MEGA TO MINI

Transforming the desert metropolis of Riyadh into a 10-min City.

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ABSTRACT

ENGLISH

This thesis examines the potential impacts of the construction of six metro lines in the metropolis of Riyadh, Saudi Arabia, and the implications for a shift in transportation modalities within the city. The study investigates the effects of this infrastructural development on urban mobility, accessibility to services, and the overall quality of life for the city's residents. It further explores how this development can be leveraged to reimagine the city's districts and spatial composition, challenging the existing car-oriented city layout.

Furthermore, this thesis discusses the principles of an X-minute city and explores strategies for implementing these principles in a city like Riyadh, which is characterized by a harsh climate and a car-oriented design. The research employs a mixed-methods approach, combining quantitative data analysis with qualitative insights from public surveys.

The findings highlight the significant role of an integrated public transportation system in transforming the city's structure into a more sustainable and inclusive urban environment. This study proposes a prototype for the initial phase of transforming Riyadh into an X-minute city, starting from Al Rabi' District and KAFD, which represents the boundary between the existing built environment and the new development zone of the city.

ITALIAN

Questa tesi esamina gli impatti potenziali della costruzione di sei linee metropolitane in progetto nella metropoli di Riyadh, Arabia Saudita, e le implicazioni rispetto a un cambiamento nelle modalità di trasporto all'interno della città. Lo studio indaga gli effetti di questo sviluppo infrastrutturale sulla mobilità urbana, l'accessibilità ai servizi e la qualità complessiva della vita per i residenti della città. Esplora inoltre come questo sviluppo possa essere sfruttato per rimmaginare i quartieri della città e la organizzazione spaziale, sfidando l'attuale layout della città, orientato all'uso dell'automobile, a partire dalla sperimentazione dei principi dela X min city.

Introducendo infatti i principi di una città X-minuti, la tesi esplora strategie per implementare questi principi a Riyadh, caratterizzata da condizioni climatiche sfidanti e da una forte dipendenza dall'automobile. La ricerca impiega un approccio misto, quali-quantitativo utilizzando anche dati desunti da interviste e sondaggi pubblici.

Le analisi condotte evidenziano il ruolo significativo di un sistema di trasporto pubblico integrato nel trasformare la struttura della città in un ambiente urbano più sostenibile e inclusivo e sostengono la sperimentazione di un prototipo per la fase iniziale della trasformazione di Riyadh in una città X-minuti, a partire dal distretto di Al Rabi' e KAFD, che rappresenta il confine tra l'ambiente costruito esistente e la nuova zona di sviluppo della città.

ARABIC

تدرس هذه الرسالة الأثر المحتمل لبناء ست خطوط مترو للمرة الأولى في المدينة المتروبولية الرياض، المملكة العربية السعودية، والتداعيات المترتبة على التحول في أنماط النقل داخل المدينة. تغوص الدراسة في تأثيرات هذا التطور البنيوي على الحركة المرورية الحضرية، والوصول إلى الخدمات، وجودة الحياة العامة لسكان المدينة. كما تستكشف كيف يمكن استغلال هذا التطور لإعادة تصور أحياء المدينة وتكوينها المكاني، وتحدي التخطيط الحالي للمدينة الذي يركز على السيارات.

علاوة على ذلك، تناقش هذه الرسالة مبادئ مدينة X-دقيقة وتستكشف استراتيجيات تنفيذ هذه المبادئ في مدينة مثل الرياض، التي تتميز بمناخ قاسٍ وتصميم يركز على السيارات. تستخدم البحث منهجًا مختلطًا، يجمع بين تحليل البيانات الكمية مع الرؤى النوعية المستمدة من الاستطلاعات العامة.

تبرز النتائج الدور الكبير لنظام النقل العام المتكامل في تحويل هيكل المدينة إلى بيئة حضرية أكثر استدامة وشمولية. تقترح هذه الدراسة نموذجًا أوليًا للمرحلة الأولى من تحويل الرياض إلى مدينة X-دقيقة، بدءًا من حي الربيع و KAFD، الذي يمثل الحد الفاصل بين البيئة المبنية الحالية ومنطقة التطوير الجديدة للمدينة.

CONTENTS

DATA AND METHODS

The methodology for this study was designed to ensure a comprehensive analysis of the area of interest. The process involved the use of data from various sources including OpenStreetMap (OSM), NEXTGIS, data created by the author, research data, statistical data, and public survey results.

Data Acquisition: The first step in the methodology was the acquisition of data. This involved sourcing geospatial data from OpenStreetMap and NEXTGIS. These platforms provide open-source data that is constantly updated by a community of users. In addition to these sources, the authors also generated some of the data used in the study. Furthermore, relevant research data and statistics were gathered from various academic and governmental sources. Public survey results were also collected to incorporate the perspective of the general public.

Data Integration: After acquiring the necessary data, the next step was to integrate all the data sets into a common platform for analysis. This involved the use of Geographic Information System (QGIS) software to ensure that all data sets were in the same geographic projection and format.

Data Analysis: Once all the data was integrated, the author conducted a series of analytical mapping procedures. This involved the use of various GIS tools and techniques to identify patterns, relationships, and trends in the data. The research data, statistics, and public survey results were also analyzed in this step to provide a more comprehensive understanding of the area of study.

Interpretation and Reporting: The final step in the methodology was the interpretation of the results from the data analysis. This involved making sense of the patterns and trends identified in the analysis. The authors then reported these findings in a manner that is understandable to the intended audience.

This methodology ensured a rigorous and comprehensive analysis of the data, providing valuable insights into the area of study. The use of data from OSM, NEXTGIS, the author, and the incorporation of research data, statistics, and public survey results, allowed for a multi-faceted approach to the analysis, ensuring a more robust and reliable outcome. However, due to the lack of precision in the rasterization the of data, fine details may be lost, impacting the accuracy of the representation.

A DAY IN A LIFE OF SAUDIS

Hello, I am Fares, an aspiring architecture student in a culturally rich city of Riyadh. My family comprises of my father, who works in the corporate office in the commercial spine of the city, my mother who is a doctor in the hospital and my sister who is a high school student. It's morning and like every other household my house is also busy with family rushing around to start their work and schools. Every morning my father drops my sister to her school which is in vicinity and 5 mins (3 km) drive from our house, while embarking for his journey to his office and without rush hours it takes him 30 minutes (25 km) to reach there. The hospital is around 20 minutes (17 km) drive from the car, and I drop my mother there before going to university which takes me 25 minutes (22 km) to reach. My professor came from a work tour from Melbourne, and he told us how the city is designed to encourage walking, bicycle rides or public transportation. It pushed me to reflect how cars are ingrained in the culture of city. A regular family in Riyadh will own minimum of two cars and in our daily lives we have adjusted to this mode of commute of the city. We stock our groceries for two weeks as the supermarkets are usually a ride of 20 minutes and it's not easily accessible to go there every couple of days. If we want to go for morning walks, we must drive to the park for 30 minutes as the neighbourhoods are not designed with public green urban spaces and if want to go to mall for entertainment, it's usually a 45-minute drive. Most of our time is spend in cars and in recent years the traffic congestion is increasing in the city resulting in higher travel time and exhaustion from the commute. I wonder if there can be a cultural and social shift in the city, from the ingrained usage of cars to the idea of walking. How can the city be reimagined to make soft mobility more accessible and well connected in this dry and hot climate?

RESEARCH INTRODUCTION

The urbanization trajectory experienced by Riyadh after the oil boom has engendered a confluence of challenges, manifesting primarily in the scarcity of public urban spaces and the burgeoning reliance on private automobiles.

This study posits the development of sustainable and inclusive urban mobility as a pivotal intervention seeking to address these challenges through a nuanced understanding of the urban fabric and a commitment to sustainable urban development. The analysis underscores the prevalent issues within the extant urban landscape, encompassing deficiencies in urban spaces, inadequacies in public transport infrastructure, and overarching mobility concerns. The project is scrutinized as a comprehensive response, encompassing not only the enhancement of vehicular mobility but also the amelioration of broader urban quality-of-life indices.

The central focus is the conceptualization and implementation of a '15-Minute City' in a challenging context such as Riyadh. This novel urban planning approach revolves around the idea that residents should have

access to essential services and amenities within a 15-minute walking or cycling radius from their residences. By prioritizing soft mobility, the project seeks to cultivate a more balanced and environmentally friendly urban transportation paradigm.

This is achieved through a series of methodologies as: Underlining the historical context and development of Saudi Arabia and Riyadh to understand the rapid modernization of the city which has affected the urban fabric and the cultural behaviour to rely on cars and proposing a paradigm shift in the society, and the need for a new strategic vision and development. Secondly, analysing the issue of climate, mobility and land use and henceforth experimenting with solutions that can transform the city. Finally, proposing a design solution for a neighbourhood and a financial district spine with a focus on soft mobility transport strategy and enhancing access to the local public transport as well as developing a sustainable urban fabric to promote the urban gravity in the city.

Source: https://www.state.gov/countries-areas/saudi-arabia/

- Chapter 1 -

مقدمة: أعمدة مدينة ال15 دقيقة

Introduction: Pillars of a 15-min City

The COVID-19 pandemic has been the main driver of change in the built environment of our cities. Because of its lockdowns and harsh restrictions on movement, people realized that there was a lack of human-centred living spaces and neighbourhoods. Furthermore, most of these disorders are associated with a car-centric urban model. These problems led to the creation of the concept of the 15-minute city by Carlos Moreno. The report analysed the concepts of the 15-minute city for the later implementation of a human-centred approach and provided key findings, implementation challenges and recommendations.

15 MIN CITY CONCEPT

Urban mobility refers to the movement of people and goods in urban areas. It includes different modes of transport such as walking, cycling, public transport, private vehicles and emerging technologies such as electric scooters and autonomous vehicles. The goal of urban mobility planning is to create efficient, safe, and sustainable transportation systems that can meet the needs of city residents while minimizing environmental impacts and traffic congestion.

Key aspects of urban mobility include:

1. Public Transportation
Developing and improving public transportation systems, including buses, trams, subways, and commuter trains, to provide accessible and affordable options for city residents.

2. Active transport
Promote walking and cycling as viable means of transport by creating pedestrian-friendly infrastructure, cycle paths and safe routes.

3. Reducing dependence on cars
Promoting the use of public transport and shared mobility services to reduce dependence on private cars and alleviate traffic congestion.

4. Sustainability
Promoting cleaner and more sustainable transport options such as electric vehicles and renewable energy sources.

Carlos Moreno defines the 15-minutes city concept "an urban set – up where locals are able to access all of their basic essentials at distances that would not take them more than 15 mins by foot or by bicycle". According to the study the common planning principles for a 15 minute city are:

1. Proximity to essential services: Residents can access services by walking, cycling, or other non-motorized means in a reasonable time.

2. Proximity to public transport: Residents have barrier free and easy access to the public transportation system to commute to areas outside their vicinity without cars.

3. Density: The amount of people in an area supports the engagement with the services and helps in thriving of local businesses.

4. Mixed Landuse: The mixed functions of the infrastructures allow people to full fill their day to day needs within their vicinity.

Source: EIT-UrbanMobilityNext9_15-min-City.pdf

5. Walkable and cydable streets: Comfortable and well connected walkable and cycling paths for the residents to encourage soft mobility.

6. Public Space and Placemaking: Public inclusiveness in decision-making for the urban spaces connects them with spaces and new functions according to their needs.

7. Inclusiveness: The streets should be safe, barrier free and easily accessible for all residents irrespective of age, gender and disabilities.

8. Ubiquity: The soft mobility should be accessible to all irrespective of their socio-economic and demographic characteristics.

To achieve the goal of diversity of people and inclusiveness, besides traditional accessibility using a proximity framework based on service proximity, implementation should include indicators such as design for all (barrier-free), safety, people's capabilities, freedom, and affordability. A ±15 minute city must provide access to basic services for ALL groups societies regardless of their capabilities and socio-economic, demographic or cultural factors.

GAP IN THE THEORY

The author describes the concept as "an urban set-up where locals are able to access all of their basic essentials at distances that would not take them more than 15 min by foot or by bicycle" (Moreno et al., 2021). Although the concepts of urban mobility and the "15-minute city" offer many advantages, there are also some problems and gaps that need to be addressed to be effectively implemented:

1. Deficiencies in infrastructure:

• In many existing urban areas, the infrastructure is not designed for active transport such as walking and cycling. There may be a lack of safe and well-maintained sidewalks, bike paths, and pedestrian crossings.

• Public transport networks may be inadequate in terms of coverage, frequency, or capacity, making it difficult for people to rely on these modes of transport.

2. Equality and accessibility:

• Not all neighbourhoods have equal access to the benefits of the 15-minute city concept. Low-income and marginalized communities often face disparities in transportation options, access to services, and safe walking infrastructure.

• Implementing policies to ensure that these communities are not left behind is essential to achieving equitable urban mobility.

3. Financing and investments:

• Transforming existing urban areas into 15-minute cities often requires significant investment in infrastructure, public transport, and sustainable urban planning.

• Securing funding and gaining political support for these projects can be challenging, especially when there are competing budget priorities.

4. Behaviour change:

• Encouraging people to change their transport habits, such as reducing car use and adopting active transport, can be difficult.

• Public awareness campaigns and incentives may be necessary to encourage behaviour change.

5. Territorial planning:

• Implementing mixed-use zoning and creating walkable neighbourhoods requires changes to existing land use regulations and policies. This can be a complex and time-consuming process involving legal and political challenges.

6. Technological integration:

Source: EIT-UrbanMobilityNext9_15-min-City.pdf

• Integrating new technologies such as electric scooters and autonomous vehicles into urban mobility plans is a challenge that requires careful regulation to ensure safety and sustainability.

7. Planning data and tools:

• Effective urban planning relies on accurate data and advanced modelling tools to assess transportation needs, predict traffic patterns, and plan infrastructure improvements.

• Some cities may lack the necessary data and expertise for urban mobility planning.

8. Resistance to change:

• Some stakeholders, including businesses and residents accustomed to a car-centric lifestyle, may resist changes that favour walking, cycling and public transport.

Addressing these gaps and challenges often requires a holistic approach involving urban planners, policy makers, community engagement and collaboration between various stakeholders. It also requires adaptability and continuous evaluation to ensure that urban mobility and the 15-minute city concept remain effective and responsive to evolving urban needs. Moreno himself puts an emphasis on the fact that the conceptualisation of the ±15-Minute City should keep a context-dependent perspective.

Mohanad Youssef

- Chapter 2 -

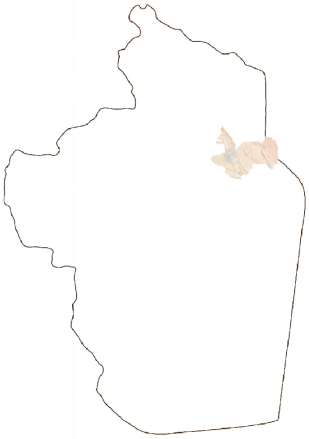
المملكة العربية السعودية

The Kingdom of Saudi Arabia

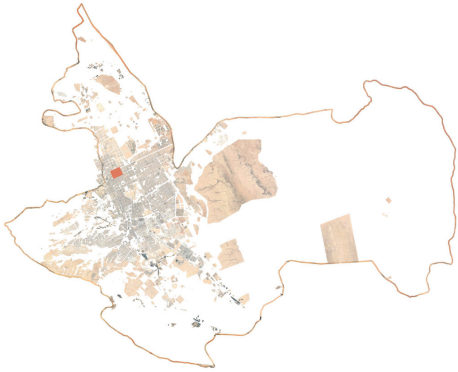
The Kingdom of Saudi Arabia, situated in Western Asia, encompasses the majority of the Arabian Peninsula. It ranks as the fifth-largest country in Asia, the second-largest in the Arab world, and the largest in West Asia and the Middle East, surpassed only by Algeria. The nation is flanked by the Red Sea to the west, and by Jordan, Iraq, and Kuwait to the north. On the east, it is bordered by the Persian Gulf, Qatar, and the United Arab Emirates, while Oman lies to the southeast, and Yemen to the south. Saudi Arabia is renowned for its deep-rooted history that traces back to antiquity and its strict interpretation of Islam. As the world's leading oil exporter with the second-largest oil reserves globally, Saudi Arabia holds significant economic influence. Riyadh, the capital, is also the nation's most populous city.

CONTEXT

Country Scale



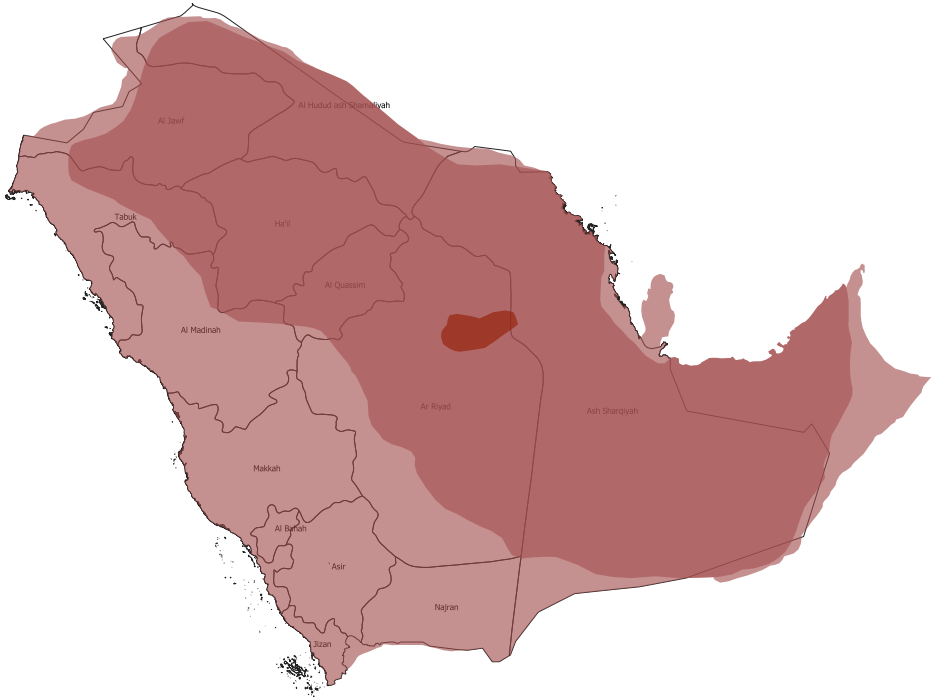
Region Scale



City Scale

Zone of Interest

THE THREE SAUDI STATES

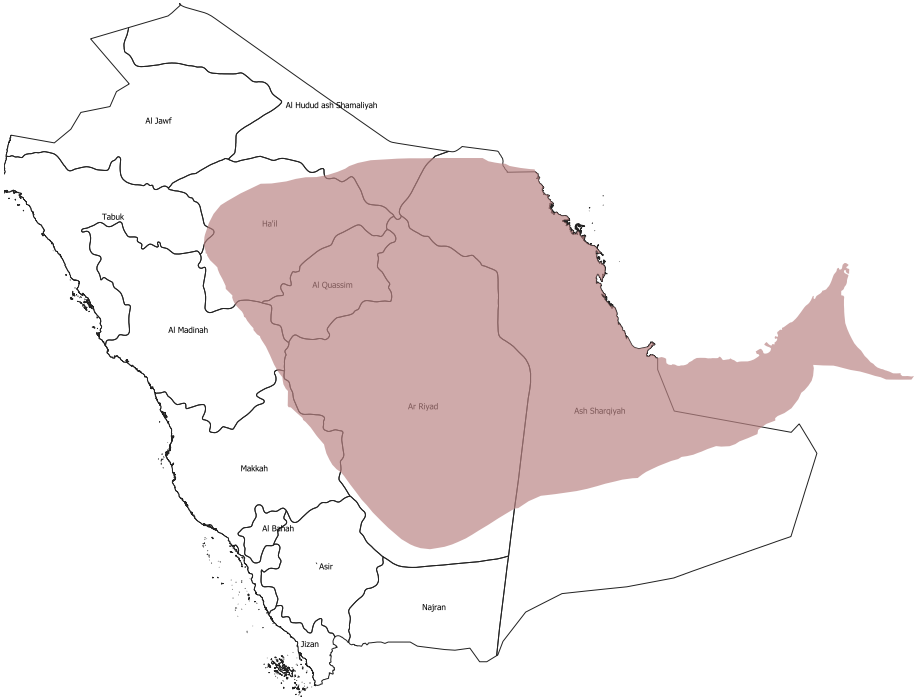


THE FIRST SAUDI STATE

Legend

- **1744 - 1786**
- **1786 - 1808**
- **1808 - 1816**

The Emirate of Diriyah, also known as the first state of Saudi Arabia, was founded in February 1727 (1139 AH). In 1744, Muhammad bin Saud, the emir of Najdi town named Diriyah, associated himself with the religious leader Muhammad bin Abdul Wahhab. He began the process of religious reform to unite many countries in the Arabian Peninsula. This state was a socio-religious movement focused on expansion of territory and influence. After many military campaigns, Muhammad bin Saud died in 1765, leaving the leadership to his son, Abdul-Aziz bin Muhammad. The Emirate of Diriyah was overthrown by by the Ottoman Empire's Egypt Eyalet in the Ottoman–Wahhabi War (1811-1818)



THE SECOND SAUDI STATE

Legend

1808 - 1816

The Second Saudi State, also known as the Emirate of Najd, was established in 1824. The founder of the Second Saudi Dynasty is Turki bin Abdullah bin Muhammad, the grandson of Saudi Arabia's first imam Muhammad bin Saud, successfully expelled the Egyptian army and its local allies from Riyadh and the surrounding areas and make the city of Riyadh. Saudi Arabia's second period is less widespread and characterized by less religious expansion, although Saudi Arabian leaders continue to be given this name. Imams still employ Wahhabi religious scholars. 1891 marked the end of the Second Saudi State and Al Saud dynasty until the establishment of the Third Saudi State in 1932.

THE THIRD SAUDI STATE

The Third Saudi state is the name given to the modern and contemporary Saudi state, the Kingdom of Saudi Arabia, which was founded by Abdul Aziz bin Abdul Rahman (also known as “Ibn Saud”). He managed to capture the city of Riyadh on January 13, 1902, and started a series of conflicts and conquests that eventually led to the unification of most of the Arabian Peninsula under his rule. The third Saudi state went through several stages of development, such as:

- **The Emirate of Riyadh (1902-1913):** This was the initial stage of the third Saudi state, when Ibn Saud consolidated his power in the central region of Nejd and fought against the rival Emirate of Jabal Shammar, which was allied with the Ottoman Empire.

- **The Emirate of Nejd and Hasa (1913-1921):** This was the stage when Ibn Saud expanded his territory to include the eastern region of Al-Ahsa, which was rich in oil and had a large Shia population. He also supported the Arab Revolt against the Ottomans during World War I, and gained British recognition and support for his rule.

- **The Sultanate of Nejd (1921-1926)**: This was the stage when Ibn Saud declared himself as the Sultan of Nejd, after he defeated the Emirate of Jabal Shammar and gained control of the entire Nejd region. He also launched a campaign to conquer the western region of Hejaz, which contained the holy cities of Mecca and Medina.

- **The Kingdom of Hejaz and Nejd (1926-1932):** This was the stage when Ibn Saud unified the two regions of Hejaz and

Nejd under one kingdom, after he defeated the Hashemite ruler of Hejaz, King Ali bin Hussein, who was supported by the British. He also annexed the southern region of Asir, which was ruled by the Idrisid dynasty.

- **The Kingdom of Saudi Arabia (1932-present):** This is the current stage of the third Saudi state, when Ibn Saud proclaimed himself as the King of Saudi Arabia, and established a monarchy based on the Wahhabi interpretation of Islam. He also signed a treaty with the British to secure his borders and oil interests, and initiated a series of modernization and development projects in his kingdom.

OVERALL CLIMATE

The Kingdom of Saudi Arabia predominantly experiences a desert climate characterized by extremely hot, dry summers and mild winters. However, climatic conditions vary across different regions and elevations.

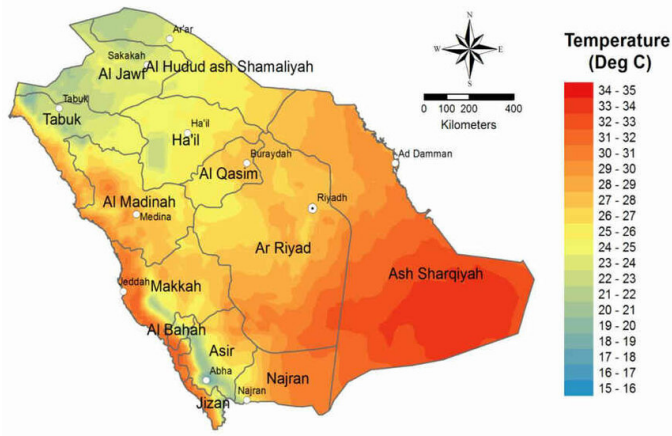
The Red Sea coast experiences a hot and humid climate with consistently high temperatures throughout the year and increased humidity during the summer. Average temperatures in January range from 14°C (57°F) in the north to 25°C (77°F) in the south, while July temperatures range from 35°C (95°F) to 39°C (102°F).

The Persian Gulf coast has a hot and arid climate, with lower humidity levels than the Red Sea coast but higher temperatures. The average temperature in January is approximately 18°C (64°F), while in July it averages around 42°C (108°F).

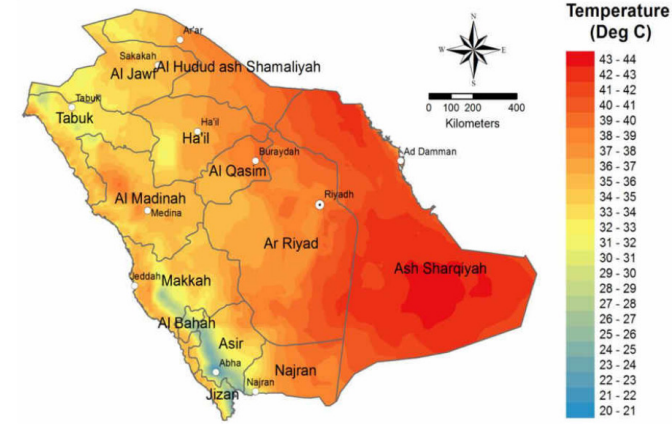
The Syrian Desert, which spans most of the country's north and east, has a continental desert climate with significant temperature variations between day and night, and between winter and summer. The average temperature in January is around 10°C (50°F), but it can drop below freezing at night. In July, the average temperature is around 38°C (100°F), but it can exceed 45°C (113°F) during the day. Rainfall is scarce and irregular, averaging less than 100mm (4in) per year.

The Plateau, covering the central part of the country, has a climate similar to the Syrian Desert, but with slightly higher rainfall and lower temperatures. The average temperature in January is around 15°C (59°F), while in July it is around 35°C (95°F). Rainfall is also very low, averaging less than 150mm (6in) per year.

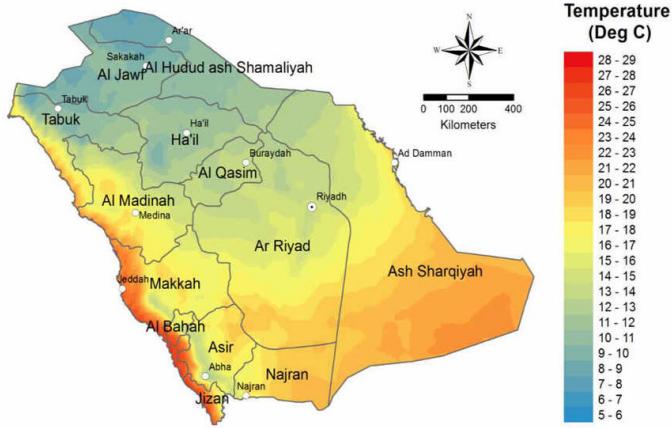
Predicted Annual Mean Temperatures (2030-2080)



Predicted Mean Temperature in July (2030-2080)



Predicted Mean Temperature in January (2030-2080)

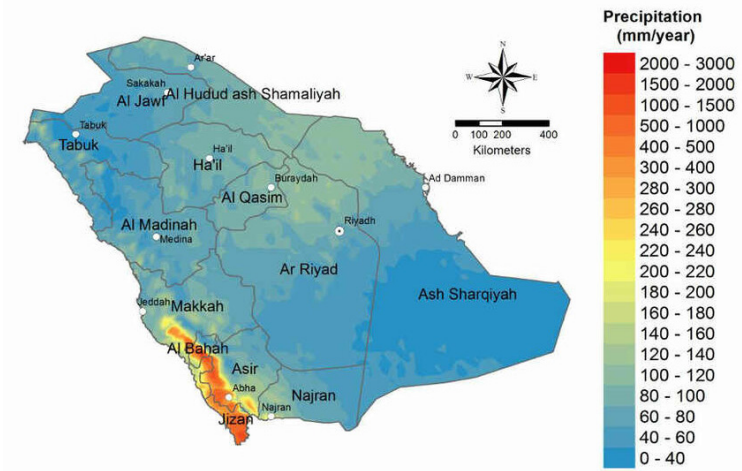


Source: KSA Third National Communitcation

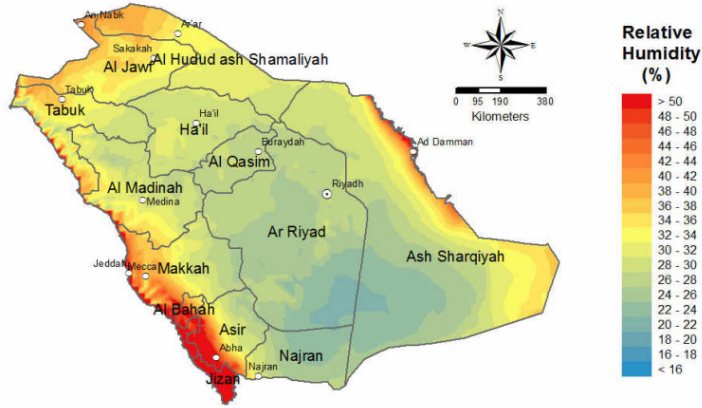
The Mountains, running along the country's southwest, have a subtropical highland climate and a semi-arid climate, offering cooler and wetter conditions than the rest of the country. Depending on the altitude, the average temperature in January ranges from 10°C (50°F) to 20°C (68°F), while in July it ranges from 20°C (68°F) to 30°C (86°F). Rainfall is more abundant and regular, especially from June to September, when it can exceed 300mm (12in) per month.

In summary, Saudi Arabia's climate is predominantly hot and arid throughout the year, with minimal rainfall.

Predicted Annual Total Precipitation (2030-2080)



Predicted Annual Mean Relative Humidity (2030-2080)



Source: KSA Third National Communitcation

CLIMATE COMPARISON

Saudi Arabia and Italy, situated in distinct climatic zones, exhibit stark differences in their respective climates. Saudi Arabia is characterized by a desert climate, typified by extremely hot, dry summers and mild winters. Conversely, Italy experiences a Mediterranean climate, marked by hot, dry summers and cold, rainy winters. Here are some comparative points between the two nations:

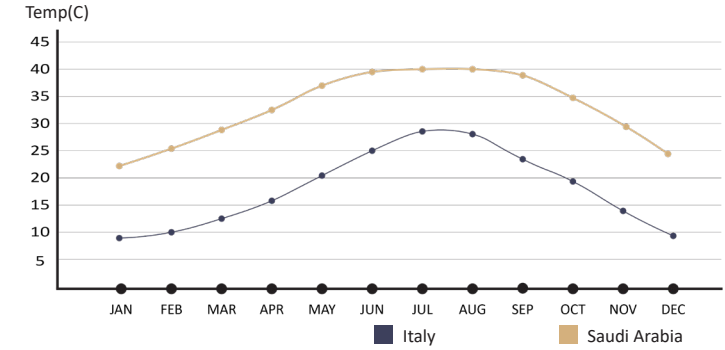
Temperature: Saudi Arabia consistently records higher average temperatures than Italy throughout the year, particularly during the summer when temperatures can exceed 40°C (104°F) in numerous regions. Italy, on the other hand, experiences more moderate temperatures, fluctuating between 10°C (50°F) and 30°C (86°F) depending on the season and region. However, both countries are susceptible to heatwaves and cold spells due to weather anomalies.

Precipitation: Saudi Arabia receives minimal rainfall, with an annual average of less than 100mm (4in) across most of the country. Italy experiences more substantial rainfall, averaging between 650mm (26in) and 1300mm (51in) annually in the central-northern plains, with even higher levels in mountainous areas. Both countries have two rainy seasons, occurring in spring and autumn, but Italy also experiences winter snowfall, especially in the Alps and the Apennines.

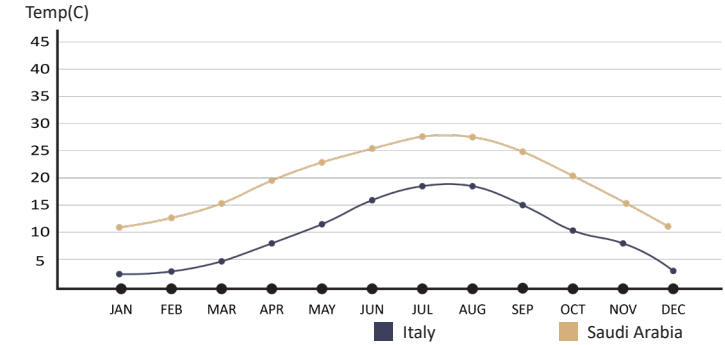
Humidity: Saudi Arabia generally has low humidity levels, with the exception of the Red Sea and Persian Gulf coasts where humidity can be high and uncomfortable during the summer. Italy experiences high humidity levels throughout the year, particularly in the Po Valley and along the coasts. The humidity can exacerbate the heat in the summer and intensify the cold in the winter.

Sunshine: Saudi Arabia is a sun-drenched country, boasting over 3000 hours of sunshine per year in most regions. Italy also enjoys abundant sunshine in the central-south and on the Ligurian coast, with more than 2500 hours of sunshine per year. However, sunshine is less prevalent in the north and interior regions, where it averages around 2000 hours or less per year.

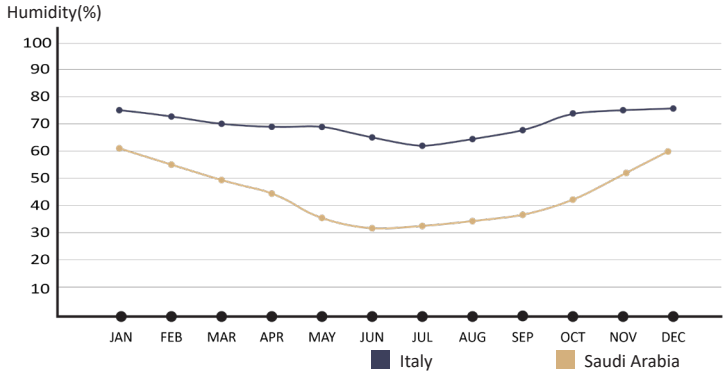
Average Daily Maximum Temperature



Nighttime Lows



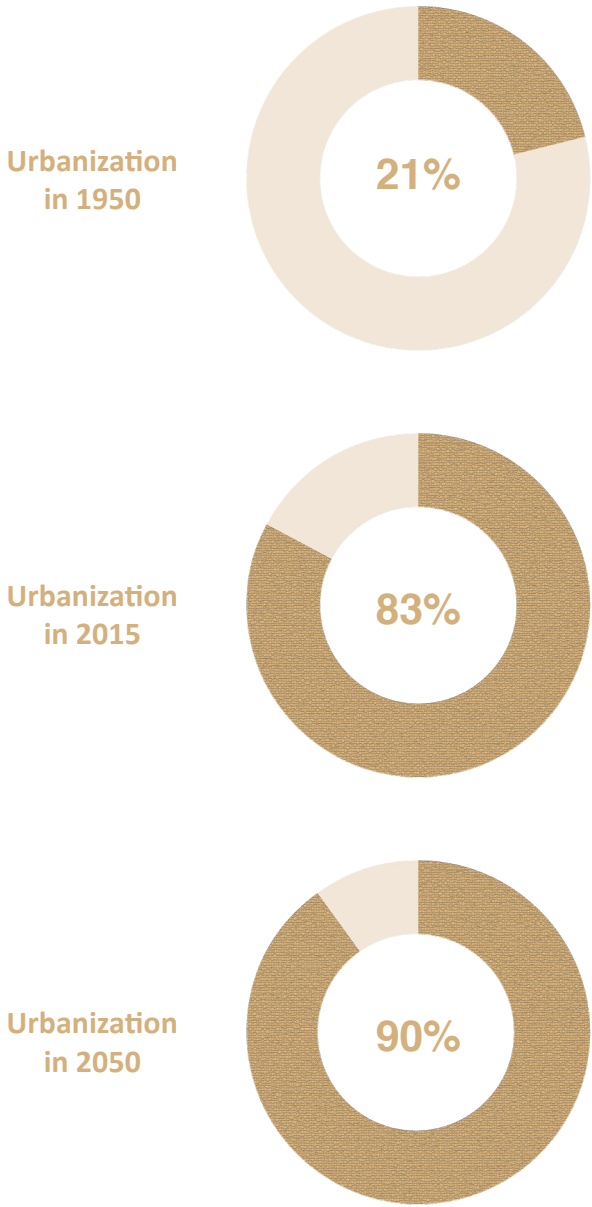
Humidity



Source: https://www.worlddata.info/climate-comparison.php

URBANIZED POPULATION

The Kingdom of Saudi Arabia holds the distinction of being the largest nation within the Gulf Cooperation Council (GCC). Countries within the GCC are witnessing significant population growth and urbanization rates. As per the Ministry of Municipal and Rural Affairs, approximately 82.1% of the total population resides in urban areas, while the remaining 17.9% inhabit rural areas. A regional analysis of urbanization rates reveals that six regions have recorded rates exceeding 80%. These include the Eastern Province (93.2%), Riyadh (90.9%), Holy Makkah (87.6%), the Northern Borders (86.7%), Tabuk (85.9%), and Jouf (84.5%).



Source: Saudi Cities Report 2019.pdf

DEMOGRAPHIC PROFILE

Recent data from the Saudi Census Portal indicates that the population of Saudi Arabia stands at 32 million. The gender distribution ratio within the country is approximately 1.6:1, with males constituting 61.2% and females making up 38.8% of the population. While the majority of the population is of Arab ethnicity and Arabic is the official language, Saudi Arabia also hosts a substantial number of expatriates from various countries worldwide. In fact, non-Saudi citizens account for 41.8% of the country's population, primarily originating from the Indian subcontinent and other Arab states. This results in a diverse, albeit complex, social composition within the nation.

