MB CONSULTANT

Environmental Social Impact Assessment for

"BORG EL ARAB INTERNATIONAL AIPORT MODERNIZATION PROJECT PHASE 2

December, 2014

EXECUTIVE SUMMARY

INTRODUCTION

The Government of Egypt (GOE) decided to implement an extensive modernization program for the major Airports in the country. Alexandria Governorate as the second largest business center in Egypt is currently served with Al Nozha Airport and Borg El Arab Airport.

Al Nozha Airport can only accommodate middle-sized aircrafts and to expand its capabilities a new land acquisition is required around the Airport, which is quite difficult. Also the instabilities of the Airport ground pose an obstacle towards any future upgrading. The current facility at Borg El Arab will fall short of meeting the future expectations. Therefore, the facilities of Borg El Arab International Airport are to be expended to cope with the expected increase of air traffic based on the development of Alexandria Governorate as well as Delta valley population and flourishing city of Borg Al Arab.

The current building of the airport only accommodate (1,000,000) million passenger/year while it reaches (2.7) million passenger /year the need for a new terminal building is very clear

The GOE in its effort to secure financial assistance has requested the Japan Bank for International Cooperation (JBIC) to provide the support for the implementation of such project. JBIC has expressed interest to finance the project. The acceptance of the JBIC to assist in building the new terminal implies implementing the JBIC and the Ministry of State for Environmental Affairs procedures and conducting an Environmental& social Impact Assessment (ESIA) before starting the construction.

JICA was the implementing agency

For this purpose the Egyptian Airports Company (EAC) has assigned MB consultant to prepare this comprehensive study in order to start the Airport development project.

The main objective of the EIA is to examine the biophysical and the sociocultural environment in the surrounding area of the project, and to ensure that possible positive and negative impacts together with the required mitigation measures during different phases of the project are identified. This report aims at describing the main findings of the current environment, identifying possible impacts of building the new terminal in Borg El Arab and presenting recommended mitigations and incurred cost implications. The ESIA also outlines the environmental Management Plan (EMP) with all the monitoring requirements.

This monitoring plan during construction phase should passed to the contractor for implementation and it should be a part of the contract.

Monitoring during operation phase will be by EAC environmental unit in Borg Al Arab

DESCRIPTION OF THE PROPOSED PROJECT

- **Borg El Arab Airport**

The Airport was established in 1997 on an existing military air base.

The Airport uses currently the existing military runway and taxiway parallel to the runway. There are three (3) taxiways between the apron and the parallel taxiway. The civilian Airport has one passenger terminal building with a peak capacity of 1,000,000 passenger/year and a car parking area. It reaches now; 2.7 million passenger/year.

The civilian Airport handled 20,825air flights (arrivals and departures) and 2,021,892 passengers in the year 2014. More than its capacity

- **New Borg El Arab Airport terminal building**

By the year 2030, about 6.7 million passengers expected to arrive/depart to/from the Airport.

The new project buildings will consist of:

- Departure hall
- Arrival hall
- Electromechanical equipment room and facilities
- Cargo village
- Car parking area to accommodate cars and buses.
- Auxiliary Buildings

- **Green Technologies**

The New Terminal building concept should be designed as an ecological green building in consideration of the world-wide environmental issues and lack of electrical power sources in Egypt, especially in summer.

In order to deliver this concept the New Terminal Building adopted the following:

- Photovoltaic Power system
- VRV system for HVAC
- LED lighting devices
- Storm water system
- Waste water treatment plant
- Shorter walking distances for passengers.
- Simplistic design and plenty open space for greeting and welcoming people.
- Ease of further expansion of check in counter, baggage claim, passport control counter and departure lounge areas.

The above makes Borg Al Arab Airport the first in Egypt that use green technology element in its design

- **LEGAL AND INSTITUTIONAL ASPECTS**

It is proposed that the project is to be partly financed by the JBIC and as such will comply with JICA guidelines relative to the environmental and social safeguard policies as well as the Government of Egypt applicable laws and regulations.

A summary of Laws having a direct relation with the project is hereafter mentioned:

- JBIC guidelines
- JICA regulation year 2010
- WB operational Policy 4.01 on Environmental Assessment;
- WB operational Policy 4.12 on Involuntary Resettlement;
- WB operational Policy 4.11 on Cultural Property;
- Law 4/1994 and 9/2009 and their Executive Regulations, which sets the overall framework for environmental protection in Egypt.
- Concerned Civil Aviation Instructions.

- **SCOPE OF ENVIRONMENTAL WORKS**

Different direct, indirect positive and negative impacts studies were achieved, also some of the effects were measured as possible and the environmental impact were evaluated and compared with local and international laws demands. The environmental fields studied are mentioned in the following:

- **Noise**

A noise study was conducted to measure and identify the affected areas in Borg El Arab Airports. Noise measurements were performed in about 44 points located in areas surrounding the project area. Continuous measurements for more than 1 hour were considered in the study. By using The INM 6.0c Model, predicted values were deduced for years 2015, 2020, 2025 and 2030. The predications were recorded using the DNL and WPCNL units.

- **Air Pollution**

The Assessment for the Air Quality and the pollution emitters from the different sources at Borg El Arab Airport area had been carried out. Available data were collected and a database was prepared. Also level of the air pollution generated from airplanes and ground equipment were measured. These measurements were analyzed and compared with the local and international specifications.

- **Water**

The project will be supplied with water from water treatment plant in Borg El Arab, which is operated by Alexandria Water Authority.

It is planned to supply the new terminal building with water from the existing water main 300 mm in diameter. There are no expected negative impacts or health risks regarding the water quality from the water supply system.

- **Wastewater**

Available data relative to origin, quantities and quality of water were collected and recorded.

- **Terrestrial Features**

Available previous researches reports and studies were collected for studying the existing flora in site project. The study included the desert life and bids. There was no special for funa and flora in the area.

- **Energy**

Energy resources (liquid fuel or electricity) were identified and evaluated with their uses in airplanes fueling and ground equipment. Use of solar energy was identified and it is a positive to the environment

- **Solid/Hazardous Waste**

Data related to the type and quantities of solid and hazardous waste, were collected. A site investigation was conducted to the landfill site.

- **Traffic and Access Roads**

A traffic study had been conducted around Borg El Arab Airport to assess the expected impacts of the traffic generated from the proposed new terminal, during the construction and operational phase. Level of service analysis was conducted on the surrounding transportation networks.

- **Vibration**

The measurement was taken 10 meter away from the edge to estimate the effect of the aircraft landing impact on the surrounding buildings, and found no impacts.

- **Socio – Cultural**

A social study was conducted to cover the social dimensions of the community, in relevant to the expected extension of the Airport. The study was carried out dealing with the demographic and social characteristics of the community. Also the study presents the results of the field survey including interviewing with the government employees, residence of the community and Bedouins. They were very positive about the project

MAIN ENVIRONMENTAL AND SOCIAL IMPACTS

- **Noise**

Noise prediction at year 2014 indicated that there are no negative impacts resulting from the noise generated due to the operation of new terminal and the new runway.

The level of noise on the adjacent areas around the Airport (at takeoff end 14 and runway end 32) as predicted on 2014, is within the allowable limits. By year 2024, the level of noise at the farming areas may increase to some limited areas to 60 dB in very small area.

- **Air Quality**

Generally, the total air pollution generated from the Airport terminal will not result in any adverse health impacts. The concentrations are well below the air quality limit values of Law No. 4 and No. 9 of Egypt and the WHO guidelines.

- **Water**

The project will be supplied with water from water treatment plant in Borg El Arab, which is operated by Alexandria Water Authority.

It is planned to supply the new terminal building with water from the existing water main 300 mm in diameter. There are no expected negative impacts or health risks regarding the water quality from the water supply system.

- **Wastewater**

Due to the construction of the new terminal building, wastewater generated will increase. Wastewater generated from the airplanes as well as waste water from the new terminal will be treated and used for irrigation indicating a positive for environment
The construction of an environmentally safe collection, disposal, and treatment systems will have a positive health impact on the Airport serving staff and passengers.

- **Energy**

There will be no negative impacts resulting from the indirect effects resulting from either the stock emissions at the power plants situated at the Alexandria zone, (SidiKrir power plant)

The Airport share of productivity extra pollutants for the power plants would be nothing but trace concentrations.

The use of solar energy system will help very much in this respect, using minimum electricity

- **Solid/Hazardous Waste**

Solid and hazardous waste will be generated at both the construction phase and operational phase. During the operational phase, solid and hazardous waste will be generated from human activities, airplanes cleaning operations, maintenance shops, fuel stations, luggage handling as well as cafeterias and kitchen areas and cargo village.

The new Airport will not have a negative impact on the existing solid waste collection system in the Airport, as new facilities will be provided to cater for the additional volumes generated. With a transfer station, and sorting at source.

- **Traffic**

A statistical analysis was conducted to estimate the Level of Services (LOS) considering different project phases.

The Maine four roads to airport was studied and a recommendation was conducted for its improvements

- **Vibration**

The measurement was taken 10 meter away from the edge indicating a very high impact. The results for all value and for all spectrum indicate lower than expected at this location meaning the damping effects of the soil is high and soil absorb quite well vibration generated, it have a good damping coefficient. Our focus was in low frequency range as it would expect to travel long distances.

- **Social - Cultural**

During the study a selected sample was used, targeting Government and Airport employees and the residents in the region. The work was carried out by means of a field survey. A guide interview study was designed for each of the previous four (4) mentioned groups, whereby the researcher could probe during the interview.

Results of the survey show unanimous positive perception of the construction of the new terminal.

A general conclusion could be drawn that the Borg El Arab community society supports the building of the new Terminal. Enhancing the quality of service and housing for the employees and the provision of measures of occupational health for the employees are some of the main concerns that need to be addressed.

The project area does not include any resettlement/relocation of the population. Moreover, the land allocated for the Airport is a public area, falling under governmental administration. It follows, therefore, that the construction of the new building will not cause any involuntary resettlement issues. Hence, the World Bank Operational Policy OP/BP 4.12 and any other Policy will not be triggered.

- **Biological**

No adverse effects are available on the surrounding wild life. The project would not result in any adverse effects on threatened, vulnerable or endangered species.

PROJECT MITIGATION MEASURES

The most significant impacts with the corresponding mitigation measures that will be implemented during all phases of the project to eliminate/investigate many of the adverse environmental impacts are as follows:

Design Phase

- **Noise**

Provide best acoustical designs for all facilities inside the Airport to achieve a good acoustical performance in all areas.

- **Vibration**

The new equipment for the project should be designed to minimize vibration at building

- **Wastewater**

A new wastewater treatment plan at Borg El Arab International Airport to treat the liquid waste water and used it for irrigation

- **Solid and Hazardous Wastes**

It is recommended to include separate the waste from its source areas at the main building and at the cargo village building which will ease the following stages. A sterilizing and fragmenting autoclave should be constituent for treatment of condemned food products due to its shortage or un-acceptance to human consumption due to its chemical contamination.

Construction Phase

- **Generation of dust due to construction activities**

  - Material resulting from excavation must be put in a location protected from wind and shall be regularly sprinkled with water until reused for fill or disposed outside the site.
  - All hauling trucks shall be securely covered to eliminate dust scatter while moving in and out of the site.
  - All vehicles delivering material to the site shall be covered to avoid material spillage. While unloading material, fall height shall be kept low to minimize fugitive dust generation.
  - All construction material should be protected so as to minimize dust generation.
  - Temporary haul roads used by the contractor shall be watered whilst in use and should be kept clean and clear of all dust and mud.
  - Construction site to be watered periodically to minimize fugitive dust generation.

- **Construction workers camp**

  - The construction contractor will submit a Health and Safety plan for construction activities.

- The construction workers camp will include adequate sanitary facilities, and will be protected from high noise levels as much as possible.

- **Noise and emissions from construction vehicle/equipment exhaust**

  - Workers exposed to loud noise (As per Factory Act requirements) shall wear earplugs/earmuffs.
  - All vehicles and equipment used should be mechanically checked to avoid excess emissions.

- **Solid waste / Hazardous waste (during Construction)**

  - Contractor documents should include waste management plans to include recycle plans for solid waste and off site proper disposal of solid hazardous wastes.

Operation Phase

- **Noise impacts on communities**

  - Adopting the International Civil Aviation Organization (ICAO) standards for landing and take-off procedures
  - Workers on the apron area should wear earmuffs so as to avoid noise generated from ground equipment.
  - A permanent automatic noise monitoring system should be implemented with four (6) monitoring stations and computer software to correlate radar information to noise level.

- **Assessment of air quality in Borg El Arab**

  - Monitoring of air quality parameters around the Airport in the future should be considered as a precautionary measure to ensure that their quality levels are within the acceptable norms set by local and international laws.
  - Monitoring will be carried out using passive samplers, and a mobile air measurement unit.

- **Social Aspects**

  - Since it is expected that the city of Borg El Arab will flourish and consequently expand, as a result of the construction of the new Terminal building. This boom must be paralleled with strict building regulations that should coincide with their strict enfacement. High buildings should be allowed within the required legal distance not around the airport.
  - A good transportation system is needed to connect the airport with the neighboring areas, especially Alexandria.

- Generation of solid wastes from aircrafts, terminal buildings and other sources within the Airport will increase due to the construction of the new terminal building.

- A contractor can be appointed to implement a solid waste management system, which should include segregation of solid wastes from terminal buildings and landed airplanes.
- Covered wastes baskets and waste bags with different colors should be used for segregation purpose.
- An interim storage area within the Airport terminals should be dedicated for the storage of segregated solid wastes. The area should be adequate to cope for the expected increased quantities of solid wastes.
- Proper disposal of hazardous wastes.

All staff at airport needs a building capacity at the area of environment namely noise, air quality and other environmental items

INSTITUTIONAL STRENGTHENING AND TRAINING

The environmental unit needs to build their capacity by adequate training

The environmental unit has to implement the mitigation measures and conduct environmental detailed audit to prepare the auditing checklists for each department at the Airport.

In case that a current management body other than the Airport authorities is awarded a contract to operate and manage the Airport buildings, the EMP has to be implemented by the environmental officer within the administration. The environmental officer will then have to report to the Airport environmental officer. Both officers are subjected to the EEAA regular audit.

In order to implement efficiently an EMP, a training program should be adopted. The program should include orientation for the Airport managers, training for heads of operating departments, training for supportive ground and terminal staff.

Training of the supportive ground and terminal staff is important to secure their commitment to implement these protective measures, to develop their skills, to observe defects, to report, and to follow up necessary correction actions. Trainee should be made aware of the environmental regulations, auditing procedures, preparation of checklists and keeping environmental registry for the Airport.

In this respect a full cooperation between EAC and EEAA offices will be a good step in this direction.

PUBLIC CONSULTATION AND DISCLOSURE

In order to ensure public participation and that the views of the affected groups and local NGOs are taken into account, two (2) public sessions were held for this project.

A scoping session and a public hearing session were held on November 1, 2014 and November 23, 2014 respectively. The two (2) meetings were attended by roughly forty-five (45) people each representing different groups including Borg El Arab, Governorate of Alexandria, EEAA, EAC, JBIC businessmen and Airport employees as well as local residence . The sessions were organized to include the following activities:

- Presentation of the status of the project at its different phases.
- Breakdown of the activities to highlight the issues that the attendees might comment on.
- Explain the environmental issues and invite the participants to raise their concerns about possible negative impacts.
- Presentation of the main results. And findings

A description of the issues raised during the meetings were documented and reflected in the study.

A complete set of the draft EA report for the proposed Borg El Arab new terminal project, including an Arabic executive summary has been placed at the meeting for public comment.

The Maine finding at the two public meeting that nearly everybody was in favor of the new building, they only concern about roads to airport and relevant authority promised crystal clear they will do the necessary mitigations.

Monitoring plan

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Design						
Noise		-Studying the general layout and the relation between Apron area, Terminal buildings area and ground equipment. -The best acoustical designs for all facilities inside the Airport to achieve a good acoustical performance inside all the Airport buildings according to standard sound levels which should be applied inside and according to WHO including ground equipment selection and types, thickness and specifications of the				

		materials used in according to measurements and conclusions presented in this EIA study; -Designing the HVAC system (ASHRE) standards including blower silencers. -Best RT and STC for the building areas.				
Vibration		The new equipment for the project should be designed to minimize vibration at building				

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
Construction activities at areas accessible to the public	Safety risk to the public at or near construction sites.	- Construction sites closed to the public.	Contractor	Egyptian airport company environmental unit	part of the construction cost	
	Noise and emissions from construction Vehicle/equipment exhaust	(As per Factory Act requirements) Shall to utilize hearing protection./ Workers exposed to loud noise Site design layout to avoid noise Impacts on residential areas wherever possible and/or necessary.	Contractor	Egyptian airport company environmental unit	To be covered as part of the construction cost.	Noise complaints register to identify concerns and check validity.
	Soil and Painting removal, modification, mixing, compaction, loss, or contamination due to construction activities.	Vehicle movements will be restricted to construction areas and roads. – Contractors will work according to strict management requirements. - Topsoil and excess	Construction contractor	Third party Inspection. Biweekly (environmental consultant to be hired)	To be covered as part of the construction cost.	Monitoring of PM10 (Dust Levels) on the concerned sites monthly.

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		soil cleared from the modernization activities will be stored in the soil storage area and must be protected from wind and regularly sprinkled with water until reused for fill or disposed outside the site				
	Generation of dust and emissions due to modernization activities.	– All material resulting from excavation must be put in a location protected from wind and regularly sprinkled with water until reused for fill or disposed outside the site. – All excavations shall be backfilled and reinstated to a similar condition as	Construction contractor	Third party Inspection. (environmental consultant to be hired) Reports to Environmental Unit at EAC	$15,000 part of the construction cost	Monitoring Dust Levels. On the indoor working environment

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		existed before the excavation started. – Temporary haul roads shall be watered whilst in use to reduce dust production during construction. - All hauling trucks must be securely covered to eliminate dust scatter while moving in and out of the site. – All vehicles delivering material to the site shall be covered to avoid material spillage. While unloading Material, fall height shall be kept low to minimize fugitive dust generation.				Ambient NO_2, SO_2, and CO concentrations
		– All construction				

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		material should be protected so as to minimize generation of dust. Construction site to be watered periodically to minimize fugitive dust generation. - Limiting vehicles and equipment speed inside the construction site and unpaved roads by introducing speed depth to reduce re-suspended dust generation. Restricting off road driving Regular cleaning of asphalted roads used by construction traffic to reduce re-suspended dust				Vehicles and equipment passing normal inspection test

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		generation. – All vehicles and equipment used should be mechanically checked to avoid excess emission				
	Construction Safety	– The construction contractor will submit an HSE plan for construction activities. All contractors must supply their workers with proper clothing and gears (PPE) and appropriate safety training and instructions. – The construction workers camp will include adequate sanitary facilities, and will be protected from high	Construction contractor	EAC Environmental Unit Third party Inspection. Monthly (environmental consultant to be hired)by EAC	part of the construction cost	Workers camp kept in good condition Number of accidents

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		noise level as much as possible.				

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Operation						
	Noise impacts on communities.	– Adopting and applying the ICAO standards for landing and takeoff procedures – Management of landing and take-off between runways so as to minimize noise between 11.00pm and 6.00am – Install three new permanent automatic noise monitoring system with	– Environmental unit at EAC – External Contractor – consultant for 12 month	Contractor and EAC environmental unit With help of consultant	6 monitoring unit =300,000$ $72,000	Noise Levels Do not exceed Compliance with Law 4, 1994 and its modification 9/2009 .

		current software to correlate radar Information to noise level. – Noise Consultant for the INM monitoring system compilation and noise analysis.				
	Air Quality during operation on indoor environment	– Portable gas analyzers for measuring the gaseous emissions. – Portable Dust monitor. – Ventilation meter.	External Contractor and consultant	Contractor and EAC	$70,000	Following up and checking the indoor environment validity
	Air quality out door	– Monitoring air quality by a mobile lab around the airport	External Contractor and consultant	Contractor and EAC Or use one of the station that EAC has in Sharm El-Shiekh or Hurghada	$360,000	Establish a data base for airport
	Soil contamination during operation	– A spill response plan will be developed for the site that will deal in detail with the	EAC Environnemental Unit	EAC Environnemental Unit	part of the construction cost	Number and volume of fuel/oil spill and/or leakage incidents

	Aircraft's Wastewater	identification and response to major, non-routine incidents. – Areas susceptible to potential spills of contaminants, such as diesel fuel loading, storage and transfer areas, will be covered in an impermeable layer (hard cover) with drainage to a suitable holding, separation or treatment facility. -Monitoring program to follow up with the operation and maintenance (O&M) in order to secure the treatment efficiency and compliance with the environmental law.	EAC Environnemental Unit	EAC Environnemental Unit	EAC Environmental Unit -day to day work	Water analysis record and progress reports every month after construction of the new plant

Technical Assistance during operation					
Supervision and monitoring of EMP	– Hiring local Environmental Consultant to assist and supervise the implementation of the EMP and noise monitoring stations – Follow Up the daily monitoring of indoor environment dust. – QC/QA of ambient air quality monitoring stations to estimate the effect of modernization and updating activities on the ambient environment – Help in filling the monitoring by forms by JICA	External EMP consultant for 24 month.	EAC Environmental Unit	$50,000	Compliance with EMP

Contents

Abbreviations, Acronyms and Units

µg	micro gram
µm	micro meter
CO	Carbon Monoxide
CO_2	Carbon Dioxide
dB	Decibel
DNL	Day Night Sound level
EAC	Egyptian Airports Company
EEAA	Egyptian Environmental Affairs Agency
EIA	Environmental Impact Assessment
EIMP	Environmental Information Monitoring Program
EMP	Environmental Management Plan
ERR	Economic Rate of Return
GOE	Government of Egypt
ICAO	International Civil Aviation Organization
Hz	Hertz
IEM	Integrated Environmental Management
INM	Integrated Noise Model
JBIC	Japan Bank for International Cooperation
km	Kilometer
kV	Kilo Volt
kVA	Kilo Volt Ampere
kWh	Kilo Watt hour
L.E.	Egyptian pound
LOS	Level of Services
m	meter
m^2	square meter
m^3	cubic meter
mm	millimeter
NGO	Non-Governmental Organization
NH_3	Ammonia
NO_2	Nitrogen Dioxide

NO_x	Nitrogen Oxide
O_3	Ozone
NPV	Net Present Value
pH	Hydrogen ion concentration
PM	Particulate Matter
SO_2	Sulfur Dioxide
SS	Suspended Solids
TDS	Total Dissolved Solids
TOR	Terms of Reference
VOC	Volatile Organic Compound
WB	World Bank
WHO	World Health Organization
ICAO	International Civil Aviation Organization
SAPI	Special Assistance for Project Implementation
BHS	Baggage Handling System
PTB	Passenger Terminal Building
PHP	Peak Hour 2-way Passenger movement
LED	Light Emitting Diode
HVAC	Heating Ventilating and Air Conditioning
AWOS	Automated Weather Observation System
RVR	Runway Visual Range
IATA	International Air Transport Association
FAA	Federal Aviation Administration of the United States
CAB	Civil Aviation Bureau
AWWA	American water works Association
SAPI	Special Assistance for Project Implementation
STC	Sound transmitting class
RT	reverberation time

Chapter 1 – Project Description

1 Introduction

The Government of Egypt (GOE) decided to implement an extensive modernization program for the major Airports in the country. Alexandria government plays an important role as the second largest business center and the first marine transportation center in Egypt. Besides it is welcoming an increasing number of tourists from Europe and Middle East for the internationally recognized sandy beaches and historical monuments.

Increasing number of passengers from delta area lead to the need of a new terminal building especially introduction of cheap flight prices.

Therefore, the facilities of Borg El Arab International Airport are to be expanded to cope with the expected increase of air traffic and passengers based on the development of Alexandria Governorate.

According to the Special Assistance for Project Implementation (SAPI) for the supplement study of Borg Al Arab Modernization Project.

The key elements of the project consist of a new passenger terminal, apron, building, car parking, and extension of the Cargo terminal building. The project is to be constructed on a land area of about36, 000 m².

The GOE in its effort to secure financial assistance has requested the Japan Bank for International Cooperation (JBIC) to provide the support for the implementation of such project. JBIC has expressed interest to finance the project. The acceptance of the JBIC to assist in building the new terminal implies implementing the JBIC and the Ministry of State for Environmental Affairs procedures and conducting an Environmental Social Impact Assessment (ESIA) before starting the construction.

The main objective of the EISA is to examine the biophysical and the socio-cultural environment in the surrounding area of the project, and to ensure that possible positive and negative impacts together with the required mitigation measures during different phases of the project are identified.

This report aims at describing the main findings of the current environment, identifying possible impacts of building the new terminal in Borg El Arab and presenting recommended mitigations and incurred cost implications. The EISA also outlines the environmental Management Plan (EMP) with all the monitoring requirements.

1.1 Existing Borg Al Arab Airport:

The Airport was established in 1997 on an existing military air base.

The Airport uses currently the existing military runway and taxiway parallel to the runway. There are three (3) taxiways between the apron and the parallel taxiway. The civilian Airport has one passenger terminal building with a peak capacity of 600 passenger/hour and a car parking area of 350 car some time it accommodate more than that.

Table (1-1) Current Aircrafts movements and Passenger Movements

Aircrafts Movements	
Year 2014	20825
Year 2013	25986
Year 2010	7312
Total	54123

Passengers Movement	
Year 2014	2021892
Year 2013	2260540
Year 2010	712073
Total	4994505

This clearly indicates a need for a new building as the number of passengers and airplane increase dramatically

1.2 Conceptual design and layout for the new terminal building& tarmac area:

Figure (1-1) conceptual design

1.2.1 Layout:

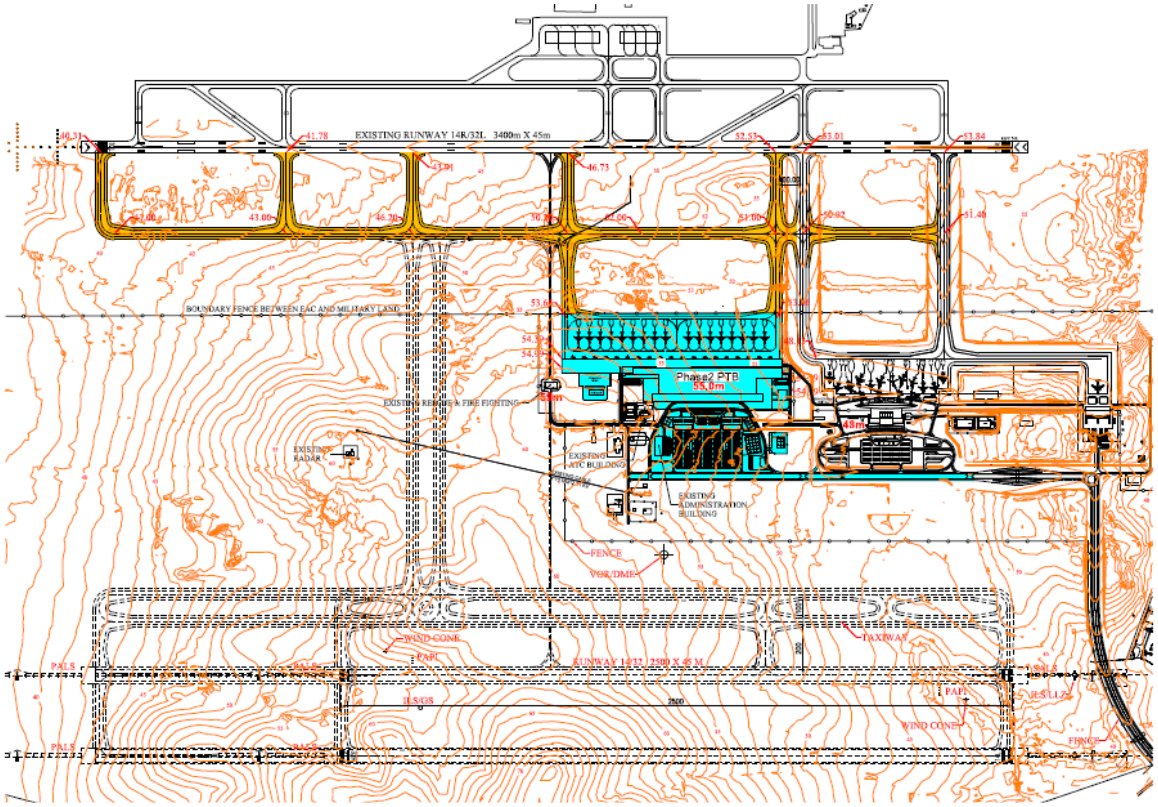


Figure (1-2) layout of the new terminal final arrangement

- Building can accommodate 4-5 million passengers / year.
- Tarmac area of 15 aircraft stands.

1.2.2 Elevations:

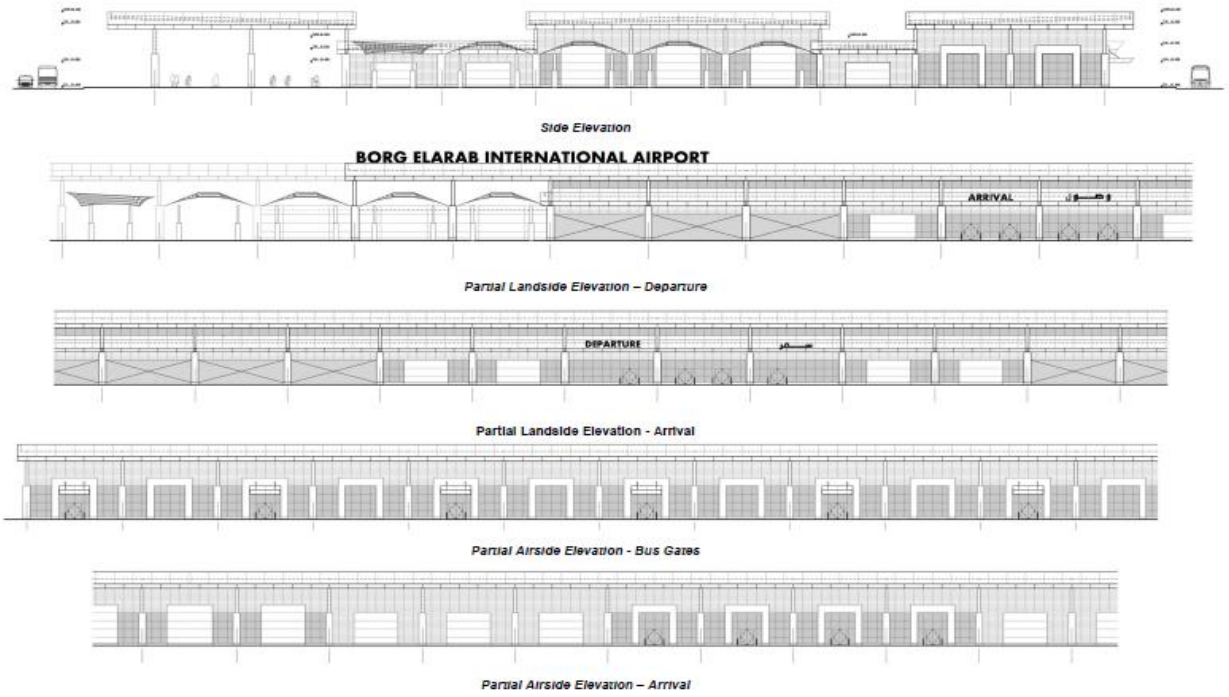


Figure (1-3) Elevations

1.2.3 Recommended layout concept:

Three concepts were studied

Concept 3 was selected it shows a combined baggage make-up and breakdown areas. The check-in hall consist of two areas of 20 counters each to reduce the walking distances and congestion, the check-in halls are connected by a 12 meter wide link. Note that also in this concept the BHS feeder belts have to cross over (or under) a section of the building and tug and dolly routing to reach the make-up carousels in the baggage make-up area. The longer distance compared to other options has an actual advantage explained hereunder. The emigration and security areas are located in between the two check-in halls. The pre-departure lounge is located behind the right check-in hall.

The arrival lobby and immigration area is located between the left check-in hall and baggage claim hall.

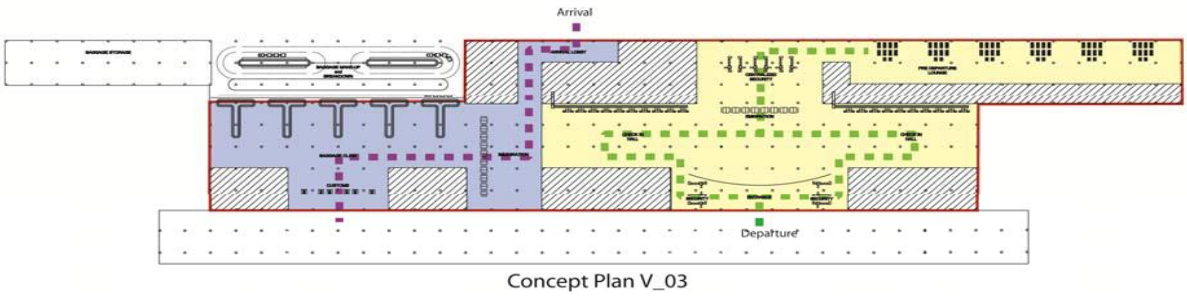


Figure (1-4) concept plane

1.2.4 Architectural Design Concepts:

The concept of the building is that of a green building incorporating energy saving elements, such as the usage of solar panels, usage of LED lighting fixtures and an energy efficient HVAC system.

The shape of the building has to be responsive to accommodate the requirements for a green building in addition to reduce the construction cost.

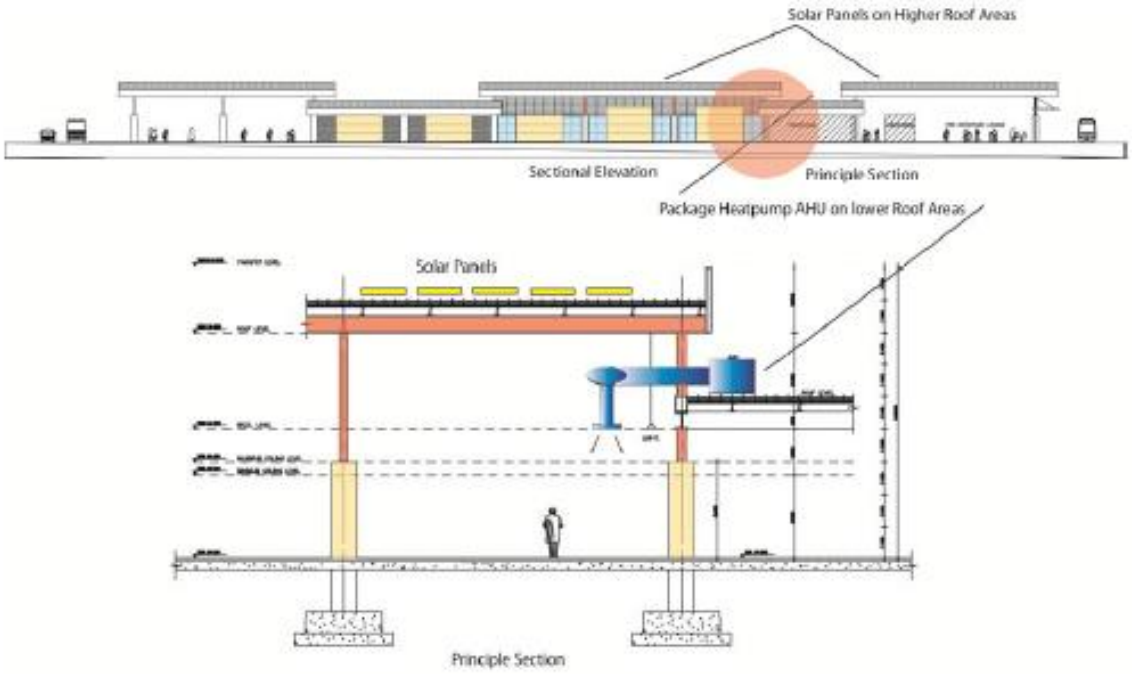


Figure (1-5) principal sections

1.3 Facility requirements:

1.3.1 General

Assuming that the Phase 2 Development would be completed by around 2017, the two Passenger Terminal Buildings (original and 2nd PTB) should be capable of accommodating a passenger volume of 5 to 6 million for the years 2025 to 2030. Therefore the nominal capacity of the 2nd PTB should be in the range of 4 to 5 million passengers per annum.

The above assumptions are reviewed in more detail and generally confirmed to be relevant except for some airport utilities requirements, as described hereunder.

1.3.2 Passenger Terminal Building

The required floor area for the Passenger Terminal Building (PTB) is planned based on the peak hour 2-waypassenger movement (PHP) and unit space requirement.

Design of the Phase 1 Terminal was based on 30m^2 per PHP. This has however been recently increased to 40m^{2}following passenger processing improvements and facility modifications (additional 3PBB installed).

The design of the new PTB at this time has been based on 30m^2 per PHP.

ICAO standards recommend 20m^2 per PHP, however the following factors have been considered from experience gained from the Phase 1 Terminal operations:

1. Unexpected amount of baggage being brought per passenger in comparison with the view in the design of phase 1.
2. Unexpected number of people who welcome and see off the passenger.

Assuming that the Phase 2 Development would be completed by around 2017, the two PTBs (1st PTB and 2nd PTB) should be capable of accommodating a passenger volume of 5 to 6 million for the year 2025 to 2030. Hence, the nominal capacity of the 2nd PTB should be in the range of 4 to 5 million passengers per annum. The required floor area is therefore shown in the following table 1.2.

Table (1-2) required floor area of passenger terminal building for 2030

	Total	1st PTB	2nd PTB
		Legacy Terminal Int'l & Dome.	Budget Terminal All International
Peak Hour 2-way Passenger (PHP)	1,831	610	1,221
Area per PHP		40 sq.m./PHP	30 sq.m./PHP
Total Floor Area		24,400 sq.m.	36,630 sq.m.

The floor area required for the Phase 2 Passenger Terminal Building is therefore approximately 36,000m2 in 2030. Table 1.3 shows the required passenger processing facilities of the 2nd PTB based on the SAPI study of air traffic movement forecast. The facility numbers required is also based on the experience gained from phase 1 and as mentioned previously the PTB floor area request by EAC.

Table (1-3) passenger processing facilities requirements

	Description	Equipment	No.	Justification
1	Security Check – Entrance	X-ray Unit	6	400 Pcs/hr (IATA + Experience 3 bags per PAX)
2	Check-in	Counter	40	180 second (IATA + Experience)
3	Departure Passport Control	Counter	16	75 seconds (IATA + Experience)
4	Security Check – Lounge	X-ray Unit	4	IATA
5	Departure Gate Lounge	Seating	104	6 Gates
6	Arrival Passport Control	Counter	20	IATA + arrival of 2 apron buses
7	Baggage Claim Hall	Belts	5	Claim Length = 50 meters / belt
8	Arrival Custom Control	Counter	12	IATA

1.3.3 Car Park

Car parking spaces were planned in the phase-1 study using ratios of 0.7 per PHP for private cars and 0.1 for taxis. Since the PHP and this ratio were found to be appropriate, the formula for planning the number of parking lots and taxi pool spaces are applied.

The required parking lots for the year 2030 is shown in the following Table 1.4

Table (1-4) parking lots

	Total	1st PTB	2nd PTB	Reference
		Legacy Terminal Int'l & Dome.	Budget Terminal All International	
Peak Hour 2-way Passenger (PHP)	1,831	610	1,221	
Private car	1,282	427	855	0.7 parking space per PHP
Shared Taxi / Minibus	183	61	122	0.1 parking space per PHP
Bus		32		Source of 1st PTB is SAPROF Study of 2004

1.4 Airport Utilities:

1.4.1 Power Supply System

Based on the design criteria the power supply requirements are determined to be as follows:
Power requirements = 5000 KVA
Other electric demands shall be established during the detailed design stage.

1.4.2 Water Supply System

Based on the design criteria the domestic water supply requirements are deemed to be as follows:
Domestic Water requirements = 1700 m_3/day
Other water demands shall be established during the detailed design stage.

1.4.3 Sewage Treatment System

Based on the design criteria the sewage treatment system requirements are deemed to be as follows:
Sewage treatment capacity = 1160 m_3/day
Other sewage demands shall be established during the detailed design stage.

1.5 Meteorological Observation System

Meteorological information is vital for aircraft operations. All the contracted states of ICAO are required to supply adequate meteorological information in accordance with Annex 3 "Meteorological Service for International Air
Navigation".
Automated Weather Observation System (AWOS) is used in airports worldwide where such systems record and provide meteorological information 24 hours a day. The following information should be collected by AWOS.

- Wind (direction, speed, significant speed variance and significant direction variance)
- Visibility (minimum visibility, direction of the minimum visibility, maximum visibility, direction of maximum visibility)
- Runway Visual Range (RVR) (RVR, RVR variance, RVR past tendency)
- Cloud (height base, cloud amount)
- Air and dew-point temperature
- QNH
- Surface temperature

1.6 Summary of Facility Requirements

The requirements for major airport facilities were established based on the peak characteristics and in compliance with the relevant standards and recommended practices of the International Civil Aviation Organization (ICAO).

The standards and practices of the International Air Transport Association (IATA), the Federal Aviation
Administration of the United States (FAA) and the Civil Aviation Bureau (CAB) were also referred to.
The following table shows the current airport facilities and further requirements for the year 2030 development of the project.

Table (1-5) Summary of current facility situation and requirement for 2030

Item		Current Situation	Minimum Requirements		
			2030		
		2012	Total	Phase 1	Phase 2
Design Aircraft		B777	B777 & A321	B777	B777 & A321
Aerodrome Reference Code		4E	No change		
Runway	Length (m)	3,400	No change		
	Width (m)	45	No change		
Runway Strip	Length (m)	3,520	No change		
	Width (m)	300	No change		
Taxiway	System	2 stub TWYs	3 stub TWYs		
	Width (m)	23	23		
Apron [Number of Aircraft]	Passenger	3(LJ)+4(SJ) or 12(SJ)	11(LJ)+8(SJ) or 32(SJ)	3(LJ)+4(SJ) or 12(SJ)	20(SJ) or 8(LJ)+4(SJ)
	Cargo	1(LJ)	1(LJ)		
Passenger Terminal Building (sq.m.)		24,400	60,400	24,400	36,000
Cargo Terminal Building (sq.m.)		887	No change		
Rescue and Fire Fighting Facilities					
ICAO RFF Category		Category 9	No change		
Number of Vehicles		3 RFF	No change		
Fire Station		800 sq.m.	No change		
EAC Administration & Operations Building (sq.m.)		3,000	No change		
Fuel Storage Tank Capacity		1,500 kl	1,500 kl	1,500 kl	N/A
Airport Utilities					
Power Supply System		4,219 kVA	9,219 kVA	4,219 kVA	5,000 kVA
Water Supply System		516 ton/day	2,216 ton/day	516 ton/day	1,700 ton/day
Sewerage System		438 ton/day	1,598 ton/day	438 ton/day	1,160 ton/day
Telephone System		50 lines + 185 extns	100 lines+ 485 extns	50 lines+185 extns	50 lines+300 extns
Car Park	Private Car	324 lots	1,427 lots	427 lots	1,000 lots
	Shared Taxi / Minibus	66 lots	117 lots	66 lots	51 lots
	Bus	40 lots	51 slots	40 lots	11 lots
Meteorological Observation System		Wind, RVR, Cloud Height, Pressure, Temperature	Ditto		

1.7 Terminal Building Summary of Areas:

Table (1-6) Summary of current facility situation and requirement for 2030

Subject	Allocated Net Areas (unless otherwise shown)	Unit
Ground Floor(*Overall Gross*)	**34,200**	**m²**
Entrance Security Check	**2,300**	**m²**
Circulation	1,990	m²
X-Ray Check (2 X-Ray for future extension)	6	Units
Terminal/Flight Information Counter	1	unit
Security / Police Offices	310	m²
Check-in Hall	**5,975**	**m²**
Circulation/Queuing	5,695	m²
Check-in counters	40	units
Odd sized check-in counter	1	units
Toilets	280	m²
Airline Counters & Offices	**1,190**	**m²**
Emigration Hall	**2,190**	**m²**
Circulation/Queuing	2,140	m²
Emigration Counters (8 Counters for future extension)	16	Units
Emigration Offices	50	m²
Centralized Security Check	**1,750**	**m²**
Circulation	1,700	m²
X-Ray Check	4	Units
Security / Police Offices	50	m²
Pre-Departure Lounge	**5,175**	**m²**
Circulation	3,335	m²
Concessions	1,075	m²
Toilets	280	m²
Prayer Room	280	m²
Private Lounge	145	m²
Smokers' Room	60	m²
Arrival Lobby	**1,630**	**m²**
Circulation	1,455	m²
Visa	35	m²
Toilets	140	m²
Immigration Hall	**2,190**	**m²**
Circulation and Queuing	1,666	m²
Immigration Offices	140	m²

Subject	Allocated Net Areas (unless otherwise shown)	Unit
Baggage Reclaim Hall	4,541	**m²**
Circulation	4,226	m²
Toilets	280	m²
Lost & Found	35	m²
Customs	1,260	**m²**
Circulation	1,150	m²
Offices	110	m²
Terminal Building Management	910	**m²**
Port Health	140	**m²**
Duty Free Shop	290	**m²**
Concessions	2,250	**m²**
B.H.S Staff Offices	305	**m²**
MEP	1,530	**m²**
Goods Delivery Waste Collection	110	**m²**
Structures, Walls and Design losses	464	m²
Mezzanine Floor(*Overall Gross*)	2,600	**m²**
B.H.S Area	1,800	m²
B.H.S Storages & Offices	800	m²
Summary of Areas(*Overall Gross*)		
Ground Floor	34,200	m²
Mezzanine Floor	2,600	m²
Total Floor Area	36,800	**m²**
PTB-2 Related Facilities		
Covered Meters& Greeters Curbside	12,500	m²
Semi Covered Plaza	7,200	m²
B.H.S (area is enclosed, but naturally ventilated)	4,333	m²
Transfer Storage(area is enclosed, but naturally ventilated)	430	m²
Baggage Storage(area is enclosed, but naturally ventilated)	430	m²
Airlines Storage (Open area, but naturally ventilated)	860	m²
Total Related Facilities (Gross)	25,753	**m²**

1.8 Potable Water System

1.8.1 General

The main objective is to supply the new terminal building with adequate potable water for the required demand and head taking into consideration necessary provisions to meet the fluctuating demands of the site.

1.8.2 Codes & Standards

The design standards adopted in the potable water system design shall include local regulations as well as widely recognized international standards. These include but are not limited to the following:

- Egyptian code for design and implementation of water and drainage networks issued by the Ministerial Decree No. 286 for the year 1990 (referred hereinafter as Ref. # 1).
- Egyptian code for design and implementation regulation of plumbing issued by the Ministerial Decree No. 289 for year 1992 (referred hereinafter as Ref. # 2).
- American water works Association (AWWA).

1.8.3 Sources of Supply

Generally the study on feeding the new terminal will be based on using the existing source of supply which is feeding the existing terminal building, as follows:

- Existing potable water tanks with capacity 1032 m3
- Existing Pump-station consisting of three (3) pumps ("2" working + "1" stand-by), each of30 m3/hr and head of 44.1 m,

1.8.4 Potable Water demand

The users of the new airport can be classified as passengers, employees, and visitors. This section will focus mainly on water usage.

Below table 1.7 indicates the Per Capita Daily Consumption that will be used in this project.

Table (1-7) Daily consumption

Item	Consumer Type	Consumption (l/c/d)
1	Passenger demand	20
2	Employees	100
3	Visitors	25

1.8.5 Project Total Potable Water Requirements

Table. (1-8) total potable water requirements

ABB.	NAME	TYPES	NO. OF BLDGS	TOTAL AREA	POPULATION PAX/DAY	WATER CONSUMPTION L/C/ DAY	WATER CONSUMPTION M³/DAY
PTB	PASSENGER TERMINAL BUILDING		1	38,800.00			
		Passengers			10960	20	219.2
		Employees			340	100	34
	EXTERNAL PLAZA (WELL-WISHERS)	Visitors	1	7,200.00	27400	25	685
	MEETERS & GREETERS CURBSIDE	Visitors	1	7,200.00	27400	25	685
	B.H.S AREA	Employees	1	4,333.00	8	100	1
	BAGGAGE STORAGE AREA	Employees	1	864.00	17	100	2
	AIRLINE STORAGE AREA	Employees	1	864.00	17	100	2
	external retail (1)	Employees		2,250.00	75	100	8
VP	VIP PAVILION	Employees	1	590.00	59	100	5.9
CB	CONCESSION BUILDING	Employees	1	650.00	130	100	13
ET	EXTERNAL TOILETS		2	330.00			
	external retail (2)	Employees		460.00	15		
M	MOSQUE		1	1,400.00	140	15	2.1
				0.00			
GH	GUARD HOUSE		2	134.00	8	100	0.8
LSS	LANDSIDE ELECTRICAL SUBSTATION		2	554.00			
ASS	AIRSIDE ELECTRICAL SUBSTATION		1	530.00			
			TOTAL	71,459.00	66570		1657

The new terminal buildings and surrounding facilities average daily requirements are 1700 m3/day.

1.9 Sewage network

1.9.1 General

The main objective of the sewage water collection system is to collect the peak sewage flow from the new terminal building by means of a gravity collection system and convey it to the existing sewage treatment plant.

1.9.2 Codes & Standards

The planning and design criteria of the wastewater system shall follow widely recognized international standards as well as local regulations and codes of practice. These include but are not limited to the following:

- The Egyptian Code of Practice for the Design and Construction of Water and Wastewater Networks - Ministerial Decree No. 286 / 1990.
- The Egyptian Code of Practice for Plumbing, 1993 - Ministerial Decree No. 359 / 1990.

1.9.3 Generated Sewage Flows

Wastewater flows from new terminal building are calculated based on 70% of water consumption.

Table (1-9) sewage flows

B.N.	ABB.	NAME	Types	Population Capita/day	Water Consumption m³/day	Sewage Effluent m³/day
01	PTB	PASSENGER TERMINAL BUILDING				
			Passengers	10960	219.2	153.44
			Employees	340	34	23.8
		EXTERNAL PLAZA (WELL-WISHERS)				
			Visitors	27400	685	480
		MEETERS & GREETERS CURBSIDE	Visitors	27400	685	480
		B.H.S AREA	Employees	8	1	0.56
		BAGGAGE STORAGE AREA	Employees	17	2	1.2096
		AIRLINE STORAGE AREA	Employees	17	2	1.2096
		external retail (1)	Employees	75	8	5.25
02	VP	VIP PAVILION		59	5.9	4.13
03	CB	CONCESSION BUILDING	Employees	130	13	9.1
04	ET	EXTERNAL TOILETS		0		0
		external retail (2)	Employees	15		
05	M	MOSQUE		140	2.1	1.47
06	GH	GUARD HOUSE		8	0.8	0.56
07	LSS	LANDSIDE ELECTRICAL SUBSTATION				
08	ASS	AIRSIDE ELECTRICAL SUBSTATION				
			Total	66570	1657	1160

1.10 New Sewage Treatment Plant

Sewage collected from the new building will be disposed to a new sewage treatment plant that will be constructed in the southern side of the new terminal building.

1.10.1 Capacity of the Treatment Plant

The capacity of the treatment plant is equal to the production flow derived from the water demand, multiplied by 0.85.

The average wastewater flow can therefore be calculated as follow:
Water demand = 1700 m_3/day
Dry weather flow = 1700 x 0.85 = 1445 m^3/ day

From the above, the new treatment plant will be designed for a daily waste flow equal to 1445 m^3 and a $B.O.D_5$ load of 362 kg /day, based on an average BOD_5 concentration equal to 250 g/m_3.

1.10.2 Treatment technology

Similar to the existing treatment plant, the treatment technology that will be used will be an Extend Aeration System, which is considered as an ideal system for smaller flows. This type of system is preferred for relatively small waste loads, where lower operating efficiency is offset by mechanical simplicity.

The extended aeration system is a complete mix system which provides biological treatment for the removal of biodegradable organic wastes under aerobic conditions. Air may be supplied by mechanical or diffused aeration to provide the oxygen required to sustain the aerobic biological process. Mixing must be provided by aeration to maintain the microbial organisms in contact with the dissolved organics. Since complete stabilization occurs in the aeration tank, there is no need for a separate sludge digester

The Equalization tank may be used for temporary storage of excess flow.

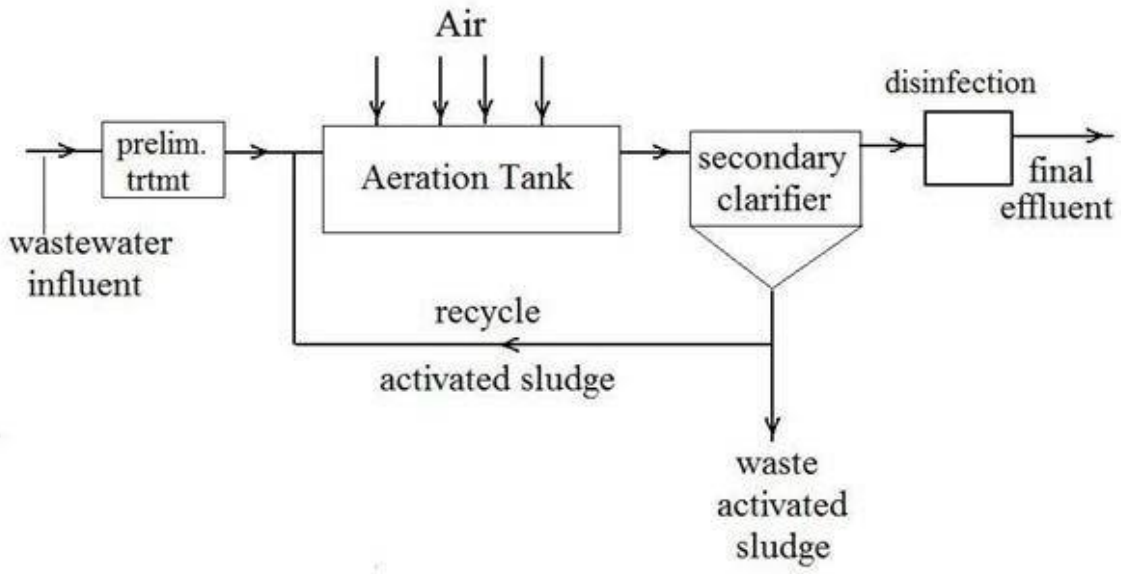


Figure (1-6) water treatment

1.11 Fire Protection System

1.11.1 General

The main objective is to protect the new terminal building with adequate fire water demand and head taking into consideration the necessary provisions to fulfill both internal and external fire protection requirements.

1.11.2 Codes & Standards

The design standards adopted in the potable water system design shall include local regulations as well as widely recognized international standards. These include but are not limited to the following:

- NFPA 13 Standards for Installation of Standpipe and Hose Systems.
- NFPA 14 Standards for Installation of Standpipe and Hose Systems.
- NFPA 24 Standards for the Installation of Private Fire Service Mains and Their Appurtenances.
- NFPA 1141 Fire Protection in Planned Building Groups.
- NFPA 1231 Water Supplies for suburban and rural fire fighting.
- AWWA Manual M31, 1992.

1.11.3 Sources of Supply

The study on protecting the new terminal is based mainly on using the existing source of the firefighting system which is protecting the existing terminal building, as follows:

- Existing potable water tanks with capacity 680 m3
- Existing Electric driven pump with Q = 1250 gpm, and head of 165 PSI.
- Existing Diesel driven pump with Q = 1250 gpm, and head of 165 PSI
- Existing Jockey pump with Q = 50 gpm , and head of 165 PSI

1.11.4 Fire Water Demand

The internal firefighting system shall consist of standpipes and an automatic sprinkler system that fully meets the requirements of the NFPA13. Hence, the maximum flow rate required for the internal firefighting system shall not exceed 1000 gpm.

According to NFPA requirements the minimum flow of 250 gpm for each fire hydrant is to be considered (NFPA 1231), for a minimum of two.

From the above, the total amount of water considered in the design of the fire network is 1500 gpm. This will accommodate external and internal fire events occurring simultaneously.

1.12 Irrigation network

1.12.1 General

The main objective is to supply new landscaped areas surrounding the new terminal building with adequate water demand quantity and pressure taking into consideration provisions to meet the fluctuating demands of the site throughout the year.

1.12.2 Codes & Standards

The design standards adopted in the irrigation system design shall include local regulations as well as widely recognized international standards. These include but are not limited to the following:

- Egyptian code for design and implementation of water and drainage networks issued by the Ministerial Decree No. 286 for the year 1990 (referred hereinafter as Ref. # 1).
- Egyptian code for design and implementation regulation of plumbing issued by the Ministerial Decree No. 289 for year 1992 (referred hereinafter as Ref. # 2).
- American water works Association (AWWA).
- Effluent standard stipulated by Decree 8 (1983) for the reuse of sewage treated waste water.
- Landscape irrigation handbook manual
- Turf irrigation manual

1.12.3 Sources of Supply

The study on feeding the new terminal landscape areas will be based on using the existing source of supply which is feeding the existing landscape as follows:-

- Existing irrigation tank and existing pump station located in the existing WWTP
- Proposed irrigation tank and new proposed pumping facilities at the new proposed WWTP

1.12.4 Irrigation water demand

The demands of the new landscape areas can be classified according to the plantation type. Below Table 1.10 Daily demands that will be used in this project.

Table (1-10) Daily demand

Item	Consumer Type	Consumption
1	trees	60-80 (l/tree/day)
2	palms	110 (l/palm/day)
3	shrubs	24 (l/plant/day)
4	grass	10(l/m^2/day)
5	ground cover	16(l/m^2/day)

1.13 Storm Water System

1.13.1 General

The main objective of the system is to collect the storm/surface water from the various project areas and satisfactorily discharge it into the surrounding terrain.

The storm/surface water shall be collected from the roofs via collection/inspection chambers, from parking area/internal roads/service road via catch basins. The collected storm/surface water will discharge into a positive gravity collection system consisting of a gravity pipework system and manholes.

The gravity collection system will finally discharge into an open lined ditch adjacent to the edge of the parking area located at the south of the project area which will convey the storm water to the project outfall (Terrain/lowest area) located at the east of the project area.

Part of the external service road will discharge into the above mentioned ditch using the side slope of the road and the other part of the service road starting from the radar area will discharge into a new lined ditch adjacent to the service road which will discharge the

storm/surface water into the existing 315 mm pipe through a new manhole which will be constructed in the existing pipeline.
Figure 1.11 indicates the proposed storm water drainage system

1.13.2 Codes & Standards

The planning and design criteria of the wastewater system shall follow widely recognized international standards as well as local regulations and codes of practice. These include but are not limited to the following:
The Egyptian Code of Practice for the Design and Construction of Water and Wastewater Networks - Ministerial Decree No. 286 / 1990.
The Egyptian Code of Practice for Road Drainage, Part 7, 1998 - Ministerial Decree No. 163 / 1998.

