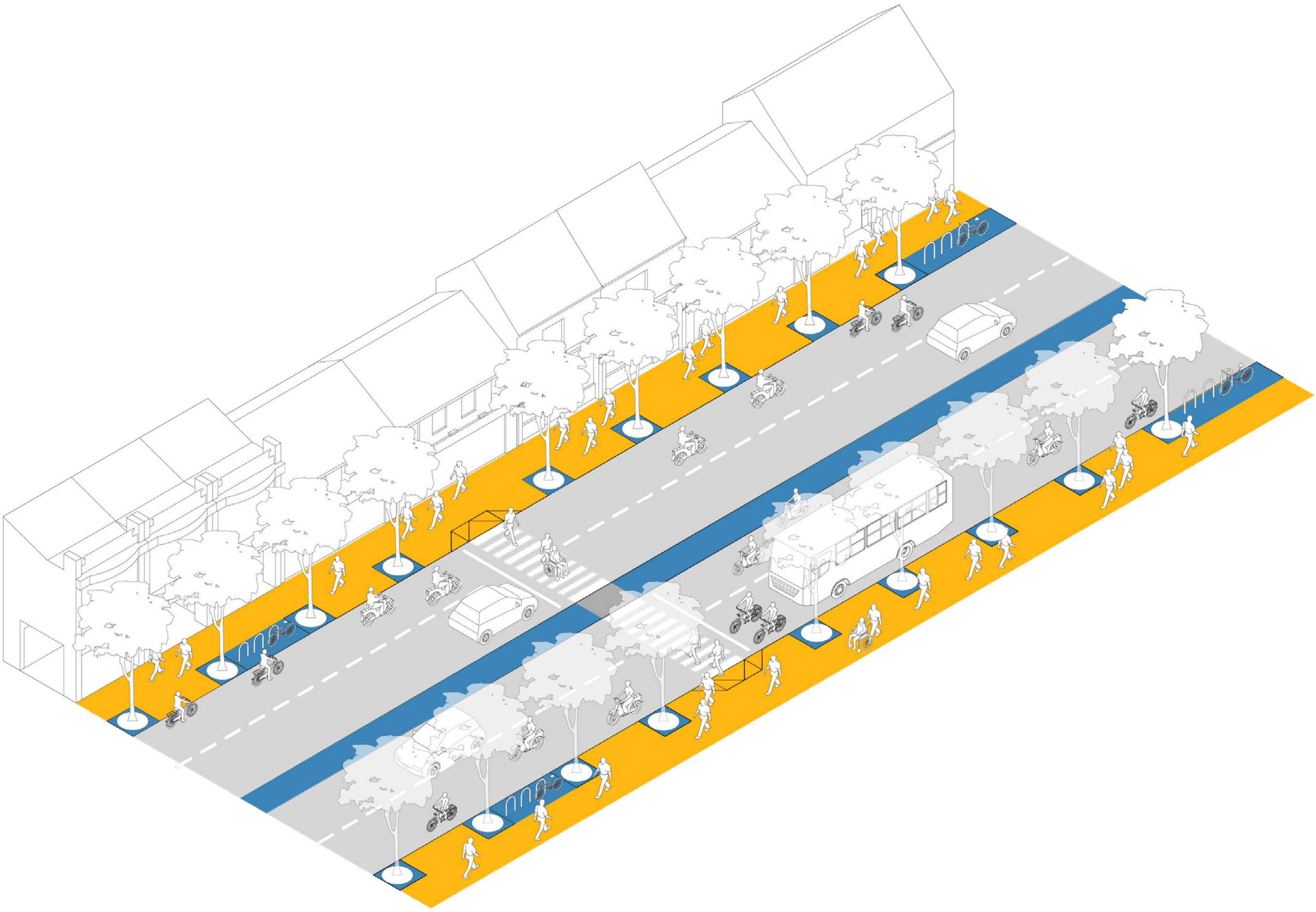


ROW 20 METERS

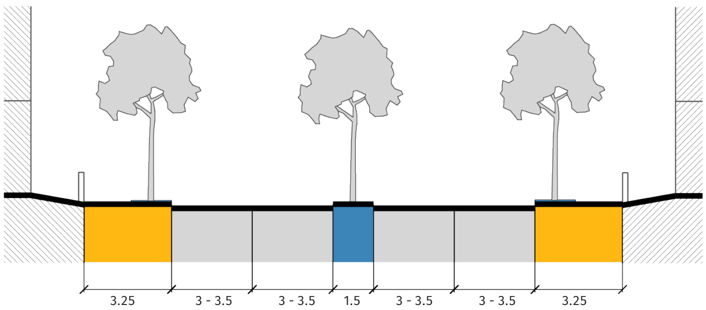


Variant 1. For streets with two lanes, one-way bicycle lane can be provided on both sides of the road. Parking spaces can also be provided if needed by moving bicycle lane toward the building sides