CURRENT POPULATION

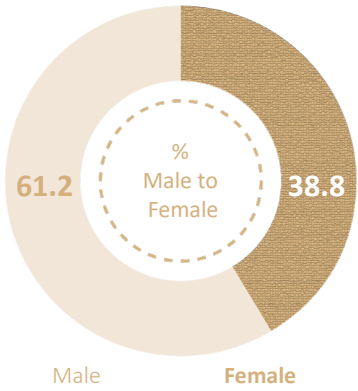
32000000

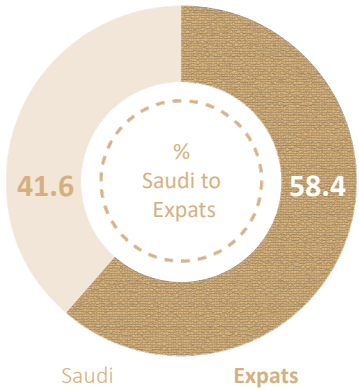
AVERAGE FAMILY SIZE SAUDIS / NON SAUDIS

4.8 /2.7

COUNTRY AVERAGE AGE

29

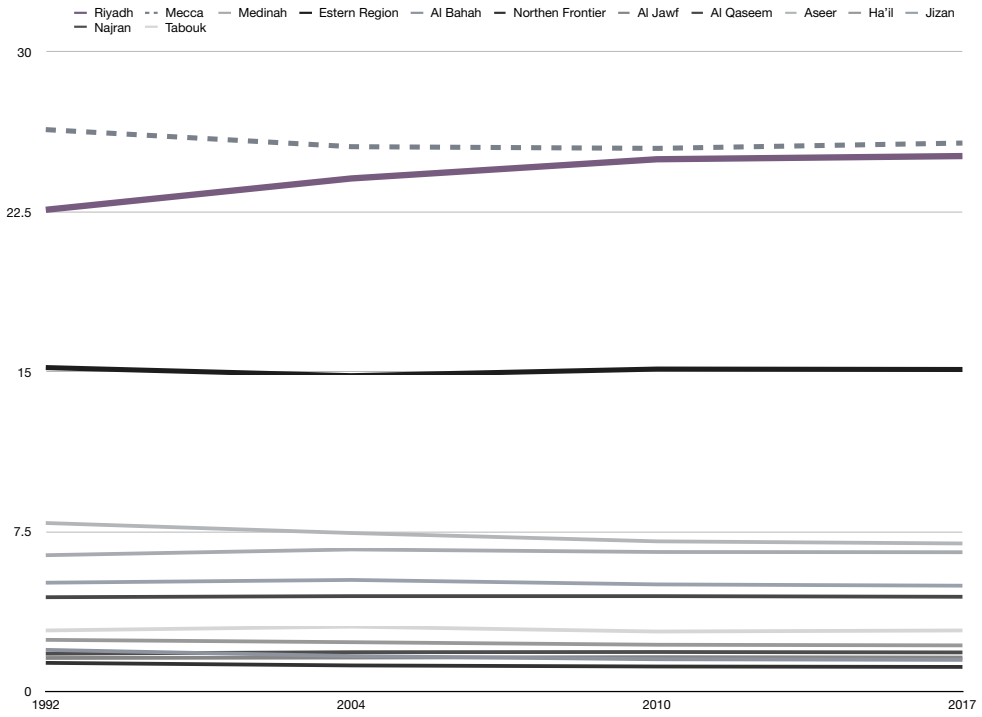




Source: Saudi Census Portal

POPULATION GROWTH

Saudi Arabia is among the countries with the heighest population growth rates in the world. According to the Saudi City Report, Annual Population growth in Saudi Arabia was 2.5% in 2015 and its ppulation has doubled over the last two and a half decadesincreasing from 16 million people in 1990 to over 32 million people. At the current growrth rate, it is projected that the population will reach 45 million by 2050. As can be seen in the graph in the next page, the majority of the country's population is situated in three major regions: Riyadh, Mecca and the Eastern Region. From 1992 to 2017, only Riyadh's population has been growing.



Source: Saudi Cities Report 2019.pdf

Source: https://statemag.state.gov/2021/10/1021pdm/

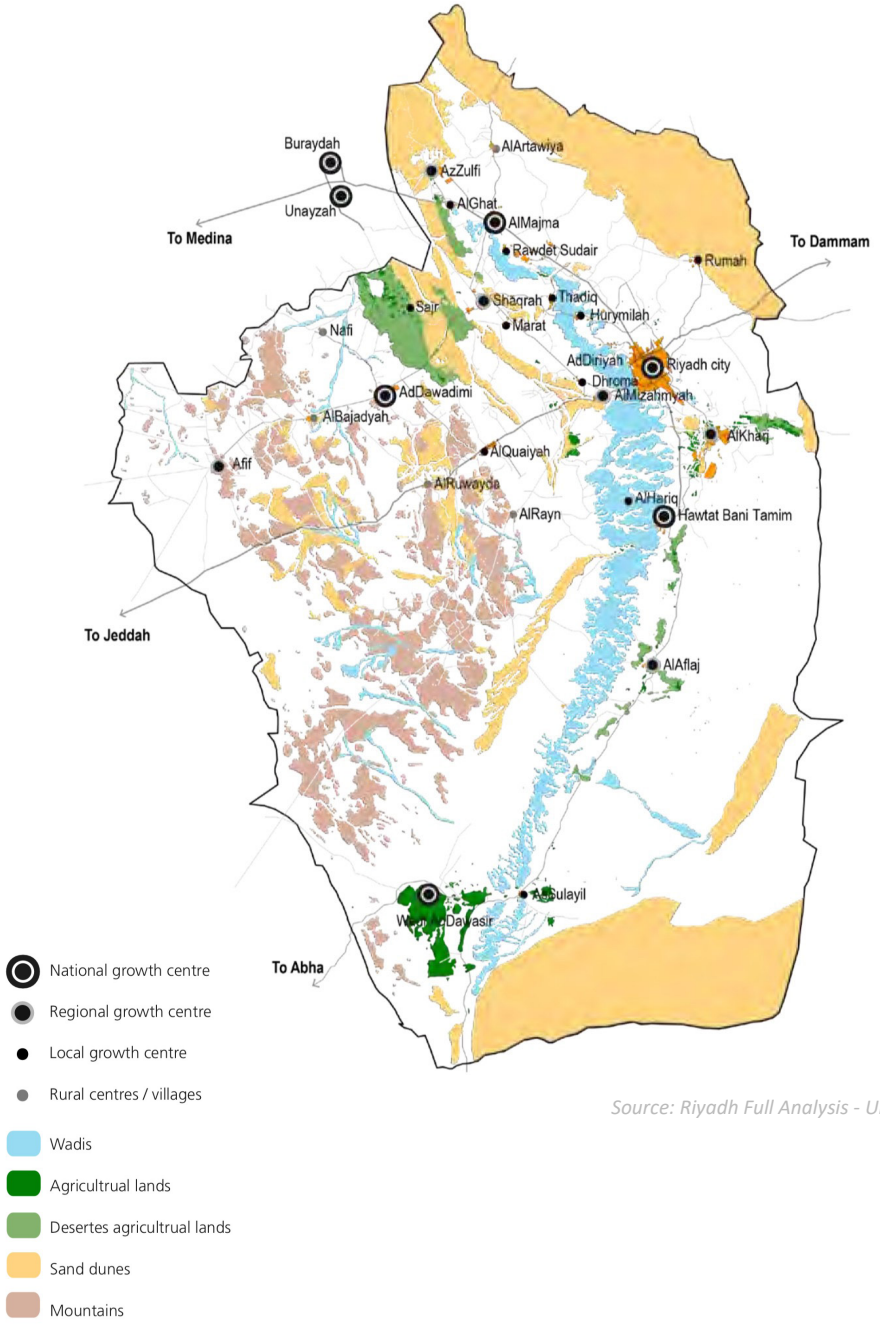
- Chapter 3 -

الرياض

Riyadh
The Gardens

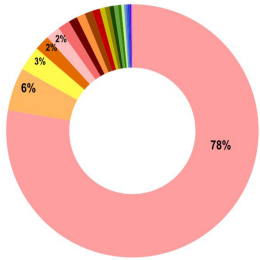
Riyadh, the capital and largest city in the Kingdom of Saudi Arabia, is one of the country's major regions. The name 'Riyadh' is derived from the Arabic term 'Rawdah', signifying a locale abundant with gardens and trees, a testament to the natural fertility offered by its location amidst numerous wadis (water courses), which have since dried up. Historically, Riyadh served as a central trading hub, connecting various surrounding villages and towns. In contemporary times, it has evolved from a relatively small, isolated settlement into a bustling metropolis that houses the government's seat, along with all the ministries and embassies responsible for both domestic and foreign affairs.

REGION STRUCTURE AND RESOURCES



Source: Riyadh Full Analysis - Unhabitat.pdf

ADMINISTRATIVE BOUNDARIES



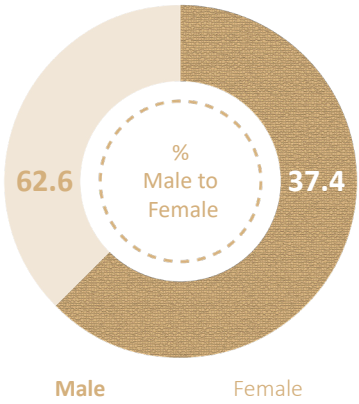
Source: Riyadh Full Analysis - Unhabitat.pdf

DEMOGRAPHIC PROFILE

The Riyadh Region is located at the geographical center of the country and has an area of 404,240 km^2 and a population of about 8.600,000 (8.6 Million) residents in 2022 according to the Saudi Census Portal. These numbers make the region the second largest in terms of both area (after the Eastern Region) and population (after Mecca Region). The city of Riyadh hosts more the 78% of the Regions population with 62.6% of them being males while 37.4 percent being females. As the economic center of the country, Riyadh has various opportunities and attracts many expats from outside the country that contribute to about 48.3 of the city's piopulation.

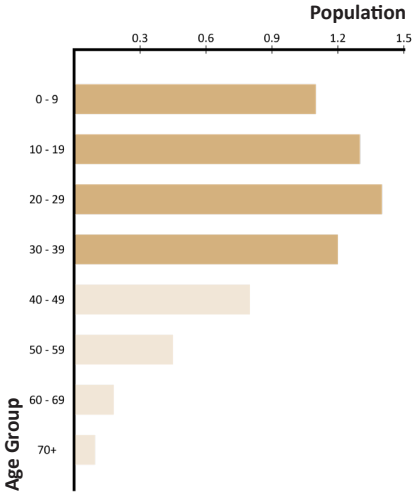
REGION POPULATION

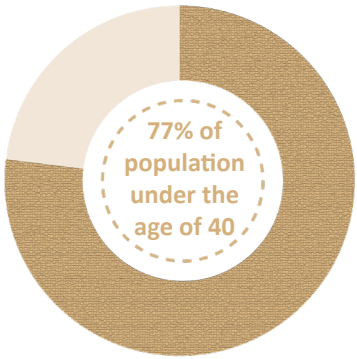
8,600,000



CITY POPULATION

7,009,120





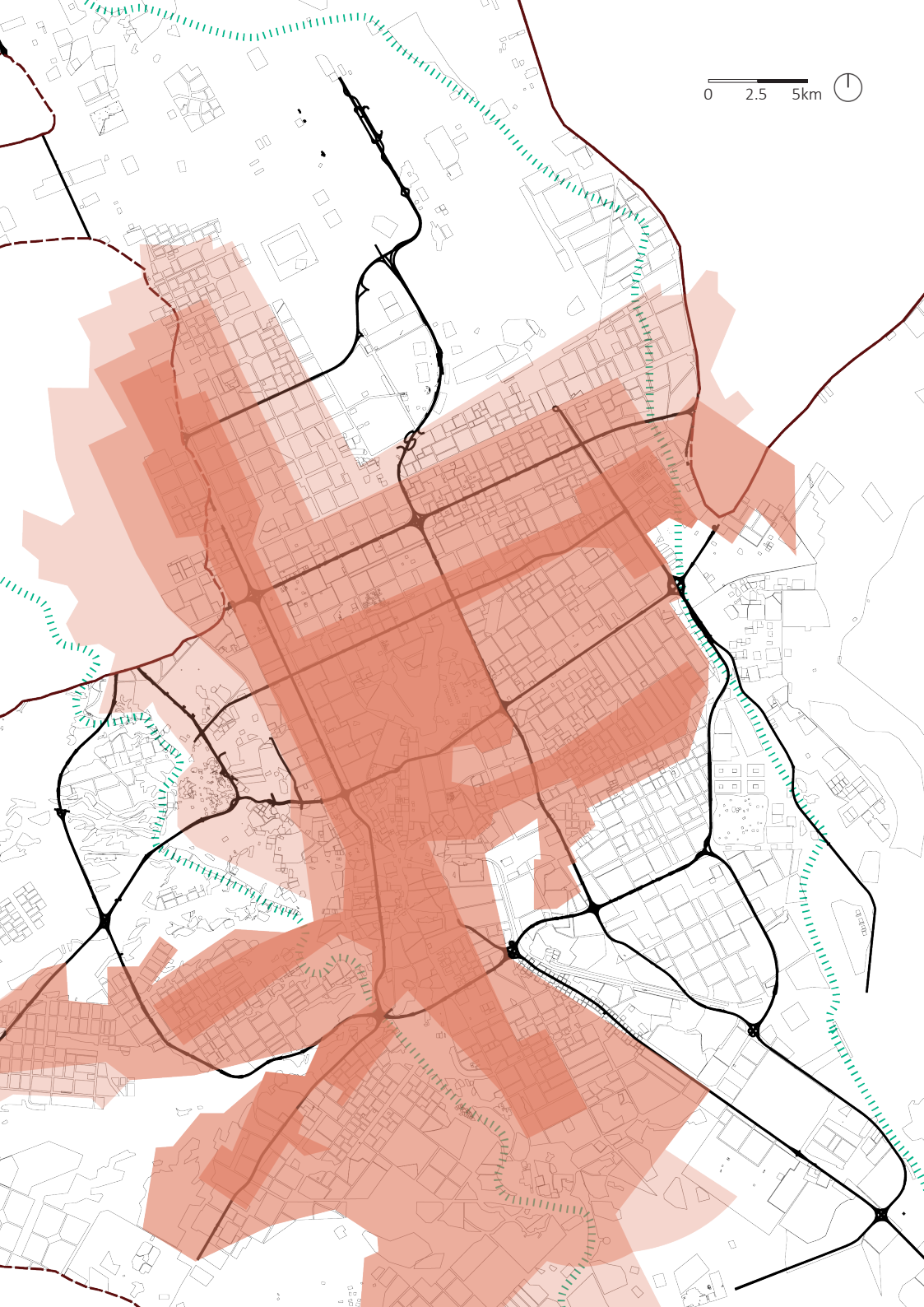
Source: Saudi Census Portal

POPULATION DISTRIBUTION

The old city represents today's urban core, where density can be up to 400 p/ha, although this is only true for a small share of the city; approximately 4% of the total built-up area. Overall, only 16% of the urban fabric performs at or above 150 p/ha. Some medium-density developments can be found within a ten-kilometre radius around the city centre. However, most of the area within the 1435 UGB is developed at very low densities, hosting approximately 40-50 p/ha.

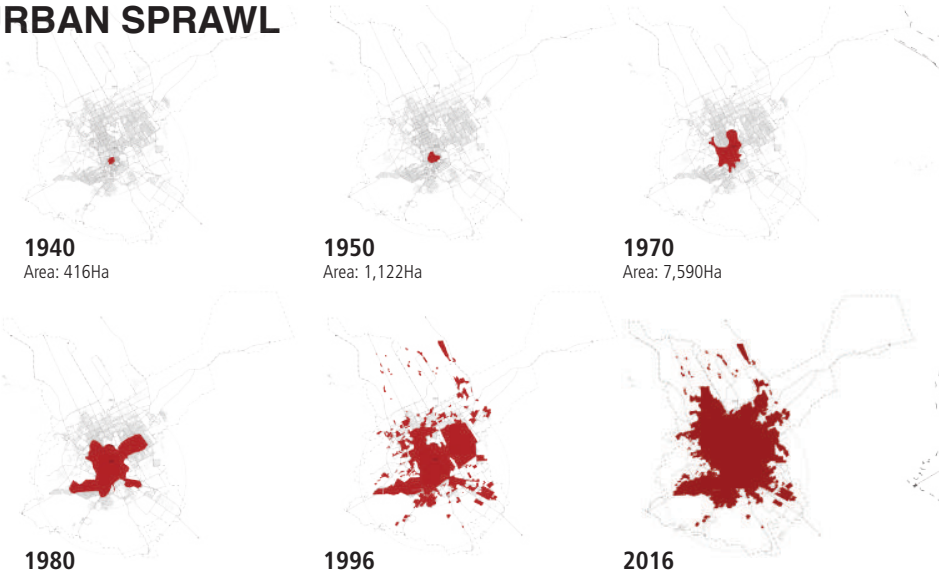
Legend

- **High Density**
- **Medium Density**
- **Low Density**

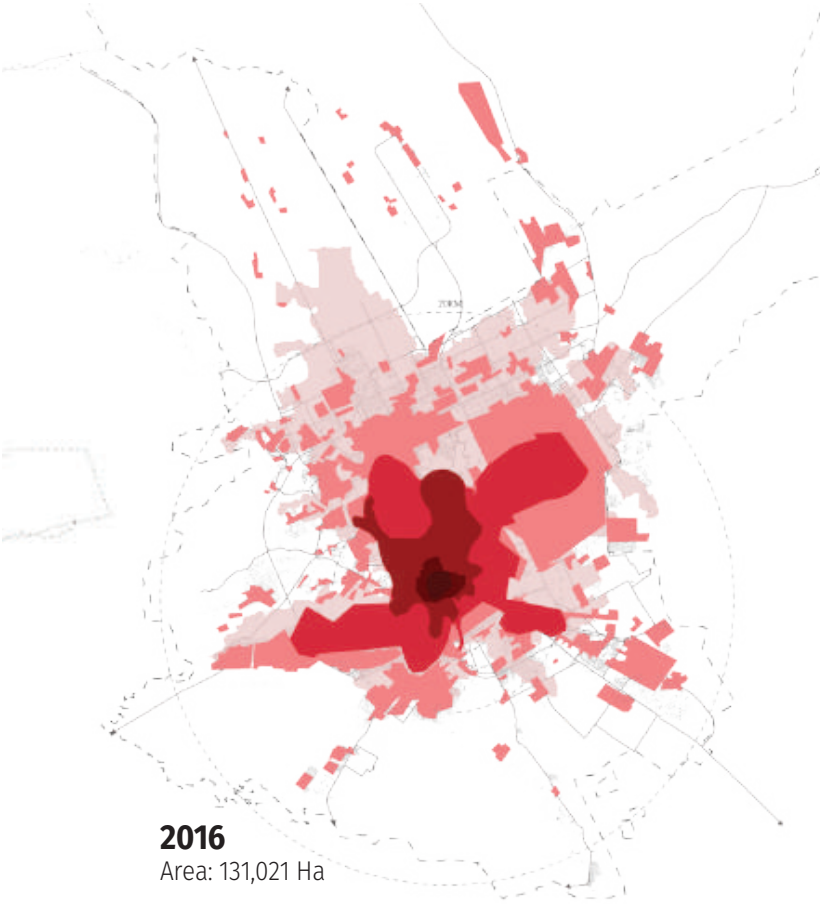

0
2.5
5km

Due to the oil boom , the city of riyadh grew both in size and population count starting from the 1960. The most drastic growth started after the 1980 with the city's population nearly doubling every 20 years. During the time between 1980 and 1990, the city went through a significant population increase reaching 2.3 million people. The city's dominant directions of growth at the time were the east and west. However, after the 1990's , the city began to expand in all directions. From this expansion from 1940 onwards, the city grew following a sprawling development pattern where the land area increased by 218 times while the population grew only 130 during that period.

URBAN SPRAWL



Source: Riyadh Full Analysis - Unhabitat.pdf



Source: Riyadh Full Analysis - Unhabitat.pdf

FUTURE SCOPE

Saudi Arabia's Vision 2030 is an ambitious and transformative initiative aimed at reforming and sustaining various sectors within the Kingdom. The vision is built on three main pillars:

Vision of a Vibrant Socierty

" Vision 2030 understands the importance of building a strong, happy, and fulfilling society as the foundation for economic prosperity, which is why we focus on creating strong roots that embrace modern Islam, national pride, Saudi heritage, and culture, while also providing world-class entertainment options, sustainable living, and efficient health and social care systems. Saudi Arabia is unique in its cultural abundance, inherently Islamic faith and national unity, and we as Saudis dedicate ourselves to fulfilling our duty towards pilgrims and promoting our rich national identity. "

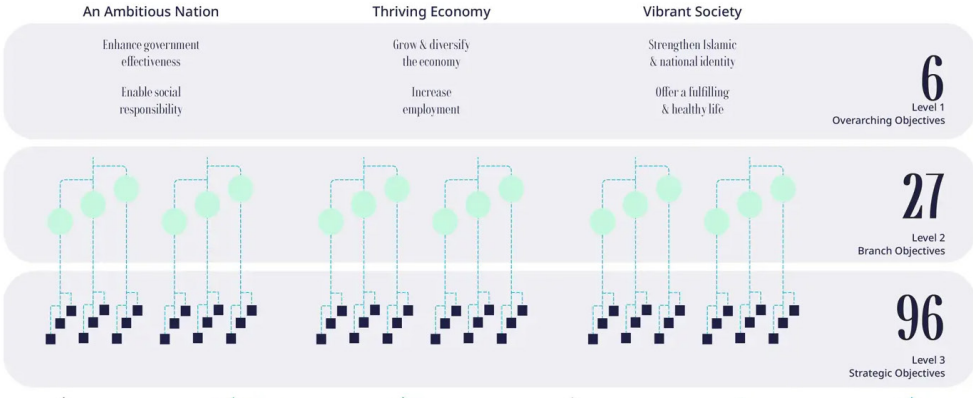
Vision of an Ambitious Nation

"The future of our nation will be determined by our young people, and we are prioritizing them, their skills and their empowerment. We are building a culture that values determination and provides rewarding opportunities for growth while also creating diverse job opportunities for Saudis, while attracting the best global talent. "

Vision of a Thriving Economy

" We are building a country that is effectively governed, transparent, and accountable, encouraging all of society – citizens, businesses, and non-profit organizations – to take the lead in identifying and pursuing opportunities to advance our collective future. This empowers everyone to play a more active role in shaping the future of our nation. "

Source: Saudi Vision 2030

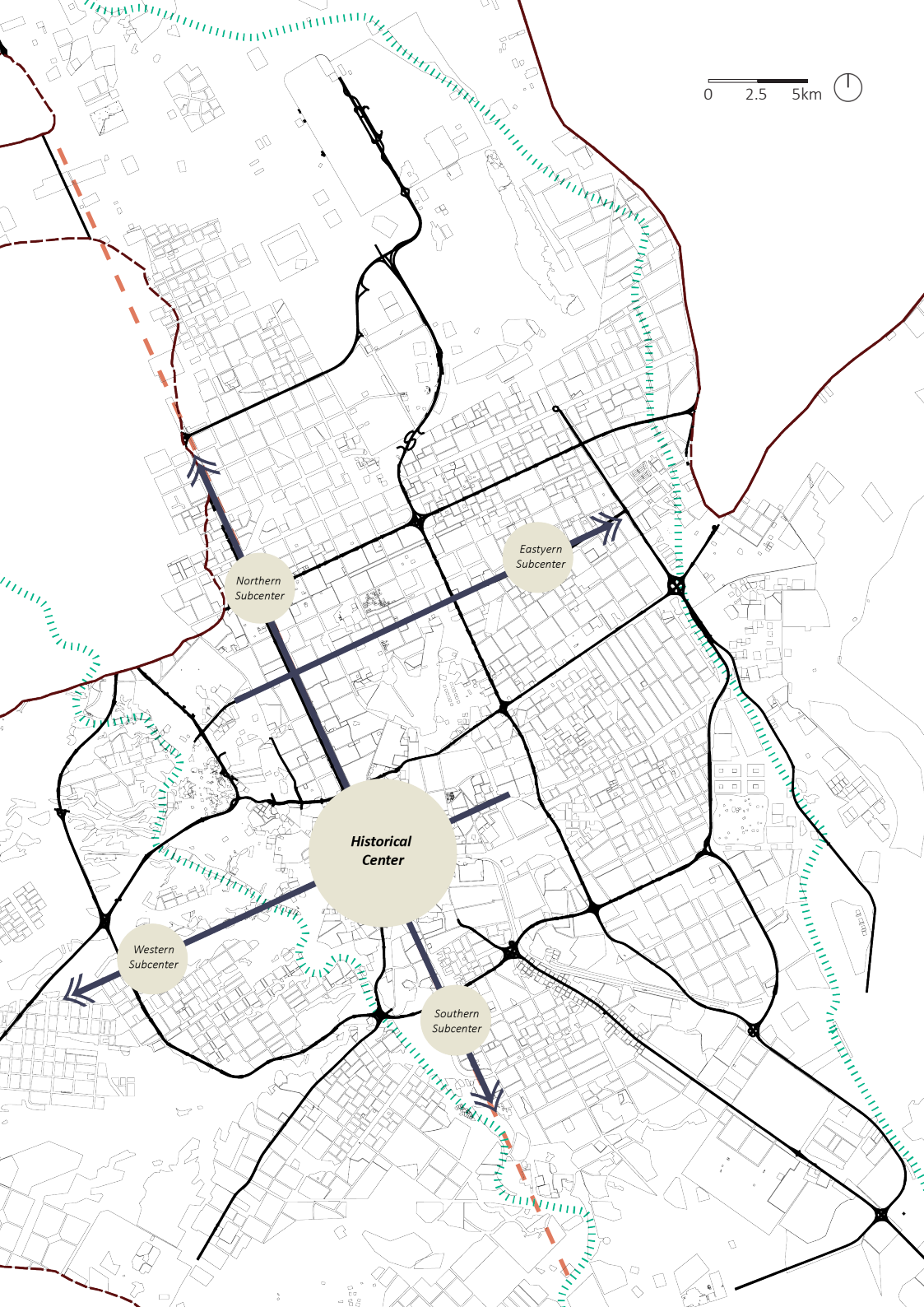


Source: Saudi Vision 2030

FUTURE SCOPE

A POLICENTRIC CITY

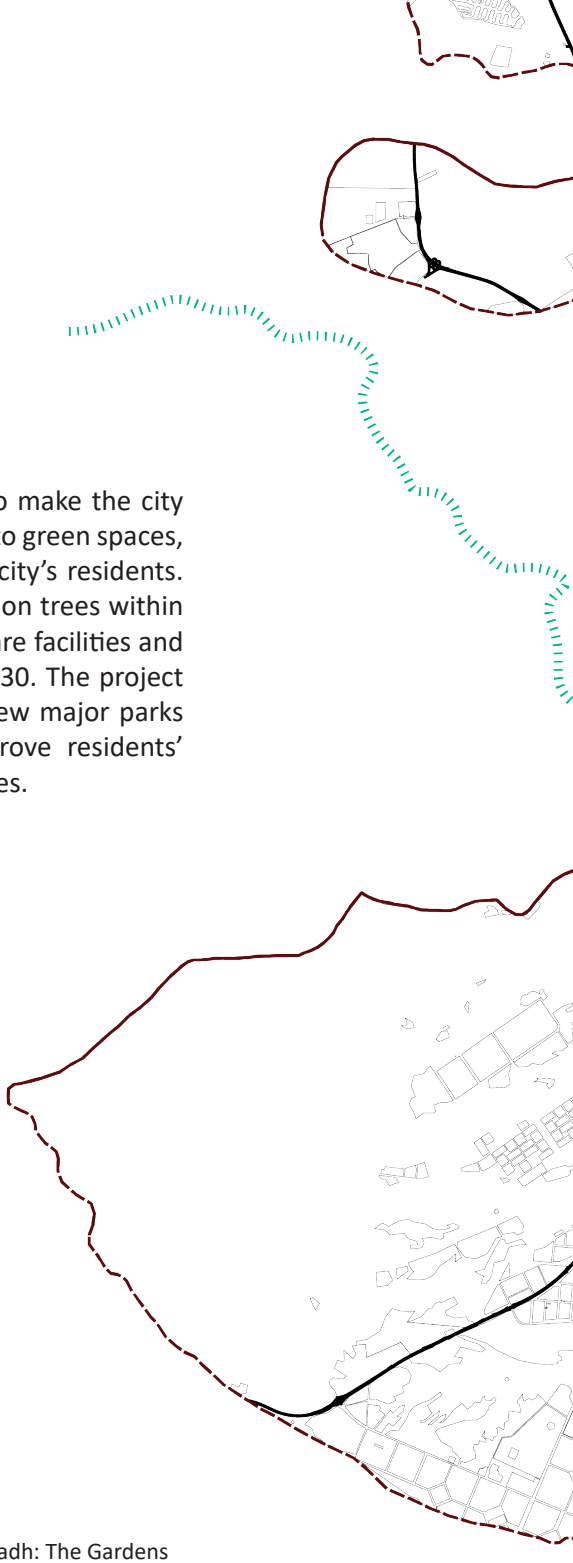
The future city plan includes a vision to attempt to change Riyadh from a monocentric city to a polycentric city. This plan by MEDSTAR(The Metropolitan Development Strategy for Arriyadh Region) aims to create subcenters 10-15 km from the city center and expand the spine to these subcenters.

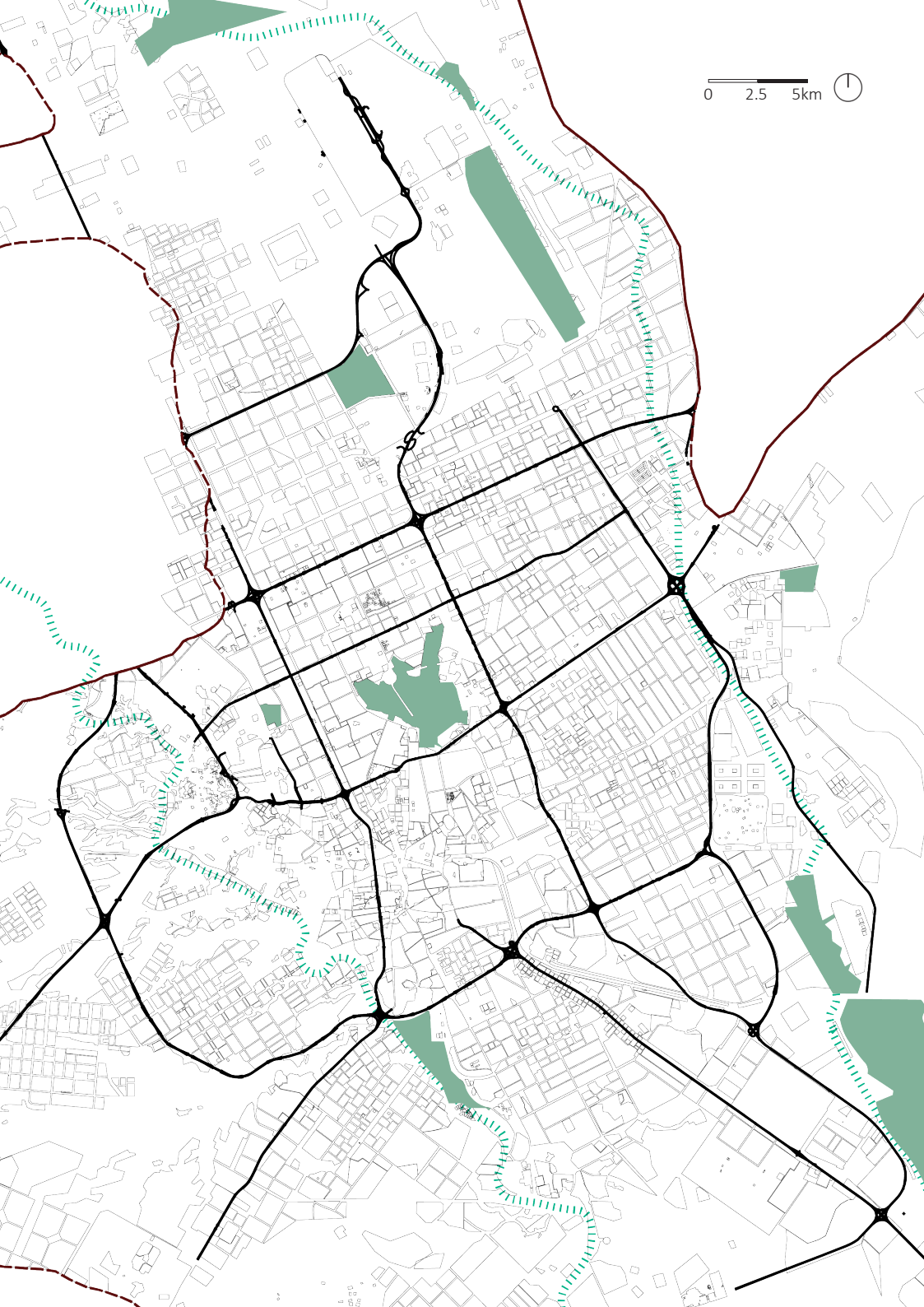

0
2.5
5km
Northern Subcenter
Eastyern Subcenter
Historical Center
Western Subcenter
Southern Subcenter

FUTURE SCOPE

FUTURE CITY PARKS

The Green Riyadh Project aims to make the city more livable by improving access to green spaces, air quality and well being of the city's residents. The project aims to plant 7.5 million trees within parks, mosques, schools, healthcare facilities and along streets and roads, all by 2030. The project also plans to intruduce several new major parks around the city, hoping to improve residents' access to green spaces.

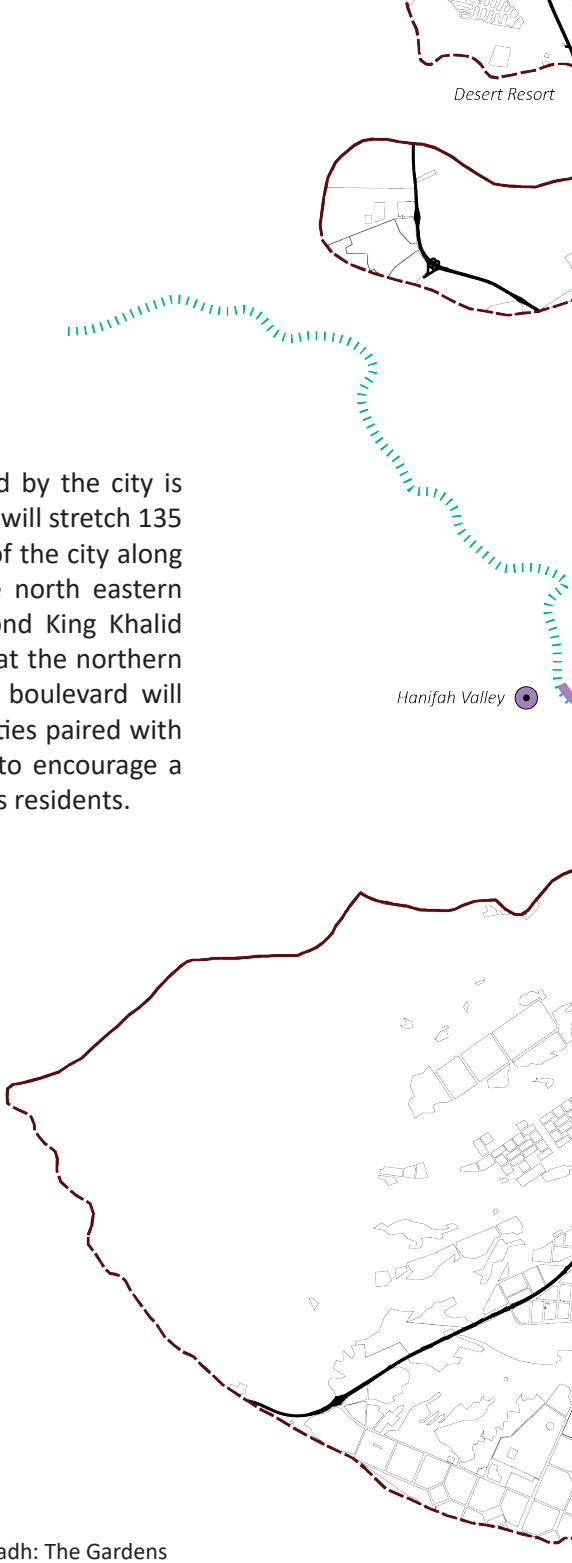


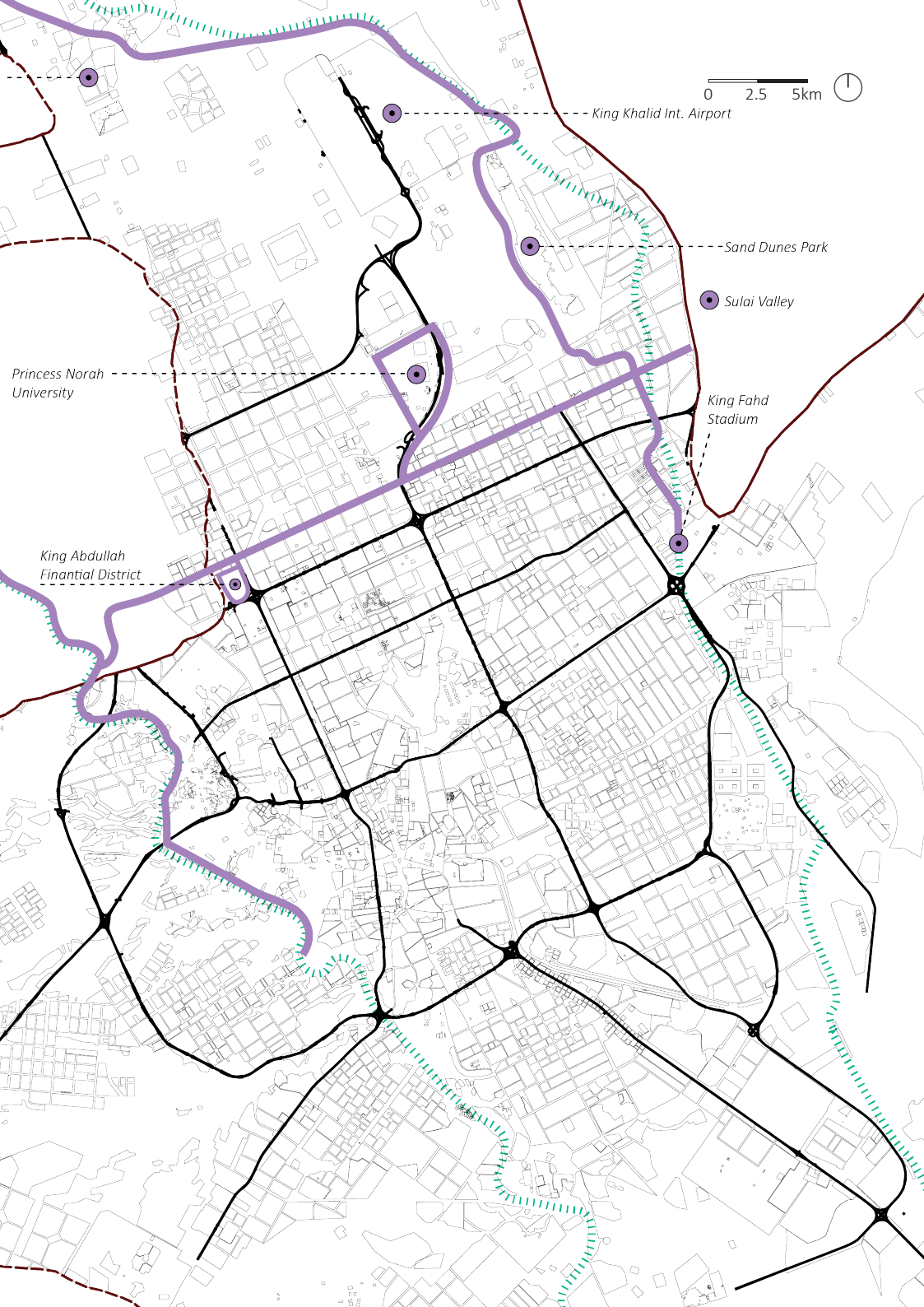

0
2.5
5km

FUTURE SCOPE

THE SPORTS BOULEVARD

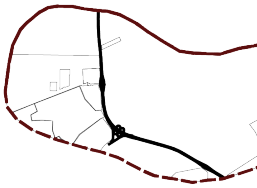
Another major project introduced by the city is the Sports Boulevard. The project will stretch 135 km from the south western side of the city along Wadi Hanifah all the way to the north eastern boundary of the city going beyond King Khalid International Ariport and ending at the northern border of the city. This massive boulevard will focus on social and cultural activities paired with entertainment amenities aiming to encourage a healthier lifestyle for the city's residents.




0 2.5 5km
King Khalid Int. Airport
Sand Dunes Park
Sulai Valley
Princess Norah University
King Fahd Stadium
King Abdullah Finantial District

FUTURE SCOPE

THE RIYADH METRO



The new metro project in Riyadh is a massive undertaking that aims to transform the public transport system in the capital city of Saudi Arabia. The project, which is part of the King Abdulaziz Project for Riyadh Public Transport, will consist of six metro lines that will cover a total length of 176 kilometres and connect 85 stations across the city. The project is one of the largest and most ambitious metro projects in the world and aims to act as the backbone of the new public tansport network and encourage a modal change within the city.

