TOWARDS REGIONAL ECONOMIC MODELING IN THE EGYPTIAN TRANSPORTATION PROJECTS*

Eng. Manar M. Abou El-Ela** Prof. Dr. Tarek A. Aboul-Atta***

ABSTRACT

The Transport sector is considered an important component of the economy and a common tool used for development, as economic opportunities are increasingly related to the mobility of people and commodities. Several techniques are used to predict and evaluate the economic impacts of Transportation Investments on the Regional Development.

Regional Economic Models are considered the most common and comprehensive approach used in estimating the economic development impacts of large-scale transportation investments. This research presents the general framework of these models accompanied by an international case study in the United States. And henceforth, proposing to adapt it in Egypt through an initial perspective of the Regional Economic assessment for an Egyptian corridor Cairo-Alexandria Freeway with the required procedure for its implementation.

1- INTRODUCTION

Transportation development has taken place since the beginning of the industrial revolution. Nevertheless, Transport by itself is not a sufficient condition for development, yet the lack of transport infrastructures can be seen as a constraining factor on development. Consequently, Economic development and transportation often go hand in hand, effective transport sector is considered an important component of the economy impacting the development and the welfare of communities as illustrated in fig. (1). When transport systems are efficient, they provide economic and social opportunities and result in positive multipliers effects. When transport systems are deficient, they can have an economic cost. Since, there is a definite, meaningful connection between economic growth and transportation; it is critical to understand how to measure and analyze the economic impacts of transportation investments to adapt it in Egypt.

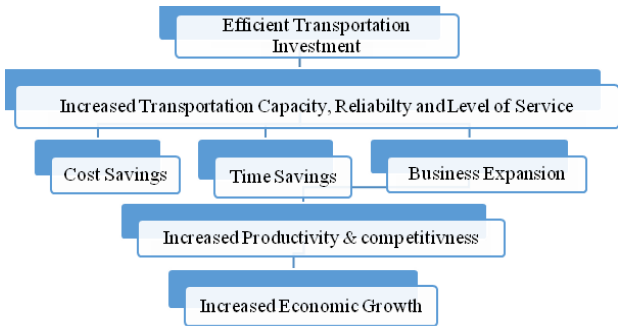

Fig.1- Transportation Infrastructure Investment and the Economic Growth
Source: Freight Transportation and the Economy, American Assn. of State & Transportation Officials, 2002

2- Transport Economic Impact Analysis

There are two main types of economic impacts; Generative impacts which represent a net economic gain to the region, while redistributive impacts reflect shifts of economic activity from one location to another. There are some common reasons for conducting Economic Impact Analysis such as; Comparing alternative Transportation Investments, stimulating to ensure Economic Growth, Encou-

*A Research Paper as a partial Fulfillment of the requirement for the degree of Doctor of Philosophy in Architecture -Town Planning
**mamahmud10@gmail.com
***mstarek3000@yahoo.co.uk

raging Investors participation and Win Public Support. Several analytical techniques and modeling approaches are utilized to study the economic impacts of transport investments depending on the purpose, and the scope of the analysis. These techniques vary in their complexity and economic accuracy. These techniques seek to provide answers to questions like; *what are the impacts, who are affected, and when these impacts will be realized.* The current research will focus on the Regional Economic Models, as they are considered the most comprehensive and most commonly used for analysis of large-scale transportation investments.

3- Regional Economic Models

Regional Economic Models are used in estimating the economic development impacts of large-scale transportation investments in a given region if various policies or projects were implemented through the changes in economic indicators by modeling the economy *with and without* the transportation investment. They have the ability to predict *Short term* and *Long term* changes.

The main factors in modeling the systems are changes in costs of living and doing business resulting from the proposed transportation improvements. Direct user savings and business cost-competitiveness associated with the investment can be used as inputs to the model. The model should contain detailed data on the current economic characteristics. Regional productivity, additional tourist spending and additional employment from business attraction are also included in these models. The key outputs are values for total ***business output, Gross Regional Product, employment, and personal income***. These values are forecasted by industry on a year-by-year basis into the future.

Meanwhile, there are only two main dynamic models that will be presented in this study namely; *TREDIS* and *REMI TranSight,* due to their maturity and competence. Both models are capable of examining transportation investment projects from different perspectives; prediction studies and evaluative studies.

