# The use of Gravitational Law to assess urban balance: the case of Makkah region in Saudi Arabia

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## Abstract
Gravitational studies have been a key instrument in analyzing spatial flows. In this research, we will be highlighting the relevance of the data related to population and distances between urban centres in assessing the urban balance of human settlements using a gravitational law. Our hypothesis stipulates that an urban centre's real urban population is different from the one included in its theoretical geographic boundaries. The assessment process is based on the functional weight of various urban centres. We will implicate the urban infrastructure then each centre's functional "Areas of Influence" in the entire region. We aim to test the validity of the mathematical Reilly law on our study corpus, which is Makkah Province, using the mentioned parameters. In addition, there was an attempt to model the real urban attraction of cities. Finally, the calculation results of the urban centres attractions are pulled down to be projected on the Geographic map of our Case Study. The study findings reveal a discordance between the real weights and sizes of the urban centres and the theoretical ones, which discloses a clear unbalance of the urban system that needs to be addressed.

## Keywords
Urban Balance, the holy Makkah, Reilly gravity law, urban area of influence.

## 1. Introduction
This paper is developed to be a part of larger-scale research that assesses the urban balance of Makkah Region in Saudi Arabia. In response to the urban complexity of this system, we opted for the application of the multi-criteria analysis (MCA) decision aid method. This method implies using many parameters that will be combined together to serve as a basis for assessment. These parameters have to do with implementing factors intrinsic to the functional urban system and which can influence the urban coherence of the province. This research focuses specifically on one of the most important criteria that need to be addressed in the urban balance assessment process: the actual population served by the urban centres. To be able to determine the latter parameter, it was essential to finalize the "area of influence" of each centre by defining its limit of attractiveness to residents. Evoking this factor in our investigation

drove us to explore mathematical gravitational theories applied to urban studies to verify the exact limits of the influence of the urban centres in our study corpus, which is Makkah region in Saudi Arabia. We argued that the Law developed by William J Reilly, founder of the Institute for Straight Thinking and originator of retail gravitation, is the more appropriate one supporting our hypothesis.

## 2. Literature Review

The use of gravity models in the urban realm has proliferated in recent years both in planning where they are used mainly as shopping model and theoretical work on patterns of interaction.

The individuals whose work dominates the literature in applying the gravity model to retailing and marketing are Reilly (1929, modified by Converse 1949) and Huff (1959). These researchers introduced simple, practical, and valuable applications of the gravity concept to describing, explaining, and predicting market behaviour. Reilly examined trade areas, market sheds, or service area (retailing) hinterlands focusing on the aggregate competitive effects of alternative markets.

Moindrot (1975) has applied Reilly Law on the Midwestern region of France. His theoretical calculations and results projected on the map were approximately matching the actual geographic delimitation of the urban centres. Therefore the size of the metropolitan cities and the attraction they have on the smaller centres were balanced. Later several investigations were conducted in France to study the urban metropolitan attraction and spot the discordance with Reilly Law. Grasland (2001) utilized Reilly Law in the Eastern French provinces and found out a neat difference between the actual geographic limits and the theoretical one. He claimed that the theoretical boundaries are much more logical and that the government should orientate its strategies to implement it. Pumain (2016) a contemporary researcher in urban and geographic realms, has recently studied the applicability of Reilly law on several regions in France and in Lyon, in particular Lyon. Her investigations served in the geo-marketing to localize the trade points, their localizations, theirs projected clients…

M Batty (1978) developed a critique of Reilly's Law by adopting a gravity model more general than Reilly's Newtonian model and applied these models to the definition of an urban hierarchy in the Reading sub-region.On the other hand, Mary E. Edwards (2007) claimed that 'A gravity model stimulates the idea that shopping areas act like magnets, attracting consumers as if they were little steel balls from a farther distance than the weaker magnets can'. In his, book Operational Urban Models: An Introduction, David Foot (2018) has extended Reilly's original ideas highlighting and overcoming some limitations in the Law, such as the lack of behavioural content underlying the ideas of the gravity model.

The gravitational theories were also applied to determine the pertinence of installing amenities, equipment, and infrastructure within a given area.For instance, in his investigation on how to define the location and the catchment area of any shopping, Nandi (2016) identified the relevance of Reilly's Law in sub-urban areas of West Bengal, where a good number of shopping malls have been constructed in the last few years. Similarly, in 2003, the French ministry of health used Reilly law to determine the theoretical population who was served by the healthcare equipment and compared it by the real number to highlight the disparities and then overcome them.

