5.3 FUTURE ROAD SYSTEM PLANNING

5.3.1 Issues

(1) Regional Highway Network

The Completion and Extension of the Ring Road Network

At the end of July 2002, the Ring Road is basically complete except for the closing of the ring in southwest Giza. It has been a major struggle for the MHUUC how to close the Ring Road since its early days of construction. The alignment of the Ring Road in the southwest link shows that it has been critically difficult to close the link at the Haram area.

The MHUUC was planning to extend the Ring Road from Interchange IC22 (see Figure 5.3.1) to the 6th of October Road, however, it was finally cancelled due to the international pressure for protecting the cultural heritage preservation area. The Ministry is now planning to extend the road from IC01 to the 6th of October Road by the plan shown in Figure 5.3.1. It also has a branch link to westward to bypass the traffic from the Ring Road (IC01) to Alexandria Desert Road.

Source: JICA Study Team based on the information from GOPP

Figure 5.3.1 The Ring Road Extension Plans

One of the major functions of the Ring Road, to facilitate the connection to the 6th of October City with the existing urban area, can be achieved with this extension. However, unclosed Ring Road will still remain a problem in the network since

north-south traffic demand on the Ring Road at the western part of Cairo remains in an inconvenient condition without direct linkage of the Ring Road.

The possibility of closing the Ring Road in this area has several alternatives. The MHUUC is still planning to close the ring with Maryotia St. (IC02-IC21). In this area, it is neither appropriate nor possible to have a viaduct structure from environmental (aesthetic) viewpoint in protecting the view of the Pyramids. Remaining alternatives will be at-grade or underpass (tunnel) structure. At-grade structure, however, will not satisfy the traffic demand or level of service that the Ring Road should be able to offer unless full access control is provided by all of the crossing roads to be in grade separation. This would only be possible by making all of crossing roads to underpass, which seems to be unrealistic. The underpass structure of the Ring Road itself, either by full tunnel or open-box structure, will be the only possible alternative.

New Community Development and Regional Road Network

The pioneer Egyptian policy of urban expansion in the desert started in 1970s to protect arable land along the Nile and in the Delta from disordered urban sprawl. More than 10 new communities have been planned and constructed during the last 30 years by the policy. Many of these new communities had an objective of having their own economic base to self-sustain their urban activities. Today many private industries are in function in these new cities, and housing units and infrastructure have been built or under construction.

The population of these new cities, however, still stays in moderate number, which suggests the implementation of these huge urban planning projects needs a long time. The CREATS estimate of the 2001 population of the three major new communities, their ultimate plans by the GOPP[1] and CREATS estimates of the 2022 population (the medium growth scenario) are shown in Table 5.3.1:

Table 5.3.1 Population of Four Major New Communities (2001/Ultimate/2022 CREATS Estimate)

New Communities	2001 Population	Ultimate Population Plan	2022 CREATS Estimate
6th of October/ Sheikh Zayed	200,000	2,000,000	1,170,000
10th of Ramadan	196,000	1,000,000	580,000
New Cairo	90,000	750,000	700,000

Source: JICA Study Team and GOPP

For the transport planning of the Study Area the critical issue will be the right of way for future plans. If the ultimate urban plan necessitates further widening of the existing regional corridors, it is critically important to secure the right of way for these transport plans. Once urban sprawl and unplanned land use activities proceed

[1] *Improving Long-term Master Plan of Greater Cairo Region, Suggested Strategy for Improving, 1997, GOPP*

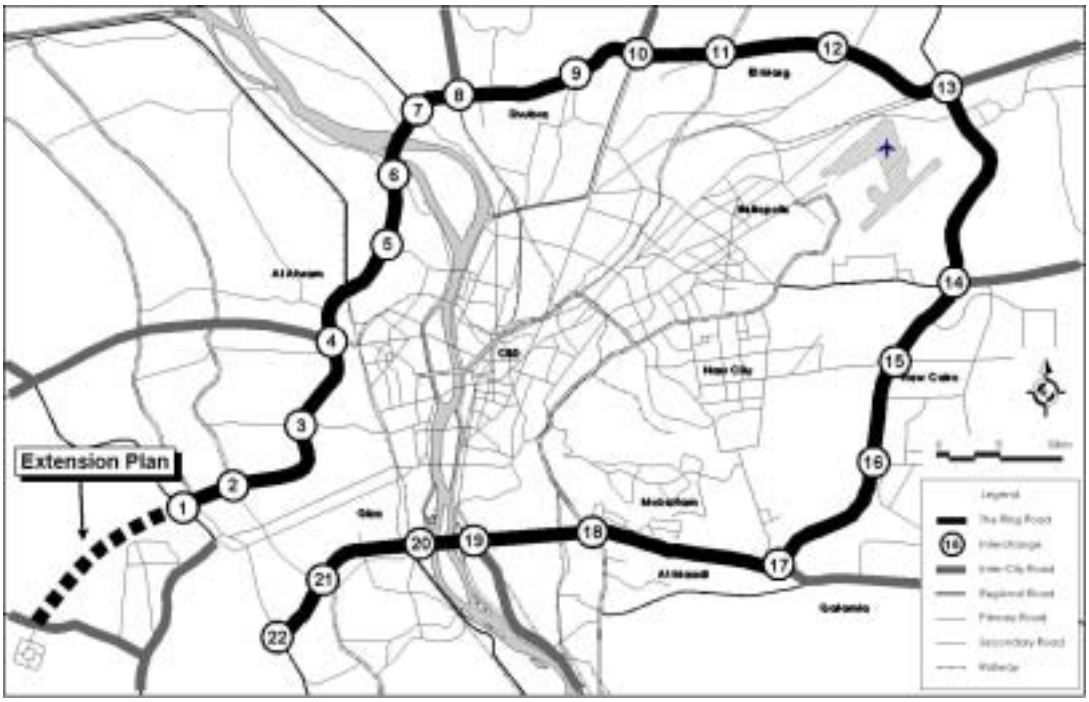
along the existing regional corridor, the development of any new major transport corridor will be extremely difficult. It is important to control the land use of planned new regional transport corridor from a long-term viewpoint.

(2) Urban Primary and Secondary Arterial Street Network

The exercise of the functional classification of the road network revealed important issues on primary and secondary arterial street network within the Ring Road area. The following are considered as the major issues in the urban primary and secondary development.

Firstly, the urban primary and secondary arterial street network within the Ring Road (Figure 5.2.3) shows there are several areas where the primary and secondary arterial network is particularly scarce. These areas are particularly Shobra El Kheima and Matareya/Ain Shams. These northern urbanization of Cairo was formulated by typical urban sprawl, and informal settlement has proceeded. Such informal settlement has caused the urbanization without appropriate primary and secondary arterial street network. Particularly, Matareya/Ain Shams has serious lack of both primary and secondary arterial system. A decent arterial network development for these areas is one of the major issues in the urban road system within the Ring Road.

Secondly, some of the access roads to/from the Ring Road are not functioning well. Currently there are 22 interchanges on the Ring Road (Figure 5.3.2). Many of these interchanges are connection facilities with major National and regional roads in GCR. There are, however, also many interchanges/connection points which do not satisfy the expected function due to their poor access roads to the inner urban area. These "poor access interchanges" are particularly Saft El Laban Axis IC (No.3), Rod El Farag Axis (No. 5), Bahtem-Ring Road Axis (No. 9), Teraat El Gabal St. (No. 11) and Moasaset El Zakah St. (No. 12). These important access roads should be properly improved so that these designated interchanges can function as it was expected in the design.



Source: JICA Study Team based on the information from GOPP

Figure 5.3.2 Location Map of the Cairo Ring Road

Thirdly, the southwest part of Nasr City has a discontinuity of primary arterial connection due to the military facilities. The lack of primary arterial connection through this area is expected to be one of the major traffic problems in the future as the traffic volume in this area increases.

Fourthly, grade separation of intersections has been well developed in all over the urban area, and this effort is still going on. Cairo Governorate is planning to invest LE310 million for grade separation projects, which is 60 % of total new road project budget of LE518 million for the next five years (2002/03 – 2006/07). Qalyobeya and Giza Governorates are also planning to spend LE 44 million (40 % of road project budget) and LE 184 million (51 % of road project budget), respectively. These projects are planned based on the existing congestion and necessity, which are appropriate methodology of planning. As a long-term transport master plan, however, CREATS should be able to propose the policy of future planning for grade separation in the urban area.

(3) Future Traffic Demand and Road Capacity Imbalance

Although it is critically important to accelerate the public-transport-based transport system in order to satisfy the huge demand increase during the next 20 years, it does not mean the improvement of road capacity can be ignored. CREATS socio-economic forecast results expect that the current number of vehicles in the GCR is 1.05 million vehicles, and it is expected to increase up to 2.5 million in Year 2022. This means GCR will have to accommodate 2.5 times more number of vehicles in the area over the next 20 years.

Due to the expected economic growth, the car ownership will increase. Even if the rail-based public transport infrastructure, such as Metro, increases the trip speed of the trips, it is difficult to attract private car owners to shift their trips to public transport, once they have reached to the level of owning their own vehicles. The more congested road condition may discourage the private car owners to use their cars, and it may promote the shift of the modal share from private to public transport. The problem, however, is that the road-based public transport in the mixed traffic will also severely suffer from the traffic congestion on the road. There are some other road users such as cargo traffic, which cannot shift their transport to mass transit.

This means that even if the urban transport policy in CREATS is to give higher priority to "people's mobility" rather than "vehicle's mobility", it does not mean the road development can be ignored. On the contrary, the sharp increase in vehicle ownership suggests that substantial increase of road capacity will be indispensable for GCR over the next 20 years.

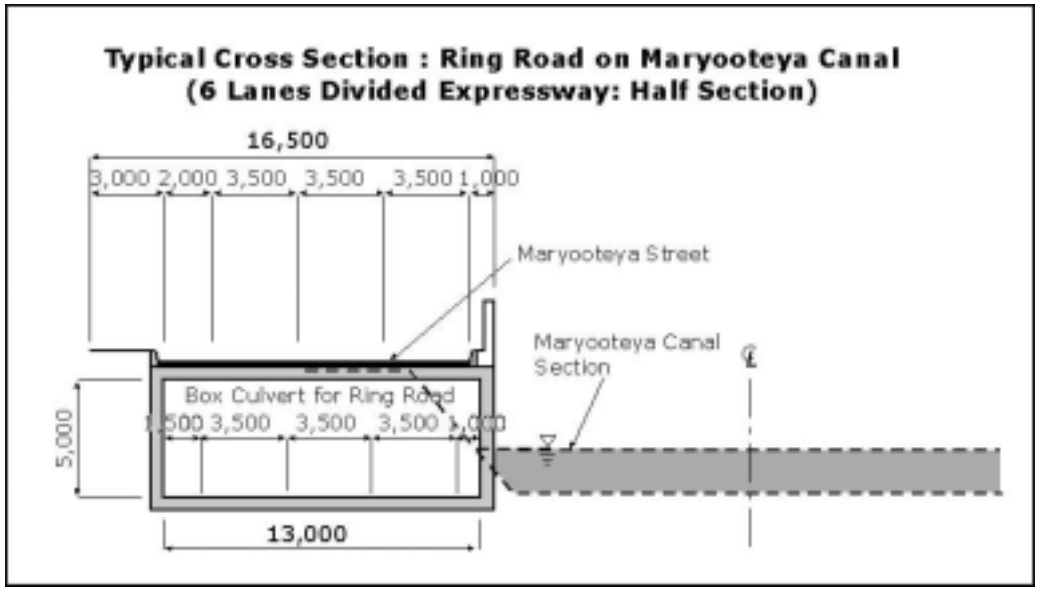
5.3.2 Approach and Action

(4) Primary and Secondary Street Improvements

Ring Road Closing on Maryooteya Street

Between the possible alternatives for closing the Ring Road in Giza, which are Mansooreya Street (IC01-IC22) or Maryooteya Street (IC02-IC21), the Maryooteya Street has obviously higher advantages in terms of right-of-way. Due to the difficulty of viaduct structure in this historic area, it is justifiable to construct the high-order expressway facility at underground level.

An example of the appropriate structure is shown in the typical cross section in Figure 5.3.3. The existing road along the Maryooteya Canal is basically a two-lane one-way street at the both sides of the Canal. Two separate box culvert structure under these streets can accommodate the existing at-grade road service at the ground level. The Canal water can also be accommodated between the box culverts so that the existing water area will be maintained. The underground structure will prevent the view of the Giza pyramids from being obstructed in the Haram area.



Source: JICA Study Team

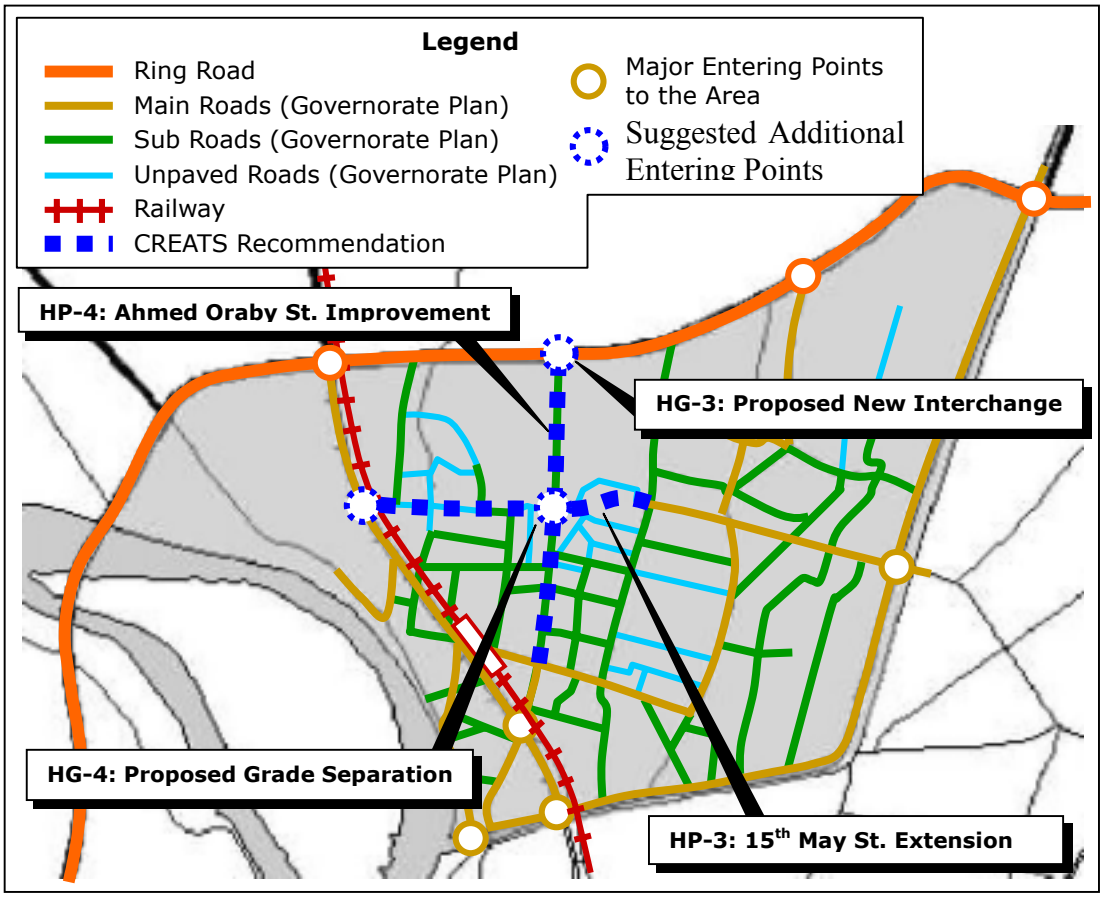
Figure 5.3.3 Proposed Typical Cross Section for Ring Road on Maryooteya

Shobra El Kheima Road Improvement Plan

The current road network in Shobra El Kheima has several critical problems. The first is that the area has a serious access problem since Shobra El Kheima is surrounded by physical barriers. The access-controlled Ring Road divides this area from the northern part in the north, the ENR and Metro No. 2 divide this area from Alexandria Agriculture Road in the west, and the Ismailya Canal runs at the east and the south. Figure 5.3.4 shows the current road network and the Governorate's improvement plan with CREATS proposals.

This makes the access route to Shobra El Kheima very limited, particularly from the northern side. For example, a driver approaching Shobra El Kheima from Alexandria Agriculture Road in the north can only enter this area through Ahmed Oraby Flyover Bridge at the southern side of the Metro station, or it has to go through the Ring Road eastward, then Ismailya Agriculture Road and finally 15th of May Street. The Ring Road interchange at Bahtem-Ring Road Axis (IC. No. 9 in Figure 5.3.2) is very poor, and it cannot work as a major access route to the area.

The second problem is that Shobra El Kheima is missing a functioning Urban Primary network, although the Urban Secondary network is relatively well formulated. It is therefore highly recommended that the primary arterial level of street improvement be implemented for the 15th of May St., the east-west corridor with direct connection to Alexandria Agriculture Road, and Ahmed Oraby St., the north-south corridor with a new connection facility (interchange) with the Ring Road. This additional street improvement will assure far better accessibility condition to this area particularly from the north and west side.



Source: JICA Study Team based on the information from Qalyobeya Governorate

Figure 5.3.4 Shobra El Kheima Primary Street Improvement Plan

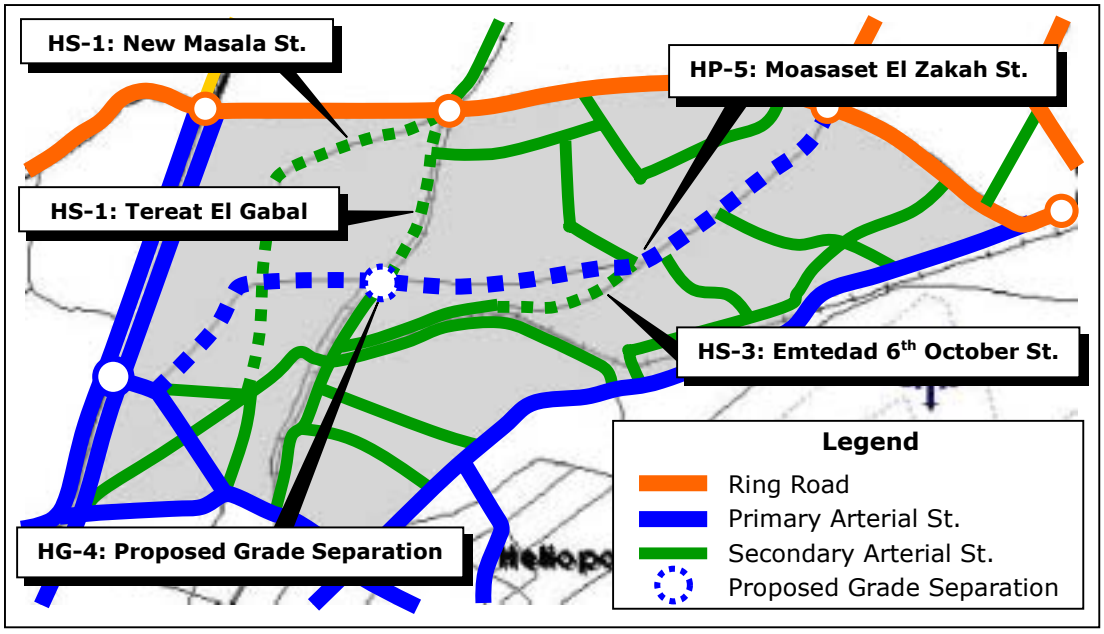
Matareya/Ain Shams Road Improvement Plan

The road network in Matareya/Ain Shams, particularly the west side of Metro Line No. 1 corridor, has a basic road network problem. It is a typical urban sprawl area, which lacks any major arterial streets. The roads in this area are all local roads, and the serviceability of road network is seriously poor.

To improve this one of the worst arterial road network condition in the city, the most important improvement is to provide a major primary arterial street in this area. Figure 5.3.5 shows the current road network and proposed improvement plan in this area. One advantage is the improvement possibility of Moasaset El Zakah St., which is mostly unpaved road or road space, but it has a decent right-of-way to improve it to a decent urban primary arterial street. It is highly recommended that this street be improved to the primary arterial level with grade separation at Metro Line No. 1 crossing to provide a major link in this area before the squatters will completely occupy the area.

Even with the improved Moasaset El Zakah St, the west side of Metro Line No. 1 still needs supporting secondary road improvement to provide better access in this area. Although constructing a new road in highly dense residential area is extremely difficult, it is strongly recommended that, at least, a new Masala St. be

developed in this area. It is also recommended that Talat El Gabel St. at the north of Moasaset El Zakah St., which runs along Metro Line No. 1, be upgraded, since the poor quality of this road causes poor shared taxi and bus services to/from Ain Shams Station and Ezbet El Nakhl Station.



Source: JICA Study Team

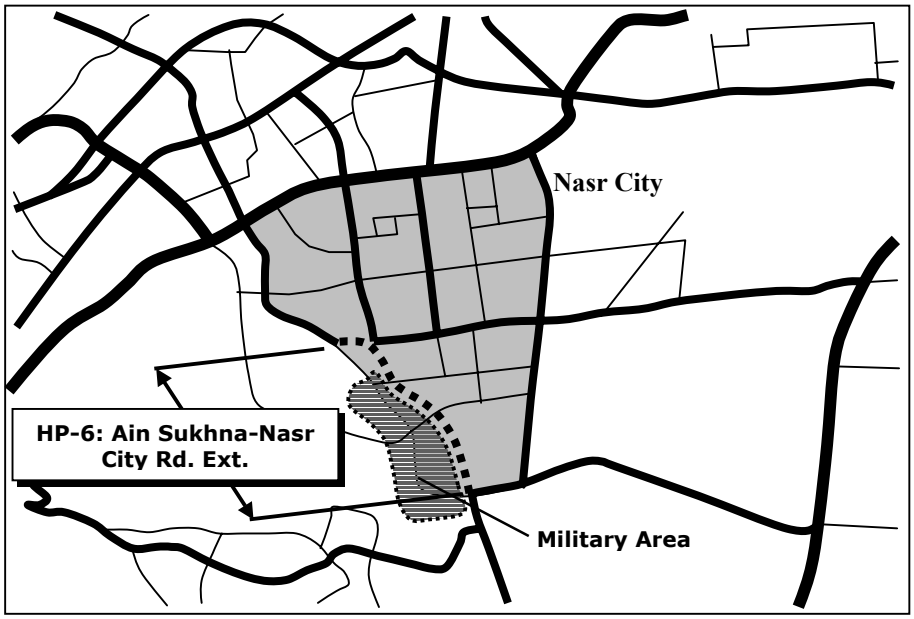
Figure 5.3.5 Matareya/Ain Shams Primary and Secondary Street Improvement Plan

Ring Road Interchange Access Road Improvement Plan

It is recommended that the "poor access interchanges" mentioned in Section 5.3.1 (2), Saft El Laban Axis (No. 3), Rod El Farag Axis (No. 5), Bahtem-Ring Road Axis (No. 9), Tereat El Gabal St. (No. 11) and Moasaset El Zakah St. (No. 12) be upgraded to the proposed urban primary and secondary cross-section conditions, even though some of these access roads have critical right-of-way problems. Particularly the primary arterial access roads, such as Saft EL Laban Axis (No. 3), Rod El Farag Axis (No. 5) and Moasaset El Zakah St. (No. 12) are critically important and in higher priority in the primary road network, since the function of the Ring Road as a bypass depends on these primary access streets.

Nasr City Primary Arterial Connection Plan

Due to the disconnection in the military area in Nasr City, the urban primary arterial connection in Nasr City needs to be improved. Since the Seket El Waily Street – El Fangary Street corridor is an important circumferential connection, it is highly recommended that this connection be kept through the Nasr City and eventually the Ring Road. The recommended connection plan is shown in Figure 5.3.6. If El Fangary Street has an extension to the two Ring Road access roads beginning at the south of Nasr City, it will also give a way to the direct high-order bus services.



Source: JICA Study Team

Figure 5.3.6 Nasr City Primary Arterial Connection Plan

Grade Separation Projects Plan

In the existing five-year plan, Cairo Governoarte is planning to provide nine locations of grade separation projects for intersections, Qalyobeya is planning one, and Giza is planning two, within the Ring Road area. The Governorates' plans are all based on the careful observations of the existing problems, and they should have higher priority. To propose the next step, what should be considered for the grade separation projects following the existing Governorates' plans is the issue.

CREATS recommends that the proposed functional classification of the road network be taken into account. Since higher hierarchy of road network should accommodate major traffic, the intersections between the higher hierarchy of roads should be given a higher priority for higher grade of traffic crossing conditions. From this viewpoint, it is recommended that the intersection between urban primary arterial and urban primary arterial be given the priority for the next stage of grade separation. Figure 5.3.7 shows the existing 27 locations of urban primary vs. urban primary intersections, among others, which already have grade separation, and 14 committed grade separation projects by the Governorates, and CREATS proposal of 15 new grade separation between urban primary arterial vs. urban primary arterial over the next 20 years, which have not had grade separation yet.

The intersection grade separation has been provided in many of the urban streets in Cairo based on the traffic analysis and for alleviation of the congestion. These locations are already extensive numbers and they are functioning well. To think about the next step, it is important that the grade separation will guide the main stream of traffic to the corridors where grade separation is provided. It is, therefore, important to guide the traffic to urban primary streets by providing grade separations on these corridors to better-balanced network functions.

Urban Secondary Streets Improvement Plan

As the nature of the comprehensive transport study all over the GCR, it is difficult to figure out all of the necessary urban secondary street improvements considering the local necessity. However, there are several important projects to be proposed from the network point of view, and these are shown in Figure 5.3.7 together with the proposed grade separation projects and urban primary arterial improvement projects. These major urban secondary arterial improvement projects are as follows:

HS-1: New Masala Street, HS-2: Talaat El Gabal Street, HS-3: Emtedad 6th of October Street, HS-4: Tereat Tirsa Street, HS-5: Khafra Street, HS-6: Tereat El Zumur Street, and HS-7: Imbaba Bridge Reconstruction.

(5) Urban Expressway System for Major Road Capacity Improvement

The CREATS Transport and Traffic Surveys have identified that the traffic volume on the streets of Cairo is an enormous amount, which is expected to increase in the future. Although improving traffic bottlenecks continues to be an important issue to solve the local traffic problem, adding a few more new links to the network cannot solve the chronic congestion in the urban area. It may solve the local problem at a time, but once a congestion of a place is solved, more vehicles will concentrate, and it will begin to show congestion again.

The completion of the 6th of October Expressway gave a large impact on traffic movement in Cairo. It offered a bypass route from Giza CBD through Helipolis and Nasr City without passing through the congestion in Cairo CBD. The CREATS Traffic Count shows that the 6th of October Expressway carries 177,000 – 127,000 pcu/day between Abdel Minim Riyad Squere and Nasr Road, and the 6th of October Bridge carries by far the dominant traffic volume of 261,000 pcu/day among the bridges over the Nile.

The recent condition of the expressway, however, suggests that this single 11.3 km stretch cannot solve all the traffic problems in the urban area. The viaduct is always with full of cars, and chronic congestion is observed all through the day. Drivers often choose other congesting routes because it sometimes can be even better.

For the long-term road sector transport planning for Greater Cairo, the extension of urban expressway network will be an important alternative. It will give a bypass function to major vehicular trips with the better level of service. Increase of road capacity by an extensive urban expressway network should give a way to better cargo flow. From engineering point of view, there is no major difficulty to construct urban expressway network in Cairo. In fact, Cairo has a greater advantage in this opportunity compared with other mega cities in the world, which is the wide road space. Generally speaking, many of the arterial streets in Cairo have a wider cross section than those of other mega cities. The most of the problems arising in other cities for constructing urban expressways is the difficulty in obtaining necessary right-of-way. Many experts in urban expressway construction would agree that when right-of-way is secured, probably 80 % to 90 % of the project

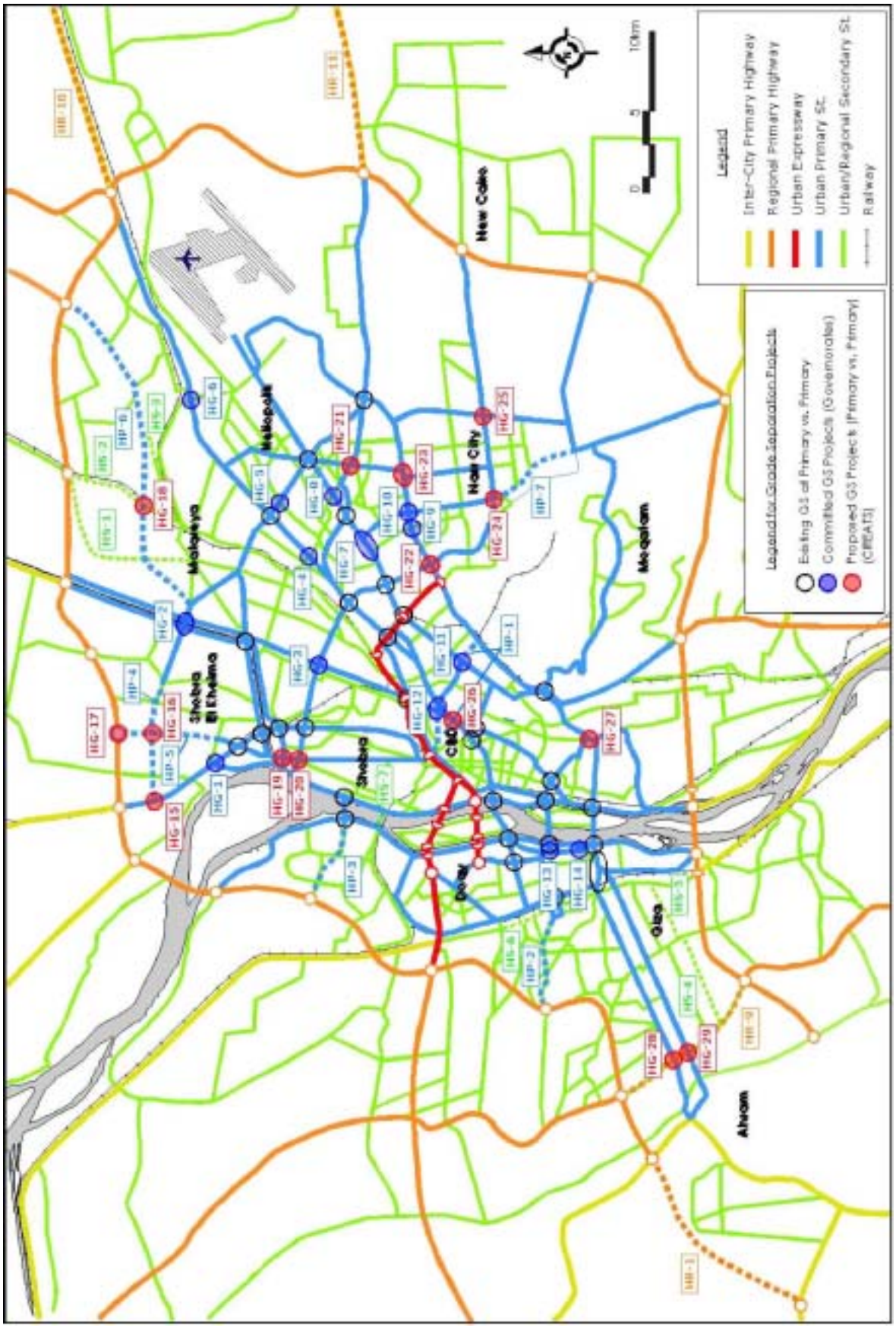


Figure 5.3.7 Urban Primary, Urban Secondary and Grade Separation Projects

Source: JICA Study Team

problems are solved. In this regard Cairo has a better opportunity of realizing urban expressway network over the existing arterial streets in general.

From the discussion above, CREATS proposes that urban expressway network extension be implemented to improve or, at least, maintain the traffic situation in Cairo. The CREATS plan of urban expressway network is shown in Figure 5.3.8. It coded the existing 6th of October Expressway and 26th of July Expressway as HE-1 and HE-2, respectively, and proposes seven routes (HE-3 through HE-9) as new proposed routes. If one of the important purposes of the extended urban expressway is to ease the traffic congestion, it must give a bypass function to the existing and future busy corridors.

The first important network is HE-3: Autostrad-Salah Salem Route and HE-4: Abu Bakr El Sadeeq Route, which will form de facto the Inner Ring Road function. This Inner Ring Road will function as a bypass to the existing HE-1: 6th of October, and HE-2: 26th of July, and it will ease their congestions. Once the Inner Ring Road is provided, it will give a way to develop radial connection from the Ring Road to the Inner Ring Road, and eventually downtown area through the 6th of October and 26th of July corridors. It should not be the other way (i.e. radial routes first, then the Inner Ring Road), because it would simply escalate the congestion on the 6th of October and 26th of July corridors. Finally the Giza connection (HE-8 and 9) will complete the network, and give an alternative function of the Ring Road Closing.

This CREATS urban expressway network will have two important functions. The first is that it will give alternative routes to various origin-destination combinations in the city. If, for example, a driver aiming to travel from Nasr City to Doqy found that the HE-1 Route is too congested, he will chose HE-3 through HE-9 to avoid such congestion. If a driver in Giza Square would like to travel to the airport, he can choose either HE-3, HE-4 and HE-7, or HE-9, Ring Road, HE-4 and HE7, depending on the condition on the expressway. When such alternatives are given, it will be important how to provide traffic information to the drivers, which is discussed in Chapter 8.

The second is that each element of the elevated expressway will work as a “Mini Ring Road” for each urban center so that the through traffic is mostly eliminated from the at-grade arterial system. It is, for example, considered very difficult to provide a new bypass to solve the traffic congestion at Haram Street and Malek Faysal Street in the Haram area, but the completed Ring Road and HE-3 with HE-8 will form a Mini Ring Road in this area, which will be able to alleviate the chronic congestion in this area.

It is, however, not easy to project further expressway network with the conventional method of direct funding through government budget. Even if it is possible, would it be fair to all the tax payers? The main users of this urban expressway network are passenger car owners, and people who cannot own a car and obliged to use public transport modes cannot enjoy the benefit from such an investment.

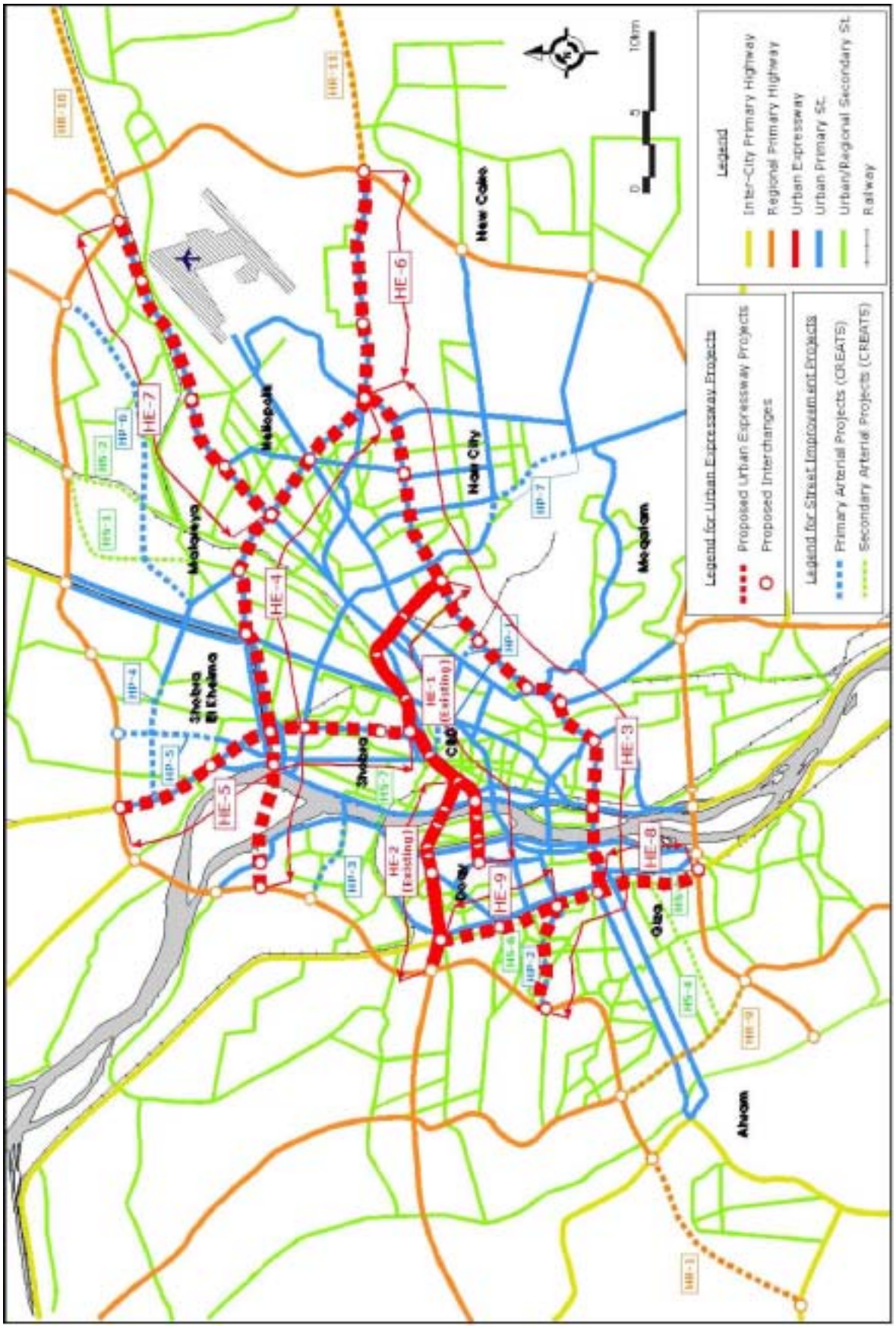


Figure 5.3.8 CREATS Urban Expressway Plan

Source: JICA Study Team

From these points of view, if the urban expressway network is to be extended, it is highly recommended that more direct road user charge system be applied for financing these projects. One way of direct road user charge system can be *toll road system*, in which user pays the toll when they use the expressway, and toll will be reimbursed to finance the project. The other way is an *earmarked road fund* in which certain portion of fuel or vehicle taxes will be exclusively used for financing such projects.

These road user charge systems can offer a fairer scheme for these projects, because the users will directly pay for the better level of service. It will also give a choice to car users between higher cost for higher level of services, or less cost for ordinary level of services. Once such an alternative is given, it will give a way to implement a priority treatment to road-based public transport on at-grade streets, in which the benefit of urban expressway can be eventually shared with public transport users. The expressway can also offer a higher level of road-based public transport on itself.

The Study Team has assumed that a toll road system can be introduced to, at least, partly finance the expressway construction, and imposed a hypothetical toll level of LE5.0 per entrance (i.e. flat toll) to analyze its performance in the CREATS transport model. The toll level of LE5.0 is the Year 2001 price, but imposed in Year 2022 situation, when the average income of the people in Cairo has increased by the expected real economic growth in our planning horizon. So, it should not be as high as the feeling of imposing LE5.0 in Year 2001.

The level of toll and its impact on traffic will be discussed in the following sensitivity section in this chapter.