* Transportation Economic Development Impact System (TREDIS)

TREDIS was developed by Economic Development Research Group, Inc. upon an earlier economic product called Local Economic Assessment Package (LEAP) since 2006. It is an internet cloud -based *Transportation Economics Suite* used by transportation planners to measure Economic Impacts, Cost-benefit, and Financial Tax analysis of multi-modal projects. TREDIS model is based on a regional industry input-output structure as well as partial equilibrium Model. TREDIS operates as a set of interconnected core modules; Travel Cost Module, Market Access Module, Economic Adjustment Module and Cost-Benefit Analysis Moduleas shown in figure (2).

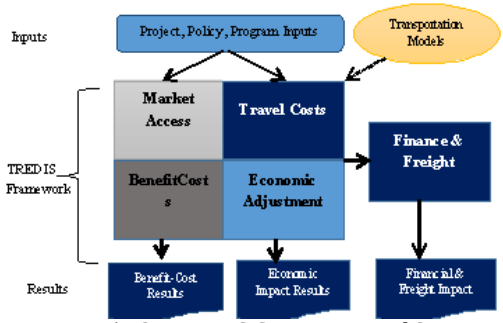

Fig. 2 - TREDIS Components and Structure
Source: www.tredis.com, 2016.

* Regional Economic Models, Inc. REMI

The REMI model is built upon a strong background in economic theory; it incorporates four major modeling approaches; Input-Output, General Equilibrium, Econometric and Economic Geography. The first application of the REMI model for transportation projects was made in 1990 using two modeling packages; REMI Policy Insight PI + (shows the total economic and demographic effects of policy/project initiative on local regions) and REMI TranSight (forecasts economic benefits of ground transportation investment). REMI Tran--Sight is considered a preprocessor for REMI PI+ as it integrates travel-demand variables with REMI PI+ to provide a complete economic perspective. It calculates direct and indirect types of costs and benefits from the project as demonstrated in figure (3). Later, this information is transferred into PI+, which produces multi-year forecasts of economic and demographic trends under the transportation investment.

3-1- Regional Economic Modeling Process

The appropriate choice between the two models may vary depending on the user preferences and needs. But, generally there are five main phases common in every Economic Impact analysis Procedure as shown in figure (4), which are;

1- Conduct Transportation Network Analyses; using Travel Demand Model to generate prediction of VHT and VMT using socioeconomic data.

2- Estimate User benefits; estimating the cost savings associated with VHT, VMT, and safety improvement for industry sectors, employers and household.

3- Calculate Direct Economic Benefits - Market Access; by capturing the changes in customer and labor market size, and identify the types of Industries that may be attracted to the region, and a projected number of additional jobs in each industry. Finally, direct tourist impacts are also estimated based on changes in travel time.

4- Project Secondary Economic Benefits; all of the previous impacts are input to a Multi-Regional Economic Model to forecast the indirect (changes in business activity) and induced impacts (change in income and jobs) of the economic benefits.

5- Conduct Cost/Benefit analysis; All previous benefits are aggregated, discounted over time, and compared to the capital and operating costs to determine an overall project Cost/benefit ratio.

Commonly, the economic impact analysis process needs a huge amount of appropriate data to calculate the project impacts. It mainly involves trusted Data source for the National or Regional values such as;Regional Economic Data, International and Domestic trade flows, Demographic Data (population, age, employment…etc.), The Geographic regions, Regional Network Data, Spatial Market Data, and Travel Demand Inputs. In addition to User Input Data related to the Transportation Project such as**;** Project Data, Travel demand variables, Commodity flows and commodity forecasts and Travel Characteristics associated with project (vehicle cost factors and accident rates).

Both models provide reports on the economic impacts of the region over time by various measures using employment, output, value added, employee wages and GDP.

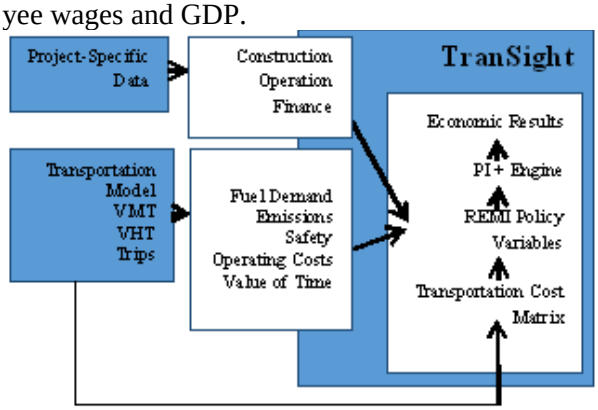

Fig.3- REMI Transight Modeling Process (Source: www.remi.com,2016)