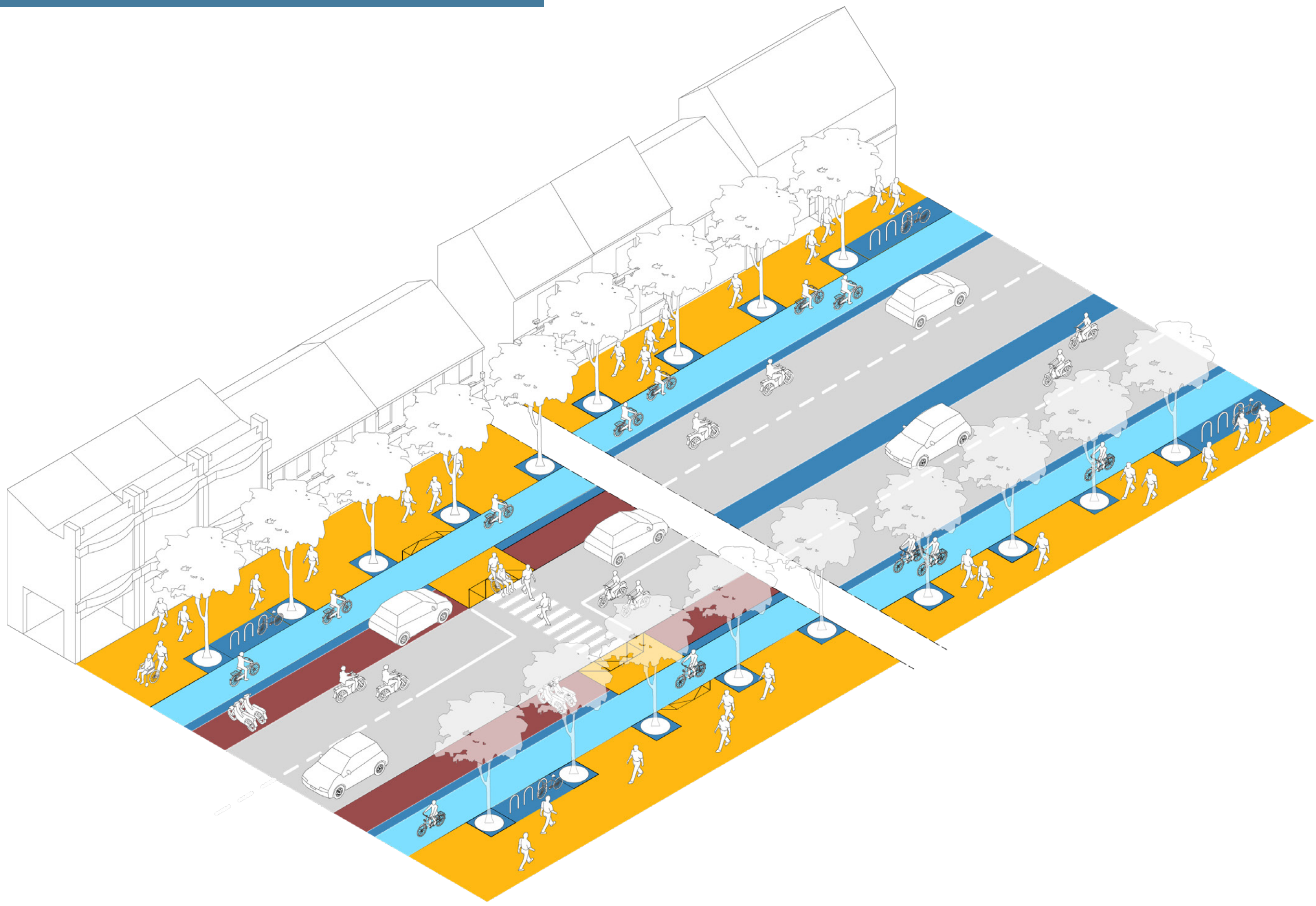




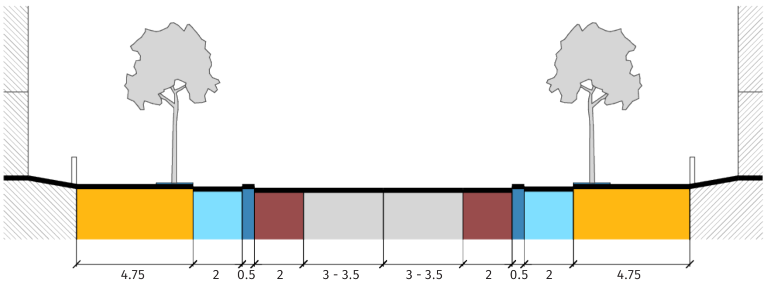
Variant 2. Streets with four lanes can be equipped with a straight median with that is 1.5 meters wide. Median cut through should be provided at every crossing



