REPUBLIC OF GHANA

TRANSPORT INFRASTRUCTURE FRAMEWORK

of the

GHANA INFRASTRUCTURE PLAN

(2018-2047)

National Development Planning Commission

SEPTEMBER 2017

(Draft Report)

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THE GHANA INFRASTRUCTURE PLAN IS
A COMPANION DOCUMENT OF THE
LONG-TERM NATIONAL DEVELOPMENT PLAN
(2018-2057)

SEPTEMBER 2017

(DRAFT REPORT)

Institute for Infrastructure Development
STRATEGIC POLICY ASSOCIATES

The Ghana Infrastructure Plan is made up of the following:

1. Energy Infrastructure Framework
2. Transport Infrastructure Framework
3. Water Infrastructure Framework
4. Human Settlements and Housing Framework
5. Social, Civic and Commercial Infrastructure Framework
6. ICT Infrastructure Framework
7. Institutional Development Framework
8. Results Framework
9. Financing Plan

TRANSPORT INFRASTRUCTURE FRAMEWORK

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Acronyms and Abbreviations

AMA	Accra Metropolitan Assembly
ANS	African Navigation Service
ATBA	Area To Be Avoided
BASA	Bilateral Air Service Agreement
BIMS	Bus Information and Management System
BIP	Boankra Inland Port
BOT	Build Operate Transfer
BRRI	Building and Road Research Institute
BRT	Bus Rapid Transit
CBD	Central Business District
CCTV	Closed Circuit Television
DFR	Department of Feeder Roads
DUR	Department of Urban Roads
DVLA	Driver and Vehicle Licensing Authority
DWP	Deep Water Port
ECH	Empty Container Handlers
EV	Electric Vehicle
FAA	Federal Aviation Administration
GACL	Ghana Airport Company Limited
GAMA	Greater Accra Metropolitan Area
GCAA	Ghana Civil Aviation Authority
GHA	Ghana Highway Authority
GHATIG	Ghana Trade and Investment Gateway
GIP	Ghana Infrastructure Plan
GKMA	Greater Kumasi Metropolitan Area
GMA	Ghana Maritime Authority
GPHA	Ghana Ports and Harbours Authority
GRCL	Ghana Railway Company Limited
GRDA	Ghana Railway Development Authority
GSA	Ghana Shippers' Authority
GSS	Ghana Statistical Service
ICT	Information and Communications Technology
IMO	International Maritime Organisation
IMT	Intercity Mass Transit
ITS	Intelligent Transport System
KIA	Kotoka International Airport
LTNDP	Long-term National Development Plan
MLGRD	Ministry of Local Government and Rural Development
MMDAs	Metropolitan, Municipal and District Assemblies
MMTD	Motor Traffic and Transport Department
MoFA	Ministry of Food and Agriculture
MoT	Ministry of Transport
NAS	National Ambulance Service
NASA	National Aeronautics and Space Administration
NDPC	National Development Planning Commission
NRSC	National Road Safety Commission
NRSS	National Road Safety Strategy
NSDF	National Spatial Development Framework
NSEZ	Northern Savannah Ecological Zone
NTP	National Transport Policy
ODA	Offical Development Assistance
PNDC	Provisional National Defence Council
PPP	Public Private Partnership
RM&E	Research, Monitoring and Evaluation
RMP	Railway Master Plan
RSA	Road Safety Audit
RTG	Rubber-Tyred Gantry
SADA	Savannah Accelerated Development Authority
SFH	Sekondi Fishing Harbour
SOE	State-Owned Enterprise
STS	Ship-To-Shore
TDM	Transport Demand Management
TFH	Tema Fishing Harbour
TMA	Tema Metropolitan Assembly
TSCS	Traffic Signal Control System
TTU	Tractor-Trailer Unit
VDS	Video Display System
VLTC	Volta Lake Transport Company
VP1000P	Vehicle Population per 1000 Persons
VRA	Volta River Authority
VTMIS	Vessel Traffic Management Information System
YD	Yamoussoukro Declaration

GENERAL OVERVIEW

i.Introduction

The National Development Planning Commission (NDPC) has embarked on a process to develop a Long-term National Development Plan (LTNDP) to shape the scope and content of the development plans that the country has used for decades.

The vision for the long-term development framework is based on the 1992 Constitution and the aspirations of Ghanaians as expressed during nation-wide consultative processes organised by the NDPC between 2015 and 2016.

ii.The Path to High-Income Country Status

Ghana's LTNDP framework envisages that by 2057, when Ghana celebrates its 100th independence anniversary, the country's economy should be:

a) Ranked among high-income countries,

b) Export-oriented, industrialised, diversified and resilient,

c) Driven by Ghanaian entrepreneurship,

d) Characterised by high-value services,

e) Dynamic, with a globally competitive manufacturing sector, and

f) Have an efficient agricultural sector capable of feeding the nation and exporting to global markets.

iii.Ghana Infrastructure Plan

A major component of the long-term plan is the Ghana Infrastructure Plan (GIP), which in turn is based largely on the National Spatial Development Framework (NSDF) completed in February 2015.

The GIP spells out the Government's vision and strategic direction for infrastructure development. It also defines investment principles and priorities over the next 30 years. The aim of the plan is to deliver economic, social, and environmental benefits to the country through the production of a defined and budgeted investment framework for the LTNDP.

iv.Vision and Strategies for the GIP

The GIP is underpinned by Ghana's LTNDP. It will guide the formulation and implementation of the LTNDP that will run from 2018 to 2057 and also chart a new strategic direction for infrastructure, guide the future direction of infrastructure delivery and define the nation's investment priorities for the next 30 years.

The GIP provides a coordinated and integrated approach to infrastructure planning, prioritisation, funding and delivery by engaging with key stakeholders across government, industry and the community, and prioritising Ghana's infrastructure needs from the perspective of a prosperous nation.

Although the GIP focuses largely on public infrastructure projects, it addresses the need to create enabling conditions for developing private infrastructure, and highlights opportunities for the private sector to engage government to find creative solutions for infrastructure delivery. Indeed, a large part of the programme will be financed by the private sector.

The long-term planning framework is expected to facilitate Ghana's transition from lower middle-income to high-income by serving both as a framework for the continuity required for formulating and implementing the GIP over the period, and as a mechanism for facilitating policy continuity despite changes in government occasioned by general elections every four years.

The development of the national vision is therefore a consultative and iterative process that will continue into the future to ensure that changes will be incorporated, once understood and quantified, to provide guidance for the further development of the GIP.

The GIP is therefore set to make the country become a high-income nation in 40 years.

v.Challenges to the Infrastructure Sector

Ghana has made major strides in modernising and extending some of the country's infrastructure services, including telecommunications and port services. However, service delivery in the transport sector lags behind significantly. Population and economic growth have thrown a harsh spotlight on infrastructure bottlenecks and accentuated the demand for increased infrastructure services in these areas.

The country has a transportation system consisting of two large deep-water ports, a 947 km railway system (only 13% is operational to some extent), a 72,000 km maintainable road network, one international airport and eight regional airports and airstrips located throughout the country.

There are deficiencies in the transportation sector, which constitute major threats to Ghana's economic growth and development. The first among these deficiencies is the lack of alternatives to road transport for the movement of bulk commodities for export. Bulk commodities such as cocoa, timber and minerals would be better transported by rail. The railway system, however, has limited coverage, serves only the southern part of the country and is virtually broken down.

The increase in the size of the urban population puts a strain on limited social and physical infrastructure. The manifestations of this inadequate infrastructure are congestion, overcrowding and the development and growth of slums.

These challenges call for improved systems for the collection, management and disposal of urban waste in order not to aggravate pollution of water bodies and flooding. The Transport Infrastructure Plan recognises all such potential social consequences and provides the necessary interventions to mitigate possible socio-economic and spatial challenges.

HIGHLIGHTS

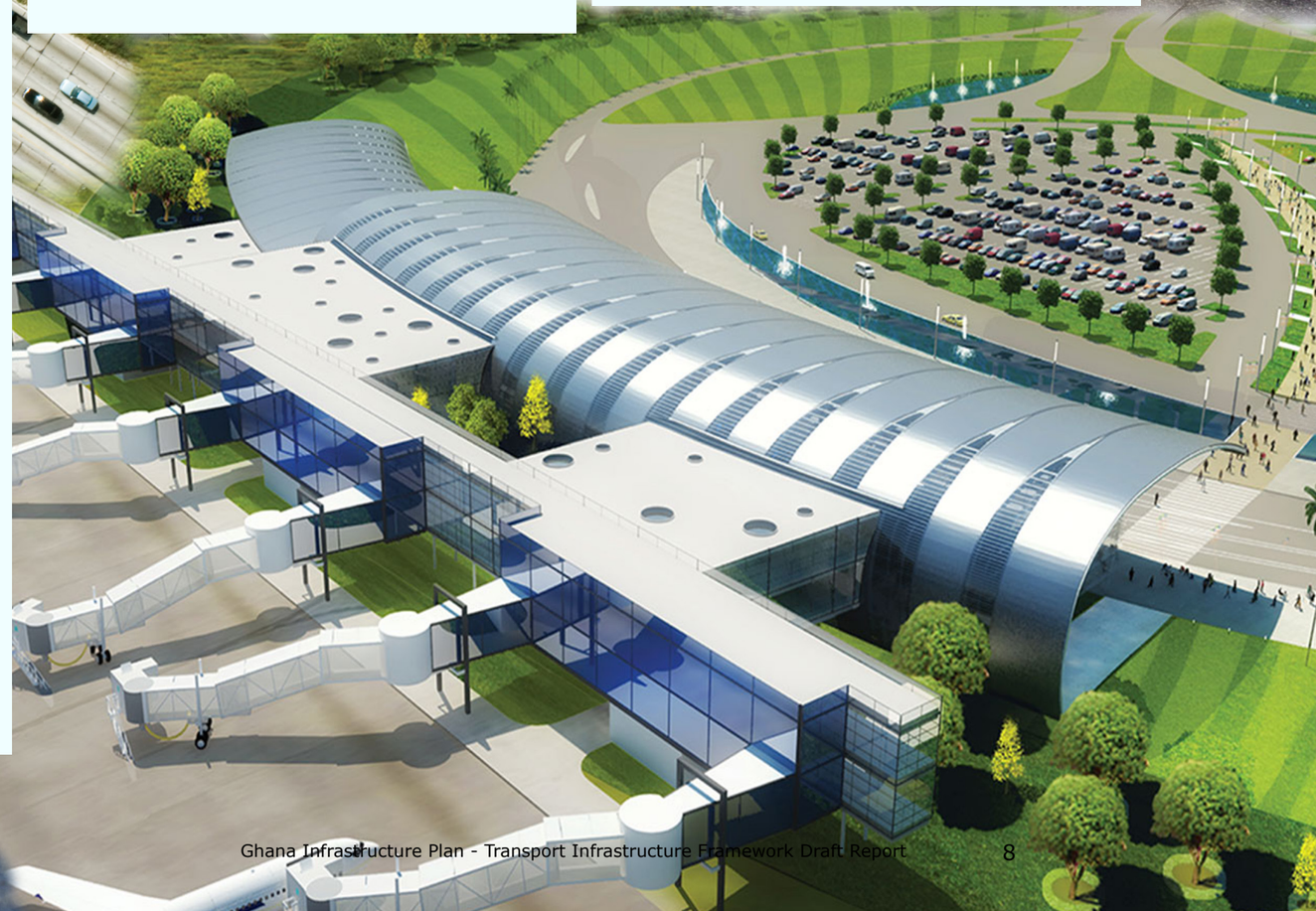
Development of an efficient intermodal connectivity for the road, railway, aviation and maritime networks

ROAD TRANSPORT

- The road network will be expanded from the current 72,000 km to 253,000 km by 2047, and the proportion of paved roads will increase from 16,000 km to 177,000 km during the same period, a jump from 23% to 70%.
- As a result of the country's objectives to use mass transport as the predominant mode of movement, the growth of vehicles will be controlled. The number of vehicles is projected to increase from 2.1 million in 2018 to 12.2 million by 2047, and the vehicular population will increase from 70 vehicles per 1,000 persons, to 250 per 1,000 persons within the same period, much lower than current high-income average of 600 vehicles per 1,000 persons.
- Mass transport will be the predominant mode of transport in the coming years, and extensive bus routes and sub-urban railway systems will connect major cities across the country. Concerning roads in urban areas, all regional capitals will be linked by multi-lane carriageway.
- A total of $272 billion will be invested in road construction to expand the network and bring them to high-income country standards, about $40 billion of which is needed to stabilise the existing network. The budget is for construction and reconstruction only, and does not cover maintenance and rehabilitation.
- A large number of roads will be tolled to generate funds for maintenance and rehabilitation works on the road network. Revenue from the tolling programme, as well as fuel levies and DVLA fees will be used to address routine and periodic maintenance activities.
- Several kilometers of missing links would be bridged on the trunk road network, and three (3) separate long-span bridges will be constructed on the Volta Lake.
- More than 1,700 km of roads in heavily trafficked urban areas will be widened within the short term.
- Four circular roads and nine radial arterial roads will be created to serve the GAMA metropolis; and the following towns on the central corridor trunk road network will have by-passes: Kumasi, Konongo, Tamale and Bolgatanga. Cape Coast and Takoradi on the Coastal corridor trunk road network will also have bypass routes.
- The Ghanaian construction industry will be developed to a high international standard, to undertake a major part of the expected construction boom. Hundreds of contractors will be meticulously trained and classified in roads and bridges, steel and building construction to achieve the targets.
- High and middle level Ghanaian professionals will be educated and recruited to lead in the design and supervision of construction works, while lower level skilled manpower will be trained and certified to address the skill needs of the sector.
- A Traffic Signal Control System, including Intelligence Transport System, Bus Information and Management System will be established in major cities to manage the intermodal system.
- Road safety will be improved through best practice engineering and administrative policies.
- Consistent efforts will be made to reduce the accident fatality rate over the planning horizon.

AVIATION

- Ghana's population growth and economic development are expected to catalyse massive growth in the international and domestic air transport sectors in the coming years.
- In the long term, new international aerotropolis will be developed at Prampram under public/private sector partnership to complement increasing traffic at KIA.
- A new Kumasi Airport and related services will be developed on a 26,000 acre land at Ankaase.
- Regional airports will be developed or upgraded to facilitate trade and tourism.
- Land developments within the vicinity of airports will be regulated to stimulate investment in airport related service industries.
- An underground sub-urban railway line, from Adenta to Accra Central will be linked to the Kotoka International Airport and the emerging airport-city related service industries.
- The Government and the GCAA will work for Ghana to regain the International Aviation Safety Assessment Category 1 status for aviation safety, which will allow Ghanaian air carriers to initiate direct flights to the United States.



MARITIME

- Investment of US$2 billion for the expansion of Tema Port including the construction of a new container terminal has commenced.
- Additional investment of US$200 million in cargo handling equipment to improve port operations at Tema Port has also commenced.
- Investment of US$990 million for the expansion of Takoradi Port is also ongoing.
- Planned investments of US$120 million by 2020 for the development of the Boankra Inland Port will reduce pressure at Tema port and trigger an increase in transit trade to landlocked countries.
- Direct railway link to be established from Tema Port to the Boankra Inland Port.
- The redevelopment of the Tema Shipyard and Drydock facility into world class facility within the short to medium term will serve the growing marine and oil industries.
- Construction of marine fishing ports and landing sites to be developed in several coastal fishing communities commencing 2018.
- According to studies by ROCHE, a French consulting company that studied the growth of traffic on the Volta Lake, the average number of passengers crossing the Volta Lake is expected to increase from 5 million passenger trips in 2018, to 45 million by 2035. Therefore, new ferry, tramping services and modern boat-building facilities will be developed to ensure safety on the lake.
- Total estimated investment of US$300 million will be made for the development of the Volta Lake and its related infrastructure in the short to medium term.
- Development of the Buipe and Akosombo ports will be carried out to improve navigational services, including investment of US$12 million for the removal of shoals at Debre.
- Development of infrastructure and tourism services in areas around Akosombo, Digya Park and other selected urban centres around the Volta Lake to provide alternative means of livelihoods.

RAILWAY

- Investment of about US$26 billion covering consultancy, infrastructure and stations; rolling stock (trains); and signal and telecommunications will be made in the railway sector over the next 30 years to deliver 4,007 km of standard gauge railway lines and additional lines for the sub-urban networks in four major cities.
- The budget also includes the procurement of passenger freight rolling stock and carriage wagons.
- The project includes more than 160 station buildings and construction/ rehabilitation of more than 2,000 office and residential buildings. The project starts in 2017 with the construction of $390 million, 84km, Tema to Akosombo railway line
- Ghana's first underground railway line will be constructed along the Liberation Road/Independence Avenue, between Accra and Adenta in the short to medium term to reduce traffic as a result of expansive Airport service related infrastructure in Airport phases 1, 2 and 3 projects.
- The Government will review the Railways Act 2008, (Act 779) by 2018 to separate the regulatory functions of the Ghana Railway Development Authority (GRDA) from its mandate of improving railway assets and promoting the development and management of sub-urban railway systems.
- The sub-urban railway networks in Accra, Kumasi, Tamale and Sekondi-Takoradi will be planned and developed as part of the overall redevelopment of the cities under the NSDF.
- A large number of north-south and transversal rail lines, as well as the Trans ECOWAS railways route will be developed as part of the developments.
- It is expected that a large number of direct, indirect and related jobs will be created with the construction of the railway programme.

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Chapter 6: Road Transport

6.1 Introduction

The level of social and economic development of any country is directly linked with the quality and extent of its transport infrastructure. Economic growth and social development depend in part on increasing the capacity and utilisation of transport infrastructure to move goods and people. Transportation is a major necessity, facilitating the production and consumption of goods and services at different locations, and allowing for increased trade and more balanced population spread.

6.1.1 National Transport Policy

An appropriate National Transport Policy guides the development and operation of the transport systems. It aims to help reduce transport costs for internal distribution of goods and services as well as keep the country's exports competitive in the world market. It is also aimed at providing safe and reliable transport services for the population.

6.1.2 Goals and Objectives

The National Transport Policy (NTP) of 2008 defines strategic goals and objectives of the transport sector. These underpin the Transport Infrastructure Plan component of the GIP. Development priorities under the Ghana Infrastructure Plan (GIP) are as follows:

- Establish Ghana as a transportation hub for the West African sub-region;
- Create a sustainable, accessible, affordable, reliable, effective, efficient, safe and secure transport system that meets user needs;
- Integrate land use, transport planning, development planning and service provision;
- Create a vibrant investment and performance-based management environment that maximises benefits for public and private sector investors;
- Develop and implement a comprehensive and integrated policy, governance and institutional framework;
- Ensure sustainable development in the transport sector;
- Develop skilled human resources and apply new technology.

The GIP is the anchor for a series of detailed, medium-term, transport sector strategic plans over the 30-year investment period. It also guides the development of an inter-modal transport system, combining road, rail, aviation and maritime and water transport in an integrated system.

6.2 General Transport Situation

Ghana has five main modes of transport, namely: road, railway, sea, air, lake and rivers. Each mode is currently developing and expanding to meet current demand and future opportunities but without any specific perspective on integration. Current investment levels in transportation infrastructure will not meet Ghana's future needs unless a new approach is adopted to address this imminent challenge. Allowing the status quo to prevail will be a continuing impediment to attaining the vision of becoming a high-income country.

6.3 Socio-Economic Conditions

6.3.1 Demographic and Poverty Statistics

A demographic analysis was undertaken to look at the inequalities in the distribution and delivery of transport infrastructure in Ghana. The regional population figures as well as the incidence of poverty information were obtained from the Ghana Statistical Service. This information and the transport distribution data were used to establish the accessibility indices, road density etc. Tables 6.1 and 6.2 present the findings.

Table 6.1: Regional Road Accessibility

Region	Area (sq. km)	Population	Total Length of Roads km	Accessibility*	Road Density
Upper East	8,842	1,031,478	3,518	293	0.40
Upper West	18,376	677,763	4,697	144	0.26
Northern	70,384	2,468,557	9,901	249	0.14
Brong Ahafo	39,557	2,282,128	10,776	212	0.27
Ashanti	24,389	4,725,046	9,861	479	0.40
Volta	20,570	2,099,869	5,671	370	0.28
Eastern	19,323	2,596,013	5,866	442	0.30
Greater Accra	3,245	3,909,764	8,650	452	2.67
Central	9,826	2,107,209	5,492	384	0.56
Western	23,921	2,323,597	5,671	410	0.24

*See Table 6.3 below
Source: Author's Construct

Table 6.2: Road Condition and Poverty Distribution

Region	Population	% below poverty line	Length in poor condition	% of poor roads
Upper West	1,031,478	71	10,020	74
Northern	677,763	50	4,852	41
Upper East	2468,557	44	1,356	35
Volta	2,282,128	34	2,527	38
Brong Ahafo	4,725,046	28	6,198	51
Eastern	2,099,869	22	1,656	30
Western	2,596,013	21	3,650	40
Ashanti	3,909,764	15	4,677	43
Central	2,107,209	19	2,460	40
Greater Accra	2,323,597	6	4,997	56

Source: Author's Construct

6.3.2 Effects of Poor Road Condition on Socio-Economic Activities

A survey by the Ministry of Roads and Highways in 2013 evaluated the effects of poor roads on socio-economic activities in Ghana in terms of accessibility, mobility and welfare. Table 6.3 gives the indices used for the evaluation.

Table 6.3: Road Condition on Socio-Economic Indices

Measure of Accessibility	Measure of Mobility	Measure of Welfare
Transport Tariffs to nearest markets	Frequency of long distance trip for all modes of transport out settlements	Transport Inaccessibility as cause of Produce Loss
Travel Time to Major Markets	Transport Waiting Times	Frequency of trips to health facility
Proportion of the Populace Accessing Health, Schools and Social Services	Proportion of households with direct access to a mode of Transport	Percentage of School age children at School
% of the Year when No Access to Transport	Total traffic passing through communities	Average monthly household income
Farm gate prices of Major Produce	Reliability of Passenger Transport	Average monthly household expenditure

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

Road Quality and Education

Almost 31% of those going to school faced some difficulties. On a regional basis, Upper East (53%), Volta (43%) and Greater Accra (40%) regions reported relatively high proportions of students who had some difficulty getting to school (Table 6.4).

Table 6.4: Distribution of Access to Education, 2013 (%)

Region	Yes	No	Total
Western	25	75	100
Central	15	85	100
Gt. Accra	40	60	100
Volta	43	57	100
Eastern	28	72	100
Ashanti	35	66	100
Brong Ahafo	23	77	100
Northern	15	85	100
Upper East	53	47	100
Upper West	35	65	100
GHANA	**31**	**69**	**100**

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

The three main difficulties faced in getting to school were bad roads during the rainy season (37%), followed by bad roads in all seasons (23%) and long distances to school (11%).

Table 6.5: Main Difficulties Faced in Going to School, 2013 (%)

Type of difficulties	Percentages
No access road	6
Bad roads (wet season)	37
Bad roads (dry season)	1
Bad roads (all seasons)	23
Difficulty getting vehicle	7
Long waiting time	4
Heavy traffic on road	6
Distance too long	11
Frequent breakdowns of vehicles	0
No money for transport	4
Other	1
TOTAL	**100**

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

Road Quality and Health

The main obstacles encountered in visiting health facilities assigned by respondents are given in Table 6.6 below. Nineteen percent of the respondents cited long distance as the main obstacle encountered while visiting a health facility. Of those who complained about distance, Upper East Region had the highest percentage (32%) and the Greater Accra Region recorded the lowest percentage (10%). This is consistent with the accessibility indices given in Table 6.6.

Table 6.6: Main obstacle encountered in visiting a health facility, 2013 (%)

Region	Main obstacle being faced								
	No access road	Bad roads	Difficulty getting vehicle	Long waiting time	Heavy traffic on the road	Distance too long	No money for transport	Other	Total
Western	1	11	40	12	5	28	1	2	100
Central	3	17	20	30	2	18	10	0	100
Gt. Accra	2	21	12	19	28	10	3	5	100
Volta	1	21	29	18	1	16	8	6	100
Eastern	0	20	37	11	3	24	2	3	100
Ashanti	1	16	40	13	10	15	5	0	100
Brong Ahafo	0	10	64	9	0	16	1	0	100
Northern	5	32	22	4	0	27	10	0	100
Upper East	1	24	34	0	0	32	9	0	100
Upper West	1	20	50	3	0	20	6	0	100
GHANA	**2**	**19**	**33**	**13**	**7**	**19**	**5**	**2**	**100**

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

Bad roads accounts for 19% of the main obstacles they face visiting a health facility. Northern Region had more than a quarter (32%) of the respondents who mentioned bad roads while the Brong Ahafo Region had 10%. Only 2% of the population mentioned no access road as the main obstacle faced visiting a health facility.

Road Quality and Agriculture

One of the main challenges to the growth of agriculture in Ghana is access to markets. Table 6.7 gives details on distance travelled to the nearest markets on a regional basis. It has also been established through research that about 50%-70% of food prices in urban centres is due to transport-related costs. Therefore, better accessibility can help to reduce consumer prices of agricultural products.

Table 6.7: Distance travelled to the nearest market 2013, (%)

Region	Distance (Km)					
	0-1	1.1-2	2.1-3	3.1-6	6.1-10	Total
Western	55	20	12	13	0	100
Central	42	21	16	21	0	100
Greater Accra	27	21	6	43	3	100
Volta	24	19	17	40	0	100
Eastern	29	19	21	31	0	100
Ashanti	30	19	18	33	0	100
Brong Ahafo	31	19	13	37	0	100
Northern	23	19	20	38	0	100
Upper East	22	24	28	26	0	100
Upper West	1	11	24	64	0	100
GHANA	**32**	**19**	**17**	**32**	**0**	**100**

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

One of the main difficulties in agricultural development is marketing of farm produce. Fifty-nine percent of farmers had difficulty marketing their farm produce due bad roads. Some 16% have no access roads to enable them to travel to market their farm produce, while 12% lacked any means of transport to market their produce. Table 6.8 depicts the various difficulties.

Table 6.8: Difficulties faced in marketing farm produce due to road quality, 2013 (%)

Region	Difficulty faced							
	No Access Road	Bad Road	No Means of Transport	High Transport Cost	Transport Not Reliable	Other	Not Applicable	Total
Western	24	41	14	11	10	0	0	100
Central	46	31	11	5	7	0	0	100
Greater Accra	23	54	15	4	4	0	0	100
Volta	24	53	3	7	8	4	1	100
Eastern	17	68	10	2	3	0	0	100
Ashanti	14	69	8	3	5	1	0	100
Brong Ahafo	10	82	1	3	4	0	0	100
Northern	11	40	25	12	12	0	0	100
Upper East	2	48	42	5	3	0	0	100
Upper West	1	59	23	1	16	0	0	100
GHANA	**16**	**59**	**12**	**5**	**7**	**1**	**0**	**100**

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

General Road Transport Services

One of the main difficulties in agricultural development is marketing of farm produce. Fifty-nine percent of farmers had difficulty marketing their farm produce due bad roads. Some 16% have no access roads to enable them to travel to market their farm produce, while 12% lacked any means of transport to market their produce. Table 6.8 depicts the various difficulties.

Table 6.9: Reasons for non-satisfaction with transport availability, 2013 (%)

Region	Long delays	Unpredictable schedule	Other	Total
Western	70	28	2	100
Central	58	42	0	100
Greater Accra	53	44	3	100
Volta	33	65	2	100
Eastern	63	36	1	100
Ashanti	54	44	2	100
Brong Ahafo	44	54	2	100
Northern	41	57	2	100
Upper East	56	44	0	100
Upper West	60	40	0	100
GHANA	**53**	**46**	**1**	**100**

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

Table 6.10: Means of transport from residence to workplace of the employed by sex and locality, 2013 (%)

Means of travel	Urban			Rural			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	GHANA
Public (taxi shared)	12`	12	**12**	4	4	**4**	7	6	**7**
Public (taxi-individual)	3	3	**3**	1	1	**1**	2	2	**1**
Vehicle (*trotro*)	22	16	**19**	6	5	**6**	11	9	**10**
Bus (Metro Mass)	0	0	**0**	0	0	**0**	0	0	**0**
Bus (public)	1	1	**1**	0	0	**0**	0	0	**0**
Train	0	0	**0**	0	0	**0**	0	0	**0**
Company car/vehicle	0	0	**0**	2	1	**1**	2	0	**1**
Boat/ferry/canoe	4	1	**2**	1	0	**1**	2	0	**1**
Private car	8	4	**6**	1	0	**0**	4	2	**3**
Motorcycle	7	1	**4**	3	1	**2**	4	2	**3**
On foot	36	59	**48**	66	82	**74**	55	74	**65**
Bicycle	7	3	**5**	16	6	**11**	13	5	**9**
TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

About 44% of workers got vehicle transport to their workplace within 15 minutes while 65% of the workforce commuted to their workplace on foot. This confirms the poor state of the current public transport available to production and service centres.

About 52% of workers cited bad roads as the main challenge faced in getting to their workplace. About half of respondents (51%) engaged in agricultural production were producing food crops for both domestic market and own consumption.

Table 6.11: Main difficulties faced by the employed going to the workplace by region, 2013 (%)

Region	No access road	Bad roads	Difficulty getting vehicle	Long waiting time	Heavy traffic on road	Distance too long	No money for transport	Other	Total
Western	20	54	6	3	9	8	0	0	100
Central	22	22	10	11	12	22	1	0	100
Greater Accra	2	51	6	8	27	3	3	0	100
Volta	29	45	2	1	1	17	2	3	100
Eastern	33	56	1	2	4	3	0	1	100
Ashanti	12	46	11	6	14	10	1	0	100
Brong Ahafo	17	71	4	3	0	3	1	1	100
Northern	35	46	2	0	0	15	2	0	100
Upper East	6	54	3	1	1	35	0	0	100
Upper West	1	69	1	0	1	27	1	0	100
Male	19	50	5	4	10	10	1	1	100
Female	18	54	6	3	6	12	1	0	100
GHANA	**19**	**51**	**5**	**4**	**8**	**11**	**1**	**1**	**100**

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

Eleven percent of the national workforce travel long distances to their workplaces, with 35% of workers in the Upper East and 27% in the Upper West regions being the worst affected.

Congestion due to heavy traffic on the road was cited as the next challenge faced by workers in Greater Accra (27%) and Ashanti (14%) regions, while Northern (35%), Eastern (33%) and Volta (29%) complained about not having access roads to their work place. Table 6.12 gives a summary of the effect of bad roads on Ghana's socio-economic activities.

Table 6.12: Effect of Bad Roads on Access to Socio-Economic Services and Activities, 2013 (%)

Region	Socio-Economic Services and Activities				% of Poor Roads
	Health	Education	Markets	Workplace	
Greater Accra	21	40	54	51	56
Ashanti	17	35	69	47	43
Central	17	15	31	22	40
Western	11	25	41	53	40
Eastern	20	28	68	56	30
Brong Ahafo	10	23	82	71	51
Volta	21	43	53	45	38
Upper East	24	53	48	54	35
Northern	32	15	40	46	41
Upper West	20	35	59	69	74

Source: Transport Survey Report by Statistical Services for Ministry of Roads and Highways, 2013

Overall supply of road transport services in Ghana is characterised by long delays and unpredictable travel schedules. The road infrastructure is currently made up of 72,405 km (inclusive of unclassified roads). Of the total, 40% is in good condition, 31% is in fair condition and 29% is in poor condition. The total national vehicle fleet, all categories combined, was 1,952,564 as of 2015. The road transport system is bedeviled by insufficient road maintenance and the dilapidated condition of most of the fleet.

6.4 Context of the Road Transport Plan

6.4.1 Overview

The predominant mode of transport throughout the country is by road – with an estimated market share of over 95% and 90% for passenger and cargo traffic respectively. The main challenge to road transportation is the inconsistency in the road surface of the classified networks. There are national roads with contiguous sections which are unpaved and paved but in very poor condition, making their use expensive in terms of vehicle operating cost.

The road network is made up of trunk roads, which mainly connect the various regions to the national capital, and the country to its neighbours. They also link areas of socio-economic activity and major production centres and markets. The Ghana Highway Authority (GHA) is responsible for the trunk roads.

Next in the hierarchy is the feeder system, which is the key transport mode in rural areas and also feeds the trunk roads with traffic from the farm gates and rural communities. The feeder road network is extensive but mainly made up of gravel and earth. The Department of Feeder Roads (DFR) is responsible for feeder roads. The urban road system is third, mainly for distribution of goods and services in the urban centres. The Department of Urban Roads (DUR) is responsible for the urban roads.

6.4.2 Vision for the Road Sector

The vision is 'to provide an integrated, efficient, cost effective and sustainable transportation system responsive to the needs of society, supporting growth and poverty reduction and capable of establishing and maintaining Ghana as transportation hub of West Africa.'[1]

6.4.3 Ghana's Road Network

Existing Condition

Table 6.13 below gives the state of the road network by surface type as of 2015. Only 23% of the road network is paved and the remaining 77% is unpaved.

Table 6.13: Road Network by Surface Type by Length, 2015 (km)

Road Agency	Rigid	Asphaltic Concrete	Surface Treated	Gravel	Earth	Total Paved	Total Unpaved
GHA	39	2,356	6,672	5807	-	9,066	5,807
DFR	-	-	1,928	27,231	12,886	1,928	40,117
DUR	3	956	5,044	5,226	4,232	6,004	9,458
Total	42	3312	13,644	38,264	17,118	16,998	55,382
% Percentage	0.06	5	19	53	23	23	77

Source: Ministry of Roads and Highways

Table 6.14 gives the condition mix per region from which the national condition mix is given as 40% Good; 31% Fair; 29% Poor.

Table 6.14: National Road Condition Mix, by Region, 2015

Region	Good		Fair		Poor		Total	
	(km)	(%)	(km)	(%)	(km)	(%)	(%)	(km)
Greater Accra	3,588	41	1,797	21	3,264	38	100	8,649
Upper West	2,320	49	1,438	31	939	20	100	4,697
Ashanti	4,050	41	3,005	30	2,806	28	100	9,861
Brong Ahafo	3,405	32	2,885	27	4,486	41	100	10,776
Central	1,753	32	2,255	41	1,485	27	100	5,493
Northern	3,875	39	3,654	37	2,372	24	100	9,901
Upper East	2,113	60	591	17	814	23	100	3,518
Volta	2,673	47	1,740	31	1,257	22	100	5,670
Western	3,194	40	2,735	34	2,045	26	100	7,974
Eastern	2,007	34	2,106	36	1,753	30	100	5,866
Total	28,978	40	22,206	31	21,221	29	100	72,405

Source: Ministry of Roads and Highways

The road condition from 2012-2015 is given in Table 6.15 below. Of the total road network, 60% is in fair to poor condition. This segment of the road network is due for periodic maintenance, rehabilitation and reconstruction investments. The segment in good condition has dropped from 42% in 2012 to 40% in 2015.

The maintenance backlog increased from 19,059 km in 2012 to 22,206 km in 2015, leading to an inefficient road infrastructure to support transportation of goods and services (Table 6.15 below).

1 Ghana Highway Authority, Draft Strategic Plan, 2015 - 2017

Road Network Size and Condition, 2011-2015

Indicator/ Year	2012		2013		2014		2015	
Road condition mix:	Condition	Length (km)	Condition	Length (km)	Condition	Length (km)	Condition	Length (km)
Good	42%	28,588	45%	31,978	35%	25,014	40%	28,978
Fair	28%	19,059	25%	17,766	33%	23,558	31%	22,206
Poor	30%	20420	30%	21,319	32%	22,847	29%	21,221

Source: Ministry of Roads and Highways

Road Network Size

The classified network size increased by 3,566km from 67,853km in 2011 to 71,419 km in 2014. The details are given in Table 6.16 below.

Table 6.16: Classified Size of Road Network, 2011-2014

Year /Indicator	2011	2012		2013		2014	
	Total length (km)	Total length (km)	Annual km increase	Total length (km)	Annual km increase	Total length (km)	Annual km increase
Trunk Roads	13,263	13,477	214	14,873	1,396	14,874	1
Urban Roads	12,400	12,400	0	14,000	1,600	14,500	500
Feeder Roads	42,190	42,190	0	42,190	0	42,045	-145
Total Network	**67,853**	**68,067**	**214**	**71,063**	**2,996**	**71,419**	**356**

Source: Ministry of Roads and Highways

National Vehicle Fleet and Operational Issues

The total national vehicle fleet by all categories is 1,952,564 as of end-2015. A total of 861,039 vehicles (or 44.1%) are roadworthy. The remaining 55.9% of the vehicle fleet are not fit to be used on our road network (Table 6.17). The Driver and Vehicle Licensing Authority (DVLA) is embarking on re-registration of all roadworthy vehicles for all categories from 2017 to enable correct estimation of the vehicular fleet in Ghana. This will also enable proper estimation of the fatality indices.

Table 6.17: Vehicle Fleet and Driver Information, 2010 -2015

Year	Driver Licensing (In-Traffic Test)			Driver Licensing (Written and Theory Test)			Road Worthy		
	No. Tested	% Passed	% Failed	No. Tested	No. Passed	No. Failed	No. Vehicles Registered	Cumulative No. Registered Vehicles	No. Road Worthy
2010	110,877	79	21	104,975	69,685	35,290	102,330	1,230,468	748,219
2011	127,827	75	25	125,957	77,440	48,517	141,819	1,372,287	839,767
2012	126,935	71	29	124,252	69,956	54,296	159,793	1,532,080	931,690
2013	97,383	70	30	109,899	57,461	52,438	176,878	1,708,958	1,003,673
2014	66,160	69	31	113,183	49,537	63,646	132,014	1,840,972	886,269
2015	25,515	71	29	85,129	45,774	39,355	111,592	1,952,564	861,039

Source: Driver and Vehicle Licensing Authority

Most of the vehicles in the country are 'used vehicles' imported from mainly European countries. The average age of these imported vehicles is 10-20 years. The high rate of emission and accidents experienced on the roads are mainly due to the high proportion of vehicles that are not roadworthy, coupled with the poor road condition.

6.5 Road Infrastructure Indices

6.5.1 Overview

Table 6.18 presents some indices used to establish the road infrastructure deficit.

Table 6.18: Comparison of Current Road Infrastructure Indices with some Upper Middle and High Income Countries, 2015

Country	Population x1,000,000	Land Size Area (Sq.km)	Classified Road Network Size (km)	Road Density	Total Length of Paved Road (km)	Ratio - Paved Road To Network	Rural Accessibility Index (RAI) -%
Australia	23.13	7,692,000	823,217	0.107	356,343	0.43	Not Available
Denmark	5.614	42,925	73,929	1.722	73,929	1	99
Qatar	2.169	1,157	9,830	0.849	9,830	1	81
Singapore	5.399	719.1	3,425	4.76	3,425	1	Not Available
South Korea	50.22	100,210	106,414	1.06	83,000	0.78	89
Saudi Arabia	28.83	2,150,000	221,374	0.102	47529	0.21	75
China	1,327	9,597,000	4,500,000	0.463	3453890	0.77	97
Trinidad & Tobago	1.341	5,131	8,320	1.621	4,068	0.66	91
Oman	3.632	309,501	69,783	0.225	29,685	0.43	81
U.K.	64.1	242,900	394,428	1.624	394,428	1	96
Ghana – Current 2013	**25.9**	**238,535**	**71,419**	**0.299**	**16,998**	**0.23**	**61**
Ghana – Proposed 2057	**57**	**238,535**	**285,000**	**1.2**	**256,000**	**0.9**	**90**
Ghana Deficit	**31.1**	**-**	**213,581**	**0.9**	**239,000**	**0.67**	**23.4**

Source: Author's construct based on World Development Indicators, 2015

The deficit in Ghana's road infrastructure compared to some upper middle-income and high-income countries is seen in the last row of Table 6.18. Taking the case of South Korea, its road density is 1.06 but its land area is 40% of Ghana, and its population is almost twice that of Ghana.

Road density is the ratio of the length of the country's total road network to the country's land area. The road network includes all roads in the country: motorways, highways, main or national roads, secondary or regional roads, and other urban and rural roads.

Considering Ghana's population density, land size and the fact that every part of the country is habitable and in active economic use, the desired road density to enable the country to attain high-income status is 1.2. This means that for the next 40 years, the road network size needs to increase from almost 72,000 km to 285,000 km. The paved segment of the network will increase to 256,000 km and the Rural Accessibility Index (RAI) will increase from its current level of 61% to 90%.

Comparing 40 year target of 285,000 km with other countries

The road density based on a network size of 285,000 km is almost like the current average for upper middle-income countries. For example, according to the World Bank, in 2009, the total length of roads in Ghana was 962 km per 1,000 km^2 of land area with 158.1 km (16%) paved and the remaining 804 km unpaved. The middle-income country (MIC) equivalent was 1,545.7 km per 1,000 km^2 of lands of which 507.4 km (33%) was paved and the remaining 1,038.3 km not paved. If Ghana aims for the MIC average of 1,545.7km per 1,000km^2 by 2057 then the country's total road network should be 368,536 km. Similarly, the United Kingdom has the same land area as Ghana and more than twice the population, and has a paved road length of 394,428km.

If Ghana reverses the current urban sprawl, adopts dense and compact settlement systems, and leaves a large part of its rural area for agriculture, the country should be able to suffice with 285,000km of roads transiting into the high-income bracket. With this number, most of the Ghanaian roads that are outside the classification system would be brought to the formal classification system , paved and tolled wherever possible.

