Enhancing public transportation and Reducing private car use in the cities

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Abstract:

Successful public transport is essential for any transport sector emissions reduction strategy. It is a public good, delivering benefits for transport efficiency, pollution reduction, the local and national economy, and social inclusiveness. To make public transport an attractive and everyday choice for residents, cities must design the service well, and overcome physical and cultural barriers. High-quality public transport services are reliable, frequent, fast, comfortable, accessible, convenient, affordable and safe, serving routes for which there is demand. Using private cars as a main mean of transportation in large cities is usually the preferable solution for their citizens. This dependency on individual private cars is usually due to the absence of other convenient public transportation. Iraqi cities are facing several environmental pollution problems from the crowded roads with the increased number of private cars.

This research will highlight the harmful impact of private car dependency on the environment and the urban context, and then, it introduces different solutions that can help in minimizing the car dependency problem in congested cities.

Introduction:

All countries and societies are currently trying to develop themselves in the field of transport and traffic, and as we all know because of the concerns of life and being in the age of speed, everyone is trying to get to the places of daily activities as quickly as possible at the lowest price, and one of the methods which commonly used in

mobility is the use of Private cars, which is considered as a huge problem in many urban city centers. This, in turn, leads to a serious environmental problem as well as traffic congestion within the urban context.

Policymakers should take positive action toward avoiding congested streets in the city center rather than just expanding the roads. Providing several options for citizens can solve the car dependency problem such as encouraging walking ability and bicycling by improving the pedestrian/bicycle environment. It is also important to enhance the quality of public transportation within the cities, by providing proper mass transportation methods to the people.

Impact of Car Dependency

Car Dependency has **environmental**, **social** and **economic** impact that may affect negatively the human living environment.

- **Environmental Impact**

The environmental consequences of transport are the result of infrastructure and the vehicles using this infrastructure, these consequences include visual pollution, air pollution, road congestion and the depletion of renewable resources. Although automobiles and Aeroplan's are considered to be more damaging to the environment than other modes of transport, most transport modes result also in some form of negative environmental consequences.

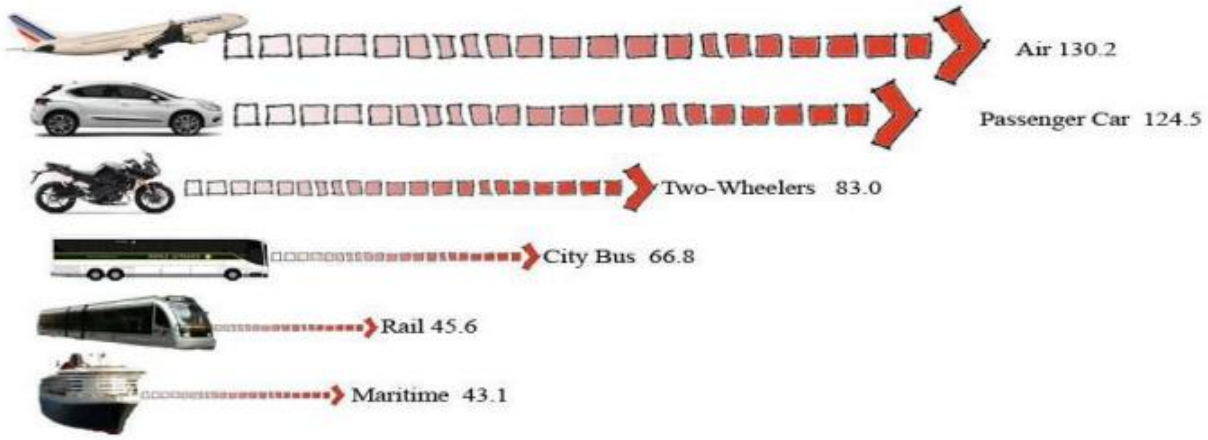


Figure-1 Co2 emissions per passengers (grams per kilometres), Source: European Environment Agency; Edited by Researcher

- **Social Impact**

Social benefits have been accompanied by the automobile such as independence, freedom as well as the ability to participate in spatially separated activities such as employment, shopping, and recreational activities. However, there are many negative social consequences associated with automobile use such as traffic noise, which causes significant health and social problems. Noise causes cardiovascular diseases and high blood pressure. It is always associated with road deaths and serious injuries resulting from accidents. Automobile use also affects livability, community life, social interaction and all the aspects related to the human biological and psychological well-being and quality of urban life. Residents on lightly trafficked streets have much more

social contacts, more friends and more are socially interactive than residents of heavily trafficked streets.

