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Curitiba practice in implementing BRT as a sustainable urban transportation system &its Application in the City of Baghdad

[1]Aws Mahmoud Mohammed

Abstract

The human need for transportation has existed from the dawn of time, and its subject was connected to man's constant movement as he traveled from one location to another in search of life's necessities. Over the years, economic and industrial development faced by the world's cities in general, including Arab countries, has led to the presence of many urban problems, including public transport issues, often reflected in their visual and audible forms in busy and noisy roads traffic blockage waste and environment pollution . Through this, the need arose for the existence of many systems and means for social, economic and political life issues within these cities, including transportation and transportation systems, which are considered to be a vital cause to insure stable urban cities through out the numerous cities around the globe, who considers transportation segment to be playing an important role for every developed and developing country at the cultural, economic Social and urban levels. Sustainable transportation systems are a keystone for the economical success and wealth of countries.in addition to there important role in fighting climate change in the world by dropping the level of air pollution, especially in the crowded metropolitan cities that are extended in growth at a high pace in particular in the developing countries.

Curitiba in Brazil considered to be the first city in the world to implement a successful (BRT) bus rapid transit system, then many cities in different countries around the world imitated this system since it approved to be a very successful mode of public transport. In this research the main goal is to find the accessibility of implementing this model of public transport in the cities of Iraq in general and the capital of Baghdad in particular .

Key words: *Sustainable Development, Sustainable Urban Transportation ,BRT Transportation*

[1]*Continuing Education Center/ University of Baghdad*

I. Introduction

The transport sector in general and urban transport in particular suffer from many problems and negatives It touches on various aspects of life, although it is the nerve of urban life, but it can be the most important Reasons for obstructing development.

Enumerating the negative impacts of transportation on various aspects of life presents significant challenges that must be addressed to reduce as much The possible effects of these, and perhaps the global trend towards concepts of sustainability also reflected on the field of transport The concept of sustainable transport is nothing but an attempt to overcome its negative effects on the environment, the economy and society .(1)

Studies have dealt with this concept precisely defining its principles and Fundamentals, but few of them dealt with how to apply these principles on the ground, taking note of the concept and principles of sustainable transportation is the first step followed by an inventory of issues Related to it, as well as the main actors, especially transport planners, methods and how to treat them to connect its issues and their interaction with each other, the main goal is to create harmony and synchronization in the interventions on The level of transportation to make it an engine for economic development, preserves environmental systems and meets current and future social needs, and is intended for sustainability (2). This study presents an outline of the BRT system implemented in Curitiba and recommend significant lessons and benefits that can be learned in its application in Iraqi cities, especially the capital of Iraq Baghdad.

The concept of sustainable development:

The term of Sustainable development was first introduced in 1980 then published in 1987 by the World Commission for Environment and Development (Brundtland Commission) report . (UNCED, 1992)

The conception of sustainable development received a global trend after 1987 when the Portland Committee established in 1984 and developed its report on sustainable development awareness, which were defined as ((society ability to provide its existing requirements with no intention to compromise the capability of up coming potential and future generation requirements)) where this indicates the characterization of two main contents: Firstly, meeting the current needs of society necessary to ensure economic growth to meet the needs of the poor and benefit from this growth, and secondly, meeting and gathering future needs by leaving the resources necessary for future generations to achieve growth and development for them (3).This definition clarifies the correlation between the current generation and the future generation, as well as the correlation between different dimensions and economical, public, and ecological domains.as well as the concepts of sustainable development spread globally after its presentation at the UN "United Nations Conference" on Environment and Development held in 1992 in the city of Rio de Janeiro, in which sustainable development definition was placed as "The development that meet up with the present requirements with no threat to the capabilities of future economic development and the wide approval of the

international community on the philosophy and ideology of sustainable development and the need to move to more modern and advanced means of production and consumption(4) .

Since then, researchers, politicians and decision-makers in all urban areas have endeavored to try to apply its foundations and principles in all these areas.

Dimensions of sustainable development

The general framework of the conception of "sustainable development" is a special concept of environment, then this concept has shifted towards a comprehensive development that includes three basic axes first the social axis, which is the right to education, health, justice and services and on the ocean and ecosystems. (5) Therefore, sustainable development is a three-dimensional development characterized by interconnected relations characterized by exact and conservative rationalization of resource consumption. As well as a fourth basic dimension, which is the moral or institutional dimension that works as an umbrella for these three dimensions, which guarantees guidance and continuity. Figure (1) shows this relationship between the fields that sustainable development seeks.

