



# Evaluation of the Urban Transport System According to the Principles of the Active City: Kufa City as a Case Study

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**Abstract:** Urban transformations resulting from technological and economic changes have contributed to the emergence of a pattern of urban dispersion. Rapid transportation based on private cars, along with investment in road networks and the decline in land values on the outskirts of cities, have helped to create the phenomenon of urban sprawl and expansion. This has led to the absence of connectivity between city areas and the separation of residential, industrial, office, retail, and recreational areas. In contrast, concerns have escalated about traffic congestion in cities, increased greenhouse gas emissions, and increased energy consumption allocated to transportation, which has enhanced interest in active mobility patterns as a sustainable solution. Therefore, the problem of our research is that the urban transportation planning process in the city of Kufa is characterized by randomness and lack of sustainability principles, with neglect of the vital role of urban transportation and its effects on the health and psychological state of the city's residents and its association with economic aspects. The research assumed that following the principles of the active city and applying them in the city's urban transportation plans contributes to improving the quality of life for residents and addressing the problems associated with urban transportation in the city of Kufa. The research aims to evaluate the current urban transportation system according to the principles of the active city. The study concluded that the horizontal extension of the city of Kufa, the abundance of infrastructure for private vehicles, and long travel distances led to a reduction in

reliance on active transportation. The design of residential neighborhoods in the city of Kufa encourages horizontal extension. It lacks a strategy of urban compactness or compaction, which forced the residents of the city of Kufa to rely primarily on private motorized transportation in the process of transportation, and with a direct relationship that increased environmental impacts and run-over accidents. The absence of encouragement and education, along with social customs, made active transportation in the city of Kufa socially unpopular.

Therefore, the planning of residential neighborhoods must be reconsidered, better communication must be provided, and infrastructure for walking and cycling must be provided according to the guidelines of sustainable urban planning. The wider spread of economic activities throughout the city may increase active travel and reduce the use of private motorized vehicles.

**Keywords:** Active City, Quality of Life, Sustainability, Active Transportation.

**Introduction:** The city and the way we use it have changed significantly. Cars were limited to a specific category of the city's residents, while everyone used other means of transportation. Since then, the use of bicycles and walking has declined, and the shift to personal vehicles has increased. The number of cars of all shapes and sizes has led to different plans and uses in the city.

There is, of course, a connection between transportation patterns and city structure. When comparing downtown neighborhoods to peripheral areas, we find that the structure of the city center is not suitable for large flows of motorized traffic. The streets are narrow, and parking spaces are limited, creating complex problems within the city. The separation of functions in these areas makes the distances to the city center, residential areas, and work areas long, which leads many city residents to choose personal cars for transportation in light of the lack of other sustainable forms of transportation in the city structure.

The current growth and the need to increase city density calls for a reconsideration of the issue of mobility. The application of sustainable urban transport planning principles, one of which is the active city, which is a healthy city designed to integrate physical activity into the daily routine, with the goal of reaching a rate of physical activity per day of at least

30 minutes or more. This activity takes more than one form, such as walking, performing fitness exercises, or cycling for purposes, discouraging the use of personal cars, and improving road safety.

1- The active city:

1-1 The concept of the active city

Urban transformations due to technological and economic changes have led to urban dispersion (Alonso, A., 2018). Rapid transit based on cars, investment in roads, and declining land values in the city suburbs have led to the development of urban sprawl, resulting in a lack of continuity and separation of residential, industrial, office, retail, and recreational areas (Frumkin, 2002, p. 201). Growing concerns about traffic congestion in cities, greenhouse gas emissions, and transportation energy expenditure have led to increased interest in active mobility. One of the forms of sustainability in which active mobility is a central focus is the active city, which is a vibrant city full of movement. People cycle or walk to work, school, friends, or home. But some people move without a specific destination: they stroll in the park, around the neighborhood, or simply along the canal. As they move, they think about things and make decisions – some crucial (Should I stop at a red light?), some less important (Should I take this or that route?), and some intuitive (Should I pass or should I slow down?). When cycling or walking, you become part of the city, using all your senses, being open to others, and contributing to shaping the city (Urban Design & strategy commissioned by the City of Amsterdam, 2017, pp. 20-21). An active city is one that constantly creates and improves opportunities in the built and social environments and expands community resources to enable all its citizens to be physically active in everyday life (Edwards, 2008, p. 3). Therefore, the researcher's operational definition of the concept of active is a lively city that encourages non-motorized forms of transportation such as walking and cycling, where residents participate in daily activities that contribute to their interaction with the urban environment, which enhances social life, public health, and environmental sustainability.

