East African Community Secretariat

THE EAST AFRICAN TRADE AND TRANSPORT FACILITATION PROJECT

EAST AFRICAN TRANSPORT STRATEGY AND REGIONAL ROAD SECTOR DEVELOPMENT PROGRAM

FINAL REPORT
PART II: EAC REGIONAL TRANSPORT STRATEGY
MARCH 2011

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STRUCTURE OF DOCUMENT

This report is made up of four parts:

- ***Part I*** provides the general background to the study. It reports on the analyses that are common to and form the foundation of the Transport Strategy and Roads Development Program, including the regional corridors, the economy and demography of the region, transport demand and transport modelling, and the principles for project identification and prioritisation.
- ***Part II*** (this document) is the Transport Strategy. It covers the policy/institutional arrangements in the transport sector in the EAC and its member countries. It then provides an overview of regional issues and identifies regional interventions in each of the transport modes, i.e. roads, rail, ports, pipelines, airports and border posts. It concludes by presenting the prioritised interventions together with an implementation approach.
- ***Part III*** is the Roads Development Program. It covers the regional roads network, and analyses roads needs from capacity and condition perspectives. It also develops some cross-cutting themes (regional roads classification system, regional roads management system and regional overload control). Regional roads projects are identified and described.
- ***Part IV*** is the list of transport projects, together with short profiles for the priority projects.

Parts II and III are drafted so that they can be read stand-alone, i.e. in isolation of the other three parts.

TERMS & ABBREVIATIONS

AADT	Annual average daily traffic
ACC	Area Control Centre
ADT	Average daily traffic
AfDB	African Development Bank
AICD	Africa Infrastructure Country Diagnostic
ANS	Air Navigation Service
bcf	Billion cubic feet
BOF	Berth Occupancy Factor
bpd	Barrels per day
CASSOA	Civil Aviation Safety
CCTFA	Central Corridor Transit Transport Facilitation Agency
CNS/ATM	Communication, Navigation and Surveillance in Air Traffic Management
COMESA	Common Market for Eastern and Southern Africa
DFI	Development Finance Institution
DRC	Democratic Republic of Congo
EAC	East African Community
EACDF	EAC Development Fund
ESA	Eastern and Southern Africa region (COMESA, EAC, IGAD and IOC)
FEU	Forty Foot Equivalent Unit
FIR	Flight Information Region
FONA	First order network assessment
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
GIS	Geographic Information System
ha	Hectare
HCM	Highway Capacity Manual
HDM	Highway Design and Maintenance
ICA	Infrastructure Consortium for Africa
IGAD	Inter-Governmental Authority for Development
IOC	Indian Ocean Community
IPPF	Infrastructure Project Preparation Facility
IRI	Roughness indicator and ride quality
JCA	Joint Competition Authority
JTC	Joint Technical Committee (on road transport)
KeNHA	Kenya National Highways Authority
KeRRA	Kenya Rural Roads Authority
km	kilometre
KOJ	Kurasini Oil Jetty
KOT	Kipevu Oil Terminal
KPC	Kenya Pipeline Company
KPC	Kenya Pipeline Company
kph	Kilometre per hour
KPRL	Kenya Petroleum Refineries Ltd

KRB	Kenya Roads Board
KRC	Kenya Railway Corporation
KURA	Kenya Urban Roads Authority
KWS	Kenya Wildlife Service
LOS	Level of Service
m	Metre
MCA	Multi-Criteria Analysis
Mlb	Million pounds
MOU	Memorandum of Understanding
Mt	Million Tonnes
Mtpa	Million Tonnes per annum
NCTTCA	Northern Corridor Transit Transport Coordination Authority
NEPAD	New Partnership for Africa's Development
NG	Narrow Gauge
OD	Origin destination
OLC	Overload Control
OSBP	One Stop Border Post
pa	Per annum
pax km	Passenger kilometres
pax/ann.	Passengers per annum
PFF	Programme Finance Facility
PFI	Private Finance Initiative
PHF	Peak hour factor
PICU	Project Implementation and Coordination Unit
PIDG	Private Infrastructure Development Group
PMMR	Performance-based Maintenance and Management of Roads
PPIAF	Public-Private Infrastructure Advisory Facility
PPP	Public-Private Partnership
PSP	Private Sector Participation
REC	Regional Economic Community
RVR	Rift Valley Railways
SADC	Southern African Development Community
SAM	Social Accounting Matrix
SBM	Single Buoy Mooring System
SG	Standard Gauge
SGr	Specific Gravity
SPM	Single Point Mooring
SPR	Special Purpose Roads
t	Tonnes
TAZAMA	Tanzania Zambia Mafuta Pipeline company
TAZARA	Tanzania Zambia Railway Authority
TEU	Twenty Foot Equivalent Unit
TICT	Tanzania International Container Terminal
TICTS	Tanzania International Container Terminal Services
TIPER	Tanzanian and Italian Petroleum Refining Company Ltd

TOR	Terms of Reference
tpa	Tonnes per annum
TPA	Tanzania Ports Authority
TRL	Tanzania Railways Limited
TTF	Tripartite Task Force
UACC	Upper Area Control Centre
UFIR	Upper Flight Information Region
UNCTAD	United Nations Conference on Trade and Development
URC	Uganda Railway Corporation
USD	United States Dollar
V/C	Volume over capacity ratio
VCI	Visual condition index
VFM	Value for Money
WEF	World Economic Forum
WP	Working Paper

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1. OBJECTIVES & STRUCTURE

1.1 Terms of Reference

The objective of the EAC Transport Strategy and Road Sector Development Program is to identify regional strategic priorities and resources for transport sector development and operational needs for the medium term in line with EAC development goals.

There are two main work streams and deliverables:

- The *EAC Transport Strategy* covers an analytical review of the transport status in the region, the preparation of a regional transport model, and recommendations on the implementation of the Strategy, including institutional, financing and private sector participation arrangements.
- The *EAC Road Sector Development Program* comprises a road characteristic survey, and assessment of road capacity and road condition, and the identification of priority roads projects and funding requirements.

This report addresses the first deliverable (Transport Strategy). It is the second part of a four-part final report:

- Part I: Study Context & Framework
- Part II: Regional Transport Strategy
- Part III: Roads Sector Development Program
- Part IV: List of Transport Projects and Profiles

1.2 Report Structure

Part II is structured as follows:

- Chapter 2: The background to the Strategy is sketched with reference to the socio-economic profile of the region, the current and future demand for transport and the current and projected performance of the transport system.
- Chapter 3: The organisation of the sector in terms of policy and institutional arrangements is reviewed. Shortcomings are identified and proposals made on required policy and institutional reform.
- Chapter 4 through 9: Each transport mode is reviewed, an assessment made of the infrastructure performance and potential interventions identified. Modes covered are road (Chapter 4), rail (Chapter 5), ports (Chapter 6), pipelines (Chapter 7), airports (Chapter 8) and border posts (Chapter 9).
- Chapter 10: Potential projects are prioritised according to the prioritisation approach set out in Part I: Prioritisation. The Strategy is budget profiled in terms of types of projects, corridors, partner states.
- Chapter 11: The main considerations for implementation are discussed, with reference to the more detailed treatment of this topic in Part I: Implementation.

2. STRATEGY CONTEXT

The EAC region comprises five countries with a population of 125 million and economic product of USD 71 billion. Trade between partner states and with the rest of the World amounts to some 20 Mtpa, moving across a terrestrial transport network made up of several corridors of which the Northern and Central carry the bulk. Expected annual growth is between 5% and 8%. From the transport model prepared for this study, present-day limitations on the transport system were identified, as well as likely constraints arising as the demand grows.

This chapter is summarised from Part I: Strategy Context & Framework.

2.1 Overview of the Region

2.1.1 Population

The total EAC population is in the order of 125 million persons. Tanzania and Kenya each account for just less than a third of the regional population, Uganda for a quarter and Rwanda and Burundi for the remaining tenth. The population is projected to grow at about 2.2%/ann., reaching 176 million by 2020.

The average income per capita in the region is in the order of USD 600, i.e. less than the typical poverty datum of USD 2/day. Of the total regional population, about two thirds are economically active (i.e. employed or employable), nearly half are ‘non-poor’ and slightly more than one tenth are employed in the non-agriculture sector – which are the main candidates for inter-country travel in the region.

2.1.2 Economic Activity

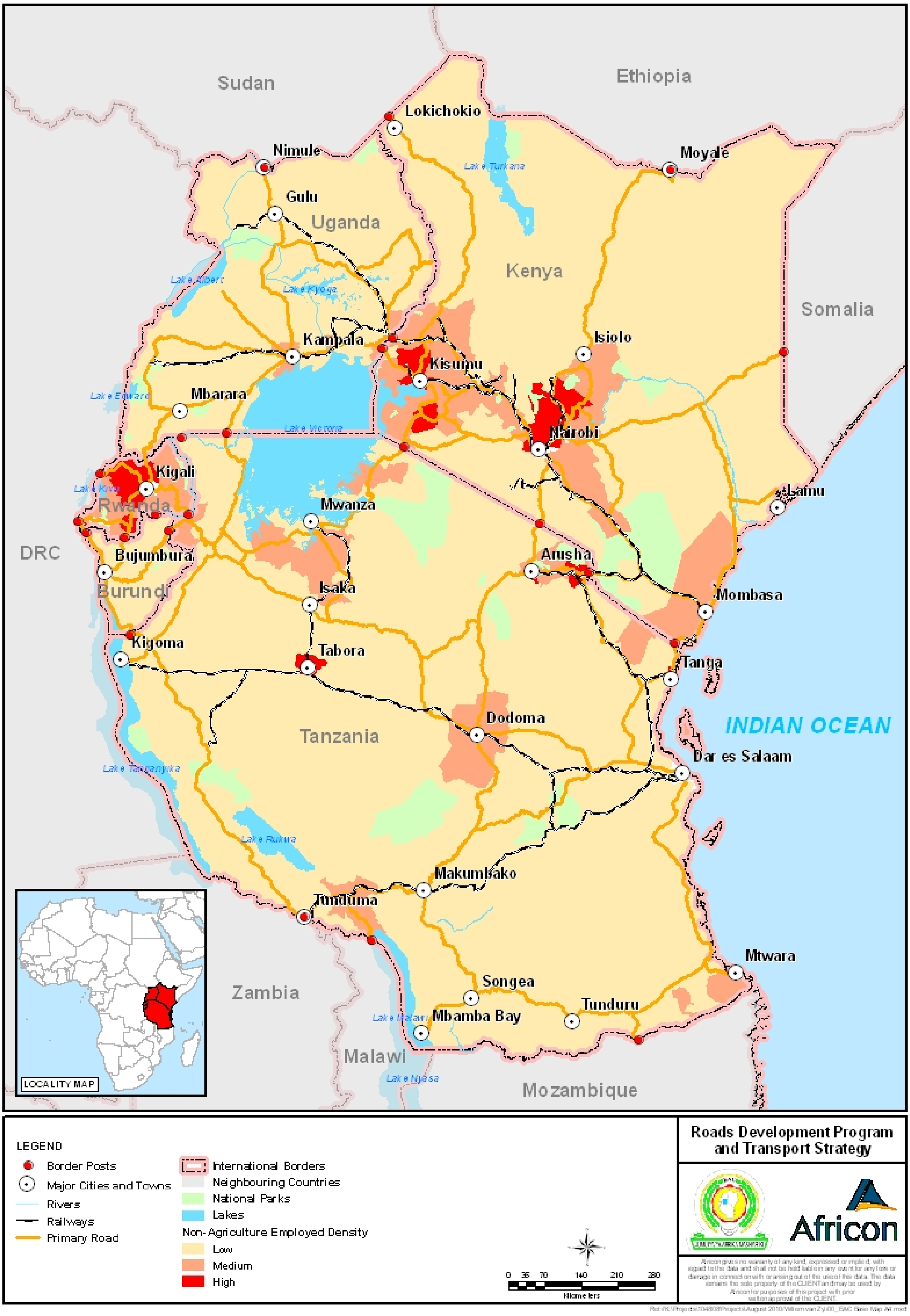
The regional GDP in 2008 was in the order of USD 71 billion. Of this, Kenya made up somewhat more than 40%. Tanzania and Uganda together added half. Rwanda and Burundi made up the remaining tenth.

The services sector makes up the largest part of GDP in the EAC region, and is the dominant sector in every economy except Burundi. In Kenya, Uganda and Tanzania, it accounts for more than half of GDP. Agriculture accounts for a third of the GDP in the EAC. It makes up nearly half of the GDP in Burundi, a third in Rwanda, and around a quarter in the three larger countries. Industry makes up between one and two tenths of the economy.

Assuming that countries will at least achieve recent growth performance going forward, but capped at 5% growth per annum, provides a conservative growth projection. The development goals countries have set for themselves provide a more optimistic growth projection. This growth rate is in the order of 8%/ann.

Whereas it is expected that the rest of the economy will evolve and grow in a fairly conventional pattern, it is in these industries that specific new projects and developments could generate step-wise growth in the region. Projects in especially two primary industries are likely to impact on the regional transport demand pattern in the next decade, i.e. mining and petroleum.

Major mining developments are likely to be on the EAC border with the DRC and nickel in Tanzania and Burundi. Key petroleum developments will be the development of the oil reserves around Lake Albert in Uganda. An important development outside the EAC with transport impacts within the region are the possible secession of South Sudan and the preferred routing for crude oil exports from there.



Map 2-1: Distribution of Non-Agriculture Employed

2.2 Transport Demand

2.2.1 Passengers

From the traffic surveys undertaken and cross-border person movements obtained for the major border posts, it is estimated that road passenger traffic between the EAC countries amounts to some 4 million pax/ann. Passenger air traffic between the eight major airports within the EAC is about 5 million pax/ann. Traffic between Nairobi, Dar es Salaam and Entebbe makes up a quarter, and traffic between Nairobi and Mombasa another quarter. Passengers by air to/from areas outside of the EAC are made up of about 2 million to neighbouring countries, 1 million to the rest of Africa and 4 million to the rest of the World.

2.2.2 Commodities

The total volume of trade within and with the EAC amounted to slightly more than 20 Mtpa in 2007. This excludes purely domestic trade within EAC countries themselves, which is understood to be in the order of 6 to 7 Mtpa.

Trade between EAC partner states makes up 1.0 Mtpa (5%), trade with neighbouring states another 1.0 Mtpa, with Southern Africa 1.4 Mtpa, with the rest of Africa 2.1 Mtpa and the rest of the World 14.6 Mtpa (73%).

EAC is a net importer with 2 kg of goods imported for every 1 kg exported. Trade with Southern Africa and the Rest of Africa is balanced. With neighbouring countries, EAC exports make up three quarters of trade. The overall trade imbalance derives from the rest of the World from which EAC imports 3 kg for every 1 kg exported.

Regional trade originates from and is attracted to a handful of major centres located along the Northern Corridor, and to a lesser extent on the Central and Dar es Salaam corridors.

Break-bulk (general, containerised cargo) makes up more than three quarters of the volume of trade and the other groupings between one twentieth and one tenth each. Directionally, break-bulk and bulk mining follow the overall pattern of goods trade with imports at double the volume of exports. For perishables, exports are double imports. Petroleum is mostly imported, including crude for refining in Mombasa and Ndola (via Dar es Salaam). The split between regional crude imports and products imports is practically even.

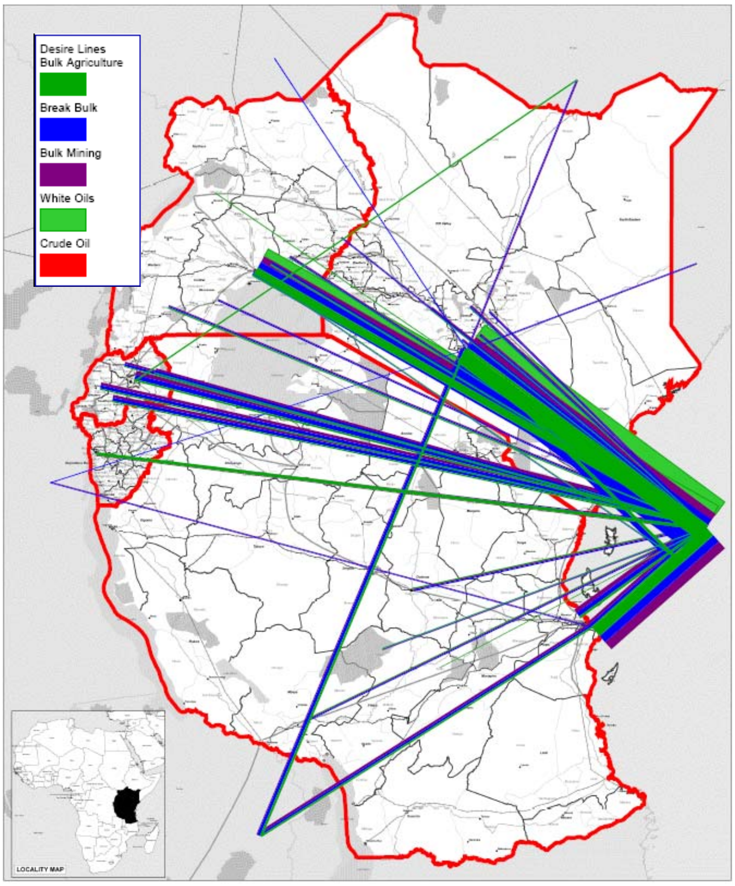


Figure 2-1: Commodity Trade Desire Lines

2.3 Regional Transport System

2.3.1 Corridors

The EAC is tied into the world via marine and air transport. The major ports (Mombasa and Dar es Salaam) are feeder ports supporting hubs on the main East-West shipping routes. The regional hub for air transport is Nairobi, both for intra-regional travel and connecting the EAC with the rest of Africa and the World.

'Corridors' has become a key organising principle for transport and development. A corridor is the backbone surface transport route forming the scaffolding to which smaller, more localised access links are attached and aggregating the load off these feeder links. They are not just transport arterials, but also routes for development attracting complementary industrial and utility investments.

Major corridors linking the EAC to the rest of the Continent are the Dar es Salaam (TAZARA) Corridor which links to the larger North-South Corridor and the Moyale-Addis Ababa Corridor. There are a further two established East-West corridors within the EAC (Northern and Central) as well as lower-trafficked North-South corridors (along Lake Tanganyika via Sumbawanga and along the Eastern shore of Lake Victoria via Sirari to Lokichokio).

Map 2-2: EAC Corridors

2.3.2 Modal Infrastructure

Surface transport modes provide the main transport links with neighbouring countries and within the EAC. The regional roads network (roads on corridors) comprises about 15 000 km. There are about 8 100 km of rail of which about 6 000 km is operational. Pipelines contribute 2 200 km to the network, excluding the TAZAMA section in Zambia. There are eight major (international) airports in the region, and a number of complementary airports making up a regional and local network. The main sea ports are Mombasa and Dar es Salaam, and a secondary network including Mtwara, Tanga and Bagamoyo, with new ports planned at Lamu and Mwambani. Ports on Lake Victoria (Mwanza South, Kisumu and Port Bell) and Lake Tanganyika (Bujumbura and Kigoma) complete the regional transport network.

2.4 Major Transport Constraints

The study TOR required the development of a transport demand model to support developing the Strategy. The main benefit of a multi-modal, region-wide model is that it brings the full spectrum of stakeholder issues onto the same platform so that considerations related to different modes and places can be traded off on the same basis.

The transport model enables an assessment to be made of how current and projected demand and the associated traffic compares with the infrastructure (supply-side) capacity. This takes place by means of so-called volume-capacity ratios. A high ratio is an indication that an infrastructure asset is under stress to handle the traffic traversing it.

2.4.1 Current Performance of the System

At present, the major constraints are experienced at the two gateway ports, specifically Mombasa. On the port side, Mombasa faces issues related to the lack of depth in the approach channel and alongside berths. There are also pipeline distribution constraints in the oil terminal. The Berth Occupancy Factor (BOF) – a measure of inefficiency – substantially exceeds international norms. Waiting time per ship is between two and three days.

Rail transfer points in general and some border posts also display shortcomings. The Kenya Pipeline Company pipeline shows impending capacity shortage, but this is an indication of fairly tight design standard rather than an actual insufficient capacity.

2.4.2 Projected Future Performance

Applying the optimistic growth scenario of 8%/ann. growth in background demand plus step-growth from new developments will require interventions in the following areas:

- Roads. The major part of the Northern Corridor (Mombasa-Nairobi-Kampala) needs to be doubled. Capacity at the Malaba border post needs to be substantially increased
- Rail. The original design capacity of the Northern Corridor network from Mombasa to Tororo needs to be reinstated
- Pipelines. Pipelines are required to evacuate crude oil from Southern Sudan (probably to Lamu) and petroleum products from Hoima (to Kampala and beyond)
- Sea Ports. For Port Mombasa, substantial additional capacity is required to handle petroleum products, break-bulk (containers) and bulk mining. No further capacity is required for bulk agriculture. For Port Dar es Salaam,

substantial additional capacity is required for petroleum products, break-bulk and bulk mining. Capacity for crude oil and bulk agriculture remains adequate. For Port Lamu, substantial crude oil export capacity would be required if the South Sudan oil exports are channelled via Kenya.

- Rail transfer points. The handling capacity of all rail transfer points (at sea ports, lake ports and rail stations) needs to be increased
- General network impedance relief. Current initiatives to unblock the Central Corridor around Singida need to be completed. The border posts between the Rwanda and Burundi and the Central Corridor as well as Taveta need to be reviewed to determine how constraints there can be relieved.

Some types of physical projects for which the transport model is too high-level to identify include:

- Road condition projects (which are assessed by means of a more detailed Highway Design Manual (HDM) model as described in Part III)
- Detailed road capacity projects (assessed by means of a more detailed first order network assessment (FONA) model)
- Aviation projects, especially passenger-related capacity (assessed as described in chapter 8).

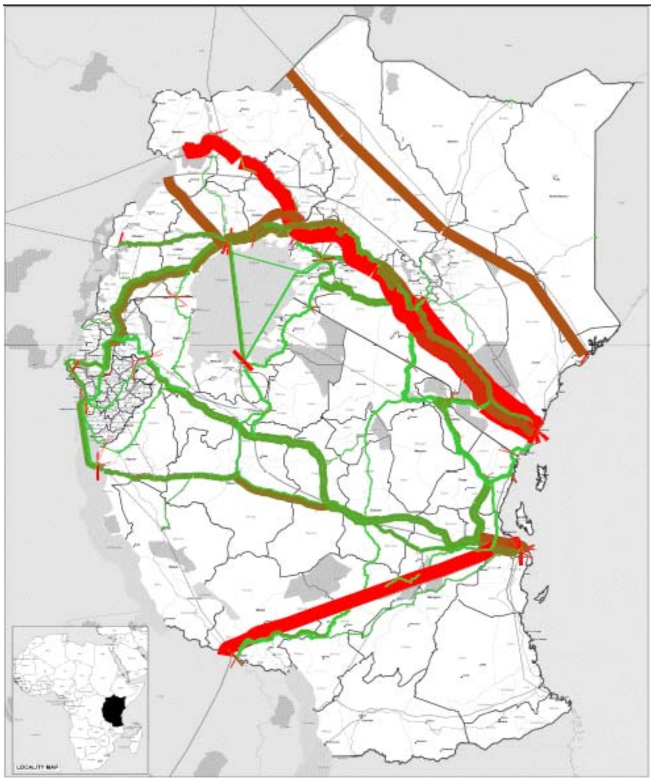


Figure 2-2: Optimistic Growth - Volume vs Capacity Constraints

2.4.3 Impact of not Addressing System Constraints

Addressing the above constraints would reduce the overall cost of transport as shown below. This is achieved by the systematic attraction and diversion of traffic to appropriate modes of which the capacity are kept ahead of demand. The figure indicates at various degrees of demand growth how the Strategy response protects the transport cost, while at the same time showing what the no-response cost increase would have been.

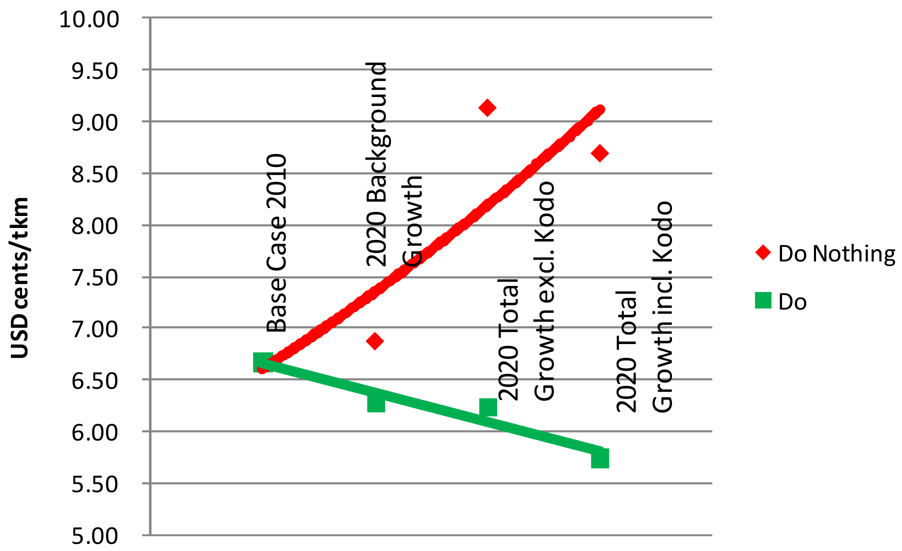


Figure 2-3: Impact on Transport Unit Cost

3. REGIONAL TRANSPORT POLICY & INSTITUTIONAL ARRANGEMENTS

The transport policy environment includes the EAC Treaty at regional level and national transport policies of partner states. A concept regional transport policy was prepared under a recent ESA (COMESA, EAC, IGAD and IOC) initiative which provides a coherent framework and principles that serve as a reference point when evaluating transport policies in the EAC. It addresses, amongst others, the relationship between regional and national transport issues which are each largely dealt with in their own domain at present. It further provides guidelines on institutional reform of the transport sector. Apart from promoting commercialised transport infrastructure provision, various regional-level institutions are required to give effect to the increased integration of EAC partner states.

This chapter is reduced from the analysis presented in Working Paper 1: Institutional & Policy.

3.1 Policy Framework

3.1.1 Existing Policy Arrangements

3.1.1.1 Community

The EAC policy on Transport has largely been encapsulated in the EAC Treaty, which has a high degree of similarity with other treaties establishing regional economic communities on the African Continent. Treaties of this nature usually cover the development and implementation of policies and strategies aimed at widening and deepening co-operation among partner states in political, economic, social and cultural fields. Transport is one of a number of disciplines in the economic field addressed in such treaties.

The EAC Treaty covers all the modes of transport except pipelines. A particular duty is placed on partner states to engage in a long list of activities, yet little guidance is provided to bridge the gap between national interest and the more overarching regional issues. It is recognised that laudable objectives such as 'harmonisation of policies, standards, rules and practices' or 'coordination of implementation programmes' occur at regular intervals in the transport section of the Treaty, but it is not indicated how this is to be achieved or what the nature is of an institutional arrangement to facilitate the process on a regional basis.

Notwithstanding the qualities of the Treaty, based on the fundamental role played by transport there is a need to intensify strategic policies in this sector to promote the free movement of goods and people. As an example of how to go about embedding policy principles, SADC introduced a legal and policy instrument dedicated to transport, together with communications and meteorology, and which in principle is worth considering for transport policy in the Community (SADC Protocol on Transport, Communications & Meteorology).

International treaties, especially those establishing RECs are by nature static law instruments which do not necessarily keep track with best practice trends and developments. Developments such as liberalisation of transport services, alternative funding scenarios or public-private participation, let alone the separation of institutional entities responsible for selected functions at regional as well as national level, have become important focus areas. What is needed at regional level is a policy instrument that will respond to the dynamics of best practice trends in transport sector infrastructure development and the provision of transport services specifically relating to issues such as minimizing transport costs, financial viability and institutional reform.

3.1.1.2 Partner states

The Partner state transport policies were reviewed from a regional perspective. Key conclusions were:

- *Diversity in policy instruments*. Although there is a significant similarity in policy themes addressed, the approach, structure and actual content vary considerably. This finding can be attributed to the apparent lack of policy guidance material that should be provided at regional level in the interest of policy harmonisation.
- *Exclusivity of national transport responsibilities*. Policies have been developed from a national perspective and leave not room for systematic coordination of transport planning and operations at regional level.
- *Regional initiatives recognised*. In certain policy statements some recognition is given to EAC, COMESA and SADC initiatives but with limited policy provisions to support regional integration of transport and transportation systems.
- *Modal integration undervalued*. Domestic transport policies mostly cover the full spectrum of transport modes, but hardly give any recognition to modal integration at national level, let alone at regional level.
- *Participation in international transport arena not clear*. The ratification of certain important international conventions and instruments appears not to be a policy concern.
- *Role of Development Partners in transport programmes not catered for*. Policies do not reveal a clear-cut coordinated approach towards development partners, partnership-based transport harmonization initiatives and donor funding from development agencies and individual countries.
- *Omission of best practice trends and developments*. Areas not fully recognized by Partner states in their policy statements include among others:
  - consumer interests/protection
  - introduction of market forces and commercial principles in the transport sector
  - the separation of the roles of policy formulation and strategic planning, transport infrastructure and infrastructure operations, service delivery and regulation
  - capacity constraints at ports of entry and lack on continuity along corridor routes
  - excessive transport costs directly related to institutional weaknesses and inferior management structures
  - regulation, i.e. the role of independent authorities and their empowerment to enforce regulations.

3.1.2 ESA Benchmark Policy

3.1.2.1 Background

A *Transport and Communications Strategy and Priority Investment Plan* was recently (mid 2010) developed by Eastern and Southern African (ESA) States, represented by EAC, COMESA, Inter-Governmental Authority on Development (IGAD), the Indian Ocean Commission (IOC) and SADC as observer. The ESA policy features best practice principles from a range of policy-making authorities from all over the world, including Africa, and is suitably adapted for the conditions prevailing on the African Continent.

The principles on which the policy is founded are:

- *Degree of Regional Integration*. The level of integration aspired to will be stage 2[1] which allows for the continuation with actions to harmonise and coordinate national policies and conduct, but pursuing joint initiatives between partner states on a case-by-case basis. Compared with the other RECs under the ESA arrangement, the EAC is well-advanced with regional integration, the Community now being a common market. It is steadily moving towards stage 3 integration (joint operations). In applying the ESA policy, it is expected that the EAC would therefore be at the cusp of transferring decision-making power to regional bodies.
- *Regional Transport Corridors*. These comprise surface transport links between designated national nodes[2] and between regional designated nodes and the rest of the continent and globally. Corridors are both transport and development conduits.
- *Modal Choice and Preference*. No mode of transport should be prioritized above another, while the mix of modes should be determined by the characteristics of traffic demand and transport economics. There could, however, be cases where a mode requires outside support to enhance the efficiency of the regional transport system in the long-run.
- *Customer Focus*. The policy is focused towards the interests of the transport customer or user, as opposed to (say) the transport operator or policy-maker.
- *Separation of Functions*. Policy, provision of transport (infrastructure and services), and regulation (oversight and enforcement) should be divorced from one another to avoid conflicts of interest.
- *Market-based Solutions*. Transport decisions should predominantly be determined by market forces, including competition for and in the market. Monopoly infrastructure should be commercially regulated while regional transport services should be liberalised in a framework of competition. In the case of market failure, appropriate interventions should correct or support the market.
- *Sustainable Provision of Transport.* Transport infrastructure (which is likely to be less exposed to market forces), should be properly financially ring-fenced, costed on a life-cycle basis, with cost responsibility progressively shifted towards beneficiaries by means of user charging.
- *Least Total Cost*. The overriding aim of the policy is to deliver a regional transport system at the lowest sustainable long-term cost.

3.1.2.2 Structure-Conduct-Performance

The policy logic adopted is the so-called Structure-Conduct-Performance paradigm. The ‘structure’ of the market determines how the role players carry on their business (‘conduct’ themselves) and which results in the ‘performance’ of the market (e.g. services offered and prices asked). The policy interventions are therefore aimed at establishing the market structure, and regulating market conduct and performance where the market structure is not self-correcting.

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[1] Four stages of economic cooperation towards full integration may be distinguished. These are harmonization of national policies and modes of conduct (stage 1); coordination of national policies and conduct with common rules and mutual national relations among Partner states (stage 2); joint initiatives under regional decision-making with national resources/implementation (stage 3); regional initiatives pursued independently of nations (stage 4)

[2] National designated nodes refer to Partner state capital cities, centres of intensive economic activity and transport demand or major sea ports; regional designated nodes are cities, entry points or places that have a relatively high proportion of the region’s population, economic activity and traffic generation

The transport sector structure should reflect policy objectives of open, unbundled, competitive and homogenous services subject to common participatory standards. Subject to certain considerations such as technical and operational dependency, the provision of transport services should be separated for the provision of transport infrastructure. The transport market should be made up of diverse and competing transport providers. In the case of infrastructure, landlord and service provider functions should be separated, and services provided on competitive or contestable basis. For transport services, there should be competition among service providers. Transport sector entities should carry on their business in accordance with internationally-accepted industry standards, harmonised across partner states.

Conduct in the transport sector refers to the management of transport infrastructure and service providers in an efficient and lawful manner. The key policy principle is the concept of commercialization, i.e. where transport providers are public monopolies they should be operated based on private sector management principles, at arm's length from the region and national government.

For regional transport infrastructure, ventures should be fully financially ringfenced, and at least the operations and maintenance costs should be recovered from users by applying the 'user pays' principle. Regional transport services should be operated competitively and financially self-sustaining.

To the extent that the sector structure and conduct do not naturally succeed in achieving the stated objectives, the sector performance should be directed and transport providers persuaded in that direction, i.e. via appropriate regulation of market entry, safety and customer service.

3.1.2.3 Required Institutional Arrangements

At national level, the ESA policy is paving the way for a common approach in dealing with regional transport infrastructure and services. Partner states are therefore expected to incorporate that policy in their domestic policies and legislation. This would include the separation of policy/planning, service provision and regulation. Partner states are expected to retain a strategic planning and policy-making role, but withdraw from transport operations (which should be provided at arm's length and preferably outside of government) and regulation (which should be provided by agencies). For transport infrastructure, they are expected to sell or concession off public assets with private good[3] characteristics, but to manage facilities with natural monopoly characteristics in a more regulated environment, i.e. as public agencies and regulatory supervision. Independent regulators should oversee the sector. These include regulators for market entry (licensing boards), conduct (safety and security regulators such as CAAs and MSAs) and commercial performance (price and service level regulators overseeing monopolies).

At regional level, the process of regional integration implies cooperation between partner states, and the increased upwards assignment of responsibility for issues of regional (supra-national) importance. The regional body must lead the process of integration and be resourced for this responsibility. Its main functions would be to provide guidelines on national policy in support of regional standardisation and integration, draw up high-level regional transport infrastructure and service master

[3] Private Goods are infrastructure or services which are not accessible by everyone, i.e. the benefits of their use can be restricted (and therefore charged for). They have the potential to pay their own way fully or partially. Transport private goods include ports and airports. Public goods are non-exclusive, so anyone can access them, e.g. roads and streets. Public goods typically do not generate their own income.

plans to serve as a reference point for national planning and for support to the region, to develop the capacity of partner states, and to promote and coordinate the creation of regional associations and agencies for specific purposes, e.g. the regionalisation of regulation and the creation of management agencies for cross-border transport infrastructure.

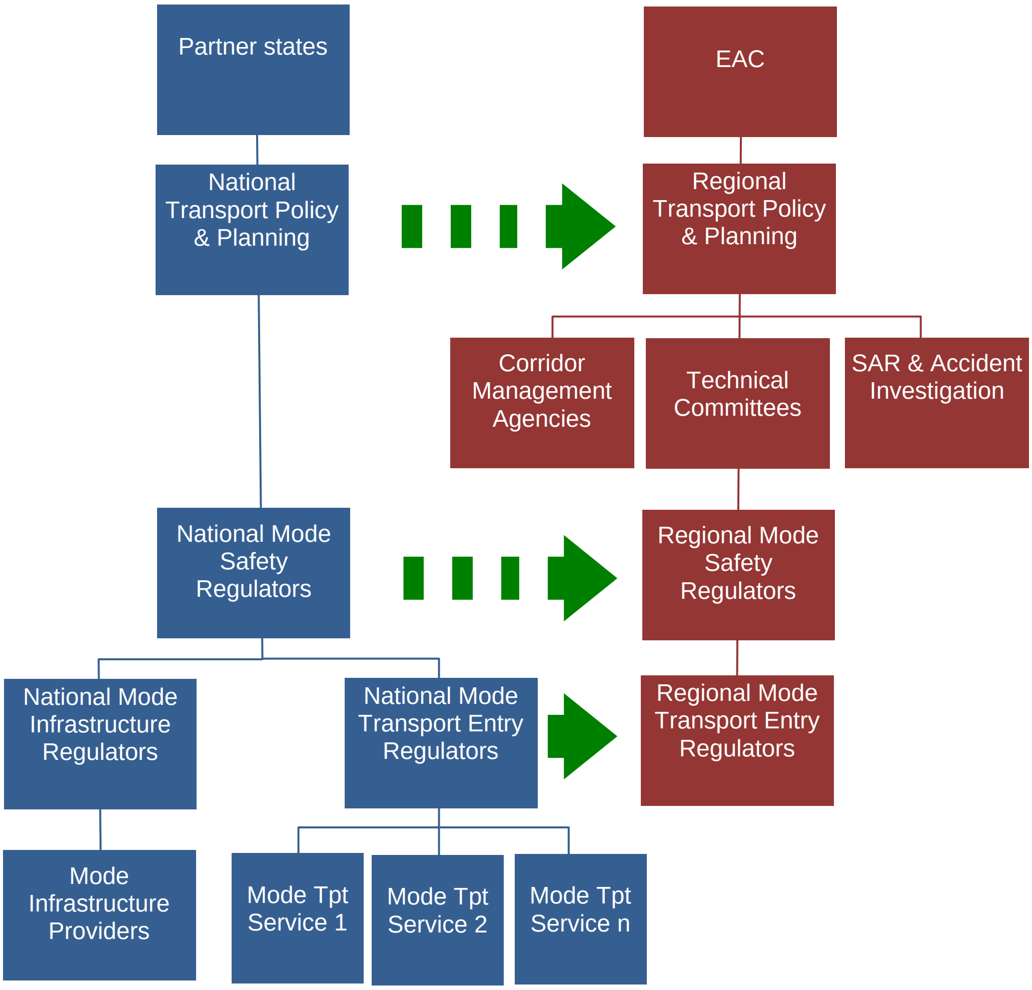


Figure 3-1: ESA Policy Institutional Prescriptions

3.2 Current Institutional Arrangements

3.2.1 Community

The transport function resorts under the Deputy Secretary General for Planning and Infrastructure. The Director of Planning is responsible for planning, research, monitoring and evaluation; statistics; fiscal and monetary affairs; and investment and private sector promotion. The Director of Infrastructure is responsible for transport and works; meteorology; civil aviation and civil air transport; and communications.

