Urban Centralization and Its Effect on the Kinetic Nodes of the Passengers in the Path of Transferring Bayaa - Bab Al-Moazam

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Abstract. In urban areas, there are many centres containing activities, events and residents. They may be main or secondary centres. However, there are centres related to urban transport. We also assume that there are urban centres called kinetic nodes that differ from each other along the transport line. In this paper, we aim to identify the causes of the discrepancy between these kinetic nodes. The problem is to find a solution to identify transmission stations that are more important than others along the al-Baya – Bab al-Moazam transport line.

1. Introduction
The corridor is the main component of transport planning. Most transport projects are carried out on a corridor basis. In essence, the corridor is the general route of travel between the two end points. The end points usually represent the main activity centres (central business areas, shopping areas, employment centres, etc.), natural features (rivers, oceans, etc.), or intersections between major transport facilities. Along the corridor between the end points, there are additional work areas, shopping malls, residential developments, and institutional uses, each one generating its own share of travel on the corridor. The lanes generally consist of one or many parallel transport routes. Each path is defined primarily by the right way. The right way is a strip of land intended to occupy a road, railway, facilities, lanes, bicycles, buses, street trees, or other special uses [1].

In urban corridors, transport stations have an important role to play in accessibility to other places. The importance, location and size of each station varies depending on its location relative to the urban area and on the demand for transportation at the station. Urban centralization is important in increasing the demand for transportation. This centrality varies by the difference in proximity to the uses of the land or the design of the transport network.

1.1. Transportation impact area
The transport area is an area close to a transport station. Or a public transport station where most passengers go for transport. Therefore, it is a transit area that acts as a customer base for transport services. It also receives the greatest benefit from transportation. This area often depends on the distances people want to walk at a specific time [2]. In most travel demand forecast models, the total cost of transit use is estimated to be the addition of the values of different cost elements, all of which are expressed as either time or cash costs. If the weight applied to the car time is 1.0, the weight applied to walking time is 2.0 to 3.0 or more [3]. In other words, a minute of arriving or walking to or from the shuttle area is exhausting two to three times more than a minute of travel time in the car, bus, tram and metro. Surveys of observed preferences and behavior indicate that walking time is much...
more stressful than the time spent in a car or transit vehicle [4]. In literature, this area is defined on the basis of the access distance, which directly provides the geographical range of the TOD. To determine the extent of TOD impact areas in the United States, the radius of the impact area can vary between (400-800 meters). This distance is determined by the walking distance that people prefer. As a result, different cities have adopted a different radius for TOD [5]. An analysis of the conditions of access to express bus and light rail stations in Edmonton, Canada, finds that no one actually walks more than 1,750 meters to reach the station [6]. In Singapore, about 60% of passengers walk to stations, with an average walking distance of 608 meters [7]. Another study in Mumbai, India, showed that walking was dominated by an access distance of 1,250 metres, with an 86 per cent share within that distance, and the average walking distance of 910 metres [8]. Walking distance guidelines range from 300 to 900 meters in Canada with a difference between cities, compared with 400-800 meters in the United States [9, 10].

1.2. The built environment

The built environment is believed to affect the demand for travel in three main dimensions: density, diversity and design [11]. The importance of urban density is that the more people live or work near the transport service, the more likely the service will be used [12]. Recent research, using data from Montgomery County Railroad, Maryland, has reached a similar conclusion: Mixed uses stimulate rail travel for all travel purposes, with rates ranging from 0.45 to 0.62. [13] New research suggests that transit stations near workplaces are more effective than stations near housing [14], Thus, a greater scramble in focusing on non-residential uses for transit developments, especially retail and employment. This is particularly obvious because most transit trips are related to work or school [15]. In Chicago, Lindsey et al. (2010) [16] found that a large proportion of trips originating from families near the crossing also end in nearby business destinations. Mixed land use (diversity) produces a more balanced demand for public transport over time (which reduces differences between peak and outer periods) and in space (in terms of flow direction) [17]. Filion (2001) [18] found that mixed-use suburban centres with well-connected roads enhanced pedestrian access to public transport facilities. In recent years, several comparative studies on land use and transport have responded to this problem by promoting new designs, with a focus on urban transit-oriented design [19]. The population and employment in peripheral areas are important factors for estimating transport passengers, but passenger numbers can be expected to rise according to the type of population or employment in the terminal area, and transit traffic is linked to social and economic variables, such as household income, age, race and car [20, 21].

