

Conference Paper

Compactness Ratio as an Indicator for the Efficiency of Road Transportation Network in Postmodern Iraqi Cities

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Abstract

The location of the city affects the composition and distribution of land uses, where topography and terrain works to influence the forms taken by cities and regions and the modes of transport used. Thus, the proportion of solidarity greatly affect the roads and streets, which take multiple forms vary depending on the modes of transport used in them.

Since the distribution of road networks is efficient and achieves the mobility of the population in the city the more efficient the activities and events distributed in the area of the city, so it was necessary to rely on two main factors, the area and the population in measuring the degree of availability of the road network in the city to evaluate the efficiency of Connected. As the greater the proportion of the compactness of the city, the more concentrated uses of the ground at a higher density and less transport distance, which is the city of Iraq pre-modernity to give greater efficiency of the transport network and vice versa when the proportion of solidarity to the city scattered uses of the earth less intensity and a greater transport distance, Post-modernity to give less efficiency to the transport network. Therefore, it was necessary to assess the efficiency of the network in the urban area by measuring the proportion of solidarity. Therefore, the index of the ratio of the integration of the transport network as an indicator of the integration of the city through its application to the urban centers of the provinces of Iraq to measure the efficiency of the transport network.

المستخلص

ان موقع المدينة يؤثر في تشكيلها وتوزيع استعمالات الارض فيها , حيث ان الطبوغرافية والتضاريس تعمل على التأثير على الاشكال التي تتخذها المدن والاقاليم وعلى انماط المواصلات التي تستعمل فيها . وعلى ذلك فان نسبة التضام تؤثر بشكل كبير في طرقها وشوارعها التي تتخذ اشكالا متعددة تختلف تبعا لانماط النقل المستخدمة فيهما .

وبما انه كلما كان توزيع شبكات الطرق كفوءا ويحقق سهولة الحركة والتنقل للسكان في المدينة كلما زادت كفاءة الانشطة والفعاليات الموزعة في مساحة المدينة , لذلك كان لابد من الاعتماد على عاملين رئيسيين وهما المساحة وعدد السكان في قياس درجة توفر شبكة الطرق في المدينة لتقييم كفاءة الترابط Connected.

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وحيث انه كلما زادت نسبة التضام Compactness للمدينة كلما تركزت استعمالات الارض فيها بكثافة اعلى ومسافة نقل اقل وهو مايميز المدينة العراقية لما قبل الحداثة لتعطي كفاءة اكبر لشبكة النقل والعكس كلما قلت نسبة التضام للمدينة تبعثرت استعمالات الارض بكثافة اقل ومسافة نقل اكبر وهو ماتعاني منه المدينة العراقية لما بعد الحداثة لتعطي كفاءة اقل لشبكة النقل . لذلك كان لابد من تقييم كفاءة الشبكة في المنطقة الحضرية من خلال قياس نسبة التضام فيها. لذلك اعطى مؤشر نسبة تضام شبكة النقل مؤشرا لتضام المدينة من خلال تطبيقه على المراكز الحضرية لمحافظة العراق لقياس كفاءة شبكة النقل فيها .

Keywords: Transportation Network, Iraqi City, Compactness, Transport Efficiency, Postmodernism.

الكلمات المفتاحية: شبكة النقل ، المدينة العراقية ، التضام ، كفاءة النقل ، مابعد الحداثة .

Research problem

Urban expansion and the expansion of transport networks with low coverage and low integration, causing low transport efficiency and ease of access. And poor connectivity to urban areas of Iraq's provinces.

Research goal

Determine the Iraqi provinces with the least efficiency of transport by adopting the index of the ratio of compactness of the master plan for the center of provinces of Iraq is an indicator of accessibility and availability of transportation in the urban areas for the provinces of Iraq.

Chapter One: The Theoretical Side

1. Introduction

The pre-modern city of Iraq was characterized by a compact form and urban harmony, a system that maintains the human scale by intensifying urbanization in a size that achieves harmony and social cohesion and is in line with the surrounding environment. The focus of this system is to focus on intensifying urban areas [1] creating limits to urban growth and focusing on the role of public transport and urban design quality. As for the postmodern period, we find that the Iraqi city has suffered from excessive urbanization and spread to the irregular and scattered and rapid spread, which affected

the quality of urban life and the development potential is difficult and a concern and paved roads is a key element in the transport network of any country [2], Facilitate the movement of passengers, ideas and goods, and countries seek to expand them because the paved road network forms an important part of their development plans.

