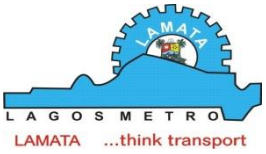

Consultancy Services for the Extension of the Strategic Transport Master Plan and Travel Demand Model to Cover the Mega City Region

FINAL REPORT

ALG TRANSPORTATION INFRASTRUCTURE & LOGISTICS

europraxis

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1 Introduction

This document is one of the deliverables included in the Terms of Reference, and serves as the Final Report for the: “Extension of the Strategic Transport Master Plan and Travel Demand Model to Cover the Mega Region in Lagos, Nigeria”. The project is financed by the International Development Association (IDA), and the agency responsible for the implementation is the Lagos Metropolitan Area Transport Authority (LAMATA).

Within the project framework, ALG-AEC Consultants have extended the Strategic Transport Demand Model (STDM) both geographically (so as to cover the Megacity Region) and time-wise *i.e.* considering the transport system up to the year 2032.

The extension of the STDM requires a consistent and integrated transport policy that covers all areas of Lagos State. This document summarizes the progress made on seven key activities to achieve the objectives of extending the STDM:

- **Definition of a proposal for road network and public transportation.** This proposal is the result of the harmonizing of all the existing urban and transport planning documents for the different sub-regions in Lagos Megacity, while carrying out a comprehensive urban dynamics analysis and running a final test with the transportation model. This whole process has resulted in changes to the said planning documents through the modification of existing proposals, the inclusion of new ones, and the suppression of overlapping projects.

- **Freight Transportation Plan**. The main objective of this plan is to describe freight movement within the Megacity and make recommendations in order to improve the operation of the Megacity’s freight transportation system. These recommendations include the proposal to prioritise specific corridors for freight transportation and the establishment of freight distribution centres within the Megacity, amongst others.

- **Non-Motorised Transport Plan**. The non-motorised transport (NMT) modes represent an important element for the adequate articulation of a multi-modal transportation system in Lagos: they allow the completion of the door-to-door transportation chain and at the same time contribute to the reduction of environmental externalities. The current Final Report includes a draft plan for NMT in Lagos, establishing the basic domains of action in a selection of urban areas within the Megacity.

- **Road safety plan**. This entails establishing guidelines to improve the safety and security for users of all transport modes, especially NMT, through the creation of a pedestrian- and bicycle-friendly urban environment, as well as providing adequate law enforcement and efficient health care systems. Furthermore, this plan must be supported by appropriate statistics through an adequate data collection and analysis system.

- **Climate Change Plan.** Lagos State is committed to the existing international directives regarding climate change. The potential effects of sea-level rise in a city like Lagos (taking into account both its geographical location and its position as one of the fastest growing mega-cities at the peak of its population growth), together with the fact that transportation is one of the main contributors to greenhouse emissions, makes it necessary to analyse the implications of the project's proposal in the climate change domain. A specific chapter of the current Final Report will focus on the baseline criteria for the ultimate evaluation of the proposal in this particular framework.

- **Economic Analysis**. In 2009, LAMATA developed a CBA model that takes results from a transport demand model, quantifies the value of the benefits, assesses the costs to reach them, and calculates the main scenario indicators of attractiveness. In the framework of the current technical assessment, this spreadsheet model has been updated with economic data that reflects the current economic situation in the region, paying particular attention to useful criteria for assessing public transport in the region. The outputs from the cost-benefit analysis have been one of the elements used to evaluate the defined scenarios, as well as a selection of projects with a particular relevance to short-term investment and implementation.

- **Institutional Proposal.** One of the key-elements for the successful implementation of the STMP extension proposal is an adequate institutional proposal. The final chapter of this Report develops a diagnosis of the current institutional framework for Lagos' Transportation system; it also proposes the required changes to establish a new institutional scheme for the planning, management and funding of metropolitan multi-modal transport projects at the state and interstate level.

Besides the aforementioned seven domains of analysis, the Final Report also includes an **Action Plan** for an implementation period of 3 years, including key-actions in the infrastructure, institutional and operational domains.

The resulting chapter structure of the report reflects all these areas of analysis and proposals:

- Chapter 1. Introduction
- Chapter 2. Diagnosis of the Current Situation
- Chapter 3. Definition of a proposal for Road Network and Public Transportation
- Chapter 4. Development of a Freight Plan for the Megacity
- Chapter 5. Non-Motorized Transport Plan
- Chapter 6. Road Safety Plan
- Chapter 7. Climate Change Plan
- Chapter 8. Cost-Benefit Analysis
- Chapter 9. Institutional Proposal
- Chapter 10. Action Plan

2 Diagnosis of the Current Situation

2.1 The Challenges of a Megacity

Lagos is internationally appraised as a Megacity with great influence on the African continent. Its rapid development, especially since the 1960s, is shown in the figure below. The transformation from a settlement in Lagos Island to a massive urban expansion beyond the traditional metropolitan boundaries is well-apparent. Lagos is expected to overtake Cairo as the biggest city in Africa by 2015, reaching a population of over 30 million people by 2030. It also represents the gateway to Western Africa, with a remarkable potential as a transportation and economic hub.

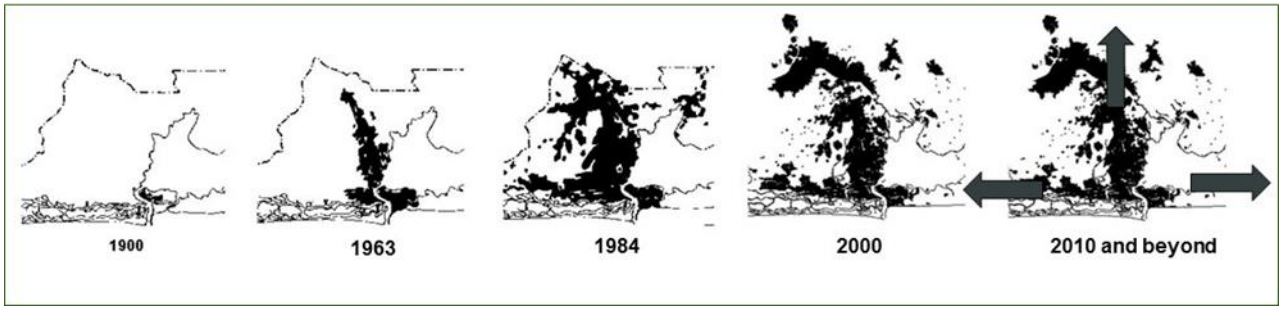


Figure 1. Lagos' urban expansion

Source: Ministry of Physical Planning/Environment; LAMATA GIS Database

However, Lagos' accelerated demographic expansion cannot continue without appropriate planning. Up till now, the rapid dynamism of this city has not been accompanied by adequate urban and transport development policies. Lack of planning has led to the proliferation of slums, degradation of urban areas and facilities, and transportation problems affecting all modes including:

- Neglected infrastructure
- No real alternatives to road transportation
- Insufficient capacity and inadequate road hierarchy
- Inadequate and insufficient link roads and bridges
- Unregulated street trading
- Inadequate traffic management
- Absence of a parking strategy
- Safety and security issues

This situation has led to a state of growing congestion, which represents a major challenge for the Megacity.

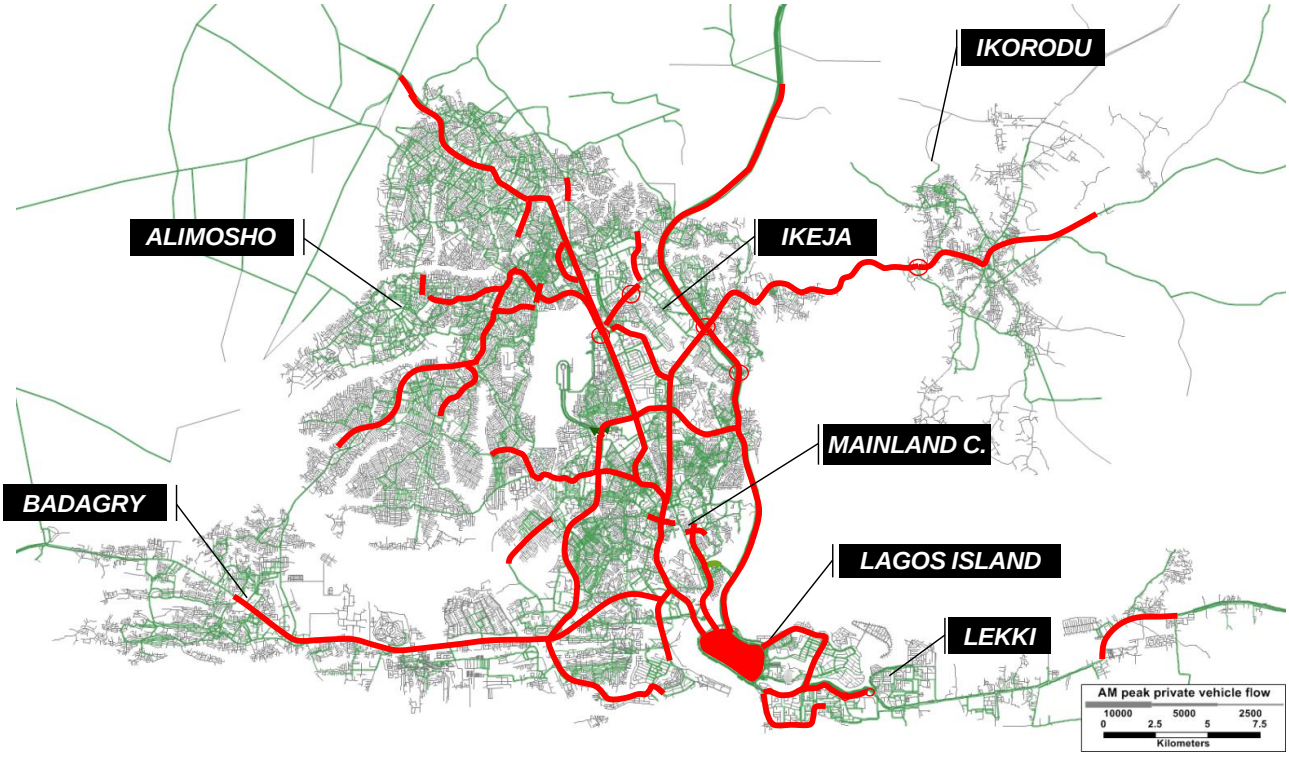


Figure 2. Current state of congestion in Lagos' road network

Source: ALG

An inadequately regulated and structured public transportation system does not help in easing the current congestion problem. In Lagos State, the public transportation system is a highly fragmented sector, which comprises of many un-regulated routes (concentrated along the main corridors). Majority of the public transport providers use mini-buses (Danfos) leading to an inefficient public transport service which is largely responsible for the modal change from public into private transportation.

The use of the mini buses itself generates additional congestion resulting in the degradation of the public transportation system in Lagos. The outcome of all this is a chaotic transportation system where the use of private vehicles becomes the best option and congestion becomes a recurrent problem.

Besides, Lagos represents a key-industrial centre in Nigeria, as well as a gateway for the delivery of many of the consumer products in several states across the Federation (Lagos State inclusive). This is responsible for the growing number of freight vehicles along the main transport corridors in Lagos Megacity area. Most of these freight movements are strongly linked to Lagos' Ports and industrial areas in locations such as Apapa, Ikeja and Ikorodu.

These freight vehicles have to share the existing road infrastructure (which is badly maintained and inadequate for freight traffic) with passengers. There are also insufficient distribution centres, warehouses, parking areas and other facilities. In brief, the Megacity does not have the basic infrastructure for a proper organization of freight movements.

In addition, the freight fleet is old and poorly maintained. Also, there is inadequate institutional framework in place (regulation, capacity building). All these conditions raise serious concerns on a number of issues such as:

- Safety and security
- Pollution
- Accidents
- Increased congestion, particularly around Lagos Ports and along the main Megacity corridors

In conclusion, there is need for an urgent urban and transport development plan (with clearly stated lines of action) in Lagos Megacity, in order to address the continuous degradation and congestion of the transport system. No action will not only lead to the extension of the current congestion levels of the whole transport network in the Megacity, but will also result in the loss of a unique opportunity to develop the Mega-city as the key-economic hub of Africa.

2.2 An urgent response is needed: STMP Extension Project

A unitary and comprehensive urban and transport development plan must be defined for the Megacity. This report extends the 2009 STMP not only geographically, but also introduces a new conceptual approach in accordance with the complexity of metropolitan dynamics as highlighted below:

- A significant number of trips come in daily into metropolitan Lagos from the furthest areas of Lagos State and some parts of Ogun State. These must be taken into account, hence the study area covers the entirety of Lagos State and some parts of Ogun state (corresponding to the Development Pressure Area, which extends to Ifo and Shagamu)
- All the components of Lagos mobility must be considered: Road planning, public transport integration and urban freight.
- All the existing planning documents, for the Model City Plans and Master Plans across different sub-regions of the Megacity, must be considered in order to establish a harmonized, unitary vision for the Megacity in the long term.

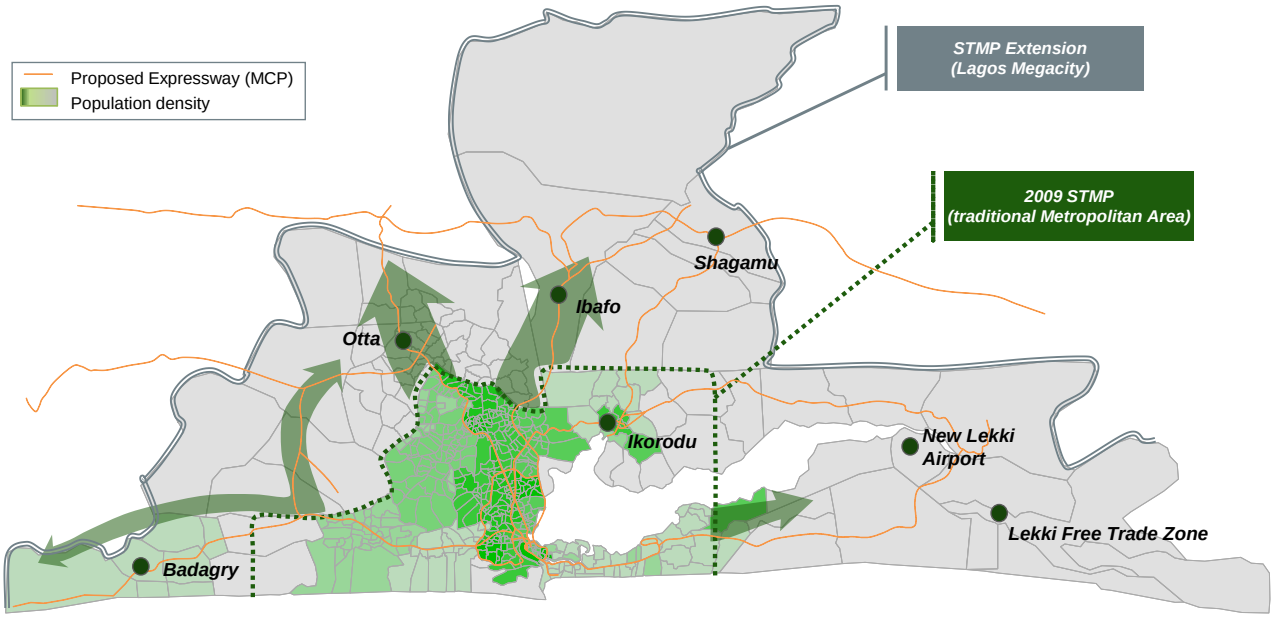


Figure 3. Study Area for the STMP Extension with main road network and population densities

Source: ALG

This report explains the methodology and main outcomes of this approach, namely: the road network and public transport proposal, the freight plan, other proposals related to non-motorized transport, road safety, climate change and institutional framework. Besides, this report includes a chapter on the cost-benefit analysis of the road network and public transport proposal, in order to outline its social value to the policy-makers, and assess the financial possibilities regarding the selection of projects for short term implementation.

3 Definition of a Proposal for Road Network and Public Transportation

3.1 Introduction: Methodology

The road network and public transport proposal for the Megacity has been built on the basis of a three-step methodology:

The first step is the definition of a vision for the long-term Megacity and its evolution over time. A key-activity in this regard is the revision of all the existing Model City Plans and Master Plans (from now on, MCPs) for the different sub-regions of the Megacity. The report has focused primarily on the urban development models, individually, and then putting all the plans together in order to assess their coherence and prepare a harmonized land use map for the megacity.

During this harmonization process, the methodology adopted required putting together all the road network and public transportation proposals of the said planning documents, focusing on their coherence, in order to define a harmonized map of proposals. A thorough analysis has been undertaken at this point in order to fill up all the existing gaps not covered by the available MCPs.

The second step is to determine how this harmonized, unitary vision for the Megacity "moves". This was done through the identification of the main urban centres of the future Megacity and conducting an analysis of the subsequent urban dynamics. The harmonised land use map has been fundamental in this regard. Additionally, more recent sources have also been consulted in order to include new urban development proposals.

The urban centres represent key mobility attraction-generation areas in the Megacity and will therefore generate the most notable mobility trends in the Megacity. This analytical process from urban centre to mobility trends is also called *relational analysis*.

The third step is the translation of the Megacity's mobility dynamics into the transportation network. This has led to the identification of the priority corridors which should serve the said mobility trends on the basis of the future road network. The resulting list of corridors, which actually represents the basis for the proposal, have been distributed into three different time horizons (2017, 2022, 2032) in accordance with the harmonized urban development model that has been adopted, together with the infrastructure projects that will have to support it.

It must be noted that at this stage the transportation model has played a significant role in the preliminary evaluation of the projects, integrating the proposal and their distribution in time horizons (2017, 2022, 2032). Regarding the evaluation process, some projects initially considered in the proposal have been discarded, due to alignment overlapping in most cases.

The resulting proposal, materialized into the final Road Network Plan and the Public Transportation Plan for the Megacity, which will be explained in this Report.

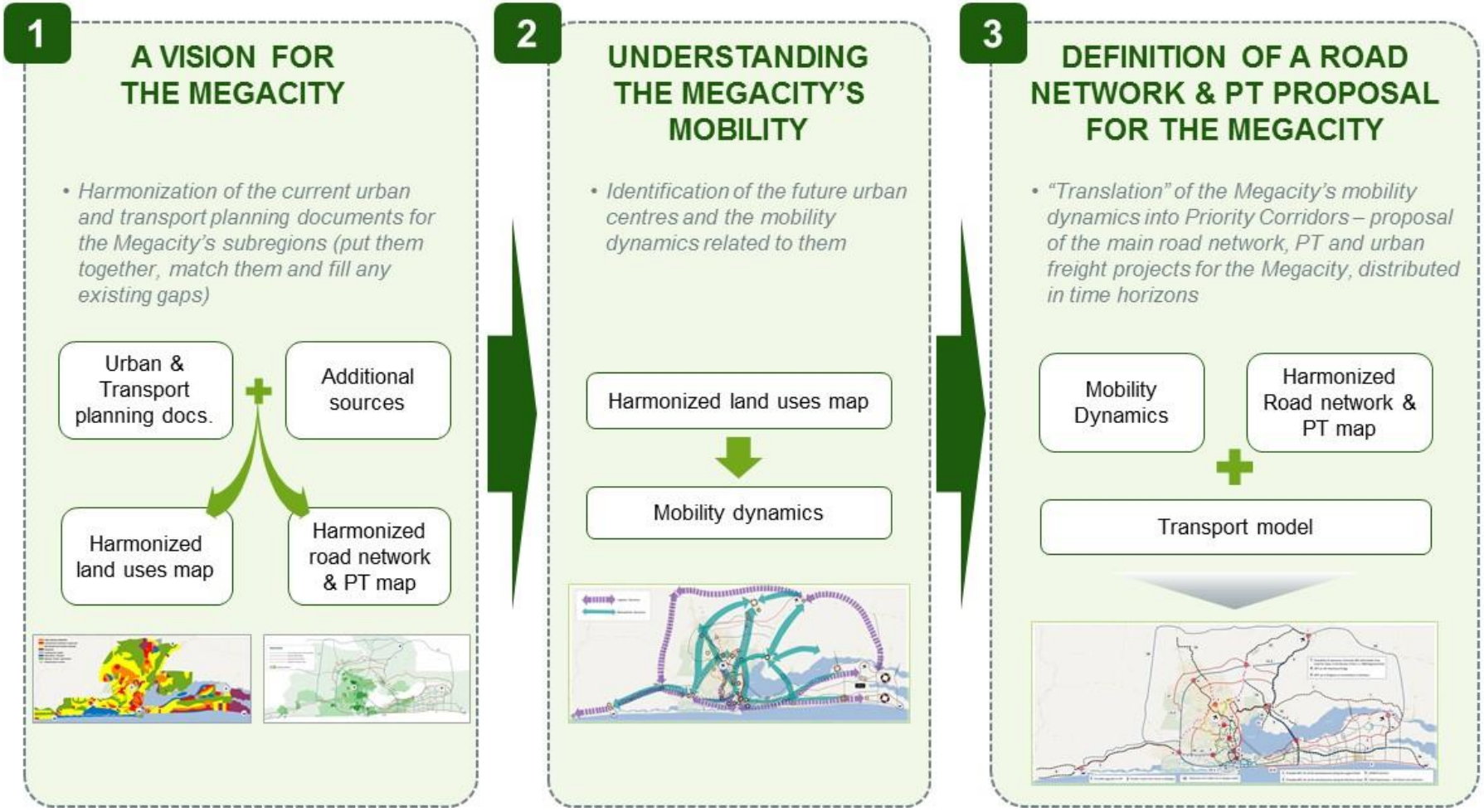


Figure 4. Main Steps of the Methodology

3.2 A Vision for the Megacity

3.2.1 A harmonised land use map for the Megacity

The following Model City Plans and Master Plans available to date were reviewed:

- Lagos Island CBD revitalisation & Marina City Development Project (2006)
- Ikoyi-Victoria Island Model City Plan (2005-2015)
- Mainland Central Model City Plan (2010-2030)
- Ikeja Model City Plan (2010-2020)
- Alimosho Model City Plan (2010-2020), draft
- Badagry Master Plan (2010-2030)
- Ikorodu Master Plan (2010 – 2020), draft
- The Comprehensive Infrastructure Master Plan for Lekki Sub-Region (2010 - 2030)
- Ogun State Regional Plan (2005 – 2025) and Development Pressure Area (DPA) Report
- Apapa Model City Plan (2012-2022), draft
- Agege Ifako – Ijaye, draft

In order to adequately harmonise the proposals in the above plans, the timeline differences amongst the various plans were assessed. Some of them had been completed and included detailed proposals for the road network and public transportation lines. Others were ongoing and only draft documents were available. Most of these drafts included proposed plan that is detailed enough for the purpose of the analysis, but in some cases (like Ikorodu) the information available included no proposal at all. In order to fill these gaps, the Lagos State Regional Plan 1980-2000 was reviewed.

There were also differences concerning the contents of the urban development proposals. Two main groups of plans were distinguished in this regard:

- Plans affecting consolidated urban areas (Lagos urban core): Residential densification, rationalisation of the urban pattern and modifications of the original STMP proposals (alignments basically) in order to respond adequately to these urban development actions.
- Plans defining new development areas (new areas of expansion). These new developments generally lead to the proposal of extensions of the STMP proposals.

However, these conceptual differences are actually connected by a common model of urban development, with its main elements being: Balance of urban uses, residential densification, mixed usage areas and corridors, introduction of new centres of activity and employment, encouragement of recreation and tourism uses where there is potential for it.

Despite the timeline differences and the gaps existing in some areas of the Megacity, there is coherence amongst all the plans. This has helped in preparing the harmonised land use map for the Megacity shown in Figure 5. The figure below shows the future land use map for the mega city based on an integration of the Model City and Master plans.

Figure 6 below shows the existing land use Plan 2002 based on the revision of the Lagos State Regional Plan 1980-2000 in comparison to Figure 5. The first difference between the harmonised map and the one corresponding to the Regional Plan is in the extension of the areas considered: The harmonised map includes all the additional areas corresponding to Ogun State Development Pressure Area (DPA) Northbound.

There are also clear differences in the urban development proposals, for instance: The harmonised map shows a multi-centre urban development in Badagry that does not exist in the Regional Plan. The same can be said of the ambitious new developments foreseen in Lekki, the detailed proposal in Lagos urban core (including urban development corridors in Mainland Central) and the developments proposed for Ogun DPA. Industrial and logistics developments are also more notable in the current plan (particularly in Lekki). Finally, there are also new proposals concerning transportation nodes (airports in Shagamu and Lekki; seaports in Badagry and Lekki), which will lead to a notable increase in passenger and freight mobility which will accelerate the integration of the current Megacity boundaries.

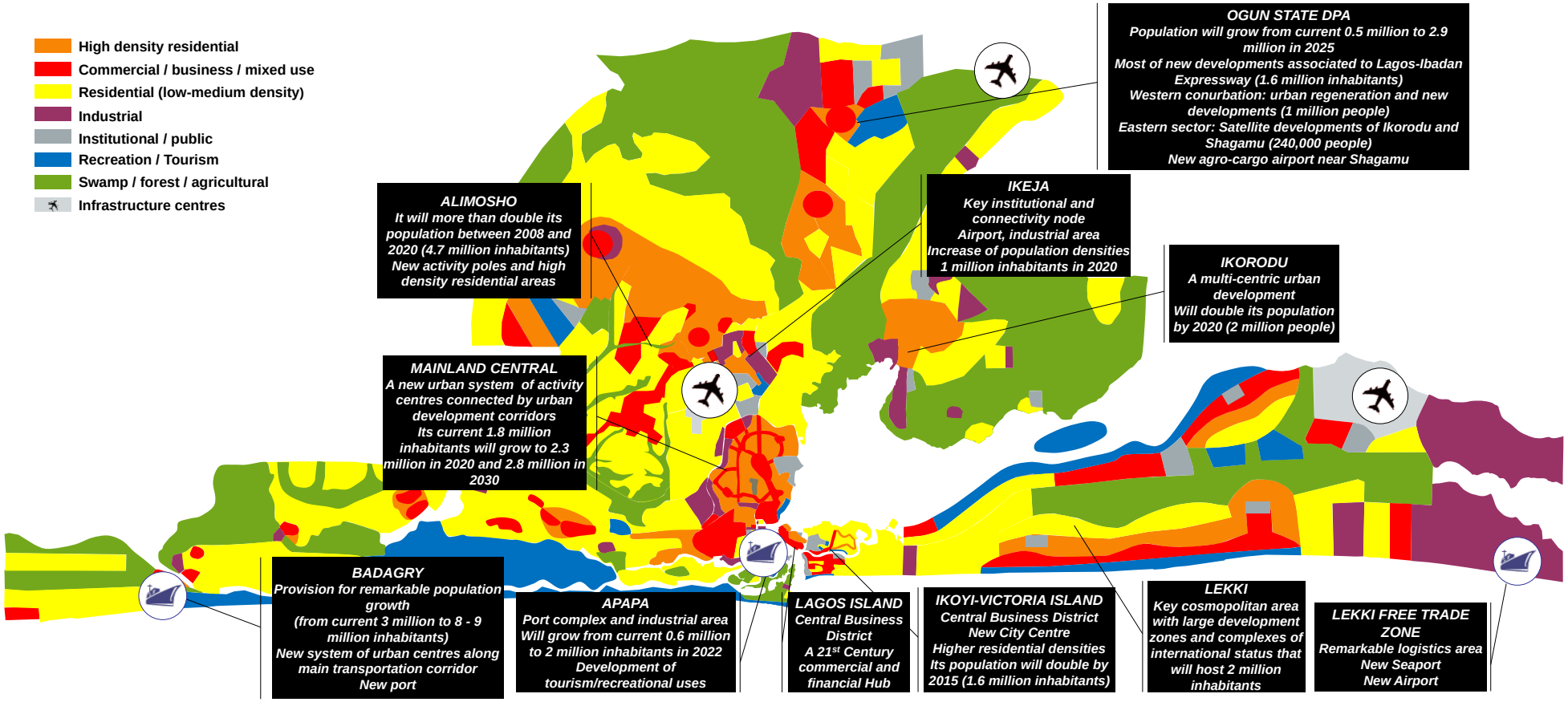


Figure 5. Integration of the Model City and Master Plans: Future Land Use Map for the Megacity

Source: ALG

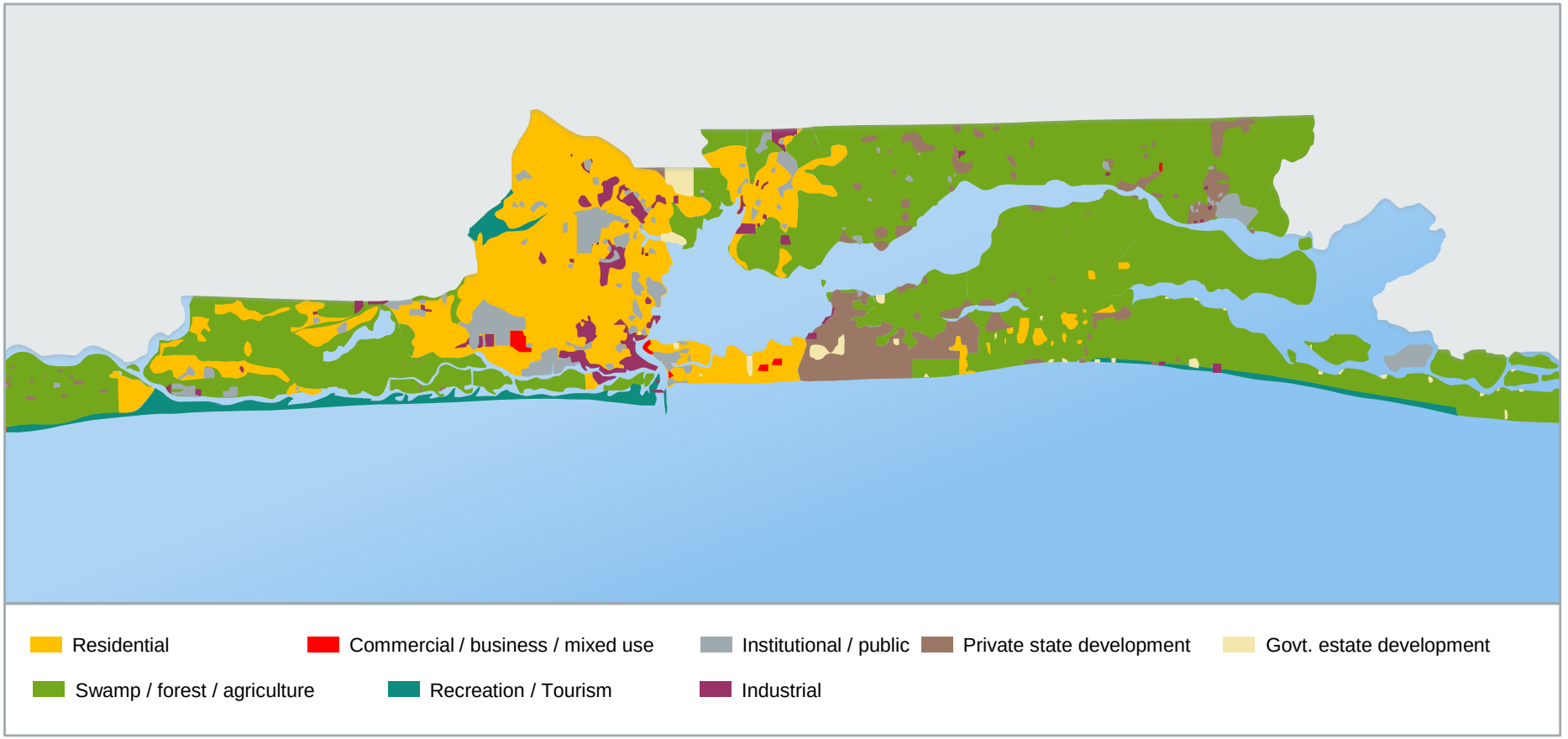


Figure 6. Revision of Lagos State Regional Plan: Existing Land Use Plan 2002

Source: ALG from the Revision of the Lagos State Regional Plan 1980-2000

3.2.2 Proposed infrastructure from the harmonisation process

3.2.2.1 Road Network

A harmonization analysis of all the road networks and public transportation proposals from the MCPs has been carried out.

The current urban settlements of each sub-region have determined the associated urban development proposals (and consequently the proposed road network). For instance, the road network proposals with respect to the new developments in Lekki sub-region are much more ambitious (five new bridges including the 4th Mainland Bridge; four major east-west primary roads, five north-south roads) than the ones corresponding to the Badagry sub-region, which are based primarily on pre-existing urban settlements and road networks.

However, there is a strong coherence between all the proposals. This coherence is found in the criteria that support them: Improvement of network capacity, connectivity and regional accessibility; road network upgrading and hierarchy; traffic management; parking strategy.

Figure 7 shows the most important road infrastructure proposals from the MCPs, comprising of basically expressways and primary roads (those that are relevant for the definition of priority corridors on a Megacity scale). All these proposals will serve two major needs of the Megacity:

- Strengthening the current radial commuting connections towards Lagos urban core.
- The establishment of transversal connections that will serve both long distance traffic (avoiding the metropolitan traffic) and also other connections within the Megacity which are not Lagos bound.

3.2.2.2 Public Transportation Network

The harmonisation of the public transportation proposals has also been done on the basis of the existing MCPs. As stated earlier, these proposals can be categorised into two main groups:

- In the most consolidated urban areas of the Megacity (Lagos urban core), the proposals consist basically of re-adjustments and additions to the original STMP projects, in order to offer better service to new activity centres and regeneration areas.
- Regarding new developments (expansion of Lagos urban core towards the whole of the Megacity area) the proposals consist of extensions to the STMP proposals. These extensions represent the first step towards the establishment of a system of corridors for the Megacity.

Figure 8 shows the main expansion corridors identified during the harmonisation process:

- To the west, the Badagry corridor would be strengthened not only through an extended land transportation corridor but also through the new inland waterways routes.

- To the North, two main corridors would connect Lagos and Ogun States: One up to Ifo (extension of the STMP Red Line) and the other one up to Shagamu (extension of the Purple Line).
- To the East, inland waterways connections between Ikorodu sub-region and Lagos Island/Ikoyi-Victoria Island would be improved.
- Finally and also to the East, the Lekki sub-region and its outstanding urban developments would be inter-connected through an extension of the LRT Green Line reaching the new Lekki Airport.

It must be noted that the MCP proposals for public transport focus on the Lagos-inbound mobility and are strongly based on the STMP network proposal, with slight modifications or additions.

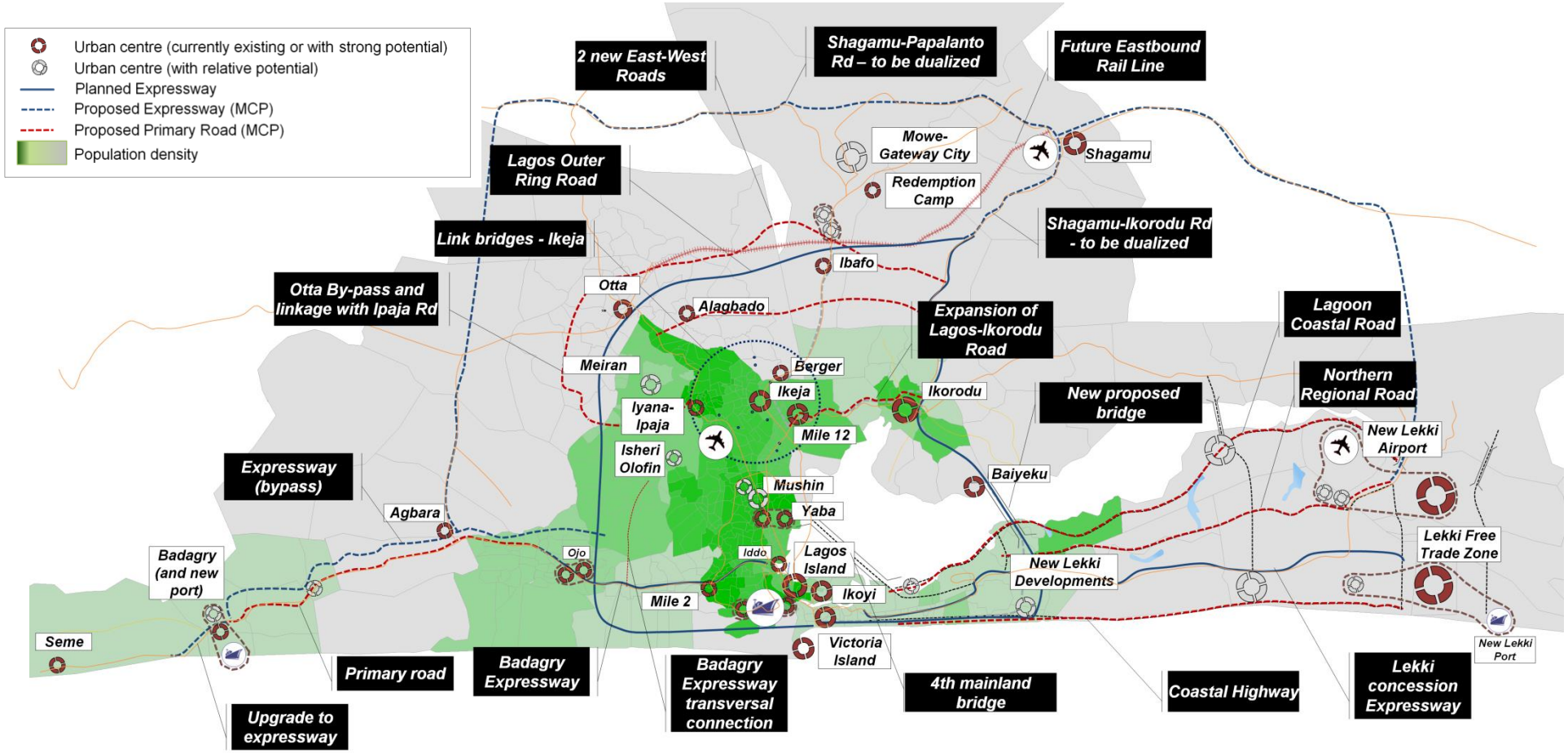


Figure 7. Proposed road Infrastructure from the Harmonization Process

Source: ALG

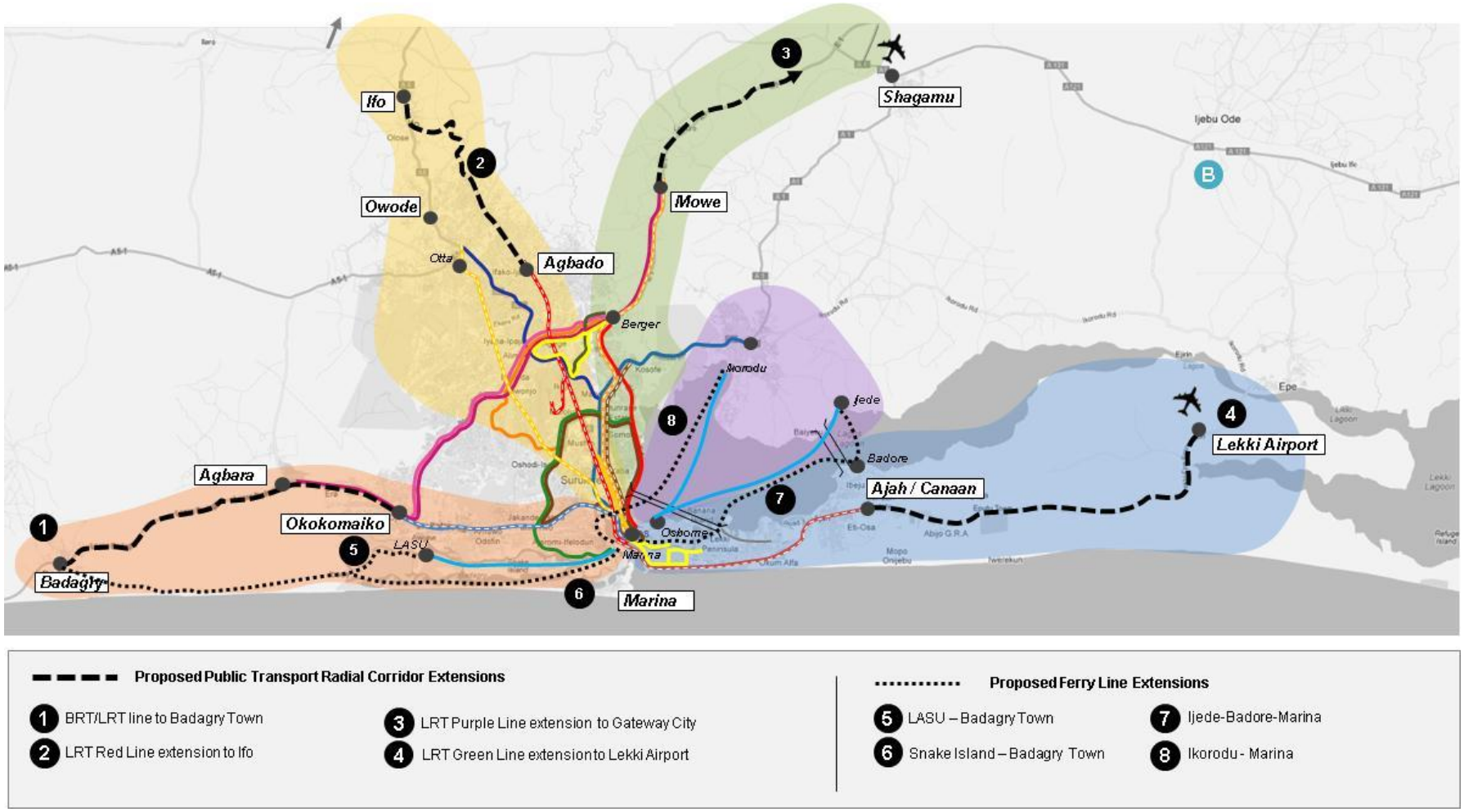


Figure 8. Harmonized proposal for Public Transportation

Source: ALG

3.3 Understanding the Megacity's Mobility

3.3.1 The basic elements of urban dynamics analysis

Lagos Megacity represents a dynamic system. The understanding of its dynamics is fundamental to any further proposals concerning land-use and transportation.

Urban dynamics is a complex system with several components:

- Land use: This is the most stable component. It only changes when land-use planning is updated. The city's land-use structure determines the location of residential, industrial, commercial areas, etc.
- Employment and workplaces: Their location is key to the definition of a very important component of the city's mobility.
- Population and housing: People commuting to and from their work or study place, as well as to their shopping malls, markets, religious landmarks, etc. will originate from residential areas.
- Transport network: This is a physical component strongly linked to accessibility. It also represents the backbone for the city's movements.
- Movements: Refers to people going from one location to the other for different reasons: work, study, shopping, leisure, etc.

The articulation of all these elements is a complex task as they interact with one another and are simultaneously influenced by external factors. In order to define the urban dynamics of Lagos Megacity, a simplified model has been adopted:

- The main trends of the Megacity's urban dynamics are determined by the connection between its residential areas and the key urban centres where employment and commercial activities as well as transportation connections are concentrated.
- These mobility trends will be channelled through transportation corridors.

Therefore, the basic work elements for the preparation of Lagos megacity's urban structure map will be the following:

- Identification of all the future urban centres of the Megacity
- Completion of the future road and public transportation network
- Relational analysis: Definition of the main mobility dynamics connecting residential areas and urban centres on the basis of the future road and public transportation network.

The Model City Plans represent the main source of information for the identification of the Megacity's future urban centres and transportation network; however they are not the only source. Other sources have also been consulted in order to fill certain "gaps". These sources include:

- New urban development projects not included in the MCPs, for instance the Eko Atlantic City.
- Certain sub-regions without a finished MCP, such as Ikorodu.
- Specific public transportation modes, such as Inland Waterways, in which more recent and extensive planning has recently been developed by LASWA.

This has led to consultations with the institutions responsible for these new projects and plans, as well as the development of specific field survey missions.

With all these elements identified and examined, the next step is the relational analysis.

3.3.2 Identification of urban centres

As described above, a key element in the relational analysis is the identification of the Megacity's future urban centres. It must be noted that our definition of an urban centre is rather restrictive and therefore a limited number of them have been identified in the city:

- Areas with high concentration of commercial activity (several major markets, a combination of mixed-uses and market, etc.)
- Transportation hubs
- Transport infrastructure nodes (airport, port) with commercial/industrial activity associated
- Areas with high concentration of institutional uses

However, considering the massive area span of the Lagos Mega-city region, it is imperative that a relatively high number of urban centres are identified. These are shown in Figure 9 and could be summarized in accordance with the points below:

- Urban centres located in Lagos urban core: Consolidation of current centres (Lagos Island, Ikoyi-Victoria Island, Apapa) and development of new ones (Eko Atlantic City, Yaba/Mushin in Mainland Central…)
- Badagry sub-region: Consolidation of the current centres in Badagry, Mile 2 (transportation crossroad) and Ojo (key employment centre in Lagos) as well as the establishment of new ones; roles associated with the sub-region, and economic dynamics (industrial production, warehousing and distribution of agricultural products coming from Ogun into Lagos urban core): Agbara, Mowo, Ajara.
- To the North, development of new centres at the current conurbation located on both sides of the Lagos-Ogun border (towards Otta and Alagbado) and also at the future urban developments associated with Ibafo-Mowe and Shagamu in Ogun State.
- To the East, development of Ikorodu as a new metropolitan centre, together with the transportation terminal at Baiyeku. At the other side of the Lagoon, Lekki sub-region will host

several centres of international and regional status, as well as key industrial, transport and logistics centres associated with the Free Trade Zone developments.

- Finally, the new transportation modes to be located at Badagry (Seaport), Shagamu (Airport), Lekki (Seaport and Airport), that will generate new dynamics in the logistics domain.

3.3.3 Urban dynamics and identification of land priority corridors

The relationship between the most populated areas of the Megacity and its main urban centres will generate the mobility trends that are shown in Figure 10 ("urban dynamics in the future Megacity"), differentiating logistics and metropolitan dynamics.

The logistics dynamics of the future Megacity will be generated by the new transportation modes and industrial developments located in Badagry, Apapa, Lekki and Shagamu. It will be represented by a whole transversal connection surrounding Lagos urban core to the North and following the coast line to the South.

An additional (but equally important) logistics connection will be established between the Murtala Mohammed International Airport and Lagos Port Complex (Apapa – Tin Can Island). The relevance of this corridor will be strengthened not only by the aforementioned transport infrastructures, but also by the development of the Airport City in Mainland Central. It will also have a massive influence on the logistics activities associated with the current industrial land available along the Apapa-Oworonshoki Expressway.

Regarding the metropolitan dynamics (that is passenger movements) two main types of connections can be identified: the radial connections between Lagos urban core and the new expansion centres of the Megacity (Lagos-Ogun conurbation, new developments in the Ogun DPA, Ikorodu, Lekki, Badagry); and the transversal connections facilitated by new road infrastructure such as Lagos Outer Ring Road and the Fourth Mainland Bridge (Ogun-Ojo, Ikorodu-Lekki) and some of the envisaged Mass Rapid Transit (MRT) lines such as the Purple Line.

The "translation" of these mobility trends into the future road and public transportation network will result in the recommendation of a number of priority corridors for different possible actions such as the establishment of MRT services and freight transportation systems prioritisation amongst them. These are shown in Figure 11.

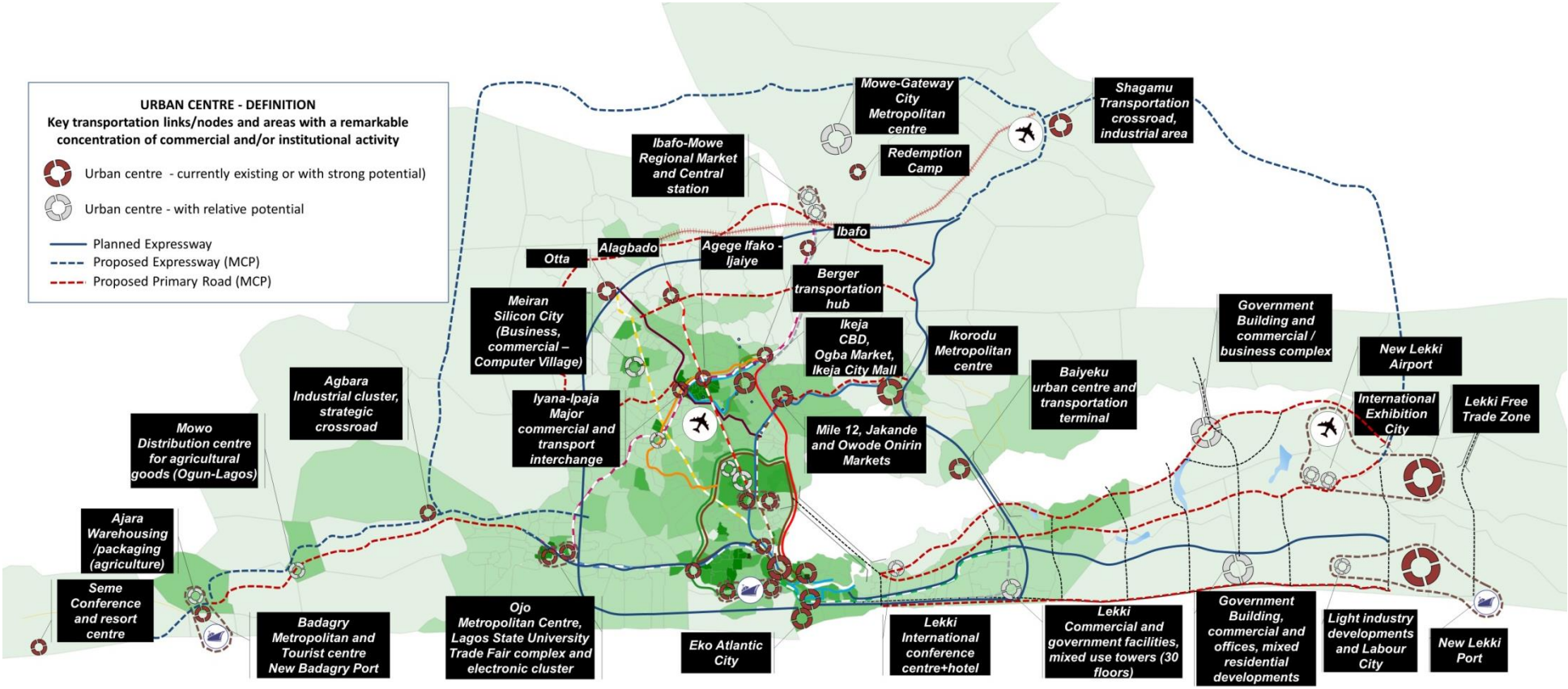


Figure 9. Future Urban centres in the Megacity

Source: ALG

Figure 10. Urban Dynamics in the Future Megacity

Source: ALG

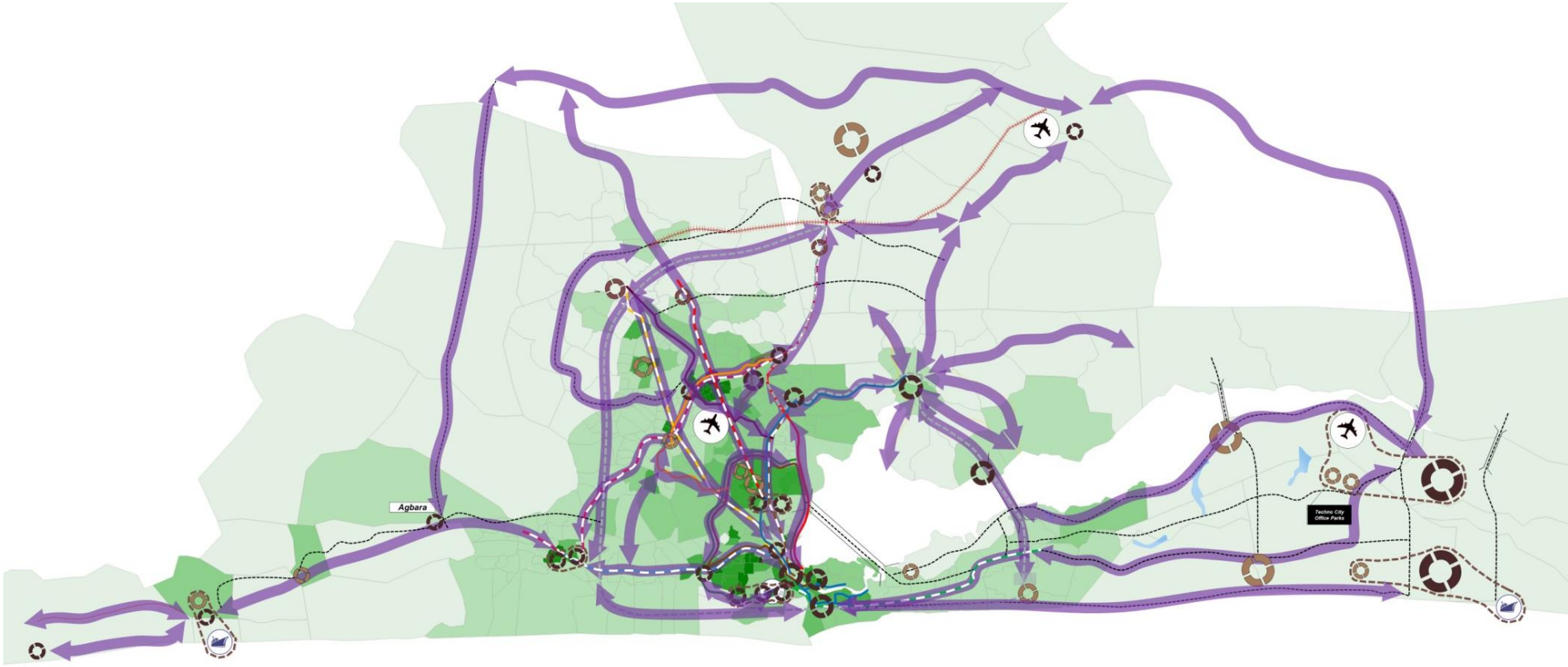


Figure 11. Priority Corridors for the Megacity

Source: ALG

3.4 Definition of a List of Projects for the Megacity

The priority corridors identified in the previous chapter represent the working basis for the definition of the road network and public transportation proposal for the Megacity, taking both land and inland waterways transportation into consideration.

