



## The Impact of the Regional Ring Road on Urban Development (Case Study of Greater Cairo Region)

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### ABSTRACT

This research aims to study the Regional Ring Road's impact on the process of urban development of the Greater Cairo region in Egypt. Roads are one of the most important factors of urban development, as construction of which may result in several positive and negative changes. The research follows the descriptive, analytical, and comparative approaches, by shedding the light on both concepts of regional ring roads and urban development and studying the elements related to them (Accessibility-Land usages-Traffic problems). Moreover, in order to emphasize the pivotal role of the roads in developing urban communities, despite the presence of some negative effects resulting from them, the research discusses the analysis of two global megaprojects (M25 in London & Sydney). In addition, the research discusses a local project (the ring road surrounding the Greater Cairo region), while comparing the former with the Egyptian experience to benefit from such comparison. The research will be divided into three parts; A: the relevant general theoretical concepts. B: presenting global and local experiences. C: a study of the Egyptian experience while discussing the changes related to roads before & after construction and their effects on the urban environment surrounding the Greater Cairo Region. These effects are for example, but not limited to; (congestion and traffic problems in the Greater Cairo, change of utilizing areas surrounding the road and the creation of new uses, roads role in achieving the connection between the Greater Cairo Region and the rest of the seven regions of Egypt). Furthermore, the research is proposing some suggestions to reduce the negative effects of roads construction.

### 1. Introduction

Egypt has been adopting a set of plans to develop its regions. These plans include the development of ring and regional road networks all over the country [1] due to their impact on development in many different fields at the urban, economic, social, environmental levels.....etc. Accordingly, we are

urged to study the impact of these roads and highways on various development processes in the seven regions of Egypt.

In this research, the Regional Ring Road (RRR) was chosen as a case study to clarify the impact of its construction on the urban development of the Greater Cairo Region (GCR). Thus, we are going through an analytical study of the impact of the northeastern arc of the RRR, negatively or positively, on the urban

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development of the GCR based on previous studies of similar global and local approaches.

Roads are considered the link between different urban areas and are one of the most important elements influencing the urban formation and the internal structure of cities. Moreover, the roads are the main controller of the urban growth of cities and the change of land uses because of their strong effects on the urban areas through which they are built [2].

Therefore, the study of the RRR effects resulting on the urban development is certainly of great importance to achieve the ultimate benefit from positives and address negatives.

### 1.1. The Research Question

The relationship between ring roads and urban development is vital, as the roads link various areas, whether urban, desert, or rural, and connect them. Urbanization begins to grow around these roads forming new urban areas. Consequently, the traffic volume increases and urbanization continues to extend until the new urban areas merge with the original ones. This will lead to a change in the whole urban structure. In addition, it will lead to a change in land uses like creating more services and more facilities. This will in turn lead to an increase in investments and activities, which achieves urban development [2].

According to the above, the direct impact of ring roads on urban development is represented directly in (accessibility) and indirectly in (land uses - traffic problems), and these are some of the elements of urban development that we are going to study in this research. Therefore, the research questions are as follows:-

- What is the relationship between constructing ring roads and achieving urban development?
- What are the effects of RRR construction on the urban development of GCR?
- How could we raise the efficiency of the RRR?

### 1.2. Methodology

The “descriptive approach” was followed to collect and define data related to both RRR and urban development. While the “comparative approach” was applied to display and compare the two global experiences (London & Sydney) and the local experience (ring road around GCR) with the case study of RRR denoting the construction of ring roads in order to achieve urban development.

While the “analytical method” was then used to study and analyze the relationship between ring roads

and urban development, and to analyze the northeastern part of the RRR, which extends from Belbeis city in Sharkia Governorate to the intersection with the agricultural road (Cairo - Alexandria) in Benha Governorate, with a length of 34.5 km. Finally, studying changes that affect the urban development process of the GCR.

Furthermore, this research aims to maximize the positives of the RRR construction and its impacts on the urban development of the GCR while reducing the severity of the negatives. Additionally, clarifying the role of the RRR in the urban development process. In the end, presenting some of the direct and indirect elements of urban development related to ring roads, through previous studies of global and local experiences in such field.

## 2. Concepts

In this part of the research, we will address the basic concepts related to the research topic, such as the concept of ring roads and regional roads, to deduce the concept of the RRR and concept of urban development, its steps, and methods of assessment.