5.4 EVALUATION OF ALTERNATIVE YEAR 2022 ROAD SYSTEMS

5.4.1 Objectives and Methodology

The traffic volume on the road network will be influenced by the changes of other network modes, such as the rail based public transport. Particularly mass railway transit such as Metro will give a huge impact on entire traffic flows in the urban area. That is why it is important to analyze the road traffic flows with other high capacity modes in the transport model.

CREATS transport model analysis is based on the person trips. Each trip will choose the pattern of the trip modes. The vehicle trips will be distributed on the road network, and they are compared with the results of traffic count surveys, which are about 100 locations all over the Study Area.

The modal choice of the person trips in the future will be influenced by various elements. One of the most important elements is the future vehicle ownership. As is already discussed, it is expected that the current 1.05 million vehicles in the Study Area will increase up to 2.5 million in Year 2022. This means the GCR will have to accommodate 2.5 times more number of vehicles in the area.

As a result of such sharp increase of vehicle ownership, more people will have a choice of using vehicles on the road. The construction of Metro and other high-capacity rail based public transport will certainly increase the average trip speed for entire modes, but it does not mean the traffic on the road will drastically decrease. It is because of the nature of the people, when they have a modal choice between public transport and private transport (cars) with both in reasonably comfortable trip speed, they will choose the private transport at most of the times, simply because it is more comfortable and more convenient. That is why whenever the road congestion decreases, additional vehicle traffic will come to the less congested roads, which eventually does not decrease the congestion at all.

The importance is that people will have a choice of modes. Even if the congestion level on the road does not seem to be very different, if people have a choice of using Metro for faster trip, it will promote the trips, and economic activities.

To test the road and public transport network alternatives in the multi-modal transport model, the alternative network scenarios are structured. The scenarios are first developed at a long term view based on the target year of 2022 situation, taking into account the urban development evolution and the expected transport demand structure. The final road development plan will be tested in the alternative scenario settings with the public transport development plan alternatives. However, the alternative scenarios are structured mainly to compare the public transport alternatives, and the road development alternatives are limited compared with the public transport alternatives.

The road network improvement plans explained in the previous section will be categorized as follows:

a) Regional Primary Highway Improvements
b) Primary Arterial Street Improvements
c) Secondary Arterial Street Improvements
d) Intersection Grade Separation Projects
e) Urban Expressway Projects

In terms of the multi-mode network improvement plans, the alternative scenarios are structured as follows:

Scenario A: Committed Network Scenario will test the 2022 transport demand with the network that the committed projects are completed.

Scenario B: Do Maximum Network Scenario will test the 2022 transport demand with the most extensive public transport and road network plans from capacity building point of view.

Scenario C: Core Network Scenario is structured mostly to test the public transport network alternatives, and in the road network plans, it is identical to Scenario B. It

is therefore considered only as a transit scenario for identifying the preferred master plan scenario, and not explained in this chapter.

Scenario D: Master Plan Network Scenario is the result of the testing procedure, and it will be eventually the proposed master plan. The road network is slightly modified based on the results on Scenario B and C.

The improvement plans from a) to d) are necessary improvements from the network point of view no matter which public transport alternative is followed, so these plans are identical from Scenario B through D. The plan for e), the urban expressway projects are necessary from volume-capacity viewpoints to satisfy the 2022 traffic demand, and tested in Scenario B and C, and it is optimized in Scenario D by eliminating a few unpopular expressway links. The detail description of each scenario is explained in the following section.

The results of each scenario testing will be summarized and evaluated by several indicators. These indicators will be average vehicle speed (km/hr), the share of private (vehicle) transport (%), daily vehicle-kilometers (in terms of pcu-km), and average congestion on the selected "mini-screen lines" (Volume/Capacity ratio). The mini-screen line analysis is considered better than showing the average congestion for the entire road network to see the real congestion situation at the selected main corridors. The selected 12 mini-screen lines are shown in Figure 5.4.1(1) and (2).

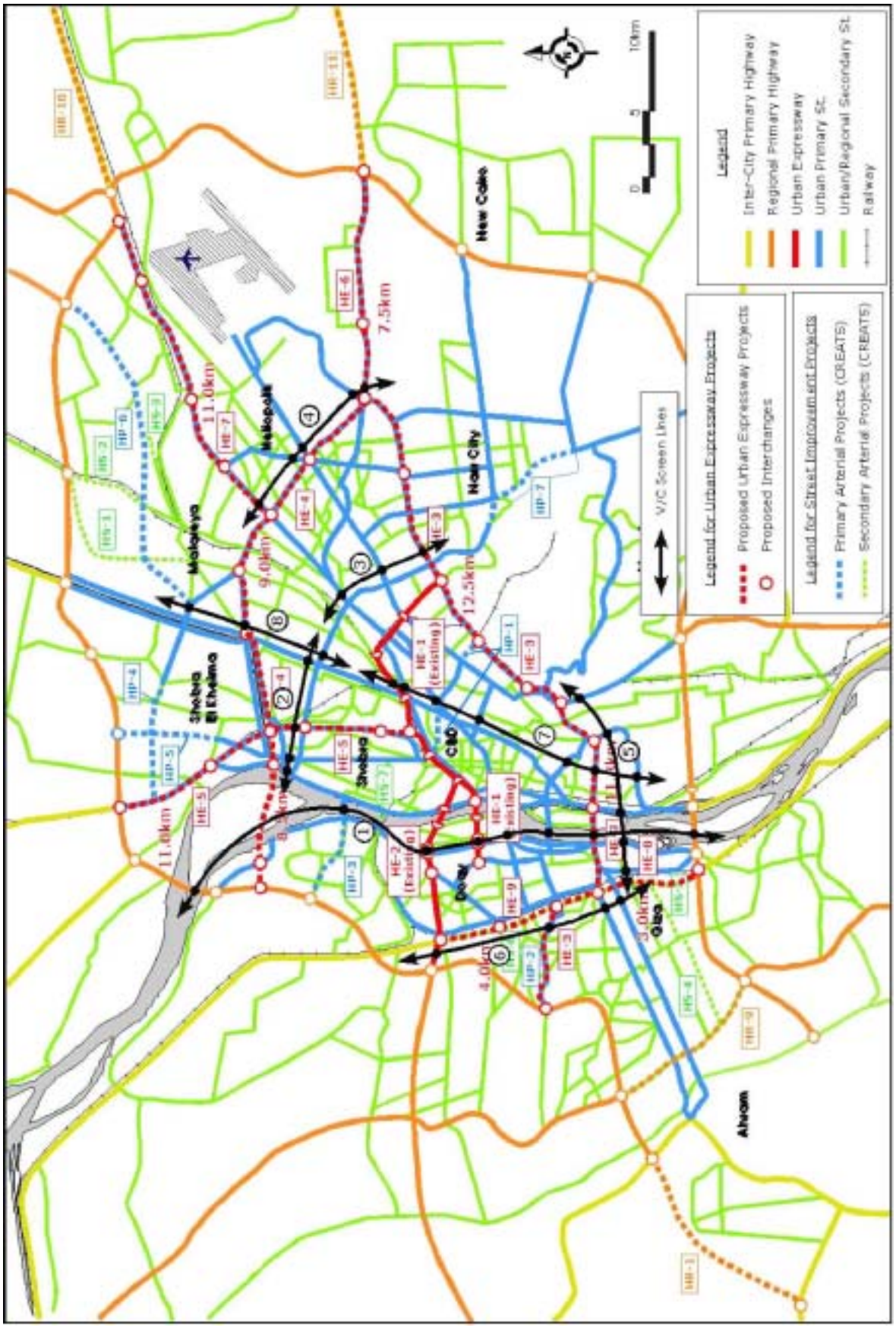


Figure 5.4.1(1) Mini-screen Lines for V/C Analysis (1)

Source: JICA Study Team

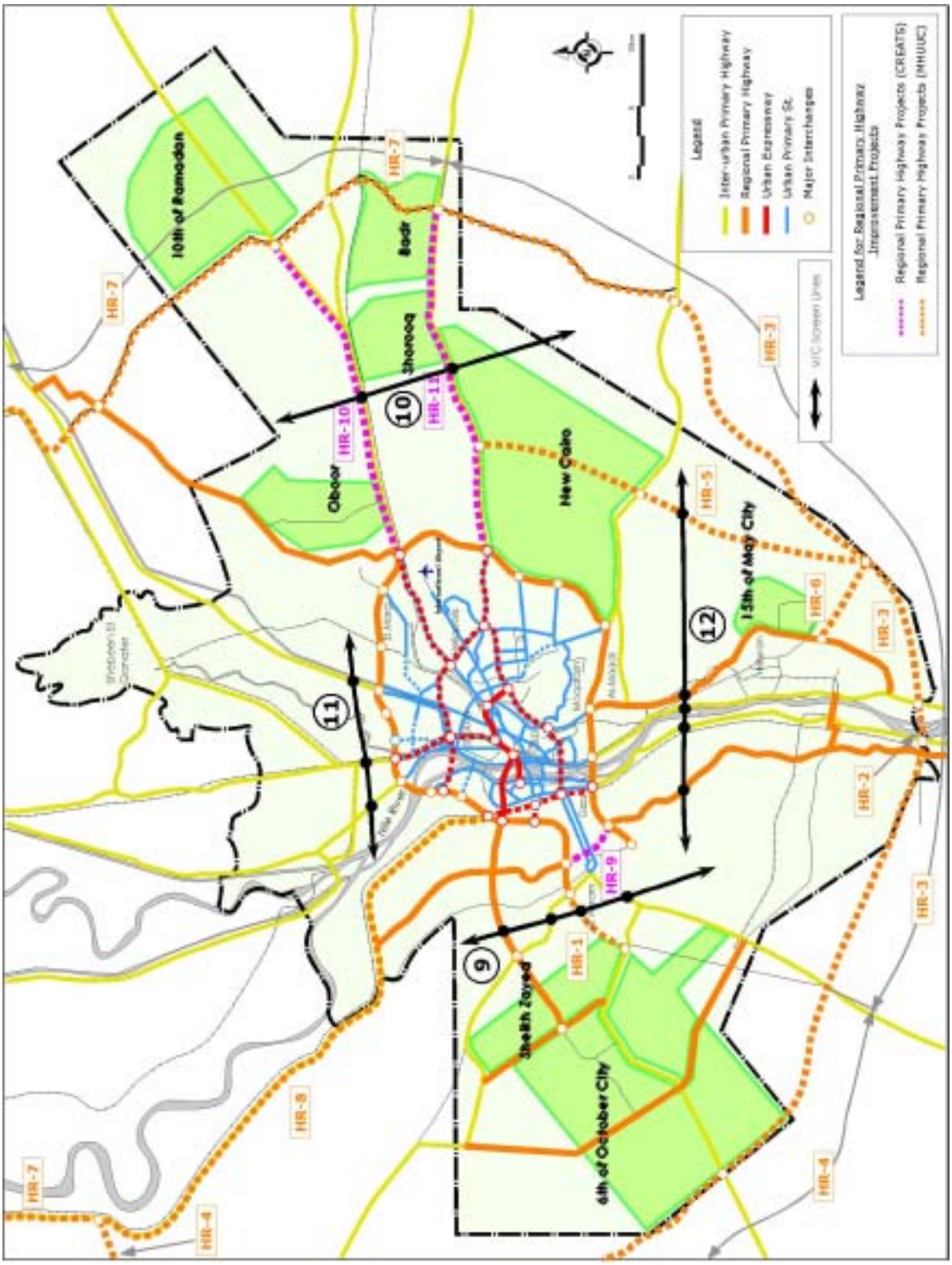


Figure 5.4.1(2) Mini-screen Lines for V/C Analysis (2)

Source: JICA Study Team

5.4.2 Scenario A (Committed Projects)

(1) Network Description

The first scenario, Scenario A, consists of only the projects which are already committed in the government and which are certain to be realized. The main purpose of testing Scenario A is to analyze what would occur if nothing were to be done in addition to these committed projects, and it is a common planning discussion to see the future needs and problems in the network. These "committed" projects include projects under construction, and projects planned under the Egyptian government's current five-year plan. The committed project investment is summarized in Table 5.4.1.

Table 5.4.1 Committed Projects Investment: Summary

Authority	Planned Budget (LE mil.)	Main Components
Ministry of Transport	111	Inter-city Road Improvements
Ministry of Housing, Utilities and Urban Communities	471	Ring Road Extension, Regional Ring Road, etc.
Cairo Governorate	518	Pavement, Grade Separation
Giza Governorate	357	Pavement, Grade Separation
Qalyobeya Governorate	109	Pavement, Grade Separation
Committed Projects Total	**1,566**	

Source: Each Government Authorities

The road investment planned by the Ministry of Transport is mainly for the inter-city road improvement in the Study Area by the General Authority for Roads, Bridges and Land Transport (GARBLT). The road investment planned by each Governorate is mainly 12 locations of grade separation projects as shown in Figure 5.3.7, and other street improvements, mainly pavements.

The largest part of the investment is the Ring Road extension projects and Regional Ring Road projects constructed and planned by the Ministry of Housing, Utilities and Urban Communities (MHUUC) and grade separation projects planned by each Governorate. The detailed components of these committed projects are shown in Table 5.4.2. These projects are shown together with the other CREATS proposals in Figure 5.4.2.

Table 5.4.2 Major Committed Projects by the Government

Committed Projects		Length (km)	Unit Cost (LE mil)	Cost (LE mil)	Remarks	Implementation Period 02-07	08-12	13-17	18-22	Agency
Regional Primary Highway Projects		136.5		471		471				MHUUC
HR-1	Ring Road Connection-Wahat (Oases)	4.5	6	25	Committed Project	O				MHUUC
HR-2	Regional Ring Road (South Tebeen Br.)	0.0 (1.0)	150 (150)	0 (150)	Committed Project	O				MHUUC
HR-3	Regional Ring Road (Suez Rd. to Fayoum Rd.)	39.0 (103.0)	4 (4)	156 (438)	Committed Project	O				MHUUC
HR-4	Regional Ring Road (Fayoum Rd. to Khatatba)	10.0 (97.0)	4 (4)	40 (412)	Committed Project	O				MHUUC
HR-5	Regional Ring Road Axis (RRR to New Cairo)	35.0 (35.0)	6 (6)	195 (195)	Committed Project	O				MHUUC
HR-6	Regional Ring Road Axis (to Autostrad)	10.0 (10.0)	6 (6)	55 (55)	Committed Project	O				MHUUC
HR-7	Regional Ring Road (Khatatba to Suez Rd.)	20.0 (160.0)	Under Planning		Committed Project		O			MHUUC
HR-8	Regional Ring Road Axis (Khatatba to Waraq)	18.0 (50.0)	Under Planning		Committed Project		O			MHUUC
Primary Arterial Street Improvements		2.1		20		20				Governorates
HP-1	Kamel Sedqy-Banhawy St.	2.1	10	20	Widening	O				Cairo Gov.
Intersection Grade Separation Projects		---		490		490				Governorates
HG-1	Alex. Dst. Rd. / Ahmed Helmi	---	35	35	Committed Project	O				Qalyobeya Gov.
HG-2	Mostrad Br. Completion	---	35	35	Committed Project	O				Cairo Gov.
HG-3	Port Said / Seket El Waily	---	35	35	Committed Project	O				Cairo Gov.
HG-4	Gesr El Suez / Qoba	---	35	35	Committed Project	O				Cairo Gov.
HG-5	Hegaz / Abu Bakr El Sadeeq	---	35	35	Committed Project	O				Cairo Gov.
HG-6	Gesr El Suez / 6th of October	---	35	35	Committed Project	O				Cairo Gov.
HG-7	Salah Salem / Yoosef Abbas & Tayaran	---	35	35	Committed Project	O				Cairo Gov.
HG-8	Salah Salem / Thawra	---	35	35	Committed Project	O				Cairo Gov.
HG-9	Autostrad / Yoosef Abbas	---	35	35	Committed Project	O				Cairo Gov.
HG-10	Autostrad / Tayaran	---	35	35	Committed Project	O				Cairo Gov.
HG-11	Salah Salem / Banhawy	---	35	35	Committed Project	O				Cairo Gov.
HG-12	Banhawy/Gaish-Port Said	---	35	35	Committed Project	O				Cairo Gov.
HG-13	Giza / Nahdet Masr	---	35	35	Committed Project	O				Giza Gov.
HG-14	Giza / Murad	---	35	35	Committed Project	O				Giza Gov.

Note: the numbers in ( ) for the Regional Ring Road Projects are for the total projects. The numbers above those ( ) are for the portion which belong to the Study Area.

Source: MHUUC & Cairo, Giza, Qalyobeya Governorates

(2) Transport Demand

The results of the model analysis for the designated indicators are shown in Table 5.4.3 with the simulated current condition results of Year 2001. The mini-screen analysis results are also shown in Table 5.4.4.

Table 5.4.3 Scenario A Performance Evaluation

Indicator	Year 2001 Simulation Results	Scenario A (Year 2022)
Average Trip Speed for All Modes (km/hr)	19.0 km/hr	11.6 km/hr
System Average Vehicle Speed (km/hr)	21.4 km/hr	9.3 km/hr
Private Transport Share (%)	29.1 %	38.3 %
2022 Daily Vehicle-km (pcu-km)	62,800,000	127,300,000
Average Volume/Capacity Ratio at Mini-screen Lines (V/C)	0.8	1.5

Source: JICA Study Team

Table 5.4.4 Scenario A Mini-screen Line Analysis

Mini-screen Line No.	2001 Current Situation			Scenario A (Committed Network)		
	Daily PCU	Capacity	V/C	Daily PCU	Capacity	V/C
1	873,919	1,167,000	0.7	1,485,658	1,167,000	1.3
2	367,002	343,290	1.1	551,757	343,290	1.6
3	439,520	366,432	1.2	702,634	366,432	**1.9**
4	327,037	635,052	0.5	625,982	635,052	1.0
5	463,904	449,114	1.0	725,592	449,114	1.6
6	349,518	367,810	1.0	625,706	367,810	1.7
7	577,812	599,912	1.0	981,715	599,912	1.6
8	281,707	250,204	1.1	474,054	250,204	**1.9**
9	118,771	263,542	0.5	466,846	428,114	1.1
10	109,894	110,172	1.0	285,601	100,172	**2.9**
11	239,801	301,800	0.8	415,547	301,800	1.4
12	196,858	239,028	0.8	343,112	332,030	1.0
Total	4,345,743	5,093,356	**0.85**	7,684,204	5,340,930	**1.44**

Source: JICA Study Team

The results in Table 5.4.3 shows that the vehicle trips on the road will be doubled, the congestion at major corridors will be doubled, and both average vehicle speed on the road and the average all-mode trip speed will drop to roughly half of the existing condition in Year 2022 if the committed projects would be the only measures to be done. In particular, the mini-screen line No. 10 shows an expected major capacity insufficiency on Ismailya Desert Road and Suez Road over the next 20 years.

5.4.3 Scenario B ("Do Maximum" Plan)

(3) Network Description

The second scenario, Scenario B, consists of the projects which are proposed by CREATS to satisfy the traffic demand forecast in the planning horizon of Year 2022. These projects consist of the network improvements and urban expressway projects discussed in the previous section. The proposed projects are summarized in Table 5.4.5, and shown in Figure 5.4.2.

Table 5.4.5 Scenario B (Do Maximum) Projects Investment: Summary

CREATS Proposal		Length (km)	Unit Cost (LE mil)	Cost (LE mil)	Remarks
Regional Primary Highway Improvements		66.8		327	
HR-9	Ring Road (on Maryooteya Road)	3.8	50	190	New Road
HR-10	Ismailya Desert Rd.	36.0	2	78	Widening
HR-11	Suez Desert Rd.	27.0	2	59	Widening
Primary Arterial Street Improvements		28.3		200	
HP-2	Saft El Laban Axis	3.8	10	37	Widening
HP-3	Rod El Farag Axis	3.0	10	29	Widening+New
HP-4	15th May St. Extension	4.0	10	39	Widening+New
HP-5	Ahmed Oraby St.	3.0	10	29	Widening
HP-6	Moasaset El Zakah St.	10.5	3	28	Widening
HP-7	Ain Sukhna-Nasr City Rd. Extension	4.0	10	39	New Road
Secondeary Arterial Street Improvements		17.2		121	
HS-1	New Masala St.	6.0	5	30	New Road
HS-2	Tereat El Gabal St.	3.0	1	3	Improvement
HS-4	Tereat Tirsa St.	3.2	2	5	New Road
HS-5	Khafra St.	2.5	2	4	New Road
HS-6	Tereat El Zumur St.	2.0	2	3	Improvement
HS-7	Imbaba Br. Reconstruction	0.5	150	75	New Nile Bridge
Intersection Grade Separation Projects		---		525	
HG-15	Alex. Dst. Rd. / 15th May Ext.	---	35	35	Flyover
HG-16	15th May Ext. / Ahmed Oraby	---	35	35	Flyover
HG-17	Ring Road / Ahmed Oraby	---	35	35	Connection
HG-18	Moasasat El Zakah / Talaat El Gabal	---	35	35	Flyover
HG-19	Saad Sleam / Shobra	---	35	35	Flyover
HG-20	Madrasit El Mamaleek / Shobra	---	35	35	Flyover
HG-21	Thawra / Nozha	---	35	35	Flyover
HG-22	Autostrad / Ismailya El Fangary	---	35	35	Flyover
HG-23	Autostrad / Nozha-Abbas El Aqad	---	35	35	Flyover
HG-24	Dr. Abdallah El Araby / Dr. Zaker Hussein	---	35	35	Flyover
HG-25	A. Mohamed El Zumur / Hassan El Mamoun	---	35	35	Flyover
HG-26	Gaish / Port Said	---	35	35	Flyover
HG-27	Salah Salem / Tareq Magra El Ayon-Ain El Hayah	---	35	35	Flyover
HG-28	Malek Feisal / Maryooteya	---	35	35	Underpass
HG-29	Haram / Maryooteya	---	35	35	Underpass
Urban Expressway Projects		91.8		9,132.7	
HE-2	New Eastward Ramp from HE-2 to HE-1	1.2	61	73	New Ramp
HE-3	Expway No. 3 (Autostrad-Salah Salem Route)	24.3	93	2,270	New Viaduct
HE-4	Expway No. 4 (Abu Bakr El Sadeeq Route)	17.5	93	1,635	New Viaduct
HE-5	Expway No. 5 (Alex. Agriculture Rd. Route)	11.0	93	1,095	New Viaduct+Nile Br.
HE-6	Expway No. 6 (Suez Rd. Route)	7.5	93	1,118	New Viaduct+Tunnel
HE-7	Expway No. 7 (Gesr El Suez Route)	18.0	93	1,681	New Viaduct
HE-8	Expway No. 8 (Tereat El Zumur South Route)	3.0	93	280	New Viaduct
HE-9	Expway No. 9 (Tereat El Zumur North Route)	4.0	93	374	New Viaduct
HE-10	Expway No. 10 (Autostrad Route)	6.5	93	607.1	New Viaduct
Total for CREATS Project Proposals				10,305.9	

Source: JICA Study Team

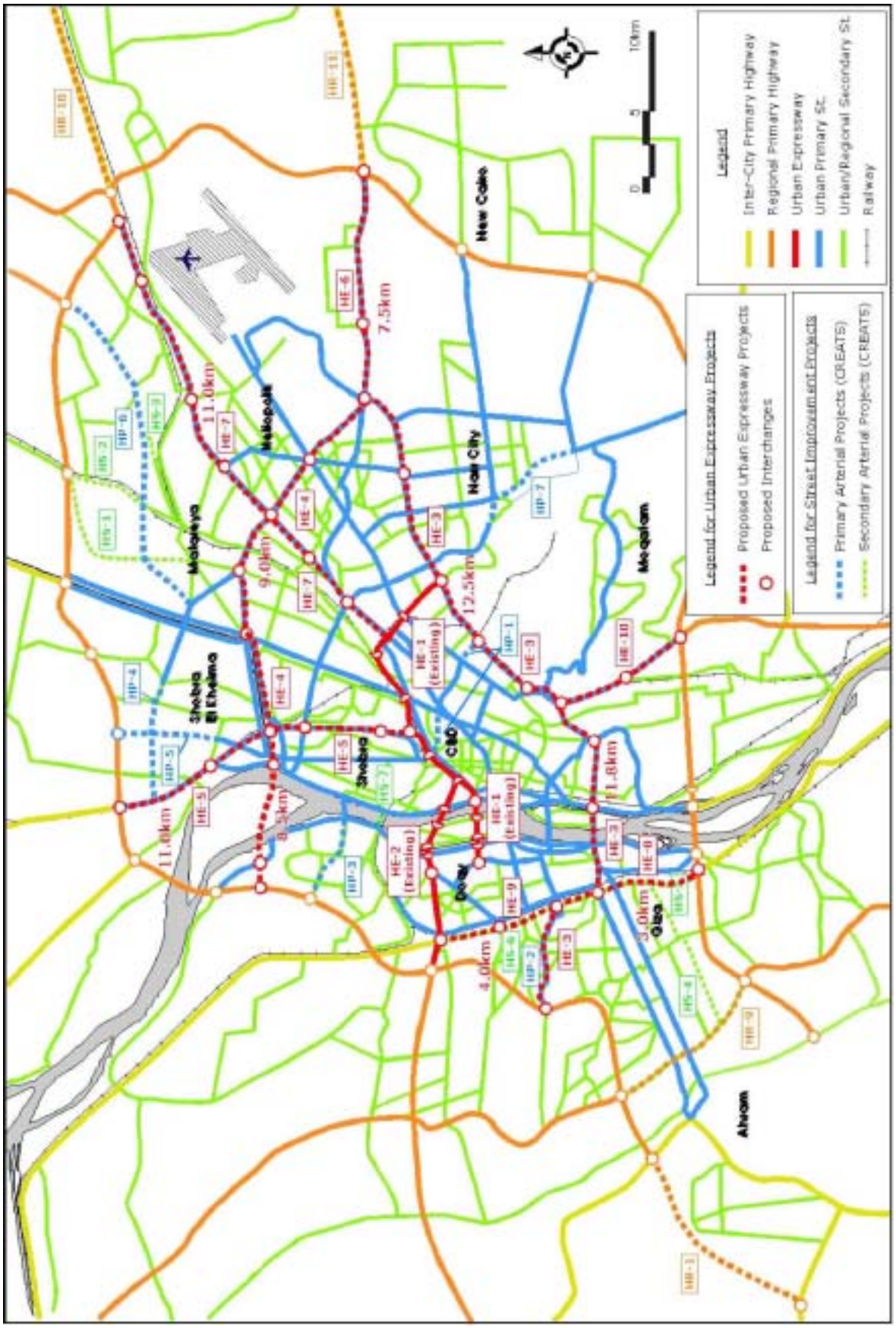


Figure 5.4.2 Scenario B (Do Maximum) Road Improvement Plan

Source: JICA Study Team

The total road investment of Scenario B, together with the committed projects are shown in Table 5.4.6.

Table 5.4.6 Road Sector Total Investment for Scenario B (Do Maximum)

Year	Total (LE mil)
Committed Projects Total	**1,566**
MOT	111
MHUUC	471
Cairo Gov.	518
Giza Gov.	357
Qalyobeya Gov.	109
CREATS Proposal Total	**10,306**
Regional Roads	327
Primary/Secondary	321
Grade Separation	525
Expressway	9,133
Road Sector Total	**11,871**

Source: JICA Study Team

The total road sector investment amount is LE11.9 billion, of which LE9.1 billion is the cost of urban expressway system.

(4) Transport Demand

The results of the model analysis for the designated indicators are shown in Table 5.4.7 with the Scenario A results. The mini-screen analysis results are also shown in Table 5.4.8.

Table 5.4.7 Scenario A Performance Evaluation

Indicator	Scenario A (Year 2022)	Scenario B (Year 2022)
Average Trip Speed for All Modes (km/hr)	11.6 km/hr	18.2 km/hr
System Average Vehicle Speed (km/hr)	9.3 km/hr	11.9 km/hr
Private Transport Share (%)	38.3 %	42.0 %
2022 Daily Vehicle-km (pcu-km)	127,300,000	144,000,000
Average Volume/Capacity Ratio at Mini-screen Lines (V/C)	1.5	1.2

Source: JICA Study Team

The results in Table 5.4.7 shows that the vehicle trip speed on the road will increase from the "committed network" to the "Do Maximum" network (9.3 to 11.9 km/hr), which will improve the congestion by 30%. The daily vehicle-km will increase (127 million to 144 million pcu-km) due to the improvement of the congestion (1.5

to 1.2) caused by the infrastructure improvement of both public transport and road network. The road condition will improve by the increase of system average vehicle speed and average V/C at selected mini-screen lines. It should be noted that the major problems observed on mini-screen line No. 10, among others, in Scenario A will become modest in Scenario B, due to the proposed widening of Islailya Desert Road and Suez Desert Road for mini-screen line No. 10.

However, since the CREATS scenario testing is a comprehensive evaluation approach for multi-sector development scenarios, the effect should be looked into from the integrated master plan point of view. The benefit of Scenario B is more in the public transport side, since the average trip speed for all modes will significantly improve (11.6 to 18.2 km/hr) compared with the average vehicle speed improvement (9.3 to 11.9 km/hr).

Table 5.4.8 Scenario B Mini-screen Line Analysis

Mini-screen Line No.	Scenario A (Committed Network)			Scenario B (Do Maximum Network)		
	Daily PCU	Capacity	V/C	Daily PCU	Capacity	V/C
1	1,485,658	1,167,000	1.3	1,893,473	1,499,000	1.3
2	551,757	343,290	1.6	707,352	647,370	1.1
3	702,634	366,432	**1.9**	750,648	664,771	1.1
4	625,982	635,052	1.0	705,992	983,534	0.7
5	725,592	449,114	1.6	762,323	763,971	1.0
6	625,706	367,810	1.7	890,367	623,857	1.4
7	981,715	599,912	1.6	1,171,453	1,004,293	1.2
8	474,054	250,204	**1.9**	692,329	523,128	1.3
9	466,846	428,114	1.1	610,717	457,086	1.3
10	285,601	100,172	**2.9**	315,448	240,400	1.3
11	415,547	301,800	1.4	472,213	340,916	1.4
12	343,112	332,030	1.0	554,342	399,003	1.4
Total	7,684,204	5,340,930	**1.44**	9,526,657	8,147,329	**1.17**

Source: JICA Study Team

5.4.4 Scenario D (Recommended Master Plan)

(1) Network Description

The third scenario, Scenario C, is structured in the course of analyzing the public transport network, and the road network in Scenario C is identical with that of Scenario B.

The fourth scenario, Scenario D, is also almost the same road network in Scenario B in terms of the road network, since most of the proposed projects are planned from the network viewpoint discussed in Section 5.3. The difference between Scenarios B and D, in the road network plan, is structured in order to fine-tune the urban expressway network. In accordance with the testing results of Scenario B and C, it was identified that the urban expressway link of HE-10: Autostrad Route of 10 km

and the 6 km section of HE-7 Gesr El Suez Route between Abu Bakr El Sedeeq and the 6th of October are not popular route. Since the diverted traffic is particularly small on these two routes compared with other routes, these sections are omitted from the Scenario D network. It can be considered as a future extension, when the network is almost completed and the next stage construction is discussed. The proposed urban expressway projects are summarized in Table 5.4.9, and shown in Figure 5.4.3. The projects other than the urban expressway shown in Table 5.4.9 are identical to Table 5.4.5 (Do Maximum Plan). The number of lanes for the elevated expressways is designated to two lanes for each direction (four lanes for both directions). Where the exclusive busway is proposed as in Chapter 4, the number of lanes for elevated expressway will be designated to six lanes for both direction so that it can accommodate two lane (for both directions) busway in the center.

Table 5.4.9 Scenario D (The Master Plan) Urban Expressway Projects

CREATS Proposal		Length (km)	Unit Cost (LE mil)	Cost (LE mil)	Remarks	Implementation Period 02-07	08-12	13-17	18-22	Agency
Urban Expressway Projects		78.3		7,872		0	2,652	2,432	2,788	MEA *
HE-2	New Eastward Ramp from HE-2 to HE-1	1.2	61	73	New Ramp		○			MEA
HE-3	Expway No. 3 (Autostrad-Salah Salem Route)	24.3	93	2,270	New Viaduct		○			MEA
HE-4	Expway No. 4 (Abu Bakr El Sadeeq Route)	17.5	93	1,635	New Viaduct		○			MEA
HE-5	Expway No. 5 (Alex. Agriculture Rd. Route)	11.0	93	1,095	New Viaduct+Nile Br.			○		MEA
HE-6	Expway No. 6 (Suez Rd. Route)	7.5	93	1,118	New Viaduct+Tunnel			○		MEA
HE-7	Expway No. 7 (Gesr El Suez Route)	11.0	93	1,027	New Viaduct				○	MEA
HE-8	Expway No. 8 (Tereat El Zumur South Route)	3.0	93	280	New Viaduct				○	MEA
HE-9	Expway No. 9 (Tereat El Zumur North Route)	4.0	93	374	New Viaduct				○	MEA
Total for CREATS Project Proposals				9,045		545	2,956	2,651	2,893	

Source: JICA Study Team ** MEA: Metropolitan Expressway Authority*

The total road investment of Scenario D, together with the committed projects are shown in Table 5.4.10.

Table 5.4.10 Road Sector Total Investment for Scenario D (The Master Plan)

Year	Total
Committed Projects Total	**1,566**
MOT	111
MHUUC	471
Cairo Gov.	518
Giza Gov.	357
Qalyobeya Gov.	109
CREATS Proposal Total	**9,045**
Regional Roads	327
Primary/Secondary	321
Grade Separation	525
Expressway	7,872
Road Sector Total	**10,611**

Source: JICA Study Team

The total investment amount is LE10.6 billion, of which LE7.9 billion is the cost of urban expressway system. The difference is due to the fine-tuned urban expressway links only.

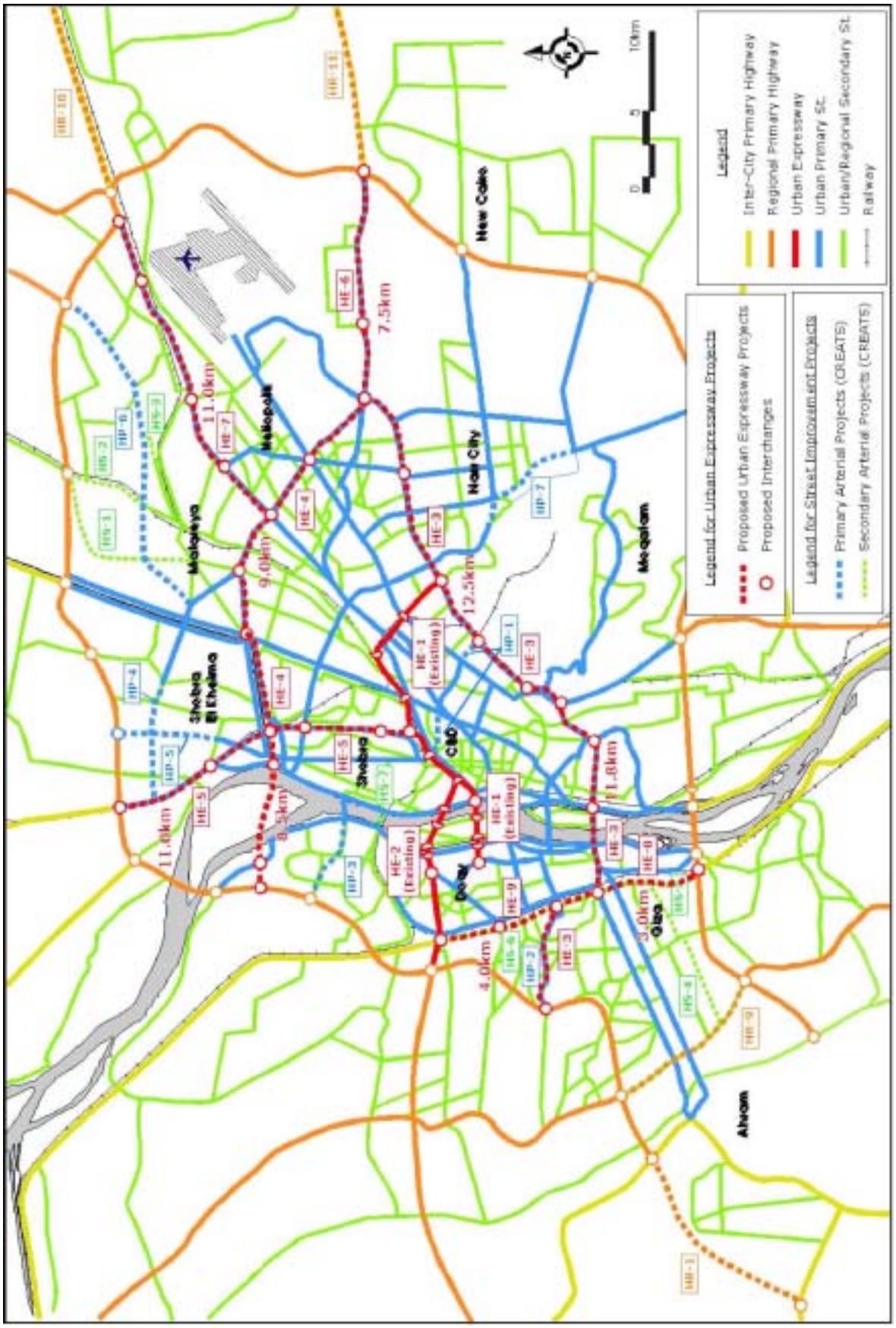


Figure 5.4.3 Scenario D (The Master Plan) Road Improvement Plan

Source: JICA Study Team

(2) Transport Demand

The results of the model analysis for the designated indicators are shown in Table 5.4.11 with the Scenario B results. The mini-screen analysis results are also shown in Table 5.4.12.

Table 5.4.11 Scenario D Performance Evaluation

Indicator	Scenario B (Year 2022)	Scenario D (Year 2022)
Average Trip Speed for All Modes (km/hr)	18.2 km/hr	18.0 km/hr
System Average Vehicle Speed (km/hr)	11.9 km/hr	11.8 km/hr
Private Transport Share (%)	42.0 %	42.1 %
2022 Daily Vehicle-km (pcu-km)	144,000,000	139,700,000
Average Volume/Capacity Ratio at Mini-screen Lines (V/C)	1.2	1.2

Source: JICA Study Team

Table 5.4.12 Scenario D Mini-screen Line Analysis

Mini-screen Line No.	Scenario B (Do Maximum Network)			Scenario D (Master Plan Network)		
	Daily PCU	Capacity	V/C	Daily PCU	Capacity	V/C
1	1,893,473	1,499,000	1.3	1,865,481	1,499,000	1.2
2	707,352	647,370	1.1	688,471	647,370	1.1
3	750,648	664,771	1.1	719,085	547,057	1.3
4	705,992	983,534	0.7	673,516	983,534	0.7
5	762,323	763,971	1.0	741,179	646,257	1.1
6	890,367	623,857	1.4	911,167	623,857	1.5
7	1,171,453	1,004,293	1.2	1,137,499	1,004,293	1.1
8	692,329	523,128	1.3	660,334	523,128	1.3
9	610,717	457,086	1.3	619,150	457,086	1.4
10	315,448	240,400	1.3	308,946	240,400	1.3
11	472,213	340,916	1.4	471,693	340,916	1.4
12	554,342	399,003	1.4	532,428	399,003	1.3
Total	9,526,657	8,147,329	**1.17**	9,328,949	7,911,901	**1.18**

Source: JICA Study Team

The results in Table 5.4.11 shows that there is no significant difference between Scenario B and Scenario D. It is important to notice that the difference is caused not only by the road network difference but also mostly by the public transport network difference. If that fact is considered, the two scenarios have the same performance results even if the the public transport network has a large difference

(The difference in the road network is minor, as is already discussed). Between Scenario B and Scenario D, the daily vehicle-km will decrease from 144 million to 140 million pcu-km, and the congestion level at the selected mini-screen lines stays almost the same except for the ones where the eliminated expressway capacity will influence the V/C value.