In Reilly's own area of interest, there has been an enormous increase in research activity devoted to explaining, interpreting, and testing the concept of gravitation in spatial systems. Our study will adopt Reilly's Law and test it in our urban system to verify its balance regarding the actually served population.

## 3. Methods

The spatial attraction between human settlements in urban systems is dynamic and necessitates a continuous assessment to sustain proper functionality. Therefore, we opted for Gravitational models as they apply to all types of exchange situations in which a spatial dimension is present. Reilly affirmed in his Law as follows: "Two cities attract trade from an intermediate town in the vicinity of the breaking point, approximately in direct proportion to the population of the two cities, and in inverse proportion to the squares of the distances to the intermediate towns" (Reilly 1931). The purpose of Reilly's Law of retail gravitation (1931) is to find a point of indifference between two locations, so the urban and economic area of influence of each can be determined. This point is assumed a function of the distance

between two locations pondered by their respective size (population often used for this purpose). An area can thus be more attractive than the other can.

The Law of retail gravitation is a heuristic idea that depicts that "customers are willing to travel longer distances to larger retail centres given the higher attraction they present to customers". According to Reilly's formulation, "the attractiveness of the retail centre becomes the analogy for size (mass) in the physical law of gravity". The Law supposes the area's geography is flat (i.e. without any rivers, roads or mountains) to adjust a consumer's choice of where to go to buy goods.

This paper aims to relevance Reilly's (1931) Law of Retail Gravitation to assess the urban balance of Makkah region in terms of serving the population in its geographic boundary.

Reilly law enables us to determine the theoretical served population, a parameter falling within the outline of the functional hierarchy in urban systems. There will be an essay to assess the functional weight of the different centres using two main parameters: the areas of Influence" and the population they serve in the system. There will be an attempt to determine the dominance relationships between neighbouring centres by considering the gravity law stated by The American W.J. Reilly, who modelled the attraction of cities from the gravity model (the Law of retail gravitation) inspired by the universal gravity law of Newton. This Law stipulates that a city exerts on each point B of its environment an attraction I, which varies in direct proportion to its mass P and in opposite reason to the square of the distance D between city A and point. According to Reilly, the influence (I) of a centre is proportional to its weight (P) and inversely proportional to the square of the distance (D), which separates it from another given centre: I = P / D2. In this gravity model, the weight of the centre corresponds to its demographic size. The distance in kilometers (D) will be replaced by the travel time (T) between the centres to deal with problems related to the condition of the roads, topography, nature, status, etc. A national road is faster than a Wilaya path or a track. A winding road is slower than a straight road. The speed relative to each type of roads represents the average journey time of private buses, EPTVE buses (ex SNTV), taxis and the data taken from the Directorate of Transport" (FARHI 2015)

**The inherent notions in the criterion of the served population**
**A systemic perspective leads the reflection**
The reflection is part of a systemic approach where the region of Makkah is considered as a system defined by the intermingling of subsystems (centres) in an organized interaction to maintain dynamic stability through articulating with each other in a complex causal relationship

**The concept of an urban framework based on hierarchization**
The urban framework is generally defined as *"the set of hierarchical cities and their areas of influence which perform, in a given territory, the functions which require a minimum of the served population"* (Merlin 2002). According to Poupard (2013), the notion of the urban framework is intimately linked to the concepts of:

- The urban network is the geographical "entrance" of this framework characterized by relationships expressed by flows of people, goods, intangible communication, and capitals.

Urban hierarchy implies a structuring in different levels and relations of domination between the neighbouring urban units

**Isochronous Curves**
**The model of isochrones: the delimitation of areas of influence by using transport time**
It is stated above that the distance D in Reilly's Law will be replaced by the travel time T and therefore $I = P / T^2$. For a reasonable consideration of the temporal dimension in the application of this Law for the purpose of geometric structuring of the areas of influence of the centres, a process based on the use of "isochronous" curves of transport time will be adopted. These areas lead to the modelling of theoretical urban boundaries, which account for the reality of the intra-urban functioning of a given system. The objective would be to specify the road journey time T between each pair of neighbouring centres to be able to calculate the area of influence I using isochrones since there are demographic data P.(Figure 1)

Between the isochronous curves corresponding to the values of the nearest I, we draw the mediating line of the segment which connects them. Then, we obtain the limit of influence between the two centres in terms of travel time, and we convert the value into the ratio of distances between the two centres. Reilly renamed the boundary between two trade

areas the breaking point (BP). *"The meeting point of the values of the curves or those that come closest to the centres considered two by two, marks the limit of attraction"* (Garnier 1995). The calculation is made for all the capital centres of governorates.

