MINISTRY OF INFRASTRUCTURE, PUBLIC WORKS
AND RECONSTRUCTION
DEMOCRATIC REPUBLIC OF THE CONGO

Project for Urban Transport Master Plan in Kinshasa City -PDTK-

FINAL REPORT

Summary of Volume 1

Urban Transport Master Plan in Kinshasa City

April 2019

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

ORIENTAL CONSULTANTS GLOBAL CO., LTD.
INGEROSEC CORPORATION
YACHIYO ENGINEERING CO., LTD.
ASIA AIR SURVEY CO., LTD.

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General Abbreviations

No.	Abb.	English	French
1	AASHTO	American Association of State Highway and Transportation Officials, United States	Association américaine des représentants des administrations des autoroutes et des transports, États-Unis
2	ACCO	Association of Congo Drivers	Association des Chauffeurs du Congo
3	ACE	Congolese Environment Agency	Agence Congolaise de l'Environnement
4	ACGT	Congolese Agency of Great Works, MITPR	Agence Congolaise des Grands Travaux, MITPR
5	ACT	Articulated Truck	Camion articulé
6	AFD	French Development Agency	Agence Française de Développement
7	AfDB	African Development Bank	Banque Africaine de Developpement
8	AGT	Automated Guideway Transit	Transports guidés urbains automatiques
9	AIP	Agro-Industrial Park	Parc Agro-Industriel
10	ANAPI	National Agency for Promoting Industry	Agence National des Promotions de l'Industrie
11	ANIPTMC	National Association of Owners of Motorcycle Taxies of the Congo	Association Nationale des Initiateurs et Propriétaires des Taxis-Motos du Congo
12	AOTU	Urban Transport Authority	Autorité Organisatrice de Transports Urbains
13	APVCO	Association of Public Transport Vehicles Owners	Association des Propriétaires de Véhicules Affectés au Transport en Commun
14	AU	African Union	Union Africaine
15	BADEA	Arab Bank for Economic Development in Africa	Banque Arabe pour le Développement Economique en Afrique
16	BCC	Central Bank of the Congo	Banque Centrale du Congo
17	BCR	Building Coverage Ratio	Coefficient de Couverture de Bâtiment
18	BEAU	Urban planning office	Bureau d'Etude d'Aménagement Urbain
19	BOP	Bottom of the Pyramid	Bas de la Pyramide
20	BRT	Bus Rapid Transit	Bus à Haut Niveau de Service (BHNS)
21	BTC	Technical Control Office, MITPR	Bureau Technique de Controle, MITPR
22	CAGR	Compound annual growth rate	Taux de Croissance Annuel Moyen
23	CAS	Country Assistance Strategy, WB	Stratégie d'aide-pays, BM
24	CBD	Central Business District	Quartier d'affaires
25	CCS-Kin	Kinshasa Southern Growth Corridor, PDTK	Corridor de croissance sud de Kinshasa, PDTK
26	CEI	Independent Electoral Commission	Commission Électorale Indépendante
27	CEPCOR	Support and Monitoring Unit of Regional Programs and Activities of Transport Corridors	Cellule d'Appui et de Suivi des Projets Intégrateurs et des Activités des Corridors des Transports
28	CI	Infrastructure Unit, MITPR	Cellule Infrastructures, MITPR
29	CNPR	National Road Safety Commission, MTVC	Commission Nationale de Prévention Routière, MTVC
30	CNTF	Shipyard and Water Transport (Republic of the Congo)	Chantiers Navals et Transports Fluviaux (République du Congo)
31	COMESA	Common Market for Eastern and Southern Africa	Marché commun de l'Afrique orientale et australe
32	CONADEP	National Driver's License Commission, MTVC	Commission nationale de délivrance des permis de conduire, MTVC
33	CRGM	Center for Geological and Mining Researches	Centre de Recherches Geologique et de Mines
34	CSP	Country Strategy Papers, AfDB	Documents de stratégie pays, BAD
35	CTB	Belgian Technical Cooperation, Belgian Development Agency	Coopération Technique Belge, Agence Belge de Développement
36	DEMU	Diesel-Electric Multiple Unit	Unité multiple diesel-électriqu
37	DEP	Direction of Study and Planning	Direction d'Etudes et Planification
38	DF/R	Draft Final Report	Projet de Rapport Final
39	DMU	Diesel Multiple Unit	Unité multiple diesel
40	DPC	Directorate of Roads and Bridges, MITPR	Direction des Ponts et Chaussées, MITPR
41	DRC	Democratic Republic of the Congo	République Démocratique du Congo
42	DSCRP	Growth and Poverty Reduction Strategy Paper	Document de la Stratégie de Croissance et de Réduction de la pauvreté

No.	Abb.	English	French
43	DSRP	Poverty Reduction Strategy Paper	Documents de Stratégie pour la Réduction de la Pauvreté
44	DT	Director of Transport, Kinshasa City	Directeur des transports, Ville de Kinshasa
45	DVDA	Directorate of Agricultural Roads	Direction des Voies de Desserte Agricole
46	ECCAS	Economic Community of Central African States	Communauté Économique des États de l'Afrique Centrale
47	EDF	European Development Fund	Fonds Européen de Développement
48	EIA	Environmental Impact Assessment	Étude d'Impacts Environnementaux
49	EIRR	Economic Internal Rate of Return	Taux de Rentabilité Interne
50	EMU	Electric Multiple Unit	Unité multiple électrique
51	EU	European Union	Union Européenne
52	F/R	Final Report	Rapport Final
53	F/S	Feasibility Study	Étude de Faisabilité
54	FAR	Floor Area Ratio	Coefficient d'occupation des sols
55	FEC	Federation of Congolese Enterprises	Fédération des Entreprises du Congo
56	FHWA	Federal Highway Administration, US	Administration fédérale des routes, États-Unis
57	FONER	National Road Maintenance Fund	Fonds National d'Entretien Routier
58	GDP	Gross Domestic Product	Produit Intérieur Brut
59	GECT	General of Studies and Technical Advice	Générale d'Etudes et Conseils Techniques
60	GET	Transport Study Group, MTVC	Groupe d'Etudes des Transports, MTVC
61	GIS	Geographic Information System	Système d'Information Géographique
62	GPS	Global Positioning System	Système Mondial de Positionnement
63	GRDP	Gross Regional Domestic Product	Produit Intérieur Brut Régional
64	HGT	Heavy Goods Truck	Camion de marchandises lourdes
65	IC/R	Inception Report	Rapport Initial (R/Ini)
66	ICC	Smart Card (Integrated Circuit Card)	Carte à puce (Carte à circuit intégré)
67	ICCN	Congolese Institute for Nature Conservation	Institut Congolais pour la Conservation de la Nature
68	ICT	Information and Communication Technology	Technologies de l'information et de la communication
69	IDP	Internally Displaced People	Population Déplacés Internes
70	IEE	Initial Environmental Examination	Examen Environnemental Initial
71	IGC	Geographical Institute of Congo	Institut Géographique du Congo
72	IMF	International Monetary Fund	Fonds Monétaire International
73	INS	National Statistical Institute	Institut National des Statistiques
74	IT/R	Interim Report	Rapport intérimaire
75	ITS	Intelligent Transport Systems	Système de transport intelligent
76	JCC	Joint Coordinating Committee	Comité Conjoint de Coordination
77	JICA	Japan International Cooperation Agency	Agence de Coopération Internationale du Japon
78	LDC	Least Developed Countries	Pays les Moins Avancés
79	LGT	Light Goods Truck	Camion de marchandises légères
80	LRT	Light Rail Transit	Transport Léger sur Rail
81	MICE	Meeting, Incentive, Convention and Event/Exhibition	Réunions, Congrès, Conventions et Voyages de Gratification
82	MICS	Multiple Indicator Cluster Surveys, UNICEF	Enquête Par Grappes à Indicateurs Multiples, UNICEF
83	MITPR	Ministry of Infrastructure, Public Works and Reconstruction	Ministère des Infrastructures, Travaux Publics et Reconstruction
84	MTVC	Ministry of Transport and Communications	Ministère de Transport et Vies de Communications
85	NCPI	National Commitments and Policies Instrument	Instrument des engagements et politiques nationaux
86	NEPAD	New Partnership for Africa's Development	Nouveau Partenariat pour le Développement de l'Afrique
87	NGO	Non-Governmental Organization	Organisation non gouvernementale
88	NMT	Non-Motirized Transport	Transport non motorisé
89	NPO	Non-Profit Organization	Organisme sans but lucratif
90	NPV	Net Present Value	Valeur Actuelle Nette
91	NR	National Road	Route Nationale
92	OC	Operation Centre	Centre d'Opérations

No.	Abb.	English	French
93	OD	Origin and Destination	Origine et Destination
94	OJT	On-the-Job Training	Se Former sur le Tas
95	ONEM	National Employment Office	Office National de l'Emploi
96	OPJ	Officer of Judicial Police	Officier de Police Judiciaire
97	OR	Road Agency, MITPR	Office des Routes, MITPR
98	OVD	Office of Roads and Drainage, MITPR	Office des Voiries et Drainages, MITPR
99	PAG	Governance Support Programme	Programme d'Appui à la Gouvernance
100	PANAV	Assistance Program for Navigable Waterways and Lake	Programme d'Appui à la Navigabilité des Voies Fluviales et Lacustres
101	PCR	Road Traffic Police, Congolese National Police	Police de Circulation Routièr, Police nationale congolaise
102	PCU	Passenger Car Unit	Unité de Voiture Particulière
103	PDCA	Plan, Do, Check, Action	Cycle PDCA (roue de Deming), (planifier, faire, vérifier, action)
104	PDNIT	Integrated National Transport Master Plan	Plan Directeur National Integre des Tranports
105	PDTK	Project for Urban Transport Master Plan in Kinshasa City, JICA	Projet d'élaboration du Plan directeur des transports urbains de la ville de Kinshasa, JICA
106	PDU	Urban Development Plan	Plan Directeur d'Urbanisme
107	PG/R	Progress Report	Rapport d'Avancement
108	PLA	Land Development Plan	Plan Local d'Aménagement
109	PNR	Congolese National Police	Police Nationale Congolaise
110	PNSD	National Strategic Development Plan	Plan National Stratégique de Développement
111	PPA	Particular Development Plan	Le Plan Particulier d'Aménagement
112	PPP	Public-Private Partnership	Partenariat Public-Privé
113	PRCMR	Project for Capacity Development on Road Maintenance, JICA	Projet de Renforcement de Capacité de Maintenance Routier, JICA
114	RATPK	Drainage and Public Works, Kinshasa Provincial Government	Régie D'Assainissement et des Travaux Publics, Province de Kinshasa
115	RND	Road Network Density	Densité du Réseau Routier
116	ROW	Right of Way	Droit de passage
117	RRR	Program for the Reunification of the Democratic Republic of Congo by Road	Programme de Réunification de la République Démocratique du Congo par voies Routières
118	RSA	Road Safety Audit	Audit de sécurité routière
119	RVF	Inland Waterway Authority, MTVC	Régie des Voies Fluviales, MTVC
120	SADC	Southern African Development Community	Communauté de Développement d'Afrique Australe
121	SCF	Standard Conversion Factor	Facteur de Conversion Standard
122	SCTP	Commercial Society of Transport and Ports, MTVC	Société Commerciale des Transports et des Ports, MTVC
123	SEA	Strategic Environmental Assessment	Évaluation Environnementale Stratégique
124	SEZ	Special Economic Zone	Zone Économique Spéciale
125	SME	Small and Medium-sized Enterprises	Petite et Moyenne Entreprise
126	SNEL	National Electricity Society	Société Nationale d'Electricité
127	SOSAK	Strategic Orientation Scheme for the Kinshasa Metropolitan Area	Schéma d'Orientation Stratégique de l'Agglomération de Kinshasa
128	SSATP	Sub-Sahara Africa Transport Policy Program, WB	Programme de Politiques de Transport en Afrique Subsaharienne, BM
129	TAH	Trans-African Highway	Routes Transafricaines
130	TAZ	Traffic Analysis Zone	Zone d'Analyse du Trafic
131	TCPK	Container Terminal of Kinshasa Port	Terminal à Conteneurs du Port de Kinshasa
132	TDM	Transport Demand Management	Gestion de la Demande de Transport
133	TEU	Twenty-foot Equivalent Unit	Équivalent Vingt Pieds
134	TOD	Transit Oriented Development	Aménagement axé sur les Transports en Commun
135	TRANSCO	Transport in Congo, MTVC	Transport au Congo, MTVC
136	TVET	Technical and Vocational Education Training	Enseignement Technique et la Formation Professionnelle

No.	Abb.	English	French
137	TWG	Technical Working Group	Groupe de Travail Technique
138	UN	United Nation	Organisation des Nations Unies
139	UNAIDS	Joint United Nations Programme on HIV and AIDS	Programme Commun des Nations Unies sur le VIH/sida
140	UNDP	United Nations Development Programme	Programme des Nations unies pour le développement
141	UNECA	United Nations Economic Commission for Africa	Commission Économique pour l'Afrique
142	UNEP	United Nations Environment Programme	Programme des Nations Unies pour l'Environnement
143	UNHCR	United Nations High Commissioner for Refugees	Haut commissariat des nations unies pour les réfugiés
144	UNICEF	United Nations Children's Fund	Fonds des nations unies pour l'enfance
145	VMS	Variable-message Sign	Panneau à messages variables
146	WB	World Bank	Banque mondiale
147	WHO	World Health Organization	Organisation mondiale de la santé
148	WWF	World Wide Fund for Nature	Fonds mondial pour la nature

Abbreviations for Transport Surveys

No.	Abbreviation	English	French
1	CS	Commuter Survey	Enquête sur les trajets
2	ADS	Activity Diary Survey	Enquête des activités par tenue d'un journal
3	SLS	Screen Line Survey	Comptages par lignes écrans
4	CLS	Cordon Line Survey (Roadside OD Interview Survey)	Enquête par cordons (Enquête OD en bordure de chaussée)
5		Cordon Line Survey (OD Interview Survey at Airport)	Enquête par cordons (Enquête OD sur les voies d'accès à l'aéroport)
6	DTCS	Directional Traffic Count Survey at Intersection	Comptage du trafic par direction aux intersections
7	PS	Parking Survey	Étude sur le parking
8	TGS	Trip Generation Survey	Enquête sur les origines des déplacements
9	TSS	Travel Speed Survey	Étude de mesure des vitesses de circulation
10	SPS	Stated Preference Survey	Enquête sur les motivations latentes
11	RIS	Road Inventory Survey	Inventaire des routes
12	LS	Logistics Survey	Étude des flux de marchandises
13	BUS	Building Use Survey	Étude sur l'utilisation des bâtiments
14	BRS	Bus Route Survey	Enquête sur les lignes de bus

SUMMARY REPORT

CHAPTER 1 Introduction

1.1 Background and Objectives

1.1.1 Background

The population of Kinshasa City, the capital of the Democratic Republic of the Congo (hereinafter abbreviated as DRC), has increased from around 2.6 million[1] in 1984 to 10.6 million[2] in 2013 at an average annual growth rate of 4.9% and it is expected to reach around 20 million[3] in 2030 and 26million[3] in 2040 at the annual growth rates of 3.8% between 2013 and 2030 and 2.7% between 2030 and 2040, respectively.

Twenty one communes out of the total twenty four communes in Kinshasa City are urbanized in terms of such land uses as CBD (Central Business District), commercial, industrial or residential areas where the population density exceeds over 200 persons per hectare in 2013. The urbanized commune area totals about 327 km^2, which accounts for only 3.1 % of the entire area of Kinshasa City that is 10,667 km^2. Meanwhile, the population of the urbanized communes dominates 82.1% of the total Kinshasa City population and they are concentrated excessively to densely built-up communes of over 500 persons/ha, such as Bumbu (1,181 persons/ha), Ngaba (902 persons/ha), Matete (688 persons/ha), N'djili (619 persons/ha), Makala (590 persons/ha) and Ngiri-ngiri (572 persons/ha) in 2013.

Despite the rapid urbanisation of Kinshasa City, current infrastructure development is still insufficient as 80% of total road length still remains unpaved under the jurisdiction of the Office des Voiries et Drainage (OVD / Office of Roads and Drainage). Among the four major arterial roads, Lumumba Boulevard, Congo-Japan Boulevard (*Avenue de Poids Lourds*), Matadi Avenue and 30th June Avenue, the heaviest traffic volume, counted as 35,749 vehicles/12 hours, was observed with frequent traffic congestions on 30th June Avenue. Ordinary bus transport is not well managed since mixed operation of public, private and owner-driven buses prevails, though it was a major means of transport about a decade ago. In addition, the existing three urban railway lines, beginning from the central station toward Kintambo/Kinsuka (West line), Matadi (South line) and the airport (East line), are hardly used. Currently, only a few operations are maintained on the South and East lines in the morning and afternoon due to degradation of the tracks, whereas the West line has stopped its operation at present.

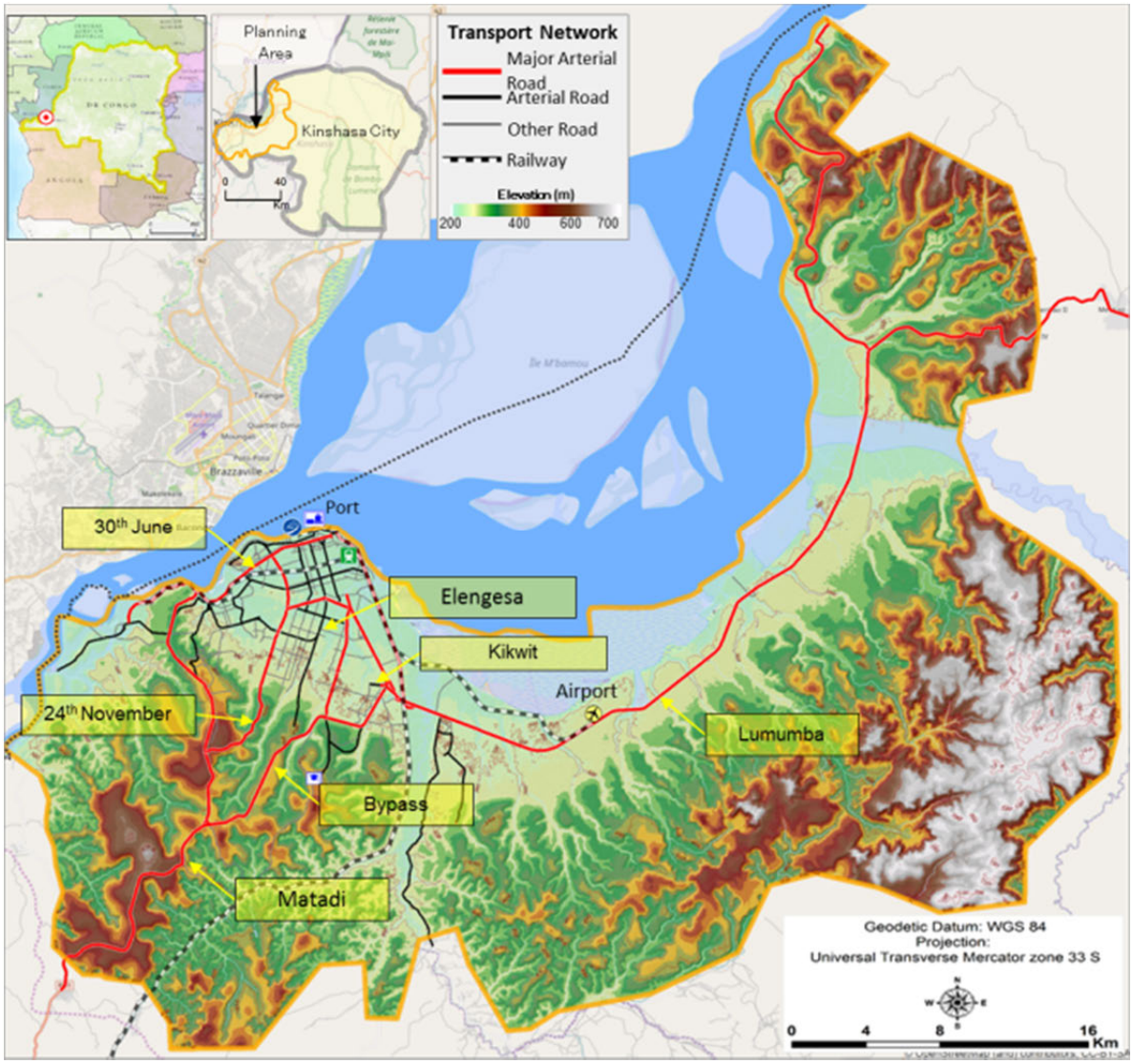
Under the above-mentioned circumstances, SOSAK (*Schéma d'Orientation Stratégique de l'Agglomération Kinoise/* Strategic Orientation Scheme for the Kinshasa Metropolitan Area) has been formulated and formally approved by the provincial congress in 2015 to promote the planned urban development of Kinshasa City with the support of AFD (*Agence Française de Développement* / French Development Agency) which calls for the necessity of Urban Transport Master Plan in parallel with urban development.

[1] Census data in 1984
[2] The estimation of INS (*Institut National des Statistiques* / National Statistical Institute)
[3] The estimation of the Study Team

1.1.2 Objectives

This Study aims to contribute to solving the urban transport problems in Kinshasa City by formulating the Urban Transport Master Plan with a middle-term transport infrastructure development programme toward 2030 as the target year, based on a transport demand forecast under a long-term development vision toward 2040.

The Study Area is the urbanised area of Kinshasa City, which covers about 1,450 km^2 out of the total city area of 10,667 km^2, as defined in Figure 1.1.1.



Source: The Study Team

Figure 1.1.1 Study Area

1.2 Scope of the Study

The Study is divided into three phases, they are, Phase 1: Analysis of Current Conditions, Phase 2: Formulation of Urban Transport Master Plan, and Phase 3: Preliminary Feasibility Study for the selected priority projects.

Study tasks included in the respective Study Phases are listed below, and their flow is shown in Figure 1.2.1.

Phase 1: Data Collection and Analysis of Current Conditions (Volume 1)

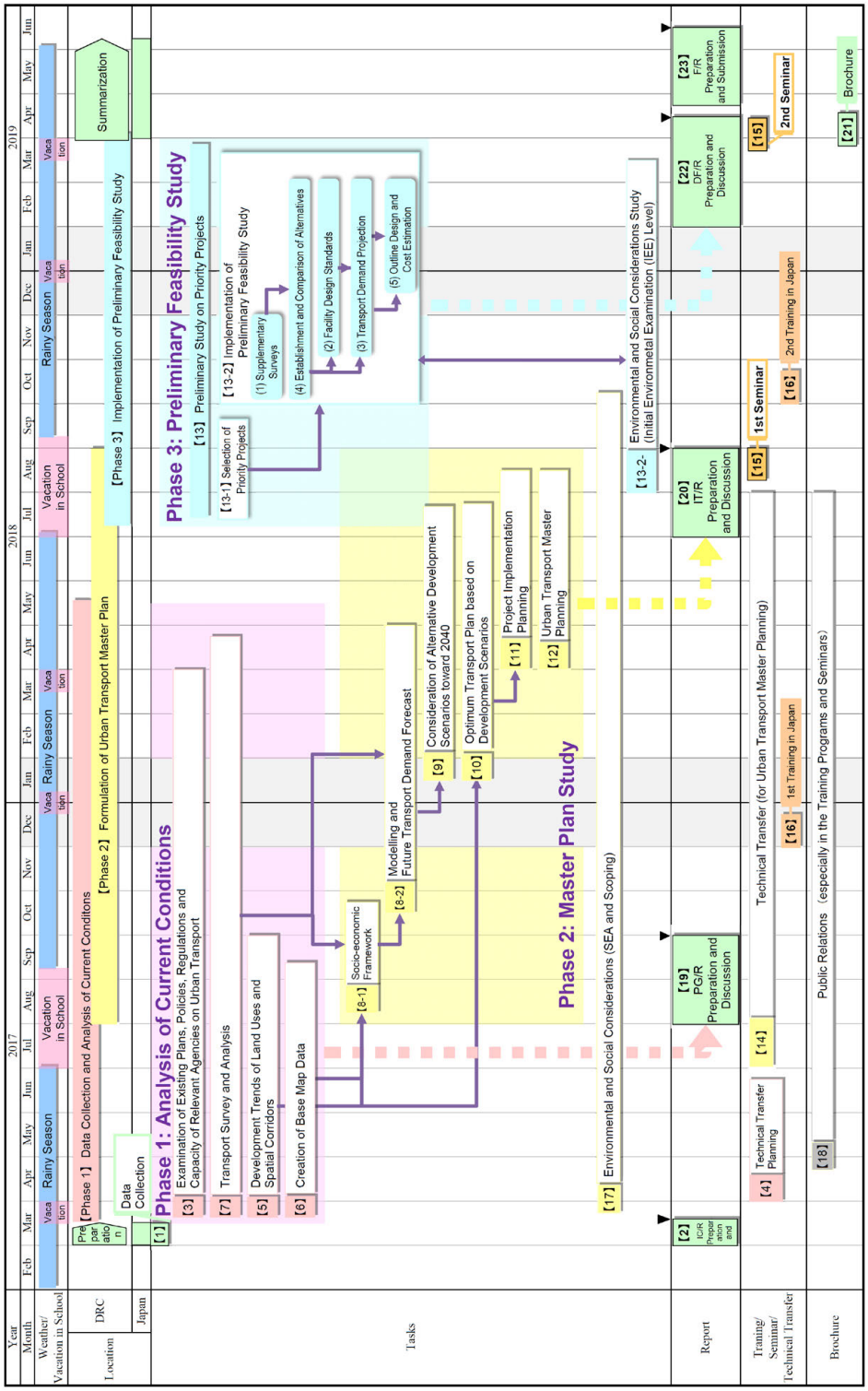
(1) Data Collection and Analysis
(2) IC/R Preparation and Discussion
(3) Examination of Existing Plans, Policies, Regulations and Capacity of Relevant Agencies on Urban Transport
(4) Technical Transfer Planning
(5) Development Trends of Land Uses and Spatial Corridors
(6) Creation of Base Map Data
(7) Transport Survey and Analysis

Phase 2: Formulation of Urban Transport Master Plan (Volume 2)

(8) Future Transport Demand Forecast
(9) Socio-Economic Framework
(10) Modelling and Future Transport Demand Forecast
(11) Consideration of Alternative Development Scenarios toward 2040
(12) Optimum Urban Transport Plan Based on Development Scenario
    a. Public Transport Plan
    b. Road Development Plan
    c. Traffic Management Planning
(13) Project Implementation Planning
    a. Identification of Individual Projects
    b. Project Programmes
    c. Implementation System
(14) Urban Transport Master Planning

Phase 3: Preliminary Feasibility Study on University Avenue (Volumes 2 and 3)

(15) Preliminary Study on Priority Projects
    a. Selection of Priority Projects
    b. Implementation of Preliminary Feasibility Study
(16) Technical Transfer
(17) Seminars
(18) Training in Japan
(19) Environmental and Social Considerations (SEA and Scoping)



Source: The Study Team

Figure 1.2.1 Flow Chart of Study Tasks

1.3 Contents of the Main Report

The main report consists of 9 Chapters, focusing on the formulation of the Urban Transport Master Plan and the project implementation program, for the target year of 2030. The following sections briefly introduce the major study activities and outcomes.

1.3.1 Data Collection and Analysis of Current Conditions (Chapter 2 through 4)

Chapter 1: Introduction mainly describes the background, objectives, planning area and introductory statements of the following chapters.

Chapters 2: Transport Survey and Analysis deals with various transport surveys undertaken by the Study, and introduces analytical results of the traffic data collected from the field. The transport survey covered not only the traffic counts, but also interview surveys as listed below:

(1) Commuter Survey (CS)
(2) Activity-Diary Survey (ADS)
(3) Screen Line Survey (SLS)
(4) Cordon Line Survey (Roadside OD Interview Survey)
(5) Cordon Line Survey (OD Interview Survey at Airport)
(6) Directional Traffic Count Survey at Intersections (DTCS)
(7) Parking Survey (PS)
(8) Trip Generation Survey (TGS)
(9) Travel Speed Survey (TSS)
(10) Stated Preference Survey (SP)
(11) Road Inventory Survey (RIS)
(12) Logistics Survey (LS)
(13) Building Use Survey (BUS)
(14) Bus Route Survey BRS)

This Chapter also discusses how the Study Team develop the method of transport demand forecast based on the data collected from the survey.

Chapter 3: Existing Framework Conditions discusses analytical results of collected data and information on the natural environment, socio-economic conditions, and current land use/urbanization of the Study Area. In addition, it reveals the information derived from the analysis of current development trend and geographical conditions of Kinshasa City, to suggest a direction of planning for the Master Plan preparation. As the prerequisite for the development planning, a necessary knowledge about legal constraints on urban development that exist in the DRC is exhibited.**Chapter 4: Existing Development Visions, Policies and Plans** introduces existing development plans that are most relevant to the Study, such as the PNSD (*Plan National Stratégique de Développement* / National Development Vision and Policy), PDNIT (*Plan Directeur National Integre des Tranports* / National Transport Development Plan) and SOSAK (*Schéma d'Orientation Stratégique de l'Agglomération Kinoise* / Strategic Orientation Scheme for the Kinshasa Metropolitan Area); and which provide the basis to prepare the future framework of urban, transport, social and economic development for Kinshasa City and the Urban Transport Master Plan, eventually.

1.3.2 Preparation of Urban Transport Master Plan (Chapter 5 through 9)

Chapter 5: Vision for Sustainable Spatial Development (2040) discusses for the first time a scale of the urban development required for the growth of the Study Area. Therefore, the future growth of urban population, employment and GRDP (Gross Regional Domestic Product) for the Study Area was investigated referring to the PNSD, PDNIT, SOSAK, INS (*Institut National des Statistiques* / National Statistical Institute) data, UN (United Nation) data and other relevant data and information. Furthermore, a possible orientation and perspectives for Kinshasa City development was examined, in order to envisage Kinshasa City and its macro-economic and social roles in the future.

Chapter 6: Preferred Spatial Development Scenario starts with the examination of the overall scale of the urban development required for the Study Area. Therefore, the balance between the future urbanization pressure (population growth) and available land suitable for the development was examined, revealing that all the potential development area need to be exploited to absorb the estimated future population of the Study Area.

After the recognition of the necessity to develop all the available land for the Study Area, alternative spatial development scenarios were compared, and the preferred one was selected. Based on the selected urban structure, all of the potential area for development was identified with suitable land uses, such as residential, industrial, commercial and other centre developments, following the proposed land use policy and transport development policy.

Eventually, the Study recommends the preferred urban structure that includes future land use plan and schematic transport network plan in the Study Area.

Chapter 7: Transport Development Scenario was established by analysing current transport issues, and reviewing existing urban transport policies, plans and projects on the transport network. It also proposes alternative transport scenarios with different modes of transport. The alternative scenarios included such options as “Do Minimum”, “Road-Intensive Road Network” and “Public Transport-Intensive Network”. The “Public Transport Intensive Network” was further specifically divided into “Rail-Intensive” and “BRT-Intensive” alternatives. For the comparison of the alternative scenarios, the overall transport demand and development costs for the respective scenarios were estimated and evaluated to select the most suitable transport scenario for Kinshasa City.

Chapter 8: Urban Transport Master Plan for 2030 describes plans identified for such transport sub-sectors as the public transport plan; road development plan; and traffic safety, control and management plan. The transport sub-sector plans are further elaborated to identify individual projects by different modes of transport or systems.

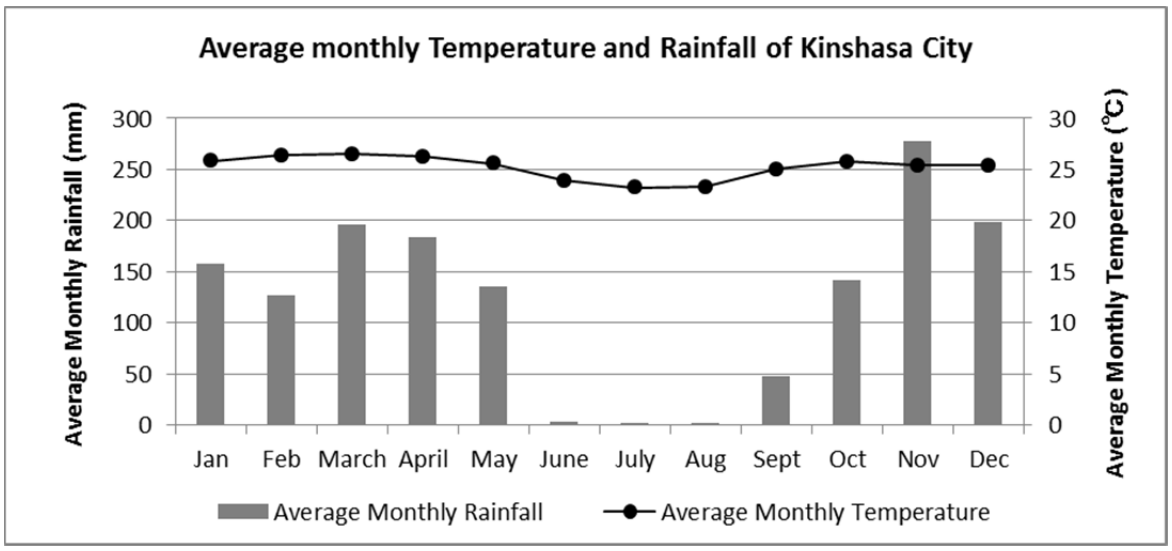
Chapter 9: Project Implementation Plan for 2030 proposes the implementation schedule towards the target year of 2030, with such priority sequence of Urgent, Short and Medium terms. Issues and policies on fund procurement and institutional enforcement are also proposed, to place those transport projects on a right track for appropriate implementation and to achieve best possible the Urban Transport Master Plan in Kinshasa City.

CHAPTER 2 Existing Framework Conditions

2.1 Natural Environment

2.1.1 Climate

The climate in Kinshasa City is defined as equatorial savannah with a dry winter in June, July and August, as shown in Figure 2.1.1. The annual average daily high temperature is about 30°C, while the average daily low temperature is about 21°C, and the annual mean temperature is about 25°C. Annual total rainfall is about 1500 mm.



Source: Climate Change Knowledge Portal, World Bank Group

Figure 2.1.1 Average Monthly Temperature and Rainfall in Kinshasa City (at location 4.34 S, 15.30 E) from 1991-2015

2.1.2 Geology and Topography

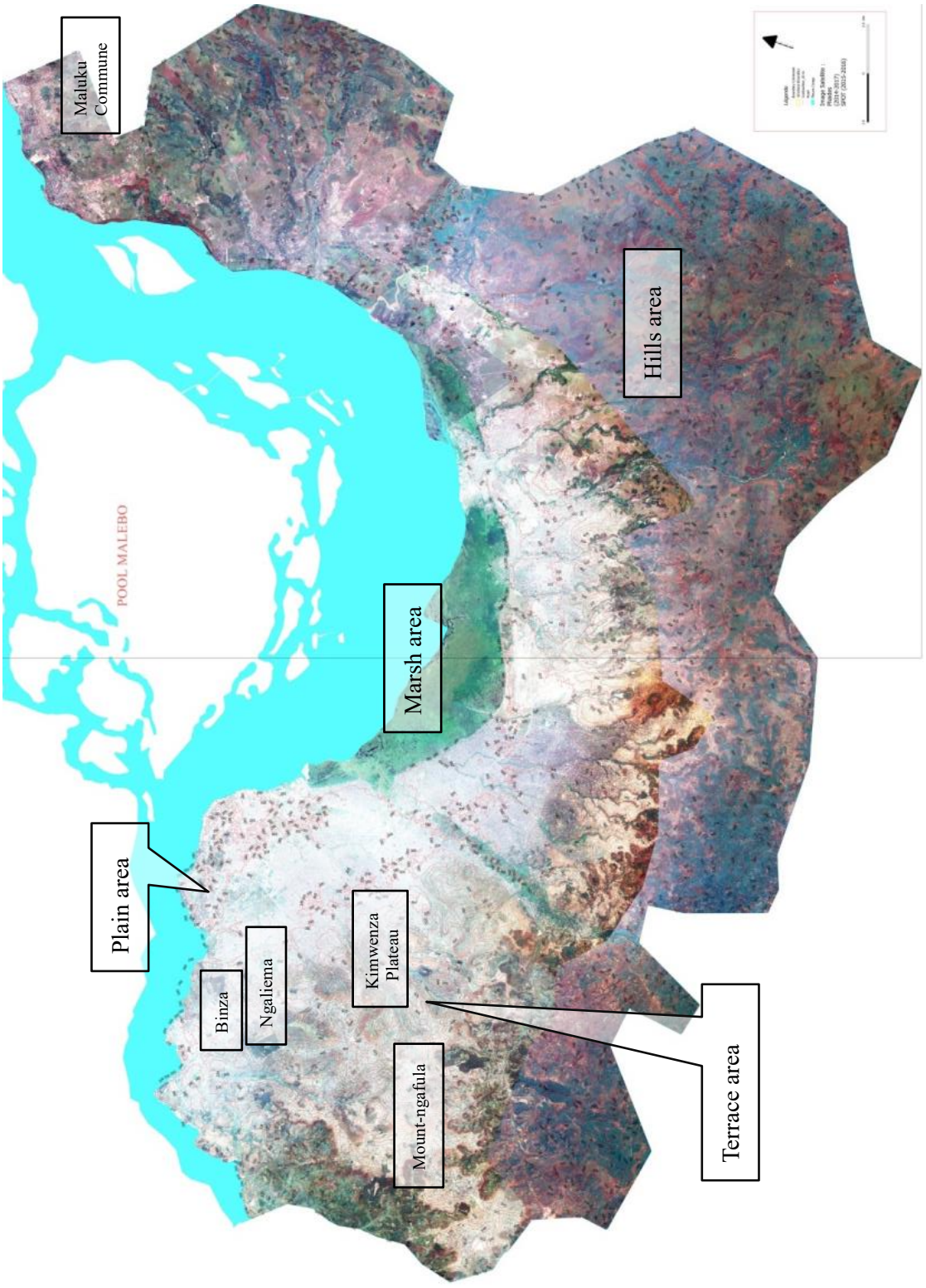
(1) Geological and topographical characteristics

The topography of the Study Area is described in Figure 2.1.2. Kinshasa City is located on a contrasted topographic site and is composed of a marshy and alluvial plain varying in altitude from 275m and 300m; hills with altitudes ranging from 310m to 370m consisting of the Mount-ngafula, Ngaliema, Amba hills; and the plateaus of Kimwenza and Binza.

The topography of Kinshasa City is characterized by:

- The Pool Malebo which is a vast lake-like widening of the Congo River dotted with islands and islets located between Kinshasa City and Brazzaville. It is about 35 km long, 23 km wide and 500 km^2 in surface area.

- The Plain of Kinshasa City which is exposed to serious problems generated by the lack of an efficient drainage system. This area extends over nearly 20,000 hectares, from the commune of Maluku at the East to the foot of the Ngaliema hills at the West. The soil is composed of a layer of low sandy alluvial masses located at an altitude between 225m to 260m with an average depth of around 10km.
- The terrace which is a set of low hills (10 to 25 metres) surrounding the plain is located in western part of the province between N'djili and Mont-ngafula. The soil is similar to the plain area. It is composed of soft sandstone deposit mixed with silica and is covering a layer of yellow clay and is covered by a brown silt layer.
- The hills are exposed to erosion and river disasters accelerated by human activities such as agriculture and deforestation.

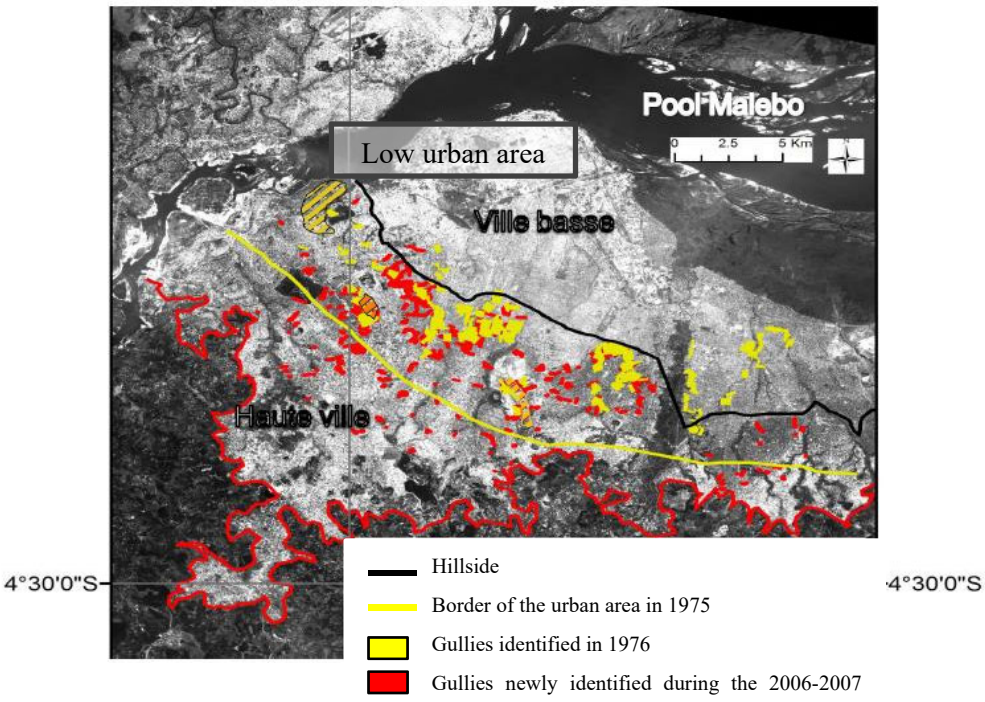


Source: The Study Team

Figure 2.1.2 Topography of the Study Area

(2) Erosion and Flooding Disasters

Due to the sandy nature of the soil, land coverage and lack or degradation of drainage and rainwater collection systems, Kinshasa City is highly susceptible to gully erosion (e.g. soil erosion generated by running water) as shown in Figure 2.1.3.



Source: Fils Makanzu Imwangana, Kinshasa en proie à l'érosion en ravine: inventaire cartographique et impact socioéconomique (presentation file_figure3.Urbanisation et risques d' érosion dans la haute ville (1975-2007))

Figure 2.1.3 Map on the Evolution of Erosion in Kinshasa (Prepared by the University of Kinshasa)

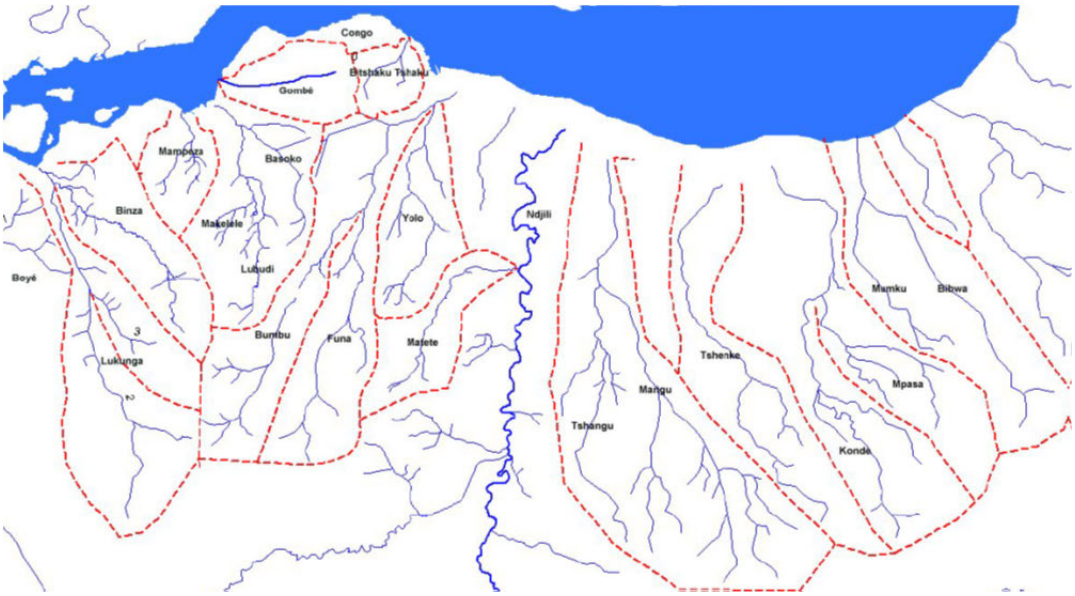
The hydrological network includes the Congo River and its main tributaries on the southern bank, which for the most part cross the province from south to north as shown in Figure 2.1.4.

Kinshasa City has suffered from many floods in the past and the risk of inundation in the densely populated districts of Funa and Lukunga is high because of the Kalamu River. The main causes[4] of flooding in Kinshasa City are said to be the following:

1) Meteorological phenomena such as El Niño
2) Heavy rains in Kinshasa City and areas upstream
3) Urbanization changing the soil coverage (e.g. discharge conditions)
4) Insufficient and degraded drainage systems

[4] Joseph- Dieudonné, Dr LUBOYA KASONGO MUTEBA(2002), Etude systémique du bassin versant de la rivière N'djili à Kinshasa

5) Uncontrolled or informal land use in valleys, especially in flood prone areas along the N'djili River
6) Uncontrolled land use in hill areas causing: a) sedimentation of the rivers resulting from erosion of upstream areas, and b) decreased vegetation on steep slopes
7) Increased solid waste disposal in rivers
8) Insufficient storm water collection facilities in hill and low areas (to avoid erosion)
9) Decreased vegetation throughout the entire area



Source: SOSAK (Strategic Orientation Scheme for the Kinshasa metropolitan Area)

Figure 2.1.4 Major Rivers

2.1.3 Environmental Issues

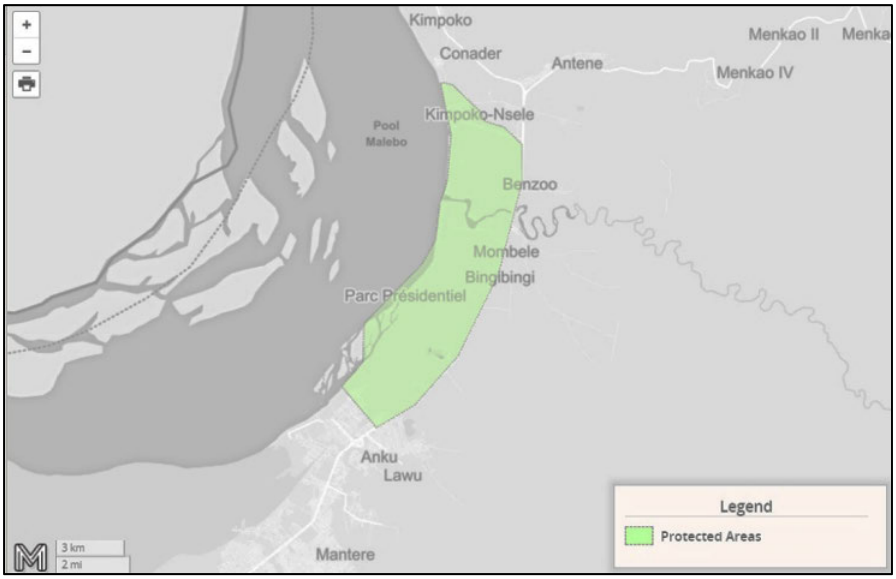
(1) Conservation Area in the Study Area

WWF is operating various conservation programs for the Congo Rainforest and Basin area. However, the areas targeted by WWF for conservation are located north of Kinshasa City but not inside the Study Area.

According to the Annuaire statistique 2014, p.297, there are 25 areas for conservation in the DRC (Democratic Republic of the Congo). Out of which, Parc Président Mobutu (de N'sele) and Réserve naturelle de Bombo-Lumene are located in Kinshasa City, and the former is located within the Study Area (Figure 2.1.5). The President Mobutu Park (*Parc Président Mobutu (de N'sele)*) was developed as a model farm for agriculture development in 1966, but was abandoned in 1991 and is currently used as a residential lot. Therefore, despite the fact that there may be restrictions on land use, the reasons for such designations may not always be for nature conservation.

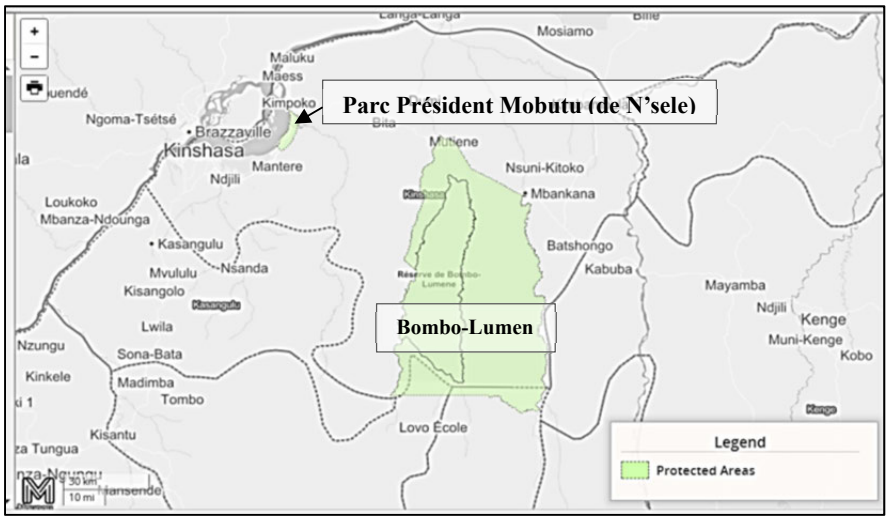
The Bombo-Lumene Nature Reserve was designated in 1976 and covers 3.5 km^2 of the south-east corner of Maluku Commune. Its northern border is located more than 30km from the border of the

Study Area (Figure 2.1.6).



Source:http://rdc.moabi.org/appui-a-l-implication-des-communuates-locales-dans-la-gestion-de-la-reserve-de-bombo-lumene-a-kinshasa/fr/#9/-4.6421/16.0236&layers=moabi_protected

Figure 2.1.5 Detailed Location of the Parc Président Mobutu (de N'sele)



Source:http://rdc.moabi.org/appui-a-l-implication-des-communuates-locales-dans-la-gestion-de-la-reserve-de-bombo-lumene-a-kinshasa/fr/#9/-4.6421/16.0236&layers=moabi_protected

Figure 2.1.6 Location of Nature Reserves

(2) Pollution

By visual observation, the major sources of air pollution in Kinshasa City include vehicle exhaust, earth dust from unpaved roads and ground surface, smoke from unregulated waste burning, and smoke from waste collection points. Also, charcoal and firewood used for cooking are domestic sources of air pollution. As for water pollution, sewage treatment is largely non-existent. Domestic kitchen and bath waste water and rain water flows into open ditches in alleys then flows into open

or covered ditches along main roads. Where the ditches along the main road are filled with earth and garbage, the water freely flows over the road surface. Rivers that receive the waste water flow slowly and show few signs of aquatic life, except for occasional plant clusters in or near water (Figure 2.1.7).