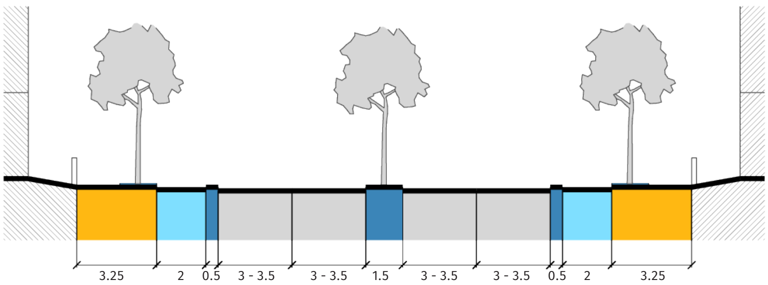
ROW 25 METERS

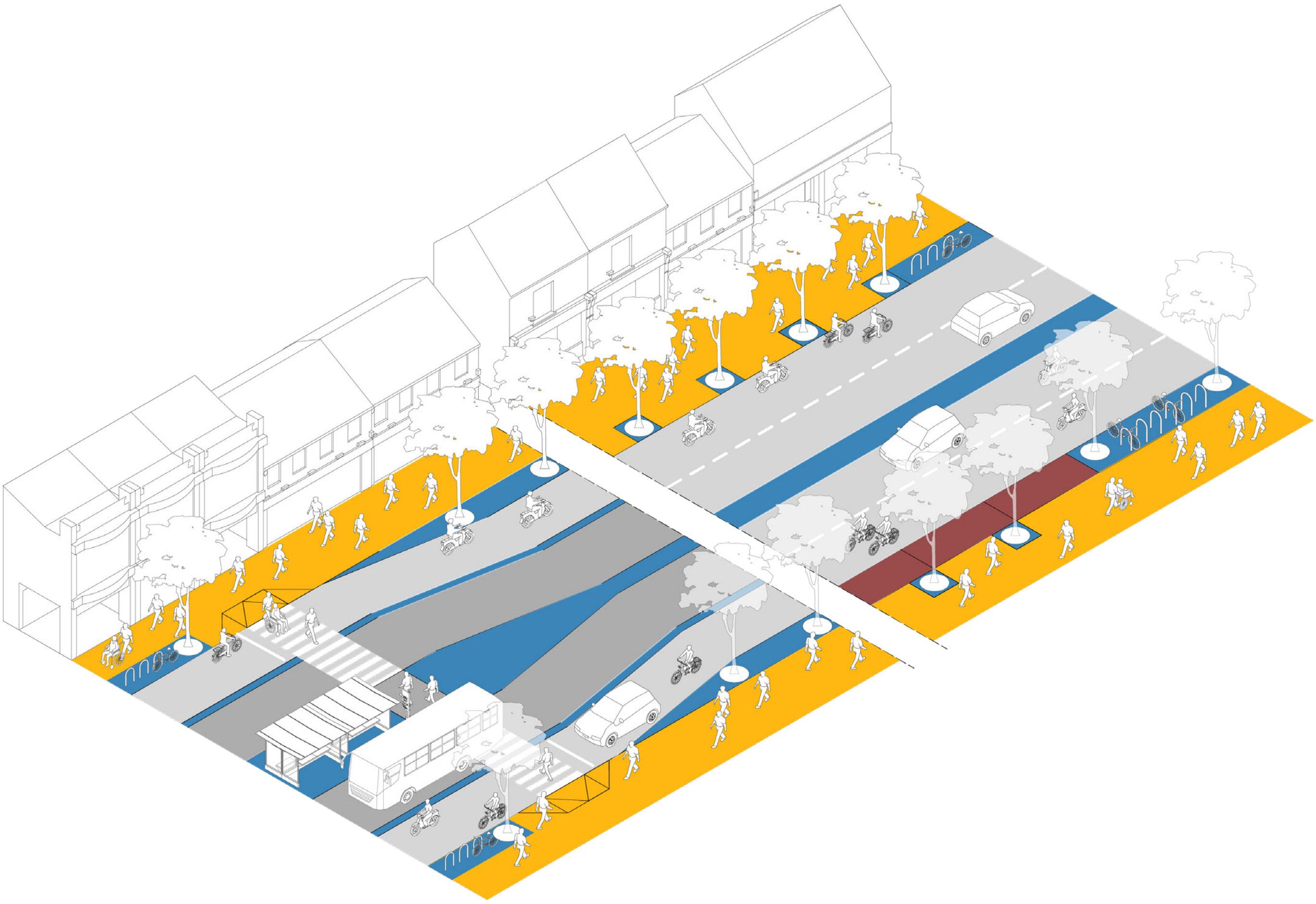


Variant 1. In a commercial area with active frontage, wide and shaded sidewalks can be provided to accommodate pedestrians and to encourage economic activities. Motorized vehicle lanes can be limited to two lanes so there will be space for bicycle lanes and parking

