NATIONAL MUSEUMS OF KENYA

WHERE HERITAGE LIVES ON

Ref: NMK/UN/2/1

31st January 2019

Dr. Mechtild Rossler,
Director of World Heritage Centre,
UNESCO
7, Place de Fontenoy, 75352 Paris CEDEX 07
FRANCE

Dear Dr. Rossler,

RE: SOC REPORT FOR 42 COM 7B.45 LAMU OLD TOWN WORLD HERITAGE SITE (KENYA) (1055)

Kindly receive the State of Conservation report for the Lamu Old Town World Heritage Property for year 2019. On behalf of the State Party of Kenya, I thank the UNESCO World Heritage Centre for the continued support in the conservation of heritage in Kenya.

Yours sincerely,

Stanvas Ongalo

For: Director General

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Dir WHC

Rec'd 1/02/19

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State of Conservation Report 2019 Decision: 42 COM 7B.45

LAMU OLD TOWN, KENYA 1055

Executive summary

Over the last 5 World Heritage Committee sessions, the state of conservation report for the old town of Lamu has been up for discussion owing to perceived threats posed by the LAPSSET project on the sites OUV. The state party through her relevant expert agencies has been trying to address these concerns and implement recommendations of the committee.

In January 2018, the state party hosted an advisory mission in Nairobi in which a number of recommendations were proposed. As recommended in the mission, the state party officially invited the World Heritage Centre to send a mission to Lamu in order to verify some of the concerns raised and not well understood. The mission scheduled for 17th-23rd February 2019, has been postponed to a later date due to security matters in the region.

The proponents of the LAPSSET project have instructed the SEA consultant to review the stakeholder engagement by initiating a series of public consultation meetings in order to capture concerns by a number of aggrieved parties.

The state party also wishes to submit to the WHC revised master plan for Lamu metropolis, the LAPSSET transportation master plan, the LAPSSET planning and investment framework and the revised chapter of LAPSSET of the management plan of the property for review by the advisory bodies.

Relevant state party organs within the Lamu WHS, have established the Lamu Old Town Cultural Heritage Committee in order to better address challenges facing the site. The committee has had its inauguration meeting with other series of meetings in which it has prepared an action plan that will address among others; development of Lamu Island structure plan and conservation master plan for the Lamu Old Town; undertaking of additional studies to better inform mitigation measures; and institute mechanism for supporting traditional cottage industries and local festivals

1. Response to the Decision of the World Heritage Committee

The World Heritage Committee,

1. Having examined Document WHC/18/42.COM/7B.Add,

2. Recalling Decisions **39 COM 7B.40**, **40 COM 7B.12** and **41 COM 7B.69**, adopted at its 39th (Bonn, 2015), 40th (Istanbul/UNESCO, 2016) and 41st (Krakow, 2017) sessions respectively,

3. Noting the recommendations of the Advisory mission carried out to Nairobi, Kenya from 24 to 26 January 2018,

4. Notes the efforts of the State Party to respond to the decision of the Committee with regards to the Lamu Port−South Sudan−Ethiopia Transport (LAPSSET) Corridor project;

5. Reiterates its concern that the scope of the LAPSSET project may continue to have significant impacts on the Outstanding Universal Value (OUV) of the property;

6. **Requests the State Party to revise the draft Strategic Environmental Assessment (SEA) of the entire LAPSSET project to include a chapter on the impacts and proposed mitigation measures for cultural and natural heritage, and specifically the impacts on the OUV of Lamu Old Town;**

Petition 22 of 2012 filed at the high court of Kenya determined that; the process of Strategic Environmental Assessment SEA was a required legal step prior to embarking on the Environmental and Social Impact Assessment (ESIA) process or implementation of any of the individual components of the LAPPSET project. This is by virtue of regulation 42 of the environmental assessment (Impact Assessment and Audit) regulation 2003, as well as the magnitude of the LAPPSET project, and the significant environmental and cumulative impacts of the project.

In order to remedy this procedural infirmities and inadequacies in the ESIA and SEA processes, the court directed that NEMA satisfy itself that the final SEA report adequately considers all the guidelines given in the disposition while reconsidering the EIA license when assessing each individual component of the LAPPSET project and its associated infrastructure.

The consultant for LAPPSET SEA has since initiated stakeholder engagements in order to adequately address all concerns from all interested parties in order to fill the gaps alluded in the petition. The NMK has officially presented the consultant with the copy of the HIA.

7. **<u>Also requests</u> the State Party to submit to the World Heritage Centre drafts of the revised Master Plan for the Lamu Metropolis, the EU transportation infrastructure plan, the LAPSSET Planning and Investment Framework, and the revised chapter on LAPSSET of the Management Plan for the property, for review by the Advisory Bodies as soon as they are completed and before they are approved;**

The state party has forwarded the above requested document to the advisory bodies for review. Copies of the documents are also hereby appended.

8. **<u>Takes note</u> of the commitment of the State Party not to allow LAPSSET developments on the islands of the Lamu Archipelago, but <u>considering</u> that there could be a spillover effect from other development related to LAPSSET, <u>further requests</u> the State Party to:**

   1. **Develop necessary planning measures and development controls (including restrictions on height, building materials, land use and use of HIAs) to ensure that any spillover developments in the setting of the property do not have a negative impact on its OUV,**

The LAPPSET Authority in collaboration with the County government t of Lamu and the NMK established the Lamu Old Town Cultural Heritage Committee on the 15th August, 2018 to address concerns raised by both petition 22 of 2012 and the World Heritage Committee. The committee has drafted an action plan to address the concerns raised in order to ensure that the perceived negative impacts on the sites OUV are mitigated. The action plan has been appended. One of the key actions of the intervention plan is the development of the lamu islands structure plan and Lamu old town conservation master plan.

   2. **As a matter of urgency, and as requested in a number of previous Committee decisions, submit a proposal for a Minor Boundary Modification to the World Heritage Centre which sets out the extent of a revised buffer zone around the property including at a minimum all of Lamu Island, the parts of Manda Island visible from the property, and the larger mangrove areas,**

The draft amended boundary plan has been prepared and presented to the world heritage committee for comments. The national authorities have initiated discussion with CGL for the review of these boundaries and formal approval y the county assembly. It is hoped that the county assembly will approve the boundaries alongside her deliberations of the Lamu island structure plan.

3. Carry out additional studies to ascertain any effects that the pollution resulting from the coal-fired power plant may have on the fragile coral stone buildings of the Old Town and any other impacts on other attributes that carry the OUV of the property;

The action plan developed by the Lamu Old Town Heritage Conservation Committee denotes the undertaking of additional studies on the fragile coral of Lamu, detailed mapping of tangible sites and monuments in the Lamu archipelago, carrying out exhaustive ICH and studies on the fragile marine of coastal environment. In addition the report proposes for consolidation of existing research reports and data to further inform proposed mitigation measures.

The action plan also denotes modeling studies to enable the proponent of the coal plant and authorities understand better how the operations of coal fired power plant may affect the environment.

9. <u>Requests furthermore</u> the State Party to complete the Memorandum of Understanding (MoU) between the LAPSSET Corridor Development Authority and the National Museums of Kenya (NMK) to include the NMK on the LAPSSET Board, as mentioned during the 2015 mission;

A draft LAPPSET-NMK MOU has been completed and is currently under review by legal department of NMK and LAPSSET authority before it be signed.

10. <u>Recommends</u> that the State Party set up a significant funding mechanism to deal with conservation issues, including training in traditional building technologies and the use of traditional building materials, within the Lamu Old Town World Heritage property as the LAPSSET project continues to develop;

The Lamu Old Town Heritage Committee has as one of its agendas setting up of support mechanism for traditional cottage industries and support for the cultural festivals. The plan seeks to train 5 individuals in each of 5 identified craft industries for the next 5 years

11. <u>Requests moreover</u> the State Party to invite a joint World Heritage Centre/ICOMOS/ICCROM Reactive Monitoring mission to the property, once the necessary security clearance has been obtained, in order to examine the state of advancement of the LAPSSET project as well as the state of conservation of the property, and to hold discussions with local stakeholder groups;

By December 2018, the tentative dates for Reactive Monitoring Mission to Lamu had been agreed between the State Party of Kenya and the UNESCO World Heritage Centre but the mission was postponed due to the UNDSS security advisory which the WHC duly communicated to the State Party. Thus, the invite was not effected as had been expected.

12. <u>Finally requests</u> the State Party to submit to the World Heritage Centre, by 1 February 2019, an updated report on the state of conservation of the property and the implementation of the above, for examination by the World Heritage Committee at its 43rd session in 2019.

Signature of the Authority

Mr. David Mbuthia

For: Director Antiquities Sites and Monuments

National Museums of Kenya

FWC BENEFICIARIES 2013

LOT 2: Transport and Infrastructures

EuropeAid/132633/C/SER/multi

CONSULTATION SERVICES FOR THE DEVELOPMENT OF AN INTEGRATED TRANSPORT INFRASTRUCTURE MASTER PLAN FOR LAPSSET PROJECT COMPONENTS LOCATED IN LAMU COUNTY, KENYA

Contract No. 2017/384946

Integrated Transport Infrastructure Master Plan

13/12/2017

Experts' Team:

Aristeidis Karlaftis – Team leader

Jacques Phedonos – Urban planner

Vantaram Ravi Shankar - Environmentalist

Dimitris Kostianis – Port & Railway Operations Specialist

Financed by:

Prepared by:

EUROPEAN COMMISSION

FWC BENEF 2013 - Multiple Framework contract to recruit short-term services in the exclusive interest of third countries benefiting from European Union external aid

Ref.: EuropeAid/132633/C/SER/Multi

Lot 2: Transport and Infrastructures

Specific Contract no. 2017/384946

Consultation Services for the Development of an Integrated Transport Infrastructure Master Plan for Lapsset Project Components Located in Lamu County, Kenya

Integrated Transport Infrastructure Master Plan

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DOCUMENT RELEASE INFORMATION

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Amendments

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Document Prepared by:

EXPERTS

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ABBREVIATIONS

ADT	Average Daily Traffic
BRT	Bus Rapid Transit
CBD	Central Business District
CP	Commercial Port
CSP	County Spatial Plan
DBL	Dedicated Bus Lane
DU	Dwelling Unit
ESIA	Environmental & Social Impact Assessment
EDZ	Environmental Development Zones
EU	European Union
FAOSTAT	United Nations Food and Agriculture Organization
IP	Industrial Port
JMB	Joint Military Base, or Military Base
KENHA	Kenya National Highways Authority
KAA	Kenya Airports Authority
KMA	Kenya Maritime Authority
KPA	Kenya Ports Authority
KRC	Kenya Railways Corporation
KPC	Kenya Pipeline Corporation
KURA	Kenya Urban Roads Authority
LAPSSET	Lamu Port South Sudan Ethiopia Transport Corridor
LCDA	LaPSSET Corridor Development Authority
LPC	Lamu Port City
LRT	Light Rail Transit
MRT	Mass Rapid Transit
NMT	Non-Motorised Transport
RoW	Right-of-Way
RFT	Railway Freight Terminal
SEA	Strategic Environmental Assessment
SEZ	Special Economic Zone
SUMP	Sustainable Urban Mobility Plan

EXECUTIVE SUMMARY

Port Planning

From a strategic perspective Lamu Port is rightly expected to be the focal point and the major transport business generator of the LAPSSET Corridor, with great potential to serve national and regional economic interests. Its future success is therefore tightly related to the LAPSSET Corridor's road, rail and oil components' growth. Furthermore, its mission should be to become a gateway link to the Northern / North-Eastern Kenya, and to the East African Region contributing to the decongestion of the Mombasa port. However, the high environmental / cultural sensitivity of the Lamu coastline call for serious attention.

The expected annual freight demand forecast for the revised time period 2020-2040 lies at the 24.8 mil tons maximum level for year 2040, with emphasis on containers, general cargo / break bulk, and agri-bulk. This forecast however needs to be carefully revised taking into consideration important external environment developments in Kenya and East African Region within the last six years.

From a zoning perspective the port will most probably have to break into two sections (the Commercial Port in the south and the Industrial Port in the north) as it is anticipated that the Joint Military Base will finally remain in its current position. This event would succeed a basic disaggregation between "dirty" and "dangerous" industrial cargo activities from cleaner and less dangerous commercial cargo activities. Provisions for separation of "clean" from "dirty" cargo are also taken within the Commercial Port zone.

The development of the Commercial Port activities is expected to be gradual but faster than this of the Industrial Port. By 2040 the Commercial port is expected to be fully developed with 16 berths and a total berth length of 4,920m. The Industrial Port is expected to grow faster within the 2030-2040 period having a zone of 8 public use berths with a total berth length of 2,410m. Some more user dedicated berths could be developed by big industrial users in the northern zone of the Industrial Port, most probably beyond the 2040 horizon.

Since there is plenty of spare storage capacity within both port sections, the capacity limiting factor is the quayside capacity. Overall capacity of both port sections reaches 38 mil tons in 2040, excluding zone 2 of the Industrial Port, and this implies a 65% port capacity utilization factor.

Regarding port hinterland interconnection, both port sections are expected to be connected to the road and rail corridors independently and efficiently. A central Rail Freight Terminal is foreseen to serve both port sections and it has been relocated to the north side of SEZ for operational efficiency purposes. Rail terminals within the port are to serve all cargo type berths. However, their exact intermodal configuration is to be determined at a later development phase of port and rail operations. The buildings and utilities foreseen by the JPC study are expected to cover adequately the needs of both ports.

A revised capital investment cost estimate of 3.6 billion USD will be roughly required for the above described infrastructure development. Its large magnitude brings up clearly the need for private funding and with it the importance of the development of an enabling environment in Kenya, to be conducive to public-private partnerships.

Finally, given the above there is a strong need for

- Freight forecast update considering this time the additional port activities proposed;
- Development of the full master plan of Lamu Port;
- KPA to assume effectively its role as implementing agency by upgrading its capacity and by developing effective interphases with LCDA;
- LCDA to assume effectively its role as LAPSSET Corridor implementation coordinator, by upgrading its capacity and by developing effective interphases with KPA and the other relevant implementing agencies.

Transport Planning

Across the County, all roads are unpaved and in a deplorable state which makes travel time increase by 300% compared to the normal time it would take to reach a destination. The main road from Mokowe to Witu is in a poor condition and often floods; large potholes rendering the road impassable by use of small vehicles.

Despite the very bad existing condition of the roads, two major road construction projects have been initiated: the A10 Lamu – Garissa – Isiolo highway and A7 Lamu – Witu – Garsen highway.

These two main roads will also form in the future the main transport axis to interconnect the various LAPSSET components to each other as well as the rest of Kenya and other East African countries.

Proposals for better interconnection of the two main highways are provided in the report. The A10 highway is to be joined by 2 service roads on each side that will distribute the traffic originating or ending at the LPC or the port/SEZ zone to their respective destinations. This way the through or transit traffic on A10 will not be mixed with urban traffic or traffic entering/exiting the port/SEZ zone. In order to achieve this traffic management, 4-leg through intersections and 3-leg (T type) junctions are identified and proposed.

Furthermore, a functional and design prioritisation of the urban road network is proposed. This prioritisation includes urban motorways, urban arterials (including BRT and NMT facilities) and urban collectors. The design characteristic, the corridor width, the Right-of-Way and the allowable traffic volumes for these roads are analysed in detail and presented in the transport planning chapter. The functional specification and further details on the effect and development of the urban roads is analysed and proposed in the Urban Planning section.

The port/SEZ zone traffic management is presented next. A classification of the road network is presented, including Primary Distributor, Secondary Distributor and Site Access Roads. Primary distributors form the backbone of the road network with the SEZ area and connect it to the main transport corridor, which in this case will be A10 (through the east service road) and A7 (through the port access road). The secondary distributors are the connector roads between the primary distributors and the site access roads, that are used to provide access to the individual sites.

A detailed plan of the Non-Motorised Transport network is presented, along with detailed design characteristics. Pedestrian walkways in all their forms (pathways, sidewalks, etc) are analysed and their specifications are given, so that the correct width and layout is considered, both during the planning stage (allowance for correct Right-of-Way) as well as during the detailed design phase. The same characteristics are also provided for bicycle ways and proposals are given regarding the safe design of crossings and intersections.

An analysis of the role and modes of public transport is presented in the Transport Planning chapter. This analysis serves as a basis for further development of public transport network, that is presented in the Urban Planning chapter. The advantages and disadvantages of various public transport modes is presented and the most advantageous mode (the Bus Rapid Transit or BRT) is described in more depth. Design characteristics and specifications as well design guidelines are presented.

Although part of the public transport network, the water or marine transport is presented separately, due to its enhanced role in Lamu County. An initial water transport network is proposed, with jetties and connections nodes to both LAPSSET components as well as other Lamu County destinations. Design guidelines and drawings of modern jetties is provided together visual images and figures of passenger, cargo and vehicle carrying ferries in order to assist in the further development of the water transport in Lamu County.

The framework of the study is to develop the required transport links for the various LAPSSET components. However, is was decided that the LAPSSET project would also benefit from an enhanced network of roads, not necessarily serving the various components, but also serving other wards outside the LAPSSET influence. For this purpose, the County Spatial Plan is consulted, and several rural roads are proposed for upgrade, in order for the whole county of Lamu to benefit from the transport master plan.

On all the above components conceptual designs accompanied with typical technical standards and visual images of proposed practises are presented. A global layout plan of the proposed Integrated Transport Infrastructure Master Plan is also provided, to form as basis for the studies to follow.

Urban Planning

The starting point for the Urban planning tasks of the LAPSSET Transport Master Plan is the port area, its operations, transport requirements and future growth. These requirements determine the type, size and location of infrastructure and support activities.

Location affects operations and efficiency and vice versa. In addition, these operations require personnel, workers and their own support facilities and services. Earlier reports and Master Plans, in response to the port components of LAPSSET, have identified the need for an urban area of varying size and population that is an essential component for overall success.

Within the study, the urban area is known as Lamu Port City or LPC. The JPC study made some very general calculations about population and water consumption needed given the size and scope of the port area. Lamu County and the Atkins Investment plan have presented more specific proposals. The Atkins plan, in particular, considered the various components and defined a development boundary than encompasses three main areas: port side industrial zone development, an urban area for long-term residents and businesses and a leisure city and civic centre.

None of these three land-use ‘units, exist in any form or shape on the ground. They are intentions and require planning and careful consideration to align and harmonise their functions. Earlier studies defined a series of larger or smaller development blocks which the current study has called Environmental Development Zones (EDZs).

There are 75 EDzs in total and they were assigned an initial land use such as Low Density Residential, Leisure City, Heavy Industry etc. There are 15 general land uses in this instance.

Though much focus has been given to the proper functioning of the port area and related facilities, there has been much less devoted to the LPC side. The urban area is expected to house and offer meaningful existence to up to 1.2 million inhabitants.

A well-functioning urban area is crucial to the whole project since it is one of the perceived advantages of re-locating and living in LPC that most of the marketing will depend. There will be tax incentives and ‘leaner’ business regulations, but ultimately managers and senior staff must be convinced on a personal level of the merits of any location i.e. the quality of housing, residential areas, efficient transport corridors and access, friendly, clean public transport, safety and security for non-motorised transport with acceptable air and water quality.

Some port area functions have been re-located. The urban planning tasks have therefore re-assigned supporting land uses accordingly. Most of the distribution proposed by earlier studies has remained.

With changes in the basic infrastructure and the use of two major corridors based around the A10 and A7 the high-density zones were partly relocated to adjoin the corridors since the medium density uses were not appropriate.

The urban planning tasks focused in particular on the transport aspects of LPC. The major transport infrastructure components (port, rail, roads etc.) are dealt with separately. However, if LPC is to maintain its importance and serve both its residents and the port side industrial zone efficiently it needs at a very early stage a planned hierarchy of roads that can collect and distribute both motorized and non-motorised traffic efficiently and safely.

The urban planning component of the Master Plan specifies urban road policies that will ensure that there is (i) sufficient road space and (ii) that road designs and RoW's provide for inclusion of pedestrian, cycling and public transport from the design stage and not after construction. The earlier in the project cycle a proper assessment is made of the function of each road the greater will be the saving in scarce resources in the long run. The urban planning component therefore urges implementing agencies to be pro-active in this regard. The overall planning framework that is being recommended is known as "Sustainable Urban Mobility Planning".

This is a simple idea. It means that when planning transport in the broadest sense (i.e. mobility) consideration must first be given to non-motorised transport and public transport with private car transport requirements addressed last. Experience has shown that the reverse sequence is very difficult to undo without great cost. Ignoring the needs of non-motorised transport is both socially unfair and extremely costly in terms of air, noise quality and lives lost due to accidents since in Kenya at least up 40-50% of daily trips are undertaken on foot. This is expected to be the case for LPC as well.

Not all urban roads need to include pedestrian and cycling facilities. Neighbourhood level local streets ironically do not need them because in theory vehicles have been 'traffic calmed' sufficiently through traffic management measures. Typical cross section for the major arterials and distributors that require SUMP facilities are shown in the appropriate section. Implementing agencies can easily include all these facilities since the LPC area is still a greenfield site. All agencies must be committed to the task and must understand that early co-operation in planning the urban area will bring synergies.

The key to sustainability is also about the cost of urban development. Compact urban areas have lower costs in terms of provision of roads, utilities, services, schools, hospitals, urban transport and so on.

Therefore, the third major theme in the section is about phasing of development. The phasing discussed in earlier studies is very strategic in nature. Phasing is required in order to ensure that port side and urban side functions are in step and mutually supporting. The second major reason is that phasing when properly implemented ensures that development proceeds in a compact and efficient manner bearing in mind the high cost of providing infrastructure. So, there should be strictly implemented development control such that isolated developments and residential units and areas are developed in a contiguous manner with the boundary that defines each development phase. In that way the principles of efficiency and SUMP can be implemented at substantial saving in resources. A sprawling and isolated population also does not address the need for a sense of place (which is very strong in Lamu Town) as well as the security and safety which is valid irrespective of any current short-term issues in the area.

To this end the study recommends 5 development phases from 2020 to 2050 onwards. Each urban side phase is matched by an industrial side phase so that 'tranches' of land are released in a systematic and planned manner allowing a given number of inhabitants to establish themselves as well as businesses, government functions, local government, health and education. At the same the urban road hierarchy will gradually take shape as well as the local neighbourhood network within the EDZs so designated.

The industrial zone phase is quite large at first since these are the main revenue and wealth generating functions for the entire area. The city side phases are more evenly distributed though incremental additions to population are less and less as the area is fully developed. The phases and populations are based on certain density assumptions. These are within international norms but there is no reason why the density mix cannot be altered as long as overall carrying capacity is respected. That is low density can be increased slightly and high density decreased etc. The target population is about 1.2 million.

In order to ensure adequate and modern public transport the urban planning section also recommends some BRT routes that will connect the various of areas of the city, industry and leisure city. Again, these BRT lines will be phased and in-line with the residential and other phases. BRT operations use normal road carriageway facilities and are therefore easily extended linearly in parallel with the developing road network. There will naturally be other complementary stage bus services that will operate on other lines as well providing feeder services to the BRT line. It goes without saying that public transport must be highly regulated to ensure the public gets served properly. Too often the main concern is to ensure the financial success of the private operator – a policy that has failed in other large urban area such as Nairobi.

Overall the urban planning tasks have looked at past master plans and have refined and aligned land uses in accordance with port related infrastructure.

In parallel the needs of the planned urban have been identified to ensure that LPC and port-side activities are mutually supportive in the medium and long term.

Railway Planning

Rail operations in the LAPSSET Corridor and Lamu County in particular are tightly related to Lamu Port hinterland interconnection needs at a national and regional level. In this sense rail development in Lamu County mission should focus on getting the Lamu port to successfully become a gateway link to the Northern / North-Eastern Kenya, and to the East African Region. Rail infrastructure and operations in Lamu therefore should focus on the following three components:

- a Rail Freight Terminal (RFT);
- port side rail terminal facilities;
- rail links between RFT and port terminal facilities;

The corridor railway line is foreseen as single, diesel, standard gauge line to serve freight. Therefore, for interoperability purposes all three above components should be suitably aligned.

The JPC study (back in 2011) has analysed in depth port and rail operations and infrastructure needs across the whole LAPSSET Corridor, including Lamu region, and consequently we will be referring mainly here on necessary changes to this study's provisions in order to encounter recent external environment conditions.

The revised Lamu port layout has two main implications regarding ports' rail connectivity:

1. the RFT should be relocated to the north-western part of the SEZ, adjacent to the Corridor, with north – south orientation, as indicated in the figure below;
2. there are separate rail links for each of the two port sections as also clearly indicated, branching off from the relocated RFT;

Regarding railway freight capacity trains are expected to be carrying from / to the Lamu Port 7.4 million tons (54%) and 14.4 million tons (58%) in 2030 and 2040 respectively. Cargo focus will be mainly on containers (including refrigerated), general cargo / break bulk, dry bulk, and liquid bulk.

The Railway freight terminal is expected to have a transverse layout and include the following main facility components:

- arrival/departure tracks;
- sorting/storage/train make-up tracks;
- container yard and cargo storage facilities;
- maintenance workshop and depot for rolling stock (wagons and locomotives);
- maintenance workshop and depot for tracks;
- logistics services facilities (3PL etc).

Maximum permissible trains' operation speed: 120 km/h - approaching speed to turnout: 50 km/h - running speed on passing loop: 50 km/h. Regarding container handling in the RFT, a Reach Stacker System seems to be preferable considering KPA's needs. Forklifts are expected to be used for handling general cargo and dry bulk cargo.

Rail terminals within the port are to serve all cargo type berths. However, their exact intermodal configuration is to be determined at a later development phase of port and rail operations.

A revised capital investment cost of 78 million USD is roughly estimated for the RFT facility, allowing the following RFT components: loading/unloading track, through track, container loading/unloading platform and general/break bulk cargo platform.

Finally, in order for the rail infrastructure / operations issues to advance seriously to the implementation phase (starting off with the preliminary & detailed engineering design), certain major prerequisites have to be fulfilled.

1. Freight forecast market study must be carried out urgently to update forecasted traffic in the LAPSSET corridor;
2. The Master Plan of Lamu port is developed;

3. the overall development masterplan of the LAPSSET rail corridor kicks off seriously with:
- the KRC assuming effectively its role as implementing agency by upgrading its capacity and by developing effective interphases with LCDA;
- the LCDA assuming effectively its role as LAPSSET Corridor implementation coordinator, by upgrading its capacity and by developing effective interphases with the KRC and the other implementing agencies;

Environmental Planning

The LAPSSET Transport Corridor project envisages the various developmental activities which would lead to the economic impacts in the region. The connectivity to the region with other parts of Kenya, South Sudan and Ethiopia will improve and will give ample scope for new areas of development like the eco-tourism. Lamu Island which is a UNSECO heritage place will definitely attract more number of foreigners and will lead for the economic benefits to the local boat men community.

Shallow marine habitats found in Lamu-Kiunga seascape include coral reefs, seagrass and mangroves ecosystems that provide four ecosystem services of provision of natural resources, regulating, cultural and supporting services. Seagrass meadows provide numerous high value ecosystem services. They are vital habitat for marine organisms and form important foraging grounds for the endangered marine turtles and dugongs. Seagrass ecosystems are vital to the fishing industries as they serve as an important habitat and source of food to large fishing communities. The sea grass stabilizes bottom sediments with their dense roots and rhizomes especially during storms. Seagrass beds also represent enormous carbon sinks and are being considered in blue carbon schemes.

A range of environmental threats occur in the Lamu-Kiunga area. They include increasing population growth, high poverty levels, deforestation of mangroves, clay mining for pottery, unclear land ownership and insecurity that has decimated opportunities in tourism, overfishing due to an increasing population size and destructive fishing, unsustainable and illegal fishing particularly the use of beach seines and poaching of turtles

The LAPSSET Project will lead to some negative impacts. They are:

- Direct loss of natural assets in areas cleared for the construction of project components, including the proposed new port, roads, railway, airport, resort town, oil refinery, fishing port, and new urban and industrial areas.
- Direct loss of natural assets over a larger area due to the wider development that LAPSSET would attract new settlements due to the up comming industries and infrastructure.
- Indirect impacts due to increased pollution and extraction of water, food, fuel and raw materials by a much larger population, however, given the scale of the LAPSSET project, these impacts would be felt over large distances, including neighbouring counties and in offshore marine areas.

- Kiunga Marine National Reserve, the pristine ecosystem incorporates about 50 calcareous offshore islands and coral reefs and can view the sea life in the coral reefs, sea grass and extensive mangrove forests which are a refuge for sea turtles and dugongs. There may be indirect impact on this marine sanctuary.

The adverse impacts can be mitigated by timely implementation of the mitigation measures. Environmental mitigation is the process of addressing impacts to the environment caused by human action — notably those resulting of highway, railways, aviation, marine, industry, water, and other infrastructure projects. First, negative environmental impacts should be avoided, for instance by re-siting the project to a more suitable location. If relocation is not feasible, strong measures should be deployed to minimize harms. Finally, if environmental impacts are inevitable, there should be appropriate compensation. This notion is conceptually sound, but has been unevenly implemented.

An Environmental Social Management Plan (ESMP) to be developed to outline measures that are to be implemented in order to minimize adverse environmental impacts during the construction cycle of a project. It serves as a guide for the contractor and the workforce on their roles and responsibilities concerning environmental management at the construction site and it provides a basic framework on environmental social monitoring throughout the development period.

The ESMP document can be used throughout the project life cycle–commissioning, mobilization and construction, operation and maintenance and decommissioning. It is regularly updated to be aligned with the project progress from commissioning to mobilization to construction to operation to decommissioning. ESMP outline the environmental and social impacts and the mitigation measures. ESMP is a practical and achievable plan of management to ensure that any environmental social impacts during all the phases are minimized and lead in the direction of sustainable development.

The ESMP is most effectively developed when impacts are evaluated by detailed ESIA completed with supporting baseline studies for the project. Impact evaluation signifies the importance for the Mitigation measures suggested during the impact analysis or assessment. The residual impact estimated with execution of proposed mitigation measures is vital towards developing ESMP. This ESMP details the mitigation measures to prevent, reduce and were ever possible offset any significant adverse effects on the environment throughout the different phases of the project. ESMPs are therefore important tools for ensuring that the management actions arising from Environmental Social Impact Assessment (ESIA) processes are clearly defined and implemented through all phases of the project life-cycle.

To ensure smooth implementation of the LAPSSET Project, it should be made it a point to explain the local population regarding the project activities and the likely impacts can be explained to the local population. An awareness campaign regarding the mitigation measures which would be implemented in the project should be explained explicitly to the local population. Public Awareness Meeting will be conducted at regular intervals during the project cycle. The grievances on the social and environmental issues will be recorded from the affected population and will be sorted out with the help of the Local County Government. During construction stage, the local people can make their grievances to the Project proponent through their County Members by registering their grievances on the Grievance Form provided. Social and Environmental Staff of the Supervision Consultant and the Environmental Specialist of the contractor will conduct periodically visit to human settlements to collect Grievance Forms. The social and environmental staff in collaboration with the LCDA Environmentalist and local environmental officer of NEMA will work out solution for the grievances.

The environmental section concludes that the LAPSSET Project would generate substantial economic, social benefits to the local population, but leads for significant risks like irreversible damage to the ecosystem. The development will affect natural capital assets. The natural assets provide a large range of vital goods by boosting the national economy. Many of the assets are already in the declining trend due to the anthropogenic activities. The old culture should not be affected with the LAPSSET Project.

Training and capacity building will be vital for the respective departments which are to implement the project. All the executing departments should report to LCDA. The LCDA functions as an umbrella organisation and the other departments like the Kenya Highways, Kenya Port Authority, Kenya Railways, all the other exciting bodies will report environmental and social issues to the LCDA Officials. They in turn interact with the local County Official in sorting the issues.

An Environmental Social Impact Assessment study should be carried out for water supply, drainage, sold waste collection and disposal and power supply projects. The project documents should follow the Kenyan Environmental Legislation and the funding agency safeguard policy. By proper implementation of mitigation measures will safeguard the pristine environment.

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1 Introduction

This project was initiated from the Request for Service No. 2017/384946 and the ensuing Specific Terms of Reference. The Contract was given to Alanet and signed on 6/13/2017.

The kick-off meeting, that marked the beginning of the project, was held on June 14th.

1.1 Project Background

The Lamu Port Southern Sudan-Ethiopia Transport (LAPSSET) Corridor project is a transport and infrastructure project in Kenya that, when complete, will be the country's second transport corridor, Kenya's main regional transport corridor being the Mombasa Port and Mombasa – Uganda Transport Corridor.

The LAPSSET Corridor project (LCP) comprises of 7 main components:

I. **Lamu Port** at Manda Bay consisting of 32 deep sea berths;
II. **Interregional Standard Gauge Railway lines** from Lamu to Isiolo, Isiolo to Nakodok (Kenya/South Sudan border) and Juba (South Sudan), Isiolo to Moyale (Kenya/Ethiopia border) and Addis Ababa (Ethiopia), and Nairobi to Isiolo;
III. **Interregional Highways** from Lamu to Isiolo, Isiolo to Nakodok and Juba (South Sudan), Isiolo to Moyale and to Addis Ababa (Ethiopia), and Lamu to Garsen (Kenya);
IV. **Crude Oil Pipeline** from Lamu to Isiolo, Isiolo to Nakodok and Nakodok to Juba (South Sudan); Product Oil Pipeline from Lamu to Isiolo, Isiolo to Moyale (Kenya) and Moyale to Addis Ababa (Ethiopia);
V. **International Airports** at Lamu, Isiolo, and Lake Turkana;
VI. **Resort Cities** at Lamu, Isiolo and Lake Turkana;
VII. **Merchant Oil Refinery** at Lamu.

Being the origin point of the entire LAPSSET Corridor Project, several components of the project will be located in Lamu County. These project components are listed below and can be seen in the map that follows.

- The Lamu Port at Manda Bay;
- Lamu Special Economic Zone;
- Lamu International Airport;
- Manda Airport;
- Lamu Resort City and Metropolis;
- The Crude Oil Pipeline Terminal Facilities (Oil loading Jetty and Tank Farms);
- Amu Coal Power Plant.

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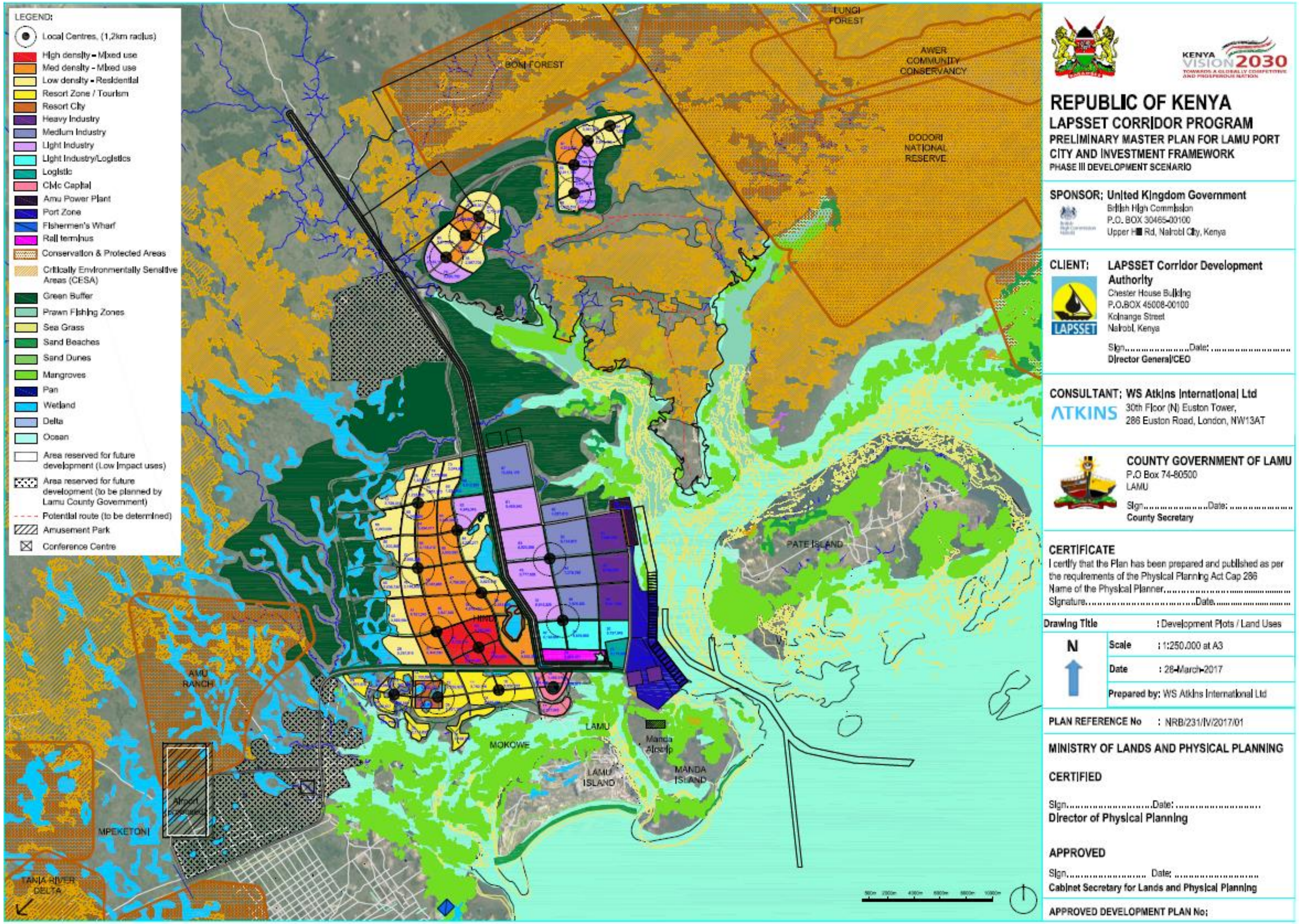


Figure 1: Existing Master Plan of Lamu county

1.2 Project organizational set-up

The core team responsible for managing the mission and the qualitative and technical support facilities is composed as follows:

- *Dr. KARLAFTIS Aristeidis*, the Team Leader (TL), is an expert with more than 20 years of work experience as Team Leader and senior expert in Transport Planning. He holds a Master's degree in Civil engineering and a PhD in infrastructure management. The experiences of Mr. Karlaftis covers roads, railways, ports and airports, as well as strategic transport planning projects, preparation of infrastructural development plans and preparation of Feasibility Studies for major road and rail infrastructure projects. He has vast experience as Team Leader in major transport infrastructure projects including highways, and railway lines connecting with port installations. Furthermore, he has contributed in major railway projects as operations and track design expert, in Europe, Asia and Sub-Saharan Africa. He also possesses good experiences in design and preparation of Tender documents, reports and Terms of Reference.

- Mr. J. Phedonos, is a senior expert specialised in Urban Planning. He has worked for more than 20 years as transport economist and qualified urban planner. He has an extensive experience in studying, analyzing and mitigating conflicts between transport infrastructure and land uses through urban planning. He has over 10 years of experience in the Sub-Saharan Africa, including in Kenya, a Country in which he has worked for many years. Mr. Phedonos has wide experience in urban and transport planning studies in similar sites to Lamu in Kenya and in Ghana. He could therefore bring to the project his insights on these tourism, cultural and transport infrastructure conflicts, in order to minimize the negative impact on Lamu Town and County during construction and more importantly during operations and to ensure sufficient economic and social choices to its inhabitants.

- Dr. Ravi Shankar Vantaram has more than 25 years of experience in the environmental field and actively engaged in a number of bilateral and multilateral funded developmental projects. He has ten publications to his credit and has had working experience in Asia Pacific and African region on different projects. Dr. Vantaram's experience ranges from transport sector, urban environmental studies, water resources management, natural resource management, occupational health and safety, and marine studies. In addition to the project execution, he was also responsible in preparing environmental documents like IEE, EIA and EMP and holding training programs and workshops in the field of Environmental Management and other related areas. He is well acquainted with the Safeguard Policy of most Bilateral and Multilateral funding agencies.

- Mr. Dimitris Kostianis is a senior international transport consultant specializing on transport policy / reform and port operations / management, with thirty years work track record and considerable senior management experience. During last decade he has led large-scale international transport and development aid projects / programs involving planning studies, policy development and implementation, transport sector reform, transport facilitation, infrastructure development (in cooperation with IFIs and donors), and port operations. For the last four and a half years he has been the advisor of the Saudi Ports Authority on seaports operations and infrastructure development. He has been graduated from the University of Birmingham (UK) as Mechanical Engineer and Economist (Bachelor of Science & Bachelor of Commerce, Double Honours Degree), and gained his Master's degree in "Monetary Economics, Banking & Finance" in the same university.

The proposed experts, have an excellent reputation for delivering high quality services in the Transport Sector and have implemented a large number of projects in relevant fields around the World, Europe and Africa in particular and together form a strong team that can deliver the project outputs.

ALANET will be in charge of the contractual and financial management of the contract. Therefore, ALANET will carry out all official communication with the Contracting Authority on contractual issues, supervising the overall implementation of the contract. ALANET will be responsible for the overall supervision of the quality and technical backstopping, will carefully monitor the efficiency, effectiveness and overall performance of the services rendered, will be responsible for the overall quality of the assignment and will carefully check the standards and contents of the different deliverables and the quality of the services delivered.

ALANET has appointed Mr. Samuele Masucci, a qualified Project Manager (PM), who will look after the proper project implementation and be the focal point of communication with the Contracting Authority and the Beneficiary. The PM will also be responsible for the logistical support, contractual and administrative arrangements for the mission and provision to the experts of any relevant documents needed for the smooth implementation of the mission.

1.3 Project description & activities

1.3.1 Objective of the project

According to the Terms of Reference (ToR), the global objective of the assignment is to support the LAPSSET Corridor Development Authority (LCDA) in implementing the LAPSSET project in a sustainable manner.

The specific objective of this project is to <u>develop an Integrated Transport Infrastructure Master Plan to *interlink the various Lamu project components*</u>. The consultancy will formulate a technically, economically feasible and socially/environmentally sustainable master plan that will ensure the transport infrastructure efficiently connects each of the project components while allowing for adequate expansion in future.

The study will develop a long-term transportation vision and overall transport network philosophy to support Lamu County's future allocation of population and employment growth. The study shall provide a baseline for long-range land-use planning, infrastructural development and infrastructure improvements. The study should also serve as a practical planning tool to assist the County Government in identifying, prioritizing, and implementing needed improvements to its transportation network in an efficient and effective manner.

The Consultants' proposals shall be based on transportation principles relating to safety, accessibility, mobility, affordability and the environment. Non-motorised transport modes (walking and cycling) shall be fully taken into consideration in the Consultant proposals as they are important modes for localized trips. The Consultant proposals shall aim at minimizing negative impact on the environment and minimizing greenhouse gas emissions.

1.3.2 Design approach & activities

In order to achieve the intended results, the Experts will work closely together with the following stakeholders: LAPSSET Corridor Development Authority, Lamu County Planning Engineers, Lamu County Authorities, as well as actors and agencies assigned with technical responsibility, such as KeNHA, KURA, KPA, KRC, etc.

The figure below describes the general methodology for the study.

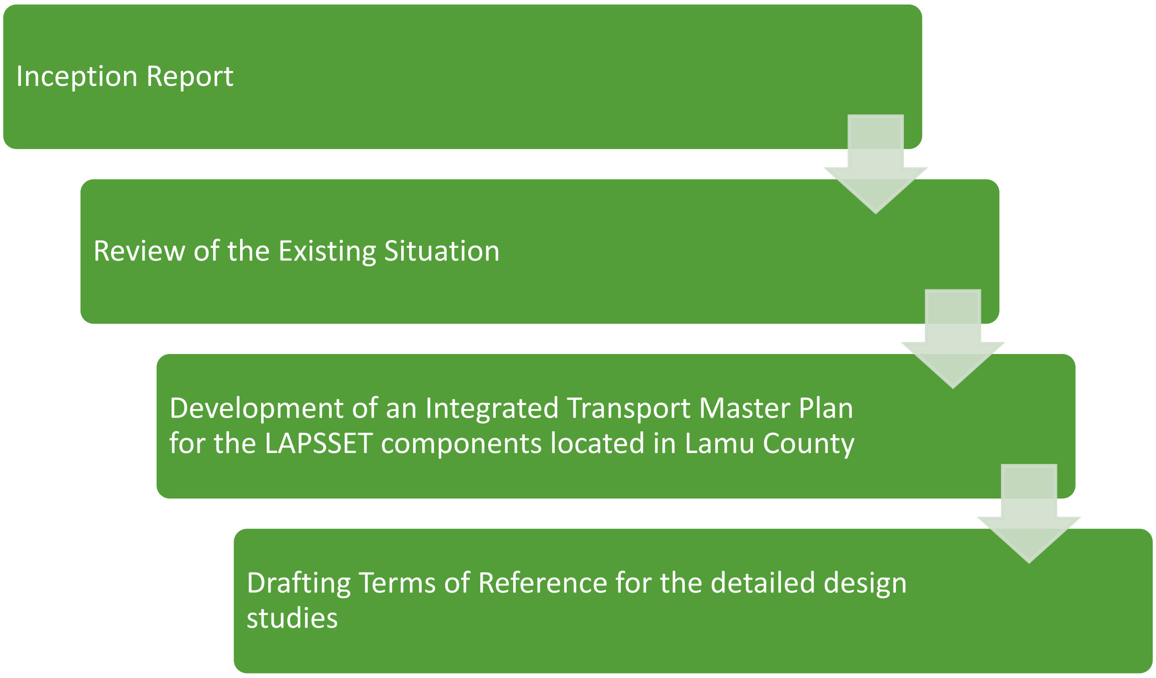


Figure 2: Schematic approach to the study

Activity 1 - Review of the existing situation

During this activity the Consultant will:

- Review the existing studies for the LAPSSET project components to understand how they intend to operate upon completion and how they would operate via the current transport networks. Such studies indicatively include:
  - Lamu Preliminary Master Plan by Howard Humphreys,
  - LAPSSET corridor feasibility study by JPC,
  - Detailed Road Designs (Lamu – Garisa and Lamu – Garsen),
  - Preliminary railway design by CCECC,
  - Detailed Port Design,
  - EIA studies for the above projects.
- Summarize the history of Lamu County physical master planning efforts as well as existing zoning policies, objectives and bylaws. Assess planned land development, highlighting any major constructions that are planned for in the immediate future and consider them in the new Transport master plan. These plans should include:
  - Lamu Partial Development Plan (PDP),
  - Draft Lamu Port Metropolitan Area Structure Plan,
  - Lamu County Spatial Plan (CSP)
- Liaise with the County Government of Lamu to review any existing transport plans and transport related projects and carry out interviews with key stakeholders. The objectives of the interviews will be to:
  - obtain up-to-date information on the project components, concerning the corresponding planning, costs and links with other projects;
  - review current issues in the preparation and the implementation of the project components;
  - identify any possible bottlenecks;
  - consider different alternatives for solving identified issues where applicable;
  - gather the aspirations of the stakeholders regarding Transport Infrastructures.

The scope of this task is to identify the following potential issues at stake, based on the information gathered:

- Changes that have occurred in the scope of the project and its main components;
- Changes that have occurred in the planning of the main project components;
- Bottlenecks in the preparation and the implementation of the main components of the Project;
- Remaining studies / designs to be undertaken for the realization of the main components of the Project.

Activity 2 – Development of an Integrated Transport Master Plan for the LAPSSET components located in Lamu County

During this activity, the Consultant will develop an integrated transport master plan for the LAPSSET Components located in Lamu County, that will include:

- Road networks interlinking the project components. The Consultant shall highlight priority road projects;
- Rail networks interlinking the project components. These should be strategically located to ensure expedited discharge of cargo from the port, and movement of goods between the port, the airports and the other components;
- Other public transport network interlinking the project components;
- Non-motorised transport facilities (cycling and walking) for the planned cities and resorts;
- Any other related transport facilities or civil infrastructure works deemed to be necessary to implement the plan.

The Consultant shall base his proposals on preliminary transport demand forecasts developed from existing and foreseen population allocation, land use, traffic volume and infrastructure and social services offer.

Finally, the Consultant will consider and evaluate existing environmental and social policies from a transportation perspective, in consultation with the National Environmental Management Authority (NEMA). Furthermore, the Consultant shall provide an assessment of short and long term environmental and social impacts of all transportation facilities proposed within the master plan and recommend possible alternatives to reduce any adverse impacts.

Activity 3 – Drafting Terms of Reference for the detailed design studies

The Consultant shall draft Terms of Reference documents for the detailed design studies to be conducted for the infrastructure proposed in the master plan.

As per the Terms of Reference, the exact list of Terms of Reference to be drafted by the Consultant will be communicated to the Consultant after agreement between LCDA team and the EU Delegation.

2 Missions and consultations conducted

As planned at the kick-off meeting, a series of meetings were held with the relevant project stakeholders; notes of these meetings are detailed in the two sections immediately following.

2.1 Kick-off Meeting

Date: 14th June 2017
Time: 09:30 am
Location: LCDA Offices, Chester House, Nairobi

Attendees:

1.	Silvester Kasuku,	DG/CEO LCDA	skasuku@lapsset.go.ke	20221.9098
2.	Kizito Ojaamong	EU	kizito.ojaamong@eeas.europa.eu	20 2802000
3.	Brian Obara	LCDA	bobara@lapsset.go.ke	0733.378834
4.	Raymond Ogalo	LCDA	rogalo@lapsset.go.ke	0711.963958
5.	Victor Odingo	LCDA	vodingo@lapsset.go.ke	0717.426220
6.	Bernard Oluoch	LCDA	boluoch@lapsset.go.ke	0725.380830
7.	John Musale	LCDA	jmusale@lapsset.go.ke	0722.317405
8.	Deborah Wangombe	LCDA	dwangombe@lapsset.go.ke	0721.617027
9.	Norman Murrage	LCDA	nmurraga@lapsset.go.ke	0702.477116
10.	Dr. Aristides Karlaftis	Team Leader	arkar@deialtd.com	0705.212082
11.	Jacques Phedonos	Urban Planner	jjph@spidernet.com.cy	0713.753045

More information on the kick-off meeting and its results is given in the official minutes submitted.

4.2 Other meetings

The Consultant in the process of the study had meetings with LCDA personnel to get more information on the existing progress of the works on the corridor and arrange the site visit in Lamu County. In addition to the close co-operation with LCDA, the LCDA team members also arranged the following meetings:

- On Monday 19/6, the Consultant met with the representative of the Howard Humphreys, design team, that undertook the Preliminary Lamu Master Plan. The progress of this study and the design concepts behind the existing master plan were discussed.
- On Tuesday 20/6, LCDA called all relevant Authorities involved in the development of the LAPSSET corridor in a meeting at its premises. The Authorities called included:
  - i. Kenya National Highways Authority,
  - ii. Kenya Urban Roads Authority,
  - iii. Kenya Rural Roads Authority,
  - iv. Ministry of Transport, Infrastructure, Housing & Urban Development,
  - v. Kenya Railways Corporation,

vi. Kenya Airports Authority,
vii. Kenya Ports Authority.

Unfortunately, despite the efforts and follow-up of LCDA officials, only a representative from KRC attended the meeting. Discussions ensued with KRC representative regarding the existing feasibility/preliminary design of the railway line that was conducted. It was understood that the railway component of LCDA is not a first priority of KRC at the moment, as the SGR project is consuming most resources.

2.2 Site Visit at LAPSSET corridor component sites

The mission to Lamu took place between Wednesday 21st June and Saturday 24th June with 2 team members from the Consultants team and 3 members from the LCDA team.

On Thursday 22nd of June the Consultants with LCDA representatives conducted a site visit at the Lamu Port construction work site, as well as a reconnaissance of the surrounding grounds that will host the various LAPSSET components in the future.

Photo 1: From the right are Jacques Phedonos (LCDA Consultant), Abdilatif Hussein (Architect/Program Assistant), PS (Ministry of Industry, Trade and Cooperatives) Eng. Mwangi Nduati, Brian Obara (LCDA's Program Officer), Aristeidis Karlaftis (Lead Consultant) and Raymond Ogalo (LCDA's Physical Planner)

Photo 2: Port construction works

Photo 3: Causeway leading to port construction work site for initial 3 berths

Photo 4: Perspective of the final phase of LAPSSET corridor

Photo 5: Location of planned Lamu resort city with study team

Photo 6: At Lamu county physical planners' office during site visit

During the mission in Lamu county, the Consultant also met the Lamu County Commissioner and the Assistant County Executive Committee member for planning, lands development, transport and infrastructure and had informative discussions about the local perception on the LAPSSET corridor.

Photo 7: Meetings held Chief Officer in charge of Physical Planning (left) and Assistant County Commissioner (right)

On Friday 23/6 a presentation of the existing urban planning efforts and studies for Lamu county took place, in the offices of KPA in Lamu old town. The county planning engineers gave a detailed presentation of the efforts undertaken by Lamu County regarding physical planning as well as zoning policies and objectives to be achieved by these plans.

Photo 8: On the Left LCDA Lead Consultant (Dr. Karlaftis) and on the right, Lamu County Physical Planner (Mr Osewe) doing presentations during Stakeholder Engagement Session

Another site visit took place on Friday 06/10 with the full Consultants' team and LCDA representatives.

This site visit gave the opportunity to the consultant to review the progress of the construction works and have meetings with KPA representative and the consultant for the supervision of the works for the three first berths.

Photo 9: On-going construction works for the first berth

Photo 10: KPA representative Mr. Mahmoud Ali explaining the port layout

Photo 11: Meeting with construction supervision representative

2.3 First Workshop

The first workshop took place on Monday 9th October at Mwana Arafa Hall in Lamu old town with impressive participation of over 80 attendants.

The meeting was opened by the County Governor and welcome remarks were extended by EU delegation representative Mr. Ojaamong and the DG/CEO of LCDA Mr. Silvester Kasuku who also made a brief presentation of the scope and progress of the LAPSSET corridor.

Photo 12: Welcoming remarks by Governor (left) and presentation from DG LAPSSSET (right)

Following this, the Consultants' team made a presentation of the review of existing situation and studies, with each consultant presenting his respective component.

Photo 13: Consultants presenting the report

At the end, the conclusions were presented, giving emphasis to the following aspects:

- Changes that have occurred in the scope of the project and its main components;
- Changes that have occurred in the planning of the main project components;
- Bottlenecks in the preparation and the implementation of the main components of the Project;

After the presentation from the Consultant, a plenary discussion session took place with increased participation from the audience.

Photo 14: Representatives from KAA and CURP speaking during plenary session

Kenya Airports Authority representative commented on the fact that KAA has no plan to implement the Mkunumbi airport (proposed by JPC), but has plans to further expand the Manda airport to cater for the expected traffic. This comment is in-line with the observations and proposals of the consultant.

Representatives Centre for Urban and Regional Planning (CURP) took the floor, further elaborating on the County Spatial Plan that was elaborated by CURP, emphasising on the environmental aspect that needs to be considered during urban planning and the necessity for community involvement. They further affirmed the consultants' observation for the need to revisit the demand forecast undertaken by JPC in 2011, so that more recent estimates can be considered.

During discussions with stakeholders, it became apparent that as the international petroleum field has changed dramatically since 2011, there is a need to revisit the 2011 demand forecasts to re-examine the feasibility for oil refineries and tank storage areas within the Lamu part of LAPSSET. This comment is further enhanced by newspaper articles and mentioning the various developments of other alternative pipeline routes, thus making the need for revisiting the 2011 demand forecasts even more pronounced, but also possibly negating the need for oil refineries and tank storage areas within the Lamu part of LAPSSET.

Furthermore, unofficial discussions with representative from the naval base confirmed that there are no immediate or mid-term plans for the relocation of the military naval base, situated in the Lamu port area.

Further comments made by participants regarding compensation for land taken, livestock holding areas, etc that are not relevant to this study, were addressed by the DG/CEO of LCDA.

List of participants is provided as Appendix to the report.

2.4 Second Workshop

The second workshop took place on Tuesday 5th December at Mwana Arafa Hall in Lamu old town with impressive participation of over 90 attendants.

The meeting was opened by the Assistant County Executive Committee member for planning, lands development, transport and infrastructure and welcome remarks were extended by EU delegation representative Mr. Walter Trenton and the representatives of LCDA Mr. Brian Obara who also made a brief presentation of the scope and progress of the LAPSSET corridor.

Photo 15: Welcome address by assistant CEC (left) and EUD representative (right)

Following this, the Consultants' team made a presentation of the review of existing situation and studies, with each expert presenting his respective component.

Photo 16: Master plan presentation from Consultants

At the end, the conclusions were presented, giving emphasis to the following aspects:

- Changes that have occurred in the planning of the main project components;
- Suggestions on bottlenecks and mitigation measures;
- Necessary studies and prioritisation of projects.

After the presentation from the Consultant, a plenary discussion session took place with increased participation from the audience.

Photo 17: Public participation during discussion session

After the presentation from the Consultant, a plenary discussion session took place with increased participation from the audience.

Kenya Maritime Authority (KMA) representative pointed out the necessity of monitoring standards and safety measures for maritime transport during port operation of the to be implemented. He also identified challenges regarding transport between islands, as well as the possibility to further dredge the Manda channel to provide accessibility to larger boats.

KenHA representative took the floor and informed on the progress of the road projects, including A7 where construction just started after delays due to the lack of security in the region and A10 where the commercial contract for PPP project was just signed.

Several participants raised concerns regarding water supply and wastewater treatment issues. Although the issues are of great importance, they fall out of the scope of this project.

The Assistant County Executive Committee member for planning, lands development, transport and infrastructure also identified the need for water transport facilities, however pointed-out that the main concern should be to keep the cultural heritage and that projects facilitating direct and enhanced access to Lamu and Manda islands (including dredging the Manda channel) should be planned very carefully to avoid destroying the cultural heritage.

2.5 Data Collection

The following data have already been collected by the Consultant, either through the meetings presented above or by freely accessible internet sites.

a. Digital Elevation Maps (DEM) of 1 arc second distance (ASTER and NASA),
b. SRTM DEM of 3 arc seconds,
c. JPC LAPSSET Corridor Feasibility study (2011),
d. Lamu Preliminary Master Plan by Howard Humfreys (2017),
e. Lamu Partial Development Plan (PDP),
f. Draft Lamu Port Metropolitan Area Structure Plan,
g. Lamu County Spatial Plan (CSP),
h. Feasibility/Preliminary design of the Railway line by CCECC (2015),
i. Amu Power Coal Plant ESIA Executive Summary (2016),
j. Draft Final LAPSSET SEA Report (2017),
k. KENYA ROAD NETWORK (NEW CLASSIFICATION – 2017),
l. LAPSSET Project Report (July 2016),
m. LAPSSET progress presentation (2017),
n. Lamu – Garisa Detailed Design (2016),
o. ESIA Study Report for LAMU PORT (2013),
p. LAPSSET Road Corridor Harmonisation Report (2016)
q. Amu Power plant designs regarding the port-side transport of coal, as initial information indicates the need for a conveyor belt of about 11km transecting the whole port, which raises serious environmental and operational concerns.

The following have been requested and are still pending.

a. Detailed design of major roads as part of the LAPSSET corridor (Lamu – Garsen) from KenHA – The report of the preliminary study conducted in 2008 was provided, without any drawings or further details. *The full detailed design studies are essential for the review of the existing studies that will be constructed and the preparation of the transport master plan*.
b. Detailed Design of the Lamu Port Berths 1-3, from KPA.

3 Port operations planning

3.1 Existing situation audit – issues and future development lines

3.1.1 Summary of existing situation

At this very early development stage of the corridor there were two main attempts dealing with the seaport's preliminary planning. The first attempt was made by JPC (see Figure 3 below), presenting back in 2011 the "LAPSSET Corridor and new Lamu Port feasibility study and master plans report", which may be considered as a prefeasibility study / preliminary master plan effort.

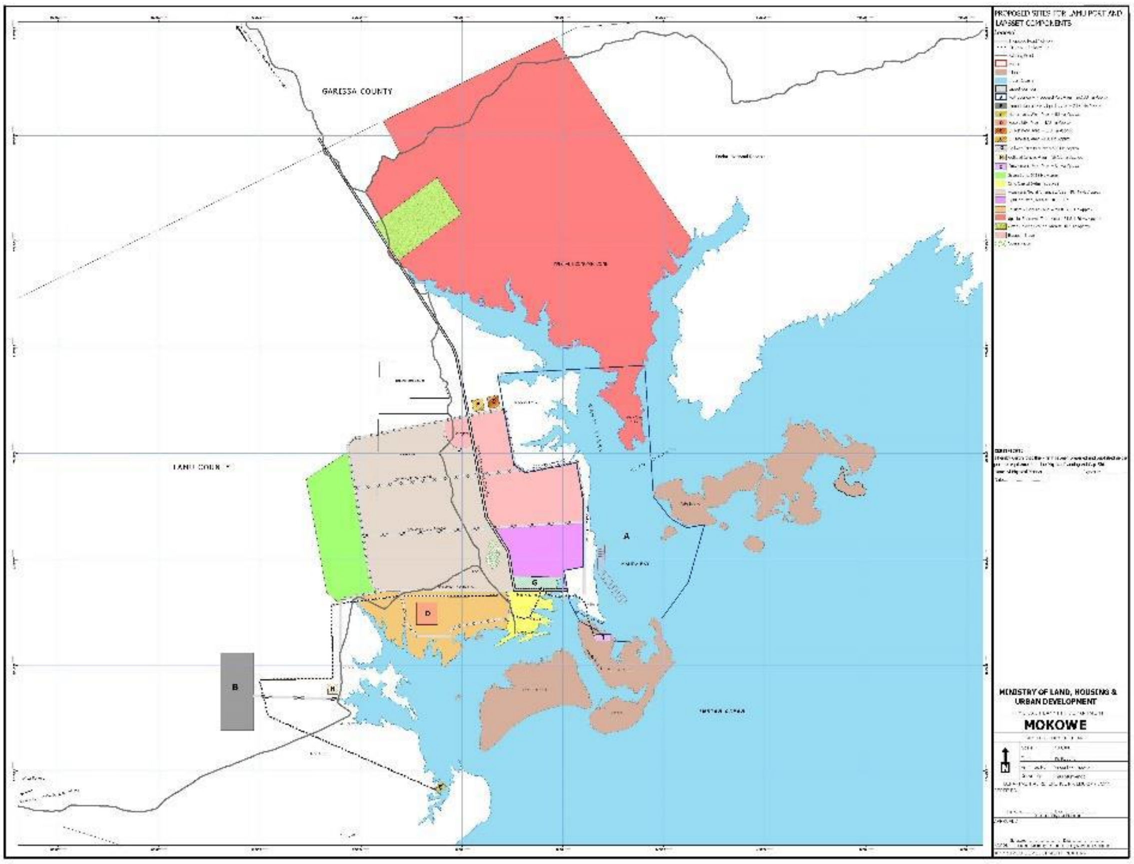


Figure 3: Port Development Plan for LAPSSET Project Components in Lamu – JPC 2011

The second attempt was made by ATKINS ACUITY, who they have delivered in 2017 (April) the "Preliminary Master Plan for Lamu Port City and Investment Framework", within which they have attempted a brief revision of JPC's port infrastructure development plan. Their proposal is depicted by Figure 4 below.

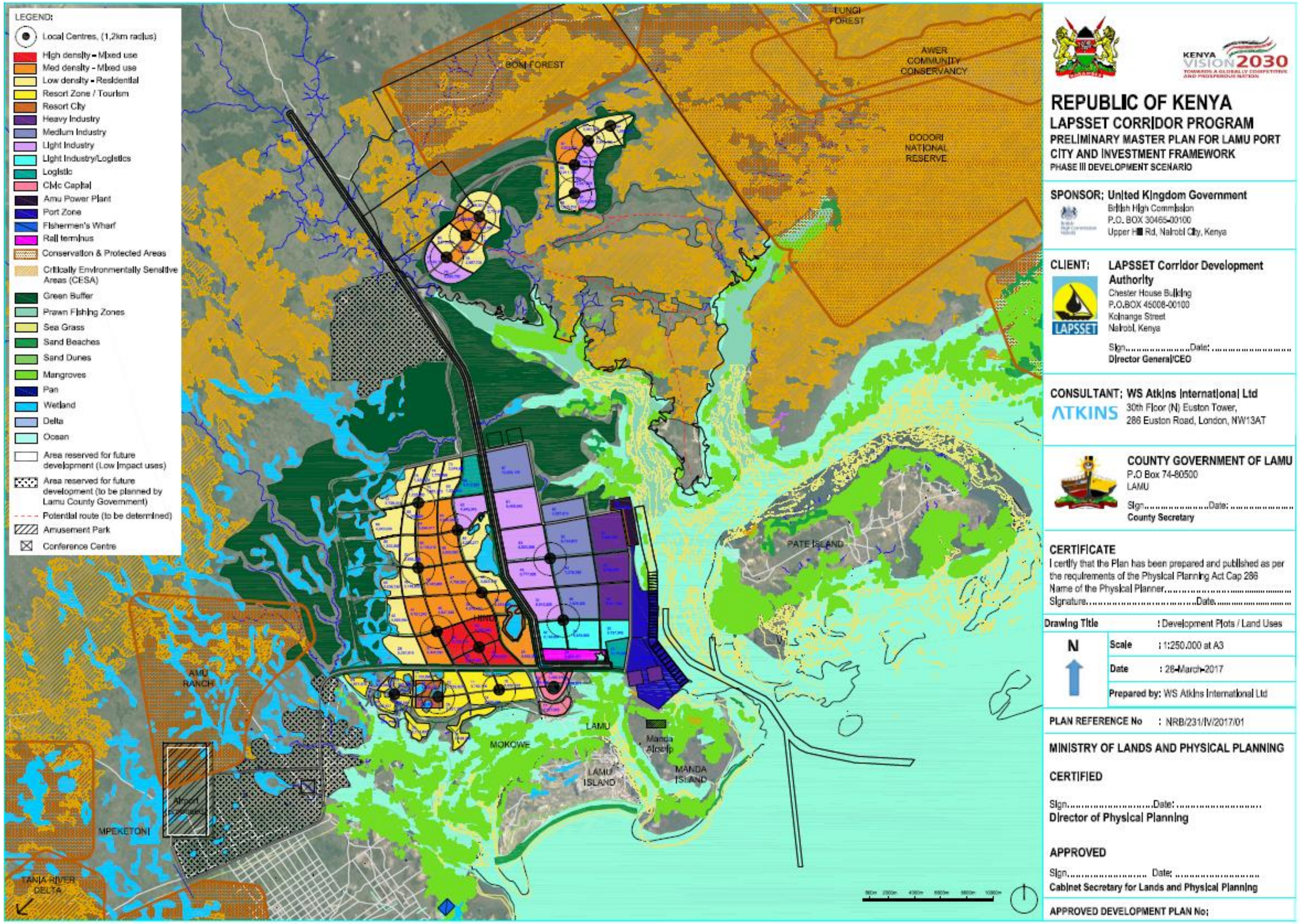


Figure 4: Existing Master Plan of Lamu county – ATKINS ACUITY 2017

The current situation on the ground has as follows:

1. The Chinese contractor CCCC has been engaged since 2015 in the construction of the following port-related infrastructure component:
    a. Three container berths each of 400m length and 17.5m draft;
    b. Access channel (two way) of 500m width and 17.5m draft;
    c. One turning basin with 800m diameter and 17.5m draft;

   The project is financed by the Government of Kenya - costing US $480 million. The first berth is planned to be ready by June 2018 and the other two by December 2020. Photos below provide a view of current work in progress.

Photo 18: Port construction works in progress

2. Supporting port infrastructure, such as port headquarters (LAPSSET plaza), police station, power connection to national grid and water network are completed (see photos below).
3. Construction of port housing for management and security is still ongoing.

Photo 19: LAPSSET Plaza & new police station

Regarding port access connections it is understood that

1. rail connection is for most of its major sections at an early conceptual development phase;
2. the initial road access link of the port (8km) does not exist;

The access road (approximately 8km long) is planned to link the Port of Lamu to the LAPSSET Corridor (A10) and to the road link A7 Lamu – Witu – Garsen (104 Km) which has been prioritised by the Government and construction works have reportedly commenced.

3.1.2 Identification of issues

A comparison between the port planning proposals of JPC and of ATKINS ACUITY identifies the following:

1. Time horizon has been shifted – A six years period has elapsed (2011 versus 2017) implying external and internal environment changes with potential impacts on freight demand forecasting figures and shifting of government priorities. However, the freight demand forecast has not been modified.
2. The boundaries of the port zone have not been modified. However, some new activities have been introduced. Specifically:
   a. The SEZ has been shifted from the Ras Kitwacha Nazi area to the port and industrial / logistics region.

b. Power plant (coal) and oil berths have been shifted to the western bank of the Manda Bay. In parallel the pipeline enters the port from a different direction.
c. An oil refinery with an oil products tank farm is foreseen in the southern side of the port, just at the back of the three berths (C1, C2, B1) currently under construction.
d. Oil berths are no longer provided, with the exception of a loading jetty within the southern part of the Port Industrial area (no indication of exact location).
e. Proposals for potential new activities are introduced without making any special provisions.

The following issues identified may form bottlenecks in the preparation and the implementation of the main components of the Project.

1. The Joint Military Base (JMB)

   JPC study expresses its concerns regarding the presence of the Joint Military Base in the middle of the proposed port development zone, while the Atkins Acuity study has no reference. The JMB is currently occupying a shoreline of around 4km, an area of 16Km2 (4kmX4km), and it effectively breaks up the proposed port land strip into two sections of around 3.5km either side, above and below the Base.

   Furthermore, it is estimated that:

   - In case the JMB is kept in its current position it would lead to a reduction of the potential number of berths by 16 and of the storage area by 40 Ha;
   - It will create serious difficulties, discontinuity and inefficiencies in port operations (splitting of the port operations into two separate sections);
   - It will generate significant investment needs for extra infrastructure needed (roads and rail lines) to deviate around it;
   - It will generate concerns for high rise structures and chimneys (see power plant chimney) to be constructed close by, due to fly zone safety requirements;

   JPC study has proposed alternative site locations for the JMB, however existing information says that the Base is very unlikely to be shifted away.

2. Refinery and tank farm of oil products

   An oil refinery with a neighboring oil products tank farm has been located in the south side of the port. This is considered having the following drawbacks:

   a. An oil refinery is a heavy industrial activity and should logically be located within the foreseen heavy industry zone (from an environmental perspective characterized as a “high pollution zone”) adjacent to the north side boundaries of the port.

b. The proposed position is too close to the container and bulk berths (1-2 km distance) of the port with high risk of obstructing port operations in these terminals through:
   - problematic rail access;
   - air pollution generation within a critical commercial port area whereby agricultural, fishing, cereals, and other food products are to be transported and stored (environmental concern by mixing commercial and industrial activities as mentioned in the "Port Development Policy" of the JPC study);
   - noise pollution (environmental concern);
   - safety concerns (dangerous goods);

3. Amu coal power plant

The option of allowing the Amu Power Plant in the specific port location is considered having the following drawbacks:

- It is estimated that an investment for a 11km coal conveyor system will be difficult to be proved financially feasible, due to high capital and maintenance costs.
- It is also believed that in case that the Joint Military Base is not relocated, it will be highly difficult to obtain permission for an elevated conveyor belt crossing through the entire length of the Base, mainly due to security concerns.

4. Port hinterland interconnections

The connection of the port with its hinterland is crucial for its fast and successful development. Given the fact that three port berths are under construction (the first berth is planned to be ready by June 2018 and the other two by December 2020), it becomes a short run priority that by mid-2018 the road connection of the port to the national road grid gets completed, particularly through the access road (8km), the A7 link Lamu – Witu – Garsen, and the A10 Lamu – Isiolo connection.

3.2 Planning and design conditions

3.2.1 Lamu Port vision and mission

The Lamu Port at Manda Bay is considered as one of the basic infrastructure components of the LAPSSET Corridor project (LCP), and as such it holds a key role in the process of development of an Integrated Transport Infrastructure Master Plan of the LAPSSET project components located in Lamu County.

3.2.1.1 Vision

Lamu port vision should therefore be to play a key role in the development of the LAPSSET Corridor and to support effectively the corridor's economic and social objectives.

3.2.1.2 Mission

Its mission is to become a gateway link to the Northern / North-Eastern Kenya, and to the East African Region contributing to the decongestion of the Mombasa port. Parallel focus should be serving a core transit cargo base from / to the landlocked countries of South Sudan and Ethiopia.

3.2.2 Main assumptions for current port masterplan

Taking into consideration the existing situation related to port planning issues, a new modified scenario was developed as the most suitable one to cover best current needs. This scenario gets analysed below.

3.2.2.1 New port development assumptions

Location

The location is maintained as the western coastline of Manda bay.

Joint Military Base (JMB)

The JMB is to be maintained in its current position since according to current estimates and for various reasons it will be quite difficult for the government to order its relocation. Therefore, a land strip of length of 4km (along the coastline), and of width 5km (from the newly dredged berth reference line) will be taken away from the port allocated land space.

As a result, surface area more than 16km2 will be allocated to the JMB, including almost the whole surface area of plot 35, which was foreseen by ATKINS for heavy industrial activities.

With the JMB finding itself in the middle of the plot allocated for port operations it becomes unavoidable that the port breaks into two sections:

- The northern part which is neighbouring the zone of heavy industrial activity, and;
- The southern part;

Zoning and port layout

A key consideration in planning the general arrangement of berths and terminals within a port is to group similar activities and functions in the same area. In practice this means creating different zones for accommodating similar ships, cargoes, and handling methodologies.

Taking into account the range of commodities to be hosted, cargoes such as Agri-bulk (cereals, sugar etc.) and palletized cargos are proposed to be grouped together in an area for ‘clean’ cargoes. Break bulk cargo such as iron, steel and timber, along with dirty bulk cargoes such as fertilizer, coal, and livestock are proposed to be grouped together in a separate zone for ‘dirty’ cargoes.

Furthermore, some new potential activities and cargoes as mentioned by ATKINS have been included in the future port activities (without though the scrutiny of a market and feasibility study).

The port of Lamu is therefore proposed having the following revised zoning.

1. The Industrial Port (north port) - assigned the task of serving the needs of the neighbouring zone of heavy industrial activity. One zone can be developed within the period 2030-2040 (when industrial development growth would be expected to pick up pace), and a second zone expected to be developed after 2040, focusing mainly on user dedicated needs.
2. The Commercial Port (south port) - assigned the task of serving the cleaner non-heavy industrial activities. Furthermore, the Commercial Port is proposed having a “Clean Cargo Zone” and a “Dirty Cargo Zone”. The “Dirty Cargo Zone” could in fact develop into a purpose cargo terminal.

The figure below outlines in schematic form the proposed zoning.

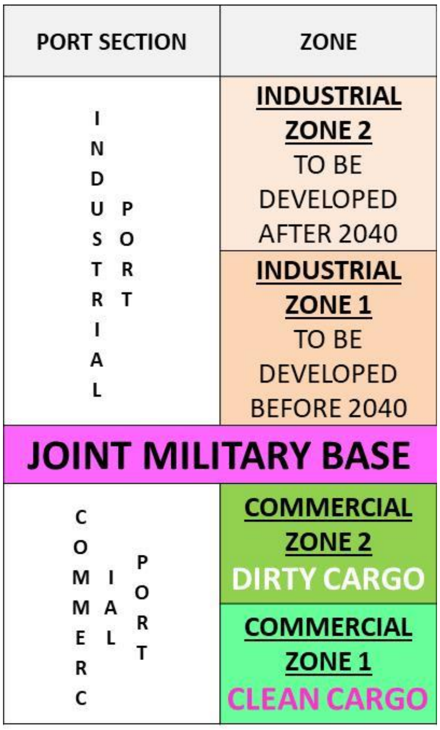


Figure 5: Lamu port zoning

Refinery, tank farm of oil products, coal power plant

The refinery, the tank farm of oil products, and the Amu coal power plant, are all considered as “dirty” and “dangerous” activities that should be restricted into the heavy industrial zone neighbouring the norther section of the port (now called “Industrial Port”).

<u>Construction phasing</u>

It is assumed that the Commercial Port will be given priority and it will be completed by year 2030 and can accommodate clean / light industrial activity. The heavy industrial activity is expected to develop more slowly and for this the Industrial Port is assumed to develop within the period 2030-2040.

3.2.2.2 Projected demand

Projected demand has been only slightly adjusted from levels forecasted by the study of JPC since the development of new forecasts was considered to lie outside the scope of the current assignment. Two adjustments were made.

Some new cargos were added to allow the inclusion of some new potential activities. These activities were mainly:

- Ro-Ro and Car Carriers (in order to accommodate vehicle and heavy equipment import and export);
- Deep fishing activity (in order to develop Lamu as a center of deep water fishing which will require a harbour to accommodate the fleet along with processing facilities);
- Ship-repair and offshore oil and gas servicing facilities;

The above activities have been estimated (with conservative estimates) to increase the overall annual cargo demand by 900,000 tons (from 23.9 mil to 24.8 mil tons).

In parallel, time horizon was suitably adjusted covering the period 2020-2030-2040.

Table 1 below presents the adjusted demand forecast per cargo type, per port section, and in total.

CARGO TYPES	COMMERCIAL PORT		INDUSTRIAL PORT		TOTAL	
	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)
Containers	7,978	8,506		5,671	7,978	14,177
Dry bulk	776	1,125		1,125	776	2,250
Agri bulk	1,827	2,432			1,827	2,432
Liquid Bulk	529	383		383	529	765
General Cargo / Break Bulk	2,370	2,096		2,096	2,370	4,192
Livestock	18	45			18	45
RO-RO / Car Carrier	200	400			200	400
Offshore oil and gas servicing facilities				400	-	400
Others	50	100			50	100
TOTAL	**13,748**	**15,087**	**-**	**9,674**	**13,748**	**24,761**

Table 1: Cargo Demand Forecast, 2020-2030-2040

3.2.2.3 Berthing Facility Plan

Lamu Port berth requirements plan was developed based on the following assumptions:

- the cargo demand forecast presented by JPC study has been slightly adjusted along the lines previously analysed;

- design vessels are maintained in line with JPC's proposals considered still valid;

No	Type of ship	Ship, Dimension (m)			Berth Dimension	
		L_{oa}/L_{pp}	Breadth	Draft	Length	Depth
1	Container Ship 100,000 DWT	350/335	42.8	14.7	400 m	16 m
2	General Cargo Ship 30,000 DWT	182/171	28.3	10.5	240 m	12 m
3	Bulk Cargo Ship 100,000 DWT	258/246	39.8	15.5	330 m	17.5 m
4	Product Oil Carrier 30,000 DWT	184/175	29.1	10.4	230 m	12 m
5	Coal Carrier 30,000 DWT	182/171	28.3	10.3	240 m	12 m
6	LNG Carrier 30,000 DWT	199/188	31.4	9.2	240 m	11m

Table 2: Design vessels

- the commercial port berths are fully developed by the end of 2030;
- the industrial port will be developed within the period 2030-2040;

Table 3 below provides full insight to used methodology plus qualitative and quantitative results regarding berth facility requirements.

Cargo Type	2030											2040										
	Estimated Cargo Volume		Handling capacity 1,000 ton/annum /berth	Berth requirements		Berths allocated to the Commercial port	Berts allocated to the Industrial port	Unit Berth Length (m)	Total Berth Length (m)	Berth length allocated to the Commercial port	Berth length allocated to the Industrial port	Estimated Cargo Volume		Handling capacity 1,000 ton/annum /berth	Berth requirements		Berths allocated to the Commercial port	Berts allocated to the Industrial port	Unit Berth Length (m)	Total Berth Length (m)	Berth length allocated to the Commercial port	Berth length allocated to the Industrial port
	1,000 ton	1,000 TEU										1,000 ton	1,000 TEU									
A. Dry Bulk (Total)	**2,603**		1,000	2.60 →	**3**	**3**	**0**		**990**	**990**		**4,682**		1,000	4.68 →	**4**	**3**	**1**		**1,320**	**990**	**330**
fertilizer	776		1,000	0.78 →	1	1		330	330	330		2,250		1,000	2.25 →	2	1	1	330	660	330	330
agri (cereals, sugar, tea, etc)	1,827		1,000	1.83 →	2	2		330	660	660		2,432		1,000	2.43 →	2	2		330	660	660	-
B. General and Break Bulk (Total)	**2,388**		440	5.43 →	**4**	**4**	**0**		**960**	**960**		**4,237**		440	9.63 →	**7**	**4**	**3**		**1,680**	**960**	**720**
Break Bulk from Up-countries & Monbasa	2,230		750	3.02 →	3	3		240	720	720		4,052		440	5.50 →	6	3	3	240	1,440	720	720
Material for Construction Breakbulk	140		440	0.32 →	0			240	0			140		440	0.32 →	0			240	-		
Livestock	18		440	0.04 →	1	1		240	240	240		45		440	0.10 →	1	1		240	240	240	
C. Liquid Bulk (Total)	**529**				**1**	**1**	**0**		**230**	**230**	**0**	**765**				**2**	**1**	**1**		**460**	**230**	**230**
petroleum³	unknown		over two million ton						-	-	-	unknown		over two million ton						-	-	-
edible	529		per berth per annum:		1	1		230	230	230		765		per berth per annum:		2	1	**1**	230	460	230	230
Refrigerated Cargo	**-64**			*	*							**-95**			*	*						
D. Container (Total)	**7,978**				**3**	**3**	**0**		**1,200**	**1,200**	**0**	**14,177**				**5**	**3**	**2**		**2,000**	**1,200**	**800**
As-container + Ref. Cargo	5,878											9,977										
Generated Container	2,100											4,200										
Container in TEU (Total)		823	300	2.74 →	3	3		400	1,200	1,200			1,491	300	4.97 →	5	3	2	400	2,000	1,200	800
Laden		570											1,013									
Empty		253											478									
E. New berth types provided	**250**				**5**	**5**	**0**		**1,540**	**1,540**	**0**	**900**				**6**	**5**	**1**		**1,870**	**1,540**	**330**
Fisheries	50				1	1		230	230	230		100				1	1		230	230	230	-
Ro-Ro & Car carrier vessels	200		500	0.40 →	1	1		250	250	250		400		500	0.80 →	1	1		250	250	250	-
Offshore oil and gas servicing facilities									0	0		400		440	0.9 →	1		1	330	330	-	330
Port vessels repair yard					1	1		350	350	350						1	1		350	350	350	-
Shipyard					1	1		310	310	310						1	1		310	310	310	-
Port vessel services					1	1		400	400	400						1	1		400	400	400	-
Total	**13,748**	**823**			**16**	**16**	**0**		**4,920**	**4,920**	**0**	**24,761**	**1,491**			**24**	**16**	**8**		**7,330**	**4,920**	**2,410**

Notes	
Material for Construction¹	The Lamu port functions as the supply base for corridor construction so long as the construction works continue in its hinterland. Cement, coase aggregates, railway rail, steel, mechanical equipment for all plants and building are the examples of commodity
Live Stock²	Two million head sheep export from Ethiopia and Sudan to the Persian Gulf countries using rail and the port before Eid al-Adha withiin 2~3months. The reason for this seasonal concentration is the sacarsity of live stock feeding capacity in the consignee countries concerning animal food, water, pen and man power
Petroleum refinery³	There exists no concensus in the Kenyan Government on the new oil refinery location based on the Sudanese crude oil.
Crude Oil Export Container Berth Capacity	Crude oil is excluded in this table but xxxx tons are to be exported through offshore single mooring buoy.
Container berths capacity	240,000 TEU/(annm*berth) for two SSG and 6 RTG per berth and 360,000TEU/(annm*berth) for three SSG and 9 RTG -> Average Capacity 300,000TEU

Table 3: Lamu Port berth requirements

The revised new port layout is then reflected in Figure 6 (map form) and Figure 7 (schematic form) below.

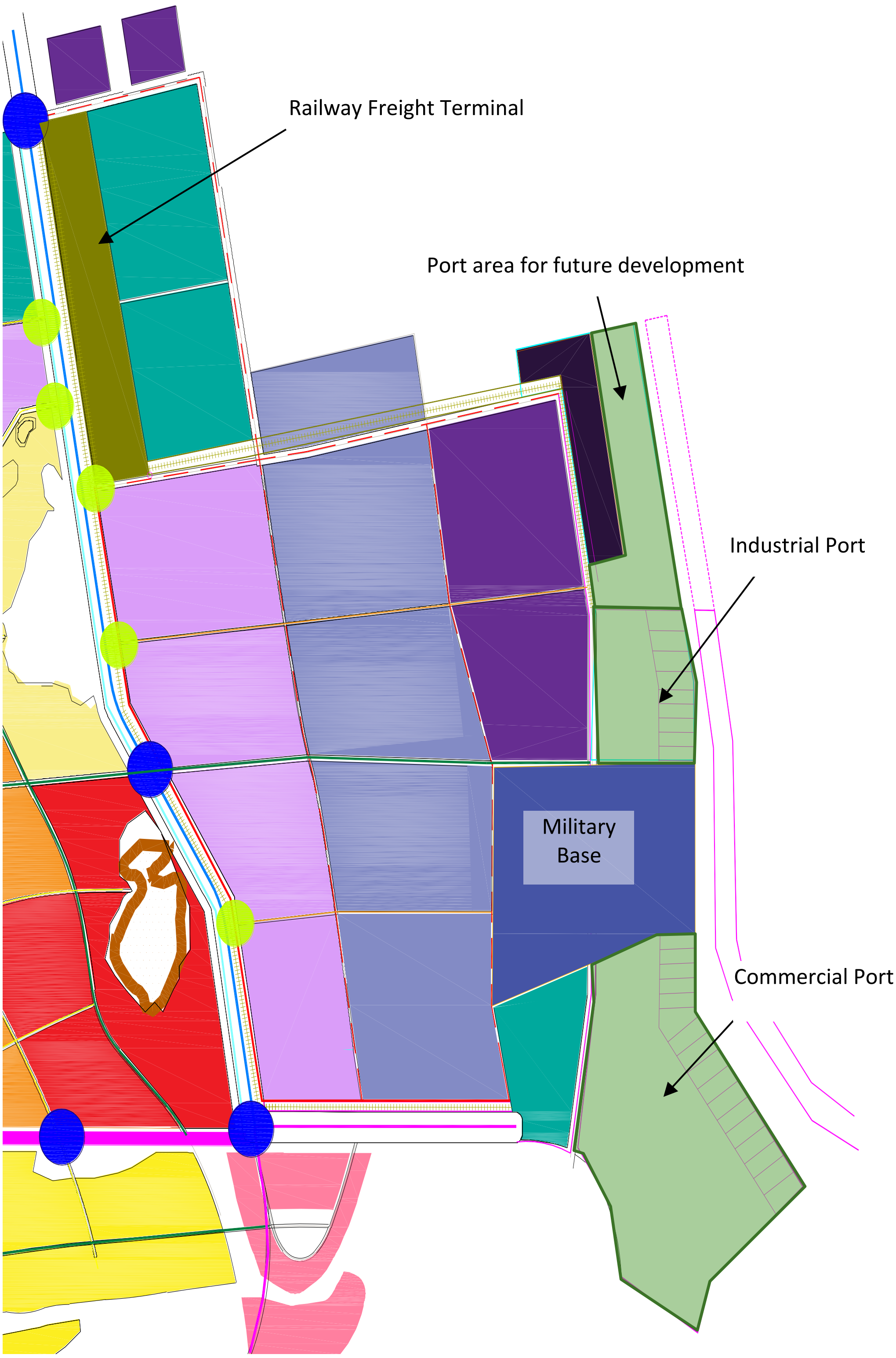


Figure 6: New port layout

PORT SECTION	ZONE	BERTH NO	BERTH TYPE	DRAFT (m)	LENGTH (m)
INDUSTRIAL PORT	**ZONE 2**		**TO BE DEVELOPED AFTER 2040 BY**		
	ZONE 1 - DEVELOPMENT BEFORE 2040	24	CONTAINERS	17.5	400
		23	CONTAINERS	17.5	400
		22	LIQUID BULK	15.0	230
		21	DRY BULK	15.0	330
		20	GENERAL & BREAK BULK	15.0	240
		19	GENERAL & BREAK BULK	15.0	240
		18	GENERAL & BREAK BULK	15.0	240
		17	OFF SHORE OIL & GAS SERVICING	15.0	330
JOINT MILITARY BASE					
COMMERCIAL PORT	ZONE 2 DIRTY CARGO	16	SHIPYARD	15.0	310
		15	LIVESTOCK	15.0	240
		14	GENERAL & BREAK BULK	15.0	240
		13	GENERAL & BREAK BULK	15.0	240
		12	DRY BULK (fertiliser, feedstock)	15.0	330
	ZONE 1 - CLEAN CARGO	11	RO-RO & CAR-CARRIERS	15.0	250
		10	GENERAL & BREAK BULK	15.0	240
		9	LIQUID BULK	15.0	230
		8	CONTAINERS (currently under construction)	17.5	400
		7	CONTAINERS (currently under construction)	17.5	400
		6	CONTAINERS (currently under construction)	17.5	400
		5	AGRIBULK	15.0	330
		4	AGRIBULK	15.0	330
		3	FISHERIES	10.0	230
		2	PORT VESSELS REPAIR YARD	10.0	350
		1	PORT VESSELS SERVICES	10.0	400

Figure 7: Port layout and berth allocation plan

3.2.2.4 Comparison of old and revised port layout

3.2.2.4.1 Capacity of the port layout presented by JPC study

The existing old study foresees 32 berths. Out of these 32 berths, 5 were allocated to containers, 4 to dry bulk, 1 to liquid bulk, and 22 to general bulk & break bulk.