The Roads and Road Transport Unit in the Transport and Works Department is at present primarily responsible for land transport affairs. The EAC has indicated that it plans to strengthen the Department with a Unit for Railways and Rail Transport and a Unit for Maritime Transport and Ports including Inland Waterways Transport.

Within the Community there are also transport-specific organisations functioning either under the auspices of the EAC Secretariat or as the result of a tripartite or multi-lateral agreement. The following organisations have a significant impact on the integration or regional transport:

- *Northern Corridor Transit Transport Coordination Authority* (NCTTCA)
- *Central Corridor Transit Transport Facilitation Agency* (CCTTFA)
- *Joint Technical Committee* under the Tripartite Agreement on Road Transport
- The EAC *Civil Aviation Safety and Security Oversight Agency* (CASSOA)
- The *Joint Committee on Inland Waterways*
- The *EAC Lake Victoria Basin Commission* to the extent that its responsibilities impact on transport infrastructure development and services as well as navigational safety and maritime security
- Various technical committees established by the EAC Secretariat, such as the Technical Committee on Axle Load Limits Implementation.

A review of the EAC structure reveals:

- *EAC not sufficiently pro-active towards regional integration*. The EAC's mandate is to realise regional integration. Yet the role played by the EAC and its Secretariat appears to be at most as facilitator instead of assuming some leadership. An example is the case of Corridor Planning Committees where stakeholders negotiate to harmonise their positions and interests with their counterparts, rather than focusing on regional integration.
- *Absence of a transport services capability*. Based on the EAC Secretariat organizational structure it appears that at the higher echelons no specific provision has been made for transport services. It is assumed that at least infrastructure services are covered under the Director of Infrastructure, but the provision for transport service delivery is unclear. This is especially important should the EAC assume a leading role in regional transport services licensing.
- *Limited institutional capacity*. It is evident that the Secretariat is at present not adequately staffed in terms of professional staff to undertake research, management and evaluating the tasks outlined. This shortcoming is perceived to constrain the process of integration in the transport sector. As the region assumes a more hands-on role regarding infrastructure of regional importance, there is also a need for technically skilled personnel to manage transport infrastructure projects.
- *Regional integration potential not maximised*. In restricting the mandate of CASSOA to harmonizing civil aviation regulations and providing guidance material the EAC illustrates that by not allowing a regional organization to perform regulatory functions, it (or the partner states) is not yet ready to move to a higher level of regional integration.
- *Insufficient funds*. A critical shortage of financial resources coupled with budgetary constraints and the associated negative effect on the implementation of transport projects are hampering the objective of an effective, continuous regional infrastructure network. This is further aggravated by an unsustainable pattern of dependence of the Community on development partners.
- *Lack of stakeholder involvement*. Although the EAC recognises the importance of stakeholder consultation and participation, from an institutional point of view very little evidence at regional level could be found that the so-called organised stakeholder forums are in place. The only exception appears to be the East African Business Council.

- *Need to coordinate Development Partners' participation*. There are a number of Development Partners, Donors and external Development Plans which have to be coordinated at a regional level.

3.2.2 Partner states

The current institutional arrangements for Partner states differ with respect to overall transport management as well as the approach to mode-specific administration. There are, however, a number of similarities and trends, especially regarding the establishment semi-autonomous agencies/authorities.

Following the logic of the institutional structure prescribed in the benchmark ESA policy, the following generalised transport sector organisation may be discerned. Major shortcomings against the benchmark policy are:

- The involvement of the mother ministry in safety and technical regulation (i.e. the absence of autonomous mode safety regulators)
- The involvement of civil aviation authorities across the regulatory spectrum and sometimes also including the provision of infrastructure-based services (airports and ANS)
- The role of incumbent operators as *de facto* market entry regulators in rail
- The blending of infrastructure and transport services under the two rail concessions.

These shortcomings therefore generally take the form of insufficient separation of functions, as shown by the dotted lines in the following figure.

Table 3-1: Typical Partner State Institutional Arrangements and Shortcomings

<table>
<tr><th colspan="2">Function/Role</th><th>Roads</th><th>Road Trans-port</th><th>Rail</th><th>Marine</th><th>Inland Water-ways</th><th colspan="2">Aviation</th><th>Pipelines</th></tr>
<tr><td colspan="2">Policy & Planning</td><td colspan="7">Ministry for Transport or Works</td><td>Ministry of Energy</td></tr>
<tr><td rowspan="3">Regula-tion</td><td>Safety & Technical</td><td colspan="3">Ministry for Transport or Works</td><td colspan="2" rowspan="2">Maritime or Ports Authority (self regulation)</td><td colspan="2" rowspan="3">Civil Aviation Authority (CAA)</td><td rowspan="2">Energy regulator</td></tr>
<tr><td>Com-mercial</td><td>N/A</td><td>N/A</td><td></td></tr>
<tr><td>Market Entry</td><td>N/A</td><td>Trans-port Licensing Board</td><td>Incum-bent operator</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="2">Transport Infra-structure</td><td>Provision</td><td>Roads Authority</td><td rowspan="2">N/A</td><td rowspan="3">Rail conces-sion</td><td rowspan="2">Ports Authority</td><td rowspan="2">Rail conces-sion</td><td rowspan="2">Airports Authority</td><td rowspan="2">CAA (ANS)</td><td rowspan="3">Pipeline conces-sion</td></tr>
<tr><td>Funding</td><td>Road Fund</td></tr>
<tr><td colspan="2">Transport Services</td><td>N/A</td><td>Private Sector</td><td colspan="4">Private Sector</td></tr>
</table>

A review of the partner states' transport institutional arrangements points out the following:

- *Existence of appropriate institutional provision for EAC Affairs*. Partner states have conscientiously designated Ministries to co-ordinate regional matters between the EAC and their respective government institutions and to serve as the communication link with the EAC Secretary General.

- *Uncoordinated Institutional Arrangements in Transport Sector*. In some instances the transport sector in Partner states is characterized by a multiplicity of ministries responsible for selected aspects of transport (Ministries of Works, of Infrastructure, etc.). This is further aggravated by laws establishing and/or enabling institutions, which are main players in transport, that were enacted in isolation or apparent ignorance of existing acts.
- *Increased separation of the provision of transport infrastructure from transport service delivery and regulation*. Although there are a number of government institutions where these key functions are still part of a single entity, a major shift towards the separation of these functions, together with the institutional transformations and subsequent establishment of state-owned agencies taking responsibility for their operation, has been observed. With reference to the above figure, areas requiring particular attention are the separation of –
    - policy-making and technical oversight functions in road and rail
    - market entry regulation in rail
    - rail infrastructure and transport services
    - technical and commercial oversight of ports and airports
    - safety and market entry regulation for air transport
    - safety regulation and provision of air navigation services.
- *Transport service delivery in the hands of the private sector*. Whereas transport infrastructure provision and transport regulation are still regarded as governmental functions, transport service delivery has largely moved into the hands of the private sector. Institutionally this may require specific adjustment in the regulatory system (in the form of safety and licensing authorities).
- *Staff establishments not adequately filled*. From the information gathered in response to capacity questionnaires issued, it is evident that the vast majority of organizations are functioning with a staff complement which is much lower than the approved staff establishment.
- *Lack of technical capabilities*. The most critical area where a lack of suitable staff is experienced is in the technical and middle management areas (degreed and non-degreed).
- *Inadequate planning for personnel training and development*. A lack of structured planning for human resource development and training has been observed. Very often the shortage of funds for training is being cited as the reason for the lack of staff development. If, however, a properly structured training and development plan is generated, it will present effective motivation to States to invest in this area.

3.3 Regionalising Transport: Policy and Institutional Reform

The status of institutions in the region and the guidance provided in the ESA policy point out three broad areas of intervention required, namely policy interventions to embed the benchmark ESA policy, institutional interventions to give effect to the benchmark policy and capacity interventions to strengthen the EAC Secretariat.

3.3.1 Policy Interventions

The EAC should introduce a scene-setting policy instrument that will not only direct and steer strategic interventions for the Community in the transport sector, but will also create a favourable climate within partner states in support of a regionally integrated transport system. The benchmark ESA policy described earlier in the text is a response to the need for a clear-cut policy direction in a regional context in Africa in general, and the EAC in particular.

The policy is the product of an intensive study of international best practice in a regional transport context. The EAC, together with other RECs, has been directly involved in the development of this policy from an REC perspective and it will therefore be appropriate to adopt this policy and purposefully introduce its implementation within the Community.

A policy of this nature should, however, be pro-actively implemented within the context of an appropriate institutional arrangement and a structured implementation plan. The EAC should therefore take steps to the adopt the ESA Policy on Regional Transport and take the necessary measures to introduce and approve such adaptations to the policy as deemed appropriate to make it EAC-specific, and endorse and publish the policy in a protocol format which should be binding on partner states. Partner states should equally internalize the policy on regional transport matters in their domestic transport policies.

3.3.2 Institutional Interventions

3.3.2.1 Policy and Strategic Planning

There should be an institutional arrangement at regional level to serve as a platform to launch policy implementation and also to facilitate conceptual planning of the regional transport network. As the institutional arrangement will still be subject to a stage 2 level of regional integration (coordination of national policies and conduct with common rules and mutual relations among Partner states), the partner states will have the advantage of taking informed decisions in regional interest, but at national level. It will also prepare the way for a certain measure of joint initiatives under regional decision-making towards stage 3 integration.

At regional (Community) level, there should be housed the overall responsibility to ensure effective coordination, collaboration and harmonization within the Community to ensure positive implementation of the policy and to serve as a vehicle for all regional strategic planning initiatives. This would include resourcing the EAC itself, appropriate regional technical committees for transport in general as well as for individual transport modes and for specific regional initiatives involving more than one transport mode, e.g. transport corridors (roads and rail) and search and rescue (aviation, maritime and inland waterways). The Joint Technical Committee with its various Route Management Groups established under the Tripartite Agreement on Road Transport presents an example of a model that could be adopted for other transport modes as well.

The key functions of these organs should be to promote and coordinate regional integration of transport over the full spectrum of all the modes through implementation of the regional transport policy, development of mode-specific regional policies aligned with EAC transport policy, provision of technical guidance, development of high level master plans and coordination of multi-modal transport standards.

Representation on these institutions should, as appropriate, consist of members from the EAC Secretariat, partner states (policy, operational and technical levels), corridor management authorities or agencies, private Sector transport role players, commerce and industry, transport specialists and regional organisations such as the Victoria Basin Commission.

3.3.2.2 Regional Safety & Technical Regulation

As the Community migrates from stage 2 to stage 3 regional integration, transport users will expect a degree of commonality of service level, operating rules and technical standards across borders. These include planning and design standards, equipment standards, and operations and operator standards.

There are also benefits to be had from centralising development and oversight of these standards as generally under-resourced, parallel, national agencies will be replaced by single regional agencies that can consolidate the regional resources and are large enough to provide specialised services which are not feasible at partner state level. Importantly, common platforms should lead to transport system cost savings.

A need therefore exists to have dedicated regional mode-specific regulatory institutions or agencies that include these functions as part of their responsibilities. An example exists in the form of the Civil Aviation Safety and Security Oversight Agency (CASSOA). Although CASSOA is currently not mandated to act independently in a regional context, the establishment of the arms-length EAC Agency nevertheless sends out a powerful message to the other modes of transport on the applicability of this model on a regional basis. The model is applicable to the regulation of road traffic/road safety and road, rail and maritime safety.

3.3.2.3 Regional Specialist Transport Functions

The motivation for having regional safety and technical oversight also applies to the functions of Search & Rescue and Accident Investigation.

Accident and Incident Investigation

In civil aviation aircraft accident investigation has been included in the safety functions and responsibilities. Although transport accident investigation has some relation to safety, international best practice provides for a separation of this function form the normal safety functions. A further tendency is to collapse mode-specific accident investigation functions into a single transport accident and incident institution.

From observations made it appears as if Partner states do not have sufficient capacity and technical know-how to conduct larger and more complicated transport accident investigations and that the responsibility is therefore mostly outsourced to specialists. In the context of the region and based on economies of scale it is likely to be feasible to undertake this function on a regional scale.

Search and Rescue (SAR)

SAR is an important activity for civil aviation, maritime and inland waterways. The Tripartite Agreement concerning the inter-state use of Search and Rescue Facilities, 2002 makes provision for the establishment of a Joint Technical Committee to deal with the matters contained in the Agreement (including SAR), but the EAC's direct involvement in the functioning of SAR appears not to be institutionalised yet.

3.3.2.4 Regional Transport Infrastructure

The provision of transport infrastructure and transport operations should be split to obtain the benefits of natural monopolies in the case of infrastructure and competition in the case of services. In both cases, the function should be properly ringfenced and provided in an efficient, business-like manner.

Duty to Provide

Because of their actual or quasi monopolistic nature, transport infrastructure should be generally provided by government agencies, but at arm's-length from government proper. In the case of private-good transport infrastructures, consideration should be given to public-private partnerships (PPP) such as concessioning (airports, ports, railway and pipelines). These agencies should retain landlord status but introduce competition in non-core services. In the case of railways, splitting the infrastructure from the transport service could provide a basis for public funding of the infrastructure while encouraging competition in the rail services.

The ‘virtual’ transport infrastructures of airspace and inland waterways should be provided in a regionally-integrated manner. Upper airspace should be operated as a contiguous whole, by public agency (Regional Upper Airspace Control Authority) because of its strategic importance, or under a PPP arrangement. Lower airspace (terminal and aerodrome control) is associated with an airport which itself should be provided on commercial terms, so that lower airspace should also be operated as one or more commercial entities under concession or management contract.

Inland waterways, including lake ports, form an integral part of the regional transport network, and often provide cross-border transport routes. There should be a single properly constituted institutional arrangement covering this discipline, as foreseen in the Tripartite Agreement on Inland Waterways which provides for a Joint Committee on Inland Waterways.

Funding of Regional Transport Infrastructure

The ESA benchmark policy advocates financial ringfencing and user charging for regional infrastructure. Users should at least pay the operations and maintenance cost, and ideally also makes a contribution to servicing investment costs. User charging is promoted especially for private good infrastructures, such as pipelines, airports and ports. Although rail should be treated in the same manner, years of underinvestment and neglect imply that the rail system will first have to be recapitalised (probably through public investment) for it to re-establish its funding base and become an attractive for private funding.

With respect to capital costs, partner states are at present responsible to arrange funding for regional infrastructure projects in their own territories, with the assistance of development partners and under transport partnership harmonisation initiatives such as the Sector Wide Approach (SWAp). For projects of regional importance, a need exists for a more regionally coordinated approach for the funding of transport infrastructure in order to alleviate funding pressure on partner states, and to guide partner states in determining their own funding strategies and ultimate engagement with funding sources.

In future, for regional projects, the Community should play a more pro-active role in preparing projects and securing funding. The entry criteria for what constitutes a regional project should be refined based on the project prioritisation criteria developed as part of this study. For approved regional projects, there should be criteria for what constitutes a properly prepared project. The region should oversee the preparation of projects to such a point that the budget and likely financing terms are clear. There should therefore also be rules for assessing the investment terms and conditions, i.e. the preferred blend of grant and commercial funds.

Transport Corridors

The concept of regional transport corridors is well-established in practice and in the benchmark ESA policy. Transport corridors typically accommodate road and rail and to some extent also inland waterways and oil pipelines. Corridor Agencies or authorities with various technical committees (including a Corridor Transit and Transport Committee) have over the years been established. The main functions of these management entities is to plan, coordinate and facilitate operations on designated corridors with a reasonably wide stakeholder representation. They have so far had a limited role regarding infrastructure development. Given the involvement of Corridor Agencies in the overall EAC planning and integrated policy and strategic planning institutional arrangement earlier alluded to, a need exists to strengthen the role of Corridor Authorities to include decision-making powers with respect to detail planning and construction, asset protection (maintenance and weighbridge operations), warehousing and inter-modal transfer facilities.

3.3.2.5 Commercial Regulation of Monopoly Infrastructure Providers

Transport infrastructures typically have locational advantages, offer economies of scale and exhibit reducing unit cost. Because they are natural monopolies they should be overseen by commercial regulators overseeing their efficiency, financial performance and service standards.

The provision of regional transport infrastructure occurs almost exclusively within the domain of ministries or government-owned agencies under the auspices of a partner state ministry. This responsibility will migrate towards regional structures over time. Whereas commercial regulators should therefore be established by partner states at first, these will also converge in future.

3.3.2.6 Regional Transport Operations

As noted in the EA benchmark policy, transport operations with a regional scope (as opposed to, for example, urban transport) should be provided commercially and competitively. The region should progressively liberalise regional transport routes, and ensure harmonized national standards (operators, operations, equipment) which enable open access to potential competitors. Incumbent operators should be treated equally. While regional routes should be contestable by regional service providers, domestic routes should for the time-being still the prerogative of Partner States. Also, the Community is not obliged to extend the open-market policy to operators from outside the region.

3.3.2.7 Regulation of Market Entry (Licensing)

Licensing of transport operators and operations currently fall under national jurisdiction. It is proposed that this function be progressively elevated to the regional level, i.e. that market entry rules and conditions are set from a regional perspective and in a standardised manner. Practically, member states would continue to issue licences, but under franchise from the region and not based on purely national considerations. An example of such authority being vested at regional level is the COMESA/EAC/SADC Joint Competition Authority (JCA) launched in 2008 to oversee the full implementation of the Yamoussoukro Decision on air transport in the three regional communities and the adoption of the Joint Competition Regulations.

3.3.3 Capacity Interventions

The EAC and its organs are the custodians of regional integration, and should be capacitated to play a more catalytic role by assuming a pronounced leadership role in the establishment and management of its institutions and also to take control of other regional institutions which may at present operate institutionally independent from the EAC. For this purpose, the EAC should strengthen its capacity, enhance its mandate and extend its sphere of influence by restructuring and further empower the EAC Secretariat to take initiatives as indicated and introduce reforms, developing and implementing a structured skills development standing training programme, recruiting staff from Partner states, establishing regional offices in Partner states and obtaining reliable funding sources.

In addition, the establishment of regional training institutions required for skills development in transport, in general and mode-specific, should be promoted.

3.4 Main Policy and Institutional Projects

The major projects that flow from the policy and institutional review are:

- Review, modify and adopt the benchmark ESA transport policy as the Community transport policy
- Audit and update national transport policies to be in compliance with regional transport policy (as developed by ESA Tripartite)
- Establish mode and topic-specific regional technical committees at the regional level to set the agenda for each mode and to coordinate between modes. Establish the co-ordinating mechanism to administer these committees in the EAC
- Establish and empower region-wide safety and technical regulatory agencies, and where these already exist (CASSOA) provide these with regulatory autonomy to set and enforce regional standards. Priority sectors are roads (possibly extending the JTC's mandate); aviation (CASSOA); ports, maritime and inland waterway transport; aviation (air transport, airports and ANS); and rail
- In considering extending CASSOA's functions and responsibilities EAC should not include accident and incident investigations, but should conduct a feasibility study on the establishment of a regional transport accident and incident investigation agency for the Community
- The Tripartite Agreement on Road Transport should be reviewed to recognize the coordinating role to be played by the EAC Secretariat while the Joint Technical Committee or any equivalent should be incorporated as an institution or agency of the EAC
- EAC should consider assuming responsibility for coordinating and administering the SAR function for the Region and ensuring that the associated tripartite agreement is suitably amended to reflect to appropriate institutional dispensation
- Develop regional technical guidelines and standards for planning and operation of infrastructure of regional importance, including feasibility and funding approaches (road, rail, ports and airports)
- For the funding of regional infrastructure projects establish an Infrastructure Funding Advisory Board to coordinate the funding of regional infrastructure projects with Partner states, investigate funding sources for regional infrastructure projects, interact with Development Partners and potential donors and to provide standardised guidelines to Partner states for the engagement with Development Partners and other donors
- EAC, with the participation of the Partner states and existing Corridor Agencies should review the functioning, mandate and associated institutional arrangements of the agencies with the view to transform them into full-blown regional corridor agencies, and properly integrated into the EAC institutional system for regional transport. Where a corridor transcends the EAC, the corridor committee should respond to more than one REC. The objective should be to avoid there being multiple regional bodies, endorsed by the same countries, with potentially overlapping functions
- Implement regional approach to transport liberalisation and establish licensing entities for road transport, aviation (JCA) and rail
- Review regional training institutions, including for aviation and marine transport services

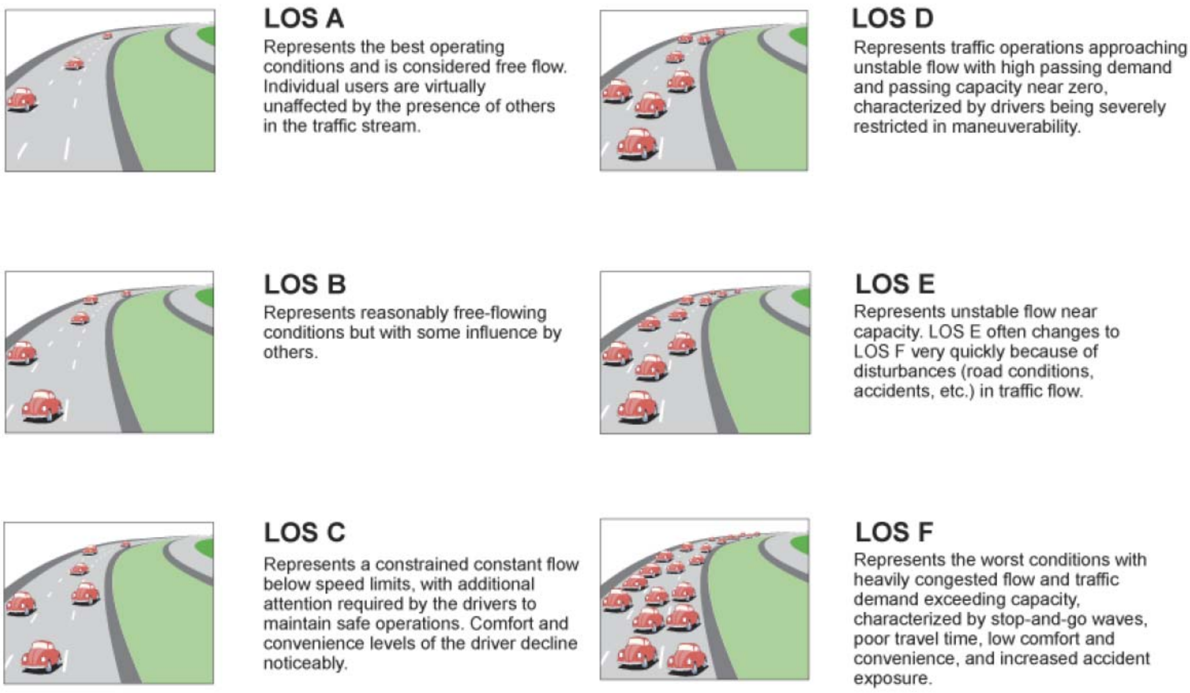
4. ROADS

This chapter presents a summary of the analysis underlying Working Paper 5: Roads Data and Working Paper 6: Roads Analysis, as also documented in Part III of this report (Roads Development Program).

In the same manner that the chapters on the non-roads modes focus on capacity constraints and interventions, this roads chapter also emphasises issues related to roads capacity and specifically the first order network assessment (FONA) analysis carried out. However, Part III furthermore reports on the roads condition assessment that was carried out. Whereas the capacity assessment projects when additional lance capacity will be required, the condition analysis indicates when interventions will be required to maintain or reinstate the road.

4.1 Reference Levels of Service

The Highway Capacity Manual, an internationally recognised standard for benchmarking the capacity of transportation infrastructure (facility) such as roadways, intersections, footways, etc. defines LOS as: *"A qualitative measure describing operational conditions within a traffic stream, based on service measures such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, and convenience."* (HCM, 2000).



Source:

Figure 4-1: Highway LOS Range

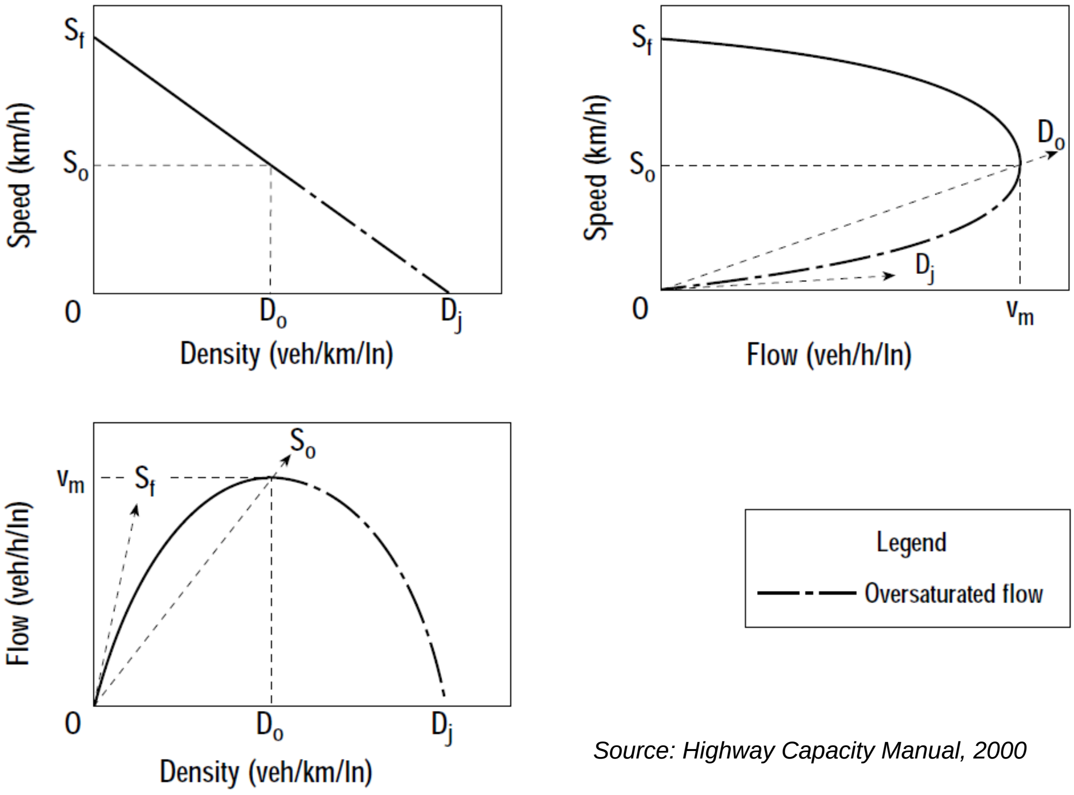
The key performance indicator that is used to evaluate the status of vehicular operations on a roadway is expressed in terms of Level of Service (LOS). LOS is indicated by using the letters of the alphabet ("A" through to "F"), "A" representing the best operating conditions and "F" the worst. When new road infrastructure is designed, most public sector entities tend to require a design LOS of at least "C" in the design year – in other words, if a facility is designed to last for a period of seven years, in year seven the facility should preferably still operate at a LOS of "C". The reality within most countries, however, is at a level that is usually exceedingly lower than this ideal situation, especially in and around urban environments.

The LOS for different kinds of analysis is determined using different approaches as recommend by the HCM. For two-lane and multi-lane freeways the approaches to measure LOS also differs but provides the practitioner with results that are comparable on from one type of facility to the next.

- Two-lane facilities: LOS is determined in terms of both *percent time-spent-following* and *average travel speed*. These two factors provide a representative measure of the efficiency of mobility. The worst of the two measures is taken as representative of the facility.
- Multi-lane facilities: LOS is determined as a relationship between the *average passenger-car speed* and the *traffic density*. It provides an indication of the freedom of a vehicle to manoeuvre within the traffic stream as well as the vehicle's proximity to other vehicles.

Figure 4-2 below illustrates the speed-density, flow-density, and speed-flow relationships on uninterrupted-flow facilities (highways) and are the basis for analysing capacity of uninterrupted-flow facilities.

Simply put, as density approaches zero (light traffic), speed increases and flow approaches zero. Similarly, as density increases (heavy traffic) speed is reduced and flow is increased until it reaches a point called jammed density where all vehicles have stopped and flow is zero.



Source: Highway Capacity Manual, 2000

Figure 4-2: Generalised Relationship among Speed, Density, and Flow Rate on Uninterrupted-Flow Facilities (Highways)

Road condition, in terms of the ride quality of a road, is also an important factor that has an impact on the speed that a vehicle can travel. In other words, the poorer the ride quality/road condition of a roadway segment, the lower the speed one is able to travel.

Therefore, there is a direct correlation between road condition/quality and free-flow speed and is an important criteria for the successful assessment of a road network and will be taken into account through this study.

4.1.1 Economic LOS

The economic function and strategic function of the identified EAC road corridors is depicted on Map 4-1 below and illustrates EAC corridors that play an important economic role and function as well as strategic role and function for the EAC as a whole.

With regards to economic function of corridors it means that these are roads that play an important part in the economic well-being of the EAC. It is therefore important that the economic function of the EAC Corridors are supported and promoted.

When viewed in terms of the LOS concept, it stands to reason that a corridor with a poor LOS would be reduced in support of its economic function and therefore the LOS concept is a good indicator or guideline as to whether a section of a corridor is being supported in terms of its identified economic function.

Map 4-2 below demonstrates the economic and strategic functions of the EAC road corridor network in terms of its LOS capacity operation projected for 2020 assuming a 5% compound traffic growth.

It is clear that the following EAC corridors and corridor feeders that serve an economic function, demonstrate poor LOS:

- Northern Corridor
- Sirari Corridor (surrounding Kisumu)
- Namanga Corridor (surrounding Nairobi and Dodoma)
- Narok-Northern Corridor feeder
- Central Corridor (surrounding Dar es Salaam, Kigali, and Bujumbura).

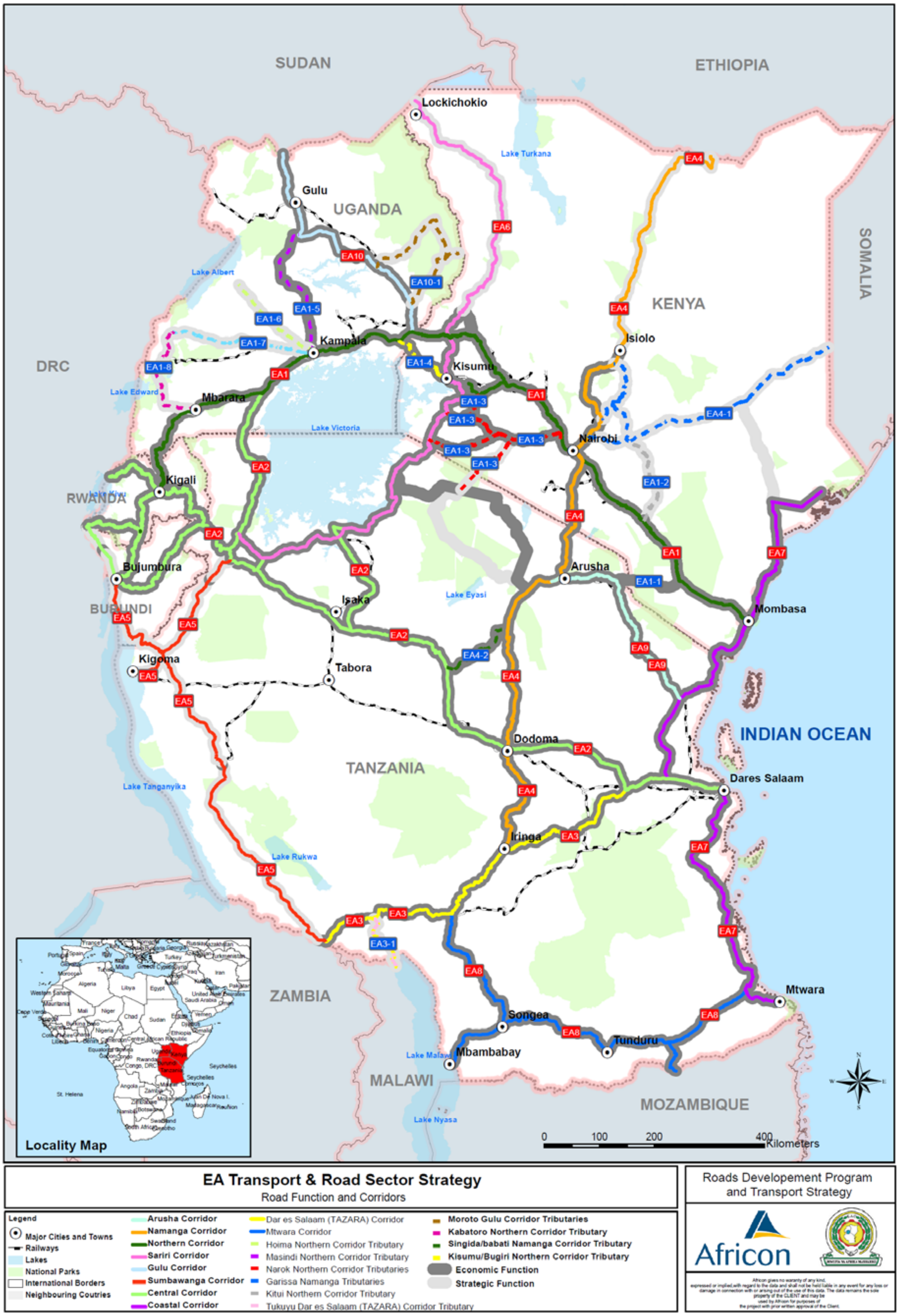
4.1.2 Strategic LOS

The strategic function of the identified EAC road corridors is also depicted in Map 4-2 below. It illustrates the EAC corridors that play an important strategic role and function both in terms of supporting the corridors that are playing an important economic role and in terms of economic potential in terms of future function for the EAC as a whole. It is therefore important that the strategic function of the EAC Corridors is identified as part of strategic planning of the EAC road corridor network.

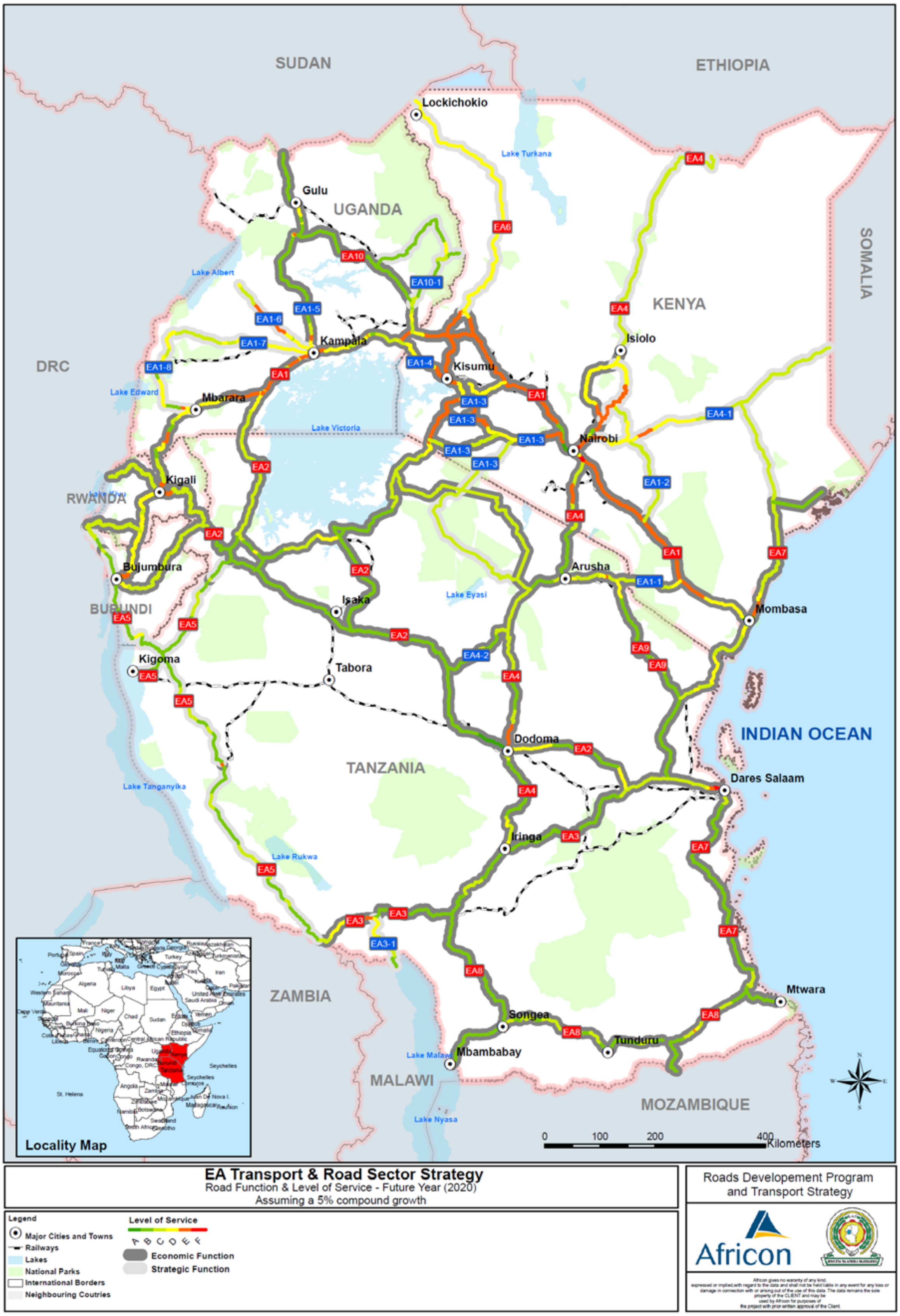
When viewed in terms of the Level of Service (LOS) concept, it stands to reason that a corridor with a poor LOS would be reduced in support of its strategic function and therefore the LOS concept is a good indicator or guideline as to whether a section of a Corridor is being supported in terms of its identified strategic function.