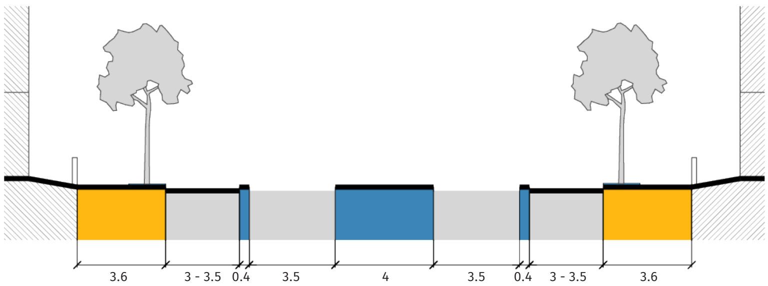


Variant 2. If needed, four lanes can be provided for motorized vehicles. Some space at the sidewalk can be interspersed with spaces for shade vegetation and road furniture

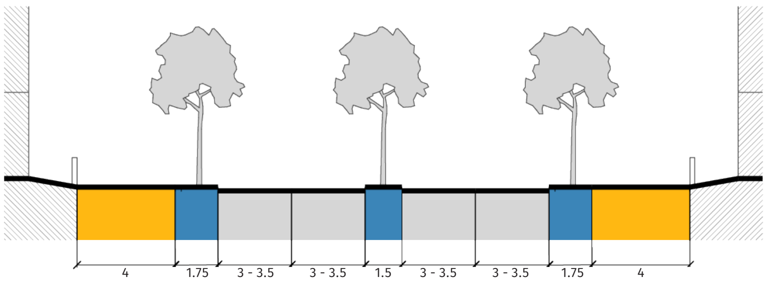




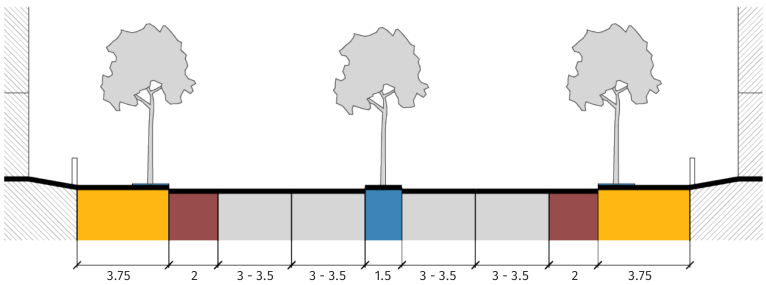
Variant 3. On street space that is 25 meters wide, BRT or special bus lanes can be provided if needed