However, in the berth requirement calculations (see table 4.1-11 of their study report) it is foreseen that the forecasted total port freight throughput demand of 23.9 mil tons is accommodated by the 20 berths (and not the full 32). More specifically only ten (10) general & break-bulk berths are foreseen to adequately caver the freight demand requirements instead of the 22 presented in the port layout (which is in fact 12 less). So, the total berth mix was developed as follows:

BERTH TYPES	No of berths	Total berth length (m)
Containers	5	2,000
Dry bulk	4	1,320
Agri bulk	-	-
Liquid Bulk	1	230
General Cargo & Break bulk	10	2,400
Livestock	-	-
Others	-	-
TOTAL	**20**	**5,950**

Table 4: Synopsis of JPC's port berth structure

It is being clear therefore that the 12 additional berths for general cargo & break bulk is a built-in surplus capacity over and above the forecasted need of 23.9 mil tons. Assuming that the extra 12 GC-BB berths have a capacity of 440,000 tons per year, the total capacity of the 32 berths comes to the level of 29.2m tons.

3.2.2.4.2 Capacity of revised port layout

The new layout foresees a total of twenty-four (24) berths split between the industrial and a commercial port as follows:

BERTH TYPES	INDUSTRIAL PORT		COMMERCIAL PORT		TOTAL	
	No of berths	Total berth length (m)	No of berths	Total berth length (m)	No of berths	Total berth length (m)
Containers	2	800	3	1,200	5	2,000
Dry bulk	1	330	1	330	2	660
Agri bulk	-	-	2	660	2	660
Liquid Bulk	1	230	1	230	2	460
General Cargo & Break Bulk	3	720	3	720	6	1,440
Livestock	-	-	1	240	1	240
Others	1	330	5	1,540	6	1,870
TOTAL	**8**	**2,410**	**16**	**4,920**	**24**	**7,330**

Table 5: Synopsis of the revised port berth structure

A total number of 24 berths with total berth length of 7,330m are provided. 8 berths of 2,140m length belong to the Industrial Port, and 16 berths of 4,920m length belong to the Commercial Port.

In case the oil pipeline is finally constructed, then a Single Point Mooring Berth (SPMB) could be additionally provided along the lines proposed by the JPC study.

The revised port layout provides a longer total berth length by 1,380m (7,330m compared to 5,950m). Its overall berth capacity is estimated to exceed the 25m tons (it goes up to the level of 38 mil tons) and therefore it covers adequately the demand needs of 2030 and 2040 in every cargo category (see details in Table 8 of the current report).

From a yard capacity perspective, the already applied norm (by JPC) of providing more than 650m of yard depth for each and every berth in conjunction with modern yard equipment (RTGs in the container yard), it allows more than adequate yard capacity in every cargo category, covering demand needs well beyond 2040.

3.3 Physical port development

When fully completed, the port will consist of two port sections,

- the Commercial Port (CP) - south section and;
- the Industrial Port (IP) - north section;

Both port sections will be able to operate either independently or jointly

3.3.1 Approach channel – Turning basins

The two-way approach channel will be 500m wide and 17.5m deep as initially foreseen by JPC study. However, due to the proposed change in the port layout, the length of the channel should be extended by a further 2,500m northwards from the northern boundaries of the JMB. This is expected to provide adequate length to serve all 8 berths of the Industrial Port.

One extra turning base will be needed for serving the IP, having 800m diameter and 17.5m draft (similar to the one serving the Commercial Port).

No breakwater will be needed due to the protected port location.

3.3.2 Berth and yard capacity

3.3.2.1 Berth and yard capacity of the Commercial Port

Berth, yard, and overall capacity of the Commercial Port have been recalculated and the produced results are presented in the following table.

	Containers	Dry bulk	Agri bulk	Liquid Bulk	General Cargo / Break Bulk	Livestock	RO-RO / Car Carrier	Offshore oil and gas servicing facilities	Others
A. Quayside Handling Capacity									
Number of Berths	3	1	2	1	3	1	1	1	3
Max. Berth Utilization	65%	35%	50%	35%	65%	35%	35%	35%	35%
Idle Time	15%	15%	15%	15%	15%	15%	15%	15%	15%
Handling Performance (t/h)	2,133	500	350	265	150	50	170	180	75
Quayside Handling Capacity (t p.a.)	**16,740,307**	**1,303,050**	**2,606,100**	**690,617**	**2,177,955**	**130,305**	**443,037**	**469,098**	**586,373**
B. Storage Capacity									
Gross Storage Area (sqm)	840,000	231,000	462,000	231,000	504,000	168,000	175,000	231,000	735,000
Factor Gross/Net	67%	67%	67%	67%	67%	67%	67%	67%	67%
Net Storage Area (sqm)	562,800	154,770	309,540	154,770	337,680	112,560	117,250	154,770	492,450
Days per year	365	365	365	365	365	365	365	365	365
Storage density (t/sqm)	2	3.75	3	3	3	0.08	3	3	3
Dwell Time (days)	6	10	10	10	15	0.5	10	10	10
Peak factor	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Storage Capacity (t p.a.)	**52,672,308**	**16,295,495**	**26,072,792**	**13,036,396**	**18,962,031**	**5,056,542**	**9,876,058**	**13,036,396**	**41,479,442**
C. Overall Capacity of Commercial Port (t p.a.)	**16,740,307**	**1,303,050**	**2,606,100**	**690,617**	**2,177,955**	**130,305**	**443,037**	**469,098**	**586,373**

Table 6: Capacity of the Commercial Port

General land use plan in the General Cargo, Container and Bulk Cargo- Breakbulk berths is maintained as indicated in Figure 4.1-34, Figure 4.1-35 and Figure 4.1-36 of the JPC study.

It is clear that there is plenty of spare storage capacity. Consequently, the capacity limiting factor is clearly the quayside capacity.

3.3.2.2 Berth and yard capacity of the Industrial Port

Berth, yard, and overall capacity of the Industrial Port have been recalculated and the produced results are presented in the following table.

	Containers	Dry bulk	Agri bulk	Liquid Bulk	General Cargo / Break Bulk	Livestock	RO-RO / Car Carrier	Offshore oil and gas servicing facilities	Others
A. Quayside Handling Capacity									
Number of Berths	2	1		1	3				1
Max. Berth Utilization	50%	35%		35%	65%				35%
Idle Time	15%	15%		15%	15%				15%
Handling Performance (t/h)	1,094	500		265	150				75
Quayside Handling Capacity (t p.a.)	**8,584,773**	**1,303,050**		**690,617**	**2,177,955**				**195,458**
B. Storage Capacity									
Gross Storage Area (sqm)	560,000	231,000		231,000	504,000				245,000
Factor Gross/Net	67%	67%		67%	67%				67%
Net Storage Area (sqm)	375,200	154,770		154,770	337,680				164,150
Storage density (t/sqm)	365	365		365	365				365
Dwell Time (days)	2	3.75		3	3				3
Peak factor	6	10		10	15				10
Storage Capacity (t p.a.)	1.3	1.3		1.3	1.3				1.3
Storage Capacity (t p.a.)	**35,114,872**	**16,295,495**		**13,036,396**	**18,962,031**				**13,826,481**
C. Overall Capacity of Industrial Port (t p.a.)	**8,584,773**	**1,303,050**		**690,617**	**2,177,955**				**195,458**

Table 7: Capacity of the Industrial Port

Once again, as there is plenty of spare storage capacity the capacity limiting factor is clearly the quayside capacity.

3.3.2.3 Overall port capacity

The overall port capacity and utilisation rate is presented in the following table.

	Containers	Dry bulk	Agri bulk	Liquid Bulk	General Cargo / Break Bulk	Livestock	RO-RO / Car Carrier	Offshore oil and gas servicing facilities	Others	**TOTAL**
Overall Capacity of Commercial + Industrial port (t p.a.)	25,325,079	2,606,100	2,606,100	1,381,233	4,355,910	130,305	443,037	469,098	781,830	**38,098,692**
Handling Volumes 2040 (t.p.a.)	14,177,000	2,250,000	2,432,000	765,000	4,007,000	45,000	400,000	400,000	285,000	**24,761,000**
Utilization 2040	56%	86%	93%	55%	92%	35%	90%	85%	36%	**65%**

Table 8: Overall port capacity and utilisation

Overall capacity of both port sections amounts to 38 mil tons in 2040, excluding zone 2 of the Industrial Port which will most probably be needed to be developed beyond year 2040. Cargo demand in 2040 is forecasted around the 24.8 mil tons level, which implies a 65% port capacity utilisation.

3.3.3 Road, rail hinterland access and gates

3.3.3.1 Introduction

Main transport connections of the port with its hinterland are foreseen in the form of:

- A10: Lamu–Garissa–Isiolo road link, providing national access to Lamu and distributing traffic to urban and port areas;
- A7: Lamu–Witu–Garsen road link, connecting the port, the urban area and the future airport;
- Railway line: Lamu–Isiolo rail link, connecting Lamu port and its industrial area to Kenya, Ethiopia and South Soudan;

Further analysis on

- Port access roads & port / SEZ road network
- Rail access of the port

is to be developed in the corresponding road and rail transport sections of the current report.

3.3.3.2 Port internal roads

3.3.3.2.1 Commercial Port internal roads

Within the Commercial Port the port road runs from the port gate to the berths and storage areas. At the stage of opening of the first berth, only 2 lanes should be constructed. This provision should however be expanded to 4 lanes as more berths are coming into the operation phase.

The port road runs from the port gate to the berths and storage areas. At the stage of opening of the first berth, only 2 lanes will be constructed. This will however be expanded to 4 lanes as more berths are opened.

Two main service roads are planned from the south to the north along both sides of the railway in port area comprising 4 lanes. Construction will be done concurrently with the construction of each berth.

3.3.3.2.2 Industrial Port internal roads

Proportional type of assumptions and arrangements are expected for the Industrial Port.

3.3.3.3 Gates

Traffic at the port gates has been calculated by making the following basic assumptions:

- The share of rail using cargo was kept unchanged reaching the level of 54% in 2030, and the level of 58% in year 2040;
- The port is assumed to work 5 days per week, 16 hours per day;

Table 9 below develops the accumulated traffic in the main gates of the Commercial and the Industrial Port separately.

It is subsequently deduced that the gates of the Commercial Port would need to be designed to accommodate maximum truck traffic of 92 trucks per hour. Assuming a dispatch time of 2 minutes per truck it comes down to a need for 8 lines at the main gates.

Correspondingly, the gates of the Industrial Port would need to be designed to accommodate maximum truck traffic of 58 trucks per hour. Assuming a dispatch time of 2 minutes per truck it comes down to a need for 4 lines at the main gates.

The traffic loads could be significantly reduced in case that the port management decides to operate the port on a basis of 7 days per week X 24 hours per day.

CARGO TYPE	COMMERCIAL PORT		INDUSTRIAL PORT	
A. CONTAINERS	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	7,978	8,506	-	5,671
Load Capacity / Truck tons	25	25	25	25
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	**52.8**	**51.4**	**0.0**	**34.3**
B. DRY BULK	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	776	1,125	-	1,125
Load Capacity / Truck tons	25	25	25	25
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	**5.1**	**6.8**	**0.0**	**6.8**
C. AGRIBULK	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	1,827	2,432	-	-
Load Capacity / Truck tons	25	25	25	25
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	**12.1**	**14.7**	**0.0**	**0.0**
D. LIQUID BULK	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	529	383	-	383
Load Capacity / Truck tons	30	30	30	30
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	**2.9**	**1.9**	**0.0**	**1.9**
E, GENERAL CARGO & BREAK BULK	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	2,370	2,096	-	2,096
Load Capacity / Truck tons	25	25	25	25
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	**15.7**	**12.7**	**0.0**	**12.7**
F. LIVESTOCK	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	18	45	-	-
Load Capacity / Truck tons	15	15	15	15
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	0.2	0.5	0.0	0.0
G. RO-RO & CAR CARRIERS	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	200	400	-	-
Load Capacity / Truck tons (2t X 8 vehicles)	16	16	16	16
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	**2.1**	**3.8**	**0.0**	**0.0**
H. OFFSHORE OIL AND GAS SERVICING FAC	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	-	-	-	400
Load Capacity / Truck tons	25	25	25	25
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	**0.0**	**0.0**	**0.0**	**2.4**
J. OTHERS	**2030**	**2040**	**2030**	**2040**
Rail % share	54%	58%	54%	58%
Annual demand (000 tons)	50	100	-	-
Load Capacity / Truck tons	25	25	25	25
Working Days per Week	5	5	5	5
Gate Working Hours / Day	16	16	16	16
Peak Factor	1.5	1.5	1.5	1.5
Trucks per Hour	**0.3**	**0.6**	**0.0**	**0.0**
	2030	**2040**	**2030**	**2040**
TOTAL TRUCKS AT GATES (TRUCKS / HOUR)	**91**	**92**	**0**	**58**

Table 9: Truck traffic at port main gates

3.3.3.4 Buildings and utilities

Buildings and utilities can be developed in both port sections along the main assumptions made by JPC study. However, it is strongly believed that further elaboration should be carried out within the scope of the actual port master plan itself.

In any case there is provision of plenty of land space to accommodate all necessary needs in both port sections.

3.4 Cost Estimate

A revised capital investment cost estimate was developed through allowing mainly for:

- an inflation cost adjustment factor of 10% for the seven years which has elapsed since 2011 when the base cost estimate was produced;
- consideration that the new quay length required is 6,130m, compared to the 5,960m accounted for then;
- the current work carried out by CCCC related to the three 400m berths currently in progress, including the construction of the main approach channel, the south channel (up to the commercial port berths) and the south turning base;

The summary table below indicates a revised capital investment cost estimate at the level of 3.6 mil USD.

Item Description Cost	Cost (in USD)	%
General Requirements	139,500,000	3.9%
Dredging	590,000,000	16.4%
Reclamation & Ground Improvement Works	170,500,000	4.7%
Quay Walls	637,050,000	17.7%
Roads & Paving	437,100,000	12.1%
Buildings + Utilities	520,800,000	14.4%
Mechanical & Electrical	158,100,000	4.4%
Equipment + service boats	558,000,000	15.5%
Provisional Items	66,030,000	1.8%
Sub-total	***3,277,080,000***	***90.9%***
Contingency (10% of Sub-total)	327,708,000	9.1%
TOTAL	**3,604,788,000**	**100.0%**

Table 10: Cost estimate summary

3.5 Time Plan

The development of a green field port like Lamu Port is expected to be demand driven with significant private sector participation in its funding. The public sector has already funded the construction of the first three berths and a basic port hinterland interconnection network, in order to provide a seed infrastructure base to facilitate future development.

Given the above it is strongly believed that a new market forecasting study is needed the soonest possible, along with a feasibility assessment of the various port activity options. These would facilitate and advance the maturity of the decision-making process regarding

- type of needed berths;
- time phasing of port development;
- funding;

From a time perspective it is currently believed that the Commercial section of the Port will most probably be developed first within the 2020-2030 period. The Industrial Port will most probably follow and will be developed within the 2030-2040 period.

On this understanding a tentative port development time plan would be the following:

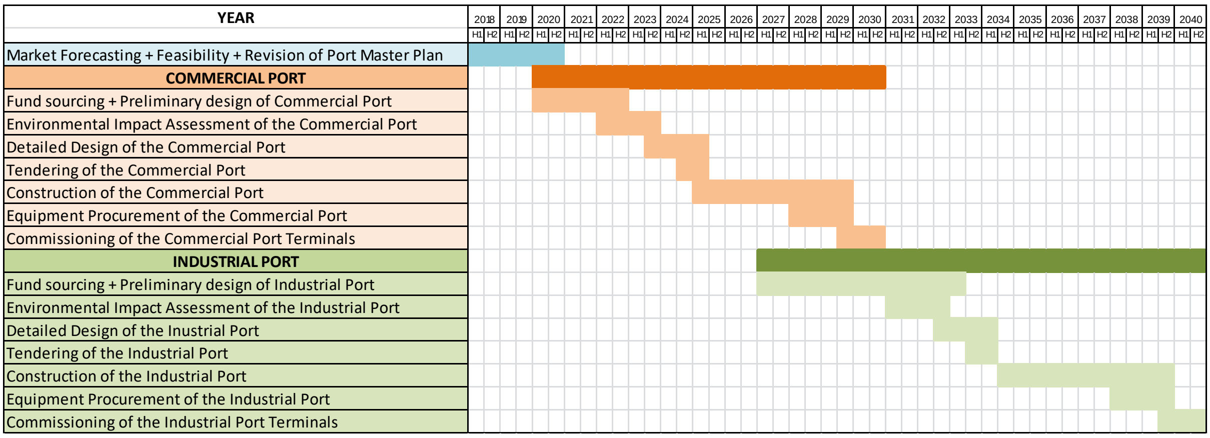


Table 11: Port development time plan

3.6 Conclusions & future development directions

- The selected port site seems to be a good strategic selection with great potential in serving national and regional economic interests;
- The port site seems also to be quite safe and well protected from high seas and extreme weather conditions;
- Financial and economic feasibility of the Lamu seaport are expected to be positive only in case that the LAPSSET Corridor gets realised. In the opposite case feasibility and viability of the seaport are questionable unless an alternative strategic plan gets elaborated soon.
- Good multimodal connectivity of the port is foreseen with regards to road and rail only within the context of LAPSSET Corridor development;
- Further reason of concern however is the fact the port site is closely located to an area with high environmental sensitivity and of an important cultural heritage. Therefore, economic feasibility needs to be given a closer attention.

- Given the external changes incurred during the last six years (since the initial master plan study has been developed by JPC in 2011) there is a strong need for the master plan of Lamu Port has to be thoroughly re-examined. The focus should be placed on:
  - Freight forecast update (the existing one is dated back to 2011 and has to be updated according more recent developments) considering this time the additional port activities proposed;
  - Revise the port layout and redesign / optimise port operations allowing the JMB in the middle;
  - Revise and optimise port hinterland interconnections given the new conditions.

4 Transport planning

This section covers the review of the road, water and air transport segment of the LAPSSET corridor, as well as the overall transportation planning and co-ordination of the various transportation segments (rural roads, urban transport, port, airport) of the corridor in the Lamu district.

4.1 Existing situation

4.1.1 Summary of existing situation

Across the County, all roads are unpaved and in a deplorable state which makes travel time increase by 300% compared to the normal time it would take to reach a destination. The main Class C road from Mokowe to Witu is in a poor condition and often floods; large potholes rendering the road impassable by use of small vehicles.

Photo 20: The Mokowe (Lamu) – Witu – Garsen road (from County Spatial Plan)

On the other hand, the planning of the rural road network for the county is sufficient and should cove the needs of the county. Specifically, roads in Witu, Bahari, Faza, Hongwe, Mkunumbi and Hindi wards are well laid-out in a good connected network to enhance linkage in the various human settlements in the wards. However, the roads are in a very bad condition that often limits accessibility to those areas. Other wards such as Mkomani; Basuba; and Kiunga have a poor road linkage and their accessibility by road is highly limited.

The two (2) main roads planned in the LAPSSET JPC 2011 master plan, have not been constructed. Nevertheless, detailed designs have been concluded and construction of A7 has begun, according to KENHA, after about 1 year of delays due to the lack of security in the area. At the same time, a commercial contract for the construction of A10 under the PPP approach, has been signed.

The anticipated dates for opening of these roads to traffic are 2020 and 2023 respectively.

Local residents, as well as tourists, most frequently use water transport means since their most viable option of transport is currently by water. It should be noted, however, that there are no dedicated public transport boats and the ones available are very few, old and slow. Other available small boats for water transport are either not safe, convenient, or time efficient.

Regarding water transport, the available transport means are accessed from the jetties as terminal facilities. KPA jetty in Amu Heritage Town is the biggest in Lamu Island and serves the greatest population in the County. Manda Airport passengers are transported to the islands or mainland from the Manda Airport jetty. The main jetty in the mainland is the Mokowe jetty, which is a very busy jetty with frequent visitors from other parts of the Country.

Photo 21:Manda airport jetty and water transport connection

Air connection to Lamu county is currently achieved through the Manda airport (LAU). This airport is located on Manda island, at 6m (20ft) above sea level and has two runways: The first runway (16/34) is paved with asphalt, while the second runway (08/26) is unpaved and is approximately 930m (3,050ft) long and 14m (46ft) wide.

The Government recently completed lengthening of Manda Island Airport runway from 1.1km to 2.3km. Improvement works are already complete for the airport terminal building. Preparations are at an advanced stage towards the construction of a parallel taxiway and aircraft apron area to improve capacity of the airport. These improvements will enhance the capacity of Manda Airport to cater for the expected traffic at least until 2030, at which point relocation of the airport to the Mkunumbi site (proposed in the JPC 2011 master plan) should be considered.

Except from Manda airport there are 12 airstrips in the County found in Mokowe, Witu, Mkunumbi, Pate, Siyu, Tenewi, Mangai, Kizingitini, Kiwayuu, Mkokoni, Kiunga and Mararani. There is also an additional airstrip located in the existing military base, located within the LAPSSET port development area.

Security is of major concern today in Lamu and adjacent counties. US department of State warns travellers *to avoid travel in the north-eastern Kenyan counties of Mandera, Wajir, and Garissa, the coastal counties of Tana River and Lamu in their entirety, all areas north of Malindi in Kilifi County, and the Nairobi neighbourhood of Eastleigh*.

On the other hand, the Foreign and Commonwealth Office (FCO) advise against all but essential travel to:

- Areas within 60km of the Kenya-Somali border,
- Garissa County,
- Lamu County (excluding Lamu Island and Manda Island),
- areas of Tana River County north of the Tana river itself,

The above warnings essentially prohibit travellers from visiting the Lamu port area, the resort city, the SEZ, etc. This security issue becomes even more pronounced for potential investors, freight operators, logistics companies, etc that are expected to form the majority of the clients for the Lamu part of the LAPSSET corridor. Security issues have also caused delays in the construction of A7 road, as reported from KENHA.

4.1.2 Identification of issues

During site visits to the area, the review of existing studies and consultations with the local Authorities and all involved stakeholders, the following issues were identified:

i. JPC traffic and freight demand study is based on simplistic demand forecast not consider bilateral country agreements. Since such agreements have been changed since 2011, a new demand forecast study should be considered.
ii. Foreseen expansion of Manda airport can cover forecasted demand at least up to 2030. Extension of the runway to 2,300m can accommodate airplanes such as the A320, B737/757, ERJ 190 and CS300ER, covering both regional and mid-range aircrafts.
iii. Master plans and studies provided so far do not include provision for local transport between islands and mainland for fishermen and local inhabitants or development of a rural road network for the county.
iv. Establishment of a regular water transport lines between the islands of Lamu, Pate and Manda is required.
v. A connection of the A10 highway towards the Somalian border should be considered.

4.2 Outline of main transport networks

The following map shows the outline of the main transportation network links that interconnect the various LAPSSET components.

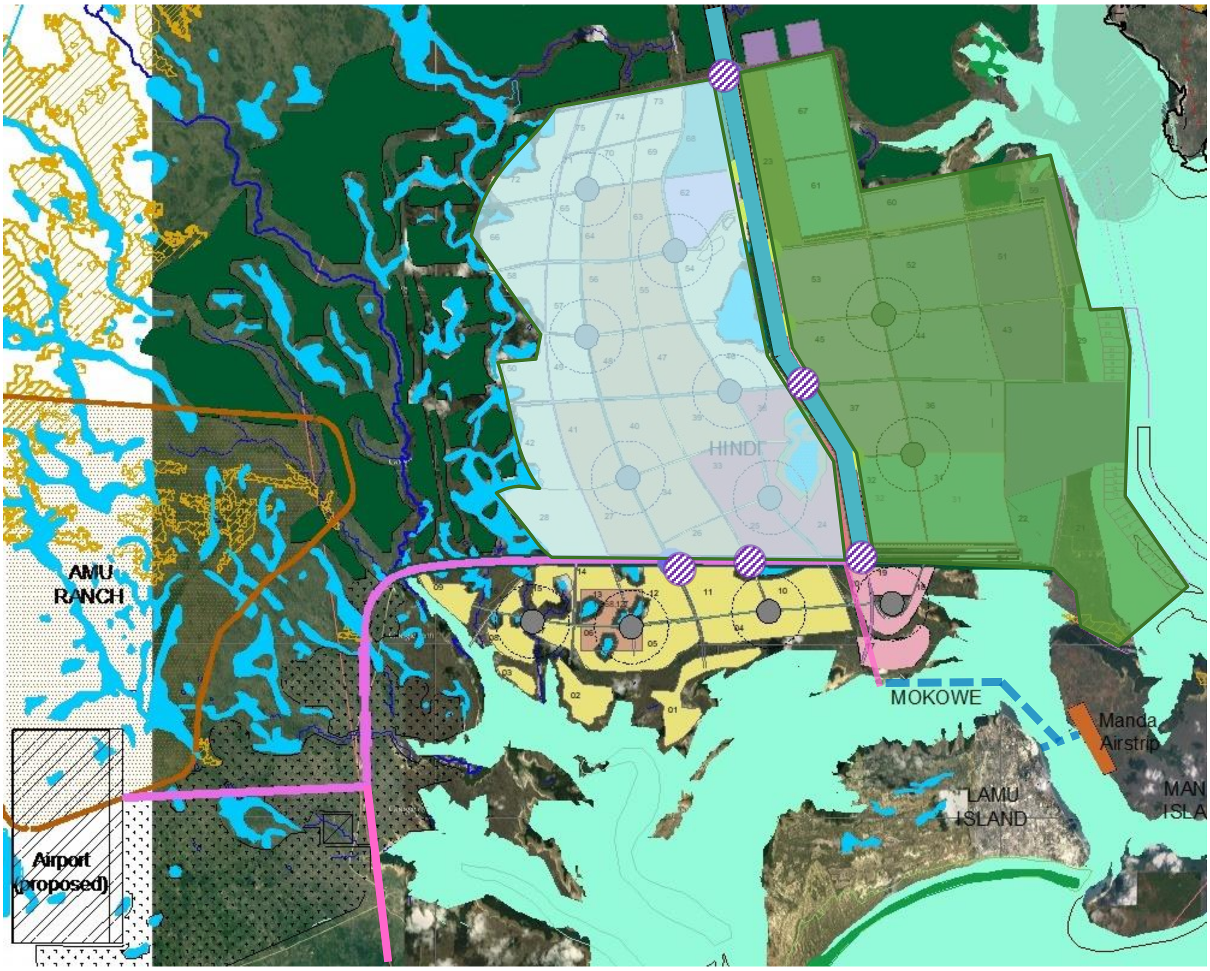


Figure 8: Outline of major transport links for LAPSSET components

In Figure 8 above the main LAPSSET corridor, including A10, is hown as blue and A7 is coloured as magenta. The urban area to the north of A7 and west of A10 is highlighted in light blue, while the port and Special Economic Zone is highlighted in green. To the south of A7 the resort area is marked in yellow and orange and the civic center in pink. The transport links within those areas are detailed herebelow in the next paragraphs.

Manda airport is also shown in dark orange colour and the main water transport links are demarcated in blue dotted lines, linking Mokowe jetty (mainland) to Manda airport and Lamu KPA jetty.

4.2.1 Main LAPSSET corridor

The concept of the main LAPSSET corridor was introduced in the JPC 2011 study in order to cater for all modes of transport, i.e. road, railway and pipeline. The original corridor was foreseen to have a width of 200m, however following studies have increased the width to 500m.

Based on the on the above and the transport needs for all LAPSSET components within Lamu county (urban area, Special Economic Zone, etc) the consultant proposes the following layout for the main corridor.

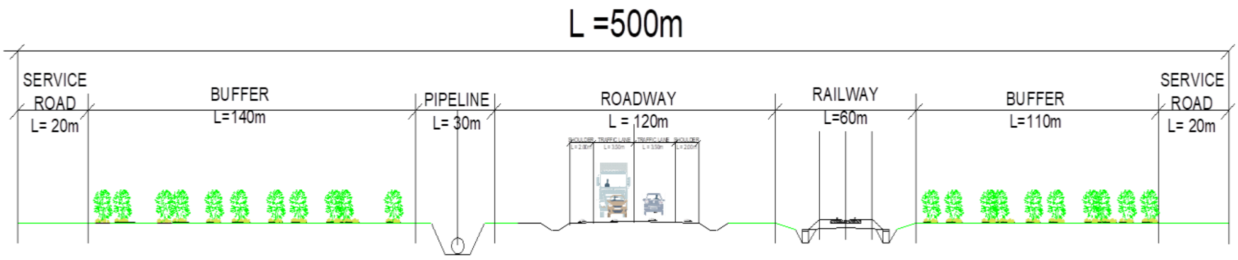


Figure 9: Typical section and arrangement of the main transport corridor

The components of the corridor are the following:

- A10 highway, which is the main highway connection of Lamu port to the national and international road network. The highway will not connect directly to the urban and port road network in order to improve safety and traffic management.
- Railway line to be located East of A10, instead of west (as proposed in the JPC 2011 study and the A10 study) in order to avoid multiple crossings with A10 for the connections to the commercial and industrial port, as well as the main railway station;
- Crude oil and product pipeline, to the west of A10;
- Green zones (Buffer zones) for the beautification and the environmental enhancement of the corridor. The zones also offer protection of the aforementioned elements and distance from the urban and port areas;
- Service roads, located on either side of the corridor. These service roads will form part of the local networks in the urban and port areas, so that the local network does not interconnect directly with the A10 highway.
- Connection of the service roads to A10 and A7 will be done through main 4-leg intersections shown in the above Figure.

4.2.2 Lamu – Garissa – Isiolo, A10 highway

The purpose of the A1o highway is to provide direct and quick access to the Lamu port and various LAPSSET components for heavy (freight) vehicles, that can be considered as 'transit' or 'through' traffic. As such, standard transportation practise requires that local traffic, especially urban traffic, is not mixed with the heavy transit traffic.

For this reason, as shown in Figure 8, it is proposed that at the north entrance of A10 towards the port and at the south exit (ending point) of A10, major intersections are constructed to divert traffic going to the urban area towards the west service road and traffic headed towards the port area and industrial zone towards the east. From the ending point, the connection with the port will be provided by the "port access road".

The above proposed traffic arrangements are required for both traffic safety as well as providing better Level of Service for each different user of the road network.

The proposals discussed below are based on the detailed design study "Consultancy Services for Environmental & Social Impact Assessment and Detailed Engineering Design of Lamu-Garissa Road" that was undertaken by SAI Engineers and was submitted on March 2016.

The detailed study also makes estimates for the traffic volumes regarding the A10 highway taking into consideration the various LAPSSET components, ignoring however the urban development. The final forecasts are given below:

Year	Low growth rate		Medium growth rate		High growth rate	
	Veh.	PCU	Veh.	PCU	Veh.	PCU
2020	1491	4843	1544	5021	1645	5372
2023	1115	3529	1176	3733	1260	4024
2025	1222	3858	1300	4118	1428	4560
2030	1526	4776	1656	5213	1938	6180

Table 12: Lamu – Garisa study traffic forecast on A10

The modal split between rail and road is estimated, in this study, to by 50%-50%, after 2023 where the railway is estimated to be operational.

Although, the traffic forecasts provided by SAI under this study, are developed using OD and traffic surveys, unlike the JPC 2011 master plan, these are being undertaken on a hardly existing road and understandably the traffic forecasts are different between this study and the 2011 JPC forecasts. Nevertheless, the high growth rate scenario of the SAI study is comparable with the JPC forecasts for 2030 (7,120 PCU per day compared to 6,180 PCU/day).

Considering that the opening of the A10 will take place in 2023 and the railway line will not be operational before 2027 (to take away heavy loads from A10), the above forecasts indicate that the anticipated PCU for 2030 will exceed the limit of 8,000 PCU/day, over which dualization of the highway cross-section is recommended.

Based on the above forecasts and the detailed design studies, the following cross-sections should be applied to the A10 highway:

1. From construction to 2030: Single carriageway cross-section with 1 lane per direction of 3.50m width and 2.00m shoulder on each side.

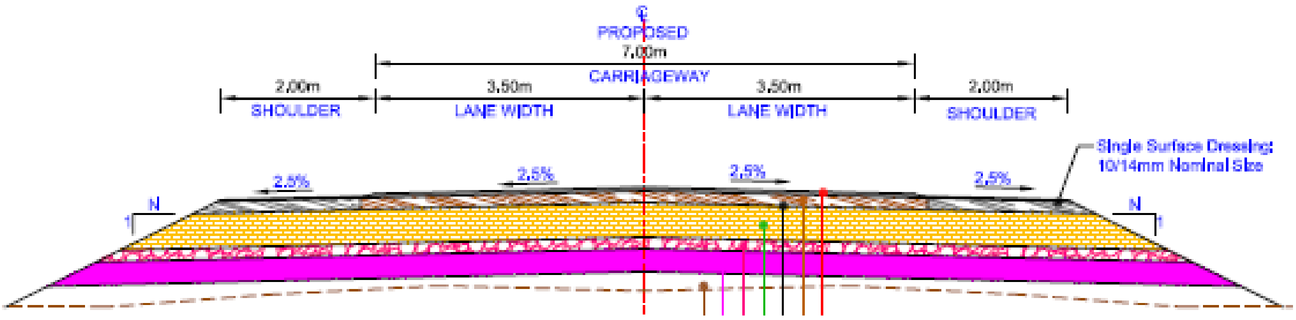


Figure 10: Single carriage cross-section until 2030 (proposed by detailed design)

2. After 2030: Dual carriageway cross section with 2 lanes per direction of 3.50m width and 2.00m shoulder on each side, with central island and metal barriers, as shown below:

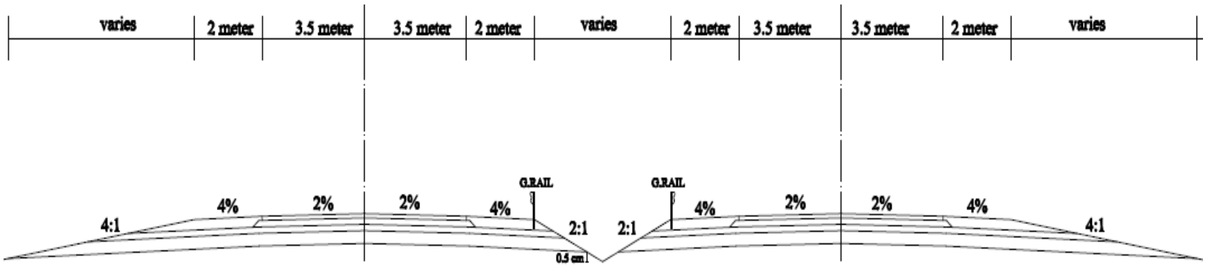


Figure 11: Dual carriageway cross-section for dualization after 2030

4.2.3 Lamu – Witu – Garsen, A7 highway

The "Preliminary Engineering Design and Tender Documentation of the Witu – Lamu – Kiunga (C112/D568/E865) Road" was undertaken by Howard Humphreys East Africa Consulting Engineers and was submitted on June 2008. This study was undertaken before the concept of LAPSSET was materialised and therefore should be used for informational purposes only.

Although, both the Consultant and LCDA have made repeated efforts to communicate with KenHA and H. Young & Co (EA) Ltd, that are currently undertaking the detailed design and build of the Lamu – Witu road, no communication was possible, and the detailed design has not been made available. However, for the purposes of this transport master plan, the information received from personal communications with KENHA that the road follows the preliminary design and existing road, are considered enough for the proposals presented here below.

The traffic forecasts for A7 are currently being undertaken by the Design-Build contractor and are not available. Yet information provided by KENHA indicates that the cross section will be that of single carriageway with one lane per direction of width 3.50m and shoulders on both sides, as shown in Figure 10 above for the A10 highway.

It should be noted, however, that the A7 will form the main road artery for the port truck traffic until the A10 is opened for traffic in 2023. Therefore, for the years 2020 – 2023, A7 will carry the traffic loads from the port and the design of A7 should take this into consideration, both for the alignment, as well as for the pavement section.

After 2023, when the A10 highway will be operational, A7 will not carry any transit loads headed out of Lamu county and therefore its role will change.

The anticipated role of A7 after the opening of A10 is to:

- Connect Mokowe jetty (mainland) to the urban network,
- Connect the resort city and civic center to the urban area,
- Provide secondary connection to the port for the urban area,
- Connect the urban network and traffic from A10 to the new Mkunumbi airport,

The above connections to be provided by A7, lead to the proposal that in the future, as the urban area grows, the A7 should be transformed to an urban motorway, as the main traffic using A7 will be urban traffic connecting to the various LAPSSET components.

As an urban motorway, A7 should be able to accommodate non-motorised transport, have public transport facilities and at the same time be a safe and quick road for the road users. It is therefore proposed that the future cross section of A7, is as follows:

Figure 12: Proposed urban motorway cross-section for A7

The above cross-section provides for Non-Motorised Transport facilities on both sides of the road with dedicated bicycle lanes protected from car traffic and wide sidewalks for pedestrian traffic. The required lanes will be 3 per direction of 3.50m each, with the left lane being used only by public transport buses (Dedicated Bus Lane).

The central island width should be 1.00-2.00m wide and the island separating the DBL and the bicycle lane should be at least 2.00m to be able to accommodate a simple bus stop facility. Bicycle lanes should be bi-directional and at least 3.00m wide (2*1.50m) and the sidewalks not less than 2.00m.

The above dimensions lead to a total width of 38 – 40m, that should be the minimum provided Right of Way for the A7, under current construction. Increased right of way should be provided at the anticipated intersection locations shown in Figure 8.

4.2.4 Service roads

The following figure shows the layout of the internal road networks of the urban and port areas and the service roads demarcated in blue, within the main LAPSSET corridor.

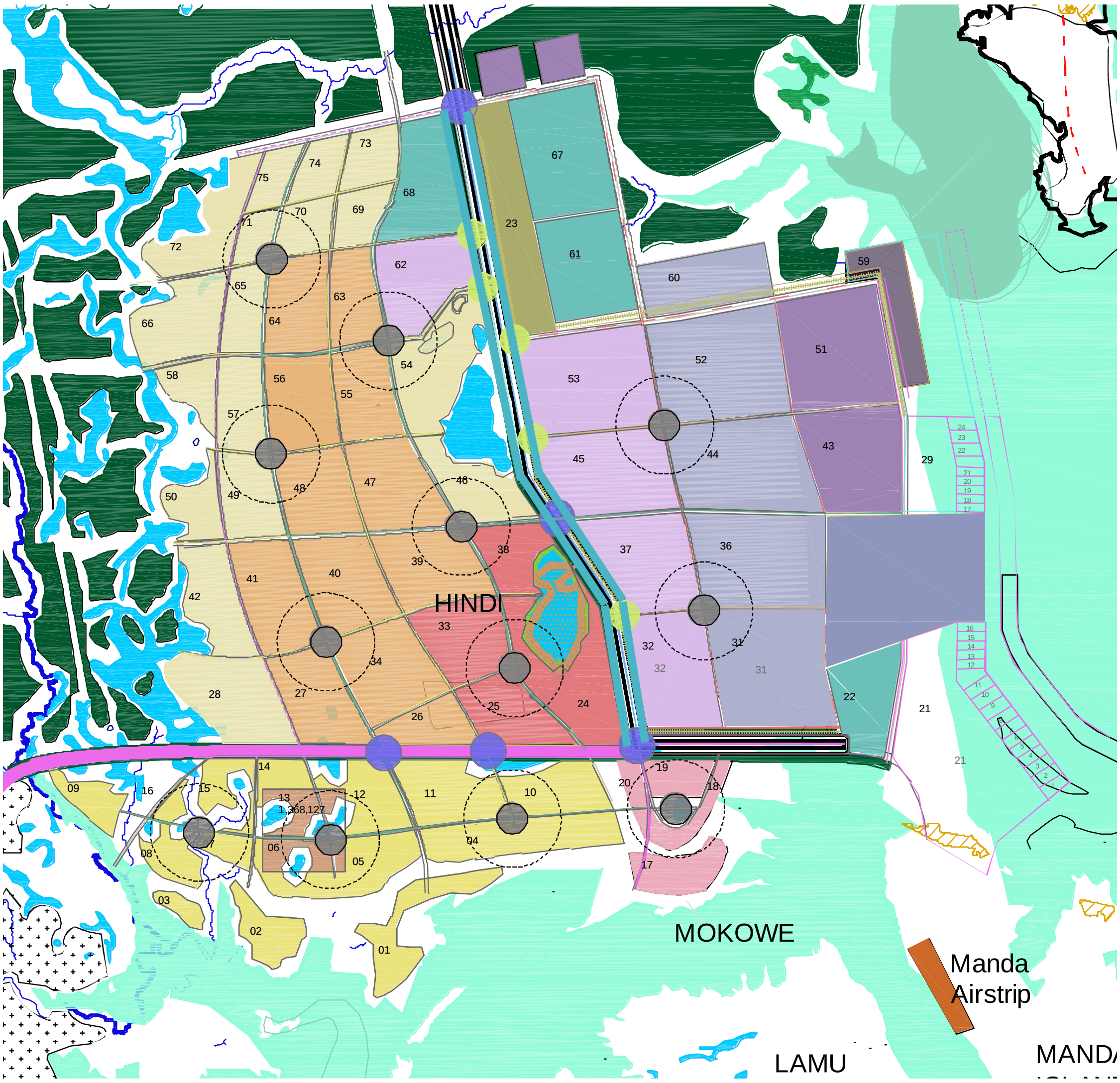


Figure 13: Layout of the internal road networks and connections with the service roads (blue)

The service roads run parallel to the main highway (A10) and allow local traffic to gain access to side properties. Where major roads are bordered by commercial or residential development, service roads are a safe way to allow vehicles to access these properties with little disruption to other traffic on the main highway.

This way both the urban area and the port area gain controlled access to the main highway network (A10) through the main junctions shown in the Figure above and at the same time the mixing of 'transit' truck traffic with urban is avoided.

As the service roads are adjacent to the urban and port areas, it is proposed they also include Non-Motorised Transport facilities, especially towards the west, where it is expected that it will be used by both pedestrians and bicyclists.

The proposed cross section for the service roads is shown below:

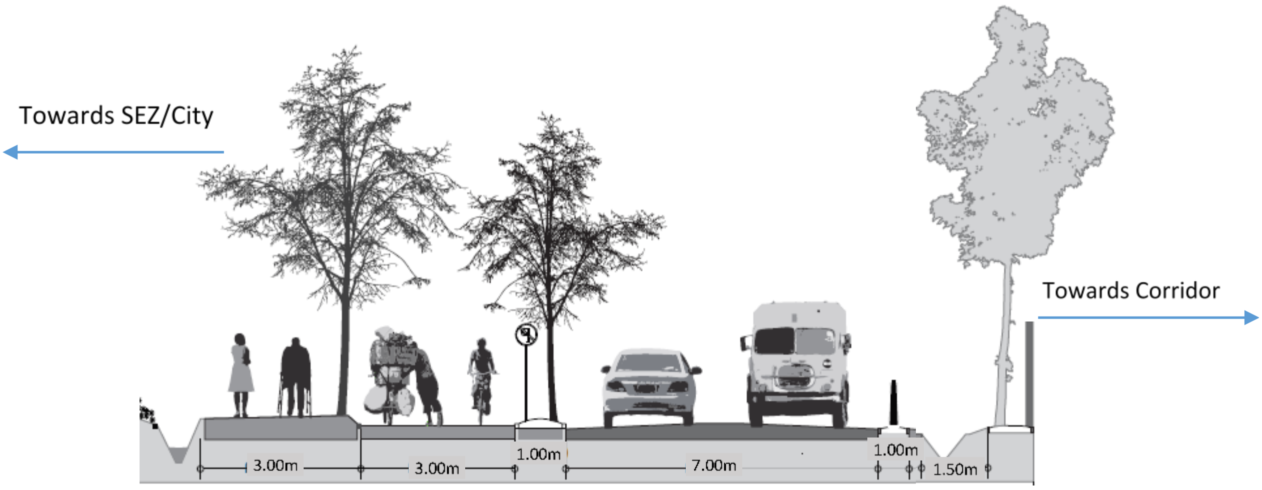


Figure 14: Proposed service road cross section

As shown in the above Figure the total width of the proposed cross section is about 20m, as also indicated in the Right of Way section presented earlier. A two-way bicycle lane and a wide sidewalk for pedestrians are foreseen and the roadway is a single carriageway with one lane per direction of 3.50m with 1.00m shoulders. The necessary trenches for the storm water drainage are also foreseen, as well as the necessary protective measures towards the center of the corridor.

4.2.5 Junctions

The purpose of the junctions is to connect the service roads to the urban and port roads and in selected points the main urban arterials and main port roads and service roads to the A10 and A7 highways.

The main intersections are shown in Figure 8 and Figure 13 with purple colouring. These are of 4-leg type and connect A10 and A7 to the local network and also offer through connection, i.e. connection between the urban area and port area.

A typical layout of such an intersection is shown in the Figure below:

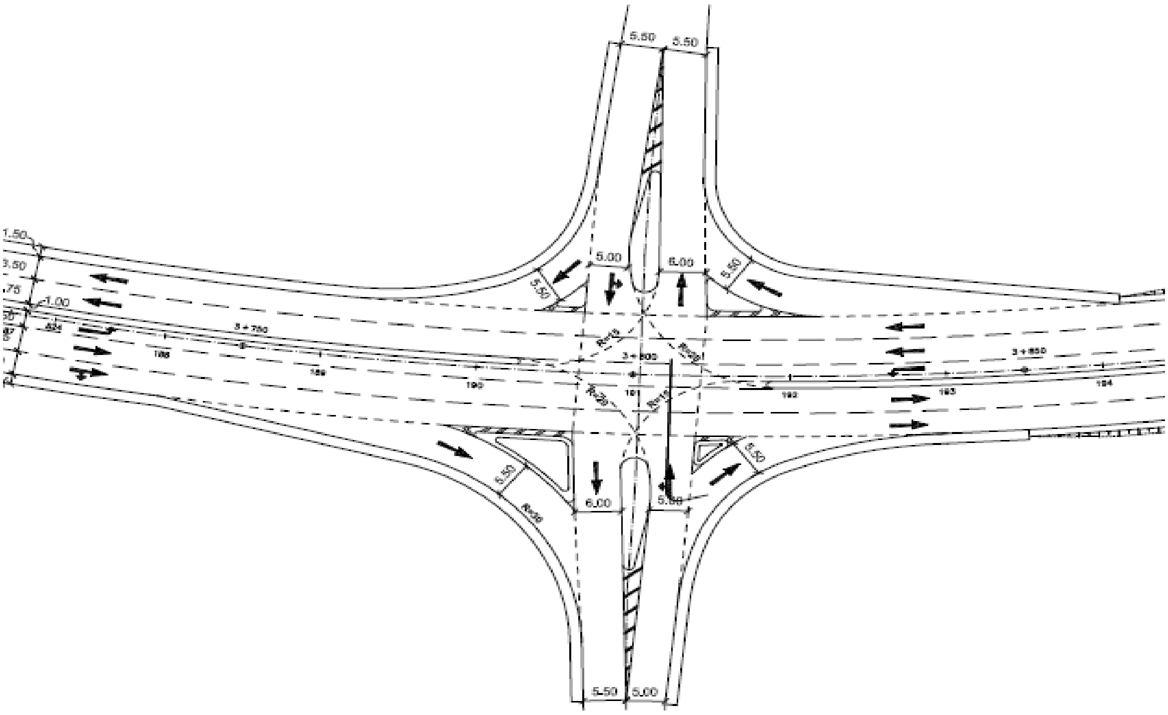


Figure 15: Typical layout of 4-leg ‘through’ intersections

The layout above represents an at-grade intersection with a non-urban road, as it is expected that the primary function of both A10 and A7 in the first years of operation will function as such.

However, there is provision for islands separating all turning movements, to allow for higher traffic loads and also permit the installation of traffic lights, when the traffic loads become such that will demand signalising of the intersections.

However, as demand will rise the intersections may require further upgrading to grade separated intersections. The most cost-effective type of grade separated intersection is the ‘diamond’ as shown in the figure that follows.

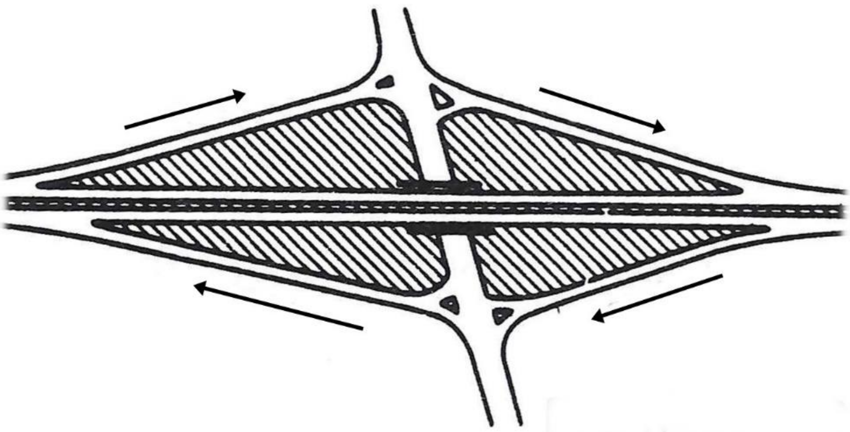


Figure 16: Diamond type grade separated intersection

Visual images of such types of intersections in per-urban environments are shown in the figures that follow.

Figure 17: Visual image of a diamond type interchange with provision for NMT facilities on ground level

Figure 18: Visual image of diamond type interchange with roundabout at the ground level and provision for NMT facilities

Figure 13 above also presents, in light green colour, the intersections connecting the urban road network (on the west side) and the port road (to the east) with the urban and port service roads respectively. These junctions will be "T" type or 3-leg intersections not allowing connection with A10 or A7 or any through movements to the other side of the corridor.

These junctions are considered as urban junctions and should allow for the passage of NMT (pedestrian and bicycle paths) and there is no forecast for grade separation.

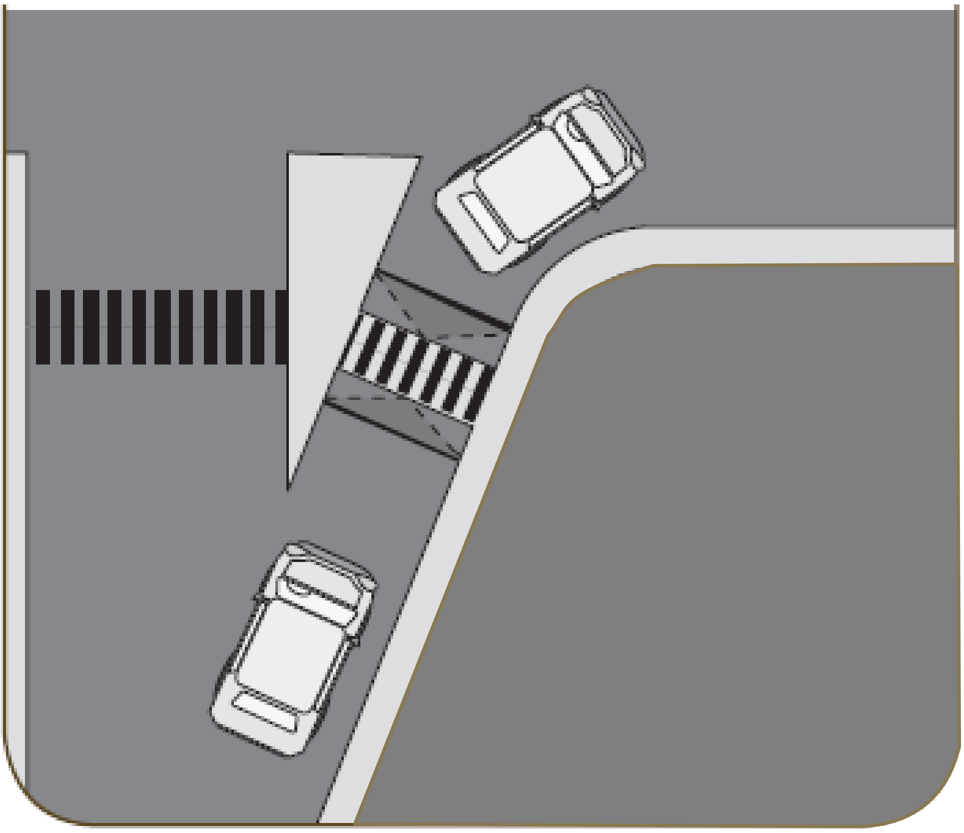


Figure 19: NMT friendly urban intersections

4.3 Urban road network

To develop efficient street transportation, to serve effectively various land use in an urban area and ensure community development, it is desirable to establish a network of streets divided into systems, each system serving a particular function or particular purpose. Accordingly, a community should develop an ultimate street-classification in which each system has a specific transportation service function to perform. The expected increase in population of the urban area, due to the increase in port and industrial activity, will certainly lead to an increase in vehicular population on urban streets. Unless a well-established road network is put in place from the beginning these will inevitably cause future problems of congestion in urban areas.

This paragraph provides a summary of urban streets with respect to their classification, related operational performance and level of services (LOS) involved in each class of urban street, in order to provide a guide for further development of the road network. The development of the urban area and the corresponding development of the road network are described in the next section regarding Urban Planning.

4.3.1 Classification of urban road networks

There are three ways of classifying urban roads:

- Functional based classification,
- Design based classification,
- Combination of functional and design based

4.3.1.1 Functional based classification

Functional classification is the process by which roads and highways are grouped into classes, or systems, according to the character of service they are intended to provide. Basic to this process is the recognition that individual roads and streets do not serve travel independently in any major way. Rather, most travel involves movement through a network of roads. It becomes necessary then to determine how this travel can be channelized within the network in a logical and efficient manner. Functional classification defines the nature of this channelization process by defining the part that any particular road or street should play in serving the flow of trips through a highway network. The four functional systems for urbanized areas are:

1. Principal Arterial streets
2. Minor Arterial streets
3. Collector street
4. Local roads.

General idea of various streets as per their mobility and land use is shown in the Figure that follows:

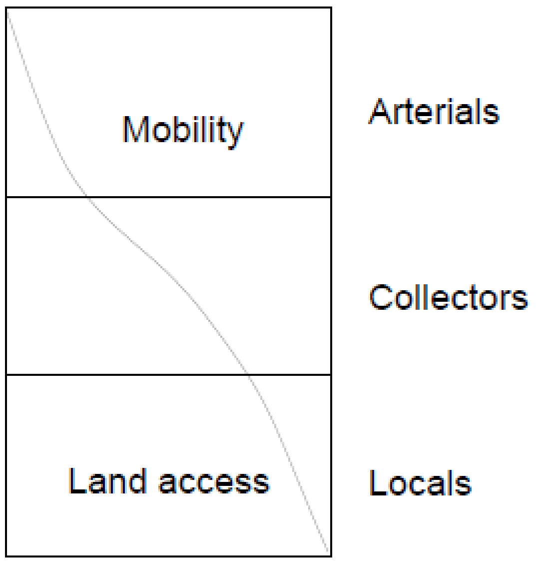


Figure 20: Relationship of functionally classified systems in service traffic mobility and land access

Principal arterials or Urban motorways

Arterial streets are basically meant to carry longer and through traffic. Function of arterial is to provide access to commercial and residential land uses. As shown in Figure 20 mobility of principal arterials is high, but land access is very low.

Major arterials serve as principal network for through traffic flow. This should be connected with principal traffic generations, important highways entering the city. It should be well coordinated with existing and proposed expressway system for good distribution and circulation of through traffic and continuity of routes should be maintained. In every urban environment there exists a system of streets and highways which can be identified as unusually significant to the area in which it lies in terms of the nature and composition of travel it serves.

In larger urban areas their importance also derives from service to rural oriented traffic, but equally or even more important, from service for major movements within these urbanized areas. The principal arterial system should carry the major portion of trips entering and leaving the urban area, as well as the majority of through movements desiring to bypass the central city. In addition, significant intra-area travels, such as between central business districts and outlying residential areas between major inner-city communities or between major suburban centres should be served by this system.

The principal arterial system will carry important intra-urban as well as intercity bus routes.

Urban arterials

The urban arterial system should interconnect with and augment the urban motorways and provide service to trips of moderate length at a somewhat lower level of travel mobility. This system also distributes travel to geographic areas smaller than those identified with the higher system.

The urban arterial street system includes all arterials not classified as urban motorways and contains facilities that place more emphasis on land access than the higher system, and offer a lower level of traffic mobility. This system should include urban connections to rural collector roads where such connections have not been classified as urban motorways.

Such facilities may carry local bus routes and provide intra-community continuity, but ideally should not penetrate identifiable neighbourhoods.

Collector streets

This system of streets includes all distributer and collector streets. Function of this system is serving between arterials and local streets to connect adjacent neighbourhood areas and to accommodate local through traffic movements and interconnect local streets with the arterial street system. Unlike arterials their operation should not always dominated by traffic signals.

Local streets

Local streets are primarily meant for direct access to residential commercial, industrial or other abutting property. All through traffics should be discouraged on local streets. Land access is very high, but mobility is very low for local streets.

4.3.1.2 Design based classification

This classification basically depends upon speed limits, signal density, driveways / access point density etc. Four basic classes can be identified:

1. High speed
2. Suburban
3. Intermediate
4. Urban

High speed roads

These are the streets with very low driveway or access point density. These are provided with separate right turn lanes and; no parking is permitted on street. Streets may be multilane divided or undivided or two-lane facility with shoulders. Signals are infrequent and spaced at long distances. Road side development is very low. A speed limit on these roads is 75 to 90kph.

Sub-urban roads

They represent streets with a low driveway/access-point density, separate or continuous right turn lane and some portions where parking is permitted. These roads possess comparatively higher density of roadside development than that on high speed streets. It has about three signals per Km. and speed limit on these roads is 65 to 75kph.

Intermediate roads

They represent urban streets with moderate driveway/access point density. Like sub-urban streets they also have some separate or continuous right turn lane and some portions where parking is permitted. These roads possess comparatively higher roadside development than that on sub-urban streets. It has about two to six signals per Km. and speed limit on these roads is 50 kph.

Urban streets

They represent urban streets with high driveway/access point density. These are usually provided with road side parking. It has highest road side development density among all above stated four classes. Signal density is about four to eight per Km. Speed limit is 40 to 55kph.

4.3.2 Road networks in Lamu port city

The functional classification of the urban road network is developed and described in further detail in the following Urban Planning section. In this section, the classification of the urban road network of Lamu port city is based on the design criteria, in conjunction with the functional criteria provided by the urban planning.

The following Figure shows the urban road network for the Lamu port city.

Figure 21: Urban road network classification

Based on the previously described network functions and design classes, the road network in Lamu port city can be classified as follows:

1. High speed roads (Urban motorways): This category includes A7 and the west service road, as well as a possible future upgrade to the west, noted in dashed magenta line in the previous Figure.
2. Intermediate roads (Urban arterials): This category includes the roads shown in green in the Figure above.

3. Sub-urban roads (Collector roads): This category includes the roads shown in yellow in the previous Figure.
4. Urban streets (Local roads): This category includes all urban streets for the local traffic and is not shown, as it requires detailed urban designs for such streets to be identified.

Urban motorways

As previously discussed, the main function of these roads is mobility and provide quick access for the road users out of the city. The roads within Lamu port city plan that play this role are the future upgrade of A7 and the west service road.

The speed on these roads should be about 70-80kph and when the Level of Service drops below "C", upgrade of the road should be considered.

Typical cross sections of A7 (functioning as urban motorway) and the service road are given in Figure 12 and Figure 14 respectively.

Urban arterials

Urban arterials in Lamu port city will have as main purpose the distribution of traffic and passengers between the urban centres identified. In order to achieve this function, they will need to provide dedicated facilities for public transport (e.g. BRT).

Figure 22: Typical cross-section of urban arterials

The urban arterials will comprise of:

- 3 lanes per direction of 3.50m width. One lane is to be dedicated to public transport, either as BRT (in the center of the road) or as DBL (on the side of the road).
- A central island of 3.00-4.00m wide in order to accommodate for the bus stops for the BRT lines.
- Pedestrian and bicycle paths (NMT facilities). As these roads are expected to have high traffic loads and speeds of about 60kph, the NMT paths should be bi-directional on both sides. Therefore, the NMT path should have a width of at least 5.00-6.00m.

The total width of the urban arterials is consequently about 40m and the identified Right of Way should not be any less, but it does not necessarily need to more than 40m.

Urban collectors

Urban collector roads in Lamu port city will functions as the main collector roads between neighbourhoods, as well as provide connection of the neighbourhood traffic with the urban arterials. Access to side activities is allowed and parking can be permitted, depending on the detailed urban plan of the area. Traffic speeds should not exceed 50kph.

Figure 23: Typical cross-section of urban collector roads

The urban collectors will comprise of:

- 1 lane per direction of 3.50m width,
- Possible parking lanes of 3.00m width, depending on the function of the area and the detailed urban design,
- Pedestrian and bicycle paths (NMT facilities). NMT paths should be uni-directional on both sides, as crossing the road is permitted. Therefore, the NMT path should have a width of about 3.00-4.00m.

The total width of the urban collectors is consequently about 20m and the identified Right of Way should be not less than 25m.

4.3.3 Design guidelines

There exist a significant number of urban road design guidelines that can referenced and used for the detailed development of the road network of Lamu port city.

The British Standard “Design Manual for Roads and Bridges” is a very good starting point, as it is also available freely for download (http://www.standardsforhighways.co.uk/ha/standards/dmrb/index.htm). Another very useful source for urban road design guidelines is AASHTO and spesifically:

- A Policy on Geometric Design of Highways and Streets,
- Guidelines for Geometric Design of Very Low-Volume Local Roads,
- AASHTO Roadside Design Guide,

Nevertheless, any design guidelines produced by KURA should first be considered.

4.4 Port zone road network

To the east side of the LAPSSET corridor and A10, the port area is developed. The port zone can be further subdivided to the port zone and the industrial and commercial zones, to be called Special Economic Zone (SEZ), as the LPASSET plan is that these zones will function as such.

4.4.1 Classification of port/SEZ road networks

The classification of roads in commercial or industrial zones is significantly different than the classification of roads in urban areas.

The purpose of the road classification in SEZ areas is two-fold; firstly, ensuring that the road network develops in a way that complements the efforts of the local planning process in affecting the shift to sustainable modes. Secondly, from a safety viewpoint, adoption of the classification ensures that the most vulnerable users of the highway are given due consideration, and aims to see the roads develop as a safer and more inviting environment for these groups.

The classification is a means of accommodating the major movements of vehicles onto those roads best suited to accommodate them whilst restricting access to sites to the lesser roads in the hierarchy. The main distinction made in the hierarchy is between 'Distributor' Roads that should be primarily designed to meet the needs of the moving vehicle and 'Access' Roads where the aim should be to discourage non-access traffic. The following categories or classes are identified:

- Primary Distributor Roads, onto which there should be no frontage or individual site access;
- Secondary Distributor Roads, onto which frontage access will be limited, though allowed in some circumstances;
- Industrial Access Roads, from which site access will be gained.

The role and function of each category can also be seen in the following Figure.

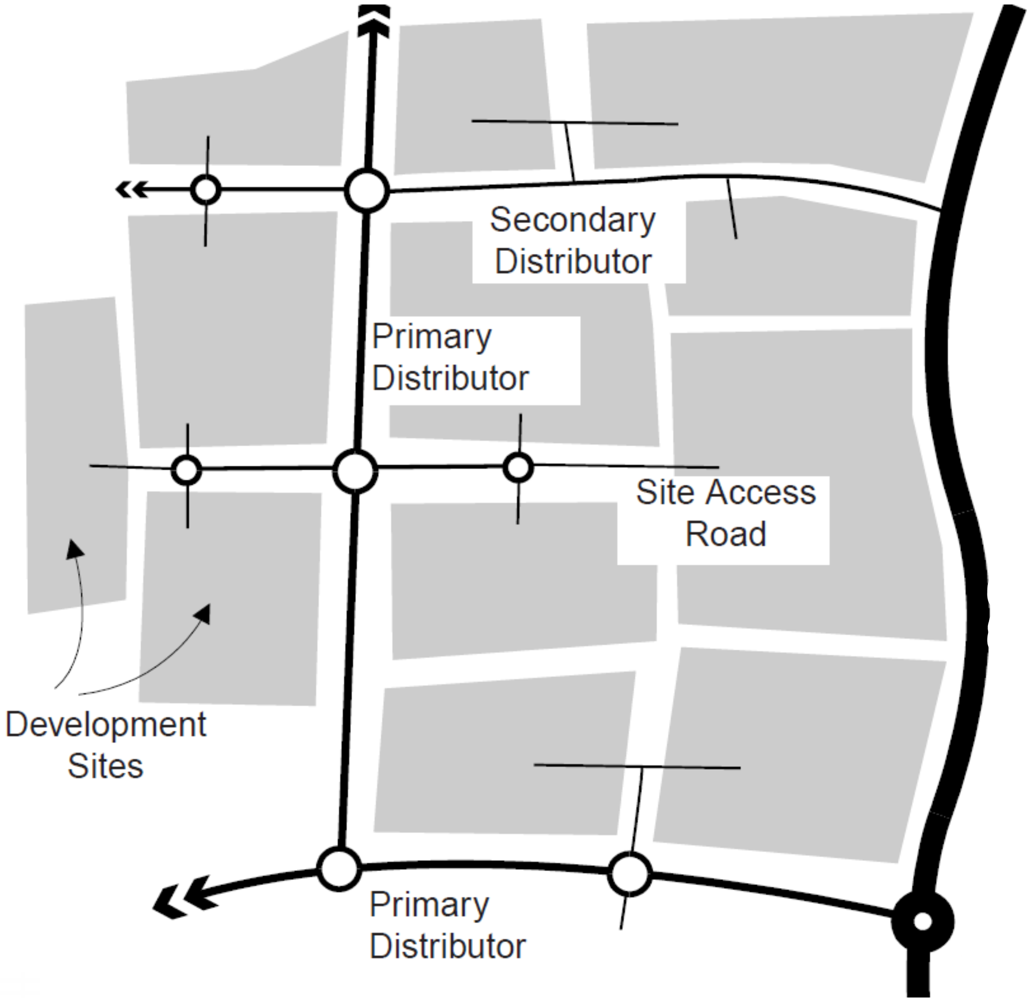


Figure 24: SEZ industrial and commercial port road classification

Primary distributor roads

The purpose of the primary distributor roads is to provide quick and direct access of the internal road network to the principal road. Intersection of the primary distributors and the principal road form the accesses or gates to the SEZ area.

Primary distributor roads also function as internal primary roads to distribute traffic to the secondary distributor roads and site access roads. In this light, therefore, direct access from individual sites on primary distributor roads should not be permitted under any circumstances.

Secondary distributor roads

The primary purpose of a secondary distributor road is to provide means of access to multiple sites. Therefore, frontage access should be limited. Generally, the route between industrial sites and the wider highway network will consist of secondary distributor roads. Large sites may have direct access whilst smaller sites will be located on access roads, which in turn will connect to secondary distributors.

Preferred layouts will have all SDR's as through roads, as this affords each site more than one means of access, and so increases operational flexibility. Secondary distributor roads will generally have an operating speed of 50km/h and this should be acknowledged by designing for higher speeds than on access roads.

Junctions onto secondary distributors should be limited, with access roads providing access to individual sites. This restriction may be relaxed in cases of large or high traffic generating concerns, however in these circumstances a higher standard of junction access will be required than normally expected for an individual site.

Site access roads

In most cases sites will gain access to the road network via a Site Access Road. These roads, which will generally be constructed to a lower geometric standard than distributor roads, are intended to provide access to individual sites.

The layout of site access roads should be arranged so that the operating speeds of vehicles are never greater than 40kph (25 mph). In addition, the network of site access roads must be designed to discourage non-access traffic.

Limits on the numbers of units per access road have not been set, as traffic generation is dependent on the nature of each particular unit. Accordingly, greater numbers of units are permissible on developments where the units are expected to have a low traffic generation.

4.4.2 SEZ/port road network analysis

The classification of the port/SEZ road network of Lamu port is based on the categories presented above that feature both functional and design criteria. The road network is analysed by function and internal traffic arrangements are further detailed.

The following Figure shows the layout of road network for the Lamu SEZ/port zone.

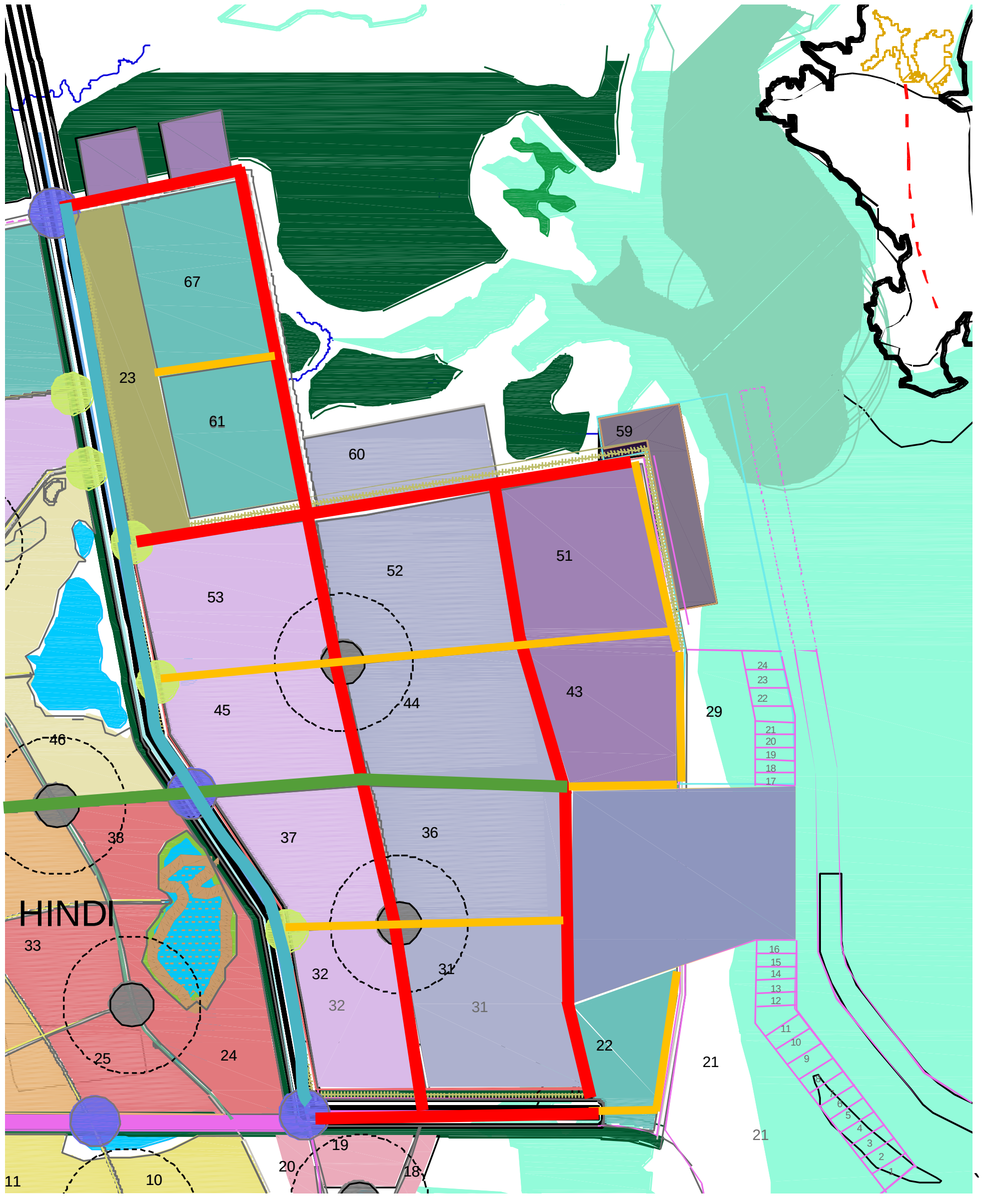


Figure 25: Layout of the road network in the SEZ/port zone

Principal roads and access gates

The principal roads that feed traffic to the SEZ/port zone are the following roads:

- The A10, through the main intersection north,
- The A7, through the main intersection south,
- The east service road

Further to the above, the main access points or gates to the SEZ/port zone are identified in purple colour in the Figure above. Secondary accesses may be provided, depending on the operational plan and the development of the facilities, through the service road (designated in light green in the above Figure).

It is also noted that, as seen in Figure 25, access to the SEZ/port zone will also be provided through the urban arterial (designated in green) that will provide the main connector between the urban area and the SEZ/port zone.

Primary distributor roads

Primary distributor roads are shown in Figure 25 in red colour and their purpose is to distribute the truck traffic from the main access points/gates to the internal of the SEZ/port zone.

The following Figure shows the typical cross-section of the primary distributor roads.

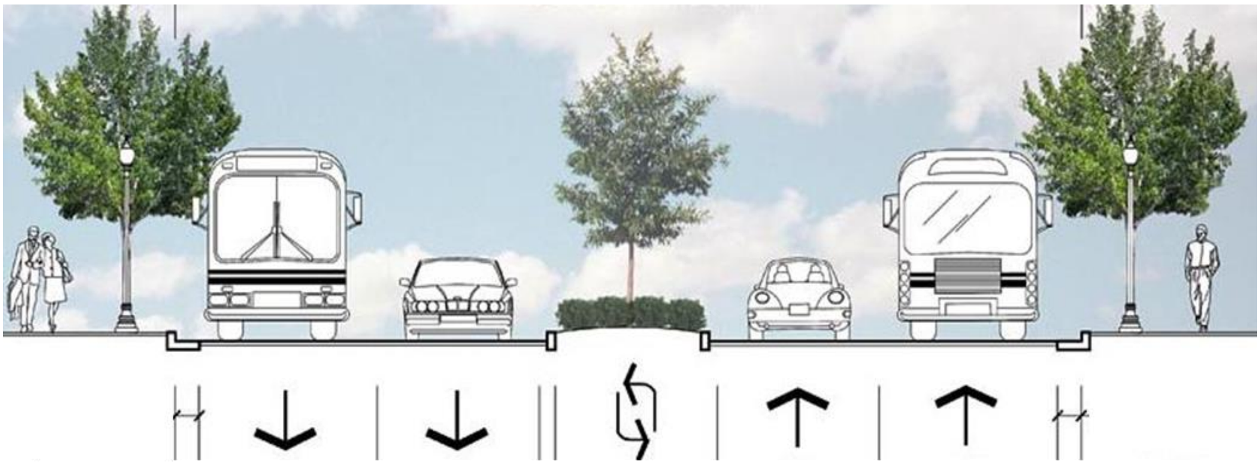


Figure 26: Typical cross-section of primary distributor roads

The primary distributor road will comprise of:

- 2 lanes per direction of 3.50m width,
- Central island of 4.00m width, so as to provide dedicated right-turn lanes at the intersections,
- Sidewalks of at least 2.00m width

The total width of the primary distributor roads is consequently about 22m and the identified Right of Way should be not less than 30m, to allow for further expansion to 3 lanes per direction.

Secondary distributor roads

Secondary distributor roads are shown in Figure 25 in orange colour and their purpose is to provide means of access to multiple sites within the SEZ/port zone.

The secondary road network should comprise:

- 1 lane per direction of 3.50m width,
- Hard shoulder of 0.75m at least on each side,

- Sidewalks of 2.00m width.

The total width of the secondary distributor roads is consequently about 12.5m and the identified Right of Way should be not less than 15m.

Site access roads

In most cases site access roads are designed and implemented by the developers. They are therefore not included in this Transport Master Plan. It is expected that the design of the site access roads will be provided during the detailed study phase of the SEZ zone or during implementation by the developer.

Nevertheless, the characteristics of the site access roads should be the same as with the secondary collector roads, with the exception that the hard shoulder can be shortened to 0.50m.

4.5 Non – Motorised Transport network (NMT)

The purpose of this paragraph is to provide background information on the design of NMT facilities and explain the principles used during the design of the Integrated Transport Master Plan. The application of these guidelines is shown under the relevant paragraphs above.

4.5.1 Basic principles

A city-wide NMT network can not only lower household transport expenditures but also increase travel range, productivity and accessibility to urban services. In other words, the benefits of non-motorised transport are exponentially multiplied when a citywide network is envisioned. A good non-motorised transport network:

- Builds upon a complete network plan;
- Provides direct routes to main destination points;
- Avoids conflicts with crossing traffic;
- Prevents the creation of urban barriers; and
- Reduces vehicle volumes and speeds in places with a high concentration of pedestrians.

There are two levels of design: the network level and the facility level. The network level refers to the connection between the main origin and destinations within the city, while the facility level relates to the design of road sections, intersections and road surface. NMT infrastructure should be part of a coherent, citywide network that is integrated into the public transport system. Even when public transport is used, walking will be involved in the first and last section of the trip. The provision of NMT infrastructure should therefore follow three principles: universal accessibility, complete streets and incremental learning.

Universal accessibility

Universal accessibility refers to the adaptability of urban infrastructure and facilities to the widest range of potential users, including people with mobility and visual impairments, the elderly, people in wheelchairs, people walking with small children, pregnant women, and people carrying heavy loads such as water or firewood.

Complete streets

A complete street is the one that is designed from edge to edge of the buildings. Complete streets incorporate infrastructure for walking and cycling, including signage, ramps and other facilities for the physically challenged. They also include urban furniture like covered bus stops, street lamps, trees and vegetation according to the context and infrastructure for rain harvesting. Complete roads promote safety for all users, and incorporate all of the principles of universal accessibility.

Incremental learning

Each city is unique, and so are its inhabitants. While some urban solutions have a great degree of replicability in different cities, others need to be carefully tested on the ground. Some measures, such as cycleways and intermodal transport stations are new infrastructure elements, both for engineers as well as users.

4.5.2 Pedestrian infrastructure

Pedestrian facilities refer to any infrastructure built to enhance the ease of pedestrian travel, including sidewalks and crosswalks. A more extensive definition encompasses walkways; trails; kerb ramps; as well as pedestrian-friendly urban furniture such as benches, urban trees and streetscapes. The key to improving walking conditions is to manage pedestrian flows so they are appropriately isolated from vehicles.

4.5.2.1 Obstacles

Urban mobility can be improved significantly by eliminating obstacles to walking. Obstacles and urban barriers can make trips much slower, unsafe, or even impossible, and consequently discourage potential users.

Common obstacles include: loss or inexistence of sidewalks, open drains, posts, urban furniture and other sidewalk obstructions; tree roots causing breaks in the pavement; dense vegetation covering footpaths; potholes; unprotected culverts; misplaced drains; and accumulated garbage or runoff; as well as street vendors, shopkeepers, cars and motorcycles encroaching public space designated for pedestrians.

Urban barriers are larger obstacles that prevent communication and continuity and impede non-motorised trips. The most common urban barriers include:

- Urban highways or high-speed/high-volume roads, which often divide cities into disconnected sectors. Overpasses and freeways make non-motorised trips particularly difficult, creating impassable barriers for pedestrians and cyclists.
- Rivers, streams and channels. In general, bodies of water can pose barriers to urban mobility. Even when bridges are present, they are often conceived exclusively for motorised transport.
- Mountains and cliffs. Steep topography can be an obstacle as it makes routes difficult, unappealing and sometimes impossible for non-motorised transport.

4.5.2.2 Footpaths & pathways

Footpaths are pedestrian walkways not associated with roads. A large part of urban pedestrian travel occurs along tracks that are not part of the official road system. If ignored these tracks may disappear as urban density increases. Protecting and upgrading these pathways has proven to be very beneficial for pedestrians.

Similar to sidewalks, footpath width varies according to the number of users. As a general guideline, in pedestrian-only zones, secondary walkways should be 2.00 – 3.00m wide, while primary walkways can be anywhere from 3.00 – 6.00m wide.

The road shoulder is the most common pedestrian facility immediately adjacent to the roadway. When equipped with appropriate safety provisions and width, the shoulder can serve the same purpose as a sidewalk, particularly in rural areas.

If the width of the shoulder is not sufficient for the number of pedestrians, it can become dangerous, especially when heavy vehicles are circulating at high speed, or when vehicles use the shoulder due to poor road conditions. While the minimum recommended standard for shoulders is 1.20m, it should be wider close to commercial centres and areas with dense concentrations of people, where ideally it should be replaced by a sidewalk.

4.5.2.3 Sidewalks

Sidewalks or footways are necessary on all roads, except on some sections of highways where there is no pedestrian traffic. Space for sidewalks can be obtained by reducing the number and/or width of carriageway lanes, which will also serve as a traffic-calming measure.

Sidewalks are composed of three elements:

i. **Frontage (the area adjacent to construction):** A minimum frontage width of 0.30-0.50m must be observed when sidewalks are adjacent to a fence or a building, while in commercial areas, this width should be at least 1.00m. This will prevent shoppers and window watchers from obstructing passers-by. On the other hand, extended frontages can also act as designated areas for café tables or merchandise display.

ii. **Effective walkway (obstacle-free area):** The effective walkway is the area that is actually used for walking. It must be continuous in order to connect different walking areas and free of any obstacle, both horizontally and vertically. A zone 2.40m high and 1.80m wide should be free from any obstruction. No utility boxes, posts, boxes, trees, signage or other urban furniture should be in this area. These types of installations should be placed in the planting zone.

iii. **Planting area (zone for trees, urban furniture and any other road uses):** The planting zone is a buffer area used for landscaping purposes that is also a protective area separating cars and pedestrians. The ideal width of a planting zone is 1.80m; enough to accommodate space for urban vegetation. If not used as landscape element, this buffer zone should still be used to protect pedestrians.

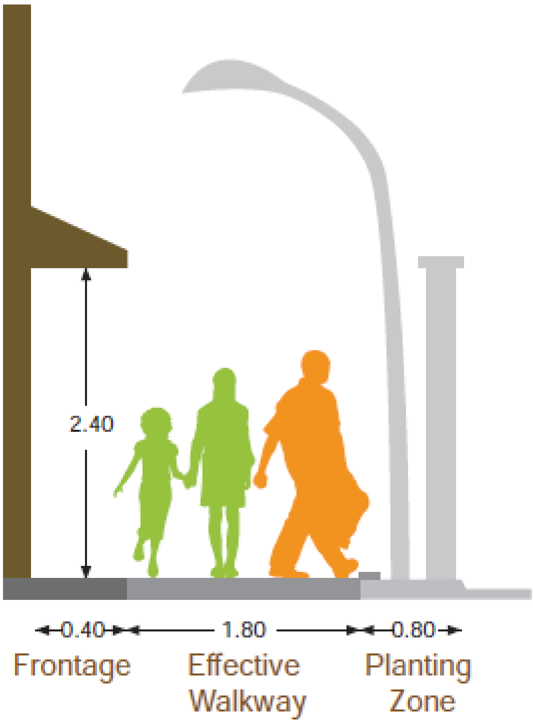


Figure 27: Elements of a correctly designed sidewalk

Sidewalk width should be suited to expected or existent needs. For two pedestrians to pass each other comfortably, each one requires a space of at least 0.80m wide. Standards for sidewalk width vary from country to country. While the standard width recommendation is 1.80m, in residential areas the minimum width should be 1.50m. Where there is no planting zone and the walkway is adjacent to the kerb, the minimum sidewalk width should be 2.00m. For commercial areas, sidewalk width should be at least 2.40m.

4.5.2.4 Crossing facilities

Crossing the road without proper facilities is one of the biggest dangers for pedestrians. The speed difference between cars and pedestrians makes the latter very vulnerable and highly prone to fatal accidents, particularly when they are children or the elderly.

Designated crossings should be placed in safe and appropriate locations, and at regular intervals. Crossing design requires site-specific and detailed investigation so that they are properly integrated into footpath improvements and barrier installation, which will in turn encourage their use.

A good pedestrian crossing has the following characteristics:

- Standard zebra stripes and stop lines;
- Location at a grade crossing where pedestrians cross a maximum of two lanes before reaching a pedestrian refuge (sidewalk or median);
- Medians are at least two metres wide to provide enough space for a bicycle to stop;
- If crossing more than two lanes at once, it ideally includes pedestrian-activated traffic lights;
- Sufficient lighting;
- Kerb ramps that are aligned to the pedestrian crossing; and
- Present at an intermittent distance (every 70-250m) depending on the urban context and concentration of pedestrians.

4.5.3 Cycling infrastructure

Creating new infrastructure must start with a city-wide vision of the cycling network. The network must be part of an integrated transport plan that takes into account the relationship between walking facilities, public transport and the automobile network. This city-wide vision will make it possible to avoid expensive investments in routes without clear origins or destinations.

The NMT network described under paragraph 4.3.2 has taken into consideration the above and provides a full network of pedestrian and bicycle lanes to accommodate for the needs of the Lamu port city residents.

4.5.3.1 Design considerations

Bicycle dimensions,

as well as infrastructure considerations, vary depending on vehicle type. The average length of a bicycle is 1.75m, while its widest part is the handlebar, which varies between 600mm and 800mm. In order to allow for manoeuvring, there should be 400mm of free space on each side of the handlebars. Thus, the total amount of space needed for a single bike lane is 1.50m. The height of the handlebars can vary between 750mm and 1250mm, while the height of the person riding it can reach 2.00m. A minimum clearance height of 2.50m will allow safe circulation, although clearance should be a minimum of 3.50m for tunnels and underpasses.