1.3. Urban Centrality

Centralization is very useful for experts working in transport and urban planning, as it helps them to determine the relative priority of each urban area in terms of network efficiency. The original concept of centralization stems from structural sociology, where many researchers have researched the essence of human relations [22]. These researchers built a human social network consisting of people (nodes) connected to each other from the edges of acquaintance (links). The centrality that describes the importance of one person to others was then determined based on the network. This concept is suitable in the natural for spatial analysis [23]. The most important principle of centrality is that the centrality of a particular point is influenced by the centrality of the adjacent points [24]. The principle applied to a central area in the transport study. A multi-central assessment (MCA) has recently been introduced to assess the centralization of linkages in spatial networks, including urban street networks. The differences and advantages of the MCA were also highlighted in [25, 26]. In short, THE MCA uses a racial graph approach that represents streets as links and intersections as a node, and calculates the distance between nodes metrically along the grid rather than topology in terms of the number of turns. This increases the reliability of network representation, lower analysis costs and stronger realism of outputs. Therefore, this centre is at the forefront of the growing wave of interest in the application of GIS on network analysis [27]. Suppose the urban network consists of N nodes and K edges, where the nodes are intersections of streets and streets are the edges. The network is described by a matrix L whose element is equal to the length of the edge connecting the nodes i and j, or 0 if there is no edge.
Another $D$ matrix is derived whose component $d_{ij}$ is the shortest path length between $i$ and $j$; Therefore, the shortest path is the only variable. The MCA model is used to assess street centrality. The MCA model consists of four main indicators: (Reachness centrality (Degree), Closeness Centrality, Betweenness Centrality and Straight Centrality.

Closeness Centrality is defined as: - it is the shortest distance required to reach from this node to all other nodes in the system that are within the search radius along the shortest path [28, 29]. It is likely that the nodes are close to each other. Some provide greater access to every other node. 

$$C_i^C = \frac{N - 1}{\sum_{j=1, j \neq i}^{N} d_{ij}}$$

**Figure 1.** Shows formula of Closeness Centrality [28]

Betweenness Centrality: - is defined as part of the shortest path between other pairs of nodes in the network that passes through the nodes [30]. This knot is important because it connects two separate sets of nodes. To simplify the example, a bridge represents an important edge for connecting two separate areas across the river. Where, $n_{jk}$ is the number of shortest paths between nodes $j$ and $k$, while $n_{jk}(i)$ is the number of shortest such paths that cross node $i$.

$$C_i^B = \frac{1}{(N - 1)(N - 2)} \sum_{j=1, k=1, j \neq k \neq i}^{N} \frac{n_{jk}(i)}{n_{jk}}$$

**Figure 2.** Shows formula of Betweenness Centrality [31]

Degree: - simply measures the number of destinations around each node within the search radius [31] related to the number of connections (degrees) that the central node contains. Nodes provide more destinations, the greater the number of destinations (nodes), the more likely it is to reach the desired destination more easily. Where $k_i$ is the degree of node $i$, that is, the number of nodes adjacent to $i$.

$$C_i^D = \sum_{j=1, N} a_{ij} = \frac{k_i}{N - 1}$$

**Figure 3.** Shows formula of Degree, [31]

Straight Centrality: - is the shortest paths from the central node to all other nodes in the straight Euclidean paths system. [32] in the sense of increased efficiency in communication between two nodes in a system when there is less deviation in the shortest path than the hypothetical static line connecting them. Where, $d_{ij}$ is the Euclidean distance between nodes $i$ and $j$.

$$C_i^S = \frac{1}{N - 1} \sum_{j=1, j \neq i}^{N} \frac{d_{ij}^{Eucl}}{d_{ij}}$$

**Figure 4.** Shows formula of Straight Centrality [32]
Figure 5. Shows the work of analyzing the urban network, where the (degree) in yellow represents the largest number of nodes connected with the central node. And (Closeness) in red represents the largest number of connections with the lowest distance between the central node and the rest of the nodes. And the blue color (Betweenness), as this node is considered one of the most important nodes because it connects two separate groups of nodes. And the green color represents the (straightness) which is the interconnection of nodes in the shortest straight distance without deviation. (Source: the researcher)