	
Domestic waste water flowing into road right-of-way	**River and waste water on road**

Source: The Study Team

Figure 2.1.7 Rivers and Waste Water Ditches

(3) Waste Management

Two landfill sites, one in the east and one in the west, are in operation in Kinshasa City.

Waste and recyclable collectors are commonly seen on streets. The volume of waste generated, however, surpasses the capacity of collection. Piles of waste are seen in front of every market, where fresh vegetables and fish often sit side-by-side with the waste.

Waste collection centres are located on major roads at regular intervals. All the waste centres observed were found to be full, and it appears that the small capacity of waste trucks to collect and transport waste to the landfill sites is the most serious bottleneck in Kinshasa City's waste management system.

Dirt and waste in roadside ditches is cleaned by workers. A survey is underway to assess governmental resources and capacity (manpower, budget, etc.) to accomplish this work, as well as to coordinate waste collection.

2.2 Existing Social and Economic Conditions

2.2.1 Population in Kinshasa City

(1) SOSAK and INS Estimates

SOSAK estimated the benchmark population in 2013, based on the registered number of people for election (2005) and its distribution ratio of age eighteen years old and over, which is derived

from MICS (Multiple Indicator Cluster Surveys by UNICEF 2001). This population estimated by SOSAK shows a lower than the population estimated by INS as shown in Table 2.2.1.

Table 2.2.1 Estimated Population by SOSAK and INS

Year	SOSAK (based on registered pop. For election)	SOSAK*1	INS *2
2000		6,200,000	6,062,000
2005	6,344,280		7,255,000
2010			8,683,000
2013		8,200,000	10,558,000
(2015)			(11,575,000)*3

Source: The Study Team

*1 SOSAK DEFINITIF S4, P35

*2 Annuaire statistique 2014 (INS + UNDP), July 2015

*3 INS estimates the population in 2015, based on the statistics in the previous years

The smaller number of registered people for the election in 2005 is considered attributable to the reason that the registration procedure for election in DRC requires electors to go to the administrative office and it takes a long time waiting at the office and many people, such as the old aged and migrants are supposed to be out of registration procedure. Therefore, the SOSAK estimate tends to be smaller than the real population number.

The Study Team evaluated the reliability of estimating process made by the respective sources of population estimates and consistency of data in the past and continuity of that in future. Finally, the Study Team adopted the 2013 benchmark population and 2015 population estimate made by INS as follows:

- Population of Kinshasa in 2013: 10,558,000
- Population of Kinshasa in 2015: 11,575,000

The estimated population for the whole of DRC and Kinshasa City are available from such sources as INS, the UN Population Division and SOSAK, which indicate that the population growth rates of DRC and Kinshasa City differ about 1% per year on average.

Since the UN estimates the annual population growth rate of the whole DRC as 2.94% (low variant) to 3.24% (high variant) for the years of 2015 to 2020, an average growth rate of population in Kinshasa City was assumed to be 3.94% (low variant) to 4.24% (high variant) between 2015 and 2017.

As a consequence, the population of Kinshasa City in 2017 was estimated at 12,505,000 (low variant) to 12,577,000 (high variant). The Study, for the moment, takes these estimates as the 2017 benchmark population of Kinshasa City.

(2) Population by Commune

In order to estimate the population by commune, INS conducted counting surveys in sample areas, and then estimated the population in other remaining areas.

(3) Population Growth Rate by Commune

Since INS has estimated the commune population in Kinshasa City of 2004 and 2013, the Study examined each commune's recent population growth rates, population density, features of land use changes and their spatial conditions; and eventually, estimated the commune population in 2017 for Kinshasa City as presented in Table 2.2.2.

Table 2.2.2 Estimated Population by Commune in Kinshasa City, 2017

Group of Commune	Name of Commune	Population (2013)	Estimated population growth 2013 to 2017	Estimated Population (2017)	Estimated Population density (2017) (persons/ha)
Residential Area	Gombe	70,594	3.40%	80,696	65.56
	Limete	435,720	1.70%	466,113	163.98
	Ngaliema	977,485	4.10%	1,147,924	179.52
Old City	Kintambo	152,918	4.10%	179,581	455.39
	Barumbu	165,720	1.00%	172,449	388.19
	Kinshasa	152,778	0.00%	152,778	494.36
	Lingwala	129,439	3.50%	148,534	538.66
New City	Ngiri-ngiri	167,019	0.00%	167,019	572.61
	Kasa-vubu	114,152	0.00%	114,152	297.51
Planned City	Kalamu	287,045	0.00%	287,045	480.93
	Lemba	449,429	3.00%	505,836	350.28
	Matete	330,177	1.00%	343,584	715.31
	Bandalungwa	322,313	3.00%	362,766	515.81
	N'djili	578,411	3.00%	651,007	697.29
Southern Suburbs	Ngaba	258,057	2.00%	279,329	977.87
	Selembao	418,925	3.00%	471,504	238.94
	Bumbu	536,018	0.00%	536,018	1,179.62
	Makala	304,615	2.00%	329,725	639.49
Urban Periphery	Kisenso	514,565	3.00%	579,147	372.22
	Masina	897,980	4.50%	1,070,858	235.17
	Kimbanseke	1,407,437	4.50%	1,678,395	254.36
	Mont-ngafula	487,722	10.00%	714,074	15.65
	N'sele	527,305	10.00%	772,027	8.10
	Maluku	872,175	10.37%	1,294,439	1.45
Total		**10,557,999**	**4.32%**	**12,505,000**	**11.72**

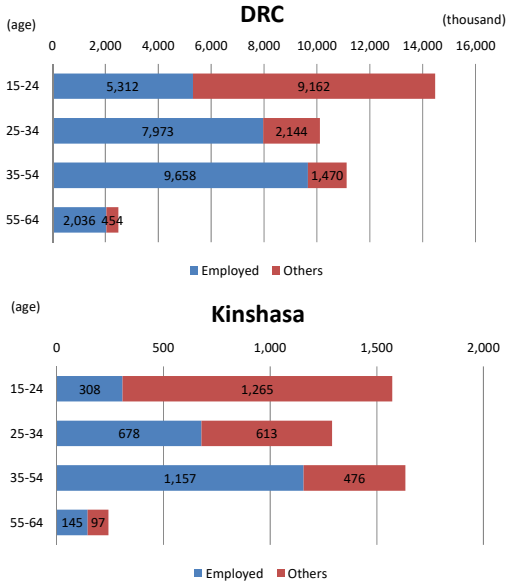
Source: The Study Team

2.2.2 Employment Conditions

The government has a plan to enforce the policies to promote investment in both the private and public sectors to develop economic activity and achieve more employment and income growth.

The survey by INS shows that in the DRC in 2012, out of the population between 15-64 years old of 38.2 million, 65% are employed and 35% are others including unemployed, housewives and

students, etc. as shown in Figure 2.2.1. In Kinshasa City in 2012, out of the population between 15-64 years old of 4.7 million, 48% are employed and 52% are others. Kinshasa City records show a lower employed ratio than DRC, and this is assumed to be due to the higher education enrolment in Kinshasa City between the ages of 15-24.



DRC (2012, thousand)	
Population between 15-64	38,208
(Employed)	24,979 (65%)
(Others)	13,230 (35%)

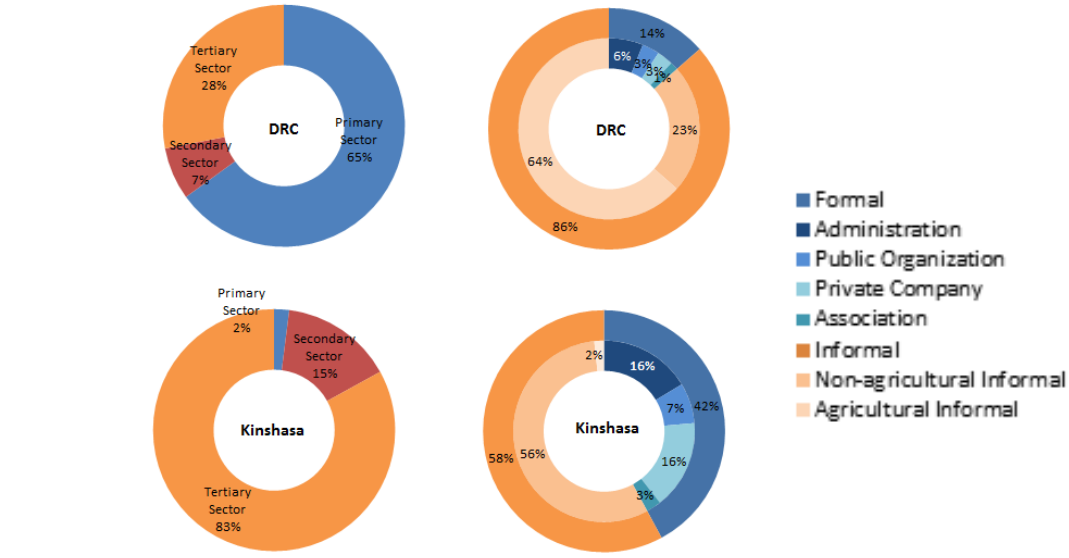
Kinshasa City (2012, thousand)	
Population between 15-64	4,739
(Employed)	2,288 (48%)
(Others)	2,451 (52%)

Source: INS

Figure 2.2.1 Number of Employment in DRC and Kinshasa City

By classifying employment by industry, in DRC, agriculture is the main economic activity mainly in rural areas, occupying about 65% of the working population as shown in Figure 2.2.2. The lack of infrastructure such as a network of rural roads and storage is one of the reasons for the low yield which cannot help them transfer to manufacturing or service sectors. In DRC, the informal sector occupies 86% of the total employment, of which 23% as non-agriculture informal and 63% as agriculture informal.

In Kinshasa City, the tertiary sector occupies 83% of the total employment, with 2% primary and 15% secondary. Divided by the type of organization, about 58% of the employment is working in the informal sector including non-agriculture and agriculture, and about 42% of the employment is working for the formal sector.



Source: INS

Figure 2.2.2 Employment by Industry and Formal/Informal Structure

2.2.3 Economic Conditions

(1) GDP/GRDP

The DRC has achieved high economic growth for the past ten years driven mainly by the mining, transportation and telecommunication sectors. The average real Gross Domestic Product (GDP) growth rates between 2007 and 2016 were recorded at 6.4% and the GDP per capita was USD 430.9 in 2016. Despite the average high growth, the real GDP growth rate contracted from 6.9% in 2015 to 2.4% in 2016 due to the deterioration of the international commodity prices. The slowdown of the economic growth caused the decline in exports and reduction of the national income. However, with the anticipated rise in the country's raw material prices, the economy is expected to rise again by 4.0% in 2017 onwards.

In Kinshasa City, the average real Gross Regional Domestic Product (GRDP) growth rates between 2007 and 2016 was recorded at 7.1%, driven mainly by the transportation and telecommunication sectors, the growth rate is higher than the national average. The GRDP per capita of Kinshasa was USD 766.2 in 2016.

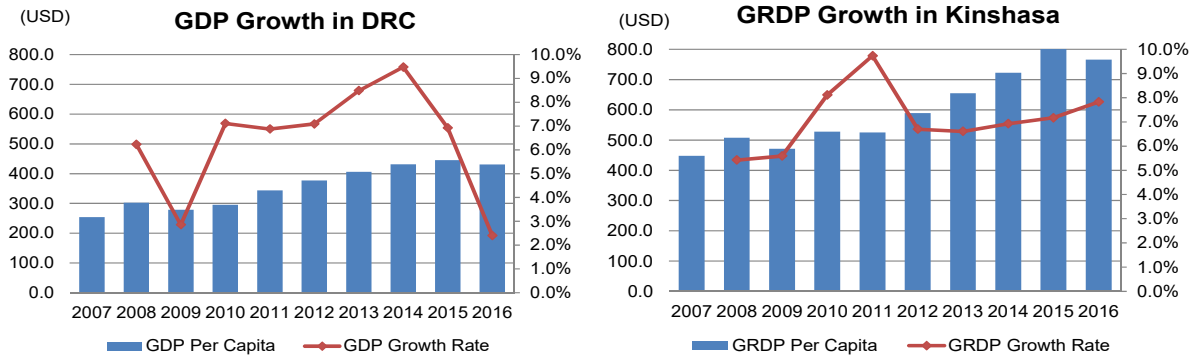
(2) GDP/GRDP by Sector

In the GDP composition by sector, the economy is composed by the primary sector for about 40%, the secondary sector for about 20% and the tertiary sector for about 40%. The main drivers of growth have been trade, transport and telecommunication, and extraction, mainly mining.

In Kinshasa City, the tertiary sector is the main source of growth which contributes about 70% of the total GRDP, mainly driven by the transport and telecommunications through the improvement of ways and means of communication.

The importance of manufacturing industries is less significant due to lack of production facilities,

their limited ability to use new technologies and less competitiveness in global competition. The secondary sector is expected to play a role of bridge between the primary and tertiary sectors. The DRC is expected to have a coherent industrial policy to expand its creation of a value chain.



Source: INS

Figure 2.2.3 GDP Growth of the DRC and Kinshasa City (2007-2016)

Table 2.2.3 GDP by Sector in 2016

2016	DRC	Kinshasa
Primary Sector	**39.6%**	**8.9%**
Agriculture, etc.	20.5%	8.5%
Agriculture	19.8%	8.2%
Forestry	0.7%	0.3%
Breeding, Hunting, Fishing	0.0%	0.0%
Extraction	19.1%	0.4%
Secondary Sector	**23.7%**	**17.7%**
Manufacturing	20.2%	14.9%
Food, beverage and tabacco industry	17.5%	13.4%
Other manufacturing	2.7%	1.5%
Construction and public works	0.9%	1.0%
Electricity, gas, steam and water	2.6%	1.8%
Tertiary Sector	**37.5%**	**72.0%**
Trade, Transport and Telecommunications	23.6%	50.4%
Other services	8.0%	3.6%
Public administration services	5.9%	18.1%
FISIM	-0.8%	1.4%
TOTAL	**100.0%**	**100.0%**

Source: INS

2.3 Existing Land Use and Urbanization of the Study Area

2.3.1 Existing Land Use of the Study Area

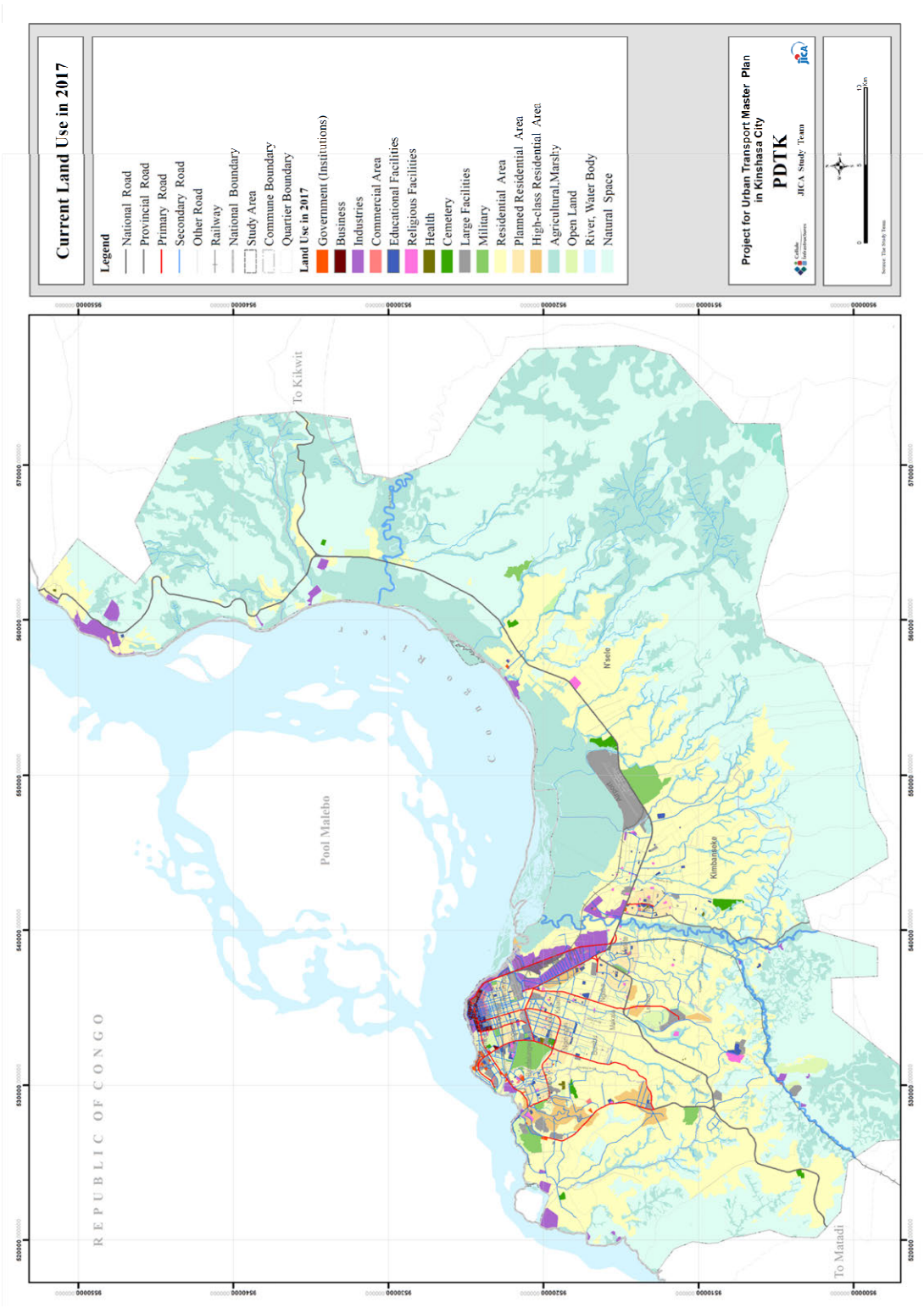
For the preparation of current land use drawing, the study referred to the following materials.

- Satellite photo of the Study Area (2014-2017): It is mostly used for identifying the urbanized area and large scale building sites.
- Result of building use survey conducted by the Study for the central six communes: A field survey for identifying building condition and building use.
- Result of site visit observation
- Land use map by SOSAK as reference
- Other published street maps for commercial use

Referring to the above mentioned materials, the Study prepared a land use map of the Study Area as presented in Figure 2.3.1.

Despite historical efforts to restructure the urban spaces of Kinshasa, the urban space of Kinshasa shows a mono pole structure. There are the sole strong commercial and business centre in Gombe, and the industrial agglomeration in Limete.

In its long history, in order to avoid over-concentration in the centre of the city, several plans were proposed as the solution. But these plans have not been implemented as planned, and the urban space was expanded with mixture of a residence, commercial, business and industrial land use and building use.



Source: The Study Team

Figure 2.3.1 Existing Land Use of the Study Area in 2017

2.3.2 Urbanisation and Land Use Changes

The analysis of the urbanization trend and land use changes aims at assuring the population and employment estimated for 2017 by the Study Team, which could only be based on the INS statistical data up to 2015 at the most. Figure 2.3.2 shows land use changes in the Study Area between 2006 and 2017. The general trend of land use changes is described as follows:

- Redevelopment

Redevelopment areas are observed mostly in the western part of the Study Area. Most of the redevelopment activities are small scale reconstruction, such as demolition of lower buildings and reconstruction of medium and/or high rise buildings.

These changes are observed frequently along arterial roads and important roads in the communes. The redevelopments with improvement of roads are executed in some communes.

- Densification

Migration and the densification had progressed in former peripheries of urbanised areas of 2006. These changes are observed in edge of the slope in the south, and in N'sele Commune, which was the eastern end of urbanisation in 2006.

In the military camp near the centre of the urbanized area, the construction of small scale housing and barracks are observed to be constructed within these ten years.

- Change of Land Use

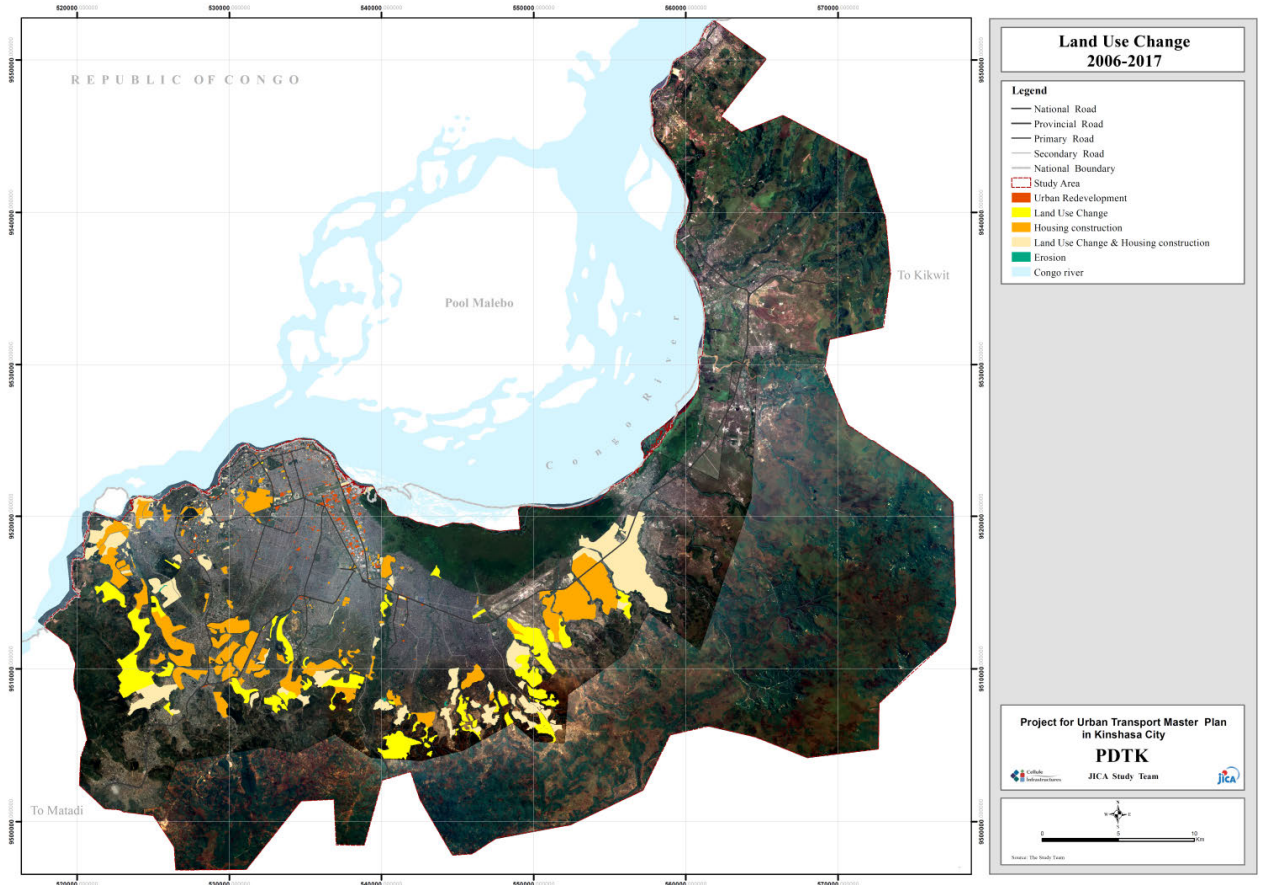
The land use changes were observed in former agricultural fields and forest areas which neighbour the urbanized areas of 2006. These areas are watched in surrounding area of the former urbanized area in Mont-ngafula, Kimbanseke and N'sele Communes.

And progress of developments housing sites on the river bank and corresponding housing site development, such as of N'djili river, has also progressed.

- Change of Land Use with Housing Construction

These urbanized areas are observed in adjacent areas of the areas, which had been developed in 2006. These areas are located along arterial roads and trunk roads, and have good access to the core area of each commune.

In recent years, the development in the suburbs of Mont-ngafula, Kimbanseke, and N'sele has notable huge urbanized areas.



Source: The Study Team

Figure 2.3.2 Land Use Changes in Study Area between 2006 and 2017

CHAPTER 3 Current Transport Systems and Issues

3.1 Current Road Network Conditions

3.1.1 Road Network in Surrounding Study Area

(1) International Road Network

DRC is connected with such international road networks as the Trans-African Highway (TAH) which consists of nine main corridors with a total length 5,450 km; Sub-Sahara Africa Transport Policy Programme (SSATP) Transport Corridors, of which Matadi-Kinshasa-Bumba-Kisangani Corridor is corresponding with RN 1 in Kinshasa City; and the Southern African Development Community (SADC) Regional Corridors.

(2) Road Comparison in COMESA

According to the statistics published by The Common Market for Eastern and Southern Africa (COMESA):

Road Network Density (RND) of DRC in COMESA is just 0.07 km/sq. km for all roads and 0.00 km/sq. km for paved road.

A road length in COMESA is just 2.6 km/1,000 people.

Compared to the member countries of COMESA, DRC is relatively less developed in terms of unit density and length of the nationwide road network.

(3) Road Network and Classification in DRC

The total road network of the DRC is approximately 153,200km in length and comprised of the roads managed by the following authorities:

- Approximately 58,100km (38%) of national and provincial roads, supported by the Ministry of Infrastructure, Public Works and Reconstruction (MIPTR), under the management of the Road Agency (OR);
- Approximately 7,400km (5%) of urban roads under the management of the Office of Roads and Drainage (OVD);
- Approximately 87,700km (57%) of local roads or agricultural roads to be managed by the Ministry of Rural Development, under the management of the Directorate of Agricultural Roads (DVDA).

(4) OR Roads

The total length of roads managed by OR is 58,149km, which consists of 20,683 km of national and 37,466 km of provincial roads.

In 1990, the MIPWR has defined a practicability priority network of 30,788 km and which accounts for 53% of all the OR roads (58,100 km as shown in Figure 3.1.1) to fulfil the following main features:

- It focuses on the three main transport corridors; namely, West - Northeast, North - South and West - Southeast; linking the provincial capitals and the main administrative centres;
- It accounts for more than 90% of road traffic;
- It joins the railway and river network;
- It serves all areas with high economic potential and population density;
- It includes the main routes of regional integration.

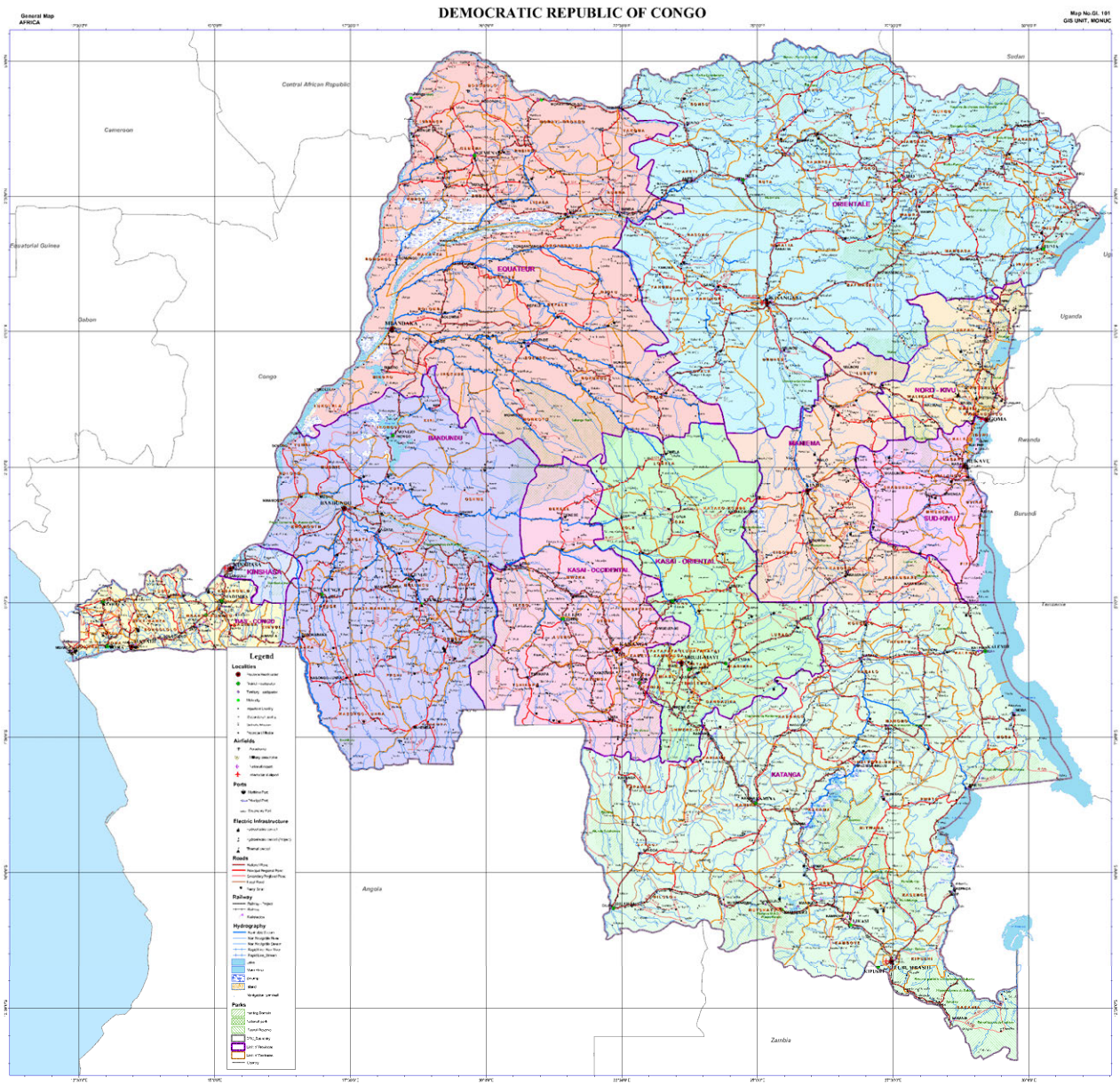
(5) OVD Roads

According to the "IDENTIFICATION AND CLASSIFICATION OF COATED ROADS IN KINSHASA, 1986", the network of roads under the management of the OVD are divided into four categories as shown in Table 3.1.1.

Table 3.1.1 Road Classification by OVD

Classifications	Definitions
Primary Road Network	− Great roads of penetration, clearing and bypass of the city centre, − Wide cross-sections of the city, − Roads in the centre of the village, especially around the market, in the shopping centre and in the administrative centre, − Main access roads to major administrative entities, − Various utility junctions.
Secondary Road Network	− "Major" roads giving access to the primary network or evacuating it to major administrative entities, − relief roads of the primary network, − Roads currently used by public transit vehicles, − Roads of public interest.
Tertiary Road Network	− Complementary roads of the mesh of the secondary network for a better service of the districts, − Secondary network relief routes, − Roads from the urban centre.
Local Road Network	− Rather, they are roads and lanes for access to houses, residential units and are not, in general, roads classified in the first three categories. − The local road network is of more interest to local residents. It is characterized by large pedestrian traffic, a light car park at night, the low traffic speed and the narrowness of the streets.

Note: excluding private roads. Source: Identification and Classification of Coated Roads in Kinshasa, 1986, OVD



Source: OR

Figure 3.1.1 National Road Network in DRC

3.1.2 Road Network in Kinshasa City

(1) Composition of Urban Roads

A total length of roads managed by OR and OVD in Kinshasa City is 3,621km, comprised of 251km of OR road network (7 %) and 3,370km of the OVD road network (93 %).

The road network of the OVD consists of 69.67km of Primary Road Network (2.1 %), which is more than 4-lane road, 337.56km of Secondary Road Network (10.0 %), 277.77km of Tertiary Road Network (8.2 %) and 2,685km of Local Road Network (79.7 %).

(2) General Conditions of the Road Network in Study Area

Existing road conditions in the Study Area are generally characterized by the areas as shown in Figure 3.1.2 through Figure 3.1.5 and explained as follows:

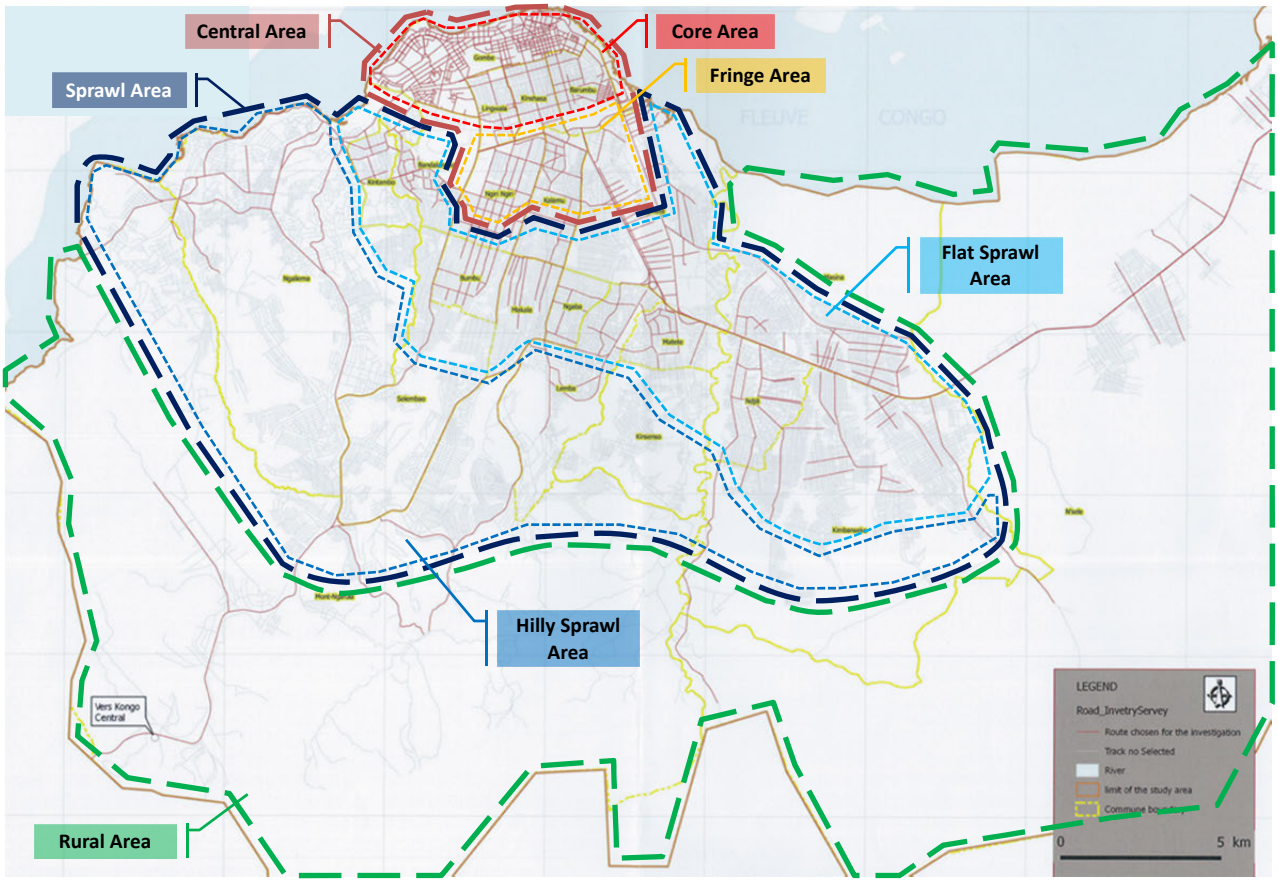
a) Central Area

As it was mentioned before, the road network in central Kinshasa City is rather dense and laid out on a grid in accordance with the Local Development Plan (PLA) in 1967. The road network, therefore, looks systematically well-developed and seems to have a road hierarchy. Also, this area is divided into two categories depending on the functions; namely, the one is the core area such as Gombe, Lingwala, Kinshasa and Barumbu Communes and the other is the fringe area such as the northern parts of Ngiri-ngiri and Kalamu Communes.

In the core area, road surface types are mainly paved and the surface conditions are rather better due to good road maintenance. The pipes of water supply buried under road pavement, however, are torn, water stains are on road surface and causes the destruction of roads in many places. On the other hand, the surface types in the fringe area are paved for main roads and unpaved for minor roads. The paved main roads, however, are deteriorated, with a lot of potholes and peeled surface due to insufficient road maintenance.

b) Sprawl Area

After independence from Belgium, the road network has been developed in disorder without any plan to accommodate the population growth. The area spreads to the peripheral of the central area excluding the north and the due east area due to the geographical constrain of the Congo River. Also, this area is divided into two categories depending on the terrain; namely, the one is the hilly sprawling area in the south of the central area such as Ngaliema, Selembao, Lemba and Kisenso Communes and the another is the flat one in the South and East of the central area such as Bumbu, Makala, Ngaba, Matete, N'djili and Kimbanseke.



Source: The Study Team

Figure 3.1.2 Existing Road Network by Areas within the Study Area

30 JUIN BLD. in Core Area

GAMBELA in Fringe Area

TABU LEY in Core Area (Water Leak)

KATANGA in Fringe Area

Source: The Study Team

Figure 3.1.3 Photos in Central Area

At first glance, the road network in the flat area looks dense and is laid out in a grid. It is, however, a long and narrow grid. And, the road hierarchy seems to consist of two classes; namely, main and minor roads; also, the intervals of the main roads aren't arranged suitably. Especially, the main roads in the east-west axis are less, compared with the north-south axis. Moreover, the roads are cut off at many places by rivers and streams. On the other hand, the road network in the hilly area is developed depending on the topography and is disconnected by valleys and steep slopes. It looks that many small clusters made by minor roads hanging on to a main road which is limited and passes on the ridge of hills.

The surface types in the sprawl area are paved for the main roads and unpaved for minor roads, the same as those in the fringe area. The roads in the flat area, however, are often destroyed by rivers and streams or have huge holes in many places and it is difficult to pass through them, even in the dry season. On the other hand, the roads in the hilly area keep better than the flat ones. Several main routes, however, are deteriorated, such as the by-pass.

UNIVERSITE in Flat Sprawling Area

LIBERATION in Hilly Sprawling Area

ELENGESA in Flat Sprawling Area

BY-PASS in Hilly SprawlingArea

Source: The Study Team

Figure 3.1.4 Photos in Sprawl Area

c) Rural Area

This area is located at the far side of the sprawl area such as Mont-ngafula, N'sele and Maluku Communes. This area basically consists of a ribbon-developed area and small town area. The road network in this area, therefore, is undeveloped and coarse.

The surface types in the rural areas are paved for national roads and unpaved for other roads. The surface conditions for national roads are good to ordinary. On the other hand, the surface conditions for other roads are ordinary to bad.

Lumumba in Rural Area

RN43 in Rural Area (Maluku)

Source: The Study Team

Figure 3.1.5 Photos in Rural Areas

3.1.3 Issues on Road Development, Maintenance and Management and Drainage

(1) Issues on Road Development

Through the review of the current situation involved with the road development, the issues are summarized as follows:

- Poor Road Network
- Disrepair of the Existing Roads
- Budget Shortage and Low Capacity for Road Development

(2) Issues on Road Maintenance and Management

- Shortage of Construction Equipment for Road Maintenance
- Insufficient Budget for Road Maintenance

(3) Issues on Drainage and Discharge Capacity

- Insufficiency of Data to Adequately Assess the Capacity of the Actual Drainage System
- Insufficient Budget for Drainage System Maintenance

3.1.4 Issues on Traffic Safety, Control and Management

General issues in ensuring traffic safety, improving traffic control and management are identified and summarized as follows:

(1) Issues in Ensuring Traffic Safety

- Evidence based approach - identifying places with frequent traffic accidents and their causes
- Enhancing education regarding an awareness of traffic safety
- Inadequate traffic signals at locations with a high risk for traffic accidents
- Maintaining traffic discipline

- Improving non-motorized traffic facilities
- Road safety audit for existing and new roads

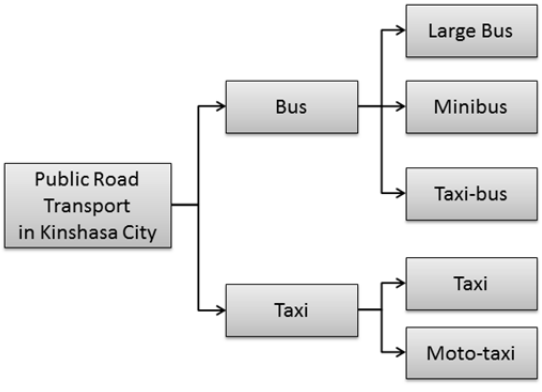
(2) Issues in Relieving Traffic Congestion

- Poor road conditions with irregular maintenance
- Road network with limited connections
- Lack of maintenance of traffic signals and inflexible signal phasing/cycle
- Lack of proper enforcement and traffic control
- Inadequate parking policy and management, including policy and management regarding stopping vehicles
- Lack of planning and coordination between land use and transportations

3.2 Public Road Transport

3.2.1 Modes of Public Road Transport

The modes of public road transport can be categorized as large buses, minibuses, taxi-buses, taxis, and moto-taxis. Some of the large-sized buses and minibuses are operated by public enterprises, while most of the remaining services are owned or run private companies or individuals as shown in Figure 3.2.1.



Public Enterprise	Private Company /Individual
Transco New TransKin	-
New TransKin Transco	Esprit de Vie
-	HiAce Combi Esprit de Mort
-	Ketch
-	Wewa

Source: The Study Team

Figure 3.2.1 Outline of Public Road Transport in Kinshasa City

Buses can be classified into three types; large bus, minibus and taxi-bus. Large buses with 40 to 50 seats are mainly operated by TRANSCO, a public enterprise, while the minibuses with 29 seats are mainly operated by New TransKin, another public enterprise, and by individuals who operate private minibuses known as Esptit de Vie (Sprit of Life). On the other hand, taxi buses with about fourteen seats known as Hiace, Combi and Esprit de Mort (Sprit of Death) are owned and operated mainly by individuals.

3.2.2 Public Road Transport Organization

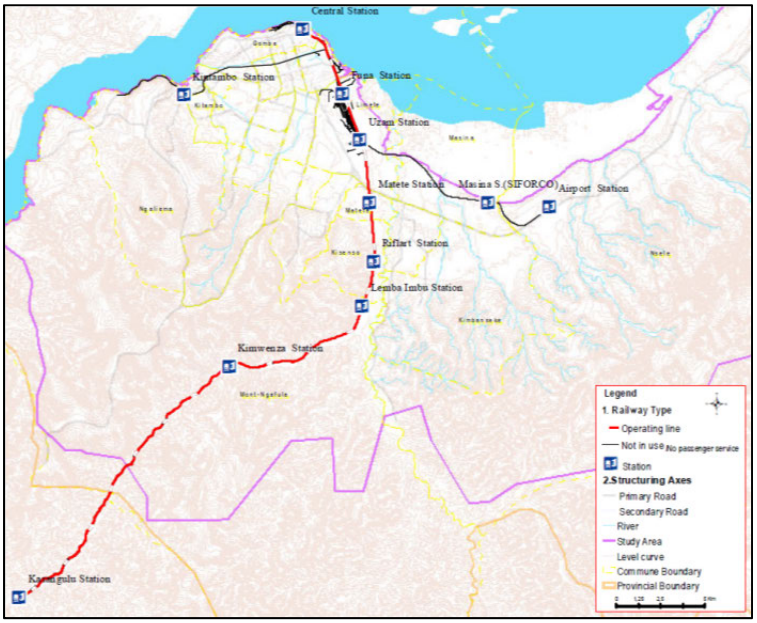
There are two public bus companies in Kinshasa City: Transco and New TransKin. APVCO is the association for owners of public buses purchased from the national Government. Similarly, ACCO and ANIPTMC are the association for professional drivers for private vehicles including the taxi and buses, and association for moto-taxies, respectively.

3.3 Railway

3.3.1 Railway Operation and Network

The railway is currently operated by the SCTP (*Société Commerciale des Transports et des Ports* / Commercial Society of Transport and Ports) between Matadi and Kinshasa City and also operates an urban railway service from Kinshasa to Kasangulu.

The only urban railway line currently under operation is the line from Kinshasa Central Station toward Kasangulu, located around 45km from the Central Station, via Kimwenza, located around 23km from the Central Station, sharing the same track with the Matadi-Kinshasa railway while the railway lines to Kintambo and N'djili airport are not in operation in 2018. The line to N'djili Airport has stopped operation since 18th September, 2015 due to financial problems while the line to Kintambo terminated the train operation in 2007. The railway network around Kinshasa City is shown in Figure 3.3.1.



Source: The Study Team based on the interview survey with SCTP and GIS data from CI in 2016

Figure 3.3.1 Urban Railway Network in Urbanized Kinshasa City

3.3.2 Train Operation and Transport Demand

Due to a limitation in the number of locomotives, the only operated trains for the urban area of Kinshasa City is I41 from Kasangulu to Kinshasa in the morning and I48 from Kinshasa to

Kasangulu in the evening with one locomotive and eight passenger wagons. In 2018, trains are operated only during weekdays.

The daily average number of passengers for a weekday is approximately 1,600 as of 2017. In general, the number of passengers is holding a declining trend due mainly to the abandonment of railway lines to Kintambo and N'djili Airport. In addition, the number of passenger urban railway service to Kasangulu is also declining.

Transported cargo volume by the entire Railways Department is also in a declining trend since 2006. The transported cargo volume in 2016 was approximately 56,000 tonnes. Major imported items are general cargo, malt, flour and salt while major exported items are wood logs and wood products.

The current urban railway service with one round trip of operation per weekday is far away from the modern urban transport system of other metropolitan areas in the world. Problems are observed in almost all aspects such as train operation, passenger demand, finance, infrastructure and rolling stock and institutional aspects. In order to function as a part of an urban transport system, significant policy intervention is required.

3.4 Riverboats, Ports and Airports

3.4.1 Maritime Ports

Although Kinshasa City does not face the ocean, a significant amount of goods are transported from three maritime ports at Matadi, Boma and Banana. Along with the rapid economic growth of the nation as well as the capital of Kinshasa City, the cargo handling volume of the three major maritime ports in tonnes show a significant increase over last fourteen years. The volume of 2015 exceeded 3 million tonnes per year which is around 2.5 times compared with 2002.

In addition to overall cargo handling volume in tonnes, container handling volume at Matadi Port is drastically increasing since 2006. The handling volume was doubled in a decade. It reached approximately 170,000 TEU (Twenty-foot Equivalent Unit) in 2016.

3.4.2 Kinshasa Port and Fluvial Transport

Despite the rapid increase of cargo handling volume at three maritime ports, a declining trend is observed at Kinshasa Port since 2012, though it increased from 2006 to 2010. In terms of port operators, the share of private ports is significantly increasing. As of 2015, the share of private ports exceeded 90%.

The total container handling at Kinshasa Port including handling by vehicles, railways and fluvial transport was around 3,500 TEU in 2015. The total volume is around 3,000 to 4,000 TEU from 2009 to 2015 except for 2012. It is also noteworthy that container handling by river boat is significantly smaller than other modes of transport.

In addition to inland waterway transport in the DRC, international cargo is handled at Kinshasa Port. According to CICOS (International Commission of the Congo-Oubangui-Sangha Basin, *Commission Internationale du Bassin Congo-Oubangui-Sangha*), the cargo handling volume of the Kinshasa-Brazzaville route was around 371,000 tonnes per year as of 2012. The passenger

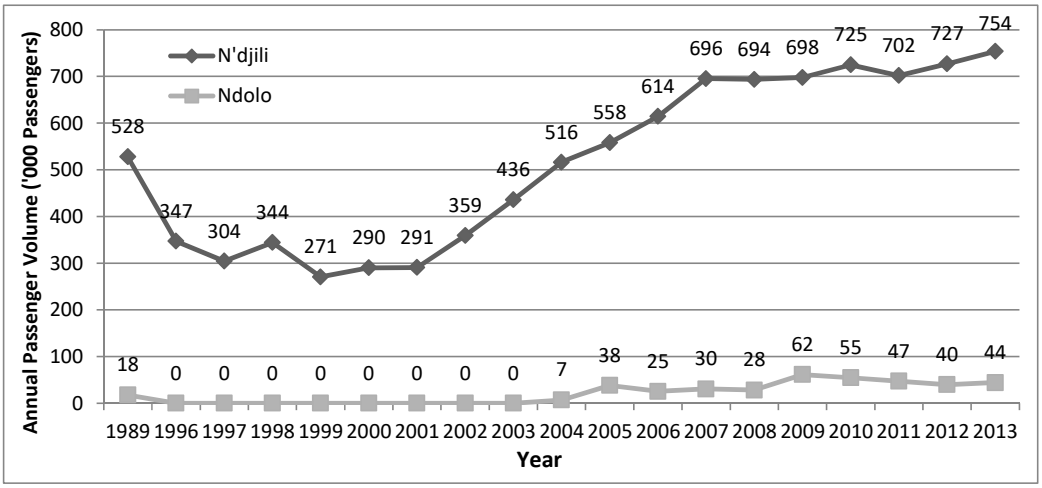
transport between Kinshasa City and Brazzaville is operated by two state companies on both banks. The departure and arrival of passengers at Kinshasa Port of the Kinshasa-Brazzaville route is operated by two state companies with over 810,000 passengers in 2012. In the Study Area, there are two major airports, N'djili International Airport and N'dolo Airport which is located in the city centre. The annual trend of aircraft movement, passenger and cargo demand of N'djili Airport are described in Section 3.4.3.

3.4.3 Air Transport

The aircraft movements of two major airports at N'djili and N'dolo located in the Study Area, in general in a declining trend as of 2013 despite a global trend of increasing aircraft movements due to low cost carriers. For further details, recent airport statistics are awaited. Comparing the two airports, the number of aircraft movements at N'dolo Airport is around 15% of that of N'djili.

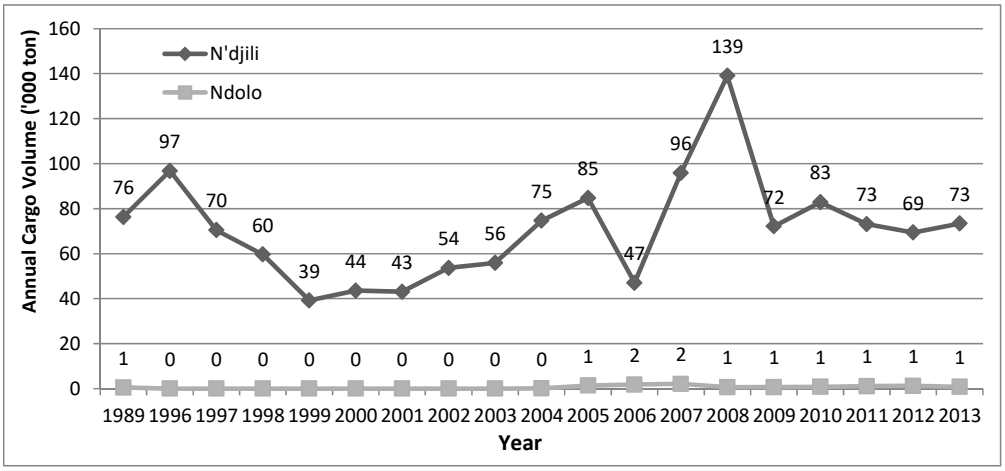
Apart from a slightly declining trend of aircraft movement, a significant increase of air passengers has been observed since 2001. Comparing N'djili and N'dolo Airports, the number of passengers of N'dolo Airport is almost 6% of N'djili Airport. This implies that the closure of N'dolo Airport for urban development, which is proposed in the SOSAK, might not give significant impact to N'djili Airport in terms of number of passengers.

