Republic of Uganda
Ministry of Works and Transport
Uganda National Roads Authority

DATA COLLECTION SURVEY ON INFRASTRUCTURE DEVELOPMENT FOR NORTHERN ECONOMIC CORRIDOR IN REPUBLIC OF UGANDA

FINAL REPORT

JULY 2019

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

EIGHT-JAPAN ENGINEERING CONSULTANTS INC.
NIPPON KOEI CO., LTD.

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JR
19-012

CURRENCY EXCHANGE RATE

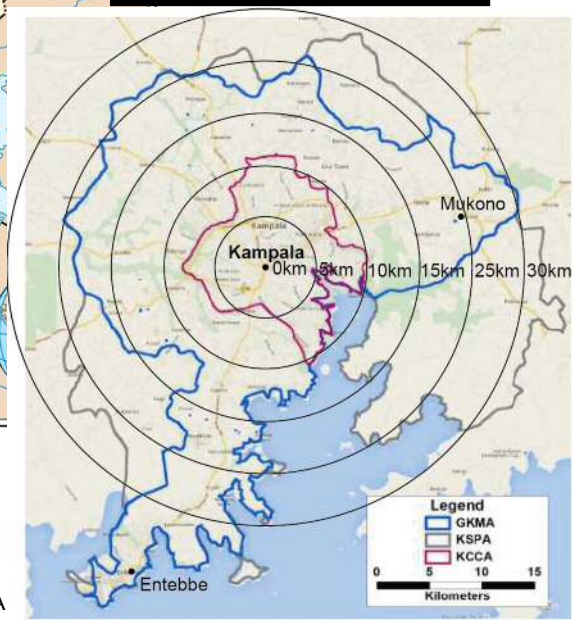
(1) Uganda Shillings (UGX) to Japanese Yen (JPY)
1UGX = 0.02993 JPY (JICA Monthly Exchange Rate, April 2019)

(2) US Dollar (USD) to Japanese Yen (JPY)
1 USD =110.423 JPY (JICA Monthly Exchange Rate, April 2019)

(3) US Dollar (USD) to Uganda Shillings (UGX)
1 USD =3,689 UGX (JICA Monthly Exchange Rate, April 2019)

LOCATION MAP OF UGANDA

Kampala City and GKMA



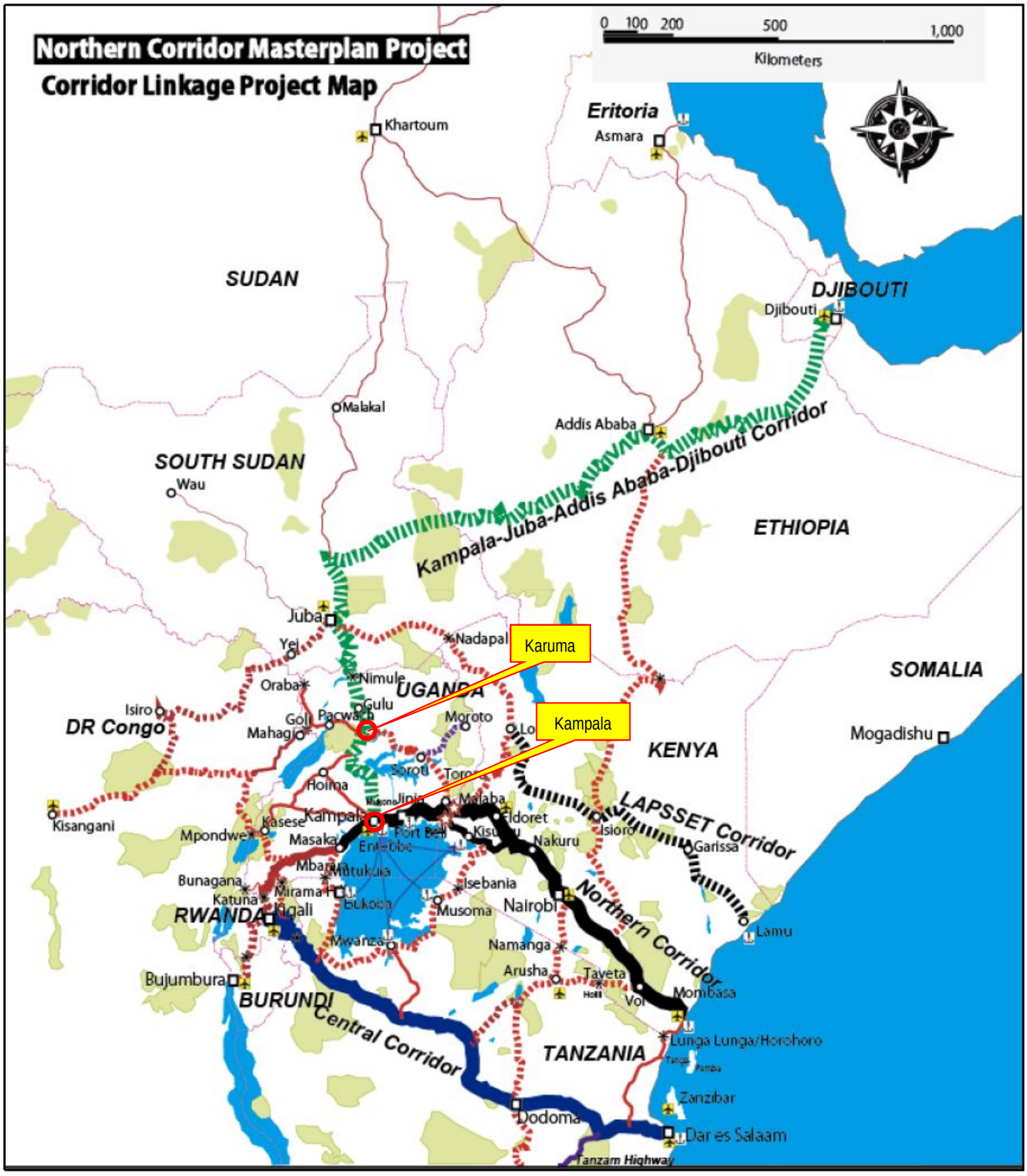
Note:
GKMA: Greater Kampala Metropolitan Area
KPSA: Kampala Special Planning Area
KCCA: Kampala Capital City Authority

