Revitalization Of Al-Rusafa District Through Relief Of Traffic Congestion

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ABSTRACT

The Rusafa district, in the central area of Baghdad, is a prominent sector that has been an integral part of the city since ancient times. Transportation in the Al-Rusafa area had certain restrictions. Many intersections in the historic Rusafa region (study area) have significant traffic congestion as a result of the large number of vehicles present. Furthermore, the streets and bridges are beyond their maximum capacity. The primary goal of this article is to create a proposed strategy for development that will improve the transportation hierarchy and accessibility in the Al-Rusafa area. The analysis indicates that the introduction of Al-Rusafa Metro, LRT, and BRT will greatly enhance the transportation infrastructure and accessibility of the region. In addition, the implementation of parking facilities and the creation of a dedicated cycling path for buses will significantly enhance the quality of public transportation. The proposed metro plan is quite straightforward and will aid in mitigating traffic congestion. Furthermore, the use of LRT will improve the connectivity of business operations within residential communities. In addition, the BRT development plan will yield favorable outcomes because its routes are located outside of the study area and cross the Tigris River.

Keywords: Al-Rusafa, Transportation, Accessibility, Parking, Metro.

1. Introduction

Rusafa, often referred to as Al-Rusafa, is one of the nine administrative districts in Baghdad, Iraq. The site is located on the eastern side of the Tigris River, with Al-Karkh situated on the opposite western side. The Rusafa side, located in the heart of Baghdad, Iraq's capital, is a prominent sector that has been part of the city since ancient times. The Tigris River separates it from Karkh, which comprises the city's essential components. Figure 1 depicts the precise geographical location of Al Rusafa.

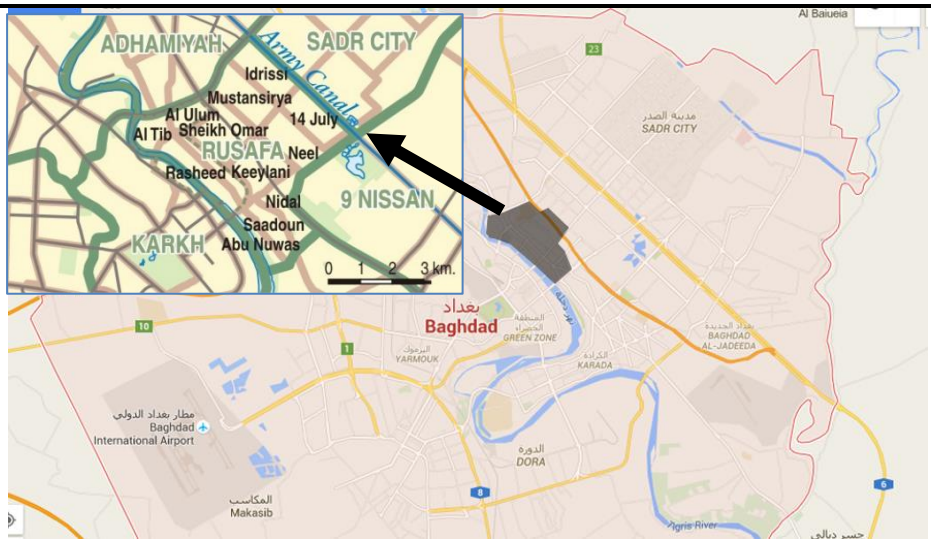

Figure 1. Site location of the city centre of Baghdad.

Al Rusafa is divided into twenty-seven distinct districts. Every district presents a varied fabric of cultures, nationalities, and religions, which is emblematic of its distinct historical background. Al-Rusafa's past is vividly reflected in landmarks such as Al-Rashid Street and the city's oldest traditional markets, which consist of open strip markets and covered markets flanked by stores and inns. Figure 2 shows the distribution of the districts over the Rusafa's map.