It is clear that the following EAC corridors and corridor feeders that serve a strategic function, demonstrate poor LOS:

- Garissa-Namanga Corridor feeder
- Hoima-Northern Corridor feeder.



Map 4-1: EAC Road Corridors – Economic and Strategic Function



Map 4-2: EAC Road Corridors Network – Economic and Strategic Function LOS

4.2 Productivity Indicators

In accordance with the Terms of Reference for this study, this section on productivity indicators strives to analyse and propose benchmarks for assessment of projected improvement in the performance of the road links, including reduction of road transportation cost and transit times, improved level of maintenance and utilisation, as well as other productivity indicators, based on a comparative analysis of level of performance of other similar but more efficient transport corridors elsewhere in the World.

In order to apply this productivity indicators approach to the roads environment, the consultant team applied the First Oder Network Assessment (FONA) methodology used to assess the road capacity bottlenecks for the EAC road network. The FONA methodology was applied to comparative corridors in the South African road environment in order to benchmark the operational performance of EAC corridors with similar corridors in South Africa.

4.2.1 Corridor Comparison Selection

In order to effectively prepare comparative benchmarks for transport corridors in the EAC, corridors of similar characteristics had to be selected. The following characteristics were applied in the corridor selection exercise:

- Corridors should be of major economic importance to the region
- Corridors should service a major port at either its origin or destination
- Corridors should be characterised by higher heavy vehicle / freight volumes
- Corridors should service multiple regions or geographies.

The following major trade corridors were therefore selected in terms of the abovementioned selection exercise (refer to Table 4-1 below).

Table 4-1: Major Trade Corridors of the RSA and the EAC

Region	Corridor	Length (km)
RSA	**National Route N3** – Connecting Johannesburg and Durban	**579**
	National Route N4 – Botswana Border to Mozambique Border via Pretoria	**815**
EAC	**Central Corridor** – Dar es Salaam – Morogoro – Dodoma – Singida – Nzega – Nyakanazi – Kigali - Gisenyi	**3 127**
	Northern Corridor – Mombasa-Voi-Eldoret-Bigiri-Kamala-Masaka-Kigali-Kibuye-Kayanza-Bujumbura	**1 926**

Source: Africon, 2010

Note: Lengths are approximate

4.2.2 Major Trade Corridor Comparison

The selected Major Trade Corridors were compared in terms of the following characteristics:

- Geometric characteristics
- Traffic characteristics
- Operational characteristics.

4.2.3 Geometric Characteristics

With regards to geometric characteristics, the following was investigated and compared (refer to Table 4-3 below):

- Number of lanes
- Terrain type (level, mountainous or rolling)
- Travel speed.

Taking into consideration the number of lanes and referring to Table 4-2 below, the following observations can be made:

- The RSA Corridor National Route N3 for the large part, has two lanes (94.8%) per direction of its total length; whereas the National Route N4 has mostly one lane per direction (77.5% of its length) as well as two lanes per direction for 22.5% of its total length
- The EAC Central and Northern Corridors both have for the largest part of their respective lengths one lane per direction (97.7% and 91.7% respectively).

With regards to the terrain type, the RSA corridors and EAC corridors compare as follows:

- The RSA corridors are for the most part characterised by a level terrain type (N3 = 77% of its total length; N4 = 83.6% of its total length)
- The EAC Central Corridor is characterised by a level terrain type for 48.1% of its total length and a rolling terrain type for 51.9% of its total length
- The EAC Northern Corridor is characterised by a rolling terrain type for a large part (90.7%) of its total length.

With regards to the travel speeds, the RSA corridors and EAC corridors compare as follows:

- The RSA corridors are characterised by high travel speeds (77% and 83.6% of their respective lengths)
- The EAC corridors are characterised by lower travel speeds of between 70km/h and 80km/h and between 80km/h and 90km/h respectively

Therefore, given the observations made above, the following conclusions can be drawn:

- The RSA corridors are characterised by higher travel speeds, which could be attributable to level terrain characteristics and higher number of lanes
- The EAC corridors are characterised by lower travel speeds which could be attributable to rolling terrain type characteristics together with mostly having only one lane per direction.

4.2.3.1 Traffic Characteristics

With regards to traffic characteristics the following was investigated and compared (refer to Table 4-3 below):

- Percentage heavy vehicles

- Traffic volumes (30th highest hourly volumes per direction).

Taking into consideration the percentage heavy vehicles and referring to Table 4-4 below, the following observations can be made:

- Between 21-30% heavy vehicles form the largest part of the traffic stream on the RSA corridors
- More than 50% of the traffic on the EAC corridors is made up of of heavy vehicles.

With regards to traffic volumes, the following observations can be made:

- Of the traffic volumes on the RSA National Route N3 corridor, 64% range between 200 – 2 000 vehicles and 21.1% are more than 2 000 vehicles (30th highest hourly traffic volumes per direction)
- Of the traffic volumes on the RSA National Route N4 corridor, 81% range between 200 – 2 000 vehicles and 5.3% are more than 2 000 vehicles (30th highest hourly traffic volumes per direction)
- Of the traffic volumes on the EAC Central Corridor, 90.6% fall below 200 vehicles with only 9.4% ranging between 200 – 2 000 vehicles and 0% more than 2000 vehicles (30th highest hourly traffic volumes per direction).
- Of the traffic volumes on the EAC Northern Corridor, 48.8% fall below 200 vehicles with 51.2% ranging between 200 – 2 000 vehicles and 0% more than 2 000 vehicles (30^{th} highest hourly traffic volumes per direction).

Therefore, given the observations made above, the following conclusions can be drawn:

- The RSA corridors are characterised by higher traffic volumes with lower numbers of heavy vehicles
- The EAC corridors are characterised by lower traffic volumes and higher numbers of heavy vehicles.

4.2.3.2 Operational Performance Characteristics

With regards to operational performance characteristics the base year LOS was investigated (refer to Table 4-4 as well as Figure 4-3 below). The following observations can be made:

- The RSA National Route N3 corridor operates at LOS A 59.3% of its total length
- The RSA National Route N4 corridor operates at a spread between LOS A, B and C for 24.4 %, 24% and 20.8% respectively of its total length
- The EAC Central Corridor operates at LOS B and C for 41.1% and 49.5% of its total length
- The EAC Northern Corridor operates at LOS D and E for 36.8% and 42.1% respectively of its total length.

Table 4-2: Geometric Characteristics

Region	Corridor	Length (km)	Number of Lanes			Terrain Type			Travel Speed			
			1	**2**	**3**	**Level**	**Mountain**	**Rolling**	**70km/h**	**80 km/h**	**90 km/h**	**100 km/h**
RSA	**National Route N3**	579	0.1%	94.8%	5.2%	77.0%	7.2%	15.9%	0.0%	7.2%	15.9%	77.0%
	National Route N4	815	77.5%	22.5%	0.0%	83.6%	5.6%	10.8%	0.0%	5.6%	10.8%	83.6%
EAC	**Central Corridor**	3 127	97.7%	2.3%	0.0%	48.1%	0.0%	51.9%	4.8%	46.1%	49.0%	0.0%
	Northern Corridor	1 926	91.7%	8.3%	0.0%	6.8%	2.5%	90.7%	43.4%	48.4%	8.1%	0.0%

Notes: The above percentages represents a percentage of the total length of a specific corridor that reflect a specific geometric characteristic

Source: Africon, 2010

Table 4-3: Traffic Characteristics

Region	Corridor	Length (km)	% Heavy Vehicles						Traffic Volumes (30th Highest Hourly Volumes per Direction)					
			<10%	**11-20%**	**21-30%**	**31-40%**	**41-50%**	**>50%**	**<200**	**200-500**	**501-1000**	**1001-1500**	**1501-2000**	**>2000**
RSA	**National Route N3**	579	9.5%	0.0%	43.5%	34.6%	12.5%	0.0%	14.5%	20.8%	25.8%	10.6%	7.1%	21.1%
	National Route N4	815	20.0%	2.2%	63.9%	13.9%	0.0%	0.0%	13.6%	37.6%	25.6%	12.2%	5.6%	5.3%
EAC	**Central Corridor**	3 127	0.0%	48.1%	0.0%	0.0%	16.3%	35.6%	90.6%	7.7%	1.2%	0.3%	0.2%	0.0%
	Northern Corridor	1 926	0.0%	31.5%	0.0%	0.0%	17.2%	51.3%	48.8%	44.7%	6.3%	0.3%	0.0%	0.0%

Notes: The above percentages represents a percentage of the total length of a specific corridor that reflect a specific traffic characteristic

Source: Africon, 2010

Table 4-4: Operational Performance Characteristics

Region	Corridor	Length (km)	Base Year - Operational Performance (LOS)					
			A	B	C	D	E	F
RSA*	National Route N3	579	59.3%	8.7%	14.6%	8.0%	4.2%	5.2%
	National Route N4	815	24.4%	24.0%	20.8%	18.1%	10.8%	2.0%
EAC**	Central Corridor	3 127	2.1%	41.1%	49.5%	6.5%	0.7%	0.0%
	Northern Corridor	1 926	5.7%	7.6%	6.8%	36.8%	42.1%	0.9%

*Notes:*Base Year (2005)*

***Base Year (2010)*

The above percentages represents a percentage of the total length of a specific corridor that reflect a specific performance characteristic

Source: Africon, 2010

4.2.4 Major Trade Corridor Comparison Summary Conclusions

With regards to the observations made in the previous sections the following conclusions can be summarised:

- Although the RSA corridors are characterised by higher travel speeds and higher traffic volumes, the majority operates at a higher LOS, which could be attributable to level terrain characteristics and higher number of lanes
- Although the EAC corridors are characterised by lower travel speeds and lower traffic volumes, the majority operates at a lower LOS, which could be attributable to rolling terrain type characteristics, and a large heavy vehicle presence together with mostly having only one lane per direction.

Therefore, it is clear that by addressing Geometric and traffic characteristics on the EAC corridors, an improved LOS can be determined.

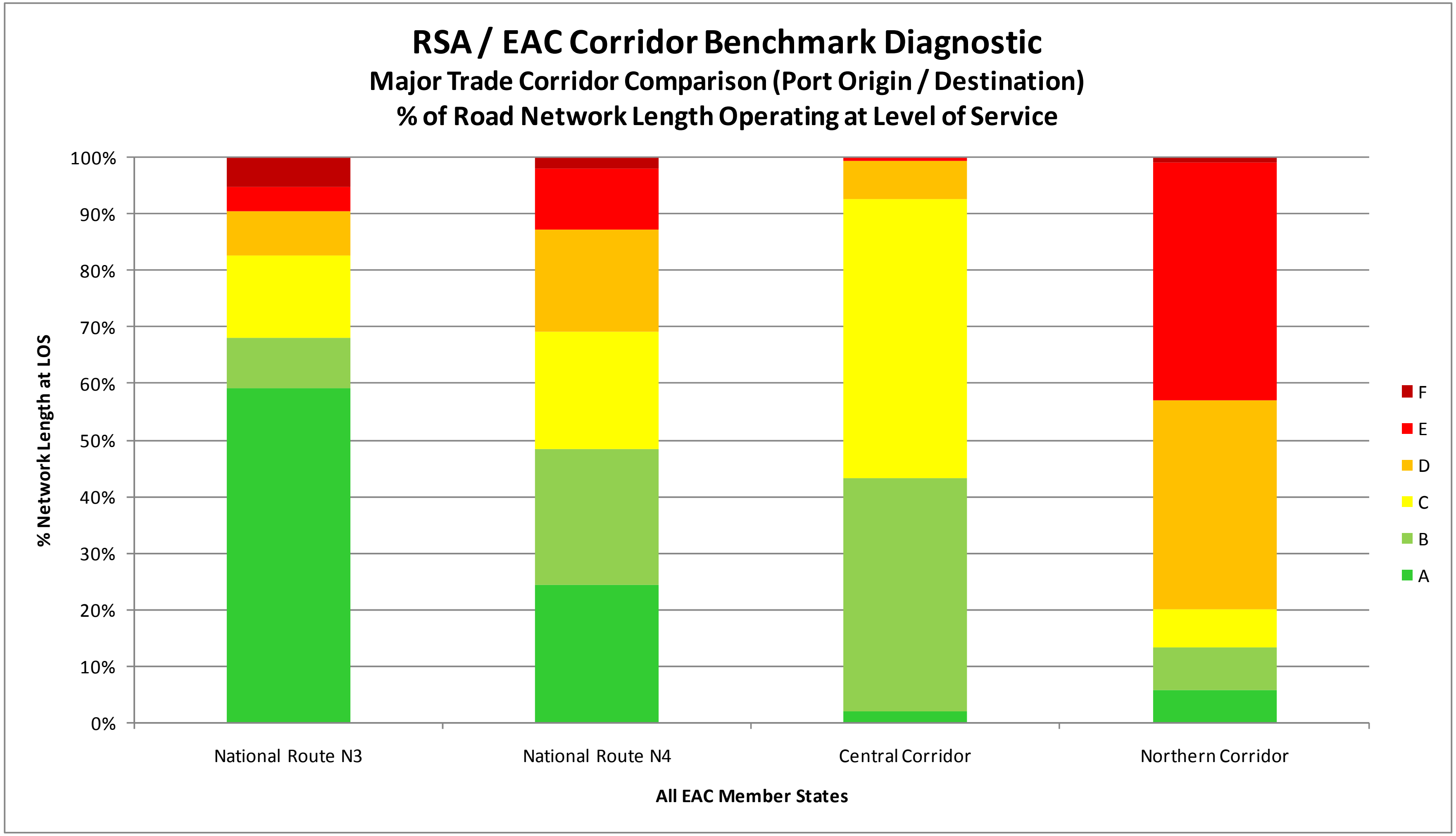


Figure 4-3: Major Trade Corridor Comparison – Percentage of Road Network Operating at Level of Service

Source: Africon, 2010

4.3 EAC Corridors

The results of the FONA analysis for each of the following identified EAC Corridors are summarised in the following sections (note that the total Corridor Length (km) for each Corridor is rounded-up):

4.3.1 Northern Corridor

Corridor Name	Northern Corridor	Corridor Length (km)	1 900 km
Corridor Description	Mombasa-Voi-Eldoret-Bigiri-Kamala-Masaka-Kigali-Kibuye-Kayanza-Bujumbura		

Lanes	1	2	Travel Speed	70km/h	80km/h	90km/h	Road Reserve	10.6m	17.6m
Length	1738 km	161 km	Length	852 km	890 km	158 km	Length	1738 km	161 km
	91.5%	8.5%		45%	47%	9%		92%	9%

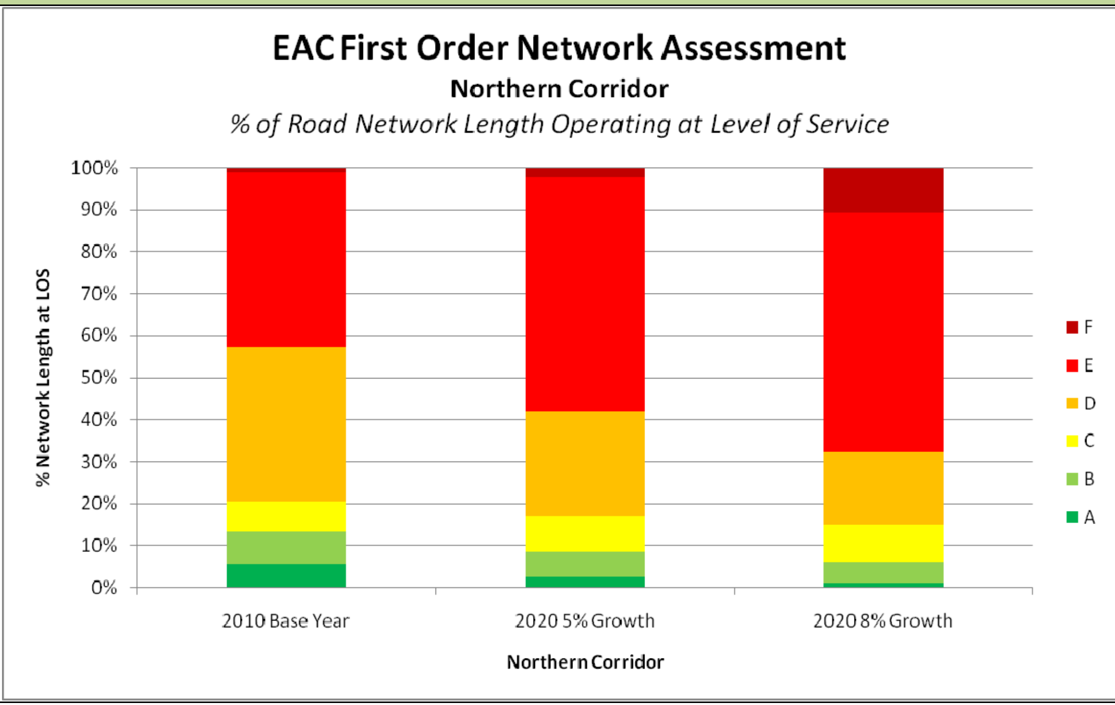
Terrain	Level	Rolling	Mountain	Land-use	Urban	Rural	Surface	Paved	Unpaved
Length	131 km	1718 km	50 km	Length	329 km	1570 km	Length	1896 km	3 km
	7%	91%	3%		18%	83%		100%	1%

Number of Accesses / km	0 Accesses	1 Access	2 Accesses	3 Accesses	≥ 4 Accesses
Length	1634 km	121 km	88 km	57 km	0 km
	87%	7%	5%	3%	0%

Traffic Volumes*	0-50	51-100	101-200	201-300	301-400	401-500	501-750	751-1000	1001-1500	1501-2000
Length	55 km	106 km	784 km	466 km	326 km	38 km	52 km	70 km	5 km	0 km
	3%	6%	42%	25%	18%	2%	3%	4%	1%	0%

Corridor Performance (Level of Service)	A *Very Good*	B *Good*	C *Acceptable*	D *Acceptable*	E *Poor*	F *Very Poor*
2010 (Base Year) Scenario	111 km	148 km	138 km	711 km	812 km	19 km
	6%	8%	8%	38%	43%	2%
2020 5% Traffic Growth Scenario	50 km	115 km	160 km	486 km	1083 km	43 km
	3%	7%	9%	26%	58%	3%
2020 8% Traffic Growth Scenario	20 km	96 km	172 km	335 km	1107 km	208 km
	2%	6%	10%	18%	59%	11%

Corridor Performance Chart



** 30th Highest Hourly Volumes (per direction)*

4.3.2 Central Corridor

Corridor Name	Central Corridor	**Corridor Length (km)**	3 100 km
Corridor Description	Dar es Salaam – Morogoro – Dodoma – Singida – Nzega – Nyakanazi – Kigali - Gisenyi		

Lanes	**1**	**2**	**Travel Speed**	**70km/h**	**80km/h**	**90km/h**	**Road Reserve**	**10.6m**	**17.6m**
Length	3026 km	74 km	Length	152 km	1419 km	1529 km	Length	3026 km	74 km
	97.7%	2.3%		5%	46%	50%		98%	3%

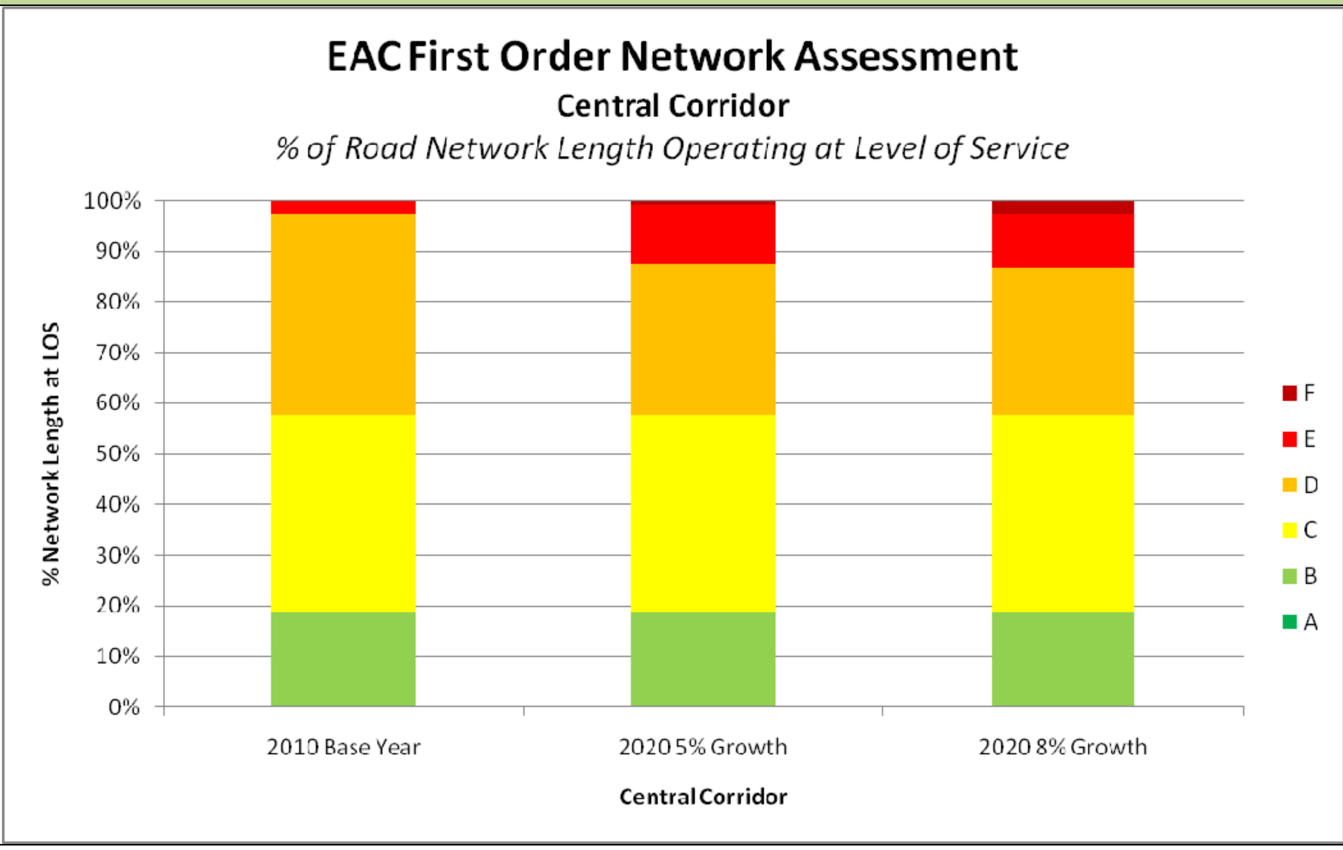
Terrain	**Level**	**Rolling**	**Mountain**	**Land-use**	**Urban**	**Rural**	**Surface**	**Paved**	**Unpaved**
Length	1506 km	1594 km	0 km	Length	125 km	2975 km	Length	2651 km	449 km
	49%	52%	0%		5%	96%		86%	15%

Number of Accesses / km	**0 Accesses**	**1 Access**	**2 Accesses**	**3 Accesses**	**≥ 4 Accesses**
Length	2382 km	428 km	164 km	86 km	41 km
	77%	14%	6%	3%	2%

Traffic Volumes*	**0-50**	**51-100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-750**	**751-1000**	**1001-1500**	**1501-2000**
Length	2413 km	397 km	0 km	160 km	0 km	83 km	24 km	9 km	11 km	6 km
	78%	13%	0%	6%	0%	3%	1%	1%	1%	1%

Corridor Performance (Level of Service)	**A** *Very Good*	**B** *Good*	**C** *Acceptable*	**D** *Acceptable*	**E** *Poor*	**F** *Very Poor*
2010 (Base Year) Scenario	0 km	67 km	142 km	144 km	9 km	0 km
	0%	3%	5%	5%	1%	0%
2020 5% Traffic Growth Scenario	0 km	67 km	142 km	108 km	43 km	3 km
	0%	3%	5%	4%	2%	1%
2020 8% Traffic Growth Scenario	0 km	67 km	142 km	106 km	39 km	9 km
	0%	3%	5%	4%	2%	1%

Corridor Performance Chart



** 30th Highest Hourly Volumes (per direction)*

4.3.3 Dar es Salaam (TAZARA) Corridor

Corridor Name	Dar es Salaam (TAZARA) Corridor	**Corridor Length (km)**	1 100 km
Corridor Description	Morogoro-Iringa-Mbeya-Tunduma		

Lanes	**1**	**2**	**Travel Speed**	**70km/h**	**80km/h**	**90km/h**	**Road Reserve**	**10.6m**	**17.6m**
Length	1074 km	6 km	Length	0 km	214 km	866 km	Length	1074 km	6 km
	99.5%	0.5%		0%	20%	81%		100%	1%

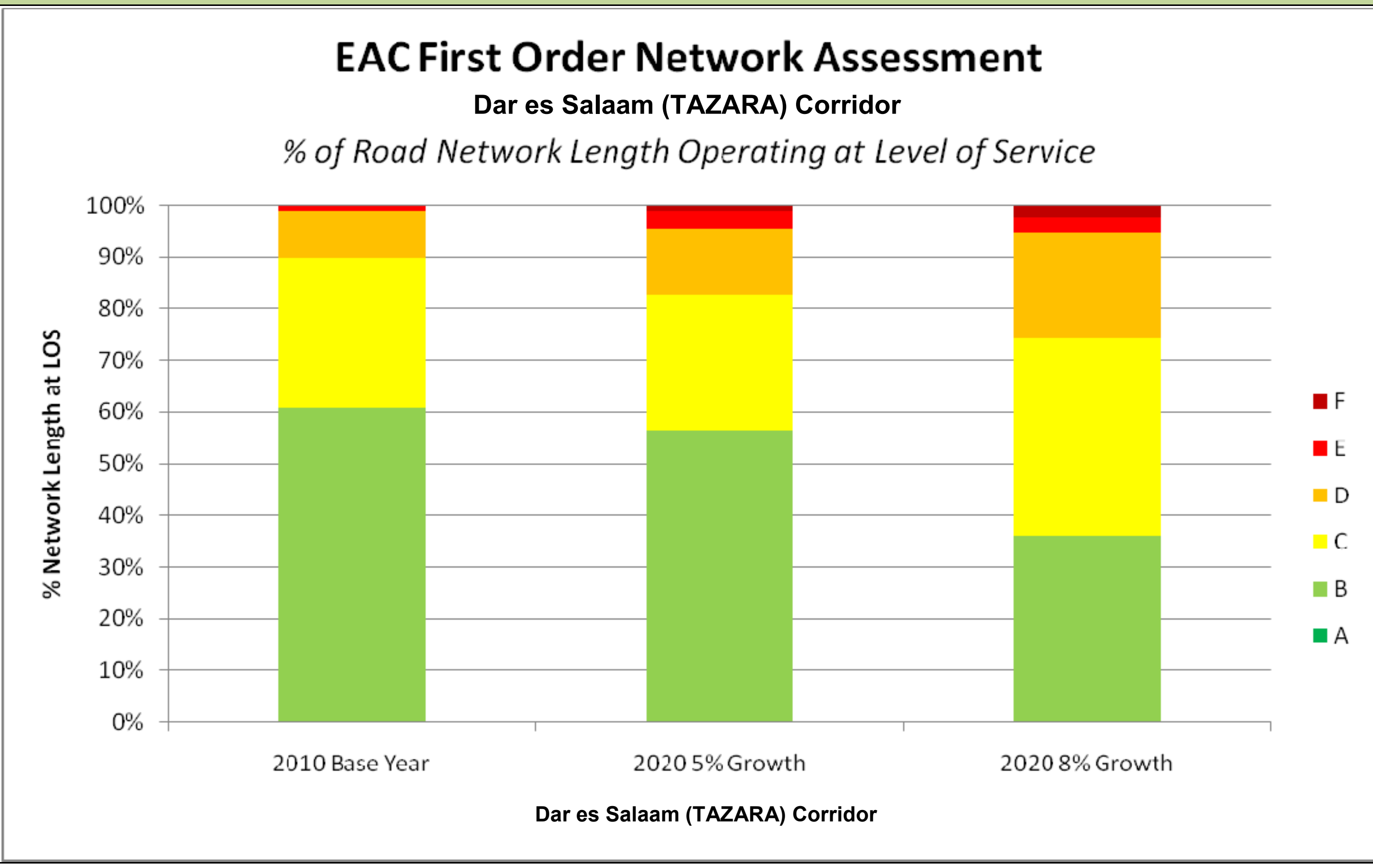
Terrain	**Level**	**Rolling**	**Mountain**	**Land-use**	**Urban**	**Rural**	**Surface**	**Paved**	**Unpaved**
Length	866 km	214 km	0 km	Length	33 km	1047 km	Length	1015 km	65 km
	81%	20%	0%		3%	98%		95%	6%

Number of Accesses / km	**0 Accesses**	**1 Access**	**2 Accesses**	**3 Accesses**	**≥ 4 Accesses**
Length	609 km	168 km	147 km	20 km	137 km
	57%	16%	14%	2%	13%

Traffic Volumes*	**0-50**	**51-100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-750**	**751-1000**	**1001-1500**	**1501-2000**
Length	149 km	675 km	36 km	176 km	15 km	8 km	0 km	9 km	11 km	6 km
	14%	63%	4%	17%	2%	1%	0%	1%	1%	1%

Corridor Performance (Level of Service)	**A** *Very Good*	**B** *Good*	**C** *Acceptable*	**D** *Acceptable*	**E** *Poor*	**F** *Very Poor*
2010 (Base Year) Scenario	0 km	657 km	315 km	99 km	11 km	0 km
	0%	61%	30%	10%	2%	0%
2020 5% Traffic Growth Scenario	0 km	610 km	284 km	137 km	40 km	11 km
	0%	57%	27%	13%	4%	2%
2020 8% Traffic Growth Scenario	0 km	391 km	411 km	222 km	33 km	25 km
	0%	37%	39%	21%	4%	3%

Corridor Performance Chart



** 30th Highest Hourly Volumes (per direction)*

4.3.4 Namanga Corridor

Corridor Name	Namanga Corridor	**Corridor Length (km)**	1 800 km
Corridor Description	Iringa-Dodoma-Kalema-Arusha-Nairobi-Thika- Muranga-Embu-Nyeri-Nanyuki-Isiolo-Marsabit-Moyale		

Lanes	**1**	**2**	**Travel Speed**	**70km/h**	**80km/h**	**90km/h**	**Road Reserve**	**10.6m**	**17.6m**
Length	1593 km	146 km	Length	85 km	1281 km	374 km	Length	1593 km	146 km
	91.6%	8.4%		5%	74%	22%		92%	9%

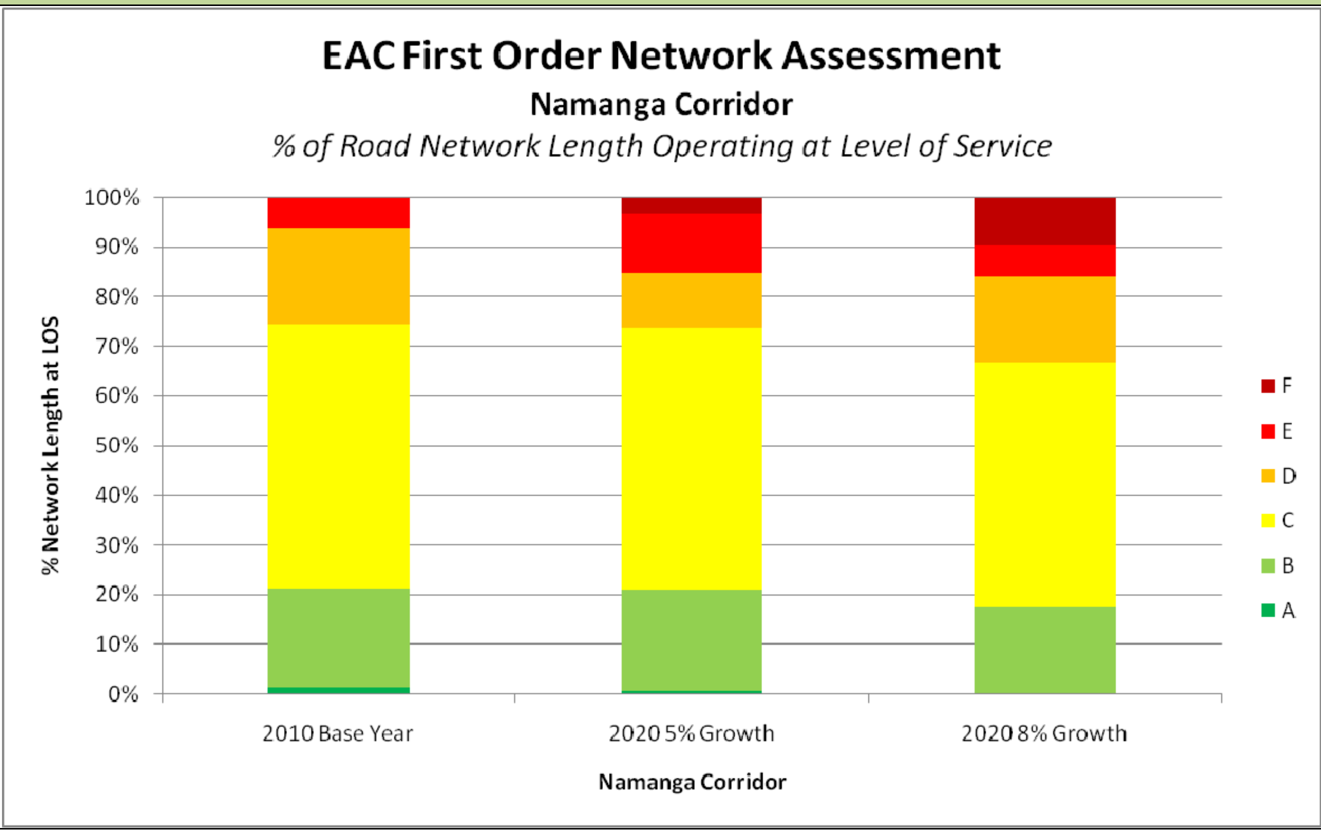
Terrain	**Level**	**Rolling**	**Mountain**	**Land-use**	**Urban**	**Rural**	**Surface**	**Paved**	**Unpaved**
Length	374 km	1281 km	85 km	Length	218 km	1521 km	Length	827 km	912 km
	22%	74%	5%		13%	88%		48%	53%

Number of Accesses / km	**0 Accesses**	**1 Access**	**2 Accesses**	**3 Accesses**	**≥ 4 Accesses**
Length	1453 km	105 km	87 km	44 km	51 km
	84%	7%	5%	3%	3%

Traffic Volumes*	**0-50**	**51-100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-750**	**751-1000**	**1001-1500**	**1501-2000**
Length	1095 km	242 km	159 km	26 km	14 km	0 km	96 km	27 km	43 km	41 km
	63%	14%	10%	2%	1%	0%	6%	2%	3%	3%

Corridor Performance (Level of Service)	**A** *Very Good*	**B** *Good*	**C** *Acceptable*	**D** *Acceptable*	**E** *Poor*	**F** *Very Poor*
2010 (Base Year) Scenario	24 km	347 km	936 km	341 km	106 km	0 km
	2%	20%	54%	20%	7%	0%
2020 5% Traffic Growth Scenario	10 km	357 km	925 km	196 km	208 km	58 km
	1%	21%	54%	12%	12%	4%
2020 8% Traffic Growth Scenario	0 km	307 km	865 km	301 km	111 km	170 km
	0%	18%	50%	18%	7%	10%

Corridor Performance Chart



* 30th Highest Hourly Volumes (per direction)

4.3.5 Sumbawanga Corridor

Corridor Name	Sumbawanga Corridor	Corridor Length (km)	1 300 km
Corridor Description	Tunduma-Sumbawanga-Kasulu-Makamba-Nyanza Lac-Rumonge-Bujumbura		

Lanes	1	2	Travel Speed	70km/h	80km/h	90km/h	Road Reserve	10.6m	17.6m
Length	1221 km	0 km	Length	23 km	296 km	903 km	Length	1221 km	0 km
	100%	0%		2%	25%	74%		100%	0%

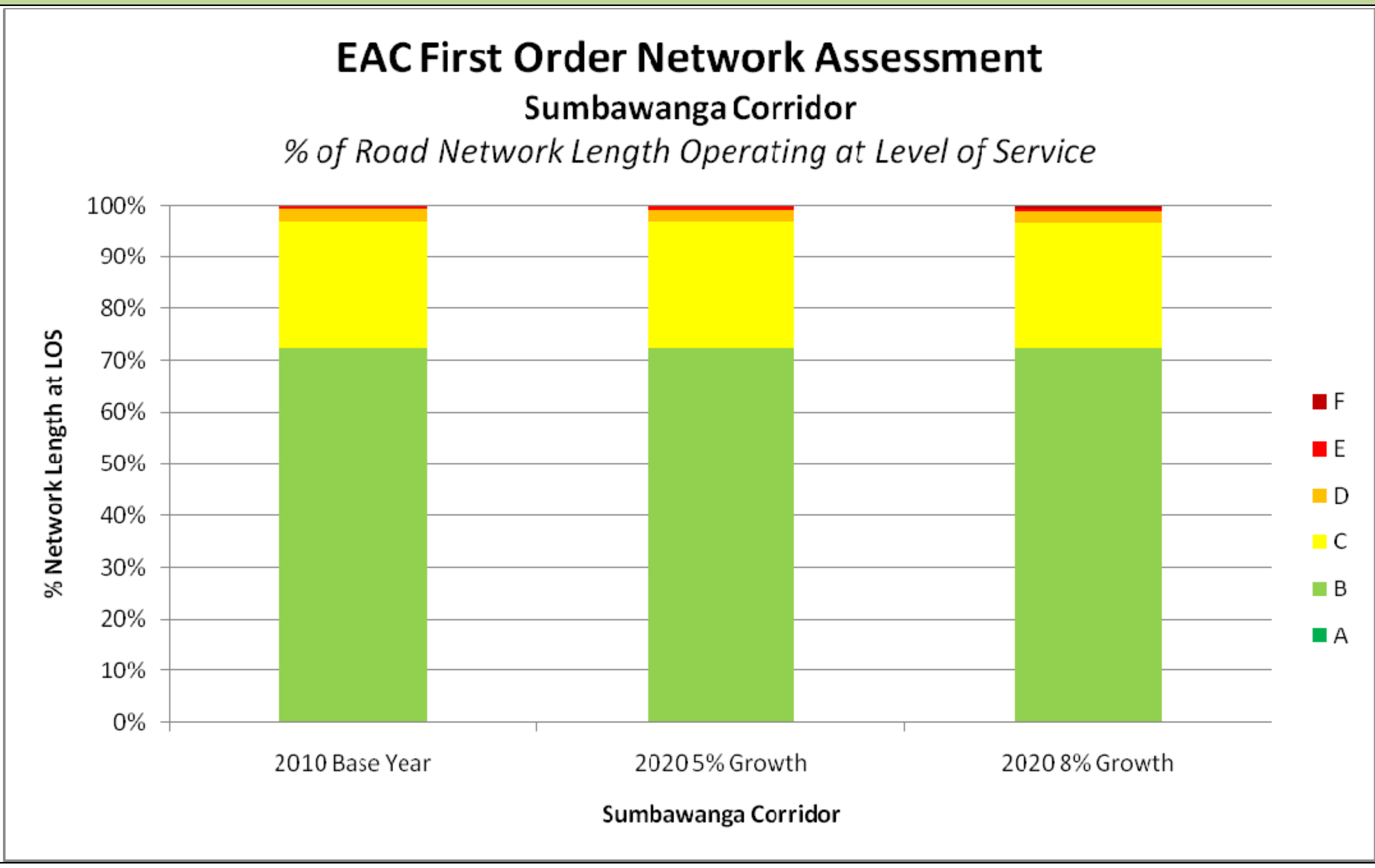
Terrain	Level	Rolling	Mountain	Land-use	Urban	Rural	Surface	Paved	Unpaved
Length	872 km	327 km	23 km	Length	62 km	1160 km	Length	312 km	910 km
	72%	27%	2%		6%	95%		26%	75%