Source: Multi-Modal Urban Transport Master Plan for GKMA

Basic Data of Uganda

Area	241,000 sq.km (197,000sq.km: land area)	• Economic Growth Rate:	4.0% (2017, Source: World Bank Estimation)
Population	38.8 million (2018, Source: Uganda Bureau Of Statistics)	• Inflation Rate:	6.0% (2017, Source: World Bank)
Capital	Kampala	• Unemployment Rate:	2.1% (2017, Source: World Bank Estimation)
Languages	English, Swahili, Luganda	• Trade Amount: (2015, World Bank	(1) Export: USD 2,267million (2) Import: USD 5,528million
Religions	Christians (60%), Traditional Religions (30%), Muslims (10%)	• Currency:	Uganda Shillings (UGX)=0.02993Japanese Yen (April 2019, JICA)
Major Industries	Agriculture, Forestry and Fishery	• Japan's Economic Cooperation:	(1) Loans: USD 44.13million (2) Grants: USD 50.36 million (3) Technical Cooperation: USD 26.04 million (2015, Source: Ministry of Foreign Ministry of Japan)
GDP	USD 25.9 billion (2017, Source: World Bank)		
GNI per capita	USD 600 (2017, Source: World Bank)		

LOCATION MAP OF NORTHERN CORRIDOR



DATA COLLECTION SURVEY ON INFRASTRUCTURE DEVELOPMENT FOR NORTHERN ECONOMIC CORRIDOR

FINAL REPORT

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LIST OF ABBREVIATIONS

Abbreviation	Description
AADT	Average Annual Daily Traffic
AfDB	African Development Bank
B/C	Cost Benefit Ratio
BMEX	Busega- Mpigi Expressway
BRT	Bus Rapid Transit
CGV	Chief Government Valuer
C/P	Counterpart
CBD	Central Business District
D/D	Detailed Design
DRC	Democratic Republic of the Congo
DUCA	District, Urban and Community Access
EAC	East African Community
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
ESMS	Environmental Social Management System
ESIS	Environmental Social Impact Statement
EU	European Union
FIRR	Financial Internal Rate of Return
F/S	Feasibility Study
FY	Fiscal Year
GCALA	Guidelines for Compensation Assessment under Land Acquisition
GDP	Gross Domestic Product
GKMA	Greater Kampala Metropolitan Area
GRDP	Gross Regional Domestic Product
GIS	Geographic Information System
GoJ	Government of Japan
GoU	Government of Uganda
HCM	Highway Capacity Manual
HWL	High Water Level
IC	Interchange
ICD	Inland Container Depot
IEE	Initial Environmental Examination
ITS	Intelligent Transport System
JCT	Junction
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
JST	JICA Study Team
KBEX	Kibuye-Busega Expressway
KCCA	Kampala Capital City Authority
KEEX	Kampala- Entebbe Expressway
KFCRUP	Kampala Flyover Construction and Road Upgrading Project
KIIDP	Kampala Institutional and Infrastructure Development Project
KPDF	Kampala Metropolitan Framework Plan
KPDP	Kampala Physical Development Plan
KMTC	Kampala Metropolitan Towns, Counties and Sub-counties
LDC	Least Developed Country
LRT	Light Rail Transit

Abbreviation	Description
M/M	Minutes of Meeting
M/P	Master Plan
MC	Municipal Council
M/C	Motor Cycle