The upcoming chapters will explain all the elements of this proposal.

3.4.1 Projects integrating the priority corridors

A number of road and public transport projects have been identified and harmonized in order to integrate the Megacity's urban dynamics corridors. These projects have originated from:

- **2009 STMP**: Existing proposals for public transport.
- **Model City Plans/Master Plan**s for the sub-regions of the Megacity: Regarding public transportation, mostly radial extensions of the STMP projects (as shown in Figure 8); regarding road network, increase of capacity of the main existing axes and proposal of new transversal connections.
- **New projects currently envisaged by LAMATA** such as the Lagos State Cable Car and the Lagos Island Monorail. These projects have been defined on the basis of an updated view with respect to the needs of these particular areas.
- **New proposals** (identified gaps, network improvements), aimed at a unitary transportation system that adequately responds to the complex OD relations of a metropolitan area.

It is important to note that all the above elements have been analysed following one main objective: To define a road and public transport proposal that efficiently responds to the future Megacity's mobility needs. This has been done through a harmonisation process which started with the revision of the 2009 STMP and the current Model City Plans and Master Plans (putting all the different projects together in a coherent manner) and has continued with the introduction of a number of modifications and additions:

- **Changes in the alignments** of specific STMP projects. This has been the case, for example, of the LRT Yellow line in the Mainland Central area.
- Proposal of new corridors responding to the **"gaps" not covered by the available MCPs**, in the following areas:
  - Ikorodu (no MCP available)
  - Lekki (additional mass transit corridors not proposed in the Master Plan)
  - Apapa (additional connections within the area)
  - Adoption of certain road proposals from the Model City Plans as potential MRT corridors.
- **A multi-modal interchanges** system for the Megacity, in order to better balance the MRT operations/services.

The resulting "package" of projects has been fine-tuned through a succession of tests with the transport model. The TransCAD assignments have shown how the Megacity's mobility demand translates into traffic and passenger loads. The adequacy (or inadequacy) of all the elements of the harmonized road and public transport proposal have been concluded at the end of this process. This has led to the introduction of additional (and final) changes including alignment corrections, suppressions of overlapping projects and addition of new connections.

The resulting proposal is described in the upcoming chapters.

3.4.2 Resulting proposal of land transportation projects

The tables and figures below summarize the proposal of land transportation projects for the Megacity, including the changes due to the transport model validation.

The proposed projects can be grouped as follows:

- Thirteen (13) public transportation projects already envisaged in the current STMP (BRT and LRT lines).
- Two (2) new public transportation projects currently envisaged by Lagos State in Lagos Island and Ikeja.
- Twenty-two (22) new projects/corridors consisting of:
  - Extensions of four (4) of the aforementioned STMP projects, in accordance with the MCPs' Harmonization and some additional proposals.
  - Seventeen (17) additional projects that has been concluded from the relational analysis which could be considered for private/public transportation prioritisation or alternatively the establishment of an improved private and freight transportation system (this last group of projects will basically consist of new transversal connections).

This whole transportation system is understood as a long-term proposal, which will develop over the years as the Megacity's population and mobility dynamics require a broader and more inter-connected transportation system.

The development of this long-term vision (and proposal) has therefore been phased in three different stages, according to the time horizons agreed: 2017, 2022 and 2032.

The distribution of the different projects integrating the proposal has been guided by two main criteria:

- The urban development pace established in the harmonized vision of the Megacity: The transportation projects will have to serve the urban developments to which they are more strongly associated.

- The results of the model assignments: The passenger load results have helped in the final choice between the 2022-2032 horizons (the most successful projects being assigned to the 2022 horizon).

The following tables and figures show all the projects considered for every mode: BRT, LRT, Cable Car and Monorail, as well as Road Network infrastructure, which actually represents the backbone of the overall public transport proposal.

STMP EXTENSION PROPOSAL - BRT PROJECTS RESULTING FROM THE HARMONISATION PROCESS			
Corridor Reference and Name	**Project Description / Comments**	**Evaluation after Transport Model Test**	**New Corridor Reference Number**
2009 STMP BRT Corridors			
Berger – TBS	As in original STMP	OK	-
Berger to LASU through Iyana Ipaja	Original STMP proposal considered now as a first phase of the Purple Line, to become LRT (Purple Line) in the long term	**ELIMINATED** Execution of LASU-Shagamu LRT responds better to passenger demand – **Substituted by LRT Purple Line**	
Circular BRT (Oshodi – Obalende – Oshodi)	As in original STMP	**ELIMINATED** Overlaps with other MRT lines make this line redundant	
Oworonshoki to Apapa	As in original STMP	OK	-
Berger to Iyana Isolo through Ikotun	As in original STMP	OK	-
Berger to Local Airport	As in original STMP	OK	-
Maryland - Otta	As in original STMP	OK	-
TBS – Ikorodu	BRT-Lite between TBS and Mile 12	**ELIMINATED** To be substituted by LRT Brown Line in the long term	-
	BRT between Mile 12 and Ikorodu (currently under construction)	Will remain as BRT	

STMP EXTENSION PROPOSAL - BRT PROJECTS RESULTING FROM THE HARMONISATION PROCESS			
Corridor Reference and Name	**Project Description / Comments**	**Evaluation after Transport Model Test**	**New Corridor Reference Number**
TBS-Okokomaiko-Ijaniki (BRT parallel to LRT Blue Line)	Not included originally in STMP - Currently under construction	OK	"12"
New corridors			
Extension of TBS-Okokomaiko-Ijaniki	Proposed extension to Badagry Town	OK	"5"
New corridor along Lekki's new coastal road	Originally considered for regular bus services	UPGRADE TO BRT - Passenger demand justifies BRT service	"3"
New corridor along Lekki's new Lagoon Road (BRT)		OK	"1"
New corridor along Lekki's Green corridor (BRT)		OK	"2"
Okun – Aja – Ikorodu Roundabout (4th Mainland Bridge) (BRT)		OK	"8"
Majidun/Ipakodo – Shagamu through Ikorodu (BRT)		OK	"9"
Ijede – Isawo through Ikorodu (BRT)		OK	"22"+"23"
Ikorodu Roundabout – Epe through Agbowa (BRT)		OK	"7"

Table 1. List pf BRT Proposals considered and results of TransCAD evaluation

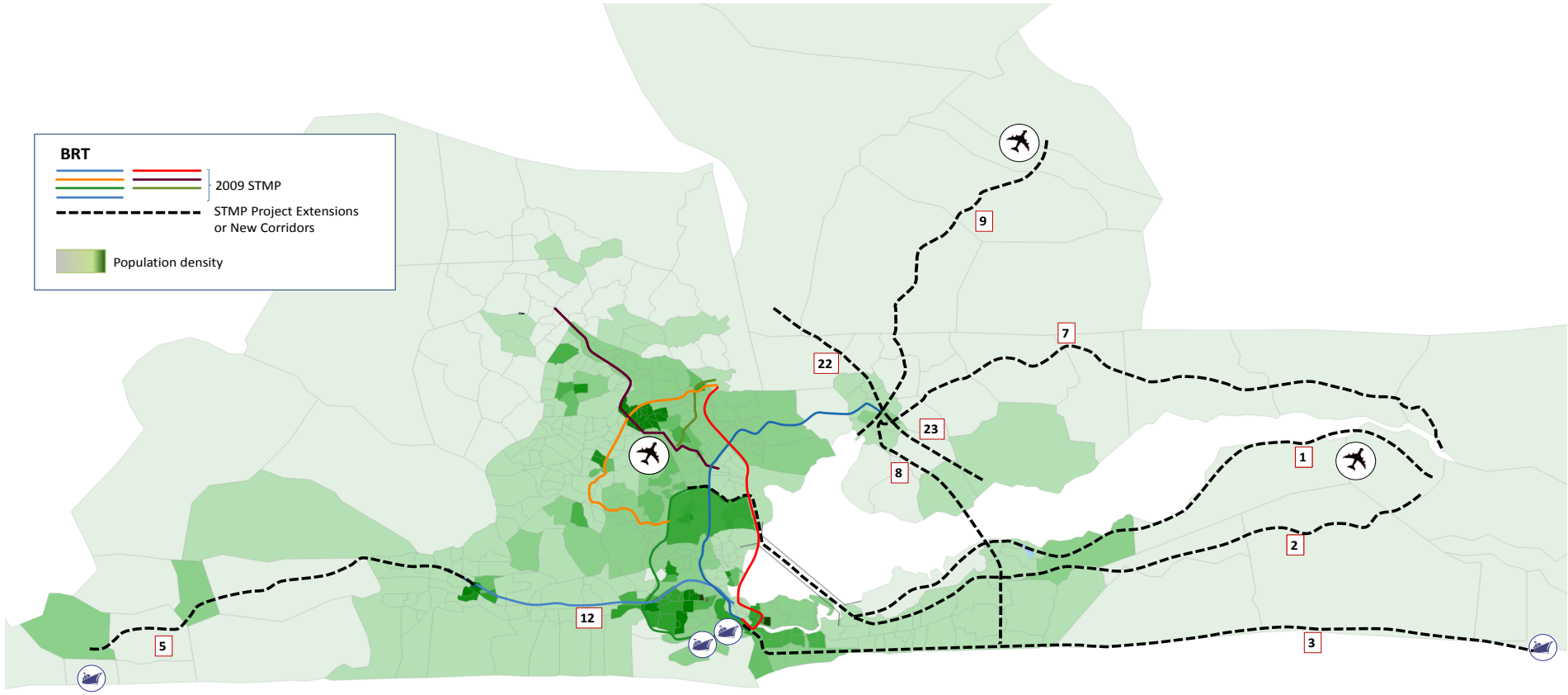


Figure 12. Final Proposal for BRT

Source: ALG

STMP EXTENSION PROPOSAL - LRT PROJECTS RESULTING FROM THE HARMONISATION PROCESS			
Corridor Reference and Name	**Project Description / Comments**	**Evaluation after Transport Model Test**	**New Corridor Reference Number**
2009 STMP LRT Corridors			
Green line (Marina to Ajah)	As in original STMP	OK	-
Brown line (Mile 12 to Marina)	As in original STMP	OK Will replace the current BRT-Lite up to Mile 12	-
Yellow line (Otta/MMA to Iddo)	As in original STMP	OK with some changes of alignment in Mainland Central Area	-
Purple Line	As in original STMP	OK	-
Red line (Marina-Agbado)	As in original STMP	OK	-
Blue Line (TBS-Okokomaiko)	As in original STMP	OK	-
New corridors			
Green line extension	Marina-Aja-Lekki Airport, Marina-Aja-Lekki Port/FTZ	OK	“4 a/b”
Purple line extension	LASU-Redeem-Shagamu	OK	“15”
Red line extension	Marina-Agbado-Ifo	OK	“16”

Table 2. List of LRT Proposals considered, results of TransCAD evaluation and proposed year of implementation

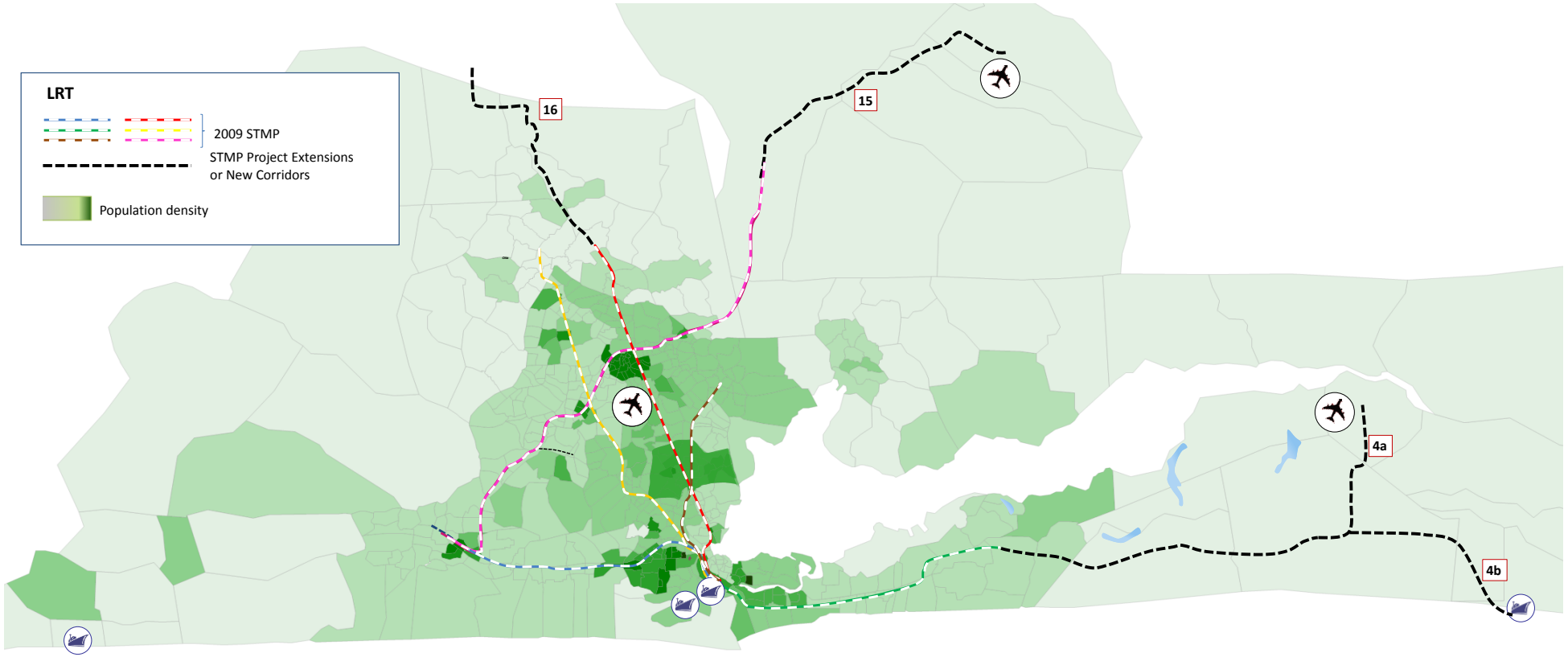


Figure 13. Final Proposal for LRT

Source: ALG

STMP EXTENSION PROPOSAL – MONORAIL AND CABLE CAR PROJECTS RESULTING FROM THE HARMONISATION PROCESS			
Corridor Reference and Name	**Project Description / Comments**	**Evaluation after Transport Model Test**	**New Corridor Reference Number**
Lagos State Projects			
Lagos State Cable Car	As planned by Lagos State	OK	-
Ikeja Butterfly Route	As originally planned by Lagos State	ELIMINATED Overlap with other BRT/LRT lines	-
Victoria Island Monorail	As planned by Lagos State	OK	-
New projects			
Extension of Lagos State Cable Car to Ipaja and Alimosho	Apapa - Ipaja	OK	"10"
	Ipaja-Alimosho	OK	"26"

Table 3. List of Cable Car and Monorail Proposals considered, results of TransCAD evaluation and proposed year of implementation

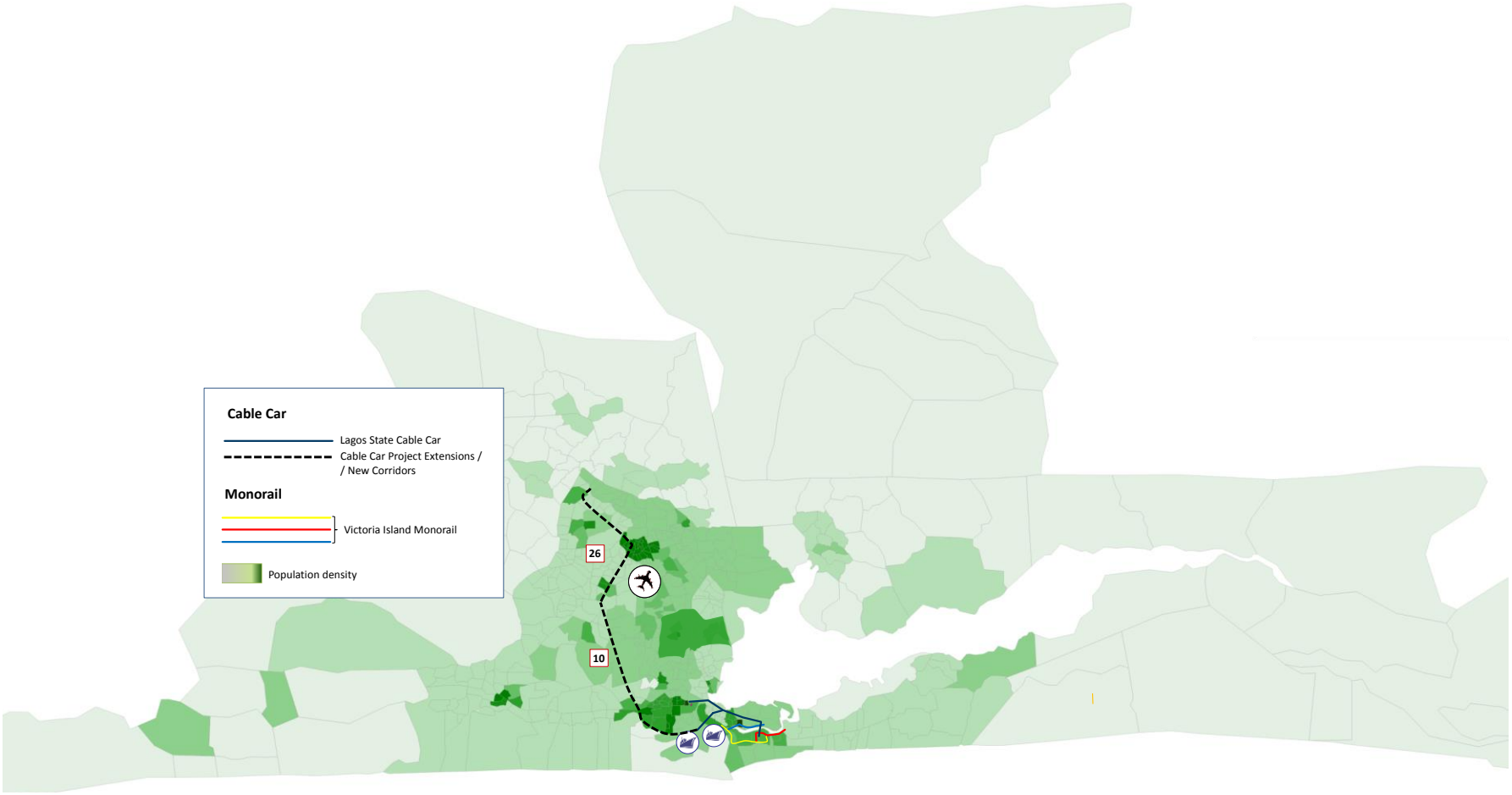


Figure 14. Final proposal for Cable Car and Monorail

Source: ALG

STMP EXTENSION PROPOSAL – ROAD NETWORK PROJECTS RESULTING FROM THE HARMONISATION PROCESS		
Corridor Reference and Name	**Evaluation after Transport Model Test**	**New Corridor Reference Number**
Owode – Otta (by-pass) – Itele - Lagos-Abeokuta Road	OK	"17"
Agbara – Sokoto Road - Shagamu	OK	"18"
Shagamu - Ijebu Ode – Lekki Airport / FTZ	OK	"19"
Lagos Outer Ring Road (modified alignment)		
Ojo – Apapa	OK	"11.1"
Ikorodu – Lekki (4th Mainland Bridge)	OK	"11.2"
Ojo - Alagbado	OK	"11.3"
Lekki – V.I / Apapa	OK	"11.4"
Alagbado - Ikorodu	OK	"11.5"
Trade Fair – Ikotun (through Ijedodo Road)	OK	"24"
Badagry – Seme (Expressway)	OK	"6"
Badagry – Seme (North)	OK	"6"
New bridge connecting Apapa Port and Sagbokoji	OK	"25"

Table 4. Road Network Projects

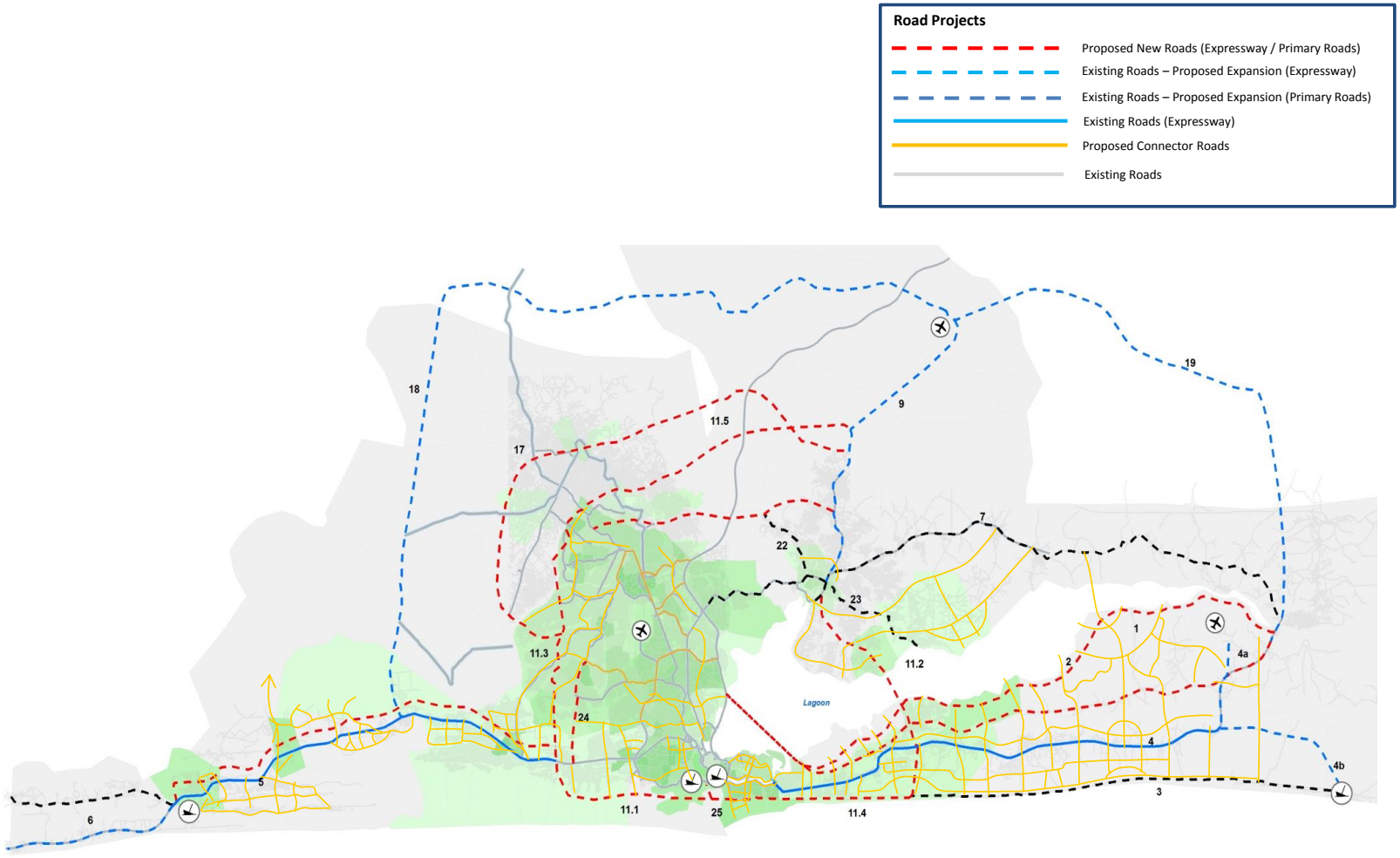


Figure 15. Final proposal for the road network

Source: ALG

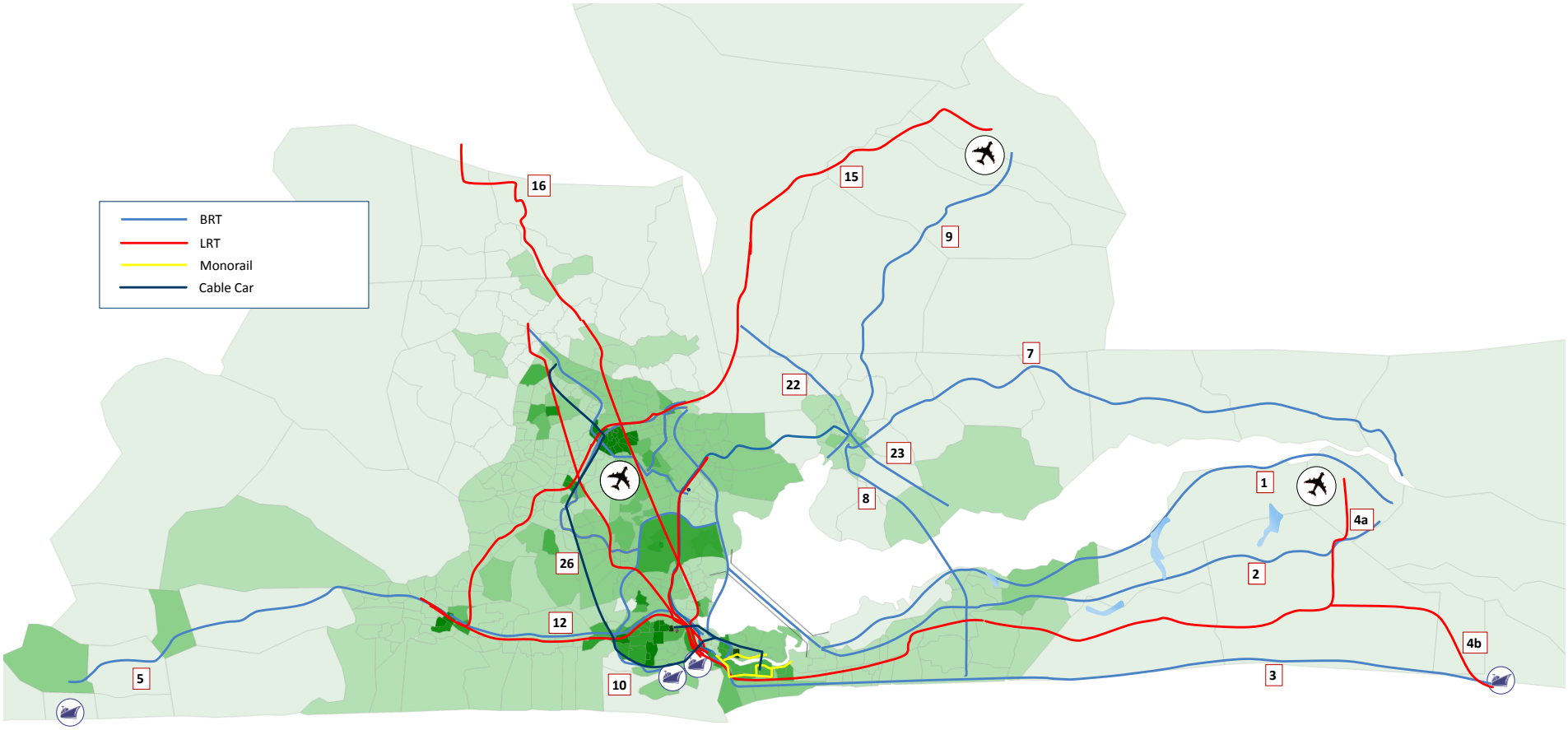


Figure 16. Final proposal for BRT, LRT, Monorail and Cable Car. The road network proposal represents the backbone for these projects

Source: ALG

3.4.3 Proposal of Inland waterways corridors

Regarding the Inland Waterways proposals, the report has looked at the compatibility between the most recent of LASWA's plan and the urban dynamics trends identified above.

The main conclusion is the following: LASWA's proposals (which are shown in the figures below) will respond to the urban dynamics of the future Megacity, at least up till the medium term.

Regarding the longer term, the possibility of extending the planned waterway lines up to the furthest developments in Lekki Peninsula and Badagry was initially considered. However these extensions were discarded later on during the TransCAD assignment process due to the strong competition of the parallel MRT lines covering very similar lengths and connecting common areas of origin and destination.

STMP EXTENSION PROPOSAL – INLAND WATERWAY PROJECTS RESULTING FROM THE HARMONISATION PROCESS			
Route Name	**Implementation**	**Route Name**	**Implementation**
Badore_Five Cowries	Current	Oworonshoki_Five Cowries	Current
Badore_Ijede	Current	AgboyiKetu-FiveCowries	Future
Baiyeku-Ajah	Current	AgboyiKetu-Marina	Future
Baiyeku-Langbasa	Current	Ikorodu-Osborne	Future
Baiyeku-Victoria Island	Current	Ikorodu-Oworonshoki	Future
Ebute Ero-Ikorodu	Current	Liverpool-FiveCowries	Future
Ebute Ojo-Irewe	Current	Marina/CMS_Oworonshoki	Future
EbuteO_I-Egba_Marina	Current	AgboyiKetu-Mile12	Future
EbuteOjo_IjegunEgba	Current	Ajah-FiveCowries-Marina	Future
EbuteOjo-Ibasa	Current	Ajah-Osborne-Marina	Future
Ijede-Badore	Current	IjegunEgba-Ekpeme	Future
Ijede-Marina	Current	Liverpool-IgboElejo	Future
IjegunEgba-Ibasa	Current	Liverpool-OlodiApapa	Future
Ijora_Ebute Ero	Current	Marina-Ekpeme	Future
Ikorodu_Addax/Falomo	Current	Marina-Liverpool	Future
Marina/CMS_Ikodoru	Current	Marina-ToluAjegunle	Future
Mile 2-Addax/Falomo	Current	Mekwen-Ekpeme	Future
Mile 2-Marina	Current	Oworonshoki-Osborne	Future

Table 5. Inland Waterways Projects

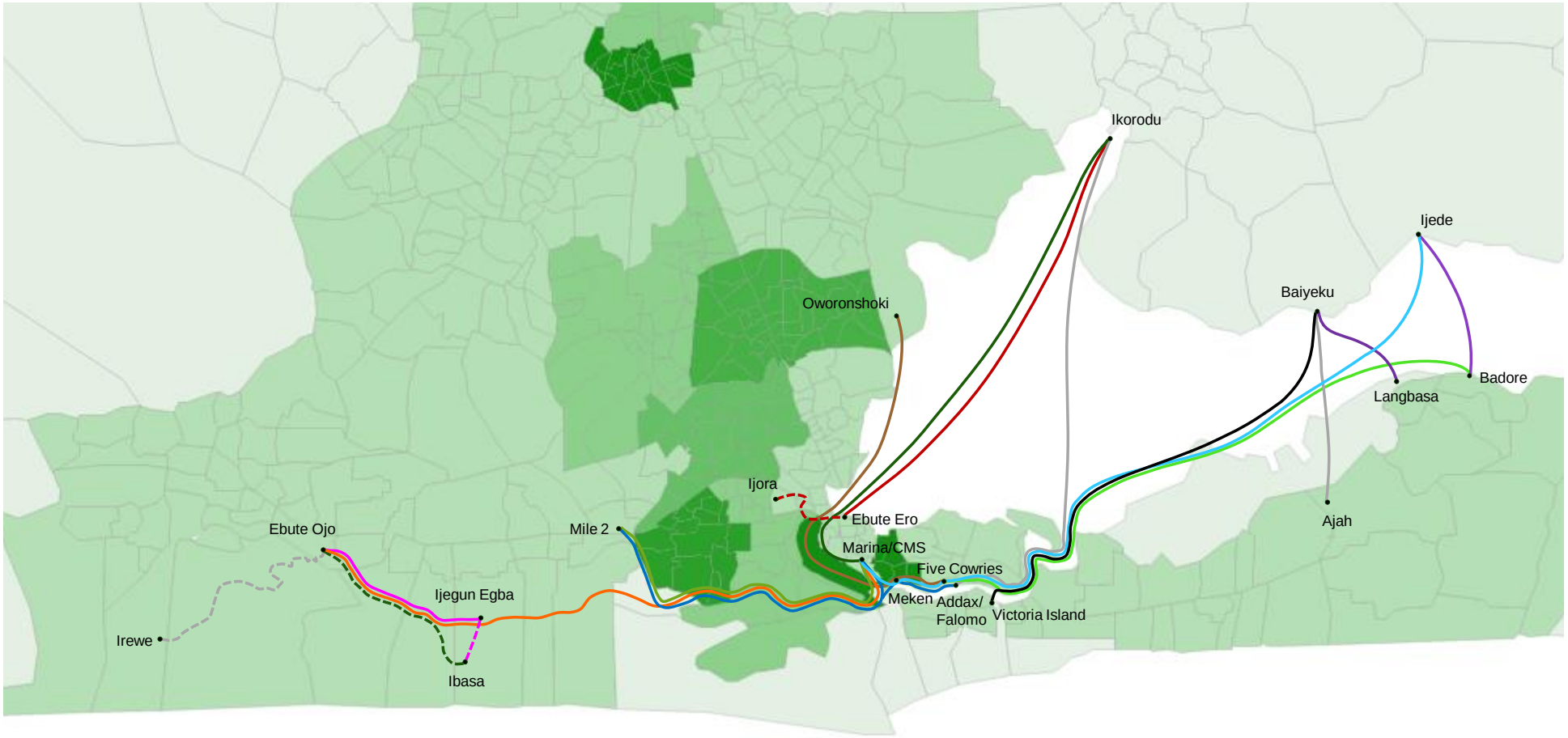
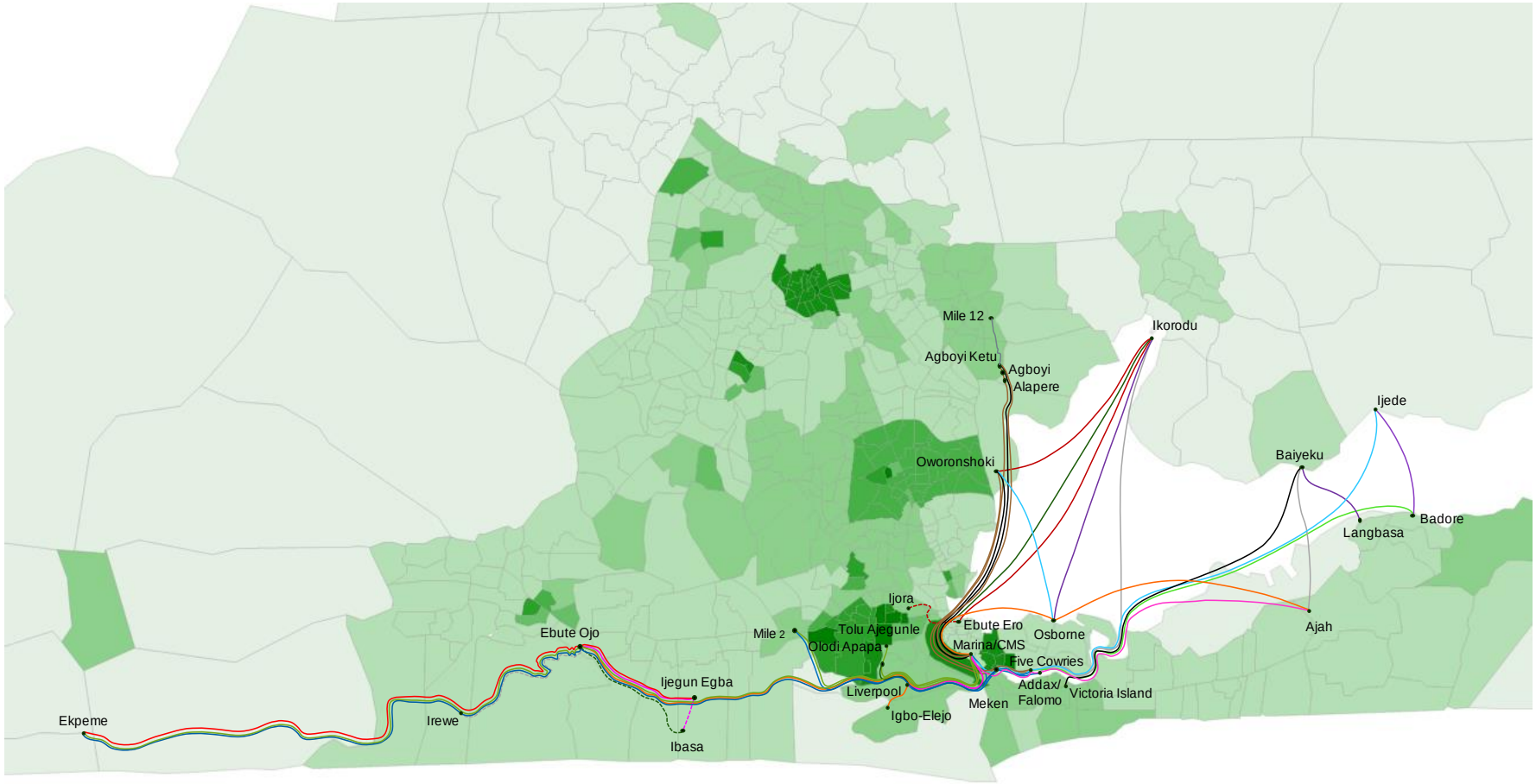


Figure 17. Inland Waterways Scheme already in operation

Source: ALG from LASWA's Plans

Figure 18. Inland Waterways Scheme in the long term



Source: ALG from LASWA's Plans

3.4.4 A System of Interchanges

In order to guarantee the correct operation and efficiency of the transport system proposed in the previous subchapters, an additional system of interchanges must be established.

The main function of an interchange is to articulate the different transport networks. This articulation must be understood from different points of view: (a) The physical connection of transport services, allowing the interchange of travellers from one mode to another; (b) The access point for the city's urban patterns into the transportation network (c) The pivotal element for an efficient transport service management.

Therefore a system of multimodal transport interchanges has been proposed for the Megacity. These interchanges are listed in the table below.

Interchanges system	Map Reference
National Theatre (urban)	A
Marina (urban)	B
Yaba (urban)	C
Oshodi (urban)	D
Mile 2 (urban)	E
Agege (urban)	F
Ojo (urban)	G
Otta (inter-urban)	H
Ibafo (inter-urban)	I
Shagamu (inter-urban)	J
Ikorodu (urban)	K
Langbasa (urban)	L
Lekki Airport (inter-urban)	M
Badagry (inter-urban)	N

Table 6. Proposal of Interchanges for the Megacity's Transport System

It is important to note that the Mainland Central area will play a key role in the Megacity's Mass Rapid Transit network: Four of the proposed interchanges will be located within this area and they will play a fundamental role in the organization of the MRT routes of the Megacity.

Mainland Central is a central and accessible (with the NRC rail terminus and bus terminus) area of Lagos urban core which is very close to the Lagos Island Central Business District and Lagos Port Complex. For this reason, a good number of the 2009 STMP proposals converge into this area and the MCP (for Mainland Central) foresees urban regeneration and developments with a remarkable potential. This includes the generation of new urban centres and the expansion of Lagos Island CBD to Iddo.

The prospect of Mainland Central as a pivotal element in the Megacity transportation system has not been considered (at least in all its potential) by the 2009 STMP.

When considering the Megacity from a unitary and comprehensive point of view, the need for a pivotal element (or system of elements) allowing an efficient (and flexible) management of routes and services, becomes apparent.

Such a system should have its central node in Mainland Central. Following this criterion, the following system of interchanges has been proposed:

- A main interchange should be considered (and named) as the **Central Station**, located **near the National Theatre** area (National Theatre Station). This new interchange should be designed within the framework of a specific plan for the area.
- Four other urban interchanges should be located at **Yaba, Oshodi, Mile 2 and Marina** in Lagos Island. These interchanges are proposed on the basis of the MRT connections which will be located in these areas, according to the proposal.
- With respect to the traditional urban core, the establishment of additional urban interchanges should be considered to ensure accessibility and connectivity to Lagos' new urban expansion areas. This would be the case of **Agege, Ojo, Ikorodu and Langbasa**.
- Finally, the system will be completed with additional **inter-urban interchanges** facilitating the integration of the most external areas of the Megacity (and beyond): **Otta, Ibafo and Shagamu**.

It is important to highlight the function of the Central Station (National Theatre) as a service regulator of the Megacitys' Transport System, facilitating interesting operational possibilities:

- Some services could stop at this station while others would continue to Lagos Island.
- The services of the Yellow and Blue LRT Lines could get to Lagos Island using the Red Line infrastructure.

These are just a couple of examples of how such a central station will facilitate the complex mobility dynamics of a great metropolitan area like Lagos. It also shows the importance of the interchange

system that is included in this proposal, as it will allow the management of a massive transportation system.

Therefore the choice of the most appropriate location for the Central Station is deemed essential. This was subject to specific analysis in the framework of the current study. The choice of the National Theatre was not immediate. The two alternatives considered are:

- **Iddo**, a key-area foreseen in the Mainland Central Model City Plan as the natural extension of Lagos Island Central Business District (through the development of Iddo New Business District), as well as the very point where a number of public transportation lines are supposed to converge when heading towards Lagos Island, according to the 2009 STMP.
- National Theatre, an area of great interest for the establishment of a new transport hub and a key-landmark of the city, with remarkable commercial possibilities.

At the end, the most cost-effective option is the National Theatre. The figure below shows the new alignments (putting the original STMP into consideration) of the MRT lines crossing the National Theatre area (LRT Blue, Red, Brown and Yellow) and then heading towards Lagos Island.

Three possible alternatives for the exact location of the Megacity's Central Station were considered. These are shown in the same figure (coloured areas A-B-C). The three of them aim at preserving the functionalities of the former central station at Iddo in terms of passenger transfer and "buffer" space/terminal for vehicles. Each one of these three alternatives has its particular pros and cons:

A) The National Theatre area represents a very interesting spot as a city landmark, with many commercial possibilities associated with it. However, this is not so easy technically speaking. In order to guarantee the possibility of service management for all the LRT lines, it would be necessary to build a branch of the red/brown line towards this station.

B) This spot will be located to the South of the National Theatre. It is possible to link all the lines in this area, with appropriate accesses (but without need for any rail branch for the Red/Brown line).

C) This will be the easiest solution operationally speaking as all lines pass through this area. However land availability might be a problem here.

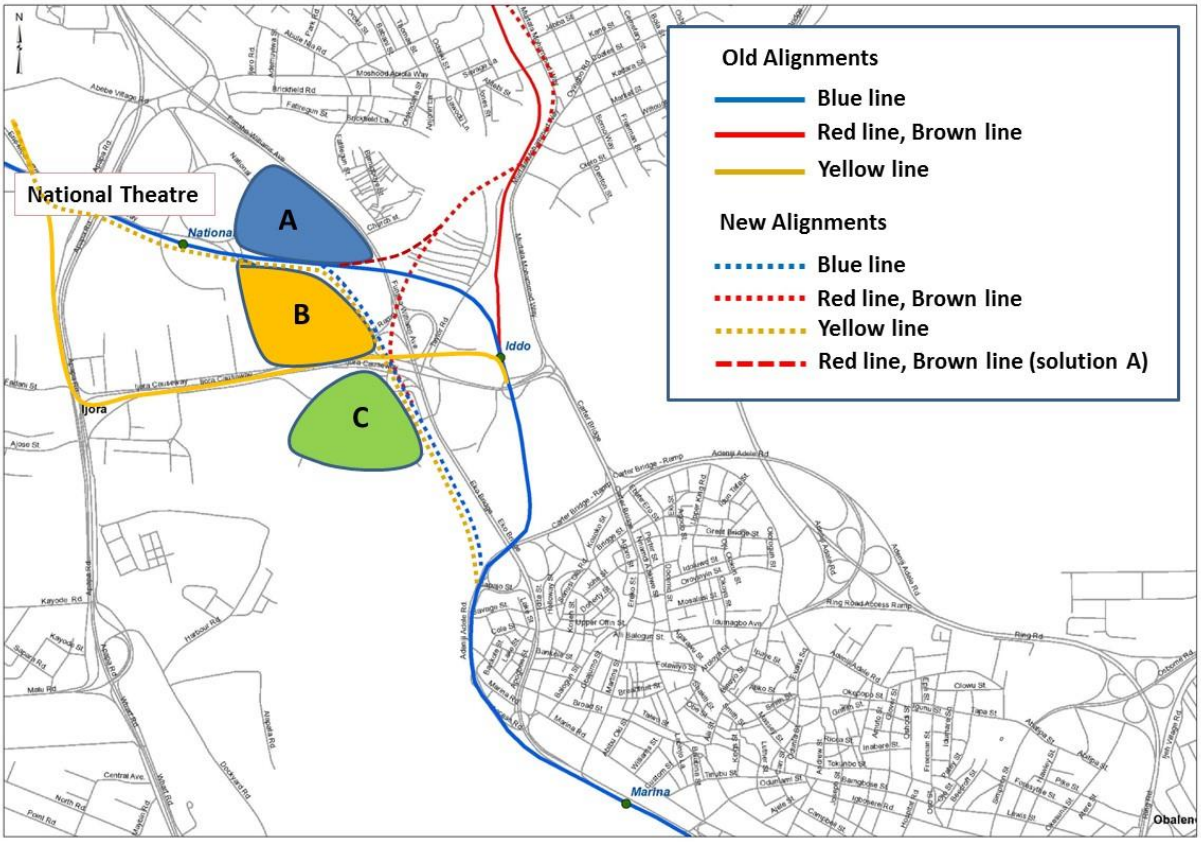


Figure 19. Possible options for the location of the Central Station (replacing Iddo)

Source: ALG

After consultations with LAMATA, option B, which refers to the "National Theatre Station" was chosen, due to its proximity to the National Theatre.

In spite of this final choice of location for the Central Station, Iddo will still remain a key activity area for Mainland Central and Lagos. Therefore full access from Iddo to the National Theatre Station has to be guaranteed, through an appropriate link fully accessible to non-motorised vehicles and pedestrians, as well as mixed uses including commercial developments.

The proposed system of interchanges for the Megacity is shown in the following figure, on the basis of the general road public transport proposal (the inland waterways have been omitted for clarity purposes).

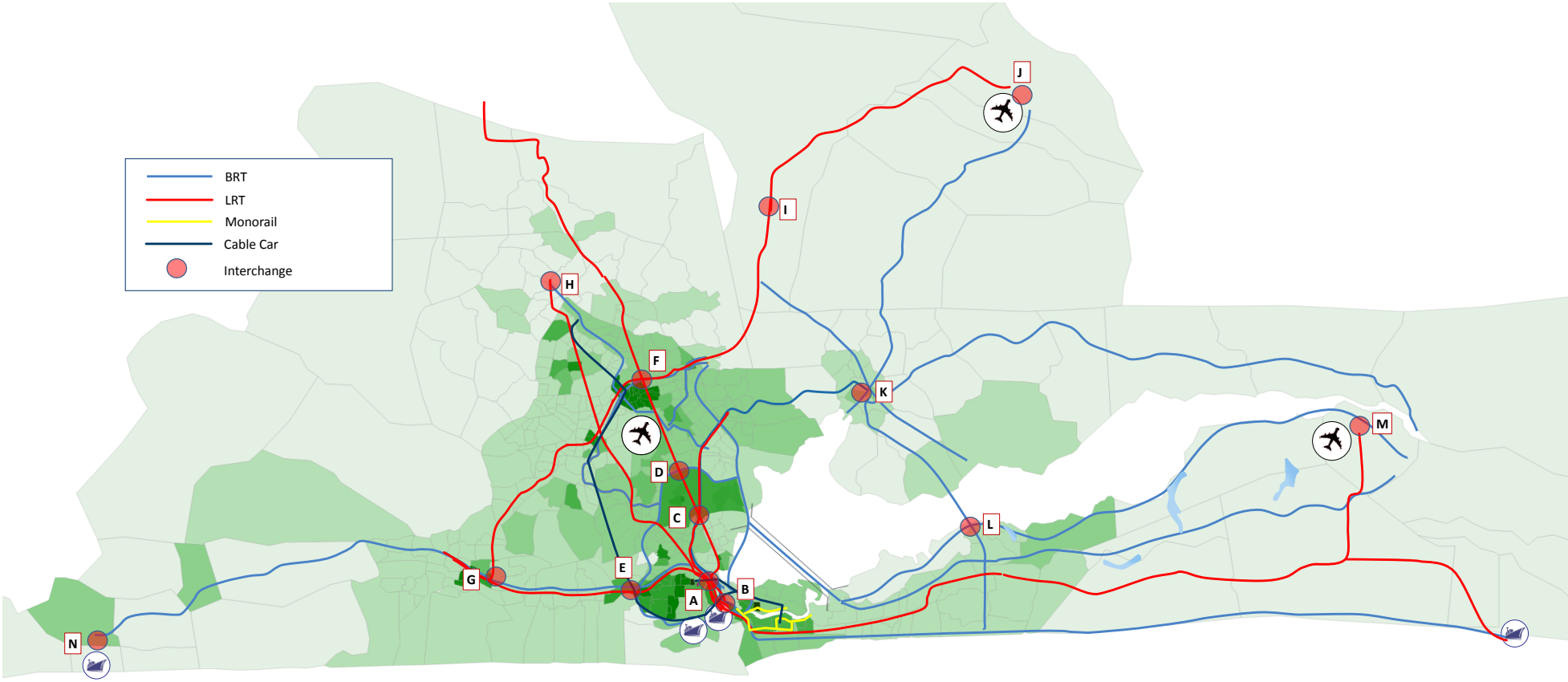


Figure 20. Multimodal Interchange Proposals

Source: ALG

3.4.5 The Proposal seen through the Transportation Model

The tables below show the passenger flow results (average hour and daily flows) assigned with the TransCAD model for the 2032 horizon year, considering the complete proposal of road and public transport projects described in the previous subchapters.