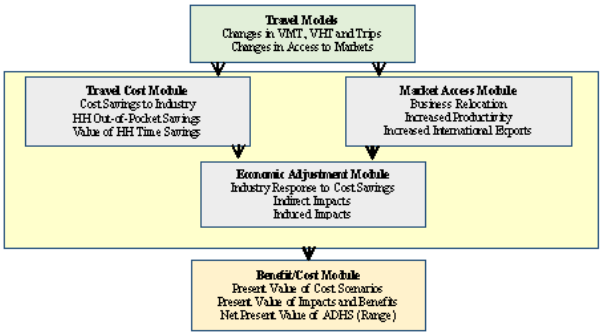

Fig. 4- The Regional Economic Modeling Process (Source: Economic Impact Study of Completing the Appalachian Development Highway, 2008)

4- International Case Study

Several regional agencies in the United States acquire the economic impact tools to be used in decision making process across their planning stages.We will present briefly one case to illustrate the capabilities of the Regional Economic Modeling using TranSight.

4-1- North Carolina I-95 Economic Assessment

Interstate 95 (I-95) in North Carolina is a major Interstate Highway, running along the East Coast of the United States illustrated in fig. (5). It was first built between 1956 and 1980, and is basically the same four-lane highway.

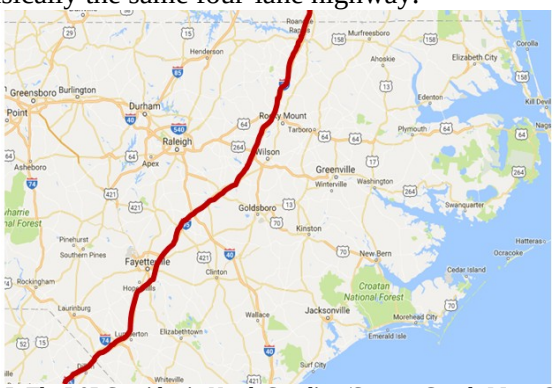

Fig. 5- The I-95 Corridor in North Carolina (Source: Google Maps, 2017

The North Carolina Department of Transportation-NCDOT recommended widening the interstate to a combination of 6-8 lanes to meet the current interstate design standards in 2012. The total cost was approximately $4.4 billion; however, about $455 million (10% of the funding need) only is available. So, NCDOT identified tolling as the most feasible financing option to fund the proposed improvements.

Given the concentration of the Agriculture, manufacturing industry sectors, military & supporting industries in the region, I-95 is considered the primary freight corridor in the area, as intrastate freight movements and regional trade utilizes it to

access markets in the northeast and major east coast ports .The purpose of the Economic Assessment is to examine the economic impacts of alternative approaches to improve and fund the proposed improvements to I-95. But, it was important to first realize the existing passenger and truck travel, future traffic growth, and sensitivity of travelers to tolls along the I-95 Corridor. Travel demand forecasts were developed to forecast vehicle miles (VMT) and vehicle hours traveled (VHT). The Travel demand model analysis showed that VMT will increase25% by 2040, and VHT will increase 26% by 2040.

Three tiers of regional impact analysis are presented; Impacts to the I-95 corridor, Eastern North Carolina (east of I-95), and the rest of the state of North Carolina.

Economic Assessments Results

An expected decrease in business transportation costs in all regions between $45.4 billion in the I-95 counties, $4.5 billion in eastern North Carolina, and $9.2 billion in the rest of the state will lead to increases in economy activity in the long-term GRP. Table (1) summarizes the economic impacts of the improvements measured over the period 2014-2050 Compared to Business as Usual scenario. In conclusion, the improvements will lead to a significant net increase in GRP $82.6 billion, increase in personal income $77.6 billion and increase in jobs 16,925 annually.

In the meantime, since the implementation of these Regional models would be very costly within the research scope (approx. $40,000), so the financial support of the governmental authorities and Ministry of Transportation is required. Accordingly, the research will present a perception in case of implementing these models and their prospective effects on the Egyptian economy.