Air cargo demand is, in general, also in an increasing trend except for fluctuation from 2006 to 2008. Together with passenger demand, further increase of cargo demand is also expected. The cargo handling volume of N'dolo Airport is much smaller than that of N'djili.



Source: "Service Statistique de la RVA" cited by "Annuaire statistique 2014 de la RDC", 2015

Figure 3.4.1 Annual Passenger Demand of Two Major Airports in Kinshasa City



Source: "Service Statistique de la RVA" cited by "Annuaire statistique 2014 de la RDC", 2015

Figure 3.4.2 Annual Cargo Volume of Two Major Airports in Kinshasa City

CHAPTER 4 Vision for Sustainable Spatial Development for 2040

4.1 Review of Existing Development Plans and Policies

4.1.1 PNSD (National Strategic Development Plan)

The DRC government is in a process of finalizing the PNSD (*Plan National Stratégique de Développement* / National Strategic Development Plan) for 2017 to 2021, the national vision for economic development by 2030. The government previously formulated the DSRP (*Documents de Stratégie pour la Réduction de la Pauvreté* / Poverty Reduction Strategy Paper) for 2002 to 2005, the DSCRP-1 (*Document de la Stratégie de Croissance et de Réduction de la pauvreté* / Growth and Poverty Reduction Strategy Paper) for 2006 to 2010, and the DSCRP-2 and the PAG (*Programme d'Appui à la Gouvernance* / Governance Support Programme) for 2011 to 2016. The PNSD 2017-2021 will be positioned as the follow up national plan of DSCRP-2 and PAG. The plans focused on the stabilization, reconstruction and the governance, and transferred to the importance of macroeconomic growth to accelerate employment. The main objectives of the three development plans are summarized in Table 4.1.1.

Table 4.1.1 The National Development Plans and the Objectives

(2002-2005) DSRP	(2006-2010) DSCRP-1	(2011-2016) DSCRP-2 & PAG
• Stabilization, transition and reconstruction • Three strategic pillars; 1) Restoration and consolidation of peace, 2) Macroeconomic stabilization, 3) Community dynamics	• Governance and the revival of pro-poor growth • Five strategic pillars; 1) Good governance, peace and institutional building, 2) Macroeconomic stability and growth, 3) Access to social services and reduction of vulnerability, 4) Fight HIV/AIDS, 5) Community dynamics	• Growth, employment creation and climate change impact • Four strategic pillars; 1) Governance and peace, 2) Economic diversification, growth acceleration and employment creation, 3) Improve access to basic social services and human capital, 4) Environment and climate change

Source: PNSD

To follow up the existing development plans, the pillars of the PNSD 2017-2021 will be: 1) Internalization of a new governance which implies a change of the attitudes, 2) Economic diversification and improvement of competitiveness, 3) Improving human development and social protection and 4) Fight against climate change and strengthening environmental sustainability.

For achieving the high economic growth, the PNSD will set the economic target indicators and action plans for the primary, secondary and tertiary sector shown in Table 4.1.2.

Table 4.1.2 Economic Target and Action Plan by Sector

Economic Target	Action Plan by Sector
• Achieving the status of middle-income countries by 2021, reaching the GDP per capita of USD 1,050.	• (Primary) Agriculture transformation, Increase agricultural productivity, and Develop agro-industrial parks (PAIs) and integrated development centres (CDIs) to attract capital investment in the agricultural sector
• Achieving the status of emerging countries by 2030, reaching the GDP per capita of USD 4,000.	• (Secondary) Intensive industrialization of the country, Create more locally added values and develop vertical and horizontal relationships, Establish industrial parks (PIs) in the country
• Joining the club of developed countries by 2050, bringing the GDP per capita of USD 12,000	• (Tertiary) Build knowledge society by investing in human capital accumulation and research & development, Build a set of science and technology parks (PSTs)

Source: PNSD

4.1.2 PDNIT (National Integrated Transport Master Plan)

PDNIT (*Le Plan Directeur National Intégré des Transports* / National Integrated Transport Master Plan) is being formulated by the Infrastructure Unit by contracting the joint venture of Louis Berger and SYSTRA with finance from AfDB. The PDNIT prepared an integrated national transport master plan for the whole of DRC.

The Project has three phases; Phase 1, analysis of transport integration (data collection and analysis); Phase 2, proposal and choice of actions; and, Phase 3, development of the master plan and sectoral policy of transports. The results of Phase 3 of PDNIT were presented in April 2018 inviting relevant government agencies and development partners. CI has approved the reports of the PDNIT from July – September, 2018, and the report has been submitted to MITPR as of March 2019.

The PDNIT study has national and urban components. The urban component has a part for overall policy on urban transport sector for top fifteen large cities with more than 300,000 inhabitants, studies on urbanized area of Kinshasa, and case studies on four cities, Lubumbashi, Kisangani, Bukavu and Matadi, which are representing Congolese urban areas.

For the urban road sector, it is proposed to develop 500 km of road network and 90 intersections to form a grid road system in urbanized areas by 2030. The 2040 road network concept is based on the SOSAK (*Schéma d'Orientation Stratégique de l'Agglomération de Kinshasa* / Strategic Orientation Scheme for the Kinshasa Metropolitan Area) long term vision. Toward 2040, PDNIT proposed to develop 3,500km of road network and 220 intersections. Several bypass roads are also proposed in suburban areas.

With regard to the public transport network in 2030, BRT routes are proposed for Lumumba Boulevard, Sendwe Boulevard, Triomphal Boulevard, 24 Novembre Avenue and 30 Juin Boulevard. For other primary and secondary routes, rehabilitation of buses and minibuses are proposed. Renovation of the railway line currently operating from the central station southward and the reopening of a railway line to the airport are proposed.

By the year 2040, several additional BRT routes are proposed, while the railway network is almost the same as for 2030, but with an extension of the airport line to the northeast. Although the

overall concept of the BRT network plan is in line with SOSAK, there are some differences, primarily in suburban areas.

The PDTK and PDNIT studies were conducted almost simultaneously, although the PDNIT started a few months earlier, and the team members for both studies communicated with each other frequently to maintain consistency between the studies. It should also be mentioned that both studies are based on the SOSAK which was legally adopted by the provincial council. Therefore, the concepts of both studies are coherent in principle. For instance, the identification of current urban transport issues and policies are similar.

However, there are differences in the resolution of transport surveys and travel demand forecasts. For instance, large-scale commuter surveys and activity diary surveys in conjunction with more than 10 additional types of surveys were conducted for the Study to analyse the travel behaviour of respondents as described in Chapter 2. With approximately 400 traffic analysis zones covering the entire Study Area, a comprehensive quantitative travel demand model was developed for the evaluation of several transport network development scenarios. Thus, it is not surprising that there are minor differences in the project lists. Considering the level of detail in analysis of the Study, the PDNIT project list could be updated using the PDTK project list.

4.1.3 SOSAK (Strategic Orientation Scheme for Kinshasa Metropolitan Area)

(1) Urban Development Planning

Development concept

SOSAK proposes eight development orientations:

- Expansion of the traffic network according to the extension of urban development
- Development of the communal and multimodal transport
- Resolution of the congestion in the centre of the city and creation of other urban cores
- Planning with forecasting for extended urban areas
- Upgrading urban facilities in poorly equipped quarters
- Development of infrastructure and facilities
- Symbiosis with the natural environment
- Promotion of a “City as Art and Culture”

Estimation of the future population

SOSAK estimates the future population based on the two different sources of the estimation for 2013 and it assumes 3% as an annual increase ratio of the population in future.

Forecast of the future development area

SOSAK studies the candidate development areas mainly located in the surrounding area of the current urbanized area. It identifies eight candidate development zones in the surroundings of the current urbanized area in consideration of their geographical features.

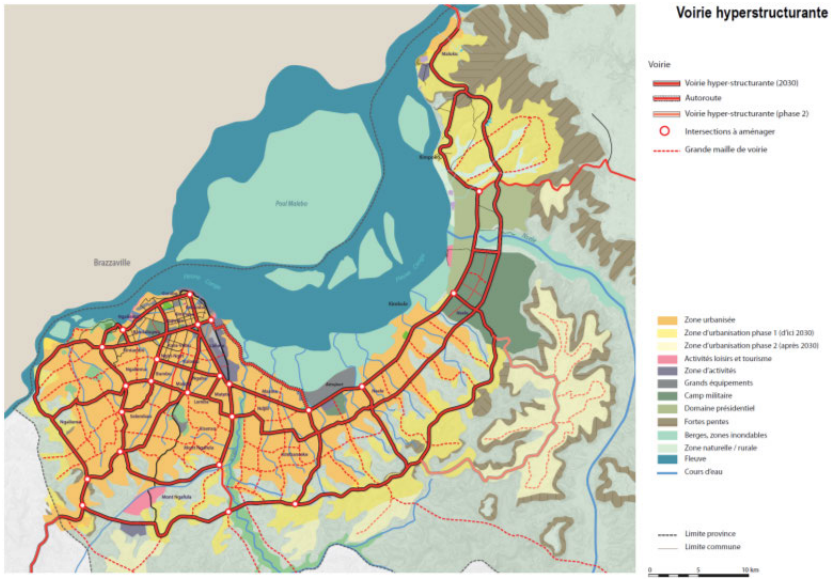
Forecast of the development scenarios and evaluation

SOSAK assumes future development demand based on the assumption of 3% annual increase in the future population and the following three scenarios are considered for evaluation.

- Progress of urbanisation between Mont-ngafula and N'sele (Scenario of the west prior development)
- Progress of urbanisation between Kimbanseke and Maluku (Scenario of the east prior development)
- Progress of urbanisation between Mont-ngafula and Maluku (Scenario without development on the plateau in southern N'sele)

(2) Transport Sector

The proposed urban road network by SOSAK is shown in Figure 4.1.1. In principle, the urban road network is planned to form a mesh of 2km considering accessibility to the arterial roads assuming that every resident in the urban area can gain access to arterial roads with 1km of walking or approximately 15 minutes of walking. Based on this urban road network, several primary arterial roads (*Voirie hyper-structurante*) are proposed to connect the city centre, industrial areas, universities, airports and river ports. These primary arterial roads include the roads in the city centre to form a grid, ring roads, and two roads to Maluku which are connecting to the proposed bridge to the Republic of Congo. The total length of this road network is 604km, and, it is estimated that it costs 3.69 billion USD until 2030. In addition, 131km of roads which requires 0.42 billion USD is proposed.

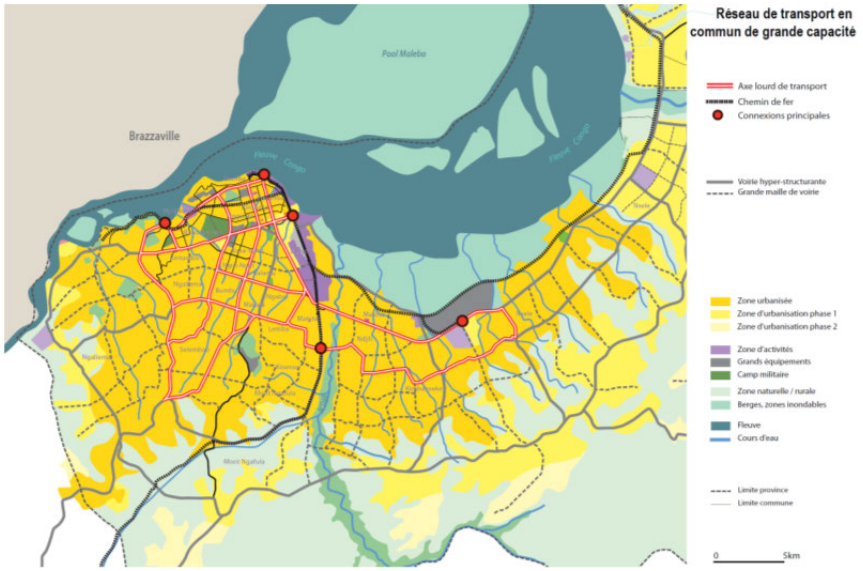


Source: SOSAK

Figure 4.1.1 Arterial Road Network Proposed by SOSAK

In terms of public transport, the railway is expected to serve as trunk routes. The existing and abandoned lines to/from Kintambo, Airport and Kimwenza are planned to be modernised. The total length of modernization is 64.1km. The cost for modernization is estimated at 0.54 billion USD. However, there is no plan of additional railway line.

A bus rapid transit (BRT) system is also proposed along arterial roads taking financial constraint into consideration for the short term option. It is also mentioned that it can be converted to a light rail transit (LRT) in the future. The public transport network is shown in Figure 4.1.2.



Source: SOSAK

Figure 4.1.2 Public Transport Network Proposed by SOSAK

In addition to infrastructure development, SOSAK also analysed institutional aspects. It proposed multi-sector organization for urban development called "Urban Development Unit" (*Cellule de Développement Urbain*) for the purpose of coordination and study of cross-sector issues. In addition, an urban development authority (*Société d'Aménagement à Kinshasa*, *SEMAKIN*) is proposed as the project implementing body under the central government.

Urban Transport Authority (*Autorité Organisatrice des Transports Urbains*, *AOTU*) which is in charge of entire urban transport of Kinshasa City is also proposed by SOSAK.

Although SOSAK covers the entire urban development sector, it does not cover all the aspects of urban transport. Therefore, further analysis is required for:

- Quantitative analysis on transport demand based on transport surveys
- Economic benefits and congestion mitigation impact of the proposed road network
- Selection of corridors and modes of trunk public transport system based on future transport demand
- Management of existing buses and taxies
- Transport demand management (TDM)

4.2 Review of Previous Transport Studies

The latest two studies in 2011 and 2013 which are also referred in the SOSAK are reviewed below.

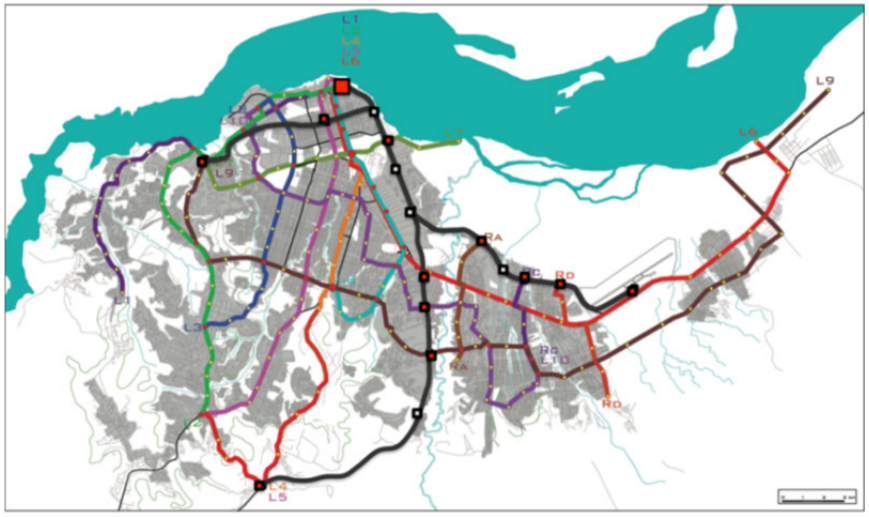
4.2.1 Urban Transport Study of Kinshasa (CTB, 2011)

A summary of projects proposed in the Urban Transport Study (*Etude du Plan de Mobilité de Kinshasa*) financed by the Belgian Development Agency, BTC (*Agence Belge de Développement*, *CTB*) in 2011 are shown in Table 4.2.1 and exhibited in Figure 4.2.1 and Figure 4.2.2 .

Table 4.2.1 Summary of Projects Proposed by Urban Transport Study of Kinshasa City, 2011

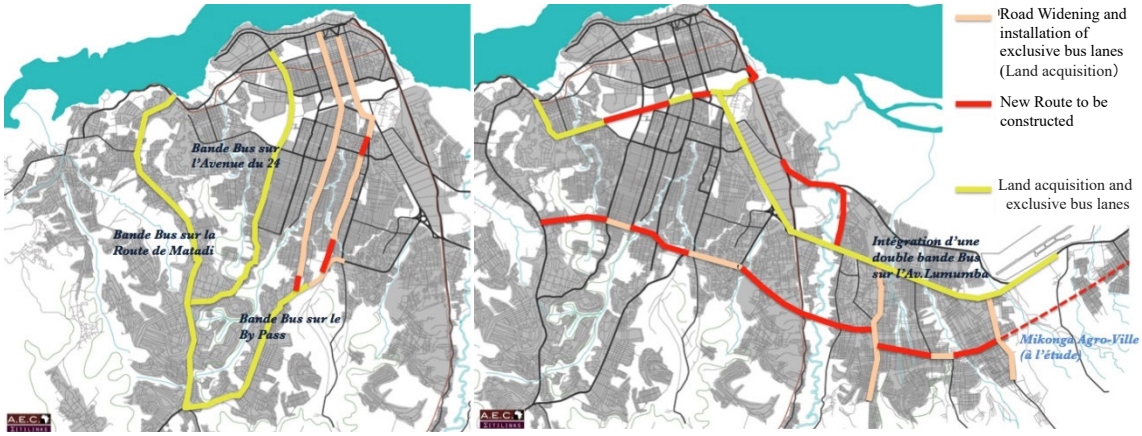
Project	Area	Contents
BRT	・ Urbanized Area of Kinshasa City	・ 7 circular routes ・ Bypass and 3 longitudinal lines (Line 7, 9 and 10A) ・ 4 routes as railway feeder service (Line Ra, Rc, Rd, 10B) ・ Total length of routes is 247 km ・ Total estimated cost is 820 million Euros
Railway Modernization		・ Improvement and track and station development of ONATRA (current SCTP) ・ Total length of lines are approximately 70km ・ Total estimated cost is 260 million Euros
Road Network Development	North-South Radial Roads ・ Elengesa Avenue ・ Kimwenza Avenue ・ Matadi Route ・ 24 Avenue ・ By Pass	・ Road widening and installation of exclusive lanes for BRT ・ Extension and improvement of Elengesa Avenue: 8.2km, 36 million Euros ・ Extension and improvement of Kimwenza Avenue: 6.3km, 28 million Euros ・ Road widening for BRT: Matadi Route, 24 Avenue and By Pass
	East-West Roads ・ Lumumba Avenue ・ Mikonga Agro-Ville	・ Road widening and installation of exclusive lanes for BRT ・ Improvement and construction of the central ring bypass (road from Kintambo Magasin to N'dolo via Kasavubu Avenue) ・ Ngaba Connection Road: road from the bypass to Mont Ngaliema via Route de Matadi (6.2km, 47 million Euros including Molwa bridge and Manifesto bridge) ・ N'djili－Kimbanseke Connection Road: the road connecting N'djili and Kimbanseke crossing N'djili River is expected to reduce the traffic of Lumumba Avenue: 6.2 km 95 million Euros including improvement of 4 intersections ・ Removal of Bottlenecks of N'djili: N'djili detour routes along Petro Congo for the reduction of traffic on Lumumba Avenue including the access road to Masina railway station

Source: l'Etude du Plan de Mobilité de Kinshasa, Final Report Phase 3, BTC, 2011



Source: l'Etude du Plan de Mobilité de Kinshasa, Final Report Phase 3, BTC, 2011

Figure 4.2.1 Long-Term Network Plan of Public Transport



Source: l'Etude du Plan de Mobilité de Kinshasa, Final Report Phase 3, CTB, 2011
Note: The left figure is on the north-south radial road network development plan.
The right figure is east-west road network development plan

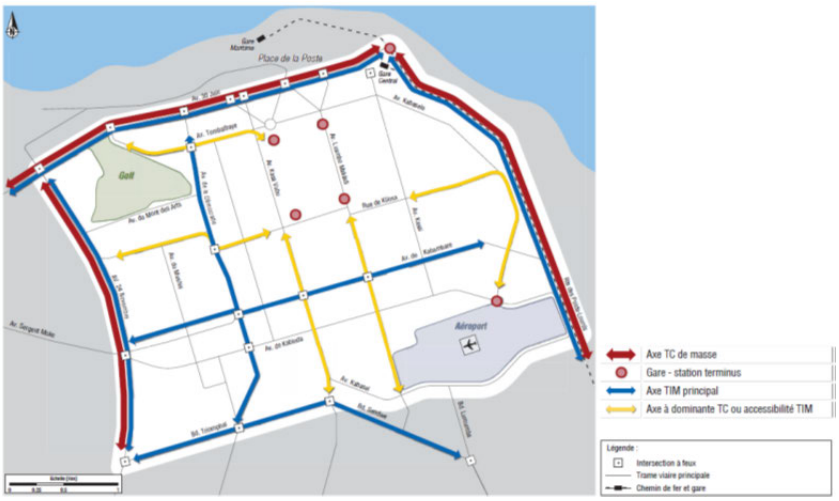
Figure 4.2.2 Road Network Development Plan

4.2.2 Technical Report of Mission on Urban Transport (World Bank, 2013)

The World Bank prepared the "Technical Report of Mission on Urban Transport" (*Mission d'expertise sur la mobilité urbaine à Kinshasa, Rapport Technique*) in 2013. The report proposed "multi-modal vision 2025" (*Esquisse d'une vision multimodale à 2025*) with five components.

- Strengthening the Road Network as a Short Term Projects
- Re-arrangement of Public Transport
- Securing Safety for Walkers and Promoting Walking
- Implementation of Urban Transport Plans
- Institutional Development and Finance

One of the proposed plans for the traffic flow management is presented in Figure 4.2.3.



Source: Mission d'expertise sur la mobilité urbaine à Kinshasa, Rapport technique, World Bank, 2013

Figure 4.2.3 Improvement of Traffic Flow Management in the City Centre

4.3 Kinshasa, its Macro Economic and Social Role

4.3.1 Assessment and Possible Orientation to the Future

Kinshasa, with its geo-strategic location, has been assuming key roles in the country and also in the region. It has grown to have over 12.5 million people in 2017 with a recent population growth rate of over 4.7% since 2005, and its high concentration in the central districts with some Communes over 500 population/km^2 density, out of the total surface of 9,985km^2. Based on those figures, Kinshasa, its role and function, is characterized and directed as follows:

- City of Consumption → Logistic hub, SEZ, agro-industrial park, diversified industrial development
- Limited as a City of Production → BOP (Bottom of the Pyramid) cluster development
- BOP market driven Cluster Development → Promotion of BOP business environment
- Limited Value Chain → Encouraged value chain
- High Level of Unemployment and Low Labour Quality → Promotion of TVET (Technical and Vocational Education Training) school
- de facto Land Locked Country/City → Land lock turnaround
- Kinshasa – in Need of Regaining its Role → City image into Art & Culture
- Planned Developments to the East → New regional function of Logistics / Road Stations
- Kinshasa → Inland Port Function

4.3.2 International Donor Community Support

Donor support by sector can be summarized by the information collected in 2012.

The most focused areas are Governance with 23% share, Health (22%) followed by Energy (16%), Infrastructure (13%) and Social Protection (11%). These allocations then well reflected the country's situation. On the infrastructure sector, the largest donor was the World Bank (31%), followed by the European Community (27%), AfDB (18%), and Belgium (12%).

4.3.3 DRC Road Fund - FONER

DRC Government has a fund dedicated for road finance sources called FONER.

Le Fonds National d'Entretien Routier de la République Démocratique du Congo (FONER / National Road Maintenance Fund) is a public administrative and financial institution created by Law n ° 08/006-A of 7 July 2008. Fees are charged on lubricants (CDF of USD 0.25 equivalent per litre) and fuel (CDF of USD 0.10 per litre) on land. Those royalties generate 98% of the total resources of the FONER.

FONER has difficulty in verifying that charges are levied on all imported fuels, particularly some difficulties in mobilizing resources. The FONER budget for 2016 was USD 128 million, whereas annual total requirements for road maintenance are estimated by FONER at approximately USD 250 million, i.e. almost double its total resources. With a view to strengthen its financial ability, FONER has been considering to introduce the "Vignette (road pricing)" system.

4.4 Future Social and Economic Framework

4.4.1 Population Growth and Control

(1) Prospect of population growth of Kinshasa City

The Study refers to the result of future population growth analysis by UN (United Nation) Population Division for the estimation of future population. It calculates the population of the whole DRC between 1950 and 2100. And it prepares three variants (Low, Medium and High variant) for estimation for the whole country of DRC. The Study takes these indexes as the natural growth ratio of population in Kinshasa City.

The current annual social population growth ratio of Kinshasa City is considered at about 1% /year, which corresponds to the difference in population growth rates between the entire DRC and Kinshasa City.

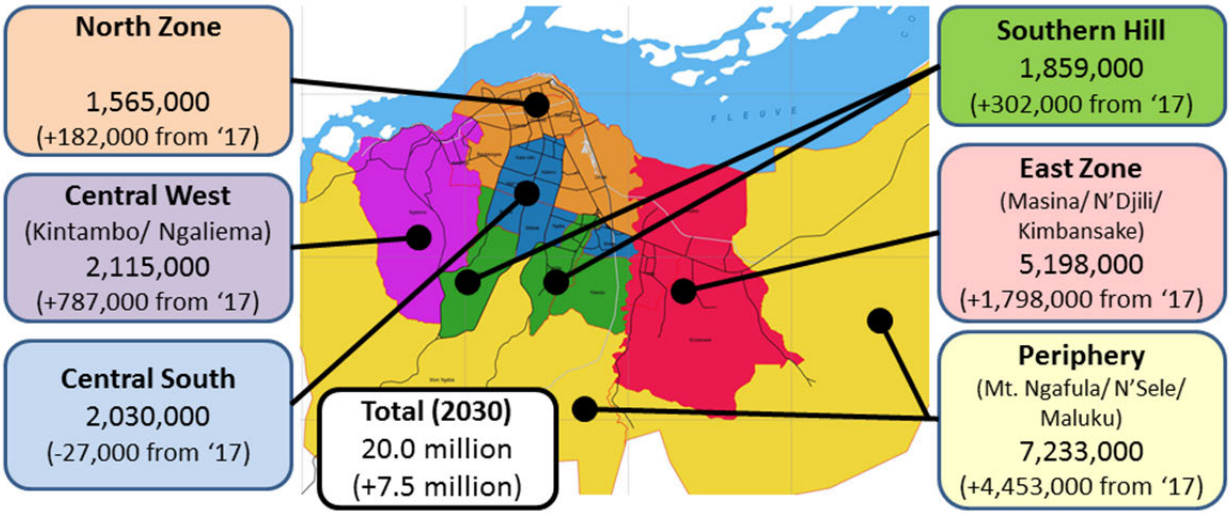
The Study examines two scenarios of social increase of population in Kinshasa City. One is the constant annual social increase of 1.0% from 2017 to 2040 (Scenario A), and the other is gradually decreasing the social increase of 1.0% to 0.0% from 2017 to 2040 (Scenario B).

Applying these different scenarios to the UN population projection for DRC and the current population of Kinshasa City, the future population of Kinshasa City was estimated to result in 20 to 21 million in 2030, and 27 to 31 million in 2040 for Scenario A (constant migration ratio); and 19 to 20 million in 2030 and 24 to 27 million in 2040 for Scenario B.

The Study will recommend to take Scenario B (decreasing social increase) for the limited land available for development. Therefore, the government will have to take proper control measures and development strategies at either the local or national level in parallel with preparing the development plan for Kinshasa City.

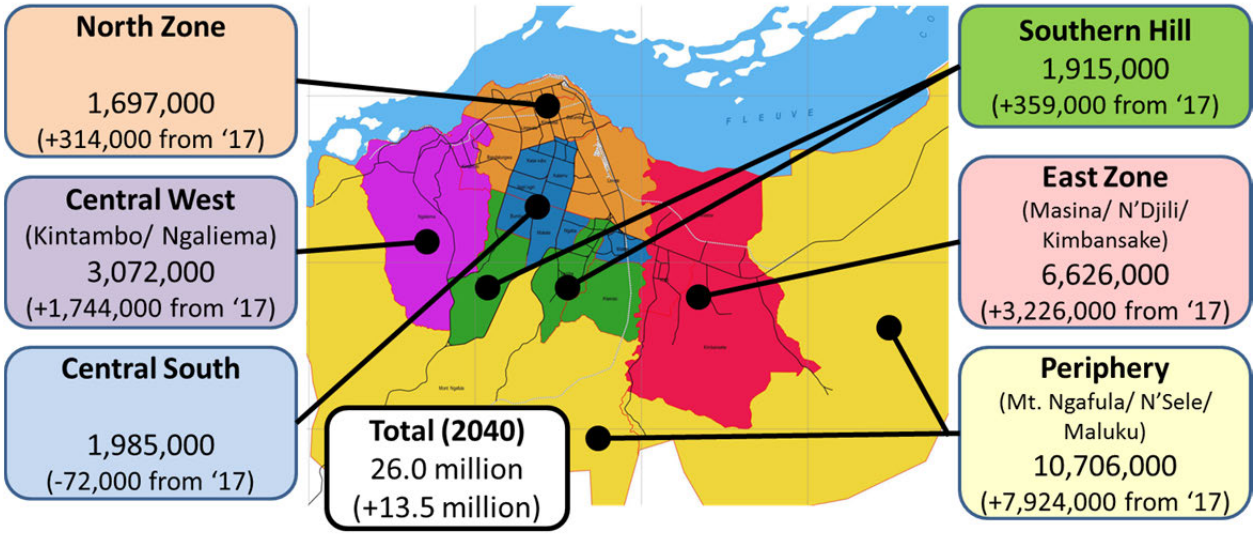
(2) Estimation of Future Population by Commune and Kinshasa City

Based on the analysis of the current communal population, population density, growth trend and potential capacity of land for development (as seen in Figure 4.4.1 and Figure 4.4.2), the future population by commune was estimated as shown inTable 4.4.1.



Source: The Study Team

Figure 4.4.1 Initial Estimation of Capacity of Commune Population in 2030



Source: The Study Team

Figure 4.4.2 Initial Estimation of Capacity of Commune Population in 2040

Table 4.4.1 Final Result of Estimated Population of the Communes of Kinshasa City

Group of Commune	Name of Commune	Estimated Population (2017)	Estimated Population (2030)	Estimated Population (2040)	Adjusted Population Increase (2017-40)
Residential Area (Cite Résidentielles)	Gombe	80,696	124,628	149,555	
	Limete	466,113	580,315	686,868	
	Ngaliema	1,147,924	1,935,408	2,137,894	
Old City (Ancienne Cites)	Kintambo	179,581	179,581	179,581	
	Barumbu	172,449	196,263	196,263	
	Kinshasa	152,778	152,778	152,778	
	Lingwala	148,534	148,534	148,534	
New City (Nouvelle Cite)	Ngiri-ngiri	167,019	167,019	167,019	
	Kasa-vubu	114,152	114,152	114,152	
Planned City (Cite Planifiées)	Kalamu	287,045	287,045	287,045	
	Lemba	505,836	742,838	742,838	
	Matete	343,584	343,584	343,584	
	Bandalungwa	362,766	362,766	362,766	
	N'djili	651,007	651,007	651,007	
Southern Suburbs (Extension Sud)	Ngaba	279,329	245,117	221,680	
	Selembao	471,504	536,615	592,757	
	Bumbu	536,018	470,367	425,392	
	Makala	329,725	329,725	329,725	
Eastern Suburbs (Excentriques)	Kisenso	579,147	579,147	579,147	
	Masina	1,070,858	1,070,858	1,070,858	
	Kimbanseke	1,678,395	2,974,445	2,974,445	1,296,050
	Mont-ngafula	714,074	2,277,776	4,021,663	3,307,589
	N'sele	772,027	2,665,247	5,242,945	4,770,918
	Maluku (Inside Study Area)	230,000	794,022	1,230,000	1,000,000
Sub Total	**Study Area**	**11,440,561**	**17,929,239**	**23,008,495**	
Outside Study Area	**Maluku (Outside Study Area)**	**1,064,439**	**2,070,761**	**2,991,505**	**1,927,066**
Total	**Kinshasa City**	**12,505,000**	**20,000,000**	**26,000,000**	**13,495,000**

Source: The Study Team

Note: Bold characters indicate adjusted numbers for finalization.

Therefore, the future population in the Study Area and Kinshasa City for 2030 and 2040 are estimated as presented in Table 4.4.2.

Table 4.4.2. Estimated Future Population in the Study Area and Kinshasa City

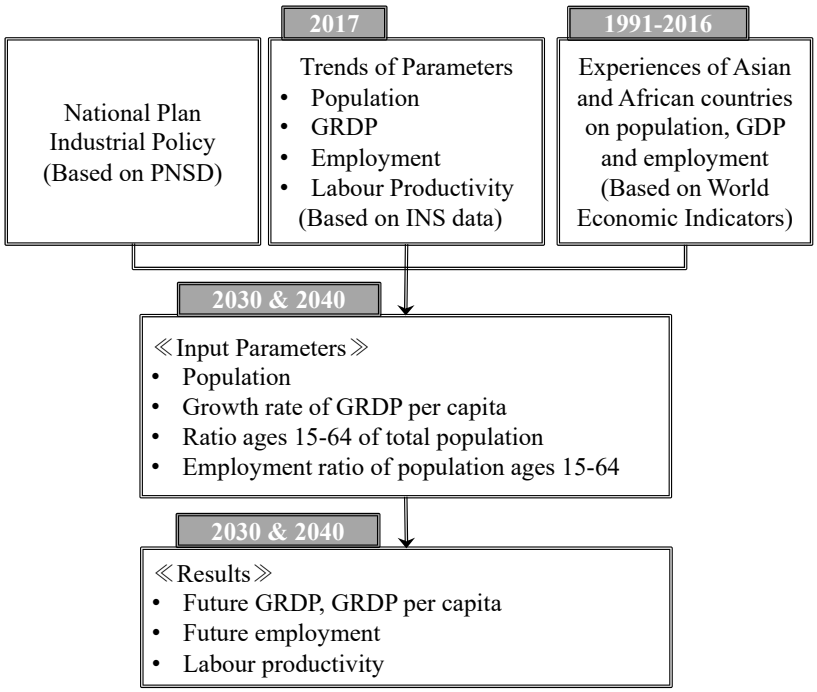
	2017	2030	2040
The Study Area	11,440,600	17,929,239	23,008,495
Kinshasa City	12,505,000	20,000,000	26,000,000

Source: The Study Team

4.4.2 Future Employment and GRDP of Kinshasa City

(1) General

The Gross Domestic Product (GP) and employment of the Kinshasa City was estimated as presented in the flow diagram of Figure 4.4.3.



Source: The Study Team

Figure 4.4.3 Flow of Developing the Socio-economic Framework

Based on the future population estimated in the previous section, review result of the PNSD and comparative analysis of experiences in the emerging countries in Asia and Africa, the future input parameters such as: 1) population, 2) GRDP per capita, 3) working age population and 4) employment to working age population ratio are assumed and consequently, the output parameters such as GRDP, the number of employment and labour productivity are derived as follows.

(2) Input parameters

- Population of Kinshasa City: estimation by the Study Team; 20 million in 2030 and 26 million in 2040
- GRDP per capita growth rate (constant 2017 USD): the rate of 3.8% has been applied based on the experiences in Asian countries.
- Ratio Ages 15-64 of Total Population (%): the ratio of working age population (age between 15 and 64) in total population is estimated to increase in response to the population structural changes. It is estimated to reach 50% in 2040.

- Employment Ratio of Population Ages 15-64 (%): the ratio of working age population in total employment is also estimated to increase as the employment opportunity increases. It is estimated to reach 51% in 2040.

(3) Results

- GRDP per capita: USD 964 in 2030 and USD 1,395 in 2040 has been calculated. It would reach almost USD 1,000 in 2030.
- GRDP: USD 19,285 million in 2030 and USD 36,263 million in 2040
- Labour productivity growth rate: CAGR of 3.3% throughout the projection period has been achieved.

The Study Team recommends the Future Growth Scenario as summarized in Table 4.4.2.

Table 4.4.2 Future Socio-Economic Framework of Kinshasa City

Planning Parameters	2017	2030	2040	CAGR (2017-2030)	CAGR (2030-2040)
Population in Kinshasa City (thousand)	12,505	20,000	26,000	3.7%	2.7%
GRDP per capita (constant 2017 USD)	597	964	1,395	3.8%	3.8%
GRDP (constant 2017 million USD)	7,463	19,285	36,263	7.6%	6.5%
Population Ages 15-64 (thousand)	5,943	9,781	13,000	3.9%	2.9%
Ratio Ages 15-64 of Total Population (%)	48%	49%	50%		
Employment (thousand)	2,897	4,892	6,630	4.1%	3.1%
Employment Ratio of Population Ages 15-64 (%)	49%	50%	51%		
Labour Productivity (USD/person)	2,576	3,942	5,470	3.3%	3.3%

Source: The Study Team

CHAPTER 5 Preferred Spatial Development Scenario

5.1 Urban Development Strategy

5.1.1 Induction of Urban Structure

From the comparison result of development demand and development supply, all candidate development areas are expected to be occupied in 2040. In other words, the candidate areas are not sufficient for development by 2040; all areas are target areas of future development.

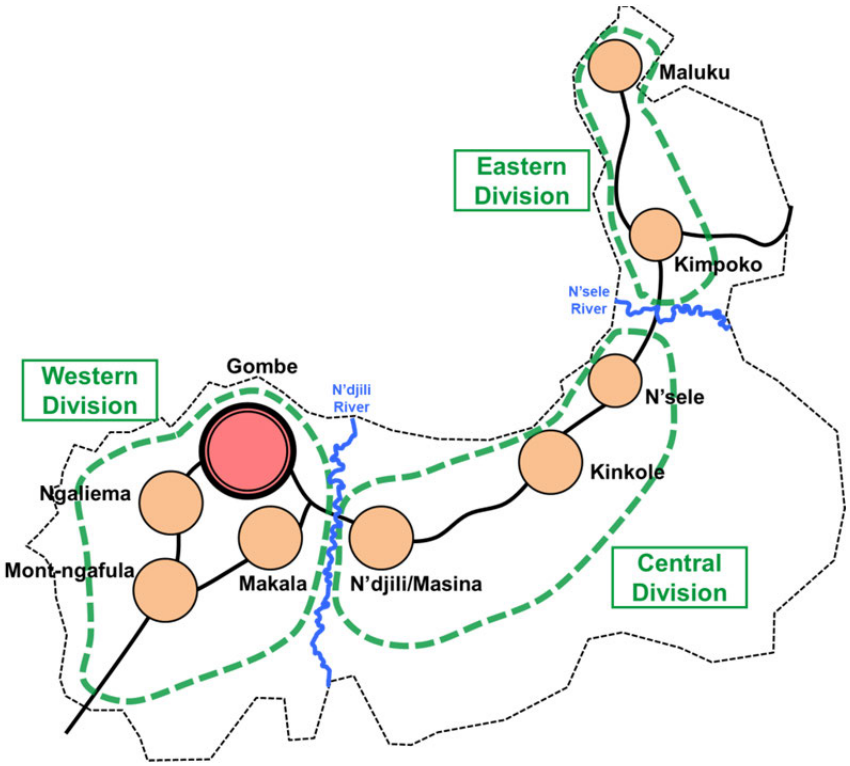
Even if there is no choice but to select all of the available potential development areas in the Study Area in the future, the induction of a preferred urban structure should be pursued as the strategy of the realization of suitable future development in the Study Area. Corresponding to the expected situation on the development of the Study Area, the following points should be considered for realizing the urban development.

5.1.2 Urban Development Strategy

The urban development strategy of Kinshasa is formulated as an integrated solution to current urban issues, spatial and environmental constrains, and development possibilities, as explained below.

Most of the urban problems of Kinshasa are caused by an overconcentration of residents, workers and buildings. Eventually, it has brought about inappropriate living conditions such as poor sanitation and the malfunction of various urban facilities. To correspond to the increasing population and housing demand, additional urban developments in the current urban area further exacerbate an unsuitable living environment. In order to minimize the negative impacts of the current urbanization, future development areas and new urban functions should be properly dispersed, spatially and sustainably.

The future Kinshasa urban area can be divided into 3 divisions by two major rivers (N'djili River and N'sele River) from the geographical point of view; the Western Division (Gombe, Mont-ngafula and Ngaliema), the Central Division (N'djili / N'sele / Kinkole) and the Eastern Division (Kimpoko / Maluku) as shown in Figure 5.1.1. For a balanced urban development, urban functions should be strategically introduced and decentralized into each division.



Source: The Study Team

Figure 5.1.1 Urban Divisions of Kinshasa

As a solution to integrate these divisions, a smooth linkage between them is important. These linkages should be strengthened by improving traffic networks. Particularly, enhancement of traffic flow along the East - West corridor, namely the N1 Road, should be addressed first. Then, access to the East-West corridor should be either improved or newly constructed from current/new development areas inland.

As urbanization progresses, land for new housing and various facilities for urban functions are required. The available land for new urbanization has been confined rapidly. Therefore, an intensive use of limited available land and the formation of effective urban linkages are the key strategies to realize the successive growth of Kinshasa City.

The linkage between the inside and outside of Kinshasa should be established simultaneously with the enhancement of the intra-city network, such as: construction of the new bridge between Kinshasa and Brazzaville; strengthening of traffic node function in Kimpoko; development of Kinkole as domestic water transportation bases; introduction of logistic functions at Kimwenza as a gateway into Kinshasa city from Matadi; and remote settlement area between agriculture areas in the southern part of Kimbanseke and N'sele. Construction of the Southern East-West corridor in the future should be planned to maximize development potentials of the southern communes.

A strategy of urban development towards the east and the periphery of the existing urbanized area of Kinshasa is expected to help decrease the pressure on the current population density of the city centre area, as well as distribute urban functions to plural sub-centres and district centres. Promoting such an urban development strategy will encourage the viability to implement urban

redevelopment projects planned for existing densely populated urban areas. Urban redevelopment needs to advance by securing land for public and social facilities, renewing urban infrastructure and functions, promoting effective use of land, and realizing balanced urban development.

5.2 Alternative Scenarios of Spatial Development

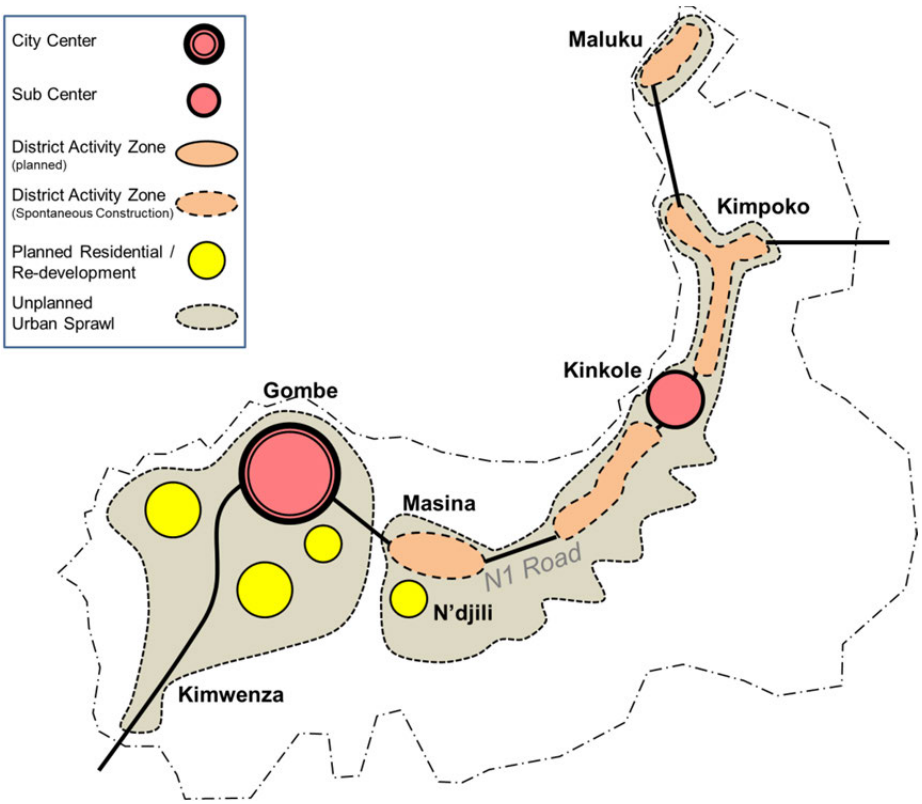
The following are three scenarios assumed to be alternative urban structures in 2040. The first is the prospect of no intervention of land use control and/or induction of development by public entities (Zero Option). The other two scenarios suggest countermeasures to address existing as well as future assumed urban problems.

5.2.1 Scenario 1: Spontaneous Urban Development without Active Control and Management (Zero Option)

The scenario without active control and management is defined as continuing the current urbanization trend.

As observed recently, changes in the urbanization of the Study Area is expanding spontaneously without proper infrastructure. As a nature of the recent development, urbanized areas are expected to grow from west to east along the N1 Road, with mixed land uses sprawling into the hinterland as illustrated in Figure 5.2.1.

The construction of roads will follow the urbanization, but land for roads will not be secured in advance because of the absence of urban planning and development control. As a result, the land uses and building uses will be mixed throughout, which makes it difficult to introduce integrated urban and industrial functions that need adequate land and good access to business functions (e.g. large area for factories and offices) .



Source: The Study Team

Figure 5.2.1 Scenario 1: Expected Urban Structure without Active Control and Management (Zero Option)

5.2.2 Scenario 2: Distribution of Urban Functions along the N1 Road

This scenario proposes the distribution of urban function along the N1 Road as the main solution for the current issues of Kinshasa City. Strategic implementation of integrated development is expected for the decentralization of the functions of Kinshasa City at the following areas:

N'djili Airport Industrial Development

Near the N'djili Airport, there is potential for the development of integrated industrial areas with air logistic functions. Airport side industrial development is realized in many cities in the world.

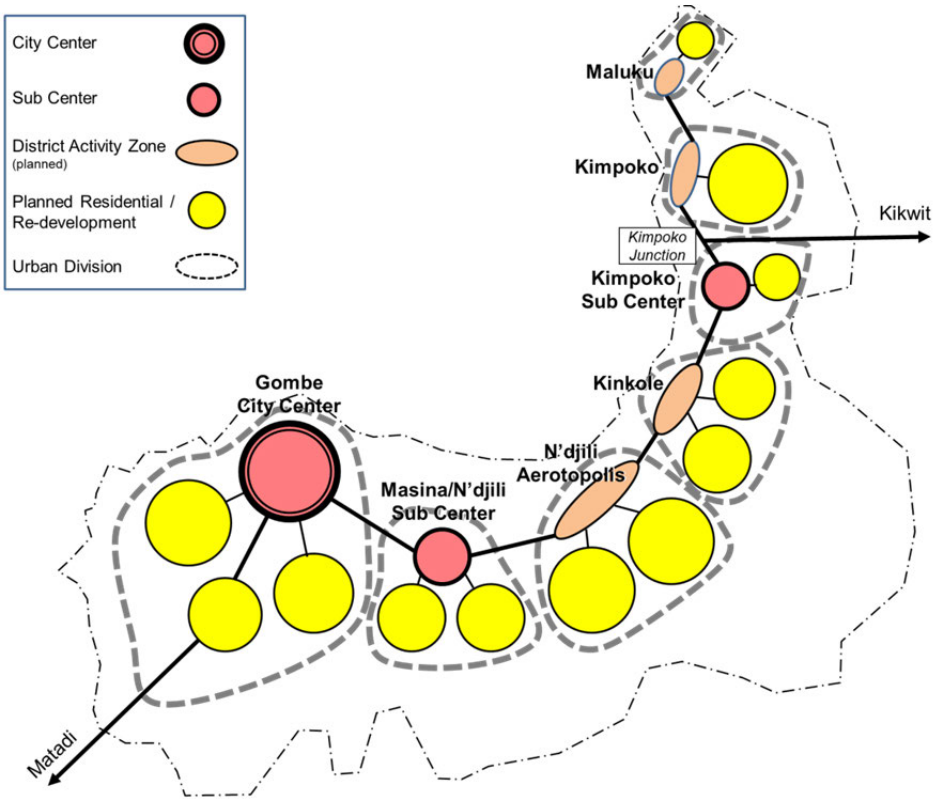
Kinkole Area Development

Kinkole has been developed with a small port for domestic cargoes. Considering the importance of the cargo network of the DRC and the limited capacity of the current Kinshasa Port in Gombe, it is important to secure several sub-ports in other areas in the Study Area. Kinkole is one of candidates for this function.

Development near the Kimpoko junction (Divergent to Maluku and Kikwit)

The Kimpoko junction of Maluku Road and the N1 Road towards Kikwit functions as a gateway

to Kinshasa City for the products from the eastern regions of Kinshasa City. Near the junction, a market with logistic and parking functions has been constructed and occupies space along the N1 Road. Integrated spatial planning is necessary in order to avoid further aggravation of the present traffic congestion along the N1 Road.