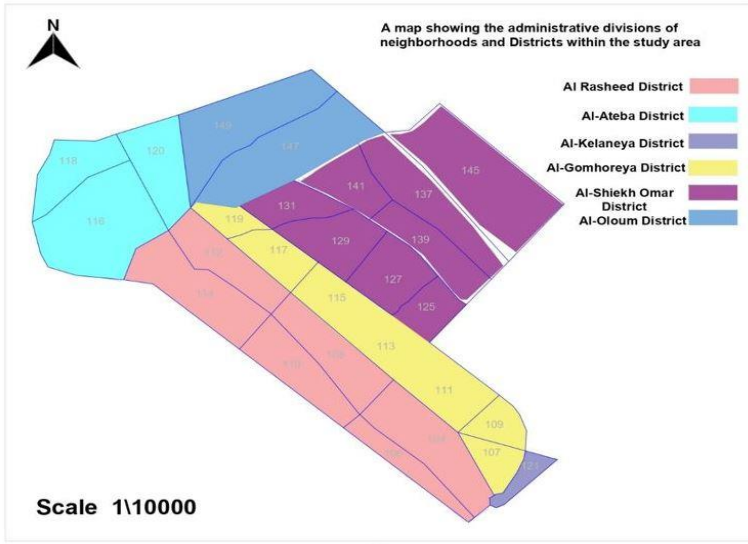

Figure 2. Existing plan showing the distribution of districts.

An effective urban transportation system can significantly improve a city's vibrancy, competitiveness, and sustainability. In Al-Rusafa area, the transportation status showed some limitations. Numerous intersections in the old Rusafa area (study area) encounter heavy

traffic due to the high vehicle density. Many vehicles primarily pass through this area to reach their destinations outside the old Rusafa area. Additionally, the central location of the most significant bridges in Baghdad, connecting the Karkh and Rusafa areas, coupled with their limited number and concentration in the old Rusafa district, has resulted in severe traffic congestion. The streets and bridges have exceeded their capacity, leading to significant issues with traffic congestion, particularly during peak hours. Moreover, notable commercial thoroughfares include Al-Rashid Street, King Ghazi Street, and Sheikh Omar Street. The mismatch between the cross-section of the streets and the level of events, traffic velocity, and citizen movement is due to factors such as the age of the streets, increased activities, higher construction and population densities, and the enormous number of cars. Also, the speed of vehicles in the center area is unknown and varies depending on traffic flow. Moreover, the distance between adjacent streets varies from 100 to 750 meters, and it intersects at certain locations and is connected to side streets.

Based on the above limitations, this study's main objective is to develop a proposed development plan in order to enhance the transportation hierarchy and accessibility for Al-Rusafa area which will enhance the urban design of the area, achieve sustainability, and make life better for residents.

2. Theoretical Framework

2.1 Importance of Transportation and Accessibility in Urban Design

The rise in urban population entails not only an increase in the number of residents and workers but also necessitates the establishment of additional transportation infrastructure to accommodate the transportation of passengers and goods within the urban transport network. Both the volume of travel and the expanding metropolitan areas, along with the distance traveled, primarily drive the increase in travel. The choice of a method to address urban transportation issues will have a direct impact on both individuals and their surroundings. A well-managed urban transport system has a significant impact on a city's overall economic and social well-being. Factors such as inadequate transportation infrastructure, poor management of transportation resources, extensive land use, and the effectiveness of the travel demand model can cause issues arising from insufficient carrying capacity. Urban transport operations encompass several tasks related to road travel, including the management of parking places, the establishment of a comprehensive public transport network, and the regulation of urban development (Süleyman, 2019).

However, people often fail to acknowledge the negative effects of land utilization on transportation. In densely populated medieval cities, where people primarily move around on foot, there is doubt about the possibility of progress without the presence of a railway system. The development of modern cities with high levels of traffic congestion and population density perpetuates this doubt. Furthermore, the private car serves as a convenient mode of transportation that allows individuals to reside or work in any part of the metropolitan area. Nevertheless, the precise extent to which land planners, investors, enterprises, and families impact the site decisions of the transport system remains incompletely comprehended by numerous urban planners (Pandya & Katti, 2012).