Legend

- City Boundary
- Water Valleys
- Federal Roads
- Blue Line
- Red Line
- Orange Line
- Yellow Line
- Green Line
- Puple Line
- Nodes

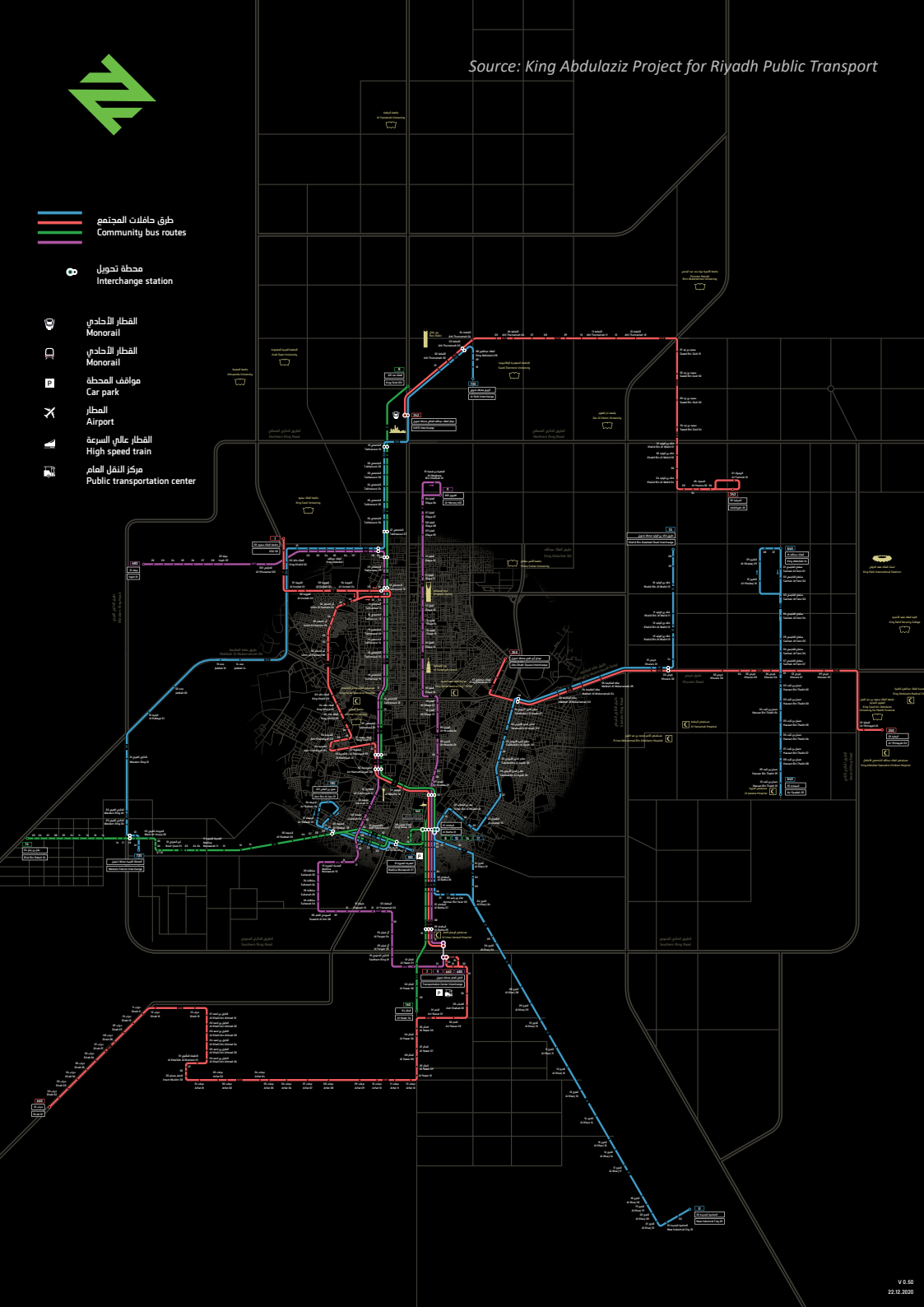

0
2.5
5km

FUTURE SCOPE

BUS NETWORK

The second part of the city's transportation plan is the Riyadh Bus Project. This project is to be integrated with the metro project connecting several districts with the business and comercial centers of the city. The project consists of 2860 stops and 80 routes, served by 842 busses. These bus routes include 3 dedicated BRT routes (160 km), 19 community lines(910km) and 58 feeder lines(835km).

Source: King Abdulaziz Project for Riyadh Public Transport

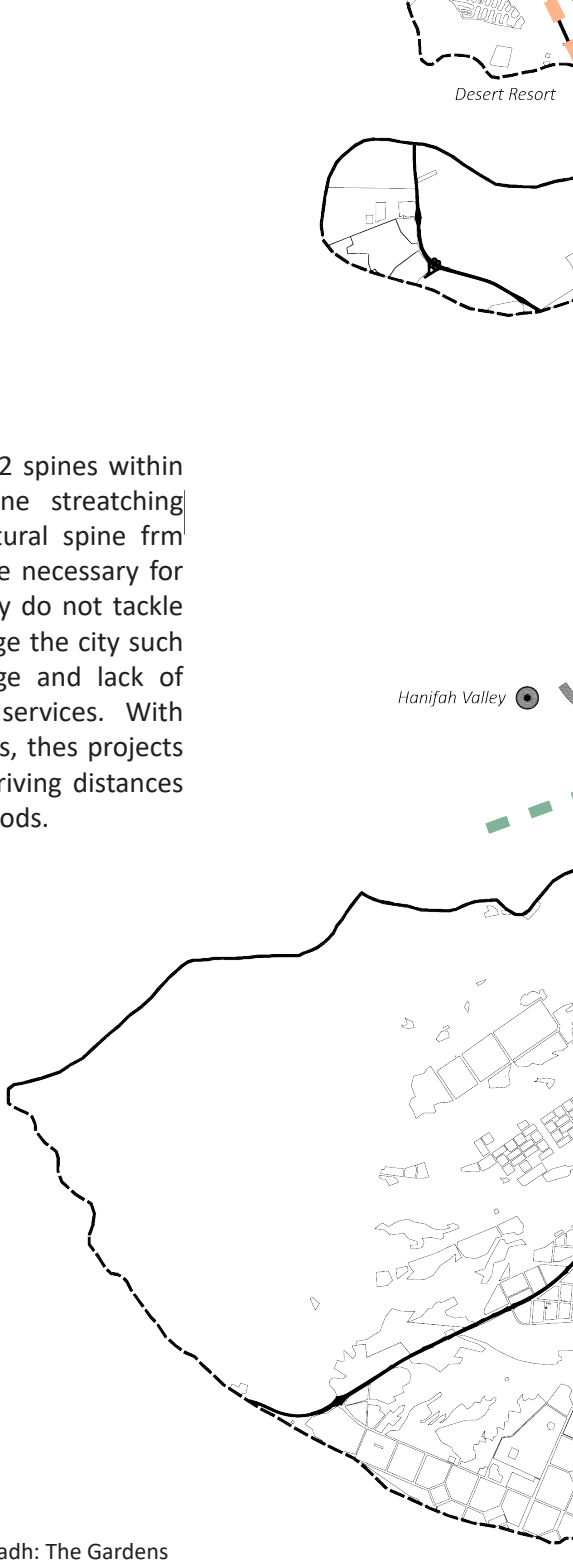


V 0.50
22.12.2020

FUTURE SCOPE

THE CITY SPINES

Combinig these projects creates 2 spines within the city, an administrative spine streatching from north to south and a cultural spine frm the west to east. While these are necessary for a metropolis such as Riyadh, they do not tackle some of the main issues that plage the city such as the dependancy on car usage and lack of soft accessibility to facilities and services. With streets designed primarily for cars, thes projects will act as attractors placed at driving distances from most neighborhoods.




0 2.5 5km
King Khalid Int. Airport
Sand Dunes Park
Sulai Valley
Princess Norah University
King Fahd Stadium
King Abdullah Finantial District

Source: https://en.wikipedia.org/wiki/File:Ghubaira_Riyadh.jpg

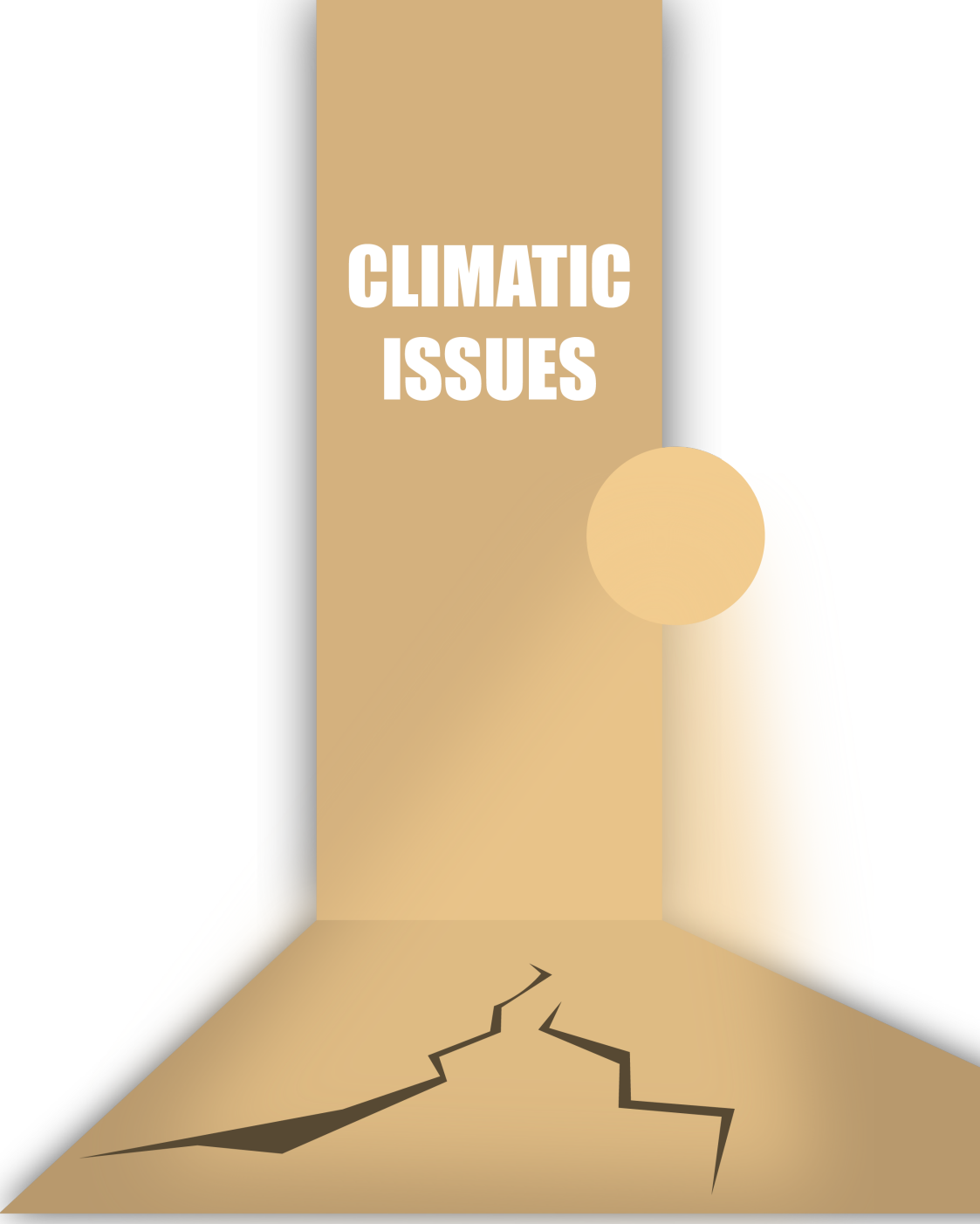
- Chapter 4 -

سياق مليء بالتحديات

A CHALLENGING CONTEXT

Riyadh is located in the central part of the country and has a population of over 8.6 million people. It is located near the center of the arabian desert and along the bed of Wadi Hanifah which results in intense summers and dry winters. In recent years, Riyadh has experienced rapid urbanization, which has led to several urban issues. One of the most significant issues is the urban sprawl that, when paired with a lack of an adequate transportation system, resulted in a city built out of human scale and fully based on car use. These issues also negatively impact the sociocultural aspects of the city.

CLIMATIC ISSUES



HARSH CLIMATE

The city experiences a hot desert climate as it is in central part of Arabian Peninsula. There are scorching summers, mild winters, low humidity, and limited rainfall. The city's climate reflects arid dessert surroundings and residents, and infrastructure are adapted to cope with the extreme heat. The climate is not the most favourable one to use soft mobility as a main way of commute.

INRODUCTION TO CLIMATIC PROFILE

Hot and dry summers: Riyadh experiences some of the hottest temperatures in the world during the summer months, which usually last from April to September. Daytime temperatures consistently rise above 40 °C (104 °F) and can sometimes even exceed 50 °C (122 °F) during hot spells. The arid desert surroundings of the city with minimal cloud cover and unrelenting sunshine contribute to these extreme temperatures.

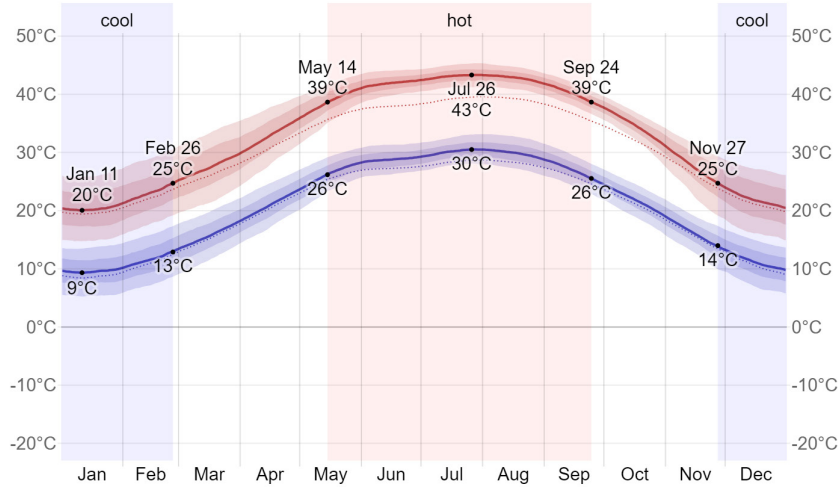
Mild winters: Unlike the scorching summers, winters in Riyadh are relatively mild and occur from November to March. During this period, daytime temperatures generally range between 15-25 °C (59-77 °F), providing welcome relief from the intense summer heat. However, nights can still be quite cool, with temperatures dropping to 5-10 °C (41-50 °F).

Low humidity: Riyadh's low humidity plays a vital role in its climate. The air is typically dry year-round, but humidity levels are exceptionally low during the summer months. This low humidity can make high temperatures more bearable because dry air allows for efficient evaporative cooling and helps the body dissipate heat.

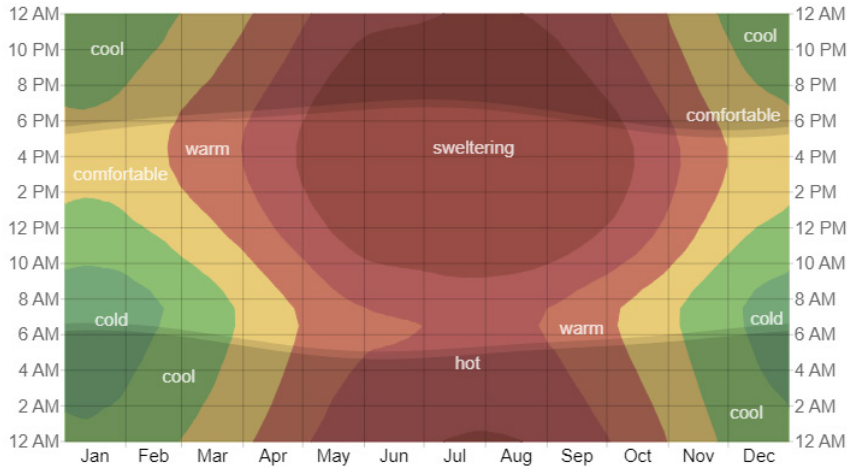
Limited rainfall: Riyadh's dry climate results in minimal rainfall, with most rainfall falling during the winter months. The city receives an annual average of less than 100 millimeters (4 in) of rainfall. This lack of rainfall contributes to a desert landscape and requires careful water management.

Riyadh's climate is characterized by extreme temperature fluctuations, both daily and seasonally. The contrast between steamy summer days and relatively cool winter nights can be quite striking. Lower humidity makes the heat more bearable to a degree, but even healthy, fit individuals need to avoid more than 15 minutes exposure to peak summer heat. This variation can make it difficult for residents and visitors to adapt to the climate and requires appropriate lifestyle adjustments.

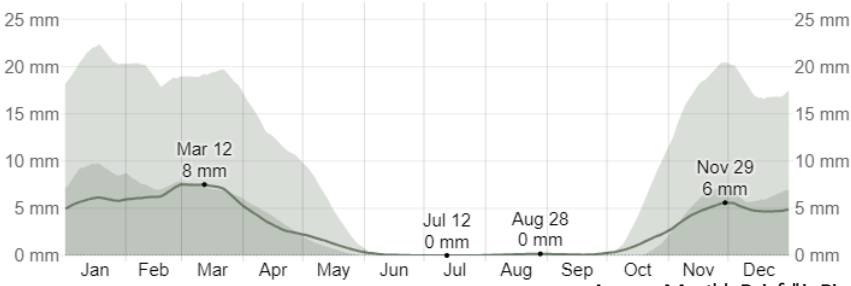
Source:https://weatherspark.com/y/104018/Average-Weather-in-Riyadh-Saudi-Arabia-Year-Round#Figures-Temperature



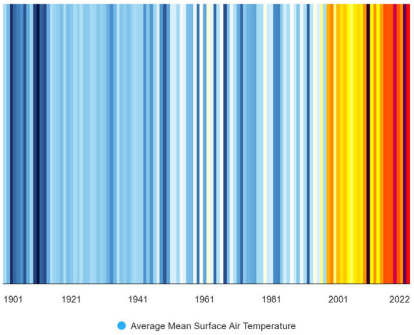
Average High and Low Temperature in Riyadh



Average Hourly Temperature in Riyadh



Average Monthly Rainfall in Riyadh



Observed Annual Average Mean Surface Air Temepature, 1901- 2022, Saudi Arabia

Source: https://climateknowledgeportal.worldbank.org/country/saudi-arabia

URBAN HEAT ISLAND

As the above graph mentions that in recent years the average mean surface temperature as significantly increased due to the soil sealing of the land.

The key causes for this increase are :

Urban Expansion: Riyadh has seen considerable urban growth and expansion over the years. This expansion includes replacing natural surfaces such as soil and vegetation with heat-absorbing materials such as asphalt and concrete. As a result, more heat is retained during the day, contributing to higher nighttime temperatures and amplifying the UHI effect.

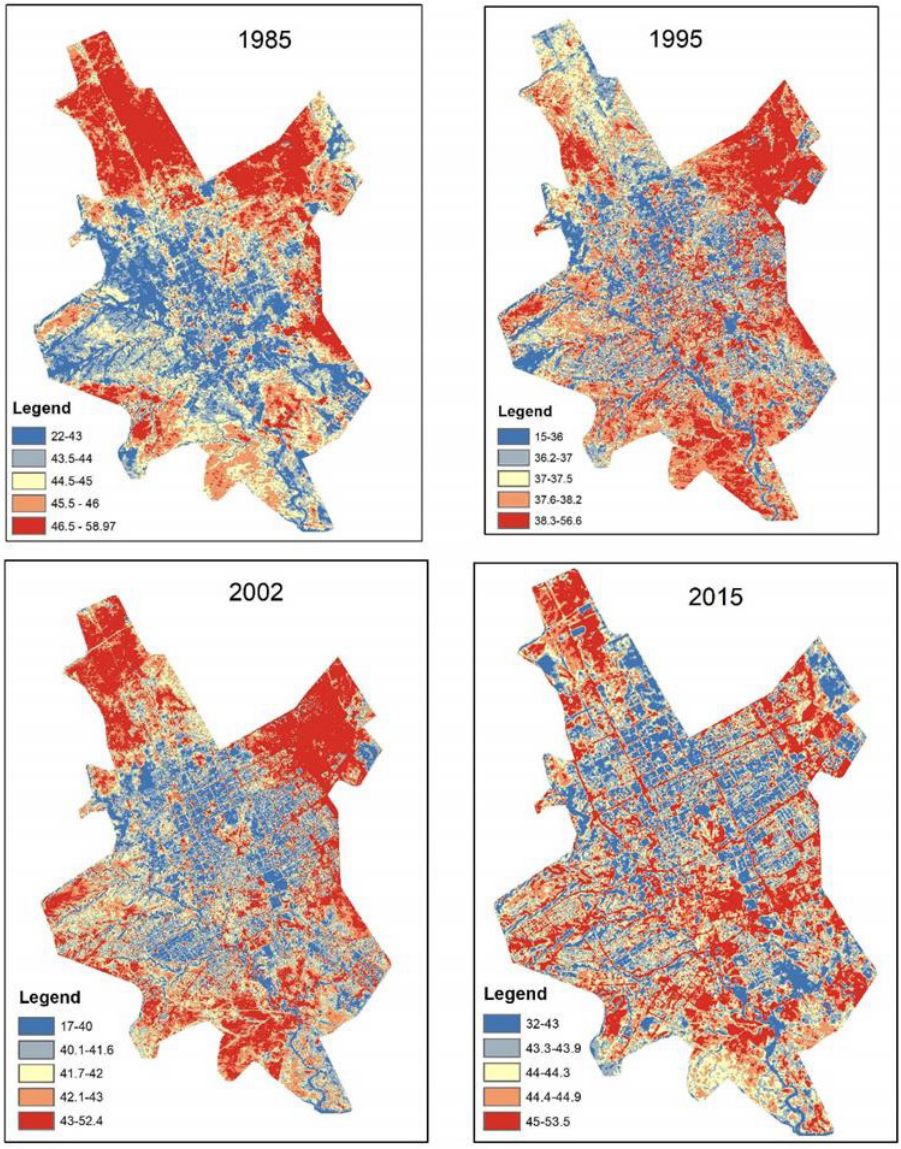
Increased energy consumption: As a city grows, so does energy consumption. Air conditioning, transport and industrial processes release heat into the urban environment, further increasing the city's temperatures.

Altered microclimate: Construction of tall buildings and concrete structures can disrupt local wind patterns and limit natural cooling by shade. This can trap heat in certain areas of the city, making them even warmer than surrounding regions.

Limiting green space: Removing green space and vegetation can reduce a city's ability to cool itself naturally through processes such as evapotranspiration. Trees and parks provide shade and release moisture into the air, helping to moderate the heat.

Traffic: Increased vehicular traffic and traffic-related heat emissions can contribute to the UHI effect, especially along major roads and highways.

This leads to increased energy consumption, health risks and reduces outdoor comfort. What is needed is an integrated policy that limits the use of the car in favor of public transport, designs functions with high demands on mobility where there is public accessibility, uses building criteria and volume distribution that mitigate the heat island.



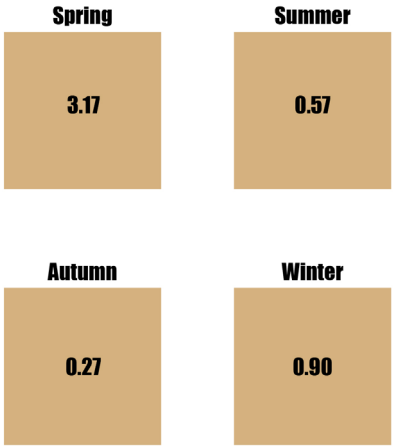
Land Surface Temperature dynamics in Riyadh from 1985 to 2015

Source: SPATIOTEMPORAL VARIATIONS IN THE IMPACTS OF URBAN LAND USE TYPES ON URBAN HEAT ISLAND EFFECTS: THE CASE OF RIYADH, SAUDI ARABIA.pdf

CLIMATIC ISSUES

SANDSTORMS

Sandstorms in Riyadh are a natural phenomenon caused by the city's desert environment and strong winds. They can significantly affect daily life, including visibility, air quality and infrastructure. Residents and local authorities take measures to mitigate the effects of sandstorms and ensure public safety during these events.



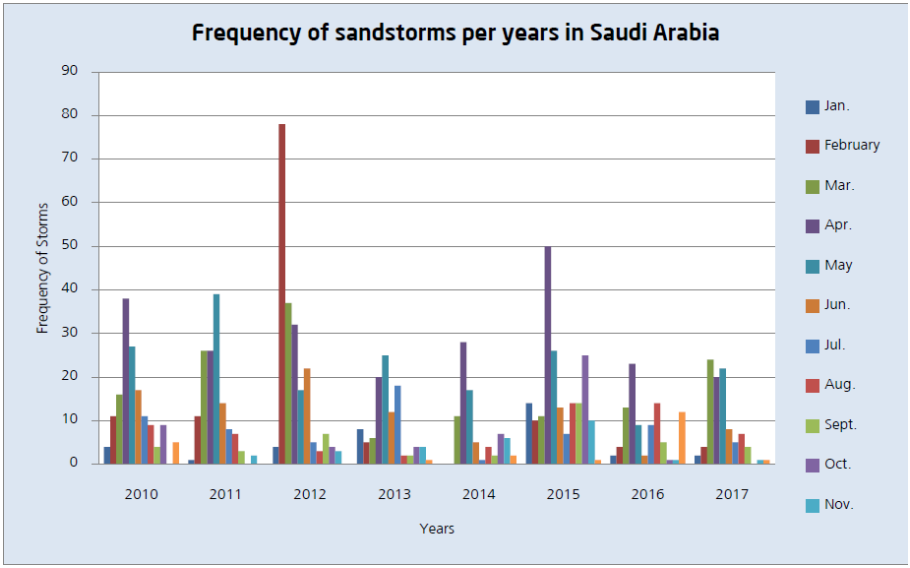
Annual Average Seasonal Sandstorms
Source: https://climateknowledgeportal.worldbank.org/country/saudi-arabia

Riyadh is in the heart of the Arabian Desert, which is characterized by extensive stretches of sand dunes and arid conditions. This desert environment provides ideal conditions for sandstorms to occur. It usually develops when strong winds pick up loose sand and dust particles from the desert surface. These winds can be associated with weather systems such as low-pressure areas, frontal boundaries, or even local pressure gradients.

They are most common during transition periods, especially in spring and fall, when the temperature differences between day and night are most pronounced. However, they can occur at any time of the year when weather conditions are favourable.

One of the most significant impacts of sandstorms is reduced visibility. Blowing sand and dust can severely reduce visibility, make travel dangerous and disrupt daily activities. it can degrade air quality in surrounding areas. Dissolved particles in the air can lead to respiratory problems and other health problems, especially in vulnerable populations. Blown sand and dust can cause damage to buildings, vehicles, and infrastructure. Sand can accumulate on roads, create dangerous driving conditions.

Residents usually take precautions by staying indoors during sandstorms to avoid exposure to blown sand and dust. It is essential to keep windows and doors closed and use air filtration systems if available. When people venture outside during a sandstorm, they often wear goggles or wrap their faces with scarves to protect their eyes and respiratory organs from airborne particles. Drivers are advised to reduce speed and use headlights during a sandstorm. It is also common to stop and wait for the storm to pass if visibility becomes dangerously low.



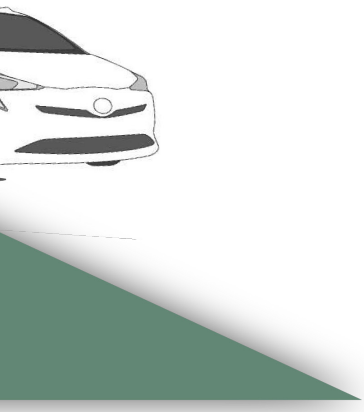
Source: Frequency Of Sandstorms Per Year In Saudi Arabia During The Period 2010-2017.pdf

Source: https://lifeinsaudiarabia.net/survive-a-sandstorm-in-saudi-arabia/

MOBILITY ISSUES

THE CAR AS AN IDENTITY

Car culture is prevalent in Riyadh, with many residents relying on personal vehicles for daily commuting and transportation needs. The use of cars in Riyadh has evolved over the years, from a rarity in the early 20th century to a common mode of transportation in the modern city. The growth of car ownership has brought both benefits and challenges to the city, with ongoing efforts to address issues related to traffic congestion and air quality while also promoting alternative and sustainable transportation options.



The first airplane landing in Saudi Arabia, early 1940s
(Source: MOT, 2016)

HISTORICAL CONTEXT

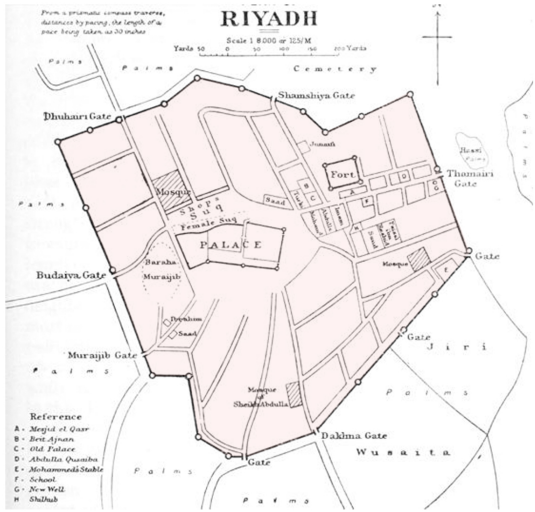
Riyadh's development from small settlements to a modern city is linked with Saudi states finding oil fields. Before 1940s, the main form of transport were camels and horses. The city was surrounded by the ancient fortified walls and nine gates.

With the advent of the motor vehicle in the 1940s, the first highway for automobiles was built in Riyadh, a paved stone road connecting the Second Grand Palace and the administrative complex two kilometers north of the existing city Qasr Al-Murabba (Royal Palace). Between the 1940s and the late 1950s, the main roads of the old city were widened to allow motor vehicle access, despite low car ownership at the time. In the 1950s, oil had recently been discovered in Saudi Arabia, and the Saudi Arabian government and the United States agreed to establish the Saudi Arabian American Oil Company.

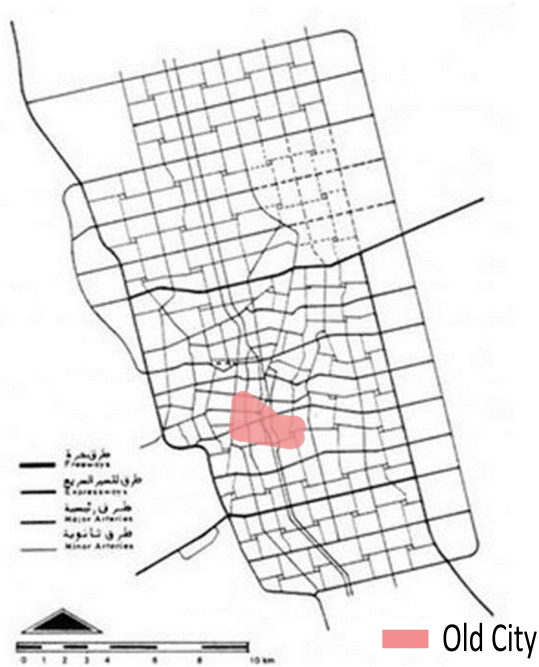
As the oil revolution began to benefit the Saudi economy, cars began to appear around town. This subsequently increased the level of vehicle ownership. During the 'Aramco phase', the kingdom experienced dramatic economic growth. This development influenced the urban form of the city and was linked by a road network, increasing the city's dependence on the private automobile. The city has transformed from a traditional pedestrian environment to a car-dependent city.

The Saudi government hired Doxiadis in 1969 to develop a preliminary masterplan. According to the master plan, spine networks were designed, each to be served by mass highways. The corresponding need was to build more residential areas and more activity centers, and so the overall increase in travel demand needed to be served by private cars. In 1979 SCET was hired and they added ring roads to connect the linear road network. The plan was the main core of Riyadh's urban structure during the city's journey to urbanization, and major roads are still expanding in the same direction .

The road network has grown significantly and play an important role in determining the urban fabric of the city and the primary source of transportation.



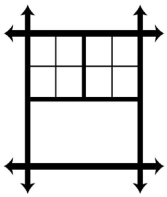
Old Riyadh landmarks, gates and streets sketched by *Philby, 1942*.



Doxiadis master plan for Riyadh ,1972
(Source: ADA, 2015, modified by author)

DOXIADIS GRID

The super grid was based on a two kilometre by two kilometre superblock and was organized along a linear spine, running north of the historical centre (Doxiadis 1968). The linear spine approach was taken because it was felt that freeeway networks would encourage people to travel back and forth to district centres instead of living within their boundaries. The large dimensions were catered by private cars as there was no provision for public transport.



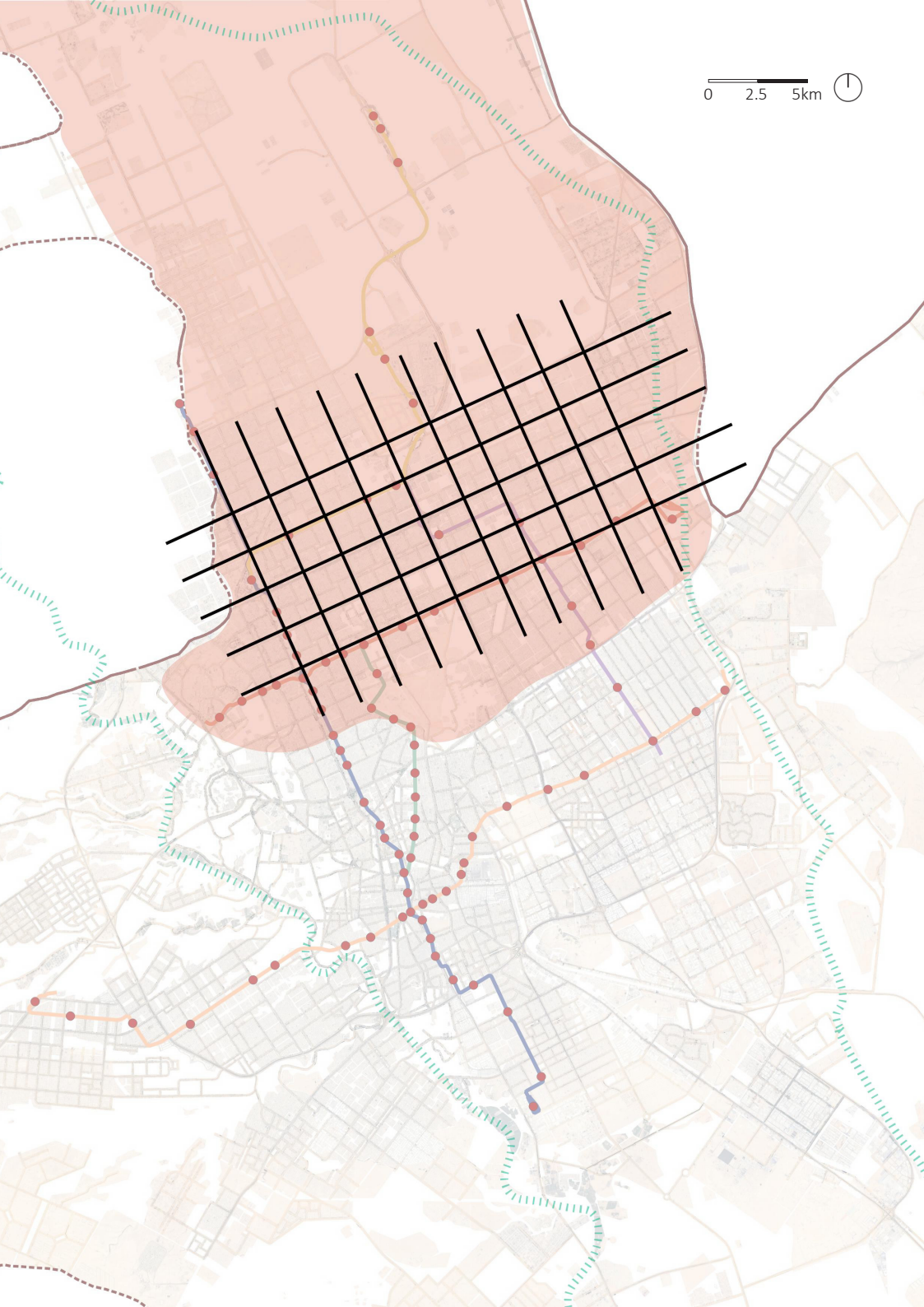
2km-2km superblocks road connection

Legend

Primary Road

Secondary Road

Tertiary Road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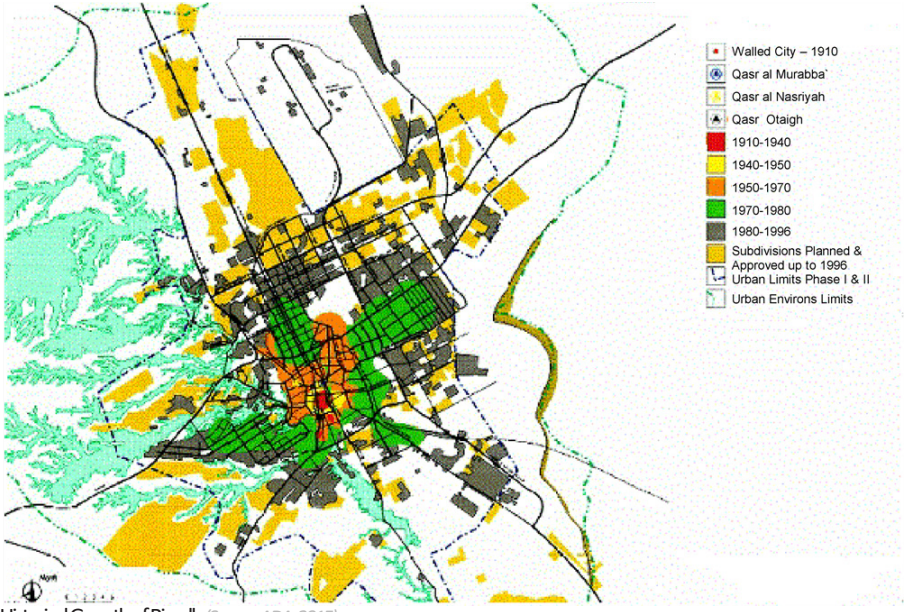
5km

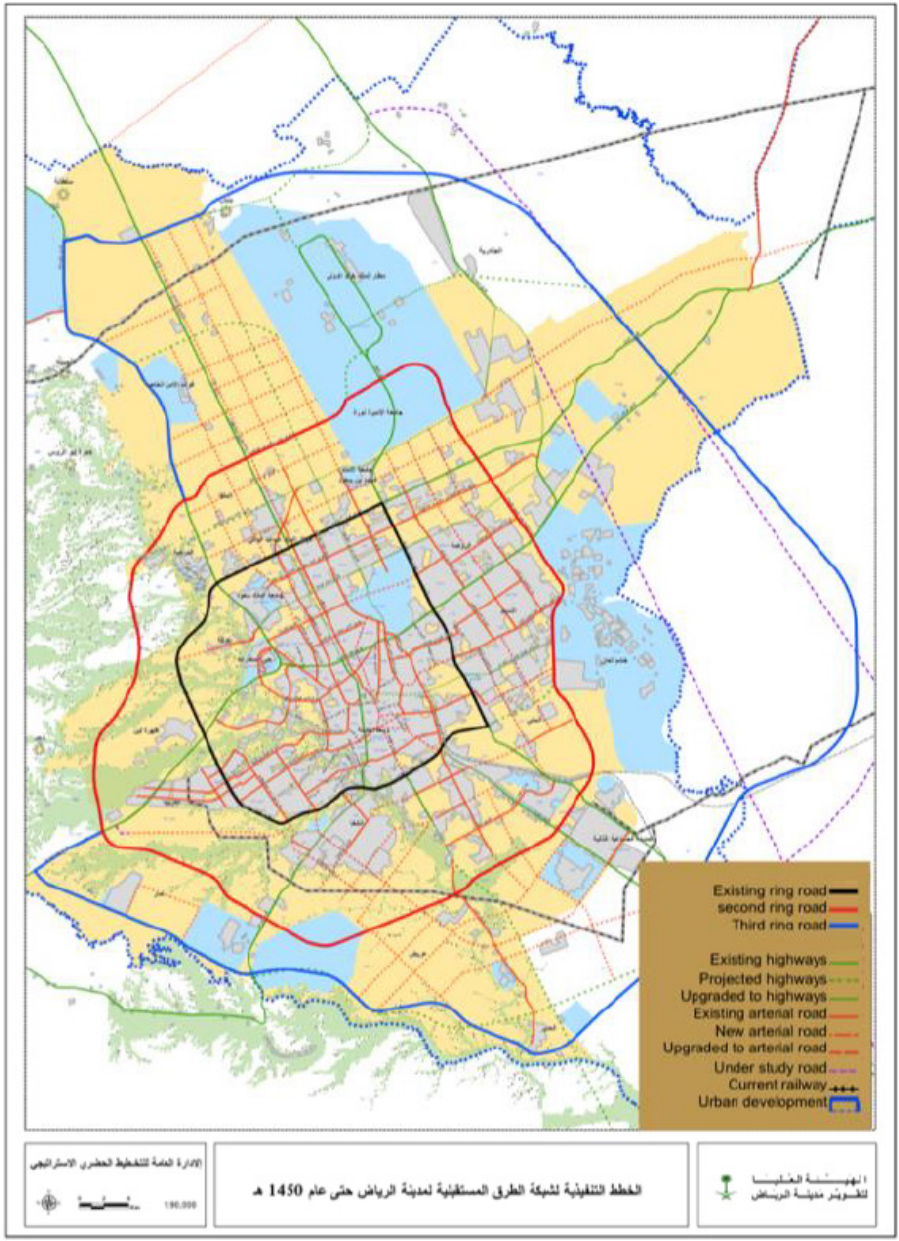


Historical Growth of Riyadh *(Source: ADA, 2015)*

ROAD NETWORK DEVELOPMENT

To implement the Doxiadis plan, the government created a technical committee chaired by the Riyadh governor that would later form the nucleus for the Arriyadh Development Authority (ADA), 1974. The built-up area of Riyadh in 1977 extended to 73 square kilometres, and the market demand for residential development outpaced supply as the implementation of the plan revealed the need for ongoing adjustments to the Doxiadis master plan. In fact, the plan was the main nucleus of Riyadh's urban structure during the city's journey of urbanisation.