- **Economic Impact**

"Historically, economic growth and transport growth have gone hand in hand". Automobile cities suffer several economic impacts, such as congestion costs in terms of the high costs of urban infrastructure.

The main problem the environment pollution and increased congestion due to the use of private cars and the absence of efficient public transportation.

Transportation Planning Policies

Enhancing the Quality of Public Transport:

The quality of the service provided by the public transpirations should be enhanced In order to encourage citizen to shift from using their private cars to use different types of public transportations. There should be also integration between different modes of public transportation in order to reduce the overall journey time of an individual.

Urban Design Policies

- **Walking Strategy**

  Walking strategy could be the better solution during the peak hour's car as well as for short distance. This strategy can lead to reduce environmental pollution reduction promoting a healthy living environment. However, there are a number of factors contribute to make walking within the city an inconvenient and unpleasant experience. Between these factors is the conflict with other modes of transport especially vehicles which often leads to pedestrians feeling unsafe and unsecure. The lack of adequate pedestrian facilities as well as the presence of anti-social behavior, including beggars and illegal street traders, create an unattractive environment and contribute to discouraging walking as a mode of travel.

- **Cycling Strategy**

  Cycling is a totally free of emissions mode of transport, which does not affect the urban atmosphere negatively. Also, cycling is known as the most energy efficient means of transport. Cycling is cost effective this is because the bicycle itself is cheap, the maintenance costs are also reasonable, and the

necessary infrastructure is cheap compared to alternative modes. It has also low space requirements. A parked bicycle uses about 1 square meter, less than 8 percent of what a car needs (and even less in the case of two-level bicycle parking). Using the bicycle as a daily means of transport is a convenient and easy way to integrate physical activity in an urban lifestyle. There is basically two ways of combining bicycles and public transport:

a) The bicycle can be parked at terminals.
b) The bicycle can be taken on the train/bus as accompanied luggage.

There are four types of bicycles facilities; these types are classified as shown in the following figures:

Figure-2 To the left plan sketch for the shared roadway; to the right plan sketch for the signed shared roadway

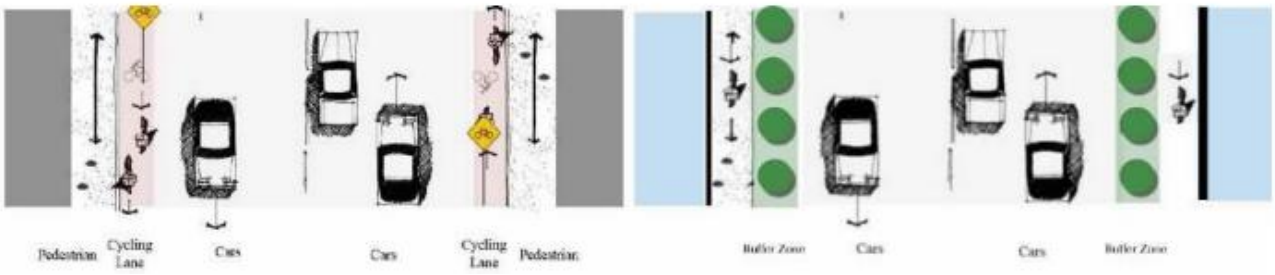


Figure-3 To the left plan sketch for the signed bike lanes; to the right plan sketch for the Shared

The main objectives are:

1. Reduce congestion and air pollution
2. Increase safety for road users and decrease traffic accidents
3. Finding proper alternatives to use instead of private cars

Reducing the number of private cars on the streets to preserve the environment and reduce pollution:

We should know that there are 4 major pollutants that come from cars:

- A car emits carbon monoxide when the carbon in fuel doesn't burn completely.
- A car's exhaust emits hydrocarbons, a toxic compound of hydrogen and carbon.
- When fuel burns, nitrogen and oxygen react with each other and form nitrogen oxides (NOx).
- Particulate matter -- small particles of foreign substances -- in the air contributes to atmospheric haze and can damage people's lungs.

According to the Environmental Protection Agency (EPA), motor vehicles collectively cause 75 percent of carbon monoxide pollution in the U.S.
The U.S. has 30 percent of the world's automobiles, yet it contributes about half of the world's emissions from cars.

By decreasing the use of private cars, we can reduce these percentages significantly, due to that people in larger numbers will share a smaller number of cars and transportation facilities

Reducing congestion:

It is possible to reduce congestion during rush hours by reducing dependence on private cars, if adequate transportation is provided without having to use the car or provide faster options to entice drivers to use it instead of their own cars.