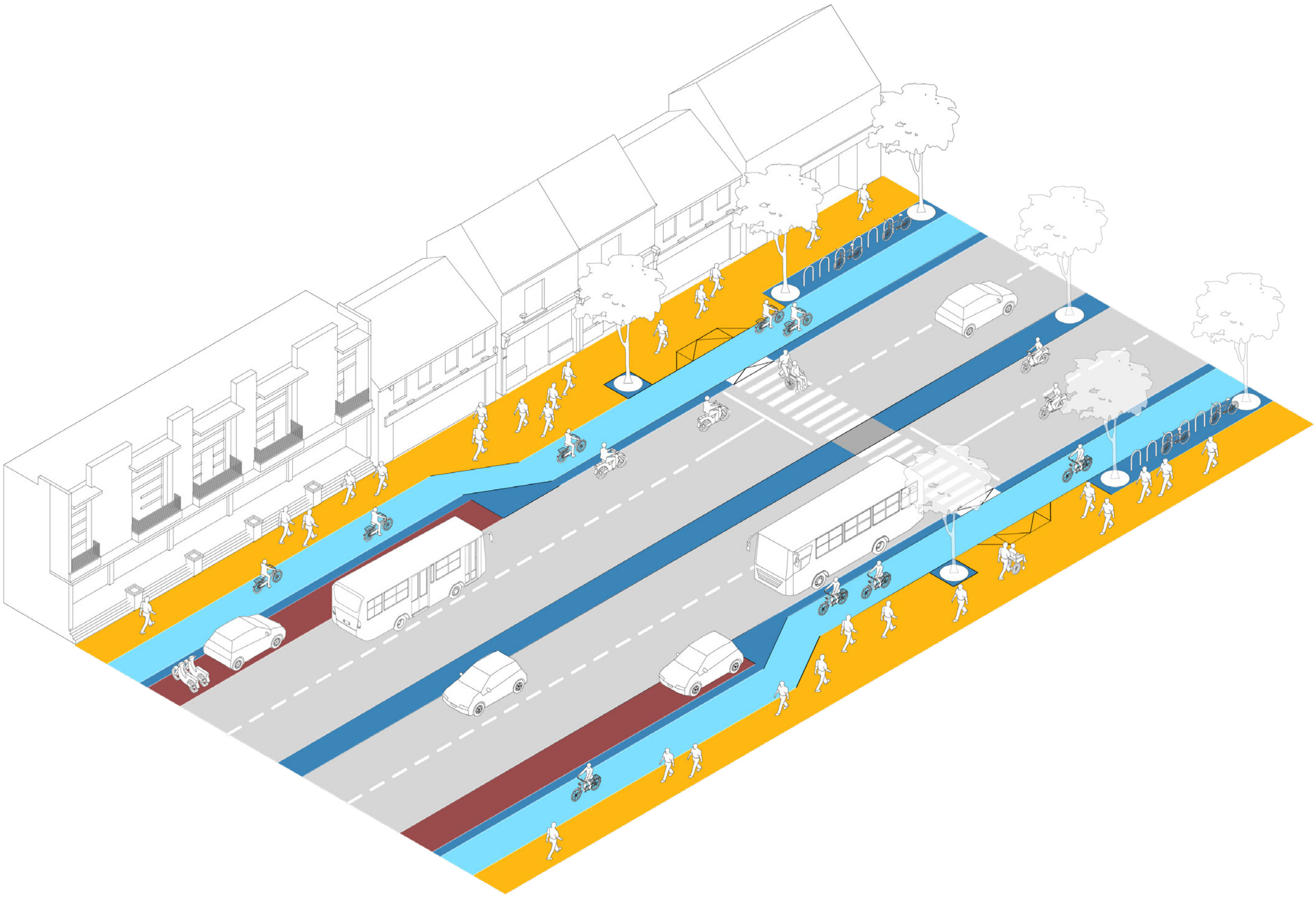
Variant 4a. On street without BRT lanes, four lanes with wide sidewalks can be made to encourage vibrant economic and social activity on the sidewalks