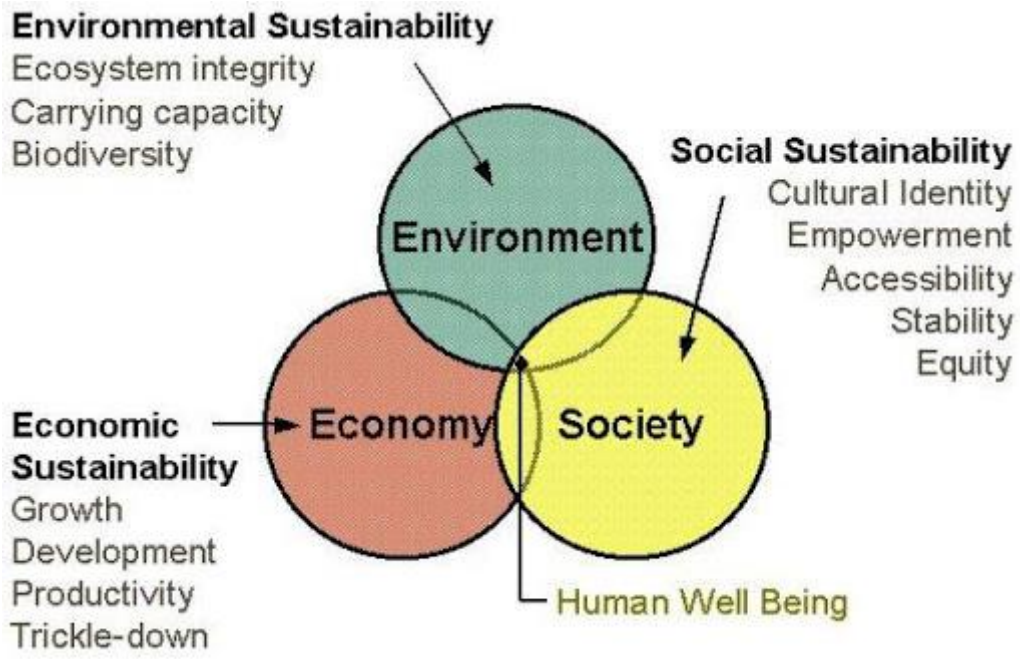


Fig (1)

And to preserve the established natural and urban environment by preserving available natural resources and rationalizing their consumption so as to preserve the natural environmental balance and achieve social justice and reduce the cost and risks to which future generations may be exposed. (6)

Urban transportation

It is a service that connects the various urban gathering points for the movement of people and goods according to plan Covering needs, achieving complementarity and harmony closely, aiming to give dynamism to life in The city and ensuring mobility for all users »(Official Gazette, 2001, p. 10)

It is also known as a group of individual and mass transportation that allows transportation within Large urban clusters(7).

Accordingly, some countries have reviewed their priorities in the face of economic, social, environmental and institutional challenges, and strive to improve public transport in particular from private transport and put it among the priorities of plans and strategies that achieve the conditions of urban transportation sustainability.

‘The concept of sustainable urban transport was a response to the negative impacts of urban transport. Where urban transport is defined as a private transport market, it is separate from long-distance transportation, but it is interconnected. Urban transportation markets mainly cater to access to work, education, retail options, health services and social interactions.Urban transport service is provided by private, public and semi-public forms of mechanical and non-mechanical transport. In this context, the definition of that different from the definition of “transport" in urban areas, because what is considered "urban" varies in different cities and countries.(8)

The concept of sustainable urban transportation

The phrase 'sustainable development of transport' is a mixture of sustainable development with transport. This requires applying the theory of sustainable development to transport networks, as a principle.(9)

The car crisis and its environmental effects is a major issue in all metropolitan regions of the world today. Growth in urbanization and car use also raises potential environmental concerns. Transport has major economic , social and environmental effects, and is a primary sustainability factor. **(10)**

It is important for community members to have the ability to access their daily workplaces and access to other important places such as health, education, and entertainment as well as shopping places with ease, and if these living requirements are not met, the quality of life will be affected and growth will be static.