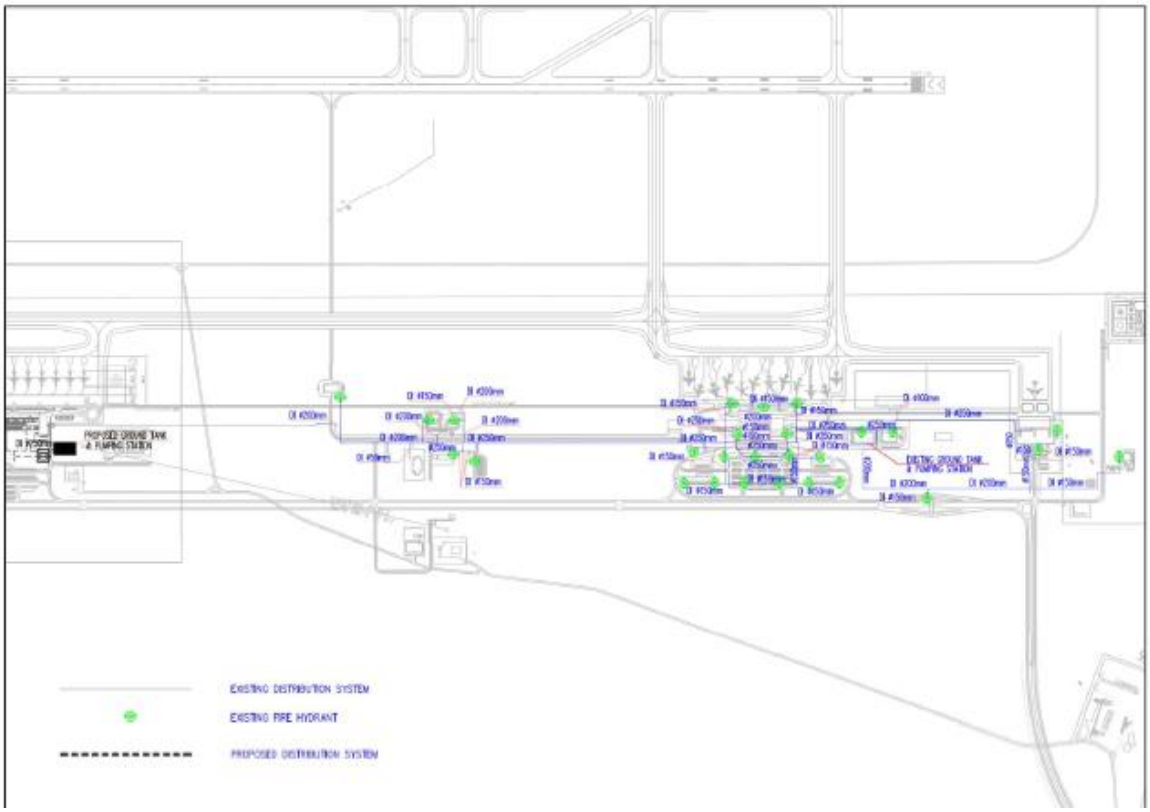


Figure (1-7) proposed firefighting system

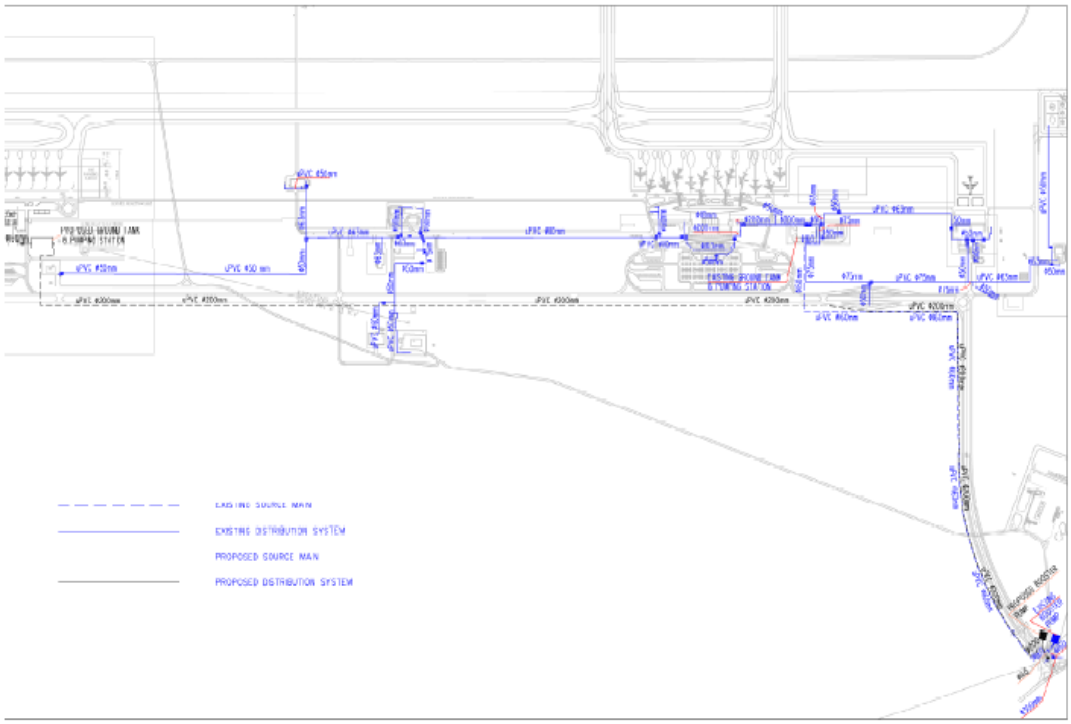


Figure. (1-8) proposed potable water supply system

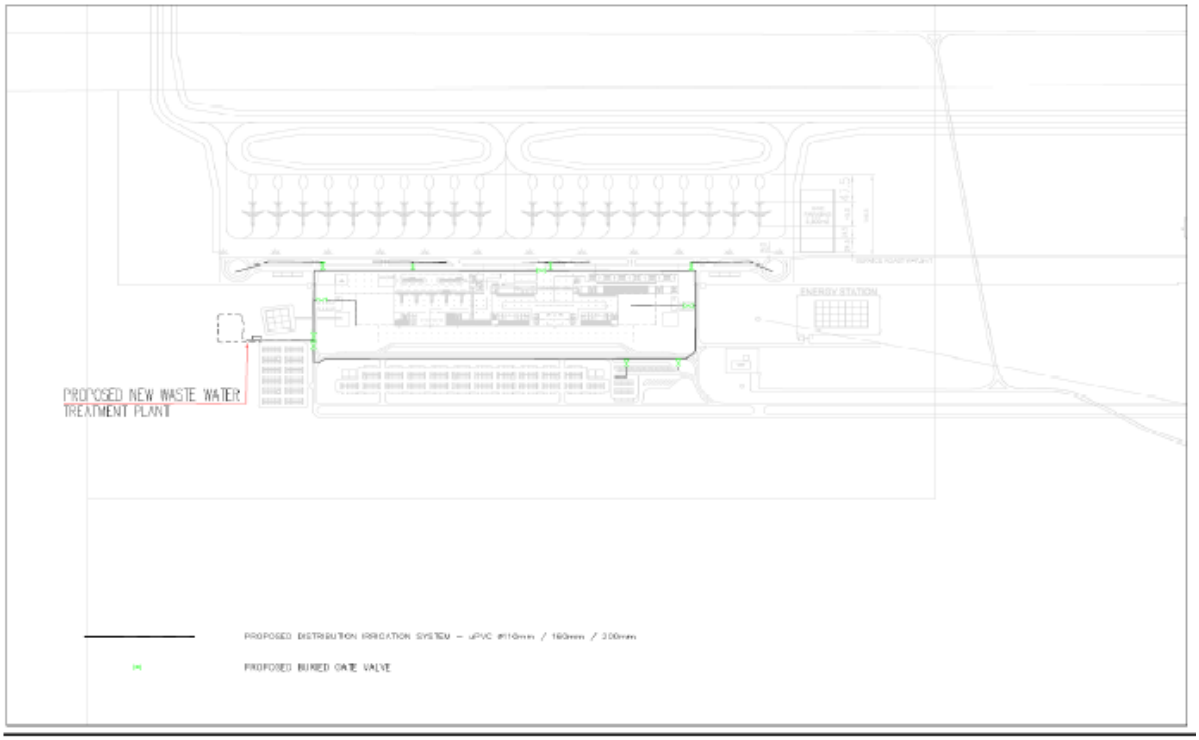


Figure (1-9) proposed irrigation system

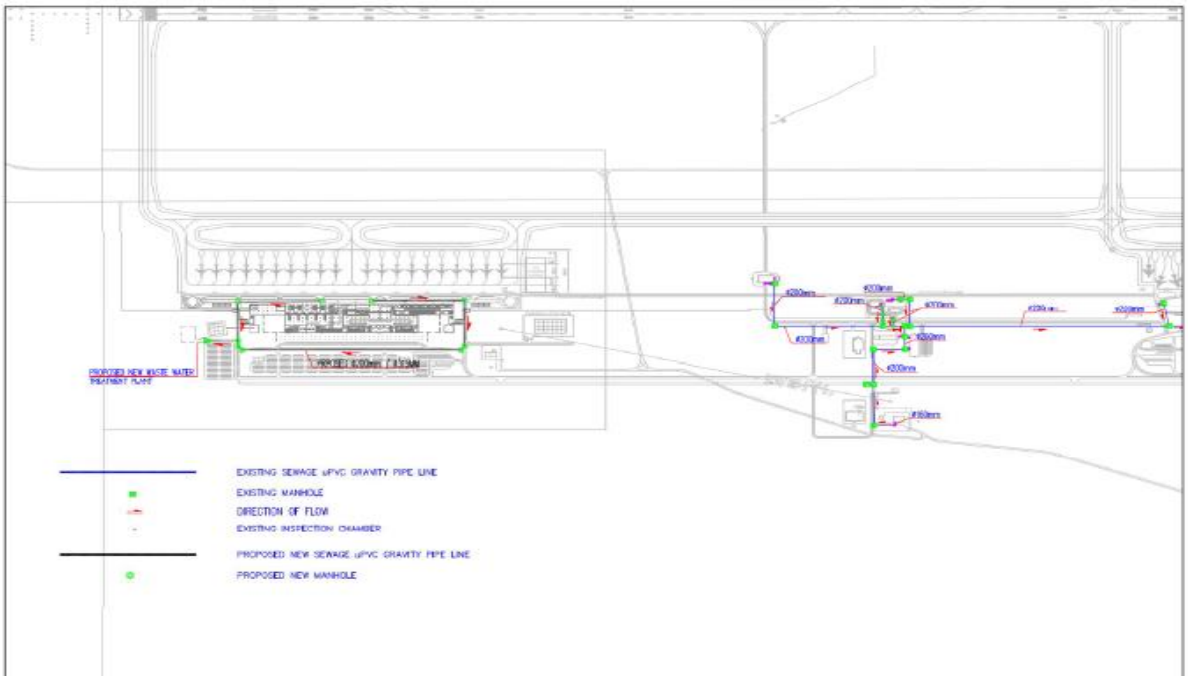


Figure (1-10) proposed sewage system

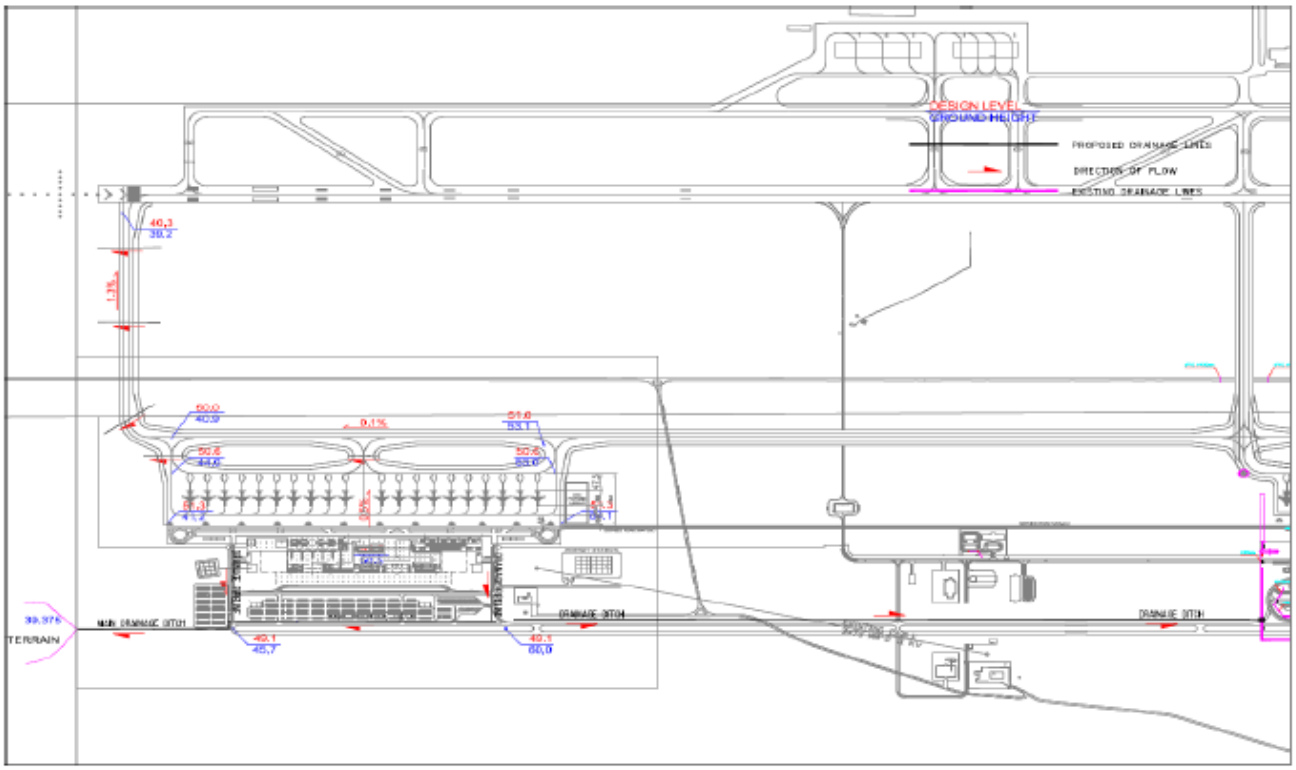


Figure (1-11) proposed storm water system

Chapter 2 – Green Technologies

2 Green Technologies

The New Terminal building concept should be designed as an ecological green building in consideration of the world-wide environmental issues and lack of electrical power sources in Egypt, especially in summer.
In order to deliver this concept a Photovoltaic Power system, VRV system for HVAC and LED lighting devices has been adopted
Other concepts of the New Terminal Building adopted are following:

- Shorter walking distances for passengers.
- Simplistic design and plenty open space for greeting and welcoming people.
- Ease of further expansion of check in counter, baggage claim, passport control counter and departure lounge areas.

2.1 Architectural Design Concepts:

2.1.1 Façade/Elevation

External finishes shall be selected according to their light or air intake ability. The principle of the facade is to combine open and solid elements based on these functional requirements, such as clear vision glass for areas that desire a level of transparency and views to -for example- the activities on the apron from the pre-departure lounge.
Other areas require daylight only glass will be filtered from direct sunlight by louvers; other areas require ventilation by means of external louvers.
The lower levels shall be executed with durable materials, higher levels by metal cladding, louvers or glazed louvers.

2.1.2 Roof

The roofs are proposed to be clad with aluminum standing seam system, similar to the concourse roof of the existing passenger terminal building.
This system allows for a light weight roof construction, reduction the structural cost and is fit for installation of the proposed solar panels. As the solar panels are fixed by means of clamps over the standing seam, there will not be any roof penetrations required, thus reducing the risk of leakages.

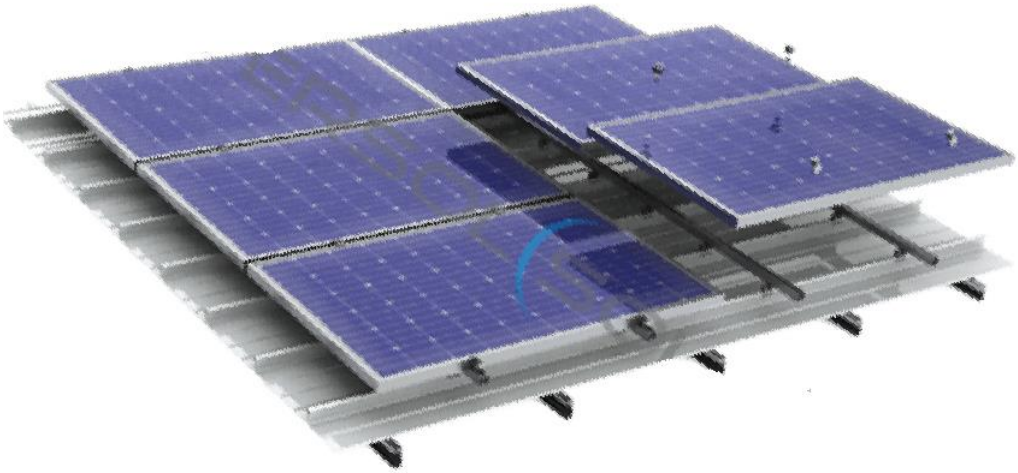


Figure (2-1) solar panels fixed by means of clamps to a standing seam roof

2.1.3 Lighting Fittings

The types of light fittings shall be selected based on the design usage of each area.
Light fitting types expected are:
LED fittings at office space areas, corridors, lobbies, waiting areas, toilets...etc.

Benefits of LED Lighting:

The benefits of LED Lighting are endless. LED Lights are energy efficient, cost effective, durable and more. They are the latest technology in lighting and offer a great alternative in replacing your current halogen or standard lights. Below is a detailed list of some of the many benefits of LED Lighting.

- Energy Efficient
  - LED Lights are that they use only 15% of the energy a standard halogen uses, provide up to 85% of the light output and create less heat making them so cool to touch. This makes LED Lights not only energy efficient but extremely cost effective as air conditioning use can be lowered. Some LED Lights can be operated by mains power, but when used with a Low Voltage LED Driver, LED Lights will produce more light output per watt.
- Long Life Span
  - LED Lights have the benefit of a super long life span of up to 80,000 hours which means you can cut maintenance costs as the lamps last up to 8-10 times longer than standard halogen lamps making them an ideal replacement.
- Improved Durability
  - LED's have no filaments so can withstand a greater intensity of vibration and shock than standard lights making them durable with less risk of breaking and need to replace.
- Compact Size
  - LED Light bulbs can be as small as 2mm making them ideal for fitting into hard to reach and compact areas.
- Fast Switching
  - LED Lights will start at full brightness, instantly, every time; therefore there is no need for backup lighting. LED Lights are a benefit because they switch on and off instantly.
- Safety
  - Most LED lights operate at low voltage so are cool to touch and much safer to handle during installation and maintenance and can be exposed to rain and snow.
- Environmentally friendly
  - The benefit of LED Lights is that they are an eco-friendly form of lighting as they do not contain mercury or other harmful gasses or emit any harmful UV rays. For example, a 13w LED light emits 68% less CO2 than a standard 40w incandescent bulb running 10 hours per day.

2.1.4 Photovoltaic Power System

Borg El Arab International Airport is located in a very hot desert area and the cost of commercial electric power required for air conditioning equipment during the daytime is a concern as well as the impact of the additional power consumption on the environment. Considering that during Alexandria's peak summer season there is sunshine for 9 hours per day, the use of photovoltaic generated power will contribute to a reduction of electric power costs during daytime (the peak electric power consumption period for air conditioners) also contributing to a reduction of the load to the environment. It has therefore been decided that the photovoltaic system will be utilized for the New Passenger Terminal Building in this project.
Photovoltaic panels will be installed in the12, 960 m^2area (360m x 36m) of the new passenger terminal building roof.

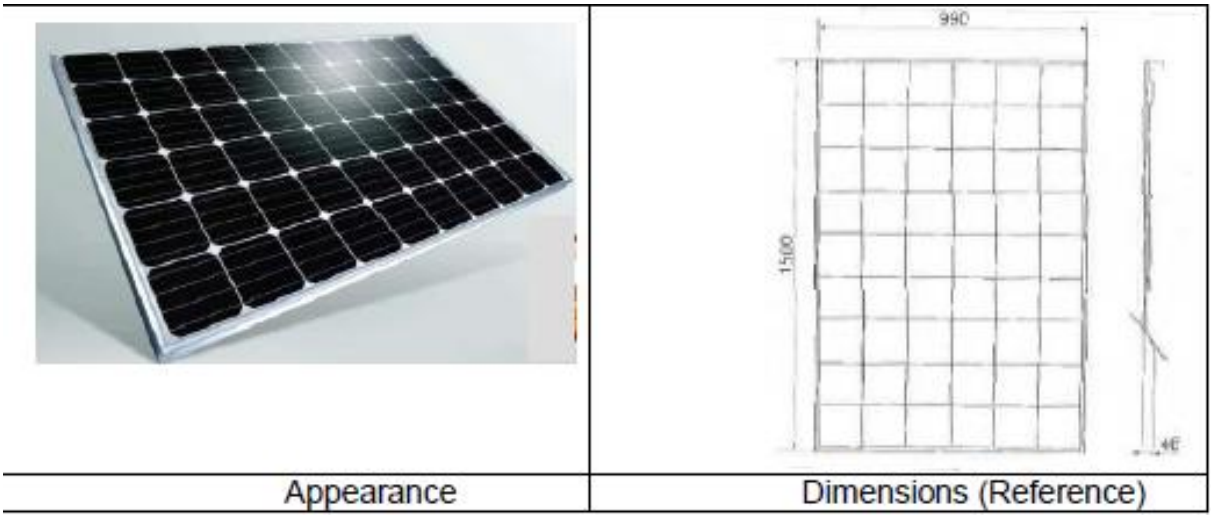


Figure (2-2) Photovoltaic Module (Reference)

Based on the anticipated load generation capacity of each panel, the overall planned power generation capacity is shown below.

- Number of Panels: 6750 pcs
- Power generation capacity (based on manufacturer data):
- Summer season 210w/pc x 6750 = 1417.5kVA
- Rainy season 150w/pc x 6750 = 1005.75kVA

Commercial electric power and photo voltaic electric power will be used for the air-conditioning equipment of which the planned consumption electric-power capacity is 2000kVA.

Condition:

- Electricity charges：0.5LE/kWh
- Initial Construction Cost of Photovoltaic power system: approximately 57M LE based on manufacturer estimate）
- Rainy season 5 months/year, summer season 7 months/year

Table (2-1) shows initial cost for power consumption of passenger terminal building

Initial Cost for Power Consumption of Passanger Terminal Building

Power to be generated — Summer **1,000** kVA; Winter **1,400** kVA

Description	Rate	Unit	Type of Power Resources		Note
			Commercial Power System	Photovoltaic Power System	
Solar Power Facilities			-	57,278,340	
Initial Cost			0	57,278,340	

Calculation of the period able to recover the initial cost

		Operation Period		unit	Power Consumption Rate	unit	Rate	Unit	Commercial Power	Initial Cost + Commercial Power	Commertial Power Expenses	Initial Cost + Commercial Power	Note
1	Summer	Day time	10		2,500		0.5		12,500		5,500		
		Night time	5	h/day	1,500	kWh	0.5	LE/kWh	3,750		3,750		
		Midnight	9		1,250		0.5		5,625		5,625		
		Total Daily Cost							21,875		14,875		
		Monthly Cost	30	day			7	M/Y	656,250		446,250		
2	Winter	Day time	8		1,250		0.5		5,000		0		
		Night time	4	h/day	750	kWh	0.5	LE/kWh	1,500		1,500		
		Midnight	12		625		0.5		3,750		3,750		
		Total Daily Cost							10,250		5,250		
		Monthly Cost	30	day			5	M/Y	307,500		157,500		
3		Yearly Cost	365						6,131,250		3,911,250		
4		Total Cost (Passed year)	1	year					6,131,250	6,131,250	3,911,250	61,189,590	
			5						30,656,250	30,656,250	19,556,250	76,834,590	
			10						61,312,500	61,312,500	39,112,500	96,390,840	
			15						91,968,750	91,968,750	58,668,750	115,947,090	
			20						122,625,000	122,625,000	78,225,000	135,503,340	
			21						128,756,250	128,756,250	82,136,250	139,414,590	
			22						134,887,500	134,887,500	86,047,500	143,325,840	
			23						141,018,750	141,018,750	89,958,750	147,237,090	
			24						147,150,000	147,150,000	93,870,000	151,148,340	
			25						153,281,250	153,281,250	97,781,250	155,059,590	
			26						159,412,500	**159,412,500**	101,692,500	**158,970,840**	
			27						165,543,750	165,543,750	105,603,750	162,882,090	
			28						171,675,000	171,675,000	109,515,000	166,793,340	
			29						177,806,250	177,806,250	113,426,250	170,704,590	
			30						183,937,500	183,937,500	117,337,500	174,615,840	
			35						214,593,750	214,593,750	136,893,750	194,172,090	

As a result of the above estimate of the cost and use of commercial power against the use of photovoltaic generated electric power plus commercial power:

- The initial expense of the system installation would be recovered after a period of approximately 26 years; however this period may be reduced should there be any increase in commercially generated power costs.
- It is also a positive consideration that the supply of stable generated electric-power from the photovoltaic system instead of the supply by the unstable commercial power is a further significant advantage to the Airport Facilities.

Benefits of Photovoltaic power system:

- Fixed energy costs.
  - When you make the decision to start generating solar power for your business, you are fixing your price of energy and taking control of your energy costs.
- Socially responsible.
  - By going solar, you demonstrate your environmental awareness and responsibility. Customers, peers, employees, and investors are more likely to work with organizations who adopt sustainable business practices.

- Solar benefits all utility customers.
    - Solar power systems provide benefits to all utility customers such as: savings on expensive new conventional power plants, reduced investments in transmission and distribution infrastructure, reduced electricity lost during transportation over power lines, and savings on the cost of meeting renewable energy requirements.
- Generate power with clean and renewable energy.
    - Solar power systems collect clean energy from the sun, turning it into a source of renewable energy for your business. When you use solar power as a primary energy source for your business, you are helping combat global climate change and reducing our collective dependence on foreign energy and fossil fuels.
- Environmental Benefits
    - Reduce your carbon footprint.
    - When fossil fuels such as coal, oil, and natural gas are burned to generate energy, they emit toxic gases into the air that cause pollution, resulting in global climate change. Solar power, on the other hand, is infinite, clean, and renewable.

2.1.5 Air Conditioning Systems

VRV System

– The Arrivals and large volume halls in the terminal building shall be air-conditioned using air-handling units located on the roof. Each air-handling unit shall be complete with pre bag carbon filter sections and adequate fresh air.
– The supply of treated air and return air to and from the areas shall be through suitably sized ductwork and air outlets.
– Individual office areas shall be air-conditioned using indoor type cassette units connected to outdoor units located on the roof. Treated fresh air shall be supplied to these areas from fresh air handling units through ductwork. Individual temperature control shall be by three speed digital display thermostats.

– Where required sound attenuators will be installed on the air-handling units to achieve acceptable sound levels.
– Heating in winter shall be provided by means of a heat pump.
– Toilets, pantries and kitchens shall be ventilated through central fans.

– A fresh air ties in and a provisional space on the roof for condensing units of each tenant will be provided for the rented commercial areas.

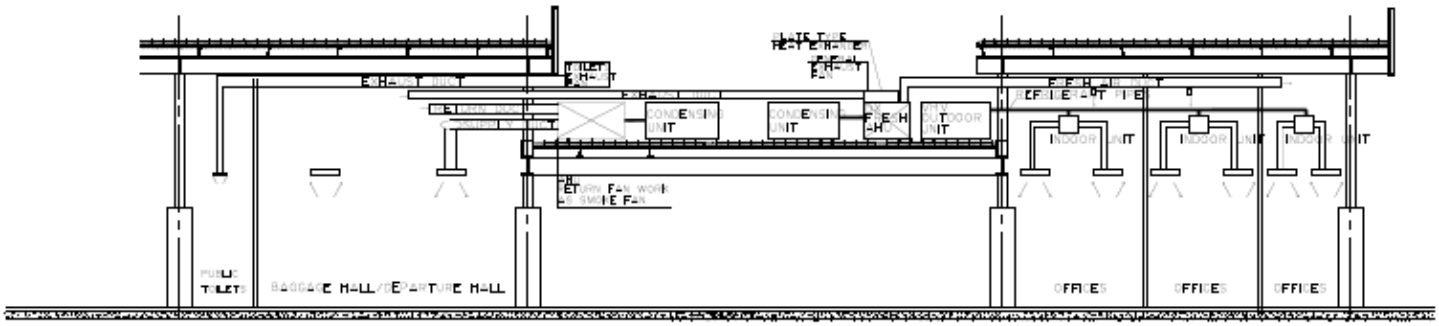


Figure (2-3) Illustrative Cross Section of VRV system

Benefits of VRV system

- Individual control
  - Conventional systems air-condition a building as a whole, whereas the VRV system air conditions each room individually. Hence it is ideal for the constantly changing occupancy of a typical building. Even further, precise level control is possible that reacts to the exact conditions in each room. Individual control promotes a far more economical and efficient system.
- Saves energy
  - Using the Home Recovery Ventilation (HRV) for ventilation dramatically boosts energy efficiency.
- Conserves space
  - Space efficiency is enhanced by the compact size of the individual units, the long maximum piping length, and the ability to realize a large-scale air conditioning system with a single piping circuit.
- Offers a wide selection of models
  - Lineup of heat pump types are 5 to 54 HP, and both in 2 HP increments. Indoor units consist of 14 types with a total of 79 models. This wide selection of models makes it possible to build a system that perfectly suits the customer's requirements.
- Operates over a broad temperature range
  - The lower end of the operating temperature range in heating has been extended from –15°C to – 20°C.
- Provides superior design flexibility
  - The extended maximum piping length gives more flexibility when designing the system.
  - Layout changes can be made easily because the capacity of the indoor units can be up to 200% that of the outdoor units.

  - New compressor technology eliminates the need for piping calculations, which shortens the time needed for design.
  - Outdoor units can be placed on the roof where they have no effect on the design of the building interior.
- Enhances ease of use
  - Units are designed to operate quietly, and are also equipped with a function for silent operation especially at night.
  - The controller is easy to operate and has many useful functions. Units can be controlled in each individual room.
- Delivers ultimate reliability
  - The self-diagnostic system identifies problems within the system quickly and accurately.
  - The Auto Restart function ensures that operation is restored with the previous settings even if the power has been shut off.
  - Units are controlled in each individual room, so local malfunctions does not cause the entire system to shut down.
- Simplifies installation
  - The lightweight, compact units can be transported using a regular lift.
  - Units can be installed on each floor.
  - The pipes are few in number, making layout simpler.
  - Inspection after installation is straightforward.

2.1.6 Storm Water System

System Description:

Roof drains are provided for all concrete roofed areas.
Steel structure roofs are provided with gutters and rain water outlets connected with cast iron stacks through adaptors.
The roof drains are piped to separate rainwater stacks (leaders) connected with rain Water stacks, arranged and routed concealed on the inner side of external walls of the building. These are then dropped down to underground and tied-in with the external storm drainage network. Stack outlets on the external walls will be carefully positioned to avoid possible nuisance. Rain water pipes and fittings are HDPE.

Storm network

Surface Run-off Flow Rate
The storm water network is designed to collect the surface water from building roofs, roads and parking areas. There is no available information about the actual area used to estimate the peak run off rate.
Point of Discharge
Surface water is collected from varies project areas and is then discharged as follows:-

- Soaking area located at the east of the terminal buildings, for collected surface water using the ground gradient of the area adjacent to the taxiways

- Terrain located at the south east of the terminal building, for collected surface water from the terminal building's roof and parking area Soaking area located at the south area of the terminal build, for surface water collected from the air side. It worth mentioning that the air side water is first collected in a lined

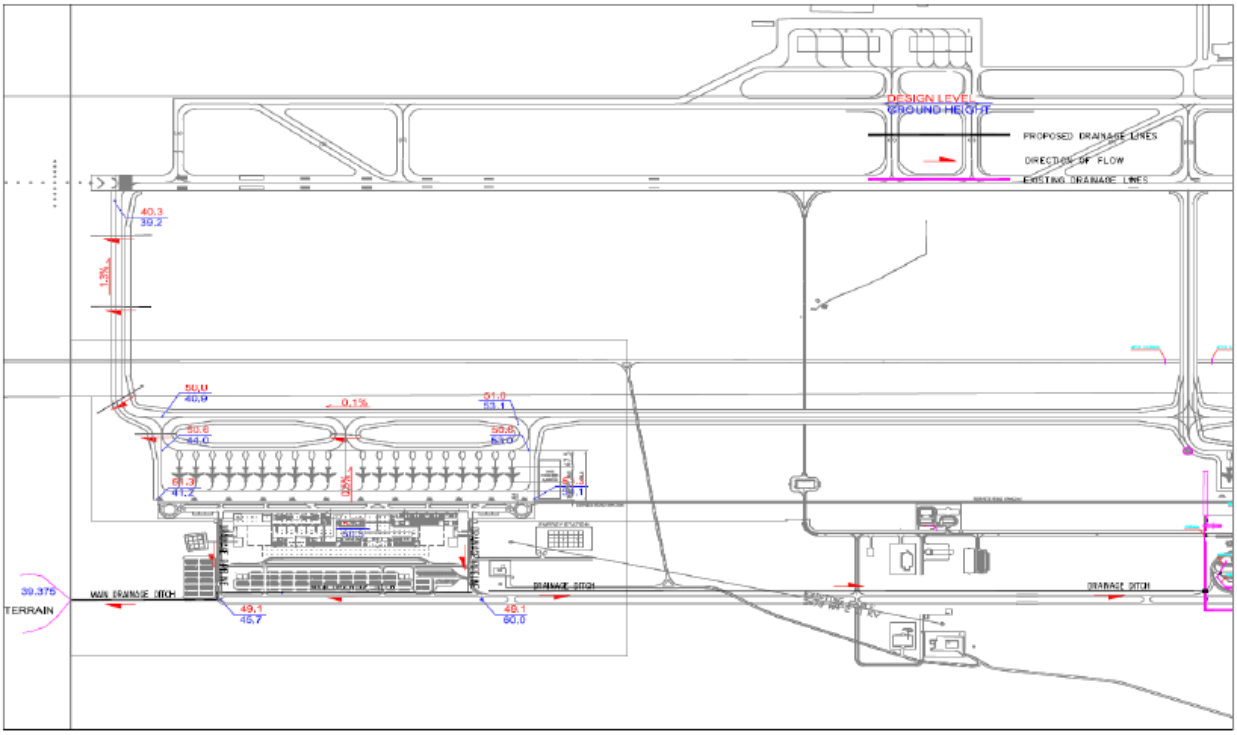


Figure (2-4) Proposed storm water system

Benefits of a Storm water system:

- Dedicated Funding Source
  - Revenue generated by a storm water utility can be used as a new, dedicated source of funds to supplement or replace the community's current storm water management funding, enabling tax-based funding to be used for other community needs.
- Sustainable Revenue
  - Revenue generated by a storm water utility is based on user fees and provides a constant, sustainable funding source that increases with the community's growth. Sustainable funding allows municipal storm water programs to operate on a stable basis to support staff, maintain existing infrastructure, and adopt long-term planning for capital investments, maintenance enhancement, and staff development.
- Shared Cost
  - A storm water utility more equitably shares the costs of storm water management among the users of the storm water system than a property tax-

based system, and increases the number of properties contributing funding of the storm water management system by including tax-exempt properties.

- Improved Watershed Stewardship
    - Through incentive programs that reduce user fees, a storm water utility encourages better storm water management, such as the use of low impact development practices (LID).

2.1.7 Water Treatment Plant Building

Domestic Cold and Hot Water supply Systems

The building shall be fed with domestic water from one water feeding pipe connected to the external domestic water supply network through a suitable tie-in-point.
An electric water heater will be provided in the toilet to supply hot water for required hot water outlets.
The electric water heater will be equipped with positive means safety devices to protect the system against the hazards of excessive pressure and temperature.
The hot water heater outlet temperature shall be limited to 50ºC Wedge-gate type control valves will be used so that they could be repacked while open and under pressure. Pressure reducing valve stations will be provided. Water pipes shall be polypropylene.

Benefits of water treatment

- Clean Water
    - Water is a renewable resource because it gets purified through evaporation and rain; however, only about 3 percent of the earth's water is potable. Although nature slowly cleans wastewater over time, the main benefit of wastewater treatment is maintaining clean water for reuse.
- New Research and Improvements
    - Wastewater treatment processes are changing as researchers develop new techniques. Such research leads to improvements in purification, the speed of water treatment and uses for the waste products removed. Development of new processes also saves more energy, time and resources, which are then available for other needs.
- Disease
    - Wastewater treatment processes can contain and remove potential disease-causing contaminants through a filtering system that blocks their path and further treatment that kills harmful organisms. This keeps potential diseases and bacteria from entering other water sources, or the ground, and harming people as well as plants and animals. Treatment systems continue to develop better methods of purifying the water.
- Economics
    - Jobs are created by wastewater treatment research and processing. Treatment facilities, for example, require regular maintenance and human operation. In

addition, returning clean water to rivers and streams helps maintain natural areas, encouraging tourism.

Finally it is clear that the new terminal building have a lot of green technology elements, this will make Borg Al Arab international airport a pioneer in this field in Egypt.

Chapter 3 – INSTITUTIONAL, LEGAL AND REGULATORY CONSIDERATIONS

3 INSTITUTIONAL, LEGAL AND REGULATORY CONSIDERATIONS

3.1 INSTITUTIONAL FRAMEWORK

3.1.1 The Egyptian Airports Company

The EAC as the project owner has been constituted by the Presidential Decree No. 72 for the year 2001 concerning the establishment of Companies in the aviation area, this Decree formed a Holding company called "the Egyptian Holding Company for Airports and Air Navigation (EHCAAN)", affiliated by two (2) companies one named the EAC and the other named as the National Company for Air Navigation. Article 12 of the Decree stipulated that EAC is concerned with:

- Establishing, equipping, operating, maintaining, and utilizing Airports and landing areas;
- Conducting agreements for operating, maintaining, and utilizing Airports and landing areas;
- Establishing commercial companies connected to all kinds of air transportation;
- Conducting and implementing special agreements for occupying different locations at Airports taking into consideration passengers and airplanes safety;
- All concerns were implemented by Egyptian General Authority for Civil Aviation under the jurisdiction of Law No.119/1983 concerning civil aviation tariffs and Law 3/1997 for granting public utilities concession for establishing, managing, and exploiting Airports and landing areas.

The Minister of Transportation issued the Ministerial Decree No.1050 for the year 2001 to formulate the Company constituent act. According to both Presidential and Ministerial Decrees, the Company replaced the Egyptian General Authority for Civil Aviation in full capacity in Airports sector for all rights and obligations.

3.2 Concerned Governmental Agencies

3.2.1 Egyptian Environmental Affairs Agency (EEAA)

This Agency was established by Article No. 2 of the Law No.4 for the year 1994 for Environmental Affairs to replace the Agency, which was established by virtue of Presidential Decree No. 631 of the year 1982 in all rights and obligations. EEAA was affiliated to competent the Minister of State for Environmental Affairs and has a public juridical personality; Article 5 of the above-mentioned Law determine the function and authorities given to the Agency to carry out its mission in the area of preserving and developing the whole country Environment. EEAA by the Law No. 4 and its modification of 9/2009 is considered to be the National Authority in charge of the Environment Protection and Development in Egypt. In order for the EEAA to realize its purposes, the EEAA was delegated the power to:

- Set the criteria and conditions, which the owners of projects and installations shall comply with before establishing their projects, and during operation;

- Conduct a field follow-up of implementing the criteria and conditions as shall be implemented by the agencies and installations, and take procedures as prescribed in the Environment Law against the violators of this criteria and conditions;
- Set the rates and percentages as necessary to guarantee that the limits permitted for pollutants are not exceeded, and to ensure complying with these rates and percentages;
- Set the bases and procedures of evaluating the environmental impacts of projects;
- Coordinate with other authorities concerning the reorganization and securing the safety of circulating hazardous materials;
- Manage and supervise the natural protectorates;
- Follow-up the implementation of international and regional conventions related to Environment;
- Coordinate with the Ministry of International Cooperation to ensure that the projects financed by the fund granting organizations and countries comply with Environment safety considerations;
- Participate in preparing the plan of ensuring the secured protection of the country against the leakage of dangerous materials and wastes representing pollution to the Environment Egypt;
- Participate in preparing the integral national plan of managing the coastal areas on the Mediterranean Sea and the Red Sea in coordination with the concerned Authorities and Ministries.

This broad span of power given by Law to EEAA (taking into consideration that we select the related functions to the current study only) reflects the huge influence of EEAA before any project licensed or during its construction phase or while it is under operation.
In addition to that the Executive Regulations issued by the Prime Minister Decree No. 338 for the year 1995 stated that: ("the Concerned Administrative Agency or the License Authority are entitled to assess the environmental impact to any installation applying for license according to the elements, standards designs, specifications, and bases issued by EEAA in agreement with the Concerned Administrative Agency, EEAA is entitled to make revision when it is needed"). Appendix No. 2 of the mentioned Executive Regulations considers airports as one of the establishments, which its environment impact should be, assessed (Item No.6). The Executive Regulations also arranged the management of any dispute that could be raised in case that the owner of any establishment protests against the results of the Environmental Impact Assessment by establishing a Permanent Revision Committee formed by the Minister of State for Environmental Affairs.

3.3 LEGAL FRAMEWORK

3.3.1 Environmental Policies and Regulations

Applicable JBIC Legislation

JBIC Guidelines encourage project proponents to implement appropriate environmental and social considerations in accordance with the Guidelines, by making clear its procedures (both before and after funding decisions are made), criteria for decision-making and requirements,

which projects subject to funding are to be met. In so doing, JBIC endeavors to ensure transparency, predictability and accountability in its confirmation of environmental and social considerations.
JBIC welcomes information provided by concerned organizations and stakeholders, so that it may consider a diverse range of opinions and information in its environmental reviews and supervision of projects. In order to encourage concerned organizations and stakeholders to provide information to JBIC at an early stage and to ensure its accountability and transparency in the environmental review process.
JBIC classifies each project in terms of its potential environmental impact, taking into account such factors as: the sector and scale of the project, the substance, degree and uncertainty of its potential environmental impact and the environmental and social context of the proposed project site and surrounding areas.
JBIC classifies the project into one of four (4) categories "A", "B", "C", and "F1"

Category "A": A proposed project is classified as Category "A" if it is likely to have significant adverse impact on the environment. A project with complicated impact or unprecedented impact, which is difficult to assess, is also classified as Category "A". The impact of Category "A" projects may affect an area broader than the sites or facilities subject to physical construction. Category "A", in principle, includes projects in sensitive sectors (i.e., sectors that are liable to cause adverse environmental impact) such as large-scale projects in sector of airports as indicated in Section 3.1 of Part 2 Point 15 or with sensitive characteristics (i.e., characteristics that are liable to cause adverse environmental impact) and projects located in or near sensitive areas.
Category "B": A proposed project is classified as Category "B" if its potential adverse environmental impact is less adverse than that of Category "A" projects.
For Category "A" projects, JBIC checks the extent of stakeholder participation and information disclosure being undertaken for the project, in accordance with the environmental impact assessment systems of the host country.
Involuntary resettlement and loss of means of livelihood are to be avoided where feasible, exploring all viable alternatives. When, after such examination, it is proved unfeasible, effective measures to minimize impact and to compensate for losses must be agreed upon with the people who will be affected.
For projects that will result in large-scale involuntary resettlement, basic resettlement plans must be submitted.
We do not have any resettlement in this project at all.
JICA 2010 new Legalizations have been reviewed and applied in this report.

Applicable World Bank Policies

The JBIC also endorses the operational policies of the World Bank for EIA, the related policies

1. **Operational Policy 4.01 on Environmental Assessment**

The World Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of Environmental Assessment (EA). The World Bank classifies any proposed project into one of four (4) categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. A Category "A" project is likely to have significant adverse

environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.
The Policy expects that the views of the affected groups and local Nongovernmental Organizations (NGOs) to be taken into consideration. This can be achieved through an already conducted scoping session and a Public Consultation to be conducted prior to the issuing the EIA final report.
Borg El Arab Airport project is considered Category "A" project. The new terminal building will produce impacts from noise that will potentially be significant for a number of people living in the areas beside the Airport. This population may also be affected by induced impacts such as an increase in traffic congestion. It should be noted that there would also be a number of nominal benefits resulting from this project including improved waste management and implementation of noise and air quality monitoring programs.

2. **Operational Policy 4.12 on Involuntary Resettlement**

This Operational Policy examines whether the development project would require any involuntary resettlement. A Land Acquisition Assessment was conducted on Borg El Arab sites. In Borg El Arab, the Airport new terminal land is a State property legally transferred to the EAC. The land is fenced, adjacent to the existing terminal. Presently the land is not used for any economic activity and there are no claims on it whatsoever. Based on this, as far as the construction of this project is concerned, the Operational Policy on Involuntary Resettlement is not triggered. However, if during design stage it was decided to either establish new roads or extend high transmission lines, each of these activities are to be revised according to the mentioned policy in a separate EIA study.
We do not have any resettlement in this project at all

3. **Operational Policy 4.11 on Cultural Property**

This Operational Policy addresses the impact on physical cultural properties having archaeological (prehistoric), paleontological, historical, religious, and unique natural values. The Policy aims at ensuring the preservation of cultural heritage.

The current project has no direct or indirect effect on any physical cultural properties or any heritage buildings. However, during the execution of works if any cultural property of archaeological significance occurs, the contract requires the contractor to immediately inform the employer and stop further work. Employer will in turn inform the Supreme Antiquities Authority and the Minister of Culture for further investigation and action.

Applicable Egyptian Legislation

Egypt has already recognized that economic development and Egyptian population welfare are tied to the sound management of its national resources and rich environment. Accordingly, it was essential to develop national environmental affairs management plans. A National Environmental Action Plan was developed in the year 1991 to provide better management for environmental issues all over the country and to develop an effective environmental legislation and create a national environmental agency capable of implementing the national plans and enforcing the application of the legislation. This National Action Plan was presented in an International Conference in Cairo in 1992 in cooperation with the World Bank. As a result of this Policy the Environmental Affairs Law (Law No. 4 /1994) and (law 9/2009) was developed together with its Executive Regulations.

The Egyptian Environmental Affairs Agency (EEAA) was established to be the competent national authority in the environment management.
The list below summarizes some of the Legislations and the international conventions related to the project which all project parties should comply with its provisions:

- Law 4/1994, 9/2009 and its Executive Regulations set the overall framework for environmental protection in Egypt. According to this Law, an Environmental social Impact Assessment (EISA) should be prepared with the application for the license of a project. The Law divides the types of projects into three (3) lists: White, Gray,
- And Black list projects. The development project at Borg El Arab International Airport is Black listed project, which is comparable to a Category "A" World Bank project and Category a JBIC projects. According to the EEAA Guidelines for Egyptian Environmental Impact Assessment, the EIA of the project in hand is to be submitted to the Competent Administrative Authority, the Ministry of Civil Aviation. The Ministry will send the EIA to EEAA for review and provide its opinion within sixty (60) days. Once EEAA has approved the project, a license to proceed can be issued. No additional environmental or social clearances are required other than the EIA approval to precede with the project activities;
- The Law requires that any new project should comply with all the relevant articles pertinent to environmental attributes, which could be impacted from project activities. This Law in Article 103 states, "All citizens or societies concerned with environmental protection shall have the right to report about any violation of the provisions of this Law". This concept aims to create public advertence about environmental protection issues, and to exhort the public to maximize their participation in the protection of environment activities for their favor and the favor of the coming generations. The Executive Regulations of Environmental Law, the Prime Minister Decree No. 338/1995, stated in Article 65 the method of implementing this participation of citizens and NGOs in the field of environmental protection;
- Law 4/1994 in Article 42 and Article 44 of its Executive Regulations on maximum allowable limits for sound intensity. Article 40 of the Law and Article 42 of its Executive Regulations on maximum allowable limits for the concentration of pollutants resulting from burning of fuels. Article 36 of the Law and Article 37 of its Executive Regulations on maximum allowable limits for pollutants in exhaust gases. Article 35 of the Law and Article 34 of its Executive Regulations on maximum allowable limits for ambient air pollutants;
- Law No.48/1982 concerning the protection of the River Nile and waterways from pollution. Decree No. 8 includes the Executive Regulations issued by the Minister of Irrigation (now the Minister of Water Resources and Irrigation). Apart from the River Nile and associated drains and canals, the regulations apply to underground water reservoirs;
- Law No. 93/1962 concerning Wastewater Drainage and its Executive Regulations as amended by the Minister of Housing and Public Utilities Decree No. 9/1989. This

Law declares the criteria of permitted wastewater (domestic or industrial) to be discharged in public sewers;

- Law No. 38/1967 concerning cleanliness (Solid Waste Management);
- Law No. 12 for Labor Code and its Executive Regulations, especially the fifth book that regulates the Safety and Working Environment.
- Law No. 10/1990 for compulsory acquisition for real estates for public use, the law addresses the compulsory acquisition in case of the construction of roads, streets, water, wastewater, energy, transportation and communication projects and all concerning urban planning and public utilities improvement.

Airports Regulations

The most important legislations in the field of Airports are:

- Presidential Decree No. 72/2001 concerning the establishment of companies in the aviation field;
- Law No. 28/1981 as amended by Law No. 94/2003 concerning Civil Aviation; this Law regulates Airports establishment and its management, airplanes and pilot licenses and safety, air transportation, aviation companies, airplanes accidents, operation manuals, and all related issues;
- Law No. 119/1983 as amended by Law No. 29/1971 and Law No. 93/2003 concerning civil aviation tariffs. This Law sets all tariffs against all kind of services provided in Airports such as navigation services, airplane landing and take-off, parking, licenses, air transportation fees, studying at the National Institute for Civil Aviation Training fees and all other related services or using utilities with in Airports and establishing a special fund for Aviation Services Development;
- Law No. 8/1997 concerning investment guarantees and incentives;
- The operation of Borg El Arab Airport will also comply with the noise abatement procedures contained within the ICAO Airport Development Reference Manual. Annex 16 of this manual contains procedures to enable the reduction of noise during aircraft operations that can be achieved at comparatively low costs. There are several methods, including preferential runways and routes, as well as noise abatement procedures for take-off, approach and landing and will be applied at Borg El Arab Airports to enable the management of aircraft related noise.

The above review will be applied in full in our study

Chapter 4 – Current Situation

4 Current Situation

The current situation is an essential part of the ESIA, it will describe the environment surrounding the proposed project and consider the base line data before the project started, and it will be as a birthday certificate for the project.

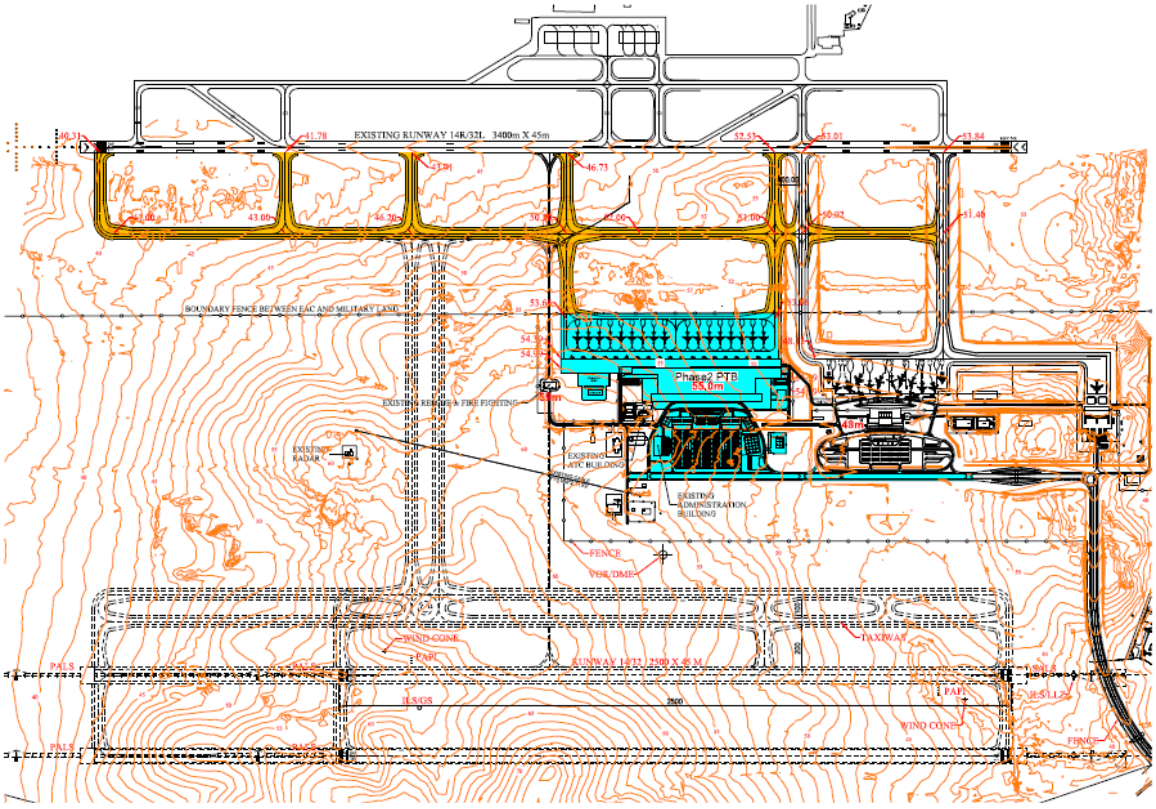


Figure (4-1) layout of the new terminal final arrangement showing the relation between the Two building

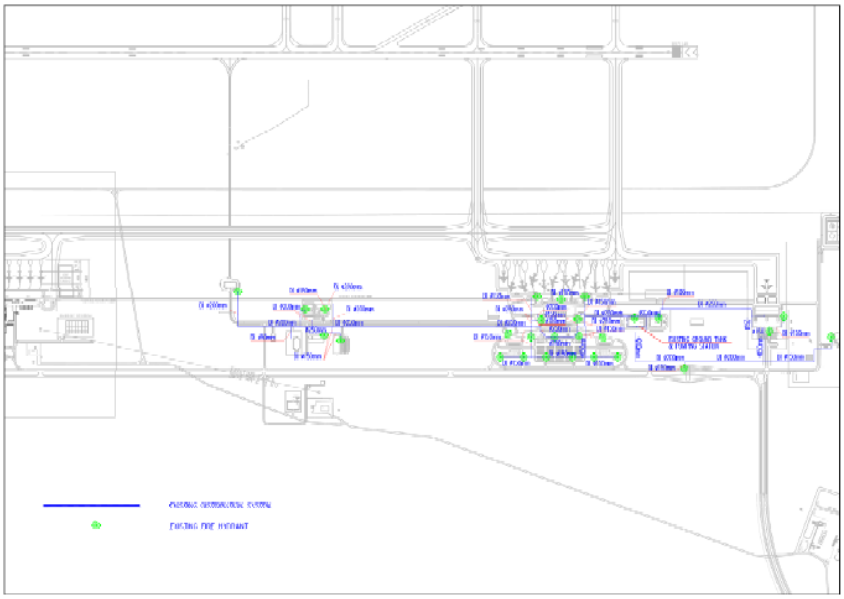


Figure (4-2) Shows Existing Fire Fighting System

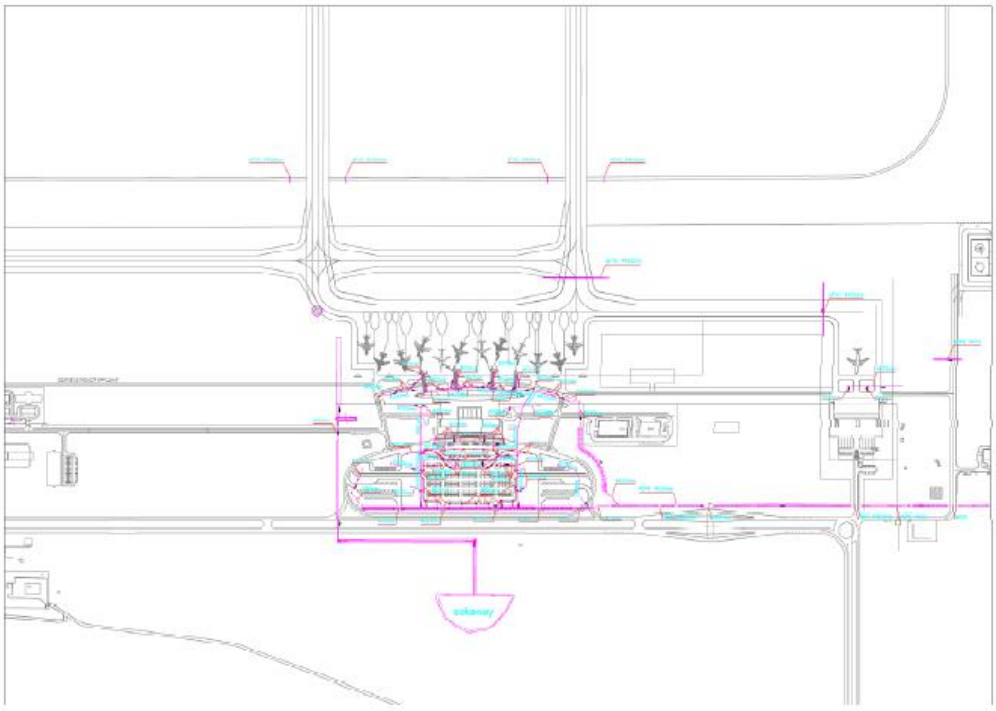


Figure (4-3) Shows Existing Storm Drainage System

4.1 Physical Terrestrial

4.1.1 General Geology of Northern Western Desert

The Northern part of the Western Desert nearest the Airport site forms an almost featureless plain, which offers few prominent topographical or geological features that would reflect its intricate geological history. Most of the surface is covered with gentle-dipping Neogene strata of reasonable litho logical uniformity. There are a few lines of major faults, and the few folds noted are minor rolls with gentle dips and large amplitude.
Deep drilling in this desert, however, has shown that this apparently geologically simple structure made by the thin cover of later sediments, which conceals beneath it an intricate geological structure, made up of a large number of swells and basins. The sedimentary column is thick. It may reach 3 km and the region seems to have been subjected to intensive compression as well as tensional movements, which brought about a far more complex picture than that noted in the Stable Shelf areas of Egypt.

4.1.2 Tectonics and Structure

The north Western Desert forms part of the African plate. At present it is characterized by having a narrow continental shelf (15 to 50 km wide), which is bound by a steep continental slope representing a major fault or hinge line separating the continental crust from the continental margin. In the past, the north Western Desert was intermittently submerged by epi-continental seas. The entire sedimentary section, except in limited areas and for short durations, is of sub aerial or shallow marine origin excluding a continental margin model and putting the north Western Desert well south of the Neo-Tethys structure.

The most important tectonic event occurred during the late Cretaceous and early Tertiary and was probably related to the movement of the North African plate toward Europe. It resulted in the elevation and folding of major portions of the north Western Desert along an east-northeast west-southwest trend and in the development of faults of considerable displacements.
The north Western Desert structure is dominated by faults; the majorities are steep normal faults and most have a long history of growth. Some of the normal faults suffered strike slip movements during part of their history. Strike slip movements seem to have affected the orientation of many of the fold axes. The strike slip movements were probably related to the lateral movements which the African plate underwent during the Jurassic (sinistral) and late Cretaceous (dextral).
Most folds owe their origin to compressional movements, which affected the area during the late Cretaceous-early Tertiary tectonic event. These folds have a northeast-southwest trend and a periclinal geometry.

4.1.3 Borg El Arab Formation

The lower Cretaceous is represented by the Borg El Arab Formation made up of a dominantly thick sequence of fine to coarse-grained clastics. The formation is divided into two (2) units, the Alam El Bueb and Kharita, separated by a widespread carbonate unit, the Alamein, and a less distributed shale unit, the Dahab. The type locality of this formation is the interval 2305 to 4054 m in the Borg El Arab well (30° 55' 20" N, 29° 31' 28" E).
Figure **(4-4)** presents the distribution of the different geological formations at Borg El Arab, which consists of the following:

- Moghra Formation;
- Marmarica Limestone Formation;
- El Hagif Formation;
- Sediment or Valley;
- Pleistocene Broken Stone;
- Pleistocene Deposit;
- Sand Sediment;
- Loam.
- Limestone Formation;

4.1.4 Morphological Regions in the Western Desert

The Western Desert can be divided into six (6) morphological regions as shown in Figure **(4-4).** Each region has certain distinctive character.