2- Forms of activity in the active city

The active city is the city in which the infrastructure supports physical activity in multiple forms, as in Table (1), compatible and scalable to achieve the following:

- A. Improving the quality of life for citizens.
- B. Ensuring tangible economic growth by raising living standards and providing job opportunities for city residents.

Table (1) Forms of activity in the active city.

Forms of Activity	Aspects	N.
<p>A- High quality in various social aspects (education, health care, public safety, housing).</p> <p>B- Access to high-quality health care services (including e-health (telecare) or remote health monitoring and management of electronic health records).</p> <p>C- Homes that encourage activity and enjoyment of nature (light and ventilation).</p> <p>D- Facilitating access to all services.</p>	Active Life	1
<p>A- Quick access to and from stations.</p> <p>B- Safe transportation.</p> <p>C- Innovative systems (more efficient and intelligent transportation systems).</p> <p>D- Effective use of traffic networks in the movement of vehicles, people and industry, to reduce traffic congestion.</p> <p>E- New social pattern: such as car sharing and diversification between the use of cars and bicycles.</p>	Active Transport	2
<p>A- Continuous monitoring of pollution rates and types.</p> <p>B- Activating programs for prevention and dealing with natural and industrial disasters, including the ability to address the effects of climate change.</p> <p>C- Using sustainable technology.</p> <p>D- Providing sustainable income and a healthy and sustainable environment that meets today's needs without sacrificing the needs of future generations.</p> <p>E- Environmentally sustainable energy consumption.</p> <p>F- Reducing energy consumption through technological innovations while promoting energy conservation and reusing materials.</p> <p>G- Providing enjoyment of nature for all segments of society (rich and poor).</p>	Active Environment	3
<p>A- Representation in wise decision making.</p> <p>B- Public and social services.</p> <p>C- Improving community access to services.</p> <p>D- Transparency.</p> <p>E- Democratic and inclusive processes.</p> <p>F- Linking government organizations and departments.</p> <p>G- Opening channels of communication between citizens and officials to know the requirements and integrate them into the plans.</p> <p>H- Periodic maintenance.</p>	Active Management	4
<p>A- The basis of social capital is human citizens, so their needs must be met.</p> <p>B- Developing material services such as transportation, water, utilities (energy) and communications.</p> <p>C- Supporting international industries.</p> <p>D- Providing a more harmonious educational environment in both urban and rural areas.</p> <p>E- The spirit of initiative and innovation.</p> <p>F- High levels of productivity.</p>	Active Economy and Production	5

Source: (Ramadan 2020, 769

From the above table, we notice that the forms of activity in the active city include multiple aspects and forms, so our research will focus on the element of active mobility, the concept of which will be reviewed in the following paragraph, with the extraction of the most critical indicators that will be verified to what extent they are achieved in the study area.

3- Active transportation

Regardless of their objectives, walking and cycling, as they are two means that rely on self-power and human energy, are among the most prominent means included in active transportation systems, which promote green and sustainable transportation and provide general health benefits. Walking is used every day to travel short distances, such as moving to facilities located in the same geographical area. On the other hand, cycling is an effective means of traveling short to medium distances as an alternative to motorized vehicles. Therefore, the appropriate infrastructure for active travel may provide many benefits compared to the infrastructure for motorized

vehicles, including physical exercise, easy access to streets, reducing the hassle of searching for parking, reducing emissions, and alleviating congestion (Rahman, 2023, pp. 4-5). Active transport, such as walking (direct access to destination, access to public transport stations) and cycling, is defined as a means of transport that requires human muscular intervention for movement. It is currently one of the main axes of transport planning due to its health benefits, environmental non-pollution, energy efficiency, and socio-economic factors. Strategies that encourage the replacement of short-distance car trips with active travel are becoming more common (Rodrigues, 2023, p. 2).

Based on what was reviewed in the concept of the active city and its forms of activity with a focus on active transport, the researcher reached a set of indicators, shown in Table (2), on the basis of which the current status of urban transport in the city of Kufa will be evaluated.

Table (2) Main and sub-indicators extracted from the study.