MDGs	Millennium Development Goals
MGV	Medium Goods Vehicle
MoFPED	Ministry of Finance, Planning Economic Development
MoLHUD	Ministry od Lands, Housing and Urban Development
MoWT	Ministry of Works and Transport
MPI	Multidimensional Poverty Index
MRT	Mass Rapid Transit
MW	Mega Watt
NDP II	Second National Development Plan
NEMC	National Environment Management Council
NKB	New Karuma Bridge
NMT	Non-Motorized Transport
NPA	National Planning Authority
NPV	Net Present Value
NSSF	National Social Security Fund
NTMP	National Transport Master Plan
NWSC	National Water and Sewerage Corporation
O & M	Operation and Maintenance
OD	Origin - Destination
ODA	Official Development Assistance
PAPs	Project Affected Persons
PC	Prestressed Concrete
PCU	Passenger Car Unit
PPP	Public-Private Partnership
PS	Permanent Secretary
Q-V	Quantity-Velocity
RAP	Resettlement Action Plan
RC	Reinforced Concrete
Rd	Road
R/D	Record of Discussions
RFB	Road Fund Board
RFP	Request for Proposal
ROW	Right of Way
SADC	Southern African Development Community
SADCC	Southern African Development Coordination Conference
SEA	Strategic Environmental Assessment
SGR	Standard Gauge Railway
SP	Service Provider
TOD	Transit Oriented Development
TOR	Terms of Reference
TSIP	Transport Sector Investment Programme
TTC	Travel Time Cost
UBOS	Uganda Bureau of Statistics
UEGCL	Uganda Electricity Generation Company Limited
UETCL	Uganda Electricity Transmission Company Limited

Abbreviation	Description
UGX	Uganda Shillings
UNRA	Uganda National Road Authority
UPF	Uganda Police Force
URA	Uganda Revenue Authority
URC	Uganda Railway Corporation
URF	Uganda Road Fund
UWA	Uganda Wildlife Authority
VAT	Value Added Tax
VOC	Vehicle Operation Cost
VVIP	Nakasero – Northern Bypass Expressway
WB	World Bank
WFP	World Food Programme
WTSDP	Works and Transport Development Plan

EXECUTIVE SUMMARY

1. Background to the Study

The Republic of Uganda - a Land-Linked country located in east Africa - is a member state of EAC (East Africa Community) and COMESA (Common Market for Eastern and Southern Africa). EAC, established in 2005 as a custom union among the member states, has a strong internal economic tie as an economic zone, and has been promoting interregional trade activities every year. In this context, formulation of a regional road network is a challenge for the entire region. Uganda possesses an important location on the road connecting several neighbouring countries such as Rwanda, D.R.Congo, and South Sudan, etc. as well as coastal Eastern African countries, such as Kenya and Tanzania. Uganda's Economic Reform Policy called "Vision 2040" has set up a railway system with standard gauge railway (SGR) as an important policy. Yet, the SGR project has been delayed, and thus, more than 92% of cargo and passenger transportation still has to depend on road transport.