Reducing traffic accidents and increase safety

This is because other means are often with dedicated roads such as trains or are isolated, such as buses in some cities where they are isolated by lines or levels, or using types that are not associated with risks such as walking.

Finding the proper alternatives to dispense with private cars:

Many cities have found alternatives to private cars, and some of them have succeeded in achieving their desired goals, while others have not worked.
These alternatives are determined by conducting research and analysis and collecting information that includes many aspects such as the geographical nature of the city, topography, available infrastructure, streets width, social aspects of the inhabitants, etc.

And according to these data we can determine which methods of transport are the most proper to use in the study area.

Increasing comfort of the population (increase quality of life):

One of the most important ways to increase the quality of life for residents is to reach their intended places as quickly and as comfortable as possible, especially at peak hours when everyone wants to reach their places of activity on time, such as students and employees.

Chapter Two: LITERATURE REVIEW

Introduction:

The private car is fast, comfortable, and convenient. However, worldwide massive car use causes extreme congestion that leads to serious environmental problems. Although breakthroughs in clean automobile technology may be under way, reducing car use seems necessary in order to achieve a sustainable transportation system. Several travel demand management (TDM) measures have therefore been proposed and some have been implemented with this aim. The article reviews research addressing the question of how effective, acceptable to the public, and politically feasible such measures are.

What is public transit?

Public transit, public transport, or mass transit are all ways to describe the movement of people in a group riding one mode of transport, usually within an urban area. Public transit is usually managed on a schedule and operates on specific lines or routes. It can be managed privately or publicly depending on the local system of governance.

Why was mass transit invented?

The sheer size of the world and the limited resources in one place have always meant that humans must travel outside of where they live, whether it's to get food, go to work, or for a social visit. Public transit provides efficiency and cost-savings for people traveling in the same direction or destination, as the cost is shared between everyone traveling.

When did public transit begin?

The first form of public transport was multiple people riding animals. Animal-drawn ferries are thought to be the earliest form of public transit. The wheel was invented in 3,500 BC but it wasn't until 1,600 BC that it was used for a chariot. This is when the idea of longer distance travel was possible by road.

History of Public Transit Timeline

1820s

The first concept of a public transit system in a city started in the 1820s in France and London with the introduction of the omnibus, a horse-drawn car that held up to 10 people at a time. With the roads as they were in those days, can you imagine how uncomfortable that would have been?

In 1825 George Stephenson built the first public steam railway in the world, the Locomotion between Stockton and Darlington Railway in the UK.

1830s

The first authenticated streetcar in America, the New York and Harlem Railroad, began service in 1932. It wasn't until 1855 in Paris that the first permanent tram line in continental Europe was opened, 1858 in South America in Santiago, Chile, and 1860 in Sydney, Australia.

1870s

The first cable car was tested in 1873 in San Francisco. Due to the rolling hills of the city, Andrew Smith Hallidie was inspired to create this form of transportation to make sure the poor horses weren't overly whipped while struggling to climb up the steep slopes.

Fast forward to 2018 — here I am by an iconic cable car in San Francisco which still runs on the same tracks to this very day.

1880s

The first public electric tram line opened in Berlin, Germany in 1881. It initially drew current from the rails, with overhead wire being installed in 1883.

1890s

In 1890 the first underground railway in the form of the Metropolitan Railway on what would become the London Underground.

The first rapid transit system in the United States was built a few years later in 1892 in Chicago — the "L" train continues to run to this day.

Boston, Massachusetts opened the first subway system in the U.S. in 1897 to avoid severe weather conditions.

1910s

Another UK first occurred in 1910 when the first mass-produced bus was introduced in London. This double-decker style is still in place today. Proof that good ideas never get outdated!

1920s

The introduction of the motorbus was in 1922 which rapidly changed the speed in which passengers were able to get to their destination.

1960s

The first bullet train was introduced in 1964 between Tokyo and Osaka in Japan. The average speed was 99 mph.

In the U.S. in the 60s, steam trains transitioned to diesel-electric powered trains.

2000s

Shanghai was the first city to implement battery buses — an electric bus that uses energy from on-board batteries to drive its electric motor. These offer zero emission and are much quieter than normal buses. China had about 99 percent of the 385,000 electric buses on the roads worldwide its cities are adding 1900 electric buses per week.

A literature review of the existing evidence base on the availability of public transportation and their quality and the quality of walk ways was undertaken. We reviewed global evidence but had a focus on Melbourne and Istanbul research and statistics.

The review included:

International example: Installing the tram network of Melbourne:

Trams have operated continuously in Melbourne since 1884 on a network which has progressively grown to become the world's largest.