2. Study Area (Bayaa transmission line - Bab Al-Moazam)

The transmission line in the study area is one of the main transportation lines in Baghdad, which connects the side of Al-Karkh and Al-Rusafa through an arterial road with a maximum design speed of 70 km / h, with two lanes (three lines for each lane). The transmission line ends between two regional transport stations (Bab Al-Moazam station and Al-Bayaa station). The main public transport means are minibuses with a maximum number of 12-15 passengers. Several lines feeding the both ends of the line transmission passengers from multiple destinations. Where the Bab Al-Moazam station is reached by destinations such as (Banks, Ur district, Al-Kayara, Al-Dakhil, Al-Bayaa, Al-Jawadar, Abu Dashir, Al-Shaab, Al-Jihad neighborhood, Al-Dora, Al-Shula, Al-Kadhimiya, Al-Mashtal, Abu Ghraib, Al-Husseiniya, Diyala Bridge, Al-Nahda, Alawi, Rashidiya, Amiriya) and the other end of the transmission line, represented by the Al-Bayaa station, it reaches it from destinations such as (Al-Jihad neighborhood, Al-Kadhimiya, Bab Al-Moazam, Al-Alawi, Al-Amiriya, Al-Dora, New Baghdad, Bab Al-Sharji, Al-Karrada, Al-Turath neighborhood). In addition, these stations are connected to a number of governorates for regional transportation. Due to the lack of organization of the transportation process and the provision of special stations for the disembarkation and boarding of passengers. The land uses and road intersections have affected on the identification of transport stations locations. As there have become semi-permanent stations in this route, and of also there are some random disembarkation and boarding places due to residential use. The first station in the line is al-Bayaa station, but due to mismanagement, passengers or buses do not enter it. Where the first ride station is the intersection of the al-bayaa. The intersection of al-Bayaa and Al-Bayaa station is close to the industrial district and the Al-Bayaa market. The second station is a station close to (Al-Bayaa Court), a landing station on which passengers whose homes are located in the Al-Amel neighborhood, as well as those who go to (Al-Bayaa Court) as well as (Real Estate Department). The third station is Yarmouk Hospital Station. Since there is a public hospital, passengers often come and go to the station, and residents of the nearby Yarmouk area also depend on the station. The fourth station is Eagles Square station. Since The Eagles Square is a intersection, the lodge could go to al-Mansour, an area where there is a lot of entertainment and commercial uses. This square is also a starting point for minibuses to reach other areas, for example (Amiriya area). The fifth station is Baghdad International Square Station (Damascus Square). This square is an important intersection with government and commercial use, and is the Baghdad International Fair, as well as its proximity to the Faculty of Fine Arts, Al-Zawra Arua Park, Baghdad Mall, travel companies and Al-Trade unions Street. This square is connected to the line connecting the Al-Mansour entertainment
district, as well as the residential use that depends on the buses passing through this square. Thus, this square is one of the squares that greatly encourages the disembarkation and boarding of passengers. The sixth station is al-Allawi Station. This station is characterized by two regional transport stations. Allawi station and railway station. Therefore, this station is important and attracts many passengers. The seventh station is the Ministry of Culture station. This station was formed due to its presence near (ministers of culture and the retirement department). In addition to being a crossroads to old Baghdad, archaeological, heritage and cultural. In addition, residents rely on this transport station, which oversees residential complexes with a high-density vertical building. The eighth station is the Al-talaa Square station, which is a crossroads. The eighth station is bab Al-Moazam station. This station is also an alternative to the main station of Bab Al-Moazam. Also, because minibuses drivers do not enter the main leg side of taxes. This station is close to (Medina Medical Hospital and Medical Technology Complex). It is also a station in the center of Baghdad.

3. Sample calculation

Simple random sampling, or random sampling, is a sampling design in which distinct units of N units in the population are selected in such a way that it is probable that each possible combination of n units is the sample chosen. The sample can be obtained with selections of n where each unit of the unspecified population already has an equal chance of being selected at each step. Equally, one can make a series of independent selections from each population, for each unit an equal probability of selecting at each step, ignoring the repeated selections and continuing until distinct units are obtained. (Thompson, 2012)

\[ n = \frac{Np(1-p)}{(N-1)(d^2/Z^2) + p(1-p)} \]

**Figure 6. Formula of sample size [33]**

P is a probability value whose value ranges from zero to one and takes a value of 0.5 if the correct value is not available

d is the percentage of permissible error and its value is usually 0.05

Z is the level of confidence, which is usually 0.95 and equals 1.96 in the normal distribution table

N is Community size (Thompson, 2012)

We focused on the passengers traveling on the transport corridor between Al Bayaa Intersection and Bab Al-Moazam. as we considered these passengers as the study population that should be studied. Where we counted the number of passengers traveling from Al-Bayaa Intersection to Bab Al-Moazam and from Bab Al-Moazam to Al-Bayaa Intersection By determining the number of vehicles in the area and calculating the number of passengers who are in it. with approximate part of the accuracy. After determining the population size, we used the sample size calculation formula.

| Time | Number of trips | Number of passenger |
|------|-----------------|---------------------|
|      | 3-0 passenger   | 4-6 passenger       | 9-7 passenger | 10-14 passenger | Sum of trips | 3-0 passenger | 4-6 passenger | 9-7 passenger | 10-14 passenger | Sum passenger |
| 7am  | 17              | 11                 | 11            | 21            | 60            | 34            | 55            | 88            | 252            | 429          |
| 8am  | 22              | 10                 | 13            | 20            | 65            | 44            | 50            | 104           | 240            | 438          |
| 9am  | 57              | 15                 | 20            | 45            | 137           | 114           | 75            | 160           | 540            | 889          |
| 10am | 70              | 14                 | 13            | 30            | 127           | 140           | 70            | 104           | 360            | 674          |
| 11am | 80              | 20                 | 9             | 17            | 126           | 160           | 100           | 72            | 204            | 536          |

