FOREWORD

Over a quarter of Kenya’s 50 million people live in cities, and the urban population is growing rapidly. By 2030, nearly half of Kenyans will live in urban areas. With this high rate of urbanisation, many of our cities are struggling to keep up with the demand for transport services and infrastructure. Nairobi and other urban areas are experiencing increasing time lost in traffic, unacceptable numbers of deaths from traffic crashes, poor access to opportunities, and rising pollution.

Along with the influx of motorised transport in our cities, once walkable places have been redesigned to prioritise personal motor vehicles. Yet walking and public transport remain the dominant modes of transport in Kenyan cities. In Nairobi, 40 percent of daily trips in Nairobi are accomplished by foot and another 40 percent are made through public transport. As many cities around the globe have realised, the trend toward car-centric city design undermines quality of life and character of public spaces.

There is urgent need to start viewing streets as places where people walk, cycle, talk, shop, and perform a myriad of social activities. Efficient mobility and liveable streets are critical to the prosperity of Kenya’s cities. My Ministry recognises that sustainable mobility will facilitate economic activity, play a key role in climate change mitigation, and enhance access to education, jobs, and health facilities. This manual aims to support the design of beautiful, safe, walkable, and liveable streets. This manual is intended for engineers, planners, urban designers, landscape architects, and, most importantly, government officials and citizens who are interested in improving the quality of urban environments and the character of streets in Kenyan cities.

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1. INTRODUCTION

In any urban setting, streets play a critical role in enabling residents to move from one part of the city to the next, meet, conduct business, socialise, and relax. The design of streets, therefore, has a large impact on quality of life.

Most African cities have experienced a surge in motor vehicle ownership over recent years. This has resulted in traffic congestion, air pollution, and a deteriorating urban environment. As many cities attempt to accommodate the increasing motorised traffic, more and more of the public realm is taken up by vehicles, leaving little or no space for the social and economic activities that enable cities to thrive. With Kenya’s urban population projected to reach 23 million by 2030, connectivity to education, employment, and social opportunities is fundamental to the development of the country. Kenya must start providing the required urban transport facilities and services to enable the citizens to access opportunities safely and efficiently.

To address these issues, the Ministry of Transport, Infrastructure, Housing, Urban Development, and Public Works (MOTIHUD) in partnership with the Global Road Safety Fund (GRSF) and Institute for Transportation and Development Policy (ITDP) is preparing this manual for street
design in urban areas in Kenya. The design manual seeks to mainstream best practice street designs that include sustainable modes of transport and improve safety for vulnerable road users—particularly pedestrians and cyclists. Besides reducing the risk of death and serious injury, more inclusive, safer urban road designs will yield significant co-benefits. Improved mobility for majority road users will not only improve road safety but also enhance access to jobs and opportunities, lower demand for travel by motorised vehicles, and reduced air pollution.

The development of the Street Design Manual for Urban Areas in Kenya is guided by the Bill of Rights of the Constitution of Kenya, Article 39, which guarantees all Kenyan citizens the right of movement. Providing equitable and universal access is in line with the provisions of Article 27, which guarantees “equality and freedom from discrimination.” Kenya’s Vision 2030 provides the appropriate base for the formulation of the standards as it targets to transform Kenya into a newly “industrialized middle-income country providing a high quality of life to all its citizens by 2030.”

The integrated National Transport Policy for Kenya recognises the important role of non-motorised transport (NMT) and public transport in responding to mobility needs for low-income groups and promoting quality of life and general well-being for the citizenry. The Policy emphasises the need to integrate NMT into the planning, design, development, and implementation of road infrastructure. The policy further aims at developing efficient, sustainable, and professionally operated public transport seamlessly integrated with NMT and land use planning.

1.1. POLICIES AND LEGISLATION

The desire for safe, attractive and vibrant streets is reflected in a range of existing transport, planning, and environmental policies and acts. These policies advocate for the creation of street spaces that persons for all ages and abilities can enjoy together.

**Constitution of Kenya (CoK) of 2010:** Establishes the devolved system of governance and the formation of county governments with departments for roads and transport that are responsible for the planning, development and maintenance of county roads, street lighting, traffic, and parking. The Constitution mandates the national government with construction and operation of national trunk roads and formulating standards for construction and maintenance of county roads. The Constitution guarantees all citizens the right to freedom of movement under article 39(1) and the right to a clean and healthy environment under article 42. All public offices are mandated to respond to the needs of vulnerable members of the society, including women, aged, children, persons with disabilities, and minority/marginalised communities.

**Integrated National Transport Policy of 2009:** Notes that urban areas, especially Nairobi, Mombasa, Nakuru, Kisumu, and Eldoret, are charac-
terised by an inadequate supply of public transport and stiff competition for limited road space among motorists, pedestrians and cyclists. The policy proposes strict parking policies, access restrictions for private cars, and road pricing in order to enhance traffic demand management. The policy notes the inadequacy of NMT infrastructure and emphasises the need to provide appropriate basic road infrastructure, including walkways, pedestrian crossing, and other facilities for NMT users.

**Nairobi City County NMT Policy of 2015:** Calls for road designs that adhere to complete street principles incorporating “dignified space” for NMT users, including continuous footpaths and dedicated cycle tracks. Street designs should be based on a user hierarchy that prioritises NMT first and cars second. It calls for the adoption of an urban street design manual.

**National Urban Development Policy (Draft of 2013):** Recognises that walking and cycling receive inadequate attention despite being key modes of urban transport. The policy calls for strategies and standards that place emphasis on safe, quality mass transport; pedestrian and cycling facilities; and well-designed public spaces in urban areas.

**Physical Planning Handbook of 2002:** Provides guidelines and minimum standards for physical planning, including planning for transport infrastructure. The handbook calls for dedicated pedestrian and bicycle facilities and adequate landscaping.

**Kenya Roads Board Act of 1999 (Revised Edition 2012):** Provides for the establishment of the Kenya Roads Board, an agency tasked with distributing revenues from fuel levies for use in road maintenance.

**Kenya Road Act of 2007:** Provides for classification, management, construction and maintenance of public roads in Kenya and establishes KeNHA, KURA, and KeRRA and stipulates their functions.

**Physical Planning Act (Cap 286) of 1996 (Revised Edition 2012 [2010]):** Provides for the preparation and implementation of physical development plans, including provisions for new roads, streets, or rights-of-way, subject to the approval and to the provisions of the Public Roads and Roads of Access Act (Cap. 399), and the Street Adoption Act (Cap. 406).

**Environmental Management and Coordination Act (EMCA) of 1999:** Establishes the National Environment Management Authority (NEMA) and legal framework for the management of the environment and lists all major roads among projects to undergo environmental impact assessment before construction.

**Urban Areas and Cities Act of 2011 (Revised Edition 2012):** Provides for the classification, governance, and management of urban areas and cities; the criteria of establishing urban areas and the principle of governance and participation of residents. Parking, traffic control, public transport, and street lighting are listed as requirements for classification of an area.
to be a city or a municipality; and street lighting for a town.

Traffic Act of 1953 (Revised Edition 2015 [2013]): Consolidates the laws relating to traffic on the roads. It states the penalties for driving vehicles at speeds greater than 50km/h on any road within the boundaries of any urban area. Highway authorities are directed to erect and maintain traffic signs and speed limiting road design features. The highway authority is also tasked with ensuring that traffic routes in the vicinity of educational institutions are equipped with safe NMT features. This Act also prohibits driving on pedestrian walkway.

Street Adoption Act of 1963 (Revised Edition 2012 [1984]): Regulates the construction, improvement, and adoption of certain local authorities of streets of a satisfactory standard. The Act directs persons intending to lay out, form, construct, widen, extend or alter an unadopted street on the necessary requirements including footpaths, the carriageway, utilities, and landscaping.

Draft National Road Safety Action Plan, 2015-2020: Developed in accordance with the United Nations’ Decade of Action for Road Safety of 2011, which aims to save lives by building road safety management capacity, improving the safety of road infrastructure and vehicles, improving post-crash response, and enhancing the behaviour of road users.

Highway Code. The Highway Code offers guidelines on the use of roads by pedestrians, cyclists and motorists. The Code directs pedestrians to cross the road at designated locations. It prohibits them from walking on the carriageway. Cyclists are advised to wear helmets and reflective clothing. The code directs all users to obey traffic signs and signals.