The high V/C value on mini-screen line No. 6 (1.4) is caused by high congestion on the 26th of July Street and Haram Street. The preferred mitigation for decreasing the congestion on these streets is widening. Although it is very difficult to solve the congestion on Haram Street by its widening, more balanced traffic demand should be sought between Malek Faysal Street and Haram Street through some way of transport demand management, since there are and will be a biased usage of Haram Street over Malek Faysal Street even though these are parallel streets in the same area. The future widening of the 26th of July should be considered if the opening of the Regional Ring Road does not improve the situation.

The high V/C value on mini-screen line No. 9 (1.4) is also caused by high congestion on the 26th of July Street. To cope with this future possibility, it is recommended that the widening of this main corridor between the 6th of October City and Central Giza and Central Cairo be considered with necessary arrangement for future right of way acquisition all through the corridor.

The high V/C value on mini-screen line No. 11 (1.4) is caused by the concentrated traffic volume on Alexandria Agriculture Road and Ismailya Agriculture Road. Since there is and will be a huge gap on congestion level between these two roads and others, the provision of the Regional Ring Road in the north of the Study Area may affect in balancing the traffic volume on this mini-screen line. Regardless the balancing of traffic by the provision of the Regional Ring Road, the increase of capacity on Alexandria Agriculture Road should be considered through the widening of four-lane bridges to balance with the six-lane earth section. If the provision of the Regional Ring Road does not improve the situation, Further widening of Alexandria Agriculture Road and Ismailya Agriculture Road should be considered from inter-city highway improvement point-of-view.

5.4.5 Scenario Evaluation

The results of the indicator analysis shown in Table 5.4.7 and Table 5.4.11 suggests that either Scenario B or Scenario D would achieve a great level of improvement of road network performance compared with Scenario A, the committed network, but the difference between Scenario B and Scenario D is minor. It can also be seen in the volume to capacity ratio chart for Scenario A, B and D shown in Figure 5.4.4, Figure 5.4.5 and Figure 5.4.6, respectively.

The V/C for entire network in each scenario is summarized by capacity range and by area (inside/outside the Ring Road) in Table 5.4.13.

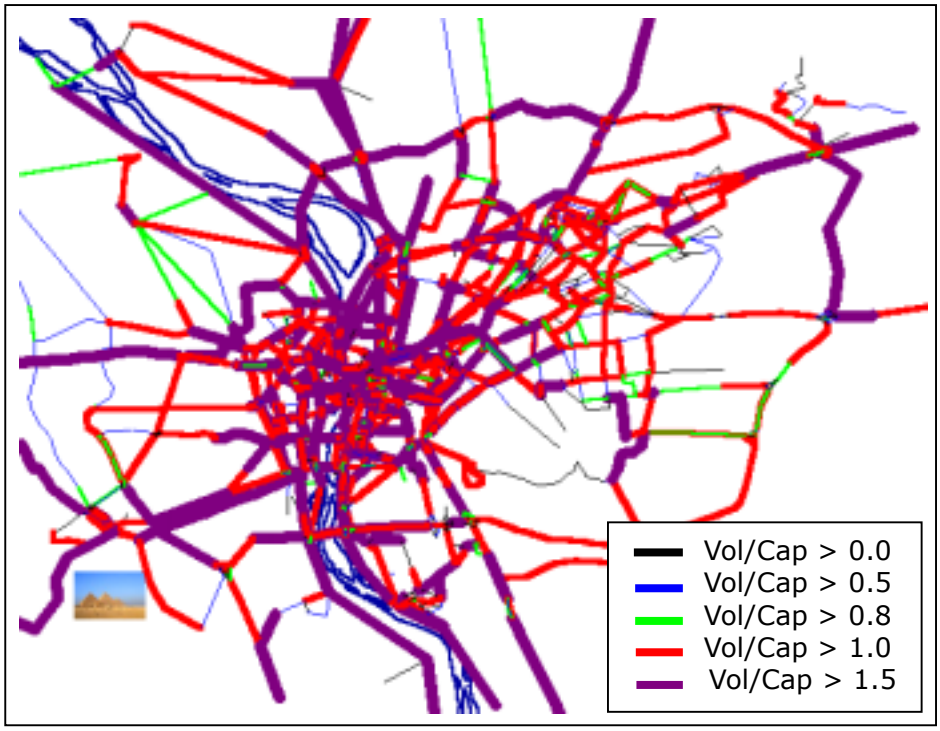
Table 5.4.13 Average Volume to Capacity Ratio for Entire Road Network

Capacity Class	One-way Daily Capacity Range (pcu)	Year 2001 Current Situation	Scenario A (Committed Network)	Scenario B (Do Maximum Network)	Scenario D (Master Plan Network)
Inside Ring Road					
Low	<20,000	0.92	1.32	1.24	1.25
Medium	20,000 - 40,000	0.72	1.17	1.04	1.03
High	>40,000	0.61	0.94	0.85	0.91
Total		0.74	1.11	0.93	0.97
Outside Ring Road					
Low	<20,000	0.89	1.33	1.09	1.09
Medium	20,000 - 40,000	0.58	1.11	1.06	1.11
High	>40,000	0.45	1.07	0.98	1.06
Total		0.55	1.12	1.01	1.08
Study Area Total					
Low	<20,000	0.92	1.32	1.17	1.18
Medium	20,000 - 40,000	0.68	1.15	1.04	1.06
High	>40,000	0.52	1.02	0.89	0.96
Total		**0.67**	**1.11**	**0.96**	**1.00**

Source: JICA Study Team

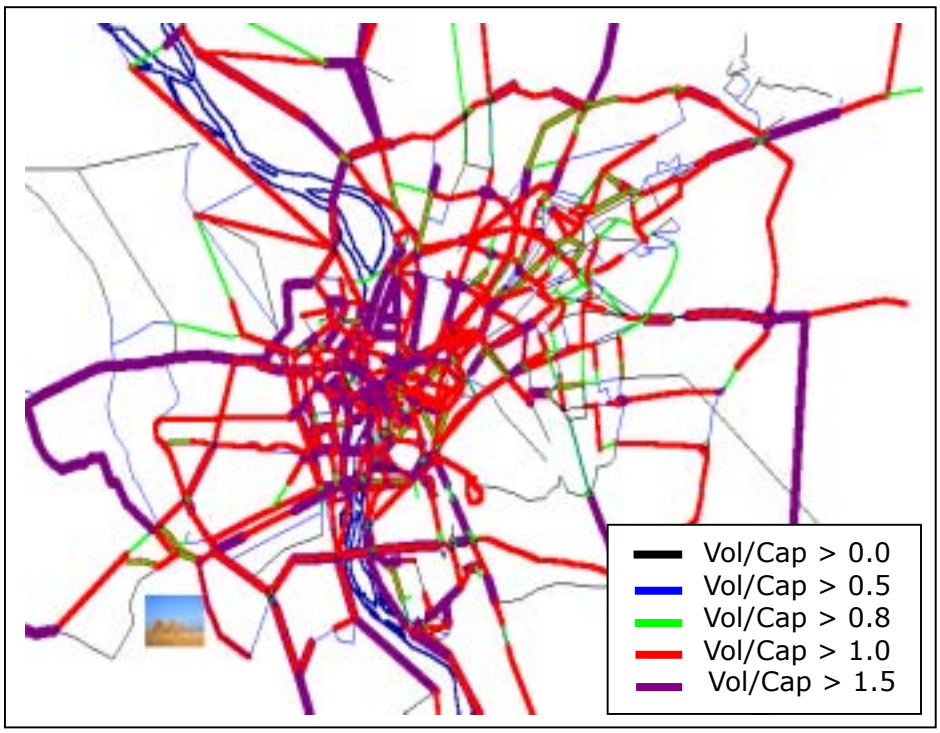
The results in Table 5.4.13 shows that the average congestion on the road will drastically increase from Year 2001 current situation to Scenario A situation in Year 2022. The V/C for Scenario B is the lowest because the traffic demand on the road would decrease affected by the highly developed public transport. The V/C value for Scenario D is higher than that of Scenario B, but it can still maintain the value of 1.0, which means that the traffic demand on the road is at the level of their capacity on average, even though the congestion on the individual road link will have severe congestion at certain corridors.

The more congested part of the road network can be analyzed by the mini-screen line analysis. The V/C on Scenario A (Figure 5.4.4) shows that the many sections of regional primary and urban primary roads are in very congested condition (V/C>1.5), even including certain links of the Ring Road. The V/C on Scenario B (Figure 5.4.5) and that on Scenario D (Figure 5.4.6) shows that in Year 2022 it is difficult to maintain daily average of V/C to be less than 1.0 at most of the major roads even with major improvements including urban expressways, as it is unavoidable at many mega cities like Cairo.



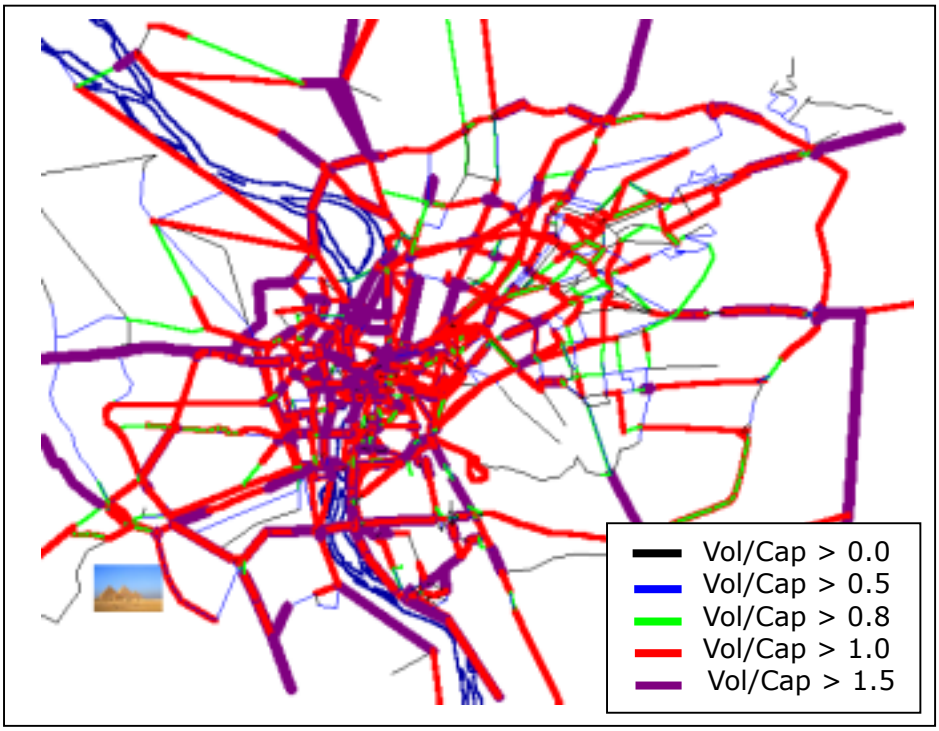
Source: JICA Study Team

Figure 5.4.4 V/C Chart for Scenario A Road Network



Source: JICA Study Team

Figure 5.4.5 V/C Chart for Scenario B Road Network



Source: JICA Study Team

Figure 5.4.6 V/C Chart for Scenario D Road Network

However, as it will be discussed in Chapter 11: The Integrated Transport Master Plan, the master plan network, particularly the public transport improvements, will provide more modal choices of travel when the road is more and more congested, and it will improve the all-mode average trip speed significantly[2].

5.5 RECOMMENDATIONS

5.5.1 Overview

The discussions made in the previous sections of this chapter have identified the approaches used to propose the road development plans. In summary, the adopted approach consisted of several steps to be followed.

The arterial road network in the Study Area has two major functions, which are Regional and Urban connection functions. The regional road system serves between the inner-Ring Road urban area and other new communities, whereas urban road system serves among the inner-Ring Road urban centers.

The major road network hierarchy in the GCR can be functionally classified as Regional Primary, Urban Primary, Urban Secondary and Urban Expressway. The functional road network will be formulated by properly categorizing the existing road network, and giving appropriate operation policies on road structures, traffic

[2] *Further discussion for integrated transport master plan evaluation is given in Chapter 11.*

management and environmental measures for each classified road category. Such hierarchy structuring will identify the missing links and improvement necessity in the road network system.

The current major governmental plan for regional road improvement is the Regional Ring Road planned by the MHUUC. CREATS future traffic demand forecasts that the road capacity will be insufficient mainly in the east area, on Ismailya Desert Road and Suez Road over the next 20 years. The widening of these two links will be of higher priority for connecting 10th of Ramadan, Badr, Shrook with inner-Ring Road urban areas.

In the inner-Ring Road urban area, CREATS recommends that the most important missing links are in Shobra El Kheima, Matareya, Nasr City, as well as new lateral (east-west) connections in Central Cairo, and Ring Road access road improvements, among others.

Further grade separation at intersections should also be planned in accordance with the hierarchy of the network. In addition to the current grade separation plans of each Governorate (Cairo, Giza, Qalyobeya), CREATS recommends that the at-grade intersections of Urban Primary vs. Urban Primary be given a higher priority for the next grade separation project candidates after implementing the Governorates' plans.

Although the urban transport policy in CREATS is to give higher priority to "people's mobility" rather than "vehicle's mobility", it does not mean the road development can be ignored. On the contrary, the sharp increase in vehicle ownership suggests that substantial increase of road capacity will be indispensable for Greater Cairo over the next 20 years. The major road capacity increase in the 20 million population (Year 2022) mega city can only be achieved by providing well-planned urban expressway system. The recommended urban expressway network is formulated with two major planning policies: 1) to establish an "inner ring road" to serve as a bypass for already heavily congested 6th of October and 26th of July elevated corridors, and 2) to function the expressway as a "mini-ring-road" for each urban center to reduce the congestion by preventing unnecessary through-traffic from entering into the urban centers surrounded by the Mini Ring Road.

The scenario testing results including not only the road network alternatives but also the public transport network alternative shows that the network performance between Scenario B and D are insignificant. The road network between the two scenarios are minor, which are only the fine-tuned expressway links, but it means the two scenario performance is similar in spite of the major difference in public transport network.

As will be discussed in Chapter 11, Scenario D is recommended as the master plan network. In the road network, it consists of the suggested at-grade primary/secondary arterial street improvements, grade separation projects, and regional primary highway improvements, and urban expressway.

5.5.2 Costing and Phasing Implications

The total outlay for infrastructure implementation in the road sector will require some 10.6 billion constant year 2001 LE, including 1.6 billion LE for committed projects. Costs are allocated by the five-year periods paralleling plan periods used by the Government of Egypt, and shown in Table 5.5.1.

Table 5.5.1 Staged Road Sector Total Investment Summary (The Master Plan)

(Unit: LE million)

Year	2002-2007	2008-2012	2013-2017	2018-2022	Total
Committed Projects Total	1,566	---	---	---	1,566
MOT	111	---	---	---	111
MHUUC	471	---	---	---	471
Cairo Governorate	518	---	---	---	518
Giza Governorate	357	---	---	---	357
Qalyobeya Governorate	109	---	---	---	109
CREATS Proposal Total	545	2,956	2,651	2,893	9,045
Regional Roads	190	59	78	0	327
Primary/Secondary	215	105	0	0	321
Grade Separation	140	140	140	105	525
Expressway	0	2,652	2,432	2,788	7,872
Road Sector Total	2,111	2,956	2,651	2,893	**10,611**

Source: JICA Study Team

The project list of the CREATS road sector project proposal is given in Table 5.5.3, as a breakdown of Table 5.5.1. Table 5.5.3 show the name of the proposed projects with code number, length, constant year 2001 cost, description, phasing implications and expected responsible government entities.

The phasing implications are designated based on the model performance of the volume to capacity ratio (V/C), and network necessity. The V/C ratios for year 2012 (intermediate year) and year 2022 (target year) and recommended implementation periods are shown in Table 5.5.2.

Table 5.5.2 Year 2012 and 2022 V/C and Implementation Period Recommendation

CREATS Proposal		V/C (2012)	V/C (2022)	Implementation Period				Agency
				02-07	08-12	13-17	18-22	
Regional Primary Highway Improvements								MHUUC
HR-9	Ring Road (on Maryooteya Road)	0.14	0.49	○				MHUUC
HR-10	Ismailya Desert Rd.	0.73	1.38			○		MHUUC
HR-11	Suez Desert Rd.	1.24	2.46		○			MHUUC
Primary Arterial Street Improvements								Governorates
HP-2	Saft El Laban Axis	0.76	1.24	○				Giza Gov.
HP-3	Rod El Farag Axis	0.49	2.12	○				Giza Gov.
HP-4	15th May St. Extension	0.63	1.03	○				Qalyobeya Gov.
HP-5	Ahmed Oraby St.	0.76	0.98		○			Qalyobeya Gov.
HP-6	Moasaset El Zakah St.	0.36	0.85		○			Cairo Gov.
HP-7	Ain Sukhna-Nasr City Rd. Extension	0.46	0.74		○			Cairo Gov.
Secondeary Arterial Street Improvements								Governorates
HS-1	New Masala St.	1.31	1.63	○				Cairo Gov.
HS-2	Tereat El Gabal St.	1.21	1.35	○				Cairo Gov.
HS-4	Tereat Tirsa St.	0.00	0.07		○			Giza Gov.
HS-5	Khafra St.	0.00	0.07		○			Giza Gov.
HS-6	Tereat El Zumur St.	1.82	2.44	○				Giza Gov.
HS-7	Imbaba Br. Reconstruction	1.25	3.18	○				Cairo/Giza Gov.
Intersection Grade Separation Projects								Governorates
HG-15	Alex. Dst. Rd. / 15th May Ext.	0.81	1.08			○		Cairo Gov.
HG-16	15th May Ext. / Ahmed Oraby	0.70	1.00				○	Qalyobeya Gov.
HG-17	Ring Road / Ahmed Oraby	0.83	0.95				○	MOT
HG-18	Moasasat El Zakah / Talaat El Gabal	0.61	1.01			○		Cairo Gov.
HG-19	Saad Sleam / Shobra	0.89	1.17			○		Cairo Gov.
HG-20	Madrasit El Mamaleek / Shobra	1.12	1.38	○				Cairo Gov.
HG-21	Thawra / Nozha	1.11	1.31		○			Cairo Gov.
HG-22	Autostrad / Ismailya El Fangary	1.08	1.31		○			Cairo Gov.
HG-23	Autostrad / Nozha-Abbas El Aqad	1.00	1.26		○			Cairo Gov.
HG-24	Dr. Abdallah El Araby / Dr. Zaker Hussein	0.35	0.54				○	Cairo Gov.
HG-25	A. Mohamed El Zumur / Hassan El Mamoun	0.66	1.21			○		Cairo Gov.
HG-26	Gaish / Port Said	1.27	1.60	○				Cairo Gov.
HG-27	Salah Salem / Tareq Magra El Ayon-Ain El Hayah	1.13	1.58	○				Cairo Gov.
HG-28	Malek Feisal / Maryooteya	1.02	1.40		○			Giza Gov.
HG-29	Haram / Maryooteya	1.33	1.71	○				Giza Gov.

Source: JICA Study Team

It should be noted that a hypothetical new organization name is allocated for expressway development. It is hypothetically named as "*Metropolitan Expressway Authority*". It is because if the expressway system is constructed as toll roads, which is recommended by CREATS, it is more appropriate to have an organization which exclusively takes care of these projects. It is particularly important to clarify

Table 5.5.3 CREATS Road Infrastructure Development Projects

CREATS Proposal		Length (km)	Unit Cost (LE mil)	Cost (LE mil)	Remarks	Implementation Period				Agency
						02-07	08-12	13-17	18-22	
Regional Primary Highway Improvements		66.8		327		190	59	78	0	MHUUC
HR-9	Ring Road (on Maryooteya Road)	3.8	50	190	New Road	○				MHUUC
HR-10	Ismailya Desert Rd.	36.0	2	78	Widening			○		MHUUC
HR-11	Suez Desert Rd.	27.0	2	59	Widening		○			MHUUC
Primary Arterial Street Improvements		28.3		200		104	96	0	0	Governorates
HP-2	Saft El Laban Axis	3.8	10	37	Widening	○				Giza Gov.
HP-3	Rod El Farag Axis	3.0	10	29	Widening+New	○				Giza Gov.
HP-4	15th May St. Extension	4.0	10	39	Widening+New	○				Qalyobeya Gov.
HP-5	Ahmed Oraby St.	3.0	10	29	Widening		○			Qalyobeya Gov.
HP-6	Moasaset El Zakah St.	10.5	3	28	Widening		○			Cairo Gov.
HP-7	Ain Sukhna-Nasr City Rd. Extension	4.0	10	39	New Road		○			Cairo Gov.
Secondeary Arterial Street Improvements		17.2		121		111	10	0	0	Governorates
HS-1	New Masala St.	6.0	5	30	New Road	○				Cairo Gov.
HS-2	Tereat El Gabal St.	3.0	1	3	Improvement	○				Cairo Gov.
HS-4	Tereat Tirsa St.	3.2	2	5	New Road		○			Giza Gov.
HS-5	Khafra St.	2.5	2	4	New Road		○			Giza Gov.
HS-6	Tereat El Zumur St.	2.0	2	3	Improvement	○				Giza Gov.
HS-7	Imbaba Br. Reconstruction	0.5	150	75	New Nile Bridge	○				Cairo/Giza Gov.
Intersection Grade Separation Projects		---		525		140	140	140	105	Governorates
HG-15	Alex. Dst. Rd. / 15th May Ext.	---	35	35	Flyover			○		Cairo Gov.
HG-16	15th May Ext. / Ahmed Oraby	---	35	35	Flyover				○	Qalyobeya Gov.
HG-17	Ring Road / Ahmed Oraby	---	35	35	Connection				○	MOT
HG-18	Moasasat El Zakah / Talaat El Gabal	---	35	35	Flyover			○		Cairo Gov.
HG-19	Saad Sleam / Shobra	---	35	35	Flyover			○		Cairo Gov.
HG-20	Madrasit El Mamaleek / Shobra	---	35	35	Flyover	○				Cairo Gov.
HG-21	Thawra / Nozha	---	35	35	Flyover		○			Cairo Gov.
HG-22	Autostrad / Ismailya El Fangary	---	35	35	Flyover		○			Cairo Gov.
HG-23	Autostrad / Nozha-Abbas El Aqad	---	35	35	Flyover		○			Cairo Gov.
HG-24	Dr. Abdallah El Araby / Dr. Zaker Hussein	---	35	35	Flyover				○	Cairo Gov.
HG-25	A. Mohamed El Zumur / Hassan El Mamoun	---	35	35	Flyover			○		Cairo Gov.
HG-26	Gaish / Port Said	---	35	35	Flyover	○				Cairo Gov.
HG-27	Salah Salem / Tareq Magra El Ayon-Ain El Hayah	---	35	35	Flyover	○				Cairo Gov.
HG-28	Malek Feisal / Maryooteya	---	35	35	Underpass		○			Giza Gov.
HG-29	Haram / Maryooteya	---	35	35	Underpass	○				Giza Gov.
Urban Expressway Projects		78.3		7,872		0	2,652	2,432	2,788	MEA *
HE-2	New Eastward Ramp from HE-2 to HE-1	1.2	61	73	New Ramp		○			MEA
HE-3	Expway No. 3 (Autostrad-Salah Salem Route)	24.3	93	2,270	New Viaduct		○			MEA
HE-4	Expway No. 4 (Abu Bakr El Sadeeq Route)	17.5	93	1,635	New Viaduct		○			MEA
HE-5	Expway No. 5 (Alex. Agriculture Rd. Route)	11.0	93	1,095	New Viaduct+Nile Br.			○		MEA
HE-6	Expway No. 6 (Suez Rd. Route)	7.5	93	1,118	New Viaduct+Tunnel			○		MEA
HE-7	Expway No. 7 (Gesr El Suez Route)	11.0	93	1,027	New Viaduct				○	MEA
HE-8	Expway No. 8 (Tereat El Zumur South Route)	3.0	93	280	New Viaduct				○	MEA
HE-9	Expway No. 9 (Tereat El Zumur North Route)	4.0	93	374	New Viaduct				○	MEA
Total for CREATS Project Proposals				9,045		545	2,956	2,651	2,893	

Source: JICA Study Team ** MEA: Metropolitan Expressway Authority*

the financial status of the organization so that it will crystallize its financial performance, and facilitate the foreign loan to minimize the financial cost. The implementation of the urban expressway itself needs many diversified issues to be tackled for long-term basis, which necessitates a exclusive organization to take care of these issues.

5.5.3 Financial Implications of the Toll Road System

The idea of the toll road system is to finance the project cost by loan, and pay back the loan by the toll revenue. Then the question will be how much the expected toll can generate revenue by the entering traffic volume on the expressway system. The purpose of preliminary financial analysis in this section is to observe what is the expected financial performance of the toll road project within the estimated conditions.

The toll system was assumed as flat toll. There are basically two toll systems for this type of project; one is *distance-proportional toll* and the other is *flat toll*. It is generally accepted that distance-proportional toll system is appropriate for long inter-city type of toll roads with relatively longer trip length, and flat toll system is more appropriate for urban expressway where the average trip length is relatively short. In this CREATS toll road analysis, it was assumed that the toll system is all **flat toll** for the proposed urban expressway.

The assumptions for project implementation periods are summarized in Table 5.5.4. It is assumed that the Inner Ring Road of the CREATS expressway system (**Package [P1]**; Route No. 3: Autostrad-Salah Salem Route, and No. 4: Abu Bakr El Sadeeq Route) will be constructed during the five years of 2012 to 2016, then the radial links (**Package [P2]**; Route No. 5: Alexandria Agriculture Road Route, No. 6: Suez Road Route, No. 7: Gesr El Suez Route, No. 8: Tereat El Zumur South Route, and No. 9: Tereat El Zumur North Route) will be constructed during the five years of 2017 to 2021. The Inner Ring Road will open to traffic in 2017, and the rest will open to traffic in 2022. The construction cost will be equally distributed during the 5 year construction period.

Table 5.5.4 Assumptions for Expressway Projects Implementation

Project Package	Period	2012-2016	2017-2021	2022-2041
P1	Expway No. 3 & 4 (L=41.8 km in Total)	(Construction)	(Operation)	(Operation)
P2	Expway No. 5, 6, 7, 8, 9 (L=36.5 km in Total)	----	(Construction)	(Operation)

Source: JICA Study Team

The assumed expressway operation performance and financial conditions are summarized in Table 5.5.5. The expected traffic volume on P1 is assumed flat (no increase) between year 2017 and 2021. The volume on the whole system (P1+P2) is assumed flat from year 2022 and afterwards. *These should be considered very conservative assumptions for this type of analysis.* The loan repayment period is assumed 20 years from year 2022, which will be until year 2041. Two cases are considered for the equity/loan balance of the project, which are, equity 10 % (loan 90 %) and equity 20 % (loan 80 %).

The traffic volume on the toll road will vary depending on the designated toll level[3]. In this section, the preliminary financial analysis is performed with an assumption of LE 3.0/entrance for the opening of Project Package P1 between year 2017 and 2021, and LE5.0/entrance after the opening of Project Package P2 in year 2022.

In this type of toll road project, the key will be normally the short-term finance. In this example it is assumed that the short-term borrowing interest is 15 %, considering the financial market conditions in Egypt.

[3] *The issue of the optimum toll level is given in Section 5.5.4: Sensitivity Testing.*

Table 5.5.5 Assumptions for Preliminary Financial Analysis

A) Traffic Volume:	2017-:	337,000 pcu/day	2022-:	502,000 pcu/day
B) Toll Level:	2017-22:	LE3.0/Entrance	2022-41:	LE5.0/Entrance
C) Annual Revenue: (300 days/year)	2017-:	LE303 mil./year	2022-:	LE753 mil./year
D) Investment Cost:	[P1] 2012-16:	LE3,896 mil.	(5 year average distribution)	
	[P2] 2017-2022:	LE3,888 mil.	(5 year average distribution)	
E) Fund Raising Conditions:		(Case 1)	(Case 2)	
	Equity Share:	10 %	20 %	
	Loan Share:	90 %	80 %	
F) Condition of the Loan:	Repayment of Capital:		20 years	
	Repayment Schedule (P1):		2017 - 2036	
	Repayment Schedule (P2):		2022 - 2041	
G) Short-term Loan:	15 % per annum			

Source: JICA Study Team

The results of the preliminary financial analysis for the two cases, Case-1 (10 % Equity + 90 % Loan) and Case-2 (20 % Equity + 80 % Loan) are shown in Table 5.5.6 and Table 5.5.7, respectively.

Table 5.5.6 Preliminary Financial Analysis Case 1: Equity 10 %, Loan 90 %

(Unit: LE million)

Interest Rate	3.0 %	4.0 %	5.0 %	5.2 %
First Year of Cash Flow Surplus	2022	2026	2039	2042
Accumulated Surplus up to Year 2041	LE6,186	LE4,923	LE1,250	LE0
Year of Maximum Short-term Loan	2019	2021	2031	2036
Total Amount of Short-term Loan	LE52	LE1,511	LE18,634	LE33,410
Max. Annual Short-term Loan	LE16	LE291	LE1,247	LE2,164

Source: JICA Study Team

Table 5.5.7 Preliminary Financial Analysis Case 2: Equity 20 %, Loan 80 %

(Unit: LE million)

Interest Rate	3.0 %	4.0 %	5.0 %	6.2 %
First Year of Cash Flow Surplus	2017	2022	2026	2041
Accumulated Surplus up to Year 2041	LE7,284	LE6,336	LE5,133	LE270
Year of Maximum Short-term Loan	---	2020	2021	2034
Total Amount of Short-term Loan	LE0	LE171	LE1,703	LE25,809
Max. Annual Short-term Loan	LE43	LE168	LE312	LE1,666

Source: JICA Study Team

Table 5.5.6 and Table 5.5.7 indicates that the accumulated surplus reduces as the loan interest increases. It shows that the maximum loan interest to maintain the project financially feasible is around 5 % in Case-1, and 6 % in Case-2. The return on investment (ROI) or the financial internal rate of return (FIRR) is 7.0 % for the project. This means the project can pay off if the loan can be borrowed with less than these interest rates. In these cases, however, the assumed equity is 10 % (LE778 million, assumed to be paid during the 10 year construction period), and 20 % (LE1,557 million, the same condition), which will, most probably, invested by the government, and will be reimbursed at the periods after repayment of the loans.

This implies that the project will pay off if the entity is successful in obtaining the reasonable financial structure. It is, however, difficult to fully privatize the whole project, such as full BOT, due to the low FIRR. The implication is that the most appropriate entity composition would be either government guaranteed public authority, such as the proposed Metropolitan Expressway Authority (MEA) to independently raise the fund with lower interest rate, or a Public Private Partnership (PPP) structure.

5.5.4 Sensitivity Testing

(1) Toll Analysis on the Expressway System

A sensitivity test was performed for optimization of the toll level for maximizing the financial performance. Table 5.5.8 shows the base case toll system of LE5.0 per entrance flat toll and three other cases of no toll, LE2.0 and LE10.0 and the expected Year 2022 daily traffic volume in pcu, and the expected daily toll revenue of the entire urban expressway system.

Table 5.5.8 Toll Level vs. Traffic Volume and Revenue

Toll Level (2001 Price)	Traffic Volume (pcu/day)	Revenue (LE mil./day)
No Toll	2,146,700	0.00
LE2.0 per Entrance	877,800	1.76
LE5.0 per Entrance	501,600	2.51
LE10.0 per Entrance	244,600	2.45

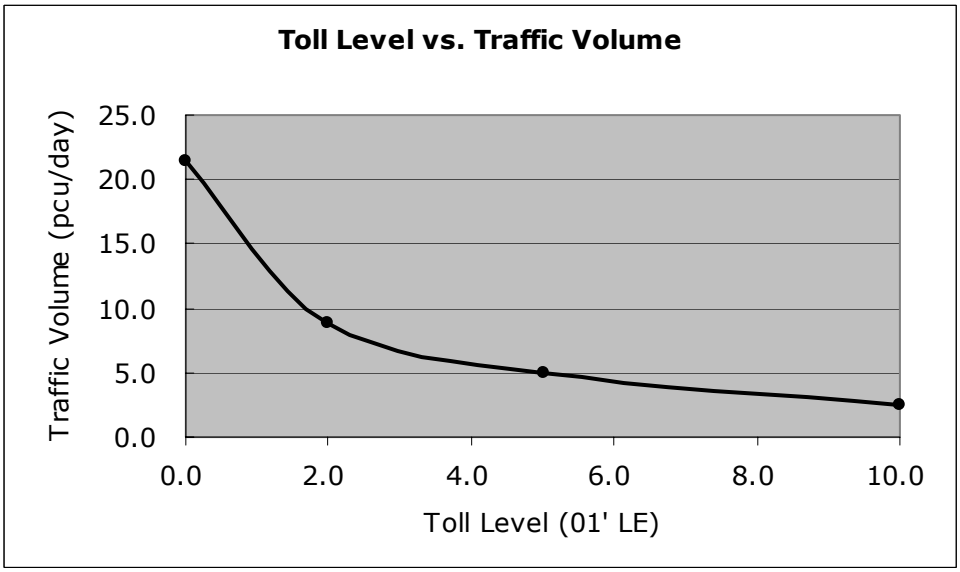
Source: JICA Study Team

These figures are drawn in the graphs in Figure 5.5.1 for traffic volume and Figure 5.5.2 for revenue.

Figure 5.5.1 shows that the traffic volume will sharply drop in accordance with the toll level. The economic benefit of the expressway will be maximum with no toll case, simply because it will maximize the traffic volume on the system. However, if the system is analyzed from the financial point of view, the increase of revenue caused by the higher toll will compensate the decreasing traffic volume. Figure 5.5.2 shows that the revenue is maximized with LE5.0 per entrance. The total

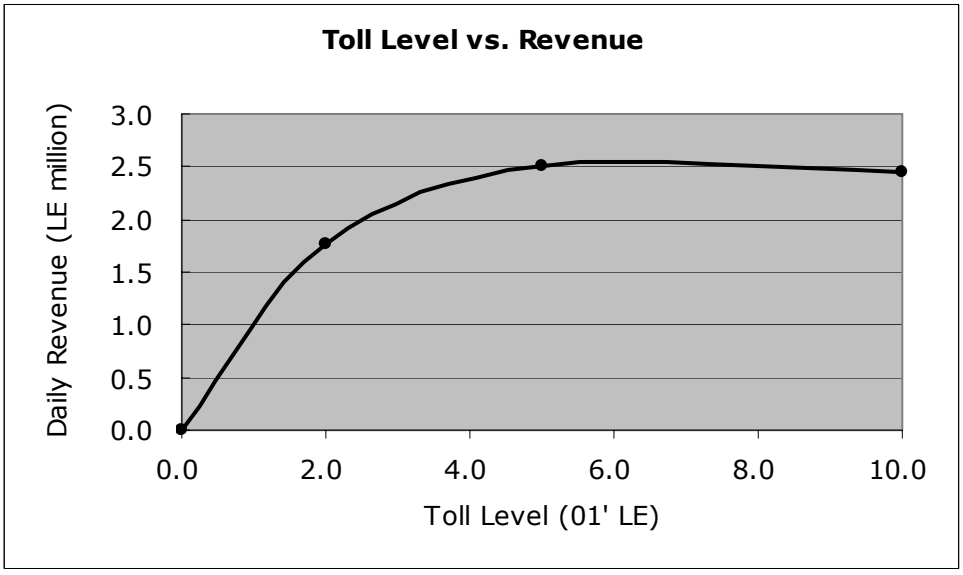
revenue will not decrease sharply with the toll higher than LE5.0 because of the balance of traffic volume drop and increase of the toll level, but there will be no reason to impose higher toll if the revenue is not significantly different.

This sensitivity testing results suggests that the toll level of LE5.0 will give the best financial revenue for the system, if the expressway system is developed as a toll road.



Source: JICA Study Team

Figure 5.5.1 Toll Level vs. Daily Traffic Volume on Expressway



Source: JICA Study Team

Figure 5.5.2 Toll Level vs. Daily Revenue on Expressway

(2) Road Network Performance WITH and WITHOUT Urban Expressway

The function of urban expressway is vital for vehicle movement in mega cities, however, it is often controversial in many of the cities. It is mainly because most of the cases the expressway is constructed as continuous viaduct over the existing arterial streets, and it will give a negative impact on urban aesthetics and other environmental aspects.

The well-planned urban expressway network, however, is the only possible system to increase the capacity, and improve the vehicle movement, which is vital for the urban economy. In the part of the sensitivity analysis, therefore, a hypothetical elimination of the urban expressway system from the final master plan network was tested in order to observe its impact on the entire road network. Table 5.5.9 shows the results of comparison among the several indicators, and Table 5.5.10 shows the mini-screen analysis results.

Table 5.5.9 WITH and WITHOUT Expressway Performance Evaluation

Indicator	WITH Expressway (Year 2022)	WITHOUT Expressway (Year 2022)
Average Trip Speed for All Modes (km/hr)	18.0 km/hr	15.7 km/hr
System Average Vehicle Speed (km/hr)	11.8 km/hr	10.7 km/hr
Private Transport Share (%)	42.1 %	41.5 %
2022 Daily Vehicle-km (pcu-km)	139,700,000	137,800,000
Average Volume/Capacity Ratio at Mini-screen Lines (V/C)	1.2	1.3

Source: JICA Study Team

The average vehicle speed will decrease from 11.8 km/hr to 10.7 km/hr, and other indicators also show a decrease. It is however interesting that the all-mode average trip speed will decrease by 13 %, which is more than other indicator values. The mini-screen analysis results also show that the change in the total volume against capacity is not drastic because of the capacity reduction. Particularly, mini-screen line No. 3: the Nasr City/Heliopolis vs. Central Cairo, No. 5: South Cairo vs. Central Cairo, No. 6: West Cairo vs. Central Cairo, will have more congestion problems than others.

This result implies that the role of the urban expressway is not only for the vehicle movement, but also for the all-mode trip speed. The evaluation of the multi-mode transport model can only show that the modal choice of person trip is not simple, but affected by many complex causes. The urban expressway system will increase the average person trip speed more than the average vehicle speed on the road.