The fundamental concept of transport analysis and foresight is the physical segregation of

human activities, as well as the necessity for travel and product movement. Following this premise reveals a clear connection between the suburbanization of cities and the increasing spatial segmentation of labor, which in turn leads to continuous mobility. Furthermore, the allocation of residential areas, industrial regions, commercial areas, and other infrastructure inside metropolitan areas has a significant impact on individuals' daily routines, professional endeavors, shopping habits, and educational experiences. The distribution of this equipment will establish transportation networks facilitated by the business network while also altering the existing transportation networks for individuals to access this equipment. Transportation systems and infrastructure services significantly contribute to the facilitation of spatial interactions, which we can quantify as accessibility. The distribution of accessibility opportunities also influences the land use system, serving as a guiding factor for fundamental decisions (Süleyman, 2019).

Sustainable urban mobility refers to a system of transportation policies and actions that promote social inclusivity and environmental sustainability. These policies and actions strive to ensure that all members of society have equal and democratic access to metropolitan areas without creating spatial segregation. Additionally, the system prioritizes non-motorized and public modes of transportation. Conversely, scientific research has extensively examined and endorsed the use of bicycles for transportation and recreational activities as a means to promote sustainable urban mobility. This is because bicycles are cost-effective and contribute to a healthier lifestyle, thereby fostering greater equality among community members (Providelo & Sanches, 2010).

Replacing motor vehicles with bicycles over short distances can significantly reduce traffic noise and emissions, thereby minimizing pollution (Litman, 2011).

When creating sustainable cities, our objectives for urban mobility are as follows: to analyze urban problems and utilize growth opportunities to transform cities into sustainable ones, to facilitate communication and discussion among stakeholders from the public and private sectors who are dedicated to creating smarter and more sustainable mobility systems, to exchange best practices and emerging trends in sustainable urban mobility, to develop recommendations for sustainable mobility models that are tailored to the unique needs and characteristics of various urban areas, and to showcase the latest technologies and innovations developed by prominent companies and start-ups with the aim of establishing more sustainable urban mobility systems.

2.2 Accessibility and Transportation Hierarchy in Al-Rusafa

Figure 3 depicts the transportation hierarchy of the study area. It is clear that secondary car traffic represents the majority of the traffic movement in Al-Rusafa. Also, Muhammad Al-Qasim Street, which crosses Al-Oloum and Al-Shiekh Omar districts, is considered the only highway in the study area. Moreover, Figure 4 shows the hierarchy of the traffic nodes in the study area.

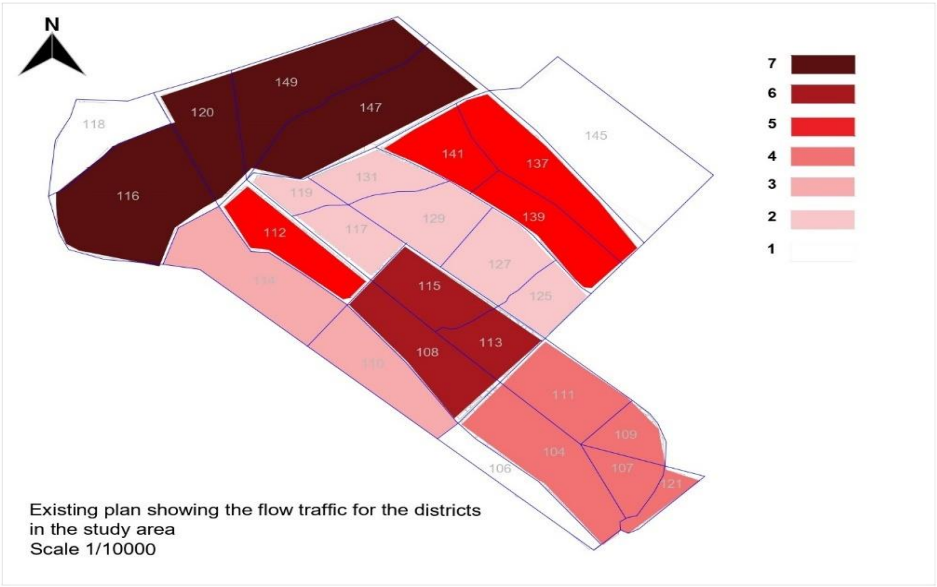

Figure 3. The transportation hierarchy within the districts.