1.2. INSTITUTIONAL STRUCTURE

Urban areas must overcome institutional barriers to achieve high-quality street environments. These challenges range from a lack of political will supporting complete streets to the need for better coordination among the multiple agencies responsible for different aspects of street design. Uncertainty regarding who is responsible for the construction of street facilities hampers the development of a consistent NMT network. Responsibilities over the planning, design, management, and maintenance of streets is split between multiple agencies and levels of government.

The Ministry of Transport, Infrastructure, Housing, Urban Development, and Public Works (MOTIHUD) is responsible for overall transport policy. The three road authorities, namely the Kenya National Highways Authority (KeNHA), Kenya Urban Roads Authority (KURA), and Kenya Rural Roads Authority (KeRRA) , are responsible for the management, development, rehabilitation and maintenance of roads in the country, as stipulated by Kenya Roads Act, 2007. The Kenya Roads Board (KRB) oversees the road network and coordinates its development, rehabilitation, and maintenance by administering the Fuel Levy.

The LAPSSET Corridor Development Authority (LCDA), established in 2013
through the Presidential Order Kenya Gazette Supplement No. 51, Legal Notice No. 58, plans, coordinates, manages and fosters transport linkage between Kenya, South Sudan, and Ethiopia. The National Construction Authority (NCA) regulates the construction industry and coordinates its development which includes but not limited to registering and classifying road contractors. The Fourth Schedule of the Constitution of Kenya assigns fourteen functions to the county governments in Kenya, one of them being county transport, including construction and maintenance of county roads (classes D, E, and unclassified roads), street lighting, traffic management, parking, and public road transport.

The National Transport and Safety Authority (NTSA) was established through Act Number 33 in 2012, representing a major step toward ensuring greater safety for road users. NTSA's functions include harmonising the operations of road transport departments and effective management the road transport sub-sector in order to minimise loss of lives through road crashes. The authority is mandated to formulate and implement the National Road Safety Action Plan. The Kenya Police, Traffic Department is charged with ensuring the free flow of traffic; the prevention and investigation of crashes; the enforcement of laws, rules, and regulations; and initiation of road safety sensitisation programmes to the public. Thus, multiple agencies have a role to play in managing the road environment.

1.3. HOW TO USE THE MANUAL

This manual offers guidance on the design of urban streets. For material specifications, drainage design, and construction techniques, users are advised to refer to the accompanying manuals. Following is a list of the available guidance documents:

- Road Design Manual Part II: Street Design Manual for Urban Areas in Kenya (this manual)
- Part V: Pavement Rehabilitation and Overlay Design, 1988
- Part IV: Bridge Design, 1993
- Standard specifications for Road and Bridge Construction, 1986
- Road Maintenance Manual, 2004
- R2000 operations manuals
2. COMPLETE STREET DESIGN PRINCIPLES

Streets rank amongst the most valuable assets in any city. They not only ensure residents’ mobility, allowing them to travel from one place to another, but also are a place for people to meet, interact, do business, and have fun. Streets make a city liveable. They foster social and economic bonds, bringing people together. Decisions about how to allocate and design street space have a tremendous impact on quality of life. Effective street designs ensure safety for all users, particularly pedestrians and cyclists, and facilitate efficient use of road space.

2.1. DESIGNING FOR SAFETY

Safe street design also aims to encourage moderate vehicle speeds. Street designs that reduce motor vehicle speeds can significantly improve pedestrian safety since the likelihood of pedestrian death in a traffic collision increases dramatically when motor vehicle speeds rise above 30 km/h. A pedestrian has a 90 per cent chance of surviving being hit by a car travelling less than 30 km/h, but only a 50 per cent chance of surviving impacts at 45 km/h.¹


Figure 2. Speed reduction is critical for safe pedestrian environments because the chance of pedestrian death in a collision increases dramatically when vehicle speeds exceed 30 km/h.
In addition to the risks associated with collisions, high speed also reduces the driver’s field of view, thus affecting the driver’s ability to respond to changing conditions in the roadway. At speeds below 30 km/h, it is much easier for drivers to see their surroundings and detect any potential conflicts with pedestrians, cyclists, or other motor vehicles. Slower vehicles also create a feeling of safety for pedestrians.

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

- **Systematic traffic calming on smaller streets** to reduce motor vehicle speeds and provide safe places for the mixing of pedestrians and other modes. Shared lanes are safe for pedestrians, cyclists, and motor vehicles to travel together if speeds are restricted to 15 km/h. For speeds up to 30 km/h, separate footpaths should be provided but cyclists can travel in the carriageway.

- **Pedestrian and cycle infrastructure that is physically separated from**
motor vehicle traffic on larger streets, paired with traffic calming or traffic control to facilitate safe crossings. Pedestrian footpaths should provide clear space for walking, with other elements positioned in a strategic manner. Similarly, dedicated cycle tracks should be provided, separate from the mixed traffic carriageway. Speeds limits of up to 50 km/h are appropriate for urban streets.

- Appropriately designed motor vehicle lanes. The design of the carriageway should reflect the speed limit. Carriageway lanes should be restricted to a width of 3.25 m per lane on arterial streets.

<table>
<thead>
<tr>
<th>Street typology</th>
<th>Speed limit for motor vehicles</th>
<th>Sample cross section</th>
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<tbody>
<tr>
<td>Local streets with shared space.</td>
<td>15</td>
<td><img src="image" alt="Sample cross section" /></td>
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<tr>
<td>Local and collector streets.</td>
<td>30</td>
<td><img src="image" alt="Sample cross section" /></td>
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<tr>
<td>Arterial streets.</td>
<td>50</td>
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Local streets with shared space. At speeds of up to 15 km/h, motor vehicles, pedestrians, and cyclists can safely mix. Traffic calming is needed to minimise vehicle speeds.

Local and collector streets. Streets with speeds of 30 km/h require separate footpaths. With traffic calming, cyclists can share the carriageway with mixed traffic.

Arterial streets. Streets with speed limits of 40-50 km/h require physically separated cycle tracks and footpaths. Traffic calming or signalisation is required at pedestrian crossings.

Figure 4. Smaller streets can function as shared spaces where pedestrians walk together with slow-moving vehicles. On larger streets with heavy vehicles and faster speeds, separate space for pedestrians and cycles is needed.
2.2. DESIGNING FOR EFFICIENCY

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

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

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

The only viable long-term solution for ensuring mobility is to build high quality facilities for public transport and non-motorised transport. These modes can carry large numbers of passengers without an exponential increase in road space requirements. In most cases, an appropriate solution is bus rapid transit (BRT). A single BRT lane with articulated buses can carry 14,000 passengers per hour per direction (pphpdir), and if pass-

![Diagram showing passenger capacity comparison]

*Figure 5. To maximise person-carrying capacity, streets should incorporate dedicated space for public transport and NMT.*
ing lanes are added at stations, the capacity increases to 45,000 pphpd. The same lane can carry 800 cars per hour—only 1,200 to 1,600 persons at typical occupancy rates—assuming that the lane receives one half of the signal time at intersections.

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

2.3. UNIVERSAL ACCESS

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

Article 54 of the Constitution of Kenya recognises the needs of persons with disabilities, stating that persons with disabilities are entitled to reasonable access to places and transport services. The Persons with Disabilities Act of 2003 further entitles persons with disabilities “to a barrier-free and disability-friendly environment to enable them to have access to buildings, roads and other social amenities.”

Figure 6. Per the Constitution of Kenya, persons with disabilities are entitled to reasonable access to places.
In order to ensure that persons with disabilities can make complete journeys, needs should be accommodated in each step of the transport chain, from origin to destination. Accessibility to transport is only as strong as its weakest link, so inclusive design must cover public passage, public transport stop and boarding, vehicle interiors, alighting, and passage to the final destination.

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

2.4. GENDER SENSITIVE DESIGN

Until recently, transport planning has tended to take a "one-size-fits-all" approach, assuming that men and women will benefit equally from improvements in transport services. In reality, women and men have different expectations from a transport system and different perceptions of security. Thus, transport policies and plans need to respond to these differences. An integrated and safe transport system provides access to education, work, health care, cultural, and other important activities that are crucial to women's participation in the society. Of particular concern in the context of street design is the level of safety and security that female users experience. Inclusive designs help to improve the experiences of women and girls, making it easy to walk, cycle, or use public transport.