### 2.1. Ring & Regional Roads

The road network is divided according to the hierarchy into four levels. First (regional roads - ring roads – highways/freeways), second (arterial roads), third (collectors and distributors), fourth (local roads) [2].

The main road network in GCR consists of (regional roads - ring roads - arterial roads) [3].

Ring and regional roads are classified in the hierarchy of road networks according to the first level, and under the name of “the main roads in Egypt”, and therefore they share the following characteristics (a highway, with total pavement and a high level of maintenance, for cars only). Each of them has the characteristics that distinguish it from the other.

- Ring Roads: It is known in Egypt because of the ring road surrounding the GCR, as it represents a link between regional roads, new settlements, and city districts. The ring road has a vital role in urban development, and the new urban communities, linking all parts of Cairo on the one hand and between them and the surrounding cities and urban communities on the other hand without passing through the overcrowded areas in the downtown [3]. Such road’s circular or semi-circular shape helps to embrace the central structure of the city, while distributing the movement on the outer

borders of the city, preventing it from entering directly to the inner centers, which limit chaotic urban growth and urbanization so that it does not move outside a specific border [4].

- In Egypt, regional roads are defined as these roads that link the governorates and cities that are far from each other [3]. Regional roads have no specific shape and are capable of accommodating the increasing volume of traffic and feature the possibility of expanding in the future. Thus, we can say that the regional ring road is a road that combines the characteristics of the ring and regional roads altogether [5].
- The regional ring road (RRR) is a free road featured with complete pavement, a high level of maintenance, designated for cars only, aims to transport over large distances between cities and regions without the need to overlap through them. RRR attributes a circular or semi-circular shape and belongs to the first level in the road hierarchy. Here are some global examples of RRR:
  - (G95 - Seventh ring road) - (China), which was operated on August 20, 2018, with a length of 940 km, connecting seven major cities and thirteen small cities, linking east and south China [6].
  - (A10 - Berlin ring road) - (Germany), which was completed in 1979, with a length of 196 km. It connects most of the major cities (Berlin - Brandenburg). Moreover, it connects them with the other cities via sub highways [7].
  - The Regional Ring Road in Egypt represents the case study in this research.

## 2.2. Urban Development

Urban development is the process concerned with fulfilling human needs, solving his problems, providing the appropriate environment for him, and achieving the basic requirements of life. It combines spatial and human development with the provision of the necessary funding to achieve both of them [8]. Furthermore, urban development includes multiple aspects; (economic, social, cultural, environmental, political, and human). It aims to improve the environment and provide the basic needs of (housing - work - services - elements of communication represented in road networks and traffic paths - infrastructure networks). These needs are achieved by (using the available resources and capabilities, whether natural or human, within the frame of (social, cultural, political, and environmental) values of society. Moreover, urban development identifies the appropriate places for developing these services

and investments [9].

The aforementioned definition is the one adopted in this research.

## 2.3. Steps of Urban Development

To develop an area urbanely through road networks, several steps are taken [10]:-

- Developing road and transport networks, establishing new urban areas equipped with transportation routes, to reduce traffic problems and congestion in central areas. Taking into consideration that providing appropriate means of transportation is one of the factors that attract residents. Notably, some countries (such as Japan) adopted this approach to achieve urban development. Hence, they established the (Tsukuba Express TX) regional railway, which was inaugurated on August 24, 2005, linking the city of (Tsukuba) with the city of (Akihabara) in the center of the capital (Tokyo) so that you could reach the destination in a time of (45 minutes) instead of (240 minutes) as illustrated in the Figure 1. In addition, the Japanese set conditions to organize the urban expansion.



Fig. 1: the Tsukuba Express (TX) railway linking Tsukuba and Akihabara in Tokyo in 45 minutes [11].

- Determining the method of developing urban areas, through urban expansion or rehabilitation of land uses in already existing areas, as shown in Figure 2.

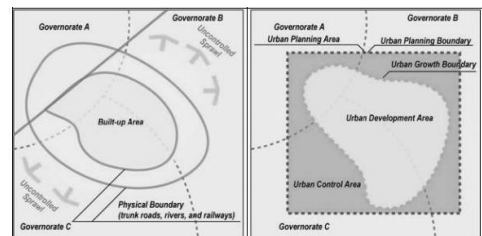


Fig. 2: demonstrates the difference between urban areas that can be developed through urban expansion and those that can be developed through the rehabilitation of land use in the areas that already exist [10].

