الهَـيـئـة العُـلـيـا
لتطـويـر مَدينـة الريـاض

RIYADH PUBLIC TRANSPORT PROGRAM

METRO URBAN DESIGN & STREETSCAPE MANUAL

FEBRUARY 2014

الهَـيـئـة العُـلـيـا
لتطـويـر مَـديـنـة الـريـاض

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Content

Executive Summary

Introduction

As part of the prepared MEDSTAR strategy study (2009), a comprehensive Transportation Plan for the city of Riyadh has been developed and acknowledged as a historic opportunity to improve the existing road infrastructure and provide a 21st Century integrated public transportation system.

The planned system consists of six METRO lines plus a Bus Rapid Transit (BRT) network, additionally supported by a further network of feeder lines and neighbourhood buses.

It is hoped that this bold vision will not only transform the face of transportation in Riyadh by relieving vehicular dominance and reliance, but additionally strengthen Riyadh's future competiveness amongst the G20 leading cities whilst improving the daily life of the inhabitants and visitors alike.

The success of the future METRO system not only requires acknowledging the importance of a high quality public transportation system but also a change in the current perception of a vehicular reliant society. This change is ultimately based on shifting the present planning priority from a vehicular one to that of a multi modal system. Fundamental to this shift is the quality/ provision of the public realm or streetscape in which the METRO system will operate.

In providing an attractive and pleasant pedestrian environment, one which encourages and supports safe passage and connectivity, one creates the enticement to promote pedestrian activity or interaction, thus helping to create a vibrant public realm.

The Project Brief

The responsibility for delivering the immediate urban streetscape enhancements (in addition to the METRO infrastructure), has been tasked to three groups of design & build consortia.

Figure 1.1 Typical existing streetscape

Figure 1.2 Typical future streetscape

Albert Speer & Partner GmbH (AS&P) were commissioned by the Arriyadh Development Authority (ADA), with developing and producing an Urban Design & Streetscape Manual (UDM) to provide the design consortia with clear guidance to achieve the following goals:

- A clear and robust set of design proposals and exemplars to enable the completion and enhancement of the existing 30% design for lines 3, 5 & 6.
- A design matrix or "toolbox" approach which can be selectively applied through analysis and design, to the various existing street types and land uses.
- A design rationale which is simple yet sophisticated and flexible enough to ensure quality and ease of implementation.

Existing Corridor Context

It is accepted that the majority of the current streetscape environs within Riyadh are not conducive to a well balanced pedestrian friendly and multi modal urban realm. A list of key problems includes:

- Car reliant and dominant infrastructure with increasing traffic congestion and pollution
- Insufficient pedestrian walkways and legible orientation
- Lack of quality open space and public realm with vegetation
- Vulnerability and safety of pedestrians
- Ultimately, the creation of a comprehensive public transport system with an attractive and vibrant public realm can provide additional benefits such as economic growth and competiveness.

Urban Design & Streetscape Manual – Objectives

The Urban Design and Streetscape Manual has been written to enable the METRO design & build consortia to develop design solutions for any given existing situation found within the proposed METRO corridors. This has been achieved by establishing a set of fundamental objectives. Such design principles would address:

- Accommodating all modes of transport.
- Considering safety, mobility and accessibility.
- Responding to the adjoining urban context (land use, density, quality of public realm, etc.).
- Creating attractive steetscapes and a vibrant public realm inviting pedestrian use.
- Responding to the unique cultural heritage and the capital city status of Riaydh.
- Considering sustainability and maintenance aspects.

The UDM cannot be exhaustive and the design consortia are to be encouraged to present and develop their own interpretations as based on the robust and tested analysis and design rationale presented within the document.

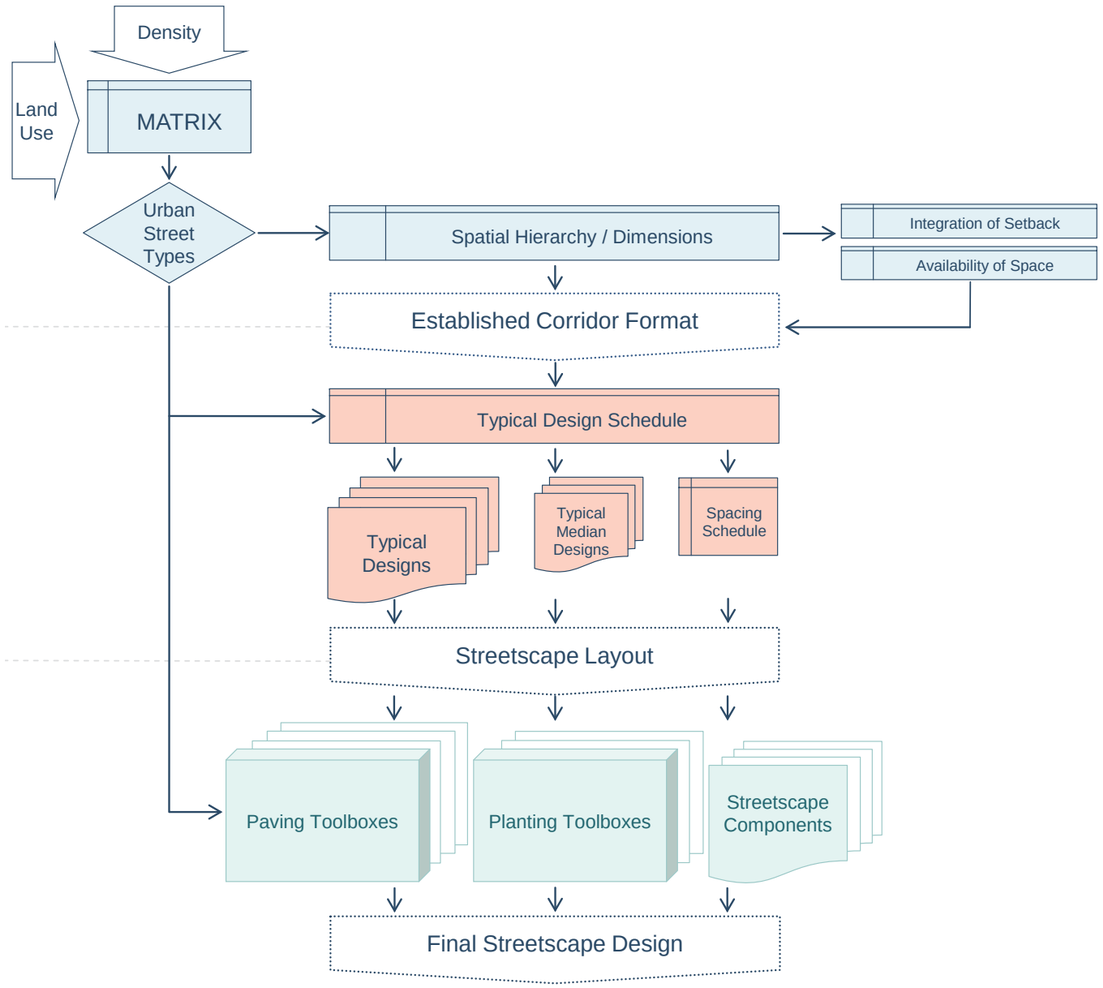


Figure 1.3 Design process overview

Design Process

1. Establishment of corridor format.

The format of the corridor is devised from the land use density (high to low), and the urban street type (residential, industrial etc). Supplementary analysis information is provided to guide the consortia through this process.

2. Using the available space to determine a hierarchy.

Once a format has been established, then the user can apply a table of model dimensions and design priorities to formulate a spatial hierarchy, e.g. Pedestrian walkway, frontage zone and furniture zone etc.

3. Applying the toolboxes and datasheet information to embellish the established street hierarchy.

A series of toolboxes/ datasheets which illustrate and provide informative information relating to materials, finishes, furniture and tree/ plant selections. This is additionally supported with best practice recommendations and advice.

Design Rationale & Concept – Applying a design

The application of the design concept or rationale is based on a fragmentation/ tearing theme inspired by Saudi Arabian landscape formations. This in turn has been incorporated into a simple 3 layer system which collec-

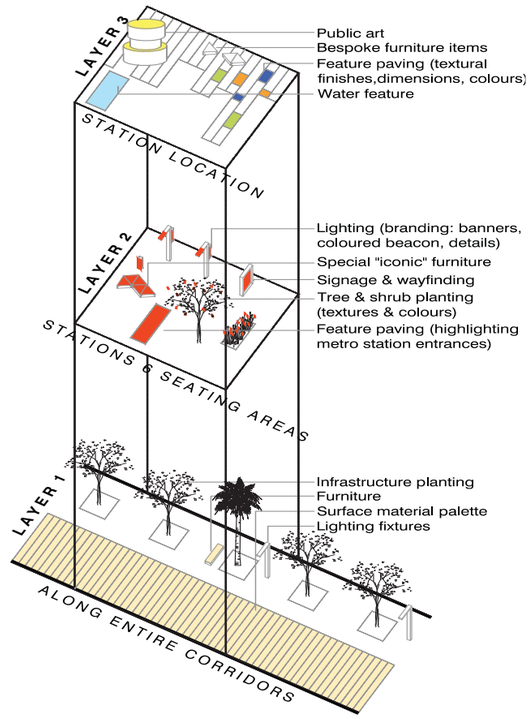


Figure 1.4 Diagram illustrating public realm design strategy and layer system/ hierarchy

tively forms and shapes the urban corridors. Layer 1 helps form the spatial infrastructure, layer 2 represents the individual METRO line's unique branding and layer 3 responds to the local character, to create a sense of place or local identity.

Typical Design Arrangements and Exemplars

A series of design proposals (scaled plans and renderings) clearly illustrate how to use and apply the design analysis, method and philosophy. This has been presented to reflect the varied and typical corridor scenarios that can be encountered within Riyadh.

The application of this Urban Design & Streetscape Manual aims to provide ADA and appointed consortia with a design manual that provides a robust and adaptable set of guidelines which will help achieve the following objectives:

Figure 1.5 Application of design rationale 'fragmentation'

- A flexible set of standards which can be suited to the varied street environs according to the urban context, avoiding a 'one shape fits all' approach.
- A cost efficient application of materials/ furniture, whereby items are suited to their setting, e.g. – enhanced finishes and individual furniture are specified at strategic nodes (stations, high intensity areas etc), and standard items to other less used areas (industrial, medians etc)
- Endorses the sustainable use of materials and Kingdom sourced or produced products.
- A non-vehicular prioritised approach which aspires to the creation of an inclusive and pedestrian friendly streetscape, one which supports the 'vision' of a fully integrated transportation system for the city of Riyadh.

Figure 1.6 Typical streetscape design arrangement

1 INTRODUCTION

1.1 Background

During recent years the Arriyadh Development Authority (ADA) has prepared a well developed Transport Plan for the city of Riyadh based on the MEDSTAR Strategy, supported by detailed designs for the improvement of the city's major road network, the METRO system and a comprehensive bus system.

The planned public transport program consists of six METRO lines (176.5 km and 96 stations), and a Bus Rapid Transit (BRT) network of an initial four lines supported by a network of feeder lines and neighbourhood buses (total over 600 km).

In this context the Government of the Kingdom of Saudi Arabia has directed ADA to:

- Implement a METRO network.
- Implement a Bus Rapid Transit Network.
- Implement a network of feeder and community buses that serves the whole city.
- Provide for Transit-Oriented Development (TOD), around the major public transport networks.

The introduction of an integrated public transport system of the intended scale will radically change the face of transportation in Riyadh and ultimately help relieve Riyadh's road network from congestion.

Riyadh's competitiveness amongst the G20 leading cities will be strengthened in the future, and quality of life for residents will increase tremendously.

As an important stage towards turning this immense vision into a reality, international design-build consortia have been appointed for implementing the METRO, including rolling stock and operating systems, but also road and streetscape along the respective METRO corridors. The consortia had submitted their bids based on the following information:

- For Line 1 and Line 2 detailed designs are available, forming the basis for implementation.
- For the remaining lines No's 3, 4, 5 and 6 a concept design (30% design) has been developed by international consultants. This design forms the basis for further detailing work to be undertaken by the consultants.

The METRO project is not only considered to be a historic chance for improving large parts of the city's road infrastructure, but to also potentially be the catalyst for further long term enhancement of Riyadh's streetscape.

King Abdulaziz Project for Riyadh Public Transport

Figure 1.1 Logo Riyadh Public Transport Project

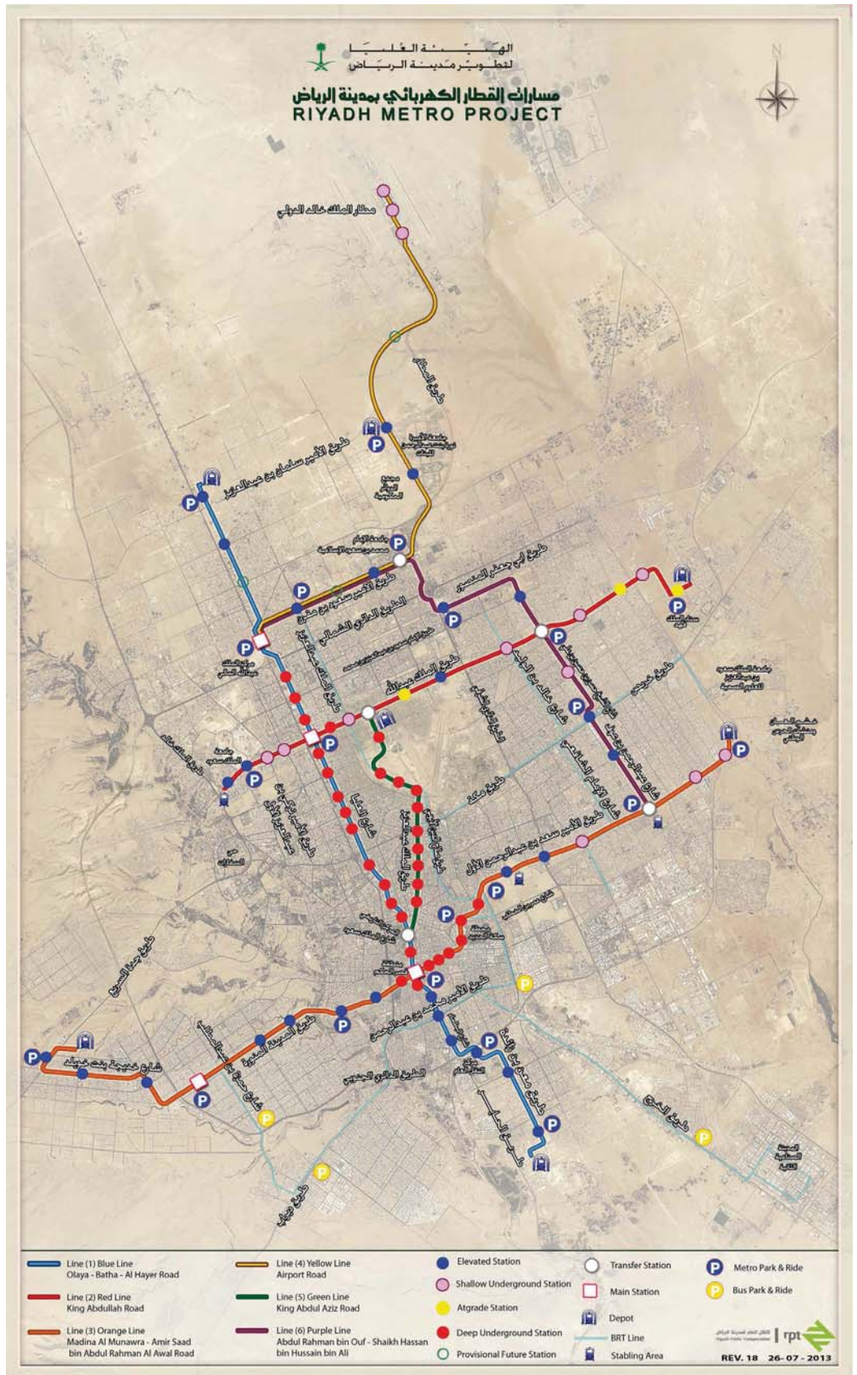


Figure 1.2 Planned METRO network

1.2 Manual Intent

This manual has primarily been written to provide supplementary road and streetscape information to support design-build consortia working on Lines 3, 5 and 6.

However, even though analysis and recommendations are focussed on situations occurring in the corridors of Lines 3, 5 and 6, this manual can be applied as guidance for similar situations arising along any of the other METRO corridors, where other streetscape guidance is currently unavailable.

The 30% design developed for Lines 3, 5 and 6 already incorporated information regarding the design of the streetscape. However, these designs have been developed in a very general form, primarily to facilitate preliminary cost estimates and define the design intent as the basis for further detailed design work.

Designers will necessarily need to adapt their designs to varying local conditions and changes resulting from the detailed design of the METRO itself. It is expected that designers will need to adapt layouts, dimensions or alignments to react to different circumstances and to ensure all relevant functions can be included.

Consortia's designers will therefore require additional guidance to develop implementable designs for the entire corridor. This manual serves as clarification of the 30% design and aims at improving cost effectiveness, maintainability and feasibility.

The manual provides guidance on:

- How to respond to the varying urban context along the corridor.
- How to prioritise different elements of the street environment depending on context and availability of space.

Figure 1.3 Traffic congestion in Riyadh

Figure 1.4 Transport vision for Riyadh

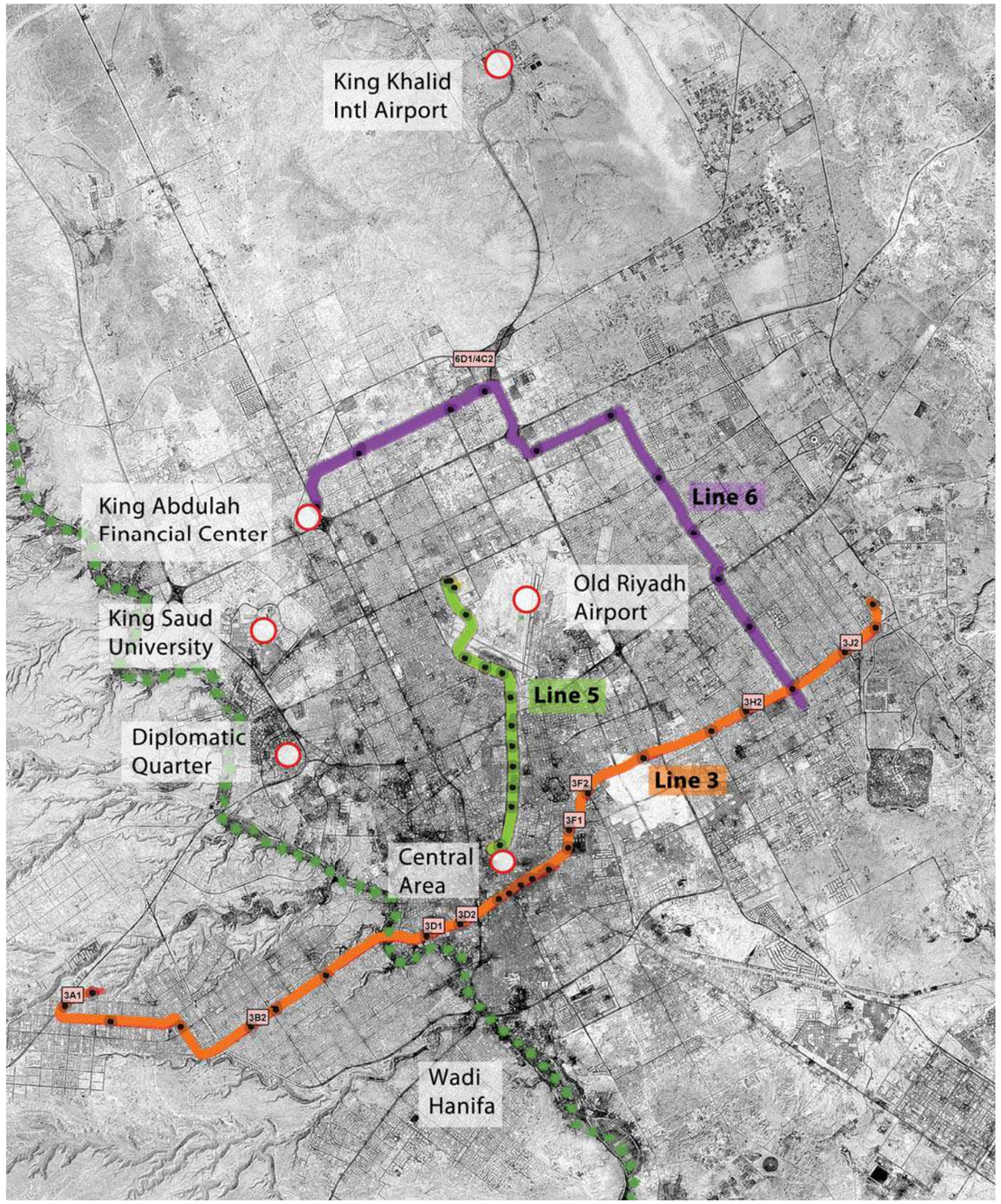


Figure 1.5 METRO Lines 3, 5 & 6

- Minimum and standard requirements of important elements, such as pedestrian walkways, crossings and refuges, or parking.
- How to create an attractive and pleasant, but functioning pedestrian environment encouraging the use of the METRO.

Both, the 30% design and the typical design exemplars given in this manual are not exhaustive. The design-build consortia's designers are encouraged to develop their own interpretations as based on the robust and tested analysis and design rationale given in this manual.

Using this manual will enable designers to develop a well balanced street environment accommodating the needs of all users. The manual clearly specifies possible materials, finishes and plants to be used, ensuring high quality whilst allowing for the competitive use of local suppliers. Overall, the manual allows for a more economic application of materials and funds, distinguishing between areas of high intensity and areas with more basic requirements.

Beyond the remit of this manual, however, a number of supporting strategies should be developed in order to yield the most benefit from redeveloping the public realm along the METRO corridors.

Envisaged, or indeed currently procured studies are:

- Urban Planning Strategies, such as the TOD projects currently being undertaken.
- Adaptation of zoning regulations for private land along the METRO corridors, regulating building heights, minimum setbacks, and maximum lot coverage.
- Comprehensive car parking strategy for the City of Riyadh, defining locations and types of parking lots, parking regulation, fees and enforcement.
- Wider networks of footpaths and cycle paths beyond the METRO corridors.

Figure 1.6 High-quality public realm

1.3 The UDM's Objectives

This Urban Design and Streetscape Manual has been written to enable the METRO design consortia to develop design solutions for the public realm associated with the Riyadh Public Transport Metro Program.

The aim of the UDM is to establish a set of defining principles and best practice exemplars, which can be both practically and flexibly developed and applied to the majority of the proposed METRO corridors. This report is not exhaustive and the design consortia are encouraged to present and develop their own interpretations based on the robust and tested information and philosophy given in this document.

The urban integration of the public transport system aims to gain the greatest possible economic, social and environmental benefit from the construction and delivery of the public transport infrastructure and services in Riyadh, both, in terms of the urban economy and the efficiency of urban development of the city, and the quality of the public realm throughout the city.

The inter-relationship between a high quality public realm and the success of the future METRO system requires a profound re-design of streets along the entire METRO corridors, based on shifting the planning priority from the current vehicular traffic bias towards the pedestrian realm along the edges of the corridor. The Urban Design & Streetscape Manual (UDM) for the METRO corridors defines the public realm's urban, streetscape, and landscape design in order to support pedestrian connectivity and safe passage for the users. It considers the provision for public transport systems, such as the METRO stations' interfaces, bus stops, taxi stands and drop-off areas, as well as key destinations along the METRO corridors.

In the absence of any streetscape manual for the city of Riyadh, this METRO related manual could even serve beyond as a blueprint for a future streetscape manual for the entire city's road network.

Part of the responsibility for the delivery of immediate urban enhancements, associated with the new Public Transport network, will rest with the contractors undertaking the METRO design- build contracts, and designing and constructing the BRT infrastructure. However, in order to guide the designers sufficiently the objective of the UDM is to create a document which demonstrates on a practical level how good urban design could be implemented in the streets of Riyadh.

The following objectives should be considered as planning fundamentals:

- Accommodation of all modes of transport and consideration of safety, mobility and accessibility for all street users.
- Consideration, integration and response to the adjoining urban context (land use, density, quality of public realm etc).
- Design for livability by creating attractive streetscapes and vibrant public realm open spaces in order to create an inviting pedestrian environment.
- Consideration of the unique cultural heritage.
- Full consideration of maintenance aspects in terms of design, proposed materials etc.

Figure 1.7 Inclusion of bus stops

Figure 1.8 Pedestrian connectivity

Figure 1.9 Pedestrian environment for all age-groups

Figure 1.10 Consideration of cultural heritage

A key immediate part of this manual is also to provide a planning framework that helps reviewing and validating the consortia's design proposals.

Since approved detailed designs for METRO lines 01 and 02 are already completed, and as line 04 largely coincides with line 06, the UDM at hand focuses on METRO lines 03, 05 & 06. However, guidance given and illustrated as designs of 'typical' situations is widely applicable accross the entire METRO system.

The guidelines given in this manual vary in the degree of bindingness, which is represented throughout the document by the words 'shall' (mandatory), 'should' (encouraged) and 'may'.

1.4 Previous Studies, Current Urban Situation and Concept Design

The UDM is based upon a thorough analysis of both, the current urban situation, and previously elaborated key studies in order to ensure consistency and proper integration of all aspects in the planning work of recent years.

Furthermore, the design-build consortia have received a concept design (30% design) for METRO lines 3, 5 & 6 worked out by international consultants. This concept design has been analysed and taken into consideration in formulating the design guidance of the UDM.

Current Urban Situation

This document provides design guidance for specific urban street typologies, which in turn are defined by their urban context. The urban context is mainly defined by adjoining land use and density, hence, the existing condition and urban context of the earmarked corridors for METRO lines 3, 5 & 6 have been carefully analysed during preparation of this UDM. The results of this analysis, in respect of land uses and densities, are outlined in the Appendix - Urban Context Analysis. The definition of land uses and densities are outlined in chapter 3.2 Identification of Urban Street Types.

The current quality of the streetscape is large-

Figure 1.11 Typical situation - industrial/ employment

Figure 1.12 Typical situation - industrial/ employment

Figure 1.13 Typical situation - residential area

Figure 1.14 Typical situation - neighbourhood area

Figure 1.15 Typical situation - neighbourhood area

Figure 1.16 Typical situation - neighbourhood area/ high density

Figure 1.17 Typical situation - central area/ mixed-use area

Figure 1.18 Typical situation - central area/ mixed-use area

ly sub standard, lacking the most fundamental elements that help structure a meaningful and functional pedestrian environment:

- Often oversized vehicular traffic space lacking safe and convenient at-grade pedestrian crossings.
- Lack of designated pedestrian walkways hampering connectivity.
- Lack of accessible design for the visually and physically impaired.
- Lack of vegetation and shade.
- Mostly non-coordinated levels and surface materials.
- Space between road and building fronts only used for uncontrolled car parking.
- Huge discrepancies in design quality and maintenance.
- Lack of design character and poor response to urban context.
- Hap-hazard locations and poor design of infrastructure elements, such as refuse collection points.

Figure 1.19 Oversized vehicular traffic space/ lack of pedestrian crossing

Figure 1.21 Lack of designated pedestrian walkways

Figure 1.23 Lack of accessibility

Figure 1.20 Lack of vegetation & shade/ levels & materials not aligned

Figure 1.22 Uncontrolled car parking between road and building fronts

Figure 1.24 Discrepancies in design quality and maintenance

Figure 1.25 Lack of hard and soft streetscape elements

Figure 1.26 Random locations & poor design of infrastructure elements

Figure 1.27 Disturbance of pedestrian connectivity

It is very important to understand that any results of the above analysis can only represent the present situation at the time of writing this UDM. Due to the dynamics of urban planning in the City of Riyadh, especially in connection with the planned METRO implementation, it is likely that urban conditions, particularly land uses and densities will change. Good examples for this expected change are the envisaged TOD projects. Hence, the selected design-build consortia shall re-assess all urban situations prior to any design work, in order to ensure an adequate design response to every single METRO corridor's public realm requirements.

2030 MEDSTAR Structure Plan for Arriyadh

Since the METRO project itself is defined in the 2030 MEDSTAR Structure Plan for Arriyadh, the MEDSTAR document represents the overall development framework for the project, and consistency with it in locating the METRO stations and corridors shall be ensured. Within the document, a planned expanded Public Transport Plan is considered as a significant opportunity to influence and guide urban development, and the need for state-of-the-art public transportation and enhanced public realm is identified.

The MEDSTAR document sets the planned development framework of the city, i.e. in terms of land use zoning and density, which shall be considered in identifying urban requirements of the individual corridor segments.

Urban Integration & Planning Assessment Study, CH2M

The most accurate information to date regarding the present and expected urban requirements along the METRO corridors represents the Urban Integration & Planning Assessment Study, which focuses on the planned METRO stations and their urban surroundings. The UDM has used this document to draw conclusions on expected urban requirements of the METRO stations' surroundings and corridor segments in-between for the purpose of developing guidance for relevant situations. However, since proposals and conditions will have, and indeed already have changed, by the time of implementing the project, the designers of the corridors will have to re-assess the individual situations again.

Arriyadh Central Area Renewal Framework, Atkins

One of the most dynamically changing parts of Riyadh in the coming years will be the city's Central Area, which will also be crossed by three future METRO lines. Acknowledging the particular importance of the central area's urban regeneration, the Arriyadh Central Area Renewal Framework proposes development policies, future zoning and a number of fundamental projects within the area with a profound impact on the METRO corridors, such as a new Madina Road Activity Corridor (TOD). These proposals will have to be verified and duly considered when identifying urban realm requirements along the METRO corridor sections in question.

Previous Studies

The UDM acknowledges that the success of the METRO project depends on its beneficial integration into the city's present and future urban environment. Hence, the envisaged/ expected development of Riyadh has to be taken into account by coordinating the corridor design with pending or expected urban- and infrastructure developments and investments identified in the following key documents.

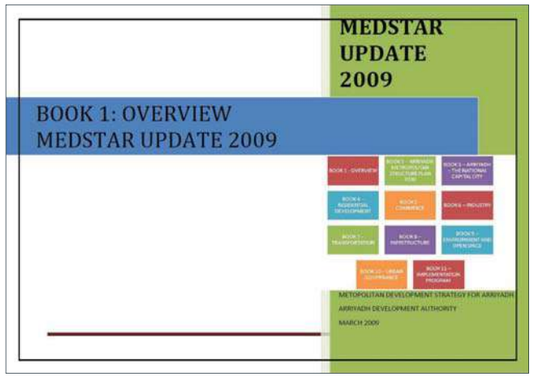


Figure 1.28 MEDSTAR, ADA

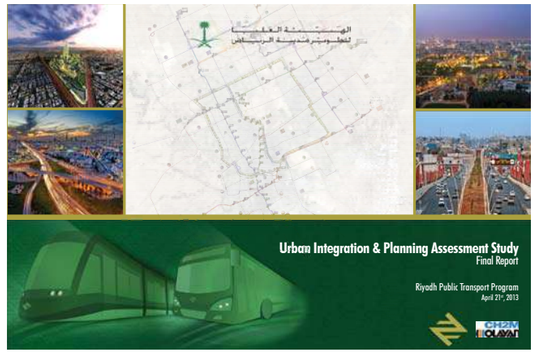


Figure 1.29 Urban Integration & Planning Assessment Study, CH2M

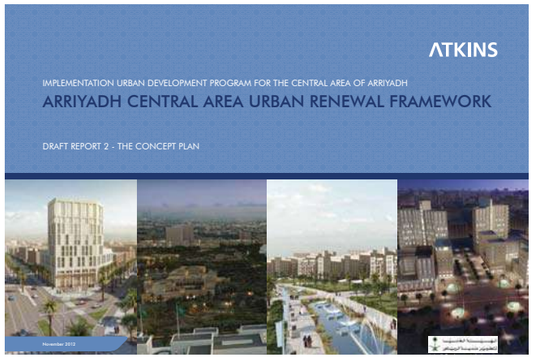


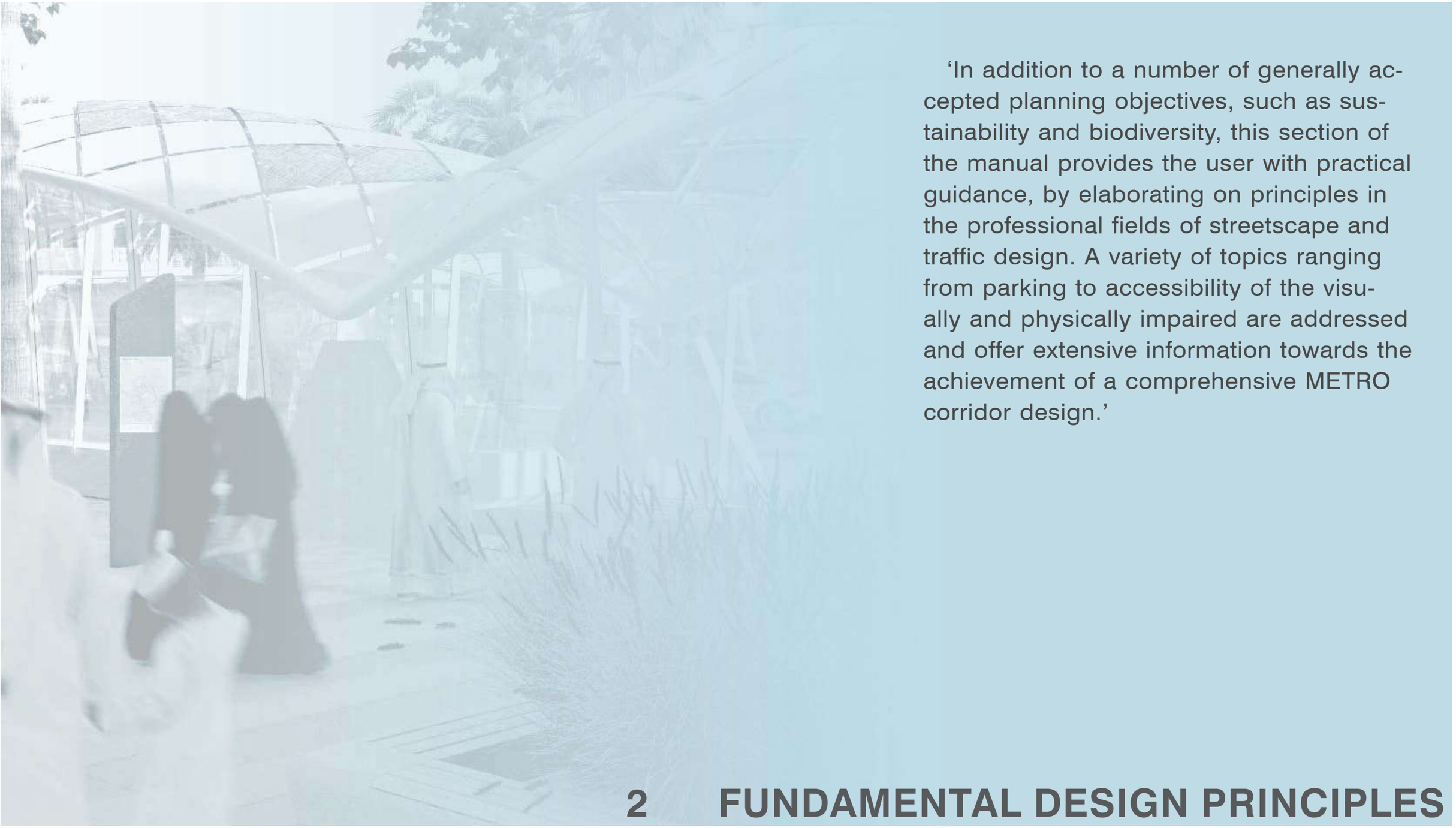
Figure 1.30 Arriyadh Central Area Renewal Framework, Atkins

Concept Design (30% Design)

As a first planning step and forming the basis of the design-build contracts to date, a concept design has been developed by international consultants for METRO lines 03 to 06. This '30% design' focuses on technical aspects of the METRO system itself, defining alignment of the tracks and station types, which were applied at a high level to the corridor segments in question. Guidance on streetscape design had only been provided in a very general form, and important elements left unconsidered in the layouts, such as bus stops, cycle lanes, at-grade pedestrian crossings between stations, shading elements, amenity facilities, variety of planting and street furniture and hardscape surfaces, etc.

Since only typical designs for the station layouts and the surrounding streetscape have been provided to date, the next design step will now have to realistically apply the typical stations and a streetscape designs in line with this UDM to the concrete geometric and contextual situations given at the specific locations. Note that, due to often limited spatial conditions, the inclusion of stations into the METRO corridors may sometimes rely on acquiring further land beyond the limits of the current ROW.

Figure 1.31 Riyadh METRO Project, Project Implementation Tender Documents, Dar Al-handasah



‘In addition to a number of generally accepted planning objectives, such as sustainability and biodiversity, this section of the manual provides the user with practical guidance, by elaborating on principles in the professional fields of streetscape and traffic design. A variety of topics ranging from parking to accessibility of the visually and physically impaired are addressed and offer extensive information towards the achievement of a comprehensive METRO corridor design.’

2 FUNDAMENTAL DESIGN PRINCIPLES

2.1 General Objectives

Supporting the whole Urban Design Manual is a set of fundamental design principles which underpin the philosophy of what is trying to be achieved within the city of Riyadh with the planning and implementation of a new integrated transportation system. The following principles have to be at the nucleus of any design proposals, if, what we are trying to achieve, is to contribute to the cultural, social and economic success of Riyadh and Saudi Arabia.

The following design principles or inherent qualities can be found in many successful urban environments, from the largest cities to a local neighbourhood street. These can be categorized as follows

- *Sustainability* – creating and maintaining an environment which exists in harmony with the social and economic requirements of future generations.
- *Environment* – minimising the impact on the existing natural environment and optimising the use of existing natural resources.
- *Health & Safety* – the perception of a safe and secure environment and the promotion of health through reducing the use of journeys by car, thus helping to lower pollution levels.
- *Prosperity* – developing an urban realm which adds to the environmental, cultural and economic prosperity of Riyadh and Saudi Arabia.
- *Inclusivity* – the inclusion of all members of society and their participation in the development, use and future of Riyadh.
- *Legibility* – navigation for the pedestrian through the public realm must be clear and simple and without ambiguity.
- *Maintainable* – the use of materials and products that are robust and easy to maintain.
- *Connectivity* – the creation of new areas and how they are positively linked to one another, locally and city wide.
- *Accessibility* – promoting free access to all places and at all times, for all sections of the community.
- *Sense of Place* – establishing a local identity and a distinct sense of place, reflecting the rich heritage and urban fabric which occupies the site.
- *Priority* – the priority of pedestrians over the vehicle, creating an environment which supports and prioritises multi modal journeys made by foot, cycle or public transport over those undertaken by the motor vehicle.
- *Variety* – the establishment of interesting and varied spaces which enhances the experience of making journeys.
- *Quality* – the use of quality materials, furniture and planting to promote a positive and safe environment for the public realm.
- *Flexibility* – providing somewhere that can transform and adapt to changes easily.

2.2 Sustainability

As one of the inherent fundamental design principles, this manual advocates a sustainable approach to the design, implementation and future management of the urban realm. Reference should also be made to the document 'Sustainable Planning Guidelines for Urban Growth in the Kingdom of Saudi Arabia' – 2013.

Key sustainability aspirations and objectives include:

- To promote and encourage access to public transport and to reduce the amount of vehicular commuting.
- The endorsement of interdisciplinary design, whereby a holistic approach is taken during the design process, implementation and post construction stages, ensuring no opportunities for sustainability are missed.
- Protect and maintain existing areas of vegetation and planting.
- To reduce energy consumption by utilizing and exploring the latest technologies, photovoltaic, grey water recycling etc.
- Reduce the impacts of the 'heat island effect' by effective use of hard and soft materials and minimizing impermeable surfacing and increasing the use of trees and vegetation for positive environmental benefits (cooling by shading, habitat creation, reducing wind velocity and noise, reduction in air pollutants through planting).
- Reducing the consumption of water.
- The specification of environmentally conscious materials, preferably by using products that maximize recycled content. Give priority to locally produced materials and products with low manufacturing energy content.
- Appropriate plant species selection to suit site conditions and climate, ensuring higher establishment rates.

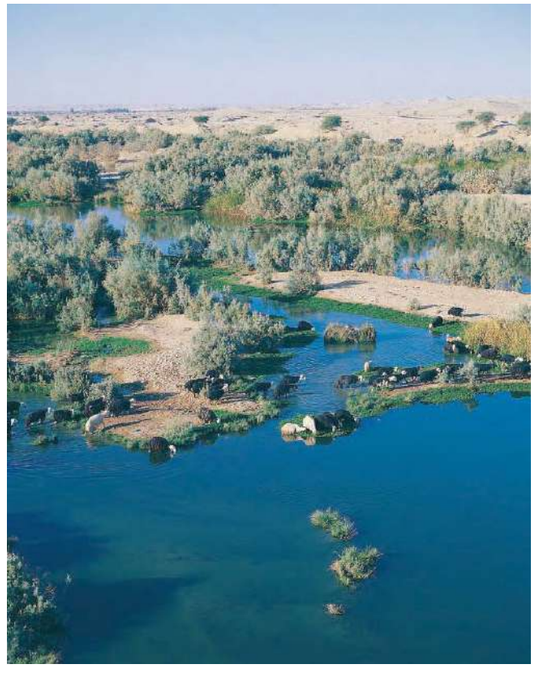


Figure 2.1 Southern Lakes - Wadi Hanifah

2.3 Biodiversity

In 2001 Saudi Arabia became a signatory of the Convention on Biodiversity. This manual aims to embrace the approach and obligations of conserving biodiversity through the following measures:

- The sustainable use of resources and materials.
- The conservation, management and protection of existing habitats and their harmonious integration into the expanding urban settlement.
- The use of native plant species to add diversity and create valuable indigenous habitats for wildlife.
- The use of sustainable urban drainage and other rain water harvesting systems.

Figure 2.2 Wheat Fields - Deeraab

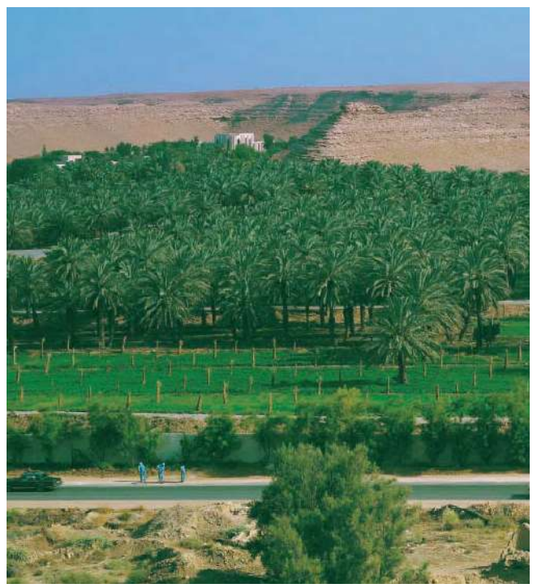


Figure 2.3 Date Farm - Wadi Hanifah

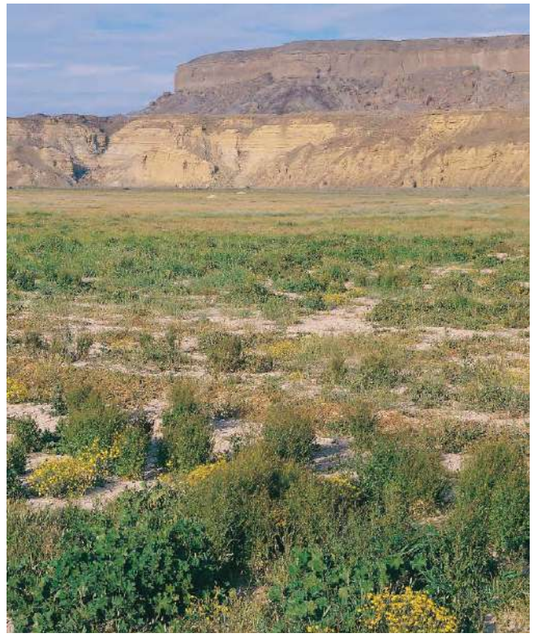


Figure 2.4 Meadow at Thumamah Park

2.4 Urban Design

‘Good urban design is a powerful tool for achieving a higher quality of life, greater economic vitality and a more efficient use of resources. It is key to making places where talented people will want to live, and which will nurture economic success.’

CABE - Commission for Architecture and the Built Environment

When we use the phrase ‘urban design’, it is with the aim of creating or shaping the built environment to provide a setting for life. This should enlighten, excite and provide public spaces which are dynamic and pleasant to use. The purpose of this urban design manual is to provide a catalyst to engage the design process to help shape and form the urban fabric to achieve these aspirations. This is as much a thought process as a practical guide and requires a collaborative approach from all concerned.

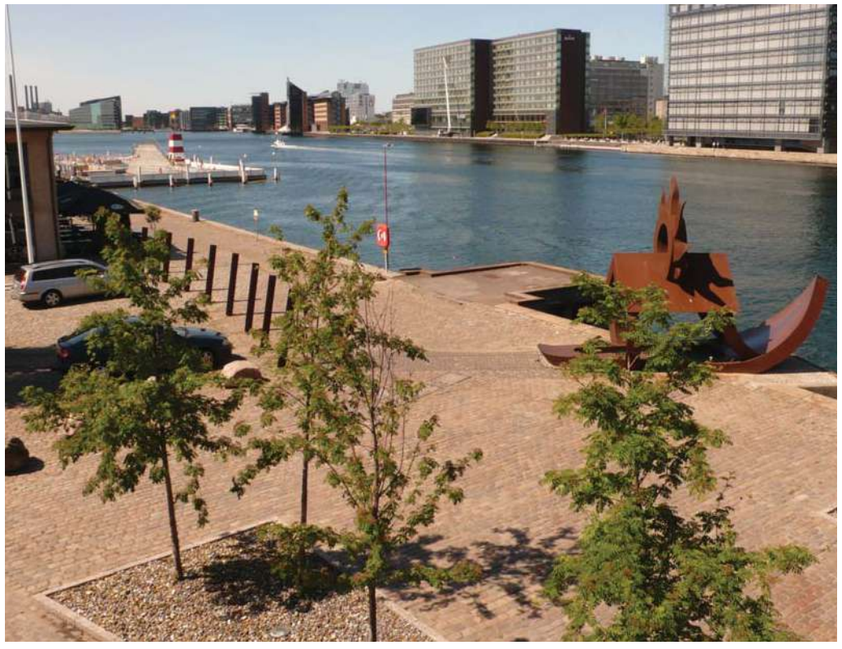


Figure 2.5 River promenade - Copenhagen - Denmark

Figure 2.6 Dubrovnik - Croatia

Figure 2.7 Berlin - Germany

Figure 2.8 Al Kindi Plaza. DQ. Riyadh. KSA

2.5 Traffic Design

Throughout the previous decades Riyadh has largely been developed along car-oriented strategies, providing substantial allowance for car infrastructure, but lacking provision for other modes of transport. Like in many other large cities throughout the world this development has reached its limits. Severe congestion problems, particularly in the central areas, and detrimental effects on living quality have been the result. Consequently, the development of an extensive public transport system throughout Riyadh is critical to maintain the dynamic growth of the city. The METRO system will form the backbone of the new public transport system, promoting a dramatic change in the transport routines and behavior of many residents of Riyadh.

Contrary to car trips which typically consist of only one mode of transport, trips using the METRO will often be multi-modal, relying on other modes of transport for the connection between living/ working/ shopping places and the METRO stations. Feeder and community buses will carry many passengers to and from the METRO station and many people from nearby will choose to walk or cycle to the stations. Overall pedestrian activity will increase substantially around the stations and along the whole corridor. The METRO will be the catalyst for substantial changes in the appearance of Riyadh. Growing commercial activity and further increasing densities along the METRO corridor will lead to further demand for pedestrian and cyclist provision.

To ensure the success of the METRO it is therefore crucial to allow for sufficient provision for pedestrian and frontage activity and streetscape improvements. The currently applied standard approach to road design in Riyadh, however, concentrated on provision for cars. The available road space along the corridor is mostly occupied by car-related functions. A shift towards more provision for alternative modes therefore requires a reduction of space given to car traffic.

A critical review of the actual requirements for vehicular traffic is essential and should be at the beginning of any streetscape re-design. The key challenge is lies in distributing available space and balancing the needs of all road activities.

Figure 2.9 Catering for frontage activity, Barcelona - Spain

Figure 2.10 Integration of METRO access, Berlin - Germany

2.6 Streetscape Design

The following presents a general overview of key design considerations or guidelines which should be deemed essential elements when designing the public realm. The list is not exhaustive and should be read in conjunction with the specific detailed guidance presented later in this manual. As such, they are minimum standards applicable to all urban street types, unless overruled by the specific guidance.

- The Streetscape shall consider the safe transit of all users, both abled bodied and impaired, including all modes of travel - adopting, where possible best international practice and examples.
- The streetscape should link to adjacent open spaces, surrounding urban areas, special destinations within their designs.
- Multimodal transport shall be given priority over vehicular traffic.
- Streetscape shall ensure emergency vehicular access.
- On-street parking should be provided in limited numbers to support commercial activity; the parking concept shall include underground-, multi-storey and surface parking lots beyond the METRO corridors' limit.
- An appropriate amount of car parking shall be designated as disabled access parking; disabled access parking shall be located near the main walkway; min. standard dimensions plus 1.2m access zone; featuring international symbol for disabled parking.
- Cycle lanes shall be applied for easy access to/ from the METRO stations; Shaded cycle racks and rental stations shall be provided adjacent to METRO stations.
- Active frontages along the METRO corridors should be encouraged; walls and fences along adjoining property boundaries should be discouraged.
- Continuous shading should be provided by trees and structures promoting pedestrian use and street activity and softening the urban fringe.
- A defensible buffer should be considered for between the pedestrian walkway and the vehicular carriageway; e.g. car parking, planting.
- Crime preventing environmental design principles shall be applied, such as maintaining clear sightlines, fostering natural surveillance, and providing CCTV and emergency call facilities.
- Street furniture and lighting shall be offered throughout; not conflicting with pedestrian walkways, vehicular routes and access (parking, loading, service, emergency access).
- Amenity facilities (kiosks, public WCs) may be provided facilitating lively pedestrian streetscapes.
- Materials shall be light coloured, non-reflective, durable and easy to maintain (climate, vandalism).
- Public art should be encouraged to add vibrancy and interest.
- Design gateway features should be incorporated to provide a sense of place/ arrival within/ at unique sections of the METRO corridors or special landmark destinations.
- Technical infrastructure shall be located at sub surface level.

Figure 2.11 Generous pedestrian realm with clear walkway (active) and furniture / planting (passive) areas. Barcelona - Spain

Figure 2.12 Dedicated cycle lanes in central median. Barcelona - Spain

Figure 2.13 Active frontages - encouraging a lively streetscape. Berlin - Germany

- Service infrastructure, such as refuse collection points, sub stations, etc. shall be avoided within the METRO corridors as much as possible; necessary facilities shall be visually screened by designed structures or planting.
- Walkways shall not be less than 1.8m wide or exceed 1:12 gradients without steps and/ or ramps; ramps and steps should incorporate tactlie paving in contrasting tones.
- Open gratings should be avoided within walkways; if unavoidable gratings shall be placed perpendicular to travel direction.
- Shaded cycle racks and rental stations shall be provided adjacent to METRO stations.
- Signage elements shall be subject to a hierarchy concept of signage and way-finding units, and a common coordinated visual appearance.
- Road lighting and public realm lighting shall be based on lighting engineers' calculations of required light levels, minimizing light pollution and promoting energy saving, where possible.
- Slip resistant materials shall be used throughout, especially near water features and on access ramps and steps.
- The choice of plants shall be coordinated with the plant manual 'Landscape Plants for the Arriyadh Region' (High Commission).
- Where deemed necessary, elevated METRO track alignment shall receive privacy screen protecting privacy of adjoining properties whilst allowing views from the trains onto the street.

2.7 Shading Strategy

Concept

Given the severe climate of Riyadh with very high temperatures and solar glare during large parts of the year, shading is considered one of the most important elements of a successful streetscape design, comfortably usable for pedestrians and cyclists. The UDM describes a strategy to achieve continuous shade throughout the METRO corridors combining the implementation of natural shading elements, i.e. appropriately chosen and pruned street trees, with artificial built shading elements, and shading elements within aligning facades.

First priority is given to provide shaded walkways and cycle paths. Furthermore, shaded seating areas are to be foreseen at certain distances recommended in a Spacing Schedule described in chapter 3.4.2, Identifying Streetscape Layout. This approach is complemented with general recommendations for the planning regulations for buildings on private plots aligning the public realm. Here, arcades and awnings shall be introduced to any buildings containing active frontages, such as shops.

This comprehensive approach serves all expected users of the public realm, i.e. travelling people along the corridors or between modes of public transport, customers heading for shops or strolling/ window shopping, and people populating the streets to wait or simply enjoy being outdoors.

Natural Shading

The backbone of the shading strategy concerns the natural shading through street trees of a large and deciduous kind. Species shall be chosen from the Planting Toolboxes T13&T14. The shown planting palette has been coordinated with the ADA Nursery Team and is in accordance with the ADA Planting Manual for the Arriyadh Region. Deciduous Street Trees with large canopies have been selected. Canopies must be pruned to maximise shading capacities, box-cut pruning shall be interdicted. Also, street trees should be as mature as possible at the time of planting, in order to achieve at least a minimum of the desired shading effect from day one.

Street trees are foreseen along all pedestrian walkways and cycle paths in order to not only facilitate comfortable connectivity, but also to enhance the visual appearance of the streetscape and to improve the microclimate.

The proposed spacing of street trees shall reflect different urban street types as shown in the Spacing Schedule S02. This responsive approach aims at providing more shading

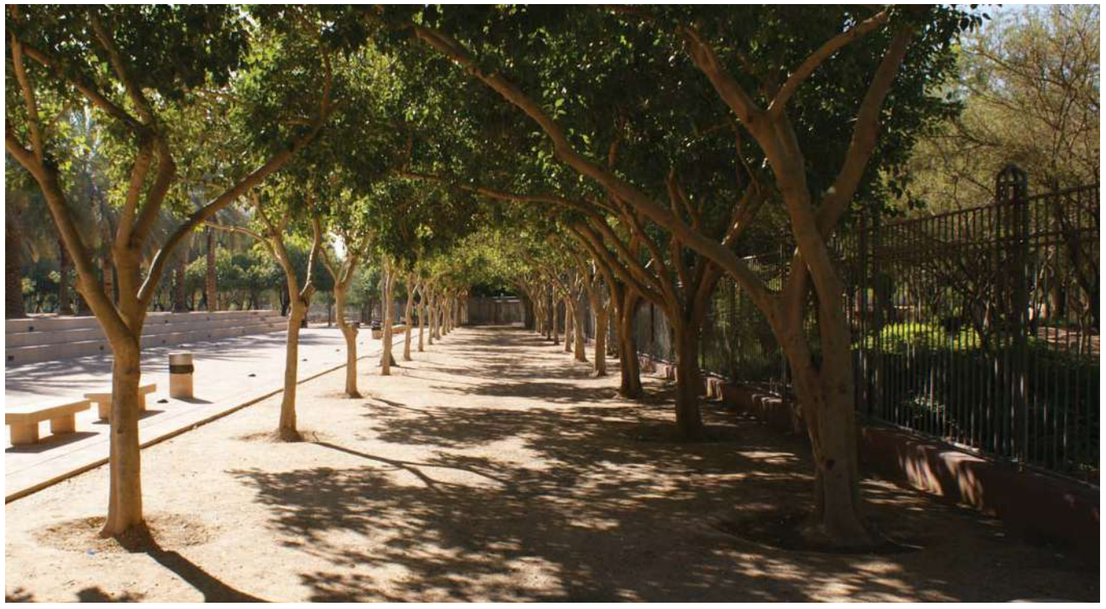


Figure 2.14 Shaded pedestrian environment – King Abdulaziz Historical Center

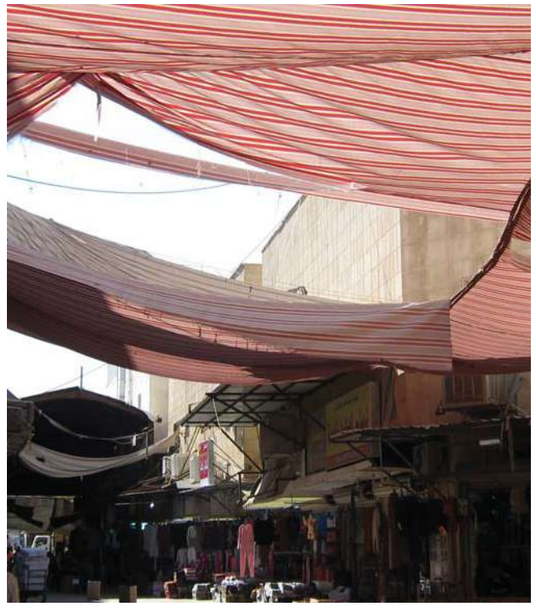


Figure 2.16 Un-regulated awnings providing shade in a souq area - Batha

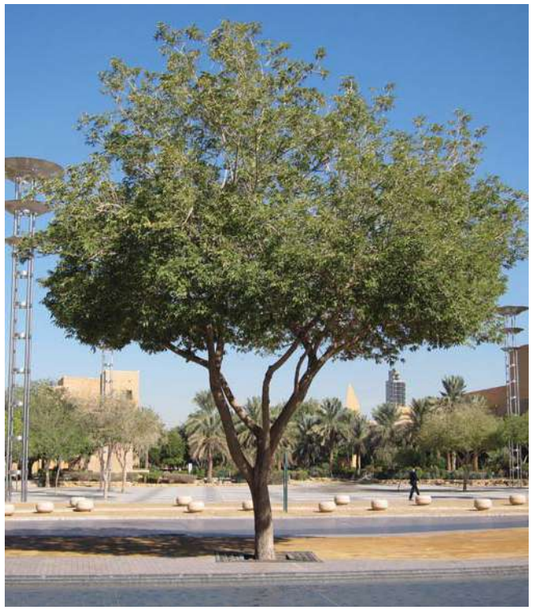


Figure 2.15 Well pruned street tree with natural canopy

trees where high pedestrian frequency is expected, e.g. at mixed-use central areas and METRO stations, whilst less trees are foreseen at lower frequency areas, such as light industrial contexts. This will help save installation and irrigation efforts.

Whilst deciduous trees generally align the walkways along the METRO corridors, seating areas are shaded by palm trees, in order to highlight these places of rest, and to provide shade immediately after installation.

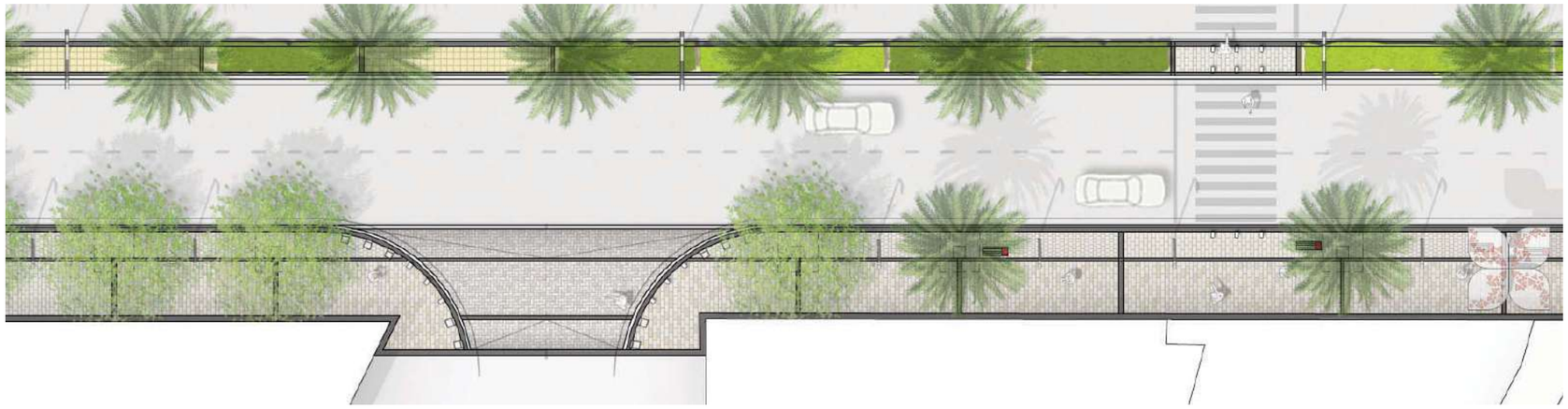


Figure 2.17 Extract of Typical Design showing deciduous trees along the walkway, palm trees highlighting seating areas and pedestrian crossings and a bespoke canopy shading structure

Shading Structures

Complementing the street trees, a modular shading structure is proposed as part of the street furniture 'family'. This structure may be applied as bus stop shelters, but also as shading for larger seating/ activity areas where space availability allows. The modular shading structures' design reflects the proposed METRO station canopy design and can be fitted with additional facilities, such as advertising panels, kiosks, cycle racks, etc.

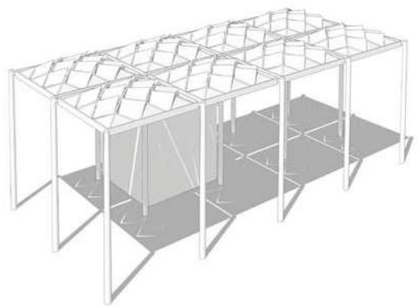


Figure 2.19 Design intent for modular shading structure

A second artificial shading element is a canopy shading structure, which shall be applied in lieu of street trees where conditions do not allow for the installation of real trees. Also water consumption for irrigation can be reduced.

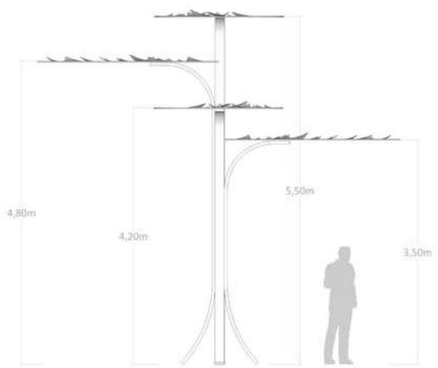


Figure 2.20 Design intent for canopy shading structure

Planning Regulations

The re-design of the streetscape along the METRO corridors should best be supported by strategies developed beyond the remit of this UDM. Regarding the provision of shade, it is recommended to include arcades and awnings within the planning regulations for buildings on private plots. Awnings shall be introduced to any buildings containing active frontages, such as shops. Where spatial conditions are particularly tight, such as in central mixed-use areas, or otherwise desirable due the built context, arcades shall be introduced.

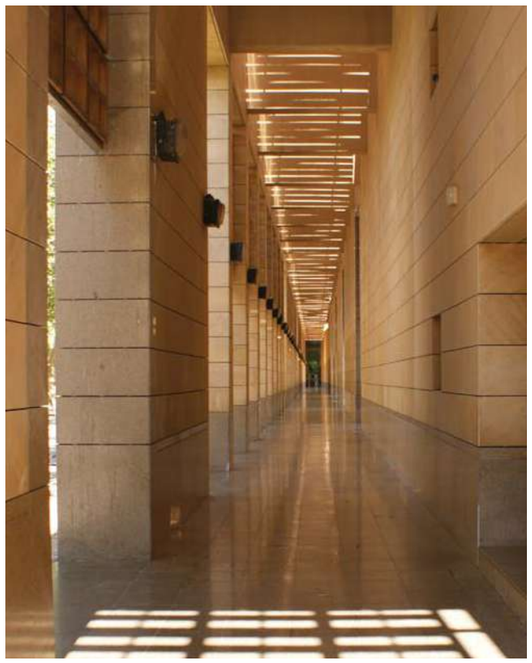


Figure 2.18 Spacious arcade along Kingabdulaziz Historical Center


صيدليات كماليات

‘How can the consultant interpret the content of the manual to achieve the desired design aspirations?

To help understand what is essential in achieving a meaningful and functioning streetscape environment can be found in the chapter entitled ‘Design Process’. In addition to suggesting ‘soft‘objectives and recommendations (as in other sections of the manual), the tool box approach is very detailed by specifying dimensions, quantities and additional ‘hard’ information. This will offer distinct and practical guidance when dealing with any given situation encountered along the corridor.’

3 DESIGN PROCESS

3.1 Using the Urban Design & Streetscape Manual

The UDM has been prepared to assist its user to define the necessary design strategies and protocols, in order to help developing informed and coherent design proposals for the proposed METRO urban realm/ streetscape of the city of Riyadh. The enclosed strategies are not definitive and the (consortia) designer must demonstrate, to the reviewing authority, how they have integrated the manual strategies within their design proposals.

Below is a list of action points which the consortia are required to undertake:

- Understand, apply or, where not applicable, interpret the design manual and its principles. If items or topics are unclear then consult with the reviewing authority at the earliest opportunity.
- Ensure that there is a coherent legibility within their proposals, (using the manual as guidance), and the design rationale is maintained, e.g., sense of place, surface hierarchy, materials, methodology.
- Try and integrate proposals with adjacent and concurrent METRO line designs, starting a design dialogue with other consortia designers.
- Follow local rule and regulations (e.g. Arriyadh Local Plan - Building Regulations and Codes, International Building Code (IBC), Saudi Building Code (SBC)).

The main principle of the UDM is providing an adequate response of the METRO corridors' public realm design to the specific user needs, with a bias on METRO users, at any given location. The user needs are mainly driven by envisaged activities and intensiveness of use of the corridors' public realm, which can be derived from the adjoining land uses and densities.

Following this understanding and after a thorough analysis of the present and expected urban development along the corridor sections, this UDM defines eight predominant urban conditions (Urban Street Types), for which design guidance is provided through manifold matrices, schedules,'toolboxes' and typical designs.

The design process is envisaged to consist of three principal design phases yielding a Corridor Format, a Streetscape Layout, and eventually a Final Streetscape Design. A 'step by step guide' on how to apply the given guidance to the design of a specific corridor segment is illustrated in Chapter 7.

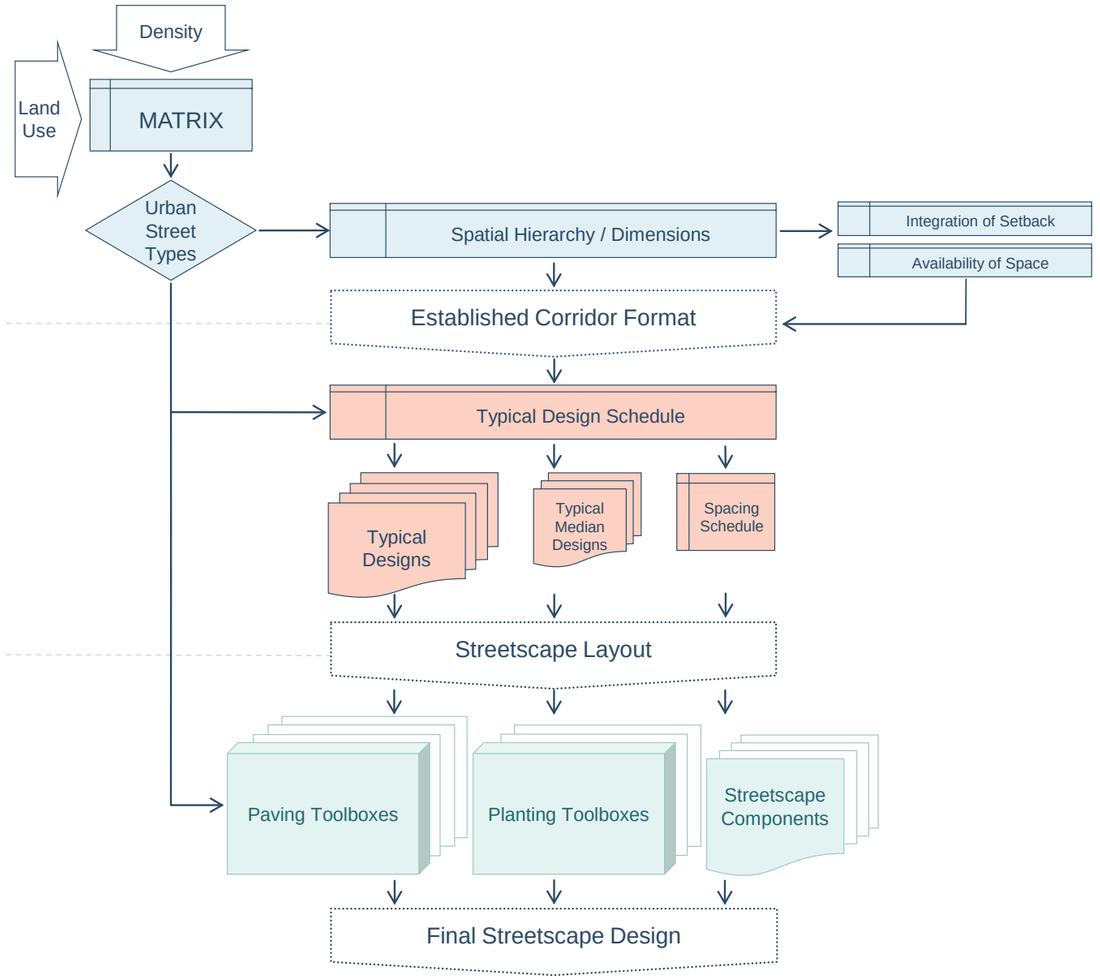


Figure 3.1 Process overview

3.2 Identification of Urban Street Types

The UDM defines eight Urban Street Types based on four different predominant land uses identified/ expected along the METRO corridors. These are divided into sub-categories which differ in level of density. The UDM also provides an initial categorisation of the METRO corridors into these Urban Street Type segments (see Appendix, Urban Context Analysis).

This UDM focuses on METRO corridors not yet fully designed. Hence, the defined Urban Street Types serve the public realm requirements along these Lines 3, 5 and 6. Furthermore, special areas (e.g. main METRO station projects) and exceptional uses/ special developments (e.g. airport), need to be considered separately.

Since the UDM is not only intended to be applicable to the present situation, but also at any time in the future METRO development, it is important that the designers use the initial Urban Street Type definition of all corridor segments in question as a first guidance only. Hence, as a first step of using this manual, the designers will have to re-assess and confirm any corridor segment's Urban Street Type in light of the following definitions.

Map 3.2 Urban Street Types categorisation - overview map

Definition of Land Uses

An area is defined as ***Residential (residential area = R)*** if the land use is predominantly housing.

- Housing units may vary in and between residential areas including single-family housing in villas and town houses.
- Zoning for residential use permits some services or work opportunities and totally exclude large commercial units, business and industry.
- Only low to medium/ low density uses occur.
- Residents seeking services must use transport. Due to the expected increase pedestrian circulation the public realm needs to be of adequate quality and fulfill certain functions concerning mobility and access.

Figure 3.3 Typical existing residential area

Figure 3.4 Typical existing residential frontage along corridors

An area is defined as ***Residential (Mixed) Neighbourhood (mixed use developments = M)*** if the land use is predominantly housing with some commercial activity along the main road corridors.

- Housing units may vary more significantly in and between neighbourhood areas. Besides single-family housing in villas and town houses, multi-family residential in multi-floor residential buildings may also be included.
- Public open space is less available.
- Zoning for neighbourhood use permits services, district commercial units and some work opportunities. However, business and industry are totally excluded.
- The density within a neighbourhood is slightly higher, thus it permits uses with densities up to a level of medium/ high.
- Increased pedestrian circulation is anticipated. Hence, the planned public realm needs to be convenient to its users and provide improved mobility and access. Users are expected to stroll along the corridors within such area.

Figure 3.5 Typical existing residential (mixed) neighbourhood frontage along corridors

An area is defined as ***Industrial/ Employment (access roads = A)*** if the land use includes primarily industrial, business and commercial.

- Buildings include factories, warehouses, office buildings, large commercial units such as malls, and public services.
- Zoning for industrial/ employment use permits mainly work opportunities. Housing is totally excluded in these areas.
- Densities vary between the levels of medium/ low and medium/ high.
- Roads mainly serve as access routes.
- Pedestrians are not expected to linger; the public realm along the roads will mainly be used by employees getting to/ from work.

Figure 3.6 Typical existing light industrial frontage along corridors

Figure 3.7 Typical existing office park frontage along corridors

An area is defined as ***Central Area/ Mixed Use/ TOD (pedestrian area = P)*** if the land is located in the center of the city of Riyadh.

- Zoning for this mixed use areas permits services or work opportunities, such as religious and cultural institutions, ministries and other public services, business, hotels and large commercial areas, such as souks. Housing also occurs, however only in form of multi-floor residential buildings. Industrial uses and warehouses are excluded.
- Densities are limited to medium/ high to high. These areas show the highest density found within the City of Riyadh.
- Opportunities for transit-oriented developments (TOD) are included with higher-density mixed-use areas encouraged near transit stops.
- Heavy pedestrian circulation occurs/ is anticipated. Users are expected to stroll along the corridors requiring high quality and accessible pedestrian environments.

Figure 3.8 Typical existing central commercial frontage along corridors

Figure 3.9 Typical existing central mixed-use frontage along corridors

Definition of Density

Low density areas mostly include suburban or urban edge housing.

- Land uses comprise single-family detached and semi-detached housing, local mosques, local retail, local parks, schools, commercial and municipal offices.
- Building heights are usually low (1 – 2 storeys).
- Resident population is approximately < 4000 persons per km2. The residential density of such areas is between 10 - 20 dwellings per hectare
- Lot sizes are large with generous spacing between buildings, separated by lawns, landscaping, roads or parking lots.
- Large areas are designated for parking.
- Walls and fences segregate land uses from one another

Figure 3.10 Typical detached residential

Figure 3.11 Typical semi-detached residential

Medium/ Low density areas are mostly sub-urban residential developments.

- Land use consists of single-family detached and semi-attached housing, as well as multi-family attached housing (or multi-unit residential buildings).
- Resident population is approximately 4,000 - 7,000 persons per km2. Medium/ Low density housing ranges from about 15 to 40 dwellings per hectare.
- Low density industrial developments including factories and warehouses are at higher LAC (Lot area coverage) levels than low-density residential subdivisions, but low in building height and number of users.

Figure 3.12 Typical multi-unit residential

Figure 3.13 Typical Light Industrial

Medium/ High density areas are mostly inner city urban mixed-use or industrial developments.

- Landuse consists of mixed-use or industrial developments, public services, business, commercial/ retail, housing, factories and warehouses.
- Resident population is approximately 7,000 - 10,000 persons per km2. Medium/ High density housing ranges from about 40 to 80 dwellings per hectare.
- Building heights are mostly mid- to high-rise.
- Mixed-use developments are generally developed as nodes around fixed guideway transit stations and require pedestrian and public transit friendly street design.
- Parking spaces are limited.
- Industrial and warehouse areas feature a vehicle oriented transport design.

Figure 3.14 Typical mixed-use commercial

Figure 3.15 Typical mixed-use commercial

High density areas are urban mixed-use developments located within the downtown center/ central area of Riyadh or special developments (e.g. KAFD).

- Most buildings are mixed use commercial with ground floor retail, public services (e.g.: ministries), hotels.
- Resident population exceeds 10,000 persons per km2. High density housing is above 80 dwellings per hectare.
- They have many high-rise buildings, closely spaced around extensive fixed guideway transit stations.
- Mixed-use developments are generally developed as nodes around fixed guideway transit stations and require pedestrian and public transit friendly street design.
- The urban design layout is mainly public transit orientated due to the density within these areas and the lack of parking spaces.

Figure 3.16 Special development

As an initial planning tool for the designers maps are provided within this UDM in the Appendix, Urban Context Analysis. Further to aerial images illustrating the urban fabric and the building typologies, the use of specific buildings are shown. All project relevant information available to date has been implemented by the authors. If kept up-dated, these maps will help the consortia to verify the character of each single corridor location and at any moment in the future.

Having analysed the predominant adjoining land-use and density, the designer shall apply the findings to the Identification of Urban Street Types matrix yielding the relevant Urban Street Type, which will inform all following streetscape design decisions.

M01 Identification of Urban Street Types		Density			
		Low	Low to Medium	Medium to High	High
Land Use	Industrial / Employment		**A2**	**A3**	
	Residential	**R1**			
	(Mixed) Neighbourhood	**M1**	**M2**	**M3**	
	Central Area/ Mixed Use / TOD			**P3**	**P4**

Table 3.17 Identification of urban street types matrix

Urban Street Types

A - Access

R - Residential

M - Mixed Residential (Neighbourhood)

P - Pedestrian / Public Transport Oriented

3.3 Identification of Available Public Realm

As outlined in Chapter 5 of this document, road dimensions currently applied in the Concept Design often do not allow for sufficiently dimensioned sidewalks/ public realm within the available road space. Enabling the designers to develop a suitable public realm along the corridor the standard approach to the traffic layout described in Chapter 2 needs to be applied first, before the resulting available public realm can be designed.

As outlined, there are two parameters for adjustment: the absolute number of lanes and the relevant standard dimensions applied. The standard setup shall be limited to 3+3, reduce to 2+ where corridor widths are limited. For details, refer to Chapter 2 of this manual.

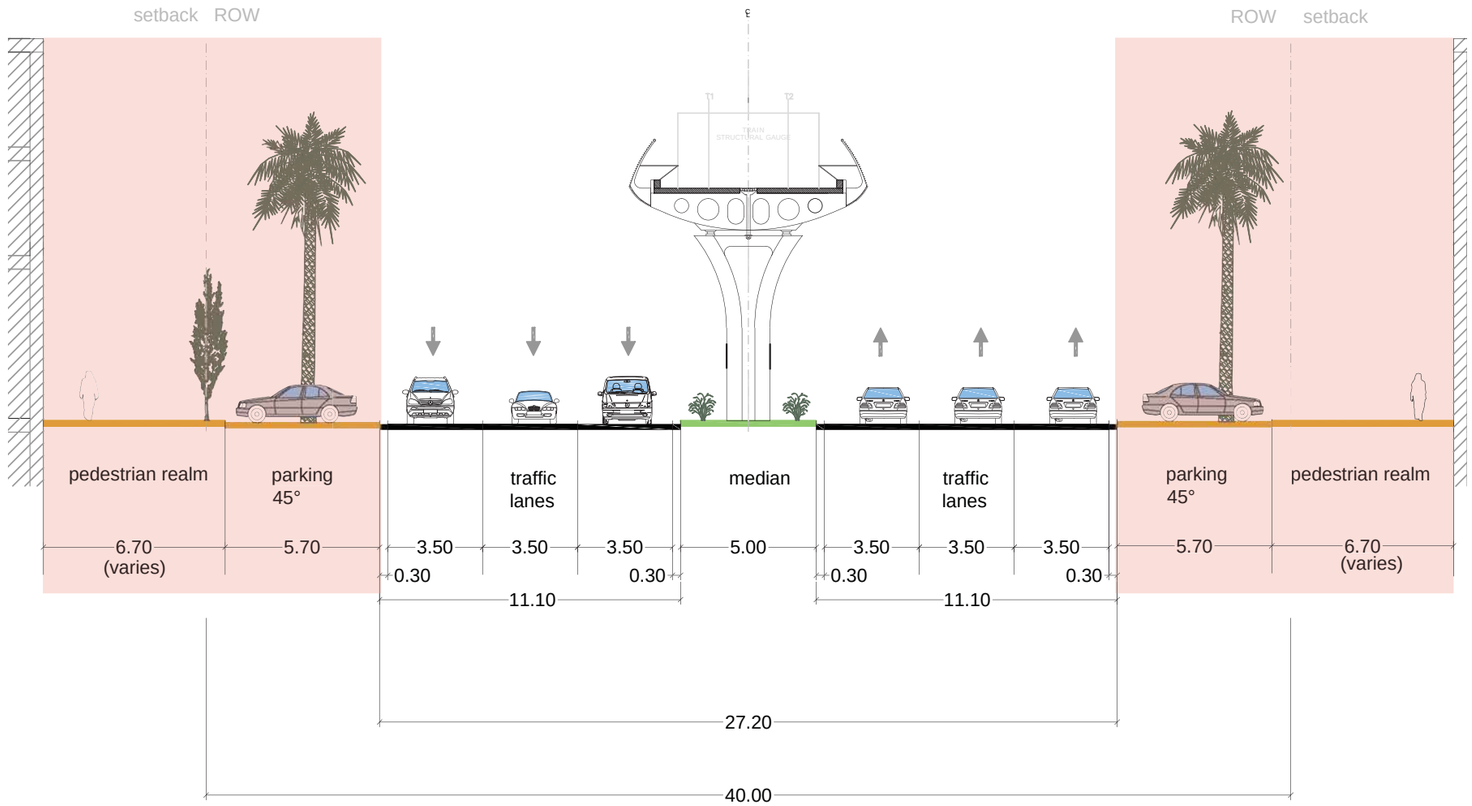


Figure 3.18 Identification of available public realm – sample road section

3.4 Subdivision of the Public Realm

As a result of the aforementioned application of a reduced traffic space within the corridors, a public realm of more or less generous width is generated along both edges of the corridor, which is first to be structured into a basic Corridor Format including all longitudinal public realm elements and zones' dimensions. In a second step, dimensional guidance in relation to perpendicular occurring elements, such as pedestrian crossings and the spacing of other single elements shall be considered, leading to complete Streetscape Layouts.

3.4.1 Establishing Corridor Format

In order to establish the suitable Corridor Format, the defined Urban Street Type needs to be fed into a Spatial Hierarchy/ Dimensions matrix. In essence, this design step establishes the functional and spatial subdivision of the public realm in relation to the Urban Street Type defined. Generally the matrix indicates all longitudinal elements to be provided. Minimum, Standard and Maximum widths of these elements consider varying spatial conditions at any given location.

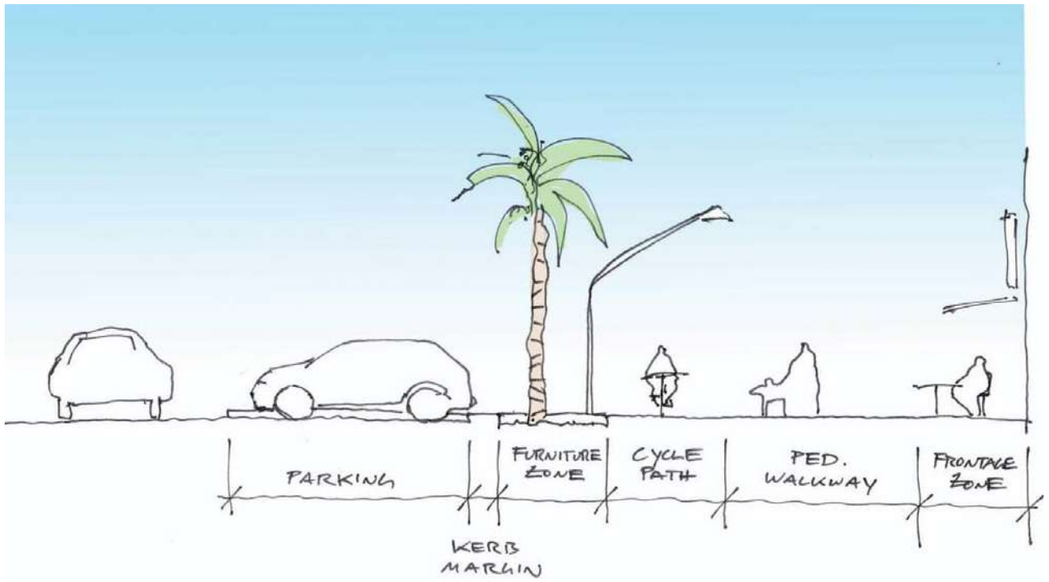


Figure 3.19 Spatial hierarchy - typical elements

		Design Priority # 3	*Design Priority # 1*	*Design Priority # 2*			*Design Priority # 3*			*Design Priority # 1*		*Design Priority # 2*	
M02 Dimensions		**Parking**	**Kerb Margin**	**Furniture Zone**		**Cycle Path**		**Pedestrian Walkway**				**Frontage Zone***	
		Standard	Standard	Min	Standard	Min	Standard	Min	Standard	Maximum		Min	Standard
Urban Street Types	A2	parallel	0.5m	0.5m	1,5m+	N/A	N/A	1.2m	1.8m	4m		N/A	N/A
	A3	45°/parallel	0.5m	0.5m	1,5m+	N/A	N/A	1.2m	2.2m	4m		N/A	N/A
	R1	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.5m	2m	5m		0m	1.8m+
	M1	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.5m	2m	5m		0m	1.8m+
	M2	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.8m	2.5m	5m		0m	1.8m+
	M3	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.8m	3m	6m		0m	1.8m+
	P3	parallel	0.5m	1m	3m+	N/A	N/A	1.8m	3.5m	6m		0m	1.8m+
	P4	parallel	0.5m	1m	3m+	N/A	N/A	2.5m	4m	6m		0m	1.8m+

Table 3.20 Spatial hierarchy/ dimensions matrix

*** frontage zone needs to react to frontage uses (see Section 5.2.5)**

The UDM identifies six longitudinal elements within the public realm along the corridors:

- Frontage Zone.
- Pedestrian Walkway or Clear Zone.
- Furniture Zone.
- Cycle Path.
- Kerb Margin.
- Parking.

These elements have been evaluated in terms of their priority within the public realm and this has been expressed as a numeric value from 1, (highest priority), to 3, (lowest priority) within the Spatial Hierarchy/ Dimensions Matrix. The designer is to apply these criteria to the existing situation and develop a framework for the development of the public realm.

The Frontage Zone

This zone can be defined as the area between the clear pedestrian walkway and the building frontage. Ideally this zone should be kept free of furniture or structures to enable unobstructed pedestrian access and ease of maintenance and cleaning. This zone can also provide a valuable route for the visually impaired that can use the edge of the properties as a boundary guideline. Within retail areas active frontages and obstruction free zones should be encouraged to promote pedestrian use (outdoor dining, window shopping, etc.) and the display of products.

In narrow urban streets where space is tight and a furniture zone cannot be provided, alternative solutions for essential furniture, (lighting for safety etc), maybe considered:

- To reduce the amount of street clutter by attaching signals, signs and lighting to buildings or integrating furniture onto existing columns, (litter bins).
- Relocate control boxes for signaling, telecoms etc. tight against the building facade or within recesses or within side streets.
- Integrate building appendages, (post boxes etc), into the building facades.
- Explore adjacent and private, (negotiation required), land uses to locate street furniture.
- Regulate with planning control and apply approval processes for building awnings, canopies and advertising signage which may encroach into the frontage zone.
- Where excessive level differences occur between the property threshold and the adjacent footway, a minimum 1200mm wide platform is to be provided, with steps and a level ramp, (max 1 in 12) being additionally incorporated if required.

Pedestrian Walkway or Clear Zone

Primary to the creation of the public realm framework is the establishment of a continuous pedestrian walkway or clear zone to enable the unhindered and free movement of pedestrians along the street environment. The pedestrian footway shall be free of any elements, permanent or temporary, which may obstruct the pedestrian thoroughfare. Uncoordinated and randomly placed street furniture can be problematic for the pedestrian, creating unnecessary barriers and hazards for all, especially people with mobility requirements or the visually impaired. The footway shall provide a clear and legible desire line to set minimum and preferred clear width requirements.

Furniture Zone

This zone can be defined as a corridor containing all street furniture elements, including tree planting/ vegetation, signage, bus stops and kiosks. It is important to consider whether there is adequate space available within the furniture zone for certain larger elements, (tree planting etc), whilst maintaining the required minimum pedestrian footway dimensions. This zone can act as an important separator between pedestrians and the adjacent road, providing a perceived degree of safety and comfort for the person on foot.

Kerb Margin

The kerb margin is a 500mm wide clear strip to the rear of the highway kerb-line. This provides an adequate distance to enable vehicles to overhang if parking or opening a door. This distance also helps prevent unwanted vehicular damage to street furniture and an additional safety margin between pedestrians and vehicles. This zone maybe utilised for the pedestrian footway if available space is restricted.