2.5. MODAL HIERARCHY

To promote safe, efficient designs, this manual uses modal hierarchies to inform design and operation decisions. The main modes include pedestrians, bicycles, public transport, personal vehicles, and freight. The default hierarchy for this manual is pedestrian > bicycle > public transport > freight > personal vehicles > personal vehicle parking, as shown on the next page.
Figure 7. To encourage the design of safe and efficient streets, this manual prioritises pedestrians, cyclists, and public transport in the user hierarchy.
3. PRIORITY NETWORKS

Urban zones must focus on redesigning streets with priority to pedestrian and bicycle networks. Walking and cycling represent the plurality of trips in Kenyan cities, and public transport trips also start and end on foot. Similarly, cities require high-quality public transport to serve longer trips. Streets designs need to facilitate NMT and public transport access in order to ensure that these modes are safe, comfortable, and convenient. The design of specific street segments must consider these larger networks in order to ensure that the designs for individual street segments add up to a coherent network at the metropolitan level.

3.1. PEDESTRIAN NETWORK

Walking is key to urban life because it is a healthy and pollution-free form of mobility and recreation. Pedestrian networks must have a complete, publicly accessible walkways where all destinations are connected to each other and are protected from vehicle traffic.

Interconnected walking networks with short block lengths allow for short and direct routes through neighbourhoods. In general, blocks should be no larger than 100 m on a side. Such networks offer multiple routes to various destinations and make it convenient to walk and cycle to complete one’s daily commute and other errands. Frequent intersections contribute to slower vehicles speeds and greater pedestrian safety.

In areas where large blocks exist, redevelopment provides an opportunity to correct past mistakes. Large blocks can be broken up to create a finer

Figure 8. A fine-grained network of streets improves access for pedestrians and cyclists. The blue lines represent pedestrians and cyclist access to the core of each urban block. The orange lines indicate vehicle access.
grained pedestrian grid. Prioritised connectivity creates finer grained networks for walking, including pedestrian-only streets.

To support the permeability of the pedestrian network, street designs should provide pedestrian crossings at existing or expected desire lines, such as at a bus stop, school, or cross street. Crossings should always be at grade, except in instances where they cross limited-access highways or natural feature such as rivers. People generally can easily cross a street with up to two lanes, low vehicle volumes, and slower speeds (i.e., less than 30 km/h). If a street has two or more lanes per direction, higher volumes, and faster speeds, crossings are generally made safer through traffic calming, traffic control, and median refuge islands.

### 3.2. CYCLING NETWORK

For cycling to be safe and comfortable, major streets require cycle tracks that are physically separated from mixed traffic. Dedicated facilities are needed to encourage cycling among people of all ages and abilities.

The cycling network should offer a dense set of routes serving all city areas and key destinations through the shortest possible routes. Specifically, all residents should be able to access a dedicated cycle facilities near their homes. The cycle network also should be integrated with public transport systems and pedestrian priority areas. Signage can help assist cyclists in navigating through the network. Secure cycle parking should be available at destinations.

Cities are encouraged to develop cycle network plans to inform the street design process. Where network plans are still under preparation, street

![Figure 9. A cycle network plan for Kisumu indicates streets that should incorporate cycle tracks.](image)
designers should incorporate cycle tracks on streets with motor vehicle speeds over 30 km/h.

3.3. PUBLIC TRANSPORT NETWORK

Public transport can move large numbers of people quickly and efficiently in urban areas. An effective public transport network should offer dedicated right-of-way services such as bus rapid transit (BRT) on high-demand corridors combined with a widespread network of local routes providing service across the metropolitan area. It is essential that street designs incorporate provision for public transport in order to avoid the need for costly retrofits.

In Nairobi, MOTIHUD's 2014 Mass Rapid Transit Harmonisation Plan defines an integrated network of BRT and commuter rail services. Any street design project on a corridor earmarked for BRT should incorporate full provision for BRT infrastructure, including dedicated bus lanes, stations, passing lanes, medians, passenger access, and intersection priority.

In Nairobi, Mombasa, and Kisumu, existing matatu routes have been
mapped using global positioning system (GPS) technology. Other cities are in the process of mapping local routes. On corridors with matatu services, street designs should provide for convenient public transport access through shelters, signage, and safe pedestrian crossings.

3.4. MOTORIST NETWORK

The motorist network should provide access to the urban area while ensuring safety and efficient movement for pedestrians, cyclists, and public transport. A well-connected motor vehicle network can reduce bottlenecks and congestion while managing vehicle speeds through the provision of frequent intersections.

Motor vehicle speeds must be managed carefully to ensure safety for other road users. The following measures can help encourage moderate travel speeds for personal motor vehicles:

- Carriageway designs with lane widths of 3.25 m or less for multi-lane carriageways.
- Speed restrictions, including 30 km/h zones near schools, incorporating physical traffic calming measures.
- Car-free zones along important city centre streets.
• Traffic cells that restrict through traffic passing through local streets.

As discussed above, specific measures are needed to manage the overall use of personal motor vehicles. The following travel demand management measures are recommended:

• On-street parking management systems incorporating IT-based payment, enforcement, and monitoring.
• Congestion charging systems.
• Road user tolls.
• Reduction in the supply of off-street parking spaces in development projects, particularly in proximity to mass rapid transit stations.

These measures should seek to cap the overall vehicle kilometres travelled by personal motor vehicles and to limit the mode share of personal motor vehicles to 20 percent of trips or less.
4. STREET ELEMENTS

This manual defines sixteen street design elements as the street components that accommodate or serve specific functions. For example, a footpath supports pedestrian movement, and street lights improve safety. The figure below shows all sixteen elements.

Street design elements demand detailed planning and need to be customised to fit the local context. Getting the elements in the right proportion and location is challenging because all elements interact with one another. For example, utility-oriented elements lie mainly underground, but when they surface in the form of utility boxes and manhole covers, they can impact the usability of elements such as footpaths and cycle tracks.
Figure 12. Well planned streets provide continuous space for walking. They also support other activities such as street vending, waiting at bus stops, and vehicle movement without compromising pedestrian mobility.
Footpaths should have a minimum clear width of 2 m and should be at a height of not more than 150 mm above the carriageway.

Physically designated parking bays make it easier to enforce parking rules.

Bulbouts at pedestrian crossings reduce the walking distance across the carriageway.

Pedestrian crossings should be located wherever there is a concentrated need for people to cross the street (e.g., at a bus stop or an entrance to a shopping mall). In dense areas, crossings can be spaced at regular intervals (i.e., at least every 100 m). Crossings should be raised above the road surface.

An adequately sized carriageway (i.e., 6.5 m or less for two lanes) allows for vehicle movement at moderate speeds of 50 km/h or less.
4.1. FOOTPATHS

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

Comfort, continuity, and safety are the governing criteria for the design and construction of pedestrian facilities. For this reason, the footpaths are divided into three main zones: the frontage zone, the pedestrian zone, and the furniture zone. The pedestrian zone provides continuous space for walking and should be clear of any obstructions.

**DESIGN CRITERIA**

- Minimum clear width of 2 m. For areas with high pedestrian volumes, wider footpaths should be provided
- Elevation over the carriageway of +150 mm
- Constant height at property entrances
- Continuous shade through tree cover
- No railings or barriers
- Ramp slopes are no steeper than 1:12
- Cross slope of 1:50
- Tactile pavers for people with visual impairments

Figure 13. Footpaths have distinct zones that serve separate purposes.

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

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

Furniture zone. Contains trees, street lights, benches, utility boxes, and other potential obstructions.
Figure 14. Footpaths designed per the zoning system provide uninterrupted walking space for pedestrians. The pedestrian zone should have at least 2 m of clear space.

Figure 15. The smallest well functioning footpath has a width of 3 m, including 2 m of clear space. Wider footpaths are recommended in areas with large pedestrian volumes.
Figure 16. Where footpaths are ramped down to the level of the carriageway, the maximum ramp slope is 1:12.

Figure 17. Bollards should be installed to prevent vehicles from parking on footpaths, with spacing of 0.9 m between at least one set of bollards to allow wheelchairs to pass.

Figure 18. Footpaths should be raised +150 mm above the carriageway to prevent the accumulation of storm water and debris. A cross slope of 1:50 is required.
Where required to provide the access to private properties, vehicle ramps should be provided in the furniture zone.

Figure 19. Footpaths should remain at the same level at property entrances and small side streets, with ramps for vehicles, in order to improve convenience for pedestrians and maintain universal access.