The transport sector plays an important and vital role in the sustainable economic and social development of countries in the world. Nevertheless, the development that occurred in the commercial and industrial processes, urban expansion and population growth, which led to an increase in the standard of living, which increased the demand for transport services in countries significantly, as the current transportation systems are old in front of this tremendous development in some countries that do not achieve the conditions that must be met In sustainable development.(11) (One of the consequences of this development was the increased need for public vehicles and private cars,

especially for mobility, which led to an increase in energy consumption and air pollution with gases emitted from the burning fuel of these vehicles, especially the Green Houses Gases, which have a major impact ,also its impact on climate change and damage to public health due to traffic congestion and high rates of traffic accident rates. (12)

Accordingly, developed countries and some countries in the world began to direct the great importance of urban transport and place it at the top of the local and global agenda and consider it mainly a challenging vaital issues which faces them in the age of the current development.

Sustainable urban transport dimensions : It is transportation that provides general visions of the economic and social development of urban areas and it provides transportation services to all segments of society, taking into account the environmental viability of the region as well as affordable prices that all members of society can use this system. (13) Where it plays an essential role in improving the quality of life of members of society and increasing the welfare of the population in cities. In order to achieve this, it requires different designs for cities in terms of structure and the new approach in planning land uses parallel to planning in public transport.Sustainable urban transport should provide a number of important elements that relate to economic, social and environmental sustainability issues as required by sustainable development, namely:((14)

Economic dimensions:

- Provides qualified infrastructure and cost-effective transportation services

Financially affordable (per generation)

- It supports economic activity to be vital and sustainable

That is, the expenditures of sustainable transportation systems must be cost-effective and form a structure of calculating the total and incorporated cost in order to achieve equal payment for all users of transportation and compare them with the total costs.

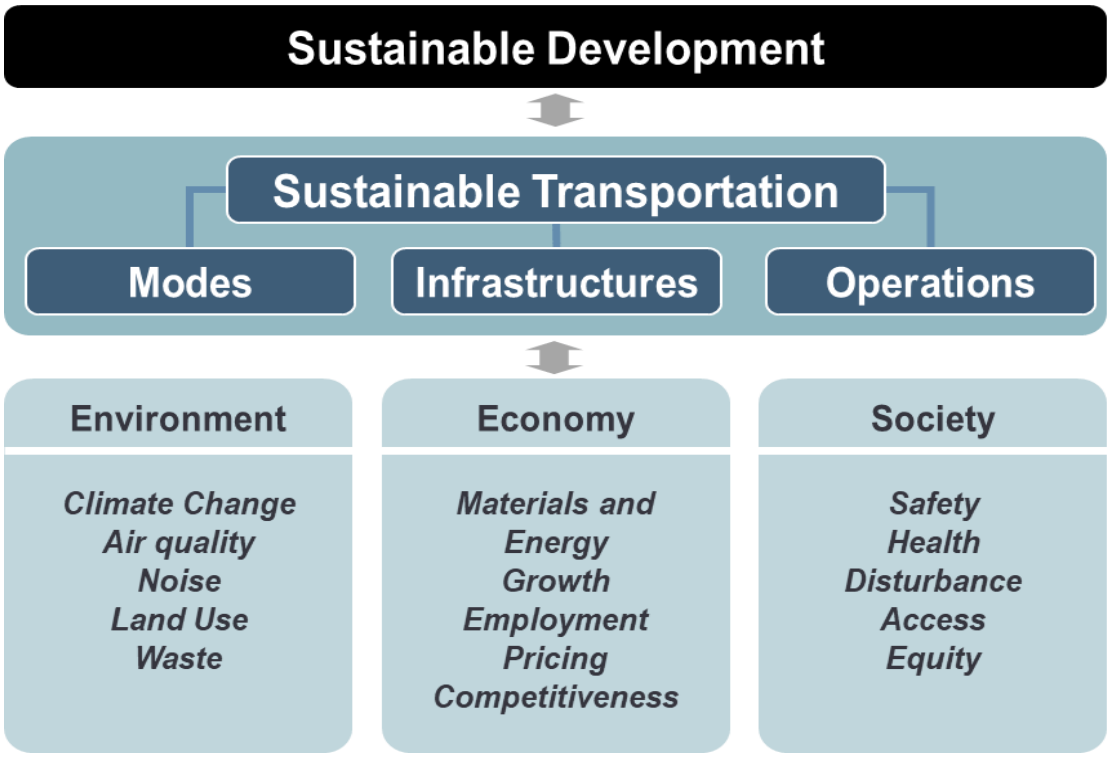
Social dimensions: The transportation system is a basic pillar in the fabric of the urban economy and has the largest role in building society and raising living conditions. Countries therefore strive to provide transport networks that achieve social justice between present and future generations and supply the necessary transportation needs to meet the needs of all people of all their social classes, along with both urban and rural areas.