Cycle Path

The approach to the provision of cycle paths focuses on METRO users cycling to and from the METRO stations, instead of providing continuous segregated high speed cycle lanes for long cycle trips. Since driver behaviour and vehicle speeds in Riyadh do not permit for cycle paths on the road, and future cycling demand is currently difficult to estimate, the UDM suggests combining cycle paths with pedestrian walkways. The typical cyclist in KSA is relative slow (i.e. heat) and integrates well pedestrian movements.

Adaptation to Availability of Space/ Design Priorities

Since allocating all elements might prove to be difficult in places, the elements prescribed are also given a design priority. This means that if the available width of the public realm proves insufficient to fit-in all elements identified being desirable for a specific Urban Street Type, certain elements shall be compromised first in terms of availability and/ or dimensions (e.g. car parking), and others last (e.g. pedestrian walkway). Likewise, if the available public realm proves excessive certain priorities are given to the designer in reacting with the design.

An Adaptation to Availability of Space Matrix indicating seven action priorities provides detailed guidance on reacting to insufficient or excessive widths of the available public realm.

M04 **Availability of Space**	**Adaptation to Availability of Space**	
	Insufficient Space	Excess Space
Step 1	Omit left-turn lanes / reduce median to required minimum dimensions	Increase walkway to maximum
Step 2	Review and reduce number of traffic lanes (i.e. traffic study - to be agreed with client)	Increase walkway up to 10m and add second row of trees within walkway
Step 3	Reduce cycle path to minimum (Design Priority #3), providing a shared space with walkway	Increase furnishing zone to include additional landscape elements
Step 4	Balance parking and cycling provision (Design Priority #3): - Reduce parking provision, i.e. parallel parking instead of 45° parking and/or parking in certain areas only - Omit whichever is more difficult to include or less desired along relevant section of road (to be agreed with client)	Utilise overprovision of available space to the benefit of residents and adjacent users: - Consider providing pedestrian boulevard to one side of road, possibly incl. playgrounds, small plazas with shading and benches etc. - Consider possible public use of increased median, i.e. walkway/ cyclepath underneath elevated track or additional parking provision for friday mosque
Step 5	Combine furniture zone (Design Priority #2) and parking provision (see parking section)	

Table 3.21 Adaptation to availability of space matrix

Integration of Setbacks

Most road corridors in Riyadh feature privately owned setbacks beyond the limits of the Right of Way (ROW), typically used as car parking, sidewalks with or without frontage uses, or private use demarcated by walls or other structures. Although privately owned land, these setbacks fall under public control in terms of design and maintenance.

The UDM acknowledges that a meaningful streetscape design can only work from frontage to frontage. Also, long parts of the METRO corridors spatially rely on this area to gain enough space for including all necessary public realm functions identified for creating a quality pedestrian realm supporting the METRO system's user friendliness. Hence, as the standard approach the entire road space from frontage to frontage shall be considered for accommodating the public realm elements identified and the streetscape design. Wherever this approach proves impossible, an alternative subdivision of the public realm shall follow the design priorities outlined in an Integration of Setbacks matrix, considering different setbacks occurring along the corridors.

M03 Integration of Setback	**Setback**			
	0m - 6m	>6m - 12m		>12m
Use of Setback	Public use	Public use possible	No public use possible	Dedicated parking / no public use
Integration into Pedestrian Realm	Integrate into pedestrian realm	Integrate into pedestrian realm	Accommodate all required elements within ROW	Accommodate all required elements within ROW
Provision of On-Street Parking (within ROW)	If possible, yes	If possible, yes	If possible, yes	Parking optional / provide access to dedicated parking if possible

Table 3.22 Integration of setback matrix

3.4.2 Identifying Streetscape Layout

Following the establishment of a corridor format the Streetscape Layout is to be completed considering dimensional guidance on all perpendicular elements, such as pedestrian crossings and other single elements in different situations.

Typical Designs & Spacing Schedule

For the purpose of illustrating the application of this UDM Typical Designs are provided for different Urban Street Types defined (refer to Typical Design Schedule). For guidance on the spacing of the proposed elements a Spacing Schedule shall be adhered to, which sets the elements in relation to their location along the corridor (e.g. distance to METRO stations) and the Urban Street Type defined.

Within the typical designs a number of special detailed situations are described in detail as a blue-print for the designs at specific spatial and geometric situations.

S01 Typical Design Schedule		**Typical Design Arrangements**			
		Typical Streetscape & Station Designs (for dimensions refer to spacing schedule)	Typical Median Designs		
			Standard	At Grade	Elevated
Urban Street Types	A2	Typical Design TD-ST-01	Typical Design TD-M-01	Typical Design TD-M-04	
	A3				
	R1	Typical Design TD-ST-02	Typical Design TD-M-02	Typical Design TD-M-05	Typical Design TD-M-06
	M1	Typical Design TD-ST-03 Typical Design TD-ST-03-sh			Typical Design TD-M-07
	M2				
	M3				
	P3	Typical Design TD-ST-04 Typical Design TD-ST-04-wide	Typical Design TD-M-03		
	P4				

Table 3.23 Typical design schedule

S02 Spacing Schedule		Seating Areas		Approx. Tree Spacing			Pedestrian Crossings (refer to Section 5.1.6, page 96 for details)		
		Minimum No. at Station Vicinity	Approx. No. along Corridor	Station Vicinity & Seating Area	Corridor	Median	Treatment of Local Road Crossing	Approx. Distance between Crossings	Mid-Block Crossing Type
Urban Street Types	A2	1 Shaded Seating Area Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 600 m in-between Stations To include: Min. 1 bench & 1 Litter Bin	Large Trees: min. 9m (centers) Small Trees: min. 6m Palms: min. 6m (Dimensions also applicable for median planting at station vicinity)	Large Trees: 15-20m Palms/ Small Trees: 12-14m	15-18m	Basic	500m	Basic
	A3	1 Shaded Seating Area Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 500 m in-between Stations To include: Min. 1 bench & 1 Litter Bin		Large Trees: 13-17m Palms/ Small Trees: 12-14m	14-16m	Basic	500m	Basic
	R1	2 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 500 m in-between Stations To including: Min. 1 bench & 1 Litter Bin		Large Trees: 12-15m Palms/ Small Trees: 8-10m If parking and tree planting are being combined, due to space constraints: one tree every 4th parking bay	12-14m	Basic	500m	Standard
	M1	2 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 400 m in-between Stations To include: Min. 1 bench & 1 Litter Bin		Large Trees: 12-13m Palms/ Small Trees: 8-10m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	10-12m	Raised Table	500m	Standard
	M2	2 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 350 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 11-12m Palms/ Small Trees: 8-9m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	10-12m	Raised Table	300m	Standard
	M3	2 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 300 m in-between Stations Each one including: Min. 2 benches 1 Litter Bin		Large Trees: 10-12m Palms/ Small Trees: 7-8m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	9-10m	Raised Table	300m	Standard
	P3	3 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 150 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 8-11m Palms/ Small Trees: 6-8m	9-10m	Raised Table	250m	Standard
	P4	3 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 100 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 8-10m Palms/ Small Trees: 6-8m	8-10m	Raised Table	250m	Standard

Table 3.24 Spacing schedule

Figure 3.25 Typical design (extract)

All prototypical designs include a junction at a METRO station, a general road junction, and a linear segment (including typical pedestrian crossings) of the typical METRO corridor. Care has been taken to including all typical conditions expected to occur on the ground, which enables the designer to design the pedestrian realm accordingly.

Obviously the prototypical designs cannot cover every single condition along the entire METRO corridors. However, with this tool in hand the designers shall apply the layout principles and design philosophy illustrated in their designs.

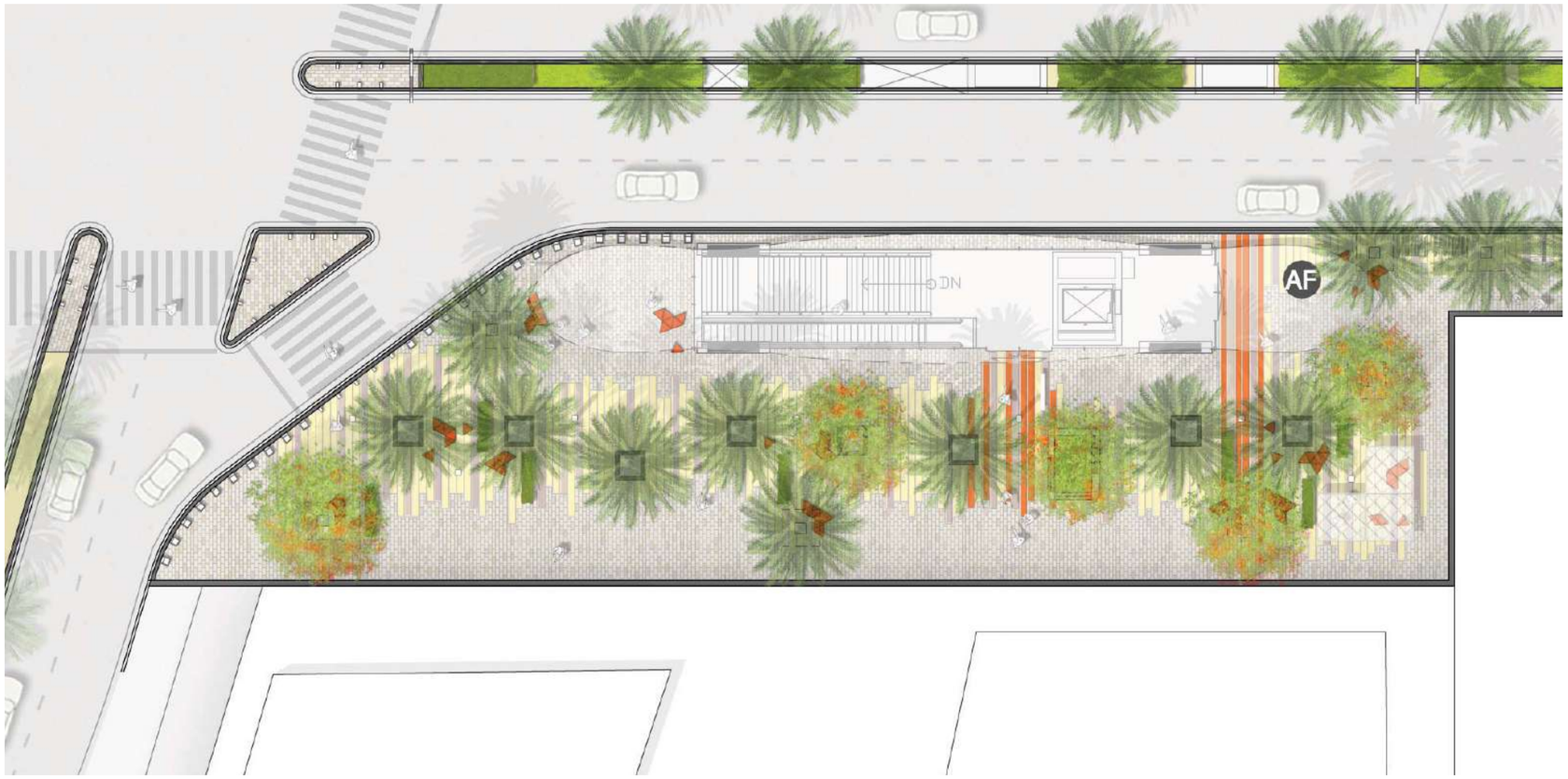


Figure 3.26 Special detail

Typical Median Designs

Also defined in the Typical Design Schedule are Typical Median Designs in relation to the Urban Street Types defined, as well as the varying METRO track alignments; i.e. underground alignment, at grade, or elevated. The track alignment obviously influences the function, accessibility, width and design of the medians the most, whilst the Urban Street Type informs more subtle aesthetic variations.

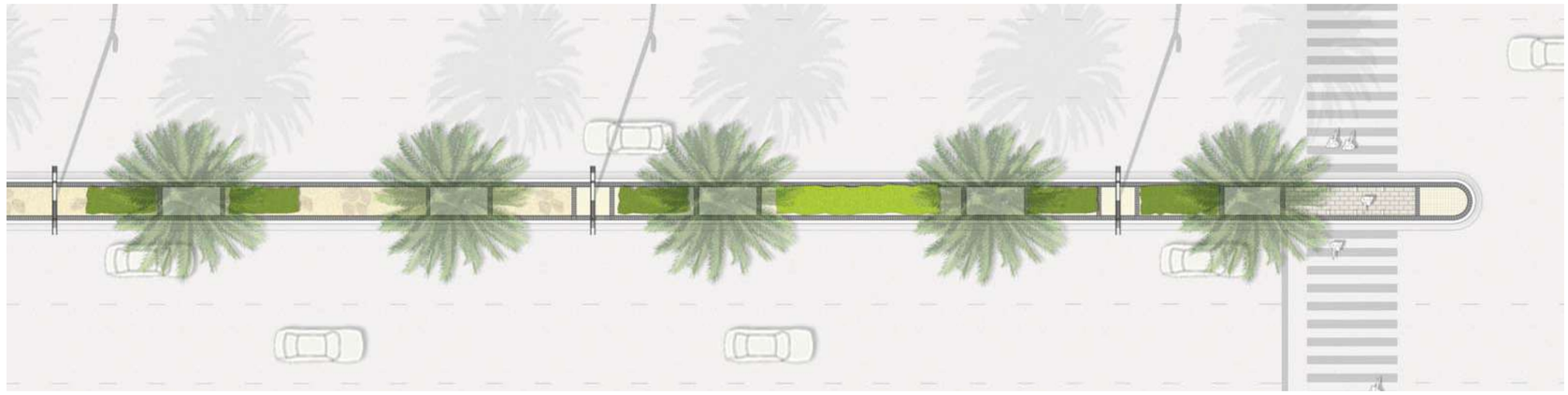


Figure 3.27 Typical median design

Applying all relevant guidance given the designers shall develop a Streetscape Layout, which subsequently can be designed in detail.

3.5 Final Streetscape Design

The final design step is to apply a detailed design to the elaborated Streetscape Layout. Chapter 4 of this manual describes a design strategy and an approach, addressing issues of a recognizable and continuous METRO urban streetscape on the one hand, and personalised characters for the different METRO lines and urban context/ special destinations (sense of place) on the other.

Figure 3.28 Sample perspective of final streetscape design

Understanding the philosophy behind the design approach described is important, since the designer will have to interpret it wherever the guidance given in this manual reaches its limits. A number of tables inform the final design of the paving (Paving Toolboxes), street furniture (Streetscape Component Datasheets) and the softscape (Planting Toolboxes). These toolboxes shall all be considered in applying the guidance to all given locations with manifold existing layout constraints. For a complete summary of all toolboxes, refer to the Appendix, Mandatory Matrices, Schedules, Toolboxes, and Datasheets.

An array of Paving Material Toolbox matrices mandatorily reference and illustrate paving material, colour, finish, format and bond to the Urban Street Types identified. Separate toolboxes are provided for the paving of the basic grid, the furnishing zone, basic infill/ surfacing (walkway and cycle path), steps to shop entrances, platform to shop entrances, edge margin, raised table, and parking bays.

T01 Paving Material Toolbox		**Basic Grid (Banding)**						
		Material	Colour		Finish	Format	Bond	
Urban Street Types	A	Precast Concrete	Anthracite - AN	AN	Sandblasted	20x10x6cm	Soldier Course	
	R	Precast Concrete	Anthracite - AN	AN	Sandblasted	20x10x6cm	Soldier Course	
	M	Precast Concrete	Anthracite - AN	AN	Fine Sandblasted	20x10x6cm	Soldier Course	
	P	Precast Concrete	Anthracite - AN	AN	High Quality Fine Sandblasted	20x10x6cm	Soldier Course	

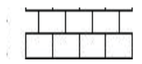
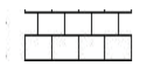
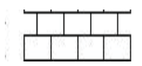
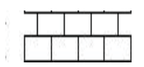
T02 Paving Material Toolbox		**Furniture Zone**						
		Material	Colour		Finish	Format	Bond	
Urban Street Types	A	Precast Concrete	Light Grey	LG	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	R	Precast Concrete	Beige / Sand Colour	LB	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	M	Precast Concrete	Beige / Sand Colour	LB	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	P	Precast Concrete	Grey /Different Tones) Beige / Sand Colour	DG / MG / LG / LB	High Quality Fine Sandblasted	Equal ratio each colour 20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	

Table 3.29 Sample paving material toolbox – basic infill/ surfacing (walkway and cycle path)

Additionally to the design guidance on the paving elements along the corridor, two further paving material toolboxes describe the paving (standard and at special locations) in the station vicinity. Whilst the standard design shall be implemented at all stations without a particularly special urban context, employing colours and materials contrasting to the basic corridor paving, the design in special urban contexts (e.g. historic center) or at special locations (e.g. important destinations to be justified by the designer's analysis) or planned/ already implemented high quality streetscape projects (e.g. METRO main station projects, square in front of General Court Bldg.) can be interpreted/ reacted to in order to create / support an 'identity' or 'sense of place'. An initial definition of such special locations is given in the Appendix, Urban Context Analysis tables for each METRO line in question, under 'Key Places of Interest'.

Figure 3.30 Existing high quality streetscape project example: paving in front of General Court, Riyadh

A Planting Toolbox matrix is referencing plant types and species to the Urban Street Types, which ensures a coherent approach to the design, and to specific locations within the corridors (along corridor, in the vicinity of METRO stations, in the median). Furthermore, special location plants are allocated, and specified in a Special Location Plants Toolbox matrix which subtly reflects the METRO lines' colours in the plants' blossoms.

T13 Planting Toolbox		Standard Planting Palette			
		Plant Type	Corridor	Station Vicinity	Median
Urban Street Types	A	Deciduous Trees	Large: Acacia nilotica Small: Acacia salicina Acacia aneura	See Corridor Palette + Special Location Trees (T14)	N/A
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Phoenix Dactylifera	Washingtonia filifera
		Shrubs/ Hedge/ Ground Cover	N/A	N/A	N/A
	R	Deciduous Trees	Large: Ziziphus jujuba Small: Acacia salicina Pithecellobium dulce Acacia aneura	See Corridor Palette + Special Location Trees (T14)	N/A
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Washingtonia filifera Washingtonia robusta	Phoenix dactylifera
		Shrubs/ Hedge/ Ground Cover	N/A	Vitex trifolia variegata + Special Location Shrub/ Hedge (T14)	Atriplex halimus Pennisetum Setaceum Duranta repens Rosmarinus officinalis Duranta variegata
	M	Deciduous Trees	Large: Ficus religiosa Small: Dalbergia sisoo Ficus sycomorus Acacia nilotica Acacia victoriae	See Cooridor Palette + Special Location Trees (T14)	N/A
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Phoenix Dactylifera Washingtonia filifera Washingtonia robusta	Phoenix dactylifera Washingtonia robusta
		Shrubs/ Hedge/ Ground Cover	N/A	Acacia redolens + Special Location Shrub/ Hedge/ Groundcover (T14)	Clereodendrum inerme Ruscus hypoglossum Atriplex halimus Pennisetum Setaceum Myrtus communis Dodonaea viscosa
	P	Deciduous Trees	Large: Albizia lebbeck Small: Pithecellobium dulce Ficus religiosa Dalbergia sisoo Ficus altissima Acacia nilotica	See Cooridor Palette + Special Location Trees (T14)	N/A
		Palm Trees	Phoenix dactylifera Wasgingtonia robusta (Only at pedestrian crossings and seating areas)	Phoenix Dactylifera Washingtonia filifera Washingtonia robusta	Phoenix dactylifera Washingtonia robusta
		Shrubs/ Hedge/ Ground Cover	Clereodendrum inerme Pennisetum setaceum Atriplex halimus Sesuvium portulacastrum Myrtus communis Agave species Dodonaea viscosa Aloe vera Carissa green carpet Sansevieria trifasciata	Plumeria obtusa + Special Location Shrub/ Hedge/ Groundcover (T14)	Clereodendrum inerme Pennisetum setaceum Atriplex halimus Sesuvium portulacastrum Myrtus communis Agave species Dodonaea viscosa Aloe vera Ruscus hypoglossum Sansevieria trifasciata Carissa green carpet

Table 3.31 Planting toolbox

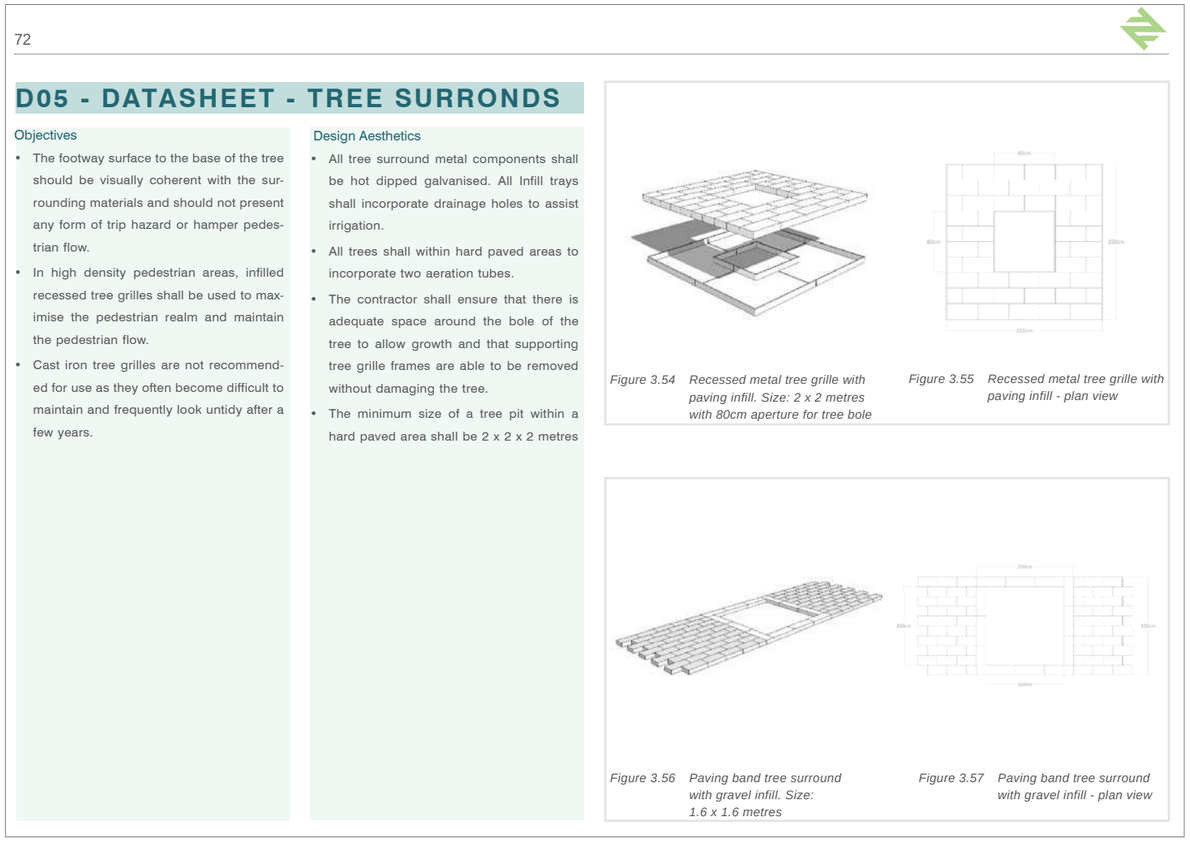
T14 Planting Toolbox		Special Location Plants				
		Deciduous Tree (Large)	Deciduous Tree (Small)	Shrub	Hedge	Groundcover
Colour	Red & Orange	Brachychiton acerifolius Delonix regia	Callistemon viminalis	Caesalpinia pulcherrima Bougainvillea glabra Jatropha integerrima Lantana camara Tecomaria capensis	Dodonaea viscosa 'Purpurea'	Celosia argentea ssp. Plumosa
	Yellow	Acacia farnesiana Thespesia populnea Acacia amplicaps	Cercidium floridum	Tecoma stans Thevetia peruviana Senna artemisioides Encelia farinosa	Duranta erecta 'Aurea'	Wedelia trilobata Gazania leucolaena Santolina chamaecyparissus
	Purple	Bauhinia purpurea Lagunaria patersonii	Duranta erecta	Vitex agnus-castus Vitex trifolia 'Purpurea' Lagerstroemia indica Leucophyllum frutescens	Duranta erecta Leucophyllum frutescens	Tradescantia pallida Tradescantia spatacea Pennisetum setaceum 'Rubrum' Limoniastrum monopetalum

If required, the following additional species can be used:	Climbers:	Jasminum grandiflorum Bougainvillea spectabilis Clerodendrum inerme Ipomea palmata Quisqualis indica	Grass & Lawn	Paspalum vaginatum Zoysia species (St. Augustin)
For distinct extensive planting areas mainly native trees & shrubs shall be used	Native Trees:	Acacia gerrardii Acacia Spirocarpa Acacia ehrenbergiana	Native Shrubs:	Calligonum comosum Panicum turgidum Capparis spinosa Hamada Rhanterium epapposum

Table 3.32 Special location plants toolbox

Chapter 4 of this manual describes the concept of choosing and designing the streetscape components to be planned as a common ‘thread’, or ‘DNA’ within the corridor design, such as lighting, street furniture, public art, structures and signage & wayfinding elements.

A set of mandatory Streetscape Component Datasheets describes these elements’ objectives and functions, as well as the design, including aesthetics principles, materials, colours, and principal dimensions. On this basis, the designer is to develop the concept into final designs for each element (for a complete summary of all streetscape component datasheets, refer to the Appendix, Mandatory Matrices, Schedules, Toolboxes, and Datasheets).



72

D05 - DATASHEET - TREE SURRONDS

Objectives

- The footway surface to the base of the tree should be visually coherent with the surrounding materials and should not present any form of trip hazard or hamper pedestrian flow.
- In high density pedestrian areas, infilled recessed tree grilles shall be used to maximise the pedestrian realm and maintain the pedestrian flow.
- Cast iron tree grilles are not recommended for use as they often become difficult to maintain and frequently look untidy after a few years.

Design Aesthetics

- All tree surround metal components shall be hot dipped galvanised. All Infill trays shall incorporate drainage holes to assist irrigation.
- All trees shall within hard paved areas to incorporate two aeration tubes.
- The contractor shall ensure that there is adequate space around the bole of the tree to allow growth and that supporting tree grille frames are able to be removed without damaging the tree.
- The minimum size of a tree pit within a hard paved area shall be 2 x 2 x 2 metres

Figure 3.54 *Recessed metal tree grille with paving infill. Size: 2 x 2 metres with 80cm aperture for tree bole*

Figure 3.55 *Recessed metal tree grille with paving infill - plan view*

Figure 3.56 *Paving band tree surround with gravel infill. Size: 1.6 x 1.6 metres*

Figure 3.57 *Paving band tree surround with gravel infill - plan view*

Figure 3.33 Sample Streetscape Component Datasheet

Design Phase		Name		Description	Page
Corridor Format	Matrices	Identification of Urban Street Types	M01	Determines the applicable Urban Street Type according to land use & density (analysis of the urban environment required)	49
		Dimensions	M02	Determines zones, dimensions and design priorities subdividing the public realm	49
		Integration of Setback	M03	Guide for integration of different setback situations	50
		Availability of Space	M04	Step-by-step guideline for adjusting zones and dimensions according to the availability of space	50
Streetscape Layout	Schedules	Typical Design Schedule	S01	Determines typical streetscape and station designs based on Urban Street Type and median situation to be used for design guidance and information	51
		Spacing Schedule	S02	Defines dimensions and quantities for hard- and softscape elements based on Urban Street Type	52
	Typical Designs	Typical Streetscape & Station Design Urban Street Type A3	TD-ST-01	Typical Design for industrial/ employment oriented Urban Street Types (A) and standard station situations (sample situation A3)	150
		Typical Streetscape & Station Design Urban Street Type R1	TD-ST-02	Typical Design for residential Urban Street Types (R) and standard station situations (sample situation R1)	160
		Typical Streetscape & Station Design Urban Street Type M2	TD-ST-03	Typical Design for mixed use Urban Street Types (M) and standard station situations (sample situation M2)	170
		Typical Streetscape & Station Design Urban Street Type M2 (Shallow UG station)	TD-ST-03-sh	Typical Design for shallow underground stations (sample situation M2)	178
		Typical Streetscape & Station Design Urban Street Type P3	TD-ST-04	Typical Design for pedestrian/ public transport oriented Urban Street Types (P) and standard station situations (sample situation P3 - narrow central area)	184
		Typical Streetscape & Station Design Urban Street Type P4 (wide)	TD-ST-04-wd	Typical Design for pedestrian/ public transport oriented Urban Street Types (P) (sample situation P4 - wide cross-section)	192
		Typical Median Design Urban Street Type A - Standard	TD-M-01	Typical Median Design for standard medians without integration of METRO tracks for industrial/employment oriented Urban Street Types (A)	198
		Typical Median Design Urban Street Type R & M - Standard	TD-M-02	Typical Median Design for standard medians without integration of METRO tracks for residential and mixed use Urban Street Types (R and M)	198
		Typical Median Design Urban Street Type P - Standard	TD-M-03	Typical Median Design for standard medians without integration of METRO tracks for pedestrian/ public transport oriented Urban Street Types (P)	199
		Typical Median Design Urban Street Type A - At Grade	TD-M-04	Typical Median Design for medians with integration of at grade METRO tracks for industrial/employment oriented Urban Street Types (A)	200
		Typical Median Design Urban Street Type R,M & P - At Grade	TD-M-05	Typical Median Design for medians with integration of at grade METRO tracks for all other Urban Street Types (R, M and P)	200
		Typical Median Design Urban Street Type R & M - Elevated	TD-M-06	Typical Median Design for medians with integration of elevated METRO tracks (applicable for Urban Street Type R)	200
		Typical Median Design Urban Street Type R & M - Elevated	TD-M-07	Typical Median Design for medians with integration of elevated METRO tracks (applicable for Urban Street Type M)	201
Streetscape Design	Toolboxes	Paving Material Toolbox Basic Grid	T01	Paving material to be used for the Basic Grid - the contrasting, linear paving element subdividing the public realm visually and functionally	55
		Paving Material Toolbox Furniture Zone	T02	Paving material to be used for the Furniture Zone - zone where all street furniture elements should be accommodated	55
		Paving Material Toolbox Basic Infill	T03	Paving material to be used for the Basic Infill - the paved 'carpet' including walkway and bicycle track along the corridor and the main plaza paving at station vicinity	56
		Paving Material Toolbox Steps to Shop Entrances	T04	Paving material to be used for Steps to Shop Entrances - steps provide pedestrian access where changes in levels between walkway and shop entrances occur	56
		Paving Material Toolbox Platform to Shop Entrances	T05	Paving material to be used for Platform to Shop Entrances - where steps to shops are required, platforms are required in front of shops to provide accessibility and continuity	57

Design Phase		Name		Description	Page
Streetscape Design	Toolboxes	Paving Material Toolbox Edge Margin	T06	Paving material to be used for the Edge Margin - the paving strip separating existing areas and new developed street (steps are replacing the edge margin)	57
		Paving Material Toolbox Raised Tables	T07	Paving material to be used for Raised Tables - providing continuous walkway and traffic calming at local access roads	58
		Paving Material Toolbox Parking Bays	T08	Paving material to be used for Parking Bays - parking bays are integrated in public realm, choice of materials meets aesthetical and functional requirements	58
		Paving Material Toolbox Vehicular Access to Private Plots	T09	Paving material to be used for Vehicular Property Access - providing walkway continuity at accesses to properties and buildings with little traffic demand	59
		Paving Material Toolbox Median Surfacing	T10	Paving material to be used for Median Surfacing - surfacing applies on medians where no softscape is envisaged	59
		Paving Material Toolbox - Station Vicinity Paving Panels	T11	Paving material to be used for Station Vicinity Paving Panels - contrasting paving panels to be incorporated at METRO stations, following design intent defined in this manual	60
		Paving Material Toolbox - Station Vicinity Paving Panels (Special Locations)	T12	Additional, contrasting paving material to be used for Station Vicinity Paving Panels at Special Locations for feature paving patterns to create local identity	61
		Planting Toolbox	T13	Defining the Choice of Plants to be used for different elements and in accordance to the Urban Street Type	62
		Planting Toolbox - Special Location plants	T14	Additional choice of flowering trees and plants to reflect the METRO line colour code at or to highlight a special location the station vicinity	63
	Datasheets	Datasheet - Litter Bins	D01	Datasheet outlining design intent and requirements for bespoke Litter Bins to be designed in line with the overall concept	64
		Datasheet - Seating	D02	Datasheet outlining design intent and requirements for bespoke Seating to be designed in line with the overall concept	65
		Datasheet - Cycle Stands	D03	Datasheet outlining design intent and requirements for bespoke Cycle Bins to be designed in line with the overall concept	66
		Datasheet - Bollards	D04	Datasheet outlining design intent and requirements for bespoke Bollards to be designed in line with the overall concept	67
		Datasheet - Tree Surrounds	D05	Datasheet outlining design intent and requirements for Tree Surrounds to be designed in line with the overall concept	68
		Datasheet - Tree Protection Bollards	D06	Datasheet outlining design intent and requirements for Tree Protection Bollards to be designed in line with the overall concept	69
		Datasheet - Raised Planter	D07	Datasheet outlining design intent and requirements for bespoke Raised Planters to be designed in line with the overall concept	70
		Datasheet - Drinking Fountain	D08	Datasheet outlining design intent and requirements for bespoke Drinking Fountains to be designed in line with the overall concept	71
		Datasheet - Lighting	D09	Datasheet outlining design intent and requirements for bespoke Lighting Fixtures to be designed in line with the overall concept	72
		Datasheet - Signage, Wayfinding & Information	D10	Datasheet outlining design intent and requirements for Signage, Wayfinding and Information Boards to be designed in line with the overall concept	74
		Datasheet - Banners & Advertising	D11	Datasheet outlining design intent and requirements for Banners and Advertising to be designed in line with the overall concept	75
		Datasheet - Modular Shading Structure	D12	Datasheet outlining design intent and requirements for bespoke Modular Shading Structures to be designed in line with the overall concept	76
		Datasheet - Canopy Shading Structure	D13	Datasheet outlining design intent and requirements for bespoke Canopy Shading Structures to be designed in line with the overall concept	77

Table 3.34 Overview of Matrices, Schedules and Toolboxes

3.6 Mandatory Matrices, Schedules, Toolboxes and Datasheets

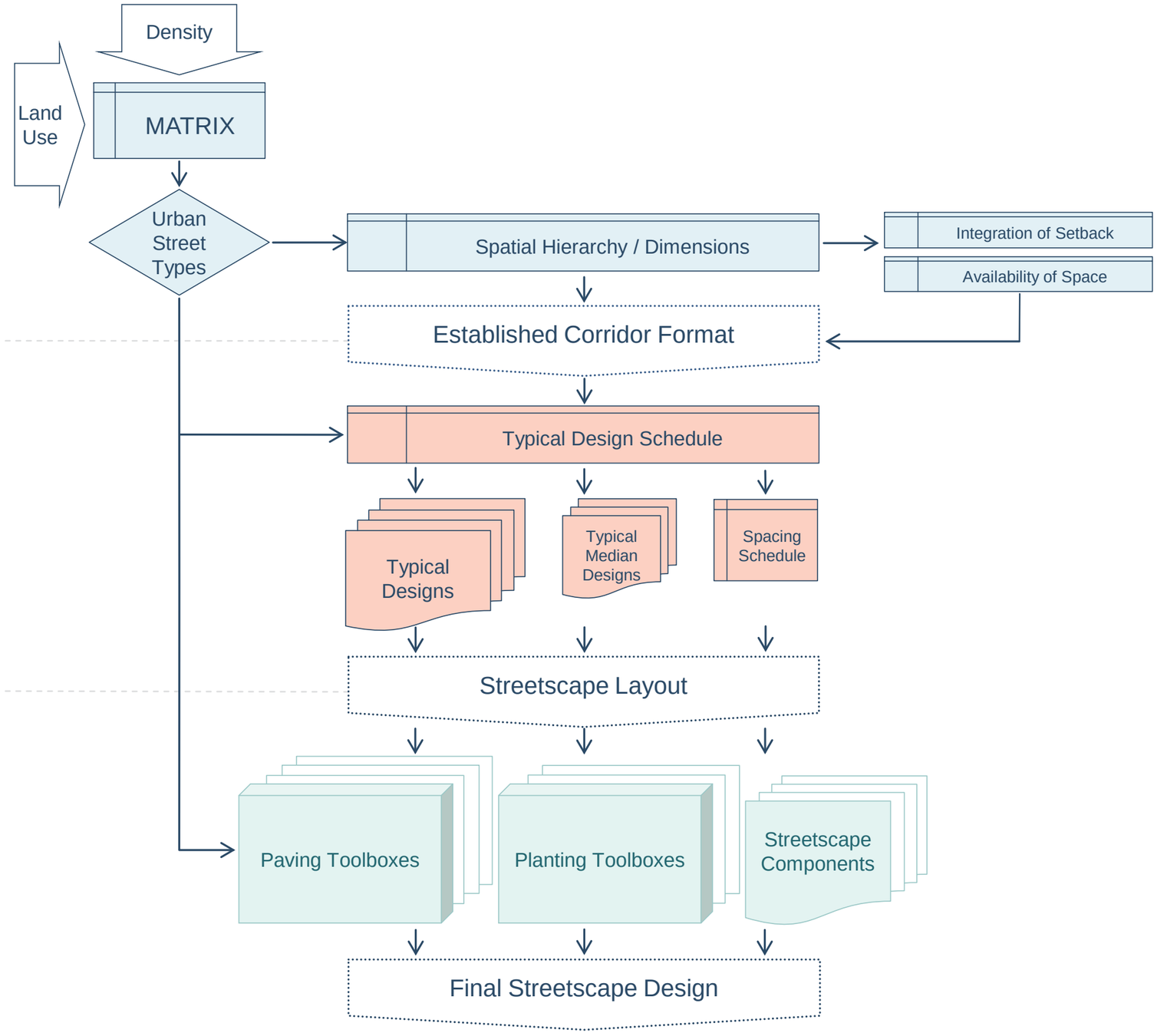


Figure 3.35 Matrices, Schedules, Toolboxes and Datasheets overview

3.6.1 Matrices

M01 Identification of Urban Street Types		Density			
		Low	Low to Medium	Medium to High	High
Land Use	Industrial / Employment		**A2**	**A3**	
	Residential	**R1**			
	(Mixed) Neighbourhood	**M1**	**M2**	**M3**	
	Central Area/ Mixed Use / TOD			**P3**	**P4**

Urban Street Types

A - Access

R - Residential

M - Mixed Residential (Neighbourhood)

P - Pedestrian / Public Transport Oriented

		Design Priority # 3	*Design Priority # 1*	*Design Priority # 2*		*Design Priority # 3*		*Design Priority # 1*			*Design Priority # 2*	
M02 Dimensions		Parking	Kerb Margin	Furniture Zone		Cycle Path		Pedestrian Walkway			Frontage Zone*	
		Standard	Standard	Min	Standard	Min	Standard	Min	Standard	Maximum	Min	Standard
Urban Street Types	A2	parallel	0.5m	0.5m	1,5m+	N/A	N/A	1.2m	1.8m	4m	N/A	N/A
	A3	45°/parallel	0.5m	0.5m	1,5m+	N/A	N/A	1.2m	2.2m	4m	N/A	N/A
	R1	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.5m	2m	5m	0m	1.8m+
	M1	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.5m	2m	5m	0m	1.8m+
	M2	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.8m	2.5m	5m	0m	1.8m+
	M3	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.8m	3m	6m	0m	1.8m+
	P3	parallel	0.5m	1m	3m+	N/A	N/A	1.8m	3.5m	6m	0m	1.8m+
	P4	parallel	0.5m	1m	3m+	N/A	N/A	2.5m	4m	6m	0m	1.8m+

*** frontage zone needs to react to frontage uses (see Section 5.2.5)**

M03 Integration of Setback	Setback			
	0m - 6m	>6m - 12m		>12m
Use of Setback	Public use	Public use possible	No public use possible	Dedicated parking / no public use
Integration into Pedestrian Realm	Integrate into pedestrian realm	Integrate into pedestrian realm	Accommodate all required elements within ROW	Accommodate all required elements within ROW
Provision of On-Street Parking (within ROW)	If possible, yes	If possible, yes	If possible, yes	Parking optional / provide access to dedicated parking if possible

M04 Availability of Space	Adaptation to Availability of Space	
	Insufficient Space	Excess Space
Step 1	Omit left-turn lanes / reduce median to required minimum dimensions	Increase walkway to maximum
Step 2	Review and reduce number of traffic lanes (i.e. traffic study - to be agreed with client)	Increase walkway up to 10m and add second row of trees within walkway
Step 3	Reduce cycle path to minimum (Design Priority #3), providing a shared space with walkway	Increase furnishing zone to include additional landscape elements
Step 4	Balance parking and cycling provision (Design Priority #3): - Reduce parking provision, i.e. parallel parking instead of 45° parking and/or parking in certain areas only - Omit whichever is more difficult to include or less desired along relevant section of road (to be agreed with client)	Utilise overprovision of available space to the benefit of residents and adjacent users: - Consider providing pedestrian boulevard to one side of road, possibly incl. playgrounds, small plazas with shading and benches etc. - Consider possible public use of increased median, i.e. walkway/ cyclepath underneath elevated track or additional parking provision for friday mosque
Step 5	Combine furniture zone (Design Priority #2) and parking provision (see parking section)	

3.6.2 Schedules

S01 Typical Design Schedule		Typical Design Arrangements			
		Typical Streetscape & Station Designs (for dimensions refer to spacing schedule)	Typical Median Designs		
			Standard	At Grade	Elevated
Urban Street Types	A2	Typical Design TD-ST-01	Typical Design TD-M-01	Typical Design TD-M-04	
	A3				
	R1	Typical Design TD-ST-02	Typical Design TD-M-02	Typical Design TD-M-05	Typical Design TD-M-06
	M1	Typical Design TD-ST-03 Typical Design TD-ST-03-sh			Typical Design TD-M-07
	M2				
	M3				
	P3	Typical Design TD-ST-04 Typical Design TD-ST-04-wide	Typical Design TD-M-03		
	P4				

S02 Spacing Schedule		Seating Areas		Approx. Tree Spacing			Pedestrian Crossings (refer to Section 5.1.6, page 96 for details)		
		Minimum No. at Station Vicinity	Approx. No. along Corridor	Station Vicinity & Seating Area	Corridor	Median	Treatment of Local Road Crossing	Approx. Distance between Crossings	Mid-Block Crossing Type
Urban Street Types	A2	1 Shaded Seating Area Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 600 m in-between Stations To include: Min. 1 bench & 1 Litter Bin	Large Trees: min. 9m (centers) Small Trees: min. 6m Palms: min. 6m (Dimensions also applicable for median planting at station vicinity)	Large Trees: 15-20m Palms/ Small Trees: 12-14m	15-18m	Basic	500m	Basic
	A3	1 Shaded Seating Area Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 500 m in-between Stations To include: Min. 1 bench & 1 Litter Bin		Large Trees: 13-17m Palms/ Small Trees: 12-14m	14-16m	Basic	500m	Basic
	R1	2 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 500 m in-between Stations To including: Min. 1 bench & 1 Litter Bin		Large Trees: 12-15m Palms/ Small Trees: 8-10m If parking and tree planting are being combined, due to space constraints: one tree every 4th parking bay	12-14m	Basic	500m	Standard
	M1	2 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 400 m in-between Stations To include: Min. 1 bench & 1 Litter Bin		Large Trees: 12-13m Palms/ Small Trees: 8-10m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	10-12m	Raised Table	500m	Standard
	M2	2 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 350 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 11-12m Palms/ Small Trees: 8-9m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	10-12m	Raised Table	300m	Standard
	M3	2 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 300 m in-between Stations Each one including: Min. 2 benches 1 Litter Bin		Large Trees: 10-12m Palms/ Small Trees: 7-8m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	9-10m	Raised Table	300m	Standard
	P3	3 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 150 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 8-11m Palms/ Small Trees: 6-8m	9-10m	Raised Table	250m	Standard
	P4	3 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 100 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 8-10m Palms/ Small Trees: 6-8m	8-10m	Raised Table	250m	Standard

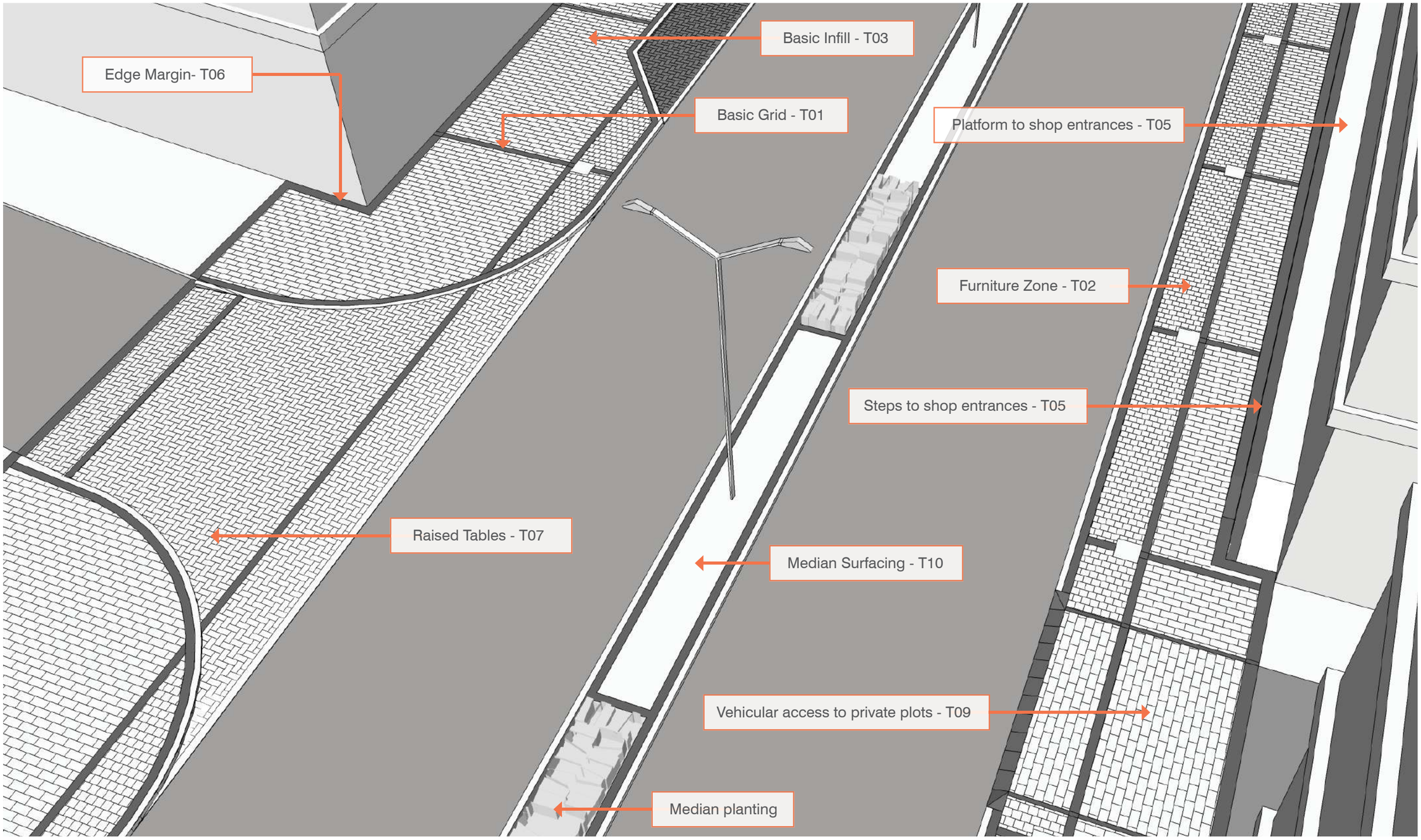


Figure 3.36 Paving and Surfacing Elements / Corridor

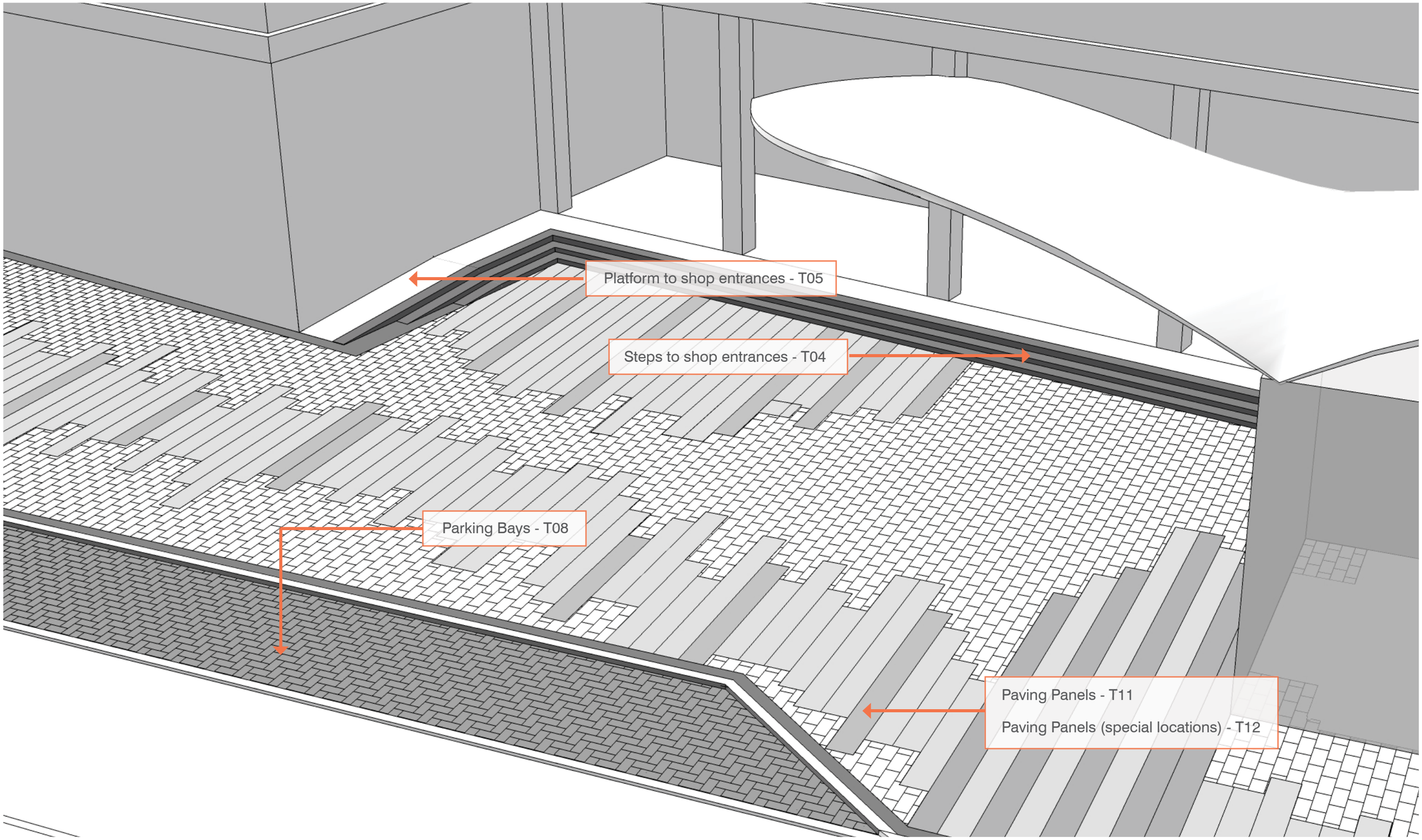
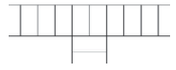
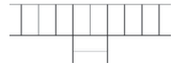
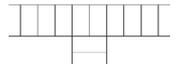
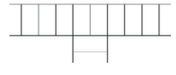
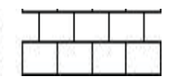
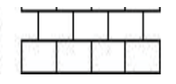
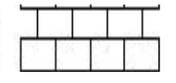
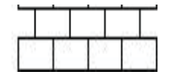
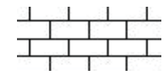
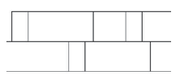
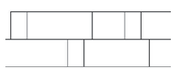


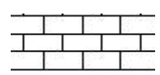
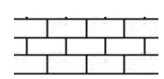
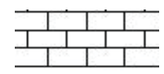
Figure 3.37 Paving and Surfacing Elements / Station Vicinity

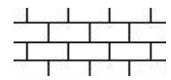
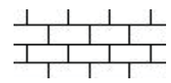
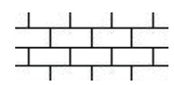
3.6.3 Toolboxes

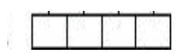
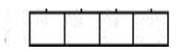
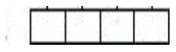
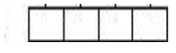
T01 Paving Material Toolbox		Basic Grid (Banding)						
		Material	Colour		Finish	Format	Bond	
Urban Street Types	A	Precast Concrete	Anthracite - AN	AN	Sandblasted	20x10x6cm	Soldier Course	
	R	Precast Concrete	Anthracite - AN	AN	Sandblasted	20x10x6cm	Soldier Course	
	M	Precast Concrete	Anthracite - AN	AN	Fine Sandblasted	20x10x6cm	Soldier Course	
	P	Precast Concrete	Anthracite - AN	AN	High Quality Fine Sandblasted	20x10x6cm	Soldier Course	

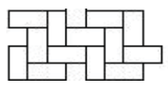
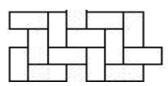
T02 Paving Material Toolbox		Furniture Zone						
		Material	Colour		Finish	Format	Bond	
Urban Street Types	A	Precast Concrete	Light Grey	LG	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	R	Precast Concrete	Beige / Sand Colour	LB	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	M	Precast Concrete	Beige / Sand Colour	LB	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	P	Precast Concrete	Grey /Different Tones) Beige / Sand Colour	DG / MG / LG / LB	High Quality Fine Sandblasted	Equal ratio each colour 20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	

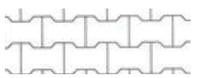
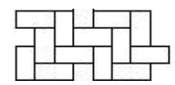
T03 Paving Material Toolbox		Basic Infill / Surfacing (Walkway and Cycle Path)						
		Material	Colour		Finish	Ratio - Format (Approx.) - Colour	Bond	
Urban Street Types	A	Precast Concrete	Light Grey - LG	LG	Sandblasted	100% - 20x10x6cm - LG	Stretcher Bond laid perpendicular to Kerb	
	R	Precast Concrete	Light Beige - LB	LB	Sandblasted	30% - 20x10x6cm - LB 30% - 20x20x6cm - LB 10% - 20x25x6cm - LB 30% - 20x40x6cm - LB	Stretcher Bond laid perpendicular to Kerb	
	M	Precast Concrete	Mid Grey - MG Light Grey - LG Light Beige - LB	MG / LG / LB	High Quality Sandblasted	30% - 20x10x6cm - LB 30% - 20x20x6cm - LB 10% - 20x25x6cm - LG 15% - 20x40x6cm - MG 15% - 20x40x6cm - LB	Stretcher Bond laid perpendicular to Kerb	
	P	Precast Concrete	Light Grey - LG Earth Red - ER Light Beige - LB Dark Beige - DB	LG / ER / DB / LB	High Quality Fine Sandblasted Exposed Aggregate	25% 20x10x6cm - DB 10% 20x20x6cm - DB 10% 20x20x6cm - ER 10% 20x25x6cm - LB 15% 20x40x6cm - LB 15% 20x50x6cm - LG 15% 20x50x6cm - LB	Stretcher Bond laid perpendicular to Kerb	

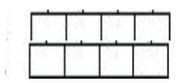
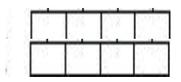
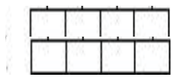
T04 Paving Material Toolbox		Steps to Shop Entrances (Applicable if difference in levels between entrance and proposed walkway level occur)						
		Material	Colour		Finish	Format	Bond	
Urban Street Types	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	R	Precast Concrete	Dark Grey - DG	DG	Sandblasted / Exposed Aggregate	80x35x15cm	Staggered joints	
	M	Precast Concrete	Dark Grey - DG	DG	Sandblasted / Exposed Aggregate	80x35x15cm	Staggered joints	
	P	Precast Concrete	Dark Grey - DG	DG	High Quality Sandblasted / Exposed Aggregate	80x35x15cm	Staggered joints	

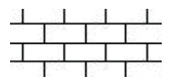
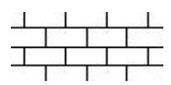
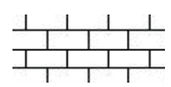
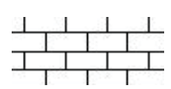
T05 Paving Material Toolbox		Platform to Shop Entrances (Applicable if steps to shop entrances required) Note: Minimum width of platform to be 1.20m						
		Material	Colour			Finish	Format	Bond	
Urban Street Types	A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
	R	Precast Concrete	Mid Grey - MG	MG		Sandblasted	20x10x6cm (10x10x6cm)	Stretcher Bond laid parallel to steps	
	M	Precast Concrete	Mid Grey - MG Light Grey - LG	MG	LG	Sandblasted	Equal ratio each colour 20x10x6cm (10x10x6cm)	Stretcher Bond laid parallel to steps	
	P	Precast Concrete	Mid Grey - MG Light Grey - LG Dark Beige - DB	MG	LG	DB	High Quality Sandblasted	Equal ratio each colour 20x10x6cm (10x10x6cm)	Stretcher Bond laid parallel to steps	

T06 Paving Material Toolbox		Edge Margin						
		Material	Colour		Finish	Format	Bond	
Urban Street Types	A	Precast Concrete	Dark Grey - DG	DG	Sandblasted	30x30x6cm	Running Bond	
	R	Precast Concrete	Dark Grey - DG	DG	Sandblasted	30x30x6cm	Running Bond	
	M	Precast Concrete	Dark Grey - DG	DG	Sandblasted	30x30x6cm	Running Bond	
	P	Precast Concrete	Dark Grey - DG	DG	Sandblasted	30x30x6cm	Running Bond	

T07 Paving Material Toolbox		Raised Tables								
		Material	Colour				Finish	Format	Bond	
Urban Street Types	A	N/A	N/A	N/A			N/A	N/A	N/A	N/A
	R	N/A	N/A	N/A			N/A	N/A	N/A	N/A
	M	Precast Concrete	Dark Grey - DG Mid Grey - MG Dark Beige - DB	DG	MG	DB	Sandblasted	Equal ratio of each colour 20x10x8cm	90 ° Herringbone	
	P	Precast Concrete	Dark Grey - DG Earth Red - ER Dark Beige - DB	DG	ER	DB	Sandblasted	Equal ratio of each colour 20x10x8cm	90 ° Herringbone	

T08 Paving Material Toolbox		Parking Bays							
		Material	Colour			Finish	Format	Bond	
Urban Street Types	A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
	R	Precast Concrete	Dark Grey - DG	DG		Sandblasted	Interlocking Blocks	Stretcher Bond	
	M	Precast Concrete	Dark Grey - DG	DG		Sandblasted	Interlocking Blocks	Stretcher Bond	
	P	Precast Concrete	Dark Grey - DG Mid Grey - MG	DG	MG	Sandblasted	Equal ratio each colour 20x10x8cm	90 ° Herringbone	

T09 Paving Material Toolbox		Median Surfacing							
		Material	Colour			Finish	Format	Bond	
Urban Street Types	A	Crushed Riyadh Limestone Gravel	N/A	N/A		N/A	N/A	N/A	N/A
	R	Crushed Riyadh Limestone Gravel & Precast Concrete	Dark Beige - DB	DB		Sandblasted	20x20x6cm	Stack Bond	
	M	Crushed Riyadh Limestone Gravel & Precast Concrete	Dark Beige - DB	DB		Sandblasted	20x20x6cm	Stack Bond	
	P	Precast Concrete	Mid Grey - MG Light Grey - LG Dark Beige - DB	MG	LG	DB	Sandblasted	Equal ratio each colour 20x20x6cm	Stack Bond	

T10 Paving Material Toolbox		Vehicular Access to Private Plots							
		Material	Colour			Finish	Format	Bond	
Urban Street Types	A	PCC Pavers. Special access kerb. Flush kerb as separation to walkway paving	Dark Grey - DG	DG		Sandblasted	20x10x8cm	Stretcher Bond laid parallel to Kerb	
	R	PCC Pavers. Special access kerb. Flush kerb as separation to walkway paving	Dark Beige - DB	DB		Sandblasted	20x10x8cm	Stretcher Bond laid parallel to Kerb	
	M	PCC Pavers. Special access kerb. Flush kerb as separation to walkway paving	Mid Grey - MG Light Grey - LG Light Beige - LB	DG	DB	Sandblasted	Equal ratio each colour 20x10x8cm	Stretcher Bond laid parallel to Kerb	
	P	PCC Pavers. Special access kerb. Flush kerb as separation to walkway paving	Dark Grey - DG Earth Red - ER Dark Beige - DB	DG	ER	DB	Sandblasted	Equal ratio each colour 20x10x8cm	Stretcher Bond laid parallel to Kerb	

T11 Paving Material Toolbox Station Vicinity		Paving Panels							
		Standard Location							
		Applicable Area	Material	Colour			Finish	Format	Bond
Urban Street Types	A	Vicinity of Station (approx.15m away from station edges)	Precast Concrete	Beige / Sand Colour (Differnt tones)			Sanblasted / Exposed Aggregate	40x40x6cm	Running Bond
	R	Vicinity of Station (approx.15m away from station edges)	Precast Concrete	Light Grey (Differnt tones)			Sanblasted / Exposed Aggregate	40x40x6cm 40x20x6cm	Running Bond
	M	Wider vicinity of Station. Starting approx. 50m away from first Station entrance	Precast Concrete or suitable locally available Natural Stone (granite, basalt, quartzite, limestone, to approval...)	Contrasting to 'Basic Infill' selection	Varies to Designer's choice		High Quality Non-slippery Non-reflecting	Varies Standard width of 'Fragment Panel' to be 40cm	To Designer's choice
	P	Wider vicinity of Station. Starting approx. 50m away from first Station entrance	Precast Concrete or suitable locally available Natural Stone (granite, basalt, quartzite, limestone, to approval...)	Contrasting to 'Basic Infill' selection	Varies to Designer's choice		High Quality Non-slippery Non-reflecting	Varies Standard width of 'Fragment Panel' to be 40cm	To Designer's choice

T12 Paving Material Toolbox Station Vicinity (Special Locations)		Paving Panels						
		Special Locations						
		Applicable Area	Material	Colour		Finish	Format	Bond
Urban Street Types	A	Vicinity of Station (approx.15m away from station edges)	Robust & locally available material to be selected. Precast concrete elements or natural stone	Contrasting to 'Basic Infill' selection	Varies to Designer's choice	High Quality Non-slippery Non-reflecting	Varies to Designer's choice. Standard width of 'Fragment Panel' to be 40cm	To Designer's choice
	R	Vicinity of Station (approx.15m away from station edges)	Suitable material to Designer's choice to express local identity and design concept as detailed in this manual	To Designer's choice	Varies to Designer's choice	High Quality Non-slippery Non-reflecting	Varies to Designer's choice. Standard width of 'Fragment Panel' to be 40cm	To Designer's choice
	M	Wider vicinity of Station. Starting approx. 50m away from first Station entrance	Suitable material to Designer's choice to express local identity and design concept as detailed in this manual	To Designer's choice	Varies to Designer's choice	High Quality Non-slippery Non-reflecting	Varies to Designer's choice. Standard width of 'Fragment Panel' to be 40cm	To Designer's choice
	P	Wider vicinity of Station. Starting approx. 50m away from first Station entrance	Suitable material to Designer's choice to express local identity and design concept as detailed in this manual	To Designer's choice	Varies to Designer's choice	High Quality Non-slippery Non-reflecting	Varies to Designer's choice. Standard width of 'Fragment Panel' to be 40cm	To Designer's choice

T13 Planting Toolbox		Plant Type	Corridor	Station Vicinity	Median
			Standard Planting Palette		
Urban Street Types	A	Deciduous Trees	Large: Acacia nilotica Small: Acacia salicina Acacia aneura	See Corridor Palette + Special Location Trees (T14)	N/A
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Phoenix Dactylifera	Washingtonia filifera
		Shrubs/ Hedge/ Ground Cover	N/A	N/A	N/A
	R	Deciduous Trees	Large: Ziziphus jujuba Small: Acacia salicina Pithecellobium dulce Acacia aneura	See Corridor Palette + Special Location Trees (T14)	N/A
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Washingtonia filifera Washingtonia robusta	Phoenix dactylifera
		Shrubs/ Hedge/ Ground Cover	N/A	Vitex trifolia variegata + Special Location Shrub/ Hedge (T14)	Atriplex halimus Pennisetum Setaceum Duranta repens Rosmarinus officinalis Duranta variegata
	M	Deciduous Trees	Large: Ficus religiosa Small: Dalbergia sisoo Ficus sycomorus Acacia nilotica Acacia victoriae	See Cooridor Palette + Special Location Trees (T14)	N/A
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Phoenix Dactylifera Washingtonia filifera Washingtonia robusta	Phoenix dactylifera Washingtonia robusta
		Shrubs/ Hedge/ Ground Cover	N/A	Acacia redolens + Special Location Shrub/ Hedge/ Groundcover (T14)	Clereodendrum inerme Ruscus hypoglossum Atriplex halimus Pennisetum Setaceum Myrtus communis Dodonaea viscosa
	P	Deciduous Trees	Large: Albizia lebbeck Small: Pithecellobium dulce Ficus religiosa Dalbergia sisoo Ficus altissima Acacia nilotica	See Cooridor Palette + Special Location Trees (T14)	N/A
		Palm Trees	Phoenix dactylifera Wasgingtonia robusta (Only at pedestrian crossings and seating areas)	Phoenix Dactylifera Washingtonia filifera Washingtonia robusta	Phoenix dactylifera Washingtonia robusta
		Shrubs/ Hedge/ Ground Cover	Clereodendrum inerme Pennisetum setaceum Atriplex halimus Sesuvium portulacastrum Myrtus communis Agave species Dodonaea viscosa Aloe vera Carissa green carpet Sansevieria trifasciata	Plumeria obtusa + Special Location Shrub/ Hedge/ Groundcover (T14)	Clereodendrum inerme Pennisetum setaceum Atriplex halimus Sesuvium portulacastrum Myrtus communis Agave species Dodonaea viscosa Aloe vera Ruscus hypoglossum Sansevieria trifasciata Carissa green carpet

Note: Planting qualities/ sizes shall be as follows - Palm Trees: 4m trunk height, Deciduous Trees: 3m trunk height.

T14 Planting Toolbox		Special Location Plants				
		Deciduous Tree (Large)	Deciduous Tree (Small)	Shrub	Hedge	Groundcover
Colour	Red & Orange	Brachychiton acerifolius Delonix regia	Callistemon viminalis	Caesalpinia pulcherrima Bougainvillea glabra Jatropha integerrima Lantana camara Tecomaria capensis	Dodonaea viscosa 'Purpurea'	Celosia argentea ssp. Plumosa
	Yellow	Acacia farnesiana Thespesia populnea Acacia amplicaps	Cercidium floridum	Tecoma stans Thevetia peruviana Senna artemisioides Encelia farinosa	Duranta erecta 'Aurea'	Wedelia trilobata Gazania leucolaena Santolina chamaecyparissus
	Purple	Bauhinia purpurea Lagunaria patersonii	Duranta erecta	Vitex agnus-castus Vitex trifolia 'Purpurea' Lagerstroemia indica Leucophyllum frutescens	Duranta erecta Leucophyllum frutescens	Tradescantia pallida Tradescantia spatacea Pennisetum setaceum 'Rubrum' Limoniastrum monopetalum

If required, the following additional species can be used:	Climbers:	Jasminum grandiflorum Bougainvillea spectabilis Clerodendrum inerme Ipomea palmata Quisqualis indica	Grass & Lawn	Paspalum vaginatum Zoysia species (St. Augustin)

For distinct extensive planting areas mainly native trees & shrubs shall be used	Native Trees:	Acacia gerrardii Acacia Spirocarpa Acacia ehrenbergiana	Native Shrubs:	Calligonum comosum Panicum turgidum Capparis spinosa Hamada Rhanterium epapposum

Note: Planting qualities/ sizes shall be as follows - Palm Trees: 4m trunk height, Deciduous Trees: 3m trunk height.

3.6.4 Datasheets

D01 - DATASHEET - LITTER BINS

Objectives

- The increase in the capacity of city wide litter bins is to be coordinated with the refuge authorities to ensure that the collection and maintenance regimes are adhered to and ease of access is provided.
- Litter bins shall be located within the proposed furniture zone where they do not create an obstruction, physically or visually. Where appropriate bins can be integrated with lighting columns to minimise street clutter and obstructions.
- Litter bins shall be located where people meet, wait or converge.
- Commercial waste bins shall be located away from the public realm or other special areas and located in designated locations, where ease of collection can be achieved. Ideally these should be located in side streets or compounds. If this is not possible then designated areas within converted parking bays should be considered.
- Avoid litter bins being located within pedestrian areas, if their placement would reduce the footway to below 1800mm in width. Alternative locations shall be sought.

Design Aesthetics

- The design of the litter bins shall be coordinated with the proposed street furniture palette and be part of the design family 'DNA'. Colours and finishes shall be uniform, robust in their durability and fireproof. The furniture palette will share a common inherent design but certain seating elements shall reflect the local character or special place of interest. It is proposed to express this in the quality of the materials and finishes, establishing a distinct but coherent hierarchy. This is described in the furniture hierarchy, (finishes), table.
- An integrated cigarette disposal unit shall be part of the litter bin design.
- Litter bins should also be leak proof to help prevent the staining of the surrounding surfacing.
- If graphics are considered, these should be part of a coordinated design and discreet in their appearance.
- A range of recycling bins should be considered and coordinated with the city authorities and the proposed design strategy.

Figure 3.38 Free-standing litter bin

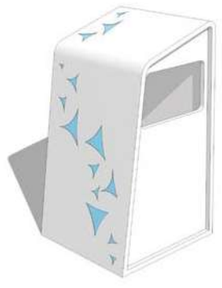


Figure 3.39 Free-standing litter bin with graphic branding

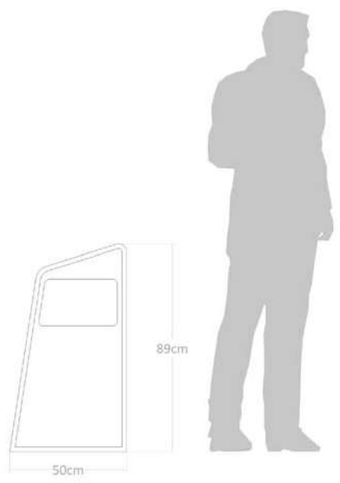


Figure 3.40 Free-standing litter bin - technical dimensions

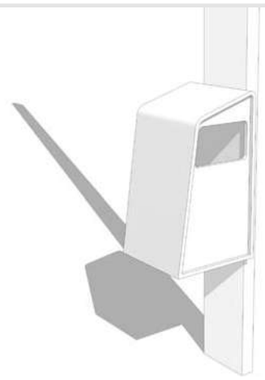


Figure 3.41 Post mounted litter bin

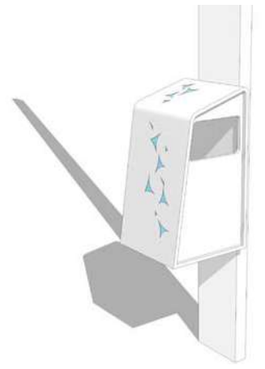


Figure 3.42 Post mounted litter bin with graphic branding

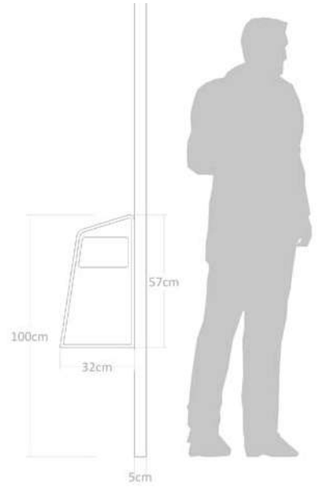


Figure 3.43 Post mounted litter bin - technical dimensions

D02 - DATASHEET - SEATING

Seating

Objectives

- Seating shall be provided on all pedestrian routes, strategic transportation nodes, school routes, public spaces and local facilities. The design aim is to provide places of rest at strategic points.
- Seating shall be located within the proposed furniture zone where it does not create an obstruction, physically or visually. Seating elements should be located in small groups to encourage social interaction.
- A range of seat types shall be developed to address the various age groups from informal seating blocks to seating with backs and arm rests to assist the less mobile.

Design Aesthetics

- The design of the seating shall be coordinated with the proposed street furniture palette and be part of the design family 'DNA'. Colours and finishes shall be uniform and robust in their durability. The furniture palette will share a common inherent design but certain seating elements shall reflect the local character or special place of interest. It is proposed to express this in the quality of the materials and finishes, establishing a distinct but coherent hierarchy.
- The placing of the seating elements will respond to the locale, with regular spacing, along high intensity routes or near bus stops or where people are likely to wait.
- Secure below ground fixings shall be used and be unobtrusive and be coordinated with the proposed surface materials.
- The materials will consider ease of maintenance and discourage inappropriate use such as skateboarding.

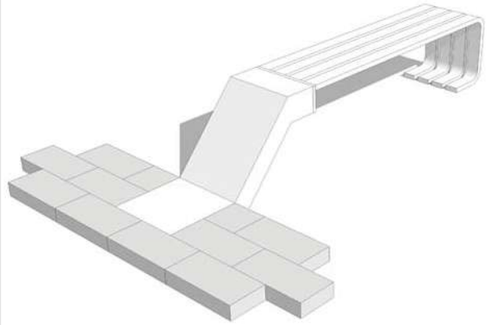


Figure 3.44 Bench

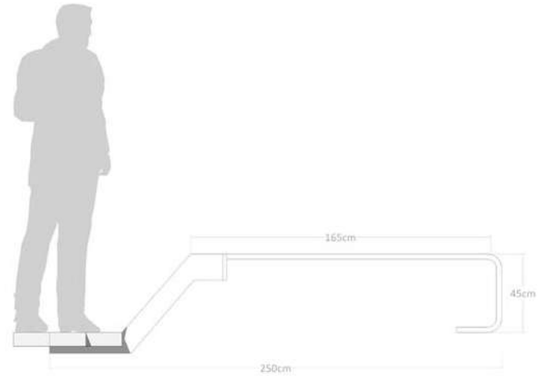


Figure 3.45 Bench - technical dimensions

Figure 3.46 Seat

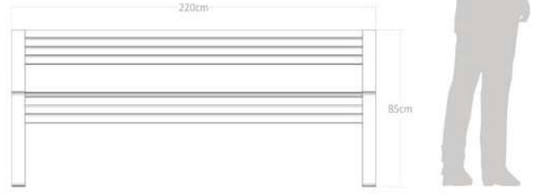


Figure 3.47 Seat - technical dimensions

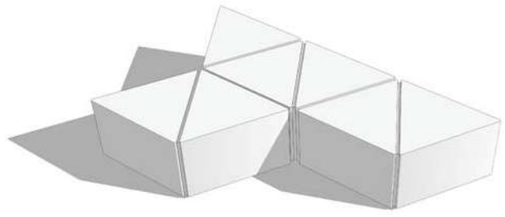


Figure 3.48 Modular seating pod

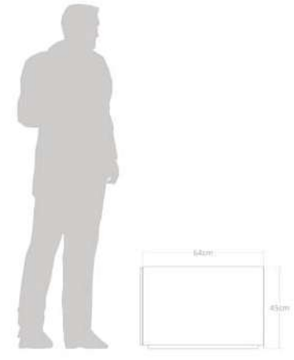


Figure 3.49 Modular seating pod - technical dimensions

D03 - DATASHEET - CYCLE STANDS

Objectives

- Cycle stands shall be located within the furniture zone and located within the vicinity of proposed transport nodes, (stations, bus stops), this will enable cyclists to take advantage of an integrated transport system and undertake multi modal journeys.
- Cycle parking areas should be secure and legible, with the designer carefully locating the stands so they do not create an obstruction to footways or access points.
- Cycle stands shall be located within shaded areas, either by trees or directly beneath a shading structure.

Design Aesthetics

- When grouping cycle stands together, a minimum of 1000mm – 1200mm between stands is recommended to allow sufficient space for two cycles to be parked parallel to one another.
- The design of the cycle stands shall be coordinated with the proposed street furniture palette and be part of the design family 'DNA'. Colours and finishes shall be uniform and robust in their durability.
- The securing of cycle stands should provide the option to enable the ease of replacement and maintenance should they become damaged or vandalised.

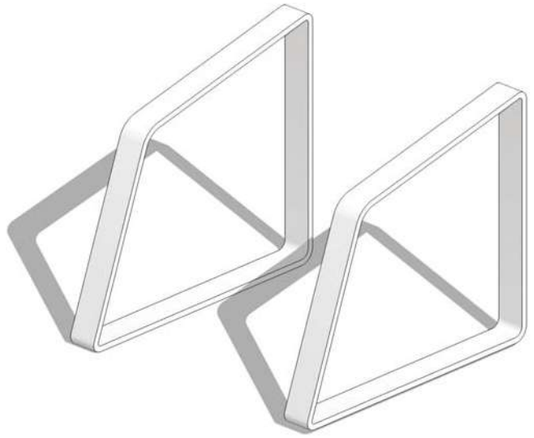


Figure 3.50 Cycle stand

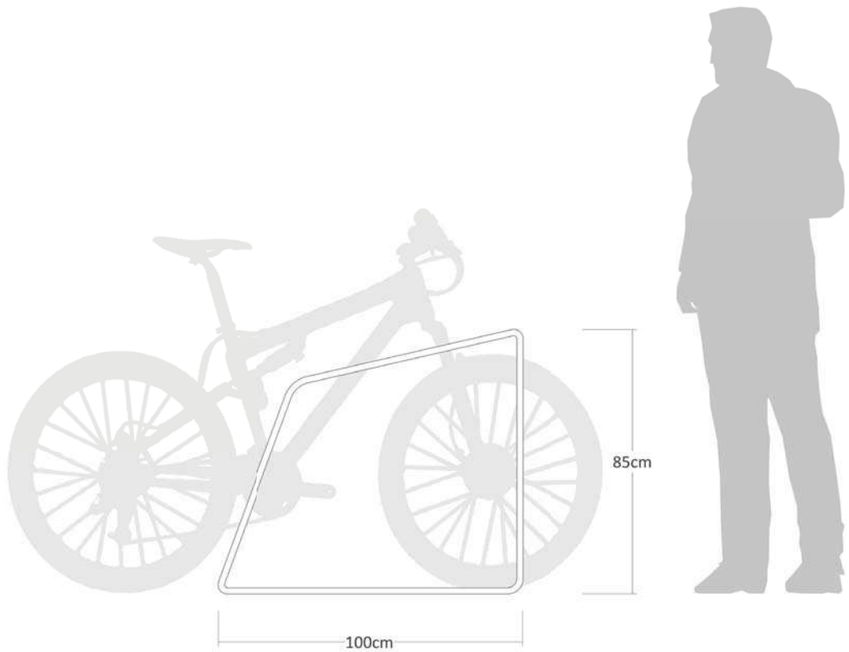


Figure 3.51 Cycle stand - technical dimensions

D04 - DATASHEET - BOLLARDS

Objectives

- Bollards are used to separate pedestrian space from vehicular space. Their main aim is to discourage vehicles from entering the public realm and to provide a safer environment for the pedestrian and cyclist.
- Alternative solutions should be considered before specifying bollards, (tree planting, furniture etc), as they can be over abundant and can often create cluttered and incoherent streetscapes, often proving hazardous for people with visual or mobility impairments.

Design Aesthetics

- Minimum dimension height of 1000mm and located at 1400mm intervals to prevent vehicular access across footways and at 3000mm centres to prevent vehicles parallel mounting the edge of the footway; 500mm back from kerb face.
- The design of the bollards shall be coordinated with the proposed street furniture palette and be part of the design family 'DNA'. Colours and finishes shall be uniform and robust in their durability. It is proposed to incorporate within the bollard design a panel which can express information such as the specific metro line colour or number, tying in with the overall metro branding strategy.
- The bollards shall incorporate ground root anchor bases to ensure their sturdiness. Where there is a regular and high chance of vehicular damage, a system which enables easy replacement, (without having to excavate the surface material), should be considered.

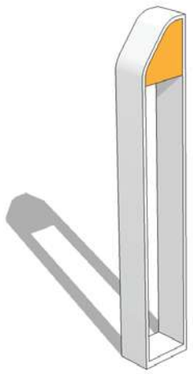


Figure 3.52 Bollard with integrated wayfinding & coloured METRO line branding

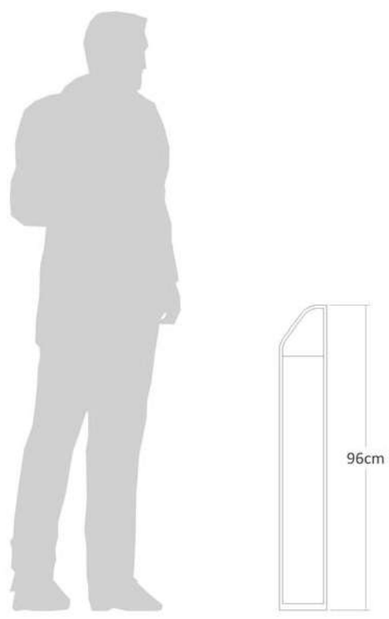


Figure 3.53 Bollard - technical dimensions

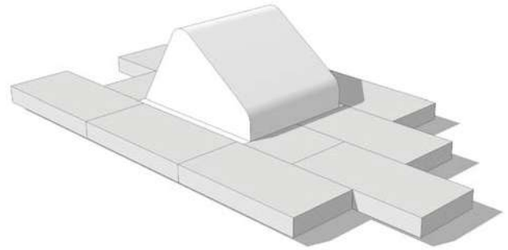


Figure 3.54 Vehicular bollard

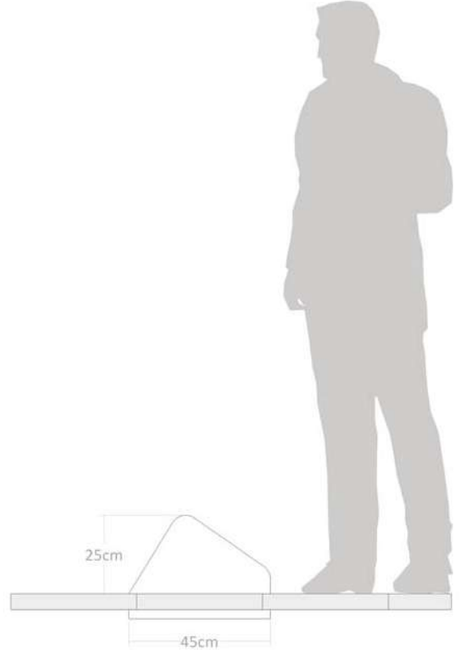


Figure 3.55 Vehicular bollard - technical dimensions

D05 - DATASHEET - TREE SURROUNDS

Objectives

- The footway surface to the base of the tree should be visually coherent with the surrounding materials and should not present any form of trip hazard or hamper pedestrian flow.
- In high density pedestrian areas, infilled recessed tree grilles shall be used to maximise the pedestrian realm and maintain the pedestrian flow.
- Cast iron tree grilles are not recommended for use as they often become difficult to maintain and frequently look untidy after a few years.

Design Aesthetics

- All tree surround metal components shall be hot dipped galvanised. All Infill trays shall incorporate drainage holes to assist irrigation.
- All trees shall within hard paved areas to incorporate two aeration tubes.
- The contractor shall ensure that there is adequate space around the bole of the tree to allow growth and that supporting tree grille frames are able to be removed without damaging the tree.
- The minimum size of a tree pit within a hard paved area shall be 2 x 2 x 2 metres

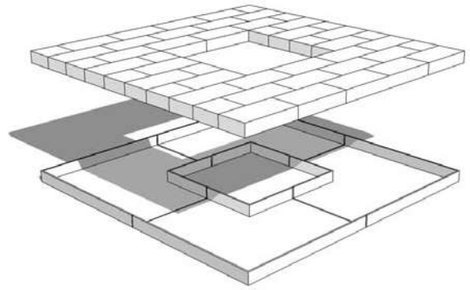


Figure 3.56 Recessed metal tree grille with paving infill. Size: 2 x 2 metres with 80cm aperture for tree bole

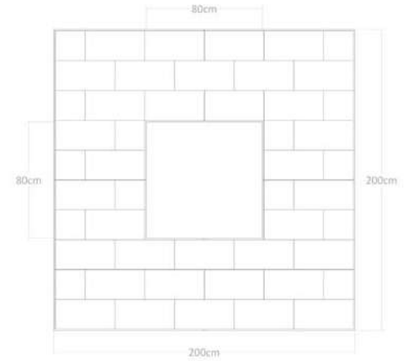


Figure 3.57 Recessed metal tree grille with paving infill - plan view

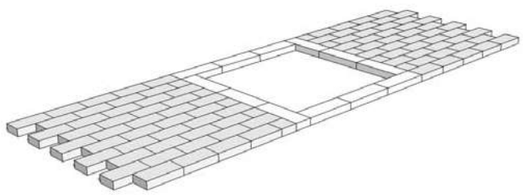


Figure 3.58 Paving band tree surround with gravel infill. Size: 1.6 x 1.6 metres

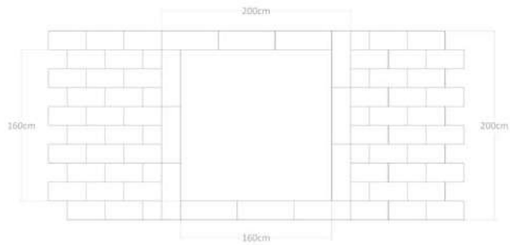


Figure 3.59 Paving band tree surround with gravel infill - plan view

D06 - DATASHEET - TREE PROTECTION BOLLARDS

Objectives

- Where parallel vehicular parking is proposed, inbetween tree planting, the immediate adjacent tree pits shall incorporate two tree protection bollards to protect the tree from inadvertent vehicular damage. These will be arranged parallel to the kerbline, one either side of the tree, as indicated in the accompanying illustrative material.

Design Aesthetics

- All metal components shall be hot dipped galvanised and polyester powder coated, colour to agreed palette.
- The bollards shall be integrated with the paving to suit the proposed bond.

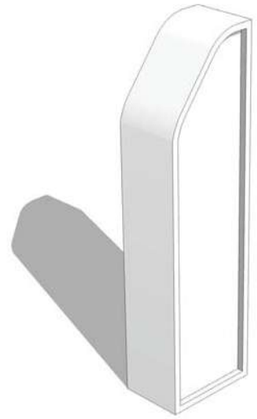


Figure 3.60 Tree protection bollard

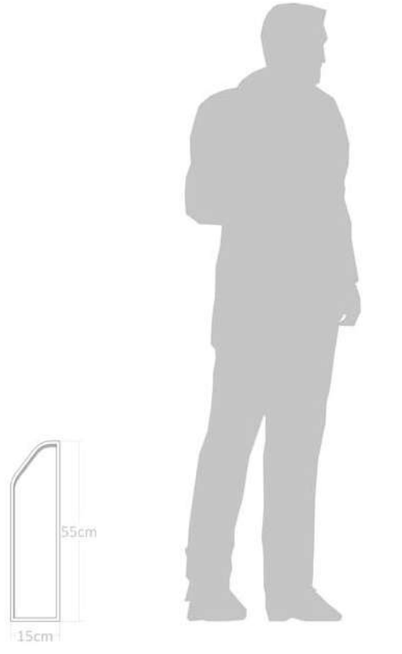


Figure 3.61 Tree protection bollard - technical dimensions

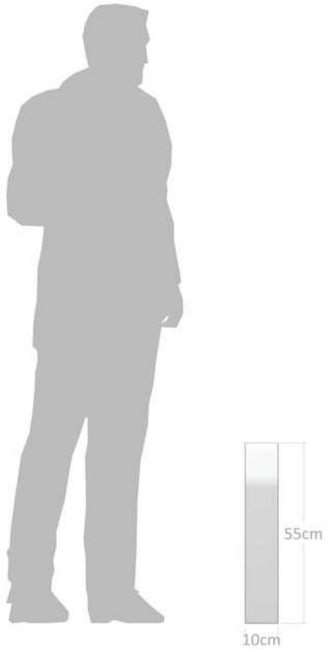


Figure 3.62 Tree protection bollards - 2 per tree pit

D07 - DATASHEET - RAISED PLANTER

Objectives

- Raised planters can provide a form of vertical separation between the pedestrian footway and the furniture zone creating a form of enclosure. In addition, they can provide multi functional uses such as informal seating and above ground tree planting areas, where below ground tree pits are not possible.
- Modular and flexible, can be adapted to suit various spaces and functions, informal screening, shading and seating.