Table 1. Shows the number of trips and passengers from Al-Bayaa Intersection to Bab Al-Moazam at 13/1/2020. (Source: the researcher surveys)
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| Time | Number of trips passenger | Number of passenger passenger |
|------|---------------------------|--------------------------------|
| 7am  | 90                        | 14 |
| 8am  | 105                       | 9   |
| 9am  | 110                       | 7   |
| 10am | 117                       | 11  |
| 11am | 107                       | 15  |
| 12pm | 93                        | 8   |
| 1pm  | 156                       | 19  |
| 2pm  | 108                       | 11  |
| 3pm  | 101                       | 11  |
| 4pm  | 98                        | 13  |
| 5pm  | 92                        | 12  |
| 6pm  | 80                        | 3   |
| Sum  | 480                       | 114 |

Table 2. Shows the number of trips and passengers from Al-Bayaa Intersection to Bab Al-Moazam at 26/02/2020. (Source: the researchers surveys)

| Time | Number of trips passenger | Number of passenger passenger |
|------|---------------------------|--------------------------------|
| 7am  | 28                        | 8   |
| 8am  | 34                        | 7   |
| 9am  | 51                        | 8   |
| 10am | 47                        | 10  |
| 11am | 52                        | 27  |
| 12pm | 23                        | 4   |
| 1pm  | 78                        | 42  |
| 2pm  | 65                        | 30  |
| 3pm  | 45                        | 21  |
| 4pm  | 20                        | 15  |
| 5pm  | 12                        | 5   |
| 6pm  | 14                        | 7   |
| Sum  | 469                       | 184 |

Table 3. Shows the number of trips and passengers from Bab Al-Moazam to Al-Bayaa Intersection at 13/1/2020. (Source: the researchers surveys)

| Time | Number of trips passenger | Number of passenger passenger |
|------|---------------------------|--------------------------------|
| 7am  | 35                        | 40  |
| 8am  | 39                        | 46  |
| 9am  | 50                        | 40  |
| 10am | 25                        | 33  |
| Sum  | 186                       | 225 |

Table 4. Shows the number of trips and passengers from Al-Bayaa Intersection to Bab Al-Moazam at 26/02/2020. (Source: the researchers surveys)
Table 5. Shows the Average number of passengers. (Source: the researcher surveys)

| Date        | Bayaa To Bab 13/1/2020 | Al-Moazam 26/02/2020 | Total Sum | Average | Bab Al-Moazam To Bayaa 13/1/2020 | Total Sum | Average |
|-------------|------------------------|----------------------|-----------|---------|----------------------------------|-----------|---------|
| Time        | Sum of passenger      | Sum of passenger     | Sum       | Average | Sum of passenger                 | Sum       | Average |
| 7am         | 429                   | 1114                 | 1543      | 772     | 228                             | 558       | 786     | 393     |
| 8am         | 438                   | 1027                 | 1465      | 733     | 187                             | 576       | 763     | 382     |
| 9am         | 889                   | 739                  | 1628      | 814     | 242                             | 644       | 886     | 443     |
| 10am        | 674                   | 637                  | 1311      | 656     | 424                             | 547       | 971     | 486     |
| 11am        | 536                   | 505                  | 1041      | 521     | 759                             | 651       | 1410    | 705     |
| 12pm        | 189                   | 286                  | 475       | 238     | 174                             | 716       | 890     | 445     |
| 1pm         | 311                   | 555                  | 866       | 433     | 962                             | 692       | 1654    | 827     |
| 2pm         | 378                   | 479                  | 857       | 429     | 940                             | 700       | 1640    | 820     |
| 3pm         | 389                   | 409                  | 798       | 399     | 631                             | 440       | 1071    | 536     |
| 4pm         | 201                   | 493                  | 694       | 347     | 303                             | 419       | 722     | 361     |
| 5pm         | 172                   | 500                  | 672       | 336     | 317                             | 338       | 655     | 328     |
| 6pm         | 161                   | 392                  | 553       | 277     | 239                             | 273       | 512     | 256     |
| Sum         | 4738                  | 7136                 | 11874     | 5937    | 5406                            | 6554      | 11960   | 5980    |

Table 6. Shows the Average number of trips. (Source: the researcher survey)