Table 5.5.10 Mini-screen Line Analysis for WITH and WITHOUT Expressway

Mini-screen Line No.	WITH Expressway			WITHOUT Expressway		
	Daily PCU	Capacity	V/C	Daily PCU	Capacity	V/C
1	1,865,481	1,492,000	1.3	1,793,366	1,265,000	1.4
2	688,471	647,370	1.1	577,760	411,942	1.4
3	719,085	547,057	1.3	662,097	429,343	1.5
4	673,516	983,534	0.7	585,659	748,106	0.8
5	741,179	646,257	1.2	730,808	528,543	1.4
6	911,167	623,857	1.4	867,842	506,143	1.7
7	1,137,499	1,004,293	1.2	1,062,096	886,579	1.2
8	660,334	523,128	1.3	583,630	523,128	1.1
9	619,150	387,314	1.6	610,172	387,314	1.6
10	308,946	240,400	1.3	304,764	240,400	1.3
11	471,693	340,916	1.4	463,788	340,916	1.4
12	532,428	399,003	1.3	529,470	399,003	1.3
Total	9,328,949	7,918,387	**1.2**	8,771,452	6,666,417	**1.3**

Source: JICA Study Team

CHAPTER 6: CARGO TRANSPORT

6.1 EXISTING ISSUES, OPPORTUNITIES AND CONSTRAINTS

6.1.1 Introduction

A large share of the territory of Egypt is covered with desert, generating concentration of households and industrial and economic activity in a limited number of regions. Industrial production is expected to grow at an annual average rate of 9.5%. According to the most conservative estimates, population is projected to reach 80 million with the growth rate around 1.3% in 2017. Industrial development is the mainstay for establishing a production base and maximizing the export capabilities of the national economy. A growth rate of not less than 9% in the fourth five-year plan is targeted which would progressively rise to an average of 11% until 2017. As regards the major freight patterns in Egypt, the Alexandria Study came to the conclusion that as to the destination of many products, the suburbs of Cairo accounts for between 25% and 86% of total production / imports[1].

The last "*Study on the Transportation System and the National Road Transportation Master Plan*" (JICA, 1993) made a detailed analysis of freight traffic patterns in Egypt. This analysis demonstrated that cargo is transported predominantly between a limited number of cities / regions and the GCR is the major center of all traffic. In this study, present and future traffic patterns were estimated for a large number of commodities. An overall conclusion of this study was that both in present days and in the future (target year 2012), Cairo will remain the most important attraction pole of freight traffic, while the connection Cairo - Alexandria will remain the dominant corridor for freight transport.

This high concentration of industrial and economic activity is directly reflected in the truck movements which also concentrate on the GCR. Even if the present volume of trucks remains limited and its growth will be lower than the expected growth of private cars, action will have to be taken to avoid that trucks will either become a serious problem or will contribute / aggravate existing traffic problems.

[1] See: *Study on Master Plan and Rehabilitation Scheme of the Greater Alexandria Port in the Arab Republic of Egypt*, JICA, 1999

6.1.2 Issues

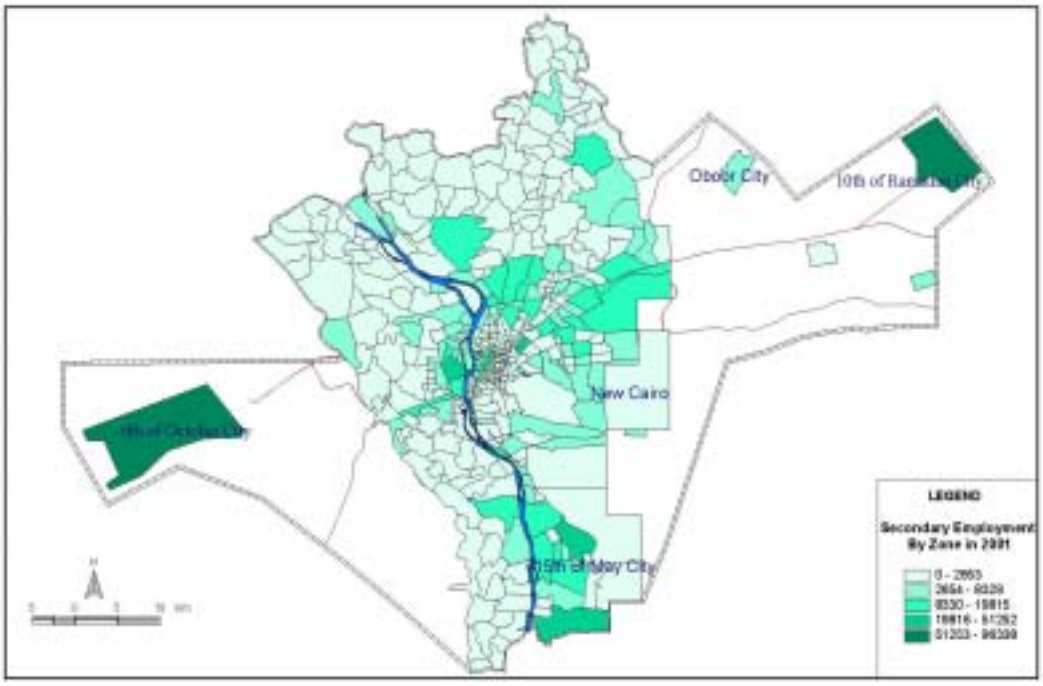
1) Industrial and economic activity

Being the center of economic and industrial activity in Egypt as well as the most densely populated region[2], Greater Cairo Region (GCR) is responsible for 38.6% of employment in the private sector[3]. With the construction of the new communities (6th of October City and 10th of Ramandan City) decentralization of industrial activity has emerged. This trend continued a previous wave of decentralization towards Nasr City, Badr City and El Oboor City. But a large number of small and medium sized industries remain operating inside the Ring Road area, in districts such as Helwan, Imbaba, Doqy, Shobra El Kheima and in the Cairo and Giza Business District.

Next Figure 6.1.1 visualizes the distribution of industrial activity in the GCR, based upon secondary employment. Secondary employment is a good indicator to evaluate the level of industrial activity, which in turn has a direct impact on truck traffic.

Although industrial activity will continue to re-locate away from the inner Ring Road areas towards the satellite cities, no major changes are to be expected in the year 2022 except a substantial increase in industrial activity.

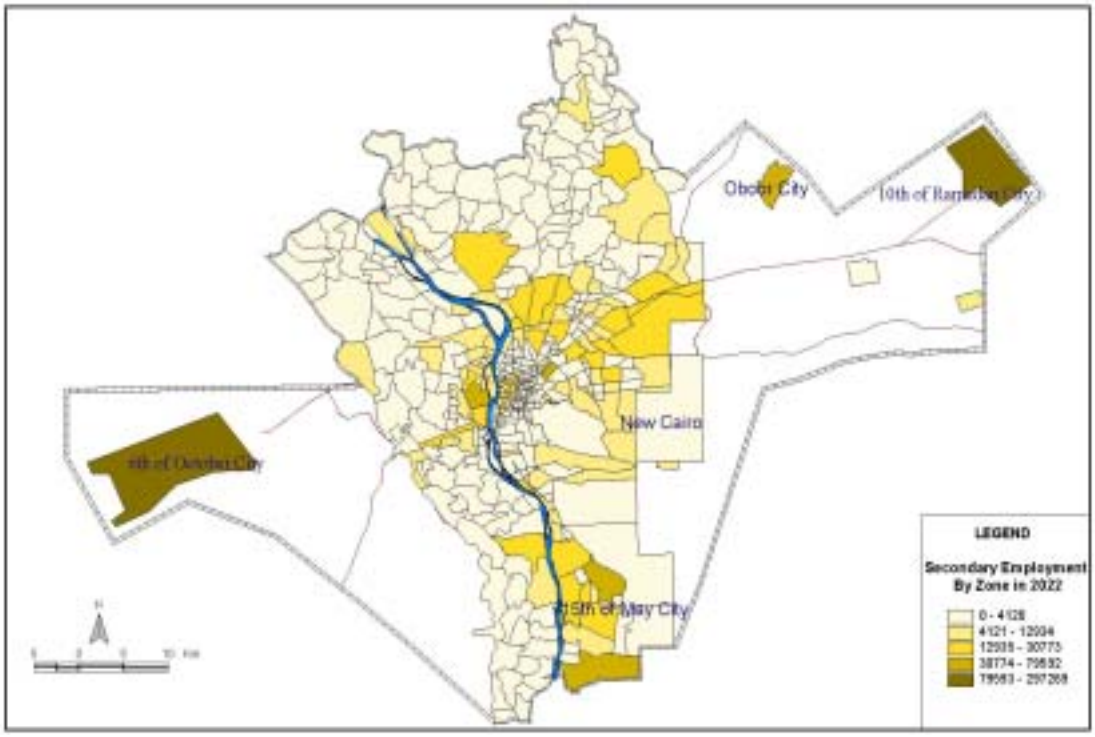
Overall distribution of secondary employment remains the same over the next 20 years (see Figure 6.1.2) from which can be deducted that the areas inside the Ring Road where at present industrial activity is relatively high, will continue to have similar levels of industrial and economic activity that influence traffic.



Source: JICA Study Team

Figure 6.1.1 Secondary Employment (2001)

[2] *See Technical Report (1) and Progress Report 2 for more detailed analyses*
[3] *Greater Cairo Atlas, 2000*



Source: JICA Study Team

Figure 6.1.2 Secondary employment (2022)

The industrial concentration in 6th of October City and 10th of Ramadan City will continue in addition to the industrial concentration in Nasr City, Oboor City and others. Next Table 6.1.1 provides a general overview of the industrial activity over the satellite cities.

Table 6.1.1 Economic Activity in the Satellite Cities

6th of October			
	Industry	Factories	Percentage
	Food Industry	140	9
	Wood and Iron Products Industry	51	3
	Plastics Industry	83	5
	Paper Products Industry	73	5
	Textile Industry	87	6
	Electrical Products Industry	143	9
	Building Material	178	11
	Metalworking Industry	121	8
	Chemical Industry	130	8
	Others	573	36
	Total	1.579	100
Badr City			
	Industry	Factories	Percentage
	Food Industry	13	3
	Wood and Iron Products Industry	28	7
	Plastics Industry	40	10
	Paper Products Industry	29	7
	Textile Industry	44	11
	Electrical Products Industry	30	8

	Building Material	32	8
	Metalworking Industry	24	6
	Chemical Industry	28	7
	Others	120	31
	Total	388	100
10th of Ramadan			
	Industry	Factories	Percentage
	Food Industry	273	16
	Wood and Iron Products Industry	115	7
	Plastics Industry	209	12
	Paper Products Industry	72	4
	Textile Industry	239	14
	Electrical Products Industry	151	9
	Building Material	110	6
	Metalworking Industry	73	4
	Chemical Industry	119	7
	Others	360	21
	Total	1.721	100
El Oboor			
	Industry	Factories	Percentage
	Food Industry	200	21
	Wood and Iron Products Industry	160	17
	Plastics Industry	124	13
	Paper Products Industry	76	8
	Textile Industry	98	10
	Electrical Products Industry	101	11
	Building Material	73	8
	Metalworking Industry	34	4
	Chemical Industry	57	6
	Others	22	2
	Total	945	100

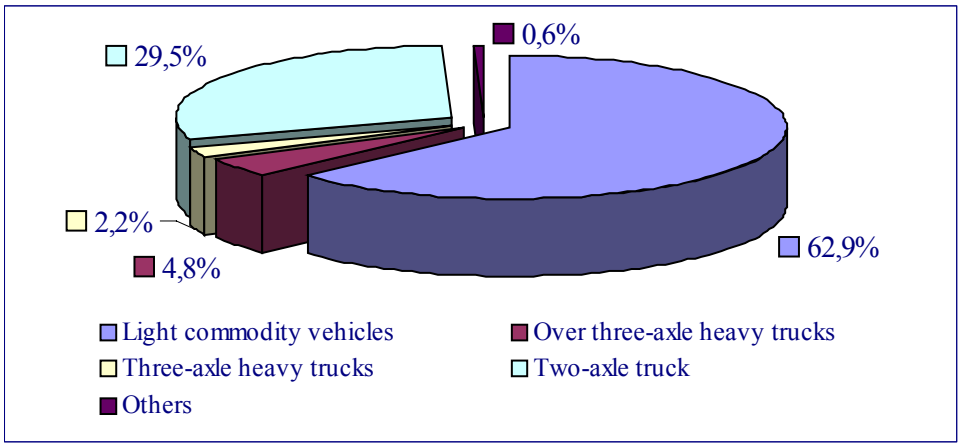
Source: JICA Study Team

2)Sector Characteristics

The structure of the transport sector has a direct impact on the modal split and the potential to future modal shifts. Although in the first analyses the number of trucks was important in some corridors and areas, this does not accurately reflect the level of impact of truck traffic on mobility. While heavy trucks (3 axles and more) have a high impact, the impact of small utility vehicles and 2 axle trucks is lower because they have the same characteristics and impact as passenger cars[4].

Although the total volume of trucks is high, almost 65% are light commodity vehicles (pick ups) with a PCU value equal to 1 (same impact as a passenger car). Increasing that percentage with the percentage of 2 axle trucks that also have a PCU value of 1 means that over 90% of all trucks are smaller truck vehicles with the same characteristics of passenger cars (see next Figure 6.1.3). It could be deducted thereof that measures proposed in the Master Plan to improve car traffic will also benefit the mobility of 90% of the trucks and that as a whole the impact of trucks on traffic in the Greater Cairo Region is moderate and will remain so in the future.

[4] *This is reflected in the PCU value (Passenger Car Unit) of the different truck types. To accurately calculate the impact of trucks on the roads, the number of vehicles has therefore to be translated into PCU-equivalents.*



Source: JICA Study Team

Figure 6.1.3 Distribution of Truck Types

As visualized in Figure 6.1.4, large trucks are mainly owned by transport and manufacturing companies. Large-sized transport companies concentrate on high-volume contracts with industries and agricultural corporations, while manufacturers continue to transport their manufactured products in stead of outsourcing this activity to specialized companies[5].

This element, although not really relevant for truck traffic, is highly important for the efficiency in transport, as will be discussed at the end of this chapter, where the recommendations are formulated to improve the mobility of trucks and increase the efficiency of cargo transport.

Source: JICA Study Team

Figure 6.1.4 Truck Types per Sector

[5] *See for a more detailed sector analysis Progress Report (2).*

3) Modal Split

In 1993, detailed forecasts were made of intercity freight traffic patterns in Egypt for each transport mode using alternative methodologies[6]. Estimates according to the different evaluation methods demonstrated that no significant changes can be expected in the modal split. Road transport will continue to dominate the transport market with over between 88% and over 90% of total cargo transported. Railway transport will transport between 2% and 4% of total cargo while waterway transport will, depending upon the calculation method, remain at a constant share of 2% of the total market or increase to 7.7%.

Caution should however be applied in the interpretation of the results of this study. Both waterway and railway transport costs were based upon present transport conditions of high volume bulk products using large barges and train-combinations.

The forecasts for railways and waterways are or can thus change by

- Efficiency improvements that could open new markets;
- The further expansion of containerized transport;
- Cargo consolidation in transit points;
- Policy measures.

The *Railway* network was originally designed to transport bulk and low value cargo. The 1996 study of the railway sector[7] argued that "As for freight transport, ENR currently uses railway's strength in large volume transport to transport iron ore and phosphates, but detailed study is necessary to decide what role ENR should play in general and containerized freight. But one point which is certain is that ENR has many low volume freight stations in short distance and this fact greatly damages train operation efficiency and wastes the precious transport capacity of the track. ENR should close those small stations and try to shift cargoes handled there to adjacent larger improved railway stations as much as possible." (p 9-54).

The *waterways* are confronted with similar problems as the railway sector. Only around 2.2 million tons are transported over the Nile per year[8], which is substantially below its real potential. But substantial efforts are made to upgrade Nile river traffic and to create new opportunities for freight traffic to and from Cairo.

The planned Intermodal terminals for railway and river transport could contribute to improve the competitiveness of these alternative modes. However, it will require more than infrastructure of terminals to develop alternative transport in Egypt. Infrastructure alone will not solve the problems of river and rail transport. Both sectors urgently need operational, structural and even conceptual transformations because at present, the rail and waterway transport sector:

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[6] *Study on the Transportation System and the National Road Transportation Master Plan, JICA, 1993 See for a more detailed discussion Progress Report 2*

[7] *The Master Plan Study for Egyptian National Railways", JICA, December 1996*

[8] *Information provided by the River Transport Authority*

- Is still overstaffed and under-experienced;
- Offers low quality vessels and railcars;
- Is badly adapted to cover economy-driven transport requirements;
- Shows low competitiveness due to a lack of expertise in management, marketing and cargo handling techniques

6.1.3 Constraints

Cargo transport in the future can be summarized as follows:

1. Road transport will remain the dominant mode for transporting cargo.

2. Both the railway and waterway authorities will increase the competitiveness of their sectors and their share in transport could increase in the future.

3. No substantial changes are to be expected in the future regarding truck traffic patterns and transport methods. The necessary changes will require a sector-based shift in mentality to adapt modern logistics principles. It will also need a substantial increase in expertise to apply modern transport concepts. These problems cannot be solved by constructing new infrastructure, but require investments in equipment, technology and human expertise. All tasks that only the private sector can achieve by it that public policy measures can stimulate and guide the evolution.

Therefore, in addition to the infrastructure, other elements need to be taken into consideration and potential effects of newly emerging patterns evaluated when formulating recommendations to improve cargo transport conditions in the Greater Cairo Region.

First, the Railway and River Authorities have started a major restructuring program to increase their role in freight transport. This strategy is presently concretized via the development of *Ather el Nabi Port* (river transport) and the planned *Bashtil dry port* (rail transport). The issue is discussed in more detail in Chapter 7.

Second, while the connection Cairo - Alexandria will remain dominant but the importance of the Ismailya corridor will increase taking into account the planned development of Sinai and the future performance of Damietta port.

Third, the expected stability in industrial location in the GCR will dominate truck traffic patterns now and in the future, and in spite of several efforts to change the patterns, they will remain relatively unchanged over the next 20 years.

Fourth, cargo transport is not an industry in its own but a service provider to the Egyptian industry. Its future therefore depends upon future industrial demand. Changes in industrial production therefore could change cargo transport patterns and methods. The possible impact of this phenomenon cannot be estimated, but should however be kept in mind while formulating recommendations.

Fifth, the privatization of the transport sector will continue. The structure of the transport sector will change and innovations will be introduced by entrepreneurs who wish to obtain a competitive advantage. This evolution is depending upon the willingness and inventiveness of the private sector. The role of government is to ensure that the conditions are in place to allow private initiative and to stimulate / support these initiatives.

6.1.4 Opportunities

Although the transport sector tends to remain as it is, privatization and governmental initiatives can contribute in improving cargo transport efficiency and in time contribute to create Intermodal transport systems that will alleviate the roads in the GCR from the present volumes of truck traffic.

1) Transport sector opportunities

A general structure of a modern and competitive transport market has to consider following driving forces:

- The *Supply Side*, which can be considered as the transport service offer
- The *Demand Side*, which refers to the needs of the industrial and production sectors in terms of transport services
- The *Regulatory Side*, which is government intervention that directly and indirectly structures markets and competition and provides for the basic infrastructure.

Governments constantly try to combine the needs of the industry with other priorities, predominantly the needs of citizens and (in western societies) the environment (natural habitat, flora and fauna, pollution levels, etc…). Policies impose rules and regulations to industries and manufacturers on the one hand, and on the transport sector on the other hand. The industrial and manufacturing sectors integrate these policies into their production processes and evaluate the costs related to that impact. From that perception, their processes in terms of costs and productivity are optimized. These decisions directly affect their needs in terms of transport, forcing the transport sector in constantly improving their service. The obligation of the transport sector to meet simultaneously governmental rules and industrial needs forces a constant improvement in process technology and innovative strategies. ICT applications (Information and Communication Technology) such as Electronic Data Interchange (EDI) are one of the driving forces in this innovation process.

This need for innovation and efficiency improvement can be a catalyst to

- Industrial reform where transport is *outsourced* to the transport sector;
- Industrial re-location according to sector-specific needs;
- Transport infrastructure improvement / development;

- Increased use of alternative transport;
- Development of multi-modal and integrated transport and in time Intermodal transport.

4)The human factor opportunity

Although further infrastructure development and regulatory action is necessary to improve present conditions, the impact of the *Human Factor in Transport* should not be underestimated. The human factor includes several components, related to professional expertise, transport system management, management attitudes operational knowledge, etc….

Two particular opportunities are a consequence of the liberalization and privatization process:

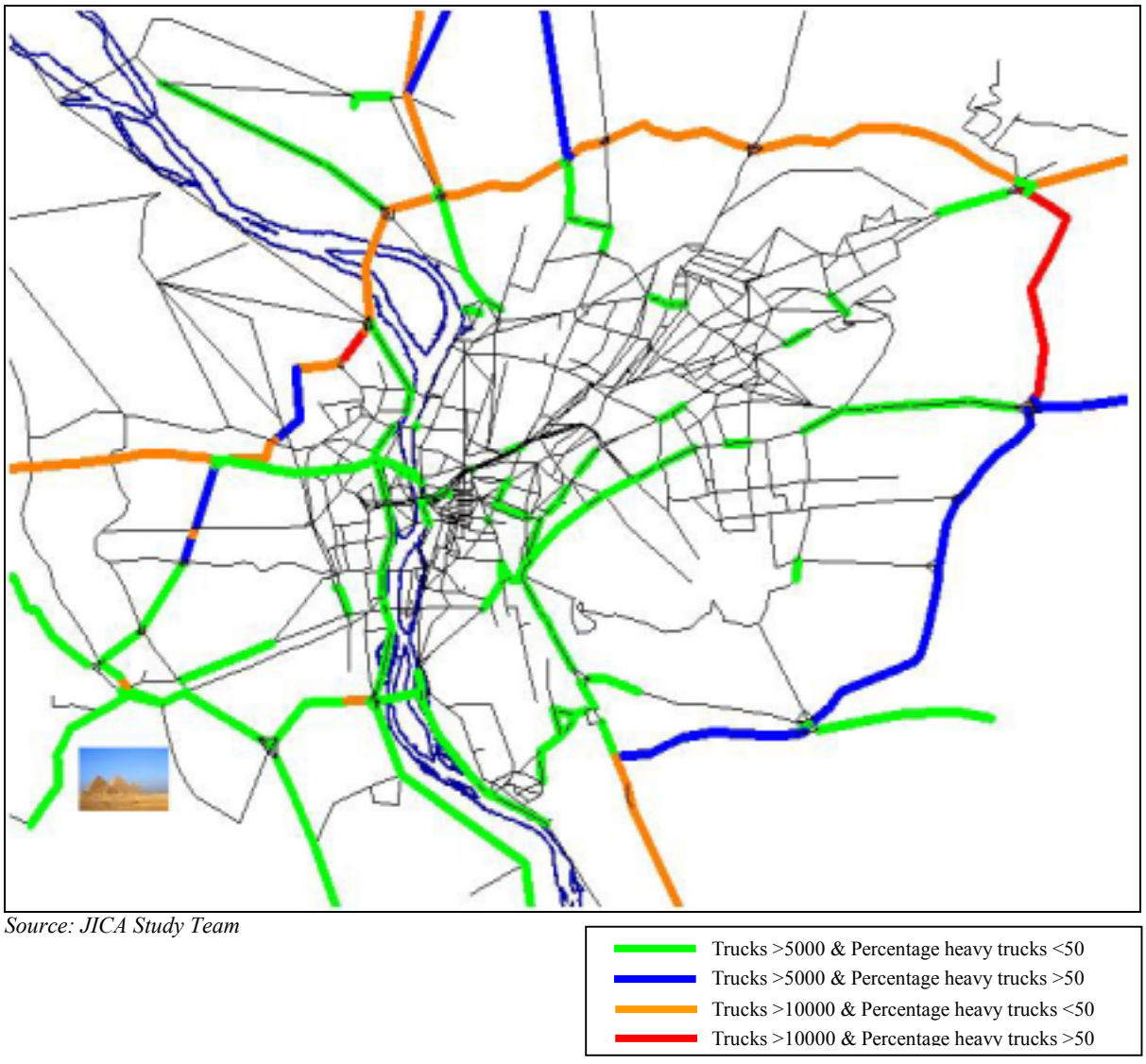
- *Increase regulatory control to structure the transport sector and improve the quality of services*;

- *Increased efficiency and innovation* at the level of (transport) operations and management as a consequence of free competition.

6.2 PRESENT TRUCK VOLUMES AND FLOWS

6.2.1 Truck Volumes

The volume of trucks and the distribution between heavy and light trucks is visualized in next Figure 6.2.1.



Source: JICA Study Team

Figure 6.2.1 All Day Truck Volumes (PCU) by Direction (2001)

Outside the Ring Road

The percentage of trucks at the outer boundary of the Study Area increases at some points to 80% of total vehicles counted, but on average, it is between 20% and 40% of total traffic[9].

Alexandria Agricultural Road is the most important freight route to and from Cairo. In one day, over 60,000 vehicles were counted on that road. The percentage of cargo in total volume is however moderate (29%) although this moderate percentage still means 26,000 trucks per day. Food stuff, in particular fruits and vegetables take up a large share of truck traffic on the Cairo - Alexandria corridor. Also animals are in high numbers transported via Alexandria Agricultural Road. Transport of petroleum products and cement is also present on this road and is transported from Alexandria port into the region of Cairo. Finally, Alexandria Port is the most important origin / destination of manufactured products, most of which are transported to the Cairo region by truck over Alexandria Agricultural Road.

Ismailya Desert Road is the second largest traffic generator for the Cairo region, with on one day over 32,000 vehicles counted. Contrary to Alexandria Agricultural Road, the percentage of cargo is very high, 76% but the actual volume is half of the actual volume on Alexandria Agricultural Road, namely 13,000 trucks per day. The percentage of trucks is particularly high because trucks from Ismailya Desert Road merge with truck traffic to and from 10th of Ramadan City and Oboor City, and with traffic from Belbies Road and Shatanouf - Ashmoun Road. An increasingly important share of this traffic is container transport from Damietta port that sends 70% of its container imports to the Cairo region, the same percentage can be noted for steel imports via Damietta port. Also over 80% of the port's agricultural trade is destined for Cairo. All these products are transported to Cairo predominantly via the Desert Road.

Finally, Autostrad also has a high concentration of trucks with a PCU volume above 10,000 per day per direction on its section before the Ring Road. This traffic, coming from the Upper Egypt, is only partly destined for 15th of May City and Helwan and the inner Ring Road area (predominantly via the extension of Autostrad). Most traffic is destined to other areas and continues its journey via the Ring Road. The availability of two roads on the opposite side of the Nile linking Upper Egypt with Cairo reduce overall truck PCU volume on both roads below 10,000 per day per direction. Traffic arriving via these roads generally converges towards 6th of October City and on to the Ring Road, while trucks enter the city via the Tereat El Zumur Route (both north and south branch). Cargo on the Upper Egypt corridor consists predominantly of agricultural products and food stuff destined for the Cairo region and the wholesale markets in 6th of October City and Oboor City.

Several of the locations outside the Ring Road have a truck volume above 5,000 PCU per day per direction. In this group, the range between the first and the last is substantial, varying from 9,488 trucks per day (45% of total number of vehicles) on Upper Egypt Agricultural Road to 5,528 trucks (or 41% of total number of vehicles)

[9] *Based upon Cordon Line Survey results (see for details Progress Report (2))*

on Ismailya Agricultural Road. All major roads on the corridor towards 6th of October City and the west section of the Ring Road have over 5,000 PCU per day per direction. This is mainly due to the convergence of several major roads in the area such as the Upper Egypt Desert and Agricultural roads; the Ring Road, the roads to Al Wahaid and Al Fayoun and Alexandria Desert Road.

The Road to Qatameya and to a lesser extent, Suez Desert Road are generating important volumes of truck traffic, the former with over 10,000 PCU per day per direction, the latter over 5,000 PCU. This traffic consists of cement and steel from the cement factories and industries along these roads. Also the port of Suez generates traffic, either imported products transported to Cairo, or container transit traffic from the Mediterranean ports to the Red Sea.

The Ring Road

The influx of trucks via Alexandria Agricultural Road and Ismailya Desert Road (to 10th of Ramadan City) feeds the entire Ring Road from the western entrance (26th of July Corridor) until Suez Desert Road. The entire section has a truck volume over 10,000 PCU per day per direction. The impact of Qatameya and Autostrad is less important, generating only 50% of the volume on the rest of the Ring Road (5,000 PCU per day per direction).

Although the Ring Road is a major corridor for transit traffic between the different corridors, a share of it enters the area inside the Ring Road, in particular via accesses close to areas where industrial activity is higher than average, in particular Giza, Doqy, Imbaba, Shobra El Kheima, Nasr City, and CBD.

Inside the Ring Road

Contrary to what could be expected, only a slight number of roads within the Ring Road area have an important percentage of trucks, concentrated on city access roads and some inner-city transit corridors.

Truck concentration can be found at the end of major inter-city roads, road to Alexandria Agricultural Road, Esco School Street toward the road to Belqas, Gesr El Suez to 10th of Ramadan City, the roads leading towards 6th of October City and Autostrad - Salah Salem Route (extension of Autostrad) along almost its entire line between Autostrad and Suez Desert Road. Also the Thereat El Zumur Route as well as Cornish Street cater for a more than average share of trucks.

The traffic patters are closely linked to the industrial and economic activity centers inside the Ring Road. Most trucks servicing the Shobra El Kheima area continue along the road to Alexandria Agricultural Road until the intersection with Abu Bakr El Sadeeq route. The extension inside the Ring Road of the road to Belqas (Esco School Street) is at present also an important entrance point. Both roads accommodate daily truck volumes of over 5,000 PCU.

Gesr el Suez towards 10th of Ramadan City, Autostrad - Salah Salem Street and to a lesser extent Abo Baker el Sedek Street have higher than average truck volumes.

They are mainly generated by industrial and economic activities in Salam City, Ain Shams and Nasr City. Although Nasr City has an additional three connections to the Ring Road, namely Ahmed el Zomor Street, the Corridor from the Ring Road to Amel City and the corridor from the Ring Road to El Moqatam, all truck traffic at present concentrates on Autostrad - Salah Salem Street.

Helwan and 15th of May City are also responsible for a more than average share of trucks on El Cornish, while Tereat El Zumur route (both south and north bound) is frequently used to serve the industries and economic service centers in Giza, Doqy, Imbaba etc… on the west side of the Nile.

But on average, the impact of truck traffic inside the Ring Road area is low with most roads having truck concentrations below 20% of total truck volume.

The Nile Bridges

Truck traffic patterns combined with the truck ban inside the Ring Road area directly influence trucks volumes on the Nile Bridges[10].

Warraq Bridge and Marazeeq Bridge both counted over 50% of trucks. Delta Bridge has a share of approximately 30% of trucks. The other 6 bridges, located inside the Ring Road, have a share of trucks that is below 10% of total vehicles. The bridges with a high percentage of trucks have a total volume that is far below the inner city bridges like 6th of October and 15th of May bridges.

Trucks between Cairo and 6th of October City move either via the north or the south, using predominantly northbound 15th of May Bridge and 6th of October Bridge and towards the south Moneeb Bridge. Both former bridges are used for to link 6th of October City with the CBD, while Moneeb Bridge is also used by traffic that continues along the Cornish to 15th of May City, Helwan and Maadi. Trucks on Moneeb bridge count for 20% of total traffic against only 5% on 15th of May Bridge. Total traffic on the latter is, however, over 130,000 vehicles per day so the total number of trucks is much higher on 15th of May Bridge.

6.2.2 Heavy Truck Impact

Interesting information on the impact of heavy trucks can be obtained when distinguishing between small trucks and pick up trucks on the one hand and heavy trucks (3axles and more) on the other hand.

The Ring Road

Only a small part of the Ring Road can be identified where traffic density is above 10,000 PCU per day per direction and has at the same time over 50% of heavy trucks. This section between Ismailya Desert Road and Suez Desert Road extends towards Autostrad where the percentage of heavy trucks remains above 50% but the total volume of trucks has dropped between 5,000 and 10,000 PCU per day per

[10] *Screen Line Survey results (see for details Progress Report (2))*

direction. With the exception of a small section at the end of the Ring Road, the rest of the Ring Road has a percentage of heavy trucks below 50%. The impact of heavy trucks on traffic flows on the Ring Road is therefore low for most sections and can, for analytical purposes, be ignored as a possible problem.

Outside the Ring Road

1. Alexandria Corridor

The Alexandria Agricultural Road is at present the most important truck route. Pick Up trucks and two-axle trucks represent 79% of total trucks while the largest truck type is responsible for only 19% of total volume[11], going to / coming from Alexandria port and serving the factories (car assembly, glass, cement, etc…) that are located in that Lower Delta region. Up north on Alexandria Agricultural Road, there is a clear separation between heavy and light trucks. While light trucks continue on Alexandria Agricultural Road, heavy trucks predominantly divert to the west towards the road to Belqas, which over its entire length has a share of heavy trucks above 50%. This could indicate that this road is frequently used by heavy trucks as alternative for Alexandria Agricultural Road. But the total number of trucks remains low on this alternative road where capacity is sufficient to accommodate traffic.

The Alexandria corridor has following truck traffic characteristics:

- Alexandria Agricultural Road, is a major throughput line for agricultural production for which pick up trucks and 2 axle trucks are commonly used;
- The corridor connects Cairo to Alexandria port and the economic and industrial centers, generating heavy truck volumes along Alexandria Agricultural Road and along the road to Belqas that is frequently used as alternative route;
- The Alexandria Agricultural Road and the road to Belqas are sometimes used as alternative for Alexandria Desert Road (toll road).
- The capacity of Alexandria Desert Road is sufficient to accommodate present volumes of truck traffic. Contrary to expectations, truck volume is between 5,000 and 10,000 PCU per day and per direction. The percentage of heavy trucks remains below 50% of total truck traffic.

2. The 6th of October City Corridor

The roads between Cairo and 6th of October City and certainly the end of the Ring Road and 26th of July Corridor have small trucks in substantial volumes. These roads are used to transport industrial and agricultural products to the factories and the wholesale market respectively and later on to Cairo and other destinations for final consumption.

[11] *See Progress Report (2)*

6th of October City is predominantly supplied from the south via Alexandria Desert Road and Upper Egypt Desert Road and via Upper Egypt Agricultural Road. The roads to Al Wahaid and Al Fayoun with a volume over 5,000 PCU per day per direction have a percentage of trucks below 50% of truck volume. From the north, 26th of July Corridor is the dominant connection, serving together with the Ring Road as link with Alexandria Agricultural Road and via 15th of May Bridge and 6th of October Bridge with the industries in Giza and Cairo CBD.

In addition to the 26th of July Corridor, several other roads between 6th of October City and Cairo are used as link with Cairo and show a higher density of truck traffic, predominantly light trucks.

3. Ismailya - 10th of Ramadan Corridor

Ismailya Desert Road is characterized by dense truck traffic (over 10,000 PCU per day per direction) that serves four specific areas, namely Oboor City (in particular the wholesale market), 10th of Ramadan City, Ismailya and the Ports of Port Said and Damietta. The effect of truck traffic on the extension inside the Ring Road remains limited, with only Gesr El Suez (extension of the Ismailya Desert road) showing a density above 5,000 PCU per day per direction.

Truck density on Ismailya Agriculture Road is below 5,000 PCU per day per direction. Trucks on this road do not cause problems, not even at its extension inside the Ring Road. The effects of heavy trucks can therefore be ignored.

4. Suez and Qatameya corridor

Truck traffic on this corridor is on average below 10,000 PCU per day per direction but is dominated by heavy trucks, predominantly entering the Ring Road via Suez Desert Road. In addition to trucks coming from Suez port, trucks serving the large number of cement factories along this road generate the high volume of heavy trucks. Contrary to Suez Desert Road, Qatameya Road has a share of heavy trucks that remains below 50% while the density is also between 5,000 and 10,000 PCU per day per direction.

The high number of heavy trucks accessing the Ring Road via Suez Desert Road joins traffic of the northern section of the Ring Road, making the stretch between Ismailya Desert Road and Suez Desert Road in terms of heavy trucks the most dense road section of the entire road network. That particular section has a density of over 10,000 PCU per day per direction, of which more than 50% are heavy trucks.

5. Upper Egypt Corridor

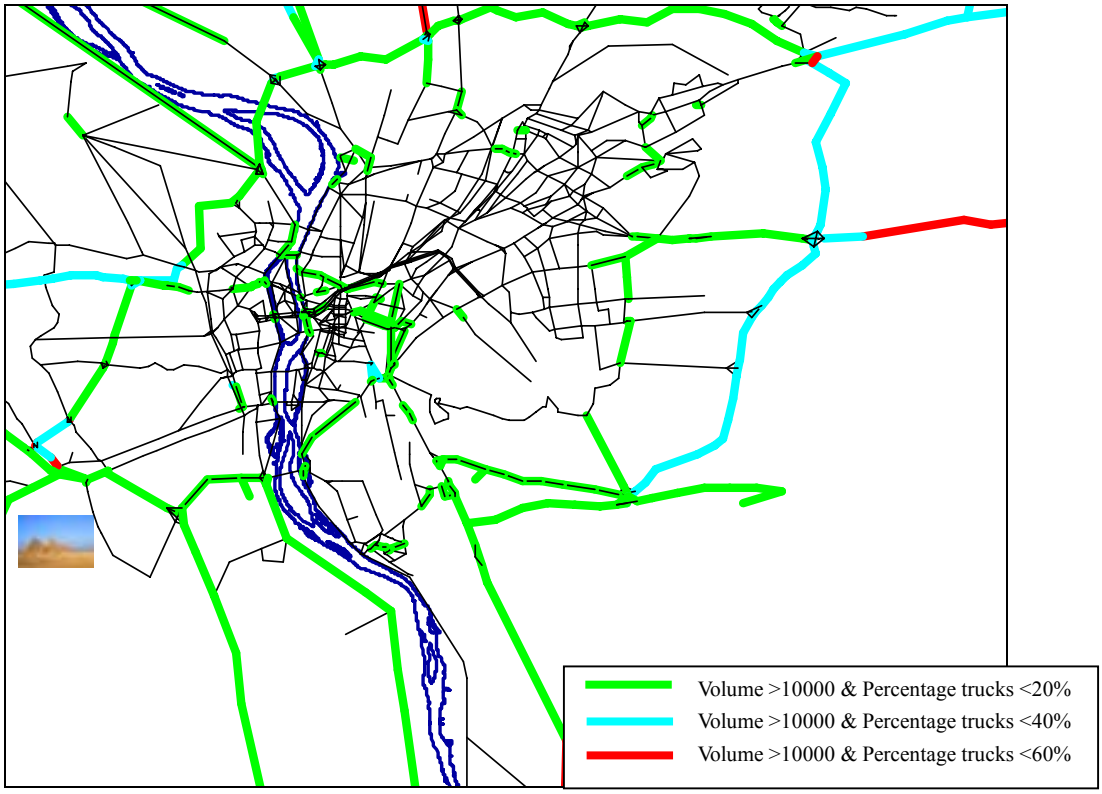
Upper Egypt is connected through Cairo via three different roads, namely Autostrad, Upper Egypt Agricultural Road and Upper Egypt Desert Road. Most trucks on Upper Egypt Agricultural Road and Upper Egypt Desert Road are small two axle trucks and pick-up trucks, used to transport agricultural products from the Upper Nile Delta to Cairo and to 6th of October City (in particular to the wholesale market). Traffic entering Cairo either continues towards the Giza and CBD area or it crosses the Nile

via Moneeb Bridge to serve 15th of May City, Helwan and Maadi. This traffic predominantly uses the Thereat El Zumur Route to reach their destinations in the north or the south.