Design Aesthetics

- Modular units proposed with standard elements to keep production costs down.
- Corner unit, seat bench and standard unit comprise the modular system.
- Profile form to fit with street furniture 'DNA' design geometry, chamfered edges to prevent chipping.
- Various finishes to suit location and local 'identity' - natural stone or reconstituted stone with sandblasted finish. In-situ concrete finish shall not be accepted.

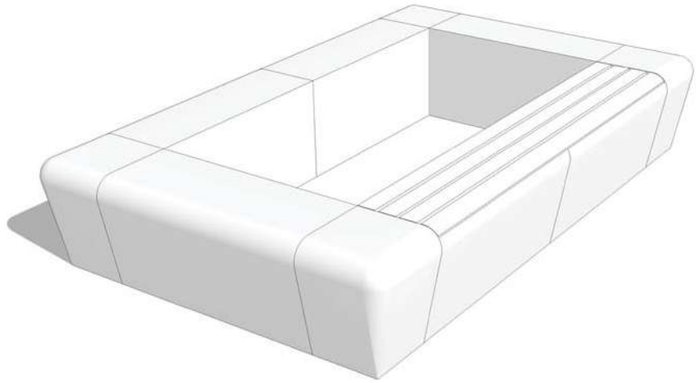


Figure 3.63 Raised planter

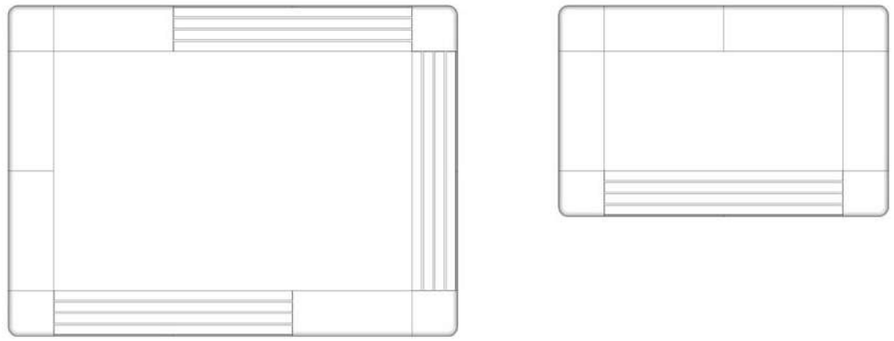


Figure 3.64 Raised planter - plan view

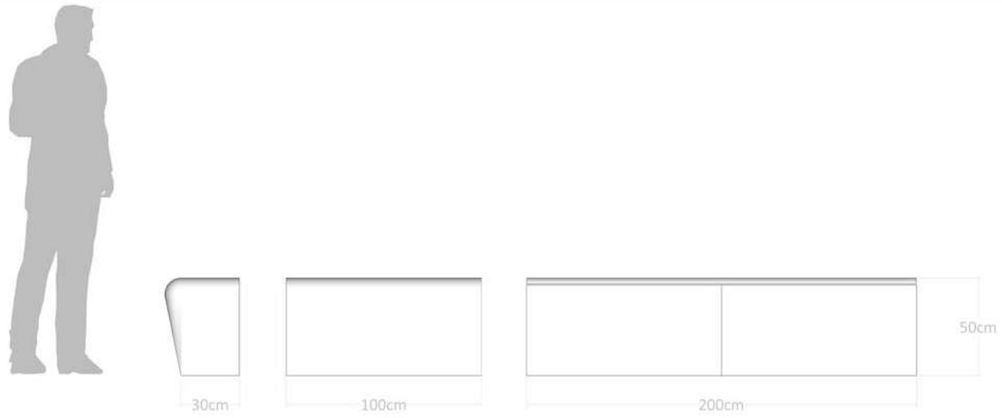


Figure 3.65 Raised planter - modular system with integrated seating

D08 - DATASHEET - DRINKING FOUNTAIN

Drinking Fountain

Objectives

- Drinking fountains should be located close or next to transportation nodes or close to where people congregate or wait.
- They shall be coordinated with other furniture items within the public realm ensuring they are unobtrusive and do not present an obstacle to the pedestrian flow.
- Ensure that sufficient room is left around the fountain to allow maintenance access and that the surrounding paving falls away to avoid water congregating to the base of the unit.

Design Aesthetics

- The design of the drinking fountain shall be coordinated with the proposed street furniture palette and be part of the design family 'DNA'. Colours and finishes shall be uniform and robust in their durability. The furniture palette will share a common inherent design but certain seating elements shall reflect the local character or special place of interest. It is proposed to express this in the quality of the materials and finishes, establishing a distinct but coherent hierarchy.
- If graphics are considered, these should be part of a coordinated design and discreet in their appearance.

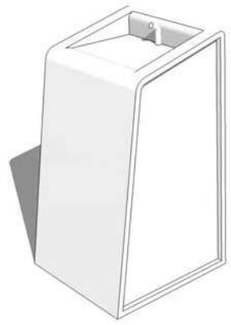


Figure 3.66 Drinking fountain

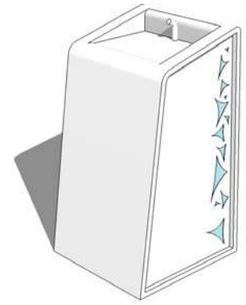


Figure 3.67 Drinking fountain with graphic branding

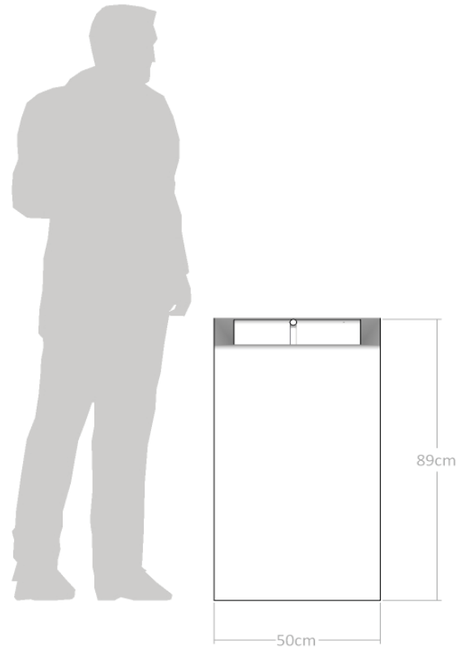


Figure 3.68 Drinking fountain - technical dimensions

D09 - DATASHEET - LIGHTING

Objectives

A number of underlying lighting objectives and requirements have been considered during the preparation of this design guidance manual, these are:

- To help provide security and increased safety to both pedestrians and road users alike.
- To enhance the public realm and provide a legible and coherent environment during the hours of darkness.
- To support the existing infrastructure and the proposed transportation strategy in providing an enhanced experience for the users of public transport.

Design Principles

- A member of the design team should include a lighting engineer or designer who can calculate and specify the accurate Lux level requirements/ appropriate lighting design class.
- All lighting components must be manufactured in accordance with the national guidance and standards set within the kingdom of Saudi Arabia. Where no relevant standards are stipulated the following minimum standards shall apply:
- British Standards EN 13201 and BS 5489-1
- ANSI - American National Standards Institute
- DIN - Deutsches Institut für Normung
- Energy efficient lighting elements shall be utilized to help reduce operating costs and meet forecast energy reduction comittments. Explore alternative technologies such as PV units for lighting signage and LED light sources.
- To help inform the lighting design strategy and evaluate and consider the relevant processes, such as crime risk perception, special area requirements, night time activities and adjacent land and current highway uses.
- Minimise the visual intrusion of lighting columns within the public realm by specifying luminaries that allow increased column spacing, (reducing street clutter), and the amount of light pollution during night time.
- The selection of aesthetically attractive lighting units which respect the existing environment and are part of the proposed coordinated furniture design ‘DNA’ intended for the METRO enhancements. Strategic locations, (stations), to incorporate coloured ‘identity’ beacons to help create a sense of place.

Design Aesthetics

- The visual style of lighting components should be of a contemporary style with both luminaries and columns being coordinated and part of a common design palette. Additional references to suggested styles and designs can be found in the supporting illustrative material.
- It is envisaged that a modular system is developed which utilises standard components such as columns with a flexible and partial bespoke configuration of lamp heads and brackets, which can be adapted to suit different location scenarios.
- All external components, (with the exception of the glass element), shall be colour coordinated with uniform finishes. This shall include additional brackets and fixtures, where specified.
- Vulnerable wall mounted units shall be specified with vandal resistant glass and fittings. Lighting to foot bridges and above ground metro lines shall be integrated within the structure and indirect where possible.
- Additional brackets, where specified, shall be coordinated with the column and appear to be as part of the design aesthetic, both in terms of proportion and design.
- Fillets to support brackets will not be accepted.
- All access doors to columns shall be flush fitting.

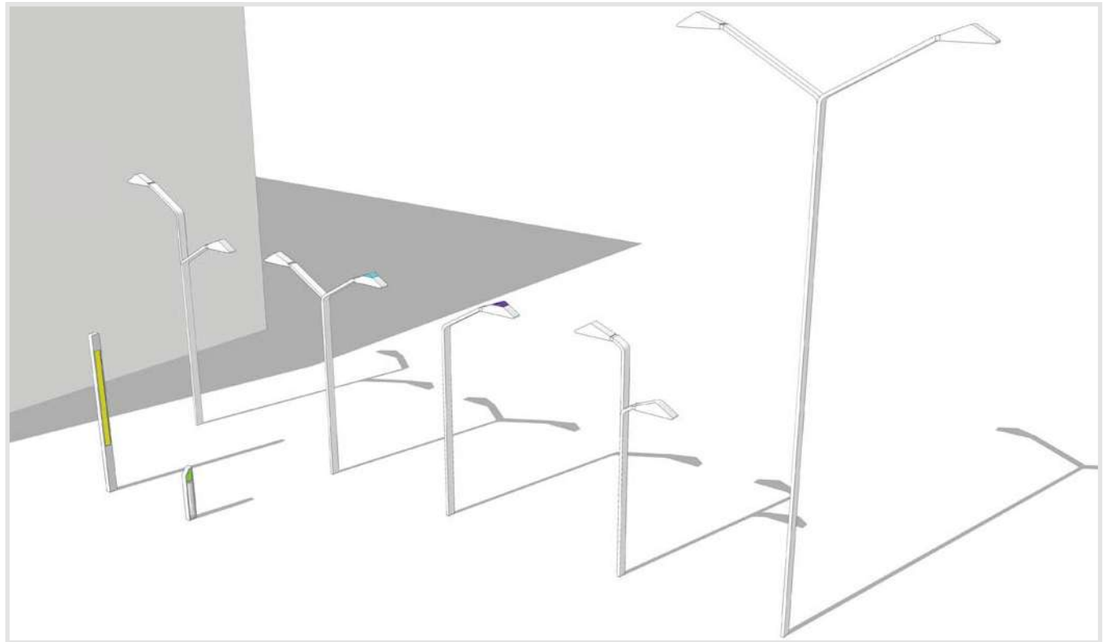
Column Location

- The positioning of lighting columns shall take into consideration the needs of the pedestrian/ cyclist in addition to the requirements of the adjacent highway. It may be appropriate to provide a double headed, (staggered or opposite) unit to a single column to meet the required lighting requirements rather than two individual columns.
- Where columns are to be located at crossings or junctions, consideration should be given to mounting signals and controls on to the columns, thus reducing street clutter and providing increased luminance at crossings.
- If possible street furniture should be integrated with lighting columns to help reduce the over abundance of vertical structures within the public realm. Items to consider could include: signage/ way-finding, traffic signals, litter bins and banners.

Wall Mounted Units & Feeder Pillars

- If appropriate to the location and building structure, wall mounted units should be considered but not mixed with columns in the same locale. Wall fixtures shall be part of the design ‘DNA’ with coordinated designs, finishes and colours.
- Feeder pillars should be located to avoid pedestrian footways, cycle routes and visibility sight lines. The finish should match the finish of the lighting columns.

D09 DATASHEET 2 - LIGHTING



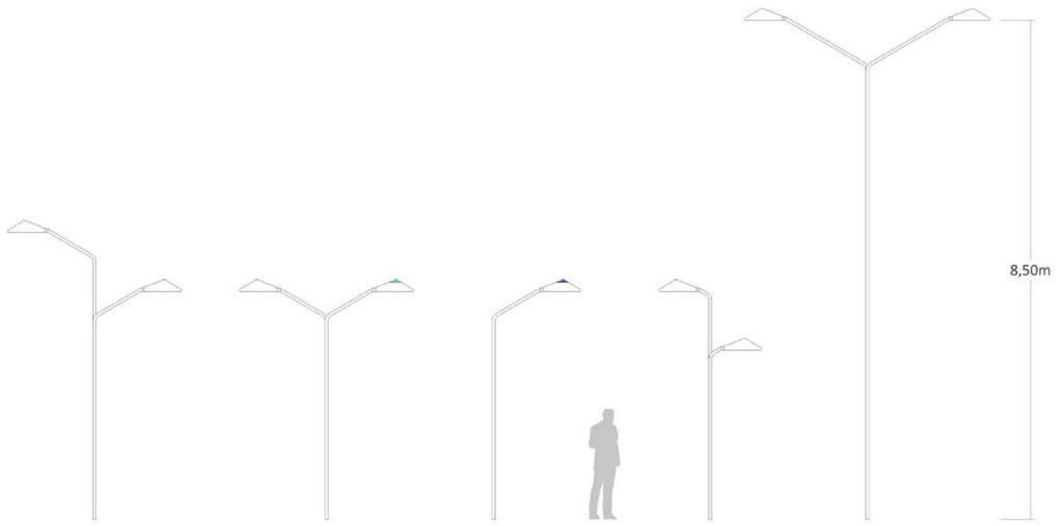


Figure 3.75 Lighting - technical dimensions

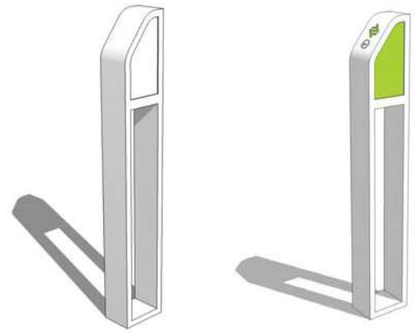


Figure 3.69 Lighting bollard - variant with branding/ colour

Figure 3.71 Lighting bollard - technical dimensions

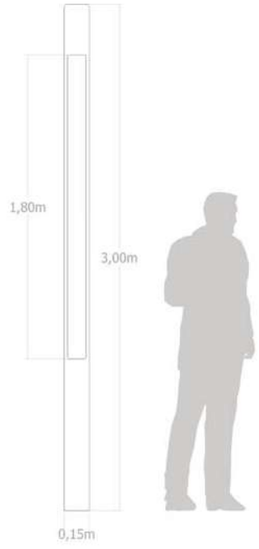


Figure 3.70 Lighting pole - technical dimensions

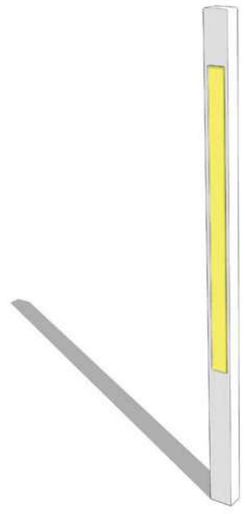


Figure 3.73 Lighting pole

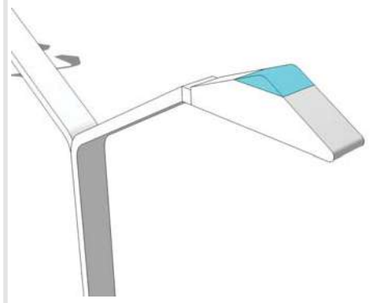


Figure 3.72 Lighting head with coloured beacon

D10 DATASHEET - SIGNAGE, WAY-FINDING & INFORMATION

Objectives

- The needs of all users will need to be considered when designing or specifying information boards and way-finding. It is important to address the needs of people with hearing or visual impairments, with audio or tactile, (Braille), facilities being significant.
- Signs and wayfinding should only be used when there is a strong requirement for their use. The 'Less is More' approach should be utilised as too many signs or information boards can result in a cluttered street environment.
- Both info boards and wayfinding should be located within the furnishing zone, where they do not create any obstruction, physically or visually within the public realm. Info boards should be positioned to the rear of the pedestrian footway, on frontages or where they can be clearly seen but not create an obstruction to the pedestrian thoroughfare. Wayfinding can also be coordinated with lighting columns or other furniture items to minimise the over use of columns and visual intrusion. Typical locations include within the vicinity of stations, bus stops and junctions or where there is likely to be the requirement for information. e.g. near popular attractions and mosques.
- Consideration should be given to locating info boards and wayfinding to restricted locations such as transport interchanges, public toilets and public buildings or where there are large numbers of people or where people begin their journeys.

Design Aesthetics

- The design of the boards and wayfinding shall be coordinated with the proposed street furniture palette and be part of the design family 'DNA'. Colours and finishes shall be uniform, robust in their durability and vandal resistant, where appropriate.
- METRO corporate design requirements need to be followed.
- Info boards should be evenly lit with uniform lighting of between 100 and 300 lux. Alternatively reflective surface finishes can be used. These are often preferred as they do not require additional energy or as frequent maintenance.
- In addition to general information, information boards should convey local facilities within the area and distances.
- Where appropriate, commercial signages to shop frontages are to be replicated on illuminated banners along the carriageway kerb line. These shall form part of the coordinated lighting and furniture strategies.

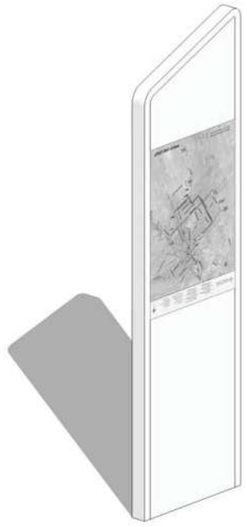


Figure 3.76 Information board with integrated wayfinding

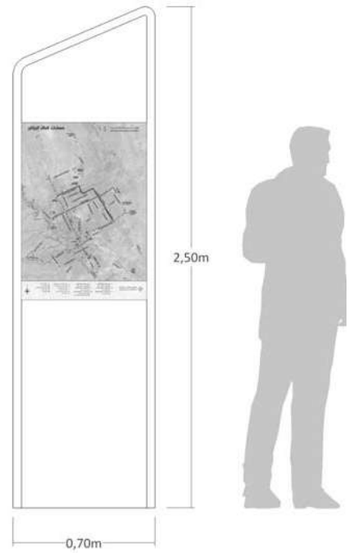


Figure 3.77 Information board - technical dimensions

Figure 3.78 Finger post for wayfinding

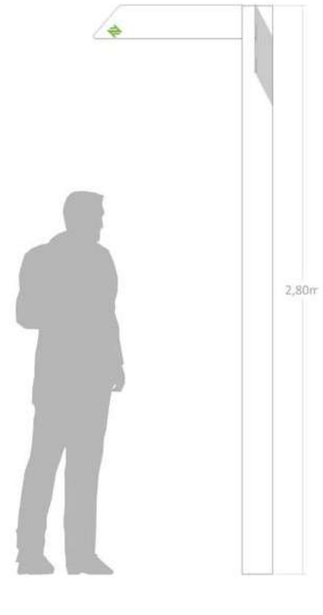


Figure 3.79 Finger post - technical dimensions

D11 DATASHEET 2 - BANNERS & ADVERTISING

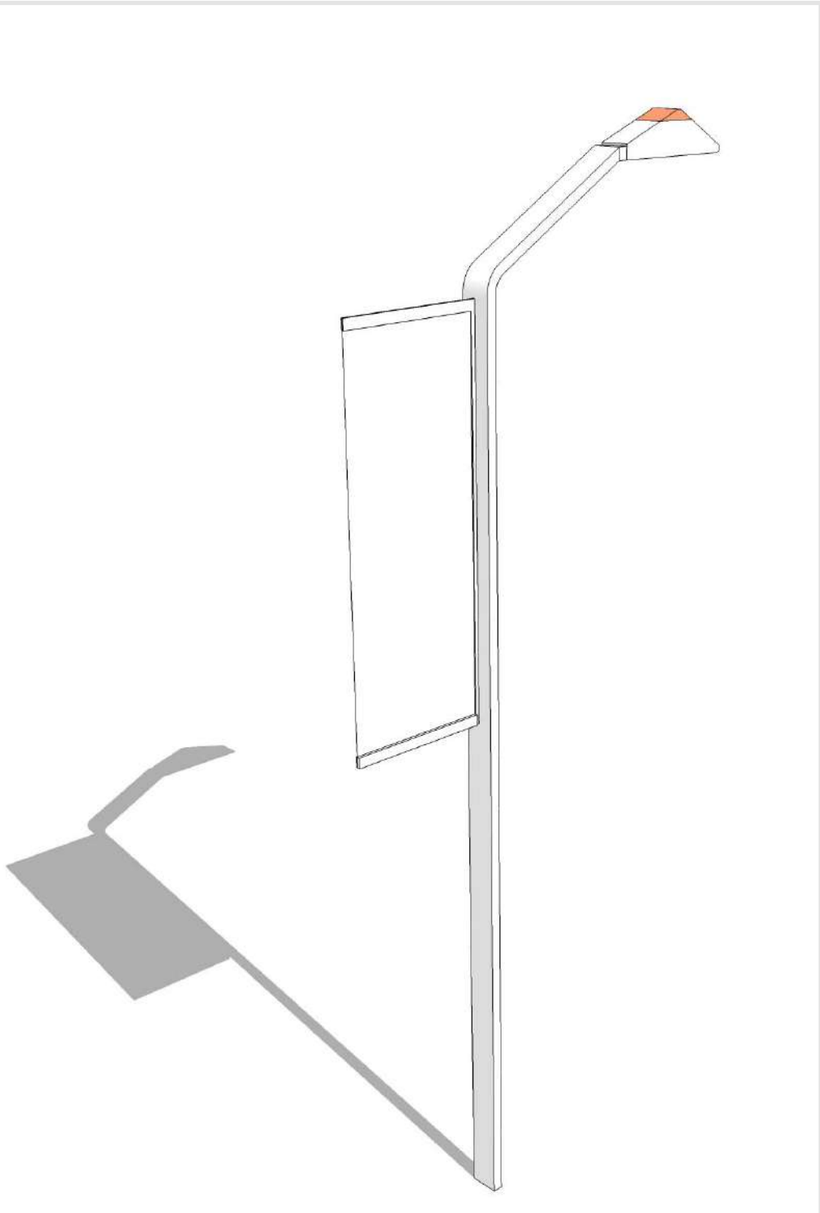


Figure 3.80 Banners & advertising

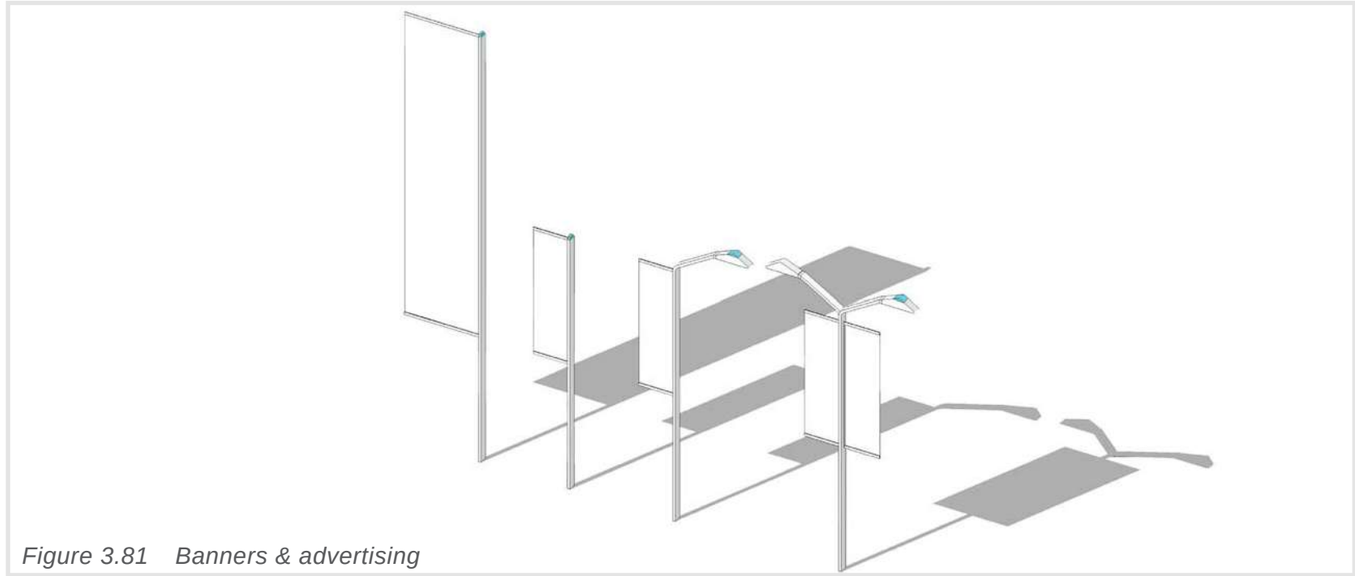


Figure 3.81 Banners & advertising

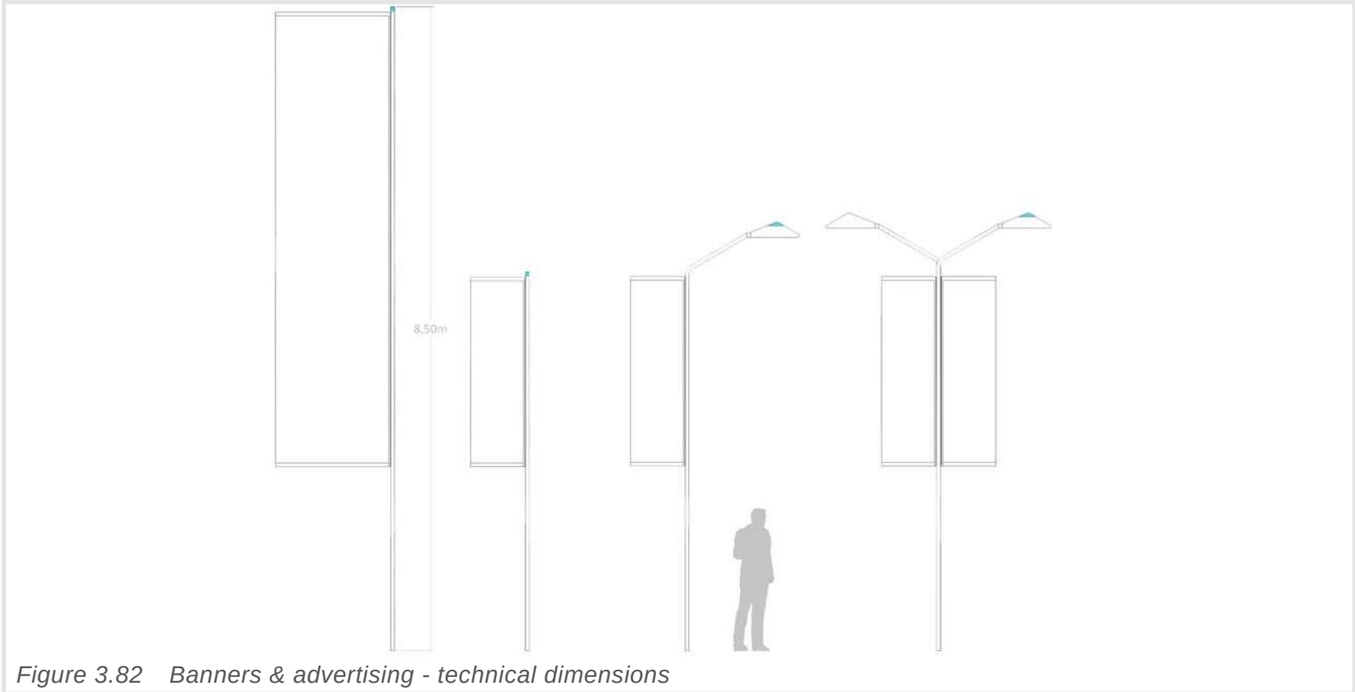


Figure 3.82 Banners & advertising - technical dimensions

D12 DATASHEET - MODULAR SHADING STRUCTURE

Objectives

- A simple yet innovative solution to provide a cost effective structure which adapts to a variety of situations through a modular concept.
- Basic module can stand alone or expand to suit desired space requirements.
- Continuous and consistent design element which is located, (where suitable space permits), within the furniture zone or within the wider public realm.
- Multi functional, providing a shading structure with additional options for a kiosk, café, WC, seating, drinking fountain, signage and interpretation boards.
- Adaptable for enclosures, such as refuse containers, sub-stations & condenser units, (METRO Stations), etc.

Design Aesthetics

- Basic modular structure size 2.5 x 2.5 x 2.85h metres with an optional half width variation of 1.25 x 2.5 x 2.85h metres.
- Fits within the proposed surface grid and hierarchy format.
- The design of the modular system shall be coordinated with the proposed street furniture palette and be part of the design family 'DNA'. Colours and finishes shall be uniform, robust in their durability and consistent.
- Roof design integrates design language of station roofs for coherent theme.

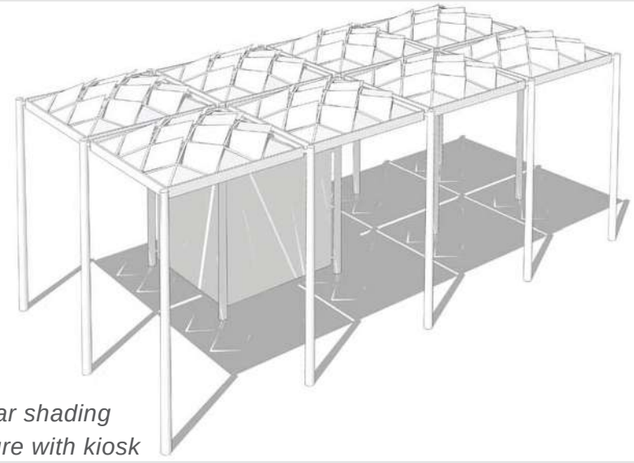


Figure 3.83 Modular shading structure with kiosk

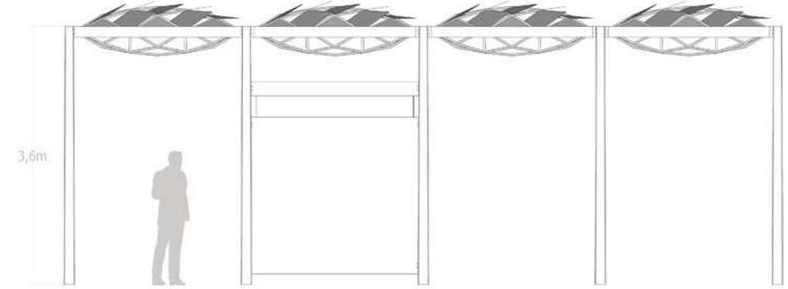


Figure 3.84 Modular shading structure with kiosk - side elevation showing unit elements

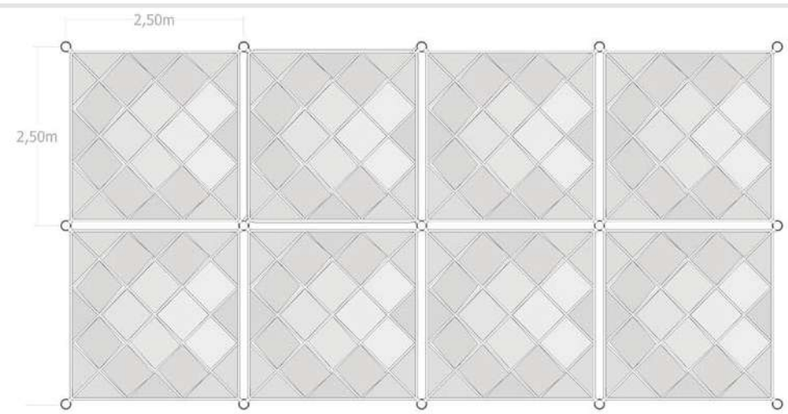


Figure 3.85 Modular shading structure with kiosk - plan view

D13 DATASHEET - CANOPY SHADING STRUCTURE

Objectives

- A freestanding bespoke shading structure which is located within the street tree planting grid and complements the linear tree arrangement.
- To be used as an alternative to a street tree where the existing space is too restrictive for tree planting or underground obstructions exist.
- Helps maintain a continuous avenue of vertical elements within the public realm and avoids visual gaps within the proposed street tree avenue planting.

Design Aesthetics

- Structure size 5.50 x 4m x 4m with perforated surfaces for dappled light.
- Fits within the proposed surface grid and furniture zone arrangement.
- The design of the canopy element shall be coordinated with the proposed street furniture palette and be part of the design family 'DNA'. Colours and finishes shall be uniform, robust in their durability and consistent.
- Canopy leaf elements integrate organic design language of station roofs for coherent theme.

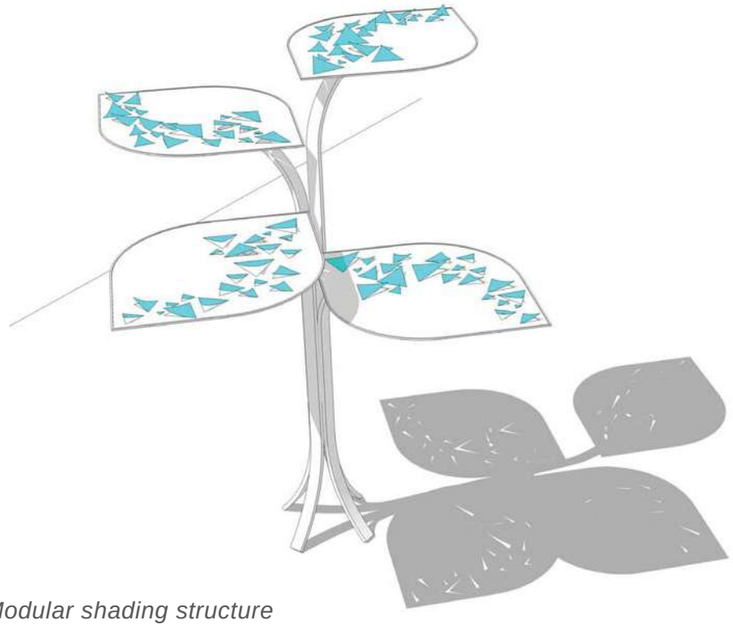


Figure 3.86 Modular shading structure

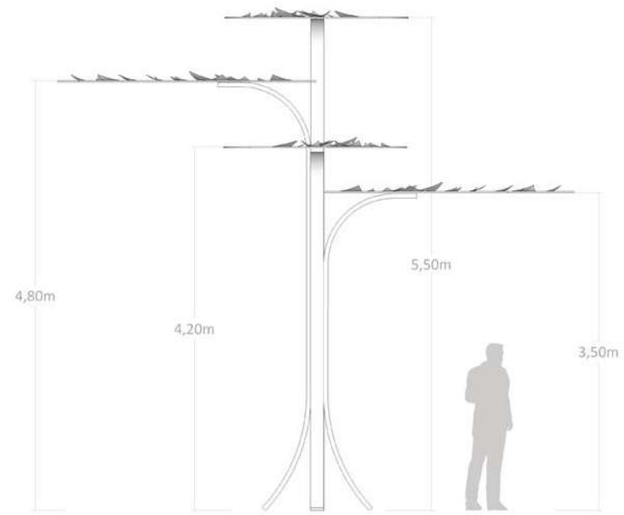
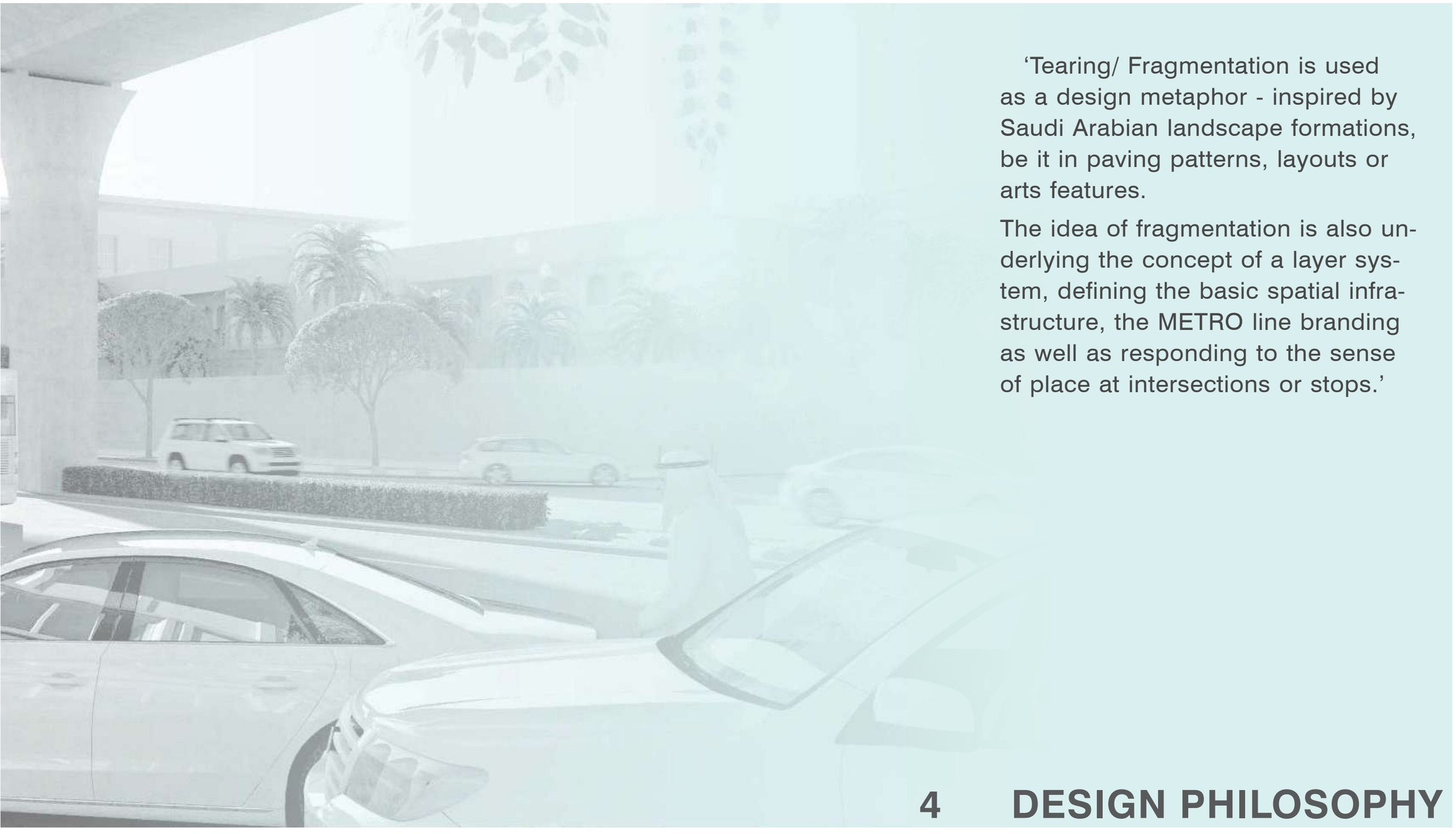


Figure 3.87 Modular shading structure - technical dimensions

Figure 3.88 Modular shading structure - plan view



‘Tearing/ Fragmentation is used as a design metaphor - inspired by Saudi Arabian landscape formations, be it in paving patterns, layouts or arts features.

The idea of fragmentation is also underlying the concept of a layer system, defining the basic spatial infrastructure, the METRO line branding as well as responding to the sense of place at intersections or stops.’

4 DESIGN PHILOSOPHY

4.6.1 Design Concept & Approach

Its physical forms define Saudi Arabia, and it is from these forms and their interaction that the manual's design concept takes its inspiration: The meaningful juxtaposition between the vast deserts and the natural rock escarpments, between the meandering dry riverbeds and their coexistence with the built environment and their abstract fragmented patterns within the city of Riyadh. This interplay between surfaces and how they merge, fragment and tear (and sometimes even threaten) one another is the basis for the contextual layer (Layer 3). This fragmentation will be expressed through form, colour and texture via the manual's various design palettes.

The designers shall use this design metaphor to convey a sense of place or local identity, unique to its setting.

Figure 4.1 Natural landscape formations - Wadi

Figure 4.2 Interplay between rock and sand

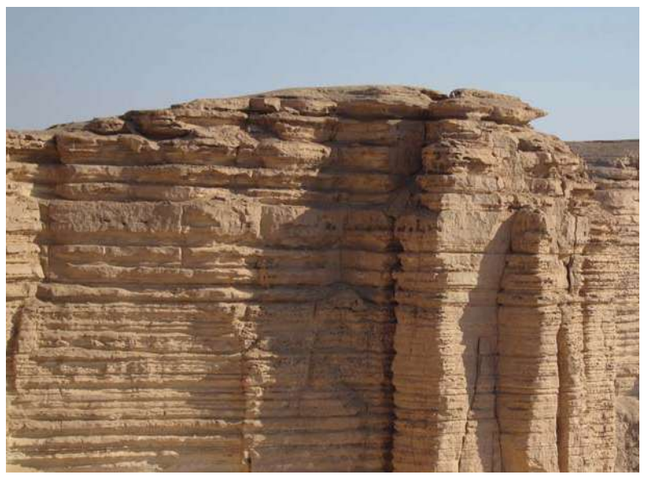


Figure 4.4 Rock layers

Figure 4.5 Fragmented surface design

Figure 4.3 Fragmented surface design

4.6.2 Design Strategy

The UDM manual sets about developing a design strategy to suit the task of implementing a design, which addresses a varied, and yet sometimes challenging, (vehicle orientated) urban environment. In addition to meeting the aspirations of a 21st century urban transit system, the design strategy and resultant environment will have to be robust enough to be implemented over the entire 90-kilometre length of three METRO lines, without appearing too homogeneous or bland.

The following graphic represents the proposed design 'layer' strategy, which this manual wishes to adopt as the basis of the intended streetscape design. This strategy helps to build a coherent and logical sequence of landscape elements that structure the external environment whilst providing flexibility for design language, expression, branding and identity.

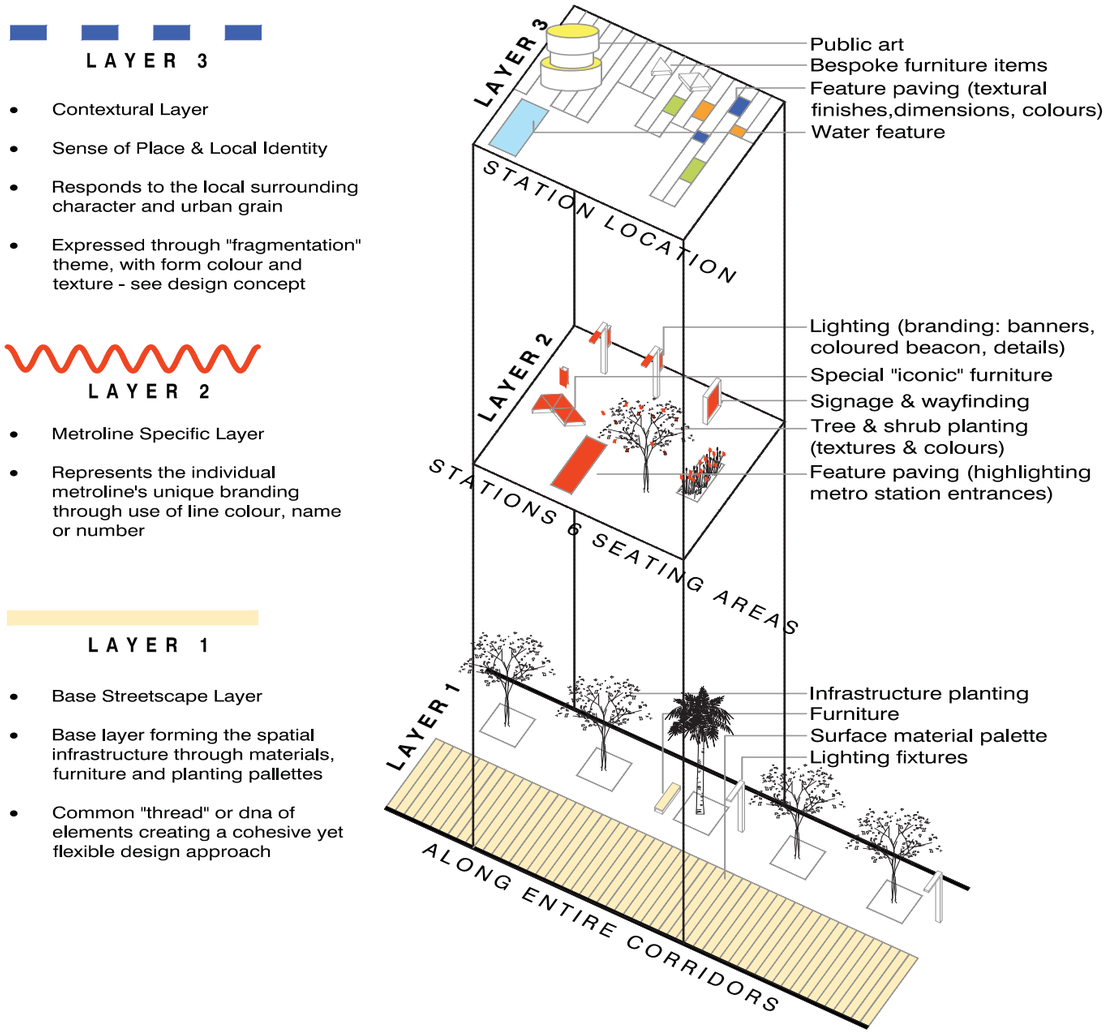


Figure 4.6 Diagram illustrating public realm design strategy and layer system/ hierarchy

Layer Philosophy

A simple three-layer system aims to categorise the public realm by layering the following fundamental elements:

- Landscape base elements - hardscape & softscape.
- METRO line route branding - Line colour or number.
- Local identity or urban character.

Collectively these layers will provide the opportunity to create a sequence of exciting and inspiring urban spaces and corridors whilst reinforcing the local character and modern tranisit system.

It is important however, that such an historic project as the METRO maintains a common thread, or robust 'design 'DNA'' design, avoiding a mere collection of un-related, fancy or fashionable designs. This long-term design framework will also prove more efficient and cost effective during construction and beyond (maintenance, replacements etc).

Layer 1

Base Streetscape Layer

This is the practical or fundamental base layer that forms the spatial infrastructure and design ('DNA' elements), a common thread, which runs through the entire METRO line public realm, forming the backbone of the design. Nevertheless, this layer is reflecting the urban street type. There will be an increase of quality and variety in materials and finishes with reaching a higher street type category.

It comprises the following:

- Surface Hierarchy - frontage, walkway, furniture, kerb zones - (Toolbox element).
- Surface Material Palette - sizes, colours, texture - (Toolbox element).
- Planting - colours, forms, texture - (Toolbox element).
- Furniture - (Design Datasheets and Design family).

Figure 4.7 Surface hierarchy and materials Moderna Museet, plaza

Figure 4.8 Planting Public space

Figure 4.9 Bespoke Seating

Layer 2

METRO-line/ Route Specific

Layer two represents, once again, a practical layer, one which responds to a specific METRO lines individual identity (colour, graphic, number or branding etc.). This could be subtly expressed through variations within the proposed paving and furniture palette, signage or lighting. A repeating graphic theme or colour could be part of the furniture design family or lighting (see data sheets), and could follow the entire METRO line or be expressed at station approaches only.

Suggested Themes

- Colour or design coding to various furniture elements – bollards, litter bins, signage & seating etc.
- Enhanced lighting columns with coloured beacons to highlight transportation node recognition.

Figure 4.10 Tree blossoms

Figure 4.11 Illuminated furniture

Figure 4.12 Lighting elements

Figure 4.13 Illuminated paving elements

Figure 4.14 Coloured street furniture

Layer 3

Contextual Layer – ‘Sense of Place’ & Local ‘Identity’

The criteria for using this layer is simply as a way to express a local character or heritage and create a ‘sense of place’. This manual suggests this is expressed within the immediate vicinity of the proposed metro stations.

This layer represents a philosophical and creative layer, one which aspires to the underlying design concept of ‘tearing’ or ‘fragmentation’ (see design concept). It is represented within the physical surface, revealing a contextual layer which responds to the cultural, historical and physical elements within the local urban fabric – helping to form an ‘identity’ or ‘sense of place’. The design manual proposes that this layer is articulated within the vicinity of the proposed METRO stations and places of special or particular interest (see design example within manual).

The designers can use their imagination by using the proposed material palettes and data sheets as a ‘ingredients’ list, to express a ‘visual clue’ or uniqueness to the location through materials, finishes, lighting, furniture and planting.

Suggested design expression elements

- Feature Paving - textural finishes – dimensions – colours.
- Public Art – literal or symbolic – permanent or transient.
- Proposed Furniture – unique bespoke items or patterns/ designs.

Figure 4.15 Paving ornaments

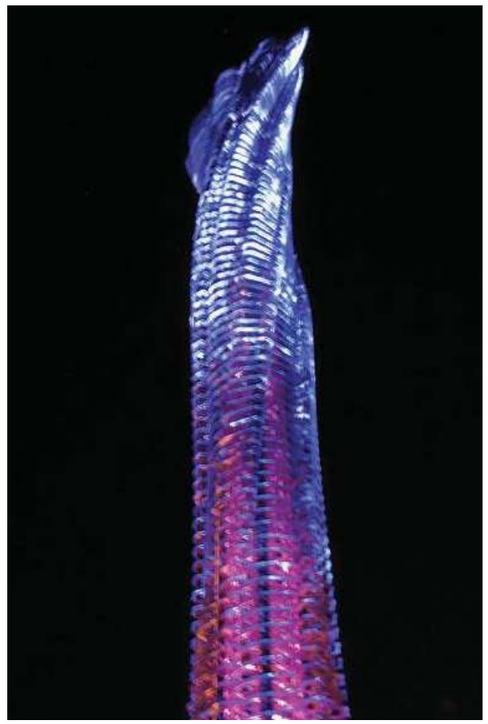


Figure 4.16 Art feature

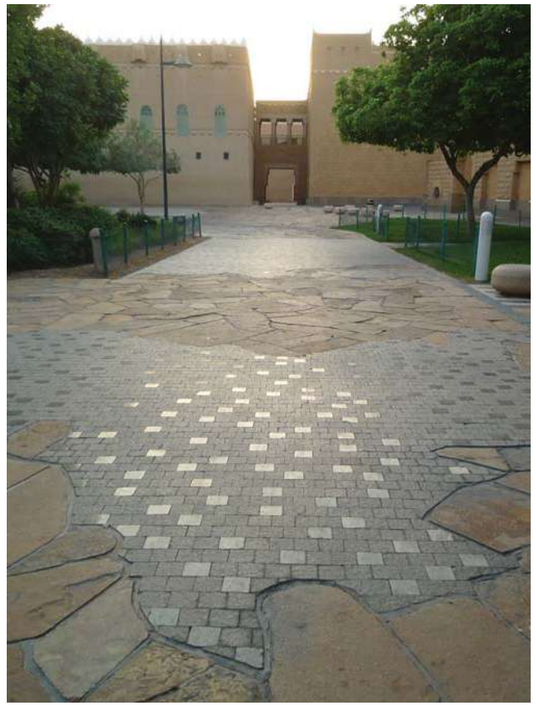


Figure 4.17 Paving patterns

Figure 4.18 Feature paving

Corridor verus METRO station design

In its simplist variation, the design strategy can be described as having two approaches to the design of the public realm.

- A formal and linear response to the public realm corridors - Layers 1 & 2
- An informal or ‘fragmented’ arrangement to the station vicinity and approaches - Layers 1,2 & 3

This juxtaposition of styles is one which reflects the design philosophy and helps provide the design opportunity to express a local ‘flavour’ or character, thus helping to create a dynamic and vibrant environment.

Layer 3 will essentially be the portal for the designer to express a ‘sense of place’ and this shall be applied within the vicinity of METRO stations.

Figure 4.19 Formal and linear response to public realm corridors

Figure 4.20 Informal ‘fragmented’ landscape applied to station areas and approaches

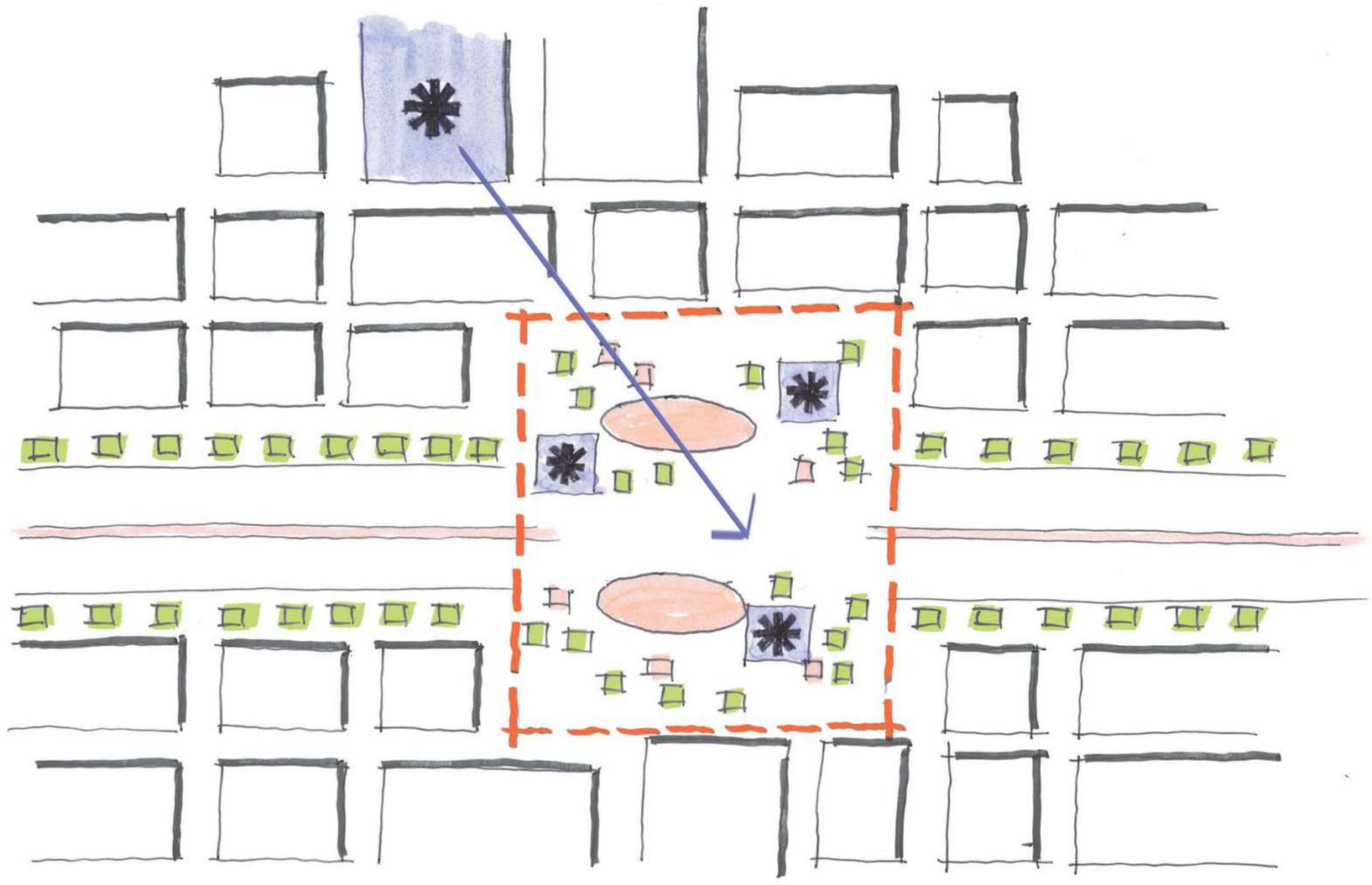


Figure 4.21 Sketch illustrating the principle of how the design flows from a linear (formal) response to that of an irregular (informal or fragmented) arrangement (red box).The arrow indicates how the local character or context can be referenced through the design and brought into the station vicinity and expressed through the elements described in layer 3.

‘In order to achieve a desirable level of cohesive and unifying design elements within the public realm (creating a common ‘DNA’ thread) and to respond to the contemporary design aspirations of the client, specific design guidelines have been formulated under the topics of transportation, surface materials, lighting and street furniture.

A number of tangible and non-tangible design issues are addressed, that supplement and support the designer in finding a solution to any given corridor section, avoiding a ‘one size fits all’ approach.’

5 DESIGN GUIDANCE & STANDARDS

5.1 Traffic and Transport

5.1.1 Introduction

Currently applied road standards often do not allow for sufficiently dimensioned walkways/ public realm within the available road space. To enable designers to develop a suitable public realm along the corridor it is essential to put limitations on lane widths and define a requirement for the review of number of lanes provided.

This section will define a standard approach for determining the required dimensions for vehicular traffic, to help maximise provision for pedestrians, cyclist and frontage activity.

It gives guidance on typical junction layouts that will provide a maximum of pedestrian safety and comfort (i.e. pedestrian green at signals) considering conditions and driver behaviour in Riyadh.

Further, it will also provide guidance on how to provide safe and comfortable facilities for pedestrians and cyclist, helping to encourage walking and cycling in Riyadh. One key aspect to provide connectivity from, to and between METRO stations and bus stops. Safe crossing facilities, provide connectivity between both edges of the road and connect neighbouring blocks.

The solutions described in this section aim to improve accessibility and road safety and help reduce speeding.

The majority of the roads along the analysed METRO corridors are typical urban arterial roads, catering for a multitude of functions. The expected increase in pedestrian activity will also demand a sensible reduction of the prescribed speed limit. As worldwide standard for urban roads, it is recommended to set and enforce a speed limit of 50 km/h along the METRO corridor (except expressways, or other roads with additional service roads).

Some sections catering for high pedestrian volumes and little importance for through traffic may require a further reduced speed limit of 30 km/h to emphasize the pedestrian focus. This could be supported by the use of raised-tables at pedestrian crossings.

In addition to the guidance provided in this manual, further studies will be required to successfully change mode choice and transform transport in Riyadh. A comprehensive parking strategy will be essential, allowing to limit duration and type of parking, and introducing effective enforcement. Particularly near METRO stations and in central areas parking control will prove useful.

Further, it is recommended to critically review signalling practice in Riyadh, with a focus on pedestrian improvements (see discussion regarding typical junction layouts).

Figure 5.1 Overprovision of traffic space (Khadijah bint Khuwailid)

Figure 5.2 Lack of sufficient pedestrian provision (Khadijah bint Khuwailid)

5.1.2 Traffic Lanes and Dimensions

To gain necessary space for the incorporation of METRO stations, bus stops, walkways, trees and shading it is essential to minimise space distributed to car-oriented uses. The reduced carriageway width will also change the visual perception of the road and help to reduce vehicle speeds, hence improve safety of pedestrians and car users.

There are two basic adjustment parameters:

- the absolute number of lanes, and
- the relevant standard dimensions applied.

Number of Lanes

Most roads affected by the METRO development are urban arterial roads. Arterial roads in Riyadh typically have a minimum setup of 3+3 lanes. In keeping with the pertaining overall road hierarchy 3+3 lanes is considered as the default setup.

The number of lanes therefore shall be limited to 3+3 lanes, even if a larger Right of Way would allow for more traffic lanes.

Where a limited Right of Way does not allow for all requirements, the number of lanes shall be reduced to 2+2 lanes.

Any diversion from this rule shall be based on a traffic study and needs to balance the requirements of all road users and road activities. Any decision to provide more lanes of traffic must be agreed with authorities.

Turning lanes

Additional left- and right-turn lanes at junctions are common throughout Riyadh. However, particularly at junctions, available space is often sparse, since more functions need to be accommodated (i.e. access to METRO stations and utilities, bus stops etc.). Right-turn lanes, in particular, often compete for space with other functions. In Riyadh, typically they also lead to fast turning vehicles, or are used to jump the queue at the signals.

To minimise this conflict right-turn lanes shall not be used as a default. Use of right-turn lanes shall be based on actual traffic demand.

Left-turn lanes can be included optionally. If sufficient median width is available for including safe pedestrian crossing facilities (pedestrian refuge on median) and a left-turn lane, left-turn lanes can be included to increase capacity and reduce queuing.

(Please see also typical junction layouts)

Dimensions

The following standard dimensions shall be applied:

- standard lane width: 3.5m (width could be reduced to 3.3m where available space is limited).
- standard lane width on service roads: 3.3m.
- standard lane width for turning lanes: 3.0m.
- standard shy way along kerb/ median: 0.3m.
- minimum width of pedestrian refuges: 2.0m.

Consequently, medians require a minimum width of 2.0m (to accommodate sufficient pedestrian refuges). Medians accommodating left-turn lanes require a minimum of 5.0m (2.0m pedestrian refuge + 3.0m left-turn lane at junctions).

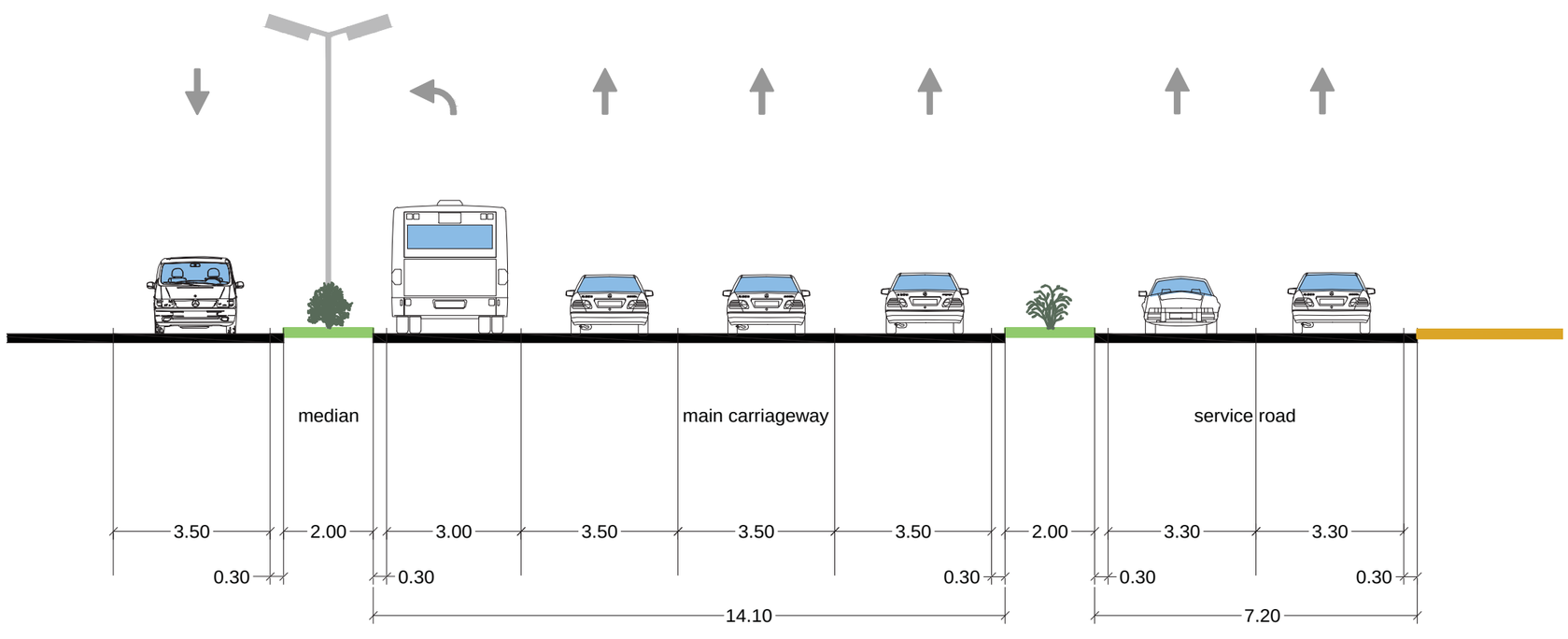


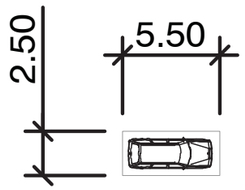
Figure 5.3 Typical dimensions

5.1.3 Parking

Providing more space for public realm will almost automatically lead to a reduction in parking provision. However, currently parking serves an important function, particularly for commercial frontage uses. To ensure sufficient parking provision can still be accommodated, parking standards have been critically reviewed and adjusted in line with recent developments in Riyadh.

In the longer term the METRO will help to reduce the demand for parking along the corridors. Commercial development will shift towards attracting the much larger number of public transport users. Hence, improving pedestrian access from/ to the stations and improving public realm along the corridor are critical for enabling businesses to participate in this development. Consequently, providing for pedestrians along the corridor is of substantially higher priority than providing for parking. Further studies are being undertaken by ADA to develop a concise parking strategy along the corridor and for Riyadh.

The standard parking bay dimensions are defined as 2.50m wide and 5.50m long (maximum 6.0m). Parking along the METRO corridor should be provided as parallel parking or 45° angled parking only (90° parking is not recommended along roads with median to avoid confusion of direction, therefore does not apply along the METRO corridors; 60° parking requires more width to enter and exit parking bays, but does not provide any additional benefit to 45° parking).



Kerb height along 45° parking bays will be limited to 10-12cm. This allows almost all vehicles to park against the kerb. Hence, additional wheelstoppers are not required, removing a potential tripping hazard and easing cleaning and maintenance. The defined kerb zone of 0.50m ensures that the kerb overhang is kept free of obstructions.

Oversizing of angled parking bays should be avoided. Buffer strips between carriageway and parking often applied in Riyadh are regularly misused as additional traffic lane, drop-off or for a second row of parking (see sample pictures). These buffers therefore, instead of reducing accident risk, add further hazards. Particularly in areas of limited availability of space, the space used for buffers is better used for improving public realm.

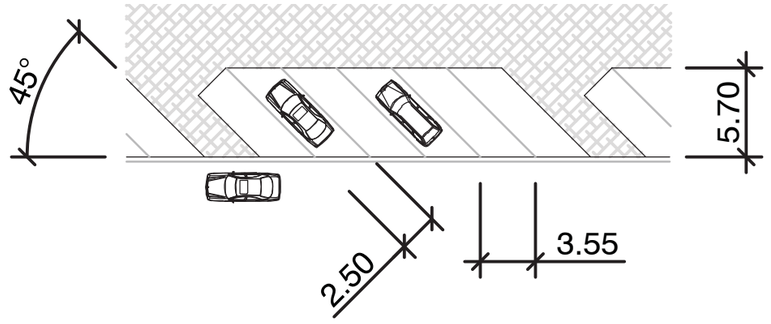


Figure 5.4 Standard dimensions 45° parking

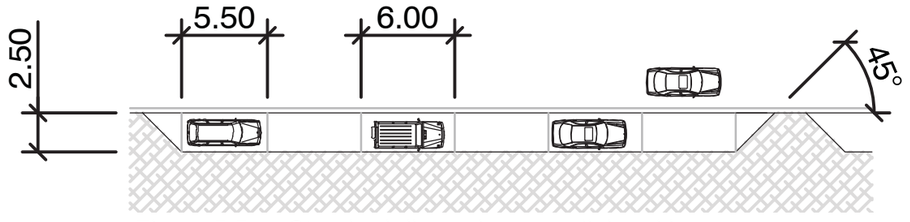


Figure 5.5 Standard dimensions parallel parking

Parallel parking strips are typically not split into separately marked parking bays, allowing for differing vehicle lengths. The length of the parking strips exceeding 18.0m can therefore be handled flexibly, they are not automatically limited to multiples of 5.50m or 6.0m.

Long sections of continuous parallel parking strips should be interrupted by buildouts, i.e. for additional landscaping. This is to ensure empty parking will not be used as additional traffic lane, or to circumnavigate queues at traffic lights.

Figure 5.6 Unsuitable use of oversized parking bays (King Abdullah Road)

Figure 5.7 Reduced walkway due to oversized parking bays (King Abdullah Road)

5.1.4 Pedestrian & Cycling Facilities

Technically, there are different ways of integrating cycle paths into the urban streetscape, all have specific advantages and disadvantages.

Often cycle paths are integrated into the carriageway, running parallel to general traffic. For cyclists this is often the fastest option, but creates several potential conflicts with turning traffic and buses and requires a certain level of road discipline of all road users (i.e. adherence to road markings).

Providing dedicated cycle paths raised to footpath level along the kerb helps segregating cars, cyclists and pedestrians, it creates however conflicts with parking vehicles, bus stops, pedestrian crossings and other road side activities. The integration of suitable facilities at junctions and crossings requires additional space, which is currently not available at many locations.

The third option would be to combine pedestrian walkway and cycle paths, which offers the most flexibility, since it can be easily accessed by pedestrians when no cyclists are present, however it may create conflicts with fast cyclists, when many pedestrians are present.

Cycling is currently a rather marginal phenomenon in the KSA and mostly related to recreational purposes. Cycling facilities are almost non-existent. It is one of the goals of the public realm improvements along the METRO corridor to promote cycling by providing suitable cycling facilities. Key focus is enabling users to use bicycles to get to the METRO stations. The most important task is therefore to provide cycle stands at the METRO stations.

Cyclists are more likely to originate from the immediate surroundings of the stations. They would be using mostly local roads, using cycle paths along the corridor itself for the 'last mile' to the station only. Hence, it is not purpose of the corridor improvements to provide continuous high capacity cycle paths along the entire corridor. But cycle paths shall be provided along the corridor where this is possible, particularly in areas with a substantial share of residential land uses.

Driver behaviour and vehicle speeds in Riyadh and the high vulnerability of cyclists currently do not permit for cycle paths on the carriageway. Future cycling demand is still difficult to estimate. Providing dedicated cycle paths may therefore result in an overprovision for cyclists and loss of space for other functions and activities.

It is consequently more appropriate to combine cycle paths with pedestrian walkway, giving most flexibility for the future. Combined paths also allow for future modes of aided personal movement, such as Segways. The typical cyclist in KSA is relatively slow (i.e. heat) and integrates well with pedestrian movements.

Along the corridor cycle paths shall be made visible using differing paving materials. At junctions cyclists would be sharing pedestrian crossings to cross main roads. Drop kerbs aiming to improve accessibility will also serve cyclists. The defined minimum width of 2.0m for pedestrian refuges also allows for cyclists to use the refuges safely.

To ensure cyclists integrate well with pedestrians at busy junctions and METRO stations, cycle paths shall terminate before the conflict areas at the junction. Additionally, traffic signs could be used to highlight pedestrian priority (see example - similar sign could be developed for use in Riyadh).

Figure 5.8 Sample sign (©) used at the University of British Columbia, Vancouver Campus

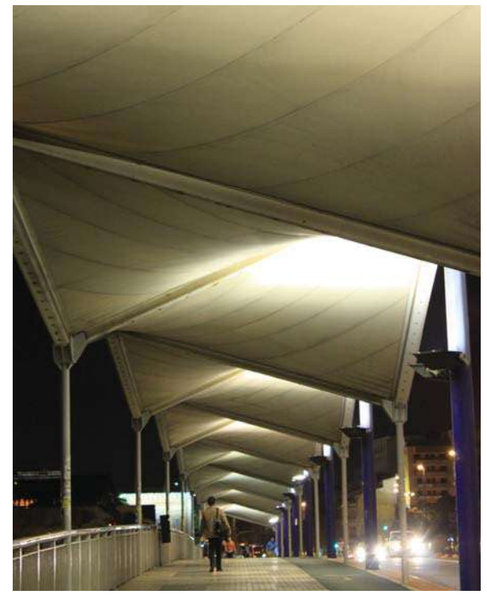


Figure 5.9 Cycle path integrated in walkway, Seville, Spain

Figure 5.10 Cycle path integrated in walkway, Cordoba, Spain

5.1.5 Integration of Local Access Roads

Access to local roads is essential for functioning of the adjacent neighborhoods. However, right-in/ right-out access roads also conflict with pedestrian movements and may even pose a safety risk. Particularly at areas with high pedestrian demand, the number of local access roads may need a critical review.

Ideally, a distance of approximately 100m between access roads can be maintained. However, a minimum distance of 50m between access roads should be kept, where possible. To ensure appropriate spacing, it may be required to close some existing local access roads.

Generally, right-in/ right-out access shall be limited to one lane per direction, to reduce the crossing distance for pedestrians and reduce the potential for illegal parking that may block pedestrian movements. Widths and turning radii shall be reduced to the minimum possible to reduce vehicle speeds, but still permit emergency access.

Typical dimensions have been defined for right-in/ right-out access to local roads with median and without median (see figures).

Some existing local roads are wider than the dimensions specified in this manual. In these cases connection shall be made in the form of kerb extensions, effectively narrowing the roads where the walkway along the arterial road and METRO corridor is being crossed.

All right-in/ right-out access roads need to give-way to traffic on the main road. Relevant signage may be required (give-way/ yield/ stop). Additionally, zebra crossing signage and/or markings may be required to emphasise pedestrian priority.

Depending on urban street type different treatments of crossings are defined (see also Spacing Schedule S02):

- raised table in areas with high pedestrian demand and priority.
- drop-kerbs and asphalt paving without pedestrian priority in areas with lower pedestrian demand.

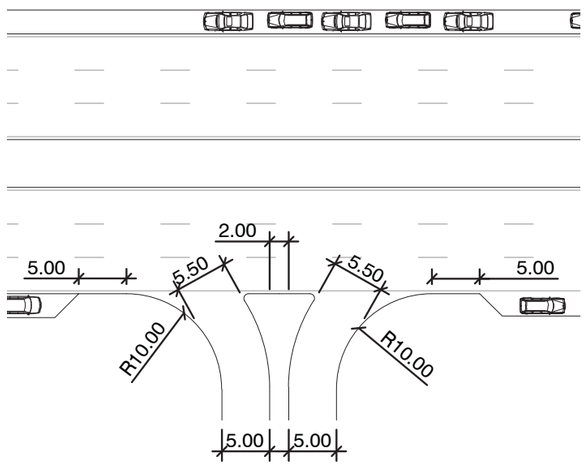


Figure 5.11 Typical right-in/ right-out access including median

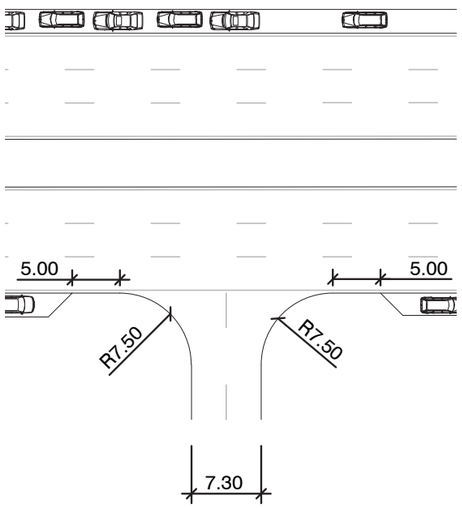


Figure 5.12 Typical right-in/ right-out access

Figure 5.13 Application of raised table, including ramp 1:10 and bollards to restrict vehicular access onto walkway

5.1.6 Integration of Driveways and Property/ Building Access

There are many locations along the METRO corridors where access to properties, small driveways or buildings across the footpath is required. Usage by vehicles is small (typically up to 100 vehicles/ day) and pedestrian usage of the footpath dominates. It is necessary to ensure that the continuation of the footpath is maintained and that a clear priority for pedestrians is communicated to car drivers.

In these locations the footpath shall be continued. Vehicular access shall be provided by using a special access kerb, integrating into the streetscape. The access kerb is 350mm in width, in line with the standard kerb width of 150mm + 200mm width of the kerb margin. A special access transition kerb as shown in adjacent figures shall be used on both sides. A minimal upstand of 30mm will ensure drainage and tactility.

The vehicular access will further be visually communicated to pedestrians by a change in paving pattern.

Access and driveways with expected higher vehicle volumes (i.e. access to larger parking lots) need to follow the design described on the previous page for local access roads.

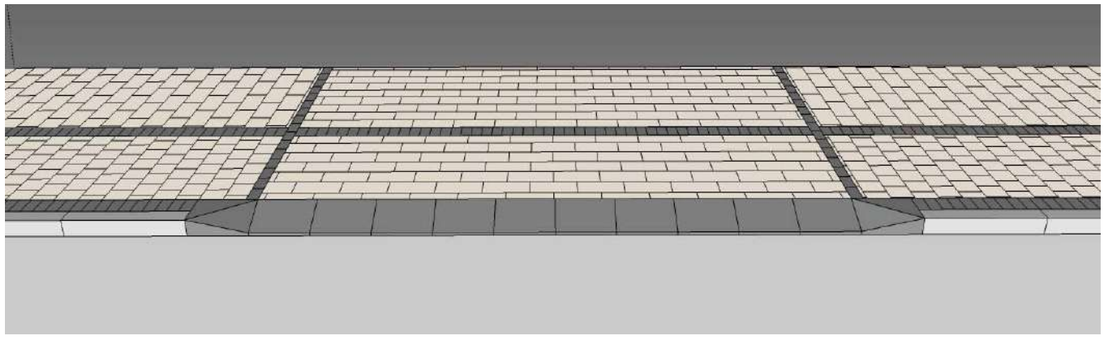


Figure 5.14 Integration of building access across footpath using access kerbs

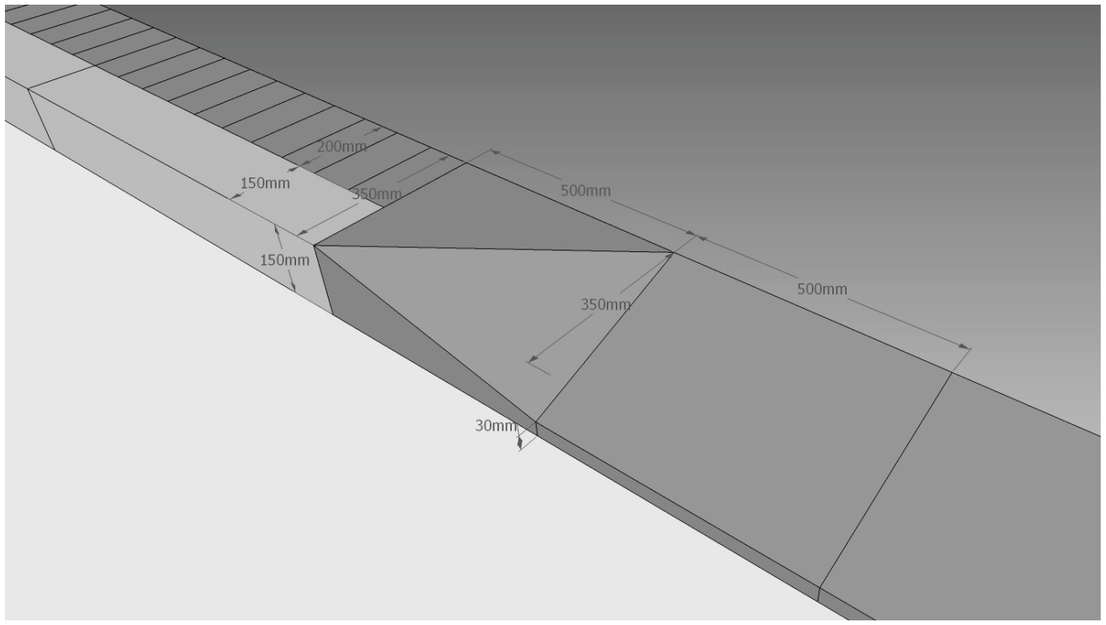


Figure 5.15 Detail of access kerb and access transition kerb, including dimensions

5.1.7 Pedestrian & Cycle Crossings

Pedestrians and cyclists are very sensitive to detours. It is therefore adamant for a working pedestrian environment to sufficiently provide safe crossing facilities. Junctions are often far away from each other. Using the junction crossing facilities for many pedestrians therefore often means an unacceptable deviation from their route. Further to pedestrian crossings at junctions it is therefore often necessary to include additional mid-block pedestrian/ cycle crossings following/ serving the actual pedestrian desire lines.

The type and required distance between crossing facilities is related to the expected numbers of pedestrians/ cyclists in the corridor, hence related to density and prevailing land uses. The type of crossing and targeted spacing is therefore referenced to the urban street typology (see Spacing Schedule S02).

Experience worldwide shows that pedestrian bridges are not easily accepted by pedestrians, mainly due to the required detour and climbing of steps. Bridges are also rather difficult to use for cyclists. At-grade crossings should therefore be given preference.

However, in sections where METRO tracks are running at-grade, at-grade pedestrian crossings are not feasible. In these instances it may be useful to consider implementing pedestrian bridges. Access to pedestrian bridges shall be treated like access to METRO stations. They are ideally located next to the kerb as a continuation of the furniture zone, maintaining sufficient space for a continuous walkway for pedestrians.

The positioning of the crossings should support typical pedestrian movements across the road (desire lines), reducing potential detours (see picture).

Generally pedestrian crossings should be positioned either upstream of entering traffic from side-streets (in driving direction before the side-street) or downstream at a minimum distance of 20m away from the side-street.

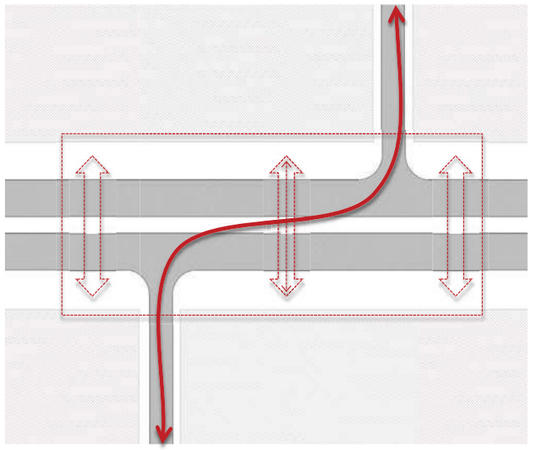


Figure 5.16 Possible locations for a pedestrian crossing serving desire lines

This distance is necessary to ensure that entering car drivers (typically looking to the left towards main road traffic), have a chance to see and stop at the crossing (which would be at their right hand side).

To ensure that vehicle drivers can see pedestrians waiting to cross at the crossing, a minimum distance of 10m upstream of the crossing shall be kept free of any obstructions that could prevent visibility of pedestrians (i.e. trees, bushes, parked cars). Trees or structures providing shading to waiting pedestrians are best to be positioned downstream of the crossing.

Zebra crossings are not suitable for crossing several lanes of potentially fast moving traffic (one vehicle might stop and block the view for vehicles on other lanes, potentially leading to accidents). Raised tables help to reduce speeds, but pedestrian priority is still often ignored by drivers in Riyadh. They also pose a risk for ambulances and other emergency vehicles, and are therefore not ideal for crossing main roads.

Hence, un-signalised zebra crossings with or without raised tables should not be used for mid-block crossings. Since introduction of strict red-light enforcement in Riyadh, adherence to traffic lights has drastically improved. Signalised mid-block crossings are therefore the preferred choice.

Depending on urban street type, two types of mid-block crossings are to be used (refer to Spacing Schedule S02):

‘Standard’ crossing facility:

- signalised pedestrian crossing.
- drop-kerbs on both sides and across the median.
- minimum of 2.0m wide refuge on the median.
- push-button facility for requesting pedestrian green.
- pedestrian signal will operate with 2 phases only (pedestrian or traffic), impact on traffic will be minimal, since the 4-phase operation at the adjacent junctions will determine capacity.

‘Basic’ crossing facility:

- drop-kerbs on both sides and across the median.
- minimum of 2.0m wide refuge on the median.
- not signalised, pedestrians have to give way to cars.

Signalised mid-block pedestrian crossings may also offer the possibility to include signalised mid-block U-turns without any additional impact on traffic (U-turn are given green signal at same time as pedestrians, no additional phase is required - see picture).

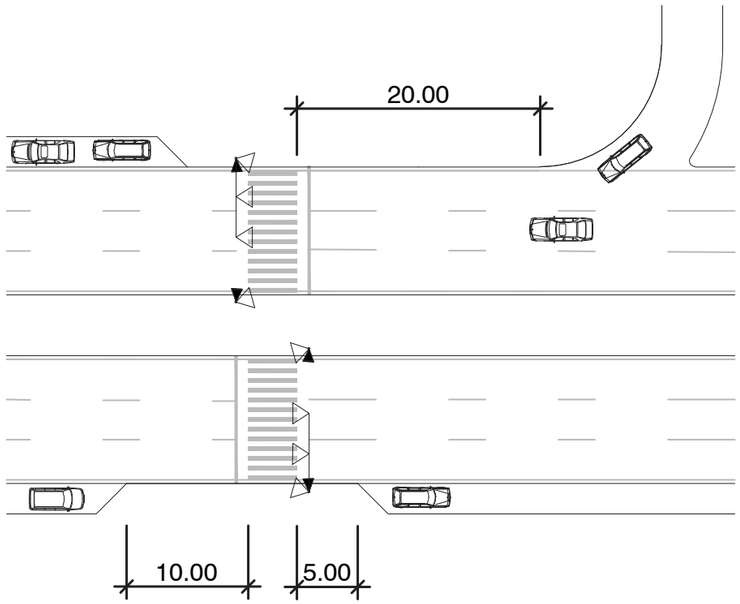


Figure 5.17 Typical signalised mid-block pedestrian crossing

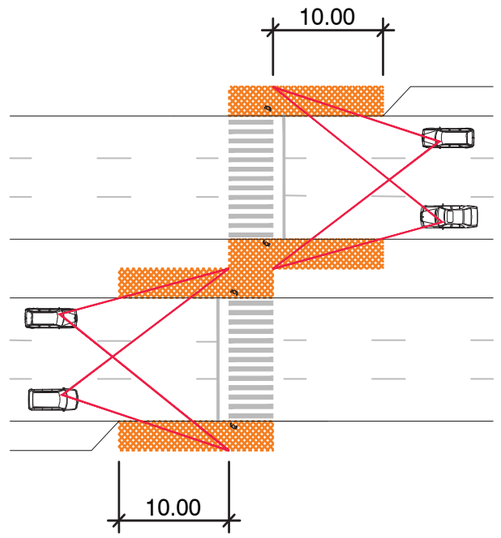


Figure 5.18 Maintain visibility at crossings

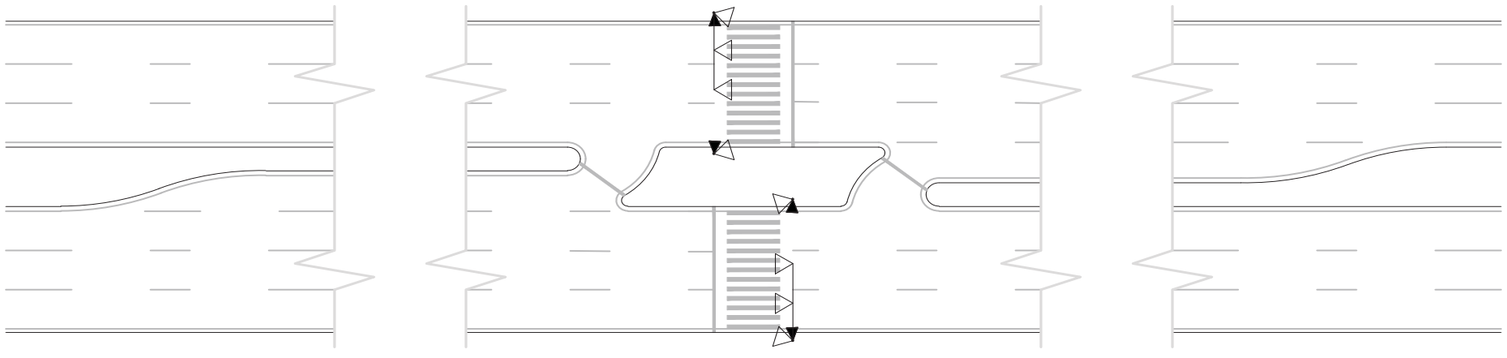


Figure 5.19 Combination of pedestrian crossing and signalised mid-block u-turns

5.1.8 Typical Junction Layouts

Current practice regarding integration of pedestrian crossing facilities seems ambivalent. Crossings have often been integrated into the design, but pedestrian signals are often missing or have been switched off.