- Olitic Limestone;
- Loose Sediment West of Delta;
- Marmarica Plateau;
- Eocene Limestone Plateau;
- Sandstone Plateau;

- The Inselbergs in the Southern Western Desert.

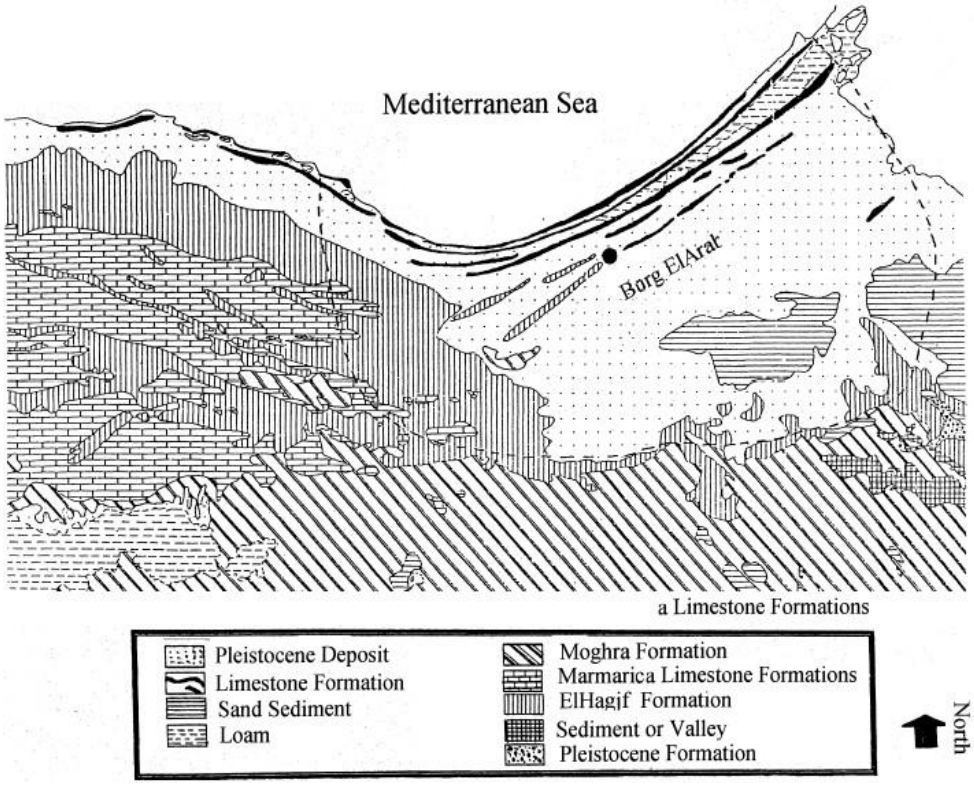


Figure (4-4): Distribution of the Different Geological Formations

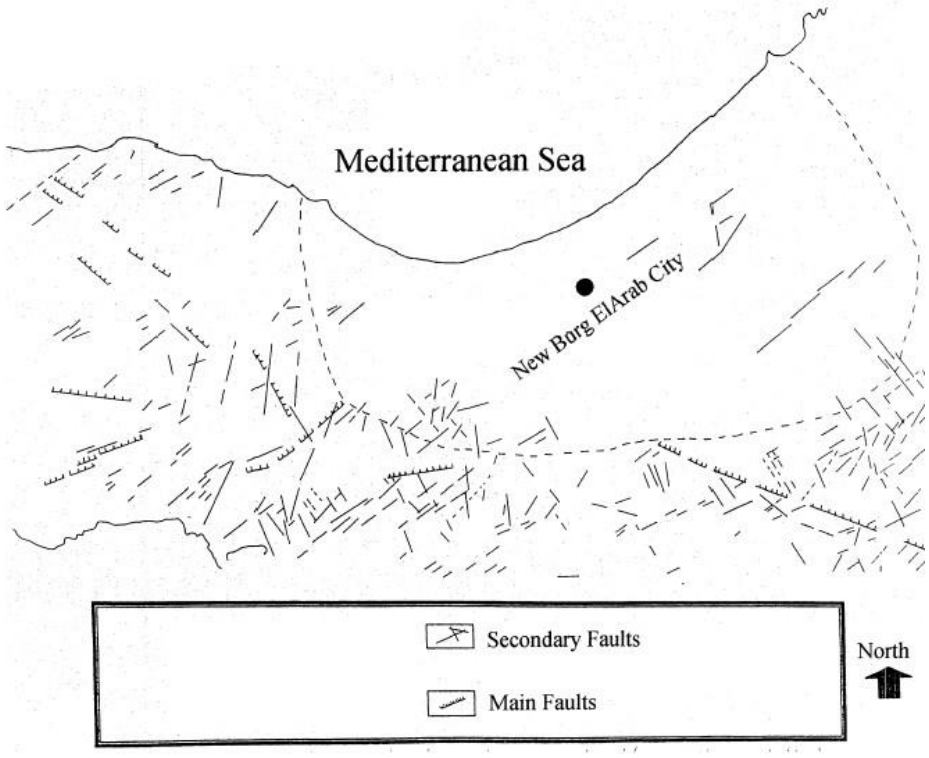


Figure (4-5): Distribution of the different types of faults at Borg El Arab

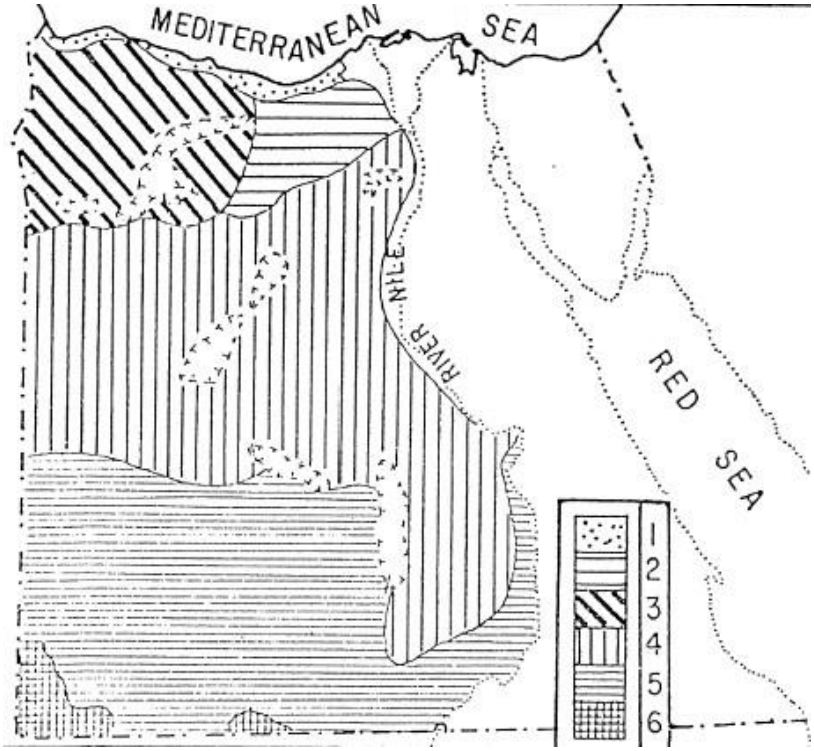


Figure (4-6): The Morphological Divisions of the Western Desert

4.1.5 Geotechnical Properties

A geotechnical investigation was conducted on February 2004, for the design and the construction of three (3) High Poles at Borg El Arab Airport; the investigation program consisted of carrying out two (2) mechanical boreholes of 15 m deep and collecting field samples for laboratory testing. The following tests were carried out on the collected samples to determine the soil engineering properties:

- Grain size distribution
- Direct shear box
- Oedometer test to find out the collapse potential
- Atterberg limits
- Free swelling

The aforementioned soil consists of the following three (3) layers started from ground surface.

- Light brown calcareous sandy clayey silt with an average thickness 2.00 m;
- Light brown sandy silty clay, some pebbles of cemented calcareous sand with an average thickness 6.00 m;
- Reddish brown silty clayey fine sand with some pebbles of cemented calcareous sand with an average thickness 7.00 m.

The report recommends that a suitable foundation depth was 3.00m from natural ground surface including 1.50 m soil replacement.

- All foundations should be rested on 1.5 m deep soil replacement; - Replacement with compacted backfill should be performed 0.5 m more all around the structure;
- Maximum allowable net Borg El Arab ring capacity should not exceed 1 kg/cm^2 above the top level of soil replacement and below the plain concrete;
- All foundation should be isolated using at least two (2) layers of hot bitumen, or equivalent;
- Ordinary Portland Cement is to be used with cement content not less than 350 kg/m^3 for all foundation items;
- Minimum steel cover is 5.00 cm;

In case of secondary loads, the allowable Borg El Arab ring capacity could be increased by 15% in case of wind loading, and 33% in case of seismic.

This indicate a minimum transmitting of vibration

4.1.6 Groundwater

Project area lies between two (2) zones, where the water level ranges from 15 m to 40 m below M.S.L. Based on the available borehole; no ground water was encountered for 15.00 m in depth. See Figure 4.7

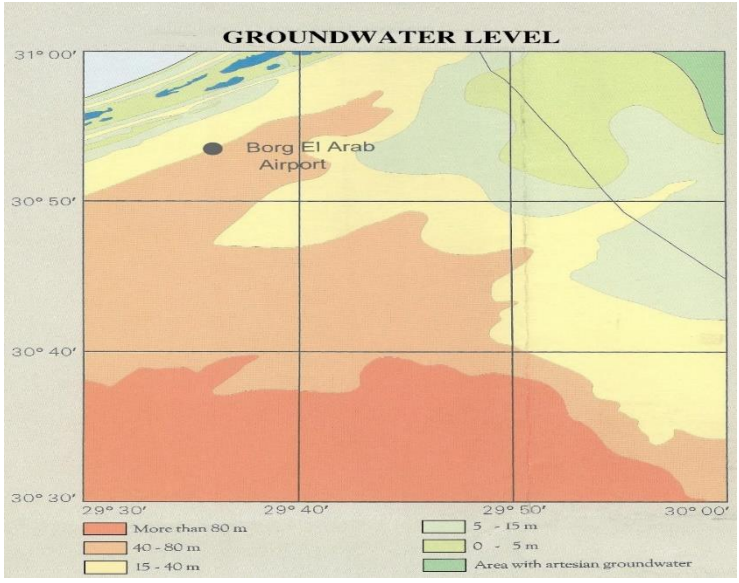


Figure (4-7) shows the map of the underground water in the region.

Generally, the groundwater table at the location of the Airport is deep.

4.2 Meteorological Features

The weather in Borg El Arab is generally considered to be Semi-arid as it is in the domain of Mediterranean Sea Meteorological Region. A study for main items of weather is presented hereafter.

4.2.1 Air Temperature

The weather in Borg El-Arab is generally considered to be Semi-arid as it is in the domain of Mediterranean Sea Meteorological region.

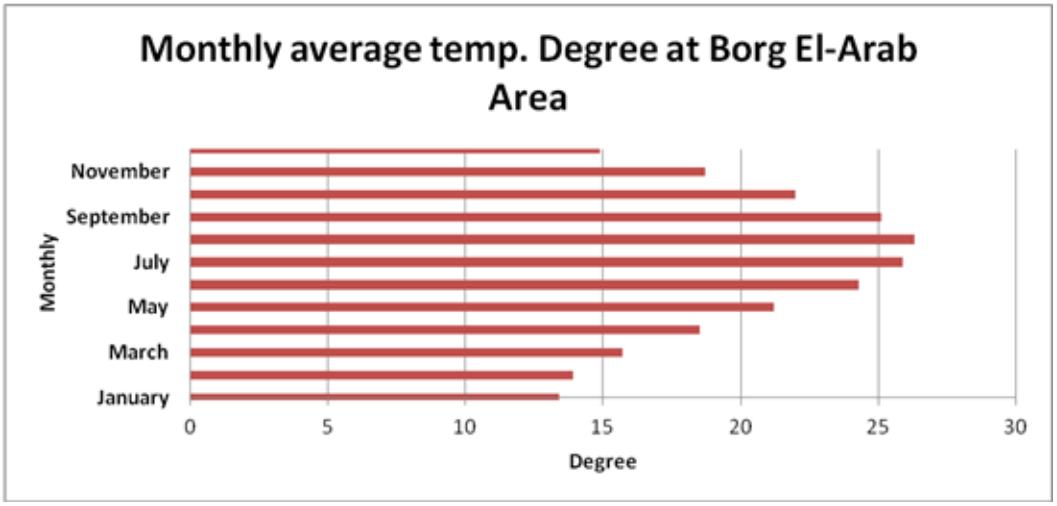


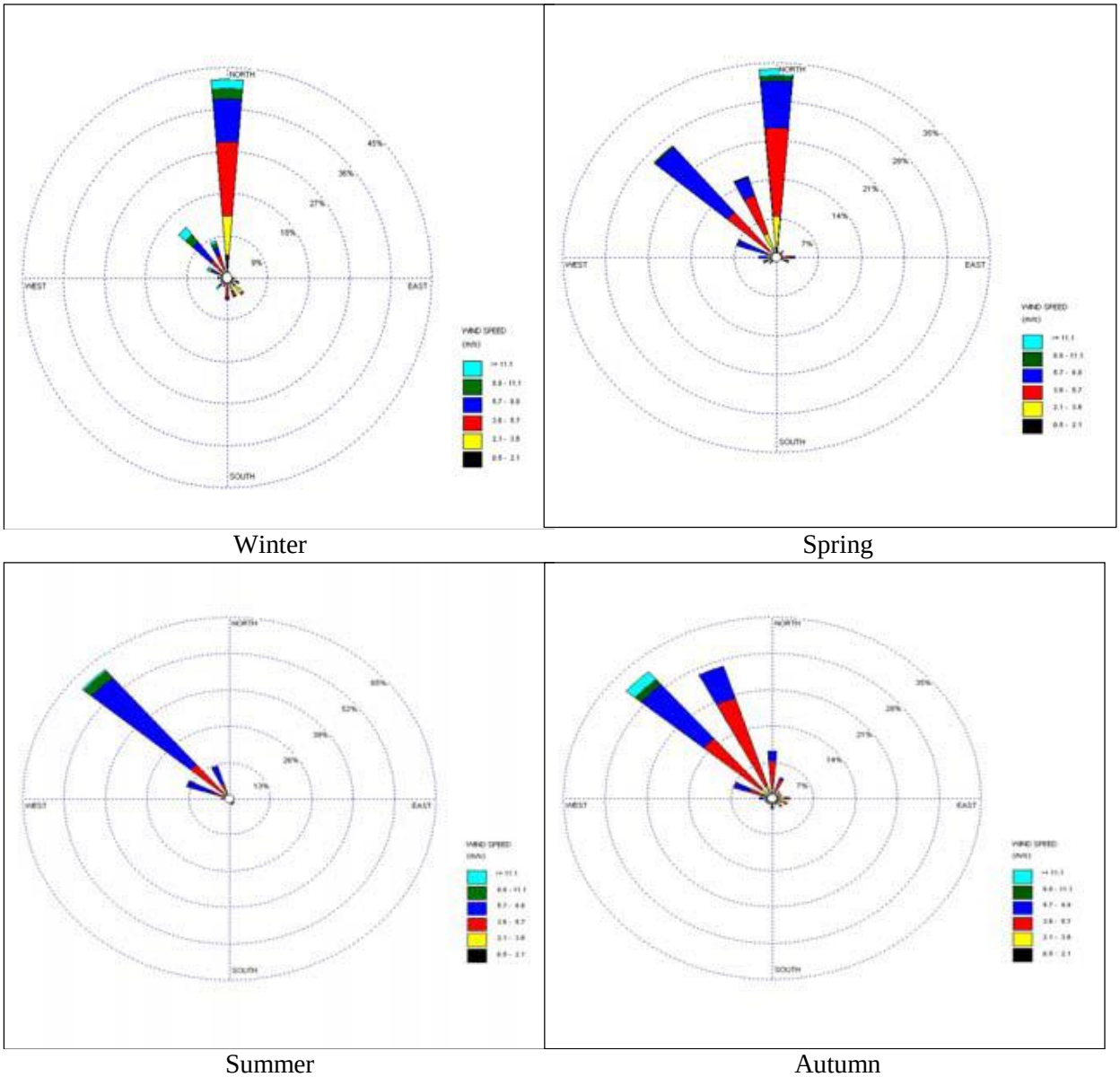
Figure (4-8) the monthly average temperature In Borg El-Arab Area

4.2.2 Humidity

Relative humidity peaks in November and decreases as the summer months approach. The 12 pm relative humidity readings are lower than the 06 am readings throughout the year. The 9 am relative humidity has an average annual range of approximately 68%with a minimum of 59% in May and a maximum of 80% in November. Similarly, a minimum 12pm relative humidity of 30% is achieved in May and a maximum relative humidity of 48% occurs in December.

4.2.3 Wind

The wind roses diagrams in Borg El-Arab area are shown in the following figures. Wind roses of the four seasons (autumn, spring, summer and winter, respectively) reveal different speeds for the different directions. The strongest windblown is in summer as average, when the wind comes from the most directions with high speed. The strong wind is in summer from the north to north west. While the weakest wind in the year is in spring and autumn. This creates a nice weather in summer because it decreases the moisture content of the air and reduces the risk of condensation, thus, the air temperature is decreased. The wind of this season comes from Northwest only. In spring, the Khamasin wind blows carrying sand and dust, its rate is 13% of the spring wind. The calm weather is 5.5% of the year.



Winter Spring

Summer Autumn

Figure (4-9) Wind roses diagrams in Borg El-Arab area in the four seasons

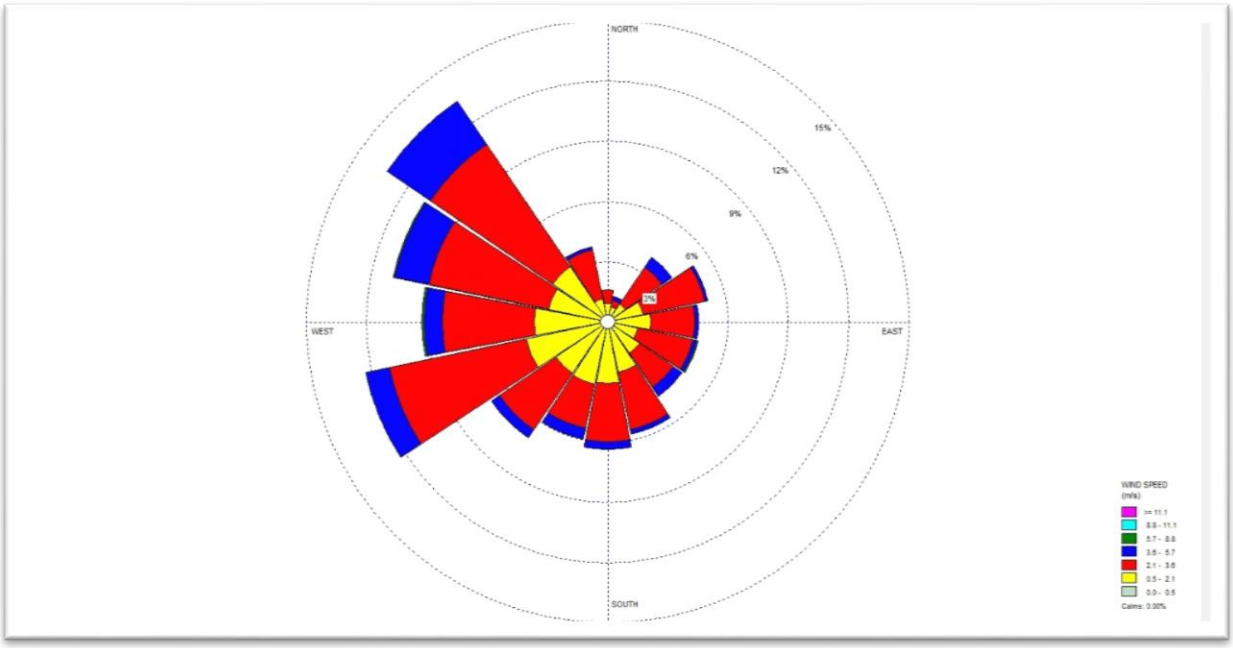


Figure (4-10) Wind rose in Alex from August 2014-October 2014

4.2.4 Rainfall

Borg El Arab Airport is located in semi-arid area with moderate precipitation rate. The annually total rainfall is about 185 mm/year. January is considered to be the most precipitation month, whereas the monthly total rainfall is 59.2 mm, while there is no precipitation during summer.

4.2.5 Evaporation

Annual mean evaporation rate in Borg El Arab is 6.9 mm/month. Maximum evaporation occurs in summer especially during September

(8.1mm/month), and minimum evaporation in winter during January (5.5mm/month). It is noticed the inverse relationship between relative humidity and evaporation, i.e. months of high relative humidity, is characterized by lower evaporation.

4.3 SOCIAL

This section presents the results of the field research carried out in the study area. The main objective of the fieldwork was to investigate the impact of the construction of the new project as perceived through the eyes of the target population.

4.3.1 Current situation in Alexandria

The following table shows the percentage rates of poverty in Alexandria city related to the total percentage of poverty in Egypt.

Table (4-1) Percentage rates of poverty in Egypt

Governorate	Percentage rates of poverty (%)
Red Sea	0.20%
Suz	0.50%
Damita	10%
Gharbia	11%
Alexandria	12%
Daquahlya	14%
Sharqya	14%
Ismaielya	15%
Monofia	15%
Quahira	18%
KafrElshiekh	18%
Port Saied	19%
Behera	20%
Matrouh	23%
Elwadi	25%
Minya	30%
Giza	32%
Fauyom	36%
Aswan	39%
Banisuief	39%
Sinai	46%
Luxor	46%
Sohag	55%
Qena	58%
Asyut	60%
Qualubia	21%

The previous table shows that Alexandria is the fifth less poor city in Egypt with 12% rate of poverty and the reason for this percentage is that; Alexandria is the second capital for Egypt and it is a coastal city that has fishing activities in addition to the usual work activities in the non-coastal cities.

The main reason of poverty is the level and quality of education.

Table (4-2) the poverty rate according to the state education

The poverty rate according to the state education	
State Education	**Poverty Rate (%)**
Higher University education	0.40%
Parchment	0.90%
Certificate Over average	13%
Secondary certificate technician	21%
General Certificate of Secondary	16%
Certificate of elementary and junior high	29%
Literacy Certificate	29%
Reads and writes	30%
Illiteracy	37%

The following table shows the numbers of the labor force in Alexandria city during the year of 2013.

Table (4-3) Labor force in year 2013 for workers of 15 years and above

Labor Force (15 years & above) 2013		
Items	**Gender**	**Quantity**
Labor Force	Male	21083
	Female	6251
	Total	27334
Employed Population	Male	18984
	Female	4686
	Total	23670
Unemployed Population	Male	2099
	Female	1565
	Total	3664
Unemployment Rate (%)	Male	10%
	Female	25%
	Total	13.40%

The previous data shows the big difference between the labor forces in Alexandria city as it depends on sex, direct and indirect job opportunities, working in the public associations, or working in private sector.

Figure (4-11) a map showing the population topographic distribution in Alexandria.

Presence of an international airport for passengers and goods in any society has direct and positive economic and social effects such as:

- Upgrading the efficiency of the basic infrastructure in the airport area and the nearby areas.
- Provision of direct job opportunities.
- Provision of a greater number of indirect job opportunities.
- Improve the traffic and transportation, and increase the trade flow on the roads.
- Increase security considerations.
- No resettlement at all for Borg Al Arab airport.

The following table shows the different corporations and the number of workers operating at the airport now.

Table (4-4) the number of workers and companies operating at the airport

The number of workers and companies operating at the airport	
Company	**Number of Employers**
EAC	300
EAS	46
Egptir G.S	65
African Airline	8
Jazeera Airline	12

Arabia Airline	9
Qatar Airline	7
TOP Aviation Service	44
Spider	8
Egypt-Air Cargo	112
Egyptian CO. Airports S.	16
Customs	32
Total	659

The previous table is a clear indication that a new terminal building will increase the number of workers and provide direct and indirect job opportunities.

According to international studies in the field of civil aviation, one (1) direct job opportunity in the civil aviation field provide seven (7) indirect job opportunities in return. In addition to that, Presence of the airport in Alexandria city will raise the flow rates of tourism in the city.

Table (4-5) the proportion of tourists in Alexandria by access method 2014

The proportion of tourists in Alexandria by access method 2014		
Items	**Quantity**	**Rate**
Land	45136	7%
Air	562554	87%
Sea	34507	5.40%
Total	642197	99%

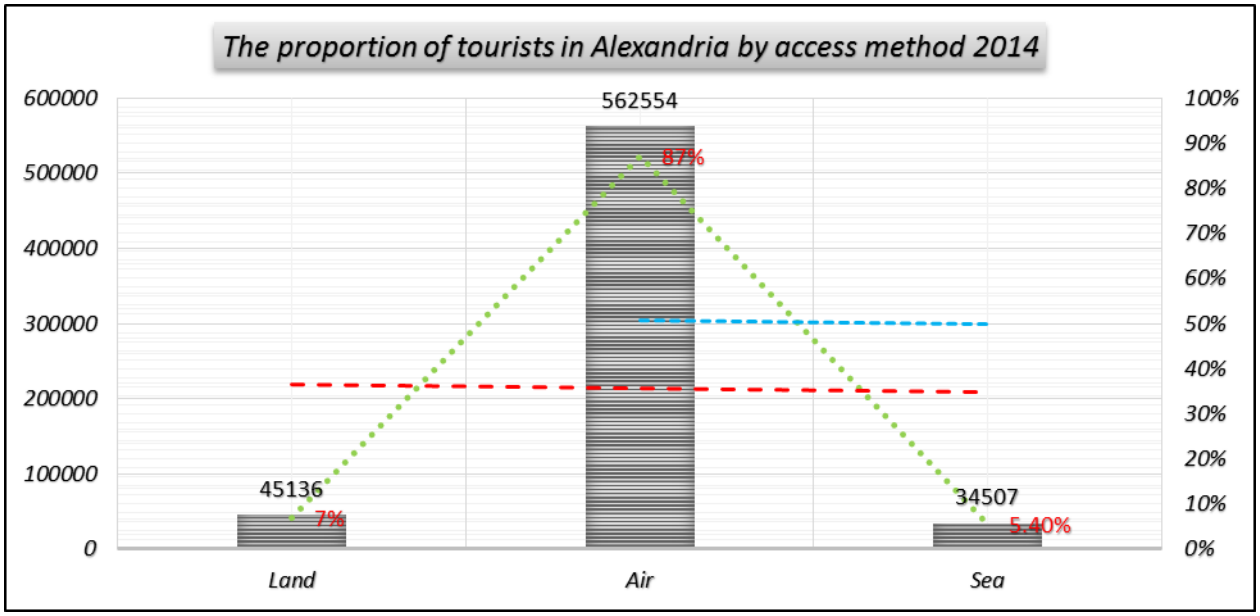


Figure (4-12) the proportion of tourists in Alexandria by access method 2014

On the previous table and graph know that the human flow of Alexandria until the beginning of 2014 through the air (Borg El Arab Airport) was the most at the level of each flow routes (land and sea), and therefore, it maximizes the importance of the airport and its role in

tourism and economic development in Alexandria Governorate and that continuous and steady growth and development and worth the improvement.

On the other side of the commercial importance of the flow of trucks and ships through the strategic seaport of Alexandria (which is a famous port worldwide) and growing steadily in line with the country's economic growth.
In the table below illustrate the percentage of growth in the movement of ships in the port of Alexandria in 2013:

Table (4-6) Development of Ships Movement 2013

Development of Ships Movement 2013	
Month	**Numbers**
JAN	13446
FEB	14610
MAR	16174
APR	17334
MAY	18476
JUL	19419
JUN	21000
OUG	19354
SEPT	17604
OCT	18050
NOV	17004
DEC	18056
Total	210527

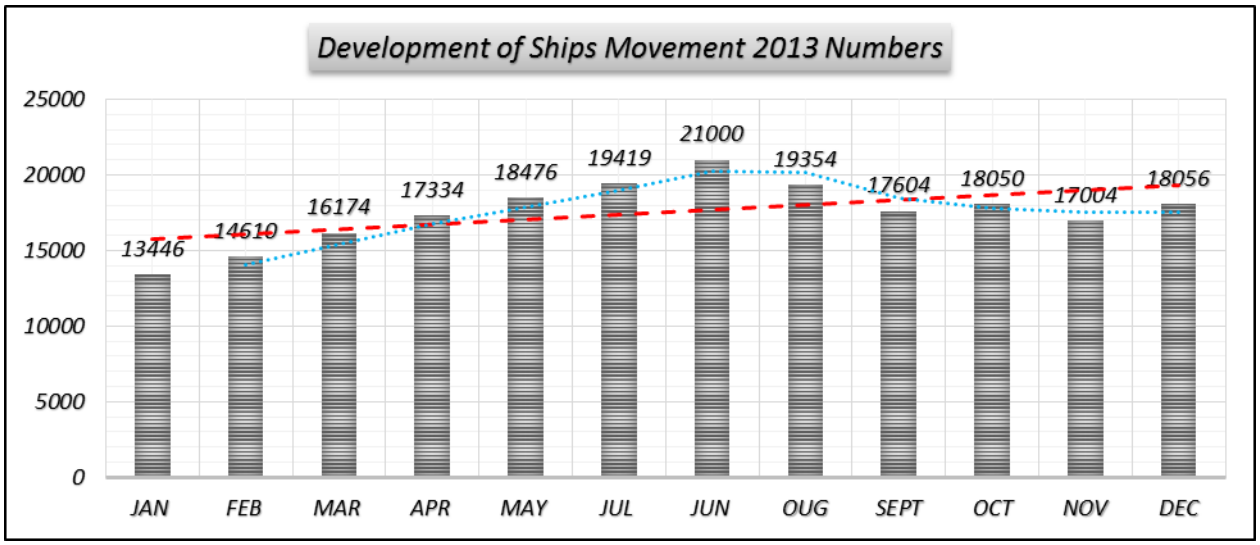


Figure (4-13) Development of Ships Movement 2013

Thus if we compare the total vessels that used the port of Alexandria during the year 2013 (210 527), ship, and we compare that planes used Borg El Arab Airport in the same year we find the size (25 986) plane, this is clear from the following comparison table:

Table (4-7) Aircrafts & Ships Movements 2013

Aircrafts & Ships Movements 2013	
Source	**Numbers**
Aircrafts	25986
Ships	78527

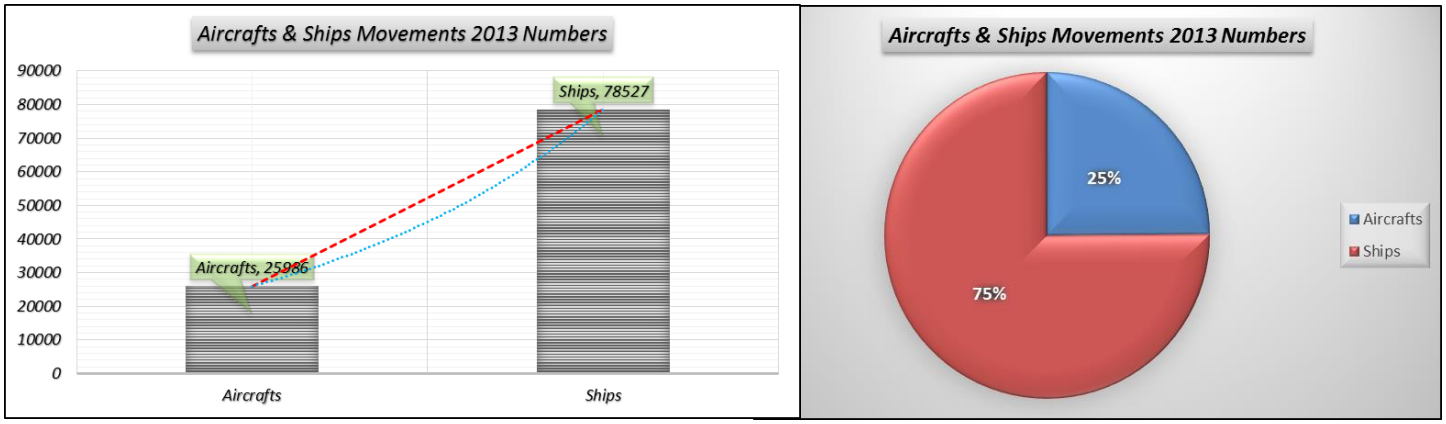


Figure (4-14) Aircrafts & Ships Movements 2013

It is therefore no longer a secret through this clarification that the logistics importance for Borg Al Arab International Airport for Alexandria, and being an important and influential in steady at this level of development.

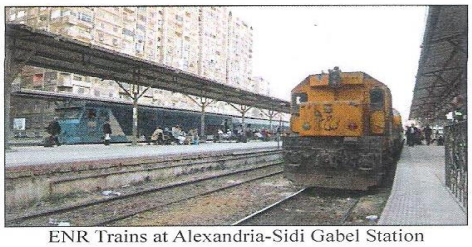
4.4 Transportation

4.4.1 Railways

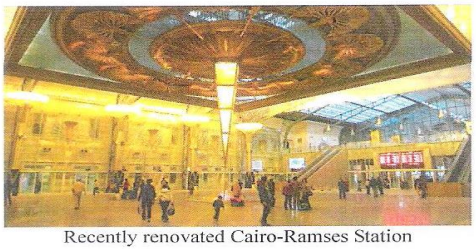
Egypt has the oldest history of railway developments in Africa and Middle –East regions since 1854. The first railways development stated from Alexandria and reached Cairo in 1856.After the first development of railways in Egypt ,its network expanded quickly, and more than 3.000 km of the network was established by year 1940.Further expansion of the rail network has been made mainly in the Nile Delta area from Cairo. Almost all railway networks in Egypt are being operated by Egyptian National Railways (ENR), a governmental transportation management organization. At present, ENR is in services with 5.138 km, and its network includes major traffic line from Aswan in south (upper-Egypt) to Alexandria in north (lower-Egypt).Since railway network developed, railways have been taking a role of major transportation in Egypt until now .According to the latest statistics by ENR, they carried 291milion passengers in 2008/09 and 7.9 million tons of freight in 2006/07 ,Accounting for about 40% of total domestic passenger movements and about 10% of total domestic cargo movements.

Table (4-8) Related statistics on National Railway Network

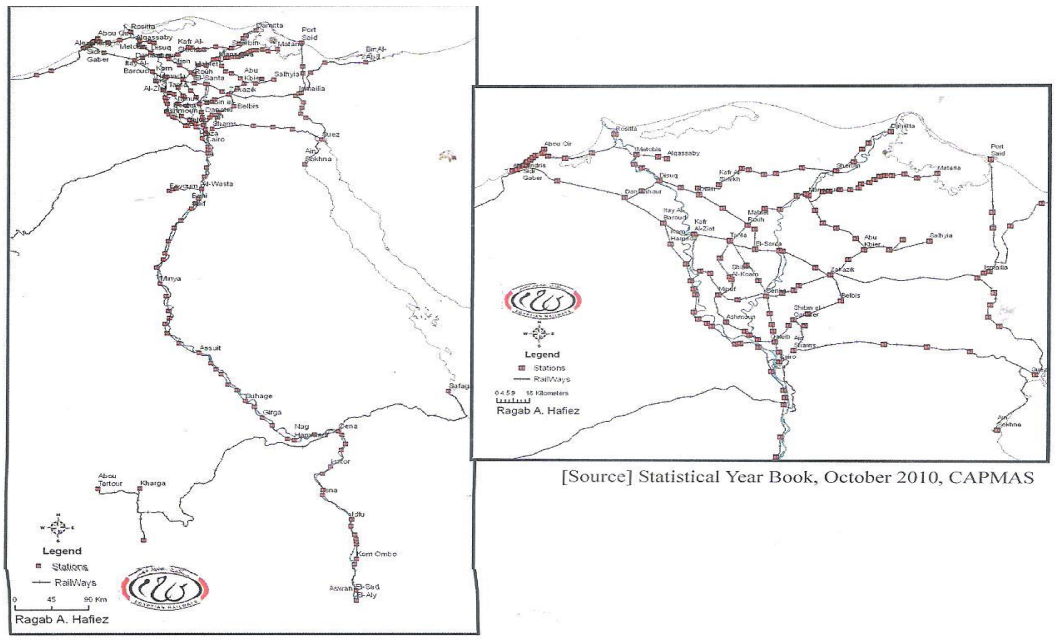
	2001/02	2003/04	2005/06	2007/08	2008/09
Daily Available Seats	744.500	678.127	614.650	544.257 (2006/07)	
Line Network (Km)	5.063	8.038	5.128	5.138	5.138
Annual Passengers (million)	450.7	418.1	435.6	374.5	291.6
Passengers/Km (million)	39.083	52.682	54.884	50.181	
Annual Cargo (million)	11.9	12.3	10.5	7.9 (2006/07)	



ENR Trains at Alexandria-Sidi Gabel Station



Recently renovated Cairo-Ramses Station



[Source] Statistical Year Book, October 2010, CAPMAS

Figure (4-15) Route Maps of Egyptian National Railways

The nationwide railway network is playing an important role of domestic transportation since the fares are set in an affordable level for local citizens, however modernization of the facilities has not well progressed. This situation and slow developments are caused by serious accident and various related problems on scheduled operations, train facilities passenger services and comfort

Aside from the ENR network ,several Streets-Cars (Trams) are in service in Cairo metropolitan area and Alexandria city ,and 3 lines of subways (Cairo Metro) are

also available in Cairo city. The Cairo metro is the only subway developed in African region operated by Cairo Metro Organization under ENR, there is a plane to go for the fourth line.

4.5 Tourism

Egypt is one of the most popular tourism destinations in the world. Since long years ago, Egypt has been developed as the tourism attractive place and received huge number of tourists from all over the world. The number of international tourist arrivals was 4.4 million in 2001 and increased to 11.9 million in 2009, with an average annual growth rate of some 13% through various sectors on tourism industry, total receipts on tourism has taken important position of national industrial revenues, and recorded 11.8 billion USD, as shown in table 4.9

Table (4-9) Chronological changes in international tourist distribution by regions

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Tourism arrivals (thousands)	4.357	4.906	5.746	7.795	8.244	8.646	10.610	12.296	11.914
Year on year		112.6%	117.1%	135.7%	105.8%	104.9%	122.7%	115.9%	96.9%
Vs.2001		112.6%	131.9%	178.9%	189.2%	198.4%	243.5%	282.2%	273.4%
Receipts (current Million USD)	4.119	4.133	4.704	6.328	7.206	8.133	10.327	12.104	11.757
Year on year		100.3%	113.8%	134.5%	113.9%	112.9%	127.0%	117.2%	97.1%
Vs.2001		100.3%	114.2%	153.6%	174.9%	197.5%	250.7%	293.9%	285.4%

Table (4-10) the origins of international tourists to Egypt

(thousands)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total	4.648	5.192	6.045	8.104	8.608	9.083	11.091			14.731
Arab countries	972	1.128	1.322	1.496	1.703	1.922	1.960			2.092
Share	20.9%	21.7%	21.9%	18.5%	19.8%	21.2%	17.7%			14.2%
Europe	3.132	3.584	4.204	5.920	6.120	6.260	7.939			11.177
Share	67.4%	69.0%	69.5%	73.1%	71.1%	68.9%	71.6%			75.8%
America	252	171	188	257	298	340	430			563
Share	5.4%	3.3%	3.1%	3.2%	3.5%	3.7%	3.9%			3.8%
Others	292	309	331	431	487	561	762			899
Share	6.3%	6.0%	5.5%	5.3%	5.7%	6.2%	6.9%	6.0%	14.0%	6.2%

The origins of international tourists to Egypt are shown in table 4.10.constantly more than 70% (or 11.2 million in 2010) of foreign tourists are Europeans. The Europeans used to focus on the tourism areas in the red sea coastal resorts including Sharm el-Sheikh and in Hurghada, and historical cities such as Luxor and Aswan.

The Majority of Tourists enter Egypt by air as popular transportation mean. Currently, 85.6% of the international passengers used air transportation to access Egypt as shown in table (4-11) below

Table (4-11) Chronological changes in tourist distribution by arrival transportation

(thousands)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total	4.648	5.192	6.045	8.104	8.608	9.083	11.091	12.835	12.536	14.731
By Air	3.800	4.280	4.841	6.736	7.210	7.611	9.436	10.960	10.774	12.616
Share	81.8%	82.4%	80.1%	83.1%	83.8%	83.8%	85.1%	85.4%	85.9%	85.6%
By sea	451	437	455	487	598	660	749	854	801	957
Share	9.7%	8.4%	7.5%	6.0%	6.9%	7.3%	6.8%	6.7%	6.4%	6.5%
By land	397	457	749	881	800	812	906	1021	961	1.0158
Share	8.5%	9.1%	12.4%	10.9%	9.3%	8.9%	8.2%	8.0%	7.7%	7.9%

As a part of the important tourism attractions in Egypt, following 7 world heritages (6 cultural heritages and 1 natural heritage) which are registered by UNESCO (United Nations, Educational, Scientific and culture organization) exist in whole Egypt. Several places of these heritages are surely famous for tourism attractions in Egypt.

Especially, the pyramids in Giza ,ancient temples I Luxor and ancient monuments in Aswan are placed as the symbols of Egyptian tourism .however ,some of the heritages are facing a crisis of collapse due to financial and maintenance problems such as in Abu Mena heritages in Borg al Arab city ,located just beside the airport in Alexandria region.

Table (4-12) List of Registered world Heritages in Egypt

Title	Heritage type	Registered year	Criteria	Area	Location
Abu Mena	Culture	1979	(iv)	183ha	Alexandria
Ancient Thebes with its Necropolis	Culture	1979	(i.iii.vi)	7.390ha	Qena
Historic Cairo	Culture	1979	(i.v.vi)	524ha	Cairo
Memphis and Necropolis (the Pyramids field from Giza to Dahsur)	Culture	1979	(i.iii,vi)	16.359ha	Giza
Nubian Monuments From Abu Simbel to Philae	Culture	1979	(i.iii,vi)	374ha	Aswan
Saint Catherine Area	Culture	2002	(i.iii,iv.vi)	60.100ha	South Sinai
Wadi Al-Hitam (White Valley)	Natural	2005	(viii)	20.015ha	Faiyum

The Availability of Hotels in Egypt is shown in table 4.13 below. The following record shows that 143.932 rooms and 266.737 beds were available in 1.446 hotels in 2008. These figures have been chronologically unchanged and stable .The figures of" Floating Hotels" in the table mean Nile River cruising ships

Figure (4-16) shows Abu Mena world heritage

Table 4.6 Hotel Capacity of Egypt

Annual Average occupancy rate of hotels in Egypt is shown in Table 4.14 in which the national average in 2007 was 63% (the figures in 2008 are neglected because of the then economics crisis) occupancy rate at Alexandria was 58% while those at Cairo, Giza, South Sinai (e.g. Sharm El-Sheikh) and Red Sea (e.g. Hurghada) were remarkably higher (more than 70%) The rate at Aswan was quite low.

Table (4-13) Hotel Capacity of Egypt

Item		2004	2005	2006	2007	2008
Hotel & Resorts	**Number**	1.307	1.278	1.273	1.280	1.230
	Rooms	111.428	116.151	126.421	133.624	131.476
	Beds	211.803	218.283	237.768	249.414	242.831
Floating Hotels	**Number**	178	164	149	149	216
	Rooms	10.034	9.915	8.895	9.187	12.456
	Beds	19.450	19.935	17.407	17.564	23.906
Total	**Number**	1.485	1.442	1.422	1.429	1.0446
	Rooms	121.462	126.066	135.316	142.811	143.932
	Beds	231.253	237.318	255.175	266.978	266.737

Table (4-14) Hotel Capacity of Egypt

(%)	2001	2002	2003	2004	2005	2006	2007	2008
Average	57	51	59	68	63	60	63	56
Cairo	72	68	63	72	68	73	78	48
Giza	63	60	49	60	58	64	76	52
Alexandria	60	47	36	36	39	70	58	39
South Sinai	65	70	65	72	67	61	73	74
Red Sea	68	69	64	75	68	69	79	53
Luxor	56	46	37	45	49	54	61	44
Aswan	42	33	25	29	31	31	29	33

4.5.1 Tourism Industry in Alexandria Region

Accommodations

In Alexandria region, there are currently 4.000 rooms at 43 hotels as shown in table 4.15, in which 167 rooms are located within 15 KM from Borg El Arab International Airport.

Table (4-15) shows a list of hotels located in Alexandria City

No.	Grade Rank	Name of Hotel	Location	Rooms	Address	Contact no.	Distance From Borg El Arab Airport (km)
1	4	Aifu Horizon Resort	Montazah	86	Al Montazah Tower, Courinsh Rd.	(203) 5497993	80
2	4	Windsor Palace Hotel	City Centre	76	17, El Shohadaa St.	(203) 4808256	55
3	4	Le Metropole Hotel	Others	65	52,Saad Zaghloul street	34861465	55
4	4	Mercure Romance Alexandria Hotel	City Centre	55	303, El Gueish Av.	(203) 5836423	60
5	4	Sofitel Cecil Alexandria Hotel	City Centre	86	Saad Zaghloul Sq.	(203) 4874856	55
6	5	Sheraton Montazah Hotel	City Centre	270	El Corneish Rd.	(203) 5480550	80
7	4	Paradise Inn Mamoura Beach Hotel	Others	30	Maamoura Beach	35479602	85
8	4	Hilton Green Plaza Hotel	Others	314	Green Plaza - somoha	34209120	60
9	3	Kaoud Sporting Hotel	Others	99	133,El-Guiesh road	35434513	50
10	5	Renaissance Hotel	Water front	158	544,El-Guiesh road	35490935	70
11	5	Helnan Palestine Hotel	Others	232	El Montazah Palace	(203) 5475033	80
12	4	Africana Hotel	Borg El Arab	86	King Mariout	(203) 4550600	15
13	4	Aida North Hotel	Costal Road	100	el-kilo77-Alexandria Matrouh Rd.	0464102802	65
14	3	Al Haram Hotel	City Centre	221	162, El Gueish Av.	(203) 5464059	55
15	local	Al Karnak	City Centre	18	91, 26th July Rd.	(203) 4871593	55
16	3	Al Maamoura Palace	City Centre	75	Maamoura Beach	(203) 5473761	55
17	1	Darwish Hotel	City Centre	36	47, El Gueish Av.	(203) 5924846	55
18		Delta Hotel Alexandria	City Centre	63	14, Champolion St.	(203) 4865188	55
19	5	Four Seasons Hotel	City Centre	118	399, El Gueish Av. - San Stefano	(203) 5818000	65
20	3	Geddah Hotel	City Centre	92	137, El Gueish Av.	(203) 546 8662	55
21		Land mark					
22	2	Motel King Mariout	Borg El Arab	26	El-Farana st,King Mariout	4551434	20
23	4	Plaza Hotel	City Centre	125	394, El Gueish Av.	(203) 5838714	55
24	5	Ramada Renaissance	City Centre	158	544, El Gueish Av.	(203) 5490935	55
25	3	San Geovanny Hotel	City Centre	32	205, El Gueish Av.	(203) 5467775	55
26	2	Swiss Cottage Hotel	City Centre	48	347, El Gueish Av.	(203) 5835886	55
27	2	Union Hotel	City Centre	44	164, 26th July Rd.	(203) 4807771	55
28	3	Mecca Hotel Alexandria	City Centre	100	44,El-Guiesh Road	35923925	55
29	3	Amoun Hotel	City Centre	120	22 El-Nasr Street - Manshaya	34818239	55
30	5	El Salamlek Palace Hotel	City Centre	20	258 El-Montaza	35477999	55
31	5+	Radisson Blu Hotel, Alexandria	Costal Road	118	Alex West	35896000	10
32	5	Mediterranean Azur Hotel	City Centre	160	Kobry Stanly	35226001	55
33	3	Cleopatra San Giovanni Hotel	City Centre	100	160 , El-Kornish Road	35428058	55
34	5+	Porto Marina Hotel	Marina	338	Marina - Gate 3	19115	75
35	3	Adham compound Hotel	El-Kafory Road	81	King Mariout - Elkafory Road	4485882	15
36	3	Samar Moon Hotel	El-Bitash	48	El-Agamy - Bitash	3094930	40
37	2	Dofil Hotel	City Centre	42	Kobry Stanly	5454805	55
38	4	Lagoon Hotel	City Centre	56	Lagoon club	3814220	60
39	3	Acacia resort Hotel	City Centre	31	Acacia Club	3818888	60
40	2	Hoilday Hotel	City Centre	41	Midan Oraby - El Manshia	4803517	60
41	2	El-Madina El-Manwara hotel	City Centre	60	Sidi Gaber	5431294	60
42	2	Nobel Hotel	City Centre	40	152,El-Guiesh street	5463374	60
43	5	ocean blue	Marina	30 Suite	Marina - Gate 5 - Gizera 22	0464452272	80
					Total number of rooms	4098	

Random interviews conducted by JICA Study team revealed that great majority (more than 75%) of the hotel guest visited Alexandria were for business purposes.

Tourism Attractions

Since the 1990's the government of Egypt and archaeologists have discovered a wealth of historic sunken treasures in the bay of Alexandria and Abukir bay. Over 2000 objects including sphinxes. Status and other objects have been mapped including pieces from the famous Alexandria Light House and Cleopatra's palace

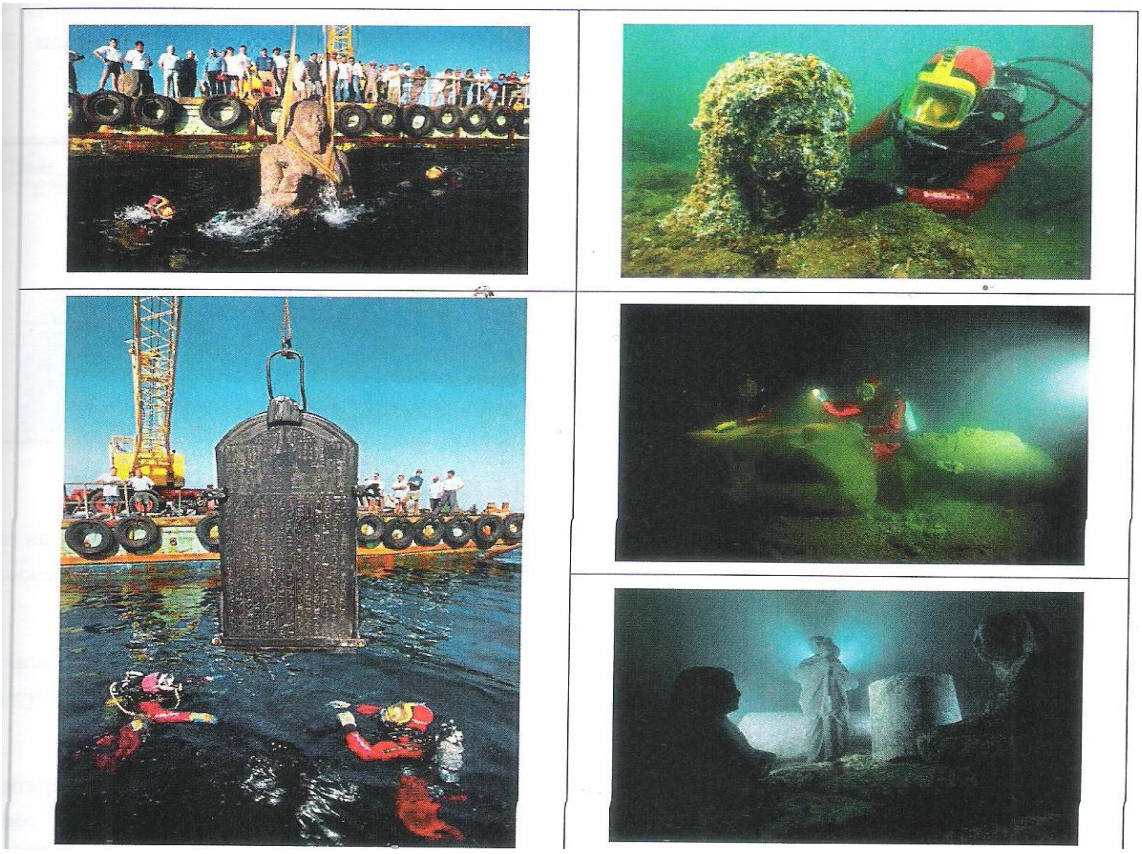


Figure (4-17) Shows Sunken Treasures in Alexandria

Since 1998 the European Institution of Underwater Archaeology (IEASM) headed by French underwater archeologist, Mr. Frank Gaddio has been salvaging various submerged objects from the ancient cities of Canopus and Heraklion- Tonis , offshore of Abukir Bay .these treasures have been exhibited at museums in Europe and Japan since 2006.
In 2006, UNESCO funded a study to look into the feasibility of developing an underwater museum near the new library in Alexandria that would provide tourists with a direct underwater view of many of these objects .the proponents state that if the museum is materialized, it would provide Alexandria with a much needed unique tourist attraction that could add as many as one million annual new tourists to the city.

Current Development projects for tourism

Currently there are two major residential and commercial development projects in the proximity of the cities of Alexandria and Borg El Arab International Airport and includes , as shown in the figure below ,hotels, schools, conference center ,a university ,an 18 holes golf course ,malls and shops and movie theaters and several hundreds of high-end houses ,villages

and townhouses .Currently the Alexandria West is less than 35% completion .Its full development is expected to house over 15.000 people.

Figure (4-18) shows Master Plan of Alex West Development

The city of Alexandria is not as well-Known and of the interest to foreign tourists as other cities throughout Egypt like Cairo, Luxor and Aswan having historical heritage resources and Hurghada, Sharm El-Sheikh and MarsaAlam having marine tourism resources.
Even though the city id frequently visited by foreign tourists because of historical and culture attractions (library, roman ruins, and museums) they rarely stay in the city for more than a day or rarely spend the night.
Most tourists come from Cairo early in the morning in comfortable tour buses and spend the entire day visiting them well-known tourist's destinations. The Alexandria ground tourist generally a part of larger tour to the rest of the major tourist destinations throughout Egypt.
Despite not being a major destination for foreign tourist, the city during the summer becomes the largest tourist destination for many Egyptians specially those living in Cairo and foreign visitors from the Middle East .During the summer Alexandria experiences the same high temperatures as many of the cities to its South and east that many want to escape but its constant cool breeze and proximity to the water make it the most attractive destination for people living in Cairo and the Middle –East .
It's estimated that during the summer Season (June through September) the population of Alexandria is doubled as people from Cairo and vicinities flee the city looking for cooler temperatures .Entire families move from Cairo for the summer months to apartments ,houses and villas they own in Alexandria for this specific purpose
Expect for this type of tourism, travelers coming to Alexandria mainly travel for business or family purposes. Most travelers from/to the Middle East are workers from the Nile Delta region that work in Middle Eastern countries or travelers that fly to Saudi Arabia for pilgrimage.

North Costal Development

One of the booming tourism spots in the vicinity of Alexandria is the north coast beach resort development between Alexandria and MarsaMatrouh, More specifically the area spreading over 45 km between Alexandria and El-Almain.
It is speculated that as many as 3.000 new hotel rooms will be built in this area in next two to three years. This new development will have a major impact on the view tourists have today of Alexandria

4.6 Road infrastructure developments

Alexandria area is connected with other regions vie 3 major national highway networks. "Agriculture Road" and "Deseret Road" connected with Cairo, and "Mediterranean Coastal Road" connects east and west of north coast of Egypt along the Mediterranean Sea, as shown in figure (4-19)

Those highways have been developed, expanded and periodically renovated as the main traffic lines in Egypt

Figure (4-19) Major Road Infrastructure Developments in North Delta area

4.6.1 Agriculture road

The agriculture road starts from the center of Cairo to the east area of Alexandria city passing through Nile Delta Area. The road is handling vast demand of cargo transport to carry agriculture products from major agriculture production areas in Nile delta area to Cairo, the biggest consumption market in Egypt, or Alexandria, the largest exporting hub port.
The Road is heavily congested, and in order to alleviate the congestion by pass road is now being constructions to the west of the existing Agriculture Road

4.6.2 Desert Road

The desert road is the most important trunk line in Egypt , connecting between the west end of Cairo /Giza area ,the west part of Cairo metropolitan ,through 6th October city ,and the west of Alexandria ,that pass through the east end of Sahara Desert
Originally ,the road was constructed for handling growing demand on agriculture road ,and as the traffic on the traffic of Desert Road further increased ,the desert road had been continuously rehabilitated to date .Current development includes expansion of traffic lanes from 3 to 4 on both directions, pavement rehabilitation, and construction of flyover for U-turn traffic ,replacing the existing U-turn lane on grade
The desert road has currently a small entry gate, located some 5 km to the east of the entrance gate Borg El Arab International Airport; thus, it may become a part of access route to the Airport in future, and we strongly recommend that

4.6.3 Mediterranean Costal Road

The "Mediterranean Costal Road" was developed from east west of Egyptian north coast. The road is starting from Port Said, north east of Egypt, up to MarsaMatrouh, North –west of Egypt passing Alexandria and El-Almein. This Road handles surface cargo and trade demand transported between Alexandria and various cities of petroleum and mining production situated a long Mediterranean coast

The road will constitute a part of "North –Africa International Highway "which will become an inter-state connecting road along Mediterranean cities between Egypt and Morocco.
At present ,the part of Mediterranean Costal Road in Egypt is temporary in service through using the existing inter-city roads with several connecting new traffic lines .those will be developed modified or improved eventually to be a part of the "Inter-State Mediterranean Costal Road "

4.7 Railway Developments

Alexandria, as the largest port of entry to Egypt. Has been traditionally developed as the base of transportation of people, trade and industry for long time the first railway network in Egypt was developed in Alexandria to handle these demands.
To date the railway network has been continuously, playing an important role in Alexandria area.

4.7.1 ENR network in Alexandria

The main railway station in Alexandria is "MahtetMasr Station" where services for various directions by Egyptian national railways (ENR) are originated or destined. SidiGaber station located in the new city center at eastern Alexandria, is renovated to be the new main station in Alexandria to serve higher quality of service and comfort

The ENR network is diverged from both of MahtetMasr Station and SidiGaber Station to Abu Qir direction for north-east, Port Said Direction for east, Tanta and Cairo direction for through, and MarsaMatrouh direction passing through the city of Borg Al Arab. The train service frequencies other than Cairo direction are still low and inconvenient and some are served with 3rd class car as local train. Other ENR's branch link was established between the stations nearby Alexandria harbor passenger terminal located on the west of Alexandria.

The rail link of ENR between Cairo and Alexandria is known as the most important trunk line in Egypt .at present, ENR is providing frequent express train service between Cairo and Alexandria every 1 hour, with an introduction of new rolling stocks imported from foreign countries (e.g. Spain, Italy and France)

A part of Express trains is served up to Luxor with sleeping train facility, which is popularly included in package tours for foreign tourists.