Number of Accesses / km	0 Accesses	1 Access	2 Accesses	3 Accesses	≥ 4 Accesses
Length	1208 km	7 km	0 km	0 km	7 km
	99%	1%	0%	0%	1%

Traffic Volumes*	0-50	51-100	101-200	201-300	301-400	401-500	501-750	751-1000	1001-1500	1501-2000
Length	1216 km	0 km	0 km	0 km	0 km	0 km	6 km	0 km	0 km	0 km
	100%	0%	0%	0%	0%	0%	1%	0%	0%	0%

Corridor Performance (Level of Service)	A *Very Good*	B *Good*	C *Acceptable*	D *Acceptable*	E *Poor*	F *Very Poor*
2010 (Base Year) Scenario	0 km	897 km	302 km	35 km	6 km	0 km
	0%	74%	25%	3%	1%	0%
2020 5% Traffic Growth Scenario	0 km	897 km	302 km	30 km	11 km	0 km
	0%	74%	25%	3%	1%	0%
2020 8% Traffic Growth Scenario	0 km	897 km	302 km	30 km	6 km	6 km
	0%	74%	25%	3%	1%	1%

Corridor Performance Chart



** 30th Highest Hourly Volumes (per direction)*

4.3.6 Sariri Corridor

Corridor Name	Sariri Corridor	Corridor Length (km)	1 500 km
Corridor Description	Lockichokio-Lodwar-Kitale-Bungoma-Kisumu-Kisii-Mwanza-Biharamuro		

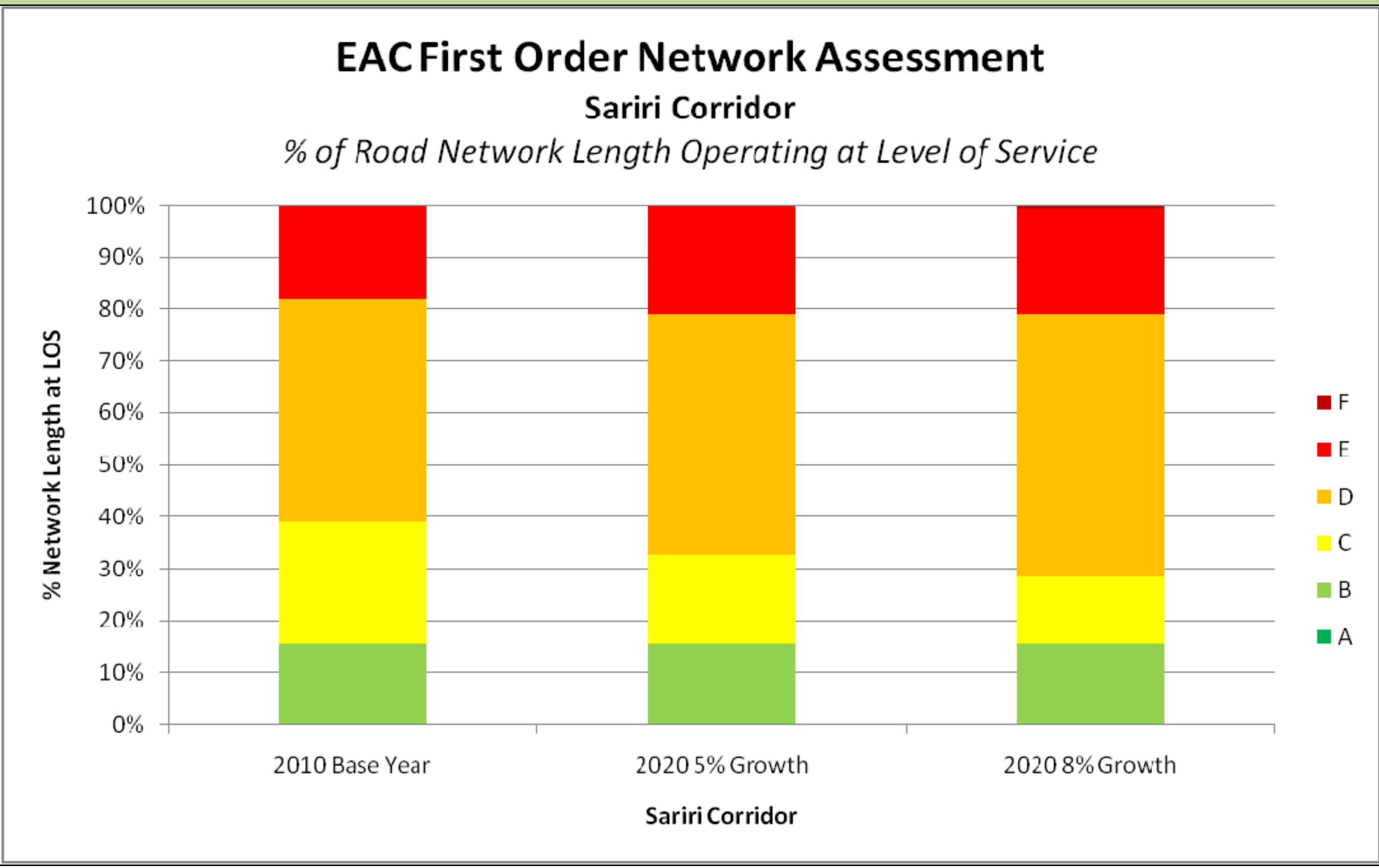
Lanes	1	2	Travel Speed	70km/h	80km/h	90km/h	Road Reserve	10.6m	17.6m
Length	1419 km	2 km	Length	843 km	361 km	216 km	Length	1419 km	2 km
	99.9%	0.1%		60%	26%	16%		100%	1%
Terrain	**Level**	**Rolling**	**Mountain**	**Land-use**	**Urban**	**Rural**	**Surface**	**Paved**	**Unpaved**
Length	216 km	1199 km	5 km	Length	31 km	1389 km	Length	1204 km	216 km
	16%	85%	1%		3%	98%		85%	16%

Number of Accesses / km	0 Accesses	1 Access	2 Accesses	3 Accesses	≥ 4 Accesses
Length	1368 km	29 km	23 km	0 km	0 km
	97%	2%	2%	0%	0%

Traffic Volumes*	0-50	51-100	101-200	201-300	301-400	401-500	501-750	751-1000	1001-1500	1501-2000
Length	971 km	136 km	281 km	21 km	2 km	11 km	0 km	0 km	0 km	0 km
	69%	10%	20%	2%	1%	1%	0%	0%	0%	0%

Corridor Performance (Level of Service)	A *Very Good*	B *Good*	C *Acceptable*	D *Acceptable*	E *Poor*	F *Very Poor*
2010 (Base Year) Scenario	2 km	216 km	334 km	612 km	256 km	0 km
	1%	16%	24%	44%	19%	0%
2020 5% Traffic Growth Scenario	2 km	216 km	248 km	657 km	298 km	0 km
	1%	16%	18%	47%	21%	0%
2020 8% Traffic Growth Scenario	2 km	216 km	187 km	718 km	290 km	8 km
	1%	16%	14%	51%	21%	1%

Corridor Performance Chart



** 30th Highest Hourly Volumes (per direction*

4.3.7 Coastal Corridor

Corridor Name	Coastal Corridor	**Corridor Length (km)**	1 500 km
Corridor Description	Mingoyo-Dar es Salaam; Chalinze-Vanga-Mombasa-Malindi-Matondoni		

Lanes	**1**	**2**	**Travel Speed**	**70km/h**	**80km/h**	**90km/h**	**Road Reserve**	**10.6m**	**17.6m**
Length	1377 km	34 km	Length	0 km	520 km	891 km	Length	1377 km	34 km
	97.7%	2.3%		0%	37%	64%		98%	3%

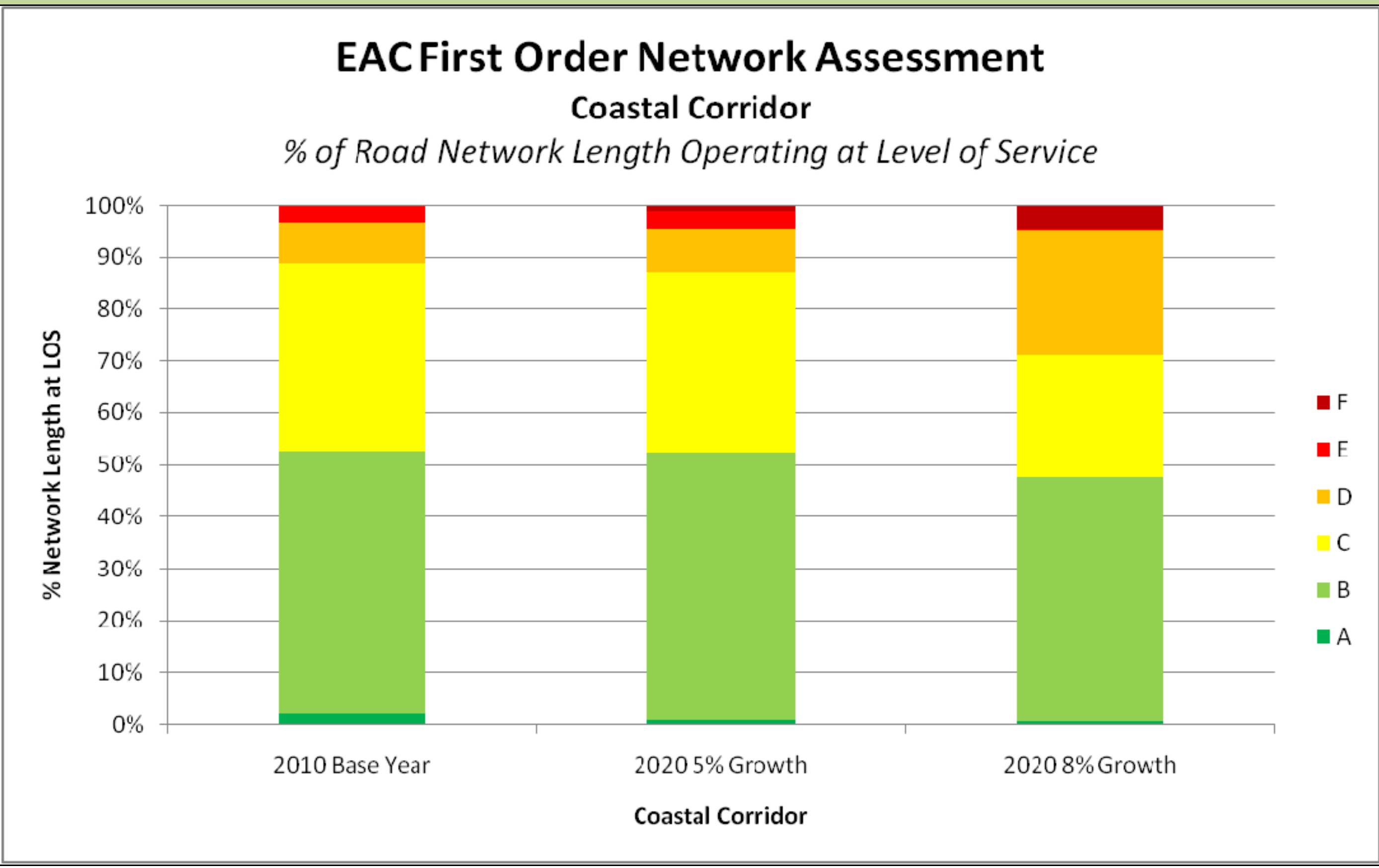
Terrain	**Level**	**Rolling**	**Mountain**	**Land-use**	**Urban**	**Rural**	**Surface**	**Paved**	**Unpaved**
Length	1087 km	324 km	0 km	Length	184 km	1227 km	Length	1256 km	155 km
	78%	23%	0%		14%	87%		90%	11%

Number of Accesses / km	**0 Accesses**	**1 Access**	**2 Accesses**	**3 Accesses**	**≥ 4 Accesses**
Length	1150 km	173 km	26 km	13 km	50 km
	82%	13%	2%	1%	4%

Traffic Volumes*	**0-50**	**51-100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-750**	**751-1000**	**1001-1500**	**1501-2000**
Length	612 km	535 km	99 km	70 km	7 km	10 km	47 km	13 km	16 km	6 km
	44%	38%	7%	5%	1%	1%	4%	1%	2%	1%

Corridor Performance (Level of Service)	**A** *Very Good*	**B** *Good*	**C** *Acceptable*	**D** *Acceptable*	**E** *Poor*	**F** *Very Poor*
2010 (Base Year) Scenario	27 km	716 km	514 km	111 km	45 km	0 km
	2%	51%	37%	8%	4%	0%
2020 5% Traffic Growth Scenario	11 km	730 km	490 km	119 km	49 km	14 km
	1%	52%	35%	9%	4%	1%
2020 8% Traffic Growth Scenario	9 km	664 km	331 km	339 km	8 km	62 km
	1%	48%	24%	25%	1%	5%

Corridor Performance Chart



** 30th Highest Hourly Volumes (per direction)*

4.3.8 Mtwara Corridor

Corridor Name	Mtwara Corridor	**Corridor Length (km)**	800 km
Corridor Description	Mtwara-Mingoyo-Masasi-Tunduru-Songea-Mbamba Bay		

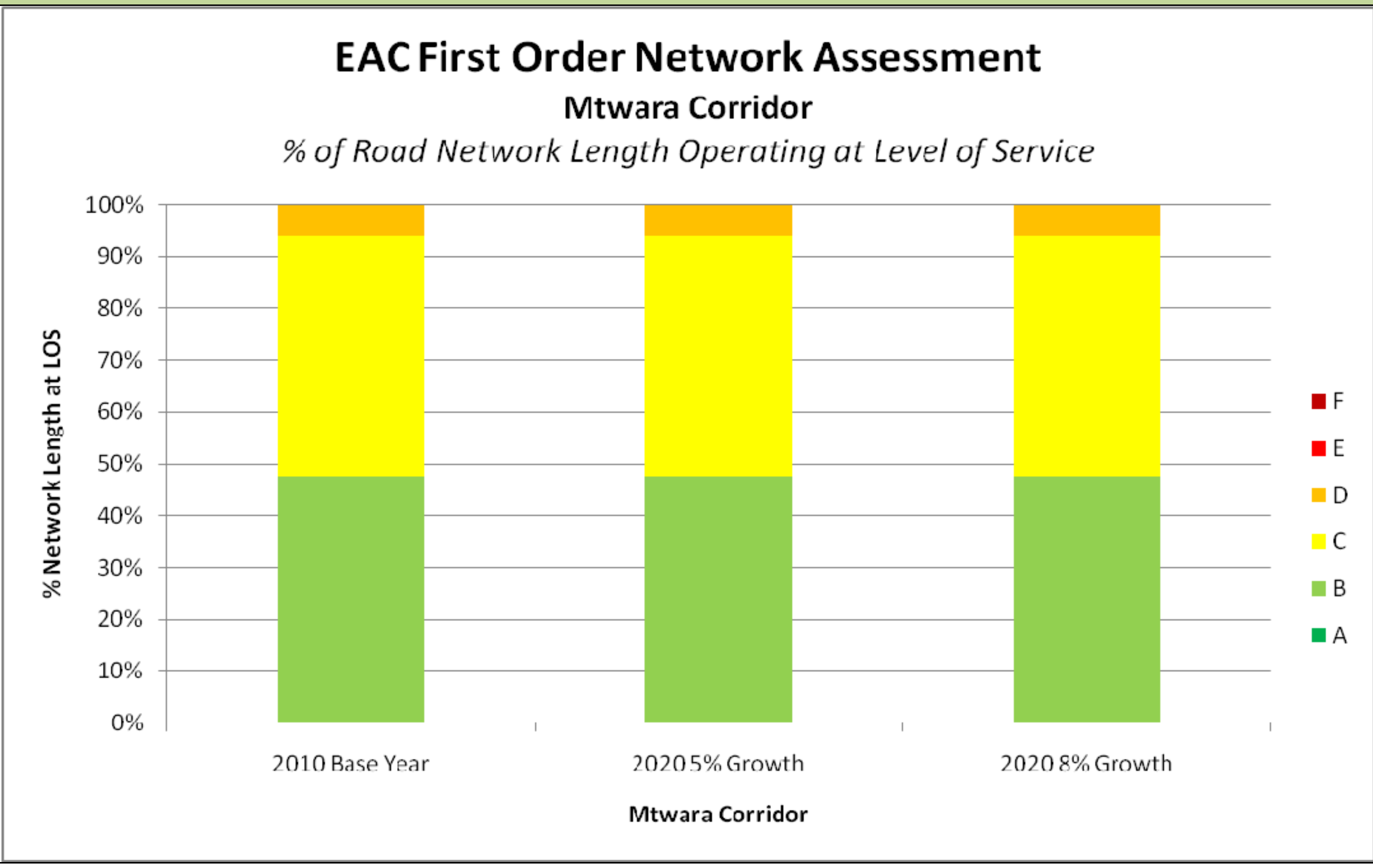
Lanes	**1**	**2**	**Travel Speed**	**70km/h**	**80km/h**	**90km/h**	**Road Reserve**	**10.6m**	**17.6m**
Length	738 km	0 km	Length	45 km	331 km	362 km	Length	738 km	0 km
	100%	0%		7%	45%	50%		100%	0%
Terrain	**Level**	**Rolling**	**Mountain**	**Land-use**	**Urban**	**Rural**	**Surface**	**Paved**	**Unpaved**
Length	362 km	340 km	37 km	Length	47 km	692 km	Length	207 km	531 km
	50%	47%	5%		7%	94%		29%	72%

Number of Accesses / km	**0 Accesses**	**1 Access**	**2 Accesses**	**3 Accesses**	**≥ 4 Accesses**
Length	683 km	38 km	0 km	0 km	18 km
	93%	6%	0%	0%	3%

Traffic Volumes*	**0-50**	**51-100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-750**	**751-1000**	**1001-1500**	**1501-2000**
Length	738 km	0 km	0 km	0 km	0 km	0 km	0 km	0 km	0 km	0 km
	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Corridor Performance (Level of Service)	**A** *Very Good*	**B** *Good*	**C** *Acceptable*	**D** *Acceptable*	**E** *Poor*	**F** *Very Poor*
2010 (Base Year) Scenario	0 km	356 km	349 km	44 km	0 km	0 km
	0%	49%	48%	6%	0%	0%
2020 5% Traffic Growth Scenario	0 km	356 km	349 km	44 km	0 km	0 km
	0%	49%	48%	6%	0%	0%
2020 8% Traffic Growth Scenario	0 km	356 km	349 km	44 km	0 km	0 km
	0%	49%	48%	6%	0%	0%

Corridor Performance Chart



** 30th Highest Hourly Volumes (per direction)*

4.3.9 Arusha Corridor

Corridor Name	Arusha Corridor	**Corridor Length (km)**	500 km
Corridor Description	Arusha-Moshi-Himo-Lushoto-A1		

Lanes	**1**	**2**	**Travel Speed**	**70km/h**	**80km/h**	**90km/h**	**Road Reserve**	**10.6m**	**17.6m**
Length	419 km	0 km	Length	0 km	41 km	378 km	Length	419 km	0 km
	100%	0%		0%	10%	91%		100%	0%

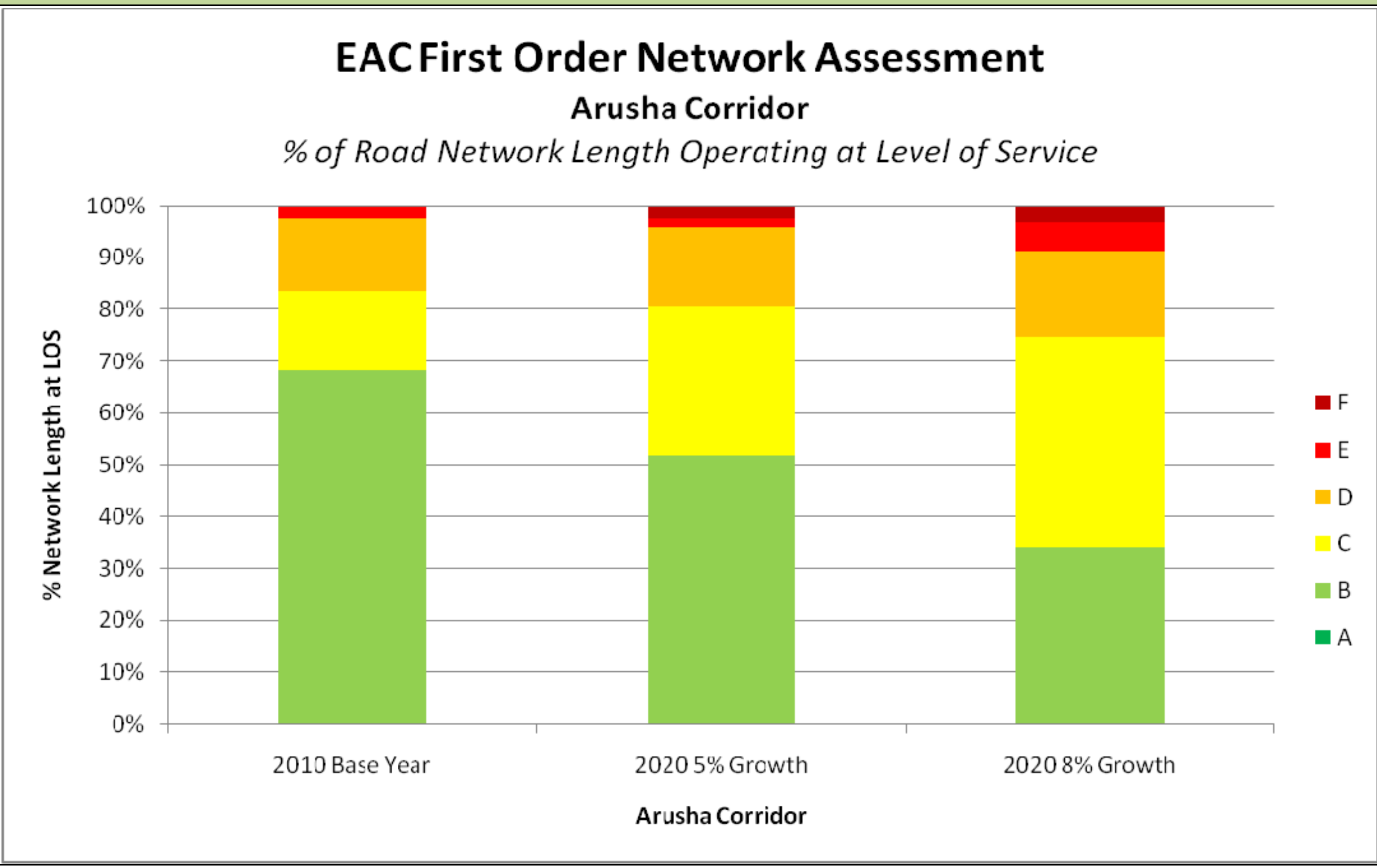
Terrain	**Level**	**Rolling**	**Mountain**	**Land-use**	**Urban**	**Rural**	**Surface**	**Paved**	**Unpaved**
Length	378 km	41 km	0 km	Length	0 km	419 km	Length	389 km	30 km
	91%	10%	0%		0%	100%		94%	7%

Number of Accesses / km	**0 Accesses**	**1 Access**	**2 Accesses**	**3 Accesses**	**≥ 4 Accesses**
Length	276 km	6 km	97 km	0 km	40 km
	66%	2%	24%	0%	10%

Traffic Volumes*	**0-50**	**51-100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-750**	**751-1000**	**1001-1500**	**1501-2000**
Length	30 km	256 km	4 km	63 km	36 km	0 km	19 km	4 km	10 km	0 km
	7%	62%	1%	15%	9%	0%	5%	1%	3%	0%

Corridor Performance (Level of Service)	**A** *Very Good*	**B** *Good*	**C** *Acceptable*	**D** *Acceptable*	**E** *Poor*	**F** *Very Poor*
2010 (Base Year) Scenario	0 km	287 km	64 km	59 km	10 km	0 km
	0%	69%	16%	15%	3%	0%
2020 5% Traffic Growth Scenario	0 km	218 km	121 km	63 km	8 km	10 km
	0%	53%	29%	16%	2%	3%
2020 8% Traffic Growth Scenario	0 km	144 km	171 km	69 km	23 km	14 km
	0%	35%	41%	17%	6%	4%

Corridor Performance Chart



** 30th Highest Hourly Volumes (per direction)*

4.3.10 Gulu Corridor

Corridor Name	Gulu Corridor	**Corridor Length (km)**	600 km
Corridor Description	Sudan/Uganda Border-Bibia-Gulu-Lira-Soroti-Mbale-Tororo		

Lanes	**1**	**2**	**Travel Speed**	**70km/h**	**80km/h**	**90km/h**	**Road Reserve**	**10.6m**	**17.6m**
Length	509 km	2 km	Length	25 km	15 km	471 km	Length	509 km	2 km
	99.7%	0.3%		5%	3%	93%		100%	1%

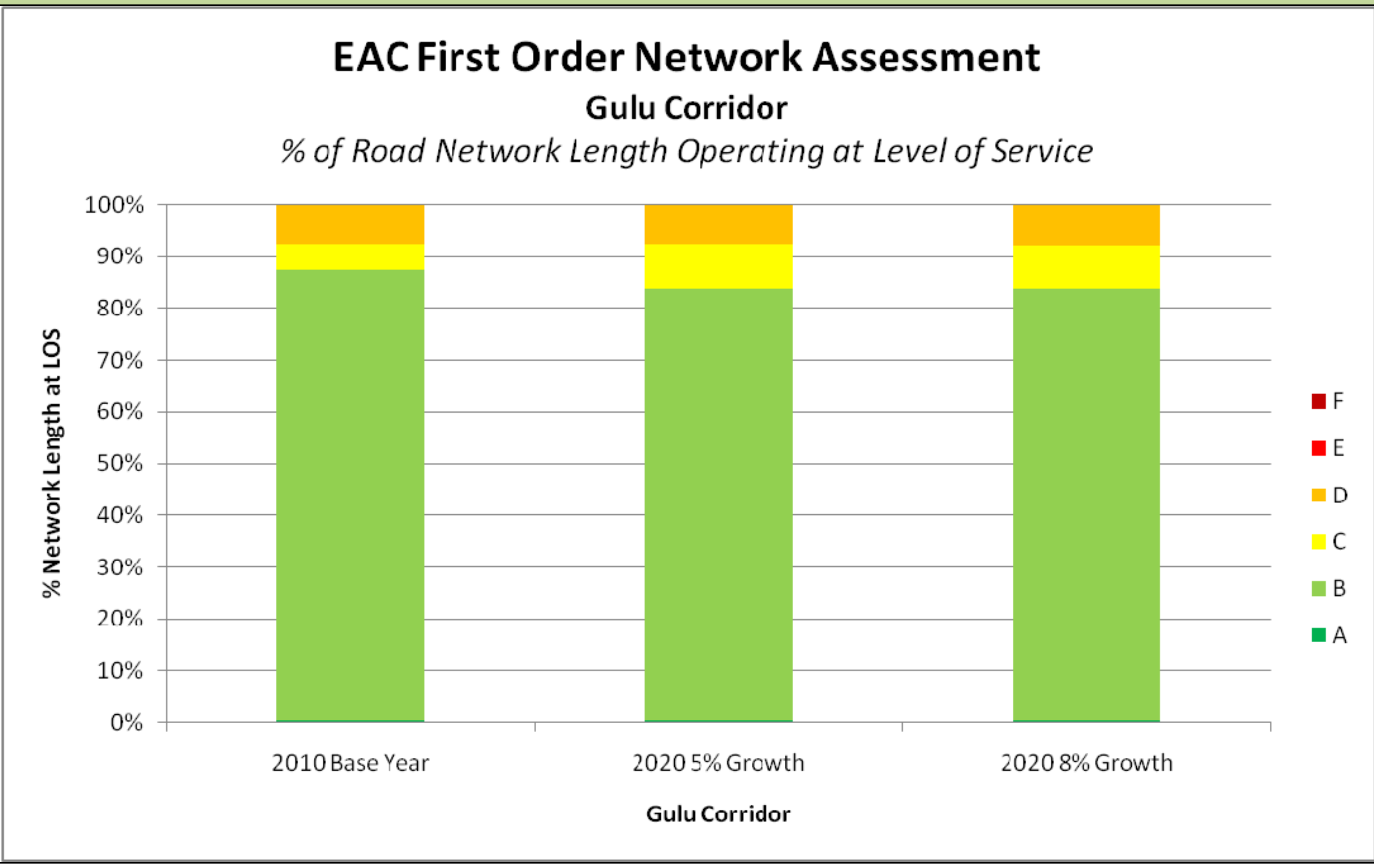
Terrain	**Level**	**Rolling**	**Mountain**	**Land-use**	**Urban**	**Rural**	**Surface**	**Paved**	**Unpaved**
Length	383 km	104 km	24 km	Length	69 km	441 km	Length	403 km	108 km
	76%	21%	5%		14%	87%		79%	22%

Number of Accesses / km	**0 Accesses**	**1 Access**	**2 Accesses**	**3 Accesses**	**≥ 4 Accesses**
Length	493 km	17 km	0 km	0 km	0 km
	97%	4%	0%	0%	0%

Traffic Volumes*	**0-50**	**51-100**	**101-200**	**201-300**	**301-400**	**401-500**	**501-750**	**751-1000**	**1001-1500**	**1501-2000**
Length	345 km	129 km	30 km	8 km	0 km	0 km	0 km	0 km	0 km	0 km
	68%	26%	6%	2%	0%	0%	0%	0%	0%	0%

Corridor Performance (Level of Service)	**A** *Very Good*	**B** *Good*	**C** *Acceptable*	**D** *Acceptable*	**E** *Poor*	**F** *Very Poor*
2010 (Base Year) Scenario	2 km	446 km	25 km	39 km	0 km	0 km
	1%	88%	5%	8%	0%	0%
2020 5% Traffic Growth Scenario	2 km	427 km	44 km	39 km	0 km	0 km
	1%	84%	9%	8%	0%	0%
2020 8% Traffic Growth Scenario	2 km	427 km	43 km	40 km	0 km	0 km
	1%	84%	9%	8%	0%	0%

Corridor Performance Chart



* 30th Highest Hourly Volumes (per direction)

4.4 Major Issues & Constraints

Table 4-5 below presents the roads capacity analysis results for all scenarios.

Table 4-5: EAC – Percentage Road Network Length Operating at Level of Service Intervals

Scenarios	A	B	C	D	E	F	TOTAL
2010 Base Year	1.3%	34.4%	39.0%	16.4%	8.7%	0.1%	100%
2020 5% Growth	0.8%	33.6%	35.3%	17.4%	12.2%	0.7%	100%
2020 8% Growth	0.6%	30.9%	35.3%	18.5%	11.9%	2.8%	100%

With regards to Table 4-5 above, the following concerns are highlighted:

- The 2010 base year scenario shows that the EAC road network is operating at high levels with only 8.7% and 0.1% of the total length operating at a LOS E and F respectively
- The 2020 5% growth scenario shows an increase in EAC road network operating at LOS D, E and F (17.4%, 12.2% and 0.7% respectively)
- The 2020 8% growth scenario shows a further increase in EAC road network operating at LOS D, E, and F (18.5%, 11.9% and 2.8% respectively).

With reference to previous sections, in particularly the summary tables for each of the EAC corridors, it is clear that road capacity on the Northern Corridor is of particular concern. The major issues and concerns regarding the Northern Corridor can be summarised as follows:

- More than 50% of the traffic on the EAC Northern Corridor is made up of of heavy vehicles
- The EAC Northern Corridor operates at LOS D and E for 36.8% and 42.1% respectively of its total length. LOS E is projected 58% of its total length for 2020 given a 5% traffic growth rate
- With regards to road condition a large percentage of the Northern Corridor requires investigations with regards to immediate rehabilitation.

5. RAIL

The regional rail network links the major economic centres in the EAC, as well as Zambia. The network is substantially run down and requires reinvestment, which was intended to be achieved by concessioning off the Northern and Central systems but has not borne noteworthy results yet. The East African standard gauge plan has as its objective to reinstate or rebuild the network at a higher service level. There are also plans to connect Rwanda and Burundi by rail.

This chapter is reduced from the analysis presented in Working Paper 4.1: Rail.

5.1 Overview of Regional Rail System

The total length of rail network in East Africa is some 7 400 km, of which about 6 000 km is operational. The systems are mostly meter gauge with the exception of TAZARA railway which is Cape gauge (1 067 mm). The EAC network was built between the 1890s and the 1950s, while the TAZARA line was built in the 1970s.

The railways have lacked the necessary funds for investment and maintenance particularly in recent years, and this is reflected in the overall poor condition of the fixed infrastructure. There are numerous speed restrictions on the EAC network due to the poor condition of rails, sleepers, ballast and bridges. The signalling and telecommunication systems are very rudimentary and are in a state of disrepair.

5.2 Reference Levels of Service

In planning a new rail system or considering alternatives to improve services of an existing rail system, it is essential to consider both the system capacity and the levels of service for the end user. Capacity refers to the total tonnage that could be transported. Level of service refers to operating speed and therefore transit time. However, the concept of rail level of service, unlike that of highways, is not well established. This probably reflects the fact that goods transported by rail are generally less sensitive to time than, for example, reliability and predictability of service.

The rail infrastructure *capacity* is derived from standard track parameters for each corridor. These parameters include axle and bridge loads, passing loop lengths, ruling grade, average achievable speeds on each section, prevailing load capacity based on coupler performance and track availability.

Factors that would influence the *level of service* typically include, but are not limited to headway (speed restrictions) and availability of rolling stock. The rail analysis undertaken for this study highlights the operational fleets as being the key drivers of the overall rail capacity.

Apart from satisfactory level of service, rail operators have to respond to usability standards as well. This can be understood as the customer or user’s satisfaction in using the service available. It would typically cover aspects such as safety of goods in transit and at terminal points, reliability of service provided in terms of keeping to timetables. Also communication to the customer as to the whereabouts of his freight as and when requested. Studies in the past have shown that the commercial responsiveness by the operators and availability of customer information has been partly the driver towards using rail to transport freight, as opposed to road for example.

Without undertaking a detailed assessment to determine the required railway level of service, a good proxy would be to assume as a benchmark the level of service that would be achieved with the broad reinstatement of the original design speed of the infrastructure. Currently, due to speed restrictions, much of the efficiency in operating the system is lost. Trains wait for longer periods at passing loops, and thus headways are increased. If the system is modelled on design speeds as were originally specified when the railways were designed, then this benchmark would indicate how the region’s infrastructure is performing in comparison to the original design criteria, all things being equal. It will indicate, on a high level, what the capacity of the infrastructure would be if the design speeds could be achieved. This would clearly highlight the shortfalls currently and thus identify potential regional projects. It is important to note that the benchmark is only based on design speed and that any other variables such as axle loads, fleet availability, ruling grades, etc, are not included in the benchmarking process. On average, the existing capacity of the operational lines in the EAC network is performing at about 65% of its benchmarked capacity, which is the original design speed.

The next higher level of service would be that achieved if the existing narrow gauge (NG) system were upgraded or replaced with a standard gauge (SG) and the associated improvement of alignment. The regional SG plan is discussed in section 0 below. The first phases would be upgrading to SG from Mombasa to Nairobi, and from there to Kampala.

5.3 Northern Corridor (KRC and URC Network)

5.3.1 Network Overview

The Northern Corridor railway infrastructure spans from the Port of Mombasa to the central highland regions, Lake Victoria and the neighbouring countries. The Kenyan railway is connected to the Uganda rail system by wagon ferries across the Lake Victoria at Kisumu and via Malaba, and to the Tanzania system via Taveta (Kenya). The total length is about 3 200 km (including non-operational sections), at 1 000 mm (meter) gauge. There is approximately 1 260 km of railway line in Uganda, of which only 330 km is operational.

The system offers international rail links with Uganda and Tanzania for import, export and transit cargo to Great Lakes region and South Sudan and a domestic passenger service operates between Mombasa - Nairobi, Nairobi - Nanyuki and Kisumu - Butere.

The railway struggles to cope with increased competition from the private road transport sector, this coupled with budget constraints have resulted in the deterioration of its infrastructure, including the locomotives, rolling stock and equipment. Since 2000, it has experienced consistent negative growth and currently, its market share in the transportation of cargo through the port of Mombasa is reduced significantly (to between 5% and 10% of cargo going through the port).