The reasons for these shortfalls often are the signaling practice in Riyadh, which does not permit pedestrian green if there is any conflicting vehicular movement.

(This is not the case in many parts of Europe or the United States, where parallel movements are permitted and vehicles have to give way to pedestrians.)

Combined with the typical 4-phase signal operation in the KSA and a standard layout without additional refuges this prevents pedestrian green across exits and generally limits pedestrian green time throughout the junction (see phasing diagram).

The lack of green time and suitable crossings however encourages jay-walking, increases pedestrian waiting time and reduces safety and comfort for pedestrians and cyclists. Each crossing of roads becomes a detriment to walking and cycling, and may reduce the acceptance of the opportunities offered by the new METRO and bus system.

It is therefore essential to incorporate junction layouts in the overall design that allow for the best possible integration of pedestrian signals and sufficient green time, reducing waiting time and improving safety.

A default junction layout including typical variations has therefore been developed based on experience with different layouts throughout Riyadh.

Figure 5.21 Example for missing pedestrian signal at exit (opposite side)

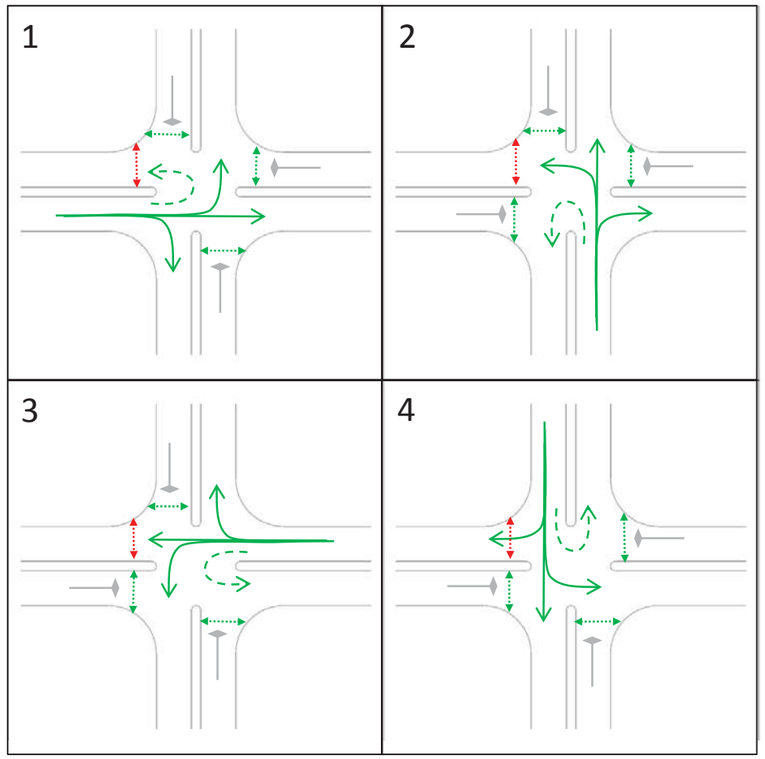


Figure 5.20 Phasing diagram illustrating conflict for on selected pedestrian crossing (highlighted in red) through all 4 phases

The default junction layout to be applied where space permits shall include right-turn slip lanes, thus forming triangular shaped islands serving as pedestrian refuges. These refuges need to fulfill the minimum requirement of 2.0m width at the narrowest point used by pedestrians.

As a standard, pedestrian crossings across right-turn slip lanes should be signalised. At junctions with minimal pedestrian movements the signalisation may not be required. If right-turn slip lanes are not signalised, speed control measures (speed bump or raised table) combined with pedestrian priority signage shall be included.

The signalisation of the right-turns ensures unimpeded traffic flow at the green signal; acceleration tapers or acceleration lanes at the exit of the slip-lane are therefore not required.

To reduce vehicle speeds and maximise the available walkway, acceleration tapers or lanes shall not be applied.

Dedicated right-turn lanes approaching the right-turn slip lane should be avoided, where possible, to minimise land take and reduce speed of vehicles approaching the crossing. At junctions with high demand for right-turning traffic, however, additional lanes may be necessary to increase vehicle storage. Where dedicated right-turn lanes are included, the right-turn shall be signalised to ensure pedestrian safety.

The phasing diagram illustrates the possible green allocated safely to pedestrians.

Overall this layout helps pedestrians to cross junctions safe and relatively unimpeded.

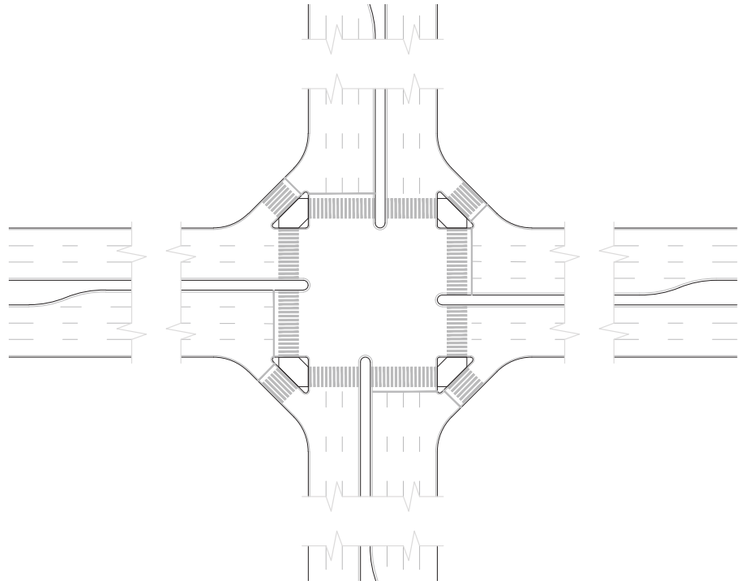


Figure 5.22 Typical junction layout, including signalised right-turn slip lanes - concept

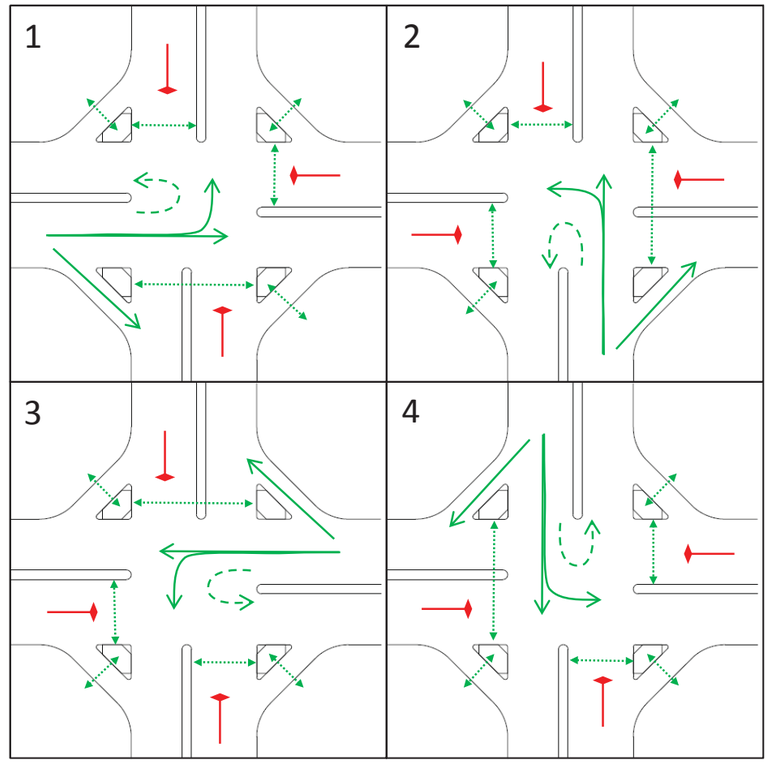


Figure 5.23 Phasing diagram – typical junction with right-turn slip lanes

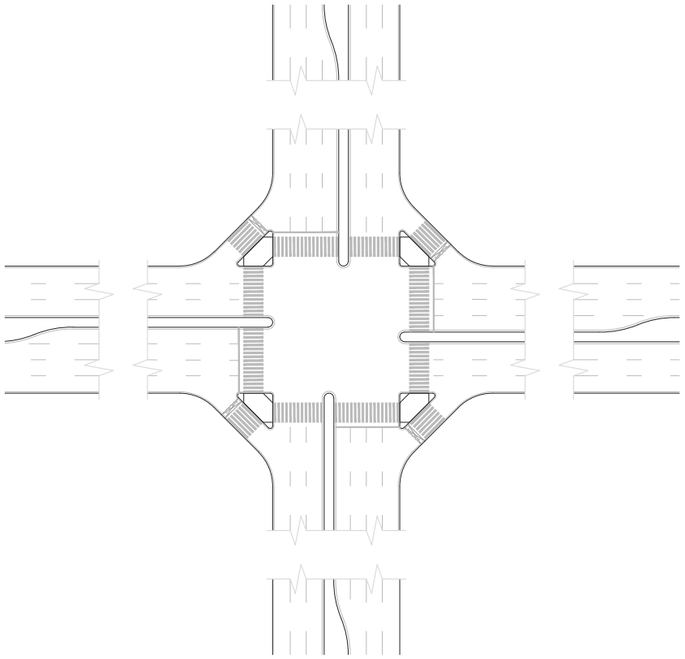


Figure 5.24 Typical junction layout including un-signalised right-turn slip lanes - concept

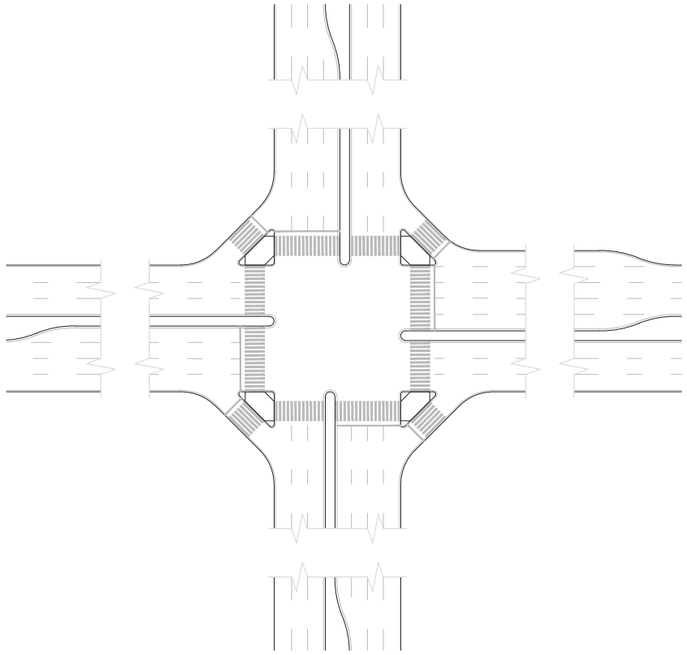


Figure 5.25 Typical junction layout including signalised right-turn slip lanes and dedicated right-turn lane - concept

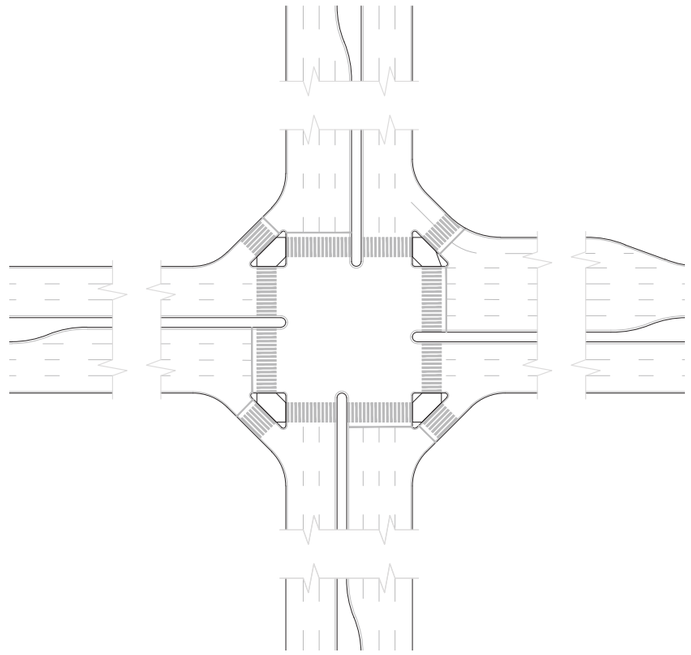


Figure 5.26 Typical junction layout including signalised right-turn slip lanes and double right-turn lanes - concept

At busy junctions, it may be possible to ban U-turns to further increase pedestrian allowance.

U-turning traffic could also be served by using dedicated signalised U-turn lanes, allowing to turn before entering the junction. At locations where U-turning demand is high and the available median width is sufficient, dedicated signalized U-turn lanes may provide a suitable solution.

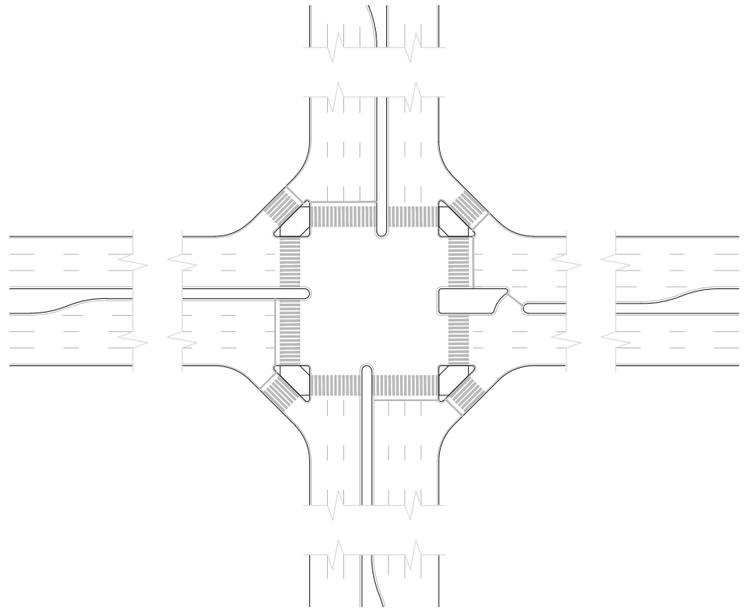


Figure 5.27 Typical junction layout including signalised U-turn lane - concept

Required turning radii for U-turns often require the crossing of several lanes (i.e. larger vehicles). Dedicated U-turn lanes therefore always need to be signalised to minimise the risk of accidents. The safe integration of signalised U-turns into the phasing at the junction is illustrated in the phasing diagram.

An existing installation of a signalised U-turn can be found at the junction of Takhassusi Road and Prince Mohammed Bin Abdulaziz Road.

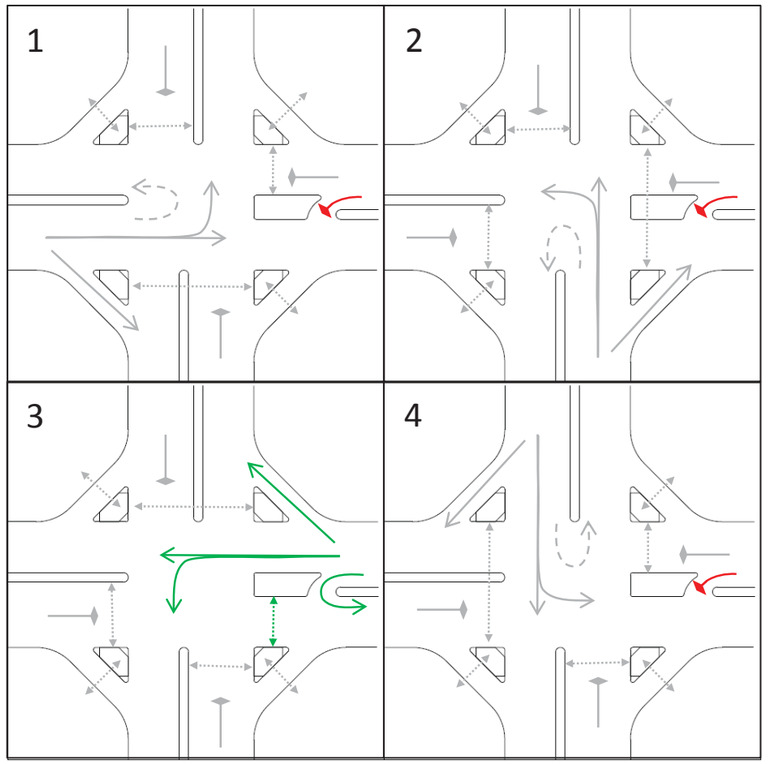


Figure 5.28 Phasing diagram – typical junction with right-turn slip lanes

Junctions with Limited Space

Some locations provide only a limited Right of Way (ROW) and do not permit the implementation of fully designed junctions due to space constraints.

The following measures help to adjust to limited availability of space:

- reduce lane width from 3.50m to 3.30m.
- omit left-turn lanes to reduce median to minimum of 2.0m.
- reduce to 2+2 lanes.

The picture illustrates the application of these measures at a typical junction layout.

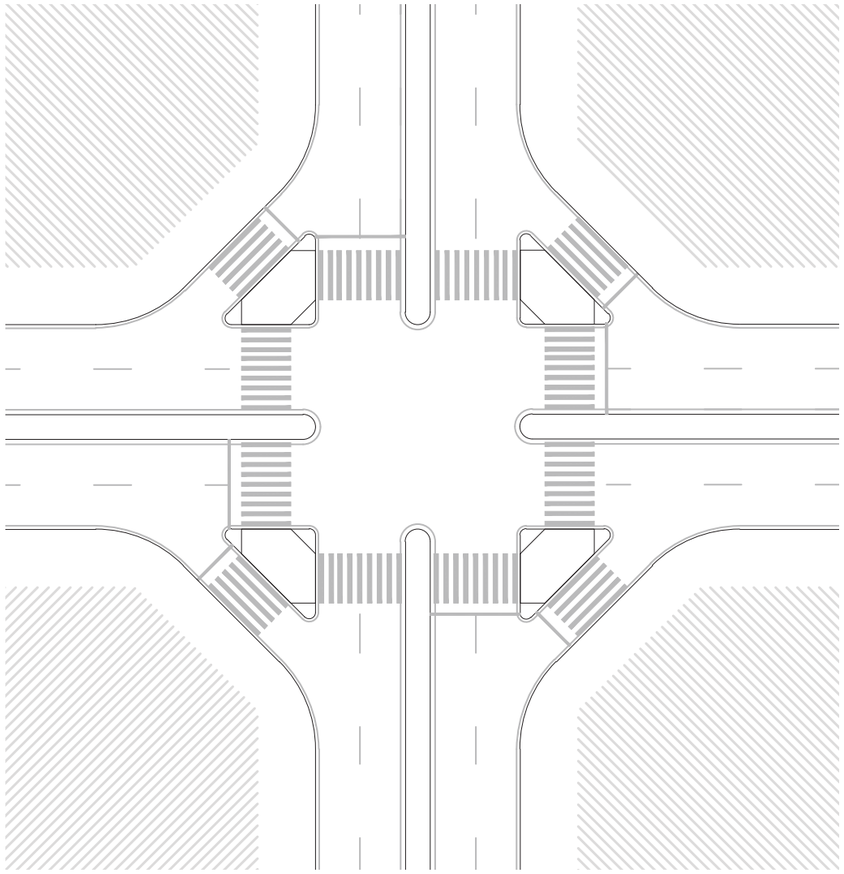


Figure 5.29 Typical junction layout – limited ROW available (reduced width and no. of lanes, without dedicated left-turn lane) - concept

Where the introduction of right-turn slip lanes is not possible (i.e. due to encroaching buildings), alternative protection for crossing pedestrians will be required.

The turning radius should be minimised, reducing the speed of right-turning vehicles, but enabling all types of vehicles to turn (often several lanes are available at the exit, allowing for smaller radii). Typically radii do not exceed 10.0m.

Ideally, relevant U-turn movements would be banned to enable a safe signalisation of the pedestrian crossing across the junction exits. However, this is often not feasible, since U-turning movements are necessary to provide access to properties from both directions. The provision of dedicated signalised U-turn lanes (see previous page) is also often not feasible due to lack of space.

It is therefore recommended to include additional measures to protect pedestrians crossing at the same time as the opposing U-turn. Signs in English and Arabic mounted next to the left- and U-turn could remind drivers to give way to crossing pedestrians (i.e. 'U-turning traffic give way to pedestrians', see examples).

Additionally amber flash lights mounted at the crossing itself should emphasise pedestrian priority at these crossings. The positioning of these amber lights is documented below.

The phasing diagram illustrates how the pedestrian green can be integrated in the phasing of the junction. It becomes clear however, that this solution provides less green time to pedestrians than the standard layout including right-turn slip lanes.

Figure 5.30 Pedestrian priority sign, USA

Figure 5.31 Pedestrian priority sign, New Zealand

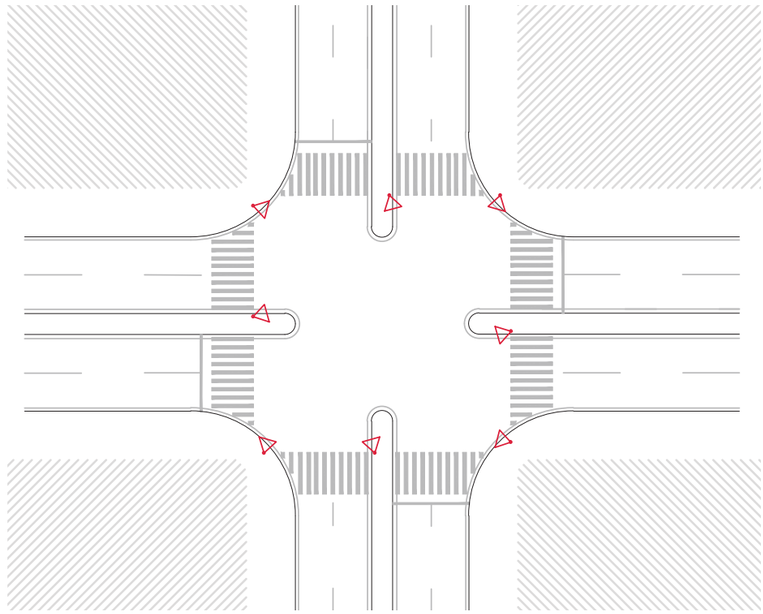


Figure 5.32 Junction layout without right-turn slip lanes, illustrating positioning of amber flash lights

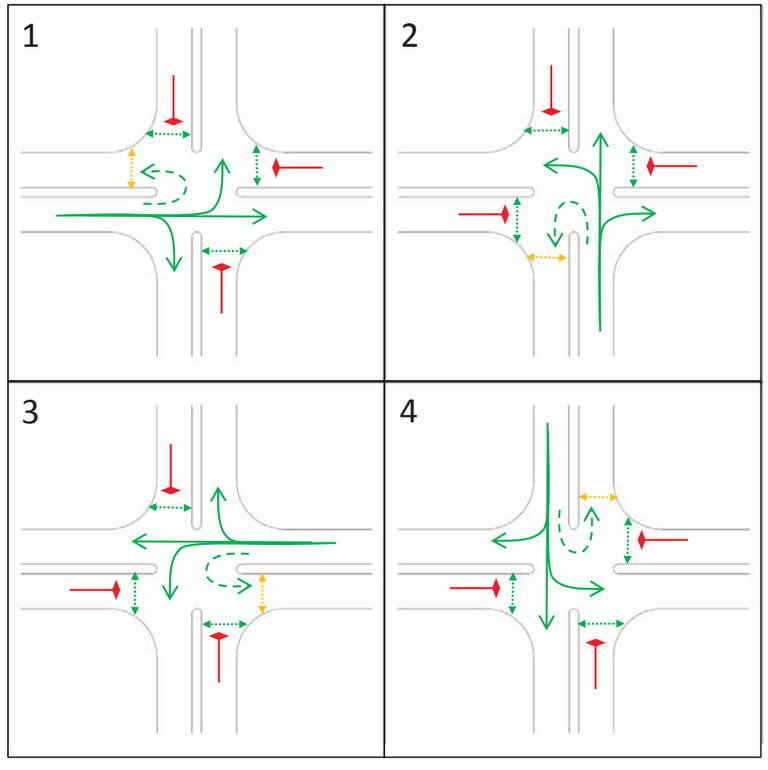


Figure 5.33 Phasing diagram – junctions without dedicated right-turn slip lanes and protected exit crossing

5.1.9 Integration of Bus Stops

The design of bus stops along the METRO corridor needs to follow the standard ADA bus stop design for feeder and community buses, developed as part of the BRT (Bus Rapid Transit) project.

The BRT stations are being designed as part of a separate contract. Interchanges between BRT and METRO require special consideration, since large numbers of passengers are expected to change between systems. It is essential that direct access is being provided, without the need to cross roads. Relevant walkways need to be sufficiently wide and shaded. Ideally, direct access is being integrated in the station design.

The following briefly summarises the basic parameters of the standard design for feeder and community bus stops.

As a standard, kerb-side bus stops are the preferred type of bus stop. This type of bus stop requires the least amount of space and integrates well into the streetscape. The standard length for kerb-side bus stops is 24.0m; the minimum required length is 20.0m.

Kerb-side bus stops are the fastest and most comfortable type of bus stops for users. They are also suitable for bus lanes, which may be introduced at a later stage.

Bus stops are to be equipped with Kassel kerbs for improved accessibility.

Bus stop lay-bys require substantially more space and would reduce available pedestrian realm and frontage access considerably. In accordance with current ADA definitions, they are only to be used along major arterials (i.e. expressway or grade separated roads), where sufficient space is available. Based on this rule bus stop lay-bys are considered to be the exception along the relevant METRO corridors.

Figure 5.34 Kassel kerb

Figure 5.35 Kassel kerb in use at bus stop in Frankfurt

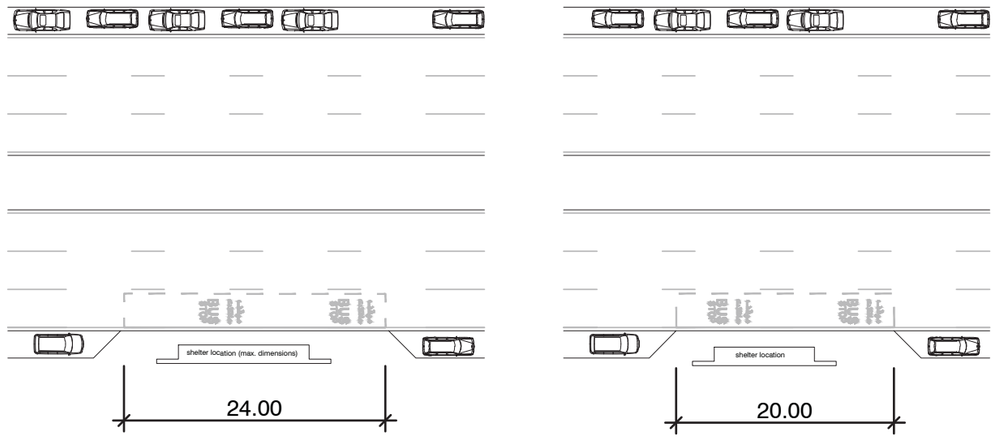


Figure 5.36 Standard and minimum road side bus stop dimensions

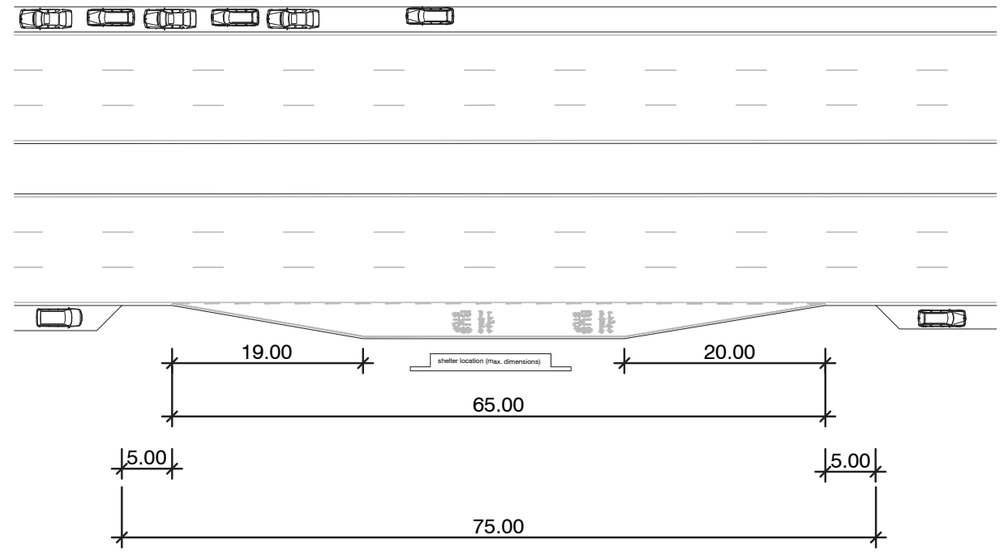


Figure 5.37 Dimensions of bus stop lay-by for fast roads

5.1.10 Integration of METRO Station Access and Bus Stops

Pedestrian movements from, to and between METRO stations and bus stops and their interaction with through movements are critical for the functioning of public places. Several aspects need to be considered when positioning bus stops and station accesses along the corridors:

- walking between bus stops (feeder/ community buses) and METRO station should be unimpeded by roads or other major obstacles.
- walking distance between bus stops and METRO station should be as short as possible to reduce possible exposure to sun or heat.
- major pedestrian movements should not be in direct conflict with each other, taking into account that pedestrians will always choose the most direct way possible.
- a continuous walkway needs to be maintained passing the station.

Since most METRO station designs include 4 separate access points at the walkway, providing unimpeded, road-crossing-free access from bus stops is typically no concern. But crossing small local roads may become an area of conflict, particularly at busy stations/ local roads. Local roads accesses should therefore be avoided between bus stops and the next station access.

At shallow underground METRO stations, however, where access to the METRO is facilitated within the median, the crossing of roads cannot be avoided.

Bus Stops

Kerb-side bus stops come into conflict with running traffic, which is often amplified when combined with traffic queuing at junctions (vehicles trying to cross at green signal but are blocked by a stopping bus; or buses cannot get to the bus stop due to queuing traffic, but are missing the green signal after boarding and alighting at the bus stop).

Consequently, kerb-side bus stops are ideally located at the exit of the junction to minimise conflicts and provide better bus performance.

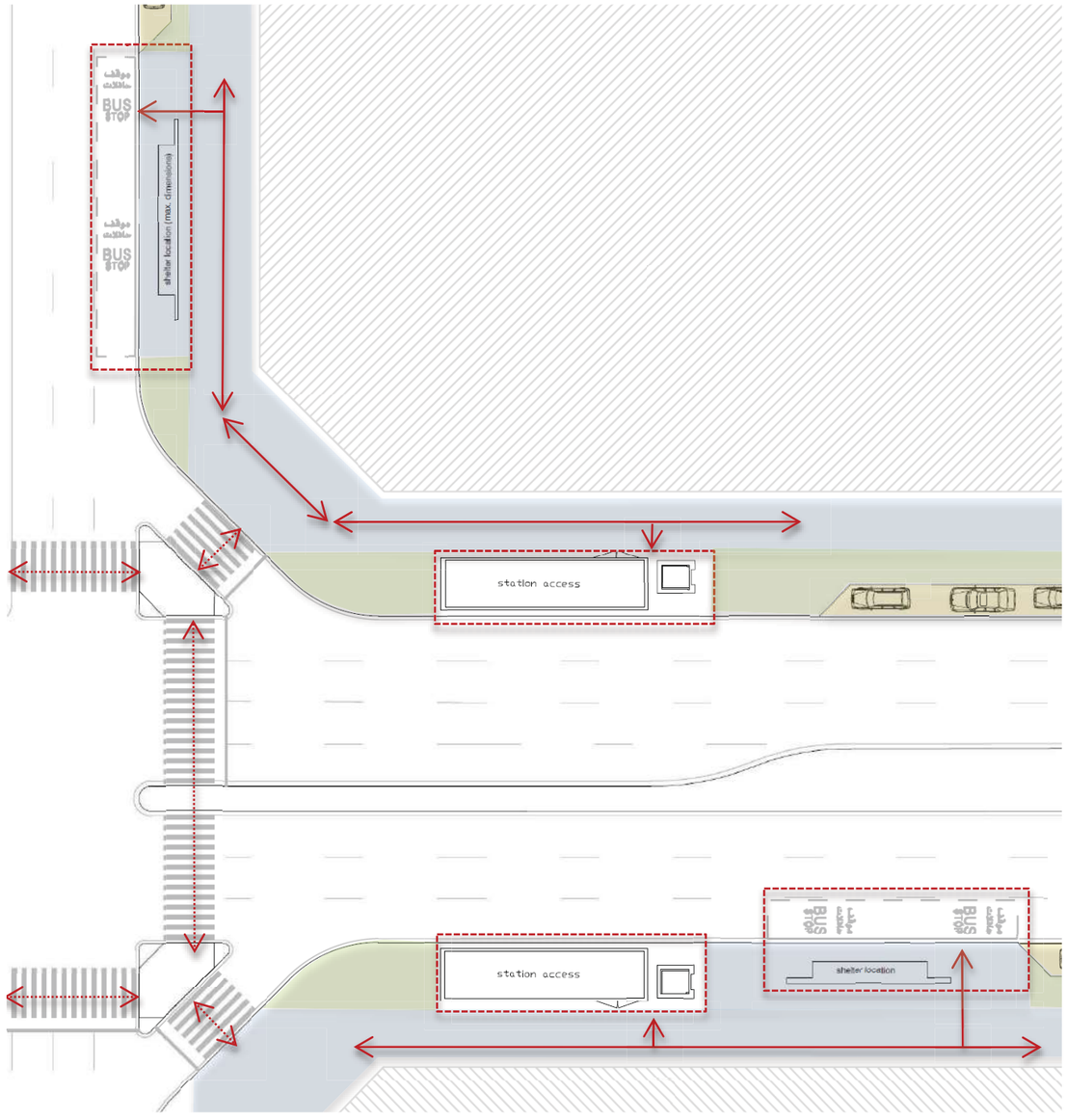


Figure 5.38 Integration of bus stops at METRO stations, buses running along METRO corridor and perpendicular

METRO stations - walkway access

At METRO stations a number of additional facilities and furniture elements (i.e. shading, cycle stands) needs to be accommodated within the public realm. Further, it is necessary to maintain a continuous walkway for pedestrians. Parking, however, is not a key function of METRO station plazas and could be omitted, if necessary.

Logically, the METRO station access and other facilities therefore form a continuation of the furniture zone, which can be widened up to the kerb zone, omitting parking provision (see also Chapter 3).

At locations where the inclusion of a METRO station access or other facilities would not allow for maintaining a sufficiently wide continuous pedestrian walkway (and a further reduction of traffic provision is not possible), it should be considered to integrate/ recess the access or facilities into the building frontage.

Along busy and/ or narrow walkways it should be avoided to locate bus stops directly opposite the station access, if this results in directly crossing the pedestrian throughway (continuous walkway). It is often better to shift the bus stop to either side. This forces pedestrians to merge into the general direction of pedestrian flow and smooths pedestrian movements.

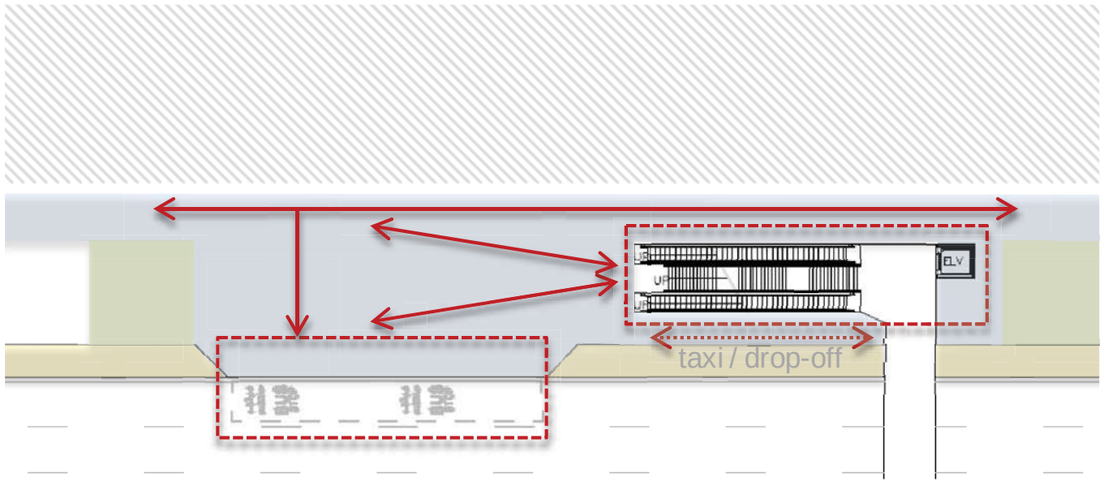


Figure 5.39 Elevated METRO station, wide pedestrian realm including bus stop and taxi / drop-off zone

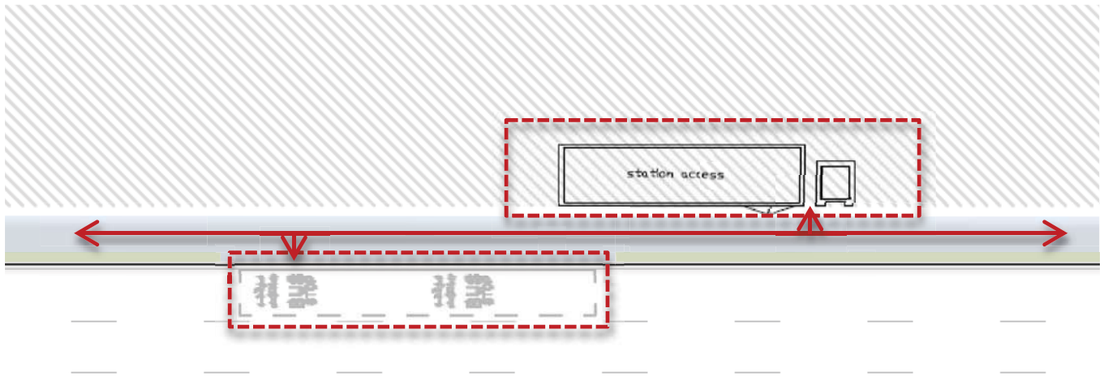


Figure 5.40 METRO station access recessed into building frontage, shifted bus stop to ease pedestrian movement

METRO station - median access

Buses typically have all access doors on the right-hand side. Hence, bus stops are always at the right-hand kerb of the road. At METRO stations where access to the METRO is facilitated within the median (e.g. shallow underground stations), direct bus access to median is therefore not possible.

Figure 5.41 illustrates the location of bus stops at the exits of the junction, along the ramp and the main carriageway of the crossing road. The latter is likely to be the most applicable solution, since in most cases feeder or community will be crossing the METRO corridor.

However, in both cases pedestrians will need to cross two traffic lights at the junction for access to the METRO. It is therefore crucial to:

- provide sufficiently dimensioned refuges to safely and comfortably accommodate the expected number of pedestrians.
- allow for continuous crossing of both relevant crossings in one signal phase.
- minimise waiting time at the signals and maximise green time given to pedestrians.

The phasing diagram shown illustrates how this can be achieved at the standard diamond interchange layout.

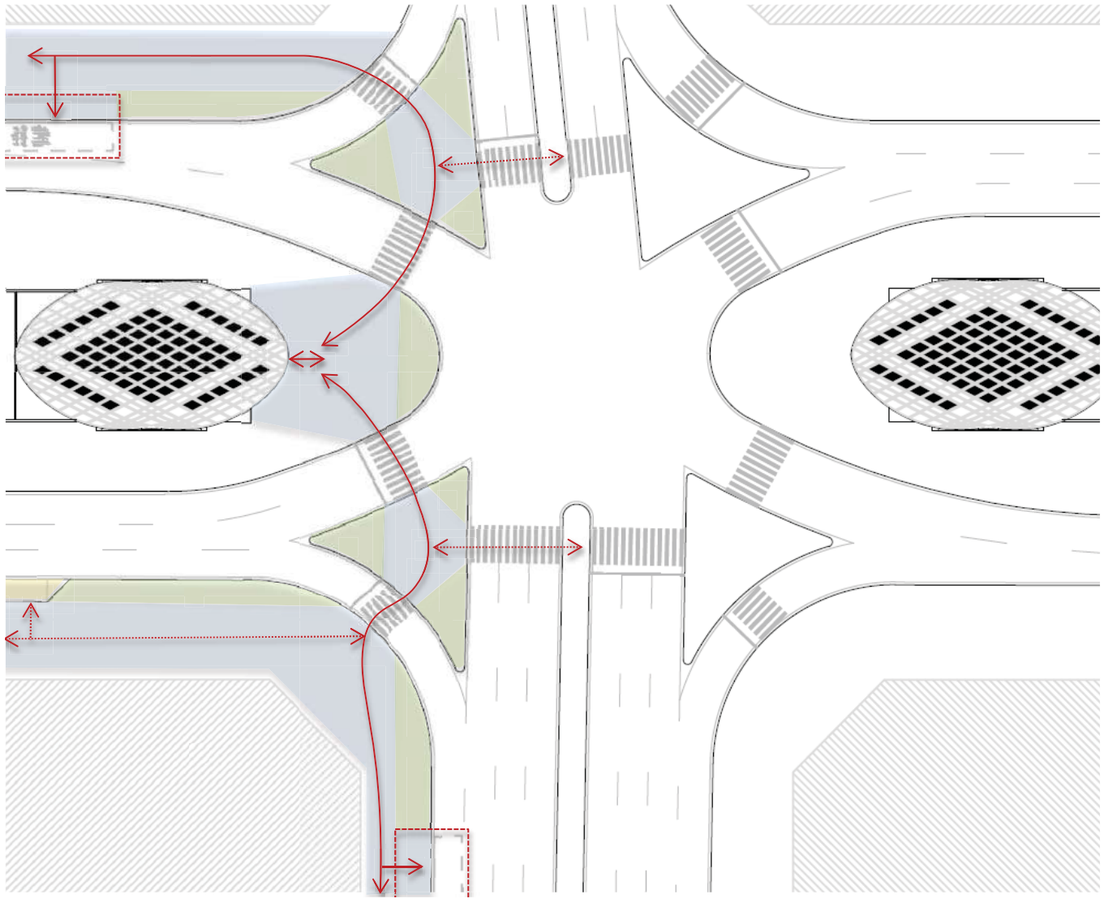


Figure 5.41 METRO station access at standard diamond interchange

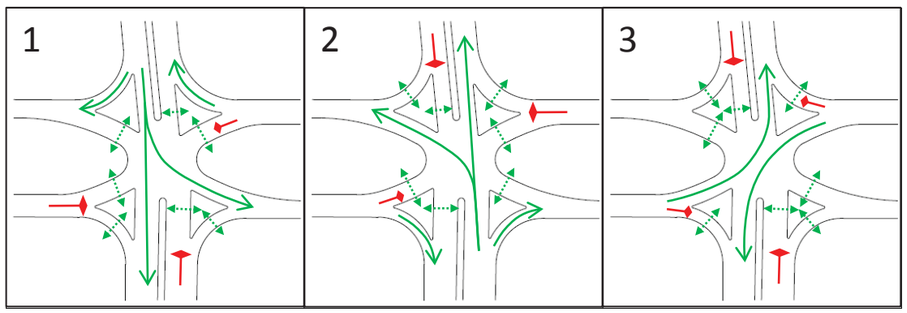


Figure 5.42 Phasing diagram - standard diamond interchange

5.1.11 Integration of Drop-off and Taxi Facilities

Introducing public transport to a car-based society such as Saudi Arabia requires overcoming prejudices and changing habits. Providing facilities for drop-off and pick-up activities at the stations is an important 'ice-breaker' helping to make the METRO an attractive transportation option.

Preferably, taxi stands and drop-off areas are located close to a station entrance. However, a few criteria need to be considered:

- do not place drop-off/ taxi facilities directly in front of entrance to avoid conflict with in and out movements or emergency procedures.
- ideally, drop-off/ taxi facilities are integrated in streets/ roads of lower priority to reduce impact on through traffic due to merging/ diverging vehicles or vehicles stopping in second row.
- placing drop-off area/ taxi stand needs to consider possible requirements for u-turns.
- avoid placing drop-off areas/ taxi stands immediately after junctions or pedestrian crossings to minimise the potential impact of blocking back.

At some stations, the preferred location for a drop-off area or taxi stand may compete with the ideal location for a bus stop. In this case preference shall be given to the bus stop, as buses carry a larger number of passengers. Taxi stands and/ or drop-off areas then need to be moved elsewhere in the vicinity of the station.

Basic dimensions for drop-off areas and taxi stands are as applied for parallel parking. However, for short drop-off areas (up to 3 vehicles) the length may need to be increased to 6m-6.5m per vehicle to ease in and out manoeuvres (i.e. approximate length of 18m-19m for a drop-off area for 3 vehicles).

To ensure easy access for people with limited mobility, possible luggage etc. drop-off areas and taxi stands shall be equipped with drop-kerb instead of standard kerb along the edge zone (see highlighted in picture).

Driveable area shall slope from pedestrian level to street level. Do not slope pedestrian area. To safeguard sensitive pedestrian area bollards are required along edge zone.

Non-essential street furniture shall be avoided along edge zone to ease movement of pawssengers getting in and out (minimum of 1.2m clearway). Signs and enforcement will be required to ensure taxi stands and drop-off areas will not be used for parking (see examples).

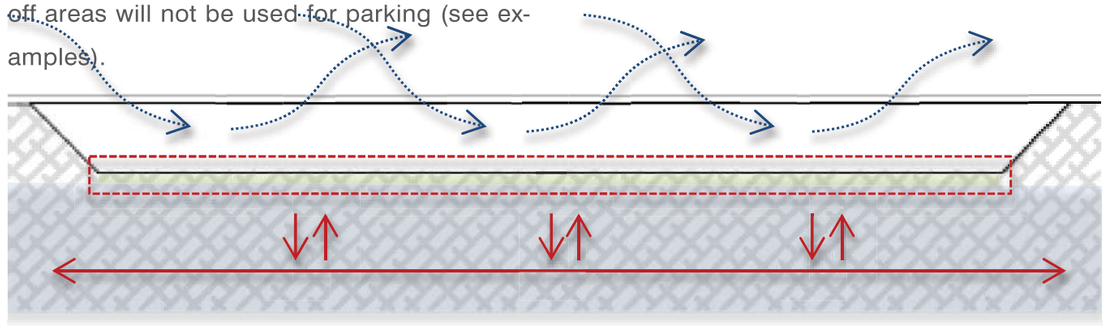


Figure 5.43 drop-off/ taxi stand, edge zone

Figure 5.44 Drop-off sign, USA

Figure 5.45 Drop-off sign, USA

Figure 5.46 Taxi stand, Italy (source: commons.wikimedia.org)

Figure 5.47 Taxi stand, New Zealand

5.1.12 Integrating Service Roads

Some roads along the METRO corridor are currently equipped with service roads. In contrast to international practice (and KSA highway standards) these service roads are up to 3 lanes wide and continue along the entire length of the road. At junctions the service roads are given the same green time as the main carriageway, and some junctions are passed unimpeded. As a result substantial through traffic is currently using the service roads, since the service road provides the faster alternative. On top, right-turning traffic has to use the service roads. Effectively, most traffic using the service roads is not related to serving the adjacent properties at all. However, high traffic volumes seem to suggest demand for several lanes of traffic.

The resulting high overall number of traffic lanes results in complex junction layouts and a difficult and unattractive environment for pedestrian oriented uses and high accident potential. The road widths required for this type of layout reduce the available space which could be used to improve the public realm and provide parking for adjacent uses.

The redesign of the corridor as part of the integration of the METRO should therefore aim at improving conditions for pedestrians and public transport, reducing traffic and number of lanes on service roads.

Figure 5.48 Vehicles bypassing traffic signal using service road (Prince Saad Bin Abdulrahman Al Awal Rd)

Figure 5.49 Substandard service road access without merging facilities (Prince Saad Bin Abdulrahman Al Awal Rd)

The implementation of the METRO will block some of the existing movements, and requires additional space to accommodate tracks, stations and other facilities. Additionally, more space is required to achieve the desired public realm improvements. Redesign and critical review of the existing traffic operation is therefore mandatory.

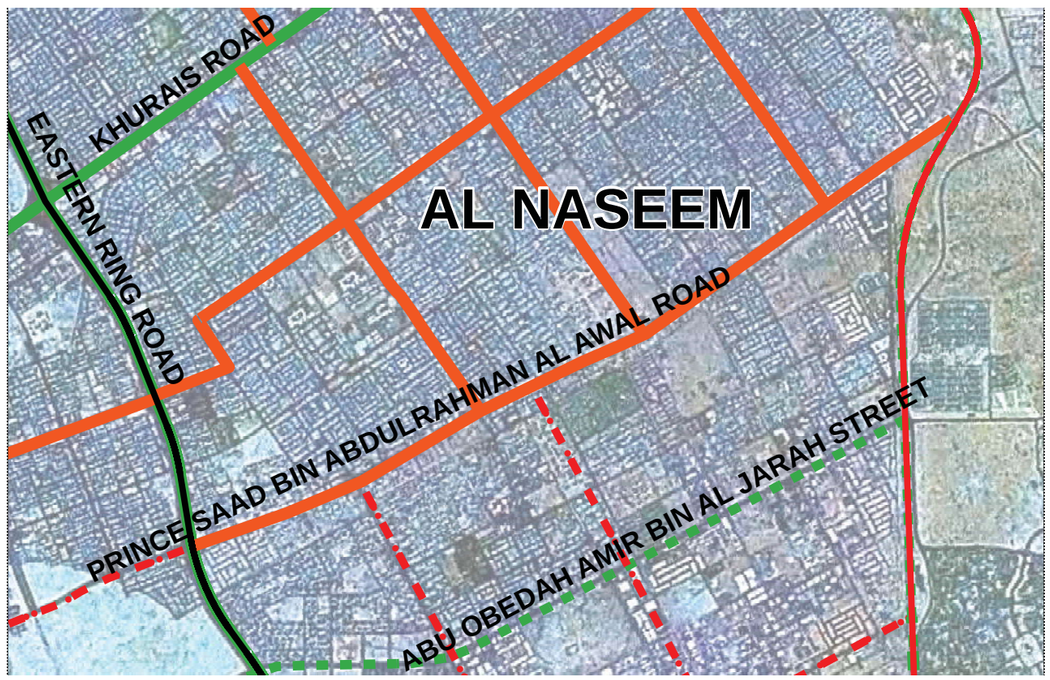
The key goal of the redesign shall be to provide a clear hierarchy:

1. the main carriageway serves through traffic and the main traffic movements.
2. the service road predominantly serves for access and service.

This means that all main turning movements should be possible from the main carriageway at all at-grade junctions. Turning via service roads should be limited to minor junctions.

Service roads should not be continuous for longer sections. Following the Riyadh road hierarchy service roads should be discontinued at main junctions.

Service roads should provide a maximum of 1 to 2 lanes, except at grade-separated junctions where service roads are combined with ramps and need to facilitate turning movements.



Map 5.50 Road hierarchy – main arterial roads connecting to Prince Saad Bin Abdurahman Al Awal Road

Based on the current 30% design two junctions along Prince Saad Bin Abdurahman Al Awal Road will be grade-separated. The junction at grade level will be serving turning movements only, the through movement will be using the underpass (standard diamond interchange). Avoiding through movements along the service lane, allows for effective signalisation for vehicles (3 phases only) and a maximum of pedestrian green time.

Discontinuing service roads poses a much larger challenge at at-grade main junctions. Ideally, service roads would terminate before reaching the junction. However, access to properties near the junction may become difficult.

Possible solutions are illustrated conceptually in figures 5.53 and 5.54. The shown examples allow for eliminating additional pedestrian crossings across the service roads at junctions. Most of the junctions along Prince Saad Bin Abdurahman Al Awal Road are T-junctions potentially allowing for further simplification (the shown example integrates access to a METRO station, e.g. at Abdul Rahman ibn Awf Road).

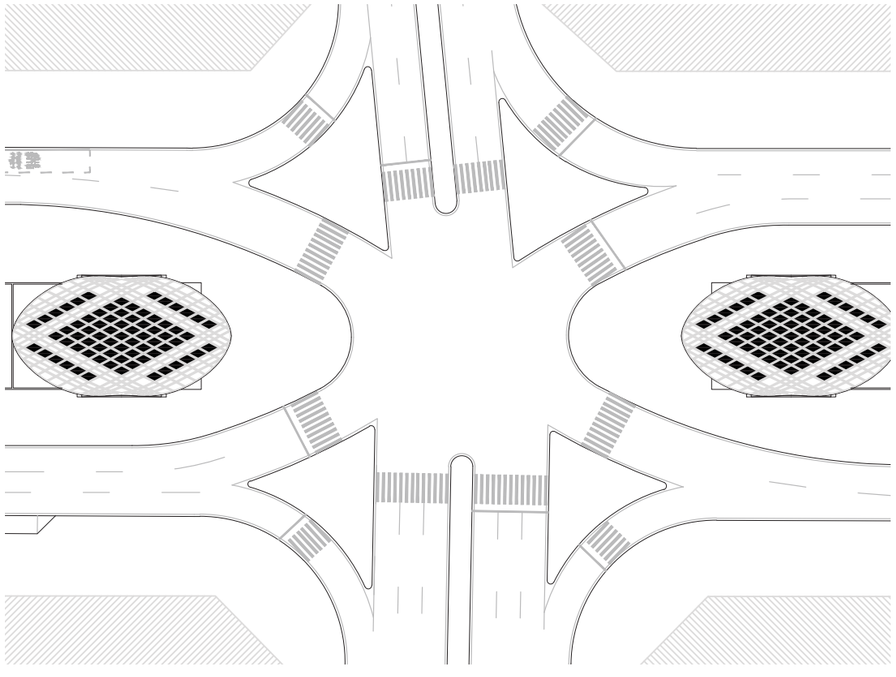


Figure 5.51 Standard diamond interchange with discontinued service roads

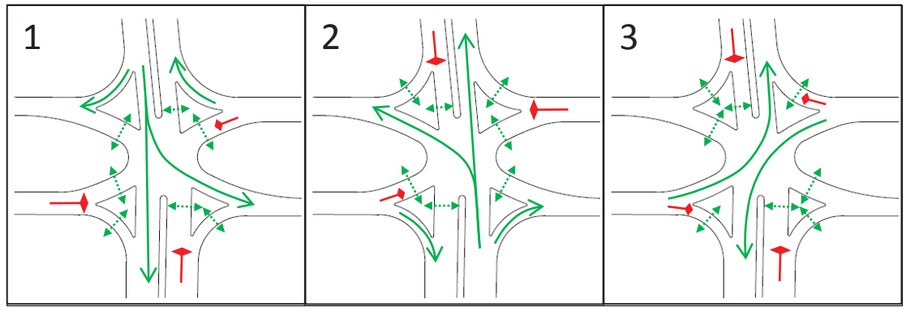


Figure 5.52 Phasing diagram - standard diamond interchange

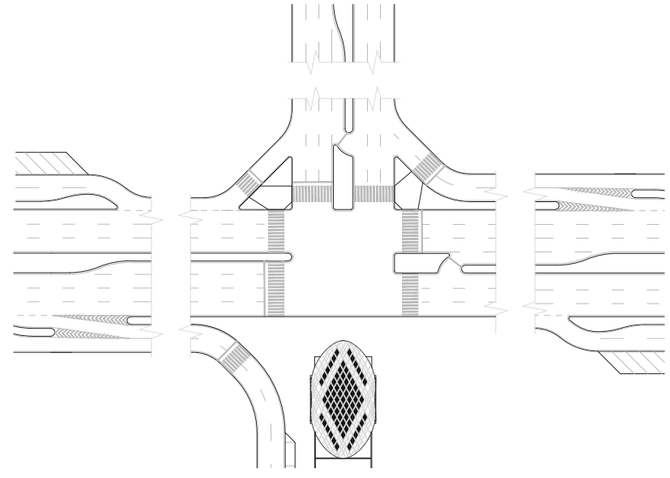


Figure 5.53 Main T-junction with discontinued service roads and possible integration of METRO station- concept

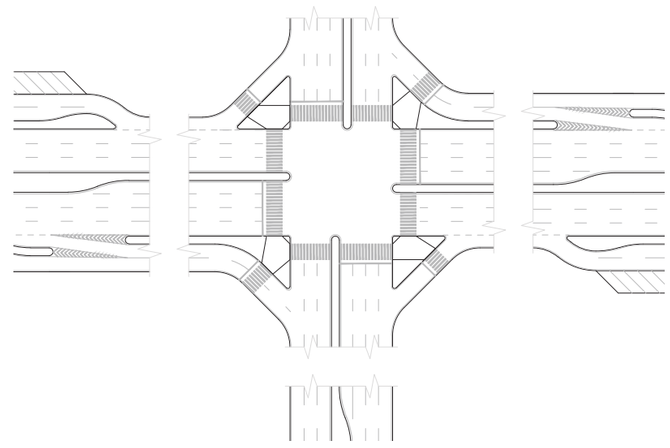


Figure 5.54 Main junction with discontinued service roads - concept

Secondary roads are ideally connected to the service road only. This way entering/ exiting traffic will impact on traffic using the service road only, but not the main carriageway.

For most secondary roads a simple (un-signalised) right-in/ right-out access as illustrated will be sufficient (see relevant section above). Depending on urban street type right-in/ right-out accesses are protected using raised tables. If no raised table is being used, simple speed control measures such as speed humps may be useful.

Some secondary roads may require direct access to the main carriageway, due to the large volumes of traffic expected. A possible signalised solution is shown in figure 5.56. This solution (based on the typical Italian approach) also allows for interchange between service road and main carriageway. The phasing diagram shows that the main carriageway and the service road do not operate at the same time. Minimal green time would be given to the service road, whilst green time for through traffic can be maximised. The shown examples do not provide for a left-turn onto the main carriageway. Preferably, this would be limited to main junctions.

Both options could potentially be used to also integrate pedestrian crossings across the main road (subject to availability of refuge on median).

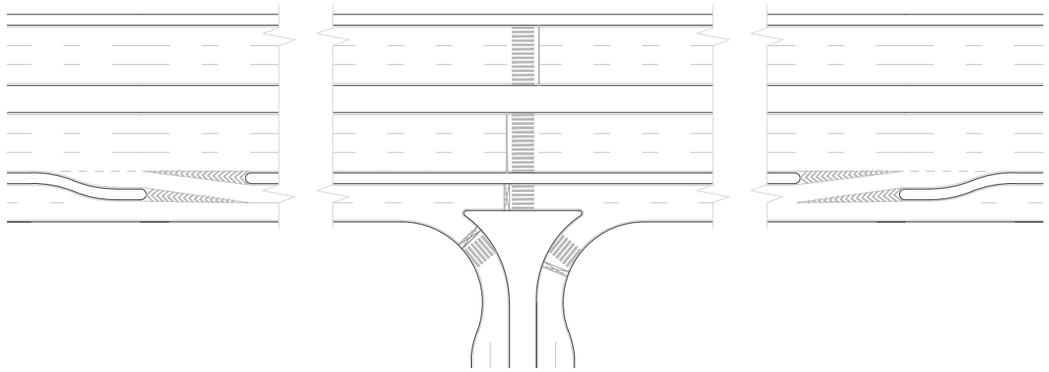


Figure 5.55 Secondary T-junction, right-in/ right-out access to service road only - concept

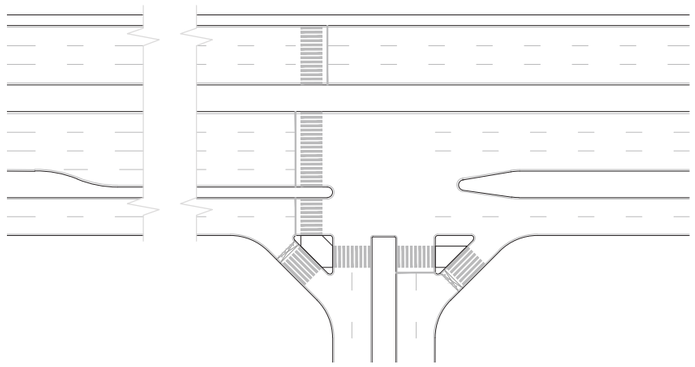


Figure 5.56 Secondary T-junction, direct, signalised access to main carriageway - concept

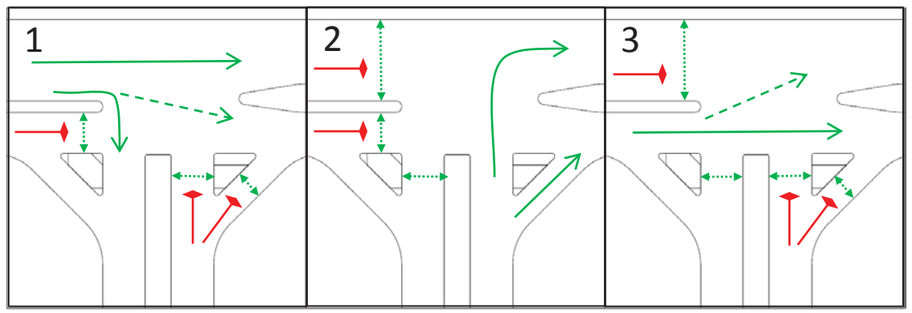


Figure 5.57 Phasing diagram – direct, signalised access to main carriageway

5.1.13 Sample Cross-Sections

Based on the design principles and dimensions described above, a number of sample cross-sections have been developed.

These cross-sections illustrate the possible application of the described principles to typical situations occurring in Riyadh and along the analysed METRO corridors.

The current situation is sketched up exemplified. The comparison illustrates how valuable space can be gained to accommodate the desired public realm improvements.

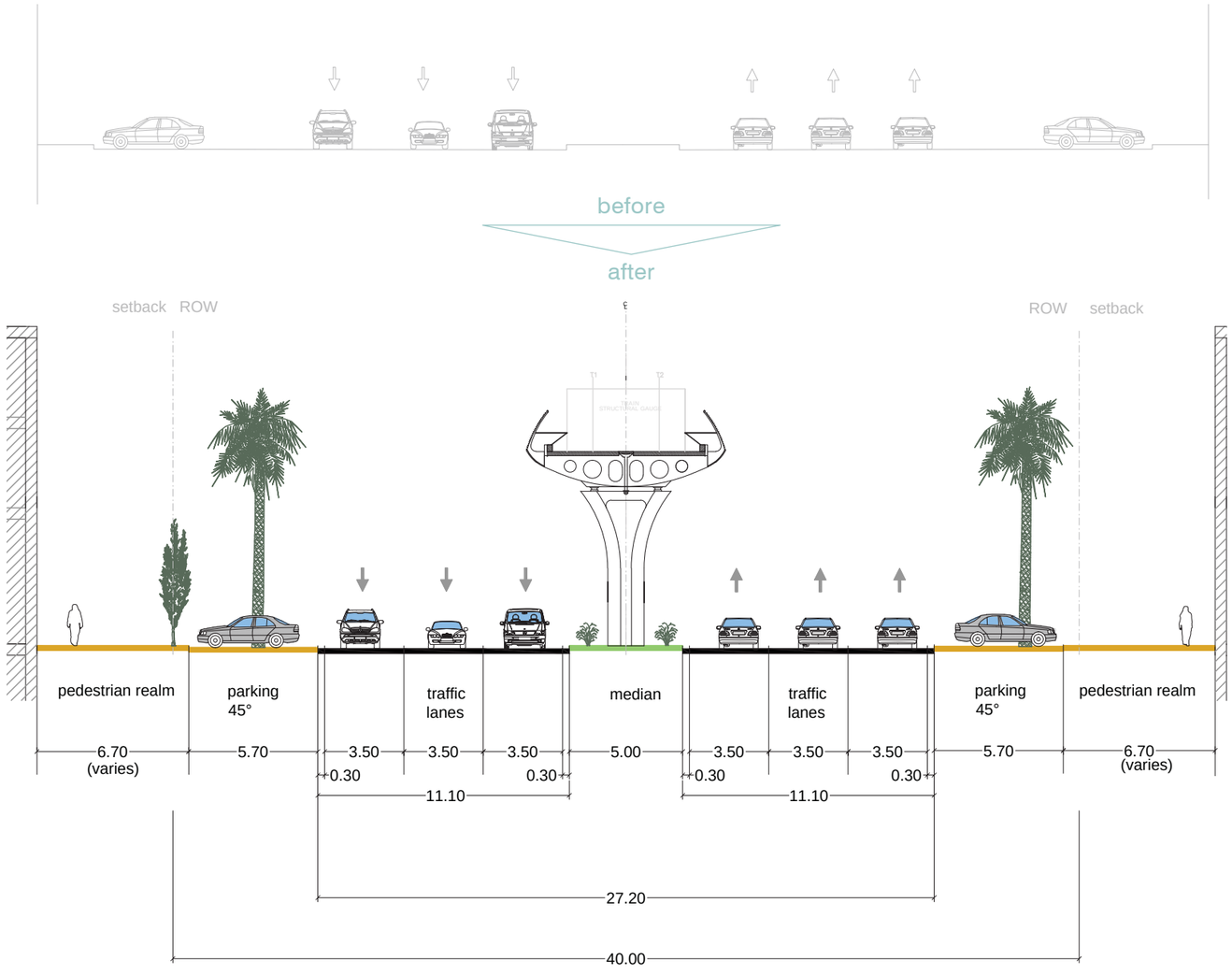


Figure 5.58 Sample cross-section 40m ROW + setbacks

Sample Cross-Sections

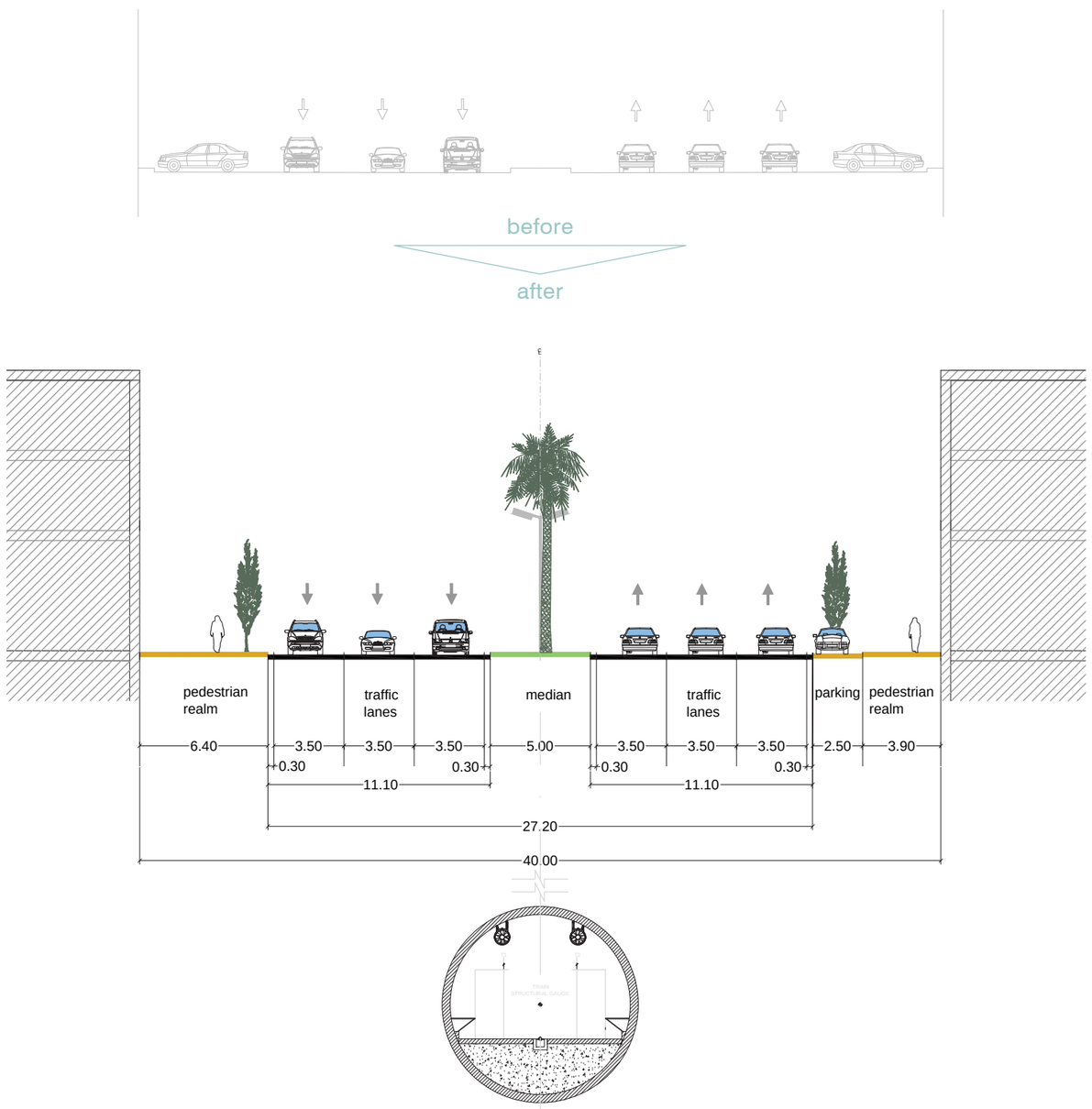


Figure 5.59 Sample cross-section – 40m ROW without use of setbacks

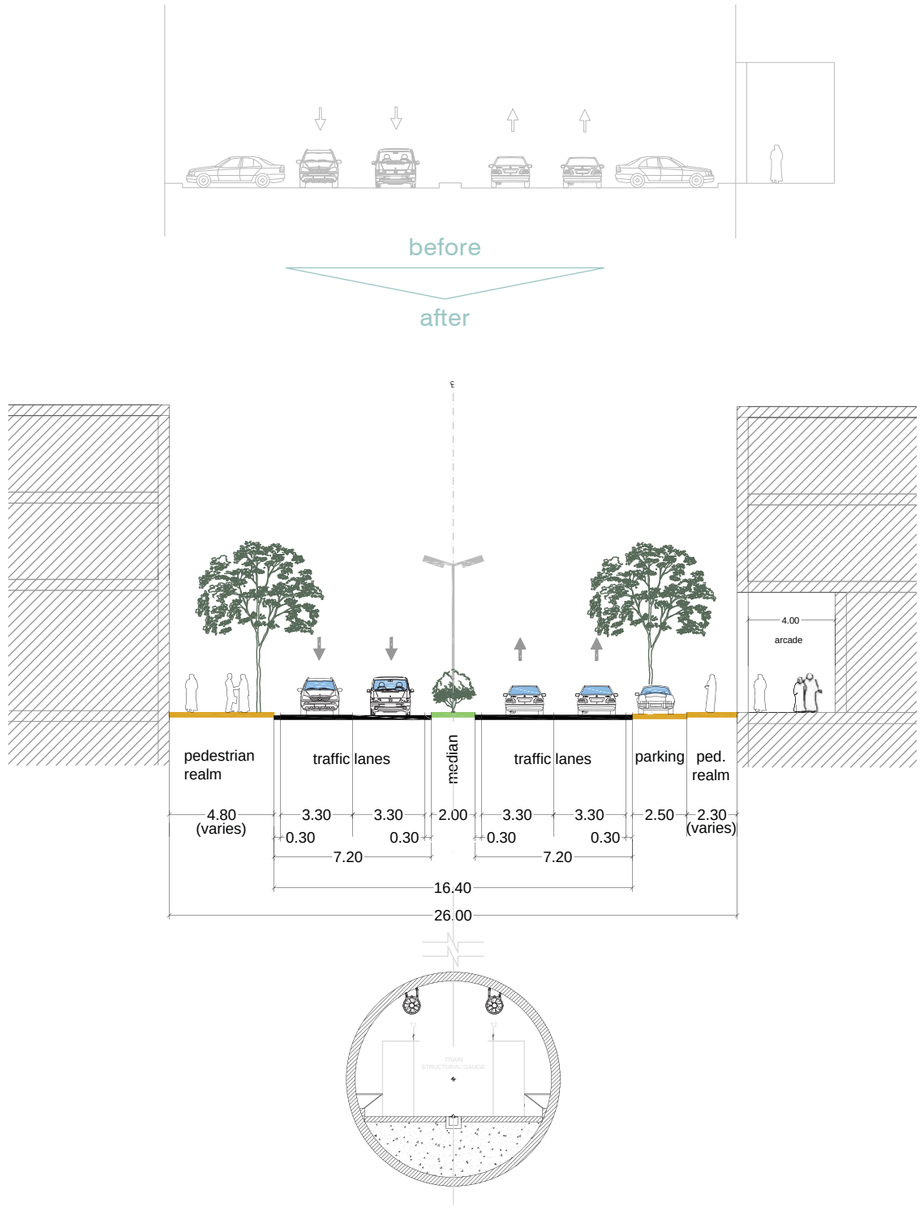


Figure 5.60 Sample cross-section – reduced availability of ROW

Sample Cross-Sections

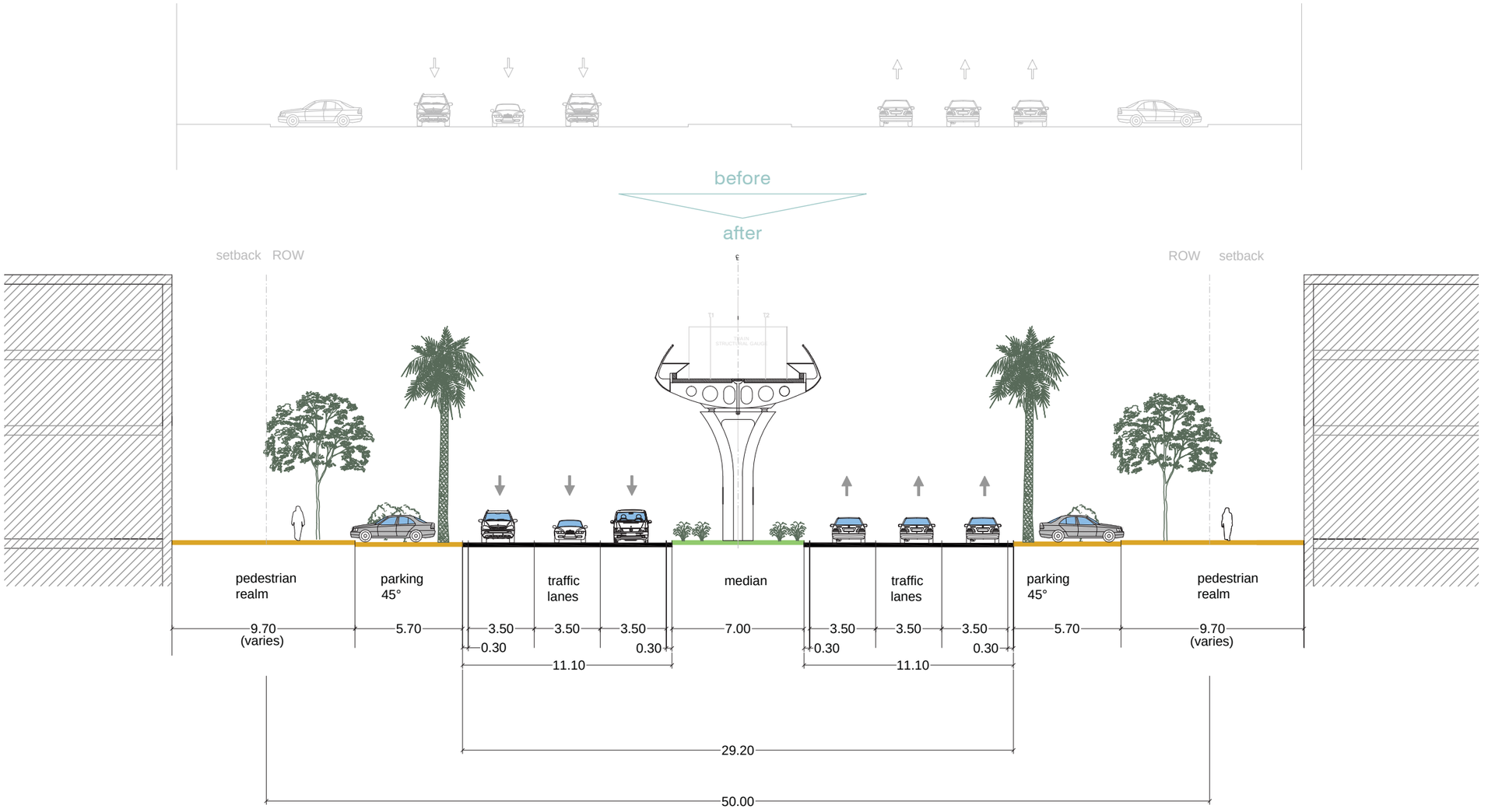


Figure 5.61 Sample cross-section – increased availability of ROW

Sample Cross-Sections

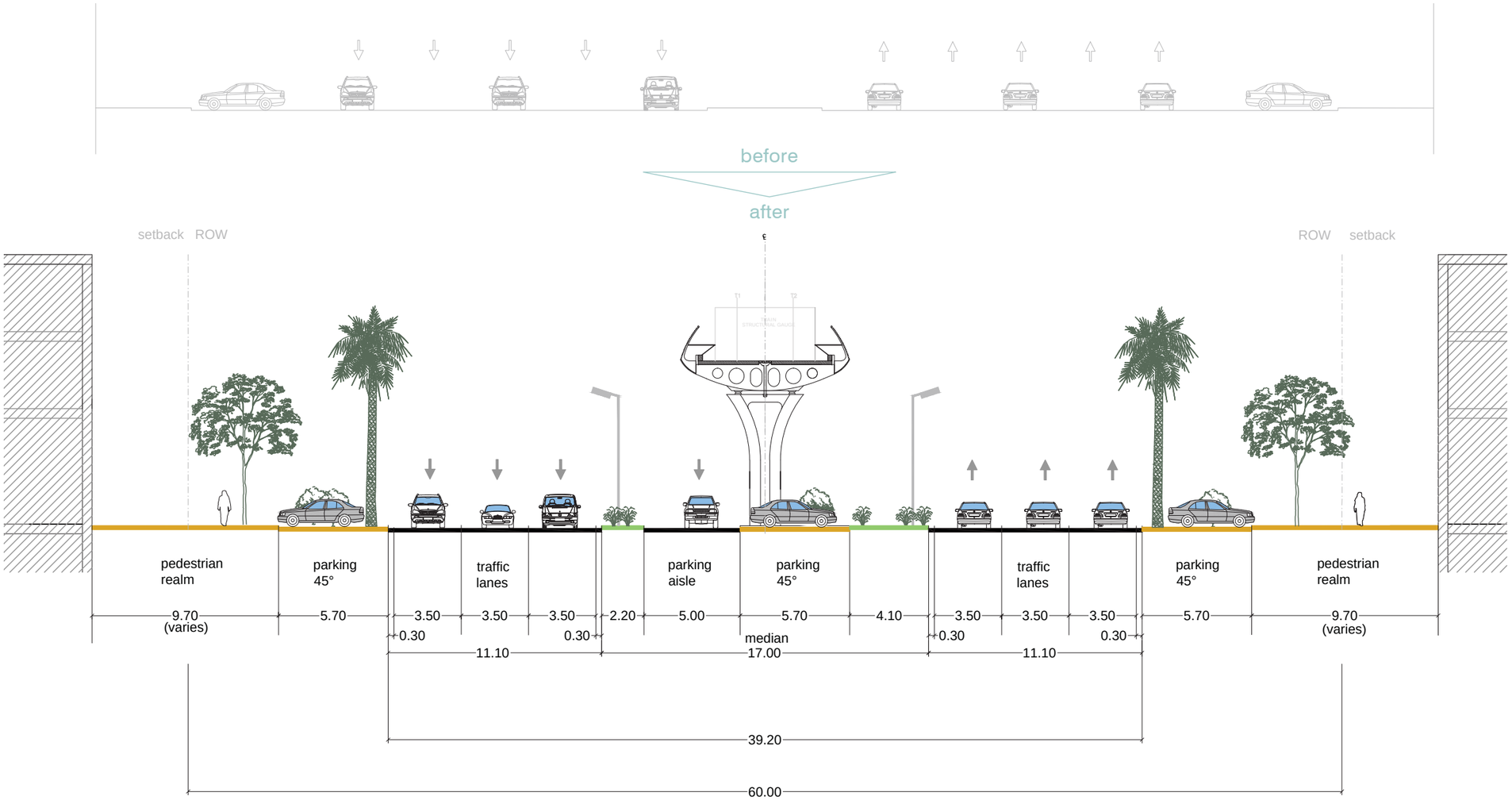


Figure 5.62 Sample cross-section – overprovision of ROW, use of median for additional parking - utilise central median additional (shaded) parking, i.e. near Jumma Mosque, without impacting on walkway boulevards

Sample Cross-Sections

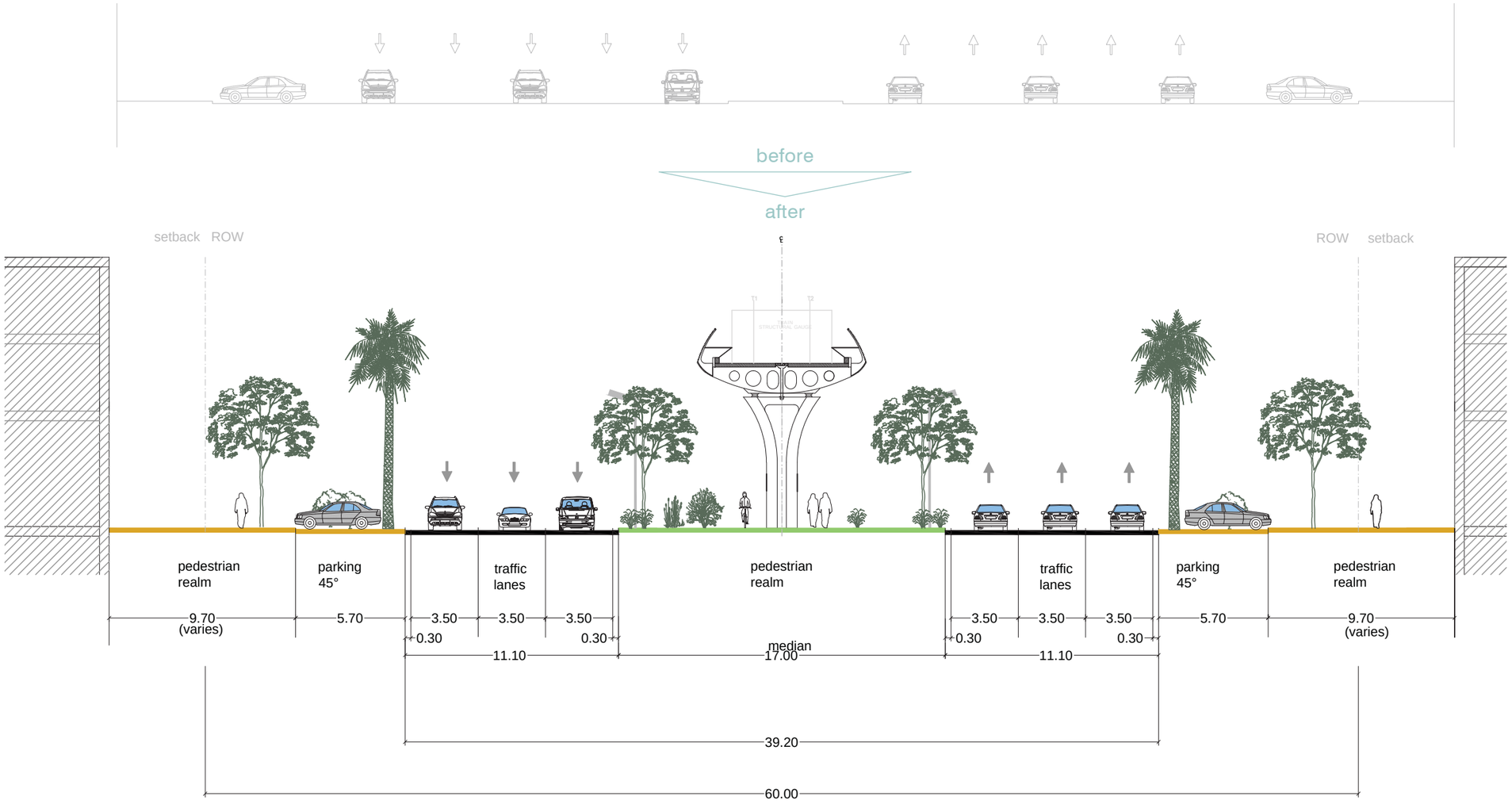


Figure 5.63 Sample cross-section – overprovision of ROW, use of median for public realm - utilise central median for public realm/ intensive landscaping - reduce impact of traffic

Sample Cross-Sections

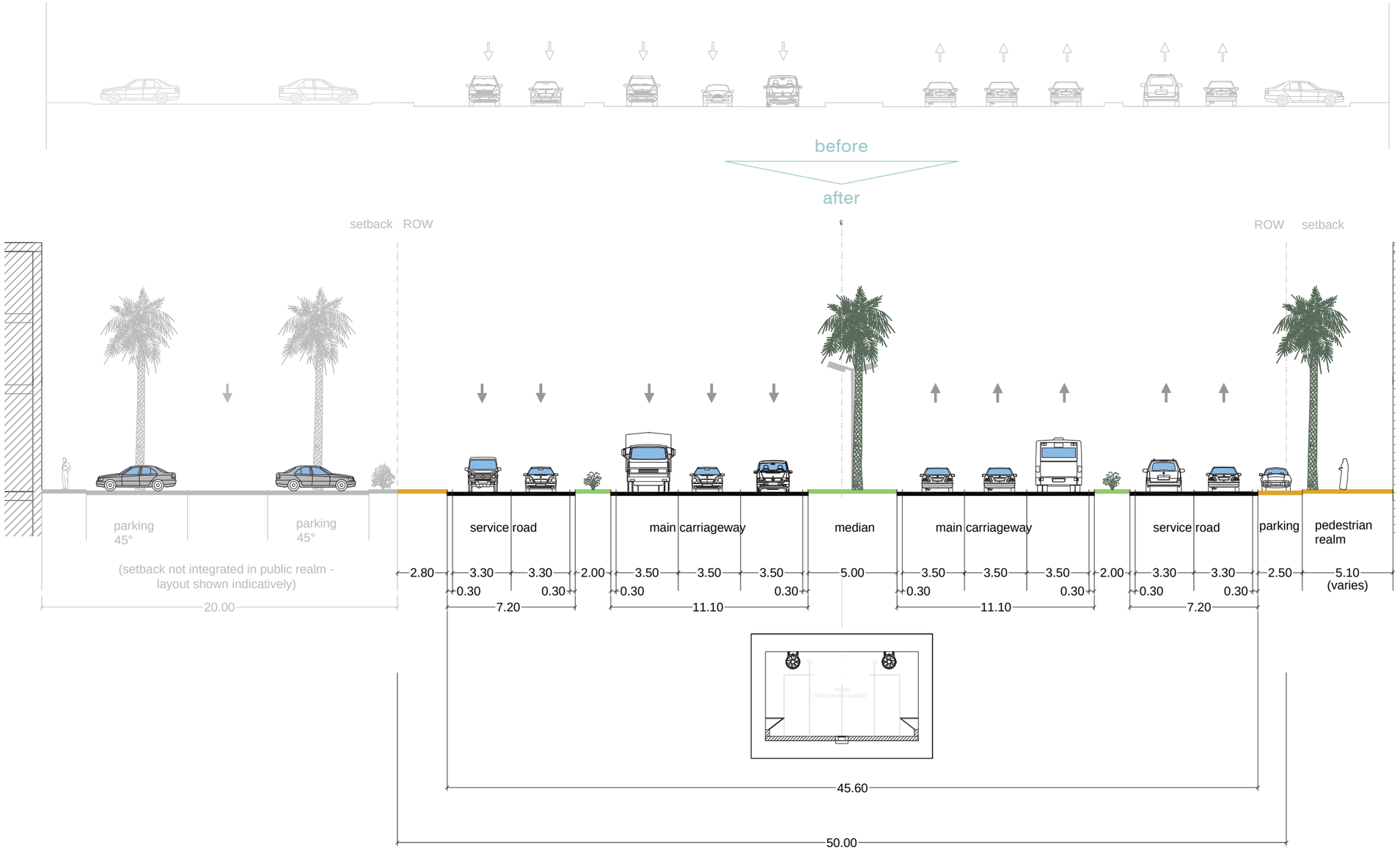


Figure 5.64 Sample cross-section – 50m ROW incl. service road, separate large setback

Sample Cross-Sections

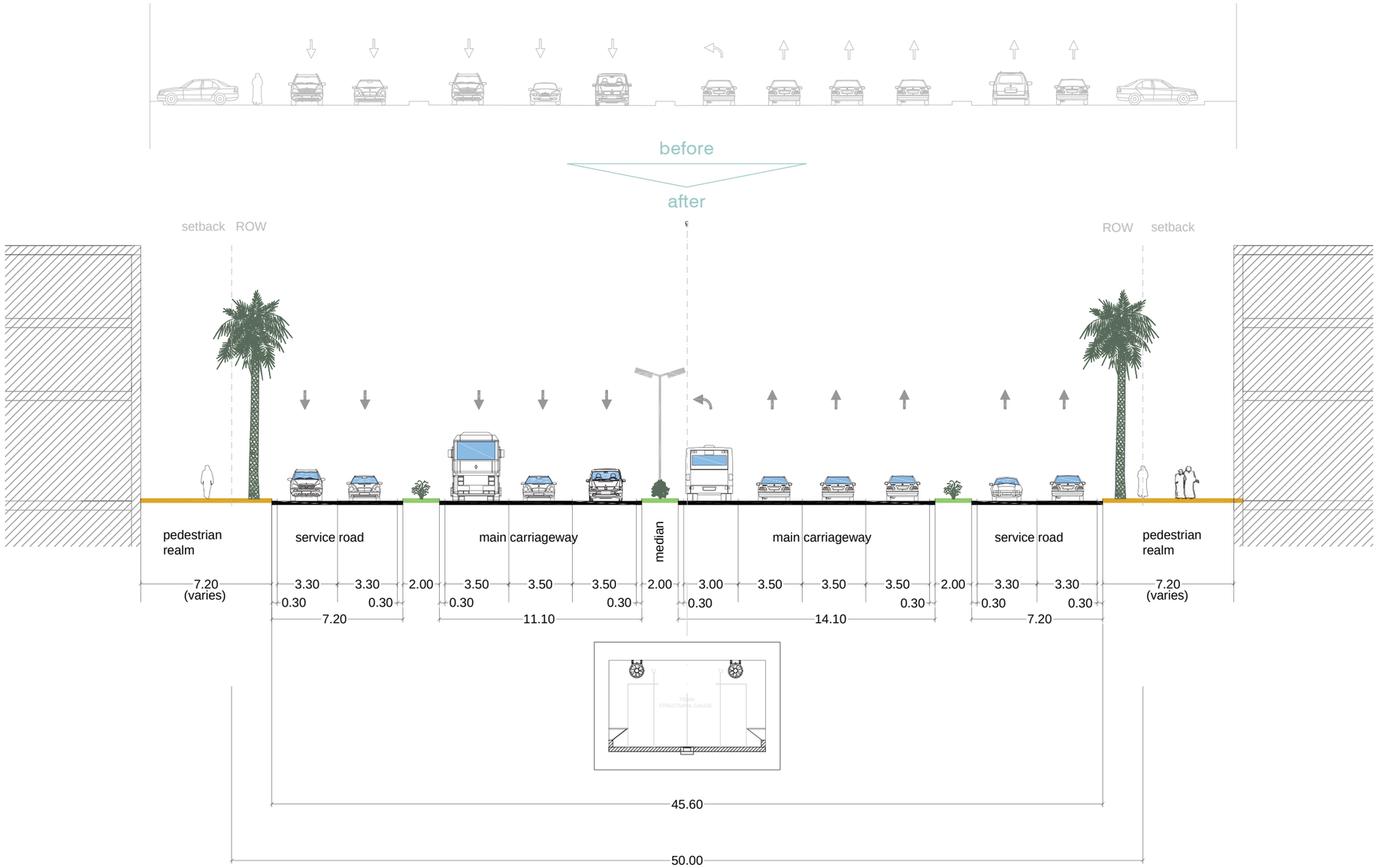


Figure 5.65 Sample cross-section – 50m ROW incl. service road

Sample Cross-Sections

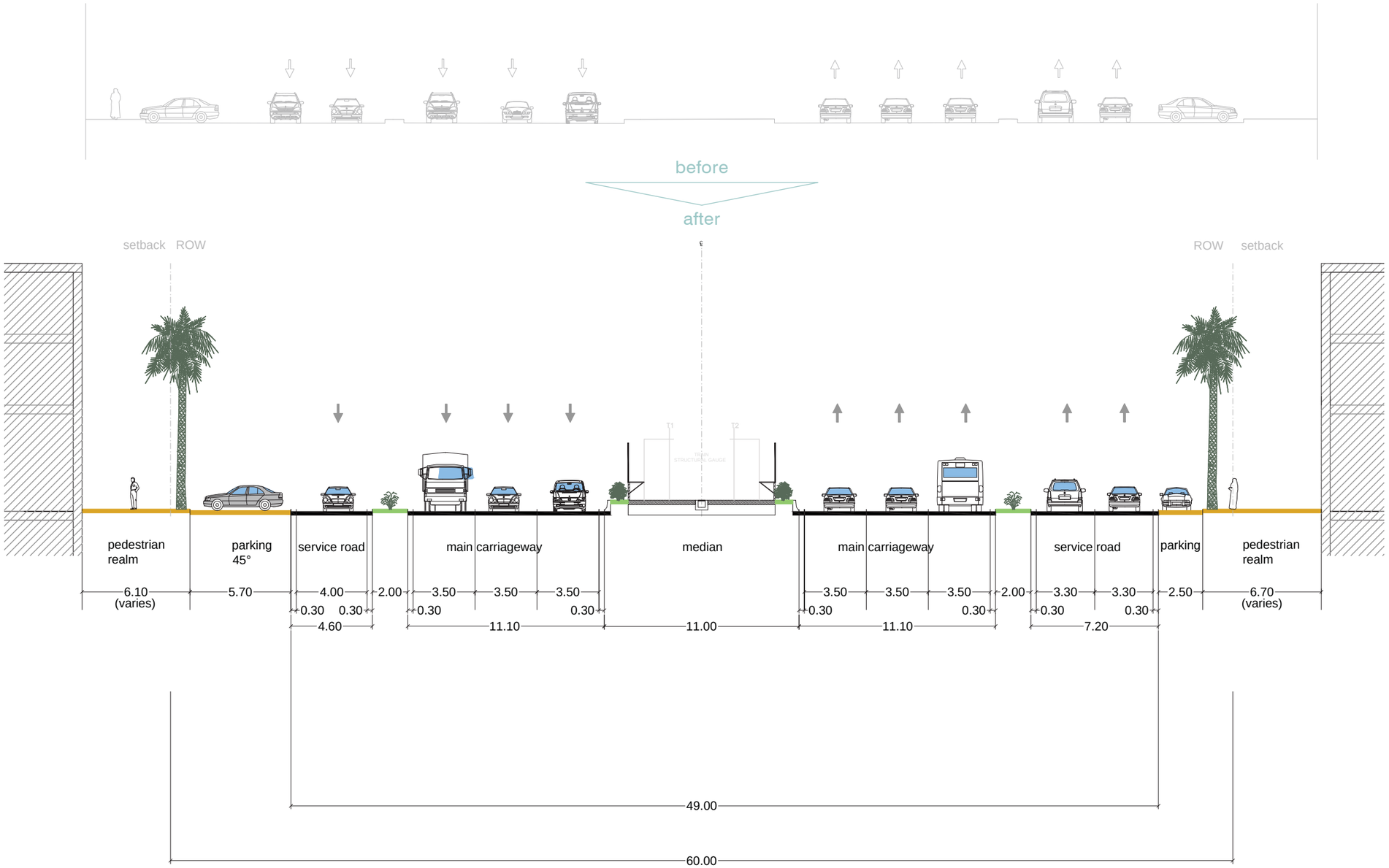


Figure 5.66 Sample cross-section – 60m ROW incl. service road

5.2 Hardscape

5.2.1 Introduction

The term ‘Hardscape’ describes the spatial elements which form the urban realm, such as surface materials, furniture and structures.