To curb the cities problem of growing population another initiative Metropolitan Development Strategy for Arriyadh, MEDSTAR, notes that extensive tracts of undeveloped land remain within the Urban Limits Phase 1 area as of 1996 and strategic policies for growth of the city for next 50 years. The policy focuses on shifting the monocentric city to polycentric system. Five subcentres were proposed to cater to new public and private functions and the road network was designed to link all of it with ring roads. The new transportation system was also aimed to reduce the volume of traffic in the city. But the lack of mass transit modes has led to congested streets and heavy reliance on cars.

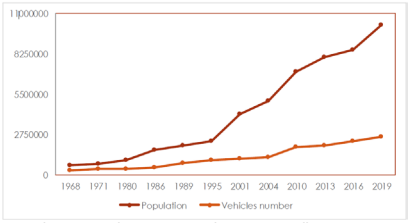


Proposed Main Road / Transport link in the city, 2015

Source: ADA, 2015

ROAD STRUCTURE

The increase in mobility is associated with growth in economic activity and population growth. This in turn led to the construction of several expressways and major roads across the city. According to the Department of Statistics of the Saudi Ministry of Transport, the use of private cars is expected to grow by 8% per year, which means that Riyadh will reach another 100% private car use by 2029.

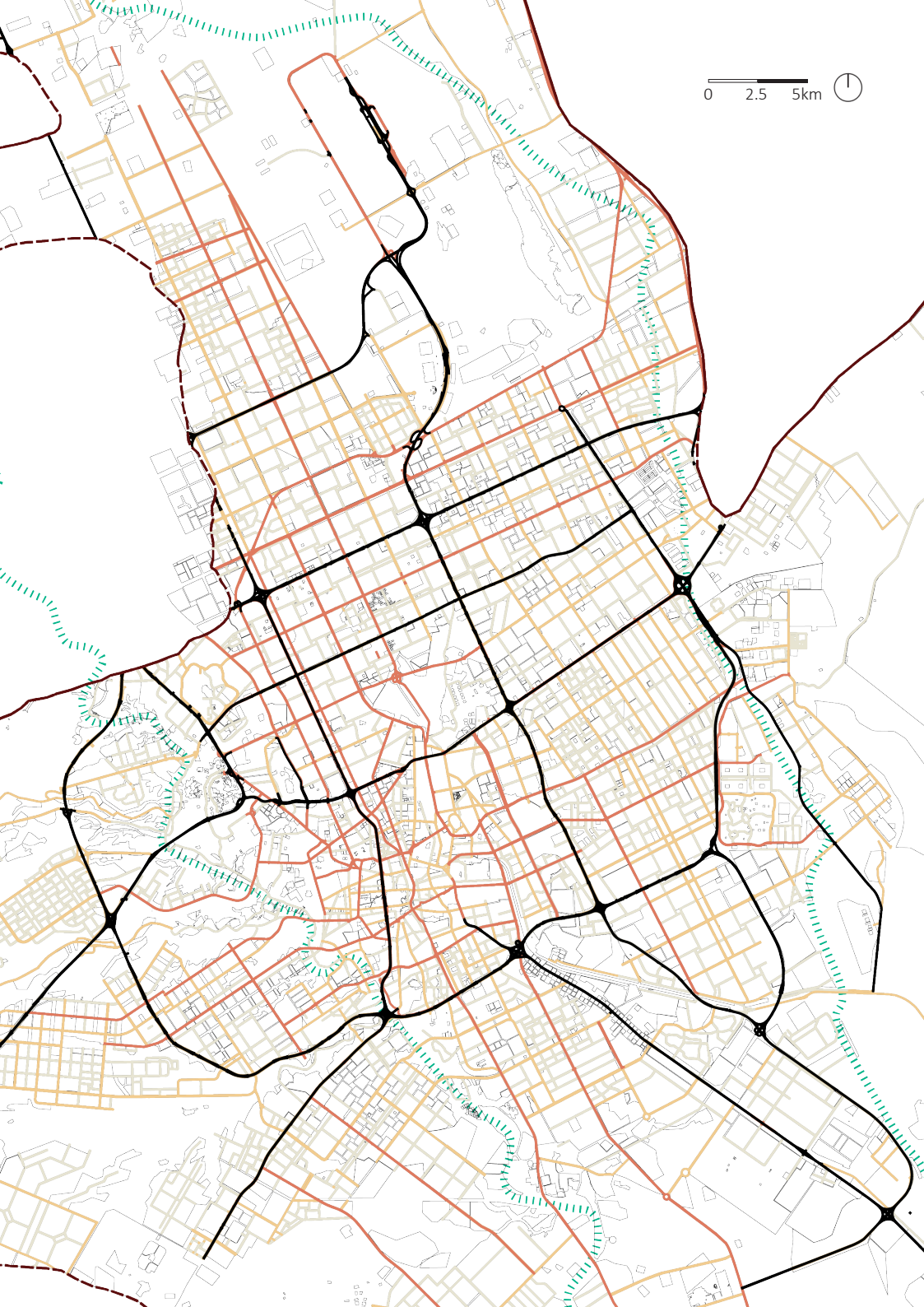


Population and car ownership in Riyadh 1968-2019

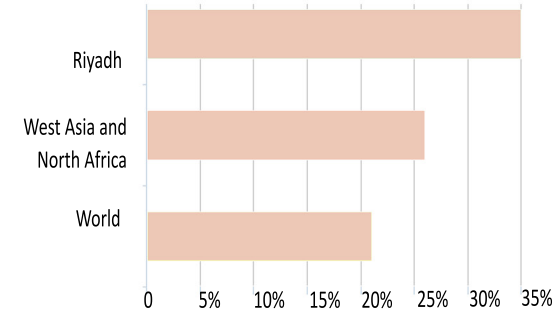
Source: ADA, 2015

Legend

- BOUNDARY
- Federal Road
- Primary Road
- Secondary Road
- Tertiary Road
- River

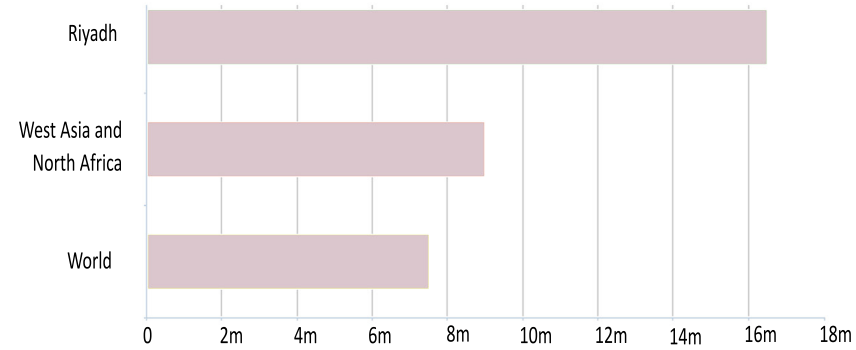

0
2.5
5km

Comparision of Built-up area of Roads

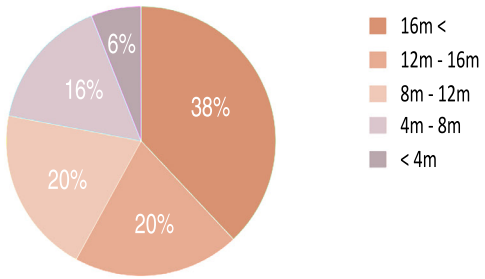


These data depicts that the policies in Riyadh led to heavy investment in their mobility infrastructure in comparison to the world. Cheap gasoline is one of the main cause for this development.

Comparison of Average Street Width

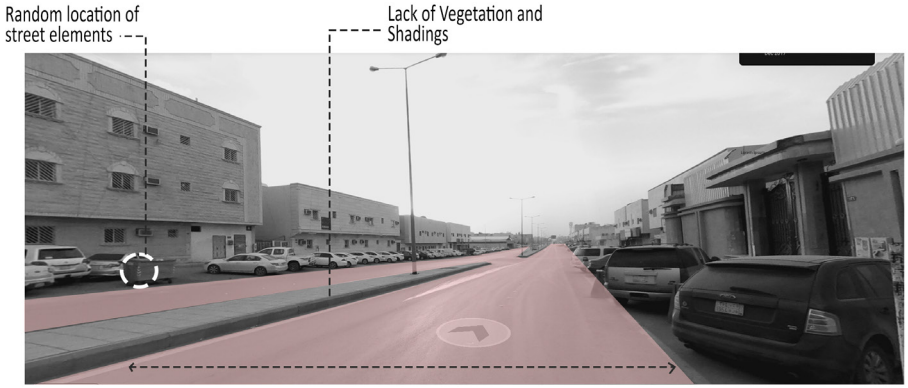


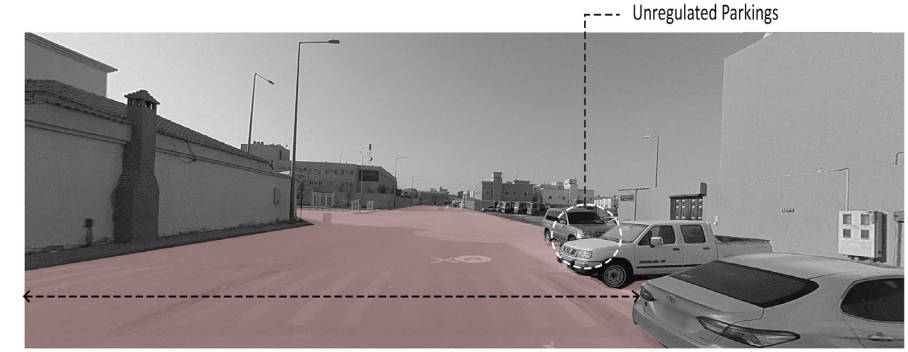
Street Width Composition



Source:http://atlasofurbanexpansion.org/cities/view/Riyadh

Issues in Existing Roads



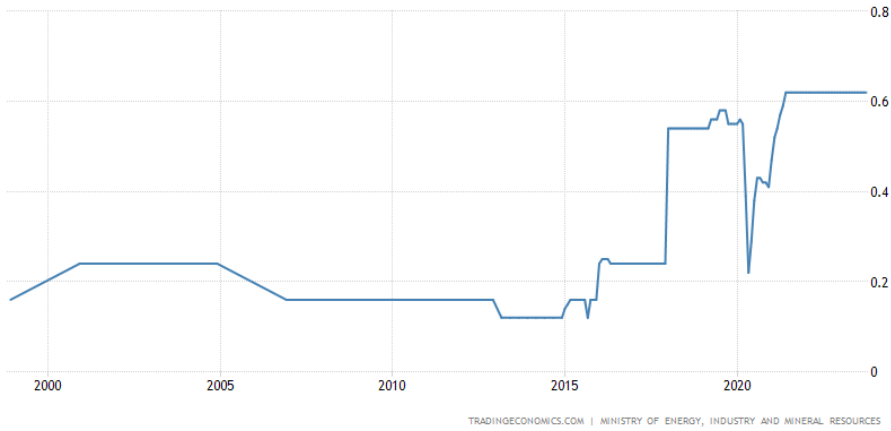


GAS PRICE COMPARISON

The dominance of automobiles within Riyadh's transportation network is notably influenced by the economical accessibility of petrol. Presently, the cost of a liter of petrol in Saudi Arabia stands at USD 0.62, significantly diverging from prices in the Italy at USD 2.08 and the US at USD 0.95. This substantial difference underscores that, in Saudi Arabia, fuel prices do not present the same economic impediment as observed in other regions, owing to the country's prominent stature as a leading global oil-producing nation.

The city's oil boom, which commenced in the 1960s, facilitated substantial government resources for continuous development. Evident in decrees issued by Saudi Arabian royalty, this financial advantage supported the inception of master plans such as Doxiadis's, contributing to the expansion of essential services. Sustaining affordable fuel prices over numerous years, Saudi Arabia's petrol rates have consistently ranked among the world's lowest and notably economical within the Gulf region.

Despite recent subsidy reductions aligning Saudi Arabia more closely with neighbouring nations, the cost remains significantly lower compared to Western Europe, America,



2003 - 0.2 USD per liter *2013 - 0.16 USD per liter* *2023 - 0.62 USD per liter*

Gasoline Price per liter in USD in last 25 years

Source: https://tradingeconomics.com/saudi-arabia/gasoline-prices

and Eastern Asia. The substantial increase in petrol prices in early 2016, despite a two-thirds escalation to 0.75 riyals (USD 0.2) per liter from 0.45 riyals (USD 0.12) for 91-octane, reveals that prices remain 72% lower than the next least expensive nation (the US).

Riyadh's distinctive access to affordable fuel mitigates the economic barrier often associated with fuel expenses and underscores the social significance of prioritizing the establishment of an effective public transport system within the city.

The economic advantage of affordable fuel also requires a nuanced understanding of individual and collective behavior. Initiatives aimed at raising awareness about the broader social and environmental consequences of private car dependence can encourage shifts in behavior. This might involve public campaigns, educational programs, and policy measures that incentivize the use of public transport and sustainable modes of commuting.

MOBILITY ISSUES

LACK OF ALTERNATIVE MOBILITY

Historically the focus of development of city has been on construction of major road infrastructures and the commute has been primarily with cars. The new MEDSTAR policy identifies the problem with using cars in today's world in the aspect of sustainability, economically and accessibility. The new policy proposed metro and bus lines to promote mass transit but even to access them, a car trip from most of the residential blocks are required.

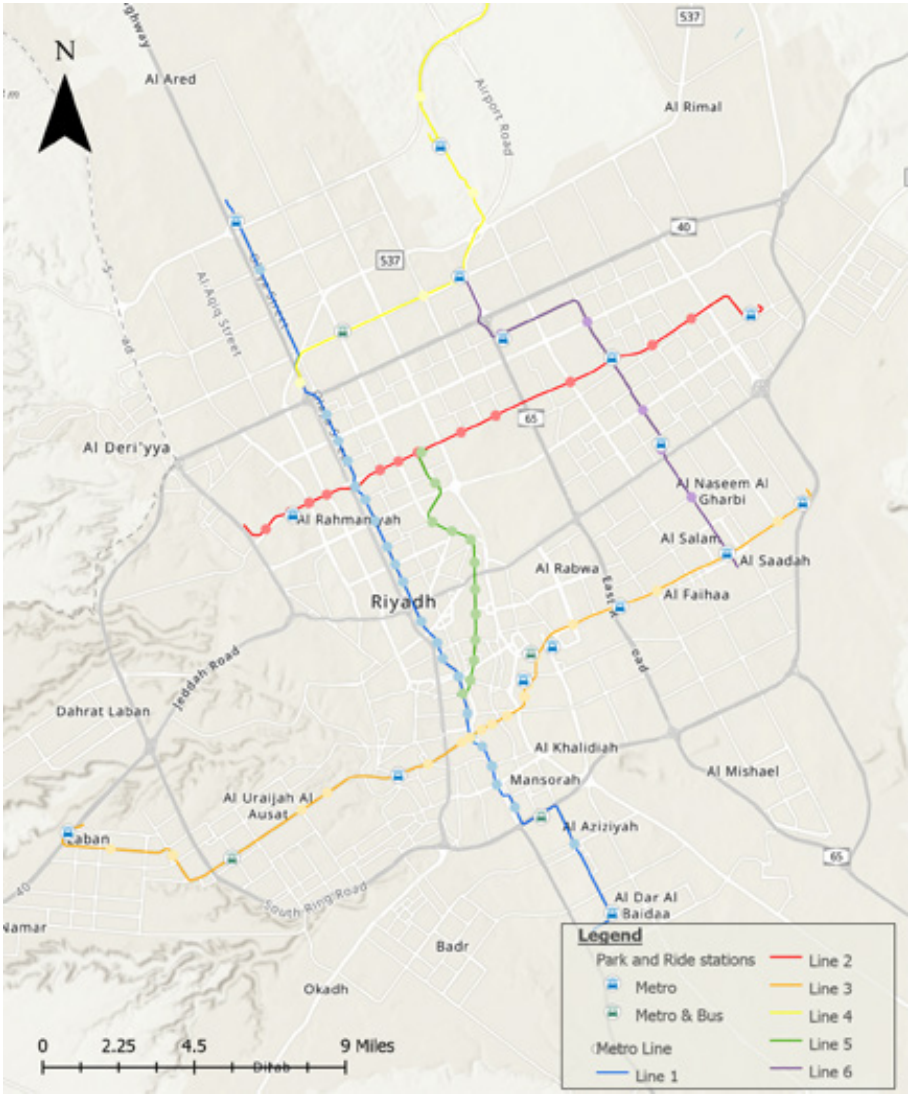
PUBLIC TRANSPORT ANALYSIS

The heavy one the dependence on automobiles created a high level of automobiles ownership, congested roads and pollution. The increasing domestic demand for fuel from automobiles ownership may also reduce Saudi oil exports potential.

A Royal Commission to address these issues for Riyadh City (RCRC) developed by Riyadh Public transport plan that was approved in December 2011 (RCRC 2012). This plan was created to minimize economic and environmental damage from current traffic behaviour and adaptation to the people of Riyadh grow.

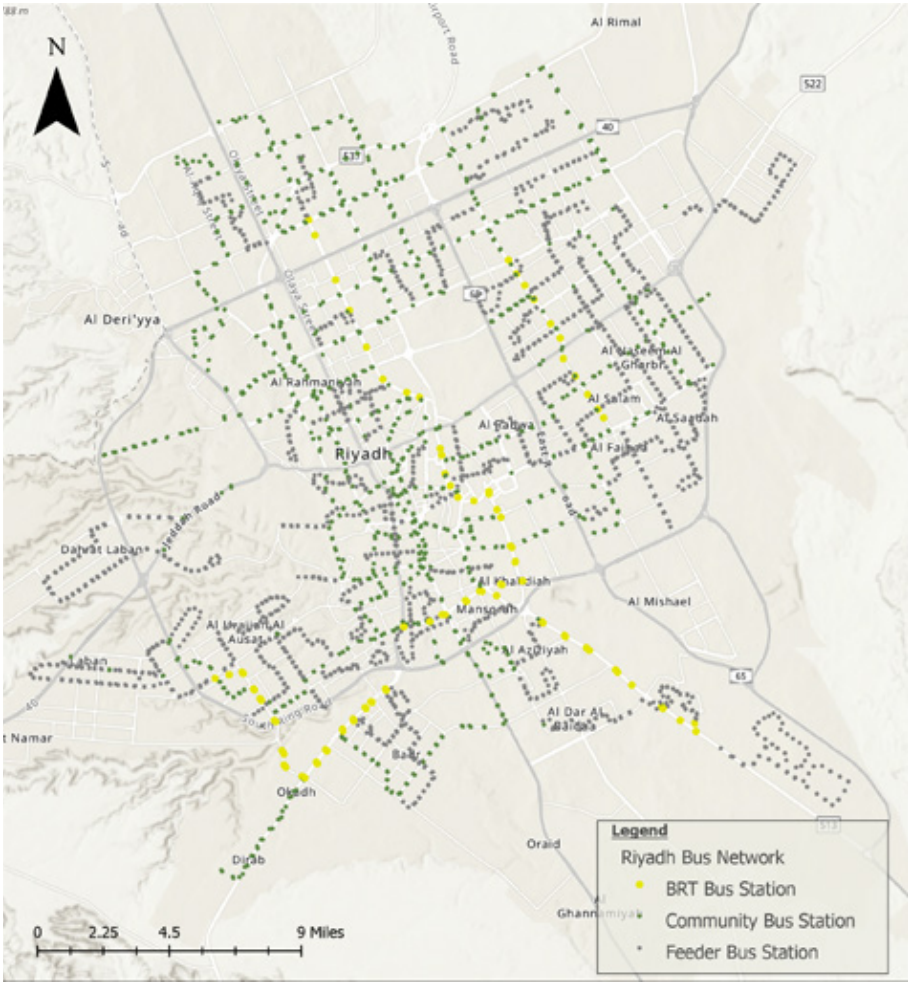
The project aims to fulfil the growing reduce the population's demand for transport traffic congestion and reduce the use of private cars. The Riyadh public transport project will develop one of the world's largest urban transport systems. The system will include 176 kilometres of subway lines and 85 stations covering most of Riyadh populated areas. A parallel is also planned bus network with stations connecting all districts. The bus network consists of three levels: bus rapid transit (BRT), community buses and feeders buses. The BRT will use a dedicated lane that provides road without traffic. Community and feeder buses will work across and within neighbourhoods, or without dedicated lanes (Riyadh metro2020a).

The low accessibility to these public transport is still a major issue to make people shift from cars to mass transit or soft mobility.



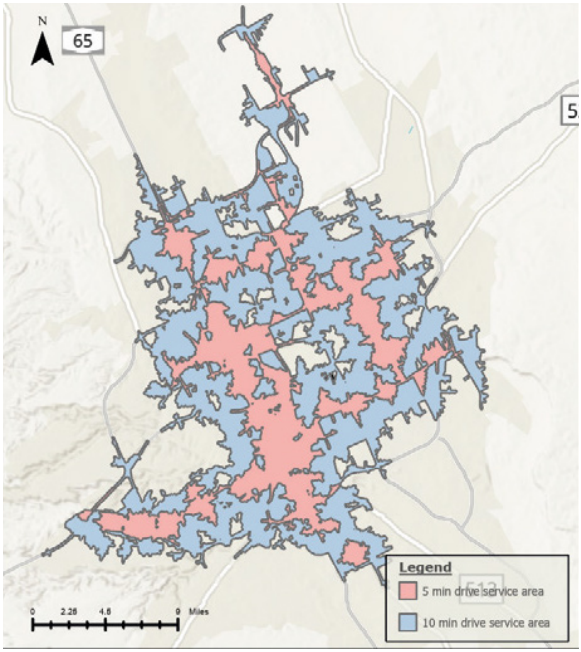
Riyadh Metro Stations

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis.pdf, 2021



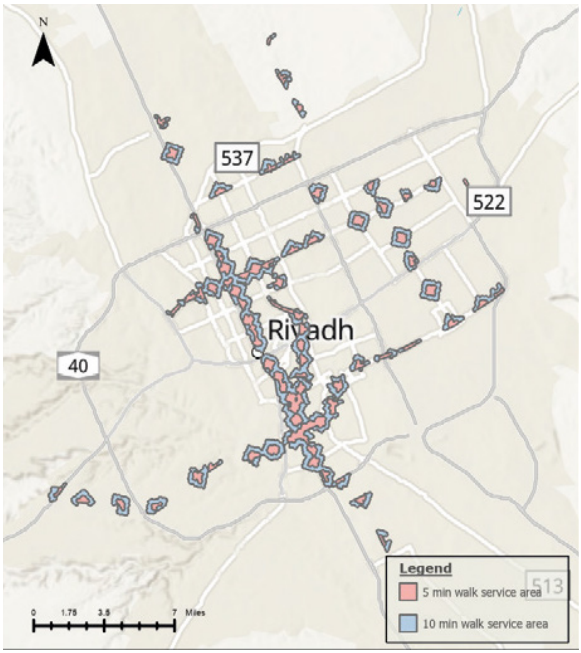
Riyadh Bus Network

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis.pdf, 2021



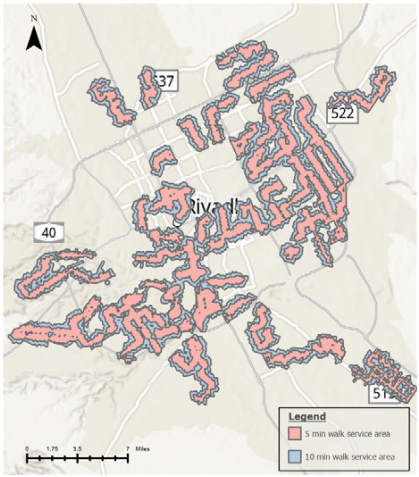
Service areas around Metro Stations within 5 min and 10 min Drive

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis. pdf, 2021



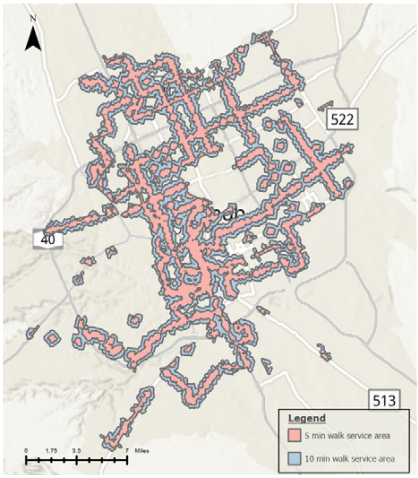
Service areas around Metro Stations within 5 min and 10 min Walk

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis. pdf, 2021



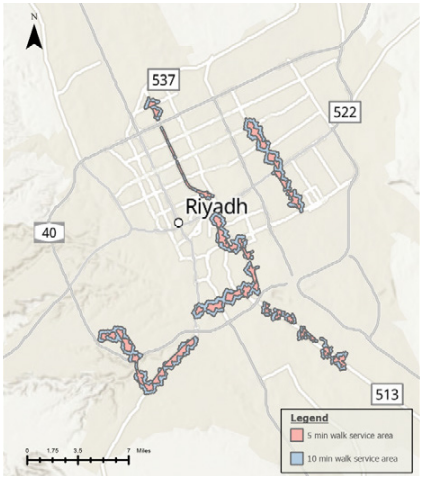
Service areas around Feeder Bus within 5 min and 10 min Walk

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis.pdf, 2021



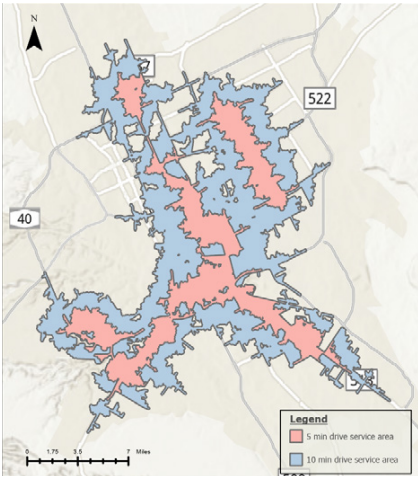
Service areas around Community Bus within 5 min and 10 min Walk

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis.pdf, 2021



Service areas around BRT Bus Stations within 5 min and 10 min Walk

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis.pdf, 2021



Service areas around BRT Bus Stationswithin 5 min and 10 min Drive

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis.pdf, 2021

Scenario	*% of population with access*
Metro – 10 min Drive	74.3 %
Metro – 5 min Drive	34.4 %
Metro – 10 min Walk	13.5 %
Metro – 5 min Walk	4.8 %
Feeder Bus – 10 min Walk	55.6 %
Feeder Bus – 5 min Walk	35.8 %
BRT – 10 min Drive	55.6 %
BRT – 5 min Drive	20.3 %
BRT – 10 min Walk	8 %
BRT – 5 min Walk	2.9 %
Community Bus – 10 min Walk	48.2 %
Community Bus – 5 min Walk	24 %

Population Accessibility Analysis Result

Source: Evaluating access to Riyadh's Planned Public Transport System using Geospatial Analysis.pdf, 2021

The analysis shows that the use of the metro station in Riyadh will largely depend on availability during the ride, because walking distance to the metro is apparently very low. Access to the metro by walking for 10 minutes or less, most users must walk to the nearest bus station. Then they can get to the metro station bus. Low pedestrian accessibility is found.

These results can help identify potential improvements to increase access to stations and estimate the possible number of passengers. If a larger percentage of users get a pedestrian access to metro stations, congestion and emissions rates will decrease because fewer users will drive these stations. Investment in road infrastructure design, elevated pedestrian traffic, pedestrian traffic lights and potential financial incentives can help make this outcome possible. Besides all of them bus levels in addition to BRT provide more walking accessibility than metro stations.

Riyadh has more BRT stations than subway stations. However, BRT stations are in the centre city, while metro stations cover all sections Riyadh.

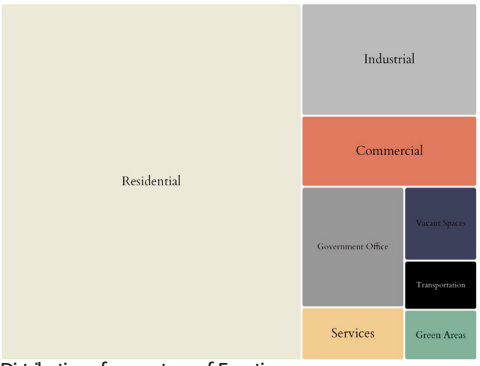
SPACIAL ISSUES

ATTRACTORS AND GENERATORS DISPARITY

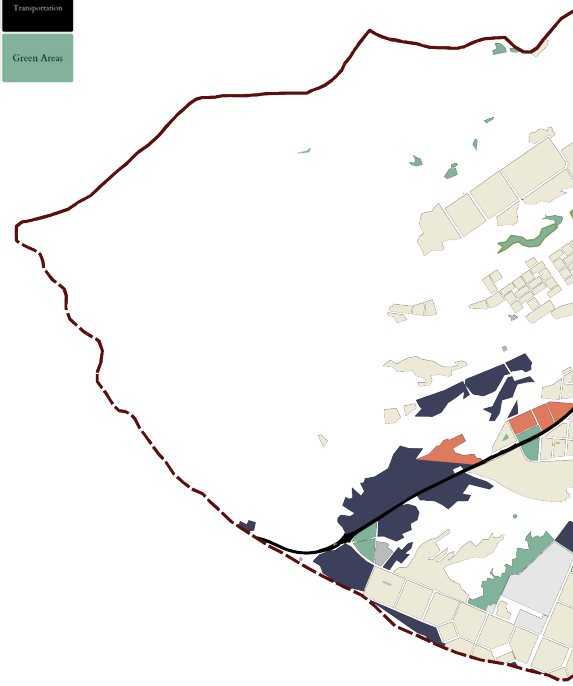
Unequal distribution of land use creates an imbalance in the urban fabric and increases travel time and number of journeys in order to access employment opportunities and services.

POOR LANDUSE

The commercial development of the city along the spines and residential services outside the area has generated a large gap in the number of services available for peoples. There is a need for redesign a neighbourhood where basic amenities are accessible to everyone.

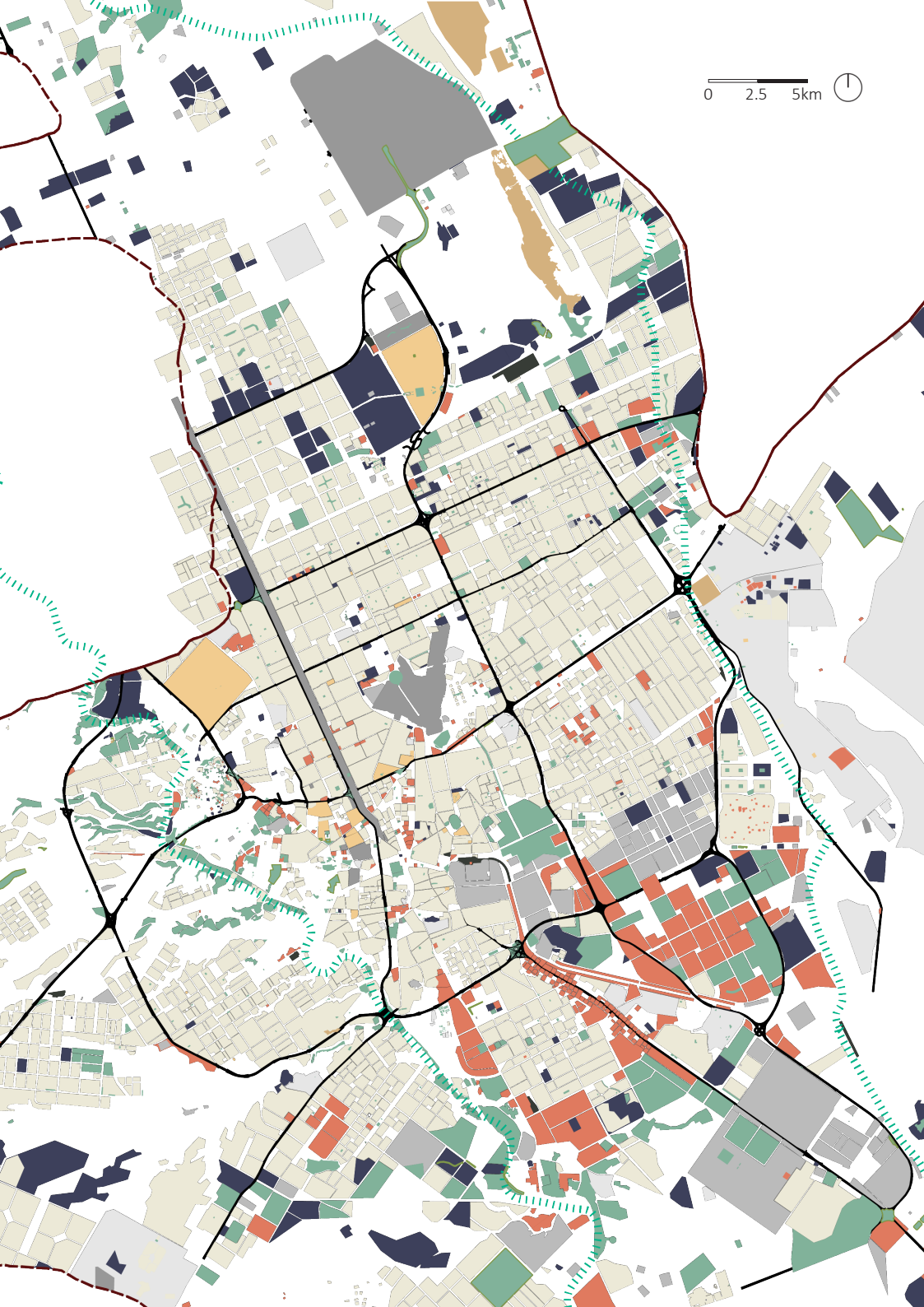


Distribution of percentage of Functions



Legend

- BOUNDARY
- Federal Road
- Residential
- Commercial
- Services
- Government Offices
- Industrial
- Green Space
- Vacant Spaces
- Dunes
- River


0
2.5
5km

TRIP CHARACTERSTICS

The primary purpose of trips in Riyadh often revolves around commuting, with home-to-work trips constituting a substantial portion of travel activities. Non-home trips, encompassing leisure, shopping, and social engagements, also contribute to the overall travel purposes within the city.

Within specific trip purposes, such as home-to-school trips, cars tend to have higher occupancy rates, suggesting multiple passengers per vehicle, often involving parents dropping off or picking up children. This contrasts with other trip purposes, where occupancy rates might be lower.

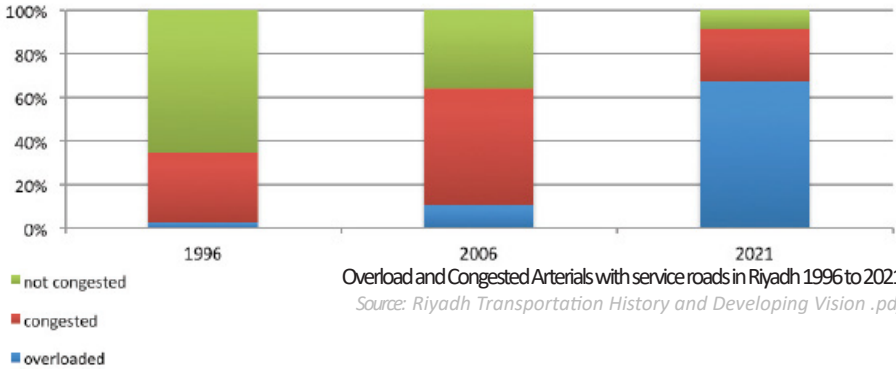
The dominance of cars in Riyadh's transportation network is significant, primarily influenced by the city's expansive road infrastructure and the historically low cost of petrol. The availability of cheap fuel has made private car usage economically feasible and, consequently, a preferred mode of transport for many residents.

The delay in establishing an adequate transit system and the realization of sub-centres runs counter to the earlier holistic vision outlined in the MEDSTAR project. The implications of this discrepancy underscore the current lag in urban development, emphasizing the need

Trip Purpose	*Vehicle Occupancy*	*Percentage by Trip Purpose*
Home - Work	1.52	32.02%
Home - School	2.54	15.55%
Home - Shop	1.76	8.58%
Home - Other	1.55	24.86%
Non-Home	1.39	19.00%

Trip characterstics of Riyadh networks

Source: ADA, 2015



Overload and Congested Arterials with service roads in Riyadh 1996 to 2021

Source: Riyadh Transportation History and Developing Vision .pdf

for reevaluating and reinstating strategies aimed at fostering a well-integrated public transit system alongside the envisioned sub-centres in Riyadh's urban framework.

Addressing congestion requires a holistic approach to urban planning. The integration of smart transportation technologies, the development of alternative routes, and the creation of pedestrian-friendly spaces are vital aspects of a comprehensive solution. Implementing zoning regulations that encourage mixed-use developments can reduce the need for extensive commuting and contribute to congestion reduction.

The infrastructure in Riyadh has struggled to keep pace with the burgeoning population and the escalating number of vehicles. Insufficient roadways, inefficient intersections, and inadequate public transportation networks contribute to traffic snarls.

SPACIAL ISSUES

LACK OF URBAN SOCIAL SPACES

"Let everyone look at the space around them. What do they see? Do they see time? They live in time after all; they are in time. Yet all anyone sees is movement."
-Henri Lefebvre; The Production of Space
The rapid expansion of urban spaces has been behind several global dynamic problems such as uncontrolled population growth, pollution, loss of greenery and deforestation. Riyadh's city development policies has focused majorly on road networks and the harsh climate results to a low quality of open urban spaces.

URBAN BUILT- UP AREAS

According to the statistics, in 2013 the 66% of the city was Urban built up, 6% as Sub-Urban built up and 25% as Urban Open Space. Since then, the urban built up has increased according to the current construction policies for the city. Even the existing open spaces lacks the proper shading and accessibility which makes the user difficult to use the space.