In Australia, trams fell out of favor during the 20th century and most networks closed or were severely cut back due to the increasing rate of private car ownership and the perception that trams contributed to traffic congestion. This led to the progressive replacement of tram services with buses in all Australian cities by 1969 (Brisbane being the last to remove their tram system) with the exception of Melbourne and a single line in Adelaide.

Figure-4 one of Melbourne trams

By the 1970s Melbourne was the only Australian city with a major tram network. Melbourne was able to avoid following the trend of many other cities around the world at the time of removing its tram system in favor of buses for the following main reasons:

Melbourne has wide city streets where the geometric street pattern made trams more practicable than in many other cities;
• The track infrastructure and trams were relatively new, having replaced Cable Tram equipment in only the 1920s–1940s. This removed the point used by many other cities, which was that renewal of the tram system would cost more than replacing it with buses.

• Strong resistance from the unions; and Modernizing Light Rail Infrastructure to Meet the

Demands of a Growing City:

Melbourne had an independent tramways board with Sir Robert Risson as the Chairman of the MMTB. Risson, successfully argued that the cost of ripping up the concrete-embedded tram tracks would be prohibitive.

By the mid-1970s, as other cities suffered increasing traffic congestion and air pollution, Melbourne's decision to retain its tram network was vindicated, even

though patronage had been declining since the 1950s in the face of increasing use of cars beyond the tram network's limits.

As cities around the world are growing, light rail is once again becoming a popular and financially viable method of mass public transport to move people efficiently. This is evident in Australia, with projects or plans in progress for the potential construction of new lines in Sydney, Canberra, Newcastle, Brisbane, Adelaide, Perth and Hobart. New light rail lines have the benefit of being built to the latest design standards for capacity, accessibility and safety. The use of advanced operational modelling and forecasting tools enables consideration of requirements for future development and expansion of the network. In contrast, systems such as Melbourne’s that have grown and evolved over many years must continually modernize their existing assets and infrastructure if they are to meet the pressures of increased customer demand and community expectations in respect to transport needs. Upgrading infrastructure assets is driven by customer experience expectations as well as legislative requirements which have necessitated development of new standards and design solutions.

Melbourne’s decision to retain its tram network is now paying off as to build a network on the scale of Melbourne’s, built now, would take at least 20 years and cost $15-25 billion to build. There are however numerous challenges associated with maintaining and upgrading a tram network that was built over 100 years ago to ensure it is capable to meet the demands of a growing city.

Figure-5 Trams map of Melbourne

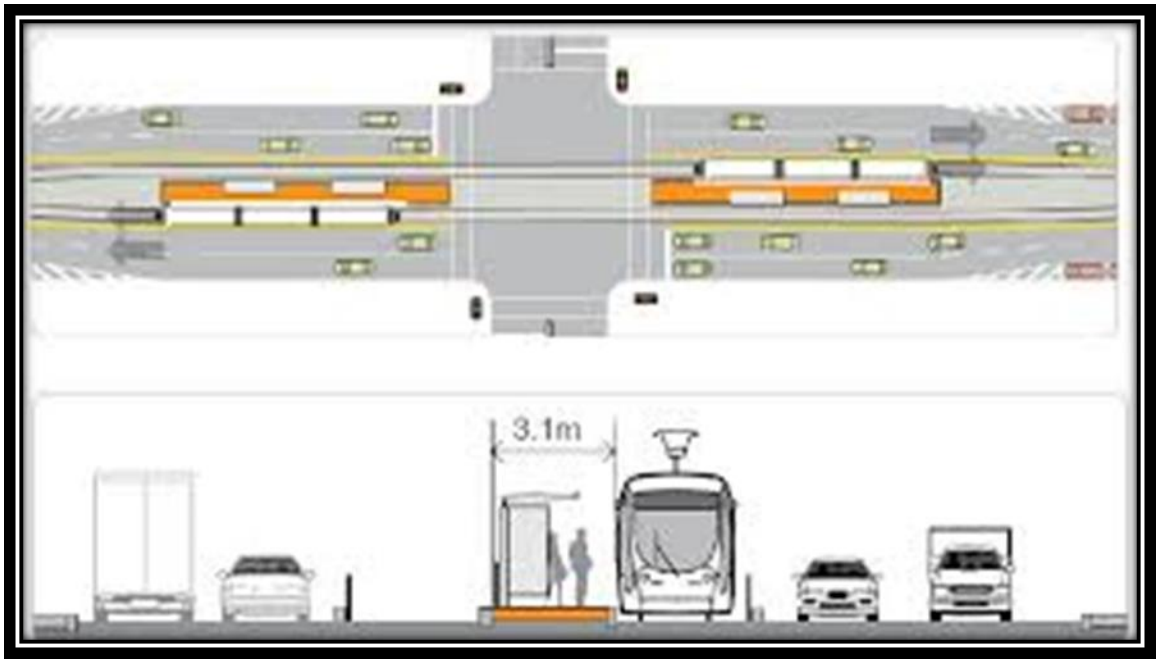


Figure-6 Melbourne street segregation (A)