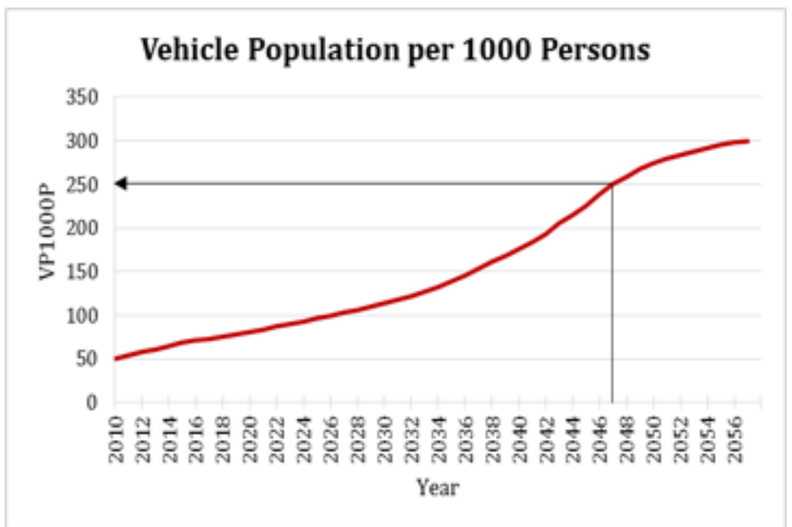
6.5.2 Vehicle Population per 1000 Persons (VP1000P)

The vehicle population in 2014 (Table 2.6) was 1,885 million for all categories of vehicles. The vehicle population per 1,000 persons (VP1000P) is one of the indicators used to determine the standard of living of the populace. The population of Ghana as of 2014 was 26.5 million, with a vehicle population of 1.885 million. The VP1000P was therefore 71.13 (i.e. 1,885,000/26,500 = 71.13) as of 2014. This meant that for every 1,000 people, 71 vehicles were available to them. Vehicle refers to cars, light, medium and heavy-duty trucks, and buses but does not include off-road vehicles or heavy construction equipment.

In 2014, the average number of vehicles available for every 1,000 people in high-income countries was about 600. It is expected that by 2057, Ghana will use more mass transport and therefore the country will adopt the decision to achieve a VP1000P of 300, which is half of the current average for high-income countries.

The GIP horizon is up to 2047. Ghana's population is projected at 50.7 million by 2047. It is expected that by 2047, Ghana VP1000P will be 250, meaning the vehicular population will be equivalent to a quarter of the population. Figure 6.1 gives the targeted VP1000P by 2047.

Figure 6.1: Vehicle Population per 1000 Person



Source: Author's construct

Ghana should also enter the automobile manufacturing industry, which is expected to boom in the coming years. US automobile industry research estimates that as of 2010, there were 1.015 billion motor vehicles in use in the world. The world vehicle population passed the 500 million-unit mark in 1986, from 250 million motor vehicles in 1970. Between 1950 and 1970, the vehicle population doubled roughly every 10 years. Two US researchers estimate that the world's fleet will reach 2 billion motor vehicles by 2020, with cars representing at least 50% of all vehicles. By 2047, the number of vehicles globally will exceed 4 billion, and Ghana should by then have developed the capacity to manufacture some of these vehicles.

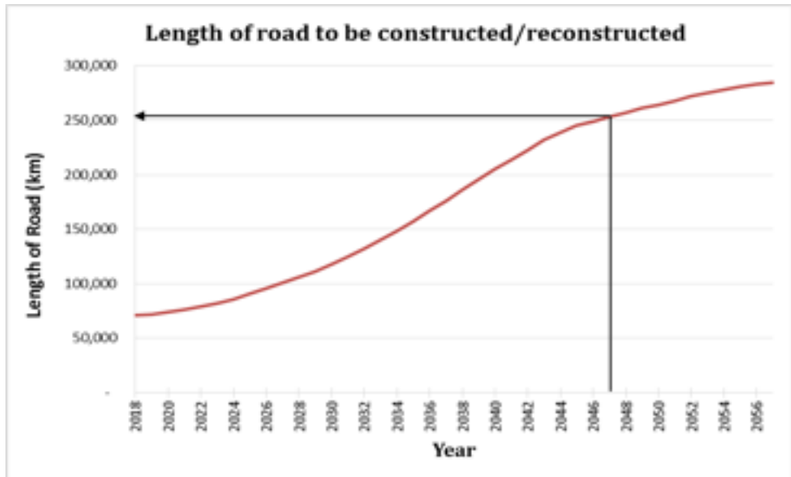
6.5.3 Projected Road Network Size by 2047

Projected Road Network Size

From the foregoing, if the size of the network in 2057 is 285,000 km then the size of the network by 2047 should exceed 253,000 km.

It will include a combination of various levels of roads, motorway (expressway), high -speed dual carriageways, four-lane roads, and two-lane roads. The road network will be expanded from 72,000 km to 253,000 km in 30 years (Figure 6.2) further broken down in Table 6.43. Basically, about 177,000 km of new roads shall be constructed or reconstructed during the development phase. This does not include roads under maintenance or rehabilitation

Figure 6.2: Length of Road to be Constructed or Reconstructed



Source: GIP Team

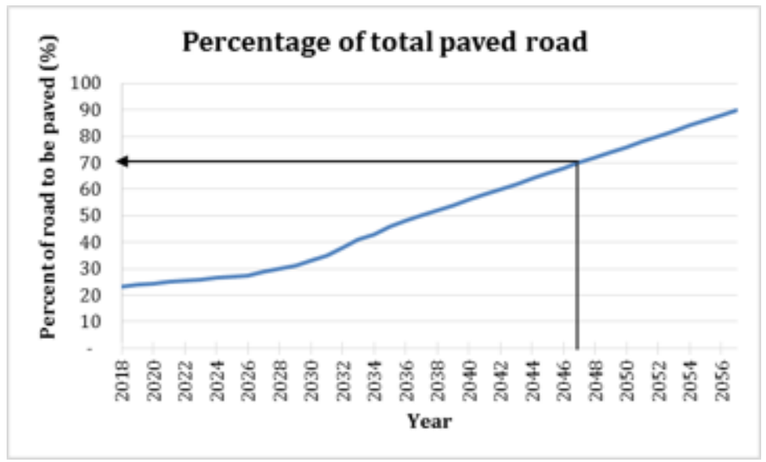
The estimated length of road to be constructed or reconstructed each year to meet the network size target of 253,000km is shown in Figure 6.3.

Figure 6.3: Annual New Road Construction or Reconstruction

Source: GIP Team

The percentage of paved roads will increase from the current 16,000 km, being 23% of the network size to 177,000 km, which is 70% of the network by 2047 (Figure 6.4).

Figure 6.4: Percentage of Total Paved Road



Source: GIP Team

Conceptual framework of Ghana's Long-Term Goal

The conceptual framework of Ghana's road sector is expected to:

i) Establish physical and economic integration with neighbours.

ii) Develop diverse economic sectors targeting sub-regional, regional and international markets.

iii) Widen development in the country to improve the living standard of the people

iv) Secure high-speed transport corridors in order to attract investment in economic sectors.

The conceptual corridor framework for the planning horizon are shown in Figure 6.5.

Figure 6.5: Spatial Concept of Ghana's Road Development

Source: The Project on Corridor Development for West Africa Growth Ring Master Plan, Draft Final Report

The National and International Expressway System:

The National Spatial Development Framework (NSDF) therefore proposes a national expressway system, in addition to the upgrading of highways and new segments.

A national expressway system will be beneficial to the economy as it will meet the growing demand for connectivity and mobility, and it will generally improve the quality of life of the citizenry. In countries where the expressway system has been implemented, there has been improved productivity and economic efficiency. The highways to be upgraded include the two Trans-African Highways that run from east to west (along the coast) and from north to south.

A number of other segments are proposed, including, inter alia:

i. The Accra-Kumasi Expressway (as Phase 1 of the Ghana African Highway Link Accra–Ouagadougou);

ii. The Kumasi-Paga expressway (as Phase 2 of the Ghana African Highway Link Accra–Ouagadougou);

iii. The Sunyani loop (Kumasi-Sunyani-Techiman);

iv. The Accra City Region Expressway.

v. ECOWAS Trans-West African Coastal Expressway

There will also be focus on northern Ghana to improve connectivity with current and new trunk roads to:

i. Improve SADA trunk road system

ii. Improve connectivity with new and improved trunk roads

iii. Create and implement strong urban growth containment policies to ensure dense and compact settlements, and prevent sprawl;

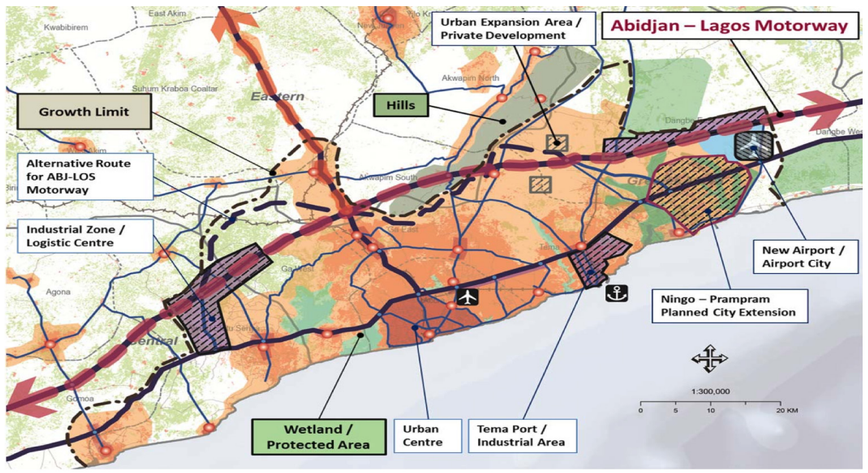
iv. Create new urban settlements at the midpoint of two intersecting trunk roads between Yapei and Tamale.

Conceptual Spatial Structure for Greater Accra

Under the new expressway system, the conceptual spatial structure for Greater Accra is shown in Figure 6.6. The future spatial structure contains the new Abidjan-Accra-Lagos motorway, a new international airport and airport city in Prampram. The new road, the Abidjan-Accra-Lagos motorway will function as part of the outer ring road for Greater Accra and it will be parallel to the Kwame Nkrumah motorway (N1).

A strong connection will be developed between the Abidjan-Accra-Lagos motorway and north-south corridors (Central Corridor and Eastern Corridor). Similarly, a strong link will be established from Tema Port to the north-south corridors (Fiqure 6.6).

Figure 6.6: Spatial Concept of Greater Accra Region



Source: The Project on Corridor Development for West Africa Growth Ring Master Plan, Draft Final Report

6.5.4 Developing the Ghanaian Construction Industry

Infrastructure is the lifeblood of prosperity and economic confidence. Successful delivery of well-planned infrastructure investments offers developing economies an opportunity to compete in the global marketplace. Construction is the activity through which infrastructure is delivered. Aside this key role, the construction industry also contributes to the development of nations through forward and backward linkages with other sectors and industries of the economy.

By forward linkages, the output of the construction industry serves as inputs in other industries. For instance, construction output including all types and forms of infrastructure like buildings, roads and dams are used as inputs by the financial, transport, energy and industries sectors. Backward linkages, on the other hand, relate to growth in industries that supply construction inputs – i.e. manufacturing companies – to the growth of the construction industry. In fact, almost every economic activity is linked with the construction industry. Therefore, the growth and development of any economy is directly or indirectly connected with the construction industry.

Concerns about the capacity and capability of Ghana's construction industry in the handling of not only this huge road programme but also other areas of construction are addressed with the establishment of a regulatory body. Issues relating to building the absorptive capacity, equipment and financial capacity, personnel (high-level, middle-level and skilled manpower), construction materials and the regulatory framework are all addressed in the report of the construction industry.

Construction Materials

A huge array of road construction materials will be developed as part of the impending boom. These include limestone, cement, steel, quarrying materials, laterite, asphalt and bitumen.

Steel - Ghana has enough iron ore deposits to drive its industrialisation and infrastructure development through to high-income status. Considering the relationship between urbanization, infrastructure and steel, there is scope for steel production in Ghana. The steel-intensive nature of infrastructure will drive the creation of vast steel production capacity in Ghana.

Developing Asphalt and Bitumen Plants - Asphalt and bitumen plants will be established throughout the country to advance this ambitious road construction drive.

Building the Capacity of Construction Industry Professionals – High and middle-level Ghanaian professionals will be educated and recruited to lead in design and construction works, while lower level skilled personnel will be trained and certified to address the skills needs of the sector.

6.6 Trunk Road Development

6.6.1 Trunk Road Investment

The Ghana Highway Authority (GHA) has a long-term vision of producing and maintaining road networks in the country that will contribute to equity and balance in socio-economic development. Through research, the road sector has established a road condition mix of 70% good, 20% fair and 10% poor as the most economical mix that will bring movement of people and freight around the network to lowest vehicle operating costs.

The main focus is the maintenance of the existing trunk road network (routine and periodic maintenance). The maintenance portfolio will be further assessed to help increase the funding capacity of the Road Fund to meet the demands of adequate road maintenance.

The Trunk Road Network Classification

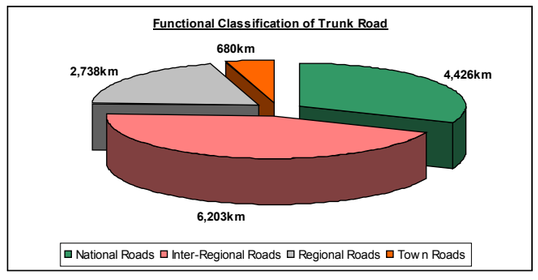
Figure 6.7 shows the functional classification of the trunk road network.

a) **National (N) Roads –** routes linking the national capital and regional capitals. It includes roads linking neighbouring countries and some other strategic roads.

b) **Inter-Regional (IR) Roads –** routes of inter-regional importance and coherence.

c) **Regional(R) Roads –** routes linking district capitals to their respective regional capitals, other nearest district capital and major industrial, trade or tourist centres.

Figure 6.7: Functional Classification of Trunk Road



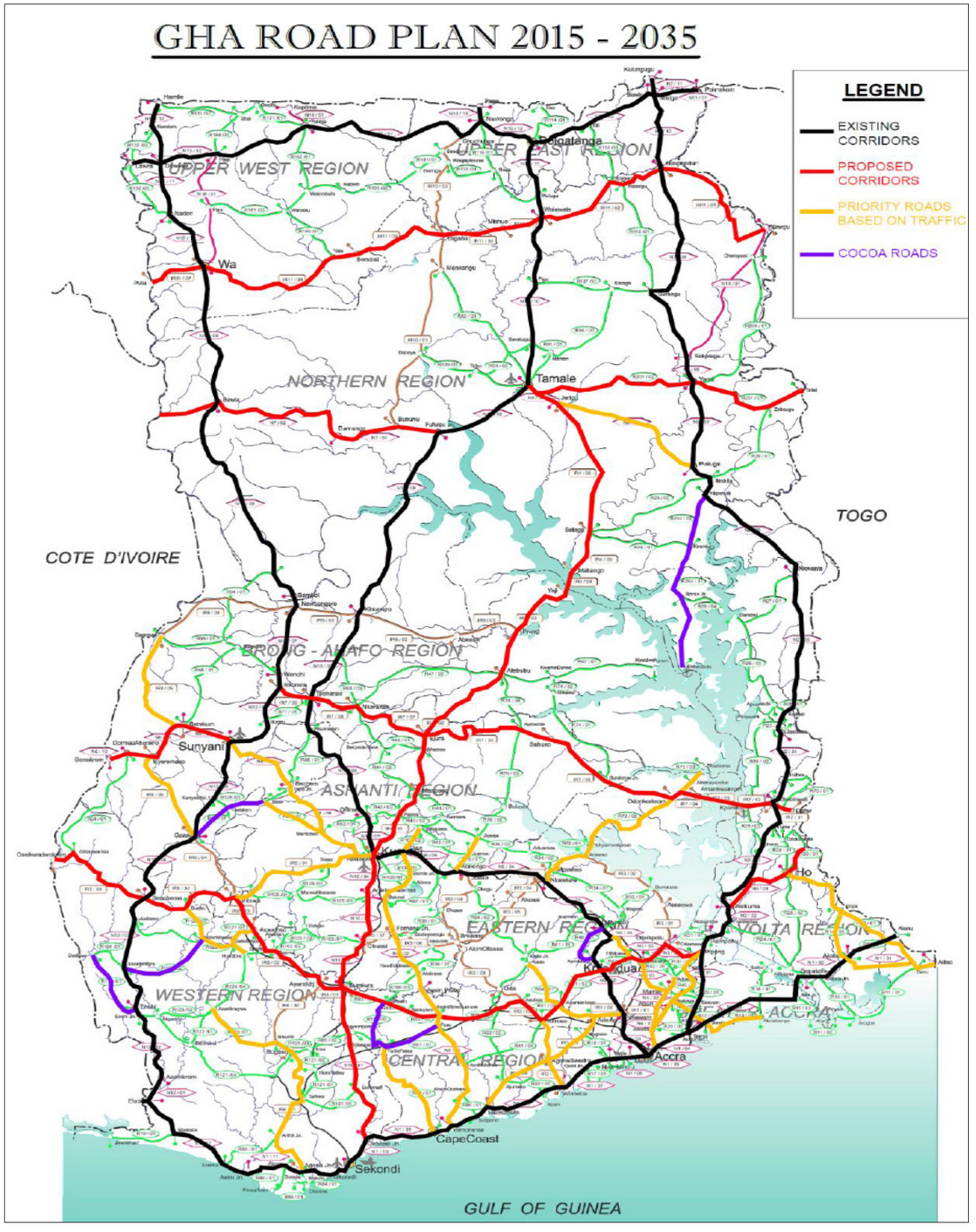
Source: GHA Strategic Plan (2015-2035)

Corridor development

In the area of development works, GHA has prepared the Corridor Programme and prioritised it in Phases 1 and 2. During this period, the missing links of the Trunk Road Network will be constructed.

In this direction, the authority has carefully selected lateral corridors within the country for development. The other categories of road sections to be developed and maintained are based on traffic volume, cocoa-growing areas and tourist sites. Figure 6.8 shows the GHA Road Plan for the period 2015 to 2035.

Figure 6.8: Ghana Road Plan (2015 – 2035)



Source: GHA Strategic Plan (2015-2035)

Priority Corridor

Some road sections are critical to the socio-economic development of the country. The development of the following priority corridors will facilitate trade and movement of goods and services within the West African Sub-Region.

Table 6.19: Priority Corridor

Corridor	Road Section
Coastal	Noepe–Akatsi–Sogakope–Accra–Takoradi–Elubo
Central	Accra–Kumasi–Techiman–Tamale–Bolga
Eastern	Tema–Asikuma–Hohoe–Kejebi–Yendi–Kulungugu
Western	Western: Elubo – Enchi – Sunyani – Bamboi – Sawla – Wa – Hamile
Northern	Lawra–Lawra-Han–Tumu–Navrongo–Bolga–Bawku–Polimakon

Source: Ghana Highway Authority

New Corridor Programme

The new lateral corridors across Ghana linking Togo to Côte d'Ivoire to be developed based on equity in socio-economic development across the country are the following:

- Upper East – West
- Northern East – West
- Central East – West
- Lower East – West

Table 6.20: Corridor Development

Road Type	Maintenance	Development (Corridor Projects)	
Trunk Road	Routine	1st Priority	2nd Priority
	Periodic	Coastal corridor: Aflao- Elubo	Upper – East –West
		Central corridor: Accra-Kumasi- Paga	Northern–East – West
		Eastern corridor: Tema -Yendi-Kulungugu	Middle –East –West
		Western corridor: Enchi-Sunyani-Hamile	Lower-East-West
		Northern corridor: Lawra-Wa-Bolga-Polmakrom	

Source: Ghana Highway Authority

Public Private Partnership (PPP) Programme

The following road sections have been registered under PPP programmes in the Plan:

i) Accra – Tema Motorway
ii) Accra – Takoradi
iii) Accra – Kumasi
iv) Tema – Akosombo – Anyirasewase
v) Tema – Sogakope
vi) Kumasi – Sunyani
vii) Kumasi – Anwiankwanta
viii) Takoradi – Agona Junction
ix) Mamfe – Koforidua – Bunso

Missing Links

During this period, GHA will construct all the Missing Links on the trunk road network. Table 6.21 gives details of all the Missing Links.

Table 6.21: List of Missing Links on Trunk Road Network

S/No.	Route No.	Road Section	Length (km)
1	N12	Kramokrom – Akontombra	11
		Sub Total	**11**
2	IR7	Ejura – Taylor	22
3	IR7	Kyirenkye -Anyinofi - Sabuso	38
4	IR7	Apapaso – Sabuso	6
5	IR7	Sabuso –Asayanso	40
		Sub Total	**106**
6	IR10	Gbasinkpa - Mankarigu	71
7	IR11	Mishuo - Kunka	71
8	R92	Nawuni - Mankarigu	40
9	R29	Nakpali - Chichagi	70
10	N9	Juanayili - Chambuligu	87
		Sub Total	**339**
11	R34	Begoro - Mpraeso	50
12	R41	Asikuma - Akoroso	41
13	IR7	Asayanso - Donkokrom	57
		Sub Total	**148**
14	IR9	Jinini - Banda Ahenkro	30
15	R74	Apapaso - Mframa	35
		Sub Total	**65**
		GRAND TOTAL	**670**

Source: Ghana Highway Authority

Heavily Traffic Roads

The capacities of these roads will be improved during this investment period (Table 6.22).

Table 6.22: Heavily Trafficked Roads Earmarked for Widening

No	Road Sections	Length (Km)	Remarks
1	Aflao-Denu	68	Asphalt Surface in good state
2	Akatsi- Ziope	38	Surface Dressed in good state
3	Denu-Ho	100	Surface dressed need Partial Reconstruction
4	Dawhenya-Akpablabanya	41	
5	Dawhenya-Afenya-Dodowa	48	Surfaced Dressed section awarded
6	Adenta-Dodowa-Kpong	55	Surfaced dressed needs Asphalt Dual Carriage way to Dodowa
7	Adenta-Mamfe-Koforidua	58	Adenta to Mamfe is in good state. Mamfe to Koforidua is Surfaced Dressed but needs Partial Reconstruction
8	Efffiduase-Bunso Road	154	Surface dressed need Partial Reconstruction
9	Winneba –Agona Swedru-Akroso	50	Surface dressed need Resealing
10	Mankessim-Agona Swedru-Adeiso	90	Surface dressed need Partial Reconstruction
11	Nsawam-Adeiso-Asamankese-Kade	82	Surface dressed need Partial Reconstruction
12	Yamoransa-Anwiankwanta	153	Yamoransa-Assin Praso needs Asphalt Overlay. Assin Praso to Bekwai is in good state.
13	Bekwai-Ejiso-Effiduase-Kamawu	29	
14	Kumawu-Agogo	28	Surface dressed in good conditione
15	Cape Coast-Twifo Praso	71	Surface dressed in poor condition
16	Nkawkaw-Donkawkrom-Ntoaboma	113	
17	Agona Junction-Tarkwa-Bogoso-Asankragwa	59	Agona Jn – Tarkwa -Bogoso (93km) AC in good condition under EU support
18	Diaso-Buako	67	
19	Asawinso-Sefwi Bekwai	26	
20	Abuakwa-Bibiani	77	AC wearing course completed under EU support 2003
21	Abuakwa-Sunyani	109	Old AC earmarked for rehabilitation
22	Mankraso-Tepa	45	
23	Goaso- Kyeremaso	64	
24	Berekum –Sampa	82	

Source: Ghana Highway Authority

ByPass to Ease Traffic

The following Bypass routes will be constructed during the period of investment as per Table 6.23.

Table 6.23: By-Pass Development on the Trunk Road Network

S/No	Sections	Remarks
1	Kumasi Bypass	Central Corridor
2	Konongo Bypass	
3	Tamale Bypass	
4	Bolga Bypass	
5	Cape Coast Bypass	Coastal Corridor
6	Takoradi Bypass	

Source: Ghana Highway Authority

The details and the cost estimates are presented in Table 6.24.

Table 6.24: Trunk Roads Infrastructure Financing Assessment (Ghana Highway Authority)

No.	Portfolio	Region(s)	Section	Route No.	Length (km)	Proposed Works	Estimated Project Cost (US$ mn)	Start	Finish
		1st Priority/Short term							
1	Coastal Corridor	Volta/Greater Accra	Sogakope - Tema Roundabout	N1	86	Rehabilitation / Expansion/ Proposed PPP project	**136**	2018	2020
		Greater Accra	Tema - Accra (M'way)	N1	19	Rehabilitation / Expansion/ Proposed PPP project	**400**	2017	2021
		Greater Accra/ Central/ Western	Accra - Takoradi	N1	192	Rehabilitation / Expansion/ Proposed PPP project	**575**	2017	2020
		Western	Takoradi – Agona Junction	N1	24	Reconstruction to Asphaltic Concrete Wearing Course	**25.2**	2017	2019
2	Eastern Corridor	Greater Accra/ Eastern	Tema Roundabout – Atimpoku	N2	65	Asphaltic Overlay	**114**	2017	2019
		Greater Accra/ Eastern/ Volta	Asutuare Jn - Asikuma Jn Over 2nd Lower Volta Bridge	N2	67	Construction		2017	2020
		Volta	Have – Dodo Pepesu (2 Sections)	N2	55	Rehabilitation Asphaltic Concrete Wearing Course	**86**	2016	2021
		Volta	Nkwanta – Volta/ Northern Region Boundary (km 50-64)	N2	14	Upgrading Asphaltic Concrete Wearing Course	**18**	2016	2021
		Northern	Gbintiri – Kulungugu Border	N2	106	Upgrading	**232**	2016	2019
		2nd Priority/ Medium term							
2	Eastern Corridor	Eastern	Atimpoku – Asikuma Junction	N2	26	Asphaltic Overlay / Upgrading	**32**	2017	2019
		1st Priority/ Short term							
3	Central Corridor	Greater Accra/ Eastern /Ashanti	Accra - Kumasi	N6	238	Rehabilitation / Expansion/ Proposed PPP project	**495**	2016	2018
		2nd Priority/Short term							
		Ashanti	Offinso - Akumadan	N10	66	Rehabilitation / Pavement Strenghtening	**62**	2018	2021
		Brong Ahafo/ Northern	Kintampo - Buipe	N10	90	Rehabilitation / Asphaltic Overlay	**93**	2017	2019
		Northern	Tamale – Walewale (km 6.3 – km73.9)	N10	68	Rehabilitation / Asphaltic Overlay	**70**	2017	2019
		Northern/Upper East	Wulugu – Bolgatanga (km0 – km37.3)	N10	37	Rehabilitation / Asphaltic Overlay / Construction of Toll Station	**39**	2017	2019

No.	Portfolio	Region(s)	Section	Route No.	Length (km)	Proposed Works	Estimated Project Cost (US$ mn)	Start	Finish
		1st Priority/Short term							
4	Northern Corridor	Upper West	Tumu – Han	N13	59	Upgrading to Double Surface Treatment	**51**	2016	2018
		Upper West	Han – Lawra	N13	52	Upgrading to Double Surface Treatment	**43**	2016	2018
		Upper East	Tumu - Navorongo (Sectional)	N13	62	Rehabilitation	**63**	2016	2018
		Upper East	Bolgatanga - Bawku – Polmakom	N11	111	Rehabilitation / Upgrading	**168**	2016	2019
		1st Priority/ Short term							
5	Western Corridor	Western/Brong Ahafo	Elubo - Sunyani	N12	335	Construction / Rehabilitation / Upgrading to Asphatic Concrete Wearing Course/ Proposed PPP Project	**677**	2016	2019
		Brong Ahafo/ Northern/Upper West	Sunyani – Sawla – Wa – Hamile	N12	468	Upgrading / Asphaltic Overlay/PPP Project	**486**	2016	2019
		1st Priority/Short term							
6	Strategic Roads	Western	Adwufia - Oseikwadjokrom (km 16 - 36)	IR5	20	Upgrading to Double Surface Treatment	**23**	2016	2018
		Western	Dunkwa - Daboasi (Sectional)	N10	77	Rehabilitation to Double Surface Treatment	**88**	2016	2018
		Central/ Eastern	Winneba - Agona Swedru - Akim Oda	IR2	85	Rehabilitation (Asphaltic Concrete Wearing Course)	**88**	2016	2018
		Eastern	Kwabeng - Kade - Anyinam	R64	56	Rehabilitation (Double Surface Treatment)	**64**	2016	2018
		Eastern	Koforidua - Suhum	N4	24	Rehabilitation (Double Surface Treatment)	**25**	2016	2018
		Eastern	Asamankese - Akroso	R41	15	Rehabilitation (Double Surface Treatment)	**16**	2016	2018
		Eastern/ Central	Adeiso - Mankessim	IR1	100	Rehabilitation (Asphaltic Concrete Wearing Course)	**168**	2016	2018
		Greater Accra / Eastern	Adenta - Agomenya	R40/R30	49	Dualization (Asphaltic Concrete Wearing Course)	**79**	2016	2019
		1st Priority/Short term							
6	Strategic Roads	Brong Ahafo	Mim - Kyeremasu - Berekum	IR8/N6	84	Asphaltic Overlay	**101**	2016	2018
		Ashanti/Brong Ahafo	Kumasi (Sofoline) - Sunyani	N6	117	Rehabilitation	**135**	2016	2019
		Ashanti / Central	Kumasi -Anwiankwanta - Obuasi Junction - Ayanfuri	N10/IR8	113	Lot 1: Dualization of Kumasi - Anwiankwanta (28km) Lot 2: Rehab of Anwiank - Obuasi Junction (31.1km) Lot 3: Asphaltic Overlay of Obuasi Junction - Ayanfuri (53.4km)	**143**	2016	2019
		Northern	Tamale - Yendi	R201	93	Rehabilitation	**80**	2016	2019
		Northern	Yendi - Zabzugu - Tatale	R201	72	Rehabilitation	**62**	2016	2018
		Northern / Upper West	Pala - Wa - Yagaba – Walewale	IR11	214	Rehabilitation	**183**	2016	2019
		Northern	Tamale - Pusuga	N9	63	Rehabilitation	**54**	2016	2018
		Northern	Sakpiegu - Chereponi – Yawgu	N14	87	Rehabilitation	**74**	2016	2019
		2nd Priority/ Medium term							
6	Strategic Roads	Western	Bawdie - Asankragwa – Humjbre	R123, R124	114	Rehabilitation (Double Surface Treatment)	**108**	2017	2019
		Eastern	New Abirem - Akim Oda	IR2/ IR3	70	Rehabilitation (Double Surface Treatment)	**116**	2018	2010
		Eastern	Koforidua - Bunso (Remaining Section)	N4	16	Rehabilitation (Double Surface Treatment)	**16**	2016	2018
		Northern	Walewale - Nakpanduri - Bunkpurugu - Wanjaga	IR11	178	Rehabilitation (Double Surface Treatment)	**153**	2019	2023
		3rd Priority/Long Term							
		Eastern	Kpong - Odumasi - Oterkpolu – Koforidua	N3	54	Rehabilitation (Double Surface Treatment)	**46**	2019	2021
		Central	Assin Foso - Twifo Praso - Agyepomaa - Insu Junction	R81, R212	88	Rehabilitation (Double Surface Treatment)	**76**	2019	2021
		Central	Nyanyano - Kasoa	R15	8	Rehabilitation (Double Surface Treatment)	**7**	2019	2021

No.	Portfolio	Region(s)	Section	Route No.	Length (km)	Proposed Works	Estimated Project Cost (US$ mn)	Start	Finish
		3rd Priority/Long Term							
6	Strategic Roads	Brong Ahafo	Atebubu - Volta Lake (Sectional)	R47	60	Rehabilitation (Double Surface Treatment)	**49**	2022	2024
		Ashanti/ Eastern	Ejura - Anyinofe - Donkorkrom - Amankwakrom (Volta Lake)	IR7	201	Rehabilitation (Double Surface Treatment)	**165**	2024	2027
		Ashanti	Kumasi - Mampong - Ejura – Yeji	IR4	222	Lot 1: Dualization of Kumasi - Agona Junction (31.6km) Lot 2: Asphaltic Overlay of Agona Junction - Mampong - Ejura - Yeji (90.6m)	**254**	2022	2024
		Brong Ahafo	Prang - Kintampo - New Longoro - Sampa	IR9	143	Rehabilitation (Double Surface Treatment)	**123**	2022	2024
		1st Priority/Short term							
7	Maintenance Roads	Volta	Ho - Dodze - Denu	R10	100	Rehabilitation (Double Surface Treatment)	**89**	2016	2018
		2nd Priority/Short term							
		Eastern	Mamfe - Koforidua	N4	35	Rehabilitation (Double Surface Treatment)	**28**	2018	2019
		3rd Priority/Long term							
		Greater Accra/ Eastern	Doryumu - Larteh Junction	R22	18	Rehabilitation (Double Surface Treatment)	**13**	2021	2021
		Greater Accra	Dodowa - Afienya - Dahwenya	R13	23	Rehabilitation (Double Surface Treatment)	**16**	2021	2022
		Eastern/ Volta	Asikuma Junction - Ho	N5	44	Rehabilitation (Double Surface Treatment)	**43**	2019	2021
		1st Priority/Short term							
8	Tourism Roads	Central	Abura Junction - Kakum - - Twifo Praso	R82	71	Rehabilitation (Double Surface Treatment)	**64**	2016	2018
		2nd Priority/Short term							
		Upper East	Wa – Gwollu	N18 / R184	111	Rehabilitation (Double Surface Treatment)	**91**	2019	2021
		Volta	Golokwati- Wli-Hohoe	R70	41	Rehabilitation (Double Surface Treatment)	**33**	2018	2020
		Ashanti	Kumasi - Abono (Lake Road) including Ring road linking all the village around lake Bosomtwe	R106	100	Rehabilitation (Double Surface Treatment)	**85**	2018	2020

No.	Portfolio	Region(s)	Section	Route No.	Length (km)	Proposed Works	Estimated Project Cost (US$ mn)	Start	Finish
		1st Priority/Short term							
9	Bridges / Interchange Programme	Northern	Rehabilitation of Buipe Bridge	N10	230 m		**12**	2016	2018
		Northern	Rehabilitation of Yapei Bridge	N10	230 m		**12**	2016	2018
		Northern	Construction of Daboya Bridge	R109	250 m		**15**	2016	2018
		Eastern	Adawso - Ekyeamanfrom Bridge on Route R72	R72	4		**239**	2017	2019
		Volta	Dambai - Borae - Kete Krachi Bridge on Route R26 (Dambai - Dodoikope)	R26	16		**957**	2017	2019
		Brong Ahafo	Kwadwokrom Bridge on Route R47	R47	3		**150**	2017	2019
		Ashanti	Suame Interchange in Kumasi	N10	0		**80**	2017	2019
		Brong Ahafo	Tano Bridge at Ntotoroso on Route R128 (Acherensua-Ntotoroso)	R128	40 m		**2**	2017	2019
		Northern	Bridge over River Kulda (Wapuli-Saboba (N14))	N14	50 m		**3**	2017	2019
		1st Priority/Short term							
9	Bridges / Interchange Programme	Upper East	Bridge over River Asibeliko on Route R113 (Kadema - Naga)	R113	50 m		**3**	2017	2019
		Eastern	Bridge over River Ponpon (Oterkpolu-Odumasi Rd)	N3	50 m		**3**	2017	2019
		Eastern	Bridge over River Birim (Oda-Ntronang)	R62	100 m		**6**	2017	2019
		Eastern	Bridge over River Asuoyaa (Mamfe -Koforidua Rd)	N4	40 m		**2**	2017	2019
		Eastern	Bridge over River Okwe at Okwenya (Somanya-Akuse Jn)		20 m		**1**	2017	2019
		Upper West	Bridge at Karni on Route N13	N13	20 m		**1**	2017	2019

No.	Portfolio	Region(s)	Section	Route No.	Length (km)	Proposed Works	Estimated Project Cost (US$ mn)	Start	Finish
		2nd Priority/Medium							
9	Bridges / Interchange Programme	Eastern/Volta	Donkokrom - Kpando Bridge on Route IR7	IR7	13		**777**	2018	2019
		Central	Bridge over River Akora at Nyakrom (Swedru-Nyakrom Road)	IR2	40 m		**2**	2018	2019
		Northern	Bridge over River Nalerigu on Route IR11 (Walewale-Nalerigu-Nakpanduri)	IRI	130 m		**5**	2018	2019
		Northern	Yeji Bridge over River Volta on Route IR4 (Ejura -Yeji- Makango - Tamale)	IR4	8		**478**	2018	2019
		3rd Priority/Long term							
9	Bridges / Interchange Programme	Brong Ahafo	Tano Bridge at Ntotoroso on Route R128 (Acherensua-Ntotoroso)	R128	40 m		**3**	2019	2021
		Northern	Bridge over River Oti on Route R204 (Yendi-Saboba)	R204	200 m		**12**	2019	2021
		Central	Ochi Bridge (Asikuma-Kokoso-Amanfupon Rd)	R62	20 m		**1**	2019	2021
		Brong Ahafo	Tanfiano Bridge (Nkoranza-Jema Road)	R44	30 m		**2**	2019	2021
		Western	Tano Bridge (Sefwi/Wiawso-Akontombra Road)	R126	60 m		**4**	2019	2021
		Brong Ahafo	Bridge at Sabie on Route R94 (Menji-Bui Rd)	R94	50 m		**3**	2019	2021
		3rd Priority/Long term							
9	Bridges / Interchange Programme	Northern	Bridge over White Volta on Route R92 (Tamale-Nawuni-Singa Rd)	R92	250 m		**15**	2022	2023
		Central	Bridge over River Pra (Assin Nyankumasi-Senchiem)	R83	100 m		**6**	2022	2023
		Ashanti	Bridge over River Ongwam at Kumawu (Kumawu-Kwaman)		40 m		**3**	2022	2023
		Volta	Bridge over River Oti at Dambai on Route R26 (Dambai-Borae No.2)	R26	4		**239**	2023	2027
		Volta	Dambai Bridge over River Oti (Dambai-Kpandai-Bimbilla Road)	R26/R202	1,600 m		**96**	2024	2028

No.	Portfolio	Region(s)	Section	Route No.	Length (km)	Proposed Works	Estimated Project Cost (US$ mn)	Start	Finish
		1st Priority/Short term							
10	Road Safety and Environment Program	All Regions	Road line marking, Traffic Calming Devices, Axle Load Control and Street Lighting				**26**	2016	2017
		1st Priority/Short term							
11	Cost to Complete Ongoing Projects	All Regions					**135**	2016	2017
	Short Term								
12	Missing Links on Trunk Road Network				670		**393**		
13	Heavily Trafficked Roads earmarked for Widening				1,706		**1,832**		
14	By-pass Development on the Trunk Road Network				143		**229**		
	TOTAL						**12,566**		

Source: GHA data adapted by GIP Team

6.7 Urban Roads Development

6.7.1 Urban Roads Investment

Investment on the urban road network will be mainly towards arterial development for movement of large volumes of traffic in the shortest possible time. This will be complemented with the construction of interchanges to reduce traffic conflicts currently experienced in the urban arterial network. The urban road investment will have to address the collector distribution segment of the urban network.