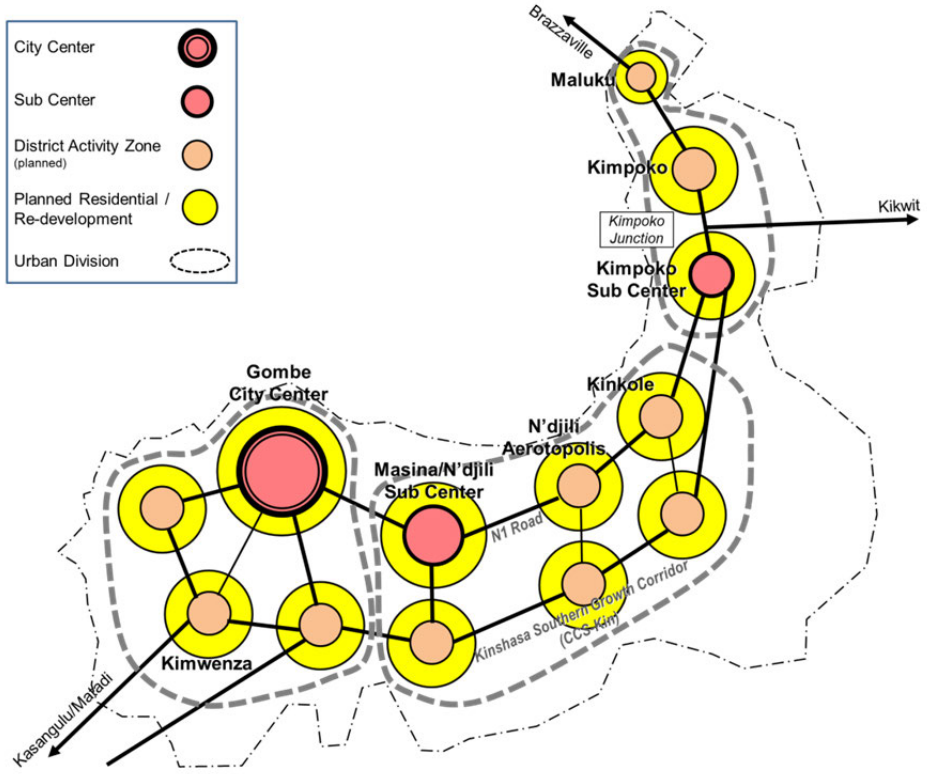
Source: The Study Team

Figure 5.2.2 Scenario 2: Expected Urban Structure with integrated developments along the N1 Road

It is expected that Scenario 2 will have a positive impact on the dispersed urban development. However, urbanization to the south of N1 road is inevitably clustered along the selected north-south arterial roads accessible to N1 Road, and movements in the east-west direction in the southern area must go via N1 Road that will degrade the traffic congestion and eventually discourage the development of formal sector industries.

5.2.3 Scenario 3: Development of Kinshasa Southern Growth Corridor (CCS-Kin) and Distribution of Urban Functions along the Corridor

Corresponding to the suggested issues and problems of Scenarios 1 and 2, Scenario 3 proposes further distribution of the functional areas in the spatial development in Kinshasa City.



Source: The Study Team

Figure 5.2.3 Scenario 3: Expected Urban Structure with Integrated Developments along the N1 Road and Kinshasa Southern Growth Corridor (CCS-Kin)

Aiming at reducing development pressures along the current N1 Road, this scenario intends to distribute urban functions and activities to the southern corridor and circular roads. Strategically planned development zones will attract people to work at district centres near their residence. Moreover, commuting routes will diversify due to the accessible locations of workplaces at each district centre, which is linked with the east-west and the north-south arterial roads. Also, the urban structure will be formed as a network of district centres, instead of a mono-centric urban structure.

5.3 Selection of Preferred Spatial Development Scenario

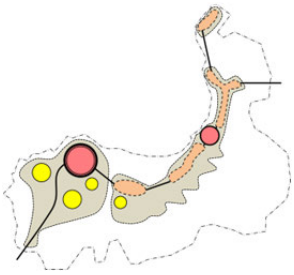
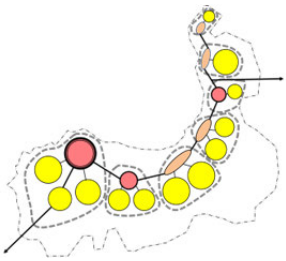
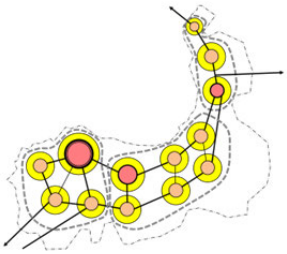
The Study evaluates three development scenarios and selects a preferred spatial development scenario. For the selection, the following aspects are set as evaluating criteria. The following six aspects were selected as aspects to be affected by the difference of spatial development scenario, based on the study of similar projects and on the open discussion with the stakeholders.

- Relevance to relating master plans (Appropriateness)
- Impacts on future residential development
- Impacts on future district centre development
- Effects on neighborhood activities
- Effectiveness of improvement in traffic conditions

- Cost for implementation (Sustainability)

The overall evaluation of the alternative urban development scenarios are summarized as shown in Table 5.3.1. Comparing the results of the evaluation, the Study selects Scenario 3 as the preferred spatial development scenario.

Table 5.3.1 Comparison of Evaluation of Alternative Scenarios

Scenario	Spatial Framework	Over-all Evaluation	Description
1. Spontaneous Urban Development without Active Control and Management (Zero Option)		C^+	Similar to the existing Lumumba Road, chaotic ribbon development will expand toward Maluku where disorderly situation is emerging in such a mixed situation as motorized and non-motorized traffic, cargo and passenger vehicles in different sizes, access and through traffic, street venders, shoppers and commuters. Informal sector activities along the N1 road will disrupt the development of formal sector and only leave worsened traffic conditions and poor living environment.
2. Distribution of Urban Functions along the N1 Road		B	This scenario assumes to plan the distribution of urban centre activities and work places along N1 road and the housing development to the south of N1 road. However, accesses to N1 road or urban centres/work places are limited and congested by the traffic generated not only from the housing area in the south but also from other cluster development that take place along the access roads. Traffic congestion on N1 road will remain unchanged, as far as all the urban and inter-urban activities depend much on the single east-west axis of N1 road. Further, it will be hard to expect that formal sector development is induced and encouraged along N1 road, since informal sector activities will be attracted inevitably to the area of easy access and concentration of people and traffic.
3. Development of Kinshasa Southern Growth Corridor and Distribution of Urban Functions		A-	New growth corridor offers new development value along the overall road network, and reduces the traffic volume into/ through the current urban area. The planned distribution of urban centres, work places and residential area along the ladder type of road network will enhance the development potentials in the south for the formal sector and endorse better traffic and urban life environment. However, a method of fund raising to invest for the scenario needs to be addressed.

Evaluation criteria: A: Significantly positive performance is expected. (Recommended)
B: Positive performance is expected to some extent. (Fair)
C: Positive performance can not be expected. (Poor)
C+: Better than C, but poorer than B or B-.

Source: The Study Team

5.4 Spatial Development Strategy

5.4.1 Land Use Policy

Based on the selected preferred scenario (Scenario 3), the Study formulated a land use plan. For land use planning, the Study examined geographical conditions, current land uses and land availability in the Study Area. Given the assumed future social and economic development framework, the land use plan was formulated in consideration of the following major land uses.

(1) Residential Area

- New Residential area in the periphery
- Urban redevelopment for the existing housings area
- Housings in urban agriculture area
- Reservation of public facilities in residential area

(2) CBD (Central Business District), Sub Centre

- Gombe CBD / Governmental zone as well as sub-centre of Western Urban Division
- N'djili sub-centre of the Central Urban Division
- Kimpoko sub-centre of the Eastern Urban Division

(3) Business/commercial area

District centres along new arterial roads
It is recommended to prepare land for district business and commercial centres in relation with construction of new arterial roads. In particular, land development around the major intersections needs to be spatially controlled, in order to avoid overcrowded traffic situation.

- N'djili Airport industrial zone
- Mpasa C&I (Commercial and Industrial) zone
- Kinsuka C&I zone
- Cogelos Complex zone

District centres in redevelopment areas
The redevelopment projects are one of the solutions to provide public services and to improve living environment at the same time.

- UPN Commercial zone
- Cite Verte Commercial zone

(4) Industrial area

Industrial areas are planned with consideration of connectivity of major roads and accessibility to neighbourhood residential areas.

- Limete industrial zone

- Kinkole industrial zone
- Libeya C&I zone
- Maluku industrial zone (SEZ: Special Economic Zone)

(5) Industrial zones along new Southern East-West corridor

The CCS-Kin (New Southern East-West Corridor) will function as a major route connecting Matadi, western and eastern parts of Kinshasa, and the central region of the DRC. The sites along the new corridor have a high potential for processing industries of foods and natural raw materials.

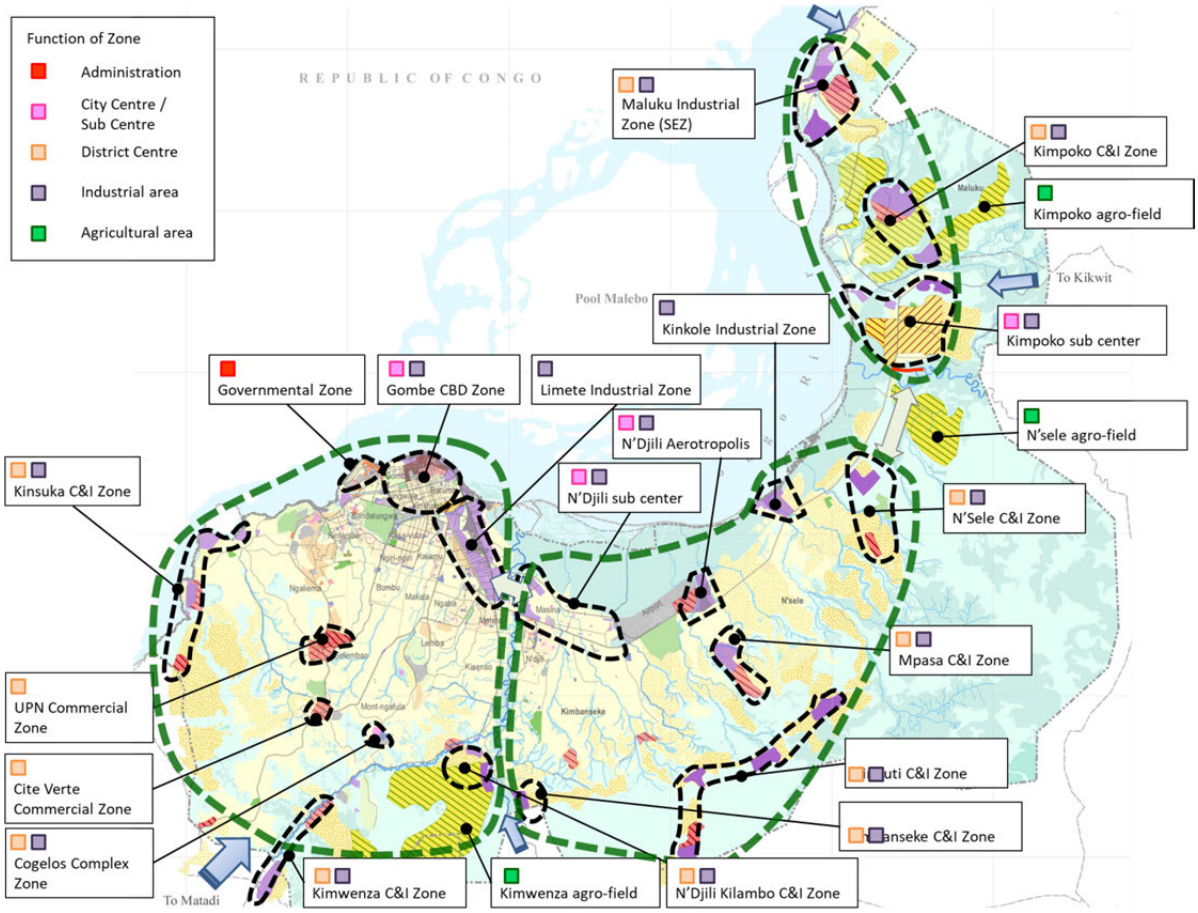
- N'sele C&I zone
- Kinduti C&I zone
- N'djili Kilambo C&I zone
- Kimwenza C&I zone

(6) Urban agriculture area (Agro-Field)

Considering the importance of the food supply to consumers in the city, urban agriculture areas are planned in the Kimpoko area of Maluku commune, and in the south of Mont-ngafula commune. Food processing industries and bio research facilities are considered in addition to farmland.

- Kimpoko agro-field
- N'sele agro-field
- Kimwenza agro-field

As a result, the future land use and development zones are planned as shown in Figure 5.4.1.



Source: The Study Team

Figure 5.4.1 Spatial Development Strategy (Land Use Policy)

5.4.2 Land Use for 2030 and 2040

Based on the selected preferred scenario (Scenario 3), the Study examined changes in land uses and creation of new development zones in the future. Changes in those developments are planned in terms of the periods 2017-2030 and 2030-2040, and are based on the following conditions:

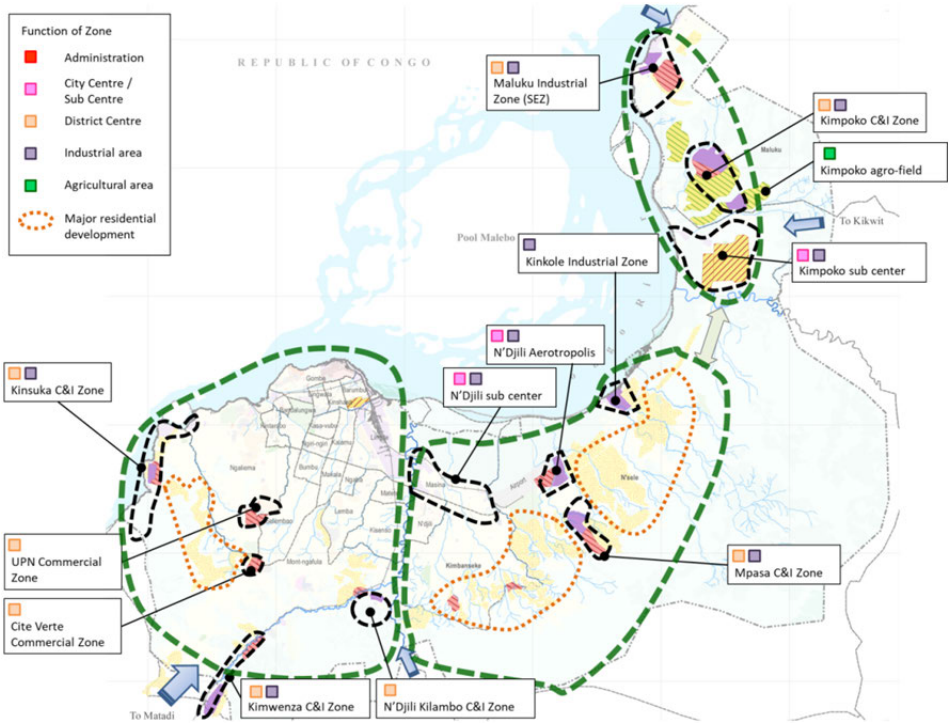
a. Estimated increase in population for each period;

b. Suitable locations and capacity of land for development/uses in residential, industrial, commercial and business;

c. Land demand required for residential, industrial, commercial and business developments for each period of time, i.e. 2017-2030 and 2030-2040; and

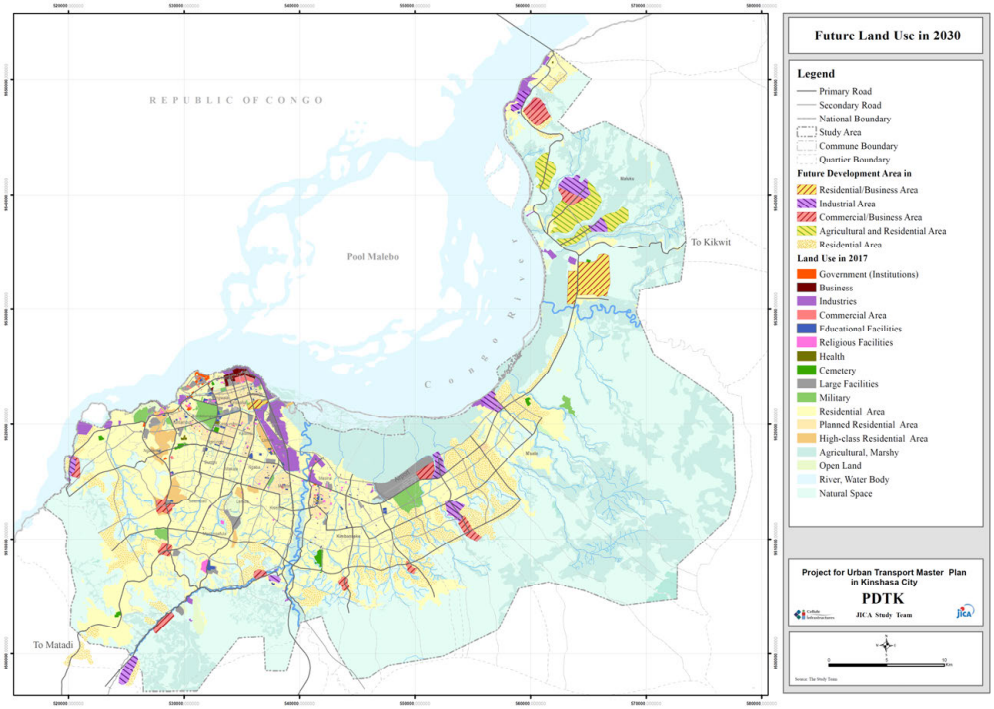
d. Existing as well as future development perspectives of transport network and other urban infrastructure.

The planned new development zones and land use plan in 2030 are exhibited in Figure 5.4.2 and Figure 5.4.3, and those in 2040 in Figure 5.4.4and Figure 5.4.5.



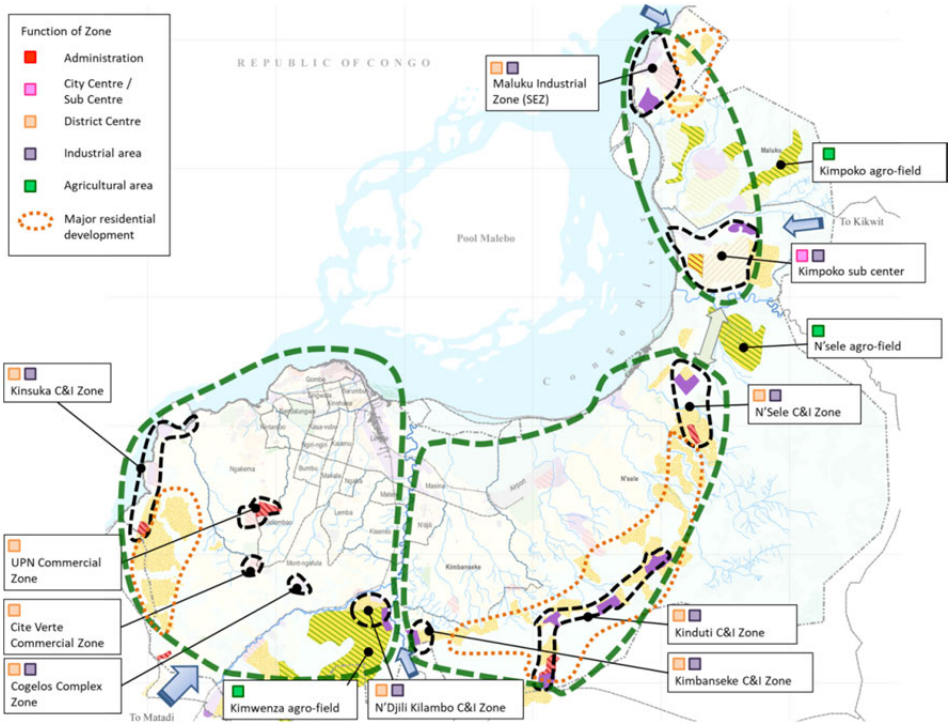
Source: The Study Team

Figure 5.4.2 New Development Zones between 2017 and 2030



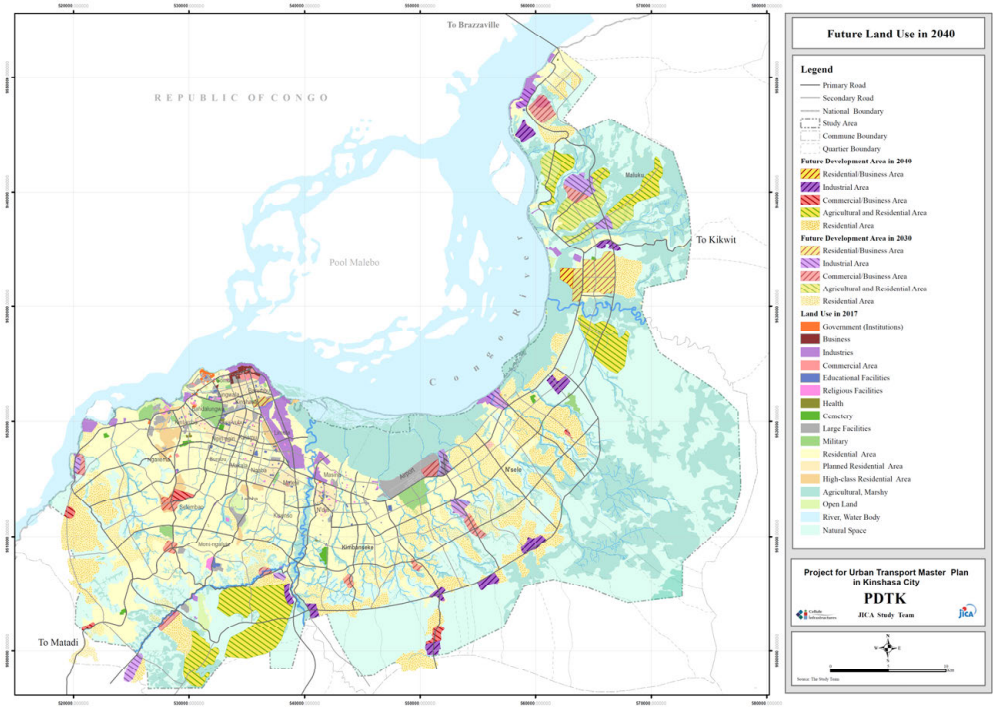
Source: The Study Team

Figure 5.4.3 Future Land Use Plan in 2030



Source: The Study Team

Figure 5.4.4 New Development Zones between 2030 and 2040



Source: The Study Team

Figure 5.4.5 Future Land Use Plan in 2040

5.4.3 Urban Transport Development Strategy

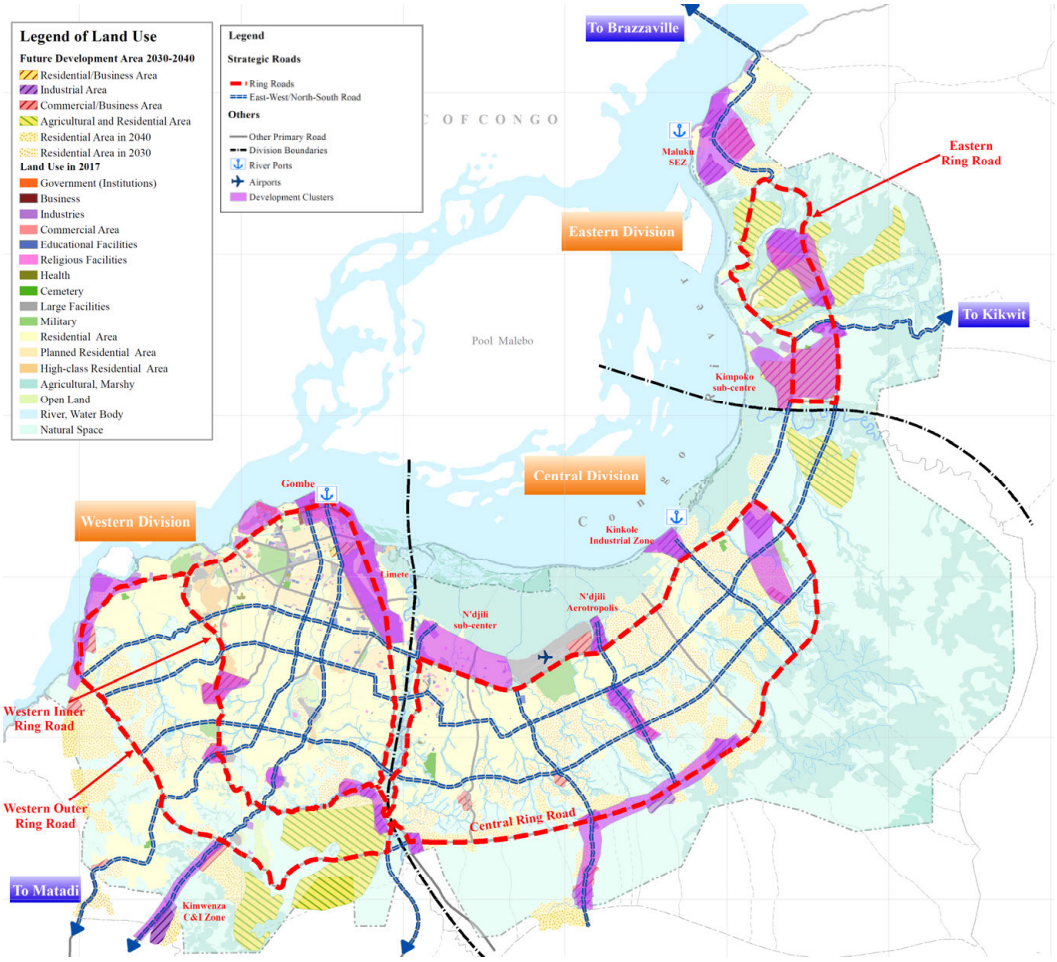
(1) Strategic Transport Network

A strategic urban transport network was planned to achieve the following purposes:

a. To assure high mobility for large and heavy-vehicle traffic (large trucks and buses in particular);
b. To connect major urban centres, such as city centre, sub-centres, commune (district) centres and development zones;
c. To provide accesses to urban/regional/international gateways, such as seaport, airport, major transport terminals (for long distance freight and passengers services) and industrial zones; and
d. To avoid through traffic that generally hampers intra-urban traffic.

Given the future land use plan and development zones, the strategic transport network is proposed that establishes ring roads that enclose the planned urban divisions; a grid shaped network inside the existing urbanized area of the Western Division; and east-west axes crossing with north-south links in the Central and Eastern Divisions.

A schematic strategic transport network in the Study Area is proposed as presented in Figure 5.4.6. Detailed locations of the strategic network are discussed in Section 7.2 later.



Source: The Study Team

Figure 5.4.6 Strategic Transport Network in the Study Area

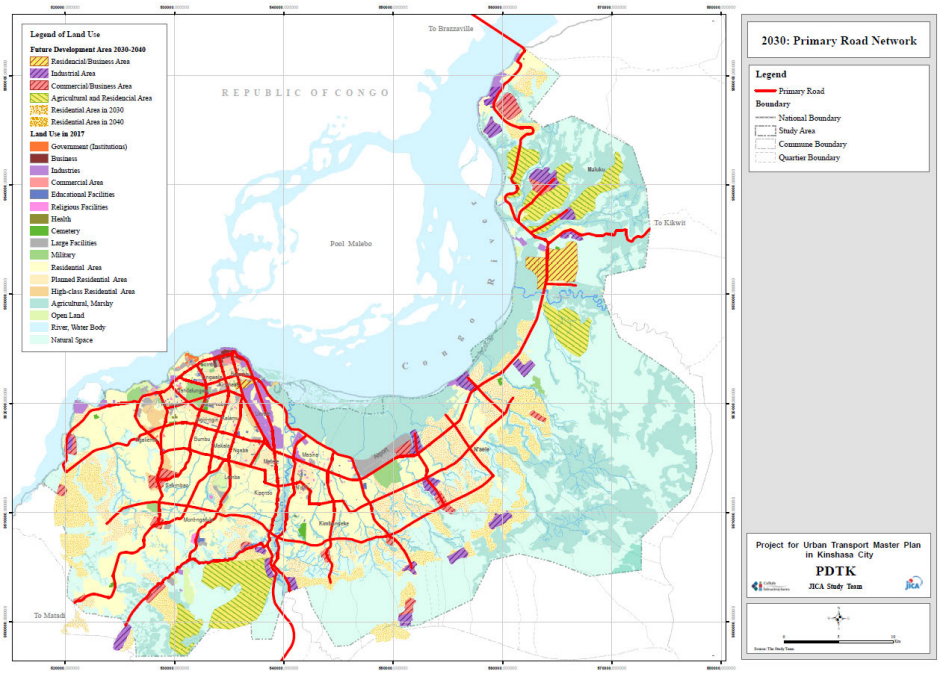
(2) Primary Road Network and Urban Structure

a) Primary Road Network

A primary road network that covers the strategic road network is defined to supplement the strategic road network, from the viewpoint of the target spacing of functionally classified road system, to secure equity in accessibility to the trunk road network. The primary road network was formed to reflect the future land use plan, development zone plan and appropriate spacing within the network. The primary road network is proposed to develop in harmony with the land use plans in 2030 and 2040, and phased in construction accordingly.

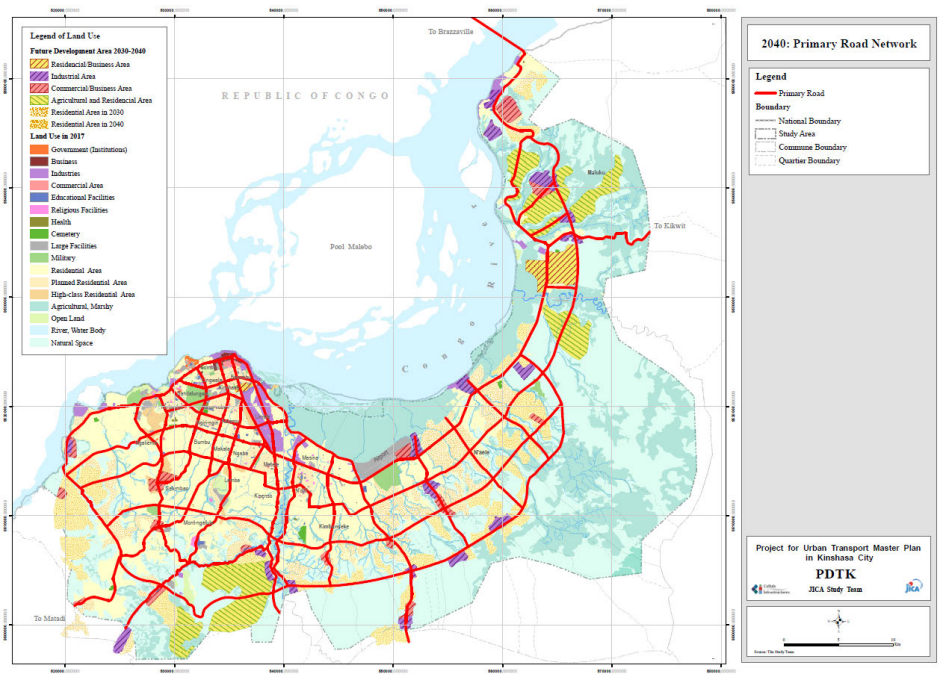
b) Strategic Urban Development Structure for 2030 and 2040

Based on the proposed future land use plan and strategic/primary road network, future strategic urban development structures for 2030 and 2040 are planned as exhibited in Figure 5.4.7 and Figure 5.4.8, respectively.



Source: The Study Team

Figure 5.4.7 Strategic Urban Development Structure in 2030



Source: The Study Team

Figure 5.4.8 Strategic Urban Development Structure in 2040

CHAPTER 6 Transport Development Scenario

6.1 Urban Transport Issues

6.1.1 Rapid and Uncontrolled Urbanization

A significant population increase is expected to grow more than double to 25.5 million in 2040 for the Study Area. A comparison of the latest satellite images with those of a decade ago reveals an increase of built-up areas, densification of urbanized areas, and urban re-development are taking place in the outskirts of the current urbanized area. If no measures are taken to alter the status quo, unorganized, scattered urban sprawl will continue.

6.1.2 Surging Road Traffic Demand

Just as most urban areas in developed and emerging countries have experienced; rapid motorization in conjunction with economic growth are expected in the Study Area. Assuming an economic growth rate similar to those in emerging Asian countries (as mentioned in Chapter 5), it is estimated that by 2040 there could be 6.3 times as many cars in the Study Area as there were in 2017.

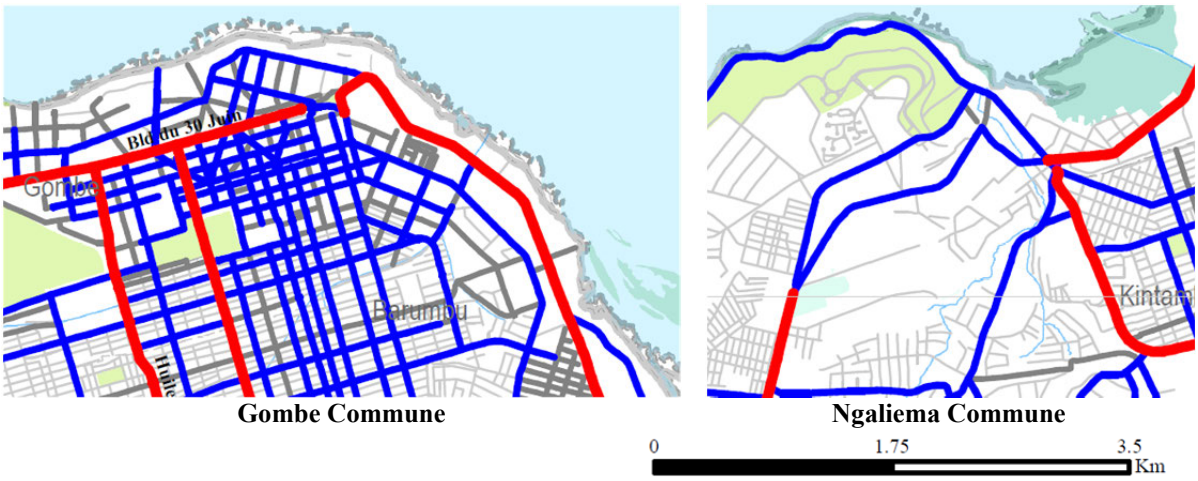
Source: The Study Team

Figure 6.1.1 Highway Assignment Results of Do Minimum Scenario in 2040

6.1.3 Incomplete Road Network

(1) Poor Road Network

The fundamental configuration of the road network has hardly changed from 1967. There are a limited number of trunk roads, and those that do exist are quite narrow. The trunk roads running in the east-west axis are more insufficient than those running in the north-south axis. Some sections of the Primary road network are discontinuous such as between Boulevard du 30 Juin and Boulevard Congo-Japon, and between Avenue L. Desire Kabila and Avenue Mondjiba as shown in Figure 6.1.2. Some sections of the Secondary road network are disconnected and include dead-ends such as Avenue Elengesa, Avenue Sefu, 6 Eme Rue, and Avenue La Oux. The density of the road network is uneven. Moreover, many Local roads are interrupted by rivers and streams, especially in the flat sprawl area. Finally, some public facilities such as Kokolo Military Camp, N'Dolo Airport and the train depot obstruct direct connections. Therefore, the soundness of the road network is severely compromised.

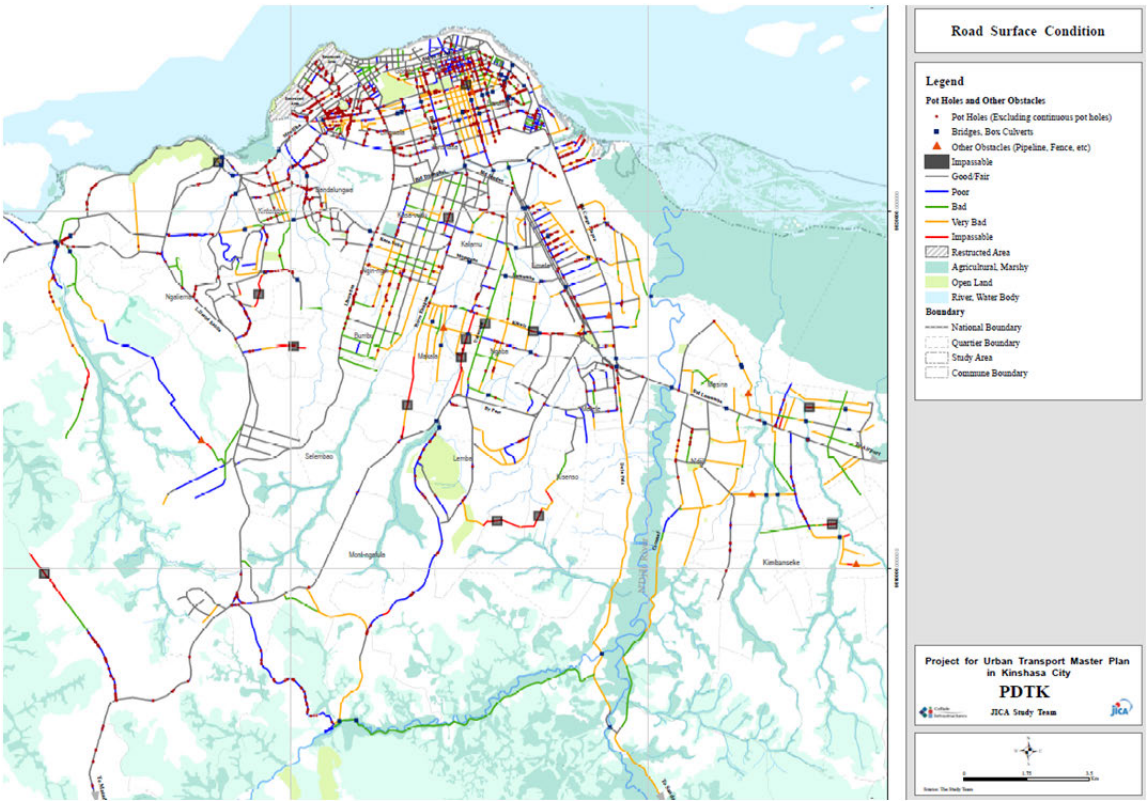


Source: The Study Team

Figure 6.1.2 Road Network Functionality Issues in Study Area

(2) Disrepair of the Existing Roads

Despite efforts of the OVD (*Office des Voiries et Drainages* / Office of Roads and Drainage) and the OR (*Office des Route*s / Road Agency), many roads have been destroyed by rivers and streams or have many large holes; and ultimately, the roads have fallen into a state of disrepair nearly everywhere. As a result, the roads are difficult to navigate even in the dry season. On more than half of RIS (Road Inventory Survey) target roads, the surface conditions were found to be poor or worse and to hinder smooth travel. Furthermore, 64.3% of RIS target roads found to be impassable are concentrated in the Flat Sprawl Area. Therefore, restoring and improving these devastated roads is an urgent task.



Source: The Study Team

Figure 6.1.3 Current Road Surface Conditions for Target Roads in Study Area

(3) Increasing Intensity, Frequency and Duration of Rainwater Inundation

The changes in land coverage due to the rapid urbanization and forest cutting in the hilly areas or rivers upstream are reducing the capacity of the soil to absorb water in the upstream areas (leading to a higher runoff coefficient). The volume of water flows into drainage channels (rivers, channels, and gutters) were planned, designed and constructed during the colonization period and therefore unable to cope with the current intensive rain water discharge volume. The discharging capacity of rivers is decreasing because of the accumulation of waste that is hindering water flow and the build-up of sand and mud from the upper stream raising the waterbed level. Moreover, the clogging of outlets and decreasing drainage system capacity are lengthening the duration of flooding.

6.1.4 Dependence on Market-oriented Public Transport Modes

(1) Less Regulated Road Public Transport Operated by Private Sector

Most drivers wait until buses are full before departing terminals. Bus drivers may stop service in the middle of routes or change the route when demand decreases. They often minimize maintenance to reduce short-term maintenance costs, which often leads to the vehicles breaking down during operations causing significant disruption to their passengers and to traffic on the road. Drivers of private transit also compete with each other for passengers. They do not mind stopping

their vehicles on the road, often at busy intersections and in front of markets and schools. This significantly reduces road capacity and results in negative economic externalities as shown in Figure 6.1.4.

UPN Intersection

Boulevard Lumumba

Source: The Study Team

Figure 6.1.4 Photos of Congestion caused by Taxi-buses and Shared Taxis (*Ketch*)

- It is common for drivers to divide a regulated bus fare route into smaller sections to increase their profit by charging separate fares for each section.

(2) Limited Capacity of Road Public Transport Operated by Public Sector

As mentioned in the above section, private bus operators are increasing their revenue by cutting individual routes into several sections. This means a virtual increase of fares for passengers. Additionally, the fares of private operators were increased in April 2018 while the fares of buses operated by the public sector, Transco and New TransKin, were set at CDF 500. This has resulted in the concentration of passengers to buses operated by the public sector in spite of limited capacity. Thus, the passenger occupancy rate of Transco and New TransKin buses are higher compared with other modes. Many passengers are queuing in front of Transco bus stops.

According to Transco, the fare necessary to cover expenses for proper bus operations should be CDF 1,600, which is over three times the current amount. As the number of buses is limited to 499 and the number of buses available for operations in 2017 was 392, it is not possible to increase their service without assistance.

(3) Dysfunctional Urban Railway Service

The current urban railway service, with one round trip per weekday operated by SCTP (*Société Commerciale des Transports et des Ports* / Commercial Society of Transport and Ports), is far from the modern urban transport systems of other metropolitan areas around the world.

The average daily (weekday) ridership is approximately 1,600 as of 2017. Ridership declined from 2007 to 2010 due to malfunctioning locomotives and coaches and deteriorating track conditions.

Since the two locomotives manufactured in Czechoslovakia, funded by the CTB (*Coopération Technique Belge*, *Agence belge de développement* / Belgian Development Agency), started operations in 2011, the number of passengers increased from 2010 to 2012. However, the number

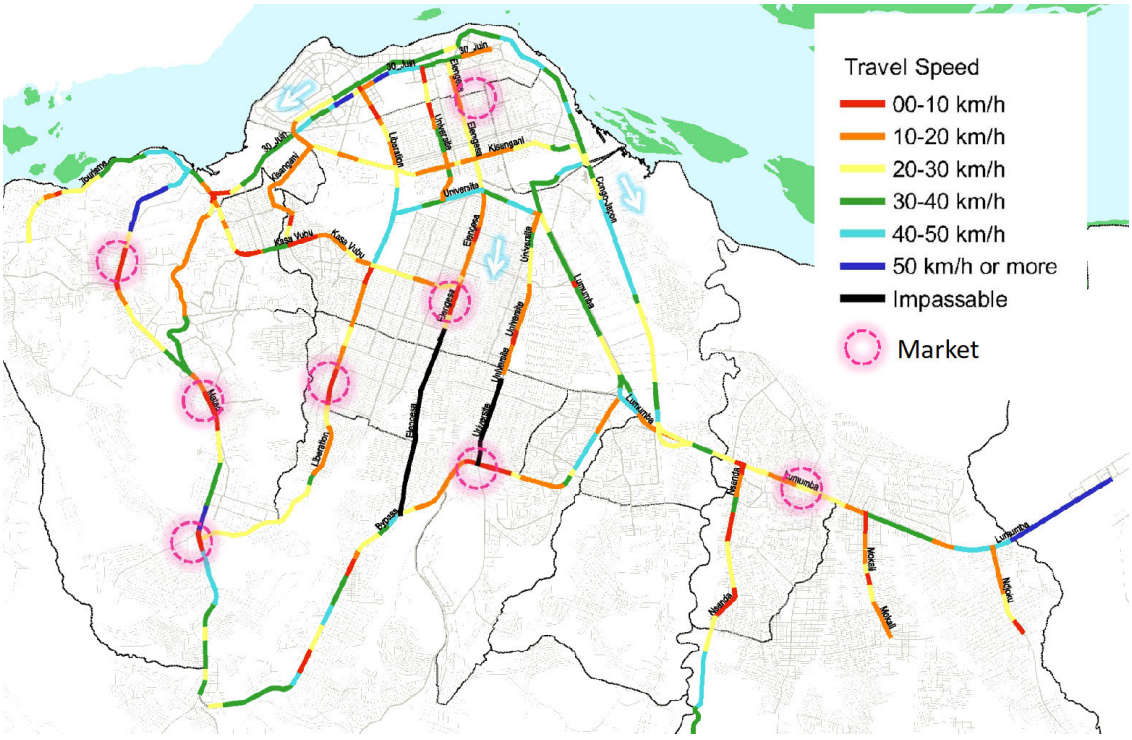
of passengers declined again after 2012 due to the bad condition of the two locomotives as those are second-hand. This implies that potential demand for urban railway service is high, though railway operations are dependent on the availability of the locomotives.

(4) Urban Areas Inaccessible by Public Transport

Residents of areas with low traffic demand and undeveloped roads are often compelled to use taxi-buses, taxis and moto-taxis (motorcycle taxi) because there is usually no or limited public bus and private bus service. While the fares are similar, these modes end up being relatively expensive due to the fact that the routes are shorter. Therefore people without access to affordable public transport service usually have to reply on non-motorized transport. This is particularly true for people with household incomes less than USD 200 per month, for whom 58% of trips are by non-motorized transport such as walking and bicycle.

6.1.5 Traffic Flow without Control

The travel speeds of motorized vehicles in Kinshasa City, shown in Figure 6.1.5, are slow during peak hours due to the vehicles being concentrated on the limited road network. This is particularly true near major intersections that have large markets and public transport transfer points (poles) nearby, along roads in poor condition (unpaved and full of potholes), and on roads with many vehicles parked or stopped on the street and with street vendors.



Source: Travel Speed Survey, The Study Team

Figure 6.1.5 Average Travel Speeds during Evening Peak hour (Outbound, 6-7 pm)


Broken traffic signal


Traffic control by police


At the intersection

Source: The Study Team

Figure 6.1.6 Picture of Main Factors of Traffic Congestion

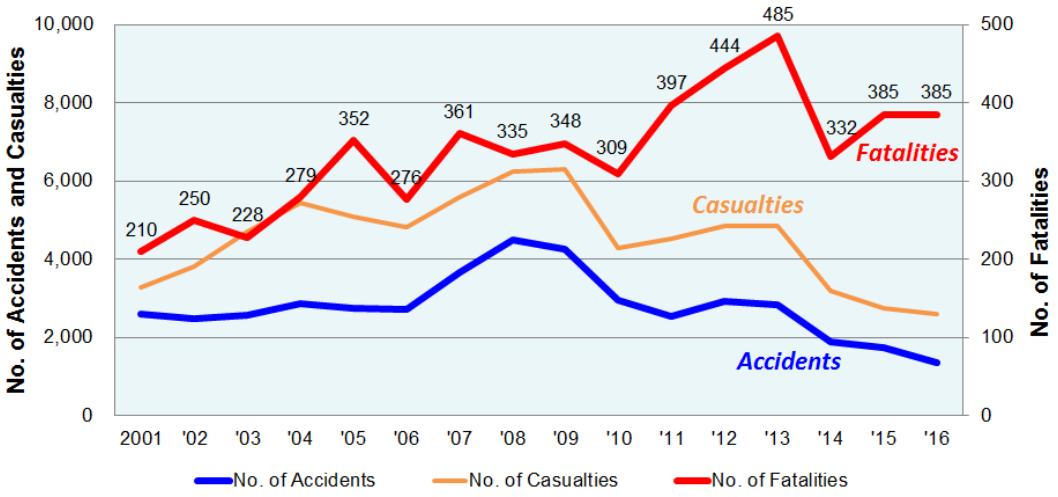
According to the CNPR (*Commission Nationale de Prévention Routière* /National Road Safety Commission), 75 traffic signals have been installed in Kinshasa City. Traffic signals are normally installed on a road project basis, which means the authorities responsible for installation differ from intersection to intersection, and management of traffic signals is the responsibility of the CNPR. Once traffic signals are broken, they tend to remain inactive due to the lack of financial resources and ability to fix them.

6.1.6 Traffic Accidents

(1) Traffic Accidents in Kinshasa City

Road accident data is summarized by the CNPR. In Kinshasa Province, the number of fatalities increased by 1.8 times in the 15 years between 2001 and 2016 as shown in Figure 6.1.7. According to a survey conducted by Handicap International (an NGO), which has been one of the partners on road safety in the DRC, 53% of residents in Kinshasa City have experienced road accidents.

Many problems were observed regarding traffic safety in Kinshasa City such as speeding, dangerous passing, drunk driving, busy intersections without traffic signals, a lack of traffic signs, illegally parked vehicles, and overloading of goods and passengers. Drivers are accustomed to not using seat-belts or not wearing motorcycle helmets. Drunk driving enforcement is not done on a regular basis, partially due to the fact that traffic police do not have sufficient alcohol test kits.



Source: CNPR

Figure 6.1.7 Number of Fatalities, Casualties, and Accidents in Kinshasa Province

(2) Traffic Safety Issues

Traffic safety issues in Kinshasa City are derived mainly from problems listed below:

- Lack of scientific (evidenced-based) approach
- Lack of the system to secure safer road infrastructure
- Insuficient traffic regulations and poor law enforcement
- Lack of continuing education and awareness for traffic safety
- Poor post-crash response
- Less cares of pedestrians and vulnerable road users

6.1.7 Institutional Issues

Urban transport sector institutional issues are summarized below by each sub-sector.

(1) Road Development, Maintenance and Management Issues

Human Resources

The workforce has been facing accelerated ageing for many years, making it difficult to smoothly transfer skills and knowledge among each organization

Equipment

Major equipment issues include a failure to repair equipment and insufficient capabilities of operators and mechanical engineers, and also insufficient road operation and maintenance equipment and spare parts.

Financing

There are three kinds of financial resources for road operations and maintenance: FONER, the central government, and the provincial government. It is planned that 60% and 40% from 95% of FONER's revenue is to be allocated to the budgets of OR, OVD and other organizations, respectively, in order to implement their road operation and maintenance plans. However, the full amount of the budget is not always implemented by FONER, which makes it difficult for OR and OVD to execute their road operation and maintenance plans.

(2) Traffic Safety, Control and Management Issues

The issues in organizations and institutions related to traffic safety, control and management are identified to be as follows:

- Legacy laws and regulations
- Ambiguity of responsibility
- Lack of qualified inspectors
- Financial problems

(3) Public Transport Operations and Management Issues

Regarding Communication, Coordination and Cooperation among all transport modes

- No framework exists for coordinating the formulation and implementation of public transport plans
- Parallel permission for public transport routes given by the national and provincial governments
- No pricing linkages (e.g. no discount when connecting between public transport modes)
- No designated mechanisms/facilities for coordinating transportation modes transfers (e.g. no points/stations, no facilities, and no routes)

Regarding Buses and Taxis

- Single operation and regulation (e.g. by TRANSCO, by Provincial Minister of Transport)
- Discrepancies in responsibilities and implementation policies at the national and provincial government[1] levels
- Excessive competition among national, provincial, and private bus operators caused by each service operating independently
- Lack of coordination between the regulatory authorities, mainly provincial and national governments, and the judicial authority: the police[2]
- Insufficient financial support for the bus operation organization (TRANSCO)
- Unclear processes for setting fares and quality of service standards

Regarding Railways, Ports and River transport (SCTP)

- Single operation and regulation
- Insufficient financial resources and resulting managerial issues (e.g. unpaid salary)
- Insufficient staffing including an issue with aging personnel
- Unclear processes for setting fares and quality of service standards

[1] The national government is actually highly involved in spite of decentralization
[2] Leads to uncontrolled bus operations, especially dictating bus stop locations.

(4) Transport Sector Finance Issues in Kinshasa City

Although the availability of information on the budget is limited, the executable budget for urban transport sector of the Study Area is estimated at approximately CDR 171 billion in 2018 (equivalent to USD 135 million, exchange rate of August, 2017). While this is larger than the estimated required budget for road maintenance for the current road network of the Study Area, CDR 142.2 billion (USD 90 million), limited infrastructure development is expected.