Table 1- Economic Impact of Build with Mitigated Tolls Compared to Business as Usual

Metric	Constr.	%	Long-Term	%	Total	%
I-95 Counties						
Business Transportation Costs ($billion 2012)					$49.3*	
Toll Cost ($billion 2012)					$4.20*	
Gross Regional Product ($billion 2012)	$2.80	0.244	$42.50	2.573	$45.30	2.818
Personal Income ($billion 2012)	$2.80	0.216	$47.20	2.420	$50.00	2.636
Jobs (average annual full-time)	1,706	0.431	9,297	2.300	11,003	2.731
Eastern NC						
Business Transportation Costs ($billion 2012)					$4.20*	
Toll Cost ($billion 2012)					$0.37	
Gross Regional Product ($billion 2012)	$0.38	0.014	$5.50	0.392	$5.80	0.406
Personal Income ($billion 2012)	$0.45	0.021	$4.60	0.462	$5.00	0.483
Jobs (average annual full-time)	120	0.014	1,140	0.365	1,234	0.379
Rest Of State						
Business Transportation Costs ($billion 2012)					$8.80*	
Toll Cost ($billion 2012)					$0.48	
Gross Regional Product ($billion 2012)	$2.20	0.014	$29.30	0.212	$31.50	0.226
Personal Income ($billion 2012)	$1.80	0.020	$20.80	0.193	$22.60	0.213
Jobs (average annual full-time)	589	0.015	4,782	0.183	5,371	0.199

*Source: Cambridge Systematic analysis using the REMI economic model. * denotes negative values, 2013*

5- Transportation &Economic Development in Egypt

Egypt is now facing a very critical stage concerning both the transportation and economic development. Despite the microeconomic deficits, the Egyptian government has placed a special priority on completing improvements and expansion of the road network to boost the economy of the country. The National Roads Project is a large Egyptian infrastructure project initiated in August 2014with an estimated cost EGP36 billion. It includes the construction of 39 new roadways with a total length of 4,460 km as illustrated in fig. (6).

Accordingly, several studies need to be taken into consideration during the project planning and implementation process such as; project prioritization, alternative studies and economic evaluation, to obtain the maximum benefit of the project especially in the presence of the huge fiscal deficits and shortage of human resources and equipment. Consequently, it is essential to introduce and examine the feasibility of implementing the Regional Economic models in Egypt and its expected benefits and requirements.

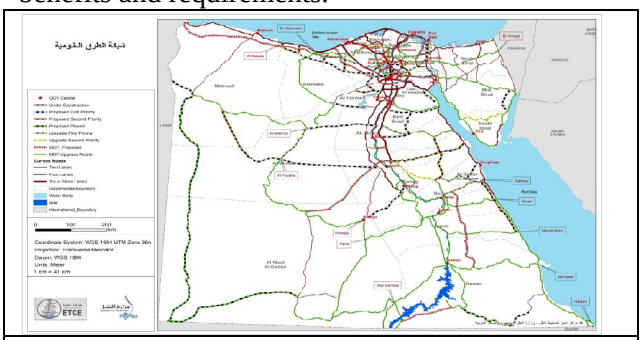

Fig.6-National Road Project Status(Source:Ministry of Transportation, 2015)

5-1- Cairo Alexandria Freeway - Case Study

Cairo-Alexandria freeway is one of the accomplished projects in the National Roads Project, and some of its economic benefits have already been accomplished since 2015. So, the corridor has been investigated to highlight the importance of the Economic Impact Assessment before and after the transportation investment. In addition to, being one of the most vital arteries in Egypt, linking the largest and most important port in Egypt with the Capital. The road capacity was four lanes for each direction to sustain 25,200 vehicle/day in 2003. General Authority for Roads, Bridges and Land Transport decided to transfer it into a freeway in 2007 in compliance with global standards to meet the future economic requirements. The Project started in 2007 and was planned to be completed by 2012, but it was not till 2015. The extended period caused a significant increase in budget (approx. doubling the budget from EGP 1.7bn. up to EGP 4.2bn.). Henceforth the National Co. for Road Construction, maintenance and operation took the beneficial rights of the road for the coming 50 years.

5-1-1-Regional Economic Profile

Regionally, Alexandria-Cairo Corridor traverses through the western desert passing through five governorates; Greater Cairo (Cairo & Giza), Menoufia, Behera and Alexandria. Greater Cairo is the economic center of Egypt, with two-thirds of the country's GNP generated in the greater metropolitan area, while Alexandria is one of Egypt's largest cities, and its principal seaport, as more than half of Egypt's foreign trade passes through Alexandria's commercial harbors. This region also represents one of the most important areas for reclamation in Egypt as the agricultural exports of the area represents 37% of the total exports of Egypt's agricultural exports.