The outline dimensions for a bicycle and rider are shown in the Figure that follows:

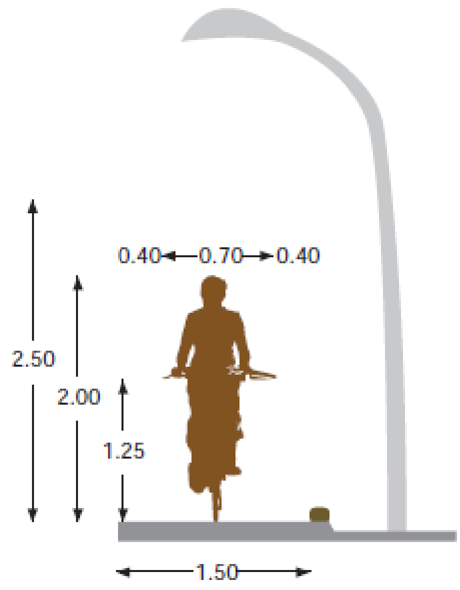


Figure 28: Required obstruction free zone for bicycles

4.5.3.2 Types of bicycle lanes

A cycleway is a facility that is provided primarily for bicycle travel. Different cycleway typologies exist. These include:

- Cycle path;
- Cycle lane;
- Shared road; and
- Green corridor.

The criteria for selecting appropriate cycleway typology depends on the existent road dimensions at its narrowest section and the required dimensions for bicycle and tricycle transit. The road dimensions should allow for comfortable, fluid circulation of different transport modes, as well as room for necessary manoeuvres for all users, including pedestrians and cyclists.

Variables to be considered here include: volume and traffic speed (defines the type of protection), previewed number of cyclists (defines the lane width), available space (defines the basic typology) and urban environment (defines any special characteristics). Other factors for consideration are: the existence of urban barriers, frequency of intersections, presence of buffer zones, number of lanes and available width for pedestrian facilities.

Cycle paths

A cycle path or cycle track is a separated path for the exclusive use of cyclists, physically set apart from motorised vehicles through grade separation or a median island. In this typology, motor vehicle cross flow is minimised.

The cycling path width should be large enough to allow cyclists to overtake each other. Typically, this width is 3.00m, but 3.50m to 4.00m is preferable if the expected volume of bicycles and mixed NM vehicles is high (more than 150 cyclists per hour).

This width will also allow for the circulation of freight tricycles, tricycle-wheelchairs, carts, bicycle-taxis, carriages and other type of non-motorised vehicles.

Cycle lanes

A cycle lane is a portion of a carriageway that has been marked for the exclusive use of non-motorised users. The separation from motorised traffic can be visual (painted markings with a standard 100mm edge line or a buffer zone) or physical (through bollards or raised kerbs). Visual separation measures are usually not enough unless there is strong traffic enforcement and education. For this reason, physical separation of lanes is desirable, although it is not always possible.

For streets where car speeds do not exceed 30km/h, the minimum lane width is 1.50m. If the volume of cyclists is above 1,500 per day or a large number of handcarts or larger NM vehicles are present, the minimum lane width should be 2.25m. A marked buffer zone of at least 0.50m should separate the cycle lane from motorised vehicles when car speeds are between 30km/h and 50km/hr, but volume is under 20,000 vehicles per day. In such a situation, desirable total lane width would be 2.00m.

Shared road

A shared road is a low-speed, sometimes kerbless roadway designed as a single surface for use by pedestrians, bicyclists and low-speed motor vehicles. On a shared road, drivers and cyclists share the same space in a way that is safe for all users. Shared roads are also known as “Zones 30” since vehicles using them should maintain a speed limit of 30km/hr.

Shared roads are adequate for neighbourhood streets with low traffic volume, less than 3,000 vehicles per day and cyclists must circulate in the same direction as motor vehicles.

Green corridor

A green corridor or green route is a dedicated off-street cycleway free from other motorised traffic. Green corridors can be built along footpaths in peri-urban areas, and can be used to overcome urban or topographic barriers (crossing rivers, streams or other topographic obstacles), increasing the attractiveness and convenience of bicycle travel. They can also be designed for recreational purposes, along attractive scenery like parks, streams, lakes, seashores, etc, as in the case of Lamu Resort City.

4.5.3.3 Intersection crossings

It is at intersections where the majority of interactions between different road users occur, and where the majority of conflicts and accidents happen. Therefore, intersections are a prime consideration in cycle path design and are crucial elements for creating high-performing NMT infrastructure. The type of intersection will determine the treatment to be used. In all cases, it is important to prevent drivers from encroaching on cyclists' trajectories.

Road design should ensure that cyclists are visible to other road users, especially at junctions. Good visibility depends on the geometric design of the intersection and the predictability of movement of each user.

Bicycle path intersections and approaches should be on relatively flat grades and close to the vehicle lane, to ensure visibility. Adequate warning should be given to permit cyclists to stop before reaching the intersection, especially on downgrades. Basic design recommendations to reduce the risk of accidents at intersections and increase trip continuity include:

- Adjust intersections to reduce crossing distance. The shorter the crossing distance, the safer it is;
- Reduce speed on all sides; and
- Increase visibility so that cars can see cyclists.

On arterial roads, cycling infrastructure should usually consist of a segregated track. In cases where there is a high volume of vehicles on a continuous turn, it is advisable to incorporate both fluxes before the intersection to increase the visibility of the NMT user. When crossing an arterial street, the crossing should either occur at the pedestrian crossing, where motorists can be expected to stop, or at a location completely outside the intersection, to give cyclists an opportunity to see turning vehicles.

Figure 29: Urban intersection with cycle lanes and sidewalks

4.5.4 Design guidelines

A number of guidelines regarding the design of NMT facilities exist. From all freely available ones the following are considered the most relevant and substantial:

- NMT facilities guideline, 2014, Department of Transport, South Africa (http://www.gailjennings.co.za/wp-content/uploads/2017/01/SA-National-NMT-Facility-Guidelines-2014.pdf).
- Various guidelines available by the Sustainable Urban Transport Project (SUTP) at www.sutp.org
- Design Guidelines for Non-Motorised Transport in Africa, by UNEP and FIA on which this document has relied heavily.

4.6 Public transport

The purpose of this paragraph is to provide background information on public transport modes and facilities and explain the principles used during the design of the Integrated Transport Master Plan. The application of these guidelines is shown under the relevant paragraphs above.

Public transport is an integral part of the Sustainable Urban Mobility Planning (SUMP) that is required and developed as part of the Urban Planning component of this Integrated Transport Master Plan.

4.6.1 Basic principles and benefits

Public transport, is a passenger transportation service, usually local in scope, that is available to any person who pays a prescribed fare. It usually operates on specific fixed tracks or with separated and exclusive use of potential common track, according to established schedules along designated routes or lines with specific stops, al-though Bus Rapid Transit and trams sometimes operate in mixed traffic. It is designed to move large numbers of people at one time.

Mass rapid transit can achieve reduced travel times through the provision of widely accessible networks, higher speed vehicles, exclusive right-of-way infrastructure, efficient fare collection systems, and/or faster boarding and alighting techniques. Furthermore, a well-organised public transport network in cities:

- facilitates access to markets and services,
- creates economic opportunities,
- encourages social integration,
- makes an efficient use of resources, and
- limits air pollution and GHG emissions.

4.6.2 Modes of public transport

From the various modes of public transport available, the following are the most commonly used and applicable in the case of the Lamu port city.

Bus service or Busway: A bus service is a the most well-known public transport mode around the world. It forms an integral part of any organized public transport system and is used within cities for local transportation of passengers and connection to the backbone (high capacity and speed) public transport modes. Conventional bus systems can vary significantly in size and quality, even within the same city. Transit ranges can range from relatively modest van services to bus systems approaching the performance of a BRT system. The quality of public transit can be seen as a spectrum of possibilities ranging from customer unfriendly informal operations to full-feature mass transit systems that achieve mass transit speeds and capacities.
This public transport mode will be used within neighbourhoods in Lamu port city to distribute the passengers and connect to the main public transport lines.

Dedicated Bus Lane (DBL): A bus lane is a highway or street reserved primarily for buses, either all day or during specified periods. It may be used by other traffic under certain circumstances, such as while making a turn, or by taxis, bicycles, or high occupancy vehicles. Bus lanes, widely used in Europe even in small cities, are increasingly applied in developing cities such as Bangkok, where counter-flow buses can move rapidly through peak period congestion.
Dedicated Bus Lanes are foreseen to be used at least in the A7 highway, at its future function as an urban motorway that will connect the urban area network, the port zone, the resort city and the future airport.

Photo 22: Dedicated Bus Lane in London, UK

Bus Rapid Transit (BRT): Many cities have developed variations on the theme of better bus services and the concept resides in a collection of best practices rather than a strict definition.

Bus Rapid Transit is a form of customer-oriented transit combining stations, vehicles, planning, and intelligent transport system elements into an integrated system with a unique identity. Bus Rapid Transit typically involves busway corridors on segregated lanes—either at-grade or grade separated—and modernised bus technology.
BRT is used in the Transport Master Plan for Lamu port city and an extensive network is being planned along the urban arterial roads, as presented here above.

Photo 23: Photo from Dar es Salam BRT corridor (from Daily News)

Light Rail Transit (LRT): A light rail transit (LRT) system is a metropolitan electric railway system characterised by its ability to operate single cars or short trains along exclusive rights-of-way at ground level, aerial structures, in subways, or occasionally in streets, and to board and discharge passengers at track or car floor level LRT systems include tramways, though a major difference is that trams often operate without an exclusive right-of-way, in mixed traffic.

Commuter rail systems: Commuter rail or suburban rail is the portion of passenger railroad operations that carries passengers within urban areas, or between urban areas and their suburbs, but differs from Metros and LRT in that the passenger cars generally are heavier, the average trip lengths are usually longer, and the operations are carried out over tracks that are part of the railroad system in the area.
With the existence of the railway line and a possible future extension towards the airport, a passenger service acting as commuter rail, might be provided.

	LRT	Tramways	BRT	DBL	City Bus
Line Capacity (PAX/hr/dir.)	15,000 – 45,000 High	5,000 – 15,000 Medium/high	7,500 – 25,000 Medium/ high	5,000 – 7,500 Low	Below 1,000 Very Low, only bus stops and maintenance shop required
Alignment	Double-track railway, elevated, a-grade or in tunnels	Double track tramway, at-grade	2 to 3 Bus Lanes	2 Bus Lanes	Use public roads
Segregation	High degree of segregation preferred, but sections with shared right of way possible	Uses public roads, but may have reserved right of way on sections with higher demand	Bus Lanes must be in general segregated, exceptions possible, reduce capacity and speed	Bus Priority Lanes must be exclusively for busses	None
Road space required	None in case of elevated and tunnel alignment, 2 lanes at-grade, additional space required for stations and terminals	2 Lanes, additional space may be required for stations and terminals, tracks can be shared with public roads or pedestrian roads	2 Lanes, possibly 3 or 4 at Stations and Interchanges, space for major Interchanges and Terminals	2 to 3 Lanes (3 to 4 Lanes at Bus Stops)	Shared with cars and pedestrian
Passengers per Vehicle/Train	250 – 1.500	Depends on length	150-180	75 - 100	75
Feeder System	Neccesary	Not necessary	Desired	Not necessary	Not necessary
Flexibility of route chagnes	Low	Low	Medium	Medium	Very high

Table 13: Basic characteristics of the various public transport modes

4.6.3 Public transport planning

4.6.3.1 Public transport network

Public transport network planning is based on the principle that regular buses and paratransit should serve as feeders to the backbone MRT (Mass Rapid Transit) to form a 'Trunk and Feeder System' of public transport. Such an arrangement will maximize the value of the MRT, increase its catchment area and improve mobility for more people.

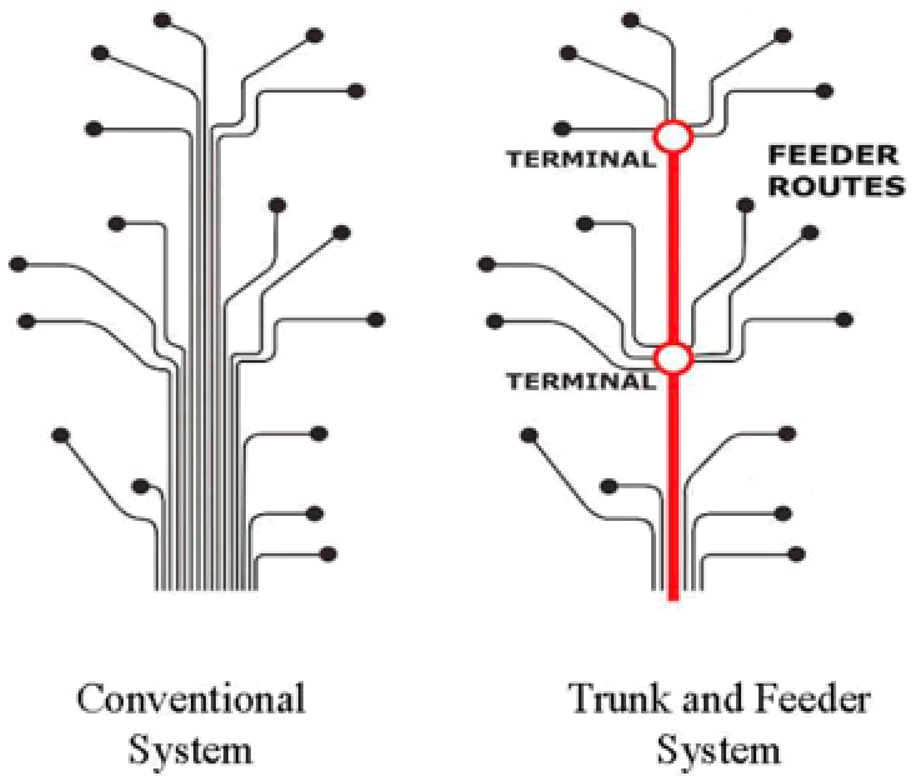


Figure 30: Concept of Trunk and Feeder System

The concept of a Trunk and Feeder System is shown graphically in Figure 30 above. Potential trunk corridors and feeder links as well as major interchange locations may be included in the public transport plan. This form of public transport, however, is suitable for relatively large cities with a higher dependence on public transport to reach city centres. For smaller cities with lower density development, some other pattern of public transport may have to be considered.

4.6.3.2 Proposed trunk route modes

While the public transport provided on the feeder routes is always the regular bus service, the trunk network has a variety of modes to select from. As rail based systems (Tram, LRT and Metro) have a very high cost of construction and significant maintenance procedures and costs and are mainly oriented towards cities of more than 1 million inhabitants, it is proposed that the various bus based services are examined for the Lamu port city. Further upgrade to LRT or Tram is also possible along a BRT corridor, for the distant future.

System Element	DBL	Light BRT	Medium Capacity BRT	High Capacity BRT
Level of Segregation	Limited	Significant	Full	Full
Overtaking Lane at bus stops	No	No	No	Yes
Stations Characteristics	Basic Shelter & Signage	Curbside Location, Level Boarding, Passenger Information	Median Location, Level Boarding, Passenger Information Onboard	Median, Passenger Info, Additional Safety & Security Features*
User Information	Provided at Stops	Provided at Stations	Provided Station and Onboard	Provided Station and Onboard
Fare Payment	On Board	On Board	Pre Boarding	Pre Boarding
Ticketing Media	Paper	Paper or Smartcard	Smartcard	Smartcard
System of Operation (Closed or Open)	Open	Open	Open / Closed	Closed
System-wide Operations Plan	No/ Multi Operators	No/ Multi Operators	Yes/Single Operator	Yes/Single Operator
Feeder Bus Routes	None	None	Some Feeder Buses	Multiple Feeder Buses
Vehicle Type	Mixed	Semi-Low Floor/Low Floor	Semi-Low Floor/Low Floor	Semi-low Floor/Low Floor, Articulated Buses
Services	Regular	Regular	Regular + Premium	Regular + Premium

Table 14: Comparison of Bus Only Lane (BOL), Light BRT, BRT, and HCBRT

4.6.4 Design guidelines

Numerous public transport design guidelines are available; however, no design guideline has found general acceptance and most cities issue their own manuals, based on their specific needs. Nevertheless, the Bus Rapid Transit Planning Guide issued by GTZ, UNEP and ITDP is a very good starting point for any implementing agency.

4.7 Air transport

4.7.1 Forecasted demand

Based on the 2011 JPC master plan the assumed annual passenger and cargo demand for Lamu is estimated as shown in the following Table considering the resort city development plan as well as New Lamu City Development Plan, under the following assumptions:

- The new Lamu Airport (Mkunumbi) would handle new air traffic generated by development of the Corridor Project including the development of New Lamu City.
- Mode of transport to be used by the visitors would be as follows:
    - International charter / scheduled flights 20 % (year 2020) – 30 % (year 2030) for resort activities.

    - Domestic scheduled flights 80 % (year 2020) -70 % (year 2030) mainly for business activities.
- Volume of the international cargo is assumed in proportion to the international passengers at Mombasa Airport.
- Volume of the domestic cargo is assumed in proportion to the domestic passengers at Mombasa Airport.

Year	Passenger Movements ('1000)		Cargo Movements (t)	
	International Charter	Domestic	International	Domestic
2009 (Actual)	0	40	-	124
2020	120	480	300	600
2025	200	350	600	800
2030	350	850	1000	1000

Table 15: Lamu airport forecasted demand (JPC study)

However, based on KAA reports Ii 2014, the airstrip handled 3,497 flight operations (1,748 take-offs and 1,749 landings) while 36,476 passengers used the facility. These figures are expected to increase in the next few years with the authority's projections showing that the airstrip will be handling more than 5,000 flight operations and serving approximately 80,000 passengers annually come 2030.

These figures differ drastically from the ones forecasted in Table 15 above, mainly due to the delay in the construction of the LAPSSET corridor components, such as Lamu port city and Lamu resort city.

4.7.2 Manda airport

Air connection to Lamu county is currently achieved through the Manda airport (LAU). This airport is located on Manda island and has two runways: The first runway (16/34) is paved with asphalt, while the second runway (08/26) is unpaved and is approximately 930m long. KAA recently completed an upgrade of the Manda airport including lengthening of the main runway from 1.1km to 2.3km and building a new airport terminal building. Further upgrade plans are underway for the construction of a parallel taxiway and aircraft apron area to improve capacity of the airport.

The following Figure shows the conceptual design for the upgrade of the Manda airport and the corresponding facilities.

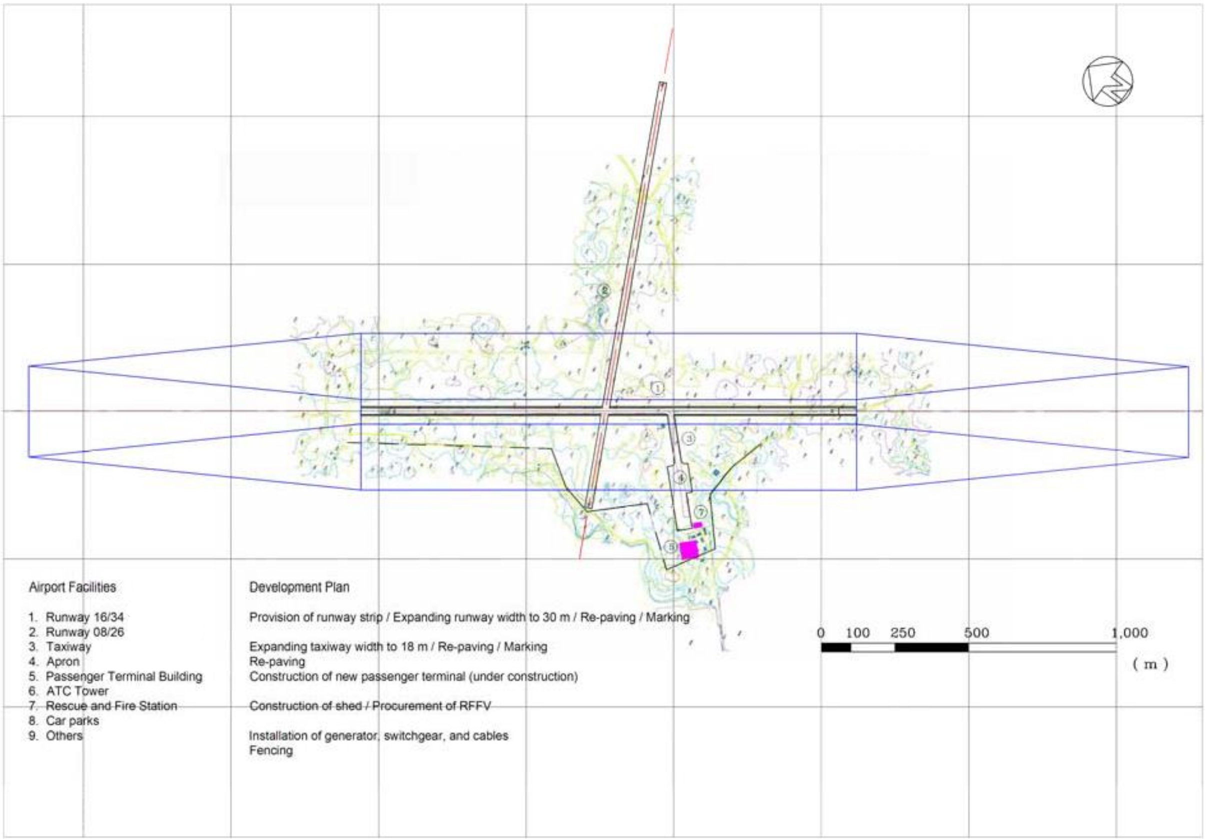


Figure 31: Conceptual Development Plan of Existing Lamu (Manda) Airstrip (JPC study)

The recent upgrade of the main runway to 2.3km, provides the same capacity as the new proposed airport in Mkunumbi for Phase I, that would handle expected traffic until 2025. Considering the differences in forecasting seen above, it is expected that there should be no problem for the Mandra airport to cater for traffic at least until 2030.

4.7.3 New Mkunumbi Airport

In the JPC 2011 master plan study where air transport demand forecasting was carried out for proposed locations, it was established that up to the year 2030 only the new Lamu airport to be located at Mkunumbi on the mainland was justifiable. Initially a runway measuring 2,500m was proposed to accommodate cat. D operations (Critical aircraft being B767-300ER).

The New Lamu Airport will need to have a main runway and a secondary cross runway for propeller driven aircraft for which the maximum permissible crosswind component is to be set at 10,000t, according to ICAO Annex 14. As discussed in the JPC master plan, the main runway in Phase I is proposed to have a length of 2,500m to enable short to medium-haul international operations. The length of secondary runway has been set 1,300m to accommodate up to ATR 42 and comparable size of aircraft.

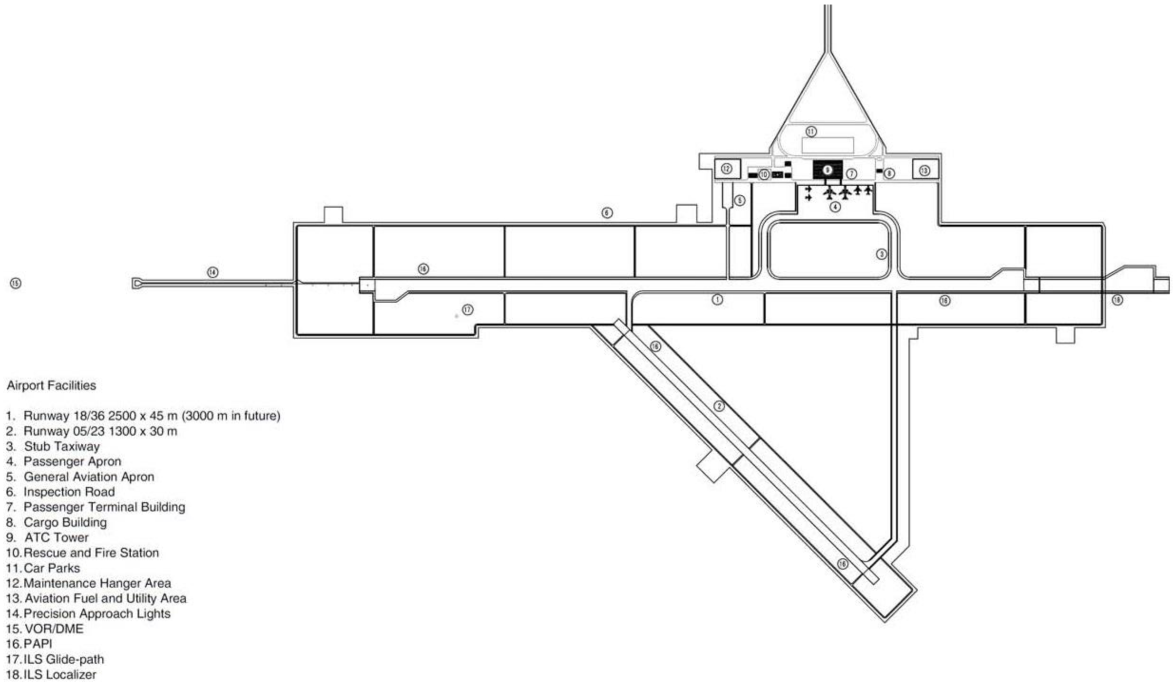


Figure 32: New Mkunumbi airport proposed layout

4.7.4 Design guidelines

International airports should always follow ICAO design guidelines and IATA regulations and recommendations.

4.8 Water transport

Another form of external connection for the Lamu County is maritime transport or also known as water transport. Water transport in the County dates back a very long time and is very important because it links Lamu with other port Cities in/and outside Kenya.

Water transport relating to the LAPSSSET corridor is covered fully under section 3: Port operations planning, as it refers to all port related activities. This paragraph refers to the water transport network interlinking the various components, such as the Manda airport, the resort city and the Lamu port city, as well as other local destinations (within Lamu county), so as to also cater for the transport needs of the local population, irrespective of the LAPSSET project. The main focus therefore of this paragraph is passenger transport and not freight or cargo transport, that is the focus of Lamu port.

4.8.1 Water transport network in Lamu county

There are several jetties in Lamu county, but the most important ones are the KPA jettie on Lamu Island and the Mokowe jetty on the mainland. These two are the busiest, registering the highest number of boats carrying both passengers and goods. Equally important is also the Manda Island jetty that connects Manda Airport to the rest of the network.

Photo 24: Typical example of passenger carrying vessels used in Lamu county

Other jetties in the county are also located at Mkunumbi, Kizuka, Magogoni, Kizingitini, Mtangawanda, Siyu, Matondoni among others.

As stated in the County Spatial Plan (CSP): “with extensive mangrove forests, swamps and mud due to tidal changes, access to and from the sea is difficult without jetties and they act as the terminal facilities to necessitate water transport within the islands”, that shows the importance of availability and correct design of berthing facilities for the water transport vessels.

The Figure hereunder shows the currently available water transport connections, as depicted in the County Spatial Plan.

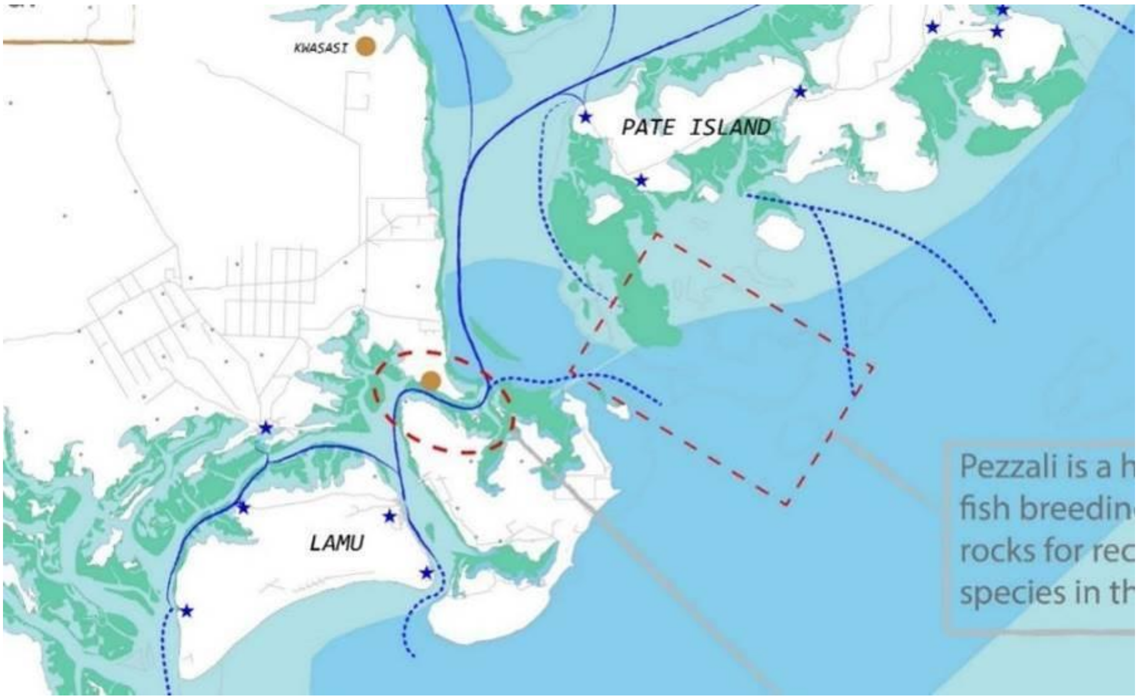


Figure 33: Current public water transport routes

It is therefore proposed that a comprehensive network of water transport routes and destinations is provided. This network will also form part of the public transport network, thus providing better and more complete service to the local population of Lamu county.

As part of the public transport, the water transport network should also be:

- Safe for the public,
- Comfortable,
- Clean,
- Affordable.

And share all the characteristics mentioned above under the respective paragraph for public transport.

Figure 34: Proposed water transport network

The network proposed in the above figure is indicative and should be formed according to the current local needs. Nevertheless, all main destinations have been covered, such as Lamu old town, Manda airport, mainland (Mokowe), as well as additional available jetties.

It should be stresses that water transport regarding Lamu and Manda islands should be strictly restricted to passenger traffic only and not cars or trucks. Cargo from Manda airport, as shown in Table 15, is very small and can easily be accommodated through cargo vessels without the necessity of motorised means.

4.8.2 Water transport facilities

The facilities provided for the water transport include both the vessels as well as the jetties and infrastructure associated with them.

Vessels

The necessary vessels for the public water transport need to be safe and vary in range and type so as to cover all requirements. Such types of vessels include:

- Fast transport for small groups (equivalent to taxi),
- Larger passenger carrying vessels (equivalent to buses),
- Car and passenger carrying vessels,
- Cargo vessels

Some examples of such vessels are shown in the photographs below:

Photo 25: Example of safe and comfortable passenger carrying ferries

Photo 26: Examples of car & passenger ferries in Greece (left) and Lake Victoria (right)

Jetty facilities

Jetty facilities should also provide all the safety and comfort expected from similar facilities of land transport (e.g. safety, cover, accessibility, etc). Furthermore, any berthing facility should provide ample docking space for the number and type of expected vessels, as seen in the following photo from Venice, Italy.

Photo 27: Example of multiple different type jetties

Jetties for dedicated passenger transport examples are shown below:

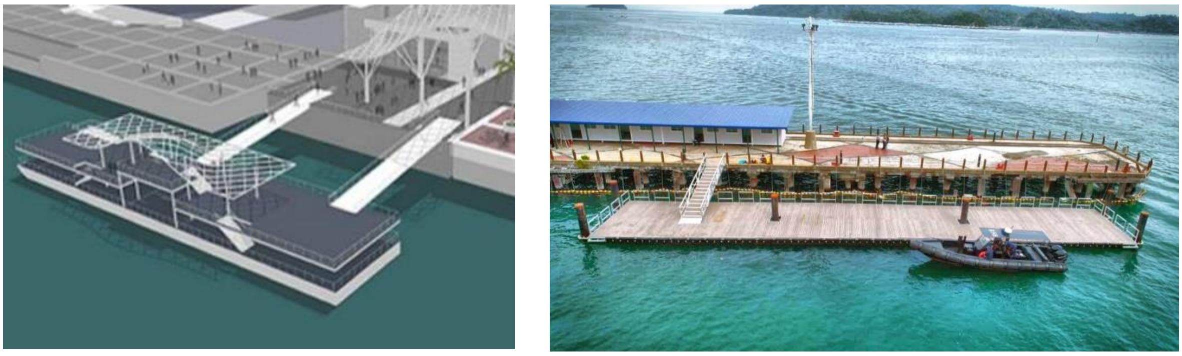


Photo 28: Visual images of typical passenger jetties

While jetties for motorised transport vehicles and passengers can be much simpler, as shown below from Lake Victoria.

Photo 29: Typical vehicle ferry docking facilities

4.8.3 Design guidelines

Ferry and boat traffic is governed by international maritime law, as well as instructions from the overseeing agencies (KPA, KMA) who enforce them, much like in land transport traffic is governed by the traffic code that is enforced by the police.

Regarding the design of jetties and docking facilities, relevant guidelines and regulations that can be used are the following:

- BS 6349-1: 2000 Maritime structures. Code of practice for general criteria, British Standards Institution.
- BS 6349-2: 2000 Maritime structures. Design of quay walls, jetties and dolphins, British Standards Institution.
- BS 6349-3: 2000 Maritime structures. Design of dry docks, locks, slipways and shipbuilding berths, shiplifts and dock and lock gates, British Standards Institution.
- BS 6349-4: 2000 Maritime structures. Code of practice for design of fendering and mooring systems, British Standards Institution.
- BS 6349-5: 2000 Maritime structures. Code of practice for dredging and land reclamation, British Standards Institution.
- BS 6349-6: 2000 Maritime structures. Design of inshore moorings and floating structures, British Standards Institution.
- BS 6349-7: 2000 Maritime structures. Guide to the design and construction of breakwaters, British Standards Institution.

4.9 Other local and regional transport links

As it has been discussed previously, the road network in Lamu county is in bad condition and connections within the county are become very difficult and time consuming.

Although not within the scope of the transport master plan, whose goal is to interconnect the various LAPSSET components within the county, it is believed that the it would be highly beneficial for the county and therefore also for the LAPSSET project, if additional roads were proposed for upgrade within the county.

In this context the Consultant has reviewed existing studies and plans and the following proposals are in line with the County Spatial Plan and the needs of the community:

1. Upgrade to Asphalt standard:
   - Majengo – Kiunga (which connects A10 with the whole northeastern part of the county);
   - Mpeketoni – Kibaoni (which connects Mpeketoni to the Lamu – Witu – Garsen road);
   - Mkunumbi – Mpeketoni (which will provide easier access to water transport for Mpeketoni).

2. Upgrade to gravel standard:
   - Witu – Kipini,
   - Witu – Pandaguo,
   - Witu – Maleli,
   - Kiunga – Mkokoni

The following Figure from the County Spatial Plan shows the proposed road network hierarchy and all the proposed road upgrades.

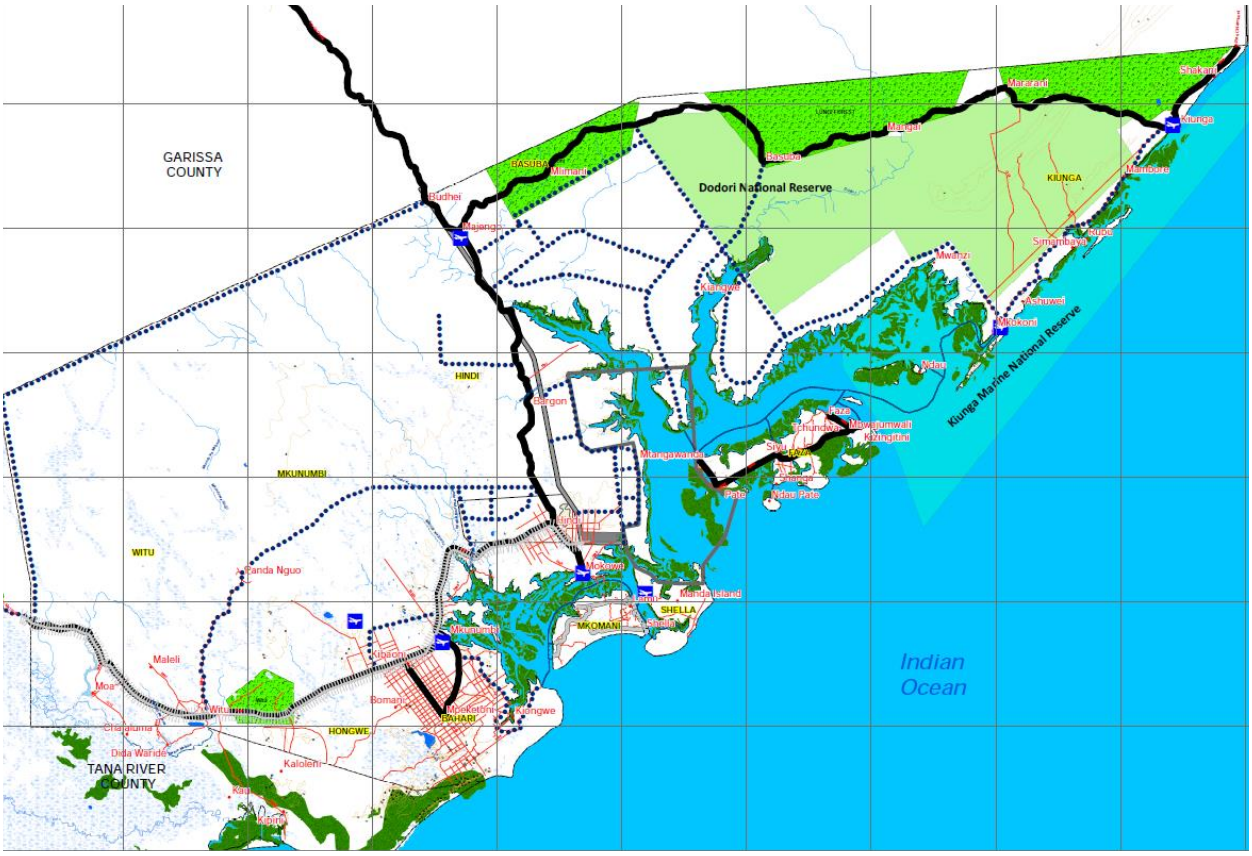


Figure 35: Proposed road upgrade projects for the Lamu county (from CSP)

4.10 Conclusions

The Integrated Infrastructure master plan, as presented before, has identified the following transportation related infrastructures (excluding rail related infrastructure that is presented in a separate chapter):

i. Lamu – Garissa – Isiolo highway (A10); This road has a signed commercial contract for construction under the concession framework and therefore does not fall within the purview of this study. Nevertheless, this studies' comments and proposals regarding intersections and connections should be taken into consideration.

ii. Lamu – Wity – Garsen highway (A7); This study is currently under construction. However, not taking into consideration the LAPSSET requirements on traffic loads and connections. Upgrade of this highway will be required in the future, so it can be incorporated in the urban network.

iii. Main urban road network; this road network will develop along with the urbanisation of the area and the influx of population.
iv. Main SEZ/port network; as with the urban roads, the port/SEZ roads will develop alongside the development of the port.
v. Manda Airport; The upgrades required are either underway or already planned. Full airport upgrade should be constructed before 2030.
vi. Water transport facilities; Current water transport facilities are adequate for the local population, but should be gradually upgraded with the influx of tourists and the growth of the urban area population.
vii. Lamu county rural roads. Following the construction of A7 and A10, the rest of the county network of roads should follow to provide access to the facilities to all the local population.

The estimated costing of the infrastructure presented in this Chapter is shown in the table below:

Project	Cost ($)	Comments
A10 Service roads and junctions	40,000,000	Additional to the A10 construction
A10 dualization	1,250,000,000	within Lamu county
Main urban arterials	35,000,000	Other roads to be provided by developers
Primary port/SEZ distributor roads	27,500,000	Other roads to be provided by developers
A7 upgrade to urban motorway	10,000,000	
County rural network (Asphalt roads)	75,000,000	
County rural network (Gravel roads)	15,000,000	

Table 16: Costing of various infrastructure elements included in the Integrated Transport Master Plan

The proposed timeline for the implementation of the required transportation infrastructure under this master plan is shown in the table below:

Project	Starting year	Ending year	Comments
A7	2017	2020	Under construction
A10	2018	2024	Under construction
A10 service roads & junctions	2022	2024	Depending on traffic loads
A10 dualization	2030	2033	Depending on traffic loads
Main urban roads	2020	>2050	Following urban development
Main port/SEZ roads	2020	>2030	Following port/SEZ development
Water transport facilities	2018	2021	
Manda airport upgrade	2020	2022	Planned upgrades
County rural network (Asphalt roads)	2020	2023	To connect to A7 & A10
County rural network (Gravel roads)	2018	2020	For immediate use of the community

Table 17: Proposed timeline for implementation of various components

5 Urban planning

This section deals with the urban planning implications of the LAPSSET corridor transport components. Throughout it is understood that LCDA is not an urban planning authority. However, as the body with overall co-ordinating responsibility for LAPSSET, it needs to provide guidance and policy recommendations, to implementing agencies, for Lamu Port City (LPC) to ensure that in terms transport provision its development, at least within Lamu County, is fully harmonised with other LAPSSET components. Figure 36 below shows the study sequence from port planning, to transport infrastructure, urban planning etc.

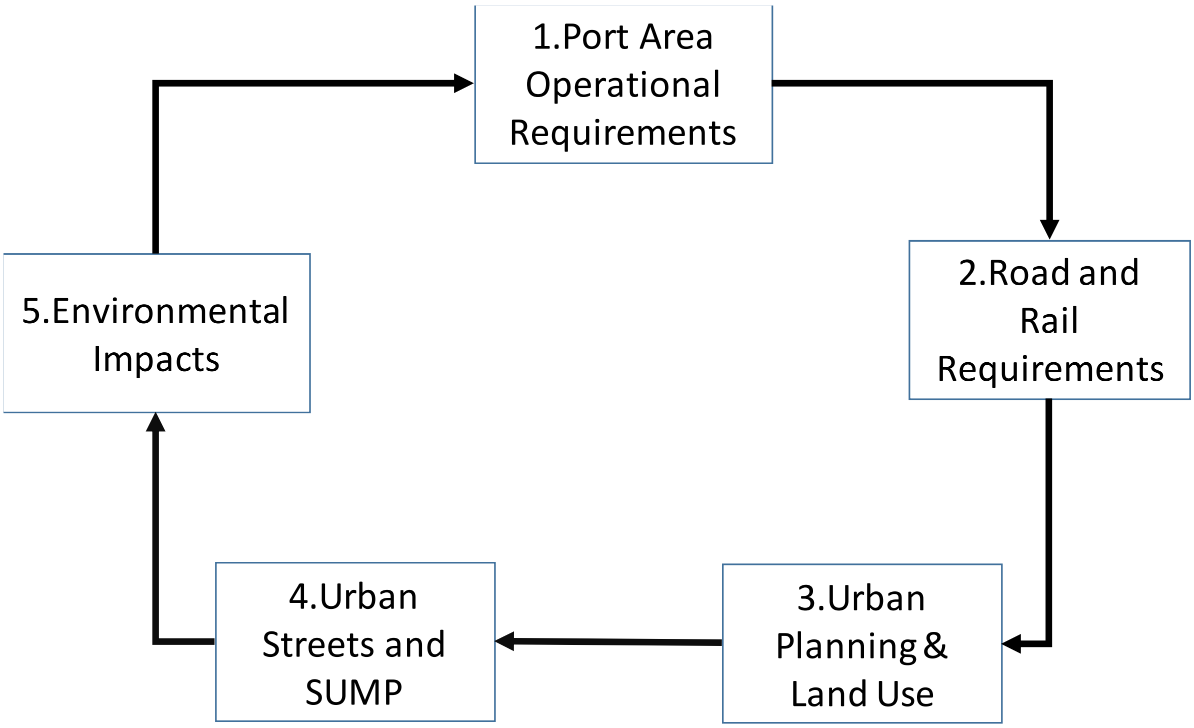


Figure 36: Urban Planning in the LAPSSET Transport Master Plan

5.1 Introduction

National planning and transport strategy should seek to achieve a hierarchy of cities and towns, linked by efficient transport networks, underpinned by economic activity and investment. It should also try to minimise overall travel demand, reduce carbon emissions and reliance on fossil fuels. Central to this is the alignment of spatial planning and transport policy to contain suburban sprawl, link employment to transport and encourage modal shifts to more sustainable modes of travel such as NMT and public transport.

In what follows it must also be remembered that Lamu Port City (LPC) being a totally new urban area will, to a great extent, be a pioneer in city planning for Kenya in that it will try to avoid the problems of existing Kenyan towns and cities. Many recommendations and standards with regard to urban transport and mobility provision (whether infrastructure, multi-modal transport) have not been implemented elsewhere due to unplanned urban developments that render any plans obsolete.

The development of LPC will provide a suitable context for these standards as well as many other urban mobility policies. It will also be a test as to how well-established enforcement and development control systems operate and the extent of capacity building that will be required for all local and central government implementing agencies and authorities.

LPC transport policy must also reduce mobility inequalities between areas where in the future motorised land transport will be available and areas, such as Lamu Town, where motorised land transport cannot be used. This can be achieved with positive measures that favour water-borne public transport trips that are comparable to terrestrial public transport arrangements.

5.2 Lamu Port City - Overall Objectives of Urban Transport Policy

5.2.1 Integration

Integration of LPC with port-related activities must be guided by an appropriate transport policy framework.

Ensuring the efficient and sustainable mobility of people and goods within the future LPC area will be an important factor that in conjunction with other factors will determine lifestyle choices and improve amenity and quality of life for both long term residents and short-term visitors. The objective of LPC transport policy should be, amongst others the reduction in the mobility inequalities and conflicts that have been observed in other Kenyan urban areas especially with regard to motorised and non-motorised transport. Priority must be given to non-motorised transport (NMT) modes and public transport followed by private car mobility rather than the reverse which usually leaves little room for NMT and public transit modes.

Integration of LPC with the LAPSSET transport components (port, rail, airport, pipelines etc.) must be balanced and achieve a degree of transport equity – that is LPC planning must not be driven purely by port requirements but by the future needs of the population who will expected to move and live in the project area. For this reason, the built environment must be attractive and promote sustainable infrastructure and transport choices. At the same time the urban area needs efficient connectivity to the employment and industrial zones so that economic activities that locate there have the lowest transport costs possible compatible with sustainable mobility.

The above principles are widely known as Sustainable Urban Mobility Planning (SUMP). SUMP puts NMT and transit modes first and private cars second. Table X below summarises the differences between SUMP and conventional transport planning:

Traditional Transport Plans	***Focus***	*Sustainable Urban Mobility Plans*
Often short-term perspective without a strategic vision	**Strategic level / vision**	Including a long-term / strategic vision with a time horizon of 20-30 years
Focused on particular urban centre/area	**Geographic scope**	Looking at wider travel area co-operation with neighbouring authorities important
Limited input from operators and other local partners	**Level of public involvement**	High level of stakeholder involvement
Not a mandatory consideration	**Sustainability**	Important to consider wider social equity, environmental and economic objectives
Low level of policy interaction	**Sector integration**	Integration of different practices and policies affecting travel
Often limited and little link between outputs and objectives	**Monitoring and evaluation**	Focus on the achievement of measurable targets and outcomes/impacts
Traditional emphasis on road schemes and new infrastructure	**Thematic focus**	Shift in favour of measures to encourage public transport, walking and cycling etc.
Not considered	**Cost internalisation**	Review of transport costs and benefits also across policy sectors

Table 18: Comparison of SUMP and Traditional Planning Frameworks

A necessary precondition for successfully implementing the LPC's SUMP vision will be to establish conditions for transport provision and mobility that offer residents and visitors a range of mobility options. All mobility options must allow, without bias, access to residential, employment, commercial and leisure activities.

5.2.2 LAPSSET Urban Transport Policy Guiding Principles

The LAPSSET transport master plan therefore will outline some basic principles to ensure that an effective and integrated mobility is available for the movement of people and goods within the LPC plan area. LPC Transport Policy must satisfy the plan area's current mobility requirements without constraining the choices available for future transport users.

Though over-used the term 'Transport Sustainability' is still a desirable goal. It ensures that satisfying the mobility needs of the present generation will not constrain the mobility needs of future generations. However, neither must LPC needs constrain the economic opportunities afforded by the port and industrial areas. The LPC and Port must work in tandem.

Proposed land uses must be distributed in a rational manner. This means matching land uses to the LPC road/transport investments to maximise expected benefits and avoid burdening and congesting any particular part of the plan area. This avoids bottlenecks appearing in any part of the plan area for the foreseeable future.

Consequently, every intervention must be:

- people centred,
- based on the principles efficiency,
- safety,
- environmental sustainability, and
- social equity.

5.2.3 Assigning Roles

For an urban planning process to be successful and productive roles need to be properly assigned. There is in many countries the 'cult' of engineering and this not wrong. It simply must be mobilised at the right moment. In Kenya often not-sufficient seriousness is attached to other profession with the result that too much is asked of one or two professions with usually poor results in terms of urban planning and life quality.

For LAPSSET there must be a recognition that a proper allocation of roles and share of responsibilities between architects and urban planners on the one hand and engineering professions on the other. The Figure below shows in simple diagrammatic form this necessity. The stages (i.e. 1 to 9) can be any suitable designation as the case may be. What it shows is that the Urban planner – Architect must be heavily involved at an early stage. This will save substantial resources in the long run.

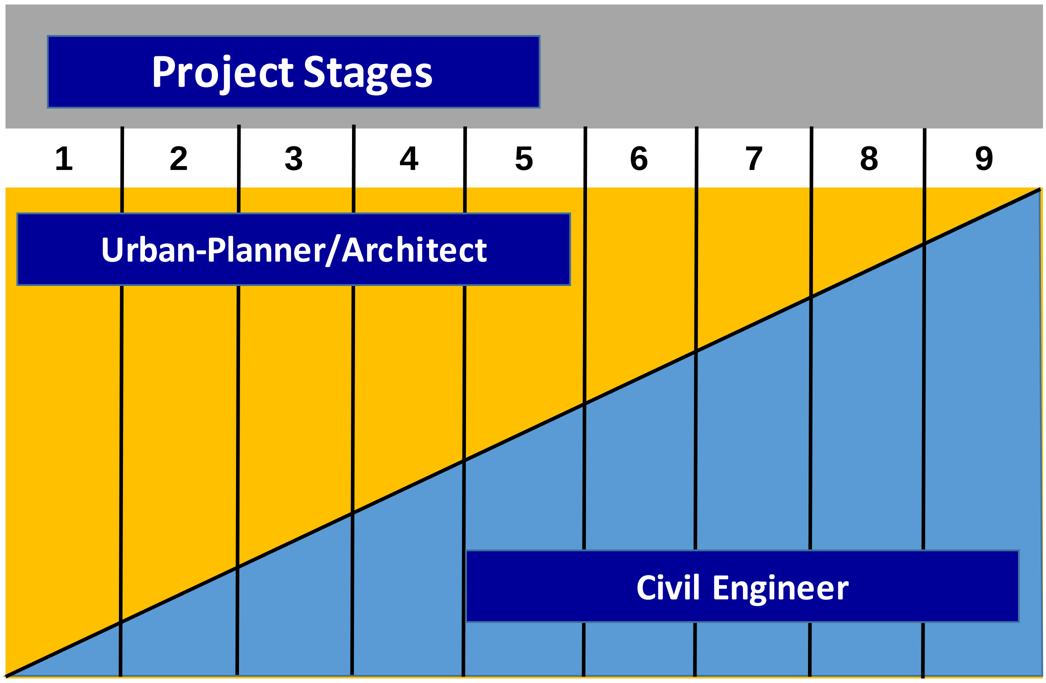


Figure 37: Assignment of Roles in Urban Planning

5.3 LAPSSET strategic level policies

Any LAPSSET SUMP policy comprises an inter-related and multi-dimensional group of tools. These must be implemented entirely and not piece-meal if the policy is to be successful. So, at a strategic level the LPC component of LAPSSET must comprise the following:

- Reduction of the use of private transport within the plan area and especially the CBD,
- Promoting the role and ensuring the operational efficiency of public transport,
- Ensuring shorter trips are possible,
- Ensuring that infrastructure and land uses promote as many trips by non-motorised transport such as walking, animal drawn transport, cycling.
- The alignment of LAPSSET transport policy with national strategic transport policies and on-going programmes for strengthening public transport such as BRT and
- Adopting lessons from successfully implemented SUMPs.

Another crucial requirement will be the setting up of a network hierarchy of modern and efficient roads comprising primary, secondary and tertiary urban roads whose objective is the efficient movement of goods and people in comfort and safety within:

- the LPC plan area,
- between the LPC and port area and
- between LPC and the rest of Kenya.

This is in conjunction with the drafting of land-use provisions and regulations that ensure a more effective control of uncontrolled linear road-side developments and hawking and the gradual introduction of quality standards for the design, construction and subsequent maintenance of every category of urban road. Road side hawking is not a right and the intended transport benefits of many expensively constructed roads in Kenya have been lost due to informal, unofficial, uncontrolled road-side activities. This particular provision also applies to Lamu Town where commercial activity is growing along the sea front.

Other objectives of transport policy are:

- A result focused system that recognises the connection/inter-relatedness of land-use policy and transport infrastructure policy so that transport planning is an integral part of urban planning and vice-versa.
- In the medium to long-term the management of on-street parking demand especially along major commercial activity spines, primary roads and residential areas.
- The design and implementation of mobility infrastructure for people with special needs.

5.4 Proposed LPC Urban Road Network Hierarchy

The LPC area will contain roads at several different levels (see Road Hierarchy for more detailed description). An important transport component of Lamu Port City is the street network. Without a well-designed street network, the City will function inefficiently and will create avoidable transport costs such as congestion and reductions in noise and air quality. All these are avoidable if agreed basic principles are adopted right from the start. As Lamu Port City is an entirely new settlement there is an opportunity implement many of the concepts that are talked about with regard to Nairobi but are difficult to put into practice due to poor planning and development control.

Lamu Port City may ultimately have a population of 1.2 to 1.5 million, but it can be built for sustainability. This will avoid future corrective interventions that will be several times costlier in the future.

Within the planned Lamu Port City urban area the road allocation will be determined according to the type of service provided. The LPC area is large in extent and it is immediately apparent that the entire spectrum of roads will be required. Descriptions of these are provided below. Some of the broad transport corridors for LPC are known already and included in the Atkins plan. These are roughly the multi-modal 'north-south' corridor that includes the A10 Lamu – Garissa – Isiolo road and the mainly road transport 'east-west' corridor along southern base of the LPC urban area i.e. the A7 Lamu – Witu – Garsen road.

These are the principal strategic corridors that allow for the efficient movement of people and the import and export of goods through Lamu Port to national and international destinations. Beyond these two axes an extensive 'internal' road network will need to be planned and built that will serve the industrial zones, port areas as well as the residential, mixed use and leisure areas of the city down to neighbourhood level.

Given the planned final population and geographical extent of LPC the investment required will be considerable and both traditional and alternative funding mechanisms will need to be mobilised for the purpose.

However, the full-development horizon is 25-30 years in the future. This will allow sufficient time for local government revenue generation required to maintain and operate all the transport infrastructure and systems.

It goes without saying that land use and urban planning provisions must be compatible with the road standard that has been assigned. The LPC road network will develop in tandem with the phased expansion but in terms of timing slightly preceding the construction 'filling in' phase so that mobility is available immediately.

One of the criticisms of the classification led approach is that the same set of standards are applied along entire routes, regardless of Context. Urban roads and streets can traverse

many areas with very different characteristics, such as industrial areas, residential areas, mixed use neighbourhoods and city, town and village centres. This clearly requires different design solutions within each of these different contexts.

(Context refers to major urban elements: (i) CBD/Town Centre = High Density (ii) Neighbourhoods = Medium Density (iii) Suburbs = Low Density (iv) Business Parks/Industrial Estates = Heavy/Medium/light Industry, Logistics etc.. These are all prescribed in the LAPSSET LPC plan and will ultimately appear over time).

5.4.1 A. The Major Road Network

(i) Major Arterials or national trunk roads: These are always 4-lane or even 6-lane divided carriageways. These are not within the LPC plan area but follow the boundaries separating LPC from the industrial zones and Leisure City. These are roads of national and regional importance with high speeds for long distance travel with exclusively grade-separated junctions with set minimum dimensions and minimum distances between junctions. Major arterials are situated outside the Plan boundaries whereas Urban expressways are natural extensions of the national roads into the plan area. This class of roads connect the outlying areas of the LPC plan area with more central functions. In terms of specifications these roads are characterised by the wide spectrum of speeds they can have which is determined by the strict control of accessibility and minimum distances between (grade separated) junctions.

5.4.2 B. Principal Arterial Road Network

(i) Primary Arterials: these are roads with physically divided carriageways with at grade signal controlled (or grade separated) junctions and a limited number of direct access points to roadside developments through service roads. Primary arterials will provide the main means of moving between different Environmental Development Zones (EDZ) of Lamu Port City. The designs must provide for BRT facilities/lanes where necessary. Any of the main inter-urban arterial or collector roads passing through Lamu Port City are likely to be suitable for adoption as principal urban arterials (where there are no urban class A roads). Their traffic volumes may also be high enough to justify dualization, whilst access is strictly controlled and made through parallel service roads/lanes.

(ii) Secondary Arterials: Main roads with or without physically segregated carriageways with controlled at grade junctions with limited access to roadside developments. The design must provide for BRT facilities/lanes. Segregation of non-motorised traffic (pedestrians and cyclists) will included from the design stage. These roads provide links between local districts within urban areas. Whilst they are important traffic routes they can have significant movements of buses and cyclists along them (segregated or on-road) and pedestrians crossing them where there are schools, shops, offices and businesses. Positive measures for pedestrian safety may be required and assistance for cyclists by way of cycle tracks and junction facilities for cyclists may be required where alternative cycle routes are not available. It is not good practice to install road bumps on these types of roads as this can lead to unnecessary congestion.

The primary arterial road network as shown in the LPC layouts will not be built in one phase but according to the principle of phase sustainable expansion. However, the RoWs must be secured and established during the development control process. This is an absolute compulsory task for Lamu County urban planning authorities given that the overall alignments for these roads are not flexible and need long-term planning.

In the case of primary arterial roads when applications for roadside developments within residential areas are being determined, Lamu County urban planning authorities must ensure that service roads will be built as well as buffer strips as well as restriction of direct access to secondary roads and to roadside developments. The objectives are:

- to reduce the loss of amenity to roadside developments whilst at the same time
- securing the traffic capacity, designated function and road safety features of the road network.

It is anticipated that this policy will reduce road accidents and environmental impacts that can be expected along the length of these roads bearing in mind that the smooth and uninterrupted flow of traffic can contribute substantially to a reduction in carbon emissions and other vehicle caused pollution.

The land requirements for road development will be ensured by the inclusion of special conditions in planning applications, or compulsory land acquisitions as the case may be.

During the detailed design phase of these roads provision must be made for all the necessary supportive infrastructure that will ensure roadside urban land uses can function in their designated manner. This may include pedestrian crossing facilities and ensuring the continuity of cycling and pedestrian routes.

Given the recommended development phasing, primary arterials will not be constructed through already built up or developed areas so that detailed ESIAs for them will not be required. If road development is out of phase with urban development, then ESIAs will be required in every instance. However, all the necessary environmental safeguards and landscaping must be considered as an inseparable part of the design so that roads harmonise with the surrounding areas.

Arterials require at-grade or grade separated junctions. The exact type will be determined following a detailed traffic assessment to be carried out by Lamu County or other implementing agency such as KURA or KeNHA.

5.4.3 C. Distributor Road Network

(i) Primary Distributors: These roads provide for local journeys and links to major routes. Many such roads will have residential and commercial access/frontage and there will be significant movements of pedestrians and cyclists. Designs should not provide unnecessarily wide roads since these encourage higher speeds which can cause problems for the movement of pedestrians and cyclists and lead to accidents. Road bumps should not be provided unless there is a specific road safety related issue. Designs should have good provision for pedestrian and cycling modes.

Distributor roads will comprise the main body of the cycling network. The primary distributor network constitutes a unitary and complete system in which all parts play their part. When segments of the primary distributor network are not implemented this can negatively affect the functioning of the entire city. The suggested phasing ensures that at all times resources are available that match the primary distributor network requirements.

The construction of primary distributors must be carried out with particular attention given to the integration of supportive SUMP related infrastructure such as sidewalks of adequate width, pedestrian crossing facilities, integration of traffic management measures, traffic calming, integration of cycleways etc.) Since the LPC site is not burdened with existing developments all of the above can be included when need can be demonstrated and recommended through specific studies.

5.4.4 D. Collector Road Network

(i) Primary Collector Roads: Roads that service through traffic and collect and distribute traffic from the road network to principal arterial roads. Collectors also provide the link between arterials and local roads, distributing traffic to residential and other defined zones. They are likely to be the main type of collector in medium-sized towns, but may be absent in smaller towns. Designs should include traffic calming features that follow standard designs. Speed bumps should follow an approved standard design and not haphazardly and unofficially installed by local communities. This presupposes that the local authorities are proactive and aware of the needs of residents.

(ii) Secondary Collector Roads: Rods that collect traffic for distribution to primary collectors or principal arterials.

5.4.5 E. Local Road Network

Designs should aim to keep vehicle speeds low (30kph or less) through traffic calming and allow vehicular access to property and also allow for the delivery of goods and servicing of premises. Segregated cycle tracks should not generally be required, and pedestrians should have considerable freedom for crossing such roads. In some circumstances shared pedestrian/vehicular areas may be appropriate. Traffic calming to keep speeds as low as

30kph be achieved through road humps (in moderation) and in accordance with design standards.

Within the local street category there are sub-categories. At this stage these may be needed only when the environmental development zones are being developed. Nevertheless, in keeping with the principle that LPC is expected to have a positive demonstration effect on future urban development in Kenya this level of detail is necessary.

(i) Major Local – Local/Shopping Streets. These roads include the main shopping and business streets in the urban central business district or suburbs of larger towns and cities, other than designated minor arterials. They are also likely to feature prominently in smaller urban settlements and markets. They need to cater for a high level of pedestrian access to commercial properties fronting directly on the street. Major local streets will be connected to collectors and other local streets.

(ii) Minor Local - Non-Residential Access Roads providing direct access to individual or groups of properties, other than residential areas, or to places of specific social or economic activity, including industrial and commercial areas, and government institutions such as schools, hospitals, prisons, government housing, etc. This class may be appropriate for many of the special purpose roads presently classified as 'G' (government) roads. Most roads are likely to be quite short and traffic volume will vary with the type of activity served.

(iii) Local Access - Residential Access. Roads providing direct access to groups of residential properties, comprising local residential streets and constituting the lowest tier of the hierarchy of urban roads suitable for motorized transport. Typical traffic volumes are expected to be about 400 ADT per 1000 population served in larger towns.

The movement towards more integrated and sustainable forms of development will result in a shift away from dendritic street layouts (i.e. roads with dead cul-de-sacs) to highly connected networks which maximise permeability, particularly for pedestrians and cyclists. When designing new street networks designers should implement solutions that support the development of sustainable communities. In general, such networks should:

- be based on layouts where all streets lead to other streets, limiting the use of cul-de-sacs that provide no through access.
- maximise the number of walkable/cyclable routes between destinations.

Figure 38 illustrates three network typologies that can be adapted to the needs of place. Street networks that are orthogonal in nature are the most effective in terms of permeability (and legibility).

Street networks that are curvilinear may also be highly effective. Street networks that are organic have usually developed over time in a haphazard manner, but can be highly connected – such as Lamu Town. The organic layout of Lamu Town and other local communities can be very different from orthogonal grids, but perform a similar function equally well.

Figure 38: Diagram Showing Examples of Residential Street Grids

5.5 Cycling/Pedestrian Network and Pedestrian Sidewalks

In keeping with the SUMP philosophy and the adjacent NMT-only UNESCO Heritage Lamu Town, LPC will also need an extensive network of cycleways and pedestrian routes. In the initial phases of development (See proposed phasing) the CBD will be the focus of many motorised trips causing congestion – unless facilities for sustainable mobility modes are designed from the start. Walking constitutes the dominant mobility mode in Nairobi (40%-45% of trips) and providing integrated facilities is not only environmentally but socially responsible since it addresses the mobility needs of all income classes not just private car owners. In fact, all road users are at some point in their journey pedestrians.

In this context it must be pointed out that a worrying trend in the used of boda-bodas has been observed in Lamu Town in violation of its non-motorised status. It must be stated in no uncertain terms that motorcycles are not classified as non-motorised traffic since they have internal combustion engines and move at high speed. The problem is exacerbated by the fact that there appears to be no regulation in evidence. If this relative ‘flexibility’ is transferred to the main LPC it will undermine master plan goals and erode the benefits of the street and road hierarchy.

There are many NMT transport alternatives that are in use throughout the world. In addition, it has been claimed ferries will undermine water transport livelihoods, whereas bodas are already doing so.

Basic definitions are as follows:

i. Cycleways: Specially configured/designed routes along the length of urban roads with separation from the main carriageway and traffic lanes or completely independent cycle routes for the exclusive use of cyclists.
ii. Pedestrian Routes/Sidewalks: Specially configured/designed routes along the length of urban roads with separation from the main carriageway/traffic lanes or completely independent pedestrian routes for pedestrian use only.
iii. Combined cycling/pedestrian routes: These are specially configured/designed routes along urban roads segregated from the main carriageway/traffic lanes or completely independent routes for the exclusive use of pedestrians and cyclists. It’s advisable to differentiate the pedestrian usage from the cycling usage through the use of different colour materials or a subtle difference in height between the two as well as the appropriate signage and markings. See the Figure below.

Photo 30: Combined Pedestrian-Cycling with differentiated materials and clear marking

The SUMP approach is shown diagrammatically in Figure 39 below.

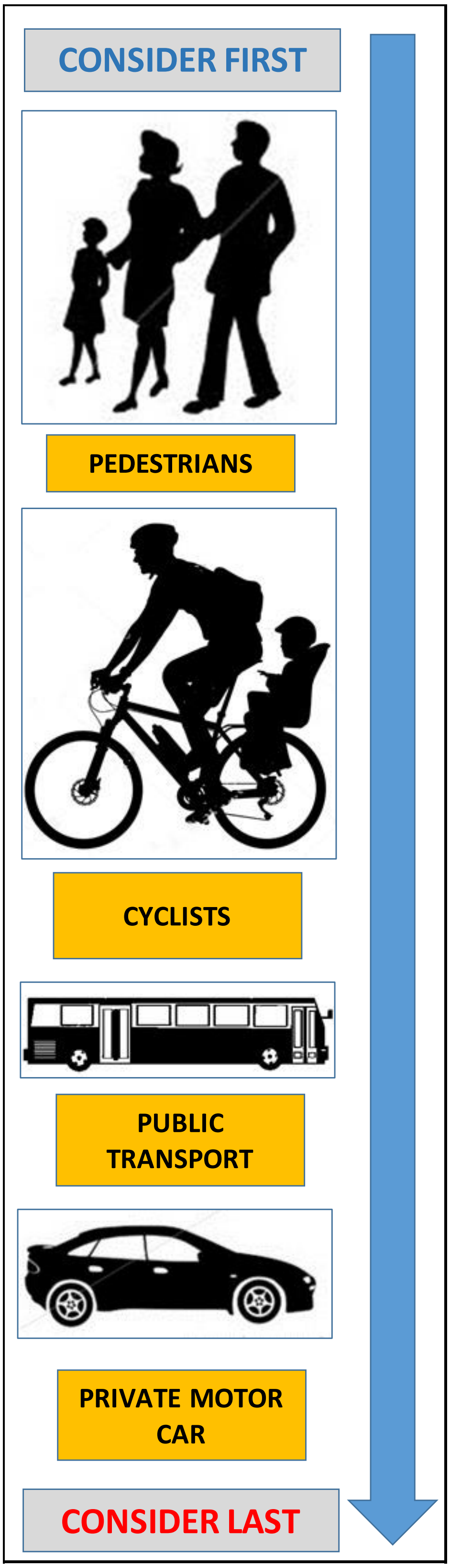


Figure 39: SUMP Considers Non-Motorised Modes first and Private Car Last

5.6 LPC Radial Roads

Many cities that have grown organically over time have radial roads that converge on a centre and when not treated funnel traffic and cause congestion. Nairobi is an example of activity with such roads. The LPC area being entirely new does not have any radial roads and is not envisaged to have any since its basic road network is defined over a grid system.

5.7 Environmental Development Zones (EDZs) and relation to Road Network

i. Principal Arterial Road Network: The principal arterial road network defines, besides other functions, the system of 'environmental zones'. These are the large quadrilaterals shown in the Atkins plan for the LPC portion of the plan (see Table below) and include Low Density Residential, Medium Density Mixed Use and High Density Mixed Use. These are fully functional urban units.

Environmental Development Zones (Atkins)			
24	41	57	73
25	42	58	74
26	46	63	75
27	47	64	
28	48	65	
33	49	66	
34	50	69	
38	54	70	
39	55	71	
40	56	72	

Table 19: Table 2 Environmental Development Zone Numbers for Low, Medium and High Density (Source: Atkins)

The EDZs constitute urban blocks where al the necessary functions for urban living are provide. Within each EDZ the population can work and move in comfort without conflicts caused by through traffic. Each EDZ will be served internally by complementary and inter-dependent local road network (major local, minor local, local access). The relationships between EDZs and the primary urban road network is particularly important given that quality of life within each EDZ is premised on the prior existence of the principal arterial road network.

ii. Collector Road Network: the collector road network will consist of roads that ensure the safe movement of private cars but primarily mass transit/public transport modes within the EDZ area. Their geometric characteristics will be determined by their function and the land-uses they will serving. So, in mostly residential areas they may have a different design than those for medium density or high density mixed use EDZs. In general, depending on the land-uses and traffic volumes on each particular corridor, collector roads will be of two-lane design with an additional provision for right turns (however right turns may be withdrawn when traffic increases substantially, and the right turn impedes other following traffic).

In contrast to secondary collector roads, primary collectors will as a rule traverse EDZs and will connect arterials since they will serve a much greater volume of goods.

5.8 Traffic Management

Whatever infrastructure is provided, its use can be improved through traffic management. Improvement of the functionality of the proposed LPC road network will be achieved through the implementation of extensive traffic management measures. This must be combined in the same area with traffic calming and mitigation measures.

Traffic management is a strategic choice and improves the quality of the environment and re-orders the priorities between private vehicles, commercial vehicles, public transport, non-motorised transport. The LPC traffic management can include a very large number of tools and techniques.

A by no means exhaustive list of traffic management measures includes:

- One-way systems;
- Traffic calming;
- Measures that discourage through traffic in residential areas (signs, reduction in carriageway width, sidewalk extensions, islands to create ‘narrowing’, limited use of speed bumps, raised carriageways at junctions, pedestrian crossings etc.);
- Exclusive bus only lanes along main arterials and primary collectors
- BRT lanes,
- Limited direct access to primary roads,
- Banning right hand turns on busy intersections,
- Strict control of on-street parking,
- Pedestrianisation;
- Cycling lanes and cycling networks.

Traffic management will be particularly applied to the CBD and historic centres. In the case of Lamu Town there is no motorised traffic allowed, nevertheless rules encouraging more efficient movements and lessening pedestrian/motorcycle conflicts are needed urgently.

In Lamu Town motorcycle drivers are already exhibiting aggressive driving behaviour and serious consideration must be given to banning them. Alternatively, they can be allowed but not within strictly enforced motorcycle free zones where pedestrians, cyclists and animal transport should have completely unobstructed mobility.

5.9 SUMP and residential density

Population density and building density determines to a large extent trip behaviour. Consequently, within the multi-centred LPC plan as population density increases there is a corresponding increase and tendency towards alternative mass transit/public transport usage since the public transport area of influence encompasses more people along potential routes. At the same time as building density increases distances between land uses become smaller making cycling and walking realistic alternatives.

The LAPSSET Transport Master Plan for the LPC area recommends have high densities in the central zones (CBD) gradually declining towards the periphery. Density variations are necessary since as the radius form the centre increases land supply increases more than proportionately. If density was allowed equally high everywhere then a central CBD model will not emerge. The key is having higher density in the centre and lower outwards.

The LAPSSET Transport Master Plan's general development strategy for LPC will be based in the medium to long term on improving the operational performance of public transport. Public transport will alleviate any tendency towards congestion if not Sustainable Urban Mobility policy is in place. However public transport must be strictly regulated and policed by a specially set up Transport Authority. Self-regulation, as in Nairobi for example, is not a solution and will gradually degenerate into a system that provides a very diminished service with totally un-roadworthy and unsuitable vehicles.

LAPSSET LPC related policy must be proactive and aimed at discouraging private motorcars in favour of sustainable modes such as NMT and public transport. Expansion of the residential area must be undertaken with public transport accessibility in mind with sufficient population density in many directions. Unregulated operators tend to focus on a few busy routes and ignore many others leaving residential populations without mobility options. This would violate the principle of transport equity for all residents irrespective of income levels.

5.10 Public Transport Policy

Policy governing the operations of public transport are not usually dealt with in urban plans but in a separate public transport document. However, LAPSSET urban planning policy must ensure that public transport can capture and increasing share of internal trips.

LAPSSET Transport Master Plan policy is committed to the optimal use of road space by all modes such that total transport system costs are minimized.

Public transport works best when combined with car restraint policies.

The impressive advantages of public transport combined with car restraint are shown in a well-known photograph taken in France some years ago. The point is still valid however.

Sixty people transported in private cars, public transport and bicycle.

Figure 40: Comparison of Road Space Availability with Different Modes

Though it is often stated that congestion cannot be solved through unsustainable road building nevertheless the primary road network needs to be in place since congestion affects public transport operations even more than private transport. To some extent the private car provides comfort and personalised environment so that avoidable delays are more tolerated than in shared transport modes.

The potential of public transport and other mass transit modes must be actively promoted throughout LPC especially in the high and medium density EDZs to ensure financial viability as well as to re-assure the travelling public that residential location will not disadvantage any group. It must be remembered that LPC residents are also potential port and supporting services workers who will require efficient public transport.

The public transit routes such as BRT are directly related to urban expansion. Scheduled stage bus routes have not been indicated, but in each instance, will be related to the adjacent land uses. The implementing planning agency (Lamu County) when examining planning/development applications must assess these in relation to transit routes.

Where possible (as indicated in the land use phasing plans) BRT with physically segregated lanes has been proposed. Scheduled bus routes need to be determined through a detailed public transport plan when LPC EDZs are being populated by residential and commercial developments.

LAPSSET transport policy will encourage a mixed planning approach through the following main approaches:

1. ***Land use planning to reduce trips and trip lengths***
2. ***Develop a transport network that is heavily public transport oriented whilst recognizing the usage of private transport for particular trips***
3. ***Manage the demand for travel.***

Many measure promoting public transport are not yet needed since the urban area is yet to be developed. However as soon as the three berths under construction are operational the public transport framework needs to be already in place. There is always policy overlap with urban transport and land use issues. The basic measures are as follows:

i. Reduce the need for a trip,
ii. Reduce the length of a trip,
iii. Promote non-motorised transport,
iv. Promote public transport,
v. Promote car sharing,
vi. Encourage shifts in peak-hour travel,
vii. Encourage shifts from congested locations,
viii. Reduce traffic delays.

With regard to public transport policy responses can be either supply side or demand side.

Supply-side measures generally aim at increasing the capacity of the road system so as to improve the traffic flow for all modes of transport using it.

Demand-side measures are intended to reduce car demand by increasing the mode share by public transport, increasing vehicle occupancy, reducing the need for travel to a given destination and/or reducing the need to travel during peak traffic periods.

With regard to public transport supply side may include:

- Stage Services: Bus stop design, size, bus-stop location/siting, number, dedicated lanes, priority lanes.
- BRT stations design, size, BRT junction designs, BRT station location/siting, number.

Demand side policies include:

- Modal share, allocation of demand into public transport such as stage bus services and BRT

- Private car diversion away from CBD, through car restraint, parking policy, road user charges.

5.11 Pedestrian and Cycle Networks

Within the LPC development boundary it is deemed absolutely essential to make provision for SUMP related infrastructure (. In already fully developed towns and cities this is a challenge but in the case of LPC this is well within the capabilities and control of all implementing agencies.

LPC must be provided with a continuous, uninterrupted network for pedestrians and cyclists. As already described these are the first modes that must be planned for in the SUMP mode hierarchy. Firstly, because as far as total cost is concerned these networks cost a lot less that roads accounting for many trips so reducing pressure on the motorised road network. Resource saved can be used on other priority projects.

In general, the following policies are recommended for both pedestrian and cycling modes as part of the SUMP framework:

i. A deliberate and phased implementation of complete and continuous pedestrian only street and sidewalks and cycleways. This network will link residential/housing areas with the principal commercial centres (Atkins: local centres), the larger educational facilities as well as any green open areas, parks etc that will be implemented.
ii. Sidewalks and pedestrian streets will have priority given priority given that the LPC plan area is still unbuilt and there are no constraints form current building lines and road RoWs. The local implementing authority must draft a programme of annual construction of these facilities as a priority and ensure that NMT gets equal priority to MT modes. It will fairly easy to claim shortage of funds but if programmed and budgeted then SUMP objectives can be realised.
iii. An important LPC marketing argument will be the green and pedestrian friendly environment, friendly to families and all income classes. The ‘identity’ of LPC will be determined by the first initial activities on this issue. The LPC area is very large and there is no reason to rush blindly into infrastructure development that can only be corrected later at much greater cost.
iv. Pedestrian and cycling facilities will be much needed in the high-density CBD areas, leisure city, civic centre since living and employment distances are much shorter and are ideal for NMT modes.
v. NMT mode needs must be taken into account at all time whenever any new phase is to start implementation. This is particularly relevant for residential and commercial/shopping areas, but also educational activities and leisure city given that visitors are by definition without private transport.

vi. Fully pedestrianized areas and zones (i.e not only linear networks) must also be considered especially at commercial centres and CBD high density zones.

vii. There must be full and complete as per standards and regulations markings and signage of all cycling and pedestrian areas.

viii. Inclusion of NMT facilities pro-actively will avoid the need for complex studies and arrangements needed when such facilities are considered for fully developed transport networks.

5.12 Land Use Revisions and Phasing of Development

The Atkins plan was taken as the starting point for the present exercise. In particular the "Preliminary Master Plan for Lamu Port City and Investment Framework". The plan defines what can be termed as "Environmental Development Zones" with their respective area (in sq. m.).

The proposed City and the Port land uses must work together, in harmony so that synergies can be achieved. The revisions were driven by this overall imperative. Figure 5 below shows this effect.

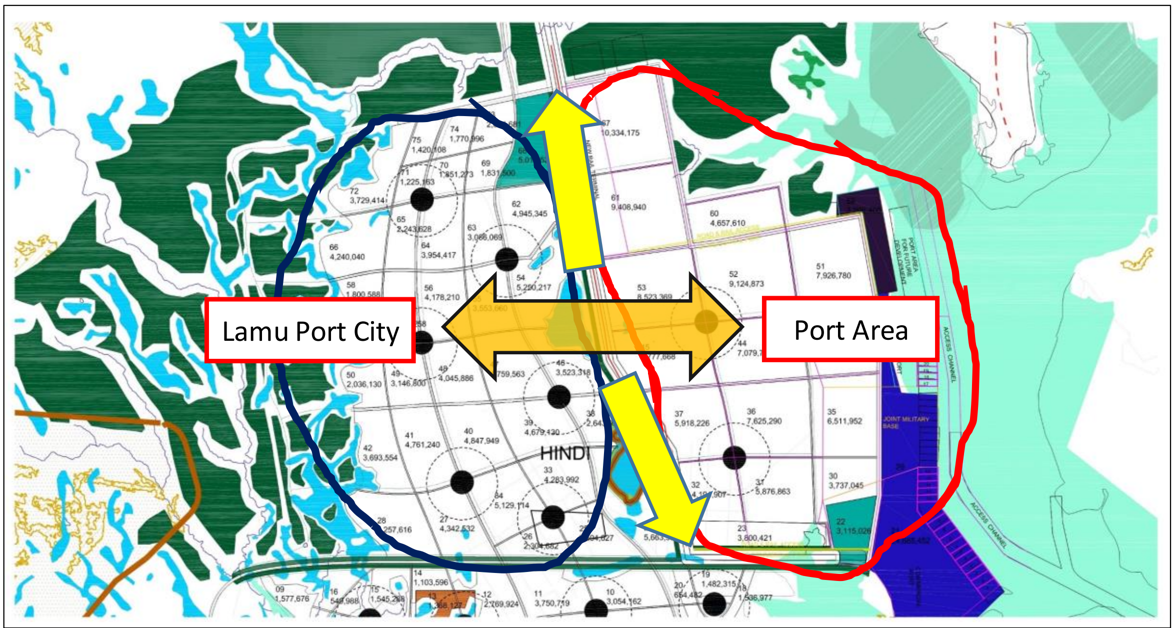


Figure 41: Harmonisation and Synergies Required between the two main LAPSSET elements

The complete list in numbered order is shown below:

Original Land Uses

No.	Area (square meters)	Designated land use (planned)	%AGE OF TOTAL/SUB ZONE
1	3,188,799	RESORT TOURISM	1.06%
2	2,144,833	RESORT TOURISM	0.71%
3	676,715	RESORT TOURISM	0.22%
4	4,685,281	RESORT TOURISM	1.55%
5	3,891,176	RESORT TOURISM	1.29%
6	1,320,809	RESORT CITY	0.44%
7	889,093	RESORT TOURISM	0.29%
8	1,556,557	RESORT TOURISM	0.52%
9	1,577,676	RESORT TOURISM	0.52%
10	3,054,162	RESORT TOURISM	1.01%
11	3,750,719	RESORT TOURISM	1.24%
12	2,769,924	RESORT TOURISM	0.92%
13	1,368,127	RESORT CITY	0.45%
14	1,103,596	RESORT TOURISM	0.37%
15	1,545,288	RESORT TOURISM	0.51%
16	549,988	RESORT TOURISM	0.18%
17	2,377,545	CIVIC CAPITAL	0.79%
18	1,536,977	CIVIC CAPITAL	0.51%
19	1,482,315	CIVIC CAPITAL	0.49%
20	654,482	CIVIC CAPITAL	0.22%
21	24,685,452	PORT AREA	8.17%
22	3,115,026	LOGISTICS	1.03%
23	3,800,421	RAIL TERMINUS	1.26%
24	5,663,393	MEDIUM DENSITY MIXED USE	1.87%
25	3,594,627	HIGH DENSITY MIXED USE	1.19%
26	2,304,682	HIGH DENSITY MIXED USE	0.76%
27	4,342,532	MEDIUM DENSITY MIXED USE	1.44%
28	5,217,616	LOW DENSITY RESIDENTIAL	1.73%
29	0	NAVAL BASE	0.00%
30	3,737,045	NAVAL BASE	1.24%
31	5,876,863	LIGHT INDUSTRY/LOGISTICS	1.94%
32	4,194,907	LIGHT INDUSTRY/LOGISTICS	1.39%
33	4,283,992	HIGH DENSITY MIXED USE	1.42%
34	5,129,114	HIGH DENSITY MIXED USE	1.70%
35	6,511,952	NAVAL BASE	2.15%
36	7,625,290	MEDIUM INDUSTRY	2.52%
37	5,918,226	LIGHT INDUSTRY	1.96%
38	2,643,956	MEDIUM DENSITY MIXED USE	0.87%
39	4,679,430	MEDIUM DENSITY MIXED USE	1.55%
40	4,847,949	MEDIUM DENSITY MIXED USE	1.60%
41	4,761,240	MEDIUM DENSITY MIXED USE	1.58%
42	3,693,554	LOW DENSITY RESIDENTIAL	1.22%
43	5,799,332	HEAVY INDUSTRY	1.92%
44	7,079,785	MEDIUM INDUSTRY	2.34%
45	6,777,668	LIGHT INDUSTRY	2.24%
46	3,523,318	LOW DENSITY RESIDENTIAL	1.17%
47	4,759,563	MEDIUM DENSITY MIXED USE	1.57%
48	4,045,886	MEDIUM DENSITY MIXED USE	1.34%
49	3,146,800	LOW DENSITY RESIDENTIAL	1.04%
50	2,036,130	LOW DENSITY RESIDENTIAL	0.67%
51	7,926,780	HEAVY INDUSTRY	2.62%
52	9,124,873	MEDIUM INDUSTRY	3.02%
53	8,523,369	LIGHT INDUSTRY	2.82%
54	5,250,217	LOW DENSITY RESIDENTIAL	1.74%
55	3,553,660	MEDIUM DENSITY MIXED USE	1.18%
56	4,178,210	MEDIUM DENSITY MIXED USE	1.38%
57	2,936,258	LOW DENSITY RESIDENTIAL	0.97%
58	1,800,588	LOW DENSITY RESIDENTIAL	0.60%
59	3,296,405	AMU POWER PLANT	1.09%
60	4,657,610	MEDIUM INDUSTRY	1.54%
61	9,408,940	LIGHT INDUSTRY	3.11%
62	4,945,345	LIGHT INDUSTRY	1.64%
63	3,068,069	MEDIUM DENSITY MIXED USE	1.02%
64	3,914,417	MEDIUM DENSITY MIXED USE	1.30%
65	2,243,628	LOW DENSITY RESIDENTIAL	0.74%
66	4,240,040	LOW DENSITY RESIDENTIAL	1.40%
67	10,334,175	MEDIUM INDUSTRY	3.42%
68	5,012,525	LOGISTICS	1.66%
69	1,831,500	LOW DENSITY RESIDENTIAL	0.61%
70	1,851,273	LOW DENSITY RESIDENTIAL	0.61%
71	1,225,163	LOW DENSITY RESIDENTIAL	0.41%
72	3,729,414	LOW DENSITY RESIDENTIAL	1.23%
73	2,044,681	LOW DENSITY RESIDENTIAL	0.68%
74	1,770,996	LOW DENSITY RESIDENTIAL	0.59%
75	1,420,108	LOW DENSITY RESIDENTIAL	0.47%
Total	302,208,055		100.00%

Revised Master Plan

No.	Area (square meters)	Designated land use (planned)	%AGE OF TOTAL/SUB ZONE
1	3,188,799	RESORT TOURISM	1.06%
2	2,144,833	RESORT TOURISM	0.71%
3	676,715	RESORT TOURISM	0.22%
4	4,685,281	RESORT TOURISM	1.55%
5	3,891,176	RESORT TOURISM	1.29%
6	1,320,809	RESORT CITY	0.44%
7	889,093	RESORT TOURISM	0.29%
8	1,556,557	RESORT TOURISM	0.52%
9	1,577,676	RESORT TOURISM	0.52%
10	3,054,162	RESORT TOURISM	1.01%
11	3,750,719	RESORT TOURISM	1.24%
12	2,769,924	RESORT TOURISM	0.92%
13	1,368,127	RESORT CITY	0.45%
14	1,103,596	RESORT TOURISM	0.37%
15	1,545,288	RESORT TOURISM	0.51%
16	549,988	RESORT TOURISM	0.18%
17	2,377,545	CIVIC CAPITAL	0.79%
18	1,536,977	CIVIC CAPITAL	0.51%
19	1,482,315	CIVIC CAPITAL	0.49%
20	654,482	CIVIC CAPITAL	0.22%
21	20,685,452	PORT AREA	6.84%
22	3,115,026	LOGISTICS	1.03%
23	3,800,421	NEW RAIL TERMINUS	1.26%
24	5,663,393	HIGH DENSITY MIXED USE	1.87%
25	3,594,627	HIGH DENSITY MIXED USE	1.19%
26	2,304,682	MEDIUM DENSITY MIXED USE	0.76%
27	4,342,532	MEDIUM DENSITY MIXED USE	1.44%
28	5,217,616	LOW DENSITY RESIDENTIAL	1.73%
29	4,000,000	NAVAL BASE	1.32%
30	3,737,045	NAVAL BASE	1.24%
31	7,777,074	MEDIUM INDUSTRY	2.57%
32	6,095,118	LIGHT INDUSTRY	2.02%
33	4,283,992	HIGH DENSITY MIXED USE	1.42%
34	5,129,114	MEDIUM DENSITY MIXED USE	1.70%
35	5,000,000	NAVAL BASE	1.65%
36	8,381,266	MEDIUM INDUSTRY	2.77%
37	5,918,226	LIGHT INDUSTRY	1.96%
38	2,643,956	HIGH DENSITY MIXED USE	0.87%
39	4,679,430	MEDIUM DENSITY MIXED USE	1.55%
40	4,847,949	MEDIUM DENSITY MIXED USE	1.60%
41	4,761,240	MEDIUM DENSITY MIXED USE	1.58%
42	3,693,554	LOW DENSITY RESIDENTIAL	1.22%
43	6,555,308	HEAVY INDUSTRY	2.17%
44	7,079,785	MEDIUM INDUSTRY	2.34%
45	6,777,668	LIGHT INDUSTRY	2.24%
46	3,523,318	LOW DENSITY RESIDENTIAL	1.17%
47	4,759,563	MEDIUM DENSITY MIXED USE	1.57%
48	4,045,886	MEDIUM DENSITY MIXED USE	1.34%
49	3,146,800	LOW DENSITY RESIDENTIAL	1.04%
50	2,036,130	LOW DENSITY RESIDENTIAL	0.67%
51	7,926,780	HEAVY INDUSTRY	2.62%
52	9,124,873	MEDIUM INDUSTRY	3.02%
53	8,523,369	LIGHT INDUSTRY	2.82%
54	5,250,217	LOW DENSITY RESIDENTIAL	1.74%
55	3,553,660	MEDIUM DENSITY MIXED USE	1.18%
56	4,178,210	MEDIUM DENSITY MIXED USE	1.38%
57	2,936,258	LOW DENSITY RESIDENTIAL	0.97%
58	1,800,588	LOW DENSITY RESIDENTIAL	0.60%
59	3,296,405	AMU POWER PLANT	1.09%
60	4,657,610	MEDIUM INDUSTRY	1.54%
61	7,508,730	LIGHT INDUSTRY/LOGISTICS	2.48%
62	4,945,345	LIGHT INDUSTRY	1.64%
63	3,068,069	MEDIUM DENSITY MIXED USE	1.02%
64	3,914,417	MEDIUM DENSITY MIXED USE	1.30%
65	2,243,628	LOW DENSITY RESIDENTIAL	0.74%
66	4,240,040	LOW DENSITY RESIDENTIAL	1.40%
67	8,433,965	LIGHT INDUSTRY/LOGISTICS	2.79%
68	5,012,525	LOGISTICS	1.66%
69	1,831,500	LOW DENSITY RESIDENTIAL	0.61%
70	1,851,273	LOW DENSITY RESIDENTIAL	0.61%
71	1,225,163	LOW DENSITY RESIDENTIAL	0.41%
72	3,729,414	LOW DENSITY RESIDENTIAL	1.23%
73	2,044,681	LOW DENSITY RESIDENTIAL	0.68%
74	1,770,996	LOW DENSITY RESIDENTIAL	0.59%
75	1,420,108	LOW DENSITY RESIDENTIAL	0.47%
Total	302,208,055		100.00%

Table 20: Environmental Development Zones with Associated Use and Area

(Original allocation on left and revised allocation right. Total remains same)

5.12.1 Land Use Review and Revisions

- High Density (EDZs 26 and 34) converted to Medium density
- Medium density (EDZs 24 and 38) converted to High Density
- Light Industry/ Logistics (EDZ 31) converted to Medium Industry
- Light Industry/Logistics (EDZ 32) converted to Light Industry
- Railway Terminal (EDZ 23) converted 50-50 to Medium and Light Industry
- Light Industry (EDZ 61) converted to Light Industry/Logistics and part of re-located railway terminal
- Medium Industry (EDZ 67) converted to Light Industry/Logistics and part of re-located railway terminal.
- Naval base has been taken into account and adjusted road network and areas incorporated into EDZ listing.
- All other land uses remain as before.