Sub-indicator	Key Indicators	N.
-Linking public transport stations and active transport routes. -Possibility of transporting bicycles via public transport.	Integration with public transport	1
-Density and connectivity of pedestrian and bicycle networks. -Presence of safe and connected sidewalks. -Provision of barrier-free passageways.	Walkability and cycling	2
-Accident rates involving pedestrians and cyclists. -Measures that reduce risks (such as reducing vehicle speeds) -Separate and safe cycling paths.	Safety and security	3
-Percentage of population using walking or cycling as a daily mode of transportation. -Rates of increase in reliance on active transport over time.	Participation and use	4
-Reducing carbon emissions due to increased reliance on active transportation.	Environmental impact	5
-Programs to educate and encourage walking and cycling. -Awareness campaigns on the benefits of active transportation.	Education and promotion	6
-Easy access to schools, health facilities, and places of work through active transportation. -Mix of land uses (proximity between different activities).	Accessibility	7

Source: Researcher.

Study area

The city of Kufa is one of the oldest Iraqi cities. It is distinguished by its good location, contains old mosques and ancient archaeological sites, and has a regional influence that goes beyond the city's borders and the borders of its administrative region, the governorates near and far from it, and may reach further than that to include Arab and Islamic countries.

The city of Kufa is located on the right bank of the

Euphrates River (Shatt al-Hindiyah), between longitudes 44°39' and 44°21' east and latitudes 33°57' and 33°12' north, at an altitude of (24 meters) above sea level (Jedi, 2023, pp. 1418). This is located in the southwestern part of Iraq, on the eastern side of Najaf Governorate. It is considered an urban center for the Najaf Governorate. Babylon Governorate borders the city to the north, Qadisiyah Governorate to the east and south, and the west is the center of Najaf Governorate, which is (10 km

away). It is 157 km away from the capital, Baghdad, on highways, 50 km away from the city of Hillah, 75 km away from Karbala, and 65 km away from Diwaniyah, the center of Qadisiyah Governorate (Al-Mashrafawi, 2021, p. 122), as in Figure 1. Given the importance of its location and center, The religious and historical city

has become a city that is visited by a large number of visitors. Still, it also faces some urban challenges that most Arab cities suffer from, the most important of which are those related to metropolitan transportation (2223 Al-Jawari, 2022).

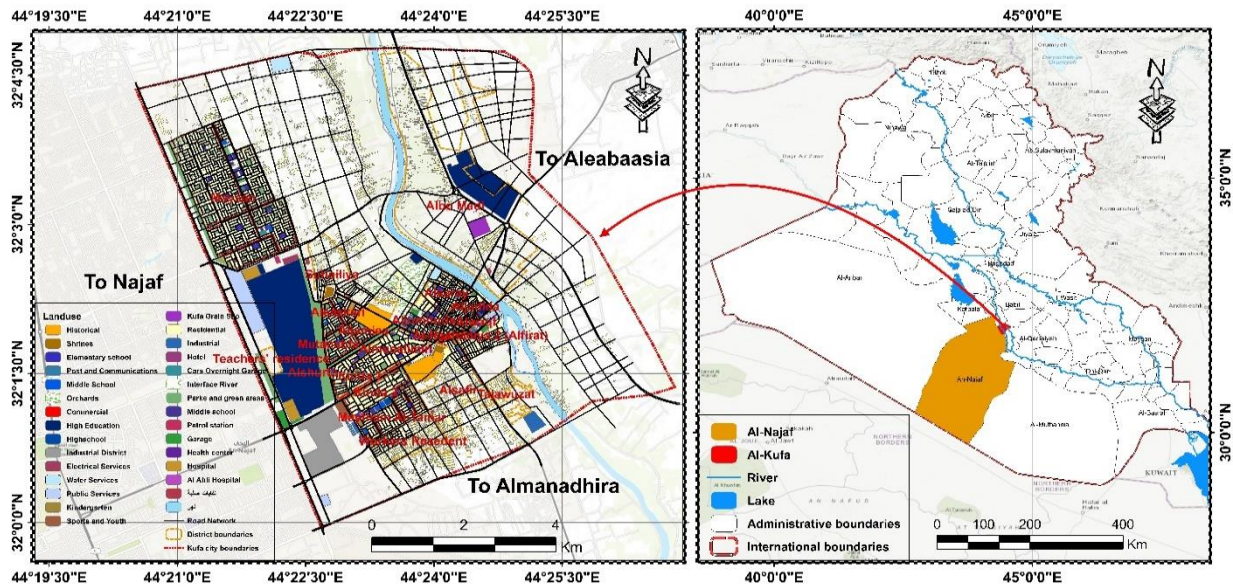


Figure (1) Location of Kufa city  
Source: (Al-Mosherefawi, 2023, p. 2)

5- Analysis of the transportation system in Kufa city according to the principles of active transportation:

5-1 Integration with public transit:

Kufa city lacks public transportation, as public transportation is limited to one route (Najaf-Kufa line). This line is devoid of facilities for public transit, especially those related to public transportation stations, and the city is bereft of paths for active transportation (walking, cycling). Therefore, the sub-indicator represented by the connection between public transportation stations and active transportation paths is not achieved. Still, the possibility of transporting bicycles via public transportation has not been achieved because the

existing means of public transportation are small vehicles with a capacity of (11) passengers.