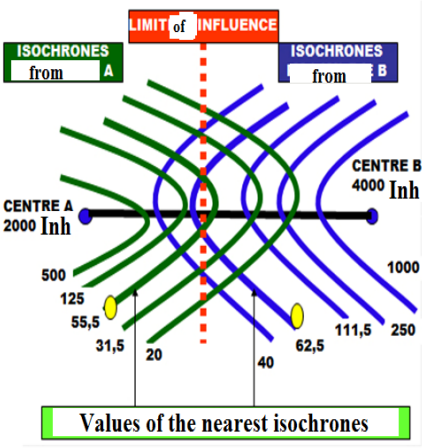


Figure 1. Model of isochrones between two centers (A, B) (FARHI 2015)

## 4. Data Collection

**A cartographic examination for statistical purposes**

Implementing a method of delimiting functional urban areas urges us to geographically specify how the different centres of Makkah region are accessed. Therefore, it is essential to grasp the urban framework of the system delicately. First, we started by examining the road network to be able to identify the distance D to be travelled between all the neighbouring centres. The second step is to assimilate the types of roads which connect the adjacent centres (main road, secondary road, built-up area, passable track, etc.) (Figure 2). At the same time, a field survey has been carried out to determine the speed V of transport relative to these types of roads (table 1). Bus drivers and taxis travelling between different cities in the region were asked about the speed with which they travel relative to the nature of these roads. The average of around twenty responses was informative enough to calculate travel time. The following table1 summarizes the speeds used according to the type of road:

Table 1. Summary table of different speeds of the road journey according to the type of the roads (Author (2017).

| Categories of Roads | Average speed in Km/H |
|---|---|
| National roads (ascent) | 80 |
| National roads (descent) | 100 |
| National roads (plain) | 120 |
| Secondary roads (ascent) | 60 |
| Secondary roads (descent) | 70 |
| Secondary roads (plain) | 80 |
| Unsealed roads | 40 |
| Passable tracks | 50 |
| Difficult tracks | 30 |
| Urban area crossing < 500 inhabitants | 60 |
| Urban area crossing of 10 000 inhabitants | 40 |

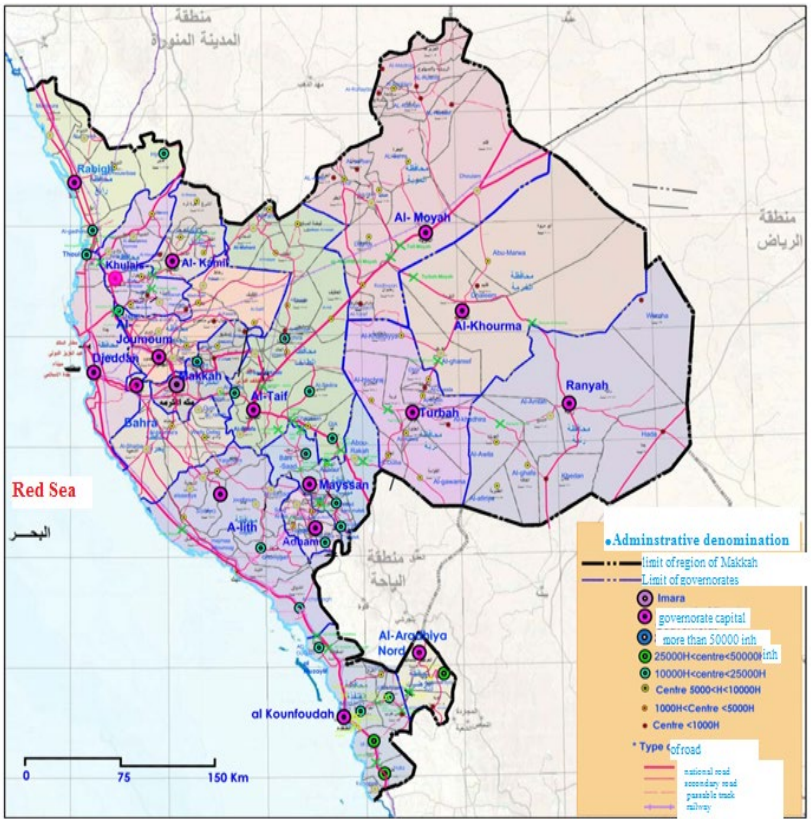


Figure 2. Map of the Region of Makkah

## 5. Results and Discussion

### 5.1Numerical and Graphical Results

**From modelling the territory to calculating the served population: An attempt of hierarchization in terms of 'geographical experience'.**