Figure 20. Footpaths that maintain a constant level through property entrances are convenient for pedestrians to use. Vehicles use a ramp, helping to reduce speeds.
4.2. CROSSINGS

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

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

**DESIGN CRITERIA**

- Located at pedestrian desire lines
- Signalised or raised to the level of the footpath to calm traffic. Footbridges and subways are to be avoided
- For tabletop crossings, a height of +150 mm above the carriageway and ramps for vehicles with a slope of at least 1:10 to reduce vehicle speeds to 20 km/h
- Width of 3 m or equivalent to the adjacent footpath, whichever is larger
- Bulb-outs in parking lanes to reduce the crossing distance

**Accessibility.** The entire crossing should be accessible to persons with disabilities.

**Height.** Unsignalised crosswalks should be elevated to the level of the adjacent footpath (i.e., 150 mm).

**Ramp slope.** Motor vehicle ramps are designed with a slope of 1:10.

**Width.** Crossings should be as wide as the adjacent footpath and never narrower than 3 m.

**Crossing distance.** Pedestrians must be given the shortest possible direct route to cross the street. The bulbout into the parking lane helps reduce the crossing distance.
Figure 21. Raised crossings compel vehicles to reduce their speeds, thereby increasing pedestrian safety.

Figure 22. Pedestrian crossings should be direct and should offer universal access.
4.3. BEST TO AVOID: FOOTBRIDGES & SUBWAYS

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

- **Increase in travel time.** Footbridges lead to circuitous walking routes that typically increase travel distances and times, thereby discouraging walking. Pedestrians typically seek out short, direct routes to their destinations.

- **Lack of universal access.** Footbridges are often inaccessible and increase barriers to persons with disabilities, people carrying luggage, and parents with strollers. Extensive ramping may be installed to accommodate wheelchairs and bicyclists, but long crossing distances and steep slopes still discourage use.

- **Obstructions on footpaths.** Due to land constraints, footbridges can sometimes block footpaths. In order to accommodate both footbridges and footpaths, there might be need to acquire land outside the public right-of-way (ROW), which can be expensive.

- **Prohibitive cost.** Footbridges cost upwards of twenty times as much as at-grade crossings.

- **Harassment and other crimes.** The walking environment in grade separated facilities is generally poor and potentially unsafe with regard to sexual assault and other crimes, especially during night-time hours, since the facilities are by definition removed from street-level activity and the security it provides.

- **Increased vehicle speeds.** Grade separation also tends to increase motor vehicle speeds, further degrading the overall walking environment in the vicinity of the footbridge, especially for those who cross at grade.
Figure 23. Foot overbridges often obstruct footpaths and cycle tracks, making them completely inaccessible.

Figure 24. Footbridges often represent a wasted investment. When presented with a choice, pedestrians prefer to cross at street level.
4.4. CYCLE TRACKS

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

**DESIGN CRITERIA**

- Positioned between the footpath and carriageway
- A minimum width of 2 m for one-way movement, and 2.5 m for two-way movement
- Elevated +150 mm above the carriageway
- Physically separated from the carriageway—as distinguished from painted cycle lanes, which offer little protection to cyclists. The buffer should be at least 0.5 m wide and should be paved if it is adjacent to a parking lane.
- One bollard placed in the middle of the cycle track, to allow for cyclists to pass on either side
- A smooth surface material—asphalt or concrete. Paver blocks are to be avoided

![Figure 25. This cycle track is physically separated from the carriageway and is wide enough for cyclists to overtake one another.](image-url)
Figure 26. For one-way movement, cycle tracks should have a width of 2 m plus a 0.5 m buffer next to the carriageway. The width should be increased to 2.5 m for two-way movement.

Figure 27. Cycle tracks should be elevated above the carriageway to allow for storm water runoff and prevent the accumulation of debris.
4.5. CARRIAGEWAY

When carriageways become congested, they can no longer fulfil their role of providing for vehicle mobility. This can be addressed through road pricing and traffic demand management measures to reduce the number of vehicles on the street. These measures reduce congestion, thereby improving conditions for the remaining users.

Street space should be allocated to the carriageway after adequate usable space has been reserved for walking, cycling, trees, public transport (including BRT if the street falls on the city's rapid transit network), and street vending. Otherwise, such activities will spill over onto the carriageway. The carriageway should be designed for appropriate speeds suited to the street's role in the network.

**DESIGN CRITERIA**

- Width defined by the function of the street rather than available right-of-way
- On major streets, a width of 6.0-6.5 m for two lanes can accommodate large vehicles such as trucks and buses. Carriageways on urban streets should not be wider than three lanes or 9.0-9.75 m per direction
- Design speeds related to the street's function. Speeds can range from 15-30 km/h on local streets to 30-40 km/h on collector streets and 50 km/h on arterial streets
- Maximum grade of 5 percent, except in cases of geographical constraints
For a shared-street, the optimum width for a carriageway is 3 m for one-way movement and 5.5 m for two-way movement.

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

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

Figure 28. Carriageway widths can encourage safe driver behaviour.
4.6. BUS RAPID TRANSIT

Bus rapid transit (BRT) can offer high-capacity and high-quality public transport service at a fraction of the cost of rail systems. Realising the advantages of BRT is a function of several design elements, including median-aligned dedicated BRT lanes, platform-level boarding, off-board fare collection, and intersection treatments. BRT also requires safe footpaths, cycle tracks, and crossings to enable convenient passenger access. Besides good physical design, successful implementation of BRT requires effective system management, operations planning, and traffic control. More information on BRT is available in the Nairobi Metropolitan Area Transport Authority’s BRT Design Framework.

**DESIGN CRITERIA**

- Exclusive BRT lanes with a width of 3.5 m must be provided in the centre of the street. The lanes should be separated from mixed traffic through a physical barrier.
- Centrally located BRT stations require a width of 4 m. Larger widths may be required if demand is high.
- Safe pedestrian access should be provided via crosswalks elevated to the level of the footpath (e.g. +150 mm).
- Stations should be placed at least 40 m from intersection stop lines to allow sufficient space for bus and mixed traffic queues.
- To achieve capacities as high as those of metro systems, passing lanes, multiple sub-stops, and express services are required.

Figure 29. BRT offers fast, reliable public transport service.
Figure 30. This typical BRT alignment on a 36 m street can accommodate passenger volumes of up to 6,000 passengers per hour per direction (pphpd) with 12 m buses and 10,000 pphpd with articulated buses.
Figure 31. Passing lanes can increase the passenger capacity of a BRT system by allowing express buses to overtake local buses at certain stations (above). The Transmilenio BRT system in Bogotá, Colombia, carries 45,000 passengers per hour per direction through the use of passing lanes. Passing lanes also may be required if separate routes converge on a single corridor in a city centre context.

To accommodate passing lanes in a narrow profile—or to provide more space for other uses such as pedestrian and cyclist mobility and informal activities—separate offset platforms can be provided in each direction (below).
4.7. BUS STOPS

Well-designed bus stops offer a comfortable, weather-protected waiting area for public transport passengers while leaving clear space for pedestrian movement behind the shelter.

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

**DESIGN CRITERIA**

- On streets with two or more carriageway lanes per direction, bus stops should be placed adjacent to the bus’ line of travel so that the bus does not need to pull over.
- On streets with one carriageway lane per direction or at terminal locations, the stop may incorporate a bus bay provided that there is sufficient clear space for walking behind the shelter. The width of the bus bay should be no more than 2.5 m.
- Bus stops require shelters with adequate lighting; protection from sun and rain; and customer information.
- Cycle tracks should be routed behind bus shelters.
- Bus stops should be provided at intervals of 200-400 m.

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**Figure 32.** On streets with two-way undivided carriageways, a 2.5 m bus bay should be provided, ensuring that there is sufficient clear with for walking behind the bus shelter.

**Figure 33.** For carriageways with more than two lanes per direction, the bus stop must be placed on a bulbout in the parking lane, leaving a clear width of at least 2.0 m on the footpath.
Figure 34. This bus stop is located on a bulbout in the parking lane. Passengers can board directly from the curb rather than stepping into the street. Clear space for pedestrian movement is provided behind the bus stop.

Figure 35. Cycle tracks should be shifted behind bus stops to create sufficient waiting area for passengers.
4.8. LANDSCAPING

Landscaping improves the liveability of streets. It plays a functional role in providing shade to pedestrians, cyclists, vendors, and public transport passengers. It also enhances the aesthetic qualities of streets.