Transport infrastructure development is stated as one of the priorities in Uganda's National Development Plan (2015/16-2019/20) (NDP II: National Development Plan II). In 2008, the government of Uganda also formulated the "Uganda's National Transport Master Plan," which is a long-term strategy for the transport sector, and made a development framework for the transportation sector for the next 15 years (from 2008 to 2023). In addition, in 2017, under support by JICA, a "Master Plan on Logistics in Northern Economic Corridor" was developed as a regional development plan for Uganda, Rwanda, Burundi and D.R.Congo, starting from the Port of Mombasa of Kenya. The Kibuye-Busega Expressway and the New Karuma Bridge projects were stated as highly prioritized by the Government of Uganda based on the above-mentioned development plan and the Master Plan. The Government of Uganda has great expectations to receive Japan's support for these projects.

The survey for data collection will be conducted to confirm the viability of these projects by Japanese ODA loan or grant aid in consideration of the above-mentioned situation.

2. Outline of the Survey

The objective of the survey is to confirm each Project justification and direction of Supports and to collect the necessary information for the formulation of each Project. The details are shown as below.

(1) To collect relevant information on Urban Transport Plan in Kampala.

Especially, to collect and analyse Current Progress of the Projects based on Development Strategy, Road Sector Development Plan prepared by the Government of Uganda, Updated Donor/Development Partners' information, and clarify the current issues for the implementation of the Projects.

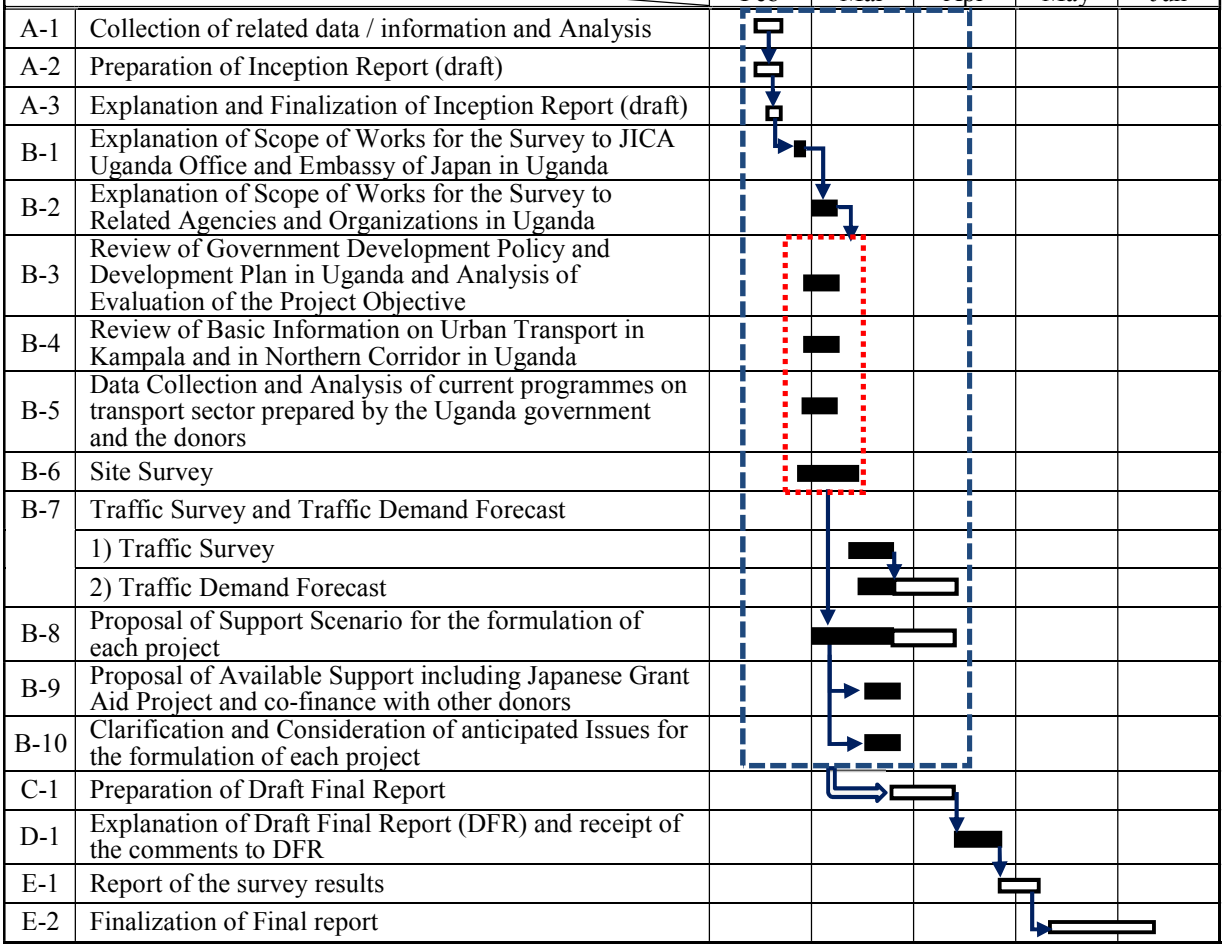
(2) To grasp existing study results such as F/S, D/D for Kibuye–Busega Expressway(KBEX) and New Karuma Bridge Construction Project, current traffic volumes, to consider the required support for the formulation of the Projects as the financial support by JICA.