In order to achieve a desirable level of unifying design elements across the public realm and to respond to the contemporary design aspirations of the client and the design manual; specific requirements have been formulated in relation to the following:

- Surface materials.
- Lighting.
- Street furniture & structures.

The emphasis for material selection has been placed within the pedestrian public realm rather than vehicular carriageways. The philosophy for material selection is the concentration of higher quality finishes to transportation nodes or special areas, (e.g. where people congregate), rather than a homogeneous blanket of standard materials along all metro lines.

As part of the design manual approach, this document provides the designer, a concise yet flexible series of ‘Toolbox’ tables which lists the recommended surface materials or planting against the identified urban street type. In addition to the recommended surface material or tree/ plants, the tables provide additional details such as dimensions, spacing, bonds and finishes. In essence, the designer is given the ingredients or spatial elements to create the urban realm and streetscape. Supplementary illustrative design information is provided with detailed design exemplars, indicating ‘typical’ design solutions for each specific street type.

The lighting, street furniture and structures have been collated into a series of data sheets which provide design intent, objectives and technical considerations.

Figure 5.67 Streetscape with bollards in Berlin/ Germany

Figure 5.68 Informal seating and lighting - London UK

5.2.2 Surface Material Selection & Technical Guidance

The selection of materials chosen for the urban realm has been based on the following considerations:

- Sustainability – Where possible, surface materials shall be sourced or produced locally within the Kingdom. If not readily available, then a suitable local partner or manufacturer could be found who can achieve the required quality and finish.
- Finishes and colours which are appropriate to the local vernacular.
- High quality, robust and suitable for their intended use, (slip resistant), easy to replace and maintain.
- Paving units to incorporate chamfered edges and spacing nodules to ensure even laying and the reduction in chipped or damaged edges.
- At corners and transitions, continuous kerb elements should be used (avoid using faceted kerbs).

Figure 5.69 High quality paving with different surfacing materials and contrasting colours

Figure 5.70 PCC paving units with chamfered edges

Figure 5.71 Locally sourced Riyadh limestone pavers

5.2.3 Designing for the Physically and Visually Impaired

At present, the Kingdom of Saudi Arabia has no definitive set of design regulations relating to accessibility for people with visual impairments or mobility issues. With this in mind, this manual aims to provide generally accepted best practice examples and references to appropriate guidance in Europe and America, rather than provide detailed bespoke national guidance. Amongst other sources, further guidance can be found here:

- 2010 ADA (Americans with Disabilities Act) Standards for Accessible Design, www.ada.gov.
- Building for Everyone: A Universal Design Approach, www.universaldesign.ie.
- Code on Accessibility in the Built Environment 2007, Singapore Building and Construction Authority, Appendix H.

In the absence of national guidance, the following points are general design aspirations, which should apply to the public realm surface design. It is worth noting, that if any adopted guidance relating to accessibility is implemented, then it must be of a national and accepted standard and consistency, rather than an 'ad hoc' approach.

Access, Surfacing and Changes of Level

- Consider access routes, levels, gradients and site layout at earliest possible stage.
- Design access routes so they are legible, easy to use, and offer choice. Supply level or flush access routes away from vehicles.
- Provide taxi ranks in appropriate locations.
- Be careful that no street furniture is obstructing access routes.
- Include resting places (seating etc) at intervals along longer sections of road.
- Provide a recommended clear width of 1.8m wherever possible.
- Provide passing places where footpath or route is restrictive or too narrow.
- Ensure width is not less than 1.2m on short constricted sections of an access route.
- Ensure ramp gradients do not exceed 6%
- All proposed surfacing should be slip resistant to the required and relevant adopted and recognised standards.
- Blistered 'tactile' surfacing should be installed at all proposed controlled and uncontrolled pedestrian crossing points, where the paving will additionally incorporate a dropped flush kerb, to aid wheeled mobility. The blister 'tactile' surfacing will help indicate to pedestrians with visual impairments, that they are approaching a carriageway crossing and should exercise caution.

Figure 5.72 Precedent image: Integrated ramped access with steps, allowing wheelchair access to retail units. See detail below.

Figure 5.73 Simple solution to provide access to shop entrances via ramp

- Tactile guidance path surfacing should be used to guide visually impaired people along a route when the traditional cues, such as a property line or kerb edge are not available. It can also be used to guide people to a specific location; and in transport terminals to guide people between facilities.This surface should be used sparingly and only after consultation with relevant visual impairment groups.
- Construction of external ramps for level access - external ramps should not exceed a certain gradient, (varies from country to country but generally accepted as 1:16/ 6%).

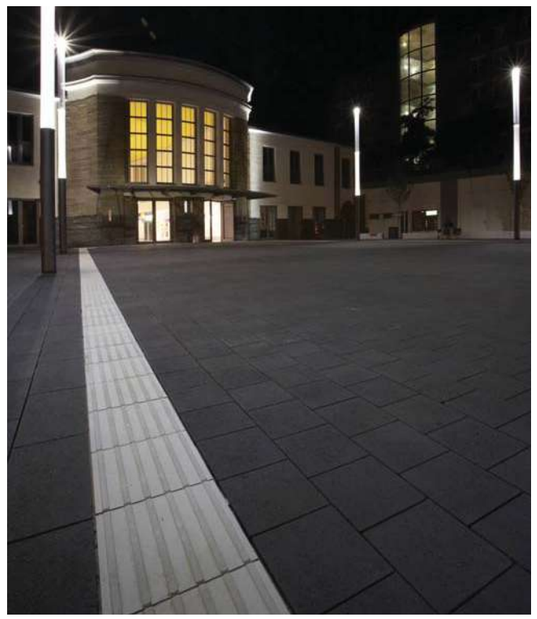


Figure 5.74 Corduroy guidance strip in contrasting tone

Figure 5.75 Obstructions at pedestrian crossing - King Abdullah Road

Figure 5.76 Drop-kerb with appropriately sloped walkway, but missing tactile paving – King Abdullah Road

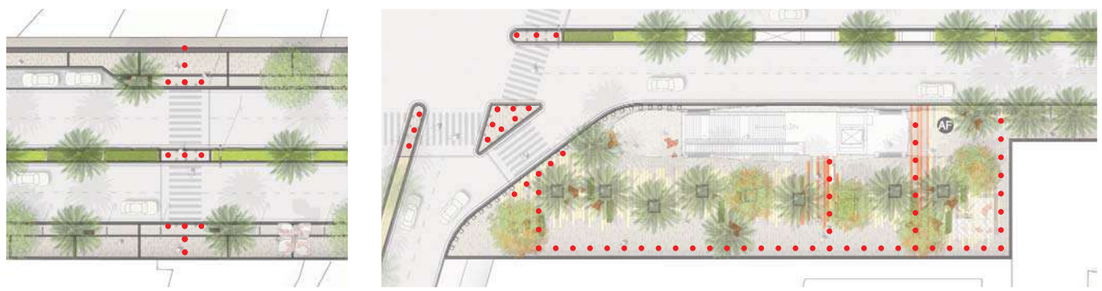


Figure 5.77 Tactile paving layout at pedestrian crossings and stations

- Proposed external steps should incorporate a contrasting nose strip and anti slip banding to all tread units. In addition, many standards stipulate the requirement of handrails and corduroy strips to the top and bottom of stairs, (See Technical Guidance).

Pedestrian Crossings

- Provide level or flush crossing points at all controlled crossing points, junctions at side roads and other access points.
- Ensure crossings incorporate dropped kerbs at both sides.
- Locate crossings where they are safe and convenient for all road users.
- Ensure recommended 1.2m width of level surface to the rear of walkway at a crossing point.
- Make sure crossings are well drained and lit.

Street Furniture

- Ensure all street furniture contrasts visually with background to aid visual legibility for the visually impaired.
- Ensure overhead signs and fixtures provide clearance of 2.3m to the path or walkway.
- Ensure drinking fountains are suitable for both seated and standing use.

- Provide seating at regular intervals, away from pedestrian throughfare.

Parking Bays for the Disabled

- 1.5m clearway required for opening of vehicle door / wheelchair access. This can be either part of the parking bay or within the adjacent public realm (kerb or furniture zone).
- Drop kerbs are required adjacent to the parking bay to enable ease of access.
- Parallel disabled parking bays need to be min 6.50m length to allow unhindered access to the rear of the vehicle.

Figure 5.78 Ramp with integrated handrail and upstands to sides

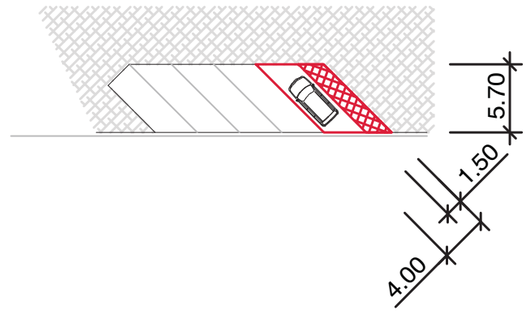


Figure 5.79 Accessible Parking - 45 Deg

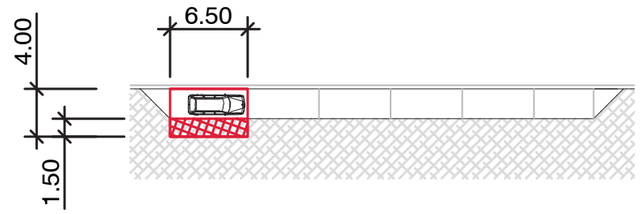


Figure 5.80 Accessible Parking - Parallel

Technical Guidance

- At crossing points, the tactile surfacing should extend for the full width of the dropped kerb and for a depth of at least 800mm.
- External steps should not be less than 1200mm wide.
- Corduroy paving should be installed at the top and bottom of steps, 400mm back from the edge of the step/ start of ramp and 800mm deep.
- The colour of the proposed tactile paving needs to contrast with the surrounding surfacing. This is to assist the partially sighted.
- The type of material used should aesthetically match the surrounding paving material, albeit in a contrasting tone. 400 x 400mm unit paving is generally used and can be either pre cast concrete or natural granite, this is dependent on the designers intention. Individual brass or stainless steel studs can also provide an attractive alternative.
- Design dimensions of Blister paving – Parallel rows of flat topped blisters, 5mm high, and 25mm in diameter.
- Design dimensions of Corduroy paving – Rounded bars 6mm high, 20mm wide and spaced 50mm apart.

Figure 5.81 Corduroy paving on top of steps

- Design dimensions of Guidance paving comprises a series of raised flat topped bars running n the direction of pedestrian travel. The bars are 5.5mm high, 35mm wide and are speced 45mm apart. A contrasting colour to the surrounding area should be used to help the partially sighted.
- All hard paving surfaces to incorporate crossfalls between 1.5 & 2.0 % to aid surface water run off.
- Applicable Standards

B.S. - British Standards Institute.

DIN - Deutsches Institut für Normung

Figure 5.83 Tactile & blister paving

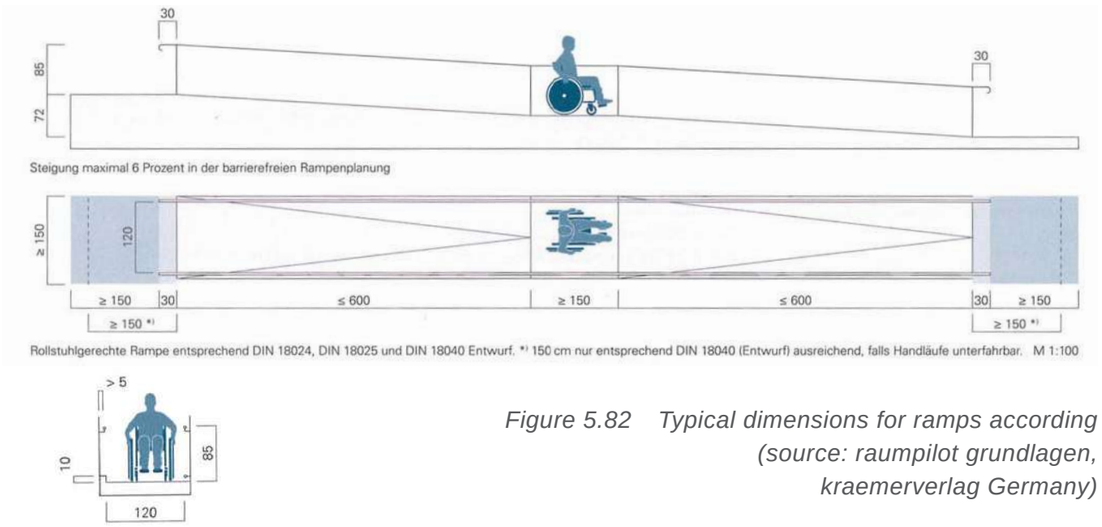


Figure 5.82 Typical dimensions for ramps according (source: raumpilot grundlagen, kraemerverlag Germany)

5.3 Softscape

5.3.1 Introduction

The ‘Softscape’ can be defined as external vegetation or planting, which comprise of the following:

- Trees.
- Hedges.
- Shrubs & Grasses.
- Ground Cover.

The intended planting palette proposes to reinforce the urban realm and provide an attractive ‘soft’ backdrop to the built environment and proposed metro system. The planting philosophy is one of a gradual increase in the density and variety of species to suit the street type/ land use hierarchy. At special places of interest and transportation nodes, a distinctive character, of form, colour and texture will create a sense of place and provide additional interest and important shading.

Alongside the material and furniture toolboxes, a dedicated planting toolbox is also proposed. This provides the designer with a selection of tree and plant species, partnered with the pre- identified urban street type. In addition, there will be supporting information, such as planting dimensions, densities and sizes. To illustrate the design intent, supplementary information is provided via illustrative exemplars, indicating ‘typical’ arrangement solutions for each specific street type.

Figure 5.84 Date palm trees (Phoenix dactylifera)

Figure 5.85 Mixed groundcover planting

Figure 5.86 Suitable street tree (Dalbergia sisoo)

Figure 5.87 Clipped hedge (Dodonaea viscosa)

Figure 5.88 Ornamental grass as a groundcover (Pennisetum)

5.3.5 Planting Objectives and Specification Requirements

A set of general planting objectives are outlined below, these are to apply to all planting proposals. Further specification requirements can be found within the appendix. These are not exhaustive but should be supplemented with further professional input and advice.

- All plant material, including tree species to be indigenous or successfully adopted into the region.
- Areas of turf to be kept to a minimum.
- Where street trees are proposed in a linear format. Tree trenches are to be excavated in preference to individual tree pits. This is to help ensure that the trees are provided with the best possible root zone to aid successful establishment.
- Consider the most appropriate plant species for the intended location and select trees to optimise canopy cover (shading).

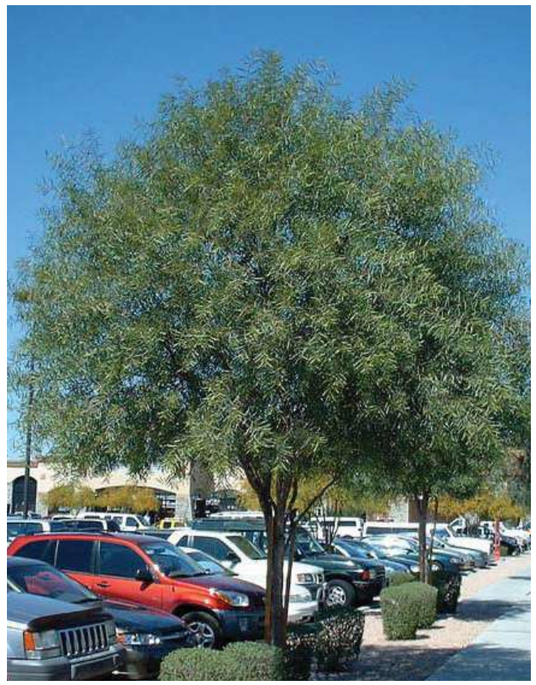


Figure 5.89 Arid climate street tree (Acacia salicina)

Figure 5.90 Colourful flowers help to create a sense of place (Cercidium floridum)

5.3.6 Irrigation Requirements

- All water proposed for irrigation purposes is to be reclaimed or recycled. This includes grey water systems, storm water collection and other secondary and approved sources.
- All irrigation lines to be drip type. No spray irrigation will be permitted.
- All irrigation regimes to operative during non-daylight hours.
- All irrigated areas are to include mulched surface to help retain moisture.
- All irrigation to include maintenance proposals and regular monitoring to ensure successful and efficient operation.
- Where existing ground water levels are high, appropriate plant selection should be considered. This may negate the requirement for irrigation.

5.3.2 Street Trees

Tree planting is an important visual and environmental element within the urban realm and add to the texture and character of the streetscape. In addition to providing contrast and structure, trees can also provide practical benefits such as shading and reduce airborne pollutants. Other important considerations are:

- The minimum recommended planting distance for trees, away from existing buildings and properties shall be 5 metres.
- The minimum recommended planting distance for trees, away from kerbstones shall be 1,50 metres.
- It is important to assess the basic conditions or factors which need to be in place for the establishment of trees to be successful. It is to be expected in Riyadh, that existing services, abandoned basements and structures are to be encountered underneath intended tree routes and tree pit locations. The contractor is to ascertain if any obstacles can be safely removed or cables slewed to permit the construction of the tree pit. If this is not possible, (due to construction constraints or excessive costs), the site engineer shall propose an alternative design arrangement, (with subsequent ADA approval), which avoids below ground obstacles but maintains a

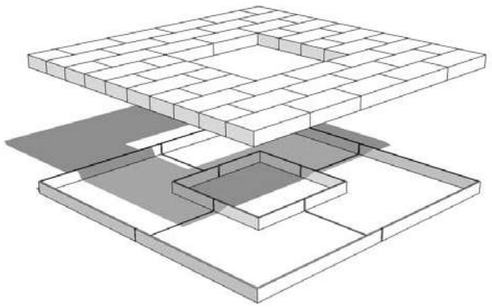


Figure 5.91 Covered treepits with a metal tray that can be filled with paving to be used in narrow walkway locations

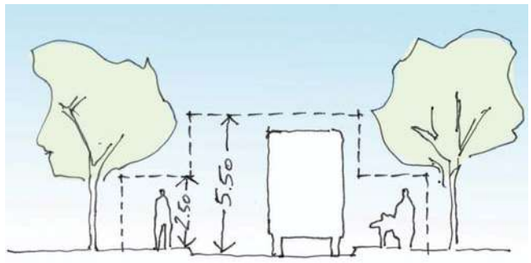


Figure 5.92 Sketch clearance from plant overhang on carriageways and walkways

clear design intent, in keeping with the original proposals. I.e. Trees may be re-orientated in a staggered line or in smaller pockets or if unavoidable, simply omitted.

- The location of underground services – prior to tree pit or deeper foundation construction, the contractor shall undertake an existing services survey to establish the location of all services. Often power lines can be slewed to permit a desired tree planting line, otherwise proposed trees will have to be repositioned, see above.
- Street trees - ideally require as much growing room as possible. The recommended min size of tree pit is 2 x 2 x 2 metres. Where appropriate and the space permits, linear trenches should be used with street tree avenues to maximise the root growing zone. If existing rock is encountered, then additional bore holes to a greater depth are required to ensure adequate drainage. The contractor shall undertake a tree pit soakaway test, whereby the tree pit is filled with water and left over a 24 hour period to observe whether natural drainage is occurring. If water is still present after 24 hours then further, deeper bore holes are to be drilled, positive drainage installed or a raised tree pit/ planter constructed, (to prior ADA approval).
- Where below ground conditions are restricted for root growth development, tree pits shall incorporate modular suspended pavement systems, (rootcells), and tree soil water retention additives.
- Where appropriate and to avoid adjacent damage to structures, services and surfacing, vertical root barriers shall be used to all tree pits and trenches within hard paved areas.
- Where appropriate, the implementation of a root watering system is recommended.

5.3.3 Species Selection

The selections of proposed tree and plant species have been chosen from the recommendations and guidance given in the Arriyadh Development Authoritie's Plant Manual (Landscape Plants for the Arriyadh Region). Additionally, this has been set against a list of other significant requirements, listed below:

- Indigeous or successfully adopted into the region.
- General suitability for the environmental conditions within Riyadh.
- Form, colour, texture and shading ability.
- Availability and ease of maintenance.

5.3.4 General Planting Specification Requirements

It is important that careful attention is given to the implementation of tree and plant material to ensure their successful establishment. In addition to appropriate species selection, routine maintenance regimes are vital and should be part of a citywide strategy.

General Maintenance Procedures for Trees/ Shrubs/ Hedges

Regular and thorough maintenance of newly planted trees and vegetation is important to ensure their successful long term establishment & visual appearance. A regular maintenance regime is recommended, which includes some or all of the following elements. The list is not exhaustive but can be adapted to suit local conditions and species requirements.

- Watering - including the checking of irrigation lines.
- Weed control.
- Checking - adjusting and replacing tree ties and stakes, including their removal once trees are established.
- Refirming of Trees and Shrubs.
- Checking of tree surrounds - topping up infill's to base of trees if required.

- General pruning – trimming excessive overhang or growth where required. Tree crown lifting, reduction and thinning - e.g. min 550cm clearance required for vehicles within carriageway and 250cm for pedestrian walkways.
- Tree canopy clearance - maintain a overhead clearance to facilitate vehicular access and avoid obstructions to the carriageway and footway and maintain visual transparency to shop frontages.
- The following overhead tree canopy clearance figures shall be maintained by regular maintenance. This will be achieved by crown lifting, thinning and reduction:

- Min 550cm clearance required for vehicles within carriageway
- Min 250cm - 450cm clearance required for pedestrian realm (footways). Above 250cm will only apply to suit visual transparency to retail frontages (to allow signage visibility). This is to be assessed on a site by site basis as required.

- Removal and reinstatement of dead, dying and diseased plants.
- Soil/ Ground aeration.
- Litter and graffiti removal.

Figure 5.93 Sketch illustrating canopy clearance zones to pedestrian realm and carriageway

Additional requirements:

- Planting qualities/ sizes shall be as follows - palm trees: 4m trunk height, deciduous trees: 3m trunk height.
- All plant material shall be supplied in accordance with the following minimum national standards:

Ministry of Communications, Kingdom of Saudi Arabia

ASTM. - American Society for Testing and Materials Standards

B.S. - British Standards

DIN. - Deutsches Institut für Normung

- The contractor shall check the existing below-ground conditions prior to planting trees, with particular reference to impermeable ground conditions, existing services and hidden building foundations/ structures which may prevent establishment.
- The quality of the tree and plant material shall be of a high and consistent standard and this should be maintained throughout the development, with all areas benefiting, (regardless of street category), from quality and consistency.
- All tree and shrub planting shall incorporate drip irrigation systems and will receive the requisite amount of water to ensure healthy establishment.

5.4 Lighting & Street Furniture

Street furniture can be categorised as vertical elements within a road environment and are generally located within the pedestrian zone. Uncoordinated and inappropriate street furniture can create a problematic and cluttered environment for pedestrians and people with mobility issues such as wheelchair users and the visually impaired. Certain elements, such as traffic signs and signals have particular fixed location requirements, whilst others will be located within a preferred location. Details of the surface hierarchy and furniture zone are outlined in Chapter 3.

The selection of external furniture elements consists of the following:

Lighting

Street Furniture

- Litter Bins.
- Seating.
- Cycle Stands.
- Bollards.
- Tree Surrounds.
- Tree Protection Bollards.
- Raised Planters.
- Drinking Fountain.
- Feeder Pillars/ Utility Cabinets.
- Utility Covers.

Signage, Wayfinding & Information Boards

- Directional Signs.
- Wayfinding.
- Information Panels.

Public Art

Special Items

- Shading Structure.

Figure 5.95 Precedent image: Exterior pillar lighting

Figure 5.97 Precedent image: Information board by fwd UK

Figure 5.94 Precedent image: Modular shading structures

Figure 5.96 Modular shading structures proposal for KAR project (sketch by AS&P)

Figure 5.98 Precedent image: Wayfinding/ signage integrated with retaining wall

Product Selection

Rather than select a series of specific ‘off the shelf’ products, (most likely from within the EU or USA), thus increasing costs due to shipping etc, and/ or the requirement for obtaining spares, we have provided a series of data sheets which sets out the design intent or aspiration for the specific items or families. The forms have been designed to provide a coherent theme or ‘DNA’ which runs as a common thread through the proposed streetscape design.

The design is based on a clean geometric contemporary form which takes its inspiration from the modern METRO station designs and local design vernacular.

It is suggested that a procurement partnership is nurtured with a local manufacturer, who can ensure the quality and consistency required. This has its advantages in terms of cost, logistics, maintenance and replacements.

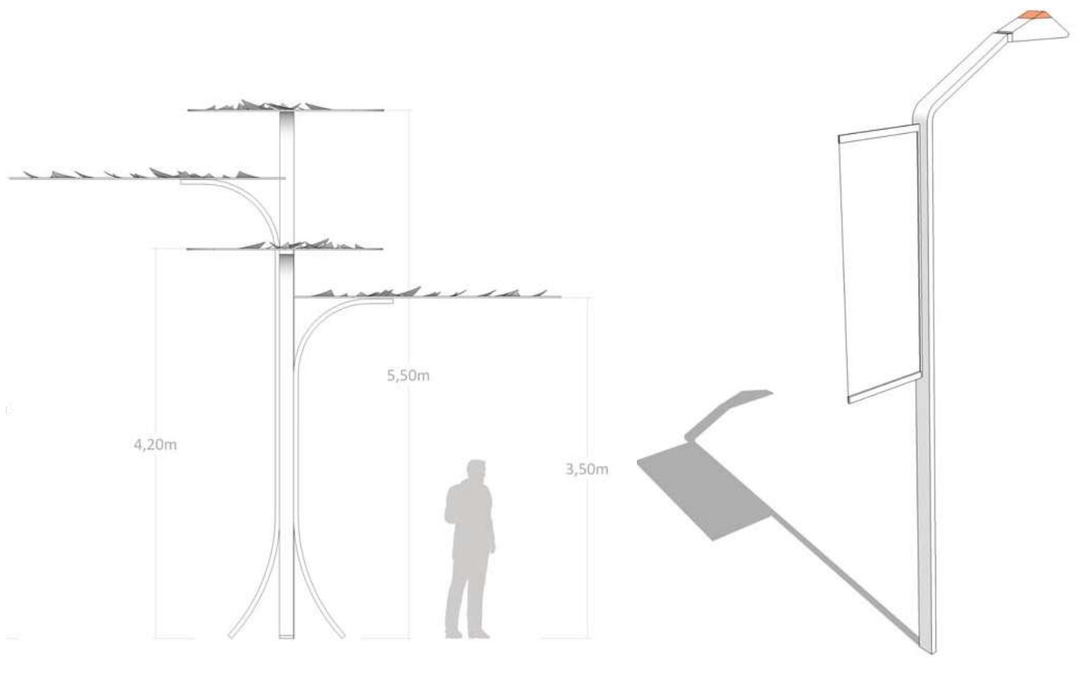


Figure 5.99 Selection of bespoke street furniture, lighting & signage family for the Riyadh METRO corridors (design intent - n.t.s.)

General Furniture Specification Requirements

All surface materials and furniture elements shall be required to meet the minimum of the following standards:

- Ministry of Communications, Kingdom of Saudi Arabia.
- ASTM. - American Society for Testing and Materials Standards.
- B.S. - British Standards.
- DIN. - Deutsches Institut für Normung.

Lighting Specification Requirements

All lighting and wiring shall be required to meet the minimum of the following standards:

- Ministry of Communications, Kingdom of Saudi Arabia.
- European Committee for Electrotechnical Standardisation (CENELEC).
- ASTM - American Society for Testing and Materials.
- B.S. - British Standards Institute.
- DIN - Deutsches Institut für Normung.-
- A member of the design team should include a lighting engineer or designer who can calculate and specify the accurate Lux level requirements/ appropriate lighting design class.

5.4.1 General Location Principles & Technical Guidance

The following section deals with a number of general recommendations which should be considered prior to locating furniture within the streetscape. Additional information is contained in a series of data sheets which provide design and technical guidance to families and individual items of furniture. See datasheet section in the rear of the document.

Primary considerations relating to the positioning of street furniture elements.

- Available space within the Right of Way.
- Adjacent land uses.
- Parking and access requirements.
- Pedestrian routes and user requirements.

5.4.2 Materials & Finishes

The philosophy behind the street furniture materials, finishes and colours is to have a range of elements which assume a neutral balance within the streetscape whilst being elegant but unassuming. A limited range of high quality materials and finishes which blend into the streetscape and minimise visual intrusion is the aspiration. Lighting columns and bollards should be finished in a mid grey. This mid tone helps the visually impaired with legibility and navigation.

Materials for Streetscape Elements

- Stainless Steel.
- Mild Steel.
- Cast Aluminum.
- Galvanised Steel.

Colours

- Branding identity, METRO livery, local identity cues
- Standard Ral Colours or equal and approved.

Finishes

- Generally hot dipped galvanised and polyester powder coated or factory painted, (no in-situ hand painting allowed).
- Lighting Columns, Bollards & Cycle Stands – Ral 9006.
- Seating and other elements, to ADA's approval.

Feeder Pillars/ Utility Cabinets

Objectives

- Utility cabinets shall be located where they do not create an obstruction, physically, (entrances or loading areas), or visually with proposed vehicular sight lines.
- Avoid utility cabinets being located within pedestrian areas, if their placement would reduce the footway to below 1800mm in width. Alternative locations shall be sought which are unobtrusive and sensitive to the surroundings.

Design Aesthetics

- The design of the utility cabinets could be coordinated with the city authority and a single model utilised, rather than numerous types and designs. This should be contemporary in design. Colours and finishes shall be uniform, robust in their durability and match the proposed furniture palette.
- If sited within an area of proposed vegetation, then a 500mm paving zone shall be provided to enable ease of access and maintenance.

Utility Covers

Objectives

- Where possible, all utility covers shall be re-orientated to run square or in line with the proposed paving bond. New covers should be positioned at a natural break in the paving.
- Proposed utility covers shall be coordinated with the final public realm design to ensure that they are located to avoid proposed trees and structures or straddling kerb lines etc.
- Recessed covers shall be utilised where appropriate and infilled with the proposed surrounding surfacing, maintaining the paving bond.

Miscellaneous Infrastructure Elements

- Additional external elements such as fire hydrants, above ground telecommunication cabinets, parking control systems and separate lighting control systems should be located to the rear of the pedestrian footway and preferably to the edge of the furniture zone.
- Where appropriate, cabinets can additionally be positioned against building lines or against solid vertical structures, as long as they do not create any obstruction to the pedestrian through zone. Refer to feeder pillar comments for additional and applicable information.
- Ideally, elements should be integrated with the general arrangement of other furniture within the public realm.
- Cabinets should be unobtrusive and painted black to help them blend into the background.

Water Features

- Water features require careful consideration and planning before they are implemented. All too often water features are incorrectly positioned or are under maintained, often resulting in them becoming redundant or being infilled with planting. It is recommended that a professional consultant is engaged to oversee the design and planning stage, ensuring the client and designers aspirations are acheived.

Design Considerations

- Location - ensure that there is sufficient space to integrate a water feature into the public realm. Allow for access and ancillary items such as pumps and water tanks.
- Maintenance - keep water features simple and easy to clean and maintain. Allow within budgeting for regular maintenance and repair.
- Safety - consider whether pools of water are to be a danger if small children are left to play nearby. If necessary consider recessed jets for interactive play and multi functional use.
- Wind - consider local wind speeds as jets of water can be displaced and wet adjacent surfaces. Ensure surrounding surfaces are slip resistant.
- Drainage - plan for adjacent drainage and paving gradients to drainage excess fountain water from nozzles and jets.

5.4.3 Public Art

Objectives

- Public art can contribute to the enhancement of our towns and cities, creating a special feature or vital clues to a particular heritage. It could be used to identify a location or aid orientation, creating a sense of place.
- Public art can be permanent or temporary. The element could be a single freestanding unit or a sequence of items that are integrated within the public realm, (furniture, branding etc).
- Proposed areas for public art include transport interchanges, strategic public spaces or simply gathering points.
- An artist or group of artists or even local community involvement and competitions could be considered as possible sources of commissions etc.

Possible Components

- Sculpture.
- Poetry - Text.
- Murals.
- Paving Surface.
- Furniture & Lighting.
- LCD – Display Screens.

Figure 5.100 Furniture as art - Berlin

Figure 5.101 Paving Mural as art - London

Figure 5.102 Water feature & sculpture as art - Berlin

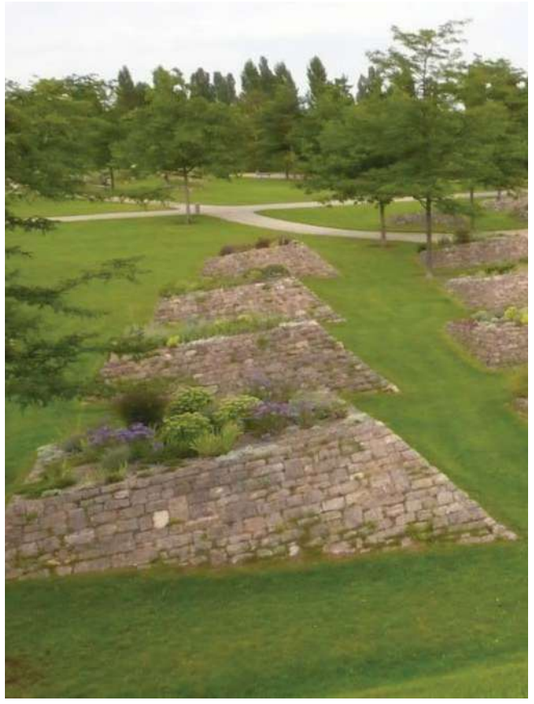


Figure 5.103 Landscape forms as art - Potsdam

Figure 5.104 Lighting sculpture as art - Rome

Figure 5.105 Bicycles with neon lighting as art - Berlin

Suggested themes along METRO lines

Listed below are a series of suggested local themes which could inspire the public art concept or brief. The themes are listed beneath the relevant METRO line numbers and are relevant to the proximety of the stations along that specific route.

METRO Line 3

Wadi Hanifah

- Natural themes - Vegetation, Water, Symbolism of life flow through the city

Madinah Road/ Central District

- Heritage and Memorial
- Falcon Souq
- Masmaq Fortress
- Ancient Mosque
- Representing the ages through Riyadh from ancient fortress city to modern Saudi capital City

METRO Line 5

- Historical Centre
- National Museum of Saudi Arabia
- Municipality & Governmental
- Could represent the macro level Kingdom wide - Landscapes, Cities, Culture

METRO Line 6

- Modern face of Riyadh
- Retail Shopping Mall
- Business Park

Figure 5.106 Natural form as art - Switzerland

Figure 5.107 Place making as art - Denmark

5.5 Design Flexibility

When developing the streetscape along the different sections of the corridor, designers will encounter various conflicts with individual constraints, such as utilities or other obstructions. In particular tree locations may be affected, since tree pits require substantial space underground to facilitate healthy growth and are therefore more likely to come in conflict with existing utilities.

It is therefore necessary that the individual designs react to prevailing site conditions and utilities. A certain level of flexibility in the design approach is therefore crucial for the success of the project.

The spacing schedule and toolboxes given in this manual already permit variations to a certain degree. A few common principles regarding use of the given flexibility need to be considered:

- The given streetscape design aims to provide continuous shading to encourage the use by pedestrians. Adaptations should not jeopardise the concept of continuous shading. For example, the use of shading structures as given in the manual may be a possible solution.
- It should be aimed at providing design continuity; the number of alignment shifts should therefore be limited.
- Alignment shifts should be located in response to surroundings, for example:
  - Highlight specific areas (i.e. seating areas, bus stops).
  - Shift alignment at local access roads, or other natural breaks (i.e. junctions, METRO stations).
  - Shift tree alignment in reaction to visible urban elements (i.e. changing building heights, setbacks or functions).

A number of general rules have been defined with regard to the zones and dimensions given in the manual:

- Shift tree alignment within furniture zone, if possible.
- Trees may be shifted into pedestrian walkway or between frontage zone and pedestrian walkway. However, the minimum width of pedestrian walkway needs to be maintained as a clearway on either side of the trees.
- Avoid shifting single trees only. Ideally, segments of a minimum of 3 trees are being shifted.
- A lengthwise variation in tree spacing should be orientated at the limits given in the spacing schedule. However, a variation of single trees needs to follow the overall design intent as defined in this manual.

The common principles and general rules described above will also help designer to create a transition between differing designs, for example as a result of different urban street types.

Designers can and should vary their designs within the limits and flexibility defined in the toolboxes and schedules of this manual, reacting to the local conditions and atmosphere. Designer shall use the range of elements, patterns and materials given in this manual to create an identity.

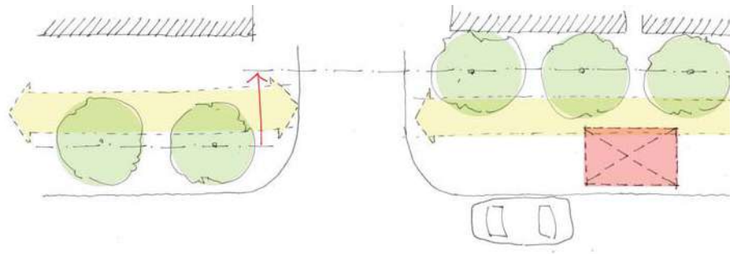


Figure 5.109 Use of local road access to shift alignment

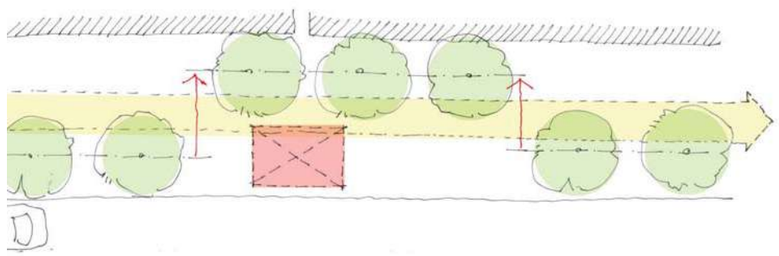


Figure 5.108 Minimum of three trees to shift alignment

5.6 Special Items

5.6.1 Privacy screen along elevated track

The cultural context in Saudi Arabia requires a protection of privacy. This is particularly evident in residential areas, where lots are mostly visually separated from the street and neighboring properties by high walls and screens, protecting the building facades and window openings as well as private external spaces from being overlooked.

In this context, elevated track alignment and elevated stations within existing road corridors of mostly limited width, potentially pose a conflict between the METRO train users enjoying the view outwards toward the streets and beyond, and the residents and/ or users of buildings directly adjoining the corridors. Train speeds usually prevent excessive actual overlooking, however, perceived overlooking might still be caused by moving trains, and trains regularly stop at stations and occasionally en-route.

An obvious tool to prevent overlooking is to enclose the elevated tracks and stations with a non-transparent screen, which potentially could also mitigate noise emissions caused by trains. However, solid screens preventing desirable views into the streets would cause a claustrophobic atmosphere for the METRO users.

Since most properties along the METRO corridors are commercially used, neither overlooking nor noise protection appear to be a problem for the majority of the corridor length. Hence, a solution is needed, which can be applied or retro-fitted on a case-by-case basis according to particular needs.

The proposed solution is a louvered design of privacy/ noise protection screens along short sections of elevated tracks (where required), featuring angled solid louvered slats, with glazed sections in-between. The angle shall be adjusted in such a way, as to allow views from the trains into the public sidewalks, however preventing overlooking of properties beyond.

The design of the louvered sections shall fit to the already planned balustrades along the elevated sections and the already designed fences along the at-grade tracks (based on metal mesh/steel cables).

The map on the right shows approximate areas where sensitive uses adjacent to an elevated track may require locally applied privacy screening. Considered uses are private external spaces, schools, governmental institutions and hotel outdoor facilities.

These findings are preliminary and need to be clarified for each individual location prior to the construction of the tracks.

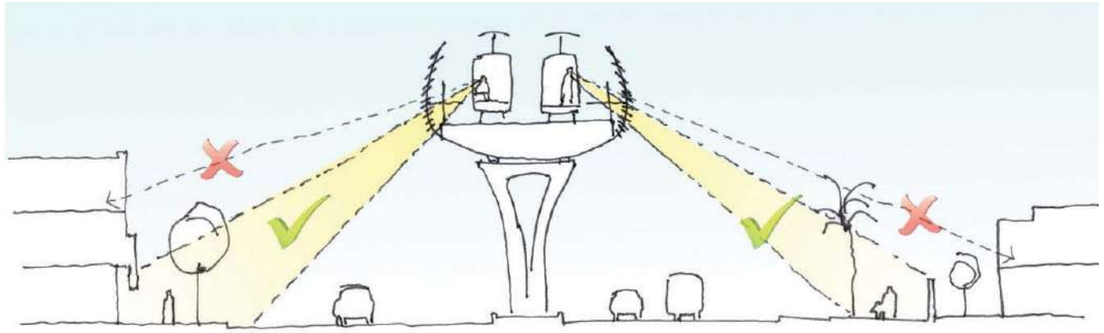


Figure 5.112 Principle of privacy screen along elevated track (where required)

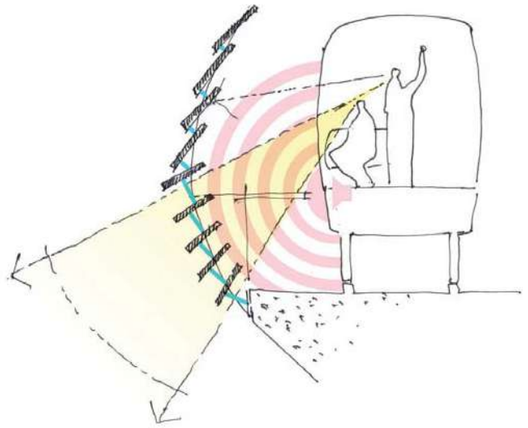


Figure 5.110 Principle of privacy screen along elevated track (detail)

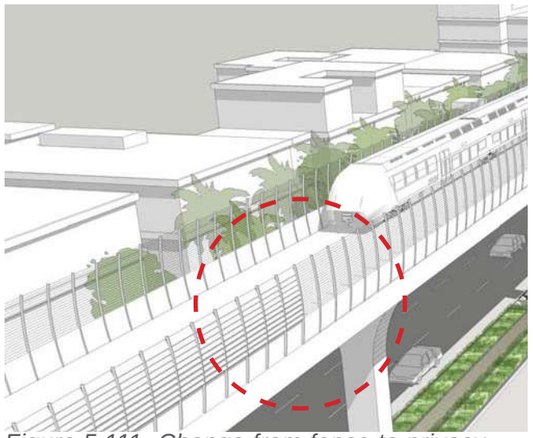


Figure 5.111 Change from fence to privacy screen along elevated track

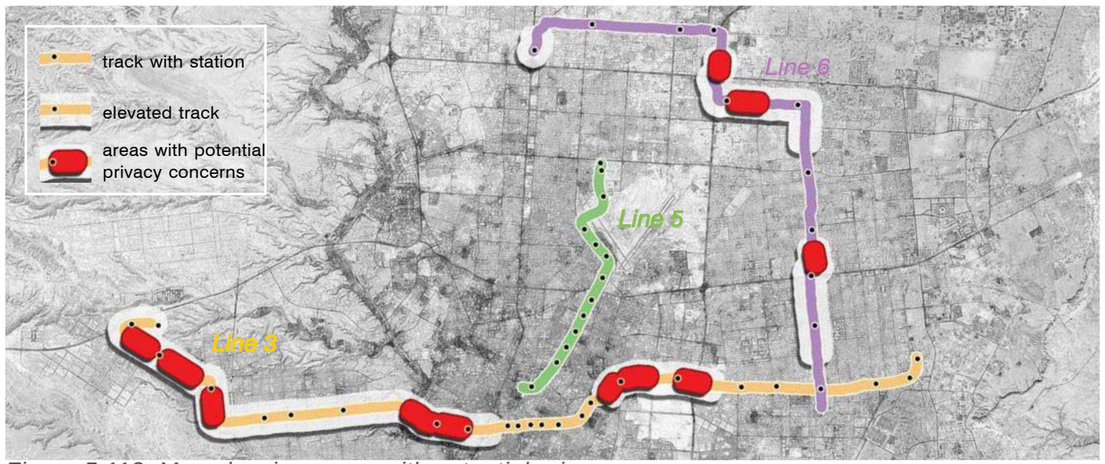


Figure 5.113 Map showing areas with potential privacy concerns

5.6.2 Transition elevated track/ underground track

The METRO track alignment varies between an elevated, an at-grade, a shallow underground, and a deep underground arrangement. The elevated track mostly runs within the street corridors' median, supported by central columns in a narrow median and cantilevering both sides over the road space, sufficiently high to ensure the required clearances for vehicles underneath the concrete track bridge elements and the stations crossing the corridor. However, where the elevated track changes into an underground alignment, geometry as well as design aspects will have to be considered carefully.

Lowering the elevated track bridges will require widening the median at a certain point due to clearance requirements of the road underneath. Also, near the ground, a special bridge support structure will have to be designed, which serves as a smooth transition of the elevated to the underground track structure in technical and design terms. Once submerging ground level, the tracks will run at a certain length within an open trench before they reach sufficiently deep levels for being covered. As soon as the METRO track is covered, the median can be reduced in width again in favor of the road space and the public realm.

The design of the transition between elevated and underground track alignment shall minimise any additional bulky elements to the already massive structure of the elevated track bridges. The aim is to avoid any unnecessary visual or functional barriers between the two street edges. Hence, the regular track bridge elements and the central column supports shall also be used along the ramped sections – only the last support element near the ground should be a specially designed structure. This transition structure shall be recessed and as slim as than the columns, so the edges of the bridge profile appear to simply sink into a gravel surface. Once meeting the ground, the curved bridge fence turns seamlessly into a balustrade around the open trench section – the curved design and the construction details shall be adopted or amended to fit the bridge fence design. The landscape design of the widened median continuous the hedge theme of the standard median design underneath elevated tracks, only featuring a wider gravel filled space in between. The last meters before the track bridge profile meets the ground shall be a gravel surface with rock boulders in lieu of the hedges.

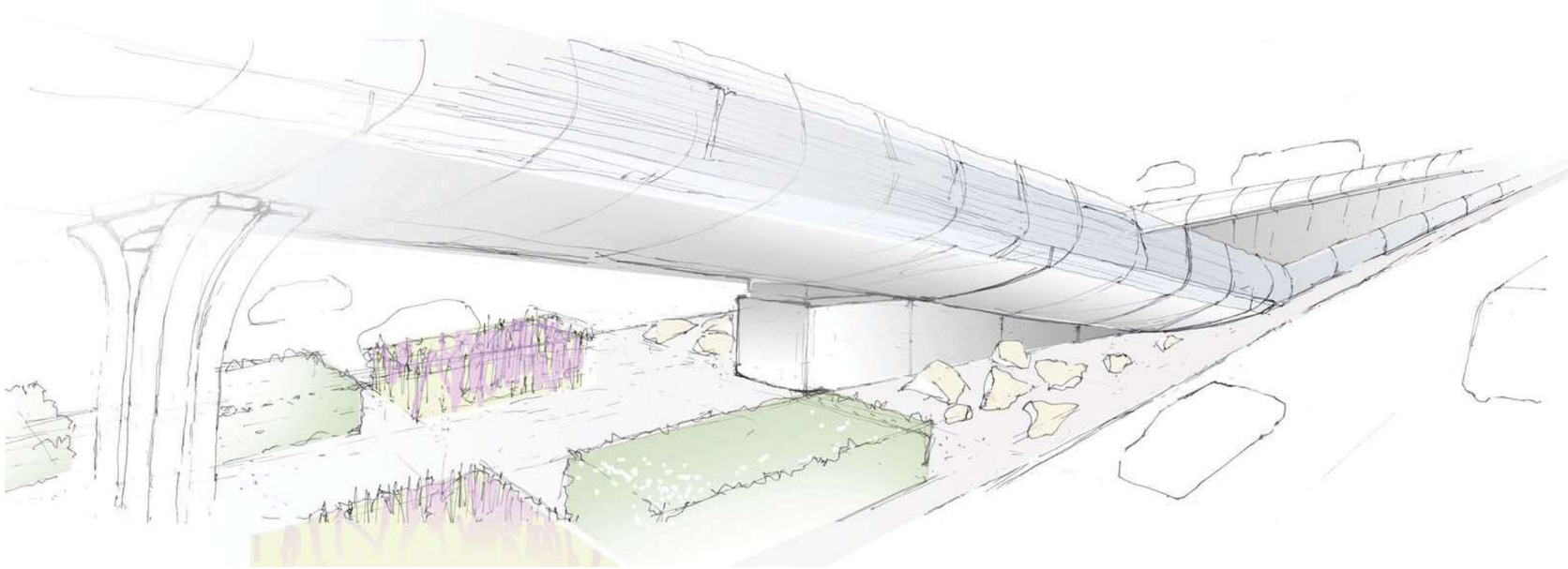


Figure 5.114 Transition elevated track/ underground track – structure & widened median design (Sample situation north of Salam Park)

The edge of the cover for the initial underground section offers an ideal location for a vertical public art/ gateway feature, which can be seen from the road traffic as well as from the submerging METRO train. Since a transition between elevated and underground alignments mostly occurs where the central parts of Riyadh are entered, these gateway features should reflect the urban context – e.g. the historic city center, as shown in below sketch illustrating the situation north of Salam Park. Other than utilizing the inaccessible space for a public art/ gateway feature, the landscape design theme of varying hedges shall be continued. Once the width of the median is reduced again and the cover is deep enough for implementing sufficient ground cover for trees, the regular median designs for underground alignments outlined in this UDM shall be applied.

Figure 5.115 Transition elevated track/ underground track – public art/ gateway feature at covered section (Sample situation north of Salam Park)

5.6.3 Advertising Strategy

Concept

The quality of the public realm will be significantly influenced by the amount and nature of advertising. A balance needs to be achieved between regulating advertising to avoid visually spoiling the public realm, and the opportunity to generate extra revenue through commercial signage and enabling businesses to represent themselves along the corridors.

As a general approach, shop signage shall be limited to the retail frontages and certain street furniture elements. General advertising can be included at bus stop shelters and by dedicated advertising elements near METRO stations. All advertising elements within the public realm shall be closely coordinated with the signage and wayfinding concept in order to avoid street cluttering.

The METRO facilities themselves shall best not include external advertising (internal advertising elements are included and covered elsewhere). This avoids cluttering and offers the chance for the METRO system to solely represent itself by applying their corporate signage design to the rolling stock.

Fences, walls and building facades shall be kept free of any advertising. Also the columns of the elevated track shall not be used for advertising to maintain a sober METRO image and avoiding distraction of drivers. The columns are rather suitable for applying a lighting strategy, highlighting this piece of important public infrastructure.

Shop Signage

Whilst being beyond the limits of the public realm, shop signage on private land (mostly attached to the building facades) should follow certain design regulations. A signage zone is defined within this manual, which also regulates locations, species and pruning of street trees, which otherwise would obstruct visibility from pedestrian and car drivers' perspectives.

Other means of shop signage within the public realm shall be limited to certain street furniture elements, such as bollards, and banners attached to street lighting posts (otherwise used for festival signage).

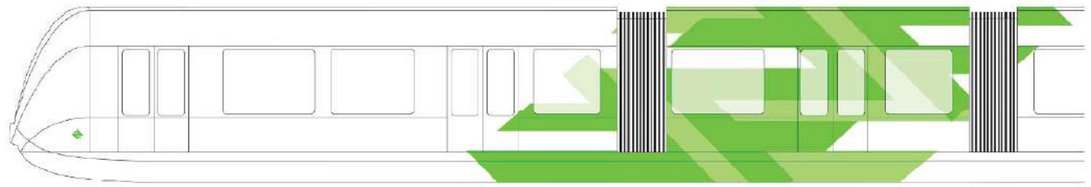


Figure 5.116 Corporate Design Style Guide - Media Consulta Advertising GmbH

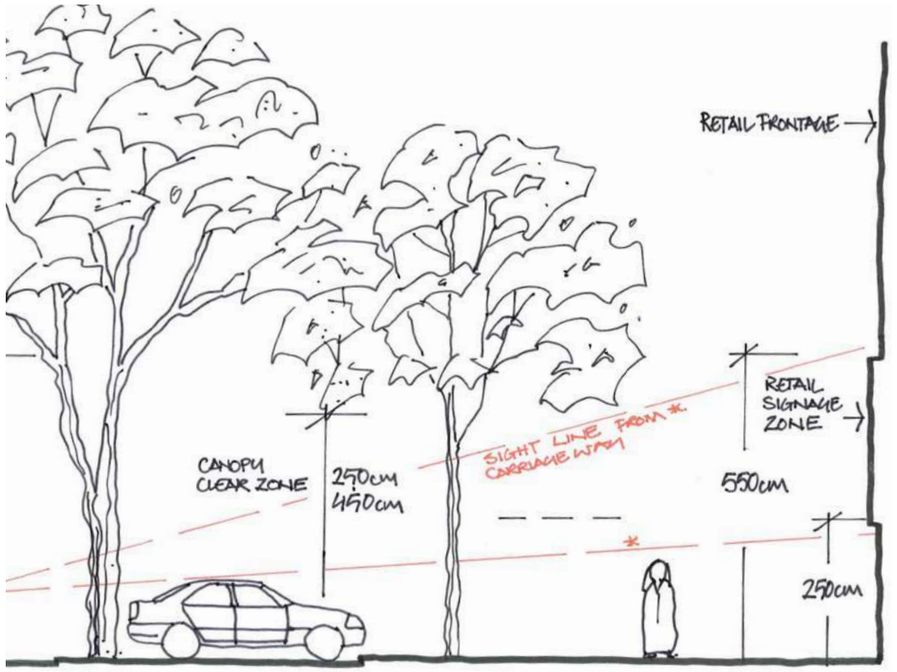


Figure 5.118 Recommended retail signage zone

Figure 5.117 Typical Shop Facade

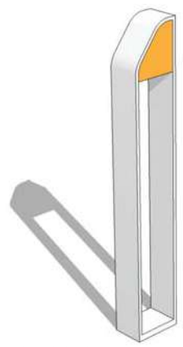


Figure 5.119 Bollard with integrated commercial signage

Advertising

Following regulated approach advertising shall only occur at bus stop shelters and on dedicated advertising elements near METRO stations. The bus stop shelter/ modular shading structures can include partitions used for wayfinding signage as well as advertising. These vertical panels can be illuminated.

Near stations information board elements can include advertising, possibly including plasma screen panels.

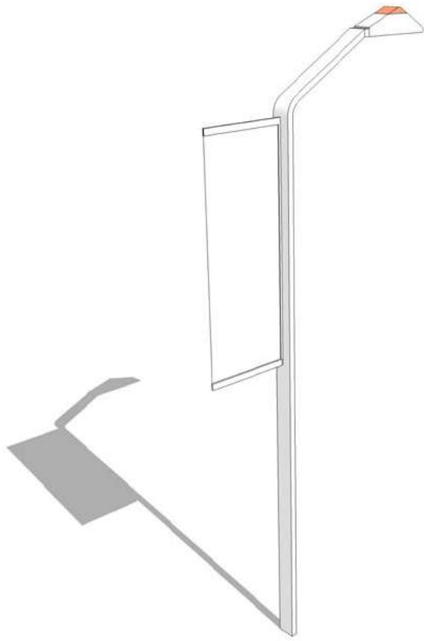


Figure 5.120 Banners & advertising

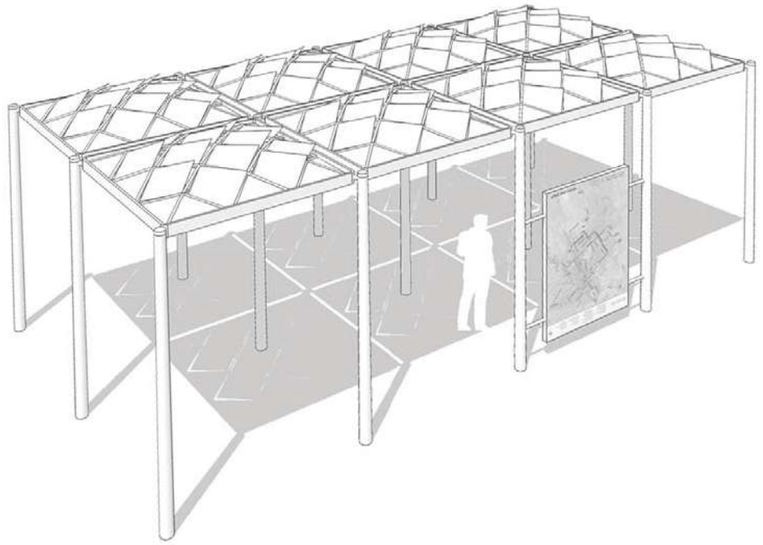


Figure 5.121 Modular shading structure including asdvertising

Figure 5.122 Information board with integrated wayfinding

5.6.4 Infrastructure Elements

The quality of the public realm along the METRO corridor will be affected by various types and sizes of above ground infrastructure elements. Three main groups of infrastructure elements are expected – elements that are directly part of the METRO system itself (ventilation shafts, emergency access shafts, condensing unit yards, etc.), general utility infrastructure (switch boxes, transformers, valve chambers, etc.), and service infrastructure (mainly refuse containers).

METRO Infrastructure

The METRO system requires a number of partly spacious above ground elements, which are to be incorporated into the overall streetscape design in a sensitive way, ensuring not only efficiency and accessibility, but also full design integration. This shall be achieved by coordinated dimensions, and surface treatments.

Unavoidable ventilation shafts and access stairs are predominantly positioned within the median of the street. High quality surfaces shall be designed in keeping with the remaining METRO buildings' design character. The use of climbing plants is also strongly encouraged where growth conditions allow.

Figure 5.123 Typical climbing plants

Larger elements positioned along the METRO corridor edges, such as emergency access shafts and condensing unit yards should be avoided within the public realm. They should be rather located in side streets, or within a wider median wherever possible.

Boundary or screening walls to these larger elements shall be limited to a minimum height. Again, surfaces shall be designed in-keeping with the remaining METRO buildings' design character and the application of greening elements to soften the built form is strongly recommended.

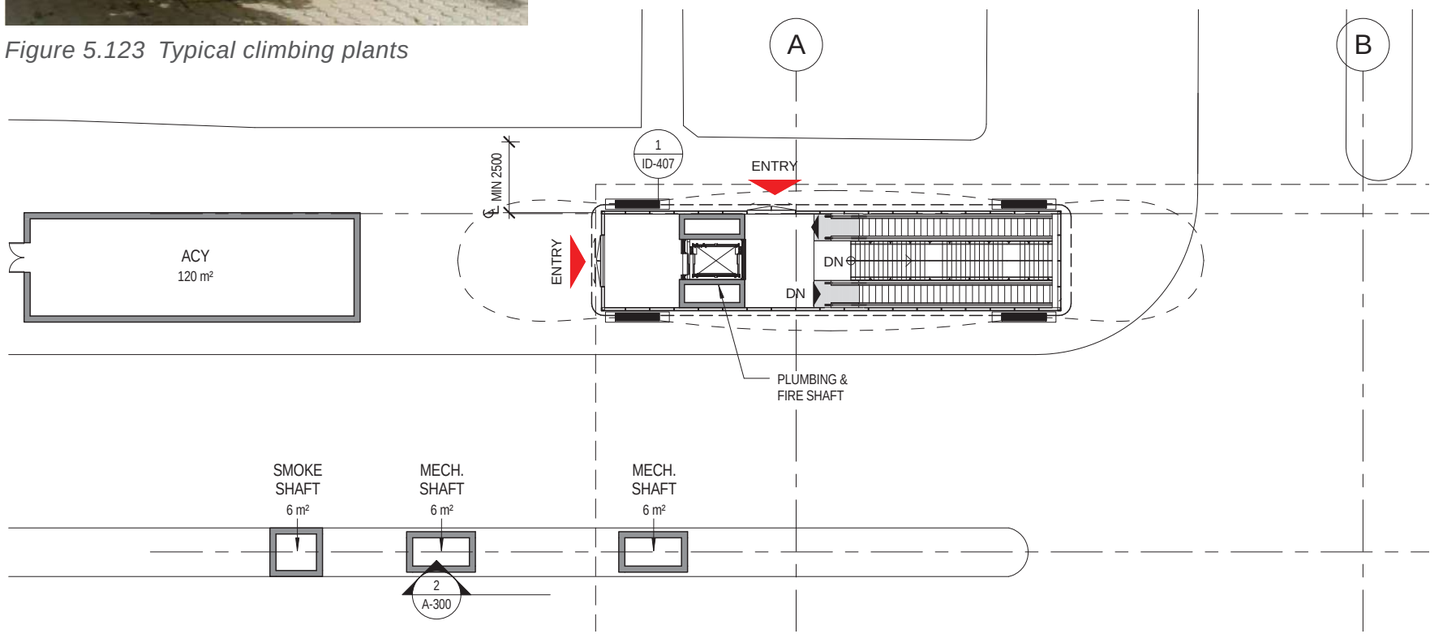


Figure 5.124 Existing concept design of typical deep underground station showing detrimental location of condensing unit yards (ACY) within public realm of METRO corridor

Utility Infrastructure

The existing streetscape in Riyadh is often spoilt by haphazardly located and poorly designed/ maintained technical utility elements.

This UDM strongly recommends coordinating planning efforts with the appropriate utility companies in order to coordinate these elements as much as possible and to avoid cluttering the streetscape. The suggested location for these elements shall be the furniture zone, ideally visually concealing them, either by planting and/ or enclosures akin to the design of the proposed modular shading structures.

Service Infrastructure

The main service infrastructure elements apparent in the existing streetscape are open, poorly designed and un-lit refuse containers, which are mostly placed along the edge of the street, sometimes even causing a traffic safety hazard.

Besides being a requisite management issue, requiring a city wide refuse collection and recycling strategy- beyond the remit of this manual, the location and accessibility of refuse containers and the minimisation of their unattractive visual appearance shall be addressed.

Since the METRO corridors generally represent the main roads and access paths through wider neighbourhoods, it is justified to clear the corridor edges from refuse containers as much as possible, by locating the required containers in side streets. The remaining refuse containers necessary to service the aligning properties shall be conspicuously placed away from METRO stations and other areas of higher pedestrian frequency. Access for service vehicles shall also be duly taken into account. Furthermore, the refuse containers shall be visually concealed by well design and integrated structures or intensive planting, such as trees and trellises.

Boundary or screening walls to these larger elements shall be limited to a minimum height. Again, surfaces shall be designed in keeping with the remaining METRO buildings' design character and the application of greening elements to soften the built form is strongly recommended.

Figure 5.125 Typical existing utility infrastructure elements

Figure 5.126 Typical existing refuse container

‘To demonstrate how the practical guidance given in the preceding chapters can be applied to a given street example, this section illustrates six typical corridor segments and related intersections. The selection of such examples covers different urban situations, ranging from a low density industrial sector to a high intensity pedestrian mixed use area.

As reference examples, road and streetscape layouts are provided, outlining all key elements; paths, patterns and materials, as outlined in the tables and tool boxes. The urban situations are illustrated in perspectives and high quality renderings. This demonstrates how an attractive pedestrian environment and streetscape can be achieved with the guidance of this manual.’

6 TYPICAL DESIGNS

6.1 Typical Design Arrangements

In order to exemplify the design guidance presented in this manual and to prove its applicability to existing situations along the proposed METRO corridors. A number of 'typical' situations were chosen to be elaborated into actual designs.

The selection of these 'typical' situations is based upon the described analysis work undertaken, and is driven by the aim to address the various urban street types, stations, track alignments, geometries of the corridors, and the urban fabric occurring along the METRO corridors.

The following criteria have been applied for selecting 'typical' situations:

- One example for each urban street type (A, R, M, P).
- Sections need to include 'typical' station (i.e. elevated and underground stations with 4 access points).
- Sections need to include 'typical' junction (standard junction without special conditions).
- Special stations have been excluded (i.e. METRO interchanges or large P+R structures) since they require individual considerations.

Further, the sections need to show the most occurring urban constellations (i.e. typical ROW, lack of space vs. ample space) and streetscape relevant elements, such as:

- Offsets in building line/ differing frontage levels
- Integration of bus stops and drop-offs
- Parallel and 45° parking

The following Typical Designs have been developed (for locations see map):

Urban Street Type A

- Typical Design TD-ST-01 (A3)

Urban Street Type R

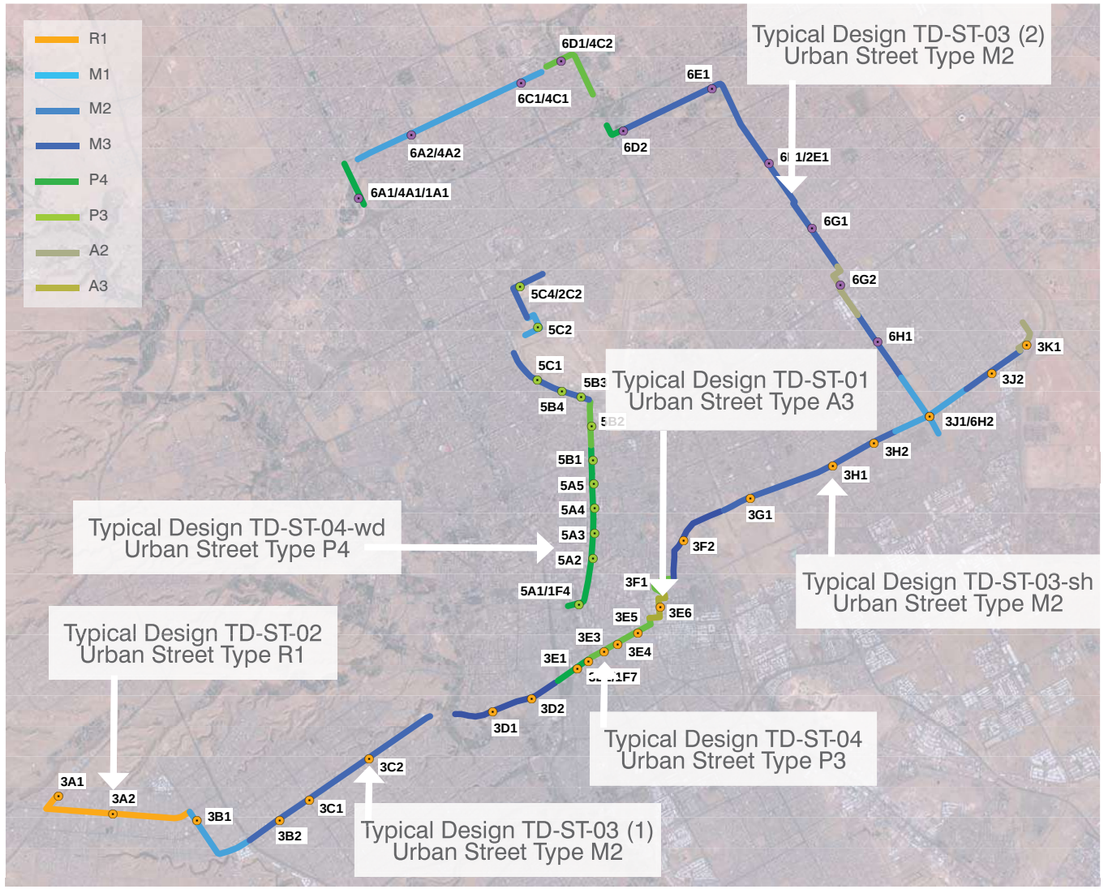
- Typical Design TD-ST-02 (R1)

Urban Street Type M

- Typical Design TD-ST-03 (applied at two locations - M2)
- Typical Design TD-ST-03-sh (including shallow underground station with central median access - M2)

Urban Street Type P

- Typical Design TD-ST-04 (limited space available - P3)
- Typical Design TD-ST-04-wd (wider ROW - P4)



Map 6.1 Map locating 'typical' situations

Like any planning task, designing the public realm along the METRO corridors will have to be formulated by a careful analysis of all local conditions on a detailed level. The design will then have to evolve through reiterative working steps, considering these conditions and being informed by a number of decisions during the process.

For instance, the question of available land for acquisition informs the available space around many stations in constrained urban situations, and the opportunity of closing side streets influences the regularity of the public realm design.

Acknowledging that this design process requires time and coordination with all stakeholders, the selected ‘typical’ situations were partly adjusted for the purpose of the manual in terms of geometry, street closures, and land acquisition according to needs and opportunities expected.

These adjusted ‘typical’ situations form the basis for developing the Typical Design Arrangements illustrated in this manual. However, all assumptions made for the selected ‘typical’ situations are to be verified by the designers as diligently for the shown locations, as for the entire METRO corridors.

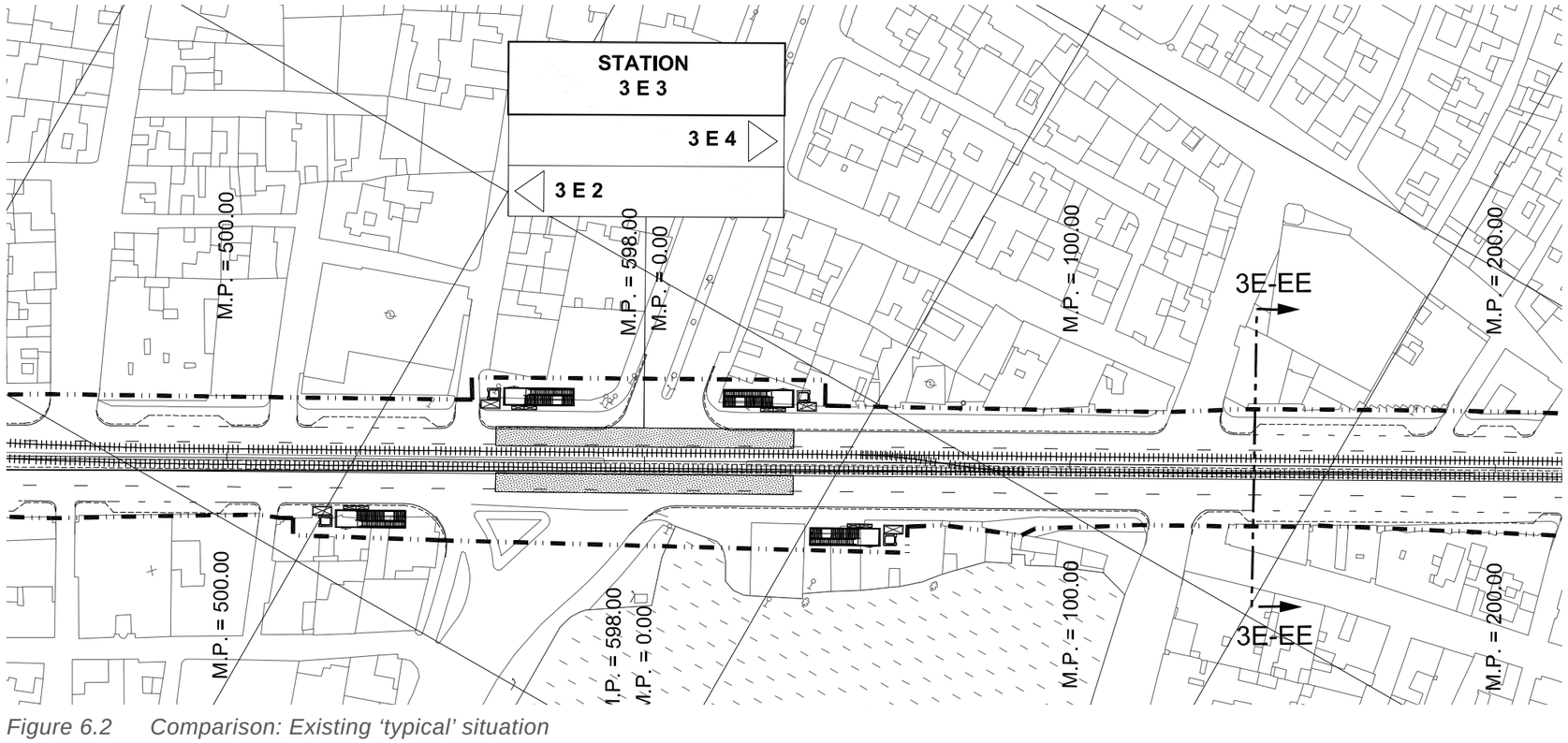


Figure 6.2 Comparison: Existing ‘typical’ situation

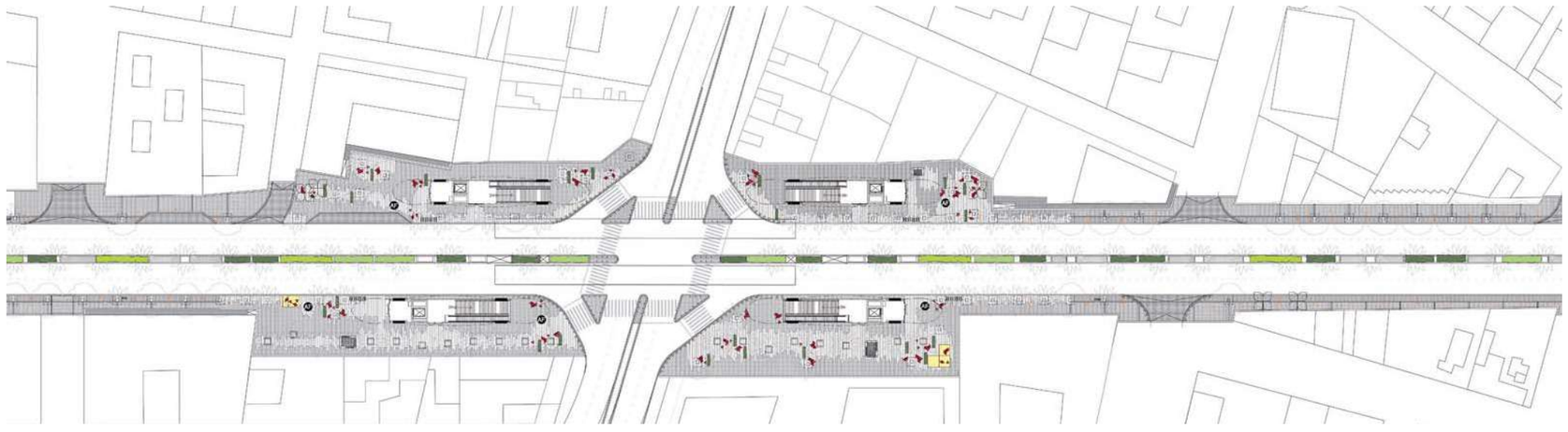


Figure 6.3 Comparison: adjusted ‘typical’ situation

6.2 Urban Street Type A

Typical Design TD-ST-01

Typical Design TD-ST-01 illustrates a light industrial/ employment urban context (Urban Street Type A3) around the planned METRO station 3E6.

The purpose of the road is mainly characterized by its access function without major pedestrian utilisation. The public realm is mainly used by employees travelling to and from work.

The METRO track alignment is deep underground, with station entrance buildings proposed either side of the road in constrained spatial conditions.

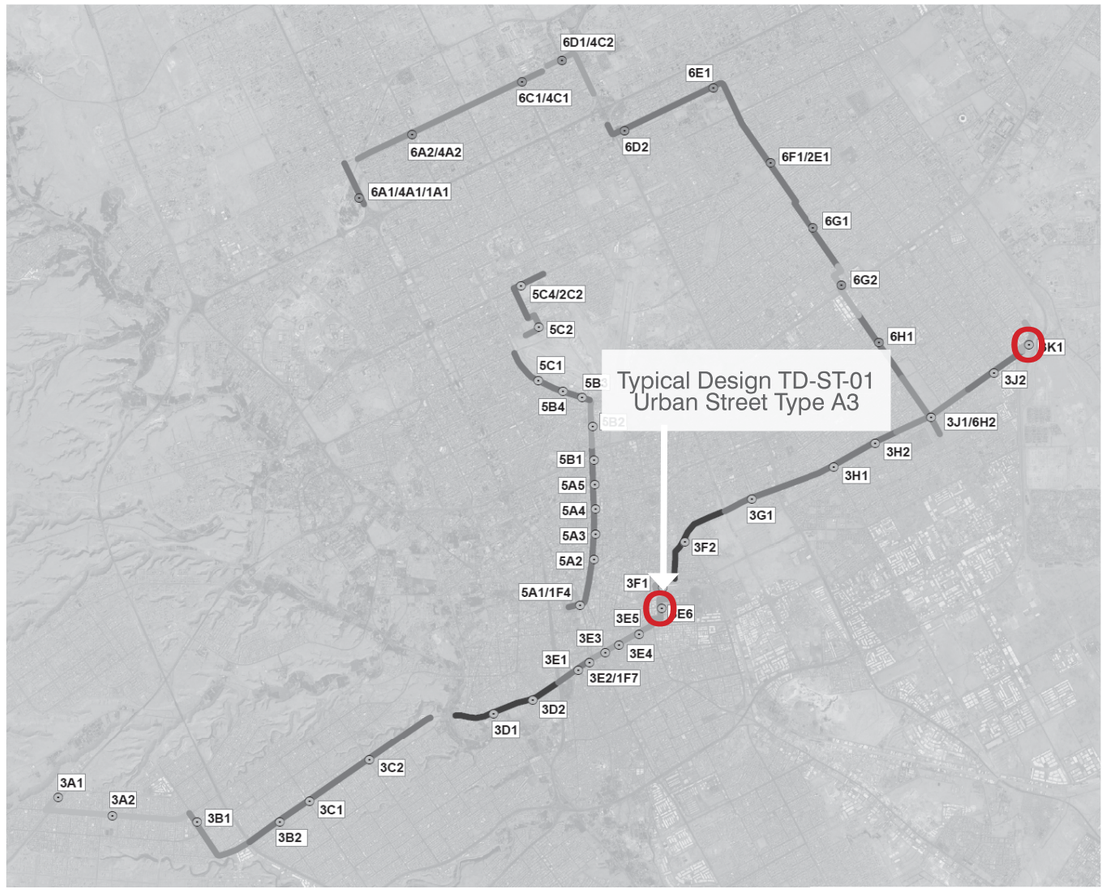
The surrounding urban fabric is characterized by intermittent warehouses which form a fragmented building frontage; the corridor edges are defined by walls and gates with set-backs enclosed on private property.

Industrial/ employment oriented roads are relatively sparse along the analysed METRO corridors.

There are currently two station where this design can be applied (highlighted in red circles - O).