The changes will help with transport functionality with regard to port operations and uninterrupted access to port industrial zones.

The high density high traffic volume zone is adjusted towards the main highway corridor (A10) since this zone will have the high-rise office buildings and port associated businesses and offices. The main multi-modal corridor already specifies 140 m green buffer zones either side. The shift of the high-density zone has beneficial effects on the local commercial centres since the centre associated with the high-density zones moves correspondingly eastwards. This brings it into alignment with the other two centres on the same principal axis creating public transport efficiencies especially for BRT. It can be observed that now three commercial centres are situated on each principal LPC transport axis respectively. These centres are also staggered thus providing a more balanced coverage than original distribution of these centres.

The Light Industry/Logistics land uses associated with the railway terminal move with the relocated railways terminal. EDZs 31 and 32 become Medium and Light Industry zones respectively. This is change creates fully aligned and contiguous Medium and Light Industry zones respectively.

Zones 61 and 62 which were initially Light and Medium Industry zones respectively now are converted to Light Industry/Logistics zones in support of the re-located railways terminal.

Table 4 below ranks the land uses by area according to the revised schedule. It also compares the main land use categories.

The overall area remains the same i.e. 302,208,055 sq. m. However, the explicit inclusion of the Naval Base has taken some area away from the port area as well as a heavy industry zone (previously EDZ 35).

The railways terminal area has been retained as before. However Light Industry/Logistics has increased whilst Light and Medium Industry have been revised slightly downwards. However, to some extent Light Industry/Logistics land use and Light Industry land use are interchangeable and can accommodate similar activities.

Lowest to Highest	Designated land use (revised)	Original Area sq. m.	Revised Area sq. m.	% Change
1	RESORT CITY	2,688,936	2,688,936	0%
2	AMU POWER PLANT	3,296,405	3,296,405	0%
3	RAIL TERMINUS	3,800,421	3,800,421	0%
4	CIVIC CAPITAL	6,051,319	6,051,319	0%
5	LOGISTICS	8,127,551	8,127,551	0%
6	NAVAL BASE	0	12,737,045	NA
7	HEAVY INDUSTRY	20,238,064	14,482,088	-28%
8	LIGHT INDUSTRY/LOGISTICS	13,808,815	15,942,694	15%
9	HIGH DENSITY MIXED USE	15,312,415	16,185,968	6%
10	PORT AREA	24,685,452	20,685,452	-16%
11	RESORT TOURISM	31,383,807	31,383,807	0%
12	LIGHT INDUSTRY	35,573,548	32,259,726	-9%
13	MEDIUM INDUSTRY	38,821,733	37,020,608	-5%
14	LOW DENSITY RESIDENTIAL	47,961,284	47,961,284	0%
15	MEDIUM DENSITY MIXED USE	50,458,305	49,584,752	-2%
	TOTAL	**302,208,055**	**302,208,055**	

Table 21: Summary of Main Land Uses and Comparison of Original and Revised Areas (Source: Atkins – Consultant)

5.12.2 CBD (High Density – Medium Density Swap)

Figures 6 and 7 below show how the CBD area was translated eastwards so that it adjoins the main transport corridor. The location of the two medium density areas was disadvantageous. The two medium density EDZs were swapped with two High Density EDZs.

Figure 42: Original LAPSSET CBD Location

At the same time the local commercial centre was moved which brought into line with the other two on the same transport axis.

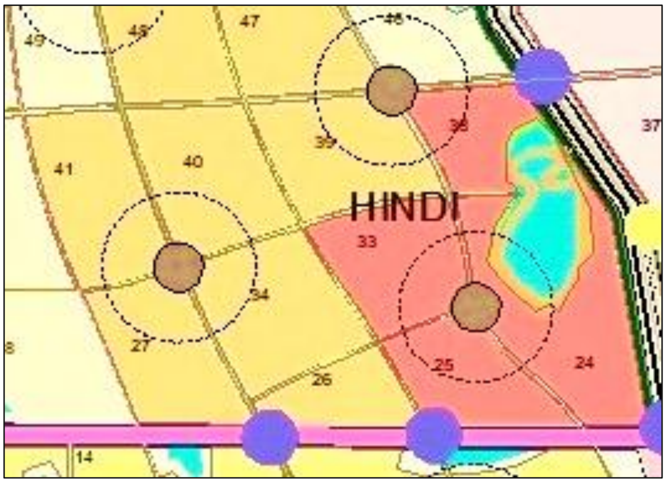


Figure 43: Revised LAPSSET CBD Location

The CBD area has increased slightly from 15.13 mln sq. m to 16.18 mn sq. m – approx. 6% increase.

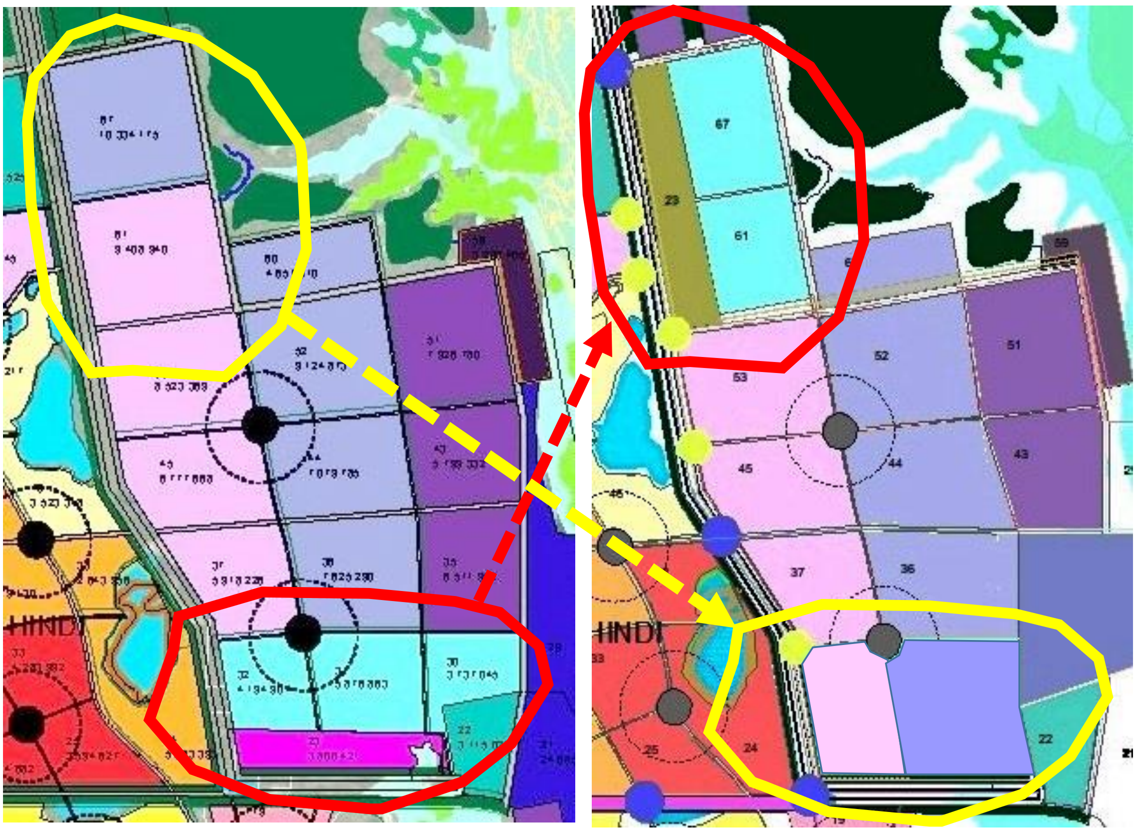


Figure 44: Changes in Railways Terminal and Associated Land Uses (L

Figure 44 above shows the changes brought about by relocating the railway terminal (see section on Port Operations for further details.

Light Industry from 35 mln sq. m. the 32 mln sq. m. and Medium Industry from 38.8 mln sq. m. to 37.0 mln sq. m. This is not seen as any disadvantage since all the light and medium industry zones are aligned and in parallel so that there can be synergies and economies of scale which as previously allocated would still be substantial but less than the revised arrangement. Overall therefore there will be no perceptible loss in output but there will be productivity gains.

5.13 Sustainability with Five-phased Expansion of LPC

As already described the entire LAPSSET project must fulfil sustainability criteria. In terms of transport this requires a SUMP approach, whereby the need to build expensive roads is kept to a minimum as well as ensuring clean air, low noise and congestion as far as possible.

Expansion of the plan area must also be carried out sustainably and this can be ensured by specifying development phases.

Sustainable urban areas are compact and use their land resources efficiently. To ensure that sustainable development and compactness is achieved development must be confined within pre-defined development boundaries in each instance. This will ensure the most economic provision of infrastructure, services and utilities in line with budgets and funding. That is the temptation to develop outlying areas in an ad-hoc manner must be resisted and this is where the development control function of local government must not operate transparently but must be seen to operate transparently.

Keeping development within specified development limits ensures that infrastructure is used more efficiently before the next quantity of land is released to the market.

The LAPSSET Transport Master Plan has reviewed existing plans and determined that there is some phasing recommended but in each instance, this is always done with regard to Port expansion rather than with equal regard to the City expansion. The JPC JICA study deals in detail with all aspects of LAPSSET within Lamu County but not the planned LPC area except to ensure that it has a minimum population to keep the port running.

However, the city itself has its own internal employment and economic and social requirements in an expanding web of dependency from port workers to transport, residence, commercial retail and wholesale activity, services etc. In such a case the phase proposed encompass much larger increments of population in five (5) phases.

These phases are listed below. (For cross-reference purposes Figures in brackets refer to EDZs). These phases refer to the High, Medium and Low Density mixed use and residential use areas.

The expansion philosophy is to identify the centre of an imaginary circle and expand outwards as far as possible.

- Phase I – 2020 – 2025 (24, 25, 26, 33, 34, 38)
- Phase II - 2025 – 2030 (27, 28, 39, 40, 41, 42, 46)

- Phase III – 2030 – 2040 (47, 48, 49, 50, 54, 55)
- Phase IV – 2040 – 2050 (56, 57, 58, 63, 64, 69, 73)
- Phase V – 2050 onwards (65, 66, 70, 71, 72, 74, 75)

The LPC area can be imagined as a quarter circle with the junction of the A10 and A7 forming its centre. In such a case expansion can be easily shown as in the Figure below:

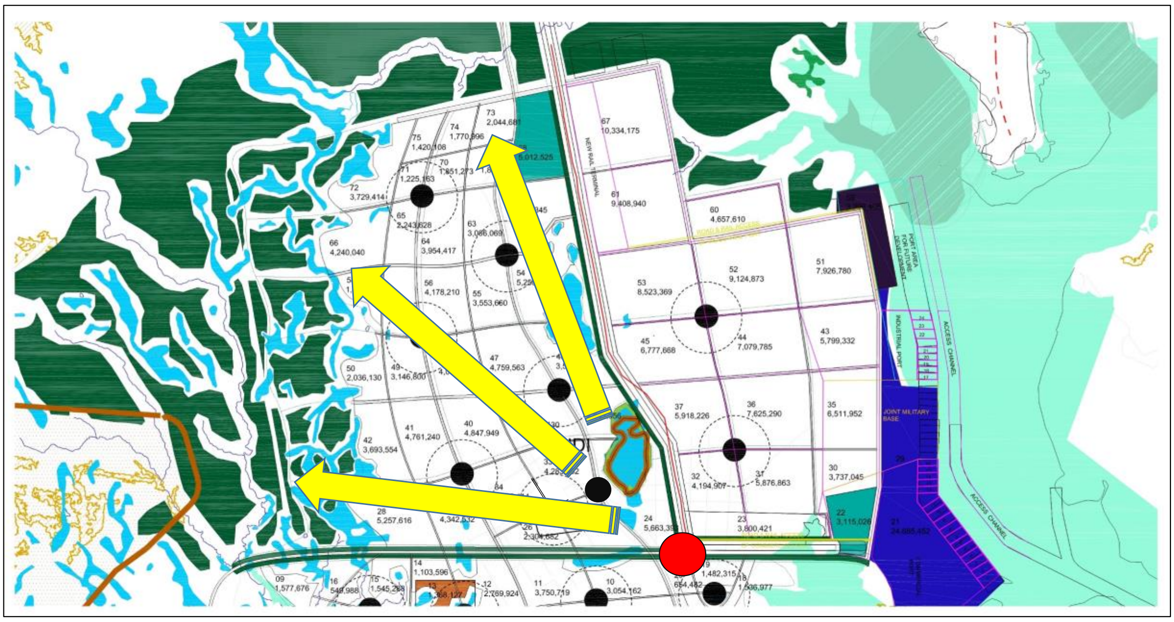


Figure 45: LPC Expansion Principle

5.13.1 Description of Phases

Figure 46 to Figure 50 show the expansion principle as applied to actual conditions and involving the EDZs defined earlier.

In each instance the grey areas indicate blanked out EDZs that are not in the illustrated phase. Each diagram reveals am\n additional 'tranche' of development land for the residential, industrial and leisure city components.

In this way if sufficient land is released there are economies of scale in the provision of infrastructure and utilities whilst limiting uneconomic provision to uninhabited areas. Each phase implies a certain population, number of dwelling units (DUs).

Below each diagram there is a corresponding table with the residential and mixed use EDZs for LPC as well as a table listing the EDZs related to Civic City, Leisure City and Industry.

The Phase I, II, III, IV and V populations are not a direct match to suggested population phases in other reports. However, the final population for 2050 is similar.

The population phases are based on 10 or 5-year increments. As development takes place there will be a slow and then more rapid growth.

Phase I industry is much more than other phases since these are the main revenue earning activities for the whole area. There is a need to attract economic activities as early as possible to establish a revenue base on which other phases and population can depend.

Population implied by the suggested phasing is as follows:

- Phase I 317,000
- Phase II 318,000
- Phase III 224,000
- Phase IV 198,000
- Phase V 99,000

Total 1,158,000

The populations per EDZ for each phase are shown in tables beneath each Phase diagram.

The earlier master plans were analysed, and the area and population figures deconstructed which allowed the use of similar density figures for the phased recommendations.

Density is particularly relevant to residential areas. It can be defined in terms of population per hectare or other measures such as dwelling units per hectare provided assumptions about population per dwelling unit are made.

For the LPC area the following densities were defined:

- Low Density 81 pp/ha
- Medium 185 pp/ha
- High 193 pp/ha

Person per Dwelling unit (DU) are as follows:

- Low Density 4.8 pp/DU
- Medium 2.9 pp/DU
- High 2.0 pp/DU

This leads to the following DU/ha assumptions

- Low Density 17 DU/ha
- Medium 65 DU/ha
- High 95 DU/ha

These density assumptions are the 'Most likely' scenario. The study also examined as a hypothetical exercise an alternative higher density scenario. The exercise can be repeated with other alternative assumptions.

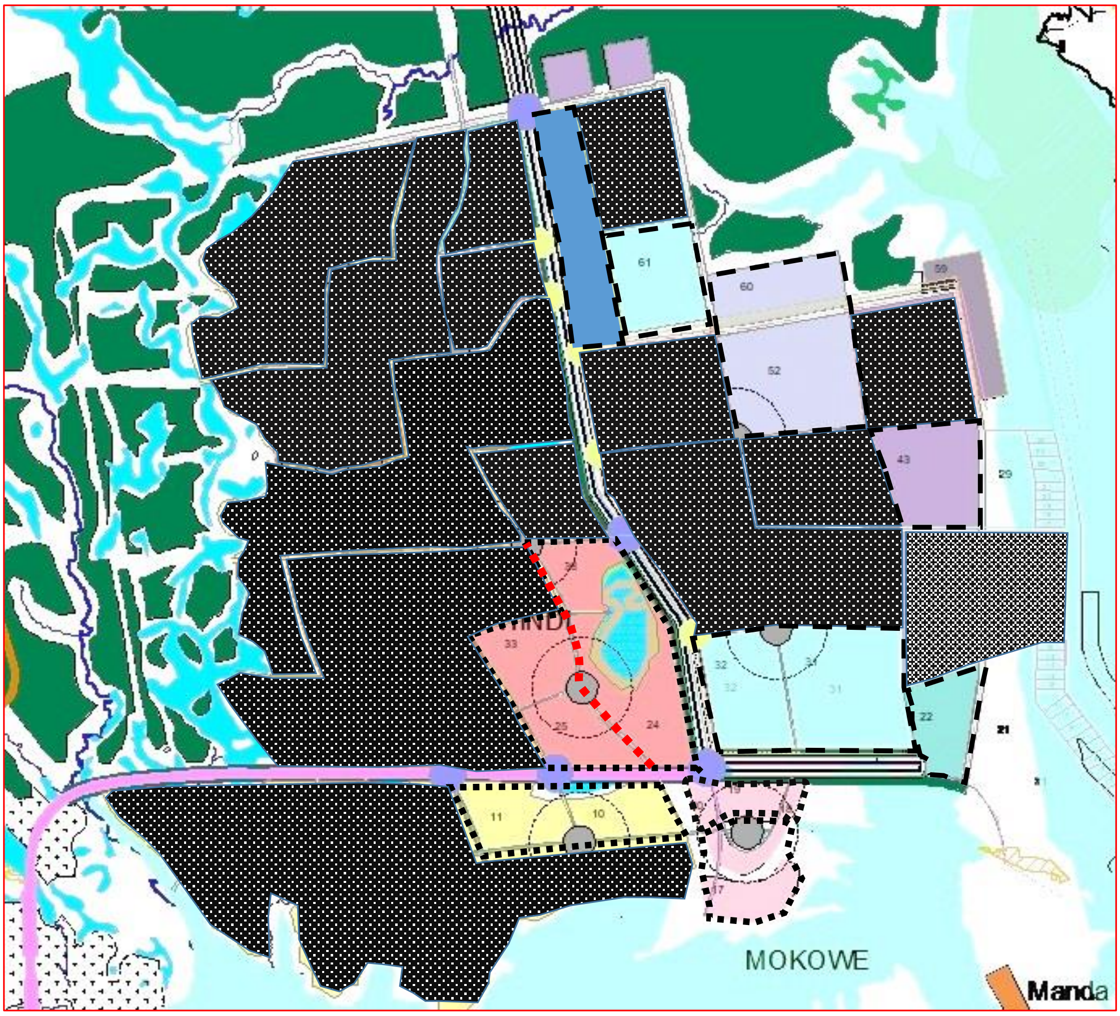


Figure 46: Phase I 2020-2030: LPC Residential, Industrial and Leisure City Expansion

Phase I shows in colour the areas that are open for development. The LPC side is approximately 23 mln sq. m. whilst the Port side is approximately 61 mln sq. m. This is because essential infrastructure needs to be put in place at the start - which is not repeated in subsequent phases.

PHASE I 2020 - 2030										
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available for Dus	DUs	Pop.	Pop/Year	DU/Year	Km of road
PHASE I	24	H	5,663,393	0.70600	3,998,380	37,797	77,093	7,709	3,780	94.39
PHASE I	25	H	3,594,627	0.70600	2,537,822	23,990	48,932	4,893	2,399	59.91
PHASE I	26	M	2,304,682	0.70600	1,627,115	10,558	30,148	3,015	1,056	38.41
PHASE I	33	H	4,283,992	0.70600	3,024,517	28,591	58,316	5,832	2,859	71.40
PHASE I	34	M	5,129,114	0.70600	3,621,177	23,497	67,095	6,710	2,350	85.49
PHASE I	38	H	2,643,956	0.70600	1,866,644	17,646	35,991	3,599	1,765	44.07
			23,619,764		**16,675,655**	**142,079**	**317,575**	**31,757**	**14,208**	**393.66**

Table 22: Phase I 2020 – 2030 Residential Low – Medium – High Density

PHASE I 2020 - 2030							
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available	Km of road	Cost of Infrastructure Provision
Phase I	23	RLWY	3,800,421	0.80	3,040,337	0.00	0.00
Phase I	17	C CENTRE	2,377,545	0.80	1,902,036	39.63	23,775,450
Phase I	18	C CENTRE	1,536,977	0.80	1,229,582	25.62	15,369,770
Phase I	19	C CENTRE	1,482,315	0.80	1,185,852	24.71	14,823,150
Phase I	20	C CENTRE	654,482	0.80	523,586	10.91	6,544,820
Phase I	10	LEI CITY	3,054,162	0.80	2,443,330	50.90	30,541,620
Phase I	11	LEI CITY	3,750,719	0.80	3,000,575	62.51	37,507,190
Phase I	22	LOGISTICS	3,115,026	0.90	2,803,523	25.96	10,383,420
Phase I	31	M INDUSTRY	7,777,074	0.90	6,999,366	64.81	25,923,578
Phase I	32	L INDUSTRY	6,095,118	0.90	5,485,606	50.79	20,317,058
Phase I	43	H INDUSTRY	6,555,308	0.90	5,899,777	54.63	21,851,027
Phase I	52	M INDUSTRY	9,124,873	0.90	8,212,386	76.04	30,416,243
Phase I	60	M INDUSTRY	4,657,610	0.90	4,191,849	38.81	15,525,367
Phase I	61	L IND/LOG	7,508,730	0.90	6,757,857	62.57	25,029,098
			61,490,359		**53,675,661**	**587.88**	**278,007,792**

Table 23: Phase I 2020 – 2030 Leisure City, Civic Centre Industry

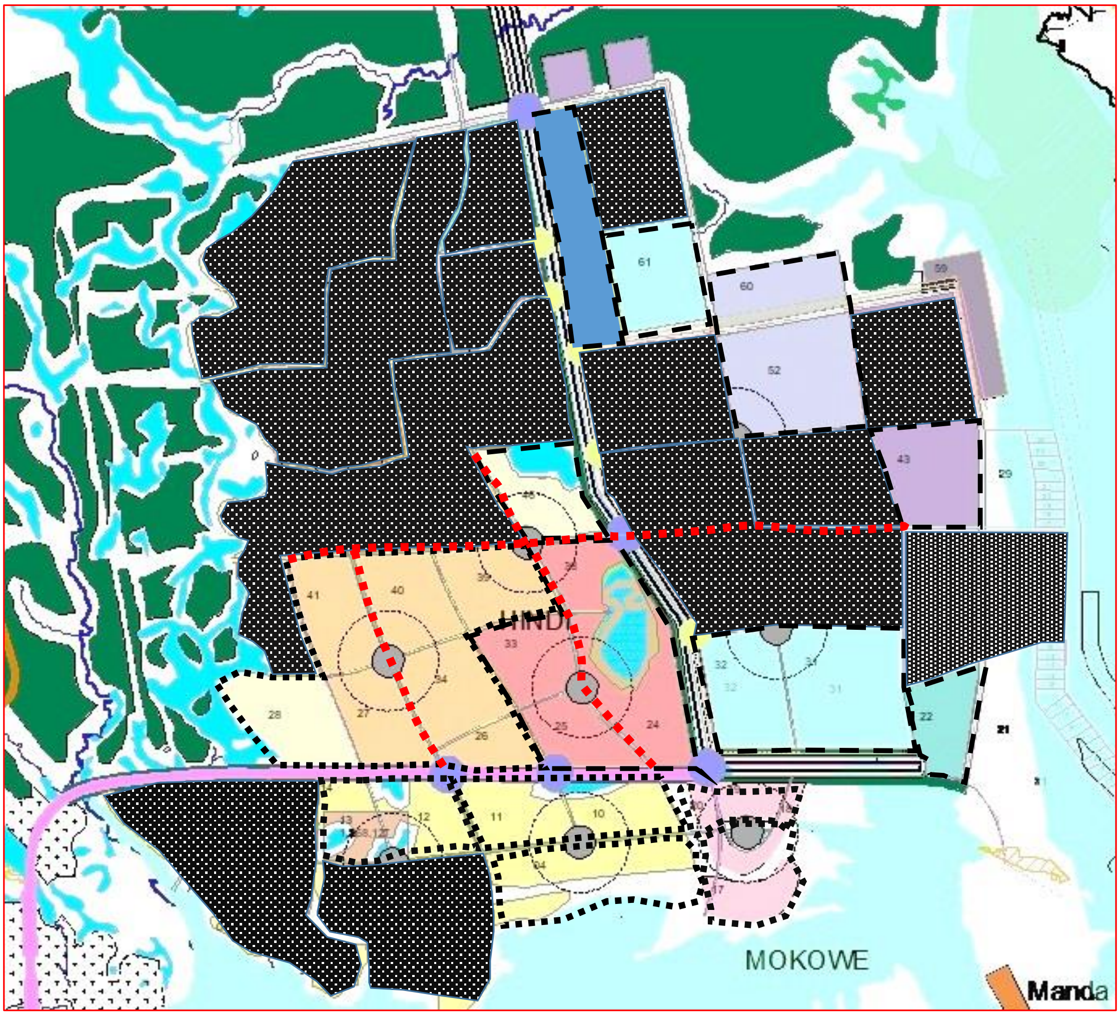


Figure 47: Phase II 2030-2040: LPC Residential, Industrial and Leisure City Expansion

Phase II shows in colour the areas that are open for development. The LPC side is approximately 31 mln sq. m. whilst other uses are approximately 9.9 mln sq. m. mainly Leisure City related.

PHASE II 2030 - 2040										
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available for Dus	DUs	Pop.	Pop/Year	DU/Year	Km of road
PHASE II	27	M	4,342,532	0.70600	3,065,846	19,893	56,806		1,989	72.38
PHASE II	28	L	5,217,616	0.74316	3,877,536	6,609	31,494		661	86.96
PHASE II	39	M	4,679,430	0.70600	3,303,698	21,437	61,213		2,144	77.99
PHASE II	40	M	4,847,949	0.70600	3,422,673	22,209	63,417		2,221	80.80
PHASE II	41	M	4,761,240	0.70600	3,361,456	21,812	62,283		2,181	79.35
PHASE II	42	L	3,693,554	0.74316	2,744,911	4,679	22,295		468	61.56
PHASE II	46	L	3,523,318	0.74316	2,618,398	4,463	21,267		446	58.72
			31,065,639		**22,394,517**	**101,101**	**318,776**	**31,878**	**10,110**	**517.76**

Table 24: Phase II 2030 – 2040 Residential Low – Medium – High Density

PHASE II 2030 - 2040							
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available	Km of road	Cost of Infrastructure Provision
Phase II	04	LEI CITY	4,685,281	0.80	3,748,225	78.09	46,852,810
Phase II	12	LEI CITY	2,769,924	0.80	2,215,939	46.17	27,699,240
Phase II	13	RESORT CITY	1,368,127	0.80	1,094,502	22.80	13,681,270
Phase II	14	LEI CITY	1,103,596	0.80	882,877	18.39	11,035,960
			9,926,928		**7,941,542**	**165.45**	**99,269,280**

Table 25: Phase II 2030 – 2040 Leisure City, Civic Centre Industry

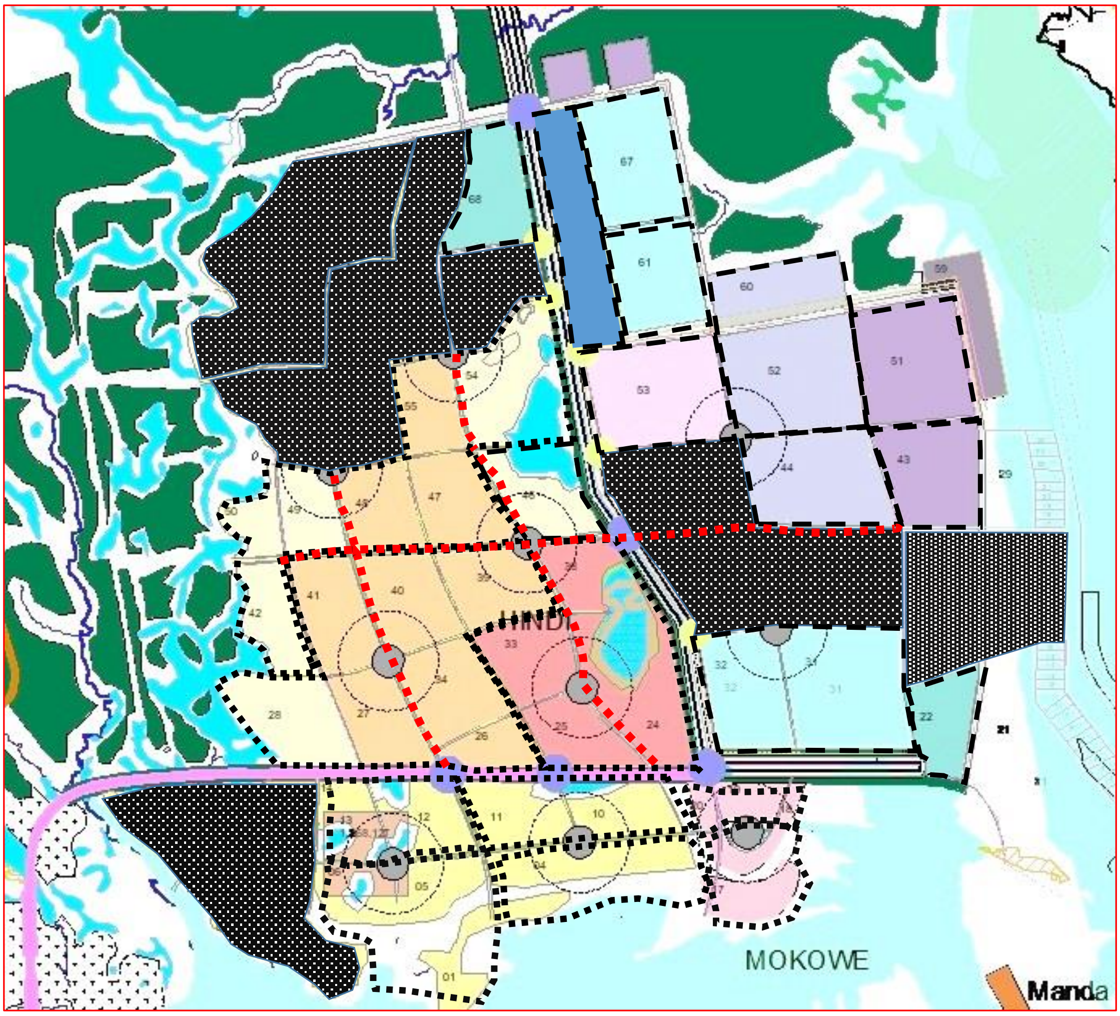


Figure 48: Phase III 2040-2045: LPC Residential, Industrial and Leisure City Expansion

Phase III shows in colour the areas that are open for development. The LPC side is approximately 22.7 mln sq. m. whilst other uses are approximately 45 mln sq. m. both Leisure City, Logistics and Industry related.

PHASE III 2040 - 2045										
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available for Dus	DUs	Pop.	Pop/Year	DU/Year	Km of road
PHASE III	47	M	4,759,563	0.70600	3,360,272	21,804	62,261		2,180	79.33
PHASE III	48	M	4,045,886	0.70600	2,856,413	18,535	52,925		1,853	67.43
PHASE III	49	L	3,146,800	0.74316	2,338,584	3,986	18,994		399	52.45
PHASE III	50	L	2,036,130	0.74316	1,513,175	2,579	12,290		258	33.94
PHASE III	54	L	5,250,217	0.74316	3,901,764	6,650	31,691		665	87.50
PHASE III	55	M	3,553,660	0.70600	2,508,899	16,280	46,486		1,628	59.23
			22,792,256		**16,479,107**	**69,834**	**224,649**	**44,930**	**6,983**	**379.87**

Table 26: Phase III 2040 – 2045 Residential Low – Medium – High Density

PHASE III 2040 - 2045							
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available	Km of road	Cost of Infrastructure Provision
Phase III	01	LEI CITY	3,188,799	0.80	2,551,039	53.15	31,887,990
Phase III	05	LEI CITY	3,891,176	0.80	3,112,941	64.85	38,911,760
Phase III	06	RESORT CITY	1,320,809	0.80	1,056,647	22.01	13,208,090
Phase III	44	M INDUSTRY	7,079,785	0.90	6,371,807	59.00	23,599,283
Phase III	51	H INDUSTRY	7,926,780	0.90	7,134,102	66.06	26,422,600
Phase III	53	L INDUSTRY	8,523,369	0.90	7,671,032	71.03	28,411,230
Phase III	67	L IND/LOG	8,433,965	0.90	7,590,568	70.28	28,113,215
Phase III	68	LOGISTICS	5,012,525	0.90	4,511,273	41.77	16,708,417
			45,377,208		**39,999,408**	**448.15**	**207,262,585**

Table 27: Phase III 2040 – 2045 Leisure City, Civic Centre Industry

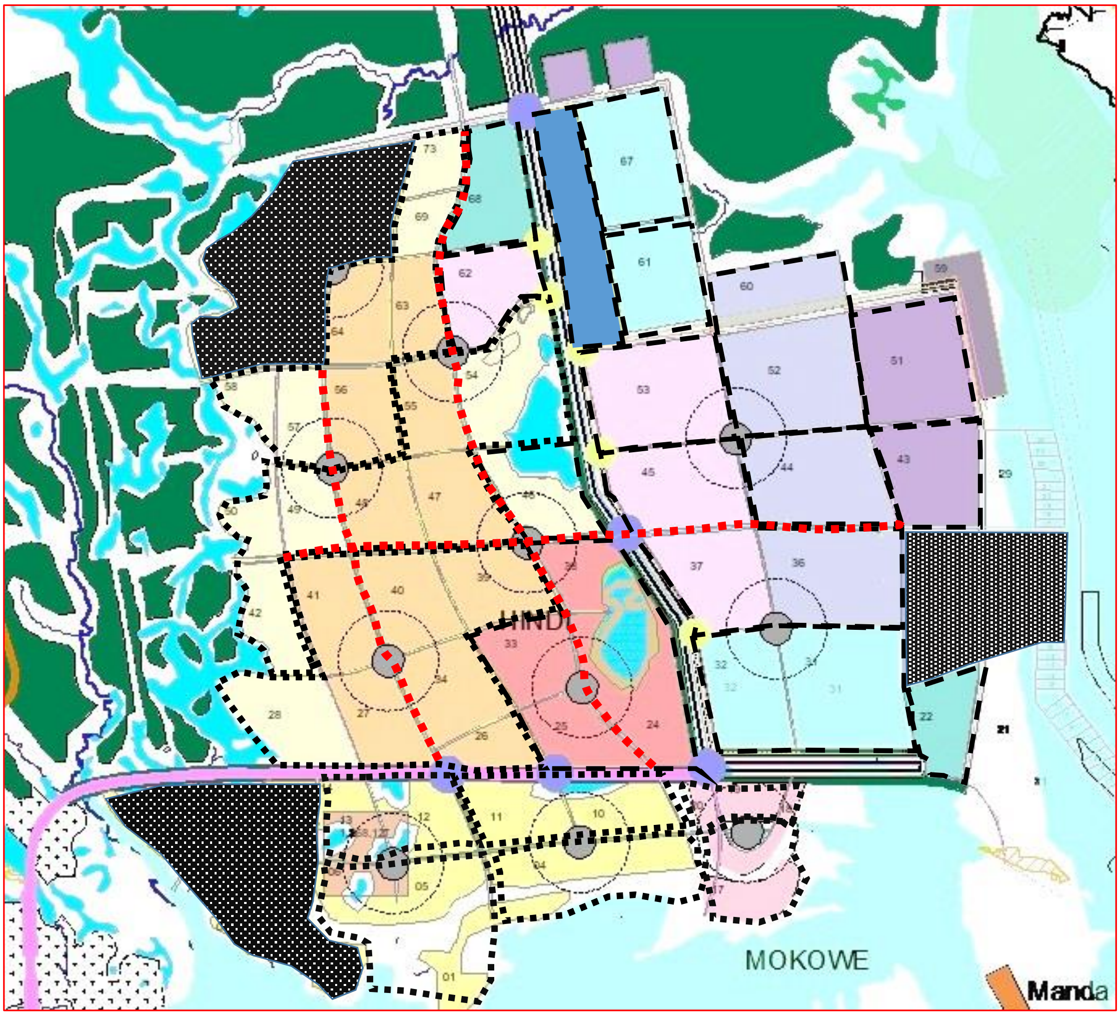


Figure 49: Phase IV 2045-2050: LPC Residential, Industrial and Leisure City Expansion

Phase IV shows in colour the areas that are open for development. The LPC side is approximately 19.7 mln sq. m. whilst other uses are approximately 34.5 mln sq. m. only Industry related.

PHASE IV 2045 - 2050										
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available for Dus	DUs	Pop.	Pop/Year	DU/Year	Km of road
PHASE IV	56	M	4,178,210	0.70600	2,949,834	19,141	54,656		1,914	69.64
PHASE IV	57	L	2,936,258	0.74316	2,182,117	3,719	17,724		372	48.94
PHASE IV	58	L	1,800,588	0.74316	1,338,129	2,281	10,869		228	30.01
PHASE IV	63	M	3,068,069	0.70600	2,166,070	14,055	40,134		1,406	51.13
PHASE IV	64	M	3,914,417	0.70600	2,763,595	17,932	51,206		1,793	65.24
PHASE IV	69	L	1,831,500	0.74316	1,361,102	2,320	11,055		232	30.53
PHASE IV	73	L	2,044,681	0.74316	1,519,530	2,590	12,342		259	34.08
			19,773,723		**14,280,378**	**62,038**	**197,986**	**39,597**	**6,204**	**329.56**

Table 28: Phase IV 2045 – 2050 Residential Low – Medium – High Density

PHASE IV 2045 - 2050							
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available	Km of road	Cost of Infrastructure Provision
PHASE IV	36	M INDUSTRY	8,381,266	0.90	7,543,139	69.84	27,937,553
PHASE IV	37	L INDUSTRY	5,918,226	0.90	5,326,403	49.32	19,727,420
PHASE IV	45	L INDUSTRY	6,777,668	0.90	6,099,901	56.48	22,592,227
PHASE IV	53	L INDUSTRY	8,523,369	0.90	7,671,032	71.03	28,411,230
PHASE IV	62	L INDUSTRY	4,945,345	0.90	4,450,811	41.21	16,484,483
			34,545,874		**31,091,287**	**287.88**	**115,152,913**

Table 29: Phase IV 2045 – 2050 Leisure City, Civic Centre Industry

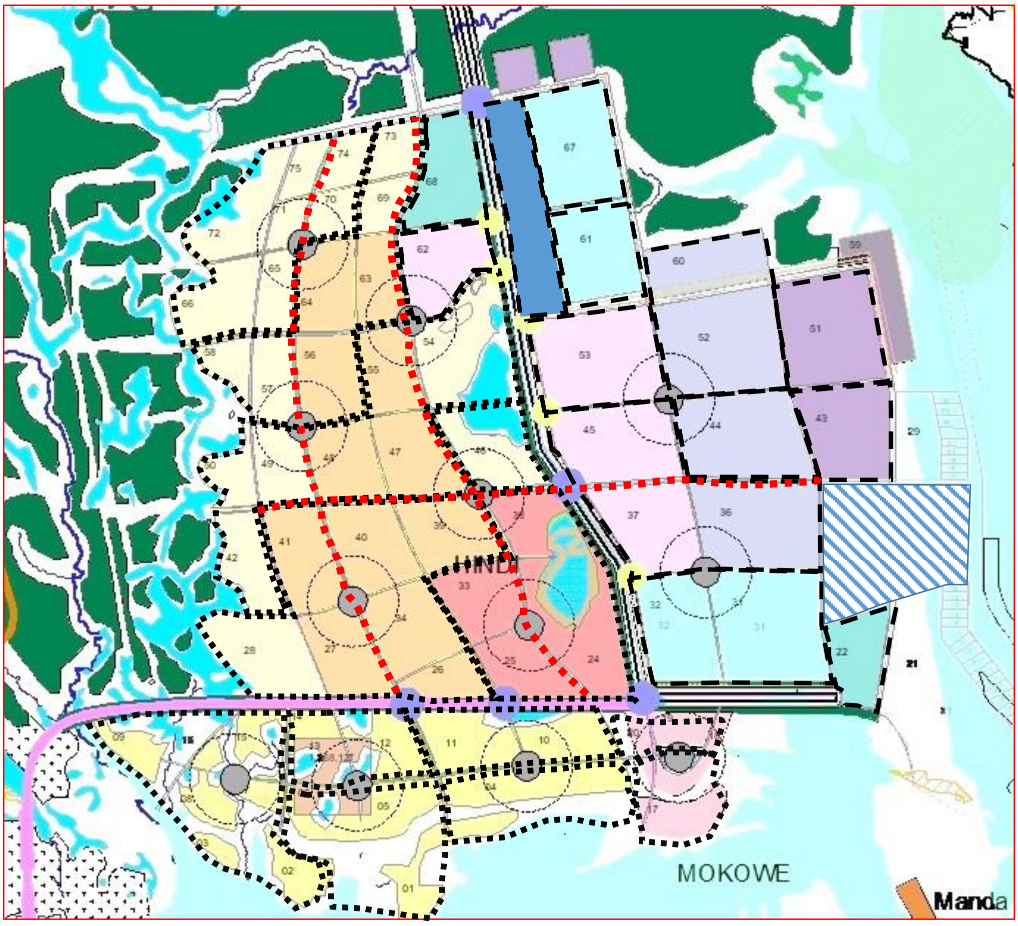


Figure 50: Phase V 2050-onwards: LPC Residential, Industrial and Leisure City Expansion

Phase V shows in colour the areas that are open for development. The LPC side is approximately 16.4 mln sq. m. whilst other uses are approximately 7.5 mln sq. m. only Leisure City related.

PHASE V 2050 ONWARDS										
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available for Dus	DUs	Pop.	Pop/Year	DU/Year	Km of road
Phase V	65	L	2,243,628	0.74316	1,667,380	2,842	13,543		N/A	37.39
Phase V	66	L	4,240,040	0.74316	3,151,038	5,371	25,593		N/A	70.67
Phase V	70	L	1,851,273	0.74316	1,375,797	2,345	11,175		N/A	30.85
Phase V	71	L	1,225,163	0.74316	910,495	1,552	7,395		N/A	20.42
Phase V	72	L	3,729,414	0.74316	2,771,560	4,724	22,511		N/A	62.16
Phase V	74	L	1,770,996	0.74316	1,316,138	2,243	10,690		N/A	29.52
Phase V	75	L	1,420,108	0.74316	1,055,371	1,799	8,572		N/A	23.67
			16,480,622		**12,247,779**	**20,876**	**99,479**	**open**	**N/A**	**274.68**

Table 30: Phase V 2050 onwards Residential Low – Medium – High Density

PHASE V 2050 ONWARDS							
Phase	No.	Density	Total Available Area Sq. M.	Adjustment factor	Area Available	Km of road	Cost of Infrastructure Provision
Phase V	02	LEI CITY	2,144,833	0.80	1,715,866	35.75	21,448,330
Phase V	03	LEI CITY	676,715	0.80	541,372	11.28	6,767,150
Phase V	08	LEI CITY	1,556,557	0.80	1,245,246	25.94	15,565,570
Phase V	09	LEI CITY	1,577,676	0.80	1,262,141	26.29	15,776,760
Phase V	15	LEI CITY	1,545,288	0.80	1,236,230	25.75	15,452,880
			7,501,069		**6,000,855**	**125.02**	**75,010,690**

Table 31: Phase V 2050 onwards Leisure City, Civic Centre Industry

5.13.2 Bus Rapid Transit

BRT is a major tool for implementing SUMP. This solution is being actively pursued for Nairobi since it is relatively cheap in infrastructure compared to rail based transport. The vehicles are also bus-based so that operations and maintenance are familiar and suitable for existing maintenance depots and engineering know-how.

BRT is not simply a bus with a physically segregated lane because in terms of operations it is more complex and requires bespoke stops and stations to prevent unwarranted and ad-hoc stopping and starting. The bus bodies have high doors so that access/egress is only possible at specified stations (Photo 31). The advantages are that it can beat congested roads and thus travel times when successfully implemented may be reduce by up to 50% or more. So, a 60-minute commute would take 30 minutes by BRT since it can run on a physically segregated lane and when correctly co-ordinated through large termini, switching to other BRT routes can be easily achieved. In terms of east Africa BRT has been very successfully implemented in Dar Es Salaam where it is being continually expanded.

Photo 31: Example of BRT Platform with raised floor for exclusive use of BRT passengers (DAR)

The LPC urban planning recommendations have specified two roughly north south BRT routes that connect all the EDZs with the CBD, leisure city and civic centre. There are also three east-west routes that allow connectivity between the two main routes as well as connecting the two routes to the industrial zone. For the convenience of visitors there is also a dedicated BRT route specified for the leisure city.

A successful BRT system is also well phased in and integrated with scheduled bus services which act as feeder routes. Large termini should be built with ability to accommodate scheduled bus services that bring passengers from destinations which the BRT routes don't cove. It must be remembered that due to their higher infrastructure and operating costs compared to scheduled bus services, BRT lines must have sufficiently high demand. (**Error! Reference source not found.** and Photo 33).

Photo 32: BRT Terminus with high standard feeder route facilities and shelters

Photo 33: Co-ordinated arrival of BRT and Feeder Buses

The BRT routes will naturally not be built all along their length but will expand in harmony with the phasing. Figure 17 shows colour coded phases for the completion of the north south and east-west lines.

The main north south BRT routes will be completed in four phases i.e Phase I to Phase IV. Route 1 or "Lamu Line" will be completed first in line with the phasing.

Route 2 "Shella Line" will begin in Phase II and will be completed with Phase V. The other routes east west will be constructed as work on the two north south routes progresses as shown in Figure 22 below

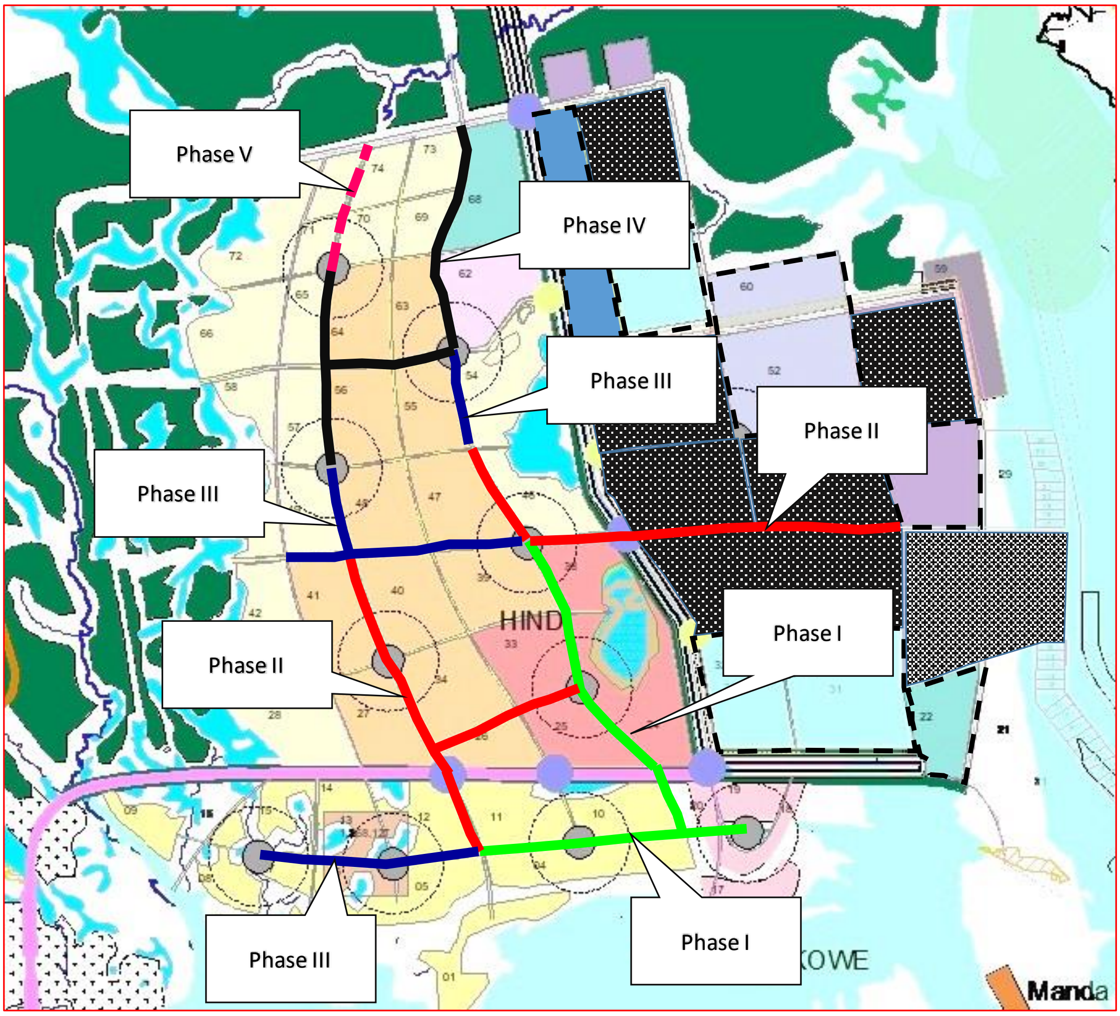


Figure 51: Proposed Main BRT Lines Gradually Extended with Phases I to V.

The completed lines are shown in Figure 52 below. At this stage six routes and names are suggested:

1. Route 1 or Lamu Line
2. Route 2 or Shella Line
3. Route 3 or Port Line
4. Route 4 or Leisure City Line
5. Route 5 or East-West South
6. Route 6 or East West North.

Other names or designations can be provided.

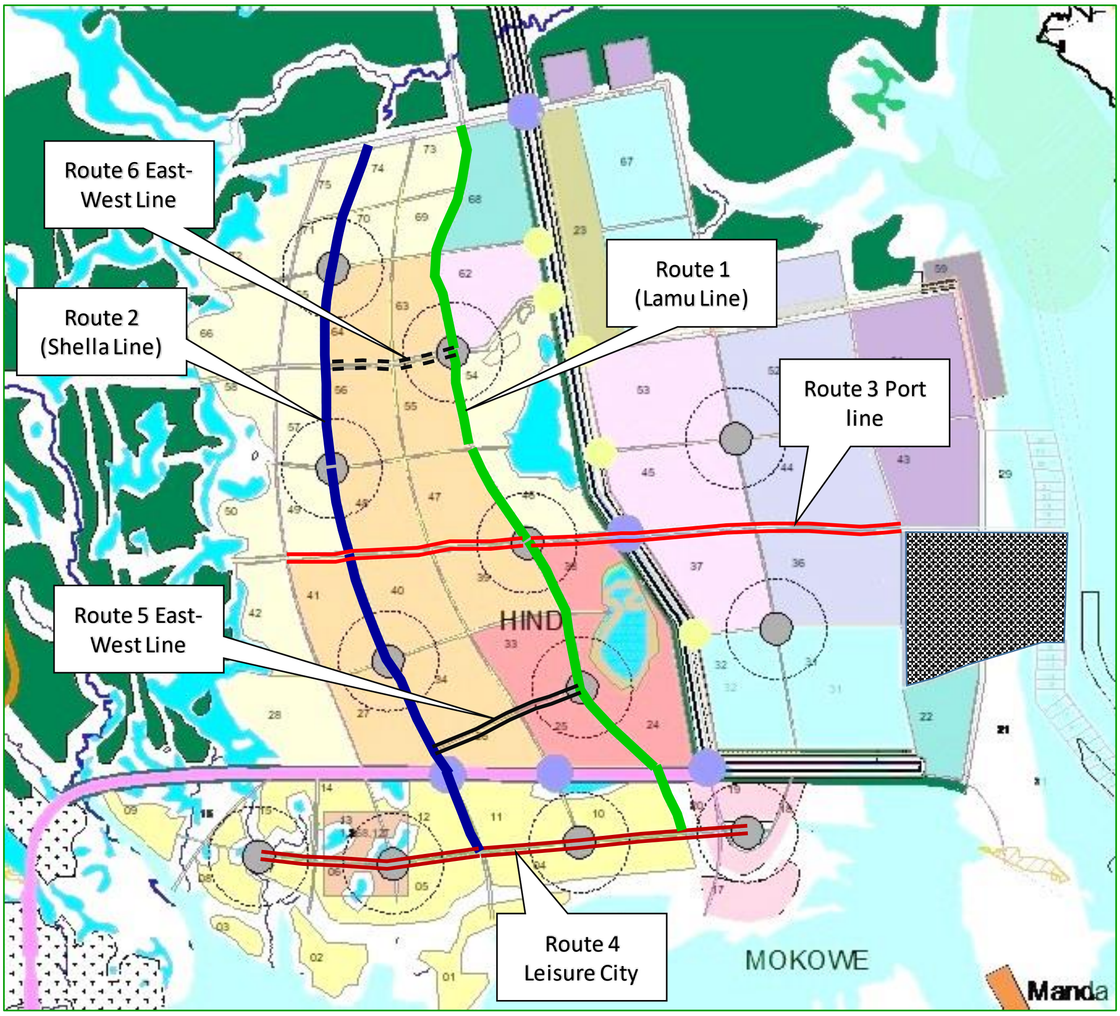


Figure 52: Completed BRT Lines

5.13.3 Large Health and Educational Facilities

The future LPC area will require both health and educational facilities of a regional reach. That is there will be a network of primary and secondary schools and health facilities, but the health facilities of Regional importance are required.

The same applies for education i.e. university level facilities. Their location is important, and Figure 53 below suggests their location with a University Campus and Regional Importance General Hospital marked E and H respectively.

The University is in direct BRT line to the Industrial zone since it is anticipated there will be synergies and interaction between the two with regard to training and research.

The General Hospital is located centrally so that it is along a BRT line within easy reach in between commercial centres.

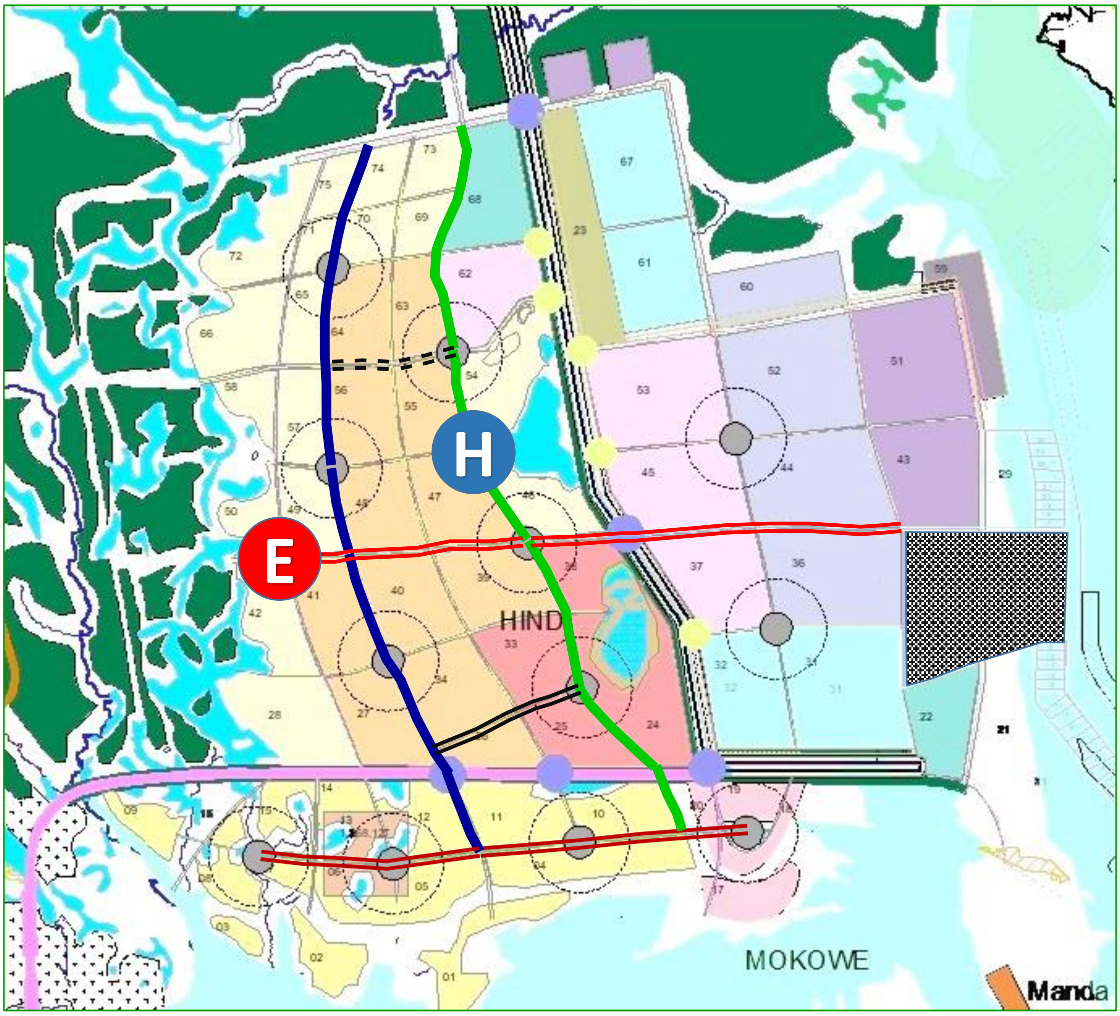


Figure 53: Suggested Location of Major Health and Educational Centres

5.14 Budgeting

Some infrastructure needs to be provided up front. This includes the cost of the road network and other associated utilities that will use the same right of way.

The cost of road provision varies widely depending on the geometrical standard, provision of traffic control devices, lighting, junctions, NMT facilities, markings and signage etc. In general, urban roads require much more in terms of ancillary road furniture and safety devices than interurban roads.

In terms of width urban roads vary from neighbourhood and local level roads up to arterials of 4 or 6 lines with divided carriageways. There are far fewer kilometres of the latter and many more kilometres of the former so the average cost per kilometre used is USD 600,000/km. This covers most cases of road provision. The same cost has been assumed for roads related to the civic centre, leisure city and resort city.

Road in industrial areas require are slightly cheaper as they are not expected to carry extremely high traffic volumes or at speeds. The cost of providing roads and related infrastructure in the industrial zones is estimated at USD 400,000/km.

In the LPC zone roads require up to 20% of available area whilst industrial zones have lower requirements than residential and commercial areas and require around 10% of available area to be committed to road space. The average right of way is 12m. With these planning magnitudes in mind the budgeting and phasing requirements are as follows:

Residential LPC Side USD		
Phase	**Required Funding USD**	**%age**
Phase I 10yrs	236,197,640	20.8%
Phase II 10 yrs	310,656,390	27.3%
Phase III 5 yrs	227,922,560	20.0%
Phase IV 5 yrs	197,737,230	17.4%
Phase V 15 yrs	164,806,220	14.5%
Total	**1,137,320,040**	**100.0%**

Table 32: LPC Side Budget and timing

Industrial, Leisure, Civic, Resort USD		
Phase	**Required Funding USD**	**%age**
Phase I 10yrs	278,007,792	36.8%
Phase II 10 yrs	99,269,280	8.5%
Phase III 5 yrs	207,262,585	28.4%
Phase IV 5 yrs	115,152,913	19.8%
Phase V 15 yrs	75,010,690	6.5%
Total	**774,703,260**	**100.0%**

Table 33: Table 16 Industrial, Leisure City, Civic Centre, Resort City, Logistics

ALL USD		
Phase	**Required Funding USD**	**%age**
Phase I 10yrs	514,205,432	26.9%
Phase II 10 yrs	409,925,670	21.4%
Phase III 5 yrs	435,185,145	22.8%
Phase IV 5 yrs	312,890,143	16.4%
Phase V 15 yrs	239,816,910	12.5%
Total	**1,912,023,300**	**100.0%**

Table 34: Combined Funding Requirements

5.15 Synthesis and Conclusions

The urban planning component is concerned with the efficient distribution of land uses in relation to the distribution of port and transport infrastructure.

Beyond that the Lamu Port City development area needs to operate internally in an efficient manner with transport sustainability in mind. Future development areas need an appropriate hierarchy of roads with facilities for pedestrian and cyclists integrated into the designs.

The LPC area is quite large and therefore a phased development approach is required to allow for compact development and promote efficient use of space. Committing widely separated areas to development prematurely increases the cost of providing transport infrastructure, services and utilities. In addition, it works against the promotion of an urban environment that is attractive in order to attract the population needed to support the port and industrial operations.

Sustainable Urban Mobility Planning ensures that non-motorised pollution free affordable transport is possible for all income classes. There is a role for private transport, but it cannot operate in an unrestrained manner in high density areas if the problems of other Kenyan cities are to be avoided.

Bus Rapid Transit solutions have been recommended as the technology is well understood and it is far less costly to build, operate and maintain than light or heavy rail options.

The urban planning requirements are LCDAs vision of the future growth of LPC. Though LCDA is not an implementing agency it has the crucial role of co-ordinating all the complex elements to ensure an attractive and productive urban environment.

The urban planning recommendations provide LCDA with an implementable framework. It is flexible with regard to timing and content and can be adjusted if changed circumstances require it.

6 Railway network planning

6.1 Existing situation – issues and future development lines

6.1.1 Summary of existing situation

6.1.1.1 General

LAPSSET corridor railway is planned to link Lamu to Isolio and then with several branches:

- to the north toward Moyale in Ethiopian border and then to Addis Ababa,
- to the north-west towards Nakodok in South Sudan border and then to Juba,
- to the south towards Nanyuki and Nairobi in order to join SGR network.

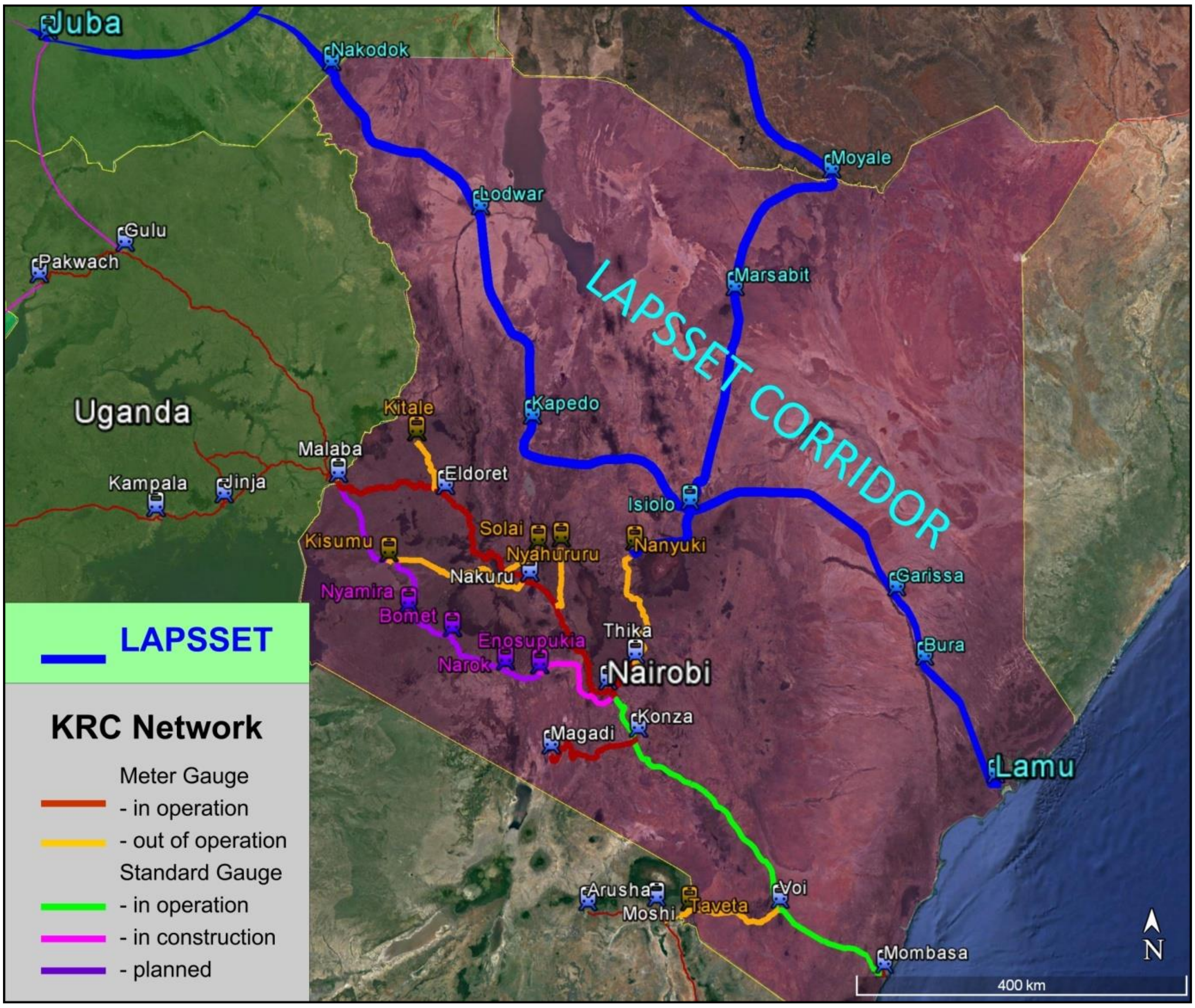


Figure 54: Port Kenyan railway network

- Two studies have been undertaken to explore the feasibility of a LAPSSET Corridor railway:

- in 2011 from “Japan Port Consultants Ltd.” (JPC) in collaboration with BAC/GKA JV Company
- in 2015 from China Civil Engineering Construction Company (CCECC).

6.1.1.2 JPC master plan

The JPC master plan submitted in 2011, foresees a standard gauge railway line. It is not foreseen to be electrified. It seems that the railway has been designed taking into account traffic forecasts until 2030 only: this could be subject to discussion as railway infrastructure shall be normally designed for a much longer period: at least 40 years of operation, i.e. until 2065 if the project would be completed in 2025. The study also provides preliminary drawings and studies for all required facilities: stations including rail terminal in Lamu and port sidings, workshops, etc. The alignment of the railway within the Lamu County (study area for this master plan) follows the corridor plan presented in the next page.

Railway Freight Terminal in Lamu

Freight trains arriving at Lamu Port on the Main Line first pass through Lamu Yard and then reach the RFT which is located behind the Wharf. The role of Lamu Yard and the RFT is to connect Lamu port with the interior of the country. In order to accomplish this in the most effective way possible, Lamu Yard and the RFT should be placed serially next to each other, as seen in the figure in the next page.

Lamu Port Side Facilities

After the Lamu yard terminal, the railway lines turn both to the right and left as they enter the berth area. This makes the track layout at the entrance very difficult. The tracks enter the port area by the use of curves with a radius of 100 m, as per the JPC study.

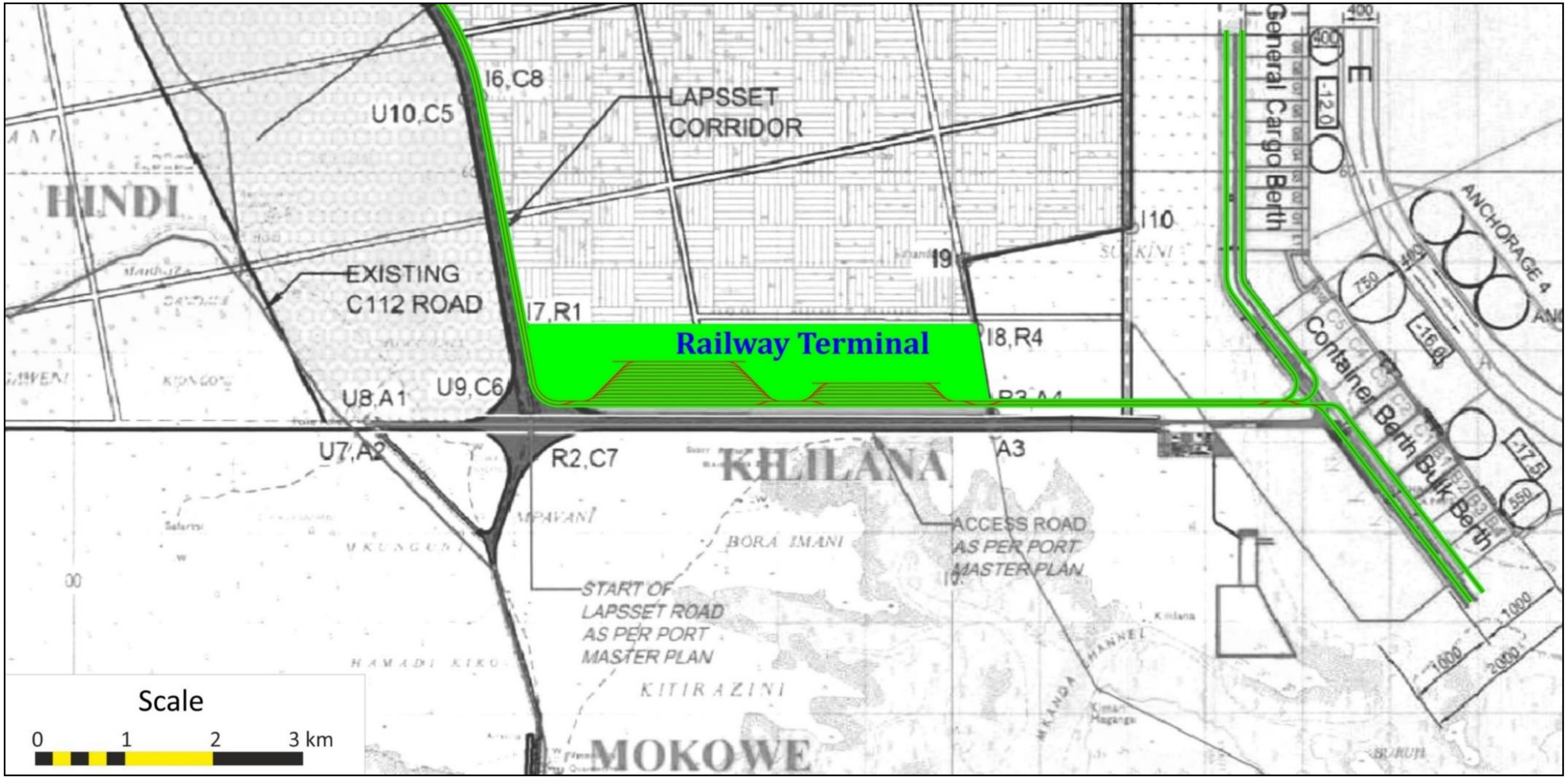


Figure 55: Proposed Railway Terminal in Lamu County

6.1.1.3 CCECC preliminary feasibility

Plans for the railway are for a Standard Gauge Railway (SGR) to link Lamu with Ethiopia and South Sudan (1,776 km of the railway will be in Kenya). The railways will consist of a single-track, diesel powered, line with passing loops. There will be branches at Isiolo to Nakodok and Moyale. In addition, the study also considers a branch linking from Isiolo to Nairobi linking the LAPSSET Corridor by rail to the capital. One more time, such study limits traffic forecasts until 2040 only as hereafter recorded.

Section and distance	Projected freight flows	Initial 2025	Medium Term 2030	Long Term 2040
Lamu – Isiolo 544 km	Lamu – Isiolo	4,090	8,060	16,500
	Isiolo – Lamu	2,230	5,250	9,100
Isiolo – Nakadok 755 km	Isiolo – Nakadok	-	3,700	5,000
	Nakadok – Isiolo	-	2,250	3,250
Isiolo – Moyale 477 km	Isiolo – Moyale	-	-	6,100
	Moyale – Isiolo	-	-	3,000

Table 35: Freight Traffic Demand Forecast (1,000 Tonnes per Year)

As per JPC study, the railway line capacity requirement could be underestimated.

Trains would take approximately 7h10 to reach Isiolo and further 6h to Moyale or 10h30 to Nakadok. It is proposed that the railway will run diesel traction engines with potential for future electrification. The line capacity would be for around 28 trains per day. The railway line has been designed with a maximum speed of 120 km/h.

The main rationale for the project is for freight services, particularly serving Ethiopia and South Sudan. The railway is likely to be used for the transportation of: liquids, bulk, break bulk, containers and refined petroleum. Estimates for passenger demand are also considered.

For the Lamu port, freight terminal facilities are planned, including both inland and port facilities.

Lamu Port Freight Facilities

At Lamu a freight terminal is proposed which would also be the main terminal and depot for the railway. Two alternative layout options were considered for the depot, with the transverse layout being deemed as most effective from an operational and cost perspective.

No further discussion is provided regarding port side facilities, and from the sketches provided it appears that the CCECC study follows the provisions of the initial JPC master plan.

6.1.2 Review of Consultations and Meetings

With no railway line present and with the planning for the railway line delayed, there were no relevant issues discussed during meetings and consultations with local Authorities.

The meeting with KRC representative revealed that LAPSSET railway corridor is not a priority project for KRC.

6.1.3 Identification of issues

From the data and meetings presented above, the following issues are identified:

- although the scope and technical planning of the railway line have not changed from the initial master plan, the planning horizon for the railway line has been significantly delayed, since the JPC master plan provided for the construction of the railway line to be concluded by 2016;
- the LAPSSET railway component is not a priority project for KRC and no short/medium term plans exist for the realisation of the railway line;
- currently there is no preliminary or final design for the railway line, that are necessary for the realisation of the project.

6.2 Planning and design conditions

6.2.1 General assomptions

The corridor railway line is foreseen as single, diesel, standard gauge line to serve freight. The specific assumptions are to remain unchanged for the purpose of the current study.

6.2.2 Port railway access

As analysed in the previous report section dealing with port operations, Lamu port has got now a revised layout with the generation of two separate port sections, the Commercial Port, and the Industrial Port, separated by the land strip of the JMB. This layout revision has two main implications regarding ports' rail connectivity:

1. Both port sections will be expected to be connected to the main railway axis (freight rail line) in an efficient and effective manner;
2. The Railway Freight Station (RFT) has to be suitably relocated in order to allow for an efficient and effective railway connection of both port sections, along with industrial facilities (situated in the heavy and/or medium industrial zones of SEZ) with potential needs for dedicated direct rail links;

Considering the above it is recommended that

1. the RFT is relocated to the north-western part of the SEZ, adjacent to the Corridor, with north – south orientation, as indicated in the figure below. The new location is

considered optimal in minimising the ton-kilometers registered for freight traffic circulation between RFT and port terminals. The new location by the northern entry of SEZ is considered also optimal because it would allow easier access to the Industrial port and to potential industrial users of dedicated rail links;

2. There are separate rail links for each of the two port sections as also clearly indicated, branching off from the relocated RFT. The rail link serving the Industrial Port could also serve industrial rail users with dedicated trucks if need arises;

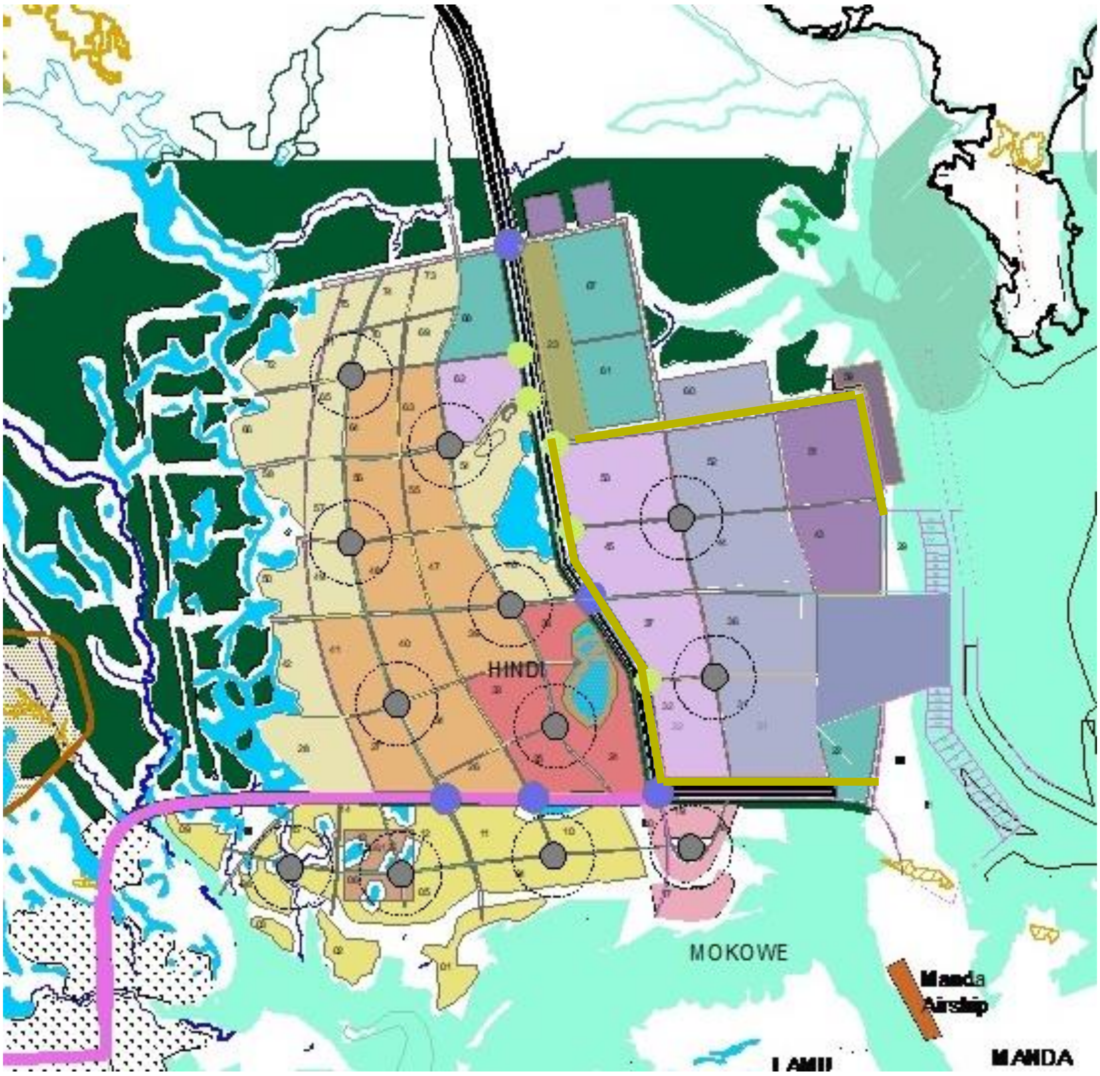


Figure 56: Rail connection of the Port / SEZ

6.2.3 Rail freight planning capacity

Regarding railway freight capacity, the total cargo volume at Lamu port is estimated (based on the revised estimate developed in the previous port-related section 3.2.2.2 of the current report) to amount 13.7 million and 24.8 million tons in 2030 and 2040, respectively, from which railway will carry 7.4 million tons (54%) and 14.4 million tons (58%) respectively (according to JPC study). The table below generates actual cargo volumes corresponding to each port section for years 2030 and 2040.

CARGO TYPES	COMMERCIAL PORT		INDUSTRIAL PORT		TOTAL	
	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)
Total forecasted annual demand	13,748	15,087	-	9,674	13,748	24,761
% share of rail	54%	58%	54%	58%	54%	58%
Annual demand for rail transport	**7,424**	**8,750**	**-**	**5,611**	**7,424**	**14,361**

Table 36: Rail corridor total freight capacity

The rail capacity requirements per cargo type are estimated further by the following table.

CARGO TYPES	COMMERCIAL PORT		INDUSTRIAL PORT		TOTAL	
	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)	ANNUAL MAX THROUGHPUT 2030 ('000 tons)	ANNUAL MAX THROUGHPUT 2040 ('000 tons)
Containers	4,308	4,934	-	3,289	4,308	8,223
Dry bulk	419	653	-	653	419	1,305
Agri bulk	987	1,411	-	-	987	1,411
Liquid Bulk	286	222	-	222	286	444
General Cargo / Break Bulk	1,280	1,216	-	1,216	1,280	2,431
Livestock	10	26	-	-	10	26
RO-RO / Car Carrier	108	232	-	-	108	232
Offshore oil and gas servicing	-	-	-	232	-	232
Others	27	58	-	-	27	58
TOTAL	**7,424**	**8,750**	**-**	**5,611**	**7,424**	**14,361**
Containers (**TEUs**)	444,136	508,618	-	339,079	444,136	847,697

Table 37: Rail corridor freight capacity demand per cargo type

6.3 Physical rail infrastructure development

6.3.1 Rail links to port from RFT

The railway corridor main line is expected to remain a single line.

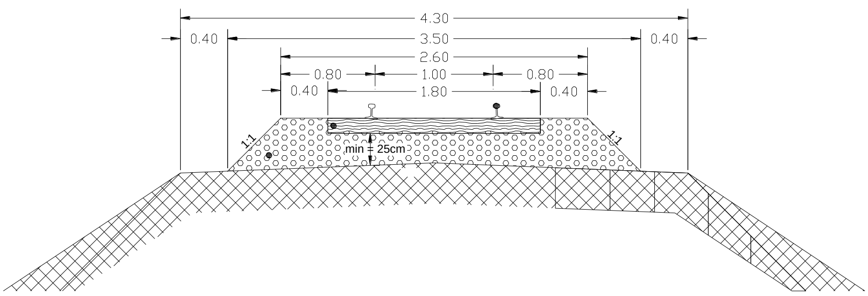


Figure 57: Single line cross-section

Dual lines are to be foreseen for connection of the RFT with the Industrial and the Commercial port terminals.

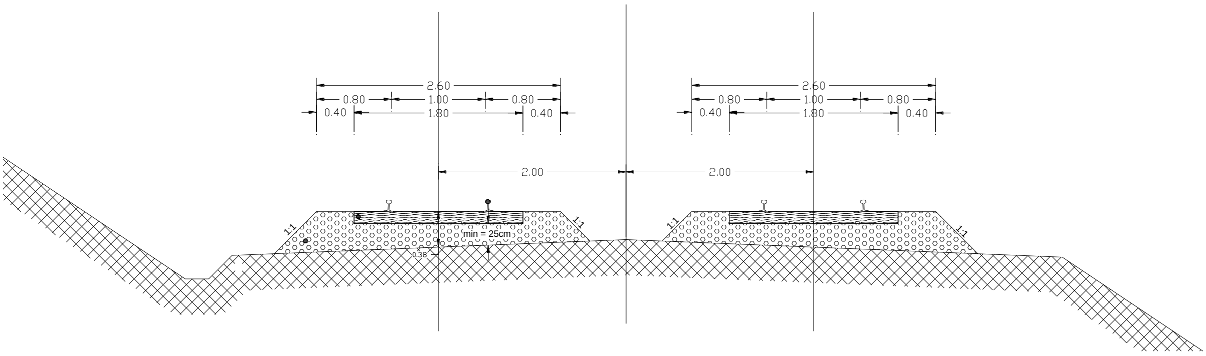


Figure 58:Double line cross-section

6.3.2 Railway freight terminal

6.3.2.1 General characteristics

The role of the Rail Freight Terminal is to connect the Main Line with the port side (intermodal loading and unloading) terminal facilities. It would consist of the following main components:

- arrival/departure tracks;
- sorting/storage/train make-up tracks;
- container yard and cargo storage facilities;
- maintenance workshop and depot for rolling stock (wagons and locomotives);
- maintenance workshop and depot for tracks;
- logistics services facilities (3PL etc) ;

From an RFT operational perspective the following assumptions are considered sufficient to be maintained.