Therefore, transportation is one of the most important pillars of development in any region, and it works to increase the degree of urbanization on the other hand. The road network represents the backbone of any country and the link between its sides and the size of its area. It also plays a major role in the distribution of the population in the country [3].

2. Road network

The road network is defined as the regularity of a group of roads in the form of a contract that includes a set of links and is a network that mediates the spatial environment of the region or the city and connects the various parts [3].

The road network is considered one of the most important elements of development due to its role in achieving communication between regions, governorates, cities and villages, in addition to its role in achieving economic growth, because it contributes to the prosperity of trade and economic activities and ease of traffic between urban communities and between production areas and distribution areas. The road network, which is well planned within urban communities, is the link between all activities and functions. It helps solve the problem of traffic and contributes to the movement of vehicles and pedestrians between and within regions and neighborhoods [4].

3. Road network density standard

The study of road density is an important criterion that reflects the economic development of the region. It also gives an idea of the extent of availability or shortage within the city, as well as being the quantitative methods of evaluating the service provided by the road, that the measurement of the density of roads expressed by the length of paved roads for the unit area, or for the population, where Thomson noted that the increase of roads is evidence that The area has sufficient means, while the opposite means that if it decreases, the network in this city or other city needs further intensification and development [4]. While Teodrovic noted that this indicator distinguishes the level of development in the country and often reflects the weight and effectiveness of road management for a country, particularly with regard to maintenance [5].

The two workers play a large role in distributing the road network and its length to serve the land uses distributed in the city. Urban and regional planning plays an important role in helping to change land-use patterns and in achieving sustainable land use and urban development to incorporate a mix of integrated uses. The density of the road network is obtained for the area or population:

- Road density index per area per 1000 km² or per 100 km².
- Road density index for the population per 1000 inhabitants [3].

The road density criterion for the population is very misleading, especially in regions or countries with large areas, as a large part of the area is not populated with populations such as deserts, mountains and unlivable areas, for example the United States of America, which has a length of network of roads amounted to more than 6.5 million according to World Bank data for 2010, it represents 50% of the road network in the world, yet it is only tenth in terms of road density worldwide, so it depends mostly on urban area or urban area. The density of roads on the basis of the population standard is the best because the population is the economically active travelers. The more the road network is densely populated, the better the network can cover the needs of the population, while the decrease means that many areas of the city are deprived of the network service so it customizations and attention to increase network lengths [6].

4. Scale of compatibility for the availability of road network

Courtat depend on the principle that the road network links the nodes and the links to cover a certain area of the earth and suggested a scale of "compactness" to measure the percentage of the fullness of that area and is expressed as follows [7]:

$$\varphi = 1 - \frac{4A}{(l_T - 2\sqrt{A})^2}$$

Where A is the area of the urban area of the study community, l_T is the total length of the roads. The value φ is the combined value which will be within the range [0, 1]. If there are no enough roads in the area, the value will be 0. If φ maximize and closer to the number 1, refers to more connection of the road network and the more coverage of the area, therefore the higher ratio of compactness. Where the concentration of uses more in a compatible area requires coverage of more methods between the uses of any higher coverage ratio of the network [8] as shown in Figure (1).

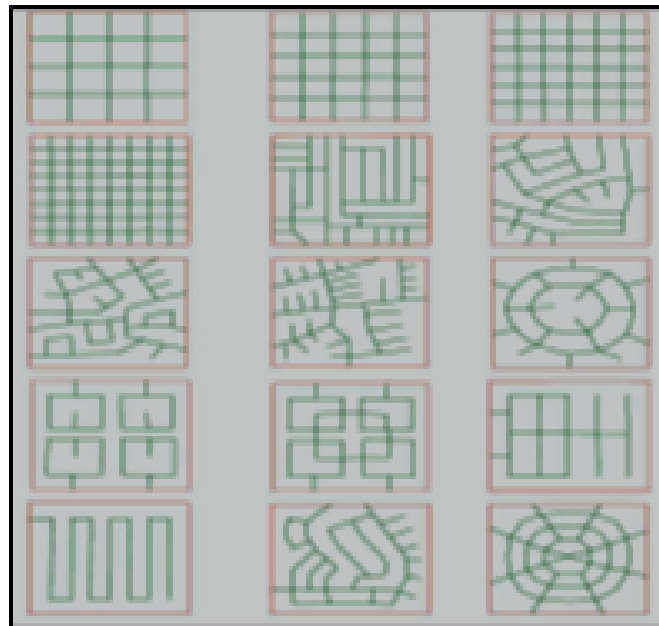


Figure 1: Transportation network coverage ratio [7].