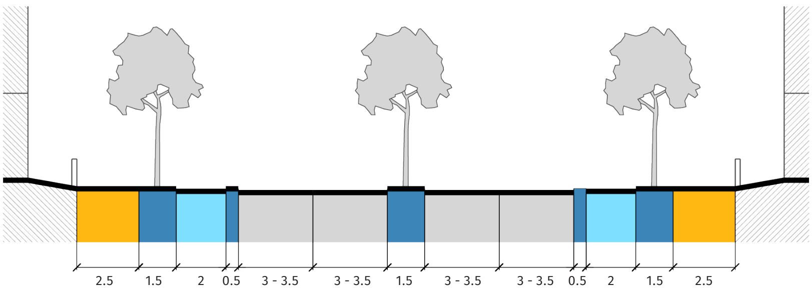
Variant 4b. Parking provision can be made by reallocating some of road furniture space in particular sections. Shade vegetation needs to be placed regularly to create a comfortable walking experience



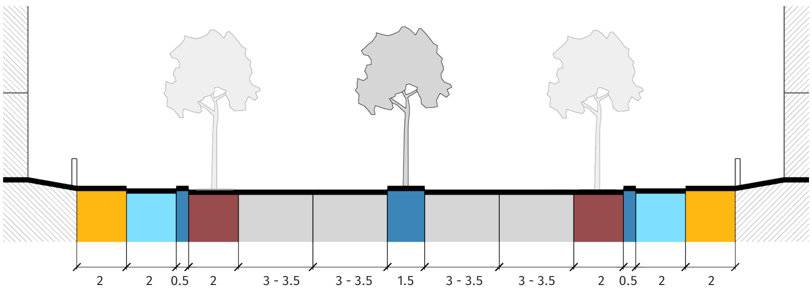
ROW 26,5 METERS



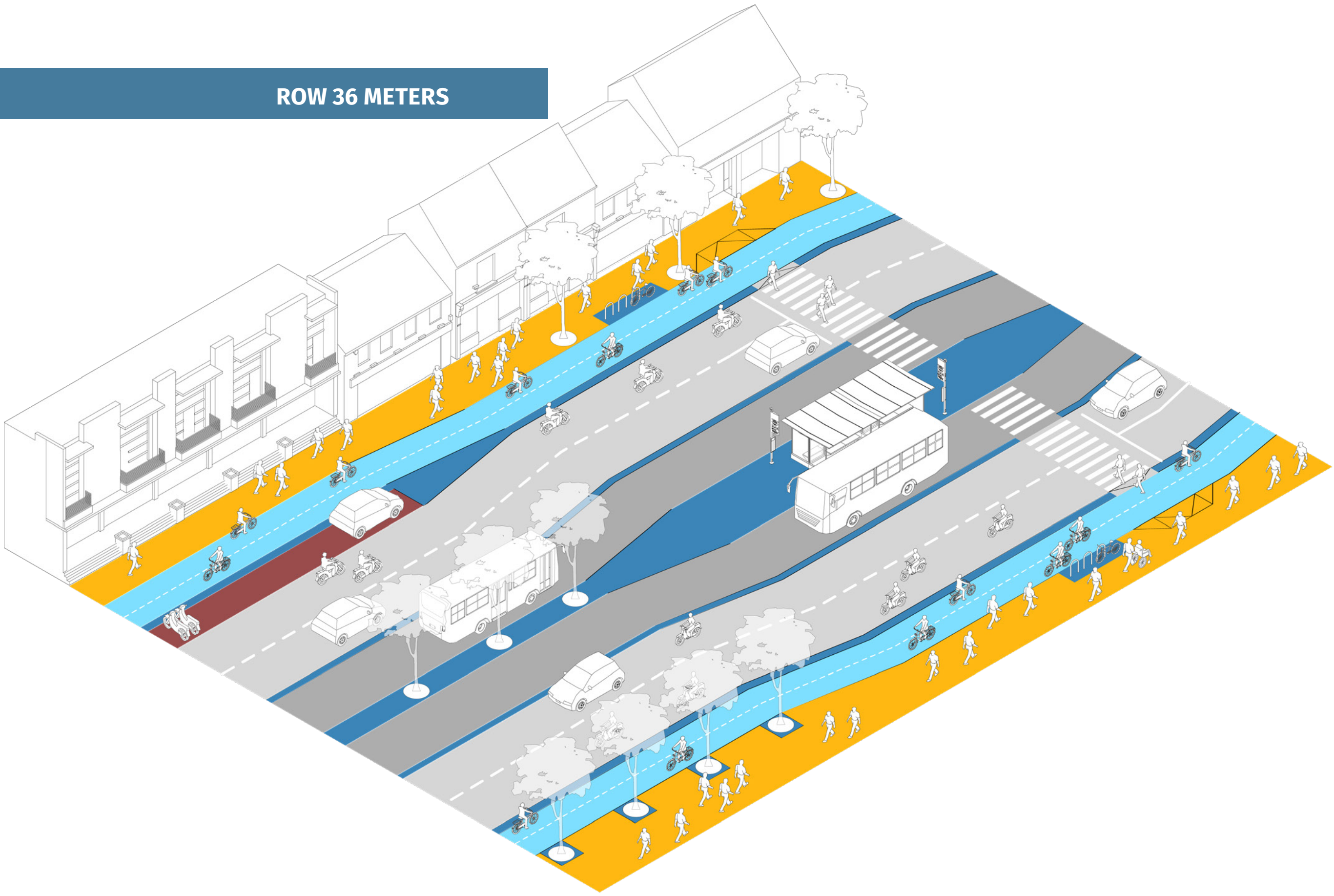
Variant 1. Sidewalk and one-way cycling lanes can be provided on both sides of the road