- Preserving agricultural lands through setting studied urban plans when constructing the road.
- Establishing a network of green and open areas along both sides of the road to renew the urban structure in the already existing urban areas.
- To develop new areas and achieve decentralization, allocating lands in the new urban areas surrounding the road to transfer some factories and important commercial centers from the densely populated central areas to new areas, providing a better living environment suitable for engaging new investments. However, to ensure the success of the previous steps and achieve the desired urban development, a strict and effective legislative system must be established.

### 3. Global and Local Experiences

Many factors are affecting the ring roads rapport with urban development, some of these factors may have a direct impact such as (accessibility), and others have an indirect effect such as (land uses - traffic problems).

In the stage of road construction preparation, some changes are to be predicted called; theoretical effects. After the construction of the road, we notice the emergence of many changes, some of which are expected and others appear all of a sudden, and they are called the actual effects.

In the following projects, the theoretical and actual effects of some ring roads are presented.

#### 3.1. The Ring Road (M25) Around London:

The road was fully running on October 6, 1986, with a length of 188 km [12]. It is the first completed ring road surrounding London to solve the problem of transit traffic, and the second-longest ring road in Europe after the Berlin Inner Ring (Berliner Innenstadtring). M25 works as a regional road to direct traffic heading to London from outside the city. It connects seven different districts with the main arterial roads at a distance of 20 km from the center. Also, it connects the main southern and eastern airports, which are four airports [13], as illustrated in Figure 3..



Fig. 3: shows the route of the M25 ring road around London [14].

- Theoretical effects of the road on urban development:

In 1981, Alfred Goldstone & Nathaniel Litchfield predicted an increase in the land value and rents in the areas surrounding the road. Moreover, the administrative services moved to cities near the road, the transformation of the main intersections of highways with the ring road into areas that attract investors to set up mega projects [13].

In 1982, the (the Regional Planning Commission of South East London) anticipated that West London would be a magnet for development in the field of technology, as it was originally a specialized area in that field. Furthermore, the marginalized situation of the eastern sector would be improved through its connection to the rest of the parts, with a recommendation to broaden industries and administrative scale [15].

In 1986, Bendixson expected to divert about 15% of the traffic inside London to the Ring Road, reducing noise and air pollution from the old neighborhoods in central London [16].

- The actual effects of the road on urban development:

- It harmed traffic.

This road is considered one of the busiest ring roads in the world, where an unexpected increase in traffic appeared due to the generation of a new destination. The northern part of the road carries more than 130 thousand cars per day despite it being designed to carry only 88 thousand. Accordingly, the UK Department for Transport announced plans to widen the road [17].

The road disability to deal with accidents, no matter how simple they are. Consequently, this causes an increase in traffic congestion when an accident occurs. Accordingly, rapid accident detection and automatic signaling systems were installed, and this led to a significant decrease in the number of collisions compared to before (from an annual average of 242 collisions to 163 in the post-application) [18].

- M25 effects on urbanization and land use [15]:

Increased the urban and population growth in the areas surrounding the road, 20-30 km from the central city and at the intersections.

Helped in the transfer of many administrative facilities such as in (Croydon-Orpington) from the city center to the road due to (the lack of sufficient

areas of land inside the cities, and the high cost compared to the land next to the road, the high connectivity achieved by the road).

Established commercial centers near the road and at intersections.

- Accessibility:

M25 achieved high accessibility at the regional level, but it did not have an impact on London, because it originally has high connectivity due to its position.

Change of land use, especially at intersections.

The connection of the Ring Road (M25) with the surrounding highways, represents an obstacle to the possibility of growth at present and in the future [19].

### 3.2. The ring road of Sydney (the capital of New South Wales in Australia):

This road is the first completed ring road in Australia. It was completed in 2007. Its length is 110 km, and it consists of 11 highways that form a circular path, as illustrated in figure 4. It works as a regional road to direct traffic heading from Sydney to outside and connects Sydney's North Airport with the west and south. Furthermore, it connects Sydney to the eastern region, this road was built to increase accessibility, eliminate congestion and traffic problems, and attract other types of development to Sydney [20].

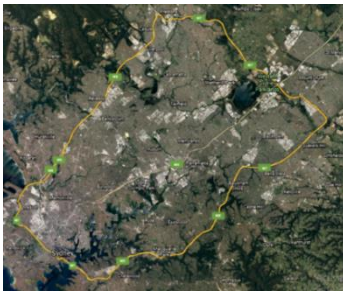


Fig. 4: Route of Sydney's ring road [14].

• Theoretical effects of the road on urban development:

A major redistribution of land uses and attracting new uses, encouraging the concentration of growth around its path instead of scattered growth on the outskirts of the city. Stimulating economic growth due to achieving connectivity between ports, airports, shipping stations, and industrial areas, achieving high communication between many transport stations [21].

Short-range trips are generated on the road to

serve the neighboring areas, which may lead to congestion that will reduce the benefits of the road. Therefore, an adequate transportation system must be provided to serve those trips [13].

The western part of the road, which is called (the Scoresby freeway), plays an important regional role by linking the north and south. It links the existing highways in Sydney such as (M2, Harbor Tunnel, M5). Thus, it helps to reach all parts of Sydney. Moreover, it facilitates traveling in the west, after the travel system was based on eastern Sydney only, due to the availability of its motorway networks [22].

The Australian Regional Government has highlighted the importance of the Ring Road for rural areas and outlying suburbs, to stimulate their competitiveness, improve the lives of those living in those rural areas, lower transportation costs, and create job opportunities for those areas [23].

• The actual effects of the road on urban development:

- Traffic movement:

Connecting it with other highways, led to achieving a high level of mobility service.

It helped attract traffic from the city center to its borders and prevented transit, which had a positive impact on the city.

- Land uses:

It helped attract a lot of new uses to the areas near the road (the growth of economic activities in the west of Melbourne near the road) [15].

- Accessibility [24]:

The total toll road network in New South Wales, the most important of which is the Ring Road around Sydney, has contributed to increasing the country's total production at an average of 89% annually, as in 1986 it represented 1.6 million dollars, and in 2020 it reached 3.4 billion dollars. It also achieved high economic returns due to transport in (the least time and cost - the best condition of the product).

Increasing employment at An average of 100 additional jobs per year. Due to the establishment of new industries in the areas and suburbs near to the road.

### 3.3. Cairo Regional Ring Road:

The first ring road in Egypt. It was finished in 2005, with a length of 100 km, surrounding the Greater Cairo region. It was built to link the governorates of Greater Cairo, linking nine major highways as shown in figure 5.



Fig. 5: Displays the ring road around the Greater Cairo Region (GCR) [14].

The road was built in order to direct traffic outside the GCR without penetrating the urban block, which helped reduce traffic congestion in the region, consolidate the urban structure of Cairo, and limit random urban growth. The Ring Road is surrounded by the Middle Ring Road and the Regional Ring Road (RRR). As shown in figure 6.



Fig. 6: Displays the middle ring road and the RRR surrounding the primary ring road around GCR [14].

- Theoretical effects of the road on urban development:

In 1984, the General Authority for Urban Planning announced in the initial plan of the Ring Road that it would have a role in [25];

- Reducing transit traffic within the main urban areas and transferring traffic to the outside of the region, in an attempt to eliminate traffic issues in Cairo.
- Connecting new urban communities to the original urban areas in order to spread urbanization and eliminate centralization.
- Establishing new urban areas in the desert area surrounding the road, to develop urban desert areas.
- Preserving the agricultural lands surrounding the urban areas from turning them into urban areas.
- Reducing economic activities in the existing urban areas and encouraging it in new gatherings, and providing job opportunities in the newly emerged settlements.

- The actual effects of the road on urban development:

- Traffic movement:

The road succeeded in attracting traffic from inside GCR to outside of it and reducing traffic congestion inside the urban areas at the beginning. Afterward, the traffic density on the road increased until it reached 135,000 cars/day [26].

The road turned into an internal road as a result of urban sprawl on both sides of the road.

The establishment of the RRR aimed to reduce the traffic density on the ring road by 50%, and the Middle ring road was established to reduce traveling on the ring road. [26].

- Accessibility:-

Connecting the road with highways and axes led to an increase in smooth connection between the various governorates of Egypt (e.g. Suez Road - Ismailia Road...). As shown in figure No. (5).

The connection between Cairo and the new cities (Al-Obour – 6th of October - New Cairo - Al-Shorouk) helped reduce travel time, and thus encourage investments and development of those cities and other new urban areas at that time, as shown in figure 7.



Fig. 7: clarifies the cities that have expanded around the road [14].

- Land uses.

The ring road led to the development and growth of new cities in the areas that it passed through, as shown in figure 7.

The development of the desert that surrounded the road and, consequently, grew up various activities that require large areas, such as Carrefour, the German University in Cairo (GUC), and the New Police Academy.

The growth of urbanization on both sides of the road increases the centralization of the Cairo region, and this is the opposite of what is expected.

Disappearance a large part of the agricultural lands surrounding the road and transformed it into urban lands. As shown in the two figures 8, 9.



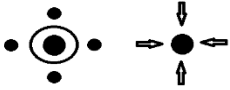
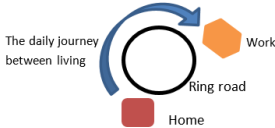
Fig. 8: showing the size of agricultural land in 1984. [14].

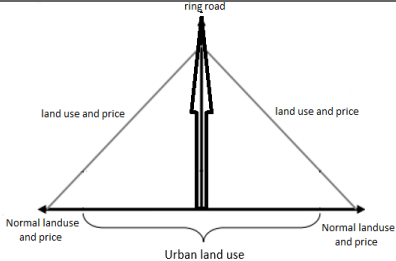
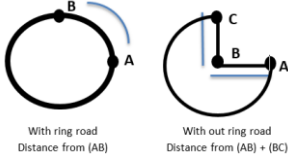


Fig. 9: shows the erosion of agricultural land in 2020 after the construction of the ring road. [14].

3.4. Theoretical and actual effects of ring roads on urban development:

In the following table, we explain the elements of urban development related to ring roads (accessibility - land uses - traffic problems) based on previous experiences.

Elements of urban development related to ring roads		Urban Development Indicators	
		Expected Effects	Actual Effects
Accessibility	Ring and regional roads helped to connect the distant urban areas	<ul style="list-style-type: none"> <li>- Increasing investments, centralizing services, activities, and logistical areas around those roads.</li> <li>- Constructing planned or random secondary traffic paths along roads to serve the new urban communities.</li> <li>- Reducing overpopulation, eliminating centralization, and achieving decentralization.</li> <li>- Achieving high accessibility for all industrial, commercial, urban, and social components.</li> </ul>	<ul style="list-style-type: none"> <li>- Investments in the field of transportation are increasing.</li> <li>- Growth and spread of urbanization along the roads, and reducing cases of regional isolation</li> <li>- Linking between cities helped redistribute urbanization, increasing the importance of existing urban centers and expanding their urban scope and multiplicity of functions. Moreover, the decline in the status of other centers had an impact on centralization and decentralization. As shown in figure 10.</li> </ul> <p>Fig. 10. </p> <ul style="list-style-type: none"> <li>- The high accessibility encouraged investors to pay huge sums of money to purchase land near the road.</li> </ul>
	Reducing trip time and costs	<ul style="list-style-type: none"> <li>- Develop remote urban areas by linking them with urban development areas.</li> <li>- Solve the problem of separating workplaces and places of residence by reducing distances and time. As shown in figure 11.</li> </ul> <p>Fig. 11. </p> <p>The daily journey between living</p>	<ul style="list-style-type: none"> <li>- Ring roads helped spread urban development in the areas where the road extends. As shown in Figure no. (10).</li> <li>- Temporary administrative facilities emerged.</li> <li>- Ring roads did not significantly affect housing and employment.</li> <li>- Achieving the connection between production and consumption areas.</li> </ul>
Change of land uses	Changes in the value and prices of land	<ul style="list-style-type: none"> <li>- The emergence of different land uses because of the rise in the value and prices of lands near the roads on one hand, and a decrease in prices of lands further away from the roads on the other hand. As shown in figure 12.</li> </ul>	<ul style="list-style-type: none"> <li>- Increasing the population and construction density in the residential neighborhoods close to the roads.</li> <li>- Change in the value and prices of lands near the roads. As shown in figure 12.</li> </ul>

		<p>Fig. 12.</p> 
Agricultural Lands	<ul style="list-style-type: none"> <li>- The complete separation between the road and the surrounding lands leads to an increase in the economic return of the agricultural sector and its use in achieving urban development plans.</li> </ul>	<ul style="list-style-type: none"> <li>- Urban encroachment on agricultural areas close to the road leads to the emergence of urban settlements. This phenomenon leads to the erosion of agricultural areas, and then the formation of slums and the consequent pressure on facilities and services that affect the road efficiency</li> <li>- Establishing a road passing through agricultural lands leads to a reduction in the area of agricultural lands, thus reducing the economic return of those lands.</li> </ul>
Urbanization	<ul style="list-style-type: none"> <li>- Redistribution of urbanization, increasing the importance of existing urban centers and expanding their urban scope and multiplicity of their functions while declining the status of other centers.</li> <li>- The emergence of urban settlements in desert areas on both sides of the roads.</li> </ul>	<ul style="list-style-type: none"> <li>- The emergence of mixed urban areas of uses, private communities, and multiple urban centers on the road.</li> <li>- Help reduce overpopulation in some densely populated cities.</li> </ul>
traffic problems	<ul style="list-style-type: none"> <li>- Eliminate traffic congestion in central cities by moving traffic around the city instead of penetrating it. As shown in figure 13.</li> <li>- Reducing trip times and the problems caused by traffic congestion. As shown in figure 13.</li> </ul> <p>Fig 13.</p>  <ul style="list-style-type: none"> <li>- The ability to assimilate the increasing demand for transportation and traffic.</li> </ul>	<ul style="list-style-type: none"> <li>- Solved problems of transportation and traffic congestion through the ability to travel without penetrating the population blocks.</li> <li>- Helped to increase the number of daily trips.</li> <li>- Increase the length of the trip.</li> <li>- It may lead to increase congestion and traffic issues if the planning of the ring road cannot be updated and expanded to cope with the increasing demand for trips in the future.</li> </ul>
<p>[27]: [31] at the disposal of the researcher.</p>		

#### 4. The Regional Ring Road (Case Study)

##### 4.1. What is the Regional Ring Road?

The Regional Ring Road (RRR) is the second ring road in Egypt. It surrounds the primary ring road that surrounds GCR, as in figure 6, and it is located at a distance of 42 km from it, approximately, this distance increases in the southwest. RRR construction began in 2008, it was fully operated on September 9, 2018, with a total cost of 8 billion pounds [26].

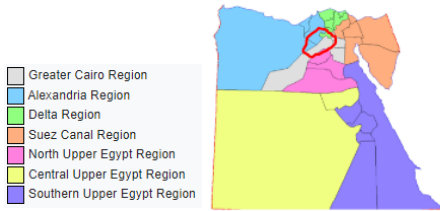
Three ministries participated in its implementation. These ministries are [26]:

- Ministry of Defense, represented by the Military Engineering Authority, implemented 200 km of the southern arc.
- Ministry of Housing implemented 49 km of the southern arc.
- Ministry of Transport implemented the northern arch with a length of 151 km.

The total road length is approximately 400 km, and the radius is 60 km on average. RRR was built according to the highest international standards in terms of the number of lanes, safety measures, and security. The speed limit on it was determined to be 120 km per hour. The road is designed to be a model of free roads, without any intersections, while utilizing bridges and tunnels as roundabouts [32].



RRR links five regions (GCR, Alexandria, Delta, Suez Canal Region, and North Upper Egypt) out of



seven regions, as clearly in figure 14. It serves fifteen different governorates out of 27 governorates.

Fig 14: Displays the relationship between the regional ring road and the regions of Egypt [31]

#### 4.2. Purpose of RRR construction [26]:

- Decreasing congestion on the primary ring road.
- Connecting agricultural and desert roads, thus facilitating movement and reducing travel time.
- Linking between the governorates and regions of the Republic.
- Encouraging investment and commercial flow between Upper Egypt, Canal, and Delta regions.
- Developing desert areas urbanely.

#### 4.3. The northeastern arc of RRR:-

RRR is divided into four main sections: (Northwest Arc - Northeast Arc - Southwest Arc - Southeast Arc). In this research, we will only study the effect of the Northeast arc of the road on the urban development of GCR, by discussing the changes that were associated with its construction and later on.