The Survey commenced mid-February, and continue to the beginning of July 2019.
Implementation schedule is shown in the following table.

- 1st Field Survey in Uganda for data collection: from February 25 to March 15, 2019
- 2nd Field Survey in Uganda for explanation of DFR: from April 18 to 28, 2019

Table 1 Implementation Schedule

		2019 Feb	Mar	Apr	May	Jun
A-1	Collection of related data / information and Analysis					
A-2	Preparation of Inception Report (draft)					
A-3	Explanation and Finalization of Inception Report (draft)					
B-1	Explanation of Scope of Works for the Survey to JICA Uganda Office and Embassy of Japan in Uganda					
B-2	Explanation of Scope of Works for the Survey to Related Agencies and Organizations in Uganda					
B-3	Review of Government Development Policy and Development Plan in Uganda and Analysis of Evaluation of the Project Objective					
B-4	Review of Basic Information on Urban Transport in Kampala and in Northern Corridor in Uganda					
B-5	Data Collection and Analysis of current programmes on transport sector prepared by the Uganda government and the donors					
B-6	Site Survey					
B-7	Traffic Survey and Traffic Demand Forecast					
	1) Traffic Survey					
	2) Traffic Demand Forecast					
B-8	Proposal of Support Scenario for the formulation of each project					
B-9	Proposal of Available Support including Japanese Grant Aid Project and co-finance with other donors					
B-10	Clarification and Consideration of anticipated Issues for the formulation of each project					
C-1	Preparation of Draft Final Report					
D-1	Explanation of Draft Final Report (DFR) and receipt of the comments to DFR					
E-1	Report of the survey results					
E-2	Finalization of Final report					