LRT		
ROUTE NAME	2-WAY AVERAGE HOURLY FLOW	DAILY 2-WAY TOTAL
Marina-Ifo (Red, extended)	99,764	1,596,224
Marina-Ajah-Lekki Airport/FTZ (Green, extended)	83,025	1,328,395
Iddo-Otta (Yellow)	80,255	1,281,779
LASU- Shagamu (Purple, extended)	78,618	1,257,894
Mile12-Marina (Brown)	73,340	1,173,440
Marina-Okokomaiko (Blue)	70,500	1,128,000
LRT Global Demand	**485,502**	**7,765,732**

Table 7. Assignment results for the LRT projects (2032)

BRT		
ROUTE NAME	2-WAY AVERAGE HOURLY FLOW	DAILY 2-WAY TOTAL
Ijede-Isawo through Ikorodu	30,762	492,192
Apapa-Oworonshoki	26,230	419,680
Berger-Iyana Isolo (orange)	25,984	415,744
Lekki Green Corridor	25,026	400,416
Maryland-Otta	20,015	320,240
Okun-Ajah-Ikorodu	18,142	290,272
Lekki Lagoon Road	17,655	282,480
Majidun/Ipakodo-Shagamu through Ikorodu	17,241	275,856
CMS-Berger	14,799	236,784

BRT		
ROUTE NAME	2-WAY AVERAGE HOURLY FLOW	DAILY 2-WAY TOTAL
Berger-Local Airport	14,181	226,896
Ikorodu-Epe	12,746	203,936
Mile 12-Ikorodu	11,793	188,688
CMS-Badagry	11,161	178,576
Lekki Coastal Road	8,983	143,728
BRT Global Demand	**254,718**	**4,075,488**

Table 8. Assignment results for the BRT projects

MONORAIL		
ROUTE NAME	2-WAY HOURLY FLOW	DAILY 2-WAY TOTAL
Victoria Island Monorail	35,687	570,989
Monorail Global Demand	**35,687**	**570,989**

Table 9. Assignment results for the monorail projects

CABLE CAR SYSTEM		
ROUTE NAME	2-WAY HOURLY FLOW	DAILY 2-WAY TOTAL
Adeniji Adele - Ozumba	7,685	122,956
Adeniji Adele - Ijora	2,778	44,448
Adeniji Adele - Apapa	2,892	46,268
Apapa - Ipaja	10,132	162,116
Ipaja - Alimosho	5,672	90,752
Cable car Global Demand	**29,159**	**466,540**

Table 10. Assignment results for the cable car project

WATERWAY ROUTES		
ROUTE NAME	2-WAY HOURLY FLOW	DAILY 2-WAY TOTAL
Liverpool-IgboElejo	14,279	228,464
Marina-Liverpool	14,148	226,368
Ijede-Marina	13,284	212,544
Marina-ToluAjegunle	12,489	199,824
EbuteO_I-Egba_Marina	11,862	189,792
Liverpool-FiveCowries	10,723	171,568
Marina/CMS_Ikodoru	6,453	103,248
Marina-Ekpeme	6,105	97,680
Badore_Five Cowries	5,668	90,688
Mekwen-Ekpeme	5,301	84,816
Badore_Ijede	3,844	61,504
Ijede-Badore	2,905	46,480
Mile 2-Marina	2,855	45,680
AgboyiKetu-FiveCowries	2,592	41,472

WATERWAY ROUTES		
ROUTE NAME	2-WAY HOURLY FLOW	DAILY 2-WAY TOTAL
Ikorodu_Addax/Falomo	2,453	39,248
EbuteOjo_IjegunEgba	2,420	38,720
IjegunEgba-Ekpeme	1,993	31,888
AgboyiKetu-Mile12	1,836	29,376
Baiyeku-Victoria Island	1,835	29,360
Liverpool-OlodiApapa	1,483	23,728
Ebute Ero-Ikorodu	1,309	20,944
Marina/CMS_Oworonshoki	1,243	19,888
Ikorodu-Osborne	987	15,792
Ebute Ojo-Irewe	892	14,272
Ikorodu-Oworonshoki	826	13,216
Baiyeku-Langbasa	811	12,976
Mile 2-Addax/Falomo	586	9,376
Ajah-FiveCowries-Marina	435	6,960
Ijora_Ebute Ero	360	5,760
Baiyeku-Ajah	326	5,216
Oworonshoki_Five Cowries	199	3,184
IjegunEgba-Ibasa	168	2,688
Ajah-Osborne-Marina	120	1,920
Oworonshoki-Osborne	93	1,488
AgboyiKetu-Marina	54	864
EbuteOjo-Ibasa	34	544
Waterway Global Demand	**132,971**	**2,127,536**

Table 11. Assignment results for the proposed inland waterway lines

As shown in the tables above, the magnitude of the population and trip figures of the 2032 Megacity lead to equally astonishing passenger figures for the different public transport lines.

Regarding the LRT lines, the Red line is expected to be the most patronized (original STMP proposal extended to Ifo and including a branch to the airport), moving almost 1.6 million passengers along one of the key-expansion corridors of the city towards the North.

The next rail line in importance will be the Green line with its two extension branches towards the new Lekki Airport and the new Lekki Sea Port, carrying more than 1.3 million passengers in total. This line will be followed by the Yellow line (with almost 1.3 million passengers per day due to the high mobility demand of the Iddo-Otta conurbation) and the Purple line (more than 1.2 million passengers per day, connecting the newly developed Pressure Areas in Ogun State with the dense urban conurbation of Northern Lagos State, i.e. Alimosho and finally the LASU area).

The Brown line follows the Purple line with more than 1.1 million passengers per day, followed closely by the Blue line.

The mobility conditions of such a massive Megacity result not only in a successful group of rail lines, but also in an equally successful system of BRT lines. The Ijede-Isawo BRT line (through Ikorodu) is the most relevant, with almost half a million passengers per day, followed by the Apapa-Oworonshoki line with almost 420,000 passengers per day.

The Apapa-Oworonshoki BRT line was originally proposed in the 2009 STMP and is now being recommended not only as one of the priority corridors in the Mass Transit Alternatives Study, but also as a rail line (between Oworonshoki and Mile 2). The results of the TransCAD assignment suggest a very similar recommendation for the aforementioned BRT lines.

It is important to note that the magnitude of the passenger figures for some of the BRT lines (particularly those with passenger loads around 400,000 passengers per day) shows the need for a careful analysis of all the factors involved with the operational plan, in order to guarantee the feasibility of a BRT solution:

- Fleet dimensioning: Vehicle capacity, formation services
- Traffic light signaling: Coordination, prioritization, times for green light, etc.
- Station design: Distance between stations (distance between stations; enough capacity for the needed service level, considering both vehicle platoons and passengers).

The monorail services in Lagos Island and Victoria Island, in spite of the apparent overlap with the Lekki Green Line and the Lagos State Cable Car, present important daily passenger loads (with an average of over half a million per day). These results are fully coherent with the Mass Transit Alternatives Study, which considered the Victoria Island Route as one of the priority corridors to implement. It is interesting to note that the proximity of Eko Atlantic City offers additional potential for this service.

Another prospective project would be the Lagos Island cable car system and its extensions to Ipaja and Alimosho. This kind of transport mode offers very interesting potential with respect to connecting areas separated by water courses, creeks, etc. The Lagos Island-Victoria Island-Apapa triangle originally considered by Lagos State represents the appropriate framework for cable cars. The resulting passenger loads prove this, especially in the case of the Adeniji Adele-Ozumba leg. The extension of the Apapa leg towards Ipaja and Alimosho will also be successful, with more than 250,000 travellers per day.

Finally, regarding the inland waterway lines, the “top-3” lines registering more than 200,000 passengers per day are: Liverpool-Igbo Elejo, Marina-Liverpool and Ijede-Marina (lines with more than 200,000 passengers per day). These are followed by Marina-Tolu Ajegunle, Ebute Ojo-Ijegun Egba-Marina, Liverpool-Five Cowries and Marina/CMS-Ikorodu (with more than 100,000 passengers per day). These inland waterway lines help to cover creek areas with bad road connections and offer a competitive service which represents a good alternative to long road distances along congested roads.

The main conclusion to be drawn from these results is the key-role of the inland waterways as an alternative to very long distances of road transportation around the Lagos Lagoon area. Also, the inland waterways provides connections along the Apapa-Badagry Creek area and other areas with little accessibility to the main expressway.

On the contrary, all those connections along the Lagoon which involve distances very similar to the alternative paths in MRT services (along the Lekki Peninsula) show the lowest levels of passenger loads.

Figure 21. TransCAD Model Assignment for Public Transport, 2032 (average number of passengers per hour)

Source: ALG

3.5 Distribution of the proposal in time horizons

The previous chapters have explained the harmonised urban development and transport network proposal for Lagos Megacity. This proposal is based on a polycentric urban development model representing a whole new mobility dynamics. The transportation system responding to this new dynamics will consist of a larger and grid-shaped network of land corridors hosting around 40 projects (most of them consisting of Mass Rapid Transit lines) and 14 multi-modal interchanges, together with an extensive system of inland waterway lines.

The development of this whole transportation system has been phased in different stages, based on the following time horizons: 2017, 2022 and 2032.

As stated in chapter 3.4.2, the distribution of the different projects integrating the proposal has been guided by two main criteria:

- The urban development pace established in the harmonized vision for the Megacity: The transportation projects will have to serve the urban developments to which they are strongly associated.
- The results of the model assignments: The passenger load results was used to determine the final choice between the 2022 and the 2032 horizons (the most successful projects being assigned to the 2022 horizon).

Figure 22 below shows the main elements of the Megacity's urban development vision (and subsequently transportation network projects) corresponding to each of the time horizons.

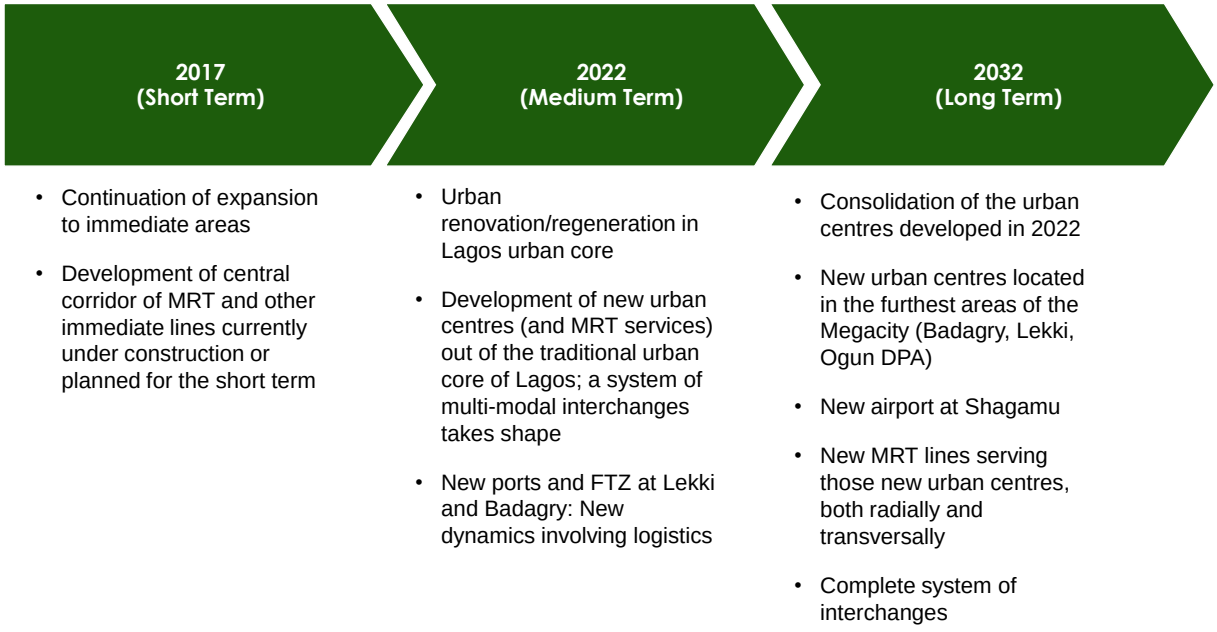


Figure 22. Main urban development criteria for the distribution of the harmonized proposal in three time horizons

The 2017 horizon represents the continuation of the current trends, with the expansion of Lagos urban core to its surrounding areas following three main directions: East (Lekki), West (Badagry) and North (Ota conurbation and Ogun Development Pressure Area).

The road network and public transportation proposals associated with this development will mainly consist of the most feasible projects according to official planning: a **central corridor of MRT services** consisting of one LRT axis (STMP red line) and one BRT axis (STMP TBS – Ikorodu), the LRT **Blue Line** (currently under construction), Lagos Island **Cable Car,** and 2 sections of Lagos Outer Ring Road, including **4th Mainland Bridge.**

A few of these projects are already ongoing and will be considered for the **Do Minimum scenario** in the Cost-Benefit Analysis. Such projects include the Blue Line and the BRT that runs parallel to the Blue Line from CMS to Mile 2 and the BRT from Mile 12 to Ikorodu.

The 2022 horizon brings in key-changes leading to the development of the harmonized vision for a polycentric Megacity, supported by a transportation network adapted to the mobility needs of a leading metropolitan area.

Regarding the urban development elements, **new urban centres** will start consolidating **out of the traditional urban core of Lagos**: to the North (Otta, Agege, Berger), to the East (Ikorodu, first stages of development in Lekki Peninsula, together with Lekki FTZ and new seaport) and to the West (Agbara, Mowe, Badagry/Ajara in Badagry, as well as the new seaport in Badagry). It is important to note that the new seaports at Lekki, Badagry and Lekki FTZ will represent a significant change in Lagos' freight transportation dynamics.

Additionally, some areas with highly populated settlements in Lagos urban core will also be transformed into urban centres through urban renovation and regeneration (Yaba, Mushin in Mainland Central, Ipaja, Igando and Ikotun in Alimosho).

The road and public transportation networks will have to change accordingly: **Key-Mass Rapid Transit projects** crossing Lagos urban core will be implemented, as well as two additional sections of **Lagos Outer Ring Road**; the future system of MRT lines at Lekki will start to be developed; additional transport connections at Apapa; and, finally, a system of multi-modal interchanges.

Regarding the **interchanges**, they represent one of the new key elements of this proposal. However, they were neither considered in the old STMP nor the Model City and Master Plans, at least under such a broad and integrating vision.

In order to balance the MRT operations/services in a massive metropolitan area such as Lagos Megacity, a system of urban and inter-urban interchanges is required. The "heart" of this system will be located at Mainland Central and Lagos Island: Marina, National Theatre, Yaba, Oshodi, Mile 2. It is important to note that the National Theatre represents a pivotal element i.e. a Central Station serving as a service regulator.

Other interchanges will also be developed within this time horizon in the expansion areas of the Megacity. Some of them will equally serve urban mobility (Agege, Ojo, Ikorodu, Langbasa) while others will have an inter-urban functionality (Ota). This multi-modal interchange system will be completed by 2032.

Finally, **the 2032 horizon represents the consolidation of a unitary and well-connected Megacity**: Many of the new development areas from the 2022 scenario will stabilize population growth and consolidate their new urban centres in the furthest areas of the Megacity (Badagry, further developments in Lekki Peninsula, Ogun).

In brief, a number of road infrastructure and public transportation projects will integrate the Megacity's transportation system: New airports in Lekki (international) and Shagamu (proposed as a specialized agro-cargo airport); final extensions and upgrades of MRT systems (Badagry for example); a system of MRT corridors starting from Ikorodu; completion of the Lagos urban core MRT system; MRT services for the full integration of Ogun's Lagos-inbound mobility; and the establishment of a grid-shaped connection network complementing the traditional radial structure.

The tables 12, 13 and 14 show the distribution of all the proposed projects in the 2017, 2022 and 2032 horizons. Figures 23 to 30 illustrate this distribution of the proposal in time horizons.

Corridor Reference and Name	Project Description / Comments	Year of implementation	Map Reference
BRT Corridors			
TBS – Ikorodu	BRT between Mile 12 and Ikorodu (currently under construction)	2017	-
TBS-Okokomaiko-Ijaniki (BRT parallel to LRT Blue Line)	Not included originally in STMP - Currently under construction	2017	“12”
Extension of TBS-Okokomaiko-Ijaniki	Proposed extension to Badagry Town	2017	“5”
Oworonshoki to Apapa	As in original STMP	2022	-
Berger to Iyana Isolo through Ikotun	As in original STMP	2022	-
Maryland - Otta	As in original STMP	2022	-
Berger – TBS	As in original STMP	2032	-
Berger to Local Airport	As in original STMP	2032	-
New corridor along Lekki’s new coastal road	Originally considered for regular bus services – Upgrade to BRT	2032	“3”
New corridor along Lekki’s new Lagoon Road (BRT)	-	2032	“1”
New corridor along Lekki’s Green corridor (BRT)	-	2032	“2”
Okun – Aja – Ikorodu Roundabout (4th Mainland Bridge) (BRT)	-	2032	“8”
Majidun/Ipakodo – Shagamu through Ikorodu (BRT)	-	2032	“9”
Ijede – Isawo through Ikorodu (BRT)	-	2032	“22”+“23”
Ikorodu Roundabout – Epe through Agbowa (BRT)	-	2032	“7”
LRT Corridors			
Red line (Marina-Agbado)	As in original STMP	2017	-

Corridor Reference and Name	Project Description / Comments	Year of implementation	Map Reference
Blue Line (TBS-Okokomaiko)	As in original STMP	2017	-
Green line (Marina to Ajah)	As in original STMP	2022	-
Purple Line	As in original STMP	2022	-
Purple line extension	LASU-Redeem-Shagamu	2022	“15”
Brown line (Mile 12 to Marina)	As in original STMP. Will replace the current BRT-Lite up to Mile 12	2032	-
Yellow line (Otta/MMA to Iddo)	As in original STM, with the exception of some changes of alignment in Mainland Central	2032	-
Green line extension	Marina-Aja-Lekki Airport, Marina-Aja-Lekki Port/FTZ	2032	“4 a/b”
Red line extension	Marina-Agbado-Ifo	2032	“16”
Cable Car and Monorail Corridors			
Lagos State Cable Car	As planned by Lagos State	2017	-
Extension of Lagos State Cable Car to Ipaja and Alimosho	Apapa - Ipaja	2022	“10”
	Ipaja - Alimosho	2022	“26”
Victoria Island Monorail	As planned by Lagos State	2022	-

Table 12. Public Transport Proposal (Land Corridors) – Implementation years

Corridor Reference and Name	Year of implementation	Map Reference
Road Network Projects		
Lagos Outer Ring Road: Ojo – Apapa	2017	“11.1”
Lagos Outer Ring Road: Ikorodu – Lekki (4th Mainland Bridge)	2017	“11.2”
Lagos Outer Ring Road: Ojo - Alagbado	2022	“11.3”
Lagos Outer Ring Road: Lekki – V.I / Apapa	2022	“11.4”
Owode – Otta (by-pass) – Itele - Lagos-Abeokuta Road	2032	“17”
Agbara – Sokoto Road - Shagamu	2032	“18”
Shagamu - Ijebu Ode – Lekki Airport / FTZ	2032	“19”
Lagos Outer Ring Road: Alagbado - Ikorodu	2032	“11.5”
Trade Fair – Ikotun (through Ijedodo Road)	2032	“24”
Badagry – Seme (Expressway)	2032	“6”
Badagry – Seme (North)	2032	“6”
New bridge connecting Apapa Port and Sagbokoji	2032	“25”

Table 13. Road infrastructure proposal – Implementation years

Corridor Reference and Name	Year of implementation	Map Reference
Inland Waterway Projects		
Badore_Five Cowries	Current	-
Badore_Ijede	Current	-
Baiyeku-Ajah	Current	-
Baiyeku-Langbasa	Current	-
Baiyeku-Victoria Island	Current	-
Ebute Ero-Ikorodu	Current	-
Ebute Ojo-Irewe	Current	-
EbuteO_I-Egba_Marina	Current	-
EbuteOjo_IjegunEgba	Current	-
EbuteOjo-Ibasa	Current	-
Ijede-Badore	Current	-
Ijede-Marina	Current	-
IjegunEgba-Ibasa	Current	-
Ijora_Ebute Ero	Current	-
Ikorodu_Addax/Falomo	Current	-
Marina/CMS_Ikodoru	Current	-
Mile 2-Addax/Falomo	Current	-
Mile 2-Marina	Current	-

Corridor Reference and Name	Year of implementation	Map Reference
Oworonshoki_Five Cowries	Current	-
AgboyiKetu-FiveCowries	2017	-
AgboyiKetu-Marina	2017	-
Ikorodu-Osborne	2017	-
Ikorodu-Oworonshoki	2017	-
Liverpool-FiveCowries	2017	-
Marina/CMS_Oworonshoki	2017	-
AgboyiKetu-Mile12	2022	-
Ajah-FiveCowries-Marina	2022	-
Ajah-Osborne-Marina	2022	-
IjegunEgba-Ekpeme	2022	-
Liverpool-IgboElejo	2022	-
Liverpool-OlodiApapa	2022	-
Marina-Ekpeme	2022	-
Marina-Liverpool	2022	-
Marina-ToluAjegunle	2022	-
Mekwen-Ekpeme	2022	-
Oworonshoki-Osborne	2022	-

Table 14. Inland Waterways Proposal – Implementation years

Corridor Reference and Name	Year of implementation	Map Reference
Multimodal Interchanges		
National Theatre (urban)	2022	A
Marina (urban)	2022	B
Yaba (urban)	2022	C
Oshodi (urban)	2022	D
Mile 2 (urban)	2022	E
Agege (urban)	2022	F
Ojo (urban)	2022	G
Otta (inter-urban)	2022	H
Ikorodu (urban)	2022	K
Langbasa (urban)	2022	L
Ibafo (inter-urban)	2032	I
Shagamu (inter-urban)	2032	J
Lekki Airport (inter-urban)	2032	M
Badagry (inter-urban)	2032	N

Table 15. Multimodal Interchanges Proposal – Implementation Years

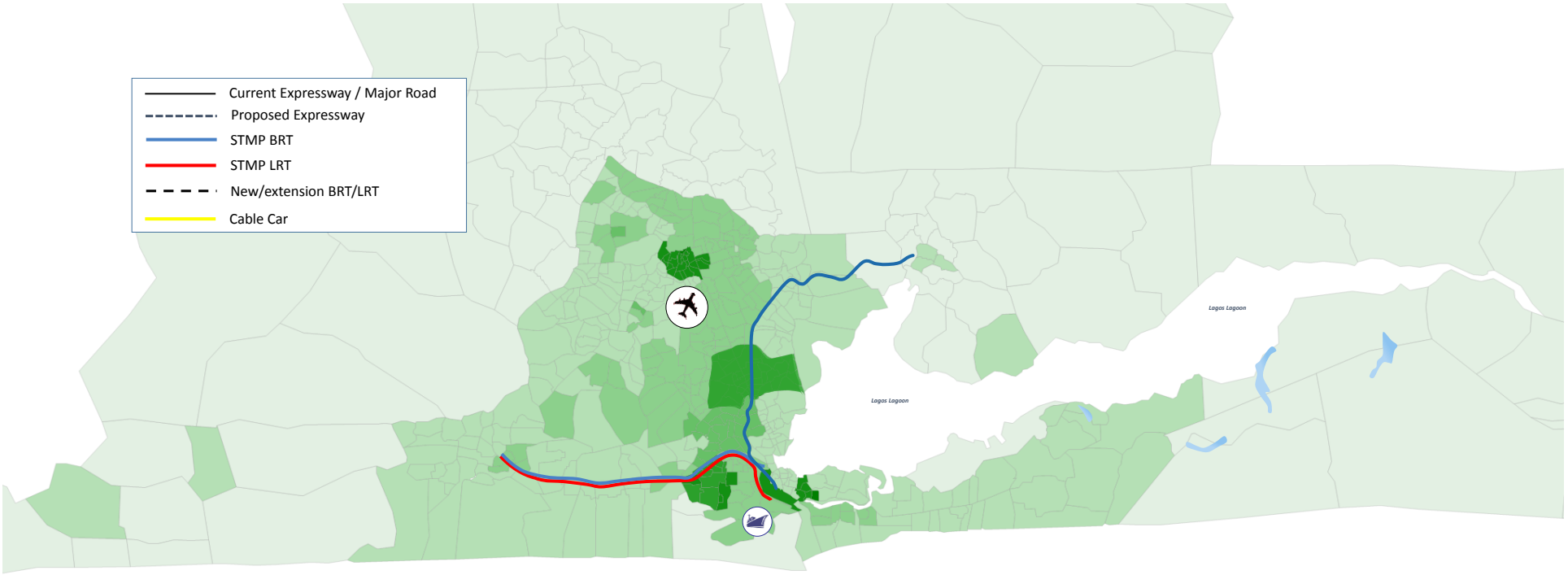


Figure 23. Land Transport Projects for the Do Minimum Scenario (2017, 2022, 2032)

Source: ALG

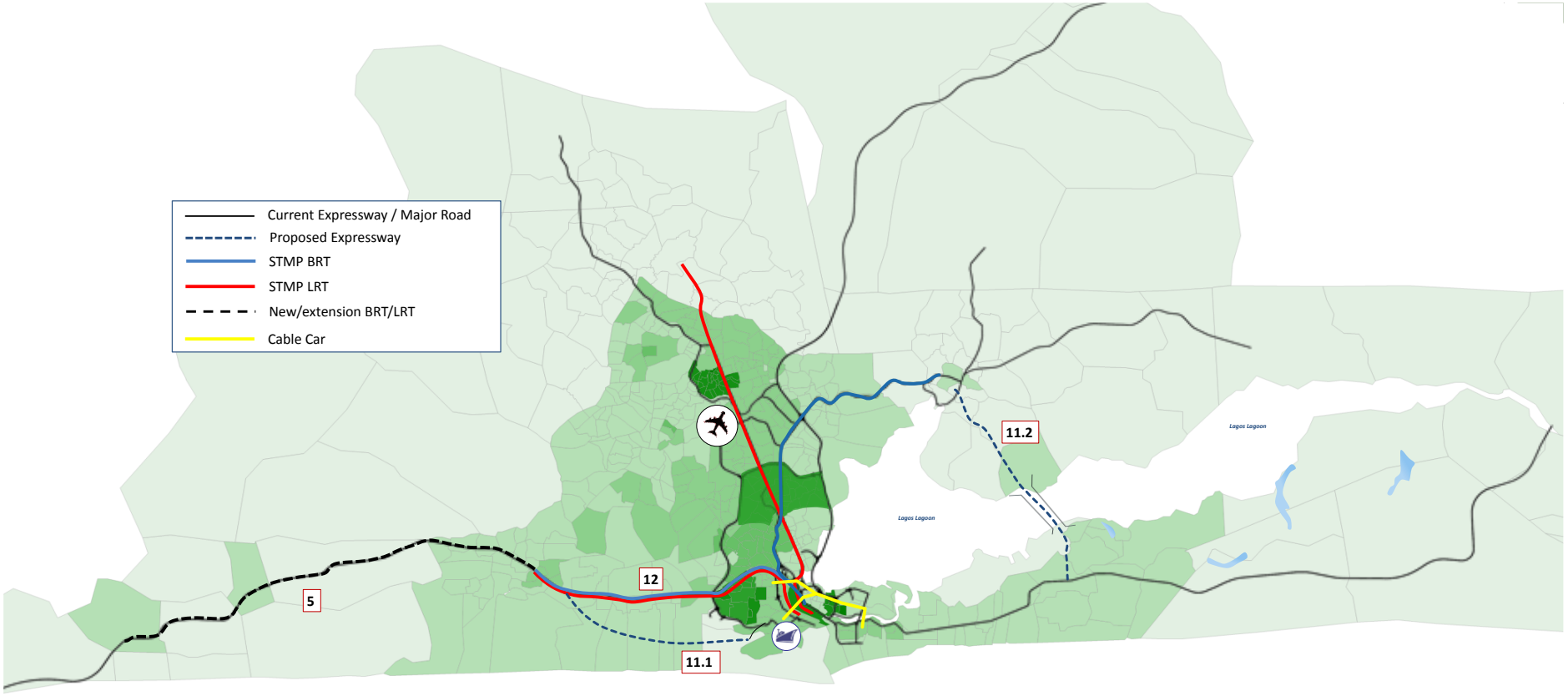


Figure 24. Land Transport Proposal for 2017 horizon

Source: ALG

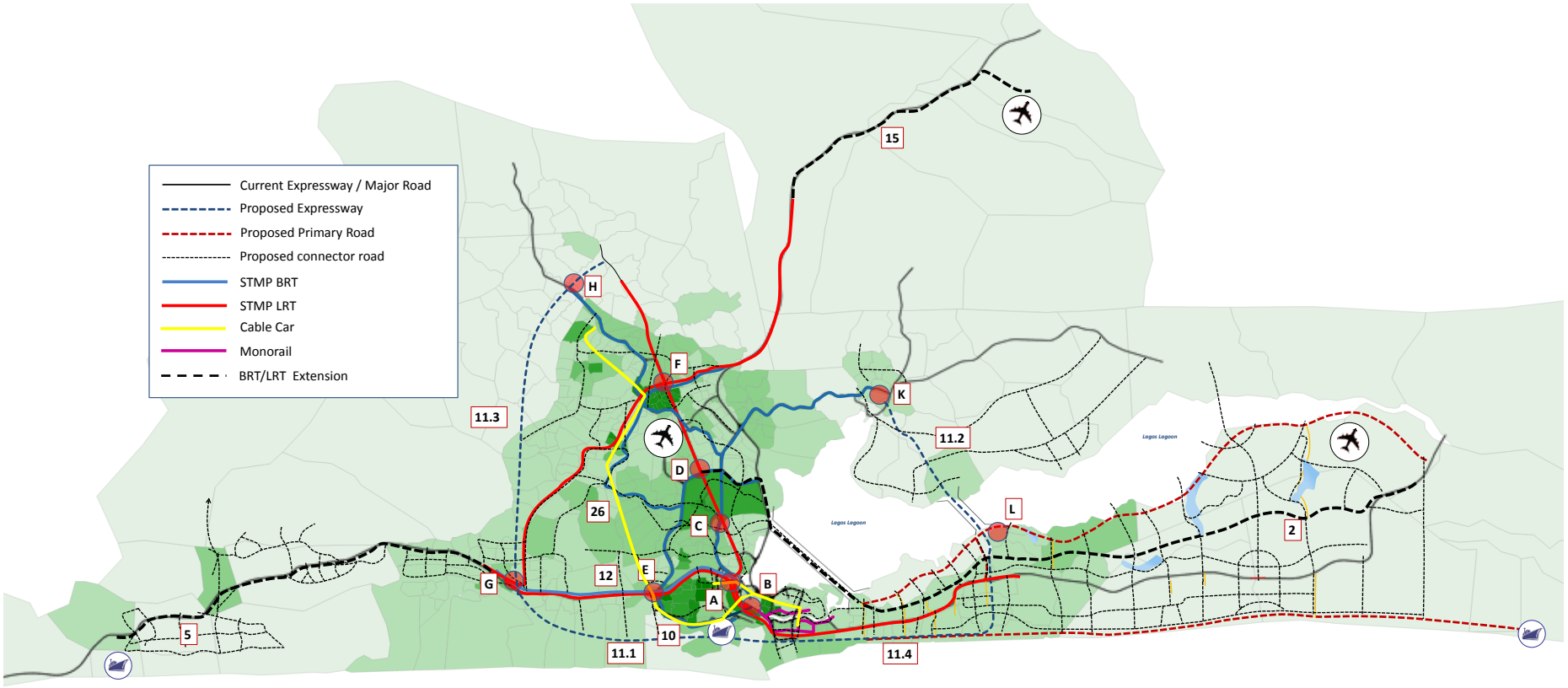


Figure 25. Land Transport Proposal for 2022 horizon

Source: ALG

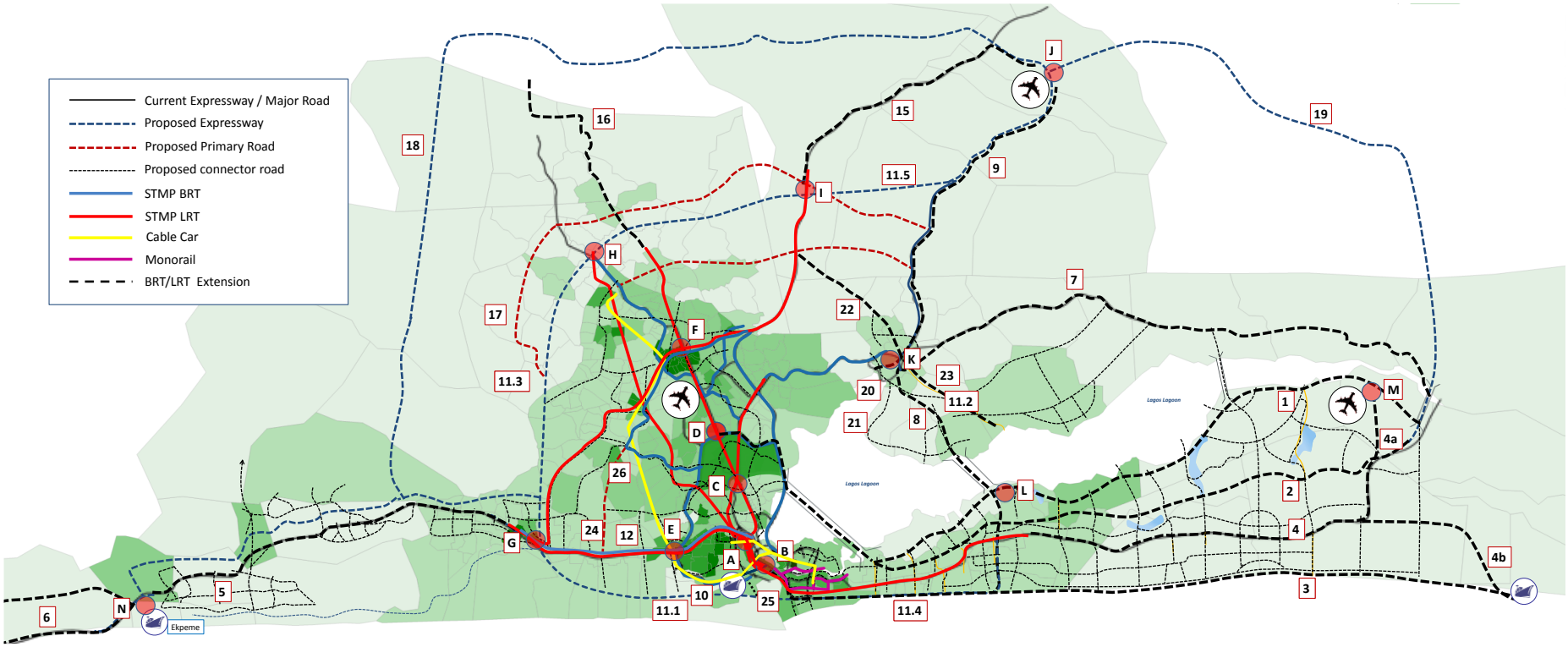


Figure 26. Land Transport Proposal for 2032 horizon

Source: ALG

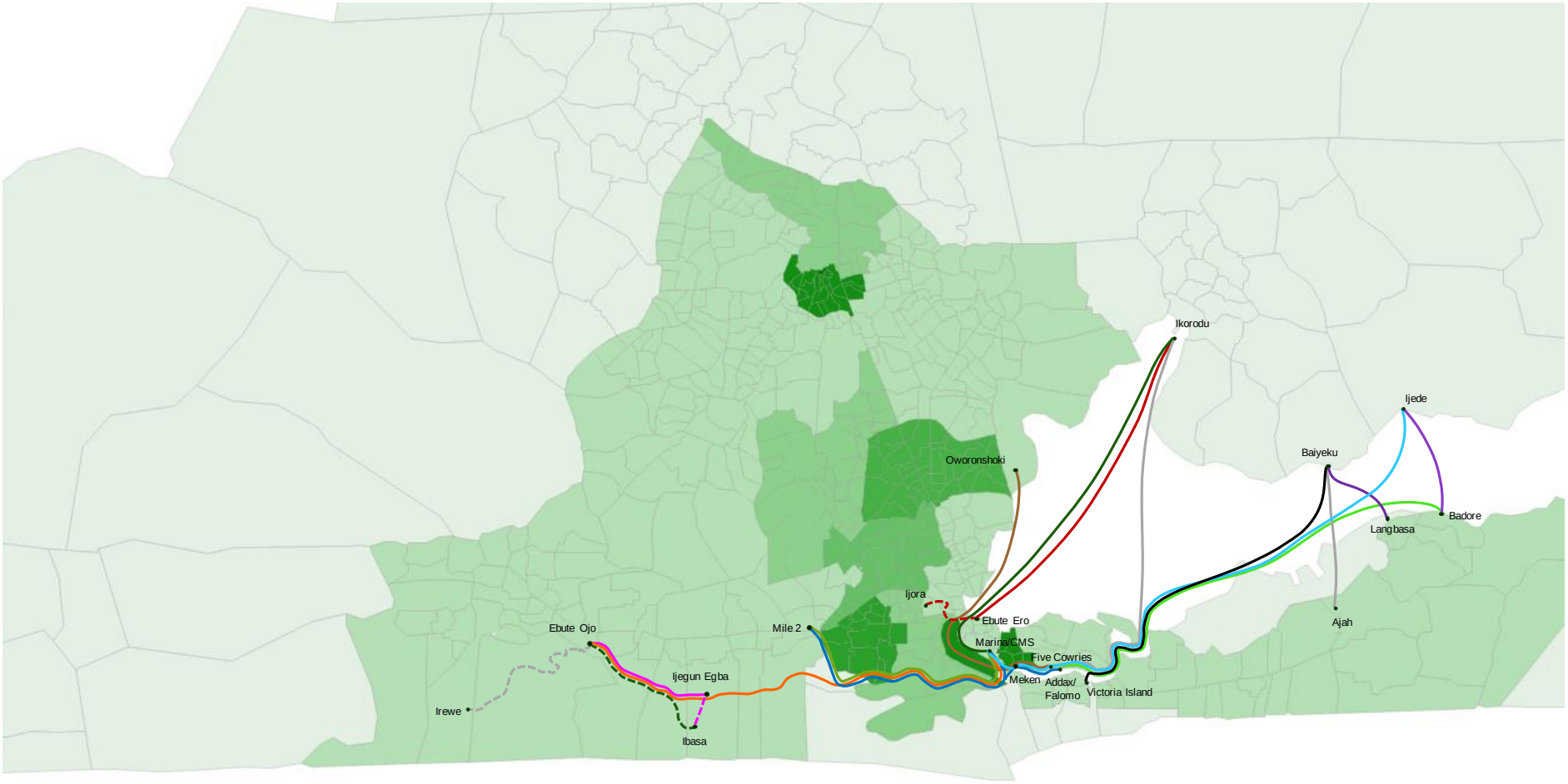


Figure 27. Inland Waterway Projects for the Do Minimum Scenario (2017, 2022, 2032)

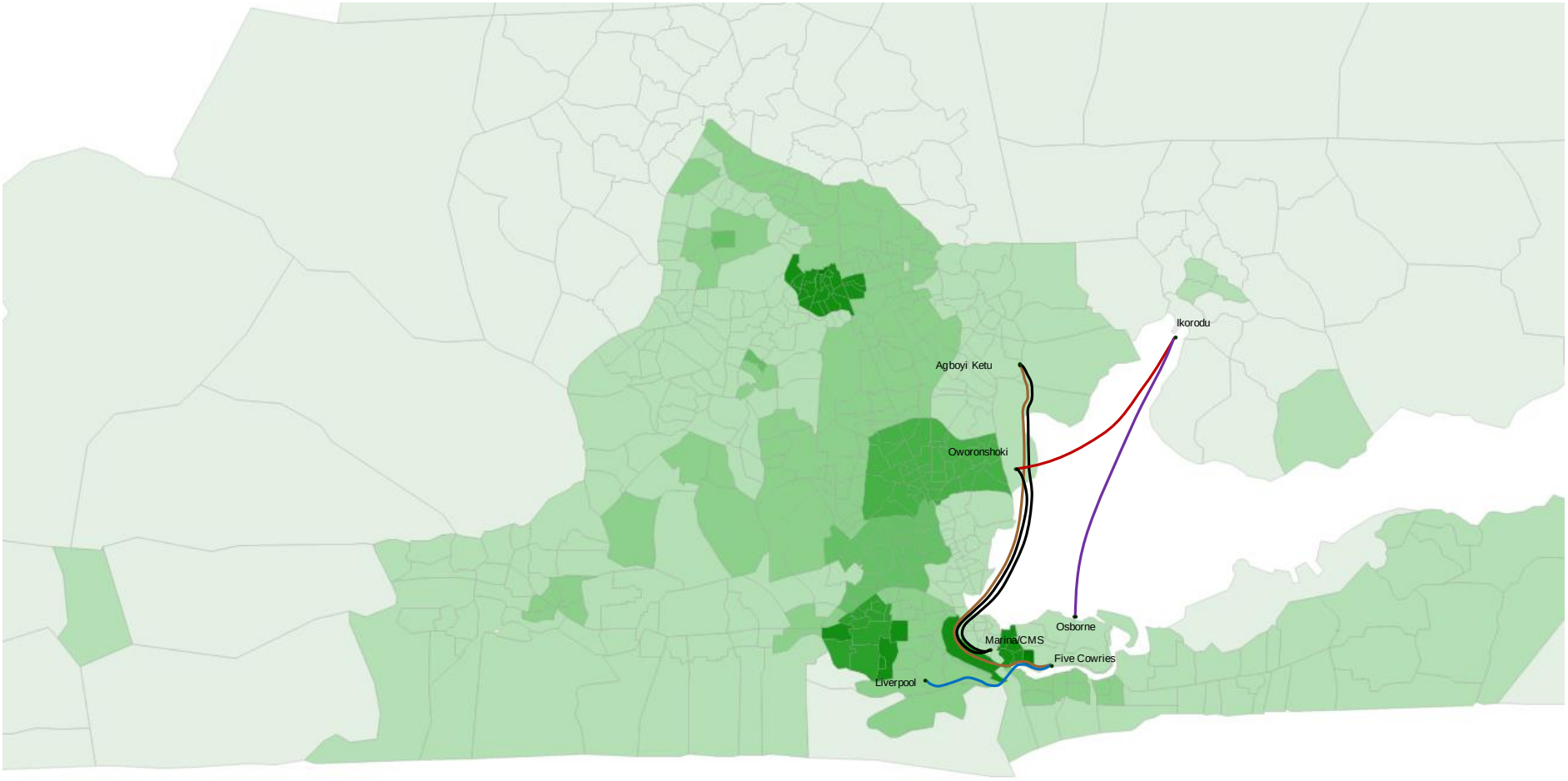


Figure 28. Inland Waterways: Proposal for 2017

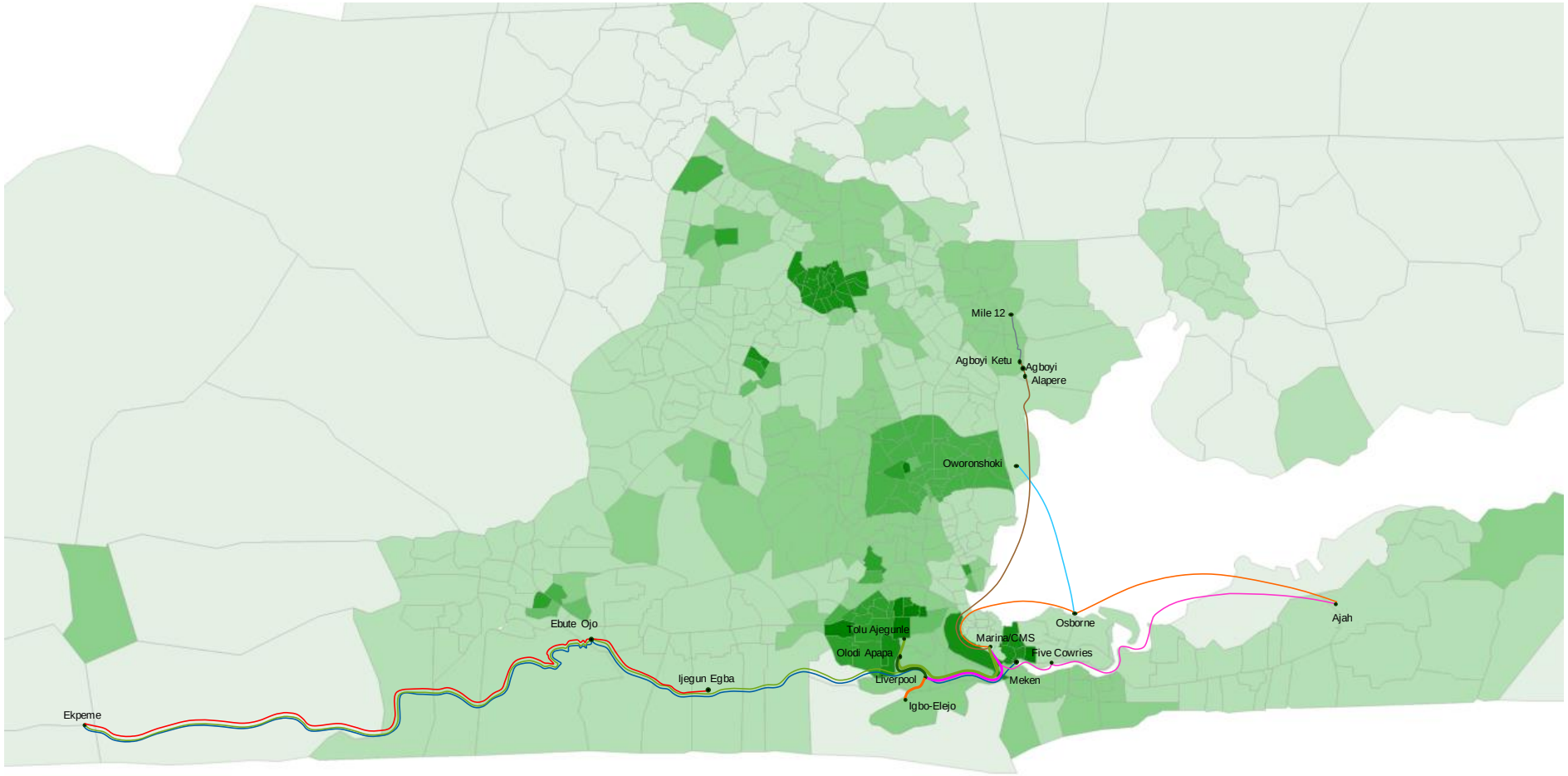


Figure 29. Inland Waterways. Proposal of additional lines for 2022

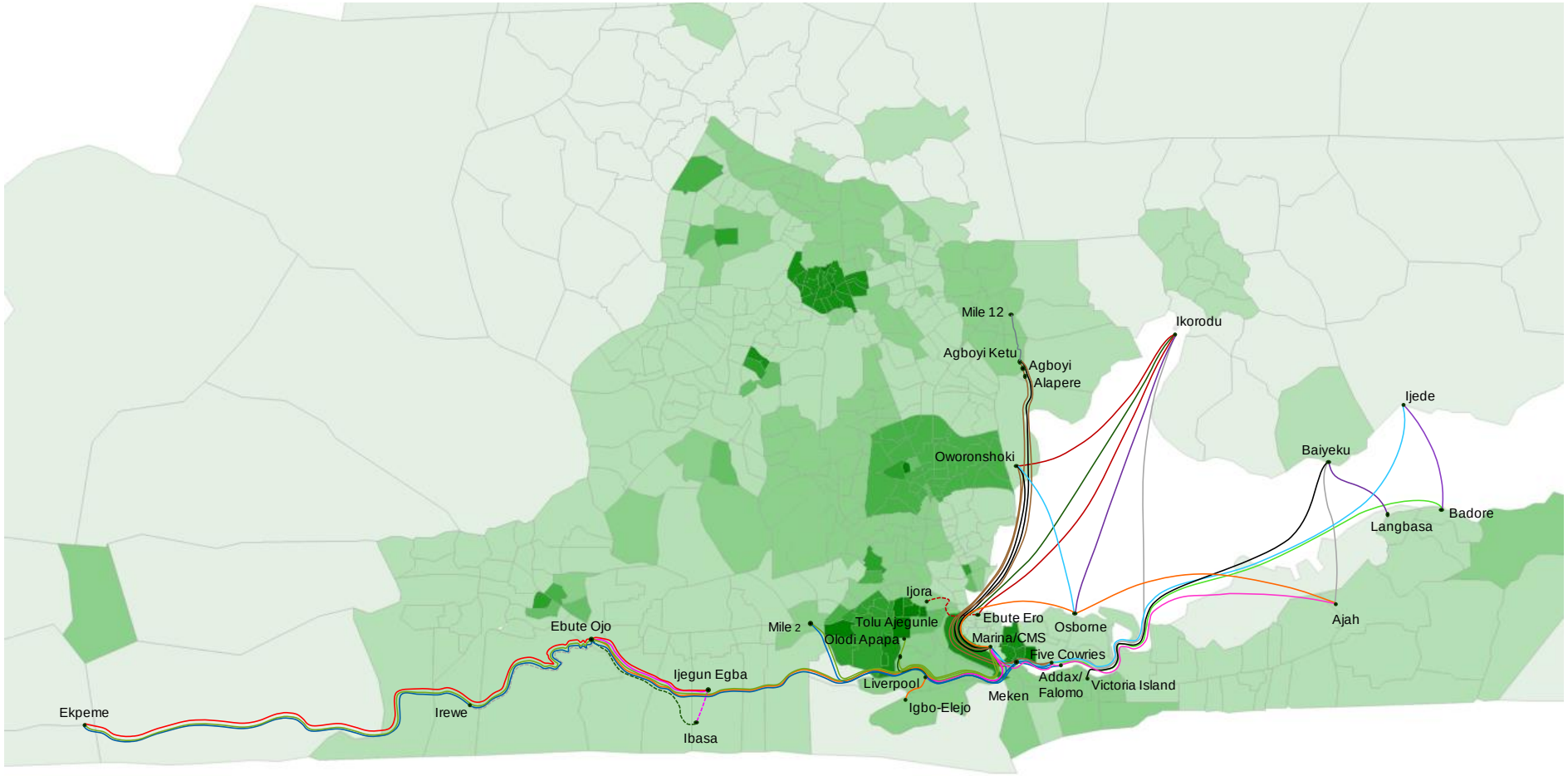


Figure 30. Inland Waterways. Complete network for 2022

4 Development of a Freight Plan for the Megacity

4.1 Objectives

Freight transportation represents a key element in the extension of the Master Plan for Lagos Megacity. Both passengers and freight are deemed essential for the Megacity's socio-economic growth and both share the Megacity's road infrastructure network.