Open Space used as car parking in middle of neighbourhoods
Source: Google Earth, Street View

Legend

Urban Built Up

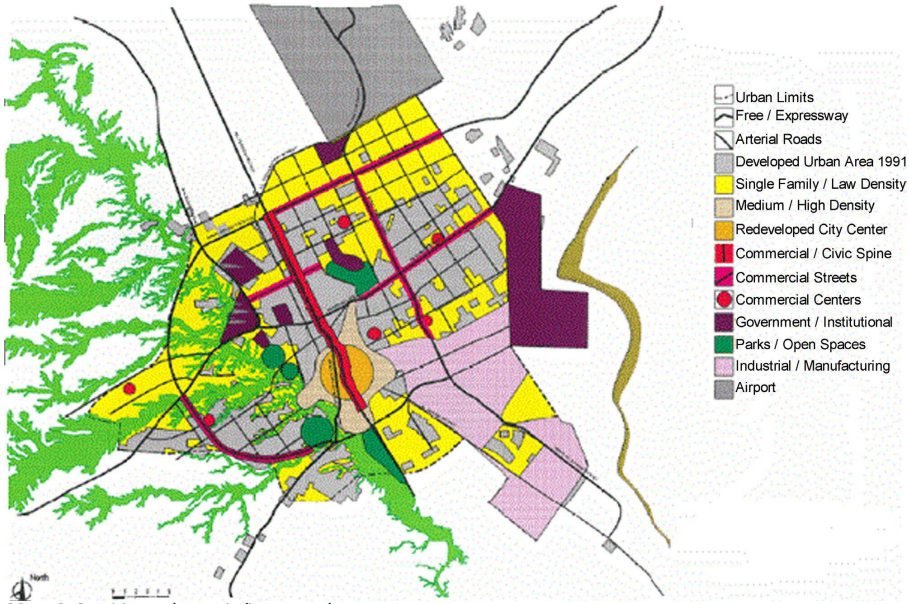
Open Urban Space

Source: http://atlasofurbanexpansion.org/cities/view/Riy

adh, 2013

Evolution of Urban Fabric

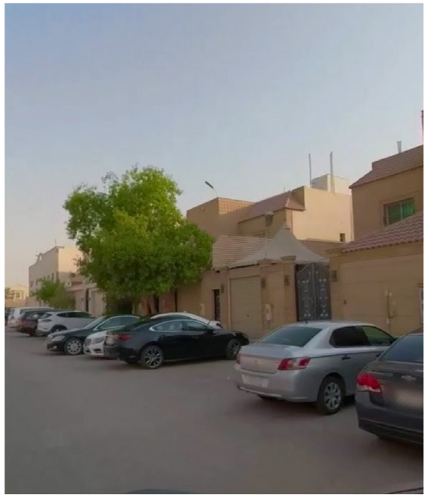
First Doxiadis Plan1973 *(Source: Developing the Riyadh Strategic Microsimulation Model as a Novel Means of Exploring Policy Transfer and Future Transport Scenarios. pdf)*



SCET 1978 revision to the Doxiadis master plan *(Source: Developing the Riyadh Strategic Microsimulation Model as a Novel Means of Exploring Policy Transfer and Future Transport Scenarios. pdf)*

Land Use Density Analysis

Low Density



4000 People / km² | 10 -20 dwellings / hectare

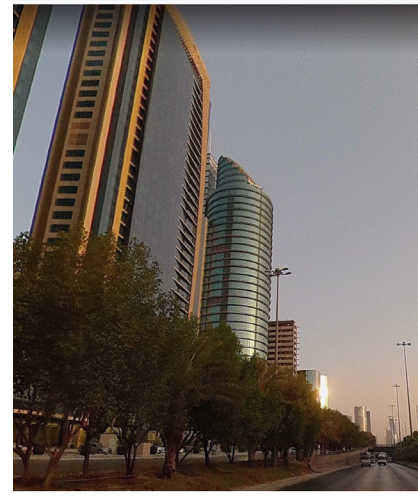
Low - Medium Density

4000 - 7000 People / km² | 15 - 40 dwellings / hectare

Medium - HIgh Density

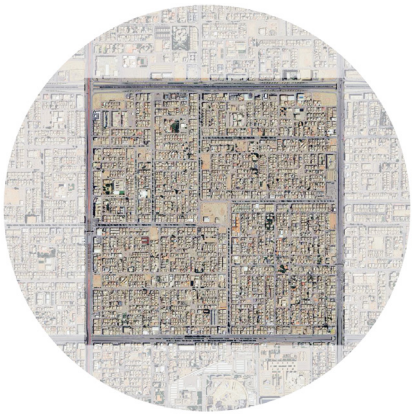
7000 - 9000 People / km² | 40 - 80 dwellings / hectare

HIgh Density



9000 People / km² | 80< dwellings / hectare

Source: Riyadh Public Transport Program. pdf, 2014



Monofunctionality of the neighbourhood

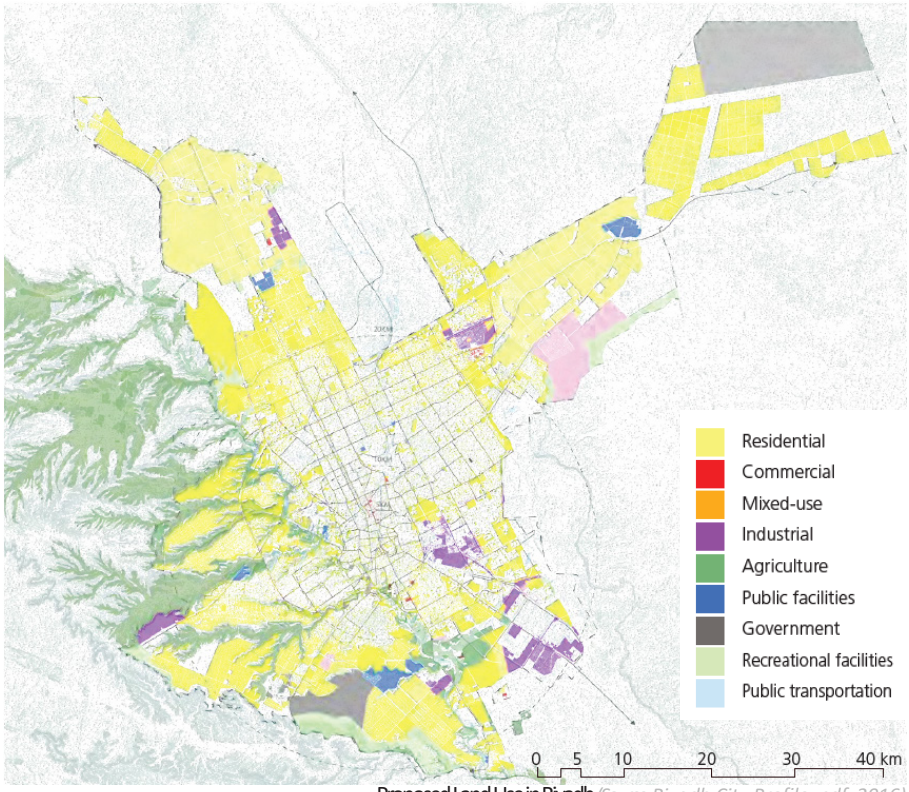
Concentrated Commercial/ Entertainment Plots

URBAN FABRIC

Riyadh is mostly characterized by large monofunctional areas. The city hosts a low distribution of mixed, commercial and retail areas. They are mostly concentrated along secondary roads enclosing residential areas or in monofunctional clusters that are unevenly distributed around the city but are accessible via major highways. By concentrating single use functions in one part of the city, such development can act as a deterrent to the diversity of uses offered in smaller centres and disrupt the balance of access and movement patterns in the city.

Most of the industrial and logistics uses, which account for 11% of the total built-up urban area, are concentrated in the south, adversely affecting the quality of urban life in the adjacent residential areas.

This polarized allocation of services leads to a lack of diversity within individual communities and increases the need commute by car, which negatively contributes to environmental pollution of the city. It should be expected to redistribute and balance the services of daily needs and some jobs under specific service ratios instead allocate them to clusters and closed areas that are not integrated into the overall context of the city. This multi-node

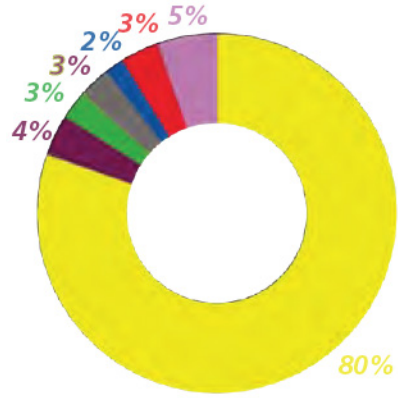


Proposed Land Use in Riyadh *(Source: Riyadh City Profile. pdf, 2016)*

city the structure can diffuse and improve traffic conditions at the same time vitality of neighbourhoods.

Concentrated points of interest such as shopping centres or entertainment districts act as major attraction points that make car ownership a necessity rather than commodity of luxury.

The relatively low densities of 71.8 p/ha are the result of sprawl, residential developments, which represent 35% of urban development fabric and only a few areas with higher density development they exist around the urban core.



Proposed Percenatge of Function in Land Use in Riyadh
(Source: Riyadh City Profile. pdf, 2016)

SUMMARY OF ISSUES

The evolution of the city has been such to encourage more cars than the soft mobility or public transports as a mode of transportation. A shift in paraigm needs to take place in order to make public shift from the reliance of cars to alternative options.

While the concept of a 15-minute city may be effective and beneficial in a European setting, it could potentially lead to adverse outcomes in cities with extreme climates, such as Riyadh. Due to the harsh nature of the climate of the city, it is not advised to be exposed to sun for more than 15 minutes for a fit person. Furthermore, the climate affects the walking speed of the residents and makes them slower than the average of **4.3 kph to 3.9 kph**. Consequently, we have tailored our approach to better suit the specific conditions of Riyadh, focusing on the **development of a 10-minute city.** This adaptation ensures our solutions are contextually appropriate and more likely to succeed.

Reimiganing the city opens up the opportunity to design the city for all individuals regardless of their age group or socioeconomical position. A city easily commuted by all residents within the community.

CLIMATIC ISSUES

HARSH CLIMATE

SAND STORMS

Plausible Solutions

- Densifying the city
- Shading the streets
- Using appropriate materials and colors.
- Creating 10-min districts.
- Harnesing solar energy potenial.

SPATIAL ISSUES

ATTRACTIONS & GENERATORS DISPARITY

LACK OF URBAN SOCIAL SPACES

Plausible Solutions

- Redistributing landuses within the neighborhood.
- Designing more accesible streets.
- Government regulations against car use.
- Improving accessibility to public transport.

MOBILITY ISSUES

THE CAR AS AN IDENTITY

LACK OF ALTERNATIVE MOBILITY

Plausible Solutions

- Creating community spaces within the neighborhood.
- Revitalizing white lands in the city
- Implementing modes of soft mobility

- Chapter 5 -

تحديد منطقة الاختبار

IDENTIFYING TEST BED

Based on a thorough analysis of the current situation and the future plan visioned for the city of Riyadh, we concluded that the northern region of the city has the highest potential to be developed as a standard for the existing neighborhood structure as well as the expansion zone of the city. Reimagining these neighborhood in terms of accissibility, equity and the general well being and quality of life measured on the human scale and slower, healthier way of life. The challenge is to acheive these goals while considering the climatic envelope of the city.

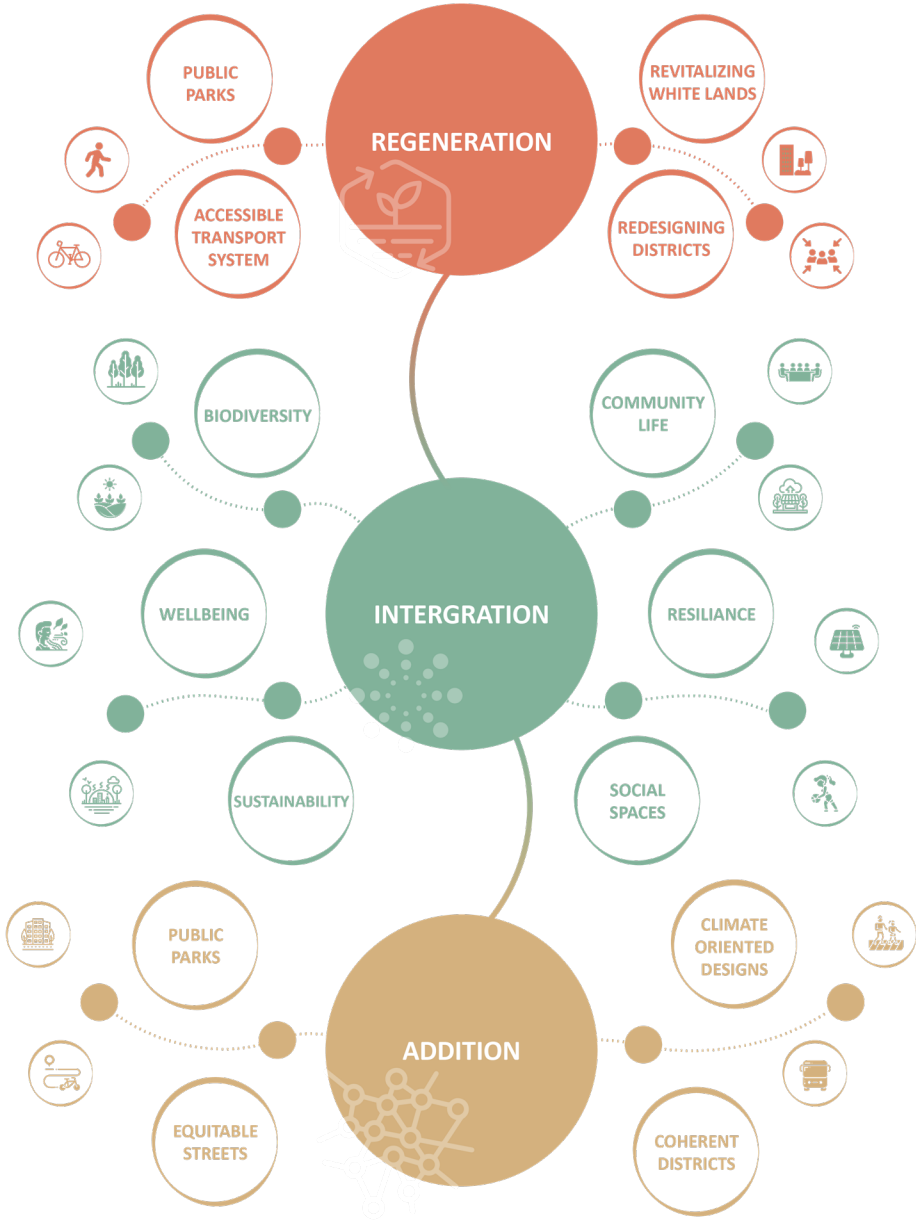
OUR VISION

In Riyadh, a vastly growing city in the middle of the Arabian Desert, the challenges are abundant and unique to the city. The pillars of a 15 min city have been thoroughly researched and even implemented in many western cities with completely different charactaristics. The main goal for the project is to revitalize the city of Riyadh and its neighborhoods by enhancing its social, cultural and enviromental values. To change a massive city like Riyadh and turn it into a 15 min city, the standard pillars of the 15 min city must be rethought and readjusted to fit within Riyadh's specific desert location. The change needs to start from the scale of the people to the city scale.

- **Regeneration:** Our vision of Regeneration focuses on creating a more livable city by prioritizing human needs over vehicular traffic. This involves reclaiming land that is currently used for vehicles and repurposing it for public use. The initiative aims to create more green spaces, pedestrian walkways, and bike lanes, making the city more accessible and enjoyable for its residents.

- **Intergration:** Our vision of Integration aims to transform the city into a more resilient community . The scope is to place the well being and quality of life at the core of the design process creating a landscape that encourgaes social interaction and is available for all. By doing so, the initiative hopes to create a more sustainable and equitable city that prioritizes the well-being of its citizens.

- **Addition:** Our vision of Addition aims to highlight and understand the city's current geographical position and its climatic classificaion and use it as a base for implementing designs within the city. This initiative hopes to unlock the full potential of the city by creating a unique identity that faded due to a globalized world .


REGENERATION
PUBLIC PARKS
ACCESSIBLE TRANSPORT SYSTEM
REVITALIZING WHITE LANDS
REDESIGNING DISTRICTS
INTERGRATION
BIODIVERSITY
WELLBEING
SUSTAINABILITY
COMMUNITY LIFE
RESILIANCE
SOCIAL SPACES
ADDITION
PUBLIC PARKS
EQUITABLE STREETS
CLIMATE ORIENTED DESIGNS
COHERENT DISTRICTS

PUBLIC SURVEY

In an effort to gain a deeper understanding of the urban landscape and the vision of its inhabitants for a comfortable city, we conducted a comprehensive public survey targeting the residents of Riyadh. This survey aimed to gauge their experiences living in the city and their satisfaction with the facilities available within their neighborhoods.

The primary objective of the survey was to identify the types of services and activities that the city's residents deem necessary within a 15-minute walking distance, and to understand how these facilities are perceived and utilized by them. The survey was designed to cater to a diverse sample of residents, encompassing not only Saudi nationals but also individuals from various countries worldwide.

Furthermore, the survey sought to uncover the challenges and barriers that residents encounter in accessing or utilizing these facilities, and to propose potential improvements. The survey comprised a combination of multiple-choice and open-ended questions, providing a comprehensive overview of various aspects of the facilities. These

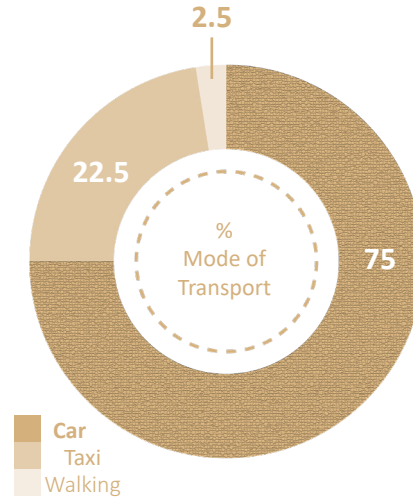
included frequency of use, ease of access, satisfaction levels, needs and expectations, preferences, and suggestions for improvement.

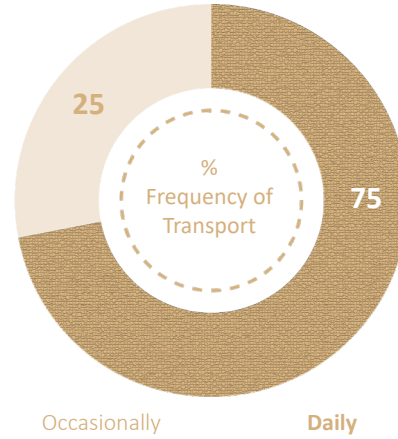
By conducting this survey, we aimed to gather valuable insights that could guide future urban planning and development initiatives, ultimately enhancing the livability and sustainability of Riyadh. It's important to note that this survey was conducted on a small scale, targeting a select sample of Riyadh's residents. While this approach provided valuable insights, the findings represent the experiences and perspectives of a limited number of individuals. To obtain a more comprehensive understanding of the city's urban landscape and the needs of its residents, it would be beneficial to conduct this survey on a larger scale. By expanding the scope of the survey to encompass a broader demographic and geographic range, we could capture a more diverse array of experiences and perspectives. This would not only enhance the reliability and validity of the findings but also ensure that future urban planning initiatives are inclusive and responsive to the needs of all residents.

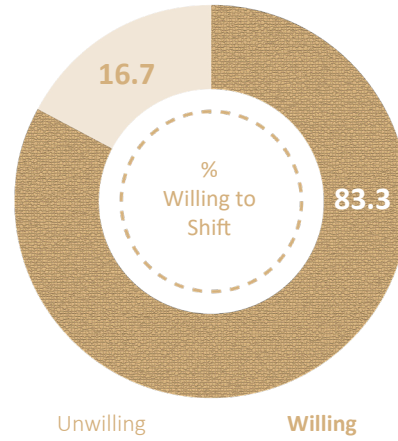
SURVEY OUTCOME

The survey was administered to both national citizens and multicultural residents, who constitute nearly half of the city's population. Comprising 21 questions, the survey aimed to assess the existing urban structure and the prospective vision outlined by the 2030 plan. The findings underscored several challenges inherent in the city's current urban design.

Additionally, open-ended questions were incorporated to facilitate participants in voicing their concerns about city mobility. The responses received primarily revolved around cognition, road and traffic conditions, and extended travel times.







Question 1 inquired about the preferred mode of transportation within the city. The responses received (Figure 1) align with our research statistics. A significant 75% of respondents reported using personal cars, 22.5% utilized taxis, and a mere 2.5% walked to their destinations. These results indicate that 97.5% of individuals primarily rely on cars for transportation.

Question 2 sought to understand the frequency of travel to regular destinations such as work or school. The data revealed that 75% of respondents commute to specific locations daily (Figure 2).

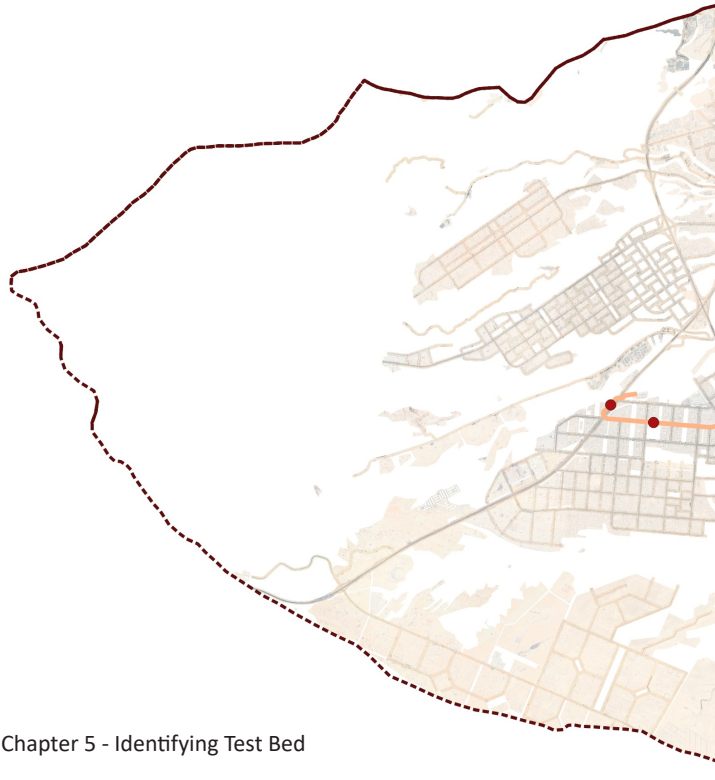
Question 3 gauged the willingness of individuals to switch from their cars to alternative modes of transport. Interestingly, 83.3% expressed a readiness to consider other options, while 16.7% preferred to continue using their private cars for city travel.

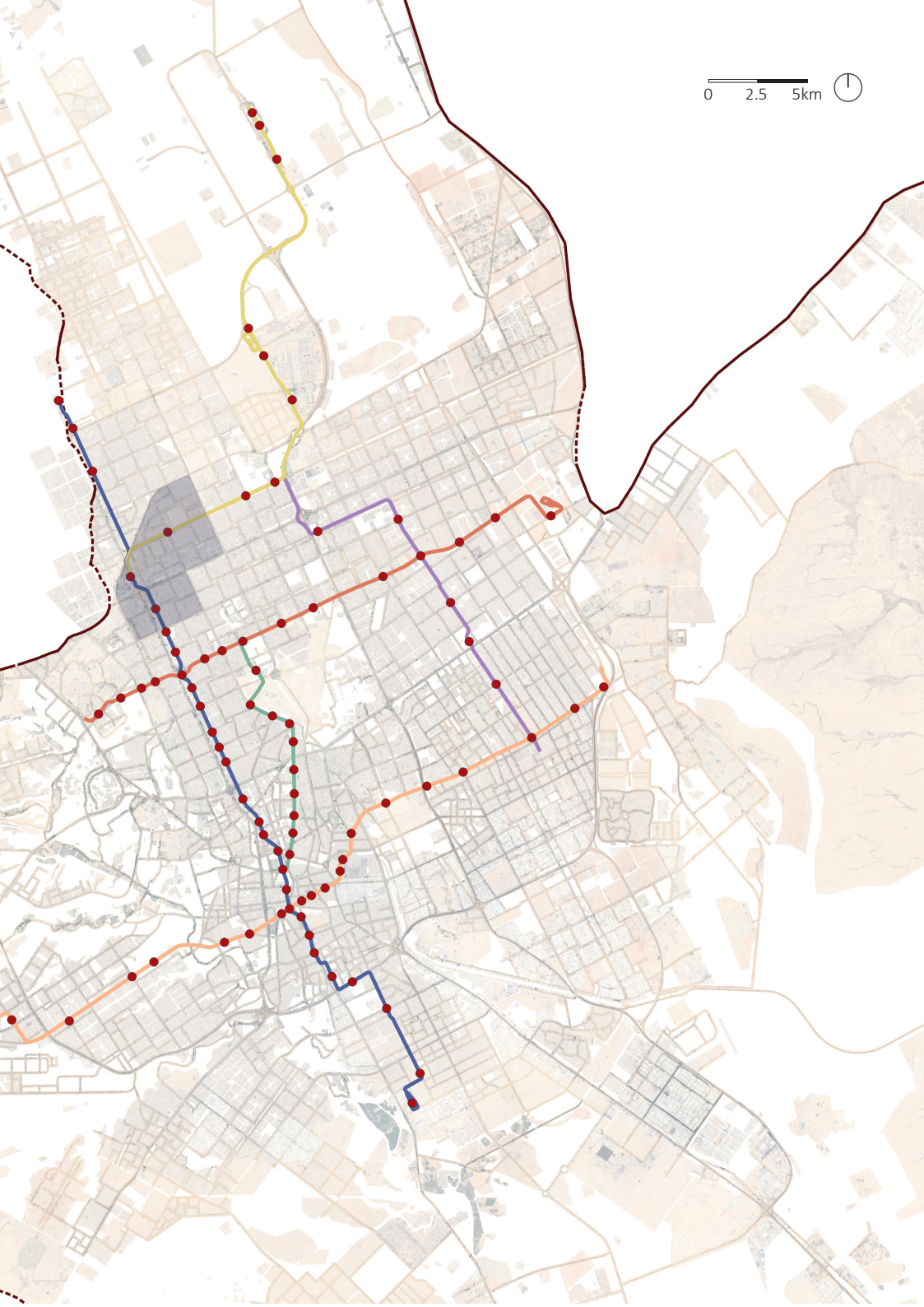
Questions 4, 5, and 6 required respondents to select five essential attractions and services within a 5-minute, 10-minute, and 15-minute range, respectively. A total of 22 options were provided for each question, and the results were as follows:

- Within a 5-minute radius, the most frequently selected option was "Parks", followed by "Supermarket", "Pharmacy", "Mosque", and "Hospital" in descending order of preference.
- Within a 10-minute radius, the top choice was "Cafe", succeeded by "Bank", "Gym", "Restaurant", and "School", respectively.
- Within a 15-minute radius, respondents again favored "Cafe" the most, followed by "Bank", "Gym", "Restaurant", and "School" in that order.

TEST BED

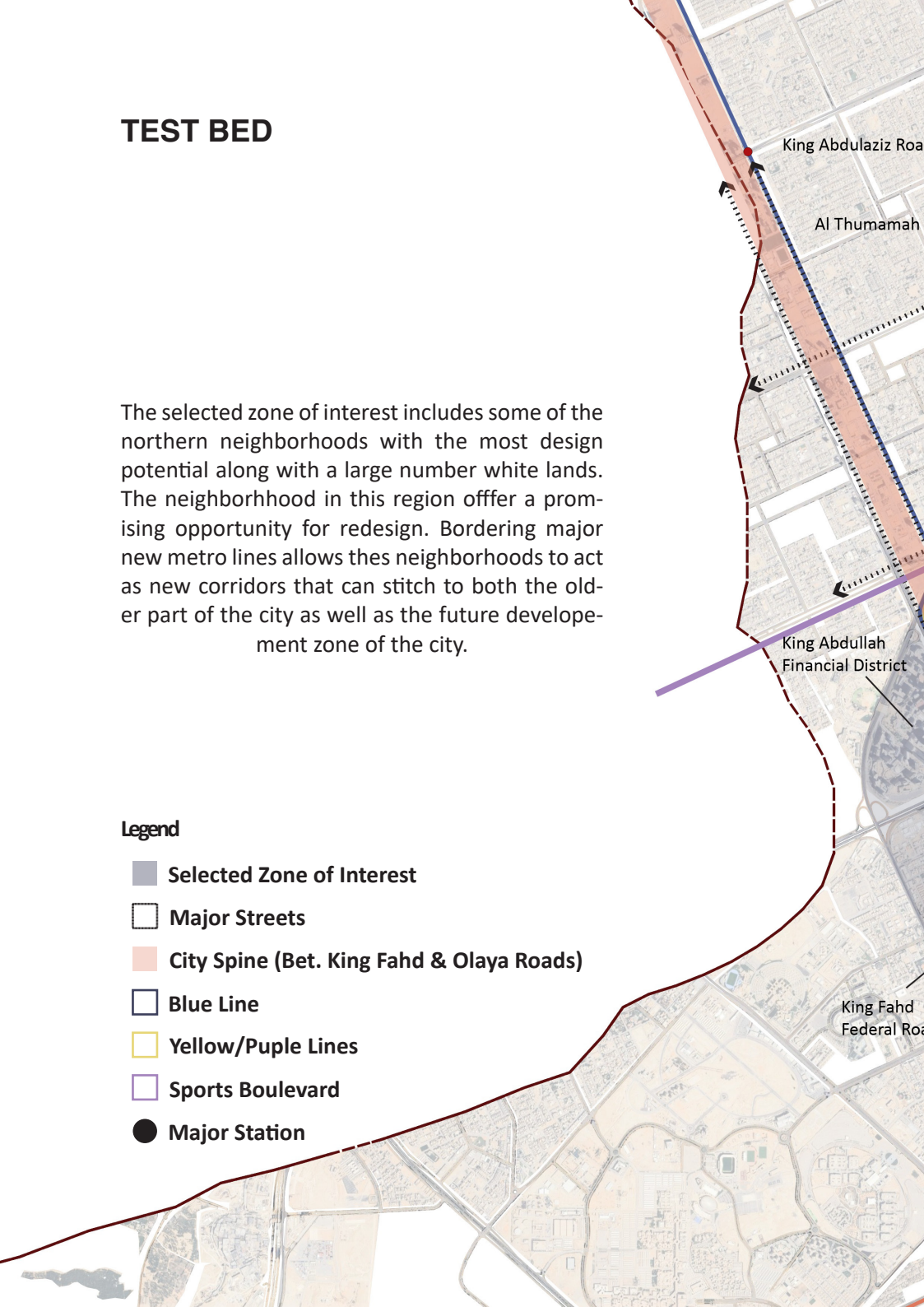
After a thorough anbalysis of the city of Riyadh, we found that the north has the most potential for redesign. The city's urban sprawl is tothe north due to the lack of natural barriers. The northern area is also where the Doxiades grid plan was implemented which primarily focused on car use. All of these factors make the northern area the best zone to redesign neighborhoods that can shape the future growth of the city.




0
2.5
5km

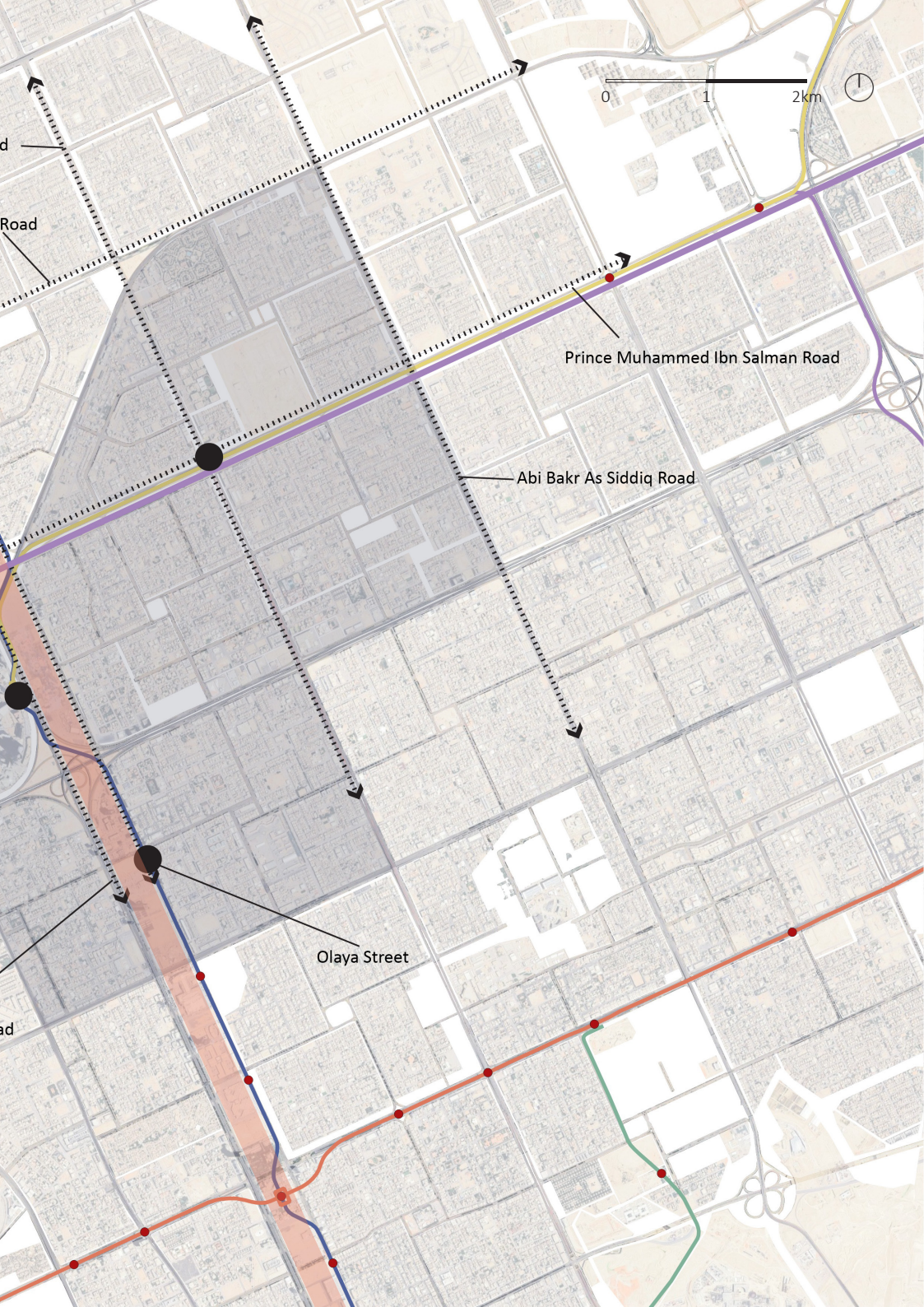
TEST BED

The selected zone of interest includes some of the northern neighborhoods with the most design potential along with a large number white lands. The neighborhhood in this region offfer a promising opportunity for redesign. Bordering major new metro lines allows thes neighborhoods to act as new corridors that can stitch to both the older part of the city as well as the future developement zone of the city.



Legend

- Selected Zone of Interest
- Major Streets
- City Spine (Bet. King Fahd & Olaya Roads)
- Blue Line
- Yellow/Puple Lines
- Sports Boulevard
- Major Station


0
1
2km
Road
Prince Muhammed Ibn Salman Road
Abi Bakr As Siddiq Road
Olaya Street

EXISITNG SERVICES

In Riyadh, the capital city of Saudi Arabia, the placement of essential services on the outskirts of neighborhoods has inadvertently fostered a car-dependent culture. This is primarily due to the fact that these services, although crucial, are situated at such distances that make them practically inaccessible without the use of a car. This urban design strategy, while seemingly efficient in theory, has significant implications in practice. It not only promotes car dependency but also contributes to increased traffic congestion, environmental pollution, and a decline in physical activity among residents.

Legend

- **Commercial/Entertainment**
- **Green Spaces**
- **Hospitals**
- **Mosques**
- **Education**

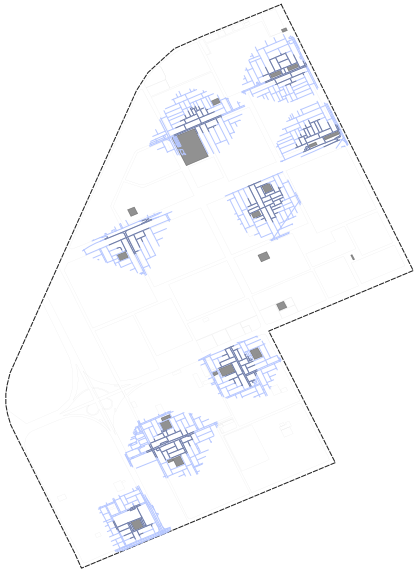
EDUCATIONAL

The educational sector in this specific zone encompasses universities, schools, and learning centers. Notably, this area is characterized by a high concentration of public schools, situated in close proximity to each other.

Legend

5-Min Walking

10-Min Walking



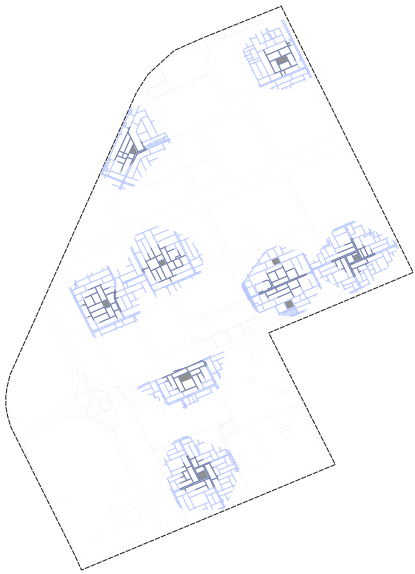
GREEN SPACES

The green spaces within the zone are primarily composed of small vacant plots, a byproduct of road intersections. Their scattered placement and inadequate size make them less accessible to neighborhood residents, thereby limiting their utility and reach.

Legend

5-Min Walking

10-Min Walking



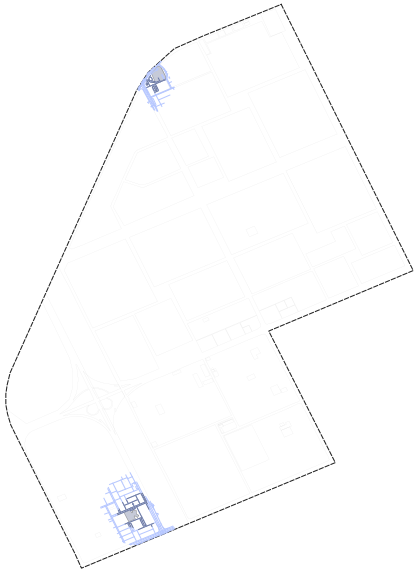
HOSPITALS

Hospitals within the zone are notably sparse and widely dispersed. While this may be manageable in a city primarily designed for car travel, it poses significant challenges for pedestrian access due to the substantial barriers created by roadways between districts.

Legend

5-Min Walking

10-Min Walking



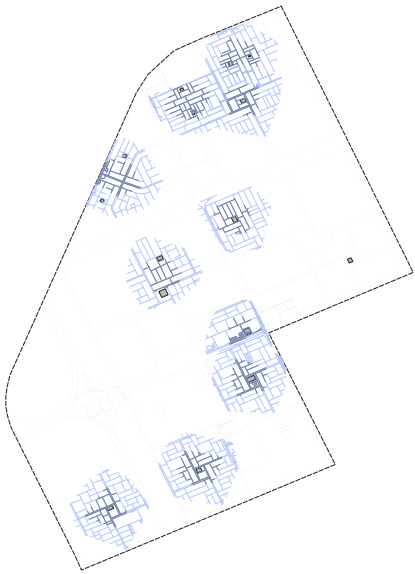
MOSQUES

Mosques, integral to Saudi and Islamic cultures, are typically abundant to cater to a large number of residents. However, their accessibility is compromised by road barriers and the absence of an adequate streetscape.