| Date        | Bayaa To Bab 13/1/2020 | Al-Moazam 26/02/2020 | Total Sum | Average | Bab Al-Moazam To Bayaa 13/1/2020 | Total Sum | Average |
|-------------|------------------------|----------------------|-----------|---------|----------------------------------|-----------|---------|
| Time        | Sum of trips           | Sum of trips         | Sum       | Average | Sum of trips                     | Sum       | Average |
| 7am         | 60                     | 182                  | 242       | 121     | 49                               | 104       | 153     | 77      |
| 8am         | 65                     | 181                  | 246       | 123     | 49                               | 114       | 163     | 82      |
| 9am         | 137                    | 160                  | 297       | 149     | 68                               | 127       | 195     | 98      |
| 10am        | 127                    | 160                  | 287       | 144     | 82                               | 94        | 176     | 88      |
| 11am        | 126                    | 142                  | 268       | 134     | 129                             | 92        | 221     | 111     |
| 12pm        | 50                     | 107                  | 157       | 79      | 37                               | 101       | 138     | 69      |
| 1pm         | 74                     | 190                  | 264       | 132     | 174                             | 92        | 266     | 133     |
| 2pm         | 89                     | 139                  | 228       | 114     | 155                             | 76        | 231     | 116     |
| 3pm         | 86                     | 127                  | 213       | 107     | 108                             | 70        | 178     | 89      |
| 4pm         | 35                     | 133                  | 168       | 84      | 54                               | 72        | 126     | 63      |
| 5pm         | 26                     | 128                  | 154       | 77      | 42                               | 62        | 104     | 52      |
| 6pm         | 24                     | 106                  | 130       | 65      | 37                               | 55        | 92      | 46      |
| Sum         | 894                    | 1755                 | 2649      | 1325    | 984                             | 1059      | 2043    | 1022    |
We collected initial data from the Bab Al-Moazam station administration, where they provided us with simple data about the number of actual trips per day, as it was roughly estimated by them that 200 minibuses make 6 trips per day. Including three flights from Al-Bayaa’ intersection to Bab Al-Moazam and three trips from Bab Al-Moazam to Al-Bayaa intersection. Provided that half of these cars make trips and they are filled with half the number of passengers, i.e. approximately 5 passengers at the beginning of the trip. And the other half of trips with full of passengers, which is about 12 passengers at the beginning of the trip. This gives us 600 round trips and 600 return trips. Where 300 of the 600 flights are multiplied by 5 passengers with 300 other flights are multiplied by 12 passengers. Thus, the number of passengers from Al Bayaa Intersection to bab Al-Moazam is 5100 passengers. And the number of passengers from Bab Al-Moazam to Al-Bayaa intersection is also approximately 5100. (5100 = 300 * 5 + 300 * 12).

In order to verify these numbers, we conducted surveys where the number of trips from Al-Bayaa Intersection to Bab Al-Moazam and from Bab Al-Moazam to Al-Bayaa Intersection. were calculated from 7 am to 7 pm depending on the number of people carried by one trip. The flights are classified into trips carrying 0-3 passengers, 4-6 passengers, 7-9 passengers, 10-14 passengers. On Monday 1/13/2020 and Wednesday 26/02/2020, separated days in order to know the change in the number of passengers from time to time. The results showed that the average of the trips from Al-Bayaa ‘Intersection to Bab Al-Moazam is 5937, and the average of the trips from Bab Al-Moazam to Al-Bayaa’ intersection are 5980. With these results, it can be said that the employees of the Bab Al-Moazam Garage Department had an approximate prediction that was successful with estimating the number of passengers on trips per day. (As Shown in Table 1., 2., 3., 4.)

According to the results, the size of the studied community is the number of passengers who rode from the beginning of the flight path and those who rode in the stations along the route. Where the average number of passengers from the boarders at Al-Bayaa Intersection is 5937, in addition to 36% of 5937 passengers, which represents the number of passengers in the stations located along the route from Al-Bayaa Intersection to Bab Al-Moazam. In this way, the size of the passenger community from Al-Bayaa Intersection to bab Al-Moazam is 8,074 passengers. Where the average number of passengers from the boarders in Bab Al-Moazam is 5980, in addition to 33.5% of the 5980, which represents the number of passengers who rode in the stations located along the path from Bab Al-Moazam to Al-Bayaa intersection. This means the size of the passenger community from Bab Al-Moazam to Al-Bayaa intersection is 7983 passengers.

The ratios of 33.5% and 36% were extracted through field surveys that compare the total number of boarding passengers at stations along the route with the total number of boarding passengers at the first station. (As Shown in Table 8.) When applying the sample size calculation formula, the results show that the number of passengers required to be studied from Al-Bayaa Intersection to Bab Al-Moazam is 367. And the number of passengers that must be studied from Bab Al-Moazam to Al-Bayaa intersection is 367.

3.1. Passenger boarding and disembarking data

This operation was done by taking a full-size minibus. And then calculate the number of passengers in it, the number of disembarking and boarding in each of the proposed stations. With the determination of the arrival and boarding times for every three hours. in order to have numbers that can be distinguished and used in a simple systematic way.