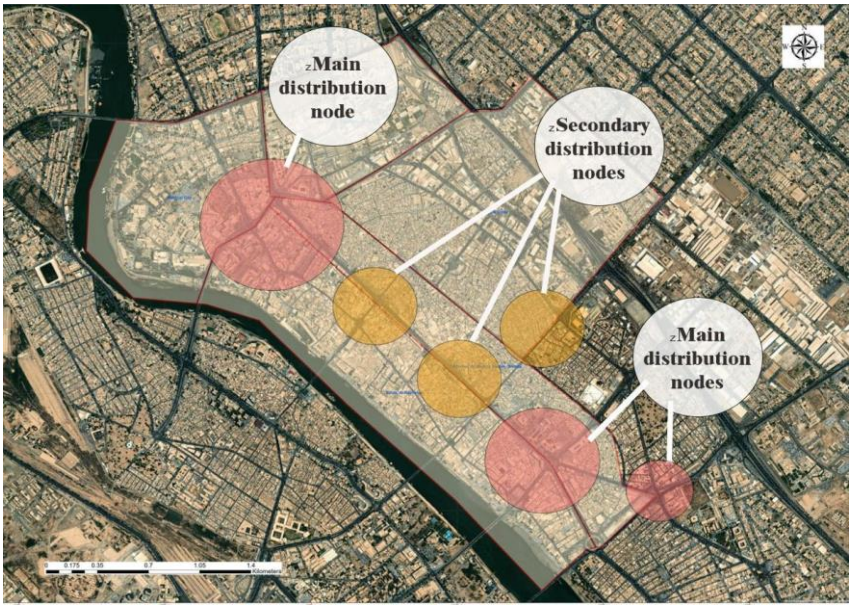

Figure 4. The most complicated hierarchy of the traffic nodes.

As could be noticed from the above figure, the red circles refer to the most complicated road hierarchy in the study area which will form critical traffic nodes for the residents.

Streets and bridges

There are some important streets and bridges existing in the study area (see Figure 5). The streets are:

- Al-Rasheed Street: Khalil Pasha established the street in 1916, making it the first of

its kind. It symbolizes the historical nucleus of the city of Baghdad. The route begins at the Jumhuriya Bridge and extends to the Bab al-Muadham Bridge, traversing Al-Midan Square and Al-Rusafi Square along the way. The roadway has a length of 3.3 kilometers and a width of 12 meters. Since 1939, the construction of bridges has morphologically divided Al-Rashid Street into five distinct districts. These areas include Al-Sink, Al-Murabba'a, Al-Souq, Al-Haidar Khana, and Al-Maidan.

- Al-Jumhuriya Street: A commercial and institutional street featuring high-rise buildings along its length. It includes several notable squares within its stretch (Al Khilani Square, Al-Wathba Square, and Al-Amin Square). It extends from Tahrir Square and passes through Al-Khalani Square and Al-Wathba until the intersection with Al-Jihad Street. Its length is (3.25 km) and its width is (20-25 m).
- Al-Nahr Street: The road runs parallel to Al-Rashid Street on the east side and the Tigris River on the west side. Businesses, historic houses, and inns line this exclusively pedestrian route, just a few meters from the riverfront. At times, there are unobstructed areas along the street that offer clear sightlines to the river. A multitude of mosques and a compilation of ancient inns adorn the Boulevard.
- Al-Kifah Street (King Ghazi Street): It is parallel to Al- Jumhuriya Street and is (3.4 km) long and (12-20 m) wide.
- Al-Sheikh Omar Street: It is one of the famous industrial streets in Baghdad because it contains many activities for maintaining cars of various types. It is (3 km) long and (20 m) wide.
- Al-Khayyam Street: Despite its small size, this road is considered one of the most important commercial areas in Baghdad. Stretching from the outskirts of Tahrir Square to the beginning of Al-Rashid Street, there is a steep fall that serves to connect Al-Jumhuriya Street and Al-Rashid Street.

There are also important bridges existing in the study area. They link both of the Tigris sides (Al-Rusafa and Al-Karkh). The nodes related to these bridges also interconnect with some of the important streets mentioned above. These bridges are:

- Bab Al-Moatham Bridge: It is a two-way bridge which is 270m long. Al-Gihad and Al-Rasheed streets are both linked to this bridge.
- Al-Shohada' Bridge: It is a one-way bridge which is 219m long. Al-Rasheed street is linked to this bridge.
- Al-Ahrar Bridge: It is a one-way bridge which is 303m long. Al-Rasheed and Al-Jumhuriya streets are both linked to this bridge.
- Al-Rasheed (Al-Sinak) Bridge: It is a two-way bridge which is 600m long. Al-Jumhuriya street is linked to this bridge.
- Al-Jumhuriya Bridge: It is a two-way bridge which is 453m long. Al-Jumhuriya and Port Said streets are both linked to this bridge.

