Integration urban land use planning with transportation planning: an evaluation toward sustainable transportation for the holy city of Karbala.

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Abstract. The integrated planning of urban land use and transport systems addresses the development of strategies to increase economic efficiency, reduce excessive use of resources, improve social aspects. The research aims to assess the integration of urban land uses with the transportation system in Karbala, which achieves sustainability. Through two world strategies, the first is planning the land uses to achieve the reliance on walking and bicycle use. It was evaluated through the zone of influence of service (Zone of influence we can define: the area that benefits from a specific service with a specified distance), the index adopted by the Ministry of Housing for the year 2018. Second is integration of land uses with public transport, identification of public transport routes, type of media used and identification of residential areas served by the network, to identify areas not serviced by the public transport network. The GIS program was used for these uses and analyzes by buffer zone were conducted for the spatial location of the services and the calculation of their zone of influence of service.

Main conclusions are:

- The weak implementation of integration strategies between urban land use and the transportation system has led to poor sustainability in the city of Karbala.
- existence of large areas of residential neighborhoods outside the zone of influence of the land use in city of Karbala.

The main recommendation are:

- adopting the zone of influence of land use when planning the city, for the purpose of achieving the integration of road network, which leads to sustainability in future cities.
- Emphasis on public transport strategy, and to identify the routes of residential neighborhoods in the north-west and south-east of Karbala.

1. Introduction.
Urban land use planning and transport are linked to each other through strong reciprocal interactions. The location of urban activities in the interrelationship will create a new transport system by generating trips and influencing regional changes, case study Karbala city, one of the cities of the Middle Euphrates in Iraq, an area of 135 km2, and the population 487827 people.

1.1. Research problem.
The problem of city is lack of integration of land use network with the transportation system in the city of Karbala, (Integration: planning the land uses by method that increases dependence on walk and the use of bicycles within the residential neighborhoods in the city and the use of public transport and reduce reliance on private transport, this is sustainable, and the since the literature review of the
city of the adoption of private vehicle by 98% in the city of Karbala[1], and a shortage in the number of public transport garages and inefficient network [2].

1.2. Aims.
Achieving sustainability of the transport system in Karbala city by improving accessibility, which is expressed by the concept of zone of influence for different land uses in the city.

2. Integrated Planning Strategy between urban land use and transport systems.
Sustainability as a concept of urban land use planning and transport, we can active it by the most important strategies are[3]:

2.1. Planned and designed neighbourhoods for pedestrians and cyclists.
The system of walking is part of the transport system, means all roads or paths that people can use foot, and this system has several classifications [4]:

- Sidewalk: refers to roads on either side or one side of the highways separated by pedestrian barriers only, usually afforestation with trees, and furnished with infrastructure including garbage bins and road lamps.
- Pedestrian paths: refer to pedestrian streets only in different areas.
- Pedestrian crossing facilities: mainly include bridges, footpaths and footpaths in order to maintain vehicles and pedestrians in their designated routes.
- Leisure paths: generally refer to urban roads for hiking, recreation, exercise, and rest. These paths are usually tooling by various trees, interspersed with seating and landscaping pieces, bringing beauty and comfort.

2.2. Integration between Urban Land Use and Public Transport.
Access to services outside of neighborhoods can also be a useful indicator for planning the integrated use of land with transport [5], as accessibility is a good measure of sustainable urban land use planning strategy. The concept is a measure of the potential sustainability of the built environment. 'fig 1' shows access to various services according to the spatial levels of the sustainable city [6]. As relations are crucial in determining accessibility and convenience. The proportion of urban land allocated to the streets is one of the factors influencing the level of communication within urban areas. Is how the streets are properly planned and designed to meet the various means of transportation used within the city [7].
3. Practical section.

3.1. Case study (holy city of Karbala).

The geographical location of the holy city of Karbala is determined between two widths (32° 40' 0" and 32° 30' 0") and longitude (43° 55' 0" and 44° 5' 0"). It is located in the central part of Iraq within the sedimentary plain and passes through the Husseiniya River, which is part of the Euphrates River, and defies the holy governorate of Kerbala from the north-east. The governor of Babel, the north-west and the west of Anbar province, and the south of Najaf province, is surrounded by four of its destinations in ancient urban centers with a historical dimension, note the 'fig 2'.