After geographically scrutinizing our study corpus in terms of connections and spatial limits, it is now a matter of revealing the gap between the administered territory shown in (Figure 2) and the real populated one. We will try to redefine the framework of this urban system by clearing the hierarchy which underlies daily exchange and the interdependence between centres. To do so, we will rely on the network that provides this exchange as it is made up of units linked by connections (channels). Then, we will consider the actual map of the region of Makkah (Figure .1) and ensure the geographic location of all the centres of the province, the routes connecting them and the exact nature of these connections. The objective is to find in all points of the populated territory which centre exerts the most potent attraction on this point and from which it benefits from its services . This traces the spatial extension of each centre's area of maximum influence. Then, we obtain a map where any point in space is assigned to only one centre.

**Determining the limits of influence by using isochronous curves**

By referring to the Law of Reilly $I = P / T^2$, with speed V which corresponds to each type of road and the distance D, it is possible to calculate the time of the road journey. (table 2).

Table 2. Distance between the centre "Makkah" and neighbouring centres. (Author 2017).

| Centers linked to Makkah | Type of road | Speed (km/h) | Distance (km) | Journey time (min) |
|---|---|---|---|---|
| **Jeddah** | National plain | 120 | 101 | 50.5 |
| **Al-Joumoum** | Mixed(Nat/sec/Agg)) | 70 | 45 | 38.57 |
| **Al-Taef** | Mixed(Nat/sec/Agg)) | 110 | 107 | 58.36 |
| **Bahra** | Mixed(Nat/sec/Agg)) | 90 | 57.8 | 38.53 |
| **Al-Lith** | Mixed(Nat/sec/Agg)) | 100 | 207 | 124.2 |

The table above is an example that illustrates the first step of the calculation. "Makkah" has been linked to the "big" neighbouring centres, namely: Jeddah, Al-Joumoum, Al- Taif, Bahra and Al-lith. In calculating the areas of influence, we will consider only the centres of governorates, which have a large population. Then, we will consider the centres by couples, fragment the journey time T into equal time intervals Tx and calculate the speeds corresponding to these intervals which are relative to the different types of roads, to ensure the relevance of the calculation. For each time interval, the area of influence $I = P / T^2$ is calculated and the nearest values of I are drawn between the two interacting units In the example opposite, we considered Makkah (centre A), and Al-Taef (centre B).(table 3)

Table 3**.** Calculation of isochrones between both centres (Makkah, Al-Taef). (Author 2017).

| Center | Population | ISOCHRONES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | T1:10 Min | | T2:20 Min | | T3:30 Min | | T4:40 Min | | T5:50 Min | |
| **Makkah** | 1547843 | **I1** | 15478 | **I2** | 3869.6 | **I3** | 1719.83 | **I4** | 967.4 | **I5** | 619.14 |
| **Jeddah** | 3955839 | **Ia** | 39558 | **Ib** | 9889.6 | **Ic** | 4395.38 | **Id** | 2472 | **Ie** | 1582.3 |

We attribute isochronous curves relevant to the travel time to the above values. Then on the line connecting the two curves of the closest values of "I", we draw the mediant line. This line will divide the distance between the centres in terms of ratios (Figure 3). This ratio will be directly projected on the road connecting the two centres on the accurate geographic map (Figure 4).

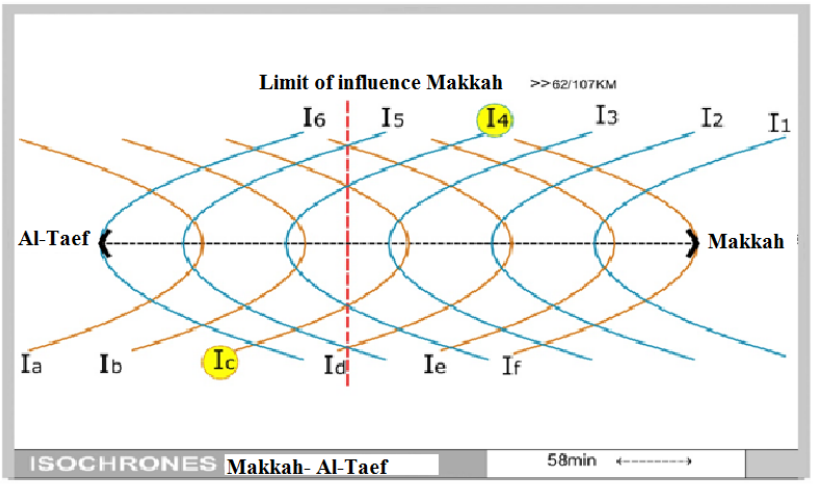


Figure 3. Isochronous curves between two centers (Makkah, AL-Taef). (Author 2017).