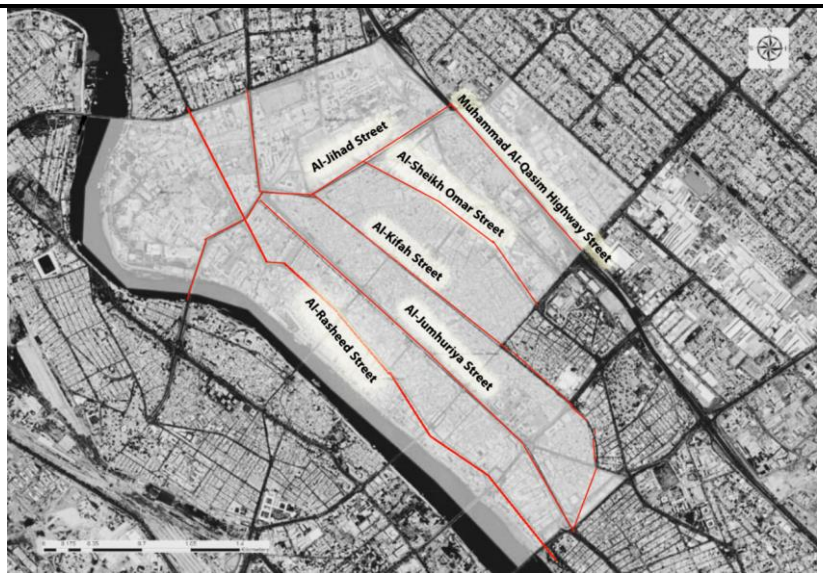

Figure 5. The main existing streets in the study area.

Parking areas

The study area's parking areas account for approximately 4% of the total land use. Figure 6 displays the land use of parking areas within the designated research region. Both multi-story car parking and ground-level parking are available. The Rusafa side of the Central Business District, including the Rusafa Municipality, has a total of twenty-three ground parking spaces. Each space's capacity varies depending on the area's allocation. Additionally, Al-Rusafi parking and Al-Sanik parking are examples of multi-story car parks that can accommodate around 640 and 700 cars, respectively.

Figure 6. The distribution existing plan of the parking area.

The main entrances in the Old Rusafa area

The number of main entrances in the old Rusafa area is 12 (as shown in Figure 7), and the traffic flow varies in terms of numbers, and the dominant characteristic is traffic jams during peak hours.

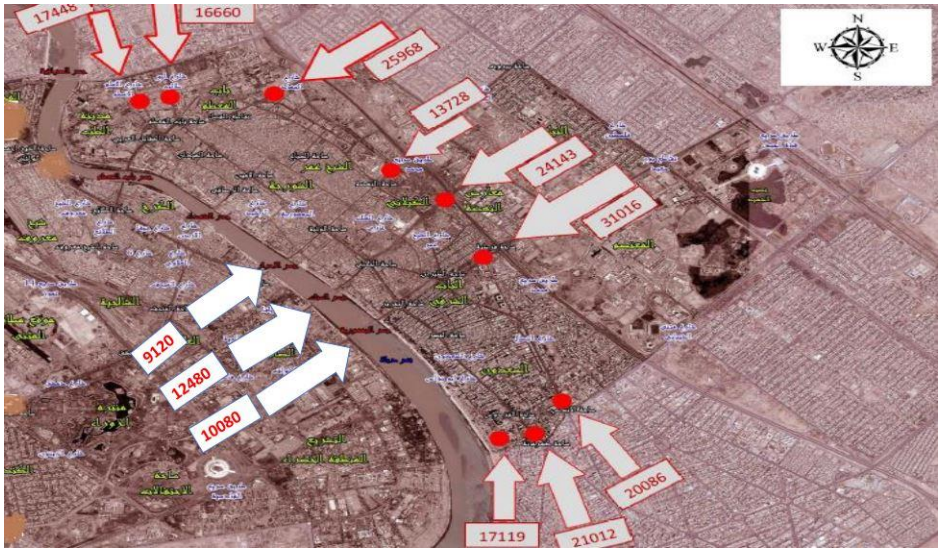

Figure 7. The nine main entrances in the old Rusafa area.