Chapter II: Practical Side

To evaluate the efficiency of the transport network in Iraq, the transport network for the urban areas of the governorates of Iraq (18 governorates) was studied. The data of the length of the network, the population and the area of each governorate were collected as shown in Table (1). With the adoption of the Geographic Information Systems (GIS) program, the area of urban centers and the length of their network for each governorate was calculated as Table 2.

The density of the road network for each governorate was determined by measuring the density of the population, the density of the network and the per capita share of the road sign for each governorate as shown in Table (3). The density of the population, the density of the network and the road share of the road are divided into three levels of planning (acceptable - medium - unacceptable) and color indices (green - yellow - red). The governorates with the acceptable coverage of the network on the governorate area are 10 governorates. The governorates with average coverage were 5 governorates, with only 3 governorates remaining with a low level of coverage of the network.

These governorates extend to desert areas. They do not need more coverage. Between the governorates of Iraq and its parties are about 80%. The per capita share of the network was acceptable for 8 governorates and medium for 6 governorates and weak for 3 governorates to give a percentage acceptance of the network availability per capita by 75% at the governorate level. Thus, the density of the network to

TABLE 1: No. of population, area and road lengths for Iraqi provinces

Road Length km	Area km²	No. capita	Governorate	No.
3194	37323	3604684	Niniwa	1
1750	9679	1412130	Karkuk	2
1456	24363	1426477	Salah Al Deen	3
1320	4555	7722975	Baghdad	4
4063	17685	1524291	Diyala	5
3513	137808	1638055	Anbar	6
1083	5119	1877068	Babil	7
881	5034	1135121	Kerbala	8
578	28824	1392268	Najaf	9
857	8153	1221549	Qadisiya	10
2056	17153	1263798	Wasit	11
4520	16072	1082070	Maysan	12
1231	51740	802489	Muthana	13
1010	12900	2016715	Dhi Qar	14
5345	19070	2713658	Basrah	15
1439	6553	1082358	Duhok	16
3762	15074	1596904	Arbil	17
3274	17023	1769863	Sulaimaniya	18
41332	434128	35282473	Total	

Reference : Researcher depend on central statistical organization

measure the level of connectivity to the province and the ratio of the share of the individual network provides an indication that the implementation of transport projects at the level of the provinces have reached the acceptable scale at the region level.

However, the efficiency ratio of the network also requires evaluation of the urban and urban area of the governorate by assessing the ratio of the urban area network to the assessment of the urban transport of each governorate and by using the Compact scale created by Courtat for provinces in Iraq as in Table (4).

The city of Baghdad achieved the highest efficiency for the service of the urban network. The compactness index was 0.96, followed by the center of Nineveh province which achieved a percentage of compactness (0.95), then the center of Arbil governorate (0.93) 0.91) is an acceptable synergy to achieve an acceptable service to provide urban transport network to the city center. The ratio of compactness of the centers of the six provinces of Basra, Babil, Wasit, Dohuk, Diyala and Sulaymaniyah medium, indicating the efficiency of middle coverage of the urban network. While the percentage of compactness is weak for the remaining provincial centers in the

TABLE 2: Urban area and road network lengths for Iraqi provinces

Road Length km	Urban Road km	Governorate	No.
366.56	3000	Niniwa	1
186.67	1100	Karkuk	2
296.15	1210	Salah Al Deen	3
128.05	1310	Baghdad	4
252.32	1800	Diyala	5
439.24	2100	Anbar	6
135.75	850	Babil	7
134.62	450	Kerbala	8
169.78	720	Najaf	9
139.88	520	Qadisiya	10
202.90	1600	Wasit	11
150.00	820	Maysan	12
227.46	950	Muthana	13
175.95	950	Dhi Qar	14
213.93	2800	Basrah	15
95.78	540	Duhok	16
190.20	1950	Arbil	17
202.13	1250	Sulaimaniya	18
945.09	23920	Total	
Reference : Researcher depend GIS program			

eight provinces of Dhi Qar, Qadisiyah, Anbar, Salahuddin, Maysan, Najaf, Muthanna and Karbala to give a weak coverage indicator of the transport network.