Therefore it would not be rational to define a Road and Public Transportation Plan without considering a parallel Freight Plan aimed at:

- Understanding how freight moves within the Megacity
- Making recommendations in order to improve the operation of the Megacity's freight transportation system. The following issues are being considered:
  - Network (priority corridors, distribution centers)
  - Regulation (fleet typology and age, traffic management, etc.)
  - Institutional framework

4.2 Methodology

The methodology used for the development of the Freight Plan is summarized in the figure below. The characterization of the different freight typologies and flows within Lagos Megacity will aid in identifying the current constraints and needs of the system. The analysis of future trends in Lagos mobility will help in identifying future challenges. The final result will be the basic scheme for a "Freight Plan".

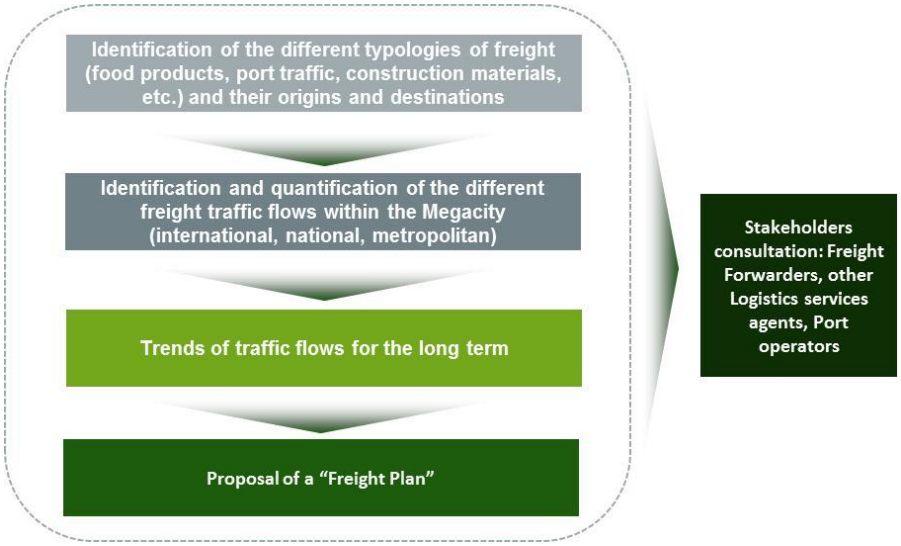


Figure 31. Methodology for the Freight Plan

The first stage for the development of the Freight Plan, that is, the characterisation of freight typologies and flows in Lagos Megacity, is discussed in the next section.

4.3 Identification and Quantification of Freight Typologies and Flows

The characterisation of freight typologies and flows represents the most delicate part of the development of a Freight Plan, as it provides the basis for constructing a solid freight transportation model. Based on the information obtained from documents and key stakeholders, the most relevant freight traffic flows in Lagos has been identified and quantified by studying the transportation corridors and axis of the Megacity that host the most important freight traffic. In order to obtain these results, the following work sequence has been carried out:

- **Analysis of Lagos in a national freight distribution context**, focusing on the relationships of the Megacity with other economic areas at both national and state levels. At this stage, consumption and production centres outside Lagos have been identified, as well as data on foreign trade, amongst other information.
- **Analysis of the metropolitan freight distribution in Lagos**, aimed at understanding the characteristics of freight transport within the Megacity. Three main aspects have been studied: main clusters, the functional relations between the latter, and relevant road network.
- **Identification of freight flows**, which was based on estimating the distribution of freight traffic along the main corridors of the Megacity, having identified the most relevant typologies of cargo within the Metropolitan Area.

In order to carry out the identification of the different typologies and flows of freight traffic in the Megacity, the following sources of information were consulted:

- National and international freight distribution
  - Existing information of foreign trade
  - Port and airport statistics
- Metropolitan freight distribution within Lagos
  - Industries' inventory: assessment of the Megacity's industrial structure and freight traffic associated
  - Markets and shopping malls inventory
  - Interviews and surveys with industries and logistics operators
  - Counts observed during the fieldwork missions

It is important to note that the counts are key to the final quantification of the identified freight flows.

Finally, an additional activity that is transversal to the ones listed above is consulting with the most important stakeholders of the freight transportation system, namely freight forwarders, port operators and other logistics agents.

The results of the mentioned activities are presented in the upcoming sections of this document.

4.3.1 Freight Distribution at National Level

Lagos Megacity plays a prominent role in Nigeria's economy, concentrating a significant part of the financial, commercial and industrial activity of the country.

The headquarters of most of the country's financial institutions and major corporations are located in the central business district in Lagos Island; a large proportion of Nigeria's industries are located within the Megacity.

Seaports are key elements in the development of Nigeria's economic activities: according to the Nigerian Ports Authority (NPA), in 2005 more than 95% of Nigeria's foreign trade was transported by sea. The Lagos ports of Apapa and Tin Can Island, along with others such as Port Harcourt (located at the Southeast) are focal points of commercial activities in the country and, also serve as major nodes of connection to Abuja (the Federal Capital) and other inner areas of the country with the rest of the World.

Moreover, the Megacity holds a strategic location in the African continent with links to other West African ports such as Cotonou (Benin), Dakar (Senegal) and Nouakchott (Mauritania) through the Trans-West African Coastal Highway and to Algiers (Algeria) in the Mediterranean Sea through the Trans-Sahara Highway. As a result of this, in 2005 Nigeria controlled 60% of the imports of the Region.

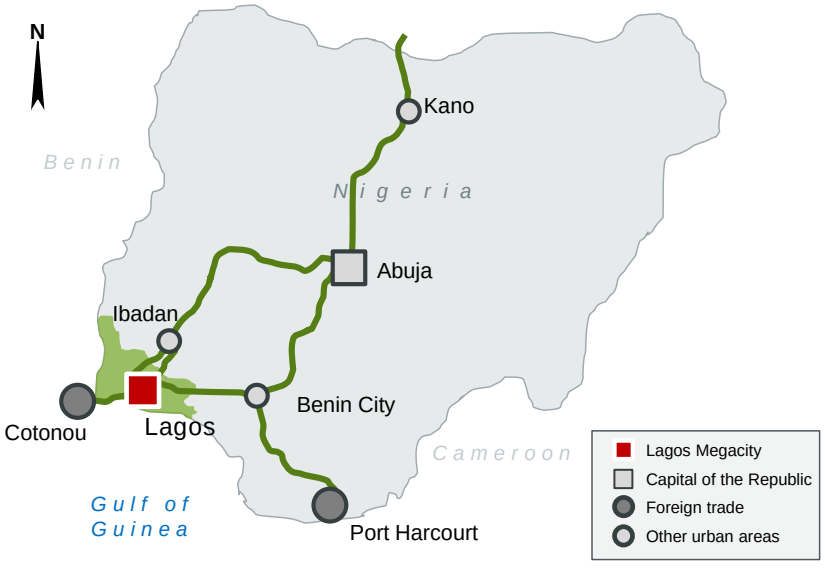


Figure 32. Location of Lagos Megacity in the Republic of Nigeria

Source: ALG

Crude oil production and distribution are key activities for the country's economy: according to the Nigerian National Petroleum Corporation, Nigeria is Africa's largest producer of oil and the sixth largest of the World, with a maximum capacity of 2.5 million barrels per day. Most of Nigeria's production –mainly crude oil– is dedicated to the international market (United States is a major partner), while a large proportion of the country's own consumption is based on refined oil imports (from China and United States, among others). Since it represents around 90% of the total exports of the country and 18% of the imports, petroleum ranks at the top of the list of commodities in Nigeria's foreign trade as shown in the figure below. It exerts a strong influence on the conditions of freight transport in the country: for instance, liquid bulk trucks account for 45% of the total fleet of the Nigerian Association of Road Transport Owners (NARTO) –a key player in Nigerian's road freight transport–, which accounted for 3.1 million vehicles in 2013.

Facilities for crude oil production operate predominantly in the on-shore Niger Delta at the South of the country, using Port Harcourt and other ports located in Delta and Rivers States for export. On the other hand, imports of refined oil enter and are distributed through the country by several means such as maritime or road transport as well as pipeline systems. Vessels with refined oil arrive at storage facilities closely located to Lagos port area, from where the commodity is either transported by road or pumped to other depots, and then distributed to the rest of the country. Besides refined petroleum products, other products imported by Nigeria are motor vehicles, machinery and electrical products.

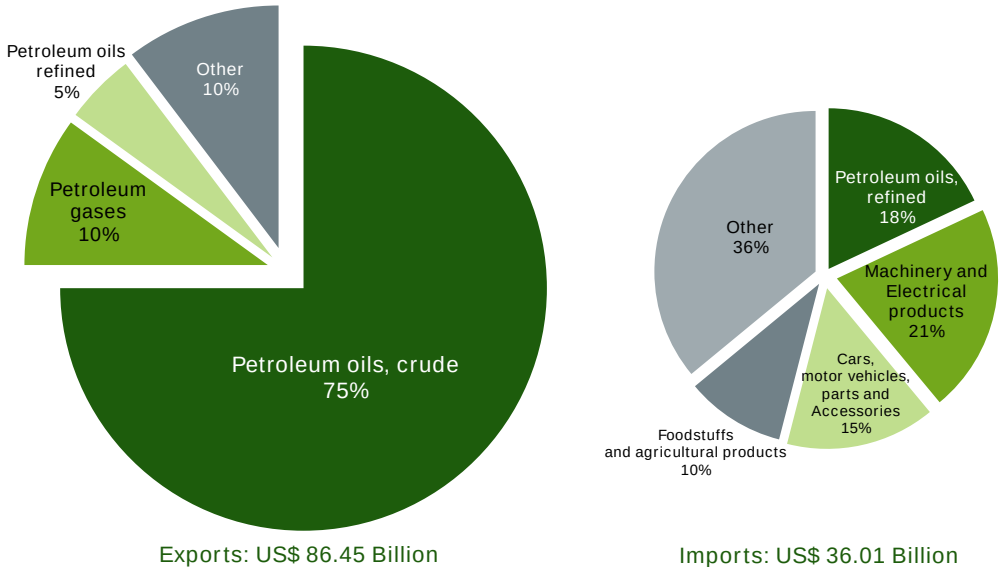


Figure 33. Nigerian Exports and Imports (2010)

Source: ALG based on United Nations Commodity Trade Statistics Database

The figure presented below, which illustrates foreign trade through Nigerian ports by origin and destination, provides some hints to understand the different roles Lagos and Port Harcourt (located in Rivers State) play in Nigeria's economy. Lagos State was by far the main destination for imports

in 2005, with more than 18 million tons, followed by Rivers State with 4.5 million. On the other hand, the latter was the origin of more than 12 million tons of exports, while the rest of the country (including Lagos State) accounted for less than a million. Lagos is, without any doubt, the main gateway for imports into Nigeria, as Port Harcourt is for exports.

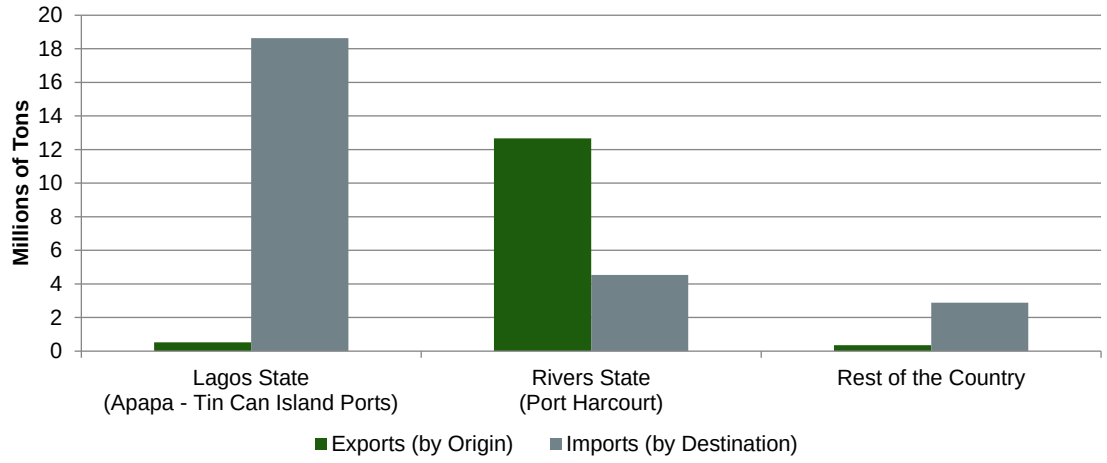


Figure 34. Exports (by State of Origin) and Imports (by State of Destination) traded through Nigerian Ports (2005)

Source: ALG based on NPA data

The general overview of freight movement through Lagos ports by either origin or destination presented in the figure below confirms the leading role of the Megacity in the Nigerian and African economy as a major market for imports. The vast majority of Lagos' port movement –more than 30 million tons, including both Apapa and Tin Can island port facilities– consists of imports, which are either traded in the Megacity's wholesale and retail markets (with buyers coming from Nigeria as well as other parts of West and Central Africa) or used by its industry.

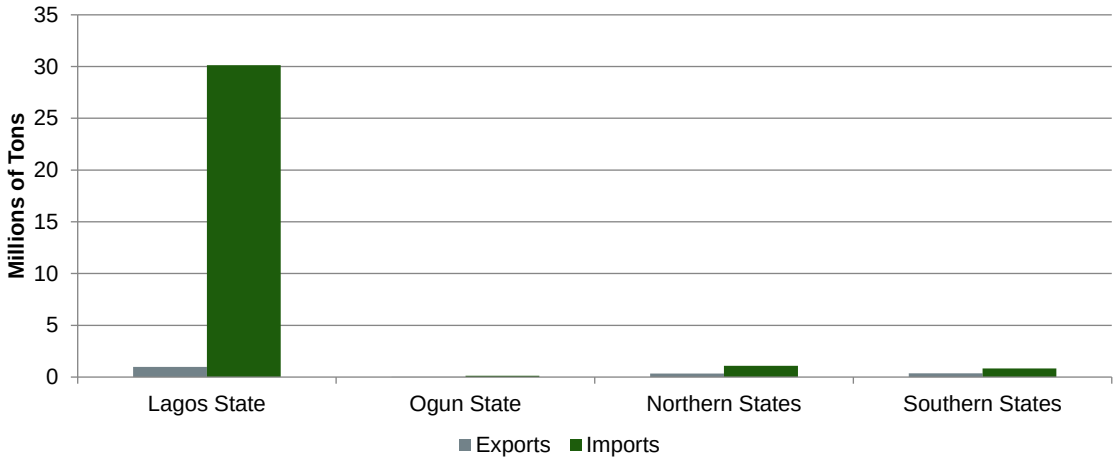


Figure 35. Foreign trade through Lagos Ports by Origin and Destination (2012)

Source: ALG based on NPA data

4.3.2 Freight Distribution at State Level

Ogun State is the only state in Nigeria sharing land borders with Lagos State –surrounding it in the North and the East– and has increased its industrial and productive activities during the last years. This is why Ogun State is the Megacity's major partner inside Nigeria, supporting the latter's role as a commercial, financial and industrial centre by supplying it with agricultural products, timber, building materials, manufactured products and other commodities. In this regard, the analysis of freight distribution at the state level is focused on the movements of goods between Ogun and Lagos States.

Freight movement between the Megacity and Ogun State is defined by the following key aspects:

- **Refined petroleum, as well as other imported products (cars, electronics, machinery)**, transported from Lagos to Ogun State and other areas of the country. A petroleum product depot located at Mosinmi (near Shagamu), provides local supply outside Lagos State.

- **Agricultural products**. Ogun State supplies Lagos with most of its vegetable, corn, citrus fruits, cassava, and yam flour. The lack of adequate facilities for food storage and preservation is the reason why all these goods have to be transported on a daily basis, using old vehicles that do not guarantee the expected quality of transport and handling conditions.

- **Industrial estates** located in Otta and Agbara, (which are two of the country's largest industrial areas), provide a wide variety of manufactured products (including food, beverages and household products) to Lagos Megacity as well as the rest of the country.

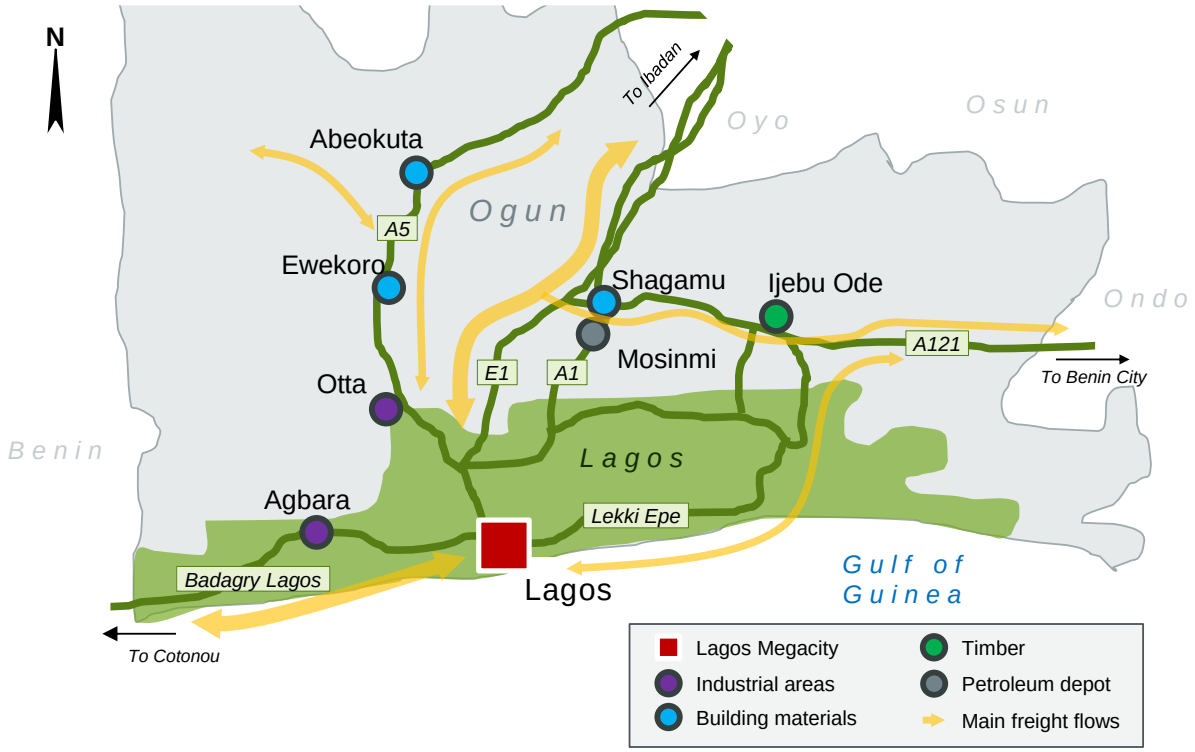
- **Building materials production centres** in Ewekoro, Shagamu (cement), Abeokuta (granite and sand), and Ijebu Ode (timber), provide Lagos Megacity with these commodities.

The Abeokuta Expressway (also called Route A5) connects Lagos and Abeokuta (the capital city of Ogun State) with Ibadan (the capital city of Oyo State and one of the largest metropolitan areas of the country) and Abuja. Due to poor maintenance, the Abeokuta Expressway is used mostly for connecting the Megacity with the Western area of Ogun State, while the Lagos-Ibadan Expressway (also called Route E1) becomes the main link between Lagos and the Northern states of the country, together with the Lagos-Shagamu Road (also called Route A1, in poorer conditions than the former two).

The poor condition of the main roads in Lagos and Ogun States has become a major challenge for the efficient development of economic activities. In this regard, the public sector has been carrying out some actions to overcome this problem during the last years. This include the improvement of Route E1 and the construction (and future upgrade) of the Lekki Epe Expressway, which is the first public-private partnership (PPP) and privately funded toll road project in Nigeria as well as in the African continent outside South Africa. It could serve as an alternative for the connection of the Megacity to the East.

Lagos Megacity has a strong commercial relationship with the port of Cotonou through the land border with the Republic of Benin. A considerable proportion of this freight movement consist of contraband cargo (mostly petroleum, cars, electrical and electronic products as well as other banned commodities). The border with Benin Republic is also a major gateway for manufactured goods such as plastics, soaps or detergents, which are exported from Nigeria to West African countries. Although there are several routes used for the bilateral trade between Nigeria and Benin, the Lagos-Badagry Expressway, which links the Megacity and Cotonou through the border city of Badagry, is by far the main one and generates a significant amount of traffic.

The figure below presents the main production areas as well as the main road freight flows that involve Lagos Megacity and Ogun State.



Travel distances by route

Lagos to Ibadan via routes

Route	Travel distance
A5: Lagos-Abeokuta Expy	170km
A1: Lagos Shagamu Rd	140km
E1: Lagos Ibadan Expy	135km

Lagos to Benin City via routes

Route	Travel distance
Lekki Epe Expy	316km
A1: Lagos Shagamu Rd	310km
E1: Lagos Ibadan Expy	310km

Figure 36. Production areas and main road connections of Lagos and Ogun States

Source: ALG

4.3.3 Freight Distribution at Metropolitan Level

4.3.3.1 Main Clusters of Freight Movement

Originally a small fishing settlement in Lagos Island which later became the seat of the British Colonial government, the Lagos Megacity is nowadays one of the largest conurbations in the World as a result of an accelerated urban and demographic expansion which began in the 1960s due to Nigeria's economic boom. The urban expansion and subsequent densification of the Megacity has been developing along the axis between Lagos Island and the port area (Apapa and Tin Can Island) in the South and Ikeja (the seat of the State capital, as well as the location of the International Airport) in the North. The market and industrial development in the Megacity follow this South-North axis. Indeed, the two most important centres for manufacturing activities of the country are located in Ikeja and Apapa Local Government Areas (LGA).

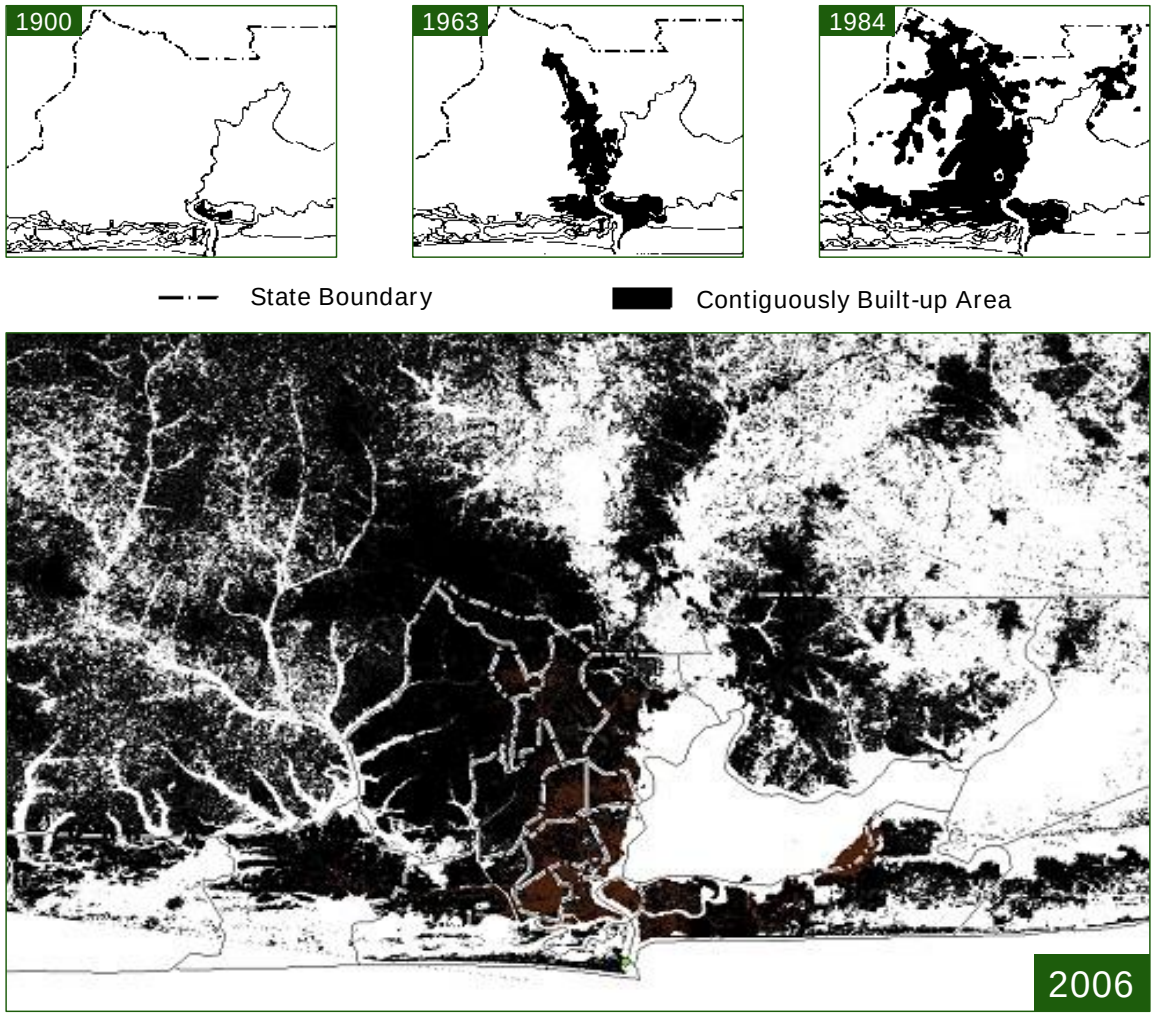


Figure 37. Spatial Expansion of Lagos Megacity (1900-2006)

Source: University of Lagos

A full understanding of the key aspects of freight distribution in Lagos Megacity requires a clear knowledge of the areas with high concentration of activities involving large freight movements. With the aim of locating these main clusters, a survey was conducted in order to identify areas of high freight concentration within the Megacity. These are classified in two main categories: centres of mass-consumption (including major markets and shopping malls) and centres of freight services (such as truck parks and terminals, besides the port area and the International Airport). Information about these facilities was gathered from different sources (available information, maps, fieldworks, interviews and data surveys).

The identified main markets and shopping malls are presented in the following tables and figure. Lagos' prominent position as a major regional commercial centre is reflected in the large number of large scale markets which offer a wide variety of traded products available in the Megacity. Most of these markets are located along the South-North axis formed by Apapa and Ikeja LGAs, as well as at the main access of the Megacity.

Market	Specialization
Idumota	Wholesale household – largest market in Lagos
Oke Arin	Wholesale household
Balogun	Wholesale household
Iddo	Rice, vegetables
Mile 12	Farm & food
Mushin	Wholesale household
Oyingbo	Food – Iddo's sister market. Foodstuff transit point between Northern Nigeria states and Lagos.
Ketu	Food
Oshodi	Wholesale household – second largest market in Lagos
Owode-Onirin	Spare parts (motor – second hand)
Alaba International	Electronics (major hub in Nigeria)
Berger	Cars/motor
Adeniji Adele	Electricals
Ile-Epo	Farm & food
Agbalata	Food (coconuts)
Daleko	Rice
Katangowa	Second hand clothes
Aswani	Clothes (textile industry area)
Ladipo	Spare parts (motor - new) – big hub

Market	Specialization
Amu	Building materials
Jakande	Fruit & Farm produce
Ojo-Alaba	Ceramics, tiles
Computer village	IT material
Tejuosho / Yaba	Wholesale household

Table 16. Major Markets in Lagos Megacity

Source: ALG

Shopping Mall	Location
Adeniran Ogunsanya Shopping Mall	Surulere
Ikeja City Mall	Ikeja
Lagos City Mall	Lagos Island
Mega Plaza Century 21 Mall	Victoria Island
Silverbird Galleria	Victoria Island
The Palms Shopping Mall	Victoria Island

Table 17. Main Shopping Malls in Lagos Megacity

Source: ALG

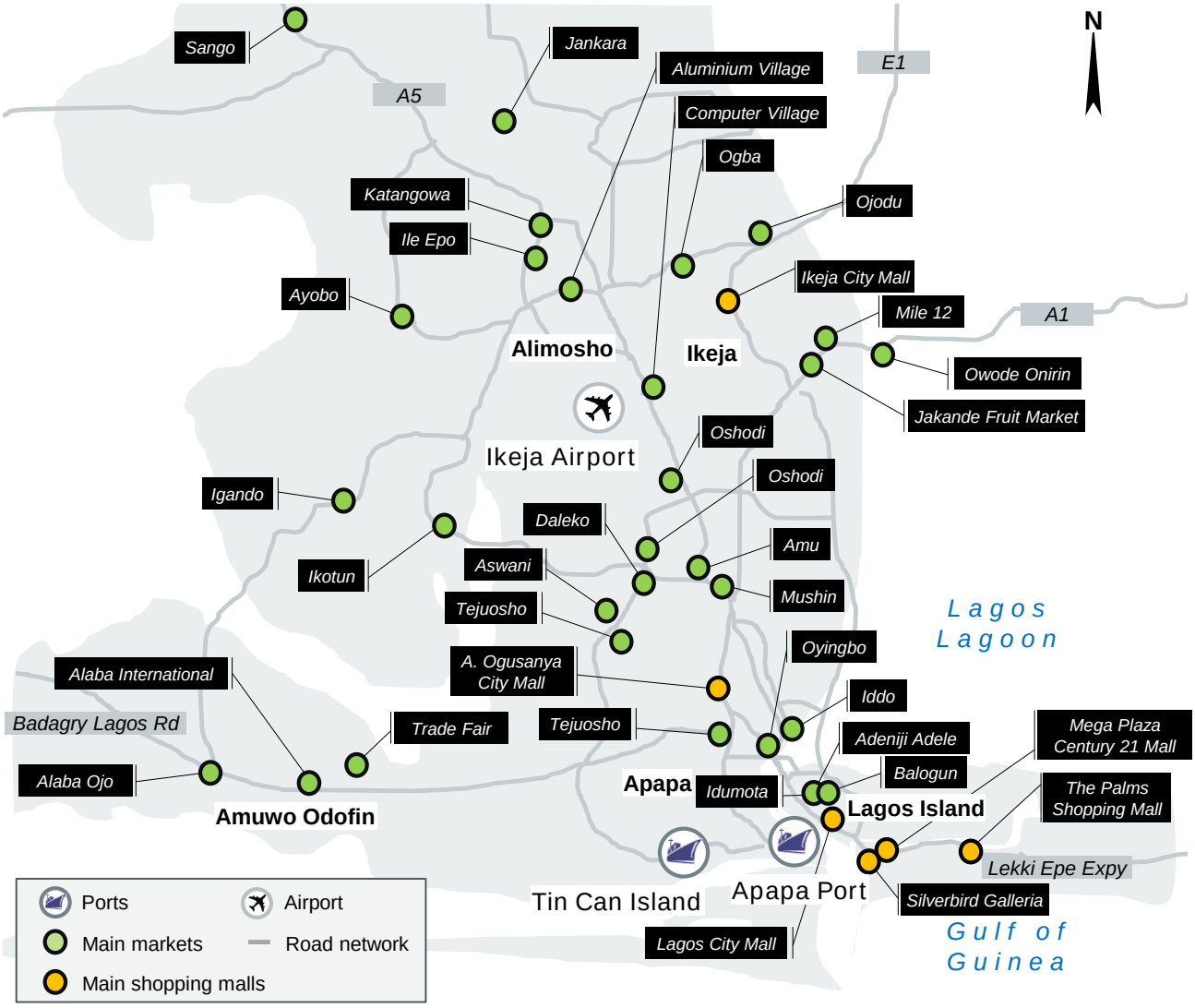


Figure 38. Main Markets and Shopping Malls in Lagos Megacity

Source: ALG

This significant commercial activity is supported by a large (and also inadequate) presence of transport services comprising, on the one hand, truck parks located close to areas with intense activity (especially at the industrial and port areas of Apapa LGA, as well as at the surroundings of the international Airport) and, on the other hand, more informal spots along the main roads, particularly along the Lagos-Ibadan Expressway.

The location of the main truck parks in Lagos is presented in the figure and table below.

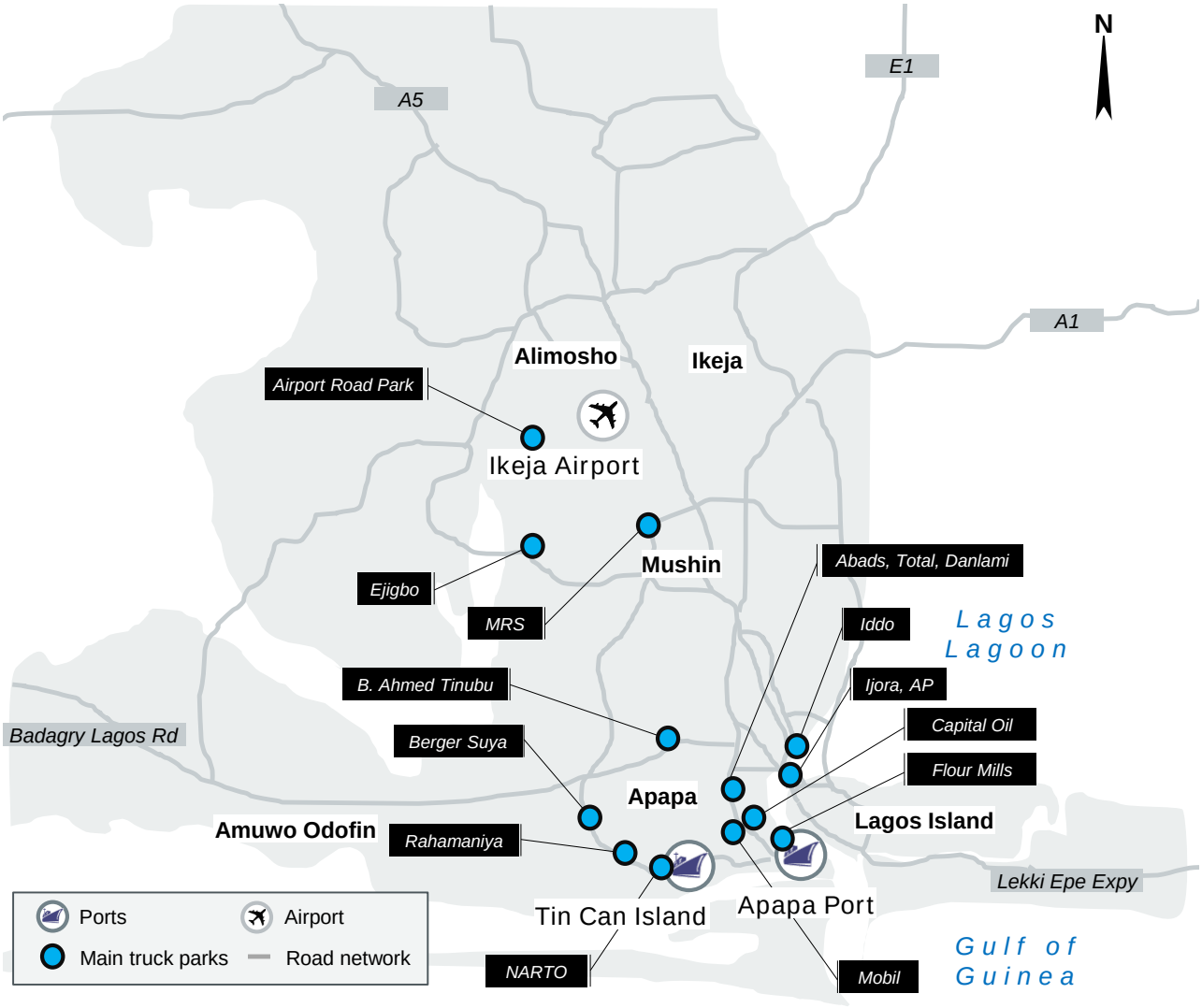


Figure 39. Main Truck Parks in Lagos Megacity

Source: ALG based on information provided by NARTO

Truck Park	Location	Capacity (trucks)
NARTO Transit Park	Tin Can Island Port	300
Rahamaniya Terminal	Ibafon, Coconut	100
Berger Suya	Apapa-Oshodi Expressway	50
Capital Oil Truck Park	Amuwo Odofin Industrial Estate	1,000
MRS Truck Terminal	Apapa-Oshodi Expressway	1,000
Ijora	Ijora	100
Iddo Terminal	Iddo Terminal Bridge	40
AP Terminal	Ijora Depot	250

Truck Park	Location	Capacity (trucks)
Mobil	Mobil Road by Boundary	200
Total	Marine Beach	300
Abads Ventures	Dock Yard Junction, Marine Beach	30
Danlami Park	Railway Yard by Dock Yard Junction	150
Flour Mills	Apapa	60
Bola Ahmed Tinubu Park	Orile by Badagry Lagos Expressway	Not available
Ejigbo Truck Park	Ejigbo	Not available
Airport Road Park	Ikeja Airport surroundings	Not available

Table 18. Main Truck Parks in Lagos Megacity

Source: NARTO

During the process of identifying centres of high freight concentration within Lagos, it was noticed that extensive economic activities taking place in the Megacity is concentrated in 6 main clusters:

- **Apapa**. A large industrial estate has developed around the ports of Apapa and Tin Can Island. These industries include manufacturing metal products, textiles, food, beverages, chemicals, as well as those products involved in petroleum-related business (Oando, NNPC, Capital Oil, etc.). This zone is home to a number of markets for imports (such as Ladipo, which offers machinery, spare parts, etc.) as well as building materials (Ojo-Alaba, Idiose, Amukoko). Apapa also has prime importance in logistic activities of the Megacity, offering a wide range of transport and handling services within its boundaries. Proof of the former is that most of the main truck parks of the Megacity are located in this area.

- **Ikeja-Alimosho**. The Ikeja LGA, the Capital City of Lagos State, is home to one of the most important industrial estates in the country, as well as the Murtala Muhammed International Airport. This cluster is home to commercial areas such as Ogba, Ojodu, (which comprise of a number of markets and shops offering a wide variety of commodities) and the Computer Village, a large market specialized in electronic equipment sales and related services.

- **Mushin.** A suburb of Lagos located mid-point between Ikeja and Apapa LGAs, Mushin comprises of some of the biggest and densest markets in Lagos Megacity, such as Oshodi, Mushin, Aswani**,** Daleko, Tejuosho, and Amu. These markets which offer a wide variety of products, ranging from foodstuff to household items and second hand items, selling both wholesale and retail products at low prices.

- **Lagos Island**. The Idumota market, located in Lagos Island, is one of the oldest markets in Lagos and the largest market in West Africa. It is densely occupied by tens of thousands of shops trading in different types of commodities. Other markets located in Lagos Island are Balogun, Adeniji Adele and Oke Arin.

- **Mile 12** is the main bulk market for agricultural products from all over Nigeria. It is the cheapest market for vegetables, fruits and livestock. Other markets closely located to Mile 12 are Jakande and Owode Onirin; the latter specializes in the trade of car spare parts.

- **Alaba International Market** is one of the largest electronics market in West Africa. It is home to the biggest importers and distributors in this field.

Other important markets are Iddo and Oyingbo, which serve as transit points between Lagos and Ogun States, as well as the Northern states of Nigeria, for foodstuff and livestock. The Lagos International Trade Fair specializes in corporate services and retail selling. Other markets, such as Igando, Ikotun, Ayobo, Ile Epo, Jankara and Katangowa, are smaller and oriented to a more local context. Worthy of mention is the industrial estate in Ikorodu, located to the East of the Megacity through Route A1. However, it is still under development and does not have extensions comparable to Ikeja and Apapa.

The figure below presents the spatial location of the previously described main clusters:

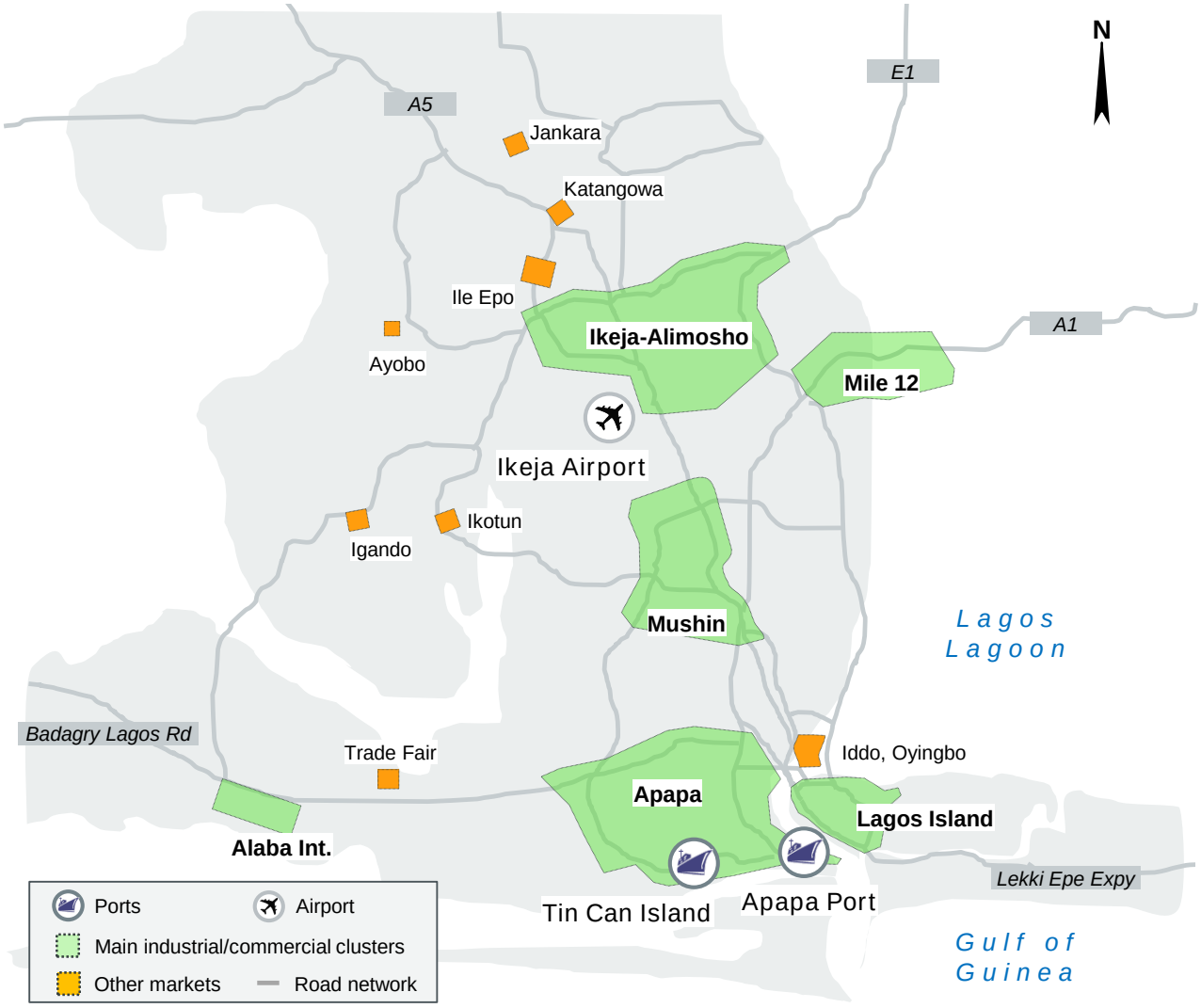


Figure 40. Main Clusters of Commercial and industrial Activity in Lagos Megacity

Source: ALG

4.3.3.2 Functional Analysis

The dynamics generated by Lagos' economic clusters are key to the understanding of the functional structure of freight transport in Lagos, as well as to the quantification of the traffic flows within the Megacity.

For this reason, an intensive interview campaign was carried out in the main industrial areas of Lagos (Ikeja, Apapa and Ikorodu). A list of companies to be interviewed was outlined, considering both production and distribution activities. The companies selected for the interview campaign and a sample of the questionnaire are shown in the following tables.

Company Name	Company Address
Elizade (Toyota) Nig Ltd	Elizade Plaza 322A Ikorodu Road, Maryland, Ikeja
Procter & Gamble Nigeria	All Seasons Business Plaza, Lateef Jakande way, Agidingbi, Ikeja.
Frieslandcampina WAMCO Nig	Plot 7B, ACME Road, Ogba Ikeja
Cadbury Nig Plc	Lateef Jakande Road, Agidingbi
Guinness Nig Plc	24, Oba Akran Avenue Ikeja
Berger Paints Nig Plc	Plot 10, Oba Akran Avenue Ikeja
Dunlop Nig Plc	Oba Akran Avenue Ikeja
Mikano International Limited	Plot 34/35, ACME Road, Ogba, Ikeja.
MDS Logistics	MDS Logistics, Oregun Road.
John Holt	Plot 3/4, Adewunmi Ind Estate, Oregun, Ikeja
Roadmarks Nig Ltd	22, Simbiat Abiola Road, Ikeja
Intercontinental Distillers Ltd	3, Ladipo Oluwole Street, Off Ademiyi Jones Avenue, Ikeja.
Vita Foam	138, Oba Akran Avenue Ikeja.
Nigerite Ltd	
A.G Leventies Plc (Motors Division)	2, Wharf Road, Apapa
Honeywell Plc	2nd gate bye-pass, Tin can Island, Apapa
Alumaco Plc	32 Creek Road
Union Dicon Salt Plc	Kariko Towers (2nd floor) 9 Wharf Road, Apapa
UTC Nig Plc	27/29 Creek Road, Apapa
Burham	2, Old Dock Road, Apapa Lagos, Nigeria.
Niger Biscuit Company Ltd	35, Creek Road, Apapa Lagos.
Oando	(5th, 7th, 10th floor) 2, Ajose Adeogun Street, Victoria island.
Samsung	15, Akin Adesola/Alakinja Street, Victoria Island.
Castplat	Lekki or Ijesha Express way
Nutricima	Shagamu Road, Ikorodu
PZ Cussons Nigeria Plc	Shagamu Road, Ikorodu

Table 19. List of Companies Selected for the Interview Campaign

Source: ALG

- The first set of questions would be focused on **general information on your company**:
  - Main commercialized products
  - Number of employees
  - Turnover
  - Location of your main centres in Lagos Mega-City
  - Square meters of production and storage facilities in each one of these centres

- First of all, we would like to know **how you get your production inputs**
  - What are your production inputs?
  - Where do you get them from and through which distribution channels?
  - Do you use any parking/consolidation centres along the way?
  - What are the final products that you obtain from them?

- The next phase of the interview will focus on **how you distribute your final products**:
  - Where do the final products go? In what proportion are they exported and consumed locally?
  - Where are they transported for national consumption? Through which distribution channels?
  - Where are they transported for exportation? Through which distribution channels?
  - Do you use any parking/consolidation centres along the way?

- We would very grateful if you could also provide us with **some information on the freight traffic (trucks per day)** generated by the aforementioned production/distribution centres. We consider both those located within the Mega-City and also other centres outside the Mega-City generating freight traffic into the Mega-City.

- Do you have your own **truck fleet**? What is its size and age?

- What **problems** does your company encounter in the distribution process through the Mega-City (insufficient road infrastructure, congestion, lack of parking areas for trucks, etc.). Do you have any suggestions of improvements in this regard?

Table 20. Example of Questionnaire used in the Interview Campaign

Source: ALG

The different companies that participated in the interview campaign provided very useful information on the production and distribution logistic chain patterns. This information has been used for the identification of the different clusters and transport centres in Lagos Megacity, as well as the interactions between each other and with outer areas. The result of this analysis is a scheme for the functional structure of freight transport in the Megacity presented in Figure 41. It consists of two types of elements:

- **Freight consolidation centres, arranged** in three levels:
  - *Transport Infrastructure*, including Apapa and Tin Can Island Ports and the International Airport. Their nodal function does not only include transport-related activities but also national and international logistics and distribution activities, generally carried out in their immediate influence areas.
  - *Main clusters*, which include Apapa, Ikeja-Alimosho, Lagos Island, Mile 12 and the Alaba International Market. Due to the concentration of economic and industrial activities in these areas, they generate high-volume of freight flows. As a result, they represent key-distribution centres at national and international levels. Ikeja-Alimosho, Mushin and Mile 12, due to their proximity, together form a “macro-zone” at the centre of the Megacity.
  - *Local markets*, such as Iddo, Oyingbo, Trade Fair, Ile Epo, Jankara, Katangowa, Ayobo, Igando and Ikotun, have a smaller area of influence, associated with the zones they supply with consumption products.

- **Functional relations,** also arranged in three levels:
  - *First level*, which comprises of big freight flows that enter or leave Lagos Megacity, either through the main road access or through Apapa and Tin Can Island Ports and the International Airport, due to foreign trade or national commerce.
  - *Second level*, includes interactions between transport infrastructure and the main clusters themselves. They involve high freight volumes destined to both wholesale and retail selling.
  - *Third level*, involves freight movement at a local level, from the main clusters to smaller markets, to which they are linked due to proximity (Jankara, Ayobo, Ikotun) or to market specialization (Trade Fair, Iddo, Oyingbo).