**DESIGN CRITERIA**

- Existing trees are to be retained in the course of street improvement projects
- Minimum distance between trees to provide continuous shade, depending on the individual trees’ canopy size and shape. A typical interval is 5-10 m between trees
- Tree pits locations should be coordinated with the position of street lights
- Tree pits should have dimensions of at least 1.5 m by 1.5 m to accommodate the trunk and root structure at full maturity. On narrow sidewalks, 1 m by 2.25 m tree pits are acceptable
- Hume pipes can lower the level at which roots spread out, thereby reducing damage to road surfaces and utilities
- Trees with high branching structures are preferable
- Medium-height vegetation should be trimmed next to formal crossings to improve the visibility of pedestrians and cyclists
- Indigenous species are preferable

Figure 36. Landscaping, especially tree cover, can improve comfort for pedestrians and cyclists while enhancing the beauty of the streetscape.
Figure 37. Every footpath should have a continuous tree line. A single tree line should be maintained in order to improve compatibility with underground utilities.

Figure 38. Landscaping can enhance the character of market areas and commercial streets. The design of the public right-of-way can be coordinated with that of adjoining properties, creating large public spaces.
4.9. VENDING

Street vending provides essential goods and services to a wide range of population groups. It also makes public space safer by contributing “eyes on the street,” particularly on streets lined with compound walls. If designed properly, vending can be accommodated in the streetscape without interfering with other uses.

**DESIGN CRITERIA**

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

Vending spaces should be placed in a bulbout in the parking lane (as pictured here) or in the furniture zone, leaving clear space for pedestrian movement.

Vendors tend to be attracted to spaces under trees or close to bus stops. Vendors also prefer spots that are visible to passersby.
Figure 39. Footpaths should be designed such that there is sufficient space for vending outside of the pedestrian zone.

Figure 40. If streets do not provide designated zones for vending, these activities can become obstructions, forcing pedestrians to walk in the carriageway.
4.10. STREET LIGHTING

Well-designed street lighting enables motor vehicle drivers, cyclists, and pedestrians to move safely and comfortably by reducing the risk of traffic crashes and improving personal safety.

**DESIGN CRITERIA**

- The spacing between two light poles should be approximately three times the height of the fixture.
- Poles should be no higher than 12 m. Especially in residential areas, they should be significantly lower than 12 m to reduce undesirable illumination of private properties. Additional lighting should be provided at conflict points.
- The placement of street lighting should be coordinated with other street elements so that trees or advertisement hoardings do not impede proper illumination.

**Table 1. Light pole height and spacing options**

<table>
<thead>
<tr>
<th>Street type</th>
<th>Pole height (m)</th>
<th>Spacing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footpath or cycle track</td>
<td>4.5–6</td>
<td>12–16</td>
</tr>
<tr>
<td>(&lt; 5 m width)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local street</td>
<td>8–10</td>
<td>25–27</td>
</tr>
<tr>
<td>(&lt; 9 m width)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arterial or collector</td>
<td>10–12</td>
<td>30–33</td>
</tr>
<tr>
<td>(&gt; 9 m width)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Figure 41. Continuous lighting improves safety and personal security.](image)

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A single row of light posts is sufficient for streets up to 12 m wide. On wider streets, dual lights can be mounted on a single central post. If a central post is insufficient or cannot be accommodated, multiple rows of posts can support lights at different levels.

Figure 42. Street lights typically illuminate an elliptical area. As a rule of thumb, the longitudinal dimension is equivalent to three times the pole height, and horizontal dimension is slightly longer than the pole height.
4.11. STREET FURNITURE

Street furniture provides people places to sit, rest, and interact with each other. Street furniture also includes services-related infrastructure, such as trash cans, street vending, toilets, and signage. Vending stands, tables, roofs, and water taps can support the formalization of street vending and promote better sanitary conditions. Finally, other street furniture, such as way‐finding signs and bus stops, provides information.

**DESIGN CRITERIA**

- Furniture and amenities should be located where they are likely to be used. Furniture is required in larger quantities in commercial hubs, market areas, crossroads, bus stops, BRT stations, and public buildings.
- Most street furniture, especially benches and tables, should be placed where it receives shade.
- Furniture should be located where it does not obstruct through movement.
- On streets with large numbers of pedestrians and commercial activity—especially eateries—trash bins should be provided at regular intervals (i.e., every 20 m).

Figure 43. Street furniture offers spaces to rest and interact.
Figure 44. Street furniture should be aligned in order to leave adequate clear width for the movement of pedestrians, cyclists, and motor vehicles.

On a narrower footpath, furniture and amenities should be provided sparingly and in the tree line to maintain 2m of clear space for walking.

Bulb-outs in a parking lane can accommodate street furniture and amenities without compromising pedestrian mobility.

A parking or service lane discontinued in the vicinity of a bus stop provides space for street vending and furniture.

On a shared street, furniture can be placed on islands that double as traffic calming elements.
4.12. STORM WATER

Adequate and efficient storm water drainage prevents water logging and erosion. Many streets presently place pedestrians and cyclists at the lowest point of the cross section, forcing them to wade through water and mud during the rainy season. Instead, footpaths should be raised to permit storm water runoff. Storm water should be carried through closed drains to free up road space for pedestrian and cycle facilities.

**DESIGN CRITERIA**

- The lowest point in the cross section should occur on the carriageway. Cycle tracks, footpaths, bus stops, and street vending areas should be at a higher level.
- 1:50 camber for footpaths and cycle tracks.
- Drain surfaces should be at grade with the surrounding street surface unless provided in landscaped areas. Drain access points should be surfaced appropriately to avoid interrupting pedestrian and bicycle movement.
- Catch pits should be located at regular intervals, depending on their size and the catchment area, and at the lowest point of the street cross section. Gratings should be designed so that they do not catch cycle wheels.
- Drainage channels should be provided underground to maximise the area available for NMT.
- More environmentally benign approaches such as landscaped swales improve groundwater recharge, reduce storm water runoff, and improve the overall liveability of a street.

Figure 45. Storm water covers should be finished properly to create smooth surfaces for walking and cycling.
Figure 46. Storm water drainage arrangements allow for storm water to drain off of footpaths and cycle tracks. Water is collected in the carriageway.

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

A simple drainage design has a single row of catch pits connected to an underground pipe.

On wider streets, drainage lines may be provided on both sides of the carriageway.
4.13. SERVICE LANES

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

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

**DESIGN CRITERIA**

- A service lane should be between 3 and 3.5 m wide for a single lane and 5.5-6.0 m for two lanes
- Service lanes should contain traffic calming elements to maintain safe driving speeds
- Access into and out of a service lane should be provided via a ramped crossing over the footpath and cycle track, which continue at their original levels
- A service lane need not be continuous, lest it become an alternative to the main road

Figure 47. Wide service lanes encourage overspeeding (left). Appropriately sized and traffic calmed service lanes enable pedestrians and cyclists to share space with motor vehicles (right).
For single-lane service lanes, a width of 3.0-3.5 m is appropriate. The narrow drive lane discourages fast driving.

On major boulevards two-lane service lane widths of 6.0-6.5 m are appropriate, depending on the volume of heavy vehicles.

Figure 48. Appropriate service lane widths can encourage safe driver behaviour.
4.14. ON-STREET PARKING

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

**DESIGN CRITERIA**

- Parking areas should be allotted after providing ample space for pedestrians, cyclists, trees, and street vending.
- Parking bay width of 2.0 m width for taxi stands and 2.2 m in commercial areas.
- Tree pits can be integrated in a parking stretch to provide shade. Otherwise, shaded street elements, such as footpaths, may be encroached by parked vehicles.
- Near intersections, parking lanes can be discontinued to reduce conflict and to give additional vehicle queueing space.
- Dedicated cycle parking should be provided at public transport stops and stations and in commercial districts.

Figure 49. Parking bays should be avoided at intersections, bus stops, mid-block crossings, or locations with unavoidable changes in the right-of-way that would compromise the width of the footpath. At crossings, the footpath should be extended through a bulbout in the parking lane.
Parallel parking for cars is preferred over angular or perpendicular parking because it saves space and is safer while exiting the parking bay. Parallel parking also doubles as perpendicular parking for cycles and two wheelers.

Angular and perpendicular parking occupy a large portion of the right-of-way. Exiting the parking bay can be dangerous because drivers have limited visibility.