Urban road investments of US$20 million or more have been itemised while those investments below US$20 million have been aggregated (as shown in Tables 6.25, 6.26 and 6.27) to be considered for the short, medium and long term respectively

Table 6.25: Short-Term Urban Arterial Road Investment

No.	Short Term Projects (2018-2028)			
	Project	Region	Length (km)	Cost (US$ mn)
1	Construction of Pedu Interchange - Cape Coast	Central Region		8
2	Dualisation of North Jukwa Road - Cape Coast	Central Region	5	20
3	Rehabilitation of Selected Roads at Green Hill-Cape Coast	Central Region	50	75
4	Rehabilitation of Selected Roads at Moree	Central Region	25	37
5	Rehabilitation of Selected Roads at Abura Village-Cape Coast	Central Region	25	38
6	Rehabilitation of Selected Roads at Abesewa Area-Dunkwa-On-Offin	Central Region	15	23
7	Updrading of selected roads at Otabilkrom area - Agona Swedru	Central Region	15	23
8	Updrading of selected roads at Woraba estate area - Agona Swedru	Central Region	15	23
9	Updrading of selected roads at Kojo Armah estate area - Agona Swedru	Central Region	15	23
10	Updrading of selected roads at Apeabir area - Agona Swedru	Central Region	15	23
11	Upgrading of Selected roads at borga estate area – Dunkwa	Central Region	15	23
12	Suame Roundabout (Interchange)	Ashanti Region		85
13	Bekwai Roundabout (Interchange)	Ashanti Region		20
14	Anloga Junction (Interchange)	Ashanti Region		30
15	Widening of Mampong Road to 4 lanes	Ashanti Region	20	60
16	Widening of Ejisu-Kumasi highway from Ejisu roundabout to Kubease to 4 lanes	Ashanti Region	27	81
17	New link connecting Lake Road and Harper Road, 4 lanes	Ashanti Region	10	40
18	Development of the middle ring road	Ashanti Region	25	30
19	First Phase of the Outer Ring Road (Ejisu – Kodie)	Ashanti Region	400	800
20	Sunyani Road	Ashanti Region	11	22
21	Lake Road	Ashanti Region	10	20
22	Walkways in all cities	Ashanti Region	100	25
23	Middle ring road	Ashanti Region	15	30
24	Mampong Road	Ashanti Region	10	20
25	New Bekwai Road	Ashanti Region	10	20
26	Old Bekwai Rd	Ashanti Region	10	2
27	Development of multi storey parking lots in Kumasi	Ashanti Region		20
28	Bank Of Africa To Hamadiya Mosque	Northern Region		30
29	Bayan Wire Area Roads	Northern Region	5	125
30	Changli Area Road	Northern Region	5	125
31	Bilpela Area Road	Northern Region	2	50
32	Tishigu Area Roads	Northern Region	2	50
33	Sakasaka / Ambariya Area Roads	Northern Region	5	125
34	Sagnarigu Main Road/ Education Ridge Area Roads	Northern Region	8	200
35	Kaladan Area Roads	Northern Region	5	125
36	Lamakara / Zobgeli Internal Roads	Northern Region	10	250
37	Lamashegu South Area Roads	Northern Region	9	225
38	Nyohini/Industrial Area Roads	Northern Region	12	300
39	Norrip Village Road	Northern Region	5	125
40	Gumani -Tunaayilii Area Roads	Northern Region	6	150
41	Village Water Area Roads	Northern Region	4	100
42	Kukuo Area Roads	Northern Region	6	150
43	Selected Roads In Tamale	Northern Region	100	70
44	Tamale	Northern Region	5	20
45	Sagnerigu	Northern Region	6	24
46	*Second Ring Road (Taysec Junction To Agric	Northern Region	30	60
47	*Third Ring Road (Abbatior -Fuo Section)	Northern Region	15	30
48	Leo (Burkina Faso) road	Upper West Region	25	30
49	Kowie road	Upper West Region	20	24
50	Bakwala road	Upper West Region	25	30
51	Kassana road	Upper West Region	25	30
52	Tumu Ring road	Upper West Region	450	540
53	Belendjan Road	Upper West Region	20	24
54	Kumfabiala Road	Upper West Region	20	24
55	Wa – Siiru Road	Upper West Region	30	36
56	Bamahu – Danku Road	Upper West Region	25	30
57	Wa – Dorimon Road	Upper West Region	20	24
58	Wa Bypass	Upper West Region	75	90
59	Tumu Bypass	Upper West Region	40	48
60	Nadowli ring road	Upper West Region	40	48
61	Jirapa ring road	Upper West Region	50	60
62	Lawra ring road	Upper West Region	50	60
63	Lawra Bypass	Upper West Region	50	60
64	Jirapa Bypass	Upper West Region	75	90
65	Nadowli Bypass	Upper West Region	60	72
66	Hamile main road	Upper West Region	25	30
67	Hamile Bypass	Upper West Region	40	48
68	Issa main	Upper West Region	55	66
69	Issa Bypass	Upper West Region	40	48
70	Construction of bypass for Aziave Fesi, Kpando	Volta Region	12	24
71	Upgrading of UHAS area roads	Volta Region	24	28
72	Arterial and Collector Roads in Sekondi-Takoradi Metropolis	Western Region	50	35
73	Dualisation of Kansawurodo Bypass Phase 3	Western Region	9	34
74	Dualisation of Sekondi Bypass	Western Region	17	66
75	Kwame Nkrumah Interchange	Western Region		23
76	Paa Grant Interchange	Western Region		24
77	Provision of paved pedestrian sidewalks in Effiakuma Zongo	Western Region	10	30
78	Bus Priority Lanes in Greater Accra Region	Western Region	40	80

No.	Short Term Projects (2018-2028)			
	Project	Region	Length (km)	Cost (US$ mn)
79	Bus Priority Lanes in Western Region	Western Region	30	60
80	Bus Priority Lanes in Ashanti Region	Western Region	30	60
81	Bus Priority Lanes in Northern Region	Western Region	30	60
82	Bus Priority Lanes in Greater Accra Region	Greater Accra	120	240
83	Bus Priority Lanes in Western Region	Western Region	60	120
84	Bus Priority Lanes in Ashanti Region	Ashanti region	60	120
85	Bus Priority Lanes in Northern Region	Northern region	30	60
86	Dualisation of Beach Road	Greater Accra	22	87
87	Construction of ACP Junction -Tema Motorway Road	Greater Accra	23	47
88	Dualisation of Haatso Atomic Road	Greater Accra	7	27
89	Dualisation of Sowutuom Ofankor Main Road	Greater Accra	9	37
90	Dualisation of Kpone to Accra-Aflao Road	Greater Accra	12	47
91	Other Aggregated Investment below US$ 20 million	Various	-	1,361
Total				**8,137**

Source: DUR data adapted by GIP Team

Table 6.26: Medium-Term Urban Arterial Road Investment

No.	Medium-Term Projects (2029-2038)			
	Project	Region	Length (km)	Cost M (USD)
1	Dualisation of Old Saltpond Road - Cape Coast	Central Region	5	30
2	Dualisation of Ankaful Road - Cape Coast	Central Region	15	90
3	Construction of Winneba Bypass	Central Region	25	37
4	Construction of Assin Fosu Bypass	Central Region	30	45
5	Construction of Agona Swedru ByPass	Central Region	30	45
6	Partial Reconstruction of Selected Roads in E/R	Eastern Region	15	23
7	Construction of Aboabo-Oyoko bye pass, Koforidua	Eastern Region	16	24
8	Widening of New Bekwai Road to 4 lanes from Santasi RB to Bekwai RB	Ashanti Region	7	21
9	Dualisation of Juaso-Konongo-Ejisu Road	Ashanti Region	34	102
10	Aboffour Town Roads in Offinso	Ashanti Region	10	20
11	Anyankasu Area Roads Development	Ashanti Region	12	24
12	Reconstruction Of Konongo-Agogo Road	Ashanti Region	20	40
13	Upgrading Of Konongo & Odumase Town Roads (15km)	Ashanti Region	15	30
14	Antoa Road	Ashanti Region	10	20
15	Offinso Road	Ashanti Region	10	20
16	Abrepo Road	Ashanti Region	10	20
17	Fuo-Taha	Northern Region	40	36
18	Gurugu	Northern Region	30	27
19	Kanvili Tuunaayili	Northern Region	50	45
20	*Second Ring Road (Taysec Junction To Agric	Northern Region	25	30
21	*Third Ring Road (Abbatior -Fuo Section)	Northern Region	20	24
22	Second Ring Road (Kalpohini- Agric Junction)	Northern Region	10	20
23	Third Ring Road (Bamvim Jonshegu-Kakpagyili	Northern Region	10	20
24	Tamale Bolga Road (Agric Junction -Savelugu)	Northern Region	10	24
25	Second Ring Road (Agric Junction-Taysec Junction)	Northern Region	25	60
26	Newly Developed Areas In Tamale Metropolitan	Northern Region	100	140
27	Newly Developed Areas In Sagnerigu District	Northern Region	150	210
28	Tamale -Kumbungu Road (Choggu Round About - Katariga)	Northern Region	15	30
29	Tamale -Nyankpala Road (Nyohini Round About - Nangbagu)	Northern Region	20	40
30	King David Junction	Northern Region		30
31	Agric Junction	Northern Region		20
32	Upgrading of Abor area roads	Volta Region	17	21
33	Greater Sekondi-Takoradi Metropolitan Area (GSTMA) Multi-sectoral PPP Project	Western Region	50	100
34	Development of Coastal Arterial (from Daboase Junction through Shama, Takoradi Harbour,	Western Region	20	40
35	Agona Nkwanta, New Atuabo, Half Assini to N1 Highway	Western Region	238	476
36	Nkroful Interchange	Western Region		20
37	Apremdo Interchange	Western Region		21
38	RCC and WAEC Interchanges, Sekondi	Western Region		29
39	Fijai-Effiankwanta Interchange	Western Region		28
40	Kansawurodo Interchange	Western Region		29
41	4. No.9 Interchange (US$28.5million)	Western Region		29
42	Pipe Ano Interchange (US$22.10million	Western Region		22
43	Shippers Interchange (US$20.10million	Western Region		20
44	Airport Ridge Interchange (US$22.10million	Western Region		22

No.	Medium-Term Projects (2029-2038)			
	Project	**Region**	**Length (km)**	**Cost M (USD)**
45	Fijai OJK Interchange (US$20.10million)	Western Region		20
46	GSTMA Outer Bypass Interchange at Daboase Junction (US$35million)	Western Region		35
47	GSTMA Outer Bypass Interchange at Apimanim Junction (US$28million)	Western Region		28
48	Other Aggregated Investment below US$ 20 million	Various	-	1,007
Total				**3,294**

Source: DUR data adapted by GIP Team

Table 6.27: Long-Term Urban Arterial Road Investment

No.	Long Term Projects (2039-2048)			
	Project	**Region**	**Length (km)**	**Cost M (USD)**
1	Rehabilitation of Selected Roads in Winneba	Central Region	30	45
2	Upgrading of Selected Arterial and Collector Roads in Agona Swedru	Central Region	25	38
3	Upgrading of Selected Arterial and Collector Roads in Saltpond	Central Region	30	45
4	Upgrading of Selected Arterial and Collector Roads in Mankessim	Central Region	30	45
5	Upgrading of Selected Arterial and Collector Roads in Assin Fosu	Central Region	30	45
6	Upgrading of Selected Arterial and Collector Roads in Agona Swedru - Agona Swedru	Central Region	25	38
7	Construction of Agona Swedru ByPass - Agona Swedru	Central Region	30	45
8	Upgrading of Selected Arterial and Collector Roads in Dunkwa – Dunkwa	Central Region	25	38
9	Upgrading of Selected Arterial and Collector Roads in Assin fosu - Assin Fosu	Central Region	25	38
10	Asphaltic Overlay of Kasoa-Nyanyaano Road	Central Region	24	22
11	Upgrading of Akwelley Area Roads	Central Region	30	45
12	Upgrading of Adom Estate Area Roads	Central Region	30	45
13	Upgrading of Ofaakor Area Roads	Central Region	50	75
14	Upgrading of UN City Area Roads	Central Region	50	75
15	Upgrading of Rock City Area Roads	Central Region	25	38
16	Upgrading of Kaemebre Area Roads	Central Region	20	30
17	Upgrading of Adamnana Area Roads	Central Region	25	38
18	Upgrading of Walantu Area Roads	Central Region	35	53
19	Upgrading of CP Area Roads	Central Region	30	45
20	Upgrading of Everlip Area Roads	Central Region	40	60
21	Upgrading of Agyenkwa Area Roads	Central Region	30	45
22	Upgrading of Opeikuma Area Roads	Central Region	25	38
23	Upgrading of Krispol City Area Roads	Central Region	25	38
24	Upgrading of Asamoah Town Area Roads	Central Region	25	38
25	Upgrading of American Town Area Roads	Central Region	20	30
26	Upgrading of Newtown Area Roads	Central Region	20	30
27	Upgrading of Zongo Area Roads	Central Region	25	38
28	Upgrading of Iron City Area Roads	Central Region	25	38
29	Missing links Construction Programme, Oda	Eastern Region	20	30
30	Construction of Aboabo-Suhyen bye pass, Koforidua	Eastern Region	20	40
31	Pentecost SHS- Suhum road Bye pass	Eastern Region	20	40
32	Widening of Western bypass to 4 lanes in certain sections (Sofoline Roundabout to Santasi Roundabout)	Ashanti Region	7	21
33	Widening of southern bypass to 4 lanes in certain sections (Santase Roundabout through Ahodwo Roundabout to Georgia Hotel)	Ashanti Region	7	21
34	Widening of Antoa Road to 4 lanes from Airport RB through Buokrom to Antoa	Ashanti Region	20	60
35	Widening of Obuasi Boete to Asokwa Jtn Road to 4 lanes (Up to Kwabenakwa)	Ashanti Region	15	45
36	Upgrading of Abompe area (10km) Roads,Obuasi	Ashanti Region	10	20
37	Upgrading of Bogobiri area Roads,Obuasi (10km)	Ashanti Region	10	20
38	Upgrading of Kunka area roads,Obuasi (10km)	Ashanti Region	10	20
39	Construction of Konongo By Pass	Ashanti Region	10	20
40	Other Aggregated Investment below US$ 20 million	Various	-	289
Total				**1,824**

Source: DUR data adapted by GIP Team

6.7.2 GAMA Road Transport

Accra, the capital city of Ghana, is considered one of the most populated and fastest growing cities in Africa. It is also the seat of the Greater Accra Metropolitan Area (GAMA). With an urbanisation rate of about 4.41%, GAMA is characterised by high population growth, resulting in a rapid sprawl of settlements and increasing daily inflow and outflow of people due to the commercial and service functions that the metropolis serves.

Objectives

The main objectives guiding GAMA are as follows:

1. To set a clear direction for transport development in the Greater Accra Region for the next 20 years, bringing together all modes of transport, across all areas of the region into an integrated urban transport system;

2. To reduce traffic congestion and logistics costs in Accra through the development of policies, strategies, and engineering measures;

3. To promote effective capacity building for transport-related officials for sustaining the Transport Master Plan through transferring advanced technological knowledge and experience from Korean experts; and

4. To ensure that Accra will become the leading city in transportation in West Africa.

Population Growth and Rising Number of Immigrants

Almost half of Ghana's economic activities are concentrated in the Greater Accra Region, especially in the Accra Metropolitan Assembly (AMA) and Tema Metropolitan Assembly (TMA) areas. Economic growth often brings about intense growth in population, especially in developing countries, and Ghana is expected to follow the same trend. The Greater Accra Region has an estimated population of about 4,010,054 people according to the 2010 National Population and Housing Census. Apart from the resident population of Accra, an additional daily influx of between 2.5 million and 3.0 million people is estimated for commercial and service purposes.

Challenges of GAMA Urban Transport

Increasing Vehicle Ownership and Urban Sprawl: Much of Accra's growth consists of urban sprawl, which militates against adequate public transport service supply, encourages vehicle dependence and reduces accessibility to destinations.

This has had adverse ramifications on the public transport service supply within the metropolis. The ownership of private vehicles has increased markedly over the past few years, particularly within the metropolis, with the number of registered vehicles standing at 890,511 in 2014 (excluding motorcycles and scrap vehicles).

In spite of the high economic growth rate within GAMA's jurisdiction, the twin issue of an increased car ownership rate in line with rising average household incomes, and below average population density caused by urban sprawl, lead to increased costs of infrastructure provision and commuting, thereby fostering high traffic congestion and hindering urban development and productivity in general.

Other challenges of public transport service in the metropolis include poor and inadequate development of intermodal facilities, lack of

proper enforcement of transport regulations, and a difficult relationship between land use and transport planning.

Traffic Congestion and Urban Challenges: The growth rate of Accra's economy appears to be fast and prosperous, but urban productivity is hindered by low-density urban sprawl, which increases the cost of infrastructure and commuting.

A rapidly growing city like Accra has two distinct characteristics. One is the above-average car ownership rates in line with rising average income; the other one is below-average population density caused by urban sprawl. Together these characteristics encourage high traffic congestion and hinder urban development. For instance, almost 70% of motorized trips depend on some form of bus transport, which occupies 30% of road space; in contrast, the remaining 70% of road space is taken over by other modes including private vehicles and taxis which transport only 30% of travellers.

The need for comprehensive long-term transport planning: The absence of long-term strategic perspectives in transport activities tends to result in provisional improvements rather than prescriptive planning. Even though substantial resources and efforts to improve Accra's transport environment have been made for a long period, citizens' daily life has not been affected much and the visible change has been marginal.

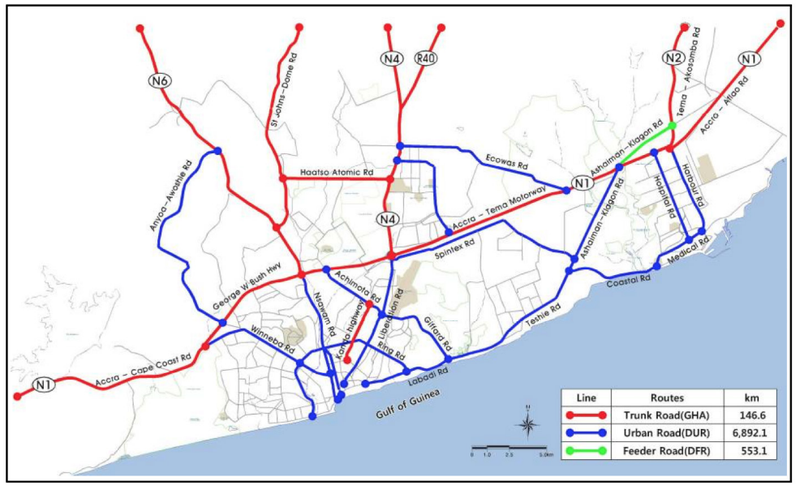
While GAMA had their own transport vision and future plan, including several short-term programmes, the city does not have an integrated transport master plan to direct development in terms of transport.

GAMA has therefore prepared a comprehensive, long-term, master plan, taking into consideration growing trends in modern technology, to improve the transport environment within the metropolis.

GAMA's Road Network

GAMA's road networks consist of trunk roads (shown in red on Figure 6.9) which connect the various regions, regional capitals and neighbouring countries, and urban roads (shown in blue on Figure 6.9) which link the various suburbs in the region.

Figure 6.9: Current Road Network in GAMA

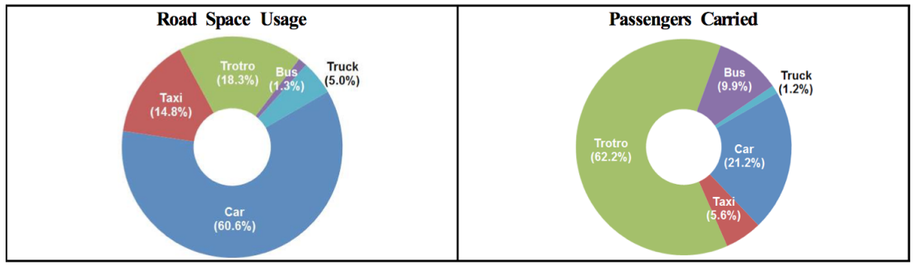


Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

Public Transport System

In GAMA, public transport is operated largely by informal operators with a mix of vehicles and mini-buses with capacities ranging from 15 to 23 passenger seats, popularly known as trotro. In GAMA, trotro accounts for the largest modal share of over 62.2%, making it the most patronised mode of transport. Even though the trotro mode of transport is the most widespread, trotro road space usage is rather low. Trotro use just 18.3% of the road space, as shown in the figure below.

Figure 6.10: Modal split of vehicles on arterial roads in GAMA

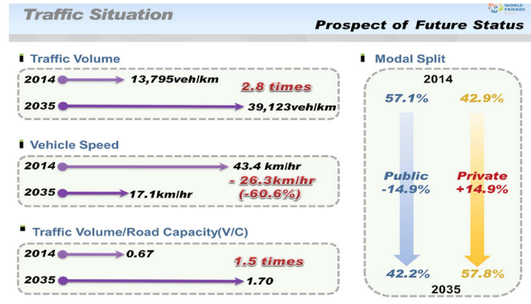


Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

Traffic Situation

Figure 6.11 below shows a volume of about 13,795 vehicles per kilometre, although the total volume of vehicles per day is about 43,962. At a total average growth rate of about 4.5%, the average traffic volume is expected to increase by about 2.5 times by the end of 2035 (from 43,962 vehicles/day in 2014 to 110,745 veh/day in 2035), and the total vehicle per kilometre travel will also increase by about 2.8 times, from 13,795 in 2014 to 39,123 in 2035. The average vehicle travel speed is likely to decrease from 43.4 km/h in 2014 to 17.1 km/h in 2035 within GAMA, and 40.7 km/h in 2014 to 7.3 km/h in 2035 within the capital city itself. In spite of the increasing private ownership of vehicles within the metropolis, a greater percentage of the population still relies on public transport systems owing to low income levels and the absence of alternative modes of transport within the metropolis, and GAMA could capitalise on this to develop a more flexible public transport system.

Figure 6.11: Traffic Situation in GAMA



Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

This increased traffic volume and decreased travel speed will lead to severe traffic congestion on every road within GAMA, resulting in a huge social cost and eventually causing GAMA's competitiveness as a city to dwindle greatly.

It is therefore imperative that road networks be expanded to match the ever-increasing sprawl of the metropolis. With lessons from other megacities from around the world (e.g. Seoul Metropolitan, London, Jakarta, Greater Tokyo, etc.), it will be expedient for GAMA to consider constructing and operating a more competitive public transit system.

Traffic Conditions and Target of GAMA

Table 6.28 shows the prevailing reality against the targets that GAMA desires to attain by the end of the plan period. These targets have been projected in comparison to average public transport performance in some major cities around the world.

Table 6.28: Transport Conditions and Target of GAMA

Class		GAMA's Status	GAMA's Target	Remarks
Public Transport	Road fleet (vehicle)	**148 veh** (6%)	**2,400 veh**	Introduce big bus
	Bus Route (km)	**0 km** (0%)	**246 Km**	Physical obstacles or real time enforcement bus route
Road Length (km)		**7,592 km** (42%)	**18,592 Km**	Major reason of congestion
Urban density (persons/ha)		**31.6%** (73%)	**Transit Oriented Development**	Urban structure of low density (Sprawl)
Registered vehicle (vehicles)		**0.89 mil** (341%)	**0.63 mil**	Increasing the public transport usage
Public transport (journeys/persons)		**52.1%** (49%)	**Transit Oriented Development**	Hub & Spoke, Improve public transport

Source: The Transport Masterplan Project in Greater Accra, 2016

As Table 6.28 depicts, the existing public transport system in GAMA remains inadequate as compared to those of major cities around the world. Existing indicators for GAMA such as public transport vehicles, annual public transport capacity, railway length, road density and others, are all very much below the world average.

Therefore, to boost its capacity in order to reach its target of measuring up to the average megacity's public transport system, GAMA has to introduce about 2,400 big buses as public transport vehicles, and construct about 246 km of public transport routes, 230 km of railway routes and about 11,000 km of roads. The authorities of the metropolis could also consider boosting the city's competitiveness by introducing Bus Rapid Transit and a Hub and Spoke system, while refurbishing existing public transport facilities in the meantime.

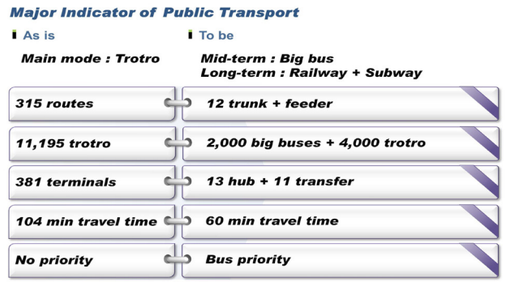
Public Transport Situation

In examining the prevailing status of the different modes of public transport in GAMA, it was established that trotro serves as the main mode of public transport in the city. However, the available fleet is inadequate and largely consists of old and rickety vehicles.

Although the possibility for rail transport exists, the absence of a railway plan for the metropolis, as well as the many constraints in actually laying railway lines within the city greatly limits this prospect. Therefore, it is expected that big buses will be introduced as the main mode of public transport in the medium term, while a plan for a rail/subway could be set in motion for implementation in the medium-to-long term. It is also envisioned that since almost all trotro converge in the central business district (CBD), the big buses will operate along the arterial roads. It is therefore suggested that 315 trotro routes be transformed into 12 trunk bus and feeder routes.

Again, though there are many terminals dotted around the city, the capacities of these terminals, their transfer facilities, convenience amenities and information systems are absolutely inadequate. It is therefore suggested that the existing 381 terminals should be transformed into 13 hub terminals and 12 transfer facilities (Figure 6.12). To increase the travel quality experience for passengers, there should be workable plans like the introduction of bus priority measures to reduce the queues and long waiting times at these terminals, and to ensure that passengers reach their destination within an hour of travel time.

Figure 6.12: Major indicator of Public Transport



Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

In the short term, trotro are in high demand. In the near future (medium term), however, it is expected that these will be phased out for the big buses and BRTs to take over and make way for the rail system to play a major role in the supply of public transport in the city in the long term.

Hub Terminal and Transfer Facilities

The CBD and its environs tend to experience high transport demand. It is recommended therefore, that approximately 3 arterial bus routes be placed along that corridor. The starting points of any additional routes will serve as the hub of the surrounding areas. Therefore, the hubs at the outskirts and the CBD's hub will serve as the terminals, while points of interchange between trotro routes could serve as transfer facilities. With this in mind, GAMA has identified 13 hub terminals and 11 transfer facilities within the metropolis (Figure 6.13).

It is envisioned that a hub terminal should have the appropriate amenities (suitable transfer facilities, sufficient bus garage space etc.). These hub terminals will be built as complexes, with shopping malls, hotels, offices and so on, using PPPs.

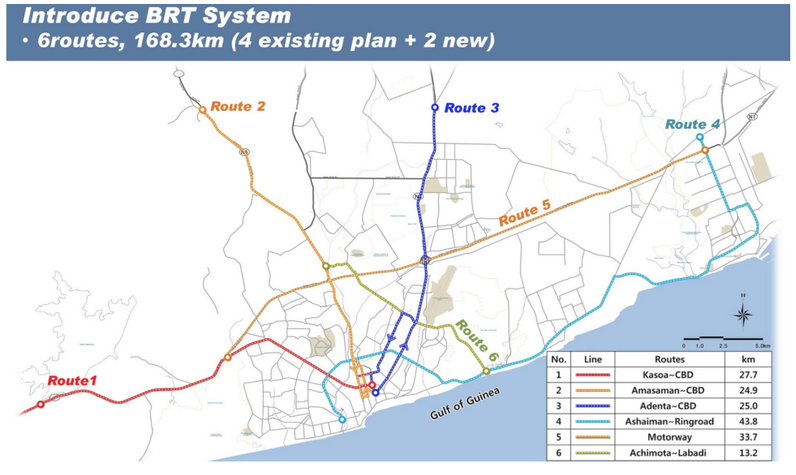
Figure 6.13: Hub Terminals and Transfer Units

Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

Bus Rapid Transit (BRT) System

The introduction of the BRT system is to increase users of public transport systems within GAMA, by making travel by bus efficient enough to dissuade users from switching to private vehicles. Given that private vehicles provide door-to-door trips to vehicle owners, the BRT should therefore be competitive enough to retain its users. In order to achieve this objective, the main factor to consider in developing BRT systems is to ensure that bus journey times are comparable to those of private vehicles.

Figure 6.14: BRT System



Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

The prospect of introducing a BRT system in GAMA has been considered for many years. However, due to many constraints, implementation has been delayed.

Six major routes have been identified:

- Route 1: Amasaman to Tudu in the CBD;
- Route 2: Aburi Road through Independence Ave. to CBD;
- Route 3: Tema Community 1 through Teshie-Nungua, Kwame Nkrumah Circle to CBD;
- Route 4: Winneba Road to UTC;
- Route 5: Sowutuom, Santa Maria to CBD;
- Route 6: Awoshie to Kwame Nkrumah Circle.

However, the absence of exclusive bus lanes has also greatly constrained the full implementation of BRT systems within the city.

Improvement of Bus Systems

In the quest to improve the quality of life of the citizens of GAMA, as well as enhance the competitiveness of the metropolis, the city needs to adopt the "hub and spokes" system, where major trotro/bus terminals function as hubs, while small terminals along roads or in residential areas serve as the spokes that link passengers to these hubs.

Table 6.29: Improvement for Public Transport

Improvement for Public Transport
· BRT + Arterial Bus + Hub Terminal + Transfer Facility

Improvement Item	Short-term	Mid-term I	Mid-term II	Total
BRT (length)	Adenta~CBD, Amasaman~CBD	Motorway Kasoa~CBD	Ashaiman~Ringroad Achimota~Labadi	6 routes
	49.9km(24.9km)	61.4km	56.7km	168.3km(24.9km)
Arterial Bus (length/bus)	Line 2-1, 2-2 Line 3-1, 3-2	Line 1, 2-3 Line 4-1, 4-2	Line 4-3, C-1, C-2, Line C-3	12 lines
	71.5km / 158(85)	122.6km / 177	98.3km / 146	292.4 / 478(85)
Hub Terminal	(Amasaman, Ofankor) Adenta, Madina, 37Lorry	Kasoa, Sowutuom Community1, Sakaman	Ashaiman, Circle, Kaneshie, 37Lorry (Achimota)	13 hub terminals (3)
Transfer Facility	5 facilities	3 facilities	3 facilities	11 transfer Facilities

( ) Existing Facilities or Vehicles

Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

In order to achieve this, some reforms need to be made in order to make the public transport system within the city more competitive. Such reforms include the creation of a total of 12 arterial bus networks, to serve as major public transit networks. Big arterial buses will therefore be commissioned to ply the arterial roads, while the trotro connect routes from residential areas to these arterial roads.

The short-term investment for the GAMA project is about US$94 million. The cost breakdown is given in Table 6.30.

Table 6.30: Funding Required for Short-Term Investment

Category		Unit	No. of items	Cost (USD 1,000)	Remarks
BRT	Exclusive lane & station	Km	25	54,642.90	MRH
	Transfer Facility	Spot	4	3,099.50	
	Plan & Design	Set	1set	2,887.10	
	Total			60,629.40	
Hub Terminal	Adenta Terminal	ml	4,723	4,567.80	
	Madina Terminal	m2	4,006	3,874.30	
	Plan & Design	Set	1set	422.1	
	Total			8,864.18	
TSM	Traffic Signal Light I Controller	Spot	29	4,018.50	MRH
	Plan & Design	Set	1	. 200.9	
	Total			4,219.50	
ITS	BIMS	Set	1set	3,957.70	GAPTE
	TSCS	Set	1set	1,860.00	
	Plan & Design	Set	1set	290.9	
	Total			6,108.60	
Purchase Cost of Vehicle		Fleet	66	13,750.00	MOT
TOTAL				**93,571.70**	

Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

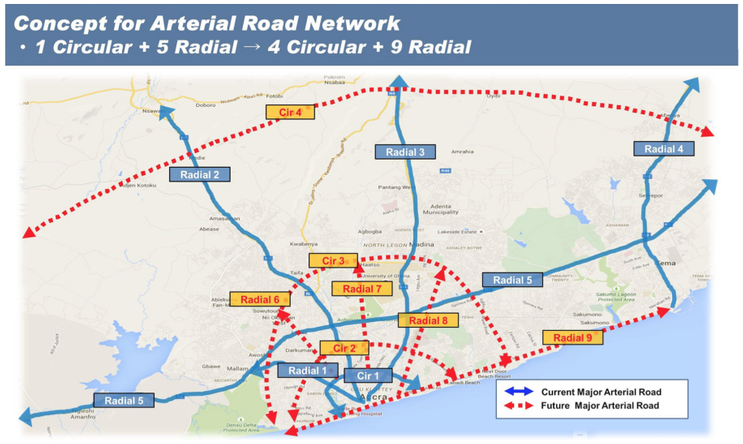
Proposed Arterial Road Network

GAMA's vehicle population is expected to grow to about 2 million by 2035. Plans should therefore be far advanced to maintain the city's competitiveness, especially in the transport sector, with standard road infrastructure in place to support this increase.

Development of more Circular and Radial Roads

Currently, there are five radial arterial roads and one circular road in GAMA. These are absolutely inadequate for the metropolis, considering growth in population and vehicular ownership, especially given the prospects in the long term. The vision, therefore, is to create four circular roads and nine radial arterial roads to serve the metropolis as shown in Figure 6.15.

Figure 6.15: Proposed Arterial Road Network



Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

Establishment of Intelligent Transport System

An Intelligent Transport System (ITS) is a technology that utilises advanced applications to provide innovative services to transport providers and users by equipping them with the requisite information to make the demand or supply of public transport services safer, faster and more coordinated. Given the current situation of a rapid increase in the number of vehicles within GAMA, several problems such as traffic congestion, limited parking space, low traffic safety, traffic violations, air and noise pollution are widespread. It is essential therefore not only to provide adequate transport facilities, but also to implement laws that are rational and to apply smart technologies to address the issues.

Installing Intelligent Transport Systems in GAMA will ensure that passengers can get information about bus routes, estimated waiting and arrival times, different stops etc. With the proper public transport systems in place, making the system smart by using advanced technology to provide such information will make public transport more attractive to current and prospective users, thereby decreasing the reliance on private vehicles and reducing congestion as well as the other current transport challenges in the metropolis.

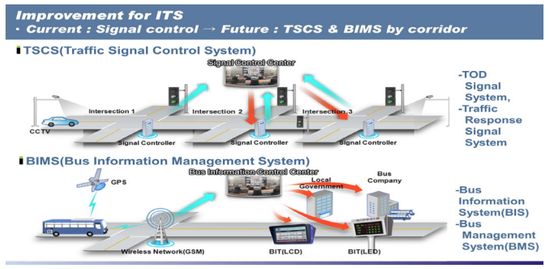
In implementing the ITS, it is necessary to first consider creating a Traffic Signal Control System (TSCS), and a Bus Information and Management System (BIMS), albeit on a small scale to begin with, in order to build experience, know-how and understanding before replicating it.

Establishment of Traffic Signal Control System

A Traffic Signal Control System (TSCS) using modern technology such as closed circuit television (CCTV) will enable monitoring of traffic situations such that authorities can respond promptly to changes in traffic conditions by regulating traffic signals from a remote, even distant, location.

The establishment of this system, which should comprise a Traffic Information Centre and field equipment will help with the collection and management of traffic data (using CCTV and Video Display System), which helps in the design of traffic signal control strategies and in managing traffic signal control facilities.

Figure 6.16: Improvement of ITS in GAMA



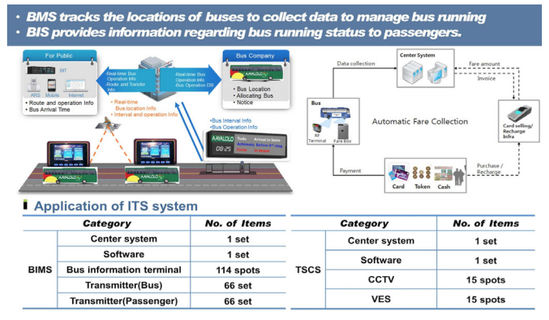
Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

Establishment of Bus Information and Management System

A Bus Information and Management System (BIMS) will enable monitoring of the operating status of each bus, and therefore aid authorities to feed passengers with accurate information such as estimated waiting or arrival time. This will greatly enhance bus transport services and lead to increased patronage, and decrease traffic congestion in the process.

The installation of the BIMS will also aid in the generation, management and communication of bus information, as well as supervision and adjustment of bus operations.

Figure 6.17: BIMS Installation Concept



	Category	No. of Items
BIMS	Center system	1 set
	Software	1 set
	Bus information terminal	114 spots
	Transmitter(Bus)	66 set
	Transmitter(Passenger)	66 set

	Category	No. of Items
TSCS	Center system	1 set
	Software	1 set
	CCTV	15 spots
	VES	15 spots

Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

6.7.3 GKMA Road Transport

Overview

In the Greater Kumasi Metropolitan Area (GKMA), road transport is dominated (82%) by low capacity modes, namely cars, taxis and trotro. The provision of effective public transport in the metropolis is bedeviled by such challenges as traffic congestion; long waiting periods and inadequate washroom facilities and comfortable seating areas.

The development of roads between Kumasi and its surrounding districts is greatly imbalanced. Whereas the road surface in Kumasi is mostly in good condition, that of neighbouring districts is generally deteriorated, with up to 62% unpaved. Again, road infrastructure to support freight in transit along the corridors of the GKMA, is generally lacking, thereby resulting in the unauthorised parking of trucks and the creation of potholes along these corridors.

Given its prospects and competitive advantage as an emerging city, certain strategies and guidelines have been defined for transportation infrastructure in Kumasi, and to ensure that the provision of transportation services within the metropolis is at its optimum.

Objectives

The main objectives guiding the GKMA are:

i. To provide high quality transportation infrastructure to strengthen socio-economic linkage of Kumasi to surrounding districts and other regions;

ii. To establish efficient public transportation along the key corridors of Greater Kumasi Sub-Region to facilitate efficient mass movement of people and goods;

iii. To support socio-economic development of Greater Kumasi Sub-Region and along key corridors and surrounding districts.

Strategy for Road Network Development

Portions of the road network in the GKMA are greatly strained due to their decreasing capacity to support the increasing volume of road users. It is therefore necessary for the capacity of these roads to be expanded to accommodate the needs of road users. City authorities have identified the following strategies to address this need:

i. Define the hierarchy of roads within the GKMA by:

• Identifying the "Urban Arterial Roads";

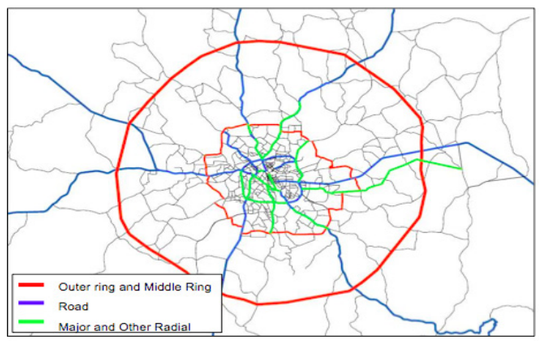
• Upgrading minor local roads to regional roads to serve as connections between major radial roads and the city centre;

• Identifying collectors/distributors among small roads.

ii. Develop mass transport network infrastructure and widen the following corridors to at least two lanes per direction: Mampong road, Offinso road, Sunyani road, Bekwai road, Lake road, Accra road, Antoa road, Abrepo road, old Bekwai and the inner ring road;

iii. Construct the first section of the Outer Ring Road between Ejisu and Kodie to divert traffic away from the city centre, and to promote development in Mampongteng and Kodie as shown in Figure 6.18 below.

Figure 6.18: Proposed Urban Arterial Roads for KMA



Source: The Study of Comprehensive Urban Development Plan for Greater Kumasi, Draft Final Report, 2013

iv. Upgrade roads that form the middle ring road and encourage their use to improve traffic circulation;

v. Construct a new arterial road as an alternative route to connect Ejisu and Kumasi; and

vi. Expand the capacity of the Western bypass, Southern bypass, Lake road, Mampong road, Harper road, New Bekwai road and Antoa road and construct the missing links to connect the Lake road to the Century Hall Road and Old Bekwai to New Bekwai, etc.

Strategy for Intersection and Signalisation Improvement

Traffic conflicts often occur at intersections. GKMA recognises this and will therefore apply the following strategies to address such traffic conflicts:

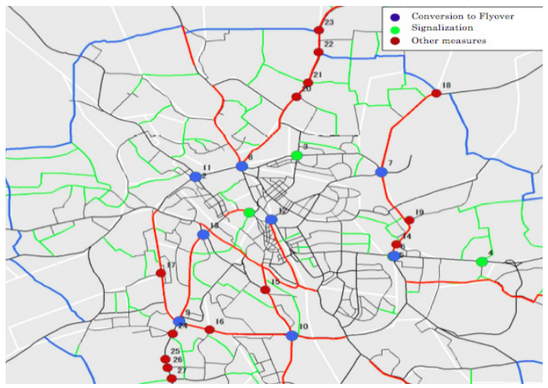
i. Establish a traffic signal control system and synchronise traffic signals on the entire road network in the metropolis to enable authorities to respond promptly to changes in traffic conditions.

ii. Optimise the use of traffic signals to clear traffic conflicts at major intersections (e.g. Suame, Abrepo, Sofoline, Anloga, Bekwai, etc) as well as minor ones; and

iii. Undertake signalisation and grade separation measures as illustrated in Figure 6.19 below.

iv. Ensure that traffic measures at critical intersections are strictly enforced.

Figure 6.19: Projects under Signalisation and Intersection Improvement



Source: The Study of Comprehensive Urban Development Plan for Greater Kumasi, Draft Final Report, 2013

Strategy for Public Transport Development

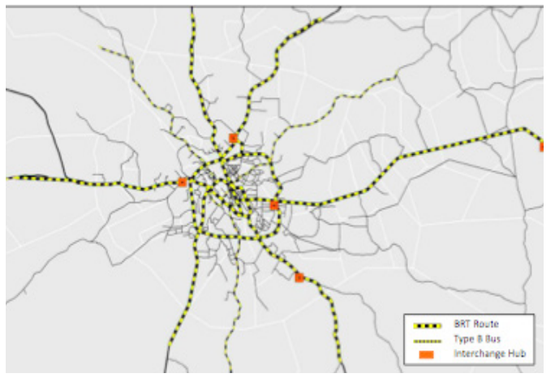
Most road users in GKMA rely on public transport. It is therefore not only pertinent to enhance the system, but to also make it more attractive to prospective users. The following strategies are thus critical:

i. Transitioning from a low-capacity (trotro) to a high-capacity transport system by introducing large buses;

ii. Creation of Bus Rapid Transit (BRT) routes to cover the nine radial roads and the inner ring road (Figure 6.20); and

iii. Develop transfer points at Tafo, Anloga, Kwadaso, Abinkyi, Ejisu and other areas, where long-distance journeys usually end, and have another mode of transport then move passengers from these transfer points to their final destinations (Figure 6.20).

Figure 6.20: BRT routes and interchange hubs



Source: The Study of Comprehensive Urban Development Plan for Greater Kumasi, Draft Final Report, 2013

Strategy for Traffic Control in the CBD

The main strategy to control traffic in the CBD (Adum and Central Market) has been to provide paid parking services to reduce illegal parking and to foster traffic flow. However, measures proposed to further enhance traffic flow in the CBD are to:

i. Enforce laws to reclaim pedestrian space from vendors;

ii. Create walkways and cycle lanes to enhance pedestrian mobility;

iii. Expand the on/off street paid parking system to other areas of the CBD;

iv. Develop a multi storey car park in the CBD; and

v. Apply vehicle access restrictions (e.g. one-way restrictions) in high-density areas in the CBD, particularly in Adum and Central Market.

Local authorities will be encouraged to integrate the provision of parking facilities in their local plans, as well as develop a framework for private sector engagement in the provision of parking services.

Strategy for Transportation Demand Management

Transportation demand management (TDM) measures play an important role in containing traffic demand and the GKMA intends to apply the following strategies to control the demand for transportation particularly in Kumasi:

i. Incorporate public transport services and make public transport provision a priority over private transport provision (e.g. ensuring proper coordination between BRT and feeder services, and providing priority lanes to enhance BRT);

ii. Explore the possibility of flexible working hours to spread out traffic demand; and

iii. Explore and implement measures that discourage the use of private vehicles and encourage the use of public transport facilities instead.

Strategy for Freight Transport Management

Kumasi lies along a major corridor for the transportation of freight and logistics across the country. The freight industry in the metropolis is however fraught with several challenges including traffic congestion, inadequate parking spaces particularly in the city centre, and the lack of terminals. Implementing the following strategies will improve the services provided by the freight industry in the context of the sub-region:

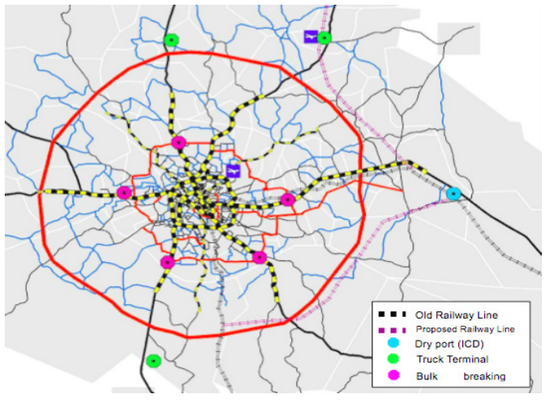
i. Freight distribution especially within the CBD should be reorganised;

ii. Cooperation among stakeholders in the freight industry should be strengthened;

iii. Create bulk breaking points on the middle ring road to reduce the risk of having large trucks on the middle ring road (Figure 6.21).

iv. Construct truck terminals to serve as bulk breaking points. This will also cut down the number of trips of large trucks in the fringes of the city.

Figure 6.21: Proposed Truck Terminals, Breaking points and Railway Line



Source: The Study of Comprehensive Urban Development Plan for Greater Kumasi, Draft Final Report, 2013

Priority Projects

Priority projects for improving the transportation sector and the provision of transport infrastructure in GKMA are:

i. A detailed GKMA Transport Master plan to be prepared by 2020 to identify the multimodal dimensions of the network, highlighting the location and area of the new airport, railway capacity and route systems, urban transport and traffic systems.

ii. The construction of the outer ring road bypassing Kumasi and stimulating the development of suburban residential areas within its catchment area;

iii. The improvement of the middle ring road, also as a catalyst for development in its immediate environs;

iv. The creation of BRT routes to serve the GKMA.

6.7.4 Developing the Road Grid System to accommodate Electric Vehicles

Overview

With developments in clean technology, the auto industry is only a few years away from the widespread introduction of electric vehicles, including long-range electric cars. It is estimated that by 2025, 50% of all new vehicles produced will be electric. A lot more change will take place in the next decade with electric cars than in the 130 years since the launch of the internal combustion engine. Already, major car manufacturers in France, UK, China and India have announced more focus on electric cars. In the long run, it is expected that electric cars will offer 30% cost savings, and lower noise levels than fossil-fueled cars.

Road Grid System for Ghana

Ghana will develop the necessary infrastructure and create nationwide charger networks in the cities and the countryside. Electric vehicles (EVs) will increase Ghana's electricity demand, which has already been catered for under the GIP. Linking chargers to the internet will facilitate web-based payments, software upgrades, remote troubleshooting, and contribute to a smarter grid. This also calls for nationwide internet connectivity.

The impact of developing road grid systems will include:

- Increased availability of EV charging stations;
- Increased viability of EV public transportation;
- Faster EV charging times;
- Easier payment and back-office systems for charger providers;
- Reduced maintenance of charging units.

Figure 6.22: Electric Vehicle Charging Station for Buses

Source: Google Images

Electric vehicles bring community benefits, such as lower or no emissions. However, for every promise of how electric vehicles will revolutionise transportation, there is a matching practical challenge. If electric vehicles need recharging, then the charging process must be fast and convenient.

Figure 6.23: Electric Vehicle Charging Station for Cars

Source: Google Images

Box 1: Electric cars are the future

The internal combustion engine (ICE) has been the main way of powering vehicles on land and at sea for most part of the century but today, its days are numbered. There is a rapid gain in battery technology which favours electric motors. The expansion of the lithium-ion battery business is set to get much bigger. Which means no more petrol or diesel cars, buses or trucks will be manufactured in most parts of the world from around 2030. The entire market for land transport will switch to electrification, leading to a slowdown of oil prices and a slug of the petroleum industry as we have known it for a century.

According to the Economist Magazine, an Electric car, powered by lithium-ion batteries can go longer miles as proved by Tesla fans who drove a Model S more than 500km on a single charge. Compared with existing vehicles, electric cars are much simpler and have fewer parts; they are more like computers on wheels. Existing electric cars reduce carbon emissions by 54% compared with petrol-powered ones, according to America's National Resources Defence Council. The figure will rise as electric cars become more efficient and grid-generation becomes greener

This is the futuristic forecast by Stanford University economist Tony Seba, who issued a report with the deceptively bland title 'Rethinking Transportation 2020-2030' that has gone viral in green circles and is causing spasms of anxiety in the established industries. Mr. Seba's premise is that people will stop driving altogether. They will switch en masse to self-drive electric vehicles (EVs) that are 10 times cheaper to run than fossil-based cars, with a near-zero marginal cost of fuel and an expected lifespan of 1 million miles (1.6 million kilometres). He gives the example of a Tesla electric vehicle Model S, which has 18 moving parts, or one hundred times fewer than a combustion engine car. "Maintenance is essentially zero," he says. "That is why Tesla is offering infinite-mile warranties. You can drive it to the moon and back and they will still warranty it."

"What the cost curve says is that by 2025 all new vehicles will be electric, all new buses, all new cars, all new tractors, all new vans, anything that moves on wheels will be electric, globally," Mr. Seba said. "Global oil demand will peak at 100 million barrels per day by 2020, dropping to 70 million by 2030." There will be oil demand for use in the chemical industries, and for aviation, though NASA and Boeing are working on hybrid-electric aircraft for short-haul passenger flights.

6.8 Feeder Roads Development

6.8.1 Feeder Roads Investment

Investment in feeder roads is planned for the 10-year period 2016 to 2026. It is mainly to clear the backlog of road maintenance (routine and periodic). Minor rehabilitation over the medium term will be to upgrade earth to gravel and gravel – based on traffic growth – to bituminous seals. Table 6.31 below gives the effect on the feeder road network over the next 10 years assuming it does not increase.

Table 6.31: Investment in the Unpaved Segment of the Feeder Road Network

Surface Type	Current Length (km)	Upgrading	Length to be Upgraded (km)	Effect
Earth	12,886	Gravel	4,642	36% Reduction of earth roads
Gravel	27,231	Bituminous Seal	6,752	350% Increase in paved
Paved	1,928	-	-	-

Source: Department of Feeder Roads

From Table 6.31, over the next 10 years, 36% of classified earth roads will be upgraded to gravel, while the paved segment will increase by 350%. A separate investment plan from 2026-2046 is needed in order to be able meet the investment requirement of the GIP. The funding required is US$6.1 billion for maintenance and development of the classified feeder road networks. The breakdown for the first 10 years is given in Table 6.32 and those for subsequent years are given in Tables 6.33 and 6.34.

Table 6.32: Department of Feeder Roads – Investment Programme for 2018 - 2028

S.N.	ACTIVITY	LENGTH/NO.	FINANCIAL PLAN (million USD)											
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	TOTAL
1	Routine Maintenance	Routine maintenance, 26,000km/yr	30	30	30	30	30	30	30	30	30	30	30	**330**
2	Periodic Maintenance	-Resealing of 800km/yr	3	3	3	3	3	3	3	3	3	3	3	**33**
		-Spot Improvement (1000km/yr)	12	12	12	12	12	12	12	12	12	12	12	**132**
3	Minor Improvement	-Upgrading from earth to gravel (500km/yr)	37	37	37	37	37	37	37	37	37	37	37	**407**
		-Upgrading from gravel to bitumen surfacing (250km/yr)	89	89	89	89	89	89	89	89	89	89	89	**979**
		-Upgrading from gravel to bitumen surfacing (Single Seal) 500km/yr	111	111	111	111	111	111	111	111	111	111	111	**1,221**
		Town Roads and Major Towns (Double Seal) 100km/yr	35	89	89	89	89	89	89	89	89	89	89	**925**
4	Bridge Programme	Steel Bridges (50 no./yr)	41	41	41	41	41	41	41	41	41	41	41	**451**
		Major Box Culverts 80 no./yr	40	40	40	40	40	40	40	40	40	40	40	**440**
		Bridge Maintenance, 30 no./yr	1	1	1	1	1	1	1	1	1	1	1	**11**
TOTAL			**399**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**4,929**

Source: DFR data adapted by GIP Team

EXPECTED OUTCOME	* NB	Network growth 2.5% per annum
To improve condition mix and surface type of Feeder Roads network as ff.		
Good	From 39% to 50%	Bituminous Surface from 5% to 20%
Fair	From 30% to 30%	Gravel Roads from 59% to 70%
Poor	From 31% to 20%	Earth Roads Reduce from 36% to 10%

Table 6.33: Department of Feeder Roads – Investment Programme for 2029 - 2038

S.N.	ACTIVITY	LENGTH/NO.	FINANCIAL PLAN (million USD)										
			2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	TOTAL
1	Routine Maintenance	Routine maintenance, 26,000km/yr	30	30	30	30	30	30	30	30	30	30	**300**
2	Periodic Maintenance	-Resealing of 800km/yr	3	3	3	3	3	3	3	3	3	3	**30**
		-Spot Improvement (1000km/yr)	12	12	12	12	12	12	12	12	12	12	**120**
3	Minor Improvement	-Upgrading from earth to gravel (500km/yr)	37	37	37	37	37	37	37	37	37	37	**370**
		-Upgrading from gravel to bitumen surfacing (250km/yr)	89	89	89	89	89	89	89	89	89	89	**890**
		-Upgrading from gravel to bitumen surfacing (Single Seal) 500km/yr	111	111	111	111	111	111	111	111	111	111	**1,110**
		Town Roads and Major Towns (Double Seal) 100km/yr	35	89	89	89	89	89	89	89	89	89	**836**
4	Bridge Programme	Steel Bridges (50 no./yr)	41	41	41	41	41	41	41	41	41	41	**410**
		Major Box Culverts 80 no./yr	40	40	40	40	40	40	40	40	40	40	**400**
		Bridge Maintenance, 30 no./yr	1	1	1	1	1	1	1	1	1	1	**10**
TOTAL			**399**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**4,476**

Source: DFR data adapted by GIP Team

EXPECTED OUTCOME	* NB	Network growth 2.5% per annum	
To improve condition mix and surface type of Feeder Roads network as ff			
Good	From 39% to 50%	Bituminous Surface	from 5% to 20%
Fair	From 30% to 30%	Gravel Roads	from 59% to 70%
Poor	From 31% to 20%	Earth Roads	Reduce from 36% to 10%

Table 6.34: Department of Feeder Roads – Investment Programme for 2039 - 2048

S.N.	ACTIVITY	LENGTH/NO.	FINANCIAL PLAN (million USD)									
			2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	TOTAL
1	Routine Maintenance	Routine maintenance, 26,000km/yr	30	30	30	30	30	30	30	30	30	30	**300**
2	Periodic Maintenance	-Resealing of 800km/yr	3	3	3	3	3	3	3	3	3	3	**30**
		-Spot Improvement (1000km/yr)	12	12	12	12	12	12	12	12	12	12	**120**
3	Minor Improvement	-Upgrading from earth to gravel (500km/yr)	37	37	37	37	37	37	37	37	37	37	**370**
		-Upgrading from gravel to bitumen surfacing (250km/yr)	89	89	89	89	89	89	89	89	89	89	**890**
		-Upgrading from gravel to bitumen surfacing (Single Seal) 500km/yr	111	111	111	111	111	111	111	111	111	111	**1,110**
		Town Roads and Major Towns (Double Seal) 100km/yr	35	89	89	89	89	89	89	89	89	89	**836**
4	Bridge Programme	Steel Bridges (50 no./yr)	41	41	41	41	41	41	41	41	41	41	**410**
		Major Box Culverts 80 no./yr	40	40	40	40	40	40	40	40	40	40	**400**
		Bridge Maintenance, 30 no./yr	1	1	1	1	1	1	1	1	1	1	**10**
TOTAL			**399**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**453**	**4,476**

Source: DFR data adapted by GIP Team

EXPECTED OUTCOME	* NB	Network growth 2.5% per annum	
To improve condition mix and surface type of Feeder Roads network as ff			
Good	From 39% to 50%	Bituminous Surface	from 5% to 20%
Fair	From 30% to 30%	Gravel Roads	from 59% to 70%
Poor	From 31% to 20%	Earth Roads	Reduce from 36% to 10%

6.9 Road Safety

6.9.1 Overview

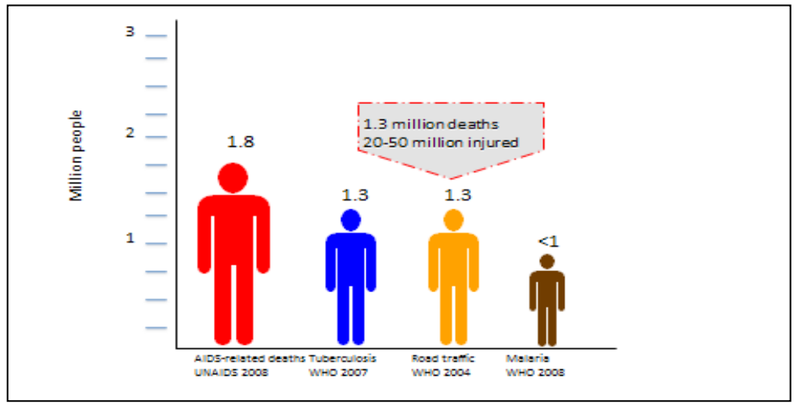
Road safety has gained global attention largely due to the rising trends in the number of persons killed and injured in road accidents and the growing concern for the associated social and economic burden to nations.

The Global Picture

Globally, it is estimated that 1.3 million persons get killed on the roads and 50 million others get injured to various degrees annually. Nations lose between 1%-3% of their GDP as a result of road crashes through loss of human capital, hospital costs, etc.

Road crashes have become a public health problem across the world. According to the World Health Organisation (WHO), road crashes kill more than malaria. Developing countries in Asia and Africa suffer the highest rates of road fatalities in spite of the fact that such countries are rather the least motorised. The WHO has predicted that road traffic crashes will become the third killer in the world above HIV/AIDS and tuberculosis by 2030 if nothing is done to halt the rising trend of road crashes and casualties.

Figure 6.24: Road traffic deaths: the facts

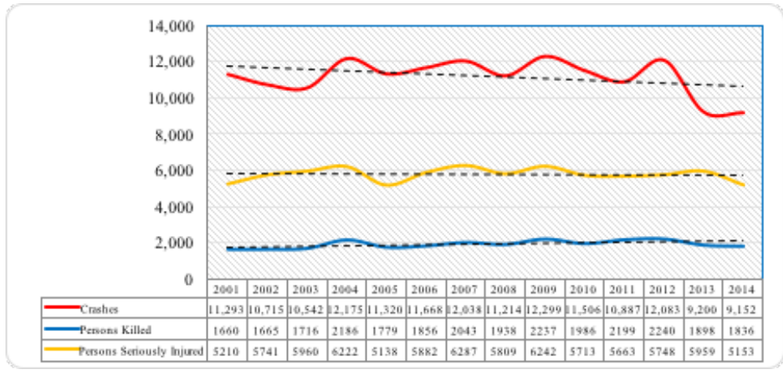


Source: World Health Organisation

6.9.2 Road Safety in Ghana

In Ghana, road traffic crashes kill about 2,000 persons and injure about 14,000 others annually on the average. About 40% of the injuries are serious. Available statistics indicate that from 2001 to 2014, there has been a consistent decline in crash occurrences and seriously injured persons by annual rates of 82 and 34 persons per annum respectively.

Figure 6.25: Breakdown of Accident Severity (2001 – 2014)

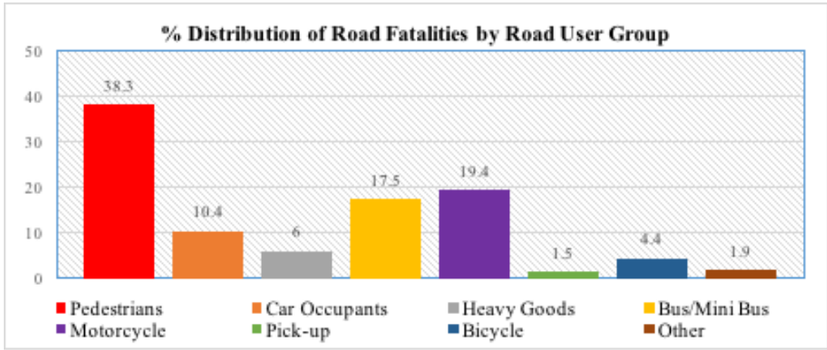


	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Crashes	11,293	10,715	10,542	12,175	11,320	11,668	12,038	11,214	12,299	11,506	10,887	12,083	9,200	9,152
Persons Killed	1660	1665	1716	2186	1779	1856	2043	1938	2237	1986	2199	2240	1898	1836
Persons Seriously Injured	5210	5741	5960	6222	5138	5882	6287	5809	6242	5713	5663	5748	5959	5153

Source: National Road Safety Commission

The most vulnerable road-user group in Ghana is pedestrians (constituting 38.8% of total fatalities), followed by motorcyclists (19.4%), bus occupants/passengers (17.5%), car occupants (10.4%), heavy goods vehicles (6.0%), bicycles (4.4%), pick-ups (1.5%) and others (1.9%).

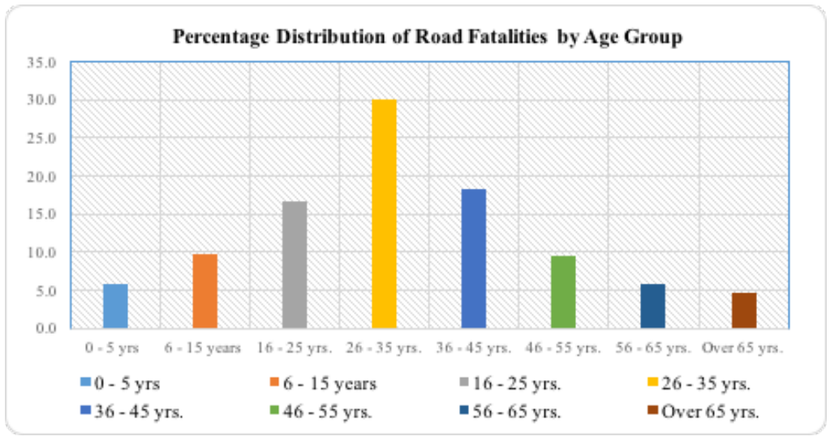
Figure 6.26: Distribution of Road Fatalities, by Road User Group (%)



Source: National Road Safety Commission

Crashes in Ghana affect the most economically active age group – persons aged 26 to 35 years (29.9%), followed by those aged 36-45 years (18.2%) and the most youthful group 0-25 years (33%), underscoring the fact that the threat to the country's human resources for future development cannot be over-emphasised.

Figure 6.27: Percentage Distribution of Road Fatalities by Age Group

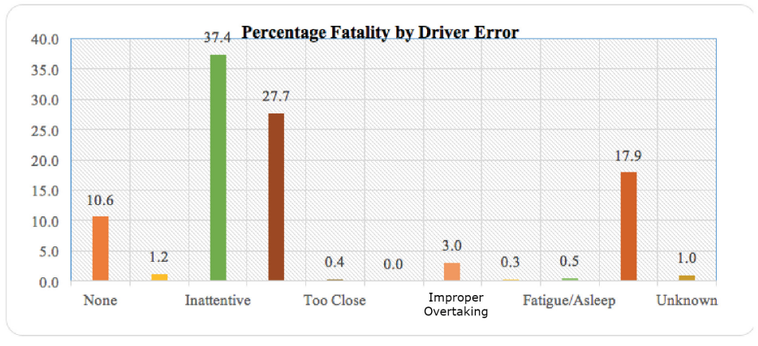


Source: National Road Safety Commission

Contributory Factors

About 90% of crashes in Ghana are attributable to human error, while faulty vehicles and poor road infrastructure share the remaining 10%. Indiscipline on the part of drivers and motorcycle riders in particular have led to violations of road traffic laws and regulations. The predominant contributory factors to road fatalities are inattentiveness (37.4%), driving too fast (27.7%), driving under the influence of alcohol and other causes (17.9%).

Figure 6.28: Percentage Fatality by Driver Error



Source: National Road Safety Commission

Excessive speeding is considered the most prevalent underlying factor in crashes in Ghana. The statistics indicate that 60% of fatal crashes are due to excessive speeding. Speed studies conducted by the National Road Safety Commission (NRSC) show that 90%-98% of motorists on the highways exceed posted speed limits, especially in towns and human settlements along the highways where the maximum speed limit is 50 kph.

The irony of the speeding problem is that pedestrians compete with fast-moving vehicles as they try to cross the road in such areas and end up eventually being knocked down and killed or injured

Where the Crashes Occur

Crashes mostly occur in the non-urban road environment (70%) and mostly on straight road sections (84.1%) and in the night at sections where there are no street lights (27%).

Figure 6.29: Accident Distribution by Environments (2001 – 2014)

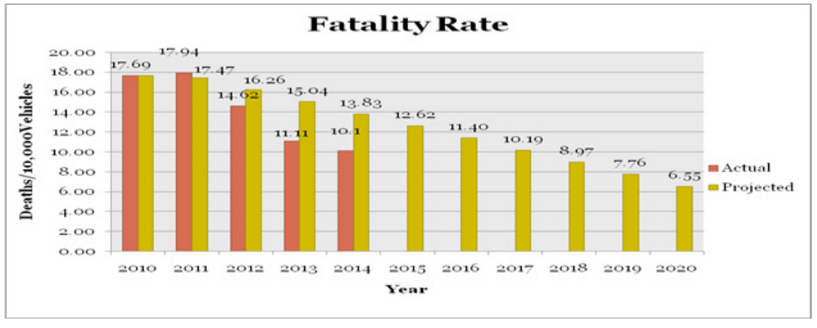
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Urban Env.	521	512	528	642	573	610	788	606	681	677	668	936	675	662
Non-Urban Env.	1,136	1,149	1,203	1,530	1,210	1,246	1,253	1,333	1,556	1,309	1,531	1,304	1,223	1,174

Source: National Road Safety Commission

Fatality Rate

Ghana's fatality rate (i.e. the number of persons killed in road traffic crashes per 10,000 vehicles) has declined consistently from close to 18 in the year 2010 to 10 in the year 2014, representing an 80% reduction:

Figure 6.30: Fatality Rate (Actual and Projected)

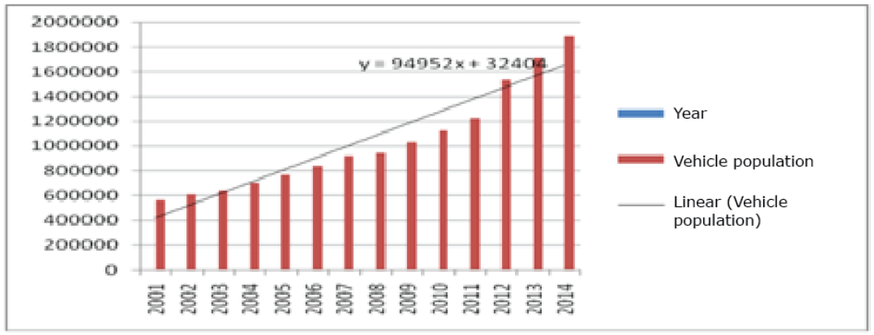


Source: National Road Safety Commission

Vehicle Population

The vehicle population in Ghana has hit 1.8 million and is growing consistently at the rate of 9%-10% annually.

Figure 6.31: Vehicle Population (2001 – 2014)



Source: National Road Safety Commission

With this trend of vehicle population, Ghana falls in the category where vehicle population growth has a direct influence of 5% increase in road crashes and casualties.

One of the indicators used to determine the level of safety of a road network is the Fatality Index. Table 6.35 below gives the Fatality Indices for the period 2010-2014.

Table 6.35: National Traffic Fatalities Indices

Year	All Crashes	All Casualties	Fatalities	Estimated Population ($x10^6$)	Registered Vehicles	Fatalities per 10,000 Vehicles	Fatalities per 100,000 Population	Fatalities per 100 Casualties	Fatalities per 100 Crashes
2010	11,506	16,904	1,986	24.865	1,122,722	17.69	7.99	11.7	17.3
2011	10,887	16,219	2,199	25.099	1,225,754	17.94	8.76	13.6	20.2
2012	12,083	15,241	2,240	25.510	1,532,080	14.62	8.78	14.7	18.5
2013	9,200	12,509	1,898	26.004	1,708,958	11.11	7.30	15.2	20.6
2014	9,152	12,863	1,836	26.505	1,885,836	9.74	6.93	14.3	20.1

Source: National Road Safety Commission

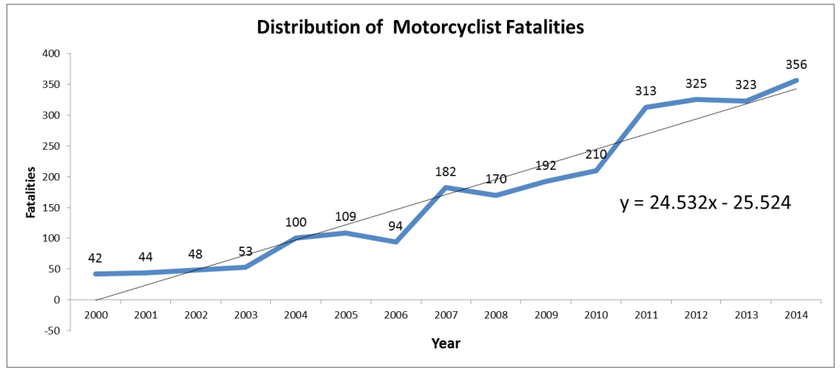
Human Population

Ghana's current population is estimated at around 28 million (2016) and the vehicle-to-human population is 71 vehicles per 1,000 humans. It is estimated that the human population will be 31 million and vehicle population about 2.6 million respectively by 2020, raising the ratio to about 85 vehicles per 1,000 human population.

The New and Emerging Challenge

The influx of motorcycles popularly called "Okada" used for commercial purposes has increased the fatality risk in Ghana. For example, persons killed through the use of motorcycle were 44 in the year 2001 and 356 in 2014 representing an increase of over 700% in 13 years:

Figure 6.32: Distribution of Motorcyclist Fatalities (2000 – 2014)



Source: National Road Safety Commission

National Road Safety Strategy

Ghana is considered as one of the countries in the world with a consistent policy, strategic and data-led framework approach to managing road safety. The National Road Safety Strategy (NRSS I) was implemented from 2001 to 2005, followed by NRSS II from 2006 to 2010 and now NRSS III from 2011 to 2020.

These strategies are derived from a comprehensive database well structured and maintained since 1991 which incorporates the police data collection system, the hospitals and finally the research and analytic prowess of the Building and Road Research Institute (BRRI).

National Road Safety Policy

In addition to the above, there is a clearly defined national policy for road safety which calls for:

1. A national body to regulate the road transport industry;

2. Competent drivers through proper training and licensing;

3. Safety in vehicle assembly, modification, use and maintenance and less adverse effect on environment;

4. Safety in planning, design, construction and maintenance of road infrastructure;

5. Promotion and incorporation of IMT (Intercity Mass Transit) in provision of road transport facilities;

6. Promotion and incorporation of pedestrian safety facilities in design and construction of road infrastructure;

7. Speedy and effective trauma care and health management;

8. Enhancement of road traffic crash data collection and analysis;

9. Sufficient and sustainable funding for Road Safety activities;

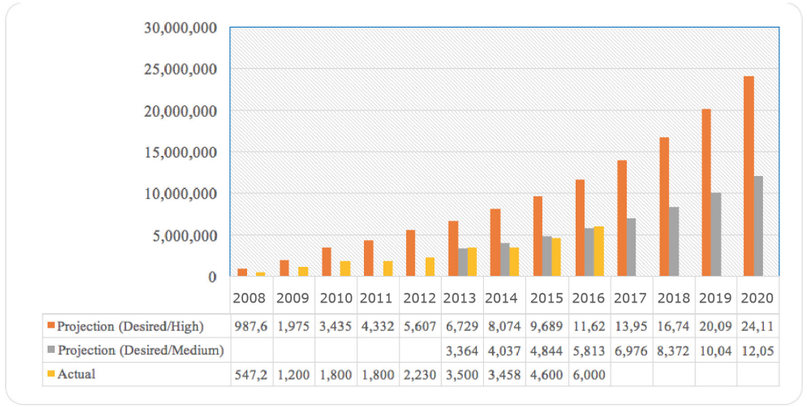
10. Encouraging and increasing funding for Research, Monitoring and Evaluation (RM&E);

11. Inter-Agency Collaboration, Human Resource and Awareness Creation.

Funding of Road Safety Activities

Funding of road safety activities is one of the most challenging areas in Ghana's road safety management. The NRSC in particular is funded by Government of Ghana (GoG) annual budgetary allocations, the Ghana Road Fund and the insurance industry. The allocation of funds to the NRSC by these sources over the years has been discretional and has consistently fallen short of the Commission's annual budget requirement by 40%-60%.

Figure 6.33: Funding Profile of Road Safety Activities (GH¢)



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Projection (Desired/High)	987,6	1,975	3,435	4,332	5,607	6,729	8,074	9,689	11,62	13,95	16,74	20,09	24,11
Projection (Desired/Medium)						3,364	4,037	4,844	5,813	6,976	8,372	10,04	12,05
Actual	547,2	1,200	1,800	1,800	2,230	3,500	3,458	4,600	6,000				

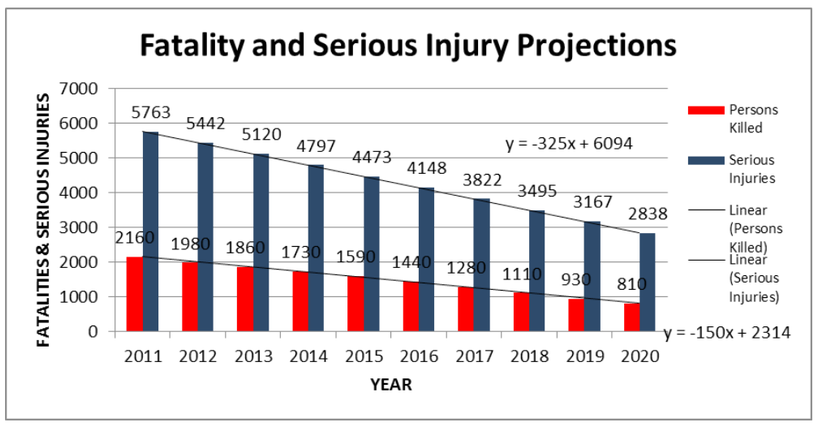
Source: National Road Safety Commission

The funding gap for road safety activities is no different for all the key road safety institutions. The result is that most stakeholder institutions are unable to fully implement their specific functions, particularly in relation to road infrastructure and education.

Way forward

The NRSC, as the main statutory agency for the promotion and management of road safety in Ghana, is leading the implementation of the Third National Road Safety Strategy (NRSS III) for the period 2011 to 2020. NRSS III was developed in line with the United Nations Decade of Action (DoA) for Road Safety in which the UN is calling on all governments to invest in road safety and also to take measures that will aim at reducing the number of persons killed and seriously injured (KSI) in road traffic crashes by 50% by 2020.

Figure 6.34: Fatality and Serious Injury Projections



Source: National Road Safety Commission

The NRSS III target is fewer than 1,000 persons killed and 3,000 persons seriously injured. This is expected to help the nation attain a fatality rate of between 1 and 5, which will position Ghana among countries with high road safety records such as Denmark, Sweden and France.

The NRSC together with stakeholders in both the public and private sectors is following up on these national and global commitments with actions through education and advocacy, engineering, enforcement and emergency response all geared towards improving the nation's commitment and responsibility for road safety management, particularly in the following three focus areas for better pedestrian safety, bus occupant/passenger safety and motorcyclist safety:

i. Road Safety Awareness Creation

ii. Speed Control, and

iii. Public Transport system

There is the need to sustain efforts to protect the gains made and move further to transform the entire road safety management framework. The following are the key areas being pursued by the NRSC into the future:

i. NSRC is seeking to be transformed into an agency with the mandate to address indiscipline and promote national integrity and behavioural change practices through enforcement of technical and operational standards for the delivery of road safety-related infrastructure and services.

ii. The Driver and Vehicle Licensing Authority (DVLA) is systematically phasing out manual service delivery to computerised/automated vehicle registration and driver licensing to improve quality of service and regulation of safety standards. NRSC is looking forward through DVLA to well-structured driver training programmes and broader and more effective vehicle registration and inspection systems, particularly for vehicles and vehicle parts entering the country.

iii. The Motor Traffic and Transport Department (MTTD) of the Ghana Police Service is gearing up to implement ICT-based enforcement of road traffic regulations, with the introduction of spot fines, operation of speed and red-light detection cameras and removal of defective vehicles and other physical obstructions from the road.

Enforcement of road traffic regulations shall adopt the use of automated systems, cameras and other sophiscated equipment that will enhance the capacity of the MTTD in traffic law enforcement and prosecution, in accordance with global best practices.

iv. NRSC has initiated the process of mainstreaming road safety management and operations into Metropolitan, Municipal and District Assemblies (MMDAs) to expand road safety activities to the Districts. MMDAs will be trained and equipped adequately through institutional capacity building to improve road safety in communities.

v. NRSC is seeking to incorporate road safety in the formal academic curriculum of primary schools and junior high schools. The Commission has produced road safety text books and teaching manuals and will urge the Ghana Education Service to formally accept them into the curriculum of basic schools.

vi. NRSC will ensure the involvement of more private sector companies in the delivery of road safety management services in the area of enforcement and engineering to promote innovation and application of ICT-based road traffic and safety management solutions.

vii. The National Ambulance Service (NAS) must be transformed into a central coordinating body to institute an integral national ambulance and emergency and first-aid response operations, well equipped with logistics (ambulance vehicles) and emergency medical technicians, unique general emergency phone numbers and call centres to deliver an effective and quick response to victims of road crashes in not more than one hour.

viii. In road infrastructure service delivery, there is a huge backlog of road signs, roadway markings and crash barriers and safe walkways and crossing points. This situation, according to the road agencies – Ghana Highway Authority (GHA), Department of Urban Roads (DUR) and Department of Feeder Roads (DFR) – is a result of inadequate allocation of funds. NRSC is looking forward to a total transformation of the road network with better design of our highways to minimise travel speeds, a forgiving road environment with improved road signs, markings and crash barriers, walkways, street lights, reflectors, safe pedestrian crossing facilities and bypasses.

It is important that the road agencies scale up their road safety activities to catch up with rising demand for road furniture – road signs, roadway markings and crash barriers – and to make conscious efforts to protect pedestrians.

The issue of Road Safety Audit (RSA) in the delivery of road infrastructure has become imperative in design, construction and maintenance. It has also become crucial that the government considers allocating adequate funds for road infrastructural safety activities.

ix. Funding is a real source of worry for road safety management in general. NRSC will champion very strong advocacy for a Road Safety Fund to ensure adequate and sustainable funding for road activities through education, engineering, enforcement and emergency response. The Police, for example will need adequate resources to acquire logistics such as speed and alcohol detecting devices, and training; the National Ambulance Service will need more ambulances, especially along the highways.

x. NRSC will put in place a rigorous regulatory mechanism based on education and enforcement to address the challenge of motorcycle safety. This will include scaling up public education targeting the users and strict enforcement of the regulation restricting the use of motorcycles for hire or reward.

xi. NRSC is taking steps under various road development projects to improve national capacity for emergency response services. The Commission is leading the process to install post-crash response posts along the major highways and harmonise emergency numbers to improve response times for crash victims.

6.10 Financing Road Transport

6.10.1 Overview

The current financing structure rests on four main sources:

- Consolidated Fund (government revenue from taxes, levies etc.);
- Donor funds (multilateral development partners - World Bank, African Development Bank, European Union, Millennium Challenge Account; bilateral agreements);
- Road Fund (mainly dedicated for road maintenance from fuel taxes and other road transport operational levies and taxes);
- Internally Generated Funds (revenues emanating from services rendered to the general public by road agencies).

Table 6.36 shows planned expenditure of the road sector from the various sources for the period 2014-2017.

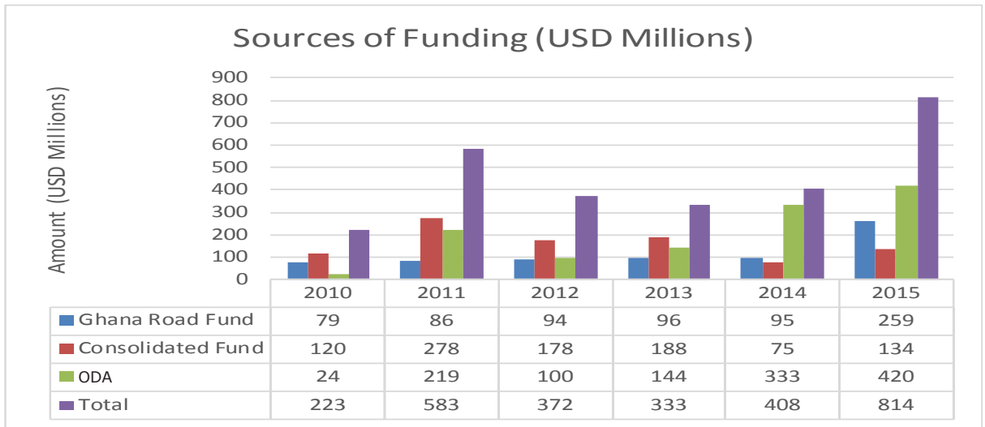
Table 6.36: Road Sector Planned Expenditure for 2014-2017 (US$ mn)

Expenditure By Funding Sources	2014	2015	2016	2017	TOTAL	%
Consolidated Fund	408	206	224	236	**1,074**	61
Donor Fund	74	60	61	64	**259**	14
Road Fund	235	60	62	65	**422**	24
Internally Generated Fund (IGF)	0.3	0.4	0.4	0.4	**2**	1
Total Expenditure By Funding Sources	717	326	348	366	**1,757**	100

Source: Ministry of Roads and Highways

Out of the planned expenditure of US$1.76 billion, an amount of about US$877 million is secured, representing almost 50% of the required funding for investment during the period. This leaves a financing gap of almost 50%. Table 6.37 below gives the breakdown of secured funding. Figure 6.35 below gives funding profile over period 2010-2015.

Figure 6.35: Funding Profile over 2010-2015



Source: Ministry of Roads and Highways

Table 6.37: Secured Funding for the Period 2014 -2017 (US$ mn)

Road Sector	2014	2015	2016	2017	TOTAL
Consolidated Fund	69	26	28	30	**153**
Donor Funds	149	88	90	92	**419**
IGF	27	5	5	5	**42**
Road fund	75	61	62	65	**263**
TOTAL	**320**	**180**	**185**	**192**	**877**

Source: Ministry of Roads and Highways

From Table 6.37 the total secured funds from all sources for the road sector is about US$876.73 million, averaging about US$219.2 million a year. Funding levels dwindled from US$319.15 million in 2014 to US$192.74 million in 2017. This can clearly be attributed to a drastic fall in donor funding from US$148.51 million in 2014 to US$92.39 million in 2017, a shortage of about 37.8%.

From the secured funds for the period, US$418.6 (47.7%) is from donor funding. Table 6.38 shows the gap between planned expenditure and secured funds.

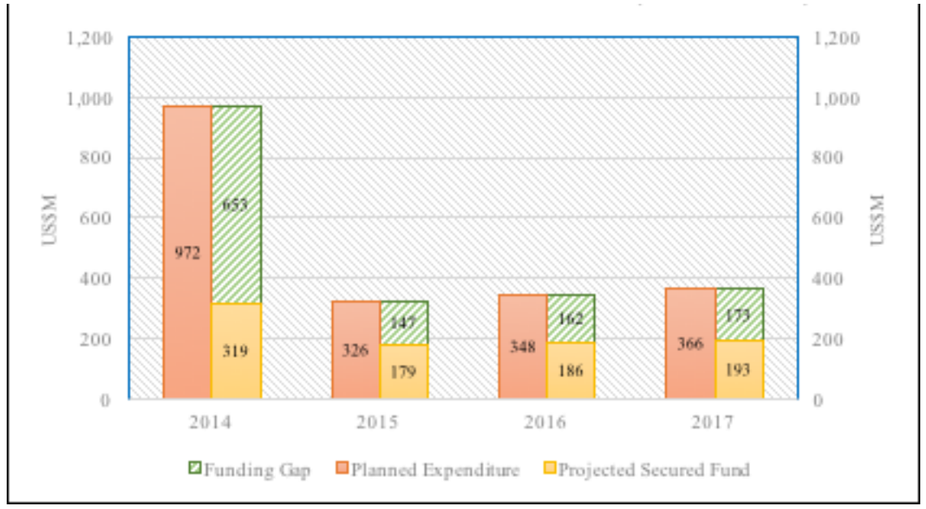
Table 6.38: Funding Gap between Planned Expenditure and Secured Funds (US$ mn)

Description	2014	2015	2016	2017	TOTAL
Planned Expenditure	972	326	348	366	**2,012**
Projected Secured Fund	319	179	186	193	**877**
Funding Gap (%)	-67%	-45%	-47%	-47%	-56%

Source: Ministry of Road and Highways

Figure 6.36 gives graphical presentation of the funding situation over the period 2014-2017.

Figure 6.36: Road Sector Planned Expenditure and Financing Gap, 2014-2017 (US$ mn)



Source: Ministry of Road and Highways

6.10.2 Summary of Investment for Maintenance and Improvement of Existing Road Network

A total of about US$40.1 billion will be required for road maintenance and improvement of the road network (Table 6.39).

Table 6.39: Summary of Estimates for Rehabilitation and Improvement of Road Transport Infrastructure

Term	Agency	Length (km)	Estimated Cost (US$ mn)
Short Term	Trunk Roads (GHA)	6,483	9,705
	Feeder Roads (DFR)	452	4,929
	Urban Roads (DUR)	9,228	8,137
	Road Safety (NRSC)	-	77
	Urban Transport	49	94
Sub-Total		**16,212**	**22,942**
Medium Term	Trunk Roads (GHA)	426	1,688
	Feeder Roads (DFR)	452	4,476
	Urban Roads (DUR)	3,848	3,294
	Road Safety (NRSC)	-	198
	Urban Transport	-	-
Sub-Total		**4,726**	**9,656**
Long Term	Trunk Roads (GHA)	867	1,173
	Feeder Roads (DFR)	452	4,476
	Urban Roads (DUR)	1102	1,824
	Road Safety (NRSC)	-	68
	Urban Transport	-	-
Sub-Total		**2421**	**7,541**
GRAND TOTAL			**40,139**

Source: Author's construct

Trunk Road Investment for the Existing Network

Over the period, trunk road investment has been packaged into short, medium and long term. A total of about US$12.6 billion will be required to maintain and improve the trunk road network (Table 6.40).

Table 6.40: Summary of Financing Plan for Trunk Road Network

Term	Priority	Length (km)	Estimated Project Cost (US$ mn)
Short Term	1st Priority	3,416	6,751
	2nd Priority	548	500
	Missing Links on Trunk Road Network	670	393
	Heavily Trafficked Roads Earmarked for Widening	1706	1,832
	By-Pass Development on the Trunk Road Network	143	229
Medium Term	2nd Priority	426	1,688
Long Term	3rd Priority	867	1,173
Grand Total	**All Projects**	**7,776**	**12,566**

Source: Author's construct based on GHA data

Urban Roads Investment for the Existing Network

Investment in the urban road network will be mainly arterial development for movement of large volumes of traffic in the shortest possible time. This will be complemented with the construction of interchanges to reduce traffic conflicts currently experienced. The urban road investment will have to address the collector distribution segment of the urban network. An investment of US$13.3 billion will be required for arterial and interchange development (Table 6.41).

Table 6.41: Summary of Financing Plan for Existing Urban Road Network

Term	Length Km	Cost (US$ mn)
Short Term	9,228	8,137
Medium Term	3,848	3,294
Long Term	1,102	1,824
Total	**14,178**	**13,255**

Source: Author's construct based on DUR data

Feeder Road Investment for the Existing Network

Feeder road investment amounts to about US$13.9 billion (Table 6.42).

Table 6.42: Summary of Financing Plan for Existing Feeder Road Network

Term	Period	Cost (US$ mn)
Short Term	2018 - 2028	4,929
Medium Term	2029 - 2038	4,476
Long Term	2039 - 2047	4,476
Total		**13,881**

Source: Author's construct based on DFR data

6.10.3 Summary of Investment from 2018 to 2047

The total investment to expand the current network size to the long-term objective of 253,000 km will require a financial outlay of US$271.7 billion. Table 6.43 shows the financing plan over the period. The budget is for construction and reconstruction only and does not cover maintenance and rehabilitation.

Table 6.43: Financing Plan from 2018 to 2047

Road Type	Motorway/ Expressway	High Speed Way (4-Lane)	4-Lane	2-Lane (High Standard)	2-Lane	Total
Trunk Roads						
Paved (km)	2,240	8,288	9,432	20,720	-	40,680
Unpaved (km)	-	-	-	-	15,920	15,920
Sub-Total (km)	**2,240**	**8,288**	**9,432**	**20,720**	**15,920**	**56,600**
Feeder Roads						
Paved (km)	-	-	-	101,540	-	101,540
Unpaved (km)	-	-	-	-	55,160	55,160
Sub-Total (km)	**-**	**-**	**-**	**101,540**	**55,160**	**156,700**
Urban Roads						
Paved (km)	285	3,298	10,449	20,748	-	34,780
Unpaved (km)	-	-	-	-	4,920	4,920
Sub-Total (km)	**285**	**3,298**	**10,449**	**20,748**	**4,920**	**39,700**
Total Network						
Paved (km)	2,525	11,587	19,880	143,008	-	177,000
Unpaved (km)	-	-	-	-	76,000	76,000
Grand Total (km)	**2,525**	**11,587**	**19,880**	**143,008**	**76,000**	**253,000**
Cost per km (US$ mn)	6	4	3	1	0.1	**-**
Total Cost (US$ mn)	**15,150**	**46,348**	**59,640**	**143,008**	**7,600**	**271,746**

Source: Author's construct

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Chapter 7: Aviation

7.1 Introduction

The government aims to modernise the airports and turn Ghana into a West African air transport hub and gateway to meet demands from economic growth. The aviation industry in Africa is projected to grow rapidly over the next two decades. In terms of air cargo transport, trade between Africa and Europe is expected to grow by 3.8% per year from 2015 to 2035, while Africa–Asia air cargo trade will expand at an average annual rate of 6.5%. Similarly, air cargo trade between Africa and North America will grow by 5.3% per year, albeit from a smaller base than either that of Europe or Asia within the same period[1].

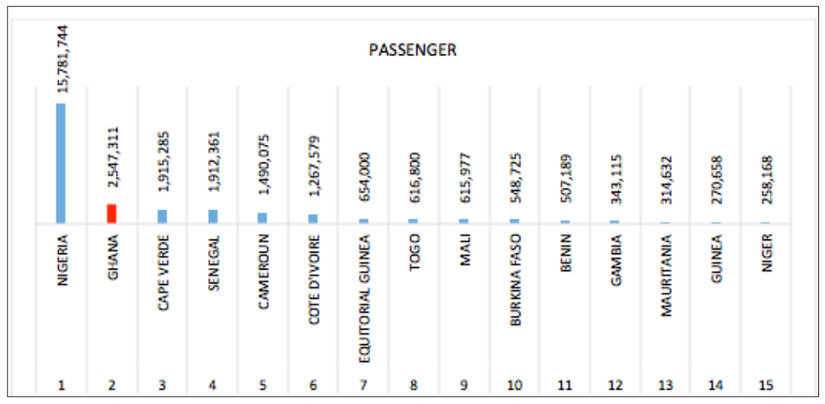
Air transport will remain a preferred solution for transporting higher value goods that are sensitive and economically perishable. It is therefore imperative that Ghana's aviation industry is developed to take advantage of present and future opportunities to contribute to national socio-economic development. .

Consequently, the government seek improvements to accommodate forecast demand and ensure the long-term competitiveness and financial viability of the aviation industry.

7.1.1 Vision

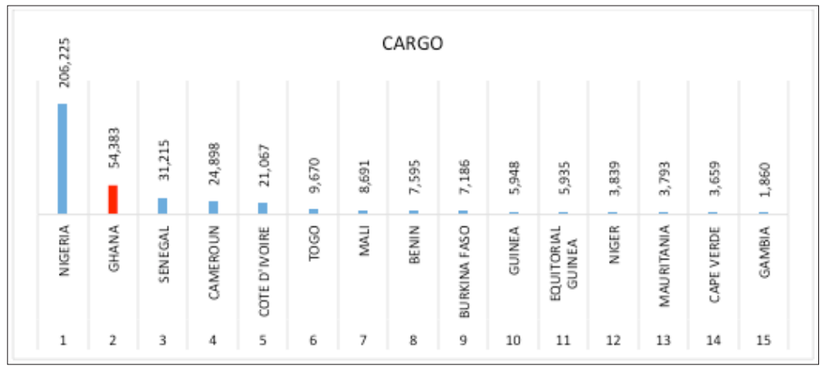
The vision is to position Ghana as the preferred aviation hub and leader in the airport business in West Africa. In recent times, Ghana's aviation industry stands out as one of the fastest growing and most competitive in the West Africa sub-region. However, Ghana has only 10% of the aviation market in the sub-region, second to Nigeria that captures 57% of the market[2]. Other airports in the sub-region also compete for hub status. Figures 7.1 and 7.2 show the passenger and cargo traffic rankings in West Africa.

Figure 7.1: Passenger Ranking in West Africa



Source: Ghana Airport Company Ltd, 2016

Figure 7.2: Cargo Ranking in West Africa



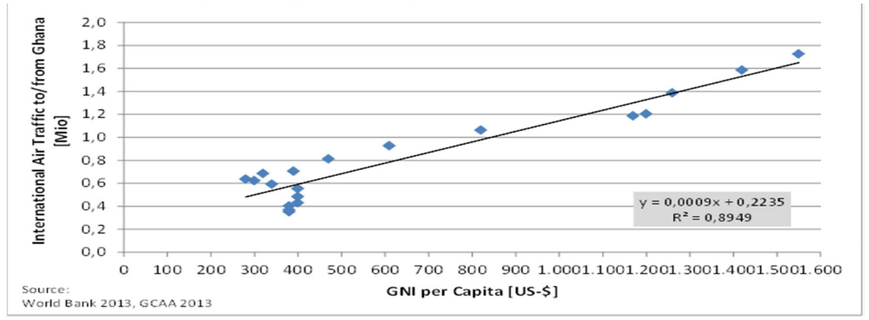
Source: Ghana Airport Company Ltd, 2016

7.1.2 Correlation between Economic and Population Growth and Air Transport

Normally, higher airport and aviation activity is directly reflected in a country's gross domestic product (GDP). Many international aviation forecasts determine future activity growth using GDP as the main, and sometimes the only independent variable.

In Ghana, passenger traffic has grown recently following the upgrade of infrastructure facilities at the airports. This growth is estimated to be about 7% per annum and is closely aligned with economic growth over the last few years. There is a positive correlation between Ghana's economic growth and air passenger transport for the period 1994 to 2012 (Figure 7.3). Similarly, a positive correlation exists between Ghana's population growth and air passenger transport (Figure 7.4).

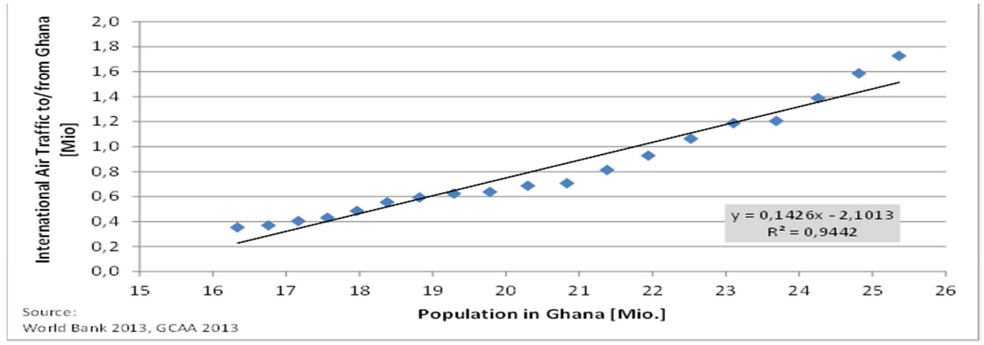
Figure 7.3: Correlation between economic growth and air transport in Ghana, 1994-2012



Source: National Airport System Plan, 2014

1Boeing World Air Cargo Forecast, 2016-2017
2Ghana National Spatial Development Framework, 2015-2035

Figure 7.4: Correlation between population growth and air passenger transport in Ghana, 1994-2012



Source: National Airport System Plan, 2014

Table 7.1 provides a summary of some external and internal factors that generally influence air transport development.

Table 7.1: Summary of factors influencing Air Transport Development

External Impacts (Demand driven)	Internal Impacts (Supply driven)
i. Size of Market • Population • Gross Domestic Product (GDP) • Gross National Income (GNI) • Employment • Motivation for travelling by plane ii. Spending ability • Personal disposal income/income distribution • Variation in exchange rate of currency iii. Ethnic and linguistic ties	i. Availability of appropriate aircraft equipment ii. Airport geographic location with respect to airline networks iii. Competition between modes of transport iv. Cost of providing services v. Availability of subsidies

Source: Technical Masterplan for Kumasi Airport, Final Report, 2015

7.2 Current State of Ghana's Airports

7.2.1 Overview

Kotoka International Airport (KIA) is the most frequently used airport for both domestic and international travels. It has passenger and freight terminals. Tamale and Kumasi airports have also been refurbished and upgraded to the status of international airports but full operations are yet to commence. Sunyani and Takoradi Airport handle domestic air travel. There are other facilities used for emergency, medical and tourism purposes including airstrips with short runways. Table 7.2 provides information on the location and status of airports in operation.

Table 7.2: Current Airports in Ghana

Name	Region	Status
Kotoka International Airport, Accra	Greater Accra	Active
Kumasi Airport	Ashanti	Active
Paga Airstrip	Upper East	Active
Takoradi Airport	Western	Active
Sunyani Airport	Brong Ahafo	Active
Tamale Airport	Northern	Active
Wa Airport	Upper West	Active

Source: National Airport System Plan, 2014

Table 7.3 shows the remaining aerodromes that are registered with the Ghana Civil Aviation Authority (GCAA) and their present status.

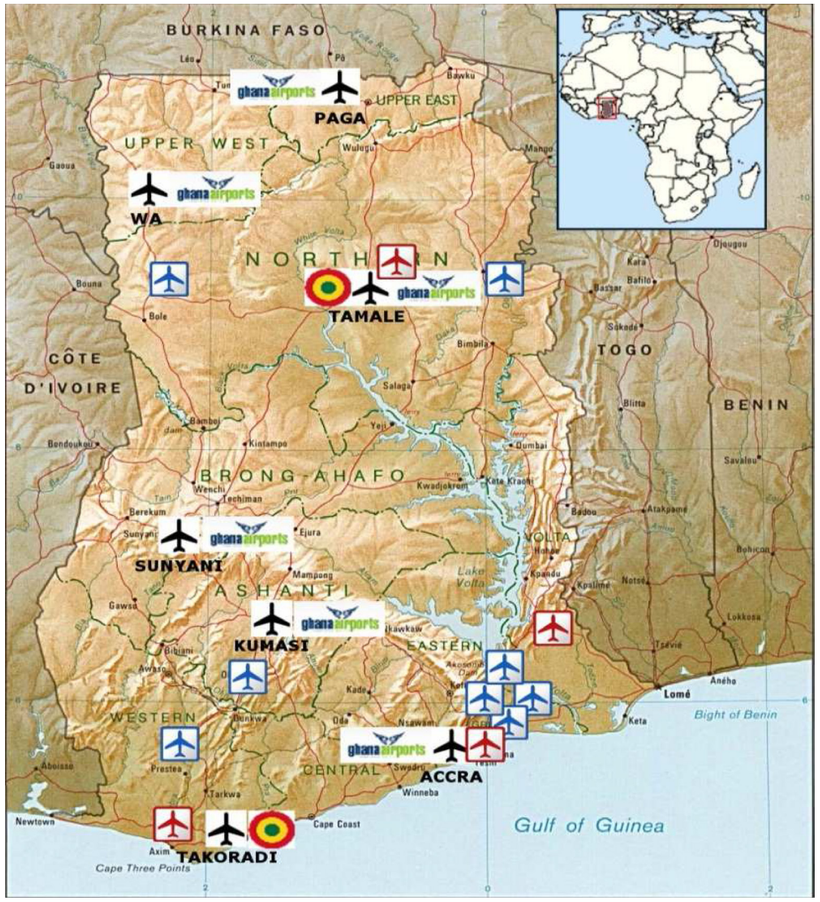
Table 7.3: Other Aerodromes in Ghana

Airport Name	Region	Status
Ho	Volta	Under construction and upgrading
Yendi	Northern	Inactive, closed
Obuasi	Ashanti	Active
Afienya	Greater Accra	Inactive
Golden Exotics Ultralight strip	Eastern	Active
Aveyime	Volta	Inactive
Okwenya-Akuse Ultralight Strip (Rocky Farms)	Eastern	Inactive
Barace	Western	Selected site, construction not commenced
Mole	Northern	Inactive
Chirano Airstrip	Western	Inactive, Unpaved runway; no other infrastructure
Akuse Airstrip	Eastern	Inactive; Paved; no other infrastructure
GOPDC Airstrip, Kwae	Eastern	Inactive; Unpaved runway; no other infrastructure
Obotan Airstrip	Ashanti	Inactive. Soon to be activated. Unpaved runway; no other infrastructure
Mim Cashew Airstrip	Brong-Ahafo	Inactive; Grass field; no other infrastructure
Tarkwa Airstrip	Western	Decommissioned and not in existence
Samreboi Airstrip	Western	Inactive; Paved runway; no other infrastructure
Bolgatanga Airstrip	Upper East	Construction abandoned. Only cleared area for the runway. At Anateem near Sumbrugu, off Bolga-Navrongo Road
Koforidua Airstrip	Eastern	Site selected in 1992. Location now built-up and densely populated
Kpong Airfields (Ultralight Strip)	Eastern	Active

Source: National Airport System Plan, 2014

Figure 7.5 shows the map of aerodromes and known airport development programmes in the country

Figure 7.5: Map of Aerodromes and known Airport Development Programmes in Ghana

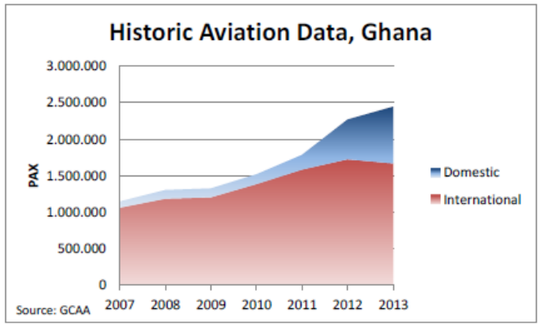


Source: National Airport System Plan, 2014

7.2.2 Recent Trend in Air Passenger Traffic

Air transport in Ghana has risen significantly during the last decade to 1.67 million international passengers and 0.78 million domestic passengers in 2013 [3]. Looking at the air transport development since 2007, the impact of the worldwide financial crisis in 2008 and 2009 is reflected by growth of only 1.5% in international traffic during that specific time. However, the Ghanaian air transport market recovered again and recorded double-digit growth in the following years. Comparing domestic and international Ghanaian air transport, a shrinking share of international flights (from 76% in 2012 to 68% in 2013) was recorded reached due to a decrease in international passengers of 3.3% (Figure 7.6). Currently, international traffic is only served at Kotoka International Airport.

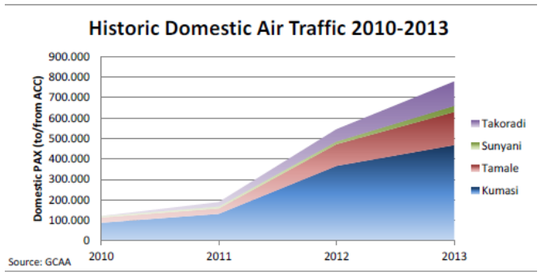
Figure 7.6: Domestic and International Air Transport in Ghana, 2007-2013



Source: Technical Masterplan for Kumasi Airport, Final Report, 2015

Meanwhile, since 2011, the domestic air transport sector is growing steadily (Figure 7.6), influenced by a rise in national income and the start of production of oil and gas in commercial quantities. In addition, stronger competition, better service and affordable prices have positively influenced the demand. Figure 7.7 focuses on the domestic airports of Takoradi, Sunyani, Tamale and Kumasi (which has the highest share among the four airports).

Figure 7.7: Domestic Air Transport in Ghana, 2010-2013



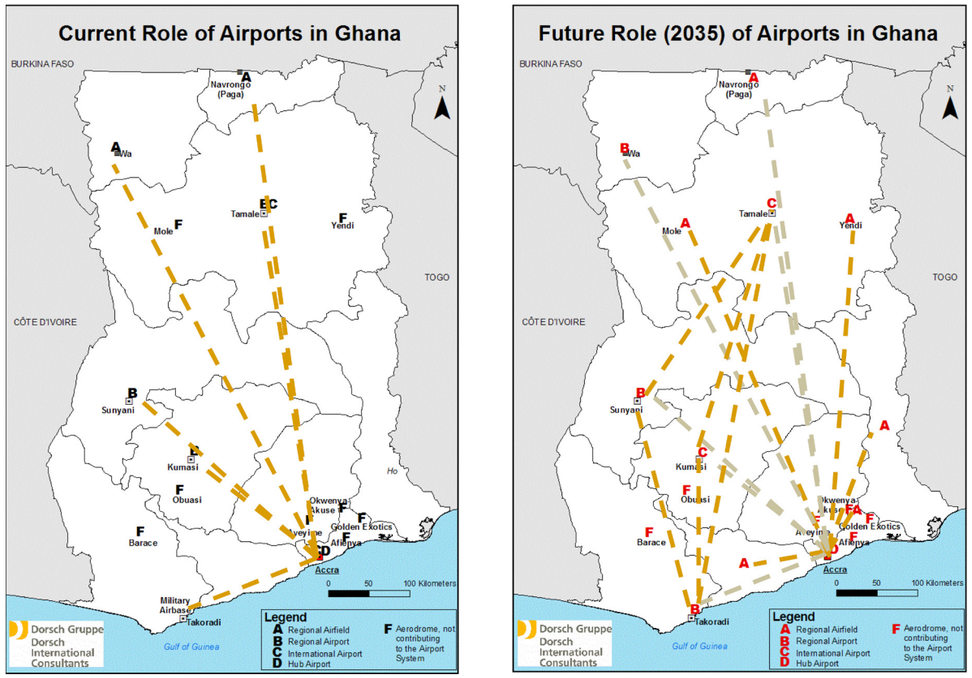
Source: Technical Masterplan for Kumasi Airport, Final Report, 2015

3 Technical Masterplan for Kumasi Airport, Final Report, 2015

7.2.3 Functional Roles of Ghana's Airports

Currently, Kotoka International Airport (KIA) functions as the aviation hub linking passengers from major cities in West Africa to Accra for onward transfer or stopover to Europe, the Americas, the Middle East and the Far East. Figure 7.8 shows the current and future air transportation system of the country. The definitions of the different role categories contained in Figure 7.8 are presented in Table 7.4.

Figure 7.8: Current and Future Roles of Airports in Ghana



Source: National Airport System Plan, 2014

Table 7.4: Definition of the role category

Classification	Type	Definition
A	Regional Airfield	• Provides for air transportation in remote regions • Improves accessibility • Commercially not viable • Less than 2,000 pax/month
B	Regional Airport	• Noticeable number of passengers (> 2,000 pax/month) • Provides scheduled air transportation • Commercially viable • Provides potential for air cargo transportation
C	International Airport	• Provides both international and domestic connections • Provides scheduled air transportation • Commercially viable • Provides potential for air cargo transportation
D	Hub Airport	• Centre for international/domestic connections • Significant number of pax/month • Gateway function • Provides scheduled air transportation • Commercially viable • Provides potential for air cargo transportation
F	Aerodrome not contributing to the Airport System	• Privately owned and operated • No or only limited services to the public • Private commercial interest

Source: National Airport System Plan, 2014

7.2.4 Issues to be addressed in the Aviation Industry

The implementation of both the liberalised skies policy and the fifth freedom right policy has led to an increased number of airlines operating in the country. However, the following issues need to be addressed:

i. Upgrade equipment to enhance operational safety and efficiency;

ii. Upgrade and expand infrastructure facilities at airports/aerodromes to meet future demand for international and local flights;

iii. Establish other international airports in Ghana;

iv. Secure title to aviation/airport land(s) for future development;

v. Establish a framework for excellent service;

vi. Continue the implementation of liberalised skies policies in order to attract more airlines to operate international and/or domestic flights;

vii. Intensify efforts to achieve hub status;

viii. Ensure full implementation of Yamoussoukro Declaration (YD);

ix. Facilitate information collaboration, technical cooperation and operational coordination among African Air Navigation Service (ANS) providers;

x. Abolish Bilateral Air Service Agreements (BASAs) between African Union member states;

xi. Capacity building;

xii. Modernisation and optimisation of Air Traffic Managements Systems.

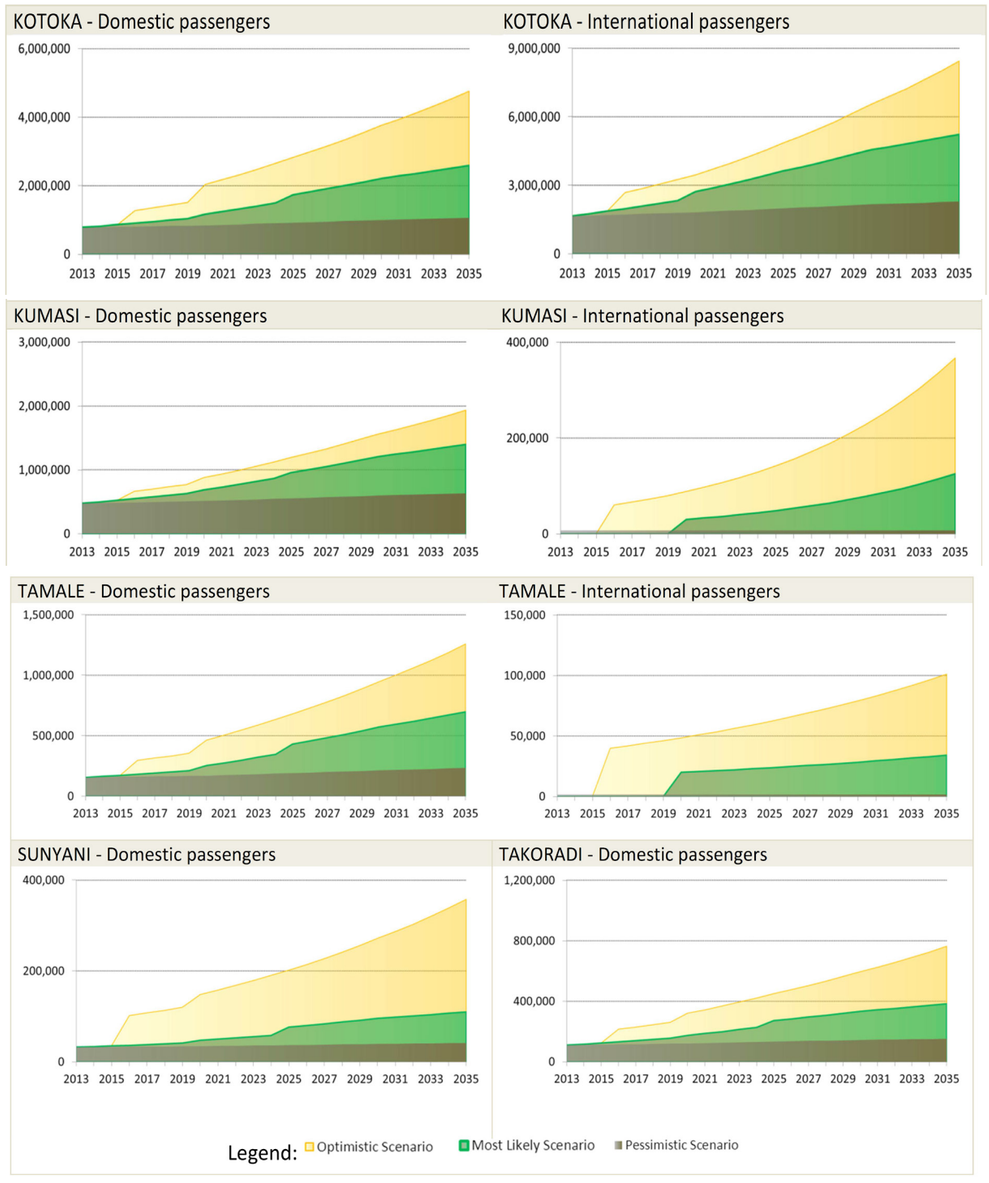
A Master Plan exists for the development of some of the country's airport infrastructure such as at KIA, Tamale and Kumasi to meet the objective of making Ghana the aviation hub of West Africa. However, there are no such plans yet for Sunyani, Wa and Ho. It is expected that an Aviation Industry Master Plan will be prepared for these towns.

7.3 Air Traffic Forecast

7.3.1 Passenger Traffic Forecast

The forecasts for the individual airports have been prepared with three scenarios (optimistic, most likely, and pessimistic) influenced by factors such as hub effect, tourism traffic, pilgrims, and domestic route network. It also takes into consideration passengers, aircraft mix, peak operations and other considerations. Figure 7.9 presents a summary air traffic forecast (domestic and international passengers) for the five major airports.

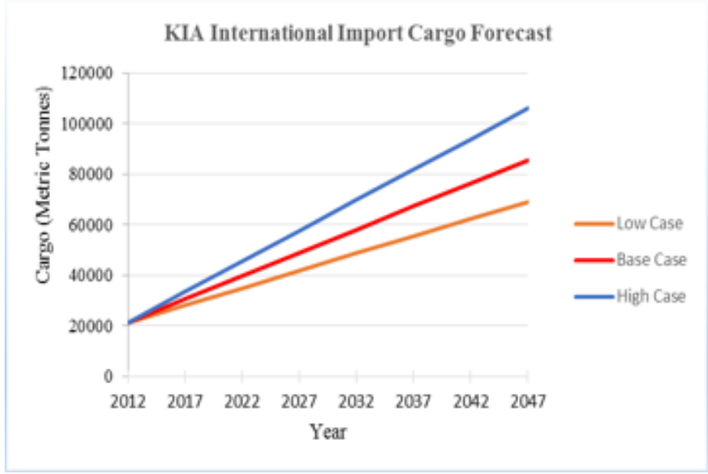
Figure 7.9: Summary of Air Traffic Forecast (Passengers) for Selected Airports



Source: National Airport System Plan, 2014

In terms of international import and export cargo, the forecasts for the low, base and high case scenarios for Kotoka International Airport are shown in Figures 7.10 and 7.11 respectively

Figure 7.10: KIA International Imports Cargo Forecast (Metric Tonnes)



Source: KIA Masterplan, Final Report, 2008 updated by GIP Team

Figure 7.11: KIA International Export Cargo Forecast (Metric Tonnes)

Source: KIA Masterplan, Final Report, 2008 updated by GIP Team

7.4 Airport Development

7.4.1 Strategic Drivers

A three-pronged strategy is envisioned to drive the development of airports within the 30-year planning period of the Ghana Infrastructure Plan. Key drivers of the strategy will involve:

i. Improvement and expansion of infrastructure facilities;

ii. Service excellence;

iii. Commercially driven corporate culture.

Figures 7.12 shows the three-pronged strategy to drive airport development. Figure 7.13 also shows the drivers to attain the strategic vision

Figure 7.12: The three (3) pronged strategy to airport development

Source: Ghana Airport Company Limited

Figure 7.13: Drivers of the three (3) pronged strategy

Source: Ghana Airport Company Limited

7.4.2 Future Role of Airports

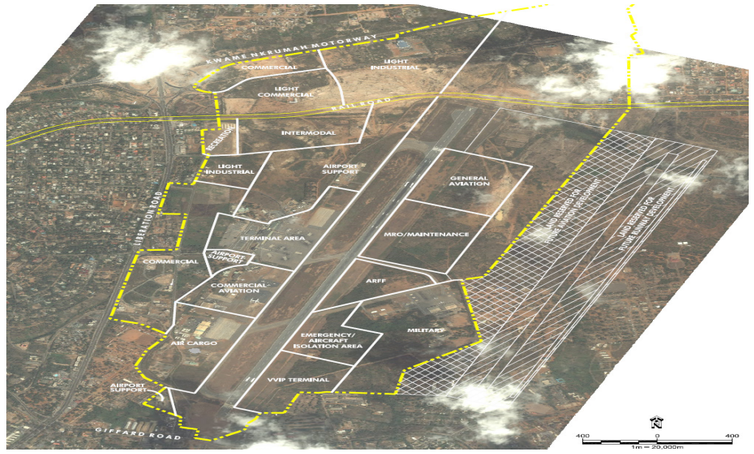
Within the plan period of the Ghana Infrastructure Plan, there will be enhanced interconnectivity between the country's airports. This will facilitate the movement of passengers and freight in an efficient and effective manner. The following section indicates the future roles of the various airports in the plan.

Kotoka International Airport (KIA)

KIA will remain an international aviation hub. It has huge potential to improve its market position. It will also continue to serve all domestic airports in Ghana. It is expected that Ghana will regain its Category 1 status based on United States Federal Aviation Administration assessment of the safety oversight provided by the Ghana Civil Aviation Authority (GCAA).

There is a master plan, including a land use plan which incorporates on-going projects and provides a cohesive framework for the future development and growth of KIA. The plan was created to identify the aeronautical and intermodal requirements of anticipated demand, surface area as well as potential environmental and socio-economic impact. Some aspects of the masterplan have either been implemented or are in progress. Figure 7.14 shows the land use plan for KIA, now and in the future.

Figure 7.14: Land Use Plan for the Kotoka International Airport



Source: Kotoka International Airport Masterplan, Final Report, 2008

Kumasi Airport

Kumasi Airport will function as an international airport. In 2013, the actual cargo volume was 43,688 tonnes [4], but the National Airport System Plan projects a cargo volume of over 60,000 tonnes in 2035. However, due to limited runway expansion opportunities, a new airport is planned on the outskirts of Kumasi and a site has been identified under the Greater Kumasi Urban Development Plan.

In the meantime, the technical masterplan for the existing Kumasi Airport outlines the development phases required to facilitate operations at the airport. Some aspects of the masterplan have been implemented while others have been phased according to the traffic forecast (Table 7.5).

4 Technical Masterplan for Kumasi Airport, Final Report, 2015

Table 7.5: Development Phases of Kumasi Airport

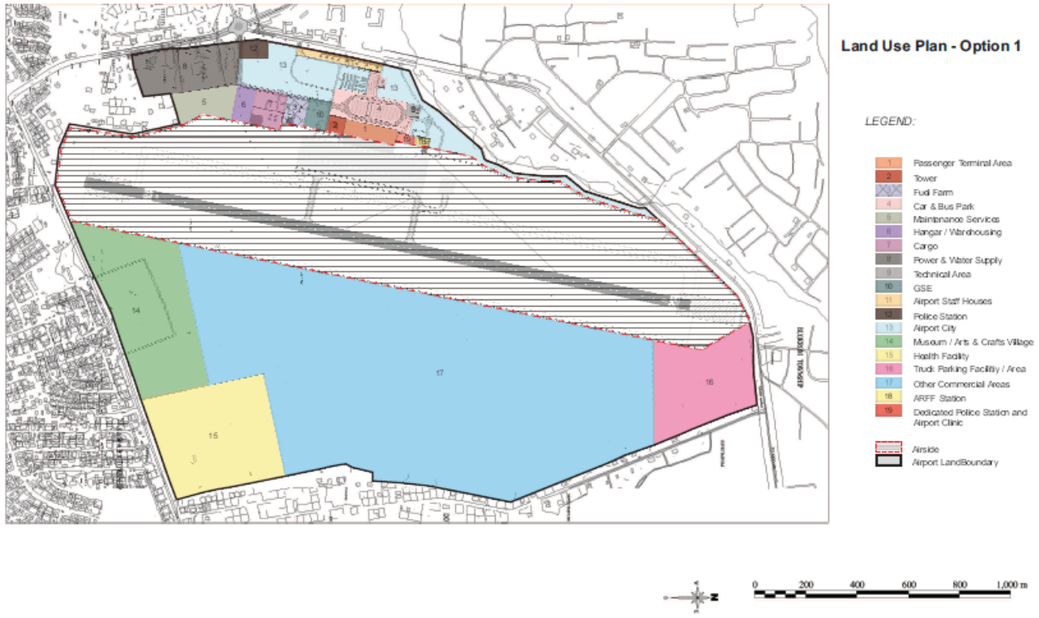
Phase	Period	Description
Phase 1	2015 – 2020	Construction of new infrastructure in order to provide sufficient capacity according to the demand and to comply with international standards. Construction shall be completed latest in 2020. Applied design parameters are derived from the figures related to the capacity demand of year 2022
Phase 2	2021 – 2025	Further expansion measures shall be implemented by 2025 to meet the capacity demand of 2030
Phase 3	2026 – 2035	To cover the demand of 2035 and beyond, further expansion shall be implemented, according to the Master Plan

Source: Technical Masterplan for Kumasi Airport, Final Report, 2015

Figure 7.15 shows the land use plan for the Kumasi Airport. Due to rising air traffic demand and additional facilities planned on airport land (offices, shopping mall, health facilities), traffic within the proximity of the airport is expected to rise tremendously. If these traffic challenges are not addressed from the beginning, congestion will worsen and it will impact negatively on productivity, safety, environment and socio-economic development.

It is recommended that collaboration between stakeholders starts with a study identifying future traffic development based on proposed land use and market capacity. As a result, stakeholders will be able to identify whether road construction as compared to the provision of an effective and efficient traffic management system – including the effective use of the traffic light system – will suffice. The development of an efficient transport network to regulate the flow of traffic is highly recommended. This may include public mass transportation to reduce the number of vehicles within the area.

Figure 7.15: Land Use Plan for Kumasi Airport



Source: Technical Masterplan for Kumasi Airport, Final Report, 2015

Tamale Airport

Tamale Airport will also function as an international airport. Currently, it serves domestic passengers and occasional international charter flights on request. It has the potential to generate international traffic and is therefore currently being upgraded to serve both international and domestic passengers.

Sunyani Airport

Sunyani Airport will continue to function as a regional domestic airport for the Brong-Ahafo Region. There is no anticipation for international flights within the planning period. A Category B role is envisioned

Takoradi Airport

Takoradi Airport is currently owned and operated by the military. It cannot be expanded in its current condition. As a result, a new "greenfield" airport development is planned to operate it as a regional airport.

Wa Airport

Wa Airport has recently been upgraded to regional airport status to support the development of the Upper West Region.

Ho Airport

Ho Airport is under construction and will be upgraded to regional airport status.

Paga Airstrip

The Airstrip is in poor condition. Its current location close to the Burkina Faso border makes it necessary to relocate it. A new greenfield airstrip is envisioned for the Upper East Region.

Additional Airports

According to the National Transport Policy of 2008, each region in the country should operate airport facilities of category A or superior. The following major airport development projects are therefore envisioned within the planning horizon:

- Princess Town, Western Region (development of new greenfield airport to take over the traffic from Takoradi);
- Prampram, Greater Accra Region (PPP development of greenfield international airport);
- New Kumasi Airport (Ankaase), Ashanti Region (development of new greenfield international airport);
- Bolgatanga, Upper East Region (development of greenfield regional airport);
- Cape Coast, Central Region (development of greenfield regional airport);
- Koforidua, Eastern Region (development of greenfield regional airport).

Table 7.6 shows the summary of the airports/ aerodromes envisioned for the development of the country's aviation industry.

Table 7.6 shows the airports/aerodromes envisioned for the aviation industry

Table 7.6: Summary of Airports/Aerodromes for the Planning Horizon

Airports	Region	Category of Airport		Future Status
		Current category	Future category	
Kotoka International Airport	Greater Accra	D	D	Hub Airport
Kumasi	Ashanti	C	C	International Airport
Tamale	Northern	C	C	International Airport
Sunyani	Brong Ahafo	B	B	Regional Airport
New Takoradi (Princess Town)	Western	-	B	Regional Airport
Ho	Volta	A	B	Regional Airport
Wa	Upper West	B	B	Regional Airport
Bolgatanga	Upper East	A	B	Regional Airport
Cape Coast	Central	-	B	Regional Airport
Koforidua	Eastern	-	B	Regional Airport
Prampram	Greater Accra	-	C	International Airport
New Kumasi (Ankaase)	Ashanti	-	C	International Airport
Mole	Northern	F	A	Regional Airstrip
Yendi	Northern	F	A	Regional Airstrip
Okwenya-Akuse	Eastern	F	A	Regional Airstrip

Source: Ghana Infrastructure Plan Team

7.4.3 Development of Airport Related Service Industry

A strategy is being prepared to regulate the use and development of land within the vicinity of airports in order to stimulate investment in airport-related service industries. Figure 7.14 is an artist's impression of land use planning for KIA airport-related service industry, phases 2 and 3.

Figure 7.16: Land Use Plan of future airports – Artist's Impression

Source: Ghana Airport Company Limited

7.4.4 Aviation Safety and Security

The modernisation of air traffic control (ATC) systems is key to improving efficient operation and safety of airflows. ATC is a critical component of the air transport infrastructure. It is made up of a network of navigational aids, communication systems and manned control centres that direct and coordinate the aircraft flows in an efficient and safe way. In addition, the use of satellite and data-based technologies offers the most cost effective way to upgrade and modernise the provision of communications, navigation and surveillance infrastructure. Improving safety and security in the aviation sub-sector requires the full commitment and cooperation of all stakeholders and it will be pursued.

Chapter 8: Maritime

8.1 Introduction

The maritime sub-sector consists of the ports and the inland water transport systems of the country. The Ghana Shipping Act, 2003 (Act 645) mandates the Ghana Maritime Authority (GMA) to ensure safety of life at sea and inland waterways, and to protect the marine environment in order to facilitate the contribution of these assets to socio-economic development of the country.

The GMA's activities include the following: survey and inspection of boats on the inland waterways; training of boat operators/mechanics; registration of ships, seafarers and related functions; operations (surveys, inspections and certification of ships); port state control of foreign ships; and flag state control of Ghanaian ships. In 2016, the GMA surveyed and issued certificates to 168 ships to operate in the country's maritime waters, comprising 132 fishing vessels and 36 cargo/ supply vessels.

In addition, the Authority undertakes the upkeep and maintenance of national shipping fleets and other activities such as maritime training, conducting examinations leading to certificates of competency and/or proficiency to seafaring personnel. These training programmes are also conducted for local people from the villages dotted along the Volta Lake like Dambai, Dzemeni, Kete-Krachi, Kpando-Torkor, Tapa Abotoasi and Yeji.

The Authority is also responsible for conducting investigations into shipping casualties; staffing of ships; crew welfare matters; prevention and control of marine pollution; adoption and implementation of international maritime conventions; search and rescue; ship building; ship repairing; ship recycling; wrecks; drydocking and port operations.

8.1.1 Maritime Domain Awareness Programme

In order to assist the government and security agencies to enforce security measures in our maritime domain, the GMA is to implement a Maritime Domain Awareness Programme to provide comprehensive information about Ghana's maritime domain through electronic surveillance systems.

Area To Be Avoided (ATBA)

The GMA obtained approval from the International Maritime Organisation (IMO) to establish an Area to Be Avoided (ATBA) around the Deep Water Port (DWP). The ATBA was established in order to enhance safety of navigation and ensure security of offshore installations and vessel traffic management in the vicinity of the Jubilee Field Terminal.

The ATBA alerts mariners to the presence of the floating production, storage and offloading (FPSOs) installations as well as underwater well-heads and production systems to ensure that mariners, including fishermen and vessels transiting the area, avoid interference with terminal operations at the oilfields.

8.1.2 Maritime Security

The Authority superintends the Ghana Maritime Security Act, 2004 (Act 675) and implements the provisions of this Act to ensure safety and security within Ghana's maritime domain. Act 675 also provides the legal framework for implementation of the International Ship and Port Facility Security Code (ISPS Code). It requires measures to be taken to ensure the safety and security of ships and port facilities. Thus in June 2011, the Authority signed an agreement for the procurement and installation of a Vessel Traffic Management Information System (VTMIS) for coastal surveillance and an Automatic Identification System for the Volta Lake.

8.2 Ports and Harbours

8.2.1 Overview

The government aims to provide efficient port facilities and ensure quality services to port users. The vision is not only to make the country's ports the leading trade and logistics hub of West Africa, but also to open up opportunities for accelerated socio-economic and industrial development in the sub-region, through Ghana.

Ports play very strategic roles in the socio-economic development of the country. They are the main international gateways for the country's import and export trade. It is estimated that 90% of Ghana's international trade in merchandise by volume is routed through the seaports of Tema and Takoradi.

The ports also handle significant volumes of traffic destined to the landlocked countries of West Africa. These factors make the ports veritable engines of economic growth and effective tools for promoting regional integration.

Ghana Ports and Harbours Authority

The Ghana Ports and Harbours Authority (GPHA) is a state-owned enterprise (SOE) established by the Ghana Ports and Harbours Authority Act (PNDC Law 160) of 1986, mandated as the sole authority to plan, build, develop, manage, maintain, operate and control ports in Ghana.

By 2030, GPHA expects to have completed all its planned projects that would make the Port of Tema the leading container hub of the ECOWAS region, and the Port of Takoradi a dominant oil and gas services hub and a dry bulk/mineral ore cluster. Achieving hub status will transform the ports into veritable growth poles for industry, trade and regional socio-economic development.

In response to growing maritime trade demand, GPHA has over the years undertaken various master plan studies to guide infrastructure and organisational development of the ports.

8.2.2 Existing Ports and Harbours of Ghana

Ghana's two main seaports are in Tema and Takoradi. Adjoining these two seaports are the Tema and Sekondi Fishing Harbours respectively. GPHA currently owns, manages and operates these two seaports. It also owns and manages the Fishing Ports in Tema and Sekondi. Although the ports handle growing cargo volumes, there is increasing congestion outside the port gates, non-existent intermodal interchange infrastructure and hinterland connectivity, and longer cargo dwell times compared to modernised port systems.

Waiting Time at Anchorage

Average ship waiting time at anchorage for Tema indicated significant improvement from 47 hours (almost 2 days) in 2005 to 31 hours (about 1.5 days) in 2010 whereas that of Takoradi increased from 11 hours in 2005 to 17 hours in 2010 due to the oil find. It is expected that the waiting times will decrease significantly after the expansion works.

The effectiveness and efficiency in the operations of Takoradi and Tema ports could be improved if the following issues are addressed appropriately. These challenges include:

- Poor transport networks in and out of the ports;
- Inadequate spatial planning for and enforcement of integrated port cluster development;
- Inadequate use of ICT in port operation systems and processes to ensure efficiency.

Dry Dock Infrastructure

Ghana has one dry dock facility, situated at the Tema Port shipyard, and which is operating below capacity. The shipyard facility has two docks, a slipway and a fitting-out quay. There are also major mechanical workshop facilities originally planned for a full-fledged shipyard and shipbuilding activities.

As of May 2017, the shipyard has begun to recover from a period of poor maintenance and mismanagement by various entities. It requires a major facelift and reorganisation as part of the Ghana Ports and Harbours Authority.

The GPHA has plans to turn the facility into a one-stop ship repair and rebuilding base for the west coast of Africa. The capacity of the Port of Tema Shipyard ranks first along the west coast's port facilities. However, it needs to be substantially re-organised to realise its full potential and to maximise the available land. The spatial plan and basic infrastructure of the facility hold immense potential for at least half a century of growth.

Artisanal Fishing and Canoes Landing Facilities

There are modern fishing ports at Tema and Sekondi which receive large fishing trawlers and vessels. However, given the prevalence of artisanal canoe fishing communities along the coast, the government, in collaboration with GPHA, launched a plan to develop 11 new or re-organised boat (canoe) landing facilities in fishing communities along the coast for improved seafood security. Considering that a large section of coastal dwellers resides in these fishing communities, the communities need to be carefully restructured. There must therefore be an integrated coastal zone management plan covering the complete structures for these canoe fishing ports and industry.

Tema Fishing Harbour

Tema Fishing Harbour (TFH) is located to the east of Tema Port, and is made up of the Inner and Outer Fishing Harbours and a canoe basin. Other facilities located within and outside the fishing harbor include a fish market hall, ice plants, fish processing plants and several private cold stores.

Sekondi Fishing Harbour (SHF)

GPHA is also responsible for the management of the Sekondi Fishing Harbour (SFH). There are sub-committee units responsible for the fishing communities such as boat owners, fish sellers, smoked-fish sellers and pre-mixed fuel dealers, all regulated by the GPHA personnel appointed as Manager of the SFH.

8.2.3 Port Infrastructure Development

Currently, GPHA has prepared two master plans to guide the expansion and development of Tema and Takoradi Ports. The plans are being executed over the GIP period.

Development Plan for Tema Port

The Tema Port Development Plan (2013–2043) is informed by traffic demand forecast. It is a 30-year plan for which implementation started in 2015. The infrastructure development is phased to respond to traffic demand forecast (Table 8.1).

Table 8.1: Main Commodities Cargo Projections for Tema Port (2023-2043)

Cargo/Target Year	2023	2033	2043
Container (1000 TEU)	2,095	3,494	4,581
Bagged Cargo (1000 tonnes)	1,427	1,664	1,696
Dry Bulk (1000 tonnes)	4,777	6,765	8,184
Liquid Bulk (1000 tonnes)	1,102	1,536	3,077
General Cargo (1000 tonnes)	1,111	1,577	2,195

Source: Tema Port – Feasibility and Master Plan Report

The construction of the Port of Tema Expansion area and facility is in three phases. as presented in the Table 8.3.

Investment Requirements

The capital expenditure required for the planned infrastructure investments is estimated at about USD2 billion, spread over the period 2016 to 2033 (Table 8.2) also provides an overview of the distribution of the necessary infrastructure investments (including engineering costs and contingencies).

Table 8.2: Tema New Container Terminal Infrastructure Investment Cost (Estimates)

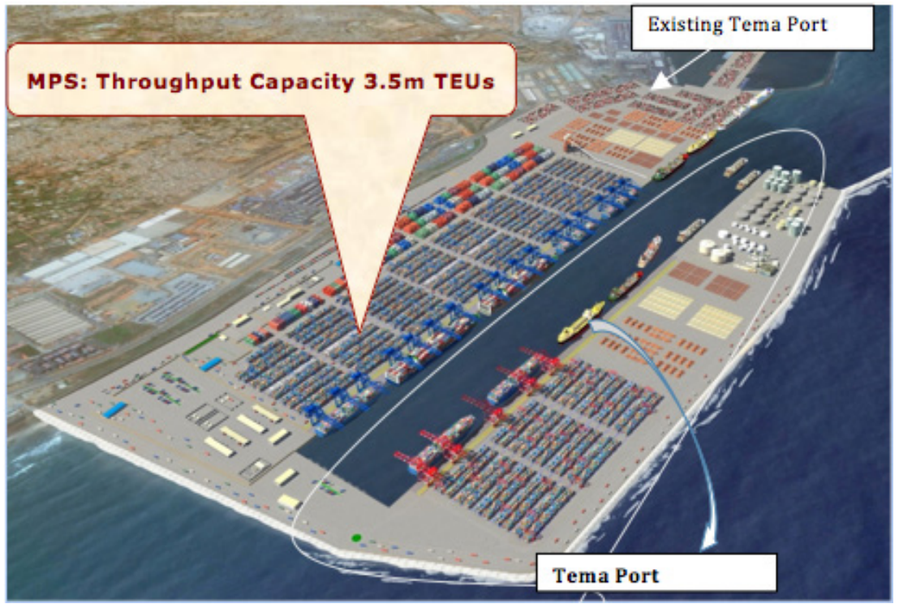
Item	Phase 1 ('000 USD)	Phase 2 ('000 USD)	Phase3 ('000 USD)	Total ('000 USD)
Dredging	77,408	-	24,922	102,330
Reclamation	354,153	94,860	96,465	545,479
Breakwater	394,852	-	43,914	438,766
Quay Walls	188,800	80,240	82,600	351,640
Pavement, Terminal Access	269,748	20,768	9,912	300,428
Utilities	233,168	20,768	9,912	263,848
Fencing	1,614	226	276	2,116
Buildings	14,585	5,664	3,257	23,506
Gate Complex	1,180	-	-	1,180
Total	**1,535,508**	**222,526**	**271,258**	**2,029,292**

Source: Sellhorn, 2014

The equipment investments required to establish the various terminals consist of investments in quay cranes for vessel loading and unloading, horizontal transport machines for container transport between quay and storage yard, stacking equipment and miscellaneous terminal equipment. Ship-to-Shore (STS) cranes have been recommended for vessel operations, while rubber-tyred gantries (RTG), reach stackers (RS) and empty container handlers (ECH) will be deployed as stacking equipment, and tractor-trailer units (TTU) are planned as horizontal transport equipment.

Work began in late 2016 and should be completed by 2022, though sections of this phase will start operations by the end of 2019. The GPHA intends to develop Ghana's ports to meet the demands of and contribute to socio-economic growth and keep the competitive advantage within the maritime market.

Figure 8.1: Proposed Tema Port Expansion Project



Source: Ghana Ports and Harbours Authority

Development Plan for Takoradi Port

The Takoradi port is being re-positioned through an extensive expansion and modernisation programme to better serve the needs of the oil and gas, mining and the trading sectors. The key components in the development plan are:

- Access channel dredged to 17.0 m water depths;
- Extension of breakwater 1.08 km northwards;
- Construction of bulk terminal with 16.0 m depth and 800 m quay length;
- Construction of oil services terminals;
- Construction of multipurpose terminals berths with 1.65 km quay length;
- Construction of open storage area for oil field, plants and machinery;
- Construction of selected access roads (in and out) of the Port.

Table 8.3 gives an overview of the proposed development plan for Takoradi Port:

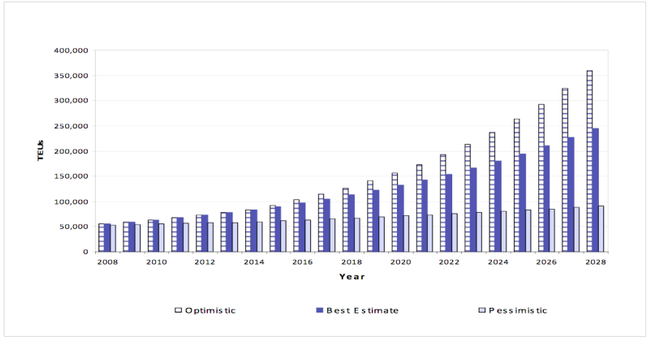
Table 8.3: Proposed Phasing of Takoradi Port Development

Phase	Completion Date (Capacities Available)	Construction Works
As-Is	May 2016	**Jan de Nul Project:** New breakwater Dry bulk pier: one berth 200 m length, -14m water depth (without equipment and pavement => not operational) Access channel, -17m water depth Turning basin, -16m water depth Oil/Cement area, -12m water depth
Phase A	Beginning of 2017	**Construction works to make dry bulk pier operational:** Installation of 1 loader for manganese Installation of 1 conveyor belt Pavement Relocation of manganese area Oil Services Hub area: Land reclamation at western side of harbour basin (Main Harbour), pavement and utilities
Phase B	Beginning of 2018	**Multipurpose and Container Terminals Construction** Construction of berths and reclamation works on southern side of new harbour basin for the development of container and multipurpose terminals.
Phase C	Beginning of 2019	**Oil Service Hub area:** Completion of Oil Service Hub area including quay wall construction **Ship repair yard:** Dredging to -14m in main harbour basin and -14m in floating dock area and reclamation at old breakwater, construction of quay walls **Completion of dry bulk length:** Construction of quay wall for 2 new dry bulk berths Installation of 1 additional loader and 1 additional unloader Installation of additional conveyor belt New Oil Berth incl. Pipelines **Multipurpose area – Phase 1:** Reclamation of land north of old pier Construction of 1st multipurpose berth on southern side of new harbour basin (Northern Basin) Other port and access facilities: Rehabilitation of existing pier New marine station, new civil engineering block, pavement + internal roads, access roads, access railway, bridge expansion, 2 Gates etc.

Source: HPC/Sellhorn, 2015 and GPHA

The growth forecast of cargo and containerised port operations is indicated below, demonstrating the need for rapid growth of Takoradi Port.

Figure 8.2: Takoradi Port Growth Forecast



Source: Sellhorn, 2014

Investment Requirement

Total investment cost for the final extension of Takoradi Port is estimated at USD990 million. The development strategy of GPHA is to invest in the basic port infrastructure of the breakwater and dredging, on behalf of the state, and cede the various terminal operations and services to private entities under strict terms and conditions.

Impact of the projects

The projects in the ports are part of the infrastructural programme designed to push the ports towards the realisation of the vision to make Tema the leading container hub of West Africa, and Takoradi the dry mineral ore /bulk, oil and gas services hub. They are designed to enhance capacity and improve performance and productivity.

Ultimately, these projects will enhance Ghana's integration into the global supply chain and improve the speed of moving goods to and from the global market place. It will also add to the attractiveness of Ghana as a destination for foreign direct investment, support industrialisation and stimulate socio-economic development. Finally, it will bolster Ghana's role in regional politics and diplomacy.

8.2.4 Other Port Projects

Tema Shipyard and Drydock

In July 2016, the government assigned the PSC Tema Shipyard and Drydock to GPHA's management. The goal of GPHA was to return the Tema Shipyard to profitability. This will require infusion of new capital to rehabilitate rundown equipment, modernise facilities, acquire new equipment and provide technical training for staff. Acquisition of International Ship Repair Permits and Certification will be needed for the promotion of the facility to international customers. A business case is currently under preparation to revive the facility.

Kpone Unity Terminal

This project involves the development of an Inland Clearance and Container Devanning Terminal in the Kpone Katamanso District of Tema. The area is about 40 acres and this would be used for devanning activities as additional capacity to the Golden Jubilee Terminal. It also meant to divert the associated vehicular and human traffic away from the port area.

Boankra Inland Port

In furtherance of the Ghana Trade and Investment Gateway (GHATIG) Programme, the Ministry of Transport, acting through its agencies – the Ghana Shippers' Authority (GSA) and GPHA – is promoting the development of an Inland Port at Boankra.

The Boankra Inland Port (BIP) Project will be an international business centre and distribution centre, offering similar services as a seaport but without a waterfront. The BIP Project is to be sited on 400 acres in Boankra in the Ashanti Region.

The Boankra Inland Port will include the following components:

- Container handling and storage depot;
- Custom bonded and open warehouses;
- Custom bonded sheds;
- Devanning yard;
- Railway marshalling yard;
- Light industry zone;
- Truck parking areas.

It is expected that the combined Boankra Inland Port and the Eastern Railway Line Project when implemented will:

- Create job opportunities for the people in and around Boankra;
- Reduce the aggregate transport cost of international cargo to importers and exporters in the middle and northern parts of Ghana;
- Facilitate the use of Ghana's Transit Trade corridor by landlocked Burkina Faso, Mali and Niger;
- Promote the establishment of export processing zones in the vicinity of the inland port; enhance and facilitate customs examination, duty payment and cargo clearance;
- Provide efficient and safer alternative to the road network, which is already congested, that is, when the rail system is revived.

The broader objective is that the inland port will provide depots, warehousing and other storage facilities for freight that moves directly and safely through and from the main seaports on the railway line and to ensure that both projects complement each other.

This project provides a unique opportunity for recapturing transit trade to the landlocked countries of Burkina Faso, Mali and Niger. The total estimated cost for the development of BIP is US$120 million. Various PPP development options are being explored towards the development of the enclave.

Marine Fishing Ports/Landing Sites

The fisheries sector plays a major role in the Ghanaian economy. Although it contributes only 3% of gross domestic product (GDP), the indirect contribution is far more significant. The direct contributions include boatyards, suppliers of auxiliary goods, services, etc. and foreign revenue. The indirect contributions are based on the importance of fish as a source of protein, indispensable for a balanced human diet.

It is estimated that over 150,000 fishermen are engaged in marine fishing and 1.5–2 million people rely on and/or provide support to these fishermen, including wives, children, close relatives as well as canoe carvers, input suppliers and office workers for industrial fleet.

The government has selected the following towns for improvement and development into Fish Landing Sites for artisanal vessels:

i. Ada, Teshie, Jamestown, Tema in the Greater Accra Region.
ii. Axim and Dixcove in the Western Region.
iii. Elmina, Winneba, Mumford, Senya-Beraku, Gomoa-Fetteh and Moree in the Central Region.
iv. Keta/Anloga in the Volta Region.

The proposed Landing Sites are made up of several physical facilities that are to be developed under the project. The facilities relate to the peculiar physical characteristics and potential fish production capacity of each existing landing site:

i. Breakwaters for a sheltered berthing and anchorage bay;
ii. Quay walls for the berthing, loading/ unloading of canoes and trawlers;
iii. Navigational aids for the safe arrival and departure of canoes and trawlers;
iv. Fish landing sheds for the transfer and sale of fresh fish in all weather conditions;
v. Ice blocks/crushed ice-making plant for sale of ice blocks to fishermen;
vi. Net mending and drying yards for fishermen to spread and mend or dry their nets.

8.3 Inland Water Transport

8.3.1 Overview

Inland Water Transport Systems provide transport services mainly to local communities within the catchment area of the water body (river or lake), by linking ferries from one end of the water body to the other as well as providing tramping and cargo transfer services.

The Volta Lake is the main means of inland water transport in Ghana. It has a total surface area of about 8,502 km^2 and stretches to about 450 km from the north to the south. The communities within the Volta Lake basin are engaged mainly in farming and fishing. Many of these communities are however isolated due to inadequate road linkages. The Lake therefore serves as a major means of transportation for local communities, as well as a mode for transferring their farm produce to markets in neighbouring communities.

Given the agricultural and mining potential of the communities scattered in and around the basin, the mode of transport will be developed to harness the socio-economic development of the area.

8.3.2 Vision and Objectives

The vision for the development of the Volta Lake transport system is 'to allow efficient and reliable multimodal transport/ logistics and local connection transport systems, and contribute to enhance regional economic development within a safe, affordable and sustainable environment.'[1]

The objectives to guide these processes include the following:

i. To connect isolated communities and provide access to basic services and markets;

ii. To develop new growth poles through the development of recreation and tourism;

iii. To develop an integrated, effective and reliable multimodal northbound and southbound transport system;

iv. To improve the efficiency of the Tema Port and reduce trucking impacts on the road network; and

v. To balance Ghana's spatial socio-economic development, east, west, north and south.

[1]Consultancy Services for Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, November 2014

8.3.3 Existing State of Volta Lake Transportation

The following comprise the existing infrastructure that supports inland water transport on the Volta Lake:

i. Vessels for north-south and tramping cargo routes, ferries and boats for informal services;

ii. Landside infrastructure for informal services, ferries, tramping cargo routes and port infrastructure at Akosombo;

iii. Warehousing and logistics installations;

iv. Roads connecting to lake transport services, including access roads between community and landside infrastructure, and feeder roads connecting major roads to local communities in the case of ferries; and

v. Transport connection (road and rail) between Tema and Akosombo.

Current surveys show that about 69% of passengers plying the Volta Lake travel on market days, while about 31% travel on non-market days. The Yeji-Makango crossing seems to be the prime route, with estimated traffic of about 550,000 passengers yearly. The Dzemeni-Galelia; Digya Park–South Otisu Island–Tapa Abotoase; Kete Krachi–Kojokrom; Dambai–Dodoikope crossings are also principal sites, each accounting for more than 200,000 passengers annually. The major ferry stations along the course of the Lake as well as the type of service provided are summarised in Table 8.4.

Table 8.4: Major Ferry Stations along the Volta Lake

Transport Service	Port	Span (km)	Type of Cargo
North - South	Akosombo-Buipe-Yapei	Buipe (km 415) Yapei (km 450)	Passengers Liquid cargo: Diesel oil, Kerosene, Petrol Solid Cargo: Agricultural inputs and produce, General cargo, Construction Materials
Cross - Lake	Adawso-Ekye Amanfrom	4.6	Passenger Vehicle Other types of cargo
	Dambai and Over Bank	3.7	
	Kete Krachi –Kwadjokrom (Deifo)	12.03	
	Yeji – Mankango	10	
	Agordeke – Kpando Torkor	32	

Source: Consultancy Services for Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

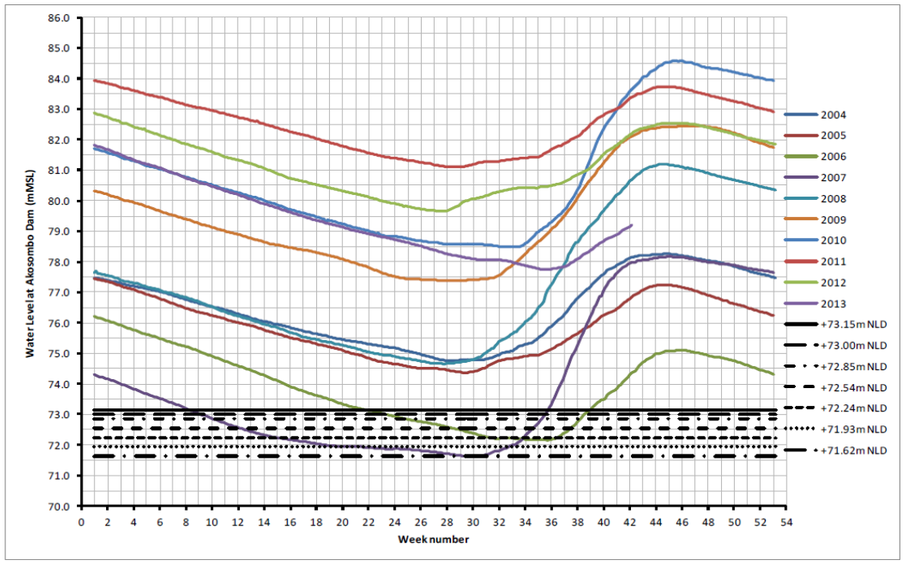
The Volta Lake Transport Company (VTLC), a subsidiary of the Volta River Authority (VRA), manages this infrastructure, while the latter provides oversight. The existence of these facilities (Table 8.4) notwithstanding, there are certain challenges in their management:

i. Facilities are generally not in good condition and therefore need maintenance or rehabilitation;

ii. Aging equipment, inadequate navigational aids and the lack of regulation for canoe construction, use and operations on the Lake; and

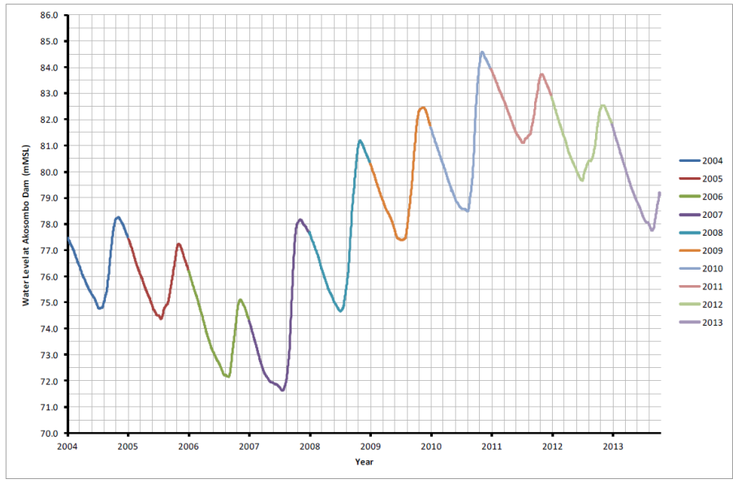
iii. Annual periodic drops in the level of the lake (as shown in Figures 8.4 and 8.5) expose sand banks and tree stumps and other underwater obstructions that greatly hinder navigation along the length of the Lake.

Figure 8.3: Weekly Water Level at Akosombo Dam



Source: Consultancy Services for Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

Figure 8.4: Water level of the Volta Lake (2004-2013)



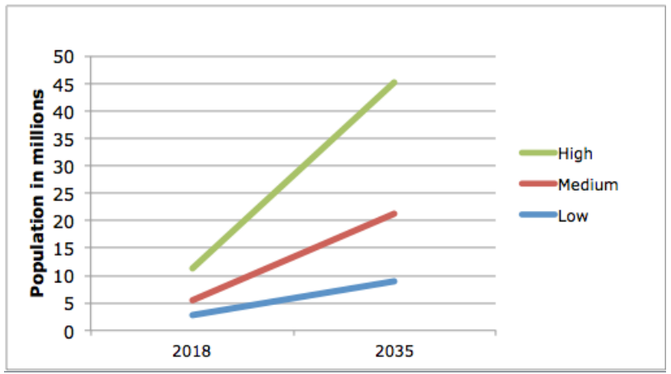
Source: Consultancy Services for Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

8.3.4 Development Scenarios

Passenger Forecast

It is estimated that between 2018 and 2035, the average number of passengers crossing the Volta Lake could increase from 11.3 million passengers per year to 45.6 million passengers (2035). This implies that passenger traffic around the principal crossing sites is expected to grow from 500,000 in 2018 to 3 million passengers per annum by 2035. See Figure 8.4. Freight transport on the Volta Lake to the northern part of the country is expected to grow from 262,000 tonnes in 2018 to 1 million tonnes by 2035, while that of the Northern and Central Lake areas will grow from 80,000 tonnes in 2018 to 360,000 tonnes in 2035. Consequently, ferry, local and tramping services as well as infrastructure will be developed to support the growth in both freight and passengers.

Figure 8.5: Yearly Passenger Traffic Forecast (2018-2035)



Source: Consultancy Services for Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

This implies that the major crossing sites will record between 1 – 3 million passengers per annum.

Ferry, Local and Tramping Services and Infrastructure

Table 8.5 shows ferry services at various locations with an annual passenger forecast in 2018, and the action that needs to be taken, whether upgrading or new construction.

Table 8.5: Ferry Services and Action to be taken

Location	Ridership 2018 (pax/yr)	Action
Major Ferries		
Adawso/Ekye Amanfrom	500,000	Upgrading
Akateng/Adikukope	500,000	New Construction
Dzemeni/Galelia	500,000	New Construction
Kpando-Torkor/Agordeke	500,000	Upgrading
Dambai/Dodoikope	630,000	Upgrading
Kete Krachi/Kojokrom	630,000	Upgrading
Yeji/Makango	850,000	Upgrading
Intermediate Ferries		
Kpetchu/Adiembra	200,000	New Construction
Asuso/Begyemse	200,000	New Construction
Local Ferries		
Bridge-Ano-Ntaboma	90,000	Upgrading
Digya Park-South Otisu Island-Tapa Abotoase	120,000	New Construction
Kojokrom – Kete Krachi/ Atikagome-Sakpiti/ Okpalama/ Otisu Kpedzi	60,000	New Construction

Source: Consultancy Services for Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

Even though it is not possible to make a clear forecast of tourism demand on the Lake over the plan period, there is a need for tourism services and infrastructure in areas around Akosombo, Digya Park and other urban centres around the Volta Lake area.

Transport on the Volta Lake is critical for boosting agriculture in the area, by moving produce from source of production to market centres. It is therefore important that crossing sites be planned to connect localities to market centres.

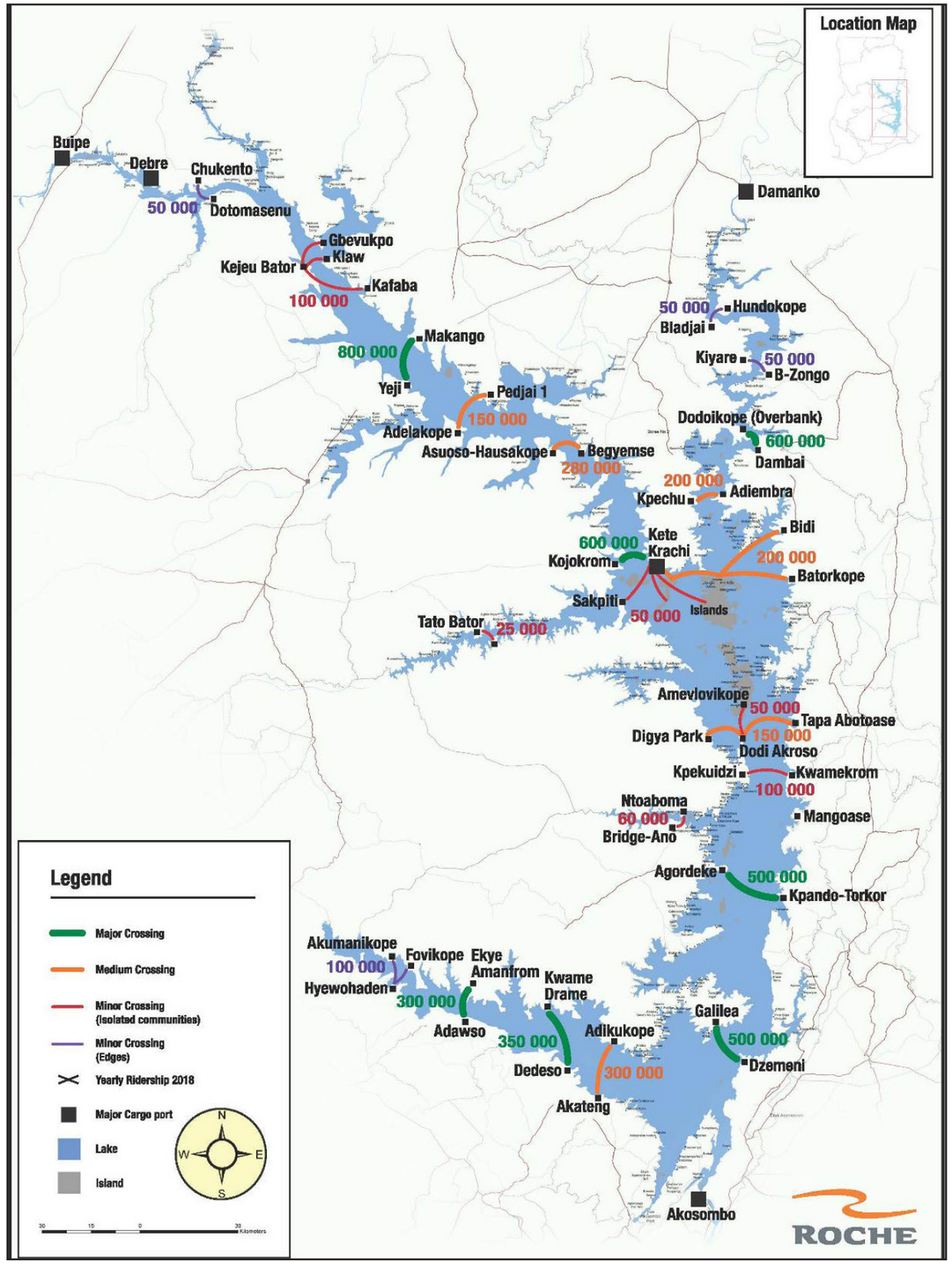
The transfer of freight on the Volta Lake to the northern part of the country as well as to landlocked neighbouring countries could also be a major area to capitalise on. Freight traffic is expected to fluctuate between 262,000 tonnes and 1 million tonnes in 2018 and 2035 respectively, while that of the Northern and Central Lake areas could vary between approximately 80,000 tonnes in 2018 up to about 360,000 tonnes in 2035. The volume of imports to the Afram Plains would be about 22,000 tonnes by 2018, and increase to 117,000 tonnes by 2035, all based on the medium case scenario.

On average, the landing stage investment cost for a local informal, ferry or tramping services is estimated at US$2.6 million. The costs are broken down as follows:

- Landing Facilities — $900,000;
- Reception Facilities — $500,000;
- Accommodation Facilities — $300,000;
- Access Roads — $400,000;
- Miscellaneous — $500,000.

Under the medium-term scenario, the forecast volumes would require two vessels for the north-south service and two vessels for the tramping service. One ferry boat is therefore required for each ferry cross-lake location.

Figure 8.6: Crossing Locations and Forecasted Annual Passenger Traffic for the Year 2018.

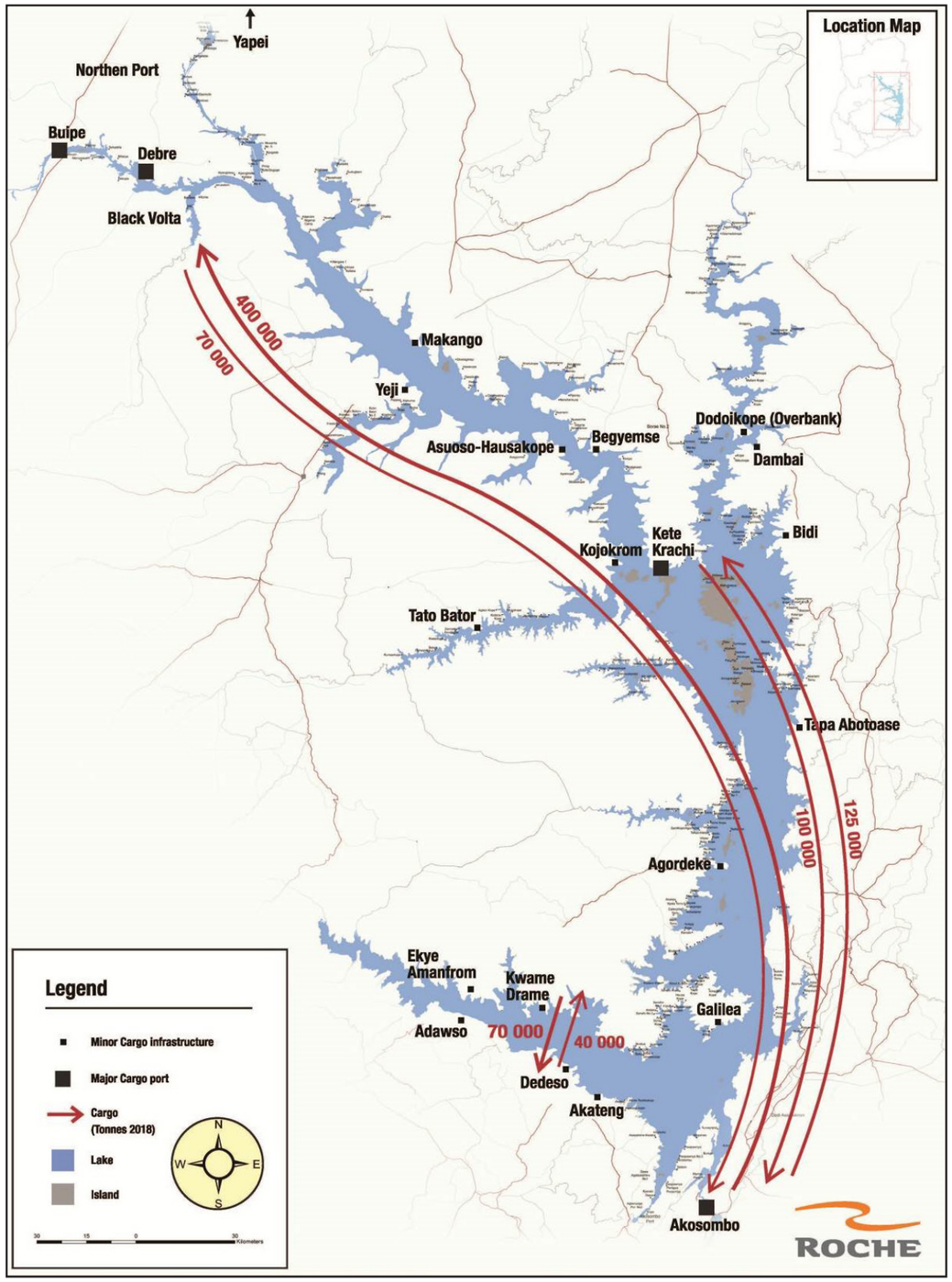


Source: ROCHE - Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014.

The construction of a northern port should take the following into consideration:

- Containerisation and handling capabilities;
- Workshops;
- Warehousing;
- Merchandise control; and
- Offices

Figure 8.7: Major Cargo Volume Forecasts for the year 2018



Source: ROCHE - Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

Priority Locations for the Installation of Tramping Services

Priority locations for the installation of landing stages were selected based on the following indicators:

1. Boat numbers;
2. Estimated Cargo;
3. Class of passengers volumes;
4. Type of slope on the bank; and
5. Town ranking.

In addition, in terms of the qualitative aspects such as the slope of the shore and the proximity of locations to each other, the following sites were selected:

1. Akateng, Dzemeni and Tapa Abotoase – for future ferry services;
2. Bruben and Hyewohoden – for the importance of their cargo;
3. Yejo, Dambai and Makango as well as Adakope and Bidi – for high interconnectivity;
4. Kete Krachi – as a high ranking town and the future lake transport hub.

Agricultural production and the population of the area were the major factors considered in selecting the priority locations for installation of tramping services (Table 8.6 below)

Table 8.6: Priority Locations for Tramping Service Installation

Potential Locations	Area Population 2010	Remarks
Fosu, Galelia, Agordeke	218,235	Agricultural Development, could also use ferries
Ntoboma	59,405	No competition
Tapa Abotoase	184,385	
Dambai	299,235	
Kete Krachi	61,000	Could also be used for northeastern districts, connection with other services
Anyinamae - Boafri, Begyemse	168,000	High costs at Anyinamae, ferry potential at Begyemse, Lower costs at Lonto
Hausakope, Asuoso	59,405	Hausakope identified by VLTC, ferry and informal service potential at Asuoso
Yeji	129,248	
Makango	135,450	Could also be used for northern districts

Source: ROCHE- Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

Major Installations

1. In spite of Buipe being a preferred location for the northern port over Yapei, given its size and function as well as the extent of existing landing and the handling and storage infrastructure, accessing Buipe safely from Debre requires a minimum water level of 250 ft. (76.5m) at Akosombo. This situation has not occurred consistently over a period of time; however it could be resolved by either dredging the Black Volta or by enhancing the installations at Debre.

2. The cost of developing and upgrading the northern port is estimated at US$25 million, and must include containerisation handling capabilities, workshops, warehousing, merchandise control and offices.

3. Developing Akosombo to serve as a major cargo hub has been estimated to cost US$55 million. This will equip Akosombo with facilities to perform trans-modal functions such as handling logistics, warehousing and merchandising.

4. A fully integrated logistics system should be set up for north-south and tramping services, including some ferry connections, for example at Kete Krachi or Dzemeni.

Connections

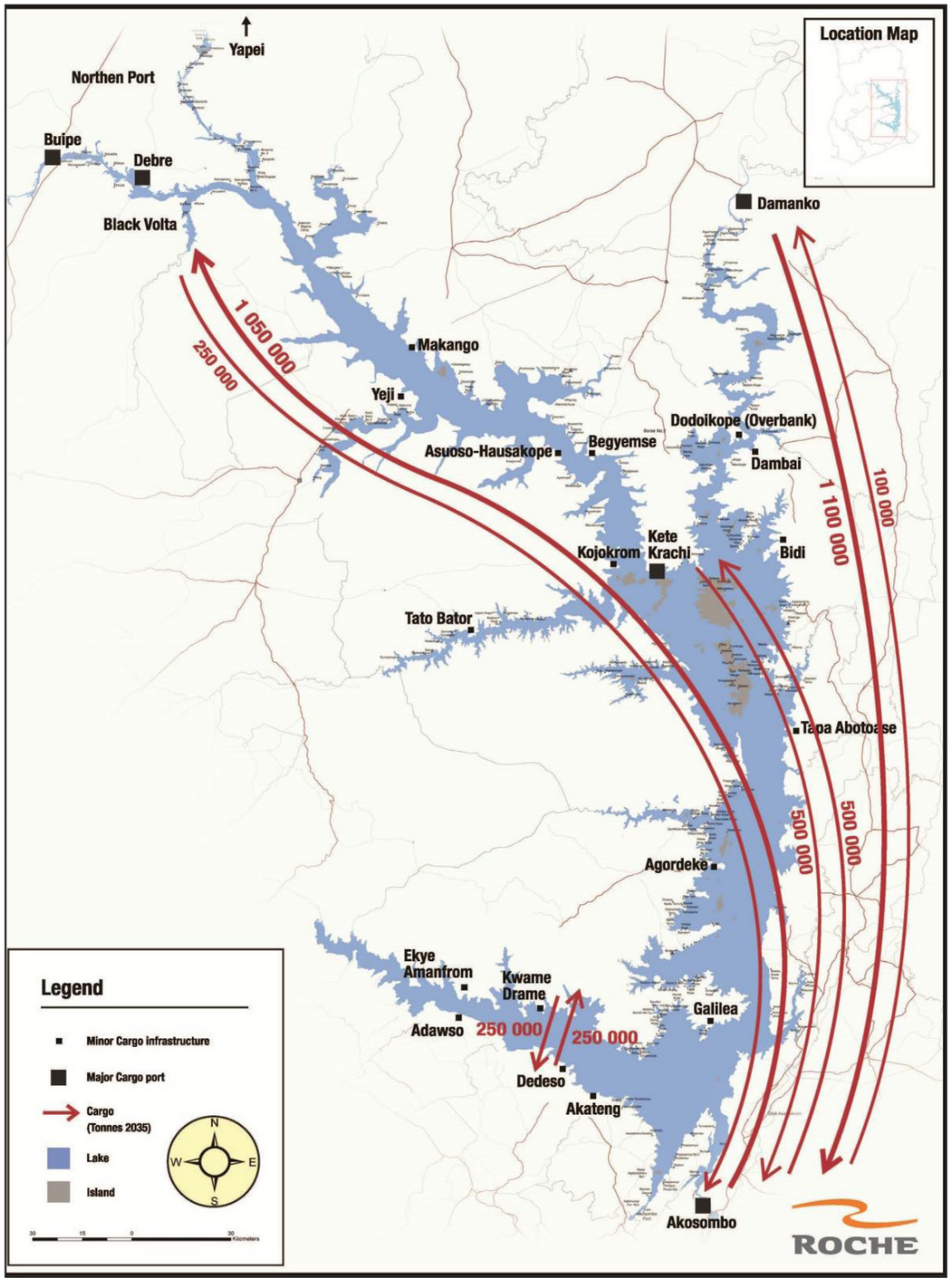
1. Feeder roads need to be built to connect the different landing sites.

2. Most of the cargo that passes through Akosombo either comes from or goes to Tema Port. This cargo must be transported by rail instead of trucking. This connection could also transport passengers between the lake area, Akosombo, Tema, and Accra. Given the volumes forecast, the railway is a solution to consider seriously in the medium term or over a longer time frame. In 2017, the Government awarded the contracted for the construction of the Tema to Akosombo railway line.

3. Even though the railway will absorb a large part of the cargo traffic and is most efficient for port-to-port, or port-to-storage/distribution centre movements, a number of passengers and cargo will continue to be transported by trucks. Therefore, the Tema to Akosombo road will be made a dual-carriageway, even as the construction of the new railway line is done. As a number of structures will be demolished along the right-of-way, it is expected that towns and settlements along the corridor will be planned and improved.

The long-term cargo forecast for 2035 to and from Akosombo Port is shown in Figure 8.9.

Figure 8.8: Major Cargo Volume Forecasts for the year 2035



Source: ROCHE - Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

8.3.5 Governance, Safety and Socio-Economic Development

Governance

In spite of the existence of a strong institutional framework, the contexts for coordination, collaboration and building of strong partnerships among stakeholders would be clearly defined, to ensure the sustainability of the project.

A steering committee, coordinated by the Volta Lake Transport Company (VLTC) and comprising District Assemblies, MoFA, NDPC, MLGRD, MoT and Ghana Navy as well as the Department of Feeder Roads, Boat-Owners' Association and Boat-Builders' Association, will be constituted to manage and coordinate various aspects of the project.

The VLTC will ensure that enough boats and landing sites are provided and maintained in good condition for optimum performance. Total revenue accrued from the provision of transport services on the Lake will be sufficient to fund this

Safety

1. There would be coherent regulations to enhance security on the Volta Lake. Steps to be taken include:

a. Identifying the most suitable navigation channels for all types of services plying the Lake;

b. Clearing navigation lanes of all obstacles, especially tree stumps;

c. Demarcating suitable routes between destinations; and

d. Resolving conflicts among all stakeholders.

2. The following safety rules will also be strictly enforced:

a. Intensifying the loading lines marking programme;

b. Initiating specific boat-loading regulations;

c. Establishing desirable volume capacity of boats; and

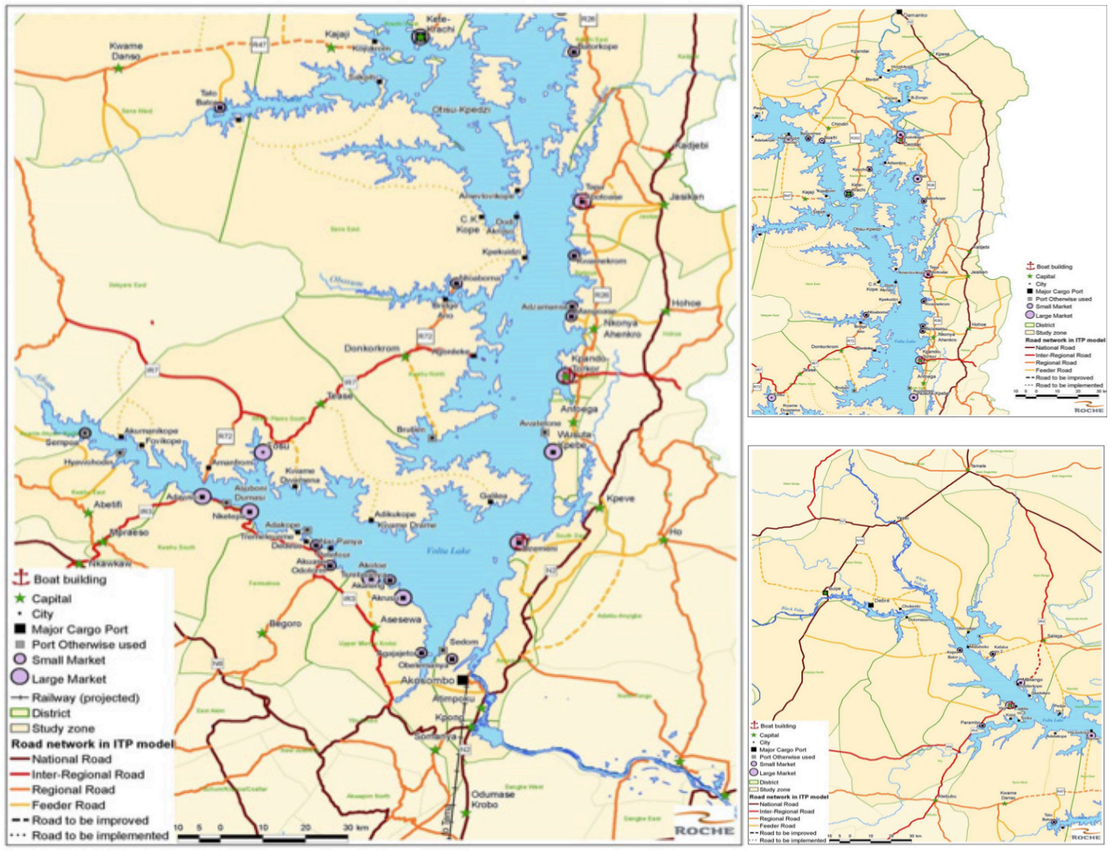
d. Empowering local associations and giving them oversight responsibility for ensuring orderliness and sanity in day-to-day operations.

Socio-Economic Development

There have been efforts to distribute basic services equitably around the Volta Lake area, however, it is the responsibility of the District Assemblies to plan on a long-term basis how to properly coordinate the transport system and the infrastructure on the Lake to optimise accessibility for local populations.

Measures to be taken include the rehabilitation and maintenance of roads leading to and from boat landing sites as well as other social service facilities (e.g. health and market facilities, etc.), planning and growing medium or large towns around the Lake area to serve as growth poles. Figure 8.9 shows the road network that must be developed.

Figure 8.9: Landing Stages, Activity Centres and Road Connections



Source: ROCHE - Report for Preparation of a Medium-Term Master Plan for Transportation on the Volta Lake and its Surrounding Region, 2014

These settlements along the Lake will be well planned, and roads and other infrastructure leading to the towns along the Lake will be improved.

Figure 8.10: Sample bridge to be constructed along strategic locations on the Volta Lake

Source:Google images

Medium-sized towns will be developed into new growth poles to create jobs and provide alternative means of livelihood for the people.

Boat Building

The Ghana Maritime Authority (GMA) should adopt a standard boat design and size, giving consideration to the ability of the boat builders to develop and manufacture these in Ghana. These standards must be enforced and boat builders must comply accordingly. All new boats must undergo a registration process where they will be assessed to ensure that all requirements are adequately met, before they are licensed for operation.

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Chapter 9: Railway

9.1 Introduction

The railway system comprises infrastructure and rolling stock (trains). The infrastructure is made up of the tracks or roadbed (including bridges and culverts); buildings (including station buildings, workshops etc. needed for train operations); and signaling and telecommunications systems (including safety assurance systems). The rolling stock is made up of locomotives, coaches, wagons, etc.

The main advantage of rail is its suitability for transporting bulk goods and passengers over long distances at cheaper rates. This buttresses the argument for ensuring the competitiveness of rail transportation in Ghana, particularly in view of the role played by other transport modes, especially road. Given its overall better safety record over road transport, rail transport should prove an attractive option to freight and passenger traffic. Rail transport also has great potential to address the challenges of reducing fuel dependency and thereby cutting down greenhouse gas emissions. Currently, rail transport's modal share in Ghana's transport mix is less than 1% for passenger traffic and 3% for freight. Future railway investments should therefore be planned and executed to achieve greater efficiency and attractiveness in order to grow its modal share.

9.1.1 Objective

The main objective of a rail investment plan is to improve the attractiveness of rail transportation in Ghana in relation to other means of transport and ensure it better serves the nation. Ghana is now poised to improve the entire rail travel chain, including ticket purchase, provision of real-time passenger information using modern communications technologies, clean and attractive passenger coaches, safe and clean passenger terminals and excellently maintained tracks for both passenger and freight trains.

9.2 Existing Railway System

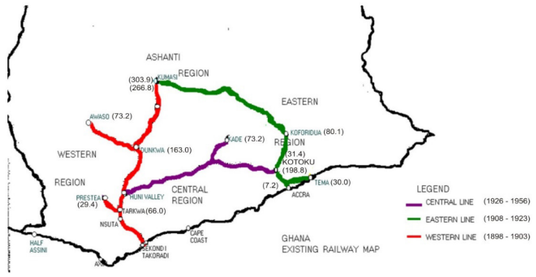
9.2.1 Rail Network Size

The railway network consists of 947 km route of 1067 mm gauge tracks (or a total of 1,200 km of lines) located in the southern one-third of Ghana (Figure 9.1). The railway is predominantly single track (except a 30 km stretch from Takoradi to Manso which is double track) and uses diesel electro-motive power.

The network forms a triangle between the cities of Takoradi and Accra, located about 200 km apart on the southern coast of Ghana, and Kumasi located about 250 km inland. The main network lines are designated the Western Line (Takoradi-Kumasi), Eastern Line (Accra-Kumasi), and Central Line, which connects the Western and Eastern Lines running parallel to the coast and about 80 km inland. The network has five branch lines: the Sekondi, Prestea and Awaso branches originating from the Western Line; the Tema branch originating from the Eastern Line; and the Kade branch originating from the Central Line. The Prestea and Kade branches, and part of the Sekondi branch are presently not active. Coverage is thus low and reduces the effectiveness of the railway sector in the transportation of goods and services overland.

Track conditions have so deteriorated that out of the 947 km, only 13% is operational to some extent. A suburban passenger service operates between Accra and Tema, while another passenger train service runs between Accra and Nsawam on the Eastern Line. On the Western Line, a limited manganese freight service runs between Takoradi and Nsuta. The Central Line and the rest of the tracks on the Western and Eastern Lines have been rendered inoperable due to the poor state of the track.

Figure 9.1: Existing Railway Network



Source: Ghana Railway Company Ltd

9.2.2 Rail Track Infrastructure

As most of the railway was built in the colonial era, the design of the track was made by following river courses, which was the cheapest way to build a rail route at the time. As a result, about 40% of the track is on curves and many have radii as low as 150 meters with steep gradients of 1.26% on the main line and 2.5% on the branch lines. As most of the track traverse valleys, it is flooded at certain points during the rainy season due to the design and inadequate drainage.

Ghana's railway track was designed for a maximum speed of 58 km/h. In general, the track structure consists of a mixture of 30 kg, 35 kg and 40 kg rails with wooden and steel sleepers.

9.2.3 Bridges and Culverts

The rail infrastructure has 287 bridges with a total length of 3,207 m. Approximately 80% of these bridges are steel girder or truss bridges with timber decks, the remainder being reinforced concrete bridges.

9.2.4 Buildings

There are 2,643 buildings belonging to the Ghana Railway Company Limited (GRCL) across the country, comprising a total floor area of 442,420 square metres (m^2). A very large percentage of the buildings, over 70%, are residential properties and currently in a state of disrepair. The breakdown between residential and other types of buildings is as follows:

- Residential – 1,923 buildings, covering an area of 288,788 m^2;
- Other types – 720 buildings, covering an area of 153,631 m^2 (including 159 station buildings);
- Currently 8 stations on the Western Line and 11 on the Eastern Line are functional.

9.2.5 Rolling Stock

The rolling stock of freight wagons, coaches and locomotives is in a poor state. Only 14.5% of all rolling stock is considered operational. As of 2015, only 8 out of 39 locomotives, 57 out of 420 wagons, and 25 out of 162 coaches are in reasonable condition for utilisation on trains. About 137 coaches are in various states of disrepair and most have been earmarked for scrap.

Almost half of the locomotives and over one-third of the wagons were purchased after 2000. All coach stock was purchased in the late 1980s. Nine locomotives and 44 coaches have been rehabilitated in the last eight years. The rail infrastructure has extensive rolling stock maintenance facilities at Location in Sekondi, with supporting facilities at other terminal stations.

Locomotives Fleet

The GRCL has a fleet of 61 locomotives, of which 26 are aged between 11 and 13 years, 10 are aged between 20 and 24 years, 22 are aged between 28 and 31 years and 3 aged above 40 years. About 22 of the locomotives meant for shunting activities are in various stages of disrepair and bigger locomotives have to be utilised to meet exigencies. At the present level of operations, the 26 fairly new locomotives are adequate. However, more locomotives will be required as and when the business grows.

Wagons

Over 50% of GRCL's wagon fleet consists of low-sided wagons used to transport bauxite and manganese ore. The rest of the fleet consists mainly of covered wagons and various types of flat wagons. All wagons are equipped with roller bearings and vacuum brakes (Table 9.1).

Table 9.1: Summary of Rolling Stock as at 2016

Rolling Stock	Total	Available for use
Locomotive	39	8
Wagons	420	57
Coaches	162	25

Source: Ghana Railway Company Limited

9.2.6 Signalling and Telecommunication

Normal signaling and telecommunications for train operations are non-existent on the rail network. Trains are dispatched and received from one station to the other on the Western Line mostly using mobile phones. Train accidents have been avoided largely due to the limited number of trains running.

The present rundown state of the railway could be attributed mainly to lack of funds for operation and maintenance resulting from years of running the railway as a part of the public service and not as a business entity.

9.2.7 Opportunities for Railway Investment

According to the 2013 National Spatial Development Framework (NSDF) report, Ghana is confronted with a number of challenges as well as opportunities. Part of the solution to the challenges depends on an improved and expanded rail infrastructure, which the Railway Master Plan promotes. Some of the challenges and opportunities are as follows:

Economic

Integrating Ghana into the West African economy can reduce income inequalities among member countries, and thus support dispersion of economic activities as well as attract investments to smaller urban settlements. The introduction of the Trans-ECOWAS Railway Line covering the entire sub-region is expected to enhance integration, and improve economic activities.

Population distribution and growth

Ghana faces the challenge of not only a growing population but also an uneven concentration of the population in the coastal regions. Extension of the rail infrastructure to cover the entire country, as stated in the Ghana Railway Master Plan, has the potential to reverse rural-urban migration and reduce population density along coastal towns.

Increasing food production

Ghana needs to increase food production to meet rising demand by expanding the area under cultivation, reducing fragmentation of cropland and increasing the land area under irrigation. Subsequently, there need to be provision of adequate warehousing and improved markets, many of which are old and unhygienic. An improved and expanded railway infrastructure is essential to support distribution of food at competitive prices and thus reduce the cost of living.

Transport

Ghana faces the challenge of increasing demand for mobility because of population and economic growth and higher incomes. This will increase demand for more freight and passengers transport services on the road, rail, water, and air transport modes.

The rundown railway network will have to be resuscitated, improved and expanded, with links to important economic centres that may not have been included in the Ghana Railway Master Plan. Provision should be made in the Railway Master Plan to extend rail services to areas not connected by rail but identified in the Ghana National Spatial Development Framework as having great potential for growth.

Mining

Ghana has large deposits of exploited and unexploited bulk minerals such as manganese, bauxite and iron ore. For example, there are large deposits of bauxite at Awaso, Nyinahin and Kibi and other sites that are yet to be exploited. Lack of rail infrastructure has compelled mining companies to transport existing bauxite and manganese ore to Takoradi Port by road, with attendant rapid deterioration of the road network. The exploitation, processing and value addition of these minerals has been held back due to lack of adequate rail infrastructure. Table 9.2 shows the mineral deposits located along the Western Line that are yet to be exploited.

Table 9.2: Western Line Mineral Deposits

Mineral	Estimated Ore Reserves	Locality
Bauxite	350 million tonnes	Nyinahin
Iron Ore	150 million tonnes	Oppong Manso
Limestone	6 million tonnes	Buipe
Iron Ore	4 million Tonnes	Pudo
Manganese	8 million tonnes	Kalimbi Hill, Bole
Manganese	880,000 tonnes	Seripe, Bole
Manganese	3 million tonnes	Kapili, Bole
Andalusite	600,000 tonnes	Bekwai
Bauxite	over 20 million tonnes	Sefwi Awaso
Manganese	over 20 million tonnes	Nsuta

Source: Industrial Mineral Resources of Ghana (Geological Survey Department)

Table 9.3 indicates mineral deposits along the Eastern Line that are yet to be exploited.

Table 9.3: Eastern Line Mineral Deposits

Mineral	Estimated Ore Reserves	Locality
Bauxite	150-180 million tonnes	Kibi
Iron Ore	1,270 million tonnes	Shieni
Limestone	15 million tonnes	Bong-Da
Dolomite	20-30 million tonnes	Akosombo
Kaolin	3 million tonnes	Kibi
Bauxite	5 million tonnes	Nkawkaw
Manganese	2 million tonnes	Konongo

Source: Industrial Mineral Resources of Ghana (Geological Survey Department)

Other Opportunities

The NSDF identified challenges in other areas such as natural and cultural heritage sites, education and health facilities. Improved rail infrastructure will provide passengers with easier access to these facilities. It may become necessary to modify rail routes to facilitate accessibility to some of these sites.

The development of the Railway Master Plan is a sine qua non for the implementation of the NSDF. In other words, the targets in the NSDF can be realised only when the Railway Master Plan is implemented. Transport connections will be improved across all major cities, mining, industrial and large scale farming areas when the railway network is connected.

9.3 Comparison of Population per Railway Track-Length for Selected Countries

Table 9.4 shows a comparison of population per railway track-length for some selected middle and high-income countries. With the implementation of the Railway Master Plan, Ghana can attain a level of infrastructure comparable to developed nation status.

Table 9.4 Population per railway track-length of selected countries

Country	Gauge Mm	Max Speed Km/h	Track Length (Km)	Population /mil	Population per track-Km
Namibia	1067	120	2,382	2,089,014	877
Romania	1435	160	22,298	19,899,120	892
Czech Rep	1435	230	9,487	10,540,057	1,111
Argentina	1676	320	36,966	41,291,022	1,117
South Africa	1067	160	31,000	54,490,406	1,757
Zimbabwe	1067	120	3,400	12,570,000	4,190
Turkey	1435	250	12,000	78,665,830	6,555
Mozambique	1067	120	3,116	20,578,064	6,604
Brazil	1000	160	29,303	207,847,528	7,093
Mexico	1435	160	17,166	127,017,224	7,399
South Korea	1435	368	5,242	49,002,216	9,348
China	1435	300	121,000	1,376,048,943	11,373
India	1676	130	115,000	1,311,050,527	11,400
Malaysia	1000	160	1,849	30,331,007	16,404
Ghana (Existing)	1076	58	947	28,000,000	29,500
Ghana 2047 (Proposed)	1435	160	4,007	52,000,000	12,977

Source: Various (Mostly Wikipedia and World Development Indicators)

The empirical figure of population per track-kilometre represents the degree of railway coverage in a country, showing that Ghana's current coverage of 29,500 persons per kilometre is one of the lowest in the world. There is therefore the need for increased coverage, and the Railway Master Plan when fully implemented, will give Ghana a population per track-kilometre of 12,977 and produce a railway system comparable to those in emerging nations.

Table 9.4 shows that most developed nations use standard gauge tracks; the coverage is adequate to serve the majority of people, and speeds range up to 160 km/h and above.

Currently, trains in Ghana run with maximum speeds of 58 km/h. Introducing higher speed trains poses great challenges to the safety of people along the tracks. Presently, settlements exist along railway lines and settlers have created pathways to their farms and other everyday destinations across railway tracks. These situations can be mitigated by the following actions:

- Proper planning of all settlements along railway lines;
- As much as practicable, fencing along railway lines through all densely populated settlements;
- Continuous education of all citizens on the safety implications of the introduction of high speed trains in the Ghana;
- As much as practicable, provide footbridges where densely populated settlements intersect with railway tracks.

It is not economical to plan for the railway to cover every part of the country. Since the aim is to promote intermodal transport, road transport is expected to feed the railway terminals along the proposed 4,007 km track with goods and passengers. It is recommended that 20% of the proposed track length or 800 km of track be added to cater for suburban railway services to be shared according to the population densities of the regional capitals.

9.4 The Railway Master Plan

The Railway Master Plan (RMP) was initiated by the Ghana Railway Development Authority (GRDA) in 2013. The plan envisaged that the rail infrastructure intervention would start in 2015 and be completed by 2047. The programme has not taken off to date. With the implementation of Ghana's LTNDP, it is expected that the intervention will start in 2018 and be completed by 2047.

9.4.1 Phases of Implementation

The project involves the construction of 4,007 km of rail network covering the entire country. The plan will be financed through Public-Private Partnership (PPP) arrangements with freight traffic projections of 36 million tonnes in 2015 rising to 285 million tonnes by 2047. Passenger traffic is projected to grow from 730,000 passengers per day in 2015 to 1.38 million passengers per day in 2047. The rehabilitation is to be carried out in phases as indicated below.

1st Phase: Rehabilitation of the Existing Lines

Only two of the three existing lines are to be rehabilitated: the Western Line (Takoradi-Awaso-Kumasi) and the Eastern Line (Accra-Tema-Kumasi) for a total of approximately 668 km including branches to Awaso and Prestea). The Central Line is not very attractive for freight and passenger traffic, and should be substituted in successive phases by the Coastal Line.

The lines remain narrow gauge, but will be modernised and adapted to the new technical standards for all the new infrastructure, but with sleepers conditioned for a subsequent transformation of the lines to standard gauge.

The traffic assignments indicate that the Western Line has a higher potential for freight traffic, and in particular that of the mines, whereas the Eastern Line is more suited for passenger transport.

On the basis of the surveys and verifications carried out, it is proposed to undertake repairs on the limited number of the current rolling stock that it is still technically possible to rehabilitate, without purchasing any new locomotives, thus avoiding any unnecessary expenses in view of the future changeover of the lines to standard gauge.

2nd Phase: Extension of the Central Corridor

Doubling of the track of the two lines rehabilitated in the 1st Phase and the conversion to standard gauge of the previously modernised track, thus creating two modern lines with double tracks on the routes with a high demand for freight and passenger traffic.

Construction of the new standard gauge single-track line that runs from Kumasi to Tamale and Paga in the north.

This phase covers approximately 1,161 km.

3rd Phase: Extension of the Transversal Links

Construction of transversal railways with standard gauge single tracks, for the stretches Tamale-Yendi, Fufulsu-Sawla, Techiman-Kwadwokurom and Nyinahin-Kumasi for a total of approximately 484 km.

4th Phase: Extension of the Trans-ECOWAS Line

This is mainly a coastal line, with standard gauge single track, that runs from Aflao (near the border with Togo) westwards to Tema-Accra-Cape Coast–Takoradi-Tarkwa-Omape for a total of approximately 498 km.

5th Phase: Extension of the Western Line

Extension northwards of the original Western Line to reach and connect the future mines. The Line starts from Dunkwa-Awaso and extends towards Techiman, Sawla and Hamile for a total of approximately 729 km.

6th Phase: Extension of the Eastern Line

This is the new route to the east of Ghana, near the border with Togo; that from Tema reaches Akosombo and then heads towards Ho and Yendi to the north, for a total of approximately 468 km.

9.4.2 Review of the Railway Master Plan

The master plan implementation strategy was premised on the state of the railway as of 2008 when as many as 36 mainline locomotives were available. Each of the locomotives cost about US$2.85 million and were designed for narrow-gauge tracks. The plan then was to rehabilitate the existing tracks with standard gauge materials in Phase 1, with the gauge adjusted to accommodate the narrow-gauge locomotives until the old locomotives were phased out. The tracks could then be re-adjusted into standard gauge in Phase 2.

The plan was scheduled to commence in 2015 but by then, only six out of 36 mainline locomotives were available so the reasons for that strategy were no longer tenable. Implementation will now commence from 2018 with the necessary adjustments. Details of the Amended Implementation Plan are shown below:

i. The Master Plan in Phase 1 proposed the rehabilitation of two of the existing lines; namely Western Line (340 km) inclusive of the Awaso Branch Line, and the Eastern Line (327 km). The amended programme proposes going straight ahead with the modernisation of the Western and Eastern Lines in Phase 1 instead of rehabilitating the existing lines as originally proposed. It is noteworthy that modernisation means conversion to the standard gauge, which is normally described in the Master Plan as expansion;

ii. The Master Plan in Phase 2 proposed a Central Corridor Expansion and mentioned various sections including the existing Western and Eastern Lines. It has already been recommended that the existing lines be modernised, so Phase 2 has been adjusted accordingly. The central line by-pass at Kade could also be extended through Kibi or Abirem to link the eastern line to boost the economy within the corridor, especially bauxite deposits at Atiwa, near Kibi.

All other phases remain as originally planned. The revised Master Plan is shown in Table 9.5:

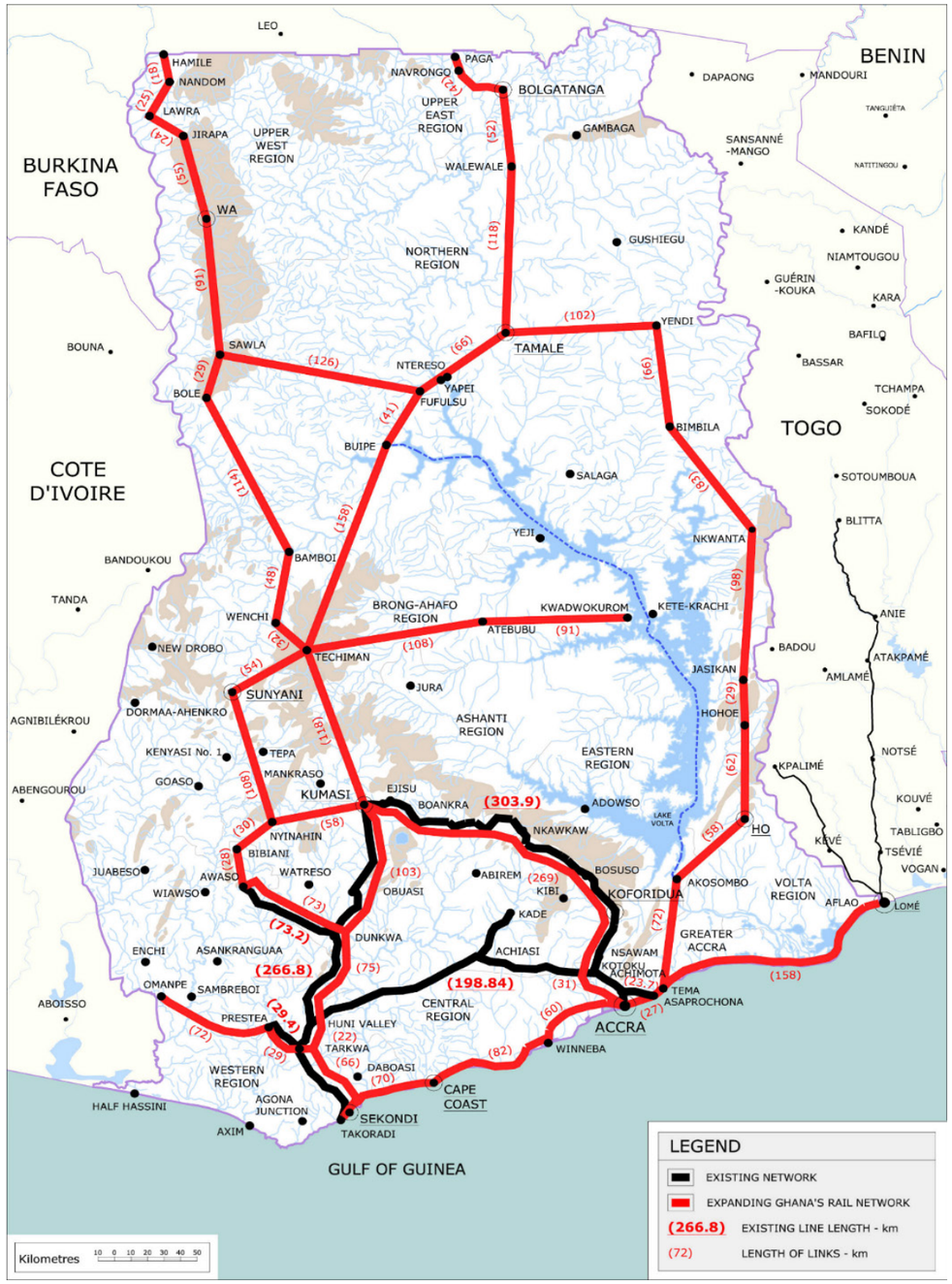
Table 9.5 Summary of the Revised Railway Master Plan

Phase	Link	Description
1	Modernisation of the Existing Lines	- Only two of the three existing lines are modernised into standard gauge infrastructure: the Western Line (Takoradi-Awaso, Dunkwa-Kumasi) and the Eastern Line (Accra-Kumasi) for a total of approximately 668 km including the Tema branch.
2	Extension of the Central Corridor	- Doubling of the track of the two lines modernised in the 1st Phase, thus creating two modern lines with double tracks on the routes with a high demand for freight and passenger traffic. - Construction of the new standard gauge single-track line that runs from Kumasi to Tamale and Paga in the North. - This phase covers approximately 1161 km.
3	Extension of the Transversal links	- Construction of transversal links railways with standard gauge single tracks, for the stretches Tamale-Yendi, Fufulsu-Sawla, Techiman-Kwadwokurom and Nyinahin-Kumasi for a total of approximately 484 km.
4	Extension of the Trans-ECOWAS Line	- This is mainly a railway line with standard gauge single track that runs from Aflao (near the border with Togo) westwards to Tema-Achimota-Kotoku-Huni Valley-Tarkwa-Omape for a total of approximately 498 km.
5	Extension of the Western Line	- Extension northwards of the original Western Line to reach and connect future mine developments. - The line starts from Awaso and extends towards Techiman, Sawla and Hamile for a total of approximately 729 km.
6	Extension of the Eastern Line	- This is the new route to the east of Ghana, near the border with Togo; that from Tema reaches the river port of Akosombo and then heads towards Ho and Yendi to the North, for a total of approximately 468 km.

Source: Railway Master Plan for Ghana, Final Report, December 2013

Figure 9.2 shows the extended railway network after the implementation of the Master Plan in six phases.

Figure 9.2: Map showing the expanded railway network



Source: Railway Master Plan for Ghana, Final Report, December 2013

9.4.3 Implementation of the Plan

Cost of the Plan

In effect, in the 1st Phase of the original Master Plan, 668 km of the existing narrow gauge line were to be rehabilitated, and in the subsequent 5 phases the network extended by a further 3,340 km of new lines and the first phase to be later converted to standard gauge. In 33 years, a total of **4,007 km** of lines will be constructed for an investment of **US$21,508 million**.

A further investment of US$53 million should be added for the management company operating under a PPP; about US$1,200 million for the rehabilitation and purchase of the freight and passenger rolling stock; and US$220 million for signaling and telecommunications. The breakdown of the cost is shown in Table 9.6. Also, the implementation programmes of the Ghana Railway Masterplan are shown in Figure 9.3.

Table 9.6: Cost Profile for Railway Investment 2015-2047

Phases –Lines	Length (km)	Financial Cost (US$)
PHASE 1: Expansion of existing line	**667.6**	**3,738,560,000**
1W -Old Western Line	**340**	**1,904,000,000**
1 - Takoradi - Tarkwa - Dunkwa – Kumasi	266.8	1,494,080,000
2 - Dunkwa – Awaso	73.2	409,920,000
1E -Old Eastern Line	**327.6**	**1,834,560,000**
1- Accra – Kumasi	303.9	1,701,840,000
2 - Achimota – Tema	23.7	132,720,000
PHASE 2:Eastern "A" Expansion	**1165.6**	**6,527,920,000**
2C – Kumasi – Techiman – Tamale	383	2,144,800,000
Tamale – Paga	212	1,187,200,000
Takoradi – Kumasi	266.8	1,494,080,000
Achimota – Kumasi	303.8	1,701,840,000
PHASE 3: Transversal Expansion	**486**	**2,721,600,000**
1 – Tamale – Yendi	102	571,200,000
2 - Fulfusu – Sawla	128	716,800,000
3 - Techiman - Atebubu – Kwadwokrom	198	1,108,800,000
4 - Nyinahin – Kumasi	58	324,800,000
PHASE 4: Trans ECOWAS Expansion	**455**	**2,548,000,000**
1 – Aflao - Tema	154	862,400,000
2 - Huni Valley – Kotoku	200	1,120,000,000
3- Tarkwa – Omanpe	101	565,600,000
PHASE 5: Western Expansion	**656**	**3,673,600,000**
2 - Awaso – Techiman	220	1,232,000,000
3 - Techiman – Sawla	223	1,248,800,000
4 - Sawla – Hamile	213	1,192,800,000
PHASE 6: Eastern "B" Expansion	**468**	**2,620,800,000**
1 - Tema – Ho	130	728,000,000
2 - Ho – Yendi	338	1,892,800,000
INFRASTRUCTURE INVESTMENT COST		**21,830,480,000**
* PPP/Management Contracting		53,000,000
*Procurement of freight and rolling stock		1,200,000,000
* Signal and telecommunications		200,000,000
TOTAL INVESTMENT COSTS		**23,283,480,000**

Source: Railway Master Plan for Ghana, Final Report, December 2013
* Additional items added by the Ghana Infrastructure Plan Team

Implementation Programme

Assuming that 2017 will be dedicated to studies of the Ghana Railway Master Plan and 2018/2019 for the assignment of the first construction contracts, the beginning of construction could begin in 2018/2019. A preliminary implementation schedule indicating in detail the execution items is shown in Figure 9.3. It is recommended that the government appoint a small committee comprising a restricted number of qualified people with strong technical background in management in both the public and private sectors to oversee the implementation. The Chairman of GRDA would be an ex-office member of the Steering Committee.

Figure 9.3: Ghana Railway Master Plan Implementation Programme and Related Investments

	Lines	Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
		L Km	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
			Construction new lines – Standard gauge																														
A	**PHASE 0: Feasibility Studies and Design**																																
B	**PHASE 1: Rehabilitation of existing line**	**667**																															
	1W – Western Line	**340**																															
	1- Takoradi – Tarkwa – Dunkwa - Kumasi	266																															
	2- Dunkwa - Awaso	73																															
	1E – Eastern Line	**327**																															
	1- Accra - Kumasi	303																															
	2- Achimota - Tema	23																															
C	**PHASE 2: Eastern "A" Expansion**	**1161**																															
	2W-Takoradi - Kumasi	266																															
	2E- Accra - Kumasi	300																															
	2C] Kumasi – Techiman – Tamale	383																															
	] Tamale - Paga	212																															
D	**PHASE 3: Transversal Expansion**	**484**																															
	1- Tamale - Yendi	102																															
	2- Fufulsu - Sawla	126																															
	3- Techiman – Atebubu - Kwadwokurom	198																															
	4- Nyinahin - Kumasi	58																															
E	**PHASE 4: Trans Ecowas Expansion**	**498**																															
	1- Afloa – Tema - Accra	185																															
	2- Accra - Takoradi	212																															
	3- Tarkwa - Omanpe	101																															
F	**PHASE 5: Western Expansion**	**729**																															
	1- Dunkwa - Awaso	73																															
	2- Awaso - Techiman	220																															
	3- Techiman - Sawla	223																															
	4- Sawla - Hamile	213																															
G	**PHASE 6: Eastern "B" Expansion**	**468**																															
	1- Tema - Ho	130																															
	2- Ho - Yendi	338																															
H	**PHASE 7: Suburban**																																
	1- Accra																																
	2- Kumasi																																
	3- Tamale																																
	4- Sekondi/Takoradi																																
	Total New Construction Km	**3,34**																															
	Grand Total (Rehabilitation+New Construction) Km	**4007**																															
J	**Procurement of Goods**																																
	Procurement of freight and rolling stock																																
	Signal and telecommunications																																

Yearly investment at constant rate (million US$)																																TOTAL m$
Feasibility Studies and Design																																
New Construction	632	632	523	488	727	727	727	727	716	716	476	476	476	457	457	457	575	812	428	496	935	935	902	939	1005	755	998	998	513	270	270	20243
Procurement of freight and rolling stock																																
Signal and telecommunications																																
TOTAL YEARLY INVESTMENT (m$)																																

Source: Railway Master Plan for Ghana, Final Report, December 2013 updated by the Ghana Infrastructure Plan Team

9.4.4 The Trans-ECOWAS Railway Line

Efforts toward the ECOWAS Initiative - Using Existing Central Line

The Railway Master Plan proposed an entirely new coastal line from Aflao through Accra and Cape Coast to Takoradi (Phase 4), a total distance of 498 km, to serve as the ECOWAS Line and discarding the existing Central Line from Kotoku to Huni Valley, a distance of approximately 200 km. This proposal will have to be evaluated for economic viability.