3. PROPOSED DEVELOPMENT PLAN OF TRANSPORTATION IN AL-RUSAFA AREA

The researcher proposed a redistribution of the road network and intersections of the study area which is shown in Figure 8 as follows:

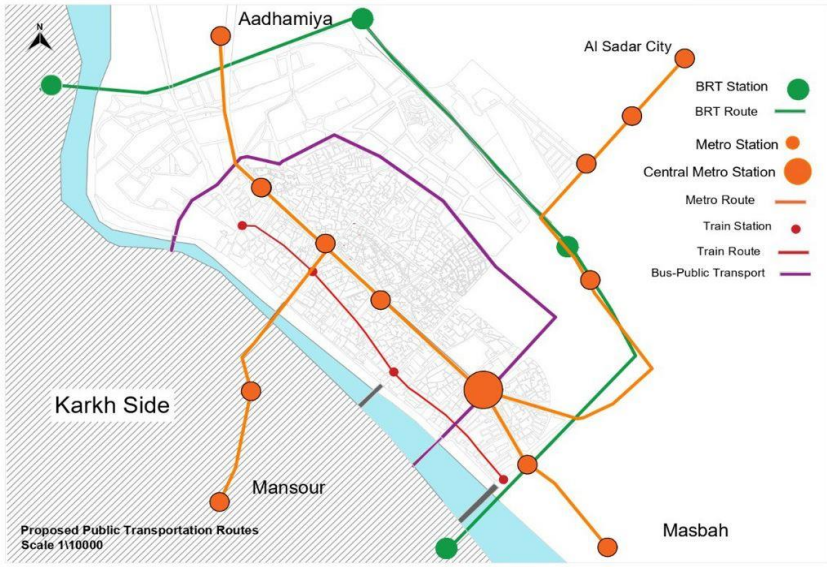

Figure 8. The road network and intersections of the study area.

This development plan proposes the introduction of some solutions to the transportation

system in Al-Rusafa area. These solutions are as follow:

3.1 Public Transportation (Bus Route)

The current idea aims to improve public bus transit by introducing a new bus cycling route. The bus route begins at Al-Sinak Bridge and proceeds towards Al-Khalani Square. It then follows Al-Kilani Street before making a left turn towards Al-Thawra Square via Al-Sheikh Omar Street. The route continues until it reaches Al-Jihad Street, where it turns left to cross Bab Al-Muadham Bridge towards the Karkh side (refer to Figure 8). Depending on the actual circumstances, the distance between each station varies between 250 and 500 meters.

3.2 BRT Route

For the purpose of connecting the two sides of the Baghdad city (Al-Karkh and Al-Rusafa) and to facilitate transportation between them through linking the Al-Rusafa area to the external development surrounding it, a special path for (BRT route) was proposed on the external borders of the study area (see Figure 9). The number of stations is 4, and its width is (7m). The sidewalks will be 0.5 meters wide and run along both sides of the road.

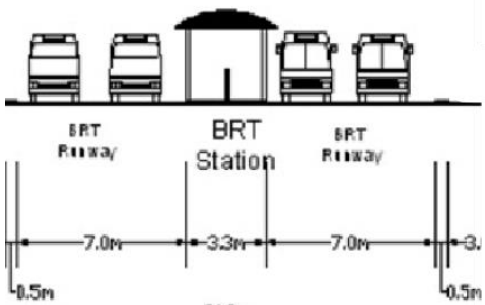

Figure 9. The BRT Route Station.

3.3 LRT Train

To improve transportation on Al-Rashid Street, it was proposed to use the light train and a special path for cars as follow (see Figure 10):

- It extends from Tahrir Square to Al-Midan square. There are difficulties in extending the light train route to Bab Al moadham bridge intersect since most of the vehicles and bus route pass through this intersect crossing the bridge.
- This line was established on Al-Rasheed Street, its length is (1.55 km) inside the case study area and the number of stations is 4 and its width is (6m) forward and reward.
- Also, a car way is suggested with (3m) in width one way to facilitate transport of goods.