There have been a number of reforms to improve its performance, for example, the rehabilitation of locomotives and wagons leading to increased availability and safety of operations. The Kenyan and Ugandan railways were concessioned off in 2006 for the following 25 years, to Rift Valley Railways (RVR). RVR is allowed to buy new equipment but the two governments retain ownership of the infrastructure. It was recently announced that an Egyptian capital investment (Citadel Capital) acquired the 35% stake of RVR which was previously held by the South African consortium Sheltam.

5.3.2 Rolling Stock

There are some 68 mainline locomotives, and 24 shunting locos. Locomotives are in poor condition and provide utilization, reliability and availability rates that are low relative to international standards. This is due to old age, lack of necessary investment in maintenance and rehabilitation over the years.

The wagon fleet consists of 1 440 open, 1 090 covered and 500 other (livestock, tankers, etc.)

5.3.3 Capacity and Level of Service

The effective capacity is determined by the lowest of above and below-rail capacities. Above-rail capacity is the lowest of locomotive and wagon fleet capacity.

On the Northern Corridor system, above-rail capacity is driven by locomotive availability. Wagon and below-rail availability are fairly well synchronised. For the operational links, above-rail capacity is only 40% of below-rail capacity, giving an effective capacity of 8.6 Mtpa.

Figure 5-1: Northern Corridor Capacity Results on Operational Lines

Link	Above-Rail Capacity (Mtpa)			Below-Rail Capacity (Mtpa)		Above Rail Capacity as a % of Below Rail Capacity
	Loco-motive	Wagon	Total Effective	One Direction	Both Directions	
Nairobi – Mombasa	3.8	7.9	3.8	3.6	7.2	53%
Nairobi – Eldoret	1.6	3.4	1.6	2.0	3.9	42%
Nakuru – Kisumu (branch)	0.2	0.6	0.2	1.3	2.6	8%
Eldoret – Malaba	2.6	4.3	2.6	2.1	4.1	62%
Voi – Taveta (branch)	0.2	0.6	0.2	0.6	1.2	18%
Konza – Magadi (branch)	0.1	0.2	0.1	0.7	1.4	6%
Nairobi – Nanyuki (branch)	0.0	0.2	0.0	0.6	1.3	3%
Sub-tot: KEN operational	8.6	17.3	8.6	10.8	21.6	40%
Malaba – Tororo	5.6	14.6	5.6	3.1	6.2	91%
Tororo – Jinja	4.7	12.2	4.7	2.0	3.9	120%
Jinja – Kampala	1.2	6.2	1.2	1.3	2.6	47%
Kampala - Port Bell (branch)	3.7	9.8	3.7	4.6	9.2	41%
Sub-tot: UGA operational	15.2	42.8	15.2	11.1	22.3	68%

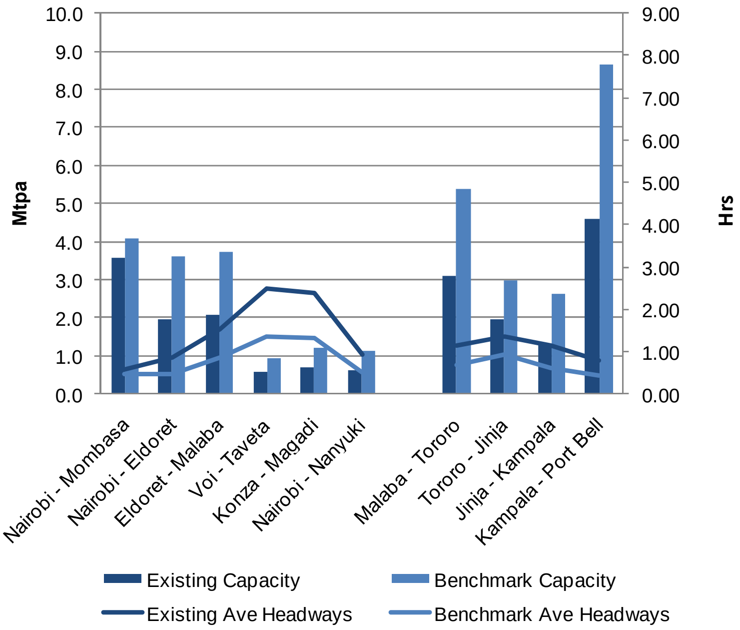
Source: Africon calculations

Currently, due to speed restrictions, much of the efficiency in operating the system is lost. Trains are waiting for longer periods at passing loops, and thus headways are increased. The level of performance of the railway system today can be assessed with reference to the original design criteria, specifically, the original design speed. On average, the available capacity on the Northern Corridor is about 59% of its benchmarked capacity (i.e. the original design speed). The mainline links from Nairobi to Kampala has an availability of 56%.

Map 5-1: Current Rail Capacity (one direction) on the Northern Corridor

Source: Africon calculations

The below-rail capacity is most constrained where actual and design headways are highest. The actual headways overrun the design headways by 74%. This situation is especially acute on the branch lines.



Source: Africon calculations

Figure 5-2: Northern Corridor: Current vs Benchmark Capacity and Headways

Non-operational lines for Northern Corridor include:

- Gilgil – Nyahururu (Kenya)
- Rongai – Solai (Kenya)
- Leseru – Kitale (Kenya)
- Tororo – Pakwach (Uganda)
- Kampala – Kasese (Uganda)
- Busembatia – Jinja (Uganda).

Major interventions required to improve the LOS include the lifting of speed restrictions. This would effectively reduce headway between passing loops due to increased speeds. In addition, the availability of assets also plays an important role in the efficient transport of freight. Effective maintenance of rolling stock and other off-rail equipment such as loading and unloading equipment can greatly improve the level of service by reducing breakdowns and turn-around times.

5.4 Central Corridor

5.4.1 TRL/RITES Network

5.4.1.1 Network Overview

The Tanzania Railway Limited (TRL) system comprises some 2 700 km of mainline infrastructure (including non-operational lines), at 1 000 mm (meter) gauge. The system connects the port of Dar es Salaam with Tabora, branching off to Mwanza (Lake Victoria) and Kigoma (Lake Tanganyika). Although the TRL system reaches the TAZARA line at Kidatu, about 250 km West of Dar es Salaam, the two systems are not interconnected due to different gauges.

The TRL situation has been deteriorating over the last seven years while waiting for privatisation. As a result the rolling stock has not been replaced. The track, especially on the Dar-Dodoma section, is prone to accidents due to technical and human related errors.

In 2007 RITES Ltd of India won a contract from the Parastatal Sector Reform Commission (PSRC) to operate passenger and freight services on the TRL system under a concession for 25 years. The concession was recently terminated in the light of general discontent over low reinvestment and the deteriorating quality of service.

5.4.1.2 Rolling Stock

TRL has 67 locomotives (60 mainline and 7 shunting) of which almost 60% have reached their depreciation life (30 years) and need replacement or major repair/rebuilding. There are some 681 covered wagons (boxcar), 207 high/large open wagons and about 469 other wagons for container carrier, fuel tanks, livestock and phosphate. About 300 of the covered wagons and 50 of the high/large open wagons need immediate repair.

5.4.1.3 Capacity and Level of Service

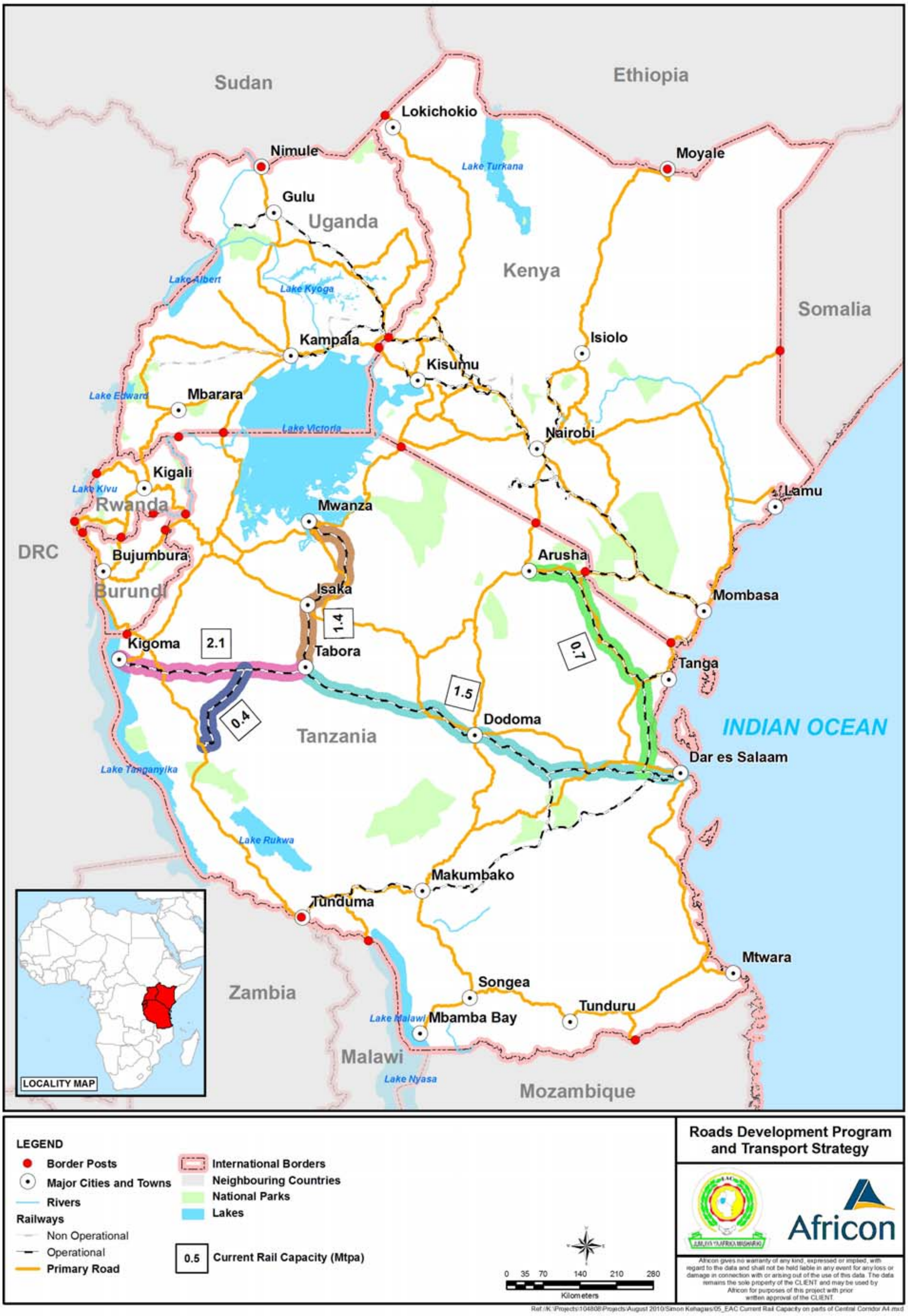
On the TRL system, the wagon fleet is the constraining factor for above-rail capacity. Above-rail in turn is on average only 31% of below-rail capacity.

Figure 5-3: Central Corridor Capacity Results on Operational Lines

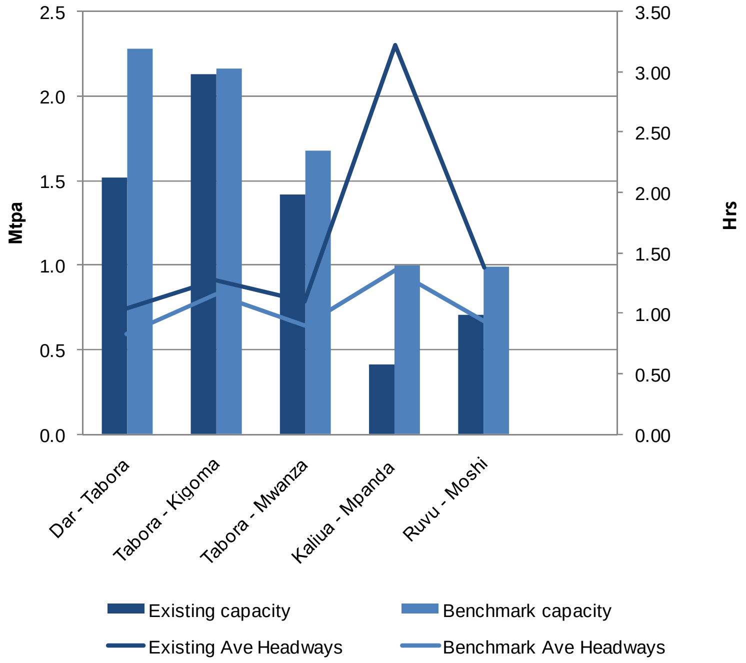
Link	Above-Rail Capacity (Mtpa)			Below-Rail Capacity (Mtpa)		Above Rail Capacity as a % of Below Rail Capacity
	Loco-motive	Wagon	Total Effective	One Direction	Both Directions	
Dar – Tabora	2.0	2.0	2.0	1.5	3.0	65%
Tabora – Kigoma	2.1	1.3	1.3	2.1	4.3	30%
Tabora – Mwanza	0.8	0.8	0.8	1.4	2.8	28%
Kaliua – Mpanda	0.4	0.3	0.3	0.4	0.8	35%
Ruvu – Moshi	0.1	0.1	0.1	0.7	1.4	5%
Mnyusi – Tanga	0.1	0.1	0.1	1.2	2.3	4%
Total (operational links)	5.4	4.5	4.5	7.3	14.7	31%

Source: Africon calculations

As is the case for the Northern Corridor rail network, speed restrictions throughout the system impair operating efficiency. On average, the Central Corridor available capacity is about 76% of its benchmarked capacity (the original design speed). The major underperforming link is Kaliua – Mpanda. Existing average headways exceed the design headways by about 55%.



Map 5-2: Current Rail Capacity (one direction) on the Central Corridor



Source: Africon calculations

Figure 5-4: Central Corridor: Current vs Benchmark Capacity and Headways

Non-operational lines for the Central Corridor include:

- Kilosa – Kidatu (Tanzania)
- Moshi – Arusha (Tanzania)
- Moshi – Taveta (Tanzania).

5.4.1.4 Reinstatement Options

The current TRL railway network was built between the 1890s and 1950s. In general, the network has lacked the necessary funds for investment and maintenance, especially in recent years, and this is reflected in the overall condition of the fixed infrastructure.

Relaying of rail on account of curve wear is required. It is, however, unlikely that there will be a need to relay rail on straight track sections or on gentle curves due to the low current and projected tonnages. However, as volumes increase, these sections should be considered for relaying as well. Very few of the current temporary speed restrictions are on account of rail wear or defects.

Ballast sections on most of the network lines consist of crushed granite rock and slag. Where steel sleepers are used, the condition of the ballast section seems to be reasonably good. However, inadequate ballast is apparently prominent cause of temporary speed restrictions.

Mainline sleepers for the most part are steel except at turnouts and some bridges, where they are wood. Approximately 30% of current speed restrictions are on account of damaged sleepers or damaged and loose fasteners.

The current condition of bridges is the major contributor to temporary speed restrictions on the network. Many bridges are beyond their service life. Most of the deterioration has occurred as a result of age and lack of maintenance and often the approach track is severely deformed. In many cases complete reconstruction of structures would be required.

Train control is, for the most part, train order systems used in conjunction with non-interlocked and interlocked signals. As with signalling systems, telecommunication systems are in a state of disrepair and are unreliable.

Further detailed investigation and conditions assessments would be required to fully understand the level of rehabilitation required on the network. However, from the high level analysis that has been carried out, it is clear that some improvements in capacity could be achieved either by improved signalling systems and/or longer passing loops. Replacing of sleepers too would assist greatly in increasing of train speeds by lifting of speed restrictions.

The following table summarises the unit cost of upgrading the TRL mainline as developed in the recent EAC Rail Master Plan (2009). The table uses three scenarios, namely:

- *Standard gauge (new right-of-way).* A new standard gauge railway on a right-of-way separate from the existing railway line, but serving the same nodes and terminals.
- *Standard gauge (existing right-of-way).* A new standard gauge railway built on the existing narrow gauge right-of-way, in most parts utilizing the existing formation.
- *Narrow gauge (reinstate existing).* Reinstating the existing mainline to nearly the same condition as originally designed for.

Table 5-1: Conversion / Upgrade Costs of TRL Mainline Dar-Kigoma/Mwanza

Type of Gauge & Intervention	Unit Cost (USD mill/km)		km	Low (USD mill)	High (USD mill)
	Low	High			
Standard Gauge (new right-of-way)	2.100	4.500	1 633	3 429	7 349
Standard Gauge (exist right-of-way)	0.600	1.400	1 633	980	2 286
Narrow Gauge (reinstate existing)	0.110	0.250	1 633	180	408

Source: EAC Rail Master Plan, 2009

5.4.2 Proposed Isaka-Kigali/Keza-Gitega-Musongati Extension of TRL from Dar es Salaam

The Central Transport Corridor (about 1 400 km long from Rwanda and about 1 500 km from Burundi to Dar es Salaam) offers the possibility of reaching the Dar es Salaam Port through a road-rail or lake-rail multimodal combination. This routing would be substantially shorter and quicker compared with the Northern Corridor (about 1 800 km long from Rwanda and about 2 100 km from Burundi to Mombasa) which links these countries to the Mombasa Port in Kenya via Uganda.

A rail extension of the existing TRL system to Rwanda and Burundi could be a catalyst for higher growth within the landlocked countries and for a diversion of traffic from the Port of Mombasa to the Central Corridor line. It would provide a transport link for the development of nickel mining in Western Tanzania and Eastern Burundi. It could also support opening up and developing the East of Democratic Republic of Congo and South-West Uganda. This area is a rich reservoir of diverse mineral ores.

Two feasibility studies have been carried out on the proposed line, both making positive findings. These studies build the feasibility case on demand projections that include general freight and mining exports. The general freight volumes differ significantly between the two studies, and are well in excess of what were identified in this study. Although they come to similar results in terms of mining volumes, the composition is quite different, even though originating from the same potential mines. There is still some work required to bed down the expected rail volumes. Of the mining prospects reviewed in those studies, the one that has been identified and included in the Transport Strategy demand forecast for the next decade is the Kabanga nickel mine. The other prospects clearly require more development and may not come to fruition in the study period.

Table 5-2: IK/KGM Comparative Freight Forecasts (tpa)

Section/ Mine		DBI Study			BNSF Study		
		2014	2024	2031	2014	2024	2031
General Freight	Nyakanazi-Keza (most trafficked)	3,026	4,403	6,918	814	5,293	8,362
Mining Freight	Kabanga Nickel	50	250	250	100	300	300
	Muremera Nickel	112	560	560	100	300	300
	Musongati Nickel	112	560	560	-	1,380	1,380
	Waga Nickel	112	560	560	-	1,175	1,175
	Nyabikere Nickel	112	560	560	-	1,175	1,175
	Mukanda Vanadium	400	2,000	2,000	-	60	60
	Luhuma Nickel	-	-	-	-	266	300
	Banro Gold	-	-	-	39	20	-
	Tanzania Gold	-	-	-	60	186	-
	Total Mining	898	4,490	4,490	299	4,862	4,690

Source: DBI and BNSF studies on Isaka-Kigali/Keza-Gitega-Musongati rail

The proposed line would branch off at Isaka. In 1999 TRC established an inland container depot at Isaka which acquired dry port status. The facility is strategically located to serve the hinterland of Rwanda, Burundi, DRC, Uganda and North Western Tanzania. The Dry Port provides a holding point for containerised and general cargo. It functions as a sub-port of Dar es Salaam. Road transport companies collect containers coming from overseas at Isaka and clear customs there, and deliver containers going overseas to the same location.

The proposed line extends over 493 km from Isaka to Kigali. At Keza, the 197 km long Burundi Line to Gitega and Musongati branches off. Primary line characteristics assumed include 120 kph maximum tangent track freight speed, maximum curvature and grade of 6° and 1.6% respectively, 2 000 m sidings at 30 km intervals, and 35.7 t axle loadings. The line will be standard gauge, implying that the existing TRL line would have to be upgraded to standard gauge as well.

Map 5-3: Proposed Isaka-Kigali / Keza-Gitega-Musongati line

Source: DB Mobility Networks Logistics Study-2008

Assessed stand-alone, there are various advantages of constructing the line at standard gauge which overcome the slightly higher initial capital cost compared with a narrow gauge solution. Narrow gauge would require shorter sleepers, narrower formation and less ballast. The standard gauge configuration could be some 10% cheaper. However, the capital expenditure savings are offset by many other factors, including higher rolling stock and maintenance costs, higher fuel consumption due to older locos and larger fleet size requirements.

When seen in context of the rest of the Central Corridor/TRL rail, constructing Isaka-Kigali/Keza-Gitega-Musongati (some 500km) at standard gauge will probably imply that the rest of the system (2 700km) would have to be converted to standard gauge as well. Given the relative disparity in lengths, that part of the system (existing TRL line) would have to justify its reinstatement at standard gauge on its own merits.

5.5 Dar es Salaam (TAZARA) Corridor

5.5.1 Network Overview

The TAZARA railway was built between 1970 and 1975 by the Tanzania-Zambia Railway Authority to give landlocked Zambia a link to the Tanzanian port of Dar es Salaam, as an alternative to export routes via rail lines to Zimbabwe, South Africa and Mozambique. TAZARA also has an agreement with SNCC of DRC for seamless connection of freight between Dar es Salaam and the DRC.

The line comprises 1 860 km of 1 070 mm (Cape) gauge, of which 975 km is within Tanzania. The gauge matches that of Zambia Railways, connected to Zimbabwe, and South Africa, so that TAZARA is a point of access to the railway systems of Southern Africa. There was originally no connection with the 1 000 mm TRL system at the port of Dar-es-Salaam, but a transhipment station has existed at the break of gauge station at Kidatu since 1998.

TAZARA experienced a fall in traffic from 1.2 Mt in 1990 to 0.6 Mt in 2003. In 2005 the governments of Tanzania and Zambia agreed to privatize the line. At the beginning of 2010 the Chinese government injected a USD 39 million interest-free loan to reinforce operations.

TAZARA has an agreement with the Railway Systems of Zambia (RSZ) for seamless connection of freight between Dar es Salaam and the Copperbelt region. Freight can now be transported between Dar es Salaam and Ndola in Zambia without transhipment. This has contributed to the line becoming more cost effective, while safety issues have also been addressed.

5.5.2 Rolling Stock

TAZARA has 18 mainline and 8 shunting locomotives. The wagon fleet is made up of 1 300 wagons of different configurations.

5.5.3 Capacity and Level of Service

Locomotive capacity (1.9 Mtpa), rather than wagon capacity (4.3 Mtpa) is the constraining factor for above-rail capacity. Below-rail capacity is between 2.6 and 4.5 Mtpa (both directions). Below-rail constraints include the poor track condition in the Mlimba-Makambako area where there have been landslides, as well as general telecommunication and signalling shortcomings. Above-rail is therefore between 41% and 71% of below-rail capacity.

On average, the Dar es Salaam (TAZARA) Corridor capacity is about 70% of its benchmarked capacity (the original design speed). Existing headways exceed design headways by 39%.

5.6 EAC Railways Master Plan

The potential advantages of an improved regional railway system were identified in the EAC Railways Master Plan. Traffic was projected to grow from about 3.7 Mt in 2007 to 16 Mt by 2030. The existing narrow gauge network could meet this demand for the next 10 to 20 years, given that the necessary investment is made. The most important factors currently limiting the network's effectiveness is the low speeds at which trains can operate, and limits to the permissible axle loads on the network. There are also fleet restrictions on capacity.

In the short term, the focus of the railways should be the removal and avoidance of temporary speed restrictions. A secondary focus should be to increase axle loads in keeping with anticipated traffic growth. Additional plans can also be put in place to further increase traffic capacity, including a more effective train control system, upgrading of signals and telecommunications and extending passing loops and adding additional passing loops on constrained lines. Investments in equipment with modern couplers and higher carrying capacity can also help in the longer term to accommodate the projected future demand.

Although these proposals will help to increase the carrying capacity, new or rehabilitated links have been identified to upgrade and improve railways in the EAC.

The thrust of the strategy is, in the short term, to pull the railways back, by restoring reliable service on the trunk lines. The medium-term strategy is to improve the level of service on the trunk lines, to extend the network to Rwanda and Burundi and to carry out feasibility studies for some other lines. The long-run strategy is to achieve best-in-class performance on the trunk lines, successful commercial operations on the Rwanda/Burundi and other medium-term lines and further extend the network.

A wider standard gauge track would have many direct benefits, but the investment costs are very high, as past studies have shown. Transforming to standard gauge poses many challenges, as it is recommended that any new rail links should be developed consistent with the gauge of the network to which they will connect. This is important in order to avoid the inefficiencies associated with the lack of interchangeability of equipment and the possibility of branch lines being cut off from the main lines. New lines should however be built with formations that can accommodate future conversion to standard gauge.

5.7 East Africa Standard Gauge Plan

Rail stakeholders have argued that against the background of the AU resolution of 2007, the perception that EAC's railways are in need of major improvements in efficiency and performance and the perceived advantages of standard gauge, it is essential to investigate the advantages and disadvantages of a change of gauge. Such investigations have already come to fruition, especially in Kenya. The Kenya Railways Standard Gauge Plan is one such study. Already, Requests for Bids have been announced for the Preliminary Engineering Design of the Mombasa – Kampala Standard Gauge Line.

Although possibly progressed the furthest in Kenya, the initiative to improve railways to a regionally uniform standard gauge belongs to the East African Community, as agreed by the five partner States during the deliberations of the EAC Railway Master Plan Study Report.

Some of the possible advantages of the network upgrade from narrow to standard gauge include increased safety, increased capacity, decreased operating costs and improved availability and maintainability of equipment.

5.7.1 Impact on Cost

The standard gauge technology has one disadvantage compared to its narrow gauge counterpart, and that is the additional capital expenditure needed for initial construction due to the longer sleeper, wider formation and additional ballast requirements. This premium is however fairly small and would generally be around 5 to 7% for a new railway line. It is important to note that the abovementioned premium is based on an alignment that would be similar to the existing narrow gauge alignment that the comparison is made to.

The impact on cost in terms of savings is primarily seen in the terms of the following areas of technology:

Availability of Research and Development (R&D). Globalization changed the railway industry. R&D became concentrated in a number of centres of excellence which are generally based in the standard and broad gauge countries. No new developments which fundamentally raised the competitiveness of NG have emerged for a long time.

Wagons and Coaching Stock. With manufacturing capacity and R&D primarily residing in the SG and BG countries, global sourcing is likely to gain momentum as the most competitive way to acquire trailing stock.

Locomotives. The power and tractive effort of NG locomotives are limited by the back-to-back wheel-set dimensions of a motored bogie. SG locomotives are substantially cheaper than their NG counterparts in terms of cost per kN tractive effort. It would be fair to say that there is no indication that NG will be able to catch up or overcome this handicap. The lower cost of standard gauge rolling stock (wagons and locomotives) as well as the lower cost of operations (less rolling stock to maintain and fewer trains to operate) can generate substantial savings compared to a narrow gauge operation. Depending on the traffic volume, this should normally be sufficient to offset the higher cost of standard gauge track and to provide real economic gain.

Track Maintenance (and Tolerances). As a composite beam the SG track structure provides better resistance to lateral displacement compared to the NG track structure. In terms of riding quality the SG track is also more tolerant to errors of twist in the running top (a 5 mm error in twist on SG will have the same effect as a 3.7 mm error on NG). The cost of track maintenance should therefore be marginally in favour of SG. SG thus has a maintenance cost advantages over NG. Although it is difficult to quantify, it is not expected to be substantial.

5.7.2 Impact on the Level of Service and Capacity of the Network

The standard gauge technology has a number of important advantages that directly relate to the level of service and consequently to the capacity of the network to handle the forecast demands:

Speed. Having a ± 32% wider wheel base, SG will provide more stability enabling higher safe speeds on both straights and curves. Minimum curve radii on NG lines are seldom set above 1 000 m as this will not restrict speeds around curves for the conventional NG speed range of up to 130 kph. SG rolling stock can safely negotiate these curves at 15% higher speeds than similar NG rolling stock. Freight traffic operations are much more dependent on price and service delivery (predictability of time of arrival at the destination) than on actual speed between stations. The extra speed capabilities of SG therefore provide limited advantage over a NG operation.

Stability (Double stacking of containers). The higher stability of SG also enables the option of double stacking containers to enable heavy intermodal freight train traffic. This is extensively used in the USA and Canada where electrification is sparsely used. Most lines in Europe are electrified. Double stacking is therefore a lot less common than in the USA. It is nevertheless used on some lines where the electrification wires have been raised.

Vehicle Profiles. SG operations allow wider and higher vehicle profiles than NG. This is also a result of the better stability. SG profiles are 200 mm wider and at least 600 mm higher than NG profiles. NG standards can arguably be widened to similar dimensions as for SG, but on existing lines such endeavours will more often than not be thwarted by a multitude of existing structures along the lines that were built to the original permissible structure profiles.

Without going into detail, it may be concluded by virtue of increased speeds, decreased headways and other improvements to the level of service, that the capacity benefit of the standard gauge network over narrow gauge can be increased by a considerable percentage. Past studies have shown increases of between four and eight times. Lengthening of passing loops due to allowable longer trains and more available tractive power on more powerful locomotives, also further increases the capacity of the standard gauge line.

5.7.3 Estimated Capital Lay-out

Conversion of the EAC railways to standard gauge would lead to benefits in terms of higher traffic carrying capacity, better availability and lower capital costs of equipment as well as potential for operating cost savings.

The cost of converting the entire existing EAC railway network to standard gauge is estimated at USD 13 to 29 billion assuming new right-of-way.

A summary of the development costs is presented in the Table 5-3 below.

Table 5-3: Low and High Estimates of SG Capex

Item	Low Estimate (New Right-of-Way) (USD m)	High Estimate (New Right-of-Way) (USD m)
Fixed infrastructure	13 000	27 800
Rolling stock	400	900
Profit/Loss during construction	70	250
TOTAL	13 470	28 950

Source: EARMP Study - 2009

Map 5-4: Proposed East African Standard Gauge Railway Network

Source: KRC

5.8 Juba-Lamu Corridor

The Juba-Lamu corridor initiative originated from the need to alleviate congestion at and to develop a strategic alternative for Port Mombasa. Regional political developments (the possible secession of South Sudan and Ethiopia's requirements for alternative sea access) and oil developments (Uganda and South Sudan) have provided additional impetus for this initiative. There is also the potential of exporting iron ore and other minerals from the North-East DRC, which could require the establishment of a bulk rail facility. There is the further potential of developing a line to Ethiopia from Isiolo via Moyale.

The feasibility study for the Lamu Corridor is ongoing. A preferred route has been identified and the demand and technical studies are awaited.

In parallel with the development of the Lamu corridor concept, the governments of Uganda and Sudan have concluded an MOU on the joint development of a railway route from Uganda to Sudan, from Gulu though Nimule and Juba to Wau. The motivation is similar to that of Juba-Lamu, i.e. that peace in Southern Sudan has led to increased local and regional trade and hence increased traffic between Juba and Mombasa. A feasibility study will be concluded in 2011.

5.9 Major Potential Rail Projects

The following railway projects would form part of a longer-term standard gauge programme:

- Upgrading Dar es Salaam – Mwanza/Kigoma to standard gauge and constructing Isaka-Kigali/Keza-Gitega-Musongati at standard gauge
- Extending existing TRL with new Isaka - Kigali / Keza – Musongati standard gauge section
- New Lamu – Juba standard gauge railway
- Replacing Mombasa – Kampala and Tororo – Pakwach with standard gauge, and to link Lamu if not via the Lamu – Juba corridor, construction of a link from a point North-West of Mombasa to Lamu
- Rehabilitating Kampala – Kasese and upgrading to standard gauge
- Construction of Voi – Taveta at standard gauge
- Construction of Modjo - Moyale railway line.

Other projects which could furthermore be considered in a future standard gauge dispensation would be:

- Construction of the Liganga/Mchuchuma-Mlimba railway line
- Construction of Kodo - Arua - Pakwach line (to link mining in North-East DRC).

The list below has been compiled with the view that the existing network may be improved by restoring the current network, including equipment, to a new condition that will effectively increase the current capacity of the below-rail infrastructure to higher level. The projects listed are based on the high-level assessment to bring the existing railway capacity to a level of service to that achieved when design speeds are used as the benchmark. They are of a lesser scale to the standard gauge projects mentioned above, but will increase the capacity of the EAC network sufficiently for the foreseeable future:

- Nairobi – Malaba (NG). The headways are long. Lifting of speed restriction will improve capacity of line to approximately 3.7 Mtpa. This line is strategically important given its role in linking Uganda
- Dar es Salaam – Mwanza/Kigoma (NG) rehabilitation

- Voi – Taveta (NG). The current capacity can be doubled to about 1 Mtpa. This allows the northern region of Tanzania near Arusha to use Mombasa as an alternative to Dar es Salaam port
- Construction of the Isaka-Kigali/Keza-Gitega-Musongati railway line at narrow gauge. Its expected capacity would be approximately 10 to 12 Mtpa.

Further, there are specific interventions required to reinstate the TAZARA railway to its design capacity, specifically:

- Repairing the sections with the poor track condition in the Mlimba-Makambako area
- Rehabilitation of the telecommunication and signalling system.

6. PORTS

The main ports in the EAC region are the sea ports of Mombasa and Dar es Salaam. In Kenya, the establishment of a port at Lamu is under investigation. In Tanzania, there are further existing sea ports at Tanga, Bagamoyo, Mtwara and Maruhubi (Zanzibar) which all have the potential for increased utilisation. A new port at Mwambani is under investigation.

Major lake ports in the region are Mwanza South, Kisumu and Port Bell on Lake Victoria, and Kigoma and Bujumbura on Lake Tanganyika, which also has major ports in the DRC (Kalemié) and Zambia (Mpulungu). Various studies have been undertaken to assess the potential navigability of River Akagera (Rwanda/Tanzania).

This chapter is reduced from the analysis presented in Working Paper 4.2: Ports.

6.1 Context of Port Assessment

The major container shipping routes around North-East Africa are between the Middle East/South-East Asia and Europe through the Red Sea, with a thinner route around the Cape. North-South Indian Ocean routes carry relatively thin traffic.

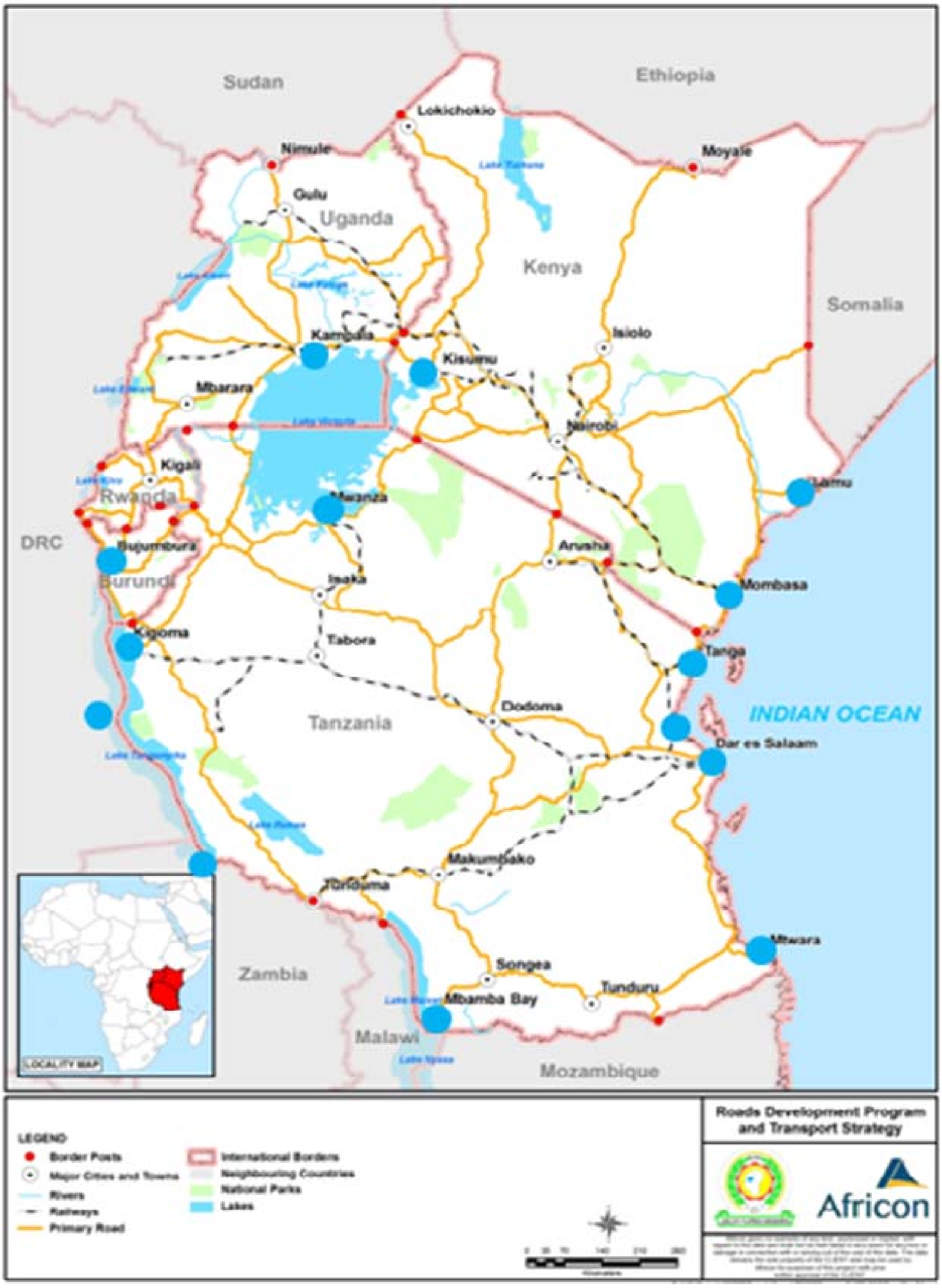
Vessel size is increasing leading to the development of hub ports. Smaller ports such as Mombasa and Dar es Salaam that cannot accommodate deep-draught, post-panamax vessels will continue to be feeder ports supporting hubs on the main East-West routes. Bulk cargo traffic is made up of resources from Africa, Australia and South America, increasingly direct towards China. Bulk cargo is very price sensitive and carried by dedicated vessels, so that the bulk shipping routes follow the cargo route.