The standard width for a parallel parking lane is 2.2 m in commercial areas and 2.0 m for taxi stands. Parking stalls need not be delineated. Larger parking slots can be provided for persons with disabilities.
4.15. UTILITIES

Streets are the conduits for major services, including electricity, water, sewage, communication, and gas. The physical infrastructure may occur in form of pipelines, telephone and fibre optic cables, ducts, and poles. Some utilities, such as telecommunications cables, require frequent access for expansion and maintenance. The placement of above- and below-ground utilities at the appropriate location in the right-of-way ensures unconstrained movement as well as easy access for maintenance.

**DESIGN CRITERIA**

- Underground utilities are ideally placed below the parking area or service lane, if present, which can be dug up easily without causing major inconvenience. Where this is not possible, underground utilities can be placed at the outer edge of the right-of-way.

- Utility boxes should be sited in easements just off the right-of-way to reduce conflicts with pedestrian movement. Where this is not possible, utility boxes should be placed within parking or landscaping areas. If it is absolutely necessary to locate utilities in the footpath, a space of at least 2 m should be maintained for the through movement of pedestrians. Similarly, utility boxes should never constrain the width of a cycle track.

- Though it is possible to accommodate underground utilities even below a tree line, this may lead to the destruction of the trees and a deterioration in liveability if the utilities need to be uncovered.

- In order to minimise disruptions, utilities should be installed with proper maintenance infrastructure. For example, telecommunication lines should be placed ducts that can be accessed at frequent service points.

Figure 53. Poorly located utilities can interrupt pedestrian movement (left). Proper placement and surfacing (right) can help ensure that pedestrian movement can occur unimpeded.
Figure 54. Appropriate placement of underground utilities can improve ease of access and minimise interruptions of the walking and cycling facilities.

Table 1. Underground utility specifications

<table>
<thead>
<tr>
<th>Utility</th>
<th>Duct material</th>
<th>Diameter (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water main</td>
<td>Milled steel/ductile iron pipe</td>
<td>0.15-0.3</td>
</tr>
<tr>
<td>Electricity: Low-tension</td>
<td>HDPE DWC</td>
<td>0.15-0.3</td>
</tr>
<tr>
<td>Electricity: High-tension</td>
<td>RCC</td>
<td>0.3-0.45</td>
</tr>
<tr>
<td>Street lighting</td>
<td>HDPE</td>
<td>0.1-0.3</td>
</tr>
<tr>
<td>Sewage: Trunk</td>
<td>RCC hume pipe</td>
<td>0.3-0.45</td>
</tr>
<tr>
<td>Sewage: Rider</td>
<td>RCC hume pipe</td>
<td>0.5-1.0</td>
</tr>
<tr>
<td>Telecom: Copper cables</td>
<td>HDPE</td>
<td>0.1-0.3</td>
</tr>
<tr>
<td>Telecom: Optic fiber</td>
<td>HDPE</td>
<td>0.1-0.3</td>
</tr>
<tr>
<td>Storm water main</td>
<td>RCC</td>
<td>0.5-1.2</td>
</tr>
</tbody>
</table>
5. STREET TEMPLATES

In this section we provide a collection of street templates to show how the elements presented above can be combined to provide varying degrees of liveability and mobility. Each template contains a ground plan and section at a scale of 1:500. If the template's cross section changes, such as in case of a meandering street (see template 9b) or a BRT corridor (see template 18BRT), we provide more than one cross section.

The templates are then shown in order of increasing street width: 6, 12, 18, 24, 30, 36, 50, and 60 m. Each template can be adjusted for a slightly wider right-of-way by increasing the width of any element except the carriageway and parking lanes.

Table 1. Guide to the templates

<table>
<thead>
<tr>
<th>Template</th>
<th>Shared space</th>
<th>Footpath</th>
<th>Cycle track</th>
<th>Dual carriageway</th>
<th>BRT</th>
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<tbody>
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<tr>
<td>9</td>
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<tr>
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<tr>
<td>60</td>
<td></td>
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</tr>
</tbody>
</table>
6 m

- Shared Traffic Lane
  - Asphalt
  - Level: ±0.00 mm

- Buffer
  - Paving
  - Level: -50 mm

- Informal Parking
  - on extended carriageway
  - in-between tree pits

- Tree Pit
  - Soil
  - Level: +150 mm

- Property Access

- Utility Box

- Trash Bin
- Drinking Water

- Social Activities
  - Paving
  - Level: +150 mm

- Ramp
MOTIHUD | Street Design Manual for Kenyan Cities   61
12 m
Option A

Traffic Lane
Asphalt
Level ±0.00 mm

Bodaboda/Tuktuk Parking
Asphalt Paving
Level ±0.00 mm

Social Activities
Paving
Level +150 mm

Street Light
Height 4.5 to 6 m
Spacing 12 to 16 m possibly wall-mounted

Private Property

Trash Bin

Drinking Water

Property Access
with ramp in sidewalk

Bus Stop
Level +150 mm

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Option B

- Mixed Traffic Lane
  - Asphalt
  - Level ≤ 0.00 mm

- Trash Bin

- Street Light
  - Height 4.5 to 6 m
  - Spacing 12 to 16 m
  - Possibly wall-mounted

- Parking
  - On Asphalt
  - Between Tree Pits
  - Level ≤ 0.00 mm

- Utility Box

- Property Access
  - With raised ramp

- Private Property

- Footpath
  - Paving
  - Level +150 mm

- Tree Pit
  - Soil
  - Level +150 mm
18 m Option A
18 m
Option B
18 m
Option D
24 m
Option B
50 m
6. INTERSECTIONS

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

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

6.1. TURNING RADIUS

The concept of the turning radius is relevant in the context of designing street corners and left turn pockets. Larger vehicles require more space in order to take a turn, so intersection designs need to take into account the size of vehicles that are expected to pass through an intersection.

Since larger turning radii encourage faster vehicle speeds, tighter corners

Figure 55. An intersection should be sized to minimise pedestrian crossing distances while accommodating left turns of a design vehicle.
are preferred because they improve safety for pedestrians and cyclists. For local streets that cater to light vehicles, as well as intersections of major streets with local streets, a 3 m kerb radius is appropriate. While larger streets need to take into account the turning radius requirements of buses and trucks, it should be noted that the effective turning radius is often much larger than the radius of the built kerb. The design of the kerb should assume that trucks and buses make the largest turn possible.

6.2. CROSSWALKS

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

Figure 56. Pedestrian crossings at intersections should be located such that there is minimum deviation from the path of travel defined by the pedestrian zone in the footpath.
6.3. LEFT TURN POCKETS

Left turn pockets can increase junction capacity by allowing vehicles to make free left turns. However, if not designed appropriately, they can compromise pedestrian safety. Traditionally, left turn lanes have been designed with a circular geometry. However, such a design is unsafe for pedestrians because it allows for fast vehicle movements. The preferred design incorporates a 30° angle of approach. Since vehicles enter the outgoing arm at a more abrupt angle, they are compelled to reduce their speeds.

The design should assume that a large vehicle completes the turn in the outermost lane of the exit arm but may enter the central lane while completing the turn. Otherwise, the left turn pocket becomes so large that smaller vehicles are able to travel at full speed around the corner.

6.4. REFUGE ISLANDS AND MEDIANS

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

6.5. BOLLARDS

Bollards help define refuge islands and other pedestrian spaces and
prevent vehicles from driving over these spaces. Bollards are especially helpful when a pedestrian area is at the same level as the surrounding road surface. Possible shapes range from slender posts to larger and heavier obstacles that can double as seats. A minimum width of 815 mm is required for the passage of wheelchairs. At entrances to cycle tracks, a wider opening is preferred.

### 6.6. BICYCLE BOXES

Bicycle boxes typically provide a space for right-turning cyclists to wait at a red light ahead of mixed traffic. When the light turns green, cycles start their turning movements first, and motor vehicles follow immediately behind. Cyclists using a bicycle box have better visibility since they

Figure 58. Pedestrian refuge island and medians improve safety by allowing pedestrians to cross different streams of traffic in separate stages.

Figure 59. A bicycle box allows right-turning cyclists to queue ahead of mixed traffic.
are the first road users to move into the intersection. This feature makes it possible to send them along with main traffic in a single signal phase instead of adding exclusive cycle phases or requiring cyclists to make right turns in two stages with straight-bound motor vehicles. Bicycle boxes also give an advantage to through cyclists who might be cut off by aggressive left-turning motorists. Bicycle boxes should be at least 3 m deep to accommodate one row of cyclists. For larger intersections with higher cycle volumes, a depth of 5 m is appropriate. Enforcement is necessary to ensure that motorists respect the stop line.