Legend

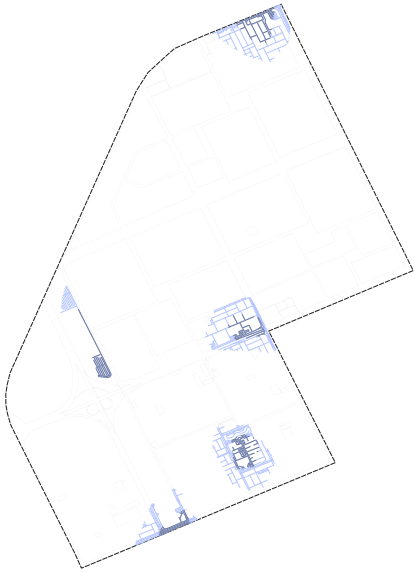
5-Min Walking

10-Min Walking



ENTERTAINMENT

The entertainment category encompasses shopping areas and activity centers. These facilities are typically clustered and spaced apart, thereby promoting car usage for accessibility.



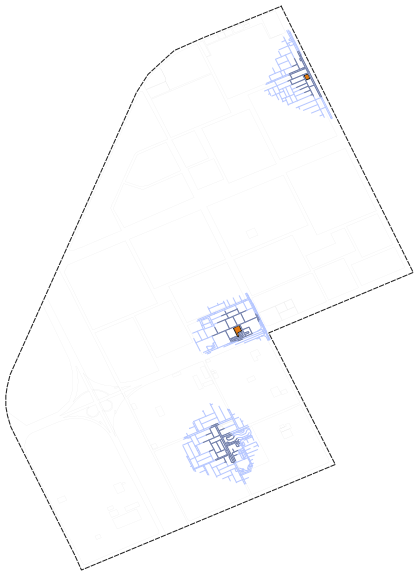
Legend

5-Min Walking

10-Min Walking

SUPERMARKETS

Supermarkets, similar to entertainment zones, are typically large-scale establishments spaced significantly apart from each other. This spatial arrangement necessitates the use of cars for accessibility.



Legend

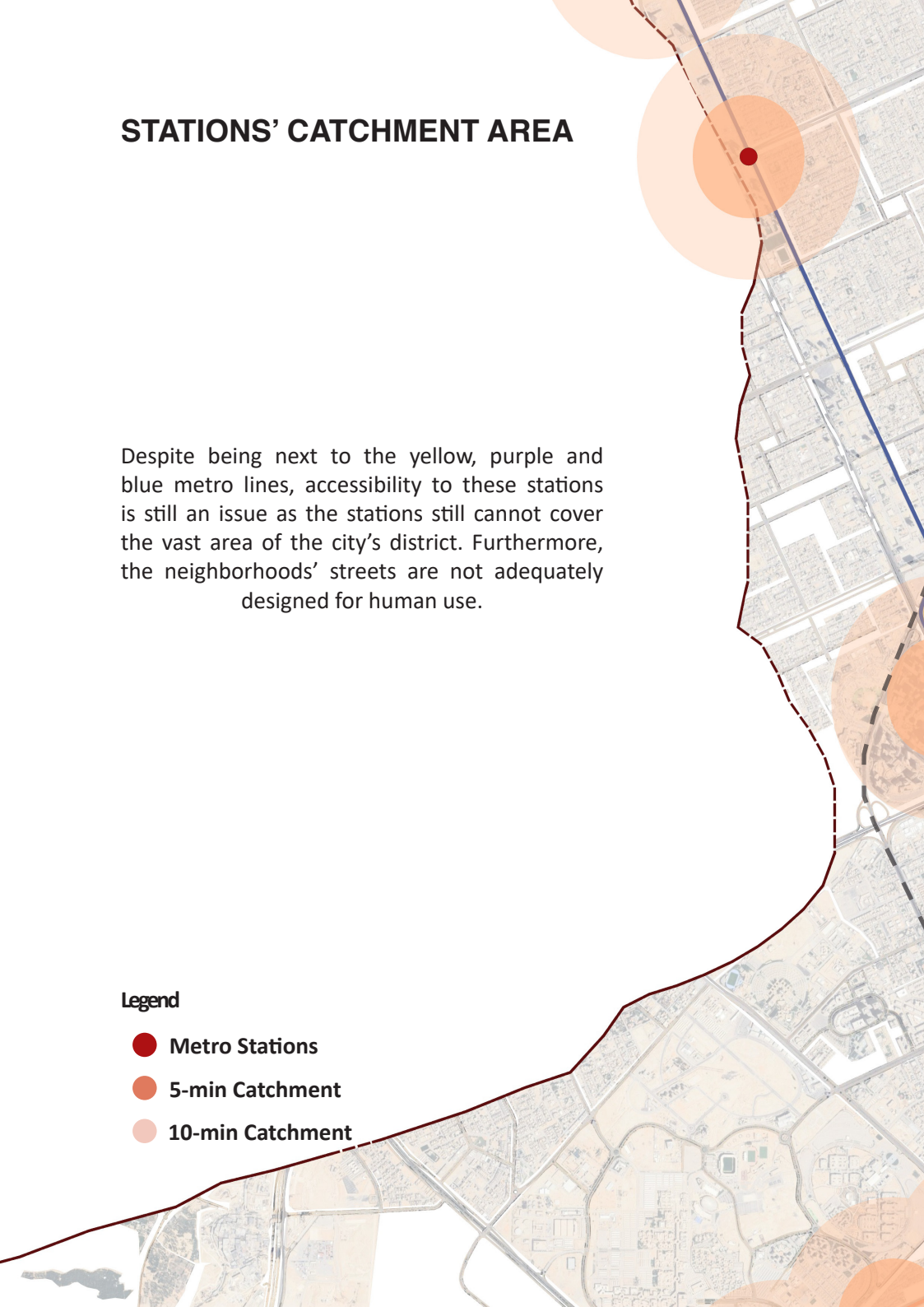
5-Min Walking

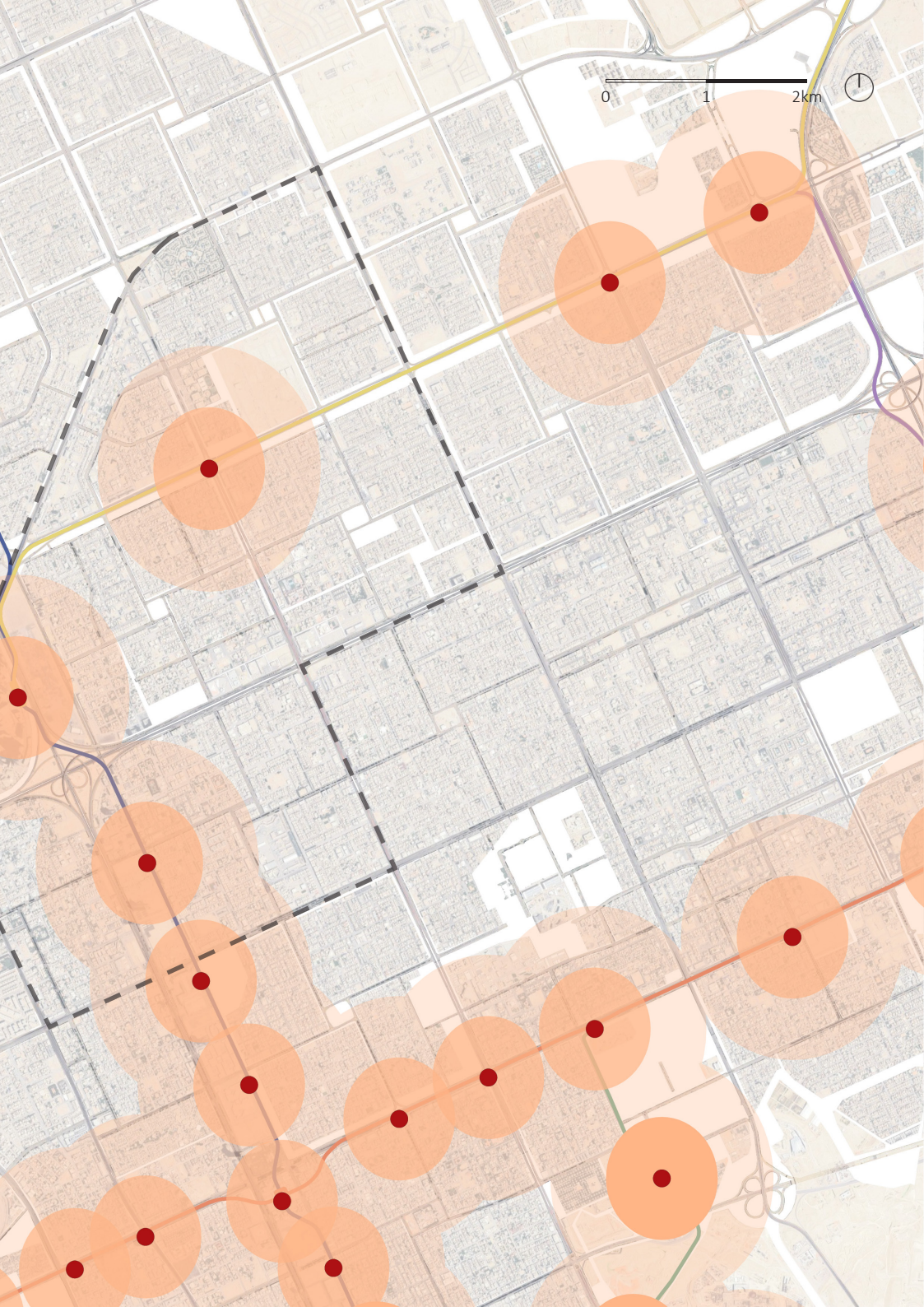
10-Min Walking

ALL SERVICES

STATIONS' CATCHMENT AREA

Despite being next to the yellow, purple and blue metro lines, accessibility to these stations is still an issue as the stations still cannot cover the vast area of the city's district. Furthermore, the neighborhoods' streets are not adequately designed for human use.

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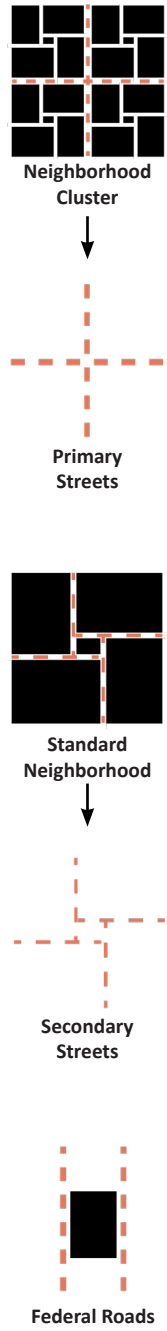
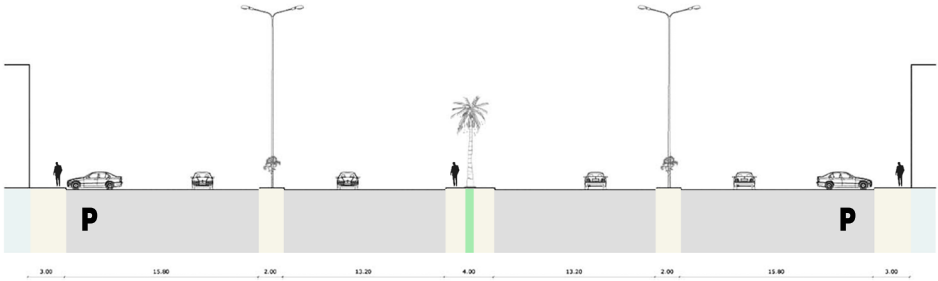
1
2km

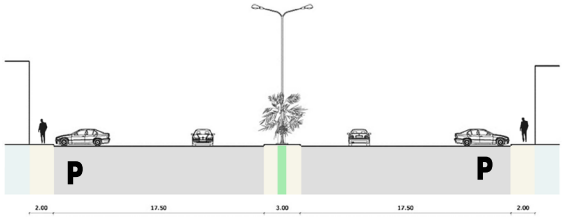
STREET TYPOLOGIES

As previously stated, the Doxiadis masterplan is predicated on a grid of 2km x 2km neighborhoods. This grid engenders various street typologies, each serving distinct functions. Primary streets, situated between neighborhood clusters, facilitate vehicular movement. Secondary streets, located within the neighborhoods, provide access to different blocks. Federal roads, which are considerably wider, interconnect all these neighborhoods and bind the city together. As evident from the street sections, these streets were primarily designed for automobile use, offering minimal to no amenities for pedestrian use.

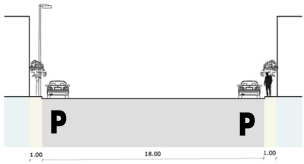




Typical cross section of Federal Roads



Typical cross section of Primary Roads



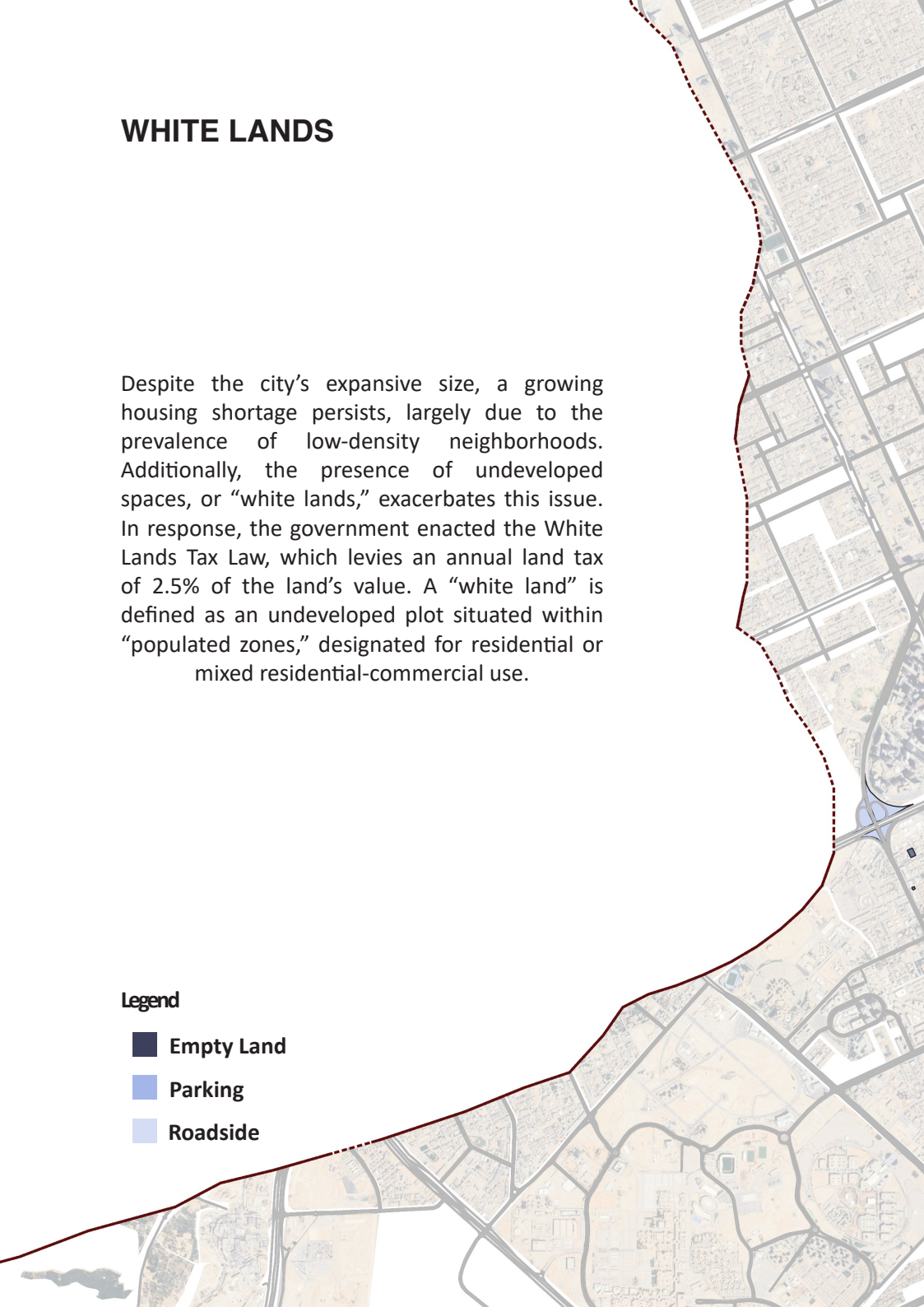
Typical cross section of Secondary and Tertiory Roads

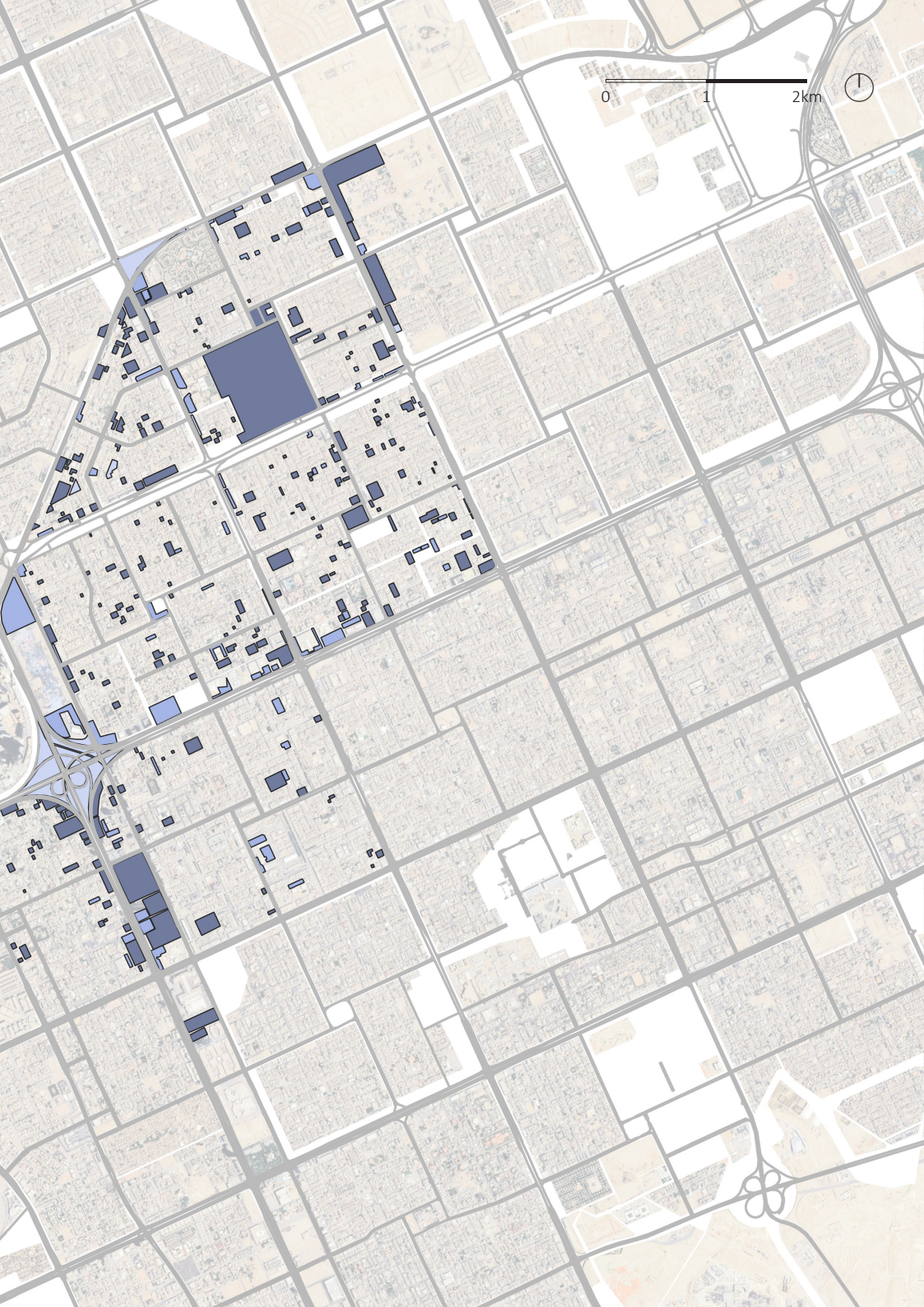
	Designed Sidewalk	Bike Lane and Paths	Bus Lanes and Sheltered Stations	Crosswalk with Pedestrian Refuge	Curb Cuts and Ramps	Lower Traffic Speed	Landscaping
Federal Roads	Present	Not Present	Not Present	Present	Present in some streets	Not Present	Present
Primary Roads	Present	Not Present	Not Present	Present	Not Present	Not Present	Present
Secondary Roads	Not Present	Not Present	Not Present	NA	Not Present	Not Present	Limited
Tertiary Roads	Not Present	Not Present	Not Present	NA	Not Present	Not Present	Limited

Source: Applying complete streets concept in Riyadh, Saudi Arabia: opportunities and challenges.pdf

WHITE LANDS

Despite the city's expansive size, a growing housing shortage persists, largely due to the prevalence of low-density neighborhoods. Additionally, the presence of undeveloped spaces, or "white lands," exacerbates this issue. In response, the government enacted the White Lands Tax Law, which levies an annual land tax of 2.5% of the land's value. A "white land" is defined as an undeveloped plot situated within "populated zones," designated for residential or mixed residential-commercial use.

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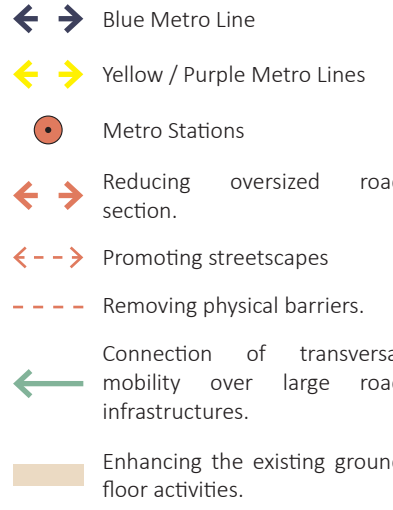
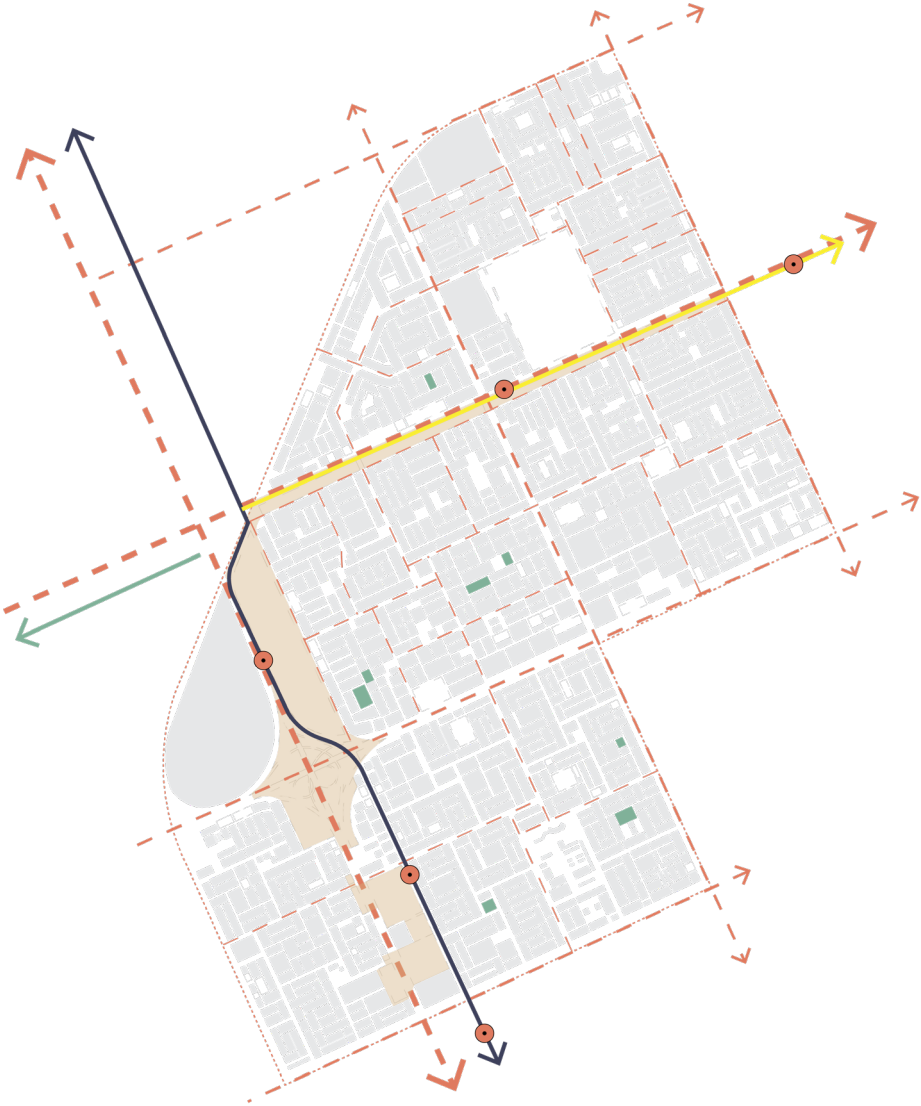
Legend:



REGENERATION STRATEGY

Our regeneration strategy centers on re-envisioning the existing city features and re-evaluating methods to enhance their appeal and accessibility to a broader populace. This is achieved by redesigning and interconnecting spaces that were previously segregated, thereby eliminating urban barriers and establishing corridors that reintroduce people to the streetscape and challenge the dominance of cars. Furthermore, we propose reducing the dimensions of major streets to mitigate the discomfort they may impose on pedestrians.



Legend:


Blue Metro Line

Yellow / Purple Metro Lines


Metro Stations

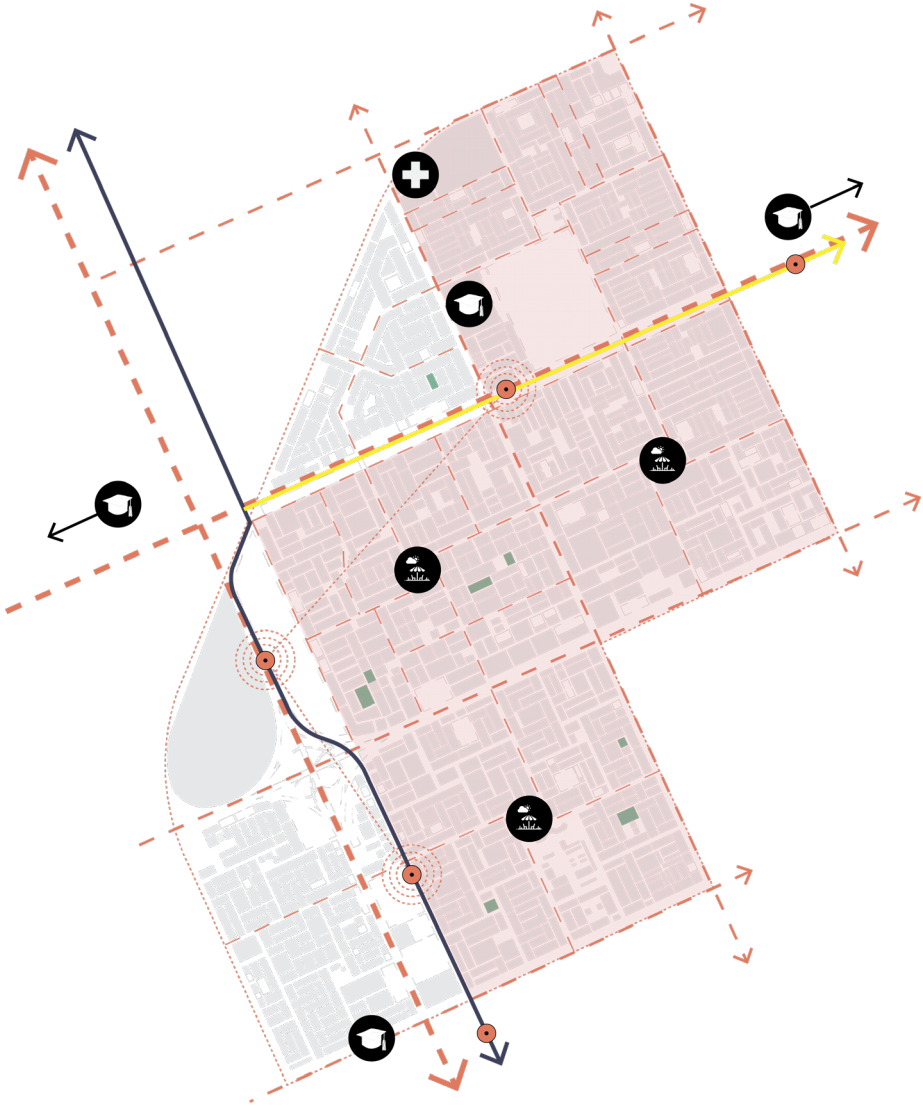

Changing road network and building functions.


Enhancing accessibility to metro stations and BRT stops.


Connecting major existing functions and implementing new ones.

INTEGRATION STRATEGY

Our integration strategy emphasizes the interconnection of neighborhoods through the implementation of design solutions. These solutions aim to link neighborhoods with each other and with major services in their vicinity. This is achieved by re-envisioning the entire neighborhood plan to enhance services and accessibility within these districts. Furthermore, we prioritize access to major metro stations, enabling residents to reach destinations outside their districts without the necessity of a private vehicle. By reimagining the neighborhood plan, we are not just improving the present, but also shaping the future.



Legend:

Blue Metro Line

Yellow / Purple Metro Lines

Metro Stations

Defining new pedestrian paths and bike lanes.

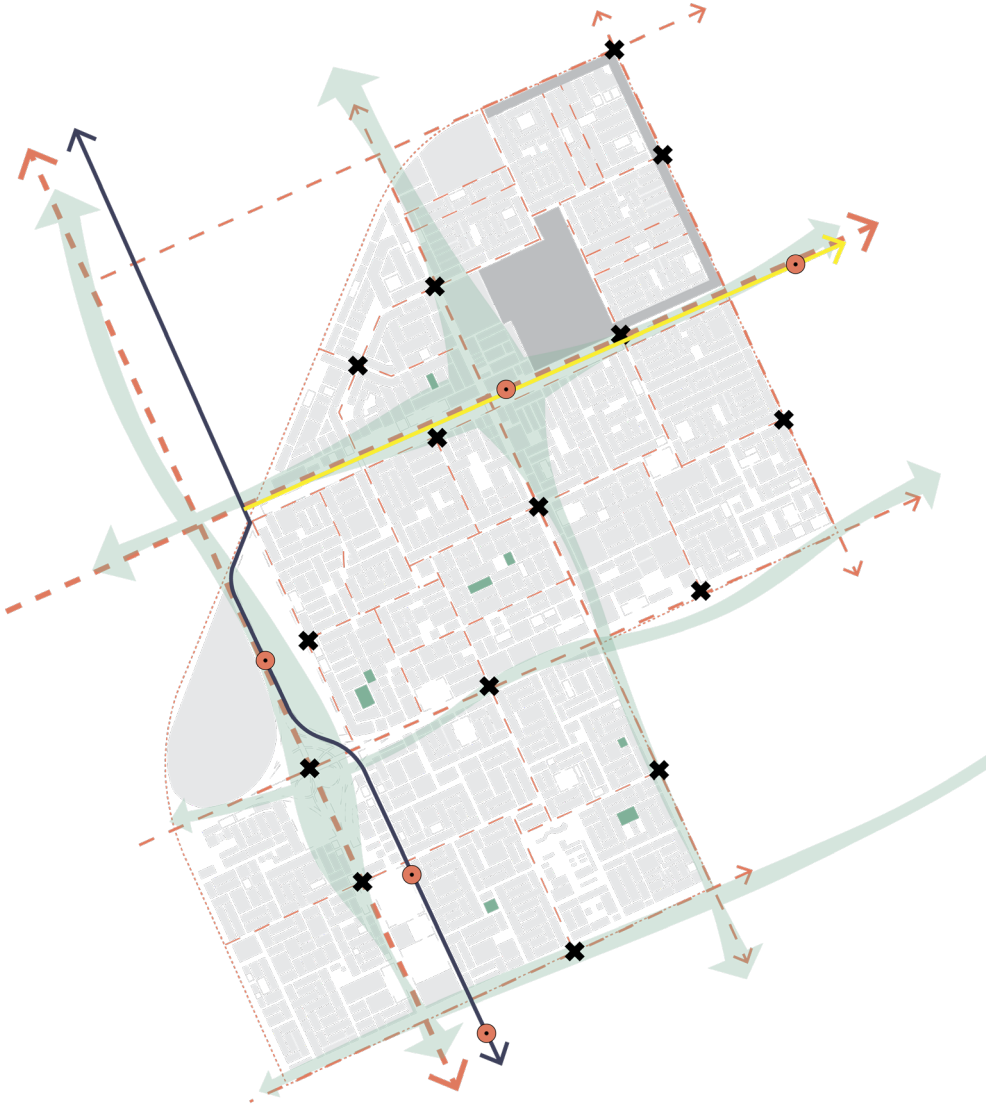
implementing new crossing zones.

Creating and ecological corridor

Making use of existing white lands and creating points of interest.

ADDITION STRATEGY

Our addition strategy is centered on leveraging the abundant vacant spaces within the zone to establish additional points of attraction within each district. We aim to enhance the city's walkability by introducing more comprehensive sidewalks, thereby encouraging soft mobility throughout the city. In alignment with the city's vision of transforming Riyadh into a greener city, we propose the creation of ecological corridors. These corridors serve the dual purpose of cooling the city and enhancing the aesthetic appeal of each space.



OVERALL STRATEGY

By executing our strategies of regeneration, integration, and addition, we can facilitate a profound transformation within the city of Riyadh. This transformation is conceived from a resident-centric perspective, ensuring that the needs and experiences of the city's inhabitants are at the forefront of urban planning efforts. We are creating neighborhoods that are resilient, adaptable, and ready to meet the evolving needs and aspirations of their residents. This forward-thinking approach ensures that our city becomes vibrant, dynamic, and inclusive for generations to come.

Legend:

Blue Metro Line

Yellow / Purple Metro Lines

Metro Stations

Regeneration:

Reducing oversized road section.

Promoting streetscapes

Removing physical barriers.

Connection of transversal mobility over large road infrastructures.

Enhancing the existing ground floor activities.

Integration:

Changing road network and building functions.

Enhancing accessibility to metro stations and BRT stops.

Connecting major existing functions and implementing new ones.

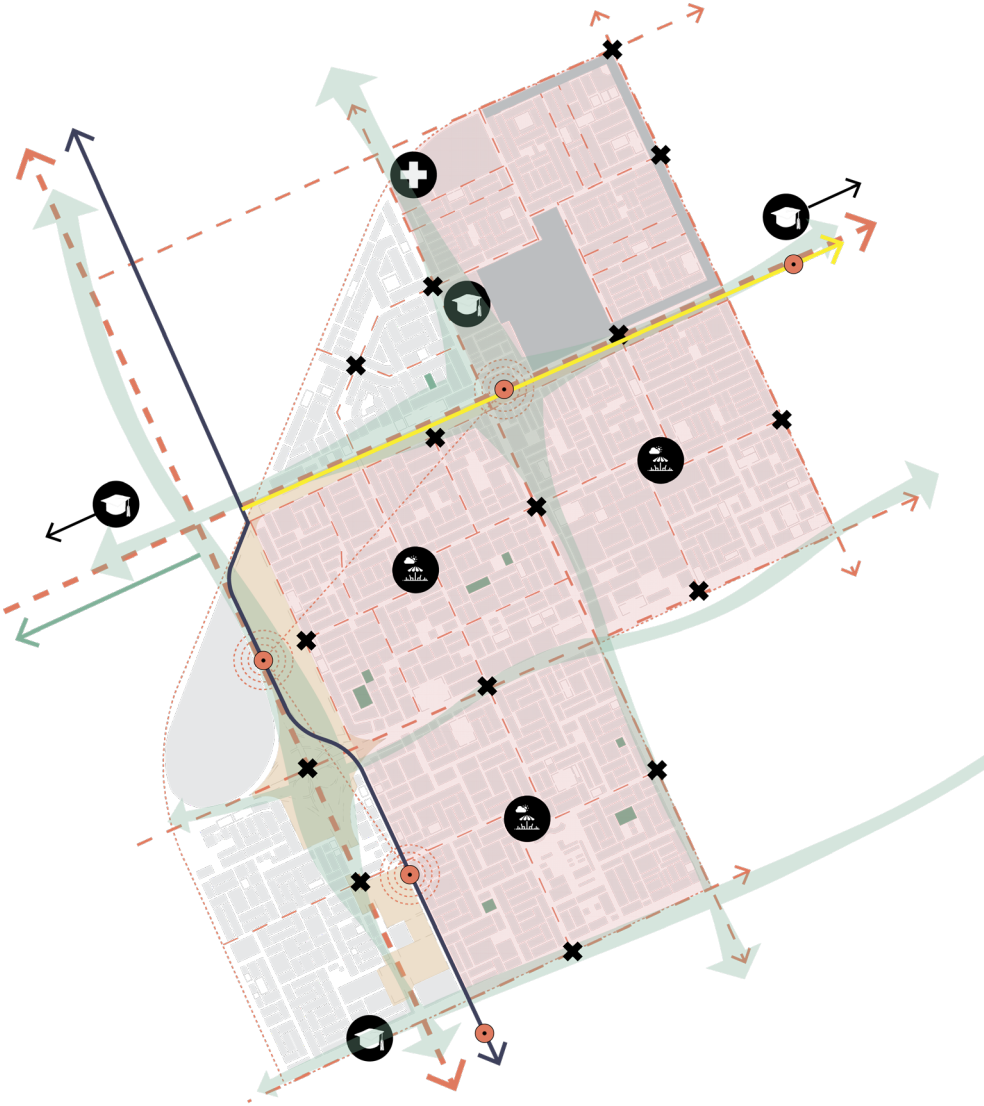
Addition:

Defining new pedestrian paths and bike lanes.

implementing new crossing zones.

Creating and ecological corridor

Making use of existing white lands and creating points of interest.



POTENTIAL STAKEHOLDERS

Given the strategic importance of the test bed's location in relation to major attractors, numerous companies could potentially become stakeholders in the execution of this project. The accessibility of these attractors could significantly influence the interest and investment of these companies, making them integral to the project's success. Their involvement could range from providing financial support to offering expertise and resources, all contributing to the effective implementation of the project. The following are key potential stakeholders that are strategically located in proximity to the project zone.

King Abdullah Financial District.