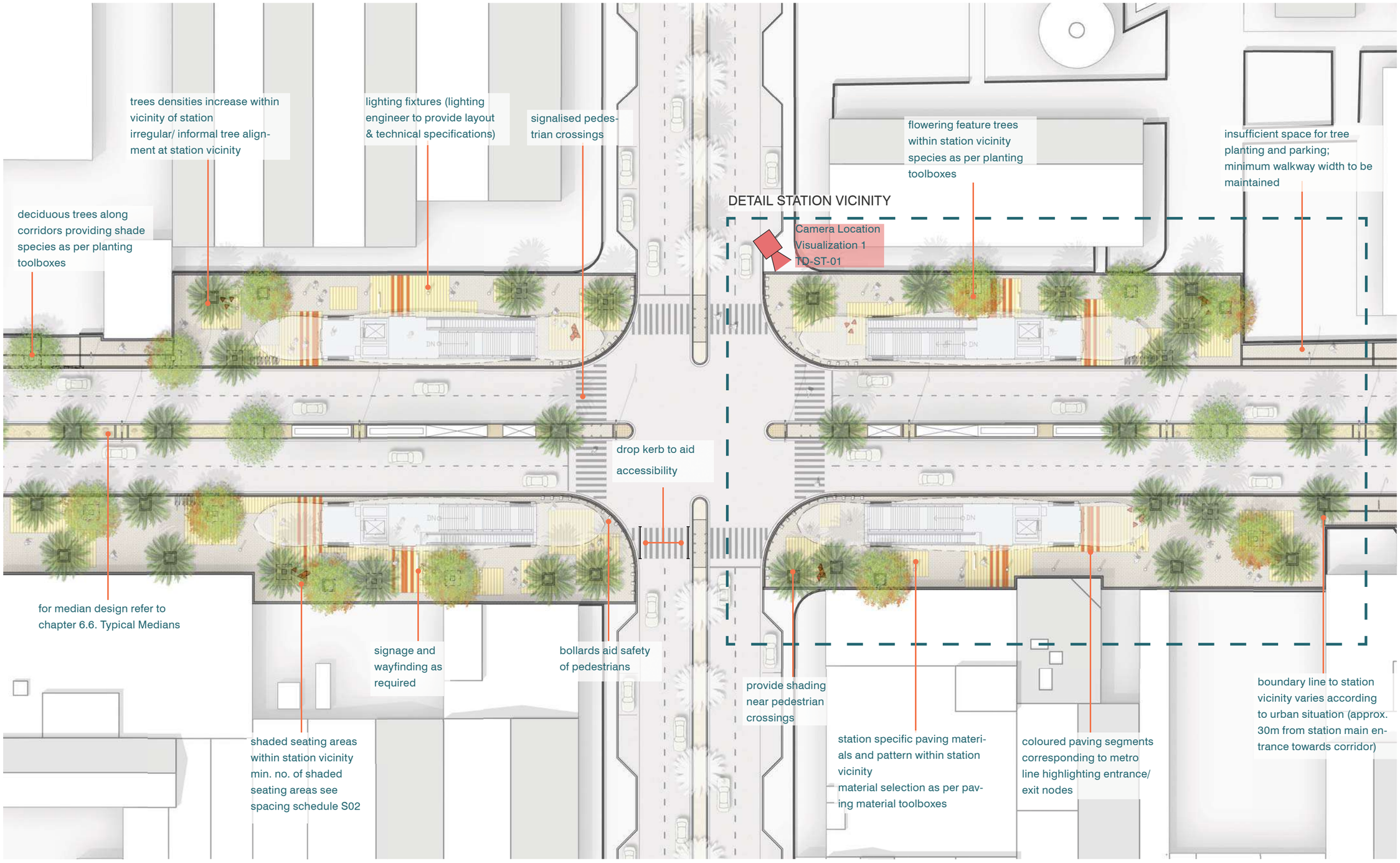
Figure 6.4 Image of current situation (1)

Figure 6.5 Image of current situation (2)

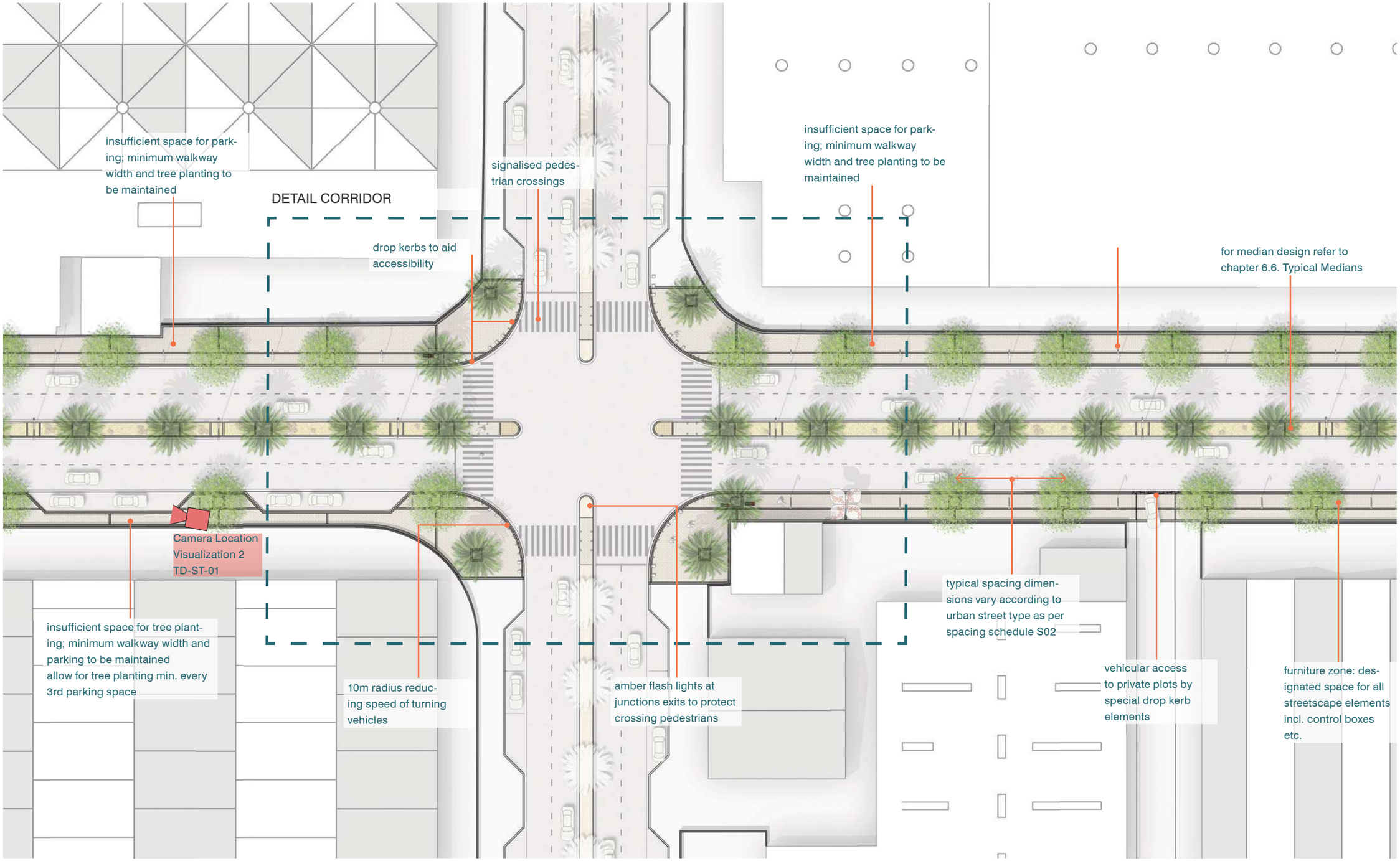


Map 6.6 *Map locating 'typical' situations - Urban Street Type A*

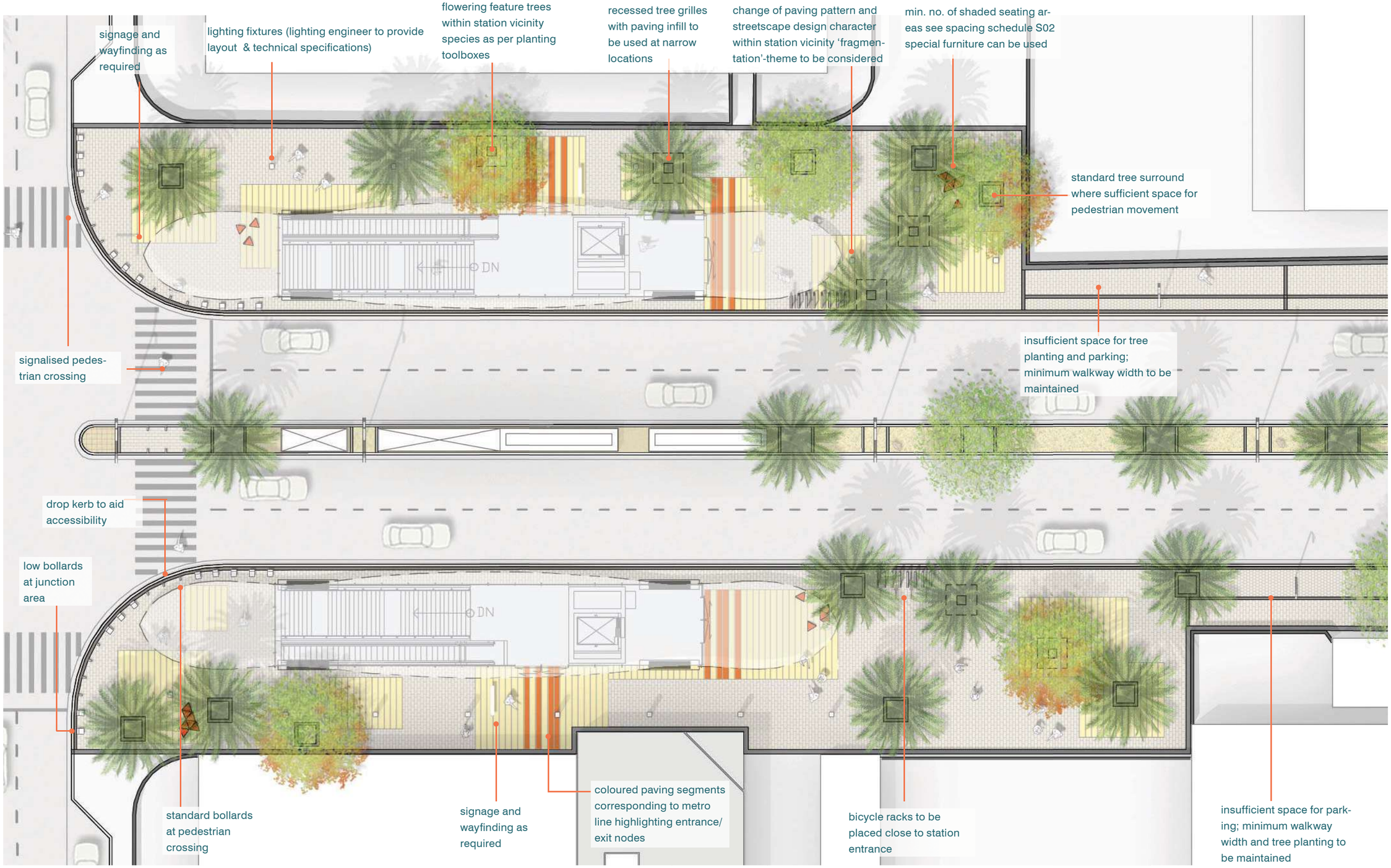
Map 6.7 *Map locating Typical Design TD-ST-01*



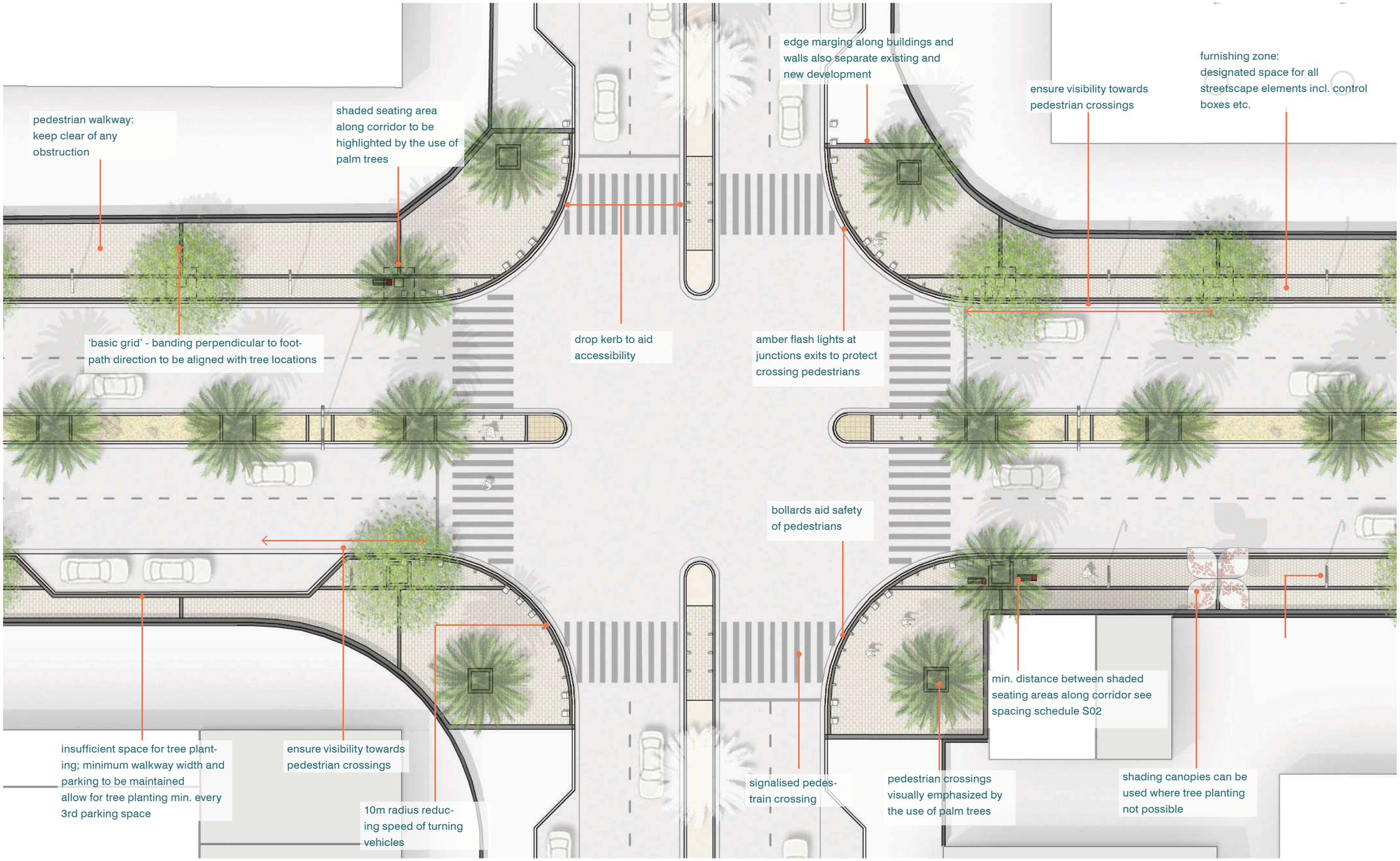
TYPICAL DESIGN TD-ST-01 (SCALE 1:500)



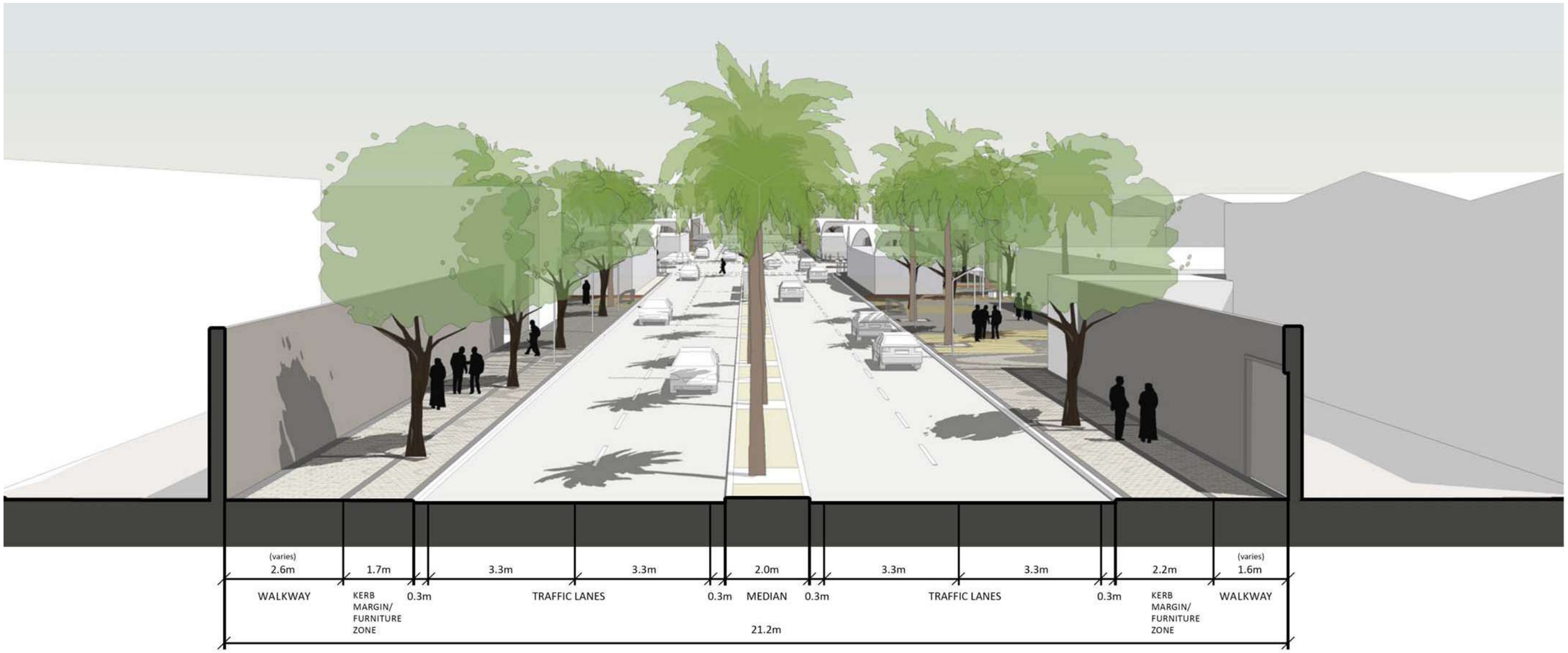
TYPICAL DESIGN TD-ST-01 (SCALE 1:500)



TYPICAL DESIGN TD-ST-01 | DETAIL STATION VICINITY (SCALE 1:250)



TYPICAL DESIGN TD-ST-01 | DETAIL CORRIDOR (SCALE 1:250)



TYPICAL DESIGN TD-ST-01 | CROSS-SECTION

TYPICAL DESIGN TD-ST-01 | BIRDS EYE VIEW

Figure 6.8 Perspective view at station vicinity - artists impression

TYPICAL DESIGN TD-ST-01 | VISUALISATION 1 | STATION VICINITY | URBAN STREET TYPE A3

Figure 6.9 Perspective view along corridor - artists impression

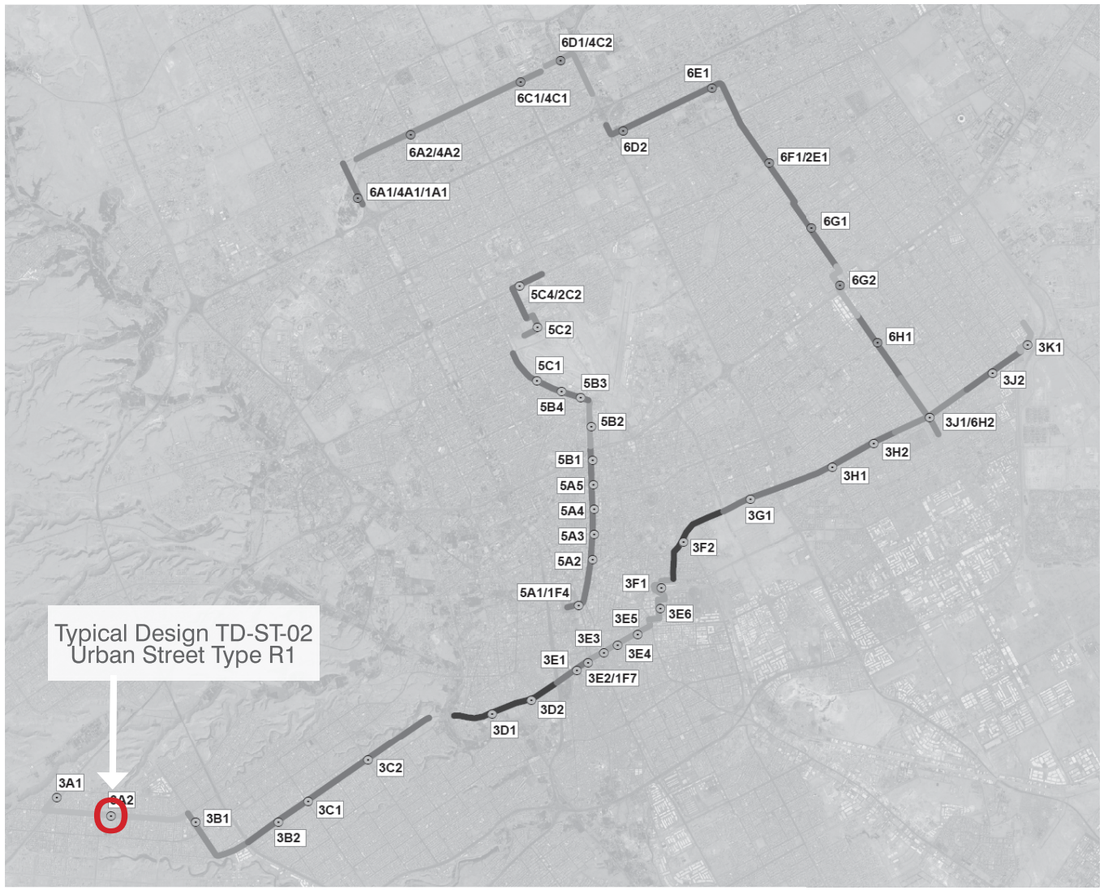
6.3 Urban Street Type R

Typical Design TD-ST-02

Typical Design TD-ST-02 concerns a residential urban context (Urban Street Type R1) around the planned METRO station 3E6. The purpose of the road is mainly characterized by its access and mobility function with some potential for pedestrian strolling and meandering. The public realm will have to provide for convenient and legible routes for commuters and cyclists heading for the METRO station. The METRO track alignment is elevated with a raised station bridging the road corridor. Station entrance stairs and escalators are planned either side of the road in constrained spatial conditions. The surrounding urban fabric is characterized by 2-3 storey detached and semi-detached residential villas which form a fragmented building frontage; the corridor edges are defined by a limited number of shops in addition to walls and gates with publicly accessible set-backs (currently mainly used for car parking).

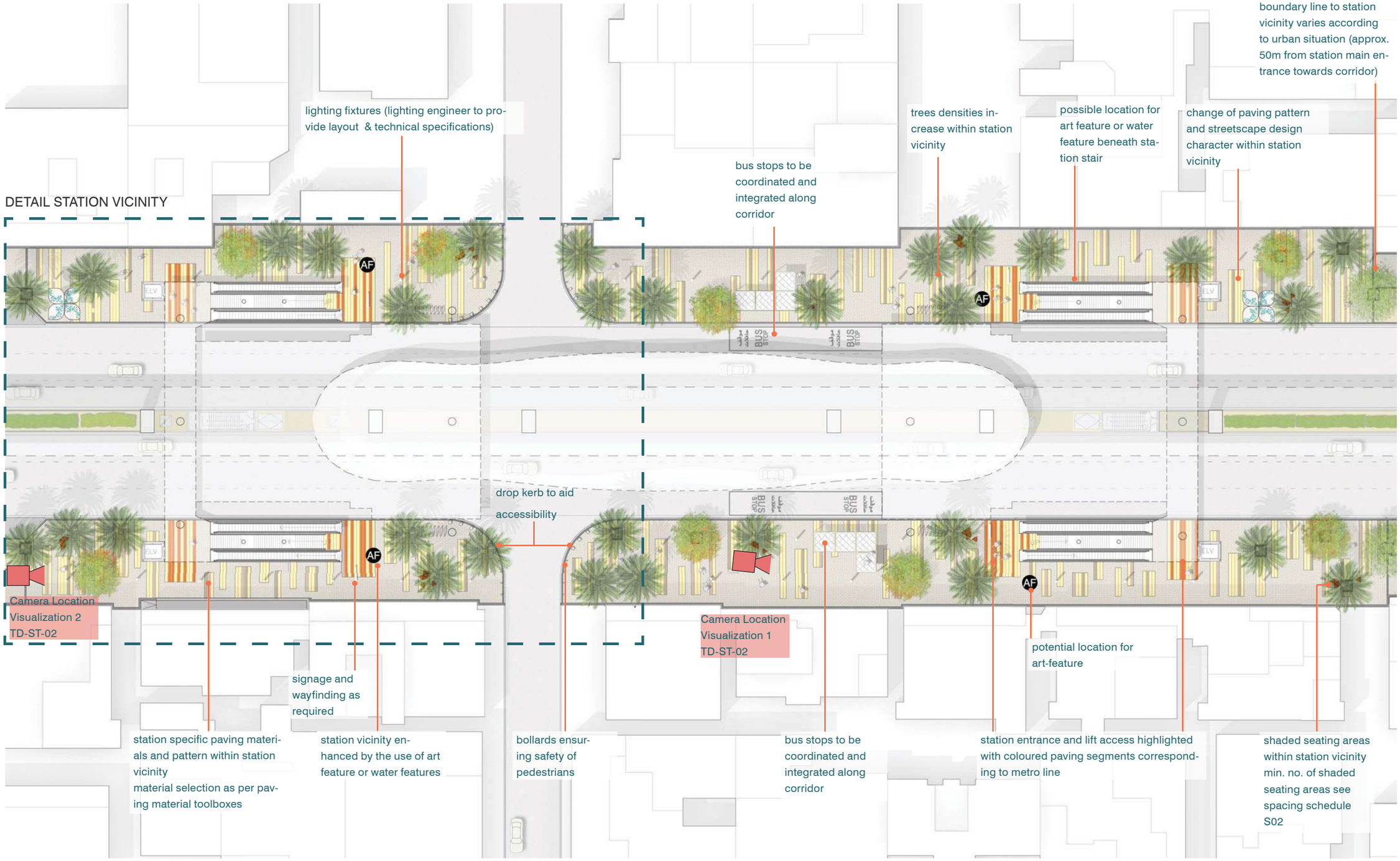
Figure 6.10 Image of current situation (1)

Figure 6.11 Image of current situation (2)

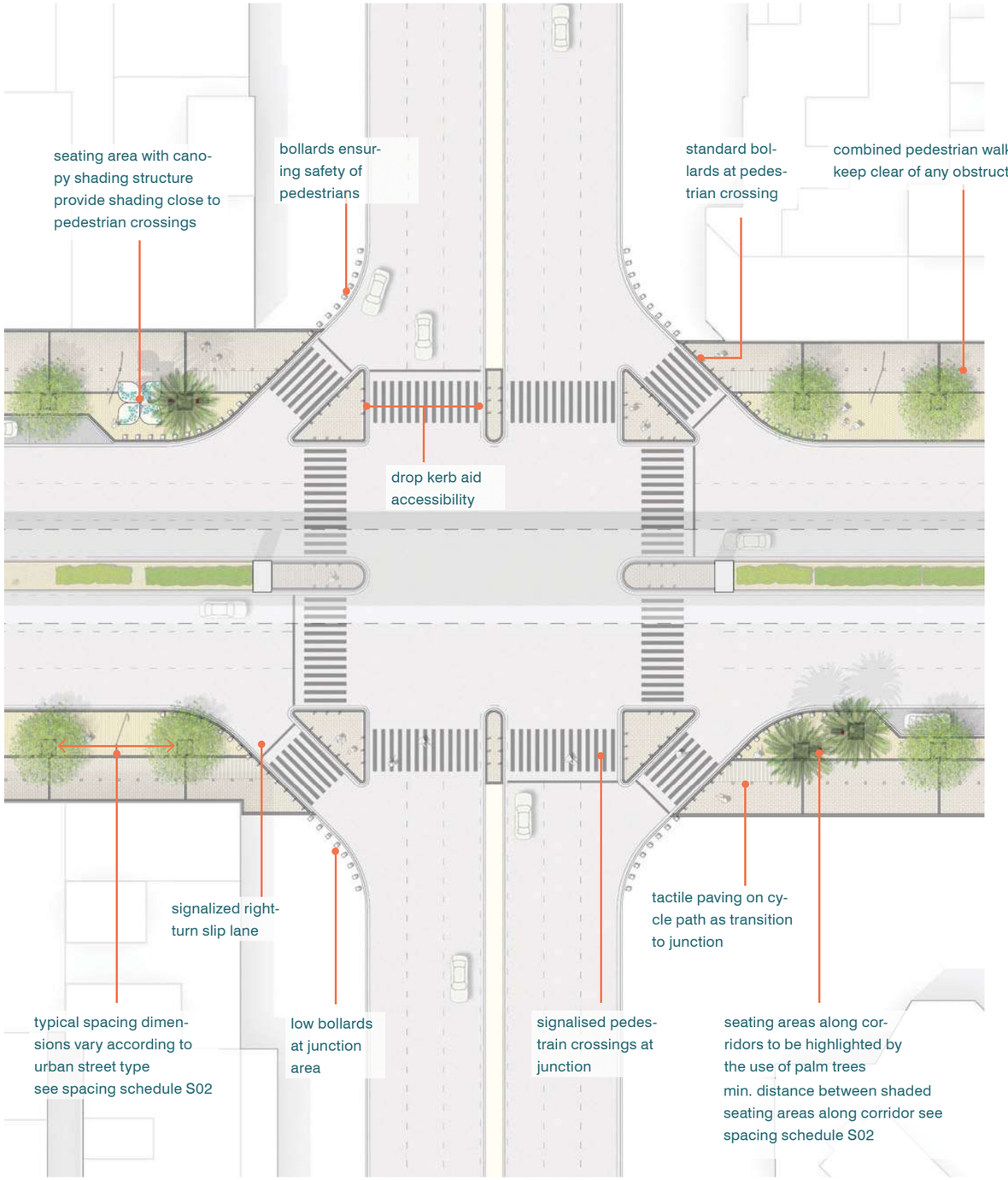


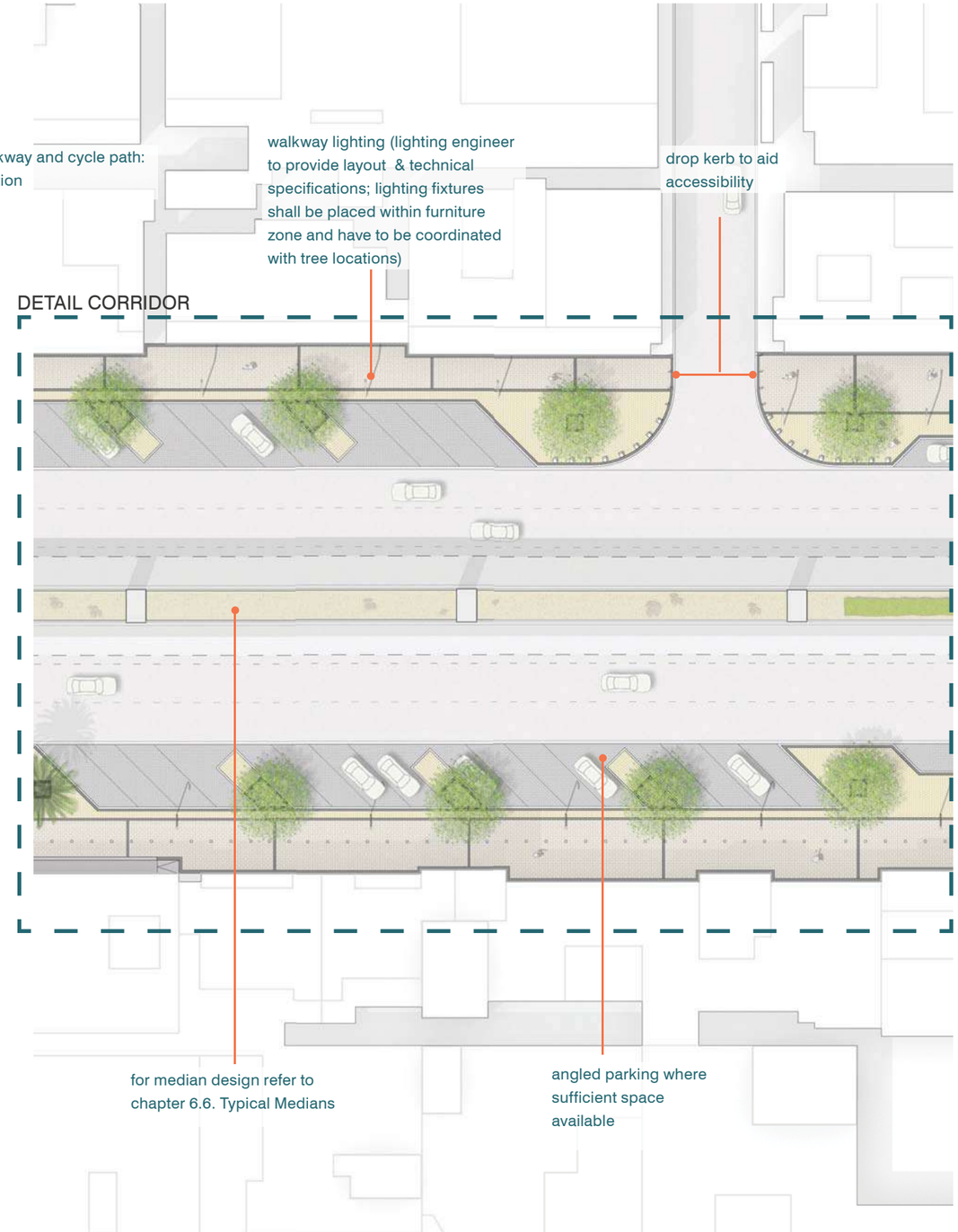
Map 6.12 Map locating 'typical' situations - Urban Street Type R

Map 6.13 Map locating Typical Design TD-ST-02

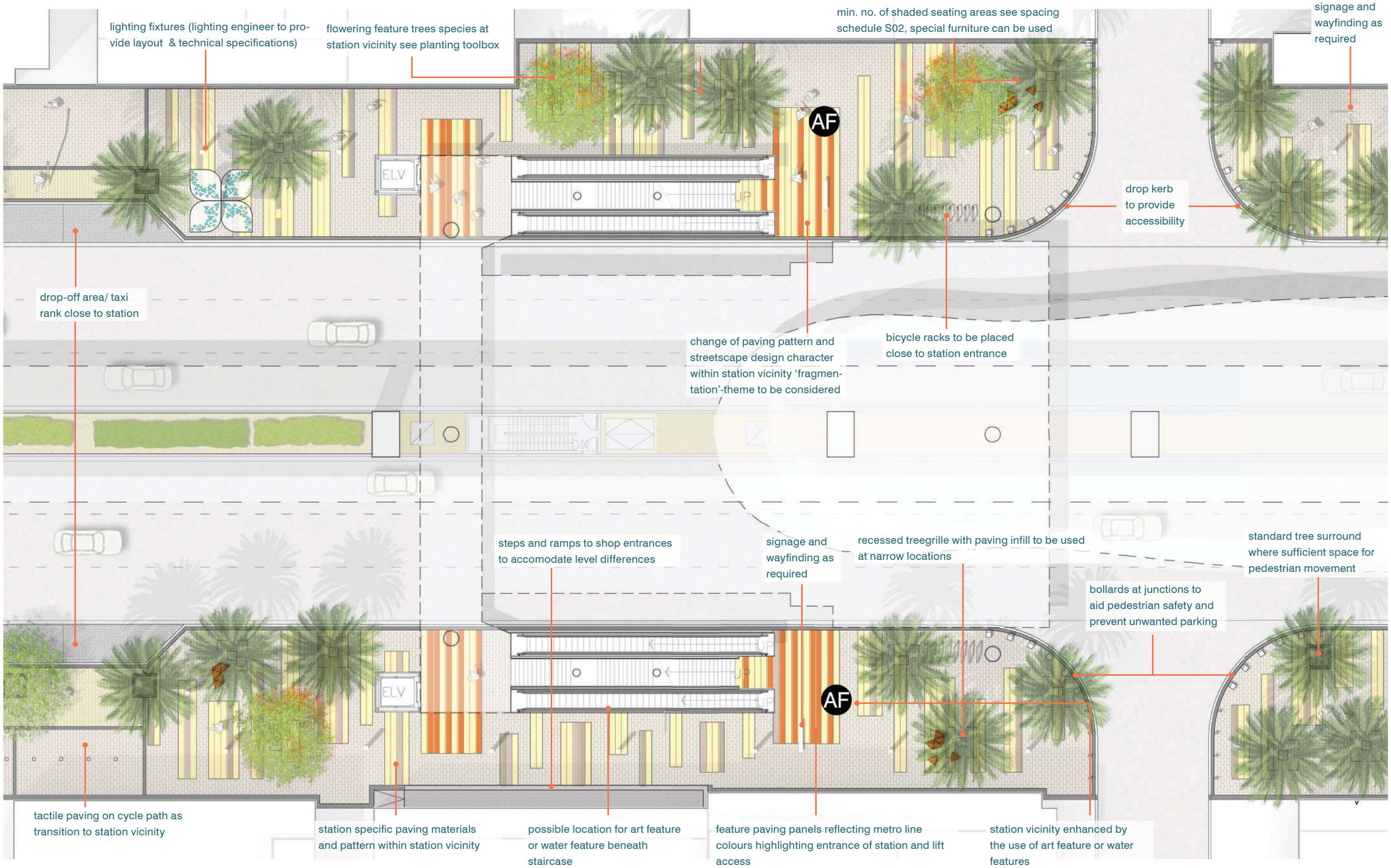


TYPICAL DESIGN TD-ST-02 (SCALE 1:500)

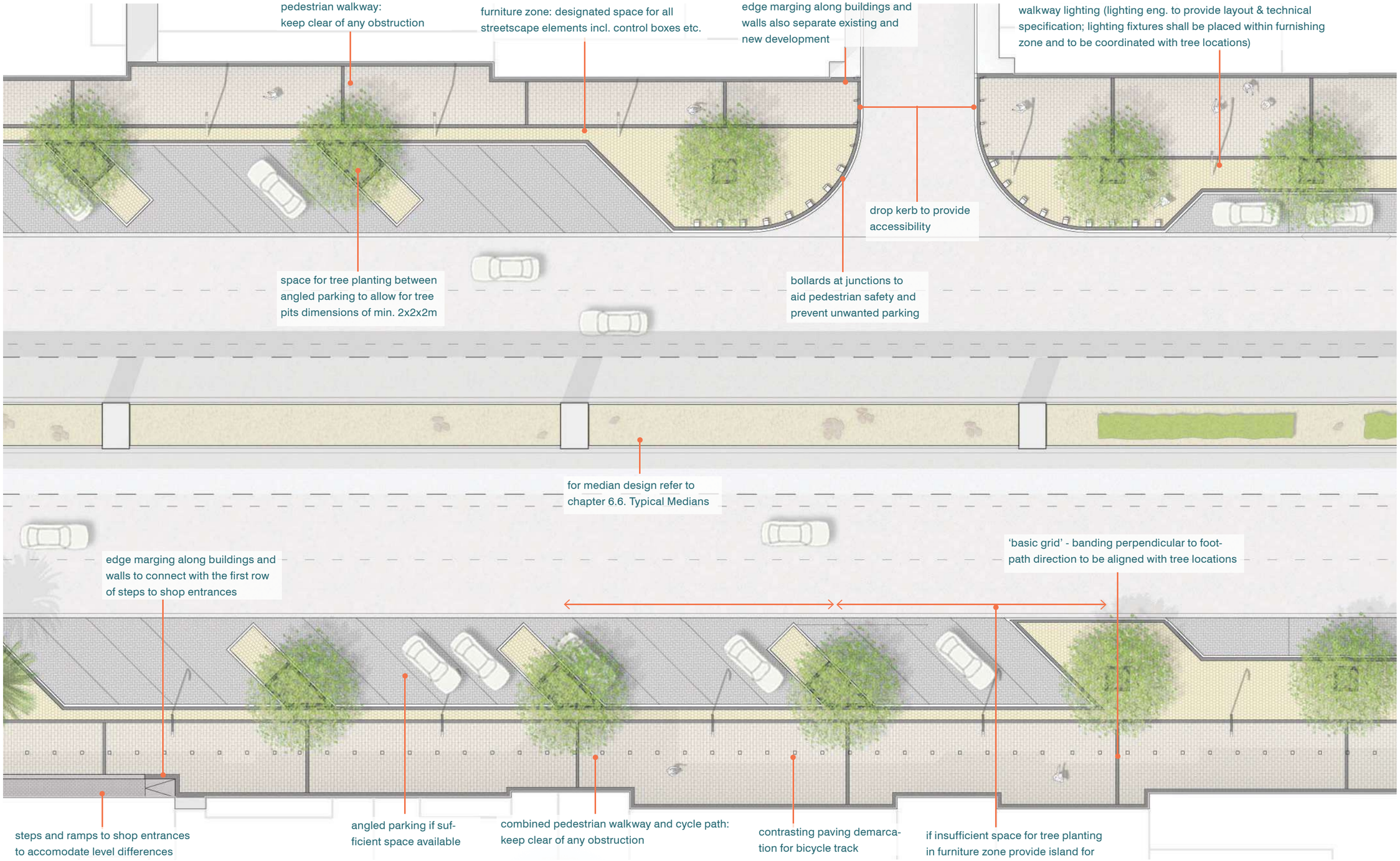




TYPICAL DESIGN TD-ST-02 (SCALE 1:500)



TYPICAL DESIGN TD-ST-02 |DETAIL STATION VICINITY (SCALE 1:250)



TYPICAL DESIGN TD-ST-02 | DETAIL CORRIDOR (SCALE 1:250)

TYPICAL DESIGN TD-ST-02 | CROSS-SECTION

TYPICAL DESIGN TD-ST-02 | BIRDS EYE VIEW

Figure 6.14 Perspective view at station vicinity - artists impression

Figure 6.15 Perspective view along corridor - artists impression

6.4 Urban Street Type M

Typical Design TD-ST-03

Typical Design TD-ST-03 concerns streets with a residential mixed-use urban context (Urban Street Type M). The purpose of the road is mainly characterized by its access and mobility function with higher potential for pedestrian strolling, window shopping and meandering. The public realm will have to provide for convenient and legible routes for commuters and cyclists heading for the METRO station, as well as for visitors to the shops typically using their car (parking demand). The surrounding urban fabric is characterized by semi-detached residential buildings and apartments; the corridor edges are dominated by shops with publicly accessible set-backs (currently used for car parking).

Urban Street Type M is the most occurring street type along the analysed METRO corridors. The Typical Design TD-ST-03 is therefore illustrated for several locations, demonstrating its application in differing situations.

Typical Design TD-ST-03 (1 and 2)

Typical Design TD-ST-03 (1) shows a residential mixed-use urban context (Urban Street Type M2) around the planned METRO station 3C2. This design shows a standard configuration, applicable for many locations.

The METRO track alignment is elevated with a raised station bridging the road corridor. Station entrance stairs and escalators are planned either side of the road in constrained spatial conditions (4 access points).

The design for the station vicinity will be adoptable for many locations, highlighted in red circles (O)

Typical Design TD-ST-03 (2) illustrates the application of this typical design to a corridor along Line 6 between stations 6E1 and 6G1, where the METRO track will be underground.

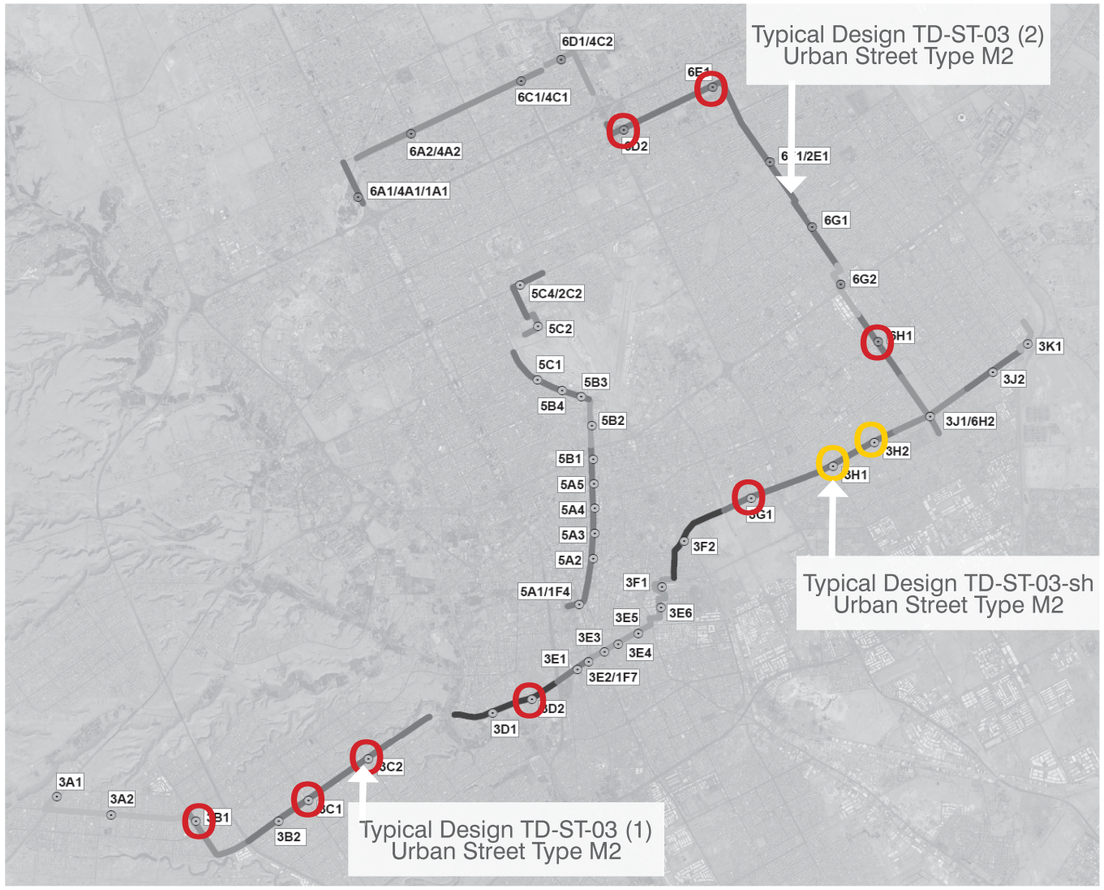
Typical Design TD-ST-03-wd

Another variation of Typical Design TD-ST-03 (Urban Street Type M2) is located around the planned METRO station 3H1. Here, the METRO track alignment changes from at-grade to shallow underground to allow for a grade-separated junction.

The shallow underground station beneath the junction will be accessed via two access buildings within the median, which requires particular care in designing adequate pedestrian crossings.

The shown design for the station vicinity clearly distinguishes between areas frequented by pedestrians and areas used for servicing (and traffic) only.

This situation occurs twice along the analysed METRO corridors (highlighted in yellow circles - O).



Map 6.16 Map locating 'typical' situations - Urban Street Type M

Map 6.17 *Map locating Typical Design TD-ST-03 (1)*

Map 6.18 *Map locating Typical Design TD-ST-03-sh*

Map 6.19 *Map locating Typical Design TD-ST-03 (2)*

Figure 6.20 *Image of current situation (1)*

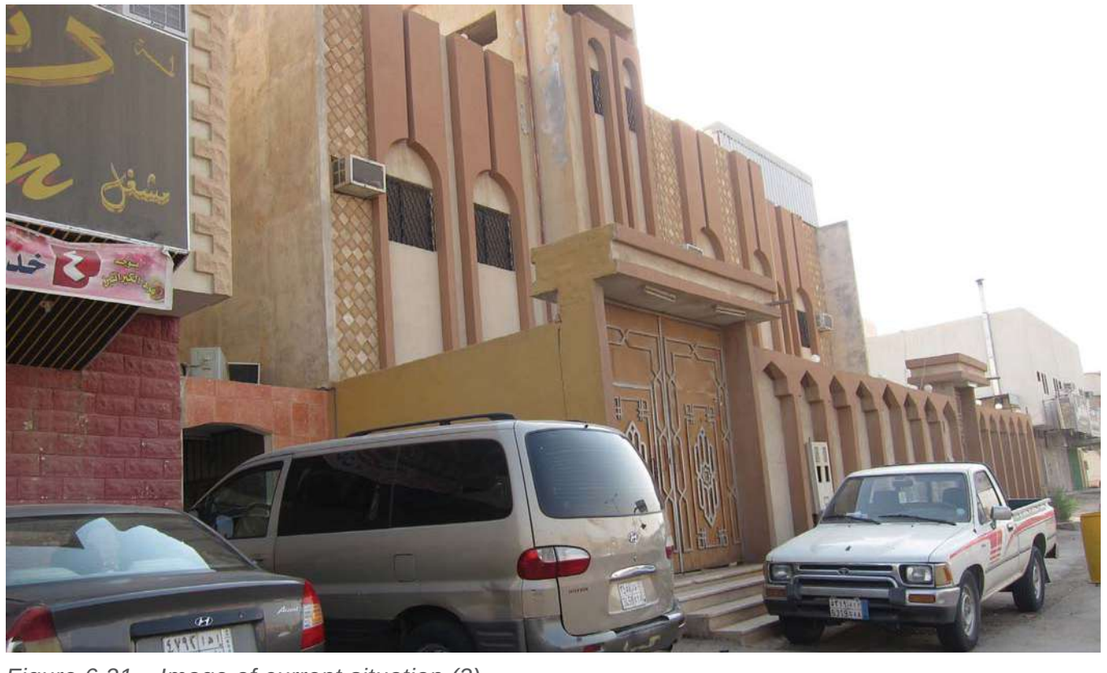
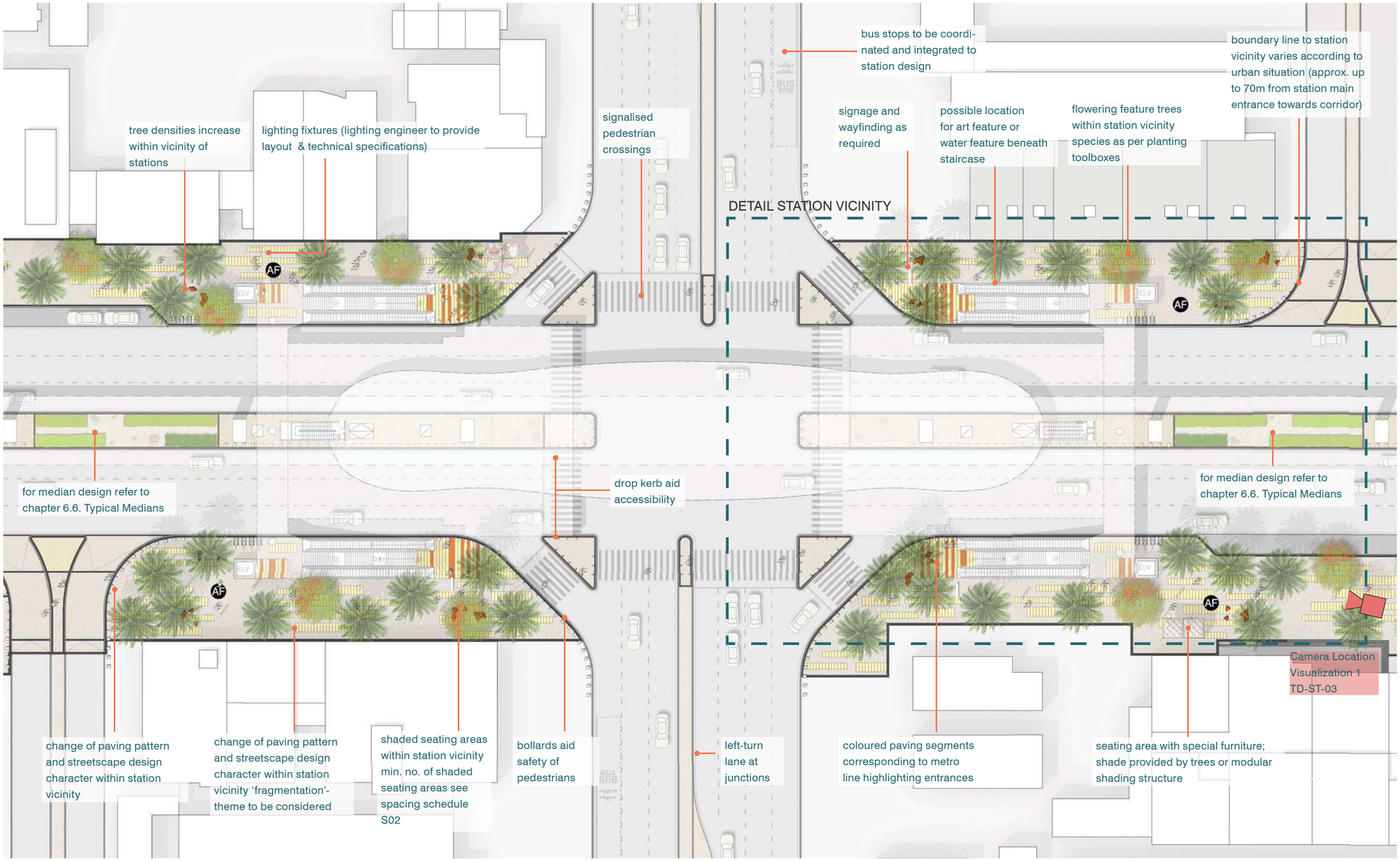
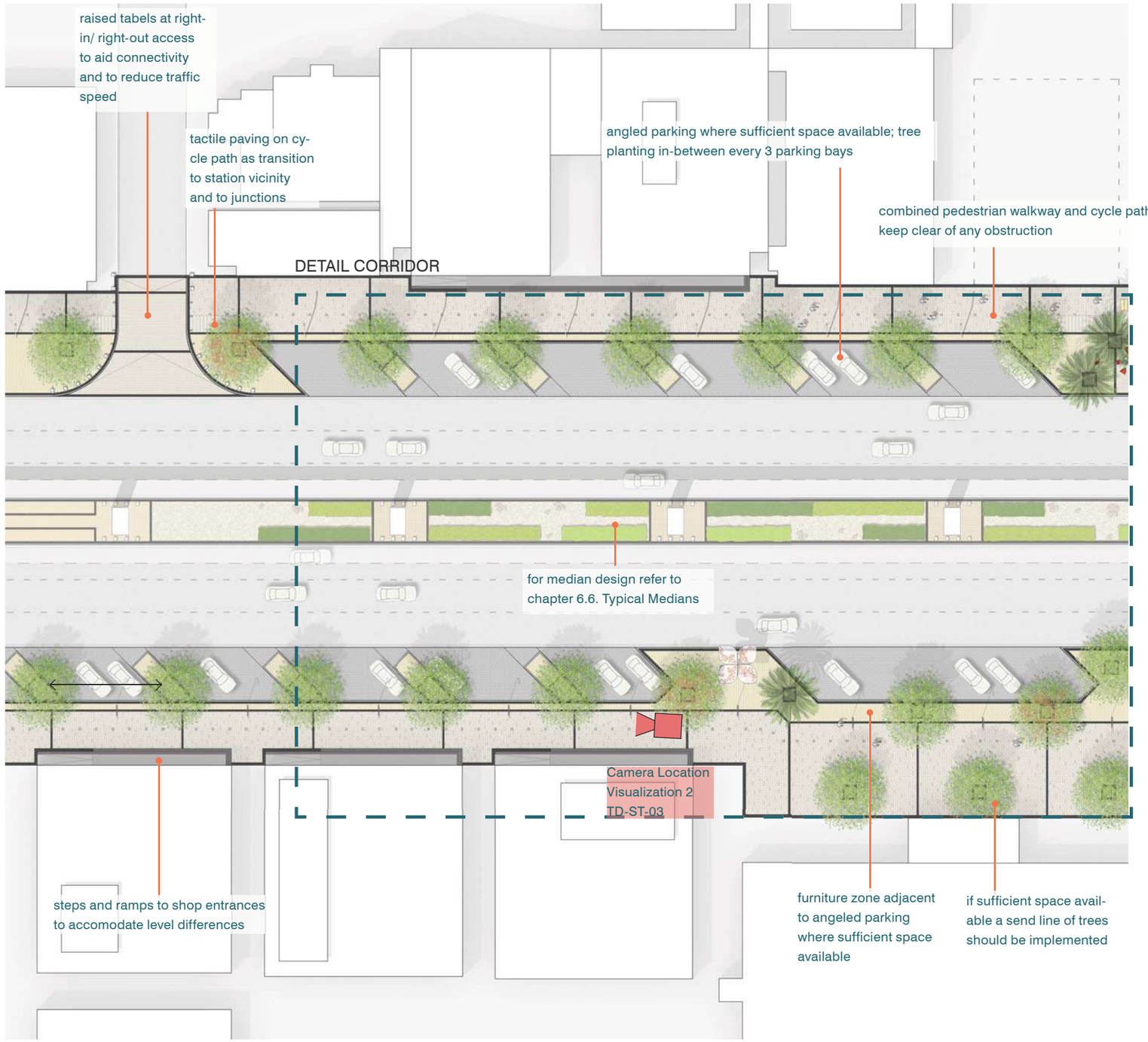
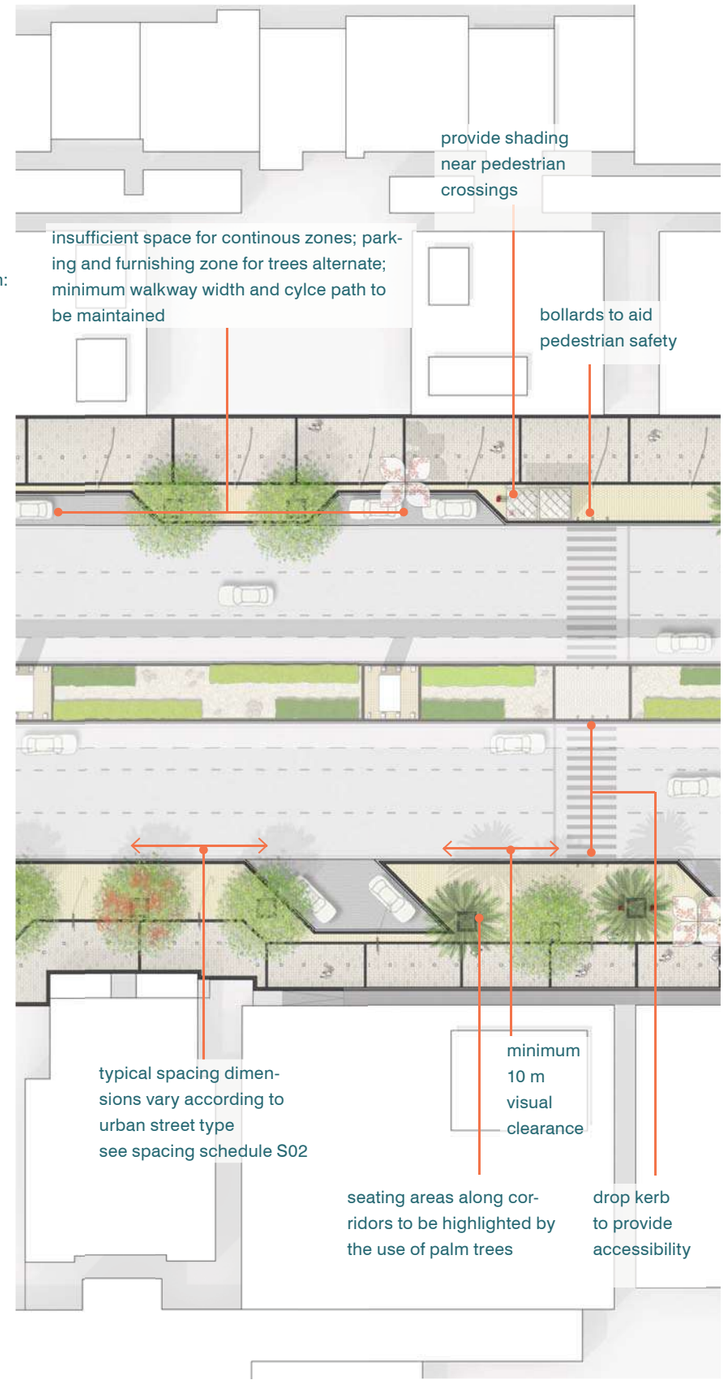


Figure 6.21 *Image of current situation (2)*

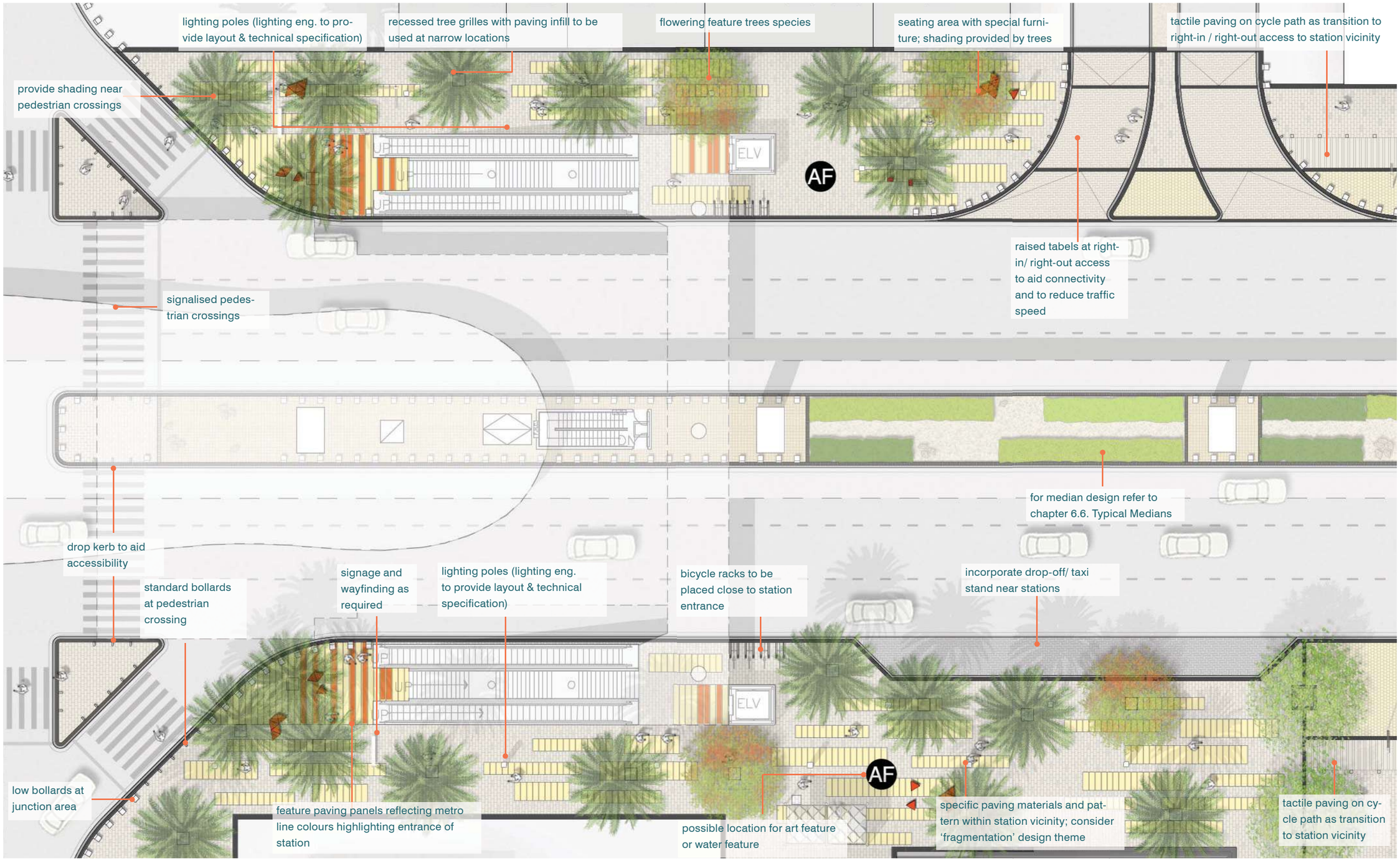


TYPICAL DESIGN TD-ST-03 (1) (SCALE 1:500)

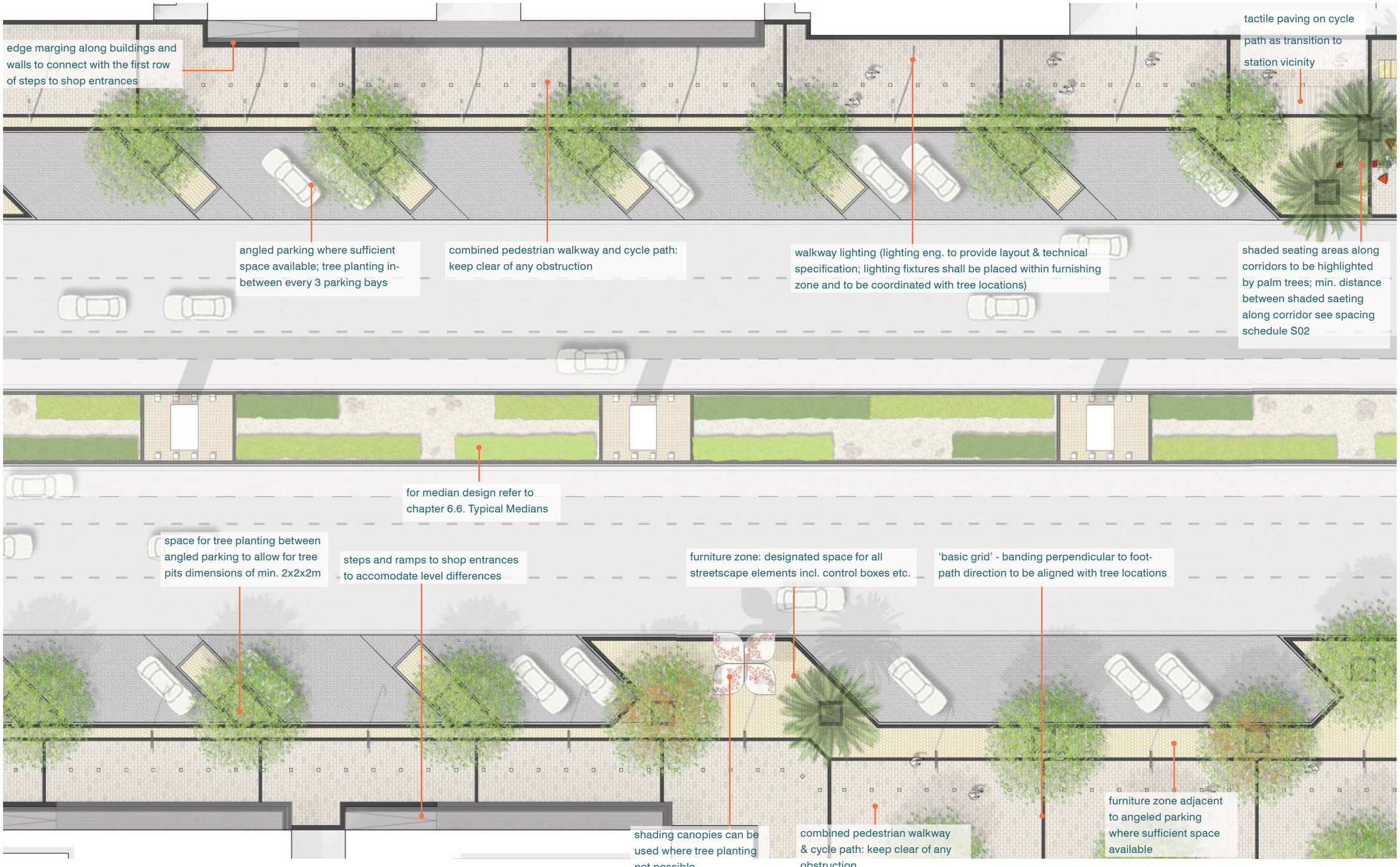




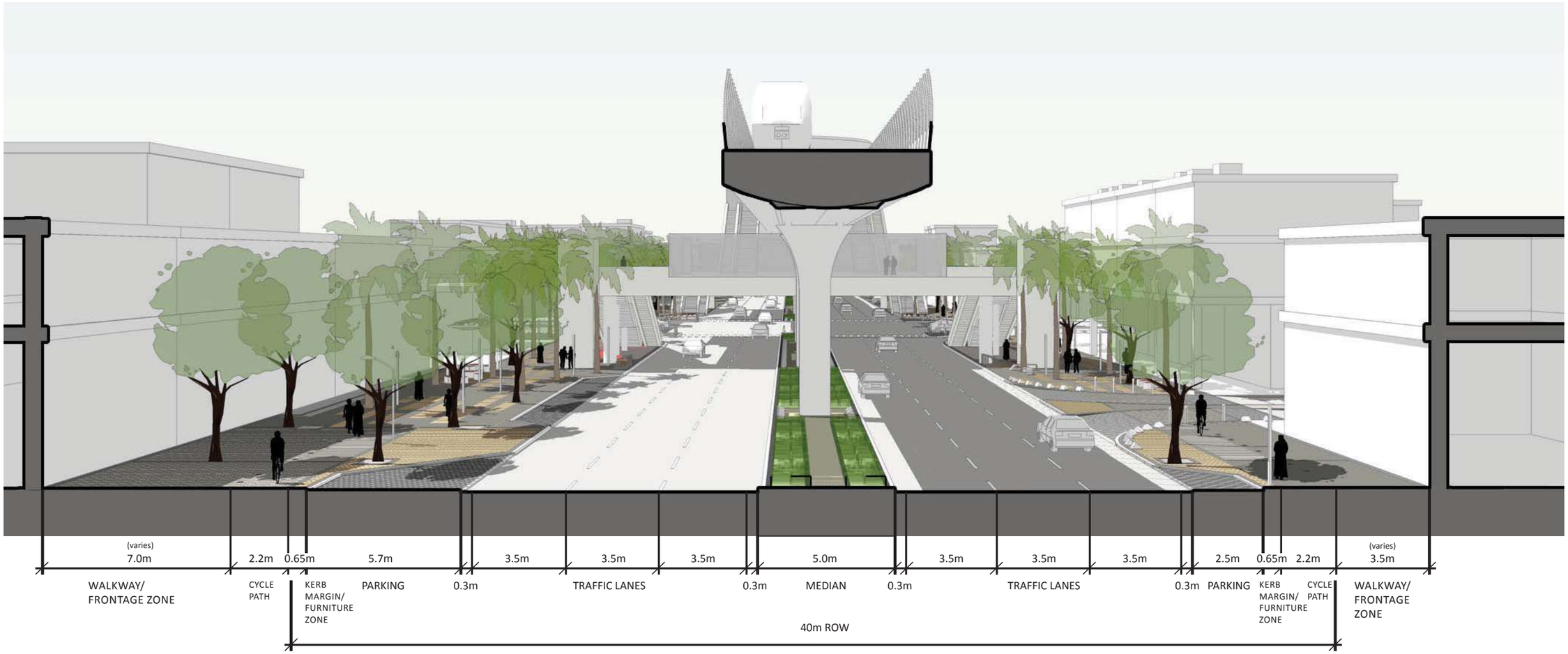
TYPICAL DESIGN TD-ST-03 (1) (SCALE 1:500)



TYPICAL DESIGN TD-ST-03 | DETAIL STATION VICINITY (SCALE 1:250)



TYPICAL DESIGN TD-ST-03 | DETAIL CORRIDOR (SCALE 1:250)



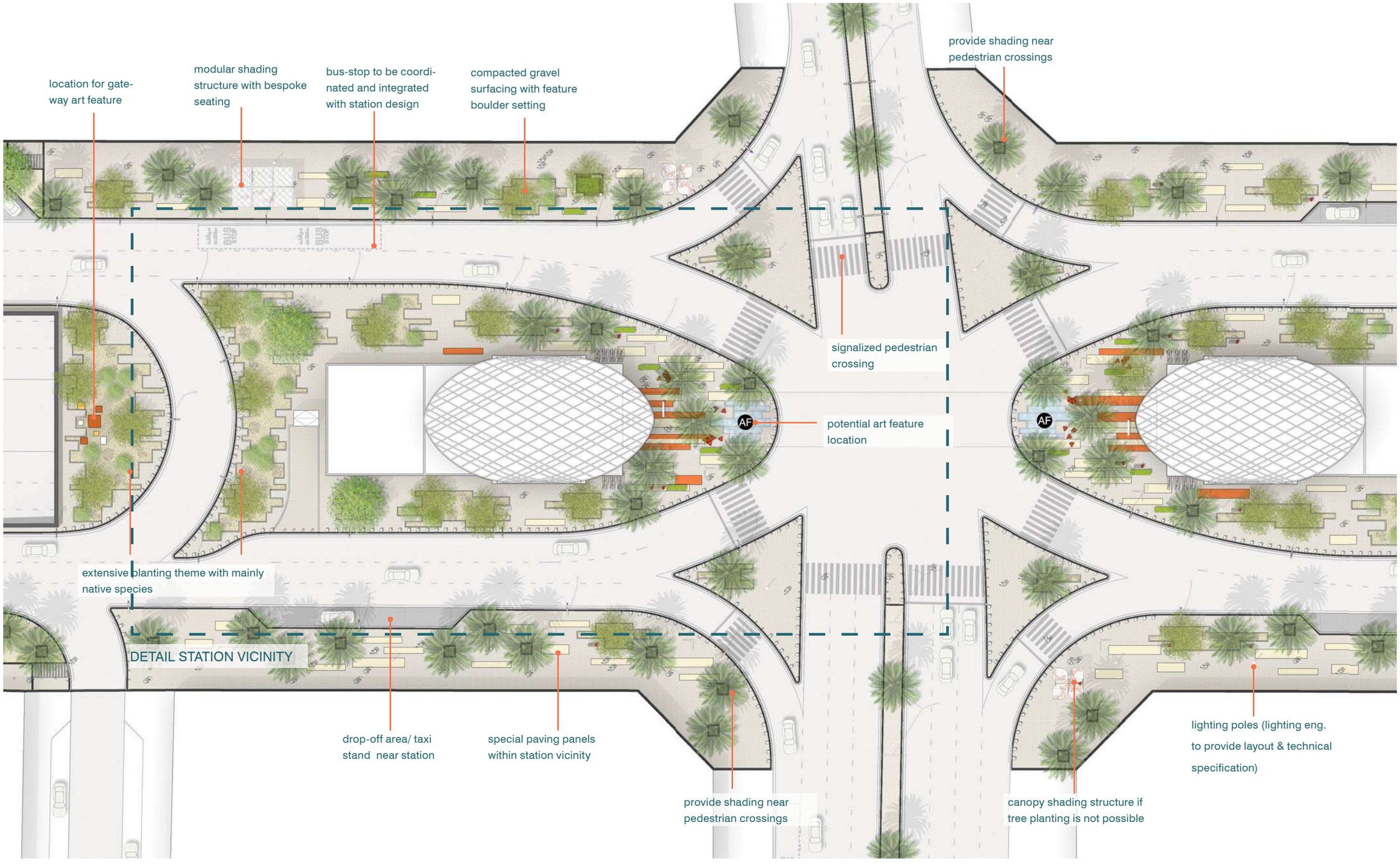
TYPICAL DESIGN TD-ST-03 | CROSS-SECTION

TYPICAL DESIGN TD-ST-03 | BIRDS EYE VIEW

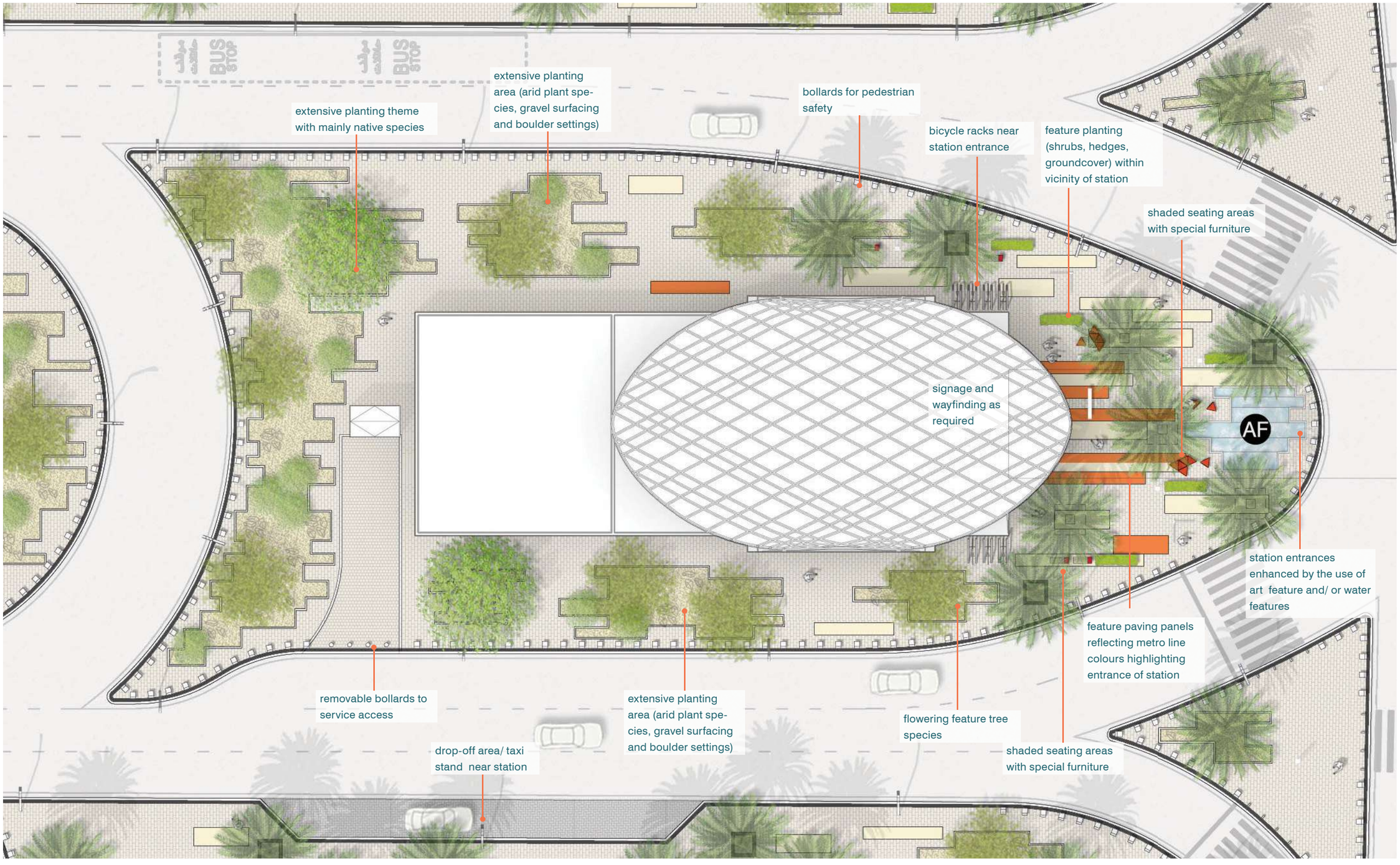
Figure 6.22 Perspective view at station vicinity - artists impression

TYPICAL DESIGN TD-ST-03 | VISUALISATION 1 | STATION VICINITY | URBAN STREET TYPE M2

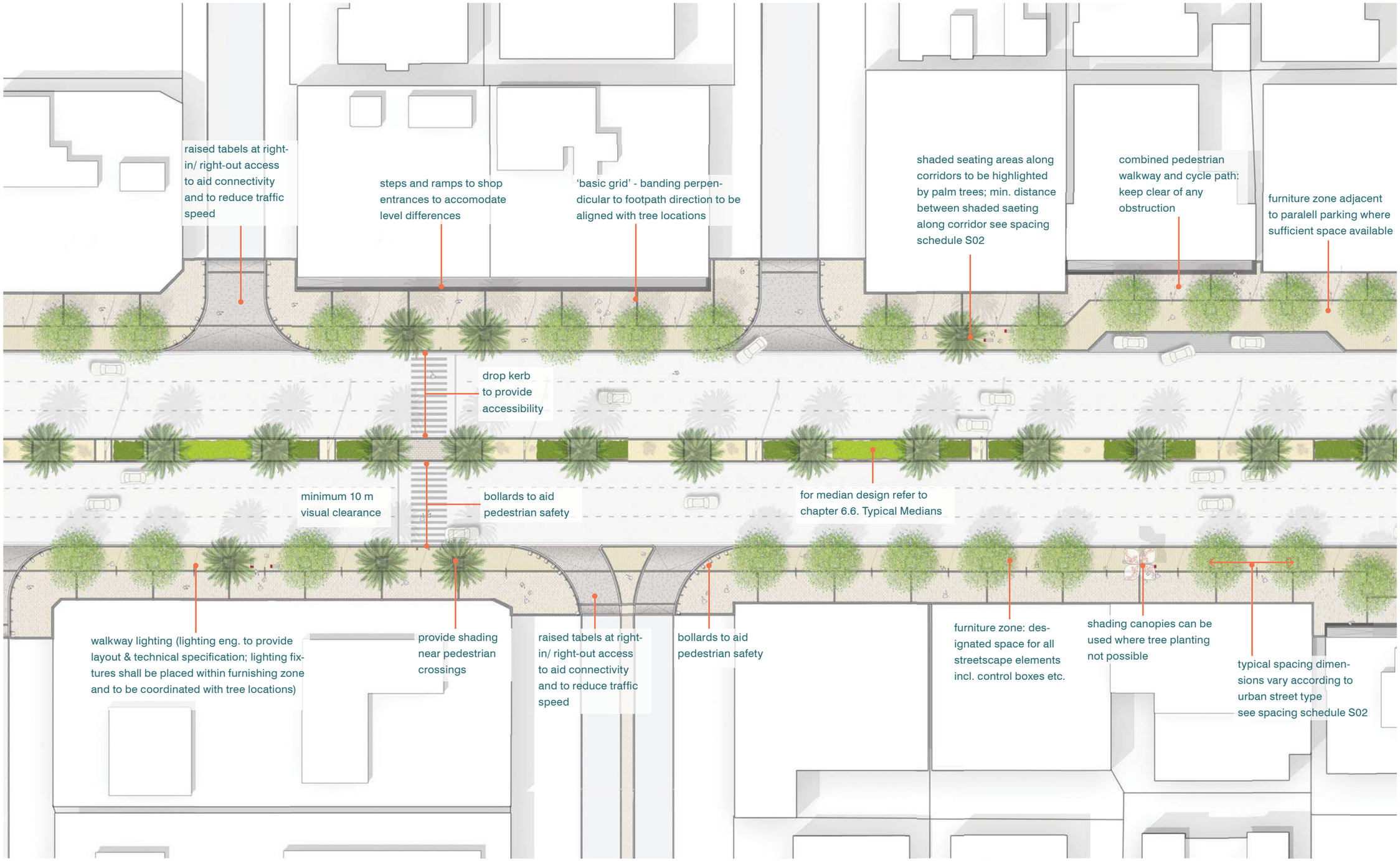
Figure 6.23 Perspective view along corridor - artists impression



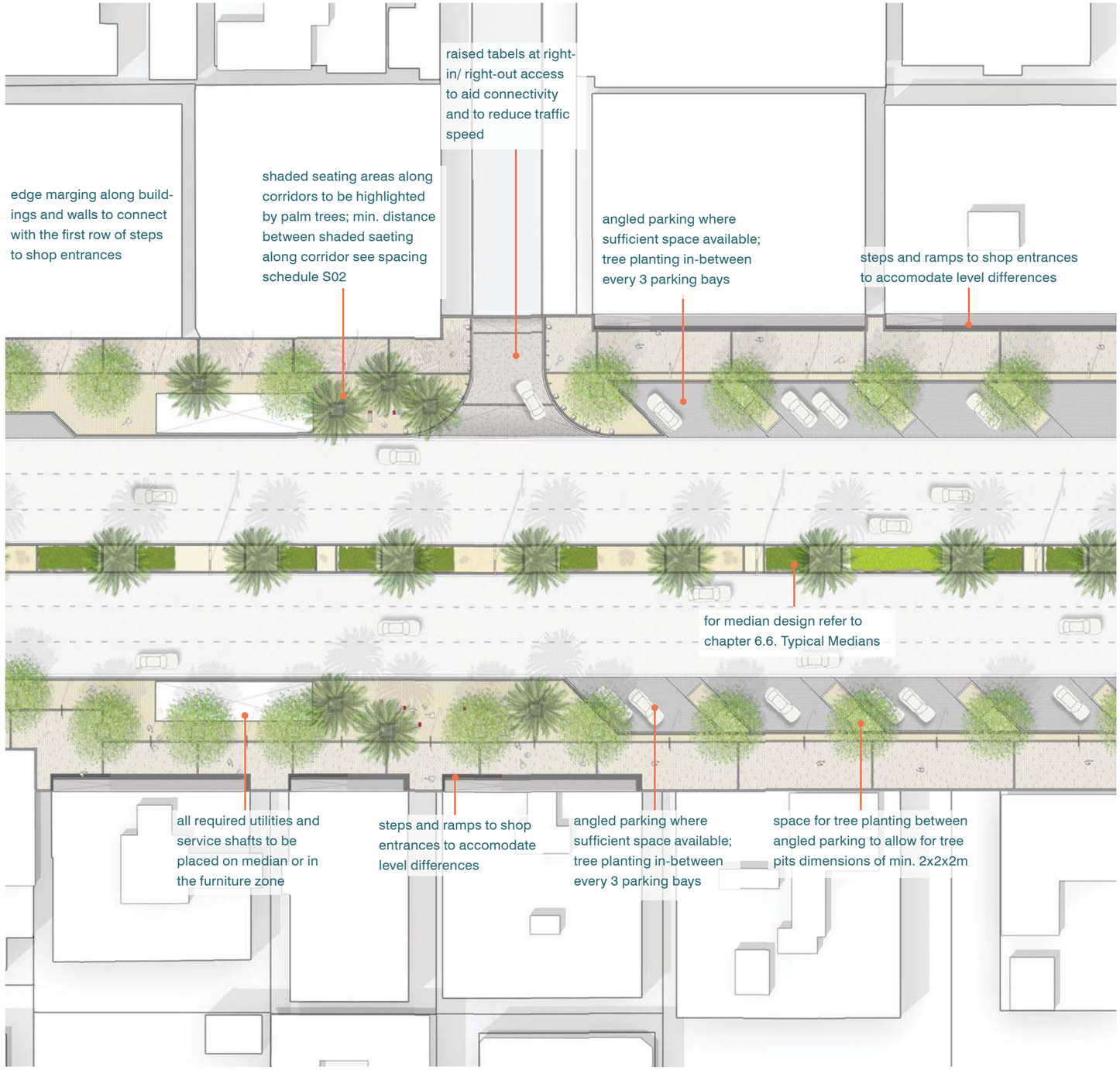
TYPICAL DESIGN TD-ST-03-sh | SHALLOW UNDERGROUND STATION (SCALE 1:500)



TD-ST-03-sh | DETAIL STATION VICINITY (SCALE 1:250)



TYPICAL DESIGN TD-ST-03 (2) | SCALE 1:500



TYPICAL DESIGN TD-ST-03 (2) | SCALE 1:500

6.5 Urban Street Type P

Typical Design TD-ST-04

Typical Design TD-ST-04 concerns a central area mixed-use urban context (Urban Street Type P3) around the planned METRO station 3E3. The purpose of the road is mainly characterized by heavy pedestrian circulation (besides its access and mobility function), with very high potential for pedestrian strolling, window shopping and meandering. The public realm will have to provide for convenient and legible routes for walking and crossing the road at-grade. The METRO track alignment is deep underground with narrow station entrance buildings planned either side of the road in very constrained spatial conditions requiring additional land acquisition. This station layout occurs often along the analysed METRO corridors. The shown typical design for the station vicinity therefore applies to many other locations (highlighted in red circles - O). A similar situation occurs at station 6G1 (Urban Street Type M2 - highlighted in orange circles - O).