### 6.7. QUEUING SPACE

The carriageway can be widened at intersections to provide additional queuing space for vehicles, which reduces overall signal time. Where the additional space is provided, the street's cross section usually becomes asymmetrical—even if the regular street section is symmetrical—in order to claim the additional space evenly from both sides of the cross section instead of eating deeply into the pedestrian/cycle space only on one side. The number of straight-bound lanes entering a intersection should equal the number of outgoing lanes in the same direction. Otherwise, the intersection may become congested as vehicles try to merge into the narrower outgoing carriageway.

### 6.8. ROUNDABOUTS

Roundabouts can improve safety for vehicles by simplifying the interac-
tions among vehicles at unsignalised intersections. However, they present challenges for pedestrians and cyclists because the increase the size of the intersection and divert NMT movements from their desire lines.

Roundabouts are warranted at moderate traffic volumes. With higher volumes, roundabouts should be converted to compact signalised intersections without the central traffic circle. Such conversions will reduce delay for vehicle and NMT users alike.

6.9. SIGNAL PHASING

The physical layout of a intersection must be designed in conjunction with the signal phasing. There are generally several possible sequences of signal phases. The optimal phasing design is determined by the relative volumes of the various movements taking place at an intersection. Phasing sequences ensure that the final vehicles from each phase are in a different part of the junction from the starting vehicles in the next phase. For example, for four straight plus right phases, a counterclock-
wise sequence is preferred.

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

### 6.10. SQUAREABOUTS

Squareabouts are a means of managing right-turning traffic at large intersections while minimising signal cycle time. Squareabouts make the right-turn phase obsolete by creating right-turn queuing space within the intersection itself. Vehicles queue in this space during one phase and exit

![Figure 63. Squareabouts allow for two-phase signal cycles, which can reduce total signal cycle times in intersections with median BRT lanes.](image)
12 m x 12 m

Option A
12 m x 12 m
Option B
24 m x 24 m
30 m x 36 m
7. DESIGN PROCESS

This chapter describes the process of designing streets in an urban environment. Connectivity and safety are key aspects to consider during a street design process. Creating an effective design involves analysing the existing conditions in the project area and then identifying design solutions to suit the local conditions.

The process of street design involves the following stages:
• Stage I: Data and Information collection
• Stage II: Concept designs
• Stage III: Design review and approval process
• Stage IV: Final designs
• Stage V: Bills of Quantities

7.1. DATA COLLECTION

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

City vision. It is useful to have a brainstorming session with key city officials to understand their vision for the city. A workshop can be held to explore the best suited options to achieve the city vision while at the same time aiming for a comfortable, safe and user-friendly street environment.

Review of existing transport and land use plans. The designer is required to compile spatial information existing transport plans, including bus rapid transit (BRT) networks, cycle networks, pedestrian networks, and pedestrian zones. The designer should also identify transport system goals that are stated in these reports.

Topographic survey. The purpose of a topographic survey is to collect data on the project site including all the existing features (see next page). The designer should supplement the topographic survey with information on underground utility networks obtained from the client.

Underground utility survey. It is necessary to conduct detailed surveys of underground utilities to establish the location of specific utility lines and

Figure 64. Stages of the design process.
TOPO SURVEY ELEMENTS

The surveys must cover all streets in the project area plus any intersecting streets up to a distance of 100 m from the intersection with the study area street. The survey should locate the following elements, each geocoded with X, Y, and Z coordinates. Each type of element should be on a different layer in AutoCAD:

- Main roads, sub-roads, and service lanes, as applicable
- Signals / road marks
- Intersection elements
- Roundabouts
- Medians / bollards / permanent barricades
- Compound walls and each access point/gate
- All utility (electricity, telephone etc.) poles/boxes
- Overhead high tension lines
- Trees: to be indicated in 2 categories: above and below 30 cm of main trunk circumference
- Front facade of existing buildings/structures
- Footpaths/pathways including all kerbs and level differences
- Kerbs
- Manholes
- Drains (covered and uncovered)
- Signboards/markings
- Service lines/cable ducts
- The difference in levels wherever it occurs
- Establishing true/magnetic north point with respect to each location
- Establishing reduced/relative level for each item

Each map should be georeferenced with latitude, longitude, and height coordinates so that it can be combined with other maps on a GIS platform. Each element should be in a separate layer.

Figure 65. Sample topo survey drawing.
determine whether relocation is necessary. These utilities may include lines for telecommunication, electricity, natural gas, water, and sewage.

**Survey of land uses.** The designer should compile land use information to help inform street design decisions. A land use survey must be carried out for every building in the study area. The land use analysis should note important activity generators, such as shopping areas, theatres, and housing developments. All land use data should be recorded using a GIS platform.

**Stakeholder participation.** Public participation is a requirement under the Constitution of Kenya, 2010, aimed at promoting transparency in decision making, facilitating public awareness, promoting public ownership of projects, and encouraging collaboration in governance processes. Public participation is, therefore, a key step in the street design process. The project team should inform the stakeholders of the planned developments and to seek their input into the designs. It is important to engage all key stakeholders including:

- National ministry responsible for transport
- County and/or city roads and transport department
- County and/or city planning department
- Local transport authorities
- National roads authorities
- Safety authority
- Environmental management authority
- Public transport operators
- Street vendors
- Business community
- Persons with disabilities
- Donor agencies and development partners

Figure 66. Renderings can help stakeholders envision proposed street designs.
• NGOs in the transport sector
• Utility providers (e.g., water, electricity, telecommunications)

**Existing NMT condition survey.** Key to designing quality and effective non-motorised transport (NMT) network is to have an in-depth understanding of the existing walking and cycling environment, and the extent to which it provides safe, convenient access for NMT users. Street conditions can be captured using the smartphone application. The app allows a surveyor to record street characteristics and remotely upload the information to an online spreadsheet. The data from these surveys are then cleaned, mapped, and analysed to inform preliminary interventions along the surveyed streets.

![Figure 67. Analysis of footpath presence.](image)

![Figure 68. Pedestrian tracking survey.](image)
Survey of NMT user movements. Information on NMT volumes on each street can help inform the design and sizing of pedestrian and cycle facilities. There are range applications available online which can be used for NMT counts, including Device Magic and Multiple Counter. NMT surveys should be disaggregated by gender, age, and disability.

Traffic counts. Data obtained through a traffic survey is necessary for intersection design and signal timing optimisation. The traffic survey quantifies vehicle movements, including non-motorised user movements. Traffic surveys should be conducted during peak periods when motorised traffic is and demand for space are highest. Counts can be conducted manually on site or by using video recording using cameras. The count should be categorised by vehicle type. Existing classified traffic count data can be obtained from KURA, KENHA, and other relevant agencies. Where necessary supplementary counts should be performed at select locations.

Parking survey. In most urban areas in Kenya, parking appears crowded and chaotic in some areas, creating the impression of an overall shortage, yet there could be several unused parking spaces within reasonable walking distance. A parking survey reveals such imbalances, and appropriate measures can be included in the street design to improve parking efficiency on the street. A parking survey seeks to quantify current parking patterns in the project area by collecting data on the existing parking capacity and demand. Three types of surveys should be carried out:

- Parking inventory survey: The first step involves recording the number of parking spaces in on-street and off-street facilities.
- Occupancy survey: The second step involves counting the number of vehicles parked on each street segment or off-street parking facility over the course of the day. These counts can be used along with the

Figure 69. Mapping of street vendors.
supply data gathered in the first step to calculate occupancy rates.

• Turnover survey: Turnover data can help determine what types of users are parking in a particular facility (e.g., all-day parking by office-goers, short-term parking by shoppers, etc.).

**Street vending and related activities survey.** The designer must document existing vending activity, including the type of vending and the physical typology of the vending structure (i.e. permanent or temporary structure). The location and characteristics of each vendor should be recorded using GIS. The survey also should capture social gathering spaces in the study area. This information will inform the placement of street furniture and other elements in the final design.

**Analysis of crash data.** The designer should obtain data from NTSA and the police on traffic crashes over the past 3 years. The crash location, type, and users involved (i.e. pedestrian, cyclist, two-wheeler, car, bus, etc) should be mapped using a GIS platform. This information will enable the designer to identify major traffic safety “black spots” and suggest traffic calming, intersection modifications, and other interventions to improve safety for vulnerable street users.