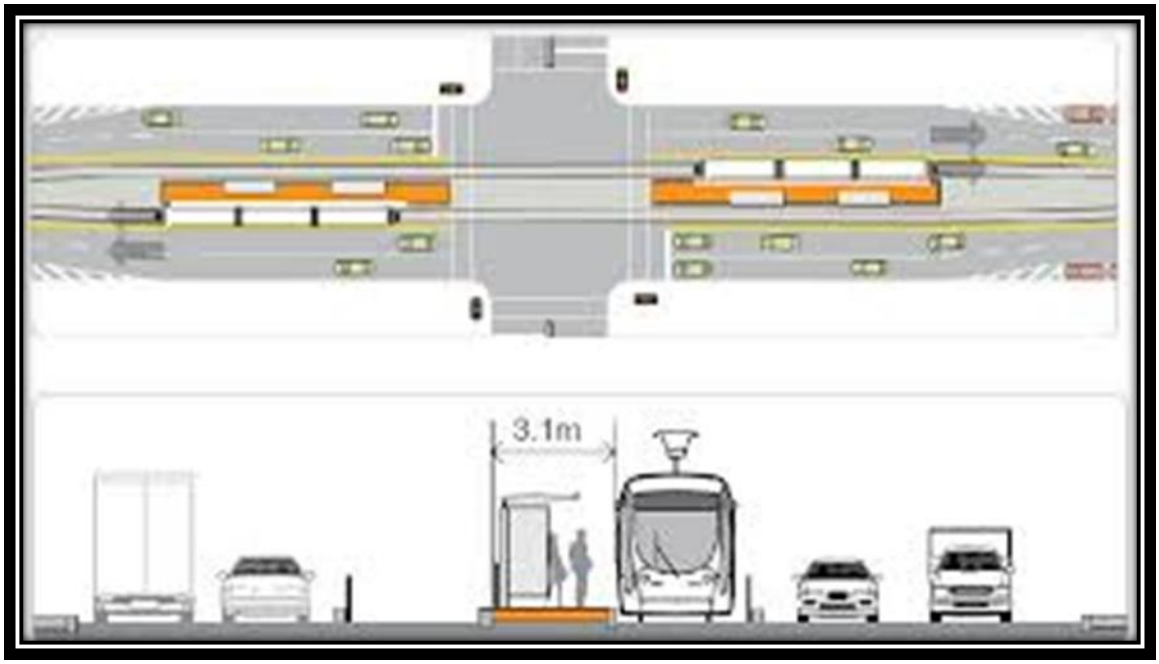


Figure-7 Melbourne street segregation (B)

Regional example: Istanbul transport system:

Minibus:

- Minibuses and buses have formed the main body of the traditional public transport system, and have remained insufficient to meet the needs of a growing population. Also caused noise pollution, harmful emissions, serious traffic accidents and traffic jams and in order to solve these problems Istanbul did a lot of improvements to their public transport system.

Figure-8 Min buses system of Istanbul

Metro:

- First metro line in Istanbul (M1) began service on 3 September 1989 and it's further developed to serve places between Aksaray and Atatürk Airport on 20 December 2002. The line has 18 stations and is 19.6 km long. As of 2012, daily ridership was 416 journey and 210,000 passengers.
- Second metro line (M2) between Taksim and 4th Levant went into service on September 16, 2000. This line is 8.5 km long and has 6 stations. The southern extension of M2 from Şişhane to Yenikapı over the new Golden Horn Bridge is opened in 2013 permitting the line to reach the Yenikapı Transfer Center.

- M4 line opened on 17 August 2012 up to Kartal, on the Asian side. The line will have a total of 19 stations and 26.5 km long.

Figure-9 metro station in Istanbul

Tram:

- Istanbul first opened the modern tram system in 1992 on the European side.
- The modern tram consists of lines T1 and T4, initially operated with 55 low-floors Bombardier
- Line (T4) was opened in 2007 between Edirnekapı and Mescid-iSelam. There are 22 stations and its total length is 15, 3 km. Since March 2009, the line works between Topkapı and Hapibler is operated with LRT vehicles. As of 2012, daily ridership was 380 journey and 100,000 passengers.