- it will serve the three routes Isiolo-Southern Sudan (border) route (533km), Isiolo-Ethiopia (border) route (738km) and Lamu-Isiolo route (448km);
- diesel-engine locomotive train is proposed to be adopted until future traffic exceeds current forecasts. The type of locomotives to be selected would be within a target range of 4,000 to 6,000 horsepower;
- Inter-modal container standards would allow as usual for two types: a) 20 feet (6.096m) containers, and b) 40 feet (12.192m) containers;
- The weight of a single stack wagon, which would be allowed to be loaded with two “20’ containers” or a “40’ container”, is defined as 16.9 ton. The weight of double stack wagon, which would be allowed to be loaded with two “20’ container” and one “40’ container” or two “40’ containers”, is defined as 16.9 ton. Permissible load combinations would therefore include a) two “20’ container” or one “40’ container” loaded on a single stack wagon, b) two “20’ container” and one “40’ container” loaded on a double stack wagon, and c) two “40’ container” are loaded on a double stack wagon;

- The following cargo types are foreseen: “containers”, “dry bulk”, ”break-bulk” ”liquid bulk” and ”refrigerated”. Livestock which is a newly introduced cargo type is expected to be loaded on trucks. Car vehicles for the purpose of our study to be treated as break bulk type of cargo;
- JPC’s provisions can be maintained unchanged regarding train formation characteristics both for containers and for general cargo (see tables below)

Item		Contents
Container Freight Train Type 1	Trains connected and number of containers	2 TEU x 50 wagons = 100 TEU
	Locomotive (Type, Length and Weight)	AC4400CW: Total length 22.3 m, approx. weight, 190.5 t AC6000CW: Total length 23.2 m, approx. weight ,191.9 t
	Train formation length	750 + 24 = 774m (15m x 50 wagons)
	Weight of train formation when carrying laden containers	Weight of train formation when carrying loaded containers = 2,695t Breakdown: Weight of wagons loading laden containers: 50t x 50 wagons = 2,500t, locomotive weight = 195t
	Weight of train formation when loaded with empty containers	Weight of wagons loaded with empty containers = 1,045t Breakdown: Wagons (without container): 17t x 50 wagons = 850t, locomotive = 195t
	Net Load	Per train formation 2,695t – 1045t = 1,650t
Container Freight Train Type 2	Trains connected and number of containers	2 TEU x 100 wagons = 200 TEU
	Locomotive (Type, Length and Weight)	AC4400CW: Total length 22.3 m, approx. weight, 190.5 t AC6000CW: Total length 23.2 m, approx. weight ,191.9 t
	Train formation length	1,500 + 24 x 2 = 1,548m (15m x 100 wagons)
	Weight of train formation when carrying laden containers	Weight of train formation when carrying loaded containers = 5,390t Breakdown: Weight of wagons loading laden containers: 50t x 100 wagons = 5,000t, locomotive weight = 195t x 2 = 390t
	Weight of train formation when loaded with empty containers	Weight of wagons loaded with empty containers = 2,090t Breakdown: Wagons (without container): 17t x 100 wagons = 1,700t, locomotive = 195t x 2 = 390t
	Net Load	Per train formation 5,390t – 2,090t = 3,300t
Container Freight Train Type 3	Trains connected and number of containers	4 TEU x 50 wagons = 200 TEU
	Locomotive (Type, Length and Weight)	AC4400CW: Total length 22.3 m, approx. weight, 190.5 t AC6000CW: Total length 23.2 m, approx. weight ,191.9 t
	Train formation length	375 + 24 x 2 = 798m (15m x 50 wagons)
	Weight of train formation when carrying laden containers	Weight of train formation when carrying loaded containers = 4,490t Breakdown: Weight of wagons loading laden containers: 82t x 50 wagons = 4,100t, locomotive weight = 195t x 2 = 390t
	Weight of train formation when loaded with empty containers	Weight of wagons loaded with empty containers = 1,240t Breakdown: Wagons (without container): 17t x 50 wagons = 850t, locomotive = 195t x 2 = 390t
	Net Load	Per train formation 4,490t – 1,240t = 3,250t

Source: JPC

Table 38: Summary of Containerised Freight Train characteristics

Item		Contents
General Freight Train Type 1	Trains connected and number of wagons	1 cargo x 40 wagons = 40 wagons
	Locomotive (Type, Length and Weight)	AC4400CW: Total length 22.3 m, weight approx. 190.5 t AC6000CW: Total length 23.2 m, weight approx. 191.9 t
	Train formation length	800 + 24 = 824m (20m x 40 wagons)
	Weight of train formation when loading laden wagons	Weight of train formation when loaded with laden containers = 2,595t Breakdown: Weight of wagons carrying laden containers: 60t x 40 wagons = 2,400t, locomotive = 195t
	Weight of train formation when loading empty wagons	Weight of empty wagons = 1395t Breakdown: Wagons (without container): 30t x 40 wagons = 1200t, locomotive = 195t
	Net Load	Per train formation 2,595t – 1395t = 1,200t
General Freight Train Type 2	Trains connected and number of wagons	1 cargo x 80 wagons = 80 wagons
	Locomotive (Type, Length and Weight)	AC4400CW: Total length 22.3 m, weight approx. 190.5 t AC6000CW: Total length 23.2 m, weight approx. 191.9 t
	Train formation length	1,600 + 24 = 1,624m (20m x 80 wagons)
	Weight of train formation when loading laden wagons	Weight of train formation when loaded with laden containers = 5,190t Breakdown: Weight of wagons carrying laden containers: 60t x 80 wagons = 4,800t, locomotive = 195t x 2 = 390t
	Weight of train formation when loading empty wagons	Weight of empty wagons = 2,790t Breakdown: Wagons (without container): 30t x 80 wagons = 2,400t, locomotive = 195t x 2 = 390t
	Net Load	Per train formation 5,190t – 2,790t = 2,400t

Source: JPC

Table 39: Summary of General Freight Train characteristics

- Maximum permissible trains operation speed: 120 km/h - approaching speed to turnout: 50 km/h - running speed on passing loop: 50 km/h;

6.3.2.2 Layout

Two layout options have been considered for the RFT:

Transverse layout - whereby arrival/departure tracks and sorting tracks are laid out serially, the one after the other (see figure below in line with JPC suggestion). It is considered most cost-effective if there is enough space length available, but has limited capacity.

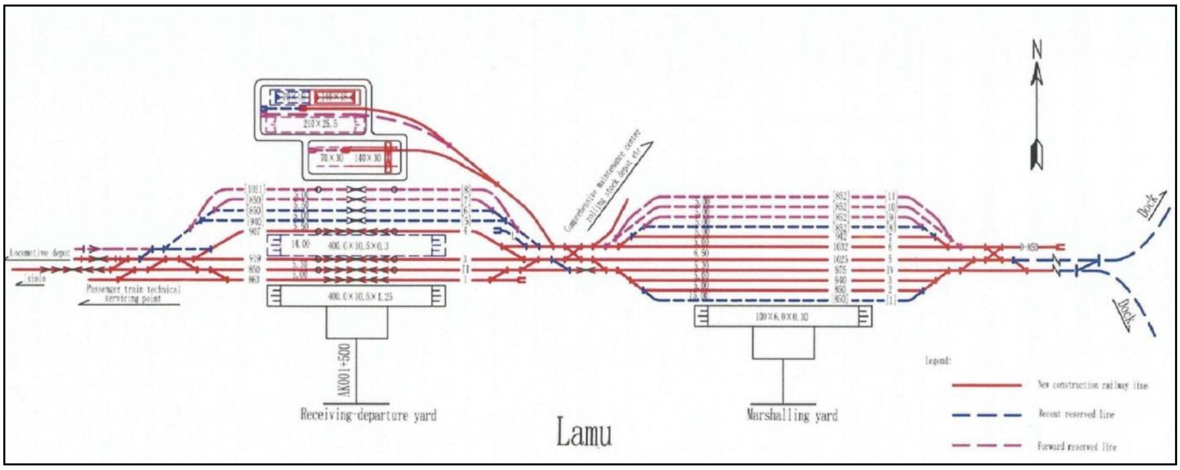


Figure 59: Transverse layout of RFT

Tandem layout - whereby arrival/departure tracks and sorting tracks are laid out in parallel (see figure below). It is usually more costly regarding operations, but can handle significantly more freight loads.

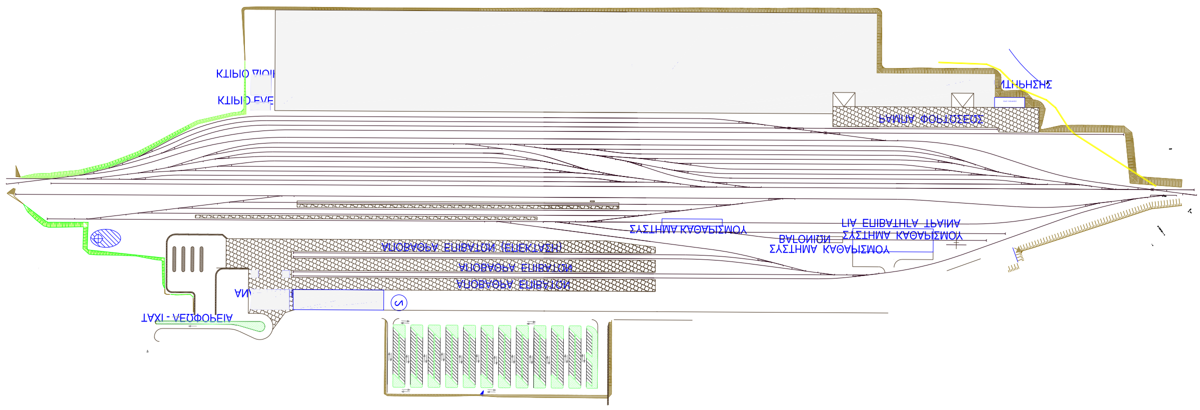


Figure 60: Tandem layout of RFT

Due to adequate effective length of the space available, the transverse layout is proposed to be initially adopted, upgrading to tandem layout at a later stage if need arises.

6.3.2.3 Container handling

Regarding container handling in the RFT, a Reach Stacker System seems to be preferable considering KPA's needs and that it would be also more efficient, cost effective and operationally flexible than a comparable RMG system, given the anticipated container volumes (see figure below).

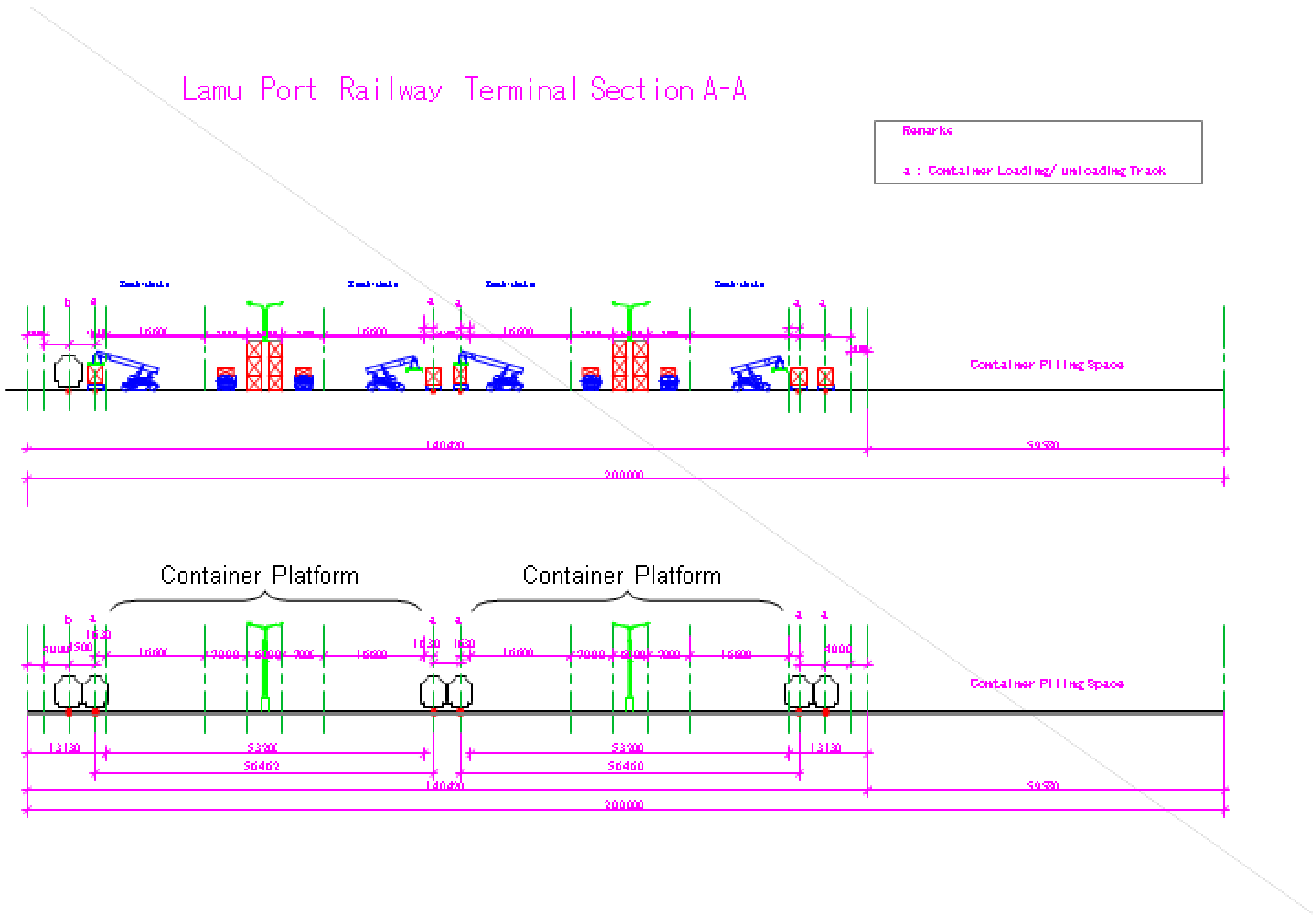


Figure 61: Lamu RFT - Cross Section A-A – Container Loading / Unloading Facilities (JPC study)

6.3.2.4 Bulk and general cargo handling

As JPC suggests, there are several kinds of loading/unloading facilities assumed as general cargo and bulk cargo handling system. Effective facilities with silo and belt conveyor are under use for handling dry bulk load/unload. Special type wagons are usually used for automobiles where they load/unload by themselves. Automobiles are in the category of break bulk cargo transportation.

For current project needs the most typical type of loading/unloading system is assumed. This is loading/unloading system by fork lift and will mainly handle general cargo and dry bulk cargo.

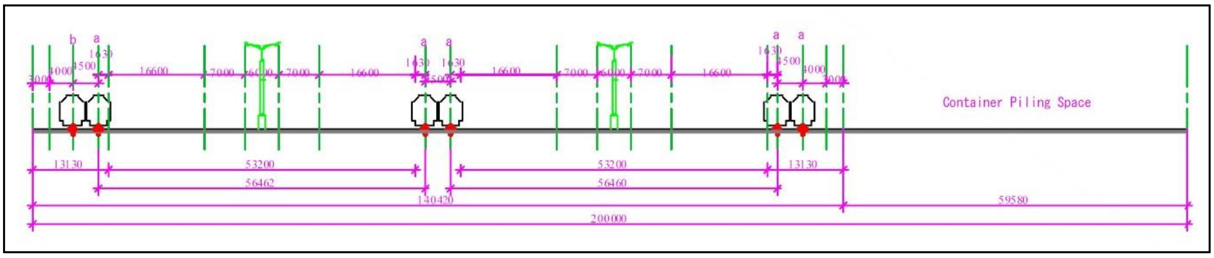


Figure 62: Lamu RFT - Cross Section A-A – Bulk Cargo Loading / Unloading Facilities (JPC study)

6.3.2.5 Design standards and conditions

The railway design standards for yard and freight terminal can be maintained as indicated by JPC as below.

Item	Standard
The Track	
Gauge	1,435 mm (standard gauge)
Design/Construction Standards	American Rail Road standards (AREMA)
Rails	60kg/m Continuously welded
Sleepers	Pre-stressed mono-block concrete
Ballast	Crushed stone to specified grading
Turnouts at passing loops	Suitable for 100 Kph on the loop line for passenger trains
Horizontal curvature	Radius 100 metres minimum
Vertical curvature	Radius > 3,000 metres minimum
Ruling gradient	Level , unavoidable<= 0.3%
Axle loading	Minimum 32.5 tonnes
Operations	
Design speed	Maximum Speed <= 30km/h

Table 40:Minimum rail design standards

6.3.3 Railway port side facilities

6.3.3.1 Commercial Port facilities

The railway connection of the Commercial Port with the relocated Railway Freight Terminal would be achieved as follows: the rail tracks leave the RFT, enter the CP entry gate and split immediately to both left and right directions, so that they access both the Commercial Zone 1 (on the right-hand side), and the Commercial Zone 2 (on the left-hand side).

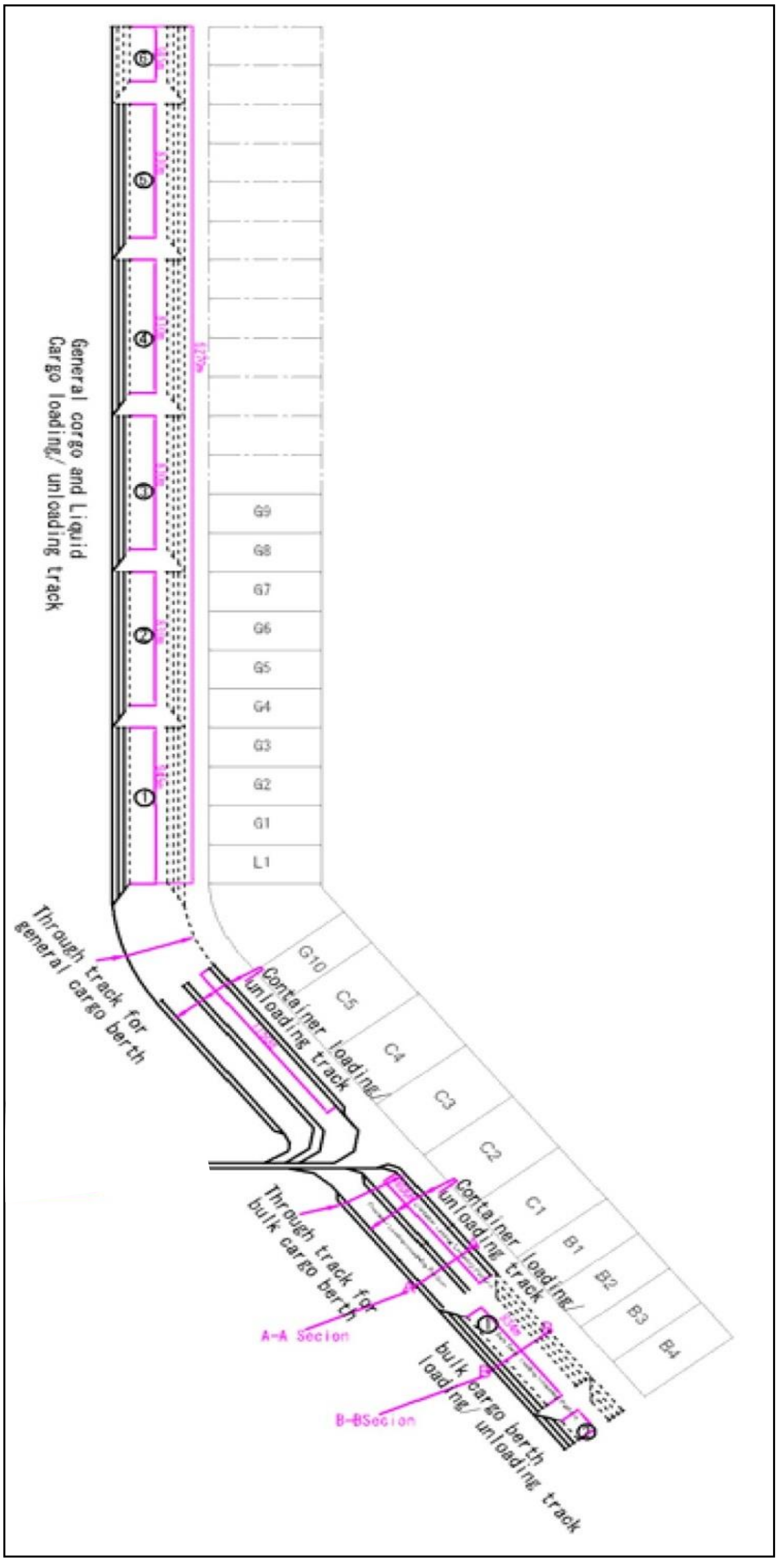


Figure 63: Track layout in the Commercial Port

6.3.3.1.1 Track layout at port entrance

From an operational perspective it is maintained that complete train units should be moving between the RFT and the freight yards of the port. The unloading and loading would then be performed continually.

According to JPC the tracks would enter the port area by using curves of 100m radius. However, this is considered a steep curvature and it is considered that an increased radius of at least 200 m has to be considered.

The above imply that train traffic will be relatively high in the RFT-CP rail link and consequently road and rail traffic at CP entry should be separated by a separate grade level intersection.

6.3.3.1.2 Track layout at port terminals

Rail terminals within the port may be either located by the berths (in order to allow direct train/ship loading and unloading), or at a distance from the berths (around 600m) as proposed by JPC.

Photo 34: Rail-Road/Ship multimodal facility

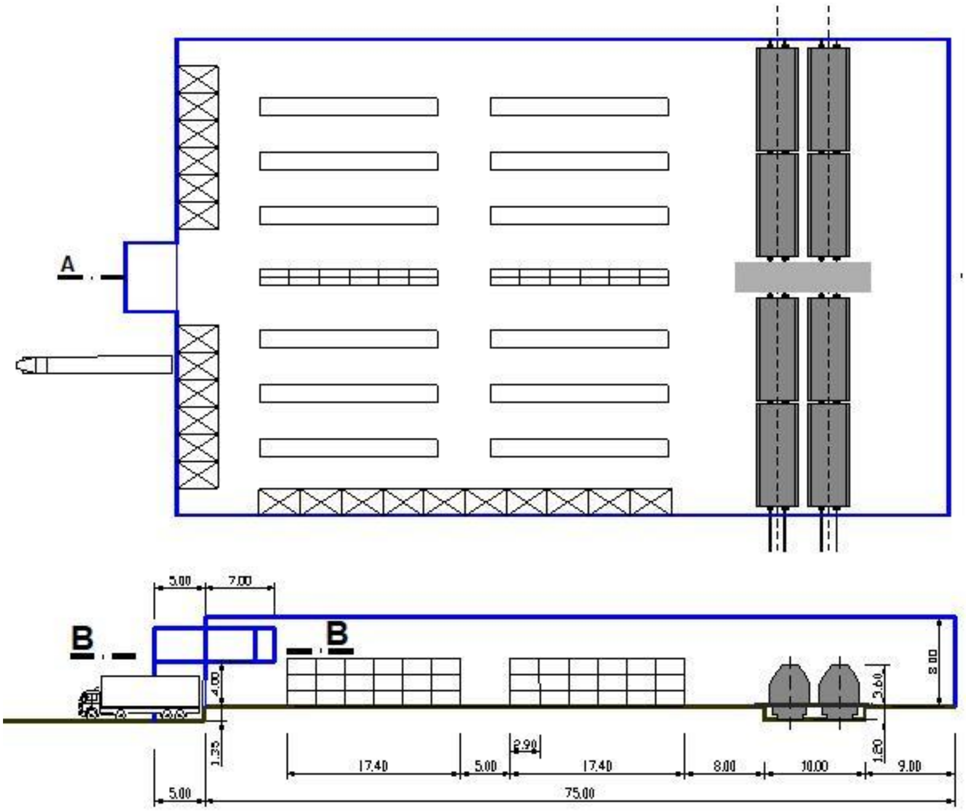


Figure 64:Rail-Road multimodal facility

It is maintained that it is currently premature to commit to a specific selection of a final configuration option. It would in general not be advisable to adopt such solutions in the absence of a) a port master plan and b) the port terminal operators who will actually operate the terminals and most probably provide the funding for infrastructure and equipment.

6.3.3.2 Industrial Port facilities

The railway connection of the Industrial Port with the relocated RFT would be achieved as follows: the rail tracks leave the RFT, enter the IP entry gate and turn only to right direction, branching off sequentially to the Industrial Zone 1 and 2 berths. Separate branches could branch off before the IP entry gate towards specific industries located within the heavy or medium industrial zones.

6.3.3.2.1 Track layout at port entrance

In parity with the Commercial Port it is also maintained that complete train units should be moving between the RFT and the freight yards of the port. The unloading and loading would then be performed continually.

The tracks would enter the port area by using curves of at least 200m radius and due to the anticipated high traffic, a flyover bridge should be foreseen for road vehicles.

6.3.3.2.2 Track layout at port terminals

Similar concerns as with the Commercial Port (see previous section 6.3.3.1.2 of current report).

6.4 Cost Estimate

A revised capital investment cost estimate for the RFT facility was developed allowing mainly for:

- an inflation cost adjustment factor of 10% accounting for the seven years period which has elapsed since 2011, when the base cost estimate (in USD) was produced by JPC;
- following RFT components: loading/unloading track, through track, container loading/unloading platform and general/break bulk cargo platform;

Capital investmet cost component	Cost (mil USD)
RFT infrastructure costs	73.7
Others and Contingency (5%)	3.7
Design and supervision (0.5%)	0.4
TOTAL	**77.8**

Table 41: Capital investment cost estimate for RFT

6.5 Time Plan

The construction of the Lamu Rail Freight Terminal is tightly related to the development of the Lamu Port and of the main railway line. Although the port development has already started, the plans for the railway corridor development seem to remain still vague and at very early maturity stage.

On this understanding current time plans for railway development in Lamu are quite premature. Nevertheless, in the table below it is attempted to provide a rough time perspective focusing on:

- RFT's main development phases, and;
- the importance of making port development plans more concrete;

YEAR	2018		2019		2020		2021		2022		2023		2024		2025		2026	
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
Market Forecasting + Feasibility + Revision of Port Master Plan																		
RAIL FREIGHT TERMINAL in Lamu																		
Fund sourcing + Preliminary design																		
Detailed Design																		
Tendering																		
Construction																		
Equipment Procurement & Commissioning																		

Table 42: Time plan for Lamu RFT

6.6 Conclusions

From the above analysis the main conclusions regarding railway infrastructure and operations in the Lamu port area have as follows:

- Time horizon has already been shifted significantly. The LAPSSET railway component remains a low priority project for KRC and no short/medium term plans exist for the realisation of the railway line. Consequently, time horizon for implementation would realistically shift beyond 2025.
- Compared to the JPC study (2011) the proposed revision of port layout (two port sections: Commercial Port and Industrial Port) brings about a shifting of RFT's location / orientation, and two new rail tracks connecting the two separate port sections.
- From an operations perspective there are limited changes of interest compared to JPC's proposals. Regarding rail facilities within the port terminals it would be advisable not to commit now to solutions in the absence of a) a port master plan and b) the port terminal operators who will actually operate the terminals and most probably be providing the funds for infrastructure and equipment.
- However, in order for the rail infrastructure / operations issues to advance seriously to the implementation phase (starting off with the preliminary & detailed engineering design), certain major prerequisites have to be fulfilled.
  a) Freight forecast market study has to be carried out urgently to update forecasted traffic in the LAPSSET corridor;
  b) The Master Plan of Lamu port is developed;
  c) the overall development masterplan of the LAPSSET rail corridor kicks off seriously with:
    - the KRC assuming effectively its role as implementing agency by upgrading its capacity and by developing effective interphases with LCDA;
    - the LCDA assuming effectively its role as LAPSSET Corridor implementation coordinator, by upgrading its capacity and by developing effective interphases with the KRC and the other implementing agencies;

7 Environmental and social review and assessment

7.1 Introduction

The LAPSSET Transport Corridor project envisages the following developmental activities like developing the airports, railways, road corridors, port facilities, power plant, urban infrastructure and oil pipelines. The construction and operation of these infrastructure assets will give rise to adverse environmental impacts on the project area. The environmental impacts should be properly identified and managed by applying timely remedial measures. Some of the potential impacts are as follows:

- Direct loss of natural assets in areas cleared for the construction of project components, including the proposed new port, roads, railway, airport, resort town, oil refinery, fishing port, and new urban and industrial areas.
- Direct loss of natural assets over a larger area due to the wider development that LAPSSET would attract new settlements, industries and infrastructure.
- Indirect impacts due to increased pollution and extraction of water, food, fuel and raw materials by a much larger population, however, given the scale of the LAPSSET project, these impacts would be felt over large distances, including neighbouring counties and in offshore marine areas.
- Geographical Information System (GIS) analysis suggests that over 150,000 Ha of intact habitats mainly mangroves, forests, coral reefs and seagrass beds) could be lost within these primary and secondary impact areas. The possible further loss of over 9,400 ha mangroves would represent a 38 % in Lamu's total stock. Water resources, fishing areas and wildlife would also be significantly affected.

7.2 Project Area

Lamu County is located in the North Coast of Kenya and it is one of the Coastal Counties in Kenya. It borders Kilifi County in the southwest, Garissa County to the north, Republic of Somalia to the northeast and the Indian Ocean to the South. The County has a land surface of 6,273.1 km that include the mainland and over 65 islands that form the Lamu Archipelago. The total length of the coastline is 130 km while land water mass area stands at 308 km. Lamu Town is situated at 341 Km by road of the North East of Mombasa that ends at Mokowe Jetty from where the sea channel has to be crossed to reach Lamu Island. It is UNESCO World Heritage Centre and it was one of the original Swahili settlements along coastal East Africa, founded in 1370.

The main economic activities in the county include crop production, livestock production, fisheries, tourism and mining, most notably quarrying. Among the challenges facing Lamu is population growth owing to migration into Lamu from other parts of the country, and further to this the anticipation of new opportunities due to the upcoming Lamu Port South Sudan Ethiopia Transport Corridor.

7.2.1 Environnent

The environmental baseline information is extracted from the Lamu County Spatial Plan, Final Report (2016-2026), May 2017.

7.2.1.1 Topography

Lamu County is generally flat and mostly lies between altitude 0 and 50m above sea level. This is with the exception of the coastal sand dunes and the Mundane sand hills which also hardly exceed 50 m above sea level and few of them exceed a gradient of 50. The highest areas of Lamu County are around Samburu Sand Hills and the Boni-Lungi Forest ecosystem. Some areas of the County's mainland such as Mokowe are below the sea level as a result of the areas being a limestone karst terrain.

7.2.1.2 Climate

Lamu County can be said to be between the tropical monsoon and arid steppe hot climate. The rainfall pattern in Lamu County is greatly influenced by the Monsoon winds with the long rains falling between late March and early June with May being the wettest month. Light showers fall in July and decreasing from August. The short rains come in November and December decreasing rapidly to a minimum in January and February. January to March is usually dry months.

7.2.1.3 Temperature

Temperature throughout the County is usually high ranging from 23 degrees Celsius to 30 degrees Celsius. Mean annual minimum and maximum temperatures range between 24 degrees Celsius and 34 degrees Celsius respectively. The hottest months are December and April while the coolest months are May and July.

7.2.1.4 Solar Radiation

The high solar potential in Lamu County shows that investments in solar energy generation in the County can not only ensure adequate load for solar equipment but also increase the accessibility to electricity and other benefits of solar energy resources to more residents of the County especially those who inhabit rural areas with little or no access to electricity currently.

7.2.1.5 Relative Humidity

The mean relative humidity in the County is 75%. Relative humidity is higher in March and September months and recorded lowest in May. The high relative humidity levels in Lamu discourage certain development land use aspects as the proposed Coal Plant under LAPSSET as the resultant emissions will be absorbed in the evaporation processes resulting to destructive rains as opposed to productive rains.

7.2.1.6 Wind Pattern

Lamu County experiences strong winds throughout the year. The strongest winds blow during the Northeast monsoon and the Southeast monsoon periods. Southeast runs from May to September and NEM from November to March with high wind speeds of up to 100 knots. Such winds necessitate tapping them for energy and possibly validate the proposed Wind Power Generation Project. The natural resources play a vital role in protecting the environment.

7.2.1.7 Geology

The principal soil types in Lamu County include a narrow strip of coastal sands towards the north where it is permeated by narrow bands of grumusols brown clay soils. The soil south of the County is composed of alternate bands of loams beyond which the grumusols are permeated by thick bands of ash and pumice soils. This geology influence groundwater availability.

7.2.1.8 Agro Ecological Zones

Due to the physiographic climatically and other natural conditions discussed above, the County is made of two broad economic zones covering the mainland for agriculture and livestock keeping, conservation and freshwater fishing and Islands for marine activities. The different agro-ecological zones are highly influenced by the rainfall variability patterns experience throughout the County and somehow define the natural potential of Lamu County.

7.2.1.9 Mangroves

The Kenya coast is bathed by the northward-flowing warm waters of the East Africa Coastal Current, located between latitudes 1 and 5° S. With a narrow continental shelf, the coastal marine environments are dominated by coral reefs, seagrass beds and mangroves, with large expanses of sandy substrates where river inputs from Kenya's two largest rivers, the Tana and Athi Rivers, prevent the growth of coral reefs. The northern part of the coast is seasonally influenced by upwelling waters of the Somali Current, resulting in lower water temperatures for part of the year. The coast is made up of raised Pleistocene reefs on coastal plains and hills of sedimentary origin, which support native habitats, dominated by scrub bush and remnant pockets of the forests that used to cover East Africa and the Congo basin. The marine environment is characterized by warm tropical conditions varying at the surface between 25°C and 31°C during the year, stable salinity regimes, and moderately high nutrient levels from terrestrial runoff and groundwater. Fringing reef crests dominate the whole southern coast and parts of the northern coast towards Somalia, forming a natural barrier to the wave energy from the ocean. Coral reefs form the dominant ecosystem along the majority of the Kenya coast, creating habitats for seagrasses and mangroves in the lagoons and creeks protected by the reef crests. The coastline in Kenya comprises of coastal coral reefs, mangroves swamps, coastal tropical forests and rangelands play a protective role against the siltation and erosion.

The Draft Summary Report on the Marine and Coastal Biodiversity, dated 19th June 2014 of Convention of Biological Diversity envisages the mangroves in Lamu area on the Indian Ocean Coast of North Eastern Kenya close to Somali Boarder are known as some extensive and species rich along the entire coast of East Africa. They are highly valuable in terms of bio-diversity, climate protection (Blue Carbon), fisheries, nature based tourism and coastal protection.

Lamu Island is surrounded by a mangroves and corals. It has a classical architecture and pristine beaches around the Island. The envisaged project will adversely affect the coastal mangroves. The mangroves have many environmental benefits like function as buffers between land and sea and provide protection against extreme weather conditions. The deep root systems prevent soil erosion and serve as nursery for marine organisms including species of fish, shrimp and crab, while the canopies provide nesting grounds for birds. Mangroves are exploited for economic purposes and used for building material and fuel wood. Mangroves, salt marshes and seagrass beds have been the ability to protect communities from floods and contribute to marine biodiversity. Lamu coast is home to 70% of the Kenya’s mangroves. It hosts eight of the nine trees pieces present in the country.

The dominant species Rhizophora mucronata and Ceriops tagal. The seaward side is occupied by Sonneratia-Rhizophora-giant Avicennia community. This is followed by Rhizophora-Bruguiera-Ceriops in the mid zone and dwarf Avicennia-Lumnitzera-Xylocarpus complex on the landward side. Other plant species associated with mangroves include Pemphis acidula and Barringtonia racemosa. Mangrove forests in Kenya provide many direct products - both timber and non- timber. Timber products include firewood, building poles and charcoal used in urban and rural areas. Other uses of mangrove poles include boat masts and fish traps/stakes. Larger logs of mangroves, especially of A. marina, are used in traditional boat construction. Aerial roots of S. Alba are also used as floaters for fishing nets.

Kenya's marine environment faces a number of threats from the growing coastal human population. Coastal development in urban and tourist centres proceeds with little regard for environmental and social impacts. With a faltering economy, industrial development in Mombasa proceeds with few checks on pollution and other impacts. The institutional, human resource and legal infrastructure for managing the coastal environment has in the past been low, however these are rapidly improving with the revitalization of national institutions and the passing in 1999 of an Environment Act. Marine Protected Areas are the key tool currently used in management of marine ecosystems, and focus principally on coral reefs and biodiversity protection. New initiatives are underway to improve application of fisheries regulations, and to use Integrated Coastal Area Management (ICAM) as a framework for protecting marine and coastal environments. The figure.1, given bellows shows the disposition of the mangroves.

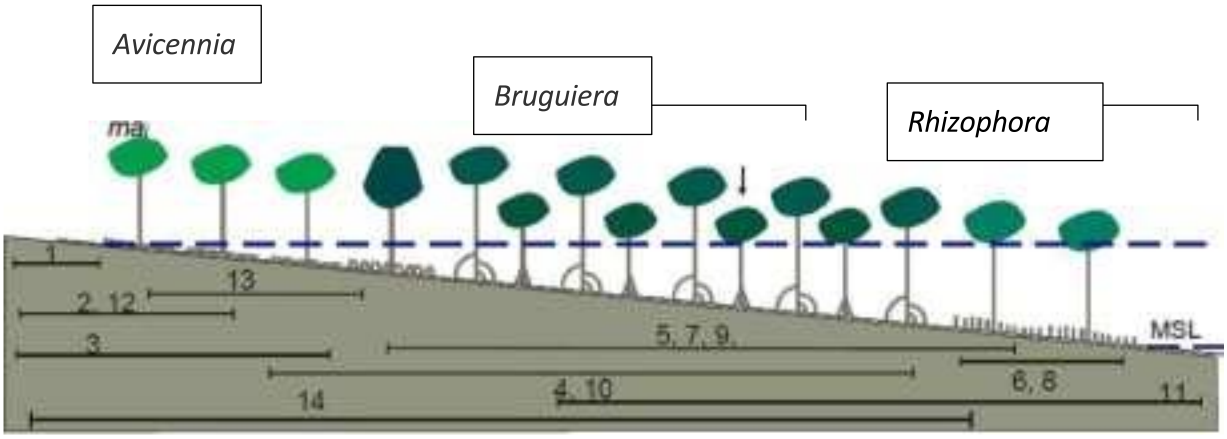


Figure 65: Zonation of mangroves along the land-sea interface

7.2.1.10 Marine National Park

Kiunga Marine National Reserve located in the Indian Ocean, the pristine ecosystem incorporates about 50 calcareous offshore islands and coral reefs and can view the sea life in the coral reefs, sea grass and extensive mangrove forests which are a refuge for sea turtles and dugongs.

7.2.1.11 Marine Habitats

Shallow marine habitats found in Lamu-Kiunga seascape include coral reefs, seagrass and mangroves ecosystems that provide four ecosystem services of provisioning, regulating, cultural and supporting services. Seagrass meadows provide numerous high value ecosystem services. They are vital habitat for marine organisms and form important foraging grounds for the endangered marine turtles and dugongs. Seagrass ecosystems are vital to the fishing industries as they serve as an important habitat and source of food to large fish species, for at least a part of their life cycle. They stabilize bottom sediments with their dense roots and rhizomes especially during storms. Seagrass beds also represent enormous carbon sinks and are being considered in blue carbon schemes.

7.2.1.12 Coral Reefs

Coral reefs are among the most productive and diverse of all marine ecosystems. They control the ecology of near shore marine environments by providing habitat and shelter to a high diversity of fish families, lobsters, octopus, dugongs, turtles and whale sharks. They act as a buffer for ocean waves reaching the shore. Coral reef ecosystem supports both artisanal and commercial fisheries and hence forms the backbone of coastal communities' economies. Recreational activities in coral reef ecosystems support the tourism industry, which subsequently engages other stakeholders such as boat operators, tour companies, tour guides and hoteliers in the hospitality sector.

Coral reefs in Kenya extend from the Tanzanian border in the south to the Somali border in the north and cover an area of 621.55 km2 representing 0.2% of the Great Barrier Reef. Kenya's coral communities conform to those of the western and central Indian Ocean biogeographic zone, with some endemic species and others of wide Indo-Pacific distribution. The reefs are typically composed of hard substrate co-existing closely with extensive sea grass communities. A continuous fringing reef dominates the southern part of Kenyan reefs while patchy and in places marginalized reefs characterize the northern part including the Pate Island to Kiunga area. These contrasting formation patterns between the southern and the northern reefs is attributed to the unique biophysical characteristics of the northern coast notably the fresh water discharge from the Tana and Sabaki Rivers coupled with the nutrient rich Somali current running south from Somalia.

7.2.2 Biodiversity Diversity Uses and Threats

Coral reefs, mangroves and seagrass as well as the pelagic habitats are vulnerable coastal habitats that provide economic goods and services, contributing to the livelihoods and food security of communities living in the Lamu-Kiunga area. Coral reefs protect the shoreline from erosion waves and storm surges, both of which are likely to increase in the face of sea-level rise. Coral reefs are sources of livelihoods of local people through subsistence and semi-commercial fishing, tourism and recreational activities.

The presence and abundance of seagrasses are regarded as indicators of the overall environmental quality of the coastal zone. Seagrass provide habitats for a wide range of organisms and also fix carbon dioxide using light energy, thus promoting local biodiversity and biological productivity. Seagrass meadows produce an array of goods and services including providing habitat for finfish and traps sediment particles to enhance water-quality, maintain the biodiversity and shoreline protection.

Mangroves provide valuable ecosystem services including habitat functions such as breeding, spawning and nursery grounds for commercial fish; provision of timber, fuel wood, and charcoal; regulation of floods, storms and erosion; and prevention of saltwater intrusion.

A range of environmental threats occur in the Lamu-Kiunga area. They include increasing population growth, high poverty levels, deforestation of mangroves, clay mining for pottery, unclear land ownership and insecurity that has decimated opportunities in tourism, overfishing due to an increasing population size and destructive fishing, unsustainable and illegal fishing particularly the use of beach seines and poaching of turtles. Another pending threat to marine habitats is the Lamu Port and Lamu-Southern Sudan-Ethiopia Transport Corridor (LAPSSET project) that is likely to lead to oil spills, urbanization and industrialization of Lamu. Numerous existing ocean-related activities occurring in the Lamu-Kiunga area are already threatening the marine and coastal habitats and resources.

The ocean-related activities, combined with the effects of global warming and the environmental threats mentioned above can affect marine habitats and communities in a variety of ways. Mangroves continuously face both natural and anthropogenic threats and pressure. Fishing has impacts on habitat and on the diversity, structure and productivity of benthic communities and their associated fishery resources, including finfish and crustaceans. It is one of the main activity affecting marine habitats and communities in this northern region. Drawing a balance between the environment and the sustainable development the legislations to be followed and implemented strictly. The Forest Act of 2005, the Kenya Forest Service (KFS) is mandated to protect all forests, woodlands and mangrove forests under their jurisdiction. The ratification of the Kenyan constitution in 2010 gave rise to the federal form of governance also referred to as counties leading to devolution of services including revenue generation. With this, conflicts of interests are bound to emerge in natural resource management within local and national setup.

7.2.3 Government Policies

The Fish Industry Act of Kenya was established to “provide for the reorganization, development and regulation of the fish industry, to make provision for the protection of fish and for the purposes connected therewith”. Through this act, the Fisheries Department was established. This department, in cooperation with other appropriate agencies and other departments of Government, promotes the development of traditional and industrial fisheries. It does this by providing extension and training services, conducting research and surveys, promoting cooperation among fishers, promoting arrangements for the orderly marketing of fish, providing infrastructure, stocking waters with fish, and supplying fish for stocking. In the course of fisheries management, the fisheries department may use legislative measures to:

- Declare closed seasons for designated areas, species of fish or methods of fishing;
- Prohibit fishing areas for all or designated species of fish or methods of fishing;
- Place limits on fishing gear, including mesh sizes of nets that may be used for fishing;
- Limit the amount, size, age, species or composition of species of the fish that may be caught, landed or traded;
- Regulate the landings of fish and provisions for the management of fish landing areas;
- Control the introduction into or harvesting or removal from any Kenya fishery waters of any aquatic plant.

The Wildlife Act has led to the recognition of the value of coral reefs and resulted in the gazettal of four fully protected marine areas, namely Marine National Parks, and six partially protected marine areas (Marine National Reserves). In one of the management plans, marine protected areas (MPAs) are defined as “areas set aside by law to protect and conserve the marine and coastal biodiversity and the related ecotones for posterity by enhancing the regeneration and ecological integrity of the mangroves, coral reefs, seagrass beds, sand beaches and their associated resources which are vital for sustainable development through scientific research, education, recreation and other compatible resource utilization". In this plan, the overall objectives for management of MPAs are outlined below:

- Preservation and conservation of the marine biodiversity for posterity
- To protect a representative sample of the coral reef and seagrass ecosystems on the Kenyan coast.
- To restore and rehabilitate the damaged marine ecosystems.
- Provision for ecologically sustainable use of the marine resources for cultural and economic benefits.
- To ensure that activities within the marine protected areas are controlled and conform to the management regulations for ecological sustainability,
- To enable the stakeholders to participate in a wide range of eco-friendly recreational activities.
- To implement zoning as a management tool in the marine protected area in order to eliminate conflicts between user groups.
- To enhance management-oriented research for optimum resource use.
- Promotion of applied research for educational awareness, community participation and capacity building
- To ensure information flows to stakeholders so that they are in a better position to understand management decisions.
- To enable young and upcoming researchers to investigate their theories and hypotheses developed at tertiary institutions of learning. To provide an information base for education and awareness programs for local communities.

7.3 Environmental Mitigation Measures

Environmental mitigation is the process of addressing impacts to the environment caused by human action — notably those resulting of highway, railways, aviation, marine, industry, water, and other infrastructure projects. First, negative environmental impacts should be avoided, for instance by re-siting the project to a more suitable location. If relocation is not feasible, science-strong measures should be deployed to minimize harms. Finally, if environmental impacts are inevitable, there should be appropriate compensation. This notion is conceptually sound, but has been unevenly implemented. The Impact matrix is given sector wise.

7.3.1 Road Sector Development

Road Sector	Positive			Negative		
Construction & Operation Stage	High	Moderate	Minimal	High	Moderate	Minimal
Construction Activities						
Borrow Areas						
Quarry Sites						
Transport of Construction Material						
Labour Camps						
Safety						
Accidents						
Storage						
Air Quality						
Noise Levels						
Water Quality						
Resettlement						
Land acquisition						
Ecology						
Soil						
Faster Nobility						
Connectivity						
Employment Generation						
Social Culture						
Air Quality						
Noise Levels						

7.3.2 Railway Sector Development

Rail Sector	Positive			Negative		
Construction & Operation Stage	High	Moderate	Minimal	High	Moderate	Minimal
Construction Activities						
Land Acquisition						
Movement of transport material						
Air Quality						
Water Quality						
Noise Levels						
Soil Quality						
Labour Camps						
Ecology						
Resettlement						
Transportation						
Emission						

Noise levels						
Employment generation						
Air Quality						
Accidents						
Water Quality						

7.3.3 Port Sector Development

Port Sector	Positive			Negative		
Construction & Operation Stage	High	Moderate	Minimal	High	Moderate	Minimal
Construction Activities						
Land Acquisition						
Movement of transport material						
Air Quality						
Water Quality						
Noise Levels						
Soil Quality						
Labour Camps						
Ecology (Marine)						
Resettlement						
Bilge Water						
Transportation						
Emission						
Noise levels						
Employment generation						
Air Quality						
Accidents						
Tourism						
Water Quality						

7.3.4 Airport Development

Aviation Sector	Positive			Negative		
Construction & Operation Stage	High	Moderate	Minimal	High	Moderate	Minimal
Construction Activities						
Land Acquisition						
Movement of transport material						
Air Quality						
Water Quality						
Noise Levels						

Soil Quality						
Labour Camps						
Resettlement						
Transportation						
Emission						
Noise levels						
Employment generation						
Air Quality						
Accidents						
Tourism						
Water Quality						

7.3.5 Amu Power Plant

AMU Power Plant	Positive			Negative		
Construction & Operation Stage	High	Moderate	Minimal	High	Moderate	Minimal
Construction Activities						
Land Acquisition						
Movement of transport material						
Air Quality						
Water Quality						
Noise Levels						
Soil Quality						
Labour Camps						
Resettlement						
Improvement in Power						
Emission						
Noise levels						
Employment generation						
Air Quality						
Fly Ash Disposal						
Ground Water Quality						
Ecology						
Soil Quality						

7.3.6 Oil Refinery and the Pipe Line

Refinery	Positive			Negative		
Construction & Operation Stage	High	Moderate	Minimal	High	Moderate	Minimal
Construction Activities						
Land Acquisition						
Movement of transport material						
Air Quality						
Water Quality						
Noise Levels						
Soil Quality						
Labour Camps						
Resettlement						
Emission						
Noise levels						
Employment generation						
Air Quality						
Water Quality						
Ground Water Quality						
Hazardous Waste						
Soil Quality						

7.3.7 Urban Infrastructure

Urban Infrastructure	Positive			Negative		
Construction & Operation Stage	High	Moderate	Minimal	High	Moderate	Minimal
Construction Activities						
Land Acquisition						
Movement of transport material						
Air Quality						
Water Quality						
Noise Levels						
Soil Quality						
Labour Camps						
Resettlement						
Ecology						
Employment generation						
Accommodation for local population						
Solid Waste						
Drainage						

Water Supply						
Power Supply						
Market Area						
Recreation Places						
Health Centres						
Educational Institutions						
Urban Roads						

7.3.8 Resort Development

Resort Cities	Positive			Negative		
Construction & Operation Stage	High	Moderate	Minimal	High	Moderate	Minimal
Construction Activities						
Land Acquisition						
Movement of transport material						
Air Quality						
Water Quality						
Noise Levels						
Soil Quality						
Labour Camps						
Resettlement						
Ecology						
Accommodation for tourist Population						
Solid Waste						
Drainage						
Water Supply						
Power Supply						
Market Area						
Recreation Places						
Health Centres						
Ecology						
Roads						

7.3.9 Vegetation and Beautification

The landscaping of the national and urban roads with trees is an important aspect of beautifying our countryside and maintaining the aesthetic value. Besides its engineering perfection, a highway must look aesthetic, and should not disturb the ecological aspects of the area. Planting of trees on either side of the carriage way is necessary not only for the purpose of beautification but also for utility and pollution control. The selection of trees for particular area is done giving due consideration to the subsoil water, soil, climate including rainfall, relative humidity and the temperatures.

Automobiles are mobile sources of pollution and emit gaseous as well as particulate matter. The plants grown by roadsides absorb gases and hold the particulate matter. Choice of plants for roadside and traffic island plantations may be for containment of pollution and forms a screen between automobile pollution and roadside residences. The choices of plants include shrubs of height 1 to 1.5 m and trees of 3-5 m height.

The intermixing of trees and shrubs should be such that the foliage area density in vertical is almost uniform. The medium sized and small trees alternating shrubs aimed at absorption of particulate and gases. Keeping safety in view, shrubs in traffic islands and at the median should be short enough, i.e. at the eye level of the motorists. Depending on the climate, only tolerant species should be chosen.

7.3.9.1 Modes of Beautification

Hedge serves many purposes. The hedge can serve as a compound wall, give shelter from strong winds. The hedge plants should have the following features like quick growing, hardy, including drought-resisting character. Clipping and pruning should be done at regular intervals and at no stage the top growth should exceed 15-20 cm in length. Once a year the hedge should receive, before the rains well rotten cow dung or horse manure at the rate of 4 kg per running meter.

Shrubs are most popular ornamental shrub is bougainvillea. A quick growing shrub and varies in height according to different species. The colours of the bracts are innumerable, ranging from white to deep magenta including other lighter shades such as yellow, orange, pink, mauve, purple, scarlet, crimson and red. The actual flowers in bougainvillea and small, tubular, ridged, and open into a star at the apex; the color may be white, light greenish yellow, cream, yellow or pink. The peak blooming time in north India is during September to December. The best time for planting in northern India is July to September. Planting in the winter should be avoided as mortality rate will be high and the growth of the plants will be very poor. The young plants and the newly planted sapling require frequent watering. Once established need very little or no watering. No drastic pruning is needed for bougainvillea's grown in the ground.

Ornamental Stones: Ornamental stone pieces of rounded form or other abstract designs are properly placed at appropriate places to enhance the beauty of the place.

Fountains: Fountains are made to work by circulating the same water contained in a pool. There are various designs of fountains. There may be straight upright water jet or a number of finer water jets converging in the form of an umbrella. The jets and pipes should be made of anti – corrosive material. To make the fountain more colourful during nights, coloured lights are provided under water, with waterproof fittings. An automatic switch would make it possible to change colours at regular intervals, which further adds beauty of the fountains.

Avenue Plantation: Accacia, coconut, palm alternatively all along the proposed right of way and Bougainvillea can be placed in between two trees.

Plantation at Traffic Island: Seasonal flowering plants will enhance the appearance of the traffic islands. The flowering plants which are suited for the local climate should be used.

Manuring: After the digging is over, the soil is to be manured and graded. Poor soils will need dressing with organic manure. Night soil manure, farmyard manure or old stable manure is used for this purpose. The manure is sieved finely and spread over the surface at the rate of 500 kg per 100 square meters of soil. The amount can be reduces depending on the soil fertility level.

Plantation: The following measures to be adopted in the Urban Roads, Highways, parks and gardens. The vegetation should be grown in all the developmental activities.

1. The trees (avenue) should be of minimum height of 90 cm at the time of plantation.
2. There should be proper watering and manuring at the time of planting.
3. Most of the saplings need protection during the winter season.
4. During the summer season, drenching of pits at regular intervals is essential, especially during first five years of growth.
5. Proper application of farm yard manure of the entire stretch in both median and right of way.
6. Plantation of hardy plants along the medians.
7. Existing plants to be properly pruned and applied manure.
8. It is absolutely necessary to give a clean cut during pruning.
9. Each pruning is done with a view to increasing the usefulness of a plant.
10. Occasional pruning will keep the plant in good health.
11. Frequent watering is required for a new plant.
12. Quick growing low hedge plants (50 cm to 1 meter) need frequent pruning during the rainy season.
13. Dustbins at every 2 KM of distance.
14. Sign boards showing slogans depicting the protection of environment.
15. Encroachments to be kept away from the beautification sites.
16. There should be strict instructions not to damage beautified areas
17. The plants should of a minimum height of 60 cm and should have two branches in a healthy condition at the time of plantation.

7.4 Environmental Social Management Plan

An Environmental Social Management Plan (ESMP) is developed to outline measures that are to be implemented in order to minimize adverse environmental impacts during the construction cycle of a project. It serves as a guide for the contractor and the workforce on their roles and responsibilities concerning environmental management at the construction site and it provides a basic framework on environmental social monitoring throughout the development period.

The ESMP document can be used throughout the project life cycle–commissioning, mobilization and construction, operation and maintenance and decommissioning. It is regularly updated to be aligned with the project progress from commissioning to mobilization to construction to operation to decommissioning. ESMP outline the environmental and social impacts and the mitigation measures. ESMP is a practical and achievable plan of management to ensure that any environmental impact during all the phases is minimized and lead in the direction of sustainable development.

7.4.1 Purpose of ESMP

- Encourage good management practices through planning and commitment to environmental and social issues concerning any project;
- To provide rational and practical environmental and social guidelines that will assist in minimizing the potential environmental and social impact of activities;
- Helps in minimizing disturbance to the environment (physical, biological and ecological, socioeconomic, cultural, and archeological,)
- Combat all forms of pollution through monitoring air, noise, land, water, waste, natural resources and social issues.
- Protection of sensitive and endangered flora and fauna;
- Prevent land degradation;
- Comply and adhere to all applicable laws, regulations, standards and guidelines of the country and the safeguard policy European Union, for the protection of the environment and social aspects.
- Adopt best practicable waste management for all types of waste (liquid and solid) with objective on prevention, minimization, recycling, treatment or disposal of wastes;
- Describe all monitoring procedures required to identify impacts on the environment and social aspects;
- Train and bring awareness to employees and contractors with regard to environmental and social obligations and compliance.
- Reduce environmental and social risk and provide better Health, Safety and Environment (HS&E)
- Bring in awareness among the workers and local population about AIDs and STI.

- Gender sensitization is also considered as a major component in the implementation activity.

The ESMP is most effectively developed when impacts are evaluated by detailed ESIA completed with supporting baseline studies for the project. Impact evaluation signifies the importance for the Mitigation measures suggested during the impact analysis or assessment. The residual impact estimated with execution of proposed mitigation measures is vital towards developing ESMP. This ESMP details the mitigation measures to prevent, reduce and where possible offset any significant adverse effects on the environment throughout the different phases of the project. ESMPs are therefore important tools for ensuring that the management actions arising from Environmental Social Impact Assessment (ESIA) processes are clearly defined and implemented through all phases of the project life-cycle.

The developed ESMP addresses the environmental and social impacts during the design, construction and operational phases of the project. ESMP outlines the key environmental management and safeguards that will be initiated by the project proponent to manage the project's key environmental and social concerns. Environmental Social Management Plan (ESMP) is the mechanism to ensure that environmental considerations are integrated into the project survey and design, contract documents and project supervision and monitoring. These are tools for mitigating or offsetting the potential adverse environmental and social

7.4.2 Environmental Social Management Action Plan

The Environmental Management Action Plan will be prepared to minimize and avoid high and medium ranked adverse environmental impacts identified during the three stages of the project cycle, during pre-construction stage, construction stage and operation stage. Each adverse impact is addressed during the implementation stage of the project.

7.5 Solid Waste Management Plan

Construction projects generate different types of solid wastes like the construction wastes, sanitation waste, biodegradable wastes (vegetables peels), plastics wastes (non-biodegradable) and the medical wastes from construction yard health center. The waste generated should be properly segregated before the disposal. Some of the measures are as follows:

- A waste disposal site should be away from human settlement, because of incidence of health hazards.
- Generally barren lands are preferable for this purpose.
- A disposal site should be away from water streams.
- The place should be away from any archaeological and historical monuments
- It should be easily accessible from the main highway.

- A preliminary environmental and social study will help in taking proper precautionary measures for selecting a location for waste disposal. The study should point out a proper location which is away from the human settlement, forestry area, and away from water resources
- No dumping on private property is carried out without written consent of the owner.
- No dumping should be allowed on wetlands, forest areas, and other ecologically sensitive areas.
- All the workers working at the disposal yard should be provided with safety attire.
- The waste carrying trucks should be properly covered by tarpaulin.
- The worker working at this area should be given proper training regarding the health hazards associated with the work.

The medical waste should be disposed away from the human settlements and water source. Generally medical waste disposal is done by digging a pit and it is given a lining with a geo textile, so that the waste will not come in touch with the nearby ground water aquifers. Once the medical waste is placed in plastic bag and buried in the pit and closed with earth and compacted. The other method is medical wastes and plastic bags are incinerated.

7.5.1 Garbage and Wastewater disposal

Disposing off the solid waste generated from the construction labour camp. The main waste generated from the kitchen comprise of the organic waste (eggshells, discarded foods, vegetable peels, meat and bones), inert materials like (polyethylene bags, and mineral water bottles) and wastewater flowing out of the construction yard. The waste water from the toilet should flow into the septic tank. Improper management may give rise to number of health problems and will give rise for the vectors to grow there. Some of the garbage management techniques are given below:

- Uncontrolled solid waste dump sites could be breeding ground for vermin, and as such could pose a vector borne disease.
- Solid waste shall be regularly collected and disposed of in disposal sites approved by local authorities. A ban on burning of garbage will also be stipulated while handling the garbage
- Composting of appropriate organic wastes should be considered.
- The solid waste should be segregated in to recyclable wastes, inert wastes and plastic wastes.
- The construction wastewater and kitchen waste water will be sent out to two settling pits and once settled the water will be used for growing plantation. The settled material will be used as manure. The construction waste would comprise of mainly of inert materials like silt.
- The wastewater pit should be totally barricaded.

- The plastics can be incinerated away from the human settlements as the plastics generate a lot of dioxins which are carcinogenic in nature. The work force should be provided with proper personal protective equipment.

7.6 Grievance Redressal

To ensure smooth implementation of the LAPSSET Project, it should be made it a point to explain the local population regarding the project activities and the likely impacts can be explained to the local population. The mitigation measures which would be implemented in the project should be explained explicitly to the local population. Public Awareness Meeting will be conducted at regular intervals. The grievances on the social and environmental issues will be recorded from the affected population and will be sorted out with the help of the local county government. During construction stage, the local people can make their grievances to the Project proponent through their County Members by registering their grievances on the Grievance Form provided. Social and Environmental Staff of the Supervision Consultant and the Environmental Specialist of the contractor will conduct periodically visit to human settlements to collect Grievance Forms. The social and environmental staff in collaboration with the LCDA Environmentalist and local environmental officer of NEMA will carry out solution for the grievances.

7.7 Construction Management

7.7.1 Occupation Health & Safety

The contractor should supply with all personal protective equipment to the work force. It is not only supplying the PPEs but the enforcement is also very important. As the project is funded by the European Union, the use of safety gadgets will become all the more important. Some of the measures of the labour safety are given below:

- The contractor shall provide all necessary safety appliances such as safety goggles, helmets, masks to the work force working at the construction site.
- Clear or coloured goggles, a screen, a face shield or other suitable device when likely to be exposed to eye or face injury from airborne dust or flying particles, dangerous substances, harmful heat, light or other radiation and in particular during welding, flame cutting, rock drilling, concrete mixing or other hazardous work.
- Foot wear of an appropriate type when employed at places where there is the likelihood of exposure to adverse conditions or injury from falling or crushing objects, hot or hazardous substances, sharp-edged tools or nails etc.
- Distinguishing clothing or reflective devices or otherwise conspicuously visible material when there is regular exposure to danger from moving vehicles.
- Hearing protection in accordance with national laws and regulations, this can be worn with safety helmet.
- In case of vibration, suitable protective gloves to be provided to the workers.

- Monitoring and control of the working environment and planning of safety and health precautions should be performed as prescribed by national laws and regulations.
- A competent person having a full understanding of the nature of the hazard and type, range and performance of the of the protection required should:
- Select suitable items of person at protective equipment and protective clothing
- Arrange that they are properly stored maintained, cleaned and if necessary for health reasons, disinfected or sterilized at suitable intervals.
- Electrician should be supplied with sufficient adequate tools and personal protective equipment such as rubber gloves, mats and blankets.
- Waterproof clothing and head covering when working in adverse weather conditions.

7.7.1.1 Construction Site

- ➢ Every construction site should have supply of drinking water.
- Sanitary and washing facilities or showers are minimum requirement at each of the construction site.
- Accommodation for taking meals and for shelters during interruption of work due to adverse weather conditions.
- The scale of provision of toilet or sanitary facilities, and the construction and installation of water flush toilet.
- If a minimum number of workers as prescribed are employed in any shift, at least one suitably equipped first aid room or station under the charge of the qualified first aid personnel or a nurse should be provided at a readily accessible place for treatment of minor injuries and as a rest place for seriously sick or injured workers.
- Where work is done over or in close proximity to water provision should be made for preventing workers falling into water.
- The equipment should be maintained in good working condition.
- The equipment should be operated by workers who have received appropriate training in accordance with national laws and regulations.
- The drivers and operators of vehicles and materials handling equipment should be medically fit, trained and tested and of a prescribed minimum age as required by the government rules and regulation.
- Suitable scaffolds from the ground shall be provided for the work force, who are working at elevated heights, if a ladder is used a proper foot holds and hand holds shall be provided on the ladder.
- Scaffolding or staging more than 3.25 meters above the ground or floor swung or suspended from an overhead support or erected with stationary support, shall have a guard rail properly attached, bolted, braced and otherwise secured at least 1 meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends there of with only such openings as may be

necessary for the delivery of the materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the support or structure.

- Working platforms, gangways, and stairways shall be so constructed that they do not sag unduly or unequally, and if the height of any platforms or gangways or stairways is more than 3.25 meters above the ground level or floor level, it shall have closely spaced boards, have adequate width and suitably provided with guard rails as described above.
- Every opening in the floor of a structure or in a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing with a minimum height of one meter.
- Every ladder is securely fixed. No portable single ladder shall be over 9 meters in length. The width between side rails in rung ladder shall in no case be less than 30 cm for ladders up to and including 3 meters in length. For longer ladders the width shall be increased at least 6 mm for each 30 cm of length. Spacing steps shall be uniform and shall not exceed 30 cm.
- Adequate precautions shall be taken to prevent danger from electrical equipment. Necessary fencing and lighting will be provided for the construction yard.
- The sides of the trench which is more than 1.5 meters or more in depth shall be steeped back to provide a suitable slope or be securely held by timber bracing so as to avoid the danger of side collapse.
- Excavation shall be made from the top to bottom. Under no circumstances shall undermining or under cutting be done.
- No electrical cable or apparatus, which is liable to be a source of danger other than cable or apparatus used for by operators, shall remain electrically charged.
- All practical steps shall be taken to prevent danger to persons employed by the employer, from the risk of fire or explosion or flooding. No floor, roof or other parts of a building shall be so over loaded with debris or materials as to render it unsafe.
- Those engaged in handling any material, which is injurious to eyes, shall be provided with protective goggles.
- The workers engaged in welding works shall provide with welder’s protective eye shield.
- The contractor shall not be employ men or women for construction work below the age of 18 years.
- When work is performed near any place where there is risk of drowning all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt first aid treatment of all injuries likely to be sustained during the course of work.
- Every rope used in hoisting or lowering materials as a means of suspension shall be durable quality and adequate strength and free from defects.

- Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 shall be in charge of any hoisting machine including scaffold equipment.
- Motors, gearing, transmission, electric wiring, and other dangerous parts of hoisting appliances shall be provided with efficient safe guards, hoisting appliance shall be provided with such means as will reduce the risk of accident during descent of load to the minimum.
- Adequate precautions shall be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced.
- When workers are employed on electrical installations which are already energized, insulating mats, working apparels such as gloves, sleeves and boots, as may be necessary, shall be provided. Workers shall not wear any rings, watches and carry keys other material which are good conductors of electricity.
- Safety provisions shall be brought to the notice of all concerned by displaying or notice board at a prominent place at the work locations.
- The contractor shall be responsible for observance, by his sub-contractors, of the foregoing provisions.
- At every workplace, there shall be maintained in readily accessible place first aid appliances including an adequate supply of sterilized dressing and cotton wool as prescribed in the factory rules.
- The contractor should take adequate measures for the control of malaria.
- The contractor should educate the work force about HIV/AIDS and launch awareness campaign among the work force.
- Child labour should be strictly prohibited for the highway construction and maintenance.
- There should be proper enforcement of the labour laws at the work place.
- All vehicles used in the construction yard should have reverse horns
- There should be proper demarcation of work areas with sign boards showing the work areas should be placed.
- The signboards should be in local language.
- Suitable warning should be displayed at all places where contact with or proximity to electrical equipment can cause danger.
- Persons having to operate electrical equipment should be fully instructed as to any possible danger of the equipment concerned.
- All the electrical equipment should be inspected before it is taken into use to ensure that it I suitable for its purpose.

All the above measures should be strictly enforced at the site. These measures are also applicable for the workforce working at the site including the supervisors. It requires a strict enforcement at the site.

7.7.1.2 Camp Site Management

There are certain provisions which are compulsory to be provided at the construction sites as per the labour regulations like every construction site should have supply of drinking water, shelters should be provided for taking meals, during interruption of work due to adverse weather conditions, the equipment should be operated by workers who have received appropriate training, The drivers and operators of vehicles and materials handling equipment should be medically fit, trained and tested and should have a prescribed minimum age, the contractor should take adequate measures for the control of malaria, and the contractor should educate the work force about HIV/AIDS and launch awareness campaign among the work force. There should be proper demarcation of work areas with sign boards. The signboards should be in local language

7.7.1.3 First Aid Facility

The employer should be responsible for ensuring that first aid, including the provision of trained personnel. Arrangements should be made for ensuring the removal for medical attention of workers who have suffered an accident or sudden illness. The manner in which first aid facilities and personnel are to be provided should be prescribed by national laws or regulations, and drawn up after consulting the competent health authority and the representative organizations of employers and workers concerned. First-aid kits or boxes should be placed at appropriate locations. The first aid box should have clear instructions and kept under a qualified first aid attendant.

7.7.1.4 Fire Fighting

There should be firefighting facility at construction locations. The staff should face any emergency situations without any problems. There should be adequate measures as listed below:

- Secure storage areas should be provided for flammable liquids, solids and gases such as liquefied petroleum gas cylinder, paints and other such materials in order to deter trespassers.
- A ban to be imposed for burning the waste. The workers should not lit fire in the forest areas.
- Smoking should be strictly prohibited, and no smoking notices be predominantly displayed in all places containing readily combustible or flammable materials
- Oil rags, waste and clothes or other substances liable to spontaneous ignition should be removed without delay to a safe place.
- Adequate ventilation should be provided.
- Combustible materials such as packing materials sawdust, greasy/oily waste and scrap wood or plastic should not be allowed to accumulate in work places but should be kept in closed metal containers in a safe place.

- Regular inspections should be made to places where there are fire risks.
- Adequate water supply with ample pressure
- Fire-extinguishing equipment should be properly maintained.
- The escape routes should be kept clear at all times.

7.7.1.5 Sanitation Facility

The scale of provision of toilet or sanitary facilities, and the construction and installation of water flush toilets, privies, chemical closets, plumbing or other toilet fixtures should comply with the requirements specified by the competent authority. Adequate washing facilities should be provided as near as to toilet facilities.

7.7.1.6 House Keeping

The construction yard, the premises should always be kept clean and tidy. The dirtiness of the construction yard is a symbol for laid down attitude of the contractor. Loose materials which are not required for use should not be placed or allowed to accumulate on the site so as to obstruct means of access to and egress from workplaces and passageways. Workplaces and passageways that are slippery, owing to oil or other causes should be cleaned up or strewn with sand, saw dust, ash or the like.

7.7.1.7 Training

The workers should be adequately and suitably informed of potential safety and health hazards to which may be exposed at their workplace.

- Every worker should receive instruction and training regarding the general safety and health measures common to the construction site like general rights and duties of workers at the construction site, measures for good housekeeping, location and proper use of welfare amenities and first aid facilities provided in the construction site, proper use and care of the items of personal protective equipment and protective clothing provided to the worker, general measures for personal hygiene and health protection, fire precautions to be taken, action taken in case of emergency and requirement of relevant safety and health rules and regulations.
- The equipment should be operated by workers who have received appropriate training in accordance with national laws and regulations.
- The drivers and operators of vehicles and materials handling equipment should be medically fit, trained and tested and of a prescribed minimum age as required by the government rules and regulation.
- Awareness should be brought about among the workforce about the HIV/AIDs by imparting awareness lectures and by putting up advertisement. The contractor should take up in a war footing and take necessary assistance from the local non-governmental organizations. Special fund is allocated for the awareness program.

- Last but not least all the Officials of Government Organisations involved in executing these Projects should undergo training in Occupational Safety and Environmental Aspects. This training programs and workshops should be conducted frequently to the stake holders.

7.7.1.8 Environmental Aesthetics

Grow vegetation surrounding the borrow pits to minimize impacts. Mud and dust on the rural access roads will be reduced considerably by the road improvements. Operation of quarries could mar roadside aesthetics. However, this will be mitigated by adopting the following measures:

- Where feasible, quarries will be sited away from the road.
- The quarries should be sited away from the sensitive locations like the schools and health centres.
- The quarries should not be very near to human settlements at least 500 meters away from the human settlement.
- The haul roads inside the quarry should be properly watered to arrest the dust arising out of it.
- In sites where quarries must be close to the road, trees and other vegetation will be left between the quarry/crushing plant sites and the road. The vegetation acts as good filters of dust.

7.7.1.9 Increased Traffic Volumes and Speed

The construction areas will have a lot of vehicles moving in addition to the regular traffic. This gives us a scope for planning for better traffic control at the site.

- An improved road (realized during the operational phase) will lead to increased traffic volumes and speed that might result in increased risks of accidents involving people and livestock, and spilling of toxic materials. Nevertheless, such risks can be avoided or mitigated through the following measures:
- Enforce speed limits, especially near schools and populated areas.
- Install appropriate signs warning drivers to slow down in settlement and livestock grazing areas.

7.7.1.10 Tree Cutting

This tree cutting would give rise to number of impacts. Some of the significant impacts are as follows:

- In-creased ambient temperature,
- Decreased air quality,
- Increased water run-off,
- Decreased quality of run-off water,

- Altered weather patterns,
- Aesthetic beauty and
- Soil deterioration.

7.8 Budgeting

There will be budget provision to handle the mitigation measure caused during the construction activities of different projects. The mitigation measures like the reclamation of borrow areas and quarry sites and debris disposal and landscaping requires certain budget. The amount required budget depends on the type of the project and the activities to be carried out at the site. The budget varies from project to project. The budget is allocated under different heads:

- Environmental Monitoring
- Green Belt development
- Environmental aesthetics
- Quarry Reclamation
- Borrow Reclamation
- Land acquisition
- Labour Camps
- Training and Capacity Building
- Sanitation
- Campsite Management
- Occupational Health & Safety

Generally, 1-2 % of the project cost is allocated for the Environmental and social aspects. Resettlement and Rehabilitation costs will be different from the environmental costs.

7.9 Conclusion

The LAPSSET Project would generate substantial economic, social benefits to the local population, but leads for significant risks like irreversible damage to the ecosystem. The development will affect natural capital assets. The natural assets provide a range of vital goods by boosting the national economy. Many of the assets are already in the declining trend due to the anthropogenic activities. The old culture should not be affected with the LAPSSET Project.

An Environmental and social impact Study to be conducted by the respective executing agencies for various other type of projects like the water supply, power supply, and waste disposal and submit the same to obtain an environmental licence from the National Environmental Management Authority prior to the execution of the project. In addition, an ESMP and an RAP should also be prepared to fulfil the requirements of the Kenyan

Environmental Legislation and the project proponent should also fulfil the requirements of the Funding agency.

Industrial sectors planned at Lamu County should strictly implement the pollution control measures and they should not degrade the pristine environment. The waste water should be properly treated before reusing for the development of vegetative cover along the industrial area. The Power Plant should implement a proper fly ash management plan and there should be a provision for the noxious gas control from the stacks. The cooling water should be properly disposed. The marine water should not be contaminated at all.

Training and capacity building will be vital for the respective departments which are to implement the project. All the executing departments should report to LCDA. The LCDA functions as an umbrella organisation and the other departments like the Kenya Highways, Kenya Port Authority, Kenya Railways, all the other executing bodies will report environmental and social issues to the LCDA Officials. The LCDA in turn interact with the local County Official in sorting out the issues.

8 Conclusions, Recommendations & Way-Forward

8.1 Conclusions

On the basis of the information gathered during the preparation of the study, the following potential issues are identified.

8.1.1 Changes in the scope of the project

The LAPSSET Corridor program is part of Kenya Vision 2030 Strategy, which is the long term national development strategy which aims to transform Kenya into an industrialising, middle income country providing a high quality of life to all its citizens by 2030 in a clean and secure environment. LAPSSET corridor is an important part of the economic pillar and will help the country achieve its economic growth aspirations.

LAPSSET is a regional project between the countries of Ethiopia, Kenya and South Sudan with an aim of linking them to each other, and to their neighbours in Eastern Africa.

As defined above, by Kenya Vision 2030 and LCDA, the overall scope of the LAPSSET project has not changed.

8.1.2 Changes that have occurred in the planning of the main project components

Referring to the Lamu port development component, there are two key relevant studies addressing port infrastructure planning. Namely:

- JPC's "LAPSSET Corridor and new Lamu Port feasibility study and master plans report", produced in 2011, and;
- The Preliminary Master Plan for Port of Lamu LAPPSET node (Planning and Investment Framework) by ATKINS ACUITY, produced in 2017;

Although they are two separate studies six years apart, carried out by different institutions, it is understood that they are closely related with the latest one being, to a considerable extent, a revision / update of the older one. Nevertheless, there are significant differences in planning that should be pointed out:

i. The time horizons for realization of the various components have significantly altered,
    - As per the JPC master plan of 2011, the first three berths should have been finished by the end of 2015, while it is estimated that they will be completed by the end of 2018.
    - The road and railway corridor were planned to be finalized by the end of 2016. Currently the detailed design for A10 has been approved, but no plans for construction exist; no designs or plans for construction of the railway line exist, and the Lamu – Witu – Garsen road is under construction with plans to finish

by 2019. However, connection from Garsen to the main asphalt road network is under design with a planned opening date of 2023.

- The same delays are also apparent in all other infrastructure components of the LAPSSET.

ii. The SEZ and the Industrial area have been substantially downsized in the Atkins 2017 master plan,

iii. In the 2017 master plan there is the provision for the Amu coal fired power plant, that was not in the original JPC 2011 study. The location and operation of this plant through an 11km coal conveyor belt, will also create significant port planning and environmental issues,

iv. The location of the oil tanks and oil refineries has been transferred to the south part of the port from their original location just north of where the Amu coal fired power plant is planned today,

v. The utilization of the Manda airport for a longer time period is suggested by the Atkins master plan, than is the case with the JICA study.

Besides the differences between the two master plans, a further change in the planning of the LAPSSET port is the existence of the military base and the latest decision that is not to be moved. This crates the following issues:

- In case the Base is maintained in its current position it would lead to a reduction of the potential number of berths by 16 and of the storage area by 40 Ha;
- It will create serious difficulties, discontinuity and inefficiencies in port operations (splitting of the port area and operations into two separate sections);
- It will generate significant investment needs for extra infrastructure (roads and rail lines) to deviate around it;
- It will constrain the development of any high-rise structures and chimneys (see power plant chimney) to be constructed close by, due to fly zone safety requirements;

The aforementioned issues have not been planned for or estimated in any master plan undertaken so far.

Although not a change in the planning of the LAPSSET corridor and its components, it was established by the Consultant that the implication of this project to the local transportation have not been identified by the studies so far and should considered in the next stage of this transport master plan.

8.2 Recommendations

From the review of all previous studies and master plans and through the interviews with local Authorities and involved stakeholders, the Consultant has proposed some modifications in the existing studies to enhance the functionality and promote the interconnection of the various LAPSSET components within Lamu county and has also proposed details regarding the transport links of these components. These proposals are shown in detail in the previous chapters and can be summarised into the following:

- The continual existence of the Military Base is considered. This fact causes a series of changes in the master plan:
    - The port is separated in two, geographically distinct parts; the commercial and industrial port.
    - The railway freight terminal is positioned to the north side, parallel to A10, so as to be able to serve both the industrial and commercial parts of the port.
    - Functional specification of some areas within the port/SEZ zone has changed (e.g. from logistics to light industry, etc) to accommodate for the relocation of the railway terminal.
- New activities for the Lamu port have been identified and quantified and a detailed port layout with proposed usage for all berths is provided for.
- Main road and railway links that interconnect the various LAPSSET components within Lamu county have been identified and solutions for correct interlinking of components are proposed,
- A prioritized road network in both the urban and port/SEZ areas to provide for enhanced traffic management has been proposed,
- Main public transport axes to provide access to the main attractors are proposed.
- Non-Motorised Transport Facilities (NMT) has been used extensively in all urban areas with interconnections to the port, airport and railway terminal.
- Maritime transport with regulated ferry services is proposed for local transport needs, as it has been neglected in all previous studies.
- Urban planning part proposed a new rational for the organic expansion of the urban area,
- The location of high-density urban areas has altered from existing master plans to better capture the existing situation and the proposed organic expansion.
- Environmental and social impacts of all proposed transport infrastructure works have been identified and quantified and mitigation measures proposed.

8.2.1 Proposed future studies / designs to be undertaken for the realization of the main components of the Project

Although the final list of required studies and their priority will come after the production of the transport master plan, during the 3rd mission, the following studies/designs form a preliminary list for further discussion.

i. Considering the above issues that have significantly altered the planning of Lamu port, it is believed that there is a strong need of a port development masterplan, which would be the guideline and facilitator of port investment (public or private). This master plan should provide updated demand forecasts taking also into consideration new developments in the East African market. It should also consider the scope of accommodating newly proposed activities / facilities and the scope of a more efficient and sustainable bundling / zoning of the various port activities within the proposed port boundaries.

ii. The Atkins report is, by definition, a strategic document. Having established in a broad fashion where the main residential and other land uses will be located there is a need for a detailed zoning plan to provide a development framework. This would include plot coverage, plot ratio, maximum number of floors, permitted land uses etc. At the same time the Lamu County Planning and Development Control functions will need to be brought up to an appropriate level in readiness.

iii. Though the Atkins plan is the latest, the earlier plans are of much use, in the sense of encouraging mixed developments that will ensure the planned Metropolis is an attractive place to stay in. Visitors always stay a few days on Lamu Island, but in this case new residents will be expected to stay for months or years if a sense of community is to be established.

iv. Although LAPSSET has no direct intervention on Lamu Island this does not mean that due to the scale of the developments there will be no impact on Lamu island and Lamu Town. To ensure that Lamu Town can successfully absorb the potential number of tourists, a Lamu Town Local Plan may need to be prepared with explicit design and land use guidelines as well as improvements to the infrastructure to ensure it maintains its non-motorized status, i.e. the pedestrian infrastructure, footpaths, public lighting, drainage etc. will need to be repaired and improved.

v. Study of developing a private investment enabling environment for seaport and related multimodal platforms investment.

   It is clear that LAPSSET corridor and Lamu port infrastructure development requires high investment that has to be sourced through various sources. The Kenyan government rightly expects that the private investment should play a major role. Due to this objective there is big scope for the government to develop systematically a PPP enabling environment which would facilitate the attraction of serious local and international private funds for investment in the LAPSSET corridor and the Lamu port in particular.

It is understood that LCDA is working towards this direction together with AfDB - NEPAD Infrastructure Project Preparation Facility and a relevant study is possible to be launched before long.

vi. Since Manda airport seems to be able to cater for the forecasted traffic for the short and medium term, a study for the upgrade of the airport, regarding both infrastructure and systems, should be undertaken. This study should also be accompanied by an ESIA that will address concerns regarding noise disturbance and pollution.

vii. A feasibility design is required for the connection between Manda island and the mainland, as well as between Manda and Lamu Islands. This study should also consider the solution of established, regular boat ferry connection instead of bridge and should also be accompanied by a SEA that will discuss in detail issues regarding cultural integration, loss of income (due to bridges), etc.

viii. A detailed master plan for the urban and SEZ transport networks should follow the suggested new port masterplan study.

ix. A detailed study for the connection of the A10 highway towards the Somalian border should be considered,

x. There is a necessity for establishing a rural road network in the whole Lamu county. The co-ordination with KERRA is required for further consideration of possible studies.

8.3 Way forward

8.3.1 Proposed studies to draft Terms of Reference

Part of the Consultants' obligations is to provide a list of possible detailed design studies for the drafting of their Terms of Reference. From all the aforementioned possible studies or designs, it is proposed that some of the below studies should be considered:

- Freight demand forecast for the Lamu port and port operational study;
- Detailed design of the Majengo – Kiunga road (feasibility design exists);
- Detailed design of Manda airport upgrades and marine jetty installations;
- Feasibility design of rural road network within Lamu county.

8.3.2 Work Plan

During the 1st mission, as well as the subsequent ones, it was brought to the attention of the Consultant that, local physical planning statutory requirements foresee for a period of at least 60 days for a public consultation for the people of Lamu. This period should come after the final approval of the master plan report and the Consultant will have to incorporate in his Final Master Plan the comments raised by the community.

This requirement does not form part of the scope of works of the Consultant since, as per local regulations, it comes after the final approval of the report. For the review of the comments from the community the Consultant will require about 10 working days for the Team Leader and 6 working days of the Urban Planner. Although, this review can take place at the home-base of the Consultant, it may be more beneficial to be conducted as a mission to Kenya, so that person-to-person consultation with LCDA officers can take place. It was further proposed that this mission is also accompanied b a further visit to Lamu, so that the final comments to be incorporated in the master plan are also communicated to the local Authorities.

The work executed until today and the approved work plan for this mission and the third mission, is shown below:

	Report	Submission Date
1.	Inception Report	28/06/2017
2.	Presentation of Inception Report	30/6/2017
3.	2nd mission in Kenya	18/9 – 16/10/2017
5.	1st Stakeholders' Workshop in Lamu	09/10/2017
4.	Submission of Existing Situation Review Report	13/10/2017
6.	3rd mission to Kenya	21/11 – 19/12/2017
7.	2nd Stakeholders' Workshop in Lamu	05/12/2017
8.	Submission of Draft Transport Master Plan	15/12/2017
9.	Terms of Reference & Final Master Plan	15/01/2018
10.	Public Consultation period	23/01/2017 – 23/03/2018
11.	4th mission for incorporation of comments from public review	19/03/2018 – 29/03/2018
12.	Final Report	06/04/2018

Table 43: Final work plan

Study Plan

		Months																																					
		June				July				August				September				October				November				December				January				February				March			
		1	2	3	4	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
1	Kick-off Meeting																																								
2	Inception report																																								
3	Draft Review of Existing Situation																																								
4	Final Review and Integrated Transport Master Plan																																								
5	ToRs for detailed design studies																																								
6	Stakeholders Workshops																																								
7	Public Consultation Period																																								
8	Review and Incorporation of Comments																																								

Indicative Staff Input Allocation

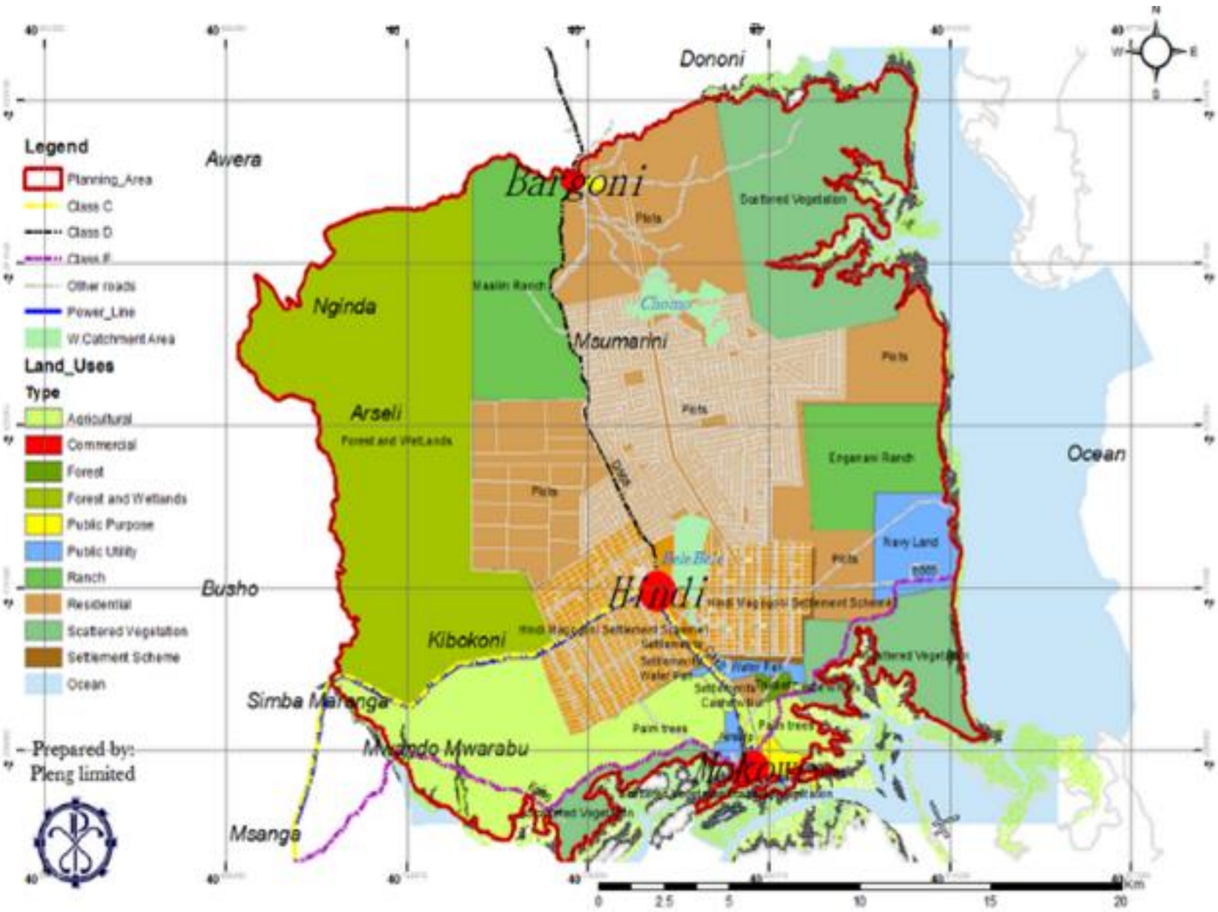
Missions:		June	July	August	September	October	November	December	January	February	March	Total days
1	Team Leader – Dr. A. KARLAFTIS**	15			12	8	9	16	5		10	75
2	Urban Planner – Mr. J. PHEDONOS**	15			12	8	9	10	5		6	65
3	Environmentalist - Mr. R.S. VANTARAM*				6	5	1	7	1			20
4	Port Operations Specialist - Mr. D. Kostianis					14			1			15
5	Railway Operations Specialist - Mr. D. Kostianis							10	1			11
6	LCDA Support Team	10			8	8	11	3				40

* 2 mission for KE3
** 3 missions for the KE1 and 2

County Government of Lamu

INTEGRATED LAMU METROPOLITAN AREA STRUCTURE PLAN

Draft Lamu Port Metropolitan Area Structure Plan



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2016

LIST OF ACRONYMS AND ABBREVIATIONS

CBO	Community-Based Organization
CDF	Constituency Development Fund
CL	Coastal Lowland
CEMP	Community Environmental Management Plan
CWSB	Coast Water Services Board
ECD	Early Childhood Development
EMCA	Environmental Management and Conservation Act
EPZ	Export Processing Zones
FBO	Faith-based Organization
FGD	Focus Group Discussion
GoK	Government of Kenya
HIMWA	Hindi Magogoni Water Association
KeNHA	Kenya National Highways Authority
KENGEN	Kenya Electricity Generating Company
KeRRA	Kenya Rural Roads Authority
KFA	Kenya Forest Authority
KMA	Kenya Maritime Authority
KNBS	Kenya National Bureau of Statistics
KPA	Kenya Ports Authority
KWS	Kenya Wildlife Services
KURA	Kenya Urban Roads Authority
LAPSSET	Lamu Port and Lamu-Southern Sudan-Ethiopia Transport
LPG	Liquefied Petroleum Gas
MoLHUD	Ministry of Housing, Lands and Urban Development

MoW	Ministry of Water
MDG	Millennium Development Goals
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organization
NLP	National Land Policy
NMK	National Museums of Kenya
PAD	Project Appraisal Document
PPA	Physical Planning Act
SEZ	Special Economic Zones
SDG	Sustainable Development Goals
SFM	Sustainable Forest Management
TARDA	Tana Athi Regional Development Authority
TOR	Terms of Reference
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
V2030	Vision 2030

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EXECUTIVE SUMMARY

Lamu County is made up of the mainland and the Lamu islands covering a total surface area of approximately 6,273.1 square kilometers. Lamu West and Lamu East make up the only two sub-counties within the County which are farther divided into 10 wards: Mkomani, Shela, Faza, Kiunga, Basuba, Hindi, Hongwe, Bahari, Mkunumbi and Witu.