The Population in the four governorates was nearly 26 million in 2006 and has increased more than 23% through the last 10 years to reach 33 million with nearly 2.2 % annual growth. The Population is expected to reach 40 million in 2025 as demonstrated in table (2). This massive increase puts a huge traffic load on the corridor. Moreover, the freight transportation growth is expected to be 30,200 truck/daily in 2020 on Cairo – Alexandria corridor.

Table 2- Change in Population of the Cairo-Alexandria corridor Governorates, Source: Calculated from CAPMAS Data, 2016.

Governorates	Cairo	Alexandria	Menoufia	Behera	Giza
Projected pop. In 2025	11,235,519	6,123,677	4,906310	7,393,717	10,473,736
2017	9,652,508	5,019,408	4,157,890	6,161,431	7,995,219
2016	9,440,374	4,901,910	4,035,137	5,959,050	7,762,792
2015	9,278,441	4,812,186	3,941,293	5,804,262	7,585,115
2014	9,183,581	4,760,374	3,889,119	5,720,943	7,486,361
2013	9,002,783	4,658,381	3,706,194	5,415,375	7,104,805
2012	8,825,725	4,564,979	3,706,194	5,415,375	7,104,805
2011	8,657,909	4,463,887	3,616,765	5,274,349	6,926,859
2010	8,482,515	4,397,946	3,533,702	5,147,722	6,756,655
2009	8,306,493	4,316,741	3,455,434	5,033,067	6,616,445
2008	8,114,855	4,238,100	3,381,399	4,903,300	6,501,530
2007	7,988,657	4,164,750	3,309,482	4,802,272	6,364,682
2006	7,968,042	3,919,290	3,321,499	4,819,797	5,800,382
Increase of Pop. In Const. Years 2007-2015	16.4%	22%	18%	20%	31%

On the other side in 2015, there were approx. 93,203 jobs in the 5 governorates along the corridor with an increase 26% than in 2009 (73000 jobs),which indicates the huge demand for employment as shown in table (3). Nevertheless, the unemployment rate is also increasing approximately 2-4% as demonstrated in table (4) which indicates the huge population growth. The Wages for some industries along the corridor Governorates have also increased significantly during the construction years as illustrated in table (5).

Table 3- Estimation of Employment in Cairo-Alexandria corridor Governorates, Source: Calculated from CAPMAS Data, 2016

Governorates	Cairo	Alexandria	Menoufia	Behera	Giza
2015	25,970	13,028	12,868	20,968	20,369
2014	25,970	12,316	12,587	21,228	19,201
2013	24,234	12,073	12,867	20,543	18,715
2012	23,773	11,883	12,866	20,731	18,383
2011	23,368	11,437	12,752	20,629	17,804
2010	21,040	12,298	12,983	18,926	9,116
2009	20,517	11,819	12,507	20,397	8,454
Employment growth Rate from 2009-2015	26.6%	10%	2.9%	2.7%	140%

Table 4- Unemployment Rate in Cairo-Alexandria corridor Governorates 2009- 2015, Source: Calculated from CAPMAS Data, 2016

Governorates	Cairo	Alexandria	Menoufia	Behera	Giza
2015	14.6%	16.1%	10.0%	9.7%	13.1%
2014	16%	18.4%	11.1%	8.2%	12.7%
2013	17.7%	18.9%	9.1%	8.4%	13%
2012	17.3%	17.3%	7.7%	7.4%	12.3%
2011	17%	19.7%	8.4%	6.4%	12.3%
2010	12.7%	12.1%	4.1%	6%	13.6%
2009	12%	14.1%	6.7%	6.1%	11.4%
Change in Unemployment Rate from 2009-2015	2.6%	2%	3.3%	3.6%	1.7%

Table 5- Average Weekly Wages for some Industries along the corridor 2009-2015 by ISIC4, Source: Calculated from CAPMAS Data, 2016.