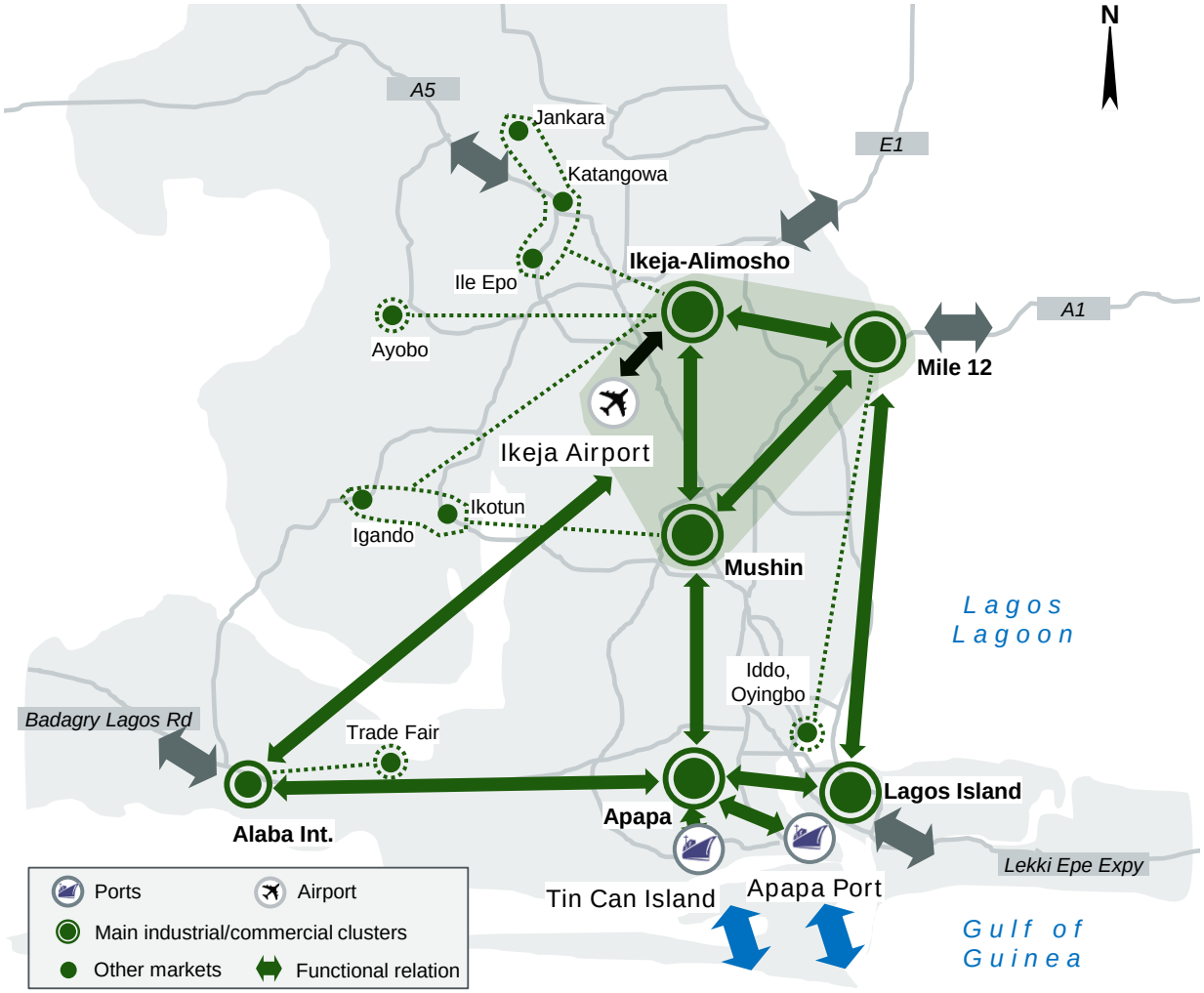


Figure 41. Functional Structure of Freight Transport in Lagos Megacity

Source: ALG

4.3.3.3 Road Network

In order to translate the functional relations between the different levels of freight consolidation centres of Lagos into freight flows, it is necessary to identify the roads that are relevant to the transportation of commodities within the Megacity. In this regard, Lagos' main road networks for freight transport can be divided into three groups:

- **North Direction**. Connects the original development axis of the Megacity (Ikeja-Apapa), linking Apapa and Tin Can Island ports to the Airport, and then continues to Abeokuta and other parts of the West of Ogun State.

- **North-East Direction**. Comprises of the most important access to the Megacity (Route E1), connecting Lagos with the North and East of Nigeria. Inside the Megacity this network passes through almost all the most relevant freight centres.

- **West Direction**. Connects Cotonou (Benin) with the main freight centres in Lagos Megacity.

Figure 42 and table 20 below show the previously described groups of roads.

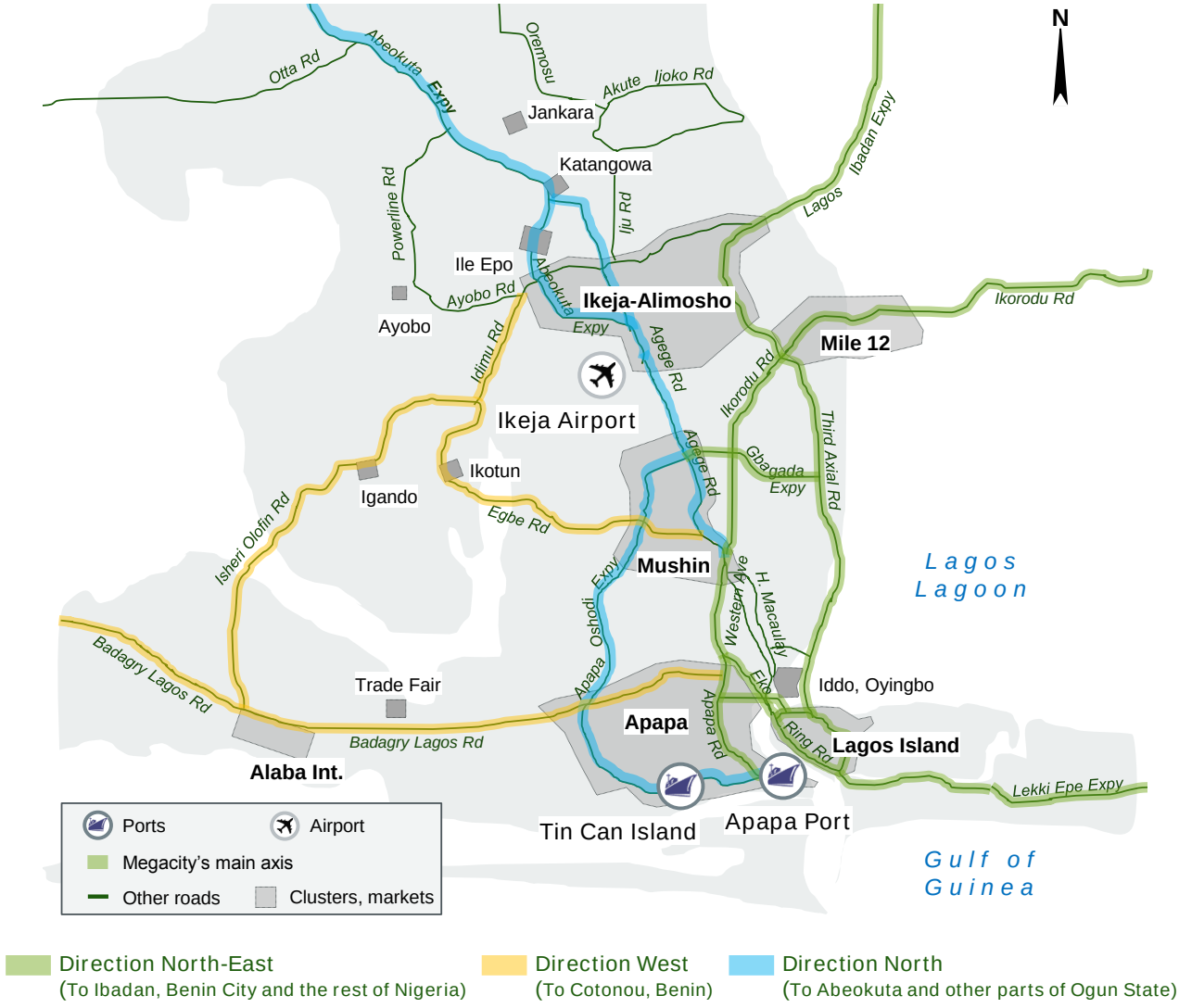


Figure 42. Main Road Network of Lagos Megacity

Source: ALG

Direction	Road Network
North	Abeokuta Expressway (Route A5)
	Agege Road
	Apapa Oshodi Expressway
North-East	Lagos Ibadan Expressway (Route E1)
	Ikorodu Road (Route A1)
	Third Axial Road, Third Mainland Bridge
	Gbagada Expressway
	Western Avenue
	Apapa Road
	Eko Bridge
	Carter Bridge
	Ring Road
	Lekki Epe Expressway
West	Badagry Lagos Road
	Isheri Olofin Road
	Idimu Road
	Egbe Road, Mushin Road, Isolo Road

Table 21. Main Road Network of Lagos Megacity

Source: ALG

4.4 Freight Flows

4.4.1 Main Patterns of Freight Distribution

The distribution of freight-related activities in the Megacity (at both national and metropolitan levels), which has been presented in the previous sections of this document, provides very useful information on Lagos' freight dynamics. On the basis of this knowledge, this section of the report will identify the general patterns of the Megacity's freight transport flows. An analysis of the distribution of freight flows within Lagos' main road network has been carried out in order to understand freight transport in the Megacity, and its results are presented in this section.

The dominant position of Lagos' port areas in the commercial activities of Nigeria as well as Western and Central Africa (already reviewed in the analysis of freight transport in Lagos at a national level, section 4.3.1) has a significant influence on the Megacity's freight transport dynamics. To this extent,

information about freight movement in Apapa and Tin Can Island ports becomes essential for depicting flows within Lagos Megacity.

The two figures below show the main distribution patterns of the cargo handled at Apapa and Tin Can Island based on the estimations of the Nigerian Ports Authority (NPA) in 2012. For imports, which represent most of the freight movement at Lagos' ports, around 93.5% of the total freight handled remains within the Megacity. On the other hand, the Megacity appears as the origin of about 57% of exports through Lagos ports, which is considerable, with a significant presence of cargo coming from the North and the East through the E1 and A1 roads (each one of them representing 20% of total exports).

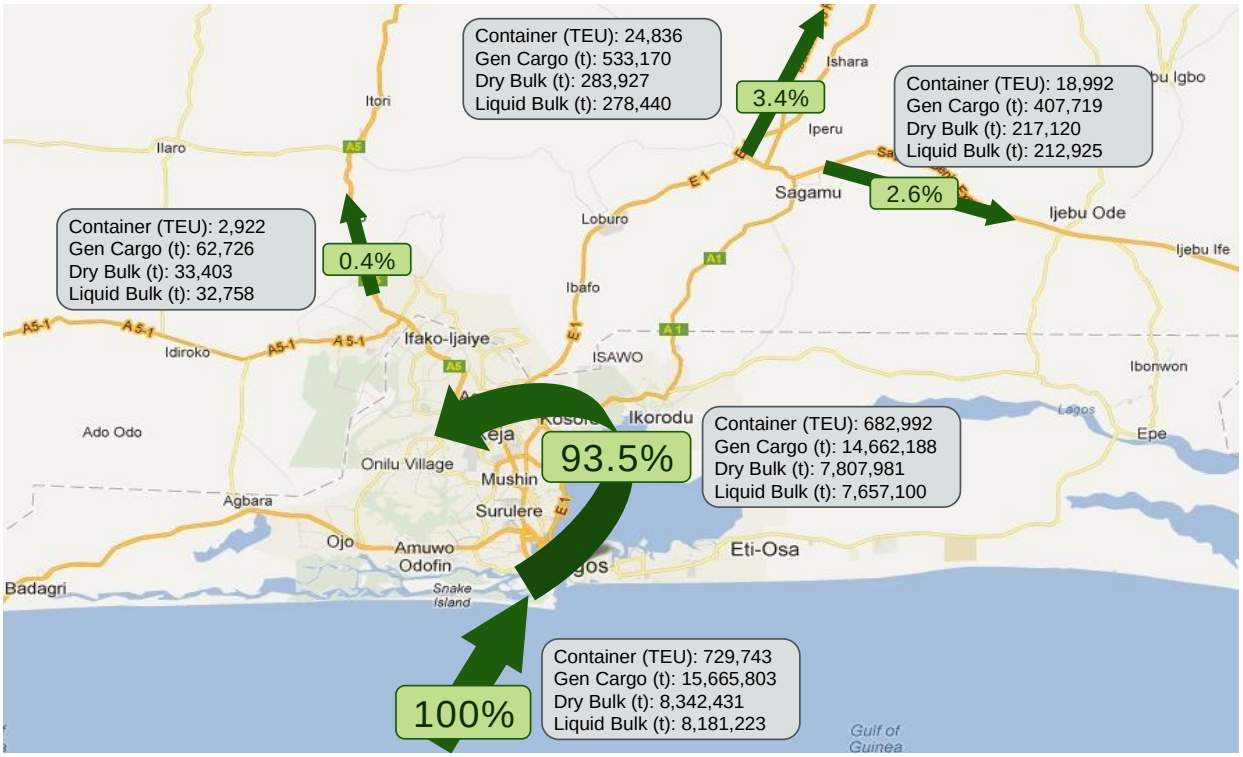


Figure 43. Imports through Lagos Ports: Main Yearly Distribution Flows within Lagos State & to other Nigerian States

Source: ALG based on NPA estimations (2012)

These figures reflect the key roles of roads E1 and A1 with respect to connecting Lagos with the rest of Nigeria as well as Western and Central Africa, and their relevant position as two of the main corridors in the Megacity.

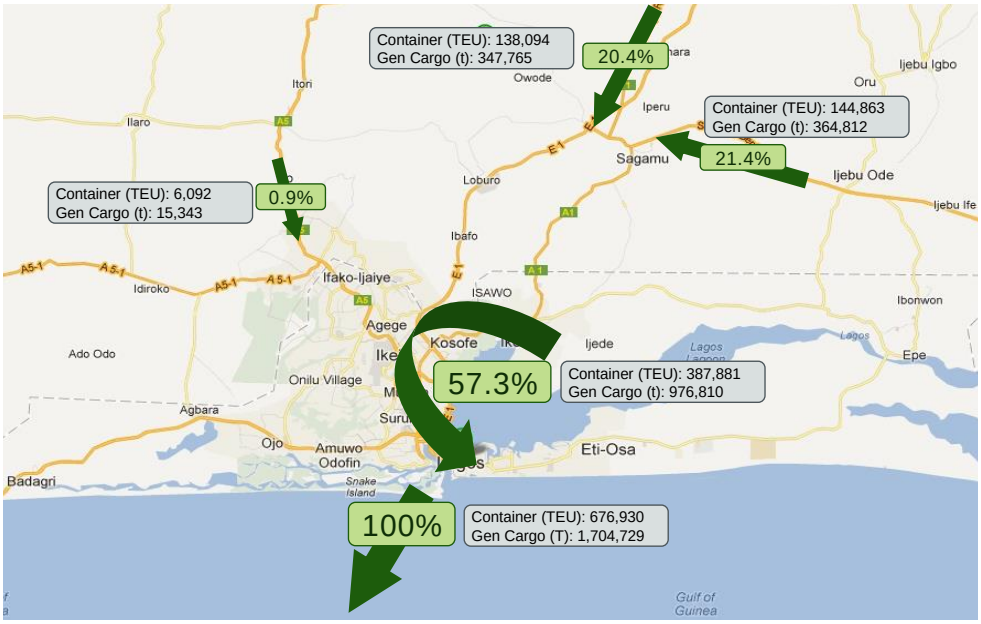


Figure 44. Exports through Lagos Ports: Main Yearly Distribution Flows from Lagos State & other Nigerian States

Source: ALG based on NPA estimations (2012)

Additionally, part of the information obtained from the interview campaign are the main industrial areas of Lagos (see Section 4.3.3.2) used as the base for a preliminary and qualitative estimation of freight traffic distribution amongst the main road corridors of the Megacity. Its results are shown in the figure below.

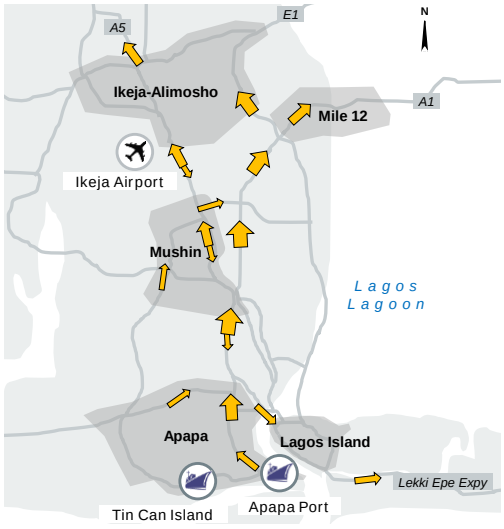


Figure 45. Preliminary Estimation of Freight Traffic Flows based on Information from the Interview Campaign

Source: ALG

The most relevant corridors identified in the South-North direction start with a common stretch at Apapa Road, crossing Mainland Central along the Western Avenue and then splitting into the Ikorodu Road/Lagos-Ibadan Expressway and the Agege Motor Road/Lagos-Abeokuta Expressway (routes E1 and A1) and the Agege Road-Abeokuta Expressway corridor in direction to the North-West (route A5).

4.4.2 Main Freight Typologies

Through the data collected from statistics, industries, market inventories, surveys and the interview campaign, the main types of products handled in the Megacity have been identified. These typologies can be arranged in two categories, based on their large-scale movement patterns within Lagos, as shown in the table below.

Distribution pattern	Typology
Imported commodities	Petroleum
	Imported manufactured products
	Inputs for national manufacturing
National production	Agricultural products
	Local manufactured products
	Building materials

Table 22. Main freight distribution patterns and typologies

Source: ALG

Freight categorised as imported commodities include petroleum, imported industrial products –such as cars, electronics and machinery as well as spare parts–and inputs for nationally manufactured products developed in the Megacity, Ogun State and other states of Nigeria. These raw materials and finished products enter Lagos by road or through the seaports to reach the clusters of the Megacity and are distributed both locally and nationally. The figure below presents a qualitative distribution of traffic flows for these products, based on the main patterns of freight distribution in Lagos described in section 4.4.1.

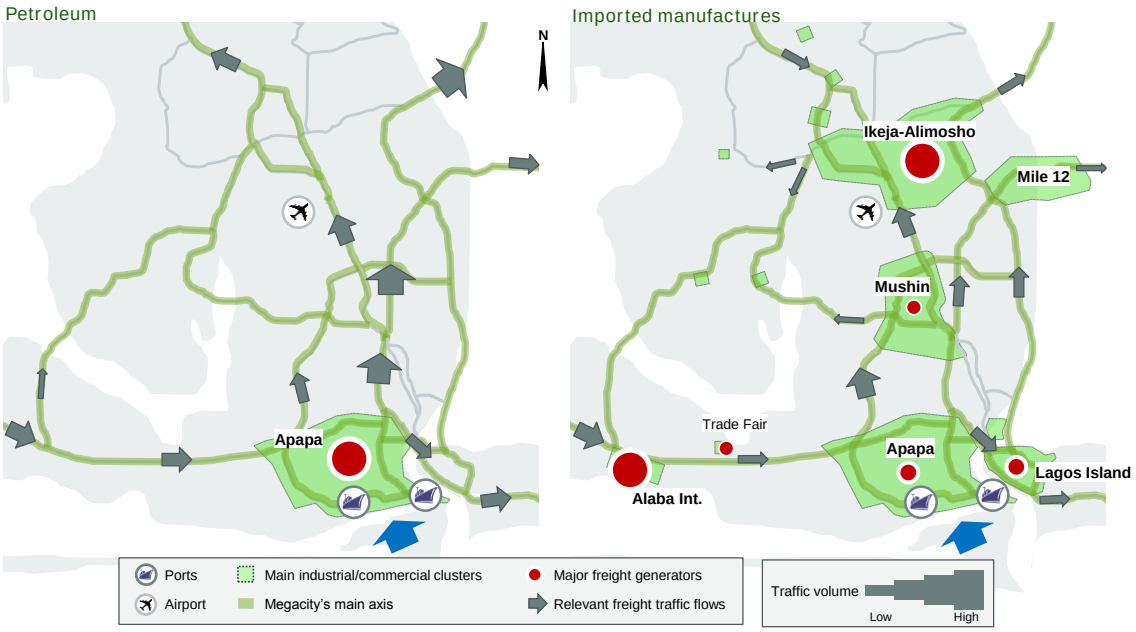


Figure 46. Qualitative Estimation of Traffic Flow Distribution in Lagos: Petroleum and Imported Manufactures

Source: ALG

On the other hand, freight categorised as national production includes agricultural products, local products (especially food-related industry) and building materials. The associated freight transportation flows either arrive in Lagos from Ogun State and other parts of the country (being received in the clusters of the Megacity to be distributed either locally for consumption and trade) or are generated within the Megacity (industrial manufacture products) before being distributed for local and national consumption. The qualitative estimation of traffic flows for agricultural products and building materials presented in figure 47 below is based on the main patterns of freight distribution within the Megacity as described in section 4.4.1.

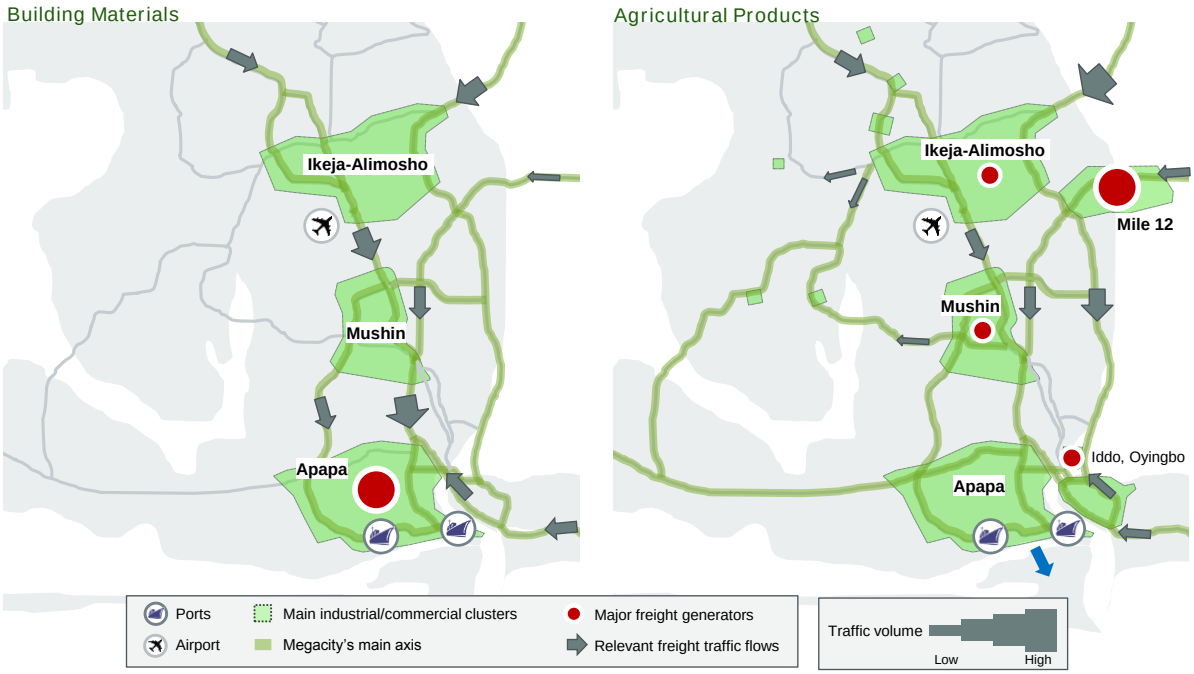


Figure 47. Qualitative Estimation of Traffic Flow Distribution in Lagos: Building Materials and Agricultural Products

Source: ALG

4.4.3 Quantification of Freight Flows

An estimation of the values for freight traffic flows through Lagos' main road network has been carried out. This estimation has been based on the description (and partial quantification) of the main patterns of freight distribution in the Megacity (detailed further above in this chapter) as well as the traffic counts gathered during the survey and interview campaign.

The results of this quantification, which are presented in the figure below, provide quite a wide margin of values (between 2,000 and 10,500 trucks per day) for those corridors included in the main road network of Lagos. The heaviest traffic is located along the North-West access to the Megacity, registering between 7,000 trucks per day (Third Axial Road, Gbagada Expressway) and 10,500 trucks per day (Lagos-Ibadan Expressway).

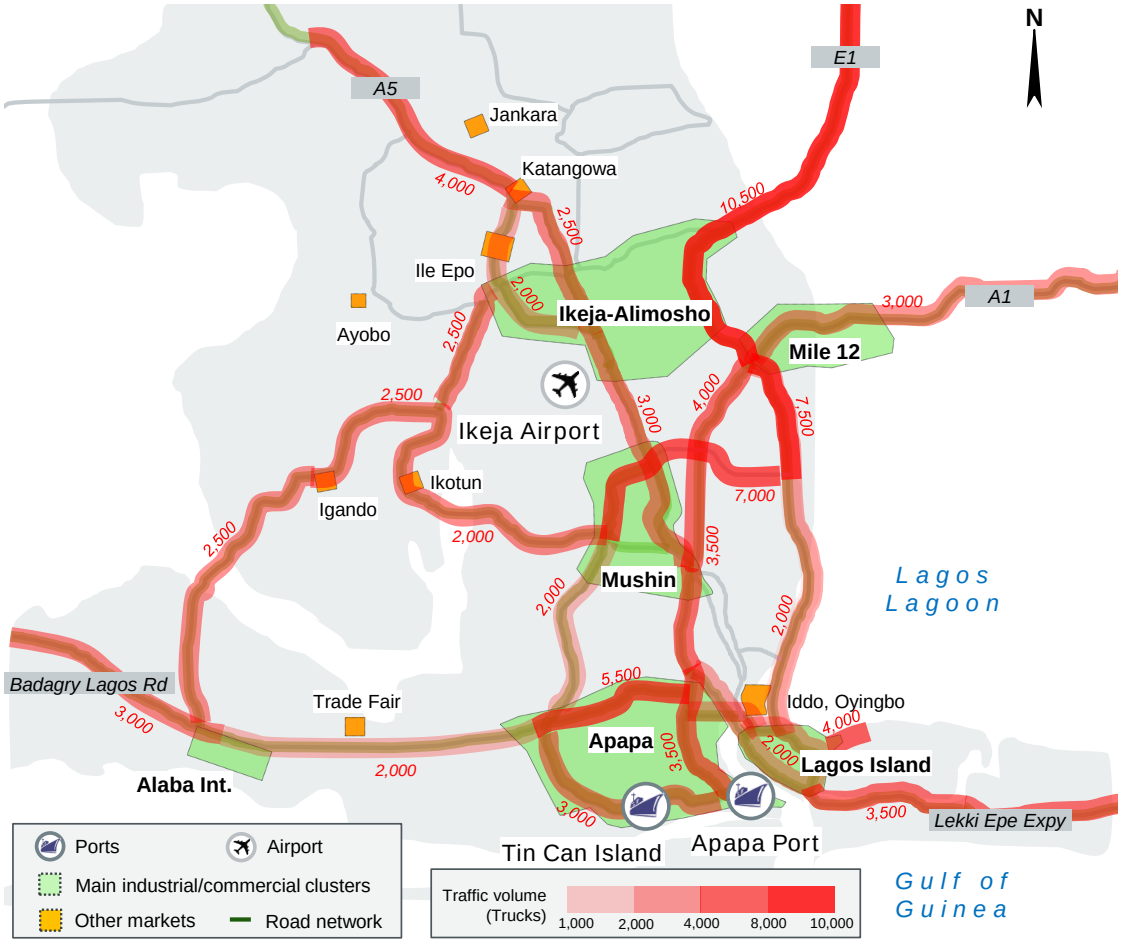


Figure 48. Quantified Traffic Flows in Lagos Megacity

Source: ALG

4.5 Conclusions: Current challenges of freight transportation in Lagos

Lagos' port system represents one of the major freight traffic generators in the Megacity. Most of its movement –more than 30 million tons per year, including both Apapa and Tin Can island port facilities– consists of imports that are traded in both wholesale and retail markets located across the Megacity (with buyers coming not only from the whole Megacity, but also from other parts of Nigeria and West-Central Africa). Some of these products are also transported in tankers (refined petroleum) along the main corridors of the Megacity towards different destination points throughout the country.

Lagos' land border with the Republic of Benin represents another freight traffic generator, due to its strong commercial relationship with the port of Cotonou (with freight movements including a considerable proportion of petroleum, cars, electrical and electronic products and other commodities shipped through Benin and then transported to Lagos). The border with Benin Republic is also a

major gateway for manufactured goods such as plastics, soaps or detergents, which are exported from Nigeria to West African countries.

Lagos' mass-consumption and industrial activities generate additional freight traffic with Ogun State, which supplies the Megacity with fresh agricultural products (to be transported on a daily basis due to the lack of adequate facilities for food storage and preservation), timber, building materials, manufactured products and other commodities.

All this freight traffic currently uses the Megacity's road network, and has to cope with the following issues:

- Growing congestion (which represents one of the main challenges of the Megacity).
- A number of problems related to infrastructure (poor maintenance, insufficient capacity and inadequate road hierarchy, absence of road links and bridges, unregulated street trading, inadequate traffic management, absence of parking strategy and a number of safety and security issues together with an absence of alternatives to road transportation).
- Specific problems related to the freight transportation system (absence of distribution centres, warehouses and parking areas for trucks; old fleet with poor maintenance; lack of regulation for the freight sector).

Lagos' freight transportation system is reaching a saturation point (both its corridors and ports will reach maximum capacity in a few years). This situation is affecting the economic competitiveness of the city.

A network system with enough capacity and connectivity must be established in order to cope with the current demand and also to develop and consolidate Lagos as the gateway to the rest of Nigeria and Western Africa.

This system must be defined in accordance with the vision that this report has developed for the Megacity. This will be explained in the upcoming subchapter.

4.6 Future Trends for Freight Flows and Proposal of a Freight Distribution System

The harmonisation of all the existing planning documents for the different Megacity sub-regions, including Ogun State, has led to the identification of future key-elements that will change Lagos Megacity freight dynamics considerably.

These new elements can be easily identified by comparing the figures below. Figure 49 shows all the freight traffic generators that have already been synthesized in the preceding sub-chapter. Figure 50 introduces new ones, namely:

- Future seaports and Free Trade Zones at Badagry and Lekki
- New airport (to be specialized in agro-cargo) at Shagamu
- New international airport at Lekki
- Future inland container terminal at Ibadan

It is clear that the two new ports in Badagry and Lekki present an opportunity for the decongestion of Apapa and Tin Can ports, allowing the future growth of the Megacity's port traffic. But this is not the only implication for this new system of ports, free trade zones, airports and inland container terminals. What all these new elements present is an opportunity for re-balancing the Megacity's freight dynamics.

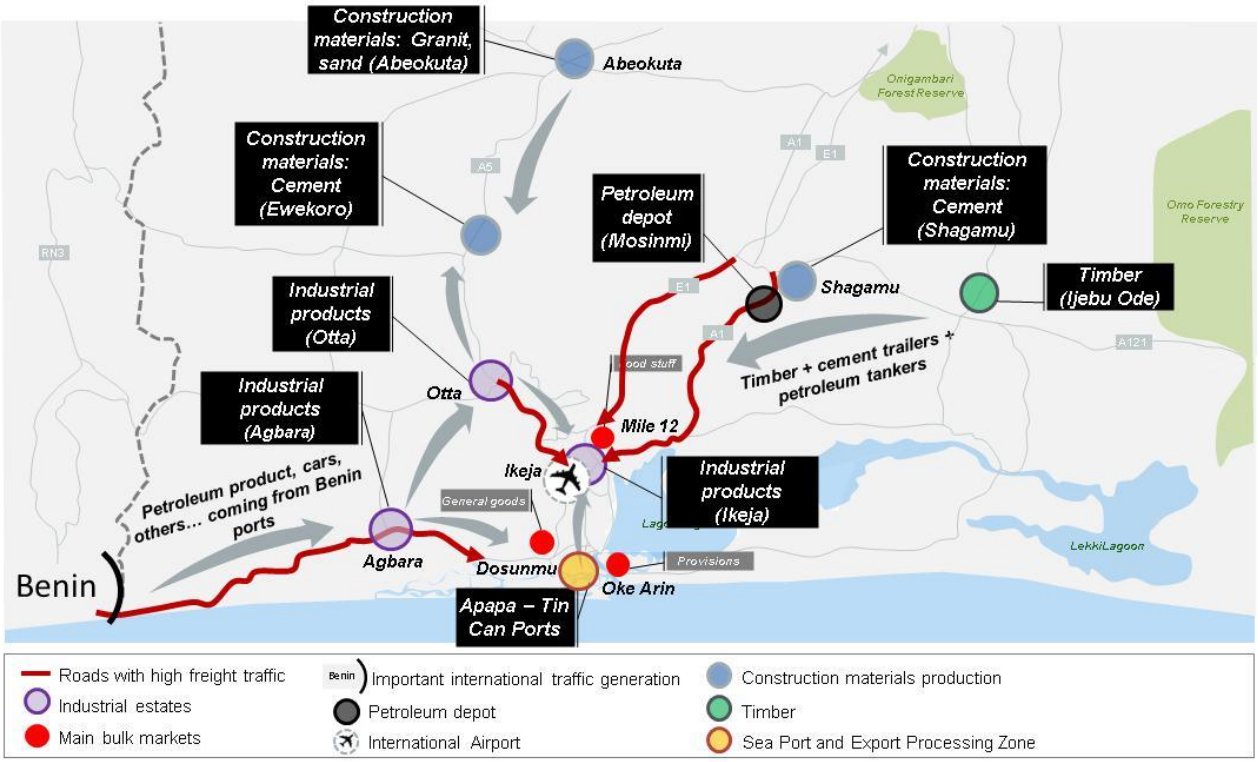


Figure 49. Current key-elements in Lagos Megacity's freight mobility

Source: ALG

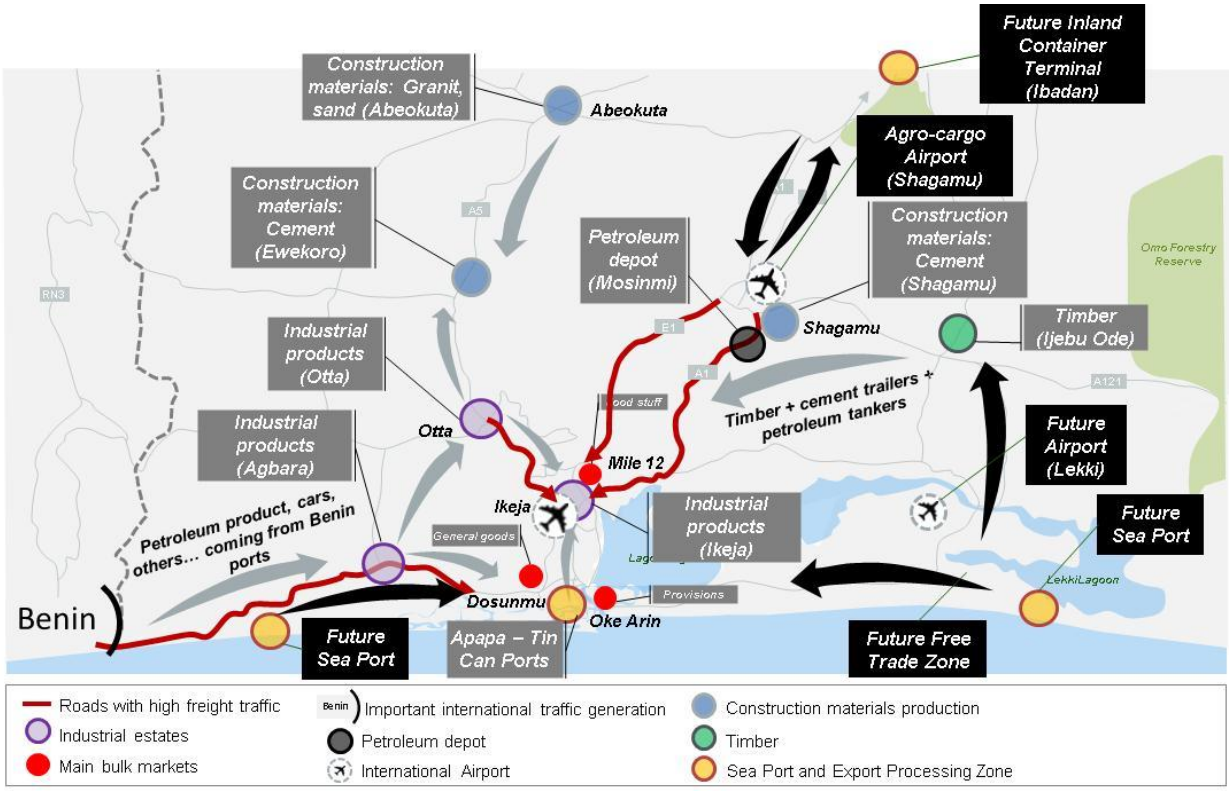


Figure 50. Future key-elements in Lagos Megacity's freight mobility

Source: ALG

This new freight dynamics has already been described in Chapter 3.3.3 (Figure 10). It will consist of an East-West axis connecting the ports in Badagry, Lagos (Tin Can, Apapa) and Lekki, and a transversal axis that will surround the whole Megacity starting from Agbara, passing through Shagamu and finally ending at Lekki FTZ and port.

This mobility should actually be served with a by-pass system to channel the long-distance freight flows along specific corridors and only allow the crossing along Lagos urban core for the local distribution of goods, as shown in figure 51 below.

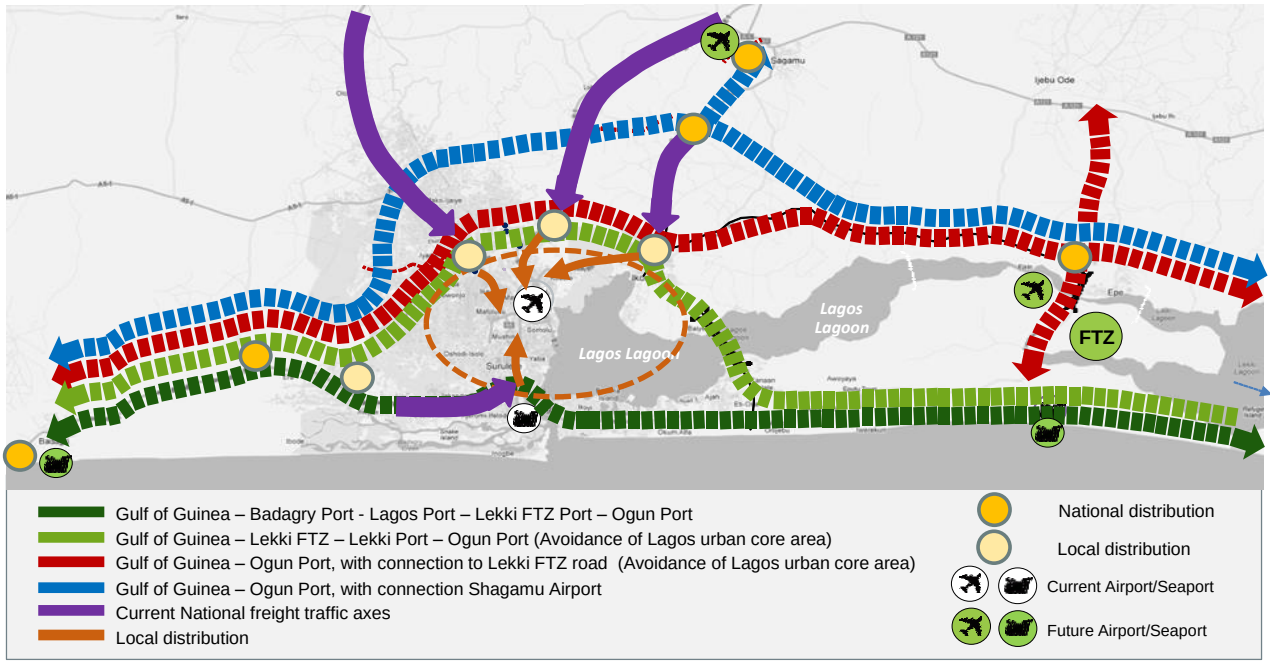


Figure 51. A vision for freight transportation in the Megacity: By-pass system with distribution centres

Source: ALG

The fundamental elements for the correct operation of this system are the distribution centres located at the key-nodes of the system. These distribution centres are highlighted in figure 51 above. Some of them will have the function of distributing over long-distance traffic to the metropolitan level whilst others will have the function of distributing goods to their final destination in Lagos urban core (local distribution). These centres will have storage and parking facilities associated with them and will contribute decisively to the better organization of road transport operators.

Such a system will require investment in infrastructure (guarantee of adequate road capacity and conditions for freight transportation along the different corridors; construction of distribution centres), but this will not be enough if it is not accompanied by the development of an organized freight transportation sector, through fleet renewal, the regulation of vehicle types (adaptation to type of goods, movement, and energy-efficient vehicles), the establishment of appropriate training amongst operators and the organization of circulation schedules and routes (GPS fleet control, etc.).

To get to this level of organization a whole institutional and regulatory system will have to be established, including not only the necessary legislation and enforcement, but also a solid association system within freight industry.

5 Non-Motorized Transport Plan

5.1 General Overview: The role of NMT in urban transportation systems

Non-Motorized Transportation (referred to as NMT) includes two modes: walking and cycling. The roles of NMT in urban transportation systems can be grouped as follows:

- As the main transport mode used by the low income earners, who cannot afford a private motorized vehicle.
- As the transport mode used in the shortest stages of daily trips, namely those covering distances between places of residence and public transportation stops. This also includes distances between public transportation stops and the final trip destination, as well as for connecting different transportation modes. It must be noted that access to public transport can involve significant walking distances.
- Finally, as a transportation mode on its own, regardless of the travelers' income level; an alternative to private transportation in the framework of a sustainable, eco-friendly urban transportation system.

NMT has been usually ignored by policymakers when defining transport plans, preferring motorized transport because they regard it as technologically driven. This preference has orientated policies and actions leading to an unsafe and less attractive NMT.

Urban areas in African cities (and Lagos in particular), can improve working and living conditions through NMT plans, not only because it represents an environmentally friendly and socially inclusive mode of transportation, but also because it represents a fundamental part of the urban transportation chain, particularly for access to public transportation modes and for modal interchange.

NMT is a key-element to the establishment of a sustainable transportation system, economically and environmentally, thereby facilitating the development of a multi-modal transportation system with adequate access to public transportation services. It also provides an effective connectivity between the different transportation modes and minimizes the environmental impact caused by motorized transportation.

5.2 Why adopt a NMT plan for Lagos?

A NMT plan for Lagos has a notable value not only in the framework of the current STMP Extension Project (representing a key element for the articulation of the different actions defined in Chapter 2), but also as a reference for other African cities as well as all megacities in emerging economies.

Non-motorised transport, especially walking, is the most common form of mobility in Lagos, particularly for low-income households. According to the analysis of the fieldwork campaign

undertaken for the current STMP Extension project, around 30%[1] of Lagos' mobility is on foot or by bicycle.

The interaction between pedestrian and motorised vehicles in Lagos is unplanned and dangerous. Indeed, there is no recognition for non-motorised means of transportation as there are few segregated traffic facilities for pedestrians (such as walkways, zebra crossings, footbridges, underpasses and signs) and no pathways for bicycle riders. As a result, pedestrians are frequently forced to walk on the carriageway sharing the same roadway with motorised transport, which implies a low level of road safety. This problem is worsened by the current problem of road capacity and an absence of road hierarchy in most of the major areas of the city.

Furthermore, the use of junctions as non-regulated commercial areas (and un-regulated street trading in general) has been identified as one of the critical issues of Lagos urban mobility. The invasion of the little roadway available for pedestrians by this kind of activity presents a general problem in all of Lagos urban core. This problem becomes particularly apparent in areas such as Lagos Island, traditionally regarded as the commercial and financial hub of Lagos. Currently, Lagos Island is at a stage of urban decline with pedestrians bearing the brunt.

The lack of space for pedestrians is also a problem in Lagos public transportation network: There is no real provision for proper accessibility to bus stops/terminals, and an increasing number of traffic accidents involving pedestrians are being registered in relation to unsafe bus stops.

Restrictions to pedestrian mobility in Lagos can also be identified at a different scale, looking at the transportation network as a whole. From this point of view, highways and even primary roads present significant obstacles for pedestrian movement in Lagos, due to the absence of proper infrastructure facilitating the crossing of such barriers. The Lagos-Badagry Expressway is a good example in this regard, having led to the isolation of a number of neighbourhoods in common urban settlements.

The absence of road infrastructure also leads to poor pedestrian mobility. For instance, the current lack of East-West connections within the Mainland Central area isolates neighbourhoods and restricts the efficient movement of people (and goods), including pedestrians.

The Lagos State Government is making efforts to redefine urban mobility in Lagos in the framework of the Lagos Urban Transport Project (LUTP) and the 2009 STMP, by undertaking actions geared towards improving NMT in general and pedestrian safety in particular. However, some of the efforts already made in this direction, such as the establishment of walkway facilities in some areas of the city, are not being utilised due to the lack of enforcement, which is another major problem in Lagos mobility. As a result, most of these walkways are being used as parking lots (especially in Victoria Island), trading and storage areas for abandoned material and in some cases by fallen electric poles.

[1] Results from the analysis of the fieldworks campaign, done by ALG. The Lagos State Government published the same percentage of people using NMT in 2012.

In particular, most of the walkways are not maintained, which accounts for the currently visible number of manholes and failing pavement.

Some other actions are planned in the framework of the existing Model City/Master Plans however, the way NMT is approached varies ostensibly: Some Plans state non-motorised transport issues whilst others define a specific action plan to improve the quality of non-motorised urban mobility.

It is clear that the NMT issue in Lagos has to be approached in a unitary, comprehensive way, aimed at responding to all the problems that pedestrians have to face daily in order to get to their place of work or study, considering the Megacity territory as a whole and tackling all the current challenges (lack of pedestrian infrastructure, network connectivity and enforcement, etc.).

5.3 The main domains of action towards a NMT plan for Lagos

The NMT plan for Lagos should respond to these challenges through a number of measures and actions, which can be grouped into the following categories:

- Facilitating pedestrian movements and community integration within and across neighbourhoods, in the Megacity.
- Non-motorized access to public transportation corridors and Mass Rapid Transit lines in particular.
- Specific non-motorized access plans to transportation hubs/modal interchanges and singular activity areas of the Megacity representing key-mobility attractors.

The **first level** of action concerning community integration, will require the creation of a continuous pedestrian network, not only through the suppression of physical barriers to allow free flow of pedestrian movements, but also through the establishment of road infrastructure as a structuring element instead of an obstacle to non-motorized transportation. This and other additional actions will encourage pedestrian movement and the generation of economic benefits at street level.

In all cases, the magnitude of pedestrian (or bicycle) flows, particularly those associated with major trip generators and attractors (shopping malls, schools, hospitals, markets, etc.) has to be considered for the appropriate design of the required infrastructure elements and facilities, which are listed below:

- Walkways for pedestrians and lanes for non-motorised vehicles with full capacity and adequate design. No obstacles must be found along these facilities (such as parked cars or traders). It is important to note that this kind of measure can accomplish two different functions: on one hand, an adequate NMT network that will undoubtedly contribute to the efficiency of the transportation system; on the other hand, it facilitates the establishment of leisure areas for pedestrians and cyclists exclusively.

- New roads (with the provision of appropriate space for pedestrians) compensating for current missing links and also to facilitate needed shortcuts.
- Proper separation from high levels of traffic and high-speed traffic.
- Traffic calming measures such as speed humps.
- Safe and efficient crossing designs at intersections such as raised zebra crossings to calm traffic and pedestrian crossing islands, medians or foot over-bridges in wide roads crossing areas to avoid detours. It is important to note that this aspect should also consider users with limited mobility.
- Installation of guard rails at road junctions.
- Properly painted, signed and lighted crosswalks and walkways.
- Construction of good/quality facilities and maintenance.
- Construction and repair of bridges over rivers and swamps.

The **second level** of the action plan, related to the accessibility of the main public transport corridor (the Mass Rapid Transit lines), comprises the whole passenger capture area, which is to be defined between 500 and 1000 meters from the corridor.

All arterial roads, intersections and the most common walking routes towards BRT and LRT stations in this area represent key elements for the establishment of accessibility improvements.

The measures to improve accessibility in these access areas should take into account the following concepts: connectivity, directness, ease of movement, accessibility (elderly people, children and people with physical disabilities must be able to reach their destinations), safety and security.

Most of the measures proposed to be implemented at the first level of action can also be considered at this transport corridor level. Moreover, dedicated cycle tracks or mixed NMT tracks parallel to the main public transport corridors can be considered.

The **third level** of action concerns NMT accessibility to the main transportation hubs and interchanges of the city with a significant passenger demand, as well as to the singular mobility attractors. The necessary actions to be undertaken in this domain are listed below:

- These nodes and areas must be connected to their users by means of pedestrian walkways, minimizing the interaction between pedestrian, non- motorized and motorized vehicles. No discontinuities should be allowed along these connections.
- They must also be sufficiently convenient, comfortable, safe and easily accessible for people of all ages and conditions
- They should also incorporate parking spaces for bicycles.

- Pedestrians with limited mobility should be considered in these accessibility plans, with specific solutions in three main domains: walkways and street crossings, curb ramps and station and vehicle entry points.
- Interchange points should incorporate shelters for the protection of passengers from all kinds of weather and provide an adequate separation from passing vehicles.
- Ease of movements around and inside stations, terminals and interchanges should be assured.
- Stations should have a proper design that guarantees universal accessibility and safety. It can be approached in accordance with three designs: at level, over bridges or underground.

It is important to note that the above actions, together with an appropriate commercial and mixed use strategy (provided with unique shops and buildings), will facilitate the transformation of the main public transport stations into city landmarks that will attract visitors and generate interesting dynamics in the area, other than the strict transportation services.

In order to guarantee their success, the three domains of action described above have to be accompanied by an **enforcement policy and a set of training programs**:

- Measures to prevent motorized vehicles parking on road shoulders and walkways.
- Measures to avoid vandalism on walkways (which currently is the cause of open manholes and trenches).
- Measures to prevent dumped trash on sidewalks.
- Measures to control and regulate vendors and hawkers, and if possible, re-locate them into proper spaces.
- Bicycle hire or sales on credit and discount.
- Establishment of organized bicycle parking.
- Traffic law and enforcement regarding the rights and responsibilities of non-motorized users of roads.
- Child Education on traffic laws, developed by schools and specific campaigns out of school.
- Incorporating the rights and responsibilities of non-motorized users in the drivers' license test.

5.4 First approach to a NMT Plan for the Megacity

5.4.1 Scope of the current approach

Once the general action guidelines have been established, the next step will be to assign them to specific action areas of Lagos Megacity.

Geographically speaking, the current chapter will focus on the main existing conurbation of the Megacity together with other urban settlements currently in process of development and consolidation, such as Ikorodu, Badagry and the Western area of the Lekki Peninsula.

It is also important to keep in mind, whilst reading this chapter, that the land use, urban development and transport infrastructure proposals identified during the harmonization process (described in previous chapters of this Interim Report) represent a fundamental basis for the NMT Plan. This is because they establish the urban pattern and infrastructure network to which all the NMT accessibility actions will be associated.

Moreover, particular proposals of certain Model City Plans will be used as examples to illustrate specific aspects of the proposal.

5.4.2 Location of actions in the different Megacity areas

Starting with the **Badagry** sub-region, the figure below shows the main areas (highlighted in green) for the establishment of a continuous pedestrian network which will allow community integration of each one of the urban settlements located in the sub-region (first action level). This pedestrian network includes all the necessary actions in order to overcome the current obstacles of the Lagos-Badagry Expressway.

These centres should be fully inter-connected, integrating a multi-centric urban system throughout the sub-region, via a passenger and bicycle-accessible mass rapid transit corridor representing a structural element for the sub-region (second action level). This action is highlighted in the figure following the future MRT corridor both in orange and lilac colour. The orange representing BRT services (the BRT line under development, and its extension towards Badagry) and the lilac represents the LRT services.[2]

Specific accessibility plans (third action level) have to be defined for the main transport terminals and interchanges (Ekpeme, Ojo and Mile 2, which will both include BRT/LRT and inland waterway services), as well as other key transportation nodes (the new Badagry Port) and activity centres (Lagos State University, the employment area of Mile 2).

[2] The distinction between BRT and LRT services is tentative in some cases. At this point of the project, the definition of the technical solution (BRT, LRT) for some of the proposed corridors has not been decided, as it depends on the final cost-benefit analysis. In the particular case of the Badagry MRT corridor, the proposed extension is proposed as a BRT for the short term with an upgrade to a LRT in the long term.