Figure-10 New &old trams in Istanbul

Funicular:

- Istanbul has built two underground funicular railways, the first one is Tünel opened 1875, and the second is Kabataş-Taksim opened in 2006.
- Tünel is 573m long, electrically powered and runs on rubber tyres with rebuilt ex-RATP MP 55 vehicles, its trip takes approximately 1.5 minutes. About 15,000 people use the line each day.
- Kabataş-Taksim operated by Ulaşım A.Ş. and connects the Seabus port and tram stop of Kabataş with the metro station at Taksim Square.is about 600 meters long and climbs approximately 60 meters in 110 seconds.

Figure-11 funicular in Istanbul

Bus rapid transit (BRT):

- The bus rapid transit (BRT) system in Istanbul is called Metrobüs. The construction of the Metrobüs BRT line began in 2005. The first line runs between Avcılar and Söğütlüçeşme. This line is 41.5 km long and has 35 stations, which are located on Istanbul's Main Highway, called the D 100. It is currently operated with Mercedes Capacity, Mercedes-Benz Citaro, and some Phileas buses. Daily ridership is 715.000 passenger.
- The bus fleet has a total of 4,012 vehicles built by MAN,Ikarus, Mercedes-Benz, BMC, Phileas, Otokar,Temsa and Güleryüz. In 2012 the daily ridership was 3,621,908 passengers, representing 30% of the city's total daily transportation.
- Buses are provided with air conditioning, Wi-Fi access, comfortable seats, real-time journey information at bus stops and improved accessibility.

- In 2010, the municipality decided to found a new company called Otobüs A.Ş. (Bus Inc.) in order to more quickly replace old vehicles.Otobüs A.Ş. had a fleet of 544 vehicles as of December 2012.

Figure-12 BRT in Istanbul

Ferryboats:

- Ferryboats sail on 15 lines serving 27 seaports on the shores of Bosphorus and Sea of Marmara. The 20 older ferryboats carry 61 million passengers yearly.
- There are 3 types of ferry in İstanbul; Sea Busses (İDO), Vapur's and private motorboats.

Figure-13 ferry boats

Local example: Changing streets directions in the city center of Sulaymaniyah City:

In this example we will clarify the changing in the directions of each of Mawlawi Street, Kawa Street, Piramerd Street, Kaneskan Street, and Qanat Street, and its effects on the city center congestion and the reaction of the residents and commercial block owners about this project which has been applied in 2019.