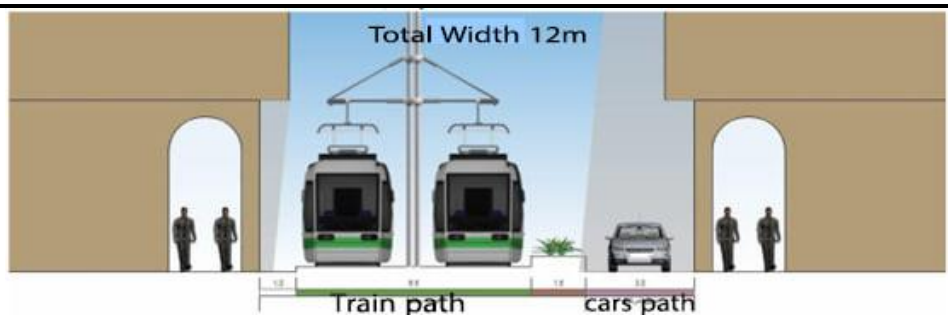

Figure 10. A cross section of the LRT route.

3.4 Al-Rusafa Metro

In 1973, The Paul Service Company conducted a comprehensive study to construct the Al Rusafa Center in Baghdad. The study proposed a two-line metro system named Baghdad Metro. The current study considers these metro lines. As a result, this study includes a proposal for two primary metro routes that originate from the central station in the heart of Baghdad and extend towards the major towns. This mode is an ideal alternative for navigating through tight residential streets.

The proposed network spans roughly 88 kilometers and has two primary lines, with a shared passenger exchange station in the Al-Khalani area. The initial stage of the metro system has two lines, each spanning 23 kilometers. Consequently, the combined length of the two lines amounts to 46 kilometers, and the total number of stations on both lines is 46. As shown in Figure 11, the initial route links Sadr City and Adhamiya City at Antar Square.

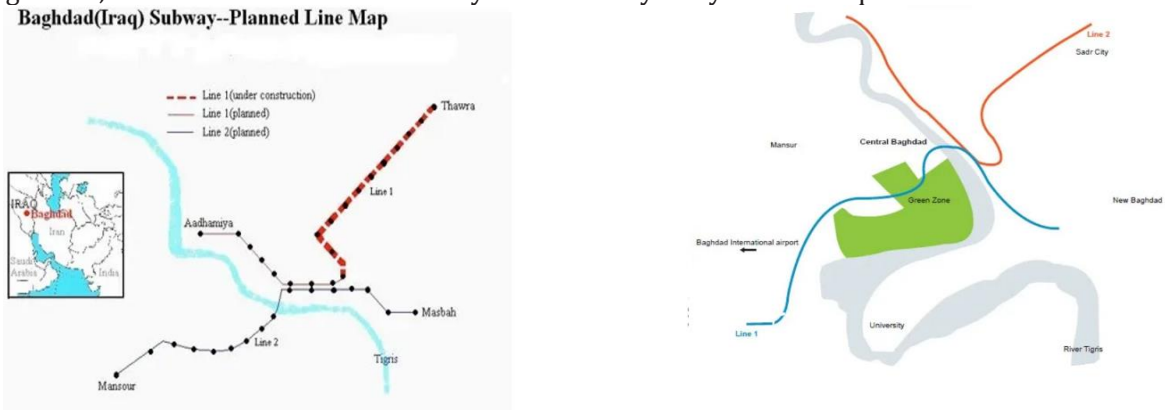

Figure 11. Paul Service Map.

The first line of the metro enters the central area after passing through Beirut Square. After Beirut Square, the first station of the metro begins, and another station comes at Al-Kindi Hospital. The route moves to the vicinity of Muhammad Al-Qasim and Bab Al-Talsem station, next to (Al-Nahda Exhibitions), and the route moves to Bab Al-Sharqi (the distance between Cordoba Square and Aviation Hall) and moves to the central station in Al-Khalani (which then meets the second line) and the first line continues towards Al-Jumhuriya Street (Al-Kholafa'

Mosque station) and reaches Al-Amin Square station and continues to another station before Bab Al-Muadham Square and continues towards Al-Waziriya Safi Al-Din Al-Hilli Street and then outside the borders of the central region and continues to Al-Adhamiya and Al-Kadhimiya, the end of the line. As for the second line, it connects (Oqba Ibn Nafi Square at the Masbah area to the Al-Bayaa and Al-Mansour areas).