## 5.2 Validation

**The geographic projection of the limits of influence**

After having theoretically determined the limits of influence between all the provincial capitals of adjacent governorates, we move on to the graphic representation of the areas of influence on the map of the urban system,

namely the region of Makkah. It would thus be necessary to project the distance ratios previously calculated precisely on the roads connecting the couples of centres being dealt with. The following is a close illustration of the projection of the road linking Makkah to Al-Taef over the boundary of the areas of influence. (Figure 4)

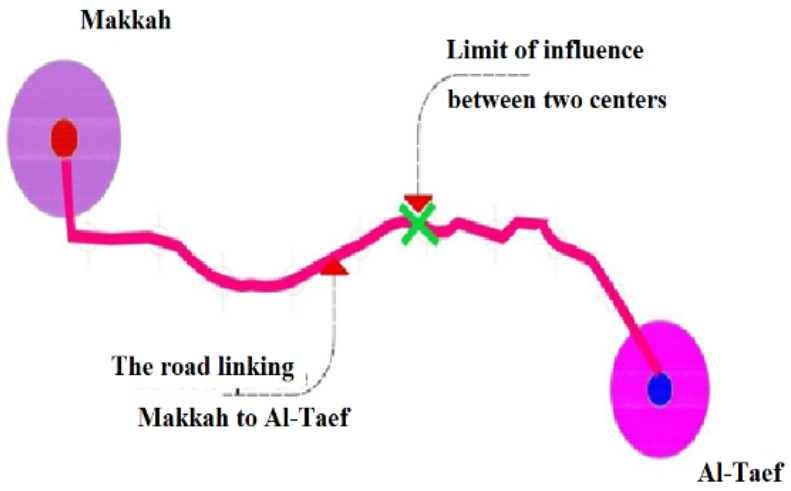


Figure 4: Representation of the 'breaking point' over the road (Makkah, AL-Taef) (Author 2017)

Once all the limits of influences between the neighbouring centres are identified, we proceed to the careful modelling of the areas of influence, which must link for each centre its gravitational limits covering the other neighbouring units. It is necessary to know how to manage the possibility of crossing areas of influence by considering several data such as proximity and the services offered by the infrastructure to favour one centre over the other. After identifying the new boundaries of the main centres in our urban system using the previous limit of influence method, we move forward with connecting the points graphically on the map. This method leads us to a new configuration of the geographic map based on the attraction law of Reilly. (Figure 5)