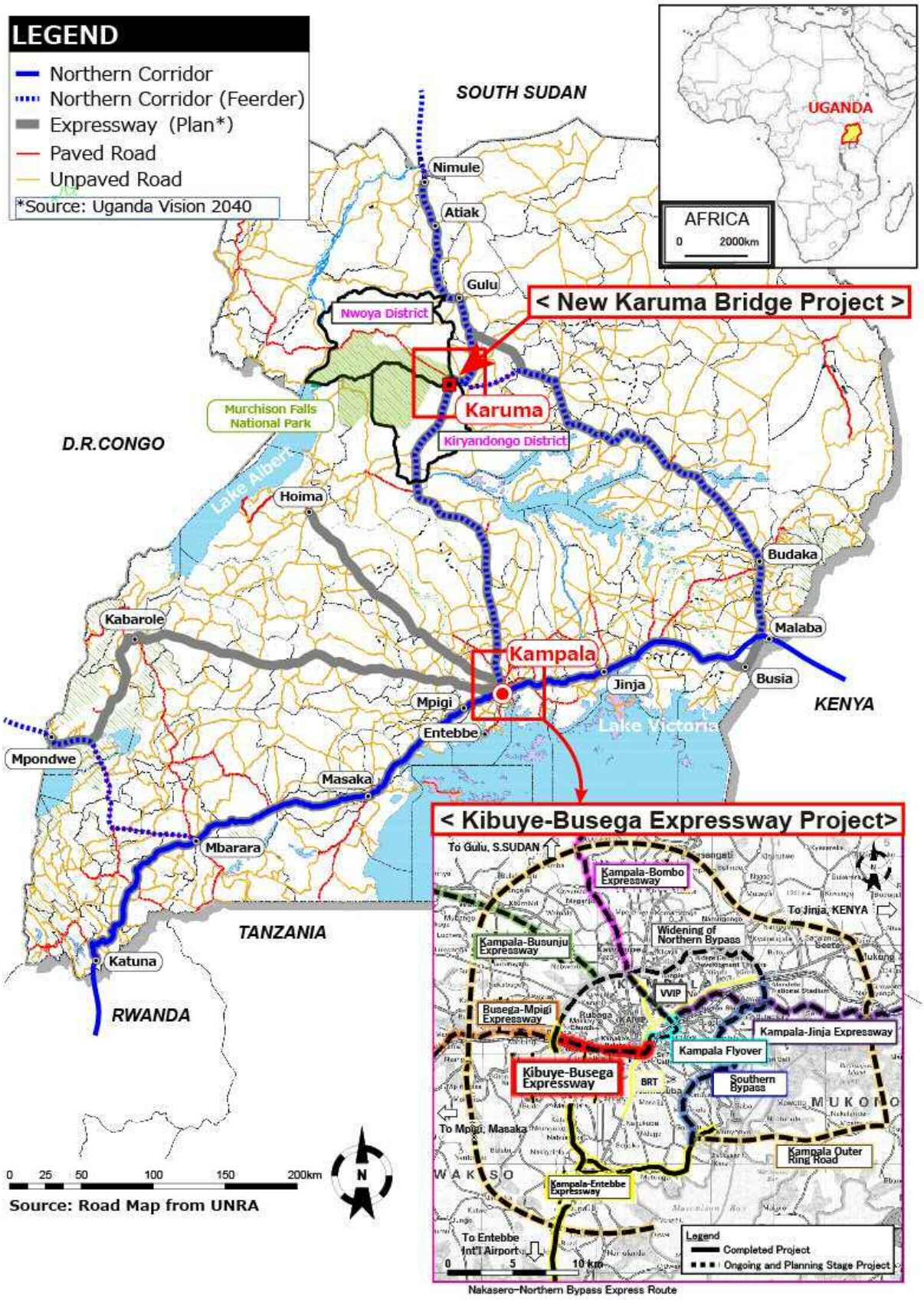
Legend: Work in Uganda Work in Japan

MoWT, UNRA, KCCA and MoFPED are the main C/Ps of the Survey.
The counterpart organizations and related agencies are as follows:

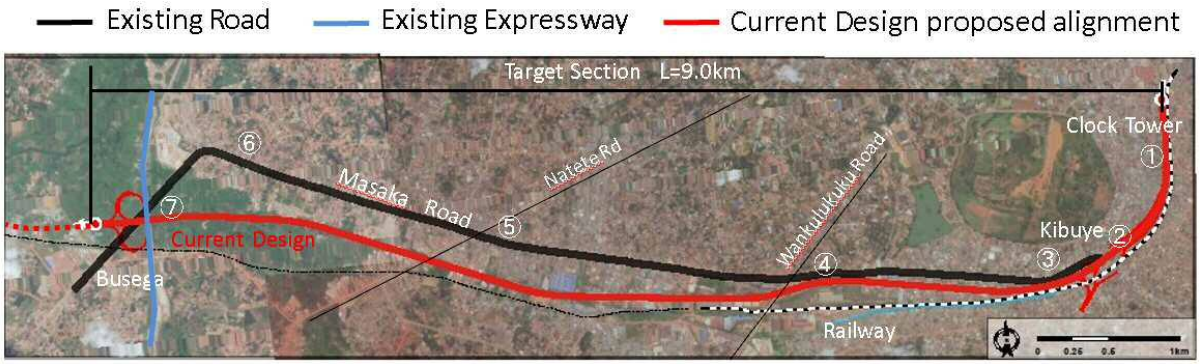
Table 2 Counterpart and Related Agencies

Main Counterparts	
	Ministry of Works and Transport (MoWT)
	Uganda National Roads Authority (UNRA)
	Ministry of Finance, Planning and Economic Development (MoFPED)
	Kampala Capital City Authority (KCCA)
Related Agencies	
	Uganda Railway Corporation (URC)
	MoWT Standard Gauge Railway (SGR) Project Office
	Uganda Police Force (UPF)
	Uganda Electricity Generation Company Limited (UEGCL)
	Uganda Electricity Transmission Company Limited (UETCL)
	National Water and Sewerage Corporation (NWSC)
	Uganda Wildlife Authority (UWA)
	World Bank (WB)
	African Development Bank (AfDB)