Table 7. Shows the number of flights we used to monitor passengers. (Source: the researcher survey)

|       | Bayaa To Bab Al-Moazam | Bab Al-Moazam To Bayaa |
|-------|------------------------|------------------------|
| Today |                        |                        |
| Wednesday | 11                      | 10                     |
| Thursday  | 9                       | 10                     |
| Saturday | 12                      | 12                     |
| Sunday   | 13                      | 12                     |
| Sum      | 45                      | 44                     |
Table 8. Shows The percentage of passengers boarding at the stations of the line to the starting station of the line (Source: the researcher survey)

| Passengers for all the days we collected data for each station | Al Bayaa Court | Yarmouk Hospital | Eagles Square | Baghdad Fair Square | Allawi station | Ministry of Culture | al talaa Intersection | Intersection of Bab Al Moazam | Al Bayaa Intersection |
|---------------------------------------------------------------|-----------------|------------------|--------------|---------------------|----------------|---------------------|----------------------|--------------------------|---------------------|
| Bayaa To Bab Al Moazam Sum | 8 | 18 | 15 | 26 | 35 | 10 | 6 | 0 | 325 |
| The ratio of the sum to the starting station of the line. Bab Al Moazam To Bayaa Sum | 12 | 22 | 7 | 23 | 21 | 7 | 10 | 304 | 0 |
| The ratio of the sum to the starting station of the line. Sum of passengers | 20 | 40 | 22 | 49 | 56 | 17 | 16 | 304 | 325 |

Figure 7. Shows passengers boarding at the stations. (Source: the researcher)

Table 9. Shows passengers disembarking at the stations. (Source: the researcher survey)

| Disembarkation of Passengers for all the days we collected data for each station | Al Bayaa Court | Yarmouk Hospital | Eagles Square | Baghdad Fair Square | Allawi station | Ministry of Culture | al talaa Intersection | Intersection of Bab Al Moazam | Al Bayaa Intersection |
|---------------------------------------------------------------------------------|-----------------|------------------|--------------|---------------------|----------------|---------------------|----------------------|--------------------------|---------------------|
| Bayaa To Bab Al Moazam. Bab Al-Moazam To Bayaa. Sum of passengers | 28 | 49 | 27 | 77 | 66 | 40 | 5 | 151 | 0 |
| Bab Al-Moazam To Bayaa. Sum of passengers | 23 | 22 | 22 | 52 | 70 | 41 | 9 | 0 | 167 |
| Sum of passengers | 51 | 71 | 49 | 129 | 136 | 81 | 14 | 151 | 167 |
4. Urban Centrality analysis for study area

We measured the centrality of the urban design of the road network that connects to the transmission line, which extends 800 meters away from it, which is the suitable walk distance towards the station. In the analysis we used a radius of 800 meters (which means the distance between the central node and the other nodes) and the results were according to maps Source research based on geographic information systems.

**Figure 8.** Shows passengers disembarking at the stations. (Source: the researcher)

**Figure 9.** Shows study area. (Source: the researcher depend on geographic information system)
Figure 10. Shows reach Centrality. (Source: the researcher depend on geographic information system)

Figure 11. Shows straight Centrality. (Source: the researcher depend on geographic information system)
Figure 12. Shows betweenness Centrality. (Source: the researcher depend on geographic information system)

Figure 13. Shows closeness Centrality. (Source: the researcher depend on geographic information system)

Where each indicator was divided into five weights, each weight represents a color on the map (0.2 represents dark green, 0.4 represents light green, 0.6 represents yellow, 0.8 represents orange, and 1 represents red), where the greater the number, the greater the centrality of the indicator.

The reason for using weights is the fact that there are large differences betweenness the reach index and the straightness index betweenness. Which will affect the correctness of the numbers.
We neglected the closeness indicator because it does not affect the centralization in the study area. Because there are no differences between the proposed stations in the closeness indicator.

**Table 10.** Shows shows the application of weights of the centrality indicators to the assumed stations. (Source: the researcher depend on geographic information system)

| Station                          | Indicator weight | Sum | Sum % |
|----------------------------------|------------------|-----|-------|
| Al Bayaa Intersection            | 0.4 0.8 0.6      | 1.8 | 60    |
| Al Bayaa Court                   | 1 0.8 1          | 2.8 | 93    |
| Yarmouk Hospital                 | 1 0.8 1          | 2.8 | 93    |
| Eagles Square                    | 0.8 0.8 0.8      | 2.4 | 80    |
| Baghdad Fair Square              | 0.8 0.6 0.8      | 2.2 | 73    |
| Allawi station                   | 1 0.6 1          | 2.6 | 87    |
| Ministry of Culture              | 0.8 0.4 1        | 2.2 | 73    |
| Altalaa Intersection             | 0.6 0.4 0.6      | 1.6 | 53    |
| Intersection of Bab Al-Moazam    | 0.6 0.4 0.6      | 1.6 | 53    |

![Centrality of network](image)