Lamu Port Metropolitan is located between $40^0\ 52^{'}\ 00^{''}$ to $41^0\ 00^{'}\ 00^{''}$ Easting and -20 13’ 00’’ to -2^0 16’ 00’’ Northing. This is the area from Mokowe town to Bargoni, including Hindi town. The Metropolitan area is approximately 600 km^2 and consists of an urban area, the port area, an industrial zone, the resort city proposed under LAPSSET and finally, a green area. Urban and port functions are the major defining sectors of the Metropolitan area.

The Integrated Area Structure Plan is being prepared in order to zone the following elements: housing, port related industries, heritage and tourism, commerce and businesses, community facilities and amenities, population dynamics, local economy, transportation and infrastructure, logistics and distribution businesses, environmental conservation, among others. This is as outlined in the Terms of Reference.

The spatial plan is an integral development policy that will guide future development in the Metropolitan area through the Area Structure Plan, the Zoning Plan, Action Plans, an Investment Plan, a Transportation Plan, an Implementation Strategy and a Monitoring and Evaluation Framework all of which will make up the Integrated Structure Plan.

The need for this policy framework within Lamu Port Metropolis is due to the forecast population of approximately 1.25 million. It is anticipated that with the proposed LAPSSET project within the area, there will be an influx of population seeking economic opportunities. Along with this influx will be a high demand for housing, social amenities, utilities, infrastructure and waste management systems, among others.

Furthermore, the proposed LAPSSET proposes a major port adjacent to the Metropolis which will, along with major developments, pose environmental challenges such as disruption of traditional livelihoods, increase in waste generation, pollution, contamination of the ground water, and erosion of cultural values.

The Integrated Area Structure Plan will, in addition to addressing the above, provide a basis for development control within the Metropolitan Area which is of huge demand within this area. Since the inauguration of the LAPSSET project on 2nd March 2012, various government institutions have requested for land for development, piecemeal allocation of land uses will result in disjointed and dysfunctional urban system, incompatible or incongruent land uses and inefficient use of the scarce land resource. Therefore, there is need to evaluate and rationalize land use allocations within the context of the holistic view of city and port growth and development.

As this document is structured, Chapter One offers basic information on the overall project, the procurement process, the Terms of Reference, objectives of the assignment, and the scope of the project including the exact area of planning within Lamu Port Metropolitan.

Chapter Two provides the Legal and Institutional Framework within which urban planning of this area is mandated. These provide the methods by which the spatial planning process is to be undertaken and the relevant institutions to oversee the same. The Constitution of Kenya, the Urban Areas and Cities Act, the Physical Planning Act, the County Government Act are a few laws that provide the mandate to plan an urban area providing the parameters to be incorporated in the process.

Chapter Three offers context of the County of Lamu covering such themes as geographic location, physiographic and climatic conditions, human settlements, prominent economic activities, existing infrastructure, land uses, administrative units and the LAPSSET projects and its various components. Pursuant to this, a baseline of Lamu Port Metropolitan, the planning area, is given providing the local context of the area within which planning is occurring.

Chapter Four details the process of planning used to develop the Integrated Area Structure Plan and the expected outputs following the same. These include planning approaches which can be summarized as evidence-based planning, participatory and consultative planning, strategic planning, multidisciplinary and integrated planning. Further to this, this section includes the data collection process, visioning process, and the stakeholders' forum as well as data analysis and presentation.

Chapter Five, an imperative section, investigates existing successful port cities around the world that have employed innovative planning principles in their spatial development. It was found that comparable port cities relevant to the case of Lamu Metropolis were the cases of Rotterdam in the Netherlands, Shanghai in China and Sao Paulo in Brazil. Borrowing from these case studies, the planning of the Lamu Port Metropolitan area seeks to establish a world class urban center.

Chapter Six, an imperative look into the planning area, outlines the situational analysis which has been formulated following the assessment carried out within the planning area during the preparation of the Integrated Area Structure Plan. This is structured as an in-depth analysis of the physical characteristics, land properties, environmental characteristics, existing developments, social characteristics and existing transportation networks of the planning area.

Finally, as regards the proposed structural make-up of the planning area, Chapter Seven provides the zoning plan demarcating the major land uses within the planning area over the next 20 years. These include adequate infrastructure, social amenities and economic nodes. Important to note, industrial functions form a major part of development over the next two decades within the Lamu Metropolis spurring from the LAPSSET components which frame the Metropolitan area, most importantly the proposed Port.

Forming the final part of the plan, Chapter Eight provides the proposed action plans, the implementation framework, the investment plan and the monitoring and evaluation framework which will make it possible for stakeholders to interrogate the extent to which projects are being implemented using key performance indicators and timelines.

LIST OF MAPS

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CHAPTER ONE: INTRODUCTION

1.1. OVERVIEW

This chapter covers project information, procurement, TORs, objectives, scope and justification of the Integrated Area Structure Plan.

1.2. PROJECT INFORMATION

The rapidly changing modern world has brought forth various challenges and opportunities for governments across the globe. Kenya is no exception and a new Constitution that was promulgated in 2010 introduced devolved governments that work in liaison with the national government to overcome the various challenges and tap in the new and existing opportunities. The modern generation is moreover rapidly urbanizing, and this calls for serious planning at all levels of government while engaging all the relevant stakeholders. The national government has, in addition, launched several development projects in various counties, in line with Vision 2030.

The coastal County of Lamu is among the counties that have generated great focus from a lot of stakeholders and interest groups. This is due to the expected massive opportunities brought about by the LAPSSET projects, which is one of the Vision 2030 flagship projects. The LAPSSET projects are particularly immense and include: a new port, the LAPSSET corridor (highway, pipeline, railway line), and international airport, all which will provide lucrative opportunities for business and other investment ventures.

The County of Lamu has already started experiencing the ripple effects of the anticipated and ongoing developments. For instance, there has been a rush by Kenyans from all over the country to acquire land in Lamu. New urban centers are sprouting while the existing ones are expected to expand rapidly. All these among other reasons have necessitated the county government of Lamu to have a sustainable spatial development plan for the Lamu Metropolitan area in place.

1.3. PROCUREMENT

In the face of ongoing and expected developments in Lamu County, the sustainability agenda has become a priority of the County Government of Lamu. The desire is to protect and secure the rich resources for future generations without compromising on the quality of life for the existing generation. The only way to achieve this is through proper planning. In the Lamu County Financial Year 2015/2016 budget, some funds were set aside for the development of the "Integrated Lamu Metropolitan Area Structure Plan". In Line with the procurement laws and procedures of Kenya, the County Government kicked off a competitive process seeking to contract a Physical Planning firm to prepare an Integrated Area Structure Plan. This involved an advertising campaign in both print and digital media.

48 | Notices/ Classifieds

COUNTY GOVERNMENT OF LAMU

CONSULTANCY FOR PLANNING & SURVEY SERVICES

S/NO	PROJECT TITLE	TENDER NO.
1.	Preparation of Lamu Port Metropolitan Area Structure Plan	CGL/TR/LPPU&W/001/2015-2016
2.	Survey of Mokowe town	CGL/TR/LPPU&W/002/2015-2016
3.	Survey & Regularization of Faza village	CGL/TR/LPPU&W/003/2015-2016
4.	Survey & Regularization of Tchundwa village	CGL/TR/LPPU&W/004/2015-2016
5.	Survey & Regularization of Siyu village	CGL/TR/LPPU&W/005/2015-2016
6.	Survey & Regularization of Vumbe	CGL/TR/LPPU&W/006/2015-2016
7.	Survey of Hindi Magogoni Settlement Scheme Phase II	CGL/TR/LPPU&W/007/2015-2016
8.	Survey of Ras kitau Settlement Scheme	CGL/TR/LPPU&W/008/2015-2016

The County Government of Lamu intends to procure consultancy services for the following planning and survey projects:

Interested consultants shall submit an original and two copies of the EOI with all necessary documentation in a plain sealed envelope clearly marked. " **EXPRESSION OF INTEREST FOR PLANNING & SURVEY CONSULTANCY, SPECIFYING THE TENDER NUMBER OF THE PROJECT** " along with the covering letter duly signed by an authorized signatory on or before **29th September 2015 at 10.00am.** Tender documents are available at the County Government of Lamu website www.lamu.go.ke.The documents should be deposited in the tender box situated at the Procurement office at the Lamu County Treasury building addressed as shown below:

COUNTY SECRETARY
COUNTY GOVERNMENT OF LAMU
P.O. BOX 74-80500
LAMU

PLENG Limited, an experienced Planning and Engineering Consultancy Firm in association with IPE Global, an international development consultancy firm, were among the applicants. After a comprehensive vetting process, PLENG Limited in association with IPE Global was successful and given the mandate to prepare the "Integrated Lamu Metropolitan Area Structure Plan".

1.4. TERMS OF REFERENCE (TOR)

In order to achieve its intention to undertake planning of the Lamu Metropolitan Area that measures approximately 600km^2, the Lamu County Government procured the consultancy services of PLENG limited in association with IPE Global. The consultancy firm was given the following Terms of Reference:

a) Undertake reconnaissance surveys in the project areas to identify preliminary issues
b) Prepare the profile of the project area

c) Develop with the stakeholders a shared vision of the Metropolitan Area and strategy to realize the vision based on international best practice
d) Collect, collate and analyze data and develop possible scenarios
e) Evaluate the scenarios using agreed criteria and formulate broad development proposals
f) Prepare the draft strategic structure plan and present to stakeholders
g) Prepare indicative maps showing the disposition of broad land use allocations to various users including but not limited to residential, commercial, industrial, parks and open spaces, public purpose, transportation, etc.
h) Prepare and present to stakeholders strategies for the following elements of the plan: transportation, conservation, economy, capital investment, land use, housing, etc.
i) The assignment was expected to take six (6) calendar months

The TOR further brought out the important steps to be followed when preparing the Integrated Area Structure Plan:

1. Stakeholder consultations to build consensus around key/ strategic issues
2. Reconnaissance surveys and transects surveys to prepare profile
3. Visioning, goal(s) and objective setting
4. Data collection, analysis, and preparation of situation analysis report
5. Scenario development, formulation of alternative development models
6. Evaluation and selection of preferred strategy
7. Preparation of draft plan and implementation strategy
8. Approval and implementation
9. Monitoring and evaluation

1.5. OBJECTIVES

1.5.1. General Objective

The overall objective of the project is to formulate an 'Integrated Lamu Metropolitan Area Structure Plan'.

1.5.2. Specific Objectives

The following are the specific objectives of the Lamu Metropolitan Structure Plan:

i. To provide a forum for stakeholders participation in plan preparation and implementation

ii. To formulate a Zoning Plan for area
iii. To prepare a Transportation Plan
iv. To prepare an Investment Plan
v. To provide an Implementation Strategy for the Integrated Area Structure Plan
vi. To provide Action Plans
vii. To formulate Policies and Regulations governing land use

1.6. SCOPE

The report provides the necessary background information that is key to the development of the Integrated Area Structure Plan. The scope of the study of this area is dealt with in the:

a) Terms of Reference (TOR) requirements
b) ii) Lamu Metropolis – Lamu County, Concept Paper (April, 2013)

Lamu Metropolitan Area covers 600km^2 spatially and includes all those areas designated as a port, port-related industries, heritage and tourism, commerce and businesses, community facilities and amenities, population dynamics, local economy, transportation and infrastructure, logistics and distribution businesses and environmental conservation.

1.6.1. Justification of the Integrated Area Structure Plan

The preparation of the Integrated Area Structure Plan is anchored on the following:

a) A legal requirement for Urban Areas to have a spatial development plan

The Urban Areas and Cities Act, 2011 mandates all urban areas to have a spatial development plan that will guide their development, provision of services and investment. Thus, the preparation of this plan is in response to this requirement.

b) The need to have a development blueprint that will guide the development of the area

This serves as another reason for the preparation of the Lamu Metropolitan Area Structure Plan. In order to curb the future pressure arising from a conflicting range of interests on the land, there is a need to have a tool that will guide this.

c) The LAPSSET Project

The outcome of the LAPSSET project will attract intensive land use activities and investments in the area. This calls for the need to have a development guide for the sustainable allocation of land use activities. Thus the Area Structure Plan will serve as an integral tool to minimize future land use conflict and ensure conformity to the regulations governing the use of Land.

d) The Lamu Metropolis – Lamu County Concept Paper

The Lamu Metropolis Concept Paper points out the importance of developing an Integrated Area Structure Plan based on:

i. Expected demographic dynamics with an influx of population seeking economic opportunities. The population of the metropolis is expected to be 500,000 by 2030 and rise to 1.25 million by 2050. This unprecedented growth in population means high demand for housing, social amenities, utilities, infrastructure and waste management systems.

ii. Port and ancillary facilities pose environmental challenges such as disruption of traditional livelihoods, destruction of fish hatcheries and nurseries, increase waste generation, pollution, contamination of the ground water, erosions of cultural values.

iii. Since the inauguration of the project on 2nd March 2012, various government institutions have requested for land for development, piecemeal allocation of land uses will result in disjointed and dysfunctional urban system, incompatible or incongruent land uses and inefficient use of the scarce land resource. Therefore, there is need to evaluate and rationalize land use allocations within the context of the holistic view of city and port growth and development.

e) The need to protect the cultural heritage, environment & ecosystem while fostering a sustainable development agenda

This plan will serve as an important tool in the conservation of the indigenous culture and management of the environment. The Boni community are indigenous foragers traditionally subsisting on hunting and gathering and collecting honey. The Boni also practice some subsistence farming, using slash and burn and shifting cultivation methods. The rights of the Boni people, as well as other indigenous groups, need to be addressed together with the environmental concerns that accompany such a huge development (port construction) especially in an area that is so culturally and biologically rich. The Integrated Area Structure Plan will foster conservation of this cultural heritage and create a nexus between the social, environmental and economic priorities hence creating a balance where the metropolis gains all-round hence promote sustainable development in the area.

f) To provide a basis for public and private investments

Among the deliverables of the Integrated Area Structure Plan is an investment plan which will guide public and private investment in the area. Thus the plan will serve as an integral tool which will provide an investment framework that will unleash the economic potential of the area.

CHAPTER TWO: LEGAL POLICY AND INSTITUTIONAL FRAMEWORK

2.1. OVERVIEW

The conducting of integrated spatial planning in Kenya is mandated under certain Acts and Policies that guide spatial development in Kenya. There are various legislative and planning documents that govern planning. This chapter brings out the various documents which depict a solid framework and principles upon which this structure plan is anchored.

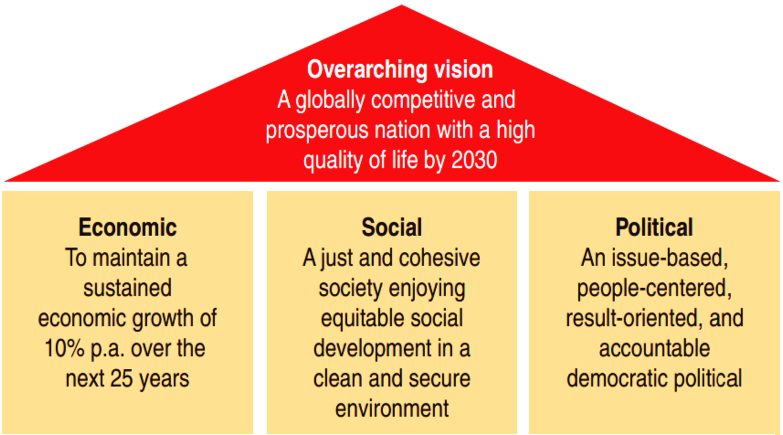
2.2. LEGAL FRAMEWORK

2.2.1. National Policies

i. The Kenya Vision 2030

The Kenya Vision 2030 is Kenya's development blueprint for the period 2008 to 2030. The vision is aimed at establishing Kenya into a globally competitive and prosperous country with a high quality of life. With the current demographic trends, as previously outlined, Kenya will be a predominantly urban country by the year 2030, in this respect therefore in order to achieve the overarching vision of the country, Kenya will need to plan for decent and high quality urban livelihoods for her population in order to achieve macroeconomic stability, continuity in governance reforms, enhanced equity and wealth creation opportunities for the poor, improved infrastructure, sustainable land reforms, human resource development, security and public sector reforms[1].

One key flagship project and key initiative under this mandate will include the ***Metropolitan and Investment Plans Initiative***: the project will facilitate the preparation of metropolitan and investment plans for six metropolitan regions.



Source: Kenya Vision, 2030

The Second Medium Term Plan (2013-2017) outlines Lamu Port as a special border town which will be mandated to have such a Metropolitan and Investment Plan prepared. This is referred to as a Strategic Integrated

[1] 2008: Kenya Vision 2030

Physical Development plan along the Lamu Port, Southern Sudan and Ethiopia Transport (LAPSSET) Corridor. The purpose of this will be the achievement of better urban areas through the increased production of housing, better planned areas and accessible services and infrastructure for all. Hence the preparation of the Metropolitan Plan which is an Integrated Physical Development Plan outlining the 20 year urban development and investment plan for the Metropolitan area.

Important to note, the First Medium Term Plan under the Vision 2030 facilitated the undertaking of a Feasibility Study for the development of the proposed LAPSSET Corridor and Port construction in Lamu. The LAPSSET components and the proposed Metropolitan region are thus imperative in the overall achievement of the Country's 30 year Vision to transform Kenya into a newly industrializing, middle-income country providing a high quality life to all its citizens by the year 2030.

ii. Sessional Paper No. 3 of 2009 on National Land Policy

The National Land Policy provides the framework under which land is administered and managed in Kenya. The main objective of the policy is to ensure effective land utilization and efficient use of land based resources and equitable distribution of land rights. In the preparation and implementation of the Area Structure Plan, the National Land Policy provides for environmental, socio-economic and political land issues including deterioration of land quality, squatting and landlessness, disinheritance of some groups and individuals, urban squalor, under-utilization and abandonment of agricultural land, tenure insecurity and management of land related conflicts. This is outlined in Section 27 where the policy will inform the following in the land use planning process:

"(a) Land tenure issues; (b) Land use management issues;(c) Land administration issues;(d) Land issues requiring special intervention;(e) Institutional framework; and (f) Implementation framework"

Additionally, development control is cited as an imperative practice in the process of planning land use. An outright clause is included in Section 51 that gives support to the need for spatial planning.

"The Government shall align the power of Development Control with the new categories of land ownership under Part 3.3.1of the Policy"

Another thing that is important to note is that the planning area has limited public land as most of the land is private land or communal land. This will during implementation of the plan require acquisition of land for public purpose, which is under this policy outlined. Land acquisition is defined under this Policy in Section 45 as:

"...the power of the State to extinguish or acquire any title or other interest in land for a public purpose, subject to prompt payment of compensation, and is provided for in the current Constitution"

In this regard Section 61of the policy outlines the management of public land giving authority to the National Land Commission to do the same:

"Identify and keep an inventory of all public land and place it under the National Land Commission (NLC) to hold and manage in trust for the people of Kenya"

Under this Policy, this power is exercised by the Commissioner of Lands on behalf of the State.

iii. The Physical Planning Handbook

The physical planning handbook provides regulations, guidelines and minimum standards for Physical Planning in Kenya forming subsidiary legislation of the Physical Planning Act (Cap 265). The Handbook heavily informs the process of preparing the Area Structure Plan.

Section 2.3.1 of the Handbook defines two types of plans a Local Physical Development Plan and a Regional Development Plan. The current Area Structure Plan being prepared for Lamu Metropolitan area falls under the following definition of a Local Physical Development Plan:

*"**Local Physical Development Plans***

A Local Physical Development Plan is a plan for the area or part thereof of a city, municipal, town or urban council and includes a plan with reference to any trading or marketing center.

Where such plans include Zoning Plans and Action Plans as below:

> ***(b) Action Plan***
>
> *It is a comprehensive plan selected for intensive change, which is to commence within a specific period by improvement, redevelopment, restoration and reuse of derelict land*
>
> ***(c) Zoning Plan***
>
> *It is a plan indicating permitted subdivision and use of land specified in such a plan."*

According to the definitions given, thus, the Area Structure Plan which is inclusive of both a

Zoning Plan and an Action plan satisfies the requirement of the planning regulations stipulated. The policy further outlines the minimum provision of basic social and physical infrastructure to be provided in land use planning. One key approach in the overall planning of the Metropolitan will be the classification of Human Settlements in order to provide for the required minimum of basic social and physical infrastructure as well as services. A Human Settlements Strategy is outlined in Section 3.3.3 of the Handbook indicating strategies for the planning of the same:

- *Development of service centers*
- *Development of growth centers*
- *Development of integrated transport systems*
- *Rural development*
- *Development of appropriate standards for urban infrastructure*

Each of the above is further disintegrated into the principles to be upheld in land uses planning according to the population being planned for. This includes the level of infrastructure to be provided for, the number of social amenities per center and the land use requirements, among others.

The Policy is thus the benchmark for planning standards and guidelines to be adhered to throughout the preparation of the Area Structure Plan and all relevant principles will be incorporated in the development of the same.

iv. Sustainable Development Goals (SDGs)

These are the seventeen international development goals that were adopted at the UN Sustainable Development Summit September, 25th 2015 to build on the MDGs. The goals adopted by all UN member countries are aimed at ending poverty, protecting the planet and ensuring the prosperity for all as part of a new sustainable development agenda. Each goal has specific targets to be achieved over the next 15 years.

Figure 1: Sustainable Development Goals

Source: UNDP Sustainable Development Goals, 2015

In the preparation of the Integrated Area Structure Plan, the SDGs provide a comprehensive framework in the improvement of social, economic and environmental conditions globally and more so in the world's poorest countries. In the preparation of the Integrated Area Structure Plan, the most imperative component of the SDGs is the 34th Declaration which concerns sustainable urban development:

"We recognize that sustainable urban development and management are crucial to the quality of life of our people. We will work with local authorities and communities to renew and plan our cities and human settlements so as to foster community cohesion and personal security and to stimulate innovation and employment. We will reduce the negative impacts of urban activities… And we will work to minimize the impact of cities on the global climate system"

This declaration provides the framework for the effective planning of a climate resilient Metropolis that will develop sustainably over the next 20 years.

Goal 11 as the most relevant SDG in the preparation of this plan states that the direction of development over the next 15 years should incorporate:

"11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by *paying special attention to air quality and municipal and other waste management*

11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces

11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning

11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters"

v. Forest Policy, 2014

This policy was formulated with the overall objective of ensuring sustainable, management, utilization and conservation of forest resources and equitable sharing of accrued benefits for the present and future generations of people of Kenya. Forests in the Constitution are classified into three categories, public, community and private forests as classified under Chapter 7 of the Act:

i. ***Public forests*** *– all forests on public land; forestland lawfully held, used or occupied by any State organ; forestland transferred to the State by way of sale, reversion or surrender and forestland in respect of which no individual or community ownership can be established by any legal process. According to the Act, the National and County Governments are responsible for all forests on public land. There is no public land within the planning area.*

ii. ***Community forests*** *– include forestland that is lawfully held, managed or used by specific*
communities, forestland lawfully held as trust land by the County Governments. These exist where there is community land owned by groups such as the Boni Community.

iii. ***Private forests*** *– forestland held by any person under any freehold or leasehold tenure and any forest owned privately by an individual, institution or body corporate for commercial or non-commercial purposes. These exist in large ranches owned by private land owners within the planning area.*

The planning area is made up of a significant area of forest coverage and thus this Policy is imperative in the management and planning for the same. Key regulations stipulated include objectives outlined in Chapter 3.2:

i. *To increase and maintain tree and forest cover of at least ten percent of land area of Kenya*

ii. *To promote public, private and community participation and partnership in forest sector development*

iii. *Promote investment in commercial tree growing, forest industry and trade*

iv. *To enhance management of forest resources for conservation of soil, water biodiversity and environment stability*

To achieve the above objectives, the policy is guided by some of the following principles as outlined in Chapter

a. *Ecosystem approach-Integrated approach to conservation and managing forest resources will be adopted and enhance to ensure that all forest ecosystem are managed in an integrated manner for the benefit of the people of Kenya.*

b. *Sustainable forest management (SFM). All forest resources shall be managed sustainably to yield social, economic and ecological goods and services for the current generation without compromising similar rights of future generation.*

Chapter 4.4 gives special attention to urban forests, making recommendation for the maintenance and increase of the same. This will be important in the planning area a large part of which will be dedicated to industrial land use which will contribute heavily to carbon emissions. The Act provides for:

"Establishment of arboreta, roadside tree planting, botanical gardens, urban forests, recreational parks and mini-forests enhances environmental, social, and economic values….A belt of amenity trees planted at the interface of road and private lands will improve the scenery on road reserves contribute to carbon sequestration, mark the boundaries between the road reserves and private lands to avoid encroachment into the road reserves.

xiii. Agenda 21 (2012)

The principle of Agenda 21[2] is a non-binding, voluntarily implemented action plan of the United Nations with regard to sustainable development. It is a product of the Earth Summit (UN Conference on Environment and Development) held in Rio de Janeiro, Brazil, in 1992.

[2] 1992: United Nations Conference on Environment & Development Rio de Janerio, Brazil, 3 to 14 June 1992

The Agenda 21/Sustainable Development is the action plan to inventory and control all land, all water, all minerals, all plants, all animals, all construction, all means of production, all information, all energy, and all human beings in the world.

The major proponent of the Agenda is sustainable development where economic growth is achieved without depletion of future resources. This is an important foundation in the preparation of the Area Structure Plan. Resources are limited in the planning area and need to be sustained over the next 20 years.

Its main themes include:

- Building a green economy to achieve sustainable development and lift people out of poverty, including support for developing countries that will allow them to find a green path for development.
- Improving international coordination for sustainable development by building an institutional framework

The 2012 Rio+20 talks led to the nonbinding document "The Future We Want" which began talks on the Sustainable Development Goals which would take over from the MDG's once they came to an end. Kenya is part of the member states that participated in taking up this agenda.

The Kenyan Government has put in place a wide range of policy, institutional and legislative frameworks such as EMCA to address the major causes of environmental degradation and negative impacts on ecosystems emanating from industrial and economic development programs. In addition, Kenya is a member of the Convention of Biological Diversity (CBD) pursuant to participating in Agenda 21. Finally, Kenya adopted a National Climate Change Action Plan for the next 4 years to act a framework in the development of the country while conserving the same.

2.2.2. Acts of Parliament

i. The Constitution of Kenya (2010)

The 2010 Constitution acknowledges the requirement for planned urban development and this is seen in Article 184, which establishes the Urban Areas and Cities Act, a necessary legislation for the:

"(b) Establishment of the principles of governance and management of urban areas and cities"

The spatial planning of Urban Areas and Cities is, under the same Constitution, devolved to County Government. In Chapter 11 and Article 185, the functions of the County Assembly entail receipt and approval of all plans and policy that concern:

"(a) Management and exploitation of the county's resources; and (b) the development and management of its infrastructure and institutions"

As regards land, Chapter 5 of the constitution deals with land and environmental matters. It categorizes land ownership as public land, private land and community land. Article 60(1) of this chapter provides that land in Kenya shall be:

"Held, used and managed in a manner that is equitable, efficient, productive and sustainable and in accordance with the following principles:

a. Security of land rights
b. Sustainable and productive management of land resources
c. Transparent and cost effective administration of land
d. Equitable access to land
e. Sound conservation and protection of ecologically sensitive areas.
f. Elimination of gender discrimination in law, customs and practices related to land and property in land.
g. Encouragement of communities to settle land disputes through recognized local communities initiatives consistent with this constitution.

Also established within Chapter 5 under Article 67 of the Constitution is the National Land Commission which is an imperative institution as relates to the administration of land in the country. The Commission is charged with management of Public Land in the country as indicated in Clause 2 of Article 62:

*"Public land shall vest in and be held by a County Government in trust for the people resident in the County, and shall be administered on their behalf by the **National Land Commission**"*

The functions of the National Land Commission as relate to preparation of the Area Structure Plan include:

a) To manage public land on behalf of the national and county governments;
b) To recommend a national land policy to the national government;

c) *To conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities;*
d) *To monitor and have oversight responsibilities over land use planning throughout the country.*

The Structure Plan thus derives its functions of ensuring efficient, productive and sustainable use of land from the Constitution of Kenya.

ii. The Physical Planning Act (Cap 286)

The Physical Planning Act outlines two types of spatial development to be prepared in Kenya: Regional Physical Development Plan and Local Physical Development Plans. The latter as defined in the Physical Planning Act defines the current Area Structure Plan being prepared for Lamu Metropolitan. Where, in Chapter 24, the plan is outlined as:

(1) Prepare with reference to any Government land, trust land or private land within the area of authority of a city, municipal, town or urban council or with reference to any trading or marketing center, a local physical development plan

(2) A local physical development plan may be a long-term or short-term physical development or for a renewal or redevelopment and for the purpose set out in the Third Schedule in relation to each type of plan

(3) Prepare a local physical development plan for the general purpose of guiding and coordinating development of infrastructural facilities and services for an area referred to in subsection (1), and for the specific control of the use and development of land or for the provision of any land in such area for public purposes

The Second Schedule in Section 24(2) matters which may be dealt with in the Local Physical Development Plan include

"Classification of the plan area for residential, commercial, industrial and other purposes, including the provision of special areas for factories, or industries generally, or for shops, warehouses, stores, stables and other buildings used for commercial and industrial purposes and fixing the sites for buildings required"

The process of spatial planning is undertaken by "local authorities" which refers to the devolved County Government. The powers given to the same under Chapter 29 are as below outlining the requirement of the planning process:

(a) Prohibit or control the use and development of land and buildings in the interests of proper and orderly development of its area;

(b) Control or prohibit the subdivision of land or existing plots into smaller areas;

(c) Consider and approve all development applications and grant all development permissions;

(d) Ensure the proper execution and implementation of approved physical development plans;

(e) Formulate by-laws to regulate zoning in respect of use and density of development; and

(f) Reserve and maintain all the land planned for open spaces, parks, urban forests and green belts in accordance with the approved physical development plan.

iii. The Forest Act (Cap 385), 2005

This Act was enacted to provide for the establishment, development and sustainable management, including conservation and rational utilization forest resources for the socio-economic development of the country. The Act recognizes the vital roles played by the forest which includes stabilization of soils, and ground water, thereby supporting the conduct of reliable agricultural activity and they play crucial role in protecting water catchment in Kenya and moderating climate by absorbing greenhouse gases. In relation to the area where planning will take place (Lamu metropolitan area), forest and forest related resources will be protected to ensure the above vital forest roles are obtained.

Article *30* of the Act states: "*Every local authority shall establish and maintain arboreta, mini-forests or recreational parks for the non-consumptive use of persons residing within its area of jurisdiction"*

Where within the planning area a number of forests are existing, the Act provides for the establishment of local authority forests. In the zoning plan, provision has been made for green zones. Under Article 24, a local authority forest can be created if:

a) *The land is an important catchment area, a source of water springs, or is a fragile environment;*

b) *The land is rich in biodiversity or contains rare, threatened or endangered species;*

c) *The forest is of cultural or scientific significance;*

d) *The forest supports an important industry and is a major source of livelihood for the local community*

iv. National Land Commission Act, 2012

The National Land Commission Act stipulates the need for an ***oversight of land use planning*** throughout the country and also management of public land on the behalf of national or county governments. Article 5 of the Act describes the Commissions functions as below which will be instrumental in the administration of land within the planning area to:

(a) Manage public land on behalf of the national and county governments;

(b) Recommend a national land policy to the national government;

(c) Advise the national government on a comprehensive programme for the registration of title in land throughout Kenya;

(d) Conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities;

(e) Initiate investigations, on its own initiative or on a complaint, into present or historical land injustices, and recommend appropriate redress;

(f) Encourage the application of traditional dispute resolution mechanisms in land conflicts;

(h) Monitor and have oversight responsibilities over ***land use planning*** *throughout the country*

v. Land Acquisition Act (CAP 295), 2010

Section 40 of the new Constitution, the state is empowered to acquire private land compulsorily for public benefit upon prompt payment in full, of just compensation. The principal legislation which guides the process is the Land Acquisition Act Cap 295which has now been repealed and replaced with the Land Act, 2012 Part viii (compulsory acquisition of interest in land). This part of the Act is yet to be effective in land acquisition process because the National Land Commission was constituted recently and we are still in a transitional period. The Land Acquisition Act details out the process to be followed for the acquisition of land in the circumstances outlined in Article 6 as defined below:

*"The acquisition of the land is necessary in the interests of defense, public safety, public order, public morality, public health, **town and country planning** or the development or utilization of any property in such manner as to promote the public benefit"*

Article 7 then stipulates that land to be marked out by the Commissioner of Lands will have a plan prepared. This is in order to have specific land use identified and planned for land acquired:

"The Commissioner may cause the land which is to be acquired to be marked out and measured (if this has not already been done), and shall cause a plan of the land to be prepared"

vi. County Government Act (CAP 265)

This Act gives effect to Chapter 11 of the constitution providing the framework for County Governments' powers, functions and responsibilities in the delivery of services. An entire section, Part XI of this Act is dedicated to County Planning. The Act mandates County Governments to prepare County Spatial Plans. The four major plans to be prepared by the county are:

***"107:** County Integrated Development Plan, County Spatial Plan, County Sectoral Plans and Urban Areas and Cities Plans. The Lamu Metropolitan Area Structure Plan falls under the category of the Urban Areas and City Plans"*

With the devolving of government services to the County level planning is important for the management of land use and spatial development. Chapter 104 obligates County's to develop County plans which shall integrate economic, physical, social, environmental and spatial planning. The County Government shall designate county departments, cities and urban areas, sub-counties and Wards as planning authorities of the county.

Planning authorities include the Metropolitan area for which an Area Structure Plan is being prepared to guide long term development over the next 20 years. The objectives for County Plans include:

"Facilitate the development of a well-balanced system of settlements and ensure productive use of scarce land, water and other resources for economic, social, ecological and other functions across a County; Maintain a viable system of green and open spaces for a functioning eco-system; Harmonize the development of County communication system,

infrastructure and related services; and Develop urban and rural areas as integrated areas of economic and social activity"

vii. Environmental Management and Coordination Act, 2015

Article 3(1) highlights that: *every person in Kenya is entitled to a clean healthy environment in accordance with the constitution and relevant laws and has the duty to safeguard and enhance the environment. The Lamu area structure will ensure that the environment is protected and any proposed land development will not result to environmental pollution.*

Article 42(1) of this Acts suggests that: *no person shall, without the prior written approval of the Authority given after an environmental impact assessment, in relation to river, lake, sea or wetland in Kenya, carry out any of the following activities*:

a. Erect, reconstruct, place, alter, extend, remove or demolish any structure or part of any structure in, or under the river, lake, sea or wetland;
b. Excavate, drill, tunnel or disturb the river, lake, sea or wetland;
c. Introduce any animal, whether alien or indigenous, dead or alive, in any river, lake, sea or wetland;
d. Introduce or plant any part of a plant specimen, whether alien or indigenous, dead or alive, in any river, lake, sea or wetland;
e. Deposit any substance in a lake, river or wetland or in, on or under its bed, if that substance would or is likely to have adverse environmental effects on the river, lake, sea or wetland;
f. Direct or block any river, lake, sea or wetland from its natural and normal course;
g. Drain any lake, river, sea or wetland; or
h. Any other matter prescribed by the Cabinet Secretary on the advice of the Authority

viii. Agriculture Act (Cap 318) of 2012

This Act promotes and maintains stable agriculture to provide for the conservation of the soil, its fertility and to stimulate the development of agriculture land in accordance with the accepted practices of good land management and land husbandry. The Act ensures protection of the land resource used in cultivation of crops. Article 48 specifies for the:

For the preservation of the soil requiring, regulating or controlling:

(i) The afforestation or re-afforestation of land;

(ii) The protection of slopes, catchment areas;

(iii) The drainage of land, including the construction, maintenance or repair of artificial or natural drains, gullies, contour banks, terraces and diversion ditches;

This Act is important in the preparation of the Integrated Lamu Metropolitan Area Structure Plan as the major land use of the proposed metropolitan area is agricultural.

ix. Water Act (Cap 242), 2012

This Act provides good management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water; to provide for the regulation and management of water. This Act will guide preparation of the Area Structure Plan as it provides the bases on conservation and protection of any water body.

Catchment areas are identified in the Act as a defined area from which rainwater flows into a watercourse to be a catchment area for the purposes of this Act. And a Catchment Management Strategy will be prepared for the same that will include:

"The management, use, development, conservation, protection and control of water resource within each catchment area"

In the preparation of the Area Structure Plan, integrated water resource management and water supply are imperative resources for integrated development in the planning area. The port area and industrial developments zoned will require extensive sources of water. The catchment management strategy as outlined in Article 3 shall:

(a) Take into account the class of water resource and resource quality objectives for the water;

(b) Be consistent with the national water resources strategy;

(c) Prescribe the principles, objectives, procedures and institutional arrangements of the Authority for the management, use, development, conservation and control of water resources within each catchment area;

(d) Contain water allocation plans which set out principles for allocating water; and

(e) Provide mechanisms and facilities for enabling the public and communities to participate in managing the water resources within each catchment area"

Additionally, Article 76 of the Act controls trade effluents to water bodies and therefore in plan preparation precautions will be taken to ensure that industrial and trade industries are located far off from water catchments or their effluent treated before release into water bodies.

x. Public Health Act (Cap 242), 2012

This Act provides for the guidelines and regulations in planning for building construction, storm water drainage, solid and liquid waste management and the general sanitation of an area. In relation to the Structure plan, buildings and provision of utility services are key components of the plan, thus bringing the relevance of this Act to the exercise.

Part XIII of Article 144 of the Act makes reference to provision of Cemeteries stipulating regulations in the dead being buried in appointed cemeteries:

"....sufficient and proper places to be the sites of and to be used as cemeteries; and it shall be obligatory where such cemeteries exist to bury the dead in such cemeteries in conformity with the provisions of rules made by any local authority"

xi. Kenya Maritime Authority Act, 2006

The principal objects of the Authority are to regulate, co-ordinate and oversee maritime affairs. The Maritime Act ensures protection of the marine environment and prevention of marine source pollution in collaboration with such other public agencies and institutions.

xii. Maritime Zone Act, 1986

It is an Act of Parliament that consolidates the law relating to the territorial waters and the continental shelf of Kenya: to provide for the establishment and delimitation of the exclusive economic zone of Kenya, to provide for the exploration and exploitation and conservation and management of the resources of the maritime zones, and for connected purposes.

The Act defines "maritime zones" as exclusive economic zone together with the territorial waters and the air space above the exclusive economic zone. The Act provides for regulations to regulate the exploration and exploitation and conservation and management of the maritime zones that may be necessary or expedient as outlined below:

(a) Prescribing measures for the protection and preservation of the marine environment;

(b) Regulating the construction, maintenance, operation, and use of, and establishment of safety areas around artificial islands (whether permanent or temporary), offshore terminals, installations and other structures;

(c) Regulating the exploration and exploitation of the maritime zones for the production of energy from the tides, water currents and winds, and for any other economic uses;

(d) Providing for such other matters as are necessary to give full effect to the sovereign rights of Kenya in the exclusive economic zone;

(e) In consultation with the Minister for the time being responsible for finance, providing for the levying of customs and excise duties;

(f) Prescribing the fees to be paid in respect of any matter or thing prescribed by this Act or the regulations;

(g) Prescribing all matters that are authorized by this Act or the regulations to be prescribed"

xiii. Tourism Act of 2011

The Act provides for the development, management, marketing and regulation of sustainable tourism and tourism-related activities and services, and for connected purposes. Lamu being an important tourist destination and a town of rich cultural heritage will in the long run require Tourism Area Development Plans.

xiv. National Museum and Heritage Act, 2006

This Act replaced the 1983 National Museum Act CAP 216 and Antiquities and Monuments Act CAP 215 and the Local Government Act (and the associated by the laws). The legislation is used as a guide management of the numerous monuments and heritage sites located in and around the planning area.

There are several unearthed heritage sites, in the case that during development of the planning area shrines, monuments or other heritage sites are uncovered, the Act provides for Article 30 which outlines Notification of discovery:

"Where a person discovers a monument or object of archaeological or paleontological interest, the person shall, within seven days, give notice thereof, indicating the precise site and circumstances of the discovery, to the National Museums, and in the case of an object,

shall deliver the object to the National Museums or to the District Commissioner to keep it for any particular purpose or for any particular period"

Additionally, important in this case is the entry onto private land for exploration of monuments and shrines. Article 29 outlines this and will be imperative in the planning of Lamu Metropolitan as a unique planning site.

"Entry onto land under exploration license: For the purposes of an exploration license, the holder thereof may enter upon any area of land specified in the license, whether or not private land, and whether or not a protected area, and exercise there all rights conferred by the exploration license".

xv. Urban Areas and Cities Act

The Urban Areas and Cities Act, 2011 mandates that all urban areas to have a spatial development plan that will guide their development, provision of services and investment as is stated in Chapter 36:

"(1) an integrated urban or city development plan shall bind, guide and inform all planning development and decisions and ensure comprehensive inclusion of all functions….(3) A county government shall initiate an urban planning process for every settlement with a population of at least two thousand residents"

Thus, the preparation of this plan is in response to this requirement. Chapter 38 stipulates that:

"A city or urban area shall prepare an integrated city or urban area municipal development plan"

2.2.3. Summary of Legal and Policy Framework

	POLICIES
1. Kenya Vision 2030	Provides for the Metropolitan and Investment Plans Initiative: the project will facilitate the preparation of metropolitan and investment plans for six metropolitan regions hence the preparation of the Integrated Lamu Area Structure Plan.
2. Sessional Paper No. 3 of 2009 on National Land Policy	Provides a platform for addressing current issues such as access to land, land use planning, restitution of historical injustices, environmental degradation, conflicts, unplanned proliferation of informal settlements, outdated legal framework, institutional framework and information management. Lamu Metropolitan has a history of land tenure issues hence this policy will provide the framework to address this in planning for the area.
3. The Physical Planning Handbook	The Handbook defines the Area Structure Plan as a Local Physical Development Plan which is a plan for the area or part thereof of a city, municipal, town or urban council and includes a plan with reference to any trading or marketing center. This includes Zoning Plans and Action Plans thus satisfying the requirement of the planning regulations stipulated.
4. Sustainable Development Goals (SDGs)	As relate to urban development the SDGs recognize that sustainable urban development and management are crucial to the quality of life of our people: "*We will work with local authorities and communities to renew and plan our cities and human settlements so as to foster community cohesion and personal security and to stimulate innovation and employment. We will reduce the negative impacts of urban activities"… And we will work to minimize the impact of cities on the global climate system*"
5. Forest Policy, 2014	Provides for the management and planning of forested areas and stipulates that development of any area should maintain a tree and forest cover of at least ten percent of land area of Kenya. This will be facilitated within the plan proposals in the Integrated Area Structure Plan.

6. Agenda 21	Facilitates sustainable development where economic growth is achieved without depletion of future resources through sectoral mandates to be implemented by member states. Acts such as EMCA and the Kenya National Climate Change Action Plan.

	ACTS OF GOVERNMENT
1. The Constitution of Kenya (2010)	Establishes devolved governments and planning at this level by the same, making provisions for the establishment of CEC to manage urban areas as well as the Urban and Areas and Cities Act to further facilitate this.
2. The Physical Planning Act (Cap 286)	Provides that physical planning entails the preparation of a local physical development plan for the general purpose of guiding and coordinating development of infrastructural facilities and services, and for the specific control of the use and development of land or for the provision of any land in such area for public purposes.
3. The Forest Act (Cap 385), 2005	Makes provision for the establishment, development and sustainable management, including conservation and rational utilization of forest resources for the socio-economic development of the country. One of its main elements is the existence of adequate planning tools (in particular management plans).
4. National Land Commission Act, 2012	Establishes the authority that is mandated as management of public land on the behalf of national or county governments. And as regards spatial planning, the commission mandates oversight of land use planning throughout the country.
5. Land Acquisition Act (Cap 295), 2010	The Act provides that the acquisition of the land is necessary in the interests of defense, public safety, public order, public morality, public health, town and country planning or the development or utilization of any property in such manner as to promote the public benefit”

6. County Government Act (Cap 265)	The Act mandates County Governments to prepare County Spatial Plans. The four major plans to be prepared by the county are: County Integrated Development Plan, County Spatial Plan, County Sectoral Plans and Urban Areas and Cities Plans. The Lamu Metropolitan Area Structure Plan falls under the category of the Urban Areas and City Plans”
7. Environmental Management and Coordination Act, 2015	Provides a framework for integrating environmental considerations into the country’s overall economic and social development. It aims at harmonizing the various sector specific legislations that impact on environment to ensure greater protection of the physical and social environment. It also recognizes the cultural and social dimensions applied in the management of natural resources.
8. Agriculture Act (Cap 318) of 2012	Maintains stable agriculture to provide for the conservation of the soil, its fertility and to stimulate the development of agriculture land in accordance with the accepted practices of good land management and land husbandry. The Act ensures protection of the land resource used in cultivation of crops and is especially applicable in the planning of the Lamu Metropolis which has agriculture as one of the major economic activities
9. Water Act (Cap 242), 2012	Provides for catchment protection and protection of wells and support for community involvement in management of these catchments. It is also useful in riverine vegetation protection including other smaller rivers that flow into the ocean.
10. Public Health Act (Cap 242), 2012	Provides for the guidelines and regulations in planning for building construction, storm water drainage, solid and liquid waste management and the general sanitation of an area. In relation to the Structure plan, buildings and provision of utility services are key components of the plan, thus bringing the relevance of this Act to the exercise.
11. Kenya Maritime Authority Act, 2006	The principal objects of the Authority are to regulate, co-ordinate and oversee maritime affairs. The Maritime Act ensures protection of the marine environment and prevention of marine source pollution in collaboration with such other public agencies and institutions.
12. Maritime Zone	Consolidates the law relating to the territorial waters and the

Act, 1986	continental shelf of Kenya: to provide for the establishment and delimitation of the exclusive economic zone of Kenya, to provide for the exploration and exploitation and conservation and management of the resources of the maritime zones, and for connected purposes.
13. Tourism Act of 2011	Tourism Area Development Plans are a mandate under this Act which provides for the development, management, marketing and regulation of sustainable tourism and tourism-related activities and services, and for connected purposes.
14. National Museum and Heritage Act, 2006	The legislation is used as a guide in the management of the numerous monuments and heritage sites located in and around the planning area. The Metropolitan is made up of a number of undiscovered heritage sites, in planning the same, the Act provides for the provision of licensing to protect the same should they be later uncovered.
15. Urban Areas and Cities Act	Mandates that all urban areas must have a spatial development plan prepared that will guide their development, provision of services and investment. Thus, the preparation of this plan is in response to this requirement.

2.3. INSTITUTIONAL FRAMEWORK

The preparation of the Area Structure Plan falls under the mandate of a number of Institutions which are outlined below:

2.3.1. County Government of Lamu

a. County Executive

The County Government of Lamu has the local jurisdiction over the planning area as Lamu Metropolitan area falls within its area of authority within Lamu County. The County Government is as outlined in legislation stated above, including the Constitution, expected to undertake the plan preparation process. The main departments of interest in the County structure include the Department of Lands, Housing and Physical Planning, Department of Public Works, Roads and Transport, Department of Health, Department of Environment, Natural Resources, Department of Tourism and the Department of Forest.

b. County Assembly

The County Assembly will be involved in the approval process of the structure for it to be legally binding. As outlined in the Constitution, the County Assembly will receive and approve the proposed Area Structure Plan.

2.3.2. National Government

Ministry of Land Housing and Urban Development

It is established under the Constitution of Kenya under Chapter 9. It has the mandate of helping land management for sustainable development. The Physical Planning Department equally falls under this Ministry that has overall oversight and responsibility over this project.

Ministry of Devolution

It has a responsibility of developing strategic and national policies as well as coordinating of Inter-Governmental Relations and Devolution comprising Management of Devolution Affairs, Technical assistance to Counties, Vision 2030 Advisory and National Development Planning among others. It will offer technical assistance in the project.

Ministry of Transport and Infrastructure

Responsibility of developing strategic and national policies concerning national roads, maritime, airport, rail, transport and infrastructure development and management, implementation of LAPSSET project and Standard Gauge Railway project. It will be of importance in the preparation of the Area Structure Plan as it will offer support in infrastructure development as well as understanding of the transport planning process and related issues.

Ministry of Tourism

The ministry of tourism is a vital stakeholder because tourism forms the backbone of Lamu. The town is a recognised rich heritage centre which complements the cultural tourism. There are many pre historic sites in Lamu which attract local and foreign tourist and for this reasons all these places should be identified, protected and developed in a manner that will accommodate more people in future.

Ministry of Agriculture, Livestock and Fisheries

Responsible for enacting strategies and policies concerning agriculture in general. Apart from tourism, fishing and agriculture are crucial economic activities in Lamu hence making this institution an important stakeholder.

Ministry of Environment and Natural Resources

Responsibility of developing policies that will offer guidance on Water and Natural Resources Management, Environmental Protection and Conservation and Coordination of Climate Change Affairs among others. Thus it will have an important input in the preparation of the master plan.

Ministry of Industrialization and Enterprise development

Responsible for national development policies concerning: Industrialization, Private Sector Development, Development of Micro and Small business and Special Economic Zones. The introduction of Lamu Port and other vision 2030 flagship projects in Lamu makes this Ministry a noteworthy stakeholder to be included in the process.

2.3.3. LAPSSET Development Authority

In charge of the proposed Lamu Port South Sudan Ethiopia Transport Corridor development, which is a project consisting of 3 major transport infrastructure components which will run parallel, i.e. the railway, highway and pipeline. The LAPSSET Corridor cuts across the planning area, thus making the development authority a key stakeholder.

2.3.4. Kenya Ports Authority

Established under the Kenya Ports Authority Act. The introduction of Lamu Port makes the Kenya Ports Authority (KPA) a key stakeholder to be included in the planning process. KPA will provide guidance and information in matters pertaining to Lamu Port and other pertinent issues.

2.3.5. Lamu Port Steering Committee

Appointed by the national government to ensure successful implementation of the LAPSSET project. The main function being to assuage community fears concerning the project. Therefore they act as a key link of enhancing information flow within the community. This makes the committee an important stakeholder in the planning process to facilitate public awareness.

2.3.6. Other Stakeholders

Since the Constitution, the Physical Planning Act and the Physical Planning Handbook all uphold public participation, there are additional stakeholders that might be of interest in the project apart from the mentioned. These include community opinion leaders i.e. women, youth, disabled and religious leaders. Relevant NGOs and CBOs are equally potential stakeholders worthy of mentioning.

CHAPTER THREE: BACKGROUND

3.1. OVERVIEW

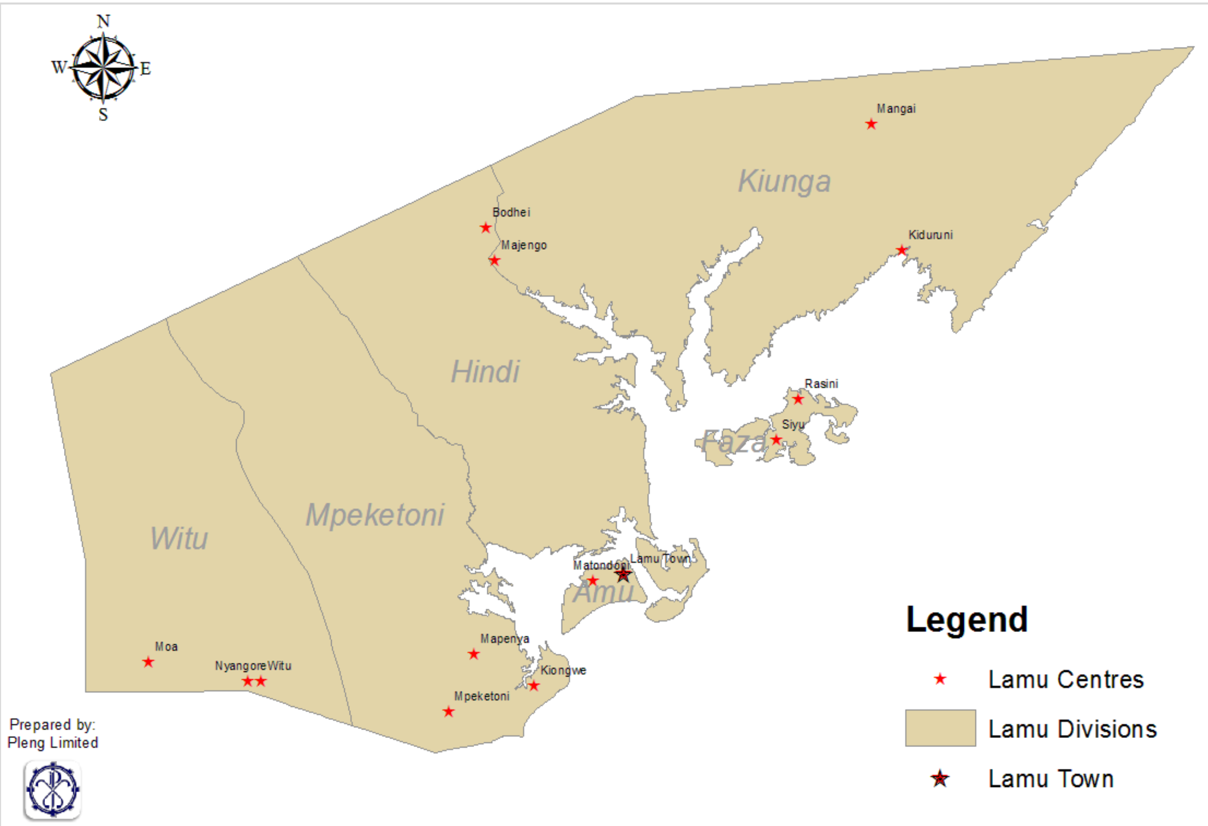
This chapter outlines the general background of Lamu County, giving the location and historical features as well as baseline information.

3.2. LAMU COUNTY

3.2.1. Location and Extent

Lamu County is one of the six counties in the coastal region of Kenya. It is located on the northern coast of Kenya and borders Tana River County to the southwest, Garissa County to the North, Republic of Somalia to the Northeast and the Indian Ocean to the South. The County covers an area of 6,273.1km^2 which consists of the mainland and over 65 islands that form the Lamu Archipelago. The total length of the coastline is 130km while land water mass area stands at 308km^2. It lies between latitudes 1^0 40' and 2^0 30' South and longitude 40^0 15' and 40^0 38' east (Lamu County Development Profile, 2013).

Map 1: Lamu County



Source: Author, 2016

3.3. HISTORICAL FEATURES

3.3.1. Lamu Old Town

This is a significant ancient town in the county with the oldest best preserved Swahili settlement in East Africa, retaining its traditional functions. The town has maintained its social and cultural integrity, as well as retaining its authentic building fabric up to date. It has also retained its important status as a significant center for education in Islamic and Swahili culture; evidenced by the annual maulidi and cultural festivals. [3]

The architecture and urban structure of Lamu graphically demonstrates the cultural influences that have come together over 700 years from Europe, Arabia and India, utilizing traditional Swahili techniques that produce a distinct culture. The core of the town comprises of a collection of buildings on a 16-hectare piece of land. The town is characterized by its unique Swahili architecture that is defined by the spatial organization and narrow winding streets. The street patterns have their origin in Arab traditions of land distribution and urban development.

The eminent Swahili researchers have identified Lamu as the cradle of Swahili civilization thus making it an important religious center in East and Central Africa since the 19th Century, attracting scholars of Islamic religion and Swahili culture. The people of Lamu have managed to maintain age-old traditions reinforcing a sense of belonging and social unity.

Lamu Old Town is managed by the National Museum and Heritage Act, 2006. Physical construction is also subjected to the Environmental Management and Conservation Act and the Physical Planning Act, which recognize that archeology is important for consideration. The Old Town has a gazetted buffer zone that includes the Manda and Ras Kitau mangrove and the Shella sand dunes. It is also protected by the Forest Act and Water Act respectively. All components are legally protected. Lamu County has the remains of some of the major heritage sites, which include[4]:

- Lamu Museum-known for its exquisite Swahili ethnography exhibits
- Lamu Fort- built in 1814 by Bwana Zeid Ngumi the last Sultan of Lamu
- Swahili House – a restored 18th-century house, reflecting the life of privileged Lamu Swahilis

[3] http://whc.unesco.org/en/list/1055
[4] http://lamu.go.ke/about/

- German Post Office- showing the post office when it was operational in the late 19-20th century
- Yumbe the former house of a Lamu Sultan
- Siyu Port
- Takwa Ruins
- Boni- Dodori National Reserve
- Kiunga Marine National Reserve

3.3.2. Administrative System

The County has two Constituencies: Lamu West and Lamu East. Lamu East Divisions includes: Faza, Kiunga, and Kizingitini while Lamu West Divisions include: Amu, Hindi, Mpeketoni, and Witu. The County has 23 locations and 38 sub-locations (Lamu County Development profile, 2013).

Currently, under the devolved government system enshrined in the new Constitution (2010), the electoral wards have been transformed into County Assembly Wards.

Table 1: Constituencies and County Wards in Lamu County

Constituency	County Wards
Lamu West	• Shella • Mkomani • Hindi • Mkunumbi • Hongwe • Bahari • Witu
Lamu East	• Faza • Basuba • Kiunga

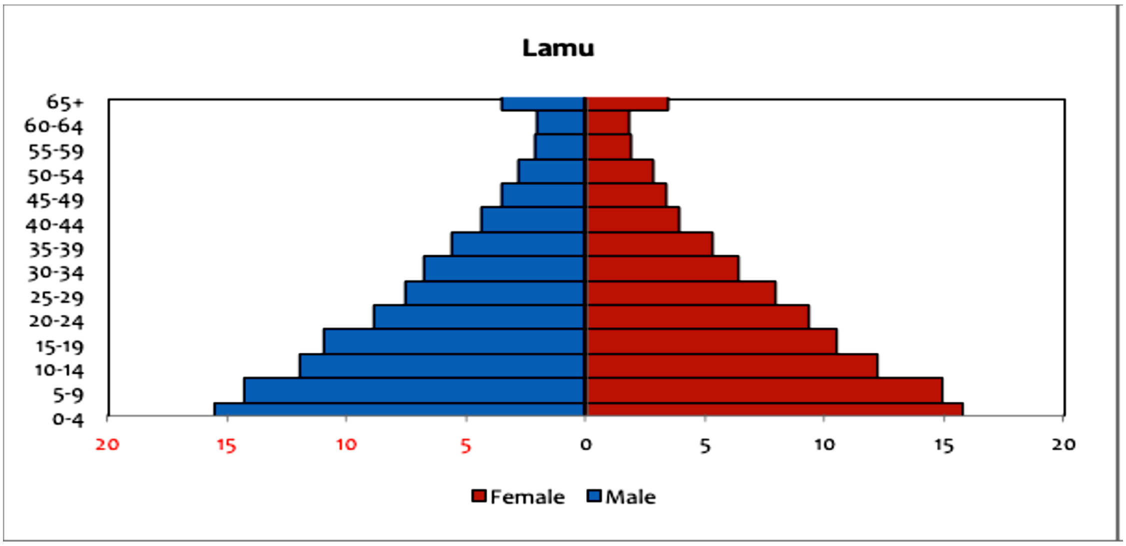
Source: Lamu County Development Profile, 2013

3.4. DEMOGRAPHIC CHARACTERISTICS

3.4.1. Population Composition, Structure and Growth Rate

The population of Lamu County was 101,539 by 2009. The County has a child-rich population, where 0-14 years old constitute 42% of the total population (Kenya National Bureau of Statistics, 2013).

Graph: Population Composition in Lamu County



Source: Kenya National Bureau of Statistics, 2013

In 2012, the population was projected to be 112,251 and expected to be 137,180 by 2017 (Lamu County Development Profile, 2013).

3.4.2. Education and Literacy Levels

The County has 150 Early Childhood and Development (ECD) Centers; 132 in Lamu West and 18 in Lamu East. There are 92 primary schools; 71 in Lamu west and 21 in Lamu East. There are two youth polytechnics in the county; Mpeketoni Polytechnic and Lamu Youth Polytechnic (constituted as a Constituent College of Mombasa Polytechnic). The County has no universities, but land has been set aside for two proposed universities (Lamu County Development profile, 2013).

According to Kenya National Bureau of Statistic (2013), only 13% of Lamu County residents have a secondary level of education or above. In Lamu West Constituency, only 15% of its residents secondary level education and above, which is almost twice that of Lamu East Constituency. A total of 54% of the whole of Lamu County's residents have primary level education, while a total of 33% of Lamu County's residents have no formal education.

Table 2: Education Levels in Lamu County

	% of Residents With Secondary Education And Above	% of Residents With Primary Education	% of Residents With No Formal Education
Lamu West Constituency	15%	55%	30%
Lamu East Constituency	7.5%	48%	44%

Source: Kenya National Bureau of Statistics, 2013

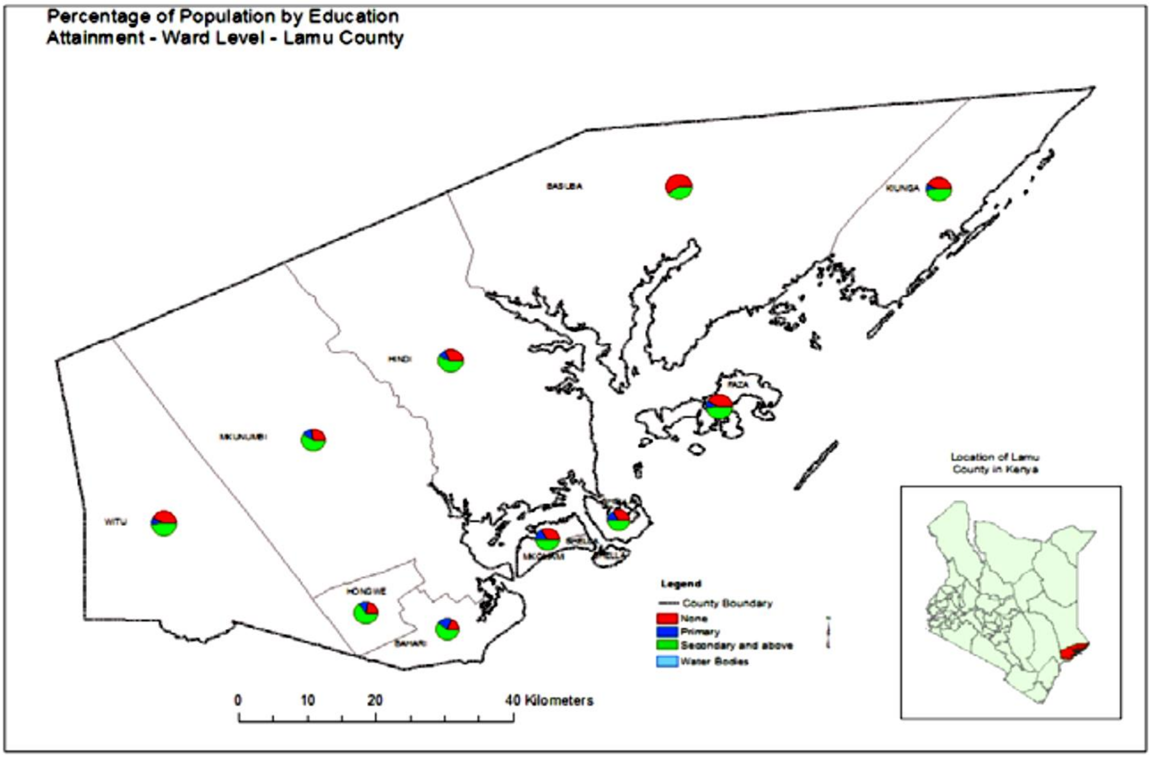
3.4.3. Employment

The County's total labor force is between the ages of 15-64 years which constitutes 54% of the total county population. Agriculture and agriculture related activities remain the largest contributor to the rural household income of 90% (a large part of the County population resides in the rural areas). Other sources include: tourist related employment (5%), wage employment (2%) and urban self-employment (2%).

There is mining in Manda, Matondoni, Lake Kenyatta, Kizingitini, and Faza where the main sand and ballast quarrying sites are located. Most of these activities are uncontrolled and support about 2000 persons. The current geological activities indicate titanium trace with oil and gas exploration ongoing on Pate Island. The County, however, lacks major industries which can be partly attributed to lack of enabling infrastructure such as electricity, good road networks, and reliable markets.

Most of the labor force is unskilled with only a small percentage engaged in fishing, boat making, wood carving and embroidery. The labor force that is literate is estimated to be 46% which implies only a small percentage of labor can be absorbed as skilled labor (Lamu County Development Profile, 2013).

Map: Percentage Population Level in Lamu County



Source: Kenya National Bureau of Statistics, 2013

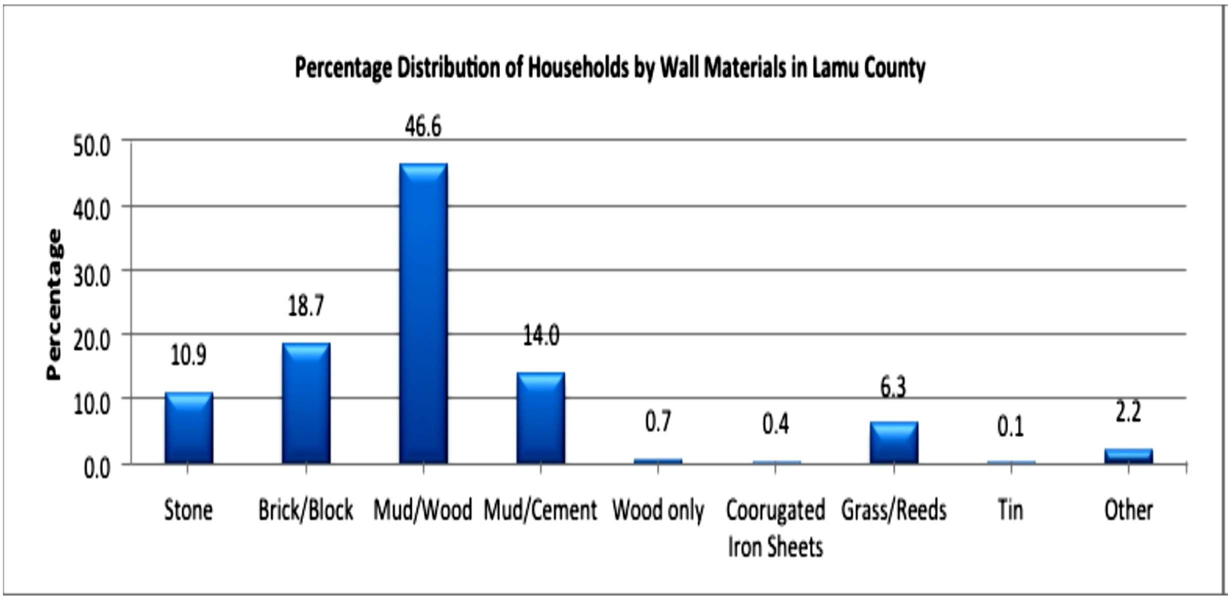
3.4.4. Housing

There are some factors that influence the type of accommodation preferred by the households in the county. These factors include:

- Availability of raw materials
- Culture
- Climate
- Settlement patterns

The houses found in the County can be classified based on roofing materials, floor materials and walling materials used. Mud/wood remains the most used walling material with 46.9% percent households having mud/wood-walled houses. Other walling materials include: mud/cement-13.9%, brick/block- 18.9%.

Graph: Percentage Distribution of Households by Wall Materials in Lamu County

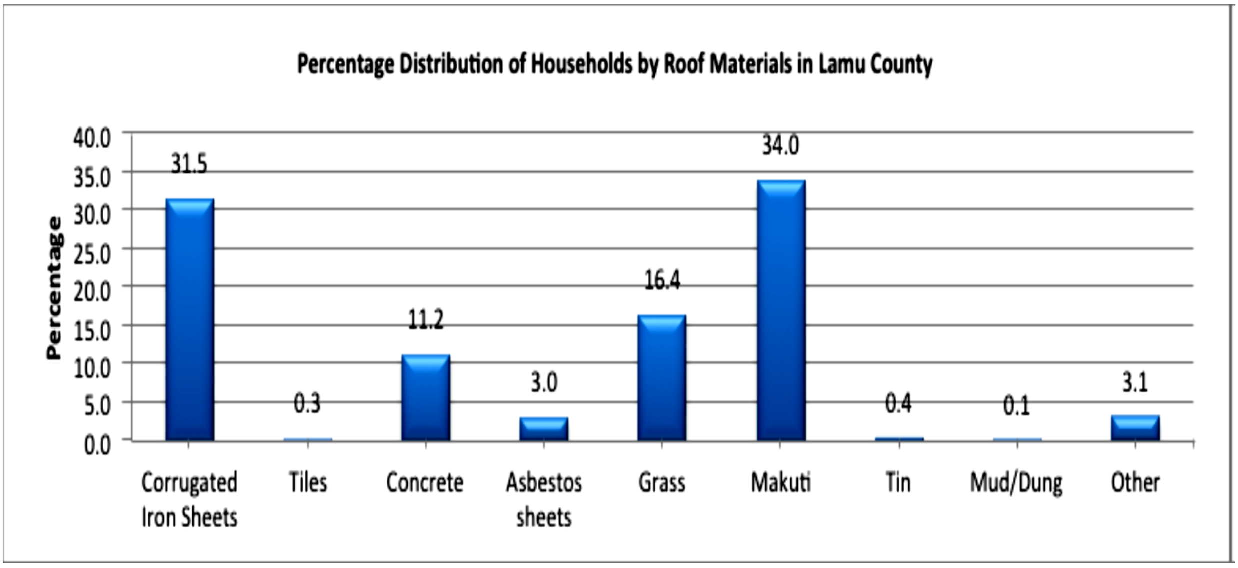


Source: Kenya National Bureau of Statistics, 2013

The commonly used roofing materials by household are:

- Makuti-34.8%
- Corrugated iron sheets-36.6%
- Grass- 16.4%

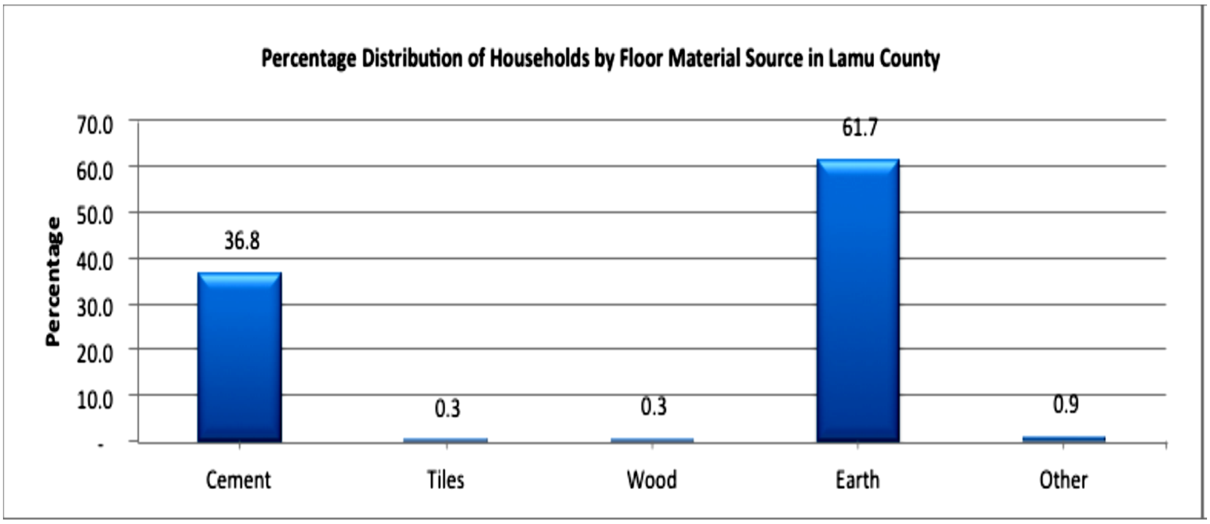
Graph: Percentage Distribution of Households by Roof Materials in Lamu County



Source: Kenya National Bureau of Statistics, 2013

62.3% of the households use bare earth as the main floor. The cement floors are mostly found in trading centers and used by 37% of the households in the County (Lamu County Development Profile, 2013).

Graph: Percentage Distribution of Households by Floor Materials in Lamu County

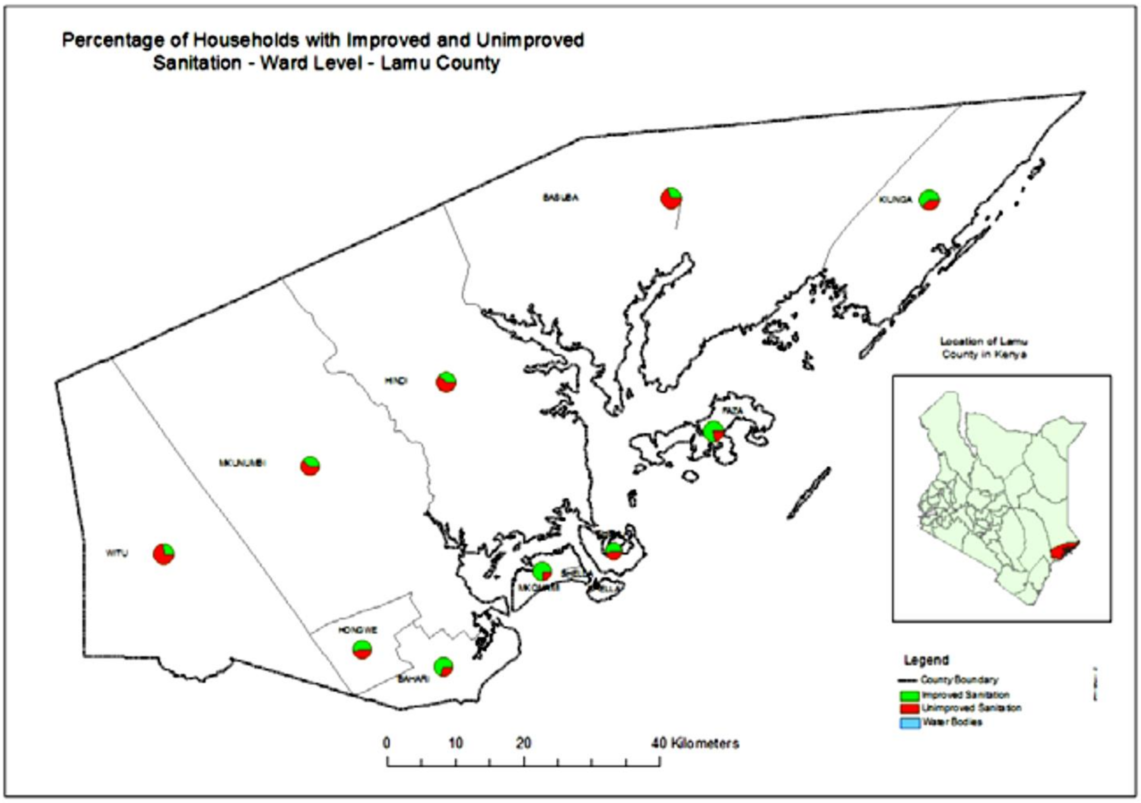


Source: Kenya National Bureau of Statistics, 2013

3.2.4.5 Sanitation

A total of 57% of Lamu County use improved sanitation, while the rest use unimproved sanitation. The methods of disposing both liquid and solid waste are disposal pits and sewerage pits (Kenya National Bureau of Statistics, 2013).

Map: Percentage of Households with Unimproved and Improved Sanitation



Source: Kenya National Bureau of Statistics, 2013

3.4.5. Health

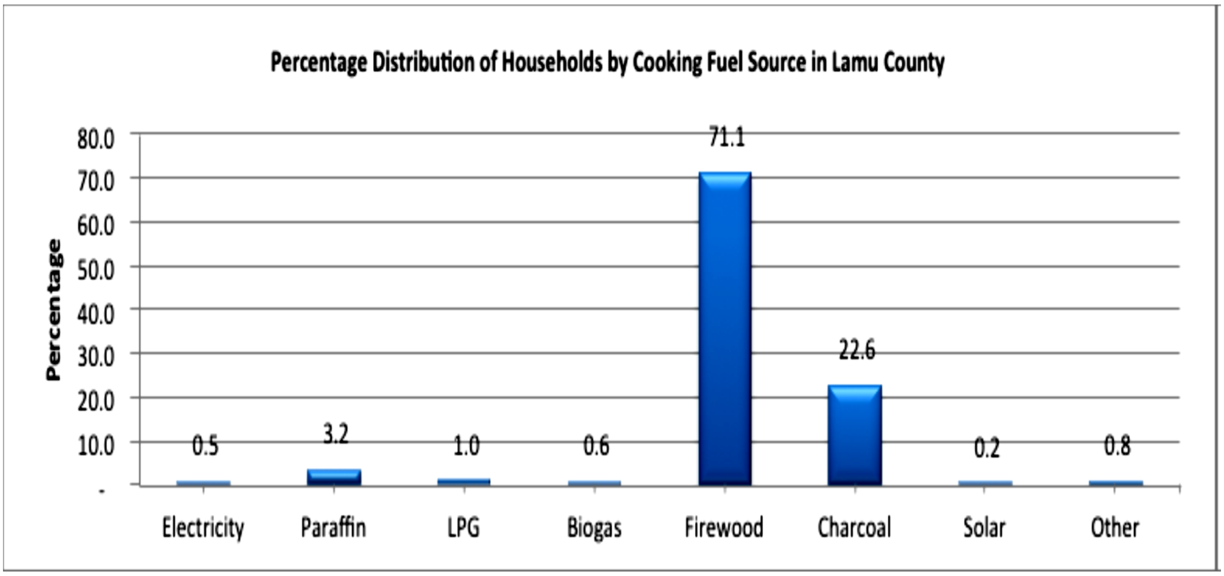
The County has 42 health facilities, of which, 24 are government owned, three are Faith-Based Organization owned, 1 is owned by a Non-Government Organization and 14 are privately owned. There are three level 5 health facilities, five health centers, a nursing home and 33 dispensaries.

3.5. ENERGY

3.5.1. Cooking Energy

Firewood and charcoal are the main sources of cooking fuel used by households at 71.1% and 22.6% respectively. The other sources are electricity, paraffin, gas (LPG), Biogas, solar and others used in the percentages shown in the figure below:

Figure 2: Percentage Distribution of Households by Cooking Fuel Sources in Lamu County



Source: Kenya National Bureau of Statistics, 2013

3.5.2. Lighting

The electrical power in the County has for over 5 decades been generated through diesel generators, recently however it was connected to the National Grid. The different sources of lighting include:

1) Mpeketoni Power Station- run by KENGEN and has three generators that produce 1,300KW per day against a daily demand of 1,000KW per day. It supplies Mpeketoni, witu and Hongwe.

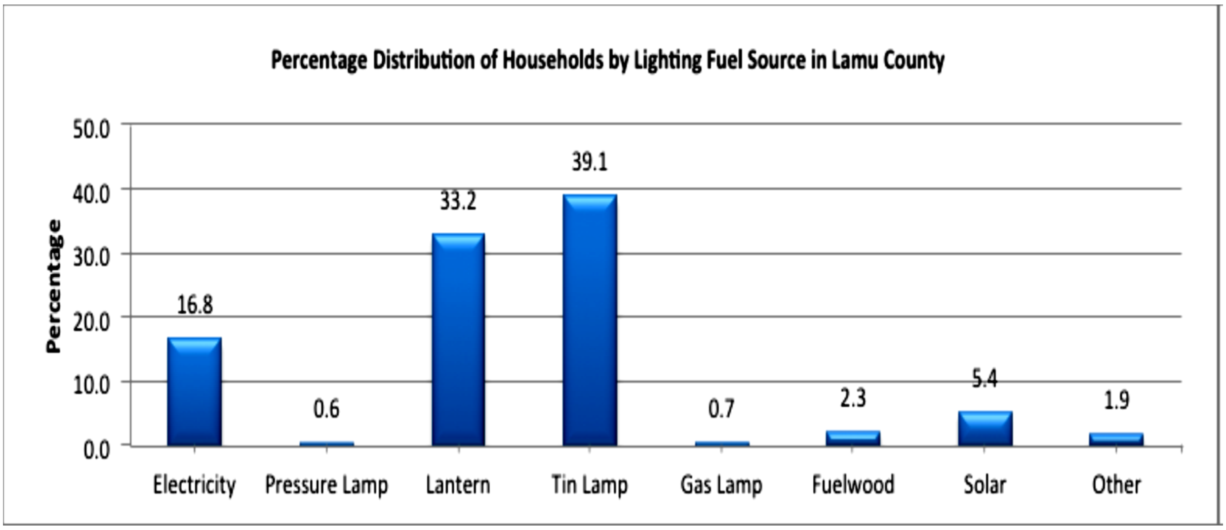
2) The Lamu Town Power Station- includes 7 generators run by KENGEN with a capacity of 20,000 KW per day against the daily demand of 18,859KW.

3) A community run generator in Faza where consumers are supplied with power for lighting only.

4) Trading centers in Matondoni, Ndau, Mbwajumwali, Faza, Kiunga and Tchundwa have generators bought through CDF.

The figure below shows the percentage distribution of the lighting sources in Lamu County:

Figure 3: Percentage Distribution of Households by Lighting Fuel Source in Lamu County



Source: Kenya National Bureau of Statistics, 2013

3.5.3. Urban Centres and Markets

The County has two main markets: Lamu Town and Mpeketoni Central. The main urban center is Lamu Old Town which is famous for rich cultural activities and heritage sites. Mpeketoni Central is renowned for trading and agricultural activities. The other trading centers located along main roads include: Hongwe, Pate, Bomani, Majembeni, Kiongwe, Baharini, Mapenya, Mkunumbi, Uziwa, Faza, Kizingitini, Siyu, Kiunga, mkokoni, Mhamarani, Katsakairu, Witu and Moa.

3.6. ENVIRONMENTAL CHARACTERISTICS

3.6.1. Topographical Features

The County lies between altitude zero and fifty meters above sea level. These low altitudes expose some parts of the County to flooding during the rainy seasons. There are rock outcrops which occur on the islands of Manda and Kiwayuu. The sand dunes are found in the Lamu Island and parts of Mkokoni in Kiunga (Lamu County Development Profile, 2013).

The main topographic features in the County include:

- Coastal Plains- these create the best agricultural land.

- Island Plains – they are found in the coastal, northern and western parts of the County which have good potential for agricultural development.
- The Dodori River Plain- found in Dodori National Reserve and home to many wildlife species.
- The Indian Ocean- provides a wealthy marine ecosystem which supports livelihoods of the county mainly tourism and fishing activities.

3.6.2. Water

The main sources of water in Lamu County include:

1. Groundwater – they are the major water sources in Lamu County
2. Surface water – this includes the sea, lakes, pans, dams and seasonal rivers
3. Rainfall- the rain harvesting structures are used to collect water for domestic use

There are several water catchment areas in the County which include: Dodori, Coastal Zone, Duldul, Lamu Bay drainage and Tana River catchments. There are also a few seasonal streams that flow from the west towards the southern eastern part of the County. The only permanent open water site in the County is Lake Kenyatta in Mpeketoni. The County has several swamp areas occasioned by rain water with the main ones located in Dodori, Hindi, Ziwa la magharini, Hindi-Bargoni road, Nairobi Ranch and Witu.