According to FONER, their 2016 national budget was USD 128 million; whereas they estimated annual total requirements for road maintenance to be approximately USD 250 million, which is almost double of the amount.

It should also be noted that Transco is receiving assistance from the government in the form of vehicles and fuels; and the railways department of the SCTP receives cross subsidies from other departments and headquarters. According to the CNPR, the Grand Commission which consists of 21 organizations and authorities hasn't been held for a long time due to a tight budget situation. Considering the budget shortfalls in all transport sub-sectors, funding for initial investment, maintenance and operations needs to be increased. Additionally, the efficiency of each government agency should be improved.

In terms of financing from international donors, as of May 2018, the only expected funding from multi-lateral donors in Kinshasa are from the World Bank for the planned Kinshasa Urban Development and Resilience Project, and from the AfDB for the Kinshasa – Ilebo Railway Project including the construction of the Brazzaville – Kinshasa Rail – Road Bridge.

6.1.8 Environmental Issues

From field observations and discussions with the stakeholders, present environmental vulnerabilities of Kinshasa City that require attention in future transport development scenarios can be summarized as shown in Table 6.1.1.

Table 6.1.1 Urban Transport Issues with Environmental Impacts in Present Kinshasa City

	Impacts Related to Road and Transportation
Environmental Pollution	• Most of the vehicles are reasonably well-maintained, but occasionally vehicles with **black or white exhaust** are observed. • Unpaved roads and ground surface are among **the main causes of dust** in the dry winter season. • **Heavy road congestion** at various places in the Study Area is contributing to **air pollution**.
Natural Environment	• Many arterial and secondary roads have **grown street trees** that provide shade, mitigate dust pollution, and give town identity to local people. **Public and private trees may be lost** due to new roads or urban development.
Socio-Economic Environment	• Many arterial and secondary roads are poorly maintained and remain in a condition where **car access is difficult**. Individuals living along such roads are **forced to walk**. • Large numbers of pedestrians are at **high risk of traffic accidents** because of insufficient provision of pavement, street lights and road crossing facilities. • Public transport is well-used, but not well-organized or disciplined. The general public is **forced to pay higher fares** on many occasions. • Heavy road congestion is observed at major intersections, markets, potholes, and where the traffic volume surpasses the road capacity. Such **congestion is the reason for many socio-economic deficiencies**, such as unpredictable public transport, large number of commuters forced to walk, and **loss of personal time and economic opportunities**.

Source: The Study Team

6.2 Objectives of Urban Transport

Through discussion in the Joint Coordinating Committee (JCC) and the Technical Working Group (TWG) of the study, four objectives were set for the urban transport system in the Study Area toward 2040: 1) Supporting Urban Economic Activities, 2) Assuring Equity in Transport, 3) Improving Safety and Security, and 4) Achieving Environmentally Sustainable Transport.

(1) Supporting Urban Economic Activities

Transport is derivative of economic activities. However, economic activities are totally dependent on passenger and cargo transport in contemporary urban areas. Obstacles in transport significantly affect economic growth of both the city and the nation. As a capital city, dysfunction of Kinshasa City means dysfunction of administration and economy of entire DRC, a country with an area comparable to that of Western Europe. It also should be noted that Kinshasa City has been a national and African transport network hub due to its strategic geographical location connecting land transport toward Atlantic Ocean and fluvial transport toward inland areas.

(2) Assuring Equity in Transport

Regardless of income level, age, gender, disability, vehicle availability or any other personal attribute; residents should have transport modes available to facilitate their daily activities of working, studying, eating, shopping, and caring for their health. In this sense, transport is a fundamental right for people. Restricted mobility results in reduced accessibility to job opportunities, education and medical services.

(3) Improving Safety and Security

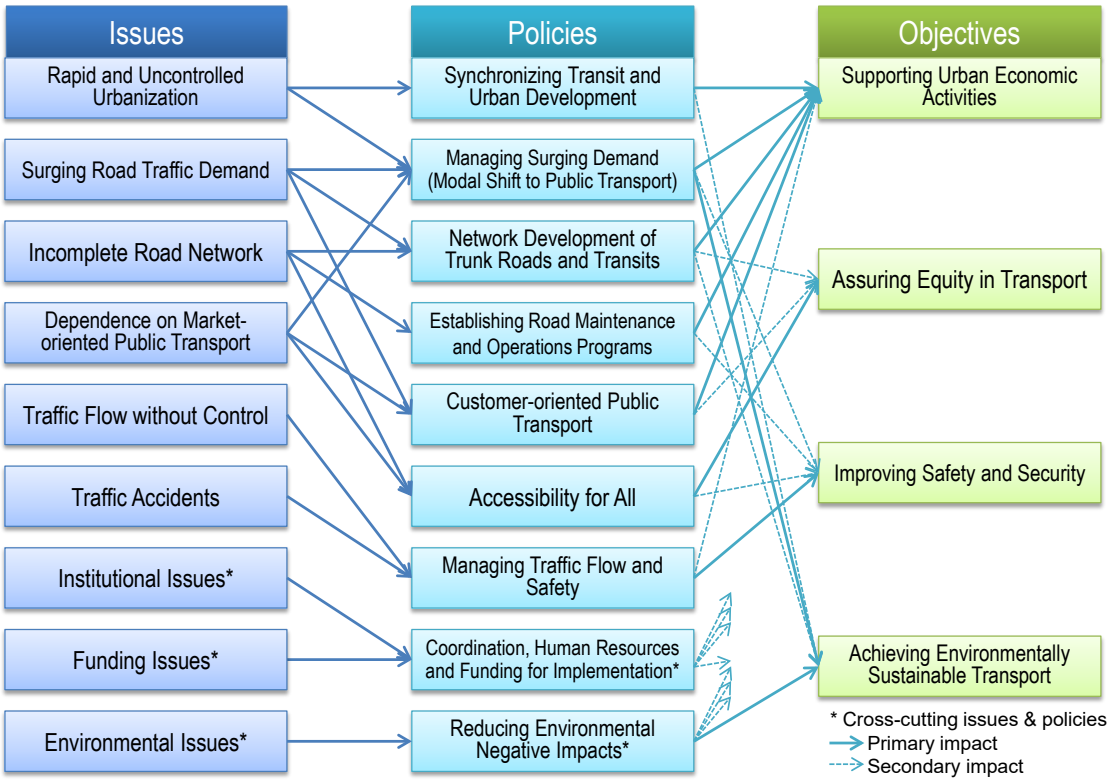
Safety and security in transport is a concern for all, including pedestrians, drivers, and passengers. Although traffic accidents can never be completely eliminated, even in developed countries, continuous effort is required to minimize accident risk. Crimes related to transport also should be taken into account.

(4) Achieving Environmentally Sustainable Transport

Urban transport systems are expected to be environmentally sustainable. Without this, cities will not be able to be sustainable in the future. While it is not possible to completely remove all negative environmental impacts, they should be reduced or mitigated to a sustainable level.

6.3 Urban Transport Policies

Based on the nine urban transport issues and four urban transport objectives discussed in the previous sections, nine urban transport policies are formulated. The relationships among the issues, policies, and objectives are summarized in Figure 6.3.1.



Source: The Study Team

Figure 6.3.1 Transport Issues, Policies and Objectives for the Study Area

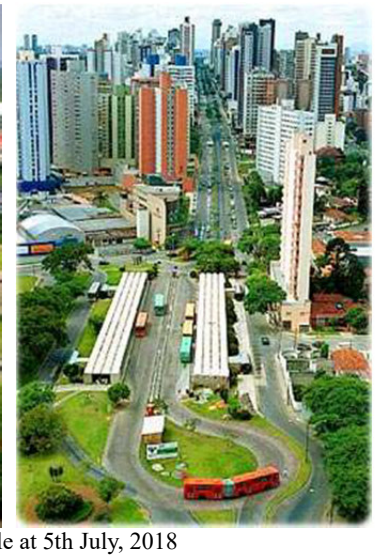
6.3.1 Synchronizing Transit and Urban Development

"Transit and land-use integration is one of the most promising means of reversing the trend of automobile-dependent sprawl and placing cities in developing countries on a sustainable pathway."[3] By introducing high density and mixed-use land uses along high capacity transit corridors, urban lifestyle based on non-motorized transport and public transport can be achieved along the transit corridor. This significantly reduces use of a car, trip lengths and emission of greenhouse gases and air pollutants. In addition, public transport can capture higher ridership due to the transit-oriented lifestyle of people along the transit. Urban policy makers in the developing world are now paying more attention to this Transit-Oriented Development (TOD) concept. In other words, high-capacity public transport projects such as railways might fail without intensive transport demand.

Images of a car-oriented city and a transit-oriented city are illustrated in the Figure 6.3.2.

[3] Suzuki, Hiroaki, Robert Cervero, and Kanako Iuchi. 2013. Transforming Cities with Transit: Transit and Land-Use Integration for Sustainable Urban Development. Washington, DC: World Bank. DOI: 10.1596/978-0-8213-9745-9 License: Creative Commons Attribution CC BY 3.0. p.3

Houston,
Example of the
Car-oriented City



Curitiba,
Example of the
Transit-oriented City

Source: Presentation by Cervero, R. Online. Internet. Available at 5th July, 2018
https://umanitoba.ca/faculties/management/ti/media/docs/cervero_-_5Ds_and_transit-Winnepeg-Nov2011.pdf
edited by the Study Team

Figure 6.3.2 Photo Images of the Car-Oriented City and Transit-Oriented City

In the current urbanized area of Kinshasa City, provision of higher FAR in areas around railway and BRT stations is required to facilitate TOD. Legal and institutional frameworks to enforce these regulations are also needed. Another option in the urbanized area is the urban redevelopment which usually constructs new buildings with higher FAR in the area close to a transit station by exchanging land ownership rights with floor ownership of the planned building.

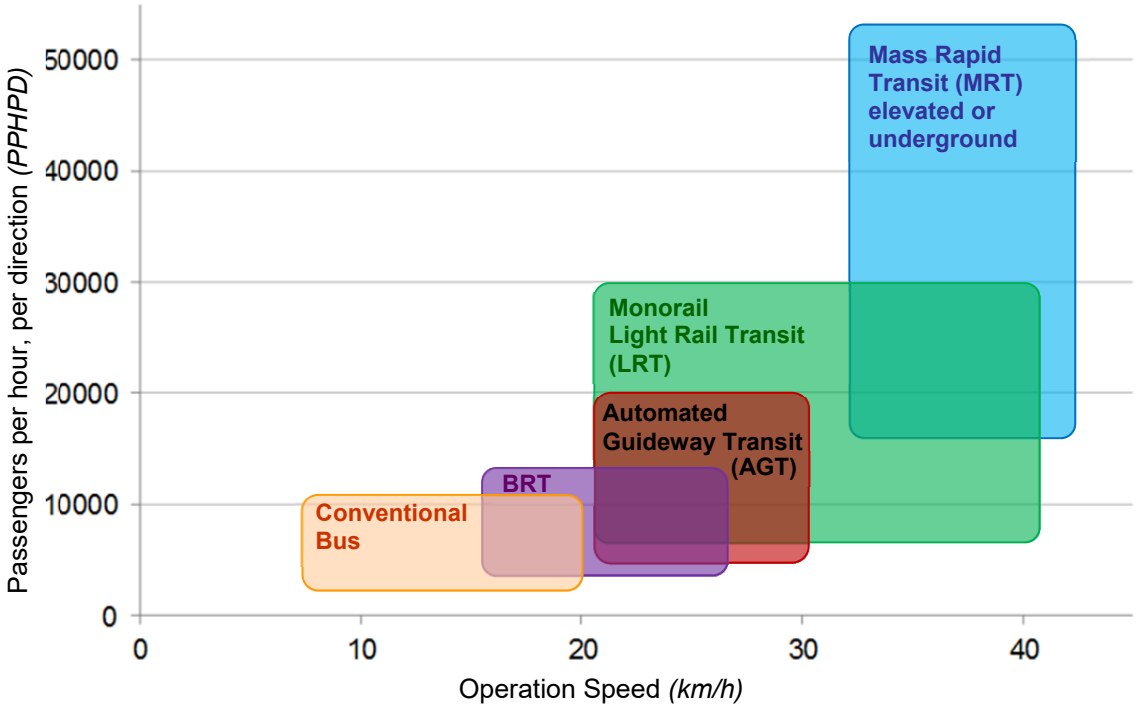
6.3.2 Managing Surging Demand (Modal Shift to Public Transport)

Since unprecedented motorized travel demand is expected in Kinshasa City in the near future as discussed a high-capacity transport system able to accommodate the demand is required. It is evident that passenger cars occupy significantly more road space than buses, and the capacity of railways is even larger than that of buses.

It should also be noted that many cities in emerging countries have experienced the vicious circle of motorization. The more the government invests in roads, the more people use cars along with economic development. On the other hand, road-based public transport modes such as buses lose their passengers as traffic congestion worsens. This further deteriorates traffic congestion due to modal shift to private modes from public transport modes. Considering the limited urban space and financial resources of Kinshasa City, it is not feasible to rely only on private modes of transport and road network development.

There are several public transport modes with various characteristics. Figure 6.3.3 shows the transport capacity and scheduled speed of different public transport modes, which are considered as key indicators for selecting the public transport mode. The current public transport modes in the Study Area (buses, minibuses, taxi-buses and shared taxis) have the smallest capacity and slowest travel speeds among all public transport modes. Taking the surging travel demand into consideration and required modal shift to public transport modes, the modes with higher capacity

and speed are indispensable.



Source: Urban Transport System Development Project for Colombo Metropolitan Region and Suburbs (2014), based on the information from the Ministry of Land, Infrastructure, Transport and Tourism, Japan

Figure 6.3.3 Passenger Capacity and Scheduled Speed of Public Transport Modes

In addition to development of the transit system, travel/transport demand management (TDM) is an option to be considered for shifting surging travel demand by private modes of transport to public modes with relatively limited investment. The TDM is a relatively new management policy on demand side, typically managing choice behaviour by providing incentive and disincentives in terms of frequency, destination, mode of travel, route, time of a day and vehicle occupancy. It also should be mentioned that some pricing options such as electronic road pricing and parking charge generates additional revenues.

6.3.3 Network Development of Truck Roads and Transits

The overall concept and policy on road and public transport network development are discussed below while detailed network plan is examined in Section 7.5 and 7.8 of the main report by comparing several network alternatives based on the travel demand analysis in Section 7.6.

(1) Road Network Development

a) Definitions of Functionally Classified Road Systems

The functional road hierarchy system and the definitions of functionally classified road systems are proposed as shown in Table 6.3.1. Also, when these characters and features are brought together, they relatively and logically fall in place together. Appropriate spacing of roads in each

system is proposed to follow AASHTO (American Association of State Highway and Transportation Officials) as shown in Table 6.3.1.

Table 6.3.1 Definitions and Conceptual Matrix of Functionally Classified Systems

Urban Systems	Definitions	Network Characteristics	Traffic Characteristics		
		Connectivity	Trip Length	Traffic Volume	Travel Speed
Primary Road System	- carries most of the trips entering and leaving the urban area, as well as most of the through movements bypassing the central city. - serves significant inter-urban travel.	Inter-urban	Long	High	High
Secondary Road System	- interconnects with and augments the primary road system. - distributes travel to geographic areas smaller than those identified with the higher system.				
Tertiary Road System	- provides both land access service and traffic circulation within residential neighborhoods and commercial and industrial areas. - collects from local streets in residential neighborhoods and channels into the primary or secondary road systems.				
Local Road System	- comprises all facilities not in one of the higher systems, - primarily permits direct access to abutting lands and connections to the higher order systems.	Inner community	Short	Low	Low

Source: Edition of the Study Team, based on AASHTO

Table 6.3.2 Target Spacing of Functionally Classified Systems

Urban Systems	Areas	Spacing	
		Minimum	Maximum
Primary Road System		1.6 km (highly developed CBD)	8 km (urban fringe)
Secondary Road System	CBD	0.2 km	1.0 km
	suburban fringe	3 km	5 km
Other Road Systems		Less than the above	Less than the above

Source: Edition of the Study Team, based on AASHTO

To development the future road network plan, the applied hierarchical classification is *Primary and Secondary roads* in the Master Plan Study.

b) Proposed Road Design Standard

Based on the functional classification comprising of primary roads down to other roads, effective

and well-coordinated road geometry and structure are proposed as follows.

There is an only one road design standard in DRC which is published by OR. However, the road types are only three; namely, National roads, Secondary roads and Agricultural Service roads. Therefore, the geometric design for the Master Plan is proposed as shown in Table 6.3.3, based on AASHTO and Japanese Road Design standards in reference with DRC standards.

Table 6.3.3 Proposed Geometric Design Standard for Master Plan

Urban Systems	Design Speed	No. of lanes	Cross Sectional Elements					
			Carriageway	Median	Shoulder	Sidewalk	Roadway	Right-of-Way
	(km/h)	-	(m)	(m)	(m)	(m)	(m)	(m)
Urban Expressways	100	4	3.50	3.0	3.0		23.0	40
		6	3.50	7.0	3.5		35.0	50
Primary Road Systems	80	8	3.50	4.5	2.5	5.0	47.5	50
		6	3.50	4.5	2.5	4.0	38.5	40
		4	3.50	4.5	2.5	4.0	31.5	35
Secondary Road Systems	60	4	3.25	3.0	3.5	3.0	29.0	30
		2	3.25	3.0	3.5	3.0	22.5	25

Source: The Study Team

c) Future Network Development of Trunk Roads

- Strategic Roads in Study Area

The strategic roads are defined to mainly serve for heavy and long distance logistics transport. They should be designed as high-mobility roads divided by median. Strategic roads should accommodate the following functions:

- To connect with logistic terminals such as seaports, airports and other freight terminals, development clusters including industrial zones and business centers, and regional and international gateways,
- To connect with CBD and high population density areas including the city centre and sub-centres,
- To form a backbone network connecting with international and regional trunk roads of the east-west and north-south roads, and
- To functionally connect with three urban divisions each other.

The strategic road network is mainly comprised of 2 categories of road based on their characteristics and functions; namely, the one is ring roads which have a bypass function and the other is east-west/north-south roads which have an axis function including regional radial roads and international links.

- Primary Roads in the Study Area

The primary road network system covers the entire strategic road network and it should be formed to fulfil the following functions:

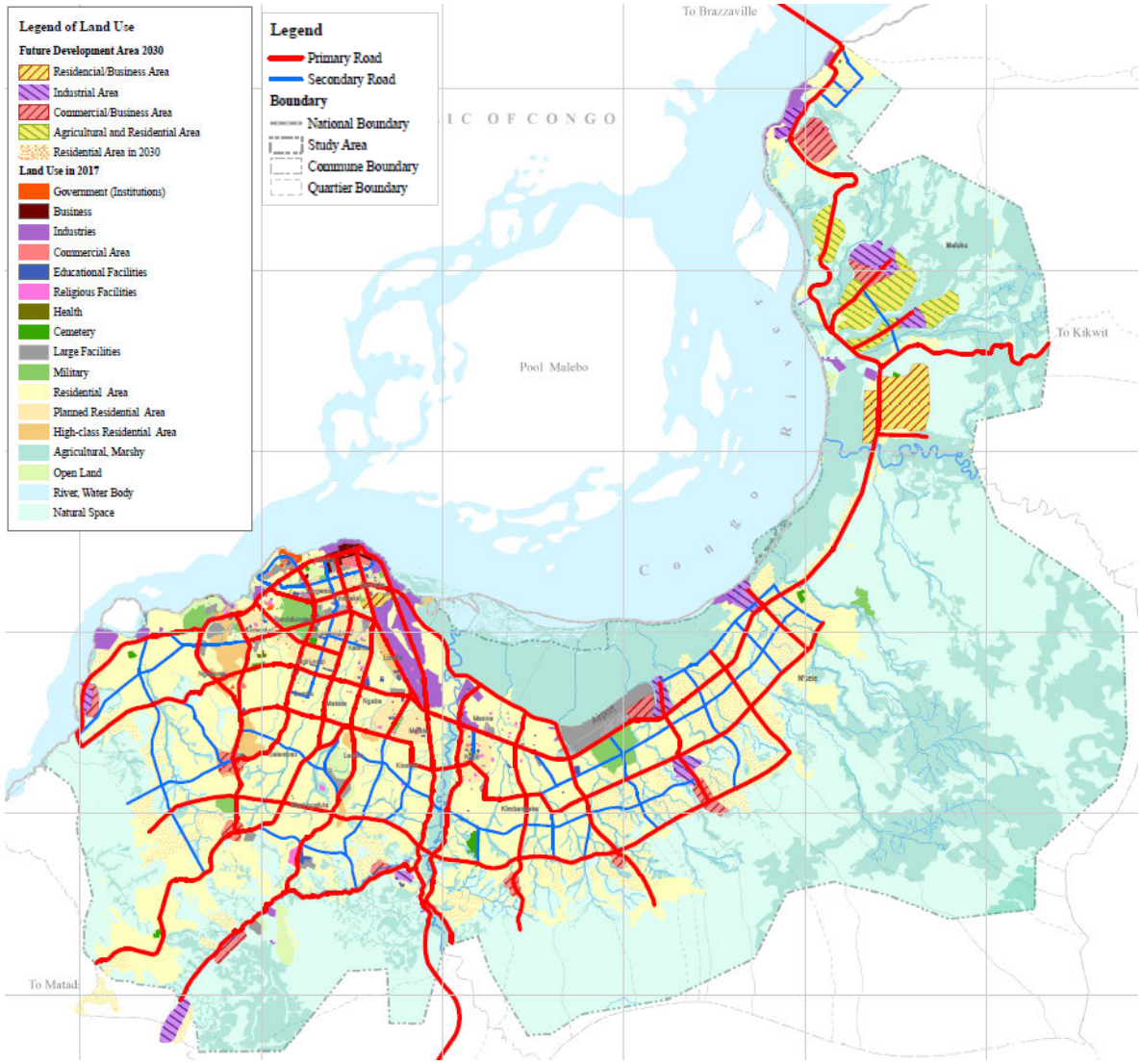
- To connect with the strategic road network and all the major urban centers including commune centers,
- To accommodate the facility to serve for a heavy-loaded, high traffic volume and relatively long distance travel,
- To assure the high mobility for a large-sized and long distance vehicular traffic,
- To form a grid pattern to secure the target spacing designed for the functionally classified system, and
- To consider the road network of SOSAK that has been approved by the Provincial Council.

➢ Secondary Roads in the Study Area

The secondary road network is planned to interconnect with and augment the primary system. Also, it distributes travel to geographic areas smaller than those identified with the higher system. It should serve for the following functions:

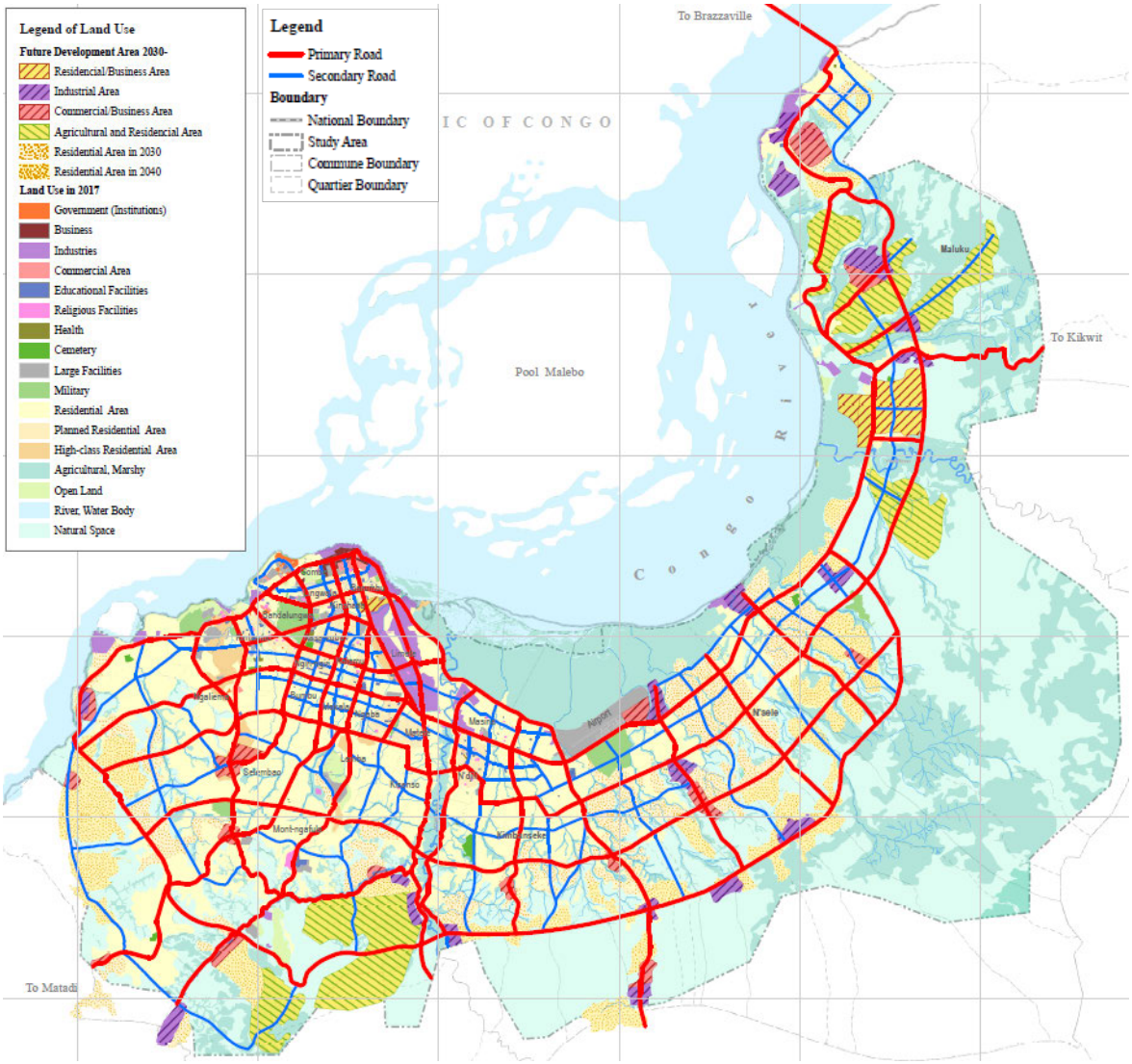
- To connect between primary roads and all the urban centers including quartier centers,
- To interconnect quartiers in communes,
- To form a grid pattern, considering the target spacing of functionally classified systems shown in Table 6.3.2, and
- To consider the road network of SOSAK that has been approved by the Provincial Council.

The Figure 6.3.4 and the Figure 6.3.5 show the proposed road network in 2030 and 2040 including secondary road network in Study area.



Source: The Study Team

Figure 6.3.4 Proposed Road Network 2030 in the Study Area



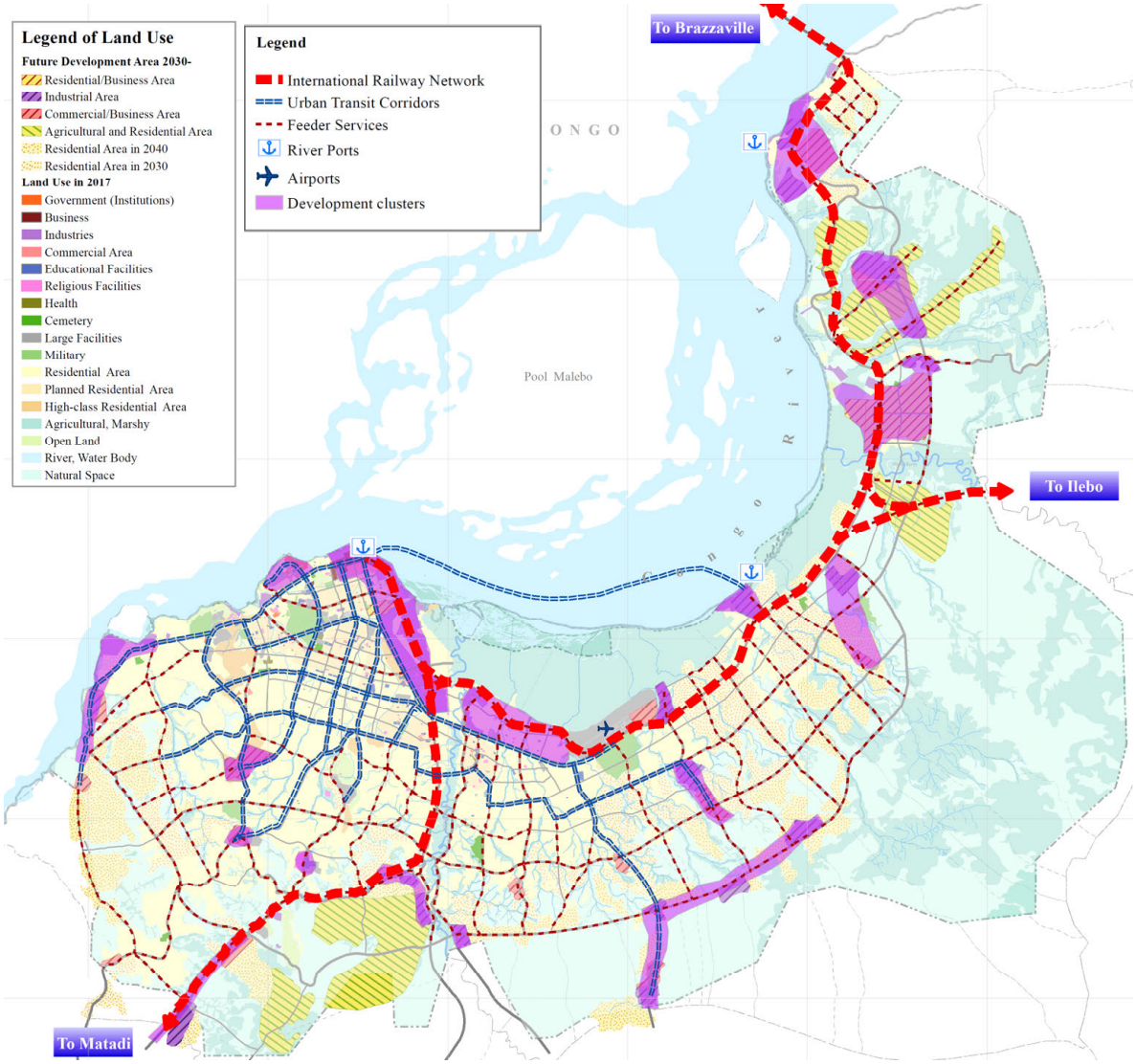
Source: The Study Team

Figure 6.3.5 Proposed Road Network 2040 in the Study Area

(2) Public Transport Network Development

For the purpose of formulating public transport network plan, seven aspects have been considered. The proposed public transport network is illustrated in the Figure 6.3.6.

- Conformity with Existing Plans and Projects
- Consistency with the Land Use Plan
- Travel Demand
- Potential Open Space for Installation
- Connectivity as an Integrated Public Transport Network
- Accessibility to Urban Functions
- Technical Considerations



Source: the Study Team

Figure 6.3.6 Concept of Public Transport Network

6.3.4 Establishing Road Maintenance and Operations Programs

(1) Policies for Road Maintenance and Operations

The road administrator must repair and maintain roads in good condition at all times. To this end, road management policies should prioritize the following:

- Maintenance of Facilities: Always maintain roads in good condition
- Maintenance of Function: Complete repairs before damage becomes critical
- Maintenance of Environment: Implement countermeasures against noise and vibration, such as those caused by differences in roadway levels

a) Efficient Road Maintenance Management to Achieve Optimal Effect at Minimum Cost

From the life cycle cost perspective, it is important to select the appropriate maintenance and repair methods at the appropriate time, and to provide the most valuable service for the cost.

b) Realization of the PDCA cycle

The maintenance and management of roads requires carrying out the PDCA cycle (Plan, Do, Check, Adjust).

(2) Policies for Drainage Management

- Basic data acquisition to facilitate the understanding on the actual situation
- Common rules (standards) to re-dimensioned drainage channels

(3) Policies for Constitution of Road Maintenance Management

a) Technical Issues

- Utilization and Distribution of Asphalt Pavement Road Maintenance Technical Guidelines
- Early Repair Work

b) Budget

Since the fund from FONER is limited, it is conceivable to allocate budget by the prioritization of repair sections based on the database made from the road inspection results.

c) Institutions

It is known that road damage progresses more rapidly as traffic volume, especially heavy vehicle traffic increases. Therefore, it is critical to strengthen institutional measures to prevent those vehicles from travelling on asphalt roads not designed to accommodate them.

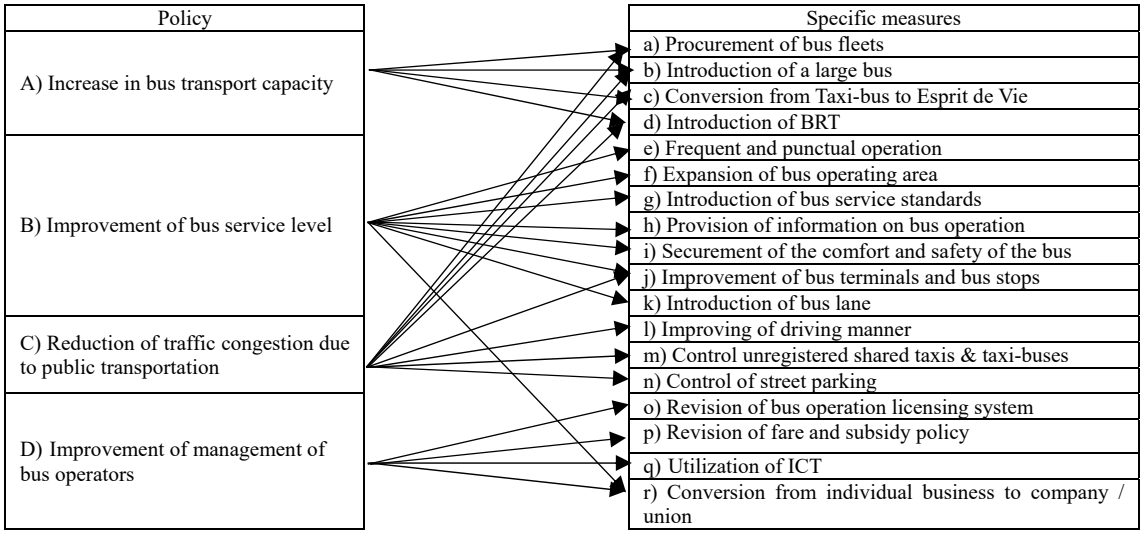
d) Human Resource Development

Utilizing the results of training by the PRCMR counterpart, the PRCMR counterpart will conduct training to OR and OVD technicians involved in the road maintenance with an aim of sharing/transferring knowledge and experience.

6.3.5 Customer-oriented Public Transport

(1) Road-based Public Transport

In order to solve the problems of the public transport discussed in Section 7.1.4, and to develop a customer-oriented public transport system, it is necessary to (A) increase the bus transport capacity to be able to serve the surging travel demand, (B) improve the bus service levels, and (C) reduce traffic congestion due to public transport. To achieve the above goals, it is indispensable to (D) improve the management ability of bus operators. Figure 6.3.7 shows the policies with corresponding measures.



Source: the Study Team

Figure 6.3.7 Policy and Specific Measures for Road-based Public Transport

(2) Railway Transport

a) Conversion from the inter-city service to the high capacity urban railway service

The current railway service in Kinshasa City is far from the urban railway service in terms of frequency, speed, capacity and service level. A fundamental transformation of railway service to an urban rapid transit is required to serve the tremendous passenger travel demand in the future, especially in 2040 as introduced by example photos in Figure 6.3.8.

Elevated Railway Track and Traffic Congestion

Interior of EMU

Source: the Study Team

Figure 6.3.8 Image of Urban Railway Service in Bangkok, Thailand

Besides, electric signalling system, Automatic Train Protection (ATP), Centralized Traffic Control (CTC) should be required to satisfy standard urban railway function for Kinshasa City in future.

Rolling stocks also should have enough capacity and speed to be served for the urban railway service. A Diesel Multiple Unit (DMU), especially a diesel–electric multiple unit (DEMU), is a

typical option for urban railway service in case the railway line is not electrified. In case frequency is high and there is no issue in power supply, installation of an electric multiple unit (EMU) in conjunction with railway electrification is an option to be considered (Figure 6.3.8) in the medium and long term.

To serve as an urban railway system, improvement of service level for passengers in terms of punctuality, speed, safety, security, convenience and comfort is critical. In addition to infrastructures, signalling, telecommunication and rolling stocks, establishment of maintenance scheme, capacity building of human resources, efficient management of the operating body and subsidies to cover losses are essential.

b) Utilization of affordable railway development options

There is a shortage of funding especially for infrastructure development. Although railway is one of the most expensive public transport modes especially for initial cost, there are several affordable options available for the railway in the Study Area. These options should be taken into account especially for urgent and short-term development plans.

The railway line which is currently under operation in Kinshasa City toward Kasangulu, a city around 45km from Kinshasa Central Station, via Kimwenza, around 23km from the Central Station, sharing the same track with the Matadi-Kinshasa railway and also the railway line to N'djili airport can be renovated with relatively small investment. For the short-term, railway lines to Kasangulu and the Airport can be utilized.

Second-hand rolling stocks are also affordable options. As long as the railway gauge is 1,067 mm, second-hand DMUs from Japan can be utilized in the railway track in Kinshasa. For instance, the gauge of Japan Railways (JR) is also the same as the railway track in the Study Area.

c) Improvement of railway administration and institution

The railway business involves technical experts from a wide range of fields and is supposed to work as one organization using diverse expertise and skills. Since the railway itself is a system, the company's management organization must be able to integrate each of the relevant technologies. At the same time, a streamlined management structure is necessary to ensure low operating costs, favourable cost performance, and sustainable operations.

6.3.6 Accessibility for All

(1) Transport Options for Low Income Household

Half of the trips made in the Study Area are by a non-motorized transport (NMT). The lower the household income, is the higher the share of a non-motorized transport trip. For the group with monthly household income of USD 25 to 100, two thirds of trips are made by the NMT. Due mainly to financial constraint, there is no option but to choose the NMT.

Reliable public transport system such as railways and BRTs should be accessible, or within walking distance such as 1km, for majority of residents in the Study Area and eventually enable them to access easily to job opportunities, schools, medical facilities and shopping. The railway and BRT routes should be aligned to be accessed by as many residents as possible while there is limitation in funding.

(2) Improving Environment for Non-motorized Transport

Despite the fact that people is dependent on non-motorized transport in the Study Area, most of roads are inaccessible. Figure 7.3.50 of the main report shows typical examples of barriers in the Study Area. Even for people with no disability, barriers are disrupting their movements.

Therefore, improvement of walking environment is highly awaited. However, priority given to walking facilities for entire roads in the Study Area cannot be completed in the short term. As discussed in Section 6.3.3, roads to be renovated and constructed should be equipped with pedestrian footways as shown in the typical cross-section of roads. Priority also should be given to the transfer point of public transport such as a railway station and a bus terminal and the roads around key urban facilities such as medical facilities, educational facilities and markets. Major roads in the central business districts (CBD) also can be prioritized as many people concentrates.

In the long term, it is expected to formulate continuous network of walking environment and bike lanes for bicycle users. For the implementation of improving walking environment, community-driven development, which gives control over planning decisions and investment resources to community group including community involvement in implementation, operation and maintenance, can be applied as unemployment of the youth is a national problem. It enhances transparency, participation, accountability, and enhanced local capacity.

Pedestrian Footpath & Bicycle Lane

Street with Bench

Open Street Café

Source: The Study Team

Figure 6.3.9 Images of Improvement of Walking Environment in Strasbourg, France

(3) Barrier-Free Transport for All

The types of people with limited mobility includes the elderly persons, the physically impaired (wheelchair users or non-users), persons suffering from an internal disorder, the visually impaired, persons suffering from a hearing or speech disorder, the mentally impaired, foreigners and others. To develop mobility environment for them, regulation, technical standards and guidelines for roads, passenger facilities, passenger coaches and buildings are required. These are the principles to be followed for the development of accessible environment.

6.3.7 Managing Traffic Flow and Safety

Traffic safety, control and management policies have been established to achieve various objectives, as shown below.

(1) Traffic Flow

To ensure smooth traffic flow in Kinshasa City, comprehensive traffic management is necessary and the following important issues must be tackled.

- Eliminate bottlenecks
- Improve parking management
- Transport demand management
- Efficient public transportation

(2) Traffic Safety

To ensure traffic safety, it is important to consider the plan from the context of the five strategic pillars described in the "Global Plan for the Decade of Action for Road Safety 2011-2020" by the WHO/UN in the African Action Plan as shown below.

Pillar 1	Pillar 2	Pillar 3	Pillar 4	Pillar 5
Road safety management	Safer roads and mobility	Safer vehicles	Safer road users	Post-crash care
Gestion de la securite routiere	*Sécurité des routes et mobilité*	*Sécurité des véhicules*	*Comportement des usagers de la route*	*Soins après l'accident*

Source: Global Plan for the Decade of Action for Road Safety 2011-2020, WHO/UN

Figure 6.3.10 Five Strategic Pillars for Road Safety (English/French)

6.3.8 Coordination, Human Resources and Funding Issues to Implement Project

Policies to address each issue are proposed as below.

(1) Coordination

In order to improve the current situation of insufficient coordination and cooperation in various aspects, the Study Team proposes to establish a council in charge of coordination among all agencies in urban transport sector, monitoring progress of the urban transport master plan and periodically revise the urban transport master plan. It is assumed that the council is a provisional coordinating body, and, managing board members as well as staff of core working unit are from central and local government agencies in charge of urban transport sector. It is expected that the council is established with necessary and sufficient legal status for fully fulfilling coordination, monitoring and planning roles.

(2) Human Resource

In this country, as a common issue across several industry and sectors, it is said that the workforce has been facing accelerated ageing for a long time. In order to address the situation, it is necessary to prepare an employment plan together with retirement plan, budgetary plan and training/education plan for employees.

(3) Funding

While the current budget for urban transport sector in the Study Area is limited, increase of tax revenue along with economic growth and other possible sources of fund are proposed as described in Table 6.3.4.

Table 6.3.4 Major Funding Sources for Project Implementation

Type of Fund	Description
Central and local government budget	While the annual available amount is limited at this moment, it is expected to increase along with economic growth.
FONER	Significant increase of budget can be expected due to motorization and increase of price per litre as automobiles are major causes of traffic congestion. The current USD 0.10 per litre for fuel and USD 0.20 per litre for lubricant should be raised considering economic externalities of motorized vehicles.
TDM (parking tax)	Parking tax as a part of TDM policy can be revenue of the government. The price level can be adjusted depending on the congestion level.
Property tax for urbanized area	Additional property tax can be applied for the urbanized area for funding of required infrastructure in urban areas.
Fare of public transport	Fare of public transport operated by public companies can be utilized not only for operation and maintenance but also partially for initial investment of public transport while it is not possible to cover entire initial investment of public transport.
Land value capture	For the new urban development of suburban areas, infrastructures including roads should be developed by the developers including private developers. For the area around railway station, higher FAR can be applied. This value should be captured by urban redevelopment project or selling of additional FAR to private sector etc.
Multi-lateral donors	Grants and loans from the World Bank, African Development Bank, and EU are expected.
Bilateral donors (Members of DAC)	Grants and loans from member countries of DAC such as JICA, AfD, Belgian Development Agency and DfID are expected.
Bilateral donors (non-members of DAC)	Grants and loans from non-member countries of DAC such as China are expected.

Note: DAC stands for Development Assistance Committee of the Organisation for Economic Co-operation and Development (OECD)

Source: the Study Team

6.3.9 Reducing Negative Environmental Impacts

Given that the population of Kinshasa City will double to about 25 million by 2040, and that transportation demand will be 2.3 times of that of 2017, negative social and environmental impacts are expected without strategic planning and investments on transportation.

To avoid and minimize the negative impacts and enhance the benefits from strategic planning and investments, the following 8 policies are proposed:

1. Traffic congestion must be avoided and the use of public transport must be encouraged to minimize vehicle emissions.

2. The use of private cars must be discouraged and the use of public transport must be encouraged to reduce transportation fuel consumption and greenhouse gas emissions.

3. Future road plans must be shared with the public, and construction activities within public ROWs must be discouraged to minimize the long-term relocation of homes and businesses.

4. Plans to expand existing roads and alignment plans for new roads must be developed in consultation with local institutions and residents to avoid negative impacts such as interference with of existing traffic and near road activities, the destruction of important historical and cultural resources, and the loss of street trees that are considered to be of importance to the local identity.

5. Effective communication and decision making procedures for the implementation of the Master Plan must be put into place to give the public a fair and reliable process for providing input and air grievances and to help resolve complaints.

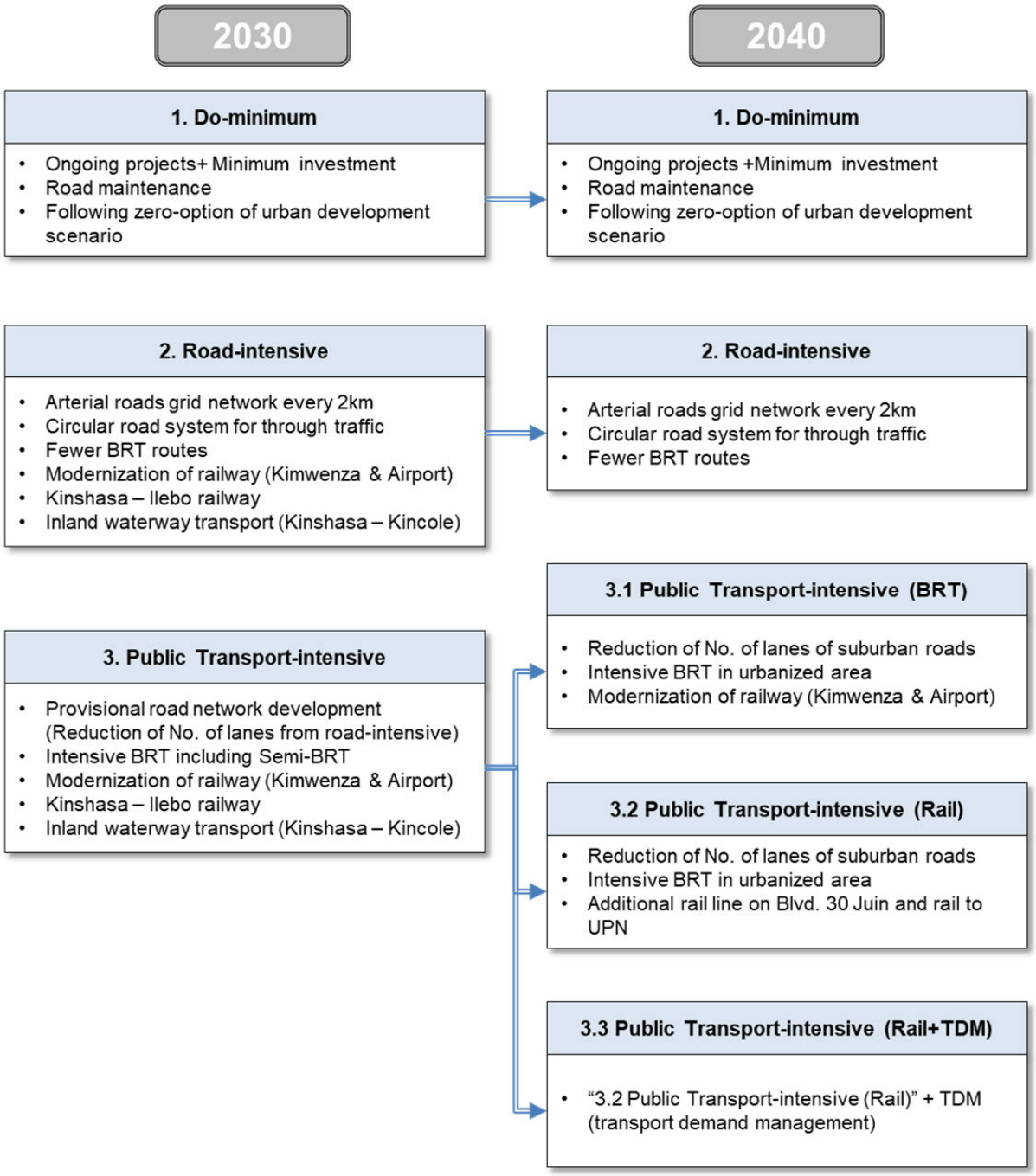
6. Kinois, especially children, women and the elderly, must benefit from affordable transportation and better access to work places, markets, schools, hospitals, etc., even with the population doubling and urban areas expanding.

7. Businesses in Kinshasa, including the markets, must benefit from increased access to goods, consumers and workers.

8. Road and traffic safety must be improved and the number of traffic accidents per capita must decrease.

6.4 Alternative Transport Network Scenarios

For the purpose of identifying the suitable transport network option as well as public transport mode, alternative transport network scenarios are prepared. Considering the limited financial resources, priority should be given. It also should be noted that the future transport modes also should be identified. In principle, 3 scenarios; 1) Do Minimum, 2) Road-intensive and 3) Public transport intensive scenarios; are prepared as shown in the Figure 6.4.1. For the 3) Public transport intensive scenario, the scenario is divided into three derivative scenarios by mode and application of TDM policy in 2040.



Source: The Study Team

Figure 6.4.1 Alternative Transport Network Scenario in 2030 and 2040

6.5 Transport Demand Analysis and Future Projection

6.5.1 Transport Survey and Analysis

(1) Transport Surveys

To formulate the comprehensive urban transport master plan for Kinshasa City, robust numerical analysis and evaluation based on a wide variety of transport-related data is essential. After analysing the collected data, the Study Team planned and conducted fourteen (14) types of transport surveys to complement and underst and the traffic situation in greater detail, including current trip characteristics, traffic volume and transport inventory; and to develop the transport demand forecast model, hereinafter simply referred to as the Transport Model.

The fourteen (14) types of survey packages were to be conducted under the Study. As shown in Table 6.5.1, these surveys results were summarized to 12 types of surveys due to similar characteristics for analysing the objective in the following sections.