6.2 Reference Levels of Service

Port capacity is the product of port navigational capacity, terminal equipment and handling capacity and port infrastructure capacity.

The Berth Occupancy Factor (BOF) is an internationally accepted indicator of the utilisation of a berth. When read in conjunction with the waiting days per ship, it gives an indication of the lack of capacity at a port. It should be noted that if the port is inefficient, the BOF would be higher than normal with a consequent higher than normal waiting period for vessels waiting for the berth. A 100% BOF is considered unachievable because of the delay factors. UNCTAD (United Nations Commission for Trade and Industry) has assessed the achievable BOF for different commodity berths and these are applied as the reference level of service in this analysis.

The optimum waiting period for vessels at a port is nil days except in tidal ports where the vessel would be docked at the first suitable time. At an efficient port, the vessel's arrival should have been communicated to the port authorities and a berth made available and when the vessel arrives it should berth. If there is congestion at the port, the vessel has to go to anchor and await an available berth, incurring waiting time delay which is measured in waiting days.



Map 6-1: Location of Major Ports in East Africa

Table 6-1: UNCTAD Berth Occupancy Standards

No of Berths	1	2	3	4	5	6
Containers	50%	65%	70%	75%	75%	75%
Break Bulks	40%	50%	55%	60%	65%	70%
Dry Bulks	50%	65%	70%	75%	75%	75%
Liquid Bulks	40%	50%	60%	70%	70%	70%

Source: United Nations

6.3 Northern Corridor

The Northern Corridor extends from its main sea port Mombasa in Kenya, through to Nairobi and further to Kampala in Uganda, Rwanda, and Burundi. These capitals and the landlocked countries of Uganda, Rwanda and Burundi are connected through this corridor by both rail and road links. The corridor has historical rail links to the Lake Victoria Port of Kisumu in Kenya which in turn services Port Bell in Uganda via a lake transport link. However, both these links are not operating optimally at present. One of these lake transport links is a rail wagon ferry service which is presently operating at a maximum of 20% capacity (one operational ferry) with the infrastructure of most ferry stations in poor condition or non-operational (Jinja). In general, road links in particular and rail links around Lake Victoria have overtaken the use of the lake transport link, with the exception of their use for local distribution. This is related in particular to the transit time incurred by the inter modal links when using lake transport

6.3.1 Mombasa Port

Mombasa is the main port servicing the Northern Corridor. It is also the port with the greatest expansion potential in the region. There are 18 berths in the port, with various cargo services:

- Kipevu container terminal. Four ship to shore container cranes and 3 berths
- Break bulk/Ro-Ro terminal with 12 fixed and various mobile cranes
- Grain terminal
- Soda Ash terminal
- Bulk minerals terminal – Mbaraki wharf (coal)
- Kipevu (KOT) and Shimanzi oil terminals/jetty.

6.3.1.1 Port Capacity

Expansion is planned at the port with the first phase being the construction of the Kipevu West Container terminal. The existing and future capacity is shown below. To achieve the 2014 projection, it is assumed that the following interventions (as planned at present) would have been carried out:

- Break Bulk - stockyards are in place, operating more efficiently
- Oil - refineries to have constructed new pipeline
- Bulk grain - partial completion of planned projects, with more efficiency on the quay
- Bulk Soda Ash - new loader installed
- Bulk Coal - Mbaraki wharf likely to take longer than 2014 to upgrade.

The port has a total capacity of some 14 Mtpa, which can be increased by about 4 Mtpa in the near term and tripled in the longer term.

Table 6-2: Mombasa Existing and Projected Capacity (t '000)

Terminal	Current	Theoretical Maximum	Maximum 2014	Maximum 2018
Break Bulk (B4-12)	991	2 268	2 000	2 500
Oil Shimanzi	1 300	1 300		
Oil KOT	3 800	3 800	5 000	5 500
Bulk grain (B3)	1 180	1 620	2 000	3 000
Bulk Soda Ash (B9)	74	203	200	405
Bulk Coal	682	1 900	700	1 900
Containers (B16-18)	15 x 380	15 x 378	15 x 500	15 x1 500
Total	13 727	16 761	17 400	35 805

Source: 'Current' data from KPA, Africon calculations

6.3.1.2 Level of Service

For most of the terminals, the reference BOF is substantially exceeded. The average waiting days per ship in 2008 was in the order of 2.6 days, and presently, this is calculated at between two to three days.

Table 6-3: Berth Occupancy Factor 2008

Terminal	BOF	
	UNCTAD	Actual
Break Bulk (B4-12)	70%	52%
Oil Shimanzi	40%	63%
Oil KOT	40%	78%
Bulk Coal	50%	56%
Containers (B16-18)	70%	89%

Source: KPA Port Master Plan

6.3.2 Port Mombasa Major Issues and Constraints

On the port side, Mombasa faces issues related to the lack of depth in the approach channel and alongside berths. There are also pipeline distribution constraints in the oil terminal.

Terminal issues include a need to upgrade the oil terminal pipeline system, the upgrading of the grain silo capacity and handling equipment and increasing the soda ash loading facilities. The coal discharge at Mbaraki wharf is severely restricted by the berth configuration and depth, the container terminal is currently running at maximum capacity and import containers suffer from extended dwell times (although this aspect is showing improvement).

Access to the Port by road is through various gates. Constraints exist due to the limited number of booths servicing the gates and the narrowness of the roads. Changing the vehicle circulation through the port would also reduce congestion. Building links to the proposed Western bypass would facilitate the movement of vehicular traffic.

6.3.3 Supporting Lake Ports

6.3.3.1 Kisumu (Kenya)

Kisumu is located in the North Eastern corner of the Kavirondo (Winam) Gulf of Lake Victoria, on the Southern shore of a small sheltered bay, fronting Kenya's third largest city. Most of the area is occupied by dockyard facilities and rail sidings grouped on an area of some 20 ha. Cargo services provided include a rail ferry berth (only one ferry out of five is operational), a dry dock and a cargo quay of 260 m. The port has a maximum capacity of about 220 000 tpa.

Major issues at the port include the fact that the lake level has receded requiring construction of quay extensions and temporary quays that cannot bear the required loads. The port requires general reinvestment.

6.3.3.2 Port Bell (Uganda)

The Port of Port Bell is located on the Northern shore of Lake Victoria, at the head of Murchison Bay, South-East of Kampala to which it is linked by road and rail. It should be noted that Jinja located some 35 km away on the River Nile also has railhead facilities which are in disuse. Cargo services provided are a ferry railhead, a general cargo quay for on and offloading of vessels and a small floating dock located at the end of the cargo quay. The port capacity is in the order of 220 000 tpa.

The main challenges at Port Bell are the limited available quay space for other (non-rail) types of cargo vessels, and the fact that the port infrastructure and equipment require extensive rehabilitation.

6.3.3.3 Port Jinja (Uganda)

A wagon ferry terminal was constructed at this port, however, it is currently derelict and would require extensive reconstruction to become operational. Service roads and rail connectivity would also have to be re-established. There is no shore infrastructure operational at present.

6.4 Central Corridor

The Central Corridor extends from the sea port of Dar es Salaam through Tanzania to Lake Victoria's Tanzanian Port of Mwanza South and Lake Tanganyika's Ports of Kigoma in Tanzania and Bujumbura in Burundi. A further extension of the corridor is via lake transport links on Lake Tanganyika to Kalemié in the DRC and Mpulungu in Zambia.

The physical constraints in Dar es Salaam have prompted investigations into the feasibility of port development in Bagamoyo North of Dar es Salaam and Mwambani Bay in the near Tanga.

6.4.1 Dar es Salaam Port

Dar es Salaam is Tanzania's main port. Like most ports worldwide it is suffering a lag in the development and provision of new facilities behind the demand for these facilities. Reasons for lagging include the port's physical constraints, exacerbated by administrative issues and the availability of capital funding.

The following cargo services are provided:

- Break bulk terminal, but also handling containers (berths 1 to 5)
- Kurasini Oil Jetty (KOJ) handling white oils
- Bulk terminal (berths 6 and 7)

- SPMBS (Single Point Mooring Buoy System) which is the crude oil terminal, located off the port
- TICTS privately operated container terminal (berths 8 to 11).

6.4.1.1 Port Capacity

The Port can currently handle between 8.4 Mtpa and 12.1 Mtpa. The port capacity can be doubled in the medium term.

The following interventions would be required to realise the 2014 capacity shown below:

- Break Bulk – projects partially completed
- Bulk – operated more efficiently
- New Multi Grade SPM/SBM oil terminal completed
- Containers – inland container depot completed.

Table 6-4: Dar es Salaam Existing and Projected Capacity (t '000)

Terminal	Current	Theoretical Maximum	Maximum 2014	Maximum 2018
Break Bulk (B1-5)	404	2 106	500	560
Oil Kurasini	1 593	1 593	435	435
Bulk (B6-7)	966	829	1 000	2 600
SPM	453	453	2 816	2 816
Containers (B8-11)	15 x 330	15 x 475	15 x 475	15 x 1 200
Total	8 366	12 106	11 876	24 411

Source: 'Current' data from TPA, Africon calculations

Note: Kurasini capacity is limited in future because it will be used for emergency purposes only after the construction of the new oil facility

6.4.1.2 Port Level of Service

The actual and reference BOFs level coincide fairly well, with the exception of the Kurasini oil jetty where the target is substantially exceeded. The average waiting days for general cargo ships was one day (2010), for KOJ 15 days (2010) and two to four days for the container terminal (2008). The port had an overall average delay of three to four days in 2010.

Table 6-5: Berth Occupancy Factor 2009

Terminal	BOF	
	UNCTAD	Actual
Break Bulk (B1-5)	65%	40%
Oil Kurasini	40%	80%
Bulk (B6-7)	65%	65%
SPM	40%	NA
Containers (B8-11)	75%	80%

Source: Royal Haskoning

6.4.1.3 Port Dar es Salaam Major Issues and Constraints

The physical constraints are the lack of enough deep water berths and land space behind such berths, with the present berths having being built for much smaller dimensioned vessels and lower cargo volumes. These physical constraints are compounded by the constraints that are put on the land behind such berths through the historical growth of the surrounding port industry and town infrastructure. This has forced the Port Authority to consider development of longer and deeper berths and dredging of the approach channels to accommodate larger vessels on a 24/7 basis.

The biggest single challenge is for the Port Authority to simultaneously develop upgraded and new facilities at the same time as continuing to accommodate the growth in volumes especially at the container terminal.

Land-side access to the port is constrained by the port's location in the City of Dar es Salaam. The roads access to the port is severely congested. The intention is to overcome some of these shortcomings with the integration of operation of existing inland container depots (ICDs) and the possible creation of a further ICD.

6.4.2 Supporting Sea Ports

6.4.2.1 Bagamoyo

Presently the Bagamoyo port development is being investigated as a relief port for Dar es Salaam, and indications are that it can make come contribution in that capacity. An expansion project to the value of USD 100 million has been identified. The project is estimated to be completed within five years.

6.4.2.2 Tanga

Tanga is a lighterage port where the cargo is discharged into small lighters (barges) and these discharge the cargo alongside the 220 m break bulk lighterage berth. It is likely that this port will continue to be used as a lighterage port, provided that the present equipment and infrastructure is both maintained and supported by the purchase of new equipment. Since the further development of the port is restricted by its geographical position close to the town, a new development further to the East (Mwambani Bay) as identified in the recent port master plan is a sensible development.

The cargo services provided at Tanga include four 5 t wharf cranes and three mobile cranes of which one (the 60 t Gottwald) is in good condition. The port further has a rail connection to the interior.

Current port capacity is between 600 000 tpa and 900 000 tpa, of which three quarters is for break-bulk and containers. This is planned to be increased to 1.4 Mtpa by 2018.

Present-day port issues are the limited depth alongside and space behind the berth, the limited depth of the by approach channel and the fact that rock found at 7 m alongside quay would be costly to dredge so that deepening the port to allow larger vessels alongside is not an option. Terminal issues include the lack of stacking area as the port is located in the village. This has forced the Port Authority to investigate expansion to the East and the development of Mwambani Bay.

6.4.2.3 Mwambani Bay

The Mwambani area is located 10km South of Tanga, covering an area of nearly 200 ha. Mwambani is fringed by a drying reef, extending in places up-to 600m offshore, though the northern and central part is free from dangers with depths of

10 to 14 m. Its close proximity to Tanga and favourable topography for road and rail construction makes this location attractive for future development.

The intention is for the port to handle spill-over traffic from Dar es Salaam and potentially from Mombasa. Access from the Tanzania hinterland may be improved by the upgrading of the Singida-Kondoa-Handeni-Korogwe-Tanga road currently being investigated. In the scenario where Mwambani alone is developed, Tanzania Ports Authority project cargoes amounting to between 1.2 Mtpa and 10.5 Mtpa (2018).

The original intention was for the port to become operational by 2016. The current status of the Mwambani port project is that a feasibility study has not yet been carried out. Although procurement has progressed, awarding of the assignment is delayed.

6.4.3 Supporting Lake Ports

6.4.3.1 Mwanza South (Tanzania)

Mwanza South Port, on the Southern shore of Lake Victoria, offers cargo services in the form of a wagon ferry railhead situated at the southern end of the main cargo quay, a 255 m split-level cargo quay, two floating docks and an oil jetty to the north which is privately owned and operated.

Current capacity is approximately 200 000 tpa which could be expanded to about 0.6 Mtpa if the railhead, break bulk and oil facilities were fully operational. The major issue at Mwanza South is a need to extensively rehabilitate and upgrade the port infrastructure and equipment.

6.4.3.2 Bujumbura (Burundi)

The Port is situated on the North-Eastern shore of Lake Tanganyika, between the Industrial zone and business district of the Burundian capital. It consists of an entrance between two breakwaters and a large basin of approximately 3.2 ha surrounded by the port facilities. There is undeveloped land in the eastern part of the Port.

Cargo services provided are a main cargo berth of 360 m on the South shore provided with four 5 t portal rail-mounted cranes and transit sheds, a bulk oil terminal on the northern breakwater, two container berths on North shore (120 m and 30 m) with a fixed 30 t lattice sheer leg crane and a small passenger terminal south of the high value goods area. There are paved storage areas in and around the port.

Current capacity (break bulk and containers) amounts to some 1 Mtpa, which could feasibly be increased to 1.2 Mtpa.

Constraints at Bujumbura include the fact that the River Ntangangwa enters the Lake immediately to the North of the port and causes silting up of the berths and entrance, especially around the two breakwaters, restricting the draught of vessels using the port. The port requires further investment to be upgraded, particularly for petroleum products. There is also limited stacking area, lack of rail infrastructure and insufficient depth alongside the quay.

6.4.3.3 Kigoma (Tanzania)

Kigoma Port is located at a railhead on the Eastern shore of Lake Tanganyika. Cargo services provided are a passenger landing jetty; a dedicated container berth with container yard both serviced by the container gantry crane with a stack capacity of 192 TEU; a 300 m-long general cargo quay and cargo sheds with three 3 t cranes and one 35 t rail-mounted bridge crane; a bulk oil jetty 1.5 km to the

North which can accommodate two vessels of 1 000 dwt and 3.6 m draught moored to mooring dolphins; and a new mobile crane expected in 2010 for handling containers.

Port capacity is about 100 000 tpa, with the potential to be increased to 0.7 Mtpa.

The major bottlenecks are the poor condition of roadways in and around port and the siltation of the berths.

6.5 Port Diversification Approach

Both the ports of Mombasa and Dar es Salaam are experiencing capacity constraints presently. Although there are solutions to overcome these constraints (expansion at Mombasa; inland container depot/s at Dar es Salaam), there is a political and strategic impetus to diversify the regional ports portfolio.

The present situation with maritime transport along the East African coast is that the two major regional ports – although important in East Africa – are not large ports on a world scale.

The shipping lines place vessels on different routes in order to achieve maximum utilisation of the vessel at all times. The vessel size and frequency of the service is therefore a fair indication of the cargo flowing on any particular route. To assess the position of Mombasa and Dar es Salaam, two of the main shipping routes (trans-Pacific and Asia to Europe) were compared with the East African and South African routes.

The North South route on the East coast of Africa has a total available TEU capacity of around 10 000 TEU per month. This represents 0.7% of the trans-Pacific route which has a monthly capacity of 1 400 000 TEU, and 1.4% of the Asia Europe route which has in the region of 700 000 TEU on offer per month. The direct route between South Africa and the large hubs in the Middle East has a available TEU capacity of around 35 000 TEU per month which is three times the capacity on the East African route.

As noted in the introduction to this chapter, the global maritime trend is towards developing super container hubs fed by regional and local ‘spokes’. There are therefore two forces at play in East Africa: a requirement to diversify the portfolio of sea ports for strategic purposes versus the need to grow ports to achieve economies of scale and to maintain their relative position in the world.

The assessment of the transport system needs over the next decade (refer Part I: chapter 5) points to the possible need for developing a specialised bulk port at Lamu. Dedicated bulk facilities for crude oil and mining exports could be established depending on how events play out in South Sudan and the North-Eastern DRC. This would provide a platform to relocate these commodities from the two existing major ports and open them up for additional container movements. The new port at Lamu could in time grow to accommodate general, container traffic as well.

6.6 Inland Container Depots (ICDs)

The physical constraints in and around Port Dar es Salaam, as well as contractual commitments to the external container handling agency (TICTS) have prompted the search for solutions outside the port itself. The concept of an inland container depot (ICD) is to provide an off-port location for the handling, storing and clearing of containers.

The Tanzania Ports Authority has commissioned a feasibility study for the construction of a large off-dock container facility at Kisarawe (inland from Dar es Salaam) or other location.

6.7 Lake Transport

Lake transport remains a very cost-effective mode of transport; however the costs and time related to the transfer of cargo (in particular high value cargo) have negated its use as a preferred transport link. In the past, wagon ferries played an important regional role and supported transport along the central corridor. Transport of bulk and low value cargoes remains a viable and cost-effective optional transport link, especially where the alternative rail or road link is long or unavailable. However, consideration should be given to improving the efficiency of inter-modal links, possibly in the form of LoLo (load-on-load-off, done with crane/gantry over the ship's side) or RoRo (roll-on-roll-off, over a ramp from the quay onto the vessel). In general, the lake ports should be reconfigured to also handle more modern vessels.

6.7.1 Lake Victoria

Lake Victoria is the largest of all the African lakes and the second widest in the world at 240 km and a length of 337 km. Its surface area is approximately 69 500 km^2, with and it has a heavily indented coastline of 3 440 km. It is situated in a wide depression between the East and West Rift valley. It is shared between Uganda on the North-Western and Western side, Kenya on the North-Eastern and Eastern side and Tanzania on the Southern, South-Eastern and Western sides.

The oldest ports, Kisumu and Port Bell were constructed at the same time the Uganda railway reached the lake in 1901 (as an alternative route to the mainline to Kampala which was only completed in 1931). The Mwanza ports were constructed after a railway branch line from central Dar es Salaam-Kigoma railway was constructed between Tabora and Mwanza in 1928. In the mid-1960s the rail-wagon terminals were constructed at Kisumu, Port Bell, Mwanza South, Jinja, Musoma and Kemondo Bay. The vessels plying the Lake are dedicated train ferries designed to carry rail wagons which are shunted onto a single train deck over the stern of approximately 1 200 dwt each. If used exclusively on the Mwanza South-Port Bell Route, combined they provided a freight task of approx 110 wagons/day. Together with the deterioration of rail services on the lake transport network has also practically collapsed with most transit cargo now going by road.

Although originally forming the backbone of transport infrastructure, the rail/lake system was largely constructed prior to the introduction of the containerization concept in shipping and has still not fully taken advantage of increasing cargo unitisation

From a purely transport economics perspective, the transport demand and preferred routings indicate that there is no immediate need to rehabilitate and reinstate the rail ferries. This investment would also be contingent on both the rehabilitation of the ports and the investment in the rail supporting the ports. These investments compete with the development of alternative road and rail links around the Lake. The demand for cross lake transport has reduced as further road options have become available. There has been a general shift of cargo from rail to road and this has negatively impacted on the demand for long-distance rail and lake transport services.

From a transport system integrity perspective, however, the lake ferry system plays an important role. It provides alternatives both in terms of route (Dar es Salaam – Kampala vs Mombasa – Kampala) and mode (road vs rail). It also provides for intra-modal competition between the Northern and Central rail systems. Even if average volumes are modest, transport on Lake Victoria contributes to the diversity of the regional transport system. There is therefore a case to be made for at least a moderate investment in that system.

A recapitalisation of lake transport should be preceded by an assessment of appropriate technology. The advantages of rail ferries are that they are a historically proven concept, and they can be utilised for both cargo and passengers. Some distractions are that they have high maintenance and per unit operating cost (related to wagon deadweight transported). This, together with the deterioration of the rail service has resulted in only one rail ferry left in operation.

An alternative approach to rail ferries would be to use RoRo ferries. The advantages lie in the simplicity of operation and relatively lower operating cost. No specialised landing area is required, only an access road. The main benefit is that it taps into the flexibility of road transport and is not exposed to the performance of the rail system. If lake transport is seen as a strategic alternative in the transport system, tying it into road transport (as opposed to rail) is crucial to ensure that it can indeed respond to crises at short notice. Freeing it from the rail system would further provide opportunities for private investors since the tranches of investment would be smaller.

Although RoRos are widely in use internationally, it moves away from the traditional approach in the region. There are also logistical challenges in the form of arranging and timing block departures involving multiple truck operators. The system would therefore be required to operate according to a predictable schedule. Setting up a RoRo system would require regional buy in and coordination.

6.7.2 Lake Tanganyika

Lake Tanganyika is situated in the Western part of the Great Rift Valley. It is outstanding for its extraordinary North-South extension, with a length of 673 km (the longest in the world). It averages 50 km in width and at its widest is 72 km wide. It has a surface area of 32 900 km^2, with a shoreline length of 1 828 km. The shoreline has mostly steep sides and most of the ports and trading areas are confined to the deltas of rivers feeding the lake.

It is bordered by four countries, i.e. Burundi, the DRC, Tanzania and Zambia, with the DRC and Tanzania possessing most of the Lake. The major ports are Bujumbura, Kigoma, Kalemié, and Mpulungu. Smaller ports are located at Kalundu (Uvira), Kasanga and Moba. The oldest ports (Kigoma and Kalemié) were constructed at the same time the central and the eastern link of the DRC railways reached the lake (in 1914 and 1915 respectively). Bujumbura port and Kalundu (Uvira) were constructed in the 1950's (Bujumbura in 1959), principally to as a gateway to trade through Kigoma.

Unlike Lake Victoria there are limited options for road haulage around the Lake and it is anticipated that corridor traffic in an East-West direction would be facilitated by lake transport between Kalemié and Kigoma.

6.8 Navigability of Major Rivers

Two major rivers in the region were briefly investigated for navigability and a potential future role in the regional transport system:

6.8.1 Navigability of River Akagera

The Akagera flows from Lake Rweru (1 450 m) on the Rwanda/Burundi border from where it forms the border between Rwanda and Burundi, Tanzania and Uganda variously, flowing into Lake Victoria at North of Bukoba. Apart from the Rusumo

Falls 60 km downstream from Lake Rweru at the confluence of the Akagera and Ruvubu rivers on the Rwanda-Tanzania border, the river is meandering with only a slight drop in elevation to Bukoba (1 150 m), more than 360 km downstream from Rusumo.

Various studies have assessed the technical viability of using the Akagera River for inland water transport operations (IWT) between a port on Lake Victoria and Kagitumba in Rwanda in the upper reaches of the River, and a study in this regard is apparently ongoing presently.

Issues under investigation in a current study (by ITECO) include whether there is a suitable lake port at the mouth of the river or in the vicinity of the mouth, the river delta shallow areas, the navigability of the upper reaches where there are many narrow bends, the possible loss of about 130km of navigable river where the main river flow will be diverted to accommodate a proposed hydropower scheme at Rusumo, and the varying levels and flow rates of the river. There are distinctly seasonal changes with typical minimum water depths of 2 metres (and maximum depths up to 4 or 5 metres). Ports being considered are somewhere upstream of Kagitumba, and possibly Kemondo Bay on Lake Victoria.

Although the study findings are awaited, based on the available information, it is expected that the study will conclude that the river can be navigated at certain times of the year. This operational time window would have to be expanded by means of substantial infrastructure implementation such flow control dams and canalisation in places to overcome the restricted navigation in parts where the river has too many bends and is narrow and to make the economies of scale acceptable. The length of tow and size of vessel would be restricted, although, depending on the infrastructure proposed, could be increased. The most suitable vessel would be flat bottomed container barges which could accommodate most of the cargoes envisaged which in turn could overcome the costs involved in multi modal handling at the Ports and standardise the type of equipment required. These barges would be towed by powerful river tugs and in all probability because of the control required would need to be pusher tugs.

Whatever the technical outcome of the study underway, it is important to note that IWT on the River Akagera will be loosely linked with transport on Lake Victoria in general. The financial health of this initiative will therefore depend on the lake transport strategy implemented.

6.8.2 River Rusizi

The Rusizi River flows from Lake Kivu to Lake Tanganyika and forms the Western borders of Rwanda and Burundi with the DRC.

Over its approximately 140 km, the river drops from an elevation of 1 500 m to about 800 m. In its upper reaches, the river is fast-flowing. It is characterised by series of rapids, narrow gullies and sandbanks. It flows through the Rusizi plains further South, characterised by tight bends and mini deltas. The delta where the river flows into Lake Tanganyika is a wetland of international importance as defined by the RAMSAR Convention for the conservation and sustainable utilisation of wetlands. Overall, the river is subject to seasonal variation in flow.

The Rusizi I hydropower dam lies at the outflow of the Rusizi from Lake Kivu. The Rusizi II dam lies about 16 km downstream. Planned hydropower dams include Rusizi III, another 25 km downstream at the confluence of the Akonyaru River, and Rusizi IV.

There has apparently been no authoritative study on the feasible of the Rusizi as waterway. The Great Lakes Railway Study envisages a “rail and lake system” serving the North-South transportation needs of the Great Lakes area. The study is sponsored by Burundi, DRC, Rwanda, Uganda and Zambia. The terms of reference acknowledge that the water segment on Lake Tanganyika provides an important link, but that the other two lakes (Kivu and Edward) would be linked by rail segments, or be bypassed altogether by building a continuous rail network joining Bujumbura, Kigali and up to Kasese. On the information reviewed, the prospects of developing the Rusizi as a viable inland waterway are poor.

6.9 Major Potential Port Projects

The key projects at the two major sea ports identified in the study are:

6.9.1 Port Mombasa

Projects that are planned and approved are:

- Dredging to 15m.
- Development of second container terminal and consolidate
- Constructing to new bulk grain discharge units
- Constructing two new soda ash loaders.

Proposed projects are:

- New bridges at the Mbaraki coal wharf
- Oil terminal relocation to Dongo Kundu.

6.9.2 Port Dar es Salaam

Planned and approved projects are:

- Dredging of channel. USD13m. 36 months
- ICD development. USD25m each. 5 years.
- Development of single point mooring to accommodate white and black oils import
- Container terminal B13 and 14
- Grain terminal development.

Proposed projects are:

- Relocation of KOJ Oil terminal across the creek.

7. PIPELINES

The regional pipeline network responds to the needs and requirements of the upstream (extraction and import/export) and midstream (refining and processing) sub-sectors. The KPC system distributes petroleum products through Kenya and towards Uganda. Although designed to transport refined products, the TAZAMA line now exclusively exports crude to Zambia. Recent developments in Uganda could lead to the region becoming an oil producer and exporter. Events in South Sudan could furthermore result in crude exports transiting the region.

This chapter is reduced from the analysis presented in Working Paper 4.3: Pipelines.

7.1 Overview of Petroleum Sector

Petroleum products are used across the entire economy in every East African country. Petrol and diesel are the primary fuels used in road transport. Oil and natural gas are used in power generation and the manufacturing industry. Kerosene and liquefied petroleum gas are used in households for lighting, cooking and heating water.

The EAC market size for petroleum product consumption in 2009 was approximately 125 000 bpd. The Kenya market alone is larger than all four other East African counties combined (some 57%) followed by Tanzania (26%), Uganda (13%), Rwanda (3%) and Burundi (1%). The limited size of the market in especially the landlocked countries – which are more than 1 000 km from the import ports – illustrates the challenges they face in establishing an efficient and competitive downstream petroleum sector. In terms of products, consumption of fuels used mainly in the transportation industry dominated (diesel, petrol [motor spirit or gasoline] and jet fuel), accounting for some 78% of all petroleum products consumed (diesel of 46%, petrol 18% and jet fuel 15%).

Demand for petroleum products should grow at a similar rate to what has been assumed for other commodities, i.e. between % and 8% per annum over the study period.

Currently, all five of the East African countries import all of their petroleum requirements, through either the Port of Mombasa or Dar es Salaam, and to a lesser extent, through Tanga and Mtwara. Mombasa and Dar es Salaam are also used for imports to landlocked Uganda, Rwanda and Burundi. Crude oil imports to Zambia also pass through Dar es Salaam.

Except at fairly low levels of demand, a pipeline is the preferred, lowest-cost transport solution for liquid petroleum products and crude oil.

7.2 Northern Corridor

7.2.1 Upstream and Midstream Petroleum Status

In Kenya, oil marketing companies process crude at the Kenya Petroleum Refineries Ltd (KPRL) plant in Mombasa to the extent of 50% of their domestic white oil requirements, with the balance of refined products imported. At Mombasa, crude oil, (imported for processing at KPRL) and products are imported via the Kurmani and Shimanzi oil jetties and the adjacent Kipevu Oil Storage Facility.

There are upgrade plans for KPRL in the order of USD 450 million, however the discoveries of oil in Uganda may affect the feasibility of this. After an initial plan to construct a 4 000 bpd refinery in Bunyoro near Lake Albert for local consumption, after more recent discoveries, the Government of Uganda intends to construct a larger refinery that would both relieve Uganda of dependence on oil product imports and allowing export of refined products within the great lakes region. Although questions remain about the refinery's location, size and product slate, it is expected that Uganda will build a 50 000 bpd refinery (or larger) to start production in 2015.

Although Kenya (140 days) and Burundi 9115 days) have a reasonably good products storage capacity, depot capacity in Uganda (20 days) and Rwanda (50 days) is however inadequate. This situation has led to fuel shortages that have had a serious adverse effect on price levels, particularly in Uganda, which suffered from prolonged shortages and price spikes in the latter part of 2008 and beginning of 2009 due to disruptions in the supply chain from Kenya.

7.2.2 The KPC Pipeline System

The Kenya Pipeline Company (KPC) owns and operates the country's white products pipeline network. White petroleum product shipments are not allowed by road for the domestic Kenya market or for export if pipeline capacity exists. Road and rail is however the only option for transporting black products (mainly fuel oil) and for onward transport of white products from Nairobi, Eldoret or Kisumu to Uganda (mainly Kampala), Rwanda, Burundi and beyond.

The KPC pipeline has a length of 895 km, from Mombasa to Nairobi (the mainline) and through the western pipeline extension to Nakuru, Eldoret and Kisumu. There are strategic terminals at Nairobi, Nakuru, Eldoret and Kisumu, and intermediate pump stations at Maungu, Mtito Andei, Sultan Hamud (the original stations) and Konza, Makindu, Manyani and Samburu (new pump stations).

The Nairobi-Mombasa pipeline segment (Line 1) is approximately 450km, with a capacity of 132 000 bpd operating at about 82 000 bpd. It has two branch lines to Jomo Kenyatta and Moi international airports. On the western Kenya line segment, Line 2 runs from Nairobi via Nakuru to Eldoret (325 km, 33 000 bpd), with intermediate pump stations at Ngema, Morendat and Nakuru. Line 3 runs from the Sinendet junction to Kisumu (121 km, 24 000 bpd).

The main products transported include Motor Spirit Premium (MPS), Motor Spirit Regular (MSR), Automotive Gas Oil (AGO), and Dual Purpose Kerosene (DPK).

Though the Mombasa-Nairobi section of line is now over 30 years old, it is maintained in good condition. Main capacity constraints on the line include head loss at the KOSF entry point. Main operational constraints relate to frequent power outages and worsening vandalism on fibre optic cables powering KPC's Supervisory Control and Data Acquisition system.

There are capacity limitations on the western Kenya pipelines, which are being addressed by the installation of a new line parallel to line 2 between Nairobi and Eldoret. Together with line 2, this would increase capacity and eliminate product shortages in Western Kenya and the neighbouring countries.

7.3 Dar es Salaam (TAZARA) Corridor

7.3.1 Upstream and Midstream Petroleum Status

Though crude was previously imported into Tanzania for refining at the Tanzanian and Italian Petroleum Refining Company Ltd (TIPER), the market was liberalised and the refinery closed in 2000. Oil marketing companies now import products directly into the country. Crude is imported via the Single Point Mooring (SPM) located outside the port in Mjimwema Bay, and products via the Kurasini Oil Jetty (KOJ). Tanzania has fairly good products storage capacity (about 106 days).

7.3.2 The TAZAMA Pipeline System

The Tanzania Zambia Mafuta Pipeline company (TAZAMA) operates a pipeline connecting Dar es Salaam to the Indeni refinery in Ndola, Zambia. Although TAZAMA was initially intended to transport refined petroleum products from Dar es Salaam to Ndola, it is now used to transport crude oil only. Apart from TAZAMA, all products are distributed by road and rail to domestic markets and beyond. The dilapidated state of the TRL rail means that most products are transported by road.

The pipeline is some 1 710 km in length, with a capacity of approximately 18 500 bpd. It is provided with pump stations at Kigamboni (Dar es Salaam), Morogoro, Elphons Pass, Iringa, Mbeya, Chinsali and Kalonje. Although designed for an annual throughput close to 1.1 million cubic metres, the current throughput is in the region of 600 000 cubic metres. Main constraints in the system include an aged infrastructure and the aged condition of the EW (seam electric welded) line pipe. While this is cathodically protected, it has been known to fail in places, requiring renewal. In addition, the poor condition of the SPM and in particular the import pipeline to the tank farm has caused feedstock shortages. Tanzania Ports Authority has however tendered to replace and upgrade the entire SPM system (into a multi-products facility capable of handling both black and white products) and award is expected in the last quarter of 2010.

7.4 Major Upstream and Midstream Developments in the Region

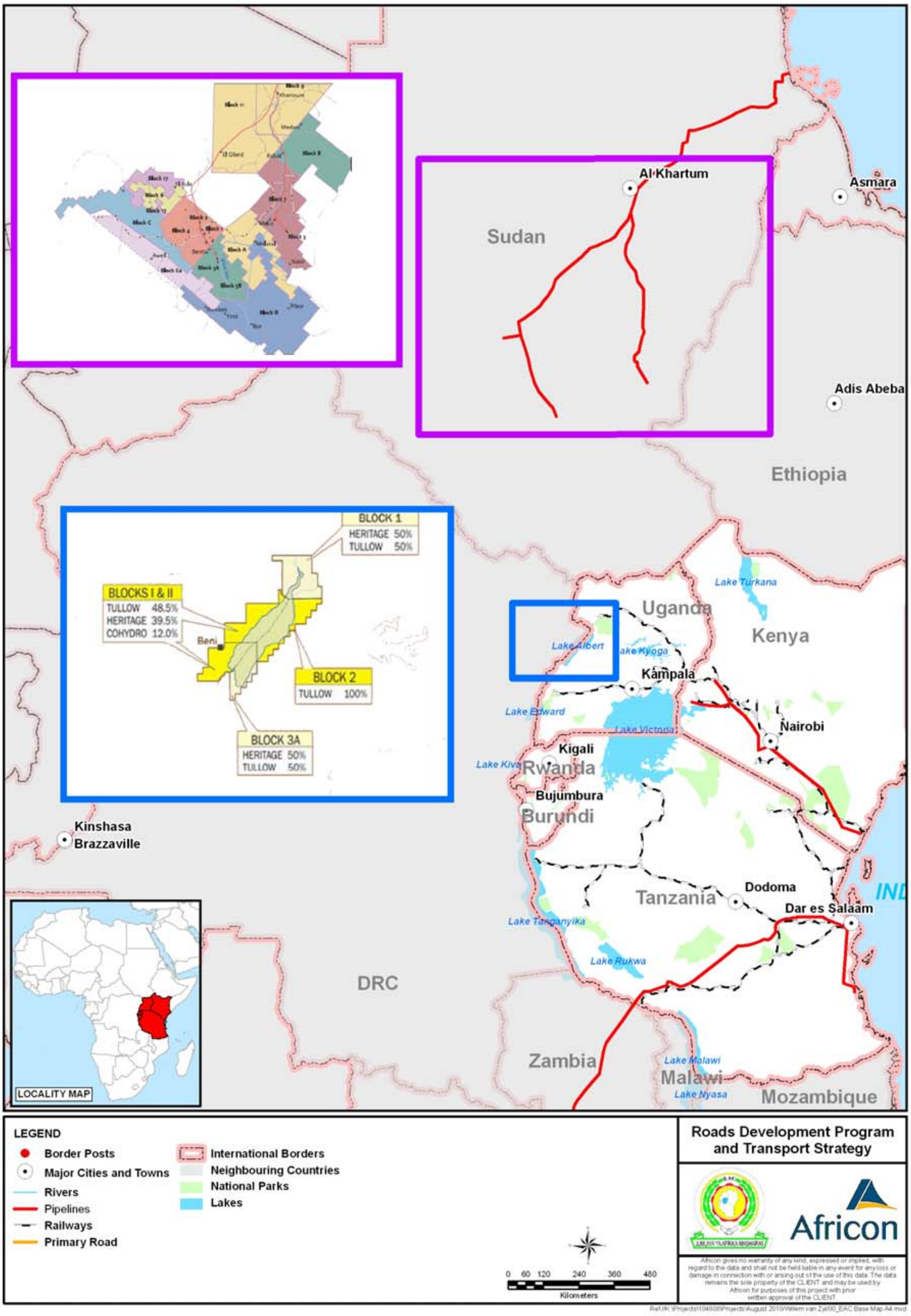
The East African Region has a total of 22 sedimentary basins on which there are approximately 75 exploration blocks, 48 of which have been licensed to various companies or consortia. In Uganda however, licensing has been suspended awaiting update of the country's regulatory framework, while in Rwanda, the Government is still undertaking a technical evaluation to define the country's oil potential.

Existing oil production and recent oil finds are located towards the North-Western edge of the EAC and into Southern Sudan.