Figure 52. Main elements of the NMT Plan for Badagry Subregion

The changes to be included in the second and third action levels must be aimed at providing pedestrians and cyclists with an efficient connection to the MRT corridors. This requires an organized coordination between the MRT and its accessibility during the planning process, in which the design of transport terminals and interchanges plays a crucial role. The design of Pedestrian areas and crossings must be up to standard thereby allowing smooth and comfortable transportation as well as fulfilling the specific needs of persons with reduced mobility. These elements, in addition to the parking space for bicycles, have to be dimensioned according to the demand of a given MRT system when passengers board and alight at each terminal and stop. The installation of traffic signals, lights and guard rails at crossings points is also a key component of interchange facilities.

Figure 53. Part of an interchange station including access ramps and cycle parking spaces

Figure 54. Crossing at LRT station including paved walking path, traffic signals and lights

To this extent, a preliminary proposal for the NMT network around Ojo interchange and the Inland Waterways' terminal is presented in the picture below. It is composed of a core off-street pedestrian and cycle network on the main routes around the transport facilities (coloured in blue) and an internal pedestrian network to provide access to the residential areas and facilities in the zone (coloured in red). Key sections of the network are to provide connectivity along pedestrian desire lines from residential areas towards key locations for education (Lagos State University playing a major role), local shopping and the proposed MRT stations. In addition, the design of the routes was based on the presence of existing corridors that are often currently used by pedestrians.

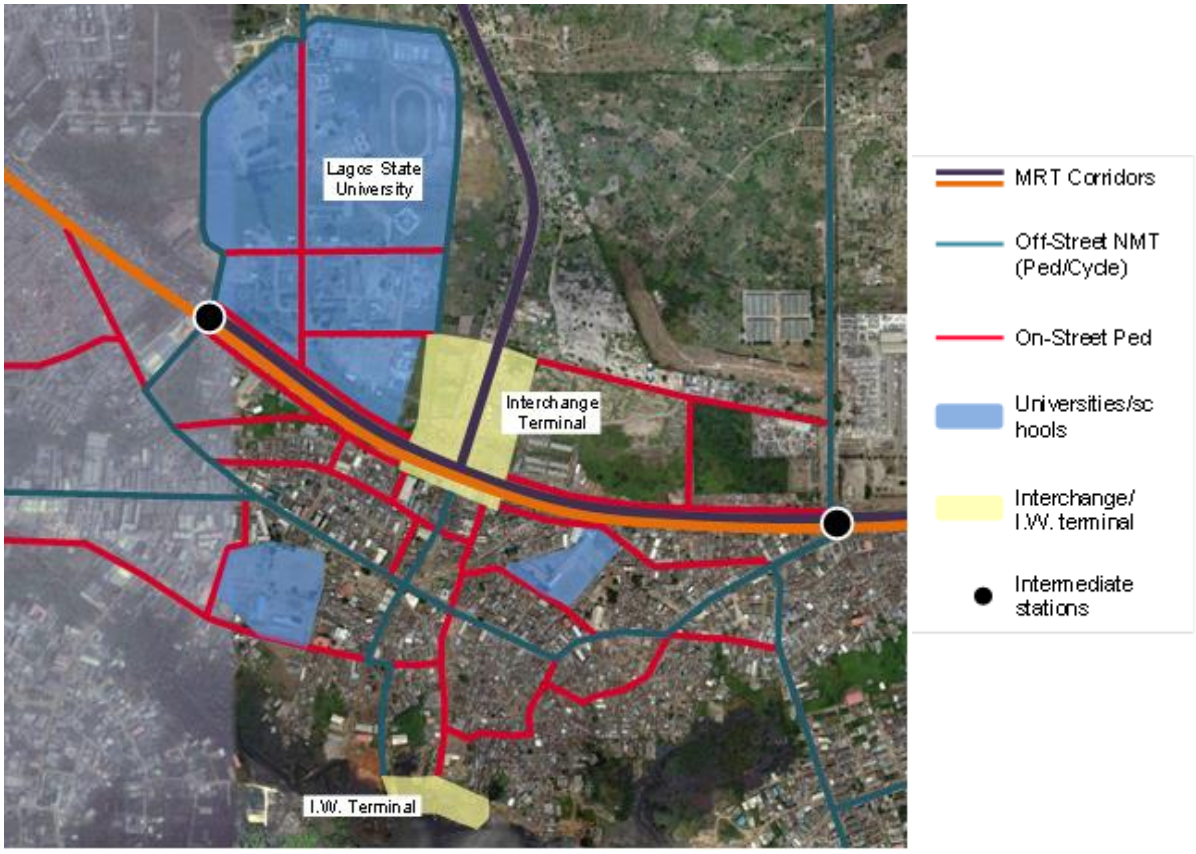


Figure 55. Preliminary proposal for NMT network, surroundings of Ojo Terminal and Lagos State University

The following figure focuses on **Lagos urban core**, including the mainland, Apapa, Lagos Island/Victoria Island and Lekki areas.

There is need for intensive action in the community integration domain (first action level), with the establishment of general accessibility to NMT throughout most of the area:

- In the degraded areas of Lagos Island, Ikoyi and Victoria Island, where the current CBD and institutional areas need to be put back into their original function and urban structure. This will require the provision of full accessibility and services for pedestrians.
- In most of Mainland Central, where the current lack of neighbourhood cohesion and East-West connectivity will have to be solved by means of adequate accessibility provision for NMT modes.
- In the residential and mixed use areas of Apapa (including both the ones currently located in the mainland and the ones to be established in the creek area), in the framework of an ambitious tourist and leisure plan.

- In the current urban settlements at the Western area of the Lekki Peninsula, where a re-organized and rationalized road network with full NMT accessibility will have to be established. This action will have to be continued in all the future development to take place towards the East.

Two key-elements should be highlighted within this domain of action:

- **Mixed use roads and avenues**, which will represent a fundamental tool to boost economic activities, where pedestrians will play a key role.
- **Promenade and recreation avenues** to be developed in areas with particular potential in this domain, such as the Apapa creek area and Mainland Central (more particularly, along the Lagos Lagoon waterfront).

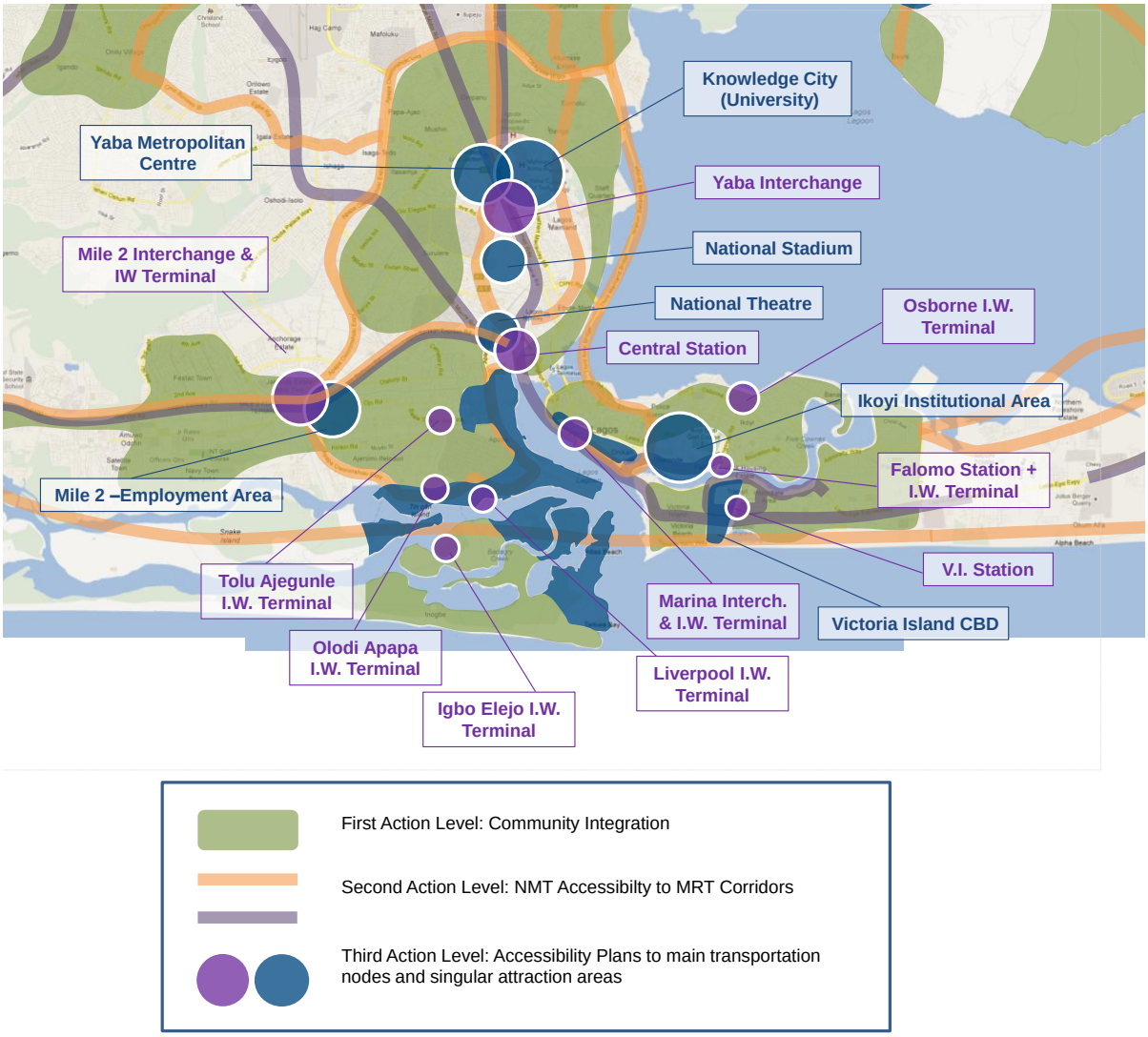


Figure 56. Main elements of the NMT Plan for Mainland-Apapa-Lagos Island-Ikoyi/Victoria Island

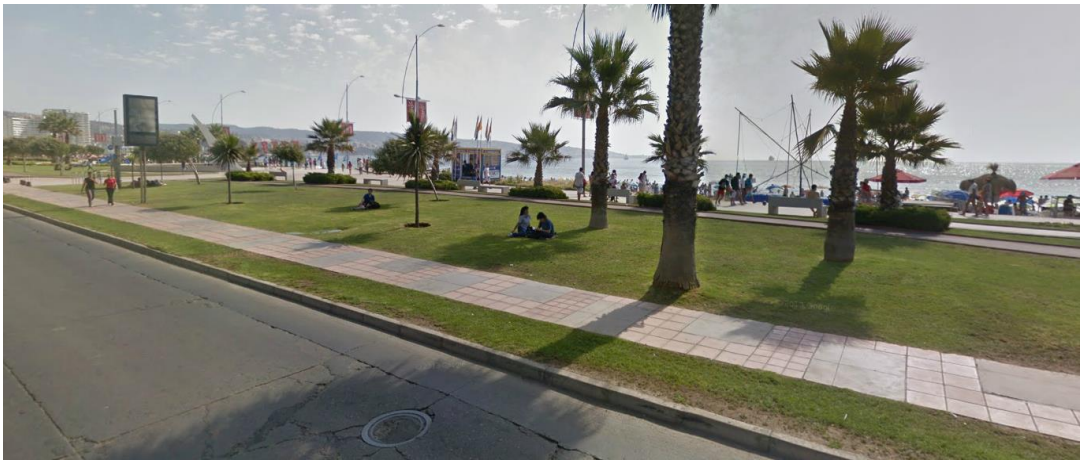


Figure 57. Promenade, including areas dedicated to recreational activities

Regarding the second and third action levels (accessibility to MRT corridors, singular transportation nodes and activity areas), a good number of Mass Rapid Transit Corridors and inland waterway routes converge in this area, with numerous important stations, terminals and interchange points. Therefore the actions to be undertaken in NMT accessibility to both the MRT corridors and the main stations and interchanges will also be intensive.

Mainland Central will play a key role in this regard: **The Central Station** to be located at the South-East of the National Theatre Area will be vital, due to its role as a pivotal element for the management of Lagos MRT services. This station deserves not only a NMT accessibility plan, but also a specific plan for its development as a future landmark of the Megacity.

The key attraction areas that require specific accessibility plans are equally numerous in this area. The **industrial area of Apapa** presents one of the most interesting challenges in this regard. It is an area of considerable extension that will require a very specific mobility plan responding to the requirements of industrial activities and operations.

The figure below depicts a preliminary proposal for the NMT network in the surroundings of Marina interchange and the Inland Waterways terminal, in the western side of Lagos Island (one of the most important commercial areas of the city). Basically, the aim is to upgrade the core pedestrian and bicycle network to provide full accessibility to the commercial and institutional areas of the CBD close to the terminal (highlighted in green in the figure), as well as to the MRT network that will be located along the Ring Road.

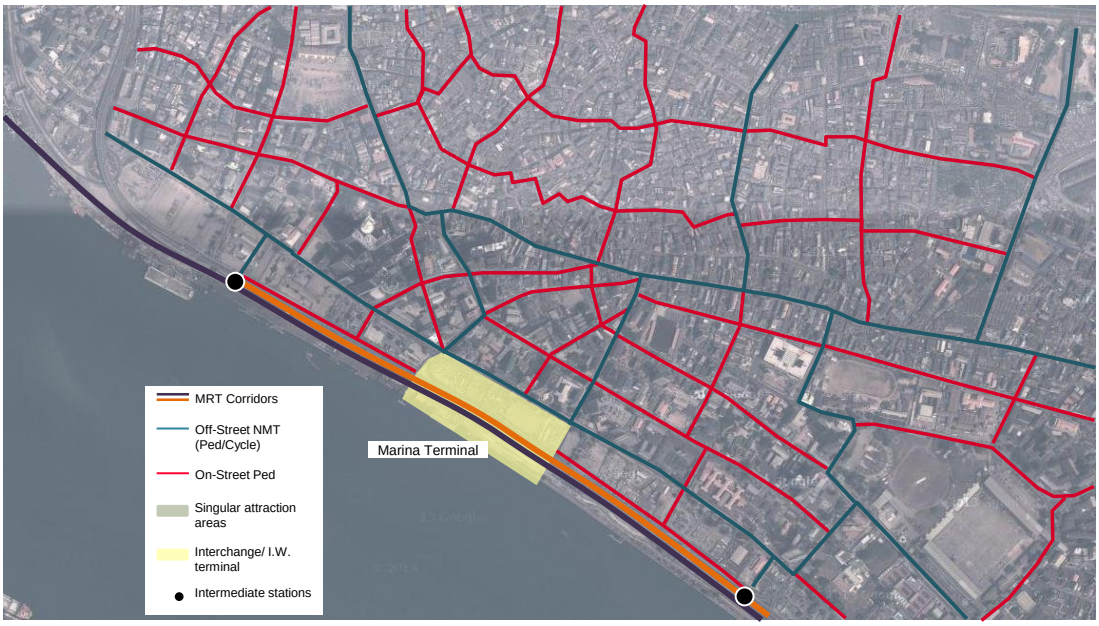


Figure 58. Preliminary proposal for NMT network, surroundings of Marina Terminal

The implementation of mass public transport lines as well as the strengthening of the NMT network will be successful only if accompanied by effective neighbourhood integration programs that include a revision of urban patterns in order to encourage walking and cycling.

As mentioned in the report *Lagos: Building a Sustainable City* (CTS-EMBARQ-Mexico and Walk21, 2012), it has been found that residents in traditional neighbourhoods make more non-work trips by walking and cycling within the areas than using motorized modes of transport.

The introduction of these measures, as indicated previously, will have to be accompanied by enforcement policies, such as the control of the occupation of public spaces by vendors and/or their relocation to proper places in pedestrian-only streets of the central areas, as depicted in the figure below.

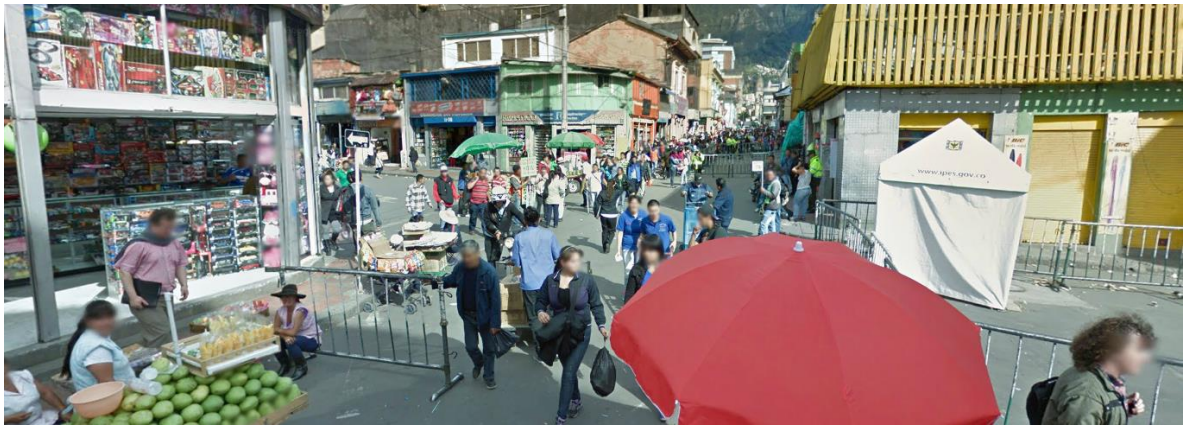


Figure 59. Pedestrian-only area, with adequate allocation of vendors in specific places of the street

The following figure shows the actions associated with **Ikeja, Agege Ifako-Ijaiye and Alimosho**. A significant number of NMT actions can also be identified in these three sub-regions, particularly at the Ikeja-Agege area.

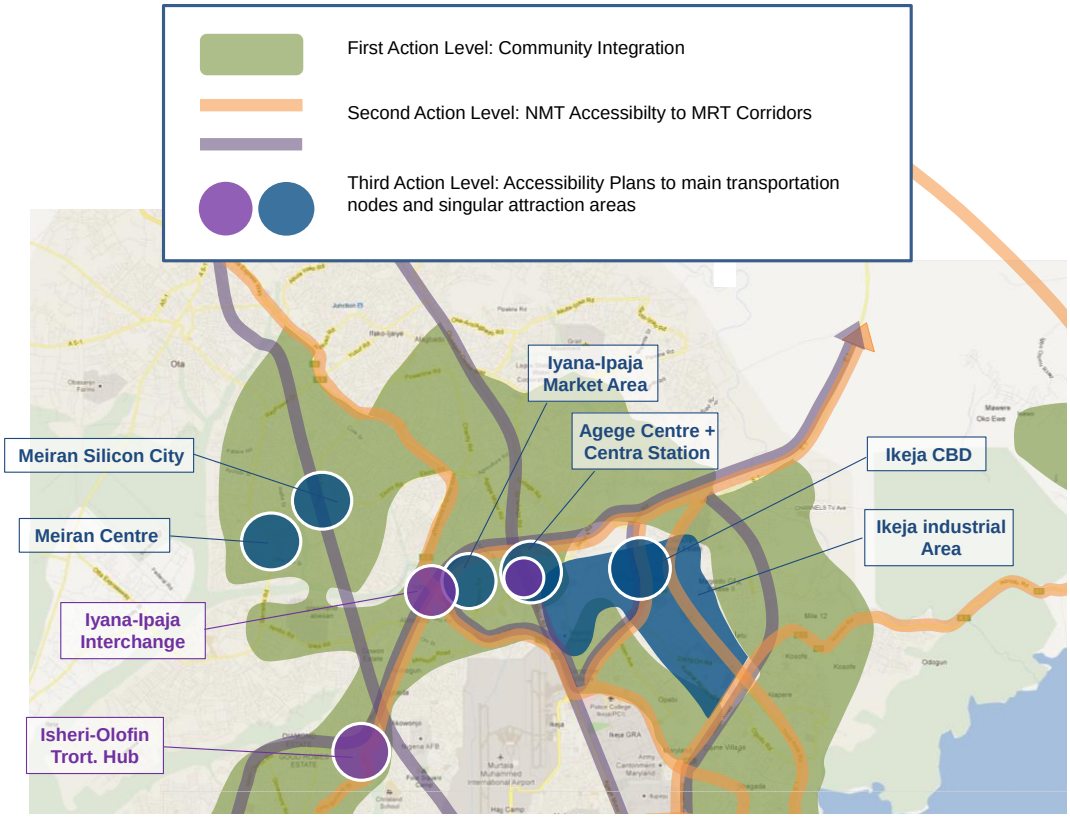


Figure 60. Main elements of the NMT Plan for Ikeja – Agege/Ifako/Ijaiye - Alimosho

Ikeja needs to renew its urban structure to attain its **original role as one of Lagos' administrative and business centres**. This will require full accessibility to NMT modes at the community integration level (together with the establishment of a network of mixed use roads and avenues), at the MRT corridor accessibility level (Ikeja also represents a major terminus for all public transportation modes and there is a good number of MRT and other public transport lines crossing the area), and at the singular accessibility plan level (for both the CBD and the industrial area).

Westbound, the Agege Ifako-Ijaiye area will bring new urban development with the consolidation of a **new metropolitan centre** (requiring its own accessibility plan) and the full integration of all the neighbourhoods of the sub-region.

Finally, Alimosho presents the challenge of important **physical barriers** not only to pedestrians and other non-motorized transport modes, but also to all kinds of traffic. This is due to its river system and natural gorges, the absence of bridges and other obstacles such as Federal/State Government acquisitions, power lines and oil pipelines. Even counting on the necessary road infrastructure action, the area defined for community integration action has been determined by the sub-region's

orographic conditions. From the figure above, the new centres at Meiran and Iyana-Ipaja will require their own accessibility plan, and the same thing can be said about the transportation centres at Iyana-Ipaja and Isheri-Olofin.

The following figure shows the actions to be undertaken in the **Ikorodu area**, one of the fastest-growing urban centres in the Megacity. The development trends of the current urban settlements suggest a community integration action area that would extend beyond Ikorodu to the different settlements located close to the Lagoon and in the northern hinterland. Besides, a MRT corridor accessibility plan would start from Ikorodu centre expanding towards each one of these settlements, thereby establishing the backbone for the integration of the whole Ikorodu sub-region.

Figure 61. Main elements of the NMT Plan for Ikorodu

Ikorodu will take great advantage from the Inland Waterways network that will connect the Lagos Lagoon area with the Badagry creeks. **Inland waterways terminals** at Ikorodu, Baiyeku and Ijede (and others like the one located at Badore in the Lekki Peninsula) will require specific accessibility plans for NMT modes to ensure the provision of adequate infrastructure for pedestrians and cyclists, as displayed in the figure below.

Finally, the other singular areas demanding a NMT accessibility plan are the **industrial areas** to the South of Ikorodu and at Ijede.

Figure 62. NMT infrastructure in I.W. terminals

5.5 Conclusions and some hints on the implementation of the NMT Plan

Non-motorized transport has traditionally been considered as “not modern” and not worth including in transportation plans. However, the current trend in the 21st-Century cities is to assign a relevant role to NMT, as it represents a key-element for sustainability of transportation systems, improving urban mobility and congestion and reducing air and noise pollution.

Before the advent of crude oil economy in the 1970s, NMT modes represented the main transportation mode in Lagos State. Now it is time to reintroduce these modes (walking and bicycle) into Lagos' mobility, through an appropriate NMT plan.

The previous chapter has defined the three different levels of a NMT plan: community integration (a capillary network of roads adequate for NMT modes within the urban settlements); MRT corridor accessibility (a 500-1000 m passenger-catchment area with full accessibility to pedestrians and bicycles); and specific NMT plans for transport nodes and singular activity areas.

The implementation of such a plan will require a strategic and institutional articulation through the definition of specific domains of action: Infrastructure design, traffic management, financial plans and training and enforcement.

The following aspects might be defined as part of the objectives of a general NMT policy:

- Integrated planning for non-motorized transport within state transport and land use planning
- Prioritization of areas with high demand for NMT facilities
- Development of road safety programs that focus on the most vulnerable road users
- Development of by-laws regarding NMT
- Monitoring of non-motorized transport in order to facilitate its evaluation

On the other hand, the implementation of the NMT Plan will require the development of practical programmes and projects based on the general NMT policy adapted to each specific situation. The main objectives of these programmes include the guidelines provided below:

- Survey the extent and nature of all different forms of NMT
- Determine specific needs of the community promoting the participation of all stakeholders
- Identify constraints for non-motorized transport
- Identify practical NMT infrastructure interventions
- Design engineering measures to address identified problems
- Identify road safety issues and develop road safety campaigns

- Develop transport campaigns based on sustainable modal choice
- Involve employers, shopkeepers, etc. in the provision of NMT facilities
- Review local NMT by-laws and ensure adequate law-enforcement

In order to coordinate all the different NMT activities, the assignment of a NMT coordinator will be necessary for the organization and guidance of the NMT planning and implementing processes. It will also be important to work in cooperation with city planners and all stakeholders involved in non-motorised transport, for example through user platforms.

6 Road Safety Plan

6.1 Overview

Road traffic injuries are amongst the eight leading causes of death globally, according to the World Health Organization (WHO)[3], which also estimates that around 1.24 million people die each year on the world's roads, and another 20 to 50 million get injured as a result of road traffic crashes. These injuries and deaths have an immeasurable impact on the families affected, who are often changed irrevocably by these tragedies including the communities in which these people lived and worked.

The global costs of road injuries are huge: the WHO estimates that the figures account for around $518 billion US dollars annually, which ranges from 1% to 3% of the Gross Domestic Product of different countries. Since these estimates are based only on direct costs, the true costs to society are in fact much higher.

According to the *Road Safety report in the WHO African Region: The Facts 2013*, Africa remains the least motorized region in the World (only possesses 2% of the total vehicles); its rate of road traffic fatalities are the highest in the world, with a regional average of 24 deaths per 100,000 population annually which is well above the 18 deaths per 100,000 population representing the global average. Furthermore, Africa records 16% of the global deaths due to road traffic crashes.

In this context, Nigeria's situation regarding road traffic issues is critical, as it records the highest fatality rate in Africa (34 deaths per 100,000 population annually), representing one of every four traffic accident deaths happening in the region. Nigeria's road traffic fatality rate almost doubles the global average which is 50% higher than the African average, as depicted in the figure below.

[3] Global Status Report on Road Safety 2013.

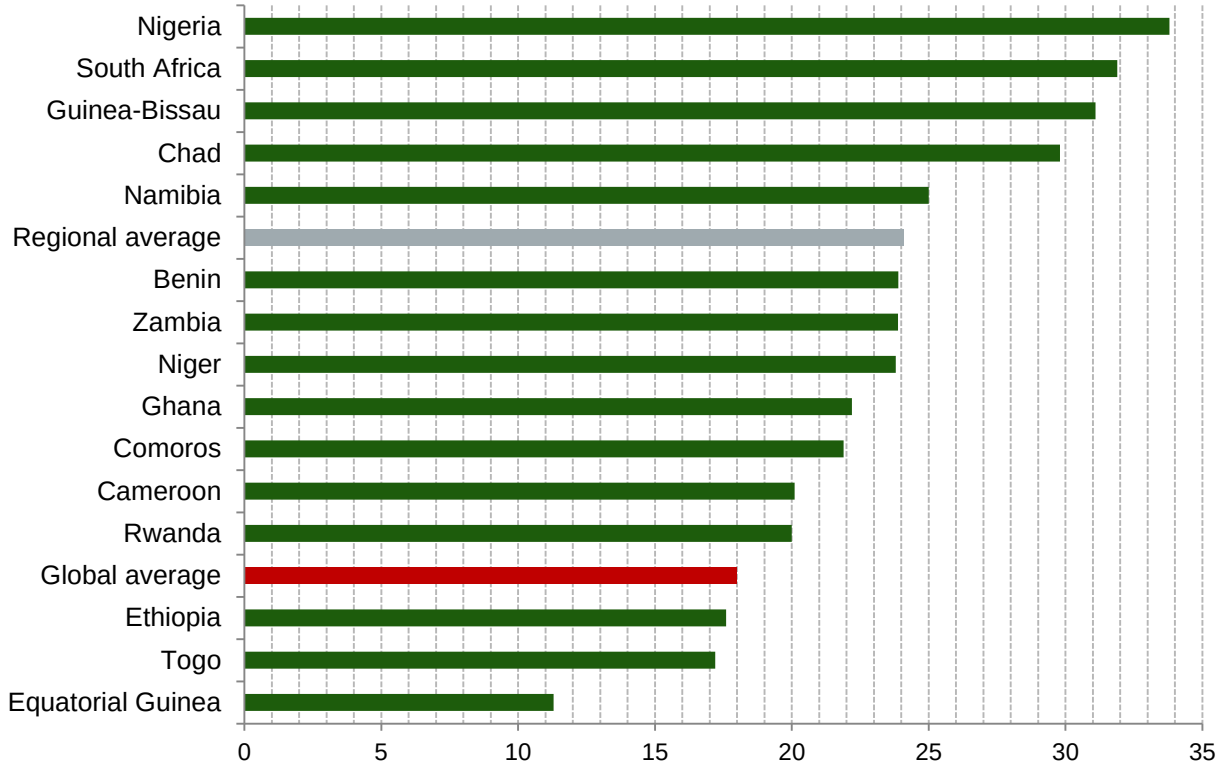


Figure 63. Fatality rates in selected countries (WHO, 2013)

Much of Nigeria's road safety issues are concentrated in Lagos Megacity. The report *Lagos: Building a Sustainable City* (CTS-EMBARQ-Mexico and Walk21, 2012) states that the road traffic crashes occurred in Lagos (almost 40,000 up till 2001, with more than 10,000 fatalities) represent (in cost) around two-thirds of those taking place in all the urban areas of Nigeria, with an impact reaching 2% of the national Gross Domestic Product.

6.2 Institutional and Legal Framework

The Public Sector in Nigeria has made efforts to address this situation. The National Road Traffic Act was enacted in 1949 and forms part of the 1990 Road Traffic Act, Chapter 548 of the Laws of the Federal Republic of Nigeria. The Act aims at regulating and controlling vehicle traffic on highways as well as vehicle and driver licenses. The Nigerian Police Force was the only authority responsible for road safety in the country until 1988. Its duties included traffic control, vehicle inspection and driver licensing. In 1988 the Federal Government of Nigeria founded the Federal Road Safety Commission (FRSC) and from that moment both institutions share functions regarding road traffic safety in Nigeria, such as apprehension of erring drivers, road clearance, rendering first aid health services, enforcement of speed limit, road crashes data collection, analysis as well as issuance of driver licenses and vehicle registration.

However, there is lack of coordination between the said institutions and the agencies responsible for the provision of road infrastructure and transport policy-making, such as the Federal Ministry of Works and Housing and the Federal Ministry of Transport. Additionally, the Nigerian Police Force and the FRSC rarely have collaborative affairs with other institutions dedicated to road safety issues, such as the Traffic Warden, Vehicle Inspection Official and other private initiatives such as Special Marshal Corps, Red Cross or Man-O-War.

Despite the limited available resources for exerting their functions, problems of overlapping objectives and lack of cooperation, it has to be said that the said agencies are making an effort to alleviate the poor state of the road traffic environment in Nigeria, especially in Lagos State.

6.3 Main issues

Like in other African cities, there are four main issues to be addressed in order to improve road safety in Lagos (WHO, 2013):

- **Inadequate NMT and accessibility policy**: Lagos transport infrastructure is not user friendly to pedestrians and cyclists. This group is the most affected when it comes to road crashes, representing approximately half of the deaths by consequence of road traffic incidences (CTS-EMBARQ-Mexico and Walk21, 2012). Few transport facilities in the city present adequate accessibility for this mode, mainly due to the fact that transport policy has been primarily focused on motorized modes (especially private cars), as its needs have not been incorporated into the planning process. Enhancing accessibility for pedestrians and cyclist is therefore key to improving the current situation, and this is being considered as part of the present STMP update.

- **Poor law enforcement**: While some relevant laws concerning road safety are yet to be introduced, enforcement needed to enact existing regulation is generally insufficient. Encouraging a culture of safe road behaviour that leads to reduction in road traffic crashes requires persistent attention. Law enforcement should be comprehensive and sustainable; paying attention to the main risk factors (speed, drink-driving, helmets, seat-belts and child restraints) as well as the details regarding its application (procedures, personnel, equipment).

- **Poor health care system**: Generally, medical institutions are poorly prepared to rescue and appropriately care for persons who survive road traffic crashes, as they lack adequate infrastructure, resources, transport, communications, and emergency management services. Better planning regarding post-crash care can improve emergency services and therefore reduce the number of deaths from road injuries.

- **Lack of data on road crashes**: Data collected from road traffic crashes in the city, (similar to the rest of the African Region) is still inadequate for target setting, planning, implementing, and evaluating road safety interventions. The installation of a data collection and analysis system is required in order to identify spatial distribution of events, major risk factors, numbers and

characteristics of persons being injured and killed on the roads, circumstances surrounding road crashes, and the extent to which interventions are being deployed.

6.4 General Outline of the Road Safety Strategy for Lagos

6.4.1 Vision and objective

The vision for Lagos in relation to traffic and road safety should focus on improving safety and security for all users of transport modes. A specific objective would be to reduce the number of road traffic accidents occurring in the city, especially their severity (number of deaths and injured people).

This should be done through the creation of a pedestrian- and bike-friendly urban environment, together with adequate law enforcement and an efficient health care system, aimed at responding to the needs of the transport system and society.

It must also be noted that the Road Safety Plan for Lagos must be supported by the knowledge of road traffic accidents in the city through an adequate data collection and analysis system.

6.4.2 Main activities

In order to achieve the main objective and the vision set for Lagos regarding road safety, the implementation of the following groups of activities are required:

- **Analysis of the current situation**. Identifying the status of road crashes, causal factors as well as current safety standards. This is a crucial task implying the definition of a series of road safety indicators, procedures for data collection and analysis as well as, (at this stage) the definition of road safety baseline for Lagos. Geographical information systems (GIS) for identifying spatial distribution of road crashes, and managing related information such as type of incidence, type of vehicle and casualties, amongst others.

  Other activities included are the diagnosis of the current efforts carried out by local authorities (LAMATA, Federal Road Safety Corps, amongst others) and the comparison of the current situation in Lagos to other similar countries in terms of infrastructure, regulations, vehicles, safety systems, education, etc.

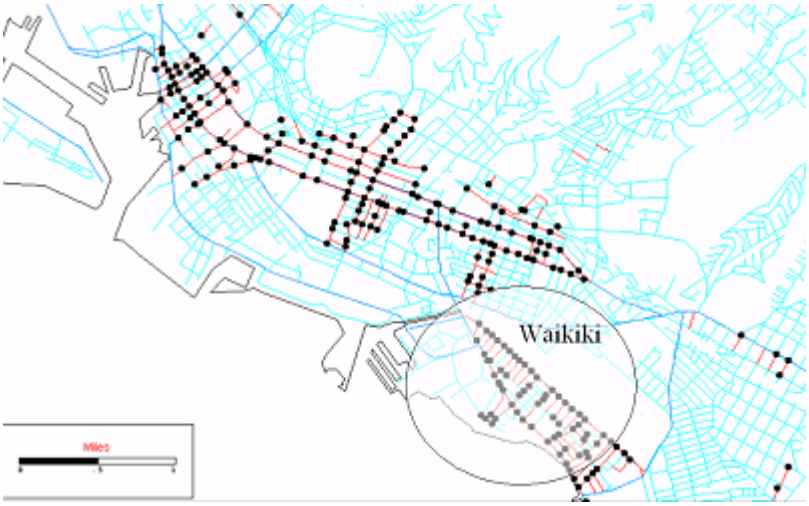


Figure 64. Example of spatial distribution of road crashes using GIS

- **Establishment of road safety policies and an implementation strategy**. The road safety policy directives and the related implementation strategy will be focused so as to achieve the targeted reduction values of road crashes and their severity. The Targeted Reduction values of road traffic crashes for the mid and the long terms is defined based on information gathered from the current road safety situation in the city as well as the situation and experiences from crash reduction in other relevant cities.

  Road safety policies comprise:

  - Road infrastructure and traffic management.
  - NMT accessibility.
  - Institutional strengthening.
  - Regulation enhancement and law enforcement.
  - Improvement of post-crash health care systems.
  - Road safety education and behavior improvement.
  - Monitoring and information system.

  The implementation strategy will be set according to three criteria: social (social costs and benefits of the interventions, benefited groups), technical (affected population, crash and casualty reduction) and economic (required investment); a set of priority interventions will be established.

- **Establishment of a monitoring system**. Through realistic policy indicators, the monitoring system will provide data on the level of achievement of the set road safety policies, which will be

the basis for further road safety planning. Additionally, through its integration into a traffic management system, it will be possible to manage incidents in real time, and communicate with the public in order to reduce disruptions in traffic.

A number of different approaches have been used for road traffic accident and injury data collection. Well established systems for road accident monitoring can be found in countries such as the United States, the United Kingdom, Canada and Australia, where transport authorities perform detailed analyses (location, injury severity, costs, etc.) with data from a wide range of sources (police, health and insurance sector, private companies). Such monitoring systems can be established in countries with less available data. For example, in Mexico, the Ministry of Health was able to introduce a Spatial Diagnosis of Road Accidents in Mexico City with available road accident data from the police and hospitals which identified the most dangerous areas, corridors and intersections through a geographic information system (GIS). Even in countries with serious scarcity of data, road traffic injury information could be collected by less refined methods such as surveys which were useful to identify and describe injury patterns (community surveys in Uganda, a demographic and health survey in Mozambique and Cambodia).

7 Climate Change Plan

7.1 Introduction

Climate change -as well as its effects on earth (rise of sea-level, sea water acidification, and glaciers melting)- nowadays presents a worldwide concern, as it is recognized as the greatest challenge to sustainable development. The situation proves to be critical in developing countries like Nigeria, especially in cities with a strategic position in their social and economic activities, like Lagos. In fact, the latter is the largest city in Nigeria and provides employment for over 45% of the skilled manpower of Nigeria (*Lagos Air quality Monitoring Study* – LAQMS, 2008).

According to the Inter-governmental Panel on Climate Change (IPCC - created by the United Nations), man is the main cause of climate change and the damages already caused by fossil fuel emissions will remain for centuries if governments do not take immediate and effective measures. Accordingly, the World Health Organization (WHO, *Climate Change and Health*, 2013) states that in the last 100 years the World has warmed by approximately 0,75°C. Furthermore, recent studies suggest that, by the end of this century, sea levels could rise between 26 and 82 centimetres due to an increase of up to 4.8 degrees in temperature. Greenhouse gases (GHG) represent the major cause of global warming over the last 50 years. The gases that constitute GHG are: carbon dioxide (CO_2), Hydro Fluoro Carbons (HFC), Perfluoro Carbons (PFC), sulphur Hexa Fluoride (SF_6), Methane (CH_4) and Nitrous Oxides (N_2O).

With a significant part of the city built in the surroundings of a large water body like Lagos Lagoon, Lagos is particularly vulnerable to the impacts of climate change. Flooding caused by the rise in sea level presents a challenge for Lagos Megacity, as it might imply a migration of population from the coast to inland areas. Salt-water intrusion into fresh water sources is also a possible consequence of climate change that Lagos will have to tackle. Therefore, concerted and urgent action is needed in order to reduce future effects of climate change as well as to increase the resilience of the city from possible events caused by the former.

7.2 Transport and climate change

Transport activity increases as the economy grows. Therefore it represents a sign of economic development. However this fact becomes a problem when growth is not accompanied by appropriate urban development and transport planning, as has been the case in Lagos in the past.

Continuous population growth and urban sprawl contribute to commuting distances. This circumstance, together with the high dependence on fossil fuel leads to the growth of pollution levels, leads to serious health effects and contributes to climate change. According to LAQMS (2008), vehicular emissions represent the major source of pollutants in Lagos, contributing approximately to 43% of its air pollution. This study also recognizes that vehicles in Lagos contribute to over half of the greenhouse gas emission from the transport sector in the country.

The Transport sector is also the fastest growing source of global greenhouse gas emissions in Nigeria. In Lagos State, the number of vehicles has increased to 234% over the last decade (2001-2009). As a matter of fact, daily trip demand is growing dramatically (according to LAMATA, it is estimated to reach 30 million by 2020). Those coming from transport are mainly carbon dioxide and water vapour, because these are the major components emitted after the combustion of petroleum-based fuels. As can be seen in the following figure, CO_2 emissions from fossil fuels have increased drastically over the last century in Nigeria.

Traffic congestion is also increasing in Lagos, which makes driving conditions even more polluting. The two main reasons for this growing congestion is the lack of a good network between hinterland and ports and inadequate transport planning in new urban areas. The former leads to freight movement within the city with subsequent friction with passenger traffic and the inefficient management of the goods; the latter makes commuting trips more complicated and therefore the use of private transport becomes in most cases the only alternative.

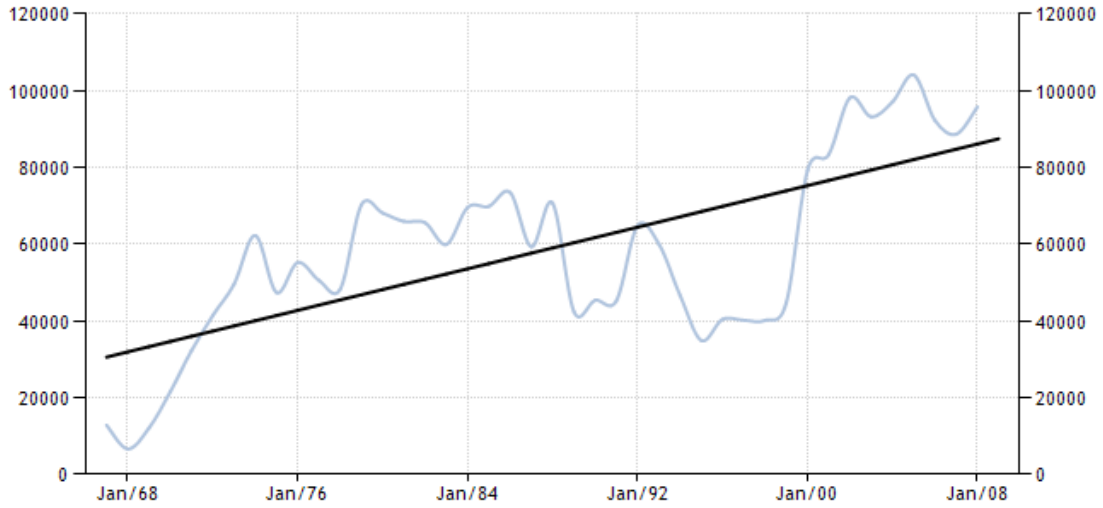


Figure 65. CO2 emissions (KT) in Nigeria

Source: The World Bank

7.2.1 Main aspects of the vehicle fleet

The *Assessment of Emissions from Road Transport* conducted by LAMATA (2009) was carried out in order to estimate the impact of the coming bus rapid transit (BRT) line on greenhouse gas emissions in the Oshodi-Obalende (via Mile 2 and CMS) corridor. The study provides some important facts regarding the main aspects of vehicle fleet in Lagos that impact on the current air ambient quality of the city.

The figure below shows the age distribution of different types of vehicles in Lagos. Over 70% of the vehicle fleet currently serving transport in Lagos are 15 years old or more. Most of these cars, buses and trucks are second-hand, imported units that do not meet the emission standards of their origin countries. In addition, vehicle maintenance is often poor and is reduced to essential interventions in

order to keep the unit working. Poor or even no vehicle maintenance leads to a progressive decline of the performance of engines, leading to less efficient fuel combustion and thus increasing emissions.

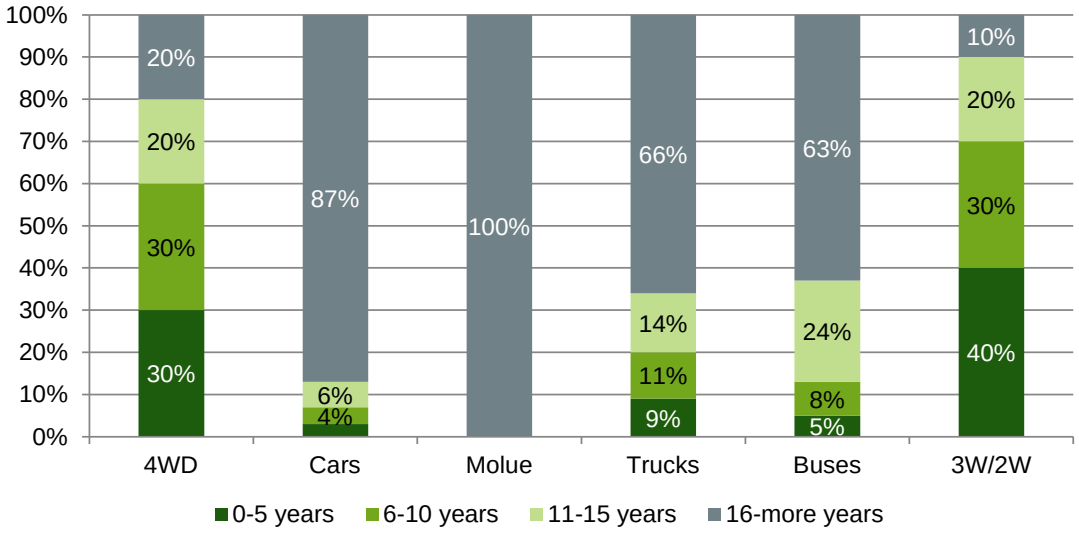


Figure 66. Vehicle classification by age

Source: Assessment of Emissions from Road Transport, 2009

These old and poorly maintained vehicles are known as “super emitters”, which are responsible for about two thirds of the CO_2 emissions in Nigeria coming from transport activity. According to the *Assessment of Emissions from Road* Transport, around 85% of the "Lagosian" vehicle fleet works with old petrol engines. A finding of this study is that an average car plying on the roads of Lagos approximately meets the EURO-II emissions standard which was already in place in Europe in 1996. EURO-II standards are actually 3 to 4 times higher than the current standard in that continent. Details of the comparison are presented below.

Vehicle type	Cars		Buses		Euro 2
	New	Used	New	Used	
CO	3.00	14.96	8.07	12.45	3.28
HC	0.006	0.22	0.006	0.17	0.34
NOx	0.07	1.2	0.15	0.36	0.25
CO_2	22.92	165.9	107.9	229.2	130

Table 23. Comparison between emission factors for vehicles using petrol as measured in Lagos in 2008 and Euro standards (g/km)

Source: Assessment of Emissions from Road Transport, 2009

7.3 Current Lagos Climate Change Policy

The Government of Lagos State has developed the Lagos State Climate Change Policy. The aim of this policy is to address climate change impacts and its consequences through the definition of adaptation and mitigation measures involving all stakeholders. These measures are related to different domains such as education, research, technology development and financing. They consider all different segments of society.

Adaptation to climate change is the primary priority of the Lagos State Climate Change Policy, which also includes disaster risk management. Mitigation is also considered through the definition of specific guidelines to reach sustainable development.

In 2011, the Lagos State Government prepared two important policy documents: The *Lagos Climate Change Adaptation Strategy (LAS-CCAS)*, which focus on adaptation, and the *Policy Framework on Climate Change Mitigation, Adaptation and Governance in Lagos State*, which defines the mitigation measures and the necessary institutional framework to accomplish it.

At the national level, the Policy supports the National Communications to the United Nations Framework Convention on Climate Change (UNFCCC). Furthermore, the Article 20 of the Nigeria's Constitution (1999) pushes all Nigerian states to "protect and improve the environment and safeguard the water, air, land, forests and wildlife of Nigeria".

The Lagos State Climate Change Policy is also aligned with the Kyoto Protocol and other key decisions taken in some Conferences of the Parties (COP), such as the Cancun Agreements (COP 16) and the Durban Platform for Enhanced Action (COP 17).

The Federal Republic of Nigeria is also a Party to the following Multilateral Environment Agreements:

- The United Nations Convention to Combat Desertification (UNCCD)
- The Convention on Biological Diversity (CBD)
- The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITIES)
- The Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat
- The Stockholm Convention on Persistent Organic Pollutants (POPs)
- The Vienna Convention for the Protection of the Ozone Layer
- The Montreal Protocol on Substances that Deplete the Ozone Layer
- The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal

In brief, both Lagos State and the Nigerian Government are fully committed to the fight against climate change through the development of policy documents and the participation of main international agencies.

7.3.1 The role of transport in the current climate change policy

The LAS-CCAS recognizes multimodal transport –the introduction of a mass transport system (MRT) comprising a combination of bus rapid transit (BRT), rail and water transport services – in Lagos as a key measure for climate change mitigation and adaption. The latter also represents one of the objectives of the current project on the extension of the 2009 STMP, only to be achieved through efficient mass transport systems together with better hinterland connection with the sea and airports and the use of non-motorized transport. All these aspects should be taken into account during the whole project: from the planning and design stage to the operation phase.

The introduction of multimodal transport is justified by their larger passenger capacity and lower emission rate than those of private car. As presented in the table below, the latter is the major emitter per passenger-kilometre in comparison to other means of transport. The emission levels of motorcycles are close to the Danfos levels and much higher than BRT, Rail transit and Bus, the most environmentally efficient modes of transport.

Furthermore, the figure below shows a comparison between the modal share and the proportion of emissions from each mode of road transport. The BRT is the most efficient of these means of transport, considering emissions per passenger. Private vehicles prove to be high pollutants in comparison to public transport vehicles, due to their low occupancy rate. On the contrary, the number of buses needed to move a large number of people are very much lower than that needed by private cars. Therefore the total emission per passenger in public transport is lower than in private transport.

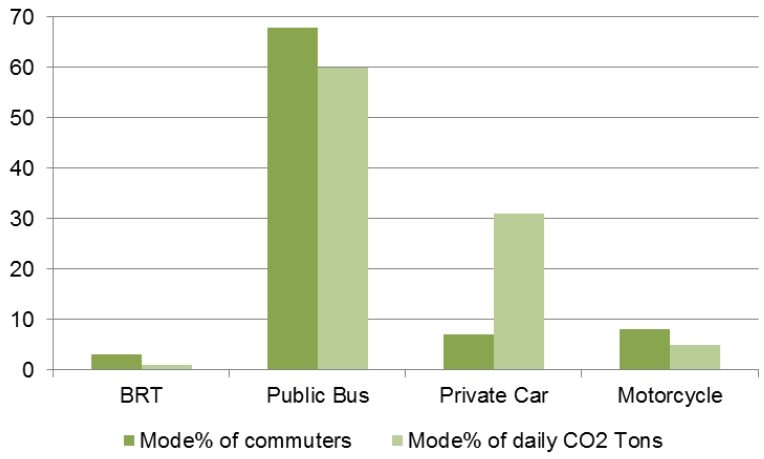


Figure 67. Modal share of commuters and CO2 emissions in Lagos.

Source: ALG based on information from Lagos State Government/Alain's model.

Additionally, the *Assessment of Emissions from Road Transport* (2009) proposes the setting of current emission standards to Euro 2 (for used vehicles) and Euro 4 (for new vehicles), as well as a series of related law enforcement measures regarding inspection, maintenance and certification, including a fuel switch from diesel/gasoline to CNG which will yield substantial environment benefits from cars and buses. These represent feasible objectives for long-term transport planning in Lagos Megacity, and the Climate Change Plan has been defined on this basis.

7.4 Potential benefits of the proposed STMP extension in the accomplishment of climate change policies

The following section details the main features of a proposed policy to address climate change in the region of Lagos.