Table 6.5.1 Survey Items

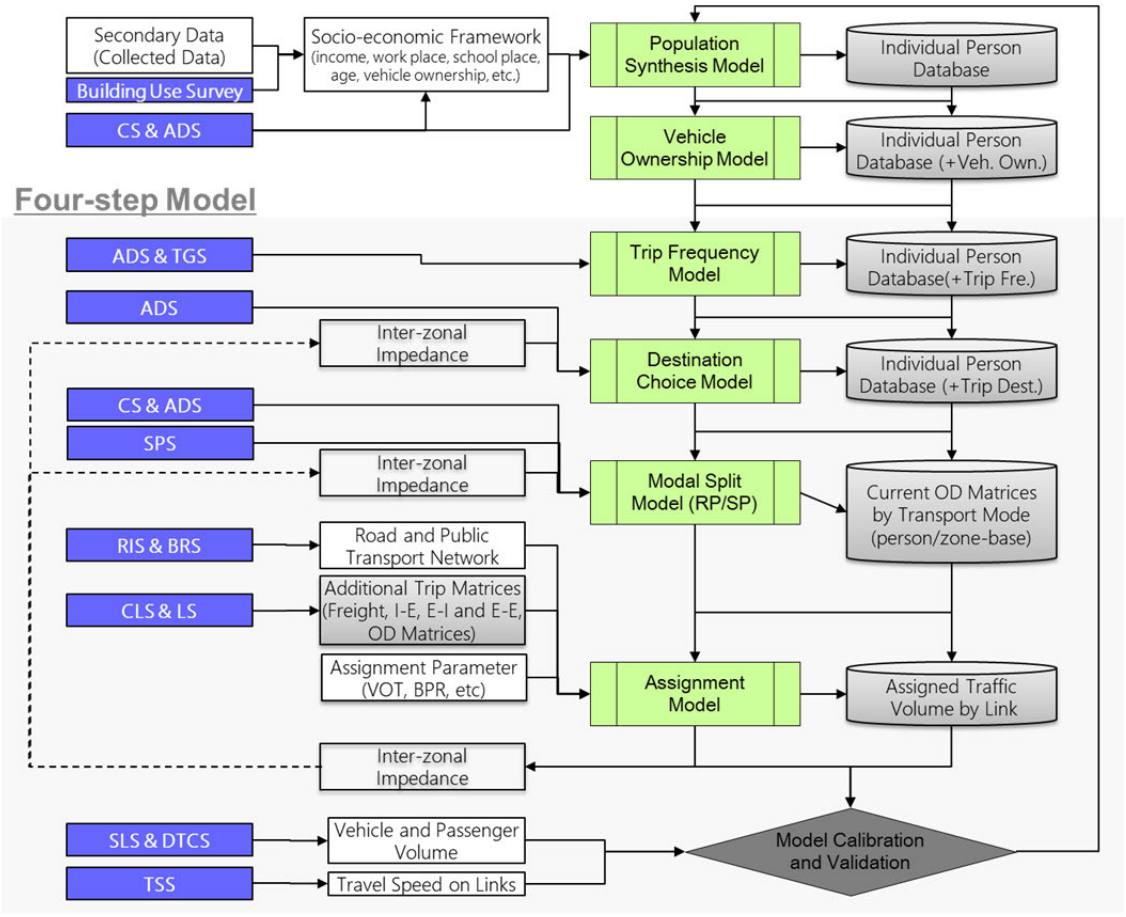
Package Name	No	Survey Name	Abbr.
1 Commuter Survey	1	Commuter Survey / Activity Diary Survey	CS/ADS
2 Activity Diary Survey			
3 Screen Line Survey	2	Screen Line Survey	SLS
4 Cordon Line (Roadside OD Interview Survey)	3	Cordon Line Survey (*)	CLS
5 Cordon Line (OD Interview Survey at Airport)			
6 Directional Traffic Count Survey	4	Directional Traffic Count Survey	DTCS
7 Parking Survey	5	Parking Survey	PS
8 Trip Generation Survey	6	Trip Generation Survey	TGS
9 Travel Speed Survey	7	Travel Speed Survey	TSS
10 Stated Preference Survey	8	Stated Preference Survey	SPS
11 Road Inventory Survey	9	Road Inventory Survey	RIS
12 Logistics Survey	10	Logistics Survey	LS
13 Building Use Survey	11	Building Use Survey	BUS
14 Bus Route Survey (BRS)	12	Bus Route Survey	BRS

*The passenger interview and count survey for ship users was conducted under logistics survey considering efficient execution of the field survey.

Source: The Study Team

6.5.2 Modelling for Transport Demand Projection

As shown in Figure 6.5.1, the transport model for the Study includes three sub-models: 1) a Population Synthesis Model, 2) a Vehicle Ownership Model, and 3) a Conventional Four-Step Model with a disaggregated approach. Each model and its assumptions will be explained in the following sections.



Source: The Study Team

Figure 6.5.1 Flow of the Transport Model

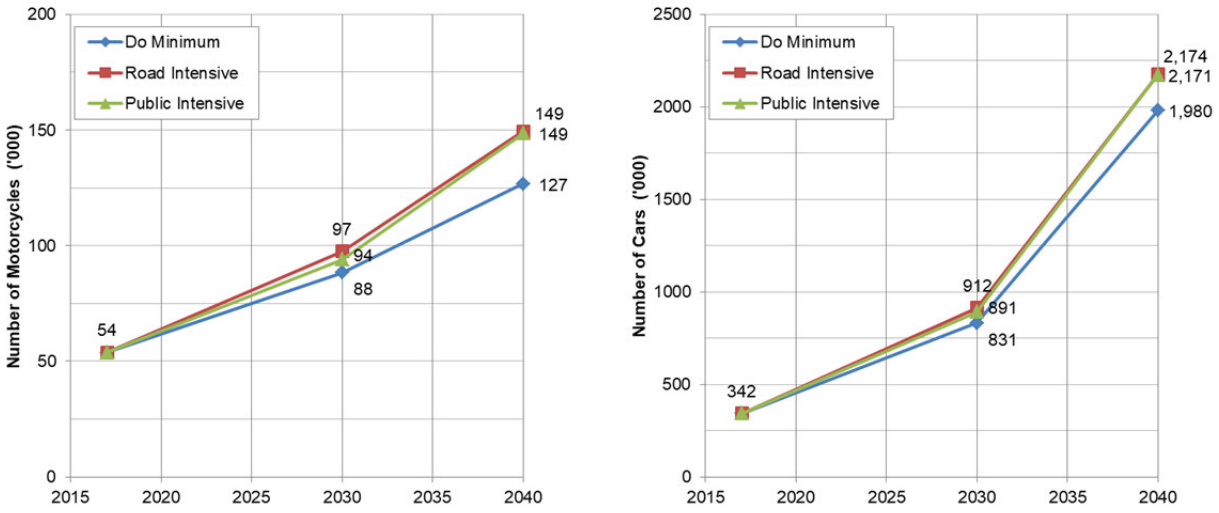
Several software programs were used to prepare input data for the transport model, including PopGen, Biogeme, and ArcGIS. These data were then inputted to Cube Voyager software to develop the transport model. Cube Voyager software was selected due to the versatility in updating the transport model and the transparency of its calculation processes. The advantage of using this software is that it has been widely applied in more than 2,500 cities (70 countries) around the world and has many examples.

6.5.3 Projected Future Transport Demand

(1) Vehicle Ownership

The number of cars and motorcycles in the Study Area is projected to drastically increase from 2017 to 2040 and this reflects accelerated economic growth and transport network improvements.

In the case of the Road Intensive scenario, the number of cars will increase from 342,000 cars in 2017 to 2,174,000 cars in 2040. This growth rate is the highest among the different scenarios and would result in nearly 6.4 times as many cars on the road in 2040 as in 2017. The share of car-owning households would also increase from 12.5% in 2017 to 36.1% in 2040. The number of motorcycles would also increase from 54,000 in 2017 to 149,000 in 2040.



Source: The Study Team

Figure 6.5.2 Number of Vehicles by Scenario (Left:Motorcycles, Right:Cars)

(2) Number of Trips

As shown in Table 6.5.2, the total number of trips in the Study Area in 2017, 2030 and 2040 was estimated based on the trip frequency model. The total number of trips in 2017 was 13 million and this number is expected to increase to approximately 21.7 million by 2030 and 30.2 million by 2040 due to population and economic growth.

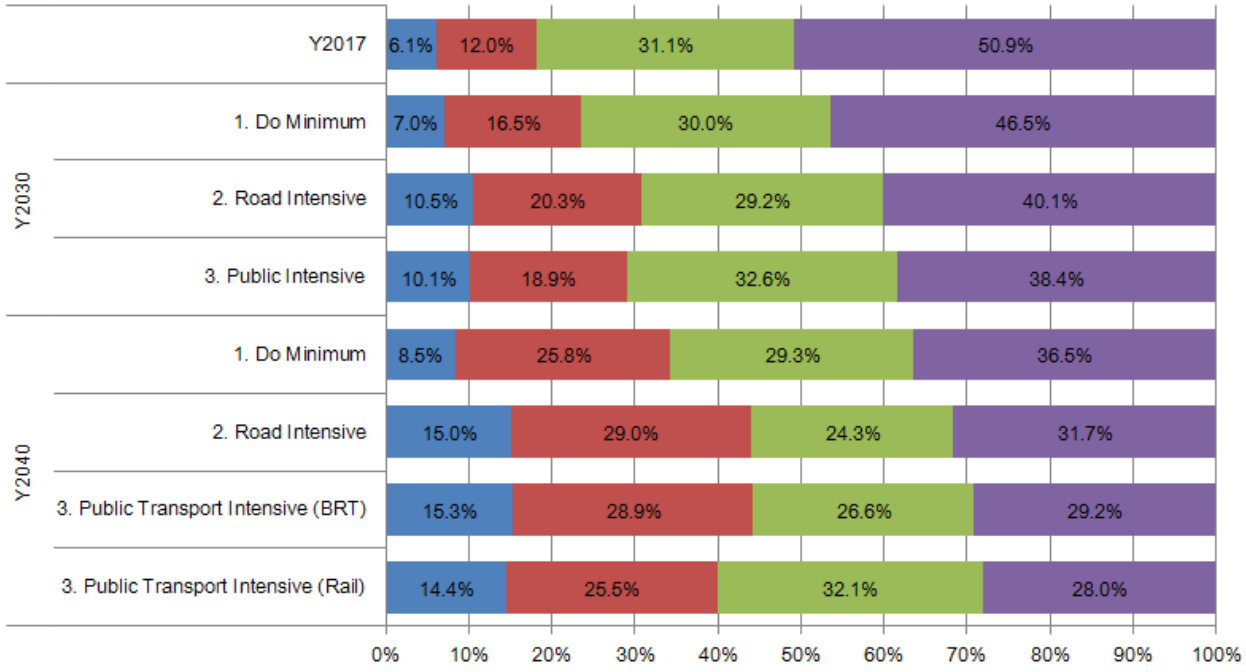
Table 6.5.2 Number of Trips by Trip Purposes by Scenarios (Unit: '000 trips)

Scenario		HTW	WTH	HTSc	ScTH	HTSh	ShTH	HTO	OTH	NHB	Total
Y2017		1,290	1,206	1,674	1,675	886	957	2,715	2,333	624	13,361
Y2030	Do Minimum	2,203	2,061	2,859	2,861	1,298	1,408	4,261	3,662	1,034	21,648
	Road Intensive	2,216	2,074	2,840	2,842	1,314	1,425	4,266	3,666	1,049	21,694
	Public Intensive	2,217	2,074	2,838	2,840	1,308	1,418	4,263	3,666	1,047	21,670
Y2040	Do Minimum	3,192	2,987	4,183	4,186	1,632	1,779	5,732	4,926	1,502	30,119
	Road Intensive	3,284	3,074	4,107	4,109	1,643	1,786	5,726	4,920	1,539	30,188
	Public Intensive (BRT/Rail)	3,287	3,075	4,107	4,110	1,642	1,786	5,722	4,924	1,543	30,196

Source: The Study Team

(3) Modal Share

Figure 6.5.3 shows the modal share by each scenario in 2017, 2030, and 2040. The share of motorcycle and car trips under the Road and Public Intensive scenarios will significantly increase from 6.1% to 14.3-15.3% (motorcycles) and from 12.0% to 25.3-29.0% (cars) due to economic growth, increasing vehicle ownership, and transport system improvements. Meanwhile the NMT share (walk and bicycle) will significantly decrease from 50.9% to 27.9-31.7% due to the increasing share of motorcycle and car trips.



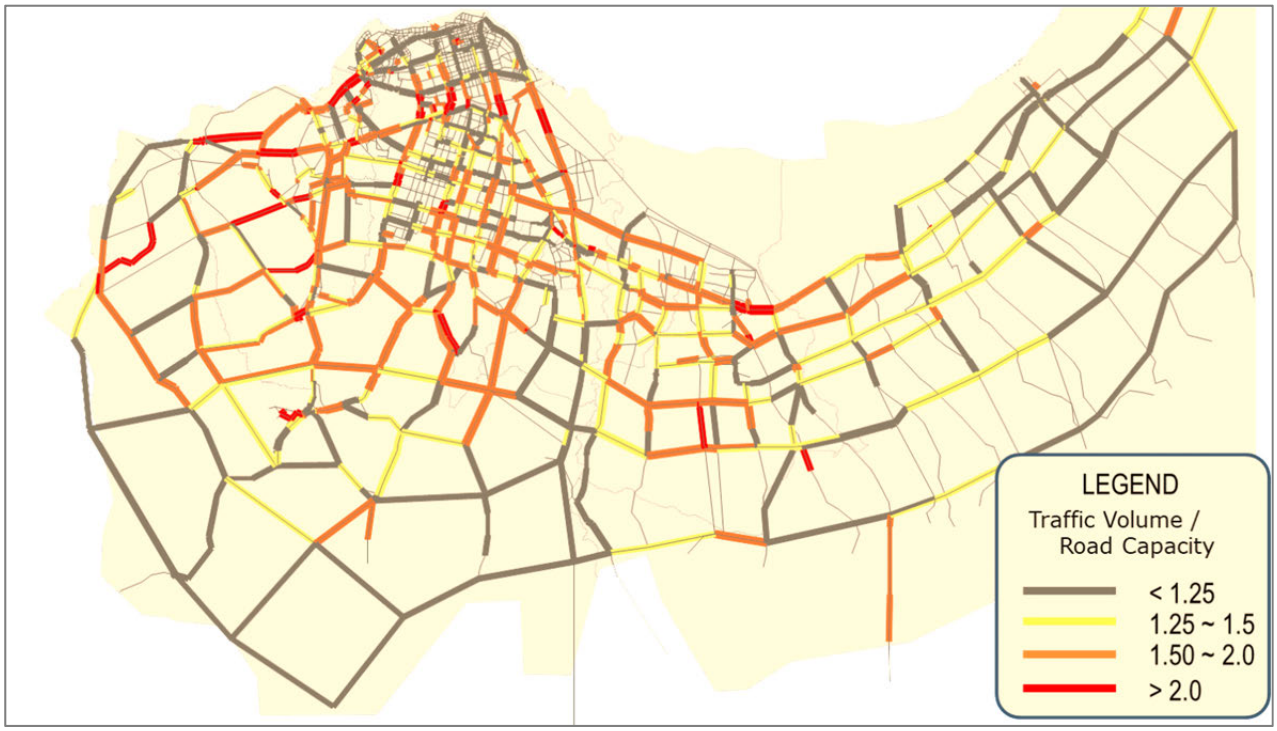
Source: The Study Team

Figure 6.5.3 Projected Modal Share of the Study Area

(4) Impact of Transport Demand

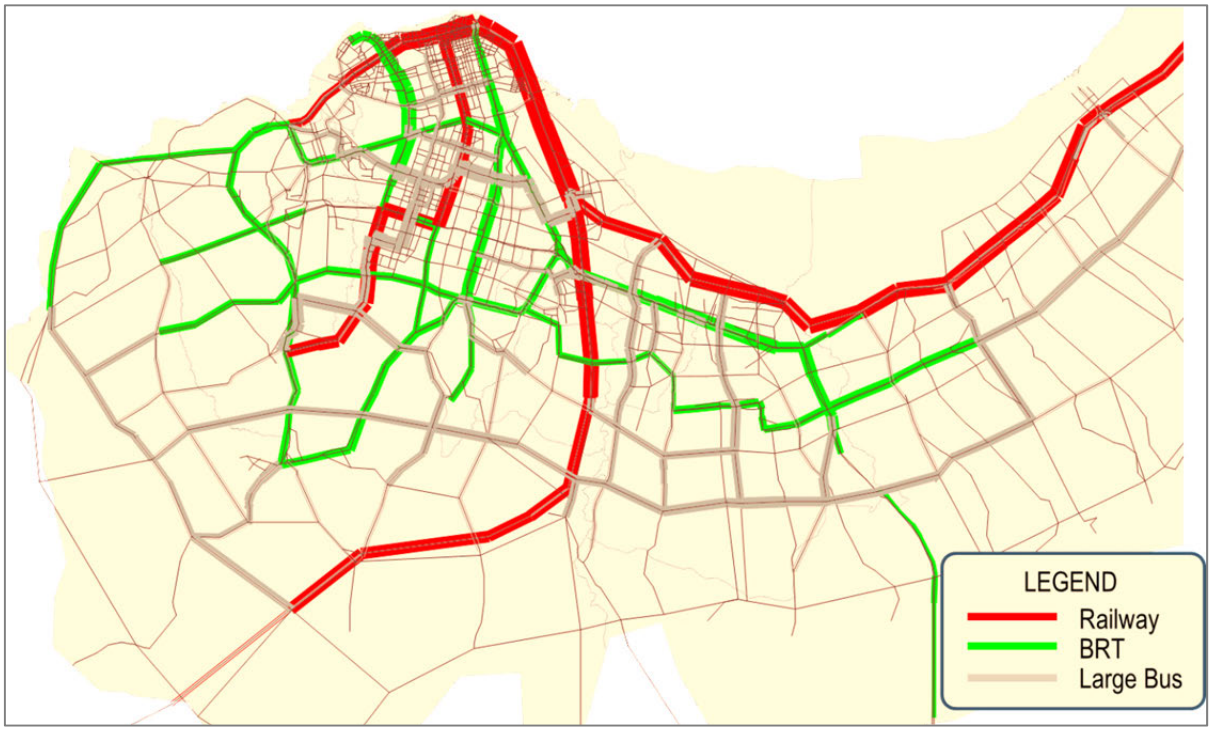
In 2030, if either the Road or Public Intensive scenarios are implemented, road congestion will be significantly than under the Do Minimum scenario. Road congestion under the Public Intensive scenario is slightly worse than Road Intensive scenario due to the reduction of the number of lanes dedicated for BRT. However, the difference between the two scenarios is not significant.

In 2040, road congestion under the Public Intensive scenario (Rail) is lowest. However, even with that scenario, the results indicate that both the road and public transport networks will be insufficient to fully absorb future demand, and additional projects and/or policies will be required to alleviate road congestion. Therefore, this study suggests introducing Transport Demand Management (TDM) schemes alongside the Public Intensive scenario (Rail) considering necessary budget for project implementation. The impacts of TDM with the Public Intensive scenario (Rail) are shown in a later section. The example results of future highway and transit assignment for 2040 are shown in Figure 6.5.5.



Source: The Study Team

Figure 6.5.4 Highway Assignment Results of Public Intensive (Rail) Scenario in 2040



Source: The Study Team

Figure 6.5.5 Transit Assignment Results of Public Intensive (Rail) Scenario in 2040

(5) Impact of Transport Demand Management (TDM)

The Study proposes a number of TDM applications as summarized in Section 7.3. Peak Hour Shift approach, and Parking charge policies in the CBD and surrounding communes (Kinshasa, Barumbu and Lingwala) are examined considering implementation costs and the difficulty of new road construction and road widening due to the lack of available of land in these areas.

The impacts of applied TDM approaches are capacity increase by peak hour shift approach and modal shift from private mode to public transport by parking charge policy. The examined parking charge policy is CDF 5,000 for each time a motorcycle or car parks in the CBD and surrounding three communes.

Motorcycle and car trips are shifted approximately 0.7% and 1.2% respectively, which would directly help to alleviate road congestion. This is an example of the use of TDM methods, and further study is required after implementation; however, the Study results indicate that TDM methods have significant impacts, helping to alleviate road congestion. Additionally, this parking revenue could be used to help fund additional solutions to transport issues, such as new road construction and road widening.

6.6 Strategic Environmental Assessment (SEA) on Alternative Scenarios

6.6.1 Preconditions

(1) Do Minimum Scenario as Baseline

Since the population of Kinshasa is estimated to double by 2040, the existing 2017 condition is far different from the baseline condition in 2040 in every aspect of environment and society. Therefore, the 'Do Minimum Scenario' is used as the baseline, and the other alternative scenarios are then compared with the conditions expected from the 'Do Minimum Scenario'. Expected baseline conditions with implementation of the 'Do Minimum Scenario' in 2040 when compared to 2017 conditions are summarised in Table 6.6.1.

Table 6.6.1 Expected Baseline Conditions with the 'Do Minimum Scenario' in 2040 Compared to 2017 Conditions

No.	Items	Expected (↑ positive / ↓ negative / = neutral) changes in 2040 compared to 2017 conditions
1	Air quality	1. ↓ Areas affected by vehicle-generated air pollution will be expanded with double the number of vehicles. 2. ↓ Traffic speeds will be slower with minimal improvement of road network. Consumption of gasoline and emissions from vehicles will increase by more than double.
2	Climate change, transboundary impacts	3. ↓ With minimal improvement to public transport, the consumption of transport fuel per capita will increase, as well as greenhouse gas emissions by the Transport Sector.
3	Involuntary Resettlement and/or Loss of Properties	4. =↓ The minimum Road Plan will be implemented with a small number of resettlements in the short term. In the long-term, land that should be road ROW for an improved city network will be occupied by businesses and houses with minimum space left for traffic. 5. =↓ The minimum improvement works and disturbance for re-designing the road space around the markets in the short term, the land that should be road ROW for better market access will be occupied by businesses with minimum space left for traffic. Traffic congestion around markets will become more serious with doubled population.
4	Physical separation of communities	6. =↓ With minimum control of land use, residential areas will be spread over a large area. A small number of resettlements is expected by 2040. In the long term, the road ROW for a better city network will need to run through already established communities.
5	Social institutions such as social infrastructure and local decision-making institutions	7. =↓ With minimum implementation of road improvements, decision-making procedures, including public involvement and grievance redress mechanism, will not be practiced in various places, and the government and the public will be left with few lessons learned from experiments.
6	Historical and cultural resources	8. = Construction of minimum new roads or expansion of existing roads will impact a small number of cultural and historical resources on or near ROW.
7	Landscape	9. = Minimum road expansion will impact a small number of existing street trees.
8	Poverty	10. ↓ With doubled population and minimum improvement of roads and public transport, the general public will suffer from much difficulty in accessing workplaces, markets, schools, hospitals, etc. 11. ↓ Businesses will also suffer difficulties accessing goods and consumers. 12. ↓ Majority of population will be living without access to all-season roads within 2 km from their homes. 13. ↓ Congestion in front of markets will continue and will worsen, which will negatively impact both businesses and customers.
9	Local economy such as employment and livelihood	
10	Traffic/public facilities, infrastructures, social services	
11	Gender	
12	Accidents, crime	14. ↓ Majority of the doubled population will be forced to walk on a small number of roads in good condition. Road and traffic safety will not improve and the number of traffic accidents per capita will increase.

Note: ↑: Positive changes, ↓: Negative changes, =: Neutral

Source: The Study Team

(2) Quantitative Evaluation

Quantitative evaluation was calculated as differences of economic benefits between "Without" and

"With" scenarios, based on the Highway Development and Management (HDM-4) Road Use Costs Model.

(3) Qualitative Evaluation

In the qualitative evaluation, the baseline condition, 'Do Minimum,' is given a 0 (zero), with an improved condition given a +1 (plus one). When a much improved condition can be achieved than +1, a +2 (plus two) was given to the scenario. A worse condition was evaluated in the same manner; A -1 (minus one) was given to an expected condition worse than the 'Do Minimum' condition.

Table 6.6.2 Scenarios for Comparative Evaluation

Evaluation	Expected Condition
-2	Worse than -1 condition
-1	Worse than the 'Do Minimum' Scenario condition
0	'Do Minimum' Scenario condition
+1	Better than the 'Do Minimum' Scenario condition
+2	Better than +1 condition

Source: The Study Team

(4) Scenarios Evaluated in SEA

The 'Public Transport Intensive' scenario is divided into three detailed scenarios in the 2040 Master Plan. Although the mode of transport is different, the coverage areas of public transit are generally the same between the BRT-Intensive scenario, the Rail-Intensive scenario and the Rail-Intensive + TDM scenario. Therefore, in this report, the 2040 Public Transportation Intensive Scenario was evaluated as one scenario.

Table 6.6.3 Scenarios for Comparative Evaluation

2040 Scenario	Scenarios compared in SEA
Do Minimum	Do Minimum (Baseline: Table 6.6.1)
Road Intensive	Road Intensive
BRT Intensive	Public Transport Intensive
Rail Intensive	
Rail Intensive + TDM	

Source: The Study Team

6.6.2 Over-all Evaluation

Table 6.6.4 summarizes the overall comparison of the three Scenarios. Compared to the 'Do Minimum Scenario', the 'Road Intensive Scenario' will give more positive impacts mainly in the social aspects. The 'Public Transport Intensive Scenario' will achieve further positive social impacts, and will also achieve positive impacts in air pollution aspects as well

Table 6.6.4 Over-all Comparative Evaluation of Scenarios

No.	Items	Do Minimum	Road Intensive	Public Transport Intensive
1 2	Air quality Climate change, transboundary impacts	0	+1	+1 to +2
3 4 5 6 7	Involuntary Resettlement and/or Loss of Properties Physical separation of communities Social institutions such as social infrastructure and local decision - making institutions Historical and cultural resources (Omitted from evaluation due to lack of data) Landscape (Omitted from evaluation due to lack of data)	0	-1 (Short term) +1 (Long term)	-1 (Short term) +1 (Long term)
8 9 10 11	Poverty Local economy such as employment and livelihood Traffic/public facilities, infrastructures, social services Gender	0	+1	+2
12	Accidents, crime	0	+1	+1
Overall Evaluation of Transportation Master Plan Alternatives		0	+1	+2

Source: The Study Team

6.7 Selection of Optimum Network Scenario

6.7.1 Overview

This section explains the evaluation and selection of the proposed five transport network scenarios in the Study Area. Each transport network scenario was evaluated by the criteria of economic, financial, and environmental aspects such as economic benefits, transport development cost, and CO_2 emissions. Then, the optimal network scenario was selected based on a multi-criteria analysis.

For the comparison of criteria, the "1. Do Minimum" scenario is set as the "Base Case (Without Scenario)", and other scenarios are set as "With Scenario". The two With Scenarios of "2. Road-intensive" and "3. Public transport-intensive" are proposed for 2030, and the four With Scenarios of "2. Road-intensive", "3-1. Public transport-intensive (BRT)", "3-2. Public transport-intensive (Rail)" and "3-3. Public transport-intensive (Rail+TDM)" are proposed for 2040.

6.7.2 Evaluation of Alternative Transport Scenario

To select the optimum transport network scenario, on whether the Road-intensive scenario is appropriate for the Study Area or Public-intensive (BRT, Rail or Rail+TDM) scenario is more suitable scenario to meet future conditions, alternative transport network scenarios were prepared and analysed based on following viewpoints:

- Supporting Urban Economic Activities;
- Assuring Equity in Transport;
- Improving Safety and Security; and,
- Achieving Environmentally Sustainable Transport.

In conclusion, as shown in Table 6.7.1, the Public-intensive (Rail+TDM) scenario achieved the highest evaluation score, followed by Public-intensive (Rail) and Public-intensive (BRT). Therefore, the Study Team would recommend to implement the Public-intensive (Rail+TDM) scenario in Kinshasa City.

Table 6.7.1 Evaluation of Alternative Transport Network Scenarios

Evaluation Criteria		Do-minimum	Road-intensive	Public Intensive		
				BRT	Rail	Rail+TDM
Supporting Urban Economic Activities	EIRR (%)	**C**	**B-**	**B+**	**B**	**A**
		(Base Case)	24.48%	25.60%	25.52%	25.68%
	NPV (mil USD)	**C**	**B+**	**B-**	**B**	**A**
		(Base Case)	11,555	11,232	11,424	11,716
	Investment Cost (mil USD)	**A**	**C+**	**C+**	**C**	**C**
		4,122	19,847	19,622	21,077	21,077
Assuring Equity in Transport	Population in the Service Area of Railway and BRT (thousand people)	**C**	**B-**	**A**	**A**	**A**
		0	8,089	12,050	12,024	12,024
Improving Safety and Security	Reduction of Accident Loss (mil USD/year in 2040)	**C**	**B-**	**B**	**B+**	**A**
		(Base Case)	7.9	7.7	8.7	9.5
Achieving Environmentally Sustainable Transport	Reduction of CO2 Emission (mil ton/year in 2040)	**C**	**B**	**B**	**B+**	**A**
		(Base Case)	4.3	4.1	10.2	13.8
	Involuntary Relocation (thousand buildings)	**A**	**C**	**B-**	**B-**	**B-**
		25.1	68.5	67.6	67.6	67.6
Total Evaluation		**C**	**B-**	**B**	**B**	**A-**

Evaluation criteria: A: Significantly positive performance is expected. (Recommended)

B: Positive performance is expected to some extent. (Fair)

C: Positive performance can not be expected. (Poor)

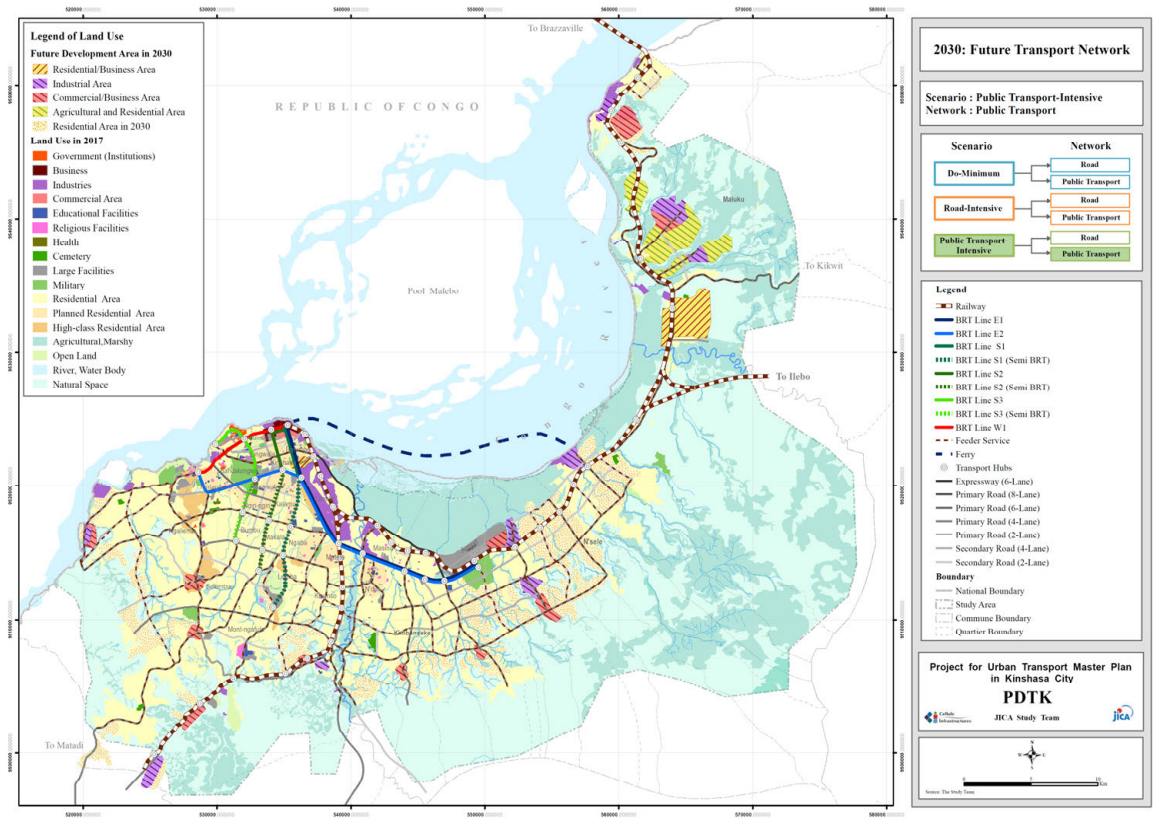
Source: The Study Team

CHAPTER 7 Urban Transport Master Plan for 2030

While the Chapter 6 formulated transport policy and transport network plan by 2040 based on travel demand analysis and scenario evaluation, this chapter details urban transport master plan for 2030.

7.1 Public Transport

In order to respond to the traffic demand of Kinshasa City by 2030, the public transport-intensive scenario, mainly based on the modernization of railways and introduction of the BRT, was selected as discussed in the Chapter 7. Figure 7.1.1 shows the future transport network in 2030. The master plan for each mode of public transport system, railways, BRT, bus and paratransit is described in this section.



Source: the Study Team

Figure 7.1.1 Proposed Public Transport Network in 2030

7.1.1 Modernization of Railways

Among three railway lines in the Kinshasa urban area, there is only one line, South Line, which is

under operation at present with one round trip from Kasangulu to Kinshasa East in the morning and Kinshasa East to Kasangulu in the evening. Total one-way trip travel time between Kinshasa East and Kasangulu is around two hour and twenty five minutes. Despite of a potential demand on the South Line, it is not operated in the daytime and it does not take a role of the urban railway function. Therefore, it is recommended to increase additional 2 round-trips between Kinshasa East and Kimwenza in the daytime without increasing in the number of locomotives and wagons. As a consequence, four round trips of the train operation will be realized on the South Line.

However, frequency of the existing train operation is only achievable at every 4-hour, which is not appraised as a convenient urban railway service. To achieve the level service as urban railway, two new trains is proposed. These two additional trains can be operated 6 round-trips on the double track section between Kinshasa East and Matete every one hour.

A type of train operational at present is locomotive-hauled train (locomotive pulling passenger wagons). This system requires replacing the locomotive every time when train returns at terminal station. Therefore, DMU (Diesel Multiple Unit) is proposed, since Matete station at present is not accommodated with a siding for replacing the locomotive, a frequent replacing will be required and minimizing a time loss for replacing is desirable. Furthermore, it is also recommended to improve the current track condition and signal system in order to assure the safety and punctuality of train operation, when procuring the new trains. It is observed that the current track condition is not well maintained with satisfactory ballast and safety system is based on the wireless communications to identify train location. When operation frequency and speed are planned to increase, it is inevitable to improve the track condition and to introduce the signalling system for the new urban railway line. Detailed plan for the above mentioned issues should be investigated by separate studies with following general works presented in Table 7.1.1.

Table 7.1.1 Proposed Work for Improvement of Track Condition and Signal System

Projects	Work Component
Track Improvement	Main work component will be replacing ballast and may include replacing sleepers, rails and rail fastening system, if required、
Introduction of Signalling System	Signalling system using the track circuit.

Source: The Study Team

Meanwhile, the N'djili Airport Line was supposed to be improved and operational by December 2017 but it is not implemented yet as of July 2018. A large number of passenger demand on this line is expected even though the line is confined to the single track operation at present. Therefore, it is recommended, similar to the South Line, to improve the current track condition and to introduce a signal system additional to the procurement of DMU.

7.1.2 Development of BRT System

(1) BRT Routes and Lanes

The BRT will be introduced on the main roads where future public transport demand is expected to be high. Since the full-scale BRT, or closed system, utilizes 2 lanes of the road exclusively, it can be introduced to the future roads with 6 or more lanes. If the full-scale BRT is applied to 4-lane roads, only 2 lanes are available for other traffic. Thus, full-scale BRT will be introduced on major roads with 6 or more lanes, and, semi (open system) BRT is proposed on 4-lane roads.

For the roads with the open system BRT, bus priority lane, which gives priority to buses over private modes during morning and evening peak hours, are applied. For the implementation of bus priority lane, strict law enforcement is a key for smooth operation of the BRT, thus, coordination with the PNC (*Police Nationale Congolaise*, Congolese National Police) is required.

Figure 7.1.2 shows the future transport network in 2030 when introducing BRT.

Source: the Study Team

Figure 7.1.2 Proposed BRT Network in 2030

Although the road cross section proposed in Section 7.3.3 is ideal in terms of road safety, open space in urbanized area is limited. Land acquisition and relocation procedure also takes time and budget while the traffic demand is expected to increases rapidly. Therefore, compromised option for installation of the BRT can be considered as a provisional measure.

(2) BRT Shelters

As discussed in Section 7.3.5, BRT shelters are equipped with platform for smooth boarding/alighting. Off-board fare collection is also a key function of the BRT as it also allows smooth boarding and alighting. The BRT shelter also should have clear, organized signage system to guide passengers. Barrier free facilities such as slope and bench are also required for all residents including people with limited mobility to access. In case the BRT is installed in the centre two lanes of the road, BRT shelters are recommended to connect to a pedestrian bridge for the passengers to avoid crossing busy road sections.

Source: the Study Team

Figure 7.1.3 Interior of BRT Shelter in Hanoi, Vietnam

(3) BRT Fleet

The same chassis with a large bus can be utilized for the BRT fleet, though, the bus fleet for the BRT system usually requires platform-level door on the left or both sides of the vehicle for platform-level boarding. Thus customization is required for bodies.

(4) Fare Collection System

The same as urban railway service in many countries, off-board fare collection should be applied for the BRT to avoid fare collection in buses. Typically, integrated-circuit (IC) card is often utilized for fare transaction. In addition to reduce transaction time and improve convenience of passengers, the card can be utilized for other transaction such as urban railway service, parking fee payment and non-transport purposes such as shopping. This can generate revenues from transaction fees.

(5) Intersection Improvement for BRT

Even the BRT utilizes exclusive lanes, the BRT operation is disrupted at intersections. This can cause significant delay of buses, and, it sometimes causes queues of buses. Thus, the Public Transport Priority System (PTPS) is recommended for a smooth operation of the BRT.

(6) Institutional Setup

The operation system for the BRT and conventional buses operated by individuals are substantially different. Staffs require special skills such as driving, maintenance of a bus, maintenance of facilities, ticketing, customer service, accounting, ICT and management. The expected operator of the BRT should have staff in these fields, and, the company should be organized and well manged.

In the Study Area, the largest and the most organized bus operator is Transco with experience of operating approximately 500 buses. Considering Transco's experience, they can be a candidate for operating the BRT while agreement of other stakeholders is required.

7.1.3 Bus and Paratransit

(1) Consolidation of Bus Routes

Since the modernized railway and the BRT covers corridors with high passenger demand, routes of other road-based public transport should be consolidated. In principle, conventional bus, minibus, taxi-bus, shared taxi and motorcycle taxi should be functioned as a feeder service of trunk routes of the railway and the BRT. Conventional bus and minibus routes will be established in areas where BRT and feeder bus services are not available. Taxi-bus, shared taxi and motorcycle taxi should be limited to short distance service as a feeder and areas with lower travel demand to avoid unnecessary competition with the railway and the BRT. The size of bus and travel demand should be consistent to minimize impact on road traffic.

(2) Re-organization of Bus and Taxi Operators

As discussed in Section 7.1.4, current road-based public transport operation except for Transco and NewTransKin is market-oriented due to excessive competition among individual operators. While the scheme of Esprit de Vie contributed to renovate bus fleet, the fundamental issue of excessive competition among individual operators still remains. Therefore, it is expected to form a company or a union for bus operation. The company and the union should hire drivers as their employee to avoid any externalities caused.

(3) Bus Stop and Terminal Development

Although there are some bus stops, some stops are not utilized by bus and taxi operators. Practically, passengers can get on and get off any place they want along the route so far. To increase travel speed of buses, locating bus stop is important. Especially for the transfer point and area with high passenger demand, bus terminals should be located to manage significant volume of passengers and vehicles.

(4) Law Enforcement

While the Kinshasa Province and the PNC commenced law enforcement program by colouring and registration sticker of shared taxis, further measures to be taken such as prohibition of all public transport vehicles from picking or dropping passengers at intersections and strict police control of illegal parking. For the control of parking, private sector also can participate. The details of parking control will be discussed in Section 7.3.8.

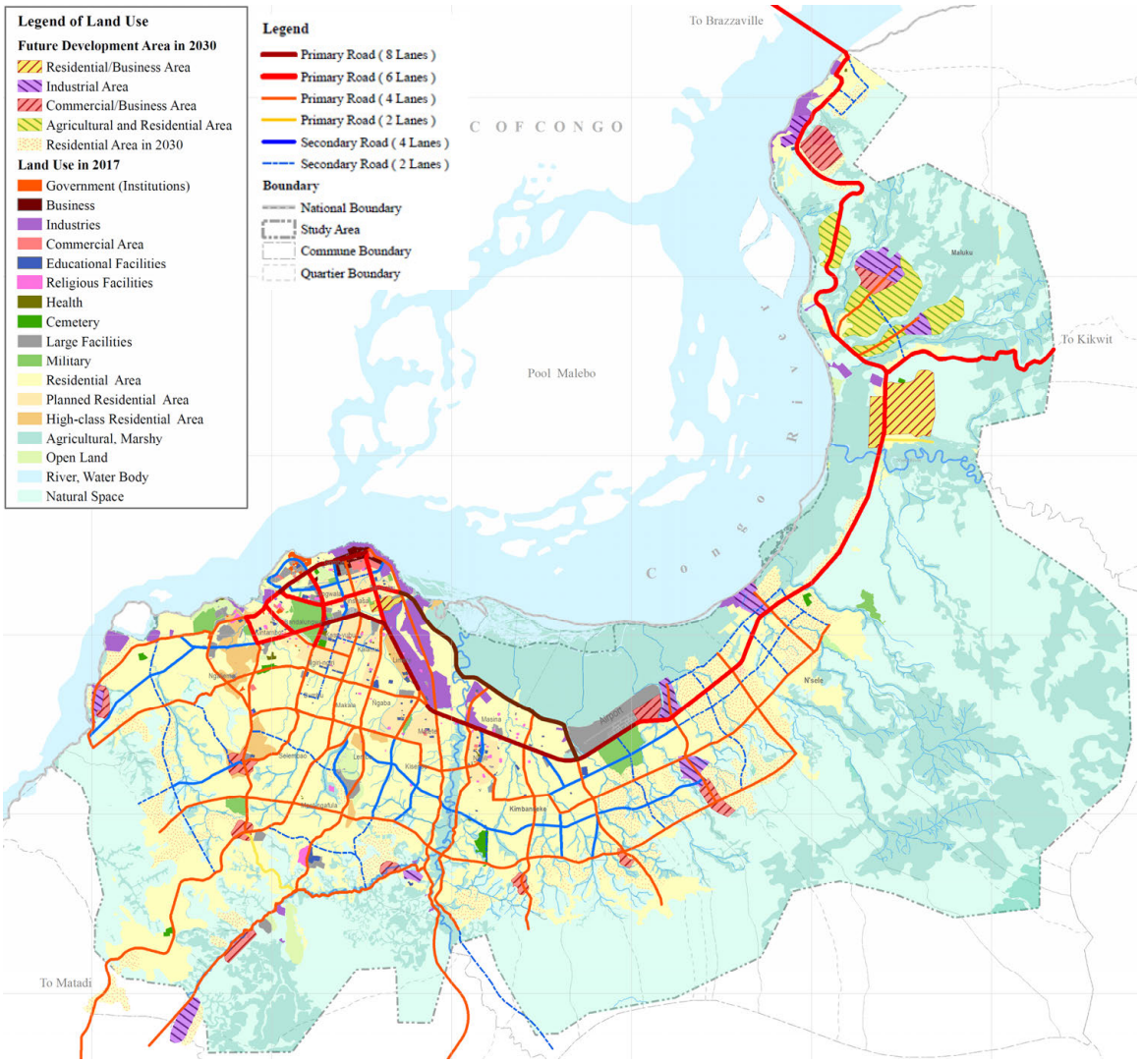
(5) Developing Regulatory Framework

The current route license and fare policy of road-based public transport is, in general, heuristic. The route license should be given based on the travel demand, compliance with safety and service standard and consistency with the master plan and government policy. The process also should be transparent and evidence-based to avoid corruption. The fare policy also should be transparent and evidence-based to avoid political intervention. For this purpose, data and information is essential for formulating policy on fares and route licensing. It is expected to formulate a department in charge of data collection, analysis for policy making. In terms of safe, convenient and comfortable operation of the buses, it is also required to formulate safety and service standard of road-based public transport.

7.2 Road Development Plan

7.2.1 Introduction

In Chapter 7, the Public Transport-Intensive Scenario was selected as the optimum one for 2030. Figure 7.2.1 shows the road network to be developed in 2030 for this scenario. In developing the future road network plan, the applied hierarchical classification is primary and secondary roads in this Master Plan. As described in Chapter 7, in a broad sense, the primary road network is made up from strategic roads, urban expressways, and other primary roads.



Source: The Study Team

Figure 7.2.1 Proposed Road Network in 2030 for the Study Area

All of the road infrastructure is necessary to sustain the urban development of the Study Area, in order that has been identified and will form the most basic framework to guide an orderly urban development. These networks will also be an important space for future development of viaducts

or underground structures for expressways and BRT, thus deserving one of the highest priorities in the Master Plan.

Road projects proposed in the Master Plan are described for such groups as the Strategic Roads, Primary Roads, Secondary Roads and Urban Expressway as below.

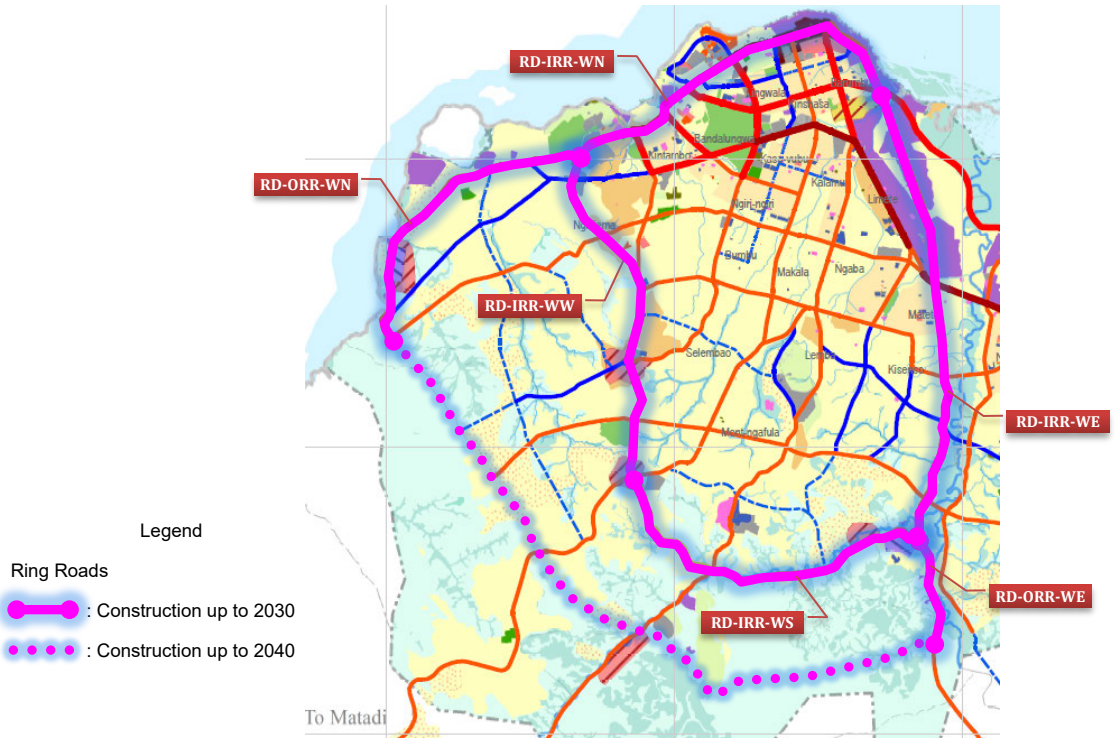
7.2.2 Strategic Road Projects

The Strategic Road Network is part of the Primary Road Network but functionally separated to stress the importance of freight movements in large size, long distance and high mobility services and consequently inter urban and inter regional traffic rather than intra urban traffic.

The Strategic Road Network is planned to consist of Ring Roads, East-West Axis Roads and North-South Axis Roads as detailed in the following sections.

(1) Ring Roads

The projects for the Ring Roads are shown in Figure 7.2.2 through Figure 7.2.4. The main objective of the Ring Roads is to divert through traffic and allow freight transport to avoid the city centre.