**Figure 14.** Shows centrality of each assumed stations. (Source: the researcher)

5. **Centrality of land use**

We have determined the land use in the study area, which is 800 meters away from the supposed stations. Assuming that the effect of residential use is equal in every station, given that each station is near a residential use. in addition to the difficulty and imprecision in measuring the effect of residential use. For this we have created weights for each type of existing land use other than residential use. Where we have focused on the uses that contain jobs and on employment as they attract the most number of trips. As well as being the uses that distinguish each station from the other. Consequently, it will have a greater impact, as we have put large weights for the use with a large number of functions than for the use with a smaller number of employment. Then we multiply the weight value with the number of uses. Then we collected the values of these uses in each station to get which of the stations is more central to the land uses.
Figure 15. Land uses at the stations [34]

Table 11. Shows land uses at the stations. (Source: the researcher survey)

| Station          | Type of land use                              | land use                  | Weight | Number | Value | Sum |
|------------------|-----------------------------------------------|---------------------------|--------|--------|-------|-----|
| Al Bayaa Intersection | Square kilometers for commercial and industrial | Al-Bayaa Station         | 2      | 0.52   | 1.04  | 2.54|
|                  | A government hospital or university            |                           | 1      | 0      | 0     |     |
|                  | Private hospital or university                 |                           | 0.5    | 0      | 0     |     |
|                  | Governmental ministry or transport station     |                           | 1      | 1      | 1     |     |
|                  | Government department                          |                           | 0.5    | 0      | 0     |     |
|                  | Change the direction of transport              |                           | 0.5    | 1      | 0.5   |     |
| Al Bayaa Court   | Square kilometers for commercial and industrial | Al Bayaa Court            | 2      | 0      | 0     | 0.5 |
|                  | A government hospital or university            |                           | 1      | 0      | 0     |     |
|                  | Private hospital or university                 |                           | 0.5    | 0      | 0     |     |
|                  | Governmental ministry or transport station     |                           | 1      | 0      | 0     |     |
|                  | Government department                          |                           | 0.5    | 1      | 0.5   |     |
|                  | Change the direction of transport              |                           | 0.5    | 0      | 0     |     |
| Yarmouk Hospital | Square kilometers for commercial and industrial | Yarmouk Hospital         | 2      | 0      | 0     | 1   |
|                  | A government hospital or university            |                           | 1      | 1      | 1     |     |
|                  | Private hospital or university                 |                           | 0.5    | 0      | 0     |     |
|                  | Governmental ministry or transport station     |                           | 1      | 0      | 0     |     |
|                  | Government department                          |                           | 0.5    | 0      | 0     |     |
|                  | Change the direction of transport              |                           | 0.5    | 0      | 0     |     |
| Eagles Square    | Square kilometers for commercial and industrial | Ministry of Communications, Al-Nsour Private College, Baghdad Gallery, General | 2      | 0      | 0     | 3   |
|                  | A government hospital or university            |                           | 1      | 1      | 1     |     |
|                  | Private hospital or university                 |                           | 0.5    | 0      | 0     |     |
|                  | Governmental ministry or transport station     |                           | 1      | 0      | 1     |     |
|                  | Government department                          |                           | 0.5    | 1      | 0.5   |     |
|                  | Change the direction of transport              |                           | 0.5    | 1      | 0.5   |     |
| Baghdad          | Square kilometers for commercial and industrial | Al-Harithiya Private Hospital, | 2      | 0.08   | 0.16  | 7.16|
| Location                | Industry/Infrastructure          | Address                                                                 | Square Kilometers for Commercial and Industrial | A Government Hospital or University | Private Hospital or University | Governmental Ministry or Transport Station | Government Department | Change the Direction of Transport |
|-------------------------|---------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------|-------------------------------|--------------------------------------------|------------------------|-------------------------------|
| Fair Square             | Industrial                      | Private Red Crescent Hospital, Al Turath Private University, Institute of Medical Technology, Institute of Fine Arts, Ministry of Electricity, Ministry of Trade, Baghdad International Fair | 1 2 2                                               | 0.5 3 1.5                        | 1 3 3                         | 0.5 0 0                                     | 0.5 1 0.5               |                                |
| Allawi Station          | Square kilometers for commercial and industrial | Ibn Al-Bitar Hospital, the railway station and Alawi station, the Ministry of Construction and Housing, the Ministry of Foreign Affairs, the Ministry of Justice, the Ministry of Municipalities Works, the Ministry of Culture, the Iraqi Museum | 2 0.07 0.14 8.14                             | 1 1 1                             | 0.5 0 0                        | 0.5 1 0.5                                    | 0.5 1 0.5               |                                |
| Ministry of Culture     | Square kilometers for commercial and industrial | National Retirement Authority, Ministry of Culture, Iraqi Museum | 2 0.54 1.08 3.08                      | 1 0 0                             | 0.5 0 0                        | 1 1 1                                      | 0.5 1 0.5               |                                |
| Al-tala'a Intersection  | Square kilometers for commercial and industrial | Ministry of Culture | 2 0.34 0.68 2.18                    | 1 0 0                             | 0.5 0 0                        | 1 1 1                                      | 0.5 1 0.5               |                                |
| Intersection of Bab Al-Moazam | Square kilometers for commercial and industrial | City of Medicine Hospital, Bab Al-Moazam Colleges Complex, Ministry of Defense | 2 0.63 1.26 5.76                   | 1 2 2                             | 0.5 0 0                        | 1 2 2                                      | 0.5 1 0.5               |                                |
|                         | A government hospital or university | Ministry of Defense | 1 2 2                                       | 0.5 0 0                           | 1 2 2                             | 0.5 0 0                                       | 0.5 1 0.5               |                                |
|                         | Private hospital or university   | Ministry of Defense |                                               |                                    |                                  |                                             |                        |                                |
|                         | Governmental ministry or transport station | Ministry of Defense |                                               |                                    |                                  |                                             |                        |                                |
|                         | Government department            | Ministry of Defense |                                               |                                    |                                  |                                             |                        |                                |
|                         | Change the direction of transport | Ministry of Defense |                                               |                                    |                                  |                                             |                        |                                |
6. Analysis