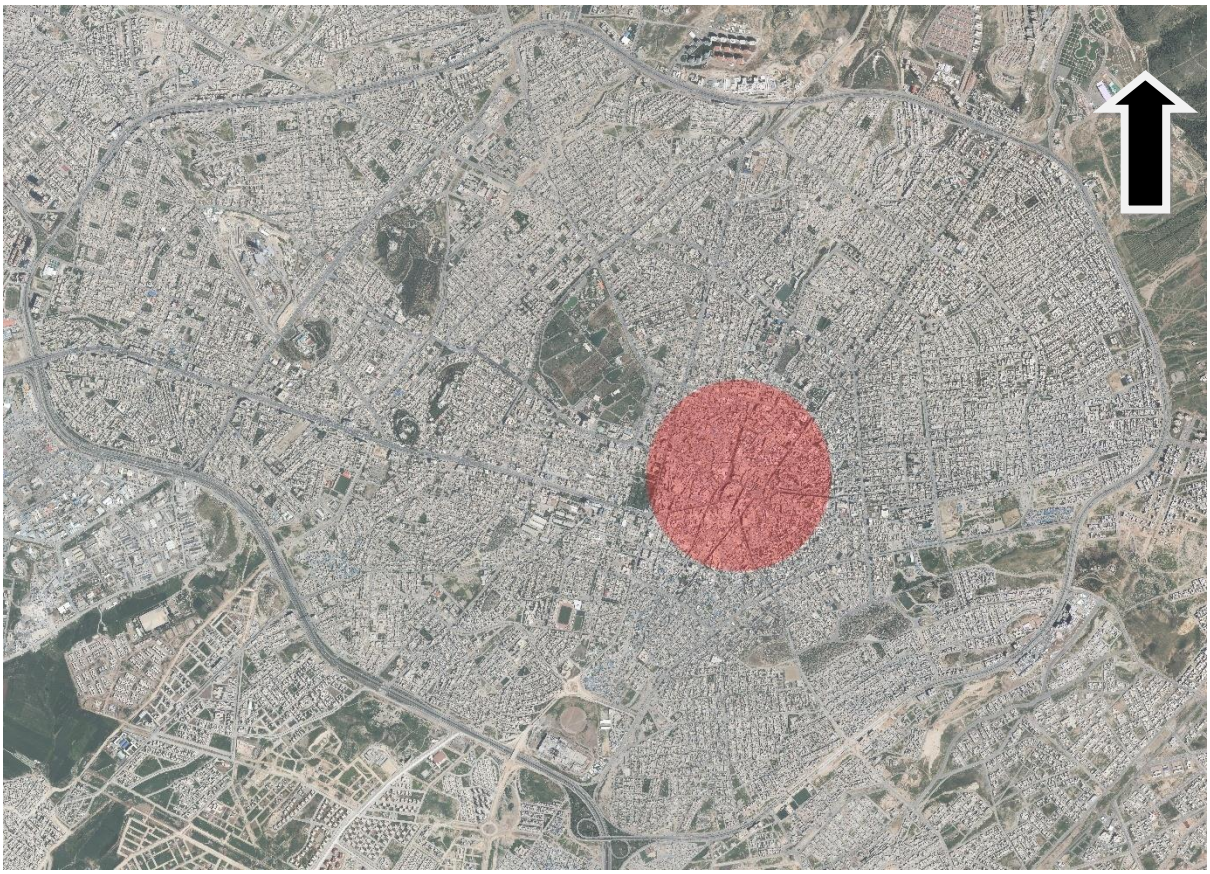


Figure-14 location of the area on sattelite image -the city center of Sulaimanyah

The map below shows the directions of the streets before the project was applied:

Figure-15 city center road directions before changing

i. Advantage for the old direction system:

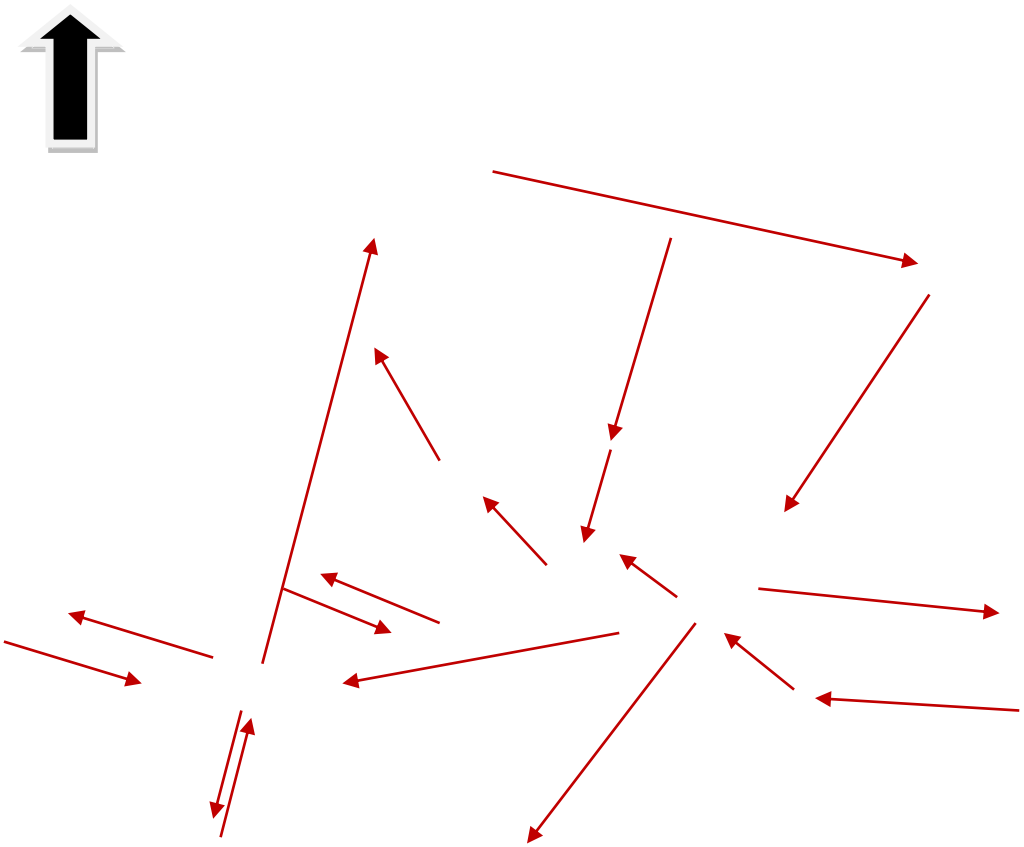
- The traffic pressure was distributed on the streets even though that didn't make any accumulation on the road.
- The traffic movement in Peramerd and Kawa streets was in two directions.
- The road was shorter compared with the new system of traffic movement.
- Access to the city center by the old road was better than the new road.