Walkability and cycling

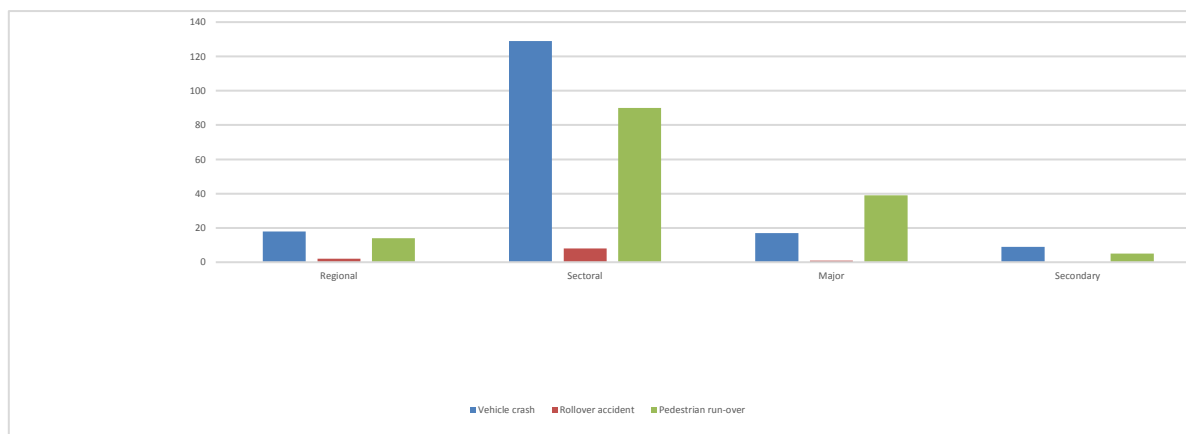
The city does not have pedestrian networks, whether they are part of the road sidewalk components or separate pedestrian paths isolated from other road components, so the connectivity index is not achieved, and it is not free of obstacles. This is due to the large number of violations on these sidewalks by the owners of shops on both sides of the road. As for its connection to some extent, its planning system separates these paths from each other at specific points, and pedestrian movement becomes intertwined with vehicle movement, which makes it absolutely unsafe.



Safety and Security

The citizen in the city of Kufa does not feel safe while moving within the city of Kufa because he is exposed to an accident whether he is walking or riding a bicycle.

In 2019, a study was conducted on traffic accidents. Run-over accidents came in second place after collision accidents, accounting for 45% of the total accidents in that year (Directorate of Transport and Communications Statistics, 2019).



Risk-reducing measures (such as reducing vehicle speed) in the study area are limited to speed bumps, which are considered old traditional solutions that are ineffective in achieving the desired goal. There are also

works carried out by planning authorities and decision-makers in the city that aim to expand the vehicle movement space, which exacerbates the problem of traffic accidents. The area is devoid of separate or shared paths for cycling.



Figure (5) is a model of the methods used to calm vehicle traffic in the city of Kufa.