	Industry	2015	2014	2013	2012	2011	2010	2009
1	Agriculture and Fishing	545	462	450	380	302	303	184.5
2	Mining & Quarrying	1530	1195	1016	622	1066	625	753
3	Manufactures	520	548	503	424	395	325	288
4	Constructions & Buildings	769.5	680	634	291	523	399	452
5	Transportation & Warehousing	898	873	784	759	604	527	454
6	Real State & Renting	542	468	404	261	424	181	161

5-1-2-Economic Assessment of Cairo-Alexandria Freeway

Meanwhile, an initial perspective is presented concerning the impact of the corridor upgrading on the Regional and National economy, and compareing it with the base case Scenario to estimate the added value and analyze the probable benefits.

1- Transportation Network Analyses (*Traffic Volume & Time*)

***No-Build Scenario;** the speed limit was 90km/hr. (approx. 146 mins.), in addition to the presence of trucks and cars on the same road. The Road capacity limit was 25, 200 vehicles/day.

*** Build Scenario;** the speed limit was increased to 120 km/hr. (approx. 110mins saving *36 min/trip*). The trucks and freight transportation were separated on a service road and the U-turns were replaced by bridges, as well as extending the Road capacity to 60,000 vehicles/day and 30,000 truck/day.

2- Estimate User benefits (*Traffic Volume & Time, Safety and Operation Cost)*

***No-Build Scenario;** the corridor was considerably congested and unsafe due to the presence of trucks on the same road, absence of light and several intersections which affects the operation cost.

*** Build Scenario;** the congestion was relieved due to the corridor expansion and the separation of freight transportation. The saving in VHT will be approx. 36 mins./trip (*approx. EGP 350 Million annual savings for passengers and freight transportation*) as calculated in table (6).

The safety level has enhanced due to the separation of trucks, new barriers, and several crossing bridges. These enhancements have *reduced the operation cost approx. EGP 126 Million for passengers and business annually* as calculated in table (8).

*** The Direct costs saving of relieving traffic congestion for passengers;**

The following direct cost is used to calculate the direct costs of traffic congestion according to Cairo Traffic Congestion Study, 2010:

- Passenger car users (LE/hr) = 13.8

- Freight transporters (LE/hr) for Medium & Heavy trucks = 37.8 & 63

*** The Direct costs saving of Vehicle Operation Cost;**

The estimated unit vehicle operating cost in table (7) are used to calculate the Vehicle Operation Cost.

Table 6- Direct cost savings of traffic congestion[1]

Cost Savings of Traffic Congestion		Total Savings
Cost savings of Vehicles	13.8 *0.6 * 60,000 = 496,800*250 = 124,200,000	EGP124 Million
Cost savings of Medium Trucks	37.8 *0.6 * 15,000 = 340,200*250= 85,050,000	EGP85 Million
Cost savings of Heavy Trucks	63*0.6 * 15,000 = 567,000*250= 141,750,000	EGP141 Million
Cost Calculations were based on 250 working days per year.		
[1-]Cost Calculations were based on 250 working days per year		
Source: Calculated from Cairo Traffic Congestion Study, 2017		

Table 7- Estimated Unit Vehicle Operating Cost

Vehicle Type	Item	Passenger Car	Medium Truck	Heavy Truck
Time Related VOC(LE/hour)	Crew Cost	0.00	8.28	11.58
	Maintenance Labor Cost	1.09	3.27	3.63
	Insurance Cost	0.09	1.07	0.88
	Depreciation Cost	1.26	3.35	2.70
	Overhead Cost	0.00	5.59	6.58
	Total	2.44	21.56	25.36
[1-]Cost Calculations were based on 250 working days per year				
Source: Cairo Traffic Congestion Study, 2010				

8- Direct costs savings of VOC for Passenger Cars and Medium and Heavy Trucks[2]

Direct costs savings of VOC		Total Savings
for Passenger Cars	2.44 *0.6 * 60,000 = 87,840*250 =21,960,000	EGP21 Million
for Medium Trucks	21.56*0.6 * 15,000 = 194,040*250=48,510,000	EGP48 Million
for Heavy Trucks	25.36*0.6 * 15,000 = 228,240*250=57,060,000	EGP57 Million
[2]Cost Calculations were based on 250 working days per year		
Source: Calculated from Cairo Traffic Congestion Study, 2017		

3- Direct Economic Benefits

The previous benefits ***(approx. EGP 476 Million annually)*** indicate the projected households and business costs savings, which will influence remarkably the fright size to and from Alexandria harbor, as well as the movement of labors in addition to encouraging the industrial and land reclamation activity in the region. Moreover, several commercial, amenities and Residential compounds have been attracted to the corridor. Additional 5000 new jobs were initiated in the first year after construction as a result of different land uses and are expected to increase significantly during the coming years. The corridor development has significantly influenced the internal tourism to Alexandria and North cost especially in the summer season.