**Right-of-way.** City management or relevant road authorities (KURA or KeNHA) may be in a position to provide the available right-of-way (ROW) widths. In addition maps showing precise, geocoded locations of the public right-of-way may be obtained from the Survey of Kenya.

**Documentation of public transport.** To document existing public transport routes and services, data on the public transport services within the project area should be collected and mapped. For Nairobi, Mombasa, and Kisumu the matatu routes have been mapped by Digital Matatus and the information is available online. All boda-boda stands within the project area also should be mapped. The designer should gather additional information on planned public transport projects within the project area from relevant bodies, such as NAMATA.

**Consultation with utility providers.** Any existing utilities within the project area should be identified during the early stages of design. Utility providers may have information on existing utility networks. Discussions with relevant utility providers should be held to agree on any necessary relocations or on the installation of a service duct. It is advisable to maintain communication with the providers as the design progresses and also during project implementation. The designer should obtain any necessary approvals from utility providers for planned relocations.

### 7.2. CONCEPTUAL DESIGNS

The designer should prepare detailed street designs for all streets in the Project Area. The design must be consistent with relevant plans, including plans for BRT networks, cycling networks, pedestrian networks, and pedestrian zones.
Street designs should offer easy and quick access to key public facilities such as schools, hospitals, bus stops, and markets. Adequate footpath space should be provided close to areas generating high pedestrian traffic volumes. Information on land uses in the project area and NMT user flows will inform the designer's decisions on the width of footpaths, location and sizing of pedestrian crossings, and other design elements. Junction designs and the width of the lanes should facilitate speed control for motorised traffic to enhance NMT user safety. Cycle tracks should be provided along axes identified in the city's cycle network plan. Facilities such as stations, or bus stop, necessary to support projected public transport passengers should be established and included in the designs.

Once typical cross sections are assigned, the various street elements should be captured in the concept layout plan. All street elements should be included in the conceptual plan, including mixed traffic lanes, public transport, pedestrian facilities, cycle tracks, bus stops, BRT stations (if applicable), vending kiosks, and landscaping. The concept design should be discussed with the city/county management and relevant road agencies for concurrence.

7.3. DESIGN REVIEW

For quality control and to ensure that the standards outlined in this manual are achieved in the design, the concept street designs should be submitted to the county transport director or road agency design manager, who will share the designs with members of a Street Design Review Committee for comments. Concept street designs will be reviewed by the review team to confirm that they are aligned with city goals, street design principles, and design standards. Street design review committees should be comprised of the following members:

- County director of transport
- County landscape architect
• A representative from the county planning department
• Regional manager from roads authority (as applicable)
• Regional manager from safety authority
• City transport authority

The designer may be required to present the plans at a public stakeholder meeting. The designer should revise the conceptual design based on the feedback received from the Review Committee and other stakeholders. The revised conceptual designs must be submitted to the client for approval. Most of the reviews should be done at the conceptual stage.

7.4. FINAL DESIGNS

Following approval by the client of the conceptual designs, the designer will prepare detailed construction drawings. The designs should include geometric and vertical profiles and should incorporate drainage designs. The final working drawings must be submitted to the client for approval.

7.5. TENDER DOCUMENTATION

The final stage of the process is to prepare specifications, bills of quantities, cost estimates, and bid documents for the implementation of the proposed street improvements, including pavements, furniture, street lighting, landscaping, and other components. The designer should work with the Client to include appropriate mechanisms in the bid documents to facilitate long-term maintenance, such as annuity-based compensation of contractors.

Bill of quantities. To achieve complete street designs, the BOQ should
incorporate the following items that are not conventionally included in road improvement BOQs:

- Footpaths
- Tabletop pedestrian crossings
- Street furniture
- Bus stops and bus shelters
- Bicycle parking
- Public toilets
- Cycle-tracks
- Landscaping

**Cost estimates.** The designer should prepare a detailed cost estimate for the project to guide the government during the tendering process.
## 8. DESIGN CHECKLIST

<table>
<thead>
<tr>
<th>Element</th>
<th>Design criteria</th>
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| Footpath              | • Height of 150 mm above the carriageway.  
• Minimum 2 m clear width in all locations.  
• Wheelchair kerb ramps have a maximum slope of 1:12.  
• Bollards installed along the edge of the footpath to prevent driving and parking on the footpath.  
• At least one set of bollards with spacing of 1,200 mm.  
• The footpath surface is uniform and non-slippery, with slope of 1:100 to avoid water stagnation.  
• Tactile warning are strips located at transition points (e.g., mid-block crossings, intersections). |
| Cycle track           | • Physically separated from the carriageway.  
• Elevated 100 mm above the carriageway.  
• Clear width ≥ 2 m for one-way movement; ≥ 2.5 m for two-way movement. |
| Property entrances    | • The footpath remains at the same level through property entrances.  
• Bollards are installed on either side of each entrance to prevent driving and parking.  
• Property access is provided at a discrete location for each plot, with a maximum entrance width of 6 m |
| Mid-block crossings   | • Pedestrian crossings at intervals of 100-150 m.  
• Crossing are raised to the level of the footpath with ramps for vehicles (minimum slope of 1:15) OR have kerb ramps at each end of the crossing.  
• Median refuge islands are provided at crossing points, with minimum dimensions of 2 m by 1 m. |
| Intersection          | • Kerb ramps on all corners of intersections to provide wheelchair access to the footpath.  
• Median refuge islands with minimum dimensions of 2 m by 1 m on all arms with more than 2 lanes to cross.  
• Signalisation if any arm has more than 2 lanes to cross.  
• Pedestrian crossings are located along desire lines.  
• Turning radii are no more than 5 m. |
| Shade                 | • Tree pits least every 20 m. |
| Lighting              | • No dark spots on footpath or carriageway. |
| On-street parking     | • Parking is provided in parallel orientation rather than angled or perpendicular parking.  
• Car parking bay size is no more than 5.0 m x 2.2 m |
| Street vending        | • The design includes designated spaces for organised street vending |
9. DEFINITIONS

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

**Average trip length**: The average distance covered by a transport mode for a trip, measured in kilometres.

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

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

**Greenway**: A waterway or strip of land with exclusive facilities for cycling and walking.

**Mass rapid transit (MRT)**: A high quality public transport system characterized by high capacity, comfort, overall attractiveness, use of technology in passenger information system, and ensuring reliability using dedicated right of way for transit vehicles (i.e., rail tracks or bus lanes).

**Mobility**: Conditions under which an individual is capable to move in the urban environment. Mode share: The share of total trips carried out by a particular mode of urban transport, including walking, cycling, bus, paratransit, rail, two-wheeler, or car.

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

**Nationally Determined Contribution (NDC)**: National pledges to reduce greenhouse gas emissions per the provisions of the 2015 United Nations Framework Convention on Climate Change Conference of the Parties in Paris.

**On-street parking**: The space occupied by vehicles to park along the edge of the street.

**Paratransit**: Service operated by the private sector on a shared or per seat basis along informally organised routes with intermediate stops. The service may or may not have a predefined fare structure. The term “intermediate public transport (IPT)” means the same but is avoided in this document for consistency. Common paratransit modes include public taxis.
Public transport (PT): Shared passenger vehicles that are publicly available for multiple users. In this document, the term “public transport” is used to refer to MRT, paratransit, and formal road-based public transport services.

Parking management: Pricing, enforcement, and other mechanisms used to guide parking operations to ensure the efficient use of street space.

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

School zone: All streets and greenways within a 200 m radius of a school.

Sustainable transport modes: The following modes are categorized as “sustainable modes” of urban transport because when compared with personal motor vehicles, they consume the least amount of road space and fuel per person-km and also entail lower infrastructure costs: walking, cycling, and public transport (including a regular bus service as well as MRT systems).

Traffic calming: Traffic calming measures ensure pedestrian and vehicle safety by reducing at least speed and potentially also the volume of motor vehicles. Traffic calming slows down vehicles through vertical displacement, horizontal displacement, real or perceived narrowing of carriageway, material/colour changes that signal conflict points, or the complete closure of a street.

Vehicle kilometres travelled (VKT): Vehicle kilometres travelled by all the personal motor vehicles (in a city) in one day.
10. SYMBOLS

- Footpath
- Carriageway
- Parking
- Shared lane
- Cycle track
- Bus rapid transit
- Landscaping
- Street furniture
- Ramp
- Utility box
- Trash bin
- Bollards
- Vending
- Bus stop
- Drinking water
- Street lights
- Tree