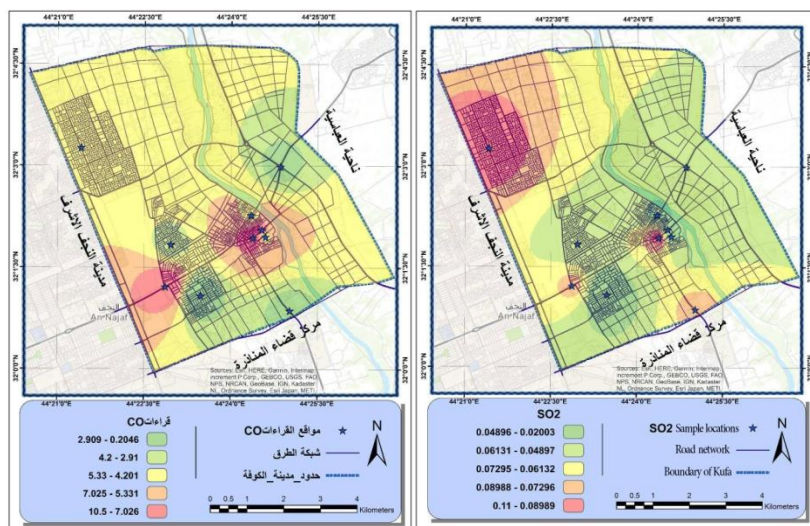
5.4 Participation and use

There is a percentage of the population who use walking or cycling as a daily means of transportation in the city of Kufa, and this percentage does not match the standards and ambitions aimed at achieving sustainability in the urban transportation process. In a study conducted by the researcher (Al-Fedawi) that dealt with three neighborhoods in the city of Kufa, it

was found that 70% of the residents of these neighborhoods rely on private cars for daily transportation (Al-Fedawi, 2022, 105). These percentages are constantly increasing, and this is due to the lack of keeping pace with the development of urban transportation planning programs, which led to the rates of reliance on active transportation decreasing over time.

conducted by (Al-Mosherefawi) on samples of readings at various points in the city of Kufa, it was found that the concentration of CO<sub>2</sub> gas resulting from incomplete combustion of fuel reached (10.5ppm). At the same time, the permissible global limits were (9ppm) with an exposure period of (8 hours), while the concentration of SO<sub>2</sub> gas in specific locations reached (0.11ppm) while the permissible limits nationally and

globally were (0.03ppm) and also exceeded the allowable limit. These percentages and readings lead to the fact that there are no trends to increase reliance on active transportation but rather the opposite, increasing mechanized transportation.



**Figure (6) Concentration of SO<sub>2</sub> Gas in The City of Kufa.**

Source: (Al-Mashrafawi, 2021, pp. 120-121)

#### 5-6 Education and encouragement

There were some trends in the basic plan prepared in the city of Kufa in 2008 aimed at encouraging walking and cycling, but they remained ink on paper and did not see the light in the implementation processes of the basic plans. As for awareness campaigns about the benefits of active transportation in the city of Kufa, the local government does not have such trends, as the reality of Iraqi society in general and the city of Kufa, in particular, does not accept such trends and adheres to some customs such as relying on private transportation.

#### 5-7 Accessibility

The horizontal urban expansion and sprawl that the city of Kufa witnessed after 2003. This led to the absence of connectivity between the city's regions and the distance between residential and industrial areas from other services such as schools, health facilities, and workplaces, which led to the lack of reliance on active transportation patterns. Some residential neighborhoods do not have essential services in a way that enables residents of the residential neighborhood to reach them on foot, which makes them dependent on neighboring neighborhoods and thus makes access to them by one of the active transportation patterns

very difficult. Land uses, especially in the city center, are characterized by horizontal mixing. Indeed, this type of mixing does not achieve the factor of convergence of distances between activities as achieved by vertical mixing.

#### CONCLUSION

The horizontal expansion of the city of Kufa and the abundance of infrastructure for private vehicle roads, long travel distances, and high transportation costs lead to a reduction in reliance on active transportation. The design of residential neighborhoods in Kufa City encourages horizontal sprawl. It lacks a strategy of urban solidarity or compactness. It lacks attention to the infrastructure for sustainable transportation such as public transportation, walking, and cycling to the point of making the city devoid of any form of active transportation, which forced the residents of Kufa city to rely primarily on private motorized transportation in the process of transportation, and with a direct relationship that increased the environmental impacts and run-over accidents. The absence of encouragement and education, along with social customs, made active transportation in Kufa city socially unpopular. Therefore, the planning of residential neighborhoods must be reconsidered. Better communication must be provided, and walking and cycling must be provided in

accordance with the guidelines of sustainable urban planning. The broader spread of economic activities throughout the city may increase active travel and reduce the use of private motorized vehicles. Moreover, launching bike-sharing programs and public education campaigns that highlight the social, economic, and environmental benefits of sustainable public transportation, walking, and cycling are effective strategies to break the social fallacy and increase active travel. This study provides critical initial insights into this issue. Thus, our findings will be helpful to policymakers in shaping the city's structure more sustainably. They will guide decision-makers in determining policy and planning options for transportation infrastructure and land use across the city and allocating funding to promote active transportation to protect the environment and public health. At the same time, this is the first study of active transportation and the built environment in the study area.

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