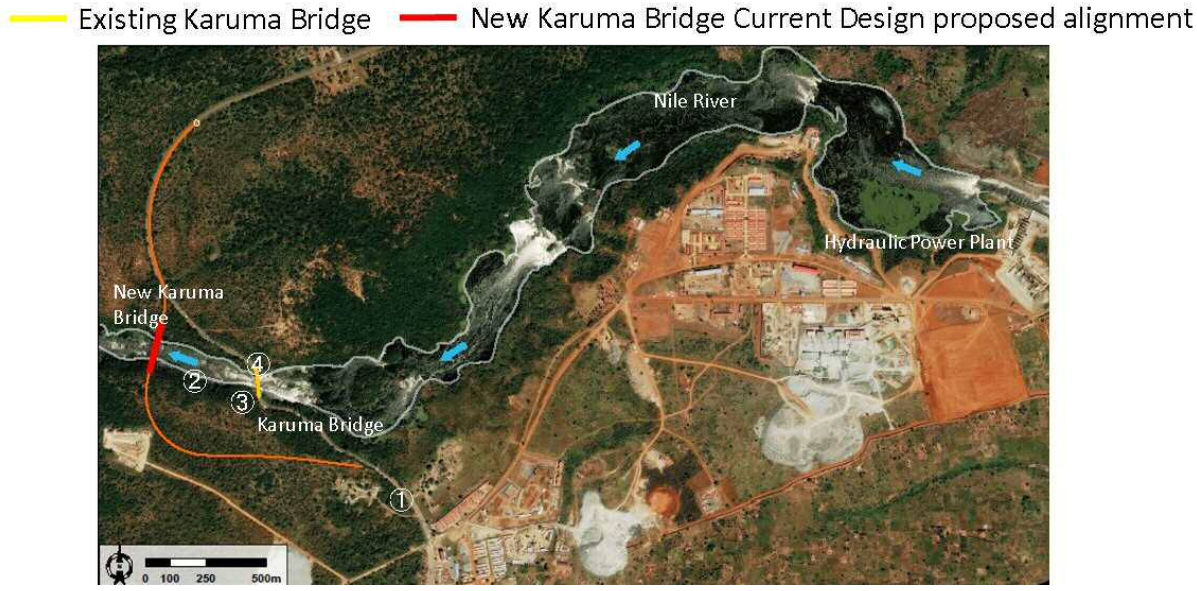
3. Project Sites



< Kibuye - Busega Expressway>



< New Karuma Bridge >



Source: JST

Figure 1 Project Sites

4. Development Strategy and Master Plan in Uganda

There are several development plans and master plans in Uganda. The target projects such as Kibuye-Busega Expressway Project and New Karuma Bridge Project are considered as high priority in these plans as shown in Table 3.

Table 3 Related Development Plan and Master Plan in Uganda

No.	Related Plan	Target Year	Organization	Published Year	Relationship with the Target Projects in this Survey	
					Kibuye-Busega Exp'way Project	New Karuma Bridge Project
(1)	Uganda Vision 2040	2013-2040	NPA	2010	**High Priority Project**	**High Priority Project**
(2)	Second National Development Plan (NDP II)	2015/16-2019/20	NPA	June 2015	**Priority Project** by the target year	-
(3)	Works and Transport Sector Development Plan (WTSDP) 2015/15-2019/20	2015/16-2019/20	MoWT	2017	Recommended the project implementation by PPP	-
(4)	National Transport Master Plan	2008-2023	MoWT/WB	August 2009	**High Priority Route,** Dual carriageway by year 2023, 6 lanes widening by year 2050	-
(5)	Kampala Physical Development Plan (KPDP)	2012-2022	KCCA/WB	November 2012	**Important West-East Axis Trunk Road** in Kampala	-
(6)	Master Plan on Logistics in Northern Economic Corridor	2017-2040	MoWT/JICA	March 2017	**Priority Project** on Northern Economic Corridor in Uganda	**Priority Project** on Northern Economic Corridor in Uganda
(7)	Multi Modal Urban Transport Master Plan (GMKA)	2018-2040	KCCA/WB	May 2018	LRT installation Plan	-