The compactness of the urban network indicates that it points to the optimum use of the land and to the regular spread of the urban growth of the city, which are very important indicators for planners to be observed by the local governments of the provinces. Where the ratio of acceptable compactness (the closer to the number 1) indicates a higher degree of optimal use of the land and it gives the value of land higher and indicates a higher degree of regular spread of urban growth as the lack of compact and poor coverage of the network of roads indicates a higher proportion of the gaps between The outskirts of the city as a result of the unplanned urban expansion or the result of the delay in the implementation of the basic design stages of the city in some areas. In the end, it is possible to rely on local mismanagement, poor services, cumulative administrative corruption in successive stages, and delayed implementation of what is planned.

TABLE 3: Population density, road network and road capita for Iraqi provinces

Road/capita km / capita	Road/Area km / km ²	Population Density capita / km ²	Governorate	No.
0.89	8.56	96.58	Niniwa	1
1.24	18.08	145.90	Karkuk	2
1.02	5.98	58.55	Salah Al Deen	3
0.17	28.98	1696	Baghdad	4
2.67	22.97	86.19	Diyala	5
2.14	2.55	11.89	Anbar	6
0.58	21.16	366.69	Babil	7
0.78	17.50	225.49	Kerbala	8
0.42	2.01	48.30	Najaf	9
0.70	10.51	149.83	Qadisiya	10
1.63	11.99	73.68	Wasit	11
4.18	28.12	67.33	Maysan	12
1.53	2.38	15.51	Muthana	13
0.50	7.83	156.33	Dhi Qar	14
1.97	28.03	142.30	Basrah	15
1.33	21.96	165.17	Duhok	16
2.36	24.96	105.94	Arbil	17
1.85	19.23	103.97	Sulaimaniya	18
1.17	9.52	81.27	Total	

Reference : Researcher depend on table (1)

This indicator can be relied upon in drawing up the planning policies of each governorate and in reviewing the priorities of allocating allocations of regions and investment quotas to the governorates to rectify these cumulative deviations in the implementation of state projects. It also shows that only 22% of the Iraqi city centers gave the percentage of compactness and coverage of a network acceptable for the post-modern period.

Conclusions

1. Only 4 governorates out of 18 governorates in Iraq achieved the highest proportion of compactness and coverage of an acceptable transport network for their centers within the limits of post-modern design in Baghdad, Ninewa, Erbil and Kirkuk.

TABLE 4: Compactness scale indicator for road service and urban network coverage for Iraqi provinces

Compactness	Governorate	No.
0.95	Niniwa	1
0.91	Karkuk	2
0.74	Salah Al Deen	3
0.96	Baghdad	4
0.82	Diyala	5
0.76	Anbar	6
0.87	Babil	7
0.45	Kerbala	8
0.62	Najaf	9
0.77	Qadisiya	10
0.84	Wasit	11
0.71	Maysan	12
0.52	Muthana	13
0.78	Dhi Qar	14
0.88	Basrah	15
0.83	Duhok	16
0.93	Arbil	17
0.81	Sulaimaniya	18
0.87	Total	

Reference : Researcher depend

compactness ratio

2. The provinces that achieved the highest percentage of solidarity for their centers imply a higher value for the land in them and to the growth of urban spread regularly and the integrated implementation of the design expansions of the base during the successive periods without these obstacles or obstacles that cause interruptions within the basic design.
3. Some governorates with concentrated centers and urban expansion achieved a ratio of solidarity and coverage of the medium network such as the provinces of Basra, Babylon, Diyala, Wasit and Dhi Qar, while it was expected that the proportion of solidarity is higher.
4. Some governorates have achieved a percentage of solidarity and coverage of weak network, three of which was very weak, namely Karbala, Najaf and Muthanna, despite the religious importance of the provinces of Karbala and Najaf locally and globally.

Recommendations

1. The need to reorient municipalities and local administrations to the governorates on the need to follow up the integrated implementation of the expansion of the master plan and reduce the deviation between the port and planned for the successive expansions of the basic design.
2. The need to redistribute the investment shares and regional allocations to the governorates according to the requirements of the current situation until the cumulative deviations of the decrease of the ratio of solidarity and coverage of the network according to the plans of expansion of the base design and successive according to the planning standards adopted in most countries of the world, including the measurement of the ratio of solidarity and coverage of the network.
3. The need to eradicate administrative corruption and neglect in the local councils of the provinces to promote the reality of these provinces according to the plan.

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