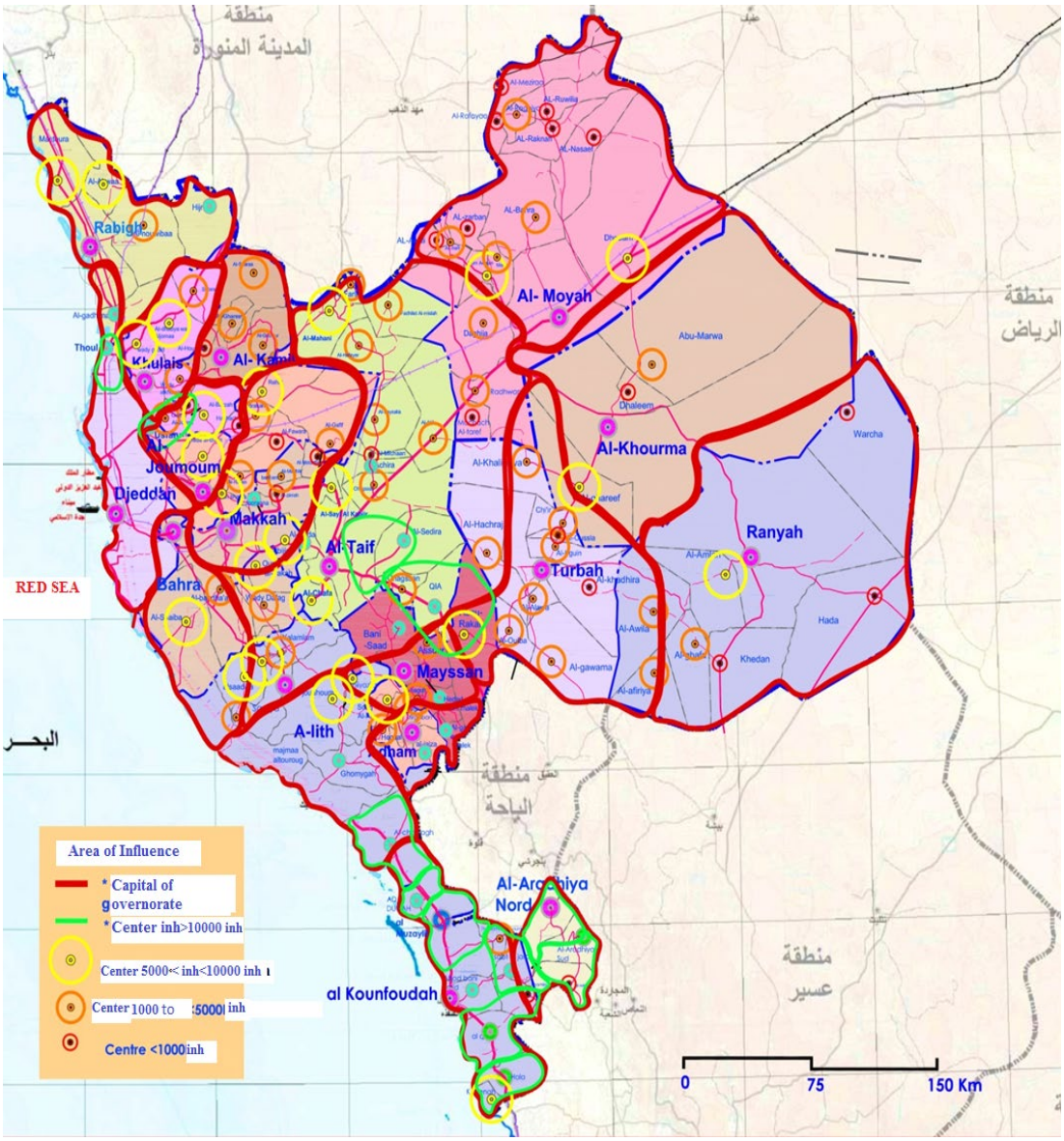


Figure 5. Projecting the Statistical results of the real areas of influence on the map. (Author 2017)

## From the geographical representation of the areas of influence to the calculation of the served populations

Once the areas of gravitational attraction are modelled, we move on to the calculation of the population served by each urban unit and this is in relation to its limits of functional influence. To do this, we identified the centres that will now be included in the new areas of attraction on the previously constructed map. Based on this, the served population has been recalculated, as it is the sum of the centres' residents attracted by the functional gravity of the major centres.(Table 3).

Table 3. Calculation of areas of influence. (Author 2017)