Environmental dimensions: human activities contribute to pressure on the environment in terms of its consumption of natural resources, which exceeds the rates of the sale's ability to be renewed or replaced, which will increase the pressure on the ability of nature to absorb waste.Therefore, with regard to environmental sustainability related to transport, the following should be taken into account Benefiting from the lands with little or no effect on the integrity of the ecosystems.(15)

- . Seeking to use infinite or sustainable sources of energy

- Prevent pollution, meet transportation needs without generating pollutants that endanger public health, global environment, and biodiversity;
- Not producing more noise than acceptable noise emissions.
- Keep pace with the development and scientific research of innovative alternative technologies which help improve transport efficiency, protect the environment and promote the use of alternative and renewable energy.
- Avoiding consumption or reducing the use of fossil fuels and reducing pollution by controlling transport demand effectively (16)

- Below figure (2) shows the relationship of sustainable development with sustainable transportation.



Fig(2)

The concept of Bus Rapid Transit (BRT)

BRT Systems consists of large buses operating on dedicated lanes and stopping at well-defined stations, which features a system that enables passengers to pay before boarding. BRT systems are not standing alone and rely on a set of preconditions that could make their efficient implementation easier or impede. A dedication to sustainability, a suitable policy environment that supports public

transport in general and appropriate institutional and organizational processes are, among other things, important elements of their delivery.(17)

They deliver mass transit services at lower cost than rail, achieving high volume comfort and safety standards while retaining the versatility of a bus with relatively short implementation times. They provide multi-corridor services which very effectively surpass and adapt to demand. BRT systems are also planned to provide cities with public transportation on the surface so that people can enjoy the city while commuting. An successful BRT is a viable substitute to the car.(18)

(3)

Curitiba Transport System

Brazil's experience relies on complementarity between central and local planning within the context of an integrated transport strategy, between the public and private sectors.

The Curitiba transportation system is recognised worldwide as a realistic example, an efficient and cost-effective system of transportation. An intermediate bus system along with five "structural hubs" augmented by "straight" articulate service on equivalent arterial roads, and through a broad .feeder bus network.(19)

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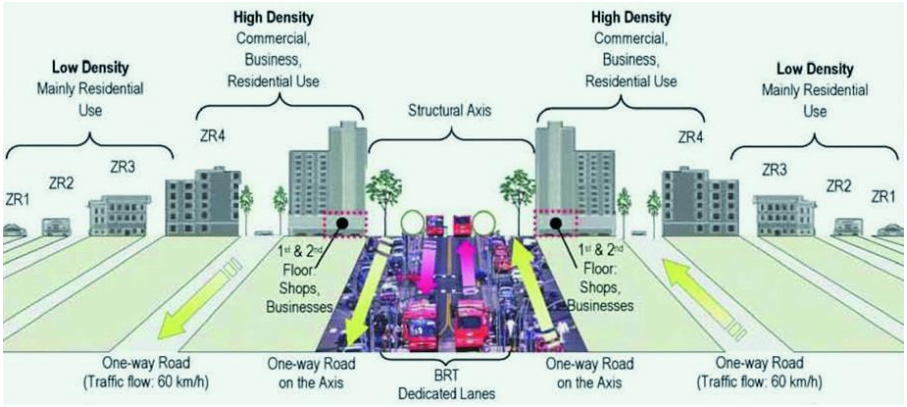

Fig (4)

The transportation in Curitiba is based on incorporated land utilizeiation and transportation strategy on the city's most important radial pathways or linear structural axes. All structural hubs were developed as a "triple system" comprising 3 strategies. Figure (4) offers overhead Triangular perspective. The central main road of the 3 roads has two-way buses within the middle of the road that feed the transport points referred to as "terminal stations", and conjointly provides a restricted range of traffic lane (one or 2 in every direction) for irregular furnishings and for admission to the facade development.The "trinary" (figure 4) was a style part want to enhance transit accessibility in Curitiba 3 equivalent roadways with compatible land uses and building heights that decrease with distance from the BRT passageway.(20)