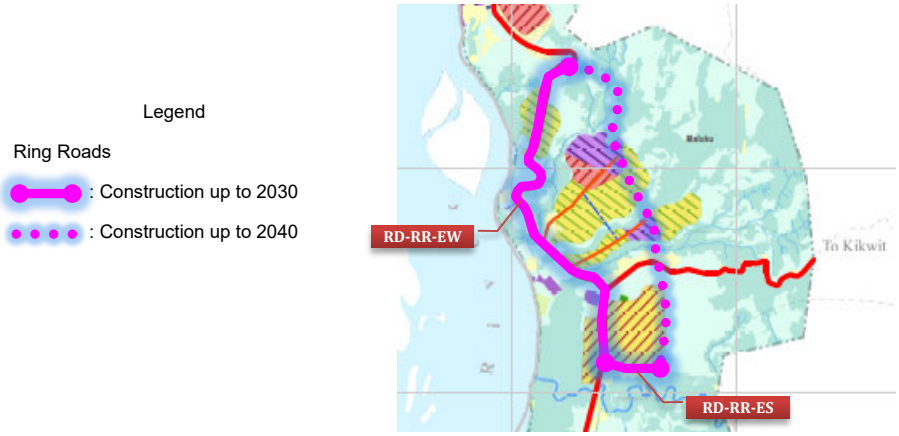


Source: The Study Team

Figure 7.2.2 Ring Roads in Western Division

Source: The Study Team

Figure 7.2.3 Ring Road in Central Division

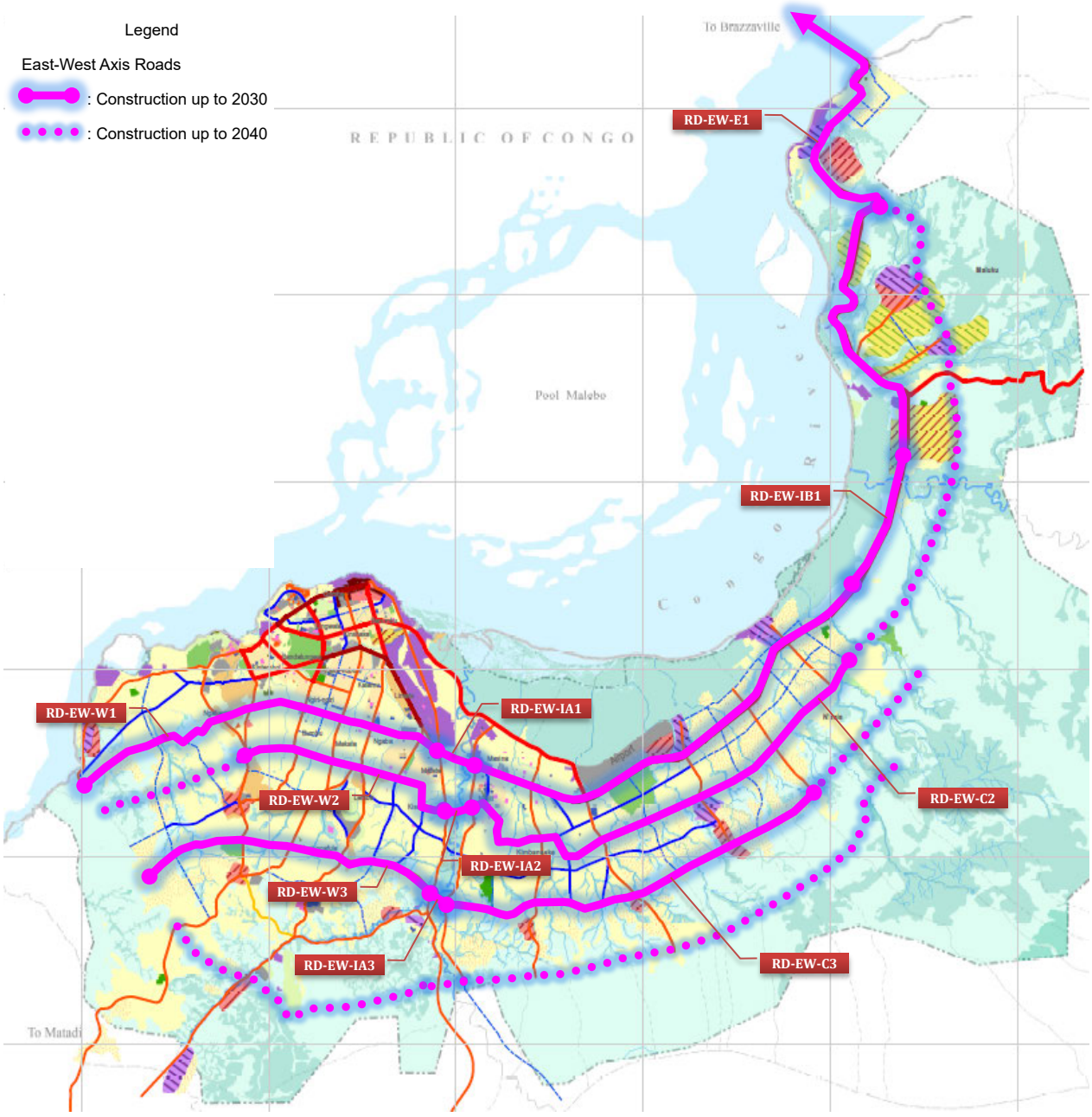


Source: The Study Team

Figure 7.2.4 Ring Road in Eastern Division

(2) East-West Axis Roads

The projects for the East-West axis roads are shown in Figure 7.2.5. The main objective of the East-West Axis Roads is to strength the linkages between divisions toward the east-west direction with each other, and to transport freight directly in the east-west direction. The East-West network consists of four roads to disperse traffic flow. However, the Fourth East-West axis road is targeted to be constructed up to 2040 in the Master Plan.



Source: The Study Team

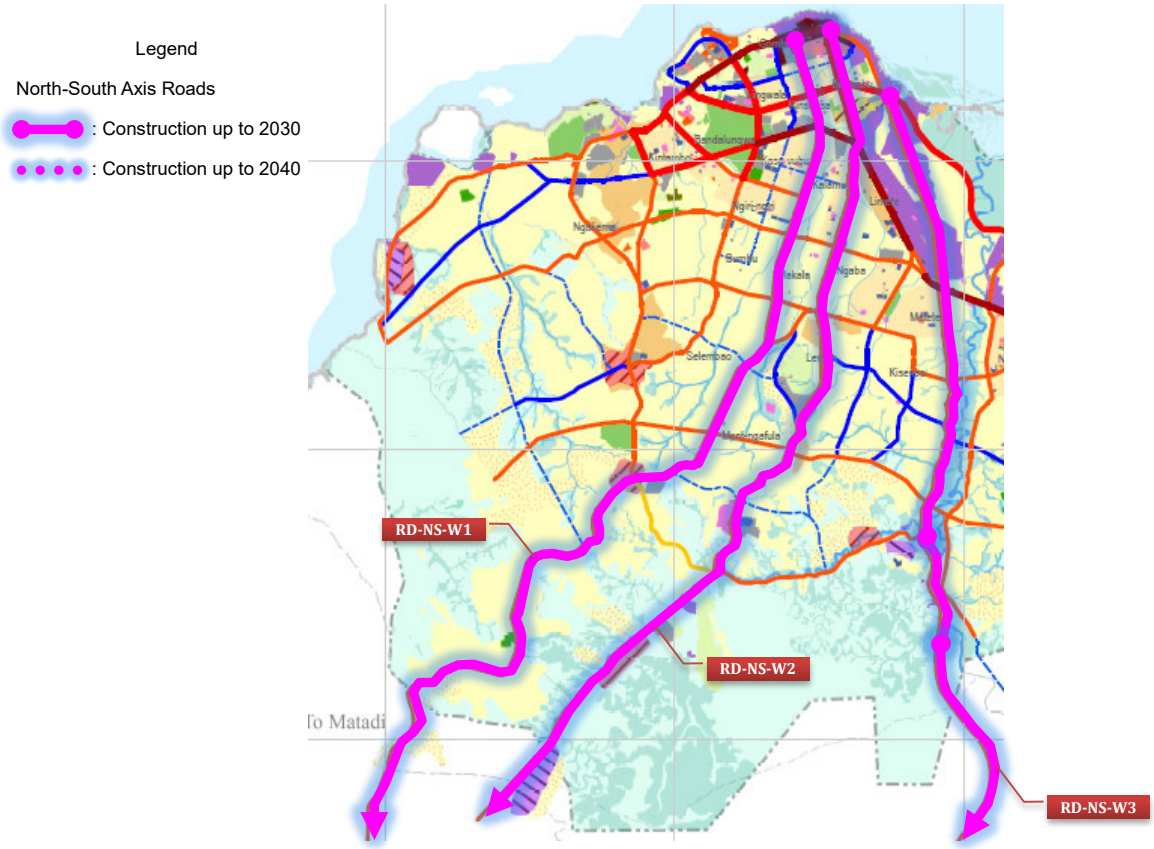
Figure 7.2.5 East-West Axis Roads in the Study Area

(3) North-South Axis Roads

The projects for the North-South axis roads are shown in Figure 7.2.6 through Figure 7.2.8. The main objective of the North-South axis roads is to strengthen the linkages between the river and mountain sides toward the north-south direction with each other, and to transport freight directly in the north-south direction.

a) North-South Axis Roads in Western Division

The North-South Axis Road network in the Western Division consists of three roads to disperse traffic flow.

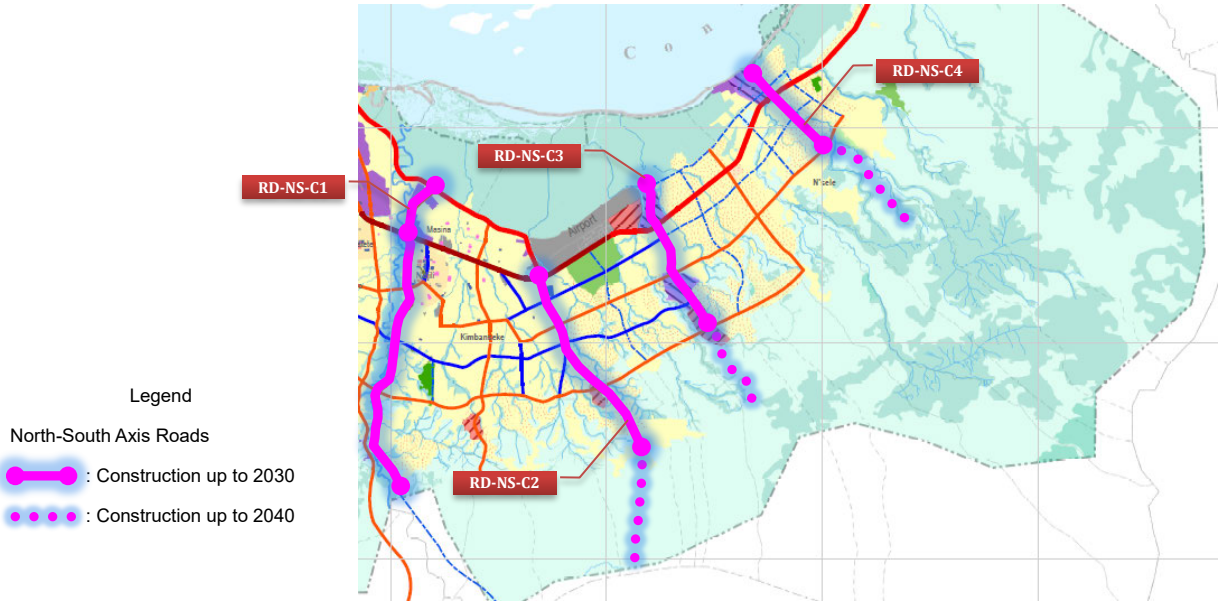


Source: The Study Team

Figure 7.2.6 North-South Axis Roads in Western Division

b) North-South Axis Roads in Central Division

The North-South Axis Road network in the Central Division consists of four roads to disperse traffic flow.

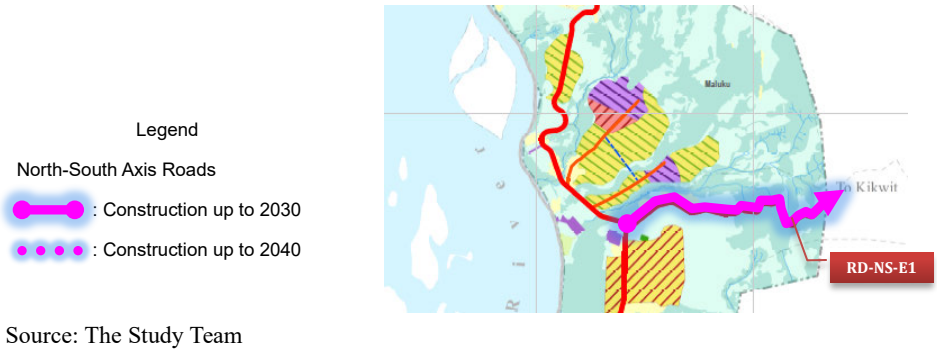


Source: The Study Team

Figure 7.2.7 North-South Axis Roads in Central Division

c) North-South Axis Roads in Eastern Division

The North-South Axis Road network in the Eastern Division is only one road for dispersing traffic flow.



Source: The Study Team

Figure 7.2.8 North-South Axis Roads in Eastern Division

7.2.3 Primary Roads

The main objective of the primary roads, excluding strategic roads, is to manage inter-commune traffic and to effectively and efficiently distribute/collect freight transport as a logistic route. The details for each primary road are described in the Main Report and the project lists in Appendix 1.

7.2.4 Secondary Roads

The main objective of the Secondary roads is to manage inter-quartier traffic and to complement

the trunk road network. The details for each primary road are described in the Main Report and the project lists in Appendix 1.

7.2.5 Urban Expressways

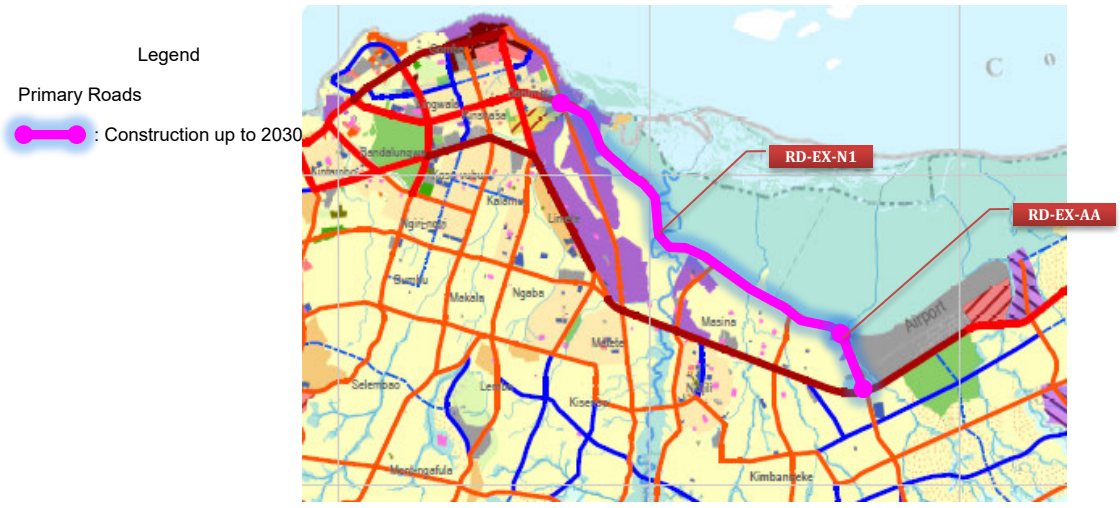
The projects for the expressways are shown in Figure 7.2.9. The main objective of the expressways is to provide high levels of safety and efficiency in the movement of large volumes of traffic at high speeds with full-access control. The expressway network consists of two sections to connect between the CBD and N'djili Airport. It is the same concept as the future road infrastructure project planned by ACGT as described in Chapter 7. On the other hand, the other sections will be constructed after 2040.

(1) River Front Line (Section-1)

The River Front Line (Section-1) is located along the Congo River. It starts from. Congo-Japon Boulevard in the Western Division, crosses over N'djili River, and reaches to the northwest corner of the N'djili Airport, also linking with large zones such as Gombe CBD Zone, Limete Industrial Zone, and N'djili sub centre.

(2) Airport Access Line

The Airport Access Line is to enhance connectivity to the airport. It diverts from the River Front Line at the northwest corner of N'djili Airport, and reaches to Lumumba Boulevard.



Source: The Study Team

Figure 7.2.9 Urban Expressway in 2030

7.2.6 Road Maintenance Scheme

(1) Division of Roles

The main roles of road maintenance management are described in Table 7.2.1.

Table 7.2.1 Main Roles of Road Maintenance Management

Organization	Roles
OR	• Maintenance of national roads passing through Kinshasa province and provincial roads connecting to neighbouring provinces
OVD	• Maintenance of Kinshasa province roads
FONER	• Collection of funds for road maintenance and allocation of budget for maintenance administration of target roads
Central Government	• Allocation of budget for maintenance administration of target roads
Kinshasa Province	• Allocation of budget for maintenance administration of target roads

Source: The Study Team

(2) Required Road Maintenance Equipment

In order to address the shortage of road maintenance equipment, the following road maintenance equipment will be provided to OVD and OR with Grant Aid from Japan.

- "Periodic maintenance equipment" that aims to carry out large-scale repairs that are necessary to attain the maintenance level,
- "Equipment for daily maintenance work" that aims to fix potholes, make sealing repairs, etc.

The above-mentioned equipment will arrive in Kinshasa around March 2020.

(3) Capacity Development for Road Maintenance

Utilizing the training results by the PRCMR counterpart, the PRCMR counterpart will conduct training to OR and OVD technicians involved in road maintenance, with the aim of sharing/transferring knowledge and experience.

(4) Financial Resources

Currently, the allocation of the road maintenance budget from FONER is a major source of revenue.

7.3 Traffic Safety, Control and Management Plan

7.3.1 Basic Concepts

Plans for traffic safety, control and management are proposed to contribute to achieving the objectives as shown in Table 7.3.1.

Table 7.3.1 Plans on Traffic Safety, Control and Management

General Objective	Specific Objective	Plan
Ensure traffic safety	Road safety management	• Development of road safety action plan for Kinshasa • Development and implementation of road traffic accident database system
	Safer roads and mobility	• Identification and improvement of blackspots • Improvement of road signs and road markings • Introduction of mandatory road safety audit
	Safer vehicles	• Update of road safety regulation (traffic rules, regulations for public transport operators)
	Safer road users	• Improvement of equipment for law enforcement • Continuous implementation of road safety education and awareness • Construction of a model training school for driving license • Introduction of demerit point system for driving license
	Post-crash care	• Improvement of mobility and medical service for accident rescue
Ensure smooth traffic flow	Eliminate bottlenecks	• Improvement of major intersections and "Pole" • Introduction of upgraded traffic signal control systems • Development of regulations for the proper traffic flow
	Improve parking management	• Revision of parking facility development policy • On-street parking management • Strict enforcement of illegal parking • Development of paring facility operated by PPP model • Parking location map and parking guidance system
	Transport demand management	• Traffic information provision for route choice by utilizing ITS (route change) • Shift traffic demand from peak hours in the city centre (peak hour shift) • Introduction park and ride (mode change) • Restriction of vehicle use in the city centre
	Smooth public transport	• Installation of bus location system to provide information • Consideration of traffic management when introducing BRT

Source: The Study Team

Note: Regarding traffic safety, the Study (PDTK) adopted the five strategic pillars by the Decade of Action for Road Safety to propose the traffic safety policy. Note that the terminology of "traffic safety" and "road safety" in this section have the same meaning; the United Nations usually refers to "road safety" rather than "traffic safety" in English, or "sécurité routière" in French.

7.3.2 Road Safety Management Projects

Regarding traffic safety policy in the DRC, the national road safety policy has been drafted in the PDNIT (*Plan Directeur National Integre des Tranports*/Integrated National Transport Master Plan), and there is no traffic safety policy specifically for Kinshasa City.

There are actions that should be implemented by the central government, such as formulating a national road safety strategy, updating the national legislative framework, and developing a nationwide accident database system; whereas, there are actions that should be taken by the initiative of the provincial government in conjunction with the national traffic safety policy.

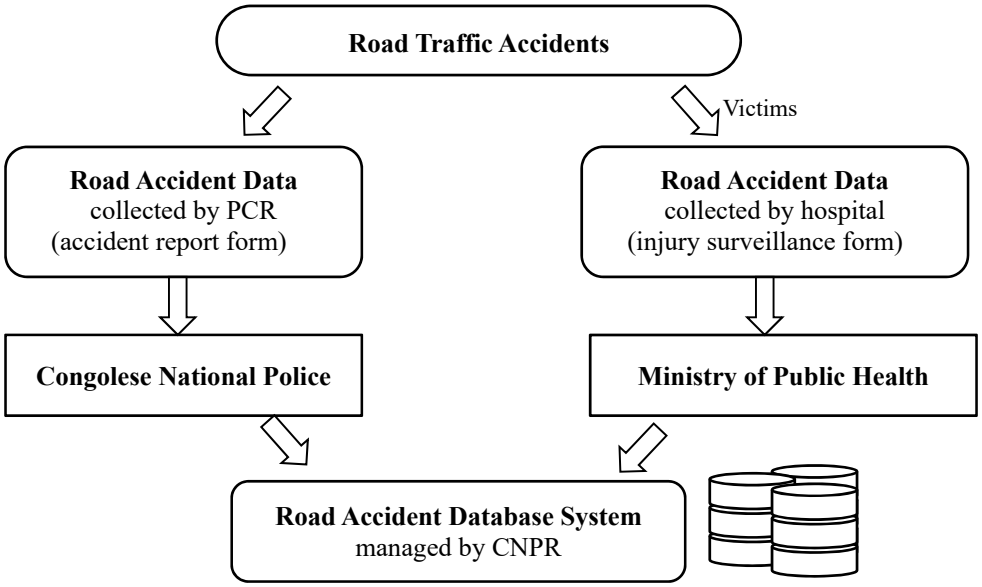
As is the nature of traffic safety policy, there are many relevant stakeholders. Therefore, having a functioning lead national agency for road safety is very important. Thus the reform of the CNPR (*Commission Nationale de Prévention Routière* /National Road Safety Commission) into a substantial authority, the National Road Safety Authority, has been proposed in the PDNIT in line with setting up a new inter-ministerial committee for road safety in DRC.

(1) Development of Road Safety Action Plan for Kinshasa

A road safety action plan for Kinshasa has not yet been developed. A road safety action plan needs to be developed in order to reduce the number of traffic accidents and victims, based on the traffic environment of Kinshasa City along with the national road safety strategy. The road safety strategy for Kinshasa City should include an emphasis on vulnerable users, including pedestrians, organized under the five strategic pillars for road safety.

(2) Development and Implementation of Road Traffic Accident Database System

An evidence-based approach is necessary to achieve safer road environments and reduce traffic accidents. Currently, there are three road accident data sources in the DRC: the PCR (*Police de Circulation Routière/* Road Traffic Police), the CNPR and the hospitals. The statistical data is available only for Kinshasa City, not for other regions. The data is finalized by the CNPR and reported to the minister of MTVC. To obtain complete and accurate data, the data collection must be standardized and include several data sources. A road traffic accident database system should be developed as a nationwide database including Kinshasa City. It recommended to make the PCR responsible for all road accident data collection using the standardized accident report form. Hospitals should submit the injury surveillance forms to the Ministry of Public Health, and the CNPR should integrate all of the accident and injury data on road traffic accidents and manage the database system, as shown in Figure 7.3.1.



Source: The Study Team

Figure 7.3.1 Road Accident Data Flow

It is very important to consider how to utilize the data effectively to reduce traffic accidents when developing the road traffic accident database system. The classification of accident causes should be consistent to make historical analyses possible.

7.3.3 Safer Roads and Mobility Projects

(1) Identification and Improvement of Blackspots

Traffic blackspots are locations where road traffic accidents have occurred frequently. The purpose of blackspot analysis is to find the priority locations by visualizing them and make a list to prioritize the locations. In data from each accident, it is recommended to include location data (latitude and longitude) collected using a GPS device so that it can be identified on a map easily.

The procedure for resolving blackspots is: i) identify blackspots from the accident data (long list), ii) prioritize the blackspots including other factors (short list), iii) observe and diagnose the site situation, iv) conduct traffic surveys if needed and v) consider the solution.

(2) Improvement of Road Signs and Road Markings

Road signs (vertical signs) and road markings (horizontal signs) should be installed at intersections and along roads properly, so that drivers can recognize intuitively to keep driving safe and for enforcing the traffic regulations.

There are not enough road signs in Kinshasa City, and it is uncommon to see speed limit signs on roads other than a few primary roads. Pedestrian crossing signage is also important for vulnerable road users, especially in the vicinity of schools. In terms of traffic management, not many directional signs are seen in Kinshasa City; it is also important to let drivers know the proper direction in order to reduce unnecessary travel. The implementation of road signs in the DRC is coordinated, controlled and monitored by the CNPR. The improvement of signage as described in Table 7.3.2 is required in Kinshasa City.

Table 7.3.2 Improvement of Road Signs

	Required Amount	Contents
Road sign (vertical sign)	5,000 signs	Speed limit, stop, one-way, pedestrian crossing, etc.,
Road marking (horizontal sign)	50,000 markings	Stop marking, directional arrow, etc.
Traffic lane marking (horizontal sign)	30,000 km	Traffic lane, centre line

Source: CNPR

(3) Introduction of Mandatory Road Safety Audit

In terms of building and maintaining safer road infrastructure, it is important to take actions from the design stage, the construction stage, and the operation and maintenance stage. RSA (the Road Safety Audit) is a method to improve road safety, with a formal safety performance examination of an existing or future road or intersection by an independent, multidisciplinary team.

It is recommended to make RSAs mandatory for new road construction and rehabilitation projects as a part of the requirements to ensure road safety, as the first step to introducing RSAs in

Kinshasa City.

The CNPR under the MTVC has a mission, by the Ordinance 78/478, of proposing road safety policy and ensuring the coordination of all studies and actions to create a better road environment. Therefore, the CNPR is responsible for road safety audits and assessments, but it is necessary to strengthen the capacity of the organization and collaboration between the MTVC and MITPR during construction and after the completion of road projects. In addition, as mentioned in the UN's *Decade of Action for Road Safety*, at least 10% of the road infrastructure project budget should be allocated to road safety.

7.3.4 Safer Vehicles Projects

(1) Update of Road Safety Regulation

The Highway Code (Law no. 78/022) regulates the basic traffic regulations in DRC. In 2014, the draft bill of the law, which included regulations related to fastening seat-belts, wearing motorcycle helmets, driving under the influence of alcohol, and using mobile phone while driving, was proposed to the National Assembly, but ultimately rejected. Although the draft bill was turned down in 2014, it is necessary to have up-to-date traffic regulation in DRC in global context, to ensure the law enforcement for the better traffic environment.

Along some streets in the city centre of Kinshasa City, on-street parking vehicles occupy the shoulder of roads. Most of the on-street parking vehicles are illegally parked vehicles, and they are also dangerous as they block the view of drivers and pedestrians.

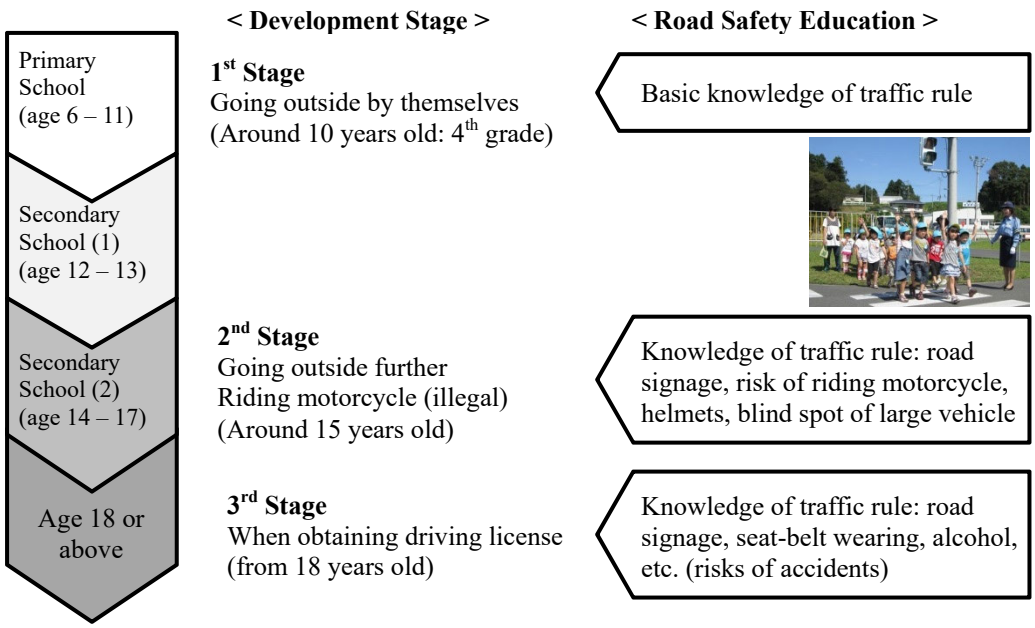
7.3.5 Safer Road Users Projects

(1) Improvement of Equipment for Law Enforcement

Speeding is the major cause of accidents in the DRC. It is necessary to take actions to prevent speeding violations in conjunction with the installation of the road signage. It is necessary for law enforcers to enforce speed limits in a fair and equitable manner with transparency. The automatic enforcement system, i.e. speed enforcement camera, or systems that enable law enforcement with evidence is very important, for both road users and the law enforcers. In addition, more transport equipment is required to strengthen the mobility and ability to enforce law and investigate accidents.

(2) Continuous Implementation of Road Safety Education and Awareness

The road safety education and awareness campaign are continuous activities to inform and remind road users of the traffic rules and proper behaviour for safety. The road safety education for school children is one of the key solutions, and needs to be programmed considering their development stages as shown in Figure 7.3.2.



Source: The Study Team

Figure 7.3.2 Road Safety Education Considering Child Development Stage

The activities for road safety education and awareness activities require the continuous efforts of all relevant stakeholders. The periodical road safety campaigns should be organized by the initiative of the CNPR, the PCR, and related organizations.

(3) Construction of a Model Training School for Driving License

Although there are three examination centres for driving license, there are no training schools to teach driving in Kinshasa City. It is recommended to establish a model training school for driving license instructors and examiners in Kinshasa City as a pilot project to strengthen the training capacity of instructors, including the test track for motorcycle and large vehicles and professional drivers such as buses and trucks.

(4) Introduction of Demerit Point System for Driving License

The demerit point system is a system of tracking individual driving records through a point system, in which traffic violations are counted as penalty points against the driver's driving license. Each type of violation has an assigned point value. Once the demerit points exceed the predetermined points, the driving license is suspended for a set period of time or revoked, in addition to the fines.

7.3.6 Post-crash Care Projects

(5) Improvement of Mobility and Medical Service for Accident Rescue

The post-crash care of accidents is one of the important factors in saving the victims' lives. The first hour after an injury is called the "golden hour," which means the time period lasting for one hour, or less, following traumatic injury being sustained by a medical emergency, when there is

the highest likelihood that prompt medical treatment will prevent death.

It is recommended to improve transport to the hospital for accident victims by facilitating the transport to dispatch rescue teams and equipment for the emergency care provided by the Fire Department and the Red Cross. Also, it is important to strengthen the capacity of hospitals for emergency care and rehabilitation including setting up a functional rehabilitation centre.

7.3.7 Bottleneck Point Improvement Projects

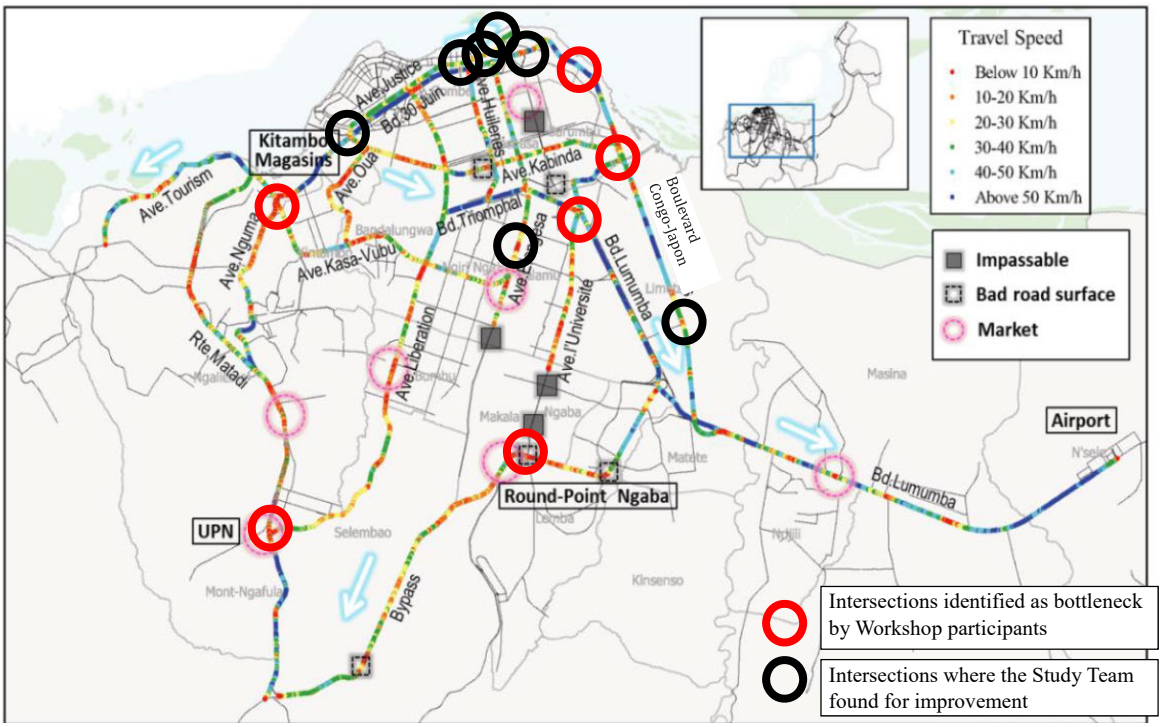
The causes of traffic congestions in Kinshasa City are summarized as follows:

- Traffic concentration on the limited number of connected roads into the city centre due to there being many missing links and poor road conditions;
- Occurrence of bottleneck points due to inadequate traffic control at improper geometric design and lack of signalized intersections; and
- Reduction of lanes caused by stopping and parking of minibuses and taxies around the intersections.

The road network should be developed in the near future in order to handle the increasing number of vehicles, but it is difficult to accomplish this in a short time span. On the other hand, it is assumed that there is a high possibility of improving bottleneck intersections and implementing proper control traffic flow by utilizing traffic signals according to traffic demand, because it can be implemented in a relatively short amount of time without land acquisition.

(1) Improvement of Major Intersections and "Pole"

In Kinshasa City, there are many large intersections with poor geometric design, such as compound intersections or places where two intersections are too close to each other. These intersections cause traffic accidents and traffic congestion due to poor visibility. Figure 7.3.3 shows the locations of bottleneck points in Kinshasa City. These intersections should be improved in order to facilitate the smooth flow of traffic.

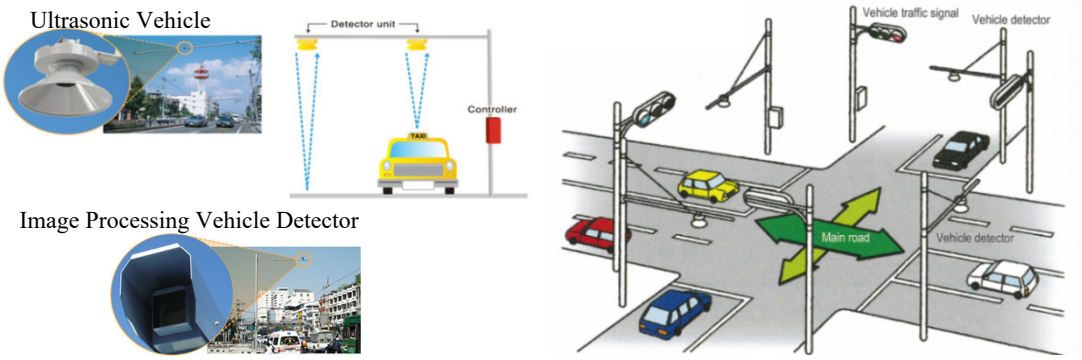


Source: The Study Team

Figure 7.3.3 Bottleneck Location Map

(2) Introduction of Upgraded Traffic Signal Control Systems

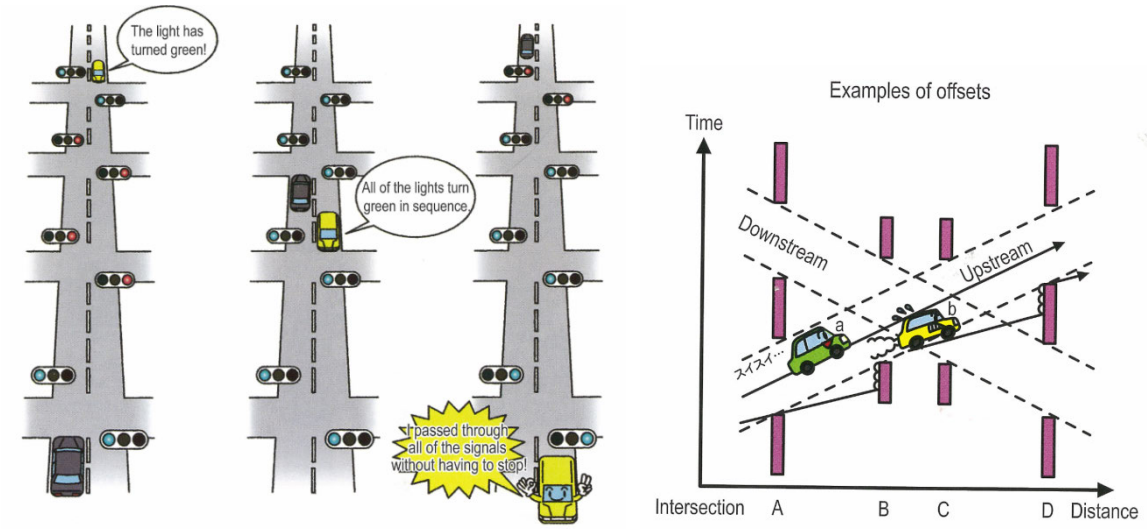
There are not many traffic signals in Kinshasa City, and most of the installed traffic signals are inactive due to breakdowns or electricity shortages. Traffic signal control systems should be installed incrementally, because a new road network is to be developed in the near future and traffic flow will be changed. As the first phase, a traffic-actuated signal control system should be installed. A traffic-actuated signal control system calculates the green light time (phase parameters) corresponding to current traffic demand by using vehicle detectors, as shown in Figure 7.3.4. Left-turn lane and left-turn phase should also be implemented at signalized intersections, in order to facilitate safe left turning and improve the traffic processing capacity of intersections.



Source: (Left) "All you need to know about traffic signals" published by Japan Traffic Management Technology Association, (Right) Sumitomo Electric Industries, Ltd.

Figure 7.3.4 Traffic-Actuated Signal Control System

As the second phase, coordinated signal control system (offset adjustment) should be introduced, in order to coordinate the operations of traffic signals that are installed consecutively to ensure the smooth flow of traffic. Coordinated signal control system is designed to optimize the cycle phase of traffic signal installed among successive intersections in major roads. As shown in Figure 7.3.5, this control is used to coordinate adjacent traffic signals by adjusting the offsets, so that vehicles can cross intersection smoothly without having to stop at the red signals.



Source: "All you need to know about traffic signals" published by Japan Traffic Management Technology Association

Figure 7.3.5 Coordinated Signal Control System

Proper and consecutive operation and maintenance after implementation of traffic signals is very important, in order to carry out sustainable traffic management. As one option, it is proposed to secure the necessary financial resource by collecting advertising revenue. Utilization of fines for traffic violations should also be considered.

(3) Development of Regulations for Proper Traffic Flow

Bottlenecks sometimes occur near the entrances of shops and restaurants where there is road-side parking in Kinshasa City. The phenomenon is especially frequently found at conflict points between vehicles going straight and left-turning vehicles in the opposite lane. This causes long queues to occur in both lanes. In such cases, the left turn should be regulated, and a median strip and signs which indicate “no left turn” should be implemented.

7.3.8 Parking Management Program Projects

Parking systems are composed of two types of parking, on-street and off-street parking. A parking management program should take the roles of on-street and off-street parking facilities into consideration.

(1) Revision of Parking Facility Development Policy

Regulation and parking tax system have already been implemented in Kinshasa City, but as they are ambiguous and enforcement is inadequate, citizens do not have adequate understanding of the rules. New policies or guidelines regarding parking management should be developed. The areas where parking facility development is promoted or restricted should be clearly defined. This policy should cover the following:

- Definition and classification of parking;
- Clarification of role between on-street and off-street parking facilities;
- Review of regulation regarding the on-street parking system and prohibition of on-street parking outside of the designated area;
- Role sharing and collaboration between public and private sectors;
- Existing off-street parking facilities are utilized adequately;
- Control and support of parking facility development by the private sector; and
- Prohibition of on-street parking and stopping on primary road and bus priority lane and BRT route network.

(2) On-street Parking Management

Proper management of on-street parking is important not only for managing the parking supply, but also for ensuring smooth traffic flow. The following policies should be applied to on-street parking management:

- Designation of on-street parking space;
- Introduction parking tax system for on-street parking at the designated area; and
- Prohibition of on-street parking outside of the designated area.

Criteria should be established as to the provision of on-street parking for each class of road. In principle, vehicles should be parked in off-street parking facilities if the parking time is long (more than 30 minutes). Outside of designated areas, on-street parking for a long period (i.e., less than 30 minutes) should be prohibited.

The selection of designated on-street parking areas should consider such factors as road classification, road geometry, road width, number of lanes, side clearance, traffic volume, congestion level, land use, and public transport routes. The fine for illegal parking should be set higher than the nearby off-street parking fees to promote to use the off-street parking facilities.

Taxis need dedicated pick-up points in busy areas. Therefore, taxi stands should be developed at places, which would allow the development of potential bottleneck points to be avoided.

(3) Strict Enforcement of Illegal Parking

Stricter parking enforcement should be conducted, including the following actions in order to realize proper on-street parking management:

a) Clear and visible indication of no parking sections

Placing more traffic signs along the prohibited section, together with coloured pavement or line markings, improves the visibility of indication of parking regulation. At the same time, on-street parking spaces should be marked clearly with paint as rectangular boxes.

b) Attaching stickers, clamps, or other devices to illegally parked vehicles

Traffic police should attach stickers, place clamps on illegally parked vehicle and charge a fine. These devices prevent vehicle owners from moving their vehicle without paying the penalty, and serve as a disincentive for illegal parking. At the same time, anti-bribery laws must be more strictly enforced, to prevent parking enforcement officers from accepting bribes.

c) Law enforcement of illegal parking using private companies

Enforcement has been entrusted to a private organization which has suitable qualification as practiced in some countries. They can crack down strictly on illegal parking. However, enforcers from private companies must be protected against disobedience of drivers or vehicle's owner. Law enforcement procedures must be defined clearly, and staff must be trained.

(4) Development of Paring Facility Operated by PPP Model

In that case of shopping malls, large supermarkets and hotels, their owner should provide the parking facilities for customers. In the case of local shopping areas or markets where it is difficult for shop owners to construct the parking facilities by themselves, the public and private sectors should develop the off-street parking facilities for visitors. Operators can gain income in the form of parking fees from drivers parked on the facilities. The government can apply the public-private partnership model to have a private company offer parking service and manage the facility as a long-term contract between a private party and a government entity.

(5) Parking Location Map and Parking Guidance System

After the implementation of parking facilities, a parking location map should be provided to drivers. A parking guidance system is also recommended for introduction to encourage more efficient use of the existing parking facilities. It is also recommended to set up parking information boards at the entrance(s) to the central area and provide information about parking locations and free spaces in real-time, so that drivers can easily search for parking spaces.

7.3.9 Transport Demand Management Projects

The government plans to develop a new road network and new public transport in the future, in order to relieve the traffic congestion due to increasing numbers of motor vehicles. However, the limited availability of financial resources and land acquisition in Kinshasa City constrains these supply-side measures. Typical TDM approaches and measures are shown in Table 7.3.3. These measures aim to reduce the number of private vehicle trips or their peak directly, by restricting vehicle use or indirectly promoting attractiveness of other modes of transport.

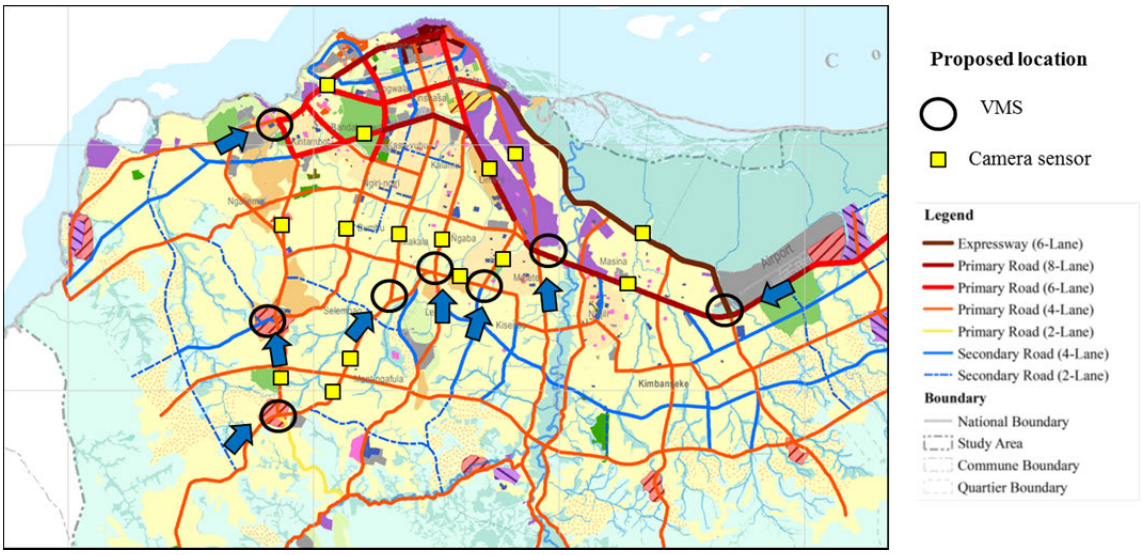
Table 7.3.3 TDM Approach and Measure (general measure)

Approaches	Measures
Route Change	・Traffic information provision system by utilizing ITS
Peak Hours Shift (Departure-Time Change)	・Shifting traffic demands from peak hours in the city centre
Mode Change	・Modal shift by providing an attractive public transport system (e.g. BRT) ・Park and Ride
Efficient Car Use	・Reversible (tidal) flow lanes, HOV lane ・Car sharing ・Efficient freight system
Trip Reduction Change	・Restriction of vehicle use ・Parking management by tax system ・Road pricing (congestion charging)

Source: The Study Team

(1) Traffic Information Provision for Route Choice by Utilizing ITS (Route Change)

Traffic information provision systems helps to inform drivers of traffic conditions, allowing drivers to select the route that shortens travel time to their destination, depending on traffic information based on real time traffic conditions. This system is utilizing ITS (Intelligent Transport Systems) technology. It is composed of three phases: traffic data collection, data processing, and information provision. Figure 7.3.6 shows the proposed installation locations based on the planned 2030 road network in Kinshasa City. The VMS should be implemented before forks in primary or secondary roads.



Source: The Study Team

Figure 7.3.6 Proposal on Installation Location of Variable Message Sign (2030)

(2) Shift Traffic Demand from Peak Hours in the City Centre (Peak Hours Shift)

According to the results of the traffic count survey, the traffic peaks occurs during morning time (7:00-8:00) and evening time (17:00-18:00) at the entrance to the central area. In the city centre, traffic demand remains high continuously during the daytime. Currently business hours for most firms and government offices are from 8:00 to 17:00. The school timing is also overlapping in Kinshasa City. If the business hours and school hours are diversified, the concentration of the travel demand in the peak hours is expected to decrease. Shifting of departure time from peak hours to off-peak hours should be encouraged.

(3) Introduction of Park and Ride (Mode Change)

The Master Plan proposes to develop BRT and railways by 2030. If TDM measures are to be introduced, improvement of the public transport is mandatory. Park and Ride facilities should be developed for parking and transport hubs in the fringe areas of the city centre, so that the commuters can change from their own car, minibuses or taxis to BRT or railway, before entering the crowded city centre.

Figure 7.3.7 shows the proposed introduction locations based on the planned 2030 public transport network of Kinshasa City. Fringe parking should be introduced in the transport hubs of railway and BRT stations at fringe areas of the city centre.

Source: The Study Team

Figure 7.3.7 Proposal Location on Introduction of Fringe Parking (2030)

(4) Restriction of Vehicle Use in the City Centre

Thus, the Master Plan proposes proper parking management: 1) Parking tax system for on-street parking at the designated area, 2) Prohibition of on-street parking outside of the designated area, and 3) Introduction of Park and Ride.

7.3.10 Smooth Operation of Public Transport Projects

(1) Installation of Bus Location System to Provide Information

To enhance convenience of bus operation and management for both users and operators after the implementation of the BRT or bus priority lanes as proposed in the Master Plan, it is also recommended to introduce a bus location system.

Through its introduction, users can obtain the current locations of buses, making buses become a reliable transport mode. Bus location information is used not only for the bus operators' operation interval management, but also users' judgement of utilization.

CHAPTER 8 Project Implementation Plan for 2030

8.1 Identification of Individual Project

Project implementation plan for 2030 is composed of 8 project sectors; namely "1) Railway Projects", "2) BRT Projects", "3) Bus and Paratransit Projects", "4) Road Projects", "5) Traffic Management Projects", "6) Road Safety Projects", "7) Waterborne Projects", and "8) Projects of Institutional and Financial Arrangement". Under these sectors, a total of 117 projects have been proposed considering objectives of the Master Plan and the Transport policies as mentioned in Chapter 6.

However, it is quite difficult to implement all the projects at the same time due to financial and institutional constraints, administrative period of land acquisition and so on. It is therefore essential that a robust strategy of project implementation is established to efficiently and effectively implement the projects. This section explains the relationship among individual projects, concepts of phasing development plans and a project list of individual projects integrated by the above-mentioned project sector.

8.1.1 Points to be Considered for Implementation of Projects

In terms of project prioritisation of the Master Plan, effective and efficient project implementation is important to meet surging traffic demands and address urban transport issues. For the implementation of each project described in Section 8.1.3, the following relations of each project needs to be taken into account. The concept of each project phase is explained in Section 8.1.2.

(1) Coordination between Urban Development and Transport Network Development

As discussed in Chapter 5 and Chapter 6, organized urban development in conjunction with transport network development is essential to secure space for future transport network development and also to control urban sprawl. In Kinshasa City, significant urban growth together with population increase has been expected by the years 2030 and 2040, but it is difficult to secure space for transport network development once unorganized urban sprawl has taken place. Especially, the road network, which is also a space for public transport such as railway and BRT, serves as the backbone of a city. Spaces for this road network cannot be created without a proper legal framework on land use.

(2) Efficient Utilization of Existing Infrastructures for Railway and BRT

For the preparation of the project list, proper utilization of present resources needs to be taken into account as it requires minimum intial investment cost for project implementation such as railways. In order to achieve a sustainable urban transport system, harmonization among different modes of transport, such as road, bus, rail and waterborne transport is essential. Especially for the development of public transport, currently available railway tracks will have to be renovated and modernized in the early stage. On the other hand, development of new railway lines requires huge initial investment as well as time for construction.

For roads with more than 4 lanes such as Lumumba Boulevard, Trionphal Boulevard and 30 Juin Boulevard, BRT can be a feasible option for expeditiously installing a new transit system as it can utilize road space with limited investment on bus coaches and shelters.

(3) Earlier Road Development to Secure Space for Development of BRT and Elevated Mass Transits

According to the result of transport demand projection, the development of Bus Rapid Transits (BRT) and elevated mass transits are essential till 2030 and 2040, respectively. These transport modes should be provided as scheduled to improve their safety and high-frequency services by using a dedicated space. However, there is a shortage of funding for the large scale infrastructure development at the earlier stage. It is, therefore, important that related road projects should be implemented at the earlier stage to secure space for the development of BRT and elevated mass transit projects in future.

(4) Coordination of Road Development and Intersection Improvement

In order to improve bottleneck reduction at major intersections in Kinshasa City, intersection improvement projects have a significant potential to ensure smooth traffic flow. The projects could be completed at lower cost and shorter period, compared to implementation of road network development. However, it should be noted that this project aims temporary countermeasure in principal and it is necessary to coordinate with the relevant road development project as much as possible to attain the comprehensive solution to the bottleneck problem.

(5) Coordination of Intersection Improvement and Traffic Signal Installation

The traffic signal installation and intersection improvement projects should be implemented at the same time to minimize the investment cost and maximize the effect of project implementation.

(6) Coordination between Flyover/Underpass and Elevated Transit Projects

Taking into account the efficient implementation of the Master Plan, space allocation of related projects should be based on a long-term perspective of the development. Flyover projects and elevated railway projects are typical projects which require close coordination in the future. In principle, elevated mass transit projects will be implemented in the later stage due to financial constraint. However, when a road flyover is planned to cross the existing railway, it should be considered how to conclude an optimum solution, whether by underpass or overpass.