| Governorate | CENTRES ADMINISTRATED IN THE INFLENCE AREA | SERVED POPULATION PER GOVERNORATE | TOTAL OF SERVED POPULATION |
|---|---|---|---|
| **Makkah** | 1-Ain shams/2-Oum Al-Rakah/3-Al-Rayan /4-makkah /5-Al madhik/6-Al-zimah /7-Al-matarifah /8-jaaranah/9-Al bijidi /10-Bani amir/11-Al-fawara/12-Al-kafif/13--Madrakah | 1547843+4826+675+441+17539+5706+1692+5855+2026+5574+882+2026+7705 | 1602790 |
| **Jeddah** | 1-Usfan-2-Jeddah 3-Thoul -4-Al-gadhima | 3955839+20528+14149+14349 | 4004865 |
| **Al-taef** | 1-Al-taef-2- Wady Daguag (bahra)-3-Yalamlam(lith) -4-Banii Saad (mayssan)5- Al-Hachraj (turbah)-6- Mashash al-Taref-07-Dhaghija -08-Radhwan (MOYAH)-09-Al-hada -10-Al-mahani -11-Al-sayl al kabir -12- Al-chafa -13-Achira -14- Al-sadira -15-Al-faysalia -16- Kayaa -17-Al-farii -18-Al-michaan -19-Faydhat al mislah -20- Chagssan -21-Al-hafayer -22- Al-atif | 883870+16406+7581+9713+9259+14460+19381+1712+16692+1328+249+1608+3565+4873+3079+3039+3234+2173+189+13625+3960+2945 | 1022941 |
| **Al-Kunfudah** | 1-Al-Kunfudah/ 2-Al-gouz-3-hala-4-Almuzaylif 5- Sabt al jarah/6-DUQAH /7-Kinanah /8-Ahad bani zayd/9-Thoulathaa al khorm | 27465+54090+34135+43039+12990+4035+12763+7160+21806 | 217483 |
| **Al-lith** | 1-Al-layth/2-Ghamighah/ 3-Al-chawagh / 4-Majmaa al tourough / 5-Joudhoum / | 20997+15083+24372+7861+5178 | 73491 |
| **rabigh** | 1-Rabigh / 2-hijr/3- Mastoura /4-Al-newibaa /5-Al-abawaa | 63147+10064+8815+3285+5159 | 90470 |
| **al jumum** | 1-Oum Al-Jourm/2-Al-Barza/ 3-Hachach/ 4-Al-Sahm/5-Rehat/ 6 -Houda-alsham/7-Al jumum | 49340+6175+3864+212+363+7400+4279 | 71633 |
| **Khulais** | 1-Khulais/2- Wady gadid / 3-Setara / 4-Al-Dhabya wa Al-jomaa / 5-Wady al-kouwar/ | 32236+5757+2891+7014+3293 | 51191 |
| **Al-kamil** | 1-Al-kamil /2-Al-Ghareef al tarajumah /3-Al-sharaa /4-Al Gou'our /5-Al-Hounou | 12124+4159+2512+1908+716 | 21419 |
| **Al-Khurmah** | 1-Al-Khurmah / /2-Al-Ghareef /3- Abu Marwa / 4-Dhaleem | 38303+6233+1941+885 | 47362 |
| **Raneyah** | 1-Raneyah /2-Al-Amlah/3-Hida /4-Al/ghafa /5-Warcha /6-khedan | 39596+5649 +322+1219+12+807 | 47605 |
| **Turbah** | 1-Turbah / 2-Al-Irguin /3-Al-Oussla/ 4-Al-Gawama /5- Chi'ir / 6-Al-Khadiraa /7-Al-Oulba / 8-Al-Khalidiyya /9-Al-Alawa /10-Al-ouwila / 11-Al Ifiriya /12-Abu Rakah | 37318+2739+776+1016+1141+19+1575+1646+1299+1474+2332+6825 | 58160 |

| | | | |
|---|---|---|---|
| **Mayssan** | 1-Mayssan /2-Thaguif /3-Hadad Bani Malek / 4-Al-Ssour/5-Banii yaziid /6-Souq Al-Ain | 18329+7363+12850+2020+5108+6898 | 52568 |
| **Al-Moyah** | 1-Al-Moyah al Jadidah/2-Dhoulam /3-Hafr Kashab /4-Al-Raghiya /5-Maran /6-Al-Mahra/7-Al-Zarban /8-Al-Rafayaa /9-Al-Ruwilia /10-Umm Al-Doum /11-Al-Raknah /12-Al-Awali/13-Al-Meziraa /14-Al-Nasaef | 9777+6860+4916+1039+1547+2092+271+320+466+9440+640+883+658+445 | 39354 |
| **Al-Aradhiyyat** | 1-Al Aradhiyya Sud /2- Al Aradhiyya Nord /3-Al-wid /Khamiss Harb | 37930+48638+397+800 | 87765 |
| **Adham** | 1-Adham /2-Al-Jaiza /3-Al-Murguiban /4-Hegual / 5-AlGarii ben Malek | 23845+15931+2685+3938+10107 | 56506 |
| **Al-Bahra** | 1-Al-Bahra/2-Al-shaiba /3-Wady Daguag /4-Al Baydha'a /5-Oum Al-Rakah /6-Al-saadiyah / Saaiya | 95850 | 95850 |

Based on the new demographic data that have been deduced from modelling the areas of influence, we will proceed by classifying the centres according to the criterion "Served Population". Thus we have obtained twelve (12) hierarchical levels with a peek at the twelfth level occupied by the centre "Jeddah" followed at level eleven (11) by a single-centre, namely that of Makkah. The city of Al-Taef occupies the tenth level, and then there is a total absence of level nine (9) and seven (7) then we move on directly to the following levels. (Table 4)