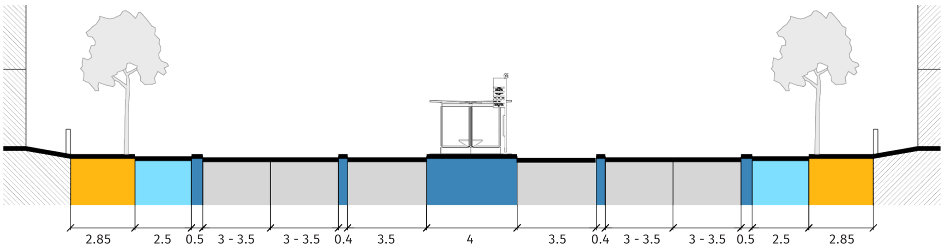
Variant 2. Parking space can be provided in certain sections by moving bicycle lanes toward sides of building. This can be done by interspersing spaces for shade vegetation and road furniture



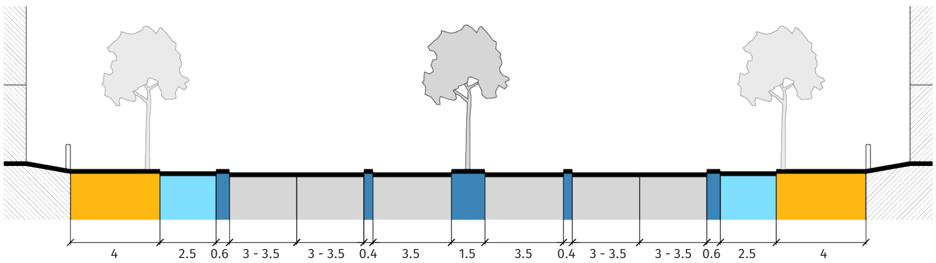
ROW 36 METERS



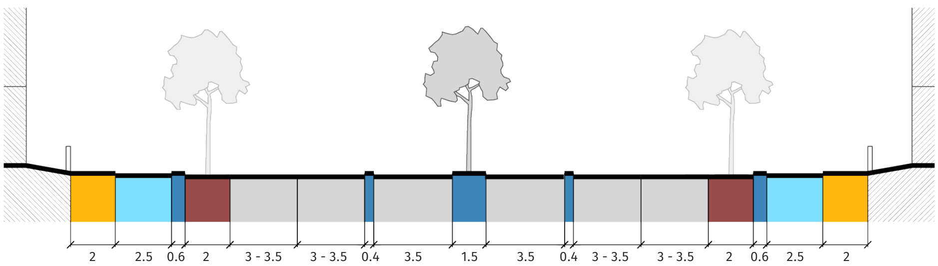
Variant 1a. Sidewalk and two-way bicycle lane on each side of road, dedicated public transport lanes, and four lanes for motorized vehicles can be accommodated on road with 36 meters of street space width. In this variant, the median is widened to accommodate BRT stations



Variant 1b. Sidewalk can be widened on sections outside BRT stations



Variant 1c. If needed, parking space can be provided by moving bicycle lane toward the side of the buildings



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