4- Secondary Economic Benefits (*Indirect and Induced impacts*)

The previous business benefits will positively impact the regional economy through the expansion of industrial, commercial and administrative services. The increase of exports and import will affect positively the development of industrial through increasing the production and no. of labors. The region is expected to change signifycantly within the coming years, which in return will affect positively the number of jobs, personal income and regional output.

5- Fiscal Effect & Taxes

The tolls have doubled for the private vehicles in 2016 with the expansion of the road capacity to 60,000 vehicle/day, *the total annual tolls for vehicles have reached EGP 150 Million* with a total increase nearly *EGP 42 Million* from 2010. The Number of trucks has increased significantly to 3 times (30,000 truck/day) with an increase in the tolls reaching 800% (with average EGP 100 per truck). So, *the total annual tolls for trucks have reached EGP 750 Million* with a total increase nearly *EGP711Million* from 2010. These tolling increases have added annually ***EGP 753 Million*** to the governmental resources.

Accordingly the investment in Cairo-Alexandria corridor was quite valuable and worthy as it is able to have an added value to the National Economy; GDP, Employment and Business output.

6- Required Procedure to adapt Regional Economic Models in Egypt

In the meantime, some essential procedure must be taken in order to start adapting the Regional economic Modeling in Egypt:

1- The need for transparency and integration between the concerned parties to ensure data integration and consistency.

2- Examine the possibility of purchasing the model for the purpose of adapting it to Egypt (costs approx. $40,000).

3- Sustainable and specialized Data collection and processing for the modeling process; Regional Economic Data and Indicators related to the Industries, business and Households, Population & Demographic data, Network Data, Market data, Geographic maps, Travel demand variables.

4- Building and compiling the model using the Egyptian data, to start an economic assessment of Egyptian transportation investments.

5- Building Capacity to transportation engineers and economic specialist to support and manage economic impact analysis process.

6- Transparency and consistency in conducting the economic analysis of the project.

7- Conclusion

Transportation Economic Assessment could be applied to the National Road Project in Egypt, since such approach is capable of ensuring the optimization of the available resources. Accordingly the Egyptian government needs to organize the essential framework through;

- The need for enhancement and integration between the concerned parties to produce unified and effective data and ensure its sustainability.
- The need for more flexible legislative framework to support the Economic Assessment approach and adapt the economic impact analysis in the strategic transportation planning process.
- Institutionalize economic impact analysis procedures for future transportation projects to ensure the conducted analysis is objective, independent and consistent.

8- REFERENCES

1- Egyptian Government's Mega Projects 2016, October 2016, www.invest-gate.me

2- International Quality and Productivity Center, Middle East, (2015), State of the Market: Financing Transport infrastructure Projects, Egypt Transport Infrastructure Summit.

3- Cambridge Systematics, Inc., (2013), Final report North Carolina I-95 Economic Assessment prepared for North Carolina Department of Transportation.

4- The Connecticut Academy of Science and Engineering, (2013), Analyzing the Economic Impacts of Transportation Projects, for the Connecticut department of Transportation.

5- M. J. Markow (2012), Engineering Economic Analysis Practices for Highway Investment, NCHRP Synthesis 424, Transportation Research Board (www.trb.org); at http://onlinepubs.trb. org/ onlinepubs/ nchrp/nchrp_syn_424.pdf.

6- W. Glen, (2011), Effective use of Economic Impact Analysis for Transportation: Adapting Models & Communications to Meet Decision-Making Needs, TREDIS software Group.

7- L. Norman V., O. Rei, (2010) Infrastructure and Economic Growth in Egypt, The World Bank & Development Research Group.

8- N. Ziad, Santiago Herrera, (2010), Cairo Traffic Congestion Study –Phase 1, Final Report, for the World Bank and the Government of Egypt.

9- L. Todd (2010), Evaluating Transportation Economic Development Impacts, VTPI (www.vtpi.org); at www.vtpi.org/econ_dev.pdf.

10- Rodrigue J., Comtois C. and Slack B., The Geography of Transport Systems, New York: Routledge, 2009.

11- W. Glen, Procedures for Assessing Economic Development Impacts from Transportation Investments, Economic Development Research Group, 2000.

12- www.tredis.com

13- www.remi.com