Contrary to the other two access roads, Autostrad has denser truck traffic that serves Upper Nile industries and the industries located in Helwan, Maadi etc... Given that it is the only route on that side of the Nile, total truck density is higher than on the two other roads. On average, a truck volume of more than 10,000 PCU per day per direction was counted on Autostrad.

6.2.3 Percentage of Trucks in Total Traffic

Analyzing the percentage of trucks in total traffic on the road network gives additional information to validate and fine-tune previous results. As can be seen in next Figure 6.2.2, there are only a limited number of areas inside the Study Area where truck traffic could at present generate problems. Compared to truck traffic volumes inside the Ring Road, outside and on the Ring Road the share of trucks is substantially higher, demonstrating the positive effect of the truck ban. Next Figure 6.2.2 visualizes the percentage of trucks on the roads and indicates that on average, trucks are not the cause of traffic problems that are occurring on the roads in the Greater Cairo Region. This does not mean however that the percentage of trucks is low everywhere or that there are not locations where trucks are causing traffic problems. It means that the supposition is valid that solutions for the traffic problems have to be found elsewhere.



Source : JICA Study Team

Figure 6.2.2 Share of Trucks of Total PCU volume >10,000 (2001)

Outside and on the Ring Road

Considering roads where truck volume is above 10,000 PCU, only 5 road sections have a truck density above 60% of total traffic (red lines). These are:

- Autostrad below 15th of May City
- Suez Desert Road (near the cement factories along the road)
- Road to Belqas
- Access ramp to the Ring Road on Ismailya Desert Road
- Mansourayya Canal (near 6th of October City)

The first two areas in the list are far from the Ring Road and do not cause any direct negative effects on traffic. The high share of trucks on the road to Belqas might indicate that many drivers take this road as alternative for the congested Alexandria Agricultural Road. The high percentage of heavy trucks increases the total impact of trucks on this road[12]. The two latter road sections are very short, each with a distance below one kilometer and are therefore a much localized problem.

The eastern Ring Road between Qatameya Road and Ismailya Desert Road and the latter road itself have a share of trucks between 40% and 60% of total traffic. Although the share of trucks is important (as is the total volume), truck traffic on these roads do not directly generate problems, given that the capacity of the roads is sufficiently high to cater for this amount of truck traffic. The cement industry along Suez Desert Road, combined with traffic to and from the port of Suez, generates in the GCR the highest percentage of truck traffic (over 60% of total traffic). The ramp to access and exit the Ring Road on the crossing with Ismailya Desert Road is a location where trucks on the Ring Road enter into a bottleneck. Other road sections with a share of trucks above 40% are near the boundaries of the study area and do not generate concrete problems.

Most access roads and the largest parts of the Ring Road have shares of truck traffic between 20% and 40% of total traffic. In case of traffic congestion on these roads the impact of the trucks remains limited.

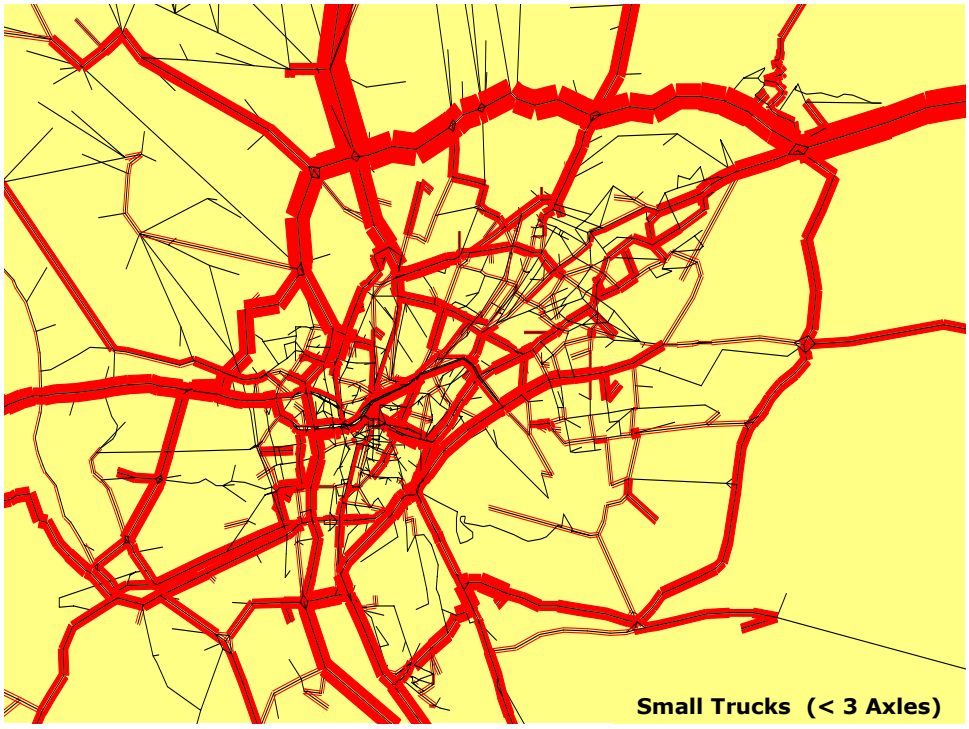
Inside the Ring Road

Most streets inside the Ring Road have a share of trucks that is below 20% of total traffic, and nowhere the share increases above 60% of total traffic. Compared to the total road network, the level of trucks in the city is low on almost all roads inside the Ring Road area.

By distinguishing between light and heavy trucks, the concrete effects of the truck ban become visible. Figure 6.2.3 hereafter demonstrates the distribution of small trucks over the road network inside the Ring Road area.

[12] *As already indicated, the PCU value of heavy trucks is higher.*

The north and east sections of the Ring Road demonstrate a high number of trucks fed predominantly from Alexandria Agricultural Road and Ismailya Desert Road (10th of Ramadan corridor) and to a lesser extent from the Ismailya Agricultural road, the road to Qanater, 26th of July Corridor and the central access road from 6th of October City and Upper Egypt. The volume of small trucks on the rest of the Ring Road is substantially lower.



Source: JICA Study Team

Figure 6.2.3 Small Truck Distribution inside Ring Road (2001)

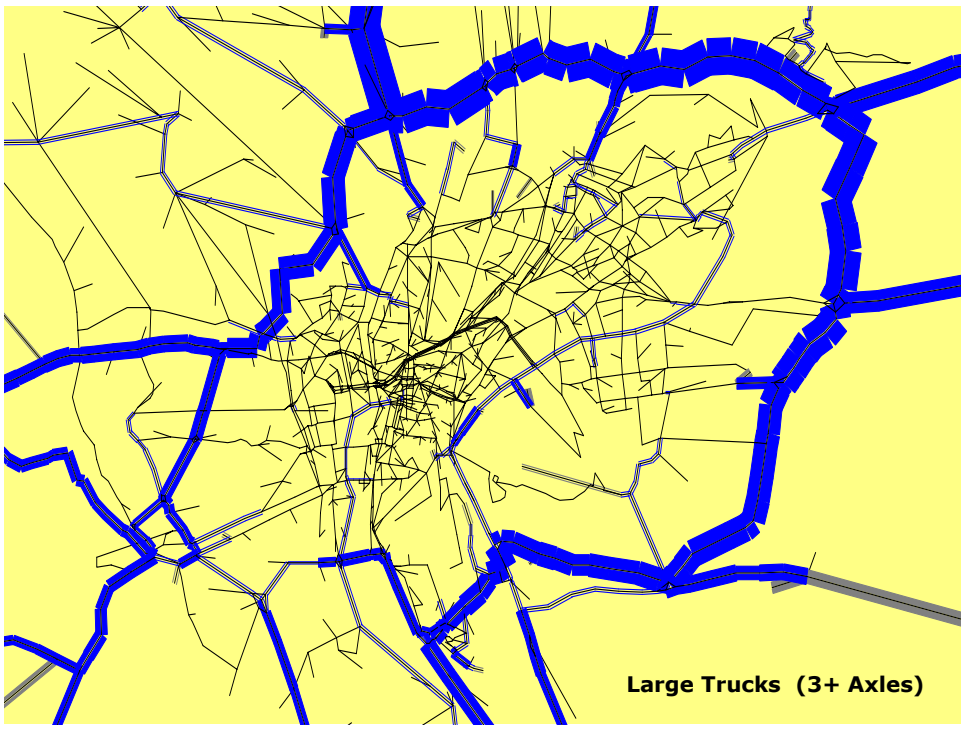
Although many central roads inside the Ring Road area accommodate light trucks, there are some corridors which are particularly used. These are:

- Gesr El Suez to Ismailya Desert Road;
- Road to Alexandria Agricultural Road;
- 26th of July and the corridor road to 6th of October City;
- Ring Road - Giza link.

To a lesser extent, the roads to Ismailya Agricultural Road and to Autostrad (Autostrad - Salah Salem Street) also attract more truck traffic;

Most of these trucks have the GBD and the CBD as primary destination and secondly commercial areas such as Shobra El Kheima, Nasr City, etc…

Large trucks are not allowed inside the Ring Road area between 6am and 11 pm. Their presence on the inner Ring Road streets is therefore much lower, as is demonstrated in next Figure 6.2.4;



Source: JICA Study Team

Figure 6.2.4 Heavy Truck Distribution inside Ring Road (2001)

In above Figure 6.2.4, on can clearly see the success of the truck ban. The number of heavy trucks that enter the city center is low. The trucks remain on the Ring Road until they have reached the nearest exit road to reach their final destination. Roads inside the Ring Road that have to accommodate more than average heavy trucks are:

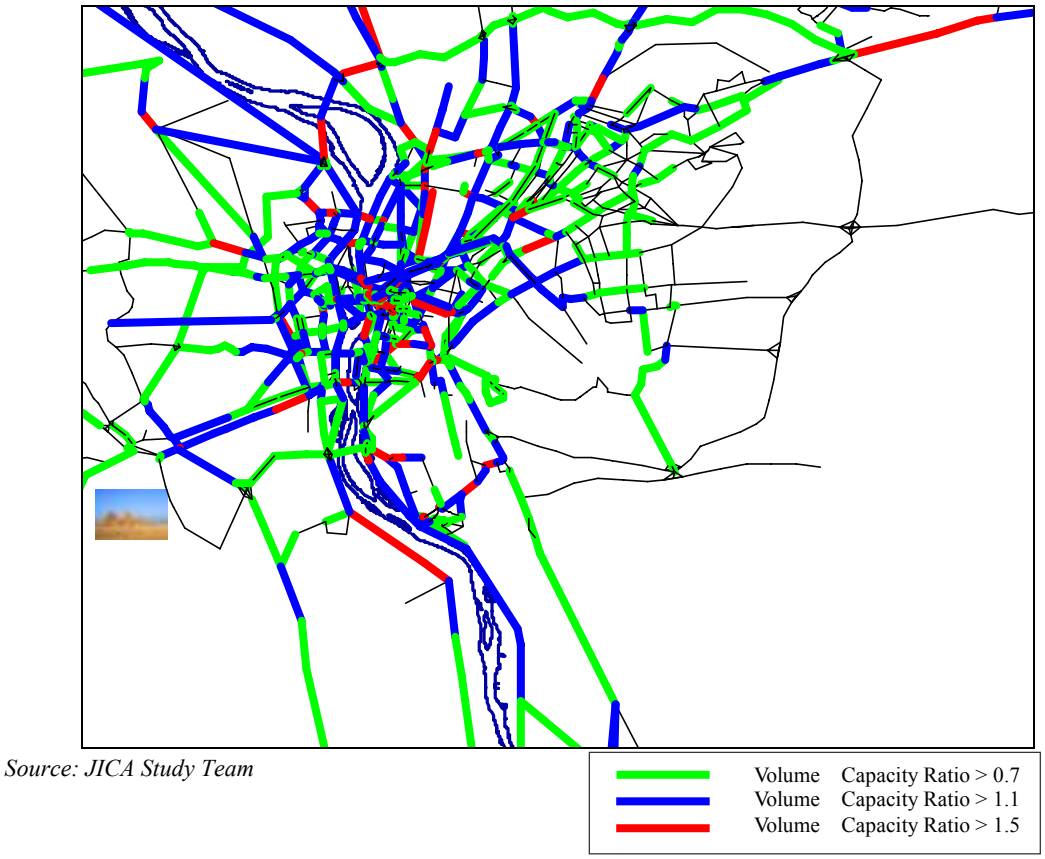
- Road to Ismailya Agricultural road
- Alexandria Agricultural Road
- Ring Road connection to Giza

To a lesser extent, Autostrad Salah Salem Street, Gesr El Suez and Tereat El Zumur corridor have to accommodate heavy trucks.

The most important destinations are Shobra El Kheima, Giza and Nasr City.

6.2.4 Traffic Density and Truck Flows

A final evaluation compares the density of traffic on the road network in the GCR with the volume of trucks (see Figure 6.2.5). Results of truck traffic analyses are therefore compared with the capacity ratios of the road network.



Source: JICA Study Team

Figure 6.2.5 All vehicles in PCU volume capacity (2001)

The Ring Road

The capacity of the Ring Road is at present sufficiently high to cater for the daily truck traffic volumes. In the section where the percentage of trucks is 40% to 60% or higher (section between Qatameya and Ismailya Desert road), the volume to capacity ratio is below 0.7. At present there is clearly sufficient spare capacity to accommodate for total traffic.

Other sections of the Ring Road, in particular west of Alexandria Agricultural Road, capacity problems exist and the road has V/C ratios between 1.1 and 1.5, indicating that at peak hours, road capacity is too low to accommodate total traffic. But the problem is not caused (or aggravated) by present truck flows, given that the overall percentage of trucks on those sections of the Ring Road is between 20% and 40% and on several sections even below 20% of total traffic.

The impact of trucks on the Ring Road can therefore be neglected as a possible problem in the short term future.

Outside the Ring Road

Truck drivers already take the road to Belqas as alternative for the congested Alexandria Agricultural Road, explaining why the percentage of heavy trucks is above 60% over the entire length of the road to Belqas. Total truck volume remains

lower than on Alexandria Agricultural Road (between 5,000 and 10,000 PCU per day per direction) and the road has at present no real problems accommodating these volumes (volume to capacity ratio is below 0.7).

Alexandria Agricultural Road has problems to accommodate present traffic volumes and the number of (both heavy and small) trucks is relatively high, therewith contribution to the capacity problem. In particular the Ring Road towards the west and the entrance of the inner Ring Road area are locations where trucks generate / contribute to the existing traffic problems.

Although several roads to 6th of October City have a high(er) share of trucks, most of these roads still have sufficient capacity to accommodate these volumes. The roads in this area having the highest percentage of trucks have volume to capacity ratios below 0.7 or between 0.7 and 1.1. Truck traffic towards 6th of October City should therefore not be a problem in the near future.

On the Upper Nile Corridor, capacity of the Autostrad is sufficiently high to accommodate present truck volumes. Overall, this is also true for the two other roads, Upper Nile Agricultural and Desert Roads although some areas close to the Ring Road have ratios above 1.1 and 1.5 and at the same time a truck volume of more than 5,000 PCU, predominantly small trucks.

Inside the Ring Road

Capacity problems are substantially higher inside the Ring Road area, but the overall impact of trucks remains low. Only few roads have a share of trucks over 20% of total traffic most of it small trucks. Some locations could be considered as a potential problem because they have simultaneously capacity limitations and higher volumes of truck traffic (mainly small trucks and pick ups).

The first area is Shobra El Kheima, in particular the road to Alexandria Agriculture Road and Esco School Street where a truck volume of more than 5,000 PCU per day per direction is observed. In total traffic, trucks only have a share of more than 20% on Esco School Street, while the share on the road to Alexandria Agriculture Road is below the 20% threshold. Also Ismailya Agricultural Road extension inside the inner Ring Road area is a truck corridor (both small and heavy trucks) but the percentage in total traffic remains below 20% with a V/C ratio above 1.1. Capacity problems in this area are generally not caused by the number of trucks but are the consequence of high concentrations of traffic in general.

A second potential problem area is Gesr El Suez towards 10th of Ramadan City close to the Ring Road. The volume of trucks is above 5,000 PCU, increasing to more than 10,000 PCU near the Ring Road. The volume capacity ratio on this road is above 1.1, indicating that the road is frequently congested. But on average, the share of trucks remains below 20% of total traffic, allowing again the conclusion that trucks are not responsible for the observed congestion.

The following corridor is Autostrad - Salah Salem Route around El Qualaa and Elsegen streets towards the CBD. With an average volume to capacity ratio above

1.1 and a truck volume over 10,000 PCU with a percentage exceeding 20% of total traffic, this area is frequently overloaded with traffic and trucks (mainly small trucks and pick ups) are contributing to the problem. *A site survey indicated that irregular parking of these trucks is an important reason of congestion, rather than the volume of trucks in total traffic. Stricter control of parking regulations could substantially reduce the problem in the area.*

The final area where problems could arise is the corridor from the Ring Road to El Moqatam. This road, linking in particular Nasr City with the Ring Road, is frequently used by trucks. Its volume to capacity ratio is above, 0.7, increasing to above 1.1 when reaching Nasr City. Many small trucks also use the end of Autostrad - Salah Salem Route to access the Ring Road. While truck volume at this location and some access roads thereto is above 10,000 PCU with a percentage of trucks above 20%, the capacity of these roads is still sufficient to accommodate these volumes because generally, the volume to capacity ratio is below 1.1 and outside the main roads below 0.7.

6.2.5 Dominant Truck Traffic Flows

To assess the dominant truck traffic flows, 18 zones inside the GCR and 4 zones outside the study area were identified and the traffic flows on the main roads, both of heavy trucks and small trucks assessed.

Heavy trucks

Heavy truck traffic travel via the Ring Road between the south and west (Upper Egypt and Qatameya) and following dominant areas:

- Eastern direction (Ismailya Desert Road and Suez Desert Road)
- North (Alexandria and industries in Lower Nile Delta)
- Northern Giza area
- 6th of October City
- Nasr City
- Shobra El Kheima
- 10th of Ramadan

Heavy truck traffic on the Ring Road moves between the north (Alexandria and Lower Nile Delta industries) and following areas:

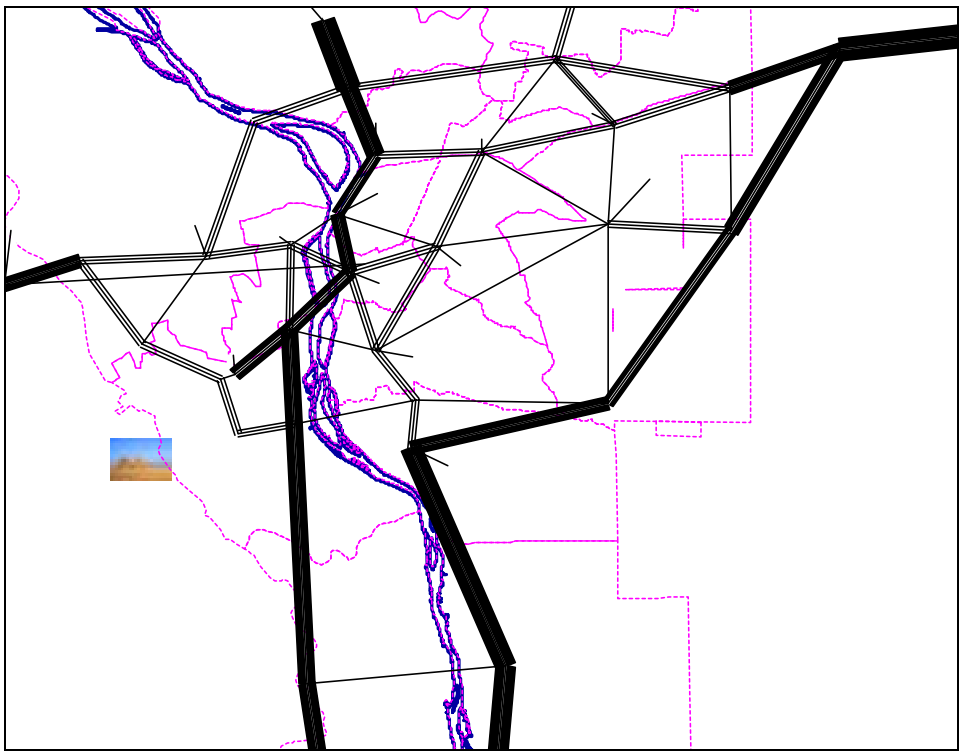
- South west direction (Qattammeyya and Upper Egypt)
- Qanater
- Shobra El Kheima
- Eastern direction (Ismailya Desert Road and Suez Desert Road)
- South Giza area

- Nasr and Salam City
- 10th of Ramadan

Heavy truck traffic also exists between the east of the Ring Road (Ismailya Desert Road and Suez Desert Road) and:

- South west direction (Qattammeyya and Upper Egypt)
- Nasr City
- 10th of Ramadan

Visualizing this data gives the next Figure 6.2.6.



Source: JICA Study Team

Figure 6.2.6 Dominant Flows for Heavy Trucks (PCU - 2001)

As is clearly demonstrated, heavy truck traffic is structured on a north-south basis with the Nile as natural separator. Most heavy trucks enter the inner Ring Road area to supply the CBD, the Giza Central Area and Shobra El Kheima. Important is that the analysis indicates that heavy trucks avoid the area within the Ring Road and that only some areas such as Nasr City need to accommodate a more important amount of heavy trucks.

East-west traffic of heavy trucks on the Ring Road exists predominantly between Alexandria Agricultural Road, Upper Egypt and too a lesser extent Suez Desert Road. Approximately 11% of the total volume of heavy trucks that enters the Ring Road via Alexandria Agricultural Road or one of its alternative routes has as

destination Upper Egypt, while only 3% of the trucks from Alexandria Agricultural Road have Suez Desert Road as destination.

West-East truck traffic from Suez Desert Road has for approximately 8% Alexandria Agricultural Road as destination, while more that 28% have a destination in the direction of 6th of October City and Upper Egypt. This explains the high percentage of heavy trucks between Suez Desert Road, Qatameya and Autostrad.

Cairo also accommodates several rail and river terminals where bulk goods are delivered by rail and road. The impact of these volumes remains limited and no serious problems could be found on the roads around these terminals.

Small trucks

By far the largest share of trucks has its origin and / or destination in one of the 18 regions of the study Area.

Truck traffic with origin or destination in the south and west (Upper Egypt and 6th of October City) is related to following regions:

- 6th of October City (double of second in line)
- Northern Giza
- Nasr City
- North (Alexandria and industries in Lower Nile Delta)
- Southern Giza
- Cairo Business District

Trucks coming from or going to the north (Alexandria and Lower Nile Delta industries) link to:

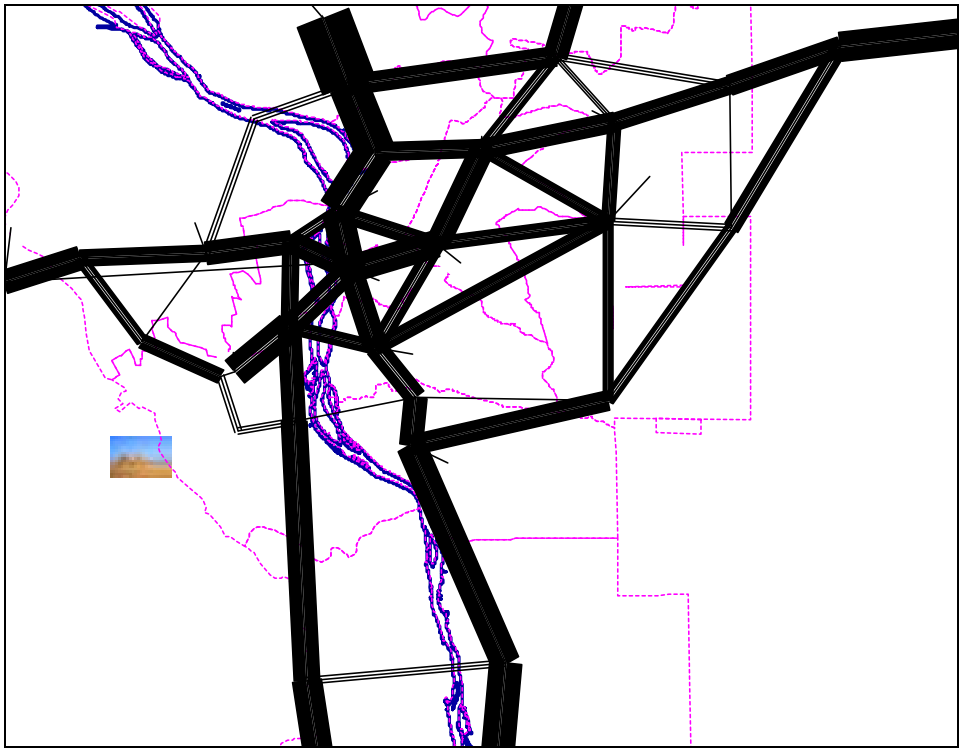
- Qanater (double of second in line)
- Shobra El Kheima (double of next in line)
- Qualyob
- Nasr City
- North Giza
- Shobra
- Cairo Business District

Small truck traffic from or to Suez and Qatameya (the east) is substantially lower than the volumes to and from other external directions. This traffic is primarily linked to:

- 10th of Ramadan (double of second in line)

- Helwan
- south west direction (Upper Egypt and 6th of October)
- Nasr City

The overall flows of small truck flows are visualized in next Figure 6.2.7.



Source: JICA Study Team

Figure 6.2.7 Dominant Flows for Small Trucks (PCU - 2001)

The above figure clearly visualizes that the Ring Road is less important to "guide" small trucks as it is for heavy trucks. The truck ban for heavy trucks to enter the Ring Road area is thus effective.

The situation is very different for small trucks that use inner Ring Road corridors to select the shortest path from north to south and east to west. It should be noted that a large part of traffic inside the Ring Road has both origin and final destination in that area.

6.3 FUTURE CARGO TRANSPORT IN THE GCR

6.3.1 Introduction

The concentration of industrial activity within the Ring Road will remain similar in the future. Al-Tibbin, Helwan, Shobra El-Kheima and others will remain centers of industrial and economic production. Also small and medium sized workshops will continue to concentrate in the CBD and in districts such as Al-Basatin, Imbaba, Doqy and Giza. Other areas with higher concentrations of industries, e.g., Nasr City, will also continue to generate truck traffic.

However, the trend for industries to concentrate their activities in the satellite cities (Oboor City, Badr City, 6th of October City and 10th of Ramadan City) could change the predicted truck movements. Future truck flows will further be influenced by a number of additional factors, among which

1. The capacity of the Ring Road;
2. The improvement of main intersections between the Ring Road and the inter-city roads;
3. The improvement of inner city road infrastructure;
4. The development of the Regional Ring Road;

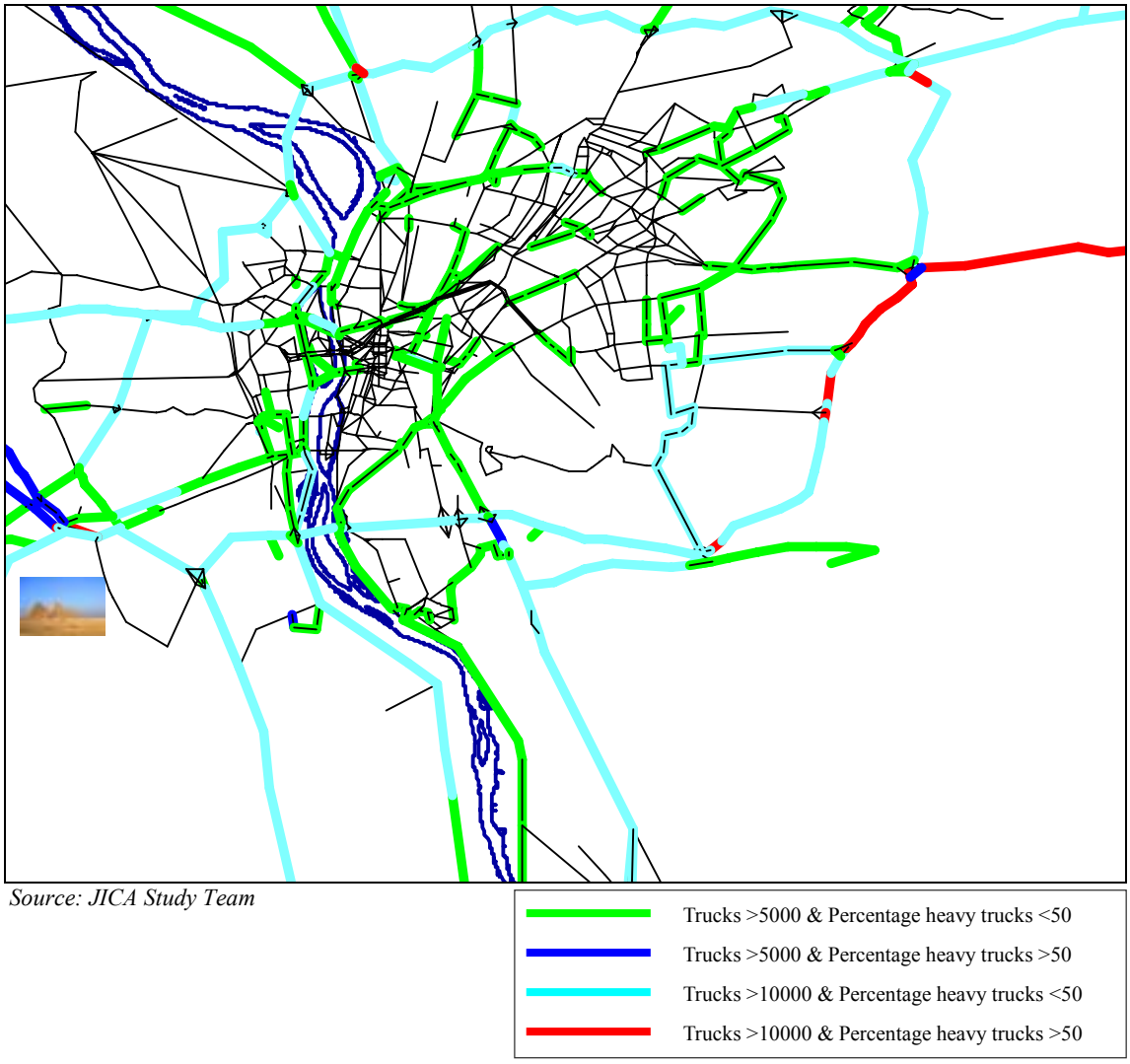
Also important will be measures oriented towards the transport sector itself, measures which have no direct link to the infrastructure but are oriented towards efficiency improvements and the development of alternative transport systems. This subject will be discussed in more detail in Chapter 7.

The future truck traffic flows will be analyzed according to two different scenarios. "Scenario A" is the "*do nothing scenario*" and evaluates the potential impact of truck traffic under the supposition that only the committed infrastructure projects are implemented and no new road infrastructure build. "Scenario D" is the "*Master Plan Scenario*" and assesses truck flows under the condition that the road infrastructure proposed in the Master Plan is realized over the next 20 years.

6.3.2 Future truck traffic flows in GCR - Scenario A

(1) Truck Volume

The total volume of trucks will double over the next 20 years. The main reasons are increased welfare and higher income generating a higher consumption and car ownership as well as increased economic activity and industrial production. But the general pattern of truck flows will not change over the next 20 years, as is demonstrated in next Figure 6.3.1.



Source: JICA Study Team

Figure 6.3.1 All Day Truck Volumes (PCU) by Direction (2022 - Scenario A)

Over the next 20 years, truck traffic will double on most of the roads that at present have at present already a high volume of trucks. This is particularly true for the Ring Road that will have over its entire length a volume of trucks above 10,000 PCU per day per direction.

Outside the Ring Road

Truck traffic east outside the Ring Road will substantially increase and several roads that at present are hardly affected by truck traffic will feel the effects in the future. In Particular Alexandria Desert Road will know a substantial increase of truck traffic. Truck volume will double over the entire road, including traffic over 26th of July Corridor. Also the truck volumes on the roads to Qanater and Waraq will double over the next 20 years, from below 5,000 PCU at present to over 10,000 PCU per day per direction in the future. This will negatively affect some roads connecting these major inter-city roads with 6th of October City and on the access roads to Cairo.

Alexandria Agricultural Road will remain an important corridor for truck traffic, but is now joined by Ismailya Desert Road and several roads connecting the industrial areas towards Ismailya and the ports of Damietta and Port Said to the Ring Road. But the distribution of traffic over the different routes ensures that the volumes of trucks remain moderate below 5,000 PCU per day per direction.

This equal distribution has positive effects for traffic on Ismailya Desert Road, where the volume of trucks, although above 10,000 PCU per day per direction shows only a moderate increase and is predominantly oriented towards Oboor City and 10th of Ramadan City.

The situation on Suez Desert Road will remain the same as now, but only the volume of trucks increases together with the rest of the roads in the area. This increase in volume has its effects on the truck volume of the Ring Road, but more importantly generates higher volumes of traffic inside the Ring Road area (see further).

Truck traffic from Upper Egypt doubles over the next 20 years and will directly influence the access roads to Cairo and to 6th of October City where several roads now show a truck volume over 10,000 PCU per day per direction.

On average, the increase in economic activity and the concentration of it in or towards the GCR will over the next 20 years have a clear impact on traffic flows to and from Cairo. But as a general observation, the number of access roads that will be used by trucks will increase, therewith better spreading the truck traffic flows and avoiding that roads will be congested with trucks.

Inside the Ring Road

The effects of increased truck traffic are particularly visible on the roads inside the Ring Road area. Although the pattern remain the same as they are now, the number of roads to and from the economic and industrial areas triples. The patterns suggest that, due to the substantial increase of truck traffic, alternative routes are sought to reach destination.

For the Shobra El Kheima district, the volume of trucks on the road to Alexandria Agricultural Road will double over the next 20 years, forcing many trucks to use alternative access roads. The extension of the road to Belqas (Esco School Street and

connecting streets) is a particular attractive alternative for trucks coming from the north. Trucks entering the area from the south prefer accessing the area via Abu Bakr El Sadeeq route which now shows a truck volume of more than 5,000 PCU per day per direction.

Truck traffic, entering the Shobra El Kheima district via Abu Bakr El Sadeeq route comes from the south via the Thereat El Zumur Route and cross the Nile via 6th of October or 15th of May bridges. Traffic on that route is also destined for the Giza area (including manufacturers in Imbaba and Doqy) and for traffic with the CBD as primary destination. The volume of trucks on this route is further increased with traffic entering the area via 26th of July Corridor and several roads linking the route with Upper Egypt. As a consequence of this concentration of truck traffic, the entire Thereat El Zumur Route has a truck volume of more than 5,000 PCU per day per direction and on several sections even more than 10,000 PCU.

Access to the CBD will become more difficult in the future. Alternative routes are therefore appreciated. This can be seen on the figure where the number of streets around the CBD will substantially increase where the volume of trucks is above 5,000 PCU. This evolution will prevent Autostrad - Salah Salem Street (at the extension of Autostrad) to be completely congested. Instead of continuing from Autostrad directly into the Ring Road via its direct extension, many truck drivers will prefer continuing along the Ring Road to enter the area via Corniche.

If no additional infrastructure is constructed inside the Ring Road area, Nasr City will undoubtedly become a problem area. But again, the volumes on the streets to and from Nasr City will remain relatively limited, and a clear distinction between heavy trucks and light trucks will become apparent. Smaller trucks, planning to enter or leave Nasr City will go via the north using Autostrad - Salah Salem Street as exit route. But the expected doubling of truck traffic will force truck drivers to select alternative routes, in particular for traffic towards the north. While at this time, north-bound traffic uses Autostrad - Salah Salem Street to enter the Ring Road, increasing numbers of trucks continue via Heliopolis district to access the Ring Road via Gesr El Suez.

This shift in truck flows will cause substantial problems in the future on Gesr El Suez. While at present, truck traffic on the end section of that road remains below 10,000 PCU per day per direction, that same section will see truck traffic double over the next 20 years. Further down the road, direction Heliopolis and Abu Bakr El Sadeeq route, traffic volumes will also increase to 10,000 PCU per day per direction near Heliopolis to diminish to 5,000 PCU when approaching Abu Bakr El Sadeeq route. Several connecting routes in the Heliopolis area will be used by trucks to access Autostrad - Salah Salem Street, either to continue towards the CBD but in most cases to access Nasr City.

While access to Nasr City is at present concentrated on Autostrad - Salah Salem Street, the alternative access roads to that area are showing a spectacular increase of truck traffic. In particular the Corridor from the Ring Road to El Moquatam and Ahmed Zomor Street will have to accommodate truck volumes above 10,000 PCU per day per direction on both roads.

(2) Heavy Truck Impact

The do nothing scenario demonstrates clearly that heavy trucks are presently not a problem and will also not be a problem in the future.

Outside the Ring Road

The percentage of heavy trucks on the access roads to Cairo will remain the same as now, and will only be above 50% of truck traffic on Suez Desert Road. Only on this road, the increase in volume of heavy trucks will follow the same rate as the increase of total traffic over the next 20 year. On all other access roads, the percentage of heavy trucks will remain below 50% of truck volumes. Compared to the present situation, this will even improve the situation on Autostrad, Alexandria Agricultural Road and on the road to Belqas, where the share of heavy trucks diminishes below 50%.

The Ring Road

The heavy influx of heavy trucks via Suez Desert Road has a direct impact on the percentage of heavy trucks on the Ring Road. With the exception of some intersections (Alexandria Agricultural Road, Qatameya and Ismailya Desert Road) only the section of the Ring Road between Suez Desert Road and the first access road to Nasr City (Ahmed Zomor Street) shows a percentage of heavy trucks above 50% of total truck traffic.

Although heavy truck traffic from Suez spreads simultaneously over the Ring Road and partly accesses the inner Ring Road area via Autostrad - Salah Salem Street, a substantial portion of that traffic clearly has Nasr City as final destination. This conclusion is based upon the fact that heavy truck traffic diminishes to below 50% once Ahmed Zomor Street is passed. A second phenomenon that substantiates this is the increase again on the section between the corridor from El Amal City to the Ring Road and Ahmed Zomor Street, where a section of the Ring Road has a percentage of heavy trucks above 50%, as is the access via the corridor between the Ring Road and Moqothan.