The environmental impact of the STMP focus on measuring the generation of greenhouse gases (GHG). The methodology applied for this assignment in Lagos takes input from two studies commissioned by LAMATA. The first one is the *Assessment of Emissions from Road Transport* (in short, AERT) in 2009 on the occasion of inaugurating a BRT line. This report includes the measurement of pollutants generated by local vehicles, measurements of air pollutants across Lagos and proposals on a series of recommendations to address these issues.

The second study has developed values for both types of fuel and suggests localized references for CO2eq in the city of Lagos. This study was conducted in 2013 and is titled *Data Gathering to Implement GHG Emissions Reduction Assessment Methodology for LUTP II BRT Corridors* (in short, GERB). It supplements GHG estimations for the cost benefit analysis of the proposed transport projects.

In particular, the AERT recommendations can serve as the basis for defining an environmental policy geared towards mitigating environmental impact during the STMP implementation period and establishing monitoring parameters to track progress.

Most measures tested do not require expensive investments for their application when compared to other transport interventions included in the STMP. AERT recommendations follow these guidelines:

- Transport planning and demand management, to implement:
  - Substitution of 20% of cars/SUVs (*Sport Utility Vehicles*) with enhanced buses services like BRT
  - One-way streets
  - Establishment of certification centers for vehicles on emissions
  - Encouragement of Non-Motorized Transportation (NMT)
- Promotion of NMT facilities, which could produce a 10% reduction in motorized trips

- Switching buses to operate with CNG (can reduce the Emission Factors (EF) for CO2 in 28.7%, 30.4% for CO, 0.06% for NOx and HC, and 100.0% for PM10).
- Switching cars and SUVs to CNG
- Limiting the age of second-hand vehicles imported to Nigeria
- Setting emission standards to EURO-IV to limit emissions from vehicles

This is important because the expected growth of the population concentrated in the region will probably be associated to a significant increase in vehicles on the roads despite significant deployment of mass transit.

Especially for private transportation, as fleet run is expected to increase, it will be necessary to reduce emissions resulting from each kilometer operated. The AERT proposes a set of measures that are deemed adequate, and if applied they can represent significant improvements in the overall level of GHG emissions associated with the STMP.

Quantification of the above guidelines is undertaken by making use of Emission Factors (EF), a parameter used to relate pollutant emissions (measured in grams) to vehicle operation (measured in km) per type of vehicle. EF applicable to the current standard of emissions in Lagos region (EURO-II), specifically designed track the following GHG: CO2, CO, SO2, NOx, PM10 and HC.

The measures presented above were tested with emission models. Possible reductions of the EF were calculated as a percentage of the current EF values, leading to the determination of Reduction Factor (RF). Such RF was then applied to the current EURO-II EF, under the form:

$$\mathbf{EFf = EFi * (1 – RFj)}$$

Where:
EFf = Final Emission Factor
EFi = Initial Emission Factor (EURO-II)
RFj = Reduction Factor applicable for each GHG j.

As these measures are not necessarily exclusive from each other, they can be applied at the same time to reduce a particular emission. The following expression can explain the concept:

$$\mathbf{EFf = EFi * (1 – RFj1) * (1 – RFj2) * (1 – RFjn)}$$

Where:
EFi = Emission Factor initial (EURO-II)
EFf = Emission Factor final
J = measure to reduce emissions as presented in the bulleted list a few paragraph above
RFj1 = Reduction Factor (as a percentage) associated to measure 1 to reduce GHG j
RFj2 = Reduction Factor (as a percentage) associated to measure 2 to reduce GHG j

RFjn = Reduction Factor (as a percentage) associated to measure n to reduce GHG j

An example can illustrate the procedure to estimate a final EF:

EFf for CO in 2020 = EFi * (1-0.2) * (1-0.1) * (1-0.112) * (1-0.533) = 7.10 * 0.298581 = 2.12

Where:
EFi for CO in cars in 2008 = 7.10
0.2 = increasing the number of buses to reduce cars by 20%
0.1 = developing NMT infrastructure to reduce car trips by 10%
0.112 = stimulating conversion of vehicle fuel to CNG by 11.2%
0.533 = introducing EURO-IV standards by 53.3%

The resulting matrix of RF follows. These values can be understood as portion of the current EF that is achieved by 2022 if all the proposed measure of the AERT is applied as suggested. For example, for Cars, the current EF for CO will be reduced to 0.298 (or 29.8%) of the current value by 2022. Also for Trucks, the current EF for NOx will be reduce to 0.45 (45%) of the current value.

Reduction factors (RF) for each EF by vehicle type, for 2022

Type of vehicle	CO	NOx	HC	PM	CO2
Cars	0.298581	0.266587	0.712800	0.276670	0.439582
SUV	0.611820	0.433458	0.844560	0.424630	0.612360
Trucks	0.338000	0.450000	0.376000	0.120000	0.750000
Buses	0.089336	0.347443	0.291226	0.000000	0.422844
Molues	0.305100	0.406800	0.340200	0.108000	0.675000

Source: ALG calculations, based on AERT proposal

Table 24. Quantification of Reduction Factors (RF) affecting GHG emissions from transportation fuel

Note that all numbers are fractions smaller than 1. Such fractions are the expected proportion of GHG emissions resulting from the application of these measures.

The next chapter of this report includes an analysis of the GHG emission reduction linked to the proposal, comparing expected values from the base scenario against those from the alternate scenario at three points in time (2017, 2022, 2032). A technical report also includes further details on the calculations of the potential benefits of implementing these policies to address climate change resulting from transport activities in the Lagos mega city region. The RF resulting from the proposed policy on climate change have been incorporated into the model for the cost-benefit analysis to quantify possible benefits of the STMP. Resulting values make part of the CBA for private transport projects.

8 Cost-Benefit Analysis

8.1 The STMP

The revision and extension of the Strategic Transport Master Plan (STMP) integrates a series of various projects which include the construction of new roads, the development of new public transport services and the establishment of a freight transport system for the Lagos region. Also included in the proposals are plans to improve conditions for non-motorized transport, the application of better safety measures ruling transportation and guidelines to reduce the impact of the transport industry on the environment, particularly the climate.

All projects have been pre-screened, evaluated and phased into three time horizons: 2017, 2022 and 2032. The resulting set of projects is identified as the STMP scenario. This STMP scenario represents a specific combination of roads, public transport services and supporting infrastructure for Lagos' transportation system. Such combination of projects has been defined as the most suitable from the technical (transportation system) point of view. However the economic feasibility of the proposed system still needs to be tested. This is the purpose of the Cost Benefit Analysis (CBA).

8.2 The Cost Benefit Analysis (CBA)

All the projects of the proposal have a cost associated with them, as they involve the extensive application of economic resources. These resources include: occupation of land, construction of infrastructure, acquisition of equipment, consumption of energy and employment of workers.

The CBA serves the purpose of quantifying the costs of all those resources identified above and comparing them with the expected benefits. The aim is to verify that the expected benefits outweigh the costs.

It is common to limit the scope of a CBA to the calculation of benefits based on (i) journey time savings (JTS), (ii) savings in vehicle operating cost (VOC), (iii) transfer savings due to better connectivity of the transport network. These three types of benefits are relatively easy to quantify and provide a direct and solid representation of tangible benefits related to transport projects. Additional benefits can be included in the analysis like the estimation of benefits from (iv) reduction in road accidents and (v) reduction in emissions of air pollutants.

The CBA essentially compares the valuation of benefits and costs in any pair of scenarios. This means that for assessing the benefits of the STMP scenario it is necessary to compare it against another scenario, which is commonly called the baseline scenario. In particular, the reader will find that for this assignment the baseline scenario is called the Do Minimum scenario.

The CBA provides an answer to the critical question: "Is society going to be better off once the proposal is implemented or not?" If the cost of the transportation projects is less than the benefits

they bring to the society, then it makes sense to go ahead with their implementation. Otherwise, a revision of the scenario is needed.

The purpose of this chapter is to briefly present the inputs used whilst undertaking the CBA and comment on the results.

8.3 The CBA spreadsheet model

The CBA relies on the application of a spreadsheet model that separates private transport from public transport or transit. For each, similar economic models were assembled as explained in the next sections.

8.3.1 Inputs

Three types of input were used to feed the CBA model:

a) Transport parameters from the Transport Demand Model (TDM) to provide information about transport variables like number of passenger, fleet size, fleet run (vehicle-kilometers), travel time, circulation speed.

b) Economic parameters to determine the project's initial investment costs (civil works, equipments, rolling stock) as well as on-going operational costs after construction, such as the Vehicle Operating Costs (VOC), and the maintenance costs as a percentage of the initial investment cost or as unit rates.

c) Other parameters representing units of time, percentages, and conversions needed for modeling.

This information was organized into:

- Three time horizons (2017, 2022, 2032) in addition to the current year 2012;
- 2 scenarios (STMP and DoMinimum/DM);
- 11 transport modes subdivided between:
  - Transit/Public Transport: Minibuses/danfos, Bus (standard), BRT light, Railway, BRT, LRT, Monorail, Cable car, Waterways/ferry
  - General/Private traffic (cars, trucks).

8.3.1.1 Inputs from the Transport Demand Model (TDM)

The transport input from the TDM for private vehicles (PV) is summarized in the following table:

Private transport		Do Minimum			STMP		
Mode	units	2017	2022	2032	2017	2022	2032
Car	Veh-km-16 hr	46,619,380	70,459,232	135,928,427	46,185,732	69,805,134	126,528,644
	Speed (km/hr)	31	22	5	34	29	27
	Travel time (min-16hr)	164,937,171	342,278,532	3,022,011,015	146,981,024	258,588,970	502,616,945
Truck	Veh-km-16 hr	5,179,931	7,828,804	15,103,159	5,131,748	7,756,126	14,058,738
	Speed (km/hr)	31	22	5	34	29	27
	Travel time (min-16hr)	10,181,307	21,128,304	186,543,890	9,072,903	15,962,282	31,025,737
Private fleet run	Veh-km-16 hr	51,799,311	78,288,035	151,031,585	51,317,480	77,561,260	140,587,382
Private average speed	Speed (km/hr)	31	22	5	34	29	27
Private travel time	Travel time (min-16hr)	175,118,478	363,406,837	3,208,554,905	156,053,927	274,551,252	533,642,682

Table 25. Key indicators for PV from the TDM

The table above indicates that in the DM scenario, the veh-km by all private vehicles during an average day in 2017 is approximately 51.8 million which rises to 151.0 million veh-km in the year 2032. Under the STMP scenario, 51.3 million veh-km are expected for 2017, reaching 140.5 million veh-km by 2032. That represents a difference of 10.5 million km lower than in the DM scenario for 2032.

Speed-wise both scenarios are very different. In the DM scenario, congestion on the roads is expected to reduce the average circulation speed from 31 km/h in 2017 to 5 km/h in 2032. This is a stark contrast with the STMP scenario that has been designed to achieve better circulation speeds between 27 and 34km/h.

Reduced congestion and thus higher speeds on the road in the STMP scenario are expected to take aggregate travel time of private transport users from 156.0 million of minutes in 2017 to 533.6 million minutes in 2032, a relatively low increase over the years when compared to the DM scenario, where the travel time values change from 175.1 million minutes in 2017 to 3,208.5 million minutes by 2032. The reason for such a high figure of travel time in the DM scenario in 2032 is circulation speed (5 km/h for that time horizon). The proposal leads to a notable improvement in speed and therefore remarkable time savings.

For the public transport model (PT) the list of modes is longer, starting with the current operating modes: minibuses and danfos, conventional buses, BRT Light and railway. This list is expanded to include the proposed modes as defined in the STMP: BRT, LRT, monorail, cable car and waterways. The table below summarizes the main inputs from the TDM for transit.

Public transport		Do Minimum			STMP		
Current routes	**units**	**2017**	**2022**	**2032**	**2017**	**2022**	**2032**
Minibus/ Danfo	Minibus lines	347	347	347	347	347	347
	Veh-km-16 hr (15 pax unit)	13,289,554	16,241,420	26,171,414	10,478,452	8,778,874	6,118,073
	Fleet Minibus (15 pax unit)	131,873	189,158	402,550	54,167	45,438	31,657
	Speed (km/hr)	6	5	4	12	12	12
	Pax-16hr	16,195,440	19,293,200	27,024,336	13,638,048	12,201,808	9,051,840
	Travel time (PAX*TIME min-16hr)	1,653,373,136	2,337,547,161	4,949,244,766	678,266,494	534,695,954	315,973,106
Bus	High capacity bus lines (100 pax)	13	13	13	13	13	13
	LAGBUS lines (100 pax)	12	12	12	12	12	12
	Low capacity bus lines (55 pax)	22	22	22	22	22	24
	Veh-km-16 hr BRT (100pax-unit)	542,950	611,195	549,505	449,913	440,286	339,234
	Veh-km-16 hr Bus (55 pax)	410,621	477,146	606,357	391,559	341,179	221,358
	Fleet BRT (100pax-unit)	6,050	7,860	8,555	2,313	2,287	1,784
	Fleet Bus (55 pax unit)	4,702	6,269	9,382	2,135	1,894	1,214
	Speed (km/hr)	6	5	4	12	12	12
	Pax-16hr	4,812,288	5,332,288	5,153,104	4,413,888	4,156,800	3,494,208
	Travel time (PAX*TIME min-16hr)	526,214,853	681,627,809	817,480,467	219,582,039	207,267,087	140,613,158
BRT light	BRT light lines	1	1	1	1	1	0

Public transport		Do Minimum			STMP		
Current routes	**units**	**2017**	**2022**	**2032**	**2017**	**2022**	**2032**
	Veh-km-16 hr biarticulated (270)	16,201	16,196	14,788	14,793	14,438	0
	Fleet biarticulated	62	74	100	42	41	0
	Speed (km/hr)	17	14	9	23	23	0
	Pax-16hr	338,752	359,792	355,008	261,792	279,424	0
	Travel time (PAX*TIME min-16hr)	13,477,643	16,129,860	22,275,706	8,585,781	8,285,042	0
Railway	Railway lines	3	3	3	3	3	3
	Veh-km-16 hr trains (1000 pax-unit)	4,382	4,382	4,959	3,844	3,844	2,768
	Veh-km-16 hr trains (600 pax-unit)	5,786	5,786	4,339	4,339	4,339	2,893
	Fleet trains (1000 pax-unit)	8	8	9	7	6	5
	Fleet trains (600 pax-unit)	12	12	9	9	9	6
	Speed (km/hr)	36	36	36	36	36	36
	Pax-16hr	177,072	197,040	225,072	92,064	98,576	41,456
	Travel time (PAX*TIME min-16hr)	5,774,974	6,043,295	6,364,998	3,524,963	3,672,905	1,355,143
Travel time Current PT	Travel time (min-16hr)	2,198,840,606	3,041,348,125	5,795,365,937	909,959,277	753,920,988	457,941,407
TT Current PT + Priv	Travel time (min-16hr)	2,373,959,084	3,404,754,961	9,003,920,841	1,066,013,204	1,028,472,240	991,584,089

Public transport		Do Minimum			STMP		
Proposed routes	**units**	**2017**	**2022**	**2032**	**2017**	**2022**	**2032**
BRT	BRT lines	2	2	2	2	6	14
	Veh-km-16 hr Articulated (160 pax)	370	370	0	0	0	0
	Veh-km-16 hr BiArticulated(270 pax)	9,900	11,164	15,309	33,412	144,753	380,085
	Fleet articulated	2	2	0	0	0	0
	Fleet biarticulated	32	40	69	90	382	1,005
	Speed (km/hr)	20	17	14	24	24	24
	Pax-16hr	198,304	226,240	312,160	238,544	1,437,520	4,075,488
	Travel time (PAX*TIME min-16hr)	7,733,288	9,735,779	16,224,070	19,589,064	73,535,488	182,799,284
LRT	LRT lines	1	1	1	3	5	8
	Veh-km-16 hr	4,628	5,870	7,225	51,601	124,894	307,738
	Fleet	10	12	14	93	217	542
	Speed (km/hr)	35	35	35	36	37	36
	Pax-16hr	681,360	875,072	1,098,352	2,220,016	4,194,880	8,786,512
	Travel time (PAX*TIME min-16hr)	6,699,554	8,606,259	10,560,977	61,468,493	139,163,936	325,887,978
Monorail	MONORAIL lines	0	0	0	0	3	3
	Veh-km-16 hr	0	0	0	0	8,997	11,441

Public transport		Do Minimum			STMP		
Proposed routes	**units**	**2017**	**2022**	**2032**	**2017**	**2022**	**2032**
	Fleet	0	0	0	0	12	15
	Speed (km/hr)	0	0	0	0	60	60
	Pax-16hr	0	0	0	0	1,106,992	1,427,472
	Travel time (PAX*TIME min-16hr)	0	0	0	0	5,809,020	7,284,246
Cablecar	CABLE CAR lines	0	0	0	3	4	4
	Veh-km-16 hr	0	0	0	29,537	241,022	261,455
	Fleet (10 pax-unit)	0	0	0	106	841	912
	Speed (km/hr)	0	0	0	18	18	18
	Pax-16hr	0	0	0	63,904	323,216	347,760
	Travel time (PAX*TIME min-16hr)	0	0	0	909,203	7,261,229	7,211,249
WW	WATER WAY lines	19	19	19	25	36	36
	Veh-km-16 hr	66,439	76,507	90,206	77,808	141,618	336,377
	Fleet (120pax-unit)	138	157	177	176	305	687
	Speed (km/hr)	34	34	34	33	33	33
	Pax-16hr	490,224	600,736	721,904	518,304	973,680	2,127,536
	Travel time (PAX*TIME min-16hr)	12,579,255	14,762,199	17,491,193	14,052,016	25,564,721	65,604,551

Public transport		Do Minimum			STMP		
Proposed routes	**units**	**2017**	**2022**	**2032**	**2017**	**2022**	**2032**
Travel time New PT	Travel time (min-16hr)	27,012,096	33,104,237	44,276,239	96,018,775	251,334,395	588,787,309
Total PT demand	Pax-16hr	22,716,368	26,687,328	34,664,864	21,354,496	24,674,320	29,310,816
Total PT travel time	Travel time (PAX*TIME min-16hr)	2,376,633,751	3,255,425,938	6,066,880,536	1,148,649,044	1,180,191,077	1,252,904,769
Total PT fleet run	Veh-km-16 hr	14,340,665	17,439,868	27,454,805	11,527,075	10,236,060	7,975,761
(PT+Priv) travel time	min/trip	2,551,752,229	3,618,832,774	9,275,435,441	1,304,702,971	1,454,742,330	1,786,547,452
PT travel time/Trip	min/trip	105	122	175	54	48	43

Table 26. Key indicators for PT (current modes) from the TDM

The table above shows how replacing the growing fleets of traditional modes of public transport (danfos, conventional buses and traditional railway) with modern, mass transit systems (BRT, LRT, monorail) and supporting transit services (enhanced ferries and cable car) reduces significantly fleet size, fleet run, travel times and -most importantly- travel time per trip, whilst serving 14% more passengers in 2032.

Passenger demand is an important value for the economic (and financial) assessment because it represents the basis for the calculation of the fleet and the design of a rough operating plan, which are the basic consideration for estimating the fleet operating cost.

Better operating speeds and shorter headways in the STMP scenario will lead to lower travel time per passenger in the order of 45-54 min on average per passenger trip. This is a notable improvement over the DM scenarios where travel time is expected to worsen from 105 minutes on average in 2017 to as much as 175 minutes in 2032.

8.3.1.2 Input of Economic Nature

The following list shows the input of economic nature used to quantify costs and benefits. These include:

- Demand growth factor
- Demand expansion factor (or DEF, the number of average days in a year)
- Accident reduction factor
- Cost of diesel and petrol (NGN/L)
- Exchange rates (XR)
- Economic discount rate
- Values of time (VoT)
- Infrastructure maintenance cost ratios
- Fleet cost per type of vehicle
- Gren House Gasas (GHG) emission factors

Transport	Value	unit	Cell name	Referential value
Interannual growth rate	**3%**		IGR	3%
Demand Expansion Factor	**312**	regular days/year	DEF	312
Share of diesel-fueled cars	**5.95%**	Lamata, 2013	DieselShare	5.95%
Accident reduction rate	**30%**		AccidRed	30%

Financial / Economic	Value	unit	Cell name	Referential value
Diesel	**167**	NGN/L	Diesel	167
Petrol	**97**	NGN/L	Petrol	97
Exchange rate NGN/USD	**165**	NGN/USD	XR	165
Exchange rate USD/GBP	**1.65**	USD/GBP	XRPD	1.65
Exchange rate USD/EUR	**1.38**	USD/EUR	XRE	1.38
Economic discount rate	**12%**		EDR	12%
VoT Public transport	**73**	NGN/h	VoTPT	73
VoT Private transport	**73**	NGN/h	VoTPv	73
Maintenance, annual, bridge	**3%**		MB	3%
Maintenance, annual, roads	**1%**		MR	1%

Fleet	Value	unit	Cell name	Referential value
Biarticulated VOC factor	**1.4**		BiartVOC	1.4
Minibus (15 pax)	**0**	USD	Mini	50,000
Bus, standard (55 pax)	**0**	USD	Std	100,000
Bus, articulated (100 pax)	**250,000**	USD	Art	250,000
Bus, bi-articulated (270 pax)	**400,000**	USD	Biart	400,000
Ferry (120 pax)	**500,000**	USD	Ferry	500,000
Railway train (1,000 pax)	**0**	USD	Railway1000	3,750,000
Railway train (600 pax)	**0**	USD	Railway600	3,050,000
LRT train (750 pax)	**3,300,000**	USD	LRT	3,300,000
Monorail train (350 pax)	**7,500,000**	USD	Mono	7,500,000
Cablecar cabin (10 pax/cab)	**20,000**	USD	Cable	20,000

Emissions	Value	unit	Cell name	Referential value
CO	**54.00**	USD/MT	CO	54
NOx	**5,593.00**	USD/MT	NOx	5,593
HC	**2,500.00**	USD/MT	HC	2,500
PM	**400.00**	USD/MT	PM	400
CO2	**8.28**	USD/MT	CO2	8.28

Table 27. Economic parameters

8.3.2 Costs

One of the main costs associated with any scenario is the initial investment cost. It is important to note that the Construction and Maintenance of infrastructure as well as the acquisition of vehicles constitute part of the costs.

8.3.2.1 Initial investment in infrastructure

Initial investment costs are incurred in a relatively short period at the beginning of the project implementation whilst maintenance costs are recurrent (annual) and necessary for the proper operation of the transport services and facilities. The next paragraphs and tables describe the main features of the STMP scenario and its implication in terms of cost.

The list begins with costs associated with the construction of new roads/corridors having no associated proposal to public transport services ("Initial investment in private mode projects"). This is followed by costs accounting for new roads/corridors that will also host BRT services ("initial investment shared by both modes, public and private") and lastly all the investments in current corridors for public transport services ("BRT projects", "LRT projects").

The initial investment in road infrastructure covers 18 so-called corridor projects which amount to USD 6.7 billion. Most of that amount is dedicated exclusively to private modes (PV) with a combined length of 672 km and a total cost of USD 5.3 billion (79%), as presented in the table below. Over half of this investment would be undertaken in 2032.

	Corridors	*Length*	CAPEX Private			Total
	Project	***km***	**USD m**			**USD m**
	Roads		**2017**	**2022**	**2032**	
`	**Ring Road**					
1	Ojo - Apapa	*21*	146.3			146.3
2	Ojo - Alagbado	*48*	329.8			329.8
3	Ikorodu – Lekki (4th Mainland Bridge)	*4*	848.5			848.5
4	Ikorodu – Lekki (4+4)	*14*	119.0			119.0
5	Lekki – V.I. / Apapa	*36*		247.0		247.0
6	Okun – Aja – Ikorodu Roundabout (4th MB)	*22*			356.8	356.8
	Lekki					
7	Lekki Green Corridor (BRT 2)	*92*		455.8		455.8
8	Lekki Lagoon Road (BRT 1)	*91*		531.3		531.3
9	Lekki Coastal Road (BRT 3)	*77*		721.9		721.9
	Transversal connections					
10	Owode – Otta – Itele - Lagos - Abeokuta	*56*			298.4	298.4

	Corridors	Length	CAPEX Private			Total
11	Agbara - Sokoto Road - Shagamu	*102*			419.7	419.7
12	Shagamu - Ijebu Ode – Lekki Airport / FTZ	*62*			192.2	192.2
13	Trade Fair – Ijedodo RdI – Ikotun	*7*			64.5	64.5
14	Bridge Apapa Port - Sagbokoji	*1*			19.2	19.2
	Ikorodu					
15	Majidun / Ipakodo - Shagamu	*13*			83.1	83.1
16	Ijede – Isawo Rd (thru Ikorodu)	*6*			149.6	149.6
18	Ikorodu Roundabout – Agbowa	*60*			374.5	374.5
7	Total	***711***	**1,443.6**	**1,956.0**	**1,958.0**	**5,357.6**

Table 28. Initial investment private mode projects

Seven of those 18 corridor projects are shared with public transport (PT) -BRT projects- with an additional investment of USD1.4 billion (21%). These are road projects spanning 350 km and combined with public transport services, sharing the right of way. They are presented in the next table. Most of these projects are also scheduled in the 2032 time scenario.

	Corridors	Length	CAPEX Public Transport			Total	Grand Total
	Project	km	USD m			USD m	USD m
	Roads		2017	2022	2032		
`	**Ring Road**						
6	Okun – Aja – Ikorodu Roundabout (4th MB)	*22*			64.9	64.9	421.7
	Lekki						
7	Lekki Green Corridor (BRT 2)	*76*		468.4		468.4	924.2
8	Lekki Lagoon Road (BRT 1)	*91*		277.0		277.0	808.3
9	Lekki Coastal Road (BRT 3)	*77*		395.8		395.8	1,117.7
	Ikorodu						
15	Majidun / Ipakodo - Shagamu	*13*			40.3	40.3	123.4
16	Ijede – Isawo Rd (thru Ikorodu)	*25*			75.3	75.3	224.9
18	Ikorodu Roundabout – Agbowa	*60*			181.8	181.8	556.3
7	Total	***363.4***	**0.0**	**1,141.1**	**362.3**	**1,503.4**	**6,861.1**

Table 29. Initial investment shared by both modes (public and private)

Besides the new road corridors proposed above (either with or without BRT projects associated), there is an additional group of projects strictly focused on public transport services along pre-existing corridors (BRTs, LRTs, monorail) as well as cable car, waterways and modal interchanges. All of them are presented in the following tables. The BRT projects are presented in the table below: 193 km for a total cost of USD 668 million. Note that most of the BRT investments (80%) are scheduled for 2022.

	BRT (as per STMP)	Length	CAPEX			Total
	Project	km	USD m			USD m
			2017	2022	2032	
1	(TBS) Mile 12 - Ikorodu (extension of 12km)	12	36.0			36.0
2	Blue BRT TBS - Okokomaiko - Ijaniki	29	86.7			86.7
3	Blue BRT (extension to Badagri)	37	93.2			93.2
4	Berger – TBS	27			81.2	81.2
5	Oworonshoki to Apapa	27		82.5		82.5
6	Berger to Iyana Isolo through Ikotun	28		142.4		142.4
7	Berger to Local Airport	10			51.1	51.1
8	Maryland - Otta	22		95.2		95.2
1	Total	192	215.9	320.1	132.3	668.2

Table 30. BRT projects

The next group of projects corresponds to 298 km of LRT lines with a cost of USD 9.0 billion, as presented below. Note that in this case the investment is expected to be completed between 2022 and 2032 and only 22% occurs in 2017.

	LRT (STMP)	Length	CAPEX			Total
	Project	km	USD m			USD m
			2017	2022	2032	
1	Red line (Marina - Agbado)	29	898.5			898.5
2	Blue line (TBS - Okokomaiko)	29	1,100.0			1,100.0
3	Green line (Marina to Ajah)	22		686.9		686.9
4	Yellow line (Otta/MMA to Iddo)	34			1,107.4	1,107.4
5	Brown line (Mile 12 to Marina)	19		582.7		582.7
6	Red line (extension)	23			639.1	639.1
7	Green line (Lekki Airport and FTZ)	62			1,796.8	1,796.8
8	Purple Line	48		1,330.8		1,330.8
9	Purple Line (extension to Shagamu)	32		877.0		877.0
2	Total	298	1,998.5	3,477.4	3,543.3	9,019.2

Table 31. LRT projects

There is only one proposed monorail project, the Victoria Island Monorail, with an initial cost of USD 1.6 billion. There are five cable car projects, spanning a total of 43 km and with a cost of USD 1,083.5 million, to be completed in 2017 and 2022.

	Cablecar	Length	CAPEX			Total
	Project	km	USD m			USD m
			2017	2022	2032	
1	Adeniji Adele - Ozumba	5	124.0			124.0
2	Adeniji Adele - Ijora	4	93.7			93.7
3	Adeniji Adele - Apapa	3		86.1		86.1
4	Apapa - Ipaja	19		470.8		470.8
5	Ipaja - Alimosho	12		308.8		308.8
5	Total	43	217.7	865.8	0.0	1,083.5

Table 32. Cablecar projects

Waterway projects include the upgrade and construction of water terminals of different sizes and the acquisition of ferry boats of 120 passengers each as suggested by LASWA and LAMATA.

The investment in terminals depends on whether the proposed locations justify the construction of new infrastructure instead of the rehabilitation of the existing facilities. Investment is minor when compared to the other mass transit systems. Terminals require an initial investment of USD 20 million, 90% of these terminals should be completed by 2017 and the 10% remaining by 2022.

Completion of the public transport network requires the development of 14 interchanges with an initial investment of USD 25 million. These facilities will improve speed and convenience of change between services and modes. The table below shows the list of interchanges together with the estimated cost.

Overall, the STMP calls for more than 1,632 km of projects for both private and public transport. This requires over USD 19.9 billion of initial investment, with about 20% incurred in 2017, 48.1% by 2022 and the remaining 31.9% by 2032, as summarized below:

	Main investment projects	Length	CAPEX			Total
	Investment type	km	USD m			USD m
			2017	2022	2032	
1	BRT	192	215.9	320.1	132.3	668.2
2	LRT	298	1,998.5	3,477.4	3,543.3	9,019.2
3	Monorail	24	0.0	1,651.2	0.0	1,651.2
4	Cablecar	43	217.7	865.8	0.0	1,083.5
5	Waterway	-	106.0	154.6	343.5	604.1
6	Passenger transfer stations	-	0.0	19.0	6.0	25.0
7	Corridors, transit use	363	0.0	1,141.1	362.3	1,503.4
8	*Corridors, private use*	*711*	*1,443.6*	*1,956.0*	*1,958.0*	*5,357.6*
	Grand total	**1,632**	**3,981.6**	**9,585.2**	**6,345.4**	**19,912.3**
			20.0%	48.1%	31.9%	100.0%

Table 33. Summary of initial investment in transport projects, STMP

8.3.2.2 Fleet

The initial investment covers not only construction. Fleet acquisition is an important cost to be considered as part of the initial investment. New fleet requirements have been calculated for both scenarios, DM and STMP, and phased over time. The table below provides details in this regard.

Calculations have taken into consideration the passenger demand for each relevant time scenario, operation of all involved routes at reasonable headways, route length, operating speed and vehicle capacity. In the DM scenario the prevailing modes of PT are the current ones, where low capacity vehicles and standard buses are the norm.

In contrast, the STMP develops mass transit solutions that require a smaller fleet of higher capacity vehicles although more expensive per unit. Overall, the total investment in fleet for the STMP scenario (USD 4,226 m) is about ten times the value of purchases by the public sector when compared to the DM scenario (USD 412 m) during the 15-year plan.

Fleet for public transport		Do Minimum			STMP		
Mode	**Vehicle**	**2017 (qty)**	**2022 (qty)**	**2032 (qty)**	**2017 (qty)**	**2022 (qty)**	**2032 (qty)**
Minibus/Danfo	Minibus (15 pax)	131,873	189,158	402,550	54,167	45,438	31,657
Bus	Articulated (100 pax)	6,050	7,860	8,555	2,313	2,287	1,784
	Standard (55 pax)	4,702	6,269	9,382	2,135	1,894	1,214
BRT Light	Biarticulated (270 pax)	62	74	100	42	41	0
Railway train	Train (1,000 pax)	8	8	9	7	6	5
	Train (600 pax)	12	12	9	9	9	6
BRT	Articulated (100 pax)	2	2	0	0	0	0
	Biarticulated (270 pax)	32	40	69	90	382	1,005
LRT train	(750 pax/train)	10	12	14	93	217	542
Monorail train	(350 pax/train)	0	0	0	0	12	15
Cablecar cabin	(10 pax/cab)	0	0	0	106	841	912
Ferry	Ferry (120 pax)	138	157	177	176	305	687
Total	m USD	115	135	162	433	1,128	2,665

Table 34. Fleet investment requirements

The above table shows the large amount of conventional vehicles (figures in *italics* in the centered square) that will be replaced by large, purpose-efficient transit vehicles (figures in **bold** in the lower right square).

8.3.3 Benefits

The reason for paying for all the above listed costs is to develop a transport system for the region of Lagos that is (i) faster than the current conditions, (ii) economically efficient, (iii) safe for the people, (iv) with a smaller footprint on the environment and (v) convenient for the users.

These same objectives are the ones used for assessing the benefits of each scenario. Not all benefits will be realised in a given scenario. For this reason each one has to be measured and valued to give the planner an idea of the final balance between costs and benefits.

8.3.3.1 Journey Time Savings

The first expected benefit from the implementation of the STMP is the reduction of travel time for both private car passengers and public transport riders. The TDM informs about the total time required by all passengers to reach their destination, for each of the scenarios.

A conservative reference for value of time expressed in NGN/hour (or USD/h) for the population of the city is obtained through information from the 2011 household income survey. The value chosen is 12,500 NGN/month for 176 h/month of work, equivalent to 0.43 USD/h. An annual 3% growth of the economy accounts for a rise to 245 NGN/h by 2032 (1.49 USD/h). This reference figure is consistent with LAMATA's reference value regarding the monetary value of time used in other modeling studies.

Scenario / Mode	units	2017	2022	2032
DM	Travel time (min-16hr)			
Travel time, Private transport		175,118,478	363,406,837	3,208,554,905
Travel time, Public transport		2,376,633,751	3,255,425,938	6,066,880,536
STMP	Travel time (min-16hr)			
Travel time, Private transport		156,053,927	274,551,252	533,642,682
Travel time, Public transport		1,148,649,044	1,180,191,077	1,252,904,769
Savings (DM-STMP)	Travel time (min-16hr)			
Travel time, Private transport		19,064,551	88,855,584	2,674,912,222
Travel time, Public transport		1,227,984,707	2,075,234,860	4,813,975,767
Value of an hour	USD/h	0.53	0.61	0.82
Time savings value on private modes	m USD/year	52	283	11,448
Time savings value on public modes	m USD/year	3,373	6,609	20,603

Table 35. Journey Time Savings

The comparison of journey time per mode and scenario shows the enormous benefits to be expected by saving time with private vehicles as well as public transport. The table above shows that by 2017 savings in private transport are in the order of USD 52.0 million. This increases rapidly in 2032 to over USD 11.4 billion. In the case of public transport, time savings are greater and more stable between 2017 and 2032, going from USD 3.3 billion per year in 2017 to USD 20.6 billion in 2032.

8.3.3.2 Reduction in Vehicle Operating Costs (VOC)

Similar to the case of journey time savings, the TDM shows the fleet run by each mode in each of the 3 time horizons. Economic valuation makes use of the operating cost of each type of vehicle.

VOC are classified according to costs related to fuel consumption and costs related to the wear and tear of the vehicle. Formulae for calculating both types of fuel are based on the vehicle speeds which

are provided by the TDM. Each type of vehicle has a different formula to assess the VOC because even if all vehicles ride at the same speed their operating costs do vary.

The parameters for the formulae linking vehicle speeds to fuel consumption per type of vehicle are based on standards applied by the Ministry for Transport in the United Kingdom after many years of studies and data collection on the matter.

The costs associated with the wear and tear of the vehicles also consider the ownership cost per kilometer and per hour of an average vehicle. The cost values associated with fuel consumption mentioned above are added to costs from vehicle ownership, arriving at an overall cost of operation for each referenced vehicle.

In the case of the other modes, LRT, monorail, cable car and inland waterway ferries, the reference values for VOC are taken from the table Unit Rates as presented in the section on Inputs.

Based on these VOC factors and the veh-km per type of vehicle, VOCs are calculated and presented in the table below. This table shows that there are significant savings from reduced vehicle operation in public modes, because the STMP scenario replaces the veh-km of small, conventional buses with large, high capacity vehicles. So, fewer vehicles with more efficient operating cost per kilometer turns into significant savings over time.

In the case of private transport, the situation is similar. Less private vehicles are expected to use the roads every year in the STMP scenario than in the DoMinimum scenario. This is partly the consequence of transferring passengers from road-based transit modes (danfos, buses) to non-road-based transit modes (LRT, ferries, cable car). The result is that road congestion is reduced and circulation speed increases, making the private mode (including commercial and freight vehicles) an efficient option. This situation benefits the economy (and thus the whole population) as goods and services are delivered more efficiently throughout the city, which is, by the way, the real benefit society derives from an improved road network.

Fleet operating annual costs will increase proportionally over the years, and become more pronounced in the STMP scenario, actually resulting in additional operating costs instead of benefits. The table below compares VOCs for the two scenarios.

Scenario / Mode	units	2017	2022	2032
Do Minimum	**km/day**			
Fleet run, Private transport		51,799,311	78,288,035	151,031,585
Fleet run, Public transport		14,340,665	17,439,868	27,454,805
STMP	**km/day**			
Fleet run, Private transport		51,317,480	77,561,260	140,587,382
Fleet run, Public transport		11,527,075	10,236,060	7,975,761
Savings	**km/day**			
Fleet run, Private transport		481,832	726,775	10,444,204
Fleet run, Public transport		2,813,590	7,203,808	19,479,044
Fleet run, Private transport	**m USD/year**	**(1,455,484)**	**(4,602,975)**	**(17,033,017)**
Fleet run, Public transport	**m USD/year**	**175,302**	**469,776**	**3,085,677**

Table 36. Scenario comparison of VOC per mode of transport

8.3.3.3 Safety improvement

The estimation of potential improvements in road safety is based on road accident statistics in Lagos State. A master plan like the STMP is a great opportunity for designing roads that make use of modern techniques in the field of safety. For this purpose, data on road accidents between 1989-2008 have been analyzed and figures on road fatalities and injuries for 2012 were projected. The available information on road accidents shows a general trend of a decreasing number of accidents after 2004.

Year	Casualties	Deaths	Injuries
1989	**2,584**	676	1,908
1990	**2,581**	770	1,811
1991	**2,564**	750	1,814
1992	**2,894**	933	1,961
1993	**2,883**	899	1,984
1994	**2,684**	720	1,964
1995	**2,549**	641	1,908
1996	**2,287**	575	1,712
1997	**2,434**	559	1,875
1998	**2,581**	574	2,007
1999	**2,622**	611	2,011
2000	**2,408**	626	1,762
2001	**3,069**	772	2,297
2002	**3,133**	776	2,357
2003	**3,058**	882	2,176
2004	**4,024**	1,028	2,996
2005	**4,268**	898	3,370
2006	**3,295**	782	2,913
2007	**3,325**	914	2,411
2008	**2,385**	650	1,881
Average		752	2,156

Table 37. Historic evolution of road accidents in Lagos State

Projections for the year 2012 are compared with the estimated number of veh-km covered by private transport vehicles in 2012 by the TDM Model. This value is equivalent to 6.44 million km for the year. Using that reference, a factor for each type of casualty is determined on a per veh-km basis.

Using the available statistical information for private modes and comparing it to the veh-km covered by motorists in Lagos State, it is possible to determine specific incident ratios for each type of cases, as shown further below.

These types of ratios are useful for projecting accidents in future years. Incident ratios indicate that 1 fatality occurs every 8.5 million veh-km, and 1 injury occurs every 2.9 million veh-km.

The STMP highlights the development of a large number of new roads. Assuming that these new roads will be designed based on modern standards on safety, it is expected that the safety record per veh-km should result in 30% improvement over previous conditions. As a reference, the Ministry for Transport in the United Kingdom qualifies the reduction in the accident incidence as 'slight' if they are below 30%.

Another means to evaluate the benefits of a reduction of accidents is the valuation of each accident. The valuation of a death and an injury is complex and debatable. For the sake of simplicity, and where there are no detailed studies, there is a consensus around localized valuations based on the Gross Domestic Product (GDP) for the country. The World Bank database informs us that the annual GDP per capita adjusted by Parity Purchasing Power (PPP) in Nigeria is equivalent to USD 2,666 as at 2012.

For working purposes, the following international factors can be used as a reference on the matter: a death is equivalent to 7.9 years of the GDP per capita, and an injury is valued at 10 work months.

Accident type	International std	USD	NGN
Fatality	7.9 years	21,059	**3,474,711**
Injury	10 work months	2,221	**366,531**

Table 38. Unit rates for accidents in Nigeria, based on GDP (PPP) per capita

Based on the statistics and international standards for valuing accidents, it is expected that for the 2017 horizon the savings due to improvement in road safety will reach USD 46.5 million, a figure that could be 30% higher if it were not for improvements in road design to be applied in the new roads, despite the increase of vehicles on the road due to higher car ownership resulting from better per capita GDP.

With this information, the projected benefits in safety are estimated for the analyzed period, as presented in the table below.

Accident type		2017	2022	2032	2052
Veh-Km Cars/Trucks	veh-km/day	144,549	218,033	3,133,261	3,133,261
Fatality	000 USD/year	111	167	2,402	2,402
Injury	000 USD/year	46,470	70,093	1,007,277	1,007,277
Total	000 USD/year	46,580	70,260	1,009,679	1,009,679
	Improvement in incident rate:	**30%**			

Table 39. Safety benefits

8.3.3.4 Reduction of air pollutants

The fourth indicator to evaluate the expected benefits from the implementation of the extended STMP is the level of emission of pollutant gases from transport activities. The extension to the STMP aims to notably reduce greenhouse gases (GHG) emissions by 2032.

The environmental impact will be focused on measuring the generation of greenhouse gases (GHG). The methodology applied for this assignment in Lagos takes input from two studies commissioned by LAMATA. The first one is the *Assessment of Emissions from Road Transport* (AERT) in 2009 on the occasion of inaugurating the BRT line. This report includes the measurement of pollutants generated by local vehicles, measurements of air pollutants across Lagos and proposals on a series of recommendations to address these issues.

The second study has developed values for both types of fuel and suggests localized references for CO2eq in the city of Lagos. This study was conducted in 2013 and is titled *Data Gathering to Implement GHG Emissions Reduction Assessment Methodology for LUTP II BRT Corridors* (GERB). It supplements GHG estimations for this CBA.

In particular, the AERT recommendations can serve as the basis to define an environmental policy geared towards mitigating environmental impact during the STMP implementation period and establishing monitoring parameters to track progress. Most measures tested do not require expensive investments for their application when compared to other transport interventions included in the STMP. AERT recommendations follow these guidelines:

- Transport planning and demand management, to implement:
  - Substitution of 20% of cars/SUVs (*Sport Utility Vehicles*) with enhanced buses services like BRT
  - One-way streets
  - Establishment of certification centers for vehicles on emissions
  - Encouragement of Non-Motorized Transportation (NMT)
- Promotion of NMT facilities, which could produce a 10% reduction in motorized trips

- Switching buses to operate with CNG (can reduce the Emission Factors (EF) for CO2 in 28.7%, 30.4% for CO, 0.06% for NOx and HC, and 100.0% for PM10).
- Switching cars and SUVs to CNG
- Limiting the age of second-hand vehicles imported to Nigeria
- Setting emission standards to EURO-IV to limit emissions from vehicles

This is important because the expected growth of the population in the Megacity will probably be linked to a significant growth in the number of vehicles on the roads, despite the significant deployment of mass transit services. This is clearly illustrated in the section on VOC where fleet run evolution for private transport modes is expected to more than double in the next 15 years in the STMP scenario, while the overall transit fleet will decrease by a third.

For private transportation, as fleet run (km/year) is expected to increase, it will be necessary to reduce emissions resulting from each one of the additional veh-km. The AERT proposes a set of measures that are deemed adequate, and if applied following a series of steps, can represent significant improvements in the overall level of GHG emissions associated to the STMP.

The calculation of improvements in GHG emissions in the SMTP follows 7 steps, as presented below.

1. Identification of the Emission Factors (EF) prevailing in Lagos (2008)
2. Calculation of the impact from Policy Measures on Emission Factors by 2020
3. Calculation of the goal values for emission factors for 2032 and 2052
4. Evolution of the EFs over time
5. Consideration of Vehicle-Kilometers:
6. Calculation of emissions of GHG
7. Valuation of GHG emissions

The last step consists of multiplying one relevant annual fleet run by each EF for each scenario. Under the STMP scenario the EF matrix evolves as presented above. Under the DM scenario, the EF remains static as the one defined for 2017 for the whole assessment period.

The resulting valuation of GHG takes into consideration referential prices in USD per MT for each of the 5 GHG components analyzed. GHG emissions pricing resulting from markets transactions is a relatively new matter and its values tend to be extremely volatile. For this reason, the values used are conservative estimates. Price references for NOx, HC and PM are taken from California EPA, Caltrans references are used for CO on market transactions from the 2000's, and references for CO2 are taken from market values for January 2013 as reported by the European Commission

The resulting values account for the CBA for Private Transport projects.

GHG	2017	2022	2032	2052
CO	33,681	2,979,278	7,092,687	9,201,630
NOx	21,086	1,997,237	4,623,905	5,832,518
HC	340,367	9,700,407	43,317,210	81,891,309
PM	0	0	0	0
CO2	211,567	13,576,991	37,413,616	55,006,588
Benefit value (USD/year)	606,701	28,253,913	92,447,419	151,932,045

Table 40. Valuation of GHG emissions from Petrol fuel (USD/year)

GHG	2017	2022	2032	2052
CO	0	0	0	0
NOx	11,642	59,983	129,761	50,776
HC	0	0	0	0
PM	0	0	0	0
CO2	1,531,039	7,820,059	17,773,930	6,955,016
Benefit value (USD/year)	1,542,681	7,880,042	17,903,691	7,005,792

Table 41. Valuation of GHG emissions from Diesel fuel (USD/year)

8.3.3.5 Reduction in transfer time

Development of mass transit at the scale proposed by the STMP requires the restructuring of other transit services, specifically the conventional bus routes. Also, more efficient and convenient infrastructure connecting mass transit with conventional services can be built. Overall, the conscientious design of the new transit system is expected to deliver a reduction in the number of needed intermodal transfers, and thus the time spent. These benefits calculated directly from the TDM are presented in the table below and included in the CBA for Public Transport modes.

Transfer time	2017	2022	2032	2017	2022	2032
Travel time (min-16hr)	150,781,049	180,973,576	227,238,361	142,670,992	174,935,695	206,176,054

Savings		
2017	2022	2032
(8,110,057)	(6,037,881)	(21,062,307)

Table 42. Transfer time savings

8.3.4 Outputs

Once the inputs and the rationale for identifying costs and benefits are explained, the next step is to calculate and analyze the outputs from the CBA model. The analysis separates figures for private transport from those for transit, which are later added together to analyse the overall benefit.

The projection of present value figures is extended 20 years beyond the last scenario year (2032). This provides an allowance to include the benefits of the projects that occur after the investment year, especially for those investments that are expected to occur in 2032.

After estimating all costs and benefits associated with the set of projects for each of the scenarios, a comparison of the future values for costs and benefits provide a better overall assessment of the STMP scenario against the Do Minimum.

CBA for Private Transport modes			0	5	15	35
Year	unit rates		2017	2022	2032	2052
COSTS			**1,443.6**	**1,987.4**	**2,025.9**	**104.5**
1. CAPEX			***1,443.6***	***1,956.0***	***1,958.0***	***0.0***
Corridors			**1,443.6**	**1,956.0**	**1,958.0**	
	Bridge	Roads				
2. MAINTENANCE	**3.0%**	**1.0%**		***31.4***	***67.9***	***104.5***
from Investments of 2017		of CW		**31.4**	**31.4**	**31.4**
from Investments of 2022					**36.5**	**36.5**
from Investments of 2032						**36.5**

Year	unit rates		2017	2022	2032	2052
BENEFITS				**-3,027.3**	**-3,042.2**	**6,234.0**
1. JOURNEY TIME SAVINGS			**52.4**	**278.1**	**11,447.0**	**20,674.6**
2. OPERATING COSTS			**-1,455.5**	**-4,603.0**	**-17,033.0**	**-17,033.0**
3. ACCIDENTS			**46.6**	**70.3**	**1,009.7**	**1,009.7**
4. EMISSIONS			**2.1**	**36.1**	**110.4**	**158.9**
Discounted values						
Costs			1,443.6	1,127.7	370.1	2.0
Benefits			0.0	-2,393.7	-815.9	91.1
B-C			-1,443.6	-6,205.9	-6,491.9	4,705.7
Accumulated B-C			-1,443.6	-9,861.5	-11,860.7	-14,242.6
Net Present Values	12.00%	discount rate				
Costs		3,384.8	USD m			
Benefits		-10,857.8	USD m			
eNPV		**-14,242.6**	**USD m**			
B/C Ratio		**-3.21**				
eIRR		**N/A**				
MIRR		**7%**				

Table 43. CBA results for Private Transport modes

In the case of the Private Transport analysis, the table above shows sustained and increasing positive benefits in journey time savings (from USD 52.4 to 20,6 million), while important negative benefits (in other words, additional costs) describe the balance in vehicle operating costs specially at the end of the assessment period. For private transport, there is no actual reduction in VOC as the growth in population and demand for private vehicles is expected to be larger than the effect of users shifting from private cars to transit.

Regarding accident reduction, the scenario shows increasing benefits resulting from the STMP projects. This is due to the large expansion of the fleet run (vehicle-kilometers) in the STMP scenario. These results also stress the need to improve safety on the roads because of the great benefits it brings to the community. There is potential for benefits but actual implementation of accident reduction measures need to be put in place.

Emissions benefits also grow in a sustained manner both for private cars (mostly petrol-fueled) and public transport vehicles (diesel-fueled) totaling USD 159 million in 2052.

CBA for Public Transport modes			0	5	15	35
Year	**unit rates**		**2017**	**2022**	**2032**	**2052**
COSTS			**2,855.8**	**7,543.7**	**8,187.2**	**265.7**
1. CAPEX			*2,855.8*	*7,481.7*	*8,031.1*	*0.0*
Civil Works + Equipment			2,538.1	6,488.1	5,528.5	
Rolling Stock			317.7	993.6	2,502.5	
2. MAINTENANCE				*62.0*	*156.1*	*265.7*
BENEFITS				**6,941.0**	**23,454.9**	**40,018.4**
1. JOURNEY TIME SAVINGS			3,351.0	6,589.5	20,512.7	37,048.3
2. OPERATING COSTS			175.3	469.8	3,085.7	3,085.7
3. TRANSFER TIME			22.3	25.8	34.7	62.7
Discounted values						
Costs			2,855.8	4,280.5	1,495.8	5.0
Benefits			0.0	4,020.3	4,317.7	761.3
B-C			-2,855.8	-907.7	3,027.3	756.3
Accumulated B-C			-2,855.8	10,977.3	54,077.1	92,843.3
Net Present Values, PT	12.00%	discount rate				
Costs		10,148.9	USD m			
Benefits		102,992.2	USD m			
eNPV		**92,843.3**	**USD m**			
B/C Ratio		**10.15**				
eIRR		**124%**				
MIRR		**19%**				

Net Present Values, PV	12.00%	discount rate	
Costs		3,384.8	USD m
Benefits		-10,857.8	USD m
eNPV		**-14,242.6**	**USD m**
B/C Ratio		**-3.21**	
eIRR		N/A	
MIRR		**7%**	

Overall NPV	12.00%	discount rate	
Costs		13,533.7	USD m
Benefits		92,134.4	USD m
eNPV		**78,600.7**	**USD m**
B/C Ratio		**6.81**	
eIRR		**48%**	
MIRR		**16%**	

Table 44. CBA results for Public Transport modes, and overall figures

Overall, a B/C ratio of almost 7 times the benefits when compared to the costs is very strong, and it is associated to a NPV of USD 78 billion over 35 years of analysis. In brief, for each Naira invested in transportation, an equivalence of almost 7 Naira will be received as benefits. These benefits include faster services, better facilities, modern transport means, and better connections and faster transfers.