ii. Disadvantage for the old direction system:

- The street was in two different directions so if one car stopped in the end of the street, the traffic movement will stop.
- The cars were able to be parked in both directions of the street.
- Increase of car to the city center cause of congestion in it.
- One cause of congestion in streets been advertising posters on the platforms.
- In Kawa and Pyramerd Street, steno sis and two lanes created too load and congestion specially while cars stopped in, then created too load in (Sera Square) roundabout.

The new directions system

In 2019 the new system was applied which has caused kind of mess at first because the people were not accustomed with it but with time, they had gone reliable with it, the map below shows the new



directions:

Figure-16 the new road directions system

iii. Advantages for the new direction system:

- Increasing speed of the street because of the direction changing.

- The cars will park in one direction of the street.
- It decreased the load on (Orzdistreet, kaniAskan Street).
- The load that (Salim street and mama risha) caused on Mawlawy street, is now divided.
- It decreased the load on Sara Square

iv. Disadvantages of the new direction system:

- A large number of private cars and taxies
- It is not a good solution, because it converted the crowd from the center to the outside of the center.
- It causes problems for the people to cross the street on the cross walks, because of high speed cars.
- Lack of accessibility to kawa street stores, which causes economical damage to the owner of the stores.
- The crowding of PiramerdStreet, because it has a small number of car parking.

v. Some details about these streets:

Mzgawtygawra-Mawlawy Street: This street has been affected Significantly due to making it one sided street and another important point is the prohibition of street hawkers which made a large difference in the rate of congestion on that street which was one of the most crowded streets of the city.

KanyAskan Street: It is already one-sided street but due to preventing of car parking on the street the rate of congestion has been decreased.

Mawlawy: In the old traffic movement system, Mawlawi Street had a lot of traffic pressure on it. But after reversing the traffic direction in the street, the pressure decreased on it to the extent that we can reach palace hotel from Sara Square in period of 2-3 minutes.
But this process has led to a weakness in the work of the owners of parking yards in Mawlawi Street. Because of most of the people now are using this street to get out of bazaar so that they don't need to park their cars.

Kawa Street: One of the good sides in Kawa street that it goes in two direction but now it is only one direction. The traffic pressure on Kawa Street increased because the road leading of Sabonkaran Street and Peramerd Street will be on it.

Old court (Mahkama) Street: After reversing the streets, the rate of congestion has decreased, because before that it was a 2 lanes (sides) street, but now it's only 1 side which moves towards Mzgawty- gawra.

Another point is the cars parking before the process of reversing the lanes which made an enormous load, the load and congestion there is less cars parking on the streets decreased by a high level now because there are less cars parking on the street

Orzdi Street: Number of cars decreased, You can reach Orzdi clinics through Peramerd Street and this increased the traffic pressure on Peramerd Street.

Sabunkaran Street: You cannot return to Orzdy or Piramerd streets, the lane direction from Sabunkaran to Sera square doesn't let you take any way freely; it only goes to Kawa Street.

Mzgawtygawra - Sera square street: It has the same lane directions and the rate of congestion didn't change significantly so that it effects the other streets and make load on it, such as Mawlawy an Piramerd streets.

Peramerd Street: The good aspect in Peramerd Street is that it can be accessed to Orzdi, Bekas, mawlawi and kawa streets through it.
Great traffic pressure on the street (traffic pressure of Bekas, mawlawi ,kawa streets and peramerd itself) even with that the traffic movement has become faster.

vi. Recommendation:

Ways to reduce congestion on the streets:

1-creating more streets.

2-expansion the width of the streets, by increasing its lane.

3-encourage the people by reducing the use of vehicles, and increasing the alternatives for transportation.

4-concern about the other factors of transportation so that the people do not only use vehicles for example creation of tram, creation of underground transportation factors such as (metro, underbus autobahn, creating lanes related to bicycle)

In conclusion…

Wide adoption of public transport is a win-win-win for passengers, local authorities, and the environment. While it's natural that a force majeure in the form of a pandemic has reduced public transit use, there are ways to make public transport the number one choice for people to get around safely and sustainably.

To make public transport services more attractive, cities and public transport solution providers should take every opportunity to ensure a high quality of service on public transport systems