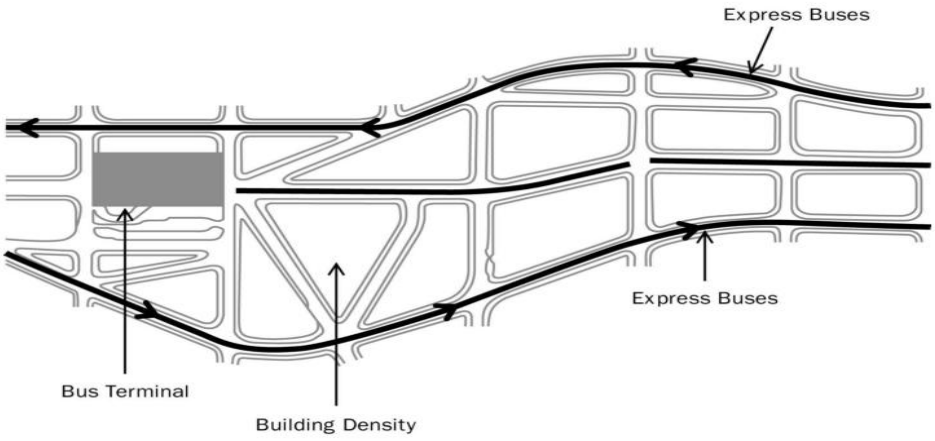

Fig (5) Trianry road concept

The Evolution of Curitiba's BRT system

Thirty years ago, forward-thinking and cost-conscious architects from Curitiba incorporated public transport with all of the other aspects of the urban planning system. They introduced a scheme that concentrated on meeting all people's transportation needs rather than those using private cars and repeatedly followed through with their program being enforced in a staged manner.

The bus network in Curitiba is composed of a hierarchical operating structure. Minibusses routed through residential communities feed passengers on circumferential routes across the city center and on inter-district routes to traditional buses. The system's backbone is comprised of the Bus Rapid Transit, which runs on the five main avenues leading downtown on a wheel hub.(21)

this type of bus is known to suit the load capacity of the urban train only. However, this type of bus is proven in terms of its load capacity to equal the load capacity of the subway, it should be noted that the type of bus does not need costly and complex facilities or equipment with different requirements, because Achievement does not need a long range capacity , BRT was seen not only as an investment in mobility but also as an opportunity to shape urban growth more effectively and in a more transit-oriented way.(22).

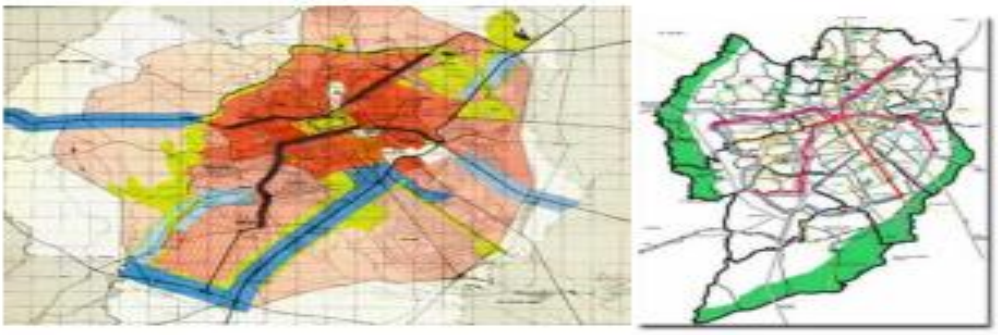

Fig (6) System of bus services

Public transportation consists of buses starting in 1974 in Curitiba, the world's first BRT system. BRT's success in Curitiba resulted in a conditional car-bus change. Based on the findings of the 1991 passenger survey, the anticipation of BRT introduction resulted in a decline around (27) million vehicle journey in a year Saving an additional (27) million liters of fuel per year.

Total of ,(28) per cent of BRT rider have moved by a car before. Curitiba consume around 30% of the fuel per capita compared other Brazilian cities per volume, resulting in a very decreased level of air pollution in the country. Around 1,100 buses operate regular flights of up to 12,500 passengers, carrying over 1,3 million passengers, fifty times as many as 20 years ago.