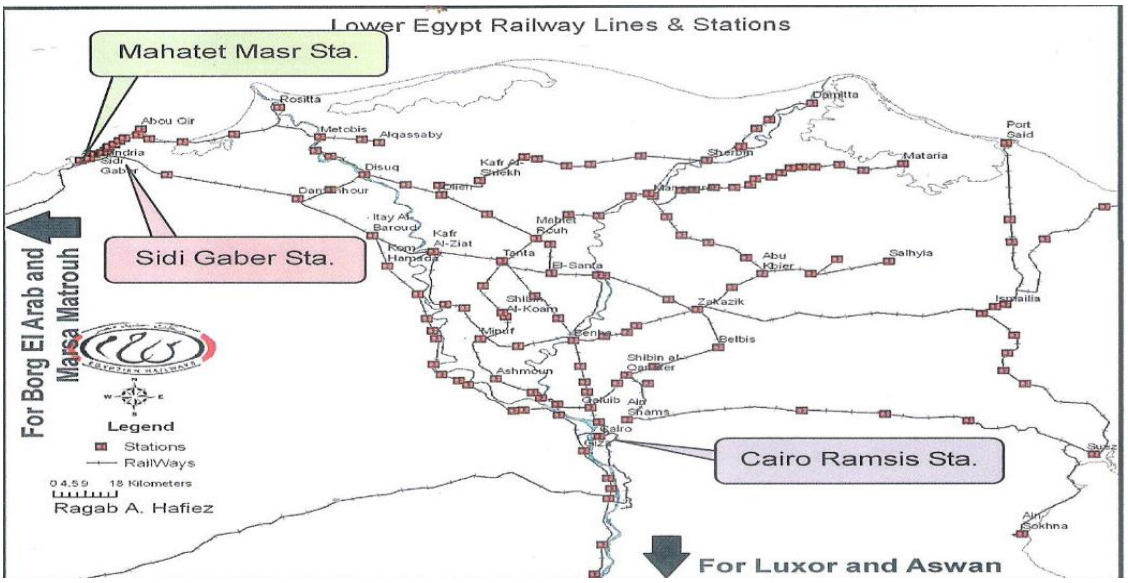


Figure (4-20) shows ENR Network in Lower Egypt

4.7.2 Tram Net Work in Alexandria

Several street car (Tram) lines are in service in Alexandria city. The Tram network has been expanded throughout the city lengthwise and crosswise in the past, and it is utilized by Egyptian citizens at low fare. As of 2011, the tram network connects between the old downtown of Alexandria near MahtetMasr Station and the new downtown area in east of Alexandria ,with 2 different operation lines, However, the other lines have been gradually abolished upon development of bus service network and private cars.

The rail link network for cargo transporting from the port is still active and expanding in all directions of the city, because Alexandria port is the largest port of trade and industries in Egypt

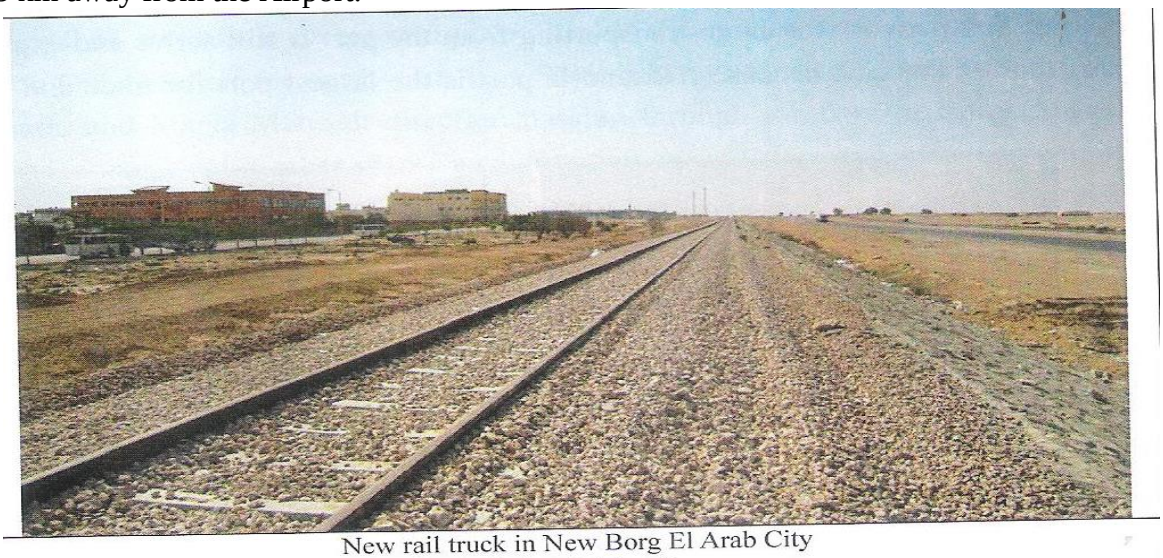
Figure (4-21) Shows Railways in Alexandria

4.7.3 Future Development of railways

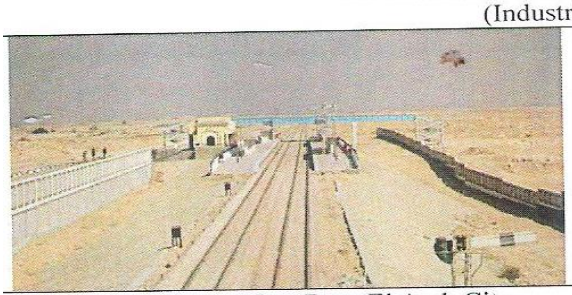
Modernization of the main trunk line between Cairo and Alexandria with an introduction of a new high –speed rail link is under study. The feasibility study to connect the 200 –Km distance between two cities within 1 hour has been assisted by Italian government. Some news sources reported about the possibility to introduce Japanese high –speed train system, the Shin-Kansen, however, it will take a long time until any decision on this matter which is made by relevant authorities.

4.7.4 New Line to New Borg El Arab City

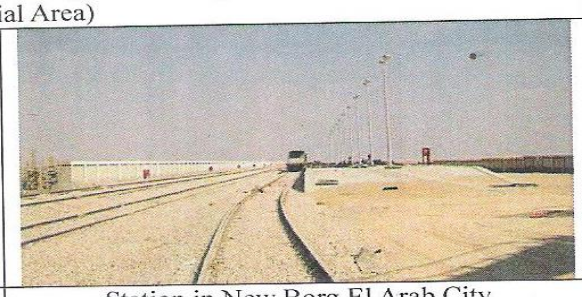
The New ENR line development project is on-going in the west area of Alexandria as of 2011. The new line would connect Alexandria city with new Borg El Arab City where new industrial areas and university were developed. The Project includes improvement of subsoil conditions and doubling the existing track, and construction of a new track to new Borg El Arab city diverging from the station near Borg El Arab International Airport .This new line is expected to be utilized for the access to Borg El Arab International Airport since it is located only 5 km away from the Airport.



New rail truck in New Borg El Arab City
(Industrial Area)



New Station at New Borg El Arab City
(Opened)



Station in New Borg El Arab City
(under construction)

Figure (4-22) New Rail Line to New Borg El Arab City

4.8 Current Situation of Industry and Trade in Alexandria Region

The city of Alexandria is well known as being the main location of major industries in Egypt. Alexandria and its immediate surrounding area account for nearly 40% of Egypt's industry and 60% of its foreign trade.
Alexandria is producing 60% of Egyptian total of textile industry 40% of its petroleum and petrochemical industry 35% of its food processing industry 30% of its plastic, 16% of telecommunication, 15% of information technology, and 15% of its pharmaceutical industry.

4.8.1 Industrial Development plans at Borg El Arab

In the airport surrounding area of the city of Borg El Arab, several industrial development projects have been planned since about 30 years ago. Borg El Arab City area is located 45 km to the west of Alexandria City and playing a role of new industrial base in Alexandria region.

However several development projects are planned or implemented or completed in whole Alexandria region, currently, the position of Borg Al Arab City is becoming more important in the industrial sector region

As a core area of the city "Borg El Arab city " is placed in the center of its area ,and Alex population is about 3500,000 according to the national election in 2014

Currently, Borg El Arab City area can be divided into 2 major areas. One is old down town of Borg El Arab called Borg Al Arab city .Borg AL Arab city is generally playing its role as the residential area in suburb of Alexandria.

The other city is "New Borg El Arab City" located 10 km to the south of old down town of Borg EL Arab .Main industrial activities in this area are played at New Borg Al Arab City and that city has been developed as a completely new urban development.

The location of the city and the Airport is shown as figure (4-23) below. The city located about 10 km to the west of the Airport and people can access to the Airport in about 15 minutes from the city .The North of the area is called Borg El Arab city ,and the south of the area has been developed as New Borg El Arab City.

Figure (4-23) Map of Borg El Arab City

The new urban development at New Borg El Arab City implemented within 15.200 acres (approx.61.5 km2) of land. The master planning and total area development have been implemented by the Ministry of Housing. Utilizes and Urban Development. Currently, The New Urban communities Authority, Under the Ministry taking a major role of managing the developments in this area .the new city would consist of industrial, commercial residential and educational establishments. Majority of the developments in the city are conducted by private industrial sector building their private industrial sector have been constructed. Currently, More than 600 factories are located in this area and major categories of industry include the followings, according to interview to the chamber of Commerce in Borg El Arab City by JICA study team:

- Petrochemical ;
- Steel and metal processing;
- Machine parts manufacturing;
- Fertilizer and Agriculture Chemicals
- Institute and research; and
- Agriculture and food processing

The industrial factories in this area were developed or established by private sector including foreign investors especially from the Middle-East countries. And some of factories were transferred from Alexandria to New Borg El Arab because of the tax holidays offered for new developments by relevant authority.

Moreover some of the factories are doing business with Russian or other European companies at the special territories dedicated for each country in the area. Although the developments have been continuously implemented, several foreign factories in this area, especially small companies, are facing difficulties to maintain their business due to unstable political situation and the end of tax holidays.

In New Borg El Arab City, several infrastructure developments are on-Going to attract or accommodate industrial demands, Especially rail and road infrastructure are being developed rapidly .As of October 2011 the rail link between Alexandria and New Borg Al Arab opened and operation has been started .However, although the rail operation started, the developments of related infrastructures such as crossover bridges and new stations are yet to be completed.

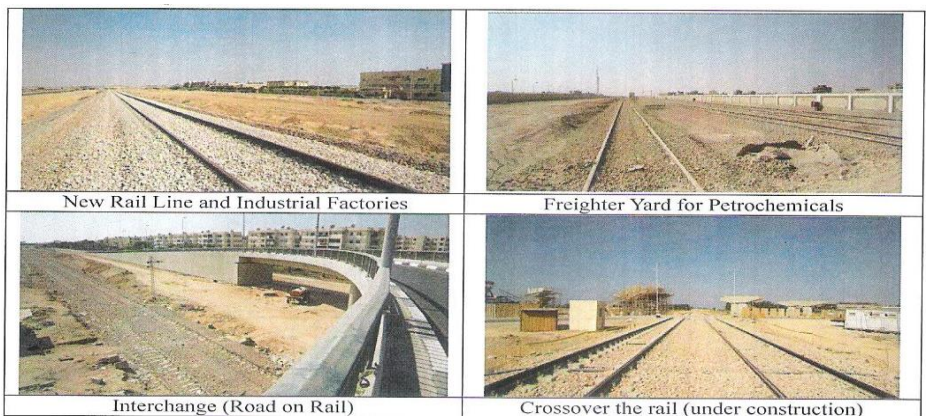


Figure (4-24) Infrastructure Developments in New Borg El Arab City

4.9 Egypt –Japan University of science and Technology (E-JUST)

4.9.1 General

The new Borg El Arab City will also house the Egypt- Japan University of Science and Technology (E-Just), a major technical cooperation project created in close coordination between the governments of Egypt and Japan. The University new campus will be constructed within a 150 acre plot of land adjacent to city for science research and technology (C-SAT, former called as MuCSAT) and will cater to 1,120 undergraduate, 420 master and 210 doctorate degree students and a 168 faculty in the faculty of engineering and a 1,250 business school students and 132 faculties for a grand total of 3,000 students and 300 faculties in the future. The university will include administrative and classroom buildings as well as a building for dormitories for 500 students.

4.9.2 General condition of higher education in Egypt

Current situation of higher education in Egypt Consists of 37 universities including 19 governmental universities and 18 private universities. Before entering to the university, pre-university education (Primary and secondary educations) is served for about 16 million students in whole Egypt through by approximately 400.000 class rooms in 43,000 schools. In the pre-university education, about 809,000 teachers are teaching at the schools however other 300,000 teachers are working abroad .at present, the system of higher education in Egypt has been facing several difficulties such as a gap between labor market needs and graduates skills ,over-population in the universities ,and growing demand for education quality
For instance, Cairo University, the largest and highest university in Egypt, Receives more than 250,000 students .Even the medical department of the university, there are 1,500 students in each grade. This means that the students are not able to obtain satisfactory environment for education.

Alexandria University is also in the same situation as Cairo University, The University receives 200,000 students in total .Due current governmental regulation for higher education, the university districts are fixed for each university, and the students can take an entrance examination of a specific university fixed by Districts. This system makes it difficult to access the universities at their own request which are located in other regions or governorates; however the governmental universities are free for education

As of now 95% of total university students are in the governmental universities. Due to these difficult situations on higher education system in Egypt, The demand for developing education quality and satisfactory education environment is growing day by day.

E-JUST could surely contribute to such demand through providing high quality education which is different from other universities
The project is very near to Borg Al Arab airport.

Footsteps of E-JUST project

The project to establish E-JUST was commenced through collaboration between Japan and Egypt in year 2005 .since starting preparation for the project, E-JUST has been watched by educational society in Japan and Egypt with interest as one of the important and innovative projects for the higher education in Egypt and Arab region .And the project was expected to improve current situation and problem on higher education in Egypt. The footsteps of the project are shown in table (4-16)

Table (4-16) Footsteps of E-JUST Project

September,2005	The idea of university establishment was officially proposed to the government of Japan by the ministry of International Cooperation(MoIC) and ministry of higher Education (MoHE) based on discussions since the Arab-Japan Dialogue forum in 2003
March ,2006	Preparation of the first opportunity study by Egypt ,and agreement on the name of E-JUST was commenced
October 2008	Record of Discussion between Egypt and Japan for E-JUST establishment was signed in Tokyo
March 2009	The president of Egypt endorsed the bilateral agreement by act 149/2009.
February 2010	First Student intake and the first academic semester started in the temporary
June 2010	The opening ceremony was held at Smart Village in Cairo on June 3.2010

Current situation of E-JUST

Since February 2010, E-JUST has started to receive the students on master and doctor courses in the graduated school and the number of students in E-JUST has increased to 70to date.

All classes of E-JUST are currently opened at city of Science research and technology (C-SAT) central building and surrounding dormitory houses in New Borg El Arab City as their temporary campus

Figure (4-25) C-SAT in New Borg El Arab City (Temporary E-Just Campus)

Currently E-JUST has already opened 6 engineering departments under 3 schools in the faculty of engineering however totally 7 departments will be established in February 2012. All currently –opened courses are supported by Japanese major universities and professors to provide higher educational opportunity to the students.

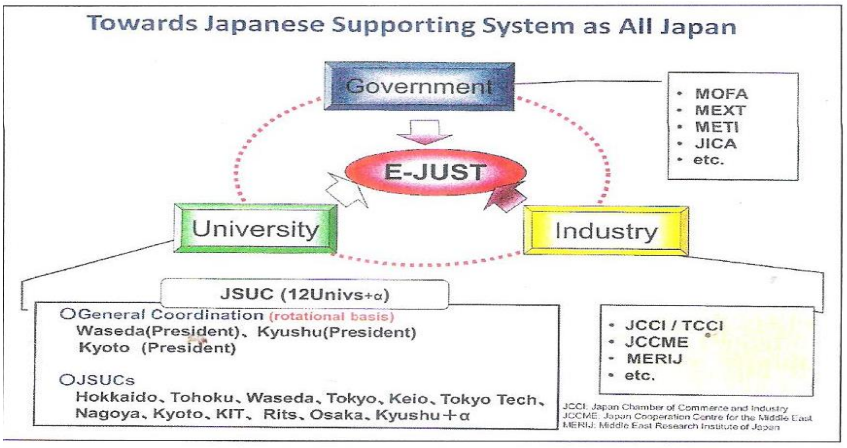
Japanese supporting University committee (JSUC) which is organized by 12 major Japanese governmental and private universities is taking a part in supporting operation and education program of E-JUST through dispatching their professors based on JICA technical cooperation scheme

Table (4-17) Supporting Structure for E-JUST Education Program

Faculty	school	Department	Main Program Supporting Univ.		JSUC
Faculty of Engineering	Electronics ,communications and computer Engineering School	Electronics and communication Engineering	Kyushu Univ.		
					Hokkaido Univ.
		Computer Science and Engineering	Waseda Univ.		Tohoky Univ.
					Waseda Univ.
	Innovative Design Engineering School	Mechatronics And Robotics Engineering	Waseda Univ.		Tokyo Univ.
					Keio Univ.
		Industrial Engineering and System Management	Tokyo Institute of Technology		Tokyo Institute of Technology
					Nagoya Univ.
		Material Science and Engineering	Kyoto Univ.		Kyoto Univ
					Kyoto Institute of Technology
	Energy and Environmental Engineering School	Energy Resources and Environmental Engineering	Tokyo Institute of Technology		Ritsumeikanuniv.
					Osaka univ.
		Chemical and Petrochemical Engineering	Kyoto Univ		Kyushu Univ.

{Remarks} Green marked: started Feb. 2010/ orange marked: started Sep. 2010 Violet Marked: started Feb.2011 Pink Colored University is governmental University /Blue colored University is Private University

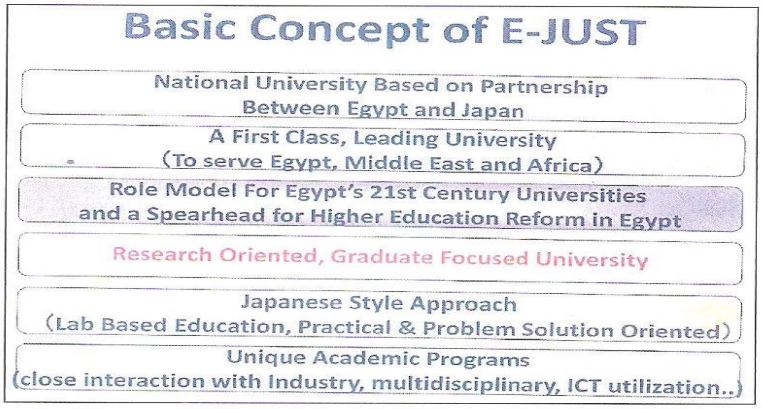
Moreover, the operations and educational programs of E-JUST are fully supported by the government, Universities and private industry sectors of Japan .As stated, Japanese Supporting Universities Committee (JSUC) is supporting the operations and educational programs of E-JUST through dispatching specialists and professors from member universities. On the other hand ,The government of Japan has organized Related governmental ministries including ministry of foreign affairs (MOFA) ,Ministry of Education ,Culture ,Sports ,Science and Technology (MEXT)and Ministry of Economy Trade And Industry (METI)to Assist E-JUST project .At the same time ,Private Industrial Sectors in Japan are also joining Cooperation group For E-just .This E-JUST project is placed as one of High Priority cooperation projects between Japan and developing country ,and all related sectors are collaborating to assist in implementing the project. And on the government side Japan international cooperation Agency (JICA) is playing its role as center to organize related the governmental agencies, universities and private sectors Basic cooperation structure for project implementation of all Japanese sectors is shown in Figure (4-26) below



[Source] E-JUST Project Office

Figure (4-26) Cooperation Structure for E-JUST Project of Japan

E-JUST has been established and operated based on its basic concepts show in Figure (4-27) below. Basically E-JUST is inviting the students who have graduated from 19 government universities in whole Egypt and requesting higher education skills including English ability. This Requirement is for maintaining education quality of E-JUST to be provided unlike education program Egyptian universities ever offered.



[Source] E-JUST Project Office

Figure (4-27) Basic Concept of E-JUST

For the cooperation between Japan and Egypt to Establish E-JUST, the government of Japan and the Government of Egypt have signed the agreement to implement the project on October 13.2008 according to this agreement, The project will continue till October 12.2013 and JICA is to place an executing agency for E-JUST on Japanese side to Supply educational and research equipment and dispatch the experts and professors. The Government of Japan ,JICA and Japanese universities would provide related assistants including dispatching 7 specialists to implement the project a total of 34 professors per year for educational program providing a total of 14 man-month experts per year to assist special subjects ,receiving 10 teachers and administrative officers from Egypt to Japan in every year ,supplying special educational and research equipment and related cost ,as JICA activities .However these figures are based on the actual record and current plan as of November 2011 the total amount for the project is estimated at about 2.15 billion Japanese yen.

On –Going Developments and Future Plans

As of October 2011 ,E-JUST is opening their educational programs at C-SAT building and surrounding dormitory houses functions as temporary campus .Most of laboratories and researching room for the students and teachers and administration offices are set in dormitory houses ,and the president room and some researching equipment are located in C-SAT Temporary campus

New Campus Developments

The new campus building development is still under process to receive the approval of the state council for contacting basic design of new building .in 2009 ,E-JUST lunched an international competition for architectural concept design of their new campus ,75 participants from Japanese and Egyptian architectural firms applied to this competition .Finally a Japanese architectural design firm ,named Arata Isozaki and Associates CO. Ltd .was selected as the first prize in 2010.His awarded concept design perspective image is shown below.

[Source] Arata Isozaki & Associates (Isozaki-Arata Design Atelier)

Figure (4-28) Awarded Concept Design Perspective of E-JUST New Campus

4.9.3 Related Development Projects

Currently, JICA is conducting the development of solar- power generation facility in adjoining land of new E-JUST campus through JICA environmental grant aid Scheme .This solar generation facility will be developed in the area of E-JUST club and mall (Commercial facilities for the students and teachers of E-JUST), which is located 1 km away from the new E-JUST campus and nearby dormitory house area, At present, A Japanese Consultant firm is designing the facilities.

[Source] JICA Study Team

Figure (4-29) Project Advertising Board of E-JUST Club and Mall

4.9.4 Educational Program Developments

As stated above, educational programs of E-JUST are Supported by Japanese universities E-JUST is providing all educational opportunities in line with Japanese lecture system, i.e. stratified –structure education scheme .At present ,E-JUST has already established a graduated school and received about 70 students .after completion of new campus facilities, E-JUST will establish departments for bachelor's degree courses .

Currently, almost all the students being education at E-JUST consist of teaching-students who already graduated from the governmental universities in whole Egypt and assist classes and researches under their professors.

4.9.5 Social and Economic Impact from E-JUST project

Currently the developments of new E-JUST campus and related facilities such as dormitory houses are under process or construction in various places in New Borg El Arab City. However present population of E-JUST is still small in number, once the project complete, the number of population related to E-JUST will increase to around 5,000 to 6,000 including 3.000 to 3.600students .consequently related commercial area should be developed to catch the demand on their life activities .As stated above ,commercial mall for E-JUST students and teacher is under consideration .such related commercial developments are expected to be implemented in and around the university o meet the life requirements of its campus .These commercial developments could impact on local society and economy through creating new economic activities.

On the other hand, the educational programs and schemes of E-JUST are really unique unlike usual Egyptian universities .According to the result of interview with the chamber of commerce in new Borg el Arab city's industrial park by JICA study team ,E-JUST 'S innovative research activities are focused and expected to have an opportunity of industry – university cooperation among factories ,industries in New Borg El Arab City Consists of petrochemical ,parts supply ,newly high-tech research and foods ,once joint industry – university research projects starts among them ,the industrial sector could receive the result and know- how of researching in E-JUST ,and E-JUST could have opportunities of positively research ,verification ,production and providing their results of searching through know-how exchange between industry sector and the university .so, it could take an advantage of industries in the area would become one of the innovative models as a science research city in the Middle-East region.

Once these projects complete, it could also lead to the movement of people, products and funds to / from the area and E-JUST. In case E-JUST and New Borg El-Arab City become a center of research and industry, the movement of people and products will surely use Borg El Arab International Airport which is most conveniently located in the vicinity of E-JUST.

Hence, Developments of the area and E-JUST are tightly linked with the demand of Borg El Arab International Airport.

4.10 Physical environment

4.10.1 Noise

Assessment Methodology

The noise impact assessment for Borg El Arab International Airport aims at assessing the noise hazards and pollution levels at the Airport and its adjacent areas. Specific emphasis will be given to assess noise impacts due to the construction in the new terminal building and the residents of adjacent areas.

The main objectives for the noise assessment can be summarized as follows:

- Assess the current noise level around Borg El Arab;
- Evaluate the noise level to comply with the guidelines of the WHO, the World Bank, the Egyptian Law 9/2009 and the International Organization for Economic Cooperation and Development;
- Determine the most affected area relative to Airport site;
- Predict the noise level in the years of 2015, 2020, 2025 and 2030;
- Propose the best mitigation measures to minimize the noise effects;
- Establish the Environmental Monitoring Plan (EMP).

A brief explanation of the technical terms that are used in the noise study are presented in Annex **(4)**

To perform the above-mentioned tasks both model prediction and detailed measurements inside and outside the Airport were executed to fulfill the above-mentioned goals.

Field Measurements

The measurement plan (locations, precautions, quantities measured, etc.) is taken from the International ISO 3891 Standards 'Procedure for describing aircraft noise heard on the ground and the ICAO standards Volume I, Annex 16 – Aircraft noise'. The reference standard quantities, by which the readings are compared, are abstracted from these standards in addition to Egyptian Law 9/2009 for Environment.

All the instruments used are manufactured by the world's leading company in noise measurements. These instruments were calibrated before and after each group of readings. Detailed of instrumentations used in this study is presented in Annex (4).

Measured Quantities

All measurements and quantities are A-weighted. The instruments quickly provide time histories of the frequency weighted noise levels from which the Equivalent Continuous Sound Level Laeq is determined. Details of measurements for Borg El Arab Airports are available in Annex **(4).**
Sequential analysis in terms of 1/3-octave frequency bands (spectrum), were also recorded as functions of time.
The signal and the digital post-processing of the outputs were carried out using an advanced measurements technique, which requires parallel filtering. This method complies with the ISO standards as related to the community noise assessment and Airport monitoring systems.

Measurements Locations

Based on the INM model prediction for year 2014, it was possible to identify the extent of the potential affected areas. Hence suitable measurements locations were selected.

Noise measurement locations were selected in the following areas within Borg El Arab Airport:

- The residential areas around the airports;
- The airport ground equipment areas;
- The terminal buildings;
- The apron area.

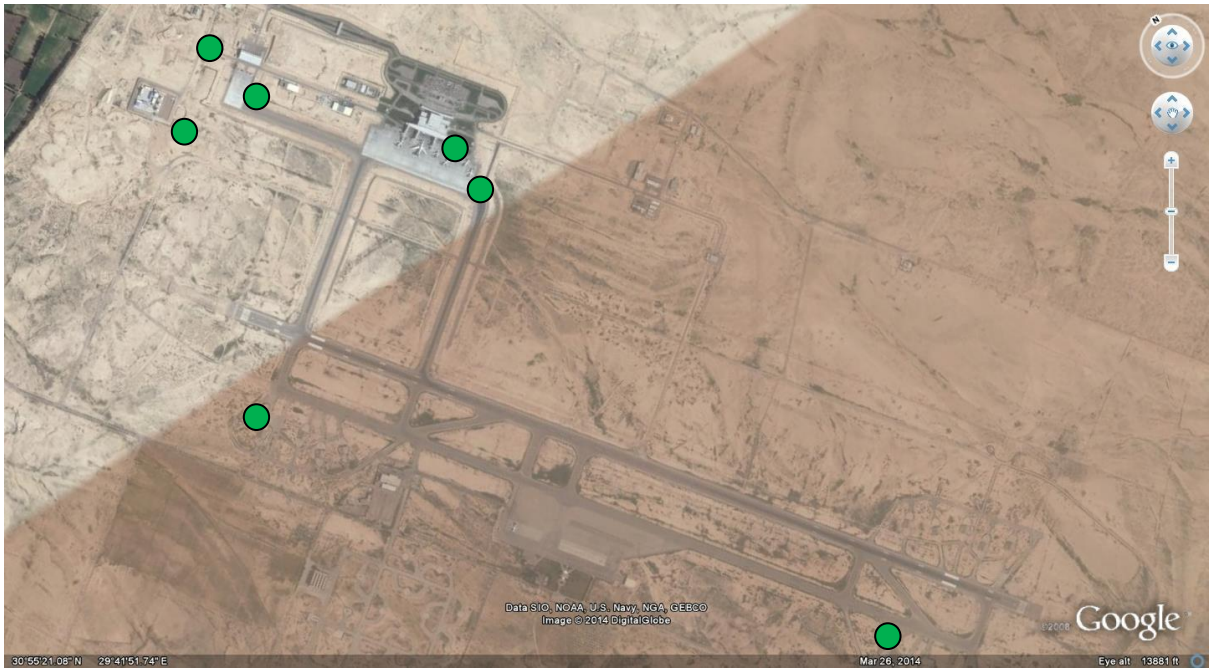
The points are selected to measure the noise pollution resulting from aircrafts and ascertain the impact of aircrafts on the people in these areas. The full base line measurements for Borg El Arab are presented in Annex (4).

Noise measurements was taken as follow

Figure (4-30) shows first group of Measurements Locations

Table (4-18) Locations and their noise level

Locations	Laeq
Location 1	66.91
Location 2	61.31
Location 3	65.06
Location 4	68.27
Location 5	70.33
Location 6	74.82
Location 7	68.78
Location 8	70.88
Location 9	63.69
Location 10	69.92
Location 11	68.81
Location 12	73.6


Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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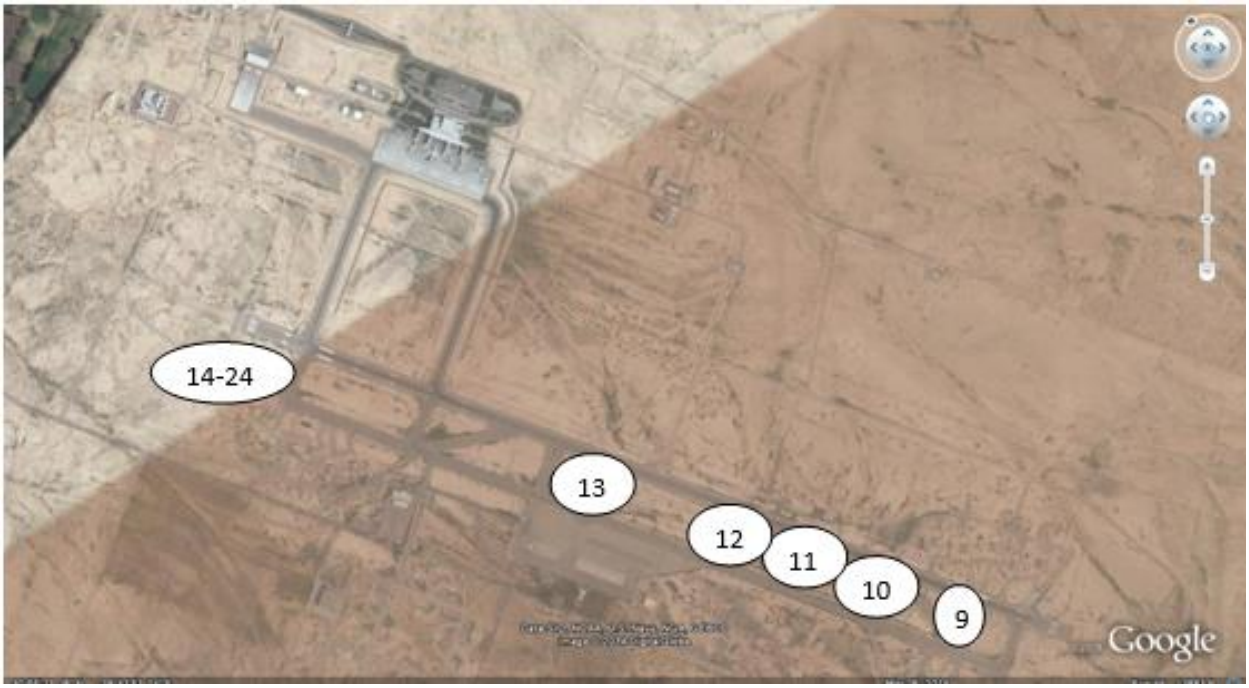

Figure (4-31) shows second group of Measurements Locations

Table (4-19) the second group of measurements with their noise levels

Readings	Description	Laeq
Reading 1	At arriving hall In the terminal building	62.69
Reading 2	At tarmac area during serving plane	76.88
Reading 3	At tarmac area during serving plane at another location	72.61
Reading 4	At tarmac area during serving plane at another location	70.26
Reading 5	Front of cargo village	60.46
Reading 6	Front of cargo village at another location	60.41
Reading 7	Front of water station treatment	53.47
Reading 8	Front of Egypt air fuel station	48.1
Reading 9	Beside run way Next to beginning end as a background	53.41
Reading 10	Beside run way Next to middle	53.57
Reading 11	The same location during passing plane on taxi way	59.53
Reading 12	Beside run way as Background value	55.67
Reading 13	Beside run way near to beginning During takeoff event	85.93
Reading 14	In the end of run way during landing event	68.44
Reading 15	In the end of run way during passing service bus	65.08
Reading 16	In the end of run way as Background value	54.55
Reading 17	In the end of run way as Background value	50.55
Reading 18	In the end of run way as Background value	44.5
Reading 19	In the end of run way as Background value	46.7
Reading 20	In the end of run way as Background value	43.62
Reading 21	In the end of run way during passing plane in the end of it	73.94
Reading 22	In the end of run way during passing plane in the beginning of it	64.1
Reading 23	In the end of run way during takeoff event	75.59
Reading 24	In the end of run way during takeoff event for another plane	77.09
Reading 25	At tarmac at moving Luggage service	79

Figure (4-32) shows third group of measurements locations

Table (4-20) the third group of measurements with their noise levels

Location	Description	Laeq
Location 1	Near Airport Noise Measurements	73.11
Location 2	Elhorya Valley Noise Measurements	74.47
Location 3	Abobakr Valley(Final Landing) Noise Measurements	74.47
Location 4	New Road For Borg El-Arab Airport	74.47

For full details of the measurements please see appendix (4)

4.10.2 Air Quality

These measurements were done to set up an air quality data for Borg El-Arab International Airport which addressed at Borg El-Arab – Alexandria Governorate. However, a measurement campaign has been done during October 2014. The measurement has been done at different places at Borg El-Arab airport.
Some VOCs measurements have also been carried out inside the parking area and inside the runway of the Airport, to assess the VOCs emissions.
The measurement campaign includes the following options for measuring the most relevant indicators and compounds such as:

- Nitrogen oxides (No_x)
- Sulphur dioxide (SO_2)
- Carbon monoxide (CO)
- Particulate matter less than 10 microns
- Volatile Organic Compounds (VOC)

Sampling &Measurement Plan

Air quality Measurements were done for the evaluation of hourly concentrations of sulphur dioxide (SO2), nitrogen dioxide (NO2) and carbon monoxide (CO). Air samples were taken on filters for the evaluation of the concentrations of Particulates matter 10 micron (PM10). All measurements were done for 24-hour average.

Sampling Site

Table (4-21) Location of measurement Points in Borg El-Arab

Site	Location	Coordinates
1	Beside Main Gate	N: 30° 56\ 44.77\\ E: 29° 42\ 00.32\\
2	At the Airplanes Runway	N: 30° 54\ 56.24\\ E: 29° 42\ 21.67\\
3	At the Car Parking	N: 30° 55\ 58.84\\ E: 29° 41\ 50.33\\

Figure (4-33) The Location continuous monitoring Points in Borg El-Arab

Standard Methods Used For Sampling & Measurement

Sampling and measurement were based on international standard methods recommended by the American Society for Testing & Materials (ASTM), US Environmental Protection Agency (EPA) and the Japanese Industrial Standards (JIS). These methods are listed in the following table

Table (4-22) Standard international methods

	Parameter	Standard Method
1	Evaluation of Sulphur Dioxide Concentration	JIS Method B 7952
2	Evaluation of Nitrogen Dioxide Concentration	ASTM Method D 3824
3	Evaluation of Carbon Monoxide Concentration	ASTM Method D 3162
4	Evaluation of PM10Concentration	EPA Compendium Method IO-2.3

Instruments & Equipment Used For Sampling & Measurement

All instruments and equipment were calibrated by certified calibration laboratories. These instruments and equipment are listed in table (4-23)

Table (4-23) Instruments & Equipment used in measurement in Borg El-Arab Airport

	Parameter	Instrument/Equipment
1	Evaluation of Sulphur Dioxide Concentration	UV Fluorescent Continuous Monitor (Thermo- England)
2	Evaluation of Nitrogen Dioxide Concentration	Chemiluminescence Continuous Monitor (Thermo- England)
3	Evaluation of Carbon Monoxide Concentration	IR Absorption Continuous Monitor (Thermo-England)
4	Evaluation of PM10 Concentration	Air metrics Sampler (Airmetrics– USA)

Quality Control Plan

QC plan contains two parts, one is concerning the quality control of the sampling, and the other is concerning the quality control of the measurement. This can be shown as follows:

1. **Sampling Quality Control**

- The pump and the flow meter used for the sampling of PM10 were calibrated using soap bubbles according to the EPA Compendium Method IO-2.3.
- The balance used for the gravimetric measurements of PM10 filters was calibrated using different standard weights.

2. **Measurement Quality Control**

- Sulfur dioxide continuous monitor was calibrated using a zero air (zero calibration) and a standard sulfur dioxide gas cylinder (span calibration).
- Nitrogen dioxide continuous monitor was calibrated using a zero air (zero calibration) and a standard nitric oxide gas cylinder (span calibration).
- Carbon monoxide continuous monitor was calibrated using a zero air (zero calibration) and a standard carbon monoxide gas cylinder (span calibration).

In addition to the points inside Borg El-Arab Airport, which will undertake measurements every hour, samples of SO_2, NO_2 and VOC have been collected at various positions around the planned terminal area

Figure (4-34) the measurement instruments using in Borg El-Arab Airport

4.10.3 Preliminary results, passive sampling& VOC

An example of measurements undertaken using passive samplers at the Borg El-Arab area is presented in Figure (4-35). The passive samplers represent an integrated average over the period of sampling. The concentrations shown below are thus two weeks average.

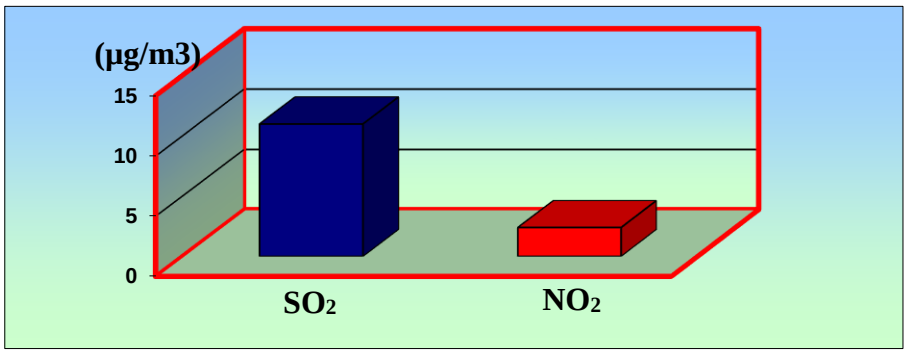

Figure (4-35) Passive samples of SO2 and NO2 collected at Borg El-Arab area.

The NO_2 and SO_2 average concentrations at Borg El-Arab area are very low and can be considered as background concentrations, this may be due to the high turbulence in the area and the good ventilation system that contribute to the dispersion of air pollutants.

Table (4-24) Volatile organic compounds concentrations around Borg El-Arab Airport

Station Unit	Concentrations (µg/m^3)			
	Total (C2-C4)	n-Bu	I-Bu	n-Pn
Borg El-Arab Airport (Runway)	14.9	1.2	3.3	8.1
Borg El-Arab Airport (Parking)	11.2	1.8	4.1	9.8

Volatile organic chemicals (VOCs) are emitted as gases from a wide array of products include of fossil fuel, chemicals and petrochemicals, some of which may have short- and long-term adverse health effects. The classification of VOCs depends on the number of carbon atoms in the compounds starting from methane with one carbon atom, n-Butane, Iso-Butan and n-pentane.

While the total number of samples was relatively limited, they did provide some indication of the VOC's present in the area

Observed values for VOCs are slightly low if we compare it to European limits, where the winter maximum does not exceed 10 micro grams per cubic meter. It is still be correct, since the location is expected to have low concentrations due to the well dispersion in the area. The total (C2-C4) gives moderate concentrations if you compare these levels to the levels recorded in the traffic areas of Cairo.

The amount of VOC's in the air is an important indicator on the reactivity potential of the atmosphere and the ozone producing capacity.

Preliminary results, one-hour averages

Continuous measurements have been performed at different sites at Borg El-Arab Airport. Figures (4-36) and (4-37) shows the highest one-hour average concentrations measured at three positions for continuous monitoring instruments.

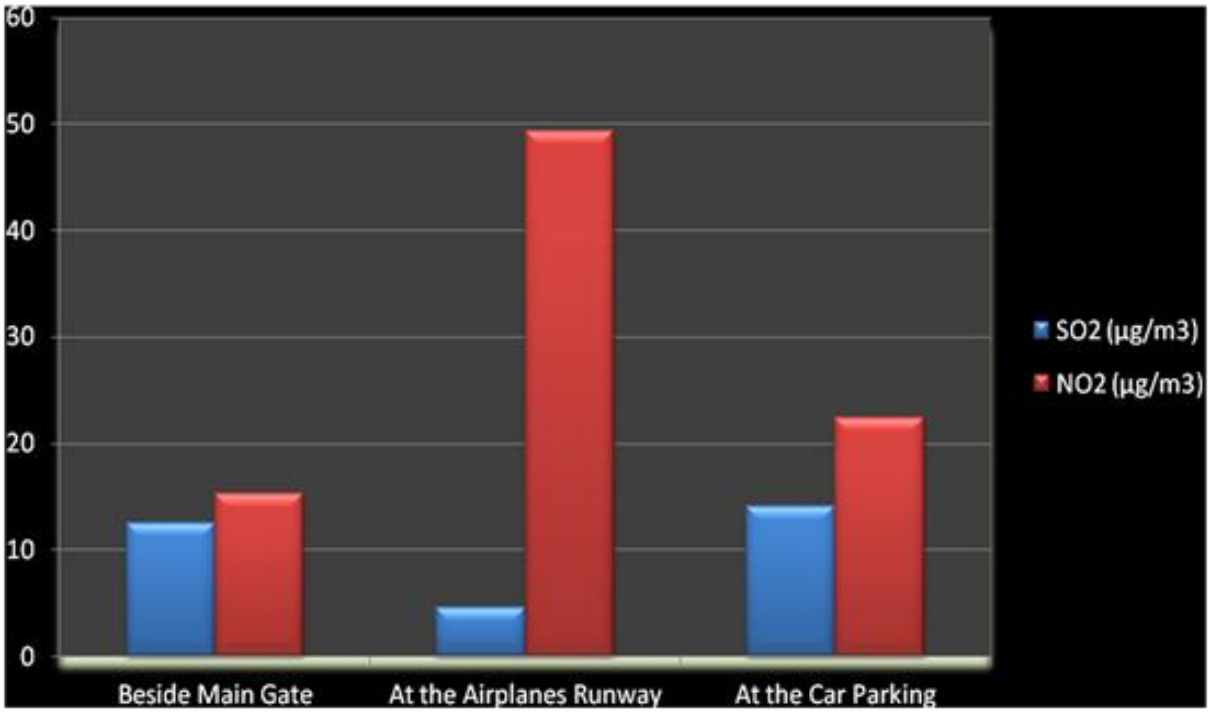

Figure (4-36) the highest one-hour average concentration of SO2, NO2 measured at the different sites during the measurement campaign, October 2014.

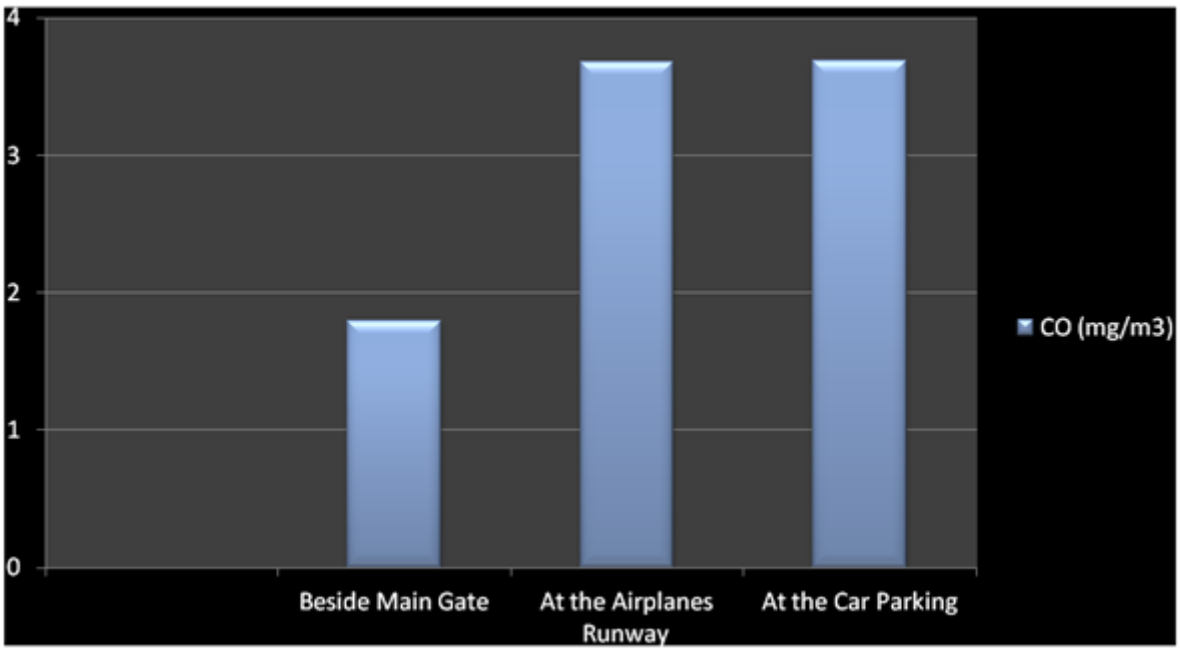

Figure (4-37) the highest one-hour average concentration of CO measured at the different sites during the measurement campaign, October 2014.

- The NO_x concentrations were highest at the airport run way area of Borg El-Arab Airport. The maximum one hour average was about 93.4 µg/m^3.
- SO_2 concentrations were low comparing to the measured concentrations at Cairo area. The highest one-hour average SO_2 concentration measured during the campaign was 37.4 µg/m^3. This was at the parking area at Borg El-Arab Airport.
- CO was slightly high at the airplanes runway and at the Car parking area with highest concentration of this two area are the same 4.3 mg/m^3
- The background PM_{10} daily average concentrations at Borg El-Arab area varied between 44 and 84 µg/m^3
- The prevailing wind during the measurement period was northern and northeastern. The wind speed average was 11 km/h. The temperature average was 26 ºC.
- The hourly concentrations of sulfur dioxide, nitrogen dioxide and carbon monoxide were low comparing to the limit values mentioned in the law no. 4/1994 – annex no. 5.
- The 24- hours' concentrations of sulfur dioxide, nitrogen dioxide, carbon monoxide and PM_{10} were low comparing to the limit values mentioned in the law no. 4/1994 – annex no. 5.

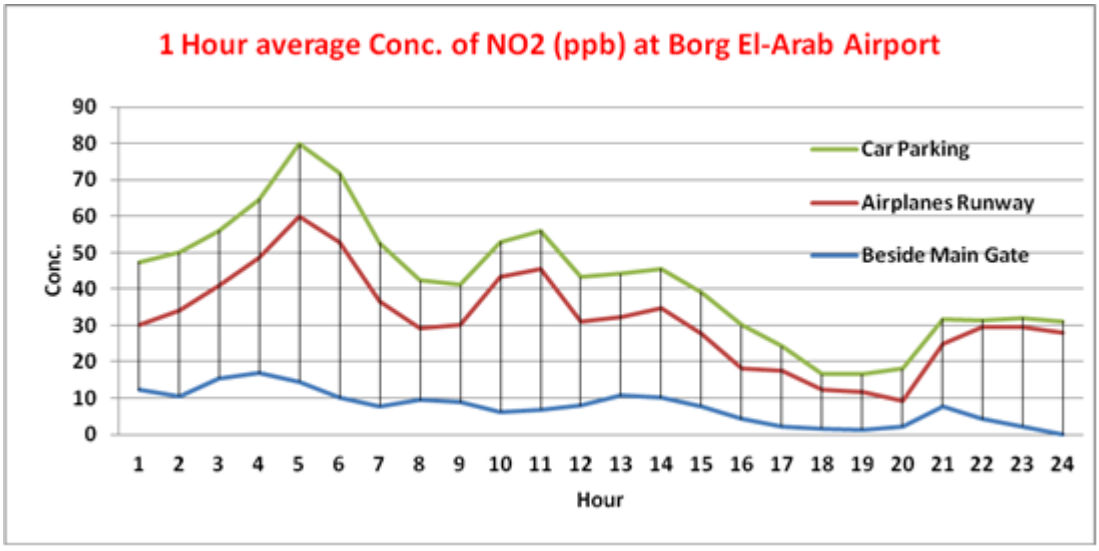

Figure (4-38) one-hour average concentration of NO2 at the different locations in Borg El-Arab Airport

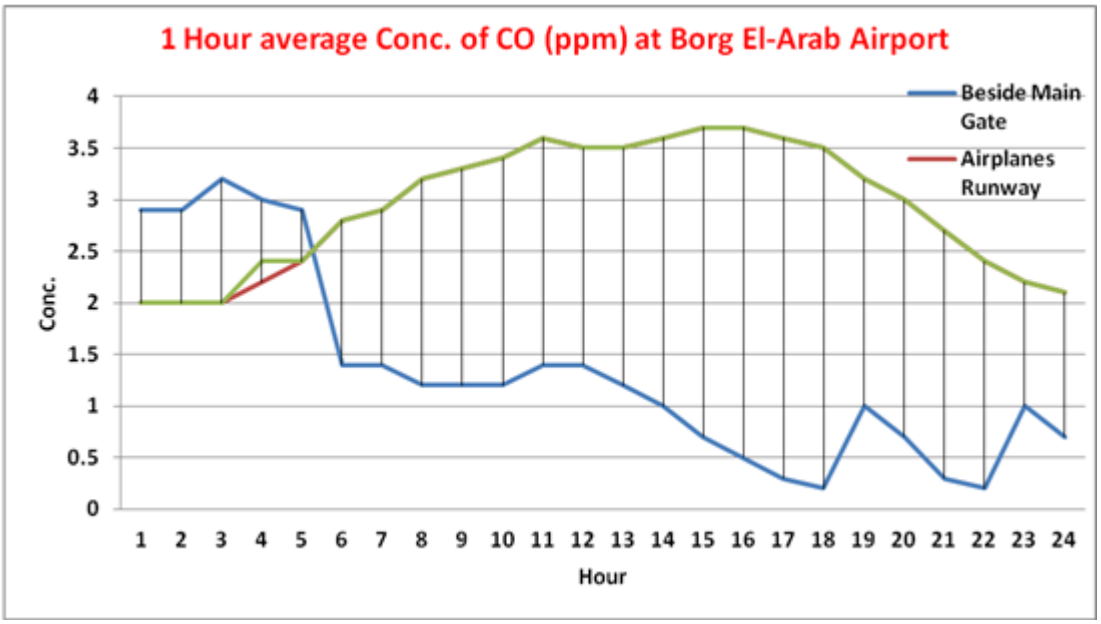

Figure (4-39) one-hour average concentration of CO at the different locations in Borg El-Arab Airport

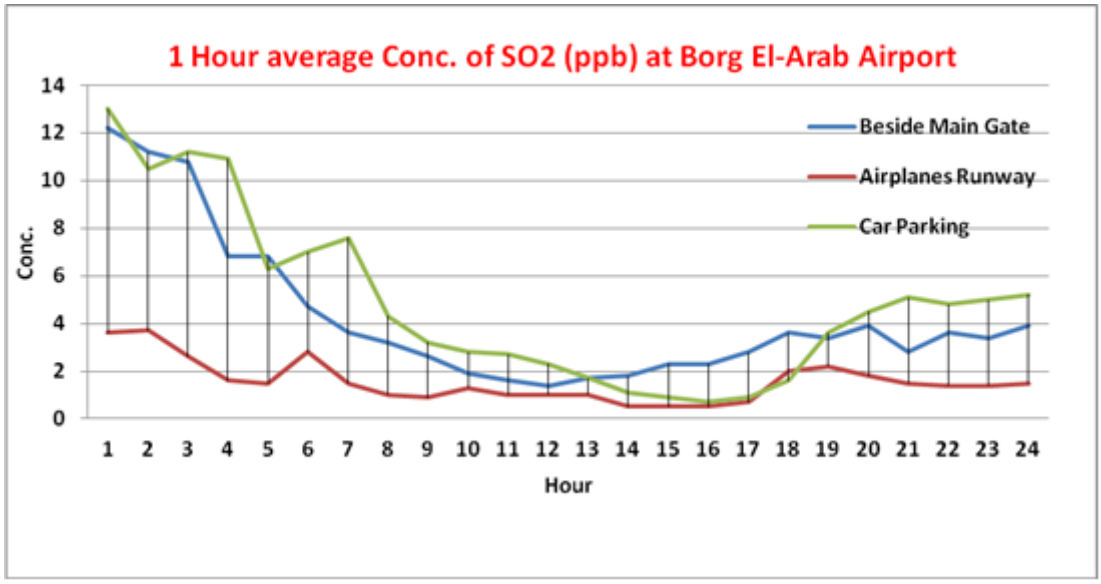

Figure (4-40) one-hour average concentration of SO2 at the different locations in Borg El-Arab Airport

Possible emission sources and compounds

The main sources of air pollution will come from aircraft engines, surface vehicles of all kinds, ground support systems, power plants, fuel tank areas, fire training activities and refueling activities. The main air pollutant compounds acting as the most important indicators for air pollution in the surrounding areas will be:

- Nitrogen oxides (NOx, and especially nitrogen dioxide NO_2), mainly from road traffic, aircrafts and power production.
- Sulphur dioxide (SO_2), from power plants, waste burning, fires and diesel vehicles.

- Hydrocarbons (HCs) consisting of different subgroups of different compounds such as benzene, toluene and xylene (BTX) and volatile organic compound (VOC), from fuel storage areas and fuelling, a source of odors.
- Particulate matter (indicator PM_{10}, particles with diameter < 10 μm), from diesel vehicles and general activities, burning and transport.
- Carbon Monoxide (CO) from road traffic, cars idling at Terminal.
- Carbon Dioxide (CO_2), from all burning of fossil fuels, only a global problem.

For Borg El-Arab airport it will be necessary to perform rough estimates of emission rates and maximum concentrations for the most important indicators. These estimates will depend on the international norms with adaptation to represent the Egyptian conditions in the study area.

Charts of the measurements results

1- Chart For CO Hourly Results

a- At the First point: (Besides main gate)

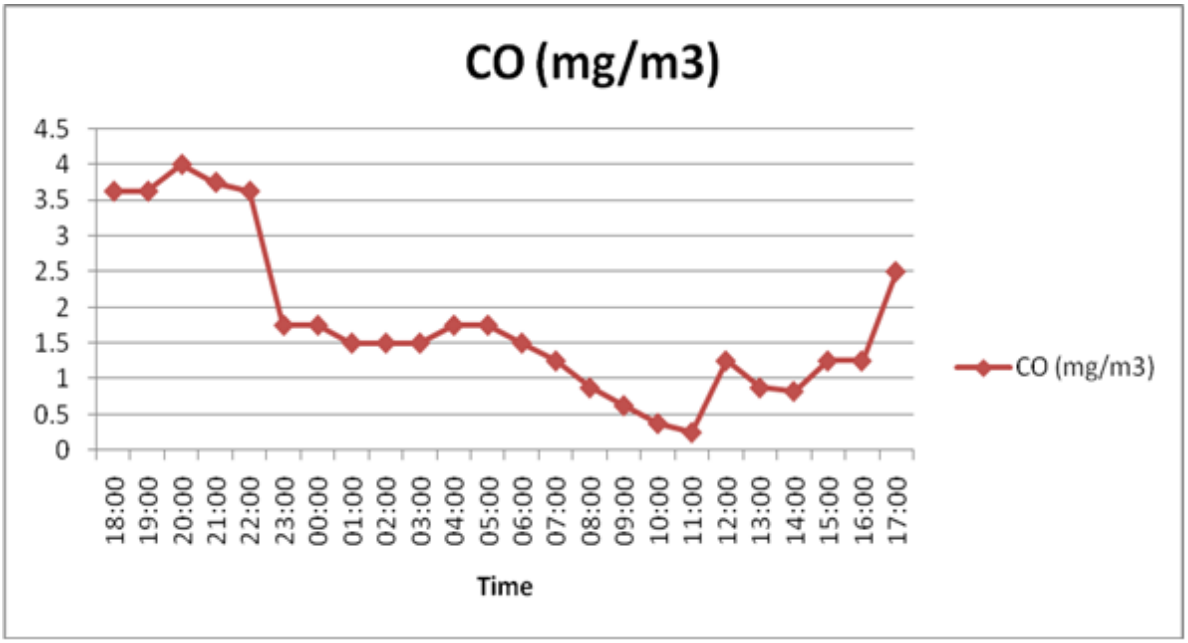

Figure (4-41) CO hourly results besides the main gate

b- At the Second point: (Air planes runway)

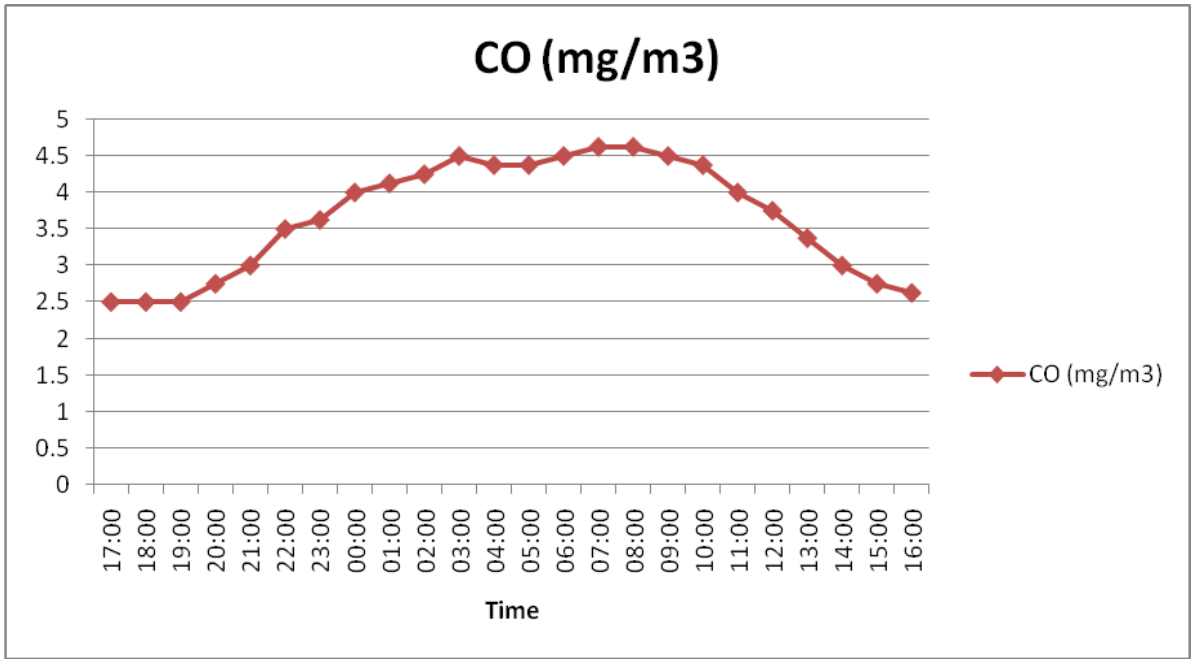

Figure (4-42) CO hourly results at the air planes runway

c- At the Third point: (Car Parking)

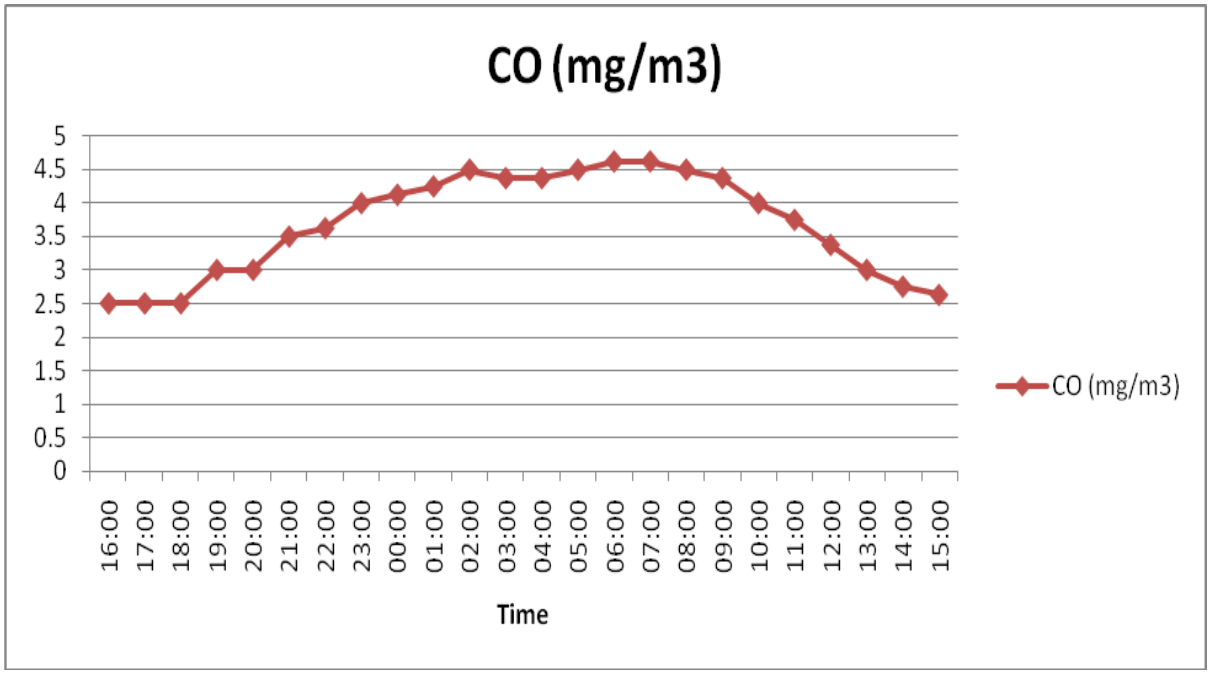

Figure (4-43) CO hourly results at the car parking

4.10.4 Traffic

Traffic and Access to Airport

Assessment Methodology

As vehicular traffic volumes increase spectacularly around the world, Traffic Access and Impact (TAI) studies have become more urgent to be performed prior to any development or upgrading of any existing roadway. They are considered a prerequisite issue before executing any improvement.

In general, the purpose of the TAI studies is to assess the traffic impacts on any proposed development of a roadway. This part represents the assessment of the traffic impacts on the proposed project (Borg El Arab Airport phase ∏) to be implemented in the surrounding road network of Borg El Arab Airport.

The main objective of this study is to assess the impacts of the traffic generated by the proposed new terminal in the Airport, during the construction and operation periods, on the surrounding road network of the Airport.
In order to achieve such objectives the following tasks were carried out:

1. Identifying the local road network surrounding the site of the Borg El Arab Airport;
2. Describing the physical characteristics of the identified road network;
3. Prediction traffic volume data through a representative sample of traffic volumes on the surrounding road network;
4. Conducting analysis on collected and historical traffic volume data;
5. Conducting basic analysis to estimate general indications of the expected operation phase of the new terminal.

To achieve the objective of this study and to perform the tasks listed above, the methodology plan adopted has been established. This plan can be divided into the following two (2) stages; firstly Data Collection the second Data Analysis and Results As follows:

Stage 1: Data Collection

- Office Data
- Field Data

Stage 2: Analysis and Results

- Traffic Growth Rate and Future Volumes
- Traffic Analysis (Capacity and LOS)

The following figure shows the methodology plan

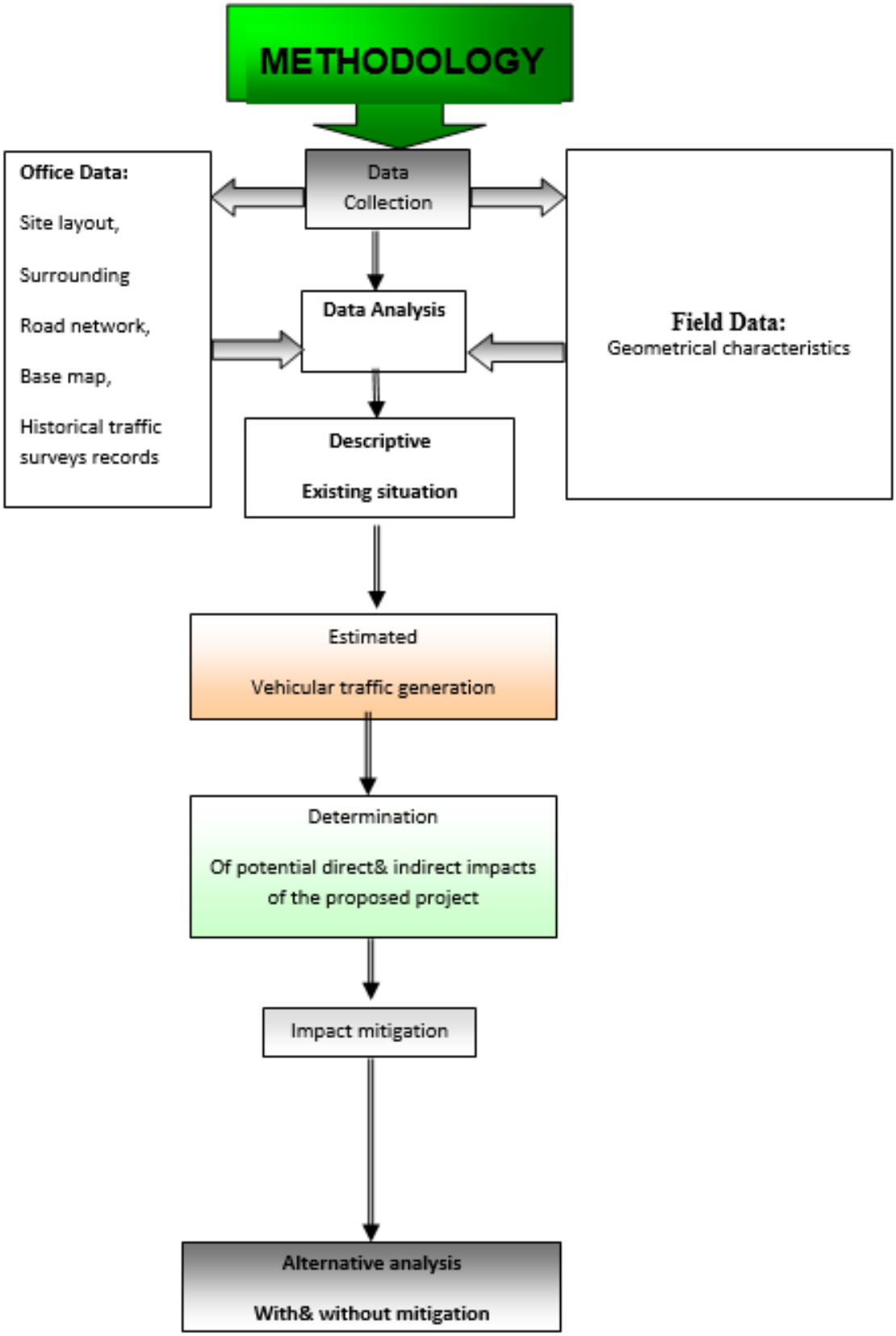

Figure (4-44) shows the methodology plan

The methodology plan

Stage 1: Data Collection

The first step in this study was to collect and assemble the following data:
The data, which were collected in this stage, were pertinent to the following:
Site layout;
Surrounding road network;
Base maps (Airport location);
Historical traffic reasons.
Geometrical characteristics
A traffic volume count was specific as the office data collection

Stage 2: Analysis and Results

Two (2) types of analysis were conducted in this study: statistical analysis and traffic analysis. Both office and field data were used in this analysis.

Traffic Analysis: The traffic analysis resulted in estimating the Level Of Serviceability (LOS). LOS is a qualitative measure that describes the operational conditions within a traffic stream and their perception by motorists and passengers. The LOS analysis was carried out as described by the Highway Capacity Manual (HCM), 1994 for multilane highways, the traffic analysis involved estimating of:
Relative parameter of Flights no. / Vehicles no.
Relative parameter of Passenger. No. / Vehicles no.
Potential traffic volume till year 2030 based on the above parameters.
Main entrance airport.

Potentially Affected Area

The entrance roads identified as potentially affected roads are as follows:

1. The link road between International coastal road and Borg El Arab Airport
2. The link road between International road and Borg El Arab Airport (Mehwar AL-Taameir)
3. The link road between Alexandria desert road and Borg El Arab Airport(Elkafouri road)
4. The link road between Alexandria desert road and Borg El Arab Airport(El aquaria road)

Base Map

Figure (4-45) Borg El Arab Airport Access Roads

The Airport Site Location

The Airport is located about 250 km north west of Cairo in the northern region of Egypt, about 43 km south west of the larger city of Alexandria and about 10 km east new Borg El Arab city.

The Airport is located at Latitude of 30˚ 35’ 04” North, Longitude of 29˚ 41’ 44” East and Elevation of 55 m above mean sea level. Access to the airport is provided via the coastal road at sidiKreir and the road connecting the Cairo – Alexandria desert road with the new Borg El Arab city as the above topographic map for Borg El Arab Airport site location and access roads.

Airport access is one key issue of airport passenger and cargo demand, movement and convenience.

In general, road and railway should consider airport access; however railway does not exist to/from the project site at present, and there is no plan of the railway project to the airport and in surrounding area in near future. On the other hand, road network is improved in the surrounding area. For considering the airport access, road network development is most concrete way.

Existing Facilities

There are four (4) main directional roads which surround Borg El Arab international Airport

The airport will be improved as an international airport. It will serve a much wider area, and the access road network should be considered on a national scale, connecting between the airport-Located region and local level, and between surrounding area of the airport.

Table (4-25) shows characteristics of the (4) main directional roads

Number	Name	No. Of Lanes (2 way)	Road Width (per direction)	Surface type condition Visual inspection	Divided
1	The link road between International coastal road and Borg El Arab Airport	4	10ms	Asphalt =good	Yes
2	Mehwar AL-Taameir	4	10ms	Asphalt = Medium	Yes
3	El Kafouri road	4	10ms	Asphalt = Medium	Yes
4-1	El aquaria road Sec (1)	2	7ms	Asphalt=failure	No
4-2	El aquaria road Sec (2)	4	10ms	Asphalt= Medium	Yes

General observations of all the links

1. Shoulders

Does not meet the specification limits in terms of maintenance.

2. Medians

Poor maintenance and the conditions are not met the full engineering.

Figure (4-46) shows the current shoulders and medians

3. Cross Intersections

Most cross intersections do not meet up to the safety of the current movement or expected, In addition to the lack of U-turn in accordance with the principles of engineering.

4. Barrier curbs & Traffic Barriers

All Barrier curbs &Traffic Barriers do not meet up to control the behavior of drivers; there is also no Curb Parking

Figure (4-47) shows the road cross intersections

5. Traffic Safety Tools AS:

Traffic Signals& Signs, Road Marking, Roadway Lighting. All roads suffer from inadequate traffic safety factors

6. Railway level crossing the intersection of Alexandria – Matrouh

Because the road from the international coastal to airport site is through synthesis coming traffic densities of the city of Alexandria and cities in central and eastern Delta ,in addition to coming densities of International Coastal Road, and because the Railway Alexandria Matrouh line intersects with the road aggregate accidentally without any protections, which may cause serious accidents

Figure (4-48) shows the current traffic safety tools AS

7. Airport Main Entrance

The current entry area in front of the main gate of the airport. It is a roundabout and cut the main road aspects of concrete barriers, does not meet the requirements of engineering specifications, whether current or anticipated traffic

Figure (4-49) shows the airport main entrance

The following figures shows the above (4) main directional roads

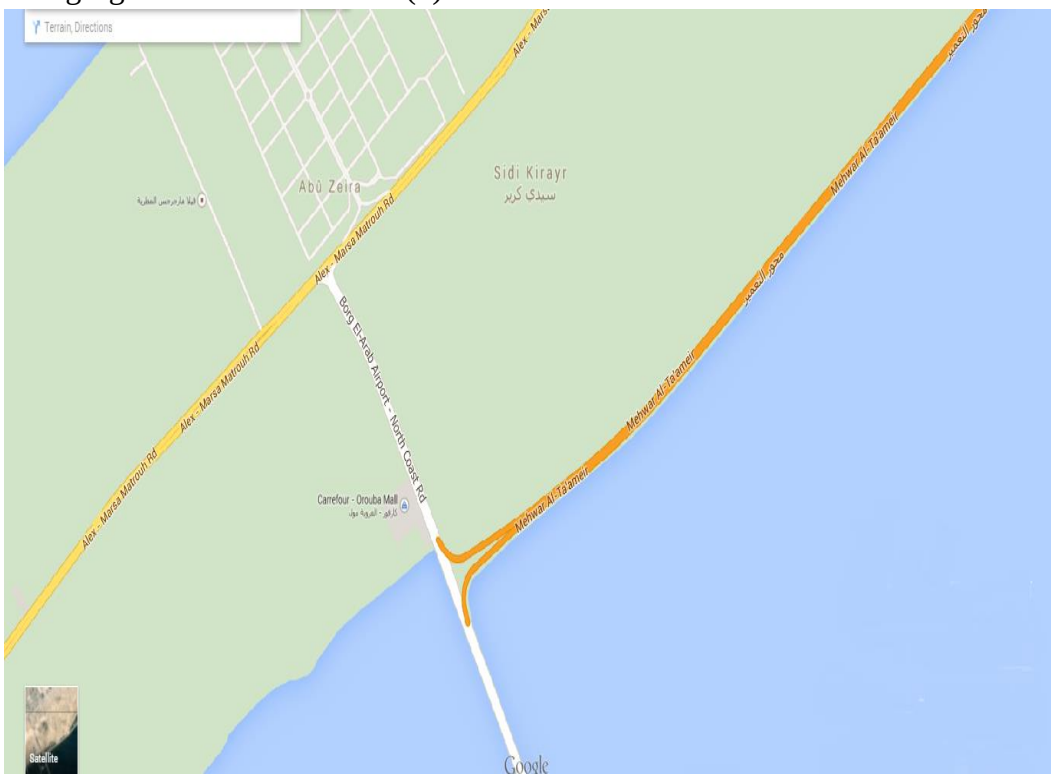

Figure (4-50) the link between coastal road and airport road And Mehwar AL-Taameir

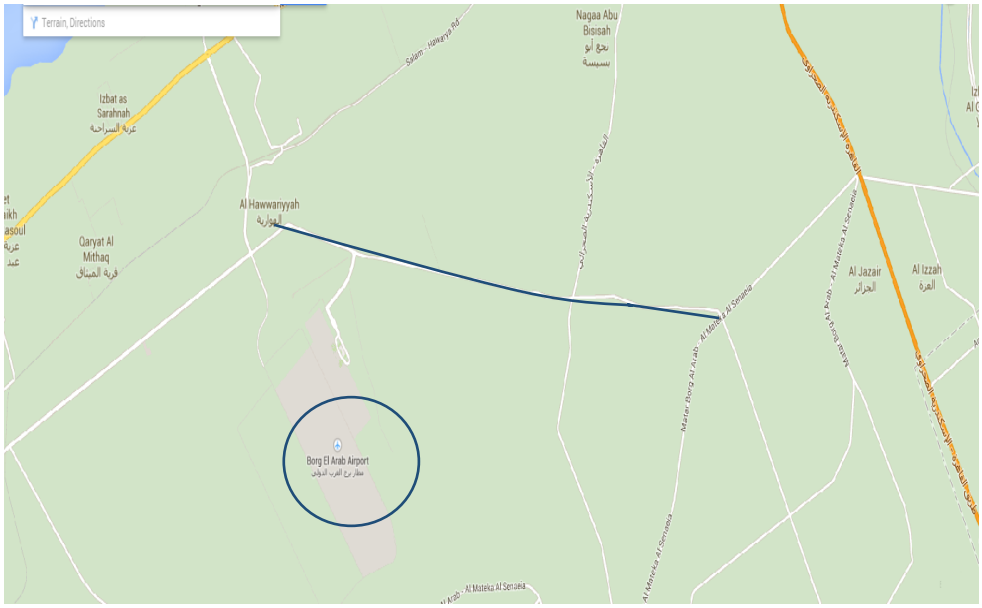

Figure (4-51) El aquaria road

Figure (4-52) El Kafoury road

Traffic volume count

A traffic volume count was specific as the office data collection; the reference in this is that the peak traffic in the study area achieved during the summer period ending last September, Therefore, the study will depend on a range of approved sources to estimate the expected traffic volume to 2030 as follows:

A. The Conceptual designs report"BORG EL ARAB INTERNATIONAL AIPORT MODERNIZATION PROJECT PHASE 2 MARCH 2013-ECG AND Others "Table (4-26) Summary of SAPI Study - Air Traffic Demand Forecast as following:

Table (4-26) Air Traffic Demand Forecast

Annual	2015	2020	2025	2030
Passenger	2,357,758	3,610,715	4,754,833	5,491,699

B. The annual growth rate

According to the Egyptian CODE 1998 Part VI of the road works page 10,Annual increase of between 2 and 4%,Due to the study area of development plans, especially in the field of export of goods through the cargo village will be taken 5%.

C. Distribution of traffic volume

The study will be based on the traffic volume distribution among all passenger vehicles types and all types of transport vehicles on the roads in the area on data analysis and statistics on the Egyptian General Authority for Roads and Bridges in 1994 based on

urban arterial roads on medium density, And 40% will be taken because influence of the nature business area.

4.10.5 Solid and Hazardous wastes

Solid waste sources in the airport

- Aircrafts.
- Passenger terminal building (arrival and departure)
- Mall.
- Administrative offices.
- Kitchens and cafeterias.
- Duty Free.
- Ground Services activities that serve the aircrafts.
- Technical and administrative stores.
- Landscape and gardens.
- Workshops.
- Airport security forces Camp.
- Facilities of private companies that provide services for the aircraft at the airport.

Evaluation of the current situation

Traditionally at international airports a proportion of 40% of the solid waste and 93% of organic waste (food residue) are resulting from the different shops and shopping areas. But the current international Borg Al Arab airport experiences a different side of objectivity. That of about 58% of the passengers who are using the airport are attached to the work of the Egyptian workers abroad and pilgrims from Alexandria–Cairo – Delta governorates and therefore, the culture of the passenger here play a pivotal role in waste volume and types.
Although there are different cafeterias within the halls of international travel, however the passenger does not buy from them in a normal way this is because their high prices. The demand for these cafeterias and restaurants is very restricted, and the passengers can get with them some food or drink to take during the waiting time for their trip.

Figure (4-53) a group of passengers of Borg Al Arab International Airport

Figure (4-54) Passenger of Borg Al Arab International Airport.


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Figures (4-55, 56, 57, and 58) show commercial area hall of international travel and the cafeterias are free of passengers

Thus, residues resulting from the airport departure halls differ from traditional waste of other airports.

Such as food residue and plastic bags and sheets of old newspapers and plastic and metal containers with high weights which is more than any from other cafeterias or restaurants in the passenger halls.

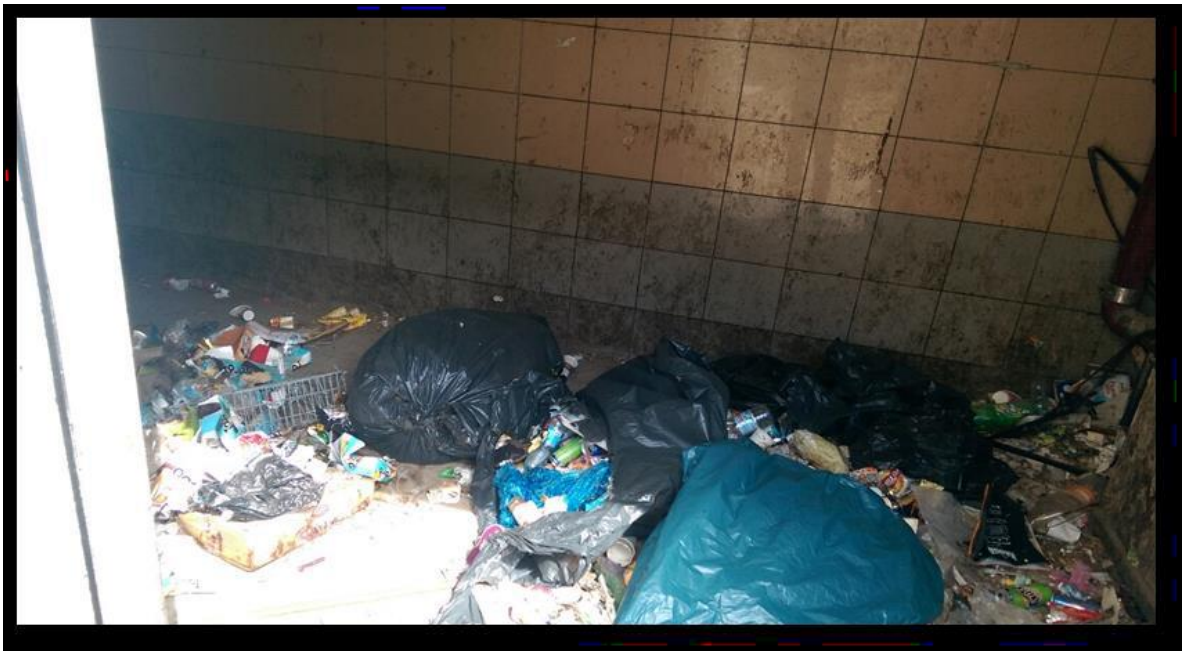


Figure (4-59) Sample of organic solid waste resulting from the passenger terminal building at the airport.

However, the case of Borg Al Arab Airport agree completely with the other airports but in terms of size and quality of the resulting solid waste
This type of waste is a common factor in all airports in the world in terms of solid waste types generated by aircraft Consists of several elements, one of the main elements is the plastic, toilet papers, cardboards and empty plastic water bottles.
The wastes generated from aircrafts are classified by its quality and appearance as a first class and easy to be recycled.
But some of the recommendations of international and domestic legislation of some countries classified these residues as hazardous wastes but the Egyptian legislation doesn't do so.

Figure (4-60) a sample of solid waste from the aircraft Borg Al Arab International Airport.

Future airport expansions necessarily mean the expansion of the movement of aircrafts and the number of passengers, thereby doubling the number of restaurants Cafeterias and which means a steady increase in the volume of solid waste generated from Operation.

Thus, the expected size of the solid waste of the airport as a whole is in a steady increase of a peak percentage of 8% from year 2020 to an expected increase in 2030 of 15%.

Table (4-27) Solid waste volume compared to the size of aircraft movement, in Borg Al Arab International Airport.

Total Volume of Human Waste 2014	
Source	Waste (Tone/Day)
Terminal	2
Parking	1.75
Offices	1.2
Public Cafeterias	0.5
Total	5.45

Table (4-28) Volume of Solid wastes resulting from different sources year 2024

Current Aircraft Movements & Forecasting				
Years	Flights	Percentage	Event	Volume of Solid Waste/tons-Year
2010	7312	Base	Base	Base
2013	25986	Base	Base	Base
2014	20825	2%	6325	136.417

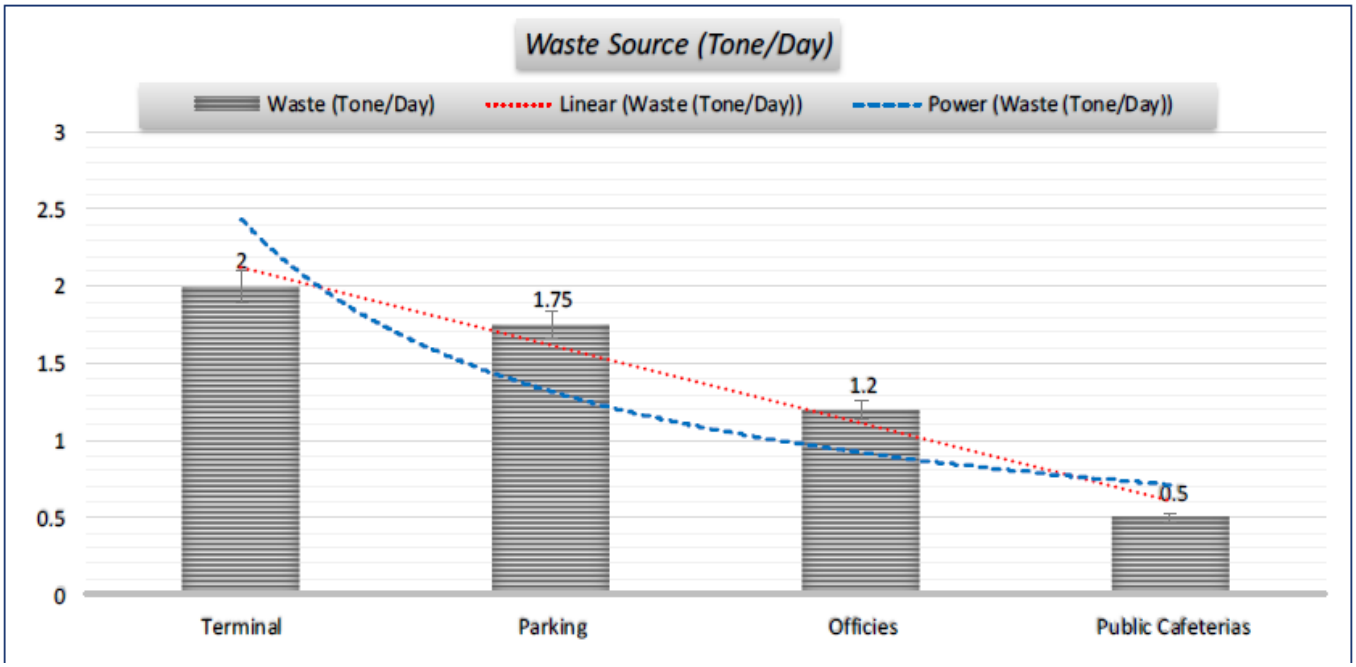


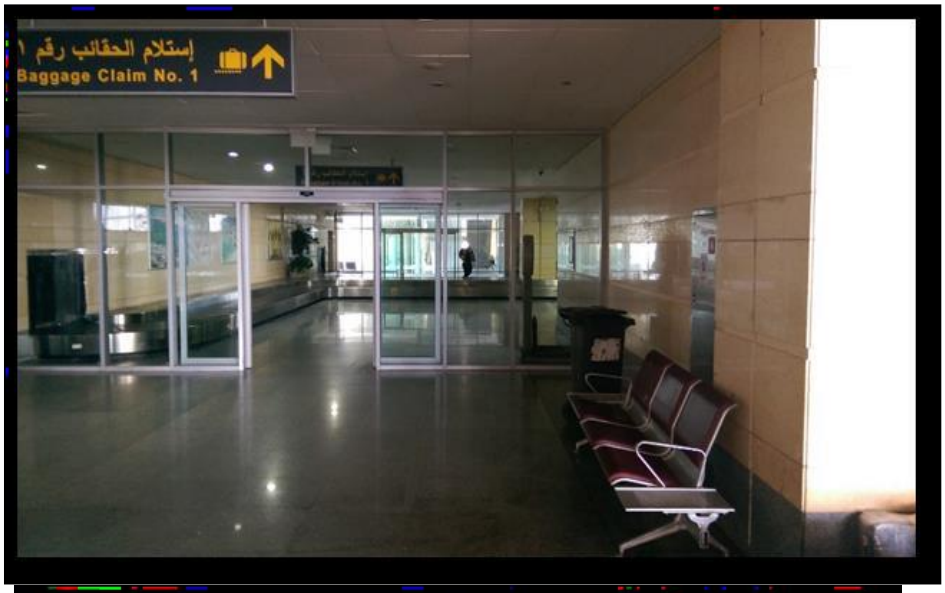
Figure (4-61) Solid waste volume resulting from different sources on the airport in 2014

Current management system for solid waste

1. **First: Collection:**

Borg Al-Arab Airport is engaged to a company specialized in housekeeping and collecting solid wastes from every source in the airport without the involvement in any stage except the collection , by the means of wastes baskets in every facility in the airport the passengers put their wastes in, besides the administrative offices that generate large amount of wastes.
In this way, the housekeeping company transfers the containers to a certain place and the dispose the wastes in the temporary collection room through a metal tube reaches from the passengers halls to the collection room directly.

Or the container is fully transferred to the building exit then gets rid of the waste and replaces the container in its initial place.



Figures (4-62, 63 and 64) show the containers where the solid wastes are collected inside the airport.

2. Second: Temporary Storage:

After the collection stage from every facility in the airport including the aircrafts. The contacting housekeeping company transfers all the wastes to the wastes' temporary collection room in the current terminal building.
Thus it provides a vehicle prepared to safely dispose all the wastes outside the airport. Where the contractor who is specialized in wastes disposal has to bury the wastes of no value in a public landfill stated by the governmental agencies in Alexandria city. Therefore the valued wastes can be recycled or sold according to the own interests.

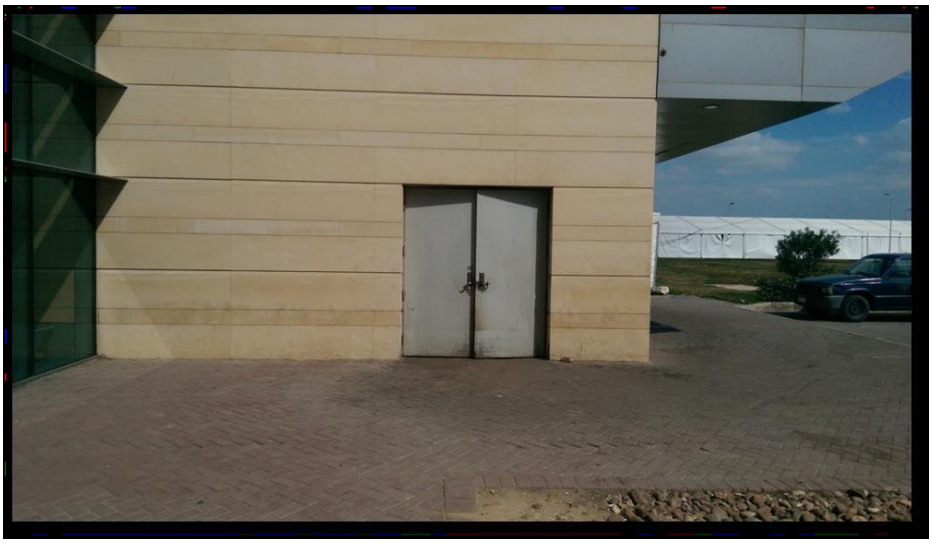


Figure (4-65) temporary assembly plant for solid waste attached to the current international terminal building in Borg Al Arab Airport from outside.

Figure (4-66) shows tube reaches the terminal building to the ground floor where the assembly room of solid wastes is located.

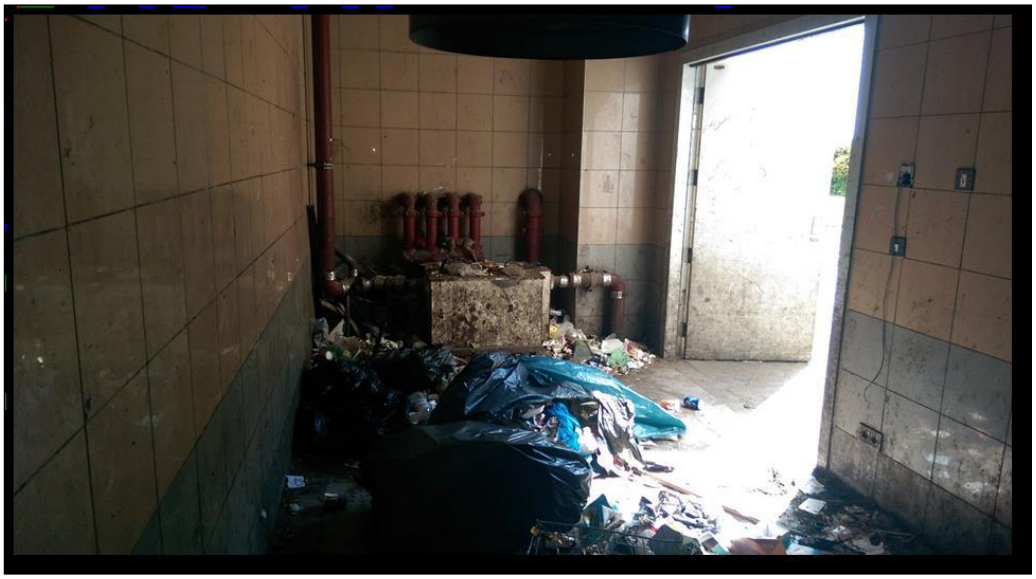


Figure (4-67) shows the assembly room of solid wastes

The ground service companies also collect wastes from aircrafts that serve it upon arrival to Borg Al-Arab international airport. And assembled in an open place in the apron area of the airport without the consideration of any environmental procedures. This is because of the absence of a temporary assembly plant for solid waste resulting from aircraft and ground service companies operating at the airport in the landing area.

Figure (4-68) shows the Aircrafts and Ground services' companies wastes assembly point in the landing area of the airport.

4.10.6 Vibration

The current vibration level was measured to compare with the standard limits

Vibration Measurements

Figure (4-69) shows the Vibration measurement groups

Table (4-29) Measurement locations and vibration amplitude **(Measured in velocity)**

Point	Amplitude (mm/sec)
Point 1	102.127 m
Point 2	86.123 m
Point 3	112.204 m
Point 4	109.006 m
Point 5	90.15 m
Point 6	101.773 m
Point 7	86.015 m
Point 8	169.095 m
Point 9	89.552 m
Point 10	88.23 m
Point 11	92.503 m
Point 12	94.084 m

Measured in acceleration

Point	**Amplitude (mm/sec^2)**
1	3.527
2	3.543
3	1.182
4	3.429
5	1.486
6	1.9
7	2.486
8	1
9	3.137
10	2.416
11	4.134
12	3.043
13	1.043
14	5.533
15	3.921
16	4.035
17	3.51
18	6.418
19	2.67
20	3.63
21	3.198
22	3.072
23	1.71
24	3.807

For more details about the vibration measurements & results see annex (10)
By using the conversion table in appendix (10) it is very clear that the max vibration will be less than 0.01 mm / sec meaning it has very limited effects.
Also the measurements was repeated in velocity terms without covert ion It was found less than Standard limits details in appendix (10)

Conclusion for runway measurements

1. The measurement was taken 10 meter way from the edge indicating a very high impact.
2. The results for all value and for all spectrum indicate lower than expected at this location meaning the damping effects of the soil is high and soil absorb quite well vibration generated , it have a good damping coefficient.
3. Our focus was in low frequency range as it would expected to travel long distances.

Chapter 5 – Potential Impact

5 Potential Impact

5.1 Noise Impact

Based on the INM prediction, Figure (5-1) represents the noise level contour within and around Borg El Arab Airport (with the existing runway) for the year 2015 due to the current aircrafts movements.

The percentage of annual increase in flight numbers in Borg El Arab Airport was adopted from the SPAI study using the Bottom up Methodology (high case) Scenario. Table (5-1) presents daily flight numbers for Borg El Arab Airport. Details of flights per each aircraft type are presented in Annex (2) as assumed in the prediction model. The annual aircraft movements (including commercial and non-commercial movements) that occurred in Borg El Arab Airport in the year 2013 were 25,986 flights.

Table (5-1) shows the expected no. of flights

Year	Total no. of flights (DNL)	Total no. of flights (WECPNL)
2015	99	78
2020	153	121
2025	200	158
2030	250	198

* On DNL prediction based on busiest day, while using average for WECPNL

* The annual growth rates are assumed according to the SAPI study for bottom-up method "See (SAPI) study page (4-64) table (4.5-6)".

* These Numbers of aircraft movements are based on appendix 1 and 2.

Figure (5-1), Figure (5-2), Figure (5-3) and Figure (5-4) show the prediction of the noise contour for Borg El Arab Airport (with the existing runway) for years 2015, 2020, 2025 and 2030 respectively using DNL noise metric.

Figure (5-1) 2015

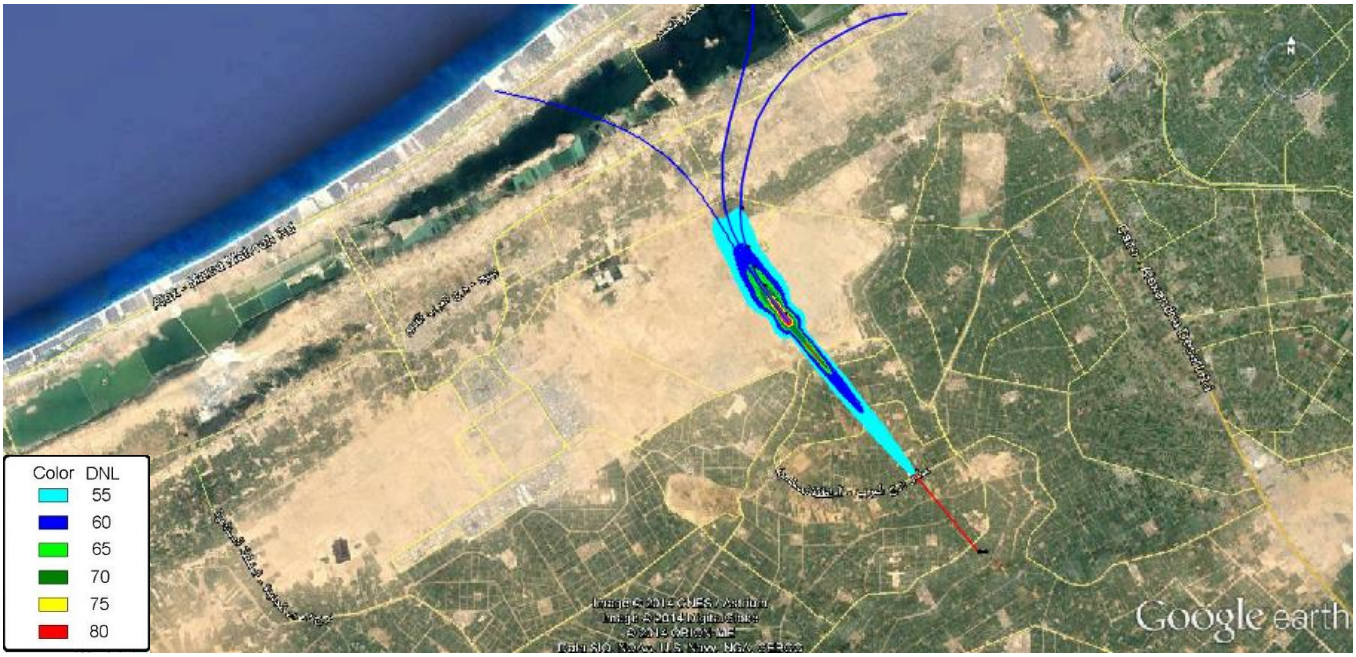


Figure (5-2) 2020

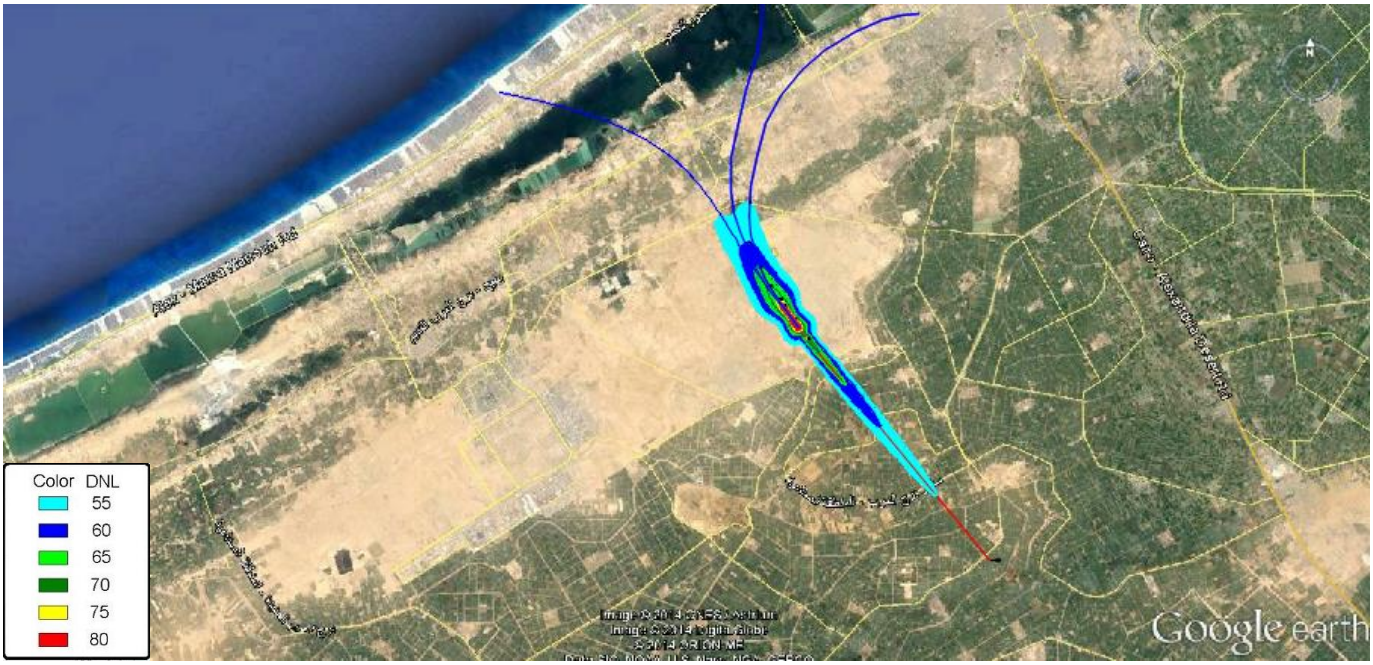


Figure (5-3) 2025

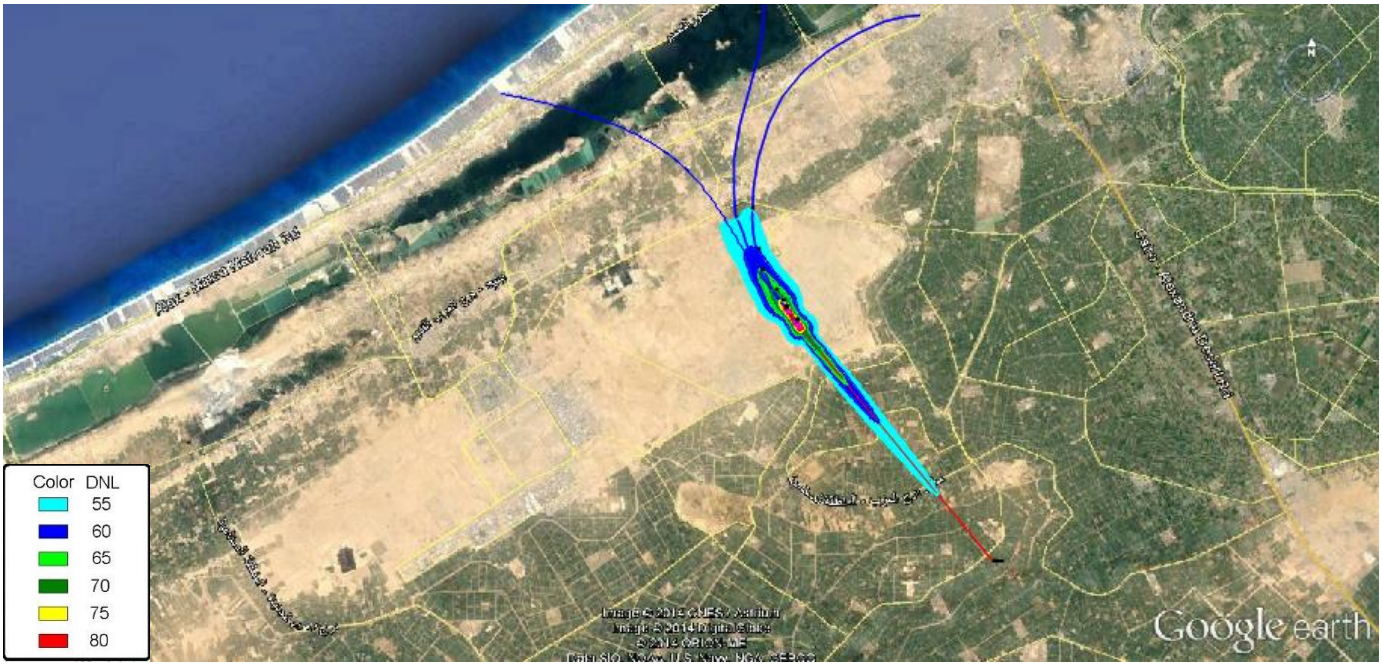


Figure (5-4) 2030

Figure (5-5), Figure (5-6), Figure (5-7) and Figure (5-8) show the prediction of the noise contour for Borg El Arab Airport (with the existing runway) for years 2015, 2020, 2025 and 2030 respectively using (WECPNL) noise metric.

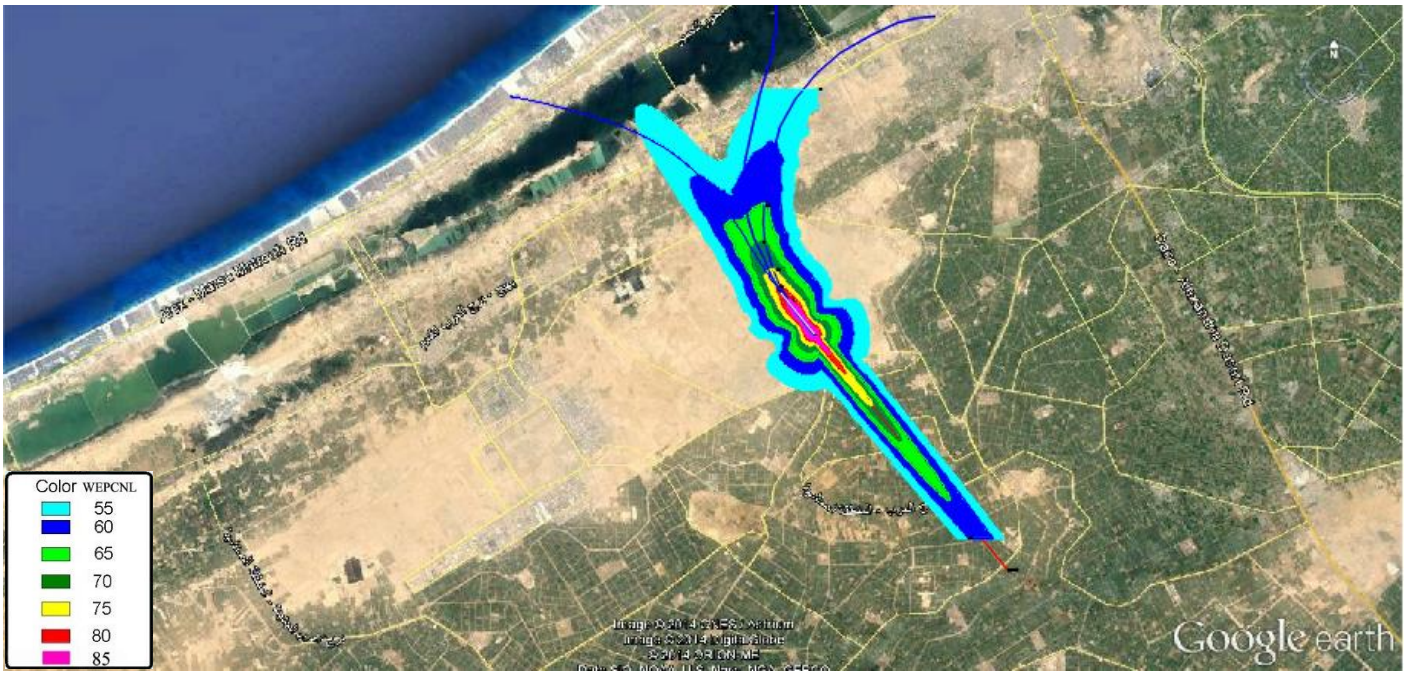


Figure (5-5) 2015

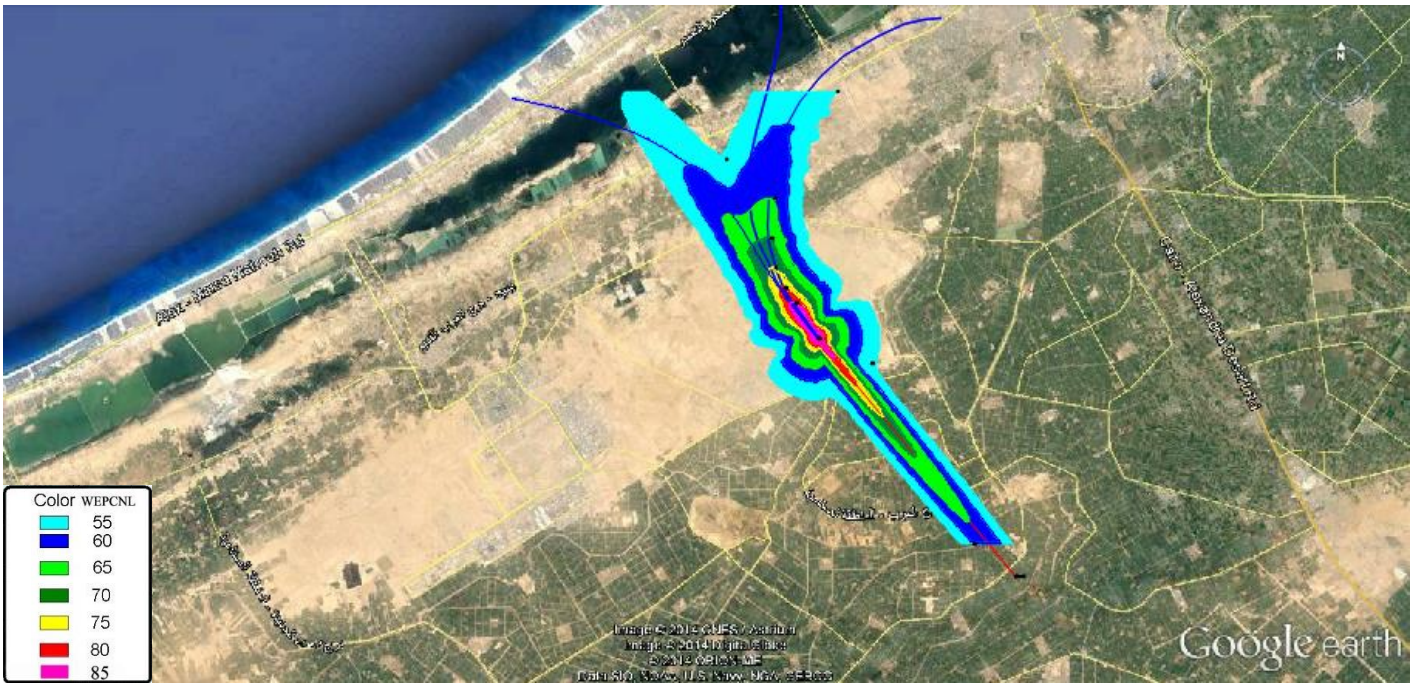


Figure (5-6) 2020

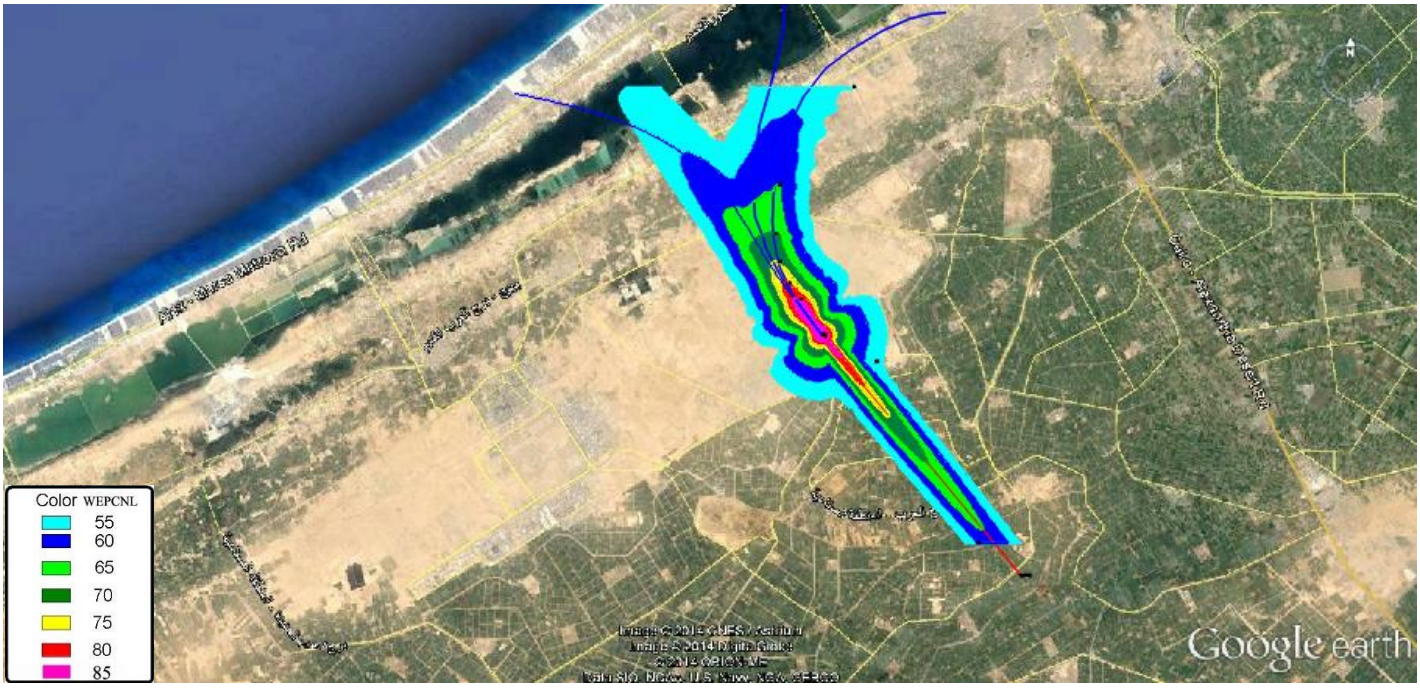


Figure (5-7) 2025

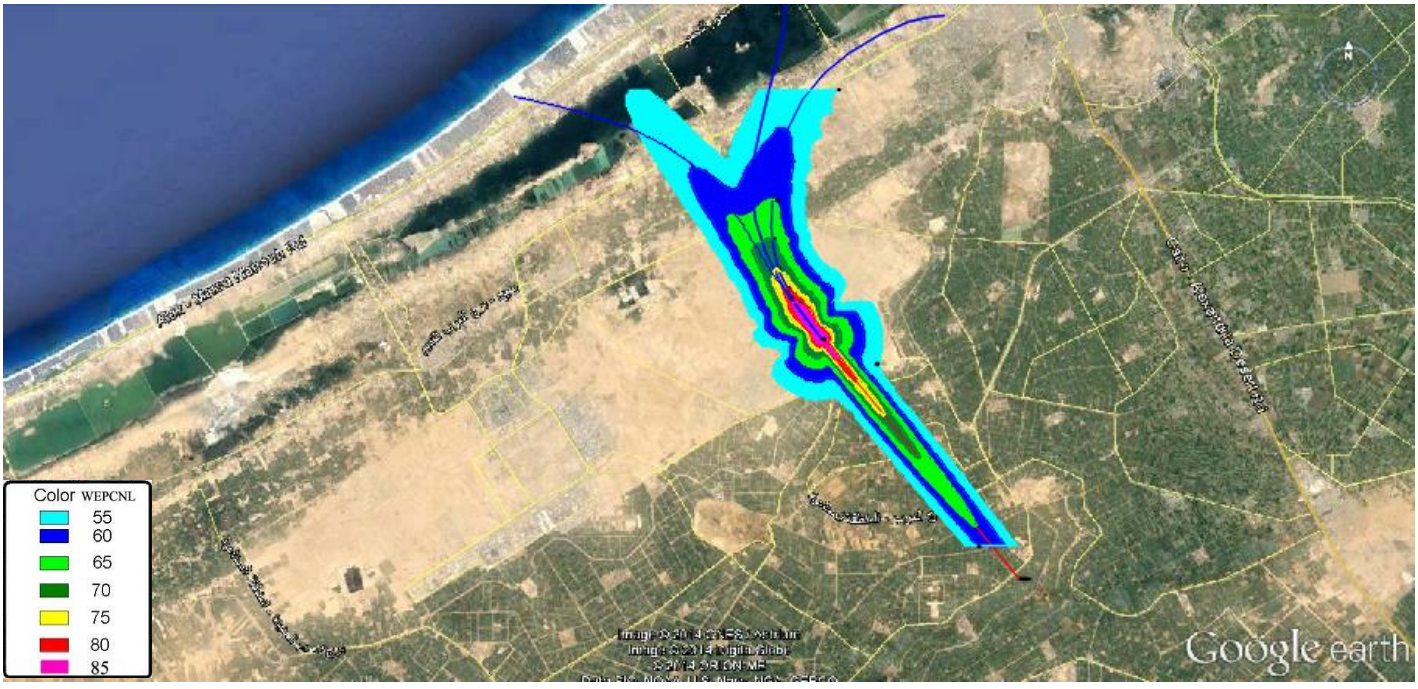


Figure (5-8) 2030

5.1.1 Contribution from the Proposed Project

5.1.2 Impacts on the surrounding areas

The surrounding area around the Airport is categorized by its low population density. The farming area at the end of runway 32 has a population density of one family per 2.5 hectare (eight (8) persons for each 2,500 km^2).

Noise prediction at year 2014 indicated that there are no negative impacts on the adjacent areas around the Airport (at takeoff end 14 and runway end 32)

At year 2030, the affected areas outside the Airport are extended mostly towards the farming area (low population density). The level of sound at the runway take-off end 14 increase in some limited areas to 60 dB.

Hence, the effect if noise on the residential areas including the schools and the chicken farms can be considered to be very limited, it is also expected that more data will be available in implementing the mitigation scheme (details are presented later Hence, a re-evaluation of the results for year 2030 can be carried out. It is expected that the value predicted will be less than that presented other sources
Such as traffic around the area

Table (4-2) summarizes the total affected area inside and outside the airport premises.

dB(A)	DNL			
	2015	2020	2025	2030
65	5.483	6.151	7.207	6.695
70	2.147	2.36	2.833	2.616
75	0.87	0.936	1.097	1.028
80	0.418	0.464	0.531	0.504
85	0.106	0.136	0.163	0.149

dB(A)	WECPNL			
	2015	2020	2025	2030
65	44.175	52.593	57.069	51.248
70	20.422	24.828	26.91	24.076
75	9.584	11.435	12.503	11.016
80	4.245	5.257	5.776	5.004
85	1.798	2.221	2.445	2.16

5.1.3 Strategic Plan for Borg El Arab Airport

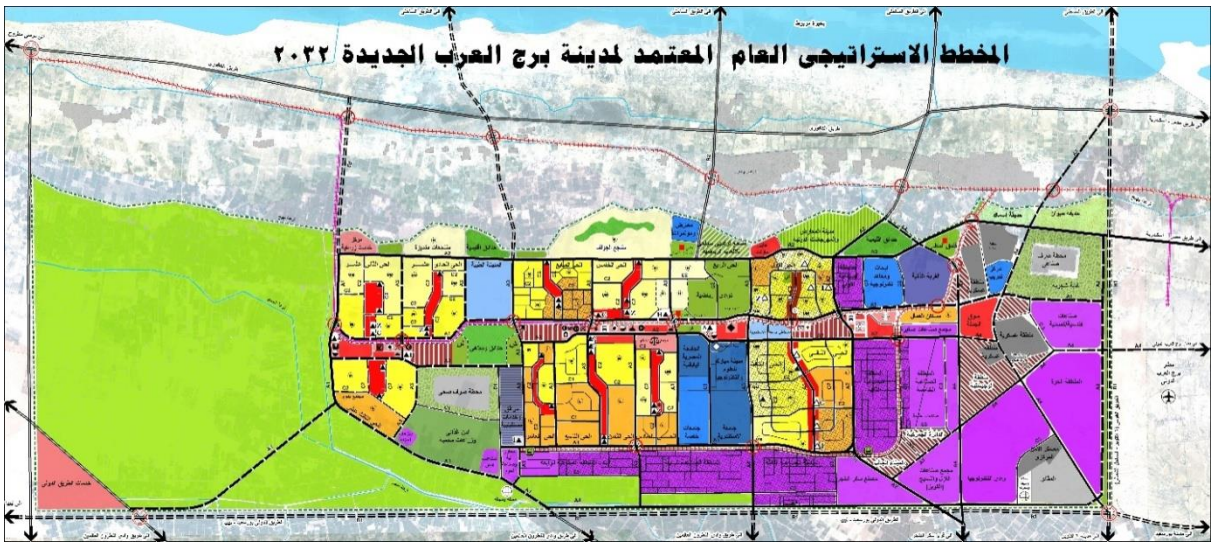


Figure (5-9) strategic plan for Borg Al Arab

5.2 Air quality impact

5.2.1 Airport layout

For many years, Borg al Arab airport has been an important link between historic Alexandria and many countries throughout the Middle East and North Africa. Borg al Arab Airport also proudly serves as the main international entry point for Alexandria and the Nile Delta Region

Borg El Arab International Airport is an airport serving Alexandria, Egypt. It is located about 40 km (25 mi) southwest of Alexandria, in Borg El Arab. The airport also serves the nearby areas of the Nile Delta. Borg El Arab is the principal airport of Alexandria starting December 2011 after the closure of Alexandria International Airport due to a major re-development program that will take two years in development.

Borg El Arab Airport had a major expansion in terms of the airport's passenger and cargo handling capacity in response to growing demand and the new facilities were inaugurated in 2010.

The airport consists of a new passenger building and an administration building. The passenger terminal is designed in the shape of a boat and consists of three floors

The new building been descried earlier in chapter1

5.2.2 Air traffic density

Passenger forecasts have been made till the year of 2024 as shown in the following table.
The basis for all emission estimates in this report is the prognoses given for air traffic density at Borg El-Arab Airport for 2024. The numbers used in the model estimates later are given in table (5-3).

Table (5-3) estimated number of flights and passengers at Average airport for 2024. Annual averages as well as peak hour traffic is presented.

	Year	flights	passengers
Annual	2010	14433	1087000
	2024	26223	2689000
Peak Hour	2024	11.4	-

As there was no available data about the rush hour prognoses during the year of 2024, rough estimation has been made assuming that Borg El-Arab airport will be developed.

5.2.3 Aircraft emissions

Emission factors

Emissions from aircraft originate from fuel burned in aircraft engines. The fuel use and emissions will be dependent on the fuel type, aircraft type, engine type, engine load and flying altitude.
Two types of fuels are used. *Gasoline* is used in small piston engine aircraft only. Most aircraft run on kerosene, and the bulk of fuel used for aviation is kerosene. Turbojet engines use only energy from the expanding exhaust stream for propulsion, whereas turbofan and turboprop engines use energy from the turbine to drive a fan or propeller for propulsion.
Most emissions at Borg El-Arab airport will originate from Civil IFR (Instrumental Flight Rules) flights, which cover the scheduled flights of "ordinary" aircraft.

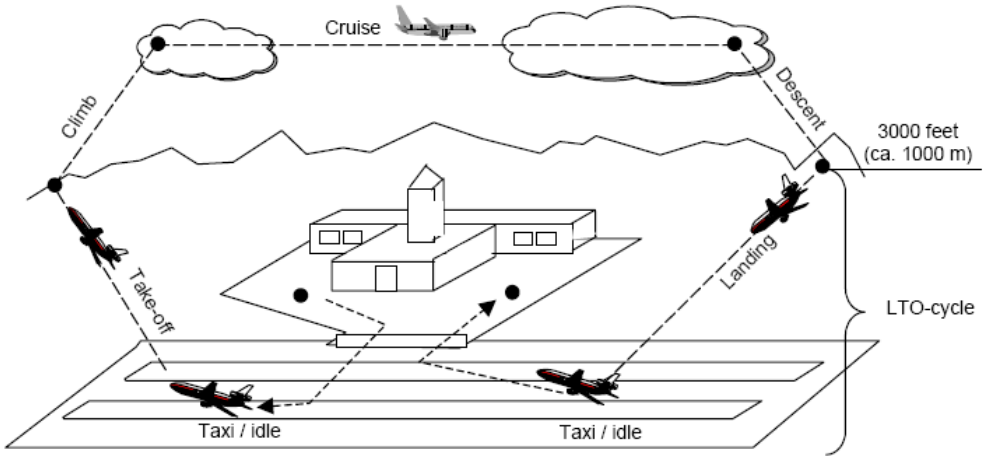


Figure (5-10) Aircraft operations divided into different cycles.

Operations of aircraft are usually divided into two main parts as shown in figure (5-10) (EEA 2000):
The Landing/Take-off (LTO) cycle which includes all activities near the airport that take place below the altitude of 3000 feet (1000 m). This therefore includes taxi-in and out, take-off, climb-out, and approach landing.
Cruise which here is defined as all activities that take place at altitudes above 3000 feet (1000 m). No upper limit of altitude is given. Cruise, in the inventory methodology, includes climb to cruise altitude, cruise, and descent from cruise altitudes.
Emissions that will impact on the local air quality only take place in the LTO cycle. Greenhouse gas emissions are also interesting in the cruise cycle. These emissions are combustion products and by-products and includes mainly CO_2 and NOx. Also methane, nitrous oxide and other by-product gases may be of interest.

Table (5-4) Default fuel use and emission factors for average aircraft for the LTO cycle and for cruise. (Source. IPCC Guidelines on National Greenhouse Gas Inventories)

		Emission factor average aircraft (kg/LTO)				
	Fuel	SO2	CO	Nox	NMVOC	CO2
LTO Average fleet	2500	2,5	50	41	15	7900
LTO old fleet	2400	2,4	101	24	66	7560
Cruise (kg/ton)		1	5	17	2,7	3150

Based on the prognoses for traffic at the Airport in 2024 we have assumed that the peak hour traffic equals 11.4 flights per hour. Using the emission factors from a typical average composition of aircrafts (EEA, 2000) we have estimated the emissions for each operational mode as presented in
Table (5-5).

Table (5-5) estimated emission loads of HC, CO and NOx, at Borg El-Arab Airport during peak hour traffic at Borg El-Arab 2024.

Total emissions 2020, (kg/half year)				
	No. of flights/hr	**SO2**	**CO**	**NOx**
Arrival	11	7	79.8	120.2
Taxe		2.8	292	38.6
Taxe		2.8	465.3	61.5
T-O		30.7	27.2	488.4

For estimating impact of air pollution we assume that the short-term peak hour situation will be the most critical. We have thus concentrated most of the modelling of future impacts on the peak hour traffic for year 2024.

5.2.4 Road traffic emissions

The data presented in the following chapter is based on the traffic count done during 2024. Based on the traffic rates; passengers and flights number during the year of 2024, we have estimated the number of peak hour cars to be 1268.The fraction of type of cars has also been estimated based on simple interviews at the airport.

The input data for modelling emissions is presented in the following Table (5-6).

Table (5-6) Distribution of cars on the airport road during peak hour (based on data for 2024).

Type of car	Fraction	N of Passengers	N cars
private & taxi (gasoline)	0.54	647	160
light diesel (taxi)	0.44	520	130
light heavy (mini buses)	0.005	29	2
heavy vehicles (buses)	0.01	72	3
Lorries	-	-	-
Total	**1**	**1268**	**295**

For the peak hour traffic the total emissions of NOx, CO, VOC, SO_2 and particles are presented in Table (5-7)

Table (5-7) the estimated total emissions (kg/h) of the main pollutants during peak hour traffic at the Borg El- Arab Airport, 2020.

Total emissions peak hour (kg/h)					
Driving 50 km/h	**NOx**	**CO**	**VOC**	**SO2**	**Particle**
Private cars	15.4	83.2	0.8	0.1	2.8
Taxis	5.5	5.2	0.3	65	1.3
Mini buses	0.6	0.5	0	1.2	0
Large buses	2.3	1.1	0	2.7	0.2
Lorries	0	0	0	0	0
Idling					
Private cars	0.8	36.6	3.4	0	0.4
Taxis	0.7	1.3	0.7	1	6.5
Mini buses	0	0.7	0.1	0	0
Large buses	0.2	0.3	0	0	0.2
Lorries	0	0	0	0	0
Total emissions	**25.5**	**128.9**	**5.3**	**70**	**1.4**

We see that the emissions from mini-buses and buses are giving the large part of contribution of the total emissions dependent of component.

5.2.5 Estimated concentrations

Air Quality Limit values for Egypt

To evaluate the existing and estimated concentrations of air pollutants in Borg El-Arab airport area we have related the concentrations to Air Quality Limit values as given in the Executive Regulations of the Environmental Law no. 4 of Egypt (Egypt 1994). These Air Quality Limit values are presented in Table (5-8).

Table (5-8) Ambient Air Quality Limit values as given by Law no.4 for Egypt (1994) compared to the World Health Organization (WHO) air quality guideline values.

Pollutant	Averaging time	Maximum Value	Limit
		WHO	Egypt
Sulphur dioxide (SO_2)	1 hour	500 (10 min)	350
	24 hours	125	150
	Year	50	60
Nitrogen dioxide (NO_2)	1 hour	200	400
	24 hours	-	150
	Year	40-50	
Ozone (O_3)	1 hour	150-200	200
	8 hours	120	120
Carbon monoxide (CO)	1 hour	30 000	30 000
	8 hours	10 000	10 000
Black Smoke (BS)	24 hours	50 *	150
	Year	-	60
Total Suspended Particles (TSP)	24 hours	-	230
	Year	-	90
Particles <10 µm (PM_{10})	24 hours	-	70
Lead (Pb)	Year	0.5-1,0	1

* Together with SO_2

5.2.6 Peak hour concentrations from flight activities

We have assumed a peak hour activity with 11 flights per hour working in the same runway in 2024. The emission rates used for the different cycles have been estimated based on the taxing and airport procedures assumed for Cairo Airport.

In the worst case with wind blowing along the runway we have estimated the maximum concentration of NO_2 downwind from the runway to be about 69 µg/m^3. The estimated concentrations still under the Hourly air quality limit value (400 µg/m^3).

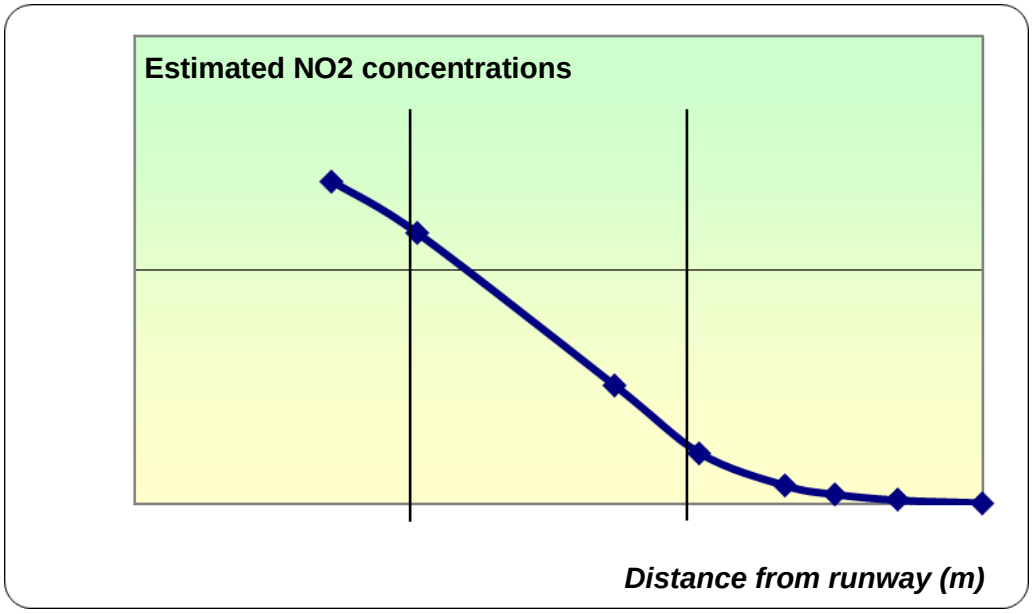


Figure (5-11) the estimated NO2 concentration downwind from the runway at the Borg El-Arab airport during peak hour traffic in 2024.

Very low concentrations of CO have been estimated at 1 km from the runway and will be considered as background.

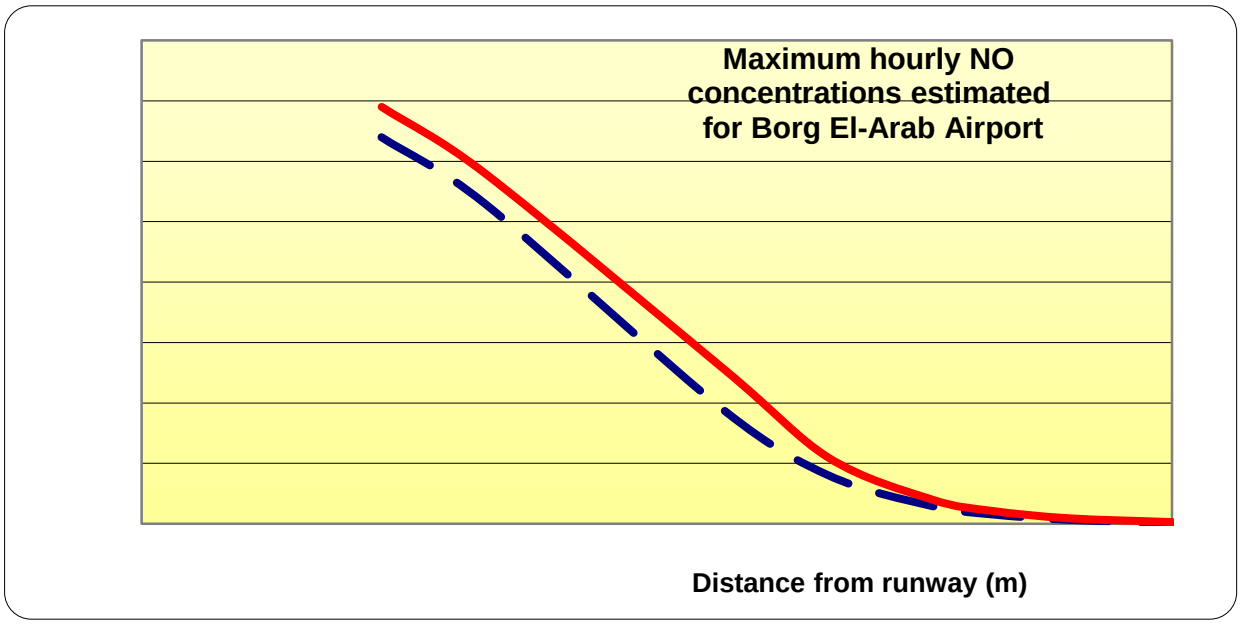


Figure (5-12) the estimated NO2 concentration downwind from the runway at the Borg El-Arab airport during peak hour traffic in 2014 & 2024.

5.2.7 Estimated impact from road traffic

Generally, the highest impact around international airports is normally found at or near the Terminal building due to road traffic, idling and accelerations.

We have assumed a traffic rate corresponding to the peak hour traffic as presented in Table (5-6).

The highest concentrations of CO are found close to the terminal building area at the Terminal building and will be less than 2.7mg/m^3 which is still under the Air Quality limit value. Already at 100 m from the area the one hour average Co concentration will be less than 1 mg/m3.

The maximum one hour average concentrations for other compounds are estimated in the Terminal area downwind from the parking and unloading zone based on simple flux models. The highest concentrations expected are:

- Nitrogen dioxide (NO_2): 118 µg/m^3
- Carbon monoxide (CO): 2.7 mg/m^3
- Non methane hydrocarbons (VOC): 78 µg/m^3
- Sulphur dioxide (SO_2): 148 µg/m^3
- suspended particles: 139 µg/m^3

These concentrations are also the normally estimated concentrations for any of the areas considerate as a result of the airport activities alone. The background PM_{10} concentrations in the area are about 60 µg/m^3 as a daily average.

5.2.8 Impact of the total airport activities

As seen from the estimates presented above, the total air pollution impact from the future Borg El-Arab airport will result in adverse health impacts especially the sulphur dioxide emissions.

The maximum one hour average concentrations estimated for year 2024 is presented in table (5-9).

Table (5-9) Estimated one hour average concentrations of NO2, CO and NMVOC in the maximum impact areas of the Borg El-Arab airport in 2024.

		Concentrations (µg/m3)				
Average	**Contribution from**	**NO2**	**CO**	**HC**	**SO2**	**Particles**
Max hourly	Traffic along road	7	100	1	77	5
peak traffic	At Terminal building	118	4435	78	148	139
	Downwind from runway	69	270	7.3		

Compared to the WHO vales there are no critical concentrations as one hour average in the area of the airport. The maximum concentration may reach 29% of the air quality limit of NO2 for Egypt.
The limit value for particulate (PM_{10}) is given as a 24 hour average, and this will not be violated due to airport activities alone.

The other indicators and compounds will be well below any limit values given in laws or regulations.

5.2.9 Air pollution in Borg El-Arab area

Air pollution at Borg El-Arab airport comes from a wide variety of sources. The most significant are:

- Aircraft landing, taking off, taxiing and running engines on stand,
- Airport heating / energy generation requirements,
- Vehicles operating at the airport,
- Private vehicles bringing passengers to and from the airport, and
- Vehicles and operations close to the airport.

Generally, hourly emissions from Nitrogen dioxide (NO2), Carbon Monoxide (CO), and Hydrocarbons (HC) are considered the main and valuable sources of emissions that can result and emitted from the increased airport's vehicular traffic. Therefore, the modeling exercise focuses on modeling of Nitrogen dioxide (NO2), Carbon Monoxide (CO), and Hydrocarbons (HC). These pollutants are the ones chosen since it is well known that the development of Borg El-Arab airport Complex will increase the load of vehicle movement traffic and aircraft gaseous emissions.

5.2.10 Objective

The objective of the air dispersion simulation modeling is to model the worst-case-scenario based on the baseline scenario surveyed in order to test and introduce air dispersion modeling as an effective tool in environmental planning and management in Cairo Airport Region.

5.2.11 Methodology

The approach and methodology to the development of the simulation was as follows:
1. Selection of the modeling tools for the meteorology model and preparing the downscaled model for one year.
2. Building an interface between the meteorology model and the dispersion model.
3. Preparing the input data in the compatible format for input to the model.
4. Conducting several test runs for tuning the model.
5. Running the simulated scenarios.
6. Submitting results to the GIS specialists for convenient visual illustration of results and discussion.
7. Discussing the results through group discussions and noting the lessons learnt for future trials.

The SCREEN3 Modeling software package is applied to our study to determine the preliminary air quality impact results, then validated and verified using AERMOD package to attain the final predicted air quality impacts of the study. The SCREEN3 Modeling software package is "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources" (EPA, 1988), which was later revised and published as a separate document (EPA, 1995a). The SCREEN3 model includes several modifications

and enhancements to the original SCREEN model, including updates to the code to ensure consistency with the dispersion algorithms in the Industrial Source Complex (ISC3) model (EPA, 1995b). Also, three new non-regulatory options were added to the code. EPA has described AERMOD as an advanced dispersion model that incorporates state-of-the-art boundary layer parameterization techniques, convective dispersion, plume rise formulations, and complex terrain/plume interactions. More recently, the PRIME algorithm, which is a building wake/building downwash algorithm developed by the Electric Power Research
Institute (EPRI), was implemented into AERMOD to make use of the AERMOD meteorological profiles.
However, its main purpose is to account for the relative locations of the stack and the building causing downwash, which is not accounted for in the original ISC or early version of AERMOD. The AERMOD modeling system has 3 components: AERMOD - the air dispersion model; AERMET - the meteorological data preprocessor; and AERMAP - the terrain data preprocessor.

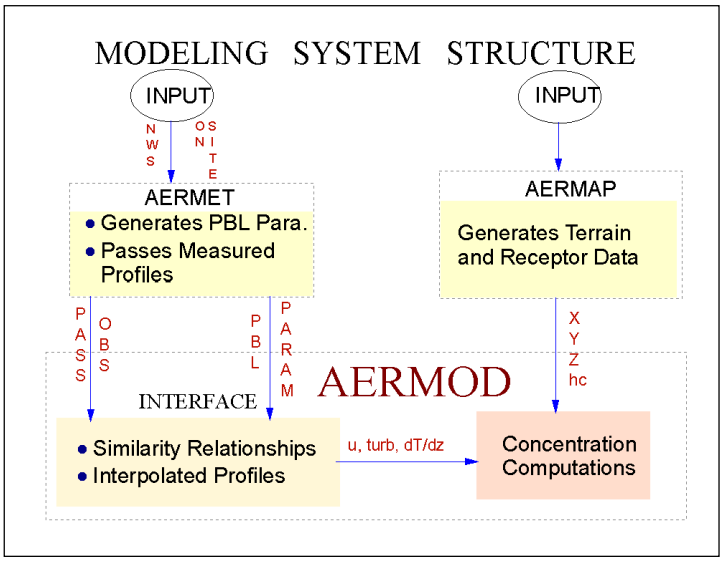


Figure (5-13) Data flow in the AERMOD modeling system

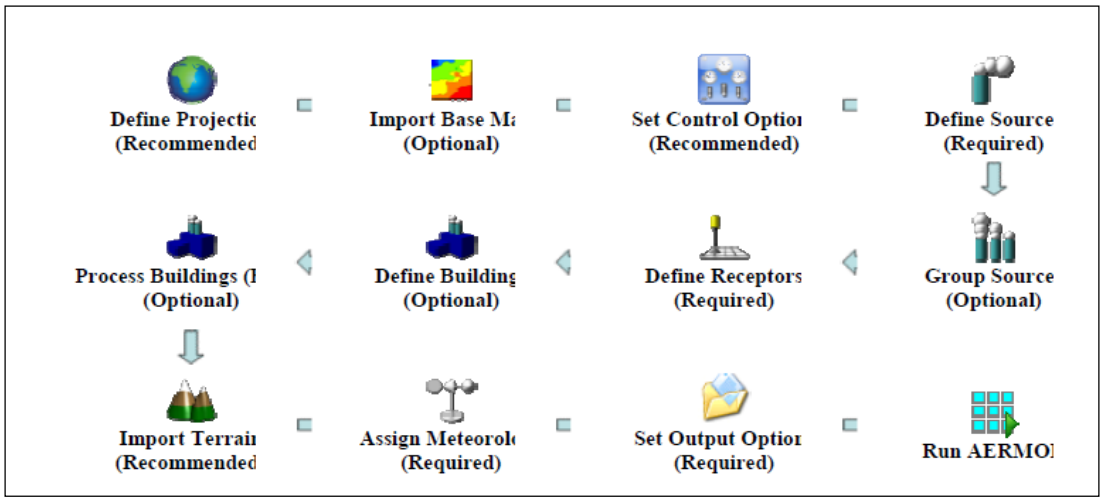


Figure (5-14) Data Input Flow for AERMOD, There are alternative methods for entering data.

5.2.12 Scope of Work

This part presents a brief description of the modeled domain, the time span considered for the modeling exercise, and the data sources used. And the modeling exercise focused on Borg El-Arab airport region.

5.2.13 Modeled Time Span

The modeling exercise will cover a 1 year time span starting Oct, 2013 and ending Oct, 2014. The meteorological inputs will be prepared for this time frame using MM5 meteorological model. This time frame is chosen to cover different seasons of the year and to be able to make comparisons with available monitored data.

5.2.14 Air Pollution Dispersion Modeling

Air Pollution Dispersion Modeling is the mathematical simulation of how air pollutants disperse in the ambient atmosphere. It is performed with computer programs that solve the mathematical equations and algorithms which simulate the pollutant dispersion. The dispersion models are used to estimate or to predict the downwind concentration of air pollutants emitted from sources such as industrial plants and vehicular traffic. Such models are important to governmental agencies tasked with protecting and managing the ambient air quality. The models are typically employed to determine whether existing or proposed new industrial facilities are or will be in compliance with the National Ambient Air Quality Standards (NAAQS).
The Air Dispersion Simulation Model has proven to be an effective tool for decision support in environmental management and planning on a regional scale. The modeling trial presented in this report is an air dispersion simulation modeling exercise focused on Borg El-Arab Airport Area using real surveyed data of emission loads.
The dispersion models require the input of data which includes:

1. Meteorological conditions such as wind speed and direction, the amount of atmospheric turbulence (as characterized by what is called the "stability class"), the ambient air temperature and the height to the bottom of any inversion aloft that may be present.
2. Emissions parameters such as volume of traffic, composition of cars, type of fuel, road network characteristics.
3. Terrain elevations at the source location and at the receptor location.
4. The location, height and width of any obstructions (such as buildings or other structures) in the path of the emitted gaseous plume.

Many of the modern, advanced dispersion modeling programs include a pre-processor module for the input of meteorological and other data, and many also include a post-processor module for graphing the output data and/or plotting the area impacted by the air pollutants on maps.
There are no specific standards for air quality at roadside areas but there are Limit values for ambient air which are given in the Executive Regulations of Egypt

Environmental Law. These Air Quality Limit values should be achieved to avoid health risks due to higher concentrations of the first priority pollutants.
In cities across the globe, the personal automobile is the single greatest polluter, as emissions from a billion vehicles on the road add up to a planet-wide problem. Driving a private car is a typical citizen's most air polluting activity. The negative effects of automotive emissions are maximized when you sit in traffic surrounded by cars, with engines idling. Everyone in a traffic jam is getting poisoned. The combustion process of gasoline and diesel fuels are mixtures of hydrocarbons (made of hydrogen, oxygen and carbon atoms.) Hydrocarbons are burned by combining with oxygen. Nitrogen and sulfur atoms are also present and combine with oxygen when burned to produce gases. Automotive engines emit several types of pollutants.

Fuel+Air=>Hydrocarbons+NitrogenOxides+CarbonDioxide+Carbon Monoxide + water

Hydrocarbons react in the presence of nitrogen oxides and sunlight to form ground-level ozone, a major component of smog. Ozone irritates the eyes, damages the lungs, and aggravates respiratory problems. A number of exhaust hydrocarbons are also toxic, some with the potential to cause cancer.

5.2.15 Nitrogen Oxides:

Under high pressure and temperature conditions in an engine, nitrogen and oxygen atoms react to form nitrogen oxides. Nitrogen oxides, like hydrocarbons, are precursors to the formation of ozone and contribute to acid rain. Catalytic converters in car exhaust systems break down heavier nitrogen gases, forming nitrous oxide (NO_2) - 300 times more potent than carbon dioxide as a greenhouse gas. Nitrous oxide makes up about 7.2 percent of the gases that cause global warming.

5.2.16 Carbon Monoxide:

Carbon monoxide (CO) is a colorless, odorless, poisonous gas, a product of incomplete burning of hydrocarbon-based fuels. Carbon monoxide consists of a single carbon atom and a single oxygen atom linked together (CO), the product Carbon monoxide of incomplete combustion of fuel. Most CO is produced when air-to-fuel ratios are too low in the engine during vehicle starting, when cars are not tuned properly, and at higher altitudes, where thin air reduces the amount of oxygen available for combustion. Two-thirds of the carbon monoxide emissions come from transportation sources, with the largest contribution coming from cars. In urban areas, the passenger vehicle contribution to carbon monoxide pollution can exceed 90 percent.
Generally, Hourly emissions from Nitrogen dioxide (**NO_2**), Carbon Monoxide (**CO**), and Hydrocarbons (**HC**) are considered the main and valuable sources of emissions that can result and emitted from the increased airport's vehicular traffic.
The modeling exercise focuses on modeling Nitrogen dioxide (**NO_2**), Carbon Monoxide (**CO**), and Hydrocarbons (**HC**). These pollutants are the ones chosen since it is well known that the development of Borg El-Arab building Complex will increase the load of vehicle movement traffic and aircraft gaseous emissions during the period of September to December every year.

5.2.17 Emission Sources

Emission inventory for the major point sources, vehicle and aircraft emissions, and the modeling exercise focuses on modeling Nitrogen dioxide (**NO_2**), Carbon Monoxide (**CO**) and total hydrocarbon (**HC**) concentrations resulting from these sources.

5.2.18 Meteorological Data Source

According to World Meteorological Organization, there are many regional centers covering the world (Alex and Borg El-Arab are of them). Each one collects the observed meteorological data from surrounding countries and resubmits the collected data to global centers which collect all data of the world and resubmit it to the regional ones. This well-known, credible process uses wireless frequencies and is opened to every country.
Egypt has 104 different meteorological stations of different types. Meteorological station observes every 12, 6, 3 or every one hour and any observation should be done within the last ten minutes of the previous hour. In addition to ground observations there are meteorological ships, rockets, aircrafts, radars and satellites observations. All available data are being collected and processed for quality assurance in the global centers. The Global center in Washington, D.C., which is called National Center for Environmental Predictions (NCEP), continues processing global observations and producing global forecasts covering ten days. They make the first five days of data available on the internet to be used by regional and local centers for more accurate processing and predictions.
NCEP broadcasts global model outputs as girded data to be used for initial andboundary conditions by World Area Forecast centers WAFS. The WAFS's horizontal resolution is 1.25°in latitude and longitude (at Equator) on 12 standard vertical pressure levels, In addition to the provided meteorological data files within the AERMOD software package.
The objective of the study was to collect the necessary input data, perform dispersion modeling and present the future air quality data as a result of the proposed development Borg El-Arab Airport.

5.2.19 Estimated Pollutant concentrations

Estimated concentration distributions modeled for **NO_x**, **CO** and **SO2** are presented below, with the concentrations represent the seasonal average and peak hour maximums in the Borg El-Arab Airport area.
The following maps reflecting the current situation of distribution and levels of the previously mentioned gaseous pollutants that are affected by the increase of traffic flow of vehicles and aircraft (NO2, CO and SO2) in Borg El-Arab Airport.

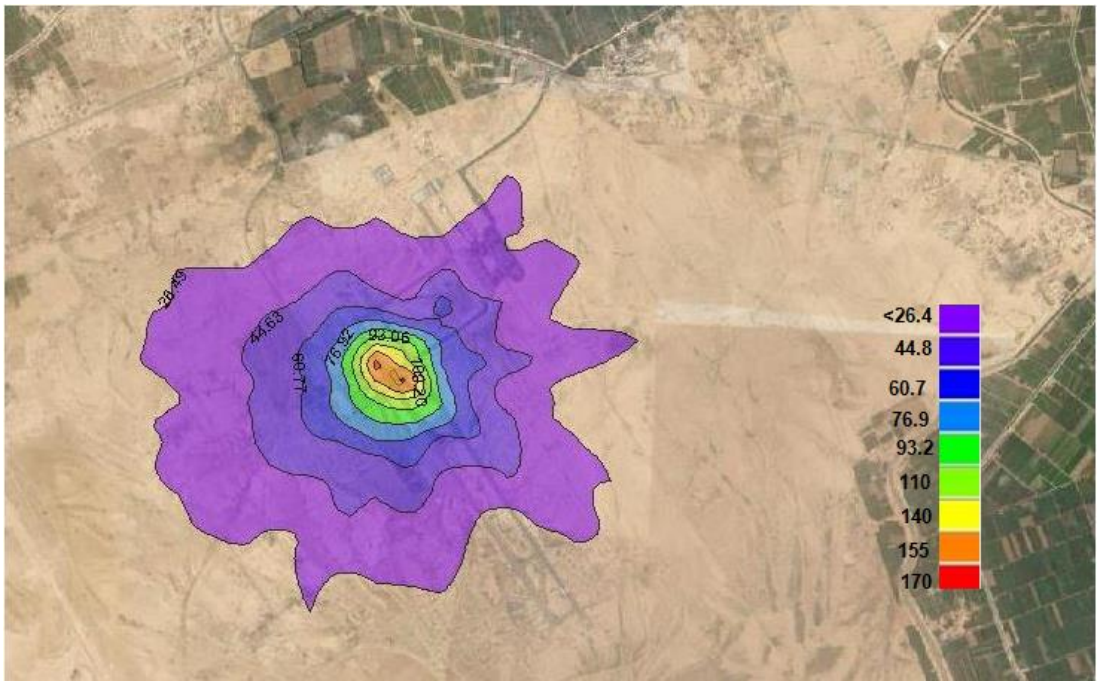


Figure (5-15) a predicted maximum one-hour average Carbon Monoxide (CO) all over Borg El-Arab Airport Area.

Figure (5-16) a predicted maximum8-hour average Carbon Monoxide (CO) all over Borg El-Arab Airport Area.

Figure (5-17) a predicted maximum annual average Carbon Monoxide (CO) all over Borg El-Arab Airport Area.

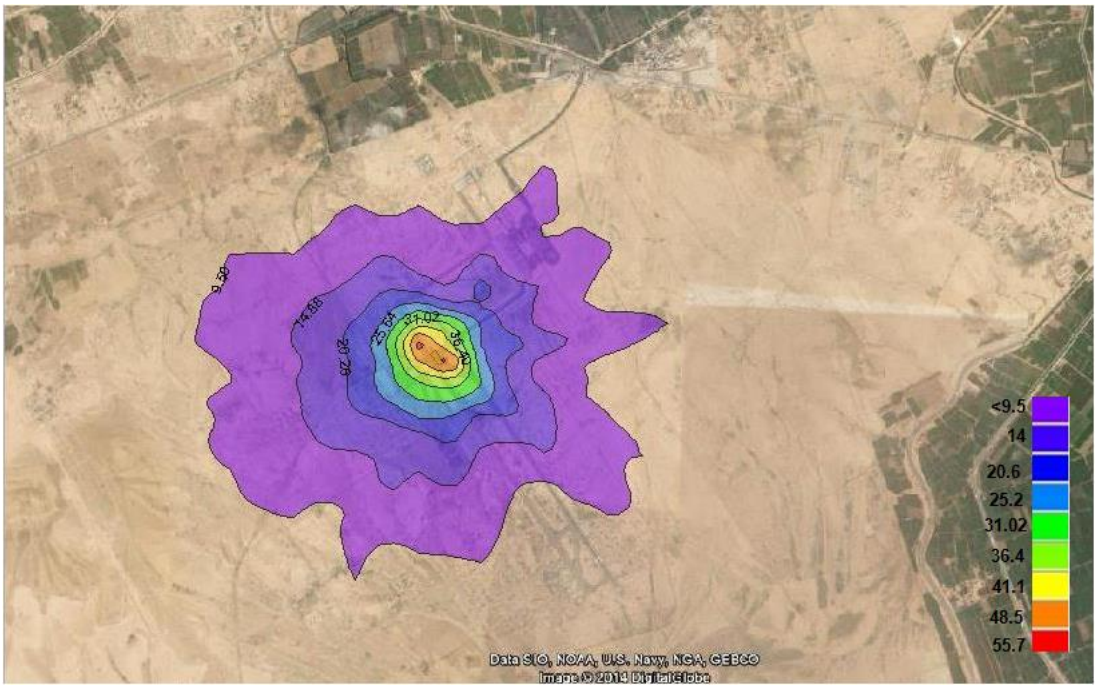


Figure (5-18) a predicted maximum1-hour average (NO2) all over Borg El-Arab Airport Area.

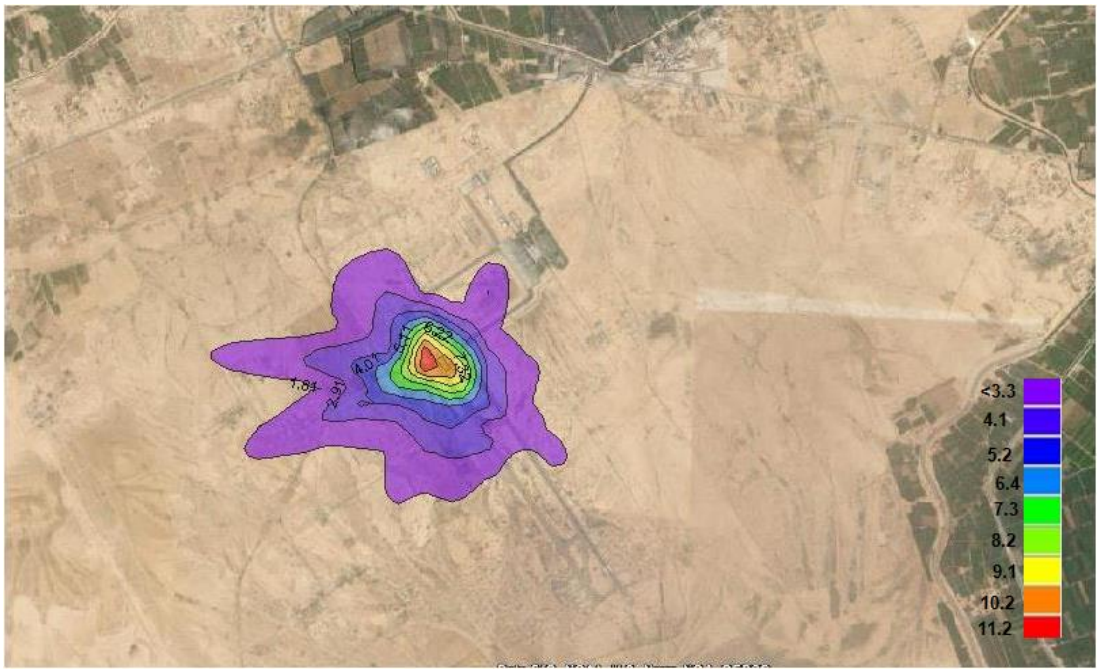


Figure (5-19) a predicted maximum 24-hour average (NO2) all over Borg El-Arab Airport Area.

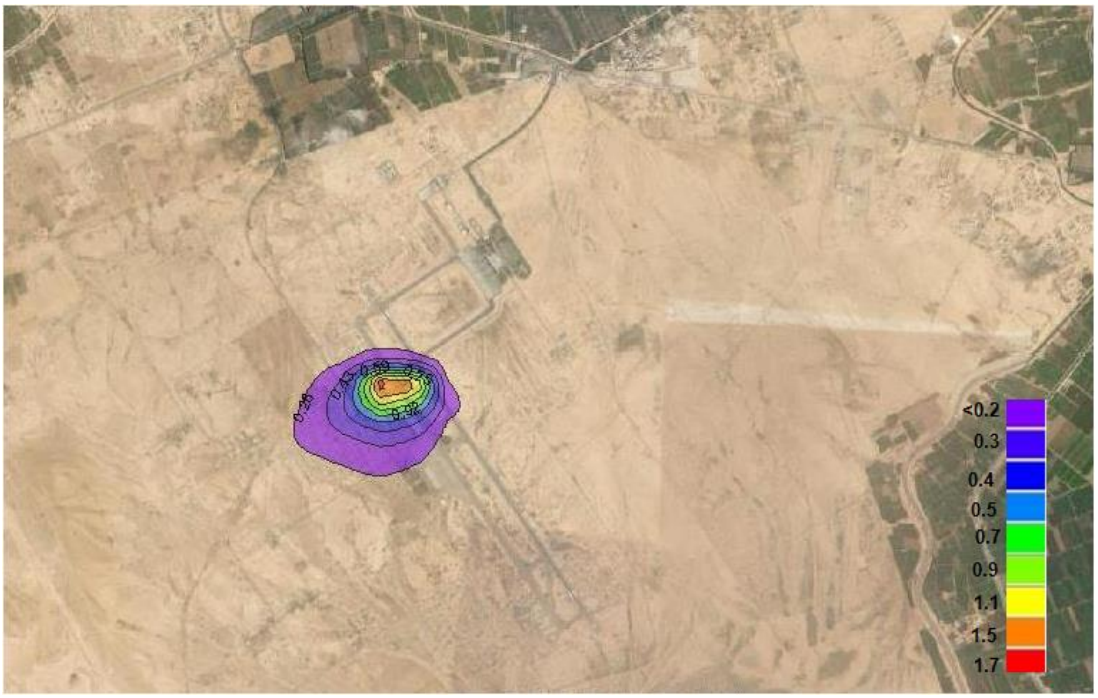


Figure (5-20) a predicted maximum annual average (NO2) all over Borg El-Arab Airport Area.

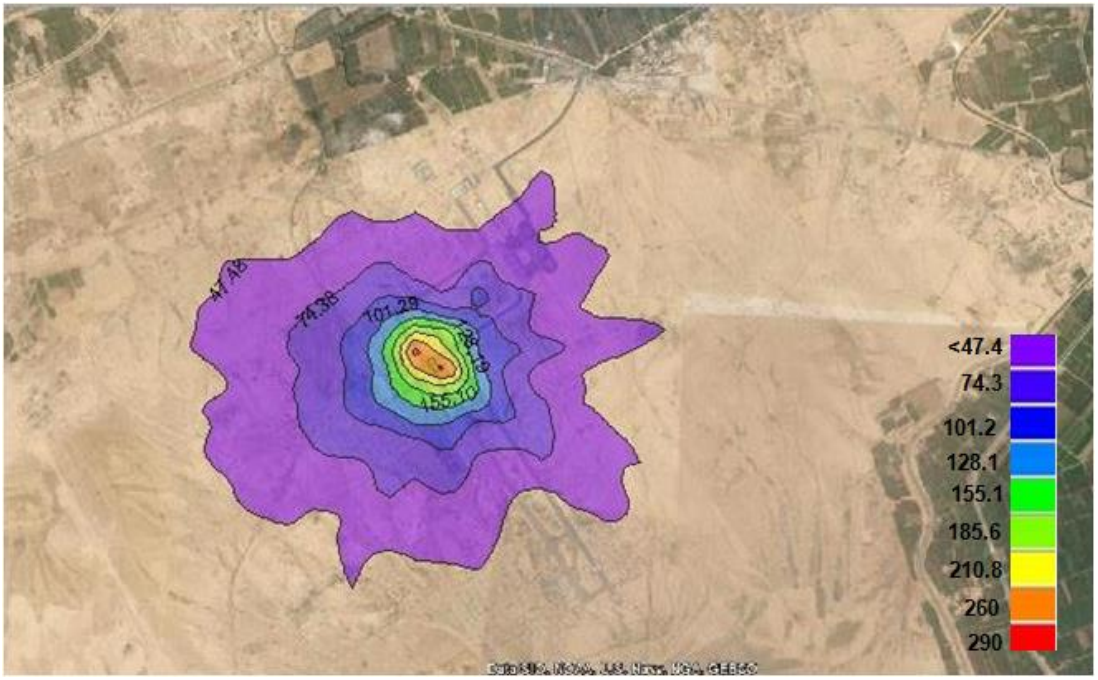


Figure (5-21) a predicted maximum1-hour average (SO2) all over Borg El-Arab Airport Area.

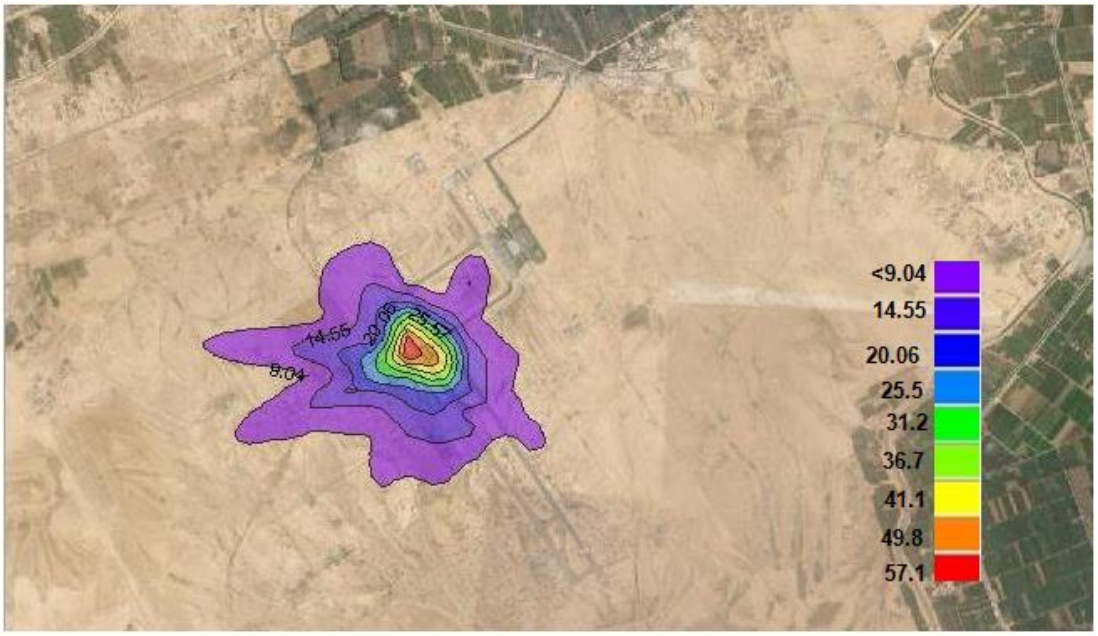


Figure (5-22) a predicted maximum 24-hour average (SO2) all over Borg El-Arab Airport Area.

Figure (5-23) a predicted maximum annual average (SO2) all over Borg El-Arab Airport Area.

In addition, the prediction monitoring program and modeling performed by MB Consultant on Borg El-Arab Airport and its impact on the baseline environment confirm these collected data and estimates as representative for all the conducted ambient pollution parameters stated on Egyptian law of environment.

5.3 Traffic

5.3.1 Analysis and Results

The link road between International coastal road and Borg El Arab Airport

The importance of this link in the transportation of passengers across the Borg Al Arab Airport from users of tourist villages and cities along the coastal road of km 21 and even the city of MarsaMatrouh and reflect less commercial traffic as possible, so it is considered that the link from the affected areas of the airport modernization project

Mehwar AL-Taameir

This is the link of the most important links in the study area due to the following considerations:

- This link is working on the transfer of traffic from the airport to the city of Alexandria And vice versa
- This link is considered as an important collector arterial, both for passengers or goods coming from central and eastern Delta and vice versa

- One of the most important links for linking the international road and the direction to either the airport or the coastal road and vice versa

El kafouri road

This is a weak link importance of the airport modernize project for the following considerations:

- Coming from the city of Alexandria or agricultural road heading to the airport Will be used Mehwar AL-Taameir through the international road,
- Next out of the way Cairo –Alexandria Desert road heading to the airport will be used El aquaria roadto provide more than 60 km to walk away
- Point of connection between Elkafouri road and Cairo -Alexandria Desert road of with high traffic densities throughout the year
- Therefore, the study Will not take into account that the link

El aquaria road

This road is divided into two section, first starts from the intersection of the link with the Cairo Alexandria Desert Road at km 41 and until the intersection at the main gate of the airport, and the second begins at the intersection of the main gate of the airport and even the city of Borg Al Arab, The importance as follows:

- Shortening the distance coming from Cairo Alexandria Desert Road, heading to the Borg Al Arab Airport, about 60 km
- Ease the traffic density on the Cairo Alexandria Desert Road, starting from fees gate
- Encourage export of goods through the airport to the village of products Nubaria City and Sadat and 6 October City
- Encourage travelers from Greater Cairo for the use of the airport, which will ease the burden on the Cairo International Airport, especially in light of upgraded Cairo-Alexandria desert road to the freeway
- As well as contribute to the establishment of agricultural and industrial communities in villages and lands on side of the first sector, which starts from the intersection of the link with the Cairo Alexandria Desert Road at km 41 and until the intersection at the main gate of the airport

So it will be considered that the link is the important link.

5.3.2 Estimation of Traffic Generation (till year of 2030) on Weaving Areas

The weaving areas, which are expected to be affected, are as follows:

- The expected Annual Passengers

Table (5-10) Assumed Capacity as 4Passengers/car

Annual	2015	2020	2025	2030
Passenger	2,357,758	3,610,715	4,754,833	5,491,699
Passenger cars/No*	589,440	902,679	1,188,708	1,372,925

- The annual growth rate= 5%
- % of transport vehicles=40%

Distribution of traffic volume due to influence road (Assumption) as the follows:

The link road between International coastal road and Borg El Arab Airport =20%
Mehwar AL-Taameir =40%
El aquaria road =40%

5.3.3 The expected traffic generation for the users of the airport for the roads are calculated and presented in the following Table 2030.

Table (5-11) the expected traffic generation table

Year	Passenger cars/No	transport vehicles	Total	Linkcoastal road	Mehwar AL-Taameir	coastal road	El aquaria road
2015	589,440	825,216	1,414,656	282,931	565,862	848,794	565,862
2016	618,912	866,477	1,485,389	297,078	594,156	891,233	594,156
2017	649,858	909,801	1,559,658	311,932	623,863	935,795	623,863
2018	682,350	955,291	1,637,641	327,528	655,056	982,585	655,056
2019	716,468	1,003,055	1,719,523	343,905	687,809	1,031,714	687,809
2020	902,679	1,263,751	2,166,430	433,286	866,572	1,299,858	866,572
2021	947,813	1,326,938	2,274,751	454,950	909,900	1,364,851	909,900
2022	995,204	1,393,285	2,388,489	477,698	955,395	1,433,093	955,395
2023	1,044,964	1,462,949	2,507,913	501,583	1,003,165	1,504,748	1,003,165
2024	1,097,212	1,536,097	2,633,309	526,662	1,053,323	1,579,985	1,053,323
2025	1,188,708	1,664,191	2,852,899	570,580	1,141,160	1,711,740	1,141,160
2026	1,248,143	1,747,401	2,995,544	599,109	1,198,218	1,797,326	1,198,218
2027	1,310,551	1,834,771	3,145,321	629,064	1,258,129	1,887,193	1,258,129
2028	1,376,078	1,926,509	3,302,587	660,517	1,321,035	1,981,552	1,321,035
2029	1,444,882	2,022,835	3,467,717	693,543	1,387,087	2,080,630	1,387,087
2030	1,372,925	1,922,095	3,295,020	659,004	1,318,008	1,977,012	1,318,008

5.3.4 Traffic Impacts

Based on the traffic analysis mentioned early the following results and impacts are listed as:

1. Roads that serve the movement of the airport is generally not enough of an engineering specification as well as the lack of safety factors and safety.
2. Railway level crossing the intersection of Alexandria – Matrouh which may cause serious accidents because the Railway Alexandria Matrouh line intersects with the road aggregate accidentally without any protections.
3. Difficult and dangerous access road of El aquaria road at its intersection with the Cairo Alexandria Desert Road.
4. The use of the first sector of the El aquaria road by now and in the future to achieve accidents.
5. Dangerous intersection of the El aquaria road through with road access to the airport from the main gate.

5.4 Water

5.4.1 WATER RESOURCES

The water is supplied from Borg El Arab Water Treatment Plant that is under the Authority of Alexandria Governorate. Water analysis results that are presented in Annex (7) indicate the adequacy for utilizing for domestic usage. It is planned to supply the new terminal with its water and firefighting requirements through the existing water main 300 mm in diameter. This main is to feed a new underground reservoir, from which water shall be pumped to the different component of the Airport. It is clear that there will be direct reference to water quality.

Consequently, it can be seen that there are no expected negative impacts or health risks regarding the water quality from the water supply system at all.

5.4.2 WASTEWATER

The flows to be generated after the operation of the new terminal are estimated to be 1160 m^3/day by year 2024. The new Airport should be planned to handle more than four million passengers per year, in addition to the permanently working and visiting staff. Extending the Airport staff and the number of flights received at the terminal shall result in an increase in the generated wastewater.

The lack of a proper treated/disposal system will result in severe negative environmental impacts as this will be a potential case of pollution transfer of diseases.
But the new water treatment plant will fully overcome this matter

The construction of an environmentally safe collection, disposal, and treatment systems will have a positive health impact on the Airport serving staff and passengers. It will prevent any possible unaesthetic conditions in and around the Airport facilities. In addition it will prevent any possible cross infection between water and sewage networks in and outside the buildings.

5.5 Solid waste, Hazardous waste impact

5.5.1 During Site Preparation and Construction

Site preparation and construction activities will result in the generation of a variety of wastes that can be divided into distinct categories:

- Excess Excavated Material: defined as inert material removed from the ground and sub-surface that will not be reused on site. The volume to be generated is unknown at this stage yet there should be a clear statement to the contracted companies regarding their responsibilities to insure proper handling techniques, which eliminate scatter of those solid materials or their improper final disposal. The contracted companies should be stated in their contracts to keep air and noise pollution under control.
- General Construction Waste: comprises unwanted materials generated during construction, including rejected structures and materials, materials which have been over ordered or surplus to requirements, and materials which have been used and discarded.

These wastes will be generated at all construction sites and will typically comprise wood waste from framework material and equipment packaging/wrapping and surplus or rejected construction material.

There is no firm basis for the estimation of the waste generated at any construction site, but it is expected that contractors will typically incorporate waste at a rate of 0.03 percent to 0.05 percent for major construction items.

Although the expected total volume of waste is quite limited, their storage, handling, transport and disposal have the potential to create visual water, dust and associated traffic impacts.

Hazardous Waste: typically generated by the maintenance of equipment, scrap batteries or spent acid/alkali, used engine oils and hydraulic fluids, chemical/oil based emulsions, spent mineral oils and cleaning fluids, and spent solvents.

Chemical waste may pose serious environmental, and health and safety hazards if not properly managed. These hazards may include:

- Occupational health hazardous on workers;
- Fire hazards;
- Soil pollution, which can impact the quality of underground water sources.

Other wastes not previously defined, mainly general refuse and food wastes, can be generated from the temporary construction site offices and from labor camps. The storage of general refuse will have the potential to give rise to adverse environmental impacts. These include odor if the waste is not collected frequently, flies, windblown litter, and visual impacts. The site may also attract pests and vermin if waste storage areas are not maintained and cleaned regularly.

In addition, disposal of wastes at sites other than approved waste transfer or disposal facilities, can also lead to similar adverse impacts at those sites.
The contractor should receive this study and approved its mitigation in full and apply its mitigations

5.5.2 During Operation

It is expected that solid wastes will increase to about 8% every year until year 2030. The day-to-day operation has the potential to generate large amounts of waste from offices, shops, cafes and restaurants, and from passengers and Airport visitors. Wastes may be about 12% by year 2024 including the cargo area.
Solid wastes will be generated from the daily cleaning operation of the Terminal Building, surrounding landscape areas, gardening, landing flights garbage, freight handling at the tarmac and cargo storage areas, ground service activities, security residential areas, and supporting Airport facilities sites located in the tarmac area.

At the currently operating Airport there is one places dedicated for proper storage of segregated solid wastes and for cleaning facilities. This situation should be corrected in the new extension building dedicated for international flights and at larger scale generation of solid waste where segregation of recyclable materials as an international trend will be implemented in full.

Hazardous wastes at small amounts will be generated and should be segregated and buried at the dedicated site in Matrouh Governorate. Or Masuria, Huge amounts of solid wastes if not segregated and continuously disposed it will create suitable environment for insects, rats, etc., which can attack the cargo retained at the village while waiting for finishing the procedures of its release from the customs or to be shipped abroad.
The Owner intends to build a Cargo Village. The estimated average wastes generated from the cargo could be high as 4 ton/day and most of these materials could be recyclable. Please see appendix (9) for details
The number and capacity of compactor trucks will be increased to cater for the increase in the volume of solid waste generated. Based on the estimated volume increase, the number of trucks to be purchased, leased or used for the purpose will be at least one (1) with a 20-ton capacity to start with.
Hazardous chemicals and their containers from spilled chemicals as accidents can create fire hazards as well as exposure health hazards to those persons working or visiting the village.
Hazardous sulfuric acid containers and lead batteries will be generated from the continuous use of Clark lifts for those large batteries. The new Airport will not have a negative impact on the existing solid waste collection system in the Airport, as new facilities will be provided to cater for the additional volumes generated. Please see appendix (9) for details.

Table (5-12) previous and the current passenger traffic and projected in Borg Al- Arab International Airport till 2020.

Passengers Movement	
Year 2010	712073
Year 2013	2260540
Year 2014	2021892
Year 2015	2251054
Year 2016	2486256
Year 2017	2725453
Year 2018	2930210
Year 2019	3190906
Year 2020	3449723
Total	22028107

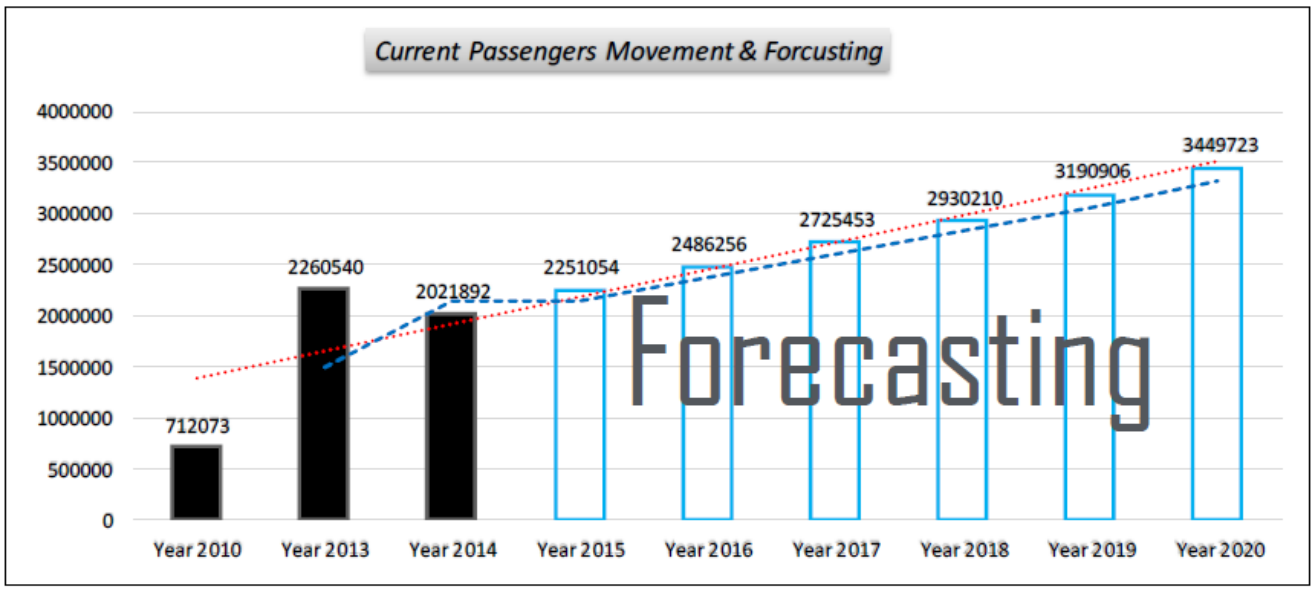


Figure (5-24) previous, current and projected passenger movement for Borg Al-Arab International Airport till year 2020.

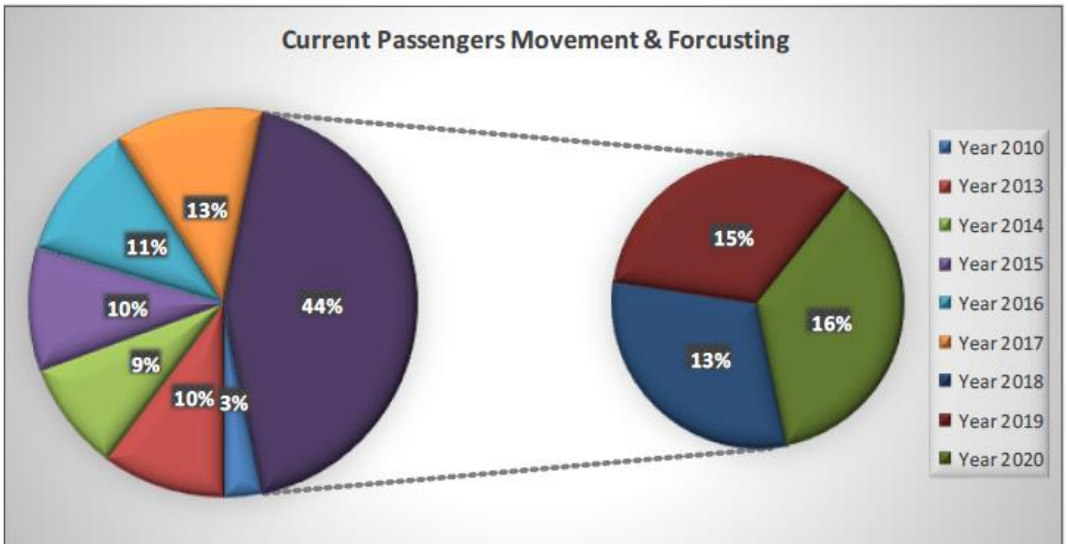


Figure (5-25) previous, current and projected passenger movement for Borg Al-Arab International Airport till 2020in percentages

5.5.3 Forecast of air traffic and passenger movement volume and the volume of solid waste for the new project

The air and passenger traffic volume is increasing continuously; this is contrary to what was expected when establishing the current terminal building. This was designed to accommodate million passengers per year where the passenger and aircraft size in the beginning of 2011 increase to 2,800,000 passengers / year in 2014.
And when the Egyptian Airport company thought of establishing a new terminal building (with low costs) to accommodate this increase, studies were carried out by specialized agencies recommending the capacity of the new terminal building to be 4 million passengers per year besides the current number of passengers reaching a total number of passengers for Borg Al-Arab international airport of 6.800.000 Steady increase in passenger numbers and aircraft using the airport, will necessarily lead to a steady increase in the potential environmental impacts of the Borg Al Arab International Airport including increased the volume of solid waste generated by activity.

In this part of the report, we will illustrate the air and passenger traffic expected, and therefore the size of the projected solid waste from this increase and their different types.

Table (5-13) shows the past, current and future passenger traffic in Borg Al-Arab International Airport till year 2024.

Current Aircraft Movements & Forecasting				
Years	Flights	Percentage	Event	Volume of Solid Waste/tons-Year
2010	7312	Base	Base	Base
2013	25986	Base	Base	Base
2014	20825	2%	6325	136.417
2015	21449	3%	1136	137.441
2016	21658	4%	1240	137.553
2017	21866	4%	1364	137.553
2018	22074	4%	1515	137.656
2019	22282	5%	1705	137.781
2020	22491	8%	2728	137.932
2021	22699	9%	3410	138.122
2022	22907	10%	3410	139.145
2023	23115	11%	3410	139.827
2024	23324	12%	4547	140.964
2025	23324	12%	4547	140.964
2026	23324	12%	4547	140.964
2027	23324	12%	4547	140.964
2028	25525	13%	5283	146.247
2029	25525	13%	5283	146.247
2030	28680	15%	8604	149.568
Total	277988	149%	30790	2385.345

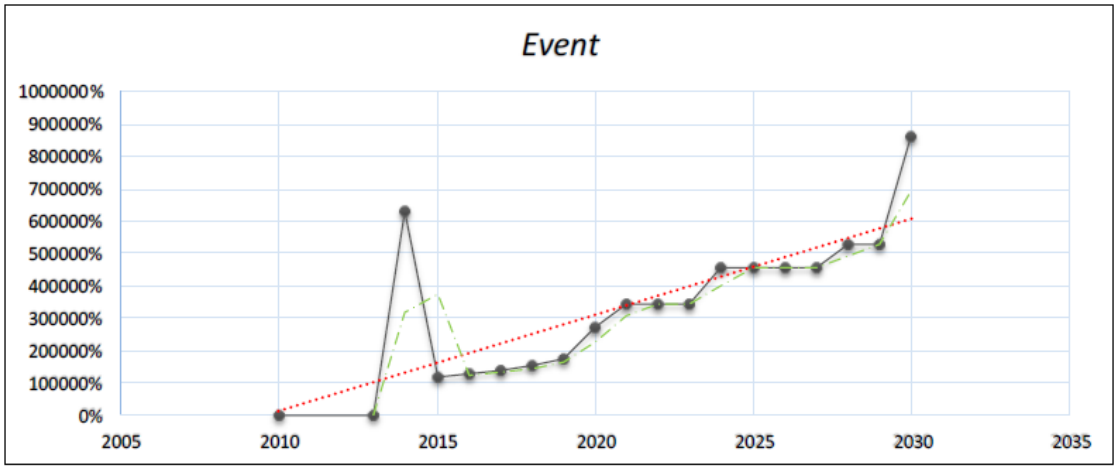


Figure (5-26) shows the expected increase in air traffic annually in percentage till year 2030.

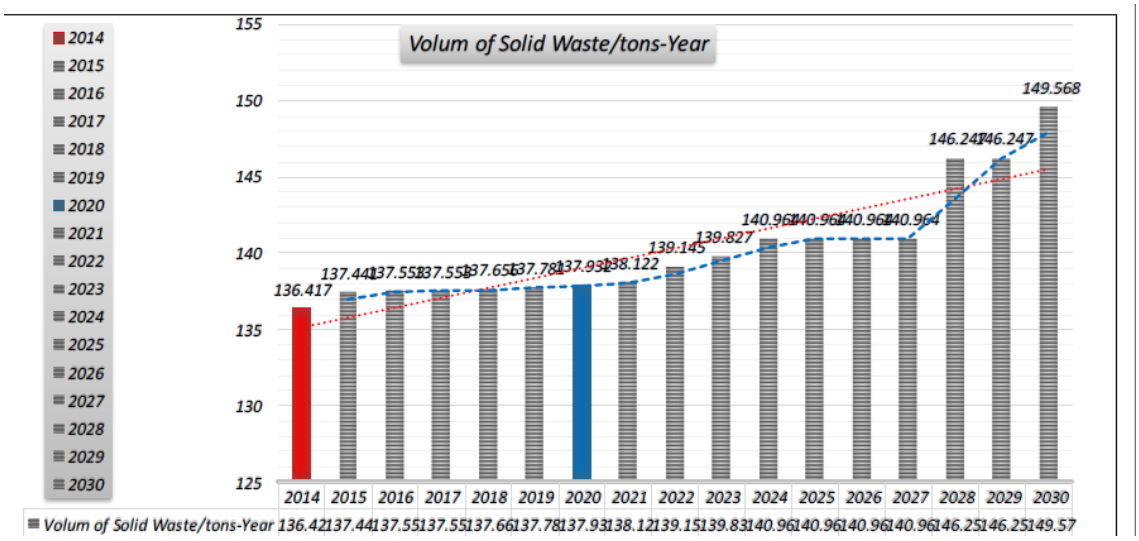


Figure (5-27) the estimated volume of solid wastes from operating the airport till year 2030.

Table (5-14) the estimated volume of solid wastes till year 2030

Forecasting for Total Event Volume of Solid Waste		
Year	Event /Kgs	Total Volume/Tone
2015	181	5.631
2016	181	5.631
2017	181	5.631
2018	181	5.631
2019	545	5.995
2020	545	5.995
2021	1000	6.45
2022	1000	6.45
2023	1000	6.45
2024	1000	6.45
2025	1200	6.65
2026	1200	6.65
2027	1200	6.65
2028	1500	7.1
2029	1500	7.1
2030	2000	8.45
Total	14414	102.914

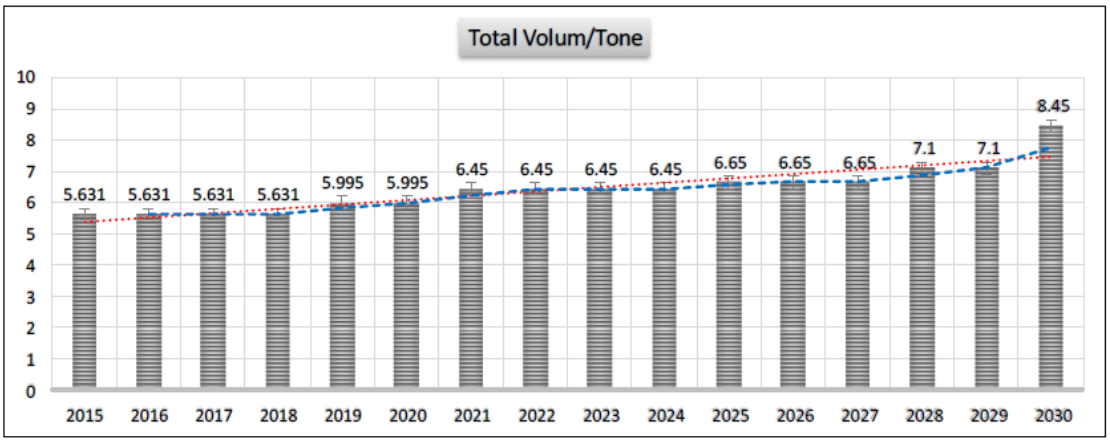


Figure (5-28) the estimated volume of solid wastes till year 2030.

It is clear from our analysis of the previous maximum estimate of the Borg Al Arab International Airport in The expected amount of waste on a 2030, after the operation of the new terminal building is about 8450 tons / year.
And by reaching year 2030 the total volume of wastes generated from the airport during the previous years with a total volume of 102.914 tons for 15 years from now.

The amount of waste generated is very large compared to the current volume, and therefore it should follow a completely different model from the current model based on the solid waste management system of Borg Al-Arab international Airport.

5.6 ENERGY

The energy systems will have certain environmental consequences that will result from the construction and operation of the energy facilities at the Airport site. These consequences were discussed in the other sections. The offsite infrastructure to support the power system has been suggested; however, certain additional decisions are required as a part of the engineering and design of the project at the detail design stage. These items include the switchyard and its location adjacent to the site boundary for the proposed support supply from the new Borg El-Arab City but the rights of way have not been identified and therefore the associated impact will be addressed later. These aspects of the project energy systems will require further action by the Airport Authority during the early stages of project engineering and detail design.

Using of solar energy system and lead lighting is a very positive step in this respect, please see chapter 2 for details and benefit.

5.7 Fueling System

High-case Scenario forecast predicted annual aircraft movements in the year 2024to be around 26,223. This may need about 150 million liters of aviation fuel. Thus the present storage capacity of aviation fuel should be expanded in order to meet the future demand and so should the present storage capacity of the oil storage tanks for both vehicles and Diesel generators.

For 2030 the estimated no. of aircrafts is 91,250. This may need about 522 million liters of aviation fuel.

Preliminary estimates for storage capacity of aviation fuel indicate that it should be increased from the current capacity of 0.25 million liters to around 7million liters by the year 2024.

The infrastructure of the aircraft fueling station should be expanded, designed and constructed in a modern new fashion to cope with the developing demands. Fuel service station for various vehicle types should, also, be developed separately to serve the Airport fleet of a variety of vehicles. Underground storage capacity of this fuel service facility should meet the expected demand up to 2030.

The contractor& designer should address this item and perform a risk assessment for this part

5.8 Stack Emissions

The electricity consumed at Borg El Arab Airport will not be generated at site within the boundary of the Airport, but rather generated in power plants situated in Alexandria zone, e.g. Sidi-Krir I & II and Abu-Kir power plants.

The combustion of natural gas and/or Diesel Fuelsat both power plants will result in stack emissions from each of the power plants units.

The share pertaining to the Borg El Arab Airport of Alexandria power plants generation is estimated to be very limited at the new building
The total energy generated by Sidi-Krir I & II and Abu-Kir units reached in 2009/2010 about 12GWh (million kWh).

This indicates that the Airport electricity generation share of Alexandria zone during 2010 didn't represent more than 0.003% of the total generation.
Meaning Very limited
Hence, it can be concluded that the effect of the construction of the new project on the increase in emissions will be minimal, specially using of solar system and other element describe in chapter 2. This quantity with the new building may be less then have meaning that it is very minimal

5.9 Oil Spills and Noise-Substations and Distribution Systems

In general, two (2) environmental problems are considered in connection with design of transformer substations: Transformer oil spilling and transformer noise and electromagnetic fields.
Transformers under normal operating conditions produce heat and noise. Heat is distributed to the surroundings without significant environmental problems, but transformer noise may be disturbing for near-by human dwellings. International standards for the design and manufacture of transformers describe typical limits for noise emission, mitigation procedures and measuring techniques. Egyptian standards, applied by the transformer operator or the authorities, may further restrict the noise emission from transformer banks. A limit of 55 – 65 dB (A) noise level, depending on the surrounding being urban or industrial zone, at the edge of the transformer substation is regarded as a safe limit for transformer substation noise. Also this can be full mitigated by proper design of the rooms containing this transformer
Cables for distribution systems may be of synthetic type or of oil – filled type. Whatever technical solution chosen for a cable system, the environmental impact is limited due to the cable system as an extremely well–protected self–containing system. In the case of mineral – oil insulated cable systems there may be a possibility for oil spillage to the surrounding soil, but as the oil is a controlled part of the secure operation of the cables, any oil spillage will

normally be detected and maintenance procedures taken to remedy the problem.

5.10 Electrical and Electromagnetic Fields

It is generally accepted that electric fields in the range to be found under normal operating conditions of transmission systems for all voltages does not present any danger for living species as long as clearance distances are secured.
Some power providers are applying a "problem awareness" philosophy, avoiding as example facilities in the close vicinity of heavy current– carrying transmission installations. However, it exists no scientific proven base for establishing limits for the exposure of living organisms to power– frequency electric or magnetic fields.
High electric fields around the conductors of a transmission line cause ionization of the surrounding air and creates transmission line corona. Especially under bad weather conditions corona effects may cause audible noise and radio and TV – interference problems in areas with limited field strength. The result is bad radio or TV reception quality. Mitigation procedures are precautions on the transmission line (bundle conductors or similar) or improvement of the transmission quality for radio and TV broadcasting. Some interference problems may be prevented through screening. Corona may further be the source of ozone generation and nitrous oxides, in general not presenting an environmental problem.

5.11 Land Use Conflicts

In general, land use conflicts between the energy (both electricity & fueling) supply facilities at the Airport and adjacent land uses will be minor. No access restrictions or interruption of existing practices will occur on adjacent Airport lands. No land use conflicts, encroachment, or interruption of services or access will occur immediately around the energy supply boundaries at the Airport as a result of the presence and operation of the facilities.

5.12 Short and Long Term Impacts

Short-term impacts can be defined as those impacts occurring as the result of construction activities. These types of impacts have an effect on environmental elements only during construction, or a short period afterwards, and the environment quickly recovers. These impacts are related to the various construction activities and solid/hazardous waste disposal. Long-term impacts, on the other hand, are associated with operation of the project and impacts, which will occur throughout the lifetime of the project. The following is a discussion of both types of impacts.
During the construction phase, activities, which will cause short-term impacts, include earth – moving, dredging and filling and other land work, facilities

construction through designated energy supply sites. These impacts will be more addressed in the next section.

- Long-term or on-going impacts will occur as a result of project operation. Air quality of the background air will be affected by the thermal generation of electric power during emergent operation of Diesel generators as well as gaseous leaks and evaporations of fuel storage and handling facilities.
- When firing the emergent Diesel oil, no exception of any of the pollutants standards will occur. However, given that the emergency power supply system will not be operated for more than 2% of total operating hours, only in case of supply interruptions or disconnections, power supply to the Airport will operate well within the emission guidelines, and no further mitigation is proposed. Also, engineering specifications of fuel storage facilities and maintenance & operation procedures will be an effective mitigation measure for such impacts.
- Operational effects due to energy systems on the nearby structures will also include noise, lighting and transport handling facilities. It is anticipated that these impacts will be considerably less following construction and, in time, surroundings will acclimate to the noise and light conditions. As a visual impact, energy facilities will be a permanent feature of the landscape but is not obvious as distinct structures from any direction.
- There will be some principal fixed-roof fuel storage tanks on the Airport at the fueling station site for storage of aviation light fuel oil. Fugitive emissions from fixed-roof tanks may occur as a result of evaporation of the liquid fuel into the space between the roof and the liquid surface. This vapor may be emitted to the atmosphere through vents during the tank filling process. However, since the fuel oil consists of not high volatility liquid and the tanks will only be filled infrequently (as this fuel will be sufficient for usage of around 15

days), the potential for significant releases through venting of the tanks is limited and therefore the potential to cause odor nuisance is not considered to be significant. Additionally, the nearest receptors are far away.

- Soil and groundwater pollution is a possible negative impact that may result from any accidental leakage of the underground fuel storage tanks. Methyl Tertiary Butyl Ether (MTBE) is a gasoline additive that is volatile in the atmosphere and mobile in groundwater. The primary source of MTBE in the environment is from leaking underground storage tanks containing reformulated gasoline. Automobile fuel blended with oxygenated reformulated gasoline commonly contains between 10% to 15% MTBE (volume/volume).
- Noise pollution is most commonly associated with Airports, highways and City traffic, and large industrial facilities; however, operating electrical substations may also produce some noise. This noise results essentially from the transformers and their refrigerating systems. The operation of the other equipment in the substation is, by nature, brief and occasional (such as opening and closing of circuit-breakers), and consequently, noise and safety risks associated with substations can be considered limited and can be mitigated with conventional noise reduction devices and environmental management procedures.
- Increased potential for a spill or accidental release to the environment: Handling of oil & fuel filled equipment and the installation of additional oil & fuel-filled equipment. However, the proper implementation of management controls and work practices will minimize the potential of this issues resulting in any significant impact to the environment.
- The hazardous material issues associated with energy systems involve the potential use of:
    - Epoxy grouts, and
    - Compressed gases, including acetylene and oxygen.

- It is worth mentioning also that none of PCB's is used today in any of the electrical equipment. The limited use of these hazardous materials is expected to be short term, only lasting the duration of the project. However, the proper implementation of management controls and work practices will minimize the potential of these issues resulting in any significant impact to the environment.

5.13 Social impact

This section presents the results of the field research carried out in the study area. The main objective of the fieldwork was to investigate the impact of the construction of the new project as perceived through the eyes of the target population.
The response is fully positive for the new building of the airport especially a lot people suffer now from the crowded area of the airport and bad roads to the airport.

The social and economic impact of constructing a new terminal building of a capacity 4,000,000 passengers/year is related to the achievement of the expected growth in passengers, aircrafts and cargo traffic in the airport, and this is what the following table clarifies:

Table (5-15) Current aircraft movements and forecasting

Current Aircraft Movements & Forecasting		
Years	**Flights**	**Percentage**
2010	7312	Base
2013	25986	Base
2014	20825	2%
2015	21449	3%
2016	21658	4%
2017	21866	4%
2018	22074	4%
2019	22282	5%
2020	22491	8%
2021	22699	9%
2022	22907	10%
2023	23115	11%
2024	23324	12%
2025	23324	12%
2026	23324	12%
2027	23324	12%
2028	25525	13%
2029	25525	13%

2030	28680	15%
Total	277988	149%

The previous table shows a large rise in the numbers of aircrafts that use Borg Al Arab international airport after the improvement by adding a new terminal building, as the number of aircrafts will reach 277988 aircraft/year, which is an increase by 149% from the base year 2013.

On the other hand, increasing the movement of aircraft at the airport with this ratio necessarily mean increasing the number of travelers using the airport, and it is as follows:

Table (5-16) Passengers Movement

Passengers Movement	
Year 2010	712073
Year 2013	2260540
Year 2014	2021892
Year 2015	2251054
Year 2016	2486256
Year 2017	2725453
Year 2018	2930210
Year 2019	3190906
Year 2020	3449723
Total	22028107

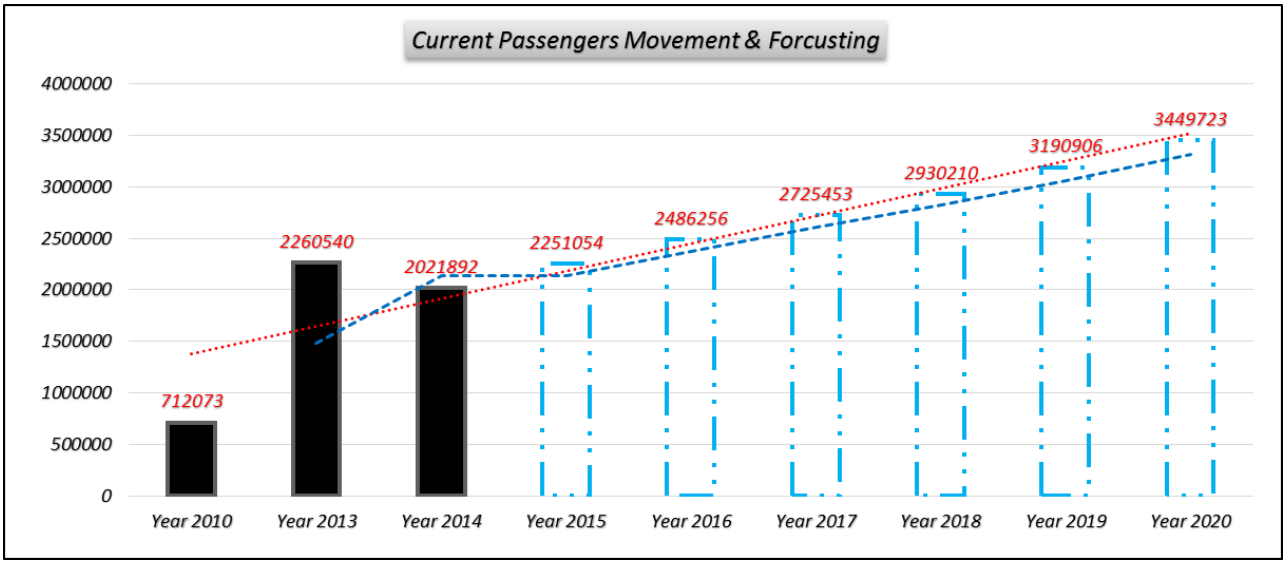


Figure (5-29) Current passengers movement and forecasting

The previous data shows the expected growth rate for the passengers of Borg Al Arab international airport for year 2020 to be (3449726) passenger.

Based on previous analyzes, the results are as follows:

- Increase job opportunities (direct and indirect) of the new project.
- Increase the efficiency of the basic infrastructure for the area of the Borg Al Arab during the strategic plan of the city (Drainage - Electric Power – potable water - Roads - transportation… etc.).
- Increase the tourism in Alexandria and its suburbs.
- Economic growth associated with the new movement and indirect job opportunities through the expansion of direct investment in the department of civil aviation activities and complementary activities.
- Urban expansion planned in advance.
- The growth of the movement of goods to and from the airport.

5.13.1 Methodology Assessment

The field study conducted was based on conducting open-ended, unstructured interviews with a sample of the target population; copies of the interview samples.

The sample selected was a purposeful sample, based on criteria of selection relevant to each respective target population, meaning that the boundaries of selection were only those identifying each respective group, with no other particular specifications.

5.13.2 Sampling

The total sample size considered for the interview is (100) interviewees.

The following groups with their perspective numbers are as follows:

- Borg El Arab Airport employees
- Companies used the airport
- Passengers using the airport
- Residents in Borg El Arab City
- University students.
- Bedouin Residents in proximity to the site
- Employees in the business/ industrial establishments in the City,
- Owners of business//industrial establishments
- Members of the Investors' Association,

- Additional interviews were conducted with some of the Bangar-Al-soukar population and the priest in the nearby monastery.

The interview has been made in the following areas:

- San Stefano mall
- Alexandria University
- San Mark College
- Egypt station
- El Etihad Al Sakandary club
- Carrefour
- Areas near Borg Al Arab Airport
- Borg Al Arab city

San Mark College

Alexandria University

Carrefour

Borg Al Arab city

Figure (5-30) Interview areas


Alex University
Masr Station
Carrefour Downtowen
The Airport
Qoutb Mousk
Google earth


- San Stefano mall
- Alexandria University
- San Mark College
- Egypt station
- Carrefour
Sanmarc
Alex University
Etthad club
Masr Station
Carrefour Downtowen
Google earth


- Qotb mosque
- Borg Al Arab Airport
The Airport
Qoutb Mousk
Google earth

Figure (5-31) for some of the areas that were considered during the field survey

A hundred copies were given to the interviewees and the results were as follows:

According to the sex of the interviewees:

Table (5-17) Sex of division terms

Sex of Division terms	
Male	52
Female	33
Unknown	15
Total	100

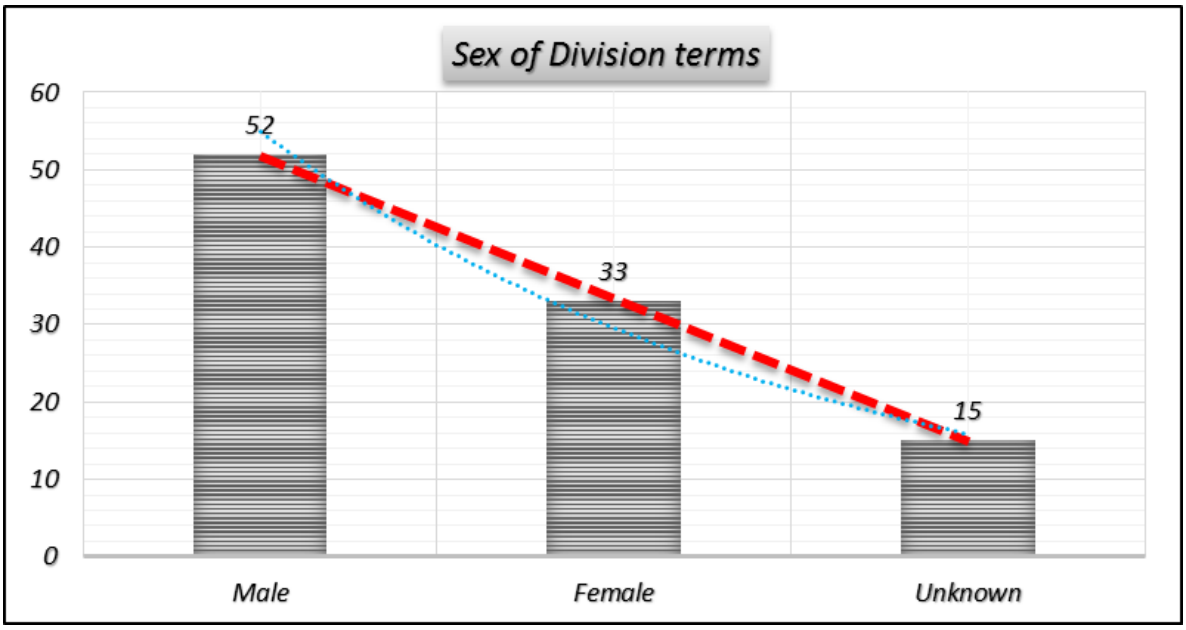


Figure (5-32) graph showing the sex of division terms

The interviewees' impression about the traffic and roads leading to the airport:

Table (5-18) Public opinion in quality of roads network

Public opinion in quality of roads network	
Poor	64
Acceptable	32
Good	3
Excellent	1
Total	100

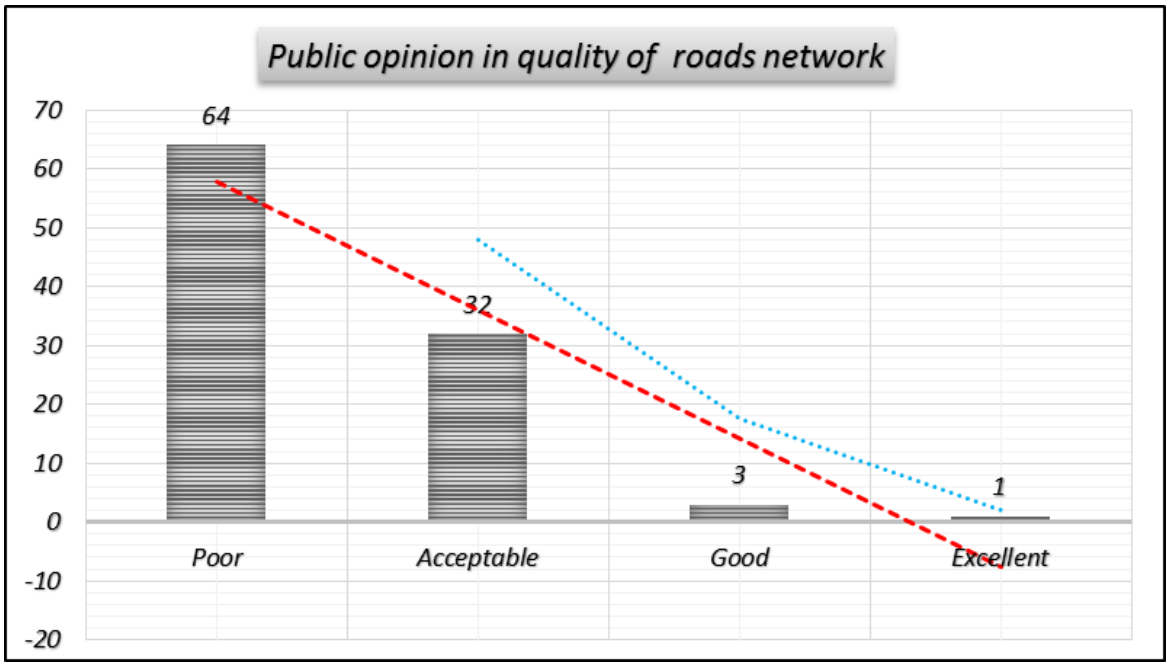


Figure (5-33) Public opinion in quality of roads network

The interviewees' approval for the new project:

Table (5-19) Public Approval of new project

Public Approval of new project	
Yes	83
No	6
Not Interested	11
Total	100

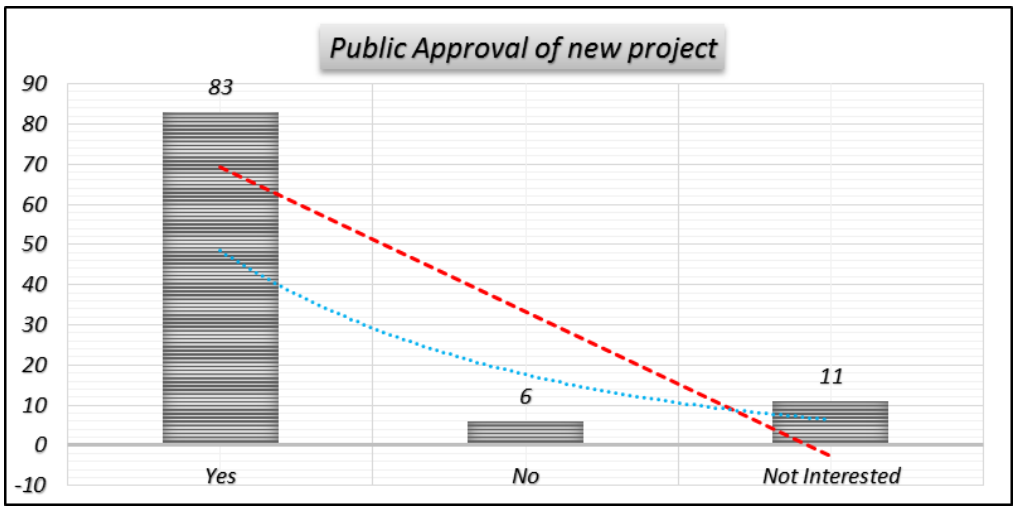


Figure (5-34) Public Approval of new project

The 6 % is only unhappy about the way new employment will be selected

The interviewees' impression about the project to be environmentally friendly:

Table (5-20) Public opinion in environmentally Terminal building

Public opinion in environmentally Terminal building	
Excellent	72
Not Interested	28
Total	100

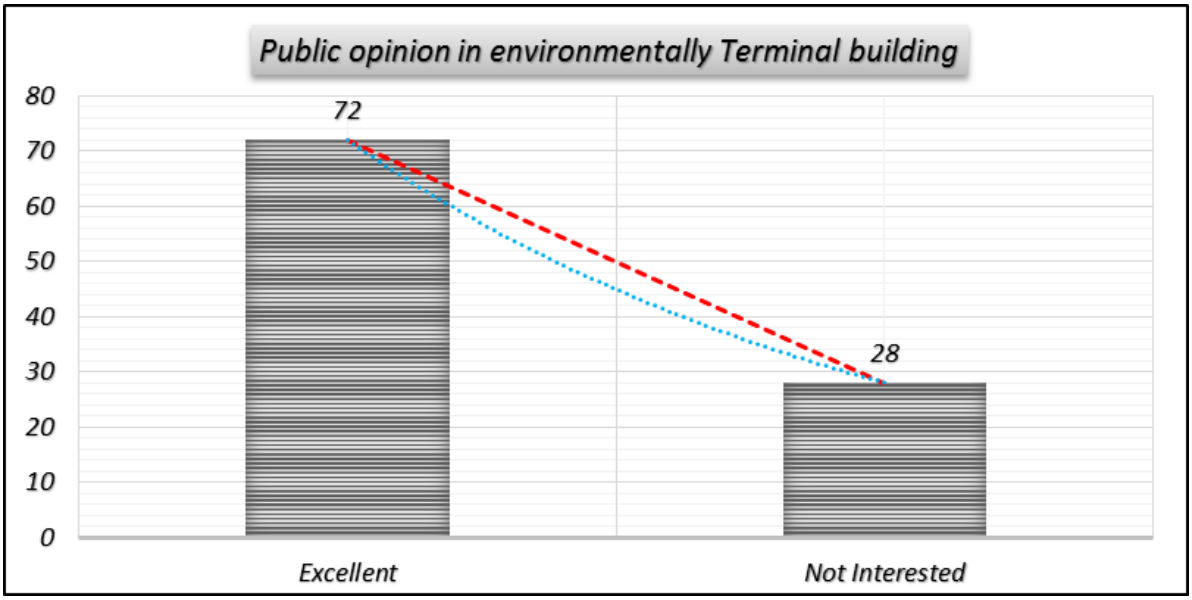


Figure (5-35) Public opinion in environmentally Terminal building

The previous analysis shows the following results:

- The major percentage of participants are males.
- Most of the interviewees agreed the new project is beneficial.
- Almost all the interviewees' agreed that the traffic and roads are very poor.
- Most of the interviewees` are excited for the project to be environmentally friendly and consume less electric power.

Recommendations:

- Improve and develop of the traffic net that leads to the airport (Very Important).
- Increase the parking lots in the airport with low fees.
- Avoid current technical notes and faults in the airport (without mentioning it)
- Use of the clean energy and saving energy.
- Separation of heavy transport pathways from normal on the airport road passenger cars.
- Provide public transport directly from Alexandria and Desert Road down to the Borg El Arab Airport directly to the lack of such transportation now. Provide free Internet retailing travel.

Figure (5-36) restaurants and cafes in Borg Al Arab airport

5.13.3 Social Aspects

The results of the field study carried out are summarized in the following section for each of the individual groups.

Residents in the Community

The establishment of the City of New Borg El Arab has attracted a sizeable population that has been growing over the years. The industrial zone, in particular, has played a major role in creating job opportunities for many from outside the City, not only from Alexandria—although its share from the residents is very high—but also from other governorates.

The respondents from the residents have a positive attitude towards the new Airport; they believe that its construction is a good way for the City to flourish. Tourism will also develop in the right direction, since the airport will be a good connecting point to the whole area of the North Coast. This situation will create job opportunities for their families.
Residents of the City expect the population to grow as business expands.

Owners of Business/Industrial Establishments and Members of the Investors' Association

The business/industrial establishments were mostly started in the last two decade i.e., dating back to the nineties, having been established at different points of this period. The owners come from different parts of Egypt, and are not necessarily residents of Borg El Arab City.

The type of business/industrial establishments covers a wide range. They include the production of foodstuffs, such as biscuits/chocolate and cheese; iron, steel and other metals; cardboard, paper, and packing material; chemicals and cosmetics; bathroom equipment; furniture and wood production; plastics; textiles; and electronic factories. There are also a good number of banks and insurance companies. The number of employees in the establishments varies with its size

This group of respondents has great support for the Airport. There is a general belief that the construction of the Airport will flourish the City, since it will create the demand for services of different sorts, especially with the expected expansion in the transportation network. The North Coast is characterized by its marvelous beaches and moderate temperatures all through the year. The presence of the new project will enhance tourism especially on the international levels.

Owners and businessmen also, believe that the Airport will definitely help in the export/import process. However, those involved with heavy products do

not have any use for it, since their transportation of goods depends mainly on ships in Alexandria, and the new Airport will have no effect on this aspect.

Employees in the Establishments

The origin of the employees in the establishment is also diversified. Whereas some of them live in Borg El Arab city, many live in Alexandria or the neighboring areas, the establishments provide transportation for their employees in this case.

Although the employees stated that they have no direct benefit from the construction of the Airport, they believe that the City will benefit from it, since the demand for services will emerge, and consequently, the City will flourish. In this case, additional job opportunities will be created.

Bedouins (Original Settlers in the Area)

Bedouins are spread out in the neighboring desert land. They have been living in the area for generations, their ancestral line going back a long way. There are no settlements within the construction site. Neither is there any in close proximity to it. The closest residential spots are quite far. There are no settlements within the site boundaries.

The living conditions of this group are not good. This can be noticed through the high level of crowding and a low level of education. Bedouins are engaged in herding and agricultural activities, for the most part.

In their responses to the interviews, they expressed that they have no affiliation with the Airport, neither to the existing one nor to the new terminal.

Because they feel no connection to the Airport, some of them have a neutral attitude towards the construction of the Airport.

Employees in the Borg El Arab Airport

The current number of employees is 300, according to the report by the personnel officer.
The respondents from this group that they are not worried about losing their jobs when the new terminal is constructed, because they know that there will be the demand for all of them, and even more employees, once the new one will function.

Bangar El-Sokkar Community

Most of the population in this area is working as farmers. They are hoping that the new airport will help them in exporting their products. And improve the roads conditions

5.13.4 Impacts

The desk information and the fieldwork have indicated that the positive impact of the proposed new building Airport in Borg El Arab cannot be underestimated.

The construction of the Airport in Borg El-Arab, if performed, taking into consideration the social aspects of the project, can expectedly help in achieving positive results for the City. In the first place, it will encourage tourism through the arrival of both international and domestic flights. In the second place, it will facilitate the export-import process in the industrial sector. More importantly, the City will grow and develop as business flourishes, allowing for further urban development in the North Coast.

5.14 BIOLOGICAL

No adverse effects are available on the surrounding wild life. The loss of few non-important natural habitats is expected during construction. Hence, it can be concluded that the project would not result in any adverse effects on listed threatened, vulnerable or endangered species. Hence, no mitigation or monitoring plans are required due to absence of sensitive biological resources or negative impacts on the terrestrial biological life.

5.15 Vibration

5.15.1 GENERAL Requirements

The work in this section includes, but is not limited to the following:

1. The airplane impact during touching the ground (this will have effect during operation phase)
2. Equipment isolation bases at building. (this will have effect during operation phase) but should be mitigated during design phase
3. Flexible piping connections. (this will have effect during operation phase)) but should be mitigated during design phase
4. Resilient Pipe Anchors and Guides (this will have effect during operation phase)) but should be mitigated during design phase

5.15.2 Submittals for approval and grantee vibration limits during design phase:

The sub-contractor shall submit to the main one the following data for approval by the engineer, clearly identifying each item of equipment supported and the isolation to be installed at each point of support.

1. Floor span if the equipment is to be supported by structure above grade.
2. Horsepower of each motor and rpm of both driven and driver, in each supported unit.
3. Detailed drawings of isolation base specified including dimensions, structural member’s sizes and isolators distribution according to the system's center of gravity.
4. Calculated static load of each isolator, according to the specified base and unit’s weight and isolator’s distribution.

5. Deflection of each isolator under the calculated load, actual loaded and unloaded measurable spring height, as well as calculated system's natural frequency, and isolation efficiency.
6. Factory certified data to allow submitted conditions of selection to be easily verified, with calculations.
7. Complete flexible connection details wherever it features.
8. Details of isolation hangers for ceiling hung equipment, piping and ductwork.

5.15.3 Assessment of vibration effects by plane landing

Prediction Methodology:

The basic prediction model for vibration propagation with distance is:

$$PPV=K\ (D/E1/2)-n \text{ --- } (1)$$

Where: K= the ground transmission constant (for a given ground types)
D= Distance from source to receive
E= Energy of source
n= Empirical constant base on a number of factors such as the geology, ground profile, frequency of transmitted wave, predominant waveform. The value of n is obtained from regression analysis and for the peat trials had a value between 0.5 and 1.5.

For a given vibration source, it may be assumed that the energy delivered into the ground is constant (over a sufficient timescale) therefore the equation reduces to:

$$PPV=K.D-n \quad \text{--- } (2)$$

This prediction method is elaborated in Hassan, 2006 (refer to references) which, unlike many other methods, contains frequency –dependent ground attenuation formulae. This method yields slightly more conservative result than other texts such as Godowsky &Dym (1976) and Nelson (1987) so is considered preferable in effects assessments. This same vibration prediction methodology was utilized in the water view connection project.

Vibration source data

Vibration data for high –vibration obtained from two references including:

- Site –specific measurements at the runway
- Measurement of equipment after installation

The measurements provide the most ideal source as they are site specific, including the actual ground type and equipment to be used on the project.

All data (measured and acquired) with a sample size of more than 6 measurements will be assembled, and regression analysis will be taken to establish propagation trends.

Prediction accuracy

Vibration prediction is less reliable than noise prediction. The primary difficulty is being able to accurately model ground conditions that are non- homogeneous and complex in three- dimensions and consequently difficult to quantify on site.

DIN 4150-1:199 German standards DIN 4150-1:199 will be used for this analysis

Vibration standards & guide for acceptance

Table (5-21) Summary of building damage criteria in DIN4150-1-2-3:1999

Type of structure	Short –term vibration				Long –term vibration
	PPV at the foundation at a frequency of			PPV at horizontal plane of highest floor (mm/s)	PPV at horizontal plane of highest floor (mm/s)
	1-10Hz (mm/s)	10-50Hz (mm/s)	50-100Hz (mm/s)		
Commercial/industrial	20	20-40	40-50	40	10
Residential /school	5	5-15	15-20	15	5
Historic or sensitive structures	3	3-8	8-10	8	2.5

The standard also contains criteria for buried pipe work of different materials and the effects of vibration on floor serviceability , as well as guidelines for measurement of vibration in buildings i.e. placement and orientation of the transducers .

It should be noted that these criteria are designed to avoid all damage to buildings i.e. even superficial damage like cracking in plaster. Significantly greater limits would be applied for damage to structural foundations.

In short

We will measure the vibration after erection of machinery and validate its value to full comply with project goals.

All our measurements very clearly indicate less than 2.5 (mm/sec) values giving the full indication that vibration at Borg Al Arab will not affect at all surround buildings

Measurements also indicate that the building subject to vibration transmitted through ground for both high and low frequency range will be much less than the acceptable level

According to soil specifications, absorption of vibration is very high.

5.15.4 Vibration Impact on the buildings near Borg Al Arab airport:

Table (5-22) vibration measurements

Point	Amplitude (mm/sec^2)
1	2.837
2	5.197
3	7.822
4	4.669
Plane Landed	
5	2.447
6	2.7
7	0.257
8	1.543
9	1.355

If we convert acceleration to velocity the max will be 0.01 mm/sec far below the acceptable level.

5.15.5 Overall conclusion

1. The measurements indicate low vibration level at runway and at the residential area.
2. The soil has a good abortion and damping coefficient clearly by measurements.
3. All measured value was in acceleration terms the velocity will be much lower.

5.16 Unavoidable Impacts

This section addresses the unavoidable impacts associated with the construction and operation of the project. These impacts are presented by environmental resource and are based on the existing environmental information discussion in chapter 4. The potential environmental impacts are considered as a part of developing the preliminary design of the project; therefore the description of the project in Chapter 1 represents an attempt to minimize the negative impacts of the project.

Most of the unavoidable impacts may not be occurred/generated within the Airport boundaries, but rather in places away from the project site (Borg El Arab City). These impacts should be considered as indirect environmental impacts but at the global level.
The Unavoidable effect is very limited due to the use of solar panels system and lead light systems and VRV air-condition systems for the new building, this implies that Global effects very limited for this project.
If EMP is fully applied, we will have very limited unavoidable effects during construction and operation.

Chapter 6 – Mitigation

6 Mitigation

An Integrated Environmental Management Plan (EMP) is proposed for Borg El Arab Airport project. The EMP shall cover the different project phases including the design phase, the construction phase and the operation phase.

The structure of the EMP will comprise the followings:

- Mitigation measures
  - Recommendation of feasible and cost effective measures to prevent or reduce the significant negative impacts to acceptable levels.
  - Estimation of the cost of the measures.
  - Identification of responsibility for the implementation of mitigation measures.

- Monitoring plans
  - Preparation of a detailed plan to monitor the implementation of the mitigation measures.
  - Estimation of the capital costs and/or the running costs.
  - Identification of the responsible bodies for implementation/supervision of the system.

6.1 DESIGN PHASE

This section outlines the main aspects of the EMP and mitigation measures for the facilities and components that may be considered during different design stages.
The consideration of the following proposed items, at the planning phase, will definitely minimize many construction and operation mitigation costs that may result if such precautions are not implemented.

6.1.1 Mitigation Plan – Design Phase

The following planning measures and precautions should be implemented during the design phase in order to eliminate/mitigate many of the adverse environmental impacts that are expected during next project phases.

6.1.2 Noise& vibration

The following measures should be taken into consideration during the design phase of the project:

- Studying the general layout and the relation between Apron area, Terminal buildings area and ground equipment.
- The best acoustical designs for all facilities inside the Airport to achieve a good acoustical performance inside all the Airport buildings according to standard sound levels which should be applied inside and according to WHO including ground equipment selection and types, thickness and specifications of the materials used in according to measurements and conclusions presented in this EIA study;
- Designing the HVAC system (ASHRE) standards including blower silencers.
- Best RT and STC for the building areas.

- **Vibration**

The new equipment for the project should be designed to minimize vibration at building

6.1.3 Water Supply

A new or extension of water treatment plant to accommodate the new components of wastewater.

6.1.4 Wastewater

There will be an increase in the generation of the wastewater from the landed aircrafts, the Terminal Building and different sources within the Airport premises. Wastewater collection system comprising of sewer pipelines, manholes, small pump stations so as to collect the wastewater generated from the new buildings and transfer it to a proposed wastewater treatment facility. Design of a Wastewater Treatment Plant with an appropriate capacity to accommodate the wastewater generated during different phases of the project. The liquid wastes generated from the aircrafts should be pretreated before being discharged to the Wastewater Treatment Plant. The treated effluent will be used for the irrigation of the landscape around Airport areas away from the Terminal Building.
In order to eliminate or mitigate the possibility of bad smell production, flies propagation, and localized high noise levels from high capacity air blowers and other equipment that may result from the new wastewater treatment facilities, the design criteria of new treatment facilities shall include the use of appropriate technologies with adequate safety factors, the use of tertiary treatment before reuse in irrigation including disinfections facilities, and the use of silencers for high noise equipment.

The cost of constructing a new treatment plant, which can accommodate wastewater generated from Aircrafts and domestic facilities, is estimated to be US$ 800,000. This cost should be included as a part of the project cost.
This option will save the Airport trouble of operating and maintaining the treatment plant. However, as indicated during the public hearing session, the head of city council of Borg El Arab prefers that the Airport will have its own Treatment unit.

Proper design of the collection systems shall include oil and grease traps at terminal cafeterias, ground services facilities, workshops, and all potential sources of oil and grease. Collection system shall also include all uncovered parts and buildings within the Airport premises for rainwater collection.

6.1.5 Solid Wastes

Design plan should include separate temporary storages area for the wastes generated at the main building and at the cargo village building.

An estimated area of at least 1000 m^2 should be dedicated to store the solid wastes generated from the main building during the Airport operational phase. An intermediate covered storage area with the estimated area should be subdivided to accommodate the different types of wastes: hazardous, non-hazardous wastes, and recycled materials (such as wood, paper, metals, etc…). Loading areas should be planned and designed and technical drawings prepared accommodating as well for the ramps to facilitate moving wastes in/out.

The Cargo Village solid wastes dedicated area is recommended to be suitable for the size of cargo. The storage area will be subdivided, to accommodate the different types of wastes: hazardous wastes, non-hazardous, recycled materials, and re-exported products. Loading areas will be planned and designed as well as ramps for moving in/out the wastes.

General refuse bins must be provided inside and outside the Terminal Building in sufficient number and size. Bins must be covered to prevent wind spreading action on collected litter.

Other hazardous materials and chemicals incidentally used in maintenance activities (e.g., solvents, paints, pesticides), are stored and handled from time to time. Airport Authority should establish appropriate segregated holding areas (described above) for these chemicals and materials.
On-site hazardous waste storage facilities can be either on-site, at the property where the waste is generated, or off-site, at a common hazardous waste storage and disposal facility. EEAA recommends the use of temporary on-site storage facilities though it is not recommended for airports due to its sensitivity areas.

Alexandria Governorate has a dedicated hazardous waste site, which should be utilized with the Governorate acceptance.

A sterilizing and fragmenting autoclave should be considered for treatment of condemned food products due to its spoilage or unacceptance to human consumption due to its chemical contamination. The technology is not hard to operate beside its lower operating cost compared to incinerators and with no dangerous gas emissions as in regular incinerators.

Figure (6-1) recycling collection and storages

Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area.

6.1.6 Energy

Energy efficiency improvements in the generation side as well as using energy efficient equipment and appliances in the demand site, in addition to implementing energy conservation measures in Borg El-Arab Airport, all will result in a considerable reduction in the Airport share of airborne emissions. Using of solar system, lead light and VRV air-condition system will dramatically reduce the electric requirements

Though transformer breakdowns and resulting oil spillage is extremely rare, precautions may be taken in the transformer substation design and layout to control any spilling of oil products. Transformers will normally have to be placed on a solid concrete foundation, which can be designed with a closed bottom in order to allow minor collocation oil leaks from the transformer during normal operating conditions.

6.2 CONSTRUCTION PHASE

In general, Impacts from construction activities will be short-term, temporary, and can be mitigated with standard construction management procedures.

6.2.1 Mitigation Plan - Construction Phase

During construction, some activities would result in adverse impacts such as traffic disruption, dispersion of construction wastes, increased air quality pollutant levels, and increased noise levels.

Appropriate measures and procedures shall be implemented in order to minimize and/or mitigate such impacts. The implementation of such procedures, including monitoring activities and environmental auditing, must be undertaken by qualified engineers and clerks of works to insure the abidance of all contractors to the environmental rules and regulations. Also, the method of construction must fulfill the requirement to avoid adverse impact to the communities.

Different construction contracts, including all contractors and subcontractors, must reflect in **their TOR** the appropriate construction safety procedures, occupational health, and the environmental mitigating measures, that may be summarized in the following:

6.2.2 Noise

It is expected that the annoyance and disturbances resulting from the construction of the new Airport might have an adverse effect only on the passengers, Airport employees and construction staff in the premises of the Airport. This is due to the fact that the construction site is located at a distance far from the nearest residential area.

Noise will be generated during the construction phase from heavy equipment mobilization, and any demolishing activities. Higher levels of noise may continue during the initial phase of these operations.

One of the main sources of noise can result from the power generators used to provide power to the site or diesel engine construction plant. This equipment is to be fitted with silencers. Since this will be a temporary act for a short time it does not require a full Noise Impact Assessment and should be on a complaint basis.

During construction, the contractor must ensure that noise levels will not become a concern and will be required to maintain a noise complaints register to record and detail any concerns from the public. The contractor will be required to have a management strategy in place to address these concerns.

The complaint register will record what corrective action has been taken, or the reasons way corrective action was not considered necessary.

Construction noise levels will still affect construction employees, Airport visitors, and Airport employees. Therefore, the contractor must also manage to perform proper protection actions. There should be limited noisy construction activities at night. The workers exposed to loud noise should wear earmuffs.

This will require the formulation of a construction noise mitigation strategy, as outlined in Table (6-1). The Table reflects the level of mitigation activities that should be carried out on site to decrease the level of noise generated during equipment site selection, selecting of equipment types, equipment relocation and time of operation for these equipment.

A noise expert for this phase during construction will help in such implementation.

Table (6-1) Noise mitigation plan

Mitigation	Description	Noise Attenuation dB (A)
Level One	Use good site practices to limit noise emissions at the source (noise expert may be very helpful here)	Not quantified but can go up to 7
Level Two	Selection of quiet plant and working methods	4
Level Three	Construction of suitable temporary noise barriers	6-12
Level Four	Relocation of equipment and/or reduction of number of plants items at one time	3-5
Level Five	Limiting equipment operating time and do a job rolling	3

6.2.3 Air Quality

Most of the construction activities are dust producing, and hence it is expected that the air quality pollution level, specially dust and particulates, will significantly increase as a result of the construction activities resulting in adverse environmental impacts. The following measures should be followed to mitigate such impacts:

- All material resulting from excavation must be put in a location protected from wind and regularly sprinkled with water until reused for fill or disposed outside the site;

- All excavations shall be backfilled and reinstated to a similar condition as existed before the excavation started;
- Temporary haul roads shall be watered whilst in use to reduce dust production during construction;
- All hauling trucks must be securely covered to eliminate dust scatter while moving in and out of the site;

All vehicles and equipment used should be mechanically checked to avoid excess emissions.

6.2.4 Traffic

Necessary to take the following actions:

1. **The link road between International coastal road and Borg El Arab Airport**
   - I. Re-reconstruction the entrance to the road link to the airport at the intersection with the international coastal road opposite the village of SidiKrier,And Taking into account the construction of U-turn two directions before going out directly.
   - II. Cover the surface of the pavement for the entire length of the road by asphaltic surface layer.
   - III. Rehabilitation shoulders, median island and curbs
   - IV. Cancellation direct intersections and replaced by U-turn
   - V. Rehabilitation Traffic Safety Tools AS: Traffic Signals & Signs Road Marking Roadway Lighting
   - VI. Construction of a bridge at the intersection with railway Alexandria Matrouh.

2. **Mehwar AL-Taameir**
   - I. Cover the surface of the pavement for the entire length of the road by asphaltic surface layer.
   - II. Rehabilitation all the engineering elements.
   - III. Rehabilitation the cross-intersection with the Cairo Alexandria Desert Road and with the coastal road
   - IV. Rehabilitation Traffic Safety Tools AS: Traffic Signals & Signs Road Marking Roadway Lighting
   - V. Rehabilitation the New Jersey corresponding to the lake

3. **El aquaria road**
   - I. Building an underground tunnel or elevated road at the intersection with the Cairo Alexandria Desert Road to safe entrance and exit the traffic movement.
   - II. Re-reconstruction the first section as a divided road (2ways-2lanes) according the engineering‘s criteria and specifications.
   - III. Rehabilitation the second section which linked with Borg El Arab city as a closest city of the airport.

6.2.5 Liquid, Solids, and Construction Wastes

During construction, it is expected that large amounts of liquid and solid wastes will result from different construction activities as well as from the workers and offices camps. In order to eliminate and /or mitigate such impacts, a waste management plan should be set by the contracted construction companies and their sub-contractors. The plan addresses the following items:

- Avoidance and minimization of waste generation through adopting the following design practices:

    - Good site management can minimize over ordering and waste material generation, particularly for bulk materials such as concrete, mortar and cement grouts. Similarly, framework should be designed to maximize use of standard panels enabling their reuse;
    - On-site reuse of materials - thereby avoiding unnecessary transport and disposal requirements;
    - Off-site recycling proper segregation of wastes on site will increase the feasibility of recycling elements of the waste stream by offsite Contractors. Concrete and masonry can be used as general fill and steel reinforcement bars can be utilized in steel mills. Different areas should be designated for such segregation and storage wherever site conditions permit; and
    - Treatment and disposal - this must be undertaken according to relevant regulations, guidelines and good practice.

- The final disposal site for all waste types detailed in the Plan must be agreed upon consultation with EAC and Alexandria Governorate – any Company. Where the Plan calls for disposal of waste off-site it must:

    - Specify the handling and storage procedures to be adopted to minimize lossor leakage, and for clean-up of small spills;
    - Ensure timely removal of waste;

- Require use of authorized or licensed waste collectors for specific waste types;
- Include measures for the cleaning and maintenance of waste storage and handling areas;
- Demonstrate compliance with all appropriate waste disposal regulations;
- Include procedures for the monitoring of waste collected to ensure correct disposal;
- Include proposals for the establishment and maintenance of a database on the quantities of wastes generated, recycled and disposed.

- The Contractor will remain liable for the waste generated due to his or their activities until it is correctly disposed of. On site, general wastes may be temporarily stored in enclosed bins or compaction units separate from construction and chemical wastes. The burning of refuse on construction sites will be prohibited. Site office wastes can be reduced through the recycling of paper if the volume is large enough to warrant collection.

- Training should be required from the Contractor as stated in his contract and provided to workers on the concept of site cleanliness and appropriate waste management procedure, including reduction, reuse and recycling of wastes.

- A Hazardous Waste Management Plan must be prepared for each Contractor generating chemical waste in accordance with the guidelines of EAC and EEAA, where these guidelines exist. In specific terms, the Plan must ensure that: use of appropriate containers for the storage of chemical wastes, i.e.: be suitable for the substance they are holding, be resistant to corrosion, maintained in a

good condition, and securely closed, have a capacity of less than 450 liters unless otherwise approved by
EAC, and display a label in English and Arabic.

- The temporarily storage area for chemical wastes is clearly signed and used solely for the storage of chemical waste, enclosed on at least three (3) sides and adequately ventilated. Containers should be arranged so that materials can be adequately separated, and covered to prevent rainfall-entering water collected within the bund. The storage dedicated place should has an impervious floor and bounding of sufficient capacity to accommodate 110 percent of the volume of the largest container or 20 percent of the total volume of waste stored in that area, whichever is the greatest.

- Disposal of non-hazardous and hazardous wastes will occur in proper and certified disposal facilities by a licensed waste collector who may transport waste to the same disposal facilities that will be used by the EAC. (The contract between the EAC and the collector may give this option). The recyclable wastes should be provided to a waste re-user approved by EAC.

6.2.6 Occupational Health and Safety

Local and international construction practice in Environmental, Health and Safety (EHS) will be applied all times. Contractors should include in the tender documents their measures to implement EHS procedures for their workers and for the subcontractors' workers.

All contractors must supply their workers with proper clothing and gears and appropriate safety training and instructions.

6.2.7 Cultural and Archaeological

There are no known archaeological or cultural sites that will be affected by the construction of the new Terminal Building. As such, there should be no adverse archaeological or cultural impacts as a result of the construction of this Terminal Building. As a precautionary measure, a protocol for site

management 'chance finds' should be incorporated into the Environmental Management Plan.

6.2.8 Monitoring Plan

Monitors Indicators

The following parameters to be considered during the construction phase should act as the monitoring indicators for the implementation of mitigation measures:

- Level of local air pollutants.
- Vehicles should pass the normal inspection tests.
- Number and quantity of oil/fuel spills.
- Fuel, oil and chemicals storage facilities to ensure that there are no leaks or spills and that contingency measures such as fire-fighting equipment and clean-up devices are in place and in order.

6.2.9 Implementation and Supervision

The implementation of the mitigation measures during the construction phase shall be part of the Contractor's scope of work and should be implemented by the Contractor. All the monitoring results should be recorded in the Environmental register form so as to be ready for auditing by the EEAA.

As part of the institutional strengthening, an Environmental unit/ committee should be formed with a qualified staff.

The Airport environmental officer, which is to be part of the Environmental unit, will be responsible for conducting the environmental supervision and auditing activities at site during the construction phase. A third party (Consultant appointed by the EAC) can also participate in the supervision activities. The tasks of the supervision body shall cover the following:

- Insure minimal air pollution from construction activities as it will stated in the TOR of the contractors.
- Insure proper wastewater and solid waste disposal during this phase as stated in the TOR of the contractors.

- Secure hazardous waste management at the site as it should be mentioned in the TOR of the contractors.
- Insure adoption of noise, and air monitoring schemes.
- Insure the workers abidance with occupational health and safety at the site and their supply with protective gears.
- Insure the proper handling of construction reflecting light materials especially during night.
- Insure minimal oils and fuel spills and control any accidental spill.

6.3 OPERATION PHASE

Care should be given to this part of the environmental management plan since it lasts almost for the whole project life. An integrated environmental management scheme that insures the sustainable operation of different project components is presented hereinafter.

6.3.1 Mitigation Plan - Operation Phase

The proper implementation of the following precautions and measures will help in mitigating the adverse impacts outlined in chapter (6). Such mitigating measures can be summarized as follows:

6.3.2 Noise

Aircraft design should meet the standards set by the International Civil Aviation Organization (ICAO) (Volume I of Annex 16). Meanwhile the Committee of Aviation Environmental Protection (CAEP) has recommended new noise abatement take-off procedures that maintain necessary safety operations. Such operational measures could help Airports to alleviate the noise impacts on neighboring communities. Two (2) procedures are contained in these standards; one of them should be applied routinely for all take-off procedures. The procedure selected for use will depend on the noise distribution required and the type of airplane involved.

All previous predicted noise values were based on the assumption that the proper procedures for landing and take-off had been adopted. In order to assure the implementation of such procedures proper functional monitoring scheme should be adopted. Details of the scheme are outlined below in the monitoring section.

When installing the monitoring system, it is possible to get a complete statistical data for planes over one year time and review the action needed to

improve the management plan, i.e. the monitoring system has its register complaint handling software which makes it easy to decide upon the best action depending on data available on the system.

The monitoring system should allow all data to be transferred via any telephone line to the appropriate authorities to take the suitable action in our case it can be monitored by Borg El Arab Airport Authority and EAC environmental unit.

Monitoring system will consist of 6 monitoring stations.

6.3.3 Air quality

Based on the outcome of the concentration estimates presented for Borg El Arab Airport, probably, there will not be an urgent need to start evaluation an optimal abatement plan for the Airport activities at this point in time. Even for the fully developed Airport at year 2030, the air quality meets the air quality limit values given in Law No.9/2009 of Egypt.

However, there are reasons to look at the impact from the road traffic bringing passengers to and from the Airport. The NOx exposure predicted at the terminal area may be reduced considerably by implementing three way catalytic converters in all cars. The change from using diesel in all mini buses and buses as well as ground services vehicles may also reduce some of the impact. The SO_2 impact will disappear almost completely in this case.

Most modern cars are equipped with catalytic converters, which also will help to reduce carbon monoxide (CO) and VOC emissions in addition the reduction of NOx emissions.

A total Air Quality Management System for Borg El Arab Airport will include three (3) phases:

- Assessment
- Control
- Surveillance

The first assessment of the air quality linked to Airport activities has been presented in this report. The control phase will depend of all environmental impacts assessed and will have to be developed in cooperation between the environmental experts and the developer. The third phase, the surveillance phase, consists of the establishment of a monitoring system as well as

institutions and infrastructures to handle this. A plan for such development including a rough cost estimate is presented in the monitoring section.

6.3.4 Social Aspects

The general attitude of the respondents is positive towards the construction of the new Airport. Some of them have a direct connection with it, as in the case of the businessmen in the City, and hence its impact is beneficial to them. Others have no direct connection, but feel that they will benefit from the indirect impact of its construction, as seen in the development of the City.

The field study has also revealed a number of recommendations. These can be summarized as follows:

- A good transportation system is needed to connect the Airport with the neighboring areas, especially Alexandria. Currently, the existing Airport has a bus service to the City center in Alexandria (when it was functioning). What the respondents need is a more regular, efficient transportation system that covers more intermediate stops to serve the whole North Coast, especially as it is expected that the new Airport would increase the need for this transportation system with the increase in the number of Airport users.
- Some respondents believe that a good transportation network in the area needs to be completed with a good railroad system. In this way, the whole North Coast can be served, and not only Alexandria;
- Since the respondents of all groups, as above given, have not expressed any negative attitudes towards the new Airport, not even environmental concerns, it is recommended that the plan for its construction be made with the community interests in mind, in order to maintain their positive outlook. What is meant here is that the required services be provided, especially the transportation system that can facilitate the connection to the Airport, in addition to the proper managerial aspects internally and externally in order to serve the needs of Borg El Arab population efficiently;
- New Road between the airport and Alex desert Road is very important step in this respect

- Expend the current bus link (super jet) to have a new stop at Borg Al Arab airport, it is already pass through Alexandria and north coast.

6.3.5 Wastewater

On utilizing WWTP at Borg El Arab there is no negative impact expected. On constructing a new WWTP in the Airport site, the following measures should be taken to mitigate the adverse impacts related to the wastewater collection and treatment, as discussed in Chapter (6):

- The operation of any wastewater treatment plant should be close to the basis of its design. Active and appropriate maintenance procedures should be practiced;
- Training of the operating staff shall be insured. Training shall include local Airport personnel as well as operators and workers hired by any contracted operation and maintenance company;
- Care should be given to the sludge management system. Sludge handling should be carried out during late night hours in closed containers to prevent nuisance to public and tourists.
- The operation of the treatment plant or observation of the operation for the gravity collection sewer should be carried out through the management body responsible for the operation of the Airport;

Moreover, the areas of the landscape within the Airport should be irrigated by the treated effluent of the treatment plant. This is considered an important water resources saving. The new system for irrigation shall comprise its own pumping system and filters and storage tank. The system shall be designed to be semi-automatic where drip emitters are used so as to minimize the water consumption.

6.3.6 Solid and Hazardous Wastes

Non-hazardous solid wastes generated by Airport operations will be collected by licensed Contractor and disposed off-site at government approved landfill sites. The contractors should collect the wastes from specifically designated waste storage areas at Airport. A new nearby certified facility for non-hazardous wastes will be located at the 71st km
(Coastal road Mersa-Matruh- Alex.), AlamNayel Area, in El-HammamCity.

Aircraft solid waste will arrive at Borg El Arab Airport in two (2) forms: Cabin waste (consisting of papers, magazines, etc…); and foods stuffs/food wastes (remains of in-flight meals). Based on the practice in some International Airports and Public Health Regulations, all waste from incoming international aircraft, particularly food, plastic cutlery and personal passenger's items are required to be segregated and inspected from terminal-generated waste. According to international laws, cabin waste can be separated and transported for offsite recycling. Food waste should be sealed and disposed by a certified Contractor in a certified landfill as soon as possible, with minimizing any storage time at the Airport. Such wastes could not be opened or re-used.

At the Cargo Village, for food and agriculture types of wastes, it is recommended, based on quantities, to be shredded and autoclaved for further use as fertilizers

The small amounts of hazardous liquid wastes generated - primarily waste oils from maintenance operations should be stored in drums and periodically collected by the diesel fuel suppliers and recycled commercially. Waste batteries should be also collected and recycled by the suppliers. Containment in cement blocks can be the recommended detoxification procedure for combustible hazardous wastes not returned to petroleum refining products as they may contain toxic compounds that are carcinogens and mutagens.

The Airport Authority though the supervision of its environmental Department will be responsible to ensure the follow up on contracts for the collection, transportation and final disposal of all wastes are being undertaken in accordance with its Environmental Management Plan. Law 4/1994, 9/2009 stipulates that handling of hazardous wastes requires a license issued by a competent administrative authority. An additional integral component of permitting hazardous wastes transportation is monitoring the performance of licensees in order to ensure their compliance with the set conditions. This is to be carried out by the EEAA branch in Alexandria Governorate. Individual transporters are required to provide documentation attesting that these vehicles meet the required specifications and are suitable for transporting these types of hazardous wastes designated in the license. It is necessary that the essential hazardous wastes documentation be appended to the licensing papers to form a part of the licensing application/procedures
The Waste Management Plan should be audited by the Airport Environmental Department on an annual basis to ensure the compliance with the plan objectives, and to update the plan as necessary to ensure its relevance. The Environmental Department of the Airport should prepare a monthly report highlighting volumes of material accumulated, transported and disposed. The Department will follow up on the adoption of the waste management for the Airport building, aircrafts, and Cargo Village using check list to control and record all the wastes at all times, and the quantities disposed.

6.3.7 Monitoring Plan – Operation Phase

Monitoring of the impacts of the project and of the effectiveness of the mitigation measures should be undertaken during all phases of the project.

Environmental monitoring is intended to provide constant feedback on the effectiveness of the mitigation and environmental protection measures, identify and define any problems encountered during mitigation compliance and provide the opportunity to adjust the approach for mitigation in a timely fashion.

The monitoring plan should be carried out in order to ensure the following:

- Continue to collect monitoring data periodically to document if the construction is having any effects on the environment.
- Outline a management approach and alternative mitigation strategies to correct any observed deviations.
- Establish a communication and reporting process with EEAA.

The monitoring plan should be carried out through an environmental unit that should be present in the Airport.

All the results of the monitoring plan should be recorded in the Environmental registry form that should be kept by the Airport Authority.

The followings represent the main aspects of the monitoring plan:

Noise

In the operation phase due to the expected increase in number of flights over the coming years and the consequent increase in the noise level as predicted by the INM, a monitoring program should be established. The monitoring system include four (6) monitoring stations with a suitable software and it should be applied inside the Airport building and residential areaespecially near schools, chicken farms, commercial and agricultural activities.

The system also includes training the staff of control tower to perform the noise monitoring according to the ICAO regulations.

The cost of the Automatic system is estimated to be US$ 215,000 as shown in Table (6-2).

Table (6-2): The cost of the noise monitoring system

Item	Cost
6 monitoring stations	6 *50,000 = 300000 US$
Training courses for staff and traffic controllers	15,000 US$
Running cost for the system (phone bill and others)	1500 US$/ Year
Total initial cost	215,000 US $

This program has been proven to be very effective and has been used in many international Airports as it allows for reduction of noise and it may be used as a tool for estimating fines for planes that violate landing and take-off procedures. Furthermore the EAC has already the monitoring software at its headquarter

In order to assure a proper implementation of such program, a training course for the staff of the Environmental unit should be conducted. This will help them to correlate the relation between air track and noise level on ground and will increase their ability to take the necessary actions to limit the noise problem inside and outside the Airport.

Air Quality

To follow up the development of a new airport in Borg El Arab and its possible impact to the environment, it is required that an air quality monitoring program is being installed in the possible maximum impact area at the Airport.

An important objective for the Airport air quality-monitoring platform is to enable on-line data and information transfer with direct quality control of the collected data. Several monitors and sensors that make on-line data transfer and control possible are available on the market. For some compounds and indicators, however, this is not the case.

A general objective for the air quality measurement program is to adequately characterize air pollution for the area of interest, with a minimum expenditure of time and money. The measurement and sampling techniques to be used in each case will be dependent upon a complete analysis of the problem.

Compounds and indicators

The compounds and indicators to be selected for the permanent air quality monitoring stations should be specific for the typical compound emitted from the Airport activities.

The main core of the on-line air quality monitoring program will be based on these permanently located measurement sites. This is necessary to meet the main objectives of the Borg El Arab Airport air quality monitoring and assessment program.

The compound selected should be possible to measure with reasonable accuracy. It should be adequately documented and linked to possible health impact, building deterioration, impacts related to the specific activity in question (normal release, accidental release, specific pollutants or potential damages in the near surroundings of the releases.

The most commonly selected air quality indicators for traffic urban air pollution are:

- Nitrogen dioxide (NO_2);
- Sulphur dioxide (SO_2);
- Carbon monoxide (CO);
- Particles with aerodynamic diameter less than 10 □m (or 2,5 m), PM_{10} ($PM_{2,5}$);
- Ozone.

The compounds listed above are referred to as the priority pollutants by the US EPA. They are also given in the Air Quality Daughter Directives of the European Union with specific limit values for the protection of health and the environment. The first three (3) are also given in the World Bank limit values for ambient air pollution. The World Health Organization guideline values also include the above indicators as well as others. Selected air quality standards have been given by Law no.9/2009 of Egypt for NO_2, SO_2, CO, PM_{10}, TSP, black smoke and ozone.

For some of the activities linked to aircraft fuel storage as well as road traffic it is suggested to include hydrocarbons measured as:

- Volatile organic compounds (VOC);
- Benzene, Toluene and Xylene (BTEX);
- Non-methane hydrocarbons (NMHC).

VOCs will participate in the production of photochemical smog, normally measured by ozone as an indicator.

Other pollutants may also have to be considered, such as:

- Ammonia (NH_3);
- Polycyclic Aromatic Hydrocarbons (PAH) with a specific selected indicator such as Benzo(a)pyrene (BaP);
- Heavy metals such as Pb, Cd, As, Hg, Ni, etc…

For estimating greenhouse gas emissions indicators such as CO_2 and N_2O could be included. However, it will normally only be required to undertake an emission inventory of the greenhouse gas emissions. This inventory will have to be updated on an annual basis.

The Measurement Program

The anticipated impact of air pollution around the Borg El Arab Airport will probably be limited to the closest surroundings of the terminal building. It is therefore suggested that a fairly limited program of measurements are installed. The ambient air quality system should include ten (10) sampling points for passive sampling.

Simple samplers for surveillance of time integrated SO_2 and NO_2 concentration distributions have been developed. The samplers are inexpensive in use, simple to handle and have a good overall precision and accuracy. They have been used in traffic studies, industrial areas, in urban areas and for studies of indoor/outdoor exposures. Investigations using passive samplers have been undertaken to develop spatial concentration distribution.

One of the internationally recognized samplers was developed by the Swedish Environmental Research Institute (IVL) and has been used in several cases by EEAA-EIMP. The sampler includes an impregnated filter inside a small plastic tube.

Other passive diffusion samplers have also been tested at a number of sites where Volatile Organic Compounds (VOC's) are the principals.

The passive samplers can be operated outside the permanent or mobile stations and will not need any shelters, electricity or data collection systems. However, they will have to be analyzed in a laboratory after exposure in the field for typically one (1) or two (2) weeks.

It will be recommended that such sampler results are coordinated and compared to automatic data from the permanent network. It may thus be advisable to handle such sampling from the shelters already available in field.

The chemical analysis of PM, SO_2 and NO_2 have to performed in a laboratory. All these analyses are being undertaken by EEAA assigned laboratories in Cairo.

Particulate matter has to be analyzed gravimetric by high sensitive scales in climate-controlled rooms. The chemical analysis of SO_2 and NO_2 in extracts from impregnated filters is performed with ion chromatography.

Or use of one mobile station that EAC has in Sharm Al shiekh or Hurghada

6.3.8 Monitoring Cost Estimates

A complete set of instruments for ten (10) sites for passive sampling have been roughly estimated.
The total costs of instruments will be around 3500 US$.

6.3.9 Water

Water quality should be monitored at least monthly to insure that the supply is bacteriologically and chemically safe and complies with the international and national standards. Monitoring should cover the source of water supply by conducting analysis the inlet pipe to the Airport area as well as the distribution facilities including storage tanks and internal networks. Regular evaluation of the results of the analysis can then be used to detect any probable water pollution.
Cost of monthly analysis is estimated as LE 1,500, resulting in an annual cost of LE 18,000.

6.3.10 Wastewater

Water quality should be monitored at least monthly for the treated effluent from either Borg El Arab treatment plant or from the proposed new plant, to insure that the effluent is bacteriologically and chemically safe and complies with standards specifications stated in the protection of Environment Law No.9/2009 mainly Law No. 93/ 1962 and its Ministerial Decree No. 44/2000 Clause No.15 for the reuse of treated wastewater in irrigation purposes the Ministry of Housing, Utilities and Urban Communities (MHUUC).

Effluent from the wastewater treatment plant will at first be monitored on a weekly basis. If consistent results are obtained, the frequency may be relaxed. Analyses to include among other parameters coliforms, BOD, COD, suspended solids, nitrates, and phosphates.

Cost of monthly analysis is estimated as LE 2,500, resulting in annual cost of LE 30,000.

6.3.11 Energy

As part of the monitoring plan during the operation phase, a number of indicators should be monitored. These include:

- Logging of fuel spill and/or leakage incidents should be undertaken. Indicators such as number of fuel spill/leakage per year, and volume of spilled or leaked fuel, as percentage of total fuel used per year should be monitored and recorded as part of the environmental register whose all pollution prevention activities should be reported;
- Normal safety procedures at the fueling station should be sufficient to limit the potential of fugitive emissions and/ or leakages of hydrocarbons. However, continuous monitoring of these emissions and level of fuel in the tanks should be an integral part of the air quality-monitoring program as well as the health and safety reporting;
- Indicators such as number of fuel or lube oil spill/leakage per year, and volume of spilled or leaked fuel (lube oil), as percentage of total fuel /lube oil used per year should be monitored and reported in the environmental register;
- Percentage of recycled used oil is a good indicator to monitor better environmental management;
- An energy management program at the existing facilities should start with the installation of a set of sub-meters in selected energy consuming centers at the Airport. Combination of sub metering equipment and software is widely used to monitor facilities energy demand and usage levels. Sub meter provides Manager with energy consumption data showing how energy is distributed to the various departments, tenants, or processes within the facility. Gross electricity consumption per square meter of the Airport is a good indicator to monitor energy efficiency improvements at the Airport.

6.3.12 Implementation and Supervision

In general, EAC should be responsible for the implementation of the EMP. However, each of the systems can be implemented by external bodies as follows:

- The monitoring system is to be implemented by an external noise Consultant in coordination with the EAC and Borg El Arab Airport Authority. The monitoring system should be carried out on a daily basis and to be continuously supervised by the Environmental Unit in the Airport.
- For the noise monitoring system, an external environmental Consultant and Contractor should carry out the implementation of the noise monitoring system.
- EEAA should carry out the air quality monitoring system.
- As the utilities related monitoring activities, this should be carried out by the Contract of the managing company.

The environmental dimension integration during the operation phase should be insured to secure best performance of the Airport.

The Airport environmental officer with the help of the environmental expert will conduct an initial extensive audit to identify the areas and hot spots to be checked and determine the frequency of their auditing. During this phase the following activities should be covered:

- Insure minimal indoor and outdoor air pollution during the operation of the Airport terminal;
- Insure the proper operation of the wastewater collection and treatment facilities as stated in the TOR of the contracted company for operation and maintenance of the treatment facility installed at the Airport. In addition, the officer will insure the proper maintenance of all toilet facilities as stated in the TOR for the contracted cleaning company for the Airport terminal;

- Insure adoption of segregation and proper handling of all solid wastes generated indoor and outdoor areas of the new terminal as stated in the TOR of the solid waste contractor;
- Secure hazardous waste management at the site as mentioned in the TOR of the solid waste contractor;
- Insure adoption of all monitoring schemes as stated in the EMP; -Insure the workers abidance with occupational health and safety at the terminal and within the contracted companies;
- Insure the training of all personnel for their part of IEMP adopted by the Airport;
- Prepare the Environmental register describing all activities pertinent to environmental actions;
- Prepare the list of contacts in case of emergencies.

Chapter 7 – Environmental Management Plan

7 ENVIRONMENTAL MANAGEMENT PLAN

An Integrated Environmental Management Plan (EMP) is proposed for Borg El Arab Airport project. The EMP shall cover the different project phases including the construction phase and the operation phase.

The structure of the EMP will comprise the followings:

- Mitigation measures
  - Recommendation of feasible and cost effective measures to prevent or reduce the significant negative impacts to acceptable levels.
  - Estimation of the cost of the measures.
  - Identification of responsibility for the implementation of mitigation measures.
- Monitoring plans
  - Preparation of a detailed plan to monitor the implementation of the mitigation measures.
  - Estimation of the capital costs and/or the running costs.
  - Identification of the responsible bodies for implementation/supervision of the system.

In this section the details of the EMP are presented. However, most of the significant issues together with the implementation schedules, cost and the responsible bodies for supervision are represented in Table (6-3).

7.1 CONSTRUCTION PHASE

In general, Impacts from construction activities will be short-term, temporary, and can be mitigated with standard construction management procedures.

7.1.1 Mitigation Plan - Construction Phase

During construction, some activities would result in adverse impacts such as traffic disruption, dispersion of construction wastes, increased air quality pollutant levels, and increased noise levels.

Appropriate measures and procedures shall be implemented in order to minimize and/or mitigate such impacts. The implementation of such procedures, including monitoring activities and environmental auditing, must be undertaken by qualified engineers and clerks of works to insure the abidance of all contractors to the environmental rules and

regulations. Also, the method of construction must fulfill the requirement to avoid adverse impact to the communities.

Different construction contracts, including all contractors and subcontractors, must reflect in their TOR the appropriate construction safety procedures, occupational health, and the environmental mitigating measures, that may be summarized in the following:

Noise

It is expected that the annoyance and disturbances resulting from the construction of the new Airport might have an adverse effect only on the passengers, Airport employees and construction staff in the premises of the Airport. This is due to the fact that the construction site is located at a distance far from the nearest residential area.

Noise will be generated during the construction phase from heavy equipment mobilization, and any demolishing activities. Higher levels of noise may continue during the initial phase of these operations.

One of the main sources of noise can result from the power generators used to provide power to the site or diesel engine construction plant. This equipment is to be fitted with silencers. Since this will be a temporary act for a short time it does not require a full Noise Impact Assessment and should be on a complaint basis.

During construction, the contractor must ensure that noise levels will not become a concern and will be required to maintain a noise complaints register to record and detail any concerns from the public. The contractor will be required to have a management strategy in place to address these concerns. The complaint register will record what corrective action has been taken, or the reasons way corrective action was not considered necessary.

Construction noise levels will still affect construction employees, Airport visitors, and Airport employees. Therefore, the contractor must also manage to perform proper protection actions. There should be limited noisy construction activities at night. The workers exposed to loud noise should wear earmuffs.

This will require the formulation of a construction noise mitigation strategy, as outlined in Table (6-1). The Table reflects the level of mitigation activities that should be carried out on site to decrease the level of noise generated during equipment site selection, selecting of equipment types, equipment relocation and time of operation for these equipment.

A noise expert for this phase during construction will help in such implementation.

Table (7-1) Noise mitigation during construction phase

Mitigation	Description	Noise Attenuation dB (A)
Level One	Use good site practices to limit noise emissions at the source (noise expert may be very helpful here)	Not quantified but can go up to 7
Level Two	Selection of quiet plant and working methods	4
Level Three	Construction of suitable temporary noise barriers	6-12
Level Four	Relocation of equipment and/or reduction of number of plants items at one time	3-5
Level Five	Limiting equipment operating time and do a job rolling	3

Air Quality

Most of the construction activities are dust producing, and hence it is expected that the air quality pollution level, specially dust and particulates, will significantly increase as a result of the construction activities resulting in adverse environmental impacts. The following measures should be followed to mitigate such impacts:

- All material resulting from excavation must be put in a location protected from wind and regularly sprinkled with water until reused for fill or disposed outside the site;
- All excavations shall be backfilled and reinstated to a similar condition as existed before the excavation started;
- Temporary haul roads shall be watered whilst in use to reduce dust production during construction;
- All hauling trucks must be securely covered to eliminate dust scatter while moving in and out of the site;

All vehicles and equipment used should be mechanically checked to avoid excess emissions.

Liquid, Solids, and Construction Wastes

During construction, it is expected that large amounts of liquid and solid wastes will result from different construction activities as well as from the workers and offices camps. In order to eliminate and /or mitigate such impacts,

a waste management plan should be set by the contracted construction companies and their sub-contractors. The plan addresses the following items:

- Avoidance and minimization of waste generation through adopting the following design practices:
    - Good site management can minimize over ordering and waste material generation, particularly for bulk materials such as concrete, mortar and cement grouts. Similarly, framework should be designed to maximize use of standard panels enabling their reuse;
    - On-site reuse of materials - thereby avoiding unnecessary transport and disposal requirements;
    - Off-site recycling proper segregation of wastes on site will increase the feasibility of recycling elements of the waste stream by off-site Contractors. Concrete and masonry can be used as general fill and steel reinforcement bars can be utilized in steel mills. Different areas should be designated for such segregation and storage wherever site Conditions permit; and
    - Treatment and disposal - this must be undertaken according to relevant regulations, guidelines and good practice.
- The final disposal site for all waste types detailed in the Plan must be agreed upon consultation with EAC and Alexandria Governorate - Onyx Company. Where the Plan calls for disposal of waste off-site it must:
    - Specify the handling and storage procedures to be adopted to minimize loss or leakage, and for clean-up of small spills;
    - Ensure timely removal of waste;
    - Require use of authorized or licensed waste collectors for specific waste types;
    - Include measures for the cleaning and maintenance of waste storage and handling areas;
    - Demonstrate compliance with all appropriate waste disposal regulations;

- Include procedures for the monitoring of waste collected to ensure correct disposal;
- Include proposals for the establishment and maintenance of a database on the quantities of wastes generated, recycled and disposed.

- The Contractor will remain liable for the waste generated due to his or their activities until it is correctly disposed of. On site, general wastes may be temporarily stored in enclosed bins or compaction units separate from construction and chemical wastes. The burning of refuse on construction sites will be prohibited. Site office wastes can be reduced through the recycling of paper if the volume is large enough to warrant collection.

- Training should be required from the Contractor as stated in his contract and provided to workers on the concept of site cleanliness and appropriate waste management procedure, including reduction, reuse and recycling of wastes.

- A Hazardous Waste Management Plan must be prepared for each Contractor generating chemical waste in accordance with the guidelines of EAC and EEAA, where these guidelines exist. In specific terms, the Plan must ensure that: use of appropriate containers for the storage of chemical wastes, i.e.: be suitable for the substance they are holding, be resistant to corrosion, maintained in a good condition, and securely closed, have a capacity of less than 450 liters unless otherwise approved by

  EAC, and display a label in English and Arabic.

- The temporarily storage area for chemical wastes is clearly signed and used solely for the storage of chemical waste, enclosed on at least three (3) sides and adequately ventilated. Containers should be arranged so that materials can be adequately separated, and covered

to prevent rainfall-entering water collected within the bund. The storage dedicated place should has an impervious floor and bounding of sufficient capacity to accommodate 110 percent of the volume of the largest container or 20 percent of the total volume of waste stored in that area, whichever is the greatest.

Disposal of non-hazardous and hazardous wastes will occur in proper and certified disposal facilities by a licensed waste collector who may transport waste to the same disposal facilities that will be used by the EAC. (The contract between the EAC and the collector may give this option). The recyclable wastes should be provided to a waste re-user approved by EAC.

Occupational Health and Safety

Local and international construction practice in Environmental, Health and Safety (EHS) will be applied all times. Contractors should include in the tender documents their measures to implement EHS procedures for their workers and for the subcontractors' workers.
All contractors must supply their workers with proper clothing and gears and appropriate safety training and instructions.

Cultural and Archaeological

There are no known archaeological or cultural sites that will be affected by the construction of the new Terminal Building. As such, there should be no adverse archaeological or cultural impacts as a result of the construction of this Terminal Building. As a precautionary measure, a protocol for site management 'chance finds' should be incorporated into the Environmental Management Plan.

7.1.2 Monitoring Plan

Monitors Indicators

The following parameters to be considered during the construction phase should act as the monitoring indicators for the implementation of mitigation measures:

- Level of local air pollutants.
- Vehicles should pass the normal inspection tests.
- Number and quantity of oil/fuel spills.
- Fuel, oil and chemicals storage facilities to ensure that there are no leaks or spills and that contingency measures such as firefighting equipment and clean-up devices are in place and in order.

Implementation and Supervision

The implementation of the mitigation measures during the construction phase shall be part of the Contractor's scope of work and should be implemented by the Contractor. All the monitoring results should be recorded in the Environmental register form so as to be ready for auditing by the EEAA.

As part of the institutional strengthening, an Environmental unit/ committee should be formed.

The Airport environmental officer, which is to be part of the Environmental unit, will be responsible for conducting the environmental supervision and auditing activities at site during the construction phase. A third party (Consultant appointed by the EAC) can also participate in the supervision activities. The tasks of the supervision body shall cover the following:

- Ensure minimal air pollution from construction activities as stated in the TOR of the contractors.
- Insure proper wastewater and solid waste disposal during this phase as stated in the TOR of the contractors.
- Secure hazardous waste management at the site as mentioned in the TOR of the contractors.
- Insure adoption of noise, and air monitoring schemes.
- Insure the workers abidance with occupational health and safety at the site and their supply with protective gears.
- Insure the proper handling of construction reflecting light materials especially during night.
- Insure minimal oils and fuel spills and control any accidental spill.

7.2 OPERATION PHASE

Care should be given to this part of the environmental management plan since it lasts almost for the whole project life. An integrated environmental management scheme that insures the sustainable operation of different project components is presented hereinafter.

7.2.1 Mitigation Plan – Operation phase

The proper implementation of the following precautions and measures will help in mitigating the adverse impacts outlined in chapter (5). Such mitigating measures can be summarized as follows:

Noise

Aircraft design should meet the standards set by the International Civil Aviation Organization (ICAO). Meanwhile the Committee of Aviation Environmental Protection (CAEP) has recommended new noise abatement take-off procedures that maintain necessary safety operations. Such operational measures could help Airports to alleviate the noise impacts on neighboring communities. Two (2) procedures are contained in these standards; one of them should be applied routinely for all take-off procedures. The procedure selected for use will depend on the noise distribution required and the type of airplane involved.

All previous predicted noise values were based on the assumption that the proper procedures for landing and take-off had been adopted. In order to assure the implementation of such procedures proper functional monitoring scheme should be adopted. Details of the scheme are outlined below in the monitoring section.

When installing the monitoring system, it is possible to get a complete statistical data for planes over one year time and review the action needed to improve the management plan, i.e. the monitoring system has its register complaint handling software which makes it easy to decide upon the best action depending on data available on the system.

The monitoring system should allow all data to be transferred via any telephone line to the appropriate authorities to take the suitable action in our case it can be monitored by Borg El Arab Airport Authority and EEAA.

Air quality

Based on the outcome of the concentration estimates presented for Borg El Arab Airport, probably, there will not be an urgent need to start evaluation an optimal abatement plan for the Airport activities at this point in time. Even for the fully developed Airport at year 2024, the air quality meets the air quality limit values given in Law No.4 of Egypt.

However, there are reasons to look at the impact from the road traffic bringing passengers to and from the Airport. The NOx exposure predicted at the terminal area may be reduced considerably by implementing three way catalytic converters in all cars. The change from using diesel in all mini buses and buses as well as ground services vehicles may also reduce some of the impact. The SO_2 impact will disappear almost completely in this case.

Most modern cars are equipped with catalytic converters, which also will help to reduce carbon monoxide (CO) and VOC emissions in addition the reduction of NOx emissions.

A total Air Quality Management System for Borg El Arab Airport will include three (3) phases:

- Assessment
- Control
- Surveillance

The first assessment of the air quality linked to Airport activities has been presented in this report. The control phase will depend of all environmental impacts assessed and will have to be developed in cooperation between the environmental experts and the developer. The third phase, the surveillance phase, consists of the establishment of a monitoring system as well as institutions and infrastructures to handle this. A plan for such development including a rough cost estimate is presented in the monitoring section.

Social Aspects

The general attitude of the respondents is positive towards the construction of the new Airport. Some of them have a direct connection with it, as in the case of the businessmen in the City, and hence its impact is beneficial to them. Others have no direct connection, but feel that they will benefit from the indirect impact of its construction, as seen in the development of the City.

The field study has also revealed a number of recommendations. These can be summarized as follows:

- There are lessons to be learned from Al-Nozha Airport. Since it is expected that the City of Borg El Arab will flourish, and consequently expand, as a result of the construction of the new Airport, this boom must be paralleled with strict building regulations that should coincide with their strict enforcement. High buildings should not be allowed within the required legal distance around the Airport.
- A good transportation system is needed to connect the Airport with the neighboring areas, especially Alexandria. Currently, the existing Airport has a bus service to the City center in Alexandria (when it was functioning). What the respondents need is a more regular,

efficient transportation system that covers more intermediate stops to serve the whole North Coast, especially as it is expected that the new Airport would increase the need for this transportation system with the increase in the number of Airport users.

- Some respondents believe that a good transportation network in the area needs to be completed with a good railroad system. In this way, the whole North Coast can be served, and not only Alexandria;
- Since the respondents of all groups, as above given, have not expressed any negative attitudes towards the new Airport, not even environmental concerns, it is recommended that the plan for its construction be made with the community interests in mind, in order to maintain their positive outlook. What is meant here is that the required services be provided, especially the transportation system that can facilitate the connection to the Airport, in addition to the proper managerial aspects internally and externally in order to serve the needs of Borg El Arab population efficiently;
- New Road between the airport and Alex desert Road is very important step in this respect
- Expend the current bus link (super jet) to have a new stop at Borg Al Arab airport, it is already pass through Alexandria and north coast.

Wastewater

On utilizing WWTP at Borg El Arab (option 1) there is no negative impact expected. On constructing a new WWTP in the Airport site (option 2), the following measures should be taken to mitigate the adverse impacts related to the wastewater collection and treatment, as discussed in Chapter (5):

- The operation of any wastewater treatment plant should be close to the basis of its design. Active and appropriate maintenance procedures should be practiced;

- Training of the operating staff shall be insured. Training shall include local Airport personnel as well as operators and workers hired by any contracted operation and maintenance company;
- Care should be given to the sludge management system. Sludge handling should be carried out during late night hours in closed containers to prevent nuisance to public and tourists.
- The operation of the treatment plant or observation of the operation for the gravity collection sewer should be carried out through the management body responsible for the operation of the Airport;

Moreover, the areas of the landscape within the Airport should be irrigated by the treated effluent of the treatment plant. This is considered an important water resources saving. The new system for irrigation shall comprise its own pumping system and filters and storage tank. The system shall be designed to be semi-automatic where drip emitters are used so as to minimize the water consumption.

Solid and Hazardous Wastes

Non-hazardous solid wastes generated by Airport operations will be collected by licensed Contractor and disposed off-site at government approved landfill sites. The contractors should collect the wastes from specifically designated waste storage areas at Airport. A new nearby certified facility for non-hazardous wastes will be located at the 71st km

(Coastal road MersaMatruh- Alex.), AlamNayelArea, in El-HammamCity.

Aircraft solid waste will arrive at Borg El Arab Airport in two (2) forms: Cabin waste (consisting of papers, magazines, etc…); and foods stuffs/food wastes (remains of in-flight meals). Based on the practice in some International Airports and Public Health Regulations, all waste from incoming international aircraft, particularly food, plastic cutlery and personal passenger's items are required to be segregated and inspected from terminal-generated waste. According to international laws, cabin waste can be separated and transported for offsite recycling. Food waste should be sealed and disposed by a certified Contractor in a certified landfill as soon as possible, with minimizing any storage time at the Airport. Such wastes could not be opened or re-used.

At the Cargo Village, for food and agriculture types of wastes, it is recommended, based on quantities, to be shredded and autoclaved for further use as fertilizers

The small amounts of hazardous liquid wastes generated - primarily waste oils from maintenance operations should be stored in drums and periodically collected by the diesel fuel suppliers and recycled commercially. Waste batteries should be also collected and recycled by the suppliers. Containment in cement blocks can be the recommended detoxification procedure for combustible hazardous wastes not returned to petroleum refining products as they may contain toxic compounds that are carcinogens and mutagens.

The Airport Authority though the supervision of its environmental Department will be responsible to ensure the follow up on contracts for the collection, transportation and final disposal of all wastes are being undertaken in accordance with its Environmental Management Plan. Law 4/1994 and 9/2009 stipulates that handling of hazardous wastes requires a license issued by a competent administrative authority. An additional integral component of permitting hazardous wastes transportation is monitoring the performance of licensees in order to ensure their compliance with the set conditions. This is to be carried out by the EEAA branch in Alexandria Governorate. Individual transporters are required to provide documentation attesting that these vehicles meet the required specifications and are suitable for transporting these types of hazardous wastes designated in the license. It is necessary that the essential hazardous wastes documentation be appended to the licensing papers to form a part of the licensing application/procedures.

Article 26 of the Executive Regulations of Law 4/1994 identifies the requirements and conditions for permitting hazardous wastes handling.

Disposal of hazardous wastes will occur in proper and certified disposal facilities. The certified hazardous waste facility closest to the existing Airport is within 5 km from the gate.
The Waste Management Plan should be audited by the Airport Environmental Department on an annual basis to ensure the compliance with the plan objectives, and to update the plan as necessary to ensure its relevance. The Environmental Department of the Airport should prepare a monthly report highlighting volumes of material accumulated, transported and disposed. The Department will follow up on the adoption of the waste management for the Airport building, aircrafts, and Cargo Village using check list to control and record all the wastes at all times, and the quantities disposed.

Energy

- With reference to the SO_2, NOx and PM emissions share of the project in the Alexandria Power Generation, mitigation measures have already been included in the design of the power plants and, given West Delta Electricity Production Company (WDEPC) strict commitment to use natural gas, no further mitigation measures are proposed.
- With reference to ambient air quality affected by emissions from the Airport electricity generation share, no mitigation measures are proposed. The maximum 24-hr average ground level NO_2 concentrations of power plants in Alexandria zone was found less than 10% of the permissible limit, and the Airport share would be nothing but trace.
- With reference to fugitive emissions from Aviation Fuel Storage Tanks, the following mitigation measures should be applied:
    - Fixed-roof fuel storage tanks at the fueling station for storage of aviation light fuel oil;
    - Fuel oil consists of not high volatility liquid;
    - The tanks will only be filled infrequently as this fuel will be sufficient for usage of around fifteen (15) days;
    - The potential for significant releases through venting of the tanks is limited and therefore the potential to cause odor nuisance is not considered to be significant;
- With reference to electrical and electromagnetic fields, the following mitigation measures should be applied:
    - Although no scientific proven base for establishing limits for the exposure of living organisms or humans to power frequency electric or magnetic fields, clearance distances will be secured;
    - Mitigation procedures, in case electricity is supplied from New Borg El Arab, are precautions on the transmission line (bundle conductors or similar) or improvement of the transmission quality for radio and TV broadcasting;

- Corona may further be the source of ozone generation and nitrous oxides, in general not presenting an environmental problem.

- With reference to spillage of oils, chemicals or fuels on site, good site management measures including adequate monitoring activities will minimize any potential risks. As part of this, regular checks of bunds and drainage systems will be undertaken to ensure containment and efficient operation.
- This oil–containing foundation technique will normally be supplemented with a larger, underground oil reservoir with sufficient capacity to collect the total oil volume from one or more of the installed transformers in case of a total break – down of the transformer's isolation and cooling system. Reservoirs will allow later recovery of the insulating oil and/or transport to an incineration facility for controlled destruction, but need regular control for function and tightness.
- With reference to hazardous materials, potential lead contamination associated with onsite storage/disposal of lead covered cable pieces will be controlled via strict storage and disposal procedures according to regulating rules.

Occupational Health and Safety

Airports indoor and outdoor environments are considered places of relative high health risks in certain areas due to the following environmental health hazards. Those hazards are of minimal impacts on passengers due to the very limited short time of exposure. The impacts can be significant on working personnel and mitigation measures in the airport terminal design as well as protective gears should be made available during the operation phase for the airport personnel and security personnel present indoor and outdoor of the air terminal once operated.

The following will indicate the mitigation for terminal building indoor health hazards and the category of exposed personnel.

Proper Mitigation Measures should be implemented for each personnel categories. These Mitigation Measures are as follows:

Selection of low microwave and/or electromagnetic emitting equipment and installation of insulation shield if indicated by the manufacturer, and Periodical measurement of the electromagnetic fields and periodical shift of operating personnel to minimize their daily exposure in order to reduce the effect of Electro-magnetic waves due to long hours of work on the

Observer officers in the airport tower

Selection of low emissions equipment and installation of insulation shield if indicated by the manufacturer, and periodical measurement of the electromagnetic fields and periodical shift of operating personnel to minimize their daily exposure in order to reduce the effect of the X-ray exposure emitted from security checking gates and passengers bags scanning equipment on the Security officers at the terminal inlet

Installation of glass shielding on check in desks with continuous cleaning in order to reduce the potential of infection from passengers especially with the increasing rates of airborne infectious diseases (SARS) on the operating personnel in check desks

Application of efficient air filters in the central air-conditioning system and operating the AC system at high circulation rates in order to reduce the effect of the indoor air pollution from airplanes exhaust in airport tarmac area on the Airport administrators, operators and clerical personnel in the airport terminal

Proper ventilation of the luggage areas under the terminal in order to reduce the effect of the exhaust of airplanes and Clark lifts on the Cargo dealing personnel operating in the passengers' luggage area in the terminal building

Proper ventilation and air conditioning for the covered areas of the Cargo Village and installation of air curtains at doors of the village built area in order to reduce the effect of dust, exhaust of and heat stress on the Cargo dealing personnel in cargo village

Proper shielding of the scanner of the cargo in order to protect the personnel from the hazardous exposed of the scattered X-rays.

Outdoor exposure to high noise, heat stress, and toxic VOC including volatile gasoline vapors is an important element in the occupational health and safety measures to be adopted by the airport management.

All workers working on the air site should wear protective clothing, head helmets, and earmuffs so as to reduce the effect of high level of noise protected from the airplanes turbines and airplanes exhausts

Gas fueling personnel should wear gas masks while fueling airplanes to protect them from the vapors of carcinogenic gasoline

7.2.2 Monitoring Plan – Operation Phase

Monitoring of the impacts of the project and of the effectiveness of the mitigation measures should be undertaken during all phases of the project.

Environmental monitoring is intended to provide constant feedback on the effectiveness of the mitigation and environmental protection measures, identify and define any problems encountered during mitigation compliance and provide the opportunity to adjust the approach for mitigation in a timely fashion.

The monitoring plan should be carried out in order to ensure the following:

- Continue to collect monitoring data periodically to document if the construction is having any effects on the environment.
- Outline a management approach and alternative mitigation strategies to correct any observed deviations.
- Establish a communication and reporting process with EEAA.

The monitoring plan should be carried out through an environmental unit that should be present in the Airport.

All the results of the monitoring plan should be recorded in the

Environmental registry form that should be kept by the Airport Authority.

The followings represent the main aspects of the monitoring plan:

Noise

In the operation phase due to the expected increase in number of flights over the coming years and the consequent increase in the noise level as predicted by the INM, a monitoring program should be established. The monitoring system include four (6) monitoring stations with a suitable software and it should be applied inside the Airport building and residential area specially near schools, chicken farms, commercial and agricultural activities.

The system also includes training the staff of control tower to perform the noise monitoring according to the ICAO regulations.

The cost of the Automatic system is estimated to be US$ 215,000 as shown in Table (6-2).

Table (7-2): The cost of the noise monitoring system

Item	Cost
6 monitoring stations	6 *50,000 = 300000 US$
Training courses for staff and traffic controllers	15,000 US$
Running cost for the system (phone bill and others)	1500 US$/ Year
Total initial cost	215,000 US $

This program has been proven to be very effective and has been used in many international Airports as it allows for reduction of noise and it may be used as a tool for estimating fines for planes that violate landing and take-off procedures.

In order to assure a proper implementation of such program, a training course for the staff of the control tower should be conducted. This will help them to correlate the relation between air track and noise level on ground and will increase their ability to take the necessary actions to limit the noise problem inside and outside the Airport.

Air Quality

To follow up the development of a new airport in Borg El Arab and its possible impact to the environment, it is required that an air quality monitoring program is being installed in the possible maximum impact area at the Airport.

An important objective for the Airport air quality-monitoring platform is to enable on-line data and information transfer with direct quality control of the collected data. Several monitors and sensors that make on-line data transfer and control possible are available on the market. For some compounds and indicators, however, this is not the case.

A general objective for the air quality measurement program is to adequately characterize air pollution for the area of interest, with a minimum expenditure of time and money. The measurement and sampling techniques to be used in each case will be dependent upon a complete analysis of the problem.

Compounds and indicators

The compounds and indicators to be selected for the permanent air quality monitoring stations should be specific for the typical compound emitted from the Airport activities.

The main core of the on-line air quality monitoring program will be based on these permanently located measurement sites. This is necessary to meet the main objectives of the Borg El Arab Airport air quality monitoring and assessment program.

The compound selected should be possible to measure with reasonable accuracy. It should be adequately documented and linked to possible health impact, building deterioration, impacts related to the specific activity in question (normal release, accidental release, specific pollutants or potential damages in the near surroundings of the releases.

The most commonly selected air quality indicators for traffic urban air pollution are:

- Nitrogen dioxide (NO_2);
- Sulphur dioxide (SO_2);
- Carbon monoxide (CO);
- Particles with aerodynamic diameter less than 10 □m (or 2,5m), PM_{10} ($PM_{2.5}$);
- Ozone.

The compounds listed above are referred to as the priority pollutants by the US EPA. They are also given in the Air Quality Daughter Directives of the European Union with specific limit values for the protection of health and the environment. The first three (3) are also given in the World Bank limit values for ambient air pollution. The World Health Organization guideline values also include the above indicators as well as others. Selected air quality standards have been given by Law no. 4 of Egypt for NO_2, SO_2, CO, PM_{10}, TSP, black smoke and ozone.

For some of the activities linked to aircraft fuel storage as well as road traffic it is suggested to include hydrocarbons measured as:

- Volatile organic compounds (VOC);
- Benzene, Toluene and Xylene (BTEX);
- Non-methane hydrocarbons (NMHC).

VOCs will participate in the production of photochemical smog, normally measured by ozone as an indicator.

Other pollutants may also have to be considered, such as:

- Ammonia (NH_3);
- Polycyclic Aromatic Hydrocarbons (PAH) with a specific selected indicator such as Benzo(a)pyrene (BaP);
- Heavy metals such as Pb, Cd, As, Hg, Ni, etc…

For estimating greenhouse gas emissions indicators such as CO_2 and N_2O could be included. However, it will normally only be required to undertake an emission inventory of the greenhouse gas emissions. This inventory will have to be updated on an annual basis.

The Measurement Program

The anticipated impact of air pollution around the Borg El Arab Airport will probably be limited to the closest surroundings of the terminal building. It is therefore suggested that a fairly limited program of measurements are installed. The ambient air quality system should include ten (10) sampling points for passive sampling.

Simple samplers for surveillance of time integrated SO_2 and NO_2 concentration distributions have been developed. The samplers are inexpensive in use, simple to handle and have a good overall precision and accuracy. They have been used in traffic studies, industrial areas, in urban areas and for studies of indoor/outdoor exposures. Investigations using passive samplers have been undertaken to develop spatial concentration distribution.

One of the internationally recognized samplers was developed by the Swedish Environmental Research Institute (IVL) and has been used in several cases by EEAA-EIMP. The sampler includes an impregnated filter inside a small plastic tube.

Other passive diffusion samplers have also been tested at a number of sites where Volatile Organic Compounds (VOC's) are the principals.

The passive samplers can be operated outside the permanent or mobile stations and will not need any shelters, electricity or data collection systems. However, they will have to be analyzed in a laboratory after exposure in the field for typically one (1) or two (2) weeks.
It will be recommended that such sampler results are coordinated and compared to automatic data from the permanent network. It may thus be advisable to handle such sampling from the shelters already available in field.

The chemical analysis of PM, SO_2 and NO_2 have to performed in a laboratory. All these analyses are being undertaken by EEAA assigned laboratories in Cairo.

Particulate matter has to be analyzed gravimetric by high sensitive scales in climate-controlled rooms. The chemical analysis of SO_2 and NO_2 in extracts from impregnated filters is performed with ion chromatography.

7.2.3 Monitoring Cost Estimates

A complete set of instruments for ten (10) sites for passive sampling have been roughly estimated.
The total costs of instruments will be around 3500 US$ per year.

Water

Water quality should be monitored at least monthly to insure that the supply is bacteriologically and chemically safe and complies with the international and national standards. Monitoring should cover the source of water supply by conducting analysis the inlet pipe to the Airport area as well as the distribution facilities including storage tanks and internal networks. Regular evaluation of the results of the analysis can then be used to detect any probable water pollution.

Cost of monthly analysis is estimated as LE 1,500, resulting in an annual cost of LE 18,000.

Wastewater

Water quality should be monitored at least monthly for the treated effluent from either Borg El Arab treatment plant or from the proposed new plant, to insure that the effluent is bacteriologically and chemically safe and complies with standards specifications stated in the protection of Environment Law No.4 /1994 mainly Law No. 93/ 1962 and its Ministerial Decree No. 44/2000 Clause No.15 for the reuse of treated wastewater in irrigation purposes the Ministry of Housing, Utilities and Urban Communities (MHUUC).

Effluent from the wastewater treatment plant will at first be monitored on a weekly basis. If consistent results are obtained, the frequency may be relaxed. Analyses to include among other parameters coliforms, BOD, COD, suspended solids, nitrates, and phosphates.

Cost of monthly analysis is estimated as LE 2,500, resulting in annual cost of LE 30,000.

Energy

As part of the monitoring plan during the operation phase, a number of indicators should be monitored. These include:

- Logging of fuel spill and/or leakage incidents should be undertaken. Indicators such as number of fuel spill/leakage per year, and volume of spilled or leaked fuel, as percentage of total fuel used per year

should be monitored and recorded as part of the environmental register whose all pollution prevention activities should be reported;

- Normal safety procedures at the fueling station should be sufficient to limit the potential of fugitive emissions and/ or leakages of hydrocarbons. However, continuous monitoring of these emissions and level of fuel in the tanks should be an integral part of the air quality-monitoring program as well as the health and safety reporting;

- Indicators such as number of fuel or lube oil spill/leakage per year, and volume of spilled or leaked fuel (lube oil), as percentage of total fuel /lube oil used per year should be monitored and reported in the environmental register;

- Percentage of recycled used oil is a good indicator to monitor better environmental management;

- An energy management program at the existing facilities should start with the installation of a set of sub-meters in selected energy consuming centers at the Airport. Combination of sub metering equipment and software is widely used to monitor facilities energy demand and usage levels. Sub meter provides Manager with energy consumption data showing how energy is distributed to the various departments, tenants, or processes within the facility. Gross electricity consumption per square meter of the Airport is a good indicator to monitor energy efficiency improvements at the Airport.

7.2.4 Implementation and Supervision

In general, EAC should be responsible for the implementation of the EMP. However, each of the systems can be implemented by external bodies as follows:

- The monitoring system is to be implemented by an external noise Consultant in coordination with the EAC and Borg El Arab Airport Authority. The monitoring system should be carried out on a daily basis

and to be continuously supervised by the Environmental Unit in the Airport.

- For the noise monitoring system, an external environmental Consultant and Contractor should carry out the implementation of the noise monitoring system.

- EEAA should carry out the air quality monitoring system.

- As the utilities related monitoring activities, this should be carried out by the Contract of the managing company.

The environmental dimension integration during the operation phase should be insured to secure best performance of the Airport.

The Airport environmental officer with the help of the environmental expert will conduct an initial extensive audit to identify the areas and hot spots to be checked and determine the frequency of their auditing. During this phase the following activities should be covered:

- Insure minimal indoor and outdoor air pollution during the operation of the Airport terminal;

- Insure the proper operation of the wastewater collection and treatment facilities as stated in the TOR of the contracted company for operation and maintenance of the treatment facility installed at the Airport. In addition, the officer will insure the proper maintenance of all toilet facilities as stated in the TOR for the contracted cleaning company for the Airport terminal;

- Insure adoption of segregation and proper handling of all solid wastes generated indoor and outdoor areas of the new terminal as stated in the TOR of the solid waste contractor;

- Secure hazardous waste management at the site as mentioned in the TOR of the solid waste contractor;

- Insure adoption of all monitoring schemes as stated in the EMP; -Insure the workers abidance with occupational health and safety at the terminal and within the contracted companies;

- Insure the training of all personnel for their part of IEMP adopted by the Airport;

- Prepare the Environmental register describing all activities pertinent to environmental actions;

- Prepare the list of contacts in case of emergencies.

7.2.5 Monitoring plan

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Design						
Noise		-Studying the general layout and the relation between Apron area, Terminal buildings area and ground equipment. -The best acoustical designs for all facilities inside the Airport to achieve a good acoustical performance inside all the Airport buildings according to standard sound levels which should be applied inside and according to WHO including ground equipment selection and types, thickness and				

		specifications of the materials used in according to measurements and conclusions presented in this EIA study; -Designing the HVAC system (ASHRE) standards including blower silencers. -Best RT and STC for the building areas.				
Vibration		The new equipment for the project should be designed to minimize vibration at building				

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
Construction activities at areas accessible to the public	Safety risk to the public at or near construction sites.	- Construction sites closed to the public.	Contractor	Egyptian airport company environmental unit	part of the construction cost	
	Noise and emissions from construction Vehicle/equipment exhaust	(As per Factory Act requirements) Shall to utilize hearing protection./ Workers exposed to loud noise Site design layout to avoid noise Impacts on residential areas wherever possible and/or necessary.	Contractor	Egyptian airport company environmental unit	To be covered as part of the construction cost.	Noise complaints register to identify concerns and check validity.
	Soil and Painting removal, modification, mixing, compaction, loss, or contamination due to construction activities.	Vehicle movements will be restricted to construction areas and roads. – Contractors will work according to strict management requirements. - Topsoil and excess	Construction contractor	Third party Inspection. Biweekly (environmental consultant to be hired)	To be covered as part of the construction cost.	Monitoring of PM10 (Dust Levels) on the concerned sites monthly.

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		soil cleared from the modernization activities will be stored in the soil storage area and must be protected from wind and regularly sprinkled with water until reused for fill or disposed outside the site				
	Generation of dust and emissions due to modernization activities.	– All material resulting from excavation must be put in a location protected from wind and regularly sprinkled with water until reused for fill or disposed outside the site. All excavations shall be backfilled and reinstated to a similar condition as	Construction contractor	Third party Inspection. (environmental consultant to be hired) Reports to Environmental Unit at EAC	$15,000 part of the construction cost	Monitoring Dust Levels. On the indoor working environment

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		existed before the excavation started. – Temporary haul roads shall be watered whilst in use to reduce dust production during construction. – All hauling trucks must be securely covered to eliminate dust scatter while moving in and out of the site. – All vehicles delivering material to the site shall be covered to avoid material spillage. While unloading Material, fall height shall be kept low to minimize fugitive dust generation.				Ambient NO_2, SO_2, and CO concentrations

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		– All construction material should be protected so as to minimize generation of dust. Construction site to be watered periodically to minimize fugitive dust generation. – Limiting vehicles and equipment speed inside the construction site and unpaved roads by introducing speed depth to reduce re-suspended dust generation. Restricting off road driving Regular cleaning of asphalted roads used by construction traffic to reduce re-				Vehicles and equipment passing normal inspection test

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		suspended dust generation. – All vehicles and equipment used should be mechanically checked to avoid excess emission				
	Construction Safety	– The construction contractor will submit an HSE plan for construction activities. All contractors must supply their workers with proper clothing and gears (PPE) and appropriate safety training and instructions. – The construction workers camp will include adequate sanitary facilities, and will be protected	Construction contractor	EAC Environmental Unit Third party Inspection. Monthly (environmental consultant to be hired)by EAC	part of the construction cost	Workers camp kept in good condition Number of accidents

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Construction						
		from high noise level as much as possible.				

Project Activity	Potential Environmental/Social Impacts	Proposed Mitigation Measures	Institutional Responsibilities		Cost Estimates ($)	Monitoring indicators
			Enforcement	Coordination		
During Operation						
	Noise impacts on communities.	– Adopting and applying the ICAO standards for landing and takeoff procedures – Management of landing and take-off between runways so as to minimize noise between 11.00pm and 6.00am – Install three new permanent automatic noise monitoring	– Environmental unit at EAC – External Contractor – consultant for 12 month	Contractor and EAC environmental unit With help of third party	6 monitoring unit =300,000$ $72,000	Noise Levels Do not exceed Compliance with Law 4, 1994 and its modification 9/2009 .

		system with current software to correlate radar Information to noise level. – Noise Consultant for the INM monitoring system compilation and noise analysis.				
	Air Quality during operation on indoor environment	– Portable gas analyzers for measuring the gaseous emissions. – Portable Dust monitor. – Ventilation meter.	External Contractor and consultant	Contractor and EAC	$70,000	Following up and checking the indoor environment validity
Air quality out door	– Monitoring air quality by a mobile lab around the airport	External Contractor and consultant	Contractor and EAC Or use one of the station that EAC has in Sharm or Hurghada	$360,000	Establish a data base for airport	Air quality out door
	Soil contamination during operation	– A spill response plan will be developed for the site that will deal in detail with the	EAC Environnemental Unit	EAC Environnemental Unit	part of the construction cost	Number and volume of fuel/oil spill and/or leakage incidents

	Aircraft's Wastewater	identification and response to major, non-routine incidents. – Areas susceptible to potential spills of contaminants, such as diesel fuel loading, storage and transfer areas, will be covered in an impermeable layer (hard cover) with drainage to a suitable holding, separation or treatment facility. -Monitoring program to follow up with the operation and maintenance (O&M) in order to secure the treatment efficiency and compliance with the environmental law.	EAC Environnemental Unit	EAC Environnemental Unit	EAC Environmental Unit - day to day work	Water analysis record and progress reports every month after construction of the new plant

Technical Assistance during operation					
Supervision and monitoring of EMP	– Hiring local Environmental Consultant to assist and supervise the implementation of the EMP and noise monitoring stations – Follow Up the daily monitoring of indoor environment dust. – QC/QA of ambient air quality monitoring stations to estimate the effect of modernization and updating activities on the ambient environment – Help in filling the monitoring by forms by JICA	External EMP consultant for 24 month.	EAC Environmental Unit	$50,000	Compliance with EMP

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