King Saud University

Saudi German Hospital

Al Rajhi Bank

Riyadh Gallery Mall

Riyadh Park Mall

Dallah Clinics

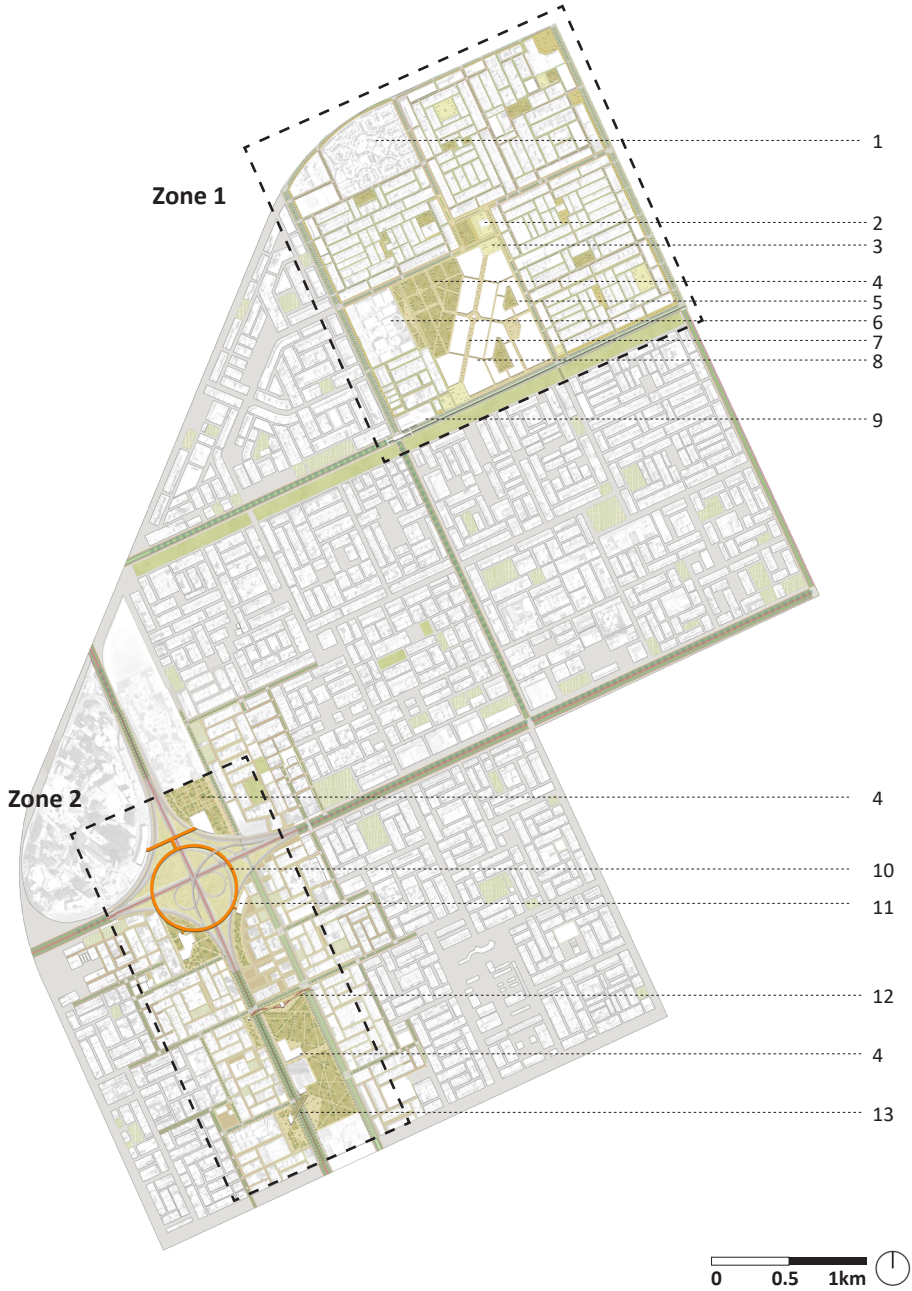
Panda Supermarkets

Legend:

1. Kingdom Hospital
2. District Central Mosque
3. Urban Plaza
4. Public Park
5. Entertainment Zone
6. Kingdom School
7. Pedestrian Boulevard
8. Conmmercial Center
9. Major Metro/BRT Station
10. Ring Skywalk
11. Commercial Building/ Ring Access
12. Transversal Soft Mobility Bridge
13. Main Pedestrian Bridge

MASTERPLAN

While our proposed concepts are applicable throughout the city of Riyadh, we have identified specific zones for initial implementation, serving as a foundation for city-wide application. Zone 1 is Al Rabi' district, located in the northern part of the test bed. The design reconfigures the neighborhood structure, encompassing changes in street functions and land use. Zone 2 is situated within the city's main administrative spine, linking the Al Nakhil and Al Muruj districts, and includes the major intersection between King Fahd Road and the Northern Ring Road. This zone emphasizes the interconnection between different city parts.


Zone 1
Zone 2
1
2
3
4
5
6
7
8
9
4
10
11
12
4
13
0
0.5
1km

Source: Haitham Alfalah

- Chapter 6 -

منطقة ال10 دقائق

A 10-MIN DISTRICT

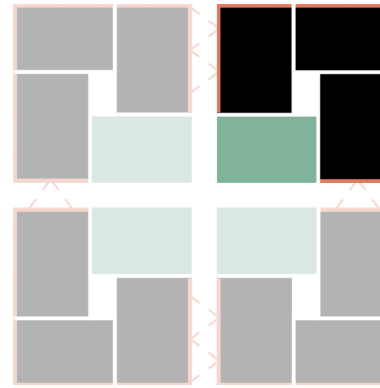
The grid established by the Doxiadis plan resulted in 2km x 2km neighborhoods, primarily designed with a car-centric focus. Our design for this zone delves into the potential and methodologies of creating a 10-minute district within Riyadh's existing climatic conditions. This approach maintains the city's unique identity while ensuring necessary services are within accessible reach. In the context of Riyadh, this involves a careful reevaluation of the existing urban fabric, taking into account the city's unique climatic conditions and cultural identity. The design strategy aims to boost walkability, add green spaces, and diversify land uses in each neighborhood, encouraging residents to opt for walking or public transportation over cars.

NEIGHBORHOOD CLUSTER PROPOSAL

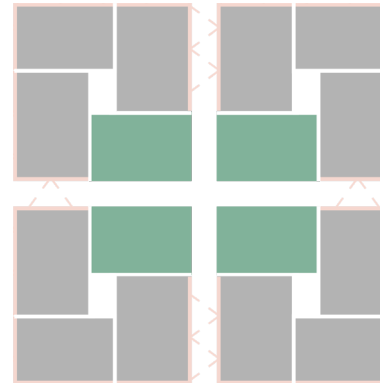
The Doxiadis Plan created a grid layout for Riyadh that shaped the neighborhoods of the city into 2 km squared spaces bordered by primary roads that have been made wider throughout the years. The landuse of these neighborhoods has been dominated by low-density residential buildings which was one of the main factors of the urban sprawl of the city. To enhance the neighborhood design, we have to start from a larger scale that forms the neighborhood clusters and reimagine the borders where these neighborhoods meet.

In the current layout, the primary roads within the neighborhoods disect it into 4 sub-neighborhoods of around 1km squared each. The perimeter of these neighborhoods should have services and open spaces that stitch them together and one of these sub-neighborhoods can be dedicated to services that are curtrently lacking in that neighborhood. Using the secondary roads, these sub-neighborhood can be further diseceted into smaller blocks that are more relevant to the human scale.These blocks can then act as superblocks with limited car access for a less poluted living space that further incentivises modal change within the city. The streets and plots within these blocks should be designed from a human-focused approach.

Primary roads split the Neighborhood into 4 blocks.

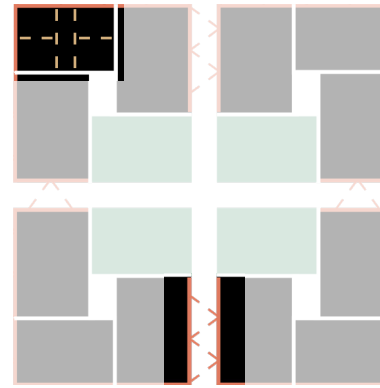


A corner block of each neighborhood is focused on providing services



Secondary roads split residential blocks into smaller superblocks.

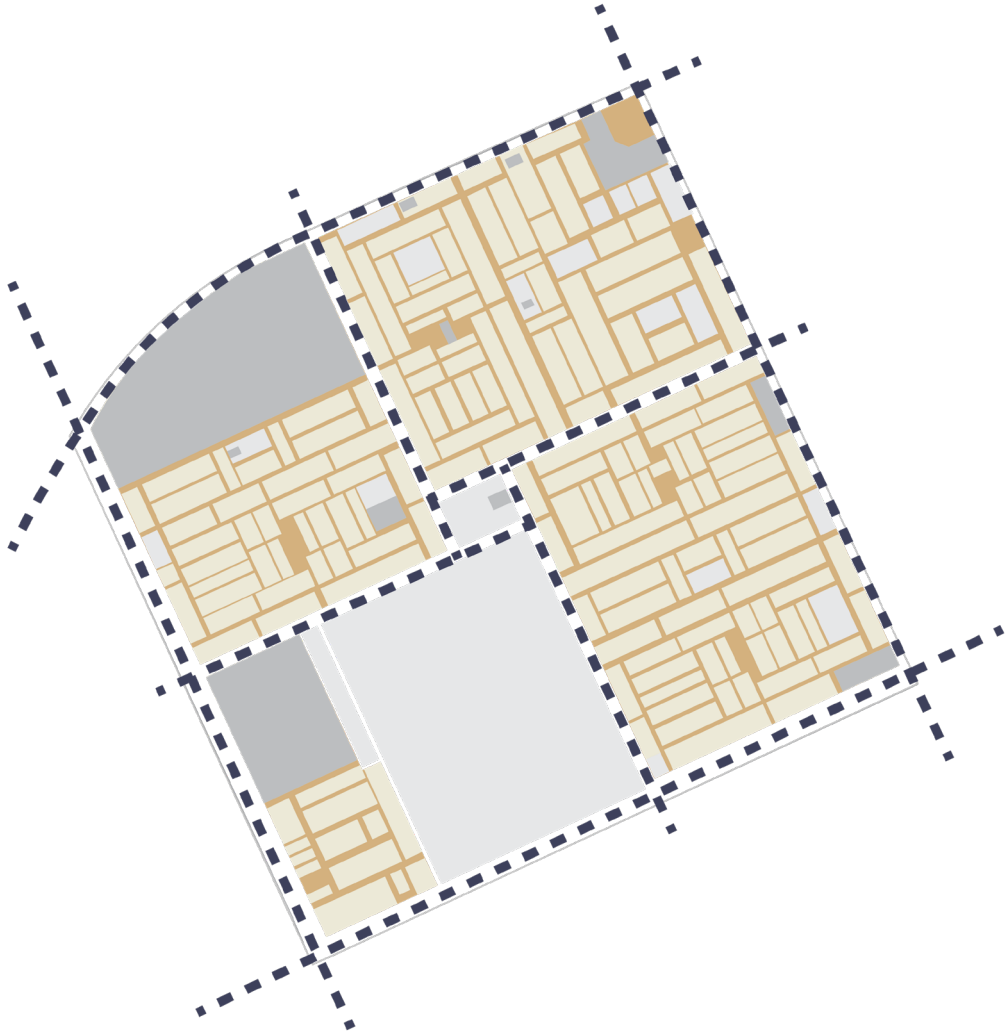
Service perimeter buildings stitch neighborhood blocks together.



EXISTING CONDITION

The present condition of the Al Rabi' district manifests as a concrete metropolis. it is predominantly occupied by residential structures, with a handful of services situated along the periphery. The Whitelands Act, as previously mentioned, exacerbates this issue by incentivizing individuals to construct additional residential spaces on their vacant lands, thereby significantly contributing to the city's urban sprawl. This compels residents to traverse extensive distances to reach their intended destinations, thereby promoting the use of automobiles.

The mobility issue originates from within, commencing with the abundant secondary and tertiary streets, which lack a distinctive identity that differentiates them from one another. A significant number of these streets remain vacant and underutilized for the majority of the day. Moreover, they are devoid of any form of intersections, shading, or vegetation. These streets converge onto the primary streets, which are even broader more challenging to transverse. This composition poses a significant issue for the city's districts. However, the substantial amount of vacant spaces in each neighborhood presents a considerable opportunity for transformation.


Residential
Services
Vacant
Primary Roads
Secondary & Tertiary Roads

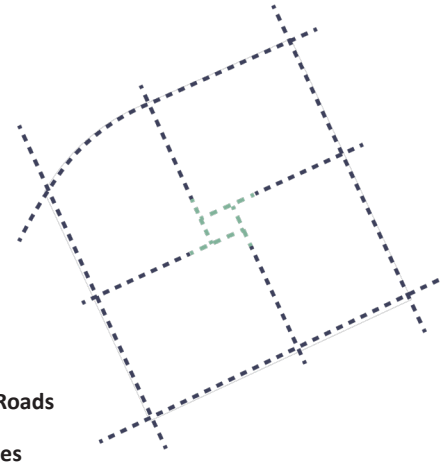
PROPOSED STREET HEIRARCHY

The proposed redesign of the districts commences with a comprehensive understanding of the roles of each street type and a redefinition of their hierarchy. This transformation originates from the primary streets, which stem from the federal roads and partition the neighborhood into four quadrants.

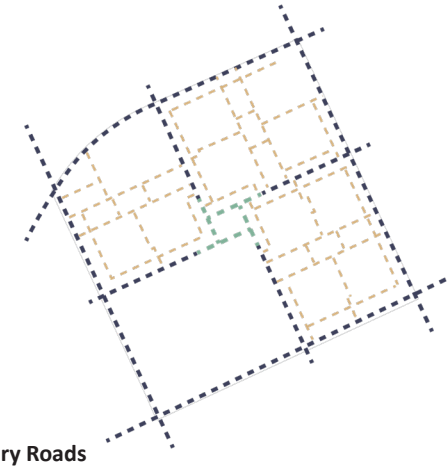
Secondary streets further dissect these quadrants into smaller blocks, facilitating cross-circulation within the neighborhood without necessitating exit and re-entry. Local streets within these smaller blocks enable resident movement on a scale that is more conducive to pedestrian walkability, particularly in the context of Riyadh.

This approach not only enhances the functionality and accessibility of the neighborhoods but also fosters a sense of community among residents. By redefining the hierarchy of streets and promoting pedestrian-friendly design, we can create neighborhoods that are not only more livable but also more sustainable and resilient in the face of future challenges.

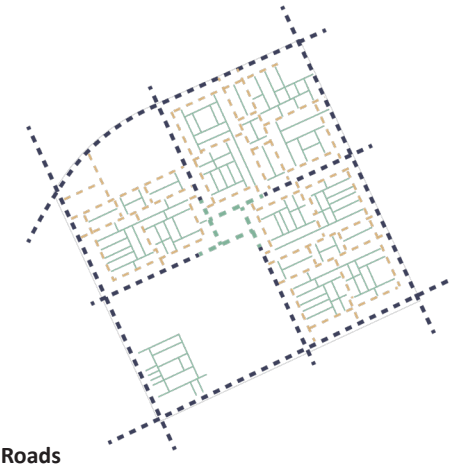
Primary Roads



Secondary Streets



Local (Limited Access) Streets

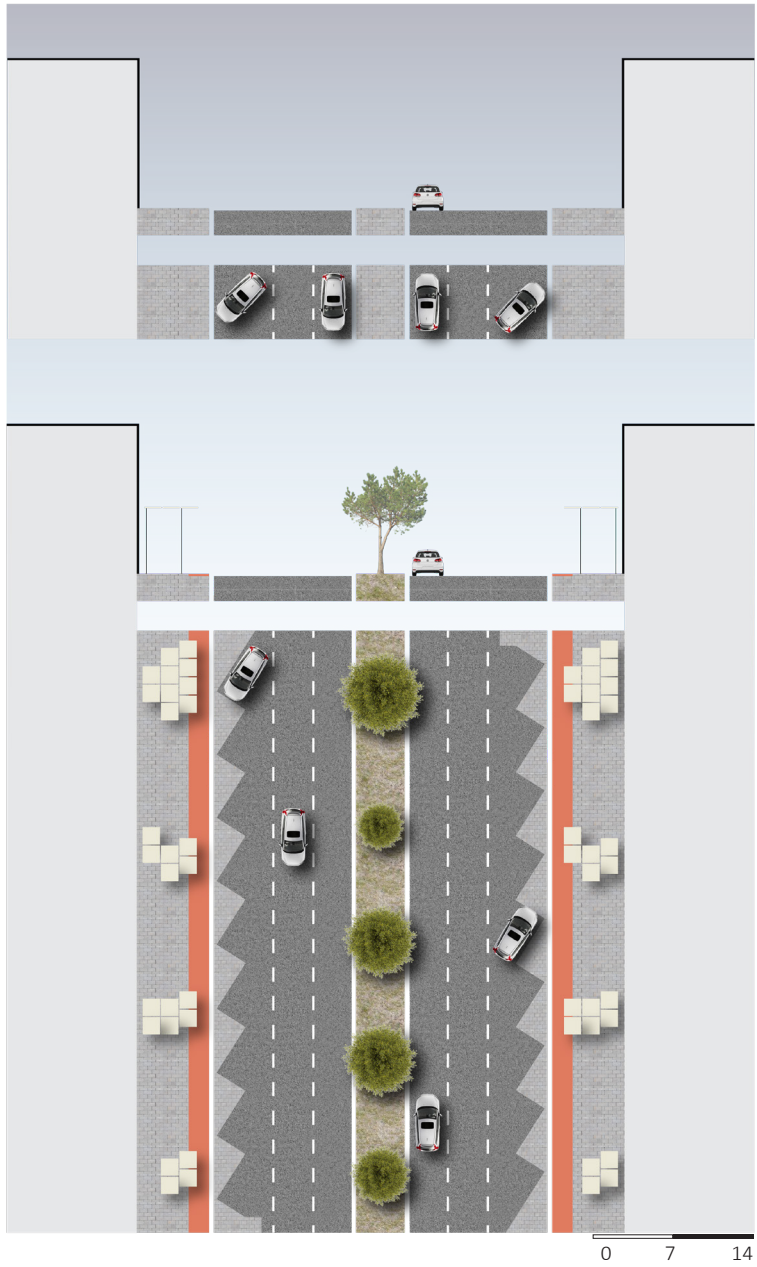


PROPOSED PRIMARY ROADS

Primary roads act as connections between several federal roads. They also marks the grid layout that forms most of the neighborhoods in the northern part of the city as well as roads that cut through these neighborhoods. These roads lack a pedestrian focused design, suffer from unplanned parking on the sides of the roads and lack any form of vegetation. This results in uninviting spaces that lack shading and forces the use of cars to access the services on their peremiter. Our proposal to redesign these roads start from the sidewalks where we rethought the design by uncluttering the streets and adding shading elements along the street sides that act as areas of refuge from the harsh daytime sun. Integrated into these light colored, textile shadings are water-mist elements, commonly used in other locations aroound the city, to help combat the dry weather and cool off people. Under these shadings are dedicated cycling lanes that make better use of the sidewalk space. Parking is allowed on the sides of these roads as it acts as a waiting zone and is necessary as a part of this transition phase to accomodate people with special needs so we defined car spots for quick parking when needed. However, adding regulations to prevent prevent extended parking and organizing these waiting zones adds to the safety of the the sidewalk. In the central part of the road, the current fully paved barrier is to be transformed into a green island. Implementing this island is all primary roads can help in reducing the overall urban heat while providing a better and more unique asthetical value to each street. While only allowing the necessary carflow within the city, this redesign of primary streets introduces people to use the sidewalks to travel between common day to daay destinations and acts a transition phase to a more human focused streets design typology.

Before:

After:



PROPOSED SECONDARY STREETS

Secondary streets have the potential to facilitate the majority of journeys within a neighborhood. The objective of revamping these streets is to render them more hospitable to residents by offering an array of amenities and attractions that foster a more sociable environment.

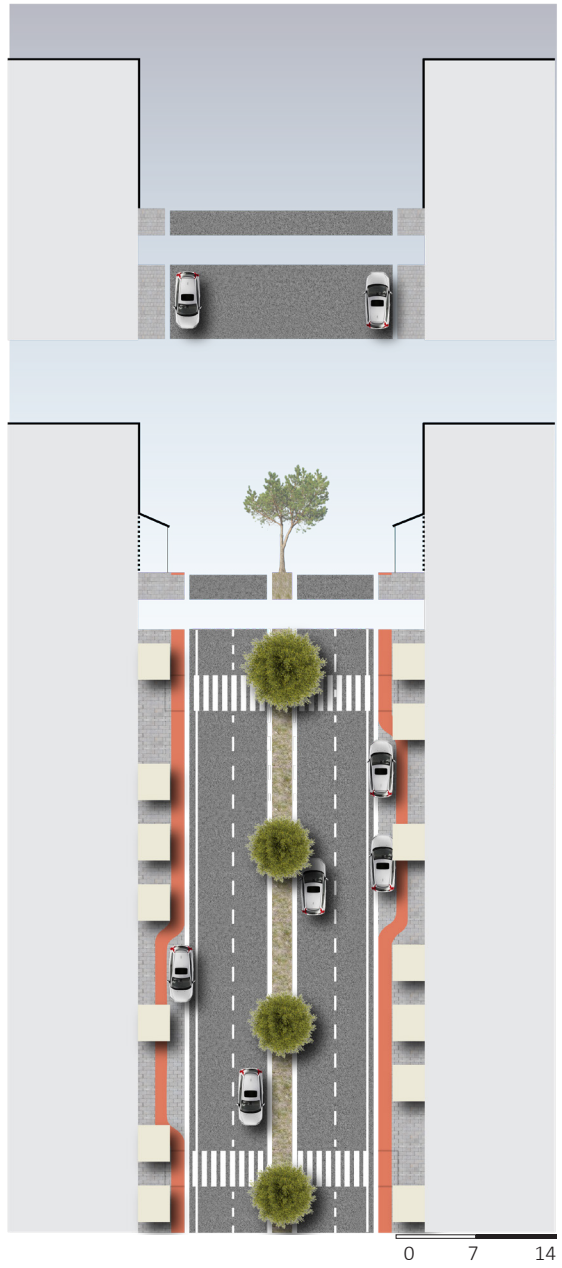
The reimagining of these streets commences with the buildings that line them. Transitioning these structures from predominantly residential to mixed-use can provide essential services and attractions at the ground level, obviating the need to venture outside the neighborhood. Given the proximity of these attractions to residences, the necessity for a car would be largely eliminated. Local businesses would have the opportunity to evolve, and with each store providing a small awning, the majority of the secondary street sidewalks could be shaded during the intense summer days. These sidewalks would accommodate the cycling lanes that connect to both the primary and tertiary streets.

In addition to the change in building land uses, the streets could be enhanced to cater to all types of individuals by increasing the number of passing points throughout the street and incorporating ramps to ensure hassle-free crossing for wheelchair users. The introduction of these elements also compels cars to decelerate, favoring pedestrians. Mirroring the primary streets, a verdant island adorned with local vegetation bisects the two sides of the street, contributing to the reduction of the overall urban heat.

Secondary streets further dissect district quadrants into smaller zones, facilitating the creation of areas that are more commensurate with the human scale.

Before:

After:



PROPOSED LOCAL STREETS

Tertiary streets, in their existing configuration, contribute to a substantial amount of underutilized space within each neighborhood. These streets are predominantly paved, with minimal to non-existent sidewalks, thereby prioritizing vehicular traffic and contributing to the issue of "car as an identity" discussed in previous chapters. Despite their designation, these streets are exceptionally wide and exhibit a similar composition across the majority of Riyadh's districts. The redesign of these streets is imperative and serves as the initial step towards facilitating a modal shift in the city's transportation paradigm.

Our vision is to transform them into secure residential spaces that discourage the use of cars. In the initial transition phase, these streets would be converted into limited access zones that only permit vehicular access to residents. This can be achieved by leveling the entire street for pedestrian use while maintaining a single car lane necessary for service access and for the residents of the area. The reamainder of the street space would be dedicated to pedestrian and cycling lanes on both sides. Regulations within these streets would favor pedestrian movement over vehicles by imposing speed limits on cars and granting priority to pedestrians.

Tertiary streets should be designed from a human perspective as social spaces primarily focused on creating a relaxing home environment. This begins with the incorporation of local vegetation on both sides of the street to create a cooler, more comfortable space. Furthermore, the lighting within these streets would primarily consist of short pole lights and lampposts aimed at illuminating a safe space for walking, rather than driving.

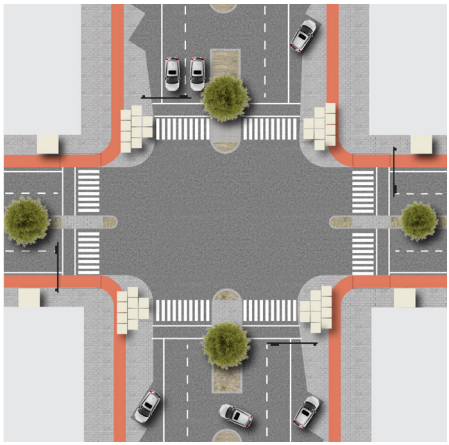
Before:

After:

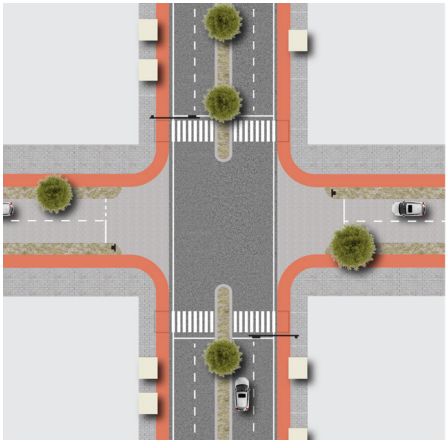
ROAD INTERSECTIONS

The hierarchy among various street typologies extends to their intersections. Intersections between primary and secondary streets necessitate traffic light stops due to their larger dimensions and faster traffic. For secondary and tertiary streets, priority is accorded to secondary streets, with traffic lights controlling access to and from tertiary streets. Intersections between tertiary streets do not require traffic stops; a simple roundabout suffices to manage the flow at these intersections since these local streets, designed for both pedestrians and vehicles, are subject to speed limit regulations.

Primary Secondary Intersection



Secondary Tertiary Intersection



Tertiary Tertiary Intersection

LANDUSE INTERVENTIONS

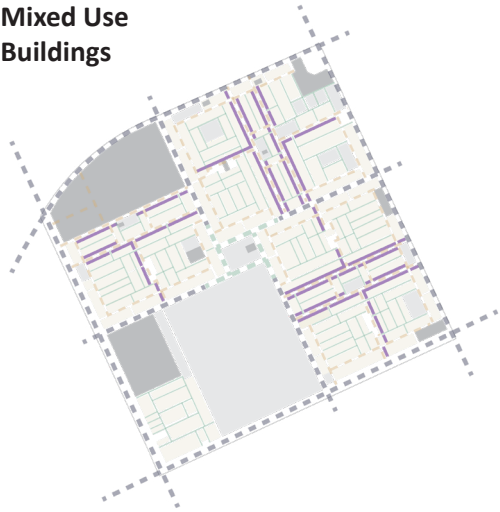
The second phase of the design intervention in Al Rabi' district involves a transformation in land use type and layout. This intervention commences at the local street level, maintaining strictly residential land uses in the surrounding areas while densifying the residential buildings within these blocks.

Adjacent to the secondary roads, we propose a mixed-use building typology that would foster local businesses and provide services in close proximity to residences. To ensure accessible amenities, we designate smaller vacant spaces within the district for public open spaces and community areas.

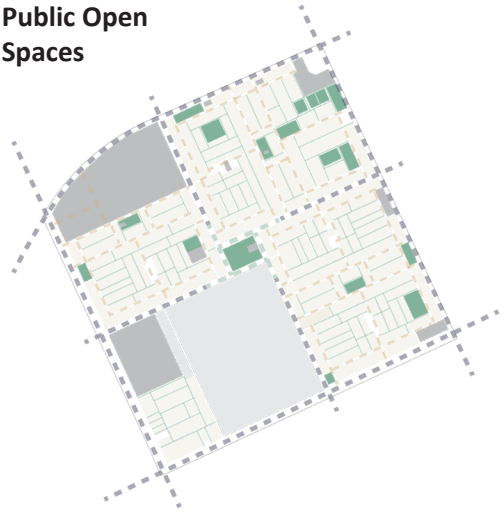
The southwestern quadrant of this district features a large vacant space, which we propose to utilize as the primary services and connectivity zone of the neighborhood.

Furthermore, we propose the implementation of additional services and office spaces in the building blocks on the neighborhood's perimeter. This would provide job opportunities within the neighborhood, eliminating the need for residents to travel outside for work.

Mixed Use Buildings

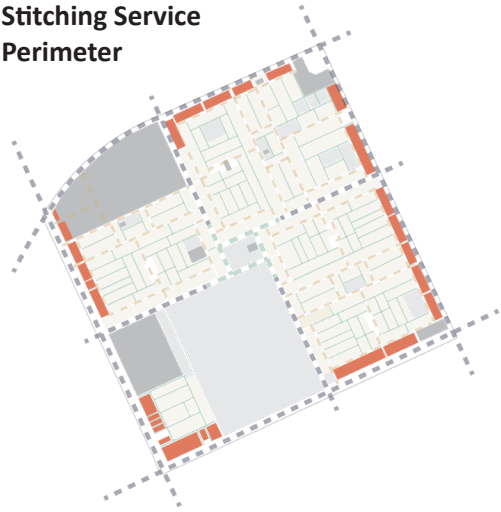


Public Open Spaces



Neighborhood Service Block

Stitching Service Perimeter



Residential

Services/Office

Open Air Facilities

Public Open Spaces

Metro Access

Mixed Use Zones

NEIGHBORHOOD DESIGN SCOPE

A 10-minute neighborhood should encompass all vital services and incentivize residents to opt for alternative transportation modes. Our proposal for the Al Rabi' district achieves this by leveraging the extensive vacant space in the southwestern quadrant for direct access to the adjacent metro and BRT station. The access to the stations is through an underpass that can be accessed from the center of the avenue, shortening the visual distance to the stations. Various attractors are strategically located in this zone to draw people in, reducing the need for long-distance travel. This neighborhood prototype can be replicated to reshape the city structure.

M1 Major metro station for the Yellow Line and the Purple Line.

1 Metro underpass enterance points.

2 Open air shopping zone.

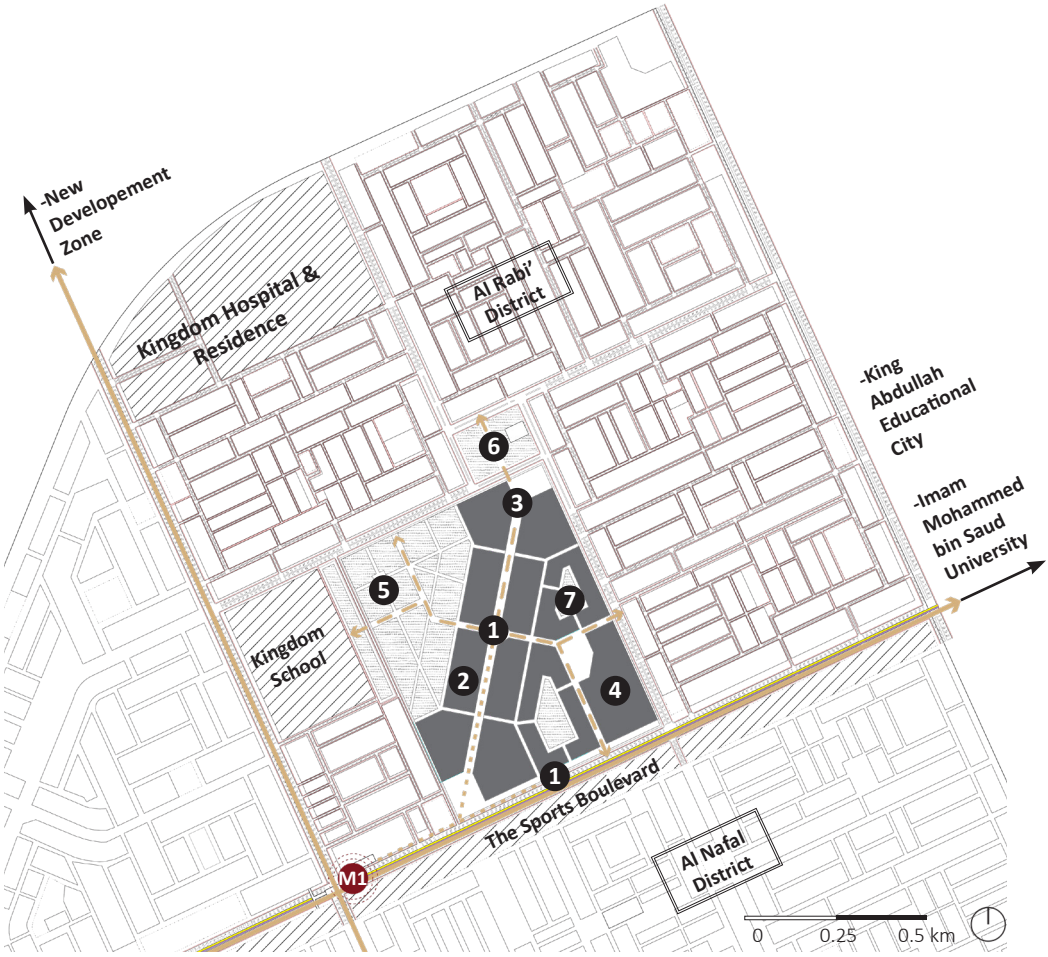
3 Pedestrian Avenue connecting all neighborhood blocks to the service zone.

4 Neighborhood supermarket directly accessible from both the current and adjacent neighborhoods.

5 Al Rabi' neighborhood park positioned on the innerside of the service zone.

6 Mosque front pop-up market in the slow intersection zone of the neighborhood primary roads.

7 A leisure and entertainment-point with a shaded courtyard for various outdoor activities.

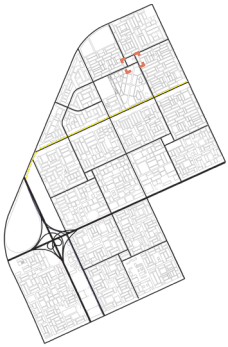

-New Developement Zone
Kingdom Hospital & Residence
Al Rabi' District
-King Abdullah Educational City
-Imam Mohammed bin Saud University
Kingdom School
The Sports Boulevard
Al Nafal District
M1
1
2
3
4
5
6
7
0
0.25
0.5 km

NEIGHBORHOOD MASTERPLAN

By conserving vacant spaces for communal use and social engagement, reducing street widths, and fostering pedestrian-friendly streets, our intervention cultivates a more vibrant neighborhood oriented towards people, not vehicles. This not only stimulates business opportunities and job creation, but also directly elevates residents' well-being and overall quality of life.

Key additions to the neighborhood include a public park serving the entire neighborhood, strategically located behind the Kingdom School for safe student access, a pop-up zone for street markets in front of the central mosque, and a plaza drawing people from the district's three quadrants into the avenue. The avenue, adorned with shopping and entertainment zones and featuring an underpass at its core for direct metro station access, further enhances the neighborhood's appeal.


0
0.25
0.5 km



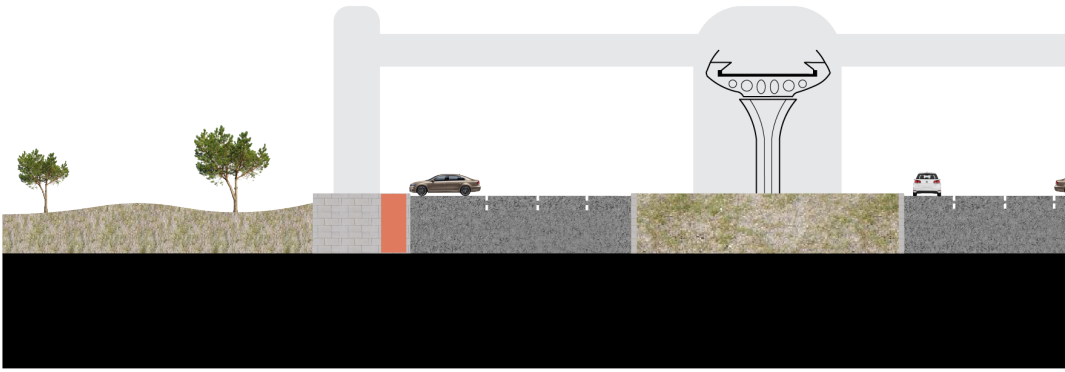
NEIGHBORHOOD CENTRAL SLOWZONE

Situated at the heart of the district is a mosque, presently encircled by an open expanse utilized for parking. Our proposed intervention envisions a transformation of this space, commencing with the introduction of a slow zone in the adjacent primary streets. This modification facilitates seamless circulation between the residential sector of the district and our newly introduced service zone. Given the mosque's role as a convergence point for the district's diverse populace, the surrounding space is earmarked for social interaction, accommodating pop-up markets, mobility hubs, and events. This redesign aims to foster community engagement and enhance the district's social fabric.


Central
Mosque
0
25
50m

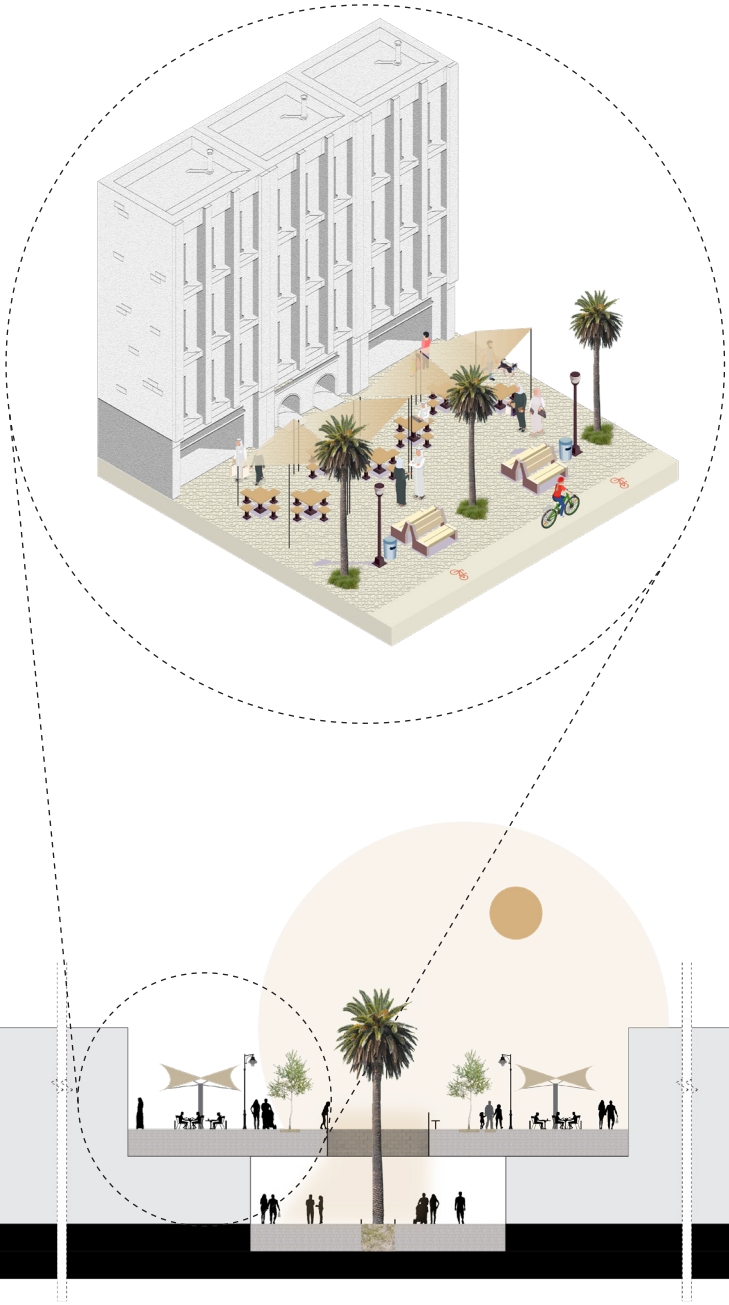
The plaza serves as a pivotal juncture between the district and the metro station, embodying a design that spans two distinct levels. The ground level is conceptualized as a tranquil gathering space, accommodating individuals from diverse directions and fostering interpersonal interactions. Conversely, the subterranean level functions as a dynamic transit zone, providing a direct conduit to the metro station while offering shelter from external climatic conditions.

PLAZA SECTION



AL RABI' AVENNUE & UNDERPASS

The Avenue, traversing the district's southwestern quadrant, serves as a semi-open commercial and entertainment hub. Its design reinterprets the desert city's identity in a modern context. The underpass entrance, located at the avenue's core, is accessible from various points within the district, facilitating direct access to nearby metro and BRT stations. This underpass functions as a sheltered pathway, minimizing the walking distance for residents amidst the city's harsh climatic conditions.



Source: www.bloomberg.com

- Chapter 7 -

سد الفجوات الحضرية

BRIDGING URBAN GAPS

The city's administrative spine, nestled between King Fahd Road and Olaya Road, extends from the northern to the southern boundary of the city. Despite its wealth of employment opportunities and attractions, the spine inadvertently fragments the city into smaller, disconnected segments due to the breadth of the federal roads, thereby impeding accessibility across both sides. This configuration further promotes the use of private vehicles for commuting between destinations. Moreover, the intersections of major federal roads encompass a vast area, rendering it impracticable for soft mobility traversal.

DESIGN SCOPE

The existing road network, intricately developed over years to accommodate the substantial volume of cars, presents a complex challenge. Transitioning to a more pedestrian-friendly city necessitates a phased approach. Our proposal is predicated on the notion that introducing pedestrian traffic into currently car-exclusive zones would challenge these roads' dominance and provide a glimpse into the potential for enhancing connectivity between the city's various destinations and districts without the need for such extensive roads. This design focuses on connecting neighborhoods to the new metro stops to incentivise the use of public transport over private cars.

M1 Major metro station connecting the Blue, Yellow and Purple Lines.

M2 Major metro station between high density districts.