The proposed ECOWAS Line can thus be either of the following two line options:

A. Aflao-Tema-Achimota-Accra-Takoradi-Tarkwa-Prestea-Omape: Total distance approx. 498 km; or,

B. Aflao-Tema-Achimota-Kotoku-Tarkwa-Prestea-Omape: Total distance 511 km.

The Master Plan stated cost as the main reason for selecting the coastal line option for the Trans-ECOWAS Line, but the distance between Kotoku and Huni Valley compares favourably with that between Accra and Takoradi. Besides, an existing right-of-way is available for the Central Line. Furthermore, allowing trains from the Trans-ECOWAS Line to pass through the Takoradi–Tarkwa section in addition to existing Western Line trains has the potential of creating congestion along that corridor. It would not be in the interest of the State to cut off people along the existing central corridor, which has a poorer road transportation network than those along the coast from Accra to Takoradi, from accessing train services.

A well-paved road network exists between Accra and Takoradi (228 km) and transport accessibility is generally adequate and easier. While there is not much heavy agricultural activity, the right-of-way needs to be acquired. On that basis, it can be conjectured that it will be more expensive to construct the coastal line. While the Master Plan identifies cost and difficulty in construction as the main reasons for the coastal line option, on the contrary, it could be cheaper and easier to build along the existing Central Line since the right of way is already available. It is therefore recommended that the use of the Central Line for the Trans-ECOWAS railway line should be revisited in future. It is noteworthy that Option A traverses 4 regions — Volta, Greater Accra, Central and Western Regions, while Option B traverses 5 regions — Volta, Greater Accra, Eastern, Central and Western Regions.

The Master Plan also proposed in Phase 5 the Western Expansion linking Dunkwa–Awaso–Hamile. Awaso is very important because of bauxite mining therefore modernisation of the Dunkwa–Awaso Line should be tackled in Phase 1. Consequently, the Western Expansion proposed in this phase should be from Awaso to Hamile. Finally, Phase 6 of the Master Plan proposed the Eastern Corridor Line from Tema through Akosombo to Yendi and to Tamale. In October 2016, Ethiopia and Djibouti launched the first fully electrified cross-border railway line in Africa. ECOWAS should be able to undertake a similar venture by 2035.

Figures 9.4 shows some railway stations in developed countries and Figure 9.5 shows a futuristic train that could be considered for the modernised railway system of Ghana.

Figure 9.4: Some Railway Stations in Developed Countries

Source: Google Images

Figure 9.5: Ghana Train by 2020

Source: Google Image

ECOWAS Railway programme

ii. There is no real regional rail network in the ECOWAS area. Since 2009, ECOWAS has been pushing for the interconnection of the rail networks that exist in 11 of its 15 member states. But unlike in Southern Africa, where intra-regional rail networks are well developed and integrated, in West Africa the rail systems are mostly fragmented and operate on three different rail gauges. Most francophone countries' rail gauges are 1,000 mm wide, but Ghana and Nigeria rails 1,067 mm wide, while Guinea and Liberia use the standard 1,435 mm width. The ECOWAS region is working on a programme to enable all West African countries to use the standard 1,435 mm width.

ii. A proposed 1,178 km-long ECOWAS coastal railway system is expected to connect Nigeria to Benin, Togo, Ghana and Côte d'Ivoire. The coastal rail line project carries hope for the entire region, in part because its completion would demonstrate that the once insurmountable technical challenges can be overcome.

iii. The project is expected to transform the region's transportation system by launching a new higher-speed passenger and goods train services. This will allow large container ships to concentrate on a smaller number of ports, thereby increasing efficiency and reducing the costs of international trade. It is also to facilitate a major industrialisation of West African countries, improve transportation of agricultural produce, and create immediate economic emancipation for more than 300 million people within the sub-region. It will also ease the numerous transportation difficulties inhibiting economic development in the sub-region.

9.4.5 Technical Considerations

Environmental Health and Safety

It is the responsibility of the state to provide the safest railways possible at present. State and regulatory agencies have to ensure that the railway system is safe for passengers, provides a safe working environment for staff, and also protects the environment along which the railway system operates. Safety is expensive but the absence of good safety practices can negatively affect all aspects of railway development.

Development of the railway system should include establishment of a Safety Department responsible for monitoring and ensuring good safety practices at all levels in the railway operating companies. Safety practices of the operating companies will be supervised by the Railway Safety and Security Inspectors who will be appointed by the Ghana Railway Development Authority (GRDA), the holding company, as provided for in Section 61 of the Railway Act, 2008

Staff Levels

Staff levels must be predetermined strictly in accordance with resources and business availability. This will ensure that no more than 20% of revenue goes into staff emoluments and other staff-related packages, according to global best practices.

Passenger Train

Steps need to be taken to set minimum standards that will help recapture lost traffic. A well-run passenger train service bolsters the image of the railway system and has the capability to attract more profitable freight traffic. Accra and Kumasi being the two largest and most populated cities in the country, the potential for successful passenger train services between them is very high in spite of the relatively short distance between the two cities. It should be noted that no public road transport vehicle can comfortably make the Accra-Kumasi journey in the 3.5 hours that can be achieved by an express train.

Freight Trains

A freight train or goods train is hauled by locomotives on a railway, transporting cargo between the shipper and the intended destination as part of the logistics chain. It is expected that the rail operation will be able to penetrate the freight corridor and recover business lost to road transport.

The following are suggested:

i. Bulk goods marketing companies such as Cocoa Marketing Company, Bulk Oil Storage and Transportation Company and some of the major shipping companies can be invited to participate as shareholders;

ii. Companies that do business with railways must be encouraged to own their own specialised wagons. This will go a long way to commit them to using rail services;

iii. Rail freight charges must be lower than road transport charges by at most 20% in the initial stages to attract more traffic to rail. With fixed costs as high as about 60%, rail can still carry more goods at relatively lower rates and be profitable. The target is for the operating companies to recover their variable costs, and part of the fixed costs;

iv. It should be ensured, possibly by legislative instrument, that all container traffic to Boankra and other inland ports anywhere in the country is made by railway;

v. Modern, faster handling equipment must be installed at all terminals to ensure faster turnaround of wagons.

Train Speed

In order for existing locomotive drivers get used to running trains at higher speeds, the maximum speeds of passenger trains should be gradually moved from 80 km/h to 160 km/h within a specified period. Locomotive drivers must be given proper orientation before being allowed to handle high-speed trains. Fencing of the track in densely populated areas will be necessary to prevent accidents that can delay train movements.

9.4.6 Efficiency Indicators

Signalling and telecommunications

An effective signaling and communications system is necessary to monitor train performance in transit to ensure train timetables are maintained. It is critical to ensure that the right types of equipment are acquired.

9.4.7 Identification of Project Implementation Risks

The following risks factors have been identified and must be mitigated:

Technical

i. For standard gauge lines, the specifications conform to that of the railways in most developed countries;

ii. For the stations, adoption of European railway standards (in line with UIC recommendations) for the stops, secondary and main stations;

iii. For signalling and telecommunications, adoption of a network for long-distance data transmission for every type of communication — voice, video service, data etc.

Financial

There could be cost overruns that will make the project more expensive. Determination to make the project financially viable may call for high fares, which can affect demand, with social and political implications. The state of the economy has implications on patronage and fares to be charged to make the project financially viable.

Safety

Consider one passenger train with 12 or more coaches carrying over 1,000 passengers. Careful planning is required to keep the railway safe when it is expected to travel at speeds of up to 160 km/h. Careful planning during construction and operation are essential to keep the railway system safe and reliable. The technical complexities of modern rail projects make the integrity of the rail system of utmost importance. Safe construction practices as well as testing and commissioning systems will be agreed before any construction begins.

The current practice of the rail track being traversed indiscriminately by human and animal traffic poses a serious safety risk. The position of level crossings, whether at grade, underground tunnel or grade separation will be carefully decided, taking safety and cost into consideration. The speeds at which the trains will run will affect not only the technical specification of the track but also the affect demand, with attendant safety implications.

Social and Cultural

Risks due to re-routing and legal actions against the project because rail tracks have to pass through heritage sites such as cemeteries, shrines, forest reserves, and private properties and built-up areas will need to be accommodated. This is very much expected when the tracks have to pass through areas where a new right-of-way is acquired and opposition should be expected from people in instances where the project cuts through villages.

Political

The project spans 30 years and will necessarily traverse the tenure of different governments. The risks of discontinuation are ever present.

Regulatory

The Government will review the Railways Act 2008, (Act 779) by 2018 to separate the regulatory function of the Ghana Railway Development Authority (GRDA) from its mandate of improving railway assets and promoting the development and management of the sub-urban railway systems. The role and interests of various ministries such as Transport, or Finance, or Roads and Highways, and other related ministries will have to be negotiated and accommodated where feasible. The Office of the President must be available to iron out all outstanding issues.

9.5 Promoting Multi-Modal Transportation

Intermodal transport will be promoted under the plan. Intermodal transport, also known as Intermodalism or multi-modal transport infrastructure allows the use of at least two different modes of transport in a trip from origin to destination. Intermodal transport enhances the economic performance of a transport chain by using modes in the most productive manner. For example, the line haul economies of railway may be exploited for long distances, with the efficiencies of taxis, buses and trucks providing flexible local pick-up and delivery.

The Ghana Infrastructure Plan recommends that the following actions:

i. Connect the railway network to the quayside in both ports at Takoradi and Tema;

ii. Connect the railway network to all existing airports and future ones;

iii. Connect the railway network to the inland port (or dry port) at Boankra and all such facilities established in future;

iv. Connect the railway network to all major road transport terminals;

v. Connect the railway network to major lake transport terminals.

Additionally, it is recommended that all railway terminals or stations in the major cities and towns should be located within the Central Business District. Suburban trains can then be organised as feeders to the main stations. Where the Central Business District is inaccessible by surface trains, the underground line and station option should be pursued. Furthermore, the law in Ghana mandates accessibility for people with disabilities. Considerations include making all facilities accessible to people with all forms of disability.

9.6 Suburban Railway Network

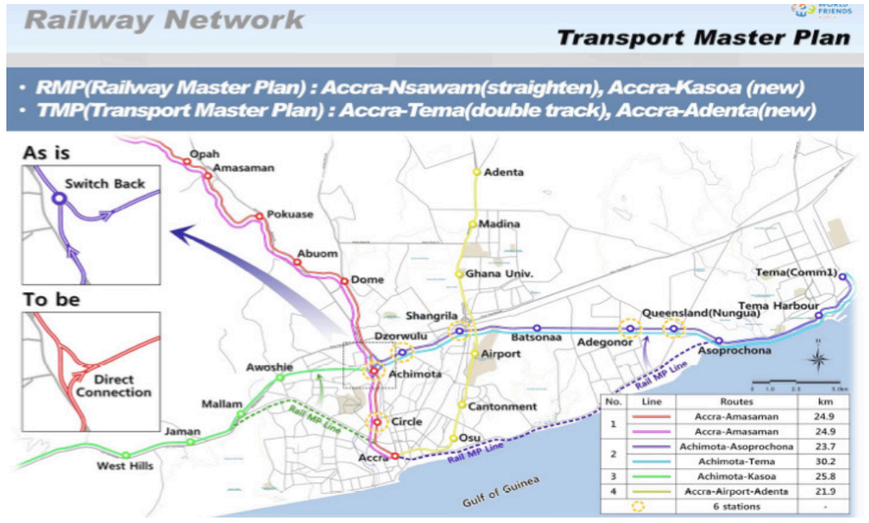
9.6.1 GAMA Railway Network

The Greater Accra Metropolitan Area (GAMA) has two railway lines adding up to about 55.1 km. These are the Accra - Nsawam line, and the Accra - Tema line. Both lines have a single track and use the same track from Accra station to the Achimota Overhead junction. As of end 2016, the Accra-Nsawam Line has 1 train, 5 stations and 9 halts, while the Accra-Tema Line has 2 trains, 7 stations and 6 halts. The railway lines are narrow gauges.

Given the long-term vision to make rail transport the main mode of public transport in the metropolis, GAMA aims to turn the existing railway line into a standard gauge and double-track railway.

The GRDA has prepared a Railway Master Plan for the entire nation. In this plan, which has been approved by the government, priority has been given to the rehabilitation, extension and development of the national network, taking ECOWAS standards into consideration and incorporating the needs of the northern part of the country as well. There is also a plan for a new inter-state railway line between Takoradi and Tema, passing through the Greater Accra Region, using the Labadi corridor. Figure 9.6 shows the schematic layout to improve the existing GAMA Railway Network as proposed by the Transport Masterplan Project of Greater Accra Metro Area Region.

Figure 9.6: GAMA Railway Network



Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

Railway Condition and Target

The GAMA reports states that the existing indicators for GAMA such as railway length and others are below the world average. Therefore, to boost its capacity in order to reach its target of achieving Accra's comparative high-income capital city public transport system, GAMA has to introduce about 250 km of railway route. The prevailing reality against the target that GAMA desires to attain by the end of the plan period is shown in Table 9.7.

Table 9.7: Railway Conditions and Target of GAMA

Class	GAMA's Status	GAMA's Target	Remarks
Railway Route (km)	55.1 km (20%)	**128 km by 2035, 250 Km by 2047**	Construct New Line
Urban density (persons/ha)	31.6% (73%)	**Transit Oriented Development**	Urban structure of low density (Sprawl)
Public transport (journeys/persons)	52.1% (49%)	**Transit Oriented Development**	Hub & Spoke, Improve public transport

Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

Improvement of Railway Network

GAMA will therefore extend its urban railway system from 55.1 km to 127.7 km by 2035. In view of this, one axis additional to both the north-south axis and west-east axis, and use of both the Labadi-Teshie and the Kwame Nkrumah Motorway corridors are recommended.

The installation of a side-track in 2 stations as well as 4 halts, to boost train operations in the short term are also recommended. In the long term, however, the recommendation is to construct a subway (due to the traffic conditions) from Adenta station to the Accra station using the Liberation corridor, while ensuring that all tracks are improved to the standard of double tracks. Table 9.8 summarises some of the improvement for the railway network in the GAMA report. The GIP team has further planned the overall GAMA network expansion to 250km by 2047 (see Box 2).

Table 9.8: Improving Railway Network in GAMA

Improvement for Railway Network

- ***length : 55.1 → 127.7km., Short-term : station improvement, frequency increase***

No	Line	Km	Project	Track	Target year	Remarks
1	***Accra-Amasaman (Accra-Amasaman-Kumasi Line)***	***24.9 (328.0)***	***Rehabilitation***	***Single***	***Short-term***	***Rail MP***
	Accra-Amasaman (Accra-Amasaman-Kumasi Line)	24.9 (300.0)	Expansion	Double	Mid-term	Rail MP
2	***Achimota-Asoprochona***	***23.7***	***Rehabilitation***	***Single***	***Short-term***	***Rail MP***
	Achimota-Tema (Accra-Tema-Aflao Line)	30.2 (185.0)	Expansion	Double	Mid-term	Change of Rail MP
3	Achimota-Kasoa (Accra-Capecoast-Takoradi Line)	25.8 (212.0)	Construction	Double	Long-term	Change of Rail MP
4	Accra-Airport-Adenta	21.9	Construction (subway)	Double	Long-term	New
-	***Circle,Achimota, Dzorwulu, Shangrila, Adegonor and Queensland station***	***6 stations***	***Station Re-building***	***Double***	***Short-term***	***New***

※ *Rail MP : RAILWAY MASTER PLAN OF GHANA, 2013, Ghana Railway Development Authority*

Source: The Transport Masterplan Project in Greater Accra Region, Final Report (Draft), 2016

Box 2: The Proposed Accra Suburban Railway System

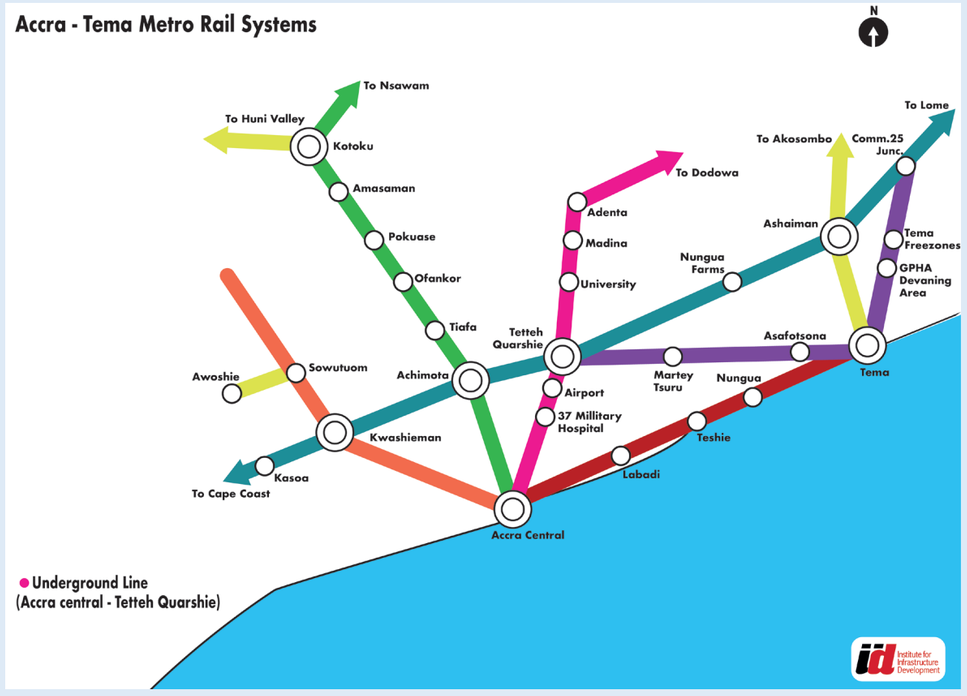
The Accra suburban railway system will largely be passenger rail transport services of length 250km that will operate between the city centre, Tema and other outlying suburbs that draw large numbers of people who travel on a daily basis. The development of the Accra suburban railway network will be linked with the planning and redevelopment of a new Accra city urban master plan. The Accra lines will have a combination of surface, underground and overhead rail lines across the city.

The line will adopt a train service that supports intermodal transport of both goods and people from the port to the inland areas of Accra and Ghana in order to ease the pressure on road travel. It will also accommodate part of the trans-ECOWAS railway route.

According to the Transport Master Plan for the Greater Accra Region (2016), GAMA's railway length in metres per 1,000 persons is 20% of comparative world cities. This means 275 km of railway routes have to be constructed in GAMA to meet the average of world cities. The current railway length is 55.1 km and the length proposed, based on Ghana's high-income aspiration is 250 km.

The Accra map in Figure 9.7 adopts the recommendations of the RMP and the Transport Master plan for the Greater Accra Region. The construction of the railway lines will influence the redevelopment of the GAMA area and harness its tourism potential.

Figure 9.7: Schematic Layout of the Proposed Accra Suburban Railway System



Source: Ghana Infrastructure Plan Team

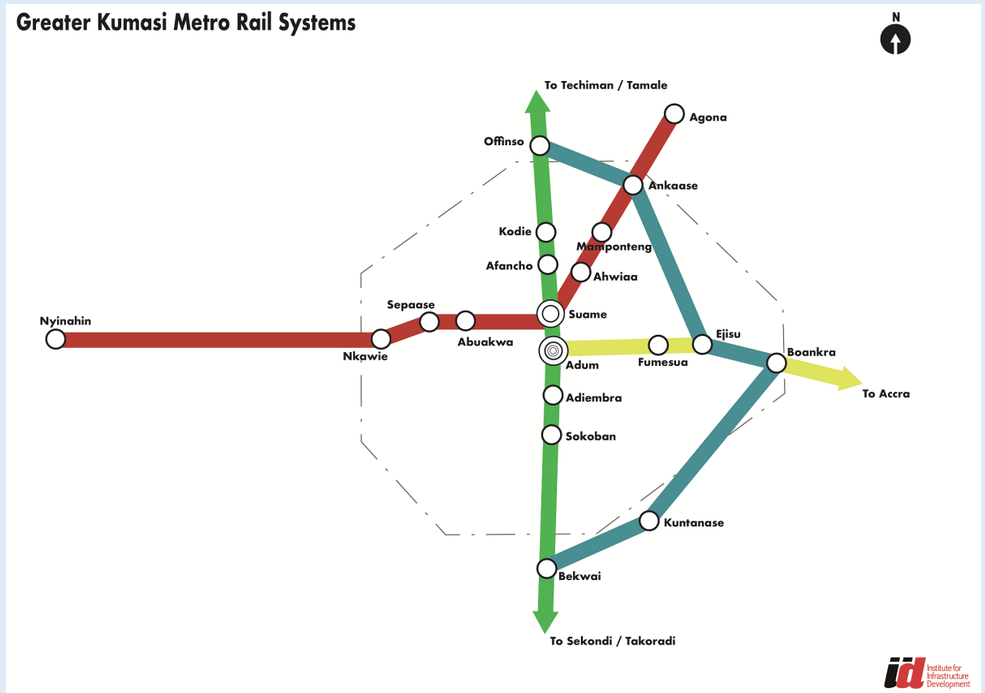
Box 3: Greater Kumasi Suburban Railway System

The estimated length of the proposed Greater Kumasi Metro Railway System is 150 km. One of the two major terminals at Adum and Suame is expected to serve as the Central terminal. The Adum Terminal will serve passenger and freight transport from the Eastern Line and Western Line while the Suame Terminal will serve traffic from the Western line to the Central Spine Expansion in the north and the Transversal Lines.

There are two proposed bypasses from Ejisu to link with the Central Spine Expansion (Kumasi to the north) and the Western Line (Kumasi to Takoradi). These lines will also facilitate the transport of cargo directly from Boankra dry port. The proposed line from Ejisu linking the Central Spine Expansion will have a freight station at the proposed new Kumasi Airport at Ankaase.

A transversal line to Nyinahin is planned in the RMP, originating from Suame Terminal and passing through Abuakwa, Sepaase and Nkawie to Nyinahin. This line will serve both suburban passenger service and freight services, especially for the huge bauxite deposit at Nyinahin. Another proposed transversal line is to link Suame to Agona. This line will be necessary to provide suburban passenger and freight services along that corridor. Due to the massive difficulties in the right-of-way, the development of the railway system shall be tied to the preparation and construction of a new urban master plan for Greater Kumasi. Figure 9.8 shows the schematic layout of the proposed Greater Kumasi suburban railway network.

Figure 9.8: Schematic Layout of the Proposed Greater Kumasi Railway System



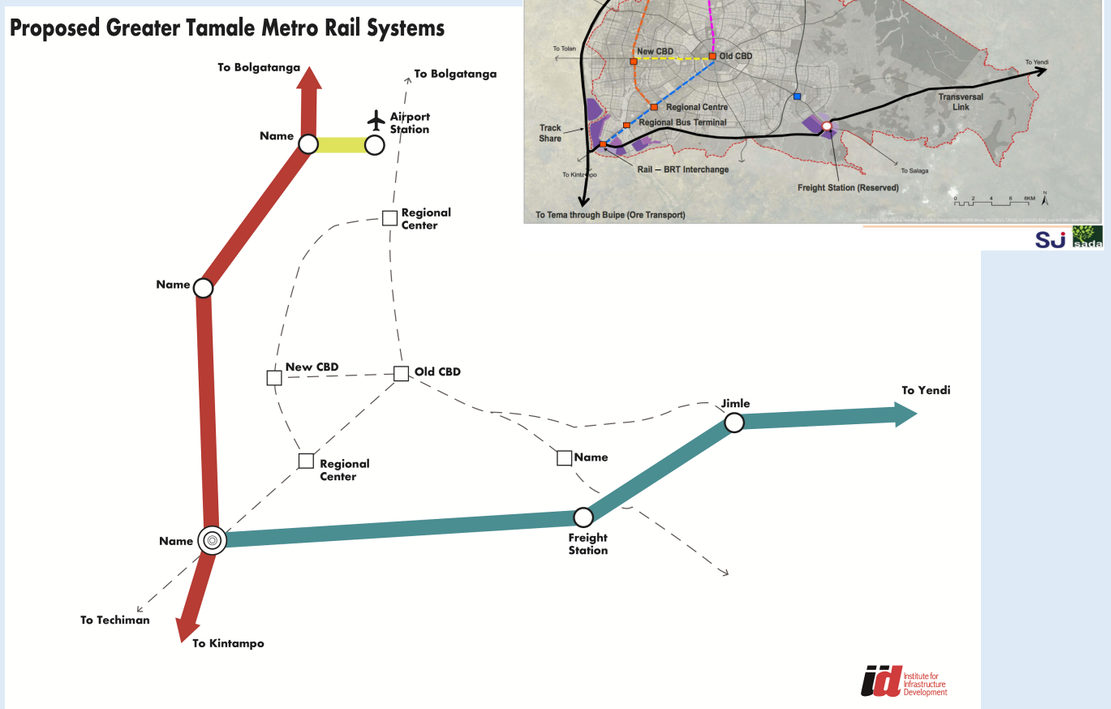
Source: Ghana Infrastructure Plan Team

Box 4: Greater Tamale Metro Railway System

The estimated length of the proposed Greater Tamale Metro Railway System is 85 km. There are two proposed railway lines that pass along the periphery of the Tamale Metropolitan Area. These lines will be integrated with Bus Rapid Transit (BRT) systems to facilitate efficient inner-city intermodal public transportation.

One of the lines branches from the Central Spine Expansion eastward to Yendi with a proposed freight station on that corridor. This line has the potential to service future light industries and link up with the huge iron ore deposits at Shieni in the Zabzugu-Tatale district. The other line branches westward and then turns northward towards Bolgatanga. On that line, two stations will serve the railway system: one at the central terminal which will serve as the Rail-BRT interchange and another station will be located close to Tamale Airport to facilitate freight and cargo transport. Figure 9.9 shows the schematic layout of the proposed Greater Tamale suburban railway network.

Figure 9.9: Schematic Layout of the Proposed Greater Tamale Railway System



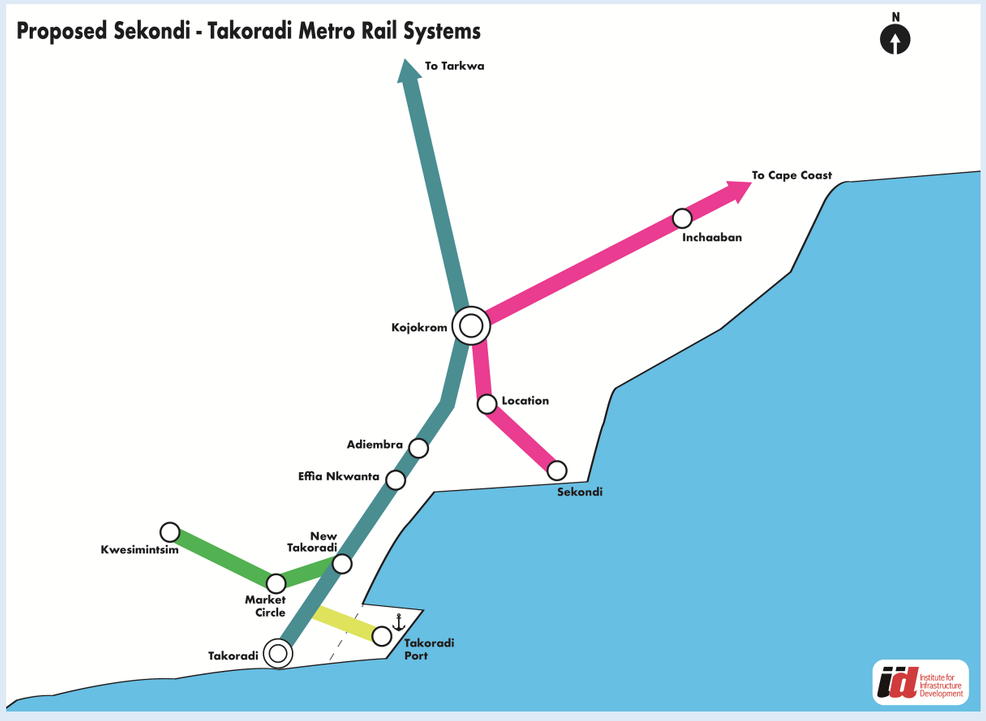
Source: NSEZ Concept Master Plan Report, 2016 adapted by the Ghana Infrastructure Plan Team

Box 5: Sekondi-Takoradi Metro Railway System

The estimated length of the Sekondi-Takoradi Metro Railway System is 35 km. The central terminal is proposed at Kojokrom. The main workshop headquarters of the Ghana railway system is at Location. The Western Line will facilitate freight transport to and from Takoradi Port to Kumasi and beyond. It will also provide suburban passenger services for towns on the route to Takoradi. A proposed railway line from Cape Coast will provide suburban passenger and freight services for towns such as Inchaban and Shama on that corridor.

A recently constructed suburban railway line links Kojokrom to Sekondi. This line provides both passenger and freight services, especially for the Sekondi Fishing Harbour. Another suburban line is proposed to link New Takoradi to Kwesimintsim with a proposed halt close to Market Circle. This line will cater for suburban passenger services for the increasing volume of passenger traffic along that corridor. Finally, over the long term, the Sekondi-Takoradi line will be developed westwards to link the emerging oil and tourism towns of Cape Three Points, Princess Town, Domunli, Esiama, Atuabo and Half Assini. Figure 9.10 shows the schematic layout of the proposed Sekondi-Takoradi metro railway network.

Figure 9.10: Schematic Layout of Proposed Sekondi-Takoradi Metro Railway System



Source: Ghana Infrastructure Plan Team

9.7 Organisational Structure of the Future Ghana Railway System

The implementation of the Master Plan will give Ghana a modernised standard-gauge rail infrastructure (single, dual and multiple tracks of 4,007 km minimum, terminals, signals and telecommunications) and rolling stock. The total length of 4,007 km is large to be effectively operated under centralised management.

The proposed Ghana Railway System will thus be converted into a holding company with five separate business centres for effective operations, monitoring and control.

The proposed five entities are as follows:

i. The Eastern Railway Line;

ii. The Western Railway Line;

iii. The ECOWAS Railway Line;

iv. Sub-Urban Rail System;

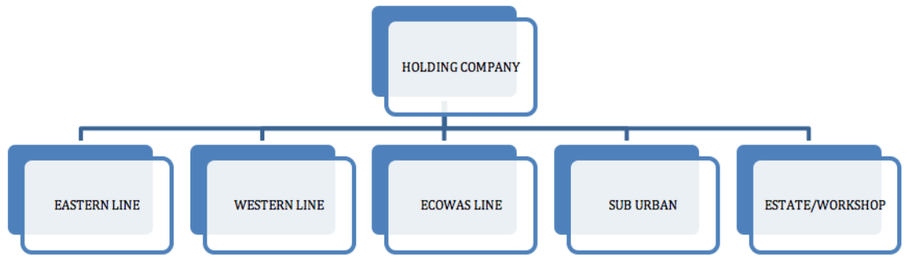
v. The Workshops/Estate Company (non-core).

9.7.1 The Holding Company

The government of Ghana will own the railway infrastructure and set up an authority or holding company to regulate and assure safety in the operations of the various companies likely to participate in the new railway system. The holding company will also be responsible for fixing fees to be levied on the train operating companies for using the railway infrastructure.

When the government decided to encourage private participation in railway operations, a new company was formed under the Railway Act 779 of 2008 called the GRDA. Under the law, the Authority was to own the railway infrastructure on behalf of the State, regulate all train operators, charge appropriate fees for using the infrastructure and assure passenger and fleet safety. The Government is in the process of reviewing the Railways Act to separate the regulatory function of GRDA from its mandate of improving railway assets and promoting the development and management of sub-urban railway, to be completed by end of 2017. The relationships among the companies are shown in Figure 9.11.

Figure 9.11: Organisational Structure of Future Railway System



Source: Source: Railway Master Plan for Ghana, Final Report, December 2013

9.7.2 The Workshops/Estate Company

The Location Workshops in Sekondi will be refurbished to handle all heavy maintenance schedules The Location Workshops in Sekondi will be refurbished to handle all heavy maintenance schedules to general overhaul for the operating companies for a fee. The operating companies can then focus on trip schedules and minor maintenance as specified in the rolling stock manuals. The Location Workshops need to be retrofitted to manufacture spare parts for the general public, as was the case in the past. The Location Workshops setup can be replicated at Kumasi or Tamale, for example, to serve the northern sector.

Currently, Ghana Railway Company Limited (GRCL) possesses 2,643 buildings out of which 1,923 are residential units. Most of the buildings are in various stages of disrepair. The railway operating companies can select from the stock of available buildings needed for their operations, and the remainder pooled and managed by an independent estate company. More buildings will be needed for operations on the extended infrastructure and an Estate Company will be in a better position to organise this business.

A school focused on railway studies will be developed and affiliated to one of the existing universities to undertake formal post-graduate studies in railway engineering, economics and finance. GRCL also has a Training Institute that will be modernised into a centre of excellence for the training of railway staff on short-term course basis.

9.8 Delivering Rail Projects in Ghana

Railway projects are complex and fraught with financial, economic and technical challenges. Elsewhere, central and regional governments as well as private sector developers or investors implement railway projects. In Ghana, this is the first time the private sector is being called upon to participate in large-scale railway projects. It is important at this stage to consider some of the key factors that will determine the extent to which the railway project will be successful and that will need the expertise of the private sector.

9.8.1 Land Acquisition

Large-scale railway projects usually require land acquisition and displacement of homes and businesses, and involuntary resettlement of local populations. While governments may have the authority to acquire land when needed for development purposes, land acquisition often causes controversy, as the associated human costs may be much more than the monetary compensation available. Moreover, in countries without clear land acquisition laws, the challenge is complex.

Transparent and tested land acquisition laws and agreements between stakeholders over fair compensation play a crucial role in the timely and successful completion of railway projects. This is an even more crucial issue if private investment is funding the project as it can increase risks and create uncertainty around the project timelines. Slow land acquisition and land clearance issues are often major reasons for the delay or cancellation of railway projects. It is expected that the State will by legislation, formally acquire all the lands wholly or in sections for the project.

9.8.2 Allocating Risk Correctly

The private sector has a role to play, since governments alone cannot deliver railway projects. Private sector involvement can be through construction companies, systems suppliers, rolling stock manufacturers, private finance and numerous services associated with railway development. For the private sector to get involved in the project and provide value for money to the government, the allocation of various project risks will be done correctly.

9.8.3 Securing Funding

Transport infrastructure is a public good and the services benefit a large number of people. Hence, it is not just the financial returns, but also the social benefits that need to be considered when planning such projects. Prior to starting any railway project, the government will undertake feasibility studies to fully understand the funding requirements of the project and the key sensitivities to the project's finance on the budget. The private sector can then be invited to participate in sections of the programme on Build, Operate and Transfer (BOT) or other appropriate basis.

9.8.4 Integration with other Modes of Transport

Economic growth and increasing pressures in the urban areas of Ghana emphasise the growing need for public transportation. Different modes of mass transit may be feasible and most appropriate in different areas of cities. A successful urban public transport strategy will offer convenience to the public by implementing integration of one mode with other modes so that people are more willing to switch to public modes of transport from private ones.

9.8.5 Public Acceptance

A major public infrastructure project such as railway development is a huge investment. For instance, the government is accountable to the public on why there should be an investment in railways instead of in other equally pressing public sector needs, e.g. education, health or agriculture. Public acceptance is a key element for successful initiation and implementation of any railway project.

9.8.6 Location Workshops

The Location Workshops that were core to the old railway network, are proposed to be a separate cost centre to enhance efficiency of operations. Their mandate remains the same, overseeing heavy maintenance schedules for the railway companies. The others are the Estate Division, the Stores Division and the railway research body.

9.9 Financing the Ghana Railway Master Plan

9.9.1 Establishment of a Special Purpose Vehicle

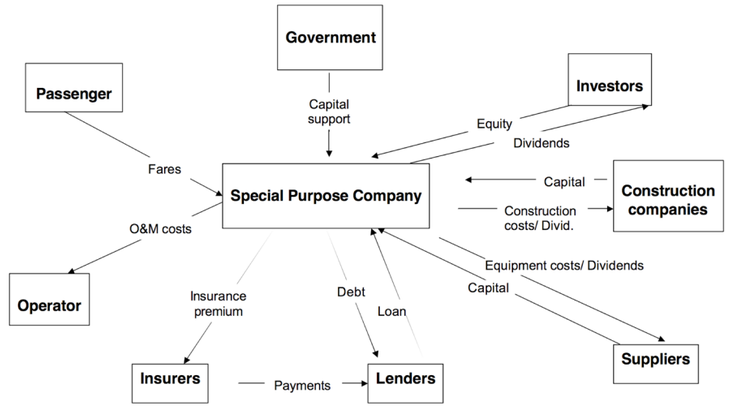
The implementation of the Ghana Railway Master Plan will require huge investment outlays for construction of new railway stations, purchase of rolling stock, signals and telecommunications equipment, restoration of maintenance workshops, logistics platforms and machinery for cargo handling. Ghana's public finances are inadequate to meet all the huge infrastructure expenses.

Since railway infrastructure has long life-cycle costs, it is financed by both project equity and debt. Debt funding involves flexible instruments and may take the form of bank loans and/or bond issuance. Bonds typically exhibit interest rate certainty, have the potential to be low rated, and can be used on more than a single project[1].

Figure 9.12 shows a typical framework for financing railway transactions by public and private stakeholders. The institutional investors and lenders (e.g. insurance companies, investment and pension funds) presenting long-term liabilities are more willing to assume long-term commitments in project financing, especially when the construction phase of the project is over.

Collaborative infrastructure investments reduce the public sector borrowing requirements and the public debt ratio.

Figure 9.12: A framework for Railway PPP financial transactions model



Source: Association for European Transport, 2003

9.9.2 Public Private-Sector Partnership

The adoption of PPP procedures will help to reduce the overall capital burden of railway development on the public purse, and allocate revenue-generating activity to the private sector. The government will unbundle railway infrastructure (land, stations, rights of way, etc.) from rolling stock and other train services equipment.

Unless otherwise agreed, the government will continue to own the railway infrastructure through the revised Railway Act. The GRDA will remain the holding company, subletting safety and environment regulatory oversight to private companies. GRDA will also confer the railway infrastructure to a public company, the GRCL, and assure the competition in railway usage for different private or public train operators.

1 Deloukas, A., Apostolopoulou. E. (2003), "Innovative Financing Techniques: European Urban Rail Projects and the Case of Athens Metro Extensions", Association for European Transport, 2003

The GRCL could also be one of the railway operators, and/or eventually offer workshop maintenance services for rolling stock.

The concession for the redevelopment of the railway system will be granted through bidding to the major users, mostly mining companies or freight carriers. The government should, in any case, try to extract the highest possible value from the concession, negotiating comprehensive mining and railway development agreements rather than separate mining or railway licenses, and acting to guarantee also the possibility of passenger train services accompanied by PSO (Passenger Service Obligation) contributions. The entire operation will be carried out with the active participation of Ghanaian building industry professionals (planners, architects, engineers, etc.) as well as contractors and service professionals during the design, construction and operation phases.

9.9.3 Land Leases and Tax

The land value increase around the railway lines and stations produces positive externalities that will be internalised to fund part of the investment. Land surplus value may be captured either by moderate leases or taxation or by voluntary cost-sharing for joint development purposes with real estate companies, industries, industrial farming complexes, etc. These non-core activities are expected to generate tremendous revenue for the company.

It is expected that mining companies, major construction and logistics companies and other commercial entities will participate with equity capital in the concession structure. The efficiencies from such integrated value chain create economic gains if properly harnessed. The revival of the railway system is of interest to the major users, e.g. petroleum and mining companies, agricultural exporters, construction companies etc., because they do not have any 'traffic risk', since they are transporting mainly their own products, which amounts they know very well.

9.9.4 The Railway Development Fund

The Ghana Railway Act that established the GRDA has vested all regulations, ownership and development of the railway assets in Ghana to that Authority. The Railway Act 2008 stipulates the setting up of a Railway Development Fund in addition to other sources for funding rail infrastructure development, such as the following:

Proceeds received by the Authority from the disposal of assets;

Proceeds received by the Authority from investments;

Allocations provided by the Minister for Finance with the approval of Parliament for the funding of railway development or for a specific project under the Fund;

Levies approved by Parliament;

Loans granted for the purposes of the Fund; and

Grants, gifts and income from other sources received for the purpose of the Fund.

There might be the need to revise the Railway Act 2008, to reflect the new and improved railway network, and include fuel tax as a source of funds.

If Ghana wishes to have a rail system similar to systems in high-income countries, then the country's gross national income (GNI) should rise to the level of the advanced nations so that it will not rely solely on foreigners for financial support to run the railway. Ghana is currently classified as a lower-middle income country with a GNI per capita of $1,400. Fortunately, the LTNDP is focused on increasing the per capita GNI to US$62,000 over the long term.

9.9.5 Recommendations

As a recap, the following points will be adopted for establishing a viable and self-sustaining railway system in the country:

i. The Government of Ghana will build and own the modern railway network as proposed in the Master Plan and allow private investors to use the infrastructure at an agreed fee;

ii. Ghana's tertiary engineering institutions will be supported to design courses to train students and practising professionals in railway technology in order to build capacity for the country's railway industry;

iii. Retooling and upgrading of the Railway Institute will be done to further train professionals in railway networks and businesses;

iv. Ghana will explore the need for further increase in railway coverage beyond 30 years after implementing the Railway Master Plan;

v. Finally, the country will upgrade and re-tool the Location Workshops, near Sekondi, as a separate business centre to manage the maintenance of rolling stock.