3.5 Suggested Parking Facilities

The researcher suggests implementing an electronically controlled subterranean parking facility with hydraulic systems. These systems would park vehicles below shelves and raise them to a designated place above ground level upon request, without the need for driver participation (see Figure 12). The fundamental premise of this project is the excessive population density in the vicinity where this garage is intended to be built, as well as the challenge of constructing parking spaces in a vertical manner in this particular location.

(a) (b)

Figure 12. (a) Circular underground parking (b) Hydraulic system for car lifting.

Moreover, the researcher suggests creating the garages indicated before, one in the service area (dedicated to education and health) and another in the Sheikh Omar region, by rearranging the land uses in that area. Furthermore, the purpose of creating a ground parking area on the river bank corniche near the intended recreational activities is to avoid the high costs and technical engineering requirements associated with constructing subterranean parking in this location.

4. Analysis And Discussion

In this proposal, the bus cycling route is chosen because Al-Khalani Square is located near active commercial activities continues to Sheikh Omar Street, which is one of the famous industrial streets in Baghdad. In addition, the dimensions of the street are suitable for this proposal: 3 Km in length and 20 m in width, then it reaches the Bab Al-Muadham Bridge. It is located near the medicine city and later on will lead to the Karkh side to connect the two sides of Baghdad city. Moreover, the proposed metro plan is generally superior for several reasons:

- The network is relatively uncomplicated, the route is isolated, there are designated stops, the absence of emergency stops allows for faster travel, and the trip to city

centres is more reliable due to the separation from street traffic, thus avoiding congestion.

- The metro's large size allows for a higher capacity. Furthermore, the stations not only provide various amenities but also cater effectively to regions with dense populations. This occurs because low-density neighbourhoods expand outward, which in turn diminishes the economic viability of the metro system due to insufficient passenger volume to match its capacity.

Also, the use of the light train (LRT) will facilitates the interconnection of commercial activity between residential neighbourhoods, especially where commercial activities dominate in the Al-Rashid neighborhood on the riverbank. The nature and width of this street (12m), and the fact that it is crowded with buildings and commercial shops. So, using this method is more appropriate than others, provided that shop owners are obligated not to exceed on the sidewalks designated for pedestrians.

Additionally, the BRT development plan will offer a great result as its routes exist on the outer of the study area and crosses the Tigris River to complete its routes around the Karkh side since it is basically existing problem in linking the historical heart of Baghdad with the external development surrounding the region. Besides, most of the respondents' answers strongly support this suggestion.

Moreover, the following recommendations could be used to enhance the transportation status in the study area:

- Implementing and coordinating public transportation: Constructing basic parts that complement the use of (Metro, LRT Train, and BRT), such as sidewalks and fences for the light train and approaches to bus stations.
- The infrastructure of Al-Rasheed - Sheikh Omar - Al-Jumhuriya streets and its connected squares, such as Al-Maidan - Al-Rusafi, will be rehabilitated and developed.
- Constructing a parallel corniche that stretches from Al-Jumhuriya Bridge to Al-Mutanabbi Corniche.
- Offering new parking facilities.

5. Conclusions

This study conducted a comprehensive examination of transportation conditions in the Al-Rusafa district of Baghdad. The goal of this study was to create a proposed development strategy that would improve the transportation hierarchy and accessibility in the studied area. The researcher suggested a reallocation of the road network and intersections. The implementation of Al-Rusafa Metro, LRT Train, and BRT systems will significantly improve the region's transportation infrastructure and accessibility. Furthermore, providing parking facilities and establishing a dedicated cycling path for buses will greatly improve public transportation. As a further investigation, the connection of bus routes between the Karkh and Rusafa sides should be studied in order to facilitate transportation for individuals traveling between the two sides of Baghdad city.

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