We have done statistical analysis between the indicators in all stations except for the first station Al-Bayaa intersection and the last, Bab Al-Moazam intersection. Because there is a large variation in the number of disembarking and boarding in these stations, in relation to the other stations. Therefore, we conducted multiple analyzes between the central indicators of the transport network represented by the independent reach, betweenness and straightness with dependent disembarking and boarding indicator. And it emerged that there is a strong to moderate positive correlation between them. Then we analyzed the dependent index of disembark and boarding with the independent index of land use. And the relationship was positive to moderate. Also, we did multiple analysis between the independent indicators of the centralization of the transmission network and land use, with the dependent disembarking and boarding indicator. And found that there is a strong positive relationship between them.

Table 12. Shows results of statistical analysis of simple and multiple regression. (Source: the researcher depend on spss program)

| Trip direction | Correlation | Betweenness | Straightness | Reach | Land use | Reach, Straightness | Betweenness | Land use |
|----------------|-------------|-------------|--------------|-------|----------|---------------------|-------------|----------|
| Passengers disembark Bab Al-Moazam - Bayaa | R 0.234 | 0.413 | 0.332 | 0.887 | 0.709 | 0.999 |
| | R Square 0.055 | 0.171 | 0.11 | 0.788 | 0.503 | 0.997 |
| | Sig Less than 95% | Less than 95% | Less than 95% | 0.008 | 0.006 |
| Passengers boarding Bab Al-Moazam - Bayaa | R 0.375 | 0.529 | 0.706 | 0.398 | 0.794 | 0.83 |
| | R Square 0.141 | 0.28 | 0.498 | 0.158 | 0.631 | 0.688 |
| | Sig Less than 95% | Less than 95% | Less than 95% | 0.008 | 0.006 |
| Passengers disembark Bayaa - Bab Al-Moazam | R 0.095 | 0.523 | 0.479 | 0.636 | 0.567 | 0.845 |
| | R Square 0.009 | 0.273 | 0.23 | 0.405 | 0.321 | 0.714 |
| | Sig Less than 95% | Less than 95% | Less than 95% | 0.008 | 0.006 |
| Passengers boarding Bayaa - Bab Al-Moazam | R 0.216 | 0.338 | 0.508 | 0.817 | 0.677 | 0.969 |
| | R Square 0.047 | 0.114 | 0.258 | 0.667 | 0.458 | 0.94 |
| | Sig Less than 95% | Less than 95% | Less than 95% | 0.02 | 0.006 |

Where R Square: effect, R: Correlation, Sig: significant
7. Conclusion

This paper relates to the measurement of the centrality of the transport Kinetic nodes, which varies due to the urban design of the transport network and the variation in the type and intensity of the use of the land. Which affects the size, type and location of the public transport station. Therefore, we calculated the sample of the public transport passenger community, assumed the location of public transport stations and collected transport network data and land use. We did a multi-regression analysis. It has emerged that there is a strong correlation between these indicators and the centrality of the transport network with the disembarking and boarding indicator to these stations. We also analyzed the simple regression between the land use independent index and the passenger disembarking and boarding dependent index. Where it appeared in the statistical analysis, there is a strong relationship between a central indicator of disembarking and boarding with a central land use dependent indicator. The performance of the multiple regression between the disembarking index and the boarding dependent index, and land use indicators and the central transport network of independent indicators. We found that there was a strong relationship between them. We have identified here the kinetic nodes and the causes of these nodes along the al-Baya Bab Al-Moazam transport line. Transport stations are heavily influenced by the use of the surrounding land and the easy access from these uses to the station itself. The centrality of the transport network is important in choosing the location of the public transport station. Where the importance of determining the centrality of the transport station, is in determining the size of the station which directly affects the delay resulting from parking at the station. The more demand for transportation at the station, well increase the bus parking time, which increases the trip delay.

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