The surrounding urban fabric is characterized by 4-6 storey mixed-use residential/ office buildings with ground floor retail; the corridor edges are dominated by shops with car parking in front. As a historically developed part of central Riyadh, set-backs do not exist and the geometry of roads, junctions and lots tends to be irregular. The corridor width is extremely tight, and the existing public realm partly relies on private arcades. The area is earmarked for re-development into a central TOD corridor, which is to be considered within the public realm design.

Typical Design TD-ST-04-wd

A variation of Typical Design TD-ST-04 is located in another higher density central area, mixed-use urban context (Urban Street Type P4), however, outside the historic centre of Riyadh along King Abdulaziz Road south of METRO station 5A3. Here, the purpose of the road is mainly characterized by pedestrian commuter circulation (besides its access and mobility function), with very high potential for pedestrian strolling, and meandering. The public realm will have to provide for convenient routes for walking and crossing the road (undesirable pedestrian bridges currently occur along King Abdulaziz Road).

This situation represents a primary commuter destination, which particularly lends itself to the introduction of the METRO.

The METRO track alignment is deep underground with emergency/utility access planned either side of the road. The surrounding urban fabric is characterized by tall free standing mixed-use office, hotels, governmental (Ministries) and residential buildings; the corridor edges are dominated by walls, fences and gates enclosing properties and parking lots.

Set-backs are typically not available for the public realm. However parking along the edge of road is also of minor importance, since most adjacent users provide parking within their property, or side street can be used for parking.

Due to the highly sensitive nature of many of the adjacent properties, providing security is a major aspect of redesigning the streetscape.

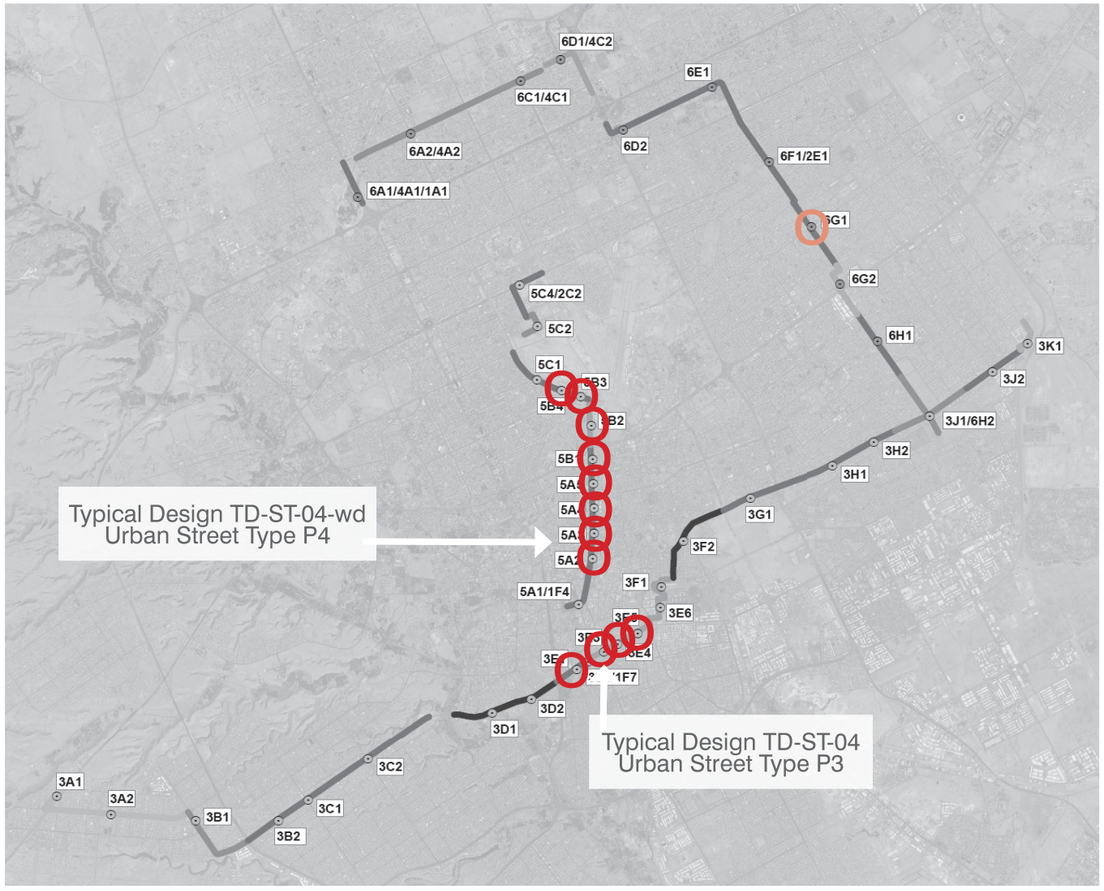
Often security perimeters are required. These should ideally be provided within the property itself. However in many locations this may not be possible. An integration of necessary features into the public realm of the street may therefore be necessary. A possible solution is already implemented in front of the High Court on Medina Road (see picture).

Figure 6.25 Image of current situation at King Abdulaziz Road

Figure 6.26 Security perimeter on public realm - King Abdulaziz Road

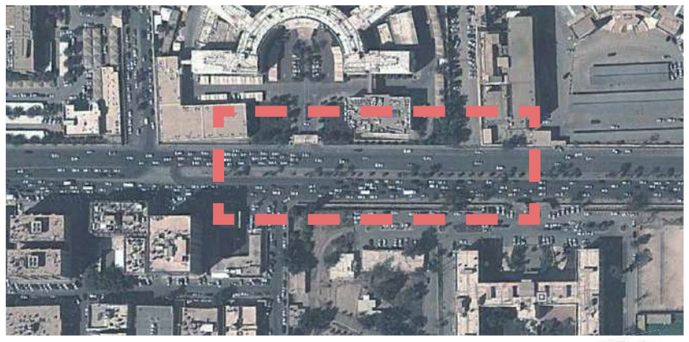
Figure 6.24 Image of current situation (Al Madina Road)

Figure 6.27 Possible security perimeter treatment - Security bollards in front of High Court - Riyadh

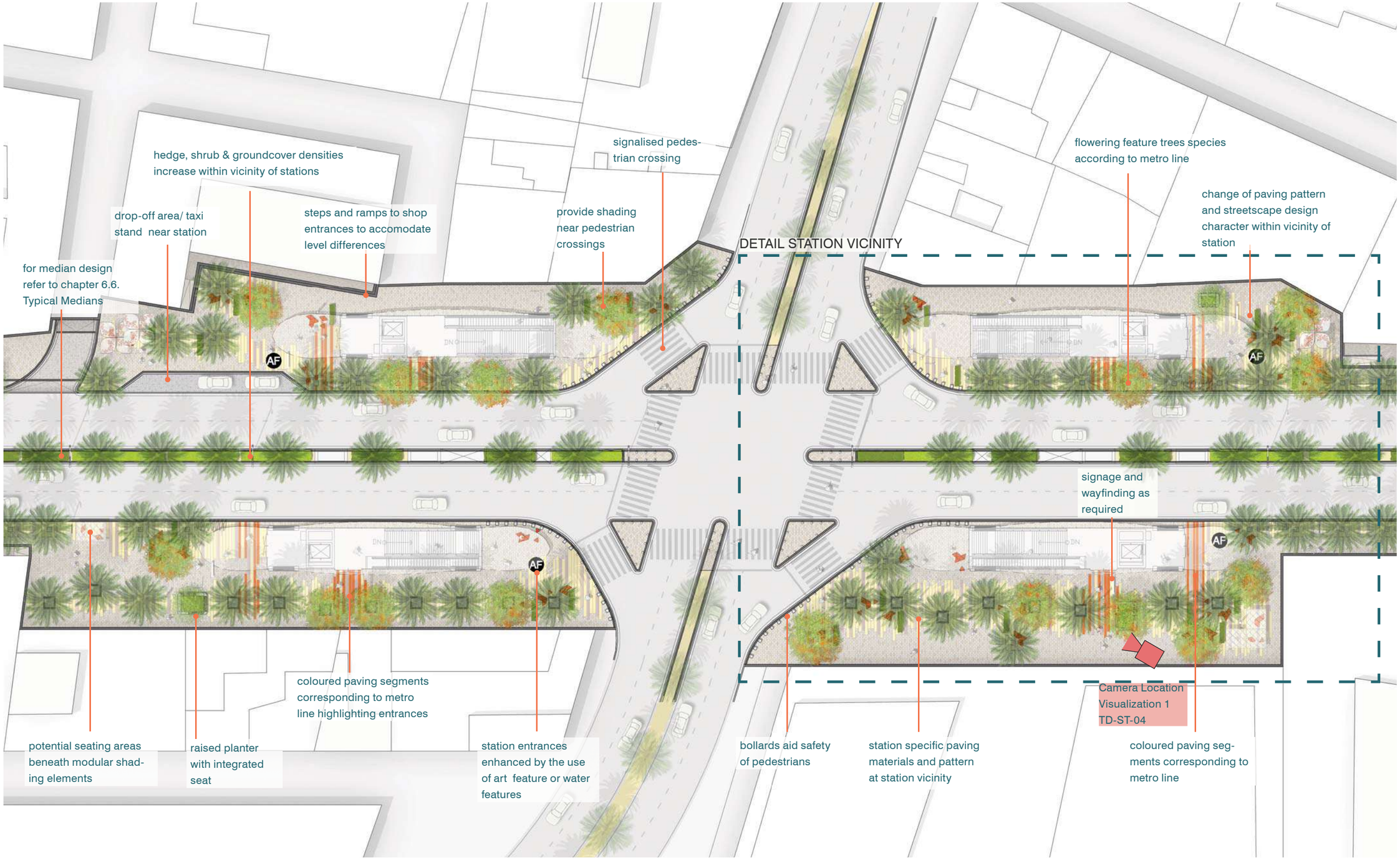


Map 6.28 *Map locating 'typical' situations - Urban Street Type P*

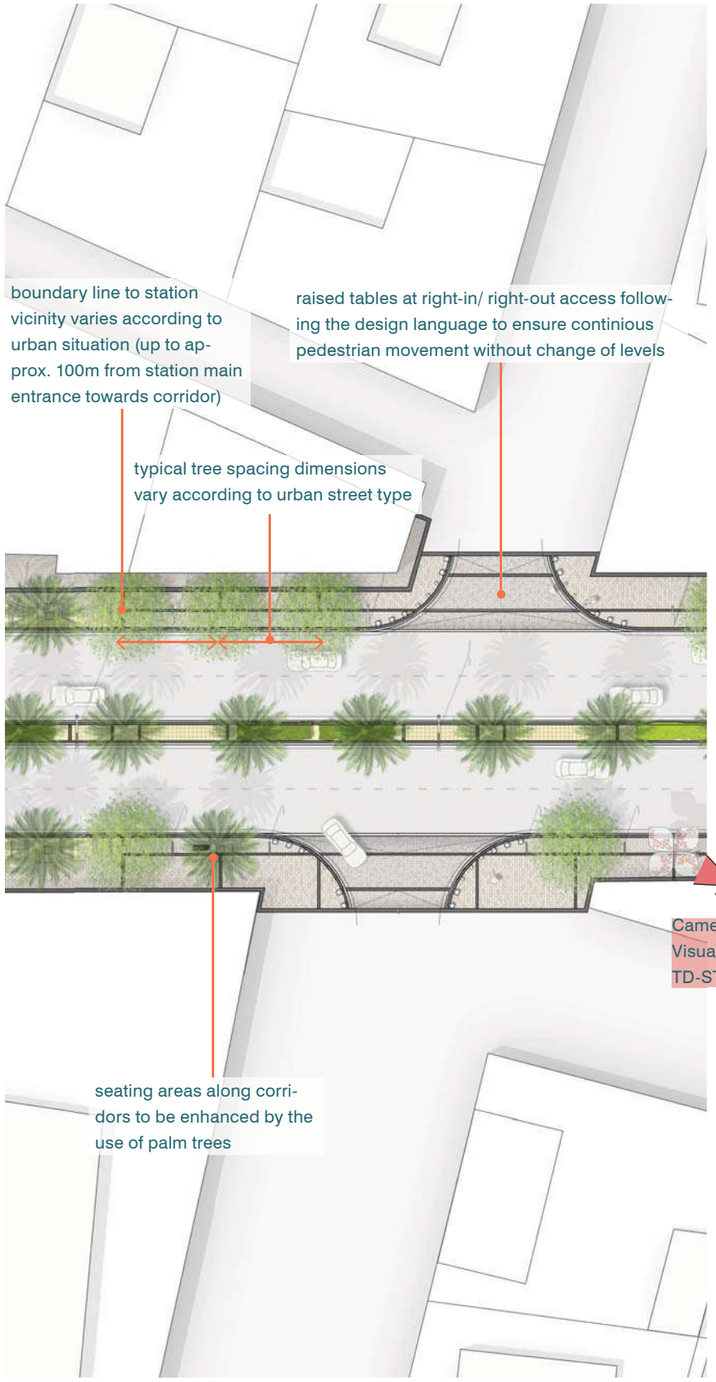
Map 6.29 *Map locating Typical Design TD-ST-04*



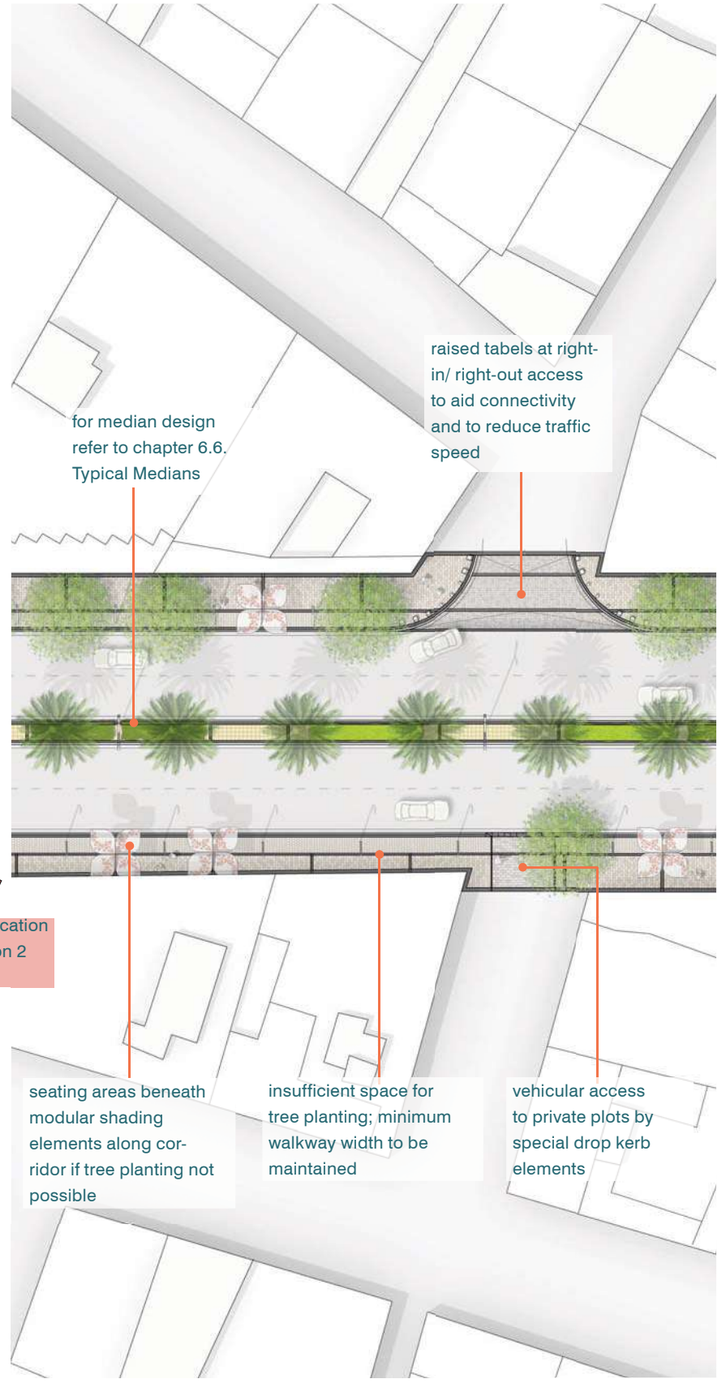
Map 6.30 *Map locating Typical Design TD-ST-04-wd*

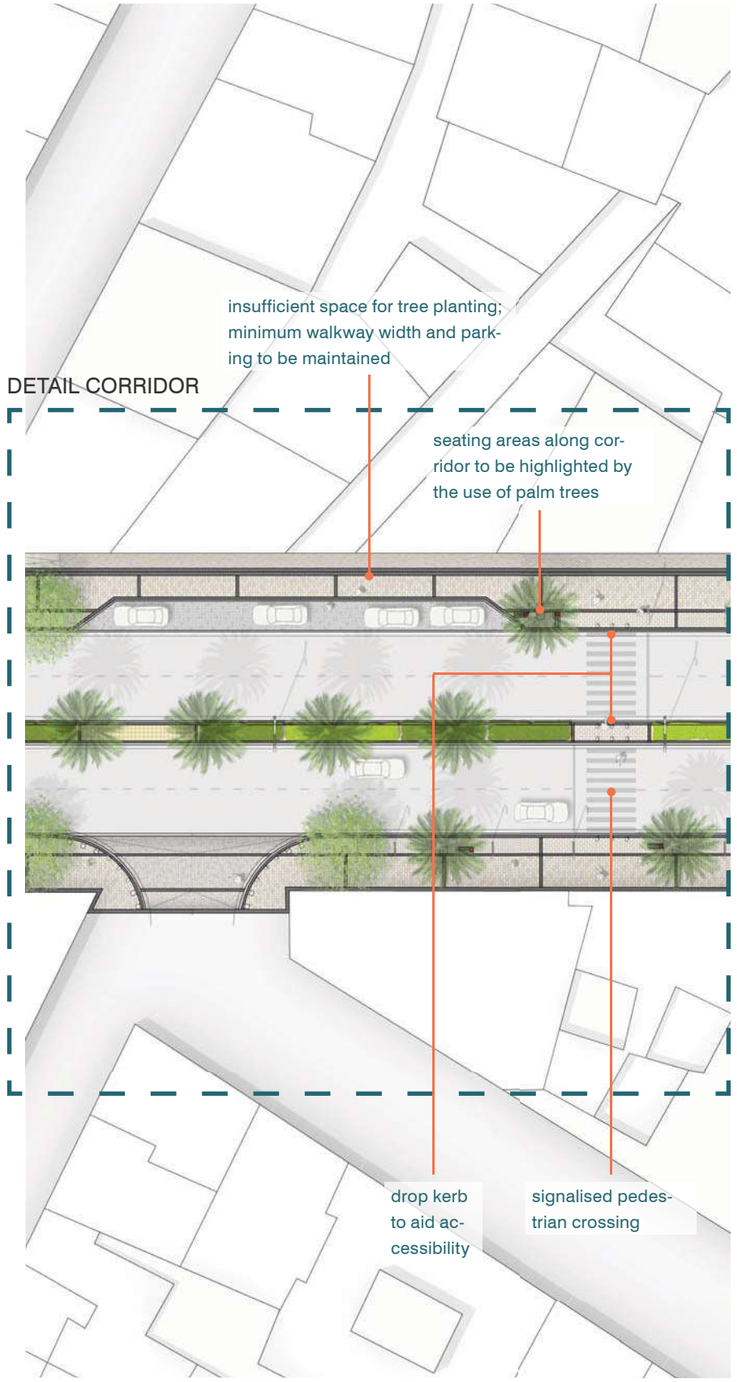


TYPICAL DESIGN TD-ST-04 (SCALE 1:500)

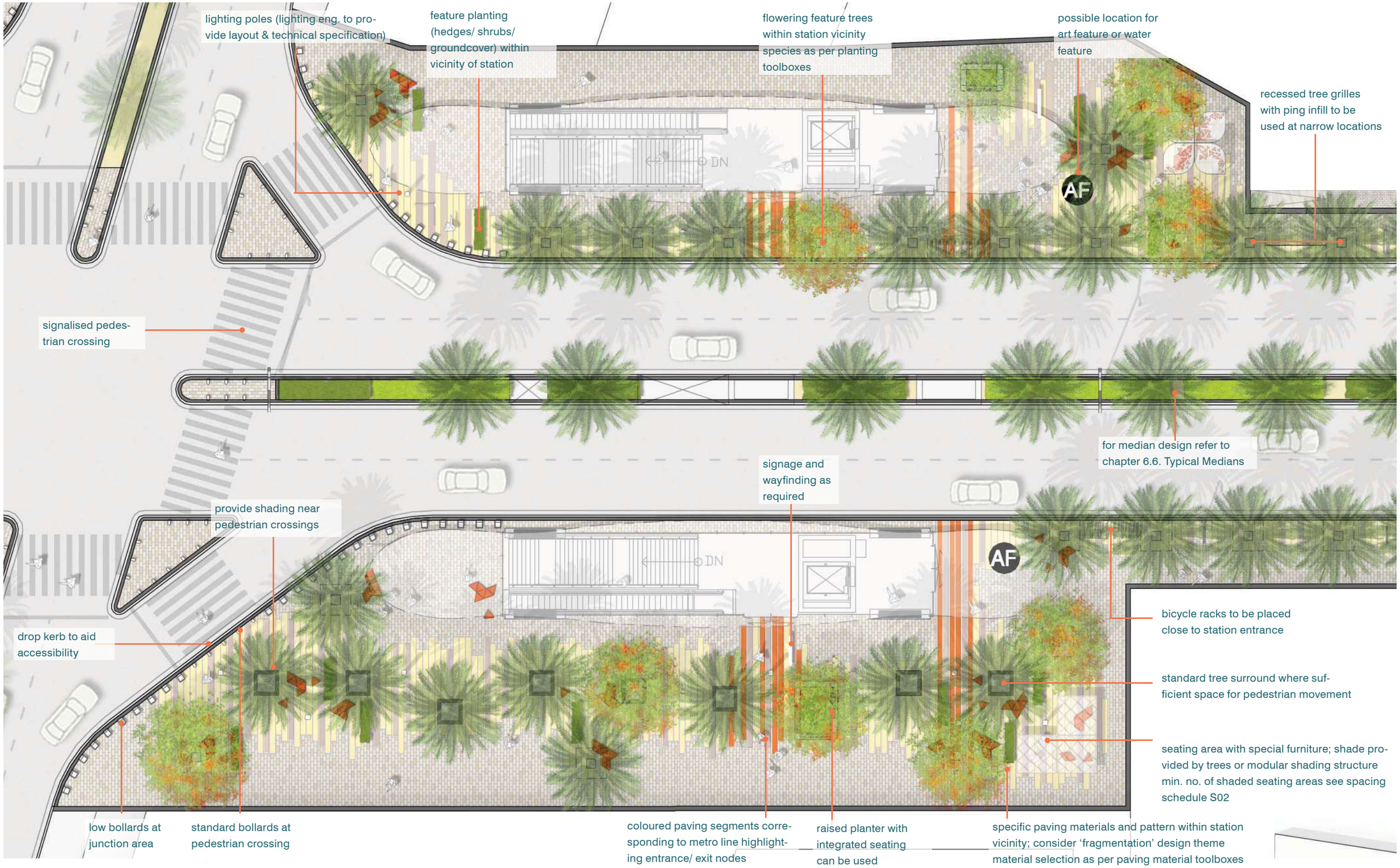


Camera Location Visualization 2 TD-ST-04

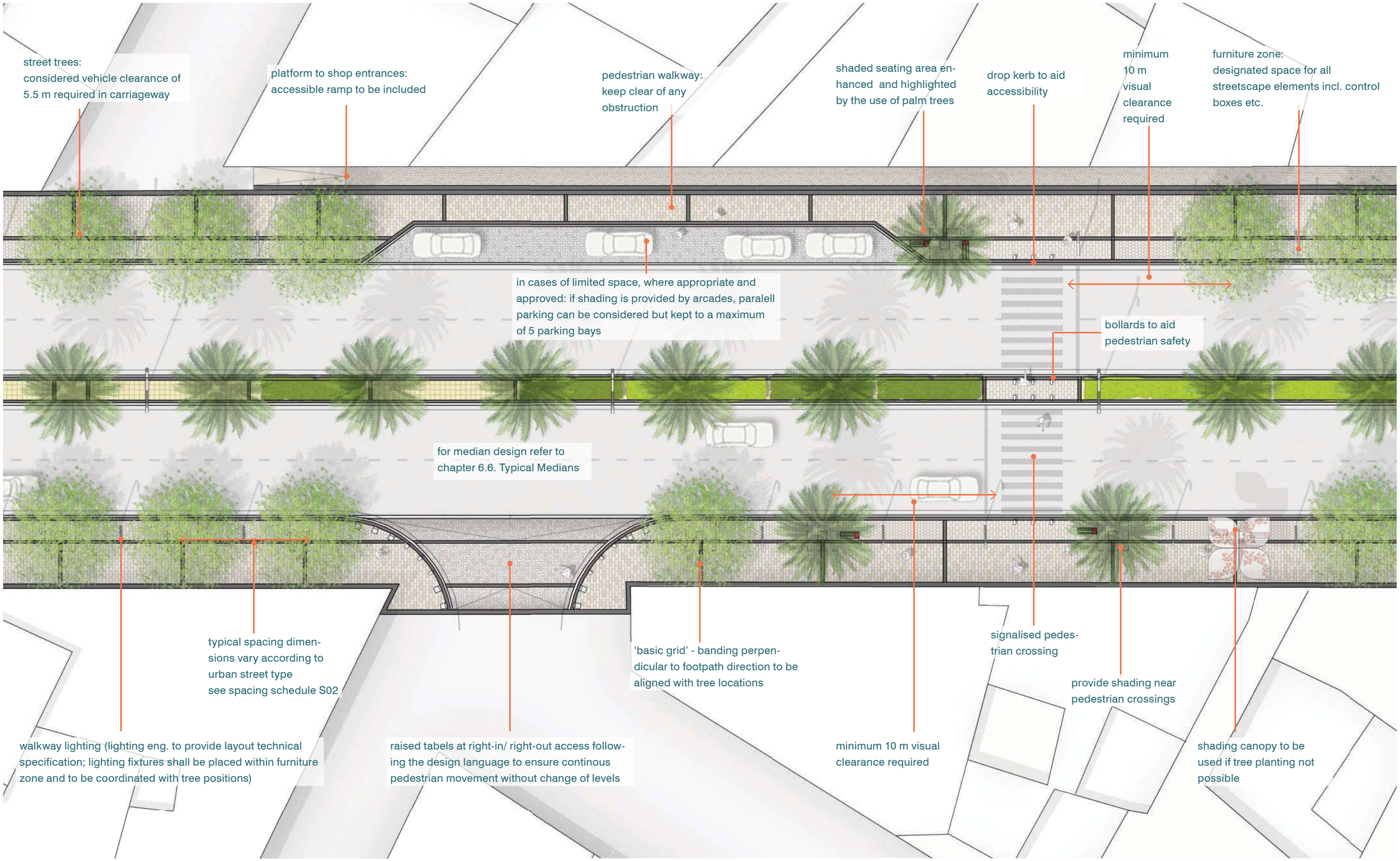




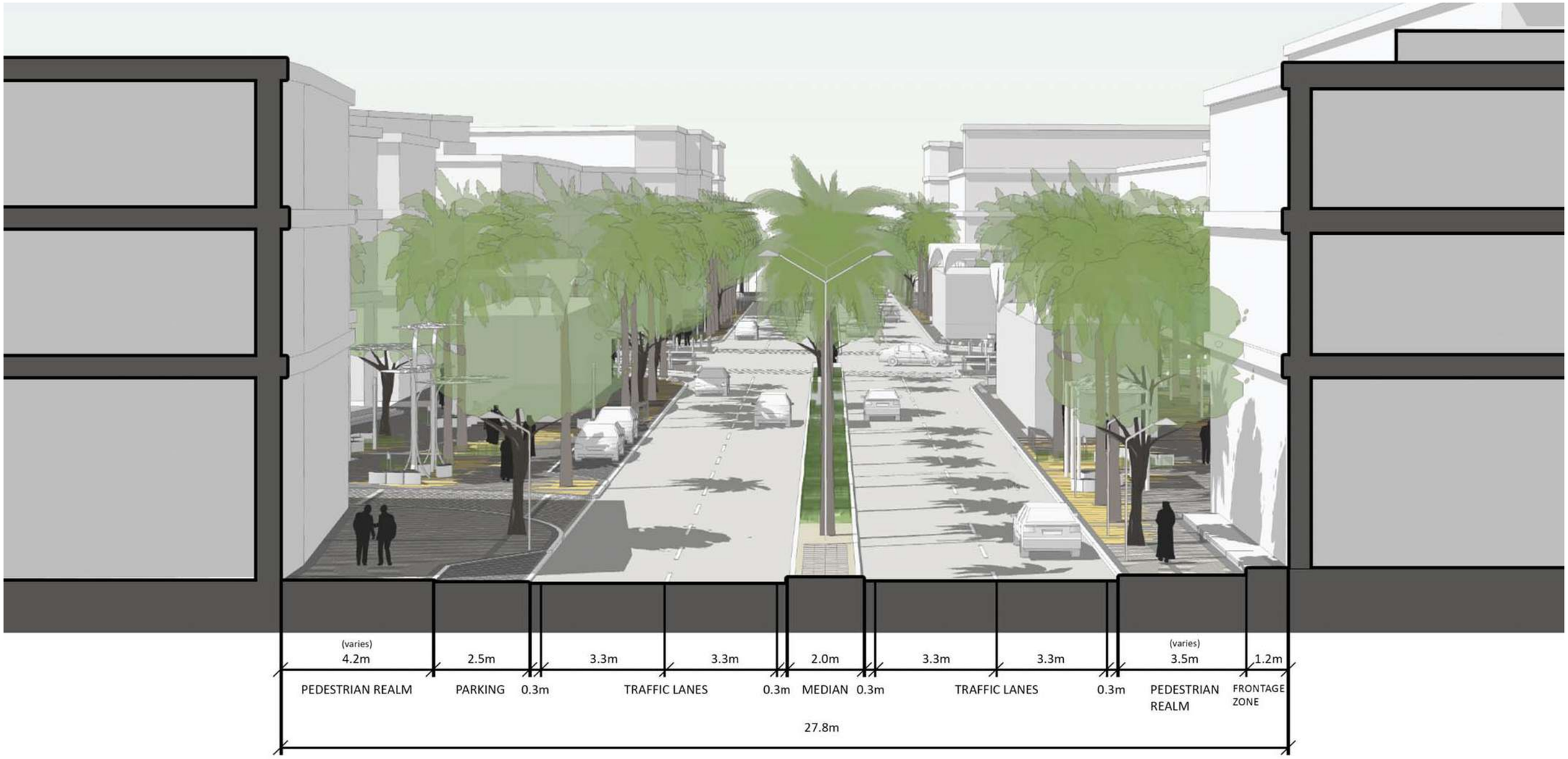
TYPICAL DESIGN TD-ST-04 (SCALE 1:500)



TYPICAL DESIGN TD-ST-04 | DETAIL STATION VICINITY (SCALE 1:250)



TYPICAL DESIGN TD-ST-04 | DETAIL CORRIDOR (SCALE 1:250)

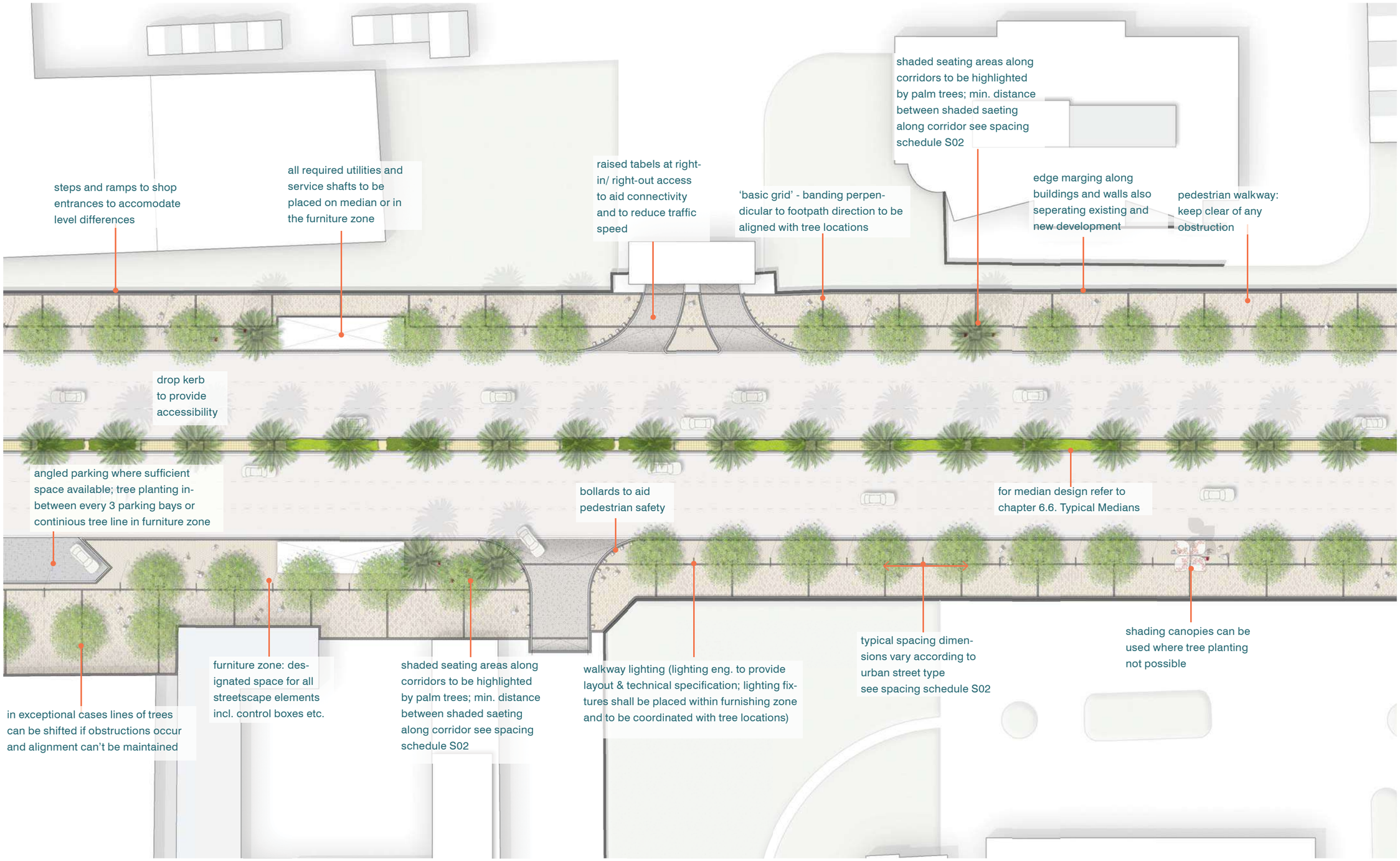


TYPICAL DESIGN TD-ST-04 | CROSS-SECTION

TYPICAL DESIGN TD-ST-04 | BIRDS EYE VIEW

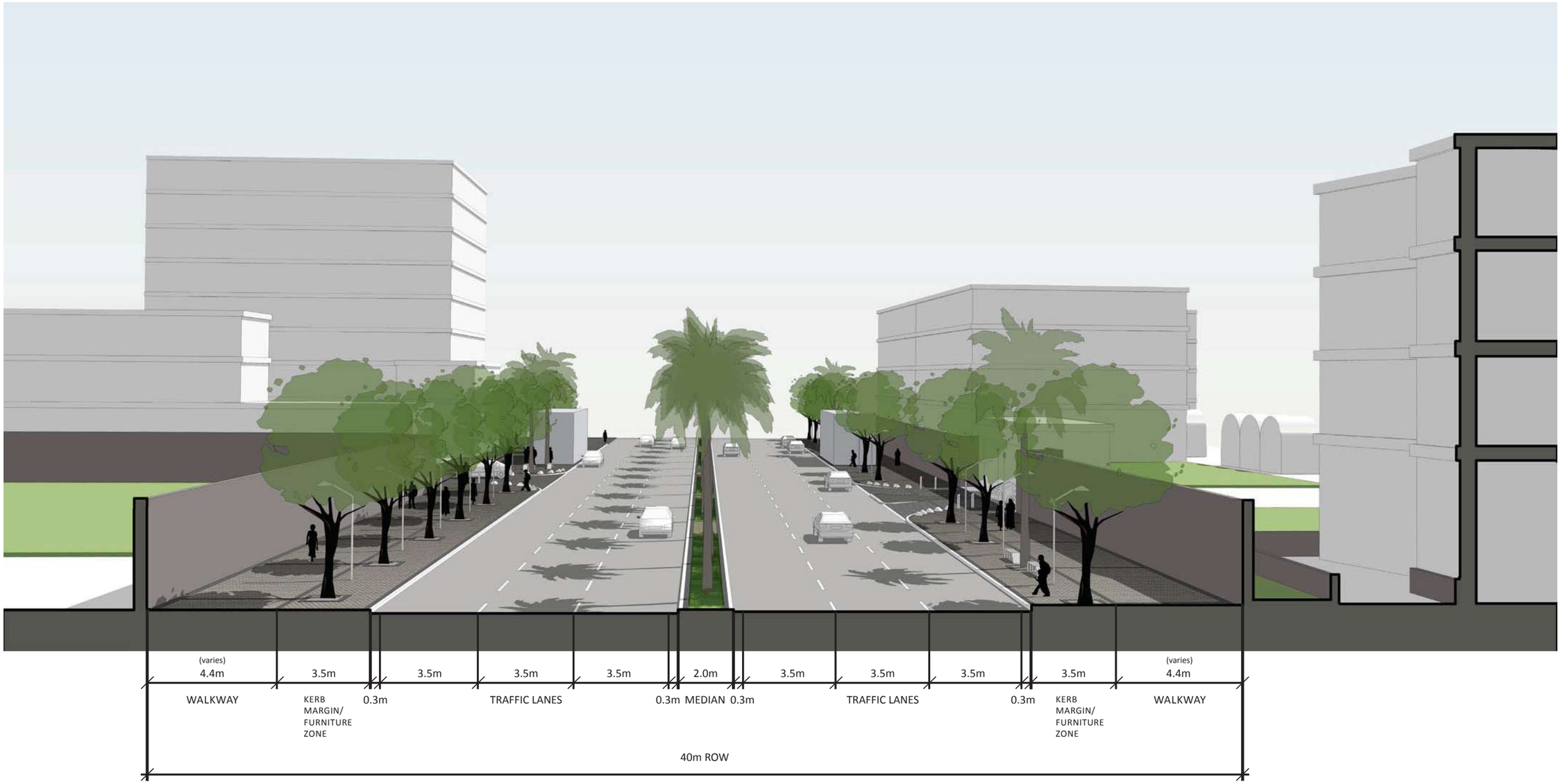
Figure 6.31 Perspective view at station vicinity - artists impression

Figure 6.32 Perspective view along corridor - artists impression



TYPICAL DESIGN TD-ST-04-wd | WIDE | URBAN STREET TYPE P4 (SCALE 1:500)

TYPICAL DESIGN TD-ST-04-wd | BIRDS EYE VIEW



TYPICAL DESIGN TD-ST-04-wd | CROSS-SECTION

6.6 Typical Medians

Different median situations occur along the corridors. These are mainly driven by the alignment of the METRO track. The key differentiations are: elevated track, at-grade track along the median, or underground (hence no visible impact).

Following these categories and in line with the Urban Street Types, 7 ‘typical’ situations have been identified along the analysed METRO corridors. The application of these designs is defined in the Typical Design Schedule S01.

Some general principles apply to all Typical Median Designs:

- Fences shall not be used on medians, apart from short, especially dangerous segments, where other deterrents are not available; or roads where pedestrians are not typically expected (i.e. freeways).
- Planting density is being used to highlight METRO stations, junctions and pedestrian crossings (i.e. increasing density at the approaches).
- The spacing of landscape elements is defined in the Spacing Schedule S02 as a function of the Urban Street Type.
- Pedestrian crossings are equipped with drop-kerbs and protected by crossings. Planting needs to consider visibilty.
- Medians shall not provide continuous pedestrian walkways, since this would encourage dangerous road crossing
  (An exeption would be a very wide median providing pedestrian and cycling facilities for leisure purposes, who would be supported by safe crossings, and planting to separate traffic and people using the median).

Typical Design TD-M-01

Typical Design TD-M-01 applies to Urban Street Type A (industrial/ employment). The design focuses on cost-effective materials and permeable surfaces.

Local limestone gravel is being used. Tree pits are separated from loose gravel by PCC banding.

Random boulder placements are being used to add interest.

Typical Design TD-M-02

Typical Design TD-M-02 applies to Urban Street Types R and M where more pedestrian activity can be expected.

The design principles follow TD-M-01. However, hedges are being added as an additional element. Fields of hedges are being placed randomly, becoming more dense at the approaches to stations and pedestrian crossings. Hedges can be used to prevent pedestrians from crossing at potentially dangerous locations.

Hard paved areas are used at the base of lighting columns (lighting layout to be specified by lighting/ electrical engineer).

Typical Design TD-M-03

Typical Design TD-M-03 applies to Urban Street Type P, where a high quality environment is being expected.

Planting along the median shall be rather intensive, using a variety of hedges, shrubs and ornamental grasses (see Planting Toolboxes T13 and T14).

Partly hard-paved areas are being used to break up planting areas at irregular intervals.

Hard-paved areas could be applied in areas with less pedestrian movement, helping to optimise implementation and maintenance costs.

Typical Design TD-M-04

Typical Design TD-M-04 applies to Urban Street Type A with at-grade METRO tracks. The design is based on utilising the bespoke METRO fencing as a defining streetscape element. With a focus on costs and implementability (available space) further streetscape elements are not envisaged.

Typical Design TD-M-05

Typical Design TD-M-05 applies to sections of Urban Street Types R, M and P where at-grade METRO tracks are present (mostly transition areas).

Irregular fields of hedges, shrubs and ornamental grasses are being used to shield/ break-up fenced areas. These alternate with extensive, desert/ rock-themed gravel surfaces with random boulder placements. and local drought-resitant species.

Typical Design TD-M-06

Typical Design TD-M-06 applies to medians with elevated tracks in Urban Street Type R. The design follows the language defined in TD-M-02. However, the design reacts to the requirements of the elevated track (i.e. wider median available, shading by METRO track). Planting shall be limited to the edges of the median, where more natural light will be available, also limiting implementation and maintenance costs.

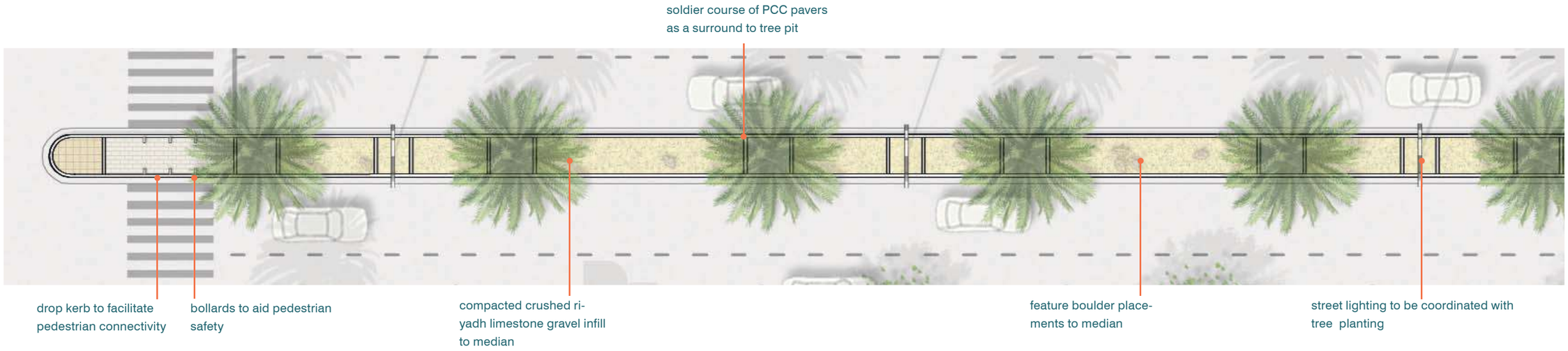
Typical Design TD-M-07

Typical Design TD-M-07 applies to medians with elevated tracks in Urban Street Types M and P.

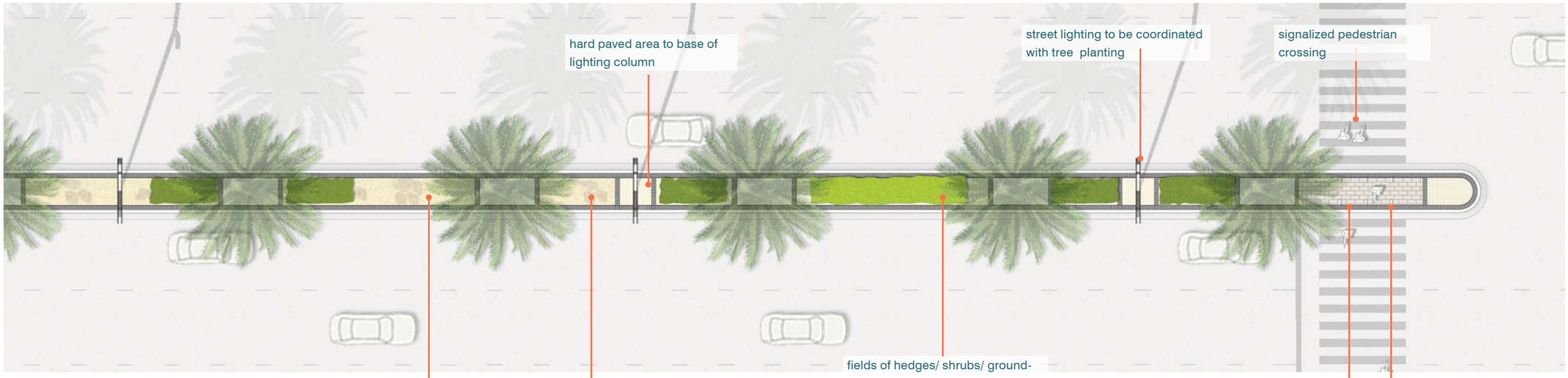
The design follows the same philosophy as TD-M-06. However, the design is more intense, allowing for a larger variety.

Figure 6.33 Intensive design theme - Diplomatic Quarter, Riyadh

Figure 6.34 Hedges used as pedestrian deterrent - Bottrop, Germany

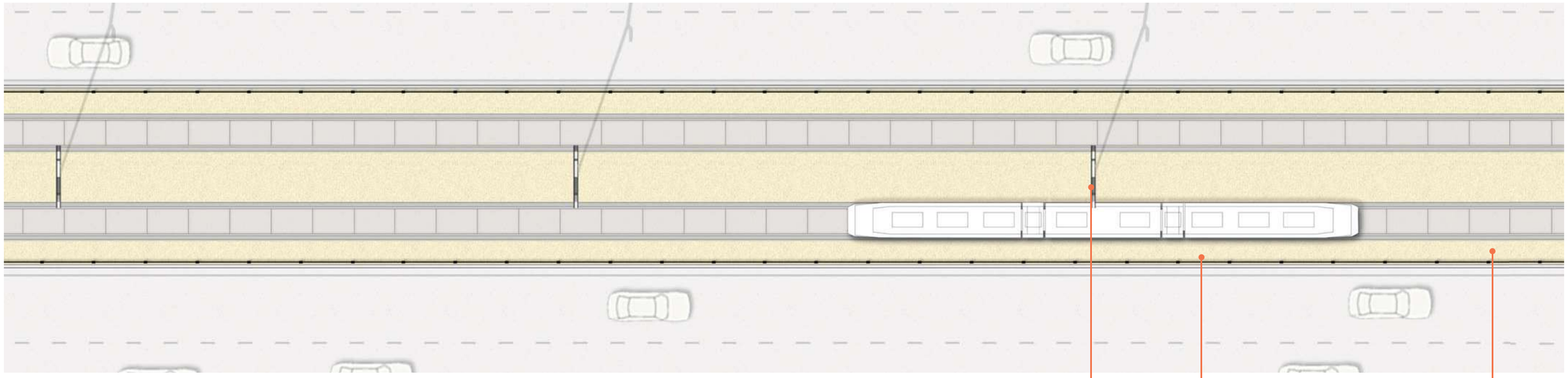


TYPICAL DESIGN TD-M-01 | URBAN STREET TYPE A | STANDARD (SCALE 1:200)

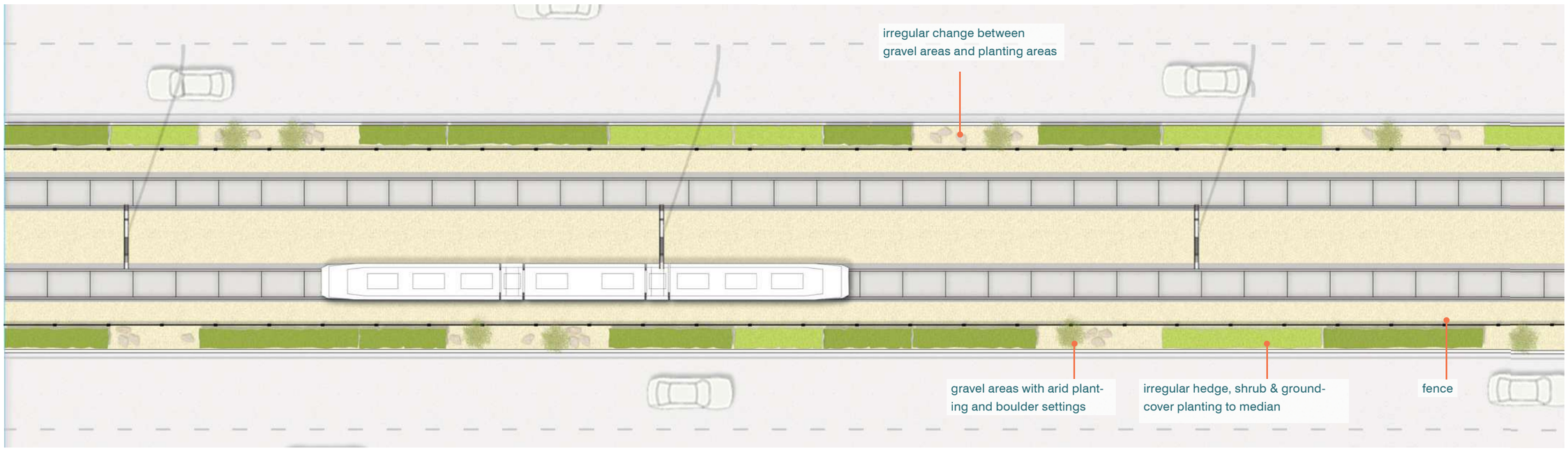


TYPICAL DESIGN TD-M-02 | URBAN STREET TYPE R & M | STANDARD (SCALE 1:200)

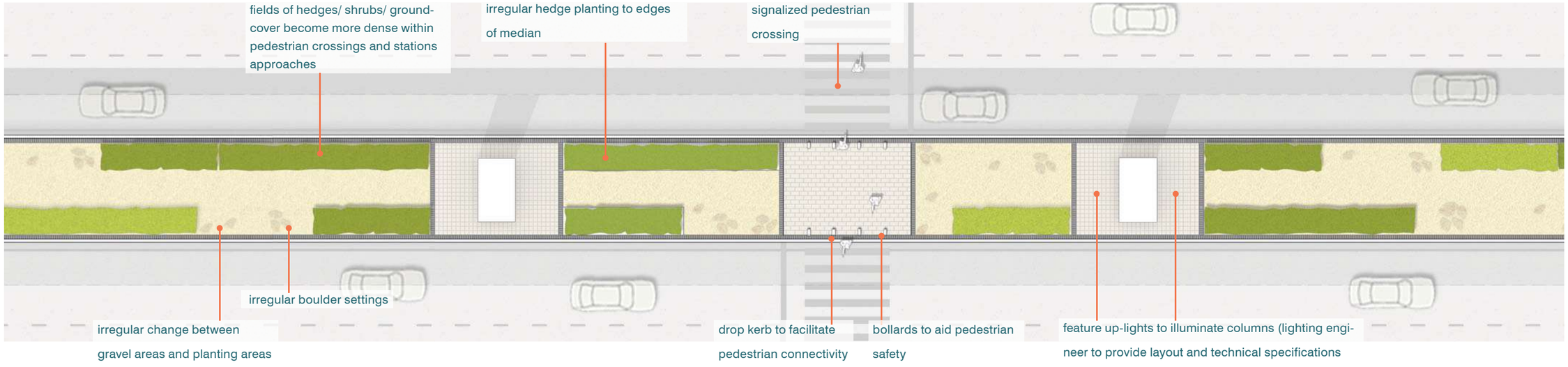
TYPICAL DESIGN TD-M-03 | URBAN STREET TYPE P | STANDARD (SCALE 1:200)



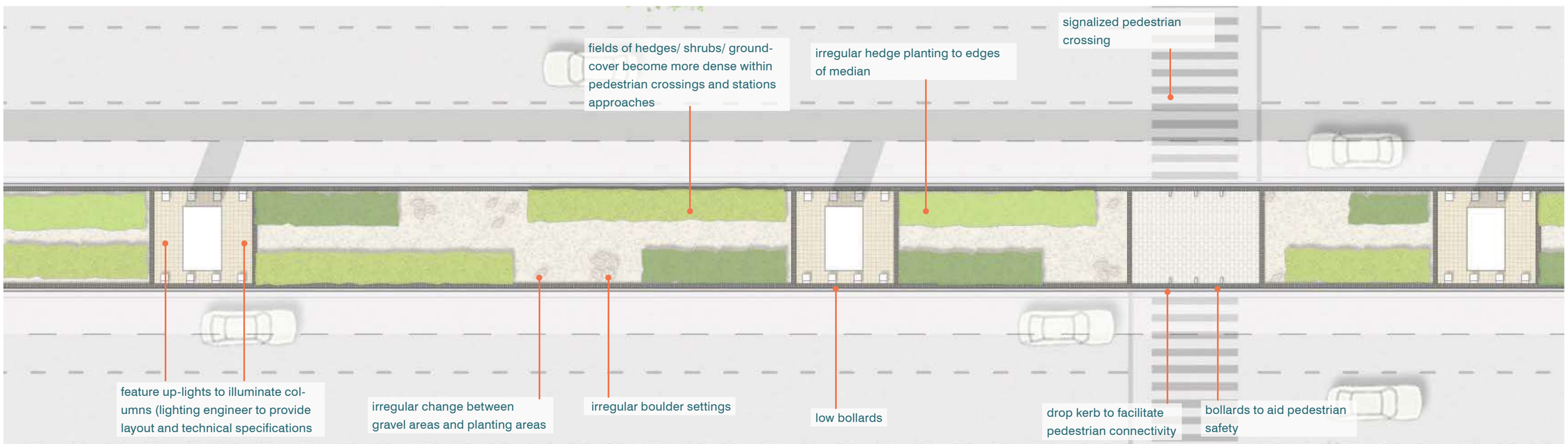
TYPICAL DESIGN TD-M-04 | URBAN STREET TYPE A | AT GRADE (SCALE 1:200)



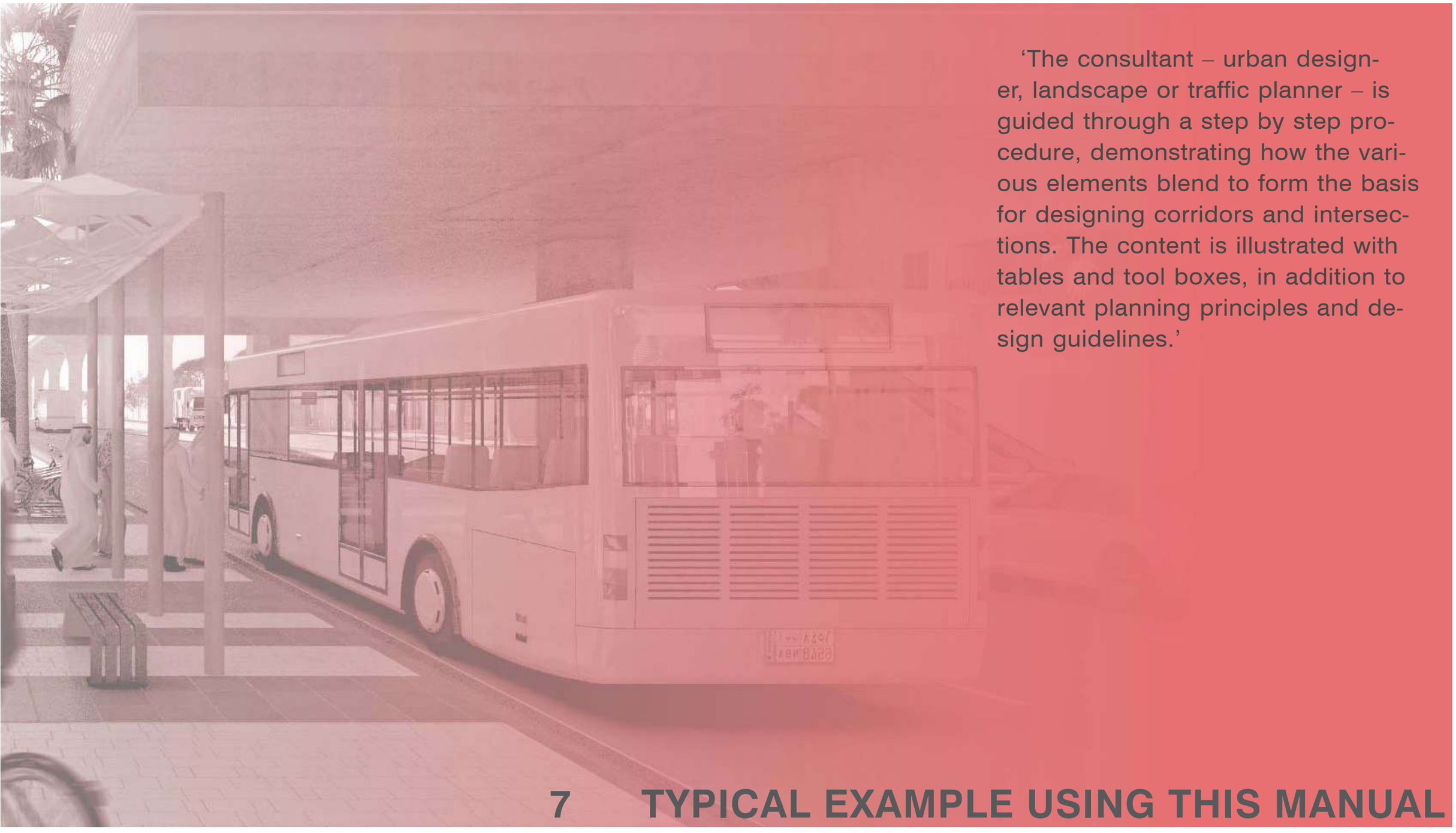
TYPICAL DESIGN TD-M-05 | URBAN STREET TYPES R, M & P | AT GRADE (SCALE 1:200)



TYPICAL DESIGN TD-M-06 | URBAN STREET TYPE R | ELEVATED (SCALE 1:200)



TYPICAL DESIGN TD-M-07 | URBAN STREET TYPE M | ELEVATED (SCALE 1:200)



‘The consultant – urban designer, landscape or traffic planner – is guided through a step by step procedure, demonstrating how the various elements blend to form the basis for designing corridors and intersections. The content is illustrated with tables and tool boxes, in addition to relevant planning principles and design guidelines.’

7 TYPICAL EXAMPLE USING THIS MANUAL

7.1 Step by Step Guide

Apply the manual to a given situation

In order to illustrate the application of the design guidance as outlined in this UDM, a 'step by step guide' is given in the following section to enable to the designers of any METRO corridor location/ segment a concise yet simple reference tool.

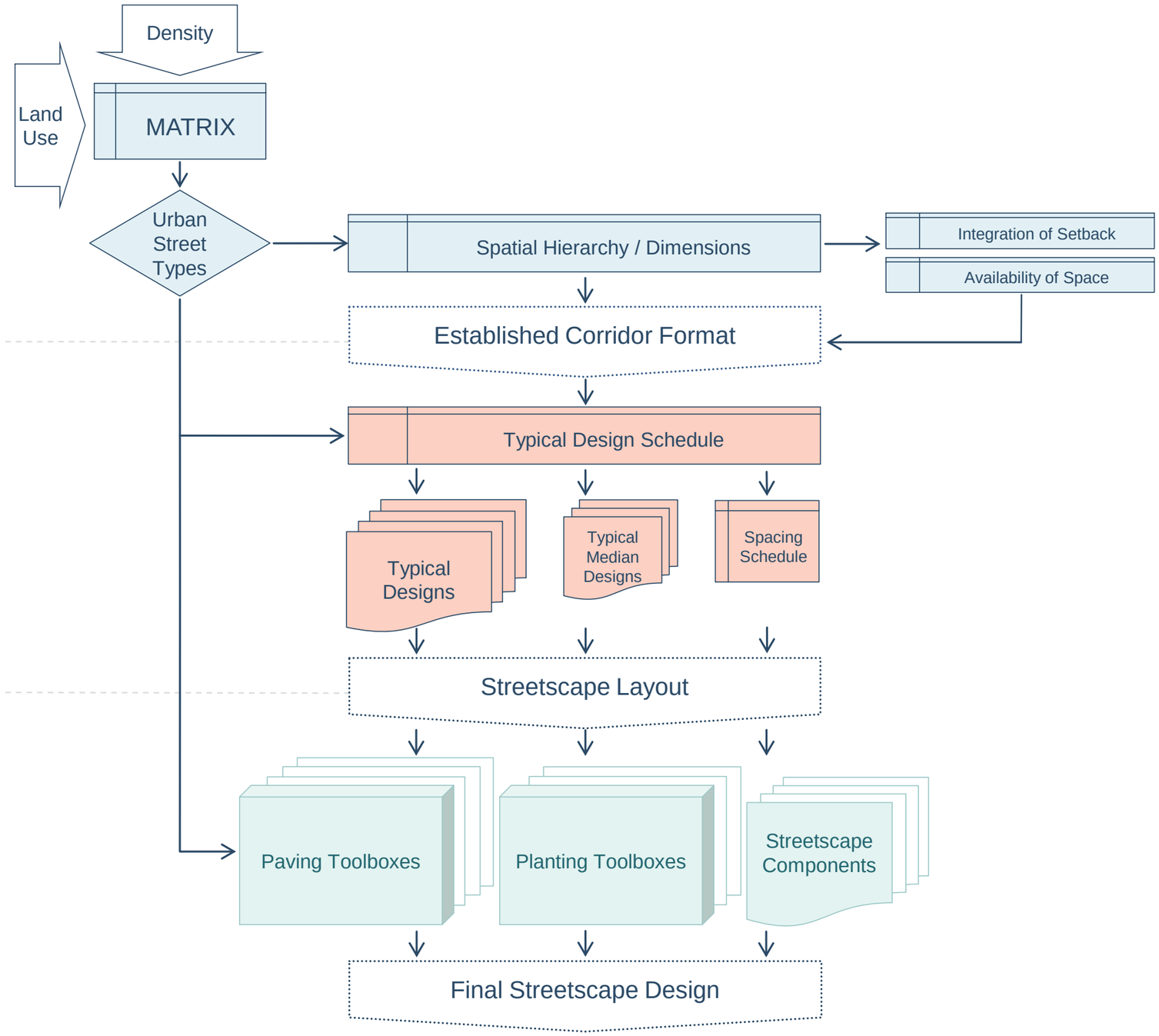


Figure 7.1 Design process - overview

1. Define Urban Street Type

The UDM defines eight Urban Street Types based on four different predominant land uses identified/ expected along the METRO corridors. These are subdivided into sub-categories which differ in level of density. The UDM also provides an initial categorisation of the METRO corridors into these Urban Street Type segments (see Appendix, Urban Context Analysis).

As a first step of using this manual, the designers will have to re-assess and confirm the implied corridor segment's Urban Street Type in light of the definitions outlined in Chapter 3. This is of utmost importance for providing suitable design responses not only to today's requirements, but also to future urban conditions.

For the purpose of this 'step by step guide' the exemplary corridor segment around METRO station 3C2 is chosen, which also represents the Urban Street Type expected along the majority of the METRO corridors in question.

Initially, the detailed maps and analysis tables given for all three METRO lines in question in Appendix, Urban Context Analysis, can be used to gain a first overview, followed by thorough data verification by the designers. As an initial planning tool for the designers maps are provided within this UDM in the Appendix, Urban Context Analysis. Further to aerial images illustrating the urban fabric and the building typologies, the use of specific buildings are shown. All project relevant information available to date has been implemented by the authors. If kept up-dated, these maps will help the consortia to verify the character of each single corridor location and at any moment in the future.

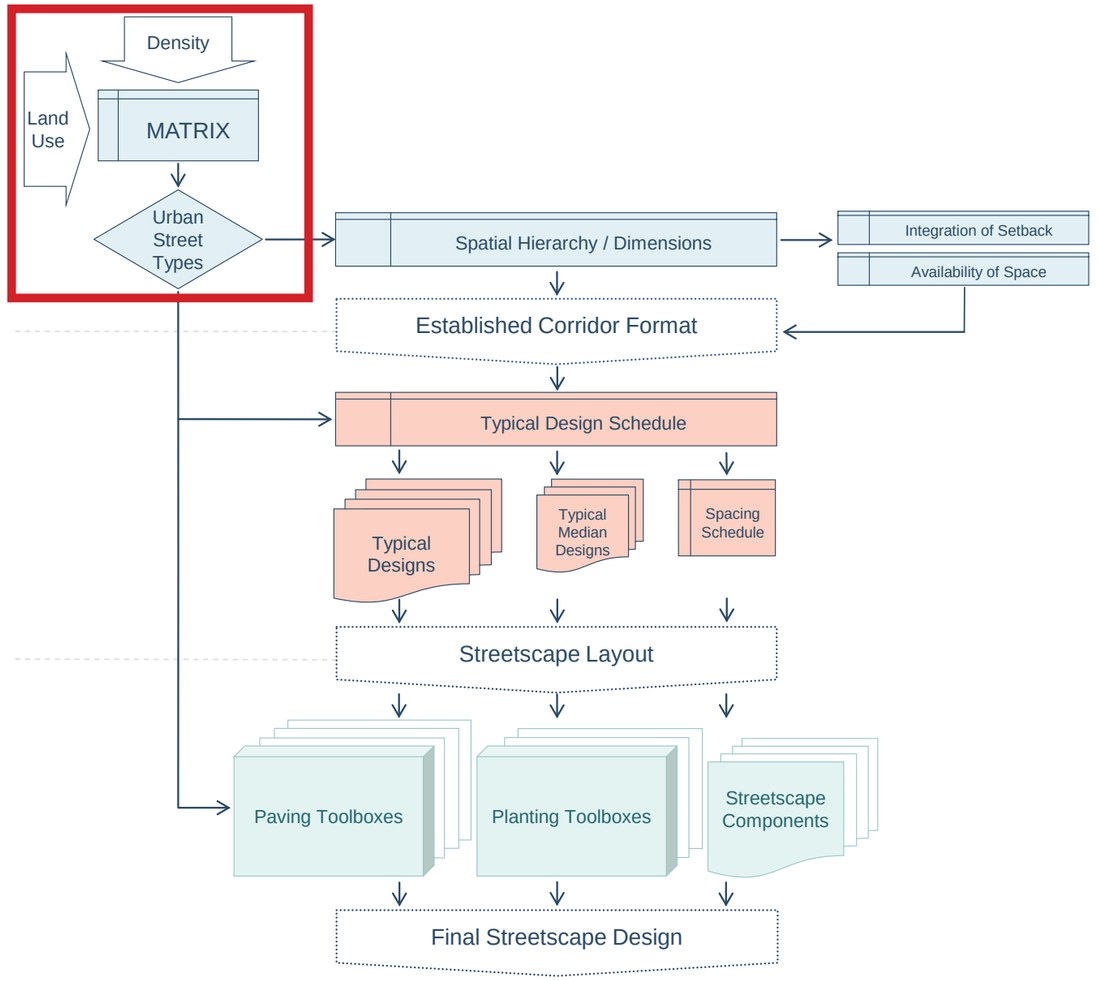
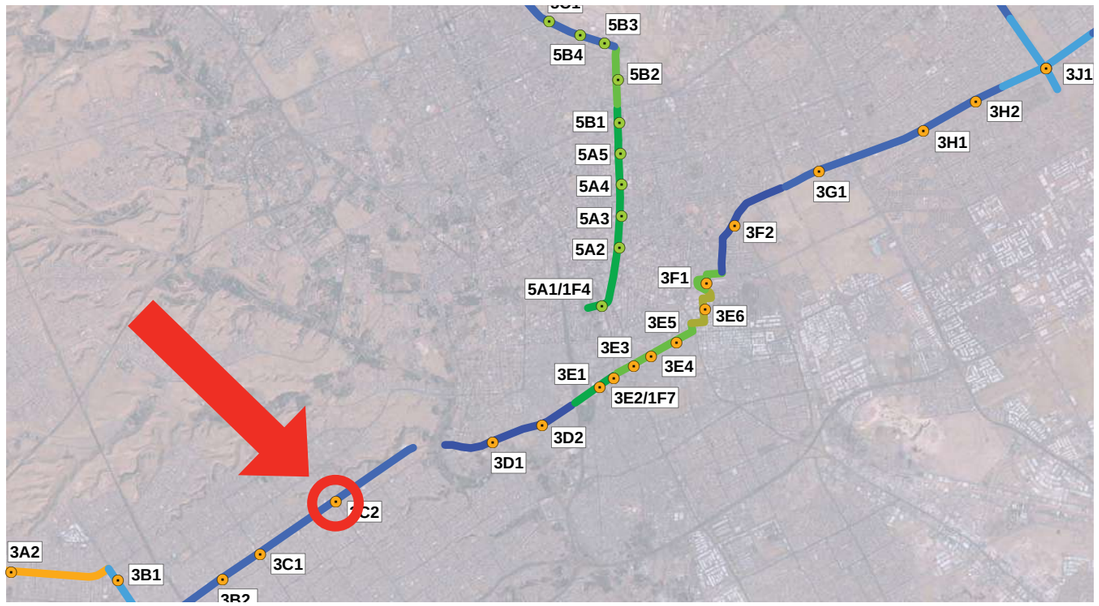


Figure 7.2 Design process – definition of urban street type



Map 7.3 Selected METRO Corridor Segment around Station 3C2 – Overview Map

Map 7.5 Selected METRO Corridor Segment around Station 3C2 – Detailed Map

Riyadh Metro Line 3 (Orange Line - 42 km)

Madinah Al Munawra - Amir Saad bin Abdul Rahman Al Awal Road

Station	Station Condition	Station Typology	Urban Street Type	Supported Land Use	Key Places of Interest	Density	Main Challenges
Metro Depot West	—	—	—	—	—	—	—
3A1	Elevated	Park and Ride (Residential)	R1	• Residential Dev.	—	low	• Access and Mobility • Jeddah Road barrier • Connectivity to Park & Ride
3A2	Elevated	**Residential** (Destination)	R1	• Residential Dev. • Recreational Facilities	**• Nassir Sport Club/ Stadium**	low	• Access and Mobility
3B1	Elevated	TOD Small Scale/ **Neighborhood**	M1	• Residential Dev. • Commercial Dev.	• Traditional Souk • Mosque • Public Park	low	• Access and Mobility • Disturbance of Residential Dev.
3B2	Elevated	**Neighborhood/** Park and Ride (Destination)	M2	• Residential Dev. • Commercial Dev.	**• Vegetable Market** • BRT Terminal	medium/low	• Access and Mobility **• Connectivity between P+R, Metro, BRT 12 Community Bus 32** • Congestion Management and Pedestrian S • Close proximity to 3C1
3C1 **→ OMRANIA**	Elevated	TOD Large Scale/ **Neighborhood**	M2	• Residential Dev. • Commercial Dev.	—	medium/low	• Access and Mobility • Close proximity to 3B2 **• Connectivity between Metro and Commu 32/39 (intermodal connectivity)**
3C2	Elevated	**Neighborhood**	M2	• Residential Dev. • Commercial Dev.	**• Prince Salam Hospital** • Wadi • Aljawhari Secondary School • Alkhalidyah Elementry School	medium/low	• Access and Mobility • High Voltage Power Lines Safety Clearance
3D1	Elevated	**Neighborhood/** Park and Ride (Destination)	M3	• Residential Dev.	**• Wadi Hanifa** • Sultanah Mall	medium/high	• Access and Mobility **• Connectivity between Metro and other m transportation (intermodal connectivity)**

Table 7.4 Selected METRO Corridor Segment around Station 3C2 – Analysis Table

Figure 7.6 Typical Urban Context

Having analysed the predominant adjoining land-use and density, the designer shall apply the findings to the Identification of Urban Street Types matrix yielding the relevant Urban Street Type, which will inform all following streetscape design decisions. For instance, the corridor segment around METRO station 3C2 is going to serve a predominantly residential neighbourhood with commercial frontages aligning the corridor edges, (Mixed) Neighbourhood, at low to medium densities. This typical urban context qualifies as Urban Street Type 'M2', implying certain user requirements to be reacted to in the streetscape design.

M01 Identification of Urban Street Types		**Density**			
		Low	Low to Medium	Medium to High	High
Land Use	Industrial / Employment		**A2**	**A3**	
	Residential	**R1**			
	(Mixed) Neighbourhood	**M1**	**M2**	**M3**	
	Central Area/ Mixed Use / TOD			**P3**	**P4**

Urban Street Types

A - Access

R - Residential

M - Mixed Residential (Neighbourhood)

P - Pedestrian / Public Transport Oriented

Table 7.7 Identification of urban street types matrix

2. Establish Corridor Format

Optimise Traffic Layout

As outlined before, road dimensions currently applied often do not allow for sufficiently dimensioned sidewalks/ public realm within the available road space. Enabling the designers to develop a suitable public realm along the corridor requires a critical review of the proposed traffic arrangement and the space given to cars.

As outlined, there are two basic parameters for adjustment: the absolute number of lanes and the relevant standard dimensions applied. The standard setup shall be limited to 3+3 lanes, which can be reduced to 2+2, where the width of the corridor is limited.

Any diversion from this approach will require an additional traffic study that clearly shows traffic requirements. Any additional provision for cars needs to be balanced with requirements for pedestrians and other road (and road side) users. This discussion is particularly important for the vicinity of junctions. Junctions are a natural bottleneck, limiting traffic capacity, but also other functions often need to be accommodated, such as the METRO station, pedestrian crossing facilities and bus stops.

Further consideration needs to be given to special situations, such as places of interest, or vehicle fly-overs, etc.

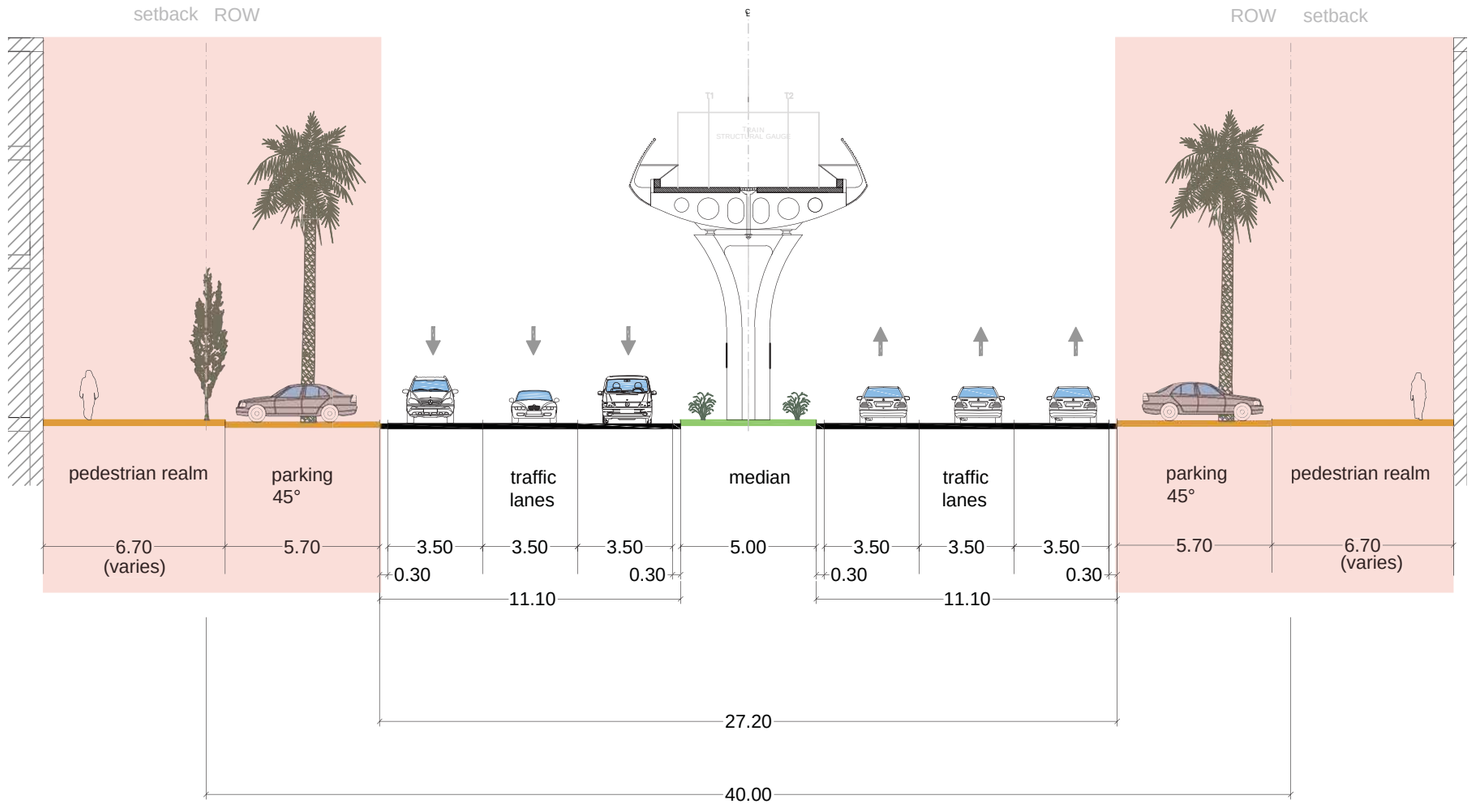


Figure 7.8 Available public realm

Spatial Hierarchy/ Dimensions Matrix

As a result of the traffic discussions a public realm of more or less generous width is generated along both edges, which is to be structured into a basic Corridor Format including all longitudinal public realm elements and zones' dimensions.

In order to establish the suitable Corridor Format, the defined Urban Street Type needs to be matched in the Spatial Hierarchy/ Dimensions matrix (M02). In essence, this design step establishes the functional and spatial subdivision of the public realm.

Generally the matrix indicates all longitudinal elements to be provided. Minimum, Standard and Maximum widths of these elements consider varying spatial conditions at any given location.

Since allocating all elements might proof to be difficult in places, the elements prescribed are also given a design priority. For instance, if space is limited, pedestrian walkways shall be definitely provided whilst car parking can be omitted.

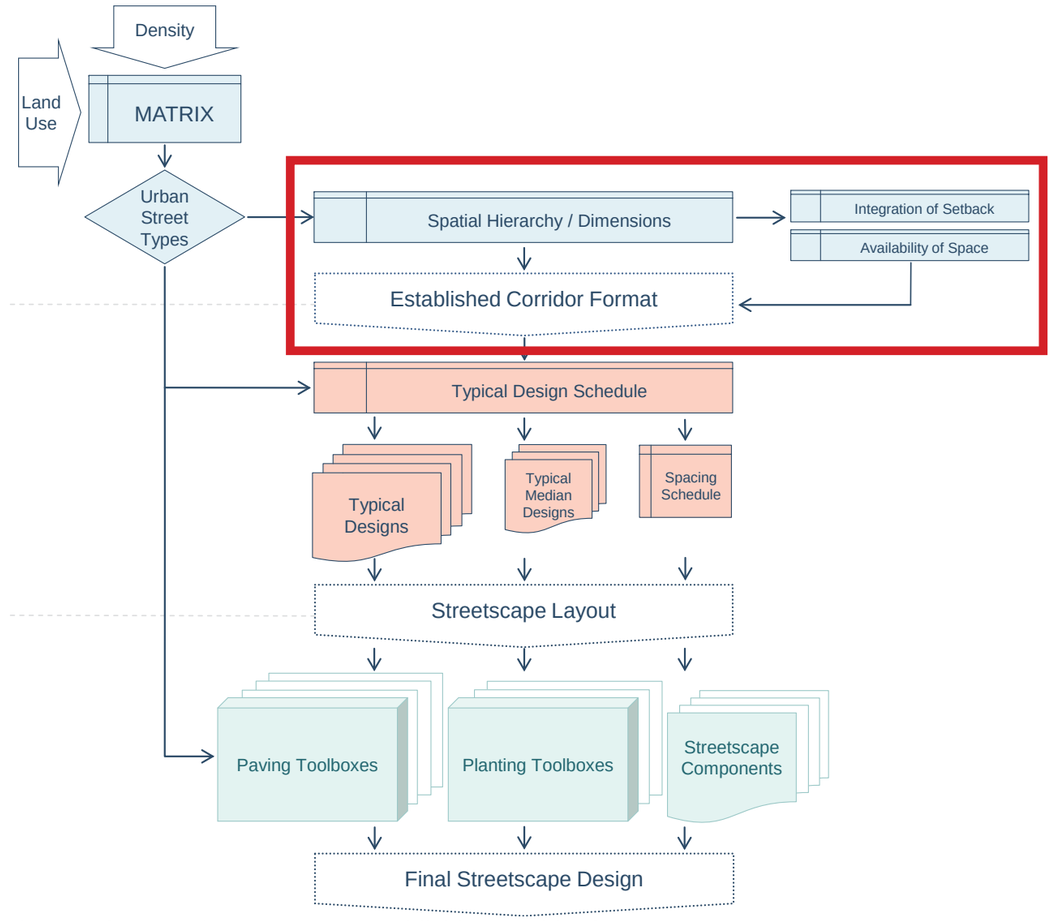


Figure 7.9 Design process – establishing corridor format

		Design Priority # 3	*Design Priority # 1*	*Design Priority # 2*		*Design Priority # 3*		*Design Priority # 1*			*Design Priority # 2*	
M02 Dimensions		**Parking**	**Kerb Margin**	**Furniture Zone**		**Cycle Path**		**Pedestrian Walkway**			**Frontage Zone***	
		Standard	Standard	Min	Standard	Min	Standard	Min	Standard	Maximum	Min	Standard
Urban Street Types	A2	parallel	0.5m	0.5m	1,5m+	N/A	N/A	1.2m	1.8m	4m	N/A	N/A
	A3	45°/parallel	0.5m	0.5m	1,5m+	N/A	N/A	1.2m	2.2m	4m	N/A	N/A
	R1	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.5m	2m	5m	0m	1.8m+
	M1	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.5m	2m	5m	0m	1.8m+
	M2	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.8m	2.5m	5m	0m	1.8m+
	M3	45°/parallel	0.5m	0.5m	2m+	1.5m	2.5m	1.8m	3m	6m	0m	1.8m+

Figure 7.10 Spatial hierarchy/ dimensions matrix

Integration of Setback Matrix

A further matrix provides guidance on considering different setbacks occurring along the corridors.

Acknowledging that a meaningful streetscape design can only work from frontage to frontage, the entire space from frontage to frontage can generally be considered for accommodating the public realm elements identified and the streetscape design. Wherever this approach proves impossible, an alternative subdivision of the public realm shall follow the design priorities outlined in the matrix.

M04 Availability of Space	**Adaptation to Availability of Space**	
	Insufficient Space	Excess Space
Step 1	Omit left-turn lanes / reduce median to required minimum dimensions	Increase walkway to maximum
Step 2	Review and reduce number of traffic lanes (i.e. traffic study - to be agreed with client)	Increase walkway up to 10m and add second row of trees within walkway
Step 3	Reduce cycle path to minimum (Design Priority #3), providing a shared space with walkway	Increase furnishing zone to include additional landscape elements
Step 4	Balance parking and cycling provision (Design Priority #3): - Reduce parking provision, i.e. parallel parking instead of 45° parking and/or parking in certain areas only - Omit whichever is more difficult to include or less desired along relevant section of road (to be agreed with client)	Utilise overprovision of available space to the benefit of residents and adjacent users: - Consider providing pedestrian boulevard to one side of road, possibly incl. playgrounds, small plazas with shading and benches etc. - Consider possible public use of increased median, i.e. walkway/ cyclepath underneath elevated track or additional parking provision for friday mosque
Step 5	Combine furniture zone (Design Priority #2) and parking provision (see parking section)	

Table 7.11 Adaptation to availability of space matrix

Adaptation to Availability of Space

Providing more detailed guidance on reacting to insufficient or excessive widths of the available space for the public realm, an Adaptation to Availability of Space matrix (M04) providing seven action priorities shall be applied according to local conditions.

M03 Integration of Setback	**Setback**			
	0m - 6m	>6m - 12m		>12m
Use of Setback	Public use	Public use possible	No public use possible	Dedicated parking / no public use
Integration into Pedestrian Realm	Integrate into pedestrian realm	Integrate into pedestrian realm	Accommodate all required elements within ROW	Accommodate all required elements within ROW
Provision of On-Street Parking (within ROW)	If possible, yes	If possible, yes	If possible, yes	Parking optional / provide access to dedicated parking if possible

Figure 7.12 Integration of setback matrix

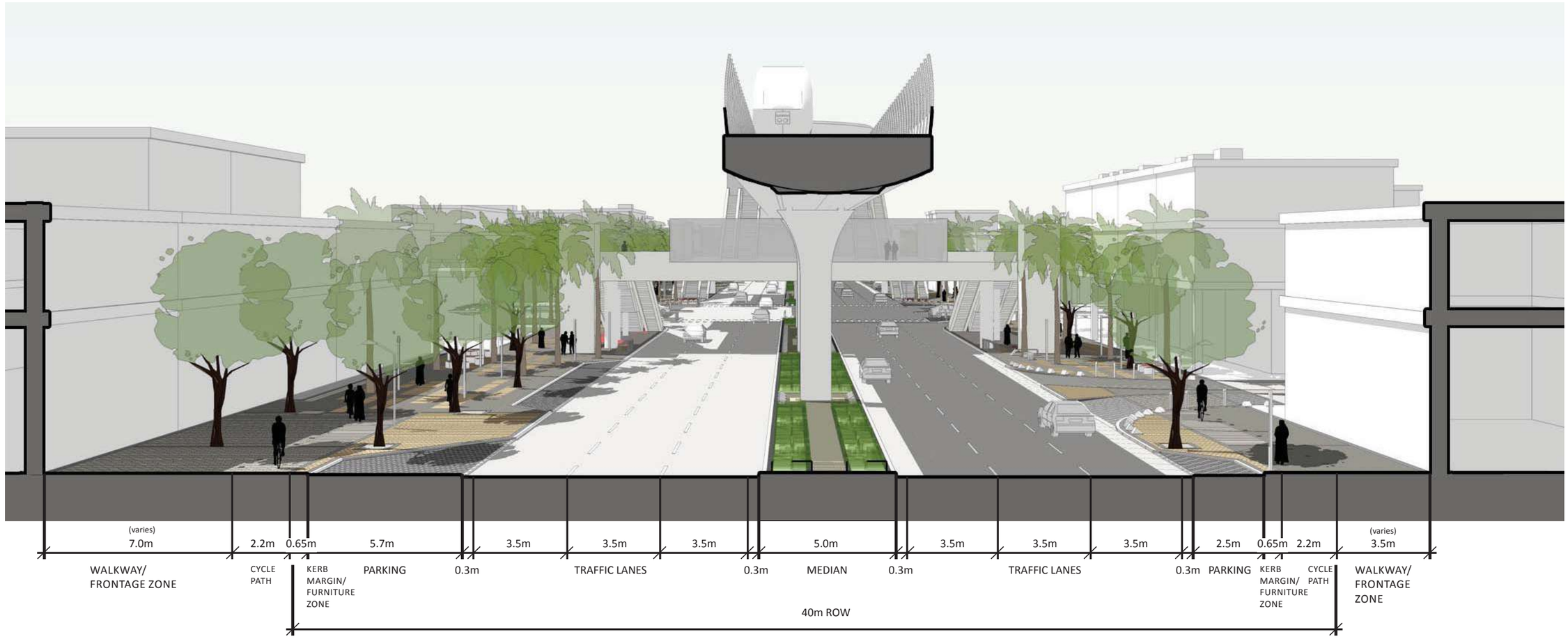


Figure 7.13 Cross section – example corridor segment

4. Streetscape Layout

Whilst the Corridor Format sets the basic longitudinal framework for spatially subdividing the public realm into zones, paths, margins, etc., the Streetscape Layout is now to be completed also considering dimensional guidance on perpendicular elements, such as pedestrian crossings and other single elements in different situations (Spacing Schedule - S02).

