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| **Environmental Protection Agency** | **Ministry Of Transport** |

**ENVIRONMENTAL ASSESSMENT GUIDELINES FOR TRANSPORT SECTOR**

|  |  |
| --- | --- |
|  | **GIAL Aircraft** |
|  | Container ship |

**(AVIATION, MARITIME, RAIL AND ROAD SUB-SECTORS)**

**JANUARY 2010**

# 

# FOREWORD

The Environmental Assessment Regulations, LI 1652, was promulgated in 1999 to give comprehensive legal cover to the Ghana Environmental Impact Assessment procedures. These Regulations require that all developmental activities likely to impact adversely on the environment must be subject to Environmental Assessment. The objective of the LI is to ensure that such development activities are carried out in an environmentally sound and sustainable manner. The requirements of the LI, however, place enormous responsibilities on all stakeholders involved in development in Ghana. The nature of the responsibilities varies for different stakeholders, depending on their statutory functions, areas of jurisdiction and interests such as policy makers, implementing or regulatory agencies, planning authorities, financial intermediaries or institutions providing training or consultants providing services in EIA.

A national Environmental Assessment Capacity Development Programme (GEACaP) was initiated in 2001 with financial assistance from the Netherlands Government. This was to assist all relevant institutions in meeting their respective obligations under the LI, and to promote sustainable development in Ghana. An important aspect of the programme was the development of Environmental Assessment Sector Specific Guidelines for eight sectors, namely; Transportation, Mining (revision), Tourism, General Construction & Services, Energy, Manufacturing, Agriculture and Health. Eight networks made up of representatives from relevant stakeholder institutions were formed to facilitate the development of the guidelines for these sectors. The key objectives of the Health Sector Core Team included:

1. Defining the screening criteria for environmental assessment for health sector investments.
2. Determining the scope of Environmental Impact Assessment (EIA) for the sector.
3. Providing systematic procedures on Environmental Impact Statement (EIS) preparations for the sector.
4. Providing guidelines on common potential impacts and mitigation measures.

This document covers all the areas outlined above and it is intended to provide guidleines for the conduct of environmental assessment in the health sector in Ghana

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**Executive Director, EPA**

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**TABLE OF CONTENTS**

1. INTRODUCTION 1

1.1 Objectives of the Guidelines 1

1.2 Overview of the Transport Sector 1

2. POLICY, LEGAL AND INSTITUTIONAL ARRANGEMENTS 2

2.1 Transport Sector Policy Objectives 2

2.2 Legal and Institutional Framework 2

3. GENERALISED ENVIRONMENTAL ASSESSMENT PROCESS 6

3.1 Registration 7

3.2 Screening 7

3.3 Preliminary Environmental Assessment (PEA) 8

3.4 Scoping/Terms of Reference 8

3.5 Consultations 8

3.6 Environmental Impact STATEMENT (EIs) 9

3.7 Environmental Permit 13

3.8 Annual Environmental Report (AER) 14

3.9 Environmental Management Plan (EMP) 14

3.10 Environmental Monitoring 14

3.11 Environmental Certificate 14

4. AIR TRANSPORT SUB SECTOR 15

4.1 Introduction 15

4.2 Screening Criteria for Air Transport Projects 15

4.3 Project Alternatives 16

4.4 Description of Aviation Sub-Sector Projects 16

4.5 Baseline Conditions 18

4.6 Impact Identification and Evaluation 19

4.7 Mitigation Measures 21

4.8 Monitoring 22

5. MARITIME, PORT AND HARBOUR SUB SECTOR 24

5.1 Introduction 24

5.2 Screening for Maritime Transport Projects 24

5.3 Project Alternatives 25

5.4 Description of The Proposed Maritime/Harbour Projects 25

5.5 Baseline Environmental Conditions 27

5.6 Impact Evaluation and Significance 28

5.7 Mitigation Measures 33

5.8 Monitoring 33

6. RAILWAY TRANSPORT SUB SECTOR 34

6.1 Introduction 34

6.2 Screening for Rail Transport Projects 34

6.3 Description of Projects in The Rail Transport Sub-Sector 35

6.4 Baseline Environmental Information 37

6.5 Impact Identification 37

6.6 Impact Evaluation and Significance 39

6.7 Mitigation Measures 43

6.8 Monitoring 44

6.9 Environmental Management Plan 45

7. ROAD TRANSPORT SUB-SECTOR 46

7.1 Introduction 46

7.2 Screening for Road Transport Sub Sector 46

7.3 Project Alternatives 46

7.4 Project Description 47

7.5 Baseline Environmental Information 50

7.6 Impact Identification and Evaluation 51

7.7 Mitigation and Benefit Enhancement Measures 57

7.8 Monitoring 58

8. Conclusions 60

8.1 Conclusions and Recommendation 60

**REFERENCES…………………………………………………………………….……61**

**definitions and terminologies……………………………………..……..62**

**APPENDICES…………………………………………………………………..………64**

**LIST OF TABLES**

[Table 1: Summary of Potential Releases To The Environment 21](#_Toc192316773)

[Table 2: Impacts and Corresponding Mitigation Measures 22](#_Toc192316774)

[Table 3: Constructional and Operational Impacts 37](#_Toc192316775)

[Table 4: Ecosystems/Land Use Types Where Rail Transport Sub-Sector Activities can be](#_Toc192316776)

[Located 40](#_Toc192316776)

[Table 5: Effects of Identified Biophysical Change Process on Provision of Goods and Services in the Area Where Railway Activity i Located. 41](#_Toc192316777)

[Table 6: Impacts on Human Resulting from Changes in the Functions of the Biophysical Environment 42](#_Toc192316778)

[Table 7: Social Change Processes Resulting from Identified Clusters of Activities 42](#_Toc192316779)

**ACRONYMS**

AER - Annual Environmental Report

BOD - Biological Oxygen Demand

CEBSL - City Express Bus Services

CES - City Express Services

COD - Chemical Oxygen Demand

DFR - Department of Feeder Roads

DUR - Department of Urban Roads

DVLA - Driver Vehicle and Licensing Authority

EA - Environmental Assessment

EIA - Environmental Impact Assessment

EIS - Environmental Impact Statement

EMPS  - Environmental Management Plans

EPA - Environmental Protection Agency

ER/V - Environmental Resource and Value

FIR - Flight Information Region

GCAA - Ghana Civil Aviation Authority

GDP - Gross Domestic Product

GHA - Ghana Highway Authority

GIS - Geographic Information System

GPHA - Ghana Ports and Harbours Authority

GPRTU - Ghana Private Road Transport Union

GRC - Ghana Railway Company Limited

GSC - Ghana Shippers Council

GTTC - Government Technical Training Center

ICAO - Convention on International Civil Aviation

IEE - Initial Environmental Examination

LI - Legislative Instrument

MART - Ministry of Roads and Transport

MMT - Metro Mass Transit

MTTU - Motor Traffic and Transport Unit

NGO - Non Governmental Organization

NLCD - National Liberation Council Decree

NRSC - National Road Safety Committee

OSA - Omnibus Service Authority

PEA - Preliminary Environmental Assessment

PNDC - Provisional National Defense Council

PSC - PSC Tema Shipyard Drydock Co. Ltd.

RAP - Resettlement Action Plan

RMU - Regional Maritime University

SEA - Strategic Environmental Assessment

SMCD - Supreme Military Council Decree

SND - Shipping and National Division

STC - State Transport Corporation

TOR - Terms of Reference

TSP - Total Suspended Particulate

VLTC - Volta Lake Transport Company Limited

**CHAPTER ONE**

# INTRODUCTION

Ghana's transport system comprises of road network of about 64,000 kilometres; a road vehicle fleet of about 650,000; a railway network of about 950 km; two major sea ports; an inland water transport system example the Volta Lake covering a surface area of 8,482km2; one international airport and four (4) main domestic airports in Kumasi, Takoradi, Sunyani, and Tamale which handle domestic flights. Apart from the Wa airstrip, for example, which is a paved airfield, there are other airstrips with short unpaved runways at Yendi, Paga, Obuasi, Ho, Tarkwa, Kete Krachi, Bimbila, Sabuba, Mole Game Reserve and Salaga which provide for medical and emergency services. There is a national air carrier, the Ghana International Airline Ltd. which is a Public Private Partnership Company between the Ghana Government and other shareholders. Foreign commercial airlines and other private airline companies also operate in Ghana. An efficient and effective transport system is a *sine qua-non* to social and economic development of any country. In Ghana, the transport sector plays a very vital role in supporting agriculture, mining, tourism, trade, industry and other sub-sectors of the economy and therefore contributes significantly to the Gross Domestic Product (GDP) of the country. It therefore behoves on government to plan, invest, develop, manage, and maintain the transport sector in a comprehensive and sustainable manner to achieve the required economic growth for the nation.

## Objectives of the Guidelines

Environmental considerations are increasingly taking prominence in development decisions and policy making process at all levels. This is due to growing concerns over the damage being caused to the environment by various activities in the quest for social progress and economic development. Mindful of the impact of various transport activities on the environment, the Ministries of the transport sub-sector and EPA have encouraged the development of environmental guidelines for this sector.

The objective of these guidelines is to assist project authorities and consultants in the preparation of Environmental Impact Assessment (EIA) of developments in any of the transport subsectors. This will ensure systematic, consistent and comprehensive coverage of environmental issues in the environmental assessment of of the various transport modes.

These guidelines are not intended to be exhaustive or a reference for the very detailed or specific problems that occur in assessing the environmental impacts of transport projects. These are intended to complement professional judgment and experience of competent consultants. These are also intended to serve as reference information or guidance tool for all stakeholders.

The guidelines will thus guide Ministries, Agencies, Authorities and Consultants in the planning and preparation of EIA with the view to ensure that various transport projects are environmentally sound and sustainable.

**CHAPTER TWO**

# POLICY, LEGAL AND INSTITUTIONAL ARRANGEMENTS

## Transport Sector Policy Objectives

With a vision to have an integrated, efficient, cost effective and sustainable transportation system that is responsive to the needs of society,supports economic growth to overcome poverty and that is also capable of establishing Ghana as a transport hub within the West Africa Sub-region, the Government plans to improve the entire transportation system. The aim is to bring it to acceptable national and international standards to be able to sustain the increased economic activities. The Government will fulfil the mission of providing leadership and an enabling environment for the development and maintenance of Ghana’s transportation system through effective policy formulation, market regulation, asset management and service provision.

Policy making in the Ghana’s Transport Sector is undergoing a 180° re-orientation from a modally planned approach to a policy-led approach where Transport Sector priorities are determined by strategic objectives set out, largely in the National Growth and Poverty Reduction Strategy (GPRS II). Based on this, the three transport sector ministries-the Ministry of Transportation, the Ministry of Harbours and Railways and the Ministry of Aviation have developed an integrated Transport Policy within a Policy Framework which reflects Ghana’s strategic goals and objectives.

The three Ministries collaborate to ensure the provision of an integrated, well managed and sustainable transport infrastructure and services that meet national and international standards through the following policy objectives:

1. Establish Ghana as a Transportation Hub for the West African Sub-Region;
2. Create an accessible, affordable, reliable, effective and efficient transport system that meets user needs;
3. Integrate Land Use, Transport Planning, Development Planning and Service Provision;
4. Create a vibrant, investment and performance-based management environment that maximizes benefits for public and private sector investors;
5. Develop and implement comprehensive and integrated Policy, Governance and Institutional Frameworks;
6. Ensure Sustainable Development in the Transport Sector; and
7. Develop adequate Human Resources and apply New Technology.

Various strategies have been developed to achieve the outlined goals.

## Legal and Institutional Framework

The responsibility for the development as well as management of the country's overall transport system falls on two ministries, namely, the Ministry of Transport (responsible for the inland and international ports and the railway system and the aviation industry). and Ministry of Roads and Highways (responsible for roads),

The transport sector’s objectives are realised through various agencies which are classified into the following five (5) sub-sectoral groups in relation to their functional areas,:

* Road Infrastructure
* Road Transport Services and Safety
* Maritime and Lake Transport
* Air Transport (Aviation)
* Rail Transport.
* Other modes of Transport

All these sectoral groups operate under the policy direction of the three respective Ministries. While road infrastructure and road transport service agencies work under the policy direction of the Ministry of Roads and Highways Maritime, Lake and Rail Transport and Air transport agencies operate under the auspices of the Ministry of Transport.

### Road Infrastructure Agencies

Three Agencies are primarily responsible for the development and maintenance of the country's roads.

### The Ghana Highway Authority

The Ghana Highway Authority was established under a GHA decree 1974 (NRCD 298) and later amended in 1997 by Act of Parliament as an autonomous body responsible for planning, designing, construction, rehabilitation, maintenance and management of highway (or trunk roads) and related road works in the country. Currently a Board of Directors have been appointed by Government in order to make it more autonomous and more user responsive.

### Department of Urban Roads

The Department of Urban Roads (DUR) was established in 1988 by Ggovernment to take over the responsibilities for reconstruction, rehabilitation and maintenance of city roads in Accra, Kumasi, Sekondi/Takoradi, Tema and Tamale.

In accordance with the current policy of decentralisation, DUR is working closely with Metropolitan/Municipal/District Assemblies to: plan and implement development and maintenance programmes, meet acceptable standards in road works and for the management of traffic in the metropolitan, municipal and district centres.

### Department of Feeder Roads

The Department of Feeder Road (DFR) was set up by Government with the responsibility fof planning and integrating feeder road construction andrehabilitation and maintenance of trunk roads in line with agricultural priorities in the country. In accordance with the current policy of decentralisation, DFR is working closely with District Assemblies to plan and implement development and maintenance programmes to meet acceptable standards in road works and traffic management.

### Road Transport Services and Safety Agencies

Road Safety, Road Traffic Enforcement, Driver Licensing and Vehicle Examination as well as the training of mechanics in the industry are administrated by the National Road Safety Commission (NRSC), the Motor Traffic and Transport Unit (MTTU) of the Ghana Police Service, Driver Vehicle Licensing Authority (DVLA) and the Government Technical Centre (GTTC) respectively.

The Intercity State Transport Company Ltd. (STC), established by LI 681 of 1971, is a Public Private Partnership Company that provides inter-regional and international road transport services for the carriage of passengers and goods. The service is complemented by the Ghana Private Transport Unions (GPRTU) and other Private Road Transport Operators.

Intra City Passengers service is provided by government agencies like the Metro Mass Transit (MMT) as well as private bus operators from the GPRTU and other private transport associations.

The Government Technical Training Centre (GTTC) develops skilled artisans for the road transport industry.

The Driver Vehicle Licensing Authority inspects and issues road worthiness certificates to new vehicles and also inspects and issues road worthiness certificate to vehicles which are already in operation. It also tests and issues licenses to drivers.

The Motor Traffic and Transport Unit (MTTU) of the Ghana Police Service enforces road traffic laws and regulations.

### Maritime and Lake Transport Agencies

Maritime and Lake Transport services are provided by five (5) public sector agencies and a joint public-private enterprise. The Ghana Maritime Authority (GMA), was set up by the Ghana Maritime Authority Act 2002 (Act 630) to replace the Shipping and Navigation Department. It performs regulatory functions for the industry through licensing of seafarers and vessels and the enforcement of international maritime standards and conventions.

The Ghana Ports and Harbours Authority (GPHA) was established by PNDC Law 160 of 1986 to plan, build, develop, manage, maintain, operate and control ports in Ghana. Currently it operates two deep-water ports at Tema and Takoradi, which handle all of the nation’s maritime trade. The Authority also operates fishing harbours at Tema and Sekondi. GPHA is a self-accounting and financing organisation. With a policy direction to make it a landlord owned port instead of a service port, most cargo handling activities have been hived to the private sector. Various investment projects have been undertaken and equipment installed to improve efficiency and productivity at the ports.

The Volta Lake Transport Co. Ltd (VLTC) is a subsidiary of the Volta River Authority (VRA) and provides freight and passengers transport services between Akosombo and Buipe on the Volta Lake and cross-lake services for local traffic.

The Ghana Shippers’ Council (GSC) was established in 1974 by NRC Decree 254 and is responsible for the protection of the interest of Ghanian Shippers while promoting the provision of relevant logistics for the growth and improvement of shipping in Ghana.

The Regional Maritime Academy (RMA) now Regional Maritime University (RMU) trains seafarers for the award of various classes of certificate of competence for the maritime industry. It also offers shore based courses in shipping and ports administration at diploma, post graduate and MA degree levels. The Governing Board of the RMU is made up of five countries namely Ghana, Sierra Leone, Liberia, The Gambia and Cameroon. The financial contributions from these countries are used to finance the operations of the university.

PSC Tema Shipyard and Drydock Company Ltd was established by Act 232 of 1964 to undertake ship building, ship repair works and to also provide dockyard services to both the maritime and fishing industries.

### Air Transport Agencies

In January 2007, in accordance with GCAA Act 678 of 2004, the Ghana Civil Aviation Authority (GCAA) was decoupled. The former GCAA is responsible for safety regulations and provision of air navigation service and the latter, Ghana Airports Company Limited (GACL) is to plan, develop, manage and maintain all public airports and aerodromes in the country. The Ghana International Airlines Limited is responsible for the provision of domestic and international passenger, mail and cargo transport.

### Rail Transport Agency

Ghana Railway Company Limited (GRC) is a limited liability company registered on 7th March, 2001, under the Companies Code 1963 (Act 179) to construct, operate and maintain the railway and its terminals/stations and other facilities like level crossing, bridges, culverts, drains and other works that will ensure the efficient and effective transportation of passengers and goods by rail.

The Ghana Government is in the process of privatising railway operations and development in Ghana. Consequently, a bill that seeks to establish Ghana Railway Development Authority (GRDA) and to regulate railway operations in the country has been presented to parliament. The GRDA shall regulate the development and operation of railway services in Ghana in accordance with the Railway Act.

### Other Modes of Transport

(a.) Non-Motorised Transport (NMT)

All other forms of transportation not requiring the use of motors, including walking, bicycles, push carts, wheel barrows, and animal drawn carts are categorised as NMT.

**CHAPTER THREE**

# GENERALISED ENVIRONMENTAL ASSESSMENT PROCESS

The Ghana Environmental Assessment (EA) system commences with registration of a proposal by the proponent. The other relevant steps are shown in Figure 2 and described in detail in the sections that follow.