9 Institutional Reform Proposal

9.1 Basic elements of the institutional scheme for the Megacity

The purpose of this chapter is to set a basic proposal for an institutional scheme for the Megacity's transport system. This proposal is based on the main conclusions drawn during the project's communication plan, including interviews with relevant authorities in this domain.[4]

This proposal aims to combine Nigeria's governance system with the existing institutional models of reference cities throughout the world. The figure of the Transport Authority has represented a key-element in this regard, given the need for an efficient coordination of the Megacity's mobility dynamics through a multimodal approach.

The proposal has therefore been constructed on the basis of three main pillars:

- The Lagos Transport Authority (understood as a "pivotal" element of the institutional scheme);
- The ensemble of entities directly involved with the different public transport infrastructure and services (named as the "basic level" of the institutional scheme);
- Interaction with governments for plans and policies approval, as well as the establishment of funding formulae ("High Level").

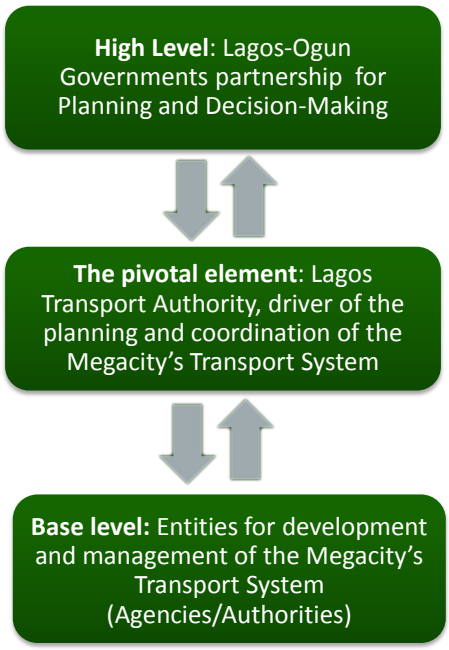


Figure 68. Basic elements of the institutional scheme for the Megacity

[4] Particularly relevant were the interviews with Prof. Akin L. Mabogunje and Dr. Oni Okanlawon

Regarding the definition of the **Transport Authority**, it is important to note that, although the institutional models of other world-leading cities have been considered (such as *Transport for London*), the current State boundaries separating the Megacity's urban sprawl necessarily lead to a cooperative structure between Lagos and Ogun governments for planning and decision-making.

According to this concept, the Lagos Metropolitan Transport Authority (LAMATA) would be strengthened as the driver of the Megacity's planning and coordination, but always in partnership with the Ogun State's government transport agency when dealing with projects crossing both states.

Regarding the "**Base Level**" of analysis, all the current agencies in charge of the different transport modes (LASWA, LASTMA, etc.) would prevail. This represents a clear difference when compared with other world cities where the Transport Authority exercises direct management and monitoring of the different transport operators, but is also far more realistic and adapted to the Nigerian reality.

There is currently a strong level of competence overlap and lack of coordination between the existing authorities and agencies, including the different levels of government (local, state, and federal). This situation presents an obstacle for the implementation of a unitary urban and transport policy throughout the Megacity. A clear distinction of roles and competences will be key to solving this problem.

Finally, at the **High Level**, the mechanism for transport policy and planning approval (as well as funding) will be addressed. As referred to above, a State Government partnership has been proposed, excluding the Federal Government from the final scheme. It must be said that this issue presented a point of disagreement between the different stakeholders consulted. On one hand, the Federal Government represents an additional source of funding and a sovereign guarantee for foreign investors, particularly regarding inter-state projects. However, it would also represent an additional source of commitments and obligations for the State Governments which should be carefully considered.

It is important to note that one of the main conclusions in this institutional analysis is the need to find new creative sources of funding for the Megacity's transport system, particularly when considering inter-state projects.

9.2 The pivotal element: The Transport Authority

9.2.1 Why a Transport Authority?

The planning and execution of a multi-modal transport network in a Metropolitan Area (even more so in a Megacity like Lagos) involves a number of operators, users, government institutions and agencies, as well as the necessary investment in order to respond to the growing complexity of its mobility system.

In order to respond to this challenge, a unitary vision (and policy) for the transport system, as well as well-coordinated planning, execution and monitoring is deemed essential. This can only be achieved through the cooperation of the Megacity's governments (Lagos and Ogun) and their transport agencies.

The key-driver of such a mechanism must be a Transport Authority.

Transport Authorities represent nowadays a well-proven formula for the development and governance of metropolitan transportation systems. Many examples can be found throughout the world in this regard. At the European level, the success of this kind of institution has led 29 transport authorities (responsible for improving the mobility conditions of some 70 million European city dwellers) to come together and share their knowledge and experiences in the framework of the EMTA (European Metropolitan Transport Authorities). A few examples of these transport authorities would be: Barcelona (ATM), London (Transport for London), Madrid (Regional Transport Consortium), Paris-Ile-de-France (Ile-de-France Transport Syndicate), Brussels (Brussels Mobility), Amsterdam (Stadsregio Amsterdam), Berlin (VBB Verkehrsverbund Berlin-Brandenburg), Vienna (Public Transport Authority Eastern Region - VOR), Warsaw (Public Transport Authority of Warsaw –ZTM).

The key for the success of these transport authorities relies on their coordinated response to the new challenges associated to the mobility dynamics of metropolitan areas. The European Commission's Green Paper on urban mobility represents the main policy guideline in this regard. Its publication has been followed by a number of multi-modal mobility strategic documents and master plans developed by the different transport authorities.

The said transport authorities have coordinated the implementation of these planning documents, including key-projects (particularly concerning Mass Rapid Transit systems and the establishment of integrated fares) that could not have been envisaged otherwise. Besides, the transport authorities play a fundamental role for the study and implementation of innovative solutions to increase NMT, the use of ITS and the improvement of operation and services data collection (as well as their publication).

In the African continent, Lagos Metropolitan Transport Authority (LAMATA) represents a reference in this regard. LAMATA was founded in 2002 as a result of the enactment of the LAMATA Law by the Lagos State Government. It was defined as a semi-autonomous agency of the Lagos State Government (LASG) with jurisdiction over the conurbation in Lagos State and a series of primary and secondary roads with important traffic loads. It was empowered to plan and coordinate plans for public transport, and make recommendations on route planning. It was provided with various transport management professionals.

In 2007 the LAMATA Law was revised, assigning additional responsibilities to this agency. LAMATA was thus empowered to plan, regulate and co-ordinate the supply of public transport through all travel modes and supporting infrastructure within metropolitan Lagos. In addition, LAMATA was

empowered to construct, rehabilitate, maintain and manage transport infrastructure and facilities in conjunction with the Ministry of Works and Infrastructure of Lagos State within the declared roads network.

It is important to note that in 2008 Lagos State Government created the Lagos State Waterways Authority (LASWA), to carry out policy reforms and investments to promote water transport as a form of public transportation in Lagos. However LAMATA, with its consolidated technical and human resources, has remained as the main planner for the whole transportation system including waterways.

LAMATA has developed a task of considerable value. Several successes can be attributed to this agency, to name a few examples: The Preparation of the 2009 Strategic Transport Master Plan (including a BRT and LRT network system), implementation of the first BRT line in the city and promotion of the LRT Blue and Red lines.

LAMATA's successes are a clear indication of the need for a driver of transport infrastructure and services planning and implementation within the Megacity. However, the development of LAMATA's competences could be much smoother if the current institutional framework (which is not well articulated and coordinated) is improved.

Besides, the STMP extension proposal introduces new challenges for the governance of a transportation system, for it involves an area that extends beyond the Lagos State administrative boundaries.

These current limitations and future challenges are explained in the following sub-chapters.

9.2.2 The STMP extension: New needs and challenges in the institutional domain

As stated earlier in this report, Lagos, internationally appraised as a Megacity with great influence in the African continent, urgently needs a unitary and comprehensive land use and transportation planning document that responds to its current mobility dynamics.

The answer to this need is the Extension of the Strategic Transport Master Plan (STMP), which establishes (as it has been described in the preceding chapters of this report) a multi-modal system which considers all the components of mobility:

- **Bus, Rail and Inland Waterway Projects** integrating a balanced public transport supply that really responds to the complexities of metropolitan mobility dynamics.

- Full accessibility of the Megacity's population to the multimodal transportation system, with special focus on **Non-Motorized Transportation and Road Safety**.

- An appropriate system of corridors and distribution centres allowing for a real **freight transportation system** that avoids the current friction with passenger vehicles along Lagos' main corridors.

- Appropriate infrastructure support for all the passenger and freight mobility proposals, with the establishment of an improved **road network in terms of hierarchy, capacity and connectivity.**

All these elements of the proposal require a perfectly articulated and coordinated institutional framework, with a competent Transport Authority with full competences for planning, coordination and monitoring of the transport system (considering infrastructure, services, fares, funding) within Lagos State, in full partnership with Ogun State's transport agencies.

As commented in the previous section, the institutional body to be taken as a reference in this regard is LAMATA. The following table summarizes LAMATA's competences according to the Lagos Metropolitan Area Transport Authority Law (2007), showing their current limitations, considering both the current institutional framework (which represents an obstacle to the full exercise of LAMATA's legal competences within Lagos State) and the new challenges coming with the STMP Extension.

Current limitations of some of LAMATA's competences	
Selection of current competences	**Limitations**
• Co-ordinate and implement the transport policies, programmes and actions of all transport-related agencies in Lagos State	• Overlaps and lack of articulation of the current institutional framework makes it difficult for Lamata to fully exercise its competences
• Ensure the physical serviceability of the roads of Lamata's competence	• Many roads are not the responsibility of Lamata, but of either the LGAs (however, with little resources) or the Federal Government (not ensuring the required level of maintenance).
• Control parking on the roads of Lamata's competence • Regulate generally both on-street and off-street parking of vehicles on declared roads and impose fees and penalties (…)	• Roads which are not the responsibility of Lamata are out of any possible parking policy to be established by Lamata. As a result, there is no appropriate framework for the establishment of an effective parking plan for the whole Megacity
• Plan, regulate and co-ordinate the supply of adequate and effective public transport and supporting infrastructure within metropolitan Lagos	• Restricted to public transport; does not include other key-components of the Megacity's mobility such as freight • Non-motorised transportation is not included, whereas it represents a key-factor for the success of a public transport system
• Conduct research for the purposes of carrying out the functions of the Authority	• In spite of having produced good-quality documents, neither the State government nor the Federal Government have adopted them as technical reference
• Make transport policy recommendations to the Governor including mechanisms for their implementation	• No limitations identified in this domain
• Carry out functions conferred by the Motor Vehicle Administration Agency Law	• The articulation of competences between Lamata and the Motor Vehicle Administration is deficitary
• Prepare plans for the management and development of transportation in metropolitan Lagos	• The term "transportation" is rather vague although it could include not only of public and private transportation but also of freight, NMT and traffic management in general.
• Construct, re-construct, maintain and manage transport infrastructure and facilities (…) necessary for the discharge of the functions of the Authority under the current Law in conjunction with the Ministry of Works	• The current lack of coordination with the competences of the Ministry of Works makes it difficult for Lamata to exercise this function
• Subject to the constitution of the Federal Republic of Nigeria, regulate rail and other modes of transportation within the State	• The current lack of coordination with the competences of Nigerian Railway Corporation makes it difficult for Lamata to exercise the function of rail regulator (and planner and coordinator)
• Levy user charges in the connection with the provision of its services and in collaboration with Motor Vehicle Administration Agency collect same or any other tariff, fees, including road taxes as may be authorised by the Governor	• The current lack of coordination with the competences of the Motor Vehicle Administration Agency makes it difficult for Lamata to exercise this function

Table 45 – The needs of a Megacity: Current limitations regarding LAMATA's competences

Source: Lagos State of Nigeria Official Gazette, No. 28, Vol. 40 (16th April 2007) – a Law to Re-Establish the Lagos Metropolitan Area Transport Authority

The solution to the aforementioned limitations has to be based on the following criteria:

- Strengthening LAMATA's position to become a **Transport Authority** with full powers within Lagos State. This will require the extension of its planning and coordination competences to all the transportation modes.
- Establishing a **solid institutional basis**. This will allow the full exercise of LAMATA's functions. The current system of government levels and agencies, with a number of competence overlaps and lack of articulation and coordination, will require specific analysis and proposals.

  These two domains of action will be analyzed in the upcoming sections.

9.2.3 Strengthening of LAMATA as a Transport Authority

The performance of the Lagos State Transport Authority functions demands the assembly of a large and multidisciplinary professional pool. Some of them will be brought from other governmental agencies whilst others may come from the private sector, whether as permanent staff or temporarily as consultants (national or international). This will facilitate the in-house development and nourishment of technical groups to govern over the important challenges of transport in Lagos.

The **Board** would be at the top of the organizational structure of the Transport Authority. This body will be in charge of resolving political and institutional issues. Its members will be high ranking government officials and the different agencies responsible for each transportation mode. This board will fundamentally consider political views and their unification in a plan forward. A representative example of this could be found in Barcelona's Metropolitan Transport Authority. Its board of directors consists of eighteen members:

- Nine members representing the regional government of Catalonia.
- Seven members representing the local authorities of the metropolitan area (Barcelona and the other municipalities integrating the metropolitan area).
- Two members representing the AMTU (association of outer metropolitan area cities with their own urban transport systems)Two additional observers, representing the Spanish State Government.

The Lagos State Transport Authority will have a very comprehensive list of **functions** to perform, which are detailed below:

Coordinating and monitoring the multimodal public transport system

- Monitoring of the public transport system as a whole
- Detecting and identifying general deficiencies, needs or opportunities in the overall system (such as unresolved demands), and studying possible solutions
- Activating the functions of other authorities (when undertaking the previous points); addressing information to the responsible administration.

Planning of infrastructure and services

- Planning the public transport infrastructures and programming their implementation on a fixed timescale for all transportation modes.
- Preparing the investment program and negotiating with responsible funding administrations.
- Following up the implementation of investments, ensuring the compliance of the planning.
- Preparing the planning instruments to ensure coordination with the different agencies in charge of the various transport modes (LASWA, LASTMA, etc.).
- Planning the services and establishing coordinated exploitation programs with all the agencies interacting with the service supply companies. Defining the operational aspects of all these services (routes, frequencies, etc.).
- Under this framework, the Transport Authority should play a planning and coordination role, monitoring the project implementation and service operations of the respective agencies and operators.

Monitoring of transport operators

- The Lagos State Transport Authority will delegate to the corresponding modal agencies the relationship management with the public and private transport operators. However it will monitor the transport system's efficiency, more particularly:
  - Preparing the selection framework and contract principles to be used by the agencies to contract the private companies (operators).
  - Following up on the development and compliance of the contracts (through the modal agencies).

Coordination of the funding of the system

- Preparation of proposals for financing agreements with responsible agencies to run public transport services.

- Settling the financial agreements with the public authorities so as to cover the deficit on the services and the costs associated to the management structure.
- Preparation of proposals for financial agreements with the different system operators, linked with service level agreements.
- Checking the income, costs and investments of the supplier companies for purposes related to the above points.

Fare policy

- Preparation and approval of a pattern of common fares in the framework of a financing policy. Such a policy will establish to which degree costs will be covered with fare revenues, as well as the possible definition of an integrated fare system.
- Assignment of the different percentages of fare revenues to the different operators.

Communication

- Definition and promotion of the corporate image of the Public Transport System and the Lagos Metropolitan Transport Authority.
- Carrying out communication campaigns in order to promote the use of the public transport system among population.
- Advertising, information and relations with users.

Other functions related with mobility

- Development of studies for the evaluation of general mobility.
- Studying, proposing, applying and financing measures regarding the rational use of roads and public spaces, without prejudice to local and district competences.
- Promotion of sustainable mobility

Regarding the structure and personnel of the Transport Authority, Figure 69 shows the consultant's proposal for its organizational scheme.

LAMATA's current organizational scheme, which has represented the starting point for the design of the new scheme, consists of five core departments (Finance, Corporate Planning, Public Transport, Roads & Traffic Management, Business Systems & General Services) and six supporting units (External Relations, Legal, Internal Audit, Transport Planning, Procurement, Environmental & Social Safeguards).

This structure should be transformed in order to consolidate LAMATA as a Transport Authority for Lagos State, through the establishment of strong departments focusing on the planning, financing, management, and regulation of the transportation system, with a clear separation between

infrastructure and operations as well as between the different transportation modes, always under a unitary and integrated vision of the Megacity's mobility.

This conception requires important changes in the current organizational structure, starting with the establishment of four main departments with their respective sub-departments and units, shown in Figure 69. Some of the current supporting units would disappear, their activities being included in the said four departments.

It is important to highlight the key-features of the new scheme:

- The **Financial Department** will focus not only on the financing formulae for the new projects and the clearinghouse process, but also on the fare system and fare integration. This is a key-issue for any metropolitan transportation system and therefore will require a specific unit for its analysis, planning and, eventually, its implementation.

- The **Transport Management and Monitoring Department** would be in charge of the overall transport network, with different units for bus and inland waterways, rail and private traffic. The control centre will represent a pivotal element of each unit, providing fundamental information to operators, passengers and the transport authority itself.

  It is important to note that a performance/audit unit will be assigned for each mode, substituting the internal audit support unit of the current organizational scheme. Likewise, the monitoring units will include amongst its activities those corresponding to the current Environmental and Social Safeguards supporting unit, which would be suppressed.

- **Regulation and Licensing** would represent a department on its own, also with different sub-departments corresponding to the different transport modes. It will include the activities of regulation and licensing for the different public transport modes, including freight transportation.

- Three different Departments will focus on **Planning, Road Maintenance&Rehabilitation and Major infrastructure Projects**, each one with the required dotation of employees and technical support, as it corresponds to a transport authority with key-tasks to undertake at all these levels

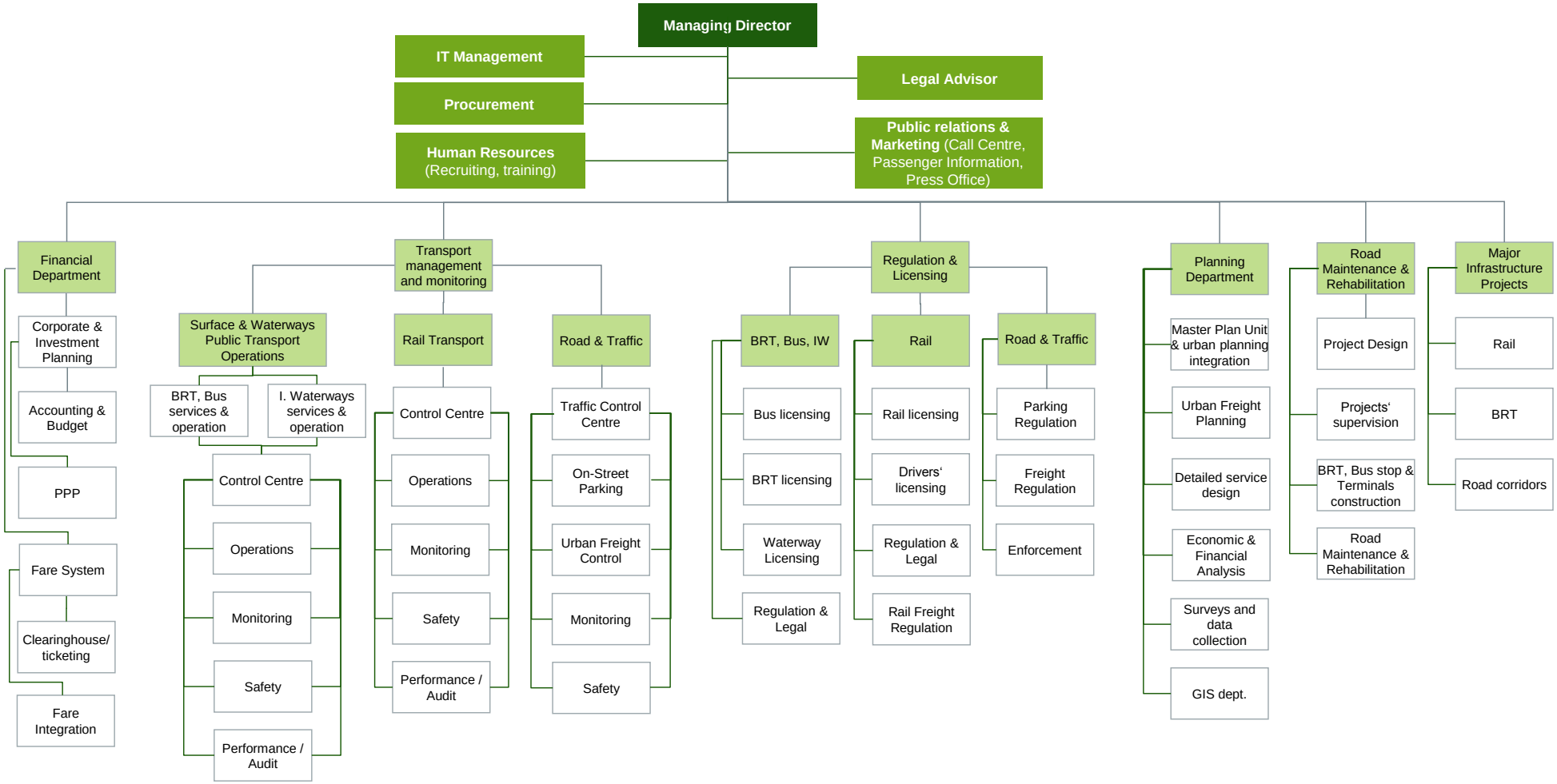


Figure 69. Proposed Organizational Chart for Lagos Metropolitan Transport Authority (LAMATA)

9.3 Establishment of a solid institutional framework at the Base Level

The Lagos State Government has taken a very important step in empowering LAMATA with the planning, regulation and co-ordination of public transport supply within metropolitan Lagos. This initiative represents a very important basis for the eventual establishment of a unitary transport policy within the Megacity.

However, there are further steps to be taken in the institutional domain in order to carry on in this direction. Two main areas can be identified and analyzed in this regard: the public transport domain (specific infrastructure and services) and the road network domain (which represents the complete infrastructure support, the backbone for the public transport services).

The establishment of a solid backbone for the Megacity's transport system, as well as the correct coordination of all transport services, must be based on the following principles:

- Consolidate LAMATA as a Transport Authority entrusted with responsibilities to define and propose actions at all transport levels (including road infrastructure) within the geographical scope of Lagos State. It is important to note that the planning and implementation of those projects crossing both the States of Lagos and Ogun will be agreed between the Lagos and Ogun State Governments and transport agencies, through LAMATA's liaise. This is an aspect belonging to the "High Level" analysis that will be explained in the following section in more detail.
- Clear division of competences, with the suppression of any existing overlaps amongst the different government levels, agencies and authorities. For example, traffic management issues within Lagos should be managed by the transport authority exclusively; road maintenance should be managed by each corresponding government arm (for example federal roads should be maintained by the Federal Government). However the transport authority will resolve any conflicts.
- The current lack of local government resources seriously compromises the maintenance and management of an important part of the Megacity's road network. Urgent action is needed, either through a transfer of responsibilities from local governments to the State Governments or by decisively strengthening local governments with the support and coordination of Lagos and Ogun States.

The above principles need to be applied in the framework of a general scheme of competences as shown below:

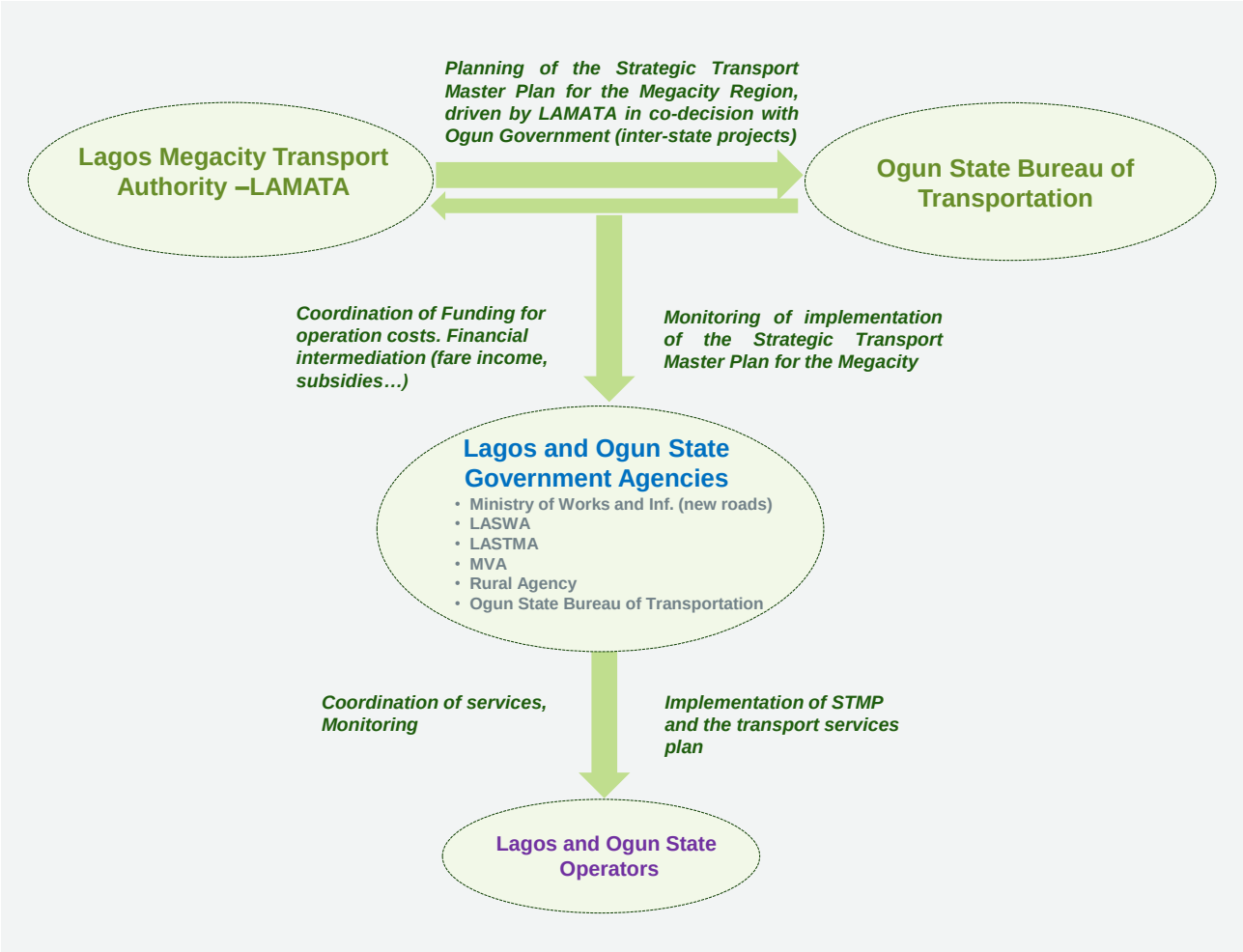


Figure 70. Institutional framework at the Base Level

9.4 High Level: Government Decision-Making

The High Level will involve government decision-making, for example planning approval and funding. This is a critical issue, particularly when considering the inter-state projects of the STMP extension.

Up till now, the funding of the STMP projects has been obtained from the World Bank and AFD funds.

Regarding the budgetary funding sources, it is important to look at the different elements of public money flow in the case of Lagos State:

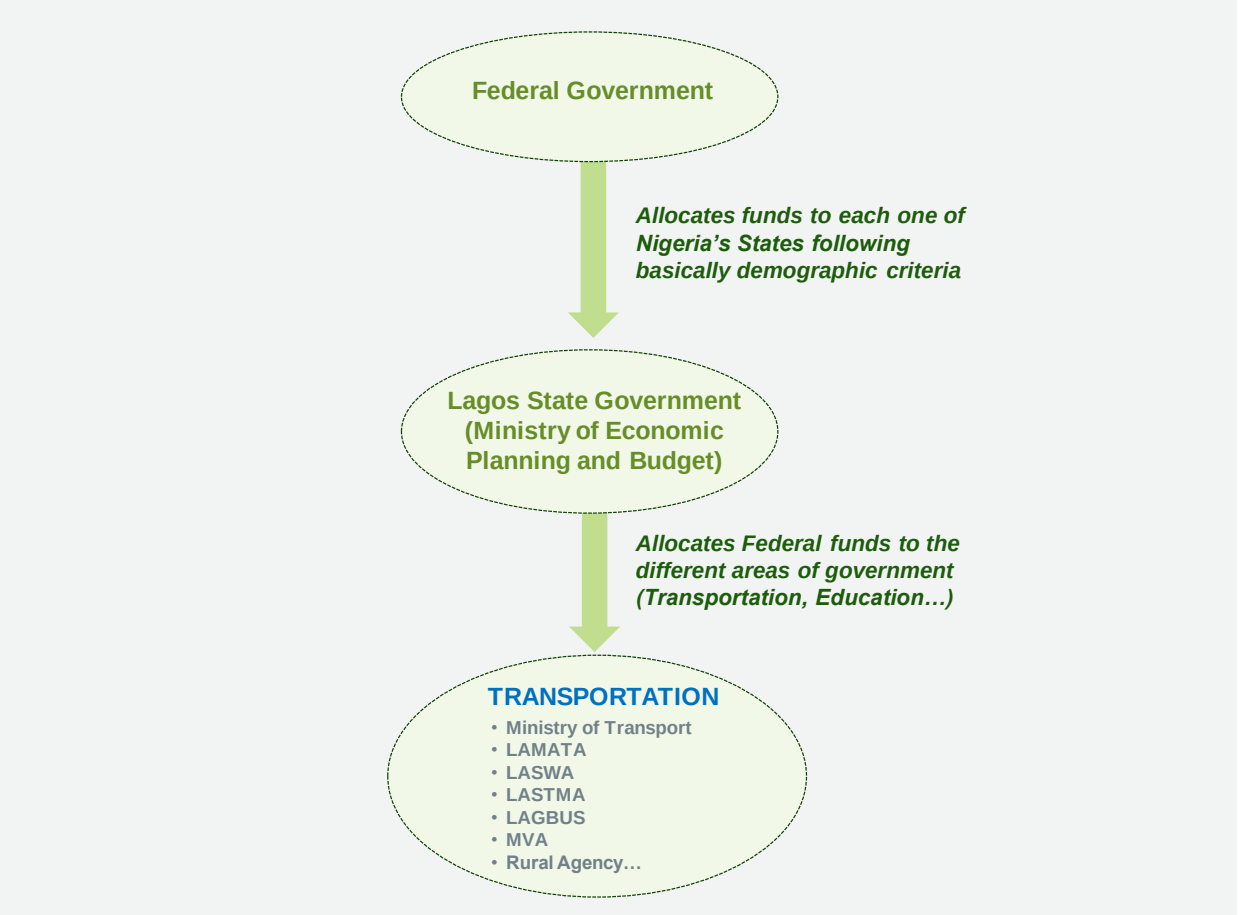


Figure 71. Budgetary funding

- The Federal Government assigns different shares of its budget to the different states of Nigeria, basically in accordance with the size of population.
- The budget assigned to Lagos State is then managed by the Ministry of Economic Planning and Budget, which will assign shares to the different areas of Government, with transportation being one of them.
- The budgetary provision for Transportation is then allocated to its different agencies (Ministry of Transport, Lagos Metropolitan Transport Authority –LAMATA; Lagos State Waterways Authority –LASWA; Lagos State Traffic Management Authority –LASTMA; Motor Vehicle Administration –MVA; LAGBUS; Rural Agency).
- Local governments get their funds directly from the Federal Government.

As stated above, this public funding scheme, in addition to the WB and foreign investment funds, allowed the development/promotion of the first STMP project in Lagos (BRT, red and blue LRT lines), located within Lagos State boundaries.

However the STMP extension involves new projects aimed at responding to the real commuting mobility dynamics of the Megacity, crossing the traditional boundaries of Lagos State into Ogun State. Ideation

This new inter-state element presents a new institutional and budgetary dimension surpassing the traditional scope of State policy and funding.

The first attempt to confront this challenge took place in December 2005, with the creation of the Presidential Committee on Lagos Megacity Region. This committee comprised of 21 members from Federal Government of Nigeria, Lagos and Ogun State Governments.

The Presidential Committee on the Lagos Megacity Region considered the challenges of Lagos' uncontrolled urban development and proposed a set of actions aimed at improving the Megacity's Transportation (focusing on a Mass Rapid Transit strategy), Sanitation and Security.

The proposals from the Committee were to be implemented by a joint action of Federal and State Governments, on the basis of a shared budget: 45% Federal Government, 40% Lagos State Government, 15% Ogun State Government.

This whole proposal led to the establishment of a Draft Bill to be considered by the National Assembly of the Federal Republic of Nigeria. However in 2007, additional considerations on the draft, particularly its legal implications, led to an interruption in the administrative procedures towards its approval resulting in the abandonment of the whole idea.

An alternative and probably more feasible scheme can be considered, considering only an inter-state Lagos-Ogun partnership, already suggested in previous sections of the current chapter. This will require, however, a thorough analysis of possible financing sources, taking into account that "traditional" funding sources such as land property taxes (particularly from 1967, when Lagos became a State and incorporated new urban areas into its tax system) will not be applicable in those areas of the Megacity belonging to Ogun state.

New tax-financing formulae linked to the use of infrastructure (wharf landing charges on cargoes moved within Lagos state have recently been put into operation), as well as PPP contracts (the current trend worldwide) or international institutions funding (such as the World Bank) provide the possibility of Inter-State cooperation with no need for Federal funding. This is a viable option, as long as the presence of a Transport Authority and policy-drafting body is guaranteed.

The figure below describes the institutional structure that could be applied accordingly. It would incorporate an Inter-ministerial Technical Committee and a Presidential Council, the "Governors' Council".

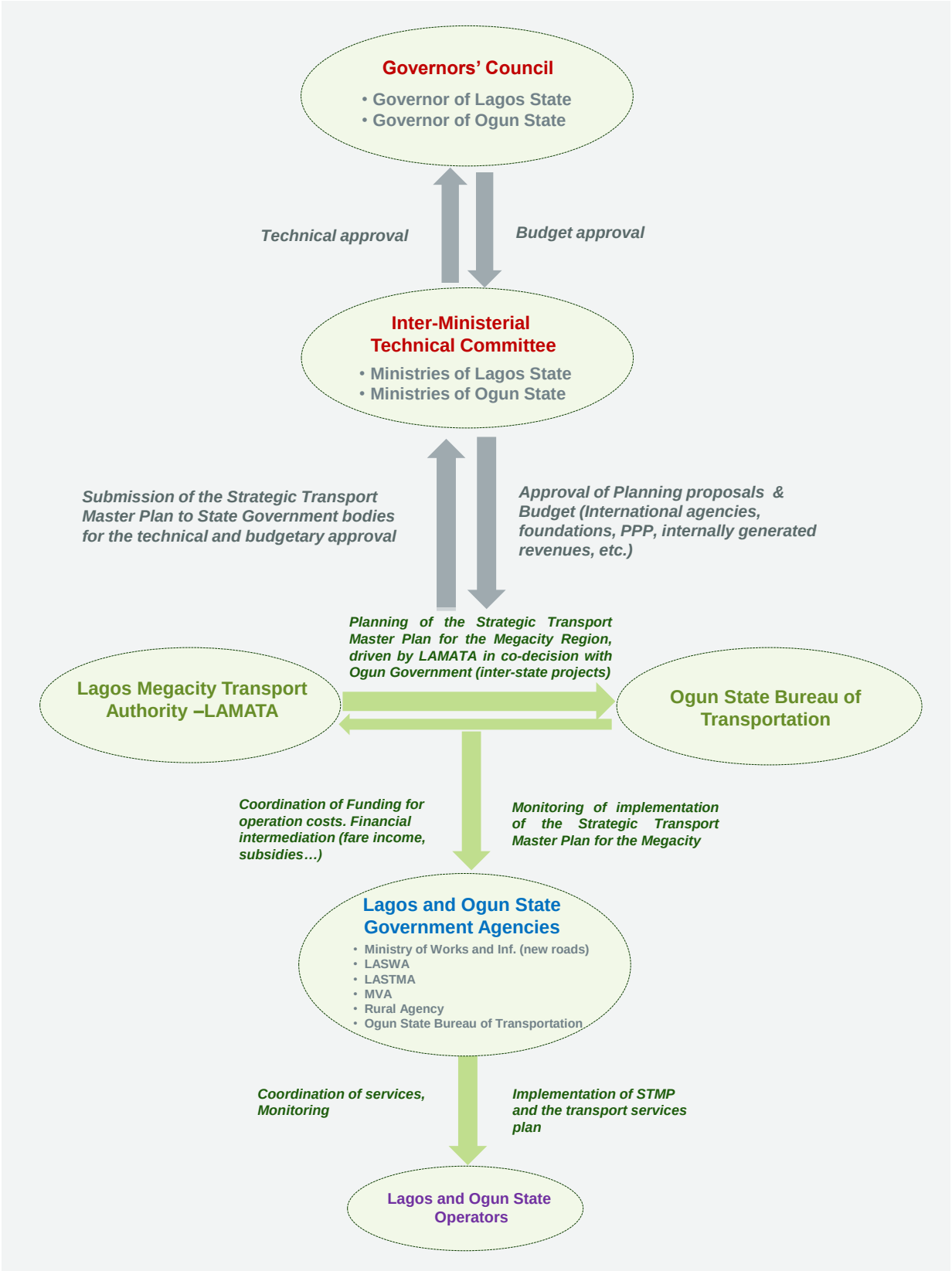


Figure 72. The complete institutional scheme: High-Level and Base-Level

10 Action Plan

An estimated implementation period of 3 years has been considered suitable for the development of the main proposals presented in the previous chapters.

The Action Plan for the STMP extension can be divided into three main domains:

- **Infrastructure**. Execution of all the infrastructure required for the proposed BRT, LRT, monorail, cable car, inland waterways and road corridors.

- **Institutional**. This domain should be considered at two different levels:

    - Establishment of the **concessional framework** and strengthening of the public transport companies. **The public transport operator system will have to be strengthened** through a re-organization requiring negotiations and the implementation of specific incentives.

    - **Strengthening of LAMATA** as the transport authority for the Megacity, through the implementation of a new organizational structure and the recruitment of additional employees, as well as the undertaking of a training plan.

- **Operational**. The new public transport lines will require a specific action plan for a successful startup of operations, as well as an efficient and coordinated continuation of services. This will require a number of actions, from the development of an information and dissemination plan to the implementation of all the necessary traffic management elements (including the establishment of the control centre and the necessary technologies for its operation).

Tables 46 to 52 show the distribution of the different public transport and road infrastructure projects of the STMP Extension throughout the 2014-2032 period.

As mentioned above, the implementation of all these STMP Extension projects (both infrastructure and services) requires specific action plans in the institutional and operational domains. These action plans have been defined on a short-term basis (a three-year time horizon), in order to guarantee the successful implementation of the whole STMP Extension, which is to be developed within the 2017-2032 period. They are shown in Tables 53 and 54.

Regarding the institutional domain, the first 1,5 years will be key for the organizational strengthening of LAMATA, including the technical, human resources and financial management capacities that will be needed for a comprehensive assumption of all the relevant transport and traffic areas.

In parallel, it will be necessary to carry out the organizational proposal to provide bus operators with a company structure, to study the incentive scheme for said operators, to study regularization of the legal status of the concessions, to draw up the training and organizational reinforcement program

for bus operators, etc. the findings of which will be subsequently implemented. These actions will start in parallel to LAMATA's strengthening but will need a longer period of time to be fully developed (actually the whole three-year action plan period).

Regarding the operational plan, the proposed action plan will be developed parallel to the implementation of the first projects of the STMP Extension. These will be extended throughout the Megacity all along the proposal development. However, these first three years represent the key-period for the establishment of a coordinated system of management and monitoring of a multimodal transport system.

Finally, it is important to note that operation of the routes under the new network should begin once the most important civil works have terminated in order to provide improved infrastructures which in turn ensure a more efficient operation. It is important to avoid beginning the operations while civil works are in progress. Even when measures are taken to expedite traffic, road works cause delays that can affect the operation at a strategically vital moment.

BRT Projects	Length km	CAPEX USD m			Total USD m	SHORT TERM			MEDIUM TERM					LONG TERM									
		2017	2022	2032		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
(TBS) Mile 12 - Ikorodu	12	36,0			36,0																		
TBS - Okokomaiko - Ijaniki (Blue Line)	29	86,7			86,7																		
Extension of Blue Line to Badagry	37	93,2			93,2																		
Berger – TBS	27			81,2	81,2																		
Oworonshoki to Apapa	27		82,5		82,5																		
Berger to Iyana Isolo through Ikotun	28		142,4		142,4																		
Berger to Local Airport	10			51,1	51,1																		
Maryland - Otta	22		95,2		95,2																		
Okun – Aja – Ikorodu Roundabout	22			421,7	421,7																		
Lekki Green Corridor	92			924,2	924,2																		
Lekki Lagoon Road	91			808,3	808,3																		
Lekki Coastal Road	77			1.117,7	1.117,7																		
Majidun / Ipakodo - Shagamu	13			123,4	123,4																		
Ijede – Isawo Rd through Ikorodu	6			224,9	224,9																		
Ikorodu Roundabout – Epe through Agbowa	60			556,3	556,3																		
Total	552,86	215,9	3.170,2	1.458,6	4.844,7																		

Table 46. Action Plan and Budget for BRT Projects

LRT Projects (from STMP and extensions)	Length km	CAPEX USD m			Total USD m	SHORT TERM			MEDIUM TERM					LONG TERM										
		2017	2022	2032		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Red line (Marina - Agbado)	29,3	898,5			898,5																			
Blue line (TBS - Okokomaiko)	29	1.100,0			1.100,0																			
Green line (Marina to Ajah)	22,4		686,9		686,9																			
Yellow line (Otta/MMA to Iddo)	33,9			1.107,4	1.107,4																			
Brown line (Mile 12 to Marina)	19			582,7	582,7																			
Red line (extension)	23,1			639,1	639,1																			
Green line (Lekki Airport and FTZ)	61,8			1.796,8	1.796,8																			
Purple Line (LASU-Shagamu)	80		2.207,8		2.207,8																			
Total	298,3	1.998,5	2.894,7	4.126,0	9.019,2																			

Table 47. Action Plan and Budget for LRT Projects

Monorail Projects	Length km	CAPEX USD m			Total USD m	SHORT TERM			MEDIUM TERM					LONG TERM										
		2017	2022	2032		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Victoria Island Monorail	24		1.651,2		1.651,2																			
Total	24	0,0	1.651,2	0,0	1.651,2																			

Table 48. Action Plan and Budget for Monorail Projects

Cablecar Projects	Length km	CAPEX USD m			Total USD m	SHORT TERM			MEDIUM TERM					LONG TERM										
		2017	2022	2032		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Adeniji Adele - Ozumba	4,9	124,0			124,0																			
Adeniji Adele - Ijora	3,7	93,7			93,7																			
Adeniji Adele - Ipaja	22		556,9		556,9																			
Ipaja - Alimosho	12,2		308,8		308,8																			
Total	42,8	217,7	865,8	0,0	1.083,5																			

Table 49. Action Plan and Budget for Cable Car Projects

Water terminal Projects	Type of Works	Status	CAPEX			Total USD m	SHORT TERM			MEDIUM TERM					LONG TERM										
			2017	2022	2032		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Civil Works on Terminals																									
Osborne terminal	Construction	On-going	2,0			2,0																			
Ebute Ojo terminal	Construction	On-going	0,5			0,5																			
Ijegun Egba terminal	Construction	On-going	2,0			2,0																			
Mile 2 terminal	Rehabilitation	On-going	4,0			4,0																			
Ikorodu terminal	Rehabilitation	On-going	0,5			0,5																			
Badore East terminal	Construction	On-going	4,0			4,0																			
Oworonshoki terminal	Rehabilitation	Finished	-			0,0																			
Ajah	Rehabilitation	Finished	-			0,0																			
Addax/Falomo	Rehabilitation	Finished	-			0,0																			
Mekwen	Rehabilitation	Finished	-			0,0																			
Liverpool	Rehabilitation	-	0,1			0,1																			
Baiyeku	Rehabilitation	Finished	-			0,0																			
C.M.S.	Rehabilitation	-	2,0			2,0																			
Coconut	Rehabilitation	-	0,1			0,1																			
Ijede	Rehabilitation	-	0,1			0,1																			
Ijora	Rehabilitation	-	0,1			0,1																			
Langbasa	Rehabilitation	-	0,1			0,1																			
Mile 12	Rehabilitation	-		0,1		0,1																			
Agboyi Ketu	Rehabilitation	Finished	-			0,0																			
Agboyi	Construction	-		0,5		0,5																			
Alapere	Construction	-		0,5		0,5																			
Ebute Ero	Rehabilitation	-	0,1			0,1																			
Five Cowries	Rehabilitation	-	0,1			0,1																			
Victoria Island	Rehabilitation	-	0,1			0,1																			
Oke Afa	Construction	-		0,5		0,5																			
Tolu Ajegunle	Construction	-	0,5			0,5																			
Olodi Apapa	Construction	-	0,5			0,5																			
Igbo-Elejo	Construction	-	0,5			0,5																			
Igbologun	Construction	-	0,5			0,5																			
Ibasa	Rehabilitation	-	0,1			0,1																			
Irewe	Rehabilitation	-	0,1			0,1																			
Ekpeme	Construction	-		0,5		0,5																			
Total			**18,0**	**2,1**	**0,0**	**20,1**																			

Table 50. Action Plan and Budget for Inland Waterways Terminal Projects

Interchanges (Passenger transfer stations)	CAPEX USD m			Total USD m	SHORT TERM			MEDIUM TERM					LONG TERM										
	2017	2022	2032		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
National Theatre South		4		4																			
Marina (urban)		2		2																			
Yaba (urban)		2		2																			
Oshodi (urban)		2		2																			
Mile 2 (urban)		2		2																			
Agege (urban)		2		2																			
Ojo (urban)		2		2																			
Otta (inter-urban)		1		1																			
Ibafo (inter-urban)			1	1																			
Shagamu (inter-urban)			1	1																			
Ikorodu (urban)		2		2																			
Langbasa (urban)		2		2																			
Lekki Airport (inter-urban)			1	1																			
Badagry (inter-urban)			1	1																			
Total	**0,0**	**21,0**	**4,0**	**25,0**																			

Table 51. Action Plan and Budget for Inland Interchange Projects

Road Corridor Projects	Length km	CAPEX USD m			Total USD m	SHORT TERM			MEDIUM TERM					LONG TERM									
		2017	2022	2032		2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Lagos Outer Ring Road																							
Ojo - Apapa	21	146,3			146,3																		
Ojo - Alagbado	48		329,8		329,8																		
Ikorodu – Lekki (4th Mainland Bridge)	4	848,5			848,5																		
Ikorodu – Lekki (stretches without bridge)	14	119,0			119,0																		
Lekki – V.I. / Apapa	36		247,0		247,0																		
Transversal connections																							
Owode – Otta – Itele - Lagos - Abeokuta	56			298,4	298,4																		
Agbara - Sokoto Road - Shagamu	102			419,7	419,7																		
Shagamu - Ijebu Ode – Lekki Airport / FTZ	62			192,2	192,2																		
Trade Fair – Ijedodo Rdl – Ikotun	7			64,5	64,5																		
Bridge Apapa Port - Sagbokoji	1			19,2	19,2																		
Total	**351**	**1.113,8**	**576,8**	**994,0**	**2.684,6**																		

Table 52. Action Plan and Budget for Road Corridor Projects

	Task	Year 1												Year 2												Year 3											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
1	**Definition of the strategies and release of the concessions**																																				
1.1	Elaboration of concession documents																																				
1.2	Concessions process																																				
1.3	Revision of bids received																																				
1.4	Formalization of contracts and their implementation																																				
2	**Institutional strengthening of LAMATA and companies of transport sector**																																				
2.1	Institutional strengthening of LAMATA																																				
2.1.1	Implementation of LAMATA's new organizational structure																																				
2.1.1.1	*Implementation of new functional structure*																																				
2.1.1.2	*Contract of additional workers and professionals*																																				
2.1.2	Design and implementation of the training plan for LAMATA's staff																																				
2.1.2.1	*Scheduling of the training*																																				
2.1.2.2	*Enforcement of the training*																																				
2.1.2.3	*Evaluation of the results*																																				
2.2	Strengthening of the public transport companies (BRT, LRT, IW…)																																				
2.2.1	Study and revision																																				
2.2.2	Creation, integration and organization of the PT operators																																				
2.2.3	Implementation of the PT operators re-organized structure																																				
2.2.4	Implementation of negotiation strategies with PT operators																																				
2.2.5	Developing incentives for PT operators																																				
2.2.5.1	*Study of the incentives*																																				
2.2.5.2	*Implementation of the incentives*																																				
2.2.6	Developing training plan for PT operators																																				
2.2.7	Technical assessment to create organized companies of PT operators																																				
2.2.8	Events for interchanging and sensibilization of PT operators																																				
2.3	Administrative review and permits																																				

Table 53. Institutional Action Plan

	Task	Year 1												Year 2												Year 3											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
3	**Operational Plan**																																				
3.1	Monitoring and Control Plan																																				
3.1.1	Definition of control technology																																				
3.1.2	Acquisition of control equipment																																				
3.1.3	Inspection and monitoring training																																				
3.1.4	Control of acquired vehicles																																				
3.1.5	Control of bedding in phase																																				
3.1.6	Control of concessionary routes																																				
3.1.7	Implementation Plan monitoring																																				
3.2	Information and Dissemination Plan																																				
3.2.1	Promotion and marketing campaign																																				
3.2.2	Design of information materials																																				
3.2.3	Editing of information materials																																				
3.2.4	Distribution of materials																																				
3.2.5	Implementation of information elements in bus stops and transport terminals																																				
3.2.6	User information system																																				
3.3	Complementary measures for management of urban transportation																																				
3.3.1	Fleet Tracking System viability study																																				
3.3.2	Fleet Tracking System definition																																				
3.3.3	Search for technology provider																																				
3.3.4	Fleet Tracking System Installation (vehicles and network)																																				
3.3.5	Signalization plan																																				
3.3.6	Creation of traffic and PT control centres																																				
3.3.7	Implementation of signal priority																																				
3.3.8	Test phase of Fleet Tracking System																																				
3.3.9	Design of bus lanes network																																				
3.3.10	*Infrastructure actions*																																				
3.3.11	*Implementation of BRT lanes*																																				

Table 54. Operational Action Plan

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