7.4.1 South Sudan Oilfields

The Sudanese oil fields are in the centre of the country, straddling the possible future border between North and South Sudan. Blocks 1, 2, and 4 (Heglig and Unity Fields) were developed in 1996, producing a medium, sweet Nile blend, with a combined production in 2008 of 210 000 bpd. These fields are linked to Port Sudan by a 994 mile, 450 000 bpd capacity pipeline. Blocks 3 and 7 (Melut Basin) produce the heavy and acidic Dar blend, at 200 000 bpd in 2008, rising to 250 000 bpd when the Qamari field came online in 2009. These fields are linked to Port Sudan via the Petrodar pipeline with a maximum capacity of 500 000 bpd. Block 5A (Thar Jath and Mala Fields) produced around 25 000 bpd in 2008, with full capacity estimated at 60 000 bpd. Oil from the field flows through a 110 mile pipeline to Port Sudan. Block 6 (Fula Field) has an output of 40 000 bpd of highly acidic Fula blend. A pipeline links the Fula field to the Khartoum refinery where it is processed largely for domestic use.

Of the above fields, Blocks 1 (Unity), a part of 4, 3, a part of 7 and 5A fall within Southern Sudan. Further exploration and field development are taking place in three blocks in the South, i.e. blocks B, 5B and EA. The development of these fields has been held back by a combination of licensing and security issues as well as negative drilling results.



Map 7-1: East Africa Oil Production and Exploration Map

7.4.2 Lake Albert Oil Fields

In the Albertine Basin, the expectation is that production in the Uganda Blocks 1, 2 and 3A should achieve 150 000 bpd by 2020. The DRC Blocks 1, 2, 3 and 5 have all been awarded for exploration, but some of these arrangements are under legal dispute and there as yet there are no indications of the likely production levels and programme.

7.5 Natural Gas Pipelines

7.5.1 Upstream and Midstream Natural Gas Status

Natural gas reserves have been discovered in Tanzania, Rwanda and Uganda. The Tanzania discoveries were made at the Songo Songo Field in 1974, at Mnazi Bay in 1981, at Mukaranga in 2007 (the Bigwa and Mafia Channel Block) and Kilwani North on the southern part of Songo Songo Island in 2008 (part of the Nyuni Block). Licenses have been issued for Songo Songo and Mnazi Bay. These fields have probable reserves of about 1 840 Bcf.

In Rwanda, natural gas has been discovered in the lower depths of Lake Kivu which is thought to contain some 1,940 Bcf of methane. No development licenses have been granted as yet. In Uganda, limited (unknown) reserves of natural gas were discovered when drilling Turaco-2 well on Block 3A in 2004.

Indigenous resources of Natural Gas are used for the generation of power in Tanzania (and to a very limited extend in Rwanda) and as a source of heat for the manufacturing industry in Dar es Salaam.

In Tanzania, gas processing facilities have been constructed on Songo Songo Island and on the Msimbati Peninsular, Mnazi Bay. Both gas plants are linked by pipeline to centres of consumption (Dar es Salaam and Mtwara respectively).

7.5.2 Natural Gas Consumption

The market size for natural gas consumption in 2009 was 23.51 Bcf, almost fully produced by the Songo Songo field. The Songo Songo gas was consumed in Dar es Salaam, about half by the power plant at Ubungo. The 0.32 Bcf produced at Mnazi Bay nearly all was used for power generation by the Mtwara Energy project.

7.5.2.1 Songas Pipeline

The Songo Songo Pipeline was constructed in 2004. It is some 233 km in length and consists of an offshore line of 26 km and an onshore line of 207 km. A branch line extends to Wazo Hill and Tageta. Capacity on the main Songas pipeline is sufficient, with compression of the onshore part of the line, to meet average demand from existing markets up until 2012. Thereafter and in order to match a gas plant capacity of 200 MMcf/d (expected in the year 2013) a second onshore pipeline will be required. Where demand increases to 250 MMcf/d, (by 2015) it will be necessary to provide a second offshore pipeline, or, commence CNG (compressed natural gas) or LNG (liquid natural gas) exports or both. To achieve this, it will also be necessary to drill additional wells into the existing Songo Songo field and into the Songo Songo West prospective.

7.5.2.2 Mnazi Bay Pipeline

The Mnazi Bay pipeline is 27km in length with a capacity of 30MMcf/d. Although current throughput is about 0.87 MMcf/d (used to power a 12 MW power plant), the pipeline has been oversized allowing for future industrial expansion, including the possible construction of a cement plant and expansion of the Mtwara Energy project into additional regions of Tanzania. Given the remoteness of the field and the limited size of domestic markets however, work is also currently being undertaken to assess the feasibility of commercializing the field's reserves. This includes the possibility of constructing an additional pipeline to connect to the Songas network at Somanga Funga; the feasibility of constructing a Urea fertilizer or gas to liquids plant; and/or extending the national grid through construction of a new 400 kV backbone to Mtwara.

7.6 Major Potential Pipeline Projects

The major pipeline projects under consideration are:

- Uganda Petroleum Products Export Pipeline
- KPC Proposed Extension to Kampala
- Uganda-Rwanda Oil Pipeline Extension
- Dar es Salaam-Mwanza Petroleum Products Pipeline
- South Sudan – Lamu Crude Oil Pipeline
- Dar es Salaam – Mombasa Natural Gas Pipeline

8. AIRPORTS

There are eight major airports in the EAC that link the countries of the EAC and the EAC with the rest of the world via scheduled international services. These are Jomo Kenyatta and Moi (Kenya); Dar es Salaam, Zanzibar and Kilimanjaro (Tanzania); Entebbe (Uganda); Kigali (Rwanda) and Bujumbura (Burundi). A number of smaller airports make up the sub-regional airports layer, including Wilson, Eldoret and Kisumu (Kenya); Arusha, Mwanza and Mbeya (Tanzania); and Gulu/Arua(Uganda). There is merit in formalising the system for classifying airports and so-doing noting their relative importance for the region.

This chapter is reduced from the analysis presented in Working Paper 4.4: Airports.

8.1 Context of Airports Assessment

Jomo Kenyatta International Airport (Nairobi) is the regional hub. Based on published flight data (Summer 2010), it carries more than two thirds of the passenger traffic with neighbouring states, more than 90% of traffic with the rest of Africa and two thirds of the traffic with rest of the World (mainly Europe and the Middle East). Other significant entry points are Dar es Salaam and Entebbe, each carrying about one tenth of traffic accessing the region.

Passenger air traffic between the eight major airports within the EAC is about 5 million pax/ann. Traffic between Nairobi, Dar es Salaam and Entebbe makes up a quarter, and traffic between Nairobi and Mombasa another quarter. The volume of intra-EAC air traffic is fairly well explained by the relative distribution of non-agricultural employed by country.

Passengers to/from areas outside of the EAC are made up of about 2 million to neighbouring countries, 1 million to the rest of Africa and 4 million to the rest of the World.

8.2 Reference Levels of Service

The regional airports were assessed in terms of ‘airside’ and ‘landside’ facilities and performance. The airside facilities are the runways, taxiways and apron areas, while landside refers to the terminal facilities (domestic and international, should both facility types exist).

A level of service (LOS) ‘C’ benchmark, as described by the International Air Transport Association (IATA) was applied to evaluate terminal facilities, i.e. a ‘good level of service; conditions of stable flow, acceptable delays and good levels of comfort’.

Level of service can be applied to both space available and passenger waiting times/delay at each facility, against acceptable waiting times as nominated by IATA. Airport terminal facilities were assessed for the peak period passenger demand, to determine whether these are under-capacity, on the threshold of LOS C or failing to achieve LOS C. Where a particular airport terminal facility is under-capacity (i.e. a higher LOS is provided), a 5% or 8% annual growth factor was applied to the peak period passenger figure to identify when this facility will reach a LOS C threshold, i.e. when any further growth to peak passengers will result in a lower LOS.

Airside facilities were assessed using a more qualitative analysis. Here, peak hourly aircraft movement figures (where available) were compared to ICAO (International Civil Aviation Organization) and IATA typical runway hourly operating figures for a particular runway configuration, e.g. single or intersecting.

8.3 Northern Corridor

8.3.1 Nairobi – Jomo Kenyatta International Airport (Kenya)

JKIA is the largest airport in Kenya, the sixth largest airport in Africa and the largest in Eastern Africa. It serves as a focal point for aviation activity in the region and plays an important cargo role for the country, as perishable agricultural exports are heavily reliant on air transport. The airport also serves as an important tourist hub and in 2007 handled approximately 4.9 million passengers against its original design to accommodate 2.5 million passengers.

The terminal building complex has two main sections, one which services international arrivals and one domestic departures as well as domestic arrivals. The departure sector is divided into three sections which cater for international and domestic arrivals and departures. Terminals1 and 2 are predominantly used for international flights, whereas the third terminal is used predominantly for domestic flights.

The outputs of the terminal model therefore indicate that many of the terminal facilities are undersized for the peak passenger figures, and processing times fall short of the LOS C benchmark. I.e. the facilities are more likely to experience overcrowding issues during peak demand periods and passengers would be subjected to long delays.

Most functions in the terminal facility are already below LOS C with current peak demand, with the exception of arrivals and immigration and customs. Although these areas would theoretically only reach unacceptable levels of service after ten years or more (at 8% growth) this situation will probably not materialise given that proposals have already been requested (September 2010) for the expansion of the terminal buildings. These aim to double the current size of the airport with the addition of a new terminal building (T4) for which a contract has been awarded and work has commenced.

The assessment of airside facilities at JKIA found there to be no theoretical capacity issues related to the current peak hour use of the existing runway and taxiway network. However, the airports authority has proposed an additional runway.

Inadequate airspace capacity surrounding the airport, as a result of outdated technology and other ATC-related issues, limited the runway operating capacity due to requirement for greater aircraft separation distances. An upgrade of the country's ATC is currently underway to modernise existing systems and install additional equipment where required. Upon implementation of the improved ATC system, aircraft separation will be reduced which will have the effect of increasing the hourly aircraft movement operations for the runway.

8.3.2 Mombasa – Moi International Airport (Kenya)

Mombasa International Airport primarily serves as a passenger airport and receives a large proportion of the country's tourism traffic and has therefore been labelled as the 'gateway' to Kenya's tourism. Figures from 2007 show that the airport processed approximately 1.2 million passengers. An increase in charter flights has increased passenger numbers during recent years. The airport has two terminals for domestic and international operations, although the older terminal facility is only partially open and is listed for international departure use.

Peak passenger demand figures show that many of the terminal facilities are operating close to the limit of their capacity, whist others were undersized. One area which the model indicated as having a gross lack of capacity is the domestic check-in facility, although this is unconfirmed by the airport operator.

If a peak hour growth of 8% is experienced, the two functional areas which are currently not operating below LOS C, i.e. arrivals and immigration and customs will start experiencing capacity problems within three to six years.

The current peak hour aircraft movements for Moi fall well within both the ICAO and IATA operating capacities for a single runway. There are no airspace capacity issues affecting runway capacity. No foreseeable delays are predicted. The runway is supported by a full parallel taxiway and an adequate number of exit taxiways which would decrease aircraft runway occupancy time, i.e. the operational efficiency of the runway increases.

8.3.3 Entebbe International Airport (Uganda)

Entebbe International is the largest airport in Uganda and is used for both passenger and cargo activities, as well as by the military. It is of particular importance to the national economy due to its perishable cargo exports and links to tourism. The airport has two terminal buildings, with one used for both domestic and international operations, whilst the old terminal building is used by the military. Approximately 1 million passengers were processed by the airport in 2008.

Comparative data from the airport was lacking during the terminal building analysis, however in general the existing terminal facility is adequately sized to cope with current peak passenger demand, with some facilities (e.g. the number of check-in desks) well in excess of requirement.

The majority of terminal facilities at Entebbe exceed LOS C requirements and will remain doing so for at least eight years at a growth rate of 8%. The areas with below LOS C capacity (arrivals and immigration and customs: red line) have sufficient space available to upgrade the functions to the required capacity.

The peak hour aircraft movements received from the airport for the runway configuration at Entebbe fall well within both the ICAO and IATA operating capacity ranges for an ‘Open V’ runway configuration and are unlikely to lead to any delays. A parallel taxiway serves the main runway and exit taxiways are positioned as such to reduce aircraft occupancy times, reducing the likelihood of delays.

8.3.4 Kigali International Airport (Rwanda)

Kigali International Airport is a main gateway into Rwanda, a landlocked country. Despite economic progress, growth of the airport is limited by its location on a hill. A new airport, Bugesera International, is being planned and will be located 40 km to the South-East of Kigali. The two airports will operate in tandem.

Kigali International has one terminal which is used for both domestic and international operations and in 2009 the airport handled approximately 250 000 passengers.

Model outputs, together with comparative data supplied by the airport indicated that the airport terminal is of an insufficient size in many areas to accommodate the current peak passenger demands, e.g. check-in facilities, departure lounge and immigration facilities. Interim improvements will be required to cope with passenger volumes until the completion of the new Bugesera International Airport.

Kigali operates with a single runway configuration. No data could be obtained on peak hour operations, but the airport did however provide an average rate of departing and arriving aircraft as one aircraft per hour (one departure and one arrival), which is a low utilisation figure implying that the existing facility is not operating close to maximum capacity. The single link taxiway would restrict the operational efficiency of the runway should peak hour aircraft movements increase dramatically in the future.

8.4 Central Corridor

8.4.1 Dar es Salaam – Julius Nyerere International Airport (Tanzania)

JNIA is considered the fastest growing airport in the East Africa Community, with a 15% growth in annual traffic in 2007. The airport consists of two terminals, with Terminal 1 serving general aviation and charter services, whilst Terminal 2 is dedicated to domestic and international operations. Figures from 2008 show that the airport processed a total of approximately 1.5 million passengers (including scheduled and non-scheduled). A new Terminal 3 is being constructed and the rehabilitation of Terminal 2 is planned.

A complete data set relating to the terminal building was supplied for the airport and the results of the analysis show that in the majority of areas, the terminal facilities were adequately sized to accommodate the current peak period passenger demand. In some cases, facility provision exceeded current demand, leaving spare capacity to accommodate future increases in the number of peak passengers. Only arrivals and immigration and baggage reclaim were below LOS C.

In some cases, terminal service levels will fall below ‘acceptable’ levels within one or two years (customs and check-in) at 8% growth rates. In general, however, the majority of the facilities will allow acceptable service levels for eight years or more.

Commercial facilities within the terminal have been allowed to encroach upon operational and passenger areas, thus reducing queuing and allowable passenger movement areas. Depending on the level of encroachment in each terminal area, the acceptable level of service in many of facilities (as described above) might only be achievable for 5 years or less.

JNIA operates with an intersecting runway configuration and the Tanzania Airport Authority records the peak hour aircraft operations as seven scheduled arriving movements and seven scheduled departing movements. Even with an allowance made for non-scheduled movements, the total peak hourly movements fall well within both the ICAO and IATA operating capacity ranges for the runway configuration. ATC was confirmed by the airport as not being a limiting factor, so it is expected that the runway and taxiway network at the airport have spare capacity to accommodate future increases in peak hourly operations.

8.4.2 Zanzibar International Airport (Tanzania)

Zanzibar Airport is situated on the island of Unguja. It is served by all major East African airlines, Southern African Airlines and flights from Europe. Figures from 2005 indicate that the airport serviced close to 0.5 million passengers per annum. During peak periods, three wide-body jet aircraft depart from or arrive in Zanzibar from Europe.

Zanzibar has one terminal for domestic and international operations. The terminal model indicates that the majority of existing terminal facilities at Zanzibar would already struggle to cope with the peak passenger demand, i.e. a low level of service, overcrowding and longer than acceptable delays. A new terminal is already under construction

Zanzibar operates a single runway which is currently being extended. No peak period data on aircraft movements could be obtained from the airport although an indicative annual aircraft movement figure of 36 000 was provided, indicating that the runway is operating below the stated ICAO/IATA maximum capacities for the configuration type. Partial parallel taxiways should also improve the overall runway operating efficiency.

8.4.3 Bujumbura International Airport (Burundi)

Bujumbura Airport serves as an international gateway to the landlocked country. The airport has one terminal which is purely for international operations, i.e. no domestic passenger facilities. It processed approximately 180 000 passengers in 2009.

The terminal building model outputs indicate that, in general, the facility provision is insufficient to handle the peak period passenger demand, i.e. low LOS and overcrowding during peak periods. Any additional growth in peak hour passengers will only exacerbate the situation.

The airport operates a single runway configuration. Although no data was obtained on peak hourly operations, it is very unlikely that the peak period movements will surpass the theoretical runway capacity and no foreseeable delays are expected.

8.5 Arusha Corridor

8.5.1 Kilimanjaro International Airport – (Tanzania)

KIA is located close to Arusha which is the hub of the Northern Tanzania tourist circuit and approximately 75 km west of Mt Kilimanjaro. The airport is an important international tourist link, although the high demand for horticulture and floriculture from the region has increased demand for cargo flights to Europe, the Middle East and the Far East.

There is currently only one terminal building at Kilimanjaro Airport which services both international and domestic operations. Figures for 2008 show that the airport processed approximately 522 000 passengers.

Much of the data for the terminal building model was sourced directly from the airport operator and as such, the conclusions drawn using the model outputs are fairly robust. The international and domestic peak periods do not coincide and the facilities would therefore be freely distributed between international and domestic passengers during peak periods to accommodate passenger demands.

In general, the terminal building facilities are adequately sized for a non-concurrent international/domestic peak and will deliver an acceptable level of service during peak periods. However, there is little capacity to accommodate future increases, and should the two passenger peaks coincide the LOS will decrease. The arrivals and immigration facility for international passengers is already deemed to be undersized to deal with the peak passenger demand.

At an 8% growth in peak hour volumes, the International Check-in and Security functions will operate below acceptable levels within one to three years. There is, however, sufficient space available in these areas to upgrade the functionality.

Kilimanjaro operates a single runway configuration and has a peak hourly operation of 22 aircraft movements, which again falls below the IATA and ICAO stated ranges. The runway is further equipped with an ILS (instrument landing system) and experiences an average of 330 good weather days which is unlikely to present a bottleneck to airport operations. ATC is also not a limiting factor. The airport has a basic taxiway network and runway operating efficiency could be somewhat restricted during peak periods due to higher runway occupancy times by aircraft. Improvements could be made to the airside 'network' to reduce these occupancy times, i.e. provision of a partial parallel taxiway.

8.6 Gulu Airport Initiative

Airports along the Gulu Corridor were not specifically analysed during the study, although current indications are that it could be of strategic importance to the region. Specifically, the expected economic activity in the region of Lake Albert will require some level of infrastructure development which will probably be phased as the demand increases.

Whilst this development investment is currently not quantified, there are signs of upcoming activity in the form of a bid notice for consultancy services at Gulu Airport. It is one of five Uganda airports identified as designated entry and exit points to boost tourism and regional trade. It calls, inter alia, for master planning services to include infrastructure for fire and rescue services, passenger terminal building with access roads, car parking and perimeter fence, basic air navigation including a control tower and cargo facilities. Other tasks include a detail design for runway rehabilitation as well as detailed designs for taxiways, aprons and airfield ground lighting.

8.7 Regional Airports Initiative & Airports Classification

8.7.1 Airports Classification Rationale

The EAC executed a study to identify aerodromes that could serve as regional access points specifically aimed at supporting tourism. The study output was a five-year investment and financing strategy for priority airports identified, which will now be formally subjected to a feasibility study. The consideration of a ‘third layer’ of airports (the first layer being the scheduled international access points and the second layer those connecting with the first) raises the issue of introducing a region-wide airport classification system.

Various systems for airport classification are applied internationally. These systems are based on a variety of criteria, including function of the airport, level of traffic (passenger or cargo), design, safety criteria and classification.

For airport function, the study team reviewed functional classification systems used in the UK and Canada. Airports were grouped according to the FAA’s stratification categories. Airport design standards were considered with reference to the ICAO reference codes. Safety criteria were assessed based on the airport classes in the FAA operating certification process.

In 2008, the EAC approved an investment and financing strategy for airports projects that would promote tourism growth in the Partner States – the priority airports project for promotion of tourism growth. This airport type would therefore make up a distinct layer in the classification of airports in the EAC.

It is proposed that airports in the EAC be categorised based on a functional classification. Taking account of the examples referred to above, the following classification system in proposed for airports in the EAC.

Table 8-1: Proposed Airport Classification System for the EAC

Airport Category	Description
International Airport	Airports supplying a wide range and frequency of international services, including intercontinental services and a full range of domestic services. Flights can be scheduled or unscheduled, and the airport can accommodate large aircraft
Regional Airport	Airports catering for the main air traffic demand of individual regions. They are concerned with the provision of domestic services, including

Airport Category	Description
	links with gateway airports, a range of charter services, and may also provide short-haul international services. Flights can be scheduled or unscheduled. Aircraft are typically smaller than at International Airports
Tourist Circuit	Airports specifically targeted at improving access for tourists, accommodating mostly charter or non-scheduled movements with fairly small aircraft (fewer than 25 seats)
Local Airport	All airports not falling under International, Regional or Tourist Circuit airports. These would typically cater for general aviation only

8.7.2 Classification of Airports in the EAC Region

The following paragraphs list the airports under each category. The lists of airports in this section may not be comprehensive, specifically with regards to local airports (as some of them may not be operational anymore, may be unlicensed). It should also be noted that classification was based on available data in terms of flight schedules, and type of aircraft using airports.

8.7.2.1 International Airports

International Airports supply a wide range and frequency of international services, including intercontinental services and a full range of domestic services. A total of ten International Airports were identified in the EAC.

Table 8-2: International Airports in EAC

Country	City/Town	Airport name
Burundi	Bujumbura	Bujumbura International Airport
Kenya	Nairobi	Jomo Kenyatta International Airport
	Mombasa	Moi International Airport
	Eldoret	Eldoret International Airport
Rwanda	Kigali	Kigali International Airport
	Bugesera	Bugesera International Airport (planned)
Tanzania	Dar Es Salaam	Julius Nyerere International Airport
	Zanzibar	Zanzibar/Kisauni International Airport
	Arusha	Kilimanjaro International Airport
Uganda	Entebbe	Entebbe International Airport

8.7.2.2 Regional Airports

Regional airports are concerned with the provision of domestic services, including links with gateway airports, a range of charter services, and may also provide short-haul international services.

Table 8-3: Regional Airports in EAC

Country	City/Town	Airport name
Burundi	-	-
Kenya	Nairobi	Wilson Airport
	Kisumu	Kisumu Airport
	Malindi	Malindi Airport
	Lokichokio	Lokichokio Airport
	Wajir	Wajir Airport
Rwanda	Kamembe	Kamembe Airport
Tanzania	Bukoba	Bukoba Airport
	Kigoma	Kigoma Airport
	Mafia	Mafia Airport
	Mtwara	Mtwara Airport
	Musoma	Musoma Airport
	Mwanza	Mwanza Airport
	Pemba	Karume Airport
	Seronera	Seronera Airport
	Shinyanga	Shinyanga Airport
	Tabora	Tabora Airport
Uganda	Arua	Arua Airport
	Gulu	Gulu Airport

8.8 Tourist Circuit Airports

Tourist airports are those specifically targeted in the 2008 Airports System Plan for the East African Tourism Circuit. These are:

Table 8-4: Tourist Circuit Airports in the EAC

Country	Airports
Burundi	Kirundo, Gitega, Gihofi
Kenya	Isiolo, Mandra, Keekorok, Nyaribo, Kilaguni, Musiara, Mandera, Moyale
Rwanda	Gisenyi, Ruhengeri, Butare
Tanzania*	Arusha Municipal, Lake Manyara, Iringa, Mpanda, Kilwa
Uganda	Kisoro, Jinja, Tororo, Mbarara, Soroti

Source: Priority Airports Project for Promotion of Tourism Growth, 2008

Note: Mafia Airport is identified as a tourist circuit airport, but is already shown under 'Regional Airports'

8.9 Local Airports

Local Airports are typically smaller airports that only cater for small scheduled passenger services aircraft, charter flights (smaller aircraft), or general aviation.

Table 8-5: Local Airports in the EAC

Country	Airports
Kenya	Amboseli, Bamburi, Elive Springs, Garissa, Hola, Kalokol, Kericho, Kerio Valley, Kilaguni, Kitale, Kiunga, Kiwayu, Lake Baringo, Lake Rudolf, Lamu, Liboi, Lodwar, Loyangalani, Mara Lodges, Marsabit, Mumias, Nakuru, Nanyuki, Nyeri, Nzoia, Samburu, Ukunda
Tanzania	Dodoma, Geita, Kilwa, Lushoto, Masasi, Mbeya, Moshi, Mwadui, Nachingwea, Ngara, Njombe, Singida, Songea, Sumbawanga, Tanga
Uganda	Kabalega Falls, Kasese, Kidepo, Lira, Masindi, Moroto, Moyo, Pakuba
Rwanda	Nemba, Gabiro
Burundi	-

8.10 EAC Upper Airspace Control Initiative

Under the EAC Treaty partner states agreed to the establishment of a unified upper area control system, i.e. a regional upper flight information region (UFIR) to be controlled by one upper area control centre (UACC).

Currently, air traffic and navigation services are provided by service providers in each of the partner states. In all cases the service providers are part of the civil aviation authorities in these countries. Each service provider is responsible for providing service in the FIR delegated to it by ICAO in accordance with the provisions of the Chicago Convention. These FIRs broadly follow the current geographical boundaries of the partner states; accept in the cases of Burundi and Rwanda. The service providers in these countries are only responsible for providing lower airspace services at their respective international airports.

Tanzania is responsible for providing air traffic and navigation services in the upper airspace above Rwanda and Burundi.

The objective is to create a single block of upper airspace (i.e. airspace above Flight Level 245) over Tanzania, Kenya, Uganda, Burundi and Rwanda which will be controlled and managed from a single area control centre. It is envisioned that the new UACC will control a UFIR, and that the existing three national area control centres (ACCs) will be responsible for managing the lower air space of the national flight information regions (FIRs) as currently defined. The UACC will coordinate with the national ACCs of partner states and FIRs adjacent to the EAC.

In 2008, the EAC completed the feasibility study for the EAC UFIR project. It covered Kenya, Tanzania and Uganda. This study involved examining the technical aspects and options of the EAC's future communications, navigation, surveillance in air traffic management (CNS/ATM) architecture, developing requirements for a single UACC and elaborating the operational and institutional aspects involved in the transition and implementation of such a control centre, including benefits, ownership structure lower airspace relationships and location.

The UACC was fund to be technically and financially feasible, and, since Dar es Salaam already controls the upper airspace (FL245+) of Rwanda and Burundi, it is expected that it will be feasible to include these two countries in the UACC initiative. The UFIR/UACC would enhance the efficiency and effectiveness of upper airspace operations for both the users and service providers, afford an opportunity for increasing performance and productivity skills of operational and maintenance personnel, provide greater reliable air transportation services with expanded access to more locations, and increase the probability of greater economic growth and better day-to-day quality of life for the general public. Implementation would take about three years.

8.11 Major Potential Airports and Airspace Projects

A number of airports projects were identified in the course of consultation with the national airport authorities. The major ones are:

- At JKIA, design and construction of second parallel runway and associated taxiways; terminal expansions
- At Moi, construction of new cargo apron, parking area and access road at Moi International Airport; airside pavements rehabilitation and new drainage works; expansion of terminal facilities
- At Entebbe, construction of rigid pavement and rehabilitation of vehicle corridor for Apron 1; expansion and modification of Terminal Building (Departures, boarding bridges); construction of fuel pier and relocation of fuel farm; strengthening of Apron 4; construction of an overlay on runway 17/35 and its associated taxiways; and rehabilitation of runway 1/30, its associated taxiways, Apron 2 and Apron 3
- At JNIA, the overhaul and upgrading of terminal capacity by means of rehabilitation of the existing Terminal 2 building and the construction of a new terminal
- In Rwanda, Kigali Airport interim terminal upgrade; and construction of a new international airport
- At Zanzibar, rehabilitation of apron and extension of taxiway; new runway; and terminal expansion
- At Bujumbura, airport terminal expansion
- At Kilimanjaro, terminal expansion; and construction of new taxiway and resurfacing of the apron.

Air navigation services projects identified include:

- CNS/ATM implementation in Rwanda
- Regional implementation plan for upper and lower airspace CNS/ATM.

9. BORDER POSTS

Although not transport infrastructure proper, border posts are the nodes where national networks connect. Time delays at border posts contribute to the overall impedances transport users experience, and from the transport modelling exercise it is known that users avoid border posts where they can by selecting routes that cross fewer borders.

This chapter is reduced from the analysis presented in Working Paper 4.5: Border Posts.

9.1 Overview of Major Border Crossings

Border posts reviewed in this study are those on the major roads corridors which capture the majority of cross-border activities in the respective countries. The corridors that form part of the study are not limited to the regional boundaries but also cross into the neighbouring countries (Democratic Republic of Congo, Zambia, Mozambique, Somalia, Ethiopia and Sudan). The main border posts to these neighbouring countries were also taken into consideration. The Unity Bridge border crossing (Tanzania – Mozambique) and Liboi (Kenya – Somalia) were not included in this analysis as there is limited traffic going through them and there is also a lack of data on these border crossings. The Taveta, Holili and Kasumula posts were excluded as they do not fall on the selected corridors. The Mugina border post on the Sumbawanga Corridor was also not covered as the border post activities are low. It has to be acknowledged that as the road infrastructure leading to these border posts is improved and as trade relations between countries increase, it is anticipated that the activities at the border posts will also increase.

Table 9-1: Border Posts of Regional Importance

Corridor	Border Post	Countries
Northern	Malaba	Kenya – Uganda
	Busia	Kenya – Uganda
	Katuna/Gatuna	Uganda – Rwanda
Central	Kanyaru/Akanyaru	Burundi – Rwanda
	Mutukula	Tanzania - Uganda
	Rusumo	Rwanda - Tanzania
	Kobero/Kabanga	Burundi – Tanzania
Namanga	Namanga	Tanzania – Kenya
	Moyale/Moyyale	Kenya – Ethiopia
Sirari	Sirari/Isebania	Tanzania – Kenya
Coastal	Lunga-Lunga/Horohoro	Tanzania – Kenya
Other	Tunduma/Nakonde	Tanzania – Zambia
	Nagpal (Lokichoggio)	Kenya – Sudan
	Bibia/Nimule	Uganda – Sudan
	Gisenyi/Goma	Rwanda – DRC

Note: Mugina (Tanzania-Burundi border) is one of the potential future border crossings of regional importance

9.2 Reference Levels of Service

Border posts operations are influenced by factors such as the geography of the location of the border post, the different agreements in place with the neighbouring country or the region, the number of officials and agencies available including the procedures they follow, the equipment available to them, and the infrastructure in place. The challenges typically faced at border posts in the EAC are:

- Data Capturing – Although ASYCUDA/SIMBA are used, some of the capturing is still manual, thus there is still discrepancies in the data between corresponding countries. Data capturing methods should be harmonised
- Not all border posts have water and electricity
- Not all border posts have access to a national/regional IT network
- Lack of adequate number of staff members, and in some cases lack of adequate training
- Infrastructure issues leading to delays – adequate parking and office buildings
- Harmonisation of all system, and increased bilateral agreements and synergy in legal frameworks.

In this analysis, the composite level of service indicator is delay (time to clear the border post). Since the focus of the Transport Strategy is on goods traffic, the delays considered relate to freight (not people) traffic. The causes of the delays may be found in two broad areas: infrastructure issues (the border post facilities) and processes (e.g. staffing levels).

9.3 Northern Corridor

The Northern Corridor is the main route for goods coming from the Mombasa port to Uganda and Rwanda, and also to the Eastern provinces of the DRC. Malaba and Busia border posts are the main gateways to Uganda from Kenya. The Malaba and Busia border posts carry the largest share of traffic. Rwanda is linked to the Northern Corridor through the Katuna/Gatuna border post with Uganda.

Malaba and Busia, have one stop controls for the Kenyan Revenue Authority and Ugandan Revenue Authority and carry out the inspections together. There is also a joint clearance area for rail. The rest of the agencies operate as two-stops border posts. Designs and tender documents have been completed for the implementation of a One Stop Border Post. Harmonisation of final designs and coordination of project implementation is still required. Harmonisation of all systems is still a critical issue.

For the Katuna/Gatuna border post, bilateral agreements are in place. Interagency coordination is required along with legal frameworks. It is necessary that there is continued human resource capacity building.

As regards infrastructure, access roads to the Northern Corridor border posts are in good condition, except on the Uganda side of Malaba. Throughout, parking facilities are inadequate and mostly in a deteriorated condition. Only Katuna (Uganda) is not provided with complementary services (banks and filling stations).

Average delays for customs clearance on the Northern Corridor is between one-and-a-half and two hours, and less than half-an-hour for immigration clearance. The busy Kenya-Uganda (especially Malaba, Uganda) border posts contribute most to the delays even though they are staffed at similar levels (i.e. staff per demand) as the other border posts.

9.4 Central Corridor

The Central Corridor from Dar es Salaam port through mostly Tanzania competes with the Northern Corridor for the traffic to/from the West of Lake Victoria. The Central Corridor enters Burundi through the Kobero border post, Rwanda through Rusumo and Uganda through Mutukula. The Bugesera border post also links Rwanda and Burundi. It is located on a good road with low traffic volumes, which are expected to increase when the new main Rwanda airport is developed a short distance from the border post. It has been constructed as a One Stop Border Post, although it is operated back-to-back.

A One Stop Border post is under development at Rusumo. Bilateral agreements are in place and consultants have been appointed for detailed designs. Joint procurement should be the preferred approach, however the current laws in Uganda and Tanzania do not allow for this.

Access roads are all in a good condition, but not to Kabanga (Tanzania). Rusumo is constrained by a narrow, one-directional bridge between the two border posts. With the exception of the two Rusumo posts and Kabanga, there is adequate parking space. None of these border posts are adequately equipped with supporting facilities in the form of banks and filling stations.

Delays on the Central Corridor border posts are around three-quarters of an hour for customs and half-an-hour for immigration. The border posts perform at similar levels, although the overall delay at Kabanga (Tanzania) is reportedly more than a day. The number of customs declarations per official at the Rwandan border posts of Akanyaru and Rusumo is more than double the average for the Corridor.

9.5 Namanga Corridor

The Namanga border post forms an important link between Kenya and Tanzania. There already exists high levels of passenger transport between the two countries on the road between Nairobi and Arusha, and freight volumes are increasing.

The Moyale/Moyale border post between Kenya and Ethiopia is relatively quiet but this could change in future with the possible development of the Kenya-Ethiopia transport links.

The access road on the Tanzania side of Namanga is being upgraded, and on the Kenya side it is in a fair condition although pot-holed. The access from Kenya to Moyale is being paved. Parking is either inadequate (Namanga posts) or requires rehabilitation (Moyale). The Kenya side of the two border posts is well-equipped with complementary facilities.

Performance statistics are only available for the two Namanga border posts. Customs delay is just more than an hour and immigration delay about quarter of an hour.

9.6 Sirari Corridor

The Sirari Corridor passes through the Sirari (Tanzania) and Isebania (Kenya) border posts. Consultants have been appointed for the detailed designs for a One Stop Border Post. The design of this border post should be similar in both countries; however joint procurement cannot be done as the current laws do not allow it. There is a need for a high level of communication between the countries to ensure that the border post is designed to specification.

Performance statistics in the form of delays are not available for the Sirari and Isebania border posts, but compared to the other regional border posts, these posts appear to be adequately staffed for the workload.

9.7 Coastal Corridor

The Horohoro (Tanzania) and Lunga-Lunga (Kenya) border posts link the two countries South of Mombasa. The access roads are in poor condition on both sides of the border. There also is a lack of parking space. Lunga-Lunga has adequate supporting facilities (banks and filling stations), but these are absent on the Tanzania side.

Although delay statistics are not available, these border posts are adequately staffed compared with posts in the rest of the region.

9.8 Extra-Regional Border Posts

Apart from Moyale, the EAC is tied to neighbouring countries via Tunduma (Tanzania-Zambia), Gisenyi (Rwanda-DRC), Nimule (Uganda-Sudan) and Nagpal (Kenya-Sudan). This list excludes a number of very small posts such as Cyangugu, Arua and Unity Bridge.

Even for the larger extra-regional posts very little infrastructure and performance statistics are available. For those that information has been obtained, Tunduma and Gisenyi have fair access roads but the Nagpal road is in a poor condition. Parking is inadequate at all three these posts. However, they are all served adequately with supporting facilities.

9.9 Major Potential Border Post Projects

9.9.1 One-Stop Border Posts (OSBPs)

The basic concept of OSBP is to change the ‘two stops’ required at conventional border posts to ‘one stop’. This is achieved by simplifying and joining procedures by agencies in both countries. Thus vehicles and goods make a single stop to exit on country and enter the other. The motivation is more efficient border post processing and a reduction in delays.

The above challenges can be achieved by the introduction of One Stop Border Posts. The construction of OSBPs produces many benefits that improve operations as opposed to maintaining conventional border posts. The main contributor to delays on regional corridors is facilitation. It is therefore imperative to introduce OSBPs in order to improve the transport system by increasing efficiency and thus reducing transport costs in the EAC.

It is important to note that the construction and implementation of One Stop Border Posts will serve little purpose if the EAC eventually adopts a European Union no border approach. It is therefore crucial to consider OSBPs in conjunction with the Common Market Protocols currently being implemented.

9.9.2 Border Post Rehabilitation

From the review of the regional border posts there are general shortcomings in the access routes to border posts as well as regards parking space at the posts. Many border posts have communication and data handling shortcomings. The review did not specifically cover the adequacy of the buildings and other structures, but a cursory overview points out that buildings are generally inadequate in terms of space and condition.

For the Transport Strategy, a non-detailed, two-level budget has been provided for the rehabilitation and expansion of large and small border posts.

10. PRIORITISATION OF STRATEGY INTERVENTIONS

A multi-step approach has been developed to determine the relative priorities of the various projects included in the projects 'long list'. Broadly following the principles of multi-criteria analysis, this approach includes both quantitative and qualitative criteria. The result is a Strategy made up of various packages of interventions.

The principles of project prioritisation are developed in Part I: Chapter 7.

10.1 Prioritisation Context

The study TOR states that 'the objective of the EAC Transport Strategy is to identify regional strategic priorities and resources for transport sector development'. This means that interventions should support an overarching plan (a 'regional strategy') and those ones that do so best should receive precedence. The intention of the TOR is therefore not to create a 'wish list' inventorising every project nominated by a transport stakeholder in the region.