Applying all relevant guidance given the designers shall develop a Streetscape Layout, which subsequently can be designed in detail.

Typical Designs

Demonstrating the application of all guidance given, Typical Designs are provided in the UDM for prototypical corridor segments according to Urban Street Types (Typical Design Schedule - S01). Within the Typical Designs a number of special detailed situations are also described as a blue-print for the designer to adopt at specific spatial and geometric conditions. Also, alternative medians are described considering the varying alignment of the METRO tracks.

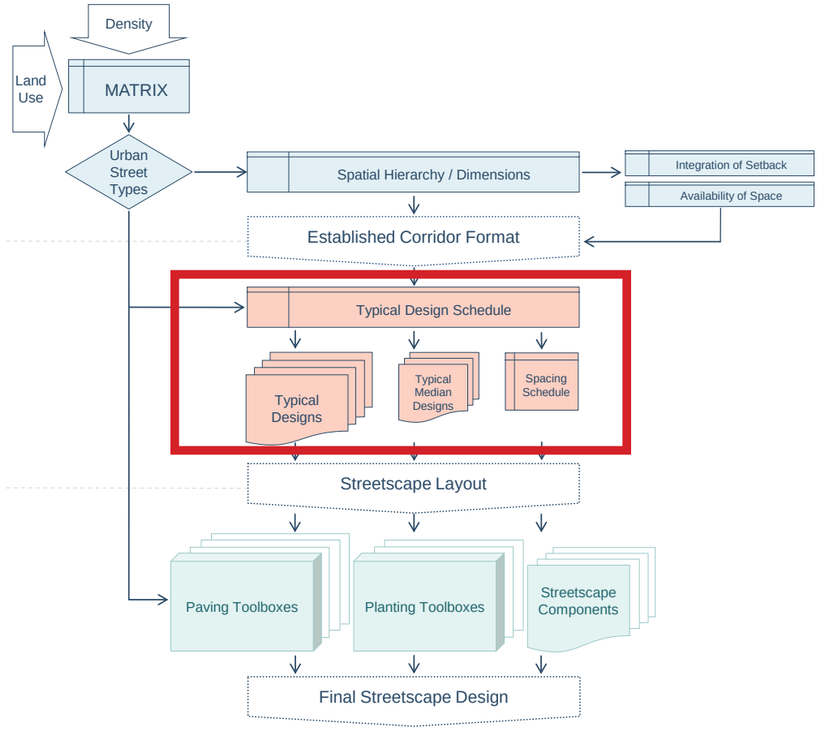


Figure 7.14 Design process – streetscape layout

S01 Typical Design Schedule		Typical Design Arrangements			
		Typical Streetscape & Station Designs (for dimensions refer to spacing schedule)	Typical Median Designs		
			Standard	At Grade	Elevated
Urban Street Types	A2	Typical Design TD-ST-01	Typical Design TD-M-01	Typical Design TD-M-04	
	A3				
	R1	Typical Design TD-ST-02	Typical Design TD-M-02	Typical Design TD-M-05	Typical Design TD-M-06
	M1				
	M2	Typical Design TD-ST-03 Typical Design TD-ST-03-sh			Typical Design TD-M-07
	M3				
	P3	Typical Design TD-ST-04 Typical Design TD-ST-04-wide	Typical Design TD-M-03		
	P4				

Table 7.16 Typical design schedule

S02 Spacing Schedule		Seating Areas		Approx. Tree Spacing			Pedestrian Crossings (refer to Section 5.1.6, page 96 for details)		
		Minimum No. at Station Vicinity	Approx. No. along Corridor	Station Vicinity & Seating Area	Corridor	Median	Treatment of Local Road Crossing	Approx. Distance between Crossings	Mid-Block Crossing Type
Urban Street Types	A2	1 Shaded Seating Area Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 600 m in-between Stations To include: Min. 1 bench & 1 Litter Bin	Large Trees: min. 9m (centers) Small Trees: min. 6m Palms: min. 6m (Dimensions also applicable for median planting at station vicinity)	Large Trees: 15-20m Palms/ Small Trees: 12-14m	15-18m	Basic	500m	Basic
	A3	1 Shaded Seating Area Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 500 m in-between Stations To include: Min. 1 bench & 1 Litter Bin		Large Trees: 13-17m Palms/ Small Trees: 12-14m	14-16m	Basic	500m	Basic
	R1	2 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 500 m in-between Stations To including: Min. 1 bench & 1 Litter Bin		Large Trees: 12-15m Palms/ Small Trees: 8-10m If parking and tree planting are being combined, due to space constraints: one tree every 4th parking bay	12-14m	Basic	500m	Standard
	M1	2 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 400 m in-between Stations To include: Min. 1 bench & 1 Litter Bin		Large Trees: 12-13m Palms/ Small Trees: 8-10m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	10-12m	Raised Table	500m	Standard
	M2	2 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 350 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 11-12m Palms/ Small Trees: 8-9m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	10-12m	Raised Table	300m	Standard
	M3	2 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 300 m in-between Stations Each one including: Min. 2 benches 1 Litter Bin		Large Trees: 10-12m Palms/ Small Trees: 7-8m If parking and tree planting are being combined, due to space constraints: one tree every 3rd parking bay	9-10m	Raised Table	300m	Standard
	P3	3 Shaded Seating Areas Each area to include: Min. 1 bench or min. 3 modular seats 1 Litter Bin	Every 150 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 8-11m Palms/ Small Trees: 6-8m	9-10m	Raised Table	250m	Standard
	P4	3 Shaded Seating Areas Each area to include: Min. 2 benches or min. 3 modular seats 1 Litter Bin	Every 100 m in-between Stations To include: Min. 2 benches & 1 Litter Bin		Large Trees: 8-10m Palms/ Small Trees: 6-8m	8-10m	Raised Table	250m	Standard

Table 7.15 Spacing schedule

Figure 7.18 Streetscape layout plan – typical design

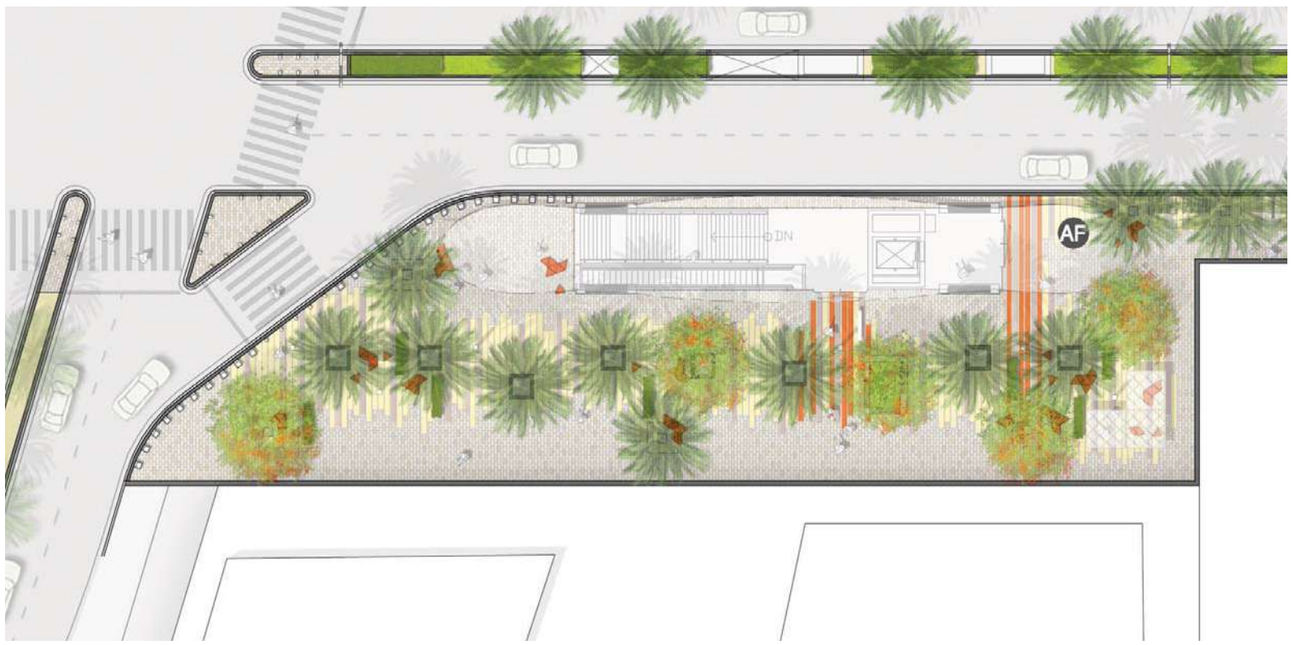


Figure 7.17 Detail situation plan – typical design

Figure 7.19 Perspective – streetscape layout example corridor segment

5. Final Streetscape Design

Eventually, a Final Streetscape Design is to be elaborated by the designers on the basis of the developed Streetscape Layout. The application of a number of Toolboxes described in Chapter 3 shall inform the final design of the paving (Paving Toolboxes), street furniture (Streetscape Component Datasheets) and the softscape (Planting Toolboxes). These Toolboxes are again referenced to the initial Urban Street Types, which ensures a coherent approach to the design.

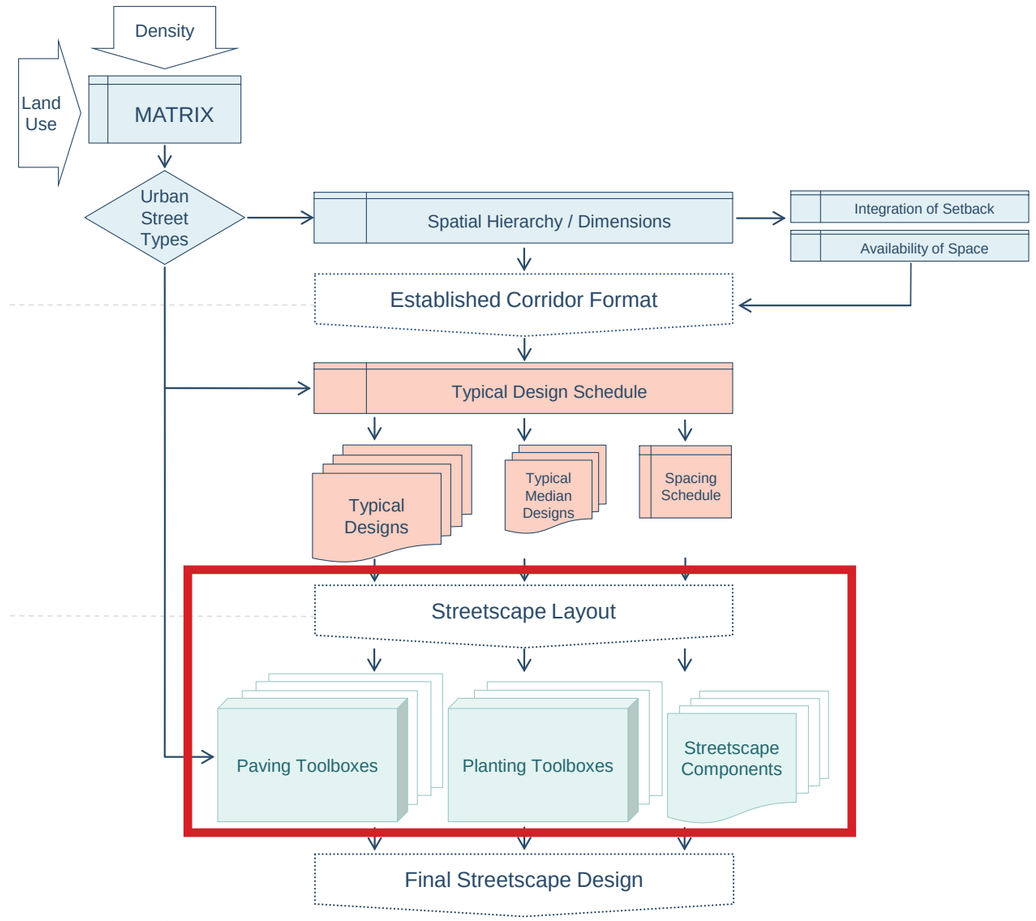


Figure 7.20 Design process – streetscape design

T02 Paving Material Toolbox		Furniture Zone						
		Material	Colour		Finish	Format	Bond	
Urban Street Types	A	Precast Concrete	Light Grey	LG	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	R	Precast Concrete	Beige / Sand Colour	LB	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	M	Precast Concrete	Beige / Sand Colour	LB	Sandblasted	20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	
	P	Precast Concrete	Grey /Different Tones) Beige / Sand Colour	DG MG LG LB	High Quality Fine Sandblasted	Equal ratio each colour 20x20x6cm (20x10x6cm)	Stretcher Bond laid perpendicular to Kerb	

Table 7.21 Sample paving material toolbox

D05 - DATASHEET - TREE SURRONDS

Objectives

- The footway surface to the base of the tree should be visually coherent with the surrounding materials and should not present any form of trip hazard or hamper pedestrian flow.
- In high density pedestrian areas, infilled recessed tree grilles shall be used to maximise the pedestrian realm and maintain the pedestrian flow.
- Cast iron tree grilles are not recommended for use as they often become difficult to maintain and frequently look untidy after a few years.

Design Aesthetics

- All tree surround metal components shall be hot dipped galvanised. All Infill trays shall incorporate drainage holes to assist irrigation.
- All trees shall within hard paved areas to incorporate two aeration tubes.
- The contractor shall ensure that there is adequate space around the bole of the tree to allow growth and that supporting tree grille frames are able to be removed without damaging the tree.
- The minimum size of a tree pit within a hard paved area shall be 2 x 2 x 2 metres

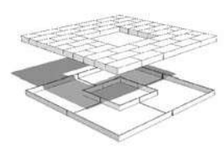


Figure 3.54 Recessed metal tree grille with paving infill. Size: 2 x 2 metres with 80cm aperture for tree bole

Figure 3.55 Recessed metal tree grille with paving infill - plan view

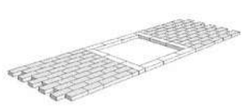


Figure 3.56 Paving band tree surround with gravel infill. Size: 1.6 x 1.6 metres

Figure 3.57 Paving band tree surround with gravel infill - plan view

Figure 7.22 Sample streetscape component datasheet

T13 Planting Toolbox		Plant Type	Corridor	Station Vicinity	
	A	Deciduous Trees	Large: Acacia nilotica Small: Acacia salicina Acacia aneura	See Corridor Palette + Special Location Trees (T14)	
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Phoenix Dactylifera	Was
		Shrubs/ Hedge/ Ground Cover	N/A	N/A	
	R	Deciduous Trees	Large: Ziziphus jujuba Small: Acacia salicina Pithecellobium dulce Acacia aneura	See Corridor Palette + Special Location Trees (T14)	
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Washingtonia filifera Washingtonia robusta	Pho
		Shrubs/ Hedge/ Ground Cover	N/A	Vitex trifolia variegata + Special Location Shrub/ Hedge (T14)	Atrip Dura Dura
Urban Street Types	M	Deciduous Trees	Large: Ficus religiosa Ficus sycomorus Acacia nilotica Acacia victoriae Small: Dalbergia sisoo	See Cooridor Palette + Special Location Trees (T14)	
		Palm Trees	Phoenix dactylifera (Only at pedestrian crossings and seating areas)	Phoenix Dactylifera Washingtonia filifera Washingtonia robusta	Pho Was
		Shrubs/ Hedge/ Ground Cover	N/A	Acacia redolens + Special Location Shrub/ Hedge/ Groundcover (T14)	Cler Atrip Myr Dod
		Deciduous Trees	Large: Albizia lebbeck Ficus religiosa Ficus altissima Small: Pithecellobium dulce Dalbergia sisoo	See Cooridor Palette + Special Location Trees (T14)	

Table 7.23 Planting toolbox

Figure 7.24 Perspective of Final Streetscape Design - sample corridor segment

8 APPENDIX

8.1 Urban Context Analysis

Prior to the definition of Urban Street Types relevant to the METRO corridors in question, an Urban Context Analysis have been conducted by the authors of the UDM in order to provide an initial overview of urban conditions to the designers, and to prove validity and applicability of the document.

The data collected and analysed, and the assumptions made for the future urban development along the corridors as comprehensively as possible are based on a physical assessment of the current METRO corridors (surveying the planned routes in person, via satellite images and digital maps containing information regarding surrounding developments), the Urban Integration & Planning Assessment Study previously elaborated by CH2M, and the Arriyadh Central Area Urban Renewal Framework provided by ATKINS.

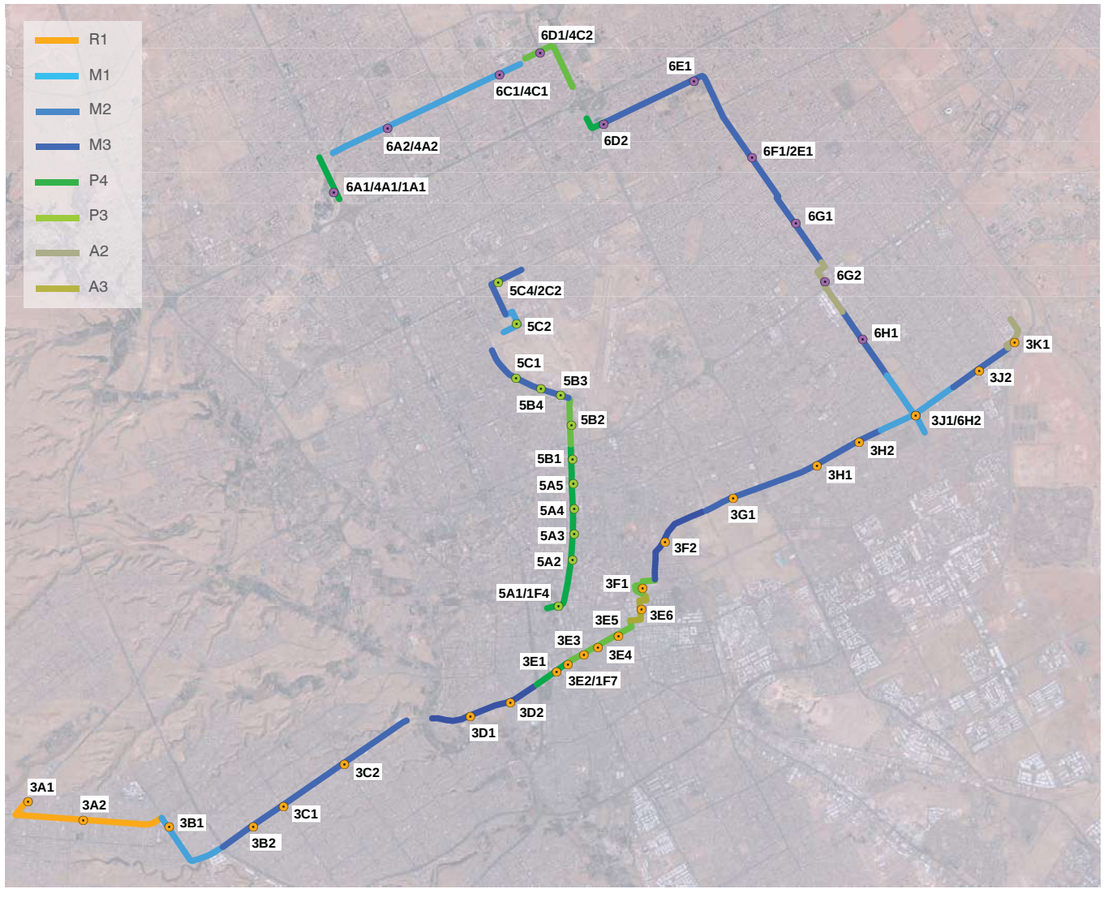
The outcome of the analysis is a table showing each of the three METRO Lines in question, containing all required information on the planned METRO stations, as well as the sequence of identified Urban Street Types. Also, a map of the city of Riyadh is provided depicting the character and land use along the routes within the wider urban context.

The information shown in the tables firstly comprises the labeling of the stations (whether it is a priority station or not), METRO track alignment, station classification according to the CH2M analysis, as well as main challenges and opportunities. In addition to this fundamental information, which has been verified or revised, the Urban Street Types have been categorised based on the authors' local knowledge of the urban planning context in Riyadh and the physical survey.

As an initial planning tool for the designers maps are provided within this chapter. Further to aerial images illustrating the urban fabric and the building typologies, the use of specific buildings are shown. All project relevant information available to date has been implemented by the authors. If kept up-dated, these maps will help the consortia to verify the character of each single corridor location and at any moment in the future.

Main criteria for the categorisation into the eight Urban Street Types identified were the identification of predominant land uses and development densities of each station's catchment area. The eight typologies are based on four different types of predominant land uses identified along the three METRO corridors. Each of the four was then subdivided into two sub-categories which differ in level of density. Please refer to Chapter 3 for a detailed definition the land use and density categories.

In order to ensure an adequate design response to every single METRO corridor section's public realm requirements at the time of the future development of the METRO corridors, the designers shall re-assess, verify or re-define all urban situations prior to any design work.



Map 8.1 Overview map - urban street types

Riyadh Metro Line 3 (Orange Line - 42 km)

Madinah Al Munawra - Amir Saad bin Abdul Rahman Al Awal Road

Station	Station Condition	Station Typology	Urban Street Type	Supported Land Use	Key Places of Interest	Density	Main Challenges	Opportunities	Stations Needs/Notes
Metro Depot West	—	—	—	—	—	—	—	—	—
3A1	Elevated	Park and Ride (Residential)	R1	• Residential Dev.	—	low	• Access and Mobility • Jeddah Road barrier • Connectivity to Park & Ride	• Large residential area to serve Park and Ride • Development opportunity of vacant land.	Unclear of intended use.
3A2	Elevated	**Residential** (Destination)	R1	• Residential Dev. • Recreational Facilities	• **Nassir Sport Club/ Stadium**	low	• Access and Mobility	• Development opportunity of vacant land. • Redevelopment potential.	Potential for community center, residential develpoment, walkshed to Nassir Sport Club.
3B1	Elevated	TOD Small Scale/ **Neighborhood**	M1	• Residential Dev. • Commercial Dev.	• Traditional Souk • Mosque • Public Park	low	• Access and Mobility • Disturbance of Residential Dev.	• Development opportunity of vacant land (TOD site). • Redevelopment potential.	Limited space to put vertical movement mechanical structure east. Shift station to the north to be situated in front of local road rather than villas.
3B2	Elevated	**Neighborhood/** Park and Ride (Destination)	M2	• Residential Dev. • Commercial Dev.	• **Vegetable Market** • BRT Terminal	medium/low	• Access and Mobility • **Connectivity between P+R, Metro, BRT 12 and Community Bus 32** • Congestion Management and Pedestrian Saftey • Close proximity to 3C1	• Redevelopment opportunity (enhancement of existing vegetable market).	—
3C1 → **OMRANIA**	Elevated	TOD Large Scale/ **Neighborhood**	M2	• Residential Dev. • Commercial Dev.	—	medium/low	• Access and Mobility • Close proximity to 3B2 • **Connectivity between Metro and Community Bus 32/39 (intermodal connectivity)**	• Development opportunity of vacant land.	—
3C2	Elevated	**Neighborhood**	M2	• Residential Dev. • Commercial Dev.	• **Prince Salam Hospital** • Wadi • Aljawhari Secondary School • Alkhalidyah Elementry School	medium/low	• Access and Mobility • High Voltage Power Lines Safety Clearance	• Limited development opportunity. • Close to Wadi / recreational value	Vertical movement mechanical structure situated in the parking, worth checking ROW for space availability.
3D1	Elevated	**Neighborhood/** Park and Ride (Destination)	M3	• Residential Dev.	• **Wadi Hanifa** • Sultanah Mall	medium/high	• Access and Mobility • **Connectivity between Metro and other modes of transportation (intermodal connectivity)**	• Development opportunity of vacant land. • Close to Wadi Hanifa / recreational value • Serve low-income housing	Limited space to put vertical movement mechanical structure north, worth checking ROW for space availability.
3D2	Elevated	**Neighborhood**	M3	• Residential Dev.	—	medium/high	• Access and Mobility • Station offset form Intersection due to curved track alingment	• Development opportunity of vacant land (potential small scale TOD site). • Park and Ride facility recommended.	Limited space to put vertical movement mechanical structure north. Shift the station to the middle of the intersection ahead or provide pes. Bridge for safe accessibility.
3E1	Deep Underground	**Employment** (Destination) (Central Area/ **Mixed Use**)	P4	• Residential Dev. • Commercial Dev. → Mixed Use	• **General and Criminal Court** • **Dhira Park** • **New Civic Boulevard** • Riyadh Principality • Salam Park • Souks	high	• Access and Mobility • **Congestion issues / heavy pedestrian circulation**	• Limited development opportunity. • Multiple site amenities and attractions serving heavy pedestrian activity.	Adjacent parking deck carries the potential of a Park and Ride site.
3E2/1F7 **(Downtown Main Station)** → **SNOHETTA**	Deep Underground	TOD Small Scale (Destination) (Central Area/ **Mixed Use**)	P4	• Residential Dev. • Commercial Dev.	• **Riyadh Historc District** • **Old Eid Mosque** • **New Civic Boulevard (Gateway)** • Souks • General and Criminal Court • Riyadh Principality	high	• **Transfer Station** • Access and Mobility • **Congestion issues / heavy pedestrian circulation** • **Connectivity between Metro and Community Bus 33 (intermodal connectivity)**	• Redevelopment opportunity (enhancement of Historc Old Riyadh).	Vertical movement mechanical structures are not shown on the stations layouts.
3E3	Deep Underground	**Residential** (Central Area)	P3	• Residential Dev.	• **Medinah Road Business Corridor** • **Cemetary** • Souks	medium/high	• Access and Mobility	• Potential redevelopment opportunity. • Potential site for TOD	—
3E4	Deep Underground	**Residential** (Central Area)	P3	• Residential Dev.	• **Medinah Road Business Corridor** • Al Marqab Primary Health Care Center • Masoudy Preparatory School	medium/high	• Access and Mobility • Incomplete pedestrian connectivity	• Limited redevelopment opportunity as older part of the city is essentially build out.	Station capture shed covers the whole 500 m radius.
3E5	Deep Underground	**Neighborhood/** Commercial (Central Area)	P3	• Residential Dev. • Commercial Dev.	• **Medinah Road Business Corridor** • Schools • Offices	medium/high	• Roundabout station (6 roads converging on the station) • Access and Mobility	• Possible redevelopment opportunity.	Major roundabout, six roads intersect with potential for redevelpoment of the area.

Table 8.2 Overview table - METRO line 3

Riyadh Metro Line 3 (Orange Line - 42 km)

Madinah Al Munawra - Amir Saad bin Abdul Rahman Al Awal Road

Station	Station Condition	Station Typology	Urban Street Type	Supported Land Use	Key Places of Interest	Density	Main Challenges	Opportunities	Stations Needs/Notes
3E6	Deep Underground	**Employment**	A3	• Industrial Dev.	• Industrial City • Dry Port	medium/high	• Location within industrial area • Heavy vehicular traffic	• Redevelopment opportunity if Dry Port relocates.	Station will serve mixed use after redevelopment.
3F1	Deep Underground	Intermodal (Destination) (Industrial)	P3	• Industrial Dev.	• **Railway Station** • Dry Port	medium/high	• **Connectivity between Metro, Community Bus 22/37 and Regional Train** • Incomplete pedestrian connectivity	• Opportunity to integrate major intermodal hub. • Redevelopment opportunity if Dry Port relocates. • Potential Park and Ride side	—
3F2	Elevated	TOD Small Scale/ Park and Ride (Destination) (Neighborhood)	M3	• Commercial Corridor • Residential Dev.	• **Prince Faisal Bin Fahd Stadium** • King Abdullah Park • Commercial Corridor	medium/high	• Access and Mobility • **Connectivity between Metro, BRT 11 and Community Bus 21/22 (intermodal connectivity)**	• TOD/PPP opportunity. • Ability to serve future TOD. • Integration of BRT and Community Bus system with metro station.	Relocate station at alternative site to better share the parking with the stadium.
3G1	Elevated	TOD Small Scale (Neighborhood)	M2	• Residential Dev. • Mixed Use Dev.	• Schools • Offices • Commercial	medium/low	• Access and Mobility • Coordination with future development	• Major develpoment opportunity of vacant land in the west (TOD / Mixed Use Develpoment).	Need to identiy future planning for large vacant land west of station.
3H1	Shallow Underground	**Neighborhood**/ Park and Ride	M2	• Commercial Corridor • Residential Dev.	• **Commercial Corridor** • Community Bus station	medium/low	• Access and Mobility • **Connectivity between Metro and Community Bus 21/34 (intermodal connectivity)**	• Development opportunity of vacant land. • Redevelopment potential. • Integration of Community Bus system with metro station.	This intersection is being build as a devided interchange. Pedestrian access is an issue. Provide segregated pedestrian footpath to cross the main road.
3H2	Shallow Underground	**Neighborhood**	M2	• Commercial Corridor • Residential Dev.	• **Commercial Corridor** • BRT and Community Bus station • Industrial/Warehouses	medium/low	• Access and Mobility • **Connectivity between Metro, BRT 21 and Community Bus 21/34 (intermodal connectivity)**	• Potential Park and Ride side. • Development opportunity of vacant land. • Redevelopment potential. • Integration of BRT and community bus system with metro station.	This intersection is beinhg build as a devided interchange. Pedestrian access is an issue. Provide segregated pedestrian footpath to cross the main road.
3J1/6H2	Deep Underground	**Neighborhood**/ Park and Ride	M1	• Commercial Corridor • Residential Dev.	• **Al Nassem Cemetary**	low	• **Transfer Station** • Access and Mobility • **Accessibility to Park and Ride facility limited.**	• Development opportunity of vacant land. • Redevelopment potential.	A cemetary occupies the parcel to the northeast. Vertical movement mechanical structures are not shown on the stations layouts.
3J2	Shallow Underground	Residential/ Employment (Neighborhood)	M2	• Residential Dev. • Industrial Dev.	• Offices • Commercial • Industrial	medium/low	• Access and Mobility • **Connectivity between Metro and Community Bus 42 (intermodal connectivity)**	• Development opportunity of vacant land. • Redevelopment potential.	Pedestrian access is an issue. Provide segregated pedestrian footpath to cross the main road.
3K1	Shallow Underground	**Employment**/ Park and Ride	A2	• Commercial Dev. • Industrial Dev.	• Offices • Commercial	medium/low	• Access and Mobility • Highway Barrier	• Development opportunity of vacant land. • Redevelopment potential.	Vertical movement mechanical structures are not shown on the stations layouts.
Stabling Area East	—	—		—	—	—	—	—	—

Table 8.3 Overview table - METRO line 3

Riyadh Metro Line 5 (Green Line - 13 km)

King Abdul Aziz Road

Station	Station Condition	Station Typology	Urban Street Type	Supported Land Use	Key Places of Interest	Density	Main Challenges	Opportunities	Stations Needs/Notes
5A1/1F4 → GERBER ARCHITEKTEN	Deep Underground	**Commercial** (Destination) (Central Area/ Mixed Use)	P4	• Cultural Dev. • Commercial Dev.	• **KAHC - Museum Complex** • Nations Park • Civic Boulevard / Plaza (Eid Al Adha) • Commercial Spine • Souks	medium/high - high	• **Transfer Station** • Access and Mobility • **Connectivity between Metro and Community Bus 22/36 (intermodal connectivity)**	• Direct connection to museum complex for pedestrians (intersection acts as barrier to the east). • Development opportunity of vacant land (east). • Redevelopment potential (east).	Central Area Renewal Framework recommends a TOD to be located at this station and a central spine to the east. In addition a renewal of the souks is proposed. Potential for high density residential development.
5A2	Deep Underground	**Employment** (Destination)	P4	• Gov. Ministry Offices • Commercial Dev. • Residential Dev.	• **Ministry Offices** • King Abdulaziz University Hospital	high	• Access and Mobility • **Connectivity to adjacent governmental ministry office complex.**	• Limited development opportunity.	Possible ministry security concerns.
5A3	Deep Underground	**Employment** (Destination)	P4	• Gov. Ministry Offices • Commercial Dev. • Residential Dev.	• **Ministry Offices** • Business Offices • Hotels	high	• Access and Mobility • **Connectivity to adjacent governmental ministry office complex.**	• Limited development opportunity.	Possible ministry security concerns.
5A4	Deep Underground	**Residential** (Destination) (Neighborhood)	P4	• Gov. Ministry Offices • Medical Center • Commercial Dev. • Residential Dev.	• **Ministry of Defense** • **Family and Community Medicare Center** • Shola Shopping Center	medium/high	• Access and Mobility • **Connectivity to adjacent governmental facilities and bus mobility.**	• Limited development opportunity.	Possible ministry security concerns.
5A5	Deep Underground	**Residential** (Destination) (Neighborhood)	P4	• Royal Saudi Naval Forces Complex • Residential Dev. • Commercial Dev.	• **Royal Saudi Naval Forces Complex**	medium/high	• Access and Mobility • Highway Barrier	• Limited development opportunity. • Link the sites/residential area to the station.	Future high desity residential development nearby.
5B1	Deep Underground	**Office** (Destination)	P4	• Residential Dev. • Commercial Dev.	• **Ministry of Islamic Affairs** • **General Organisation for Social Insurance** • Hotels • Business Offices	high	• Access and Mobility • Incomplete pedestrian connectivity. • **Connectivity to future development.** • **Connectivity between Metro, BRT 1 and Community Bus 13/38 (intermodal connectivity)**	• Redevelopment potential.	Possible relocation of BRT station to improve connectivity.
5B2	Deep Underground	**Neighborhood**	P3	• Armed Forces Offciers Club • Residential Dev. • Commercial Dev.	• **Armed Forces Offciers Club** • Hotels	medium/high	• Access and Mobility • Limited pedestrian infrastructure.	• Limited redevelopment opportunity. • Provide key link for residentail neighborhood.	Improved pedestrian access required.
5B3	Deep Underground	**TOD Small Scale/ Redevelopment** (Neighborhood)	M2	• Gov. Ministry Offices • Commercial Dev. • Residential Dev.	• **Ministry of Health** • **Military Airport** • Business Offices	medium/low	• Major Intermodal Station • Access and Mobility • **Connectivity to future development.**	• Development opportunity of vacant land. • Collocation of a major BRT and community bus transfer station and the metro with access to the airport.	Area characteristics are changing.
5B4	Deep Underground	**Neighborhood**	M2	• Residential Dev. • Commercial Dev. • Public Services	• Business Offices • Commercial Corridor	medium/low	• Access and Mobility • **Connectivity to future development.** • **Connectivity between Metro, BRT 11 and Community Bus 11/21/22 (intermodal connectivity)**	• Limited development opportunity.	—
5C1	Deep Underground	**Neighborhood**	M2	• Residential Dev. • Commercial Dev.	• Business Offices • Commercial Corridor	medium/low	• Access and Mobility • **Connectivity between Metro, BRT 11 and Community Bus 11/21/22 (intermodal connectivity)** • Highway Barrier	• Limited redevelopment opportunity. • Collocation of BRT and community bus transfer station and the metro.	—
5C2	Deep Underground	**Neighborhood**	M1	• Residential Dev. • Commercial Dev. • Education	• **Riyadh College of Technology** • **Tourism and Hospitality College of Excellence** • **Prince Sultan University**	low	• Access and Mobility	• Development opportunity of vacant land. • Potential redevelopment opportunity. • Potential site for TOD • Connection to future development, college and university	—
5C4/2C2	Deep Undergro	**Neighborhood** (Destination)	M2	• Residential Dev. • Commercial Dev. • Education	• **Prince Sultan University** • **Ministry of Education** • Masoudy Preparatory School	medium/low	• Transfer Station • Access and Mobility • **Connection between station plattforms and surrounding land use.** • **Connection between university, metro and BRT.**	• Limited redevelopment opportunity.	—
Depot	—	—	—	—	—	—	—	—	—

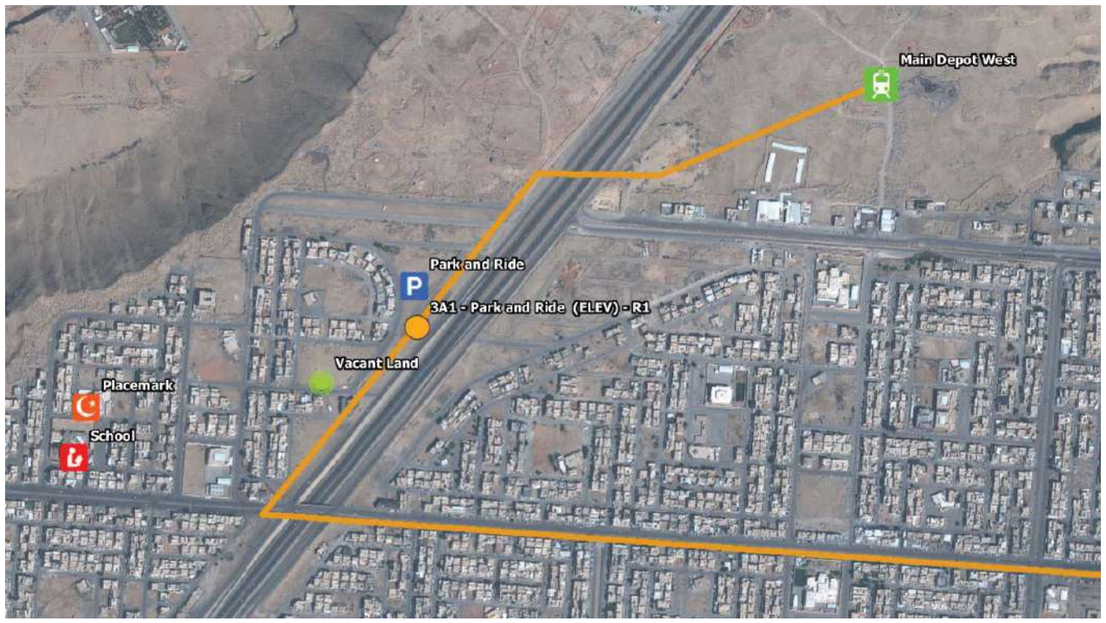
Table 8.4 Overview table - METRO line 5

Riyadh Metro Line 6 (Purple Line - 30 km)

Abdul Rahman bin Ouf - Shailh Hassan bin Hussain bin Ali

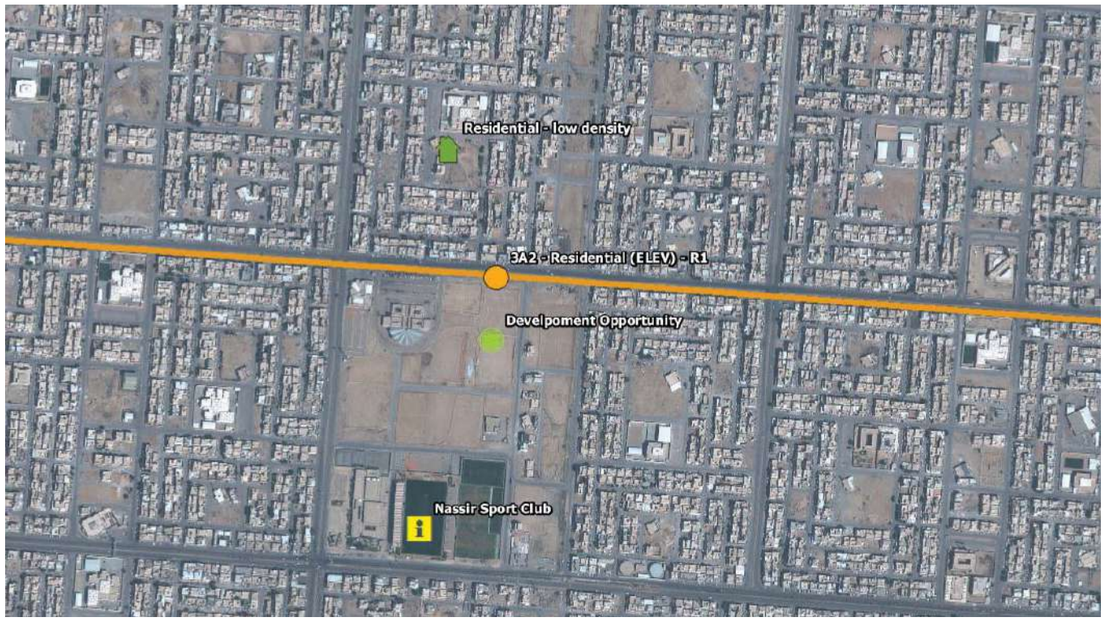
Station	Station Condition	Station Typology	Urban Street Type	Supported Land Use	Key Places of Interest	Density	Main Challenges	Opportunities	Stations Needs/Notes
6A1/4A1/1A1 → ZAHA HADID	Elevated	**TOD Large Scale**/ Park and Ride (Destination) (Office/ Employment)	P4	• Offices • Employment • Mixed Use	• **KAFD** • **Future Development**	high	• **Transfer Station** • Access and Mobility • **Mobility and connectivity shall be programmed for all modes connectiong to Metro and KAFD**	• Development opportunity of vacant land.	Development of KAFD is currently under construction.
6A2/4A2	Currently under review by ADA	**Neighborhood**/ Park and Ride	M1	• Residential Dev. • Commercial Dev.	• Kingdom Schools	low	• Access and Mobility • **Connectivity between Metro, BRT 1 and Community Bus 45 (intermodal connectivity)**	• Development opportunity of vacant land. • Redevelopment potential.	The Current roundabout will be replaced with a divided interchange.
6C1/4C1	Currently under review by ADA	**Residential** (Destination) (Neighborhood)	M1	• Residential Dev.	• **Imam Islamic University**	low	• Access and Mobility • **Connectivity between Metro and Community Bus 45/46 (intermodal connectivity)** • **Access to university by female students.**	• Development opportunity of vacant land.	The Current roundabout will be replaced with a divided interchange. Overhead power lines and roundabout interchange create poor station accessibility and connectivity.
6D1/4C2	Currently under review by ADA	**University**/ Park and Ride (Destination) (Office/ Employment)	P3	• Educational Dev. • Residential Dev.	• **Imam Islamic University** • **Technology Park** • SABIC HQ • FAL Compound	medium/high	• **Transfer Station** • Access and Mobility • **Connectivity to Technology City Business Complex and SABIC HQ.** • **Connectivity between Metro and Bus**	• Development opportunity of vacant land.	Overhead power lines and roundabout interchange create poor station accessibility and connectivity.
6D2	Elevated	**TOD Small Scale/Hotel/ International Business** (Destination) (Office/ Employment)	P4	• Hotel/Office • Commercial Dev. • Residential Dev.	• **Hilton Tower Complex** • **Granada Mall** • **Granada Center (Offices)** • Schools	high	• Access and Mobility • **Connectivity between Metro and Community Bus 22 to Mall and hotel development.** • **Distance to key places of interest.**	• Development opportunity of vacant land. • Redevelopment potential. • Connection to key places of interest	Large growth in station capture zone. Office growthin station area. Existing mall parking presents an opportunity for future redevelopment.
6E1	Elevated	**TOD Small Scale** (Neighborhood)	M2	• Residential Dev. • Employment	• Numerous Residential Compounds • Future Development	medium/low	• Access and Mobility • **Further evaluation between Metro and possible bus connection.**	• Development opportunity of vacant land. • Redevelopment potential.	intersection Ash Shaikh Hassan Ibn Hussain Road/ Al Imam Saud Bin Abdulaziz is ongoing. (Additional station close to the intersection with Khalid Ibn Al Walid - higher demand anticipated)
6F1/2E1	Deep Underground	**TOD Small Scale**/ Park and Ride (Neighborhood)	M2	• Industrial/Warehouse • Commercial Dev. • Residential Dev.	• **Souk?**	medium/low	• **Transfer Station** • **Connectivity between transfer station and access to taxi, and park and ride is vital.** • Access and Mobility • Limited Infrastructure	• Significant vacant land (muliple parcels); strong candidate for a development site; possible TOD. • Redevelopment potential.	Pedestrian accessibility is not marked on the layout.
6G1	Shallow Underground	**Residential** (Neighborhood)	M2	• Residential Dev. • Commercial Dev.	—	medium/low	• Station access to bus (community bus 41) and taxi is vital. Bus stops at station. • Roadway serves as barrier; limited pedestrian connectivity.	• Redevelopment potential.	Area characteristics are changing.
6G2	Elevated	**Employment**/ Park and Ride	A2	• Industrial/Warehouse • Commercial Dev. • Residential Dev.	—	medium/low - medium/high	• Access and Mobility • **Khurais Road barrier** • **Connectivity between Metro and Community Bus 13 (intermodal connectivity)**	• Station serves mixed-use area. • Potential for additional park and ride facilities to the south (Khurais Rd. presents major access barrier). • Development opportunity of vacant land. • Redevelopment potential. • Future land use might change urban street type to M2.	This station is connected with BART line 3 and will serve a shopping mall. Potential creation of public garden, green space & playground.
6H1	Elevated	**Neighborhood**	M2	• Commercial Dev. • Residential Dev.	—	medium/low	• Access and Mobility • **Connectivity between Metro and Community Bus 36 (intermodal connectivity)** • **Limited pedestrian connectivity**	• Redevelopment potential. • Community bus to serve station.	Improve station mobility.
6H2/3J1	Deep Underground	**Neighborhood**/ Park and Ride (Destination)	M1	• Commercial Dev. • Residential Dev.	• **Cemetary**	low	• Transfer Station • Access and Mobility • Site adjacent of large cemetary	• Development opportunity of vacant land. • Potential redevelopment opportunity. • Potential site for TOD	Pedestrian accessibility is not marked on the layout.

Table 8.5 Overview table - METRO line 6

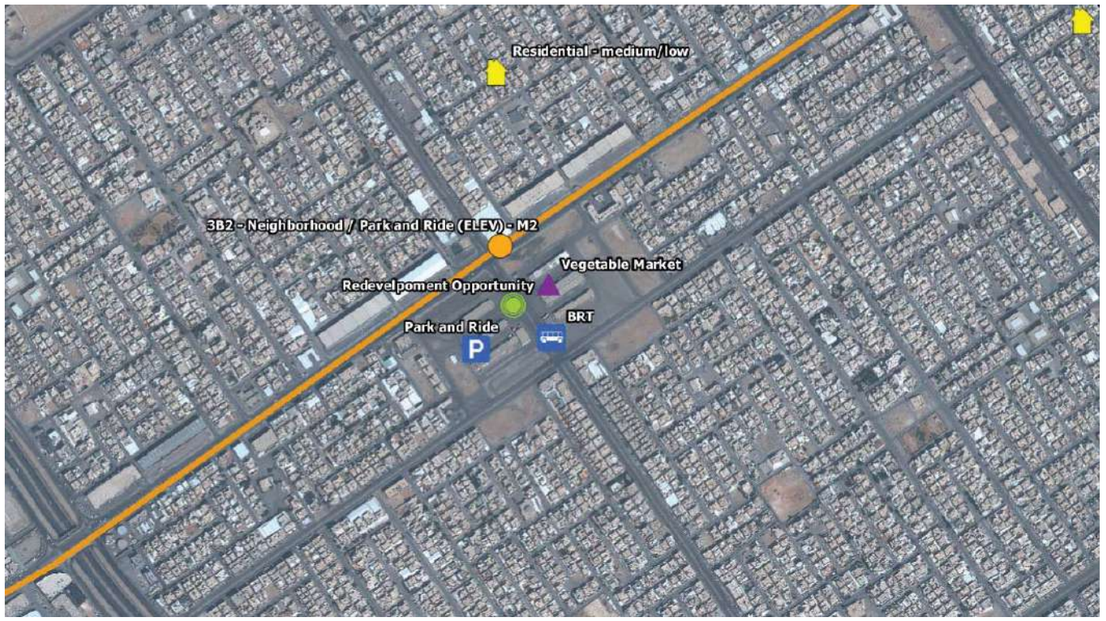


Map 8.6 Detailed Map - Corridor Segment around Station 3A1

Map 8.8 Detailed Map - Corridor Segment around Station 3B1

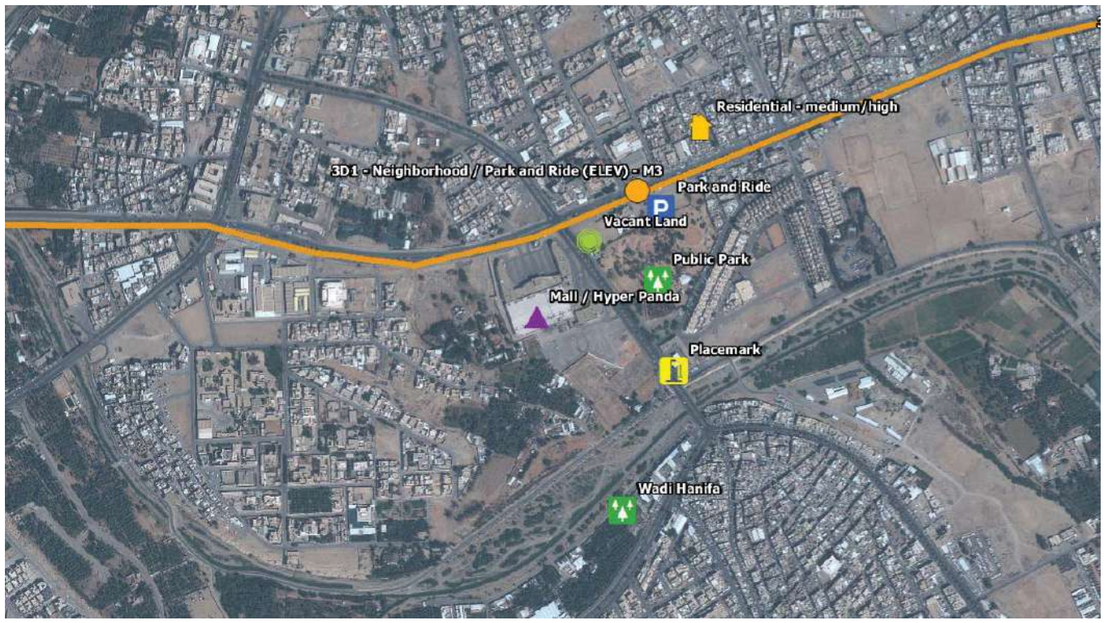


Map 8.7 Detailed Map - Corridor Segment around Station 3A2

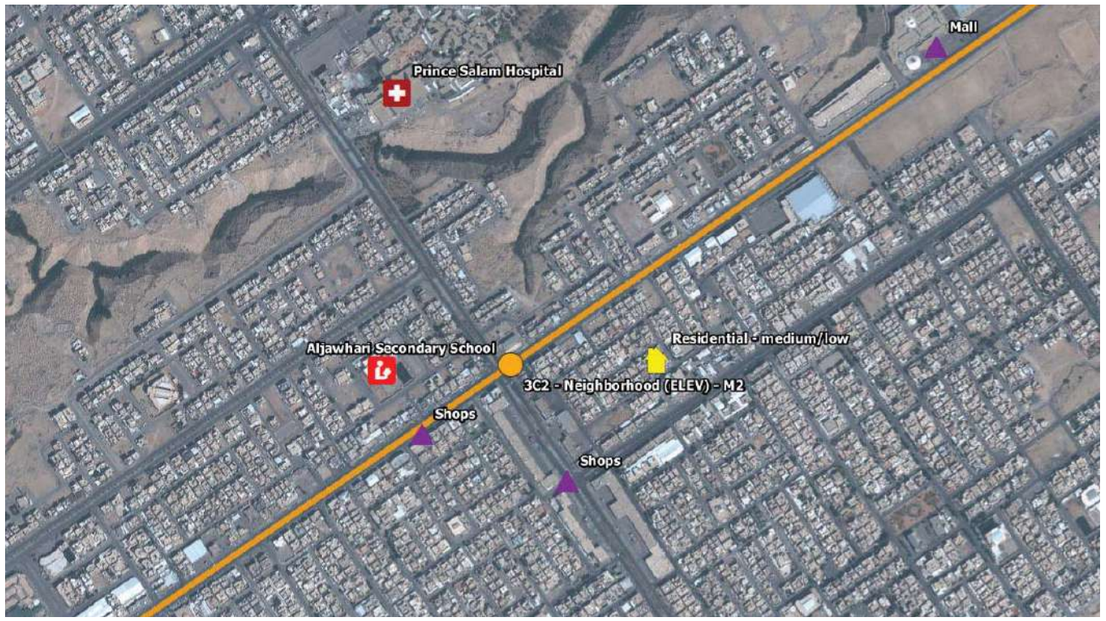


Map 8.9 Detailed Map - Corridor Segment around Station 3B2

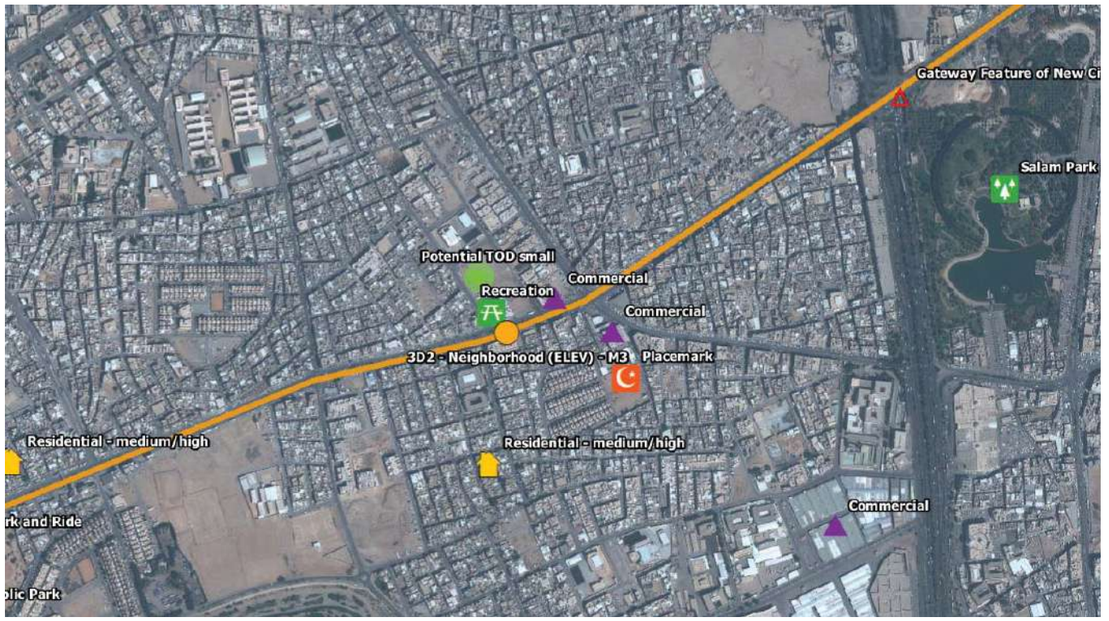
Map 8.10 Detailed Map - Corridor Segment around Station 3C1



Map 8.12 Detailed Map - Corridor Segment around Station 3D1



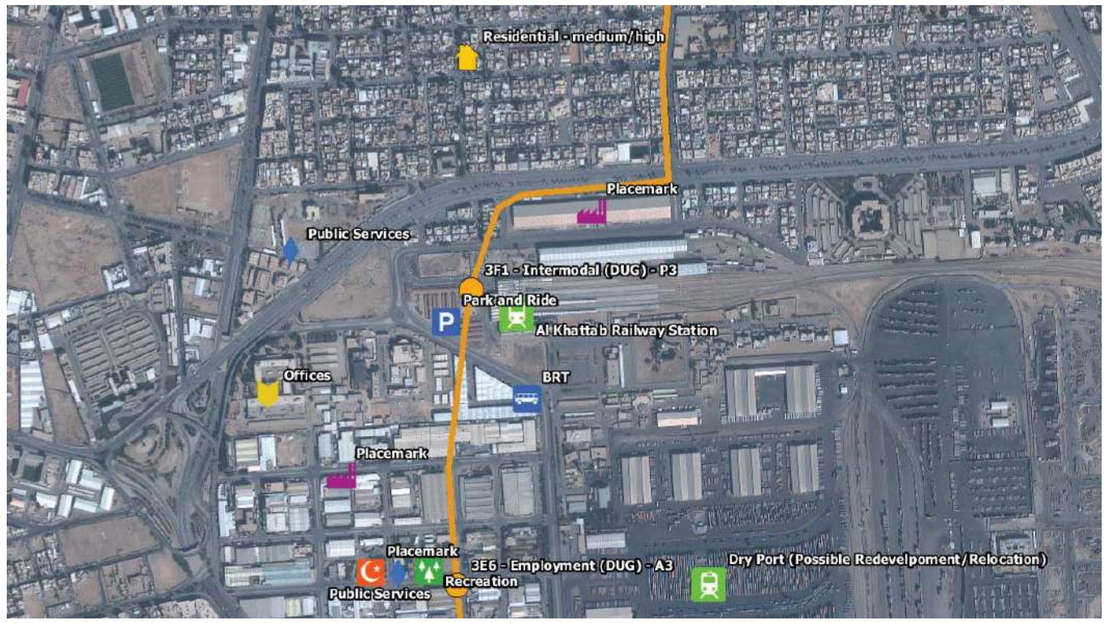
Map 8.11 Detailed Map - Corridor Segment around Station 3C2



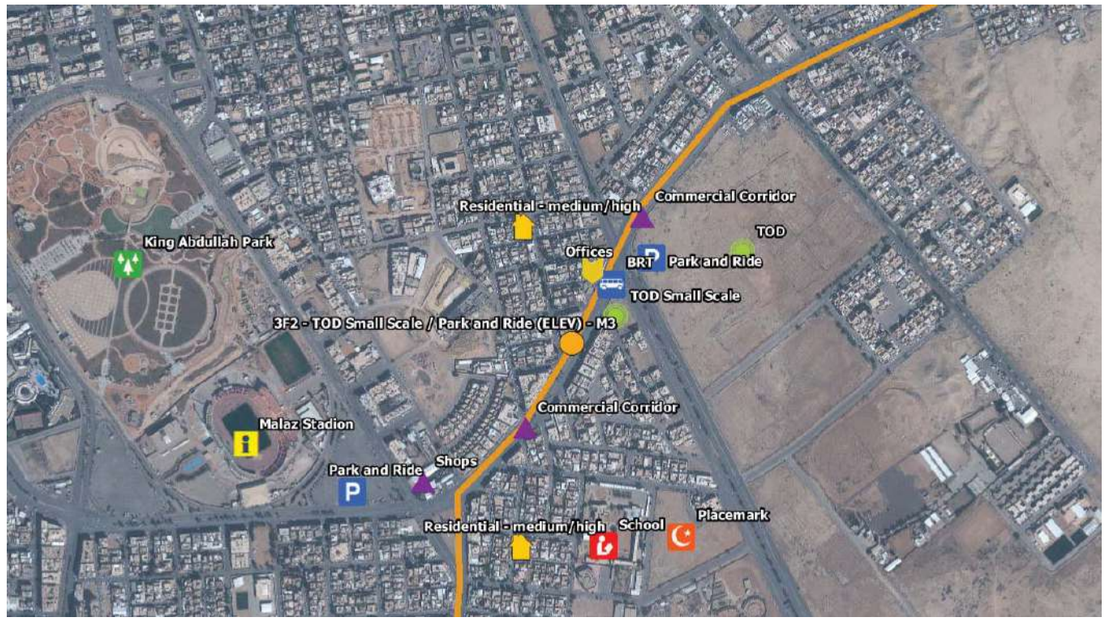
Map 8.13 Detailed Map - Corridor Segment around Station 3D2

Map 8.14 Detailed Map - Corridor Segment around Station 3E1, 3E2 and 3E3

Map 8.15 Detailed Map - Corridor Segment around Station 3E4 and 3E5



Map 8.16 Detailed Map - Corridor Segment around Station 3E6 and 3F1



Map 8.17 Detailed Map - Corridor Segment around Station 3F2

Map 8.18 Detailed Map - Corridor Segment around Station 3G1

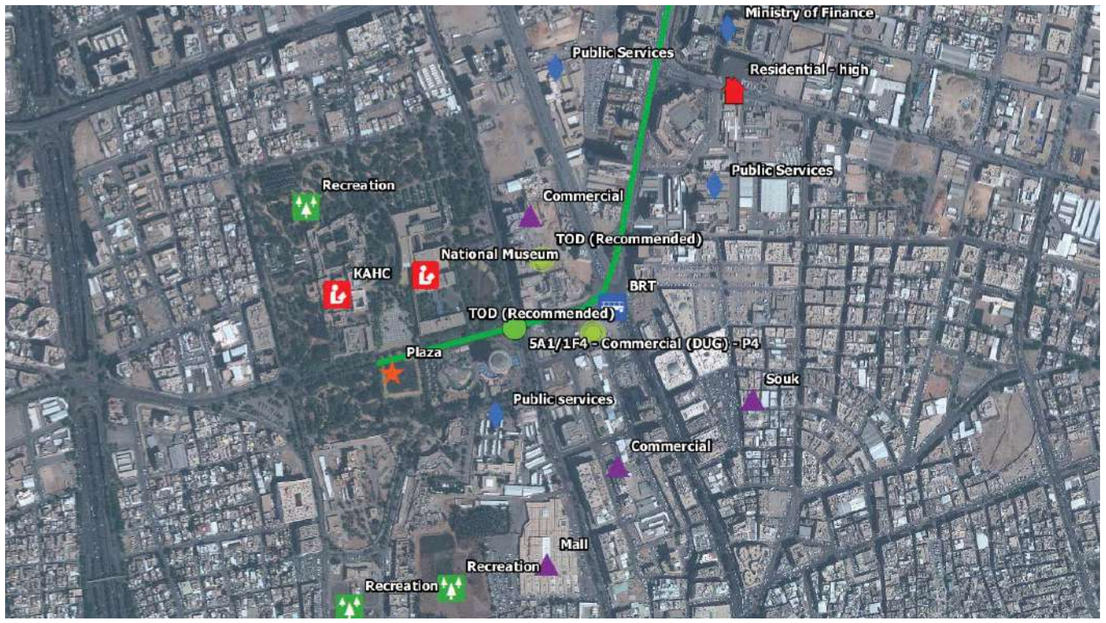
Map 8.20 Detailed Map - Corridor Segment around Station 3H2

Map 8.19 Detailed Map - Corridor Segment around Station 3H1

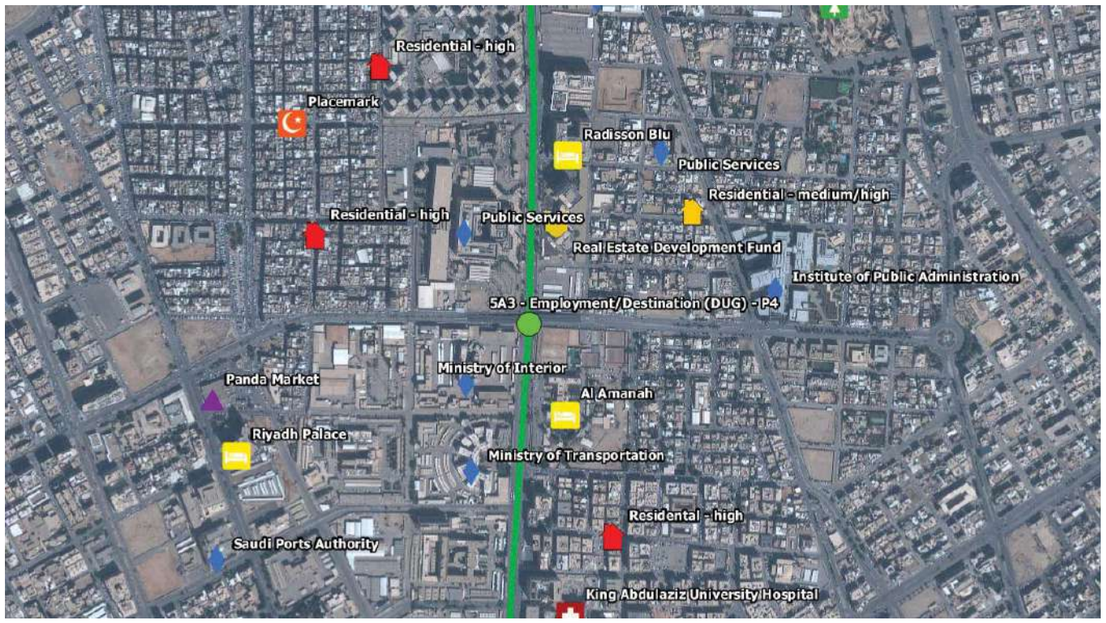
Map 8.21 Detailed Map - Corridor Segment around Station 3H2/ 3J1

Map 8.22 Detailed Map - Corridor Segment around Station 3J2

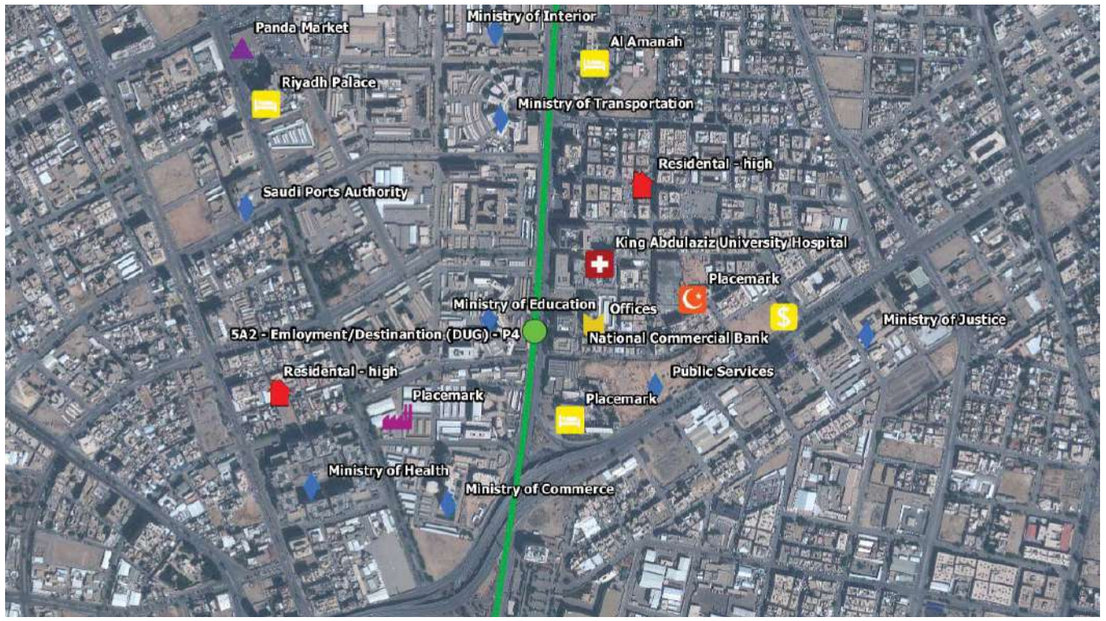
Map 8.23 Detailed Map - Corridor Segment around Station 3K1 & East Stabling Area



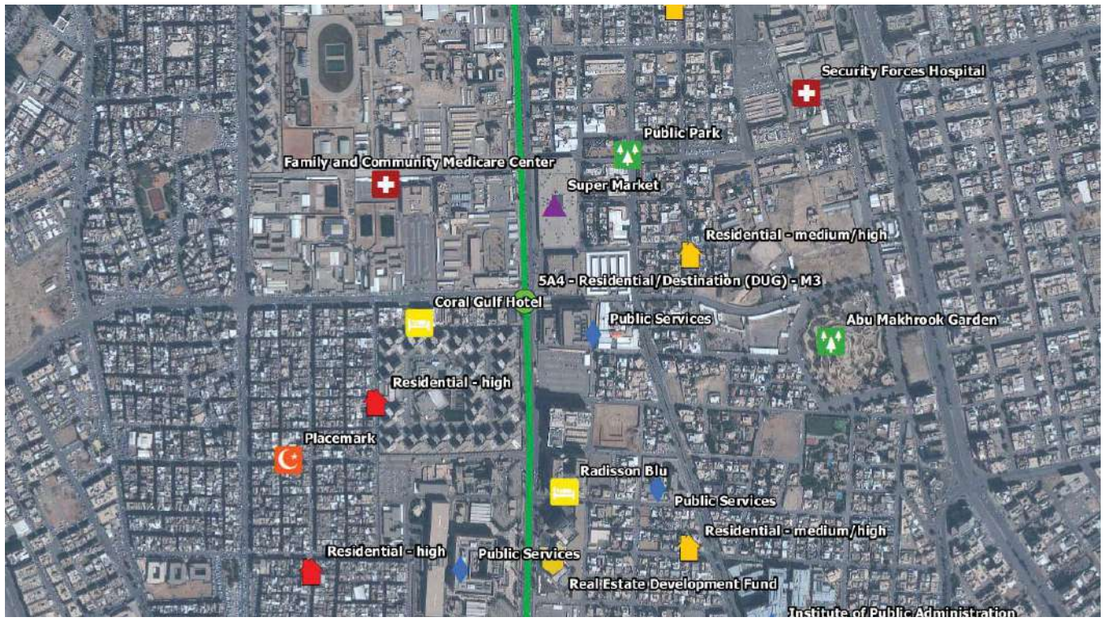
Map 8.24 Detailed Map - Corridor Segment around Station 5A1 / 1F4



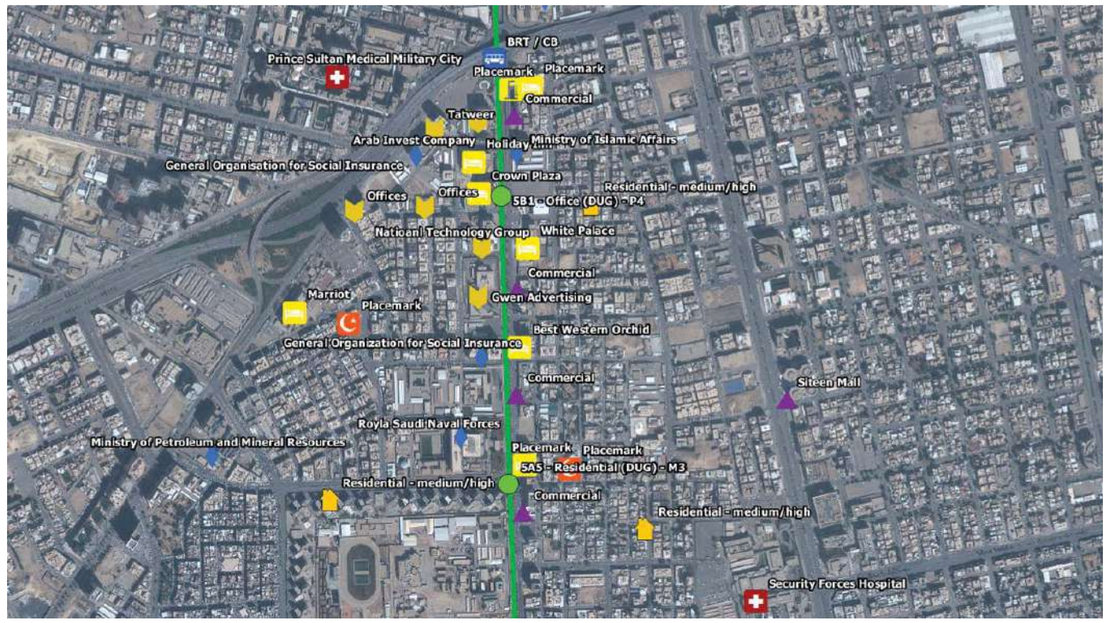
Map 8.26 Detailed Map - Corridor Segment around Station 5A3



Map 8.25 Detailed Map - Corridor Segment around Station 5A2



Map 8.27 Detailed Map - Corridor Segment around Station 5A4



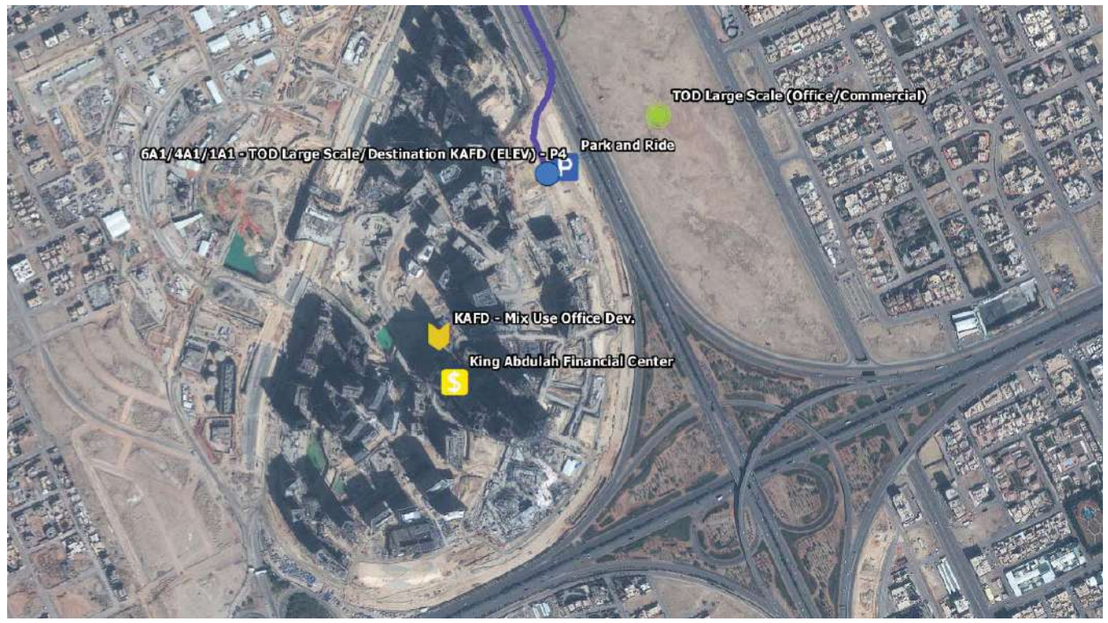
Map 8.28 Detailed Map - Corridor Segment around Station 5A5 and 5B1

Map 8.29 Detailed Map - Corridor Segment around Station 5B2

Map 8.30 Detailed Map - Corridor Segment around Station 5B3, 5B4 and 5C1

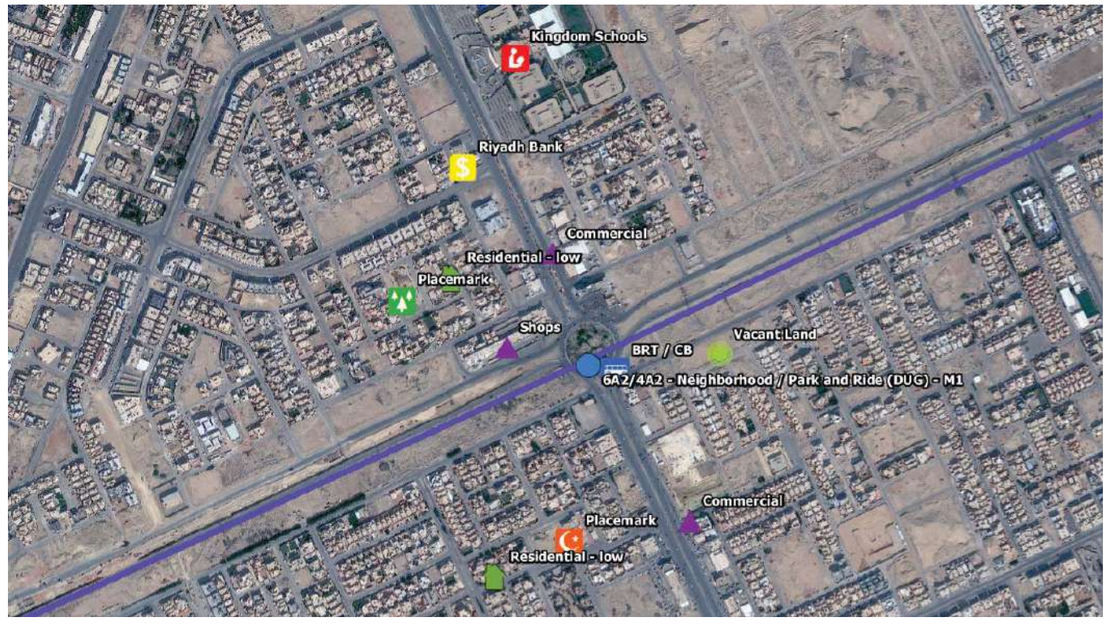
Map 8.31 Detailed Map - Corridor Segment around Station 5C2

Map 8.32 Detailed Map - Corridor Segment around Station 5C4/ 2C2

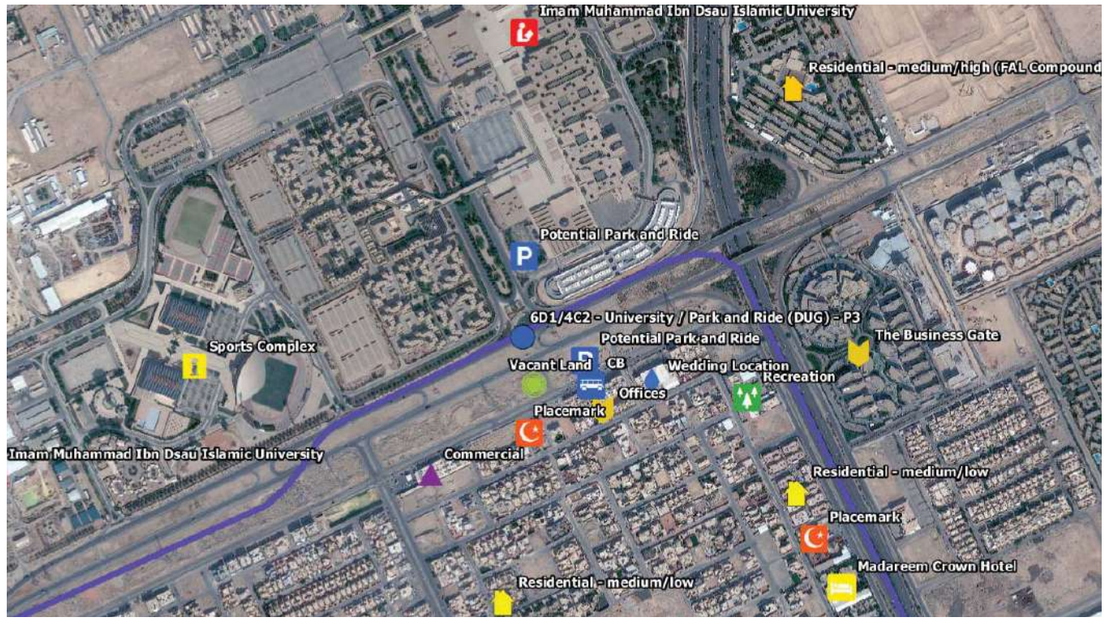


Map 8.33 Detailed Map - Corridor Segment around Station 6A1 / 4A1 / 1A1

Map 8.35 Detailed Map - Corridor Segment around Station 6C1/ 4C1



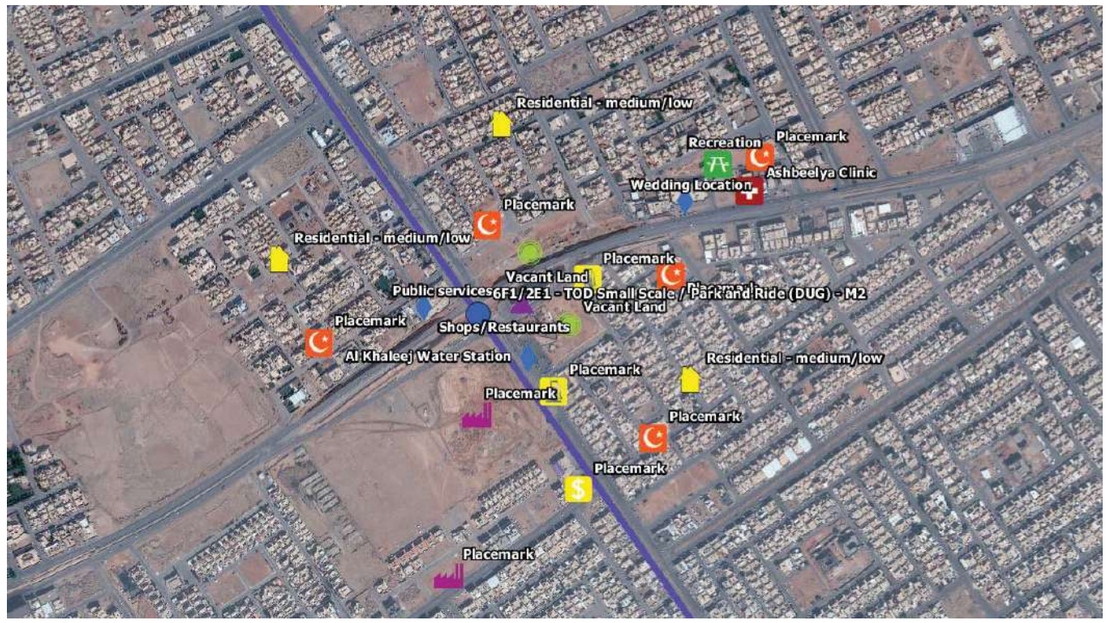
Map 8.34 Detailed Map - Corridor Segment around Station 6A2/ 4A2



Map 8.36 Detailed Map - Corridor Segment around Station 6D1/ 4C2

Map 8.37 Detailed Map - Corridor Segment around Station 6D2

Map 8.38 Detailed Map - Corridor Segment around Station 6E1



Map 8.39 Detailed Map - Corridor Segment around Station 6F1/ 2E1

Map 8.40 Detailed Map - Corridor Segment around Station 6G1

Map 8.41 Detailed Map - Corridor Segment around Station 6G2

Map 8.42 Detailed Map - Corridor Segment around Station 6H1

Map 8.43 Detailed Map - Corridor Segment around Station 6H2

8.2 Planting Specification (by ADA Nursery)

Soil composition.

- Topsoil or growing medium shall be free-draining, non-toxic and capable of sustaining healthy plant growth.
- The soil shall not contain calcium carbonate, subsoil, refuse, roots, heavy clay, noxious weeds, phytoxic materials, coarse sand, rocks, brush, litter or any other detritus materials.

The soil shall have following characteristics:

- 1. PH 6.0 to 7.0 of saturated soil
- 2. EC less than 2500 mmhos in satu rated extract
- 3. Physical loamy made up by particle size as follows:

  Sand (2mm to 0.05mm) 70% to 80%

  Silt (0.05mm to 0.002mm) 25% to 30%

  clay (<0.002mm) 5% max

- The representative samples of soil shall be analysed for all the above characteristics and results submitted to the Engineer/ Consultant for approval.
- Report suitability of topsoil for growth of the planting material. A qualified independent soil testing laboratory shall provide a soil analysis, and according to the results obtained, recommend quantities of nitrogen, phosphorous, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to improve or produce satisfactory.

Fertilizers

- General fertilizer recommended is Sulphur coated slow release shall be Osmocote or equal and approved.

Planting Medium:

- Planting medium shall consist of a homogeneous mixture of soil, compost and fertilizers as specified,
- The Recommended soil mix for planting soil shall be (50 % sweet sand, 30 %Wadi soil 20% soil additives(compost, organic, petmoss, includ2%perlit)) and to be add slow release, fertilizer 2 Kg/ 1 m3 soil.
- Peatmoss shall be coarse brown sphagnum peat, not containing woody materials, free from sulphur and iron. Its pH value shall be in the range of (4 - 5). Organic matter content shall be 5-99% dry weight, and the water holding capacity shall be from 45-55%.
- Specified soil additives shall be mixed with sweet soil at the rates specified. The soil shall be mixed mechanically by an approved method to create a homogeneous mixture. Application rates for ameliorants shall be checked and approved by the Consultant prior to mixing each batch.

Size of planting pit shall be as follows:

I. palm pit 2.0mx2.0mx2.0m

II. tree pit 2.0mx2.0mx2.0m

III. large shrubs 1.0mx1.0mx1.0m

IV. shrubs/ grasses/ succulents 0.5m depth

V. lawn 0.3m depth

VI. groundcovers & bedding plants 0.3m depth

Planting Palette

PALMS

Phoenix dactylifera

Washintonia filifera

Acacia farnesiana (multi stem)

Acacia nilotica (huge tree)

Cercidium floridum (street tree)

Dalbergia sissoo

Moringa peregrina (street tree)

Pithecellobium dulce (street tree)

Washingtonia robusta

Acacia salicina (multi stem)

Acacia victoriae (street tree - low water requirement)

Delonix regia (huge tree)

Ficus altissima (street tree)

Thespesia populnea

Ziziphus spina

TREES

Acacia ampliceps (low water requirement)

Acacia aneura (low water requirement)

Albizia lebbeck (huge tree)

Callistemon viminalis (small tree applied in planters)

Ficus religiosa

Ficus sycomorus

Ziziphus jujuba (street tree)

SHRUBS

Acacia redolens

Aloe vera

Dodonaea viscosa (hedge)

Duranta aurea

Jatropha integerrima

Lagerstroemia indica

Sansevieria trifasciata

Senna artemisiodis

Atripex halimus (hedge)

Bougainvillea glabra

Duranta erecta (hedge)

Duranta repens

Lantana camera

Leucophyllum frutescens (hedge)

Tecoma stans

Tecomaria capensis

Caesalpinia pulcherrima

Clerodendrum inerme (hedge)

Duranta variegata

Encelia farinosa

Myrtus communis

Plumeria obtusa

Thevetia peruviana

Vitex agnus

SHRUBS (Continuation)

Vitex trifolia

GROUND COVER

Agave sisalana

Carissa macrocarpa

Iresine herbstii

Limoniastrum monopetalim

Sesuvium portulacastrum

Tradescantia pallida

Celosia argentea

Common Portudaca

Rosmarinus officinalis

Ruscus hypoglossum

Wedelia trilobata

Gazania leucolaena

Ipomea pes caprae

Santolina chamaecyparissus

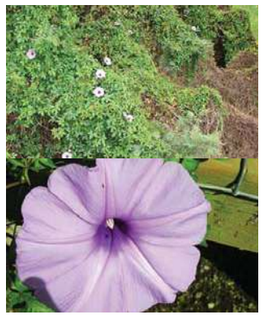
Senecio cineraria

CLIMBERS

Jasminum grandiflorum

Bougainvillea spectabilis

Clerodendrum inerme



Ipomea palmata

Quisqualis indica

GRASS AND LAWN

Pennisetum setacum ‘rubra’

Pennisetum setaceum

Paspalum

Stenotaphrum secundatum

GLOSSARY OF ABBREVIATIONS

ADA - Arriyadh Development Authority

AS&P - Albert Speer & Partner GmbH

ASTM - American Society for Testing and Materials Standards

BRT - Bus Rapid Transit

BS - British Standards Institute

CABE - Commission for Architecture and the Built Environment

CENELEC - European Committee for Electrotechnical Standardisation

CCTV - Closed Circuit Television

CH2M - CH2M Hill

DIN - Deutsches Institut für Normung.

KAFD - King Abdullah Financial District

LAC - Lot Area Coverage

LED - Light Emitting Diode

MEDSTAR - Metropolitan Development Strategy for Arriyadh

PCC - Precast Concrete

ROW - Right of Way

TOD - Transit Oriented Development

UDM - Riyadh METRO Urban Design Manual

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Reference Information Figures I Maps I Tables

1 Introduction

2 Fundamental Design Principles

3 Design Process

4 Design Philosophy

5 Design Guidance & Standards

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