Inside the Ring Road

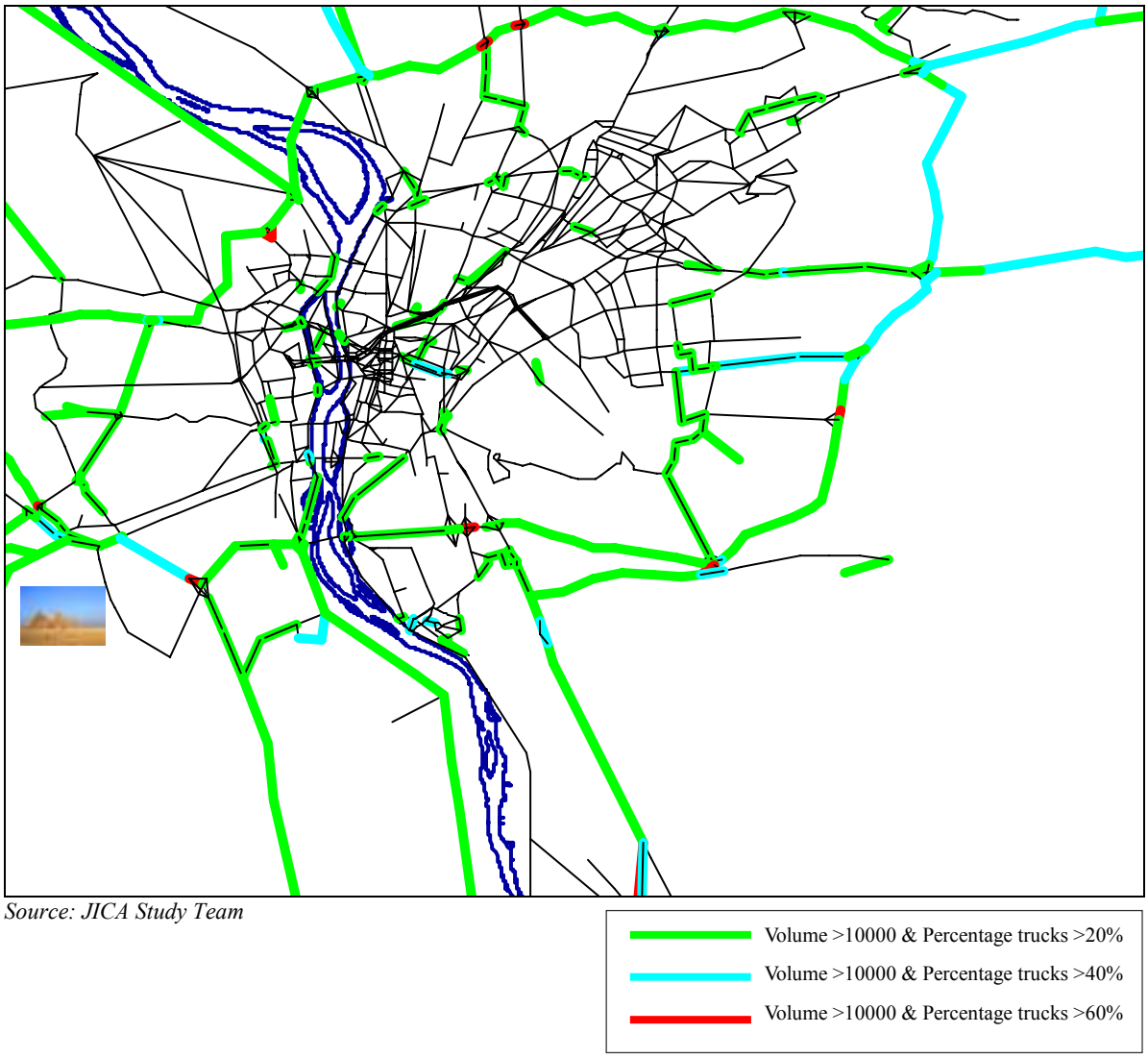
Heavy truck traffic remains everywhere below 50% of total truck traffic inside the Ring Road. As explained above, only few sections could have traffic problems caused by heavy trucks. These areas / corridors are the road to Alexandria Agricultural Road and consequently the alternative access roads, Thereat El Zumur Route (in particular on the crossing with 26th of July Corridor and the Ring Road) Gesr El Suez and the access roads to Nasr City.

These roads all demonstrate high truck volumes and although none of these roads has a percentage of heavy trucks above 50%, heavy trucks add to the high volume of trucks on these roads. The concentration of economic and industrial activity and of small manufacturing companies in several areas inside the Ring Road is responsible for this increase.

On average, heavy trucks will in the future not be a substantial problem on the roads inside the Ring Road and a stronger enforcement of the truck ban will help keeping the future impact within acceptable limits.

(3) Percentage of Trucks in Traffic

The evaluation of the share of trucks on the roads in 20 years time underlines the idea that truck traffic is not the problem of congestion in the GCR (see Figure 6.3.2).



Source: JICA Study Team

Figure 6.3.2 Share of Trucks of Total PCU Volume >10,000 (2022- Scenario A)

On many roads, the situation will even improve. This certainly does not mean that these roads will not know substantial traffic problems. It only means that *in the future, the percentage of trucks on the roads will reduce*. This indicates that truck traffic in general will grow less rapidly as other traffic. It also suggests that no specific infrastructure measures will be necessary to accommodate for the volumes of trucks, expected to enter the GCR in 20 years from now.

Outside the Ring Road

Truck volumes on Alexandria Agricultural Road and on Ismailya Desert Road will grow at least with a similar speed as other traffic. On Alexandria Agricultural Road, the percentage of trucks will increase from more than 20% at present to more than 40% in the future, in particular when approaching the Ring Road. For Ismailya Desert Road, the percentage remains constant (over 40%) on the section near the Ring Road, but will double in the future to more than 40% on the road past Al Badr City. The continued concentration of economic and industrial activity in 10th of Ramadan City is one of the main reasons for this increase. Truck traffic from Ismailya and the ports of Damietta and Port Said, as well as the economic development of the Sinai, will divert over alternative routes on the corridor (in particular Ismailya Agricultural Road and the Road to Salem City). The amortization of truck flows over these roads will ensure that the overall share of trucks remains below 20% of total traffic over the next 20 years.

Overall, the percentage of trucks on the Upper Egypt roads remains the same but at the extensions towards Cairo and 6th of October City the percentage of trucks even reduces, with truck volumes in several streets dropping below the 20% of total traffic whereas the share is now between 20% and 40%. Only on Alexandria Desert Road, truck volumes will grow substantially faster over the next 20 years than other traffic. As a consequence, the percentage of trucks on this road will increase from a level between 20% and 40% to a level above 40%.

Also the situation on Suez Desert Road will improve. The present percentage of trucks is over 60%, but will reduce over the next 20 years with 50% to a level between 20% and 40% of total traffic. Given that a large portion of this traffic is directed towards Nasr City, the effects on the Ring Road and on the access streets to Nasr City inside the Ring Road will be obvious.

Outside the Ring Road, the impact of trucks on traffic remains within acceptable limits for the next 20 years, with an average share between 20 and 40% on the main corridors and between 40% and 60% on these inter-city roads that at present accommodate already a higher volume of trucks.

The Ring Road

The situation on the Ring Road will not dramatically change over the next 20 years and truck traffic will grow in parallel with total traffic. Only on some access points to the Ring Road, the share of trucks peaks above 60% of total traffic. On average, truck traffic remains constant on the northern and western section of the ring road at a level between 20% and 40%, and on the eastern Ring Road section between Ismailya Desert Road and the corridor between the Ring Road and the road to Moqothan.

Once again, the influence of economic activity in Nasr City becomes clear. Compared to the present situation, the percentage of trucks in total traffic reduces with 50% over time once trucks have reached the first entrance point to Nasr City after its traditional entrance via Autostrad - Salah Salem Street. It is clear that a large

portion of trucks, traveling on the Ring Road from Ismailya Desert Road, have Nasr City as origin or destination, an observation that will be confirmed once truck shares on the roads inside the Ring Road area are discussed.

Inside the Ring Road

The expected increase in truck traffic will not substantially affect the situation inside the Ring Road. Areas that see a higher percentage of trucks at present will also have higher shares in 20 years time. Comparing the present situation with the situation in 20 years confirms the statement that trucks are not the problem. Their percentage is on most roads inside the Ring Road below 20% of total traffic, except on some streets accessing or inside areas with a concentration of (smaller) industries and manufacturing companies.

Nasr City is the only exception. While traffic patterns and percentages of trucks remain relatively constant, even in areas with a higher economic activity, the access roads to Nasr City will show more truck percentages in the future. In particular Ahmed Zomor Street will become an important access corridor for trucks with a percentage of trucks above 40% (the only road in the inner Ring Road area) and the connecting road from Nasr City to the corridor between the Ring Road and Moqothan where truck traffic will increase from below 20% to a percentage between 20% and 40%.

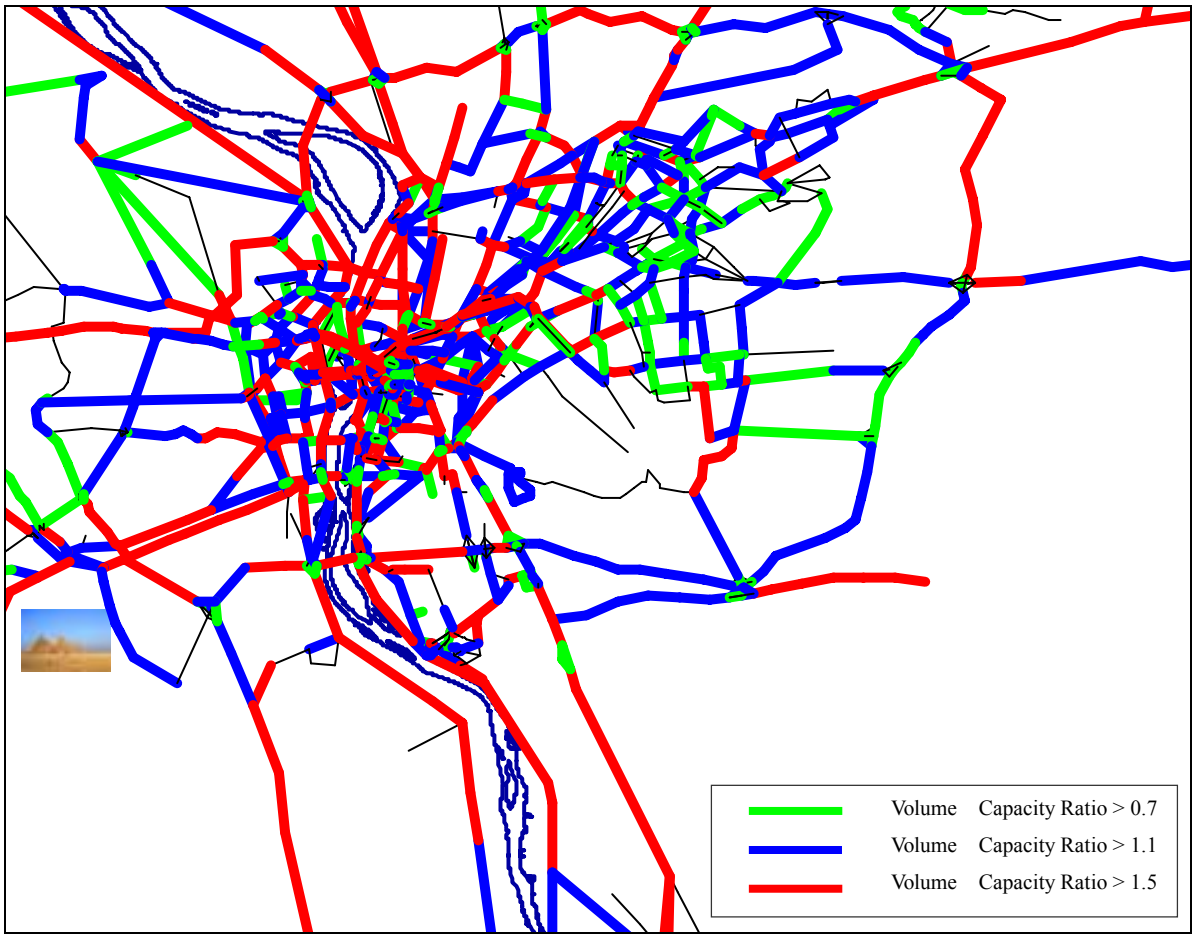
(4) Traffic Density and Trucks

The results of the above analyses leads to the suggestion that on average, trucks do not cause serious traffic problems inside the GCR. With few exceptions, the percentage of trucks is now and will remain also in the future within reasonable limits, and the percentage of trucks (heavy and light trucks combined) will nowhere increase above 60% of total traffic. On the contrary, on several roads where high(er) volumes of trucks can now be observed, the percentage will reduce over the next 20 years.

So from a purely truck-oriented perspective, it could be concluded that there are no serious problems to expect over the next 20 years. However, this is an oversimplification of reality. Trucks are not the only users of the road infrastructure but converge with private and public transport.

It is therefore necessary to evaluate the situation on streets and in areas where traffic problems are to be expected over the next 20 years and compare these results with the expected evolution of truck traffic. Although truck traffic will not increase as rapidly as the expected growth of private cars, trucks can become a problem on corridors where congestion is eminent and the share of trucks is high.

Figure 6.3.3 clearly demonstrates that not on most relevant streets inside the Ring Road area, on the Ring Road as well as on most inter-city access roads the volume to capacity ratio will soar above 1, in many cases even above 1.5.



Source : JICA Study Team

Figure 6.3.3 All Vehicles in PCU Volume Capacity (2022 - Scenario A)

In that context, the question is valid whether streets or areas can be identified where truck traffic could cause problems in the future or could contribute to expected traffic congestion. Therefore, an evaluation was made of corridors that have a high volume over capacity ratio (above 1.1) and at the same can expect time a high volume of truck traffic in the future.

Outside the Ring Road

In general, cargo transport on the roads outside the Ring Road will remain controllable over the next 20 years. On most access roads where traffic problems are eminent, the percentage of trucks remains between 20% and 40%.

On most roads, such as the Upper Egypt roads and Autostrad, Ismailya Agricultural Road, most roads between Cairo and 6th of October City, El Cornish (towards 15th of May City), Alexandria Desert Road and the roads to Qanater, the percentage of trucks is below 40% or even below 20% of total traffic. But on most of these roads, total traffic will soar to a volume to capacity above 1.5.

Therefore, the future impact of cargo transport to and from Cairo will not substantially affect the traffic situation on these roads.

Only on Ismailya Desert Road and on Suez Desert Road, the volume of truck traffic will increase above 40% of total traffic. Although the problem will remain relatively moderate on Suez Desert Road (V/C ratio of 1.1), the traffic situation will degenerate on the connection to 10th of Ramadan City, where the percentage of trucks is between 40% and 60% of total traffic and the volume to capacity ratio equal to 1.5.

Undoubtedly, trucks will in the future be a part of the problem on this inter-city road.

The Ring Road

The percentage of trucks on the Ring Road will become particularly high between Ismailya Desert Road and Ahmed Zomor Street, linking the Ring Road to Nasr City. But only the section between Ismailya Desert Road and Autostrad - Salah Salem Street has a V/C ratio above 1.5, reducing to a level between 1.1 and 1.5 and further below 1.1 on the section between Suez Desert Road and Ahmed Zomor Street.

On the rest of the Ring Road, the V/C ratio is at a level above 1.1 and on many sections between Suez Desert Road and 26th of July Corridor above 1.5. But the percentage of trucks on these sections remains within the 20% to 40% range, indicating that the problems are generally not created by truck traffic, although they undoubtedly will contribute to congestion.

The overall impact of heavy trucks will gradually reduce, except for the Ring Road section between Ismailya Desert Road and Ahmed Zomor Street where the number of heavy trucks will remain very high.

Only at some crossing of the Ring Road with inter-city roads (e.g., Alexandria Agricultural Road and Ismailya Desert Road), heavy trucks will be important but the effect quickly vanishes on the Ring Road itself.

Inside the Ring Road

Trucks are definitely not causing traffic congestion in the area inside the Ring Road. Most roads have a percentage of trucks below 20%.

On many inner Ring Road streets where the V/C ratio is above 1.5, the percentage of trucks remains below 20% of traffic, with the exception of a small number of streets and street sections where it rises above the 20% level. But the percentage of trucks never increases above 60% inside the Ring Road area.

The only area where trucks will in future contribute to the traffic problem is (again) on the access roads to Nasr City, as well as inside Nasr City itself. The main access roads to Nasr City have a V/C ratio above 1.1. This higher ratio can also be observed on the roads that have a higher than average truck percentage, in particular Autostrad - Salah Salem Street, Ahmed Zomor Street and the Corridor road from Moqothan to the Ring Road.

Specifically on the corridor road to Amel City, trucks have a percentage between 20% and 40% and have therewith an important responsibility for the high level of the V/C ratio (some sections of that access corridor have a ratio above 1.5). In these streets trucks will frequently be responsible for observed congestion.

The same can be said about Ahmed Zomor Street. Trucks have a percentage between 20% and 40% of total traffic all the way inside Nasr City, and in particular on the extensions of that access road, the V/C ratio increases to a level above 1.5. Also here, trucks will in future frequently create congestion.

Some minor problems can also be expected at some access roads to CBD. Most of the streets in the CBD have very high V/C ratios and a small number will in future have a percentage of truck traffic between 20% and 40%. But the number is very limited, indicating that the expected increase in traffic congestion is not as a consequence of increased truck traffic, but is caused by the much more prominent increase of private vehicles.

The same is true for all other regions where economic and industrial activity is concentrated or a high number of manufacturing companies are located. The Giza area, Doqy and Imbaba and Sheibra El Kheima all have percentages of truck traffic below 20% (except on very few street sections), despite the fact that most streets in these area have V/C ratios above 1.1 and in many cases above 1.5.

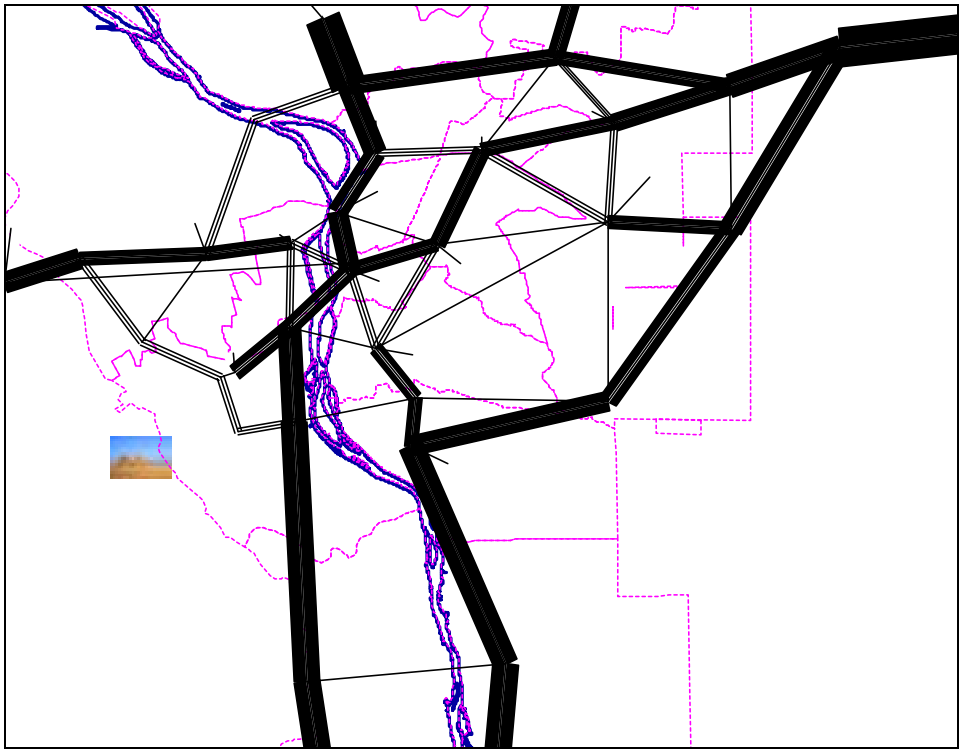
(5) Dominant truck traffic flows

Patterns of truck flows will not dramatically change in the future. The overall impact of the truck ban and of the relocation trend towards the satellite cities will reduce in time, consolidation the flows of trucks as demonstrated in next Figure 6.3.4.

Heavy trucks

The pattern of heavy truck flows will in the next 20 years remain similar to the present flows, as can be seen in Figure 6.3.4. But some changes can be observed, although they will not dramatically affect traffic.

A first heavy flow is the flow of heavy trucks that enter the inner Ring Road area and either continues via 6th of October Bridge or via El Cornish towards the road to Alexandria Agricultural Road. Their primary destinations are the CBD, Shobra El Kheima. They also transit to Oboor City and 10th of Ramadan City.



Source: JICA Study Team

Figure 6.3.4 Flow concentration for Heavy Trucks (PCU - 2022)

The concentration of truck traffic towards the north-eastern section of the Ring Road (destination 10th of Ramadan City) has an important effect on Gesr El Suez, where many heavy trucks join to access the Ring Road.

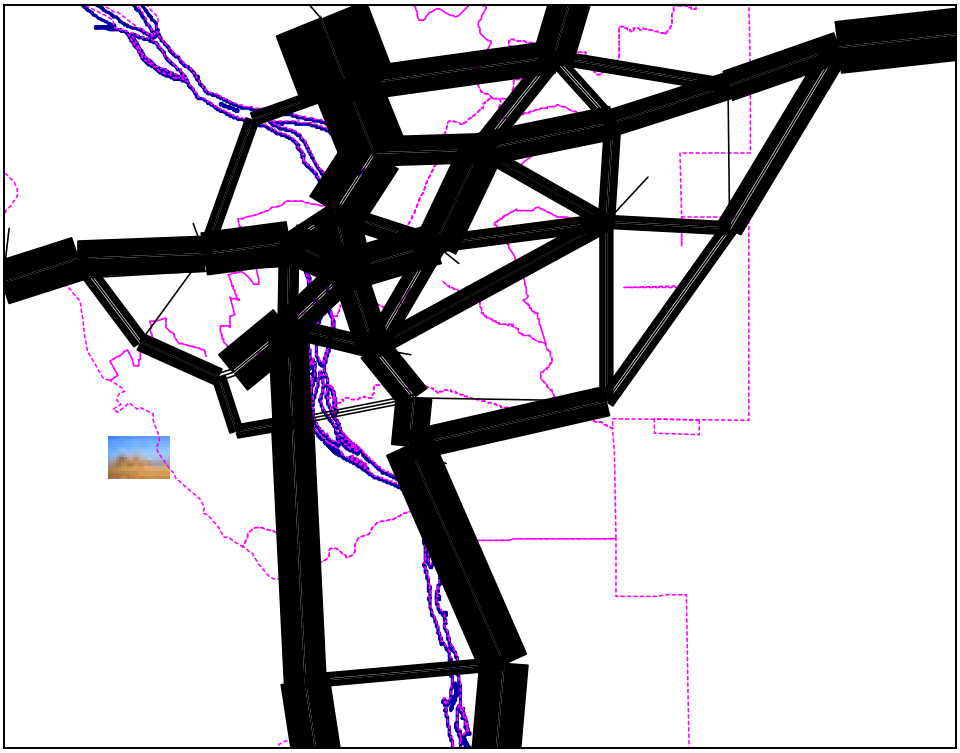
A second stream of heavy trucks follows the north south route west from the Nile via the Tereat El Zumur corridor. These trucks come from and go to Upper Egypt and have predominantly 6th of October City and Cairo as destination. For the latter, these flows link to the above flow inside the inner Ring Road area.

The volume of heavy trucks that access Nasr City and the Giza districts are important and can clearly be distinguished. Heavy trucks enter Giza via the 26th of July Corridor, while trucks with Nasr City as destination massively take Ahmed El Zomor Street.

The last important corridor for heavy trucks is the north south link east of the Nile. Only a small share of this traffic enters the inner Ring Road area, while the large majority continues its journey along the Ring Road towards Suez, 10th of Ramadan City and further on towards Alexandria Agricultural Road.

Small trucks

The flow of small trucks is similar to the heavy trucks, but has a higher concentration on destinations inside the Ring Road (see Figure 6.3.5). The present main destinations will continue to attract a large portion of small truck traffic for the next 20 years. Only its volume will dramatically increase in the years to come.



Source: JICA Study Team

Figure 6.3.5 Flow concentration for Small Trucks (PCU - 2022)

The dominant destinations for small trucks are the areas of CBD and Giza area, Shobra El Kheima, Nasr City 6th of October City, Oboor City and 10th of Ramadan City.

The dominant access corridors by which these flows move are Alexandria Agricultural Road, 26th of July Corridor, Ismailya Desert Road, Upper Egypt Agricultural Road and Autostrad and to a lesser extent Ismailya Agricultural Road.

Inside the Ring Road, the proposed express way system consisting of the existing 6th of October corridor, the Alexandria Agricultural Road route, the Abu Bakr El Sadeeq Route and the Suez Road route will become the priority corridor for small truck movements.

Although these patterns are similar to the present flows, the total volume will over time increase. This volume, combined with other future traffic on these corridors,

will undoubtedly contribute to the anticipated problems on several roads where the share of small trucks is particularly high.

As will be demonstrated in the analysis hereafter, the truck flow concentrations (both heavy and light trucks) that exist now and are expected in the future coincide with much of the new road infrastructure. From that perspective, it could be argued that this road infrastructure is necessary to accommodate future truck traffic.

On the other hand, it also could be argued that the development of new road infrastructure will only consolidate these patterns and that measures should be taken to avoid the excessive movement / concentration of trucks in particular inside the Ring Road area.

The analysis hereafter on the potential effects of the new road infrastructure is therefore particularly interesting, which allows differentiating between road infrastructure that is necessary and road infrastructure that has no effect on truck movements.

But, as was already argued before and will be confirmed in the following paragraphs, trucks (both small trucks and heavy trucks) are not the real issue! On the contrary, the forecasts indicate that the expected rise in truck traffic will be much smaller that the total increase of traffic, making on many roads the future percentage of trucks in traffic smaller that it is now.

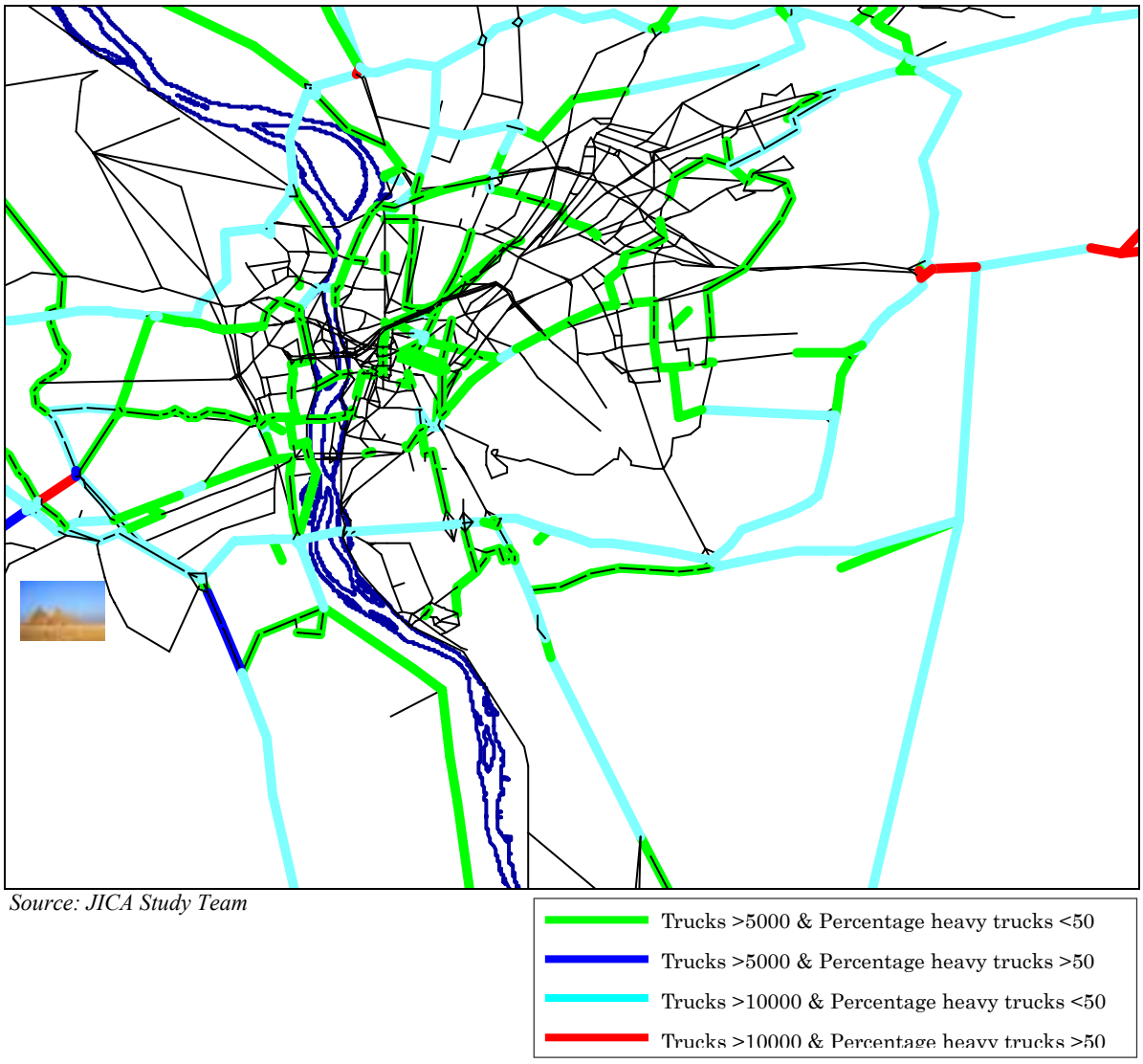
6.3.3 Future truck traffic flows in GCR - Scenario D

(2) Truck Volume

Although it could be expected that the proposed infrastructure investments dramatically affect / improve truck movements, the effects remain relatively low as can be observed in the next Figure 6.3.6.

Outside the Ring Road

In the west, this increased influx of trucks from Alexandria and Upper Egypt will continue to have an impact on the capacity of different roads between 6th of October City and Cairo. While the volume of trucks was in 2001 only high between 26th of July Corridor and 6th of October City and on 26th of July Corridor itself, the volume on all major roads in that area will increase over the next 20 years above 5,000 PCU and at several roads even above 10,000 PCU per day per direction, this even with the proposed new road infrastructure.



Source: JICA Study Team

Figure 6.3.6 All Day Truck Volumes (PCU) by Direction (2022 - Scenario D)

The latter is in particular true on the roads connecting Alexandria Desert Road and 6th of October City where the level of trucks will double and on Salah Salem Street where truck traffic increases to 5,000 PCU per day per direction, an increase caused by the proposed new road infrastructure. The new and improved road infrastructure between Cairo and 6th of October City, in particular the section that closes the Ring Road, will offer trucks a better access to Upper Egypt, 6th of October City, the 26th of July Corridor, the Ring Road and ultimately to Cairo.

In the north, on the Alexandria Agricultural Road and adjunct roads, the development of new road infrastructure will have no effect on truck traffic. The truck traffic patterns and density remains almost identical with or without the new infrastructure. As could be observed in Scenario A, future truck volumes on these roads will increase above 5,000 PCU, while the level of trucks on the road to Belqas will drop below the 5,000 PCU level.

East of Cairo, truck traffic will double on all inter-city roads by 2022 and reach a level above 10,000 PCU per day per direction on Ismailya Desert Road and Suez Desert Road. Truck volumes on the Ismailya Desert Road to 10th of Ramadan City will remain high with a volume above 10,000 PCU per day per direction, even with the new road infrastructure in place. Truck traffic in the region will in future be better distributed, reducing the present concentration of traffic on the road to Khatatba with approximately 50%.

The effects of the new road infrastructure have only limited importance for Suez Desert Road and Qatameya Road, where the situation remains relatively unchanged between the two scenarios.

In the south, towards Upper Egypt, traffic will double on the Upper Egypt Roads and Autostrad where truck levels will increase above 10,000 PCU on the largest part of these roads.

On this corridor the impact of the new road infrastructure will be the most visible, in particular the proposed closing of the Ring Road and of the construction of the new bridge over the Nile. The volume of trucks on Upper Egypt Agricultural Road will reduce to 5,000 PCU per day per direction until the intersection with the Regional Ring Road (HR-6; Suez Rd to Fayoum Rd) that links the Upper Egypt Roads together. The Cornish, parallel to Autostrad has a truck volume over 5,000 PCU in Scenario A, but will drop below that level with the new infrastructure in place.

Overall, truck traffic will remain stable on the main inter-city roads. The new road infrastructure will not have a substantial impact on the volumes of trucks on these roads, but will offer more and better alternatives to truck drivers. The only real improvement, undoubtedly generated by the proposed road infrastructure, can be observed on the Upper Egypt access roads, where the share of trucks decreases. The traffic situation will also improve on the access roads to Cairo from the 6th of October City corridor, where trucks no longer concentrate on 26th of July, but also use the connection to Wahat (HR-1; Oases), therewith reducing on the other roads traffic with approximately 50%.

The Ring Road

The volume of truck traffic will reach more than 10,000 PCU per day per direction over the entire Ring Road with the exception of a small section between Suez Desert Road and the Corridor Road to Zomor Street (Nasr City) and some intersections of the Ring Road with inter-city roads where the volume of trucks reduces to a level below 10,000 PCU per day per direction. Surprisingly, the effect of the new road infrastructure on the volume truck traffic on the Ring Road remains small and is only visible on the afore-mentioned section.

Inside the Ring Road

The concentration and patterns of truck movements inside the Ring Road will not dramatically change over the next 20 years, independent of whether or not the new road infrastructure will be realized. In both scenarios, the number of streets where

truck traffic reaches above 5,000 PCU per day per direction will grow, in some sections over 10,000 PCU per day per direction.

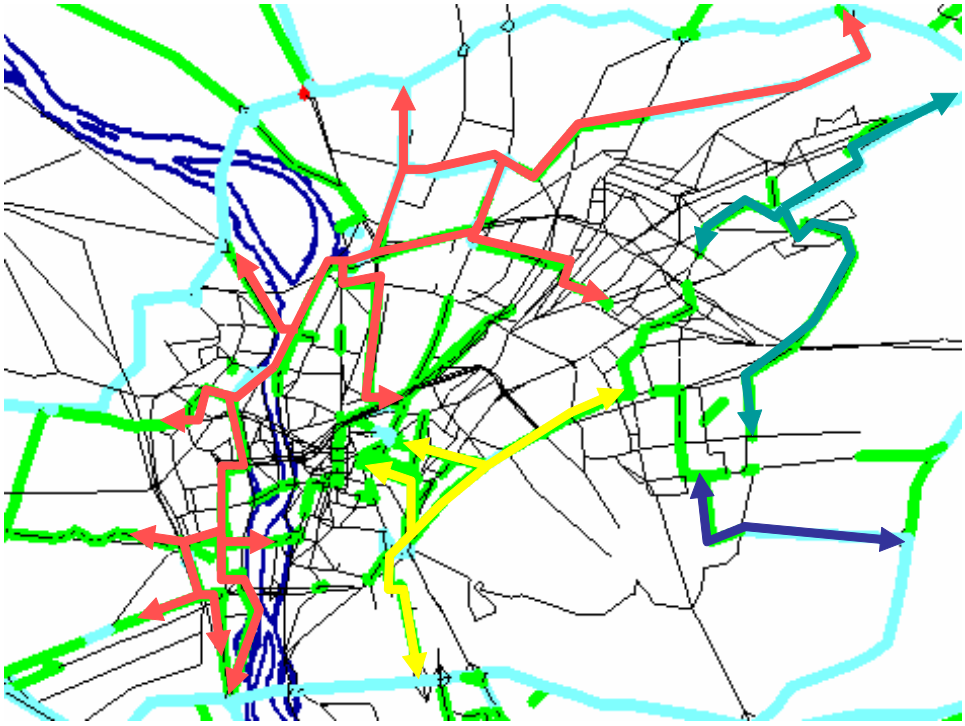
But the impact of the future roads will be much more visible in terms of truck volumes inside the Ring Road area where several new or improved roads will attract truck traffic, increasing the volume from below 5,000 PCU to over 10,000 PCU per day per direction on several clearly identifiable roads.

Nasr City will continue to attract high volumes of truck traffic. However, the access and exit patterns of these trucks will change over time as a consequence of the new road infrastructure. A positive effect of the new road infrastructure is that Autostrad - Salah Salem Street will show a notable decrease in truck traffic (below 5,000 PCU per day per direction). Most trucks will access Nasr City from the south-east via the corridor from the Ring Road to Amel City. In spite of the proposed Ain Sukhna - Nasr City road extension (HP-7), the volume on the corridor to El Moqatam, connecting directly to that new road extension will drop from over 10,000 PCU to below 5,000 PCU. From the north, cargo will in future enter Nasr City over the inner-city Expressway, via Abu Bar El Sadeeq Street (HE-4), crossing the Autostrad - Salah Salem Street below Heliopolis to link with the Ring Road via Gesr El Suez (HE-7). Truck traffic on the connection between the 2 roads will double with the new infrastructure in place. The advantage of these condensed traffic flows is that it will alleviate the roads in the Heliopolis area from trucks and reduce the percentage of trucks below 20% of total traffic.

The CBD will remain in future a very important pole of attraction for predominantly light trucks. While roads having a truck PCU volume over 5,000 are at present limited, its number will rise over the next 20 years. All important access roads to the CBD from 6th of October and Autostrad - Salah Salem route will have truck shares above 5,000 PCU per day per direction. The area near El Qalaa and Elsegen Streets, now already characterized by high truck volumes, will see this volume soar to over 10,000 PCU per day per direction. These patterns coincide with the structure of the new roads inside the Ring Road that will attract traffic from other roads to CBD, such as the link from El Cornish where traffic will reduce to below 5,000 PCU.

The impact of the new road infrastructure is the most visible in the Shobra El Kheima area. Without the new road infrastructure (Scenario A), traffic will concentrate on the road to Alexandria Agricultural Road and on the access road linking to the road to Belqas. This truck traffic will influence truck volumes on Abu Bakr El Sadeeq route where the volume of trucks is above 5,000 PCU per day per direction. With the new road infrastructure, truck traffic will now concentrate on 15th of May extension (HP-4) and on Moasaset El Zakah Street (HP-6) as alternative for the Abu Bakr El Sadeeq corridor. On Moasaset El Zakah Street, the volume of trucks will increase to more than 10,000 PCU per day per direction, making it the densest truck corridor inside the inner Ring Road area.

For the inner Ring Road area, the new road infrastructure will create new and more concentrated truck traffic flows in the future (see next Figure 6.3.7).



Source: JICA Study Team

Figure 6.3.7 Truck Flow Concentration inside the Ring Road

In summary, following major truck flow corridors can be identified under Scenario D:

- The Gezr El Suez Route towards Autostrad - Salah Salem Street
- Autostrad - Salah Salem Street from Autostrad towards CBD and Nasr City
- the west corridor, from Upper Egypt, over 6th of October City, via Tereat El Zumur Corridor into CBD, Giza and via "15th of May extension - Moasaset El Zakah Street corridor" into Shobra El Kheima and further to Ring Road via the road to Ismailya Agricultural Road;
- Corridor to Amal City from Ring Road to Nasr City.

(6) Impact of Heavy Trucks

Outside the Ring Road

The share of heavy trucks will continue to increase on Suez Desert Road over the next 20 years. The road will continue accommodating a high volume of truck traffic and over 50% of that will also in the future be heavy trucks. The effect of the new road infrastructure will remain limited to a small section on Suez Desert Road near the new link with the Regional Ring Road (HR-3; Suez Rd. to Fayoum Rd.) where the percentage of heavy trucks decreases below 50% of truck traffic. The rest of Suez Desert Road as the Regional Ring Road section from Suez Desert Road towards 10th of Ramadan City (HR-7; Suez Rd. to Kathatba Rd.) will still accommodate over 50% of heavy trucks.

Overall, the percentage of heavy trucks will not change as a consequence of the new road infrastructure. The heavy truck traffic patterns, observed in Scenario A, can also be observed in Scenario D.

The Ring Road

The limited effect of the new road links on heavy truck traffic is clearly demonstrated as with the expected volume of heavy trucks on the Ring Road. Only on the section between Ismailya Desert Road and Qatameya Road, the share of heavy trucks will in the future be above 50% without the new roads, but will drop below the 50% level if the new road links are developed (HR-3 and HR-7).

For the rest of the Ring Road, the volume of heavy trucks will remain below 50%, independent of the availability of new road infrastructure.

Inside the Ring Road

The truck ban inside the Ring Road will prove its effectiveness also in the future, more than the development of new road infrastructure will do. Over the next 20 years, total traffic inside the Ring Road will substantially increase, but the share of heavy trucks will remain everywhere below 50%. The situation will thus not change as a consequence of the proposed new road infrastructure. Even on the access roads to the industrial centers and on the connecting roads to the inter-city roads, the share of heavy trucks remains everywhere below the 50% mark.

(7) Percentage of Trucks in Total Traffic

Considering the future percentage of trucks (heavy and light trucks combined) in total traffic, it can be observed clearly that the new road infrastructure will have more impact on future truck traffic than the previous analyses suggested.

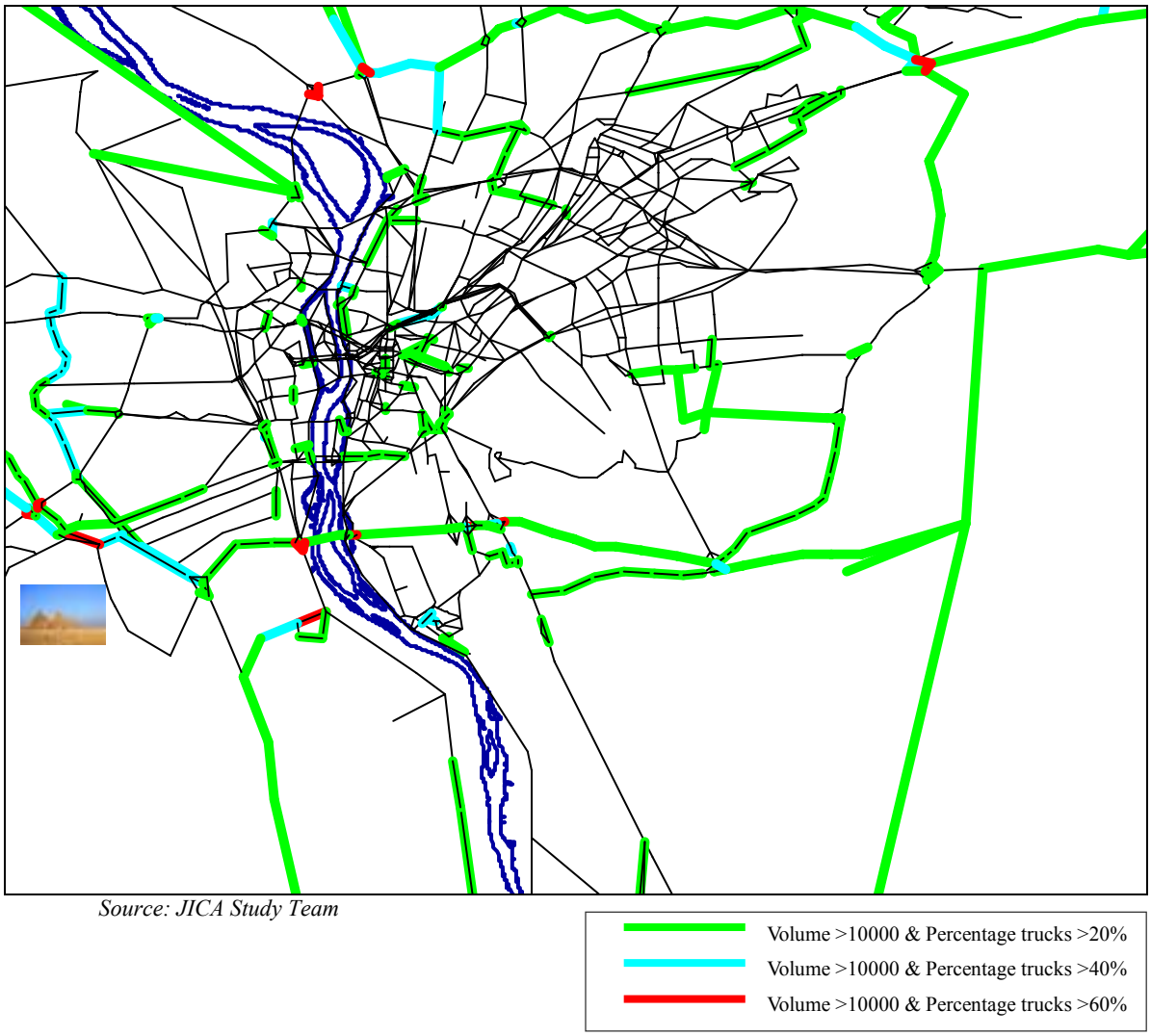
While the number of road sections where traffic was above 40% of total traffic is at present relatively high (26th of July Corridor; Ring Road between Ismailya Desert Road and Qatameya Road; Ismailya Desert Road, etc…), this percentage diminishes with the new and improve road infrastructure on most roads to levels below 40%, only with few exceptions. The reduction of the percentage of trucks can be generated by the development of new road infrastructure.

The concrete effects can be divided in two levels, equal to the area where they occur:

1. Important effects on the roads to and from the Ring Road

2. Small effect on the inner Ring Road area

Overall, the situation does not dramatically changes with the development of the new road infrastructure as far as truck traffic is concerned (see next Figure 6.3.8).



Source: JICA Study Team

Figure 6.3.8 Share of Trucks of Total PCU Volume >10,000 (2022 - Scenario D)

Outside the Ring Road

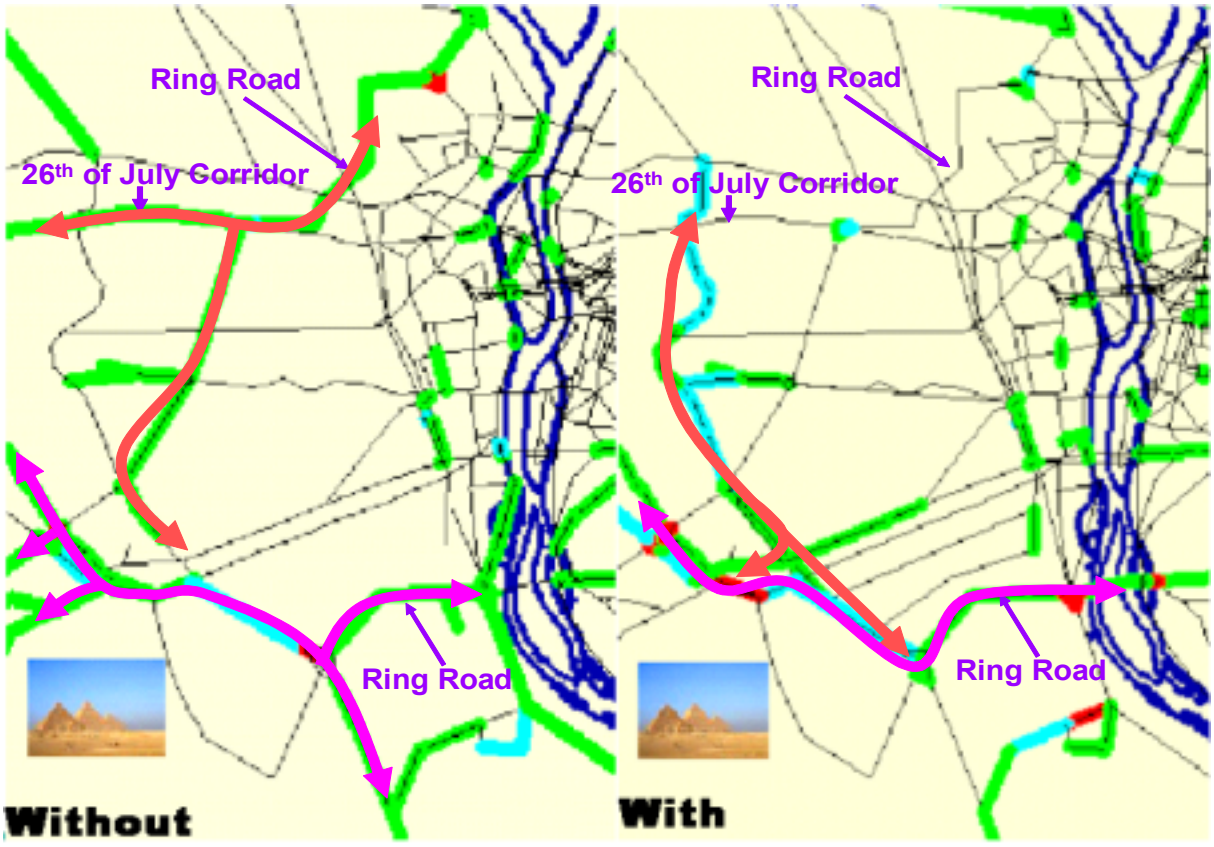
With the new road infrastructure in place, the percentage of trucks on the access roads will drop as compared to the situation without new roads. Compared to present levels, the drop in percentage of trucks occurs with both scenarios but the decline is more intense with the road infrastructure. Some concrete effects can be observed that could be attributed to the construction of new roads. For example, Autostrad has a future percentage of trucks between 20% and 40%, but with the creation of the Regional Ring Road (HR-3; Suez Rd. to Fayoum Rd.) this percentage will drop below 20% on most of the Autostrad.

The percentage of trucks on the road to and from 10th of Ramadan City will remain above 20%, even with the construction of new road infrastructure. While the percentage of trucks on that road is expected to be between 40% and 60% without the new road infrastructure, it will drop over the next 20 years to a level between

20% and 40%, which is half of the expected level without the construction of the Regional Ring Road (HR-7; Khatatba to Suez Rd). Similar patterns can be expected over the next 20 years on all other inter-city roads. Suez Desert Road, Alexandria Desert Road and the Road to Qanater, the 26th of July Corridor and Upper Egypt Agricultural Road will all have a lower percentage of trucks if the proposed new infrastructure is developed. Many of the access roads will even see the percentage of trucks drop below 20% of total traffic.

Particularly interesting is the possible impact of closing the Ring Road on Maryooteya road on the different roads between 6th of October City and Cairo. With the new infrastructure, truck traffic will concentrate on the new Ring Road corridor and make more efficient use of the Ring Road.

Without the proposed final Ring Road section, that particular corridor (Maryooteya road) can expect in the future an overall percentage of trucks below 20% but this percentage will soar to more than 40% with the new road infrastructure, as demonstrated in Figure 6.3.9 below (left side scenario D with new infrastructure, right side scenario A without infrastructure).



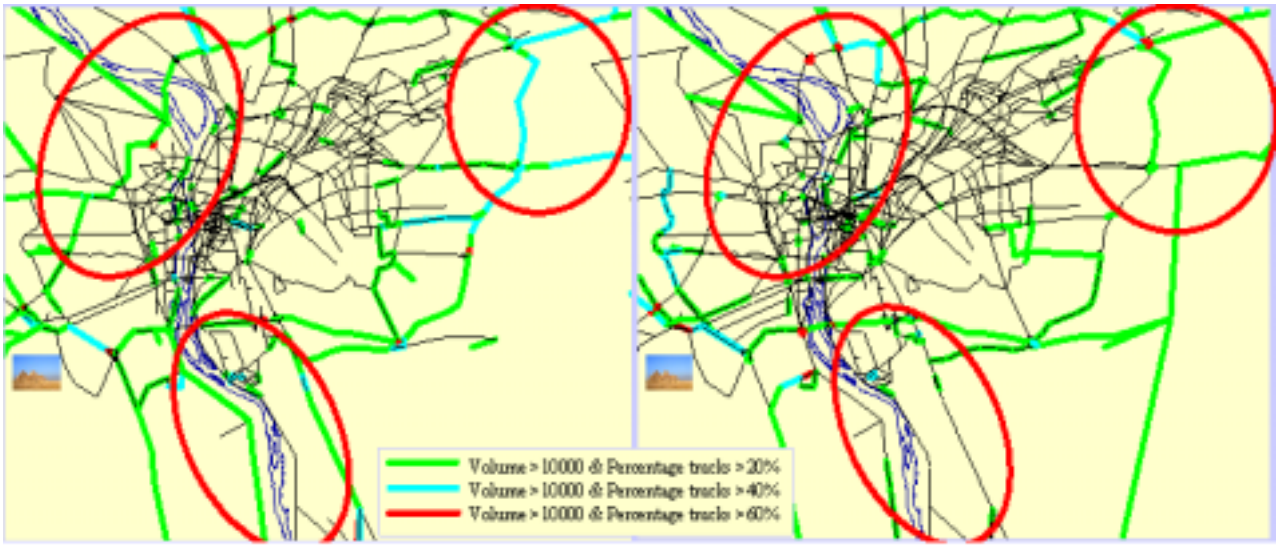
Source: JICA Study Team

Figure 6.3.9 Shift of Truck Traffic Flow with New Road Infrastructure

In case the proposed new road infrastructure is not realized (Scenario A, Figure 6.3.9 right side), one can clearly see that truck flows to and from Alexandria will concentrate on 26th of July Corridor to the east side of the Ring Road to go either north or south towards 6th of October City (red arrows).

A second concentrated flow can be found between Alexandria Desert Road and Upper Egypt and the south entrance of the Ring Road over 6th of October City (purple arrows). With the proposed new road infrastructure in place (Scenario D, Figure 6.3.9 left side) traffic to and from Alexandria (via Desert Road and Road to Qanater) shifts from 26th of July Corridor and the east section of the Ring Road to enter the Ring Road at Maryooteya road and continue towards 6th of October City, the south west entrance of the Ring Road and to a lesser extent towards Upper Egypt (red arrows). The second flow (purple arrows) remains dense even with the new infrastructure in place.

But the overall positive effects on truck traffic flows in the GCR should not be underestimated. Truck traffic density substantially reduces on the east section of the Ring Road, between Ismalia Desert Road and Suez Desert Road and on Upper Egypt Desert and Agricultural Roads as can be seen in next Figure 6.3.10. It should be noted that this positive flow structure is also a consequence of the planned Regional Ring Road. The potential effects thereof can, however, not be calculated in the context of the CREATS study.



Source: JICA Study Team

Figure 6.3.10 Secondary effects of closing the Ring Road

The Ring Road

As compared to Scenario A the percentage of trucks in total traffic drops dramatically on the west side of the Ring Road where it decreases on the entire Ring Road to a level below 20% of total traffic. Also on the Ring Road section between Ismailya Desert Road and Suez Desert Road, the percentage of trucks plummets from

more than 40% to below 20% between Suez Desert Road and the corridor between Ring Road and Amal City.

The percentage of truck rises again above 20% on that section and on the rest of the southern Ring Road until Upper Egypt Desert Road.

The Regional Ring Road will offer interesting alternatives for truck traffic, allowing them to avoid the Ring Road's most congested sections. While the effects will be clearly visible on the western and eastern sections of the Ring Road where the percentage of trucks drops below 20% of total traffic, the effects of new road infrastructure remain relatively low on the northern and southern sections, where the percentage of trucks in total traffic will remain between 20% and 40%, independent whether the new roads are build or not.

This evolution clearly demonstrates that future north-south transit traffic, in particular between Alexandria and Upper Egypt and between Alexandria and Suez will avoid in future the Ring Road to use the Regional Ring Road.

Inside the Ring Road

With the exception of a few locations which are already known at present (Shobra El Kheima, CBD, GBD and Nasr City) trucks do not count for an important percentage of total traffic on the roads inside the Ring Road and the situation will not change over the next 20 years. Even stronger, the situation will remain similar, regardless of whether the proposed new roads inside the Ring Road area are build or not. The only visible effect of the new roads will be that traffic shifts from one road to another and that this shift can have a positive impact or a negative one.

The first visible difference is on the roads towards Nasr City. Autostrad is no longer the priority access road and truck traffic on Ahmed El Zomor Street will practically disappear while the percentage is now over 40%. The percentage of trucks on the corridor from Maqathon to the Ring Road will also drop below 20% of total traffic while it remains above that level without the new infrastructure. The impact on traffic of accessing Nasr City from the Ring Road will be concentrated on the corridor from the Ring Road to Amel City which will remain the only access road to Nasr City that has over 20% of trucks in total traffic. This evolution is undoubtedly supported by the proposed road to New Cairo and the improved connection inside Nasr City via the construction of The Ain Sukhna - Nasr City Rd. Extension (HP-7).

In Shobra El Kheima, the effects of the proposed road infrastructure will increase the percentage of truck traffic on the 15th of May extension and on Moasaset El Zakah Street where the truck percentage will increase above 40% for the former road, and from below 20% to more than 20% for the latter road. The 15th of May Street extension is undoubtedly used by trucks as alternative for the road to Alexandria Agricultural Road, which explains for the higher share (above 20%) on the latter Ring Road section.

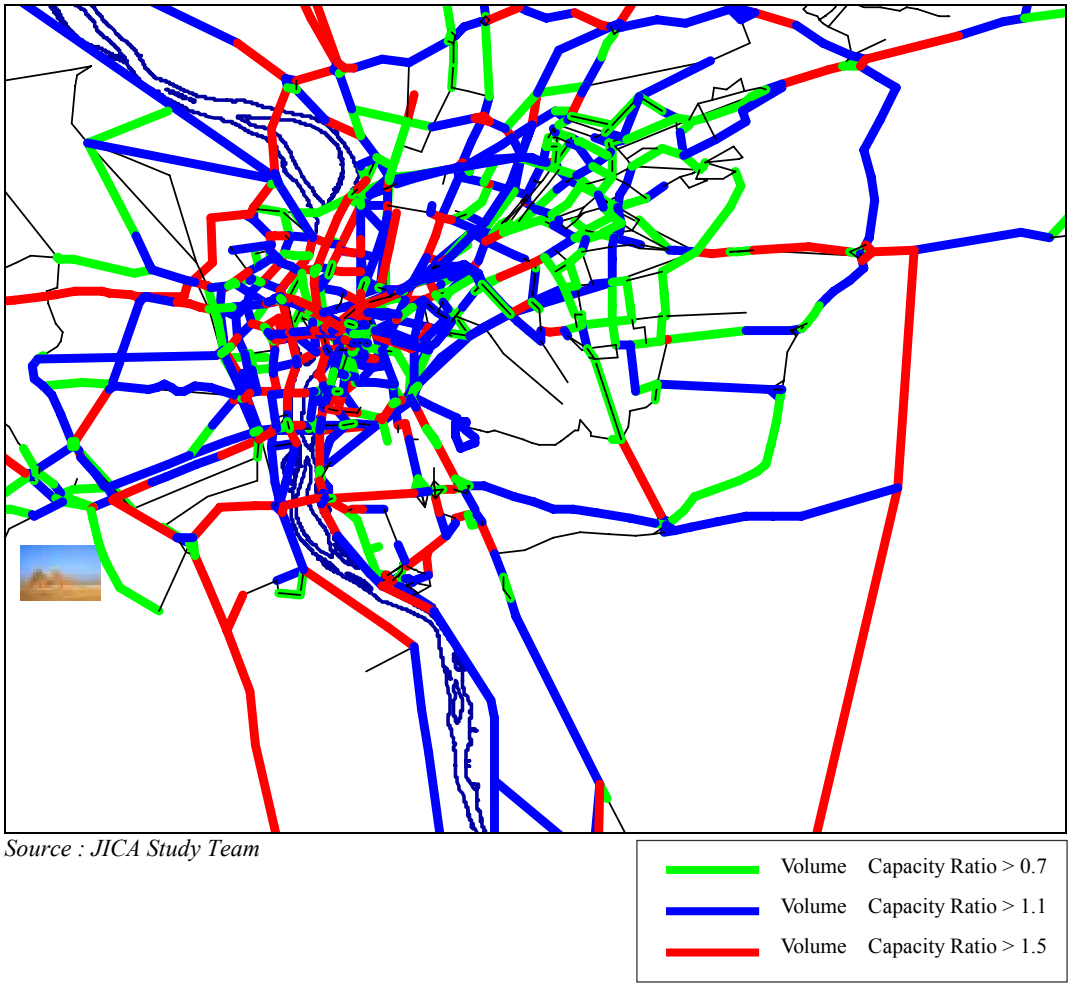
For the CBD and GBD areas, the patterns do not change if new road infrastructure is introduced, although some small shifts between roads can be observed. It remains a

remarkable and important fact that inside the Ring Road area, the total percentage of trucks on most roads is below 20%, even for several roads that at present have a percentage of trucks above 20% of total traffic.

This forecast indicates that over the next 20 years, the increase of trucks inside the Ring Road area is much lower than the expected increase of other traffic. On overall, the orientation of trucks inside the Ring Road area that exist at present will persist in the future. The contribution of the new road infrastructure is limited to some minor shifts towards a number of improved corridors.

(8) Traffic Density and Trucks

The expected future situation with new road infrastructure (Scenario D) will remain similar to the case without new road infrastructure (Scenario A) as is demonstrated in next Figure 6.3.11.



Source : JICA Study Team

Figure 6.3.11 All Vehicles in PCU Volume Capacity (2022 - Scenario D)

The total share of trucks fluctuates between 20% and 40% on streets where the V/C ratio is between 1.1 and 1.5. The new road infrastructure does not make a big difference inside the Ring Road area and has local effects outside the Ring Road that have already been discussed in the earlier paragraphs.

See for example the future situation on the 26th of July Corridor. Truck volumes on the access roads to this corridor will substantially increase over the next 20 years but the new road infrastructure will have the share of trucks drop below 20% of total traffic, while it remains above that level without the new road infrastructure. Overall, with or without the new roads, the percentage of trucks remains moderate and the contribution of truck flows to the congestion will be limited.

The impact of the new road infrastructure will be particularly visible on the Ring Road. The V/C ratio will over the next 20 years increase above 1.5. but the new roads will drop the percentage of trucks below 20% of total traffic on the westbound section of the Ring Road and on the Suez Desert Road section of the Ring Road.

Several truck flows will shift in the future to avoid expected future road congestion. The direct consequence is that many roads with a percentage of trucks over 20% (and in some instances over 40%) are connections with minimal capacity problems (low V/C ratio). Striking examples are the 26th of July Corridor, Autostrad and Ismailya Desert road, where capacity ratios of 1.5 are expected, but the percentage of trucks will remain below 20% of total traffic.

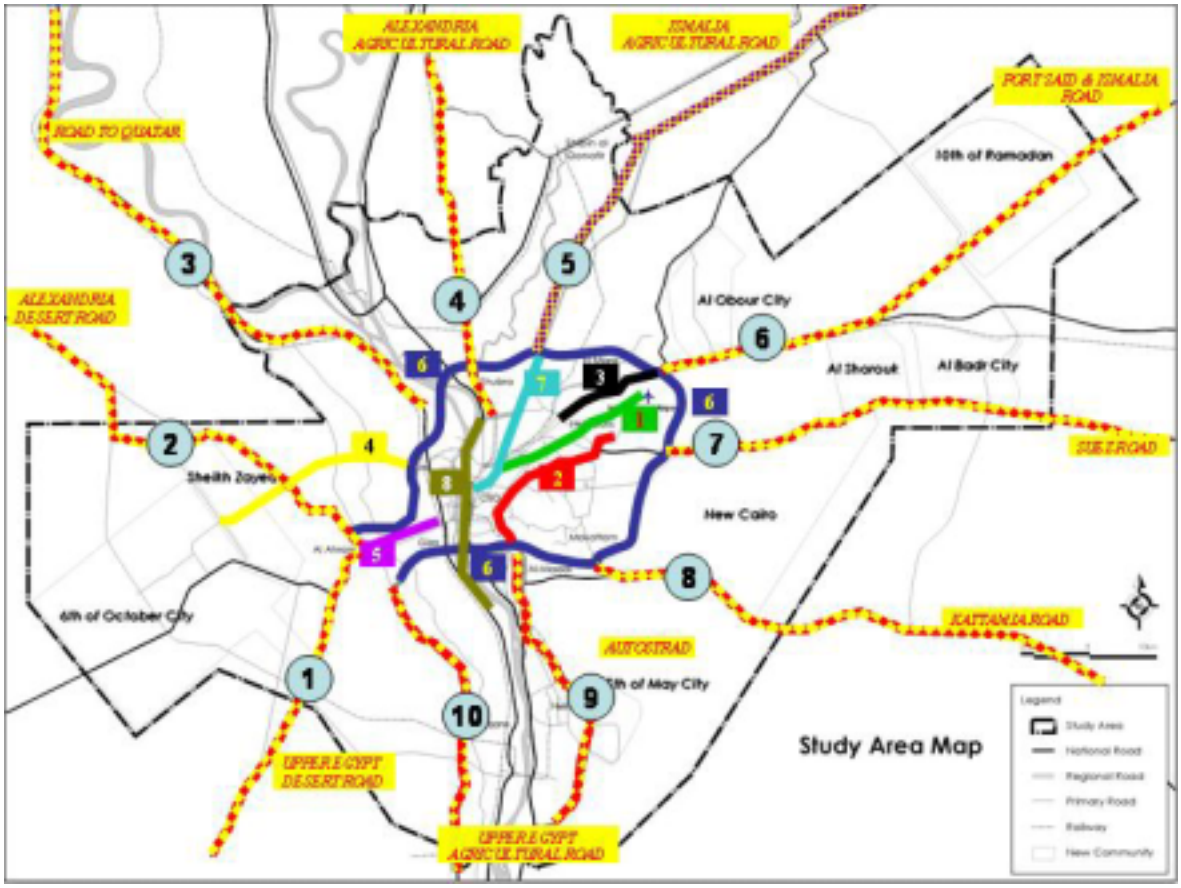
It can be said that the proposed improvements of several road connections near 6th of October City, in particular the closing of the Ring Road (HR-9; Ring Road on Maryooteya Rd.) and the construction of the Regional Ring Road (section HR-3 Suez Rd to Fayoum Rd; HR-7 Khatatba to Suez Rd) will be beneficial for efficient truck flows in the future.

6.3.4 Résumé of truck traffic evolution on some main corridors

As was clearly demonstrated in the above analyses, trucks are at present not a major issue and will not become so in the future. The detailed analyses furthermore indicate that trucks will only contribute to expected future traffic problems on certain inter-city corridors and on a limited number of inner-city main roads.

For that reason and to clearly indicate the potential future problem areas in respect to truck movements, this paragraph resumes the results for the roads and corridors as indicated in next Figure 6.3.12. In the thereafter Tables, some comparative analyses are provided for the dominant roads.

It should be clearly noted that the fact that a road / corridor is included in the list, does not automatically implies that truck traffic is or will become a concrete problem. It only demonstrates that on some roads, the share of trucks has or could reach a level where specific attention is required. In all cases, the truck volumes add to the existing and expected high volumes of other traffic, therewith contributing to the possible future grid lock of several of the major roads and corridors in the GCR.



Source : JICA Study Team

Figure 6.3.12 Main corridors and streets with potential truck traffic problems

Table 6.3.1 Truck Traffic on main corridors and streets outside Ring Road (2001)

Outside Ring Road

Name	Small Truck	Big Truck	Total	% of Total Vehicles
Giza-Asyout Road	6,566	5,334	11,900	23.7%
Alexandria Desert Road	8,854	7,446	16,300	58.4%
Qanater El Khairyiah Khataba Road	2,400	600	3,000	20.0%
Alexandria Agricultural Road	23,368	9,532	32,900	20.4%
Ismalia Agricultural Road	8,000	1,600	9,600	14.0%
Port Said Road	28,827	10,773	39,600	47.7%
Suez Road	5,700	11,000	16,700	58.4%
Kattamia Road	5,352	4,848	10,200	22.8%
Autostrad	12,381	4,219	16,600	17.1%
Upper Egypt Agricultural Road	16,344	2,356	18,700	22.2%

Source : JICA Study Team

Table 6.3.2 Truck Traffic on main corridors and streets outside Ring Road (2012)

Name	Small Truck	Big Truck	Total	% of Total Vehicles
Giza-Asyout Road	8,055	6,245	14,300	23.2%
Alexandria Desert Road	12,200	10,300	22,500	57.7%
Qanater El Khairyiah Khataba Road	8,652	1,648	10,300	43.5%
Alexandria Agricultural Road	51,916	21,084	73,000	45.6%
Ismalia Agricultural Road	10,936	2,364	13,300	15.1%
Port Said Road	34,084	3,616	37,700	47.0%
Suez Road	24,841	15,959	40,800	29.8%
Kattamia Road	29,125	5,175	34,300	32.1%
Autostrad	9,910	2,790	12,700	15.2%
Upper Egypt Agricultural Road	12,226	974	13,200	17.1%

Source : JICA Study Team

Table 6.3.3 Truck Traffic on main corridors and streets outside Ring Road (2022)

Name	Small Truck	Big Truck	Total	% of Total Vehicles
Giza-Asyout Road	10,512	10,688	21,200	25.4%
Alexandria Desert Road	16,400	13,800	30,200	57.0%
Qanater El Khairyiah Khataba Road	12,387	2,213	14,600	40.9%
Alexandria Agricultural Road	59,351	25,449	84,800	38.4%
Ismalia Agricultural Road	14,717	3,083	17,800	14.0%
Port Said Road	44,095	11,705	55,800	33.7%
Suez Road	33,838	22,462	56,300	19.1%
Kattamia Road	20,429	8,551	28,980	17.2%
Autostrad	9,734	3,566	13,300	10.6%
Upper Egypt Agricultural Road	16,169	3,731	19,900	15.4%

Source : JICA Study Team

Truck movements outside the Ring Road will remain stable over the next 20 years. But some remarkable phenomena can be observed which confirm the analyses above:

- Traffic from Upper Egypt (via Autostrad and Upper Egypt Agricultural Road) will remain relatively constant in absolute volumes while the percentage of trucks in total traffic will substantially reduce therewith confirming the overall tendency that truck traffic increase will be inferior to the increase of private cars. The long-term stability in truck volumes is, however, caused by a sharp decline between 2001 and 2012 and a consequent growth until 2022, bringing the levels of both large and small trucks back to the 2001 level.

- Traffic from the Alexandria area, using Alexandria Agricultural and Desert Roads and Quanater El Khairyiah Khataba Road will know a substantial increase in truck

volumes. While the percentage of trucks on Alexandria Desert Road will remain fairly constant over the next 20 years, the percentages on the two other roads will double. Large trucks have the tendency to use Alexandria Desert Road, while smaller trucks use the two other roads. But it should be noted that the increase of large trucks is particularly impressive on Quanater El Khairyiah Khataba Road, where the total daily volume of large trucks will evolve from 900 PCU per day per direction in 2001 to 2.213 PCU per day per direction in 2022. From the three main roads to Alexandria, the Agricultural Road is now and will be in the future the most problematic because in 2022, the high volume of trucks will not even represent 40% of the total traffic on that road. Quanater El Khairyiah Khataba Road will also have to be monitored in the longer term future, because the share of trucks will grow from approximately 20% of total traffic to 40%. But it is not guaranteed that this evolution will create problems, because the absolute volumes of trucks are nothing compared to the levels noted on both other inter-city roads.

- The volume of trucks on Suez Desert Road will triple over the next 20 years, an increase that is partly the consequence of the spectacular increase in small truck volumes, while heavy trucks demonstrate a more equal increase. If problems arise in the future on Suez Desert Road, they will not be caused by these trucks, because the percentage of trucks (small and large trucks combined) on this road will drop dramatically from 58% to 19%.

- The Ismalia Corridor is dominated by traffic on Port Said Road / Ismalia Desert Road (linking Cairo to 10th of Ramadan City) is and will remain undoubtedly the road with the highest volume of truck traffic. With a truck volume of 39,000 PCU per day per direction, it is the road with the highest number of trucks. But the increase in truck volumes to 55.800 PCU per day per direction is less dramatic than Alexandria Agricultural Road that in 2022 will take the lead over Port Said Road in absolute numbers of trucks. As it is the case for several other inter-city roads, the percentage of trucks in total traffic will drop, in the case of Port Said Road from almost 50% to just above 33%, clearly indicating that traffic congestion will only to a lesser extent be the consequence of increased truck traffic. Ismalia Agricultural Road will also know an increase in truck traffic with a volume that will almost double over the next 20 years (in the beginning predominantly small trucks, later a substantial increase in heavy trucks). But the impact on total traffic will remain limited, because the percentage of trucks in total traffic remains stable around 14% of total traffic.

In summary, the situation on the inter-city roads to and from Cairo will remain relatively stable. While the number of trucks will increase on all roads, the percentage of trucks on all these roads will generally diminish. This clearly indicates that possible congestion on these roads in the future will not or only partly be caused by trucks. The real cause of eventual congestion on the inter-city roads near Cairo will have to be sought in the expected impressive increases of private car traffic.

The only exception is on the Alexandria Corridor. This exception is logical because the expected increase in economic and industrial activity in the GCR will also be in the future oriented towards / concentrated on Alexandria (port), the industrial areas in the north and the fertile Nile Delta. While the increase in large trucks will be

relatively stable, it is in particular the spectacular increase in small trucks that will most probably cause important traffic problems on this corridor. From the three dominant roads in this corridor; Alexandria Agricultural Road, Alexandria Desert Road and Quanater El Khairyiah Khataba Road it is the Desert Road that will have the most stable evolution with approximately 57% of trucks in total traffic and a gradual increase spread over both small and large trucks. The two other roads will in the future have to accommodate for spectacular increases in truck traffic (both small and large trucks) with truck volumes on Alexandria Agricultural Road triple over the next 20 years and on Quanater El Khairyiah Khataba Road quadruple over the same period.

The evolution of truck traffic on the main inter-city roads to and from Cairo is summarized in next Table 6.3.4.

Table 6.3.4 Truck Traffic evolution outside Ring Road (2001 - 2022)

SUMMARY	*Total Trucks*			*% of Trucks*		
Name	Year 01	Year 12	Year 22	Year 01	Year 12	Year 22
Giza-Asyout Road	11,900	14,300	21,200	23.7%	23.2%	25.4%
Alexandria Desert Road	16,300	22,500	30,200	58.4%	57.7%	57.0%
Qanater El Khairyiah Khataba Road	3,000	10,300	14,600	20.0%	43.5%	40.9%
Alexandria Agricultural Road	32,900	73,000	84,800	20.4%	45.6%	38.4%
Ismalia Agricultural Road	9,600	13,300	17,800	14.0%	15.1%	14.0%
Port Said Road	39,600	37,700	55,800	47.7%	47.0%	33.7%
Suez Road	16,700	40,800	56,300	58.4%	29.8%	19.1%
Kattamia Road	10,200	34,300	28,980	22.8%	32.1%	17.2%
Autostrad	16,600	12,700	13,300	17.1%	15.2%	10.6%
Upper Egypt Agricultural Road	18,700	13,200	19,900	22.2%	17.1%	15.4%

Source : JICA Study Team

The Ring Road and key roads inside the Ring Road

Evaluating the evolution on the Ring Road and inside the Ring Road area is more complicated because the expected evolution is conditioned several factors such as the construction of new road infrastructure, the development of alternative cargo transport, policy measures to structure / limit truck traffic, etc…

Furthermore, a detailed street-by-street analysis is less relevant because alternative streets can be selected in case of high congestion on a specific road. Therefore, the comparative analysis hereafter is focussed on several main areas on and inside the Ring Road. These areas consist of the main truck traffic “corridors” that have been identified in the cargo transport analyses.

Table 6.3.5 Truck Traffic on Ring Road and streets inside Ring Road (2001)

	Area	Small Truck	Big Truck	Total	% of Total Vehicles
1	Salah Salem Corridor	9,213	1,687	10,900	14.5%
2	Autostrad Street	6,747	153	6,900	6.9%
3	Gesr El Suez Road	12,270	1,330	13,600	13.3%
4	26th of July Corridor	16,917	6,483	23,400	44.3%
5	Faisal Street	1,533	767	2,300	2.3%
6	Ring Road (Between Port Said and Suez Rd)	18,321	12,079	30,400	52.1%
6	Ring Road (Southern River Crossing)	16,347	3,153	19,500	16.0%
6	Ring Road (Northern River Crossing)	23,560	12,840	36,400	31.6%
7	Port said Street	2,064	236	2,300	3.1%
8	Nasr Street	10,732	268	11,000	12.3%

Source : JICA Study Team

Table 6.3.6 Truck Traffic on Ring Road and streets inside Ring Road (2012)

	Area	Small Truck	Big Trucks	Total	% of Total Vehicles
1	Salah Salem Corridor	8,487	613	9,100	9.1%
2	Autostrad Street	4,133	67	4,200	4.0%
3	Gesr El Suez Road	21,820	1,480	23,300	27.2%
4	26th of July Corridor	23,593	6,007	29,600	30.2%
5	Faisal Street	1,343	157	1,500	1.9%
6	Ring Road (Between Port Said and Suez Rd)	18,878	10,722	29,600	44.6%
6	Ring Road (Southern River Crossing)	38,670	5,430	44,100	23.0%
6	Ring Road (Northern River Crossing)	22,656	6,844	29,500	19.7%
7	Port said Street	2,246	54	2,300	3.1%
8	Nasr Street	4,021	1,079	5,100	5.8%

Source : JICA Study Team

Table 6.3.7 Truck Traffic on Ring Road and streets inside Ring Road (2022)

	Area	Small Truck	Big Truck	Total	% of Total Vehicles
1	Salah Salem Corridor	6.210	990	7.200	6,2%
2	Autostrad Street	7.886	1.314	9.200	6,9%
3	Gesr El Suez Road	21.921	3.579	25.500	19,5%
4	26th of July Corridor	24.157	9.543	33.700	12,9%
5	Faisal Street	2.787	813	3.600	3,1%
6	Ring Road (Between Port Said and Suez Rd)	24.348	20.052	44.400	34,3%
6	Ring Road (Southern River Crossing)	40.317	14.783	55.100	20,0%
6	Ring Road (Northern River Crossing)	22.741	12.259	35.000	15,7%
7	Port said Street	1.935	149	2.084	2,1%
8	Nasr Street	6.960	1.440	8.400	6,9%

Source : JICA Study Team

The impact of truck traffic (both small and large trucks) on the Ring Road and inside the Ring Road area is less important than the impact this traffic has on the inter-city access roads.

Inside the Ring Road, the share of truck traffic inside the ring road at present hardly exceeds the 15% of total traffic and this share will reduce over the next 20 years to below 10%. Only the Ring Road, 26th of July Corridor and Gesr El Suez Road (the access to Ismalia Desert Road) show much higher truck traffic volumes that demonstrate particular evolutions related to expected socio-economic evolutions, the increase in car ownership and the possible impact of new road infrastructure.

The most remarkable conclusions in respect of truck traffic volumes on and inside the Ring Road are:

- The Ring Road has sufficient capacity to accommodate present and future truck traffic. Only the section between Suez Desert Road and Ismalia Desert Road have at present a high percentage of trucks but this share will gradually diminish to shares below 30% of total traffic. Important is the different evolution of small and large trucks on the Ring Road. While the number of small trucks will continue to increase at all Ring Road sections, the number of large trucks will remain relatively stable over the next 20 years (with a clear reduction over the next 10 years).

- Most of the inner Ring Road corridors presently have low percentages of truck traffic, predominantly small trucks. Over the next 20 years, this percentage will drop or remain stable confirming the previous conclusions that truck traffic will not be the cause of future traffic congestion. Their percentage is too low to have a significant impact on the expected evolution of traffic inside the Ring Road area.

- Two corridors, 26th of July Corridor and Gesr El Suez Road, have to be monitored closely, although the expected trend is that the percentage of trucks will reduce significantly over the next 20 years.

- Truck traffic on 26th of July Corridor is at present very dense and the number of large trucks is not negligible. But while the number of small trucks will almost double over the next 20 years, the number of large trucks will only increase with approximately 50%, indicating that the impact of the proposed new road infrastructure will contribute in alleviating this corridor. The percentage of trucks will in time reduce spectacularly, from 45% to 13% of total traffic, clearly indicating once more that the impact of truck traffic in future traffic will further reduce.

- Truck traffic on Gesr El Suez Road (the access to Ismalia Desert Road) is very high at present and will remain a problem also in the future. In particular the number of large trucks is at present already at an unacceptable high level (as compared to the other roads inside the Ring Road area and taking into account the truck ban) and will even triple over the next 20 years!

As an overall conclusion of this comparative analysis, it can be stated that the results of the previous analyses are confirmed and that truck traffic (both small and large trucks) is not and will not become the cause of existing or future traffic problems on the Ring Road or inside the Ring Road area.

The evolution of truck traffic on the Ring Road and on the main corridors inside the Ring Road area is summarized in next Table 6.3.8.

Table 6.3.8 Truck Traffic on Ring Road and main corridors inside Ring Road

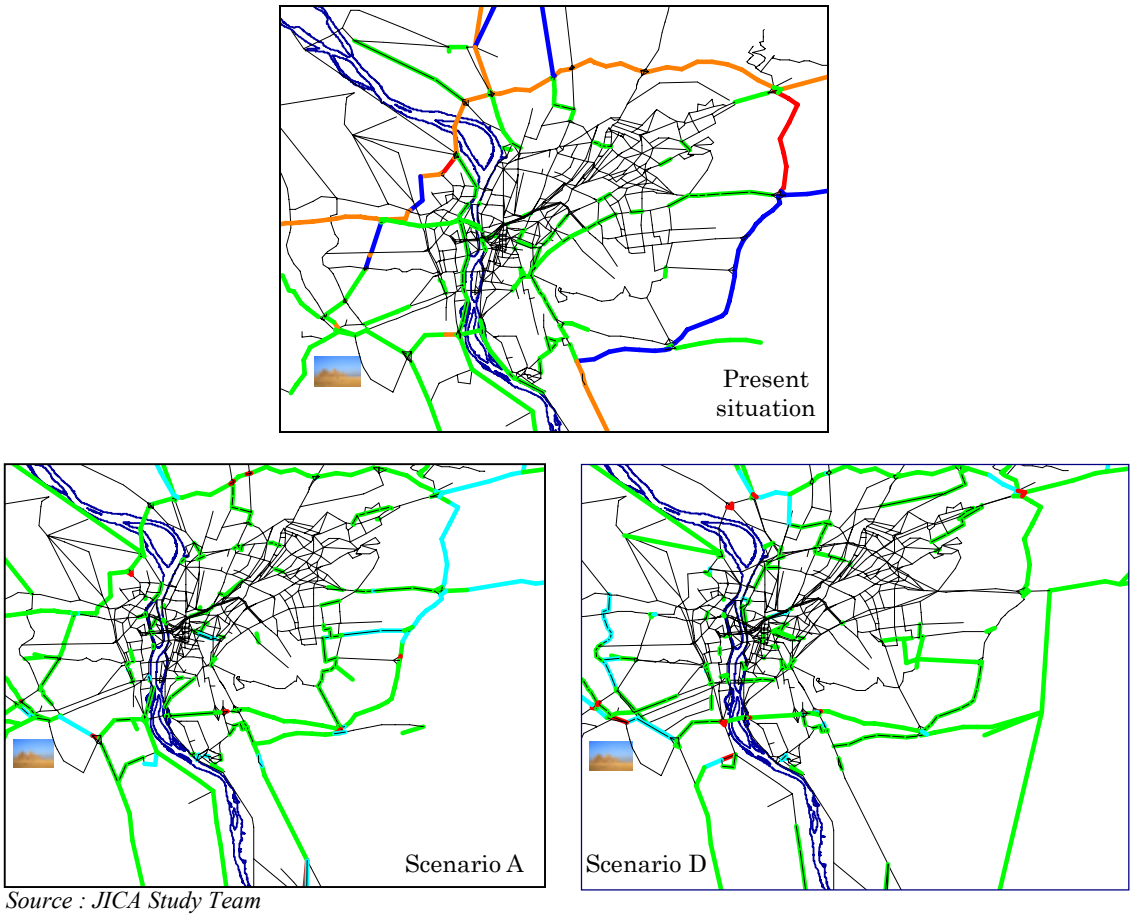
	Area	Total Trucks			% of Trucks		
		Year 01	Year 12	Year 22	Year 01	Year 12	Year 22
1	Salah Salem Corridor	10,900	9,100	7,200	14.5%	9.1%	6.2%
2	Autostrad Street	6,900	4,200	9,200	6.9%	4.0%	6.9%
3	Gesr El Suez Road	13,600	23,300	25,500	13.3%	27.2%	19.5%
4	26th of July Corridor	23,400	29,600	33,700	44.3%	30.2%	12.9%
5	Faisal Street	2,300	1,500	3,600	2.3%	1.9%	3.1%
6	Ring Road (Port Said - Suez Rd)	30,400	29,600	44,400	52.1%	44.6%	34.3%
6	Ring Road (Southern River Crossing)	19,500	44,100	55,100	16.0%	23.0%	20.0%
6	Ring Road (Northern River Crossing)	36,400	29,500	35,000	31.6%	19.7%	15.7%
7	Port said Street	2,300	2,300	2,084	3.1%	3.1%	2.1%
8	Nasr Street	11,000	5,100	8,400	12.3%	5.8%	6.9%

6.4 CONCLUSIONS

Although the total volume of trucks will substantially increase on all roads over the next 20 years, also on the new road network if build, the overall effects of cargo transport on traffic in the Greater Cairo Region will remain low.

The creation of the Regional Ring Road will avoid that too many heavy trucks will interact with traffic on the Ring Road, while the truck ban inside the Ring Road will also in the future help to control the influx of heavy trucks in that area.

As can be seen in Figure 6.4.1, the percentage of trucks (both small and heavy trucks) in total traffic will in future even regress compared to the situation today. In particular on the Ring Road and inside the Ring Road area the percentage of trucks in total traffic will drop and this independent of whether or not the new road infrastructure is developed.



Source : JICA Study Team

Figure 6.4.1 Present Percentage compared to Future Percentage of Trucks

In general, it can be expected that over the next 20 years:

- The percentage of all trucks combined in total traffic will reduce on all roads although total truck traffic will double;
- The impact of heavy trucks on traffic, which at present already is limited will further in the future;
- Without the new road infrastructure, the percentage of trucks will remain below 40% on most of the Ring Road and the access roads, with few exceptions on roads and road sections where the percentage of trucks is at present already over 40%.
- If the new road infrastructure is developed, the percentage of trucks will drop spectacularly on the Ring Road and on several inter-city roads to Cairo, where the percentage drops below 20% of total traffic.
- The impact or new road infrastructure inside the Ring Road will remain limited.
- The percentage of trucks on total traffic inside the Ring Road area will reduce in the future with or without the new road infrastructure. The percentage of trucks will remain below 20% on most of the roads inside the Ring Road area and the number of roads where the percentage is above that level will reduce as compared to now.
- The new road infrastructure will centralize the movement of trucks inside the Ring Road area on clearly identifiable corridors.

The forecasts suggest that *trucks will in future increasingly use roads that avoid congested areas.* Corridors with particularly dense traffic will in the future have lower percentage of truck traffic, where roads where capacity is more than sufficient have higher percentage of trucks. The results do not mean that trucks could not cause problems in the future, but *only imply that the expected traffic problems will only to a limited extent be caused by truck traffic.* The volume of private cars will grow much faster than the number of trucks and the capacity problems of the future will be a consequence of rising number of private cars, rather than an increase of truck movements. The truck ban inside the Ring Road will also in the future keep the volume of large trucks low. However, problems with heavy trucks could arise because increased economic and industrial activity will boast these numbers to levels that double and triple the present volumes although the percentage in total traffic will reduce. But adding the trucks to congested roads will undoubtedly increase the level of congestion. The percentage of small trucks in total traffic will in the future reduce but their volume will also substantially increase and continue to concentrate on the areas where at present economic activity is concentrated.

The overall conclusion is that only few capacity problems can be expected over the next 20 years that will be caused by truck traffic. New road infrastructure will be important but not critical for future cargo transport in the Greater Cairo Region.

6.5 RECOMMENDATIONS

6.5.1 Infrastructure Development

Traffic problems of the future in the GCR will only to a lesser extent be caused by cargo transport. As demonstrated, the percentage in total traffic of trucks will reduce over the next 20 years, on many roads with 50% or more. From a cargo transport perspective, the existing road infrastructure is sufficient to accommodate future increase. The new road infrastructure will further reduce the possible impact of truck traffic to a level where it is no longer a subject for real concern (at least in respect to road infrastructure).

It does not mean that the new infrastructure is not necessary. The reduced percentage of trucks in total traffic still means that its volume will at least double over the next 20 year. Therefore, measures oriented towards truck movements should be considered to minimize truck movements, therewith providing more space on the road infrastructure for other vehicles.

For trucks, no new road infrastructure is necessary in the near future, but following road infrastructure will contribute to improve the efficiency of truck movements:

Short and Medium term

1. HP-5 (Ahmed Oraby St.)
2. HP-6 (Moasaset El Zakah St.)
3. HP-7 (Ain Sukhna - Nasr City Rd. extension)
4. HR-9 (closing the Ring Road)
5. HR-1 (connection Wahat)
6. HE-8 (Tereat El Zumur south route)
7. HE-9 (Tereat El Zumur north route)

Long term road development

1. HR-3 (Suez Rd. to Fayoum Rd.)
2. HR-4 (Fayoum Rd. to Khatatba)
3. HR-7 (Khatatba to Suez Rd.)

The development in the medium term of the three first road infrastructure proposals inside the Ring Road will have a positive effect on truck movements inside the Ring Road area, in particular in Shobra El Kheima and Nasr City. Closing the Ring Road and developing the connection to Wahat and the Tereat El Zumur Route will improve access to Cairo from Upper Egypt, 6th of October City and Alexandria and Qanater.

A less important but interesting long term road infrastructure development is the link from the south towards 10th of Ramadan City (HR-10 Ring Road to Ismailya; HR-11

Ring Road to Suez). This line will directly link 6th of October City with 10th of Ramadan City and improve access to 10th of Ramadan City and the eastern Ring Road from Upper Egypt Agricultural and Desert Roads.

The above listed road infrastructure will help to control truck flows in four problem areas where truck shares are particularly high and capacity problems exist in 2022:

1. Shobra el Kheima
2. The access to 6th of October City
3. Cairo Business District
4. Nasr City

Shobra El Kheima area

Most trucks servicing the area need to pass until the intersection of the road to Alexandria Agricultural Road and Abu Bakr El Sadeeq route before entering the area or come via the Road to Belqas on to Esco School Street.

The road infrastructure will improve the access to the area via new urban primary street connections, which will benefit total vehicle throughput on the extension of Alexandria Agricultural Road and inside the area. As a consequence, the share of trucks on the road to Alexandria Agricultural road will decrease below 20%, while truck shares will rise in particular on the 15th of May Street extension where the truck percentage will rise in the future to a volume between 20% and 40% of total traffic.

Connection to 6th of October City

The new road infrastructure will link the two ends of the Ring Road to the satellite city offering infrastructure users a wide variety of new possibilities to go from one end of the Ring Road to 6th of October City. The distribution of total traffic in that area over several roads will substantially reduce truck traffic density. Interconnecting the Ring Road will certainly alleviate truck traffic on the Tereat El Zumur Route where truck traffic is at present already dense. It will also have an important positive impact on truck movements on the 26th of July Corridor, where the percentage will reduce below 20% of total traffic.

Truck traffic from the Upper Nile Delta and in particular from Alexandria Desert Road will concentrate on the new access to Cairo, increasing truck traffic on the corridor from Upper Egypt and Alexandria Desert Road, increasing the percentage of trucks from below 20% to a level between 20% and 40%.

Cairo Business Districts

CBD will also in the future continue to attract a high volume of trucks, predominantly small trucks and pick ups. The proposed Autostrad - Salah Salem Route Expressway and Tereat El Zumur Route will have a positive impact on traffic throughput and will reduce the negative impact of trucks on the access roads to this area.

Nasr City

The proposed road infrastructure will partly alleviate some roads to and from Nasr City from truck traffic, including heavy trucks, but only because these flows divert to new roads that will become better accessible, in particular on the corridor to Amal City.

6.5.2 Supporting Measures: Structuring and Controlling Truck Flows

(1) Goods Vehicle Demand Management

Before imposing any truck flow control measures, which directly or indirectly affect the operations of economic actors (industry and commerce), it is imperative that detailed studies are conducted

1. **To clearly identify the specific target areas for such measures;**
2. **To assess the economic, financial and operational consequences of the measures;**
3. **To formulate recommendations for the affected industries and commerce on how to incorporate the measures in their operations.**

It is in that context strongly recommended, before any of the proposed structural measures are imposed that careful consideration is given to alternative measures which ***manage the demand of goods*** by industry and commerce.

Taking the principle that transport is a ***service to the industry and commerce***, local industry-oriented and low cost measures ***to control the demand*** for truck traffic could bring in many cases an (interim) solution for the existing traffic problems in highly affected areas such as the Giza and Cairo central areas.

For example, in streets around schools, traffic is particularly high during beginning and end of school hours. This traffic is generated by parents bringing their children to school and by school buses. If at the same time commercial goods are delivered to small shops and kiosks in these streets, the combined effect on traffic throughput is substantial. One low cost and easy to implement solution is to prohibit the delivery of goods to these shops and kiosks during these particular hours (beginning and end of school). The direct and / or indirect effects for the shops in question of this demand-oriented measure are low to negligible, while the positive effects on traffic can be highly positive.

For that reason, it is recommended that an in-depth study is conducted to

1. Identify and clearly delimit on the basis of the CREATS results within the GCR the streets / areas where traffic problems are particularly high;
2. Identify the nature of the traffic problems and the actors causing the problems;

3. Develop specific local measures to solve either temporarily or permanently the problem. In case the proposed measures are temporarily, recommendations should be formulated for a sustainable solution.

In cases where the problems are more substantial and traffic problems are predominantly generated by for example throughput truck traffic, more comprehensive measures as proposed hereafter can be considered / imposed.

(2) Structural Flow Control Measures

1) Day Time Total Truck Ban

A daytime total truck ban (between 7am and 23pm) will **control access of small trucks (pick up and two axle trucks) in certain areas and / or on certain roads where traffic is (will become) particularly heavy**. This measure limits the access of trucks to in certain areas or on certain roads where *trucks have a higher than normal Percentage and where the v/c ratio is high. The objective is to reduce their impact on private and public traffic at times when the latter is particularly dense*.

After careful study of the economic impact, a total truck ban could be imposed over time on following main roads and in following areas of high truck traffic:

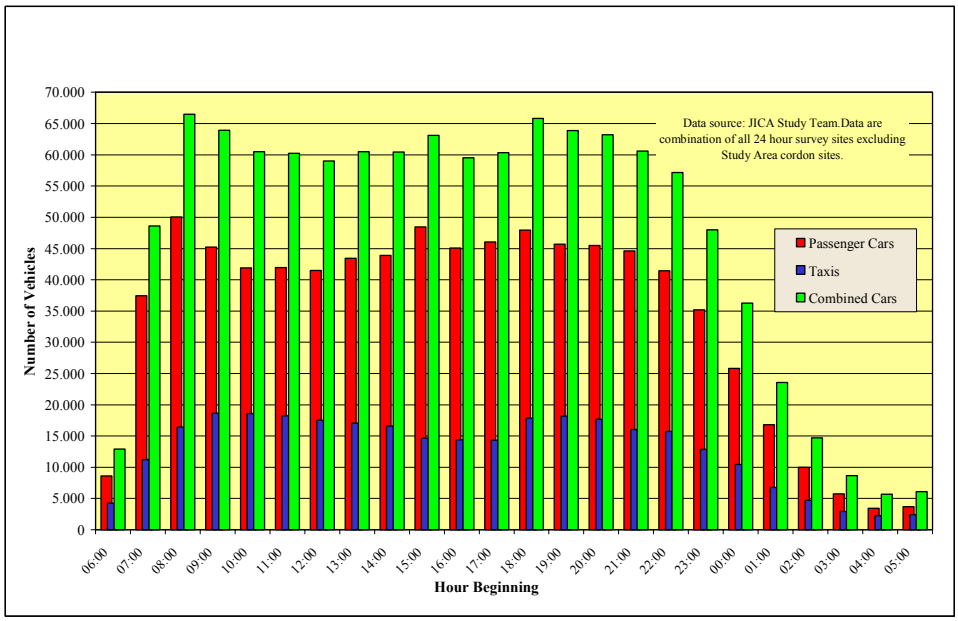
- The 6th of October Elevated Expressway and new Expressway sections;
- Some main roads such as Autostrad - Salah Salem corridor, Tereat El Zumour corridor, Ain Sukhna - Nasr City Road extension, 15th of May Street extension - Abu Bakr El Sadeeq Route, etc…;

Most trips are made during day time between 7 am and 23 pm[13], which means that truck traffic on the main corridors and in the areas with high traffic density should be avoided as much as possible during these periods (see Figure 6.5.1).

Present percentage of trucks and total level of congestion suggests that a total truck ban in the CBD and GBD is urgently needed, given the high volume of (small) trucks in these districts and on the access roads to both areas. A total truck ban could be imposed in other areas in a medium-term future, when traffic congestion becomes too high.

The expected future percentage of truck traffic on the streets inside the Ring Road implies that only the CBD and GBD will remain a serious trouble area. Although this suggests that the measure should only be imposed temporarily in other areas, a day time total truck ban will help controlling the expected congestion inside the Ring Road area caused by private cars and might therefore be indefinitely maintained in other areas also.

[13] *See Progress Report 2 for a more detailed analyses*



Source: JICA Study Team

Figure 6.5.1 Hourly Traffic Fluctuation per Day (2001)

The drastic measure of banning all truck traffic on certain roads and in certain areas should be supported by a second initiative oriented towards the shops, workshops and industries.

2) Introduction of the Night Delivery System

The supply of stores and factories could be regulated in areas where the total truck ban is imposed and traffic is particularly dense. The principle is not new but applied in many European cities, where shops are supplied during night time or early in the morning and trucks are banned from the streets during daytime. The area where this measure could urgently be introduced is the Cairo and Giza central areas. In a second phase, the measure could be extended to some other areas where truck traffic reaches higher than average percentage, e.g., above 40% of total traffic, when v/c is relatively high.

It should be noted that the truck ban does not apply to final delivery to consumers of foodstuff and household utilities to private households.

Some shops or enterprises may apply for an exception on the truck ban. In some cases, their demand might be valid and an exception could be considered. But it would be unfair to the others that apply the truck ban if no alternative measures are imposed that make applying for an exception less attractive. For that reason, next measure could be imposed to support the nigh delivery system and total truck ban.

3) Introduction of a Daytime Service License

Shops and industries in areas with a total daytime truck ban and night delivery system that apply for an exception will need to purchase a ***daytime service license***. The introduction of such license is to avoid that the truck ban and night delivery system is weakened by a high level of exceptions. The high cost of the license will guarantee that applying for an exception to the system is unattractive and shops and factories will only apply if they really need to.

The principle is based upon the *recuperation of congestion costs*[14] . According to Button (1993), congestion implies "*a 'dead-weight' welfare loss and ... [reduces] the economic efficiency of any transport system*" (p. 118). One of the measures to recuperate this loss is via the introduction of the license for storeowners and factories in districts where total traffic is particularly dense and who apply for an exception of the imposed truck flow control measures.

The price of the license should be sufficiently high to make escaping from night delivery obligations unattractive. **In particular traffic in the Cairo and Giza Business District could benefit from this measure and together with the daytime truck ban and night delivery system, the daytime service license should be introduced in the CBD and GBD in the short-term future.**

For the above three measures (day time truck ban, night delivery and daytime service license), it is emphasized again that in-depth studies are required to assess the economic and operational consequences of these measures for storeowners and industries in the areas where the measures are to be imposed.

4) Law Enforcement Improvement

An important comment should be made at this point. The above measures can only generate a positive effect **if they are actively enforced and controlled**. Enforcement and control does not only relate to the above proposed measures, but extents to **all traffic rules and regulations for all road users**.

The reason is that congestion in the streets is not only caused by one type of vehicle or one type of activity / traffic movement, but by a combination of interacting factors.

According to Vickrey[15], several types of congestion can be observed:

1. *Simple interaction* congestion is caused by slow moving vehicles;

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[14] *See for a detailed description of congestion and possible solution, KENNETH J. BUTTON: "transport economics, second edition", Edward Elgar Publishing Ltd, 1993, pp 109 - 121, and 243 - 260*

[15] *Vickrey W. "Congestion Theory and transport investment" in American Economic Review (papers and proceedings), 1969, 59, pp. 251-60, see BUTTON (1993) p. 116.*

2. *Multiple interaction* where vehicles, added to dense traffic, causes substantial delays to all infrastructure users. On average, every minute the marginal user is delayed, the other users are suffer a delay of 3 to 5 minutes;

3. *Bottleneck situations* emerge when infrastructure capacity reduces either as compared to a previous or subsequent section or as a consequence of vehicles blocking throughput traffic. If maximum capacity is reached or traffic flows are blocked, the bottleneck will immediately generate congestion because of its incapacity of dealing with the traffic levels and flows;

4. *Trigger neck situations* occur in relation to bottleneck situations and consist of delays imposed upon infrastructure users, which not using the bottleneck that is causing the congestion (bottleneck) but suffer because of multiple interaction by vehicles that avoid the blocked area and use an alternative road;

5. *Network and control congestion* is generated through artificial means such as traffic lights, police intervention and other control methods. If properly used, they can structure traffic, but if improperly used of one of the other types of congestion occurs, these control devices can be the cause of additional or increased congestion.

Based upon above differentiation, traffic inside the Ring Road presently generates different types of congestion and the supply of goods to stores, shops and (small) production enterprises only add to the problem. But measures that affect commercial truck traffic are useless without simultaneously controlling the behavior of other road infrastructure users.

Some important reasons for traffic congestion inside Cairo are the badly maintained vehicles that frequently malfunction in the middle of traffic as well as illegal and uncontrolled parking and the chaotic behavior of many drivers. These factors are not only directly responsible for congestion but also "*trigger"* small trucks and pick ups in causing additional bottleneck congestion while supplying stores.

For example, double parking or an abandoned immobilized vehicle can force a truck to stop in the middle of the street (third lane parking) to deliver his goods, therewith blocking all traffic using that street. If parking rules were observed, the truck could double park, still leaving space to other vehicles to pass during time of delivery.

(9) Large Trucks: Redirecting their Flows

Access of large trucks inside the Ring Road area is prohibited between 6am and 23pm except with a special license. The introduction of this measure generated positive effects on mobility and should be maintained via a much stricter enforcement and control.

Inside the Ring Road area, the presence of large trucks (3 axles and more) is low except in the GBD and CBD, Shobra El Kheima and in Nasr City. However, the total share of heavy trucks remains everywhere below 50% and their impact on total traffic should therefore not be overestimated.

Further reducing flows of heavy trucks could be achieved by two supporting measures, namely ***the relocation of industries*** and ***the reorganization of truck movements***. Both will be discussed in some detail hereafter.

1) Industrial Relocation

Many of the industries located in the inner Ring Road area are there for historic reasons. At the time they started activities in that area, traffic was not a problem and population density was relatively low. Over time, the city expanded and the factories were gradually surrounded by habitat, with traffic problems as a consequence. Most of these industries have no direct relationship with their surroundings in terms of supply or consumption and could in theory easily relocate to areas outside the city center, in particular towards the satellite cities. The reasons why many factories have not yet relocated can be found in the high costs of relocation.

Measures that are applied in Europe to exit industries from populated areas are relocation premiums, land price measures and in a longer term plan penalizing tax measures. Each of these measures will be discussed briefly.

Relocation premiums

Industrial companies located in the inner Ring Road area, and in particular in the CBD, GBD and Shobra El Kheima can be stimulated to relocate their business to the satellite cities via a financial premium at the moment these companies relocate their activities. The amount of the premium can be defined upon the total investment cost or the land value of the present industrial site. Independent of the approach, the level of the premium should be sufficiently high to have an effect on the decision of companies to relocate their activities.

Land price measures

A second measure that could be applied in combination with the relocation premium is a land price measure. The purchase of land to develop the new industrial site is together with the construction of the factory itself one of the most important costs. While the relocation premium compensates to a level for the construction cost of the factory, measures on the level of land price will add to the attractiveness to relocate. Land price measures depend upon the ownership of the land.

If the land is predominantly in private hands, a premium equal to a certain percentage of land purchase cost could be given to the industrial investor to purchase the land. If land is owned by government, the price of the land could be kept artificially lower than its actual value. In addition, government could ensure that the land is foreseen of all utilities (water, electricity, telephone, etc…) so that the industrial investor does not need to invest in these provisions.

A good example of this policy was the approach of the French government for the development of the Northern region of France in preparation of the opening of the Channel Tunnel. After having identified a number of strategic locations, the French government purchased the land and developed it as industrial zones. They created the

necessary transport infrastructure (ensuring the availability of all transport modes) and provided all utility services (electricity, gas, telephone and other communications, etc…). After completing the development of the various industrial zones, they put the land up for sale at a low price, sometimes even at a symbolic purchase price[16]. The fruits of this policy are now visible and the region has resurrected from the industrial waste land that was left after the collapse of the coal industry to a modern industrial area. The industries are efficiently integrated in the populated areas and the industrial zones house high value industries such as transport companies, high-tech companies and service companies. Adapted and modern transport infrastructure ensures that traffic flows in the region only show low levels of congestion as compared to many other regions in Europe.

In addition to these short term measures, the French government supported industries planning to develop their factories in these areas through long term positive tax measures such as exemptions of land tax, reductions in social charges (related to employment) and reductions in corporate taxes.

Tax measures

Positive tax measures such as the French government did, can be used at the beginning of the policy implementation to stimulate industries to relocate their activities to particular locations.

For example, companies planning to relocate to the satellite cities could be exempted from land taxes and reductions in social charges if new employment is created, making the relocation for companies highly attractive from a tax and personnel charge point of view.

After a (limited) number of years, the policy could be inversed and tax measures could now be introduced to "*punish*" companies that have not relocated outside the Ring Road area.

Two measures could be imposed:

1. An *eco-tax* upon all industries that remain within the inner Ring Road area. The level of the tax could for example be related to total ton/km[17] transported per year.
2. Direct taxation of industries located inside the Ring Road, where a fixed sum is taxed each year as "*social compensation*" for the traffic problems these companies generate and calculated as a percentage of total annual turnover.

[16] *For large industries with a high level of employment, land was put at their disposal at a price which was close to nothing. This attracted many larger companies in particular companies located or planning to locate in Belgium where the purchase cost of industrial land sometimes reached 30 times the land price in France.*

[17] *The price of the license could be based upon the number of tons transported over the length of kilometres the vehicle moves inside the Ring Road area. Industries generating high volumes of cargo and located deeper inside the centre of the inner Ring Road area thus pay much more that industries located near the Ring Road.*

2) Restructuring the Flow of Heavy Trucks

Heavy trucks are only a problem on very few locations and the impact will become even lower in the future. But total congestion on the Ring Road and many roads inside the Ring Road could make up an argument to extend / generalize in the medium to long-term future the present heavy truck ban.

Banning heavy trucks from the Ring Road during peak hours

The analyses demonstrated that only few sections are showing higher levels of heavy trucks, and that even these levels do not constitute a real problem for traffic. The share of heavy trucks on the Ring Road is even expected to drop everywhere below 50%. But total traffic on the Ring Road will soar, making it a heavy condensed corridor. Banning heavy trucks during peak hours (between 7am to 11pm) can be considered to increase the capacity of the Ring Road[18] and could simultaneously support the proposed relocation policy.

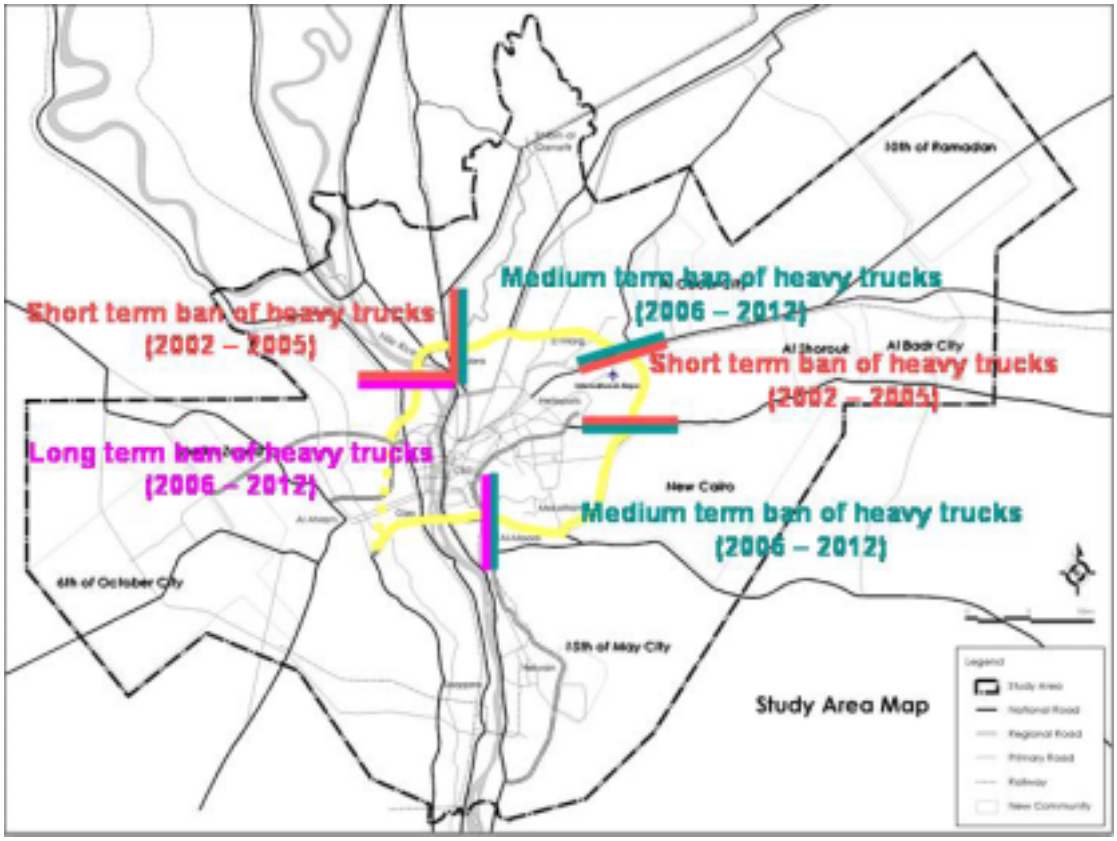
The measure is based upon the European transport policy that tries to standardize and expand the policy of many European countries to ban truck traffic during the week-ends and holidays[19]. In the case of the Cairo Ring Road, the measure would be highly effective if imposed from Sunday till Thursday.

The measure does not need to be imposed on the entire Ring Road at the same time but could be gradually implemented in accordance with future expected capacity problems. As demonstrated in next Figure 6.5.2, following pattern of implementation could be followed, based upon the present and future volumes of heavy trucks on the Ring Road:

1. *Short term*: section between Ismailya Desert Road and Suez Desert Road and at the entrance of Alexandria Agricultural Road, between Ismailya Agricultural Road and Warraq Bridge;
2. *Medium term*: section between Suez Desert Road and Autostrad and section between Ismailya Desert Road and Alexandria Agricultural Road;
3. *Long term*: other sections of the Ring Road including proposed new section to close the Ring Road.

[18] *Heavy trucks are banned from highways and cities in many countries in Europe. This measure is not only imposed to reduce congestion, but also to increase safety on the roads at times when traffic is dense and many private cars are using the road infrastructure.*

[19] *White Paper; "European transport policy for 2010 Time to decide", Brussels, 12/09/2001; COM(2001) 370*



Source: JICA Study team

Figure 6.5.2 Implementation of the Ban of Heavy Trucks on Ring Road

In 2022, traffic of heavy trucks on the Ring Road will thus be completely forbidden during day time. Trucks can travel on the Regional Ring Road, therewith circumventing the ban. This measure will thus complement / support the truck ban inside the Ring Road.

The implementation in the short term of the ban will directly contribute to alleviate the small areas inside the Ring Road that at present have a higher percentage of heavy trucks. Its effects will directly improve the situation on the access roads to the industrial area of Nasr City and Shobra El Kheima. The truck ban on the section between Ismailya Desert Road and Suez Desert Road and on the section between Ismailya Agricultural Road and Warraq Bridge will ensure that most heavy trucks enter that area only during night time, therewith reducing its impact on total traffic during daytime when the roads are already condensed.

3) Terminal Development

Given that supply and delivery with heavy trucks will only be during night time, supporting terminal infrastructure (truck stops) needs to be developed in order to provide trucks the necessary infrastructure to park their vehicles when the truck ban is in force. These terminals should be located outside the Ring Road and the development of these terminals should be parallel to the enforcement of the truck ban

on the Ring Road. The primary function of the proposed terminals is a truck stop but in time, these truck stops could be transformed in value added terminals.

In particular, these truck stops could be transformed into cargo transfer points that support the introduction of the above suggested measures. These terminals could be equipped with low-cost material to transfer cargo that enters the terminal from large trucks to small trucks that will ensure final delivery inside the Ring Road area (*stripping*). Also in the opposite direction, these terminals could collect cargo that enters the terminal in small trucks and consolidate the cargo into large trucks that bring it to their destination outside the GCR such as ports or industrial areas (*stuffing*).

Also the more efficient use of existing rail and river terminals could support a shift to rail and river of a share of the cargo that is presently transported by road. This shift will also contribute in limiting truck movements on the roads and therewith contribute to the alleviation of existing and expected congestion. This effort will require in the short-term future the *structural and operational rehabilitation of existing rail and river terminals*. In the medium term, and this parallel with the growth of container transport, the *Bashtil Dry Port and Ather EL Nabi Por tamong others could be developed as container terminals for Cairo*. The transformation into intermodal terminals could be considered in the long-term future.

The issue will be discussed in more detail in Chapter 7.

(10) The Urgent Need for a Sector Restructuring Study

In above recommendations, the need for a Goods Vehicle Demand Study was argued. This study is intended to exactly define the conditions for implementing the above proposed measures and to evaluate the possible effects on the industry and commerce in the GCR. However, from a transport efficiency perspective, this study is insufficient and needs to be supported by a more comprehensive study of the transport sector.

Night time delivery and truck bans on congested roads are highly unpopular measures for the industry, in particular in Europe and Japan. An argument frequently used in this context is the negative impact these measures have on "*Just in Time*" (JIT) delivery systems. However, even in the developed economies, the share of companies that actually need JIT is low, while most companies can efficiently operate under these regulations using sophisticated *stock management systems and cargo flow management*. But implementing these management systems requires logistics expertise and adapted hard- and software.

The knowledge about the hardware, software and humanware conditions of the Egyptian transport sector is low and in many cases inexact. Any of the above measures could therefore have a positive effect on overall traffic flows, but at the same time be catastrophic to the commercial transport service. The developed economies, however, heavily depend upon efficient transport and the share of total

logistics cost can increase to 10% of total operating cost[20]. They therefore demand a high quality and reliable service. The increasingly negative effects of traffic force transport operators to invest in techniques and technologies that accommodate / compensate the negative effects of congestion and of the regulatory measures that limit the use of trucks and favor alternative transport modes such as rail and river transport.

Both the industry and the transport sector work closely together to find efficient solutions to the problems at hand. Measures are in that context taken both at the managerial level (new concepts of cooperation) and at the operational level (new transport and logistics approach). But an important and in many cases critical success factor is the introduction of new and sophisticated techniques and technologies.

Traffic problems will increase in Egypt and will in future cause more damage to the economy. However, nor the industries or the transport sector are ready to find concrete and practical solutions to the traffic problems of the (near) future. Transport processes are chaotic and unstructured, generated by transport companies and industrial companies with limited knowledge of transport and logistics technologies and techniques.

Transporters also use badly maintained and outdated equipment, further reducing the efficiency of cargo transport. Container transport and Intermodal transport is relatively well organized in the ports and railway, while it is hardly applied in road transport and inexistent in river transport.

Important changes at the sector level will be necessary for cargo transport in Egypt to become efficient in the future. The reality is that traffic problems will increase dramatically in and around Cairo and that congestion will have an impact on road transport in the future.

Only when the transport sector prepares NOW for the problems OF THE FUTURE, the cost of congestion to the Egyptian economy will remain acceptable. If the sector is not prepared, the competitiveness of Egyptian transport will totally disappear and the economic losses will be important. A *Transport Sector Restructuring Study* is therefore urgently required.

The context of the study will be discussed in more detail in next Chapter 7 on Intermodal transport.

[20] *See Progress Report 2 Chapter 8 for a more detailed discussion*

6.5.3 Résumé of the Proposed Measures

The transformation of the transport sector into a modern and efficient service sector is of all measures the most important one. It will also be the most difficult to realize and undoubtedly the most expensive one. Achieving this will require a long term approach that includes following phases:

1. Short term action: Transport Sector Rehabilitation Study and Goods Vehicle Demand Study for Cairo; introducing / stimulating the profession of cargo integrator and consolidator (in relation to truck terminal development); rehabilitation of river and rail terminals to introduce the use of alternative transport modes;
2. Medium-term actions: stimulating road container transport; introduction of EDI and other information management systems; promoting the use of alternative transport modes; etc…
3. Long-term actions: Development of Intermodal transport.

Measures influencing truck traffic flows are:

Short term measures:

1. Rail and river terminal rehabilitation for general cargo and container transport;
2. Enforcement of existing truck ban and extension of the ban to some critical areas such as the Cairo and Giza central areas;
3. Development of 3 truck terminals (Upper Egypt Road Terminal in the south, Alexandria Road Terminal in the north and the Suez Road Terminal in the east) and if possible, introduction of cargo transfer services (stuffing and stripping);
4. Introduction of the night delivery system and of the small truck ban in CBD and GBD (except between 11 pm and 6 am);
5. Start of the industrial relocation program.

Medium term measures

1. Development of Bashtil Dry Port and Ather EL Nabi Port as container terminals;
2. Transformation of truck terminals into value added centers;
3. Truck ban on Ring Road section between Alexandria Agricultural Road and Suez Desert Road and on the access roads from inside the Ring Road to the Ring Road;
4. Introduction of the night delivery system and truck ban in other areas;
5. Introduction of the industrial location license;
6. Road infrastructure development inside the Ring Road and closing the Ring Road;

Long term measures

1. Transformation of Bashtil Dry Port and Ather EL Nabi Port into Intermodal terminals;
2. Total truck ban on and inside Ring Road except during night;
3. Development of Intermodal transport
4. Road infrastructure development outside the Ring Road