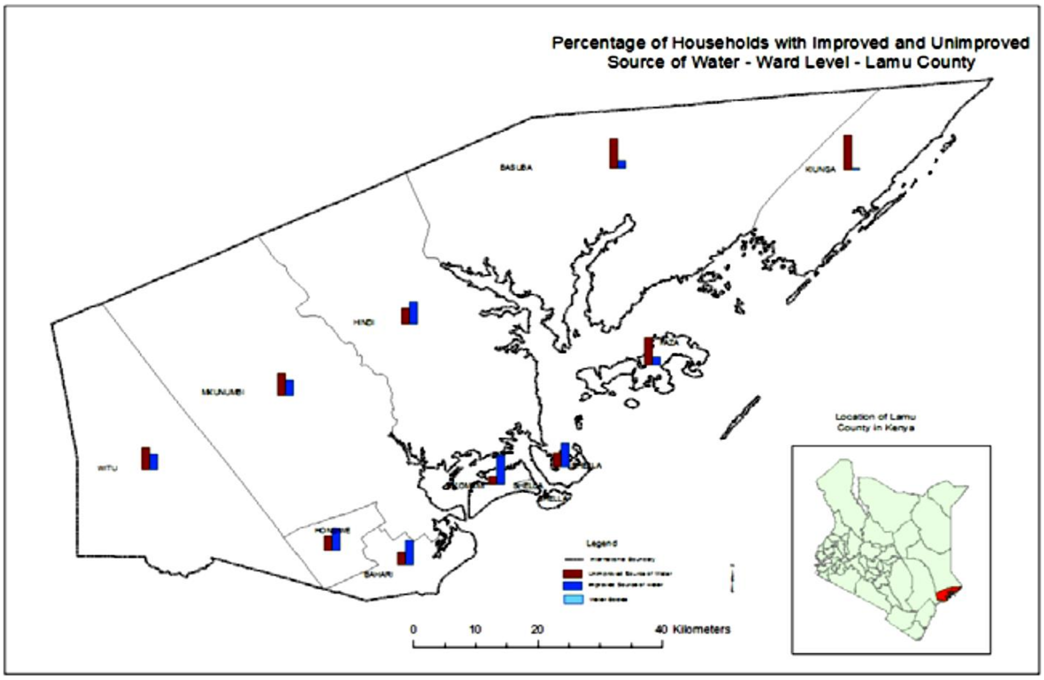
Water in the County is managed by various institutions, namely:

- Lamu Water and Sewerage Company – manages Lamu and Mokowe water distribution systems
- Lake Kenyatta Water Association – supplies and manages water in Mpeketoni Division
- Hindi Water Association – supplies water in Hindi Division
- Witu User Association – supplies water to Witu Division
- Community Committees – manage the djabias and dams

According to Kenya National Bureau of Statistics (2013), 53% of residents in Lamu County use improved sources (protected borehole, protected spring, piped water) of water while the rest use unimproved sources (stream water, rivers, lakes, djabias, dam, and pond).

The Map below shows the distribution of this in percentage of households with improved and unimproved sources of water:

Map: Percentage Distribution of Households with Unimproved and Improved Source of Water



Source: Kenya National Bureau of Statistics, 2013

3.6.3. Forest

The County's gazetted forest area covers 428km^2 which is 64% of the total forested area in the county. These comprise of:

- Mangrove forests (382km^2)
- Witu forest reserve (46km^2)

The non-gazetted forest area covers 280km^2 which is 36% of the total forested area and comprises of Lunge forest (95km^2), Boni forest (185km^2) and Lake Kenyatta buffer zone (0.16km^2). Total forest coverage in 708km^2 or 11.51% of the total Lamu County (Lamu County Development profile, 2013).

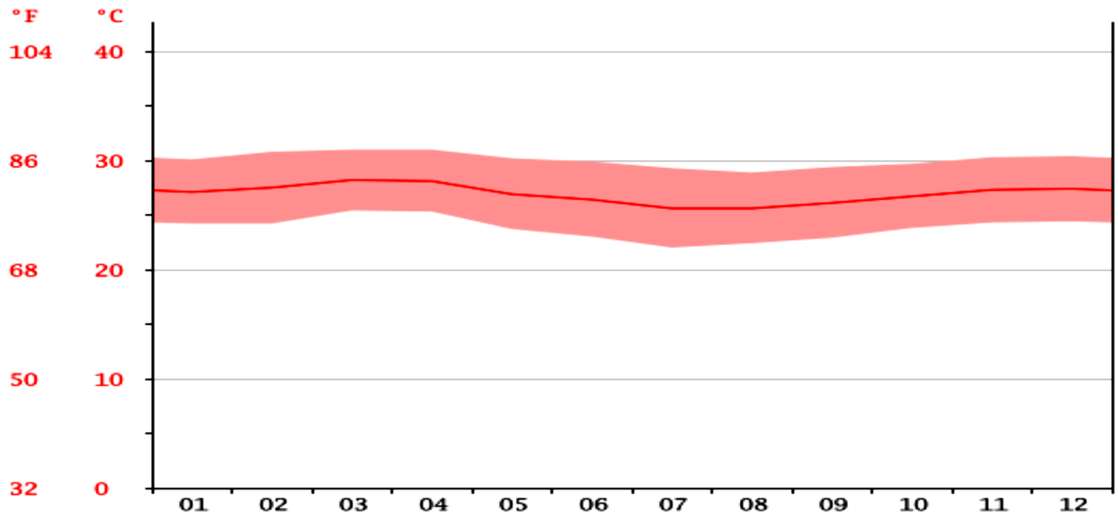
3.6.4. Soils

Lamu County is covered by quaternary deposits ranging from estuarine deposits to sands, clays and coral limestone. Nine types of quaternary deposits have been identified: sand dunes, undifferentiated quarternary sands, near surface coral limestone, beach deposits, alluvial deposits, deltaic coral, offshore coral and barrier island complex.

3.6.5. Climate

The County's annual temperature ranges between 23^0C and 32^0C. The high temperatures are experienced from December to April while low temperatures occur from May to July. Climate in Lamu County is considered tropical (Lamu County Development Profile, 2013). The graph below shows the annual temperature range of the county:

Graph: Climate Lamu[5]



There is a bimodal rainfall pattern with long rains occurring form mid-April to end of June with the highest rainfall recorded in the month of May. There are 3 major rainfall zones occasioned by the oceanic effect where rainfall reliability decreases as one moves towards the hinterlands. These three zones are:

- The arid areas along the northern borders mainly Kiunga, which receives rainfall below 540mm annually.
- The semi-arid areas of Amu, Faza and Kizingitini divisions which receives between 550mm- 850mm of rainfall annually.
- The sub-humid zone covering areas of Witu and Mpeketoni divisions receiving rainfall between 850mm-1110mm annually.

[5] http://images.climate-data.org/location/47680/temperature-graph.png/

3.7. ECONOMIC ACTIVITIES

3.7.1. Agriculture

According to the Lamu County Development Profile (2013), the County can be sub-divided into two livelihoods zones: the rich agricultural and livestock zones in the mainland (mainly settlement schemes); the fishing and marine zones (Islands). The County is categorized into five agro-ecological zones depending on the difference in physiographic, climatic and other natural conditions. These zones include:

i. Coastal Lowland (CL)
ii. Coconut- cassava zone (CL-3)- suitable for agricultural activities
iii. Cashew nut-cassava zone (CL-4)- suitable for agricultural activities
iv. Livestock-millet zone (CL-5) – suitable for livestock keeping
v. Lowland ranching zone - suitable for livestock keeping

The rich agricultural zone is composed of Mpeketoni, Witu and Hindi divisions. These areas consist of land parcels ranging from 5 to 10 acres. The size of agriculture farm land varies from one division to another, but on average, the farm size per household for the County is 4 acres (Lamu County Development Profile, 2013). The size of Arable land is estimated to be 85% of the land surface. The exploited land currently stands at 56,923hectare (21,311 hectare under food crops, 13,316 hectare under farm forest and 22,476 hectare under cash crops).

The main crops grown in the County include maize, cowpeas, dolichos, cassava, pigeon peas and green grams. Crops grown for commercial purposes include mangoes, coconut, cotton, bixa and simsim with cotton production being the highest source of income contributing 42% of the household income. Other crops percentage contribution to the household income is as follows:

- Maize-8%
- Cassava- 7%
- Bixa – 6%
- Mangrove- 5%

The main livestock species in the County include cattle, sheep, goat and poultry. Cattle and goat rearing is predominantly found in Hindi and Witu while daily farming is practiced mainly in settlement schemes area of Mpeketoni and parts of Hindi and Witu.

There are a number of ranches in the County which can be classified into:

a) 5 operational ranches which cover 65,620 hectares
b) 7 non-operational ranches which cover 81,420 hectares
c) 3 idle ranches which cover 56,000 hectares
d) 5 proposed ranches which cover 56,000 hectares

Fishing in the County is divided into marine in-shore and fresh water fishing. The marine in-shore fishing is done at 3100km^2 of territorial marine water measuring 144km from Dar-es-salaam in Kiunga to Ras Teweni. Fresh water fishing is concentrated in channels, ox-bow lakes of Tana River and other inland water bodies. There are five species of turtle, more than 100 species of reef fish, species of hard coral and tilapia.

3.8. MINING

There are mining prospects in Lamu as areas of oil and gas exploration have been discovered. Natural gas has been discovered at block L8 on Kenya's offshore at Mbawa well. Offshore oil exploration activities are also ongoing in block L10A and L10B on the Lamu Basin. There are also sand and ballast quarrying sites in Manda, Matondoni, Lake Kenyatta, Kizingitini and Faza.

3.9. TOURISM

The County has a unique advantage as a tourist destination due to its rich cultural identity. This consists of:

- Lamu Old Town- a world heritage site
- Four museums with ethnographic collections
- Archeological sites and monuments that stretch from Witu to Kiunga, Takwa ruins, pate ruins, Siyu and Shanga
- Other cultural attractions include traditional dhow making, woodcraft, weaving, henna painting and festivals (Maulidi and Lamu Cultural Festivals)

There are also beautiful beaches with clear and warm waters throughout the year. Water sporting activities are also undertaken in the area, such as water skiing, surfing, snorkeling, creek/ deep sea fishing and dhow sailing.

The County is also rich in flora and fauna. There are 3 national reserves (Dodori, Boni, Kiunga Marine Reserve), 2 National Parks (Dodori National Park and Kiunga Marine Park). Wild animals, including the big 5, are found in the 2 national parks and 3 private ranches

(Amu, Nairobi and Bujra). There has been increased human- wildlife conflict in the County especially in areas such as: Mpeketoni, Witu, Mokowe, Hindi and Dodori Creek.

3.10. OTHER ECONOMIC ACTIVITIES

The local people have found niches in different sectors where they get their income. These include: boat transport, curio shops, races (dhow, donkey), restaurants, tour guides, beach boys, carpentry (large scale), fishing, harvesting and sale of mangrove products.

3.11. ROAD AND TELECOMMUNICATION

Existing infrastructure in Lamu County is inadequate and grossly underdeveloped. This is evident in the road network which consists of a total of 688.6km of which only 6km is in bitumen standard. The main roads are the D568 Road, C112 Road and E885 Road.

Plate 1: Road within Hindi Town

Source: Author, 2016

There are eight main jetties in the County used by passengers, fishermen and for loading goods coming and out of the island. These jetties include: Amu, Mokowe, Manda, Matondoni, Lamu Customs, Fisheries/ Hospital (Lamu County Development profile, 2013).

Plate 2: Photo of Mokowe Jetty

Source: Author, 2016

The County has 13 airstrips where 11 are public and two are private. Manda airstrip is the main one used by passengers in the County. The other airstrips include: Manda Point 11, Manda Bay Naval, Mokowe, Kiunga, Kiwayuu Island, Kiwayuu Main in Mkokoni, Witu, and Mukunumbi.

There are five branches of the public post office, and several private couriers: G4S, air and road transport courier services and the German post office. Telkom Kenya provides landline services in Lamu town estimated at 2600 fixed telephone connections. There is also the mobile network services whose network connectivity is estimated to cover 60%. The internet coverage is poor (only 15% of the County has access). Radio and television coverage is also poor (Lamu County Development Profile, 2013).

Plate 3: BTS Station within Lamu Metropolitan Area

Source: Author, 2016

3.12. LAND AND LAND USE

The land suitable for crops in the County is 5,517km^2, while the land not suitable for crops is 649.7km^2, and the land under water is 308km^2. The people living in the peri-urban areas of the County practice subsistence small-scale farming and livestock keeping. However, most of the farmers do not have title deeds. The households with titles stand at 42%-13,000 households.

Large portions of land in the County remain unregistered and most of these areas are made up of ancestral land. These include: Kiunga, Faza, parts of Hindi, Manda Island, Witu, and Bahari. There are a number of heritage sites thus Government is hastening the process of resettlement especially with the aim of conserving the Swahili Villages.

In addition, most of the land set aside for ranch purposes remains idle and some of it is not in use at all.

3.13. THE LAPSSET

The government has initiated an enormous project under the Vision 2030 Strategy. Vision 2030 identified LAPSSET development as vital for spurring growth in the country, providing an alternative transport corridor and acting as a platform for opening up the vast northern parts of Kenya consisting of over 70% of the land mass which to date remains unexplored.

The project components include:

- The proposed Lamu Port at Manda Bay
- The Standard Gauge Railway lines from Lamu to Isiolo, Isiolo to South Sudan and Uganda, Isiolo to Ethiopia and Nairobi to Isiolo
- A Highway from Lamu to Isiolo, Isiolo to South Sudan, Uganda and Isiolo – Moyale- Addis Ababa(Ethiopia)
- A Crude Oil Pipeline from Lamu to Isiolo, Isiolo to South Sudan, Uganda, and product oil pipeline from Lamu to Isiolo-Moyale-Addis Ababa(Ethiopia)
- International Airports at Lamu, Isiolo and Lake Turkana
- Merchant Oil Refinery at Lamu
- Malindi-Garsen-Lamu Road
- Isiolo-Maralal-Lokichar Road
- High Grand Falls Multi-Purpose Power Generation Dam
- Water Supply Lines
- Power Supply
- Fiber Optic Cable and Communication Systems

These projects are also aimed at providing alternative tourist attraction sites, opening up the select areas and the overall country for trade, all while making the country a transport, trade and logistics hub in the region.

Plate 5: LAPSSET Project Site for Anticipated Port

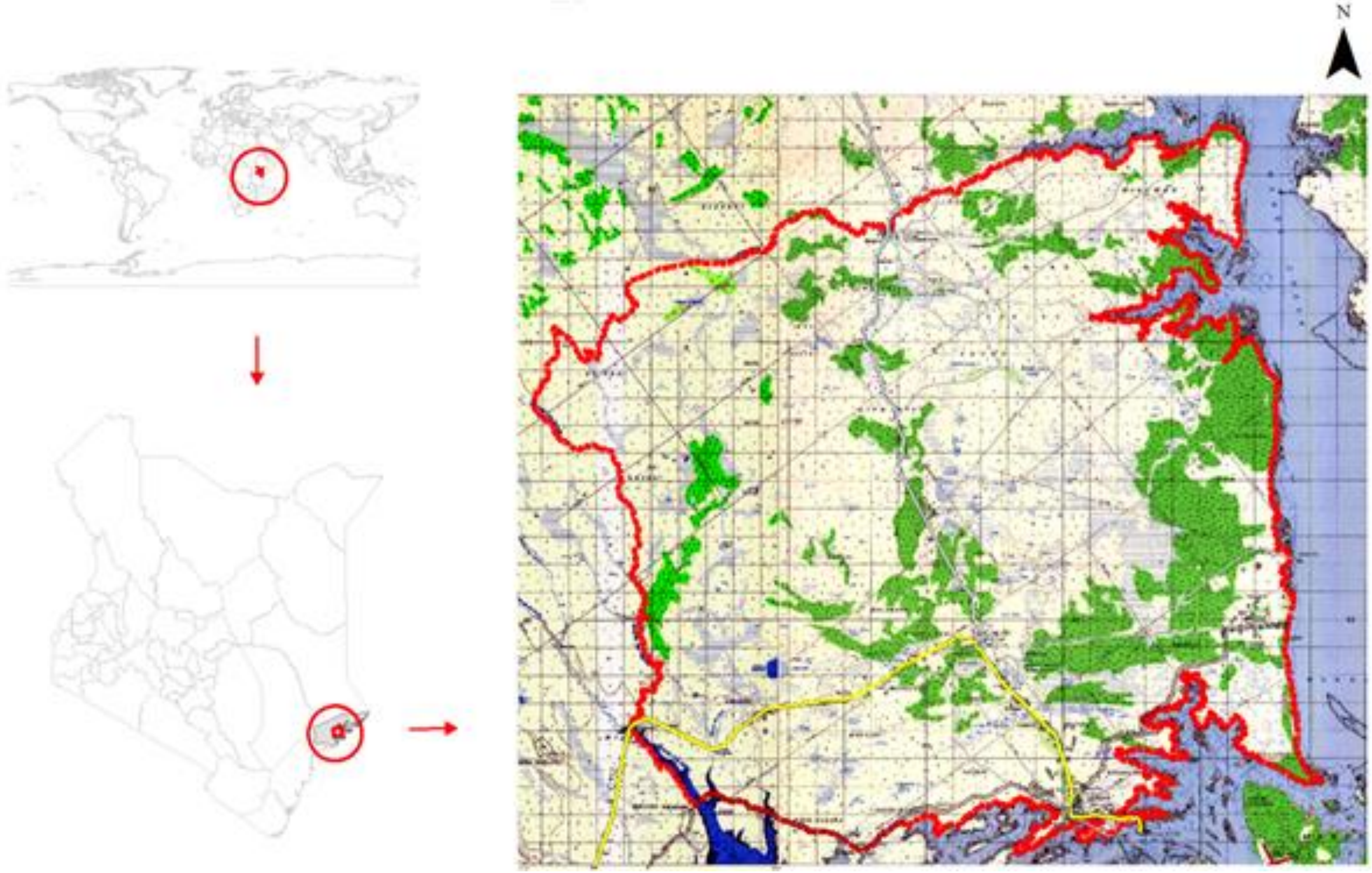
Source: Author, 2016

3.14. PLANNING AREA – LAMU PORT METROPOLITAN AREA

Since the inauguration of 'the Lamu Port South Sudan and Ethiopia Transport (LAPSSET), there has been demand for land by different individuals, government institutions and also private investors. The LAPSSET is expected to have significant impacts on the different sectors of Lamu County. There is a need to evaluate and rationalize land use allocation within the context of the holistic view of a city and port growth and development (Concept Paper Integrated Spatial Development Plan, 2013). The area set aside as the port, and the city is known as the **Lamu Metropolitan Area**, the planning area.

The Lamu Metropolitan area is located in the Lamu West sub-county and falls within longitude 40.67^{o} to 40.93^{o} East and latitude 2.00^{o} to 2.24^{o} south. It covers an area of $600km^{2}$ extending from Mokowe to Bargoni. It is divided into four user zones; port, port-related industries, urban area and administration area.

Map: Locational Context of Lamu Port Metropolitan Area



Source: Author, 2016

CHAPTER FOUR: METHODOLOGY

4.1. OVERVIEW

This chapter discusses the planning approaches applied, data collection processes which include interviews, visioning process, and the stakeholders' forum as well as data analysis and presentation.

4.2. PLANNING APPROACHES

The achievement of the project's objectives and successive completion of the project needs an elaborate and inclusive planning approach to be followed. Some of these approaches are clearly outlined in Kenya Constitution 2010 and emphasized in Physical Planning Act CAP 286, the County Government Act of 2012, Environmental Management Act 2015 and the Urban Areas and Cities Act of 2011. The table below summarizes the planning approaches:

Table 3: Planning Approaches in Detail

Planning Approaches	Application in Lamu Metropolis Planning Process	Summary
Evidence-Based Approach	• The use of a "problem tree" to analyze the 'causes' and 'effects' of the problems	• Brings out tangible/ factual information • Need for identification of strategies to guide housing developments, infrastructure developments, overall development, natural and cultural conservation • It used to identify evidence that supports the need for the project
Participatory and Consultative Approach	• The consortium consulted with the community, relevant County	• This approach based on the principle of minimizing the 'gap' between planners and

	Government departments and other stakeholders through: ○ Community visioning ○ Stakeholder forums • Stakeholder interviews	plan beneficiaries/ participants and increase community involvement Ensures local people's input as well as that of the stakeholders regarding information is assimilated in the planning process • Use of participatory tools and methodologies such as: workshops, interviews, community visioning process to get community ideas and understanding of principle issues
Strategic Approach	• Development of a vision to help focus the plan towards addressing the issue that is collectively identified as a major concern • Embedding of the Monitoring and evaluation systems at the plan preparation and implementation phases	• Ensures plan responds to real needs in a way that offers long-term perspectives • There is development of a vision to help focus the plan towards addressing the issues that are collectively identified as major concerns
Multidisciplinary Approach	• The consortium is composed of a pool of professionals drawn from different disciplines; Planners, GIS specialist, Land Surveyor, Engineers	• Recognizes importance of including expertise from relevant fields in the planning process

	and Environmentalists, among other professionals • All the professionals will contribute to the formulation of the final Area Structure Plan.	
Integrated Approach	• The planners involved different stakeholders in the planning process to formulate a comprehensive and all-inclusive plan • The plan also integrates a number of sectors and interlinks them to achieve holistic growth • In the legal and institutional framework a number of documents were referenced to form the basis of the planning of different facets of development	• Ensures the bringing together of different institutions, sectors, policies and legal frameworks

Source: Author, 2016

These approaches ensure that the plan is:

i. Flexible

The planning process should be adaptable to allow modifications and revisions whenever necessary so as to avoid rigidity associated with traditional planning approaches. It is necessary given the dynamics of urban development. The planning process was subjected to constant review due to the need for continuity, adaptability, revision and review, uncertainty in forecasting and evaluation. Flexibility was allowed to adjust planning and public involvement procedures to suit specific situations and requirements for various planning participants. The approaches ensure that the plan has taken into consideration the change influencing elements, while taking long term perspectives of present problems and issues.

ii. Sustainable

The approaches ensure the plan strives to create a productive harmony in the existence of human and nature that permit fulfilling the social, economic and other requirements of present and future generations. Sustainability is important to ensure that there is and will continue to have natural resources for future generations.

4.3. INCEPTION REPORT

The consultants prepared and submitted an Inception Report to the County Government of Lamu, Department of Physical Planning. It was the first deliverable of the planning process. The purpose of the report was to develop a common understanding regarding the aim and expected deliverables of the project. Basically, the Inception Report was a presentation of the consultants' interpretation of the project and approach to the assignment in line with the project Terms of Reference. The Inception Report addressed the following issues:

- Goals, objectives, scope and purpose of the project
- Justification of the structure plan
- Methodology conceptual framework and work plan
- Project management structure and procedure
- Planning approaches-strategic approach, participatory approach, multidisciplinary approach, integrated approach
- Project outputs- Integrated metropolitan area structure plan, zoning plan, action plans, transportation plan, investments plans and implementation strategy.
- Legal policy and Institutional Framework
- Background of the project area
- Comments on Terms of Reference (TOR) - matters arising and recommendations.

4.4. DATA COLLECTION

4.4.1. Data Collection Instruments/Tools

The planners designed data collection tools which included: reconnaissance checklist, transect survey checklist, interview questions for the various categories of people representing different stakeholders. There was also identification of data that required the use of GPS and cameras.

4.4.2. Interviews Schedules

The key stakeholders were identified and interview questions which were sector specific formulated. The key stakeholders identified were:

• Kenya Wildlife Services (KWS) • Ministry of Trade, Tourism and Culture • Ministry of Environment and Natural Resources • Kenya National Highway Authority (KeNHA) • Kenya Forest Authority (KFA) • Kenya Maritime Authority (KMA) • Coast Wildlife Compensation Committee • Ministry of Education • TARDA • Kenya Railway Authority • CBOs • NGOs • Private Investors	• Ministry of Agriculture and Irrigation • National Museums of Kenya (Lamu) • Kenya Ports Authority/ Lapsset • Ministry of Youth and Sports • Coast Water Board • Kenya Rural Roads Authority (KERRA) • Ministry of Water (Nairobi office) • Save Lamu • Ministry of Fisheries • Ministry of Health and Sanitation • Ministry of Lands and Housing • The County Commissioner • National Environmental Management Authority (NEMA) • Department of Statistics (Lamu) • Kenya Urban Roads Authority (KURA)

4.4.3. Observation

A reconnaissance checklist was developed and key elements to be observed were listed as follows:

Item	**Comments**
✓ Economic activities practiced	
✓ Social infrastructure	
✓ Physical Infrastructure	
✓ Natural environmental features	
✓ Proposed areas of the LAPSSET projects	

For the purpose of record, photographs were taken within the five days of fieldwork undertaken, capturing the topography of the planning area, types of housing, current situations of the towns and their surroundings, the proposed LAPSSET components (Port Headquarters, Amu Power, among others), and road conditions, among others.

4.4.4. Transect Survey

A transect survey was undertaken along the Major Road, (D568), identifying different important features. The transect survey was from Mokowe to Bargoni (the proposed Oil Refinery location), and finally to Mukunumbi (the proposed International Airport area). Coordinates of the various points were taken using a GPS for mapping and boundaries development.

4.5. VISIONING PROCESS

Public involvement is a vital requirement and thus the public was involved from the early stages and throughout the planning process. This is a requirement stipulated in the Constitution, the Physical Planning Act and the Physical Planning Handbook. The overall goal is the involvement of the public in decision-making and developing a vision of the Lamu Metropolis they want. Public involvement sought to:

i. Inform the public about the Area Structure Plan, the value of the plan and the requirements from the community
ii. Gather a wide range of perceptions regarding spatial planning of the Metropolis to ensure important issues are not overlooked
iii. Address any doubt or concern about the project
iv. Develop trust and working relations among stakeholders, CBO’s, NGO’s, private investors and the community

The planning team used the best public involvement practices which included encouraging active participation in the meetings with communities and stakeholders, provision of multiple opportunities for the locals to express their concerns, giving careful consideration to culture and protocols, usage of the local language, among others.

4.6. STAKEHOLDERS’ FORUM

4.6.1. Actual Data Collection

The field visits were conducted from 10th May to 15th May, 2016. During the visits the following tasks were undertaken:

i. Observation of the social and physical setting of the planning area
ii. Interviews and discussions with officials (key stakeholders) from the planning region and County government officials
iii. Observation of people's activities in the towns Mokowe and Hindi as well as the different settlements
iv. Carried out transect survey from Mokowe to Bargoni (proposed oil refinery location) then to Mkunumbi (the proposed international airport area)

4.7. CHALLENGES FACED WHILE COLLECTING DATA

i. Poor Roads

There are no tarmac roads in the proposed metropolitan areas. The condition of existing roads is poor which made them impassible as it was raining heavily

ii. Insecurity

Due to the previous attacks by the terrorists in the neighboring town (Mpeketoni), the area is under 24 hour surveillance by the military. The planners could not go very far from Lamu town and needed to get back in town before night fall.

iii. Flooding

There was flooding on the roads as a result of the heavy rains which limited the movement during field visits.

Plate 7: Flooding within Planning Area

Source: Author, 2016

4.8. DATA ANALYSIS AND PRESENTATION

The data collected was analyzed and presented in maps showing existing land uses, road networks, water catchment areas, settlements, the different town centers and proposed areas for the LAPSSET projects. The maps are then discussed to give a detailed situation analysis of the planning area.

CHAPTER FIVE: CASE STUDY

5.1. SAO PAULO CITY

5.1.1. Introduction

Sao Paulo is located in the South East of Brazil, and is an alpha global city. The city has an area of 1,509 Km^2 with an urbanized area approximately 1,000 Km^2. The population of the city was 11.3 million by 2010 census.

It is one of the best cities for business in Latin America ahead of Miami, Santiago and Mexico City. It has more than 100 foreign investment companies such as a Ford, GM, and Volkswagen. This makes the city a leading car manufacturing region. It is third largest stock market of the world and second in America.

The Sao Paulo Port capacity is 90 million tons yearly. The storage capacity of dry and liquid goods is approximately 5.9 tons and 2.5 million barrels respectively. The major types of cargo handled by the port include coffee, sugar, oranges, wheat.com, soy, citrus fruits juices, coal and vehicles.

Map

5.1.2. Historical Development

Sao Paulo City was a Portuguese colony in 1763 and during this time it was called Rio de Janeiro because of its coastal location and proximity to the mining region of Minas Gerais. In the late 1850, the city was also known as slave trade center. The slave trade was later suspended in 1888 and through promulgation of land laws there was introduction of wage labor, and capitalism in Brazil. As a result Sao Paulo became a major industrial city in the country. The city has a large number of immigrants from all over the world including Italians, Japanese, Eastern Europeans, Spanish, Portuguese and Germans making it one of the most culturally diverse cities in Brazil today.[6]

5.1.3. Transportation Infrastructure in São Paulo Combines Rail, Road, Air and Waterway

Infrastructure of Sao Paulo connects to the countryside through wide network, including:

[6] http://www.discoveringsaopaulo.com/2014/04/a-brief-history-of-sao-paulo.html

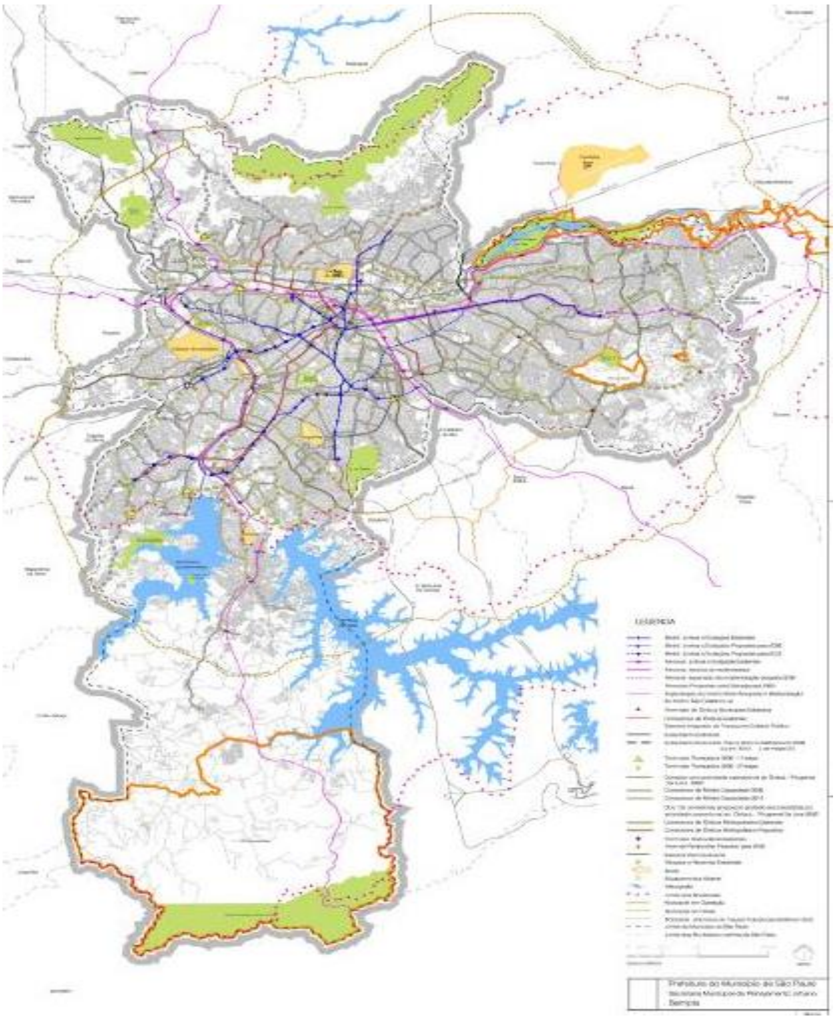
A double highway, railways, waterways and airports – the city has three airports in total each dealing with different activities for example the Campo De Marte Airport handles some private and small aero planes, Guarulhos International Airport operates domestic and international flights while the Congonhas Domestic Airport operates domestic and regional flights, mainly to Rio de Janeiro, Belo Horizonte and Brasilia. Cargo handling by air is mainly done to transport high valued and perishable goods because of its high cost.

The city has underground subways which are fairly limited. Subways are the fastest and safest transport option in the city. They operate from 5.00 AM to midnight. The city has a bus system with roughly 17,000 buses which serve the 16 million inhabitants of Sao Paulo city.

The railway network in the city is well connected to iron ore sources and agricultural processing industries. Some of the most important railways are: North-South Railway, linking the region of Anápolis (GO) to the Itaqui Port, in São Luís (MA), transporting mainly soybeans and soy chaff; the Carajás Railroad, joining Carajás Hills to the Ponta da Madeira Terminal, in São Luís (MA), principally taking iron ore and manganese, and the Vitória-Minas Railroad, which basically carries iron ore to the Tubrão Port. The North region depends more on waterways, through this system agricultural products in the Sao Paulo city are circulated in the central and west region.

Sao Paulo Transport System

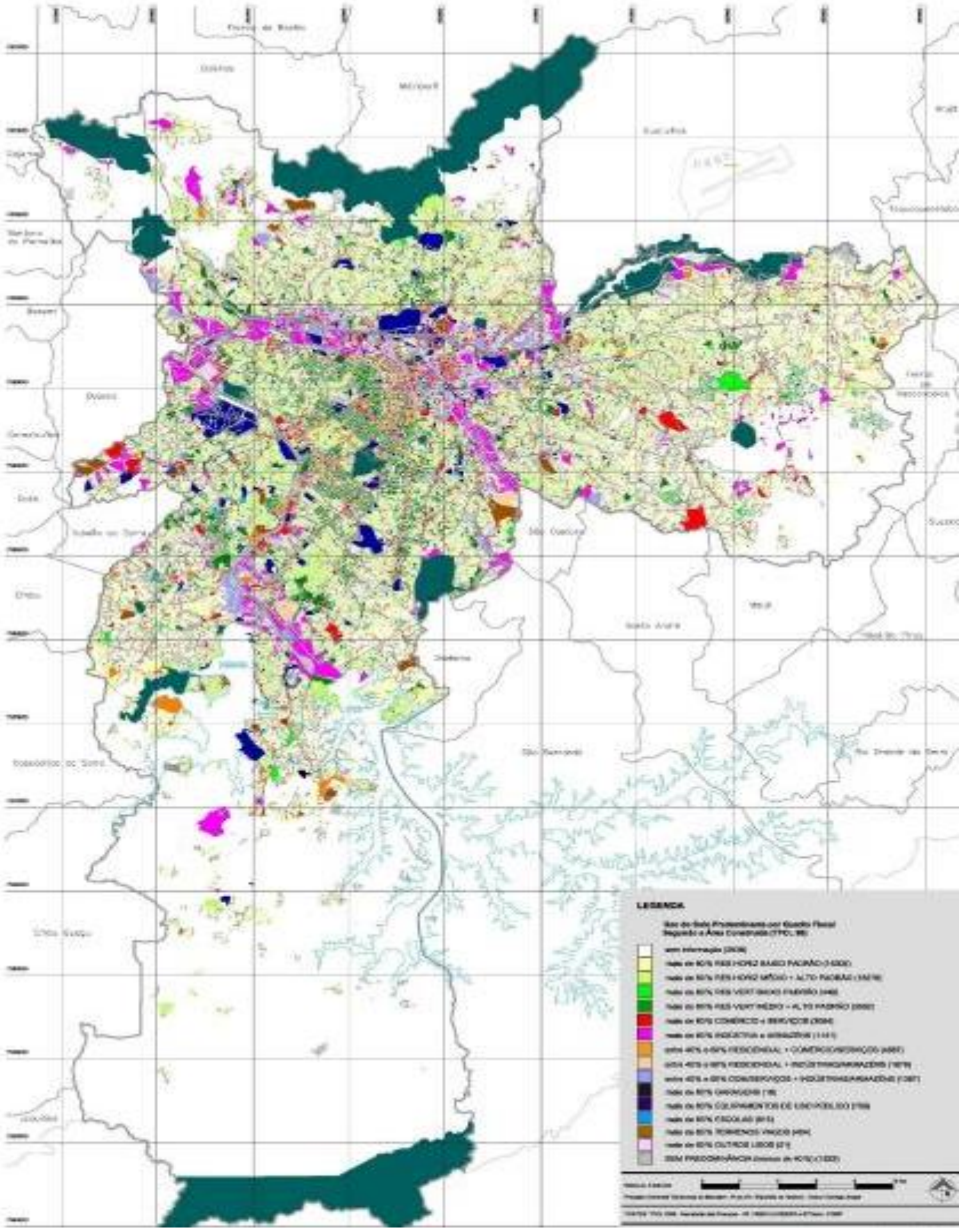
Map 5.1 Map showing roads distribution in Sao Paulo



Source:http://www.zonu.com/brazil_maps/Sao_Paulo_City_Public_Transport_Structural_Network_Map_Brazil_3.htm

Land Use in Sao Paulo

Map 5.2 Land use Map for Sao Paulo



Source: http://wikitravel.org/en/S%C3%A3o_Paulo

Sao Paulo is one of the most developed agro-industrial systems in the world. The land under agriculture in the city totals 21 million hectares. It is the world's largest producer of sugarcane and oranges and Brazil's largest producer of peanuts, natural rubber, flowers, vegetables and eggs. The city produces 61% of the oranges juice in the world. Most of the food processing industries are situated in the western part of Sao Paulo near Burra Funda.

Sao Paulo city is also known for large manufacturing of automobile. The city hosts different automobile firms like: Ford, General Motors, Honda, Hyundai, Mercedes-Benz, Scania, Toyota, Chery and Volkswagen which are located in Avenida Paulista. The city also concentrates the largest part of Brazil's pharmaceutical industry especially the Campinas area. There are more than 42% of the total pharmaceutical industries in Brazil concentrated in this area.

Sao Paulo has also predominated air industry in Brazil. The city accommodates Embraer Company which is involved in aircraft design, development, production, sales and after sales support. The company operates in the commercial, executive and defense and security aviation segments and is the world's largest manufacturer of commercial aircraft of up to 120 seats. Other companies located in the city are the five oil refineries which produce 44% of gasoline, diesel oil and kerosene. The refineries are located in Santos where there are large oil deposits.

5.1.4. Policies

Climate Change Policies

The city employs environmental policy on climate change. The policy focuses on use of sustainable fuel, forest protection and recovery, financial cities and cleans public transport.

As a result of adoption of this policy landfills in Bandeirantes and Sao Joao were transformed into biogas power plants. The projects controls the emission of greenhouse gases by 20% and it also generates sufficient energy to 600 people in the area.

Public polices for preserving and expanding green areas

Along the roads and rivers they introduced linear parks for preserving and expanding green areas. This promoted the environmental quality for the city.

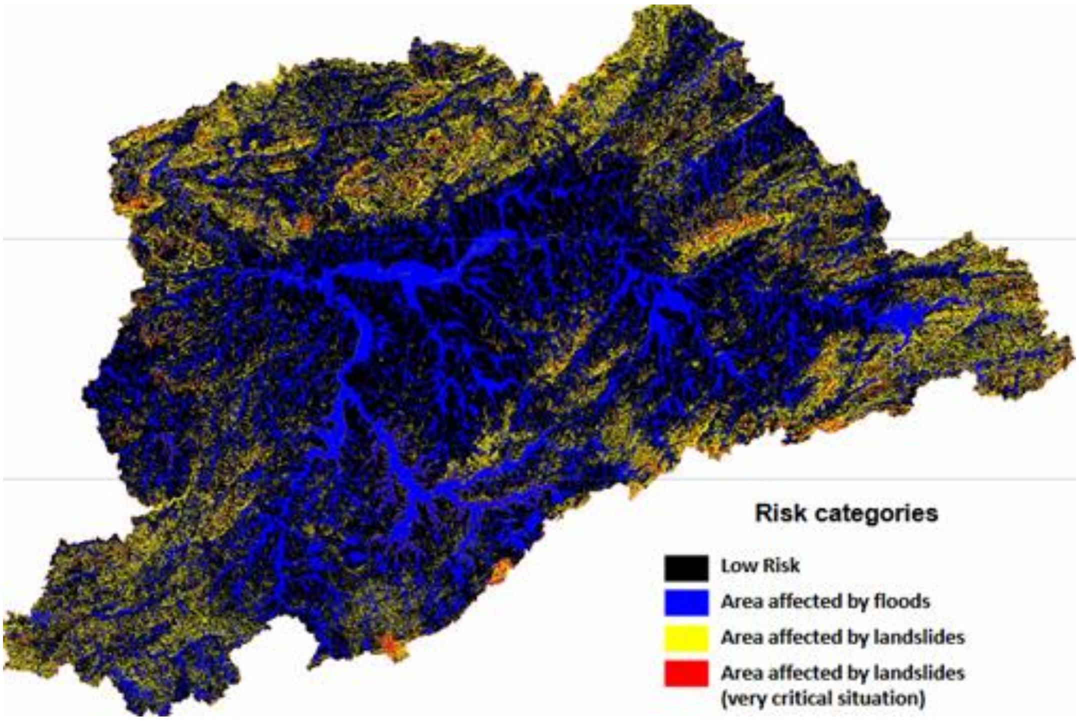
Plate 5.1 Picture showing best land uses

Source:http://www.usp.br/internationaloffice/wc2/media/presentations/WC2_USP_Secretary_Bucalem.pdf

Mapping All Risk Areas

The Port is affected by major challenges such as floods and landslides. This has been delaying development of land in Sao Paulo. However mapping of all risk areas in the port has given the Municipality an opportunity of allowing the prioritization of preventive actions. Also, land developers have benefited from this information since they are able to know the best structures.

Map 5.3 showing all the risk areas



5.1.5. Best Land Uses

Linear Parks

The city has the largest linear park in the world**,** Varzeas do Tiete Park. The park has significant environmental gains like preserving the river and ensuring the sanitation of the area. The park also conserves environmental functions of the wetland and providing flood control. Also the parks throughout the city have improved the aesthetic value of the area leading even to rise in land market.

Ecofrota Program

Introduction, what is the program?

The program promotes the use of biofuel in public transport throughout the city. The program has resulted to the reduction of fossil fuel consumption by 15%. Ecofrota also has promoted the use of cleaner fuels including biodiesel ethanol, hybrid or electric with the city making city to have less air pollution. The life span of the residents in the area has been improved because of inhaling less polluted air.

Solar System to Heat the Water

The city has already set a law to ensure that all the residential building in the city have solar system to heat water used by the inhabitants.

The new houses and buildings assembled with more than four bathrooms must adopt a solar panel heating system. Some commercial buildings, such as private clubs, gyms, hotels and motels, schools, hospitals, clinics and industrial laundromats also need to install the solar panels. The system should meet at least 40% of the annual energy needs of the toilet water and water for pools that the building may require.

The City Housing Secretariat – SEHAB

It provides the housing information system – HEBISP. This information provides a comprehensive overview and update of planning and environmental conditions in the settlement of the city. The information allows people to define priorities for intervention, assist in the development of City policies and integrated plans with other agencies. HABISP promotes increased citizen participation—it provides an opportunity for data disclosure and is an important resource for the population in general as a source of information about policies and plans under development.

Operation Clean Stream

The city has a program of cleaning all the rivers in the metropolitan area. By 2009 more than 42 streams had already been cleaned and at least 500 liters of sewage water piped in a second. All the informal settlements have been improved due to this program.

Traffic Control Program

The city adopted the traffic control program restricting car usage one day a week, depending on the last digit of car number plate. For example, on Monday, number plates ending in 1 or 2 are prohibited from circulating in certain areas, between certain times. Also the program allows the people to commute to city using only car and bus. This reduces traffic congestion and air pollution. Pollution in the city by car and vehicles in the city has been controlled through encouraging car owner to use ethanol fuels and adoption of Hybrid Electrical Vehicles.

Failures

a. Sao Paulo developed quickly without major planning despite the implementation of urbanization plans. This resulted to population influx in the city resulting to congestion and later urban sprawl. Due to population influx many people lives in slums which are frequently affected by floods.
b. Ineffective public transport associated with high number of cars and other vehicles in circulation leading to consistently congested traffic on many roads of the city.
c. The green area per capita is very small in the city despite of several parks across the city. This contributes to more flooding as there is low permeability in the paved ground.
d. Pollution is high in the city and this can confirmed by high pollution of two rivers crossing the city.

5.2. SHANGHAI PORT

5.2.1. Introduction

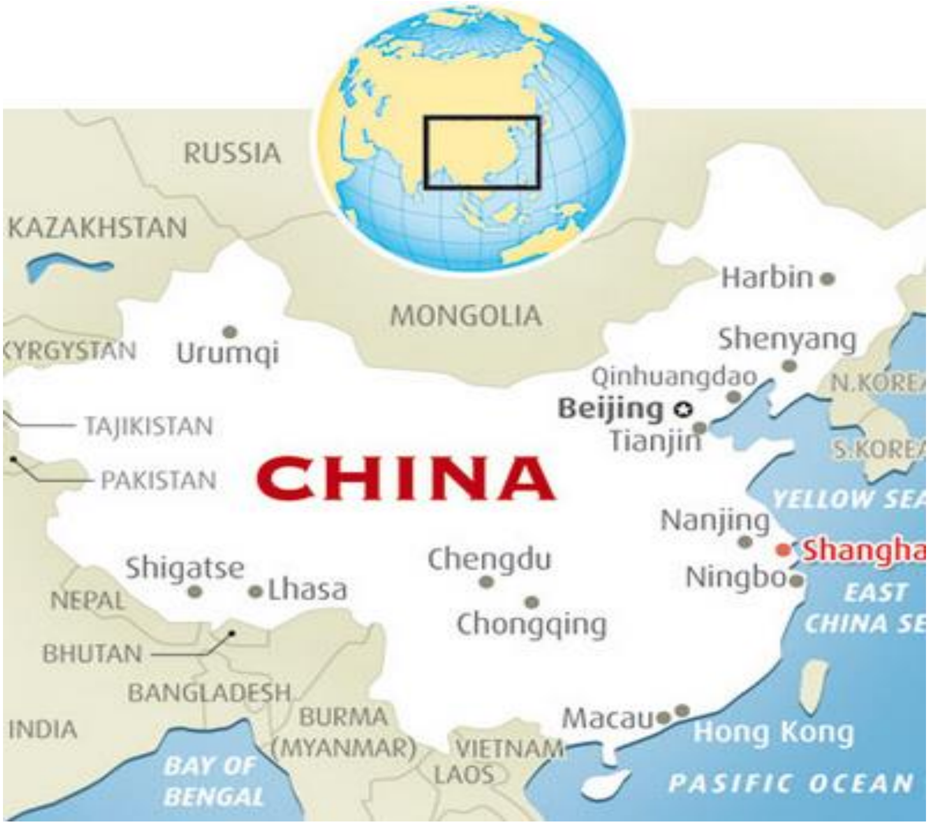
Shanghai is the largest Chinese city by population in the world. It is a global financial center and transport hub with the world's busiest container port. The city is the commercial capital of China. It is strategically located in the central china. The city has an area of 6340 km2 and a population of 24,150000 according to the 2013 census.

5.2.2. Location

It is located in east-central China, on the coast of the East China Sea between the mouth of the Yangtze River (Chang Jiang) to the north and Hangzhou Bay to the south. The Coordinates of the city are 31° 12′ N, 121° 30′ E.

Figure 5.4 location map of Shanghai

Source: http://kids.britannica.com/comptons/art-128929/Shanghai-China?



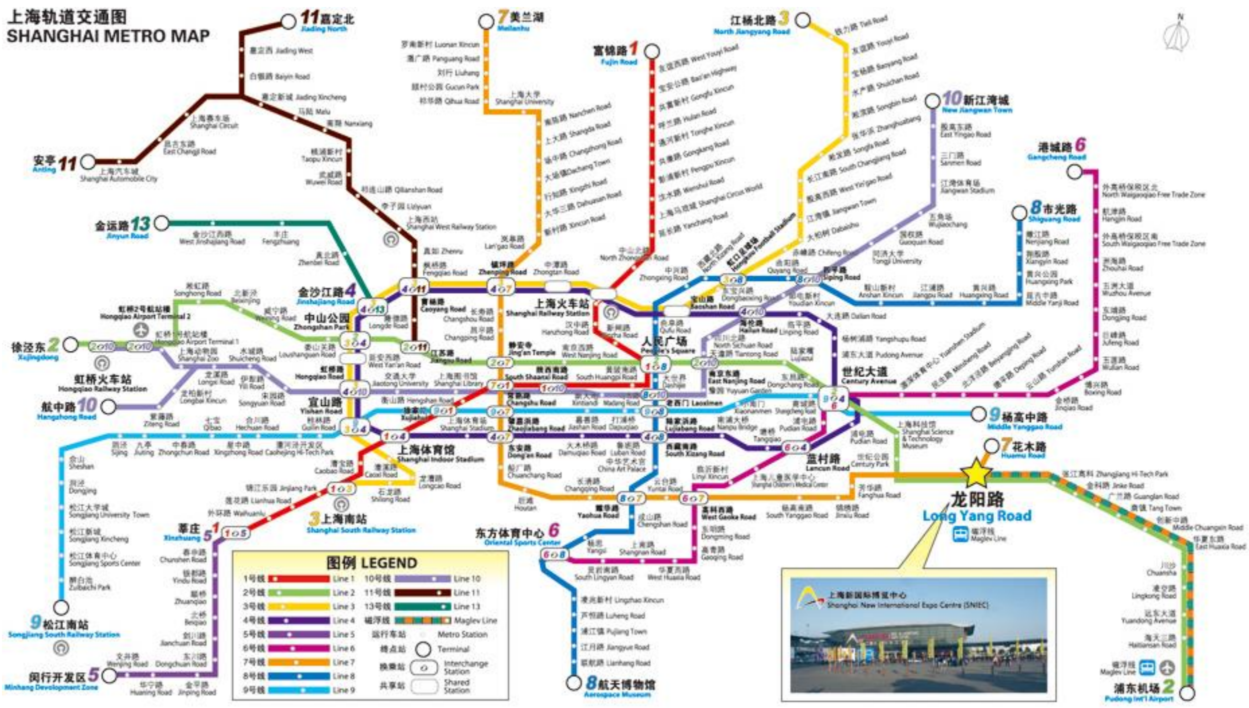
Source: https://www.google.com/search?q=location+of+shanghai&newwindow=1&client

5.2.3. Historical development

The Port of Shanghai, which originally existed as Shen or Hudu between the fifth and seventh centuries AD, was given official city status in 1297 by the Yuan Dynasty. Originally the Shanghai started as a small agricultural village which later developed into a trading port. Through the courtesy of the Quing Dynasty the port was allowed to collect customs duty for all foreign trade this made it to become one of the significant seaport 1735.

In 1930s Shanghai become the most important port in Asia and the world's largest trading and banking firms set up along the Bund. During this time the most products passed through it were tea, porcelain and silk.

Transport map for Shanghai



Source: http://www.chinacoat.net/2013/exh_02_en.htm

The highway network in the in Sao Paulo is the best in Brazil as it connects all the economic hubs. In total, there are 200,000 km of highways. According to a National Transport Confederation (CNT) survey, of the 20 best Brazilian highways, 19 are in the city of São Paulo. The network of the highway is the Radoanel Mario Covas, a beltway which connects highways radiating from the Sao Paulo metropolitan region forming a circle around it.

A highlight in this network is the Rodoanel Mário Covas, a beltway which connects the highways radiating from the São Paulo Metropolitan Region by forming a circle around it.This means that a large proportion of cargo destined for the Port of Santos or municipal districts in the São Paulo Metropolitan Region no longer passes through urban areas in this densely occupied region. This facilitates flow and reduces the risk of accidents and environmental degradation. The Rodoanel is a national benchmark in environmental sustainability.

The city of Sao Paulo has the largest port in South America which handles more than 105 million tons of cargo annually. The ports of São Paulo also serve the states of Minas Gerais, Mato Grosso, Mato Grosso do Sul, Goiás, Paraná, Rio de Janeiro, as well as the countries of the MERCOSUR.

The São Paulo railroad network plays a fundamental part in Brazilian inter-regional transportation. It connects the producing regions of the São Paulo city, Minas Gerais, Bahia, Sergipe, Goiás, Mato Grosso and Mato Grosso do Sul to the Tietê- Paraná Waterway and to the ports of Santos, Rio de Janeiro, Itaguaí and Guaíba. One of the branches connects the Port of Santos to Paraguay and Bolivia, with prospects of serving as a connection between the Atlantic and Pacific Oceans in the near future.

An important part of this network connects the municipal districts of São Paulo and Rio de Janeiro, passing through the country's main industrial region. The railway network in the city transports more than 130 million tons of cargo, mostly steel products, sand, cement, iron ore and general cargo.[7]

5.2.4. Land use map

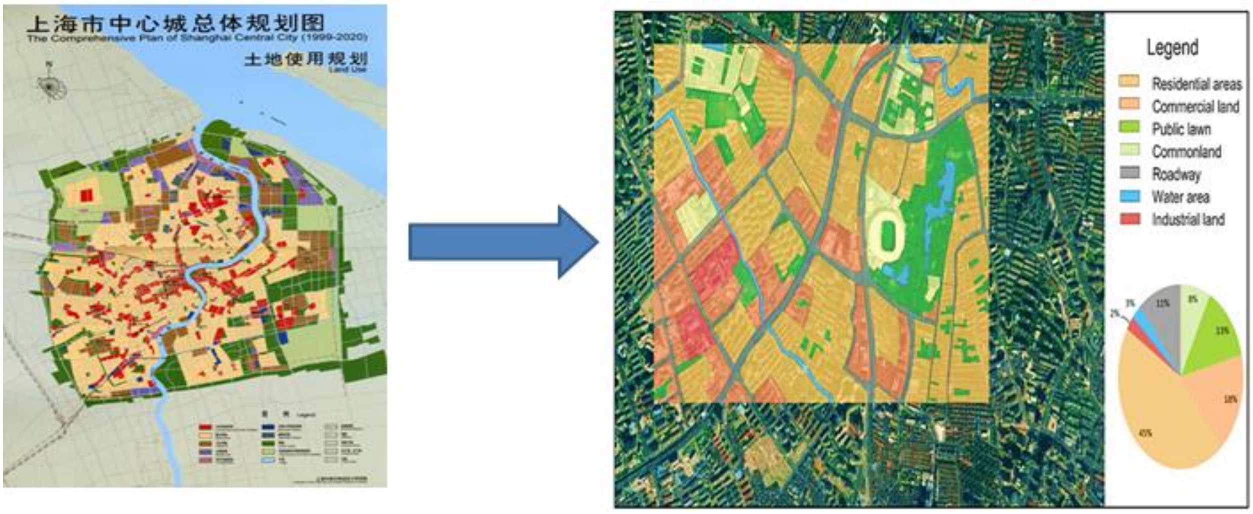


Figure 5.4 **Map of land use classification**

Source: http://www.mdpi.com/2072-4292/7/8/9542/htm

The overall planning of the shanghai port is coordinated with the structure of Shanghai City planning. Shanghai has five major function areas which are adjustment to the port terminal with different functions. The five different areas include;

North-Western Area:

Steel and metal as well as gold smelting industries, big scale ore and coal terminals are situated here. There is also bulk cargo loading and unloading terminal.

Northern Area:

[7] http://www.saopauloglobal.com/eng-index.aspx

This is the area with a big scale terminal for container and integrated terminal. Also there is an automobile industry and Haitong international Automotive terminal.

South-west area

Here there is chemical industry park and a batch of special purpose terminals for oil and chemicals.

South Area

Shanghai container and bulk freight center are located here because of the presence of Xioayangshan deep water port**.**

5.2.5. Best land uses

- Provision of alternatives food sources- manmade lakes
- Increasing green areas with the urban areas.
- Integration of transport to the land uses.
- The local government resists approving more density if there no new transportation systems in place.
- Use of green belts to enforce perimeter of urbanization

5.2.6. Policies

a. Hukou system.- restriction of rural –urban migration

The system controlled population movement from rural to urban as migrants were restricted from getting urban labor, credit markets, formal sector housing, rental markets, urban insurance and social security.

b. Brownfield development policy

The municipal government developed many industrial parks in rural areas that attracted factories from the city center. Small scaled industries are also integrated in the suburbs promoting infrastructure development especially public transport to increase connection between the city and new cities.

c. Free-wheeling land market policy.

d. Expanding of green area policy

The policy allows the developing and upgrading all the areas adjacent to the port. Developing green areas reduces negative externalities like (water and air pollution, noise etc.) The policies also support energy conservation and emission reduction. All the emitting vehicles are not around in the port and also over-aged carriers and single-hull tankers upgraded.

Finally the policy has worked on the reduction of the emission of suphide, nitride and greenhouses gases by comprehensive handling of cargo.

Opportunities

The Huangpu River

The river flows through the heart of Shanghai, therefore supplying more 24 million people with water. It is also important for navigation, fishery, tourism and receiving wastewater after treatment.

Jichang Garden

This is 400 year old garden with architecture used during Ming Dynasty. The garden attracts tourist from all over the world every year.

Grand Canal

It is longest manmade waterway on Earth; the ancient canal still plays a vital role in local commerce.

5.2.7. Lessons learnt

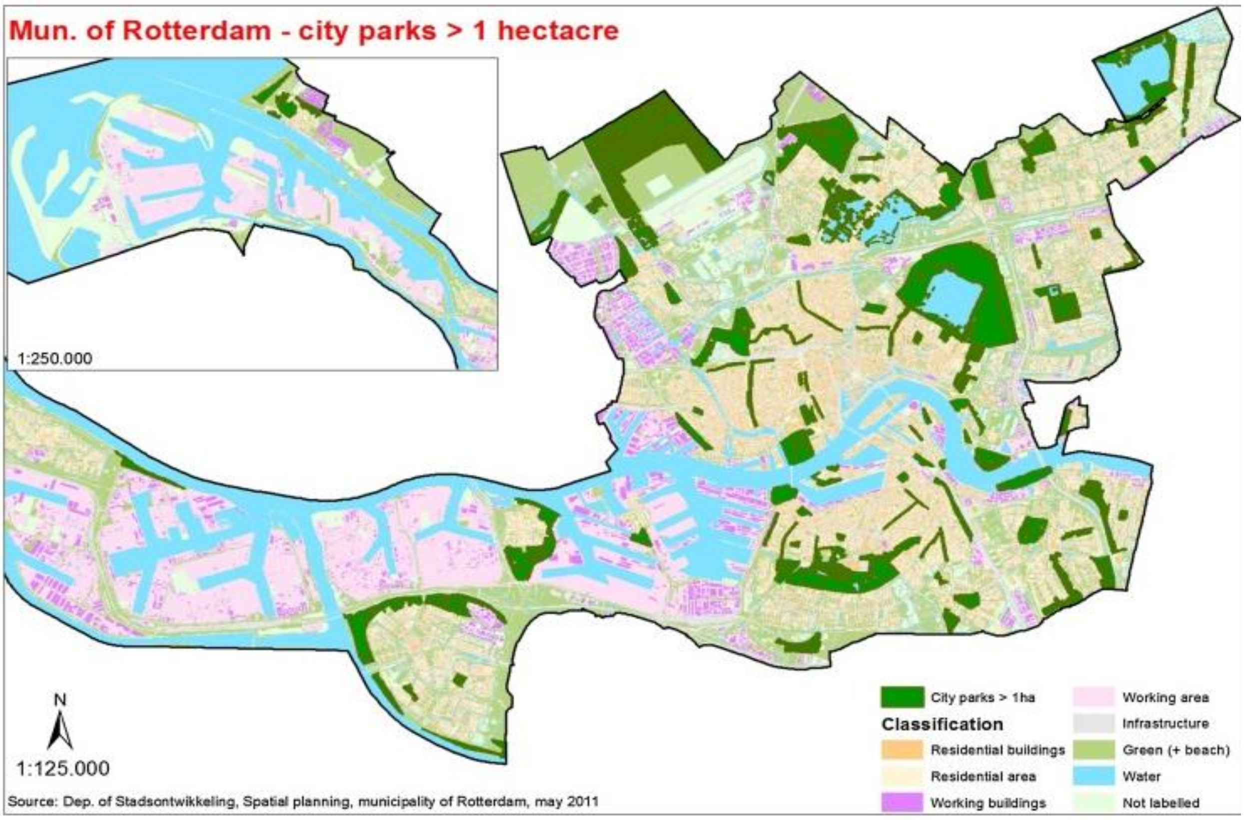
- Plans should be people focused.
- The transport infrastructure should be integrated for connectivity.
- The vision for city should not just reflect on physical development but also consider economic social and environmental impacts.
- Land use should be intensified around important transportation nodes
- Zoning laws should be flexible to allow for changes of use of site.
- Industries can be clustered to bring economic growth and provide an area with new identity.
- Plans should embrace functional, demographic and aesthetic diversity
- Policies must emerge for each area’s comparative advantage

5.3. ROTTERDAM

5.3.1. Introduction

Rotterdam is the second largest city of the Netherland. Rotterdam is best known for its reputation of having the largest port of the world. The growth of the port from small fishing villages to the largest business hub center in Netherland is contributed by its favorable geographical position, with excellent hinterland connections to German through Rhine. The port is considered to be the biggest in Europe as it has a capacity of handling 465 million tonnes annually. The port area includes 125000 ha (land and water, of which approx. 6,000 is business sites). The total length of the port area is more than 40 km. it is estimated that approximately 30,000 seagoing vessels and 110, inland vessels visit the port of Rotterdam every year.[8] It accommodates 611000 people from 173 different nationalities.

It is has a total of 117 public parks (1765 ha), some of which are well known like Zuidepark and Kralingse bos. Green space in Rotterdam covers 19.7 % of the total city's surface whereas water amounts to a 34.9 % including the harbor.



[8] https://www.portofrotterdam.com/en/the-port/facts-figures-about-the-port

5.3.2. Historical development

The growth of Rotterdam can be traced back in 1270, when a dam was built in that modest river, forming the heart of small fishing village. The trade and shipping flourished as result of construction of this dam leading to expansion and growth of Rotterdam. Construction of Rotterdam Schie shipping canal further lead to the growth of city as it become the shipping center for Netherlands, England and Germany.

The port city grew further during industrial revolution in 1800. Many industries were constructed during this time and it allowed the Rotterdam to become hub for the Dutch East India Company. In 1872 the port was busted further after the construction of Nieuwe Waterweg which was now serving all the industries along Rhine and Meuse rivers to the North Sea.Nieuwe Waterweg encouraged use of larger vessel as it was deepened and by the end of 1970s the Europoort was develop at the mouth of Nieuwe Waterweg which promoted trade.[9]

Location of Rotterdam map

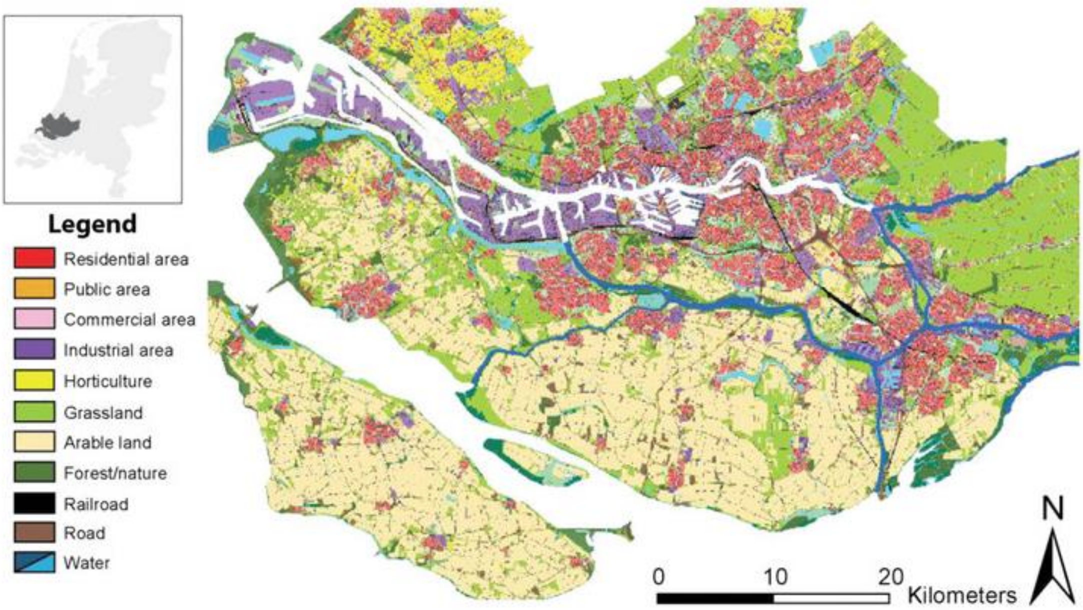
It is located in north Eastern Europe on the edges of the North Sea in Rhine-Meuse Delta. Its coordinates are 51, 55’ N and 4 28’ E. The nearest countries to this port are Belgium and Germany.

9 http://twente.co.uk/a-history-of-the-port-of-rotterdam/

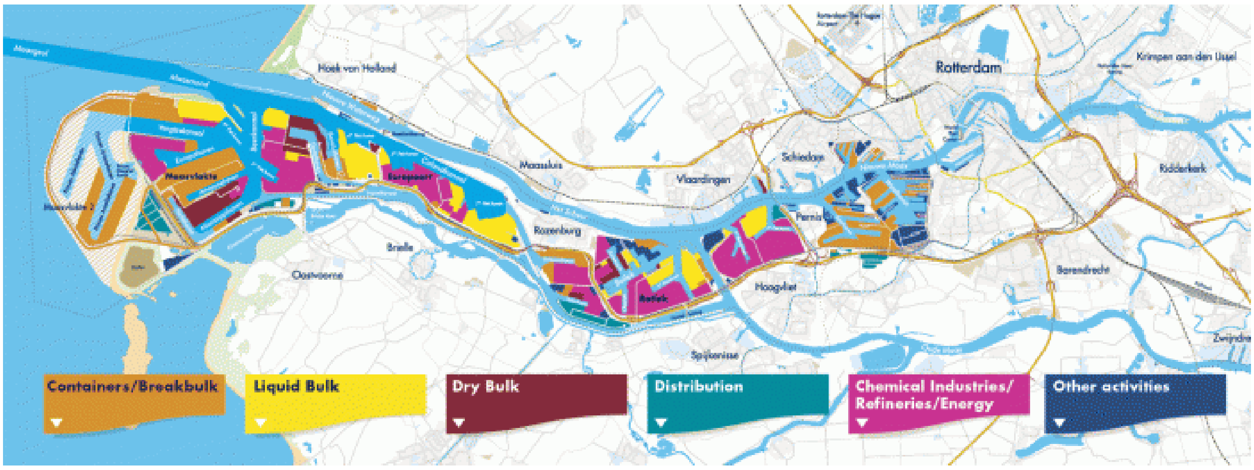
Source: http://www.worldatlas.com/webimage/countrys/europe/netherlands/nllatlog.htm

LAND USE MAP

Rotterdam has more than 10 land uses types raging from residential, public land to industrial. Commercial and industrial developments are located along the river for easier transport of products. Farming uses are limited and are concentrated in the western part. Recreational uses are distributed evenly in the city from east to west for example Gateway Landing, Lock 8 park, Kiwanis park, Woestina tittle League Ball Fields in Rotterdam junction and the



Source: https://www.researchgate.net/figure/269689210_fig8_Figure-4-Land-use-map-of-the-greater-Rotterdam-area



Map of the Port of Rotterdam. Different areas and several towns in the boundary Source: portofrotterdam.com

5.3.3. Transport system In Rotterdam

The transport system in Rotterdam is characterized by different modes ranging from walking, cycling, scooters, cars, buses, trams, and trains to water taxis. The system is intelligently integrated, functional, timely and efficient.

Despite array of transport modes, more people appear to be taking to bicycles. This is creating demand deficit for other modes especially buses and trams within the city.

Transport Infrastructure and City of Rotterdam

Source: https://oshlookman.wordpress.com/2014/09/16/exploring-transport-infrastructure-in-the-city-of-rotterdam-the-netherlands-2/

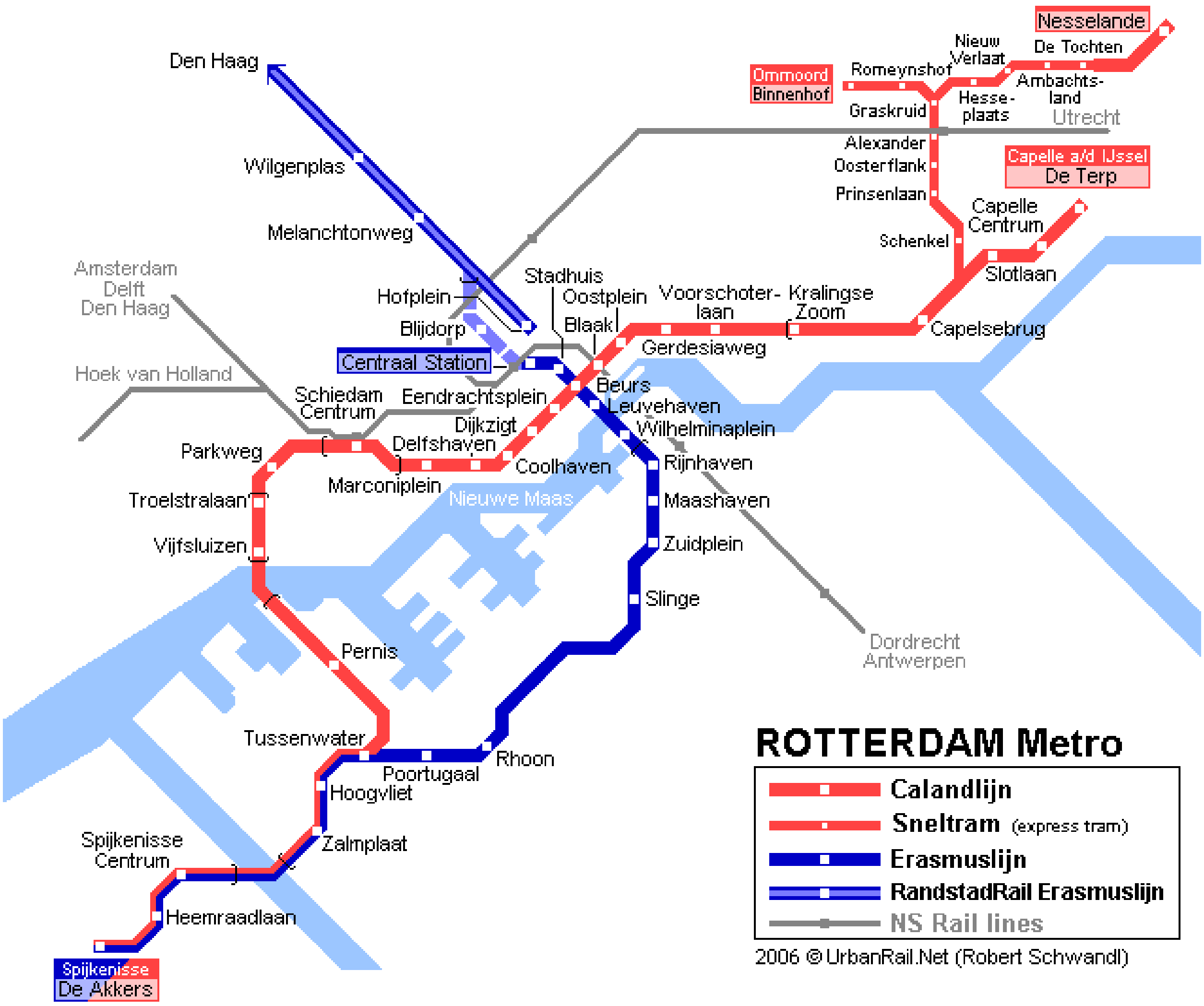
Bicycles, Scooter, Cars and Tram at Eendrachtsplein, Rotterdam

Source: https://oshlookman.wordpress.com/2014/09/16/exploring-transport-infrastructure-in-the-city-of-rotterdam-the-netherlands-2/

Bicycles Parking Racks along Mauritsweg

Source: https://oshlookman.wordpress.com/2014/09/16/exploring-transport-infrastructure-in-the-city-of-rotterdam-the-netherlands-2/

Sights and sounds from Rotterdam revealed further details on the mechanism of intelligence transport infrastructure in the city.



5.3.4. Policies

Environment pollution control policies

Reducing carbon iv oxide

Most of this gas is released from industries, built up environment and traffic and transport. To ensure CO2 emission is reduced fuels containing petrol are not encouraged in the town and where they are used the price is higher. Also solar, biomass and wind energy is encouraged to be used in industries as it results to less pollution. Residential houses in the city most of them are encouraged to install solar panels for heating, lighting or cooking to further reduce the pollution.

Rotterdam has also adopted another way of reducing amount of greenhouse gases in the air through the process of C02 capture and store. All the industries which are known for contributing high amount of C02 are located in almost one place.

Clean transportation of passangers and goods. Constrction of bicycle paths and places to park bicycles in the inners city.

Policies applied in Rotterdam

Rotterdam is governed by various policies which includes;

a. Housing policy

   This is the policies which encourages recycling of old building than building new houses. In fact squatting laws encourages landlords fixing up abandoned housing units otherwise instead of losing these unused structures. Housing policy also ensures that historical buildings are preserved within the city. In Rotterdam there are some buildings which are more than four hundred years old which some acts as tourism center.

b. Green city policy

   Rotterdam is earthly friendly city because it has more bicycles than people and this leads to low petroleum consumption. The government sets laws that even prohibits cars in some areas and allows only bikes and pedestrians.

   Areas like near the A-10 Highway and Schiphol airport where there is high consumption of petroleum, the government has regulations for controlling and reducing emission.

   The city has a program of cleaning the canals 2 to 4 times a week removing the surface litter and discarded bicycles and sunken boats. This turns the canals into vibrant place of aquatic life.

c. Environment policy

   The city has policy to deal with too much noise, air quality, soil quality and external safety. Industrial noise, road traffic and rail traffic noise are cumbered through legislation which operates 24-hour period. Schools and hospitals are located in one place where the noise is less than or equal to 50 dB (A). All the industries which produced noise more than 50 and 60 dB (A) respectively are situated together.

d. The city has a policy which controls land development. For example high risk companies are located in one place and surrounded by risk contours. This ensures that vulnerable properties such as houses and certain offices are not allowed.

5.3.5. Opportunities

In Rotterdam, there are many opportunities for sustainable development of the city: opportunities for the City itself, and also for its residents, entrepreneurs, and visitors.

Through optimization of cycling facilities in the city, creates an opportunity that promotes the city and its unique sustainable cycling infrastructure. Also the policy on ground water quality, use of thermal storage and the use of subsoil for construction and provides the city with an opportunity to legally establish the use of space for rainwater drainage and water storage facilities in the city.

5.3.6. Best practices

Roofs turn green

Green roofs have a positive impact on the water system, the urban environment, the internal environment in building, air quality, biodiversity and amenity. Vegetation on the roof means less heat in summer and less cold in winter. Vegetation on flat roofs of shops and business in the city blocks provides a substantial increase on living environment.

The bicycle as Rotterdam Dominate mode of transport

Rotterdam is the world's premier 'cycling city'. 77% of the population has bikes and they use them on daily basis ether while going to work and shopping. Cycling in the city has reduced the emission of greenhouse gases making the city livable.

The right mix

Rotterdam is a compact city, with every square meter being used for some purpose or other. Presence of garden city, green spaces, parks, sports fields, allotments and public garden improves the air quality, climate control, reaction and above all recreation.

5.3.7. Lesson Learnt

a. Mobility gains a lot from spatial planning
b. Most effective strategy: building (in high density), close to city center, good public transport and complement with a form of pricing
c. Transport policy and spatial policy have to work together.

Reference

1. Camila Matins-Bekat and Kishore G. Kulkarni, The Journal of Developing AreasVol.43 (1), “Income Distribution and Economic Growth: The Case of Brazil,” fall 2009, pp. 341-351.

CHAPTER SIX: SITUATIONAL ANALYSIS

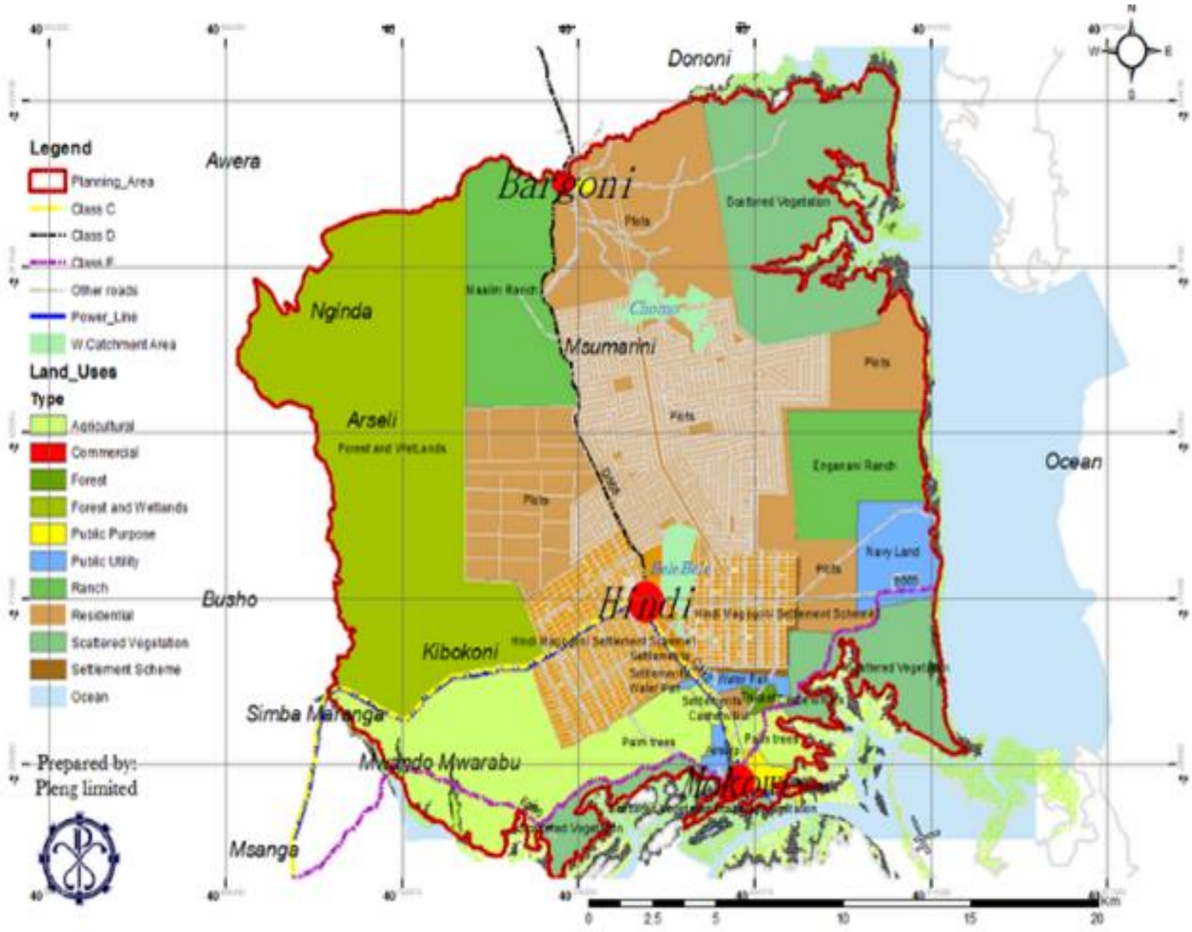
6.1. OVERVIEW

This chapter gives an in-depth analysis of the physical characteristics, land properties, environmental characteristics, existing developments, social characteristics and existing transportation networks of the planning area.

6.2. EXISTING LAND USES

Most of land in the planning area is scarcely developed which provides an opportunity to prepare a Lamu metropolitan area. There are however, existing Land uses as shown in the map below:

Map: Land Uses within Lamu Port Metropolitan Area



Source: Author, 2016

There are two functional towns in the planning area: Mokowe- Administrative town and Hindi - Economic and Residential town. Hindi town has two settlement schemes:

i. Hindi Magogoni phase 1- The residents of these settlement have title deeds.

ii. Hindi Magogoni phase 2 also known as Swahili scheme- This a new proposed settlement area and the residents don't have title deeds yet.

The agricultural lands are around and within the settlements as most of the households practice subsistence agriculture. Agriculture is practiced in small scale with an average farm per household being 10 acres or 4 hectares.

There are a number of ranches in the area, most of which are privately owned. They include: Maalim Ranch, Enganani Ranch, T.S.S Ranch, Boni-Bargoni Ranch, Khairalla Ranch, Farouq Ranch and Amu Ranch (Community owned). Most of the ranches are not developed and some are inhabited by wildlife or have vast acres of forest cover.

Plate 8: Maalim Ranch within Lamu Metropolitan

Source: Author, 2016

The forest and wetlands area extend from Nginda to Kibokoni. This area is inhabited by the equatorial forest and some wild animals such as: Antelopes, Buffalos, Giraffes, Monkeys, Lions, Leopards, Baboons among others.

There has been intense cutting of trees and grabbing of land within this area due to speculations of the opportunities that might be brought by the LAPSSET projects. This grabbing of land is said to have started in 2002 and intensified in 2008. Most of the land is divided into small parcels then each parcel fenced and left idle as shown below:

Plate 9: Idle Land within Lamu Port Metropolitan Area

Source: Author, 2016

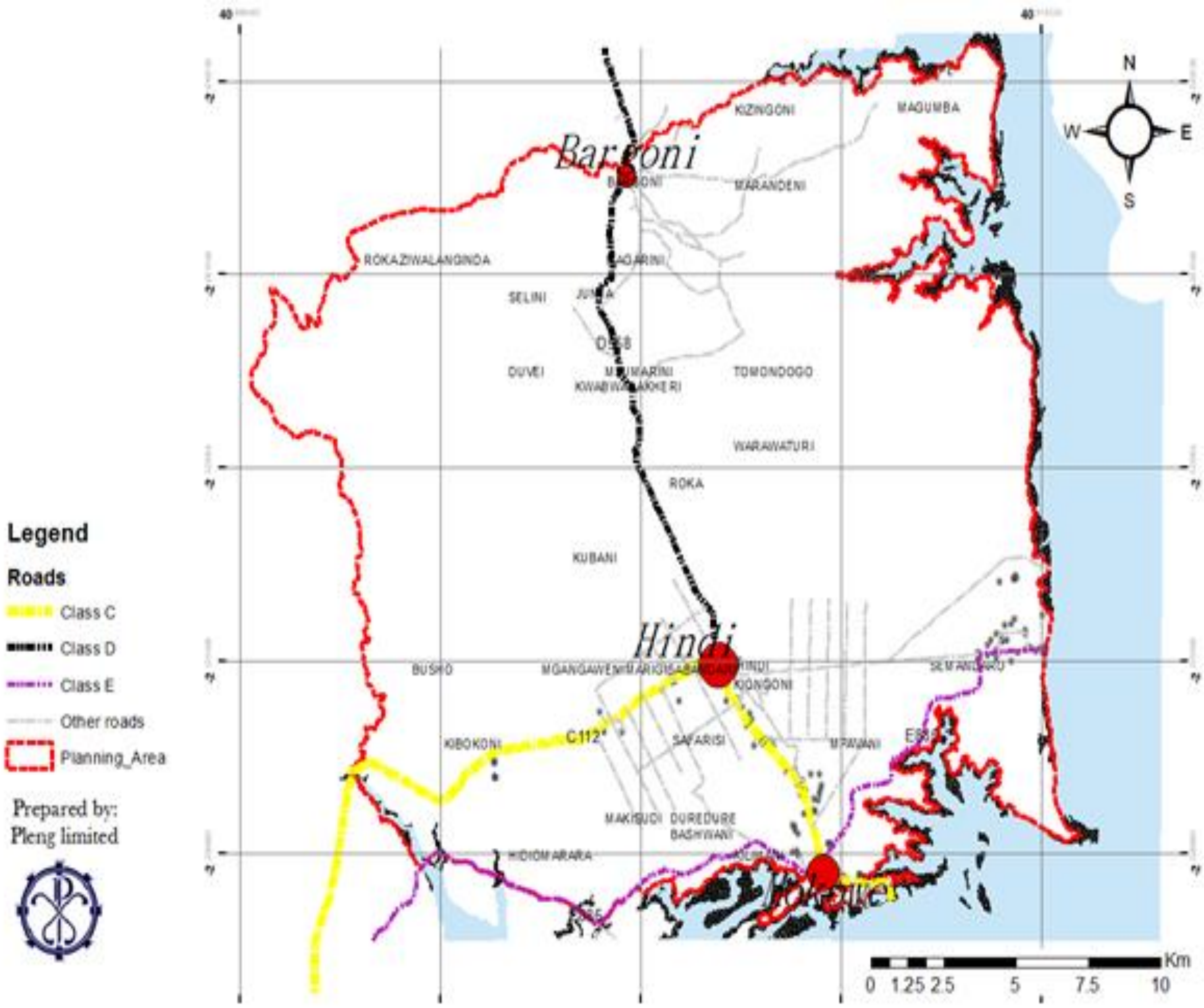
6.3. Existing Road Networks

There exist some roads: The D568 road joining Mokowe to Garseni and the C112 road which goes up to Mombasa, the E885 road that extends from Magogoni area to Mokowe and E886 road that extends from Mokowe area to Koreni area. There are other roads that are used within the area and are not classified.

Plate 10: Characteristic of Roads within Lamu Metropolitan

Source: Author, 2016

Map: Lamu Metropolis Existing Road Network



Source: Author, 2016

Plate 11: A section of Road D568

Source: Author, 2016

6.3.1. Transport Modes

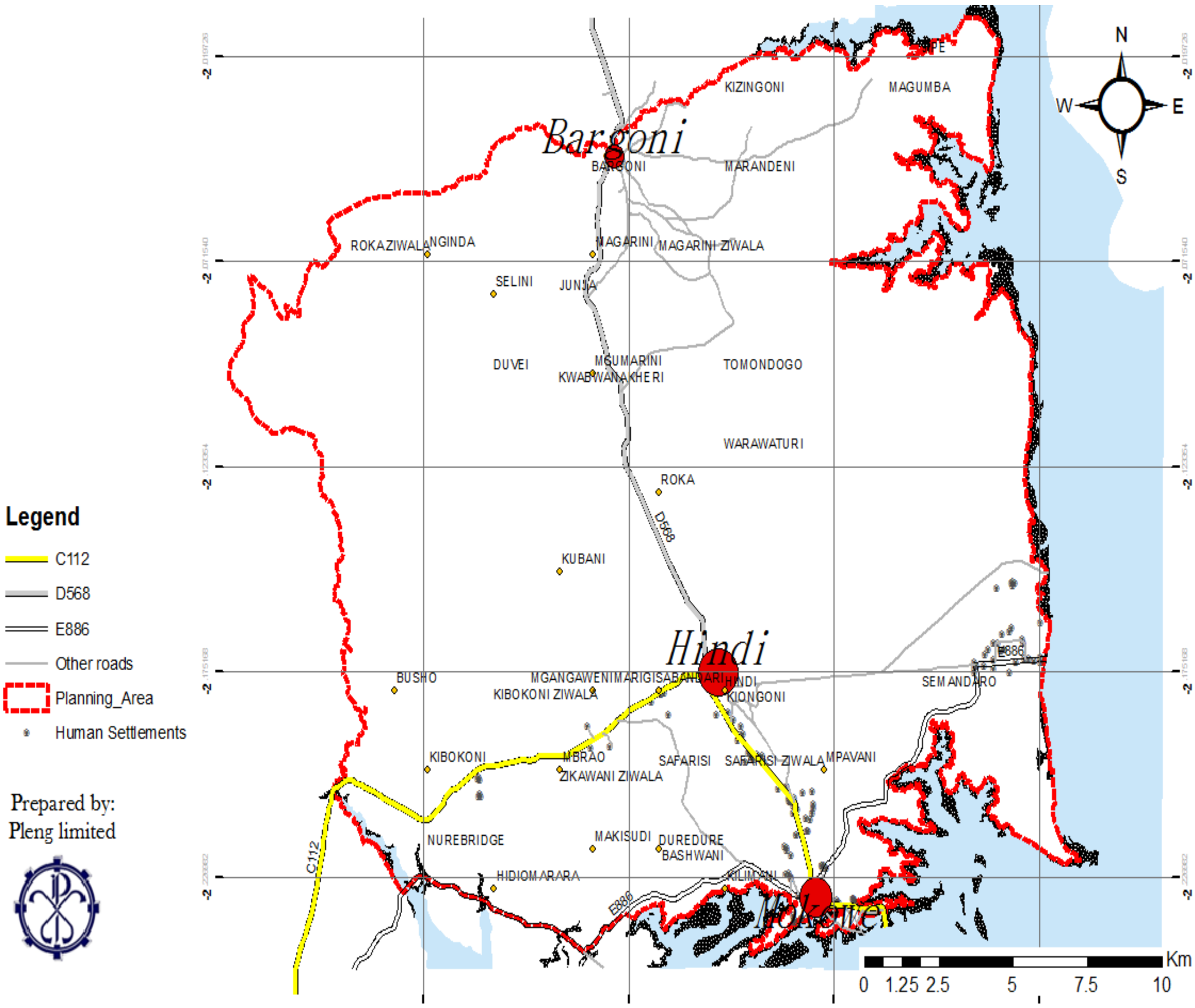
There are a number of transport modes in this area. They include: Buses, Bicycles, Motorbikes, private vehicles, boats. The buses are mainly used for the long distances i.e. From Mombasa to Mokowe. The Bicycles and motorbikes are used within the area by the residents as few of the residents own private vehicles. Other private vehicles are owned by the public institutions with offices around the area. The boats are used to connect from Mokowe to Lamu town as well as other islands.