Figure 1. Access to various services according to the spatial levels of the sustainable city. Ref.[7].

Figure 2. Administration division of holy Karbala governorate.
Ref: Based on the map of the holy province of Karbala in 2018 using ArcGIS 10

3.1.1. planned and designed neighbourhood for pedestrian.

In this section, the first strategy: integration of the land uses with the transport system by planning land uses for the adoption of walking and bicycles by the steps:

- Adoption of the criterion of the zone of influence of land uses adopted by the Ministry of Housing in 2018 [11], for different uses, as an indicator of integration.
- To compare the zone of influence of different uses of the reality of the situation in the neighbourhoods of Karbala with the previous criteria, and to plot the reality of the situation using GIS by (Buffer zone).
- Diagnosis of the proportions of land uses where integration has not been achieved and identified on the figures.

The Iraqi Housing Ministry has identified housing criteria as a zone of influence service for residential uses, as follows[11]:

- 500 m for primary schools.
- 800 m for health centres, local markets and mosques.
- 300 m for open or green areas.

The reality of the study area was compared to the previous criteria and the results were as follows:

- In primary schools, the proportion of out of zone of influence is 63% shows ‘fig 3’.
- The proportion of out of zone of influence for for the health centers is 55.33% shows ‘fig 4’, for local markets is 63.43% shows ‘fig 5’, for local parks is 58.69% shows ‘fig 6’, and for local mosques is 57.72% ‘fig 7’.
- As for the paths and streets within the residential neighborhoods, The network design, which is characterized by many intersections, making pedestrians crossing the streets in these intersections.
- Infringement of sidewalk by shops or residential houses, which makes the residents have to walk within the street, which leads to the loss of safety element to walk within these streets.

Fig 3. Zone of influence of primary school.
Fig 4. Zone of influence of health centers.

Fig 5. Zone of influence of markets.
3.1.2. Integration of Urban Land Use with Public Transportation System.

Steps:
- Identification of public transport routes, type of media used.
- Identification of residential neighborhoods served by the network, to identify residential neighborhoods not serviced by the public transport network.

The Analysis results are:
- In the city there are two main carriages of internal transport, the first is located near the shrine of Imam Hussein in the center of the city, while the other is in the area of Bab Tourej, and branches of these garages transport routes to the neighborhoods of the holy city of Karbala, 'fig 8'
- The public transportation means used are mostly private mass transit vehicles with a capacity of 11 passengers (light transport) and a small number of private transport vehicles with a capacity of 28 passengers (medium transportation).
- Many neighborhoods, especially the northwest and southeast of the city relatively far from the city center, do not reach the public transport service (outside the zone of influence of the mass transit service of 500 meters), where the proportion of residential neighborhoods outside the service of 51.93%, 'fig 8' shows garages and routes of private mass transit lines and their service range.
- The current transport network is used only by private transport and some medium vehicles, and no public transport network is available.
4. Conclusions.
After analyzing the situation of the city of Karbala to diagnose the integration between the uses of the urban land and the transport system, the following conclusions were obtained:

- The weak implementation of integration strategies between urban land use and the transportation system has led to poor sustainability in the city of Karbala.
- Failure to comply with the zone of influence of the service for different uses led to the lack of integration between the planning of land uses and the transportation system in the city of Karbala.
- The existence of large areas of residential neighborhoods outside the zone of influence of the land use in city of Karbala,
- And the planning of most of the streets do not encourage walking and the existence of many excesses on sidewalks for pedestrians
- Internal garages in the city and its routes do not cover the city in general, as 51.93% out of the zone of influence of these tracks, leading to the failure to adopt public transport.

5. Recommendations.
- The need to adopt a strategies for integrated planning between the uses of urban land and transport system for Karbala when prepare the master plan.
- Adopting the zone of influence of land use when planning the city, for the purpose of achieving the integration of road network, which leads to sustainability in future cities.
- You must plan the streets in a status that encourages walking, by providing paths for pedestrians, with the planting of these paths and prevent overrun.
- Activation on public transport strategy in the northeast and southeast of the city of Karbala.
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