Curitipanos spends around 10% of their travel income, which is far below the national average because they use 80% Express or direct bus services. (23)

A trunk corridor and feeder bus network function in which buses are routed via a set of corridors when traveler turn between bus vehicles, feeder lines, and Interdistrict connections without additional tariff charges. Buses hold by a private corporation under municipal jurisdiction are using a specific color coding scheme.

The most important characteristic of the Bus system include

Buses, which are owned by private companies under municipal jurisdiction, use a common color coding scheme.

Key Bus system features include

.Physically separate intermediate bus lines, separated by two local service streets;

· 26 Mid- and end-of-line Bus Transfer Terminals for Bus Takers;

· Automated collection of tickets

· Off-vehicle ticketing stations and bus platforms;

Direct "express service" in parallel one-way arteries; and distinctly colored bi-articulated buses along the byway, each with five doors, equipped for level ("high-platform") tube station boarding.(24)

Fig (8) Articulated buses

II. Conclusion

Traffic problems in a city such as Baghdad are an significant issue. The officials in the city must take into account other experiences that can help to contain the crisis and to address its cause, using current resources, the existing streets and the accumulated experience, in a way consistent with the prevailing economic , social and technical situation.

It seems that the Curitiba BRT system experience is the best way to deal with

the challenges of constant crowding in Baghdad city, and the most suitable for city conditions. These buese has the capacity of accommodating 60 to 100 passengers and not minibuses, and this system depends on specific and limited paths on these buses only From the beginning of the route to the arrival center, other means of transport are not allowed to interfere with these lanes except at limited intersections, with emphasis on passing through the most populated and moving areas such as markets and schools,

The implementation of the rapid transit bus system around the world varied between complete success in Cordoba, Brazil, and failure in some other countries, such as India

Many Curitiba lessons can be applied in the city of Baghdad and other cities in developed countries. There are, of course, variations in the nature of the region, economic prosperity and income levels, car ownership, public viewpoint and public transport image, and other factors that make it important to determine local conditions. In reality, Nonetheless, there may be some relevant policies and values.

In order to implement a successful BRTsystem we need 3 vaital factoers :

1-Official support :

Implementation of such a system requires continuous cooperation between the various city administrations, and the full delegation of authorities capable of imposing order and protecting the

tracks, and it also requires good policy for those affected, such as store owners, minibus unions and drivers who are deprived of using these The tracks, knowing that the application of this system usually passes through overlapping stages of implementation, review and modification, may take a long and short time, until finally stability is achieved on the optimal system.

2-**Commitment** :this system needs commitment of passengers and drivers to order, and cooperation to make the experiment a success, it requires patience in long lines, respecting the routes and preferring the interest of the group, because the city authorities, no matter how hard they are, will be unable to maintain order inside the stations And prevent interference outside it, as happened in New Delhi, India, and caused the failure of the rapid transit bus system. When the public knows the advantages of this system and acknowledges its limitations they can not be cautious and respect it and so that at the first tests the system fails and things go back to their old past.

3-The main benefit of the rapid transit bus system is the low cost relative to other alternatives, such as trams, subway and highway networks, as well as the speed of project implementation, and the lack of need for large buildings and services, as existing roads and established parking spaces can be used after minor treatments, and it can be completed within a few months. And, if the experiment succeeds and passengers and drivers become accustomed to the system, those in charge of city order can expand the lines and improve services, and thus spend the vast amount of money allocated to fuel support building roads and bridges in expenses that are more useful and beneficial to the people.

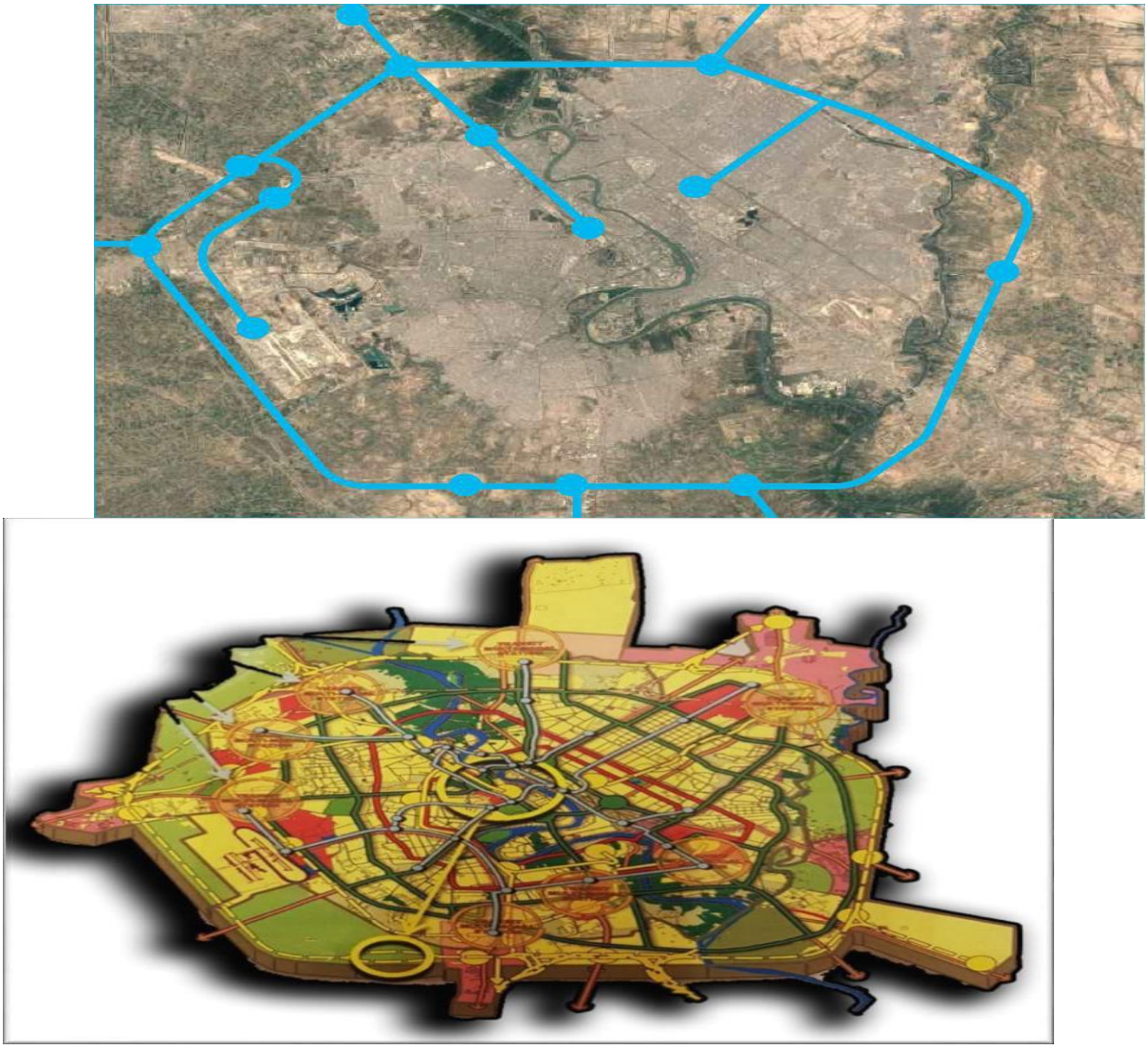

Fig (5)

The process of applying this system requires cooperation between the government and the private sector, as it was applied in the Brazilian Curitiba , which was one of the successful experiences in maintaining this system.

In the city of Bagdad, this system can be implemented by choosing routes that serve densely populated neighborhoods, so that busses pass successively from the beginning of these lines to the center of Bagdad through familiar and predefined stops, so that busses move frequently. Every few minutes, according to the estimation of the traffic engineers, while minibusses operate on feed lines perpendicular to express transport routes, and pick up passengers from remote areas to bus stops, taking into account stop times, which is a journey that takes more than two hours at peak times without the use of rapid transit routes.

The Ministry of Transport shall plan and organize the tracks for express buses, according to the map of Baghdad for Public Transport Fig No. 5, in which it clarifies the special tracks of trains,

which can be used to plan and organize the tracks of these buses and ensure the safety of individuals or passengers at the disembarking stations.

According to its qualities such as traffic control, lesser installation and renovation costs , high throughput efficiency and greater versatility relative to rail transport, the BRT system can in many cases satisfy transportation needs at this level of mobility. The advantages of BRT and also the reduced time required to complete the investment and the prospect of restoring the linear rail network corridors will further lead to the further expansion of BRT systems around the world.

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