Table 4**.** Hierarchization of centres according to the criterion of the served population**.** (Author 2017)

| **Population served by the previous criteria ( number of inhabitants)** | **Centres** | **Rank** |
|---|---|---|
| **< 1000 inhabitants** | Al-wid - Al-Meziraa - Al-Nasaef -Al-Awali - Al-Raknah - Al-Zarban -Mashash al-Taref- Al -Rafayaa -Al-Ruwilia - Al-Khadiraa - Al-Oussla -Warcha - khedan - Hida - Dhaleem - Al-Hounou - Hachach - Al-Sahm - Al-michaan - Al-zimah -Al-matarifah | **1** |
| **1000 to 5 000 inhabitants.** | WadyDaguag-Al Baydha'a -Baniamir-Al-faysalia -Al-farii-Faydhat al mislah -Chagssan -Al-hafayer-Al-atif-Thoulathaa al khorm -KhamissHarb -Yalamlam -Saaiya -Al-newibaa-Rehat-Al-fawara-Al-Rayan -Al-kafif-Setara-Oum Al-Jourm-Wady al-kouwar-Al-Ghareef al tarajumah-Al-sharaa-Al Gou'our -Abu Marwa -Al Ifiriya -Al-ouwila - Al ghafa-Al-Hachraj-Al-Irguin -Al-Gawama -Chi'ir -Al-Oulba -Al-Khalidiyya -Al-Alawa-Al-SSour-Radhwan -HafrKashab-Dhaghija -Al-Raghiya-Maran-Al-Mahra-Al-Murguiban -Hegual -Al-madhik-Al Ifiriya -Dhaghibja | **2** |
| **5000 to 10 000 inhabitants** | Al bijidi- Al-mahani - Al-sayl al kabir<br>Al-chafa - Kinanah - Majmaa al tourough<br>Al-saadiyah - Baniiyaziid - Joudhoum<br>Mastoura - Al-abawaa-Oum Al-Rakah<br>Ain shams - Wadygadid - Al-Dhabyawa Al-jomaa- Al-Barza- Al-Ghareef<br>Al-Amlah- Thaguif - Abu Rakah<br>Al-Moyah al Jadidah- Dhoulam - Umm Al-Doum - SouqAl-Ain- Al-shaiba<br>Madrakah- Houda-alsham-hijr-Al-sadira | **3** |

| | | |
|---|---|---|
| **10000 to 25000 inhabitants** | Al-kamil-usfan-kayaa-Ghamighah-AlGarii ben Malek-Al-chawagh -al-hada-ahadbanizayd- Achira -hadadbanimalek -sabtaljarah-doughah-al-jaiza-al gadhima-jaaranah | **4** |
| **25000 to 50000 inhabitants** | Al-Khurmah -Raneyah-Al-Moyah -Al muzaylif- Al Aradhiyya Sud-hala | **5** |
| **50000 to 100000 inhabitants** | Al-Bahra -Adham -Al-Aradhiyyat-Mayssan-Turbah -Khulais-al jumum-rabigh-Al-lith | **6** |
| **100000 to 200000 Inhabitants** | 0 | **7** |
| **200000 to 400000 inhabitants** | Al-Kunfudah | **8** |
| **400000 to 800000 inhabitants** | 0 | **9** |
| **800000 to 1600000 inhabitants** | Al-taef | **10** |
| **1600000 to 3200000 inhabitants** | Makkah | **11** |
| **1600000 to 3200000 inhabitants** | Jeddah | **12** |

## 6. Conclusion (12 font)

By adopting a gravity model more general than the Newtonian one used by Reilly, we were able to reveal a significant disparity between the actual urban boundaries and the theoretical ones modelled and projected on the map of our case study. Empirical studies seem to confirm the existence of a very marked functional polarization in the urban system of the Makkah region. There is a significant difference within the administrated functional areas; the large centres such as Jeddah, Makkah and Al-Taef serve the centres located in their urban administrative territories and a large part of the rural populations of the lower levels. Their functional influence is much more significant than the actual projection of their regions. The geographic proximity of these large centres contributes to the over-concentration of the population and the over-exploitation of services, which are not provided for the centres with lower number of occupants. We don't claim to have an inclusive, comprehensive diagnosis of the urban balance complexity in Makkah Region. Yet, we believe that this research is a milestone in the broader investigation that will include other parameters. This urban imbalance needs to be first scrutinized and approved using more assessing parameters and then addressed in terms of goods and equipment, which could be the subjects of further promising research investigations.

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