(7) Transport Policy for Funding

Taking into account the financial constraint of the DRC government, the projects which require heavy investment at the initial stage should be implemented in the later stage, though appropriate transport policies or investment programmes for funding and temporal countermeasure to alleviate the current traffic congestion should be planned as the urgent- and short-term projects.

(8) Organization for Project Implementation

In order to successfully implement the Master Plan, it is desirable to set-up a special organization for planning the project implementation in the earlier stage. The Study Team recommends fully utilizing the existing JCC and TWG. The further details of the organization framework is

explained in Section 8.3.

(9) Time Required for Land Acquisition and Resettlement

Some new network development projects such as road development requires a significant amount of land acquisition and resettlement. It is also recommended to follow international standards such as JICA's Guideline for Environmental and Social Considerations to minimize disputes with land owners and residents as it further delays project implementation. It should be noted that these processes will take significant time. Therefore, projects which require land acquisition and resettlement are planned in the short-term and medium-term. Especially, projects requiring significant volume of land acquisition and resettlement are planned in the medium-term.

8.1.2 Concepts of Phasing the Development Plan

The Master Plan targeting the year of 2030 proposes the phased development programme for the urban transport system for urgent-term (Present~2020), short-term (2021~2024), and medium-term (2025~2030), based on the points explained in Section 8.1.1 as well as current progress of projects and required time for preparation. An outline of the expected future urban transport system at each phase and necessary actions to be taken are listed as follows:

(1) Urgent Development Plan (Present~2020)

Projects under the Urgent Development Plan are listed in consideration of minimizing the amount of funding is necessary, no land acquisition and resettlement is required, and the current financial capability of the DRC government is enough for the project implementation. These projects need to be completed by the year 2020.

Major developments to be implemented by 2020 include: Revision of Parking Facility Development Policy, Development and Implementation of Road Traffic Accident Database System, Continuous Implementation of Road Safety Education and Awareness and Establishment and Operation of the Institutional Framework and so forth.

(2) Short-term Development Plan (2021~2024)

Short-term Development Projects are planned to be completed from 2021 to 2024. However, the preparation activities should begin even before 2021. The projects under the Short-term Development Plan are selected considering the least amount of land acquisition and resettlement, and development of sustainable funding sources for the implementation of both Short and Medium-term Projects. In this regards, the introduction of reliable public transport system such as BRTs and parking management system is very much relevant and feasible as short-term development projects.

Some of the major projects which need to be completed by 2024 are: Development of Bus Rapid Transits (BRT), Development of Bus Terminals and Stops, Improvement of Major Intersections and "Pole", On-street Parking Management, Introduction of Upgraded Traffic Signal Control Systems, etc. Although projects like the BRT will require a large amount of funding, those listed in the short-term plan are confined to the project section where land acquisition is not needed or is minimal. The section where a full phase BRT line is hardly implementable due to land constraint, will be operated as an open system, namely Semi-BRT, which means, common use of a vehicular lane with other traffic using bus priority rule. As there are several roads with more than 4 lanes are

in the CBD of the Study Area, a BRT project can be commenced as soon as it is ready for financial and institutional arrangement.

As all the projects are essential to be completed by 2024, priority orders are not assigned among the short-term development projects. Due to financial constraints, which as the result require a long period of land acquisition and resettlement, it might be difficult to start all the projects at the same time. Therefore, it is desirable to start the projects one by one, whenever the project becomes ready for implementation taking the points mentioned in Section 9.1.1 into consideration.

(3) Medium-term Development Plan (2025~2030)

The projects which require large-scale land acquisition and resettlement, and thus, a huge amount of investment needed to implement the projects, are considered as Medium-term Development Projects. Medium-term Projects are planned to be completed by 2030. However, the preparation should start even before 2025. As these projects will require more funding compared to Short-term Projects, it is important that the Short-term Projects will be implemented on time and earn enough funding for smooth implementation of Long-term Projects. Some high costing projects such as elevated mass transit projects and other remaining BRT lines will be implemented after 2030, when the funding can be confirmed.

In this list, as many as 76 road construction/improvement projects are included which will be essential to complete dense road network by fulfilling the missing road links. Some other major projects need to be completed by 2030 are: Traffic Information Provision for Route Choice by Utilizing ITS (Route Change), Introduction of Park and Ride (Mode Change), Installation of Bus Location System to provide updated bus operation information, etc.

Same as the Short-term Development Plan, due to fund constraints, it might be difficult to start all projects at the same time. Therefore, it is expected to start the projects one by one, whenever the project fund is available.

8.1.3 PDTK Project List: Identification of Individual Project

List of the proposed projects described in project profiles are summarized, according to different sectors in Section 8.1.3 from Table 8.1.1 to Table 8.1.8. The projects are colour coded in accordance with priority which is described in detail in Section 8.1.2. The colour codes shown below indicate phases of the development plan.

Urgent
Preparation Stage for Short Term Project
Impementation Stage for Short Term Project
Preparation Stage for Medium Term Project
Implementation Stage for Medium Term Project

Preparation stage means the activities such as Feasibility Study, Confirmation of Funding, Loan Agreement, etc. which are essential prior to implementing a project. The implementation stage means the activities such as Detailed Design, Tendering, Construction, Commissioning, etc.

Table 8.1.1 Railway Proposed Projects

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
9.1.1 Railway Projects								
	RL-M1	Modernisation of South Line (Kasangulu Line)	SCTP				150.50	5 USD/car-km
	RL-M2	Modernisation of Airport Line	SCTP				96.00	5 USD/car-km

Source: The Study Team

Note: SCTP - Societe Commerciale des Transport et des Ports

Table 8.1.2 BRT Proposed Projects

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
9.1.2 BRT Projects								
	BRT E-1	Development of Bus Rapid Transit (BRT) Line E1	DT; MTVC				284.80	0.8 USD/car-km
	BRT E-2	Development of Bus Rapid Transit (BRT) Line E2	DT; MTVC					
	BRT S-1	Development of Bus Rapid Transit (BRT) Line S1	DT; MTVC					
	BRT S-2	Development of Bus Rapid Transit (BRT) Line S2	DT; MTVC					
	BRT S-3	Development of Bus Rapid Transit (BRT) Line S3	DT; MTVC					
	BRT W-1	Development of Bus Rapid Transit (BRT) Line W1	DT; MTVC					
	BRT - PTPS	Public Transportation Priority Systems (PTPS)	PNC, CNPR				0.00	0.00

Source: The Study Team

Note:

The cost for BRT-PTPS is included in the installation of traffic signals in traffic management projects

DT - Director of Transport, Kinshasa Provincial Government

MTVC - Ministère de Transport et Vies de Communications

PNC- Police Nationale Congolaise

CNPR- Commission Nationale de Prévention Routière

Table 8.1.3 Bus and Paratransit Proposed Projects

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
9.1.3 Bus and Paratransit Projects								
	Bus-1	Development of Bus Terminals and Stops	Kinshasa Province				14.50	-
	Bus-2	Tight Control of Minibus, Taxi-bus and Shared Taxi	DT; PNC				0.00	0.20
	Bus-3	Institutional Reform of Bus and Taxi Industries	DT; MTVC				0.00	0.00
	Bus-4	Reinforcement of Bus and Taxi Regulatory Body	DT				3.00	2.50

Source: The Study Team

Note:

DT - Director of Transport, Kinshasa Provincial Government;

PNC- Police Nationale Congolaise

MTVC - Ministère de Transport et Vies de Communications

Table 8.1.4 Road Proposed Projects

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
9.1.4 Road Projects								
	Enhancement of Mobility Function of Road Network /Development							
	RD-ST-PR1	Enhancement of Mobility Function of Road Network /Development of Elengesa Ave.	CI; OVD				17.10	0.30
	RD-ST-PR2	Enhancement of Mobility Function of Road Network /Development of University Ave.	CI; OVD				36.60	0.70
	Enhancement of Traffic Distribution Function of Road Network /Development							
	RD-ST-SR1	Enhancement of Traffic Distribution Function of Road Network /Development of Itaga	CI; OVD				10.00	0.20
	RD-ST-SR2	Enhancement of Traffic Distribution Function of Road Network /Development of Bongolo Ave. + Rue de Busu	CI; OVD				16.00	0.30
	RD-ST-SR3	Enhancement of Traffic Distribution Function of Road Network /Development of Assossa Ave.	CI; OVD				21.00	0.40
	Inner Ring Road in Western Division							
	RD-IRR-WN	Northern Section of Inner Ring Road in Western Division	CI; OVD				24.50	3.70
	RD-IRR-WE	Eastern Section of Inner Ring Road in Western Division	CI; OVD				142.80	4.60
	RD-IRR-WS	Southern Section of Inner Ring Road in Western Division	CI; OVD				189.40	3.90
	RD-IRR-WW	Western Section of Inner Ring Road in Western Division	CI; OVD				41.00	2.70
	Outer Ring Road in Western Division							
	RD-ORR-WN	Northern Section of Outer Ring Road in Western Division	CI; OVD				138.90	2.90
	RD-ORR-WE	Eastern Section of Outer Ring Road in Western Division	CI; OVD				69.10	1.40
	Axis Road in Western Division							
	RD-EW-W1	First East-West Axis Road in Western Division	CI; OVD				307.60	7.20
	RD-EW-W2	Second East-West Axis Road in Western Division	CI; OVD				175.20	3.80
	RD-EW-W3	Third East-West Axis Road in Western Division	CI; OVD				271.20	5.40
	RD-NS-W1	First North-South Axis Road in Western Division	CI; OVD; OR				216.50	8.20
	RD-NS-W2	Second North-South Axis Road in Western Division	CI; OVD				403.00	9.20
	RD-NS-W3	Third North-South Axis Road in Western Division	CI; OVD				31.90	0.60

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
	Primary Road in Western Division							
	RD-PR-W1	East-West Primary Road (1) in Western Division	CI; OVD				80.90	2.20
	RD-PR-W2	East-West Primary Road (2) in Western Division	CI; OVD				63.70	6.30
	RD-PR-W3	East-West Primary Road (3) in Western Division	CI; OVD				73.80	1.90
	RD-PR-W4	North-South Primary Road (1) in Western Division	CI; OVD				69.40	1.60
	RD-PR-W5	North-South Primary Road (2) in Western Division	CI; OVD				38.60	3.60
	RD-PR-W6	North-South Primary Road (3) in Western Division	CI; OVD				10.10	1.00
	Secondary Road in Western Division							
	RD-SR-W1	East-West Secondary Road (1) in Western Division	CI; OVD				67.00	1.40
	RD-SR-W2	East-West Secondary Road (2) in Western Division	CI; OVD				94.80	1.90
	RD-SR-W3	East-West Secondary Road (3) in Western Division	CI; OVD				47.10	1.10
	RD-SR-W4	East-West Secondary Road (4) in Western Division	CI; OVD				22.90	0.50
	RD-SR-W5	East-West Secondary Road (5) in Western Division	CI; OVD				88.10	1.80
	RD-SR-W6	East-West Secondary Road (6) in Western Division	CI; OVD				65.20	1.30
	RD-SR-W7	East-West Secondary Road (7) in Western Division	CI; OVD				86.00	1.80
	RD-SR-W8	East-West Secondary Road (8) in Western Division	CI; OVD				59.90	1.20
	RD-SR-W9	North-South Secondary Road (1) in Western Division	CI; OVD				154.60	3.10
	RD-SR-W10	North-South Secondary Road (2) in Western Division	CI; OVD				45.80	0.90
	RD-SR-W11	North-South Secondary Road (3) in Western Division	CI; OVD				34.80	1.90
	RD-SR-W12	North-South Secondary Road (4) in Western Division	CI; OVD				46.40	1.10
	RD-SR-W13	North-South Secondary Road (5) in Western Division	CI; OVD				129.60	2.70
	RD-SR-W14	North-South Secondary Road (6) in Western Division	CI; OVD				64.60	1.30
	RD-SR-W15	Circular Secondary Road (1) in Western Division	CI; OVD				22.90	1.10
	Ring Road in Central Division							
	RD-RR-CN	Northern Section of Ring Road in Central Division	CI; OVD; OR				121.90	9.60
	RD-RR-CW	Western Section of Ring Road in Central Division	CI; OVD				168.40	3.80
	Axis Road in Central Division							
	RD-EW-C2	Second East-West Axis Road in Central Division	CI; OVD				359.90	8.00
	RD-EW-C3	Third East-West Axis Road in Central Division	CI; OVD				375.60	7.50
	RD-NS-C1	First North-South Axis Road in Central Division	CI; OVD				16.10	0.70
	RD-NS-C2	Second North-South Axis Road in Central Division	CI; OVD				132.30	2.80
	RD-NS-C3	Third North-South Axis Road in Central Division	CI; OVD				106.50	2.10
	RD-NS-C4	Forth North-South Axis Road in Central Division	CI; OVD				64.20	1.40
	Primary Road in Central Division							
	RD-PR-C1	North-South Primary Road (1) in Central Division	CI; OVD				180.90	3.90
	RD-PR-C2	North-South Primary Road (2) in Central Division	CI; OVD				99.90	2.00

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
	Secondary Road in Central Division							
	RD-SR-C1	East-West Secondary Road (1) in Central Division	CI; OVD				84.60	1.70
	RD-SR-C2	East-West Secondary Road (2) in Central Division	CI; OVD				217.70	4.40
	RD-SR-C3	East-West Secondary Road (3) in Central Division	CI; OVD				250.20	5.00
	RD-SR-C4	North-South Secondary Road (1) in Central Division	CI; OVD				2.10	0.20
	RD-SR-C5	North-South Secondary Road (2) in Central Division	CI; OVD				22.10	0.40
	RD-SR-C6	North-South Secondary Road (3) in Central Division	CI; OVD				25.70	0.50
	RD-SR-C7	North-South Secondary Road (4) in Central Division	CI; OVD				36.20	0.70
	RD-SR-C8	North-South Secondary Road (5) in Central Division	CI; OVD				39.60	0.80
	RD-SR-C9	North-South Secondary Road (6) in Central Division	CI; OVD				50.90	1.00
	RD-SR-C10	North-South Secondary Road (7) in Central Division	CI; OVD				78.50	1.60
	RD-SR-C11	North-South Secondary Road (8) in Central Division	CI; OVD				40.70	0.80
	RD-SR-C12	North-South Secondary Road (9) in Central Division	CI; OVD				31.40	0.60
	RD-SR-C13	North-South Secondary Road (10) in Central Division	CI; OVD				9.50	0.20
	Ring Road in Eastern Division							
	RD-RR-EW	Western Section of Ring Road in Eastern Division	CI; OVD; OR				92.50	6.50
	RD-NS-E1	First North-South Axis Road in Eastern Division	CI; OVD				27.50	0.50
	Axis Road in Eastern Division							
	RD-EW-E1	First East-West Axis Road in Eastern Division	CI; OVD; OR				96.90	4.50
	RD-NS-E1	First North-South Axis Road in Eastern Division	CI; OVD; OR				74.10	4.20
	Primary Road in Eastern Division							
	RD-PR-E1	North-South Primary Road (1) in Eastern Division	CI; OVD				84.00	1.70
	RD-PR-E2	North-South Primary Road (2) in Eastern Division	CI; OVD				62.80	1.30
	Secondary Road in Eastern Division							
	RD-SR-E1	East-West Secondary Road (1) in Eastern Division	CI; OVD				17.00	0.90
	RD-SR-E2	Circular Secondary Road (1) in Eastern Division	CI; OVD				60.40	1.20
	RD-SR-E3	North-South Secondary Road (1) in Eastern Division	CI; OVD				13.00	0.30
	Axis Road between Divisions							
	RD-EW-IA1	First East-West Axis Road between Western and Central Divisions	CI; OVD; OR				1.40	1.10
	RD-EW-IA2	Second East-West Axis Road between Western and Central Divisions	CI; OVD				28.80	0.60
	RD-EW-IA3	Third East-West Axis Road between Western and Central Divisions	CI; OVD				25.70	0.50
	RD-SR-IA1	East-West Secondary Road (1) between Western and Central Divisions	CI; OVD				27.20	0.50
	RD-EW-IB1	First East-West Axis Road between Central and Eastern Divisions	CI; OVD; OR				18.30	2.50
	Urban Expressway							
	RD-EX-N1	Urban Expressway (River Front Line, Section-1)	CI; OVD				212.60	4.30
	RD-EX-AA	Urban Expressway (Airport Access Line)	CI; OVD				28.30	0.60
	Fly Over							
	RD-FO	Introduction of Fly Over	MITPR; OR, OVD				212.00	4.24

Source: The Study Team

Note:

CI, MITPR - Cellule Infrastructures, Ministère des Infrastructures, Travaux Publics et Reconstruction

OVD- Office des Voiries et Drainages, MITPR

OR- Office des Routes, MITPR

Table 8.1.5 Traffic Management Proposed Projects

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
9.1.5 Traffic Management Projects								
	TM-1	Revision of Parking Facility Development Policy	MTSJL, Kinshasa Province				0.70	0.00
	TM-2	Improvement of Major Intersections and "Pole"	CI, MITPR; OR, OVD				26.90	0.00
	TM-3	On-street Parking Management	MTSJL, Kinshasa Province				0.70	0.00
	TM-4	Strict Enforcement of Illegal Parking	MTSJL, Kinshasa Province				0.70	0.00
	TM-5	Development of Parking Facility Operated by PPP Model	MTSJL, Kinshasa Province, Private sector				13.90	0.00
	TM-6	Shift Traffic Demand from Peak Hours in the City Centre (Peak Hour Shift)	Kinshasa Province				0.70	0.00
	TM-7	Restriction of Vehicle Use in the City Centre	Kinshasa Province				0.70	0.00
	TM-8	Parking Location Map and Parking Guidance System	MTSJL, Kinshasa Province, Private sector				13.90	0.00
	TM-9	Introduction of Upgraded Traffic Signal Control Systems	CI,, MITPR; OR, OVD				29.10	0.04
	TM-10	Development of Regulations for Proper Traffic Flow	OR, OVD				0.70	0.00
	TM-11	Traffic Information Provision for Route Choice by Utilizing ITS (Route Change)	CI,, MITPR; OR, OVD				8.60	0.00
	TM-12	Introduction of Park and Ride (Mode Change)	Kinshasa Province				24.20	0.00
	TM-13	Installation of Bus Location System to Provide Information	TRANSCO, New TransKin				1.80	0.00

Source: The Study Team

Note:

MTSJL- Ministère des Transports, Sports Jeunesse, et Loisirs

CI, MITPR- Cellule Infrastructures, Ministère des Infrastructures, Travaux Publics et Reconstruction

OR- Office des Routes, MITPR

OVD- Office des Voiries et Drainages, MITPR

Table 8.1.6 Road Safety Proposed Projects

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
9.1.6 Road Safety Projects								
	TS-1	Development and Implementation of Road Traffic Accident Database System	MTVC, PNC				2.00	0.00
	TS-2	Continuous Implementation of Road Safety Education and Awareness	MTVC, ME				0.00	1.00
	TS-3	Development of Road Safety Action Plan for Kinshasa	Kinshasa Province, MTVC,				0.70	0.03
	TS-4	Identification and Improvement Plan of Blackspots	MTVC, MITPR/OVD, OR				0.70	0.00
	TS-5	Improvement of Road Signs and Road Markings	MTVC				4.85	0.00
	TS-6	Introduction of Mandatory Road Safety Audit	MTVC, MI, MITPR				0.70	0.00
	TS-7	Update of Road Safety Regulation	MTVC				0.35	0.00
	TS-8	Improvement of Equipment for Law Enforcement	PNC				1.20	0.00
	TS-9	Construction of a Model Training School for Driving License	MTVC				10.00	0.00
	TS-10	Introduction of Demerit Point System for Driving License	MTVC				0.35	0.00
	TS-11	Improvement of Mobility and Medical Service for Accident Rescue	MSP				4.20	0.00

Source: The Study Team

Note:

MTVC- Ministère de Transport et Vies de Communications
PNC- Police Nationale Congolaise
ME- Ministère de l'Education
OR- Office des Routes, MITPR
OVD- Office des Voiries et Drainages, MITPR
MSP- Ministère de la Santé Publique

Table 8.1.7 Waterborne Transport Proposed Projects

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
9.1.7 Waterborne Transport Project								
	TW-1	Ferry Service: CBD (Ngobila Beach) – Kinkole Port	Kinshasa Province, MTVC, SCTP				19.00	3.00
	TW-2	Development of Kinkole Passenger Port	MTVC, SCPT				45.20	1.80

Source: The Study Team

Note:

MTVC- Ministère de Transport et Vies de Communications
SCTP- Société Commerciale des Transports et des Ports

Table 8.1.8 Institutional and Financial Arrangement Proposed Projects

Proposed Project			Implementing Authority	Urgent Present ~ 2020	Short-term 2021~ 2024	Medium-term 2025~ 2030	Initial Cost (mil USD)	O & M Cost (mil USD)
9.1.8 Projects of Institutional and Financial Arrangement								
	IF-01	Establishment and Operation of the Institutional Framework	CITMPK				0.02	0.11
	IF-02	Capacity Building	CITMPK, External experts/ organizations				-	0.03
	IF-03	Preparation for Succeeding Institutional Framework	CITMPK, External experts/ organizations				-	0.14

Source: The Study Team

Note:

CITMPK- Council for the implementation of transport master plan in Kinshasa (tentative)

8.2 Fund Availability and Project Programmes

8.2.1 Required Investment

The initial investment cost, operation and maintenance cost are estimated and summarized in Table 8.2.1, Table 8.2.2, and Table 8.2.3 respectively. The total initial investment cost is estimated at approximately USD 21 billion, and, the total cost for operation and maintenance is estimated at approximately USD 11 billion. Thus, the entire cost required for master plan implementation is roughly USD 32 billion by 2040. Taking the financial constraint of the DRC government into account, the projects which require heavy investment, such as elevation of railway tracks, are planned in the intermediate-term while some road projects are planned in the short-term as the road space will be utilized not only for road itself, but also for installation of public transport modes.

Table 8.2.1 Initial Investment Cost for the Urban Transport Master Plan for 2040

[Unit: USD million]

Period	Road	Railway	BRT	BUS	Mng.	Safety	Water	IF	Total
2020	707	62	71	0	1	2	0	0	843
2021-23	2,122	185	214	18	87	23	64	0	2,713
2024-30	4,862	672	35	0	39	0	0	0	5,608
2031-40	5,551	6,045	316	0	0	0	0	0	11,913
Total	13,243	6,964	636	18	127	25	64	0	21,077

Note: 'Mng.' stands for 'traffic management'. 'Safety' stands for 'traffic safety'. 'Water' stands for 'waterborne transport'. 'IF' stands for 'institutional and funding arrangement'.

Source: The Study Team

Table 8.2.2 Operation and Maintenance Cost for the Urban Transport Master Plan for 2040

[Unit: USD million]

Period	Road	Railway	BRT	BUS	Mng.	Safety	Water	IF	Total
2020	70	0	0	0	0	1	0	0	71
2021-23	294	0	0	0	0	3	0	0	297
2024-30	1,180	2,069	142	16	0	0	34	1	3,443
2031-40	2,789	4,097	224	0	0	0	22	2	7,134
Total	4,333	6,167	366	16	0	4	55	3	10,944

Note: 'Mng.' stands for 'traffic management'. 'Safety' stands for 'traffic safety'. 'Water' stands for 'waterborne transport'. 'IF' stands for 'institutional and funding arrangement'.

Source: The Study Team

Table 8.2.3 Total Cost for the Urban Transport Master Plan for 2040

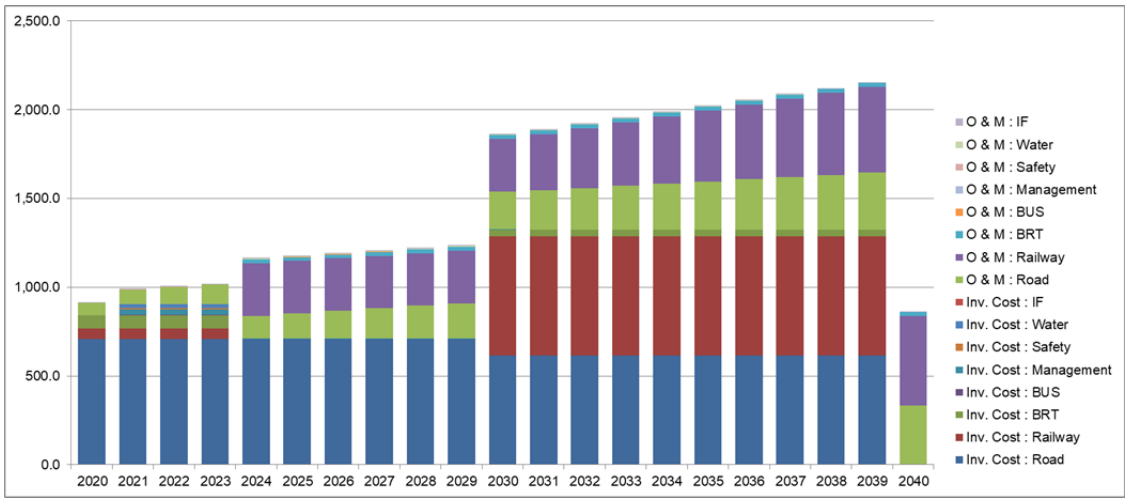
[Unit: USD million]

Period	Road	Railway	BRT	BUS	Mng.	Safety	Water	IF	Total
2020	777	62	71	0	1	3	0	0	914
2021-23	2,416	185	214	18	87	26	64	0	3,010
2024-30	6,042	2,741	177	16	39	0	34	1	9,051
2031-40	8,341	10,143	540	0	0	0	22	2	19,047
Total	17,576	13,130	1,002	34	127	29	119	3	32,021

Note: 'Mng.' stands for 'traffic management'. 'Safety' stands for 'traffic safety'. 'Water' stands for 'waterborne transport'. 'IF' stands for 'institutional and funding arrangement'.

Source: The Study Team

The yearly allocation of costs is estimated based on the proposed period as described in the project profile. For the period between 2020 and 2023, the annual fund requirement is from USD 914 million to USD 1,017 million. For the period between 2024 and 2029, annual fund requirement is from USD 1,163 million to USD 1,234 million.



Note: 'IF' stands for 'institutional and funding arrangement'. 'Safety' stands for 'traffic safety'. 'Water' stands for 'waterborne transport'. 'Management' stands for 'traffic management'. 'O&M' stands for 'operation and maintenance'. 'Inv. Cost' stands for 'initial investment cost'.

Source: The Study Team

Figure 8.2.1 Approximate Annual Cost of the Urban Transport Master Plan for 2040

8.2.2 Public Funding Sources

As a primary source of funding, five types of public finance options are considered, and, the available amount for implementation of the urban transport master plan is estimated. Methods and assumptions made are described below.

(1) Internal Receipts (Central and Local Government Budget)

As discussed in Section 7.1.8 of main report, it is expected that approximately USD 135 million, which is composed of USD 51 million from internal receipts, USD 16 million from external receipts and USD 68 million from FONER, are available for the urban transport sector of Kinshasa as of 2018[4]. The USD 51 million as of 2018 is expected to grow in line with the economic framework discussed in Section 5.2.4 of main report as the revenues are usually proportional to economic activities.

(2) External Receipts (International Donors)

External receipts from multi-lateral donors, bilateral donors (members of DAC) and bilateral donors (non-members of DAC) are estimated at USD 16 million in 2018. The same as assumptions of the internal receipts, it is expected to grow in line with economic growth.

(3) FONER

The funding for the urban transport sector in Kinshasa from FONER is USD 69 million in 2018. It should be noted that the funding from FONER is earmarked for road maintenance only. Significant increase of budget can be expected due to motorization and increase of price per litre as automobiles are major causes of traffic congestion. The current tax of USD 0.10 per litre for fuel is assumed to be gradually raised to 0.40 per litre in 2030 considering economic externalities of motorized vehicles. Based on the travel demand forecast, the fuel consumption in 2018, 2030 and 2040 are estimated. It is also assumed that the laws and regulations need be revised, then, the funding from FONER can be utilized for all projects of the urban transport master plan.

(4) Travel Demand Management (TDM)

As mentioned in section 8.3 of Chapter 8 and section 9.1, revision of the parking facility development policy (TM-1), on-street parking management (TM-3), strict enforcement of illegal parking (TM-4), development of parking facility operated by PPP Model (TM-5) restriction of vehicle use in the city centre and (TM-7) are proposed. While the main objective of these traffic management policies is to control surging travel demand by private motorized transport modes during peak hours by charging fees and fines, this package of parking policy generates revenues from additional parking tax. It is assumed that the Government can receive tax revenues from the year 2020. While the further detailed analysis is required for the price of the parking tax, the CDF 1,580 (equivalent to USD 5) and CDF 5,000 are assumed in 2020 and 2040 respectively considering affordability of vehicle users. The year between 2020 and 2040 are interpolated assuming the same growth rate. For the implementation of these projects, study on the revision of parking facility development policy (TM-1) should be implemented at first. In this study, details on restrictions on parking such as target area, enforcement method, required legal framework, price level, time, fines, financial scheme can be studied based on supply-demand balance of parking.

[4] The budget of FONER is estimated from the 2018 national budget of CDF 264 billion multiplying execution ratio of 82% in 2016 budget and 40% allocation ratio to Kinshasa Province according to FONER. The ratio of external receipts among total receipts is assumed to be 23% according to the budget from 2014 to 2018.

(5) Fares of Public Transport

While it is not possible to cover the entire initial investment and operation and maintenance cost for public transport, fares of public transport can be utilized for the master plan implementation. It is assumed that fare revenues from the high capacity public transit modes including railways, BRTs and buses are to be utilized mainly for the operation and maintenance of public transport. On the other hand, fare revenues from public transport modes operated by private sectors such as minibus, taxi-bus and taxi are not considered as sources of funding for master plan implementation.

8.2.3 Land Value Capture (LVC)

Land value capture (LVC) is a public financing method by the governments[5] which are expected to:

- Trigger an increase in land values via regulatory decisions, such as a change in land use or floor area ratio (FAR), or infrastructure investments, such as transit.
- Institute a process to share this land value increment by capturing part or all of the change.
- Use LVC proceeds to finance infrastructure investments, such as transit and TOD-related investment; fund any other improvements required to offset impacts related to the changes, such as densification; and implement public policies to promote social equity, such as provision of affordable housing to alleviate shortages and offset potential gentrification.

There are two types of LVC instruments: tax- or fee-based and nontax- or non-fee-based which is called “development-based LVC.”

In the case of Kinshasa, the development-based LVC can be a useful tool not only for funding but also for urban development considering rapid population increase in the near future and required urban developments, although the government should setup an implementing agency such as a state-owned enterprise for both urban and transport system development. Property tax or fees levied to private developers and private land owners are also an option for capturing added value.

The expected added land values are estimated for the new urban development areas mainly in the suburbs of the city until 2030 and 2040 as shown in Table 8.2.4 and Table 8.2.5. The current land price of new urban development area is assumed as same as the current land price of suburban fringe areas such as the southern area of Kimbanseke Commune. With the increase of floor area ratio (FAR) together with urban infrastructure development, the land price will significantly increase. The future FAR is set following typical examples in Japan and other developed countries by land use category. It also assumed that 70% of floors by land use category will be constructed and utilized compared with the planned FAR referring to examples in Tokyo, Japan.

However, it should be noted that LVC works only if FAR is properly regulated as a part of land use plans of the Kinshasa Province. This means that the Kinshasa Province has to formulate a legal framework for it, and, institutional setup as well as capacity development is also required for

[5] Suzuki, Hiroaki, Jin Murakami, Yu-Hung Hong, and Beth Tamayose. 2015. Financing Transit-Oriented Development with Land Values: Adapting Land Value Capture in Developing Countries. Urban Development Series. Washington, DC: World Bank. doi:10.1596/978-1-4648-0149-5. License: Creative Commons Attribution CC BY 3.0 IGO

regulating building permits.

It is assumed that the future unit price per floor area by floor use is the same as the current price of the same land use category. The land price information is acquired from interviews with the Kinshasa Province. Significant added value is expected with the urban development together with infrastructure development. It also should be noted that infrastructure development cost and construction cost of urban areas should be borne by the added value, and, it also includes return to investors and land owners. Nevertheless, some part of the added value can be utilized for infrastructure development as infrastructure contributes land value increase.

Table 8.2.4 Added Land Value of New Town Developments until 2030

[Unit: USD million]

Land Use Category	Area (ha)	A. Present Value	B. Future Value	B-A. Added Value
Commercial/ Business Area	1,493	597	14,273	13,676
Industrial Area	1,674	670	4,671	4,002
Agricultural and Residential Area	1,745	698	1,341	643
Residential / Business Area	1,193	477	7,603	7,126
Residential Area	8,904	3,561	42,573	39,011
Total	15,008	6,003	70,461	64,458

Source: the Study Team

Table 8.2.5 Added Land Value of New Town Developments between 2030 and 2040

[Unit: USD million]

Land Use Category	Area (ha)	A. Present Value	B. Future Value	B-A. Added Value
Commercial/ Business Area	438	175	4,185	4,010
Industrial Area	1,210	484	3,375	2,891
Agricultural and Residential Area	5,827	2,331	4,477	2,146
Residential / Business Area	152	61	966	906
Residential Area	10,044	4,017	48,024	44,006
Total	17,670	7,068	61,027	53,959

Source: the Study Team

LVC Example – Tama New Town Development, Tokyo, Japan

Tama New Town is a famous and one of the biggest new town developments located approximately 30km westward of CBD Tokyo. In the area of roughly 3,000 ha, 300,000 people are planned to reside or work in the new town. Approximately 2,226 ha are developed as a new residential area development project by 3 public urban developers; Tokyo Metropolitan Government, Japan Housing Corporation (currently Urban Renaissance Agency) and Tokyo Metropolitan Housing Supply Corporation. The remaining area of 644 ha is developed as a land readjustment project. With various agreements and memorandums among the 3 public urban developers, central and local governments and other stakeholders, the 3 public urban developers

ha ve invested a significant amount of infrastructure development such as arterial roads, railways, river improvement and sewages. The invested infrastructure cost and the amount covered by the public urban developers are summarized in Table 8.2.6. Approximately 42% of infrastructure of arterial roads, railways and river improvements are covered by them.

Table 8.2.6 Infrastructure Development Costs for Tama New Town and Contribution by Public Urban Developers

Infrastructure	USD Million		JPY Million		Percent
	Total Cost	Paid by Developers*	Total Cost	Paid by Developers*	
Railways	1,036	540	114,700	59,815	52%
Arterial Road	1,009	360	111,716	39,916	36%
River Improvements	270	75	29,948	8,317	28%
Sub-Total	2,315	976	256,364	108,048	42%
Ref. Sewages	517	N/A	57,200	N/A	N/A

Note: Developers are Tokyo Metropolitan Government, Japan Housing Corporation (currently Urban Renaissance Agency) and Tokyo Metropolitan Housing Supply Corporation
Note: USD 1 = JPY 110.7330

Source: Shimoda, Y., Oosawa, M. and Kishii, T. (2011) "Construction of Major Public Facilities on the Tama New Town Development" in Journal of Japan Society of Civil Engineers, Ser. D3 (Infrastructure Planning and Management) Vol. 67, Issue 5, p. 67_I_351-67_I_359 (in Japanese)

One of the reasons why the 3 public urban developers can cover these costs is that there is the huge added value of land prices. While the acquired cost of land was USD 1,228 million, it increased to USD 14,342 million, which is 11.7 times of the original price as described in Table 8.2.7. It also should be noted that the 3 public urban developers have to bear costs of levelling, construction of service roads, planning and administrative procedures.

Table 8.2.7 Added Land Value of Tama New Town Development

Item	USD Mn.	JPY Mn.
Land Acquisition Cost	1,228	136,000
Land Sold	14,342	1,588,100
Ratio	11.7	11.7

Note: USD 1 = JPY 110.7330

Source: Shimoda, Y., Oosawa, M. and Kishii, T. (2011) "Construction of Major Public Facilities on the Tama New Town Development" in Journal of Japan Society of Civil Engineers, Ser. D3 (Infrastructure Planning and Management) Vol. 67, Issue 5, p. 67_I_351-67_I_359 (in Japanese)

Considering the above example of Tama New Town, the public urban developer can cover significant amount of infrastructure development by utilizing the added value of lands.

8.2.4 Required Investment and Funding Sources

The total estimated funding sources from public sectors and the estimated expenditures are summarized in Table 8.2.8. The total funding sources required for the master plan implementation is estimated at USD 32 billion for the entire master plan period from 2020 to 2040. On the other hand, the estimated public funding sources for the entire period is USD 34 billion which is slightly

higher than the overall expenditures for the master plan implementation. The largest source of public funds is from FONER as an increase of tax is assumed. TDM policies such as a parking tax are also key financial sources of transport infrastructure development. The more people start to use vehicles, the more revenues are expected. Considering the externalities of vehicle usage, it can be justified.

However, a significant amount of deficit, a total of roughly USD 3.0 billion, is estimated for the period between 2020 and 2030. Especially for the early stage of the master plan, significant funding is required for project implementation. Therefore, other financial sources need to be considered in addition to the currently expected public funding sources discussed above.

Table 8.2.8 Estimated Expenditures and Public Funding Sources of the Master Plan

[Unit: USD million]

Year	Estimated Expenditures			Public Funding Sources						Balance	Acc.
	Initial Inv.	*O&M*	**Sub-total**	*Internal*	*External*	*FONER*	*TDM*	*Fare*	**Sub-total**		
2020	*843*	*71*	**914**	*59*	*18*	*148*	*102*	*0*	**327**	**-587**	**-587**
2021	*904*	*85*	**989**	*63*	*19*	*185*	*109*	*0*	**378**	**-612**	**-1,199**
2022	*904*	*99*	**1,003**	*68*	*21*	*228*	*118*	*0*	**434**	**-569**	**-1,768**
2023	*904*	*113*	**1,017**	*73*	*22*	*275*	*127*	*0*	**497**	**-520**	**-2,288**
2024	*713*	*450*	**1,163**	*79*	*24*	*328*	*137*	*291*	**859**	**-304**	**-2,592**
2025	*713*	*464*	**1,177**	*85*	*26*	*388*	*147*	*306*	**952**	**-225**	**-2,816**
2026	*713*	*478*	**1,191**	*91*	*28*	*455*	*159*	*322*	**1,055**	**-136**	**-2,952**
2027	*713*	*492*	**1,205**	*98*	*30*	*529*	*173*	*339*	**1,169**	**-37**	**-2,989**
2028	*713*	*506*	**1,219**	*106*	*32*	*612*	*187*	*356*	**1,294**	**74**	**-2,914**
2029	*713*	*521*	**1,234**	*114*	*35*	*705*	*204*	*375*	**1,432**	**198**	**-2,716**
2030	*1,329*	*532*	**1,861**	*122*	*38*	*807*	*223*	*394*	**1,583**	**-278**	**-2,994**
Sub-total	*9,164*	*3,811*	**12,975**	*957*	*294*	*4,661*	*1,686*	*2,383*	**9,980**	**-2,994**	
2031	*1,324*	*565*	**1,889**	*130*	*40*	*870*	*241*	*413*	**1,693**	**-195**	**-3,190**
2032	*1,324*	*598*	**1,922**	*139*	*43*	*937*	*261*	*433*	**1,812**	**-109**	**-3,299**
2033	*1,324*	*631*	**1,955**	*148*	*45*	*1,009*	*284*	*455*	**1,940**	**-14**	**-3,313**
2034	*1,324*	*664*	**1,988**	*157*	*48*	*1,087*	*310*	*477*	**2,079**	**92**	**-3,221**
2035	*1,324*	*697*	**2,021**	*167*	*51*	*1,170*	*341*	*500*	**2,230**	**210**	**-3,012**
2036	*1,324*	*730*	**2,054**	*178*	*55*	*1,261*	*376*	*525*	**2,394**	**341**	**-2,671**
2037	*1,324*	*763*	**2,087**	*190*	*58*	*1,358*	*417*	*550*	**2,573**	**487**	**-2,185**
2038	*1,324*	*796*	**2,119**	*202*	*62*	*1,463*	*465*	*577*	**2,769**	**650**	**-1,535**
2039	*1,324*	*829*	**2,152**	*215*	*66*	*1,575*	*524*	*606*	**2,986**	**834**	**-701**
2040	*0*	*862*	**862**	*229*	*70*	*1,697*	*595*	*636*	**3,227**	**2,365**	**1,664**
Sub-total	*11,913*	*7,134*	**19,047**	*1,756*	*539*	*12,425*	*3,814*	*5,172*	**23,705**	**4,659**	
Total	*21,077*	*10,944*	**32,021**	*2,712*	*833*	*17,086*	*5,499*	*7,555*	**33,686**	**1,664**	

Source: The Study Team

Note: 'Inv.' stands for investment. 'O&M' stands for operation and maintenance. 'FONER' stands for *Fonds National d'Entretien Routier* (National Road Maintenance Fund). 'TDM' stands for travel demand management policy such as parking taxes. 'Fare' in the table above means fare of public transport. 'Acc.' stands for accumulation.

8.3 Organization for Plan Implementation

8.3.1 Outline of the Implementation Framework

The Study Team recommends to fully utilizing the existing JCC and TWG which were organized to execute the PDTK in co-ordination and cooperation with JICA and the Study Team. Their contributions to realizing the Master Plan could be significant, since they are thoroughly aware of the background and the process of the Study through participation to such meetings as JCC, TWG and Workshops.

After the PDTK by JICA is completed it is imperative that the subsequent step is to authorize the PDTK proposed Master Plan following the legislative procedure as required. Even including such an authorization process, a driving force organization should be established in order to implement the Master Plan projects of various transport sub-sectors, such as roads, railways, buses, traffic safety, control and management, and further it will even extend to not only hardware projects but also software projects.

8.3.2 Composition and Roles of the Implementation Organization

As the result of a comparative study of a similar nature, which deals with a set-up of the organization to implement the master plan projects, the Study Team proposes the overall organizational framework for implementing the Master Plan projects as shown in Figure 8.3.1, where the Council of the Master Plan Implementation will take a core role as a driving force to pursue the implementation of the Master Plan as described in Table 8.3.1.

The Council consists of the Joint Steering Committee (JSC) and the Technical Working Group (TWG), whose members can be basically the same as those of the current Joint Coordinating Committee, though a representative of DEPR, MTVC should be added, and the Technical Working Group organized for the PDTK, respectively. Among others, the JSC should take the principal responsibility to lead the Council and take necessary initiatives for the master plan implementation, which should begin with the authorization of the proposed urban transport master plan by the Kinshasa Provincial Parliament.

The authorized master plan should also be endorsed by the central government in order to secure the fund procurement and to maintain close cooperation with relevant ministries and offices such as MITPR, MTVC, the Prime Minister Office and the Presidential Office.

Subsequently, the JSC supported by TWG will have to discuss, coordinate and decide upon which projects should be selected and how to raise the necessary funds and who to undertake the project implementation.

A list of priority projects recommended by the Council should make an application to the Managing Board which consists of ministers and the governor who have authority to allocate a budget for project execution. Once the consensus is made at the managing board an executing minister will be able to instruct its project implementation unit to undertake the project.

Monitoring is another important task of the Council with the support of TWG and which will help complete and assess the selected project. This, as a consequence, will also contribute to prepare the coming list of priority projects.

Table 8.3.1 Overall Organizational Framework for the Master Plan Implementation

Item	Description
Type of entity	Not a permanent but an Ad hoc organization in the short term. In the long-term, however, it could be transformed to a permanent one in the Kinshasa Provincial Government.
Year of establishment	2020
Estimated activity period	2020-2030
Method of composition	The overall organization for the Master Plan implementation is largely composed of "Managing Board", "Council" and "Project Execution Units". The Council (core implementation unit), which should demonstrate a driving force as a key role to pursue the overall implementation of the Master Plan, will consist of the "Joint Steering Committee" and "Technical Working Group".
Main roles:	
- Managing Board	1. Approval of the proposition delivered from the Joint Steering Committee 2. Instruction to the relevant government unit to execute the project 3. Instruction to the Joint Steering Committee, if required so as to facilitate the implementation of the Master Plan
- Joint Steering Committee	1. Coordination in general among agencies concerned, 2. Promotion of authorizing the Master Plan, 3. Preparation of the proposition to the Managing Board for implementing the Master Plan projects, 4. Monitoring the progress of implementing the Master Plan projects, and 5. Review and up-date of the Master Plan
- Technical Working Group	1. Support the Joint Steering Committee from technical and project implementation points of view 2. Prepare a draft plan for the project implementation
- Project Executing Units	1. Prepare reports as requested by the TWG or its member agencies 2. Execute Master Plan projects as instructed by the respective line ministries 3. Supervise the implementation of projects
Members	**Managing Board:** - Presidential Office - Prime-minister Office - Minister of MPTPI - Minister of MTVC, and - Governor of Kinshasa Province **Joint Steering Committee:** - Conseiller Principal Infrastructures de la Présidence - Conseiller Principal au Collège chargé des Infrastructures de la Primature - Conseiller Planification, MITPR - One representative of Cellule Infrastructure, MITPR - One representative of DEPR, MTVC - One representative of Ministère Provincial du Plan, Budget, Travaux Publics et Infrastructures

Item	Description
	- One representative of Ministère Provincial des Transports, Sports, Jeunesse et Loisirs - One representative of Bureau d'Etudes d'Aménagement et d'Urbanisme - One representative of Office des Voiries et Drainage - One representative of Commission Nationale de Prévention Routière - One representative of Groupe d'Etudes des Transports - One representative of Office des Routes - One representative of Société Commerciale des Transports et des Ports **Technical Working Group (TWG):** - Ministère des Infrastructures et Travaux Publics - Ministère Provincial du Plan, Budget, Travaux Publics et Infrastructures - Ministère Provincial des Transports, Sports, Jeunesse et Loisirs - Cellule Infrastructures - Bureau d'Etudes d'Aménagement et d'Urbanisme - Office des Voiries et Drainage - Commission Nationale de Prévention Routière - Groupe d'Etudes des Transports - Office des Routes - Société Commerciale des Transports et des Ports - Agence Congolaise de l'Environnement
Regulatory authority and Positioning	- The Provincial government of Kinshasa is the competent authority to take the lead to implement the Master Plan project in close cooperation with CI. Therefore, chairmanship of the Joint Steering Committee will be held by either the Coordinator of CI or the Provincial Minister of Ministère Provincial du Plan, Budget, Travaux Publics et Infrastructure. - Also, the Technical Working Group will be chaired by the representative of Ministère Provincial du Plan, Budget, Travaux Publics et Infrastructures
Legal status	The institutional framework should be established based on a certain governmental decree to be issued in order to make its legal status and positioning clear.
Financial resources	CI (international donors), Kinshasa province

Source: The Study Team

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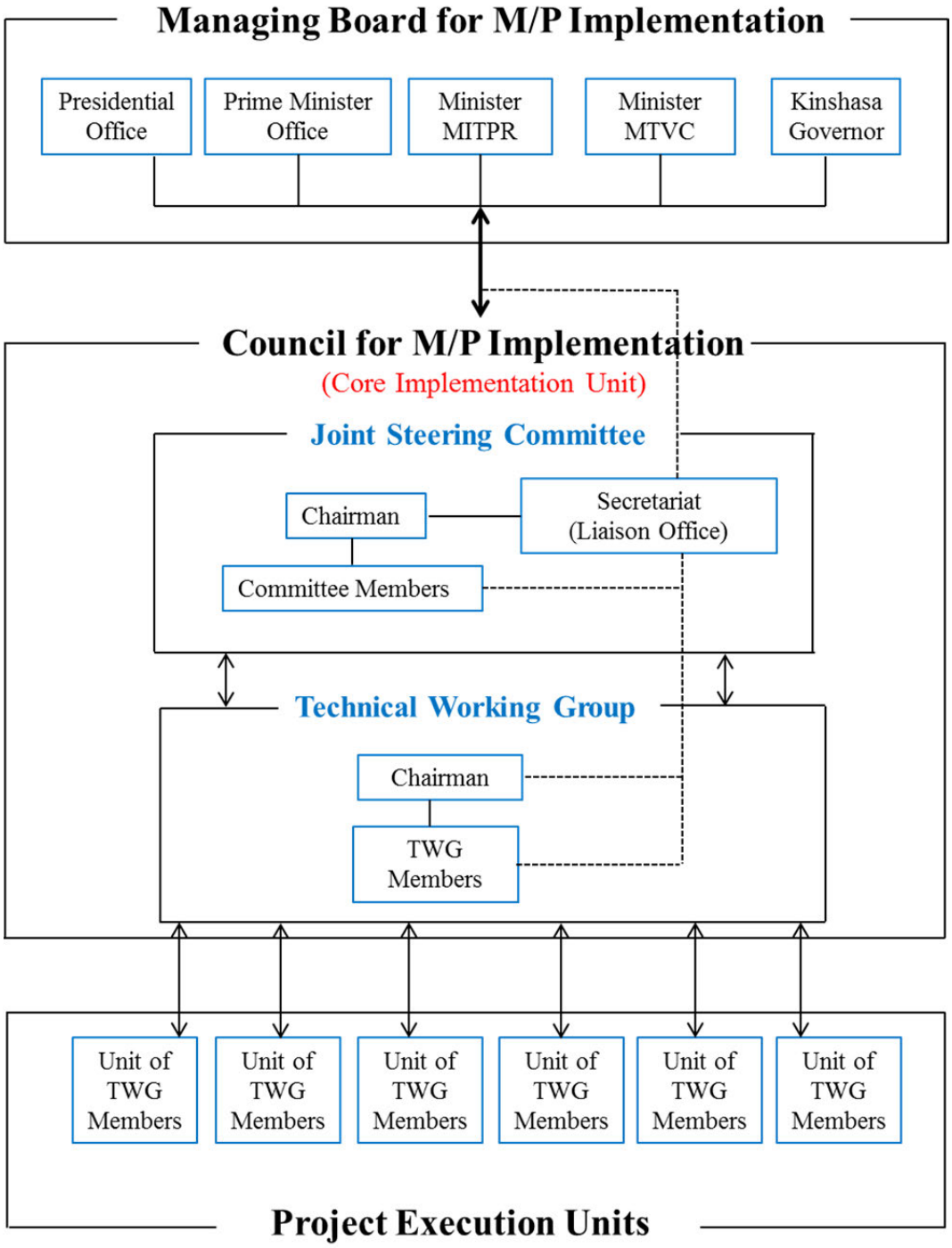

Source: The Study Team

Figure 8.3.1 Organization Structure of Institutional Framework

8.3.3 Future Plan toward the Year 2040

In order to enhance the institutional capability and sustainability of implementing the urban transport Master Plan in Kinshasa, the Study Team proposes that the institutional framework at the year 2030 be gradually succeeded by a permanent governmental agency which needs to be newly established as an authority with appropriate executing responsibilities and legal status.