Registration

Screening

Scoping/Terms of Reference

Preliminary Environmental Assessment

Environmental

Permit

Environmental Impact Statement

Environmental Permit

Environmental Permit

Annual Environmental Report

Environmental Management Plan

Environmental Monitoring

Environmental Certificate

FIGURE 1: OVERVIEW OF ENVIRONMENTAL ASSESSMENT SYSTEMS IN GHANA

## Registration

The Environmental Assessment System commences with the registration of the proposal, at EPA after completing the appropriate registration form. These Forms include Environmental Assessment Registration Forms EA1 and EA2 for Schedule 1 and Schedule 2 new undertakings respectively, (refer to forms and schedules in Appendices 2, 3 and 4) and EM1 for existing undertakings.

## Screening

Screening is carried out by the Agency to determine what level of Environmental Assessment (Environmental Impact Statement or the Preliminary Environmental Assessment) is required to be conducted for the proposed undertaking. . This exercise normally involves visits to proposed project sites to verify information in the registration form and to hold consultations with relevant stakeholders within the likely area of influence of the undertaking. Screening decision must be made within 25 working days from receipt of the registration form. The key issues to be considered in the screening stage of environmental system in Ghana include the following:

* Zoning status (proposed landuse for the undertaking);
* The size and output of the proposed undertaking in relation to the location;
* The technology to be used;
* Concerns of the general public;
* Landuse considerations;
* Other factors relevant to the particular undertaking (such as proximity to high tension lines,
* Planning considerations.

The output of screening is a screening report, which may present one of the following five decisions:

1. Approval may be given for the undertaking to proceed;
2. Objection to undertaking and communication of the decision to not proceed as per proposal
3. Additional information/clarification required;
4. Preliminary Environmental Assessment required;
5. Environmental Impact Assessment required.
6. Strategic Environmental Assessment required.

Category ‘A’ undertakings require Registration, Category ‘B’ will require a Preliminary Environmental Assessment, Category ‘C’, an Environmental Impact Assessment and Category ‘D’, Strategic Environmental Assessment.

Environmental assessment is normally unnecessary for Category ‘A’ undertakings or developments as these projects (for example ---) are unlikely to have significant environmental impacts. On the other hand category ‘B’ undertakings (for example ---) have significant environmental impacts and will thus normally require that proponents prepare a PEA. A mandatory EIA is required if the undertaking falls into Category ‘C’. Such projects (for example ---) have potential diverse and significant environmental impacts. Category ‘D’ covers policies, plans and programmes will require an SEA, as the effects are cumulative or cross-boundary.

Indicative criteria for detailed screening for projects in the various sub-sectors have been provided under each sub sector.

## Preliminary Environmental Assessment (PEA)

Preliminary Environmental Assessment is required for undertakings with a potential to induce small to medium scale impacts. These are normally undertakings listed in Schedule 1 of the EA Regulations, 1999 (LI 1652). The findings of a Preliminary Environmental Assessment are compiled into a Preliminary Environmental Report (PER) by the proponent. The PER is expected to provide sufficient information on the undertaking to serve as a basis for decision-making on an Environmental Permit.

## Scoping/Terms of Reference

A proponent must submit a Scoping Report on a proposed undertaking to the Agency under one of the following conditions:

* The screening decision on the undertaking indicates that EIA is required;
* A registration form is submitted on a Schedule 2 undertaking
* The proposal relates to an issue under Schedule 5.

The purpose of scoping is to ensure that the EIA is carried out with an appropriate focus on the key areas/issues of concerns or impacts. The output of scoping is the terms of reference (TOR) for the EIA.

It involves the identification of the key environmental issues based on consultation with all relevant stakeholders (interested and affected parties/communities such as government departments, ministries, local authorities, etc.) who must provide an input into the EIA.

The Proponent submits ten (10) copies of scoping report and draft TOR for consideration and agreement with the Agency, prior to the conduct of the actual EIA studies.

## Consultations

Consultation with communities who are likely to be affected by a project is an integral component of a competent EIA, and should be carried out in addition to any social or socio-economic studies and consultation with local government bodies and NGOs. Such consultation during the EIA studies is usually a relatively informal process and is not intended to replace the formal public hearing. Local Community involvement is desirable from several points of view:

* It can provide additional information on present environmental baseline conditions which may not be available from official sources, or which may not be readily apparent to field study teams.
* It allows concerns regarding real or perceived impacts to be identified, so that these can be given due consideration in shaping the project to minimize overall impact.
* It can lead to suggestions for impact mitigation measures from the communities concerned which may be more acceptable, and can often be more effective, than measures formulated by outsiders who may not have a full appreciation of local condition, attitudes and traditions etc.
* Effective consultation which leads to local community views being given consideration in the project design and management is likely to have a significant effect in reducing the possibility of confrontation during implementation, which may cause delays and give rise to additional costs and/or local social unrest.

## Environmental Impact STATEMENT (EIs)

The proponent commissions the actual Environmental Impact Study based on the agreed TOR. The EIA normally involves baseline survey and inventory, description of the proposed project, potential impact identification, prediction, mitigation, consideration of alternatives and other issues included in the TOR.

The findings of the EIA are compiled into an Environmental Impact Statement (EIS), which forms the basis for the environmental decision-making on the proposed undertaking for obtaining Environmental Permit.

To facilitate assessment and improve clarity and credibility of the Environment Impact Statement, information should be organised systematically under following broad headings:

* General description of the proposed development
* Description of the existing environment
* Identification and prediction of impacts of the proposed development
* Measures to mitigate adverse impacts

### General Description of the Proposed Development

The description of the proposed development is one of the factual foundations upon which an EIS is made. A systematic approach is very important to ensure that all relevant aspects of the development are accurately and fully described. The objective is to provide a description in sufficient detail which, if taken together with the description of the existing environment, would allow an independent reader to arrive at a complete assessment of the significant impacts likely to arise from the proposed development.

The following headings may serve as useful reminders of the topics to be addressed by description or illustration as appropriate:

* Goals and benefits of the project.
* Alternatives examined (location, designs, processes)
* Characteristics of the project (planning, site layout, design, size or scale)
* Description of construction (land-use requirement; proposed works; environmental protection measures)
* Description of operational phase (processes or activities; scope; type and amount of materials needed; human resources required; facilities and utility services required; all outputs (products and wastes); and methods to be used for the management and disposal of these outputs
* Description of decommissioning phases (proposed growth, description of other changes
* Description of other development (spatial areas affected by the project, off-site facilities.
* Benefits and drawbacks of the project.
* Anticipated reactions from residents and workers of surrounding communities.

### Description of Existing Environment

The description of the existing environment is the second of the factual foundations upon which an EIS is made. An accurate description of relevant aspects of the existing environment is necessary to predict the likely significant impacts of a development. This information also provides a valuable reference (baseline) which can be used for environmental monitoring of the impacts of the project, once it is in operation.

The following is a range of environmental topics broken down into its constituent elements so that it can be systematically described:

* *Atmospheric conditions:* (temperatures, wind speed and direction, humidity, air quality standards and data, sources of air pollution etc.);
* *Geology:* (soils characteristics, geologic hazards);
* hydrology (surface water, aquifers, watersheds, water quality standards etc.);
* *Ecology:* (flora and fauna, habitats endangered species, environmental stresses);
* *Land use:* (agriculture, forests, industrial, commercial, residential), transportation routes such as roads, rail, water and air, utilities and water resources;
* *Human beings:* (population composition and distribution, socio-economic conditions, cultural and ethnic diversity, population growth rate);
* *Social services:* (electricity, tele-communication, water supply, hospitals, etc);
* *Cultural heritage:* (unique features of the area or its people; cemetery, fetish grove, festivals etc)

The environment is an extremely complex combination of natural and human factors, many of which are constantly changing. The description of the environment therefore requires competent multidisciplinary team. The skill of the specialist in environmental information collection lies in knowing exactly what data are relevant. To facilitate evaluation of the EIS, references to recognised standards should be included where appropriate.

To assist the preparation of systematic, accurate and comprehensive descriptions the following attributes should be included:

* *Context:* – describe the location, extent or magnitude of the environmental factor (e.g. what volume of water flows in the stream?).
* *Character:* – indicate the distinguishing aspect of the environment under consideration (e.g. Is it unpolluted water?).
* *Significance:* – indicate what quality, value or designation is assigned to this aspect of the existing environment (e.g. Is it protected by legislation?).
* *Sensitivity:* – describe changes which could significantly alter the character of this aspect of the existing environment (e.g. Would any further increase in nutrients cause eutrophication?).

### Identification and Prediction of Impacts

The central purpose of EIS is to identify potentially significant adverse impacts at the planning stage of the project and to propose measures to mitigate or ameliorate such impacts. In theory, a new development can cause an infinite number of possible impacts while in practice a very limited number of impacts are probable. Only probable or likely impacts are addressed. Probable impacts can be described as those which are planned to take place, and those which can be reasonably foreseen to be inevitable consequences of the normal construction and operation of the development.

All components of the environment are constantly changing due to a combination of natural and human processes. When predicting likely impacts it is important to remember that there are two available for comparison, the existing environment and the environment as it would be in future if no development of any kind were to take place – the “do nothing” impact. The “do nothing” scenario can be useful when assessing impacts caused by developments which themselves are designed to alleviate environmental or infrastructural problems.

It is very important to identify all the potential impacts, both positive and negative; cumulative and residual; direct and indirect; and especially those for which there is public concern. As a first step, “impact boundaries” should be set in order to:

* ensure a certain level of fairness, cost-effectiveness and efficiency in the EIA exercise.
* focus time and resources on the most important issues.
* limit the amount of information to be gathered and analyzed to a manageable level.
* recommend realistic and feasible mitigation and monitoring measures.

Simple methods used to identify impacts include the following:

* *Ad-hoc Methods:* – use of similar projects and professional judgment.
* *Matrices:* – use of two-dimensional tables (project activity vs. impact)
* *Checklist:* – use of specific list of environmental parameters investigated for possible impacts
* *Networks:* use of cause-effect linkages possible between various environmental factors).
* *Geographic Information Systems (GIS*)*:* use of computerised systems for multiple map overlays.

### Evaluation of Impacts

The extent to which the identified impacts are assessed is guided by an evaluation of the likelihood of their occurrence (risk). This evaluation can be supported by judgment based on documented experience elsewhere or a systematic risk assessment. Such assessment is usually employed only where the ‘worst case’ impacts pose significant threats to the environment or human health. Three objective criteria can be used to determine whether an impact is of significance:

*Magnitude and Severity*: any development which can cause effects over a wide area, to a large number of receptors, or effects which are of an intensity which is significantly in excess of those normally experienced

*Duration:* any development which can cause impacts for a long period of time or which will cause permanent changes to any aspect of the environment.

*Certainty:* where the magnitude, intensity, duration or consequences of any change can be anticipated with a reasonable level of certainty.

### Significance of the Impacts

Once impacts have been analyzed, it is important to determine their significance to determine whether the impacts are acceptable, require mitigation, or need to be avoided. The significance of an impact is determined based on characteristics and the importance (or value) attached to them.

Significance must be derived from community preferences and can be assessed through public involvement. The approach used to determine significance must take into account the social and cultural aspects of local value systems and traditional practices. Impact significance, can be determined based on the following considerations:

#### Environmental Standards

Departures in values of different environmental parameters from the Environmental standards stipulated under the legislations are among the most commonly adoptedcriteria for assigning significance to impacts. The standards are criteria designed to achieve certain environmental conditions within specified limits, and are believed to be a pre-requisite to achieve social objectives (usually health-related). Examples include: noise levels, limits on effluent discharge concentrations, clean air and water quality standards and or limits to the use of natural resources.

#### Ecological Importance

Different categories of criteria for determining ecological importance include risks of reduction in biological diversity (gene pool, species and ecosystem); rarity and endangerment of species (Red List Species by the IUCN) loss of critical habitats and ecosystem functions

#### Social Importance

Effects on the environment are translated into impacts based on factors valued by society (e.g., impacts on cultures, natural).

#### Statistical Significance

Statistics can also be used to determine the significance. This is when thresholds have been established to define an acceptable range.

#### Community Influence

Sometimes, an impact may acquire significance where society as a whole, community or a significant number of individuals is concerned about some aspect of a development that may adversely affect their well-being factors (e.g. livelihood, health drinking water)..

### Mitigation and Enhancement Measures

Once the significance of impacts has been determined during the impact evaluation stage, attention should be concentrated on defining measures which can be taken to avoid reduce, regulate and offset significant adverse impacts, and to enhance beneficial impacts.

Several approaches may be taken to develop mitigation and benefit enhancement measures; in some cases a combination of the approaches may be appropriate. Whatever methods are selected to address the potential impacts associated with a specific project, it is important that they should be technically and economically feasible. Wherever possible, proven technology or other approaches which have been shown to work in practice on similar projects in similar circumstances should be adopted. The use of unproven approaches should only be proposed as a last resort when other options are unavailable.

It should be recognised that implementation of a mitigation measure to reduce one impact may itself lead to other impacts. Examples are design of an alignment which avoids cutting down trees but increases land-take, and development of resettlement plans which do not take into account the secondary impacts associated with moving large numbers of people into areas already occupied by others where resource and social conflicts may arise. In many cases, a compromise or balance between conflicting or interdependent measures may be necessary to achieve the minimum overall impact.

#### Avoidance Measures

The prime measure to be considered in the reduction of adverse impacts is to avoid creating the impact in the first place, or to take action, which limits the extent of an impact. This is always much more effective than creating an impact and then attempting to control or compensate for it, since control measures are frequently not fully implemented, and compensation measures may not fully redress the situation for a variety of reasons.

#### Engineering Design Measures

The incorporation of design features in a project, which are specifically aimed at reducing impacts, is also commonly used. Examples include the use of engineering measures to stabilise slopes in landslide prone areas and incorporation of suitable crossing over points of an appropriate type to enable safe crossing of roads by r pedestrians and animals. Some of the positive benefits associated with a road project such as improved road safety can also be enhanced by measures such as the adoption of safe sight line distances in design, and careful design of road junctions. Most of these represent nothing more than good engineering design practice, which for many years have been incorporated in project designs.

#### Project Management Measures

Project management measures are commonly used to minimise impacts arising through the construction phase, and take the form of incorporating specific environmental protection AND management clauses in the construction contract, and ensuring that the construction supervision team properly enforces these. Examples include measures to reduce construction noise and dust nuisance, impacts associated with the establishment and operation of construction camps, and rehabilitation of sites such as borrow pits. Most of these are good construction practices which should be included in the contract documents.

#### Institutional Measures

Institutional or regulatory measures are widely used to control impacts during the operational phase. These include measures such as imposition and enforcement of higher standards of vehicular noise and air pollutant emissions as means of improving air quality; proper planning and execution of maintenance works to reduce delays to traffic and reduce incidents of accidents when in-service maintenance is being carried out, and the use of speed limits to improve road safety.

## Environmental Permit

An Environmental Permit for an undertaking issued by the Agency is an evidence of compliance with the EIA Procedures. Environmental Reports (PERs and EISs) submitted are reviewed and the appropriate review decisions are made.

The review exercise is supported by a cross sectoral national EIA Technical Review Committee (TRC) whose review recommendations are acted on by the Agency. Environmental Permits are always issued with a schedule of conditions including the following key requirements:

1. Give notice of commencement of operation of the undertaking;
2. Submit Annual Environmental Reports and Environmental Management Plans to the Agency;
3. Obtain Environmental Certificate;
4. Obtain all other relevant permits and/or licences applicable to the sector.

## Annual Environmental Report (AER)

Any undertaking approved for development, is required to submit an Annual Environmental Report (AER) on the undertaking to the Agency. The first AER must be submitted after 12 months from the date of “notice of commencement” of the undertaking and subsequently after every 12 months.

The AER shall report on the relevant aspects of the undertaking including monitoring returns, adequacy and appropriateness of mitigation measures, other environmental standards and measures as well as nominated targets.

## Environmental Management Plan (EMP)

Operating undertakings covered by PERs and EISs are required to submit Environmental Management Plans (EMPs) within 18 months of commencement of operations, and thereafter every 3 years. The EMP shall set out the steps and approaches to be taken to manage the operations of the undertaking in order to ensure environmental soundness and sustainability.

## Environmental Monitoring

An Environmental Audit of an undertaking is the periodic, systematic and objective evaluation of the required environmental effectiveness of the operational and management systems of the undertaking. The management of an undertaking may commission an independent expert to conduct the Audit in order to be fully informed of the true status of relevant areas of the undertaking.

The Agency shall also carry out its own Audit (Compliance Audit) to verify and inform itself about the compliance status of an undertaking. This will provide inputs in the Agency’s review of EMP’s and AERs submitted on undertakings, leading to the granting of Environmental Certificate.

## Environmental Certificate

Within 24 months of commencement of operations, an undertaking covered by a PER or an EIS may be issued with an Environmental Certificate provided the following conditions are met:

1. Confirmation of actual commencement of operations;
2. Evidence of acquisition of other permits, approvals, consents or licenses applicable to the sector and the particular undertaking;
3. Evidence of compliance with relevant mitigation commitments;
4. Evidence of compliance with other environmental permit conditions;
5. Submission of a current Annual Environmental Report on the undertaking (verified and considered satisfactory);
6. Submission and acceptance of an Environmental Management Plan for the Undertaking;
7. Satisfaction of Environmental Audit conditions; and
8. Payment of an Environmental Certificate fee.

**CHAPTER FOUR**

# AIR TRANSPORT SUB SECTOR

## INTRODUCTION

The Aviation sector in Ghana is fast developing with a new ministry overseeing the sector activities and also responsible for policy formulation. The sector has the Ghana Civil Aviation Authority responsible for air transport regulation and the provision of air navigation services. A newly created Ghana Airports Company Limited is solely responsible for the planning, development, management and maintenance of all public airports.

The Ghana International Airlines Limited together with other domestic and foreign airlines are responsible for the provision of both domestic and international passenger, cargo and mail services. In addition the sector is also experiencing the increased development of general aviation which involves the use of light aircraft and the construction of small airstrips for private use.

Aerodrome establishment and operation make special demands on the environment in terms of height restriction on surrounding area developments – Aircraft, flight paths, Approach Lanes and Flight Circuits exerts considerable influence on land use in airport neighbourhood that need to be clearly identified and addressed. Concentric Height Zoning is necessary in most instances.

Airport (aerodrome) sites require specific site characteristics. Relatively vast, leveled areas and locations devoid of hills are suitable for aerodromes. Such demands may affect ecologically sensitive sites and demand stringent mitigation measures. It is always advisable to identify and list activities that impact negatively on the eco-sensitive location.

Aerodrome establishment, maintenance and expansion work and operation involve large tracts of land that may have some effects on demography, economy and cultural life of adjoining land uses. Land use compatibility and Highest and Best Use concerns should therefore be addressed in Environmental Impact Assessment Statements. Measures to address land degradation should also be identified and addressed.

## SCREENING CRITERIA FOR AIR Transport PROJECTS

Category ‘A’ – Only Registration Required

* Airport Operation processes/services;
* Collation and dissemination of meteorological information, etc;
* Communication services for flying.

Category ‘B’: Preliminary Environmental Assessment (PEA) Required

* Update of an airport master plan;
* Maintenance of existing aerodrome facilities;
* Maintenance of ancillary airport infrastructure;
* Maintenance of air navigational equipment;

Category C: Mandatory Environmental Impact Assessment Required

* Establishment/construction of new airports, airstrips and heliports (aerodromes)
* Development of an airport master plan;
* Expansion or changes to existing aerodrome facilities;
* Expansion or changes to ancillary airport infrastructure;
* Installation or changes to air navigational equipment;
* Regional air navigation requirements, e.g. flight route establishment.

Category D: Strategic Environmental Assessment Required

* Development of strategic Action Plans for the sector;
* Formulation and implementation of policies and programmes.

## Project Alternatives

Location –The report should provide all features of the location relevant for environmental assessment purposes. A location map of the area should be provided to indicate general compatibility with surroundings and to provide brief justification for the choice of the site.

Design – Basic design parameters for the most feasible option and its suitability for the venture should be indicated.

Technology – Key features of adopted technological process should be described and justifications provided.

## DESCRIPTION OF AVIATION SUB-SECTOR projects

Proponents shall be required to give description of the nature, location and coverage of key project activities. Checklists of key activities of aviation projects to be described include the following:

Construction

Key aviation infrastructure developmental activities including but not limited to the list below should be described adequately in Environmental Impact Assessment Statements:

* Establishment of new airports, airstrips, heliports (aerodromes).
* Expansion/Changes/Maintenance of existing aerodromes facilities.
* Expansion/Changes/Maintenance of ancillary airport infrastructure.
* Installation/Changes/Maintenance of air navigational equipment.
* Airport operation processes/services e.g. ATC services.
* Regional air navigation requirements e.g. flight routes establishment.
* Pilot/aircraft licensing and/or inspection.
* Safety regulations and security.
* Site evaluation/testing
* Acquisition of land, clearance and management prior to construction.
* Timing of construction, duration and phasing
* Site preparation works
* Type and nature of physical development in surrounding areas.
* Access to project site
* Traffic, noise, dust and vibration
* Materials (including transportation, sourcing and storage)
* Construction techniques
* Employment
* Accommodation
* Working hours
* Pipe-laying/drainage works
* Extension of infrastructure (water, power, roads)
* Spoil deposition
* Fencing

The focus should be on the following:

1. Description of the key features of project.
2. Description of the constructional processes, phases and list of construction activities.
3. Description of the key local materials to be sourced for the works.
4. Description of the key waste-products and mode of disposal.
5. Description of the physical infrastructural set up for and major equipment for construction activities.

Operational Phase

Key operational processes including but not limited to the list below should be described adequately in Environmental Impact Assessment Statements for aviation projects.

* Passenger facilitation,
* Type, hours and frequency of air traffic services,
* Meteorological services
* Seasonal and daily variations
* Horizontal and vertical alignment of runway and parking areas
* Clearance requirements
* Safety, lighting beacons and other navigational aids
* Control areas
* Regional air navigation requirements e.g. Flight route planning and establishment.
* Aircraft maintenance, inspection and pilot licensing.
* Aviation safety and security arrangements or requirements. i.e. Access controls, screening.
* Building (civil) maintenance activities
* Passenger areas
* Fuel storage areas/ Fuel dumping
* Cargo areas
* Catering services
* Emergency services/Procedures
* Security services
* Boundaries, security and access control
* Hazards and risk analysis
* Strategic/military risks
* Level of activity (including intensity of air traffic)
* Noise and vibration
* Flight approach/takeoff paths
* Maintenance of site
* Bird and mammal control
* Drainage from increased hard surfaced/compacted ground areas, including introduction of pollutants
* Traffic, parking, transportation, signposts and access
* Communication and associated electromagnetic radiation

The focus should be on the following;

1. Key features of operational processes.
2. The phases of the operational processes.
3. Describe any bottlenecks that need to be resolved regularly or as and when necessary.
4. Indicate the effect of the operational activities on the environment.

Future Growth, Associated Developments and Decommissioning

* Potential for construction of new/extended runways
* Terminal facilities, car parking, access road
* Intensification of use requiring new navigation/communications equipment.
* Alternative uses
* Accommodation facilities
* Catering facilities
* Transport links
* Cargo handling/storage facilities
* Industries availing of air transport facility.

## BASELINE CONDITIONS

Environmental Impact Statements should contain information on the existing environment before the execution of the project and how the area is likely to develop if the project were not to proceed. The information on the environment should be relevant to the interaction and outcomes of the project activities and should be in the context of the surrounding area.

The baseline environmental information may be described in the following sub-sections:

* Physico-chemical Environment
* Ecological Environment
* Landuse and socio-economic Environment

### Physical Environment

Aerodrome establishment and operation imposes restriction on the height of developments in surrounding area. – Aircraft, flight paths, approach lanes and flight circuits exert considerable influence on land use in airport neighbourhood. These influences on landuse need to be clearly identified and addressed. Concentric Height Zoning is necessary in most instances.

### Ecological Environment

Airport (aerodrome) sites require specific site characteristics. Relatively vast, leveled areas and locations devoid of hills are suitable for aerodromes. Requirement of such land features may affect ecologically sensitive sites and demands stringent mitigation measures. It is always advisable to identify and list activities that may impact negatively on the eco-sensitive locations.

### Land Use and Socio-Economic Environment

Aerodrome establishment, maintenance and expansion work and operation involves large tracts of land that may have some effects on demography, economy and cultural life of adjoining land uses. Land Use compatibility and Highest and Best Use concerns should therefore be addressed in the report. Land degradation mitigation measures should also be identified and addressed.

## IMPACT IDENTIFICATION AND EVALUATION

The Environmental Assessment Statements (EIS) should indicate the significance of all impacts, including the residual impacts which are likely to remain after mitigation measures. The residual or persisting impacts should be assessed in relation to acceptable limits or standards set for specific impacts. Mitigation or other preventive measures can be adopted for all avoidable and residual impactsonly when theses are properly identified. The potential environmental impacts associated with airport projects include the following:

### Airport Wastes and Pollution Runoff

Pollution from the airport in the form of sanitary wastes (liquid and solid) and surface runoff containing oils, chemicals, etc. can seriously degrade water quality and thus impair beneficial water uses (BWUs). Usually the "first flush" of surface runoff, after the rains will contain most of the pollutants discharged to the ground between rains. Also, the airport's pollution emissions can seriously degrade groundwater quality if not properly managed. Some major airports produce sanitary liquid and solid wastes much like a small city, hence skilled sanitary engineers are needed for ensuring proper management of these wastes as well as surface runoff.

### Changes in Nearby Land Values

Airports often result in major changes in nearby land values, both (1) positively due to the increased commercial value of many of the properties, and (2) negatively mainly due to noise and other nuisances including traffic congestions, and degradation of environmental aesthetics. The EIA should include provisions for careful evaluation of these effects.

### Environmental Aesthetics Degradation

This can be a serious problem hence is an important parameter to consider in airport site selection as well as planning/design. Landscaping activities, involving raising of tress and construction of ponds can be very helpful in improving aesthetics.In addition, a peripheral pond can be advantageously used as the secondary treatment system for airport sanitary sewage.

### Encroachment into Precious Ecology Areas:

1. *Terrestrial ecology/forest and wildlife:* New airports opening up natural/rural areas for development will also pose hazards for wildlife.

2. *Estuarine Swamplands:* Major airports in urbanizing regions are often located near the seacoast and often encroach upon valuable or even precious ecological estuarine zones, hence this factor should be carefully considered during the airport site selection process. An offsetting measure which can often be used is to convert (by appropriate engineering measures) nearby lands into new estuarine areas having similar ecological characteristics.

### Noise and Vibration Disturbances

This is often the most significant environmental hazard posed by airport operations, and requires detailed attention in the EIA, which should also include the delineation of iso-noise contours expected to occur during both daytime and night time operations. This will help in delineating zones which will require resettlement or compensation for serious loss in property values.

### Air Pollution Emissions

These originate primarily from airplanes and other airport vehicles, and from losses/evaporation of fuels. The first flush when rains begin commonly contains significant sanitary wastes and oil and other chemical residues from drippage and leakage. The constituent pollutants should be identified and emission levels should be indicated in the EIA.

Motor Vehicle Traffic Impacts

1. *Traffic congestion:* Under design capacity of access/exit points, together with failure to provide adequate parking has been a common deficiency at many airports. This has resulted in traffic congestion and accidents.

2. *Traffic hazards due to proximity of planes landing or taking off:* When the distance between the planes and vehicle traffic is too little, accidents may occur because of "shock" impact on the vehicle driver.

Constructional Impacts

1. *Erosion and silt runoff during construction:* The construction phase may lead to silt runoff that could adversely affect downstream beneficial uses of property values, including use of temporary holdings.. These impacts need to be assessed for incorporating appropriate controls on silt run off.

2. *Depreciation of exposed areas/lands:* The construction may result in continuing depreciation of environmental aesthetics which needs to be assessed and evaluated so that appropriate provision for resurfacing/replanting of exposed areas can be made.

3. *Construction stage hazards:* These should be identified for assessing any associated hazards.

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### Post-Construction Monitoring

The project operations plan should provide for continuing periodic post-construction monitoring program for assessing the actual environmental impacts of the project and for recommending needed corrective measures.

Disruption of Surface Hydrology

Airport site location often results in significant alteration in the surface waterways hydrology in its vicinity, which of course can affect all beneficial waterways uses (BWUs) including water supply for communities and industry, irrigation, fisheries recreation, navigation and others.

Disruption of Groundwater Hydrology:

Changes in groundwater hydrology stemming from airport location (or operations) can impair the yields of wells in the vicinity.

Resettlement

Resettlement associated with most major airports, low costs allocated for resettlement and people’s unwillingness to resettle on new sites are some of the major challenges.

Sanitary Waste Disposal

In situations where connection to a municipal sewerage system is not feasible, an attractive alternative (when applicable) is the use of a simple septic tank system (12-hour retention) followed by ponding with retention of one week or more, with one of the chlorinated pond’s effluent for irrigation of green areas of airport during the dry season (discharge to waterways when not needed for irrigation), especially when the ponding can be planned to form an attractive system of artificial lakes.

Cross-effects of the various impacts, their time or seasonal effects and their general inter-relationships should be indicated, if any. Table1 below shows some of the potential releases to the environment.

TABLE 1: SUMMARY OF POTENTIAL RELEASES TO THE ENVIRONMENT

|  |  |  |
| --- | --- | --- |
| **Environmental Media** | **Source of Impacts** | **Pollutant/Risk** |
| Water | Identify key sources of sanitary and kitchen wastes for institutional and commercial premises. Check for discharges into natural water bodies. Levels of elements should not exceed EPA guidelines and standards. | BOD, COD, Oil, coliforms, pH, Nitrate, Phosphate |
| Air | Aircraft/Vehicular Movements | TSP, PM10, CO, SO2 |
| Land | Soil movement, waste disposals, metal scrap, refuse disposal, solid waste etc. | Solid non toxic waste |
| Noise | Aircraft/Vehicular movements, Construction Works, Equipment Operation | Reference to acceptable EPA noise levels for different zones |
| Radiation/Electro-magnetic waves | Navigational Equipment Aircrafts | Reference to acceptable radiation levels |
| Chemical Emissions | Vehicular/Aircraft operations | Reference to acceptable emission on levels |
| Safety – Issues -Accidents, Fire, Traffic and Aircraft Safety work arrangement | Aircraft, vehicles, equipment, furniture and operational set-ups. | Reference to relevant work place safety manuals |

## MITIGATION MEASURES

The EIS should contain recommendations for incorporating environmental safeguards, promoting positive impacts and minimizing the negative impacts. This effort should lead to the preparation of an environmental resources management plan for the project. Re-forestation, resettlement and compensation payments are examples of mitigation measures that can be adopted.

Mitigation measures should be proposed for all major identified impacts of the project. These should be addressed both in the constructional, operational and post-operational phases of the project. Table 2 below shows examples of impacts and mitigation measures.

TABLE 2: IMPACTS AND CORRESPONDING MITIGATION MEASURES

|  |  |
| --- | --- |
| **Impacts** | **Mitigation Measures** |
| 1. Noise pollution | a. Noise certification of aircrafts  b. Night curfews  c. Banning of types of aircrafts  d. Operation of quieter aircraft engines  e. Specification of approach/take-off paths  f. Land Use Planning  g. Acoustical barriers  h. Planting of screening trees |
| 2. Air Pollution | a. Employ technology that lessens gaseous emissions of pollutants by aircrafts  b. Decrease traffic congestion of ground vehicles and provide alternative  transport where necessary  c. Reduce pollution from aircraft engine testing and maintenance, air conditioning and burning of refuse etc. |
| 3. Water pollution | a. Pre-determine allowable points and quantity of waste water  b. Sanitary and industrial waste water should be directed to receive sewage treatment  c. Chemicals employed should be selected and used in a manner to minimize water pollution  d. Install and conduct regular inspections of oil-water separators  e. Adopt measures to minimize accidental oil spills  f. Ensure airport operations such as aircraft repairs etc. are undertaken at the designated areas  g. Develop a system to check water mechanism around oil-fuel (underground) storage tanks and pipelines |
| 4. Flora and Fauna destruction | a. Compliance with all legislative controls for the protection of flora and fauna in the area  b. Protection of flora and fauna may dictate re-siting of airports or limit airport expansion requirements  c. Development of other areas as suitable wildlife habitat or re-planting of particular types of vegetation or provision of artificial water bodies  Airport environments and operations should be cognizant of the following for overall maximum benefits:  i. Natural features preservation  ii. Agricultural practices  iii. Highway development  iv. Recreational facilities  v. Municipal Utilities  vi. Commercial, industrial, residential and institutional zoning requirements |

***Source: ICAO Airport Planning Manual***

## MONITORING

Airports require a framework for monitoring the magnitude and trends in the impacts on the environment especially during the operational phase. Annex 16 to the Convention on International Civil Aviation (ICAO) has been developed to prescribe the mode of monitoring and allowable limits for the key environmental impacts resulting from airport establishment and operations.

Procedures for monitoring key impacts from airports as specified by ICAO Convention Annex 16 on Environmental Protection include the following:

Documentation and Record-Keeping

Airport operations are required to develop formats and Incident Log Books necessary to help track trends in the levels of the impacts on the environment. This will guide the re-designing of the mitigation measures for abatement of the impacts on the environment.

Annual Environmental Report Format

Airport Operations are required to submit Annual Environmental Report. The report should include:

* Executive Summary
* Introduction
* Environmental Policy Objectives, Strategies and Targets
* Environmental activities for the year under review
* Environmental Problems encountered (accidents, incidents and other major events)
* Monitoring Results against expected national and international quality standards
* Conclusion/Other notes

Environmental Management Plan Format

Aviation projects should be covered by Environmental Management Plans (EMPs). The EMPs should essentially indicate:

* Key Impacts on the Environment
* Mitigation Measures
* Monitoring Mechanisms
* Annual Environmental Reporting Format
* Decommissioning Plans

Decommissioning Plan

Airport Environmental Management Plans should include programs for retiring and disposing off equipment, facilities or any airport infrastructure in a manner most conducive to environmental protection objectives.

**CHAPTER FIVE**

# MARITIME, PORT AND HARBOUR SUB SECTOR

## INTRODUCTION

Development projects, which are essential to the socio-economic advancement of all countries, invariably result in impacts on environmental resources and values (ER/V). Port Harbour projects can disturb the existing environmental system to an unusual degree (compared to many other types of development) because of the sphere of influence.

The purpose of an EIS (Environmental Impact Statement) report is to ensure that the planning of development projects has been given careful consideration to environmental effects, so that the plan will, to the extent practicable, minimize all adverse effects, and also achieve beneficial effects or enhancement of environmental values, especially for the purpose of offsetting any unavoidable adverse effects.

## SCREENING FOR Maritime Transport PROJECTS

Category ‘A’ – Only Registration Required

* Port operation processes/services
* Signalling and Lighting
* Inland Water Jetties that can take more than 5 boats of less than 25 metres.

Category ‘B’: Preliminary Environmental Assessment (PEA) Required

* Operations: e.g. loading and discharge of cargo, bunkering (fuelling of vessels), stuffing and stripping of containers, beaching of laid-up vessels
* Inland Water Jetties that can take more than 5 boats;
* Loading and Discharging of General Cargo;
* Bunkering within the Port Basin;
* Disposal of Wreckage;
* Discharge of all Dangerous Cargo;
* Installation and Operation of Rigs.

### Category C: Mandatory Environmental Impact Assessment Required

* Harbour construction;
* Quay extension;
* Dry-docking (repairs and maintenance of vessels);
* Dredging
* Bunkering outside Port Basin.

Category D: Strategic Environmental Assessment Required

* Development of strategic Action Plans for the sector;
* Formulation of and implementation of policies and programmes.
* Port Construction

## Project Alternatives

Begin with a precise summary of how the reasonable options were selected, and provide the basis for elimination of options determined not to be reasonable. This section should also present the observations/findings of the screening and scoping activities. It is important that the conclusion of this section captures a prioritised history of the alternatives proposed, including their environmental benefits and costs.

The following key alternatives should be considered:

* Conceptual alternatives
* Alternative designs and costs for the proposed project
* Technology

Conceptual alternatives should be evaluated at the macro-level and should involve comparing the potential environmental consequences of constructing port/harbour to enhance international trade and navigation. The do-nothing scenario must be included if accurate assessment of the possible changes resulting from implementing the port/harbour project is to be realised in the long run

The design alternatives involve assessing various options. This involves providing about two or three different designs and assessing their positive and negative impacts on the environment. Factors to be considered in arriving at the best conclusion are:

* location/siting;
* technology etc.

## DESCRIPTION OF THE PROPOSED MARITIME/HARBOUR PROJECTS

The project’s area or sphere of influence should be identified and the pertinent environmental resources within the area should be described. The description should include essentially the salient information about the project in detailed manner such that with the availability of the baseline conditions, one can identify the possible beneficial and adverse impacts.

A description of the general area covered by the project should be provided. It is also essential to provide a map of the area indicating any areas protected by statute or by the policies of a national or local authority.

This chapter should include discussions on the following maritime/harbour activities:

### Construction

* Port/harbour design concept and engineering standards adopted
* Materials, tools and equipment and other logistics to be used.
* Labour force (both skilled and unskilled)
* Environmental alternatives during construction at site (e.g. source of earth material, resettlement of affected groups etc)
* Utility services and their relationship with the port/harbour project (e.g. power supply, water, tele-communication services, access/alternative roads etc)
* Information on pollution prevention strategies (containment of oil spill etc).
* Occupational health and safety issues of workers.
* Evaluation site testing
* Time of year, duration and phasing
* Site preparation works
* Employment
* Accommodation.
* Working hours.
* Construction techniques.
* Materials (including sourcing, transportation and storage).
* Access
* Traffic, noise, dust, vibration
* Pipe Laying
* Extensions of infrastructure (water, power, railways, roads)
* Dredging/disposal of spoil.
* Fencing.

### OPERATION

* Type tonnage, frequencies, seasonality.
* Loading/unloading, handling, storage and processing and/or distribution by type of product.
* Marine structures, including dredging, filling and navigation aids.
* Induced effects such as erosion and siltation.
* General handling equipment, cranes, conveyors.
* Fire and hazard control equipment.
* Runoff interceptor and treatment systems.
* Dust control systems.
* Storage facilities
* Access, parking and traffic movement (on-site and off).
* Solid waste generation and disposal
* Water supply (bunkerage).
* Power supply.
* Monitoring proposals.
* Pollution and emergency control procedures.
* Access control, fences, water, signs, security.
* Traffic (on water and roads).
* Pest control.
* Cleaning facilities.
* Storage.
* Lighting.
* Public address systemsEmergency procedures.
* Employment.
* Seasonally, hours of operation and shifts.

### Decommissioning (if applicable;

* Possible uses of the facilities should the port cease or reduce operations.

### Future Growth and Associated Developments

* Likelihood of adjacent secondary/tertiary developments.
* Likelihood of future expansion.
* Port related industry.

## BASELINE ENVIRONMENTAL CONDITIONS

### Ecological Studies

All estuarine and shallow marine water are the breeding and reproduction zones for most of the marine/estuarine life of commercial and sports value in the world, including both finfish and shellfish, and including species living in the area and species (both freshwater and marine) which migrate to the estuarine zones for purpose of reproduction. Estuarine zones are especially valuable for reproduction due to the ready availability of food and relative safety from predators. Hence an important aspect of an EIS for a proposed port/harbour project is a field survey for assessment of the fishery and other sensitive marine ecological values in the area (such as coral reefs) to obtain data which will describe the existing ecology of the area, and thus be available for guiding design of the project so as to minimize damage to and/or enhance these ecological values.

Such surveys should include field sampling, over the different seasons of the year, including both the water column and the benthos, and including use of sufficient physical, chemical, and biological parameters so that a quantified picture can be established of the existing aquatic ecology in the affected riverine, estuarine, and marine areas. Based on this information, a quantitative estimation can be made of the effects of alternative port/harbour layouts on fisheries and other aquatic ecological values, so that the most favourable layout can be selected. The design can then incorporate features that minimize damage and even enhance conservation of these values.

In summary, the EIS should include description of surveys made and planned for initial and subsequent assessments of the ecological values establishing the characteristics of the water column, and shoreline areas, including physical characteristics (temperature, dissolved oxygen, and suspended matter in the water column, and the nature of particle-size in bottom sediments), chemical characteristics (selected parameters including salinity for the water column, and chlorinated hydro-carbons and hexane extractable from the bottom sediments), and biological characteristics including fish catch surveys and plankton in the water column.

The following other relevant information should be provided in the chapter:

* Land uses
* Natural Resources
* Forest/vegetation (types and boundaries
* Water resources (rivers, streams, lakes, swamps, beaches, bays, flood ways, estuaries etc.)
* Human resources
* Agricultural areas (types of crops and boundaries, including aquaculture)
* Industrial development (types of industries, sizes, employment levels).
* Transportation facilities (roads, canals, railways, etc.)
* Communities (population location and densities)
* Institutions (hospitals, schools etc)
* Archaeological, cultural, and historic treasurers.
* Other aspects of economic and human development.

In addition to the maps, supplementary information should be provided on available resources for evaluating the expected impacts on them as a result of the project. The environmental information required to establish the baseline setting of the project can be derived from secondary sources, although much may have to come from special surveys and investigations carried out as part of the EIA, and some may already have been assembled in connection with previous environmental studies in the project area.

Government organizations, universities and other institutions in the project area may be able to supply relevant information, and should be consulted. NGOs frequently have detailed information on local conditions and should also be consulted, as should local people in the project area, who can often supply information on such aspects as present agricultural conditions, which may not be available from official sources. Additional surveys should be carried out as part of the EIA to validate existing information, provide new data, or to fill gaps in the existing data.

Two questions commonly arise in relation to the collection of baseline data for an EIA:

* Over what geographical area should baseline data collection extend?
* What level of detail is required on each topic?

There are no simple answers to these questions when applied to port projects in general, because requirements vary from project to project. The area over which impacts of various types are likely to be experienced, and the level of details required depends on the nature and complexity of impacts and determines the spatial coverage of baseline data.

For example, some impacts associated with port projects are very localized, but others are more widespread. Direct impacts associated with land acquisition are confined to the area of land-take, but the secondary or indirect impacts such as induced development of agriculture in unsuitable areas may have very wide geographical implications, particularly if land-take is extensive and large numbers of farmers are displaced from productive agricultural land.

Soil erosion and land slipping may have localized direct effect within and adjacent to the project reserved areas, but the secondary effects associated with derived sediment entering watercourses may have much wider geographical distribution, affecting reservoir storage capacity and the hydraulic characteristics of watercourses several kilometers downstream.

## IMPACT EVALUATION AND SIGNIFICANCE

The major Environmental Resource/Value (ER/V) affected by port/harbour projects usually include fisheries and marine ecological values. A basic requirement for the EIS is preparation of a base map, which shows in meaningful detail all of these basic environmental resources/values in the affected areas. On this same base map, the proposed project should be laid out, i.e., the proposed port/harbour facilities, shipping lanes, and all expected associated commercial and industrial developments including warehouses, access roads, and other important facilities. Factors requiring special attention in preparing the EIS include the following:

* Fish (finfish and shellfish) (riverine, estuarine, marine)
* Coral reefs and associated sensitive marine ecology
* Mangrove swamps and other shoreline vegetation
* Dedicated use areas (pearl oyster areas, shrimp farming areas, etc.)

Each of the resources should be described and evaluated for without and with project conditions, with presentation of plans for necessary correction/compensation/enhancement measures.

With respect to coral reefs, every effort should be made to avoid any construction in or near coral reefs, which represent an irreplaceable and priceless national asset. Also, corals can survive only in clear transparent water; hence care must be taken in the design of shoreline facilities not to result in transport of turbidity to coral reef zones.

The impacts on the resources noted above can be caused by (filling or dredging for creating the harbour facilities or associated commercial and industrial activities, and pollution effects resulting from operation of these facilities, including pollution discharges (oils, refuse) from both ships and shore installations.

### Beaches, Recreational Areas, and Other Land Values

Beaches and other recreational assets in the affected areas (such as natural beauty spots, sand dunes, etc.) must be delineated and evaluated with respect to (1) their physical and aesthetic properties under existing conditions and extent of current and projected use both under 'with' and 'without project' conditions, with estimates of the values of filling, (2) project operations (pollution effects), and (3) alterations of local current patterns affecting erosion and deposition patterns in the vicinity. The EIS should include the evaluation of the likely impacts and describe the necessary correction or enhancement measures needed for protecting the existing beach sands or to promote desired erosion/deposition for enhancement of local land values for various beneficial uses. Also, the EIS should include discussion of all aesthetic values in the affected area, and provisions for both protection and proper public utilization of these values.

### Oil Handling Facilities/Emergency Spill Plan

Oil pollution is probably the single greatest pollution hazard resulting from port/harbour/shipping operations. Whenever Ports and Harbours (P&Hs) are used as transfer points for crude oils or refined products involving hauling by oil tankers, there will always be the hazard of a major oil spill from the tankers when outside the harbour, and the provision of P&Hs for this purpose may introduce this hazard of spills which can be *very* deleterious to marine and coastal ecology and to coastal tourist resorts. Whenever this threat exists, the agencies sponsoring the new (or improved) P&H should include, as part of the feasibility study, discussion of O&M measures which should be implemented for preventing spills and for emergency measures for clearing up actual spills from tankers, with recommendations on how this can be managed from the institutional and financial points of view. Preferably this can be done as a component of a National Oil Spill Contingency Plan (NOSCP). It is important that the decision makers in the Government are fully aware of the hazard contingency which goes with granting of approval for oil tanker operations.

Oil leakage and spills within harbour*:* The detailed FS/EIA should describe in detail the O&M procedures and precautions to be used for controlling/preventing leakage/spills during transfer of petroleum crudes or refined products from ship to shore to other installation, and including prevention of discharge of bilge waters, plus the provisions to be made (both for facilities and for operations) for emergency cleanup of spills which might occur.

### Harbour Sanitation/Management of Pollutants

Ports and harbours around the world have traditionally been regarded as "appropriate for unsanitary conditions", and only in recent years has it been recognized that it is feasible to maintain clean harbours provided it is recognized that special care must be exercised in planning and designing the harbour to incorporate the needed controls in the plan. The problem is that P&H projects have conventionally been (and are still being) planned and designed as if they represent "ordinary urbanizing areas", but they are not; hence the need is to modify the approach to planning/design to accommodate the special need for: (a) water supply; and (b) management of liquid and solid wastes from offices, residences, commercial establishments, and industries in the harbour complex. If not done, then the cost of correcting the sanitation problem becomes relatively very high.

Wastes *escaping from harbour:* In the absence of adequate facilities for control of liquid and solid wastes in harbours, these materials (especially floatables) may escape from the P&H area and travel along the coast and be deposited at beaches or elsewhere causing damage to property and ecology.

*Air pollution emissions:* One of the most serious problems of this type is the escape of dusts from handling of fine-particulate materials such as tapioca powder and coal dust. This requires provision of special equipment and measures to reduce escaping dust to tolerable levels.

*Hazardous materials:* Another serious problem arises from handling of hazardous materials including inflammables, explosives and toxics. The EIA must include discussion of how any such hazards can be mini­mized and how spills can be controlled.

### Erosion and Deposition Phenomena

The EIS must include an analysis of the effects of the proposed project in altering local current patterns and associated patterns of erosion and deposition, and the use of this information for guiding the design of the facilities. The basic principle should be that no existing shoreline values (beaches and others) will be adversely affected by the project, or, if affected, these effects be offset so that non suffers from the project through loss of shorelines values.

### Local Drainage Courses

Local drainage courses (streams) are an especially valuable and sensitive component of coastal environmental resources that tend to be impaired or ruined by coastal developments including ports and harbours unless careful provision is made in the project plan to protect and conserve these natural resources. The object should be to maintain the natural integrity of the stream, so that it remains an attractive, clean, aesthetically valuable, and ecologically productive resource, so that it does not become paved over, covered, and degenerate into an open sewer, etc.

While it is not within the control of a proposed port or harbour project to assure protection of the stream from all developments in the vicinity, the project plan needs to include careful attention to this problem so that construction and operation of the port/harbour and associated facilities takes into account the need for protecting local stream values.

### Disposal of Dredging Spoil

Disposal of dredged material or spoil has often been a very sensitive issue in port/harbour projects, due to the use of the material for filling and thus destroying valuable ecological areas, especially fishery reproduction zones.

Discharges of dredging spoils, if not carefully planned, can be very damaging to: (a) marine ecology including fisheries reproduction zones and fragile organisms including corals; (b) recreational beaches and resorts; (c) impairment or destruction of estuarine mangroves and the associated fisheries reproduction; and (d) discoloration of near shore coastal waters with gross impairment of environmental aesthetics and hence of recreational, resort and tourist values. Hence the project plan must include careful provision for disposal of excess materials. Preferably filling in low – lying areas of relative little ecological significance (e.g., paddy area needed for urban development).

### Water Supply and Pollution Control

In addition to the special problem of oil pollution, careful planning is needed in the project design to include proper water supply and waste disposal facilities, so that the port/harbour area will be maintained clean and not become a sanitation mess. This means (a) provision of adequate water supply distribution lines for serving both onshore facilities and ships in berths, (b) provision for handling of both sanitary sewerage and solid wastes from onshore facilities and ships in berths, (c) provision for handling of industrial liquid wastes from factories in the development area, (d) necessary air pollution controls for onshore facilities (for smoke and odor control), (e) institutional mechanisms for financing and providing for competent management of these facilities, and (f) plans for continuing to assure competent management.

With respect to liquid sanitary and industrial wastes, it is preferable that the development plan provide for a comprehensive sewerage system which can receive treatment and dispose of all sanitary and industrial wastes from the area, under a single system of management, with the costs assessed against the participants in proportion to benefits received. Otherwise, each factory or port installation must have its own system for handling sanitary and industrial liquid wastes, which will mean a total cost much greater than for a comprehensive system. Air pollution control should be provided by each installation, where needed, on an individual basis.

There will be large cost savings and much greater effectiveness if, in the port/harbour development plan, provision can be made for a single agency to build and operate comprehensive area – wide systems for serving all installations in the area, including three separate systems, (1) water supply, (2) liquid wastes (sanitary and industrial), including collection, treatment, and disposal, and (3) solid waste collection and disposal, plus (4) provision for periodic monitoring to check the operation and performance of these systems.

### Socio-Economic Assessment

This section of the EIS should evaluate the expected impact of the project on the population living in the affected area, and to be attracted to the area because of the project either temporarily or permanently, including necessary socio-economic surveys to establish baseline data for evaluation the existing conditions. The overall project plan should include provision for sharing in the project benefits by the local population, as well as contributing to the regional and national economy.

### Alternative Port/Harbour Locations

This section of the EIS should discuss alternatives to the proposed project, which were considered, including their relative environmental effects, and reasons for selection of the recommended project.

### Impacts of Dredging

The major adverse impacts of dredging resulting from disturbance of the natural aquatic ecosystem, and the potential for damaging the natural wildlife (including shell fish, water fowl, endangered species of plants, etc.) can be very great. Evaluation of these possible effects require field investigations to establish the without-project status of the key species present and their relationship to environmental factors such as depth, nature of the benthos, etc. this process can show that a proposed action will not result in adverse impacts on values that need to be protected. On the positive side, dredging can be very helpful by providing the following:

* Improving navigation
* In furnishing sand and aggregate essential to construction based on use of concrete
* Indirectly by providing filling materials for land reclamation.
* Increasing draft which allows bigger vessels to call at the port.

### Displacement Due to Harbour Location

Selection of the harbour site should consider possible economic losses due to displacements of: (a) fisheries reproduction on fishery capture zones; (b) precious fragile ecological zones, including corals and zones of outstanding aesthetic beauty; (c) precious estuarine/mangrove swamp zones needed for fisheries and/or for wildlife protection; and (d) precious historical/cultural/religious monuments on sites. The decision makers should clearly understand that the use of the site may result in irrevocable loss of these resources. Where resettlement will be necessary, this will be a part of the overall project cost.

### Operation and Maintenance Skills

A common mistake in the planning of environmental control facilities is the use of control methods used in the industrialized countries (ICs) with the assumption that these systems, which usually depend upon availability of skilled operations personnel, will function at the same level of efficiency as in the ICs. This is not the case, hence the EIA must recognize and deal with the realities of this problem.

### Environmental Monitoring

An essential aspect of environmental protection is the continuous periodic monitoring of effects of the project on the environment, both within and outside the harbour. This is a new concept in the project implementation process, and the technology for planning, establishing, operating, administering and financing the necessary minimum monitoring programs in the beginning stages of the project.

The type and extent of the necessary monitoring program should be the "minimum necessary" for ascertaining the onset of unacceptable environmental degradation in order that corrections may be made in a timely way.

### Occupational Health/Industrial Hygiene

The EIA should also present the recommended occupational health program including measures for protecting P&H personnel from occupational hazards, including routine hazards and emergency hazards (for example, a major fire or release of toxics to the harbour environment).

### Communicable Disease Hazards during Construction

For major construction projects requiring importation of workers from other regions, there may be a serious hazard for outbreaks of communicable diseases should any of the imported workers be disease carriers, especially outbreaks of malaria. For this reason the construction operations should include provision for control of anopheline mosquitoes in the worker camp areas.

## MITIGATION MEASURES

Mitigation measures can be broadly categorized into the following strategies that are aimed to meet defined objectives:

* Mitigation by avoidance

Measures considering siting, design, process, technology, route alternatives and ‘no go’ options to avoid impacts. These measures are applicable in planning stage of the project. Examples include the following:

* Selection of alternative route or relocation of facilities such as roads, power and water lines,
* Traffic routing

Avoid dumping solid or liquid waste materials into nearby water bodies

l

* Mitigation by reduction

Measures attempting to reduce impact or to limit the exposure of receptors to impacts.

These measures are applicable only in the progressive phase of the development project. Such measures include:

* Reducing solid and liquid wastes through recycling;
* Use of silt traps and planting of cover crops to reduce soil erosion or sedimentation from project sites;
* Limiting the scale of a proposed project;
* Reducing noise transmission by installing acoustic filters;
* Limits to growth
* Limits to hours of operation
* Control of associated development
* Limits to types of cargo
* Mitigation by remedy

These are measures undertaken to restore the environment to its previous condition or to a new equilibrium and are applicable only towards the end phase of project implementation and represents the ‘end of pipe’ approach to help improve adverse conditions created by the proposed development. Examples of mitigation by remediation include:

* Installation of additional pollution control equipment;
* Landscaping to reduce visual intrusion and soil erosion;
* Remediation of contaminated or polluted water and soil;
* Restoring the quality of flow of a diverted stream or river to its original condition;
* Dust suppression
* Noise containment
* Runoff management and control
* Compensation

These represents measures to achieve no net loss and represent on-sites or off site measures considered early in the planning process and also alongside the development to offset residual impacts. Examples include

* Compensating affected communities;
* Resettlement or relocation of affected communities.
* Enhancement

These measures are aimed to achieve net positive gains and are generally applied in parallel with other compensation measures to encourage opportunities to limit the scope and scale of impacts and on improving environmental features.

It is essential that mitigation measures are considered in the following hierarchy: avoidance, minimization, rectification, compensation and enhancement

## MONITORING

Monitoring is the collection of information at set locations and at regular intervals in order to provide the data that may be used to define current conditions, establish impact trends, etc.

Monitoring ensures continuity between conception, planning, construction and operational phases of the project. It also ensures that development projects achieve their environmental objectives. Monitoring is however expensive and should thus focus on the key environmental elements only. Some relevant physical parameters that should be monitored include the following:

* Noise
* Air Quality
* Water Quality
* Biological Environment
* Social Environment

**CHAPTER SIX**

# RAILWAY TRANSPORT SUB SECTOR

## INTRODUCTION

The Ghana Railway Company Limited has a rail network of about 950 km and a gauge of 1067mm (3ft 6ins) mainly constructed in the Southern part of the country in a triangular form from Sekondi/Takoradi to Kumasi with branch lines to Awaso and Prestea forming the Western Line; and from Accra/Tema to Kumasi through Kotoku forming the Eastern Line; and a cross line from Huni Valley to Kotoku with a branch line to Kade forming the Central Line.

Railway and associated developments are of concern principally for visual, noise and vibration considerations particularly in settled areas.- Severance can create problems for other infrastructure, fanning interests, amenity uses and wildlife. The locations of routes and stops can significantly affect settlement patterns in the long term. Routing through sensitive areas, land take, vegetation clearing can fragment wildlife habitats..

## SCREENING FOR Rail Transport PROJECTS

### Category ‘A’ – Only Registration Required

* Suburban Rail transport operation
* Construction of culverts up to 6ft opening;
* Installation of Signaling equipment;
* Construction of small station buildings and staff accommodation;
* Construction of level crossings

### Category ‘B’: Preliminary Environmental Assessment (PEA) Required

* Long distance passenger and freight rail transport operation
* Construction of siding line/marshaling yards and depots;
* Construction of multi-cell culverts and small bridges;
* Construction of drains
* Installation of communication equipment;
* Construction of major station buildings, warehouses and terminals
* Major rehabilitation works;
* Construction of sound barriers;
* Construction of fencing;
* Protection of right-of-way.

### Category C: Mandatory Environmental Impact Assessment Required

* Construction and operation of surface railway line;
* Construction and operation of underground rail line;
* Construction of surface railway line
* Construction of underground railway line;
* Construction of major bridges;
* Establishment of borrow pits;
* Construction of viaducts;
* Construction of tunnels;
* Construction of grade separation;
* Operation of quarries for ballast production;
* Construction of workshops and fuel dumps.

### Category D: Strategic Environmental Assessment Required

* Development of strategic Action Plans for the sector;
* Formulation and implementation of policies and programmes.

## DESCRIPTION OF PROJECTS IN THE RAIL TRANSPORT SUB-SECTOR

The project’s area of influence should be identified and the pertinent environmental resources within the area should be described. The description of the project area and its site should contain a detailed description of:

* Project alternatives
* Planning, Site Layouts, Designs, Processes (Compensation payments vis-à-vis relocation of project, social effects, etc.)
* Constructional Phase
* Operational Phase

A description of the general area through which the railway line runs is to be provided, including any areas protected by statute or by policies of a national or local authority. The following are some identified railway activities that are to be described in detail:

### Construction

* Time of year, duration and phasing.
* Site preparation works.
* Corridor acquisition, clearance and management prior to construction.
* Noise, vibration, traffic, dust.
* Materials (including sourcing, transportation and storage).
* Watercourse diversions
* Working hours.
* Construction techniques (especially scale of machinery to he used).
* Pipe-laying.
* Extension of infrastructure (water, power, roads, etc.).
* Spoil deposition.
* Fencing.
* Construction and operation of surface railway line
* Construction and operation of underground railway line
* Construction of siding lines/marshalling yards
* Construction of level crossing
* Construction of small bridges, culverts and drains
* Signaling equipment (Installation and Operation)
* Communication equipment (Installation and Operation)
* Construction of major bridges
* Construction of station buildings, terminals and warehouses
* Construction of workshops and fuel dumps
* Construction of staff accommodation
* Construction of viaducts
* Construction of sound barriers
* Production of sleepers
* Fencing and protection of right-of-way
* Construction of tunnels
* Production of ballast

This section should also describe the following:

1. Railway design concept and engineering standards adopted
2. Materials, tools and equipment and other logistics to be used
3. Environmental alterations during construction at site (e.g. land grading, soil disposal, and right-of-way clearing).
4. Utility services and their relationship with the railway project (e.g. water, transportation, telecommunications, electricity)
5. Labor force (both managerial and unskilled)
6. Information on storm water occurrence and diversions
7. Projected occupational conditions related to workers health and safety.

### Operation

* Horizontal and vertical alignment.
* Design and location of bridges, culverts, crossings, structures, signals and yards.
* Power and signal network.
* Power supply requirements and associated developments.
* Frequency, type and scale of usage.
* Passenger and/or cargo access.
* Speed of trains/trams.
* Noise and vibration generation.
* Loudspeaker systems.
* Parking location and adequacy.
* Waste disposal.
* Emissions from engines.
* Maintenance (including use of herbicides)
* Safety.
* Lighting.

This section should also describe the following:

1. Materials, tools, equipment and other logistics to be used
2. Environmental alterations during operation (e.g. disposal of waste, noise and air pollution)
3. Labour force (both managerial and unskilled)
4. Projected occupational conditions related to workers’/passengers’ health and safety

### Future Growth and Associated Development

* Extensions to network.
* Extensions to station/parking capacities.
* Increase in frequency/change of traffic type
* Cleaning/catering services.
* Retail outlets (especially in or near station
* Industrial and commercial development
* Residential development (especially near stations).
* Provision of emergency health facilities within the station
* Provision of fire fighting facility in the station

## BASELINE ENVIRONMENTAL INFORMATION

### Bio-Physical Environment

* Existing air quality and dispersion patterns
* Existing water quality/stream dynamics
* Flora and Fauna – Absence/presence of endangered species, overall biodiversity or specialized habitats that might be affected by routing or construction related impacts or disturbance during operation phase
* Existing land uses-project corridor and surrounding
* Fisheries resources
* Ecologically sensitive sites (wetlands, forest reserve, terrestrial systems, flyways) (see appendix 4 for a list of environmentally sensitive sites prescribed by LI 1652.)
* Existing mineral resources
* Topography of the area

### Human Environment

* Population pattern within the corridor
* Infrastructure within the corridor
* Agricultural patterns within the corridor
* Cultural, ecological sites
* Socio-economics, economy, employment, public health
* Religious sites.

## IMPACT IDENTIFICATION

The EIA should identify the anticipated positive and negative impacts (beneficial and draw-backs) to the environment resulting from the development of the proposed railway project. For identification of impacts, it is useful to draw up a list of parameters relevant to the projects under consideration. These should include but may not be limited to the items listed in Table 3.

TABLE 3: CONSTRUCTIONAL AND OPERATIONAL IMPACTS

|  |  |
| --- | --- |
| **ON-SITE BIOPHYSICAL CHANGE** | **OFF-SITE BIOPHYSICAL CHANGE** |
| **Surface Railway Line** |  |
| Deforestation and destruction of biodiversity | Noise pollution |
| Impacts on agricultural productivity | Emission into air |
| Impacts on wetlands productivity and functions(land degradation) | Water quality (surface and groundwater) |
| Increase in vibration effects | Social disruptions from land use conflicts |
| Land use conflicts (utility services) | Air pollution from emissions (type and size of particulates and volume gas emissions) |
| Changes in socio-economic parameters (income resources and impacts |  |
| Degradation of sensitive areas | Inundation of farmlands, settlements etc |
| Soil erodability | Public health impact |
| Compensation and resettlements | Sedimentation |
| Occupational health and safety |  |
| Landslides (seismology) |  |
| Subsidence |  |
| Effects on surface structures |  |
| Vehicular – Pedestrian traffic conflict  (community severance) |  |
| Accidents and safety issues |  |
| Aesthetics |  |
| Noise pollution |  |

**CONT**

|  |  |  |
| --- | --- | --- |
| **ON-SITE BIOPHYSICAL CHANGE** | **OFF-SITE BIOPHYSICAL CHANGE** | |
| **Underground Railway Line** |  | |
| Subsidence | Noise pollution | |
| Vibration effects | Air pollution | |
| Effects on surface structure | Water Pollution | |
| Occupational health and safety | Land use conflicts | |
| Loss of vegetation |  | |
| Accidents and safety issues |  | |
| Groundwater pollution |  | |
| Aesthetics |  | |
| Landslides (seismology) |  | |
| **Siding Line/Marshalling Yards** |  | |
| Loss of vegetation | Noise pollution | |
| Impact on agriculture | Emission into air | |
| Impact on wetlands | Water quality | |
| Vibration effects | Compensation and resettlement | |
| Socio-economic effects | Land use conflicts | |
| Sensitive areas |  | |
| Soil erosion |  | |
| Occupational health and safety |  | |
| Land slides(seismology**)** |  | |
| Accidents and safety issues |  | |
| **Level Crossing** |  | |
| Vehicular- pedestrian traffic | Land use conflicts | |
| Accident and safety issues |  | |
| **Major Bridges, Viaducts and Tunnels** |  | |
| Deforestation/Loss of Vegetation | Noise pollution | |
| Vibration effects | Air pollution | |
| Aesthetics | Sedimentation | |
| Accidents and safety | Land use conflicts | |
| Socio-economic impacts | Flooding | |
| Occupational health and safety | Public health impacts | |
| **Minor Bridges** | |  |
| Deforestation/Loss of Vegetation | | Noise pollution |
| Vibration effects | | Air pollution |
| Aesthetics | | Sedimentation |
| Accidents and safety | | Land use conflicts |
| Socio-economic impacts | | Flooding |
| Occupational health and safety | | Public health impacts |
| **Culverts** | |  |
| Deforestation/Loss of Vegetation | | Noise pollution |
| Vibration effects | | Air pollution |
| Aesthetics | | Sedimentation |
| Accidents and safety | | Land use conflicts |
| Socio-economic impacts | | Flooding |
| **Drains** | |  |
| Erosion | | Public health impacts |
| Loss of Vegetation | | Land use conflicts |
| Vibration effects | | Air pollution (dust) |
| Aesthetics | | Noise pollution |
| Accidents and safety | | Water pollution |
| **Signaling Equipment** | |  |
| Removal of vegetation | | Air pollution |
| Vibration effects | | Noise pollution |
| Aesthetics | | Visual Intrusion |
| Accidents and safety | | Land use conflict |
| **Communication Equipment** | |  |
| Deforestation | | Noise pollution |
| Vibration effects | | Air pollution |
| Accidents and safety | | Land use conflicts |

A brief comparison of the impacts associated with alternative sites highlighting the pros and cons of these alternative solutions, notably the advantages of ensuring proper environmental management in a new compact designated area like the selected site should be provided.

## IMPACT EVALUATION AND SIGNIFICANCE

A critical feature of an environmental assessment is determining whether a given impact is significant. Having quantified the magnitude of the impact (i.e. the level of change), there are various ways of interpreting whether or not it is considered significant. For many effects, there are no simple rules or formulae which define threshold of significance and there is, therefore, a need for the interpretation and judgment on the part of the consultant, backed-up by data or qualified information wherever possible. Such judgments will include the assessment of the numbers of people experiencing a change in environmental impact as well as the assessment of the damage to various natural resources. The consultant preparing the Environmental Statement will need to make it clear how they have defined whether a change is considered significant or not.

This chapter provides information on the scope of consultations that have to be made in order to identify the main impact issues and recommend tools to be used for impact identification and evaluation. The consultant is at liberty to make his own choice of methodology and the document used should be provided as an appendix. Where applicable, a scale of significance should also be suggested.

The EIA should identify the various types of impact (beneficial and detrimental) based on the location of the railway project. It should indicate how the location of the project at a particular location, will affect the ecosystems and its components (flora and fauna) as well as land use types. Below are tables indicating some suggested impacts:

* Ecosystems/Land Use Types Where Rail Sector Activities Can Be Located
* Effects of Identified Biophysical Change Process on Provision of Goods and Services in the Area Where Railway Activity is Located
* Impacts on Human Health and Well-Being Resulting from Changes in the Function of the Biophysical Environment.
* Social Change Processes Resulting from Identified Clusters of Activities.

The above-identified types of impacts are not exhaustive. The consultant should as much as possible identify all impact types that will affect the environment as a result of locating the railway project at a particular area.

**TABLE 4: ECOSYSTEMS/LAND USE TYPES WHERE RAIL TRANSPORT SUB-SECTOR ACTIVITIES CAN BE LOCATED**

|  |  |
| --- | --- |
| **RAIL TRANSPORT SUB-SECTOR** | **ECOSYSTEM/LAND USE TYPE** |
| **1. Construction and operation of surface railway line** | Dry land  Tropical forest  Settlements  Mountains (tunnels or cutting)  Flood plains and swamps |
| **2. Construction and operation of underground Railway line** | Dry land  Underground water  Through Mineral Deposits  Under the sea/river  Various types of rocks  Settlements |
| **3. Construction and operation of siding line** | Forests (tropical)  Forests (Plantations)  Dry Land  Flood plains and swamps  Over rivers and streams  Agricultural areas (Farms)  Settlements |
| **4. Construction of Level Crossing** | Dry Land |
| **5. Construction of Minor Bridges** | Over rivers and streams  Forests (Tropical) and Forests (Plantations)  Lakes and reservoirs  Tidal areas, Flood plains and swamps  Valleys  Irrigation systems |
| **6. Construction of Major bridges, Viaducts and Tunnels** | Over rivers and streams  Forests (Tropical Plantations)  Lakes and reservoirs  Tidal areas  Flood plains and swamps  Irrigation systems  Road (Road over/under bridges)  Underground water  Through Mineral Deposits  Under sea/river  Various types of rock  Settlements |
| **7. Construction of Culverts** | Over rivers and streams  Lakes and reservoirs  Tidal areas  Valleys  Irrigation systems |
| **8. Construction of Drains** | Forest (Tropical)  Forest (plantations)  Dry Land  Flood plains and swamps  Agricultural areas (farms)  Settlements |
| **9. Installation of Signaling equipment** | Forests (Tropical)  Forests (Plantations)  Over streams/Rivers  Dry Lands |
| **10. Installation of Communication Equipment** | Forests (Tropical)  Forests (Plantations)  Dry Land  Irrigation systems |

TABLE 5: EFFECTS OF IDENTIFIED BIOPHYSICAL CHANGE PROCESS ON PROVISION OF GOODS AND SERVICES IN THE AREA WHERE RAILWAY ACTIVITY IS LOCATED.

|  |  |
| --- | --- |
| **LOCATION OF ACTIVITY** | **EFFECTS OF BIOPHYSICAL CHANGE ON GOODS AND SERVICES** |
| **1 Dry land** | Scarcity of dry land for other development activities like provision of housing, industries, schools etc. |
| **2. Forests** | Production of timber for development activities like construction, furniture and other wood products.  Establishment of timber industries and other related industries  Supply of timber for fuel and other domestic use  Generation of employment  Tourism due to loss of biological diversity  Land fertility |
| **3. Forest Plantations** | Production of timber for development activities like construction, furniture and other wood products.  Establishment of timber industries and other related industries  Supply of timber for fuel and other domestic use  Generation of employment  Tourism due to loss of biological- diversity  Land fertility |
| **4. Settlements** | Provision of utility services like electricity, water etc.  Shortage of accommodation  Farming activities  Generation of employment  Cultural/Traditional changes |
| **5. Valleys** | Tourism e.g. migration of wild animals (game and wildlife). Tourist attraction especially through forest  Supply of water if valley contains river |
| **6. Mountains** | Tourism e.g. migration of wild animals (game and wildlife) Tourist attraction especially through forest |
| **7. Flood Plains and Swamps** | Agricultural activities e.g. rice farming  Reduction in employment  Transmission of diseases |
| **8. Over Mineral Deposits** | Reduction in employment  Reduction in foreign exchange earning |
| **9. Rivers and Streams** | Supply of water  Provision of accommodation due to flooding |
| **10. Underground water** | Supply of quality underground water  Reduction in underground water supply due to pumping of underground water during construction |
| **11. Various Types of Rock** | Provision of houses and other surface structures due to probable subsidence or failure |
| **12. Agricultural Areas** | Shortage of farmlands  Shortage of employment  Reduction in food supply |
| **13. Lakes and Reservoirs** | Tourism  Shortage of employment  Reduction in fish supply  Shortage of water supply |
| **14. Tidal Areas** | Tourism  Shortage of employment  Reduction in supply of fish  Inadequate supply of water  Reduction in mangrove supply |
| **15. Irrigation Systems** | Inadequate supply of water for farming  Reduction in employment |

TABLE 6: IMPACTS ON HUMANS RESULTING FROM CHANGES IN THE FUNCTIONS OF THE BIOPHYSICAL ENVIRONMENT

|  |  |
| --- | --- |
| **dry land** | **Human impacts** |
| 1. Scarcity of land | Farmers - Affects all gender  Housing - “  Industries – Change in employment level for employable age group for all gender  Schools - Affects schooling of all gender |
| **Forests/Forest Plantations** | **Human Impacts** |
| 1. Timber production for development activities | Construction Industry - Change in employment level for employable age  Housing Construction - Affects all gender and all categories of employees  Furniture and other wood products industries - Change in employment level for employable age and gender |
| 2. Establishment of Timber Industries and other related Industries | Change in employment level for all employable age and gender  Reduction in income of employable age and gender |
| 3. Supply of timber for fuel | Affects all gender and age  Low level income for fuel wood suppliers |
| 4. Tourism potential | Low level of income to individuals and state  Low level of employment for all gender and the employable age. |
| 5. Land Fertility | Low level of income for farmers of all gender and of farming age. |
| **Settlements** | **Human Impacts** |
| 1. Provision of utility services e.g. water, electricity etc. | Diseases for all gender and age  Low level of employment for all gender of working age |
| 2. Shortage of accommodation | For all gender and age |
| 3. Farming activities | Affects farmers of all gender and farming age  Low income levels  Low level of production of agricultural products |
| 4. Generation of employment | Reduction in level of employment for all gender of employable age  Low-income levels of employees. |
| 5. Cultural/Traditional Changes | All gender and age. |

TABLE 7: SOCIAL CHANGE PROCESSES RESULTING FROM IDENTIFIED CLUSTERS OF ACTIVITIES

|  |  |
| --- | --- |
| **ACTIVITIES** | **SOCIAL CHANGE PROCESSES** |
| 1. Construction and Operation of Surface and Underground Railway | Establishment/displacement of settlements  Change in farming activities due to access to market centers  Changes in population dynamics, seasonal increase in population and population densities  Changes/conversion of economic activities  Increase in income and employment levels  Establishment of industries including mining and timber  Increase in food supply to marketing centers  Improvement in Tourism  Easy movement of people and goods  Inter-modal transport development between rail, road, air and water. |
| 2. Construction and Operation of Siding Line | Establishment of industries  Movement of goods  Increase in economic activities |
| 3. Construction and Operation of Level Crossing | Movement of road vehicles and people across railway track |
| 4. Construction of bridges, culverts and drains | Movement of people and goods  Increase in economic activity |
| 5 Installation and Operation of Signaling and Communication Equipment | Movement of people and goods  Increase in economic activities |

## MITIGATION MEASURES

This chapter should identify and recommend the possible means for adopting environmental safeguards, minimizing detrimental impacts, enhancing beneficial aspects of the project and for effective management of environmental resources affected by the project. Mitigation measures can be broadly categorized into the following strategies that are aimed to meet defined objectives:

* Mitigation by avoidance

Measures considering siting, design, process, technology, route alternatives and ‘no go’ options to avoid impacts. These measures are applicable in planning stage of the project. Examples include the following:

* Selection of alternative route or relocation of facilities such as roads, power and water lines,
* route diversions
* Design alternatives
* Modal/technological alternatives
* Alternative stations/junction sites

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* Mitigation by reduction

Measures attempting to reduce impact or to limit the exposure of receptors to impacts.

These measures are applicable only in the progressive phase of the development project. Such measures include:

* Reducing solid and liquid wastes through recycling;
* Use of silt traps and planting of cover crops to reduce soil erosion or sedimentation from project sites;
* Limiting the scale of a proposed project;
* Reducing noise transmission by installing acoustic filters;
* Limits to growth
* Limits to hours of operation
* Control of associated development
* Limits to types of cargo
* Landscaping
* Vibration reduction measures such as choice of rolling stock
* Reduction in overspill of loudspeaker noise/lighting
* Mitigation by remedy

These are measures undertaken to restore the environment to its previous condition or to a new equilibrium and are applicable only towards the end phase of project implementation and represents the ‘end of pipe’ approach to help improve adverse conditions created by the proposed development. Examples of mitigation by remediation include:

* Installation of additional pollution control equipment;
* Landscaping to reduce visual intrusion and soil erosion;
* Noise barriers or bounds and landscaping
* Remediation of contaminated or polluted water and soil;
* Restoring the quality of flow of a diverted stream or river to its original condition;
* Dust suppression
* Noise containment
* Hours of construction and operation
* Underpasses/bridges for humans/wildlife/domesticated animals
* Runoff management and control
* Compensation

These represents measures to achieve no net loss and represent on-sites or off site measures considered early in the planning process and also alongside the development to offset residual impacts. Examples include

* Compensating affected communities;
* Resettlement or relocation of affected communities.
* Enhancement

These measures are aimed to achieve net positive gains and are generally applied in parallel with other compensation measures to encourage opportunities to limit the scope and scale of impacts and on improving environmental features.

It is essential that mitigation measures are considered in the following hierarchy: avoidance, minimization, rectification, compensation and enhancement

### Vegetative Cover

Vegetative cover should be immediately established on all cut/fill slopes. The activities of establishing vegetation on barren slopes are treated as part of construction and maintenance operations of railway projects. Strip forest, suitable for site conditions, on either side of the railway line should be created. This should be raised and maintained by forest authorities. No felling except of dead or dying trees should be permitted in this area. Afforestation of land adjoining the railway line should be carried out on either side of the railway line.

### Erosion Control

Where erosion is likely to be a problem, cleaning and grubbing operation should be so scheduled and performed that grading operations and permanent erosion control features can follow immediately thereafter. Temporary erosion control measures may also be provided between successive construction stages.

### Drainage

Drainage of water from railway line should be given top attention and necessary drainage system should be constructed to drain off rainwater to natural watercourse. In particular, suitable intercepting and water catchment drains should be provided on top of cut slopes for speedy and safe disposal of the rainwater. These drains should have gentle gradients and side slopes to carry flow without erosion.

### Culverts

The location and alignment of culverts should be so chosen as to avoid erosion at the outlet and silting at the inlet. The cross drainage structures should discharge safely on the valley side. To safeguard against erosion, Channel-training and erosion-control works like pitching/paving of the channel at out fall points, should be provided.

### Blasting of Rocks

Instead of heavy blasting of rock, controlled blasting using a low charge should be resorted to. Holes for blasting should be chosen keeping in view the line of least resistance taking care not to open up cleavage planes, joints and fissures of rock mass.

### Excavated material

Excavated material should not be dumped haphazardly; it should be duly dressed up in a suitable form at selected places so that it may not be washed away from rain. Such spoil deposits may be turned, if necessary. Railway formation after excavation should be provided with adequate protective works without delay.

### Infrastructure Facilities

Adequate provision for infrastructure facilities e.g. water supply, energy needs and sanitation facilities must be provided for construction/maintenance labor and other personnel deployed during execution of the project.

## Monitoring

When uncertainty over impact magnitude and/or effectiveness of mitigation over time exists, the monitoring program will enable subsequent adjustment of mitigation measures as and when necessary. Monitoring procedures for air, noise and water are as follows:

### Air Monitoring

Monitoring stations for air quality along the railway line is recommended. The results obtained must be used to compare with the background data. Additional locations may be selected, if it is required (e.g. where complaints are made). Parameters to be monitored are CO, HC, SO2, Nox, and Pb. Frequency and duration of sampling and locations of monitoring stations may be sorted out in consultation with the local meteorological department. Records of sampling methods and analysis must be compiled and should be made available for inspection.

### Noise Monitoring

Regular monitoring is recommended for purpose of determining the need for noise abatement measures during operation. The location for monitoring stations and the monitoring program may be sorted out in consultation with the EPA.

### Water Quality Monitoring

Monitoring of lead (Pb) content in the nearby water bodies and plants is recommended to determine if there is a significant increase in the content. The recommended monitoring program including locations, frequency, method etc. must be sorted out in consultation with the state water authorities e.g. Ghana Water Company Limited, Community Water Sanitation Authority or Water Resources Research Unit.

All projects, which have been prepared or are covered by Environmental Impact Statements and/or Environmental Management Plans, are expected to submit Annual Environmental Reports on their operations.

### Ecological Monitoring

Monitoring of changes in the ecology in the project area is essential The recommended monitoring program including locations, frequency, method etc. must be sorted out in consultation with relevant state institutions e.g. Ghana Wildlife Division, Forestry Division, EPA.

## Environmental Management Plan

All projects should be covered by Environmental Management Plan (EMP). After one year of operation, the proponent is expected to submit an EMP every three years. An Environmental Management Plan is an implementation plan for mitigation, protection and or enhancement measures, which are recommended in the Environmental Impact Statement (EIS). The EMP should present in detail how these measures should be operated, the resources required, and the scheduled for implementation.

The EMP document, which should be submitted to the EPA, should contain an implementation plan for each of the selected mitigation, protection and enhancement measures.

**CHAPTER SEVEN**

# ROAD TRANSPORT SUB-SECTOR

## INTRODUCTION

Ghana’s road network continues to expand over the years since it is the most utilized mode of transportation carrying over 97% of passengers and 93% of freight in the country. The continual increase of the network has its consequent environmental and social issues that need to be tackled through the mainstreaming of adequate and effective management issues within the project cycle.

Road transport developments tend to have widespread impacts because of their linear nature. Principal concerns would normally include noise, vibration, air quality, material assets (roads), severance, landscape issues, safety (humans and fauna) and cultural heritage. The route alignments can significantly affect settlement patterns in the long term. This chapter therefore stipulates and presents the guiding principle for addressing environmental and social issues associated with the planning and implementation of road projects in Ghana.

## SCREENING FOR Road Transport SUB Sector

Category ‘A’ – Only Registration Required

* Traffic and axle load studies
* Routine maintenance (desilting, roadside maintenance, drain cleaning, pothole patching etc)
* Roadside furniture (lighting, signing, road marking/roadside paving, etc).

Category ‘B’: Preliminary Environmental Assessment (PEA) Required

* Periodic maintenance (regravelling, resurfacing of paved and unpaved roads, resealing, spot improvement, asphalt overlay, culvert/bridge rehabilitation);
* Routine maintenance (minor rehabilitation works).

Category C: Mandatory Environmental Impact Assessment Required

* Major rehabilitation and upgrading
* Development projects: (reconstruction of an existing road; paved or unpaved, bridge construction (of steel, concrete or timber), construction of entirely new road)
* Establishment of borrow pits.

Category D: Strategic Environmental Assessment Required

* Development of Strategic Action Plans for the sector;
* Formulation of and implementation of policies and programmes.

## Project Alternatives

At an early stage in the EIA, several alternatives may still be under consideration. In case of new construction, these are usually alternative route corridors. Upgrading, reconstruction and rehabilitation usually involves fewer alternatives, since the existing road largely determines the route. Nevertheless, there may be several options under consideration at various locations.

Most feasibility studies involve comparison of the alternatives during the early stages, and selection of the most appropriate-. This is based on consideration of technical, economic and environmental aspects, and frequently a compromise has to be made in order to select the best option in the circumstances, taking all relevant factors into account.

EIA is one of the planning tools used for the comparison of alternatives. The approach taken is to undertake a rapid assessment of the alternatives, using the principles outlined below, and then to compare them on the basis of residual impact.

The preferred alternative, which may not necessarily be the most environmentally suitable alternative, because other factors must be taken into consideration, is then subjected to a more detailed investigation.

If more than one option still remains open as a result of the pre-feasibility studies, then a detailed description of the project, justification of the route and the project benefits. should be given. Each alternative should be summarized separately in a way that emphasizes the differences, and in particular, differences that would affect the nature, location and extent of key impacts.

In dealing with alternatives, begin with a concise summary of how the reasonable options were selected, and provide the basis for the elimination of options determined to be not reasonable. This section should also present the findings of the screening and scoping activity. It is important that the conclusion of this section include a prioritization of the alternatives proposed, including their environmental benefits and cost.

The two types of alternatives that should be considered are:

* Conceptual alternatives to overcome the transportation problem and
* Alternative designs for the proposed project

Conceptual Alternatives

These are evaluated at the macro-level and involve comparing the potential environmental consequences of building a road with other conceptual solutions such as restricting private vehicle usage, supporting public transportation and encouraging non-motorized modes of transport. The do-nothing option must be included if accurate assessment of the possible changes resulting from implementing the road project is to be achieved.

Alternative Designs

This involves assessing changes in the basic project concept such as routing, construction methods, or materials. Two to three alternative design options should be considered under which there might be several alternative treatments. It will be necessary to select alternative(s) for consideration that are practical and sustainable and are supported as reasonable by affected groups. If a preferred route option is chosen as a result of a weighted rating decision methodology, then this evaluation process should be presented.

## PROJECT DESCRIPTION

Once a particular alternative has been chosen or selected as the preferred option, a detailed description should be outlined in this chapter. The project description should include but not be limited to the following:

### Planning, Feasibility, Design Phase

During planning, the environmental specialist's principal role on the project team is to advise on route selection, to avoid sensitive habitats or resource areas, and to propose changes or alternatives to the project design.

*1. Planning / Pre-feasibility Phase:* The project management activities at project planning / pre-feasibility phase should include:

* Description and classification of the project
* Participation in the initial site inspection visit and coordination with project team members
* Advising on selecting the corridor or site to avoid sensitive habitats
* Screening projects early in the project cycle to identify salient environmental parameters of the proposed road works and to assess the sensitivity of the receiving environment
* Suggesting means to control secondary developments within the influence area of the road
* Identifying alternatives to the proposed project
* Scoping the environmental study
* Writing Terms of Reference (TOR) for the Environmental Impact Assessment

2. *Feasibility Study / Preliminary Design Phase:* The principal activities should include:

* Obtaining consulting services (contract tendering) for the conduct of the Environmental Impact Assessment
* Conducting or overseeing the Environmental Impact Assessment
* Analyzing for significant environmental impacts
* Conducting consultation with key stakeholders

3. *Detailed Design Phase*: Principal environmental management activities during the detailed design phase include:

* Incorporatingresults of the EA into the project design and implementation process through mitigation measures
* Submitting the EA to the regulatory agency for review and approval
* Participating on the EA Review Committee
* Designing mitigation measures
* Preparing a Resettlement Action Plan (RAP) when needed
* Preparing a Project Monitoring Program

### Construction

Checklist of items to be described during the constructional phase includes the following:

* Site evaluation
* Exploratory boreholes and trenching
* Time of year, duration and phasing
* Employment generation
* Staff accommodation and camping
* Working hours
* Site acquisition and management prior to development
* Site preparatory works
* Materials (including sourcing, transportation and storage)
* Pipe laying/drainage works
* Water course diversion/coffer dams
* Access
* Noise, vibration, traffic and dust
* Fencing
* Adjustment to existing infrastructure
* Type of project (new construction, upgrading, reconstruction, rehabilitation, etc), objectives and justification
* Length of route corridor and its location with respect to major topographic features, centers of population, administrative boundaries etc.
* Width of road reservation and land acquisition requirements
* Location and key dimensions of major cuttings, embankments and structures
* Earthworks and pavement quantities
* Spoil deposition
* Pavement type
* Current and projected traffic (split into heavy and light vehicle categories)
* Possible sites for quarries, borrow pits, spoil disposal areas, and estimated quantities for each area
* Possible construction camp sites and estimated workforce numbers
* Tentative project schedule in bar-chart form showing all key activities and milestones.
* A summary, preferably in table form of the technical, economic and environmental features, which are essential to the project.

### Operation

Once a road project becomes operational, a wide range of impacts may be experienced, the nature and extent of which will depend on the characteristics of the road concerned and its environmental setting. The EIA should attempt to identify, characterise, and evaluate these, while recognising that many uncertainties may exist regarding future conditions. Many of the impacts are of long-term duration and are likely to be effective throughout the life of the project. Some of these may become more significant with time, especially those that are related to traffic volume, which will almost certainly increase over the life of the project

While some of the impacts may be mitigated partly or wholly, by taking specific actions in relation to planning and design, other impacts are largely or entirely outside the control of MRT and fall within the spheres of responsibility of other authorities. Examples of this latter category are impacts arising from inadequate enforcement of legislation regarding vehicle noise and pollutant emissions, and matters relating to enforcement of planning restrictions and driver behaviour. Checklist of items to consider for discussion include:

* Cross sections, horizontal and vertical alignment.
* Design and location of bridges, culverts, crossings, junctions and other major structures
* Type, volume and variations of traffic
* Design speed, sight and stepping distances
* Noise and vibration
* Constraints techniques and materials
* Air and water emissions
* Light, signaling and signage
* Accident and emergency plans
* Routine maintenance: - Some negative effects are careless disposal of silt, increased traffic speed, careless cutting of trees and burning of verges for vegetation control.
* Periodic maintenance: - Some negative effects are the exploitation of sand, stone and gravel quarries and increased in traffic speed.
* Control litter and limiting potential pollution sources
* Sources of main materials (if known)
* Proper storage and management of maintenance materials and equipment
* Avoidance of direct discharge of highway runoff to receiving waters
* Properly managing roadside and median vegetation
* Waste from road maintenance activities should be disposed off properly.
* Landscape and environmental measures
* impacts resulting in fragmentation of habitats of endangered species or those posing barrier for movement of animals across the road if the road route is aligned through important wildlife areas.
* Other safety measures

The project description should be accompanied by map(s), at suitable scale indicating the location of all key features of the project and its surroundings, all relevant on-site facilities, and off-site facilities where the location is known, diagrams and photographs sufficient to show the nature of the project and the location of the entire project component.

## Baseline ENVIRONMENTAL information

The baseline information is very important in any EIA study and should be considered as one of the major tasks that need to be tackled with caution. The objective of determining baseline environmental conditions is to provide a description of the relevant aspects of the physical, biological, social, cultural and socio-economic setting in a 'without project' scenario. This forms the basis for assessing the impacts which the project is likely to have on the environment subsequently.

In some cases, the current environmental conditions may be subject to changes, which are independent of the project, and these should be identified so that the exact baseline or without-project environmental conditions form the basis for impact assessment. Some of the environmental information required to establish the baseline setting of the project can be derived from secondary sources, although much may have to come from special surveys and investigations carried out as part of the EIA, and some may already have been assembled in connection with previous environmental studies in the project area.

Governmental organisations, universities and other institutions in the project area may be able to supply relevant information, and should be consulted. NGOs frequently have detailed information on local conditions and should also be consulted; as should local people in the project area, who can often supply information on such aspects as existing land, use in road route, present agricultural conditions, traditional resource uses etc., which may not be available from official sources. Additional surveys should be carried out as part of the EIA to provide new data, or to fill in the gaps in the existing data. Some of the relevant baseline environmental data to be collected include the following:

### Bio-Physical Environment

* Existing air quality and dispersion patterns
* Existing water quality/stream dynamics
* Noise and vibration
* Visual Intrusion
* Flora and Fauna
* Existing land uses-project corridor and surrounding
* Fisheries resources
* Ecologically sensitive sites (wetlands, forest reserve, terrestrial systems
* Existing mineral resources
* Topography of the area

Monitoring of the biological environment will be mostly restricted to sensitive areas such as mangrove forests, wetlands and forest areas containing rare or endangered species of flora and fauna or providing important ecosystem goods and services. It is important to liaise with interested groups during biological monitoring.

### Human Environment

* Population pattern within the road corridor
* (The road corridor needs to be defined for study depending on type and the width of road (state or national highway, expressways) route, surface and anticipated traffic volume).
* Infrastructure within the corridor
* Agricultural patterns within the corridor
* Cultural, ecological sites
* Socio-economics, economy, employment, public health
* Religious sites.

Follow up surveys of community groups that the EIA predicted could possibly be affected should be conducted regularly. The data collected should be collated and analysed by those with a formal monitoring responsibility. Information on the health and safety of the communities could be made available when the authorities are consulted.

## IMPACT IDENTIFICATION AND EVALUATION

Once the basic information on the project and the baseline environmental conditions have been obtained, the next stage of the EIA process involves the identification of potential impacts, prediction of their magnitude or extent, and evaluation of their significance.

Positive and Beneficial Impacts

The positive impacts common to all road projects during the construction phase are usually numerically fewer than the negative impacts, and most are related to improvements in social, economic and socio-economic conditions. Virtually, all become apparent during the operational stage of the project, and are permanent rather than transitory. Benefits may be experienced at the local, regional and national or even international levels, depending on the nature of the project and the population it serves. They are usually considered to be of major significance. Generally, positive direct impacts include:

* reduction in vehicle operation costs arising from higher design standards than those applicable to existing roads
* reduced travel times between points served by the road
* improved access to markets, including overseas markets if the road facilitates movement of goods to ports
* improved access to tourist facilities
* employment opportunities for the local population during construction

Indirect beneficial impacts of road projects include:

* strengthening of local and regional economies through the stimulation of industry and commerce, leading to the creation of improved job opportunities
* improved access to more distant and varied employment opportunities
* improved access to health care and education

Positive impacts are largely achieved through the selection of appropriate road alignment and the use of suitable design standards. However, there may be others which are specific to the project concerned. The EIA report should therefore ensure that the direct and indirect benefits that can be accrued from all the various phases of the road project are outlined.

* + 1. **Negative Impacts**

A wide range of potential negative impacts is usually associated with most forms of road projects, many of which can be controlled through the adoption of appropriate mitigation measures.

From the EIA viewpoint, it is usually more convenient to categorise impacts in relation to the various phases of a project, and the activities associated with each, than to classify them in relation to the environmental component or value, which is impacted. The three distinct phases are:

* **Pre-construction phase**, during which surveys and investigations are carried out, and arrangements are made for land acquisition and any resettlement of those displaced from acquired land.
* **Construction phase**, during which actual land clearance takes place along the alignment and at any ancillary sites, and the various construction operations are executed.
* **Operation and maintenance** phase, when the road is open to traffic, and routine and major maintenance are carried out.

These guidelines consider the potential impacts associated with each phase, and indicate possible mitigation measures. It must be emphasised that the coverage of impacts and mitigation measures given in the following sections is not comprehensive.Additional impacts and/or mitigation measures should be considered for impacts peculiar to the specific project. An attempt has been made to include a wide range of possible impacts and mitigation measures, most but not all of which, are applicable to the majority of road projects. Not all of the impacts would be expected to occur on any single project, and judgement is necessary to identify those applicable in any given situation. Similarly, it is necessary to select the most appropriate form of mitigation measure appropriate to the circumstances, and different measures from those mentioned here is always welcome.

### Pre-Construction Phase

#### Site surveys and investigations

Surveying, site investigation and other activities can give rise to several adverse impacts, most of which are restricted to the immediate vicinity of the alignment. Most of these can be quite long-lived, given the length of time which elapses between preparatory work and the commencement of construction works which is usually between 4 and 5 years. The report should include measures taken to address or avoid these impacts.

#### Uncertainties regarding the future

Land and property owners often suffer considerable uncertainties regarding how much of their land/property they will lose as a result of land acquisition for the road reservation. Impacts associated with land acquisition are among the most common experienced impacts ofn road projects, and are often the most difficult to evaluate and mitigate.

#### Inducement of squatter influx

Squatters may attempt to occupy land along and adjacent to the proposed alignment, in the hopes of receiving compensation.

#### Destruction of vegetation, agricultural and cultural heritage

In the case of new road construction, it may be necessary to clear areas of relatively dense vegetation in order to obtain enough site distances. Other activities such as excavation of trial pits and execution of site investigations involving drilling or boring, may also require the clearing of vegetation.

In designing road projects, every opportunity should be taken to minimise loss of agricultural land, particularly high-productivity land. The impact on individuals who are partly or wholly dependent on land for their livelihood may be, and usually is, of major significance.

#### Resettlement

People, who have to be displaced from their homes and agricultural land, may induce additional resource pressures in the resettlement area.

Construction Phase

The nature and extent of impacts likely to arise during the construction phase are broadly related to the scope of works involved. In general new construction will involve a wider range of impacts, which are often of greater intensity, than upgrading.

Although construction is a transient activity, and some of the impacts are themselves of transient nature e.g. noise and air pollution, others may have far-reaching and long-term effects e.g. landscape instability and erosion.

#### Site clearance

Site clearance, involving removal of vegetation and topsoil, is needed along the alignment before construction of the road commences, and also at ancillary sites such as quarries, borrows pits and spoils disposal areas.

* Loss of cultural heritage
* Loss of sensitive or rare habitat
* Loss of trees
* Noise, vibration and dust from building
* Noise and dust nuisance from general site clearance
* Interference and relocation of utilities and services
* Increase in erosion and sediment deposition

#### Base camp establishment and operation

Construction of road projects typically involves a large workforce, many of whom, are likely to be engaged locally. Non-local labour is usually housed in camps at one or more sites adjacent to the alignment, and at some ancillary sites, especially quarries. The labour camps are often located in or adjacent to other facilities established and operated by the contractor, including site offices, material storage areas, workshops and plant maintenance facilities, concrete batching plant, asphalt plant, fuel stores etc. Given the length of the construction period, and the scale of operations involved, these camps can have significant adverse effects on the environment if adequate protection measures are not adopted.

* Friction between workers and the local
* Increase in pressure on local services
* Increase in water pollution
* Depletion of natural resources by the workforce
* Effects on land quality (abandoning site without reinstatement)

#### Establishment and operation of quarries

At the feasibility study stage when the EIA study is conducted, it is unlikely that the precise location of quarry sites will be known, since it is the Contractor’s responsibility to select these quarry sites. Prediction of impacts in specific terms is therefore impossible, and for EIA purposes may have to be generalised, and based on knowledge of the conditions existing in most likely quarry sites, which will usually be in areas where quarrying activities are ongoing.

In cases where specific quarry locations are unknown at the time of the EIA, the report should concentrate on defining those sites and defining appropriate mitigation measures to deal with any adverse impacts. Maps should be employed to define areas. Whiles potential impacts including the following should be addressed.

* Loss of productive land
* Disturbance to wildlife and loss of habitat
* Generation of noise and dust nuisance
* Increase in erosion and sediment deposition
* Blasting methodology, vibration and associated safety hazards
* Landscape instability

#### Establishment and operation of borrow pits

A considerable amount of materials from borrow pits are often required for road construction purposes, especially in cases where unsuitable and insufficient cut material is available for pavement construction. The haulage distance between cut and fill sites, if not economically viable, also requires that suitable materials within acceptable distances are explored.

The opening of borrow pits for road construction has, in the past, resulted in substantial environmental damage in may parts of Ghana, and this matter should be given very careful consideration in developing the EIA and the EMP.

The EIA should concentrate on identifying areas where materials should not be permitted on environmental grounds, and formulating impact control measures which will cover the range of impacts which could reasonably be expected at approved sites. Maps of the approved sites and locations should be included in the study. Impacts should not be limited to:

* Loss of productive agricultural land
* Loss of sensitive habitat and vegetation
* Increase in erosion and sediment deposition
* Risks of creating receptacles for waterborne diseases

#### Spoil disposal

Spoils do arise on road construction projects as a result of unbalanced cut and fill, when excavated material has properties, which make it unsuitable for use as fill and also waste from unwanted materials e.g. old culverts. The following impacts do arise as a result of improper disposal of the spoil.

* Interference with natural drainage
* Increase in erosion and sediment
* Pollution from special spoils

#### Mobilisation of heavy plant and machinery

Most road construction projects require the mobilisation (and demobilisation) of heavy plant and machinery, including such items as bulldozers, scrapers, and quarry and other plant. These are normally transported to site by road, often on heavy transport vehicles, which are relatively slow-moving, and themselves are heavier, and when loaded may be wider than normal vehicles. These may lead to damage to road structures and pavement, and inducement of traffic congestion

#### Haulage of materials

Road construction projects of all types usually involve transporting large quantities of materials, all of which are moved by vehicles. These are likely to include:

* rock from quarries to crusher plants/stockpile areas
* aggregate from crusher plants/stockpile areas to concrete batching plants, and concrete to work sites
* aggregate from crusher plants/stockpile areas to wet-mix macadam and hot-mix asphalt plants and on to work sites
* borrow material to work sites
* rock from stockpile areas to work sites
* excavated material from cuttings to fill areas or to spoil
* bitumen to site

A range of impacts is likely to be associated with such transport operations, whose level of significance may vary from location to location, depending largely on the volume of traffic involved. The following could be foreseen.

* Damage to road pavement and structures
* Inducement of accidents
* Generation of noise and air pollution
* Generation of dust nuisance

#### Earthworks

Construction of earthworks often represents a major part of the overall construction works associated with road projects, and in many cases, the volume of earthworks is considerable. In hilly or mountainous areas, the cut/fill quantities are considerable in order to achieve the desired standards of vertical and horizontal alignment. Even in relatively flat areas, a considerable volume of fill is required to construct embankments to raise the surface above flood levels and to protect the pavement from sub-surface water. However, in the case of upgrading projects, which do not involve widening of the carriageway, the volume of earthworks is relatively small.

Impacts associated with earthworks construction are broadly related to the total volume of earthworks, and the particular environmental conditions at the site. Major impacts are likely to be associated with projects in hilly areas where large numbers of cuttings and embankments have to be formed.

* Increase in slope instability
* Increase in erosion and sediment deposition
* Interference with aquifers
* Interference with natural drainage patterns
* Interference with services and infrastructure

#### Concrete structures

Most road projects involve the construction of structures of various types and sizes, and may include large and small over-bridges and under-bridges, culverts and other cross-drainage works, together with many minor structures.

* Inducement of traffic congestion
* Pollution of water bodies
* Disturbance to watercourses
* Noise and vibration disturbance from piling

#### Construction of Base Course and Surfacing

* Air pollution from asphalt plants

Operation and maintenance phase

Once a road becomes operational, a wide range of impacts may be experienced, the nature and extent of which will depend on the characteristics of the road concerned and its environmental setting. The EIA should attempt to identify, characterise, and evaluate these, while recognising that many uncertainties may exist regarding future conditions. Many of the impacts are of long-term duration and are likely to be effective throughout the life of the road. Some of these may become more significant with time, especially those which are related to traffic volume, which most often than not, increase over the life of the road. Some of the issues that need to be considered include:

* Increase in traffic noise
* Increase in air pollution levels
* Water pollution from highway run-off
* Severance of communities
* Road Safety and traffic calming measures

Crossing the road may pose particular problems for pedestrians if traffic speeds are high. The elderly and young children are particularly at risk if inadequate provision is made for crossing the road. Another issue to be considered is the need to move livestock across roads to fields.

Increased traffic volume and average vehicle speeds associated with upgrading projects may result in an increase in accidents involving vehicle-vehicle, vehicle-pedestrian and vehicle-animals. New construction, and upgrading involving widening, particularly in rural areas, may also result in high frequency of accidents, especially vehicle-pedestrian until those crossing the road have learned to cope with the traffic. The EIA should indicate how the project would be implemented to forestall safety related issues..

## MITIGATION AND BENEFIT ENHANCEMENT MEASURES

Once mitigation and benefit enhancement measures have been selected, their effectiveness in minimising or enhancing the potential impact they are intended to address should be evaluated, and the residual impact determined.

This is one of the most challenging stages in EIA process, involving a a realistic assessment of the effectiveness of the proposed measures, in order to effectively address the predicted impacts, which the project is likely to have on the environment. Each of the significant impacts should be identified and based on the efficacy and feasibility of mitigation measures the level of residual impacts should be determined which should be broadly categorised according into the following classification:

* Residual impacts are **None** - when the predicted impacts are not significant
* Residual impacts are **Unknown** -when thenature and extent of potential impact is uncertain, and/or the effectiveness of proposed mitigation measures is uncertain
* Residual impacts are **Low** - when the potential impact is fully understood, and proposed mitigation measures are known to be effective if properly adopted
* Residual impacts are **Moderate** - when potential impact is moderate, but the proposed mitigation measures are known from past experience to be only partially effective, or no immediately effective measures are available, and/or are not under the control of the project authorities and may not be adopted, or are unlikely to become effective during the early years of the project
* Residual impacts are **High** - Similar state of mitigation efficacy as for moderate residual impacts but there are major potential impacts of the project

In the case of impacts for which design solutions are available, low residual impact would normally be anticipated on the grounds that the recommendations contained in the EIA would be translated into reality during the detailed design phase, if they have not already been incorporated in the feasibility study designs. This is usually also the case for construction-related impacts, even when the true nature and extent of impacts is uncertain as a result of uncertainties in the location of materials, haulage routes, quarries and other ancillary sites, on the assumption that the mitigation measures proposed are effective, and that incorporation of suitable clauses in the contract documents will take place during the detailed design stage, and that enforcement can be achieved through effective construction supervision.

Moderate and high residual impacts are usually, but not always, associated with mitigation measures that have to be adopted by authorities other than the project authority. One common example is the minimisation of air quality impact by the enforcement of existing or more stringent limitations on vehicle air pollutant emissions, which is completely outside the remit of the road authority, when the option of re-routing the road to avoid infringing air quality limits is not available for economic or other reasons.

The use of a matrix can be useful in summarising the results of residual impact assessments and its corresponding mitigation measures. Some of the possible mitigation options include:

* Routing/siting or other alternatives
* Design alternatives (width, surfaces, side slopes, fences, signs and lighting)
* Width of carriageway
* Surface alternatives
* Road markings/signage
* Lighting Railings
* Landscaping
* Drainage
* Hours of operations
* Frequency of usage
* Do-nothing option
* Underpasses/bridges for humans/wildlife/agricultural livestock.

The inclusion of clauses in construction contract documents to control the activities of the contractor which are potentially damaging, is a powerful mitigation measure, but only if the clauses are enforced. However, if design has not taken environmental matters properly into account, or if designs are inadequate to address specific impacts, control on the activities of the contractor will be insufficient to minimise many impacts, which depend on specific design measures. Conversely, if environmental protection measures incorporated in the designs are not constructed as designer intended, their function and effectiveness may be impaired. The importance of proper supervision and contract enforcement in reducing construction impacts cannot be over-emphasised.

## MONITORING

The principal activity during the road construction phase is monitoring to ensure that mitigation measures, conditions and specifications are fully implemented during construction and also resolve problems as they are encountered.

The most critical project elements to be monitored are the implementation and effectiveness of erosion and sedimentation control measures, disposal of debris and wastes, management and reclamation of borrow pits, and materials handling and storage areas.

The actual construction site should receive the most attention and other associated activities such as construction base camp, quarry and mineral extraction sites, excess material and spoil deposit sites, asphalt mixing plant and construction traffic between all of the above sites must also be considered.

Design of the monitoring program should include:

* Selecting the indicators, specifications and conditions for key characteristics
* Identify the control area / treatments where these exist for key issues
* Confirm relationship between indicators and mitigation / environmental goals and objectives
* Assign tasks and responsibilities including a reporting structure and means to resolve conflicts
* Perform environmental compliance monitoring and reporting
* Analyze trends and recommend changes to management with special consideration to erosion and sediment control and restoration of borrow sites.

Mitigation measures designed to reduce the impact of the construction activities should be monitored and enforced by the environmental monitoring authorities during construction.

This can be achieved by:

1. Defining the proposed mitigation and compensatory measures
2. Specifying who is responsible for the monitoring activity
3. Including implementation of mitigation measures in contract specifications
4. Making environmental competence one of the selection criteria for contractors
5. Briefing, educating, and training contractors in environmental protection methods.

Compliance monitoring should not be confined to the road project right-of-way, it should cover all sites affected by the project (i.e. borrow pits, quarries, disposal sites, waterway, diversions materials treatment areas, access roads, work camps). Monitoring must be continued in the project operational phase.

Environmental Management Plans (EMP)

Environmental Management Plan (EMP)

This is a document prepared by a proponent indicating steps that are intended to be taken to manage any significant environmental impact that may result from the operation of the undertaking.

The EMP constitutes a regulatory approach to promote compliance to environmental regulations by operating undertakings. It thus facilitates the development of environmental management system at the proponent level. The EMP should contain the following:

* Executive Summary

The executive summary should be non-technical outlining the main environmental issues addressed in the EMP that can be used as management information for decision-making.

* Introduction
* Policy On Environment, Health & Safety: - Environmental Policy, Objectives and Targets, Legal/Regulatory Requirements: and Occupational Health and Safety Policy-
* Impact Identification
* Current Environmental Management Practices - Discuss the current environmental management practices
* Evaluation Of Environmental Performance
* Environmental Action Plan (EAP) – containing a summary of the main mitigation measures proposed to achieve desired resource conservation, waste minimization, and better quality of life for the public and at the work place environment, environmental quality objectives (EQOs), targets/scope, actual actions to be taken, time frame, budget, the responsible manager(s), and the type of documentation.
* Occupational Health And Safety Action Plan - Identify the major health and safety issues where applicable (noise and hearing loss, plant lighting, work environment temperature, ventilation etc) and proposed management practices
* Emergency Preparedness And Response Plan/Contingency Plan: Where applicable, the plan should outline among others:
* Procedures for all potential hazards associated with the operations, including accidental spills of all hazardous materials in accordance with material safety data sheet (MSDS) and other local/international standards,
* Oil spill contingency plan in the context of national oil spill contingency plan(where applicable)
* Procedures for Environmental Incident/Accident investigation and responses
* Procedures for handling hazardous and flammable materials in transit
* Fire/explosion
* Environmental Management Framework including
  + institutional arrangement for environmental performance review and corrective actions, Employee training
  + Employee and management information/manuals to involve entire workforce in identifying how wastes and emissions are generated and their reduction measures

In the EMP section of the EIS responsibility for undertaking monitoring, as well as the reporting procedure should be specified.

**CHAPTER EIGHT**

# Conclusions

## CONCLUSIONS AND RECOMMENDATION

The Environmental Statement is the communication of the results undertaken in the assessment. It is important that it is laid out clearly with technical terms defined. Graphical presentations should be included where appropriate. The report should include clear section headings, full references and contain a non-technical summary.

It is important that the Statement is an impartial assessment of the environmental impacts of the development and is not a best-case report in favor of the proposal. All impacts, whether positive or negative, should be detailed. In addition, all assumptions made with the process of the environmental assessment be detailed, and methods used to assess any environmental effects explained clearly.

The concluding section of the report should be prepared so that essentially it becomes a complete and understandable document in itself. This should include:

* A review of gains versus losses in environmental resources and values and over all net gains, which justify the need for the project.
* Explanation of how unavoidable adverse impacts have been minimized or will be minimized or offset and compensated for.
* Explanation of use of any irreplaceable resources.
* Provision for follow up surveillance and monitoring.

**REFERENCES**

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2. Asian Development Bank, (1995) *Environmental Guidelines for Selected Infrastructure Projects*
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8. Ministry of Transportation, Ghana (2007), Draft National Transportation Policy, Accra, Ghana

**DEFINITION AND TERMINOLOGY**

Because environment assessment technology is a newly evolving field, there is as yet little consensus on the precise terminology to be used. However the following concepts appear to be evolving at this time:

**Benthic fauna:** animal organism living in bottom muds.

**Bilge water**: wastes from ship bottom usually containing considerable oils.

**Combine sewer**: sewer which receives sanitary sewage flow in dry season plus storm runoff in rainy season.

**Desludging**: removal of accumulated solid materials by pumping from a septic tank or leaching pit.

**Environment:** the surrounding zone (the specific zone to be affected by the project), all natural resources (physical, biological and human resources), people economic development and quality –of –life values.

**Ecology:** study of interrelationship of organism to their environment.

**Ecosystem:** a community and its environment (living and nonliving considering collectively; may range in extent from very small to very large units).

**Environmental effect or impact:** an effect on an environmental resource or value resulting from natural or man-made actions, including project development (measured by physical, chemical and biological parameters)

**Environmental Impact Assessment (EIA):** assessment of changes in environmental resources or values resulting from a proposed project (called an environmental impact statement (EIS).

**Environmental monitoring:** observation of effects of development projects on environmental resources and values, including sampling, analysis, temporary monitoring during the project construction stage and continuing periodic monitoring following commencement of Project operations.

**Environmental planning:** planning activities with the objective of preserving or enhancing environmental values or resources.

**Estuarine swamp or lagoon:** estuarine area (mix of sea and river waters), often with margroves very valuable for fisheries reproduction. Estuarine are commonly very valuable fisheries reproduction zones.

**Fishery capture zone**: area where fishermen catch adult species of fish, including finfish and shellfish.

**Fishery reproduction zone:** area which adult fish use for reproduction and where juveniles stay for food and protection (nursery).

**Flotables (or floatables):** materials which float on the water surface, including oils, greases, rubber bits, etc.

**Hazardous wastes:** all wastes which pose significant hazards to people and ecology, including toxics, inflammables, explosives and incendiary materials.

**Infiltration:** inflow of groundwater into sewer through leaky joints.

**Initial environmental examination**: an initial examination for estimating probable environmental impacts in order to ascertain whether follow-up detailed studies are needed (whether an EIA is needed), and if so, preparation of the EIA / TOR.

**Leaching pit:** pit which receives toilet wastes, with the liquids disposed by leaching into the soil (when properly functioning)

**Sanitary landfill:** method of disposing of municipal refuse by disposition on land with periodic covering of deposited material with layers of earth for prevention of odor nuisances and hazards of vector diseases.

**Sanitary sewage:** sewage flows from community except industrial wastes.

**Sanitary sewer:** sewer designed to receive essential sanitary sewage flows, excluding storm water.

**Septic tank / leaching system:** septic tank plus subsurface leaching system for disposal of effluents. The term “septic tank” generally means both the tank and the leaching system.

**Storm sewer:** sewer or conduit for receiving storm surface water runoff (storm water).

**Sulfide corrosion:** corrosion of sewer pipe wall or of treatment / pumping plants / force mains due to generation of sulfides in sewage.

**APPENDICES**

**APPENDIX 1: SCREENING REPORT**

ASSESSMENT NO………..

Receipt of forms (Date) \_\_\_\_\_\_ Inspection Date \_\_\_\_\_\_\_

Proponent/Representative(s) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Company’s Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A: Information Analysis and Inspection Results

1.0 Description of Proposed Activity

1.1 Type of Activity

1.2 Size (No. of workers, Output, Land take)

1.3 Raw Materials (type & quantity)

1.4 Wastes (type, quantity and the receiving medium)

\*Comment on the description of activity

2.0 Site Information

2.1 Location & Surroundings

2.2 Zoning

2.3 Infrastructure & facilities

\*Comment on site information (appropriateness, sensitivity, compatibility etc.)

3.0 Environmental Impacts

3.1 Impacts Considered

\*Comment on impacts identified and considered (include possible impacts not considered)

4.0 Management of Impacts

4.1 Measures

\*Comment on adequacy of measures

5.0 Comment on Public Perception (views of neighbours, traditional authorities, residents, etc.)

6.0 General comments and observation

1. Recommendation

OFFICERS

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature \_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Signature \_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_

**APPENDIX 2: UNDERTAKINGS REQUIRING REGISTRATION AND**

**ENVIRONMENT PERMIT *(SCHEDULE 1)***

AGRICULTURAL AND RELATED SERVICES

1. AGRICULTURE

Livestock farms

Community pastures

1. involving the clearing of land of greater than 40 hectares in area; or
2. involving the clearing of land located in an environmentally sensitive area.

Fruit and other vegetable farms

Management areas

(a) involving the clearing of land of greater than 40 hectares in area; or

(b) involving the clearing of land located in an environmentally sensitive area.

1. FISHING AND TRAPPING

Fishing –

1. fish or shell fish farming in salt water, brackish water or fresh water, where the proposal includes the construction of shore-based facilities other than wharves;
2. permanent traps or weir fisheries, salt water.

Services incidental to fishing –

Fish or shellfish breeding and propagating services, or fish or shellfish hatchery services, where the proposal includes the construction of shore based facilities other than wharves.

1. LOGGING AND FORESTRY

Logging –

Management of forested land for the primary purpose of harvesting timber in

a contract area.

1. FORESTRY SERVICES

Forestry services –

1. application of pesticides;
2. introduction of exotic species of animals, plants or microbial agents.

**MINING (INCLUDING MILLING), QUARRYING AND OIL WELLS**

1. MINING
2. metal mines;
3. non-metal mines.
4. CRUDE OIL AND NATURAL GAS
5. crude oil or petroleum production facilities;
6. natural gas production facilities.
7. QUARRIES AND SAND PITS

Stone quarries –

1. where the total area is greater than 10 hectares, or
2. where any portion is to be located within an environmentally sensitive area.

Sand and gravel pits –

1. where the total area is greater than 10 hectares, or
2. where any portion is to be located within an environmentally sensitive area.

**MANUFACTURING**

1. FOOD

Meat and poultry products –

1. abattoirs;
2. meat, fat or oil processing facilities
3. poultry processing facilities.

Fish products –

Flours, prepared cereal foods and feeds –

Feed mills

9. BEVERAGES

1. distillery products;
2. brewery products;
3. wines
4. RUBBER PRODUCTS
5. tyres and tubes;
6. rubber hoses and beltings;
7. other rubber products
8. PLASTIC PRODUCTS
9. foamed and expanded plastic products;
10. plastic pipes and pipe fittings;
11. plastic films and sheetings;
12. other plastic products
13. LEATHER AND ALLIED PRODUCTS –

Leather and allied products

Leather tanneries

1. PRIMARY TEXTILES –
2. man-made fibres and filament yarns;
3. spun yarns and woven cloths;
4. broad knitted fabrics
5. TEXTILE PRODUCTS
6. natural fibres processing and felt products;
7. carpets, mats and rugs;
8. canvas and related products
9. other textile products.
10. WOOD
11. sawmill, planing mill and shingle mill products industries;
12. veneers and plywoods;
13. other wood products;
14. wood preservation facilities which use hazardous chemicals or similar chemical processes;
15. particle board or wafer board production.
16. PAPER AND ALLIED PRODUCTS –
17. pulp and paper;
18. asphalt roofing;
19. other converted paper products.
20. PRIMARY METALS
21. FABRICATED METAL PRODUCTS
22. TRANSPORTATION EQUIPMENT

Shipbuilding and repair –

Facilities engaged in building and repairing all types of ships above 4,000 tonnes

displacement including marine production platforms for petroleum, natural gas or mineral resource extraction.

**NON-METALLIC MINERAL PRODUCTS**

1. REFINED PETROLEUM PRODUCTS
2. CHEMICALS AND CHEMICAL PRODUCTS –
3. industrial chemicals;
4. agricultural chemicals;
5. plastics and synthetic resins;
6. paints and varnishes.
7. Soaps and cleaning compounds;
8. Other chemical products.
9. OTHER MANUFACTURING

Scientific and Professional Equipment –

1. photographic films and plates manufacturing;
2. floor tiles, linoleums and coated fabrics manufacturing;
3. other manufactured products.
4. CONSTRUCTION

Industrial construction (other than building) –

1. construction of pipelines for the transmission of oil, natural gas and other related products from the source to the point of distribution, where –
2. any portion of the pipeline is to be located at a distance greater than 500 meters from an existing right-of-way; or
3. any portion of the pipeline is to be located in an environmentally sensitive area;
4. diesel electric power generating plants having a capacity greater than 1 megawatt;
5. gas turbine electric power generating plants having a capacity greater than 1 megawatt;
6. nuclear electric power generating plants.
7. HIGHWAYS AND HEAVY CONSTRUCTION
8. roads
9. waterworks and sewage system –
10. construction of trunk pipelines for transmission of water from the source to the point of distribution;
11. construction of trunk sewer pipelines;
12. construction of trunk sewer pipeline outfalls.
13. hydroelectric power plants and related structures –
14. construction of dams and associated reservoirs;
15. inter-or intra-basin water transfers;
16. construction of hydroelectric power developments.
17. UTILITIES
18. establishment of waste disposal sites;
19. establishment of facilities for the collection or disposal of hazardous waste materials.

**WHOLESALE TRADE**

1. PETROLEUM PRODUCTS

Petroleum products, wholesale –

Establishment of petroleum products storage facilities

1. OTHER PRODUCTS, WHOLESALE

Waste materials, wholesale –

Establishment of facilities for the purpose of assembling, breaking up, sorting or

wholesale trading of scrap, junk or waste material of any type.

1. SERVICES

Economics services administration –

1. resource conservation and management programmes involving introductions of exotic species of animals or plants for any purpose;
2. resource conservation and management programs involving introductions of native species of animals or plants into ears where those species do not occur at the time of the proposed introduction;
3. designation of land for cottage development or other recreational development.

**ACCOMMODATION, FOOD AND BEVERAGE SERVICES**

1. ACCOMMODATION SERVICES

Establishment of recreation and vacation camps.

1. AMUSEMENT AND RECREATIONAL SERVICES

Commercial spectator sports –

1. establishment of horse racetrack operations;
2. establishment of racetrack operations for motorized vehicles sports and recreation clubs and services;
3. establishment of facilities, including trails,
4. establishment of outdoor firearm ranges;
5. establishment of marina operations;
6. establishment of facilities, including trails, for motorized recreational vehicles;
7. other amusement and recreational services.

**APPENDIX 3 UNDERTAKINGS FOR WHICH ENVIRONMENTAL IMPACT ASSESSMENT (EIA) IS MANDATORY (SCHEDULE 2)**

1. AGRICULTURE -
2. land development for agriculture purposes not less than 40 hectares;
3. agricultural programmes necessitating the resettlement of 20 families or more.
4. AIRPORT -

Construction of all airport or airstrips as well as the enlargement of existing airports or airstrips.

1. DRAINAGE AND IRRIGATION –
2. construction of dams and man-made lakes;
3. drainage of wetland;
4. irrigation schemes.
5. LAND RECLAMATION –
6. coastal land reclamation;
7. dredging or bars, estuaries.
8. FISHERIES -
9. construction of fishing harbours;
10. harbour expansion;
11. land based aquaculture undertaking.
12. FORESTRY -
13. conversion of hill forest land to other land use;
14. logging or conversion of forest land to other land use within the catchment area of reservoirs used for water supply, irrigation or hydro-power generation or in areas adjacent to forest, wildlife reserves;
15. conversion of wetlands for industrial, housing or agricultural use.
16. HOUSING -
17. human settlement development undertaking;
18. housing development.
19. INDUSTRY -
20. chemical – where production capacity of each product or combined products is greater than 100 tonnes/day;
21. petrochemicals – all sizes or raw materials requirements of 100 tonnes/day or greater;
22. non-ferrous-smelting –
23. aluminum – all sizes;
24. copper – all sizes;
25. others –producing 50 tonnes/day and above product;
26. Non-metallic –cement –

lime - 10 tonnes/day and above burnt lime rotary kiln or 50 tonnes/day and above vertical kiln.

1. iron and steel;
2. shipyards;
3. pulp and paper.
4. INFRASTRUCTURE
5. construction of hospitals;
6. industrial estate development;
7. construction of roads and highways;
8. construction of new townships;
9. construction of railways.
10. PORTS
11. construction of ports;
12. port expansion involving an increase of 25 per cent or more in handling capacity per annum.
13. MINING
14. mining and processing of minerals in areas where the mining lease covers a total area in excess of 10 hectares;
15. quarries –

Proposed quarrying of aggregate, limestone, silica, quartzite, sandstone, marble and decorative building stone within 3 kilometers radius of any existing village, residential, commercial or industrial areas, or any area earmarked for residential, commercial or industrial development;

1. sand dredging.
2. PETROLEUM –
3. oil and gas fields development;
4. construction of off-shore and on-shore pipelines;
5. construction of oil and gas separation, processing, handling and storage facilities.
6. construction of oil refineries;

(e) construction of product depots for the storage of petrol, gas or diesel which are located within 3 kilometers of any commercial, industrial or residential areas.

1. POWER GENERATION AND TRANSMISSION –
2. construction of steam generated power stations;
3. dams and hydroelectric power schemes;
4. construction of combined cycle facilities in national parks;
5. construction of nuclear-fueled power stations;
6. erection of power transmission lines.
7. RESORT AND RECREATIONAL DEVELOPMENT-
8. construction of coastal resort facilities of hotels with more than 40 rooms;
9. hill top resort or hotel development;
10. development of tourist or recreational facilities in national parks;
11. development of tourist or recreational facilities on islands in surrounding waters.
12. WASTE TREATMENT AND DISPOSAL –
13. toxic and hazardous waste –
14. construction of incineration plant;
15. construction of recovery plant (off-site)
16. construction of wastewater treatment plant (off-site);
17. construction of secure landfills facility;
18. construction of storage facility (off-site)
19. municipal solid waste –
20. construction of incineration plant;
21. construction of composing plant;
22. construction of recovery/recycling plant;
23. construction of municipal solid waste landfill facility;
24. construction of waste depots.
25. municipal sewage –
26. construction of wastewater treatment plant;
27. construction of marine outfall;
28. night soil treatment.
29. WATER SUPPLY –
30. construction of dams impounding reservoirs;
31. groundwater development for industrial, agricultural or urban
32. ENVIRONMENTAL CONSERVATION AND MANAGEMENT
33. activity to remove “designated” status from an area designated for wildlife conservation and management;
34. activities relating to-
35. wildlife conservation and management;
36. forest conservation and management;
37. watershed conservation and management;
38. commercial exploitation of fauna and flora.

**APPENDIX 4: ENVIRONMENTALLY SENSITIVE AREAS *(SCHEDULE 5)***

1. All areas declared by law as national parks, watershed reserves, wildlife reserves and sanctuaries including sacred groves.
2. Areas with potential tourist value.
3. Areas which constitute the habitat of any endangered or threatened species of indigenous wildlife (flora and fauna).
4. Areas of unique historic, archaeological or scientific interests.
5. Areas which are traditionally occupied by cultural communities.
6. Areas prone to natural disasters (geological hazards, floods, rainstorms, earthquakes, landslides, volcanic activity etc.)
7. Areas prone to bushfires.
8. Hilly areas with critical slopes.
9. Areas classified as prime agricultural lands.
10. Recharge areas of aquifers.
11. Water bodies characterized by one or any combination of the following conditions -
12. water tapped for domestic purposes;
13. water within the controlled and/or protected areas;
14. water which support wildlife and fishery activities.
15. Mangrove areas characterised by one or any combination of the following conditions-
16. areas with primary pristine and dense growth;
17. areas adjoining mouth of major river system;
18. areas near or adjacent to traditional fishing grounds;
19. areas which act as natural buffers against shore erosion, strong winds or storm floods.