But there is an opportunity cost associated with prioritisation: selecting one project means not selecting another. A prioritisation process that considers individual projects' contribution to the regional transport system will inevitably be controversial in an environment made up of countries, transport modes, and service providers who look to the regional strategy as an important endorsement of their own initiatives.

10.2 Prioritisation Approach

The prioritisation process applied in the study is based on a multi-criteria (or 'variate') analysis approach, also referred to as a generalised utility analysis model methodology.

At the project outset, stakeholders emphasised the importance of the economic performance of projects both in terms of positive transport results and economic impacts beyond the transport sector. At the study review stage, the portfolio of prioritisation criteria was broadened to include more qualitative criteria in the form of the strategic implications of projects. 'Strategic' projects are those that are visionary (they change the structure of the existing regional transport network) and provide alternative access (an 'insurance policy' against the preferred transport route not being available). Apart from the outright merit of including a strategic perspective in the prioritisation approach, it has the added effect of contributing to a more representative distribution of projects across partner states.

10.3 Prioritisation Steps

The prioritisation steps are shown in the following figure:

- *Regional Screening*. There is an initial screening to ensure that projects are indeed 'regional'. They must fall on corridors, whether existing or planned. A regional project may fall exclusively within one partner state, but the fact that it is located on a corridor implies that it has impacts beyond that country.
- *Screening for Ongoing Projects*. Projects should not already have progressed so far that including them in the Strategy would be superfluous. The test of whether a project has developed sufficient momentum already is whether funding is already committed.

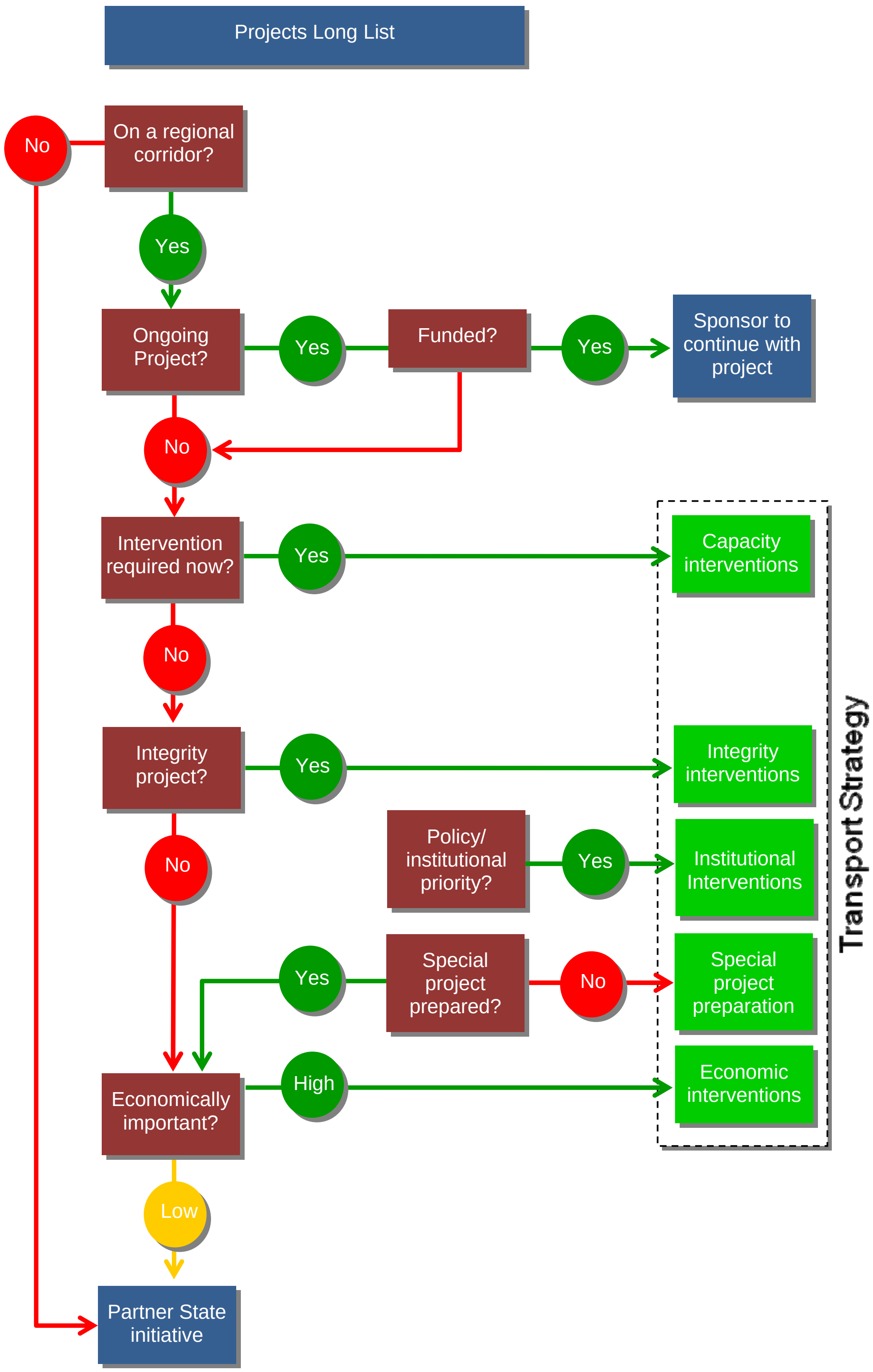


Figure 10-1: Summary Project Prioritisation Process

- *Regional Capacity Projects.* The first wave of interventions in the Strategy itself focuses on addressing the immediate shortcomings of the transport system. These are the components identified via the transport model as being already stressed or stressed in the course of the Strategy period.
- *Transport System Integrity Projects.* These interventions aim to establish a principal network of certain minimum qualities which network is not primarily defined on purely economic considerations (although many of these interventions are also fully justifiable on economic grounds).
- *Policy & Institutional Projects.* These projects do not relate to physical infrastructure, but have to do with the modernisation of the management of the regional transport system.
- *Roads Projects.* Roads are a specific class of project. Because the level of analysis for the Roads Development Program is deeper than that for the other modes, roads projects are projected to be required at specific points in time. Therefore, roads projects are phased over the ten-year timeframe of the Strategy not because of their relative importance, but based on when they are required from an engineering perspective.
- *Economic Tests.* Future (i.e. non-ongoing) projects that do not have as their principal aim to ensure the transport system integrity ‘compete’ for inclusion in the Strategy based on economic merit. Economic merit is determined with reference to the economic importance of the project area (measured in annual goods trade on the actual or closest transport link) and the cost of the project. The highest ‘value-for-money’ (VFM) projects are those that have the most trade associated with them (‘value’) for the lowest investment cost (‘money’).
- *Special Projects.* The last category of project corresponds with the ‘visionary’ element of strategic projects. Many special projects on the projects long list are beyond the purely concept stage but they are not yet ready for implementation. Rather than indiscriminately bringing these projects into the Transport Strategy proper for implementation, special projects are ‘warehoused’ in anticipation of the outcome of the various preparatory activities still required. That means that for purposes of the Strategy, special projects are all studies (feasibilities, demand assessment, etc.) contributing to understanding them better so that they can progress to the list of projects subjected to the economic prioritisation tests.

10.4 Timing of Interventions

Two groups of projects have a timeline associated with them – regional capacity projects which are ‘immediate’ interventions that must be carried out as soon as possible and roads projects which are sequenced over the duration of the Strategy. It is anticipated that ‘integrity’ interventions and ‘policy/institutional’ projects would also be executed in at least the medium term. The main driver of the timing of the remaining projects categories is likely to be the availability of financial and other resources.

10.5 Non-Prioritised Interventions

The Transport Strategy focuses on interventions of regional importance and scale. Projects that do not achieve a high prioritisation on this stage may still be necessary, useful and feasible at the local level, and stakeholders are encouraged to pursue these projects based on such considerations.

10.6 Prioritised Interventions

10.6.1 Overview

The prioritisation approach leads to a portfolio of interventions that may be depicted as shown in the following figure. Since the 'Ongoing' projects are already taken care of in terms of financing, the first layer of the Strategy proper is the 'Priority' projects. As noted before, the roads projects intersect the priority projects in that there are a number of roads interventions required immediately.

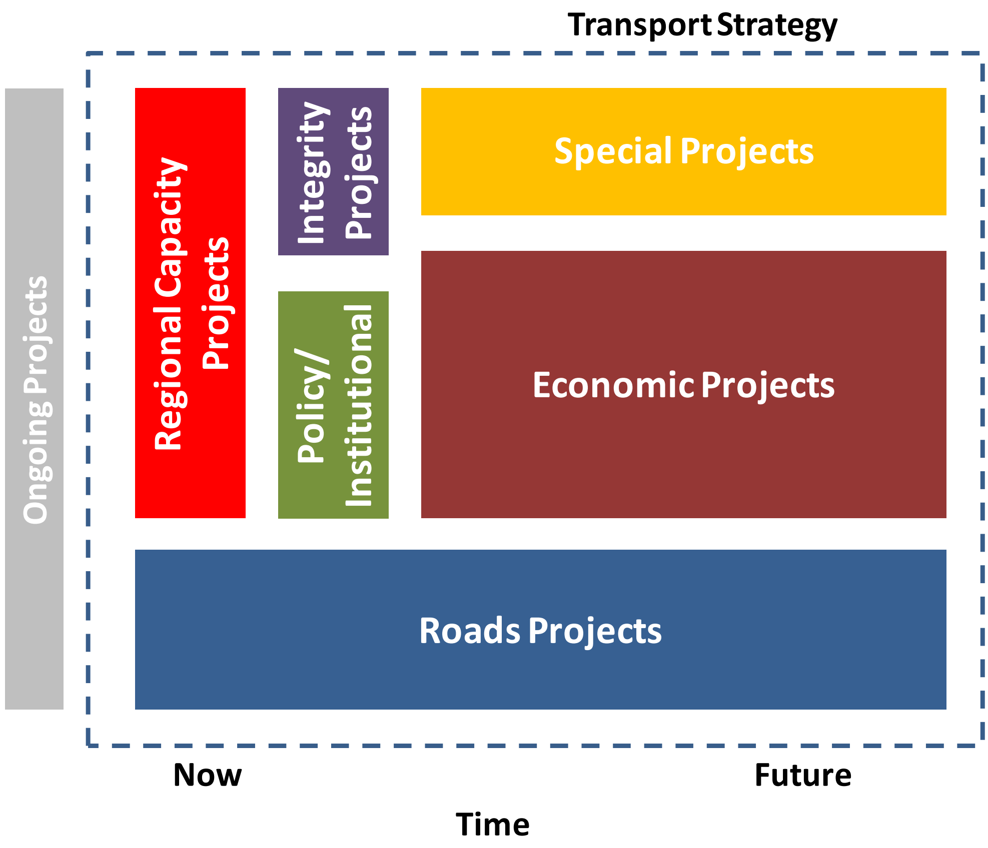


Figure 10-2: Classes of Project in Transport Strategy

10.6.2 Projects Long List

There are some 230 projects included in the long list.

The long list of potential projects was developed over the course of the study, i.e. a period of nearly two years. This necessarily means that implementation has commenced for some projects originally included in the list. These were screened off and are not shown in the long list in Part IV.

10.6.3 Project Profiles

The Terms of Reference require project profiles including technical requirements, economic benefits and funding requirements. Profiles are included in Part IV. These cover the main fields of information that a funder would require to make an initial assessment of the nature, merits and impacts of a project.

The TOR requirement is for profiles for roads projects under the Road Sector Development Program specifically. However, profiles for the main non-roads projects are included as well, i.e. projects classified as 'regional capacity', 'integrity' and 'policy/institutional'. These are also included in Part IV.

10.6.4 Strategy Budget

The total expenditure associated with the 'long list' of projects is approximately USD 17 billion.

The project cost includes all the remaining steps of the project cycle. In other words, if a feasibility study has been carried out, the project budget provides for the detailed design and actual construction. Where there is uncertainty about the actual status of the project, a conservative view is taken by including the earlier steps in the project cycle as well.

Many of the projects were priced by the respective agencies responsible for the particular mode in the Partner State, such as a ports authority, and usually based on an analysis in the form of a master plan. Where agency estimates are not available, the amount provided for is the consultant's estimate. Given the number of projects involved and the wide range of sectors and locations, the estimate is fairly rough. It is based on typical unit rates and project budgets for similar projects in Southern and Eastern Africa – in as far as such information is available.

The 'Special Projects' category – which includes high-investment projects such as standard gauge development – includes only the cost of relevant studies[4]. This type of project is generally at concept stage and requires substantial project preparation before a go/no-go decision can be taken.

It should also be noted that some projects in the 'special' category have corresponding projects in the 'economic' category. For example, the rehabilitation of the Northern Corridor rail system is included under 'economic' and the development of a Northern corridor standard gauge line under 'special'.

The implication is that the financial estimate for the project long list has an element of double counting in the 'economic' prioritisation categories. The total amount should therefore be treated with the necessary caution. However, the four main categories of project – roads, regional capacity, integrity and policy/institutional – do not double count and the amounts associated with each of these categories are therefore more robust.

Table 10-1: Total Strategy Budget (USD billion)

Type/Mode	Air	BP	Multi	Pipe	Port	Rail	Road	Total	%
Economic	1,278	17	1	1,540	103	1,981	11	4,930	29%
Policy & Institutional	-	-	15	-	0	2,154	4	19	10%
Regional Capacity	150	10	-	10	1,343	1,616	-	3,130	18%
Roads Project	-	-	-	-	-	-	5,220	5,220	30%
Special	1	-	-	52	19	285	1	357	2%

[4] Note that in previous versions of the strategy the capital amount for special projects had been shown, but only the amounts for studies are shown in this report

Type/Mode	Air	BP	Multi	Pipe	Port	Rail	Road	Total	%
System Integrity	139	78	-	200	49	3,149	-	3,615	21%
Total	1,567	105	16	1,802	1,515	7,031	5,235	17,271	100%

The contribution of roads projects is 30%. Of the various mode analyses, the roads mode was required to be done the most vigorously. It is also generally acknowledged that roads are the priority mode in East Africa and developing countries in general.

With reference to Figure 10-3 and focussing on the priority projects only, i.e. roads, regional capacity, system integrity and policy/institutional, there are two categories that make up the bulk of the strategy costs. Roads projects require 50%, and Rail projects 42%. Port projects contribute 6%.

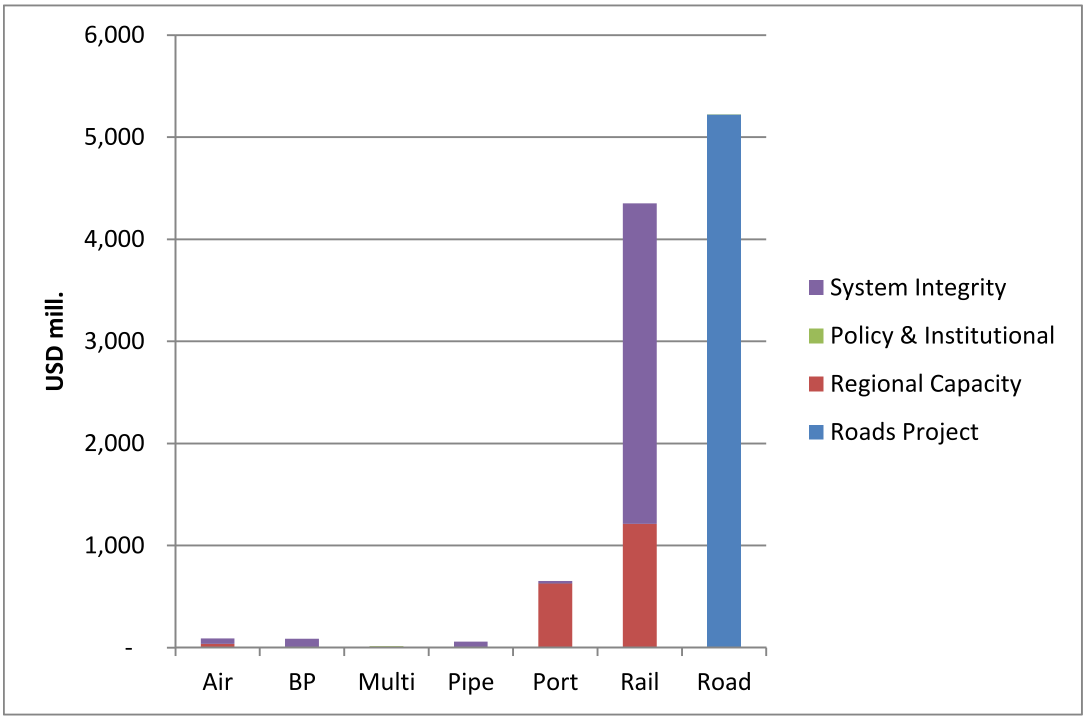


Figure 10-3: Relative Contribution of Priority Projects

The roads projects are distributed amongst the countries as shown below. The cost of roads projects in Kenya is 29% of the total, in Tanzania 24%, in Uganda 11%, in Rwanda 3% and in Burundi 3%.

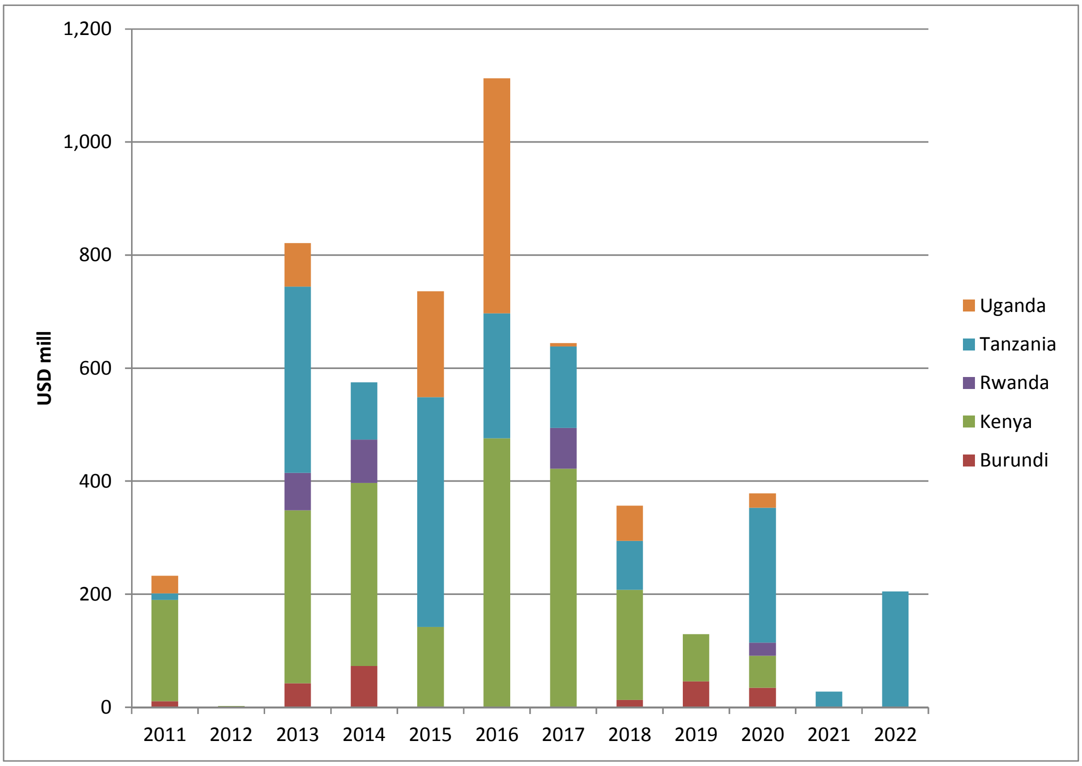


Figure 10-4: Distribution of Roads Projects by Country and Year (USD billion)

The distribution by corridor is shown below. Excluding the special projects, projects on the Northern Corridor represent 25% of the total, 9% on the Central Corridor and 67% on the others.

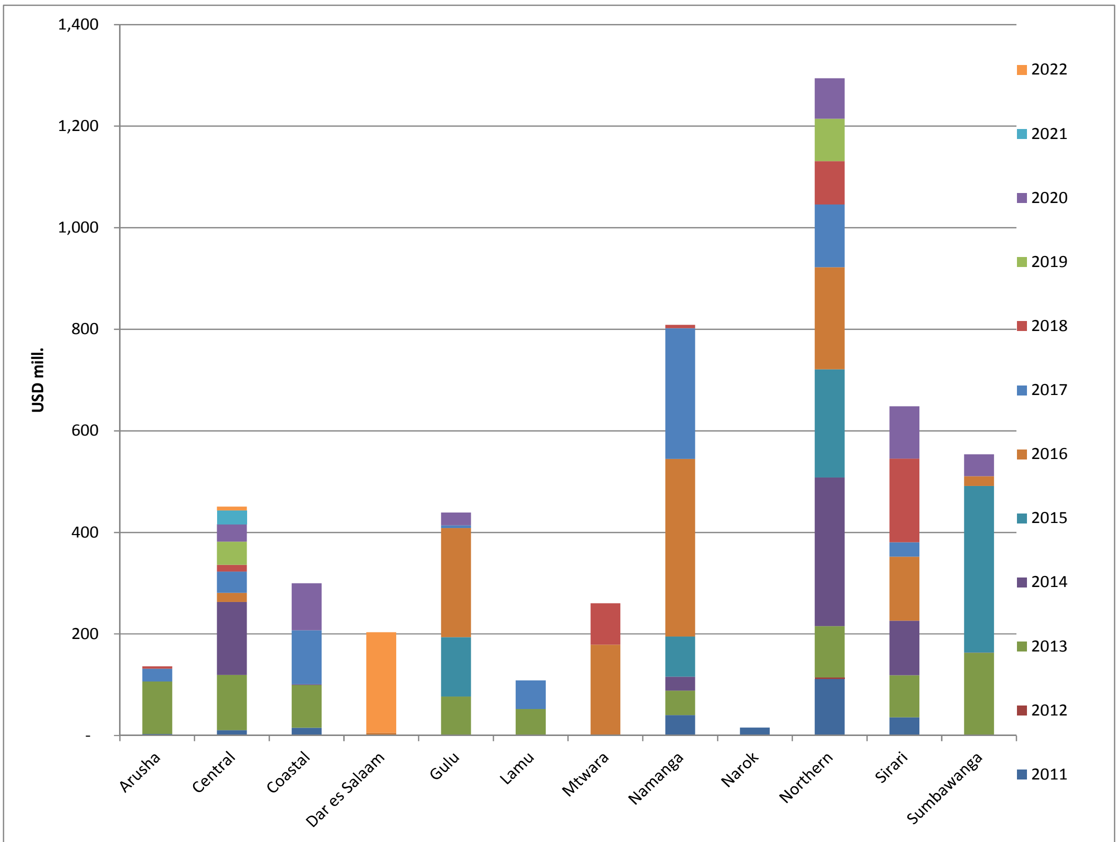


Figure 10-5: Distribution of Budget

As noted in the implementation chapter of Part I, the projects' budgets should be appropriately assigned to public and concessionary funding on the one hand, and commercial funding on the other. The funding rules applied in the Strategy are summarised below:

Table 10-2: Assumed Use of Public Funding

<table>
<tr><th>Type/Mode</th><th>Road</th><th>Rail</th><th>Port</th><th>Pipe</th><th>Air</th><th>BP</th></tr>
<tr><td>Studies</td><td colspan="6">100% public</td></tr>
<tr><td>Rehabilitation</td><td colspan="2">100% public</td><td colspan="3">75% public</td><td rowspan="3">100% public</td></tr>
<tr><td>Upgrading</td><td rowspan="2">100% public</td><td colspan="4">50% public</td></tr>
<tr><td>New Construction</td><td colspan="4">25% public</td></tr>
<tr><td>Policy/Institutional</td><td colspan="6">100% public</td></tr>
</table>

Based on the funding rules, the public or concessionary part of the total expenditure amounts to USD 12.5 billion. Special projects make up 1% and roads 42%. Excluding the special projects, roads make up 42% and rail 39%.

Table 10-3: 'Public' Share of Strategy Budget (USD billion)

Type/Mode	Air	BP	Multi	Pipe	Port	Rail	Road	Total	%
Economic	377	17	1	1,005	28	497	11	1,935	15%
Policy & Institutional	-	-	15	-	-	-	4	19	0%
Regional Capacity	38	10	-	10	629	1,213	-	1,899	15%
Roads Project	-	-	-	-	-	-	5,220	5,220	42%
Special	-	-	-	24	9	93	1	127	1%
System Integrity	55	78	-	50	24	3,139	-	3,345	27%
Total	470	105	16	1,088	690	4,942	5,235	12,545	100%

11. STRATEGY INSTITUTIONALISATION & IMPLEMENTATION

The priority regional projects will mostly be carried out by partner states or their agencies. The EAC will coordinate regional initiatives and support states where necessary. Projects require proper preparation. They must be investigated, structured and supported for them to attract financing. Since public funding is limited, other sources of funding (including private funding) need to be explored. Private sector participation can contribute to both the financing and execution of projects. The greatest challenge in this regard is to introduce commercial business principles in the roads environment, including exploring ways of transferring risk to the private sector.

The principles presented in this chapter are developed in more detail in Part I: Chapter 8.

11.1 Project Preparation

Most of the projects on the long list from which interventions making up this Transport Strategy are selected are only an idea to which little value has been added, i.e. a project that is identified (and now prioritised) but not yet properly defined.

11.1.1 Scope of Project Preparation

Project preparation entails developing a project to the extent that potential investors, operators and other role players are sufficiently interested in the project to commit resources to bringing the project to financial close. The major steps in project preparation are:

- *Enabling Environment*, including designing enabling legislation, establishing regulatory approaches, carrying out project-relevant institutional reforms, capacity building to support projects and consensus building for projects
- *Project Definition*, i.e. identification of desired outputs, prioritisation vs. other projects, identification of project partners, action planning and pre-feasibility studies
- *Project Feasibility*, including addressing organisational/administrative, financial, economic, social, technical/engineering and environmental issues
- *Project Structuring*, entailing public/private options assessment, technical/engineering support, project financing and legal structuring
- *Transaction Support*, which is the continuation of the project structuring phase (finance, technical/engineering and legal), procurement, negotiation and post-signing financial agreements
- *Post-Implementation Support* is the process of monitoring, evaluation and possibly renegotiation/refinancing.

Where a project covers more than one country, it requires coordination between parallel political, administrative and legal systems. This would imply some form of agreement (inter-governmental MOU) be concluded before project feasibility can run its course.

During the third phase of preparation (feasibility), two streams of projects would develop: those that will essentially be ’public’ projects with primarily developmental and economic objectives, and ‘private’ projects that have sufficient commercial traits to attract PSP and commercial funding. The public projects could eventually be partly funded by commercial debt, but such loans would be made to the project sponsors (governments). Funding of private projects would be on a limited recourse (project finance) basis. Private projects require intensive preparation through the next preparation phases (project structuring and transaction support).

11.1.2 Project Preparation Facility

Recognising project preparation shortcomings, a number of preparation facilities have been created. These include the Public-Private Infrastructure Advisory Facility (PPIAF) at the World Bank and the NEPAD Infrastructure Project Preparation Facility (IPPF) at the African Development Bank.

In the region initiatives are afoot to establish the Project Implementation and Coordination Unit (PICU) by the Tripartite Task Force (TTF), comprising COMESA, SADC and the EAC. The Eastern and Southern Africa (ESA) region (COMESA, EAC, IGAD and IOC) recently considered the establishment of the Program Finance Facility (PFF). In both cases, the main consideration was the need for a strong project pipeline. A specialist unit would therefore be mandated with developing and maintaining such pipeline. It would maintain sector intelligence, identify regional projects in collaboration with national infrastructure agencies (e.g. roads boards), develop projects up to pre-feasibility stage where required and hand projects over to more experienced project preparation facilities for detailed feasibility and structuring.

There is a decision in principle to consolidate the PICU and PFF initiatives. Since EAC is a member of both regional groupings driving the PICU and PFF, it would be appropriate for it to support such streamlining and to actively participate in its establishment and operation.

Many of the projects identified under this Strategy coincide with partner states' own priorities and are likely to be developed (prepared and funded) by them. However, the EAC should monitor progress and act as project developer of last resort where partner states are unable to mobilise a regionally important project.

11.2 Infrastructure Financing Considerations

As the name suggests, the PFF (merged with PICU) will also have a mandate to package regional projects for funding. The PFF will monitor available funding across the spectrum of national, concessionary donor and commercial sources. It will consider the appropriate blending (i.e. share of commercial funding required) and match the project characteristics (sector, location, size) with the available funds and finance instruments.

11.2.1 Scope of Funding Sources

The range of funding institutions covers a spectrum of public to private role players. Public funds include national governments and the resources they have available from their domestic tax base or funds obtained from other funders. Regional economic communities (RECs) are groupings of states pursuing a common purpose. These rely for their funding on partner states, or (typically) development finance institutions. Development finance institutions (DFIs) provide financing for developmental purposes, which they obtain from their members (mostly countries) or other funders (e.g. other DFIs or commercial sources). Towards the private end of the funding spectrum, there are commercial financial institutions ('banks'), and private equity which is capital held by private individuals, companies, etc. which may be in the form of a private equity fund (i.e. a pool of private capital).

There are some important differences between the public and private ends of the funding spectrum. Public funding goes predominantly to social or economic purposes, and private funding to commercial purposes. 'Commercial' implies that investments must deliver financial returns, over-and-above any non-financial social/economic returns.

11.2.2 Investment Funds

Although the lines between them are often somewhat blurred, four broad types of fund are distinguished:

- *Regional development funds*, are funds created by and overseen by RECs, although some of the capital is from DFIs and commercial banks
- *DFI funds* are operated by DFIs, primarily resourced by the DFIs and their members
- *Infrastructure funds* are funds where DFIs are the major investors, but which sometimes also involve commercial institutions.
- *Private equity funds* are managed by commercial banks and private equity firms which provide the majority of the capital, sometimes with additional capital from DFIs. The descriptions of the last two funds indicate that the differentiation between them is not clear-cut.

As for COMESA (COMESA Regional Infrastructure Fund) and the Tripartite (Tripartite Trust Account), the EAC is also in the process of establishing a regional development fund. The decision to establish the EAC Development Fund (EACDF) was taken during the Tenth EAC Council of Ministers Meeting in August 2005.

The EACDF would address development issues, e.g. infrastructural development, investment promotion, imbalances and other development issues in the EAC. It would do so by providing grants or loans for supporting regional oriented development projects in the region, providing means to facilitate the sustained mobilisation of internal and external financial resources for the partner states, providing a special facility for budgetary support and promoting regional integration through development projects in partner states.

11.3 Private Sector Participation

Governments are increasingly turning to the private sector to assist with infrastructure development to augment their own limited fiscal base, because the private sector can often deliver projects more efficiently (at lower cost and higher levels of service) than the public sector and because some projects are inherently commercial (i.e. they can recover their investment from their beneficiaries) and should therefore in principle not be funded from the public budget.

Private Sector Participation (PSP) implies a risk-sharing relationship between public and private project partners. The degree of risk differs per type of contract:

- ‘Management contract’, where the government retains all business and funding risks, but improves the management of the business by outsourcing it to an external party usually for a limited period of time
- ‘Lease’, where the government remains the owner of the assets and an external party carries the business and financing risk, which may include a duty to modify and improve the assets
- ‘Concession’, where the government transfer the asset ownership and business risks to an external party, for a period long enough for that party to recover any investments it makes, after which the ownership and risk revert to government
- ‘Privatisation’, where the government transfers the assets and business risk permanently.

In exchange for taking the business risk, the private sector may charge a fee on the beneficiaries of the service. The private shareholding provides comfort to lenders off whom the private shareholder can leverage further funding.

11.4 Funding and PSP Potential in Transport Infrastructure

The infrastructures that have been able to generate revenue are the ones that have been in a position to reinvest and are therefore generally in the best condition. These are the so-called 'private good' modes, i.e. infrastructure or services which are not accessible by everyone so that the benefits of their use can be restricted and therefore charged for. Private goods can often pay their own way fully or partially. In a transport context, private goods include ports, airports and pipelines.

Although providing a public service, these are already fairly well-ringfenced financially and institutionally with a commercial revenue stream. Projects in these sub-sectors should mostly be in a position to access non-concessionary funding, although some non-commercial funding could be required to leverage off.

While rail has similar characteristics (ringfenced with an actual or potential revenue stream), in the region this mode has suffered from years of neglect and has to be redeveloped on a large scale. Below and above rail investments should be separated, with below-rail accessing concessionary funding.

'Public goods' are non-exclusive, so that anyone can access them. Examples in transport include urban streets and often roads in general. Public goods have limited revenue generating potential and are therefore typically subsidised.

In the case of roads, more so than any other transport infrastructure, the private and public good natures are the most difficult to separate. Except where roads are physically cordoned (fenced) off, their use and benefit are not easily restricted to a select group. This has meant that roads funding is often obtained from the general fiscus or at least with some form of government underwriting.

11.5 Financing and PSP Assumptions Applied in the Strategy Finance Plan

The above discussion on PSP and funding points to the fact that it cannot be assumed that transport infrastructure will be financed by default by governments, donors or from any other form of concessionary or public funding. Funders require efficient provision of infrastructure and a financial contribution by those who benefit from it. This approach includes roads.

Infrastructure provision will include some element of PSP, with the private party having to assume some commercial risk and therefore only interested in the deal if there is an underlying economic rationale for the project. Project preparation will therefore have to be more incisive to provide comfort to funders and service providers.

Specific principles supporting the above position would therefore be:

- A bias towards 'sweating' existing assets, i.e. a preference for maintenance rather than new construction, preferably with a financial contribution by users
- A presumption against new construction requiring public funding if there is no charging mechanism and revenue stream in place
- A preference for some degree of private funding for construction
- An assertion that investment in 'regional' transport services – which by its nature has a financial rationale – should always be privately funded
- An understanding that studies and preparation will have to be publicly funded, at least up to the point where the financial merits of a project are proven.

Applying these principles allows funding 'rules' to be developed – as shown in Table 11-1. Up-front preparatory work (where the economic and financial merits of a project are not yet known) will have to be publicly funded, as would initiatives related to policy and institutional issues (which relate to sector governance and do not have an immediate financial return).

The roads projects identified in the Roads Development Program are all outside the urban areas. These roads do not carry the levels of traffic that would attract private or commercial investment.

Given the bias towards maintaining the assets that already exist, for the other modes it is proposed that more public funding effort goes to asset preservation. The test for new infrastructures should therefore be the commercial viability thereof, with public funds used to seed, but not to provide the bulk of the investment.

The summary financing principles therefore are:

Table 11-1: Infrastructure Funding Mix Assumptions for Strategy Finance Plan

<table>
<tr><th rowspan="2">Activity</th><th colspan="2">Public Funding</th></tr>
<tr><th>Roads</th><th>Other Modes</th></tr>
<tr><td>Studies and Preparation</td><td colspan="2">100%</td></tr>
<tr><td>Rehabilitation</td><td rowspan="3">100%</td><td>75%</td></tr>
<tr><td>Upgrading</td><td>50%</td></tr>
<tr><td>New construction</td><td>25%</td></tr>
<tr><td>Institutional/policy</td><td colspan="2">100%</td></tr>
</table>

With respect to PSP, the form of ownership and control of transport infrastructure should correspond with the economic purpose thereof. Private good infrastructures should be opened up to PSP in all its facets (funding, management and even ownership) while the scope for PSP in public good infrastructures will be more limited. Monopoly infrastructures could be opened to PSP, but the extent of PSP should be matched with equally intensive regulatory oversight.

Table 11-2: Selection of PSP

<table>
<tr><th colspan="2">Nature of Business</th><th>Public Agency</th><th>Manage-ment Contract</th><th>Lease/ Concession</th><th>Private</th></tr>
<tr><td rowspan="2">Natural Monopoly</td><td>Public Good</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Private Good</td><td>X</td><td>X</td><td>X</td><td></td></tr>
<tr><td>Non-Monopoly</td><td></td><td></td><td></td><td>X</td></tr>
</table>

The general principles regarding PSP should therefore be:

- To concession off (or even sell) public assets with private good characteristics (e.g. land transport, airports and ports)
- To divest from transport operations, including rail, trucking and busing at the regional level
- To manage facilities and services with natural monopoly characteristics in a regulated environment (i.e. most transport infrastructure, but not transport operations)
- To have pure public ownership in transport operations only where there is no private interest in providing it.

11.6 Roles and Responsibilities of Partner States and EAC Secretariat

The process of regional integration may be understood as a series of fairly discrete steps. The EAC is presently at a stage 2 level of integration. It is moving beyond the harmonisation of policies and modes of conduct of individual partner states (stage 1), and is exploring stage 3 integration in the form of joint operations where states still furnish the means to implement agreed common objectives. The final stage (4) of integration would entail the carrying out of operations by the REC itself. Stage 2 entails the co-ordination of policy and conduct, in which states submit to common rules in their mutual relations. Co-operation manifests itself in the development of rules and the oversight of compliance with these rules.

Even though it is referred to as 'regional' infrastructure, all transport infrastructure covered in this report are owned by partner states. The ownership role is mostly performed through public agencies which are commercialised to differing degrees. There are some examples of networks (e.g. Northern Corridor rail) or specific facilities (e.g. ICTC at Port Dar es Salaam, Kilimanjaro Airport) having been concessioned off or under management contract.

Although there are various examples of national agencies cooperating and pooling resources (e.g. Kenya-Uganda joint railway concession, integrated upper airspace management initiative, one-stop border posts), there is no indication that partner states intend relinquishing their ownership role to the EAC. They will therefore remain responsible for the planning of, investment in and operation of their transport assets, even if via contract.

The role of the Community will be to guide partner states on the components of the transport system that are of regional importance. In principle, these are infrastructures associated with the identified regional corridors.

11.7 Project Monitoring & Updating Mechanism

The projects making up the Transport Strategy and Roads Development Program have been spatially captured in a GIS environment. Each project is accompanied by a basic fiche contained such details as the project name, projected year of implementation and cost.

The user can interrogate the progress of rolling out the Strategy at the click of a mouse. A maintenance procedure allows the Secretariat to update the projects. New projects can be added, existing ones substituted. It also provides the functionality that the project status can be updated periodically.