1 Intermediate speed bike lanes reducing federal street width.

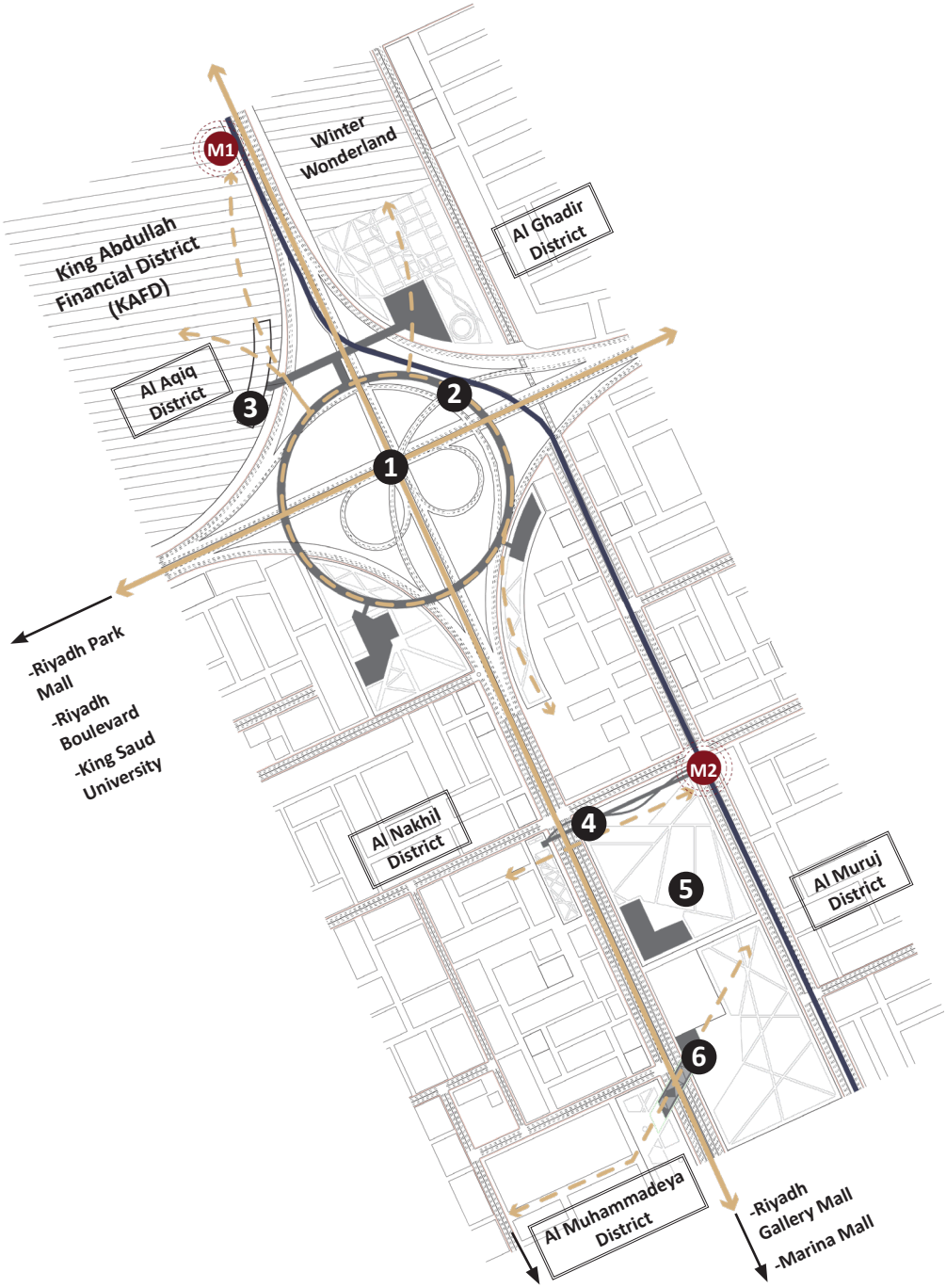
2 Ring Skywalk connects pedestrians from 4 major neighborhoods accross a complex federal read intersection.

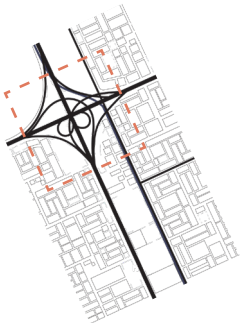
3 Using an existing building in KAFD provides direct accesses to the district as well as M1.

4 Pedestrian bridge stitches Al Nakhil and Al Muruj districts connecting them to M2 and the speed bike lanes.

5 Olaya Grounds Park acts as an entertainment and mobility hub.

6 Olaya Skywalk weakens road dominance and connects to Al Muhammadeya District.


M1
Winter Wonderland
King Abdullah Financial District (KAFD)
Al Ghadir District
Al Aqiq District
3
2
1
-Riyadh Park Mall
-Riyadh Boulevard
-King Saud University
M2
Al Nakhil District
4
5
Al Muruj District
6
Al Muhammadeya District
-Riyadh Gallery Mall
-Marina Mall



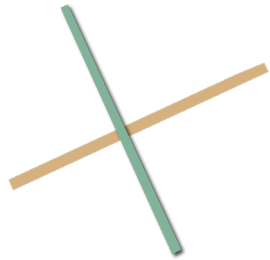
INTERSECTION STRUCTRUE

The intersection of King Fahd Road and the Northern Ring Road forms a multi-layered network of roadways and connections. The Northern Ring Road, which is the lowest layer, tunnels beneath the intersection, while King Fahd Road runs perpendicularly above it. The remaining layers establish four connections between the two directions of each road, eliminating the need for traffic lights. The Blue Metro Line is constructed atop these layers. This intricate network impedes pedestrian movement between the four neighborhoods surrounding this junction.

In response to this challenge, the Ring Skywalk has been introduced as an innovative solution. Positioned two layers beneath the topmost metro line, the ring serves as a pedestrian bridge, connecting to four strategically located buildings at the intersection's corners. This architectural intervention not only facilitates pedestrian movement but also enhances the connectivity between the neighborhoods.

Despite its complexity, this solution boldly challenges the dominance of the roadways. It reintroduces pedestrian activity to the area, effectively stitching together the corners of these neighborhoods and fostering a sense of community.

King Fahd Road



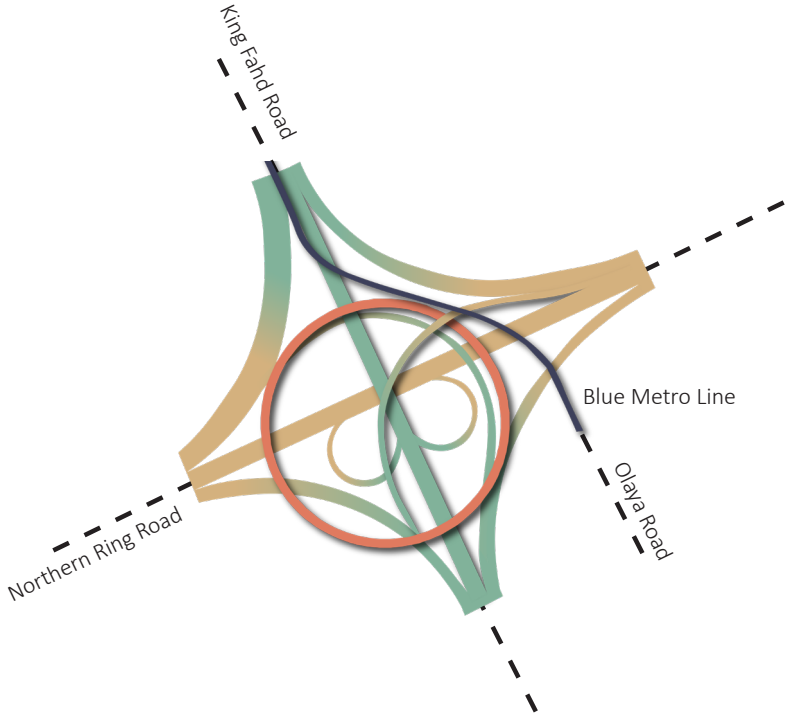
Northern Ring Road

Exits Group 1

Exits Group 2

Ring Skywalk

Exits Group 3

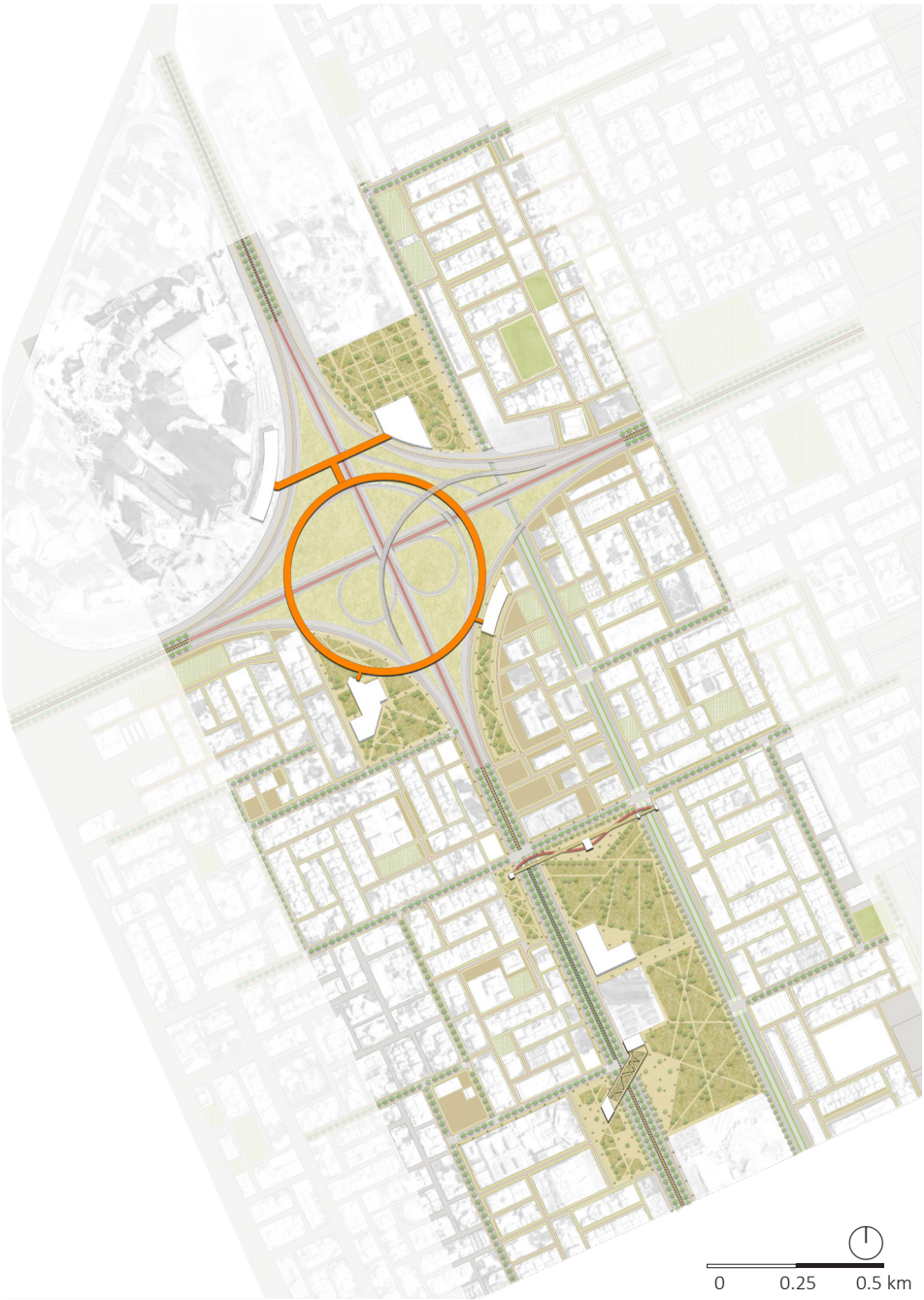


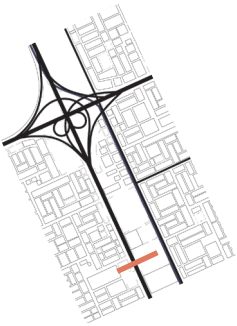
NEIGHBORHOOD MASTERPLAN

The significant challenges posed by the primary federal roads necessitate a multi-stage solution. We posit that the initial step in addressing this extensive road infrastructure issue is to contest their prevailing influence on the landscape. Although tunnels provide a means of crossing these roads, their visual concealment does not symbolize the drastic transformation required in the area.

The Ring Skywalk, commencing from the intersection of King Fahd Road and the Northern Ring Road, is conceived as a striking and emblematic feature that represents the shift in transportation modes. This ring establishes connections between four neighborhoods (AL Aqiq, Al Ghadir, AL Muruj & Al Nakheel), which would otherwise be impassable.

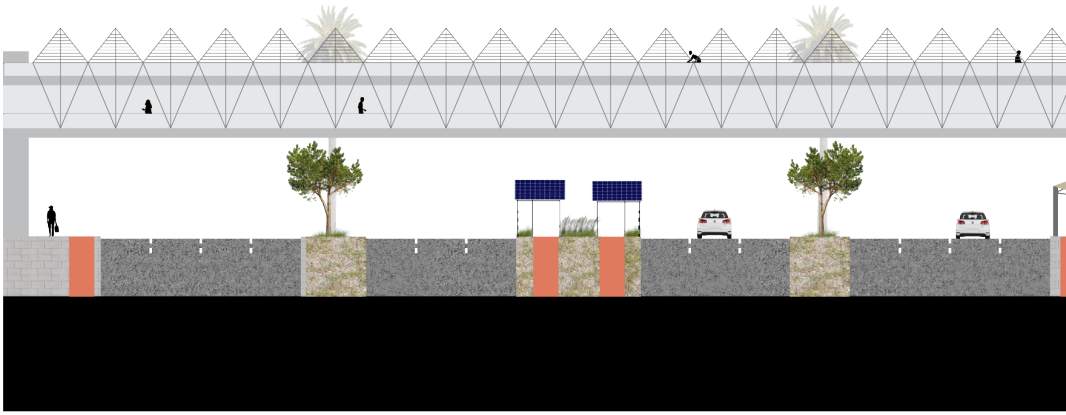
The lower section of this zone facilitates a link between two neighborhoods (Al Nakheel & AL Muruj) across two major roads (King Fahd & Olaya). These connections also provide access to two significant metro stations in the vicinity. One station is located adjacent to KAFD, connecting the blue, yellow, and purple lines, while the other station is situated between Olaya Road, servicing the blue line.

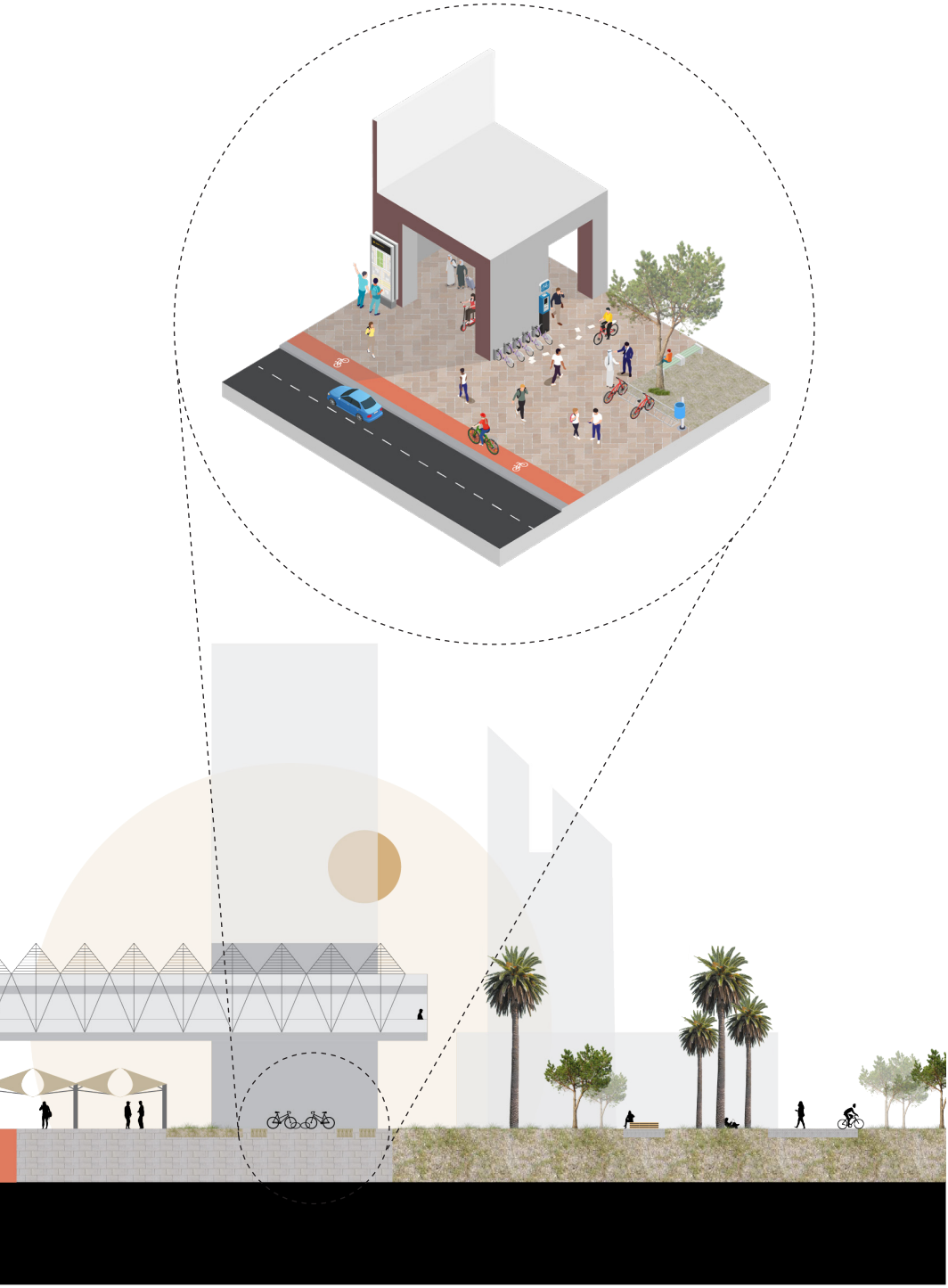

0
0.25
0.5 km



The Olaya Skywalk is a transversal bridge that provides a social and mobility solution, linking the two neighborhoods surrounding King Fahd Road and offering direct access to the Olaya Metro station. The bridge features a dual-level design: an enclosed level for rapid transit, shielded from external weather conditions, and an open-air level for leisurely movement and event hosting. The bridge's base functions as a mobility hub encouraging soft mobility use.

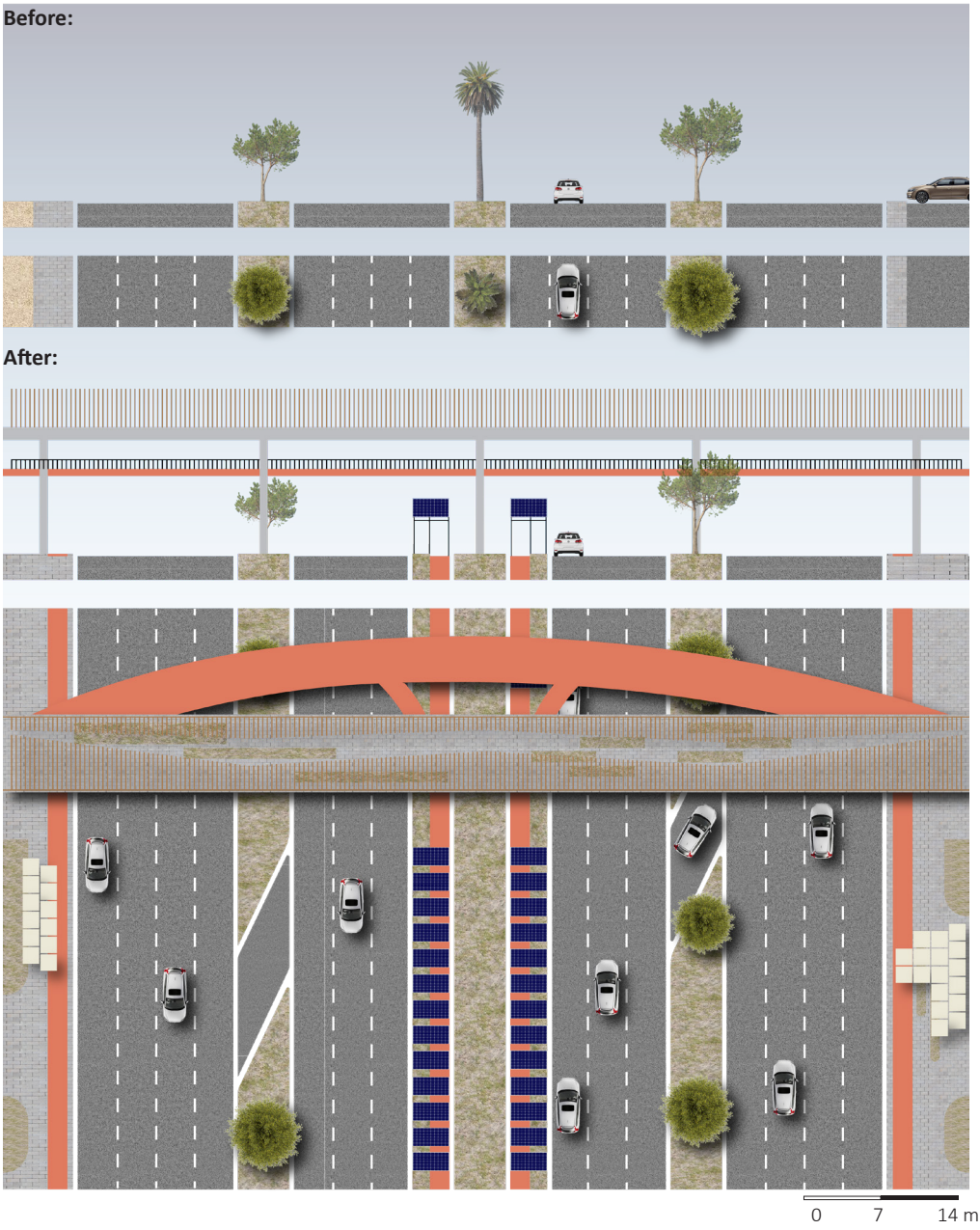
SECTION A-A





FEDERAL ROADS

Federal roads tend to suffer from the theory known as induced demand which states that as roads become wider and are able to accommodate higher volumes of traffic, additional vehicles will materialize as drivers feel incentivised to use the expanded roads due to the beleif that the added lanes have reduced congestion. The federal roads in Riyadh form can reach to more than 16 car lanes creating huge barriers all over the city and no matter how wide they become, they still suffer from traffic jams during busy hours of the day. These barriers also split the city into larger patches as they cannot be crossed on foot in their current state. Furthermore, the whitelands that border these roads often end up being used for parking areas. Our proposal for this type of roads aim to reimagine how a federal road can act as a graduated transition area from a car-centered zone to a human-centered zone. This transition starts from the white lands around these roads which must be targeted to open spaces that incentivise human access to the roads. This access is further enhanced by adding shaded side walks and bike lanes along the road. To break the barriers that these roads create, pedestrian bridges that act as points of interests can be implemented in important locations along the road. These locations can provide direct access to important metro and bus stations to residents living on the other side of the road. As previously mentioned, The city suffers from an urban sprawl and zones of interest can still be harder to reach. With the rise of electric bikes and scooters we propose the implementation of a speed bike lanes covered in solar panel shadings in the center of these roads which allow users to reach destinations that are further away from home while providing energy for the city.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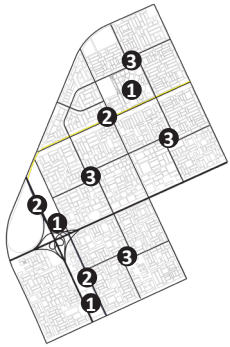


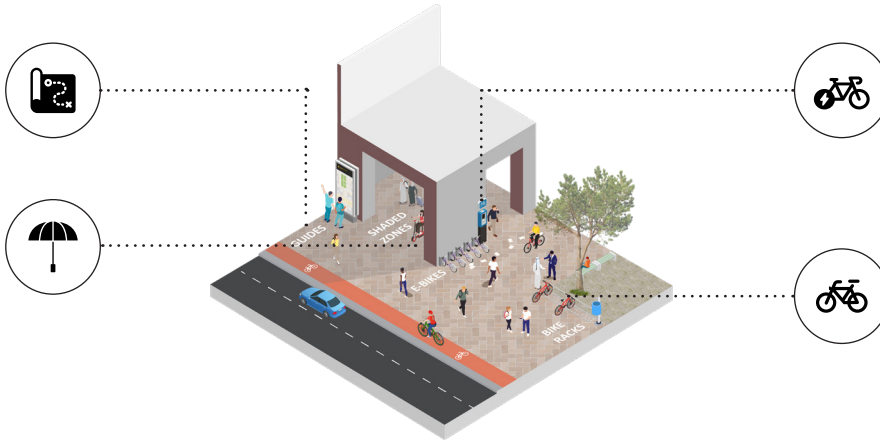
MOBILITY HUBS

Mobility hubs are strategic points in a transportation network where passengers can switch seamlessly between different modes of transport. These hubs are designed to integrate various transportation services, such as buses, trains, bicycles, car-sharing, and even pedestrian paths, into a single, accessible location. We divide our mobility hub solutions into three categories depending on their location as follows:

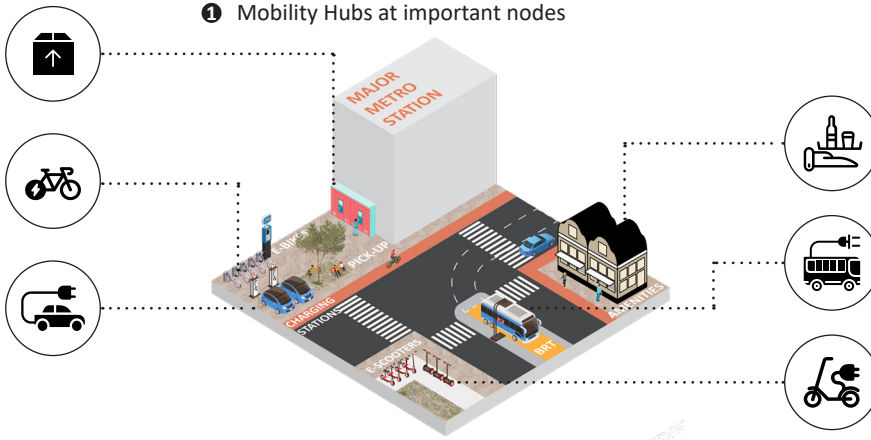
Mobility hubs at important nodes: These hubs are smaller and more frequently placed around the city at connections between important elements such as between neighborhoods or at an access path to public transport.

Mobility hubs at major stations: These hubs larger in size and include a large amount of facilities and quick services such as car charging stations, package pickup points and connection to BRT.

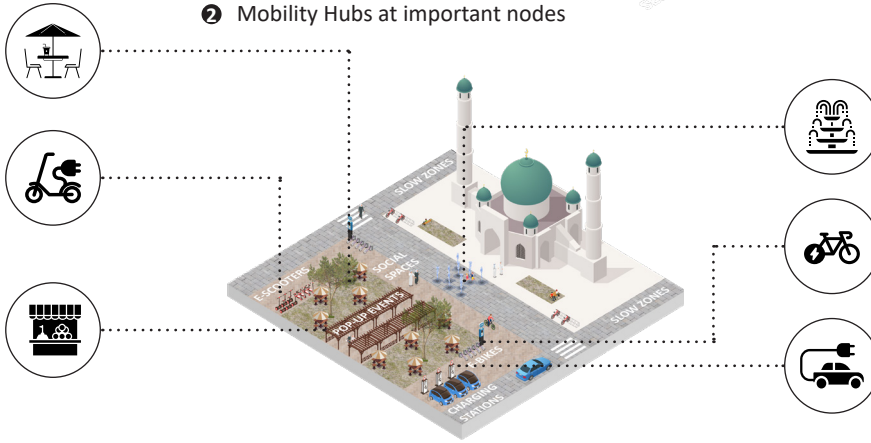
Mobility hubs at district central mosques: These hubs make use of the strategic position of mosques at the center of each district for creating social events and acting as a meeting point.



❶ Mobility Hubs at important nodes



❷ Mobility Hubs at important nodes



❸ Mobility Hubs at district central mosques

PHASES OF TRANSFORMATION

The transformation of a road oriented city into a pedestrian oriented city is a multifaceted process that must be executed in several stages.

The first step involves the implementation an adequate vision and transportation infrastructure that covers the majority of the city's districts.

The second phase follows up with redesigning 10 min neighborhoods to be less car oriented and more pedestrian friendly. These neighborhoods must include the majority of the residents needs within walking distance.

This phase also includes redesigning public spaces and road infrastructures to make them more welcoming to pedestrians.

The third phase involves implementing regulations that incentivise a modal change As these regulations take effect and people begin to adapt to these changes, a shift in transportation habits is expected, therfore reducing car dependency and paving the way for the next phase of the transformation.

The subsequent phase involves the gradual reduction of vehicular access and the expansion of pedestrian pathways. This could be achieved through strategies such as the introduction of pedestrian-only zones during certain times of the day or the conversion of parking spaces into 'parklets' or mini-parks. Throughout this process, it's crucial to engage with the community and stakeholders to ensure the changes are well-received and beneficial to all users of the space.

The final phase of the transformation is the complete pedestrianization of these zones. By this stage, the area would have been reimagined as a space where pedestrians, cyclists, and public transport are given priority, contributing to a more sustainable and livable city.

Ultimately, the goal of this transformation is not just to create pedestrian-friendly spaces, but to promote a shift in urban culture where sustainable modes of transport are the norm, contributing to the overall health, well-being, and quality of life of the residents.

1

Phase 1: Planning & Visioning (Now)

-Creating a vision for the transformation of the city
- Implementing an intricate public transportation system.
-Constructing multiple projects that provide attraction points that were lacking in the city.

2

Phase 2: Our Proposal

-Reimagining districts as 10 min districts to be more inclusive and provide necessary services.
-Redesigning streets with a suitable heirarcy to disect large districts.
-Implementing an adequate pedestrian and cycling solution that is specific to the city's needs.
-Breaking urban barriers that are currently car only zones.
-Providing incentives that encourage a modal change.

3

Phase 3: Community Engagement

-Transmitiing informations on the benifits of a 10 min city.
- Researching critical points that would incentivise the use of the provided amenities and services.
-Planning events, public information campaigns and initiatives that would bring people and businesses to the area.

4

Phase 4: Policy Implementation

-Providing Policies against the unevcessary use of cars.
- Zoning changes to provide more mixed-use developements
-Creating incentives for businesses to relocate within neighborhoods

5

Phase 5: Evaluation & Adjustment

-Collecting data on travel patterns of residents in each area.
- Monitoring the usage rate and satisfaction for the provided services over time.
-Using collected information to make improvements where needed.

CONCLUSION

The research project endeavours to instigate a paradigm shift in societal behaviour within the urbanized context of Riyadh, with the overarching goal of mitigating the prevalent dependence on vehicular transport. This envisioned transformation seeks to cultivate more sustainable and health-centric living conditions within the city. The main objective of the research is: How can an X-minute city concept be implemented in the context of heavy reliance on cars for mobility in Riyadh? To understand and propose a concept-based solution the research was carried out in three parts:

Historical Geographical Context: Underlining the historical and geographical context and development of Saudi Arabia and Riyadh to understand the rapid modernization of the city which has affected the urban fabric. Additionally, an examination of extant policies and initiatives pertaining to urban mobility was analysed to understand the collective vision of the society.

Climate, Mobility and Landuse Analysis: A meticulous analysis of the interplay between climate conditions, prevailing mobility patterns, and extant land use practices is requisite for discerning the multifaceted challenges inherent in the current urbanscape. The study had scrutinized the climatic implications of heightened vehicular activity, delineated prevailing mobility patterns, and redefined the existing land use practices to unearth their implications on urban liveability.

Design Solution for Soft Mobility: The core of the research endeavour involves the proposition of a conceptual design tailored for a designated neighbourhood and the financial district spine. Emphasis is placed on fostering soft mobility strategies, encompassing pedestrian-centric infrastructure, dedicated cycling lanes, and optimized access to public transportation. Concurrently, proposals for alterations in land use shall be advanced to substantiate the envisaged shift in mobility paradigms. The integration of smart city technologies will be considered to augment overall mobility efficiency and accessibility.

An integral part of this research is the formulation of a timeline with the sequential phases of implementation for the envisioned soft mobility concept. This chronology defines the critical milestones, ranging from infrastructural development initiatives to policy alterations, and considers the potential introduction of pilot projects to gauge feasibility and public receptivity. The research also incorporates strategies for public input and for aligning the proposed soft mobility changes with the preferences and needs of the residents. Simultaneously a need for the engagement of pertinent stakeholders, spanning governmental bodies, commercial entities, and community organizations, is identified to implement a collaborative and inclusive implementation process. In effect, the research aspires to integrate the x-min city concept into a practical solution, thereby offering a comprehensive framework for effecting a transformative shift in Riyadh's urban mobility landscape.

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ANNEXURE

Riyadh Urban Survey

Hello. We are 2 master's degree students from Politecnico di Milano university, and we prepared this short and confidential questionnaire designed to gather valuable feedback from citizens and residents of Riyadh, Saudi Arabia for use in an educational urban project.

The survey aims to understand participants' experiences, preferences, and challenges related to accessibility and public transportation without requiring any personal identification information.

Completely anonymous, the survey ensures privacy and encourages candid responses. The collected data will be used for research & educational purposes to improve neighborhoods and public transportation services and make commuting more efficient and user-friendly. Thank you for participating and contributing.

Warm Regards,
Priya Jalan & Mohanad Youssef

- {Questions with (*) next to them are required while the rest are optional.}

Demography

1. What is your age? *

   Mark only one oval.

   - 12 - 17
   - 18 - 24
   - 25 - 34
   - 35 - 44
   - 45 - 54
   - 55 - 64
   - 65 - 74

2. What is your gender? *

   Mark only one oval.

   - Male
   - Female

3. What is you Home Country? (Nationality) *

Mark only one oval.

- Saudi Arabia
- Bangladesh
- India
- Pakistan
- Yemen
- Egypt
- Sudan
- Philippines
- Syria
- Lebanon
- Jordan
- Indonesia
- Malaysia
- Nepal
- Ethiopia
- Afghanistan
- Palestine
- Sri Lanka
- Nigeria
- Kuwait
- Morocco
- Eritrea
- Chad
- Sumal
- Uk
- China
- Bahrain
- Other: _____

4. For how many years have you been residing in Riyadh? *

Mark only one oval.

- <5
- 5 - 10
- 10 -15
- 15 - 20
- 20 +

5. What is your occupation? *

Mark only one oval.

- ◯ Business & Finance: Accountant, Banker, Consultant, Entrepreneur, Sales Representative.
- ◯ Healthcare & Medicine: Doctor, Nurse, Pharmacist, Dentist, Psychologist.
- ◯ Information Technology: Software Developer, Data Analyst, IT Technician.
- ◯ Education: Professor/Teacher/Educator, Student.
- ◯ Creative & Arts: Artist, Designer, Photographer, Writer/Author.
- ◯ Public Service: Civil Servant, Police Officer, Firefighter, Social Worker.
- ◯ Engineering & Construction: Engineer, Architect, Technician, Surveyor, Electrician.
- ◯ Hospitality & Service: Chef, Waiter/Waitress, Barber/Hairdresser.
- ◯ Science & Research: Scientist, Researcher.
- ◯ Marketing & Communication: Marketing Specialist, Journalist, Translator.
- ◯ Agriculture & Farming: Farmer.
- ◯ Legal: Lawyer/Attorney.
- ◯ Transportation: Truck Driver.
- ◯ Fitness & Wellness: Fitness Instructor, Personal Trainer.
- ◯ Real Estate: Real Estate Agent.
- ◯ Unemployed

6. Do you have any disabilities? *

Mark only one oval.

- ◯ Visual impairment
- ◯ Hearing impairment
- ◯ Mobility impairment
- ◯ Cognitive or learning disability
- ◯ Chronic health condition or illness
- ◯ Neurological Disabilities
- ◯ None
- ◯ Other: _____

Transportation

7. How do you primarily commute within the city? *

Check all that apply.

- ☐ Car
- ☐ Taxi
- ☐ Walking
- ☐ Cycling
- ☐ Public Transport

8. Do you feel that the city's current infrastructure and planning make it easy for individuals with disabilities to move around and access public spaces? *

Mark only one oval.

- ◯ Yes, the city's infrastructure is well-designed and accessible for people with disabilities
- ◯ No, the city's infrastructure lacks adequate accommodations for individuals with disabilities.
- ◯ I'm not sure. I don't have any disability.

9. How often do you commute to your workplace or educational institution? *

Mark only one oval.

- ◯ Daily
- ◯ 2-4 times a week
- ◯ Once a week
- ◯ Occasionally (less than once a week)
- ◯ Rarely or never commute to workplace or educational institution

10. Have you tried any of the new public transportation options in Riyadh? *

Mark only one oval.

- ◯ Bus
- ◯ Metro
- ◯ None

11. If Yes, how would you rate the new transportation systems? (1 being "very dissatisfied" and 5 being "very satisfied")

Mark only one oval.

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4
- ◯ 5
- ◯ I haven't tried any of the new transportation systems

12. Are there any specific issues or challenges you face related to transportation and mobility in the city?

13. In your home country, do you usually walk/use a bike? *

Mark only one oval.

- ◯ Yes
- ◯ No

14. Are you willing to switch to public transportation instead of a car if public transportation was made more accessible? *

Mark only one oval.

- ◯ Yes, I would switch to public transportation.
- ◯ No, I would rather still use a car.

15. If you selected "No" in the previous question, can you specify why?

_____

_____

_____

_____

_____

Facilities & Proximity

16. Are there enough parks and green spaces in the city? *

Mark only one oval.

- ◯ Yes
- ◯ No

17. What destinations would you like to have **within 5 minutes walking/cycling** from your neighborhood? **(Select 5)** *

Check all that apply.

- [ ] Parks
- [ ] Banks
- [ ] Primary School
- [ ] Cafe
- [ ] Pharmacy
- [ ] Nursery
- [ ] University
- [ ] Cinema
- [ ] Mosque
- [ ] Gym
- [ ] Public Transport
- [ ] Bakery
- [ ] Supermarket
- [ ] Shopping
- [ ] Hospital
- [ ] Secondary School
- [ ] Restaurant
- [ ] Co-working Space
- [ ] Museum
- [ ] Sports Center
- [ ] Library
- [ ] Theme Park

18. What destinations would you like to have within **10 minutes walking/cycling** from your neighborhood? **(Select 5 answers not similar to the previous question)** *

Check all that apply.

- [ ] Parks
- [ ] Banks
- [ ] Primary School
- [ ] Cafe
- [ ] Pharmacy
- [ ] Nursery
- [ ] University
- [ ] Cinema
- [ ] Mosque
- [ ] Gym
- [ ] Public Transport
- [ ] Bakery
- [ ] Supermarket
- [ ] Shopping
- [ ] Hospital
- [ ] Secondary School
- [ ] Restaurant
- [ ] Co-working Space
- [ ] Museum
- [ ] Sports Center
- [ ] Library
- [ ] Theme Park

19. What destinations would you like to have within **15 minutes walking/cycling** from your neighborhood? **(Select 5 answers not similar to the previous questions)** *

Check all that apply.

- [ ] Parks
- [ ] Banks
- [ ] Primary School
- [ ] Cafe
- [ ] Pharmacy
- [ ] Nursery
- [ ] University
- [ ] Cinema
- [ ] Mosque
- [ ] Gym
- [ ] Public Transport
- [ ] Bakery
- [ ] Supermarket
- [ ] Shopping
- [ ] Hospital
- [ ] Secondary School
- [ ] Restaurant
- [ ] Co-working Space
- [ ] Museum
- [ ] Library
- [ ] Sports Center
- [ ] Theme Park

20. Are there any green (Sustainable) initiatives or policies that you would like to see implemented?

_____

_____

_____

_____

_____

21. What additional recreational facilities would you like to see in your neighborhood?

_____