6.4. SOCIAL CHARACTERISTICS

6.4.1. Settlements and Housing

This area has informal settlements because a number of houses are constructed on land that occupants have no legal claim to and it is unauthorized housing. These settlements are concentrated around the Hindi town and along the road between Mokowe and Hindi while the rest of the area has sparsely distributed settlements.

Map: Settlement Patterns and Villages within Lamu Metropolitan Area



Source: Author, 2016

6.4.2. Housing

Most of the houses in this area are semi-permanent with mud walls and makuti/iron sheets roofs as illustrated below:

Plate 12: Housing Characteristics within Lamu Metropolitan Area

Source: Author, 2016

There are however permanent housing in the Mokowe area and a few in the Hindi Area. Most of the permanent houses in Mokowe area are the offices belonging to the different public institutions while in Hindi town, they are businesses premises.

Plate 13: Mokowe Town

Source: Author, 2016

There is no sewerage system for liquid waste disposal, thus the informal houses use pit latrines and sock pits.

Plate 14: A section of Hindi town

Source: Author, 2016

6.4.3. Markets

The place lacks designated market areas as a result; there is encroachment on the roads by the residents as they put up unauthorized commercial stalls. The stalls constructions have however been stopped and some of them demolished to prevent further unauthorized developments in the area.

Plate 15: Stalls on the Road

Source: Author, 2016

To curb encroachment; A market place (4 acres of Land) has been identified and fenced out where stalls will be constructed and the residents can use them at a fee.

Plate 16: Proposed Market in Hindi Town

Source: Author, 2016

6.4.4. Educational Institutions

The place has few education institutions which are sparsely located. There are no institutions of higher education in the area and there are only two secondary schools; Mokowe Secondary School and Hindi Secondary School located in Mokowe town and Hindi town respectively. The primary schools are thirteen; Six of them offer complete classes (1-8) while the rest have incomplete classes (don't participate in the K.C.PE exams). The table below is a summary of primary schools found in the area:

Table 4: Educational Institutions in Lamu Metropolitan Area

Public Schools with Complete Primary Education (1-8)	Public Schools without Complete Primary Education	Private Primary Schools	Community Primary Schools
• Mokowe • Arid Zone • Kauthara • Ndeu • Kibiboni • Bargoni	• Bobo • Safirisi • Ungu • Mkunguni • Bora Imani • Kililana • Roka	• Joy Academy • Tumaini Academy	• Juhudi

Source: Author, 2016

The literacy levels in the area are low as most of the residents have primary level education or below.

Plate 17: Bargoni Primary School within Lamu Metropolitan

Source: Author, 2016

6.4.5. Sports

The residents in this area engage in different kinds of sports: Soccer, volleyball, netball, rugby, swimming, athletics, and basketball. There is a 15 acres stadium in Hindi within the existing settlement scheme at Ndeu which is not equipped to support the sports. There is also a playing field which is 4acres within Hindi town.

6.4.6. Health Institutions

There are a number of dispensaries in the area which include: Mokowe Health center, Hindi dispensary, Bargoni dispensary and a dispensary within the National Youth Service (NYS). A modern institution is being established in Hindi region to meet the medical demands of the area. The health institutions however lack specialized medical professionals to serve the local population and in most cases referrals are sent to Malindi and Mombasa.

6.4.7. Culture and Heritage Sites

There are communities within the area that still engage in cultural activities;

a) The Boni community is the least populated tribe in Kenya. They live in a village in Bargoni area called Mangai. Their activities normally involve searching for honey in the bush, shifting cultivation. Farming in Bargoni area is however, affected due to prolonged dry season.

   The community has one health center and education center based in the military camp and they have to walk over 50km from their village to reach Bargoni center as a result of poor transport.

b) The Orma are semi-nomadic people, they keep cattle and move from place to place. Livestock keeping is their basic means of survival. They live in round, wood-framed huts which are thatched with grass and in some cases woven mats. They move during dry season leaving the frames of their homes and return when the rains return.

c) The Bajuni community mainly practice fishing and farming. They have also been the backbone of Mangrove trade on the Indian ocean coast and wood carvings. They also specialize in dhow building.

There are also some ruins within the area, in places like: Dodo, Pokoni, Kililana. Some of the ruins are ancient villages of the Bajunis.

6.5. Environmental Characteristics

6.5.1. Topography

The Lamu Metropolitan area is basically flat with no hills and mountains. Its attitude ranges from 0- 25m above sea level. The low attitude exposes some areas to flooding during rainy seasons; these flood prone areas are on the coastal line which experiences flooding during the high tide. Due to the area being flat and poor drainage, the place is vulnerable to flooding. However, its proximity to the ocean provides a wealthy marine ecosystem which supports livelihoods through fishing, transport and tourism activities.

6.5.2. Hydrology

There are several swamp areas occasioned by rain water with the main ones located in Chomo kuu along the Hindi- Bargoni, Bellebelle in Hindi and Bargoni. There is one seasonal river; Bargoni river.

6.5.2.1 Hindi Area

The hydrogeological and geophysical studies have indicated that bellebelle depression is underlain by aquiferous layer of thickness varying between 10 and 20 meters. This is currently the fresh-water source for Hindi – Magogoni area. Five boreholes have been sunk within the belle belle swamp and under the management of Hindi Magogoni Water Association (HIMWA).

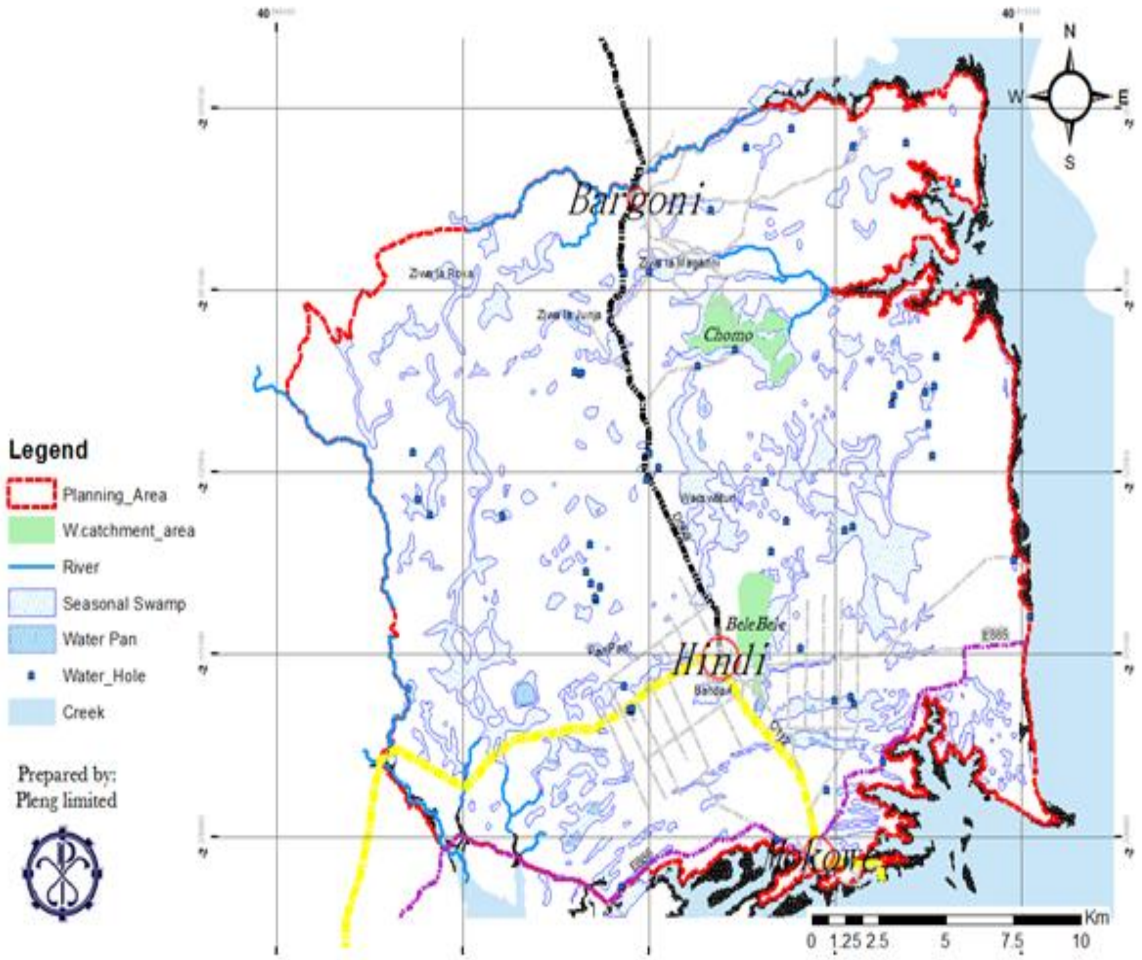
6.5.2.2 Chomo Area

A study by Ground water Survey (K) Ltd (1992) in the Lamu area reveals that a fairly extensive aquiferous layer composed of coral limestone or calcareous sands exists in the Chomo depression. It is anticipated that the aquifer can function as fair productive system recharged partly by rainwater and maybe to a larger extent by direct recharge from the stored dam water. Lately the swamp has receded to the extent that accessibility across the swamp is possible in most sections.

The fresh saline interface is basically shallow approximated around 25 meters below sea level. Large scale abstraction will be severely limited by the danger of salt water up coning.

Currently three boreholes had been drilled and managed by the Lamu Water and Sanitation Company. One of the three boreholes was abandoned due to high salinity levels while the two have been the only source of water supply to the Navy Barracks, Magogoni (17km water pipeline) and Mokowe water supply (12km water pipeline). The Mokowe pipeline was connected in 1996 and still supplying water to the area. The map below shows the water catchment areas:

Map: Water Catchments in Lamu Metropolitan Area



Source: Author, 2016

Direct recharge is obtained through downward percolation of rainfall or river water into the aquifer. If the infiltration rate is low due to the presence of an aquiclude (such as clay), the recharge to the aquifer is low. Percolation depends on the soil structure, vegetation cover and the state of erosion of the parent rock. Rocks weathering to clay soils naturally inhibit infiltration and downward percolation. Aquifers may also be recharged laterally if the rock is permeable over a wide area. Discharge from the aquifers is either through natural processes as base flow to streams or springs or artificial discharge through human activities.

6.5.2.3 Proposed Alternative Fresh Water Sources

a) Hindi Area - 2 sites proposed by the Ministry of Water for drilling of boreholes

b) Chomo Area – 4 sites proposed by the Ministry of Water for drilling boreholes

c) Desalinization – Desalination of sea water is a possible avenue for water supply proposed by private individuals and hotels, this is largely inaccessible since the process is costly. A number of proposals have been made to the County for provision of the same. Companies such as Armstrong and Duncan Holdings Company and Milele Water have proposed supply desalinized water as a by-product of mineral extraction to the County. The minerals include Sodium Chloride, Gypsum, Magnesium, Calcium, Hydroxide, among others.

6.5.3. Flora and Fauna

The biggest percentage of land of Lamu Metropolitan area is covered by equatorial forest, which is a habitat for different species of plants and animals. The forest has indigenous trees such as:

a) Mmbuyu (baobab)
b) Mkoma (palm tree)
c) Mkorosho(cashew nuts tree)
d) Mnazi (coconut tree)

Plate 18: Vegetation Cover in Lamu Metropolitan Area

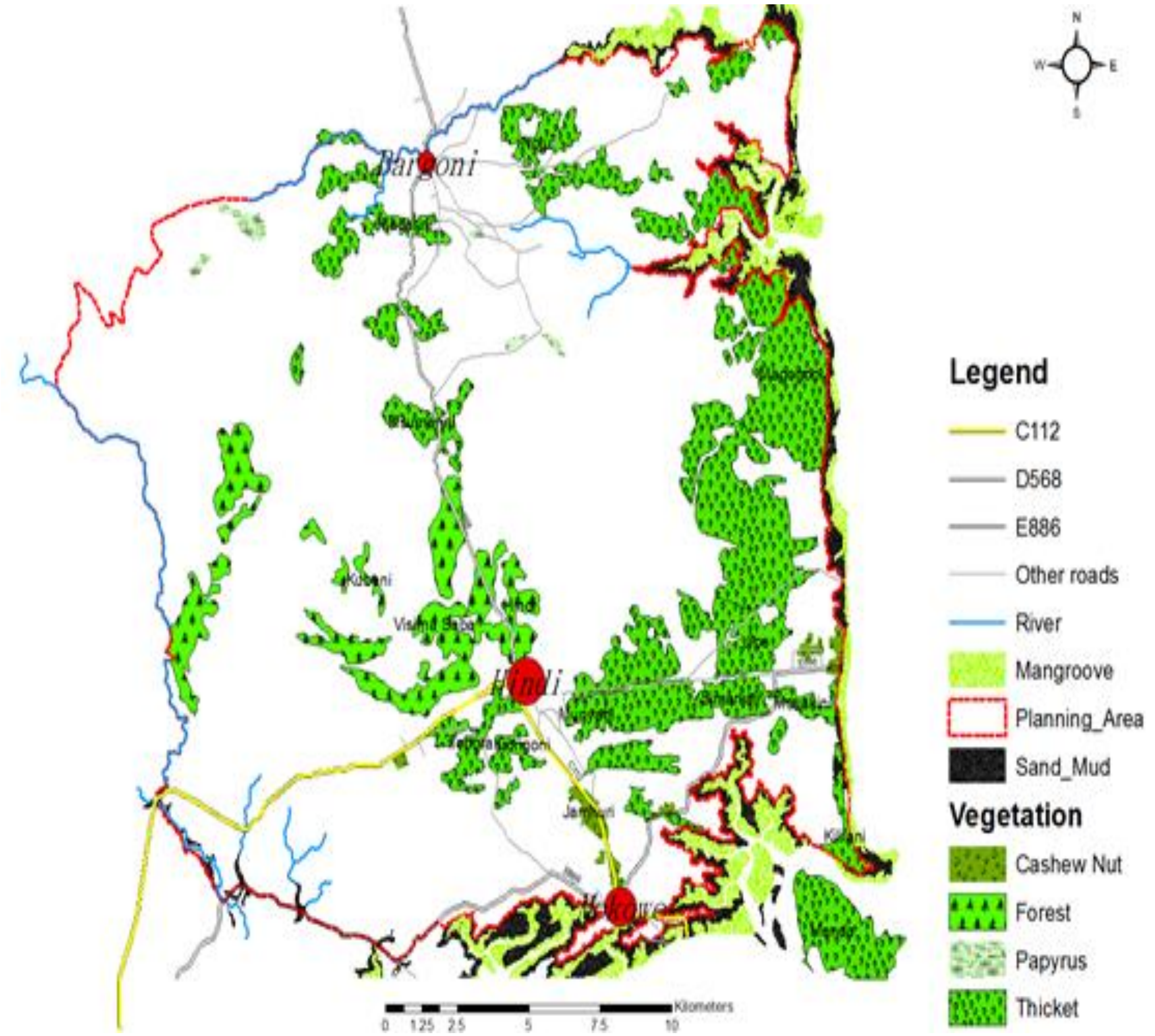
Source: Author, 2016

6.5.4. Equatorial Forest Vegetation

There are several species of wild animals in this area. They include: buffalos, antelopes, baboons, leopards, lions, monkeys, crocodiles and hippopotamus. Encroachment on the wildlife corridor has led to increased human-wildlife conflicts and invasion by wild animals in the centers especially the chimpanzees and Lions.

The map below shows areas covered by the equatorial forest:

Map: Vegetation Cover in the Planning Area



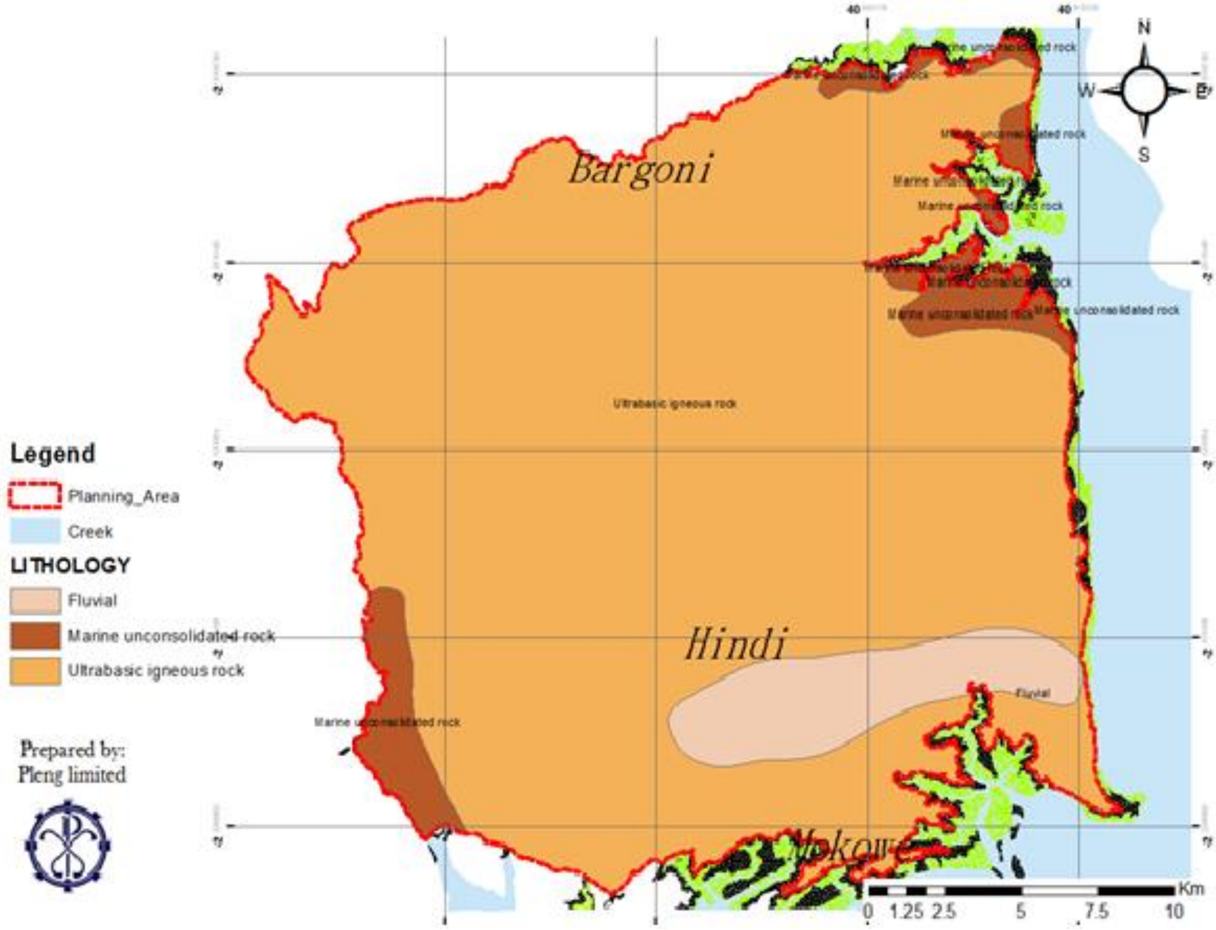
Source: Author, 2016

6.5.5. Soil

The soils in the area are moderately well drained, very deep and yellowish green to grayish brown in color. The soils are molted, very firm sandy clay loam with a very thick ranging 0.6m to 1m topsoil of light brownish grey to yellow colour. They also include friable loamy sand with inclusions of many small bottomlands of gleyic to albic LUVISOLS, Sodis phase with ferralo-chromic LUVISOLS, dystric or solodic PLANOSOLS and cambic ARENOSOLS. The soil pH ranges from slightly acidic (6.02) to neutral (7. 11).

The map below shows the type of rocks found in the area:

Map: Rock Formation in the Planning Area



Source: Author, 2016

6.5.6. Climate

The planning area is considered a sub-humid zone receiving rainfall between 850-1,110mm annually. There is a bimodal rainfall pattern with long rains occurring from mid-April to the end of June with the highest rainfall recorded in the month of May. The long rains output account of 80 per cent of the annual crop production. Short rains occur in the months of November and December and are generally unreliable. The months of January to March and August to October are usually hot and dry.

The temperatures range between 23^{o} C and 32^{o} C. The high temperatures are experienced from December to April while low temperatures occur from May to July. The annual mean temperature is 27^{o} C. The following table summarizes the climatic factors of the planning area throughout the year.

Table 5: Temperature

month	1	2	3	4	5	6	7	8	9	10	11	12
mm	7	3	28	134	307	157	87	44	46	43	50	30
°C	27.1	27.5	28.2	28.1	26.9	26.4	25.6	25.6	26.1	26.7	27.3	27.4
°C (min)	24.2	24.2	25.4	25.3	23.7	23.0	22.0	22.4	22.9	23.8	24.3	24.4
°C (max)	30.1	30.8	31.0	31.0	30.2	29.9	29.3	28.9	29.4	29.7	30.3	30.4
°F	80.8	81.5	82.8	82.6	80.4	79.5	78.1	78.1	79.0	80.1	81.1	81.3
°F (min)	75.6	75.6	77.7	77.5	74.7	73.4	71.6	72.3	73.2	74.8	75.7	75.9
°F (max)	86.2	87.4	87.8	87.8	86.4	85.8	84.7	84.0	84.9	85.5	86.5	86.7

Source: http://images.climate-data.org

6.6. ECONOMIC CHARACTERISTICS

6.6.1. Agriculture

Agriculture contributes highly to the economy of this area, as most of the residents practice it. The area is divided into different agricultural zones; Mokowe area is considered a cashew nuts zone while Hindi area is considered a casual nut cassava zone. Farming is done on small scale and is rainfall dependent. Farmers also use irrigation to grow vegetables, tomatoes and cotton with water from the catchment areas. The average agricultural land per household is 4 hectares.

This sector faces a number of constraints:

- **Ranches:** Hindi is full of large tracts of land that are privately held and mostly idle. This has significantly reduced the agricultural produce as the land area available for agriculture are minimal.
- **Land Use Disputes:** There have been disputes between the farmers and pastoralists because the pastoralist herds graze on the farms. The farmers are calling for the County government to establish legislation to bar pastoralists from entering into the farmers' land.
- **Markets:** Proper markets where farmers can sell their produce are lacking in the area unless they go to Mpeketoni. This discourages farmers from producing surplus and as a result reduces production.
- **Agricultural Facilities:** There is lack of facilities that can promote agricultural activities. For instance, the production of cotton has declined because the cotton ginneries in Lamu town and Mpeketoni have been closed down.

- **Speculation:** There has been increased transfer of land ownership within the area due to speculation. Agricultural lands have been significantly reduced as most the lands sold are fenced and left idle.
- **Accessibility:** The roads are impassible during the rainy seasons which makes it difficult for farmers to take their produce to the consumers and vice versa.

6.6.2. Fishing

Fishing is among the crucial economic activities in the planning area owing to its close proximity to the ocean with the main fishing practice being artisanal inland fishing. There is also fish farming practiced in Mokowe, however it is not fully exploited. Plans are underway to rejuvenate the fishing industry through the establishment of fish ports as proposed under LAPPSSET. These ports will increase the capacity of the fishermen and enable them to practice deep sea fishing.

6.6.3. Pastoralism

This is mainly practiced by the Orma and the Boni communities. They move from one place to another to look for pastures for their livestock. These communities mainly rely on the animal produce for income hence they supply milk and other animal products in the area.

Plate 19: Pastoralism within Lamu Metropolitan

Source: Author, 2016

6.6.4. Tourism

Tourism is not well defined in this area as there are no activities that are directly linked to the sector. The place has potential of developing the tourism sector using the available resources such as:

1) Culture – Boni and Bajuni cultures
2) Ruins – ancient Bajuni settlements
3) The close proximity to the Ocean
4) The Flora and Fauna - the national reserves and parks
5) The proposed LAPSSET resort city

Plate 20: Beach Located in Ndununi within the planning area

Source: Author, 2016

6.6.5. Other Retail Businesses

There are several retail businesses in the towns and centers. They get their supplies from Lamu town and Mpeketoni wholesaler shops. These businesses serve the people of Hindi and the surrounding areas.

Plate 21: Retail Businesses within Hindi Town

Source: Author, 2016

6.7. THE LAPSSET PROJECTS

Among the LAPSSET projects, there are some major projects found within the Lamu Metropolitan Area. These projects include: Lamu Port, LAPSSET Highway, LAPSSET Railway, LAPSSET Resort City, LAPSSET Crude Oil Pipeline, LAPSSET Power Supply, and LAPSSET Oil Refinery.

6.7.1. Lamu Port

It is one of the economic enabling projects that will revolutionize the LAPSSET Corridor. It will constitute a total of 32 berths along 6000m coastline. The government is constructing the first three berths and will then engage the private sector to build the remaining 29 berths on a PPP framework.

Lamu port's terrestrial geographical positioning puts the country at an advantage and thus, the he first three berths are anticipated to create a business case for the entry of the private sector. In addition, the three berths will generate cargo for the railway in the long-run and for the roads in short term.

Lamu port will provide reliable connectivity of transport systems in Kenya and for landlocked nations such as Ethiopia, Uganda and southern Sudan. It will give access to international markets and open up a transport network that will increase the development agenda and improve trade ties in the region. A special economic zone (SEZ) will be created near the port enhancing its economic outcome. The port will form a solid economic base for the region once completed.

Plate 22: Lamu Port Headquarters

Source: Author, 2016

6.7.2. LAPSSET Corridor

The LAPSSET corridor consists of three major transport infrastructure components (the highway, the railway and pipelines) that will run parallel to one another. The long-term sustainability of the whole corridor lies within visionary and long-term plans that place premium in future connectivity, trade increase and population dynamics.

6.7.3. LAPSSET Highway

The planned LAPSSET highway runs from the proposed port of Lamu through Garissa-Isiolo (530km), Turkana, South Sudan and a link from Isiolo to Marsabit, Moyale and Ethiopia. This road network will position the country as a transport and logistics hub of unparalleled means in the region.

It will provide critical infrastructure necessary to provide services, and grow trade in areas it traverses. Additionally, the road network is expected to ease access to market and open the areas for expanded economic activities.

6.7.4. LAPSSET Railway

The Railway will start from Lamu to Isiolo then branch at Isiolo to South Sudan and Ethiopia. This project is an economic enabling activity which has low recoup rate and enviable for private sector investors. It converts to a viable option for private sector and government to undertake.

6.7.5. LAPSSET Crude Oil Pipeline

There will be a crude oil pipeline from Lamu to Isiolo, Jonglei (south Sudan) to Lokichar and a product oil pipeline from Lamu to Isiolo- Moyale-Addis Ababa. The crude oil and product oil pipeline are expected to tap into the massive oil discoveries and the other projects such as the railway which can be funded by proceeds from oil sales.

6.7.6. Lamu International Airport

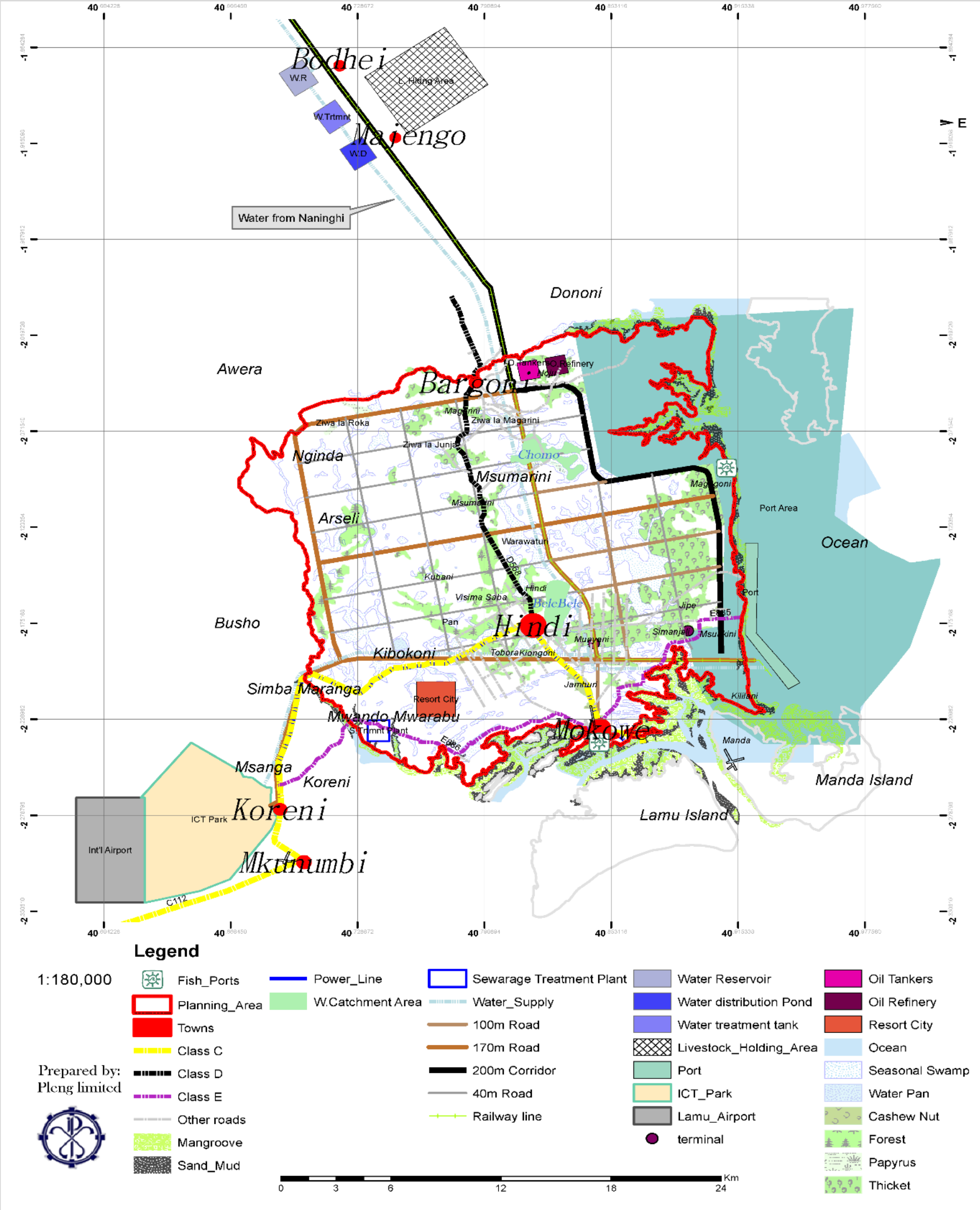
The Lamu International Airport will be located in Mkunumbi area which is outside the planning although located adjacent. This will have an enormous impact on the Lamu Metropolitan Area as it will primarily serve the proposed Resort City in Ndeu. This will also give the country’s transport sector great impetus by creating efficiency in transport and logistics sector.

6.7.7. LAPSSET Resort City

The city is aptly positioned to revolutionize the tourism industry as the place has, for generations, retained and sustained rich cultural practices, favorable weather and rich biodiversity.

The map below shows the location of the LAPSSET project components in the planning area:

Map: LAPSSET Project Components



Source: Author, 2016

6.8. SWOT ANALYSIS

	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Hydrology and Topography	• Adequate rainfall • Numerous water catchment areas • Seasonal Swamps • Flat terrain of the land makes it easier and cheaper to develop infrastructure	• Salinity • Flat Land with poor drainage systems • Vulnerability to flooding • Seasonal swamps • No permanent Rivers	• Alternative fresh water sources-desalinization and Nanighi water • LAPSSET Projects • Rain Water harvesting potential	• Flooding • Poor liquid waste disposal
Climate	• Adequate rainfall • Favorable weather	• Poor drainage	• Potential for solar energy harvesting • Potential for rain water harvesting	• Clearing of the forest
Location	• Near the Ocean • Proximity to Lamu Old Town	• Undeveloped infrastructure	• Close proximity to Somalia • Near the proposed LAPSSET	• Terror threats • Insecurity

Soil	• Favorable for crops farming • Rich in minerals	• Salinity	• Soil analysis by LAPSSET	• Contamination from poor waste disposal
Land	Large undeveloped lands	Lack of land tenure security Large tracts of idle land in the form of ranches	Potential land uses under LAPSSET Lamu Metropolitan Structure Plan	Land Grabbing Lack of land titles
Transport	• Existing diversified modes of transport	• Poor roads • Lack of connecting roads	• Proposed transport channels under LAPSSET • Lamu Metropolitan Structure Plan	• Poor drainage systems. • Land Grabbing • Encroachment
Flora and Fauna	• Diversified species of animals	• Human – wildlife conflict	• Can be developed and conserved as a tourism product • Lamu Metropolitan Structure Plan • LAPSSET identified green areas and proposed resort	• LAPSSET Projects • Poaching • Land Grabbing • Some cultures practices-shifting cultivation

			city	
Housing	• Availability of Land to upgrade housing	• Lack of good sewerage system • A big percentage is informal housing • Sparsely located houses	• Improved infrastructure by proposed LAPSSET projects • Lamu Metropolitan Structure Plan	• Land Grabbing
Education	• Availability of land to construct educational institutions	• Lack of adequate educational institutions • No institutions of higher learning • Low literacy levels • Sparse settlements	• Indirect influence from proposed LAPSSET Projects • Lamu Metropolitan Structure Plan	• Culture
Health	• Availability of Land to construct health facilities	• Lack of adequate health institutions. • Lack of medical specialists • Sparse settlements	• Indirect influence from proposed LAPSSET Projects • Lamu Metropolitan Structure Plan	• Culture

Source: Author, 2016

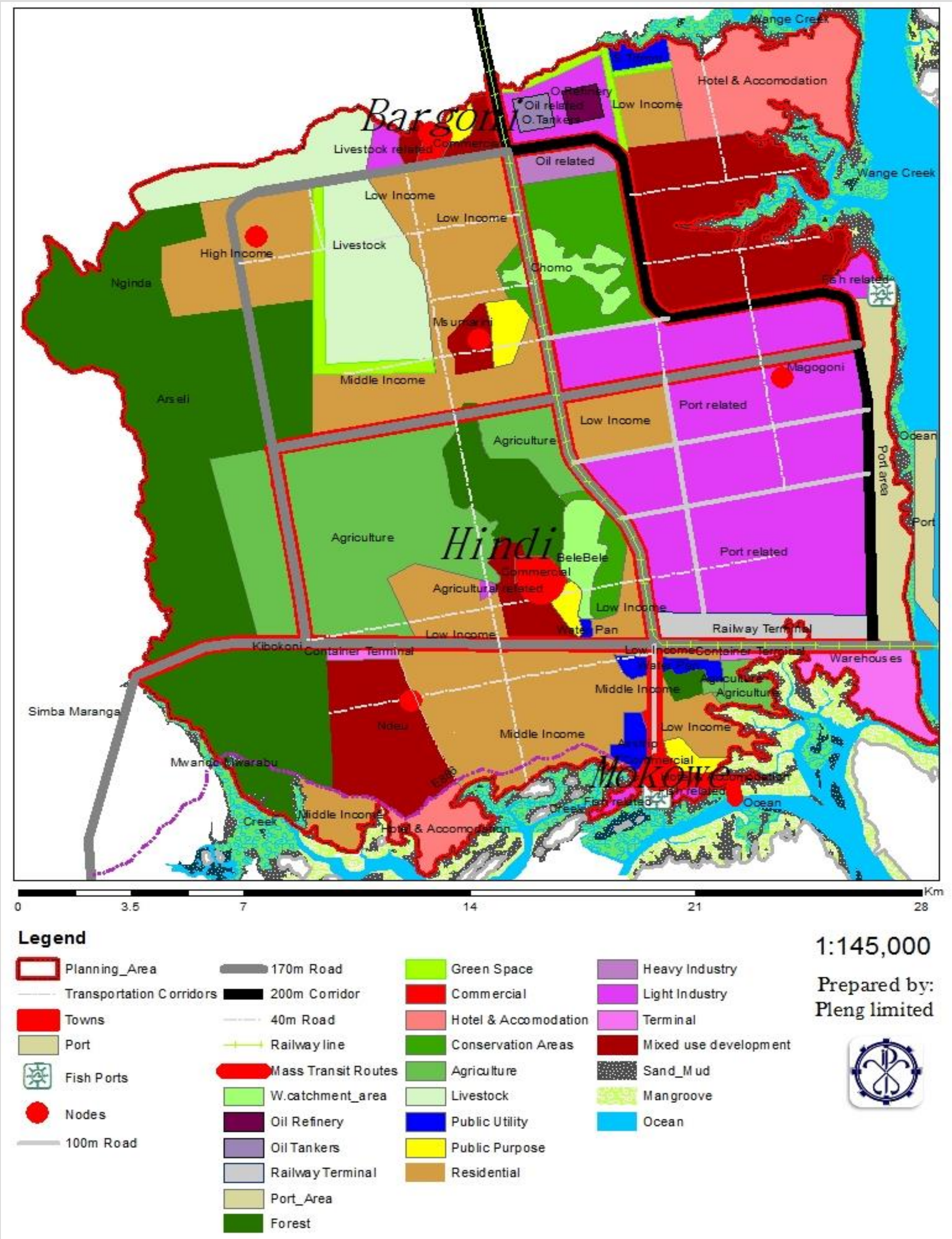
CHAPTER 7: LAMU METROPOLITAN AREA STRUCTURE PLAN

7.1. OVERVIEW

This chapter gives an in-depth discussion of the Lamu Metropolitan Area Structure Plan and its components. It gives a zoning plan for the metropolitan area and sectoral specific plans that form the foundation of the Integrated Area Structure Plan.

The Integrated Area Structure Plan involves a broad categorization of land uses giving structure to the land uses within the Metropolitan area. It equally sets out the framework for environmental protection, connectivity of the settlements as well as all metropolitan functions including the proposed LAPSSET components. Finally, the Integrated Area Structure Plan will inform the formulation of different sector strategies, planning policies and further detailed planning for the different urban centres within the metropolitan area.

Map: Lamu Port Metropolitan Area Structure Plan

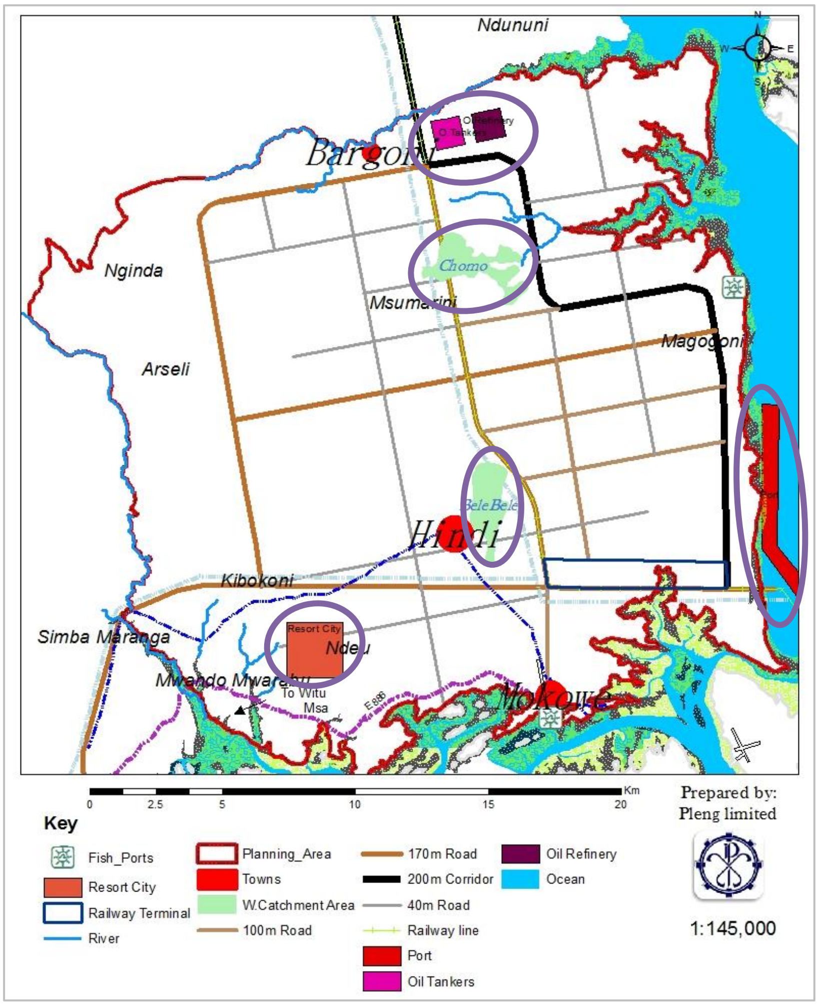


Source: Author, 2016

7.2. STRUCTURING ELEMENTS

The map shows the structuring elements that define the Lamu Metropolitan Area Structure Plan. These elements define the characteristics, development and distribution of land uses within the Metropolitan Area.

Map: Structuring Elements Lamu Port Metropolitan Area



1. Proposed Lamu Port
2. Proposed Oil Refinery and Oil tankers
3. Rivers, Water Catchment Areas (Chomo & Belebele)
4. Proposed Resort City at Ndeu
5. Urban Centers, Mokowe, Hindi and Bargoni
6. Proposed Main LAPSSET Corridors
7. Ocean/Creek

Source: Author, 2016

7.3. LAMU METROPOLITAN AREA ZONING PLAN

The core objective of the zoning plan is to show the delineation of different land uses into their respective zones. This plan shall serve as an integral tool for development control in the planning area. It will therefore map the permitted and restricted use in the different land use zones. The following are the basic principles guiding the zoning of Lamu metropolitan area:

7.3.1. Basic Principles in the Zoning

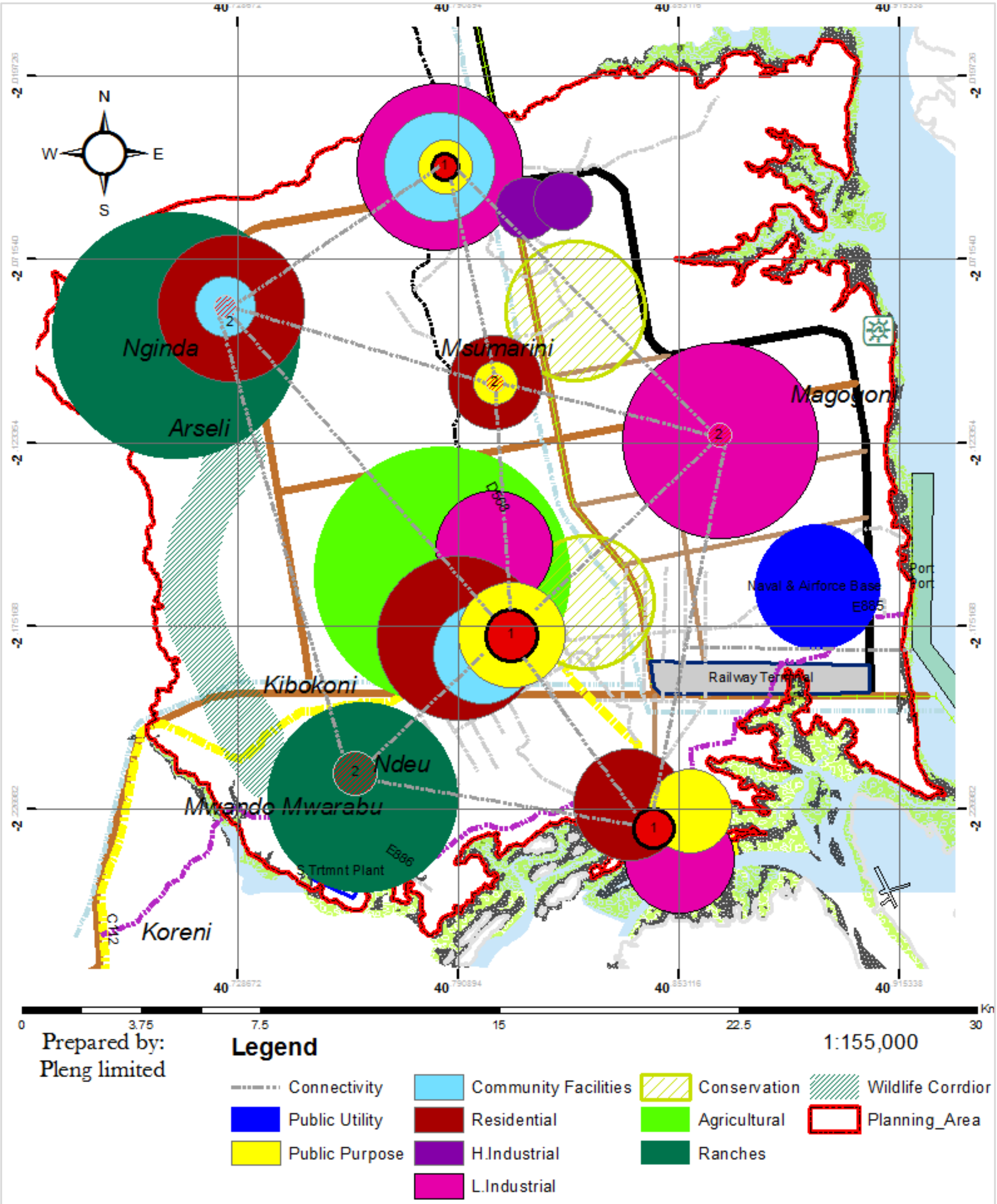
- Sufficient land should be zoned at appropriate locations throughout the metropolitan to accommodate the expected growth in population and other growth needs of Lamu metropolitan within the lifetime of the Plan.
- Zoning should be designed to promote particular uses in appropriate locations, promote quality of life and living standards of the people, to reduce conflict of uses and to protect resources both natural and man-made. Where appropriate, zonings should be used as a tool for shaping the city and not solely reflect existing land uses.
- Development should be encouraged in established centers such as Hindi, Mokowe and Bargoni and the redevelopment of underutilized and brownfield land in these areas should be promoted with a view to consolidating and adding vitality to existing centers, and ensuring the efficient use of urban lands.
- That intensification of development should be permitted adjacent and close to public transport nodes and corridors in order to maximize the use of public transport, to minimize trip generation and distribution and to promote sustainable development.
- Mix land use is also encouraged to promote a differentiation in land uses results in more animation and activity in those areas.
- For a detailed of the identified urban nodes, there will be a need for the preparation of respective Integrated Strategic Urban Development Plan which will be more detailed and shall be in line to this zoning plan.

7.3.2. Land Use Zoning Concept Plan

The zoning plan is derived from a zoning concept informed by the polycentric model design of a metropolitan area. This concept plan is illustrated in the map below:

Map: Land Metropolitan Area Zoning Plan Concept

Key: Primary and secondary nodes missing



Source: Author, 2016

From the model above, the metropolitan area has 3 primary cores and 4 secondary cores which complement the functioning of the primary core. The primary cores are; Mokowe, Hindi and Bargoni, whereas the secondary cores are located in; Magogoni, Msumarini. Nginda and Ndeu. These nodes will serve as key commercial centres which will influence the distribution of other land use activities in their surroundings.

7.3.3. Key Land Uses

The key land uses as identified in the concept design are as tabulated below:

Table 6: Key Land Uses

Land Use	**Components**
Residential **(*With community facilities*)**	High Income Middle Income Low Income
Industrial	Agricultural Fish related Manufacturing Warehouses Container Terminal Special Economic Zone (SEZ) Export Processing Zone (EPZ)
Public Purpose	Public Offices
Commercial	Commercial centres Hotels and Accommodation
Public Utilities	Navy and Airbase Sewerage treatment Plant Water Pans and treatment areas
Transport	Railway Terminal Transport Corridors
Agricultural	Crop production

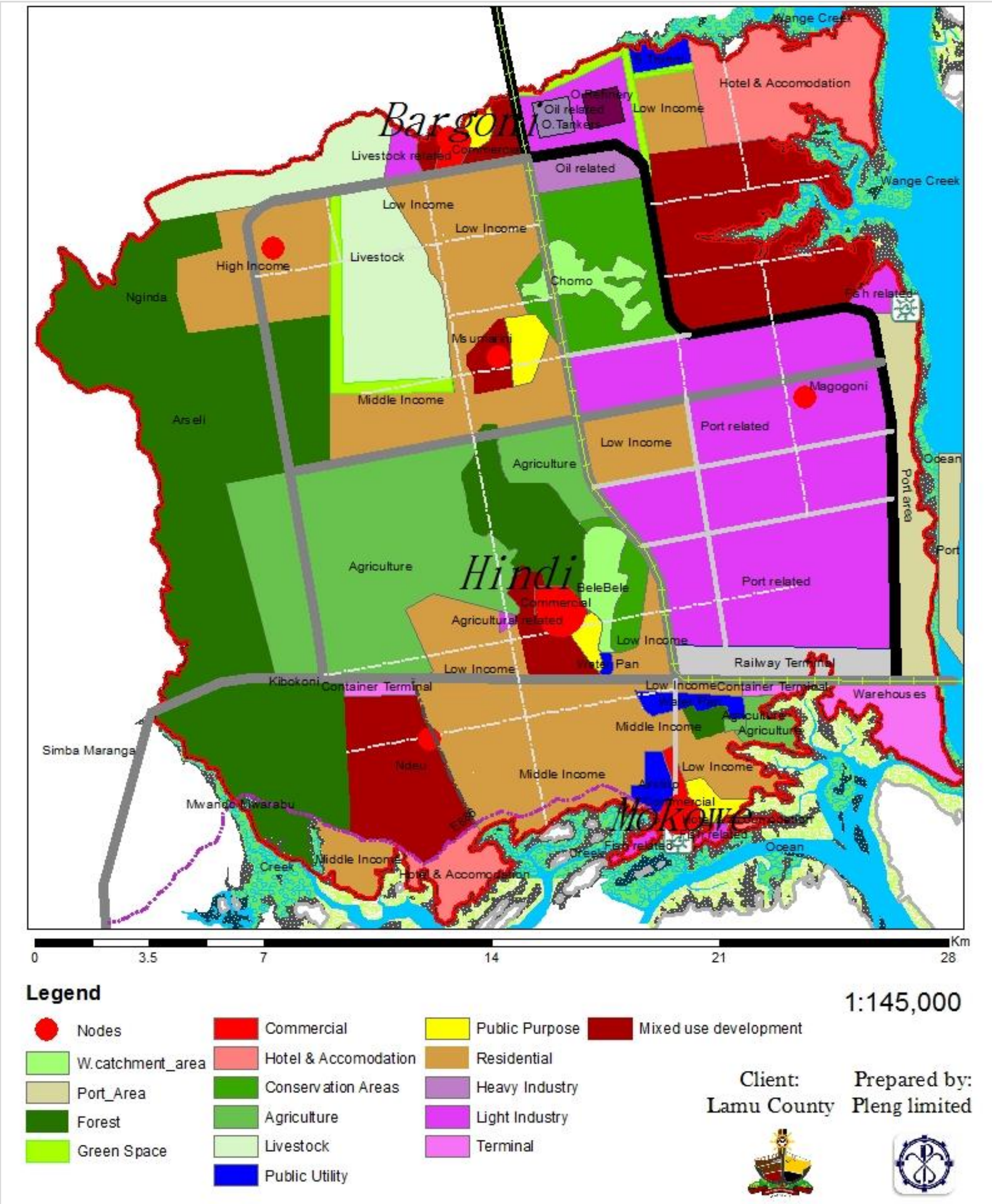
	Livestock keeping
Mixed Use	Mixed land uses
Green Spaces	Trees and Vegetation
Conservation	Water Catchment
Forested Areas	Natural Forests

Source: Author, 2016

7.3.4. Zoning Plan

The zoning plan details out the spatial distribution of the different land uses in the planning area as specified in the table above.

Map: Lamu Metropolitan Area Zoning Plan



Source: Author, 2016

Residential

The objective of the residential land use zone is to provide accommodation for the people living in the metropolitan area. This use is broken down into 3 categories:

i. High Income Zone

This zone is designated for the high income earners. They are located in the outskirt and periphery of the metropolitan far from the chaos of the urban areas.

ii. Middle Income Zones

These zones are designated for the middle income earners. These zones are located in the urban areas and their outskirts.

iii. Low Income Zones

These zones provide accommodation for the low income earners. These zones are strategically positioned near their working place and near mass transit corridors to facilitate their commuting from home to their working places.

Industrial

The objective of this zone is to accommodate all the industrial uses. These zones are strategically positions along main transport channels to facilitate the transportation of raw materials and products from the industries. It categorized into; port related, oil related, agriculture related, fish related and livestock related.

Commercial

The objective of this use is to provide a place for commercial activities. It includes commercial centres and Hotels along the sea shore.

Mixed Use development

The objective of this use is to provide accommodation for a range of land use activities. These are mainly in areas where there is a need to have a mix of uses that will enhance the quality of living and foster a vibrant economy.

Public Utility

The objectives of this zone is to provide space for the provision of public utilities that will foster service provision to the community.

Public Purpose

These zones are necessary to facilitate administration functions and service delivery to the public. Hence the importance of these zones.

Agriculture

The core objective of these land use is to enhance food security in the area, the agricultural zone will provide opportunity for crop production among other functions hence feeding the metropolitan area. The zone is categorized into crop production and livestock keeping.

Transport

This land use zone provides for movement of people, goods and services within and without the planning area. This use involves different categories which include: roads, railway, water and air.

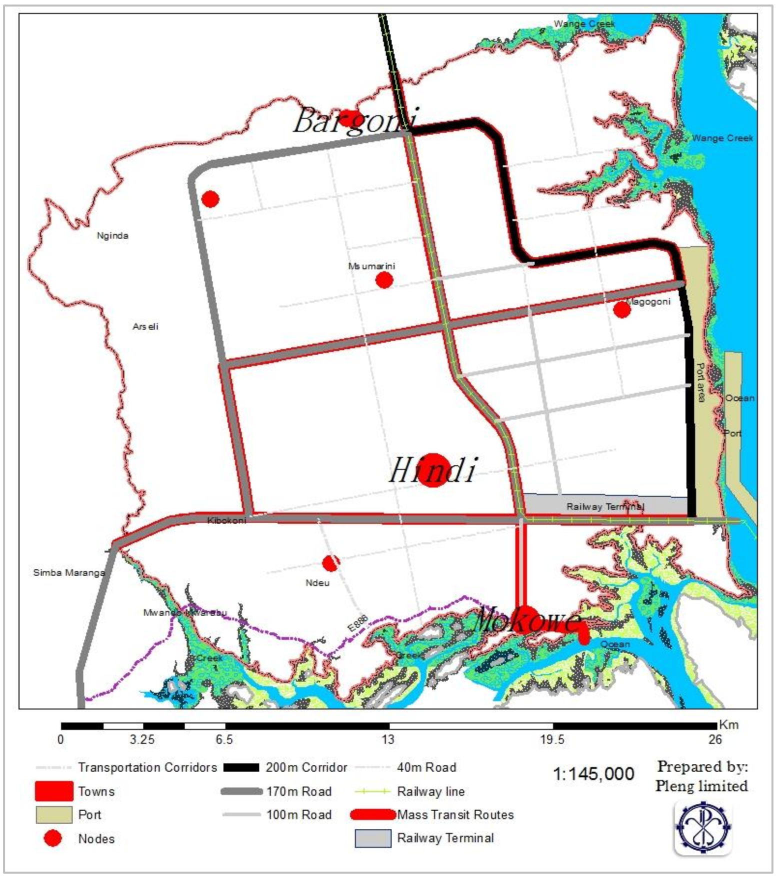
7.4. Sector Specific Plans

Sector plans gives a highlight of the different proposals at the sector level. The key sectors identified are; transport, environment, industrial & economic zones and finally housing and human settlements.

7.4.1. Transportation Plan

This plan outlines the different transport modes and means in the metropolitan area. Below is a plan showing the layout of the transportation network.

Map: Lamu Metropolitan Area Transport Plan



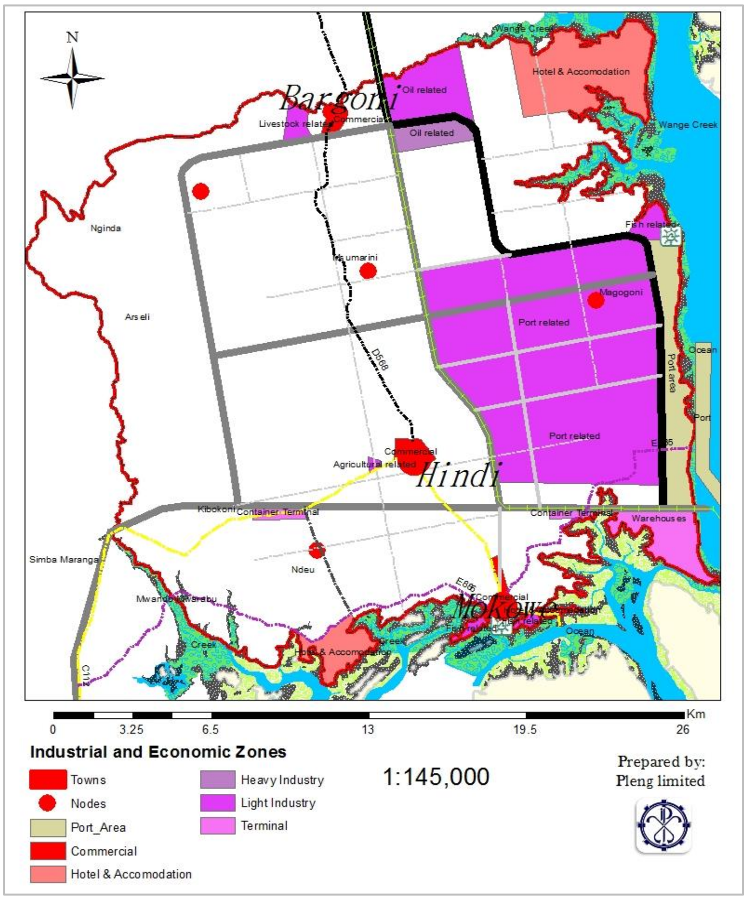
1. The plan has 3 transport modes:
   - Road
   - Railway
   - Ocean
2. It has mass transit routes along the main transport spines of the metropolitan
3. The following are the classes of the proposed road network:
   - 200m Corridor
   - 170m Road
   - 100m Road
   - 40m Road

Source: Author, 2016

7.4.2. Industrial and Economic Zones Plan

The plan details the industrial and economic zone in the metropolitan showing the different industrial and commercial zones. These and distributed based on the defining structure of the metropolitan area as identified in the structuring elements plan aforementioned.

Map: Industrial and Economic Zone Plan



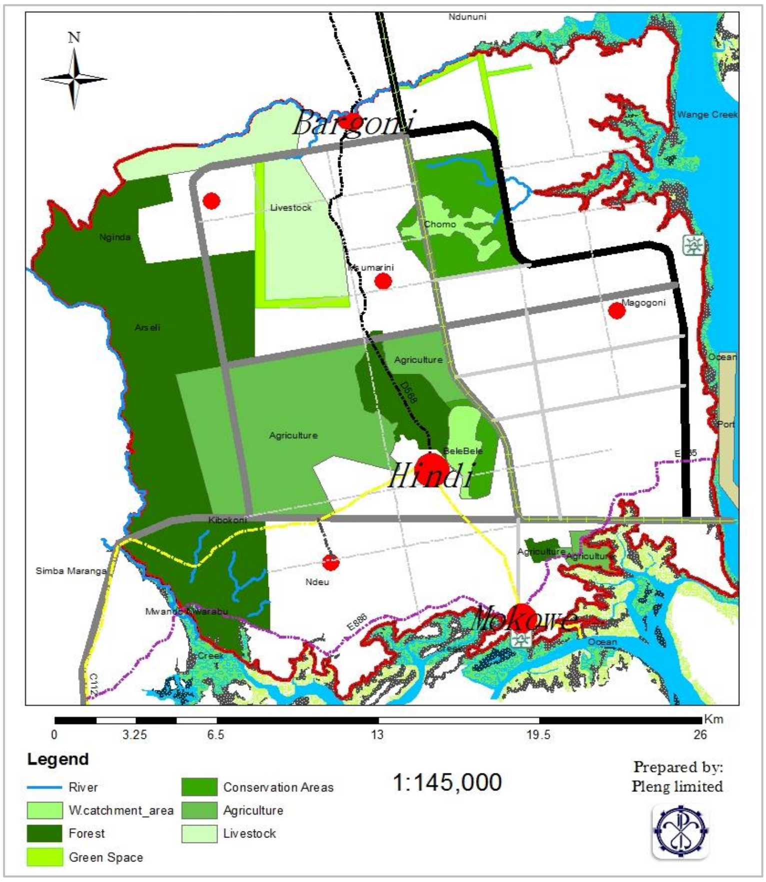
1. The industrial zones in the plan are classified into 5 main categories depending on their function:
   - Port related
   - Oil related
   - Agricultural related
   - Fish related
   - Livestock related
   - Container terminal
2. Economic zones in the plan are classified as follows:
   - Commercial business districts (CBDs in Mokowe, Hindi and Bargoni)
   - Commercial nodes located in Ndeu, Nginda, Msumarini and Magogoni
   - Hospitality zones located around the resort city and Ndununi
   - Mixed use zones

Source: Author, 2016

7.4.3. Environment and Open Space Plan

This plan emphasizes on the protection and conservation of the environment including its resources. This plan identifies green spaces, forests and vegetation cover. The plan below shows the environmental plan of the Metropolitan area:

Map: Green Zones and Open Spaces



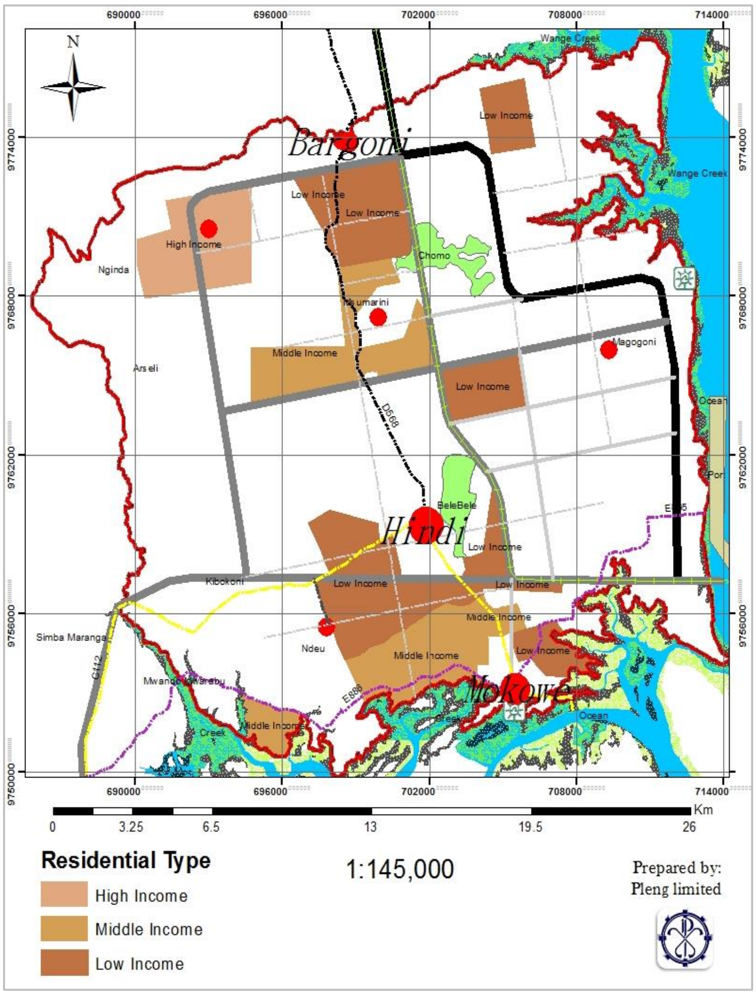
Source: Author, 2016

1. The plan provides the 3 forest covers to provide a habitat for a variety of wildlife species.
   One of the forest extends from Nginda down to Ndeu which provides a wildlife corridor to the periphery of the resort city
2. The plan provides for protection on the water catchments i.e. Belebele and Chomo through creating areas of conservation around them.
3. It equally provides for green spaces, which create buffers, increase aesthetics and protect the environment.
4. Provides for large scale open spaces in terms of agricultural farms and ranches.
5. Provides for buffers for all water bodies to prevent encroachment and protect the environment.

7.4.4. Housing and Human Settlements Plan

This plan provides for the residential layout which constitute an important land use among the several uses of the metropolitan. This plan is as shown below:

Map: Settlement Distribution Plan



1. The plan provides for the following types of residential settlements
   - High Income
   - Middle Income
   - Low Income
2. The high income are located around Nginda away from the Primary cores
3. The low income settlements are located near their working places and along the mass transit routes to ease their commuting.
4. The plan provides for mixed use development which provides additional residential zones

Source: Author, 2016

CHAPTER 8: ACTION PLANS, IMPLEMENTATION STRATEGY

8.1. OVERVIEW

This chapter brings out the goals expected from the implementation of the Integrated Lamu Area Structure Plan. Action plans and implementation strategies have been developed to enhance the realization of the goals.

8.2. GOAL

The Purposes of formulating the Integrated Lamu Area Structure Plan is to:

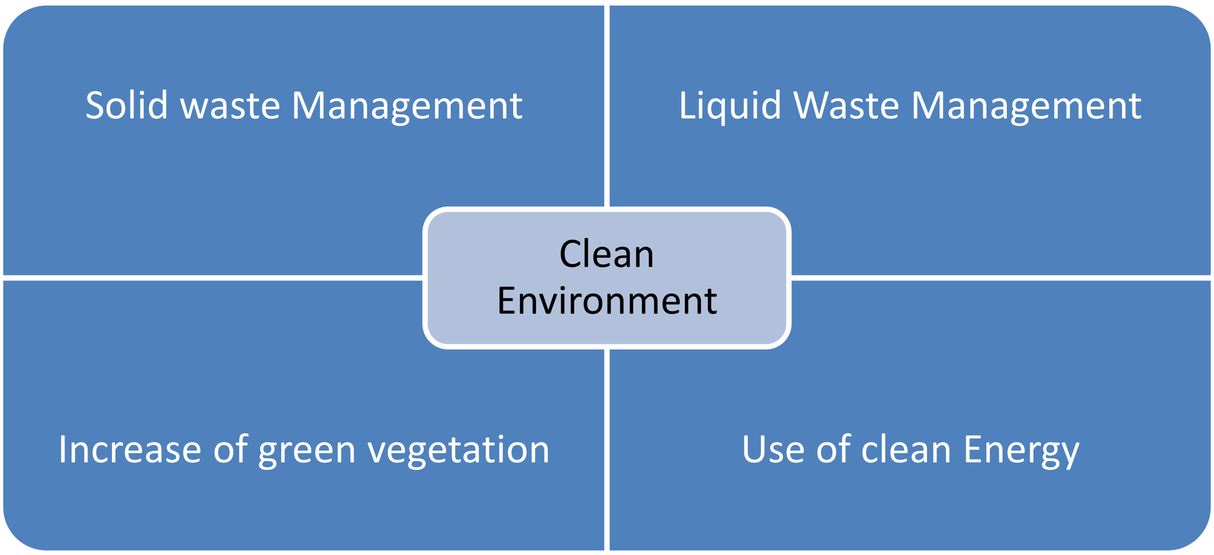
1. Ensure sustainable spatial development of Lamu Metropolitan that integrates port and city functions.
2. Provide high quality of life in a secure and clean environment now and for posterity.
3. Provide the basis for public and private investments.
4. Coordinate sector programmes, projects and land development management.

8.3. OBJECTIVES

The major objectives of the Integrated Area Structure Plan are used to formulate Action plans and implementation strategies.

8.3.1. Clean Environment

Clean Environment is one of the major objectives on the Area Structure Plan which can be achieved through the actions shown in the matrix below:



8.3.1.1 Solid Waste Management

Action Plan	Implementation Strategies	When?	By Who?
Solid Waste Management	• Identification of damp sites within the Lamu Metropolitan Area	• Short term • (≤1 year)	• County Government
	• Separation of bio-waste and plastic waste	• Through out	• Investors, County Government, residents, NGOs, CBOs
	• Install recycling plants	• Short term • (1-5 years)	• County Government, investors
	• Create awareness on solid waste disposal	• Throughout	• NGOs, CBOs, County government, residents, Investors
	• Provide solid waste bins in towns and within the settlements	• Short term (≤1year)	• County Government, investors, CBOs
	• Train farmers on how to recycle bio-waste	• Short term • (≤ 1 year)	• County Government, Investors, CBOs, NGOs
	• Develop policies to enforce waste management	• Short term • (≤1 year)	• County Government

8.3.1.2 Liquid Waste Management

Action Plan	**Implementation Strategies**	**When?**	**By Who?**
Liquid Waste Management	• Identification of water sewerage treatment plant location	• Short term (≤1 year)	• County Government
	• Construction of sewerage system connecting different households and businesses	• Short term (≤ 5)	• Investors, County Government, residents, NGOs, CBOs
	• Create Awareness on the liquid waste disposal	• Short term (≤ 1 year)	• County Government, investors
	• Develop policies to enforce waste management	• Short term (≤ 1 year)	• -NGOs, CBOs, County Government, residents, investors

8.3.1.3 Use of Green energy

Action Plan	**Implementation Strategies**	**When?**	**By Who?**
Use of Green Energy	• Construction of Hydro power Plant and solar systems	• Medium term (5-10 years)	• County Government
	• Train on the production and usage of biogas	• Short term (≤ 1 year)	• Investors, county Government, residents, NGOs, CBOs
	• Create Awareness on the	• Short term	• County Government,

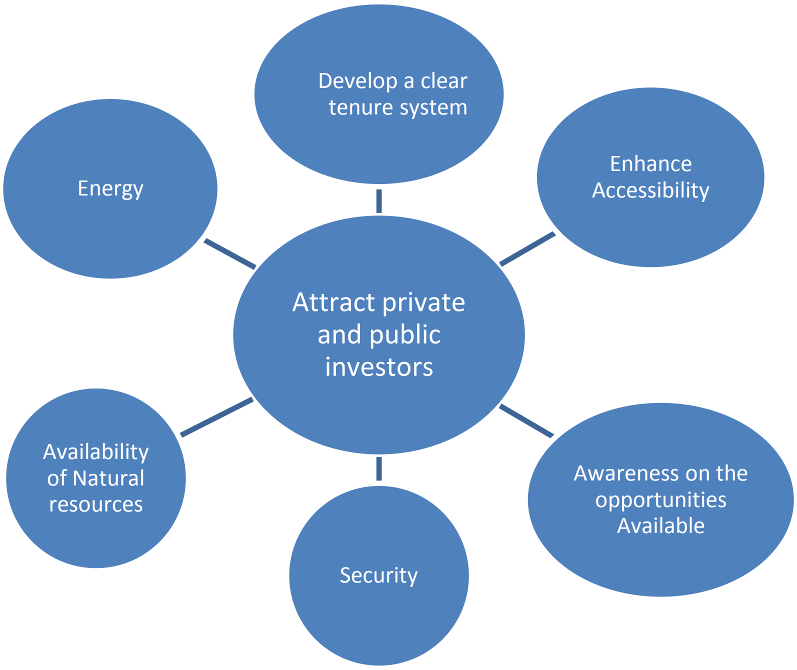
	use of green Energy	(≤ 1 year)	investors
	• Develop policies to enforce the Use of green energy	• Short term (≤ 1 year)	• NGOs, CBOs, County government, residents, investors
	• Use of Solar energy	• Medium term (5-10 years)	• County Government, investors, CBOs

8.3.1.4 Increase the Vegetation Cover

Action Plan	Implementation Strategies	When?	By Who?
Increase the vegetation Cover	• Develop green buffers separating industries from the rest of the town	• Short term (1-4 years)	• County Government
	• Preserve the existing forest	• Long term	• Investors, county government, residents, NGOs, CBOs
	• Create Awareness on the importance of the green buffers	• Short term (1-4 years)	• County Government, investors
	• Develop policies to enforce the development of green buffers	• Short term (1-4 years)	• NGOs, CBOs, County Government, residents, Investors

8.3.2. Attract Public and Private Investors

To attract public and private investors, the following actions need to be taken:



8.3.2.1 Develop a Clear Tenure System

Action Plan	Implementation Strategies	When?	By Who?
Develop a Clear Tenure System	• Legalizing land ownership	• Short term (1-4 years)	• County Government
	• Develop policies to curb illegal land transfers	• Short term (1-4 years)	• Investors, County Government, residents, NGOs, CBOs

8.3.2.2 Enhance Accessibility

Action Plan	Implementation Strategies	When?	By Who?
Enhance Accessibility	• Construct intercity roads within the towns and connecting the different towns in the region	• Medium and Long term	• County Government
	• Encourage Mixed use	• Short	• Investors, County

	within the different centers	term	Government, residents, NGOs, CBOs

8.3.2.3 Create Awareness on Available opportunities

Action Plan	Implementation Strategies	When?	By Who?
Create Awareness of available opportunities	• Advertising	• Short term (1-5years) and continuous	• County Government
	• Hold meetings with prospective investors	• Short term (≤5 years)	• Investors, County Government, residents, NGOs, CBOs

8.2.2.4 Enhance Availability of Natural resource

Action Plan	Implementation Strategies	When?	By Who?
Enhance Availability of Natural Resources	• Use of solar Panels	• Short term	• County Government
	• Construction of Rainwater harvesting plant	• Medium term	• Investors, County Government, residents, NGOs, CBOs
	• Use of alternatives such as desalinization, the Nanighi Water	• Long term	

8.2.2.5 Enhance Security

Action Plan	Implementation Strategies	When?	By Who?
Enhance	• Install CCTV	• Short term	• County

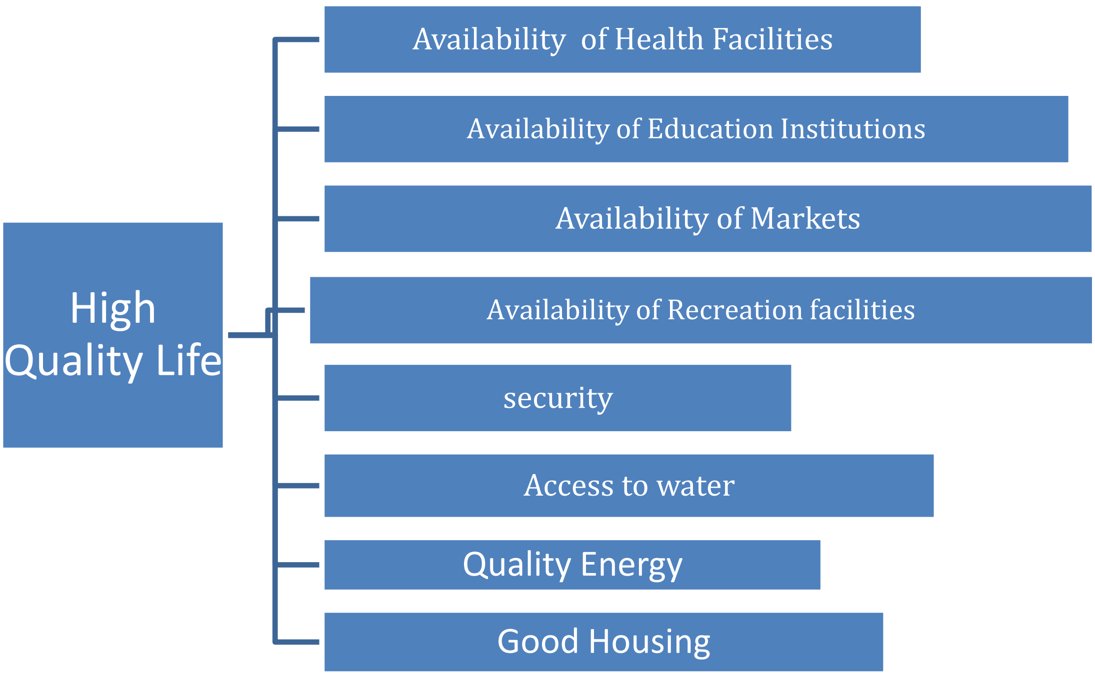
Security			Government
	• Introduce Nyumba kumi Initiative	• Short term	• Investors, County Government, residents, NGOs, CBOs

8.2.2.6 Availability of Energy

Action Plan	Implementation Strategies	When?	By Who?
Provision of Energy	• Use of garbage to provide bio-gas	• Short term	• County Government
	• Use of Solar Panels	• Short term	• Investors, County Government, residents, NGOs, CBOs

8.3.3. High Quality Life

The Integrated Lamu Metropolitan Area Structure Plan is focused on providing high quality life to the current and future residents.



8.3.4. Health Facilities

Action Plan	Implementation Strategies	When?	By Who?
Provision of Health Facilities	• Build Sub-County hospitals within the towns	• Short term	• County Government
	• Provision of Ambulances per town center	• Short term	• Investors, County Government, residents, NGOs, CBOs
	• Provision of medical staff and medicine		
	• Provision of access roads to the hospitals		
	• Construction of dispensaries		
	• Encourage private investors		

8.3.5. Educational Institutions

Action Plan	Implementation Strategies	When?	By Who?
Education Institutions	• Construction of primary schools and pre-schools within the settlements	• Short term	• County Government
	• Construction of secondary schools	• Short term	• Investors, county government, residents, NGOs, CBOs
	• Construction of colleges and	• Short	

	universities	term	
	• Provision of Staff		
	• Construction of public library		
	• Construction of research centers		

8.3.6. Recreation facilities

Action Plan	Implementation Strategies	When?	By Who?
Recreation Facilities	• Designing and development of public parks within the neighborhoods	• Short term	• County Government
	• Construction of a stadium	• Short term	• Investors, County Government, residents, NGOs, CBOs
	• Introducing a variety of sports and gymnastic stations		
	• Construction of Social Halls		

8.3.7. Security

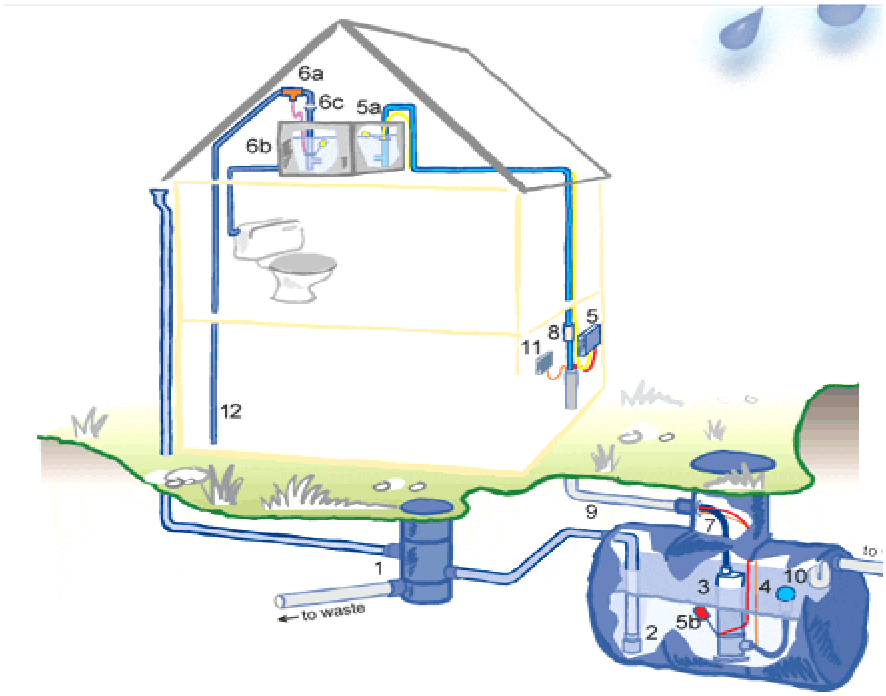
Action Plan	Implementation Strategies	When?	By Who?
Security	• Install CCTV cameras	• Short term	• County Government
	• Use of Nyumba kumi initiatives.	• Short	• Investors, County

		term	Government, residents, NGOs, CBOs
	• Install patrol systems		
	• Increasing number of police posts in the area		

8.3.8. Water

Action Plan	Implementation Strategies	When?	By Who?
Provision of Water	• Identify other sources of fresh water	• Short term	• County Government
	• Construct water pipelines connected to the houses	• Short term	• Investors, County Government, residents, NGOs, CBOs
	• Construct water harvest system for each house (policy)	• Short term	

Plate: Example of Proposed Water Harvesting System per House



Source:

8.3.9. Energy

Action Plan	Implementation Strategies	When?	By Who?
Energy	• Installing the solar systems per house	• Short term	• County Government
	• Use of Bio-gas	• Short term	• Investors, County Government, residents, NGOs, CBOs

8.3.10. Housing

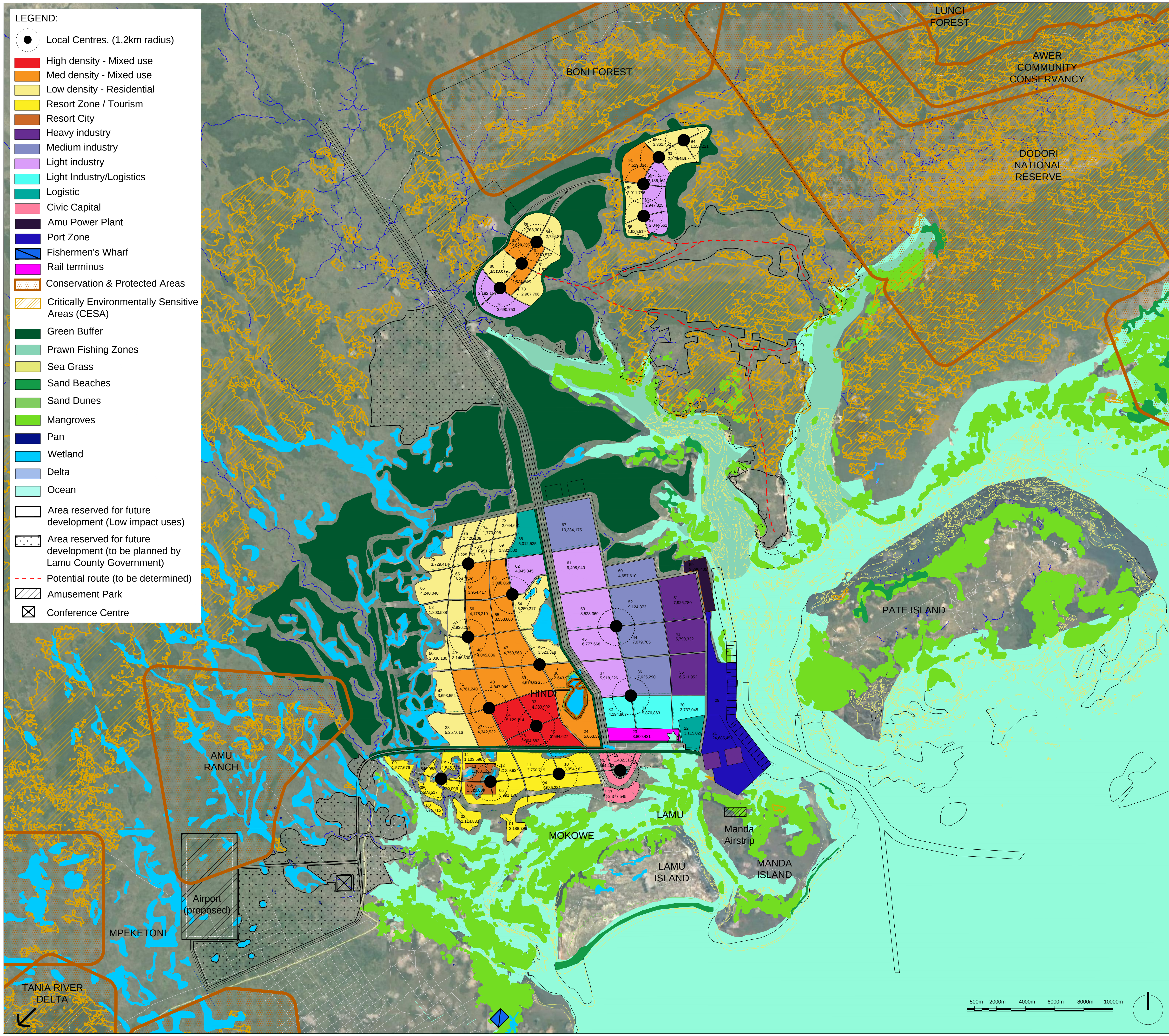
Action Plan	Implementation Strategies	When?	By Who?
Housing	• Affordable houses	• Medium term	• County Government

	• Good drainage system	• Short term	• Investors, County Government, residents, NGOs, CBOs

8.3.10 Markets

Action Plan	Implementation Strategies	When?	By Who?
Markets	• Identify a market area per town	• Short term	• County Government
	• Construct market stalls	• Short term	• Investors, County Government, residents, NGOs, CBOs
	• Construct access roads to the markets	• Short and medium term	• County Government

REFERENCES



REPUBLIC OF KENYA

LAPSSET CORRIDOR PROGRAM

PRELIMINARY MASTER PLAN FOR LAMU PORT CITY AND INVESTMENT FRAMEWORK

PHASE III DEVELOPMENT SCENARIO

KENYA VISION 2030
TOWARDS A GLOBALLY COMPETITIVE AND PROSPEROUS NATION

SPONSOR: United Kingdom Government
British High Commission
P.O. BOX 30465-00100
Upper Hill Rd, Nairobi City, Kenya

CLIENT: LAPSSET Corridor Development Authority
Chester House Building
P.O.BOX 45008-00100
Koinange Street
Nairobi, Kenya

Sign……………………Date: …………………………
Director General/CEO

CONSULTANT: WS Atkins International Ltd
30th Floor (N) Euston Tower,
286 Euston Road, London, NW13AT

COUNTY GOVERNMENT OF LAMU
P.O Box 74-80500
LAMU

Sign……………………Date: ……………………
County Secretary

CERTIFICATE
I certify that the Plan has been prepared and published as per the requirements of the Physical Planning Act Cap 286 and the County Government Act 2012
Name of the Physical Planner……………………………………………
Signature……………………………………Date…………………………

N

Drawing Title: Preliminary Development Plots / Land Uses
Scale: 1:250.000 at A3
Date: 28-March-2017
Prepared by: Richard Ainsley, MRTPI

PLAN REFERENCE No: NB: To be assigned by the National Director of Planning)

MINISTRY OF LANDS AND PHYSICAL PLANNING

CERTIFIED

Sign…………………………Date: …………………………
Director of Physical Planning

APPROVED

Sign………………………… Date: …………………………
Cabinet Secretary for Lands and Physical Planning

APPROVED DEVELOPMENT PLAN No: