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E1555 v2

Republic of Ghana

URBAN TRANSPORT PROJECT

Ministry of Roads and Highways

In collaboration with

Ministry of Local Government & Rural Development

Implemented by

Department of Urban Roads

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Trunk BRT (Lot 2) Running Way and Terminals
Accra Pilot Bus Rapid Transit Route

January 2011

CENTRE FOR ENVIRONMENT & HEALTH RESEARCH & TRAINING

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List of Acronyms

AFD	Agence Francaise de Developement
AMA	Accra Metropolitan Assembly
BRT	Bus Rapid Transit
CBD	Central Business District
CMB	Cocoa Marketing Board
DA's	District Assemblies
DFR	Department of Feeder Roads
DUR	Department of Urban Roads
EAP	Environmental Action Plan
ECG	Electricity Company of Ghana Ltd
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
ESMF	Environmental and social management framework
FIDIC	International Federation of Consulting Engineers
GAMA	Greater Accra Metropolitan Assembly
GEF	Global Environmental Facility
GHA	Ghana Highway Authority
GoG	Government of Ghana
GPRTU	Ghana Private Road Transport Union
GT	Ghana Telecom
GWCL	Ghana Water Company Ltd
LI	Legislative Instrument
LVB	Land Valuation Board
MoT	Ministry of Transportation
MRH	Ministry of Roads and Highways
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NGOs	Non Governmental Organizations
OLC	Obetsebi Lamptey Circle
OP	Operational policy
PAPs	Project Affected Persons
PMU	Project Management Unit
PS	Permanent Structure
R	Residence
RAP	Resettlement Action Plan
RPF	Resettlement policy framework
SPSS	Statistical Package for Social Surveys
TSDP	Transport Sector Development Programme
RSDP	Road Sector Development Programme
TCPD	Town and Country Planning Department
TS	Temporary Structure
TUC	Trade Union Congress
UTC	United Trading Company
UTP	Urban Transport Project
WB	World Bank
WHO	World Health Organization
WRC	Water Resources Commission

EXECUTIVE SUMMARY

Introduction

The Government of Ghana, with assistance from the World Bank (WB), the Global Environment Facility (GEF) and the Agence Francaise de Developement (AFD) intends to undertake an Urban Transport Project (UTP) with pilot implementation in the Greater Accra Metropolitan Area (GAMA). It is within this context that the Accra Bus Rapid Transit (BRT) Pilot Project, a component of the UTP, is being implemented to improve the flow of traffic within the city. The participating Assemblies under the UTP are Accra Metropolitan Assembly (AMA), Tema Metropolitan Assembly (TMA) and Ga West Assembly (GWA).

The Department of Urban Roads (DUR) has engaged Centre for Environment and Health Research and Training (CEHRT) for the Environmental and Social Impact Assessment (ESIA) of the project. As part of this assignment, CEHRT is to undertake a detailed assessment of the environmental impacts of the proposed project to ensure that its potential impacts on the environment are identified, assessed and appropriate measures recommended for their mitigation or enhancement.

Policy, Legal and Institutional Framework

The National Environmental Policy (NEP) adopts a preventive approach to environmental management and promotes Environmental Impact Assessment (EIA) as the main tool to achieve sound environmental management. The EIA Procedures, which was published in June 1995, provide a step-by-step approach for the assessment of proposed developments.

The legal and institutional framework for environmental assessment is provided by the Environmental Protection Agency (EPA) Act, 1994 (Act 490) and the Environmental Assessment Regulations, LI 1652 of 1999. The latter legislation provides legal backing for EIA system in Ghana. EIA is mandatory for the construction of roads and highways.

The Government of Ghana (GoG) transport policy provides for continued improvements to the nation's rural and urban road network. The Ministry of Roads and Highways (MRH) is responsible for formulating policies and overall strategies on roads and vehicular transport. The DUR, Ghana Highway Authority (GHA), and Department of Feeder Roads (DFR) are the implementing organizations under MRH. The BRT project falls within the jurisdiction of DUR. The DUR will therefore, through its Environmental Management Unit, implement and monitor the environmental management plan of the project.

The MRH has prepared an Environmental and Social Management Framework (ESMF) as well as a Resettlement Policy Framework (RPF). The purpose of the ESMF and RPF is to provide corporate environmental, social and resettlement safeguard policy frameworks, institutional arrangements and capacity available to identify and mitigate potential safeguard issues and impacts of each sub-project.

The World Bank's Operational Policies on Environmental Assessment, Involuntary Resettlement and Physical Cultural Resources are considered as relevant for the proposed works. The OP 4.01 requires among others that screening for potential impacts is carried out early, in order to determine the level of environmental assessment and propose measures to mitigate potential adverse impacts.

Description of the Pilot BRT Project

BRT is an enhanced bus system that operates on bus lanes or other transit ways in order to combine the flexibility of buses with the efficiency of rail. BRT utilizes a combination of advanced technologies, infrastructure and operational investments that provide significantly better service than traditional bus service.

Development of this system will be in line with the Ghana Government's Road Sector Development Programme (RSDP) that aims, among others, at reducing congestion and facilitating the free movement of goods and people to enhance accelerated growth of the national economy.

The operational design of the Pilot BRT is an externalised system with tributary routes that start outside the BRT corridor but feed into it. The buses travel on tributary routes to Winneba and Graphic Roads which form the main spine, or BRT corridor, of the pilot scheme. The tributary services then join the main corridor.

The BRT Pilot Project is divided into four main parts:

1. The tributary services. There are 5 tributary origins in north and north-west Accra;
2. The route along Winneba Road from Mallam Junction to First Light Junction. In this part of the route the BRT buses will run in mixed traffic and stop at BRT stations at the kerbside. There will be 14 stations (in both directions of travel) in this section of route;
3. First Light to Obetsebi Lamptey Circle (OLC) and then Graphic Road to Kwame Nkrumah Road. This section of route will have a segregated BRT located in the median. There will be 6 stations in this section of route. Two additional lanes will be added on the section from OLC to Official Town Junction (in front of Accra Brewery). The BRT will pass through the middle of the OLC. One of foot bridges in front of the Kaneshie Market will be fitted with a lift mechanism to enable people living with disabilities to access the bus stations.; and
4. The BRT distribution system in the Central Business District (CBD) will have two routes.
5. CBD loop via South Liberia Road, Independence Avenue, Barnes Road, North Liberia Road and returning to Barnes Road via Kwame Nkrumah Avenue. This loop route will have 5 stations and the buses will run in mixed traffic.
6. A route south on Kwame Nkrumah Avenue to UTC and then return the same way to Graphic Road. This route will have 2 bus stations at CMB and a terminal at UTC.

This report is only concerned with sections 3 and 4 above.

Description of the Proposed Works

Works on the entire BRT Pilot Project will be constructed in several packages. This report is concerned with the following proposed works:

Winneba Road (Mallam to First Light)

This route covers approximately 5.3km. The works to be carried out in this section consist of the provision of BRT stations at the side of the road (no segregation of BRT is proposed here) and reconfiguring of traffic signalised junctions where needed to accommodate BRT stops. Stations in this section will be located at the kerbside or on separator islands. The main works to be carried out in this section include:

1. The Construction of Bus Stations (14 No) at locations predetermined by traffic feasibility studies. These are basically of reinforced concrete and steel;
2. The reconfiguration of junctions to meet with design year traffic demands and characteristic at the intersections; and
3. The reconstruction of culverts, which have known histories of perennial flooding during rainy seasons.

Winneba Road (First Light) and Graphic Road for Kwame Nkrumah Avenue (UTC)

This covers approximately 5.0km. The main works to be carried out in this section include:

1. The construction of bus stations (14No) at locations predetermined by traffic feasibility studies. These are basically of reinforced concrete;
2. The reconfiguration of junctions to meet with design year traffic demands and characteristic at the intersections;

3. Installation of new traffic signals and signs to meet the expected design year traffic demands and characteristic;
4. The construction of concrete storm drains around First Light and OLC, which have known histories of perennial flooding during rainy seasons;
5. Reengineering of the OLC. Changes to the roundabout;
6. The construction of pedestrian foot bridges (2No) at Kaneshie Market;
7. Construction of two additional (segregated bus lane) to accommodate the BRT on the Graphic Road;
8. Traffic diversion and management during construction; and
9. Road line markings.

CBD Loop via Liberia Road and Barnes Road

This covers approximately 3.0km. The main works to be carried out in this section include:

1. The construction of bus station (4No) at locations predetermined by traffic feasibility studies. These are basically of reinforced concrete;
2. The reconfiguration of junctions to meet the design year traffic demands and characteristics at the intersections;
3. The installation of new traffic signals and signs to meet the expected design year traffic demands and characteristics;
4. Rehabilitation of existing walkways;
5. Road line markings; and
6. Traffic diversion and management during construction.

Consideration of Alternatives

The alternatives considered are:

- No development alternative;
- Upgrading of existing roads;
- Selection of project corridor;
- Selection of appropriate project design; and
- The BRT project implementation alternative.

The "No development alternative" assumes that the present state of the project roads pertain, i.e. the BRT ilot project would not be implemented. This would imply that the roads would be left in their present state, where: congestion on the Graphic Road corridor will become worse, tro-tros and taxis will continue to dominate public transport in Accra with the attendant emission of "green house gases". Free movement of people and goods to and from the areas in the road corridor will continue to be hindered, vehicular conflicts and vehicular–pedestrian conflicts would continue and there would be increasing problems in handling traffic within the BRT's area of influence.

Furthermore, the BRT project forms part of the Government's Road Sector Development Programme (RSDP). A choice of the "No Action Alternative" will therefore not be in line with the government of Ghana's long-term development objectives. This alternative is therefore neither in the interest of national development nor of the project objectives.

The "Upgrading the existing road" option proposes that the existing carriageway be expanded into 4 or 5 lanes to increase the capacity of the road to handle the volume of traffic. The feasibility of this option is doubtful mainly in view of the space available for its development and the huge property impact and the associated compensation payments. The implementation of this option would also expose businesses and residents along the project corridor to various environmental, social and safety impacts and as well as impacts on the operations of businesses and institutions.

Selection of the corridor for pilot implementation was based upon the degree of compliance of each of the potential BRT corridors with passenger demand, cost, potential impact, accessibility to low income communities and urban and regional planning impacts. The selected corridor was Winneba Road from Mallam to the Accra CBD. The route is the heaviest loaded route in the metropolitan area and was predicted to carry the highest number of potential users of the system, as well as to deliver the largest saving in travel time.

Selection of appropriate design for the BRT was based upon a comprehensive transportation study which considered 5 alternative configurations. The BRT system to be implemented is the median type with central bi-directional stations, a mix of trunk and feeder bus services, electronic fare collection and several terminals where transfers between local feeder and trunk line bus services would be made. Median location within the roadway increases the travel speed, as there are fewer conflicts with vehicles entering and leaving the road, and with other transport vehicles attempting to pick-up and drop-off passengers or goods. This will lead to increases in travel speed, resulting in smaller vehicular fleet and depots.

Environmental Impact Assessment

Methodology

Review and Collection of Information

The environmental impact assessment is an integral part of the project. It was therefore necessary for other reports on the project to be reviewed. The study of secondary data provided information including land use activities in the pilot corridor and impact of the preliminary design proposals on the land use activities. The findings from the desk study set the basis for the type of baseline data collected from the project road corridor.

Additionally, environmental assessment reports on similar projects were reviewed. Relevant information was gathered from this review for the preparation of this environmental and social impact assessment.

Collection of Baseline Information

The procedures used for the baseline information gathering involved:

- Visits to the project corridors: Winneba and Graphic Roads as well as the Kwame Nkrumah Avenue to identify the physical and socio-economic features in the project area that are of interest; Review of relevant literature on the physical and socio-economic conditions in the project area, including project documents such as hydrological report and air quality monitoring report;
- Consultations with stakeholders in the project area;
- Social baseline surveys to gather necessary information on land use activities and persons/businesses likely to be displaced as a result of the construction and operation of the BRT.

Consultations

Consultation and disclosure activities undertaken included coordination with institutions represented on the BRT Technical Committee and other stakeholders. As part of the scoping study for the environmental assessment of the BRT, over 100 persons comprising transport operators, business owners, passengers, pedestrians and residents in the project area were interviewed. The purpose of the exercise was to introduce the project to the directly affected stakeholders, to generate feedback on the key issues of environmental and social concern and their mitigation.

During the main EIA phase, stakeholders including officials of the EPA, residents, businesses, drivers' unions and market traders were consulted. The views of the consultees were sought on, among others, the potential impacts of the BRT and appropriate mitigation measures. There was also interaction with leaders of the various drivers unions and their views and opinions were recorded.

Focus group discussions were also held with leadership of the Kaneshie Market Traders Association. Issues discussed included the construction of the BRT and its potential effects on their trading operations. Questionnaires were also administered to some stakeholders.

Identification and Assessment of Potential Impacts

The major issues of environmental and social concern during the project construction phase include:
Construction Phase Impacts include:

- Displacement of persons and businesses;
- Demolition of structures;
- Impacts on air quality;
- Impacts on ambient noise and vibration levels;
- Impacts on water resources and drainage;
- Construction waste generation;
- Disruption of public utilities;
- Modification of Landscape;
- Impact on Traffic;
- Impact on Public health and safety;
- Impact on Occupational health and Safety;
- Construction camp issues; and
- Archaeological/cultural impacts.

The operation/post-construction phase impacts are mainly socio-economic in nature. Operational phase will have both positive and negative impacts. The most significant positive impacts of the road works will include:

- Improved Air Quality
- Noise and Vibration
- Road Safety and Travelling Comfort
- Improved Transportation Services
- Improved Access to the City Centre
- Reduced Vehicle Operating Cost and Expenditure on Transport
- Reduction in Government Expenditure on Fuel

The expected negative impacts during the operational phase will include the following:

- Increased Vehicular-Pedestrian Conflicts
- Displacement of Trotro Operators
- Potential Traffic Congestion

Mitigation Measures

The reconstruction of roads for the operation of the Pilot BRT service will displace some livelihood activities (involving over 200 operators) in the pilot road corridor and therefore the need for the preparation of a RAP to prevent or at least mitigate the adverse impacts associated with the project. The Project Affected Persons (PAPs), including shop owners and traders will be paid appropriate compensation. The total budget for resettlement and compensation of project affected persons and businesses are estimated at US$214,320.

Additionally, mitigation measures have been proposed to address the negative impacts and to enhance the positive ones. These include operation and maintenance of equipment in accordance with manufacturer's specifications to minimise emission of hydrocarbons, particulates and noise; appropriate disposal or re-use of excavated material; implementation of soil erosion prevention measures; implementation of

management practices to eliminate breeding sites of disease vectors; ensuring that the utility lines are relocated; appropriate management of construction camps; appropriate management of archaeological finds; implementation of appropriate traffic management measures; and provision of protective equipment to workers.

Summary of Negative Impacts and Mitigation

No	Impact	Mitigation
1	Displacement of project affected persons/businesses	Valuation and payment of appropriate compensation
2	Demolition of structures	Valuation and payment of appropriate compensation
3	Impact on air quality	Implement dust suppression measure (watering of exposed surfaces Delivery of materials early in the morning and at late evening Operate plant and equipment in accordance with manufacturer's specifications
4	Impact on noise and vibration	Advance information to businesses and residents before commencement of works Schedule works to limit exposure to noise Prevent works at night Servicing of equipment/trucks according to manufacturer's specifications
5	Impact on surface water resources	Limit release of materials into water bodies Protect surfaces susceptible to erosion Proper disposal of spent fuels, oils and lubricants
6	Public utilities	Liaise with utilities companies to relocate supply lines Advance information on relocation to public Arrangements for alternative supplies
7	Waste generation	Disposal of wastes at dumpsites
8	Landscape modification	Thorough investigation of proposed sites Implementation of excavation and rehabilitation plans
9	Traffic impacts	Prepare and implement traffic management plan Erect signboards and road signs to inform motorists Give prior information to the public
10	Public health and safety	Implement HIV/AIDS awareness programme Elimination of conducive areas for disease vectors Restricting access to work sites
11	Occupational health and safety	Implement safety training programme Provision of personal protection equipment Provision of first-aid kits Proper servicing and use of equipment/plant
12	Construction camp	Provision of waste disposal facilities Maintenance of sanitary facilities Management of waste oils, fuels and lubricants Implement health and safety precautions Fire management Proper decommissioning
13	Aesthetics and visual quality	Proper waste management Rehabilitation of manholes/trenches Landscape plan

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1.0 INTRODUCTION

1.1 Background

The Ghana Poverty Reduction Strategy (GPRS) defines transport improvement as an integral component for opening up the country for increased productivity. The fundamental policy of the Ministry of Roads and Highways (MRH) in this respect is to establish an efficient, modally complementary and integrated transportation network for movement of goods and people at the least possible cost. The Transport Sector Development Programme (TSDP) has been formulated within the framework of this policy direction to ensure the objectives of the GPRS are met. The participating Assemblies under the UTP are AMA, TMA and GWA.

The Government of Ghana, with assistance from the World Bank (WB), the Global Environment Facility (GEF) and the Agence Francaise de Developement (AFD) intends to undertake an UTP with pilot implementation in the GAMA. The overall objective of the UTP is to improve mobility and transport affordability in GAMA through regulatory reforms and by facilitation of movement of persons on major corridors through a combination of traffic management and implementation of a high quality high Bus Rapid Transit (BRT) system.

This report gives the results of detailed assessment of the environmental and social impacts of each of the proposed works of the Pilot BRT project to be undertaken. The purpose of the safeguards assessment is to ensure that the potential impacts of the BRT on the physical and human environment are identified, assessed and appropriate measures recommended for their mitigation or enhancement. This assessment covers proposed works to accommodate the BRT route from First Light Junction on Winneba Road, through Graphic Road and into the CBD area. The study will recommend remedial solutions to social and environmental impacts.

1.2 Environmental Impact Assessment (EIA)

1.2.1 EIA Study Scope

Geographically, the study is limited to the proposed BRT project corridor (from Mallam Junction through the Graphic Road, Kwame Nkrumah Avenue to the CBD and its environs. However, reference is made to the general area of influence of the BRT project where appropriate. The scope of the study covers the following:

- Establishing an environmental and social baseline for the project area, including identifying, categorizing and preparing socio-economic profiles of persons engaged in the livelihood activities that are likely to be displaced during the construction and operation phase of the BRT system;
- Identifying major land use activities in the project road corridors including land use activities likely to be affected by the design, construction and operation of the BRT service;
- Consulting with businesses, residents, motorists, members of the general public and institutional stakeholders to solicit their views on the project, its likely impacts and possible mitigation measures;
- Identifying and assessing environmental and social impacts resulting from the project, including evaluating possible impacts of the Pilot BRT system on the PAPs and businesses;
- Recommending appropriate measures to mitigate potential negative impacts and to enhance positive ones;
- Preparing a RAP, based on World Bank's Social and Environmental Safeguard Policies particularly OP 4.01 and OP 4.12 and prepare broad guidelines for resettlement plan for the PAPs;
- Developing management clauses based on FIDIC (1999) General Conditions of Contract to be included in the contract document and identifying the responsibilities of various agencies and stakeholders of the project; and
- Outlining a monitoring plan, including parameters to be monitored and timing and responsibilities for implementation.

1.2.2 EIA Methodology

The ESIA began with a scoping study (0). The purpose of the scoping study was to:

- Collect initial information regarding areas of scope of baseline;
- Facilitate the consultation and participation of the local communities and the relevant stakeholders in the process of identifying and assessing the environmental implications of the project;
- Identify the most relevant and significant environmental issues of concern out of a myriad of issues with the view of focusing on them; and
- Develop a draft Terms of Reference (ToR) for the ESIA and present to the EPA for its study and approval.

(a) Review and Collection of Information

The methodology involved reviewing various documents including:

- Hydrological analysis, drainage and design;
- Geotechnical studies;
- Preliminary draft engineering report on the design of Accra Pilot BRT route;
- Assessment of travel characteristics of commuters to markets, schools and health facilities along the Pilot BRT corridor;
- Land use map of the Pilot BRT corridor;
- Socio-economic survey of households in the BRT corridor; and
- 2000 Population and Housing Census.

The study of secondary data provided information on the physical and socioeconomic environment including drainage systems, infrastructure, populations, and land use activities in the pilot corridor as well as likely impacts of the design proposals. The findings from the desk study set the basis for the type of baseline data collected from the project road corridor.

Additionally, environmental assessment reports on similar projects were reviewed. Relevant information was gathered from this review for the planning, conduct and reporting of the environmental and social impact assessment.

(b) Collection of Baseline Information

A major part of any ESIA assignment is establishing the characteristics of the existing environment prior to project commencement. The baseline information provides the basis for benchmarking and is used to predict the likely changes that may occur as a result of the implementation of the project.

The procedures used for the baseline information gathering involved the following:

- Visits to the project sites to identify the physical and socio-economic features in the project area that are of interest. These observations formed the basis for subsequent detailed studies of the environmental components;
- Review of relevant literature on the physical and socio-economic conditions in the project area, including project documents such as hydrological data; and
- Consultations with stakeholders in the project area.

Baseline socio-economic data collection on sections of the Pilot BRT corridor was prioritized as follows:

- Data collection on targeted land use activities around the Kaneshie Market area from 'First Light to the city centre where unauthorized trading activities and unauthorized parking of commercial vehicles are likely to affect the implementation of the project; and
- Data collection targeted land use activities in the median of Kwame Nkrumah Avenue where unauthorized trading activities and other temporary activities are taking place in the right of way of the proposed BRT route.

Survey instruments for the social baseline surveys were designed and tested. The survey instruments including structured and semi-structured questionnaires, census forms and maps were designed to collect different types of data on land use activities. These survey instruments were tested before being administered.

Census of all PAPs was undertaken to determine the magnitude of displacement. The names of the business owners, their addresses, types of business activities and types of structures were captured. In addition, all businesses whose lands are within the zone of critical impact were also identified. The names of owners, addresses, turnovers as well as data on employment levels were captured. The type of structure, land and size were also valued and documented as part of the census.

(c) Public Consultation and Disclosure

In January 2008, the DUR organized a public forum on the BRT project. A number of institutions such as the Ghana Railway Company Ltd (GRCL), Town and Country Planning Department of Accra Metropolitan Assembly (AMA), Electricity Company of Ghana (ECG), Ghana Water Company Limited (GWCL), Ghana Telecom (now Vodafone) were consulted for their approval and support in designing and implementing the project.

As part of the scoping exercise for the assessment, public consultations were undertaken in November 2007 by interviewing and interacting with over 100 stakeholders, namely: transport operators, business owners, passengers, pedestrians and residents in the project area. The purpose of the exercise was to introduce the project to the directly affected stakeholders, to generate feedback on the key issues of environmental and social concerns and their mitigation.

During the main ESIA phase, stakeholders including officials of the EPA, residents, businesses, drivers' unions and market traders were consulted. The views of those consulted were sought on the potential impacts of the BRT and appropriate mitigation measures. They also expressed various views on the potential impacts and mitigation measures that will need to be implemented to lessen the effects of the project on the environment and livelihoods.

Consultations were also held with the leadership of drivers unions operating from the Kaneshie Market area and Central Accra. The outcome of these discussions were recorded. Focus group discussions were also held with the leadership of the Kaneshie Market Traders Association. Questionnaires were also administered to some institutions and businesses in the project corridor.

The outcome of these consultations and coordination efforts were considered during the identification of potential impacts and the development of appropriate mitigation measures.

(d) Identification and Assessment of Environmental Impacts

The outcomes of the initial consultations were used together with information from other sources to develop a checklist for the identification of the main issues of environmental concern. Reference was also made to the ESMF the road sector and literature on similar projects.

All the identified impacts were evaluated as to whether they are:

- Construction / operation phase-related;
- Positive / negative;
- Permanent/temporary; and
- Cumulative.

Once the impacts were identified, the extent of the possible changes in the baseline environmental conditions caused by the project was predicted. The significance of the predicted impacts was assessed in terms of:

- The effect on existing environmental and social conditions;
- Environmental loss and deterioration;
- The extent to which the project affects public health or safety;
- The degree to which an action may affect historical, cultural, and archaeological sites; and
- The potential for cumulative significant impacts.

(e) Identification of Mitigation Options

This involved discussions with the project planners, engineers and other professionals and applying the information to the development of measures designed to avoid, prevent or minimize the undesirable impacts of the project on the affected environment. References were also made to the ESMF for the road sector and materials on similar projects.

1.3 Structure of the ESIA Report

The report is divided into the following sections:

- Introduction;
- Policy, legal and institutional framework;
- Description of the Pilot BRT project;
- Consideration of alternatives;
- Physical and socio-economic baseline information;
- Public consultation and disclosure;
- Identification and assessment of environmental and social impacts;
- Mitigation of environmental and social impacts;
- Environmental and social management plan;
- Conclusion; and
- Appendices.

2.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 Ghana Government's Environmental Policy

Ghana's Environmental Policy is the result of a series of ggovernment actions initiated in March 1988 to prioritize environmental issues. Subsequent to this, an Environmental Action Plan (EAP) was drawn up which identified specific actions to be carried out to protect the environment and ensure better management of natural resources. The plan provides a broad framework for the integration of environmental issues into development strategies and actions.

The National Environmental Policy (NEP) was adopted in 1991 to provide the framework for the implementation of the National Environmental Action Plan (NEAP). The ultimate aim of the NEP of Ghana is to improve the surroundings, living conditions and the quality of life for the entire citizenry, both present and future. It seeks to ensure reconciliation between economic development and natural resource conservation, to make high quality environment a key element supporting the country's economic and social development.

The NEP aims to ensure that a preventive approach is adopted in the pursuit of sound environmental management. The main preventive tool envisaged in the policy is EIA.

2.2 Legal and Institutional Framework

2.2.1 Legal Framework for Environmental Assessment

The current legal and institutional framework for environmental assessment is based on the EPA Act, 1994 (Act 490) and the Environmental Assessment Regulations (EAR), LI 1652 of 1999.The enactment of the EPA Act 1994 (Act 490) provided the initial legal backing for the establishment of EIA system in Ghana. The Act mandated the Agency, among others, to ensure compliance with the laid down EIA Procedures in the planning and execution of development projects, including compliance in respect of existing projects.

To facilitate compliance with the above requirement, the Ghana EIA Procedures was published in June 1995. The procedures provide a step-by-step approach for the assessment of proposed developments. This marked the beginning of formal EIA administration and implementation in Ghana.

Pursuant to section 28 of the EPA Act 1994, the EAR, 1999, (LI 1652) was enacted to provide the necessary specific and complete legal backing for EIA system in Ghana. The procedures contain a logical step-wise environmental assessment system with provisions for, among others:

- Registration of proposed and existing undertakings;
- Screening with schedules of undertakings requiring EA registration and mandatory EIA;
- Submission of various levels of Environmental Reports for review and approval (Preliminary Environmental Reports, Scoping Reports, Environmental Impact Statements, Environmental Management Plan, Annual Environmental Reports);
- Environmental Assessment Reports Review system; and
- Issuance of environmental permits and certificates prior to commencement of developments.

With the passing of the EPA Act and the EAR, EIA is mandatory for seventeen (17) types of activities classified as environmentally critical. Construction of roads and highways is one of these undertakings and therefore EIA mandatory.

2.2.2 The World Bank Requirements

The Bank's Safeguard Policies, which are ten in number, are meant to ensure that operations of the Bank do not lead to adverse impacts or cause any harm. The safeguard policies are:

- Environmental assessment (OP 4.01);
- Natural habitats (OP 4.04);

- Forestry (OP 4.36);
- Pest management (OP 4.09);
- Physical cultural property (OP 4.11);
- Indigenous people (OP 4.20);
- Involuntary resettlement (OP 4.12);
- Safety of dams (OP 4.37);
- Projects in international waters (OP 7.50); and
- Projects in disputed areas (OP 7.60).

Three out of the ten safeguards are deemed relevant for consideration under the BRT Pilot Project:

- Environmental Assessment;
- Involuntary Resettlement; and
- Physical Cultural Property.

The operational policy on environmental assessment (OP 4.01) is dealt with in detail below whilst the policy on Involuntary Resettlement has been discussed in detail in the RAP.

The operational policy on cultural property requires that the project's potential impacts on physical cultural resources are identified and assessed as an integral part of the EA process. When the project is likely to have adverse impacts on physical cultural resources, appropriate measures for avoiding or mitigating these impacts are identified as part of the EA process. These measures may range from full site protection to selective mitigation, including salvage and documentation, in cases where a portion or all of the physical cultural resources may be lost.

The following Category A or B are subject to the provisions of this policy: (a) any project involving significant excavations, demolition, movement of earth, flooding, or other environmental changes; and (b) any project located in, or in the vicinity of, a physical cultural resources site.

2.2.3 The World Bank Operational Directive OP 4.01

The OP 4.01 requires, among other things that screening for potential impacts is carried out early, in order to determine the level of environmental assessment and propose measures to mitigate potential adverse impacts. The Bank's project screening criteria group projects into three categories:

Category A – detailed environmental assessment (EA) is normally required as the project may have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works.

Category B – The scope of EA for a project in this category is narrower than that of a Category A project. A more limited environmental analysis is appropriate as the project's potential adverse environmental impacts are less adverse than those of Category A projects. These impacts are site-specific; generally reversible; and in most cases mitigation measures can be designed more readily for their management, and

Category C – A proposed project in this category is likely to have minimal or no adverse environmental impacts. Unlike category A and B projects, no further assessment is carried out on projects in this category after the screening.

The EA policy ensures that appropriate levels of environmental assessment are carried out as part of project design, including public consultation process, especially for Category A and B projects. Project affected groups and organizations are consulted for their views on the environmental implications, positive and negative, of the project. Such views have to be taken into consideration in the project design.

The policy requires that EA is initiated as early as possible in project processing and is integrated closely with the economic, financial, institutional, social and technical analyses of a proposed project. EA takes into account, among others, the natural environment (air, water, and land); human health and safety; and social aspects (involuntary resettlement and cultural property). EA considers natural and social aspects in an integrated way.

2.2.4 Road Sector Policy and Administrative Framework

The GoG transport policy provides for continued improvements to the nation's rural and urban road network. This objective will be met through an improved road maintenance as well as rehabilitation and construction programme.

The MRH is responsible for formulating policies and overall strategies on roads and vehicular transport. Specifically, the Road Sector Policy seeks to:

- Achieve sustainable improvements in the performance of trunk, feeder and urban roads and road transport services in all regions of Ghana;
- Strengthen the capabilities for management and implementation in the road sector; and
- Establish management systems that will ensure the upgrading and preservation of an improved road system and the use thereof in an environmentally, socially and financially sustainable fashion.

The DUR, GHA, and DFR are the implementing organizations under MRH. The BRT project falls within the jurisdiction of DUR.

2.2.5 Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF)

The MRH has prepared an ESMF as well as a RPF to be used as guidelines for the TSDP but with focus on road sector projects. The ESMF and RPF represent statements of policy, guiding principles and procedures, as well as environmental and social safeguards instruments of reference for the road sector projects, agreeable to all key stakeholders such as the EPA, the World Bank, MRH and the implementing Agencies.

The purpose of the ESMF and RPF is to provide corporate environmental, social and resettlement safeguard policy frameworks, institutional arrangements and capacity available to identify and mitigate potential safeguard issues and impacts of each sub-project. It is envisaged that with the preparation and use of the above-mentioned documents/guidelines, national, local environmental and social requirements will be met which will also be consistent with the World Bank's safeguards.

The EIA study has thus been conducted within the framework of the ESMF and RPF of the road sector.

2.2.6 Institutional Framework

The EPA has the mandate to decide on project screening, guide the conduct of any environmental assessment studies and to grant environmental approval for road sector projects to commence. Its mandate also covers monitoring of implementation phase of road projects to ensure compliance with approval conditions, mitigation measures, and other environmental commitments and quality standards.

The EPA has an Environmental Assessment and Audit (EAA) Department that supervises the administration of Ghana's EIA procedures. The EAA Department is headed by a Director who is supported by three Programme Officers. The department works with other departments of the agency and it regularly calls on staff of these departments to provide additional hands when the workload demands that. The EAA Department also coordinates the activities of the EIA Technical Review Committee, which meets periodically to review and approve environmental reports. The EPA therefore has enough capacity to review and approve this EIS and to monitor the construction and operation of the Pilot BRT Project.

The DUR, the client, will have the ultimate environmental management responsibility for the proposed works. The DUR has an Environmental Management Unit which is headed by an Environmental Specialist with significant knowledge and experience in environmental assessment, management and monitoring; he is supported by an Environmental Officer. The Unit may be over-stretched as it is responsible for the environmental management of a number of DUR projects. Thus, though the unit has the knowledge and skills to manage this project, it may not find the time to be fully engaged on it. There may therefore, be the need for DUR to add to the personnel of the unit or limit their involvement in other projects so as to allow the two officers to spend time on this project.

2.3 World Bank Polices Verses National Policies

The environmental policy and EA legislation and procedures of Ghana and those of the World Bank, which are relevant to the project, are outlined above. In principle the two sets of policies and procedures on environmental and social assessment are similar in many respects. In the event, however, of conflict between the World Bank policies and that of Ghana with respect to this project and its related requirements, the Bank's policies will take precedence over the national requirements.

3.0 DESCRIPTION OF THE PILOT BRT PROJECT

3.1 Justification for the BRT System

Bus Rapid Transit (BRT) is an enhanced bus system that operates on bus lanes or other transit ways in order to combine the flexibility of buses with the efficiency of rail. BRT utilizes a combination of advanced technologies, infrastructure and operational investments that provide significantly better service than traditional bus service.

Development of this system will be in line with the Ghana Government's Transport Sector Development Programme (TSDP) that aims, among others, at reducing congestion and facilitating the free movement of goods and people to enhance accelerated growth of the national economy.

The development of a median type BRT route, with central bi-directional stations, a mix of trunk and feeder bus services, electronic fare collection and several terminals where transfers between local feeder and trunk line bus services would enhance safety for vehicles and pedestrians and provide benefits such as operation at faster speeds, provision of greater service reliability and an increased customer convenience.

The corridor selected for the implementation of the pilot BRT is the heaviest loaded route in the metropolitan area. Daily traffic volumes on the Winneba and Graphic roads can peak at 50,000 and 40,000 respectively. The high traffic volumes have led to a situation where the two roads are almost always choked with traffic with the attendant negative implications for the environment and socio-economic development.

The traffic volume on the Winneba and Graphic roads is likely to increase significantly in the near future. This projection is based on the growth of communities such as Kasoa, Budumburam and others to the west of Accra. These communities would contribute to the traffic volumes in Accra as residents access the CBD of Accra. The Winneba-Graphic road corridor would carry the bulk of this traffic. In light of the above, the environmental, safety and socio-economic justification for the BRT project is established; the BRT project would help relieve congestion, enhance mobility and improve the environment in the selected corridor.

3.2 The Proposed Pilot BRT

The operational design of the Pilot BRT is an externalised system with tributary routes that start outside the BRT corridor but feed into it. The buses travel on tributary routes to Winneba and Graphic Roads which form the main spine, or BRT corridor, of the pilot scheme. The tributary services then join the main corridor.

The BRT Pilot Project is divided into four main parts:

1. The tributary services. There are 5 tributary origins in north and north-west Accra. Their origin of travel points at which they join the BRT corridor are:
   - Kasoa (joins the BRT corridor at Mallam Junction);
   - Gbawe (Mallam Junction);
   - Awoshie (Odorkor Junction);
   - Sowutuom/Santa Maria (Odorkor Junction); and
   - Nyamekye (Darkuman Junction).

There is one further tributary at the city end of the route which will have a terminal at Kwame Nkrumah Circle and which will leave the main BRT corridor at Obetsebi Lamptey Circle (OLC).

2. The route along Winneba Road from Mallam Junction to First Light Junction. In this part of the route the BRT buses will run in mixed traffic and stop at BRT stations at the kerbside. There will be 14 stations (in both directions of travel) in this section of route (Appendix C1 and C2).

3. First Light to OLC and then Graphic Road to Kwame Nkrumah Road. This section of route will have a segregated BRT located in the median. There will be 6 stations in this section of route. Two additional lanes will be added on the section from OLC to Official Town Junction (in front of Accra Brewery). The BRT will pass through the middle of the OLC. One of foot bridges in front of the Kaneshie Market will be fitted with a lift mechanism to enable people living with disabilities to access the bus stations (see Appendix D1, D2 and D3).
4. The BRT distribution system in the Central Business District (CBD) will have two routes:
   - A CBD loop via South Liberia Road, Independence Avenue, Barnes Road, North Liberia Road and returning to Barnes Road via Kwame Nkrumah Avenue. This loop route will have 5 stations and the buses will run in mixed traffic (Appendix E)
   - A route south on Kwame Nkrumah Avenue to UTC and then return the same way to Graphic Road. This route will have 2 bus stations at CMB and a terminal at UTC.

This report is concerned with sections 2, 3 and 4 above.

3.2.1 Median BRT Location

The segregated BRT way will be located in the median of the route and in general, separators will be used to separate the BRT way from the normal mixed traffic lanes. The decision to have median running was dictated by the intense activity on the frontages along the route and also the absence of any service roads east of First Light.

If at a later time it is decided to segregate the route west of First Light then the presence of service roads – or sufficient right of way to provide service roads – then either median or lateral running will be possible.

3.2.2 BRT Stations

At locations where there are BRT stations in each direction of travel, the stations will be staggered to minimise the width of the BRT facilities. Passenger access to stations will be via surface pedestrian crossings or via crossing points at signal controlled junctions. Only at a single location, Kaneshie Market, will access to a station be via a pedestrian overbridge.

The stations will be provided with platforms that will be slightly above normal walkway height to make it easier for passengers to step up/down from buses. Enough space will be provided to accommodate passengers who come to access the BRT service.

3.2.3 Terminals and Depots

Bus depots will be provided at Kasoa and at Mallam and are intended to provide full service facilities as well as stabling of buses when not in use. A major terminal will be located at Kasoa crossroads. Other smaller terminals will be located at Gbawe, Awoshie, Sowutuom, Santa Maria, Kwame Nkrumah Circle and UTC.

3.2.4 Feeder Bus Services

It is assumed that Accra BRT will be protected from direct competition through regulation and that feeder services are able to be planned. This is dependent upon a complementary regulatory regime supported by an institutional structure to monitor and enforce planned public transport in Accra. Outside of Greater Accra regulation cannot be assumed, as such any service operating that has a relationship to BRT, as feeder or tributary, must compete for trips on the basis of either cost or level of service.

It is intended that reconfigured bus feeder services will no longer operate in Winneba and Graphic Roads but will serve adjacent areas to the corridor and feed into the BRT route. Tro-tro passengers would alight from the small buses at or close to the BRT route and walk to the nearest BRT station.

3.2.5 *Fare and ITS Systems*

In arriving at passenger forecasts and deriving revenue forecasts for BRT, tributary and feeder services it has been assumed that the passenger will be asked to pay no more than that which is paid at present. Fare levels will however be subject to review alongside financial analysis. The operational service plan requires that payment is made in a manner which does not cause additional delay to the vehicle, ensuring that minimal dwell times at stops can be achieved. Various fare collection systems have been reviewed within previous project reports focusing primarily upon paying to enter closed stations allowing boarding and alighting to be unhindered by further payments or ticket verification.

It is probable that in the medium term Smart Card ticketing will be adopted. However, in the year of opening and early years of the scheme an interim fare system will be used although the form of this has not been fixed. At present users pay per journey on the vehicle. Monies are collected by the drivers mate and retained by the driver and/or owner. Such a system may be replicated within the BRT system proposed if paper ticketing is adopted. It may be that this minimal intervention approach is required in the short term in order to achieve early operation with a defined migration path to a more flexible form of payment such as the use of Smart Cards.

3.3 Description of Winneba and Graphic Roads

The proposed project sites are located on Winneba Road (from Mallam Junction eastwards) and Graphic Road and in the CBD. The BRT corridor is 13.1 km in length. The profile of the route varies from a low point near Mallam Junction (elev. 4.2m) to a high point at Odorkor (elev. 28.5m) and then falls gradually at Toyota and the Korli Bridge over the Odaw River (elev. 3.5m)

3.3.1 *Winneba Road*

Winneba Road runs from Mallam Junction to OLC. The road is 6.9 km long and has a dual 2-lane cross-section from Mallam to just west of Odorkor Junction. From this point to First Light Junction the road has a dual 3-lane cross-section with service roads. From First Light to OLC there are no service roads and the cross-section has 3-lanes in each direction with a concrete wall surmounted by razor wire in the median in the vicinity of Kaneshie Market. At either end of the Market there are pedestrian overbridges. There a several signal controlled T-junctions (at Dansoman High Street, Odorkor, Darkuman Road, Dansoman Road and the junction east of Kaneshie Market referred to in this project as the MMT/OLC Junction. There is one signal controlled cross-roads at First Light.

3.3.2 *Graphic Road*

Graphic Road is a continuation of the Winneba Road and runs from the Obetsebi Lamptey Circle and ends at the intersection with the Kwame Nkrumah Avenue. It is 2.2 km long with about 1.5 km of it forming part of the boundary separating Okai Koi South and Ablekuma Central Sub-Metropolitan Assemblies. The remaining 0.7 km separates Ashiedu Keteke from Osu Klotey Sub- Metropolitan Assemblies.

The road has a dual 2-lane cross-section throughout its length. There are four signal controlled junctions. Two of these are T-junctions (Official Street and Agbogbloshi Road) and two are cross-roads (a staggered junction at Toyota Motors and a conventional crossroad junction at Kwame Nkrumah Avenue).

Most of the road passes through the South Industrial Area and the rest through the Adabraka residential area. Major establishments along the Graphic Road include Pepsi Cola, Toyota Ghana Ltd, Universal Motors, CAL Bank Ltd, Beyeeman Freezing Company Ltd, Orca Deco, and Graphic Communications Group Ltd.

3.4 Description of the Works

The project works are described in this chapter. The project location is shown in figure 3.2 below.

3.4.1 Overview of the Works for the Pilot BRT Project

The works starts from just east of Mallam Junction on the Winneba Road through First Light at Kaneshie, Kaneshie Market, Obetsebi Lamptey Circle, Graphic Road and Kwame Nkrumah Avenue.
Some development works will also be carried out from Kwame Nkrumah Avenue through Liberia Road (South and North Links), Independence Avenue and Barnes Road.

3.4.2 The Proposed Project Works

The proposed works are outlined below:

(a) Winneba Road (Mallam to First Light)

This route covers approximately 5.3km. The works to be carried out in this section consist of the provision of BRT stations at the side of the road (no segregation of BRT is proposed here) and reconfiguring of traffic signalised junctions where needed to accommodate BRT stops. There are 14 BRT stations in this section 5 of which will be located at the kerbside and 9 located on separator islands. The main works to be carried out in this section include:

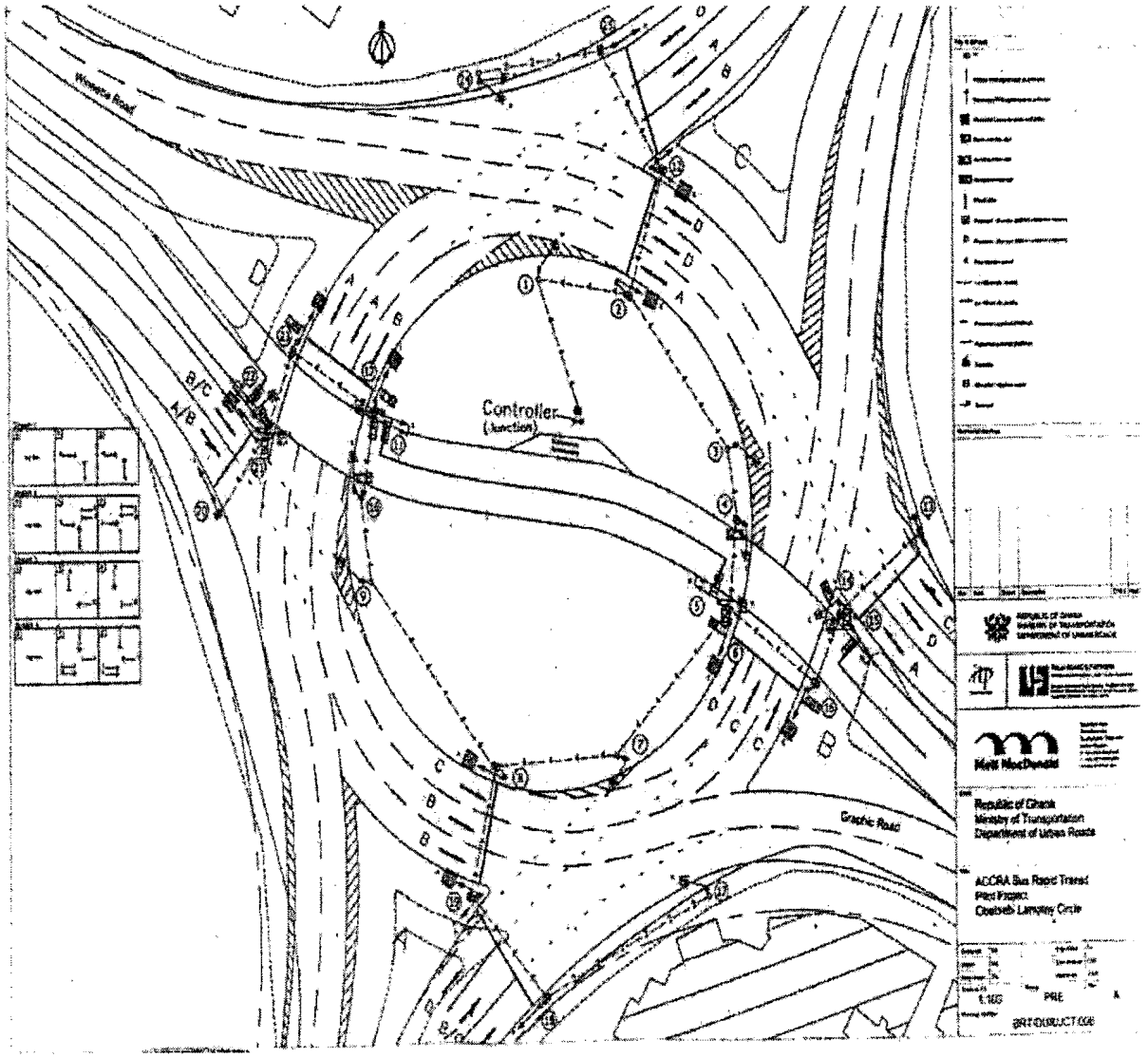
1. The Construction of Bus Stations (14 No) at locations predetermined by traffic feasibility Studies. These are basically of reinforced concrete and steel.
2. The reconfiguration of junctions to meet with design year traffic demands and characteristic at the intersections.
3. The reconstruction of culverts, which have known histories of perennial flooding during rainy seasons.
4. Road line markings and signage.

(b) Winneba Road (First Light) and Graphic Road for Kwame Nkrumah Avenue (UTC)

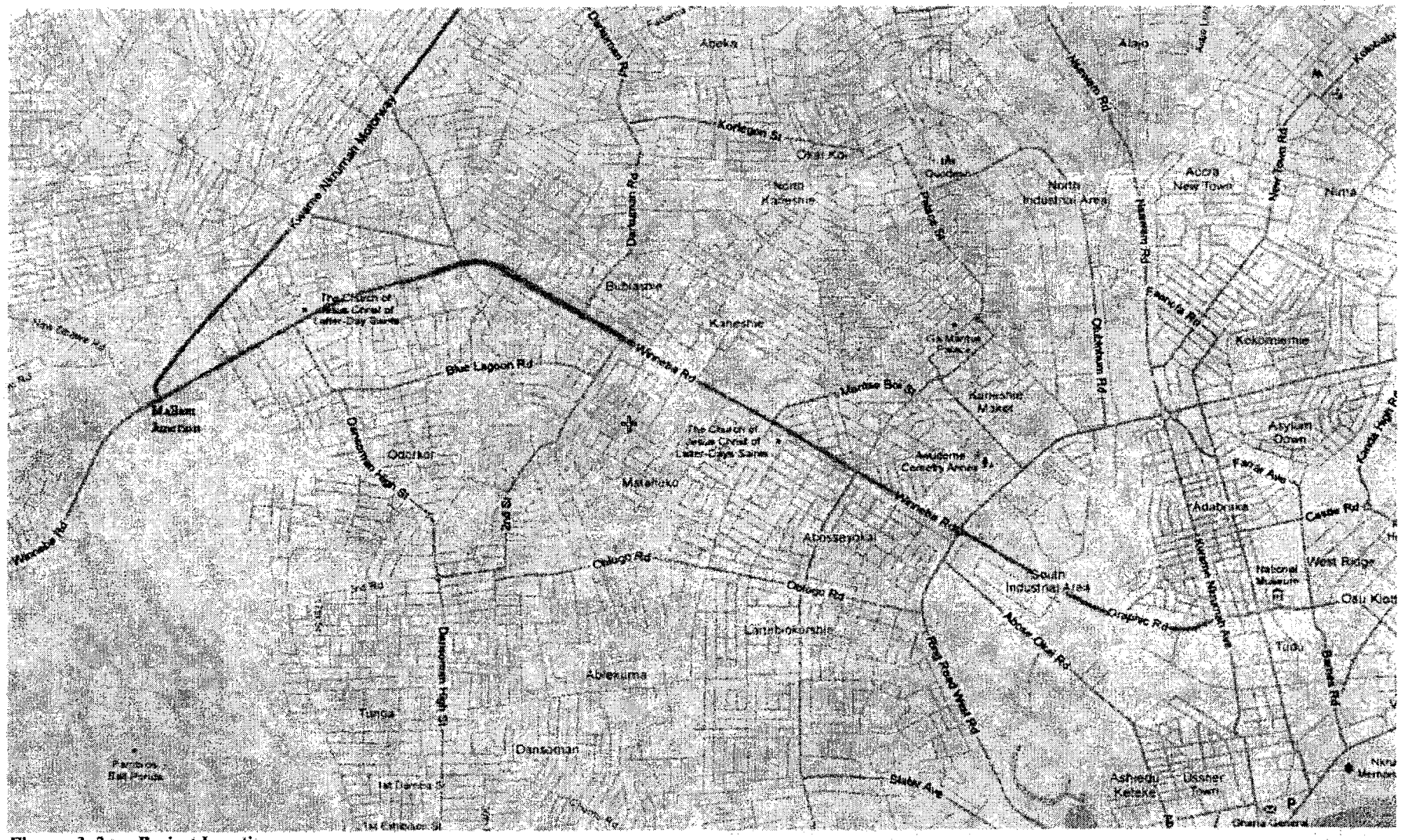
This covers approximately 5.0km. The main works to be carried out in this section include;

1. The Construction of Bus Stations (14No) at locations predetermined by traffic feasibility Studies. These are basically of reinforced concrete.
2. The reconfiguration of junctions to meet with design year traffic demands and characteristic at the intersections.
3. Installation of new signs to meet the expected design year traffic demands and characteristic.
4. The construction of concrete storm drains around First Light and Obetsebi Lamptey Circle, which have known histories of perennial flooding during rainy seasons
5. Reengineering of the OLC. Changes to the roundabout are outlined below:
   - Signalisation of all arms of the roundabout;
   - BRT lane added through the centre of the roundabout;
   - Additional lanes on some approaches ; and
   - Signal controlled staggered pedestrian crossings have been provided at approximately 100 metres from the roundabout on each approach.
   - Figure 3.1 below shows the redesigned OLC indicating the BRT lane passing through the middle of the roundabout.
6. The construction of pedestrian foot bridges (2No) and Kaneshie Market. One of the foot bridges will be fitted with a lift mechanism to enable people living with disabilities to access the bus stations.
7. Construction of two additional (segregated bus lane) to accommodate the BRT
8. Traffic diversion and management during construction.
9. Road line markings and signage.

The activities leading to the implementation of any of these facilities mentioned above will have a destabilizing effect on the existing road pavement structure and furnishing where the facilities are to be established.



Figures 3.1 Reengineered OLC Roundabout



Figures 3. 2 Project Location

Figures 3.3 Morning Peak Period Traffic Conditions at Kaneshie Market

Therefore remedial action will be taken to reinstate the damaged sections of the road after the implementation of these facilities. In addition, the existing roadway after being subjected to the damaging effect of construction equipment will be strengthened with a 50mm thick Asphaltic Concrete Overlay.

The activities for the implementation of the BRT facilities will include,

1. Relocation works of ECG, AVRL/GWCL and Ghana Vodafone facilities;
2. Excavation Works;
3. Earthworks;
4. Concrete Storm Drainage Works;
5. Crushed Stone Base Works;
6. Concrete Works;
7. Asphalt Paving Works;
8. Rehabilitation of existing walkways;
9. Road line markings and signage; and
10. Traffic Diversion and management during construction.

The works will involve the movement and use of heavy construction equipment and machinery such as excavators, dump and tipper trucks, giant cranes, compactors, concrete mixing plant and trucks, bitumen storage tanks and trucks; asphalt plant and paving machines etc.

Figures 3.4 Peak Hour Traffic in Kwame Nkrumah Avenue at UTC

(c) CBD Loop via Liberia Road and Barnes Road

This covers approximately 3.00km. The main works to be carried out in this section include,

1. The construction of Bus Station (4No) at locations predetermined by traffic feasibility studies. These are basically of reinforced concrete.
2. The reconfiguration of junctions to meet the design year traffic demands and characteristics at the intersections.
3. Rehabilitation of existing walkways.
4. Road line markings and signage
5. Traffic diversion and management during construction.

The activities leading to the implementation of any of these facilities mentioned above will have a destabilizing effect on the existing road pavement structure where the facilities are to be established. Therefore remedial action will be taken to reinstate any section of the existing road that becomes destabilized as a result of the construction activities.

The activities for the implementation of the BRT facilities will include,

1. Excavation Works;
2. Earthworks;
3. Crushed Stone Base Works;
4. Concrete Works;
5. Installation of Traffic Lights and Road Signs;
6. Asphalt Paving Works;
7. Rehabilitation of existing walkways;
8. Road Line Markings; and
9. Traffic Diversion and Management during construction.

The works will involve the movement and use of heavy construction equipment and machinery such as excavators, dump and tipper trucks, giant cranes, compactors, concrete mixing plant and trucks, bitumen storage tanks and trucks; asphalt plant and paving machines etc.

4.0 CONSIDERATION OF PROJECT ALTERNATIVES

In accordance with good practice, it is appropriate for the EIA to examine feasible alternatives to the proposed project to compare alternative project locations and designs. The aim is to establish whether there are reasonable alternatives which could be pursued which meet the project's objectives with less environmental and social impact, and if there are, to explain what other factors determined the choice of Project location and design that is proposed. In the case of the BRT project, the following alternatives have been considered:

- No Development Alternative;
- Upgrading of Existing Roads;
- Selection of the Project Corridor;
- Selection of the Appropriate Project Design; and
- The 'BRT Project Implementation' Alternative.

4.1 No Development Alternative

A major objective in implementing the BRT project is to help to reduce congestion and enhance mobility so as to facilitate the free movement of goods and people in that part of the Accra Metropolis where the BRT is to be constructed. The Winneba-Graphic Road is one of the busiest corridors with traffic hold-ups being a constant feature. The number of cars in GAMA is projected to increase from 181,000 in 2004 to over 1 million in 2023. The highest traffic volumes are found in the Winneba Road and Liberation Road corridors, which have volumes of over 50,000 vehicles per day at certain points.

The "No Development Alternative" assumes that the present state of the road pertains, i.e, the BRT pilot project would not be implemented. This would imply that the road would be left in their present state, where:

- Congestion on the Winneba road corridor will become worse since its present state will not be able to accommodate the increased traffic volume;
- Free movement of people, goods and services to and from the areas in the road corridors will continue to be hampered; and
- There will be a general decline in business and other socio-economic activities along the road with impacts further afield in other parts of the Metropolis.

Due to increasing population and socio-economic activities in the Accra metropolis, the "No Development Alternative" would lead to increasing problems in handling traffic within the project corridor, especially where vehicles, pedestrians, businesses and trading activities compete for the same space leading to vehicular-human conflicts. These conflicts will be very much pronounced in places such as First Light-Kaneshie Market area and the Bonsu Brothers-UTC area.

If the BRT project were not implemented, vehicular-vehicular conflicts and vehicular–pedestrian conflicts would continue. Road accidents resulting in loss of life and/or damage to property would also increase. Development opportunities such as easy movement of people and goods as well as reduction in vehicle operating and maintenance costs would also not be realised.

With the continuous growth of Kasoa and nearby communities and the increasing trade and movement of goods and people between these areas and the Accra Metropolis, the volume of traffic of the Winneba-Graphic road is likely to increase significantly. The increase in the traffic volumes would result in further congestion and traffic hold-ups with the attendant negative effects on free movement of goods and services and therefore productivity. The "No Development Alternative" would therefore have negative implications for trade and commerce.

Without the BRT, tro-tros and taxis will continue to dominate public transport in Accra. Over half (56%) of daily passengers are carried by tro-tros, and a further 15% by taxi. Approximately 1 million passenger trips are made each day into and out of the central area of Accra using tro-tros and taxis. Unfortunately, these vehicles are inefficient in terms of fuel combustion and they emit "greenhouse gases" such as carbon monoxide (CO), carbon dioxide (CO2), and nitrogen oxides (NOx) into the atmosphere which contribute to global warming. The tro-tros and taxis are also inefficient in terms of amount of road space used, and congestion caused, to transport each passenger.

Furthermore, the BRT project forms part of the Government's Transport Sector Development Programme (TSDP). A choice of the "No Development Alternative" will therefore not be in line with the government of Ghana's long-term development objectives. This alternative is therefore neither in the interest of national development nor of the project objectives.

4.2 Upgrading of the Existing Road

An alternative to the implementation of the BRT project is the upgrading of the existing Winneba Road-Graphic Road corridor into a 4-5 lane carriageway. An expansion of the carriageway with the appropriate supporting facilities (traffic signals, depots, terminals, and bus-stops) would increase the capacity of the road to carry the traffic load much more effectively than the current situation. This would go a long way in reducing the traffic congestion on the road and thereby enhance mobility and the movement of goods and services along the corridor.

Although this option seems laudable, its implementation would be fraught with a number of challenges. Most of the properties along the route are built very close to the edge of the right of way. Thus the expansion of the road into a 4-5 lane carriageway would have significant property impact. The project corridor is a heavily built up area with a number of leading businesses operating in the properties located along it. Among the businesses with properties along the project corridor are Graphic Communications Group Ltd, CAL Bank, Pepsi Beverages Ltd, Toyota Ghana Ltd., Rana Motors, etc. There is also the Kaneshie Market Complex and a host of private commercial properties including fuel stations. If this alternative is adopted for implementation it would involve the demolition of a significant number of properties and the payment of large sums of money as compensation. The payment of such compensations would make this alternative very expensive and render the project non-viable.

Related to the above is the physical and economic displacement of project-affected residents and businesses. Residents in properties affected by the expansion of the carriageway would be displaced physically and the DUR would be obliged to take appropriate steps to resettle them. With their premises along the road demolished, businesses and organizations would have to relocate their operations. The stresses and strains of resettling in new communities, finding and developing alternative business locations and moving operations could affect the smooth conduct of business with the attendant loss of revenue.

Expansion of the existing carriageway with the attendant road works and demolitions would expose residents and businesses in communities along the road corridor and road users in general to several environmental, social and safety impacts. High level noise and vibrations, dust pollution, the generation of construction debris resulting from the demolitions as well as vehicular-pedestrian conflicts, vehicular accidents, delays in traffic flows and a host of impacts resulting from the road works would constitute a significant disturbance to both residents and road users.

Lastly, experience elsewhere has shown the building more capacity for general traffic is not effective as a means of tackling congestion as it stimulates traffic growth and simply delays the onset of serious congestion.

4.3 Selection of the Project Corridor

Development of the design for the project was based upon a comprehensive transportation study prepared by DHV in 2005. Based upon the general criterion of hourly peak passenger bi-directional flows greater than 10,000 in 2013, and the need to provide an integrated public transport network, the following routes were identified as routes on which BRT services could operate in an exclusive running-way:

- Guggisberg Avenue from Mpoase to CBD;
- Winneba Road from Mallam to CBD;
- Nsawam Road from Apenkwa to CBD;
- Liberation Road and Independence Avenue from Tetteh Quarshie to CBD;
- Ring Road from Korle Bu to Labadi;
- Motorway Extension from Mallam to Tetteh Quarshie;
- Accra - Tema Coastal Route;
- Nima / Kanda Highway; and
- CBD / Ministries circulation system

In order to select a corridor for pilot implementation, each of the potential BRT corridors was assessed on the degree of compliance with five criteria:

a. Levels of personal mobility (total passenger demand);
b. Ease of implementation (constraints – Right of Way, road development, land use and social and potential for inclusion in planned road improvements);
c. Transport impacts (potential for reducing passenger travel time);
d. Increased accessibility for low income population (coverage in low income areas); and
e. Urban and regional planning impacts (connection with existing and planned urban and regional transport services).

The highest ranked corridor was Winneba Road from Mallam to the Accra CBD. Winneba Road rated highly with regard to the number of potential users of the system and the impact that the BRT will have on travel time in this corridor. Notwithstanding the need for grade separation at the Railway crossing on Graphic road, the existing portion of three lane road, and relatively low impacts on the Graphic Road section contributed to a good scoring for ease of implementation. Integration with the CBD and good linkages to transportation infrastructure resulted in an above average rating for BRT with regard to urban planning impacts.

Additionally, the Winneba road corridor is considered to have the highest social and economic benefits. The road is one of the heaviest loaded routes in the Metropolitan area and was predicted to carry the highest number of potential users of the system, as well as to deliver the largest saving in travel time.

4.4 Selection of the Project Design

A review of BRT applications has shown that the way in which segregated lanes have been implemented is adaptable to local circumstance. In general terms, five alternate configurations were identified:

- Operation within the median with island stations;
- Median operation with bilateral stations;
- Median operation with cross-over at stations; and
- Tidal flow median operation.

In depth BRT studies by DHV indicated a preference for a median type BRT route, with central bi-directional stations, a mix of trunk and feeder bus services, electronic fare collection and several terminals where transfers between local feeder and trunk line bus services would be made.

Median location within the roadway increases the travel speed, as there are fewer conflicts with vehicles entering and leaving the road and with frontage activities along the route. Following preparation of an Operations Service Plan by the consultants not all of DHV's recommendations were adopted. Lateral stations will be built and the BRT will be an externalised system based on tributary services as opposed to a feeder/trunk service.

4.5 The 'BRT Project Implementation' Alternative

With the implementation of the BRT, there will be significant reduction in noise and air pollution associated with the removal of tro-tro services and their replacement by more efficient large bus services operating within the BRT lanes.

The performance objectives of the BRT have been identified to include the following:

- Reduction of travel time in BRT corridor;
- Increase in overall travel speeds;
- Increase share of large buses in market;
- Reduce carbon dioxide emissions;
- Length of sidewalks improved Bus shelters and terminal facilities built;
- Increase in Bus km/day, passengers/bus/day and peak hour PT vehicles; and
- Reduce average walk times to bus stops.

With specific reference to problems and issues related to public transport provision in Greater Accra a BRT system can address:

- Issues related with the institutions and regulations by the need for the establishment of a clear and strong framework of regulation and administration to support the BRT;
- Issues related to the users of public transport through improvements to the quality of public transport and reduction in journey time;
- Issues related to the transport providers who currently suffer from high capital and operational cost and inadequate facilities; and
- Issues related to the community at large through improvements to the current situation of high accident rates, low levels of security, high pollution levels and lack of accessibility to the urban poor.

The building of the pilot project also forms an integral part of the Government's Transport Sector Development Programme (TSDP). BRT is expected to contribute to the Ghana Poverty Reduction Strategy, by providing better accessibility to the low income residents to get to employment and education opportunities.

5.0 PHYSICAL AND SOCIO-ECONOMIC BASELINE

5.1 Project Area of Influence

The project's area of influence extends from the area west of Mallam Junction along Winneba and Graphic Roads to the CBD of Accra. The primary zone of influence is 500 metres to each side of the Winneba and Graphic Roads and the routes selected for the CDB Distribution system (Liberia Road, High Street and Kwame Nkrumah Avenue). The flanking communities served by existing tro-tro routes are:

- McCarthy Hill;
- Mallam;
- Odorkor;
- Bubiashie;
- Mataheko;
- Kaneshie;
- Abossey Okai;
- South Industrial Zone; and
- The CBD Zones flanking Kwame Nkrumah, High Street and Liberia Road.

Though the project will have varying degrees and levels of impacts on residential, commercial and land use activities in the corridors in general, the critical areas of influence by the project that are the subject matter of this assessment are the safety zones required for the reconstruction of portions of the road median from the First Light Junction to Kwame Nkrumah Avenue around Bonsu Brothers/UTC area that is expected to facilitate the operation of the pilot BRT service.

The zone of critical impact is therefore that section of the project sphere of influence that experiences the most intensive concentration of the project implementation impacts. For the purpose of this study, the zone of critical impact required for the construction of the BRT between the First Light Junction through Graphic Road ending close to the Bonsu Brothers Building on Kwame Nkrumah Avenue and is defined to include:

- Winneba Road – From First Light Junction to Obetsebi Circle. Existing cross section of the road is defined on the south side by commercial properties including SG-SS Bank property line as built and in the north side by Kaneshie Market property line as built.
- Graphic Road – From Obetsebi Circle to Kwame Nkrumah Avenue / Graphic Road Junction. Existing cross section of the road that is defined on the south side by the commercial property lines (Beyeeman, Japan Motors etc.) as built and in the north side by Toyota, Orca Deco property line as built.
- Kwame Nkrumah Avenue -From Graphic Road/ Kwame Nkrumah Junction to Bonsu Brothers Building. Existing cross section of the road that is defined on south sides by the Cocoa House, Liberty House as property line as built and in the north side by Republic House property line as built.

5.2 Climate

The project is located in the Greater Accra Metropolitan Area (GAMA), which falls within the dry equatorial climatic zone. Accra is located in the driest part of the country. This dryness is due to the prevailing south-south westerly winds blowing almost parallel to the coast and to the cool currents of the Atlantic Ocean occurring offshore.

Accra enjoys double maxima rainfall pattern and more marked dry seasons. The lowest rainfall in the country occurs in the Greater Accra Region where the average rainfall is between 74 and 90 cm with the major rainy season from May to July. The minor rains start in September and end in October. The highest rainfall is experienced in June. About 77% of the annual rainfall occurs between May and October. The dry

season starts in November and lasts until March. The dry Harmattan winds (North Easterly Trade winds) are usually severe in January and February.

The highest mean monthly temperature for Accra is about 30°C and it occurs between February and April, at the beginning of the rainy season. The months of July and August are relatively cool with mean temperature of about 26°C. The low temperatures during this period are due to increased cloud cover and the low sea surface temperatures resulting from up-welling of the sea in the Gulf of Guinea. The average humidity is about 75% at 0900 GMT and 60% at 1500 GMT.

The climate is strongly influenced by the hot and dry Tropical continental air mass which originates from the heart of the Sahara desert, and the Tropical maritime air mass, which though hot, contains a great deal of water it collects from its long journey across the sea. The seasonal migration of the Inter-Tropical Convergence Zone (ITCZ) determines the changes in the seasons.

5.3 Topography, Geology and Soils

The physical features of the GAMA consist of an original plateau that has been eroded to form isolated ridges and gently sloping valleys. The topography is thus uneven and is characterised by several small hills.

The Accra Area is underlain by three main rock types: Accraian Series, Togo System, and Dahomeyan Rocks. The Accraian Series is a sedimentary rocks belonging to the Devonian age deposited in a basin formed by the older Dahomeyan Rocks (late Pre-Cambrain) consisting of gneisses and schists, which are in turn, intruded in places by rocks of Togo System (early Pre-Cambrian) made up of quartizites, schists, shales and phyllites.

The rocks of the Dahomeyan and the Togo Systems underline most of the area to the west, north and east of the city, while the Accraian system of rocks underlies most of the Central Business District of the city.

The Obetsebi Lamptey Circle project area is underlain by the Accraian sandstone. Typical residual soils which develop over the sandstone generally consist of compact reddish brown lateritic silty sand or clayey sand whose particles size distribution varies within a wide range. The soil profile is sometimes capped with a very hard lateritic layer at some places. There is generally little problem regarding the bearing capacity and settlements of structures founded on the residual soils. At the project site, the sandstone is, however, covered with a thick mantle of alluvial soils resulting from periodic flooding of the areas.

The Graphic Road project site is underlain by shales also of the Accraian Series. Few outcrops of the rock are, however, visible since they are obscured by the deposition of a thick mantle of soft, normally consolidated alluvial sandy or silty clays, previously laid down as a result of the periodic flooding of the Odaw River and the Korle Lagoon before they were drained in the early 1960s in addition to dredged materials. Previous investigations close to the project area have shown that the underlying shales are highly fractured with iron-stained joints and that sound coreable rock may not be encountered at depths less than 20m below existing ground surface.

The Accraian Series is characterised by extensive faulting system and a number of inferred and observed faults have been mapped within it. In addition, it is generally believed that contacts between the major rock formations are also potential faults. Numerous previous site investigations in this part of Accra have established that alluvial formation is highly variable in nature and engineering properties, and contains pockets of loose sand and soft clay in addition to inclusions of hard gravel layers which may give the false impression of the existence of a firm or competent formation. The alluvial soils are generally weak to considerable depths, with typical undrained shear strengths of 10kPa at depths of around 3m. This has necessitated the use of piled foundation for most of the heavy structures in the Kaneshie Light Industrial Area.

5.4 Air Quality and Noise

Under the Monitoring and Evaluation component of the Urban Transport Project, the DUR is supporting the EPA to monitor roadside air quality as a basis for assessing changes before, during and after the implementation of the BRT system. The EPA has set up three roadside air quality monitoring sites at Graphic Communications Group, Kaneshie First Light and Mallam Junction; data have been collected at these sites from August 2008 to March 2009. Below are results of air quality monitoring at the three monitoring sites[1] .

Major sources of particulate matter on the BRT corridor include road dust, windblown dust and emissions from vehicles. The 24-hour PM10 values at the Graphic, First Light and Mallam Junction monitoring sites ranged from 25.7 to 3421µg/m3, 29.6 to 2672µg/m3, and 28.5 to 2790µg/m3 respectively.

The PM_{10} results were compared with the EPA and the World Health Organization (WHO) air quality guideline values for PM10. During the period under review, 34 out of the 35 samples (97 percent) collected from the Graphic Communication Group site, 28 out of 36 samples (78 percent) from the First Light site and 32 out of the 35 samples (92 percent) exceeded the EPA 24-hour PM10 air quality guideline of 70µg/m3. On average, over 90 percent of samples collected from the three sites exceeded the WHO 24-hour PM10 guideline value of 50µg/m^3.

Table 5.1 ***Air Quality Monitoring Results (August 2008 – March 2009)***

	Aug-08	Sept-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09
Graphic Comm. Group								
Monthly 24-hour (ug/m3)	186	156.2	249	189.4	827.9	381.5	114.8	224.5
Maximum 24-hour (ug/m3)	186	318	608	311	3421	1313	132	286
Minimum 24-hour (ug/m3)	186	26	86	135	117	88	91	102
EPA guideline (24-hour)	70	70	70	70	70	70	70	70
Kaneshie First Light								
Monthly 24-hour (ug/m3)	418	95	166	101.6	623.8	306.4	111.5	193.2
Maximum 24-hour (ug/m3)	418	225	252	149	2672	1042	210	259
Minimum 24-hour (ug/m3)	418	57	75	44	133	59	45	30
Mallam Junction								
Monthly 24-hour (ug/m3)	135	108.6	227	228	626.2	363.3	71.3	178.1
Maximum 24-hour (ug/m3)	135	234	297	324	2790	1185	97	218
Minimum 24-hour (ug/m3)	135	29	29	190	124	118	29	157
EPA guideline (24-hour)	70	70	70	70	70	70	70	70

The mean monthly PM10 levels for three sites were also higher than the 24-hour EPA guideline of 70µg/m^{3}and WHO 24-hour guideline value of 50µg/m^3.

[1] Environmental Protection Agency: Report on Roadside Air Quality Monitoring on BRT Corridor, Accra. April 2009.

The EPA also takes noise level measurements at four locations namely, Obetsebi Lamptey Circle, Total Head Office, Darkuman Total Filling Station and Mallam Junction Total Filling Station. Results of noise measurements at Obetsebi Lamptey Circle and the Mallam Junction Total Filling Station which are in the BRT corridor are presented below.

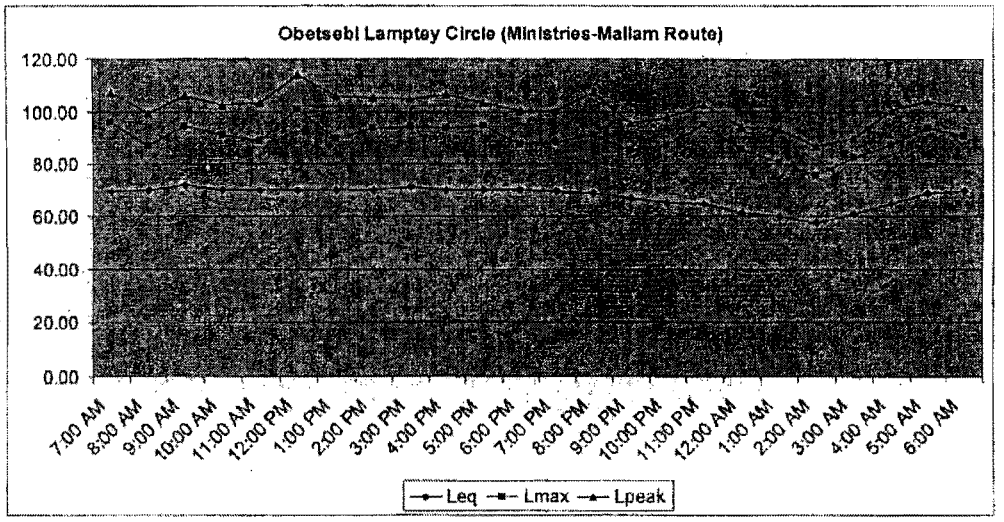


Figure 5.1 Noise Levels Measured at Obetsebi Lamptey Circle

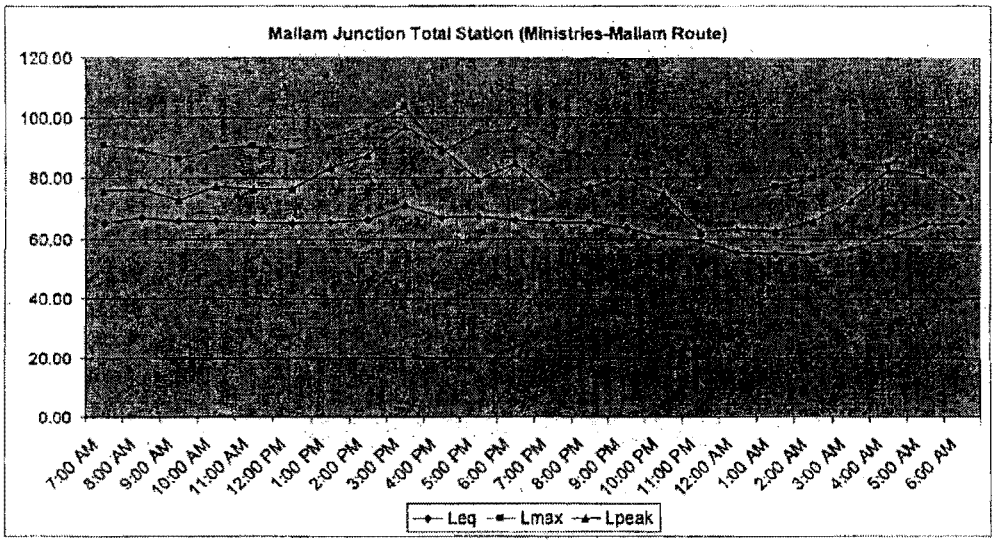


Figure 5.2 Noise Levels Measured at Mallam Junction Total Station

From the tables below, noise levels at the Obestsebi Lamptey Circle and Mallam Junction Total Station are high with a Leq (24hr) of 69 dB(A) and 64.7dB(A) respectively. Under EPA's noise monitoring program, areas that record levels above 70 dB (A) are described as "hot spots" in accordance with the World Health Organisation's 24- hour noise level guideline value for traffic areas of 70 dB (A).

Table 5.2 ***Noise Measurements***

Location	Distance from middle of Road (m)	Leq (24hr)
Obetsebi Lamptey Circle	30	69
Total Head Office	8	68
Darkoman Total Filling Station	30	66.2
Mallan Junc. Total Station	25	64.7

5.5 Water Resources and Drainage

Three major streams namely Bawere Stream, Lafa Stream and Odaw River, drain the project area.
The Bawere stream basin lies to the west of Accra and covers McCarthy Hill, Gbawe, Jaman and part of Mallam. It is bounded to the South and South-west by McCarthy Hill, Jaman settlement to the west, the hills forming the eastern boundary of the Densu Lake to the north and Mallam settlement to the east. Gbawe town is located almost central in this catchment area. The basin is drained by the Bawere Stream which crosses the project area at chainage 650. The size of the catchment is 11.6km^2 and is largely rural with a few medium class developments.

The Lafa Stream drains Awoshie and parts of Darkuman and Odorkor. These areas lie to the north west of Accra on the city boundary and are developing medium class residential areas with some high class housing. The Lafa Stream passes through the area, after crossing the Ofankor road from Kwashiman, and is the main drainage channel. Anyaa road forms the western boundary of the catchment area. The size of the catchment area of the Lafa basin up to the Anyaa road is 21.1 km^2 and is largely rural. The area is relatively flat with slopes along the stream varying from 0.4 to 0.9 percent. A tributary joins the main stream about half way along the stream course through the area. Surface water drains via unpaved roads which have no side drains into the Lafa, the course of which has not been properly defined. Construction of buildings is taking place along the stream and inevitably the occupiers suffer from flooding during the rainy season.

Odaw Catchment Basin is large and covers most of the central part of Accra. It is bounded to the east by the ridge running along the Independence Avenue up to the Airport, Shiashie, Madina, Adenta, Oyarifa and Peduase; to the north by the Akwapim mountains up to Aburi; to the west by the Akwapim ridge running from Konkoronu to Berekuso, Bobomase, Abokoib to Kwabenya, John Teye Memorial School, Ofankor, Tantra hill, Abeka, North Kaneshie, Feo Yeo and South Industrial Area up to the Graphic road. The land use in the catchment ranges from light industrial through residential to farming communities. The southern part of the area from Graphic road up to Ofankor is developed whilst the northern part from Ofankor through Abokobi to the Akwapim Mountains is sparsely developed. The catchment is drained by a number of streams including the Onyasia.The results of analyses of surface water of the three streams are presented in table 5.3 below. [2]

The results are presented alongside World Health Organisation (WHO) guideline values for drinking water[3] and natural background levels for tropical surface waters[4]. In relation to the ambient, the surface waters were warm with a temperature range of 29.4 – 30.6. With a pH range of 7.5 – 7.9, the waters in the study area are considered neutral. They, however, contained high quantities of dissolved materials as indicated by a comparison of the conductivity range of 1125 to 1368 µS/cm, to the natural background range of 50 to 300 µS/cm. The surface waters were also generally turbid with low dissolved oxygen levels. The poor physical quality of the surface waters was due to intense human activities in the project area without the support of adequate waste disposal facilities. Of the 3 streams, the Odaw is the most polluted; a physical observation of the Odaw shows the extent of pollution due to the dumping of domestic, municipal and industrial waste, with a mass of polythene material floating on the surface of the stream.

[2] Results of the water and sediment quality analyses are taken from Millennium Development Authority: Construction of Tetteh Quarshie Interchange – Mallam Junction Road. Final Impact Assessment Report, October 2008

[3] WHO. *Guidelines for drinking water quality.* Vol.1 2nd edition. Geneva, WHO. 1984

[4] Stumm W and Morgan J.J. *Aquatic chemistry.* New York, John Wiley & Sons. 1981

Table 5.3 ***Water Quality and Sediment Analysis of Odaw Stream***

Parameters	Concentration	WHO Limits	Natural Background
Ph	7.5	6.5-8.5	6.5-8.5
Conductivity (µS /cm)	1258	-	50-300
Turbidity (NTU)	25	5	-
Dissolved Oxygen (mg/L)	7.3	-	7
Salinity (%)	0.7	-	-
Temperature (°C)	29.8	-	22-30
Total Dissolved Solids (mg/L)	695mg/L	-	-
Chemical Oxygen Demand	132 mg/L	-	7
Phosphate	2.35 mg/L	-	0.02
Sulphate	95 mg/L	400	0.1-10
Nitrate	0.748 mg/L	10	10.23

Source: Millennium Development Authority: Construction of Tetteh Quarshie Interchange – Mallam Junction Road. Final Impact Assessment Report, October 2008

Table 5.4 ***Water Quality and Sediment Analysis of Lafa Stream***

Parameters	Concentration	WHO Limits	Natural Background
Ph	7.7	6.5-8.5	6.5-8.5
Conductivity (µS /cm)	1368 µS /cm	-	50-300
Turbidity (NTU)	25	5	-
Dissolved Oxygen	7.5 mg/L	-	7
Salinity (%)	0.7%	-	-
Temperature (°C)	30.6°C	-	22-30
Total Dissolved Solids (mg/L)	678 mg/L	-	-
Chemical Oxygen Demand	135 mg/L	-	7
Phosphate	2.31 mg/L	-	0.02
Sulphate	92 mg/L	400	0.1-10
Nitrate	0.814 mg/L	10	10.23

Table 5.5 ***Water Quality and Sediment Analysis of Bawere Stream***

Parameters	Concentration	WHO Limits	Natural Background
pH	7.8	6.5-8.5	6.5-8.5
Conductivity (µS /cm)	1125	-	50-300
Turbidity (NTU)	25	5	-
Dissolved Oxygen (mg/L)	6.5	-	7
Salinity (%)	0.6%	-	-
Temperature (°C)	29.4°C	-	22-30
Total Dissolved Solids	554 mg/L	-	-
Chemical Oxygen Demand	149 mg/L	-	7
Phosphate	6.6 mg/L	-	0.02
Sulphate	40 mg/L	400	0.1-10
Nitrate	2.48 mg/L	10	10.23

5.6 Project Area Population

Accra has a current population of about 2 million. It is the most populated and the fast growing metropolis in Ghana with an annual growth rate of 4.3 percent[5]. In addition, Accra has a functional population of 2.5 to 3 million people in terms of socio-economic activities.

The population growth rate in GAMA is high, at 4.4% between the 1984 and 2000 census counts. Due to combination of expected lower fertility rates in the future and a possible under counting in the 1984 census,

[5] Ghana Statistical Service: National Population Census, 2000.

the expected rate of population growth in GAMA was taken as 2.7% for the period up to 2008, dropping to 2.5% in the period to 2013, and then to 2.0% to 2023. In addition to this natural growth, net inward migration to GAMA is expected. The combined effect of growth and migration will be to increase the population of GAMA to just under 4 million by 2013, and by 2023 the combined population of the three assemblies will exceed 5 million. Table 5.6 below presents the population of communities within the project sphere of influence of Winneba and Graphic Roads.

Table 5. 6 ***Population of Communities in Road Corridor***

LOCALITY NAME	2000		2009				
ABOSSEY OKAI	21,489	-0.4	20,704	10,084	48.7	10,620	51.3
ACCRA CENTRAL	5,941	1.5	6,772	3,313	48.9	3,460	51.1
ADABRAKA	25,425	-2.6	20,096	9,935	49.4	10,162	50.6
BUBUASHIE	23,967	0.3	24,612	12,159	49.4	12,453	50.6
DANSOMAN	49,230	6.3	86,838	41,281	47.5	45,557	52.5
DARKUMAN	14,985	3.6	20,677	9,946	48.1	10,731	51.9
KANESHIE	26,179	1	28,605	13,796	48.2	14,809	51.8
KWASHIEMAN	46,007	7.1	87,504	43,298	49.5	44,206	50.5
MATAHEKO	11,961	-0.4	11,505	5,663	49.2	5,843	50.8
NORTH ODORKOR	45,269	7.6	89,854	45,426	50.6	44,428	49.4
SOUTH ODORKOR	33,802	4.5	50,511	24,699	48.9	25,811	51.1
MALLAM	7,153	2.3	8,806	4,256	48.3	4,550	51.7
GBAWE	28,989	22.2	212,915	106,718	50.1	106,197	49.9
ODUPONKPEHE (KASOA)	34,719	-	149,278	73,872	49.5	75,406	50.5

5.7 Transport Situation

Population growth and increasing rates of car ownership are expected to increase the number of cars in GAMA from 181,000 in 2004 to over 1 million in 2023. The highest traffic volumes are found in the Winneba Road and Liberation Road corridors, which have volumes over 50,000 vehicles per day at certain points.

Winneba road-Graphic road corridor is one of the busiest in the city. Traffic on the road is usually heavy and is characterised by slow travel speeds. As part of the feasibility and design phase of the pilot corridor, a comprehensive traffic data collection exercise was carried out in the corridor from August to October 2007. The surveys undertaken included, among others, classified traffic counts at six locations, along the BRT route. The survey locations were as follows:

- Winneba Road east of Mallam Junction;
- Winneba Road east of Odorkor Junction;
- Accra Academy (north of Outer Ring Road);
- East of Kaneshie Market;
- Japan Motors; and
- Orca Deco.

These counts provide, among others, insight into the volume of traffic using the corridor, the daily profile of vehicle movements, tidality of vehicle flow and the makeup of the traffic by vehicle type.
The two graphs below summarise the traffic flows observed over a 16 hour period from 0600-2200 at the six traffic count locations.

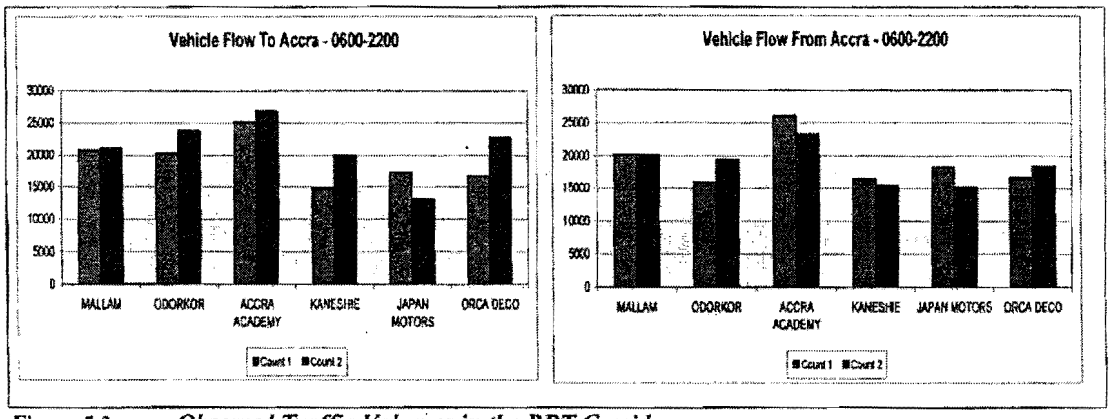


Figure 5.3 Observed Traffic Volumes in the BRT Corridor
Source: Consultant's Surveys

Traffic flow levels along the corridor reach 25,000 vehicles per direction over the 16 hour period. There is a fair amount of variation in flows observed between the two counts at most sites, and in both directions. The makeup of the traffic by vehicle type averaged across all sites is shown in the table 5.7 below.

Table 5. 7 ***Average Traffic Flow along Mallam Corridor - breakdown by vehicle type***

All Sites	Car %	Taxi %	Tro-tro/ bus%	Car %	Taxi %	Tro-tro/ bus %
AM peak hour	51%	11%	29%	22%	16%	55%
PM peak hour	35%	22%	35%	41%	12%	37%
16 hour	40%	18%	34%	32%	16%	43%

From the table, tro-tro and bus vehicles account for nearly 35 percent of all vehicles heading towards Accra along the corridor, with cars and taxis accounting for nearly 60 percent of traffic. The proportion of buses recorded in the reverse direction is slightly higher. The amount of road space taken up by public transport vehicles is fairly significant, particularly accounting for the longer average length of the vehicles. If the corridor were to be regulated, preventing competition between BRT and existing services, the reduction in vehicles along the corridor would lead to a significant reduction in vehicle flow, with the potential to improve congestion for other corridor traffic. Figure 5.4 below shows the existing traffic situation in front of the Kaneshie Market.

Figure 5.4 Traffic Situation Infront of the Kaneshie Markert

Table 5.8 Passenger Flow Along BRT Corridor by Vehicle Type

	To Accra			From Accra		
All sites	Car	Taxi	Tro-tro/ bus	Car	Taxi	Tro-tro/ bus
AM peak hours	18%	4%	78%	6%	4%	90%
PM peak hour	12%	6%	81%	14%	3%	82%
16 hour	13%	6%	82%	9%	4%	86%

5.8 Land Use in the Project Corridor

5.8.1 Winneba Road First Light to Obestebi Lamptey Circle (OLC)

From First Light to OLC the cross-section has 3 lanes in each direction with a concrete wall surmounted by razor wire in the median in the vicinity of Kaneshie Market. At either end of the Market there are pedestrian overbridges.

The right of way (Safety Corridor) in this section of the road varies from 26.70m – 34.60m. This consists of between 2.5m and 3.5m of pedestrian walkways on each side of the road, 12.30m of three lane carriageway on each side of the road.

There is a signal controlled T-junction east of Kaneshie Market referred to in this project as the MMT/OLC Junction and one signal controlled crossroads at First Light Junction.

Land use in this corridor is predominantly commercial. There are no residential activities in the immediate area of the road. Beyond First Light Junction and up to Obetsebi Lamptey Circle are Abossey Okai suburb on the south and Kaneshie suburb on the north. The immediate environs along the road are commercial but most of the suburbs are residential. Major commercial establishments abutting the road include the Kaneshie Market complex and attached lorry park, a fuel station and several small scale shops on the north side, the Cape Coast–Takoradi long distance lorry park, fuel stations, banks and several small scale shops on the south side.

The zone of major concentration of human and vehicular activities is in the immediate environs of the Kaneshie Market complex. In this area the two walkways flanking the road carriageways are overrun by hawkers while one lane on each side of the road is normally encroached by unauthorised parking of commercial vehicles. This situation reduces the three lane road on each side into two resulting in traffic congestions on that section of the road. During peak periods and in the peak direction there is often double parking of buses which leaves only a single lane available for use by through traffic.

The proposed BRT safety zone requires a right of way corridor of about 34m, both at the construction and operational phase of the BRT project. The existing right of way therefore meets the safety requirement so far as unauthorised hawking on walkways and illegal parking of commercial vehicles in the carriageways are discontinued.

5.8.2 Obestebi Lamptey Circle - Graphic Road

The Graphic Road has a dual-2 lane cross-section throughout its length. There are four signal controlled junctions. Two of these are T-junctions (Official Street and Agbogbloshi Road) and two are cross-roads (a staggered junction at Toyota Motors and a conventional crossroad junction at Kwame Nkrumah Avenue).

The right of way (Safety Corridor) in this section of the road is 27.10m. This consists of between 2.5m and 3.5m of pedestrian walkways on each side of the road and 7.80m of two (2) lanes carriageway on each side of the road.

A large section of the Graphic road runs through the South Industrial Area. Land use in this area is predominantly light industrial with some commercial activities in operation. There are no residential

activities in this area. Some of the major establishments along the Graphic road include Toyota Ghana Ltd, Japan Motors, Rana Motors, Universal Motors (car dealers); Pepsi (beverage production); CAL Bank, Stanbic Bank (financial institutions); Orca Decor (dealers in household and office furniture), Letap Jewellery Ltd, Quickfit Service Centre (a car servicing facility), Beyeeman Freezing Company Limited (a cold storage warehouse) and Graphic Communications Group Ltd (a newspaper publishing business). There are also a number of small-medium scale enterprises engaged in the sales of various items, especially car tyres and other accessories.

The Graphic road is part of the boundary separating Okai Koi South and Ablekuma Central Sub-Metropolitan Assemblies as well as Ashiedu Keteke from Osu Klotey Sub- Metropolitan Assemblies. Residential areas in the vicinity of the Graphic road are Adabraka and Fadaama.

Generally, the construction of structures that house major business establishments in the Graphic Road corridor have respected the property lines demarcated by the Department of Town and Country Planning. This has to a large extent preserved the safety zones/right of way of the Graphic Road. However, beyond their property lines most business establishments are using spaces between the walkways and property lines for parking and display of goods.

Both the walkways and carriageways are free from unauthorised encroachment by petty traders and parking of commercial vehicles respectively. However located in the road median are street lamp posts, billboards, Ghana Railway Company's Signal lights and barriers, Signal Houses and a Toilet which will have to be displaced to allow for the construction of the BRT lanes and the overhead bridge.

The proposed cross-section for the construction and operation of the BRT service requires the construction of a 4 lane bridge with two (2) BRT and 2 mixed traffic lanes and one lane service roads at grade which will carry some through traffic and also service Letap Jewellery and Orca Deco Shopping Mall. The provision of the four (4) lane bridge over the railway line will require the expansion of the existing bridge across the Korle Lagoon, the relocation of the Ghana Railway Company's Signal lights, Guard House and Toilets the provision of temporary road access during the construction stage that will involve some land take. The land take will affect the parking lot of Orca Deco, the displacement of sign post of Quick Fit Car Service Centre. The Fence Wall of Letap Jewellery and operational space of tenants in Toku House Building may be affected by Land take.

The construction of the BRT median will also involve the relocation of street lights and other utilities in the median.

5.8.3 The CBD Routes

The intersection of the Kwame Nkrumah Avenue and Graphic Road ending at the Bonsu Brothers/UTC building constitute the rest of the pilot BRT road.

This section of the Pilot BRT Road is a divided road with three lanes southbound and two lanes northbound and a central median. The carriageways are of variable width. While the ROW appears to be sufficient for the reconstruction and operation of the BRT service, traders, Cargo Services Operators, Chop Bar Operators and the Metro Mass Transport Services Operator are currently located in the median that is to be reconstructed into exclusive BRT lanes.

5.9 Infrastructure

A survey[6] carried out in June 2007 identified 48 schools, and 15 health facilities in the project's zone of influence. The schools comprised 34 basic, 6 secondary and 8 tertiary institutions. Only three out of the 15

[6] Asare S, June 2007: Assessment of Travel Characteristics of Commuters to Markets, Schools, and Health Facilities Along the BRT

health facilities are public facilities. Twenty-nine of the schools are publicly owned while the remaining 19 are privately owned. Five markets were identified as shown in table 5.9 below.

Table 5.9 Identified Markets along the BRT Corridor

No	Name	Location	Owner	Capacity	Year Established
1	Makola	Makola	AMA	4000	1986
2	Kantamanto	UTC	Private	3000	1983
3	Agbogloshie	Agbogloshie	AMA	4000	1990
4	CIBA	Mallam Junction	Private	600	1984
5	Kaneshie	Kaneshie	Private		1972

Various interchange points along the corridor provide public transport services that cover most locations in GAMA, and a number of regional destinations such as Kumasi, Cape Coast and Takoradi. Routes from Mallam run predominantly to the CBD area and suburbs in the vicinity of Mallam. However, a number of longer routes serve Kasoa, Madina in the north and Teshie-Nungua in the east.

From Odorkor, routes serve the areas north of the terminal such as Achimota, Kwashieman and Sowutuom as well as a few regional destinations such as Cape Coast and Takoradi. Terminals in the Kaneshie Market area are used by taxis, tro-tros, bus and intercity services. Most major destinations within GAMA can be reached from a Kaneshie terminal. Kaneshie Main Station serves many GAMA and regional destinations. However, the majority of routes serve the area to the north and northeast of the terminal. Kaneshie-Takoradi Station serves mostly long distance routes to the west (Cape Coast, Takoradi and Tarkwa), while the Abossey Okai Station serves the western Accra suburbs of Korle Bu, Chorkor, Mamprobi etc.

6.0 COMMUNICATION PROCESS, PUBLIC CONSULTATION AND DISCLOSURE

This section concentrates on the BRT communication process plan, consultation and disclosure activities during the environmental assessment of the Project, but also includes reference to consultation and coordination activities that have been undertaken by the Consultant as part of a wider process of stakeholder engagement.

6.1 BRT Communication Process Plan

The various phases of the project identified for communication purposes include:

- Preparation and design;
- Implementation (i.e. preconstruction and construction); and
- Post construction and evaluation

6.1.1 General Communication Stages

The communication strategy being used involves three-step approach:

1. Stakeholder sensitization;
2. Public education; and
3. Education

This three-step approach is directly linked to the phases identified above.

Stakeholder Sensitization

A number of tools identified and being used to disseminate information include:

- Workshops;
- Focus Group Discussions; and
- Education materials.

Public Education

Sensitizations at this level are targeted at the general public who are the ultimate beneficiaries of the project. The focus is on communication through the media. The strategy employed includes:

- Radio and television interviews;
- Newspaper advertisements and press;
- Radio and television advertisements and documentaries;
- Billboards;
- Handbills and other published materials, etc.

Additionally, there will be a series of seminars and public fora to educate the general public.

Evaluation

A series of surveys will be designed and conducted to track awareness and measure the impact of the communication activities over a one-year period. The communications effort at this level will seek to reinforce the message of the project and also invite feedback from all stakeholders on activities.

It is considered that building the discipline of monitoring and evaluation into the strategy from the start will allow:

- Relevant and appropriate use of the information; and
- Review and refine the strategy and keep it as a living, flexible document that supports the wider urban transport project (UTP) objectives.

The assessment process includes:

- Evaluation of participation in and feedback from workshops/ conferences/ discussions/ presentations;

- Evidence of strategy implementation;
- Evidence of translation of strategy into work operations;
- Tracking media coverage including volume and nature of coverage;
- Tracking Parliament/Government and social discussions of the project; and
- Monitoring website usage (how many search hits?).

6.1.2 Communication Tools

The preferred communication channels of the UTP include:

- Workshops, fora, focus group discussions and seminars;
- Media;
- Presentations;
- Publications;
- Emails;
- Reports;
- Project publications and CD-ROMs; and
- Internet

6.2 Consultation and Disclosure

6.2.1 Coordination with Stakeholders

The project design consultant has used BRT Technical Steering Committee as a vehicle for conveying project design proposals to various stakeholder institutions listed below. The views and inputs of the Technical Committee that meets to discuss the project and reports of the project consultant were solicited through their periodic meetings.

- Ministry of Roads and Highways;
- Department of Urban Roads;
- Ghana Highway Authority;
- Environmental Protection Agency;
- Town and Country Planning Department;
- Motor Traffic and Transport Unit, Ghana Police Force;
- Ghana Road Transport Coordinating Council;
- Accra Metropolitan Assembly;
- Ga West District Assembly;
- Land Valuation Board; and
- Lands Commission.

A review of the minutes of the Technical Committee meetings provided useful insights into the various concerns raised by the institutional stakeholders. These include:

- Integration of landuse, transport planning and pedestrian safety in the design;
- Encroachment of hawkers;
- Need to incorporate the concerns of disabled persons into the design;
- Need for critical assessment of major traffic attractors to the CBD area which will affect traffic demand modeling;
- Integration of BRT requirements and junction designs into the N1 design; and
- The need to intensify public education on the project.

Between January 9 and11, 2008, the DUR organized a public forum on the BRT project. The project consultant presented the project design at the forum to solicit comments and inputs into the design.
As part of the project planning and design, the consultant liaised with and contacted the Ghana Railway Company Ltd seeking approval for height and lateral clearances provided for railway lines under the proposed flyover bridge. Other institutions that were contacted are:

- Town and Country Planning Department of AMA: on the layout of the BRT route; and
- ECG, GWCL, GT (now Vodafone): on relocating utility lines and the costs.

6.2.2 *Scoping Phase of the EIA*

A public consultation exercise was undertaken in November 2007 by interviewing and interacting with 103 individuals, comprising 56 females and 47 males. The individuals included transport operators (15), business owners (32), passengers (23), pedestrians (12) and residents (21) in the project area. The interviewees were selected from places of human concentration such as the Orca Déco-Letap area (14), Kaneshie Market and Lorry Park (21), Abossey Okai (17), the Accra Academy area (15), Swanzy Arcade (17), and UTC area (19). Officials of the Kaneshie Transport Union were also consulted.

The purpose of the exercise was to introduce the project to the directly affected stakeholders, to generate feedback on the key issues of environmental concern and their mitigation. Among the issues raised by the stakeholders are:

- Road works would worsen the already bad traffic congestion on the BRT route;
- Business will go down as the public will want to avoid the inconveniences involved in getting to the businesses along the route;
- Dust pollution and the resultant respiratory difficulties;
- Vehicular-pedestrian conflicts;
- Diversion of traffic resulting in long and inconvenient trips;
- Temporary disruptions to water flow, electricity and telephone service;
- Danger involved in crossing the road to access the BRT buses;
- Payment of compensation for demolished shops and structures;
- Long delays in government projects that will expose residents in the project area to long periods of inconveniences due to dust, traffic, etc.
- Exposure of the public, especially children to dangerous conditions, such as trenches, pits, etc;
- Water collected into pits could create good breeding grounds for mosquitoes with attendant increase in malaria cases.

6.2.3 *Main EIA Phase*

This phase aimed to provide information on the Project and also obtain further baseline information as well as consult on the potential impacts and mitigation measures. Discussions/informal interviews were held with relevant stakeholders and they centered on issues including:

- Proposed project works;
- Environmental concerns;
- Effect of project works on business and other activities;
- Effects of the project works on supply of utilities; and
- Resettlement/compensation (where appropriate).

Interviews and focus group discussions were held with samples of residents, business owners, vehicle drivers/operators and traders to seek their views on the BRT and obtain data on their social profile, economic status, and business locations. Summaries of the concerns/views expressed by various consultees are presented in table 6.1 below

Table 6.1 ***Summary of Consultation Outcomes***

	Stakeholder	Persons Consulted	Concerns/Views
1	EPA	Ebenezer Appah-Sampong, Deputy Director, Environmental Assessment and Audit Dept. Kwabena Badu Yeboah, Deputy Director, Greater Accra Region.	• Consultation with businesses and persons in project area as well as other stakeholders to solicit their concerns and views • Exposure of persons to excessive noise and dust pollution during construction works and appropriate measures to mitigate the effects • Cumulative effect on the Odaw River • Effects of construction works on traffic flow on the project corridor and adequate measures to manage the situation • Proper location of borrow areas and their reinstatement • Compensation for businesses which may be affected by works • Impacts on utility supplies to communities • Proper management of liquid and solid waste • Creation of conditions for transmission of diseases.
2	Businesses	Nana Dentu, General Manager, Quickfit Service Centre. Mad. Mavis Osei, Builder's Choice. Agya Poku Adu, Agya Herbs Ltd. James Gadzekpo, Saint James Stationery. Veronica Sackeyfio, VESAC Salon. Akosua Pokua-Adusei, Sweet MotherCare. Mr. Adu-Poku, MD, Jon Willsen Tyre Centre. Fagsal Sharam, MD, Orca Décor. Mr. Alex Addo, MD. Shamrock Bay Enterprises. Joyce Asiamah, Manager, Drinking bar. Mr. Yeboah, Yekwas Enterprise (cement dealer). Mr. Bright Boateng, Sound Lab (Car audio sales). Mr. Charles Oppong Boateng, Nyame Adom Ventures Ltd. Mr. Owusu Banahene, O.B Agrochemicals. Mr. Francis Owusu, Allied Cold Stores. Grace Owusu, By His Grace Restaurant. Kofi Abu, Jomo Spare Parts. Kwaku Okyere, Blessed Hands Spare Parts. Kofi Boadi, HANS Ventures. Janet Agyiri-Obeng, EatWell Restaurant	• Adequate compensation for persons whose businesses or properties would be affected by the project • Restoration of frontages of shops that will be affected by excavations for utility lines • Exposure to dust, a situation that will keep customers away • Inadequate access to premises • Limited space for business activities due to the creation of diversion routes close to their premises • Exposure to noise pollution and vibrations • Damage to water supply and electricity lines resulting in power outages and disruptions in water supply • Effect of works on the already heavy traffic on the Graphic road and the Kwame Nkrumah Avenue • Execution of some of the work activities that will generate excessive noise and dust early in the morning (before business starts at 0800hr) or over the weekends (particularly on Sundays) to limit the expose of persons to these impacts • Long delays in government projects which could affect their businesses for long periods of time • Creation of muddy conditions during the rains • Insanitary conditions resulting from choked drains and wastes • Difficulty in and cost of relocating business • Loss of customers as they will avoid inconveniences in project area
3	Residents	Rev. Adjei Daffour, Repentance to Salvation Ministry, Tema Abraham Torgbor Mensah, Businessman Mercy Afflu, Nurse, Holy Trinity Clinic Alex Adjetey, Mechanic Ransford Adomako-Nyame, Student, Central University College Mad. Benedicta Ahulu, Pensioneer/Trader	• Exposure to dust pollution and the associated health problems especially for children • Noise pollution and disturbance of rest and sleep • Damage to water supply and electricity lines resulting in power outages and disruptions in water supply • Management of waste generated by construction workers, food sellers and others • Creation of man-holes and trenches and the possible danger they pose to residents, especially children and the elderly • Increase in incidence of malaria due to the collection of water in man-holes and trenches where mosquitoes would

	Otu Baako-Essien, SSNIT Esther Adjetey, Seamstress Akwasi Agyemang Afrifa, Spare parts dealer Opanin Agyei Manu, Businessman Asare Baffour, Driver Comfort Addai, Food vendor, Kaneshie Musah Gibrine, Motor/bicycle mechanic Alex Sowah, Trader Evelyn Paddi, Nurse, Korle Bu Teaching Hospital Maame Entwi-Mensah, Businesswoman Alfred Dzakpatsu, Teacher, Blessed Mary School and Creche, Dome Akosua Dansowaa, Hairdresser Matthew Dorwuna-Hammond, Ghana National Fire Service Gyasi Preko, Businessman Imoro Musah, Vulcanizer Nana Abu Bonsrah, Public servant John Sei-Dzandu Jonathan Aklologo, Student Accra Polytechnic Lovelace Bremansu, Trader	thrive • Provision of employment for the many unemployed youth in the area. • Influx of "strangers" and the potential for increased crime • Diversion of traffic into roads in communities and the dangers associated with it. • Compensation for persons whose properties will be affected • Migration of labour to the area and potential conflict with the youth • Potential rise in incidence of STDs including HIV/AIDS • Traffic hold-ups and delays in journeys • Reckless driving of trucks and accidents • Safety of residents especially children and the elderly • Siltation of drains with excavated soils and the creation of pools of stagnant water for disease vectors • Creation of insanitary conditions resulting from non-management of wastes

Although various consultees came up with what in their opinion would constitute impacts of the project and had some misgivings, there was no outright opposition to the construction and operation of the BRT. Most of the consultees welcomed the BRT and hoped that it would be constructed on schedule to minimize the duration of the impacts associated with the construction phase. Some of them, however, expressed doubts about the readiness of the government to pay appropriate compensation for affected properties and businesses.

In addition to the above individual consultees, interactions were held with the leaders of the various Transport Unions Ghana Private Road Transport Union (GPRTU) of the Trade Union Congress (TUC) operating from the Kaneshie market area and Accra Central area. The unions include the Kaneshie Transport Union, the Odorkor-Circle branch, the Total branch and the Okaishie-Kumasi Cargo Service, all of the GPRTU of the TUC. It was clear from the interactions with the drivers that were not very much aware of the BRT. Though some of the executives were aware of the proposed BRT, the majority of union members were quite oblivious of the project. It appeared the representatives of the drivers' union on the BRT Steering Committee may not have briefed the rank and file of the unions about the BRT Project and the role of the unions to ensure its successful construction and operation. Not surprisingly therefore, the drivers' unions were not in favour of the project. The main reason for their rejection of the project was purely economic and had nothing to do with the potential environmental and social impacts of the project.

The drivers pointed out the negative impact of the projects on their livelihood. Most of the drivers interviewed believed that the project will have negative impacts on their business in terms of loss of revenue. They indicated that they may have to relocate from their current stations of operation and that can affect their passenger base and thereby reduce their daily sales. They also cited the competition for passengers with the BRT fleet on the road corridors. The BRT buses which will be newer will operate on a strict schedule and that will attract passengers to patronise the BRT buses at the expense of the tro-tro buses.

Focus group discussions were also held with leadership of the Kaneshie Market Traders Association to obtain information on their perceptions about the BRT project and the possible impacts on their livelihood activities and resettlement options. Other issues discussed were the scale and duration of their operations. Executive of Market Association provided information on how long they have been operating from the current zone, and the challenges they face at current sites. For those traders selling on the pavements, especially around the Kaneshie Market area, who may be displaced by the project, the discussions focused on resettlement issues such as compensations. The traders expressed worry at their possible displacement and expressed the fear that they may not be relocated to places where they can continue to profitably engage in their trade. Some also expressed the need for the AMA to work together with them when it becomes necessary to move from their places of operations.

In early August 2009, questionnaires were administered to a cross-section of stakeholders in the project corridor (see table below for list of stakeholders). The questionnaire sought to solicit the respondents' views on potential impacts of the project during both the construction and operational phases and proposals for the mitigation of the identified impacts.

Analysis of the questionnaires indicates that the most important potential negative impacts, in terms of the number of respondents who identified them, are as follows:

1. Noise and vibration (through operation of equipment and machinery);
2. Air pollution (through dust generation);
3. Disruption of public utilities (during relocation of cables and pipes);
4. Impacts on traffic flow;
5. Visual intrusion (blocking of view by the infrastructure);
6. Waste generation (excavated soils and rocks and domestic waste);
7. Surface water pollution (introduction of materials into water bodies);
8. Impacts on public health and safety (creation of conditions for disease vectors and accidents); and
9. Occupational health and safety (the safety of workers on the project).

Table 6.2 List of Stakeholders to whom Questionnaires were Administered

Ashiedu Keteke Sub-Metropolitan Assembly	Okaikoi Sub-Metropolitan Assembly
Graphic Communications Group	Kaneshie Market Company
Kaneshie Transport Union	Intercontinental Bank
UBA Bank	Agricultural Development Bank
Total Fuel Station	Shell Fuel Station
Goil Fuel Station	VW Automobile
Modern Automobile Services	Japan Motors
Nissan Motors	Orca Decor
Rainbow Trading Co. Ltd	Quickfit Service Centre
Shamrock Bay Enterprise	Allied Cold Stores Limited

6.2.4 Disclosure

The World Bank's policy on disclosure requires that all the people residing in the given areas of a project have the right to be informed of the proposed development project in the respective areas. Twelve copies of this report will be submitted to the EPA. The Agency will make copies of the report available in its library at the head office and Greater Accra Regional office for public review and comments on the findings of the assessment. Copies of the report will also be available at the offices of the DUR and Accra Metroplitan Assembly as well as the offices of the relevant sub-metropolitan assemblies, including Ashiedu Keteke, Ablekuma, Okaikoi and Osu Klottey sub-metropolitan assemblies.

The World Bank will prepare a summary of the report and other relevant information on the project which will be disclosed to the Ghanaian public. The disclosure shall be carried out in-country through the

Ministry of Roads and Highways and the DUR. The summary shall also be made available at the World Bank Info-shop in Washington.

7.0 ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

7.1 Introduction

With respect to the World Bank Safeguard Policies, the implementation of the BRT Pilot Project will trigger the Safeguard Policies on:

1. Environmental assessment;
2. Involuntary resettlement; and
3. Cultural property.

Against the requirements of the Ghana Environmental Assessment Regulations LI 1652, the project fall under Schedule 2 Undertakings for which EIA is mandatory.

7.2 Methodology for Impact Identification and Assessment

The aim of this section is to identify and assess the environmental and social impacts likely to be associated with the pilot BRT project. Though both environmental and socio-economic benefits (positive impacts) could be derived from the project, the emphasis of this assessment is on the potential negative environmental impacts, particularly associated with the construction phase of the project.
The key environmental issues were identified based on the following:

- Field observations;
- Review of literature on similar projects;
- Use of checklists;
- Experience gained from working on similar projects; and
- Consultation with stakeholders.

The impacts of the project on the baseline conditions and features in the project area are mainly categorized on the basis of the stage of project development – construction or operation. Additionally, the impacts were evaluated as to whether they are:

- Positive/negative;
- Permanent/temporary; and
- Cumulative.

Construction Phase Impacts include:

- Displacement of persons and businesses;
- Demolition of structures;
- Impacts on air quality;
- Impacts on ambient noise and vibration levels;
- Impacts on water resources and drainage;
- Construction waste generation;
- Disruption of public utilities;
- Modification of Landscape;
- Impact on Traffic;
- Impact on Public health and safety;
- Impact on Occupational health and Safety;
- Construction camp issues; and
- Archaeological/cultural impacts.

Operational phase impacts include:

- Improved Air Quality
- Noise and Vibration

- Road Safety and Travelling Comfort
- Improved Transportation Services
- Improved Access to the City Centre
- Reduced Vehicle Operating Cost and Expenditure on Transport
- Reduction in Government Expenditure on Fuel
- Increased Vehicular-Pedestrian Conflicts
- Displacement of Trotro Operators
- Potential Traffic Congestion

7.3 Potential Construction Phase Impacts

The potential environmental and social impacts associated with the proposed project works include those described below.

7.3.1 Displacement of Project Affected Persons/Businesses

The results of the baseline surveys indicate that the reconstruction of sections of Winneba Road from the First Light to Obetsebi Lamptey Road, Graphic Road and Kwame Nkrumah Avenue into exclusive BRT bus lanes will displace some stakeholders who earn their leaving in the road corridor. Major stakeholders who will be affected are presented in table 7.1 below.

Table 7. 1 ***Identification of Project Affected Persons***

ITEM	LEVEL OF DISPLACEMENT	NO. OF STRUCTURES/ VEHICLES	PERSONS AFFECTED	COMMENTS
WINNEBA ROAD				
Commercial Vehicles Operators who park in road carriageway around the Kaneshie Market Area	Total Displacement from the carriageway	Average of 1,200 vehicles/day	1,200 Drivers, 1,200 Mates and 1,200 Vehicle Owners to be affected	To reduce congestion in the corridor
Assorted Traders Operating on Road Sidewalk/Pavements around Kaneshie Market	Total Displacement from road sidewalks	886	917	To allow pedestrians to use the sidewalk
Assorted Traders Operating in Road Median	Total Displacement	184	191	To allow for construction
Okaishie Kumasi Cargo Service Operating in Road Median	Total Displacement	3	130	To allow for construction
Mama Grace Restaurant Operating in Road Median ant	Total Displacement	5	1	To allow for construction
Metro Mass Transport Operating in Road Median	Total Displacement	2		To allow for construction

7.3.2 Demolition of Structures

The only permanent structures that will be demolished are two passenger sheds at the yard of the Metro Mass Transit at the Bonsu Brothers area. These sheds will have to be demolished to create space for the BRT terminal.

7.3.3 Air Quality/Dust Pollution

Construction works will involve excavation and other earthmoving activities that will release dust particles into the air. The delivery of sand, gravels and aggregates to the project sites will also release plumes of dust into the atmosphere as will the movement of construction equipment and trucks on exposed loosened soils. The quality of air in the work area would deteriorate with an increase in levels of dust. The high level of dust in the atmosphere is considered significant since the project corridor is very busy with a high concentration of persons in places such as the Kaneshie Market, Abossey Okai Spare Parts Market and the Bonsu-Brothers-UTC area. Thus, a significant number of persons engaged in business and the travelling public would be exposed to dust pollution. The extent of the pollution would depend on the intensity of works and the season; intensive works during dry periods (ie. Harmattan season between November-February) would generate the most dust.

Fumes from construction equipment (asphalt plants, concrete mixers, etc) and trucks plying the road would increase the concentration of carbon monoxide, nitrogen oxide, lead, hydrocarbons, and specific particulate matter in the air. These pollutants can induce several health problems (coughing, sneezing and eye irritation). The impact is considered to be negative and significant particularly in areas where commercial activities and residential accommodation are located close to the road.

The 24-hour PM_{10} values at the Graphic, First Light and Mallam Junction monitoring sites range from 25.7 to 3421$\mu g/m^3$, 29.6 to 2672$\mu g/m^3$, and 28.5 to 2790$\mu g/m^3$ respectively. These indicate high levels of particulates in the air in the project corridor. Dust and other particulates released into the atmosphere during the construction phase of the project would therefore increase the volume of particulates and therefore have a cumulative effect on ambient air quality. The changes in quality of air are considered significant since they could have direct implications for the health of workers on site and the general public. Mitigation measures will be required to reduce the impact of project activities on air quality within the project area during the construction phase.

7.3.4 Noise and Vibration

Noise levels measured at the Obestsebi Lamptey Circle and Mallam Junction Total Station are high with a Leq (24hr) of 69 dB(A) and 64.7dB(A) respectively. Ambient background noise and vibration levels are expected to increase as a result of various construction activities including excavations, drilling, piling, ramping and the operation of heavy construction equipment and trucks. Construction equipment that would be deployed at the project sites include dozers, graders, scrapers, concrete mixers, and pile drivers could generate noise levels in the range of 75-100 dB(A)[7], increasing the ambient noise level.

The use of these equipment would result in the emission of high noise levels along the project corridor, especially at work sites between First Light Junction and the Kwame Nkrumah Avenue. Businesses and residents closest to the work sites would be exposed to noise levels which could be higher than EPA's ambient permissible daytime noise level of 60 dB(A) for commercial or light industrial areas. High noise levels would constitute a significant nuisance in places such as Kaneshie Market, Abossey Okai Spare Parts Market and where there are large concentrations of persons. Construction workers will be the most exposed to high noise levels.

Vibrations will occur when heavy construction equipment and large trucks operate at the work sites. Continuous vibrations can cause cracks in structures and create discomfort and nervous problems in humans. The overall impact of noise and vibration on the surrounding environment is expected to be significant but temporal; noise generation at a work site would cease with completion of project works there.

[7] US EPA, 1997; "Noise from Construction Equipment and Operations, building Equipment and Home Appliances". NTID 300.1

7.3.5 *Impact on Water Resources and Drainage*

Of the water bodies in the project corridor, it is the Odaw Stream that will be directly impacted upon by construction activities since the Lafa and Bawere Streams are located outside the main work zone (i.e. the First Light-Kwame Nkrumah Avenue). Expansion works on the existing Odaw Bridge will involve drilling and concrete works within the Odaw channel. This will introduce debris and earth directly into the Odaw Stream. Soils removed as a result of the drilling works will be released directly into the channel. Cement, sand, stones and other materials could also be released into the stream during reinforcement and concrete works.

Surface run-off from construction sites and camp would carry hydrocarbons e.g. waste oil and lubricants into the Odaw Stream. The impact on water quality is considered negative and cumulative since the Odaw Stream is already burdened with domestic, municipal and industrial wastes.

Implementation of the project would necessitate excavations and earth movements. These activities would expose loosened soils which could be washed and deposited in nearby drains. The construction of new culverts could also result in the siltation of watercourses. The significance of the siltation of drains and watercourses is that it would be adding to the waste loads already deposited in most of the drains in the project corridor. Drains in the area are choked mostly with plastic and domestic wastes and this affects the free flow of storm water leading to flooding in areas along the road corridor. The deposition of silt resulting from works on the BRT project would therefore be contributing to the problem of flooding in the area. Generally, in the construction phase, the impact on water resources and drainage would be negative and significant.

7.3.6 *Generation of Construction Waste*

Large quantities of construction waste would be generated from works on the project roads. The construction of the BRT route would involve removal of the median in the project roads together with all objects (billboards, avenue trees, etc) within it, parts of the existing bituminous road surface and old bridge materials on the Odaw Channel. The concrete crash barriers and pedestrian footbridges in front of the Kaneshie Market would also be removed. Between Mallam and First Light Junction, 2,400m^3 of debris from the demolition of the existing kerb including foundation would be disposed off. From First Light to UTC area, works will involve the removal of existing kerb and surface dressing and disposal of an estimated 22,540m^3 of waste. About 800m^3 of waste will be generated from the demolition and site clearance between Kwame Nkrumah Avenue and Barnes Road. About 50 avenue trees on the Graphic road and Kwame Nkrumah Avenue would be uprooted. These wastes would have to be removed from the work zone to create an obstruction free environment for the effective execution of the project works.

7.3.7 *Construction Camp Impacts*

The Contractor will establish a construction camp at a location in the vicinity of the proposed BRT route. However, the potential sites for the camp had not been identified at the time of the assessment. Facilities at the camp will probably include offices, laboratories, asphalt and concrete batching plants, vehicle maintenance workshops, material storage areas and ablution facilities.

The construction and operation of the camp would result in some impacts that would require mitigation. Dust generation and soil erosion would result during site preparation and construction activities on the selected camp site.

Used oils and fuels generated from the servicing of project plant, equipment and trucks as well as spent chemicals from the laboratory would constitute an important source of liquid waste. The liquid wastes, if not managed properly could lead to pollution of both surface and underground water as well as soils. Improperly managed oils could be washed into surface drains and eventually into the Odaw Stream as well as contaminate underground water resources through spillage.

Noise and fumes from concrete and asphalt plants in the camp would exposure persons in the area to disturbance and air pollution. Material wastes, mainly waste paper and packaging materials, will be generated in the offices. Volumes of these wastes is however likely to be low and insignificant as administrative activities would be minimized.

Considering that over 200 persons will be employed on the project, liquid and solid waste from the ablution facilities will be an important waste stream that will have to be managed properly in order not to create insanitary conditions which could result in the outbreak of diseases.

An important environmental risk at the camp would be the outbreak of fires. The use and storage of inflammable fuels and oils in a space where activities such as welding will take place could create conditions for fires. Since various electricity-powered office equipment and appliances such as computers, printers and air-conditioners, etc will be installed, electrical fires could be a real danger at the camp. The use of inferior cables, faulty electrical wiring, improper installation and overloading of circuits are all electrical faults, which if not detected early and rectified could result in fires. Fires at the camp could lead to injuries, loss of lives and damage to properties.

7.3.8 Disruption of Public Utilities

The project corridor has a mix of industrial, commercial, residential and service land uses and hosts the Kaneshie Market, the Abossey Okai Spare Parts Market, the Bonsu Brothers-UTC business area, as well as many leading businesses including banks, shops and offices. The corridor is therefore served with electricity, telephone facilities and water which are supplied via underground and overhead cables and pipes. These underground pipes and overhead lines along and across the project roads will have to be relocated to make room for the proposed project works.

Excavations and other earth moving activities could destroy electricity cables, telephone cables and water distribution pipes if they are not relocated prior to the commencement of project works. It is estimated that 1.35km of power lines, 9km of water supply pipes, 2.14km of telephone lines along the road corridor will have to be relocated. The relocation as well as potential destruction of the utility lines would result in temporary disruption of power, water supply and telecommunication services to suburbs of commercial, industrial and residential importance along the project road as well as other areas serviced by these utilities. The impact on public utilities in the construction phase is negative and significant as it will impact negatively on the livelihoods of several thousands of residents and socio-economic activities in the suburbs.

7.3.9 Traffic Impacts

Traffic Diversions

Construction activities on the project roads are likely to cause traffic delays, especially in busy sections of the road such as the Kaneshie Market-Obestebi Lamptey Circle, Graphic road and Kwame Nkrumah Avenue. With the traffic volume of more than 25,000 vehicles daily, it will be necessary during the construction period to move traffic off the corridor onto certain designated diversion routes in the neighbourhood. This will help in creating sufficient road space for project works to progress efficiently and safely.

Construction works on the Odaw Bridge and the Flyover Bridge would obstruct the free flow of traffic on the Graphic road with the attendant traffic congestion. Traffic on the road would therefore have to be diverted onto existing routes in the project area or routes built at the bridge points for the purpose. Construction activities on the circular roads would also affect the flow of traffic to the CBD.

Traffic diversions may obstruct routes from residential areas to offices, markets and other areas thereby increasing travel times for pedestrians and vehicles. Traffic jams, increased periods of waiting and traffic accidents may result from traffic diversions. The impact of project works on traffic and road users would be negative and significant.

Vehicular-Pedestrian Conflicts

Related to the traffic diversions are pedestrian-vehicular conflicts which are likely to occur on the project roads and diversion routes. This impact will occur in the work zone and the neighbouring suburbs between members of the general public, project workers, trucks and equipment used by the Contractor(s). Such conflicts will be most pronounced in the areas of high commercial activity or heavy traffic such as the First Light-Kaneshie Market area, Graphic road, Kingsway-UTC area.

7.3.10 Public Health and safety

The effect of emission of smoke and hydrocarbon particulates from project plant and equipment as well as dust pollution on public health has been alluded to elsewhere. Additionally, execution of the project could have negative implications for the health and safety of the general public, particularly the thousands of residents and persons who do business along the project corridor. Project activities could create conditions for malaria and other diseases as well as expose the public to accidents and injuries.

(a) Malaria

During the construction phase, stagnant water could collect in pits and trenches created as a result of excavations at the project sites. The collection of stagnant water would create conditions suitable for the breeding of mosquitoes and other disease vectors. The breeding of mosquitoes, particularly in the residential neighbourhoods, will expose residents to mosquitoes with the attendant increase in the incidence of malaria.

(b) Other Diseases

Inadequate management of domestic solid and liquid waste and construction waste generated at the work sites and construction camp(s) would create conditions for the growth of vectors of diseases such as cholera and dysentery. The outbreak of these diseases would have far-reaching negative implications for the health of residents in the environs of the project corridor.

(c) Safety

Project activities such as excavations and truck movements would expose members of the public to risks such as accidents and injuries. The project roads traverse busy residential, commercial and industrial areas with lots of persons undertaking various ventures. These persons will be operating in the space where their presence and activities could bring them into conflict with construction activities. Such conflict would expose them to risks and hazards that could result in injuries and fatalities.

7.3.11 Occupational Health and Safety

Construction activities would expose about 300 workers on site to conditions that could be hazardous/risky to their health and safety. The potential for safety and health hazards will be most acute when:

- Workers are not provided with adequate personal protective equipment and enforced to use them;
- Technical specifications relevant to safety measures are disregarded in the installation and use of plant and equipment (e.g. negligent execution of works, general non-observance of safety rules) leading to inherently unsafe systems;
- The operating personnel have not received sufficient training and experience in connection with safety measures and their observance; and
- Improper and insufficient supervision of workers.

The workers will be exposed to dust pollution and its attendant respiratory difficulties; noise and vibration that could result in temporary or permanent hearing loss; injuries resulting from falling from heights and falling objects, as well as from the improper handling of equipment and tools. The workers could also suffer cuts by stepping on sharp objects such as nails and other metal off-cuts. Injuries could also occur from clashes between vehicles and the workers as they both operate within the same space. This impact is

considered significant since it affects human lives and would therefore require adequate mitigation measures.

7.3.12 Landscape Modification

Removal of the median in the project roads, excavations, stockpiling of aggregates and other materials as well as roadside littering will modify the landscape. In addition, large quantities of construction waste will be generated. Improper stockpiling of such waste and the indiscriminate parking of construction equipment could affect the aesthetics of the project area. Since the project roads pass through commercial and industrial areas in or close to the CBD of Accra, the impact of the project works on the aesthetic and visual quality of the landscape is considered negative and significant. The impact would however, be temporary as it would be existent mainly during the construction phase of the project.

It is expected that the local visual characteristics of the Graphic road would be affected by the presence of the Flyover Bridge. Currently, motorists and pedestrians have a good view of Graphic road. However, with the construction of the 6.10m-high bridge, this view will be blocked. Optical impairment of the landscape by the presence of the bridge is unavoidable and could be regarded as a residual impact.

Large volumes of aggregates, sand and gravel will be required for construction works on the BRT route and these will be worn from sand pits, quarries and borrow pits. Landscape disfiguration will occur with the establishment and operation of the sand and borrow pits and quarries.

The reconstruction of the OLC roundabout to allow for the bus lanes to pass through the middle of the roundabout will result in landscape modification (figure 3.1). Redesigning the OLC roundabout will result in aesthetic and visual quality impact of the landscape which impact will be permanent.

7.3.13 Archaeological / Cultural Impacts

The likelihood of disturbing chance finds appears to be low as there is little or no evidence of archaeological sites in the project corridor, especially between Fist Light Junction and Kwame Nkrumah Avenue, where most of the excavations and earth movements would take place. Although there is a remote possibility of the existence of such sites or objects, it is important that this potential impact is considered and appropriate mitigation proposed for it.

The BRT route is of median location and would go through the Obetsebi Lamptey Circle. Located in the centre of the Circle is the statue of Obetsebi Lamptey. The creation of the BRT would therefore involve the removal of the part of the Circle and the statue. This could lead to public agitation if not properly handled. Such development could lead to delay of implementation and could cause serious corporate risks.

7.3.14 Economic Impact

The BRT project would create employment opportunities for skilled as well as unskilled labour in the project area. It is estimated that some 300 persons would be directly employed in the construction of the BRT. In addition to these employees, the project would create indirect employment or income-earning opportunities for a number of people, such as food vendors and petty traders, who would provide supporting services to the employees. There will also be opportunities for people engaged in the project implementation to upgrade their technical skills. The impact on employment and income is considered to be significant and positive in both construction and operation phases.

7.4 Potential Operational Phase Impacts

The operational phase of the project will have mostly positive impacts since most of the negative effects will be significantly minimized. However there will be some negative impacts associated with the operational phase. The positive environmental impacts of the BRT would include those described below.

7.4.1 Improved Air Quality

Most of the tro-tro's and buses plying the Winneba and Graphic roads are not energy efficient and emit a lot of smoke and hydrocarbon particulates into the air. With the implementation of the BRT project and the replacement of the tro-tro's and mini-buses with energy efficient large buses, there is likely to be a significant reduction in vehicular emissions into the atmosphere. It is estimated that the BRT will reduce carbon dioxide by 10 percent. The resultant improvement in air quality would have very positive impacts on public health, especially for the hundreds of residents and people who do throng places such as the Kaneshie Market, Abossey Okai Spare Parts Market and the UTC area to do business every day. Improvement of the road condition will ease the movement of vehicles and result in a more cost effective consumption of fuel and reduced production of exhaust fumes by vehicles using the road. Consequently, there will be improved air quality along the road corridor. The post construction impact on air quality is therefore positive.

7.4.2 Noise and Vibration

High noise and vibration levels associated with the construction phase of the project would cease after completion of the works. In the operational phase, vehicular movement would cause noise and vibrations but the impacts are not expected to exceed the present level of noise and vibration. There will be significant reduction in noise associated with the removal of tro-tro's and mini-buses and their replacement by more efficient large bus services operating within the BRT lanes.

7.4.3 Road Safety and Travelling Comfort

The use of transport terminals for loading and unloading passengers and the traffic safety measurements that the BRT designs take into account will significantly reduce vehicle-vehicle and pedestrian-vehicular conflicts. Overall increases in vehicle speeds through traffic management measures and removal of congesting activities at informal tro-tro terminals dotted along the road will result in substantial reductions in bus passenger travel times for trips made within the Winneba Road corridor. The provision of overhead bridge over the railway line including the provision of an at-grade pedestrian walkway will reduce the human-rail-vehicular conflicts and the associated accidents in the area. The impact is significant and long term but localized.

7.4.4 Improved Transportation Services

The introduction of the scheduled BRT service in the project will improve road transport services in the corridor drastically. The large capacity buses will augment the existing number of buses that ply communities within the project corridor such as the Metro-mass transit buses. The proposed scheduling of the movement of the BRT buses will promote efficiency in the service delivery. The proposed BRT service is expected to reduce waiting time in for passengers. This coupled with the use of modern buses and the introduction of new fare collection system will enhance the quality of journeys in the project corridor during the operational phase of the project. This impact is significant and long term.

7.4.5 Improved Access to the City Centre

The proposal to develop a dedicated bus lane from First Light Junction to UTC (Bonsu Brothers) for the operation of BRT system will reduce the travelling time between communities along the Accra-Winneba Road and Accra Central (City Centre). The expansion of the Odaw Bridge and the provision of an overpass bridge across the railway line are also expected to reduce traffic congestion on the Graphic Road. These two interventions under the project are expected to improve access to Accra Central from western corridor during the operational phase of the project. This impact is significant and long term as well as regional.

The significant reduction in traffic congestion and the improved travel times within the Winneba corridor will have a positive impact on trade and commerce and other economic activities. The BRT and the associated gains in travel times would be good for business as improved access to markets, offices and commercial/business areas is key to enterprise development and growth. The movement of persons, goods

and services from the Western and Central regions and Kasoa and its environs in particular to the CBD would be greatly enhanced and the return flow would equally be fast and safe.

7.4.6 Reduced Vehicle Operating Cost and Expenditure on Transport

Upon the completion of the project, motorists will benefit from the saving accruing from a reduction in the vehicle operation cost. This will happen in two ways. Firstly, construction of the over pass at the railway crossing on the Graphic road traffic conditions will improve leading to improved speeds. Given the inverse relationship between speed and fuel consumption expenditure on fuel and lubricants will reduce given pump prices. Secondly, with the introduction of the more efficient public BRT system in the corridor it is envisaged that there will be shift from the use private vehicles to the public transport system. As the unit cost of accessing public transport is lower than the use of private cars, households are expected to make savings on their monthly expenditure on transport all things being equal. This impact is significant, long term and regional.

7.4.7 Reduction in Government Expenditure on Fuel

Closely related to point above is the expected reduction in the importation of fuel by government. This will result from the expected shift to public transport and decongestions on our roads. Fuel import is a major item to the current account section and major contributor to balance of payment problem and inflationary pressure in Ghana. The expected reduction in the importation of fuel associated with the pilot project is slightly significant, long term and regional.

7.4.8 Negative Impacts

The operational phase may present some negative challenges that needs to be mitigated. Some of the expected negative impacts during the operational phase are discussed below.

a) Increased Vehicular-Pedestrian Conflicts

The existing two carriage ways will increase to three after the segregation of the bus lane from the mix traffic lanes from Graphic Road to First Light. This means that pedestrians will have to cross three carriage ways instead of two. This has the potential to increase vehicular-pedestrian conflict during the operational phase of the project. Knockdowns could increase when pedestrians cross the road without proper caution.

An issue that could arise during the operation of the BRT is that of overcrowding at the bus stations especially at those sections where the BRT is segregated from the mixed traffic. There is a tendency for waiting spaces to get overcrowded with pedestrians waiting to cross the road from or to the bus stations. This issue could be worsened with the arrival of two or three BRT buses at about the same time with the passengers rushing to the crossing point at the same time. In the event of such a situation, the tendency for vehicular-pedestrian conflict could increase significantly, resulting in knockdowns. Children will be at greater risk since they are usually out-muscled by older folk in such situations and may more likely be the ones pushed onto the street. This impact will be significant at terminals sited near schools or market places where there would be significant numbers of school children or market women crossing the road.

b) Displacement of Trotro Operators

Tro-tro and bus vehicles account for nearly 39% of all vehicles along the project corridor. These are likely to be displaced with the more efficient BRT service. This situation could result in untold economic hardship to the operators of the existing public transport services. Both drivers and their car owners may be out of employment resulting in economic hardship for their dependants.

c) Potential Traffic Congestion

Table 5.7 shows that about 39 % of all vehicle trips are made of tro-tros and buses. Analysis of passenger flow by vehicle type underlines the importance of public transport to a majority of travelers along the corridor as over 80% of the trips are made on tro-tros or buses (table 5.8). From First Light to OLC, two

lanes will be taken (one from each carriageway) from the existing six lanes for segregation into the BRT lanes. The number of lanes on each carriageway will thus reduce. Dedicating lanes for BRT thus implies that traffic congestion will increase in the other lanes other than the dedicated BRT lanes as more vehicles will now have to use the remaining two lanes. This will increase travel time for majority of road users. Inefficient management of the BRT services thus will affect about 80% of travelers on this corridor.

Summary:

In summary, the expected outcomes of the BRT project, listed below, would offset the adverse effects associated with the project implementation:

- Reduction in noise and air pollution associated with the removal of tro-tros and their replacement by more efficient large bus services operating within the BRT lanes;
- Reductions in bus passenger travel times for trips made within the Winneba corridor;
- Overall increases in vehicle speeds through traffic management measures and removal of congesting activities at informal tro-tro terminals;
- Introduction of traffic control measures at junctions to reduce vehicle and pedestrian accidents;
- Transfer of vehicle and taxi passengers to new bus services;
- Stimulation of development associated with improvements in accessibility along the corridor and in the CBD;
- Landscaping along BRT route and at stations;
- Improved drainage along the project corridor which has been subject to flooding; and
- Improvements in accessibility of residents of flanking communities through the provision of additional feeder bus routes and services to BRT stations.

7.5 Evaluation of Potential Positive and Negative Impacts

The environmental and social impacts are scored on a basis of 0 to a maximum of 3. Positive impacts are indicated by positive signs (+) and negative ones by negative signs (-). The number reflects the magnitude of the impact, where 1 denotes low impact, 2 moderate impact and 3 high impact; "0" indicates that no impact is expected. The score for the identified impacts of the project is presented in table 7.2 below.

Table 7.2 Scoring of Positive and Negative Impacts

Environmental Components	Construction Phase	Operational Phase	Mitigation Required
Displacement of project affected persons/businesses	-3	0	Yes
Demolition of structures	-2	0	Yes
Air Quality	-3	+1	Yes
Water Resources	-2	+1	Yes
Noise and vibration	-3	+2	Yes
Disposal of Construction Waste	-3	0	Yes
Disruption of utilities	-3	0	Yes
Traffic impacts	-3	+2	Yes
Public Health & safety	-2	+1	Yes
Occupational health & safety	-3	0	Yes
Landscape modification	-2	+1	Yes
Archaeological/Cultural impact	-1	0	Yes
Road safety	-1	+2	
Transportation service	-1	+2	
Access to city centre	-1	+3	
Vehicle operating cost	0	+2	
Government expenditure	0	+1	

8.0 MITIGATION OF ENVIRONMENTAL AND SOCIAL IMPACTS

8.1 Introduction

The issues of environmental concern mostly relate to the construction phase of the project and to the activities of the Contractor. The emphasis of the assessment has been on the construction phase impacts and therefore, as outlined below, the Contractor carries the responsibility of implementing measures to mitigate the negative outcomes of the activities. However, the ultimate environmental management responsibility for the BRT project will rest with the DUR. The Environmental Management Unit of the DUR will work closely with and support the Contractor(s) to ensure that appropriate mitigation measures are implemented.

8.2 Mitigation of Construction Phase Impacts

8.2.1 Displacement of Project Affected Persons and Demolition of Structures

A number of measures were adopted at feasibility and design stages of the project to minimize the adverse project impacts on the human activities, land use and properties in and along the project routes. Notable among these interventions are:

1. Construction of an overpass bridge over the railway crossing near Letap Jewellery on the Graphic Road to reduce the possible railway-road conflict;
2. The expansion and re-construction of the bridge over the Odaw River on the Graphic Road to cater for the BRT bus lanes;
3. Converting two (2) lanes on existing dual carriage way (6 six lanes) into the priority/exclusive bus lanes if possible (e.g. around the Kaneshie Market) to save structures like the Kaneshie Market, SG-SSB Bank and other structures; and
4. Using the road median of the Kwame Nkrumah Avenue around Bonsu Brothers as the pilot route rather than expanding the existing carriage way.

These design considerations have reduced intensity of the adverse impacts on the human activities and properties along the project routes.

There are a number of activities and land uses that will be displaced before construction work can begin. For the petty traders within the median of the Kwame Nkrumah Avenue around the Bonsu Brothers Building in Accra Central and on the pavement around the Kaneshie Market whose temporary structures will be displaced, appropriate compensation will be paid for the loss of the structure and supplementary allowance to cover for short term unemployment and other externalities. All issues related to compensation have been addressed in the Resettlement Action Plan (RAP). In addition the traders may apply to sell in any designated hawkers markets in the city.

The fence walls of the two companies along the Graphic Road which will be demolished due to the construction of the overpass at the railway crossing will be instated at a cost to the project while businesses whose frontages will be affected along the Graphic Road will be compensated for the land take. Additionally, facilities belonging to the Ghana Railway Corporation which will be demolished will also be appropriately valued and compensation will be paid to the Corporation before they are demolished. Compensation for these demolitions has been dealt with in detail in the EIA report on the bridge works on the Graphic Road.

The shops who display their wares on the pavement around the Kaneshie Market will be asked to remove their wares from the pavement before construction begins.

All compensation and resettlement issues will be handled within the Framework of the O.P. 4.12, Act 125 and other local and international protocols.

The full costs of resettlement activities necessary to achieve the objectives of the project are included in the total costs of the project. The budget is summarised below in table 8.1 below. Details on the compensation and resettlement are presented in the RAP.

Table 8.1 Budgets Estimate of Compensation and Resettlement

No.	Items	No of Business Activities	Amount (GH¢)
1	Supplemental Assistance - Fully Impacted Temporary Structures in Mallam – Kaneshie Corridor	886	**200,805.00**
2	Supplemental Assistance - Fully Impacted Temporary Structures in Kwame Nkrumah Avenue Corridor	190	**46,705.00**
3	Public Meeting and Disclosure		**1,200.00**
4	Training for Resettlement Staff		**500.00**
5	Monitoring of RAP by DUR, (5 visits by PMU)		**1,200.00**
6	Grievance Redress and Dispute Resolutions		**1,000.00**
7	Evaluation and Audit by Independent Consultant		**35,000.00**
8	Sub-total		**286,410.00**
9	Contingencies/Provisional Cost (10% of subtotal cost)		**28,641.00**
10	**Grand Total**		**315,051.00**

8.2.2 Air Quality/ Dust Pollution

The Contractor will implement dust suppression measures to reduce dust particles released into the air. Daily spraying of exposed surfaces by water dowsers is the only practical method of dust suppression. The Contractor will confirm the estimate of the quantity of water that will be required for dust suppression before an application is made for a water use permit from the Water Resources Commission. The Contractor, depending on the weather conditions, will be required to water at least once daily. The Environmental Monitoring Team (EMT) will be responsible for ensuring that the dust suppression carried out by the contractor is as effective as may reasonably be achieved through regular watering.

The Contractor will organize works on the sites to ensure that the number of persons exposed to dust pollution during the delivery of cement, gravels, stone chippings and sand is kept low as much as possible. The Contractor will ensure that dust-producing materials are covered with tarpaulins when being transported by trucks.

The delivery of these materials will also be organized in such a way that the bulk of them take place before 0800 hours and after 1700 hours to limit the exposure of businesses and traders in the area to dust pollution. The delivery of these materials will also take place over the weekend, especially during late Saturday afternoon and Sunday. Similarly, where possible, major construction activities that generate large volumes of dust would be scheduled for weekends when most of the offices and businesses in the immediate vicinity of the work sites will be closed. The Project Engineer will determine works that needs to be reserved for weekends.

The Contractor will ensure that stockpiles of sand and gravels are doused regularly to prevent strong winds from blowing the finer particles into the air. Cement would be kept in a store/warehouse to prevent the release of powdery particles into the air.

The Contractor will operate and maintain all plant and equipment in accordance with the specifications of the manufacturer to minimise emission of smoke and hydrocarbon particulates. The engines of trucks and equipment would be properly maintained and serviced to reduce the emission of black smoke. The Project

Engineer will ensure that air quality requirements set out in the standard specifications of the Ministry of Transportation's standard specification for road and bridge works.

8.2.3 Noise

Most noise-generating construction activities will have to take place mainly between the working hours of 0800-1700 hours to prevent the generation of high-level noise in the evenings. It is important that the working hours are adhered so as to ensure that residents in the project corridor are not exposed to sleep-disturbing noise. Whenever it becomes necessary for some work to be done in the night, the hours will have to be approved by the Project Engineer having due regard for possible noise disturbance to the residents and businesses.

Since daytime noise will be inevitable during the implementation of project works, the Contractor shall be required to make the businesses and persons in the area aware of the disturbance prior to commencement of works. This requirement will be part of the contract conditions and included in the special specifications for the contractor. The Contractor would implement a public awareness program to inform the public and especially residents and businesses in the corridor of the schedule of project works. The Contractor will schedule the works to coincide with periods when the exposure of businesses and people will be limited.

The Contractor will ensure that all construction equipment and vehicles are well serviced and operated according to the manufacturers' specifications to limit the generation of unnecessarily high level noise.
The Contractor shall bear the responsibility of repairing any damages caused to buildings as a result of vibrations generated from the use of construction plant, equipment and machinery.

8.2.4 Water Resources and Drainage

Prior to the start of the works, the Contractor shall submit to the Project Engineer for approval, schedules for carrying out temporary and permanent erosion/sedimentation control works, road works, bridges and other structures across water courses, particularly the Odaw Stream. The Contractor shall keep the whole of the works free from contaminating water resources according to his obligations in the terms of the General Conditions of Contract. Except otherwise specified, he shall be responsible for the provision of temporary drainage works to deal with water, whether from existing drainage systems, water courses, precipitation or any other source or cause. This will be in addition to any permanent drainage works specified and installed. In discharging and diverting water he shall avoid flooding or damaging other works or services and causing erosion.

Exposed surfaces susceptible to erosion shall be seeded with indigenous grass species or stabilized to limit the washing away of loose soils into the Odaw Stream and other water courses. Construction of temporary berms, and use of temporary mulches, and other erosion control devices or methods will be employed where necessary to control erosion and sedimentation. These will be clearly stated as part of the contract conditions.

The Contractor will plan and execute earth and concrete works with due diligence and skill to prevent the release of materials into the Odaw Stream. The Contractor will also provide proper facilities for the storage of fuel, oil and lubricants as well as waste oils and lubricants, to prevent leaks and spillage, which could be washed into the Odaw Stream and other water courses.

8.2.5 Disposal of Construction Waste

The Contractor will use excavated gravels and other construction waste as fill material if tests on them prove them suitable. Where the gravels and construction waste are found to be unsuitable as fill material, it will be disposed of at a dump site approved by the Project Engineer and the District Assembly.

The Contractor will remove all construction debris and other wastes from the sites to ensure that the sites are free of all obstructions and the hazards they can potentially create. The wastes will be hauled and disposed at designated waste dump sites approved by the Project Engineer. The Contractor will select waste disposal sites that are at least 500 metres away from sensitive locations like settlements, educational institutions, religious sites, play grounds, protected areas, streams and rivers, flood plains, and drainage channels.

The Contractor will be responsible for managing and rehabilitating the dumpsites by planting local species of shrubs and other plants at the end of the project or whenever it is found necessary for this to be done. Under no circumstance will the Contractor allow the dumpsites to be used for the disposal of hazardous waste materials. Used lubricants shall be collected and forwarded for recycling. The Project Engineer will ensure that waste disposal meets the requirements on pollution prescribed in the standard specifications for roads and bridge works.

8.2.6 Public Utilities

The Contractor shall be responsible for arranging, in liaison with the appropriate Authority, the relocation of or alterations to services such as power and telephone lines, water mains, sewers and surface water drains which are affected by the Works. The arrangements for such moving or alteration shall be subject to the agreement of the Engineer and the appropriate Authority and in accordance with the current version of the Road Reservation Management Manual for Coordination.

The Contractor shall take all reasonable precautions to protect existing services during construction and during their relocation and will be held responsible for any damage caused by him to existing works or services. The Contractor shall be responsible for the reinstatement of services so affected, at his expense and to the satisfaction of the Engineer. Installations adjacent to the Works shall be kept securely in place until the work is completed and shall then be made as safe and permanent as before.

In areas where the relocation results in disruption over long periods of time, the contractor will make arrangements for alternative supplies. For instance, if the relocation of water supply lines disrupts the flow of water for extended periods of time, the contractor will make arrangements for water tankers to supply water to the affected households or communities. The Contractor shall inform the Engineer immediately if any existing works or services are exposed, located or damaged.

All costs that may be incurred by the Contractor as a result of programming and co-ordinating work to enable any alterations to services to be carried out, and the cost of any safety precautions that shall be deemed necessary due to the proximity of the Works to existing services, shall be at the Contractor's expense.

8.2.7 Construction Camp Management

Upon the selection of a suitable site for the camp, the Contractor will apply to the EPA for an environmental permit before works on the camp begins. An environmental assessment will be carried out on the potential impacts of the location and activities at the sites and the report submitted to the EPA for approval and issuance of an environmental permit.

The Contractor will ensure that the camp is served by proper waste disposal facilities including incinerator pits for domestic solid waste, septic tanks for sewage and drains for surface run-off. The Contractor will maintain facilities such as toilets, bathrooms, offices and workshops to adequate standards. All facilities will be maintained in a sanitary condition to the satisfaction of public health authorities and the project engineer. The Contractor will adopt and enforce regulations to prevent indiscriminate urination or defecation outside the camp. Strict adherence to the provision on such facilities in the standard specifications will be ensured by the Project Engineer.

The workshops will be provided with proper oil interceptors to collect surface water run- off from areas around refuelling points and service bays. The Contractor will transport waste oil to the nearest commercially run oil disposal operator. No burning of waste fuel or used tyres will be allowed at the camp. Fuel trucks servicing plant will be obliged to carry at all times, anti spill trays and a supply of suitable material, such as sawdust, for absorption of minor spills.

The Contractor will provide proper safety in accordance with the standard specifications for road and bridge works of Ghana. The Contractor shall provide adequate security by day and night at the camp. This shall include the provision of suitable gates and fencing and the full-time attendance of permanent watchmen.

Additionally, strict regulations shall be instituted at the camp to ensure that operations and activities of workers at the camp do not pose a threat to the social order of communities in the project area. Unless otherwise instructed, upon completion of the Contract and, after receiving approval in writing from the Engineer, the Contractor shall take down and remove all structures forming part of his own camp and that of the Engineer, and shall arrange for the disconnection of all services, remove all drains and culverts, backfill trenches, fill in all latrine pits, soakaways and other sewage disposal excavations, with the exception of items and services that are required to revert to the ownership of the Employer and shall restore the Site, as far as practicable, to its original condition and leave it in a neat and tidy condition. A detailed Environmental Management Plan (EMP) will be prepared by the contractor once the a site is selected for the work camp to deal with the management of the camp.

8.2.8 Traffic Diversion

A Traffic Management Plan will be prepared, the implementation of which will ensure that proper and sufficient traffic management systems have been put in place. It will be clearly stated in the contract documents that the Contractor shall implement all measures for ensuring safe passage of traffic on the project roads at all times.

The Contractor shall submit a Traffic Control Plan related to traffic accommodation to the Engineer, not less than 30 days before work commences. Such a plan shall show amongst other things the method of protection of the public and give details of the hours of operation, location, types and numbers of traffic safety devices, barricades, warning signs, flagmen and the like. The Contractor shall provide and maintain temporary signs, barriers, lights etc. along diversions and existing roads adjacent to the Works in order to ensure the safe passage of traffic during the Contract in accordance with the Code of Practice for Signing at Road works. The Contractor shall provide adequate notice of the implementation of diversions etc. and shall ensure efficient and safe passage of traffic at all times. The Contactor shall at all times carry out work on the road in a manner that would create least interference to the flow of traffic. During execution of the works, the Contractor will in accordance with the directives of Project Engineer, provide and maintain a passage for traffic either along a part of the existing carriageway or along a temporary diversion close to the project roads.

As indicated in the figure 8.1 below, westbound traffic on Graphic Road will be diverted through Additrom Road and Official Street before rejoining the Graphic Road. Northbound traffic will be rerouted on to the Official Street through the Brewery Road and the Ahinakwa Road. Eastbound traffic will remain on Graphic Road.

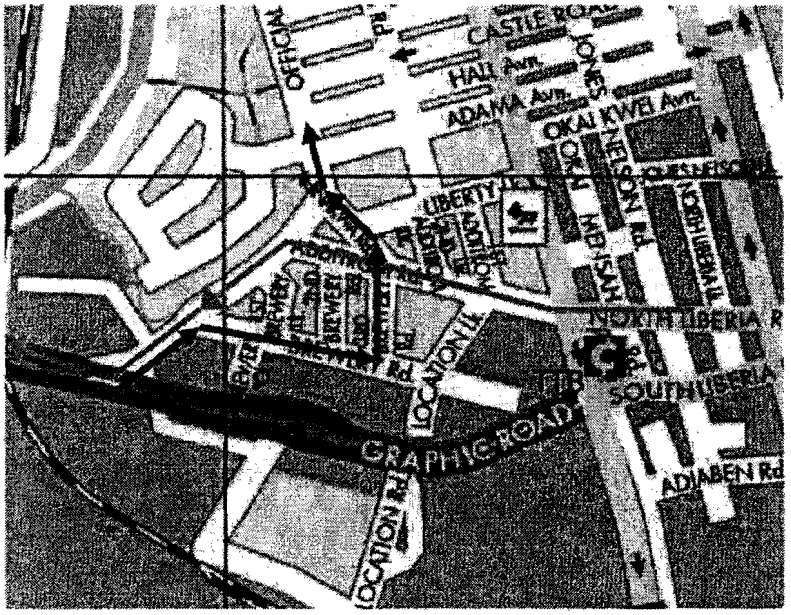


Figure 8.1 Proposed Traffic Diversion at Graphic Road (East)

Works on the Winneba Road in the vicinity of Kaneshie Market will also necessitate the diversion of traffic onto neighbouring roads (see figure 8.2). As indicated below, west bound traffic will be rerouted onto the Mantse Akrama Street through the Asafoatse Omanie Street and the Asafoatse Ashie Street before rejoining the Winneba road. Eastbound traffic will remain on Winneba Road.

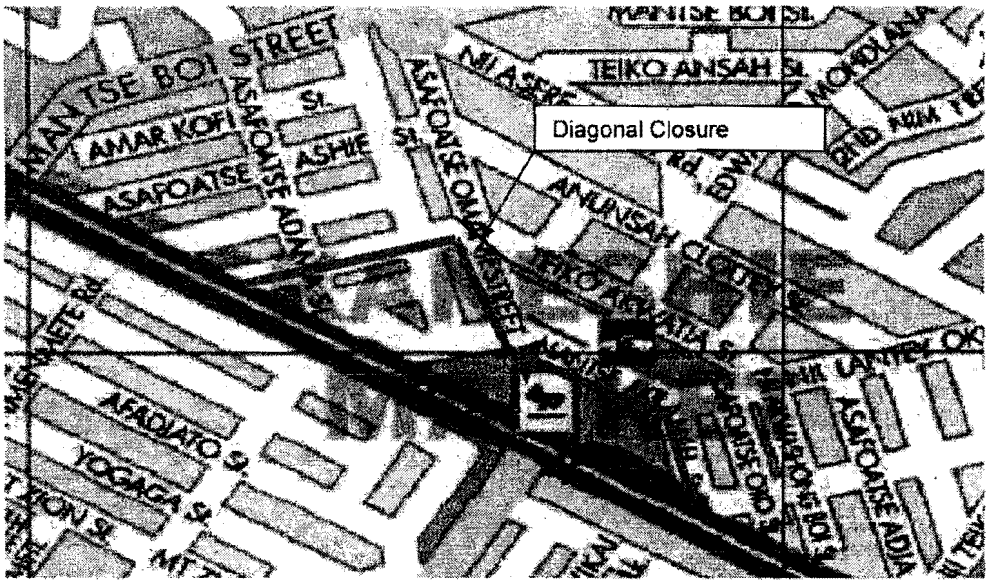


Figure 8.2 Proposed Traffic Diversion at Kaneshie Market

The Contractor shall take all necessary measures for the safety of traffic during the construction phase, including providing, erecting and maintaining traffic control devices such as barricades, signs, markings, lights and flagmen as may be required by the Project Engineer for the protection of traffic approaching or passing through sections of the road where work will be on-going. Additionally, the Contractor will provide excavation sites with effective barriers and reflective signage to prevent any accidental approach by vehicles during the day and night.

Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor shall remove all temporary traffic installations, structures and signs and reinstate all affected roads to conditions similar to what prevailed prior to the commencement of construction. This shall be done to the satisfaction and approval of the Project Engineer.

8.2.9 Pedestrian-Vehicular Conflicts

Due to the busy nature of the project corridor and the fact that the traffic would have to be diverted onto access roads in the adjoining residential areas, it would be extremely important to ensure that the travelling public, motorists, pedestrians and residents are made aware of project works to, among other things, limit vehicular-pedestrian conflicts and the associated inconvenience, injuries and loss of lives. The Contractor will be obliged to implement all measures for ensuring safe passage of traffic and pedestrians around or through the construction site and the neighbouring communities/residential areas at all times. The Contractor will provide appropriate traffic control devices as required by the Project Engineer and local Traffic Police. Traffic wardens will be employed by the contractor to help direct traffic. The contractor will be required to provide appropriate warning signs on the road to alert both drivers and pedestrians. Appropriate speed limits would also be clearly posted at vantage places on the diversion roads.

8.2.10 Landscape Modification

Management of Borrow Areas

The Contractor would consider the following criteria before finalizing the locations of borrow pits:

1. The borrow area should not be located in agricultural field unless unavoidable i.e. barren land is not available;
2. The loss of productive and agricultural soil should be minimum and separately preserved for re-spreading and re-use;
3. The loss of vegetation is minimized; and
4. Required standard of materials are available.

Borrow pits would be established after thorough investigation of sites and a detailed report submitted by the Contractor to the Project Engineer for approval. The submission shall include:

- Exact location markers to be placed in the field;
- Plan of the area indicating type and size of trees;
- Excavation plan (management of vegetation and top soil, volume and depth of excavation); and
- Rehabilitation plan for borrow pit and interim road. Considerations would be given to waste and spoils to be received, grading and spreading of top soil, re-vegetation, seeding /planting of vegetation for protection of slopes from erosion, storm water management, erosion protection and ponding.

The surface of borrow pits will first be cleared of all obstructions including grass and vegetation, and the top soils shall be carefully removed and stockpiled. After removal of the materials, the area will be levelled and provided with side slopes at batters not exceeding 1:5 unless otherwise specified, and adequately drained where directed. The topsoil will then be replaced, to the satisfaction of the Project Engineer.

The Contractor shall be held liable if he opens up unauthorized pits and/or fails to rehabilitate any of such sites according to the authorized plan. The Engineer would seek the consent of the relevant institutions (e.g. Minerals Commission, the relevant municipal/district assembly and the EPA) before issuing certificates for full payment to the Contractor. Some amount of money would be withheld if the Contractor fails to reinstate and also open up an unauthorized site. The sum withheld would be ample for bringing in another Contractor to complete the requirements. Rehabilitation of interim roads and borrow pits will take place as soon as they are no longer needed for the project and not at the end of the project.

The objective of the rehabilitation programme is to reinstate the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and use. Securing borrow pits in a stable condition is a fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit floor to approximately the access road level. The re-development plan will be prepared by the Contractor before the start of work in line with the landowner's requirement and to the satisfaction of environmental as well as public safety best practices.

Aesthetics and Visual Quality Management

The Contractor will be responsible for managing wastes generated at the project sites. The Contractor will remove all construction debris from the sites and dispose them at approved dumpsites. The Contractor will ensure that manholes and trenches resulting from excavations are back-filled as soon as feasible. In this context, pits and quarries could be used as landfills for the disposal of spoils and re-vegetated.

The Contractor will assemble all his equipment at the camp and will schedule the movement of his equipment and trucks to ensure that only those that are required for specific works are moved to the project sites. To enhance the aesthetics of the project area after construction works, the Contractor will employ the services of the Parks and Gardens Department or a private landscaping firm to implement the landscaping plan in the project design.

8.2.11 Archaeological / Cultural Impacts

The likelihood of disturbing chance finds appears to be low as there is little or no evidence of sites of archaeological or cultural significance in the road corridor. If during the course of construction a site is discovered, the Contractor will not disturb any chance finds further until an assessment is undertaken by a competent archaeological specialist and actions consistent with best practice are implemented.

If it is subsequently determined that significant archaeological or cultural items are likely to be found during construction, the Contractor with the approval of the Project Engineer and in collaboration with the Ghana Museums and Monuments Board (GMMB) will implement chance find procedures to meet the relevant regulations. Procedures would include provision for a qualified archaeologist/cultural historian on site during ground clearance and excavation to provide expert opinion on the significance of finds and their appropriate treatment.

The statue at the OLC will be removed and kept with the GMMB for safe keeping. Five weeks before works begin around the OLC, the project implementation committee will hold a stakeholders meeting (DUR, AMA, PWD, GMMB and family representatives of Obetsebi Lamtey family). This is to inform them of the impending works and to present to them the detailed reengineering plan of the roundabout to them. Arrangement for relocating the monument of Obetsebi Lamtey before construction and reinstate it after construction activities will also be presented and agreed upon. The cost of relocation and reinstatement will be included in the conditions of contract and the Engineer will ensure that this is implemented.

8.2.12 Public Health and Safety

(a) Sexually Transmitted Diseases (STDs) and HIV/AIDS

The Contractor will provide an HIV/AIDS Awareness Programme for the benefit of his employees and persons in the immediate neighbourhood of the corridor. To prevent exposure to STDs and HIV/AIDS, the Contractor will ensure that the employees and residents are adequately educated on the dangers of the menace. The Contractor will liaise with the Ghana AIDS Commission or an Approved Service Provider such as Ghana Social Marketing Foundation to implement a workplace HIV/AIDS education program for the employees. The Contractor will post and maintain HIV/AIDS awareness posters at vantage points in the project corridor and in the communities. The Contractor will also liaise with the service provider to provide

construction workers and residents with pamphlets in languages they understand, which will reinforce the outcomes of the HIV Awareness Program stated above. Such educational materials will be made available to the project monitoring team for inspection.

The HIV/AIDS awareness program will also include preventive activities such as peer education and counseling, condom use promotion and distribution. The Contractor will work with the Ghana AIDS Commission to make condoms available to its employees at readily accessible points which will be suitably protected for the duration of the contract. Additionally, the Contractor will also encourage voluntary HIV/STD testing and provide information on services concerning support and care for those that are or might be infected.

(b) Malaria and other Diseases

The Contractor will implement management practices aimed at eliminating breeding sites for disease vectors. The Contractor shall pump out water that collects in trenches and manholes created at the project sites. Also, manholes resulting from excavations will be back-filled as soon as feasible. In this context, borrow pits and quarries will be used as landfills for the disposal of spoils and re-vegetated. It is expected that the prevention of the creation of pools of stagnant water will help in reducing the incidence of malaria.

The Contractor will work to prevent diseases such as cholera and dysentery through the proper management of wastes, both liquid and solid, from the work zone and camp site. The construction camp shall be provided with sanitary latrines and urinals and waste from these facilities will be channelled into septic tanks. The Contractor would ensure that the sewage system for the camp is properly designed, built and operated so that no health hazard occurs and no pollution to the air and watercourses takes place. Garbage bins would also be provided in the camp and regularly emptied and the garbage disposed off in a hygienic manner.

(c) Public Safety

The Contractor will prepare a Health and Safety Plan as part of the EMP of the work camp which will cover all measures and precautions necessary to ensure the health, safety and welfare of all persons entitled to be on the project sites. Such precautions shall include those that, in the opinion of the Project Engineer, are reasonable to prevent unauthorized entry into the site and to protect members of the public from any activities undertaken by the Contractor. Specifically, the measures will include:

- Public information and education program to alert/warn the public of construction sites and activities and the potential accident risks. Measures will include public announcements via radio and newspapers and the erection of appropriate signage;
- Fencing off of the construction sites to restrict access to the public in order to prevent accidents to pedestrians;
- All trenches developed as part of utility relocation or construction activities will be sealed after construction work is over;
- Provision of temporary road access and pedestrian walkways and well laid out with directional signs to guide motorists and pedestrians.

8.2.13 Occupational Health and Safety

The Contractor will protect the health and safety of employees by developing and carrying out a safety training programme for them. The safety training program shall consist of an initial safety induction workshop, periodic safety training courses and meetings. Additionally, the Contractor will be obliged to ensure the health and safety of the workers by, among others, providing them with protective clothing such as hard boots, helmets, nose masks and overalls. The Contractor will ensure the proper and adequate use of the protective clothing by all employees on site.

Site supervisors will ensure that conditions on the sites do not unnecessarily expose the workers to potential hazards and risks. Equipment and plant shall be serviced regularly to ensure smooth operation and project works will be scheduled to avoid vehicular-worker conflicts in the work zone as much as possible. The Contractor will also take all reasonable steps to avoid increasing the risk of fire through activities on site. Very clear and legible "NO SMOKING" signs will be displayed in areas of high fire risk such as the fuel storage and vehicle workshops. Firefighting equipment (fire extinguishers and sand buckets) will be provided at vantage points in the camp site, material storage areas and workshops to fight any accidental fires. Additionally, fire prevention and fighting techniques would be included in the induction programs that will be organized for the workers. The Contractor will liaise with the Ghana National Fire Service for resource personnel to provide the training, which would include fire drills.

The Contractor shall have and maintain a well-stocked first-aid kit on site to treat minor injuries and ailments. The Contractor will also have an arrangement with a health facility in the project area whereby workers who get involved in accidents or suffer major injuries will be quickly transported there for professional medical attention.

8.3 Mitigation of Operational Phase Impacts

8.3.1 Pedestrian-Vehicular conflicts

All major junctions will be regulated by traffic lights in order to reduce vehicular-pedestrian conflicts. All bus stops will have marked pedestrian crossing points controlled by traffic lights. All arms of the OLC roundabout will be controlled by traffic lights. This will provide crossing points for pedestrians. The two foot bridges in front of the Kaneshie Market will be maintained with one fitted with a lift system for use by people living with disabilities and the infirm. These measures are to ensure that pedestrian-vehicular conflicts are reduced to the minimum.

8.3.2 Displacemen of Trotro Operators

As part of the implementation process for the UTP, an Operational Advisor for the transport operators has been employed to help reorganise the existing transport operators to take over the operation of the BRT service. This is to ensure that the existing operators do not go out of bussiness with the introduction of the BRT. The design of the BRT system is such that there is the need for feeder services. Displaced trotros will be deployed to other feeder routes to feed the BRT service. Thus, while the drivers and operators will move onto the BRT service, the trotro buses will be redeployed to other routes to offer feeder services to sustain the BRT service.

8.3.3 Traffic Management

Displacing the 35% of tro-tros/buses from the mixed traffic lanes will have an operation flow impact (considering that buses have higher Passenger Car Unit (PCU) factor) of more than the 35%. More travellers on this corridor are expected to join the more efficient BRT service. Improving travel time for buses on the BRT lane will bring improved mobility for 80% of users and reduce emissions from the buses and noise pollution. As part of the project design, adequate space will be provided for passengers at the various bus stations.

9.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Environmental Management

It is important that the mitigation measures outlined in Section 0 are adequately implemented to prevent the occurrence of the identified negative impacts of the project or to minimize their effect, if they do occur. However, the effective implementation of these mitigation measures will, to a large extent, be dependent on the development of an environmental management plan.

The environmental management plan indicates how proposed mitigation measures will be implemented, responsibilities and the cost of implementation. The Environmental Management Plan (EMP) will act as an abridged Operational Manual for the project with respect to environmental and social issues during the implementation and operation of the project. It sets out in practical terms, how the mitigation measures proposed should be implemented.

Management of these impacts will also be best achieved through the incorporation of suitable clauses or performance bonds in the Contract Documents so as to enable the Resident Engineers to control any of the activities which may result in adverse impacts. Rigorous enforcement of these environmental and social clauses incorporated in the contract document will ensure the smooth implementation of the mitigation proposals.

9.1.1 Commitment of DUR

The issues of environmental and social concern mostly relate to the construction phase of the project and to the activities of the Contractor. However, as the project proponent, DUR is committed to building and operating the BRT in compliance with the environmental management and monitoring requirements/standards available. Accordingly, the DUR is committed to providing the Contractor with the requisite resources and support to implement the mitigation measures. DUR through its Environmental Management Unit, will oversee the implementation of the EMP.

Additionally, DUR will incorporate suitable clauses or performance bonds in the contract documents so as to enable the Project Engineers to control any of the activities which may result in adverse impacts. Rigorous enforcement of these environmental clauses incorporated in the contract document will ensure the smooth implementation of the mitigation proposals.

The DUR is committed to working with the Contractor, Engineer, EPA and other stakeholders to ensure that the BRT is constructed and operated with minimal impacts on the environment and socio-economic conditions in the project area.

9.1.2 Basic Responsibility of the Contractor

The Contractor's responsibilities are defined in the following clauses, to be incorporated in the contract document or specifications for the works. The general conditions of contract are modelled on the General Conditions of Contract prepared by the International Federation of Consulting Engineers (FIDIC Conditions of Contract, 1999). Within these general conditions of contract is Clause 19.1, which deals with "Safety, Security and Protection of the Environment".

9.2 Key Environmental and Social Clauses

9.2.1 General Clauses

Clause 1: The contractor shall be responsible for familiarising himself/herself with all national and local legislation relating to his/her activities during the construction phase of the project.

Clause 2: The contractor shall throughout the implementation/construction phase of the project take all reasonable steps to protect the environment on and off the sites so as to avoid damage or nuisance to

persons or property of the public or others resulting from pollution, noise or other causes arising as a consequence of his/her methods of operation.

9.2.2 Specific Clauses

Waste Disposal

Some quantities of waste, both liquid and solid, which are generated as a result of the project works, need to be dealt with adequately to avoid environmental problems, either on or off site. Effective spoil and waste disposal at the work sites and construction camp depend on the waste management plan drawn by the Contractor and approved by the Project Engineer. Elements of the waste management plan shall include the following:

Clause 1

The Contractor shall at all times maintain all sites under his control in a clean and tidy condition and shall provide appropriate and adequate facilities for the temporary storage of all wastes prior to disposal. For example, adequate and appropriate waste containers for petroleum residues shall be placed in special areas designed for the storage/disposal of the substances.

Clause 2

The Contractor shall be responsible for the safe transportation and disposal of all waste generated as a result of his activities in such a manner as will not give rise to environmental pollution in any form, or hazard to human or animal health. In the event of any third party being employed to dispose off waste, the Contractor shall be considered to have discharged his responsibilities only when he has satisfied himself that the proposed transportation and disposal arrangements are such as will not give rise to pollution or health hazard.

Clause 3

The Contractor shall be responsible for the provision of adequate sanitary facilities for his workforce and that of his sub-contractors at the base camp and all construction and ancillary sites. The Contractor shall not allow the discharge of any untreated sanitary waste to groundwater or any surface watercourse. The Contractor shall provide details of sanitary arrangements to the Project Engineer and the DUR for approval. This is to ensure that the proposed facilities are adequate and are unlikely to pollute water resources, if properly operated and maintained.

Clause 4

To protect watercourses, no excavated material shall be dumped at least 500 metres on both sides of any watercourse. Location of the spoil areas shall be determined by the Contractor and subject to the approval of the Project Engineer. Excavated materials shall not be dumped haphazardly, but shall be duly dressed up (e.g. with vegetative cover) in a suitable form at selected places so as not to be washed away by rain.

Water Resources

In view of the potential for accidental spillages and leakages of petroleum-based products and other hazardous materials associated with plant areas/construction camps, specific control measures are necessary to minimise possible pollution of water resources. In this direction therefore, the following are to be incorporated in the specifications:

Clause 1

The Contractor shall take all reasonable measures, at all sites under his jurisdiction, to control the pollution of water resources.

Clause 2

The Contractor shall put in place all reasonable measures to prevent spillage and leakage of materials likely to cause pollution of water resources. Such measures shall include, but not be limited to the provision of bunds around fuel and oil storage facilities, and oil and grease wraps in drainage systems associated with vehicle and plant washing bays, servicing and fuelling areas. The Contractor shall submit details of such pollution control measures to the DUR for approval.

Borrow Pits

Re-instating borrow pits to their near-original state after winning gravel, sand or soil have been a problem in construction practice. Some have, therefore, become receptacles for breeding grounds for disease vectors such as mosquitoes. In view of this, the incorporation of the following clauses has been proposed:

Clause 1

The Contractor shall reclaim all lands affected in one way or the other during the construction phase to make them available for future use. Specifically, the Contractor shall reclaim the borrow pits and quarry used. The Contractor shall ensure that any gravel or borrow pit are re-graded and covered with topsoil to ensure their natural regeneration. Plan for each site should cover:

- *pit location and area;*
- *access arrangements;*
- *a working plan giving an outline of the direction, phasing and depth of working; and*
- *a reclamation plan indicating details of final grading, drainage and sediment control, re-soiling measures and design after use; and arrangement for consultation.*

Clause 2

The extent of the right-of-way being cleared shall be within the limits stated in the design in order to reduce land destruction to the minimum. This reclamation shall be to the satisfaction of the Project Engineer

Clause 3

The area exploited shall be graded to an appropriate shape with mild slopes to avoid excessive erosion. These areas shall be re-vegetated with grass, trees, shrubs etc to the satisfaction of the Project Engineer immediately after the work is completed.

Erosion and Slopes

Construction works at the bridge sites in the rainy season or improper construction methods, which leave the soil exposed unnecessarily, could cause significant erosion.

Clause

The Contractor shall take all reasonable measures at all sites under his control, to protect all cuts and fills slopes liable to erosion and make them stable. The cuts and fills slopes shall be done at angles gentler than 900.

Transportation of Materials

Potential localised problems can arise along the access roads as a result of transportation of raw materials.

Clause

The Contractor shall ensure that vehicles transporting raw materials along the local access roads do not cause a safety hazard, excessive noise, dust or disturbance to any local inhabitants.

The Project Engineer and/or DUR shall have the right to require the Contractor to carry out improvements to the access roads.

Traffic Management during Construction

There are potential negative impacts for existing traffic, parking, access and road safety as the project works take place. These can be mitigated by requiring the Contractor to undertake temporary traffic management measures.

Clause 1

The Contractor shall take responsible precautions to keep all public or private roads clear of any spillage of material from his traffic to the satisfaction of the Project Engineer and/or the DUR. All such spillage, which occurs, shall be cleared without delay.

Clause 2

The Contractor shall provide, erect and maintain on the site and at such positions on the approaches to the site, traffic signs and traffic control signals necessary for the direction and control of traffic. The signs shall be reflectorised or adequately illuminated by night in a manner approved by the Project Engineer and kept clean and legible at all times. The Contractor shall reposition, cover or remove signs as required during the progress of the works.

Clause 3

The Contractor's operations throughout the contract shall be so conducted as to maintain the flow of existing road traffic. The Contractor's method of working within the project corridor shall be to the approval of the Project Engineer.

Clause 4

The Contractor shall construct and maintain temporary diversion ways wherever the works will interfere with existing roads to the satisfaction of the Project Engineer and the DUR and to the approval of the Traffic Police.

Noise, Vibration and Air Quality

Heavy construction plant and equipment can generate excessive noise as a result of inadequate silencing, which may result in considerable nuisance to the public, e.g. during excavation and piling. Emissions (including lead, carbon monoxide, carbon dioxide, nitrogen oxides, sulphur oxides, nitrous oxide, and particulate matters (ash, dust) from inadequately maintained vehicular engines can result in an increase in health hazard to the population living along the project corridor.

Clause

All vehicles and plant operated by the Contractor or his Sub-Contractors shall at all times be maintained in accordance with the original manufacturer's specifications and service manuals, with particular regard to the control of noise and particulate emissions. The DUR shall have the right to require the Contractor to replace or rectify any vehicle or plant, which in its opinion, emits excessive noise or smoke within 24 hours of the Contractor being so notified.

Contractor's Camp

Problems associated with the Contractor's camp could be minimised if appropriate regulations are established and necessary actions taken. This involves the provision of facilities and activities both prior to and during construction. The following clauses are recommended:

Clause 1

The contractor shall avoid siting camps near ecologically sensitive areas. The contractor shall maintain all sites under his control in a clean and tidy condition and should provide adequate facilities for temporary storage of all waste prior to disposal.

Clause 2

The contractor shall make adequate provision for water and electricity for use by his agents and the Engineer's staff on site. Specifically, the Contractor shall make provision for the supply of potable water to site by the company's water tankers and stored in temporary reservoirs on site for drinking and other uses. The reservoirs shall be installed at appropriate locations to make them easily accessible from all directions. Electricity shall be provided on site by the use of portable generating plants or drawn from the national grid.

Clause 3

The contractor shall ensure that adequate sanitary facilities are provided at the base camp and construction site. Details of his toilet and other sanitary facilities shall be presented to the Project Engineer for approval, prior to the commencement of works. The latrines shall be maintained and cleaned in accordance with the sanitary requirements of government health authorities. He shall indicate in detail the method(s) to thoroughly disinfect and fill all latrines when no longer required.

Clause 4

On completion of works, the camp site shall be reclaimed to its previous use. The reclamation shall be done to the total satisfaction of the Project Engineer.

9.3 Key Responsibilities

The key stakeholders in the environmental management of the proposed works are: the DUR, the Engineer, the Contractor, Public Authorities and, to some extent, the public. The EMP outlined in tables 9.1, 9.2, 9.3, and 9.6 below allocates the responsibility for implementation of the proposed mitigation measures to the various stakeholders.

Table 9.1 Environmental Management Responsibilities of DUR

Activity	Responsible Institution	Resource Requirement	Reporting
Issue necessary instructions and guidelines to be incorporated in the project document.	DUR	Personnel, Supervision and budgetary allocation for monitoring	Quarterly/Monthly reports
Observe the overall environmental performance of the project.	-Ditto-	-Ditto-	-Ditto-
Issue instructions and guidelines for additional mitigation measures to be included during project execution.	-Ditto-	-Ditto-	-Ditto-
Approve of locations for quarries and borrows pits and plan for their rehabilitation.	-Ditto-	-Ditto-	-Ditto-
Inspect and together with the Resident Engineer, mark trees along the existing road to be felled	-Ditto-	-Ditto-	-Ditto-
Issue interim notes of approval for staged rehabilitation of project areas, e.g. construction sites, borrow pits, campsites.	-Ditto-	-Ditto-	-Ditto-
Conduct awareness raising campaigns on public health as well as on traffic safety.	-Ditto-	-Ditto-	-Ditto-

Organize valuation and payment of compensation to project affected persons	-Ditto-	-Ditto-	-Ditto-
Issue letter of recognition that all environmental obligations have been appropriately fulfilled	-Ditto-	-Ditto-	-Ditto-

Existing staff capacity at the Environmental Management Unit of the DUR may not allow it to fully carry out these responsibilities as well as lead the implementation of the EMP. There are currently two officers in the Unit with the requisite skills and experience to effectively carry out these responsibilities. However, these officers are engaged on other DUR projects and will therefore not be fully available to the BRT project. In view of this, it will be necessary for DUR to hire additional staff to the Unit and/or reorganize the work schedule of the staff so as to free their time to provide regular support to this project.

Table 9.2 Environmental Management Responsibilities of EPA

Activity	Responsible Institution	Resource Requirement	Reporting
Issue necessary environmental permits.	EPA	Support for monitoring	Environmental permits for the works and quarries
Approve of locations for quarries and borrows pits and plan for their rehabilitation.	-Ditto-	-Ditto-	-Ditto-
Observe the overall environmental performance of the project.	-Ditto-	-Ditto-	-Ditto-
Provide advice and guidance on additional mitigation measures to be included during project execution.	-Ditto-	-Ditto-	-Ditto-

The EPA has enough capacity in the Environmental Assessment and Audit Department and other departments to carry out these environmental management responsibilities.

Table 9.3 Environmental Management Responsibilities of the Project Engineer

Activity	Responsible Institution	Resource Requirement	Reporting
Propose environmentally friendly BRT route alignment and design standard.	Engineer	Contract sum and supervision	Monthly/Quarterly Progress Reports and Site Meeting Reports
Propose a route alignment requiring minimum or no demolition of houses/properties	-Ditto-	-Ditto-	-Ditto-
Design the project for the least negative environmental impact during the operational life of the BRT.	-Ditto-	-Ditto-	-Ditto-
Design the project for environmentally friendly	-Ditto-	-Ditto-	-Ditto-

construction methods.			
Design the project prescribing materials with the least negative environmental impact.	-Ditto-	-Ditto-	-Ditto-
Incorporate any feasible traffic safety measures within the project design: • Speed limit zones • Rumble strips • Lay-byes • Pedestrian crossings or walkways	-Ditto-	-Ditto-	-Ditto-
Design environmentally friendly bridge drainage systems: • Install drains along the approach roads to avoid erosion. • Locate discharge points for drains • Install permanent bar screens in drains for waste trapping • Design turnouts from approach road drains to avoid soil erosion			
Incorporate all suitable clauses requiring the Contractor to execute his work with due diligence and applying environmentally friendly methods. Any such requirement must be accompanied by the necessary methods for monitoring and enforcement. Clauses with principle content as outlined above are considered as the minimum requirement.			
Supervise and enforce the Contractor's performance on all environmental requirements included in the Contract Documents.			
Assist the Environmental Management Unit of DUR to monitor the overall environmental impact of the project and recommend additional mitigation measures for implementation when deemed necessary			
Liaise with the local health, traffic and educational authorities to plan agreed awareness raising campaigns.			

The Environmental Specialist on the Resident Engineer's team will play the lead role in carrying out these responsibilities. The Project Engineer will, however, supervise the Environmental Specialist to ensure that the responsibilities are carried out as expected. The Resident Engineer's team will also work closely with the Environmental Management Unit of DUR and the EPA in managing the environmental aspects of the proposed works.

Table 9.4 Environmental Management Responsibilities of the Contractor

Activity	Responsible Institution	Resource Requirement	Reporting
Ensure that site managers, foremen, and workers are well informed about all environmental issues of the project	Contractor	Contract sum, Supervision, and Land	Quarterly/Monthly Progress Reports
Ensure that all site managers and foremen are trained in environmentally friendly construction methods	-Ditto-	-Ditto-	-Ditto-
Ensure that all equipment mobilised fulfil the environmental requirements of the Contract Documents	-Ditto-	-Ditto-	-Ditto-
Establish and maintain environmentally friendly and sanitary construction camp	-Ditto-	-Ditto-	-Ditto-
Obtain necessary approvals for all borrow pits and quarries	-Ditto-	-Ditto-	-Ditto-
Establish a waste management plan comprising all types of wastes	-Ditto-	-Ditto-	-Ditto-
Apply environmentally friendly equipment and construction methods	-Ditto-	-Ditto-	-Ditto-
Ensure health and safety for all workers and visitors to the site	-Ditto-	-Ditto-	-Ditto-
Fulfil all environmental requirements of the Contract Documents	-Ditto-	-Ditto-	-Ditto-
Inform the Project Engineer if any unforeseen negative environmental impact should occur	-Ditto-	-Ditto-	-Ditto-
Ensure that all affected project areas have been properly cleaned of waste, graded and re-vegetated	-Ditto-	-Ditto-	-Ditto-

The Contractor will hire an Environmental Specialist as well as a Health and Safety Officer to oversee the implementation of actions outlined in the responsibilities above. These officers will have to work closely with their counterparts on the Project Engineer's team as well as the Environmental Management Unit of the DUR and the EPA.

The general public has not been assigned any specific tasks in the environmental management plan. However, the public would be encouraged to express concerns on the project whenever they become aware of previously unforeseen impacts or when impacts take on a different order of magnitude than expected. The public have an unwritten obligation to inform the authorities and the Project Engineer about such developments as early as possible for appropriate action to be taken.

9.4 Monitoring

Monitoring ensures that the impacts have been accurately predicted and that mitigation measures are being implemented as planned and has the desired effects. Since the emphasis of the assessment has been on construction phase impacts, this section deals mainly with construction phase monitoring although the responsibilities of some of the stakeholders would extend into the operational phase of the BRT project.
All major stakeholders in the project have a monitoring responsibility of some kind. However, only the Project Engineer, the DUR, the EPA, and the Contractor are allocated specific and formal monitoring obligations (Table 9.5). The Traffic Police, Health authorities and other public authorities will automatically monitor some of the effects of the project during their daily work. Such information should be collated on a regular basis and analysed by those with a formal monitoring responsibility.

The implementation of the project impacts on the functional areas of various institutions for which reason it is relevant to assemble a cross-sectional team to meet at regular intervals to monitor and assess the level of compliance to the set standards and constructional specifications by the Contractor. Such a team could include representatives from the Motor Transport and Traffic Unit (MTTU) of the Ghana Police Service, the National Road Safety Commission (NRSC), the Metropolitan Assembly, DUR, EPA, Residents' Associations and the Contractor. However, due to the resettlement/compensation issues involved in this project, the Land Valuation Board (LVB) should be included in this multi-institutional team.

During construction, safety of vehicular traffic and pedestrians will essentially be the responsibility of the Contractor. The Contractor would liaise with the MTTU for assistance in achieving traffic safety through regular patrols in the corridor during the construction phase. The NRSC would also be contacted by the DUR to provide technical support in the implementation of the traffic management plan.

The DUR's Environmental Officers will pay regular visits to the site to ensure that the mitigation measures proposed in the EIA and EMP are being effectively implemented to ensure sustainable development. Personnel of the EPA would also visit the project sites to assess level of compliance of the Contractor with the conditions set out in the schedule to the environmental permit as well as the effectiveness of the measures implemented for the management of identified impacts.

The DUR will be responsible for the resettlement of project affected persons. It will therefore be the responsibility of DUR to monitor the payment and monitoring of compensation. Though the LVB will not have a direct monitoring role, it will be important that the expertise and support of the LVB are sought whenever necessary.

The Assembly(ies), particularly the Environmental Health Units, would visit the sites to ensure that the health and safety of residents in the communities and the general public are not affected unduly by the Contractor's activities, particularly in the areas of waste management. An area of particular monitoring interest would be the creation of conditions for the possible outbreak of diseases such as malaria, dysentery and cholera.

The Department of Parks and Gardens will monitor the implementation of the landscape plan as part of decommissioning exercise at the end of the construction phase of the project.

Residents in the project area would report on any adverse impacts on their livelihood activities for appropriate management action from the Contractor or relevant stakeholder.

A monthly meeting of the cross-sectional monitoring team would be instituted by the DUR. All issues of significance identified during monitoring and patrols shall be thoroughly discussed with a representative of the Contractor and the Project Engineer. Corrective measures shall be clearly spelt out and discussed and, as much as possible, deadlines set for these to be implemented.

Table 9.5 Monitoring Responsibilities of Major Stakeholders

Institution/Person Responsible	Parameters to be Monitored	Output	Time frame
Department of Urban Roads	• Overall Environmental Performance of the Project • Community relations • Coordination of monitoring • Payment of appropriate compensation	• Monthly Environmental Report	• Once a month but responsibility runs throughout the project life cycle
EPA	Overall Environmental Performance of the Project	• Instructions/directives to Contractor and the Engineer	• Throughout project life cycle
The Project Engineer	• Construction methods and materials • Environmental management of construction site • Implementation of mitigation measures for air, water, soil, traffic, occupation health and safety (OHS), etc. • Environmental management of borrow pits and quarries • Contractor's waste management • Rehabilitation of impact areas • Community relations • Environmental performance of contractors equipment • Accidents reporting (traffic, spills etc.) • Environmental performance of mitigation measures	• Monthly Environmental Report • Incident Reports • Accident Reports	• On-going responsibility throughout construction phase
The Contractor	• Environmental performance of equipment and plants • Implementation of interim and permanent mitigation measures • Implementation of OHS measures	• Maintenance records • Accident Reports • Mitigating actions e.g.	• On-going responsibility throughout construction phase.

	• Air quality • Accidents of any kind	sprinkling, traffic signs, safety barriers	
Traffic Police	• Traffic nuisances • Traffic management measures • Traffic safety measures • Traffic accidents	• Police reports and instructions to Contractor and DUR	• On-going responsibility throughout construction and operational phases
Health Authorities	• Change of frequency of diseases • Occurrence of new disease in the area • Conditions for disease(s) outbreaks	• Health reports	• Upon observation of incidence of diseases
Department of Parks and Gardens	• Implementation of landscape plan	• Technical support to to landscape contractor	• Post construction phase
Local Communities	• Negative environmental impacts. • Social disturbance	• Complaints to Contractor and Supervising Engineer	• Throughout project life cycle

The bulk of the monitoring responsibility rests with the Project Engineer. The Environmental Specialist on the Resident Engineer's team will lead in the monitoring of the identified parameters and report to the Project Engineer. It will, however, be important for the Project Engineer to be very much aware and interested in the monitoring results in order to take immediate actions to rectify any potentially risky situations that are identified.

Table 9.6 ***The Environmental and Social Management Plan***

Management of Construction Camp Site The construction, layout and extent of the construction site and its components shall be planned, designed and managed in such a manner that environmental impacts are minimized.	• Contractor • Resident Engineer
Site layout and establishment A layout plan and the method of establishment of the construction camp, i.e. all offices, accommodation facilities, batching areas, storage & stockpiling areas, workshops, vehicle washing areas and all other areas/facilities required for the undertaking of activities required for completion of the project. The plan shall include the location and layout of waste storage and treatment facilities, ablution facilities, stockpiling and spoil areas and hazardous material storage areas. The demolition and removal of these facilities on completion of construction works shall also be detailed.	• Contractor • Resident Engineer
Ablutions • Adequate toilet facilities shall be erected and maintained in clean and sanitary conditions. The facilities would be established in consultation with the Environmental Health Unit of the AMA. • Toilets shall be located away from any natural water body • Potable water shall be made available for workers at work areas at all times.	• Contractor (Environmental Officer) • Sub-Metropolitan Assembly(ies) (Environmental Health Officers)
Workshop, Equipment Maintenance and Storage • All vehicles and equipment shall be kept in good working order to maximize efficiency and minimize pollution. • All maintenance, including washing and re-fuelling of plant on site shall take place at designated locations at the workshop area. • Steps would be taken to ensure that no contamination of soil or vegetation occurs around Workshops and plant maintenance facilities. These include bunding of all machinery servicing areas, provision of drip trays to collect used oil, lubricants, etc. during maintenance and for all stationary plant. • Washing of equipment shall be restricted to urgent maintenance requirements only • Wastewater collection facilities shall be provided.	• Contractor (Environmental Officer)
Materials Handling, Use and Storage • The potential environmental impact of the handling, use, storage and disposal of materials used during construction shall be minimized by taking into account environmental factors in the siting of any material storage areas.	• Contractor (Environmental Officer) • Engineer
Transportation • All suppliers of materials and their delivery drivers would be made aware of the requirements of this EMP. • Materials shall be appropriately secured to ensure safe passage between destinations during transportation. Loads shall have appropriate cover to prevent them spilling from the vehicle during transit. The supplier shall be held responsible for any clean-up resulting from their failure to properly secure transported materials.	• Contractor • Suppliers • EPA • DUR
Stockpiling • Activities shall be planned so that materials excavated from borrow pits and cuttings, in so far as possible, can be transported directly to and placed at the point where it is to be used. • The location of storage areas shall take into account the wind direction, distance to residential and commercial areas and water bodies; stockpiles shall be positioned and sloped to create the least visual impact. • No foreign material generated/deposited during construction shall remain on site.	• Contractor • Suppliers • EPA • DUR

• Storage areas shall be adequately fenced if necessary. • Areas affected by stockpiling shall be reinstated to the satisfaction of the DUR and EPA.	
Hazardous substances • All hazardous material / substances (e.g. petrochemicals, oils, etc.) shall be stored on site only and under controlled conditions. • All hazardous material / substances shall be stored in a secured, appointed area that is fenced and has restricted entry. • Hazard signs indicating the nature of the stored materials shall be posted on the storage facility or containment structure. • Fuel shall be stored in a steel tank supplied and maintained by the fuel suppliers. The tank shall be located in a secure, demarcated area and an adequate bund wall (110% of volume) shall be provided. The floor and wall of the bund area shall be impervious to prevent infiltration of any spilled / leaked fuel into the soil. • Staff handling hazardous substances / materials shall be properly trained and supervised to ensure they follow appropriate safety procedures.	• Contractor • Fuel Suppliers • EPA
Surfacing materials • Over spray of bitumen products outside of the road surface and onto roadside properties shall be prevented. • Appropriate fire control measures shall be employed when heating of bitumen products.	Contractor
Cement and concrete batching • Concrete mixing directly on the ground shall not be allowed and shall take place on impermeable surfaces at designated sites • The concrete batching activities shall be located in an area of low environmental sensitivity to be identified and approved by the EPA and DUR. • All runoff from batching areas shall be strictly controlled, and cement-contaminated water shall be collected, stored and disposed of at a site approved by the EPA. • Contaminated water storage facilities shall not be allowed to overflow and appropriate protection from rain and flooding shall be implemented. • Used (empty) cement bags shall be collected and stored in weatherproof containers to prevent wind blown cement dust and water contamination. Used cement bags shall not be used for any other purpose and shall be disposed of on a regular basis via the AMA solid waste management system • All excess concrete shall be removed from site on completion of concrete works and disposed of. Washing of the excess into the ground is not allowed • All excess aggregate shall also be removed.	• Contractor • Resident Engineer • EPA • DUR
Waste Management • Waste management on site shall be strictly controlled and monitored. Only approved waste disposal methods shall be allowed. • All site personnel would be instructed in the proper disposal of all waste.	• Contractor • Resident Engineer
Solid waste • All facilities shall be maintained in a neat and tidy condition and the designated sites shall be kept free of litter. Measures shall be taken to reduce the potential for litter and negligent behaviour with regard to the disposal of all refuse. At all places of work, litter bins, containers and refuse collection facilities for later disposal shall be provided. • Solid waste may be temporarily stored on site in a designated area prior to collection and disposal. Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. The waste storage area shall be fenced off to prevent wind-blown litter. • No burning, on-site burying or dumping of waste shall occur. • All solid waste shall be disposed of off site at an AMA approved landfill site. • Domestic waste shall be transported to the approved refuse disposal site in covered containers or trucks. • Proper records of waste generated and disposal shall be kept and made available upon request by the client.	• Contractor • Resident Engineer • AMA

Construction Rubble/Waste • Inert construction rubble and waste materials shall be collected daily disposed of at an approved AMA disposal site • Waste in transit shall be covered by appropriate material such as tarpaulin to prevent spillage and littering of haulage routes.	• Contractor • Resident Engineer • AMA
Scrap metal • All scrap metals such as sheet metal, nails, tins shall be stored in a designated scrap metal containers • The stored scrap metal shall be sold to interested scrap metal dealers • Any unsold scrap metal shall be sent to an AMA approved disposal site.	• Contractor • Resident Engineer • AMA
Hazardous waste • All hazardous waste (including bitumen, etc.) shall be regularly disposed of at an AMA approved hazardous landfill site. This shall be done under the supervision of appropriate agencies such as EPA • Empty hazardous substance containers, contaminated substrates and materials used in the clean-up of spillages shall be stored in a designated, impermeable container and transferred to the AMA appropriate disposal site on a regular basis. • Used oil and grease shall be stored in steel tanks and sold to an EPA approved used oil recycling company.	• Contractor • Resident Engineer • AMA • EPA
Wastewater • Water from kitchens, toilets, sinks etc. shall be discharged into septic tanks • Runoff from fuel depots / workshops / machinery washing areas and concrete batching areas shall be channeled into public drains after they have gone through oil interceptors installed along main on-site drains	• Contractor • Resident Engineer • AMA
Noise Control • All operations that result in undue noise disturbance to residents and businesses and/or dwellings (e.g. vibrations from construction machinery, piling at bridge sites, crushing, etc.) shall be restricted to daylight hours on weekdays • Prior information and warning shall be given to any local communities and/or residents that could be disturbed by noise generating activities well in advance and shall keep such activities to a minimum. • Strict vehicular and machinery maintenance schedules would be enforced. • There would compliance with the relevant EPA permissible noise guidelines and AMA noise byelaws by adopting effective noise abatement equipment where possible. For example installing silences on exhaust of noisy machinery and siting of concrete mixers away from residences.	• Contractor • Resident Engineer • AMA • EPA
Dust Control • Dust generation shall be minimized and a dust control programme shall be implemented to maintain a safe working environment, minimize nuisance for surrounding residential, commercial and industrial areas / dwellings • Construction vehicles shall comply with speed limits and haul distances shall be minimized. • Construction vehicles would be maintained regularly to reduce exhaust emissions • Material loads shall be suitably covered and secured during transportation. • Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors. • Dust suppression measures (e.g. water sprays vehicles, covering of material stockpiles, etc.) shall be applied when necessary.	• Contractor • Resident Engineer • EPA
Soil Erosion and Sedimentation Control • All areas susceptible to erosion shall be protected by installing necessary temporary and permanent drainage works as soon as possible and by taking any other measures necessary to prevent storm water from concentrating in streams and scouring slopes, banks, etc.	• Contractor • Resident Engineer • EPA

• Any erosion channels developed during the construction or maintenance period shall be backfilled and compacted and the areas restored to a proper condition. • Stabilization of cleared areas to prevent and control erosion and/or sedimentation shall be actively managed. • Traffic and movement over stabilized areas shall be restricted and controlled, and damage to stabilized areas shall be repaired and maintained. • In areas where construction activities have been completed and where no further disturbance would take place, rehabilitation shall commence as soon as possible.	
Water Pollution • Measures shall be taken to minimize the pollution of the Odaw Stream. These include: • Use of shredded mulch to absorb accidental spillage • Adoption of stringent work procedures in such areas to avoid spills and ensure proper waste disposal • Earth piles and spoil heaps shall be located away from the Odaw • Excavated topsoil and materials shall be transported in appropriate manner to approved sites • Minimize construction material to be dropped into the Odaw. • The Odaw Stream shall be protected from erosion and direct or indirect spills of pollutants, e.g. sediment, refuse, sewage, cement, oils, fuels, chemicals, wastewater, bituminous products, etc. • In the event of a spill, prompt action shall be taken to clear polluted areas and prevent spreading of the pollutants. • Drip trays shall be used for all pumps, generators, etc. in order to prevent water contamination as a result of fuel spills or leaks.	• Contractor • Resident Engineer • EPA
Protection of Flora • The removal, damage and disturbance of trees shall be done with the consent and permit from the EPA • All trees removed shall be replanted based on an approved landscape plan and in collaboration with the Department of Parks and Gardens	• Contractor • Resident Engineer • EPA • Dept. of Parks and Gardens
Fire Control • All reasonable steps shall be taken to avoid increasing the risk of fire through activities on site. This shall be done in consultation with the Ghana National Fire Service • Basic fire-fighting equipment is available at all construction areas and facilities. These would be checked periodically • A designated officer shall be appointed and shall be responsible for ensuring immediate and appropriate action in the event of a fire. All site personnel would also be trained in basic fire fighting procedures and techniques • Periodic fire drills would also be conducted on site with support from Ghana National Fire Service	• Contractor • Resident Engineer • Ghana National Fire Service
Quarries and Borrow Pits • All quarries and borrow pits will be located away from human settlements. • Thorough site investigations shall be conducted and detailed reports submitted to the EPA Greater Accra Regional Office for approval before borrow pits are established. • Borrow pits will be reclaimed according to an agreed plan with the EPA	• Contractor • Resident Engineer • EPA • Minerals Commission
• Before relocating any utility lines such as water, electricity, telephones relevant agencies would be consulted. • To reduce disruption of utility services new lines would be provided before existing lines are removed or alternative supply arrangements would be made • Safe drinking water shall be made available at the site offices and all other working areas. • There shall be shall compliance with Water Resources Commission Act 1996 by obtaining water abstraction permits be taking water from rivers or streams and the use thereof.	• Contractor • Resident Engineer • Water Resources Commission • Utility Companies

• If water is stored on site, drinking water and multi-purposed water storage facilities shall be clearly distinguished and demarcated.	
Traffic Management • Develop and implement a Traffic Management Plan • The Traffic Engineer of the Contractor shall ensure that traffic is not unduly disrupted during construction. The flow of existing traffic would be maintained. • Traffic control and construction activities shall be coordinated to provide safe and efficient flow of traffic whilst ensuring efficient, safe and rapid construction progress. • Where construction activities occur at multiple places in the project corridor, construction activities and traffic movement would be coordinated to minimize delays. • Warning and directional signs would be provided and erected and maintained on sites and approaches to construction sites. • Temporary diversions would also be provided wherever works will interfere with existing traffic. The selected diversion routes would be presented to the Project Engineer and the MTTU for approval. • Access to markets, shops, offices, and residential areas shall be maintained. • Traffic control devices, equipment and installations such as delineators, drums, barricades' and flagmen as well as warning signs would be provided.	• Traffic Engineer of the • Contractor • Resident Engineer • Police (MTTU)
Public and Occupational Health and Safety • Develop and implement Public and Occupational Health and Safety Plans • Educate workforce on duty care and operational procedures • Workforce shall be fully trained in the proper handling and operation of construction equipment and safety measures as part of workers orientation programme. There shall be continuous training programmes for workers periodically • Protective and safety clothing/gear such as hard boots, helmets, earmuffs, nose masks and hand gloves will be provided for construction workers. • Reflective jackets shall also be provided for workers use • The use of protective gear/clothing shall be strictly enforced and non compliance shall be fully sanctioned • First aid kit stuffed with the necessary medications will be provided on site during construction. • Work sites will be fenced off to prevent access by the public • Reflective borders and adequate illumination will be provided around the construction site at night. • There shall be compliance with the Factories, Shops and Offices Act 1970 and the Labour Act	• • Contractor • Resident Engineer • Labour Commission, Factories Inspectorate Dept.
Employment • Local labour (male and female, skilled and unskilled) shall be given priority in employment. • Only a core team of skilled staff shall be retained on site	• Contractor • Resident Engineer
Protection of Heritage and Cultural Features If any archaeological artefacts or sites are uncovered during earthmoving activities, work in the vicinity of the find shall cease immediately. The National Museums and Monuments Board and/or the Archaeology Department of the University of Ghana shall be immediately notified.	• Contractor • Resident Engineer • National Museums Monuments Board • Traditional Authorities
Landscape Plan A landscape plan would be developed as part of the project design. The plan shall be submitted to DUR for approval. The plan would include the following: • Handling of plant material rescued • Establishment and maintenance of a project-specific nursery, if required; • Topsoil, mulch, fertilizer and soil stabilizer requirements and application; • Landscaping and re-vegetation methods for identified areas, • Procurement requirements and a list of species of plants to be procured, if any;	• Contractor • Resident Engineer • DUR • Dept. of Parks and Gardens

• The use of any herbicides, pesticides and other poisonous substances, if required.	
Communication with Interested and Affected Parties (I&AP's): • Surrounding communities shall be informed of any inconveniences caused by the construction activities. • I&AP's shall be made aware of the existence of a complaints register and the methods of communication available to them. A complaints line is to be made available.	• Contractor • Resident Engineer • DUR
Resettlement Action Plan A RAP has been developed to the resettlement and compensation of PAPs and businesses • Identify PAPs and businesses • Valuation of properties • Development of payment of schedules • Payment of compensation	DUR
Decommissioning of Sites • Upon completion of the project various sites such as camp site, batching plant site, concrete pavement blocks making sites, borrow pits, stockpiles would have to be decommissioned. • Borrow pits will be reclaimed according to an agreed plan with the EPA and DUR. • Equipment and materials would be removed from campsites and the site restored to its near-original or enhanced form • All temporary structures and facilities shall be properly and safely decommissioned and removed from site once all construction activity associated with such facilities has ceased. Closure, decommissioning and rehabilitation shall extend to removing any residual pollution or sources of pollution. • Any erosion channels developed during the construction or maintenance period shall be backfilled and compacted and the areas restored to a proper condition.	• Contractor • Resident Engineer • DUR • Dept. of Parks • Gardens • EPA • Ghana Police • AMA
Environmental Monitoring There shall be environmental monitoring to ensure compliance with all the environmental specifications and requirements and the effectiveness of the mitigation measures. Parameters to be monitored include overall construction and environmental mitigation and management (dust, traffic, water pollution, community impacts etc). Responsibilities for such monitoring activities are shared among various stakeholders.	• Contractor • Resident Engineer • DUR • Dept. of Parks and Gardens • EPA • MTTU of Ghana Police • AMA

9.6 Cost of Mitigation Measures

The cost involved in implementing mitigating measures is not isolated but incorporated in the total contract sum. Payment related to the project are measured and paid, whereas the cost involved in the mitigation of the environmental impacts would only be paid after the Contractor has satisfied the implementation measures. In this direction, the Contract Documents should include bonds and guarantees, eg. performance bonds, to be provided by the Contractor. A summary of cost of mitigation measures is presented in table 9.7 below.

Table 9.7 Summary of Cost of Mitigation Measures

NO	Item	Proposed Mitigation Measures	Estimated Cost of Mitigation ($)
1	Utilities	Relocate utilities before commencement of project works	8,200,000
2	Traffic Diversion	Oblige the contractor to keep the road open for traffic during the project implementation.	205,000
3	Water Resources	Prevent erosion, ensure proper sanitary facilities at construction camps and prevent contamination of surface water bodies and ground water.	50,000
4	Air quality	Minimise generation of dust at work sites and borrow pits.	40,000
5	Establishment of borrow pits	Adequate operation and rehabilitation of borrow pits and other landscape modifications.	100,000
6	Noise Pollution	Ensure that the EPA Guideline on ambient noise is observed.	30,000
7	Public Health and safety	Eliminating breeding sites of disease vectors, barricade sites to prevent access.	50,000
8	Construction Camps	Management of construction camp impacts.	50,000
9	Environmental Campaigns	Environmental information, traffic safety, HIV/AIDS and awareness raising campaign	40,000
10	Construction waste	Dispose of construction debris to ensure clean work sites and sanitation	60,000
11	Occupational health and safety	Provide workers with protective equipment and training	60,000
12	Monitoring	Cost of Logistics and Monitoring by DUR and cross-sectional monitoring team	50,000
	Total		**8,935,000**

Notes:
1 and 2 above are from the project Bill of Quantities
The other costs were estimated based on industry costs and the advice of consultant's engineers.
There will be no compensation for the 2 passenger sheds to be demolished at the MMT yard at UTC as they belong to the state.

9.7 Decommissioning

Decommissioning will involve a range of actions necessary to remove or make safe components of the project and to restore the area occupied by the project, to the benefit of other land users. A number of considerations will be incorporated into the detailed design of the project so as to facilitate the decommissioning process. These will include a review of the following:

- Ease of replacement and/or dismantling;
- Location of equipment;
- Avoidance of potential contamination; and
- Ease of cleaning.

The Contractor will properly dismantle, remove, and safely dispose of any structures, equipment and waste materials and liquids at the end of construction works in the road corridor. To ensure effective decommissioning, the following are proposed to be incorporated in the contract document:

"Upon completion of the contract, and after receiving approval in writing from the Project Engineer, the Contractor shall arrange for the disconnection of electricity supply to all temporary structures, e.g. camps, workshops and sheds. This shall be followed by the dismantling and removal of all structures forming part of any site office and laboratory. The Contractor shall remove all drains and any sewage disposal system, and any disabled machinery, and shall restore the site, as far as practicable, to its original condition, and leave it in a neat and tidy condition. The dismantled parts should be arranged according to type and prepared for transportation.

Also, on completion of the work in borrow pit, quarry, stockpile or spoil area, the Contractor shall furnish the Project Engineer with a certificate signed by the owner stating that the said owner is completely satisfied with the reinstatement of the area.

The above activities will be carried out under the supervision of the Supervising Engineer."

Potential effects of the decommissioning exercise and their mitigation are outlined in Table 9.8 below.

Table 9.8 ***Effects of Decommissioning and Mitigation Measures***

Issue	Effect	Proposed mitigation
Noise and vibration	noise and vibration from the operation of pile drivers, earth moving and excavation equipment, concrete mixers, cranes and the transportation of equipment, materials and people	Plan activities so that activities with the greatest potential to generate noise are carried out during periods of the day that will result in least disturbance - Limit noise generating works to daytime to have least disturbance
Air Quality	Generation of dust caused by excavation and movement of earth materials, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. Also, exhaust from diesel engines of earth moving equipment and haulage trucks	Watering of exposed surfaces to minimize dust generation Proper and regular servicing of equipment to reduce smoke emissions
Waste	Non-hazardous debris from demolition of structures and site clearance; excess fill material, scrap wood and metal. Also, spent fuel and lubricants	Separate waste into different streams and manage appropriately – gather usable materials into storage and dispose of debris at approved sites Appoint waste oil management firm to dispose of spent fuels and lubricants
Contaminated soils	Spillage of fuels and lubricants on soils	Clear contaminated areas and backfill with new soil
Public health and safety	Exposure of members of the general public to physical, chemical and other hazards at the site under decommissioning	Restrict access to the site, through a combination of physical fencing, installation of signages, and safety and health education and awareness creation

		campaigns
Occupational health and safety	Exposure of workers to injuries and accidents resulting from slips and falls, manual handling, working at height, struck by falling objects, etc	Provision and use of PPEs (such as safety glasses with side shields, face shields, hard hats, and safety shoes); training of workers in lifting and materials handling techniques; good housekeeping; training in and use of fall prevention devices; and adequate supervision

10.0 CONCLUSIONS

The Government of Ghana's decision to build and operate a pilot BRT project in Accra is laudable. Due to the growth in vehicle numbers in the capital city, traffic congestion has become a significant issue of concern to road users, residents, pedestrians, business people and the public in general who have to ply the Winneba-Graphic road corridor. The Winneba-Graphic Road corridor selected for the implementation of the pilot BRT is the heaviest loaded route in the Accra metropolitan area. The corridor traverses busy commercial, industrial and residential suburbs. Selection of the corridor for pilot implementation was based upon the degree of compliance of each of the potential BRT corridors with passenger demand, cost, potential impact, accessibility to low income communities and urban and regional planning impacts.
Besides relieving traffic congestion, the development of the BRT route will enhance safety for vehicles and pedestrians and provide benefits such as operation at faster speeds, provision of greater service reliability, an increased customer convenience, and improved access to the city centre. The BRT project will also help improve the environment through the replacement of old fuel inefficient tro-tro mini-buses with more efficient large buses.

Like with most projects of this nature, the construction of the BRT is bound to have both negative and positive environmental as well as socioeconomic impacts. The environmental assessment of the pilot BRT has identified a number of both potential impacts including displacement of persons/businesses, air and noise pollution, traffic diversions, public health and safety, and other environmental and social impacts. In order to ensure that the BRT project does not have any long lasting deleterious impacts on the environment and the people, mitigation measures have been proposed for each of the impacts. It is hoped that the implementation of the mitigation measures will help in reducing the effects of the identified impacts. And to facilitate the implementation of the measures, an Environmental Management Plan (EMP) has been developed. The EMP will act as an abridged operational manual for the project with respect to environmental and social issues during the implementation and operation of the project. The plan sets out in practical terms, how the mitigation measures proposed should be implemented. The successful implementation of the plan will depend on the commitment of DUR and other stakeholders and the commitment of funds from the Government of Ghana and donors.

A RAP has been developed to deal thoroughly with the issues of compensation for project affected persons/businesses. To ensure a smooth take-off and completion of the proposed works, it is imperative that the Government and DUR mobilize the funds for the implementation of the RAP.
Various stakeholders have been identified and their roles and interests are important in ensuring that the proposed works are carried out in an environmentally friendly and socially responsible manner. Whilst these stakeholders, including the EPA and LVB, have the requisite capacity to deliver in their areas of expertise, their contribution to the successful implementation of the proposed works will depend, to a greater extent, on the coordinating capacity of the DUR. It will therefore be incumbent on the DUR to ensure that work plans are developed and adhered to, meetings are held and needed resources and support are provided in a timely manner.

REFERENCES

- Burton, J. D. and Liss, P. S., 1976. Estuarine Chemistry. Academic Press. London, 229p.
- Dickson K.B. and Benneh G. (2001): A new Geography of Ghana, Revised Edition, Longmans
- DIWI/MDC 2006, Feasibility Studies and Design of Arterial and Local Roads in Accra East Corridor.
- ECODIT (Lebanon): Environmental Assessment of the Mudeirej Bridge Reconstruction Project, Final Report. August 2007
- Environmental and Social Management Framework, 2006. MoT Safeguard Document for TSDP
- Environmental Protection Agency: Environmental Assessment Regulations, LI 1652. 1999.
- Environmental Protection Agency: Ghana Environmental Protection Act 490. 1994.
- Ghana Statistical Service (2000): Population & Housing Census Summary Report of Final Results, March 2002
- Ghana Statistical Service, 1984: Population Census of Ghana: Demographic and Economic Characteristics – Greater Accra Region.
- Jorgensen, S. E., 1970. Handbook of Environmental Data and Ecological Parameters. Pergamon Press, Oxford, 12162p.
- Leroy W. Demery Jr: Bus Rapid Transit in Curitiba, Brazil – An Information Summary. Publictransit.us Special Report No. 1. December 11, 2004.
- Livingstone, D. A., 1963. Chemical Composition of Rivers and Lakes. In: Fleicher, M. (ed.). Data of Geochemistry. Wiley, New York, 780p.
- Ministry of Transportation: Bus Rapid Transport Project. Hydrological Analysis and Drainage Design. February 2009
- Ministry of Transportation: Standard Specification For Road and Bridge Works, Final Draft, September 2006
- Ministry of Transportation: Urban Transport Project, Infrastructure and Operational Design for Accra Pilot Bus Rapid Transit Route: Geotechnical Investigation Report, February 2008
- Resettlement Policy Framework, 2006 MoT Safeguard Document for TSDP
- Tennessee Valley Authority: Wilson Dam Bascule Bridge Replacement, Colbert and Lauderdale Counties, Alabama. March 2008.
- The World Bank: Environmental Assessment Sourcebook, Vol. 1: Policies, Procedures, and Cross-Sectoral Issues, World Bank Technical Paper Number 139.
- World Bank, 1997. Roads and the Environment: A Handbook. World Bank Technical Paper No. 376. The World Bank, Washington DC:U.SA
- World Bank, 1998. Environmental Assessment Sourcebook. Volume I. The World Bank. Washington, D.C., USA.
- World Health Organisation, 1984. Guidelines for Drinking Water Quality, Vol. 1. Recommendations. WHO, Geneva, 130p.

APPENDICES

Appendices

Appendix A **EIS Scoping Report**

1.0 Introduction

1.1 General

Bus Rapid Transit (BRT) is an enhanced bus system that operates on bus lanes or other transit ways in order to combine the flexibility of buses with the efficiency of rail. BRT utilizes a combination of advanced technologies, infrastructure and operational investments that provide significantly better service than traditional bus services - operating at faster speeds, providing greater service reliability and increased customer convenience. BRT reduces congestion, enhances mobility and improves the environment. The direct environmental benefits of the BRT Pilot Project are: the reduction of vehicle emissions through the use of more efficient buses and traffic management measures to relieve congestion, the creation of a safer pedestrian environment which will reduce accidents, the design of stations to minimise energy requirements in construction and operation, the inclusion of bicycle lanes along the whole of the Winneba corridor to offer an alternative to vehicle use and finally the development of self sustaining landscaping at stations and along the route to buffer the BRT route and reduce visual impacts. Some of the other benefits of the Project in terms of transportation system improvements are listed below.

The Government of Ghana, with assistance from the World Bank (WB), the Global Environment Facility (GEF) and the Agence Francaise de Developement (ADF) intends to undertake an Urban Transport Project in the Greater Accra Metropolitan Area (GAMA). The overall objectives of the Urban Transport Project are to improve mobility and transport affordability in GAMA through regulatory reform and by facilitation of person movement on major corridors through a combination of traffic management and implementation of a high quality high performance bus rapid transit system.

This proposed project, the Accra BRT Pilot Project is one component of the Urban Transport Project. The development of the design for the proposed project has been based upon a comprehensive transportation study prepared by DHV in 2003. The BRT Pilot Project is to be implemented in the Winneba Road corridor stretching from the Central Business District (CBD) to Mallam Junction to serve the western sector of the city and the CBD. It will involve the construction of a median type BRT route, with staggered stations, a mix of trunk and feeder bus services, electronic fare collection and several terminals where transfers between local feeder and trunk line bus services would be made and a depot for servicing and maintaining vehicles.

The Client for the proposed project is the Department of Urban Roads (DUR) within the Ministry of Transport. A project Advisory Office (PAO) has been created to manage the overall Urban Transport Project.

The performance objectives of the Urban Transport Project include the following:

- Reduction of travel time in BRT corridor (65 min base to 40 by 2012)
- Increase in overall travel speeds (15km/hr base to 20kph by 2012)
- Increase share of large buses in market (15% base to 45% in 2012)
- Reduce CO2 by 10% (120 ug/m3 monthly average baseline
- Length of sidewalks improved (0 base to 40km in 2012, not all BRT)
- Bus shelters and terminal facilities built (0 base to 6 in 2012)
- Bus km/day (base 125 to 225 in 2012)
- Passengers/bus/day (265 base to 800 in 2012)
- Peak hour PT vehicles (3,200 base to 1,800 in 2012)
- Average walk time to bus (40 min base to 20 min in 2012)

Under the provisions of the Ghana Environmental Assessment Regulations, 1999, (LI 1652) the pilot project is a schedule II project for which an Environmental Impact Assessment (EIA) is mandatory. The project has been duly registered with the Environmental Protection Agency (EPA). The first stage in the EIA process involves Scoping, which is intended to focus the EIA on the key issues. The following is a presentation of the findings of the Scoping process carried out for the detailed EIA study.

1.2 The Scoping Exercise

The scoping exercise involves

- Visits to the proposed terminal and depot sites;
- Travels along the proposed routes;
- Consultations with all stakeholder institutions;
- Consultations with affected communities and individuals;
- Discussions with project consultants;
- Study of project documents and other relevant literature.

Objectives of the scoping exercise are to:

- Identify and examine the range of possible environmental impacts associated with the construction and operation of the project with the view of focusing on the significant ones for further studies and analysis.
- Solicit the views and concerns of affected communities, individuals and other stakeholders for consideration in the EIA
- Propose a draft Terms of Reference (ToR) for the EIA study.

1.3 Regulatory and Institutional Framework Consideration

The relevant policies and the regulatory instruments that must be considered for the successful construction and implementation of the project have been assembled and reviewed as part of the scoping process. In addition, consultations with relevant Ministries, Community based organizations, Government Departments and Agencies, etc. have been initiated.

The policies and regulatory instruments considered include:

- Environmental Protection Agency, Act 1994 (Act 490)
- Environmental Assessment Regulation, 1999 (LI 1562)
- Ministry of Transport's Environmental and Social Framework and Resettlement Policy Framework, 2007
- World Bank's Operational Policies on Environmental Assessment (OP 4.01) and Involuntary Resettlement (OP 4.12).

Other regulatory and statutory authorities whose input will be crucial for the successful implementation of the BRT have been identified and they include:

- Accra Metropolitan Assembly
- Electricity Company of Ghana
- Aqua Vittens Rand Limited/Ghana Water Company (AVRL/GWCL)
- Ghana Telecom
- Ghana Private Roads Transport Union

2.0 The Project

2.1 Description of the Proposed Project

The study area would extend from the area west of Mallam Junction along Winneba and Graphic Roads to the Central Business District (CBD) of Accra. The planned bus priority route (from Mallam Junction to the Kwame Nkrumah Avenue) is 9.1km long, excluding a circulation route within the CBD. The primary influence zone is 500 metres to each side of Winneba and Graphic Road and the selected routes for the CDB distribution system (Liberia, High Street and Kwame Nkrumah Avenue). Figure below presents the study area for the EIA.

Figure 1 Study Area

The project would comprise of the following stages:

2.2 Pre-Constructional Phase (Design and Feasibility)

The pre-constructional activities cover the initial investigations and assessment phase. The main components being:

Route identification and Survey: - The DHV report identified 9 corridors where the introduction of BRT appeared to be feasible. The corridor with the highest social and economic benefits was identified as the Winneba Road corridor from Mallam Junction through the Graphic Road to the CBD. The corridor was selected for pilot implementation, based upon the degree of compliance of each of the potential BRT corridors with passenger demand, cost, potential impact, accessibility to low income communities and urban and regional planning impacts. This is the heaviest loaded public transport corridor in the metropolitan area and was predicted to carry the highest number of potential users of the system, as well as to deliver the largest saving in travel time.

Various route options for BRT service buses operating within the CBD have been evaluated with a specific route recommended. BRT studies by DHV indicated a preference for a median type BRT route with central stations, a mix of trunk and feeder bus services, electronic fare collection and several terminals where transfers between local feeder and trunk line bus services would be made. This general configuration has been confirmed by the Consultant and approved by DUR as the basis for design development and implementation. The cross-section for the BRT route and adjacent road is shown in Figure .

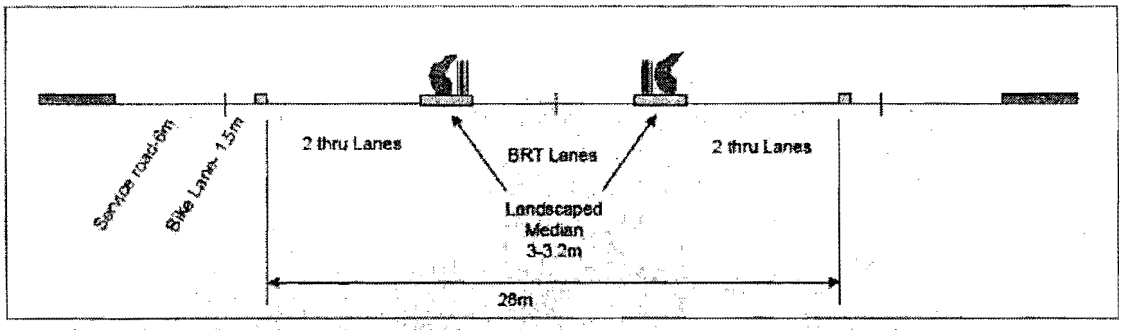


Figure 2 BRT Typical Cross-Section

Materials Testing/Investigation: - All necessary field investigations and laboratory tests shall be carried out in order to establish the design of road pavement and structure foundations. The quality of the quarry products to be used and its suitability for the road works and structures would also be investigated.

Hydrological and Drainage Studies: - All necessary hydrological data will be gathered with the assistance of the Hydrological Division of the Ministry of Works and Housing, on existing drains, culverts, streams or ponds in the project area. This will help in the design and construction of appropriate drains at the appropriate sites.

Assessment of Right-of- Way: - The Consultants have confirmed median operation as preferred cross-section on the basis lower impacts and costs, compared to a bi-lateral configuration. The pilot corridor varies in width from 50 to 20 metres. BRT infrastructure would be built within these existing rights of way with a minimum of land take. Median operation would require the road to be reconfigured and the existing median removed to accommodate the configuration. The approximate width requirement for the BRT route and adjacent roads is 23.3m but may vary from 22.7m to 28m depending upon the type of barrier and/or median used to divide the BRT lanes from other traffic. All structures within the existing median and proposed stop locations shall be identified and assessed to determine requirements for their removal or relocation. Issues of compensation shall be duly addressed by DUR and Land Valuation Board (LVB).

2.3 Construction Phase

The proposed project will have three main construction components:

1. Median-type BRT route;
2. Stations separately serving in-bound and out-bound buses, a mix of trunk and feeder bus services; and
3. Terminals and a depots.

The main tasks of the construction phase for the three components of the proposed project would include:

- Demolition of certain structures
- Earthworks
- Haulage of materials.
- Construction of roads and structures

- Installation of systems and operational control equipment

The different tasks that would be undertaken under the three components of the proposed project are as below:

The BRT Route

- Creation of a median BRT lane within the existing ROW
- Relocation of street lighting
- Relocation of water supply, drainage, telecoms and electricity lines under new medians
- Grade separation required at two locations:
- Obetsebi Lamptey Circle, where the Ring Road intersects with Winneba and Graphic Roads. A relatively simple structure is proposed that allows free flow movement for the Winneba Road – Graphic Road movement, and retains the existing roundabout for all turning movements and through traffic on the Ring Road;
- Grade separation of the level railway crossing on Graphic Road by means of a Road over-Rail bridge extending to Official Street and includes the re-construction of the Korle-Lagoon Bridge.

Stations and Terminals

- Land fill activity to build depot and terminals;
- The construction of stations, depot and terminal buildings;
- Provision of utility services including drainage, telecoms, electricity, water supply for terminals.
- Stations to be self-sustaining as much as possible.

Road Junctions

- Traffic engineering at all road junctions between Mallam and Kwame Nkrumah Avenue;
- Redesign of the junctions to locate stations, handle pedestrian movements and control turns.

2.4 Post-construction Phase

The post construction phase will cover issues relating to the operation and maintenance of the project such as:

1. The regulation of urban passenger transport;
2. The establishment of the associated planning, procurement, monitoring and evaluation capacity;
3. Area wide traffic management and enforcement mechanisms, which will focused on:
   - Low cost measures;
   - Safety;
   - Environmental improvements;
   - Public education and enforcement plans.

Baseline Conditions in the Project Corridor

2.5 Socio-Economic Environment

2.5.1 Project Area Population

A key socio-economic problem facing Ghana is the inadequacy of its urban infrastructure and services in the face of a fast growing urban population. Over 40 percent of the Ghanaian population lives in urban areas, with 14% of Ghana's population concentrated in the Greater Accra Metropolitan Area (GAMA). Accra, the capital city and main administrative and commercial centre of Ghana, according to the 2000 census, had a population of 1,659,000. The population of the other urban centres were: Tema 506,000 and Ga 550,000.

The population growth rate in GAMA is high, at 4.4% between the 1984 and 2000 census counts. Due to combination of expected lower fertility rates in the future and a possible under counting in the 1984 census, the expected rate of population growth in GAMA was taken as 2.7% for the period up to 2008, dropping to 2.5% in the period to 2013, and then to 2.0% to 2023. In addition to this natural growth, net

inward migration to GAMA is expected. The combined effect of growth and migration will be to increase the population of GAMA to just under 4 million by 2013, and by 2023 the combined population of the three assemblies will exceed 5 million.

2.5.2 Communities

The project's area of influence extends from the area west of Mallam Junction along Winneba and Graphic Roads to the CBD of Accra. The primary influence zone is 500 metres to each side of Winneba and Graphic Road and the routes selected for the CDB Distribution system (Liberia, High St and K Nkrumah). The flanking communities served by the existing trotro routes are:

- McCarthy Hill
- Odorkor
- Bubiashie
- Mallam
- Mataheko
- Kaneshie
- Abossey Okai
- South Industrial Zone, and
- The CBD Zones flanking Kwame Nkrumah, High Street & Liberia Road

2.5.3 Urban Transport Situation in GAMA

Population growth and increasing rates of car ownership are expected to increase the number of cars in GAMA from 181,000 in 2004 to over 1 million in 2023. Based upon the DHV master plan studies the highest traffic volumes are found in the Winneba Road and Liberation Road corridors, which have volumes over 50,000 vehicles per day at certain points. Approximately 10,000 vehicles entered the central area of Accra within the Ring Road in the morning peak hour and on a typical weekday 270,000 vehicle trips are made into, or out of, the Accra central area. Higher volumes, of approximately inbound 16,000 vehicle trips in the morning peak hour and 300,000 daily vehicles trips in both directions, crossed into the area inside the Motorway Extension. Approximately 1.3 million passenger trips per day were estimated to enter or leave the area within the Accra Ring Road and 1.6 million passenger trips into or out of the area within the Motorway Extension. Approximately 1 million passenger trips were made each day into and out of the central area of Accra using trotros and taxis. Eighty four percent of these passenger trips were made by public transport. Over half (56%) of daily passengers were carried by trotros, and a further 15% by taxi. In Accra, trotros and taxis carry an average number of passengers per trip of 13 and 2.3 respectively. These vehicles are inefficient in terms of the amount of road space used, and congestion caused, to transport each passenger.

Congestion is a major problem on arterial routes with 70% of major roads in 2003 operating at unacceptable level of service at some time during the day (<20 km/h). Considerable scope therefore exists to improve the efficiency of people movement through a shift from low capacity public transport vehicles to large and double-decker or articulated buses with the potential to carry over 100 passengers.

Government control over the operation of public transport is very limited; however, the private operations are strictly controlled by trade unions of which the most powerful is the Ghana Private Road Transport Union (GPRTU). The overall quality of public transport is poor, most vehicles are old, and maintenance standards are extremely low. High vehicle maintenance costs arising from poor road surfaces and limitations imposed on earnings by the acute congestion on the urban roads constrain the operators to invest in new vehicles. The limited number of vehicles and their low capacities result in long waiting times during the morning and evening rush hours.

2.6 Traffic volumes

Traffic counts performed in the fall of 2007 and in 2003 provide the basis for describing the traffic conditions in the corridor. For the Pilot Project 16hour traffic counts were taken at six stations along the route Figure and Figure show the results of these counts.

At the Accra Academy site, the highest traffic volumes were observed; over 25,000 vehicles in each direction were counted. At Odorkor the highest passenger flows to Accra were measures at 250,000 passengers per day. In the reverse direction the highest passenger volumes were at Mallam at 200,000 per day. The average mode split at all counting stations in the Accra direction was 40% cars, 18% taxis, 34% trotro and large bus. In the reverse direction the mode split was 32% car, 16% taxi and 43% trotro and large bus. In the peak hours the proportion of cars was slightly higher. In terms of passengers carried daily cars transported only 9-13% of the market, taxis 4-6% and trotro/large buses 82-86%.

As part of the DHV study traffic volumes were found to be highest on Wednesday (111% of the weekday average) and lowest on Thursday (88%) of average. The evening peak hour, with 6.8% of daily traffic was slightly higher than the morning peak hour which had 6.6% of daily traffic.

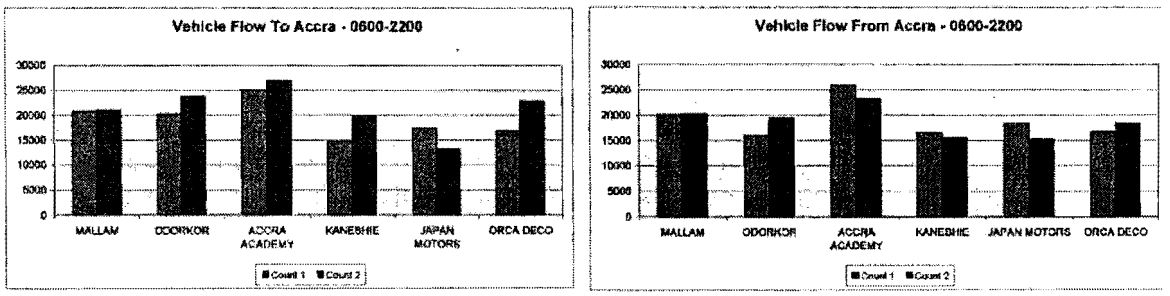


Figure 3 Traffic Volumes at Survey Sites

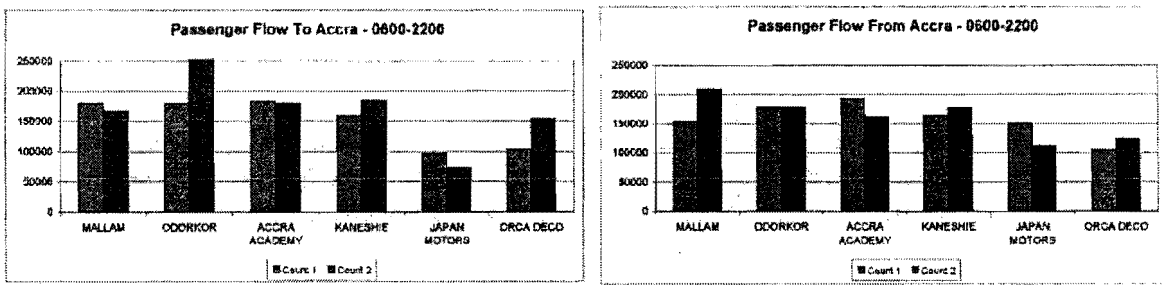


Figure 4 Passenger Volumes at Survey Sites

2.7 Land Use and Economic Activities

2.7.1 The Main Route

The main route of the BRT pilot project, Winneba and Graphic roads, is a major arterial in Accra which serves traffic from the Western and Central regions of the country. It also serves traffic from Ablekuma North, Okaikoi South and Ablekuma Central Sub Metros of the Accra Metropolitan Assembly.

2.7.2 Winneba Road

Winneba Road starts from the Mallam Junction on the west and ends at Obetsebi Lamptey Circle covering a distance of 6.8km. The section from the Mallam Junction to Outer Ring Road junction, known as First Light Junction, separates South Odorkor and Mataheko suburbs on the south from North Odorkor and Bubuashie on the north. These areas are predominantly residential with some commercial activities along the immediate frontage of the road. Between First Light Junction to Obetsebi Lamptey Circle are

the Abossey Okai suburb on the south and the Kaneshie suburb on the north. The immediate frontage along the road is commercial but most of the suburbs are predominantly residential. Kaneshie Market and bus terminal are located in this section of the road as is the Accra Academy just west of First Light.

2.7.3 Graphic Road

The Graphic Road is a continuation of the Winneba Road and starts from the Obetsebi Lamptey Circle and ends at the intersection with the Kwame Nkrumah Avenue. It is 2.3km long with about 1.5km of it forming part of the boundary separating Okai Koi South and Ablekuma Central sub Metros. The remaining 0.8km separates Ashiedu Keteke from Osu Klotey sub Metro. Most of the road passes through the South Industrial Area and the rest through the Adabraka Residential Area. Major commercial establishments along this section are Toyota Ghana Ltd, Kingsman Enterprises, Graphic Communications Group Ltd, and Accra Brewery.

2.7.4 Central Business District (CBD) Distribution Routes

The proposed BRT routes in the central area would operate along Liberia Road, High Street, Kojo Thompson and Kwame Nkrumah roads. The Thompson and Nkrumah routes would operate as one-way pairs while the routes along Liberia and High Streets would operate in both directions. In contrast to the BRT route along Winneba and Graphic roads the BRT will share the use of these roads with other vehicular traffic from the other sectors of the city including: Ayawaso Central, Okai Koi South, Okai Koi North sub metros and beyond, Osu Klottey, Ashiedu Keteke, Adabraka, Asylum Down, Ridge, CBD, Ministries, Ussher Fort and the James Town sub metro areas.

Major establishments found along the BRT route in the CBD include: most Government Ministry offices, educational institutions, major markets, bus terminals, Ghana Railways central station and a wide mix of commercial establishments to numerous to name individually.

2.8 Utilities, Infrastructure and Facilities Identified Along the BRT Corridor

The project corridor is well served with utility services such as service roads, water, electricity and telephone lines, roadside drains, culverts, pipelines, street lighting, traffic signals, bus terminals and fuelling stations. A survey carried out in June 2007 identified 48 schools, 5 markets and 15 health facilities in the project's zone of influence. The schools comprised 34 basic, 6 secondary and 8 tertiary institutions. Twenty nine of the schools are publicly owned while the remaining 19 are privately owned. Four of the markets are under the jurisdiction of the AMA and the remaining one is privately managed. Only three out of the 15 health facilities are public facilities. Markets identified within the zone of influence of the project are Makola, Kantamanto, Agbobloshie, Kaneshie and CIBA.

Table 2.1 Identified Markets Along the Corridor

No	Name	Location	Owner	Capacity (sq m)	Year Established
1	Makola	Makola	AMA	4000	1986
2	Kantamanto	UTC	Private	3000	1983
3	Agbogloshie	Agbogloshie	AMA	4000	1990
4	CIBA	Mallam junction	Private	600	1984
5	Kaneshie	Kaneshie	Private	large	1972

Source: Asare S, June 2007: Assessment of Travel Characteristics of Commuters to Markets, Schools, and Health Facilities Along the BRT Pilot Corridor; Final report

Various interchange points along the corridor provide public transport services that cover most locations in GAMA, and a number of regional destinations such as Kumasi, Cape Coast and Takoradi. Routes from

Mallam run predominantly to the CBD area and suburbs in the vicinity of Mallam. However, a number of longer routes serve Kasoa, Madina in the north and Teshie-Nungua in the east.

From Odorkor, routes serve the areas north of the terminal such as Achimota, Kwashieman and Sowutuom as well as a few regional destinations such as Cape Coast and Takoradi. Terminals in the Kaneshie Market area are used by taxis, trotros, bus and intercity services. Most major destinations within GAMA can be reached from a Kaneshie terminal. Kaneshie Main Station serves many GAMA and regional destinations. However, the majority of routes serve the area to the north and northeast of the terminal. Kaneshie-Takoradi Station serves mostly long distance routes to the west (Cape Coast, Takoradi and Tarkwa), while the Obossey Okai Station serves the western Accra suburbs of Korle Bu, Chorkor, Mamprobi etc

In addition to the major terminals described above a number of smaller loading and unloading stops exist along the proposed BRT route. Existing bus services along the pilot corridor use sixteen (16) intermediate stops in each direction between Mallam Station and the Cocoa Marketing Board (CMB) terminal. Six (6) out of these give opportunities for interchange with other routes.

2.9 Natural Environment

2.8.1 Climate

The project area lies within the dry equatorial climatic zone and is characterized by two rainfall peaks and separated by marked dry seasons. Mean annual rainfall ranges between 74 and 90 cm with the prime season (which begins March and ends in mid-July) accounting for about 67% of the annual rainfall. The second season starts in mid-August and ends in October.

Mean monthly temperature is highest (about 30oC) between March and April and lowest (about 26oC) in August. Average monthly relative humidity is higher in the rainy seasons but the highest monthly relative humidity in the project corridor does not exceed 75%, while the lowest is about 60%.

2.8.2 Topography, Geology and Soils

The predominant relief of project corridor is undulating. On the whole, the general elevation of the corridor is not more than 80 metres above mean sea level and varies no more than 10m along the route with low points at Mallam and Korli Lagoon.

The rocks underlying the road corridor are mainly of the Dahomeyan series of the Precambrian era which forms the basement complex of Ghana. The rocks are mainly metamorphic, consisting of gneisses and schists.

The major soil groups in the corridor include coastal savanna, ochrosols, lateritic sandy soils, tropical black clay or Akuse soils and coastal sands.

2.8.3 Air Quality

Construction and earth works at the project site will involve the use of cement, bitumen/asphalt, excavation of earth, base filling and demolition of structures. The major air quality indicator associated with these activities is Total Suspended Particulates (TSP) or dust. This manifests visibly as plumes causing visibility loss, respiratory tract diseases and amenity losses. Dust and vehicle emission gas levels will therefore be established in the EIA to serve as a basis for gauging any changes in the quality of air, particularly during the construction phase of the BRT. Pollution from vehicle operations (particulates, CO and CO2, NOX, hydrocarbons, and sulphur oxides) is expect to decrease with the reduction in traffic congestion and the removal of polluting vehicles.

2.8.4 Noise

Although sections of the route are perceived to be noisy, a study by the EPA indicates that none of the seven hot spots as far as noise in the metropolis is concerned are located on the BRT route. Noise levels at

various locations on the route can therefore be assumed to be within EPA noise levels for commercial and residential areas. Nonetheless, the baseline ambient noise levels will be established in the EIA.

2.8.5 Drainage and Water Quality

The major water body draining the project area is the Odaw River, over which a bridge runs close to the level railway crossing on Graphic Road. The quality of the Odaw River can be described as poor. The river is one of the most polluted water bodies in the metropolis due to the discharge of household and industrial waste upstream. Public waste and human excreta are visible from the bridge.

On both sides of the BRT route at Mallam are wetlands which act as sinks for the area. These wetlands are of local ecological importance and so they are not designated as Ramsar sites. Already there is evidence of encroachment by businesses and squatters on the wetlands. Sections of the wetland bordering Winneba Road will be filled during expansion of the road to accommodate the BRT. The expansion of Winneba Road will be designed to minimise the negative impacts on the wetlands.

2.8.6 Biodiversity

The road corridor is highly urbanised and unlikely to contain any protected or unique species. The original vegetation has been cleared or greatly modified through various human activities. Some avenue trees have been identified at various sections of the road and efforts will be made to preserve as many of them as possible. Any soil, tree or green area losses are likely to be compensated by the extensive landscaping planned for the new BRT medians and the Stations.

3.0 Key Issues of Environmental Concern

As part of the scoping exercise some of the potential environmental impacts were identified via the review of relevant literature, discussions with experts on the project and consultation with members of the general public residing or doing business in the project area. The settlement characteristics along the Winneba corridor vary from commercial and industrial areas to the east; Kaneshie Market related activity in the middle; and commercial backed by residential and educational/social uses to the west. Given this variation in conditions it is not possible to relate all the potential environmental concerns to specific areas along the route at this stage. It is likely that most of the potential impacts would occur at various areas along the road corridor. Notwithstanding, some of the potential impacts, which will be analyzed fully in the EIA which are likely to require mitigation/management include the following:

3.1 Constructional Phase

3.3.1 Land-Take and Location of Borrow Areas:

Excavation and transport of borrow materials;

3.1.2 Soil Erosion and Sedimentation:

Excavations could expose loosened soils to be eroded and deposited in drains and natural water courses;

3.1.3 Impacts on Wetlands

- The existing road will be expanded into the adjacent wetlands in the Mallam area to accommodate the BRT
- Deposition of sediments

3.1.4 Construction Materials

The movement of construction materials to the corridor can have traffic impacts, especially in busy areas such as around the Kaneshie Market, the Makola Market and the CBD.

3.1.5 Disposal of Construction Waste:

- Disposal of rubble from constructional activities;
- Destruction of aesthetic view of road corridor by the haphazard stockpiling of excavated soils;

3.1.6 Impact on Air Quality:

- Air Pollution caused by release of dust during:

- Demolition of structures,
- Excavation works,
- Delivery of cement, sand, stones, and gravels,
- Vehicular movement on the road corridor; and
- Exhaust fumes from vehicles and plant and equipment.

Air pollution from the above sources will be a nuisance and potential source of respiratory diseases for residents, businesses and users of the road. However, the impact would be particularly problematic for residents close to the road and in places of high human concentration such as the markets and the CBD.

3.1.7 Noise Pollution and Vibration

- Excessive noise from use of machinery and equipment such as excavators, concrete mixers and compactors during construction stage. Like air pollution, noise pollution will be a nuisance to persons living or operating along the road. Noise from construction activities will go to accentuate background noise levels in residential areas such as Odorkor as well as the Ministries area.
- The operation of heavy duty machinery and equipment and vehicular movement will increase vibrations in the immediate road corridor.

3.1.8 Disruption of Traffic Flow:

- Construction vehicles could increase traffic volume on the main road. Increased vehicular traffic flow will have implications for air quality, noise, serenity of the area and the safety of residents of the area.
- Temporary diversion of traffic by closure of road lanes and prohibition of selected turning movements during construction
- Increases in local traffic where road is used as a diversion route
- Compromise traffic safety in settled areas along the road corridor.

Looking at the busy nature of the road, the addition of more vehicles and disruptions as well as diversions will make this impact very significant. The effects of the traffic impacts will be much more pronounced in already congested areas such as the Kaneshie and Makola Markets and the CBD.

3.1.9 Disruption of Utilities:

Excavations and other earth moving activities can sever electricity cables, telephone lines and water distribution pipes laid along and/or across the route. Disruption of utilities will equally affect residents and businesses along the road but delayed restoration of the services will be particularly costly to businesses and government Ministries.

3.1.10 Displacement of Business Activities:

- Excavations and construction works on the route are likely to affect access to commercial establishments.
- Commercial activities on both sides of the route will be displaced. Retailers of goods who operate in kiosks or have their wares spread on the pavements along the road will be displaced. This impact will occur particularly in the CBD and around the Kaneshie and Makola Markets.

3.1.11 Property Impacts

- Construction of the depot and terminals, and other works in the Right-of-Way would result in the demolition of some residential and commercial property
- Loss of revenues and amenity due to disruption during construction for both residents and commercial establishments

3.1.12 Public Health and Safety:

- Exposure to dust particulates from excavations and construction;
- Injuries due to vehicular-pedestrian conflicts
- Water in pits and trenches could create conducive breeding grounds for malaria carrying mosquitoes.

3.1.13 Occupational Health and Safety:

- Exposure to workplace accidents;
- Injuries and hazards to construction workers;
- HIV/AIDS risks to workers and consultants from sex workers.

3.1.14 Management of Construction Camp

- Poor sanitation and waste management
- Management of waste oils.

3.2 Post-Construction/Operational Phase

While most of the negative environmental impacts will occur during the construction phase, it is envisaged that the positive impacts of the BRT project will occur during the operational phase. The positive impacts, which are incorporate in the overall objectives of the Urban Transport Project include:

- Reduction of travel time in BRT corridor (65 min base to 40 by 2012)
- Increase in overall travel speeds (15km/hr base to 20kph by 2012)
- Increase share of large buses in market (15% base to 45% in 2012)
- Reduce CO2 by 10% (120 ug/m3 monthly average baseline)
- Length of sidewalks improved (0 base to 40km in 2012, not all BRT)
- Bus shelters and terminal facilities built (0 base to 6 in 2012)
- Bus km/day (base 125 to 225 in 2012)
- Passengers/bus/day (265 base to 800 in 2012)
- Peak hour PT vehicles (3,200 base to 1,800 in 2012)
- Average walk time to bus (40 min base to 20min in 2012)

Permanent negative impacts will be associated with displacement of residents and traders at terminal sites where property will be required and the removal of illegal traders using the footpaths in commercial/market areas. In addition the existing public transport services (trotro and large buses) are to be reformed as part of the Urban Transport Plan; but these reforms are not a part of this "pilot" project.

In general property acquisition along the route will be very modest and only occur at junctions and adjacent to BRT stations. It may be necessary to acquire additional right-of-way to construct the bridges over Obetsebi Lamptey Circle and the railway line, but this depends upon the width of the bridges (several options are being examined).

Mitigation plans will be required to minimise displacement effects.

In total the project benefits are expected to out-weigh any negative impacts.

4.0 Consultations

4.1 Introduction

This chapter presents the initial results of consultations held as part of the Scoping Exercise for the Environmental Impact Assessment (EIA) of the BRT project. The aim of the chapter is to show our objectives for consulting and involving stakeholders. It sets out who the key stakeholders are and how they were identified as important participants. It then outlines our initial findings of consultation.

The consultations were intended to

- provide information about the project and its potential impacts to those interested in or affected by the project, and solicit their opinion in this regard;
- provide opportunities to stakeholders to discuss their opinions and concerns;
- manage expectations and misconceptions regarding the project;
- verify the significance of environmental, social and health impacts identified; and

- inform the process of developing appropriate mitigation measures.

The consultations were governed by the requirements of the Environmental Assessment Regulations 1999, LI 1652 and the World Bank Operational Policy OP 4.01.

Ghanaian Regulations Relating to Public Consultation

ESIA consultation in Ghana is governed by the Environmental Assessment Regulations of 1999.

Advertisement of the scoping notice must be done through:

- Advertisement of the scoping notice to relevant ministries;
- Advertisements in at least one national and one local newspaper if there is any; and
- Making copies of the scoping report available for inspection by the general public in the locality of the proposed project.

Publication of the Environmental statement:

- The Environmental Impact Statement must be made available to the general public, relevant public agencies, organisations, NGOs, metropolitan, Municipal and District Assemblies and local communities to they may make any comments and suggestions on any matters therein.

Public hearings

The Environmental Protection Agency must conduct a public hearing if:

- There appears to be an adverse public reaction to the project;
- The undertaking will involve resettlement;
- The undertaking could have extensive effects on the environment.

World Bank Requirements for Public Consultation

The World Bank Group's Environmental Assessment Policy (OP 4.01) requires that:

- Project-affected groups and local non-governmental organisations (NGOs) be consulted about the project's potential environmental and social impacts during the ESIA process; and
- Local views are taken into account in designing the environmental and social management plans as well as in designing the project.

In addition to the requirement for consultation with stakeholders, the World Bank Group has specific requirements for disclosure of documentation resulting from the ESIA process. These include:

- Preparation and publication of a Public Consultation and Disclosure Plan (PCDP) for consultation;
- Disclosure of the draft ESIA in public places in-country; and
- Preparation of an Environmental Action Plan (EAP) containing social as well as environmental measures designed to manage, mitigate and monitor the impacts identified during development of the ESIA. This must be made available locally.

4.2 Phase 1 – Consultations with Members of BRT Technical Committee

A number of stakeholder institutions (presented below) are represented on the BRT Technical Committee that meets to discuss the project and reports of the project consultant. They include:

- Ministry of Transportation
- Department of Urban Roads
- Ghana Highway Authority
- Environmental Protection Agency
- Town and Country Planning Department
- Motor Traffic and Transport Unit, Ghana Police Force
- Ghana Road Transport Coordinating Council
- Accra Metropolitan Assembly
- Ga West District Assembly
- Land Valuation Board
- Lands Commission

A review of the minutes of the technical committee meetings provided useful insights to the various concerns raised by the institutional stakeholders. These include:

- Integration of land use, transport planning and pedestrian safety in the design
- Encroachment of hawkers
- Need to incorporate the concerns of disabled persons into the design
- Need for critical assessment of major traffic attractors to the CBD area which will affect traffic demand modelling
- Integration of BRT requirements and junction designs into the N1 design
- Need to intensify public education on the project.

4.3 Phase 2 Public Consultation Exercise

To document the views of the stakeholders, a public consultation exercise was undertaken over a period of seven days (November 16-18, 2007 and January 9-12, 2008). In all, 103 persons comprising 56 females and 47 males were consulted in areas such as Kaneshie Market Area, Abossey Okai, Orca Décor-Letap area on the Graphic Road, Swany Arcade and UTC area. The consultess were mainly business owners, passengers, pedestrians and residents in the project area. The purpose of the exercise was to introduce the project to the public at large and to solicit views/concerns they might have regarding the project and its impacts. Some of the issues raised by the public include:

- Effect on existing bus operations due to competitive BRT competitive services;
- Unknown effect of public transport regulatory reforms;
- Disruption of trotro operations during construction;
- Road works will worsen the already bad traffic congestion on the route;
- Business will go down as the public will want to avoid the inconveniences involved in getting to the businesses along the route;
- Dust pollution and the resultant respiratory difficulties;
- Vehicular-pedestrian conflicts;
- Diversion of traffic resulting in long and inconvenient trips;
- Temporary disruptions to water flow, electricity and telephone service;
- Danger involved in crossing the road to access the BRT buses suggesting the need for pedestrian footbridges;
- Provision of park and ride facilities to induce motorists to switch to the BRT service
- Payment of compensation for demolished shops and structures;
- Long delays in government projects that will expose residents in the project area to long periods of inconveniences due to dust, traffic, etc.
- Exposure of the public, especially children to dangerous conditions, such as trenches, pits, etc;
- Water collected into pits could provide conducive breeding grounds for mosquitoes with attendant increase in malaria cases.

The views/concerns expressed by the consultees were considered during the identification of the key issues of environmental concern. These views/concerns will be discussed in much more detail and with reference to specific sections of the road during the assessment and evaluation of the potential impacts in the EIA.

5.0 Proposed Draft Terms of Reference for ESIA

These Terms of Reference (ToR) have been prepared as part of the scoping exercise of the ESIA on the proposed BRT project. This scoping exercise has been carried out in accordance with the requirements of the EIA Law and Regulations of Ghana, and has included primary and secondary data collection, and consultation with a range of key stakeholders.

These ToR will guide the ESIA study that that will consider both positive and negative impacts during the construction and operation of the BRT. The study will recommend measures for the mitigation of significant environmental impacts remaining after feasible adjustments have been incorporated in the project design.

Scope of EIA Study

The Proposed Terms of Reference (TOR) for the EIA study of the project comprises the following:-

Introduction

This section will discuss the following:-

4. Project background.
5. Purpose and objectives of the project.
6. Regulatory and institutional framework
7. Scope and structure of the EIS Report.

Institutional and Legislative Framework for the EIA

A description of the operations, policies and regulations of various institutions that seek to protect the environment from the negative impacts of the construction and operation of the proposed BRT will be presented in this section. The EIA will situate the project within the institutional and legislative framework defined by the policies and regulations of the various stakeholders and the extent to which they will contribute to the construction and management of the BRT.

Description of the BRT Project

Project description will be built on information from project documents and consultation with the project planners/designers, contractors and developers. The description will cover:

8. Project components and layout, including:
   - Proposed route (length and other characteristics)
   - Grade separations
   - Terminal and depot development
   - Feeder routes
9. Types, quantities and sources of materials
10. Equipment to be utilised during construction
11. Workforce
12. Operation and management of the BRT

The narrative description will be complemented with maps, photos and appropriate diagram.

Baseline Conditions of the Project Site

To be able to assess any environmental changes resulting from the construction and operation of the BRT, the baseline environmental conditions prevailing in the project corridor will be established. Baseline data would be obtained by collecting, collating and reviewing studies and information on the project area. Information/data from these sources will be supplemented and validated by information/data gathered from trips to project corridor. The baseline conditions that will be considered include:

- Climate (rainfall, temperature, wind direction);
- Topography, Geology and Soils;
- Flora and Fauna;
- Surface Water/Drainage;
- Ambient Air Quality;
- Ambient Noise Levels;
- Communities
- Infrastructure and Utility Services;
- Land-use / Socio-economic Activities;
- Traffic conditions;
- Utilities and infrastructure

Analysis of Project Alternatives

The EIA will include an analysis of realistic alternatives on the basis of available information. It should be noted that the former DHV report and associated GAMA Urban Transport Plan provides the basis for the BRT plans and the selection of the Winneba Corridor as a "pilot project" together with the recommendations for a median configuration, feeder and trunk bus serves, and stations located near existing cross roads. Notwithstanding, the EIA analysis will consider alternatives with respect to the project design, objectives and management. It is expected that the analyses, where appropriate, will lead to proposals that would be considered more appropriate from an environmental, social and economic perspective, compared to the original proposal. The analyses would also provide a justification for the accepted design.

The alternatives that will be considered are:

- No-action alternative: this alternative assumes that the present state of the road corridor and transport system will remain;
- Build Alternative: this implies constructing the BRT to acceptable safety, speed and environmental standards.

Identification and Assessment of Potential Impacts

The potential impacts of the project would be identified in relation to:-

- Pre-Construction phase;
- Construction phase;
- Post-Construction phase.

The methodology for the identification of the potential impacts would involve site surveys, surveys of similar road projects and consultations with the relevant stakeholders.

The following have been identified during the scoping study as areas of potential project impact that need to be fully considered in the EIA. These, and others that emerge as the EIA progresses, will be addressed:

- Destruction of vegetation and soils;
- Landscape modification;
- Noise pollution and vibration;
- Air pollution;
- Erosion and siltation of water courses;
- Generation and disposal of construction waste;
- Traffic flow and safety;

- Vehicular-pedestrian conflicts;
- Disruption of utility services;
- Demolition of structures;
- Relocation of economic activities;
- Construction camp management;
- Public health effects;
- Occupational health and safety.

Impacts would be evaluated in terms of their being:-
- Positive or Negative;
- Short or Long-term; and
- Direct or Indirect
- Cumulative

The significance of the predicted impacts will be assessed in terms of:
- The effect on health and safety of residents in the project area;
- The effect on ecologically sensitive/critical areas;
- The effect on traffic flow in the area;
- The effect on existing socio-economic conditions and development.

Mitigation/Management of Impacts

Proposals for the mitigation of the significant negative impacts of the project will be outlined. A team comprising the project designers, engineers, and other professionals involved in the project will discuss the identified impacts and propose various interventions for the mitigation or reduction of the magnitude of the adverse environmental impacts and the enhancement of the beneficial impacts. The team will use the "Environmental and Social Management Framework (ESMF) for the Transportation System Development Programme - Roads Sector by CEHRT, 2007, as a background document in devising appropriate mitigation measures. As much as possible, the mitigation options will be cost-effective measures that will be specifically tailored to the impacts in order to achieve the aim of limiting the harmful effects of the project. Measures for the mitigation of residual negative environmental effects will be recommended after feasible adjustments have been incorporated in the project design.

Monitoring Plan/Programme

The parameters of various environmental components and others will be monitored periodically to evaluate the effectiveness of the mitigation measures and/or establish the extent of changes in the baseline conditions. Periodic monitoring will be carried out on:
- Air Quality;
- Noise Levels;
- Water sources/bodies quality
- Traffic Flow and Accidents; and
- Waste Management.

Provisional Environmental Management Plan

To ensure the implementation of the mitigation measures and an effective monitoring programme, and to deal with environmental impacts and other concerns, which could not be predicted at this stage, a Provisional Environmental Management Plan will be outlined. The plan will cover, among others:
- The duties and responsibilities of the personnel charged with the environmental management of the road;
- The cost of environmental management;
- Financial resources available for environmental management.

Conclusion

This section will cover:-

- General overview of the main conclusion of the study;
- The need and justification for the project.

Report Format

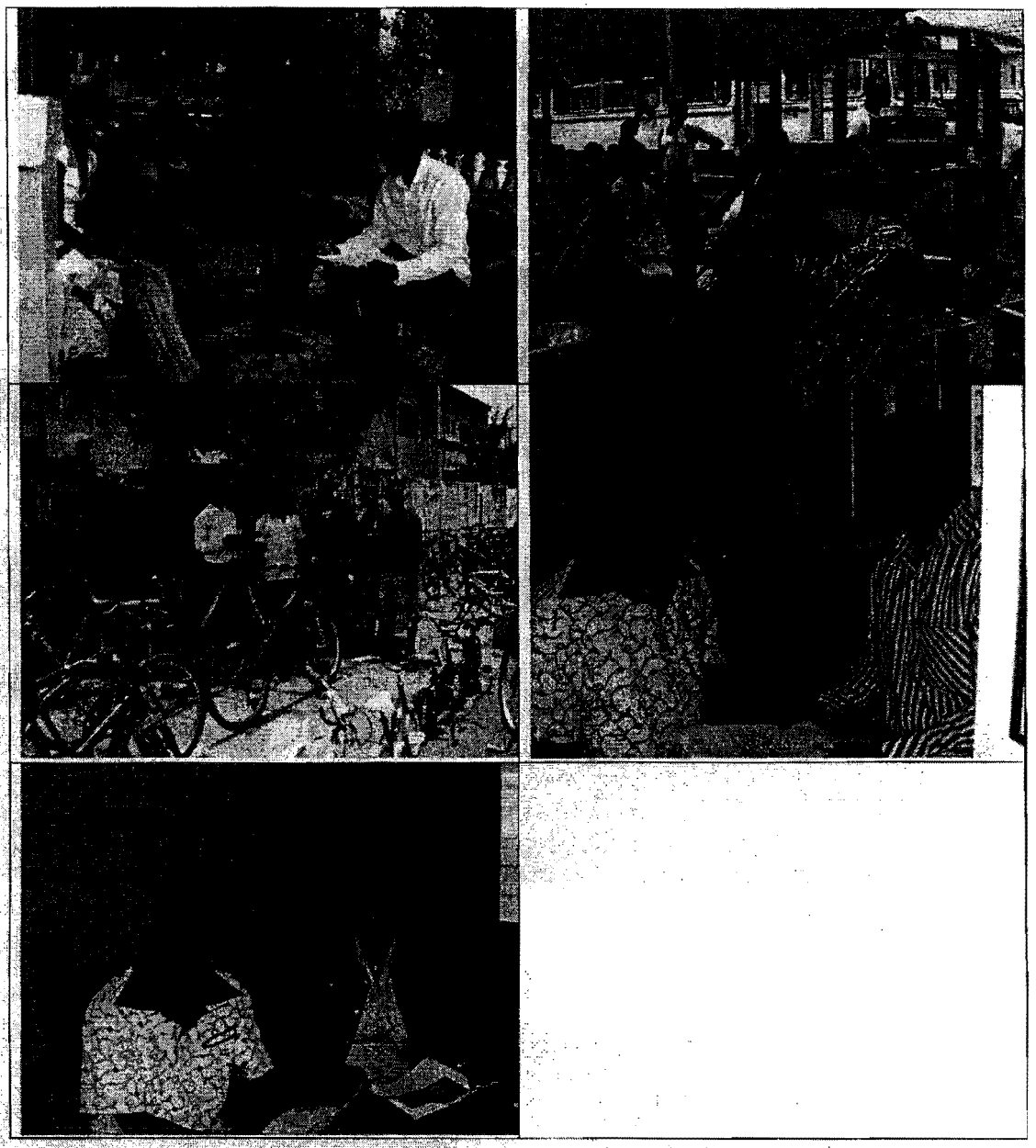
The EIA report will be based on the guidelines of Ghana EPA and the World Bank. The main text will focus on findings, conclusions and recommended actions. The conclusions and recommendations will be substantiated by relevant data.

The results/findings of the EIA will be compiled into an Environmental Impact Statement, which will have the following structure:

1. Executive Summary
2. Policy, legal and institutional framework
3. Description of the BRT Project
4. Analysis of Alternative Approaches
5. Baseline Information of the Project Area
6. Assessment of Potential Environmental Impacts
7. Mitigation of Environmental Impacts
8. Environmental Monitoring Plan
9. Provisional Environmental Management Plan
10. List of References
11. Appendices

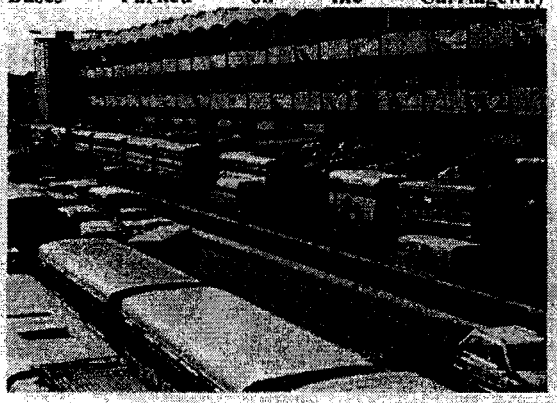
A copy of the draft EIA will be submitted to the Environmental Management Unit of the Department of Urban Roads (DUR) for review before the final revised copy is forwarded to DUR for sending to the Environmental Protection Agency (EPA). DUR's comments will be incorporated in the final document submitted to EPAvia DUR. In line with the Ghana EIA procedures, ten (10) copies of the EISA will be submitted to the EPA for review.

Appendix B Consultations with Stakeholders

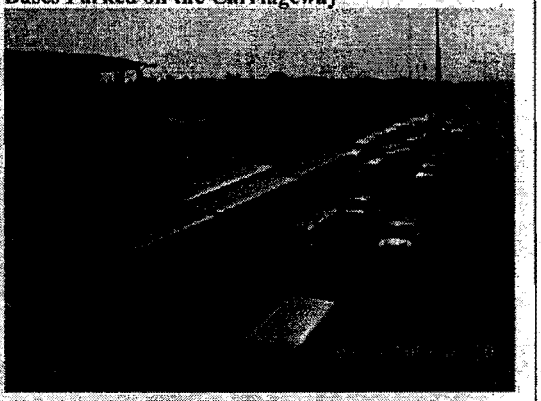


Appendix C BRT Corridor Photos Kaneshie Market Area

Buses Parked on the Carriageway



Buses Parked on the Carriageway

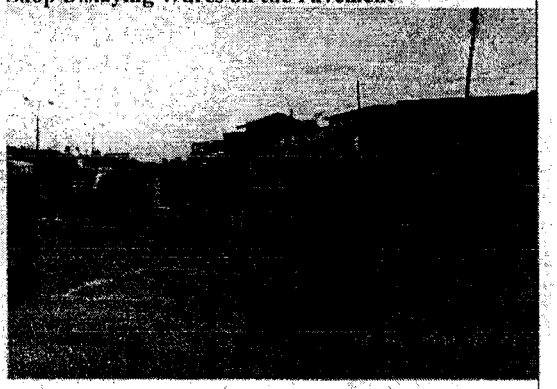


Traders occupying the Pavement

Traders on the Pavement

Trading on the Carriageway

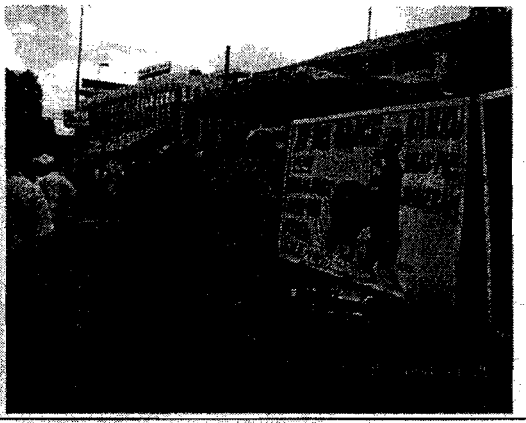
Shop Dislaying Wares on the Pavement



The Median in Kwame Nkrumah Avenue Near UTC

Loading bay to be Affected

Restaurant to be Affected



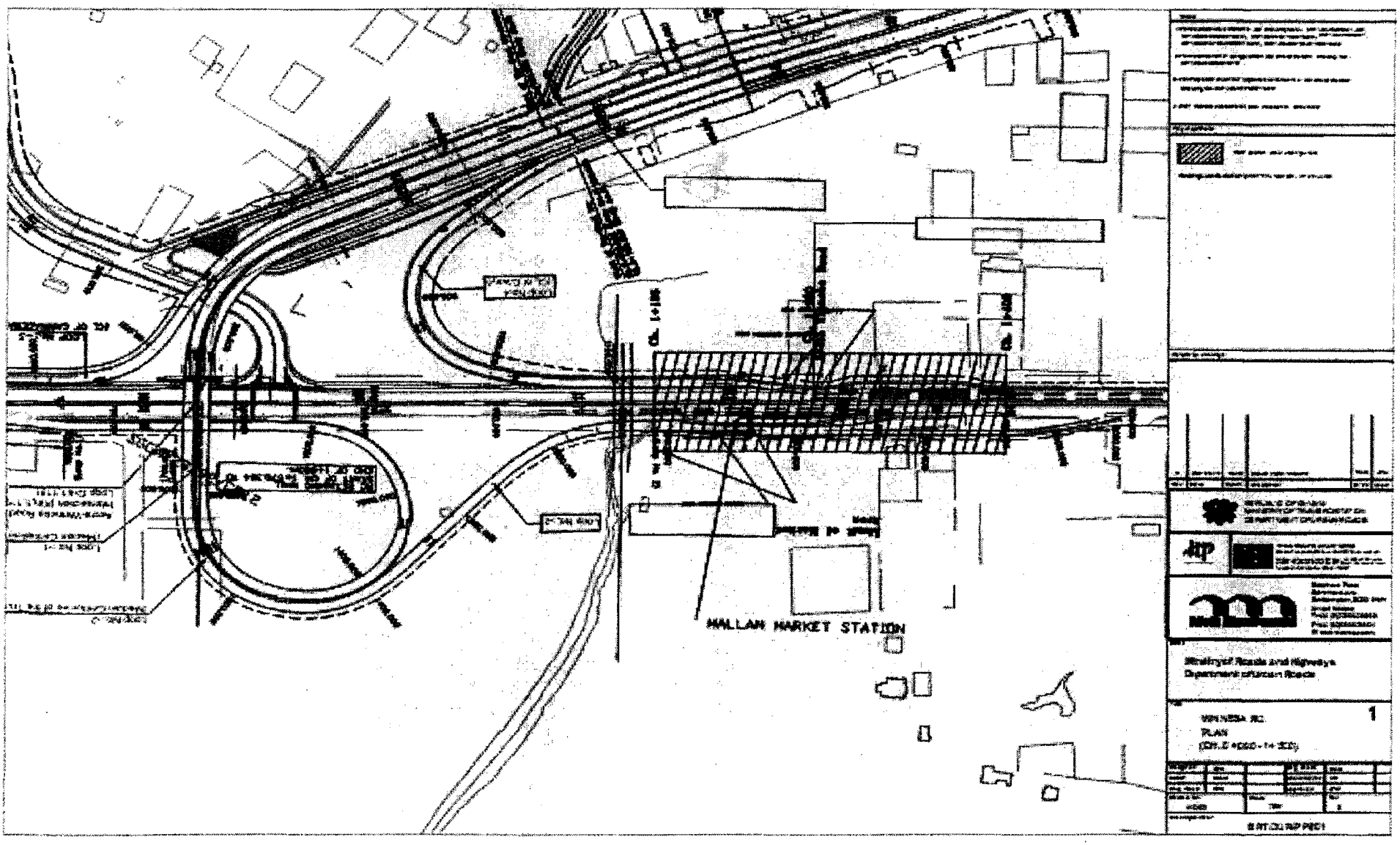
Trading in the Pedestrian walkway

Trading Activities in the Median

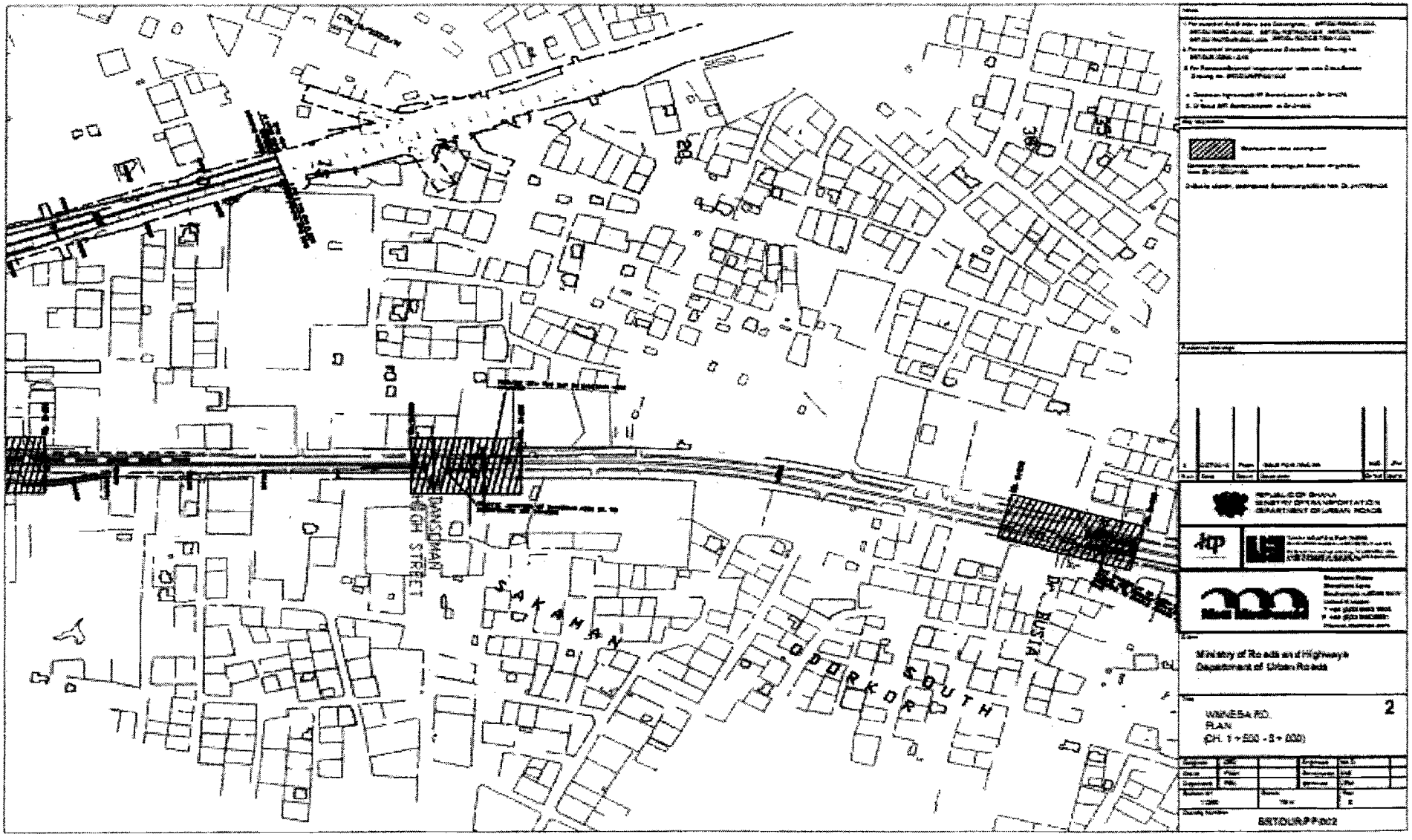
Trading in the Median

Trading in the Median

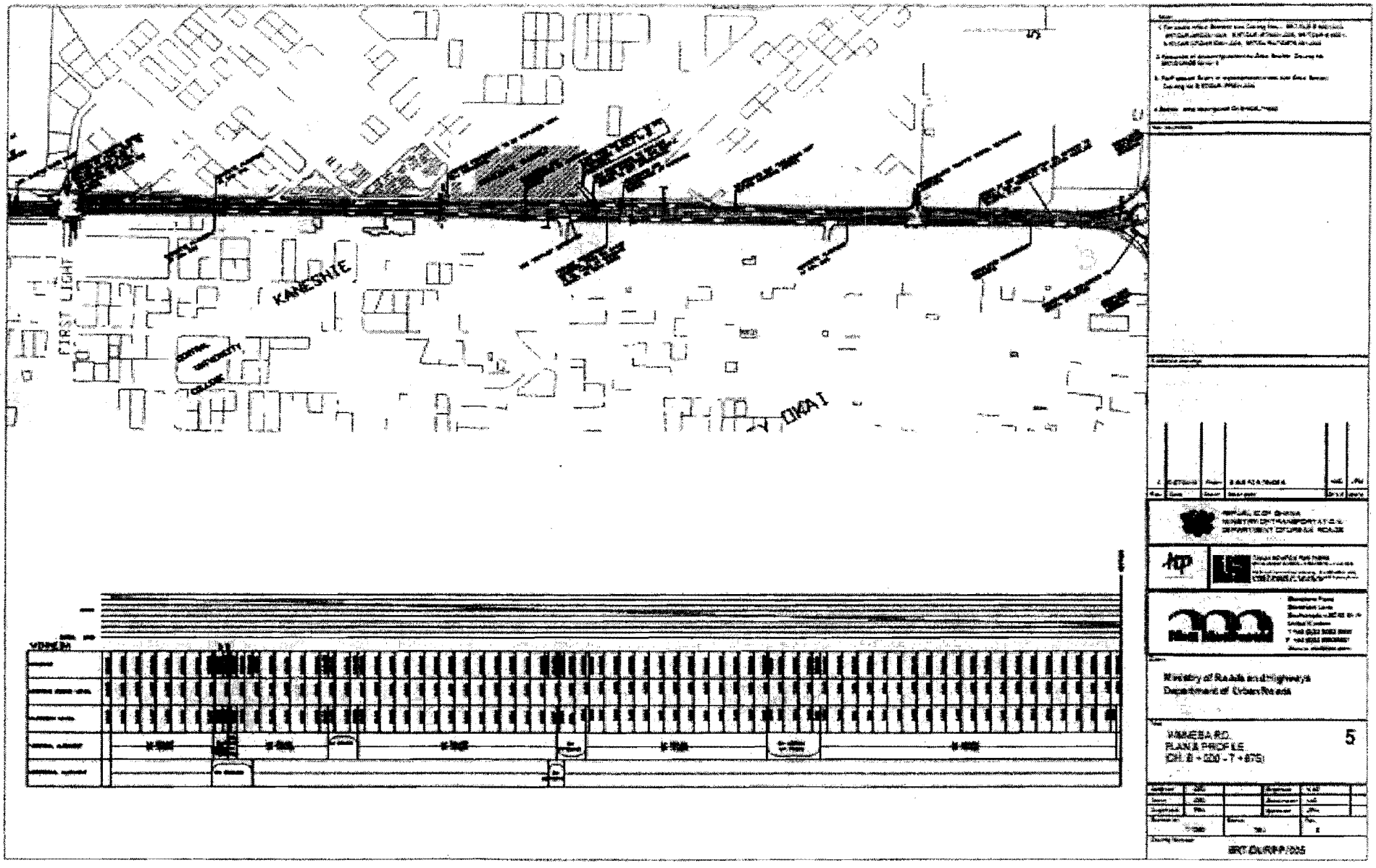
Appendix C1 A Section of the PRT Route showing the Re-engineered Mallam Junction



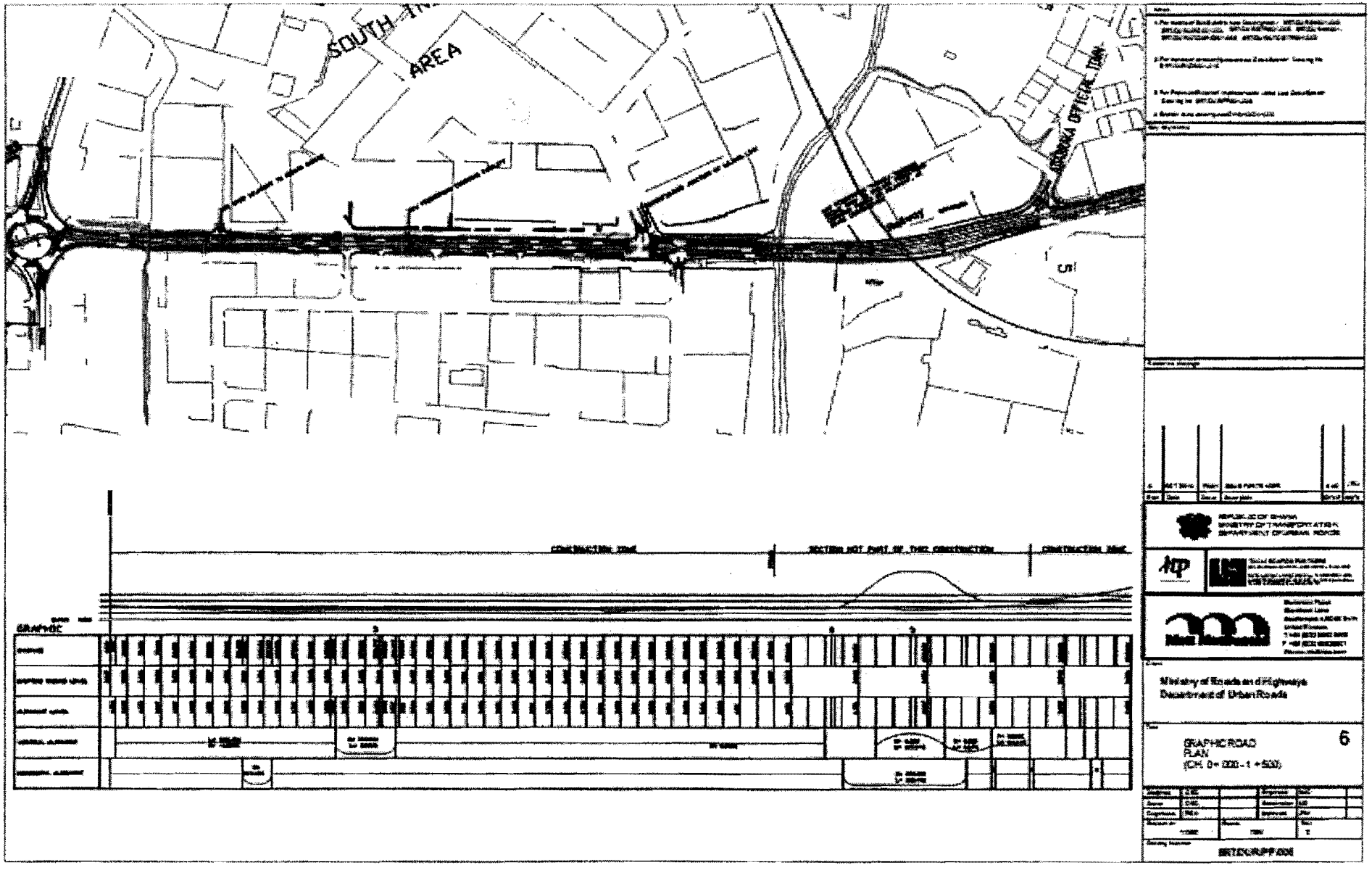
Appendix C2 A Section of the BRT Route from Mallam Junction to First Light



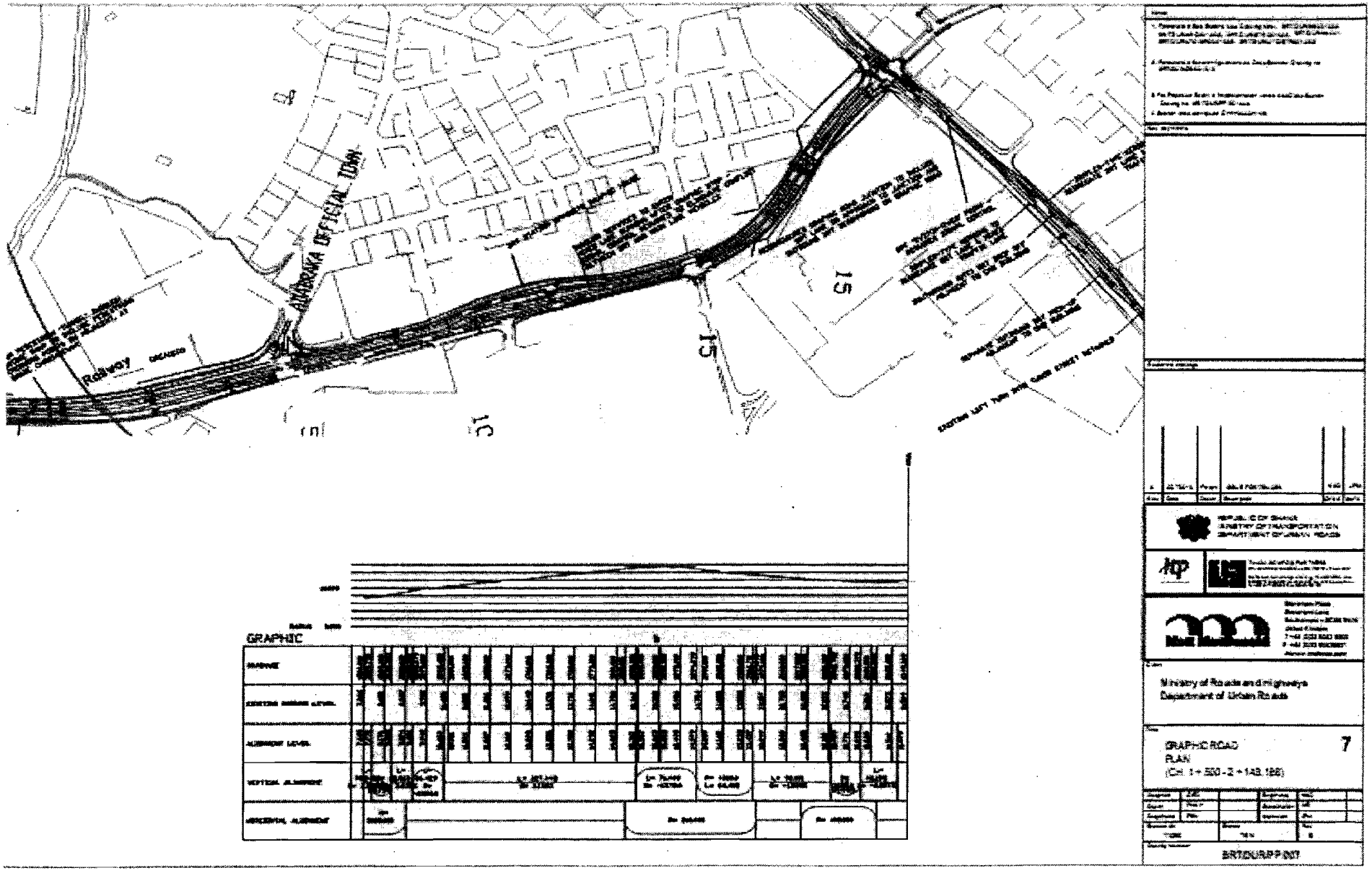
Appendix D1 Layout of BRT Route from First Light to OLC



Appendix D2 Layout of BRT Route from OLC to Graphic Road



Appendix D3 Graphic Road Showing Partly Segregated Lanes and BRT in Mixed Lanes



Appendix E Layout of CBD Loop showing BRT in Mixed lanes