- Northeast arc:

It extends from the city of Belbeis in the Sharqia Governorate to the intersection with the agricultural road (Cairo-Alexandria) in Benha City, as shown in the figure 15. Its length is 34.5 km includes 27 bridges and 26 tunnels [32].



Fig 15: shows the northeastern arc of RRR [14].

- Theoretical effects of the road on urban development [32]:

- Facilitating traffic and alleviating traffic jams on the main roads in Egypt.
- Connecting Lower Egypt governorates to GCR.
- Connecting East and West Nile to dissolve traffic jams.
- Encouraging movement of commercial, agricultural, and industrial transportation between the different regions.
- It is expected RRR will reduce 35% of the traffic on the ring road, creating traffic fluidity within the capital, and thus dropping the accident rate to 40% less [26].
- It will contribute to transporting traffic rush coming from Belbeis and the industrial zone of 10th of Ramadan City and redirect it to Banha and the Cairo-Alexandria agricultural road.

- The actual effects of the road on urban development:

- Traffic: Connecting it with other highways led to a high level of transportation service (less time and cost–maintain best product condition).

It helped in attracting traffic from the center of the crowded urban areas (Industrial Zone of 10th of Ramadan and Belbeis), which had a positive impact on traffic.

RRR is one of the toll roads, therefore it will contribute to increasing the economic returns of the state.

With the construction of the intersection of RRR with the Cairo-Alexandria Agricultural Road – Banha Road, with a length of 540 m and a width of 42 m, the two roads were fully connected, accordingly, the problem of traffic congestion in this area was solved [32]. As shown in figure 16.



Fig 16: displays the intersection of RRR with the Cairo-Alexandria agricultural road [14]

The construction of the intersection between RRR and the Ismailia Agricultural Road, as shown in figure 17, helped achieve more accessibility and solved traffic problems in those areas.

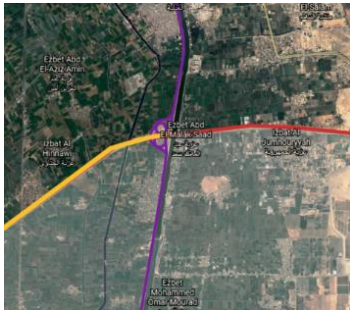


Fig 17: Displays the intersection of RRR with Ismailia-Agricultural Road [14]

- Land Uses:

Compared to what happened in previous experiences of changing land uses, it is possible to expect the impact of the road on the surrounding uses. In the northeastern arc, what surrounds the road is mostly agricultural lands, if strict laws are not enacted to preserve those lands, they be consequently eroded and transformed into an urban investment, residential, service, commercial areas...etc.

- Accessibility

The northeastern arc of RRR achieved more accessibility through its connection to the main roads (Shubra-Banha Free Road, Cairo-Alexandria Agricultural, and Ismailia Agricultural.....). It also reduced travel time, especially the journey from the Industrial Zone of the 10th of Ramadan in eastern Cairo (Cairo-Alexandria Agricultural Road).

On the same approach as the previous global and local experiences, we concluded that RRR will support the development and emergence of new cities and encourage investments along both sides. Thus, centralization in GCR will be reduced and decentralization will be attained.

Increasing the coherence between the Delta, the Canal, and GCR regions by providing a smooth route between them and reducing the travel time.

## 5. Conclusion

Within the framework of the research objective, which is to reduce the negative effects of RRR, and through processing previous experiences, a set of proposals were developed to increase the RRR efficiency have been concluded as the following:

- Supporting the road with a high level of services and mass transportation, in order to contribute to eliminating traffic congestion.
- Achieving a high level of accessibility with the radial roads, providing alternatives to take over in emergency cases, in order to reduce the risk of overcrowding.
- Considering the possibility of growth, expansion, and providing flexibility to modify the road in order to cope with the population increase and future urban growth.
- Reinforcing the roads with green areas (green belt) on both sides of the road, and protecting them against random urban sprawl.
- Applying modern road technology (accident detection systems, automatic signals for emergency services, monitoring and communication systems along the road, slope measurement, and variable speed limits), to improve adaptability and reduce accidents [22].
- Doing a mindful study of the road and the expected effects on its surroundings, before starting its implementation, to avoid negative impacts, which cause problems that affect the urban development.
- Keeping in mind the necessity to preserve agricultural areas by enacting strict laws.

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