[Note]
NPA: National Planning Authority
MoWT: Ministry of Works & Transport
KCCA: Kampala Capital City Authority
WB: World Bank
JICA: Japan International Cooperation Agency

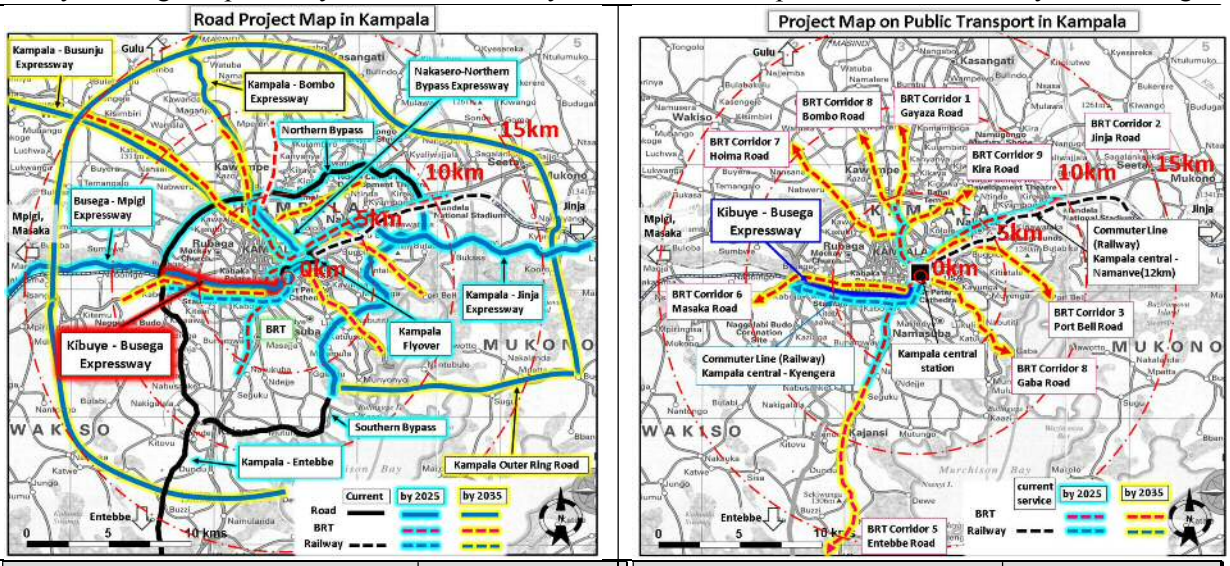
5. On-going and Planning Stage Projects

On-going and planning stage projects related to Kibuye-Busega Expressway Project and New Karuma Bridge Project are summarized as follows, respectively.

(1) On-going and Planning Stage Projects related to Kibuye-Busega Expressway Project

Kampala-Jinja Expressway and Kampala Flyover Project will be inaugurated by 2025 to connect the eastern part of Kampala city with the east side of Uganda. Busega-Mpigi Expressway will also be opened by 2025 to connect the western part of Kampala city with the west side of Uganda. There is a missing link between Kibuye at the end point of Kampala Flyover Project and Busega, which is the beginning point of Busega-Mpigi Expressway. It is desirable that Kibuye-Busega Expressway Project be completed to link the Kampala Flyover Project with the Busega-Mpigi Expressway Project by 2025.

By 2025, major trunk roads including expressways within 10km from Kampala city will be opened for traffic as shown in Figure 2.
On the other hand, BRT corridor No.6 and westbound commuter train services from Kampala central station as new public transport systems will be introduced. Three types of urban transport modes, i.e. Kibuye-Busega Expressway, BRT and Railway services will be operated between Kibuye and Busega.



Major Road Projects	Completion Target Year	
	by 2025	by 2035
Kampala Flyover Lot-1 (Clock Tower FO)	✔	
Kampala Flyover Lot-2 (Kitgum House FO)	✔	
Busega-Mpigi Expressway	✔	
Kampala-Entebbe Expressway	Completed	
Northern BP	✔	
Southern BP	✔	
Kampala-Jinja Expressway	✔	
Nakasero-Northern BP Expressway	✔	
Kampala Outer Beltway		✔
Kampala Bombo Expressway		✔
Kampala-Busunju Hoima Expressway		✔

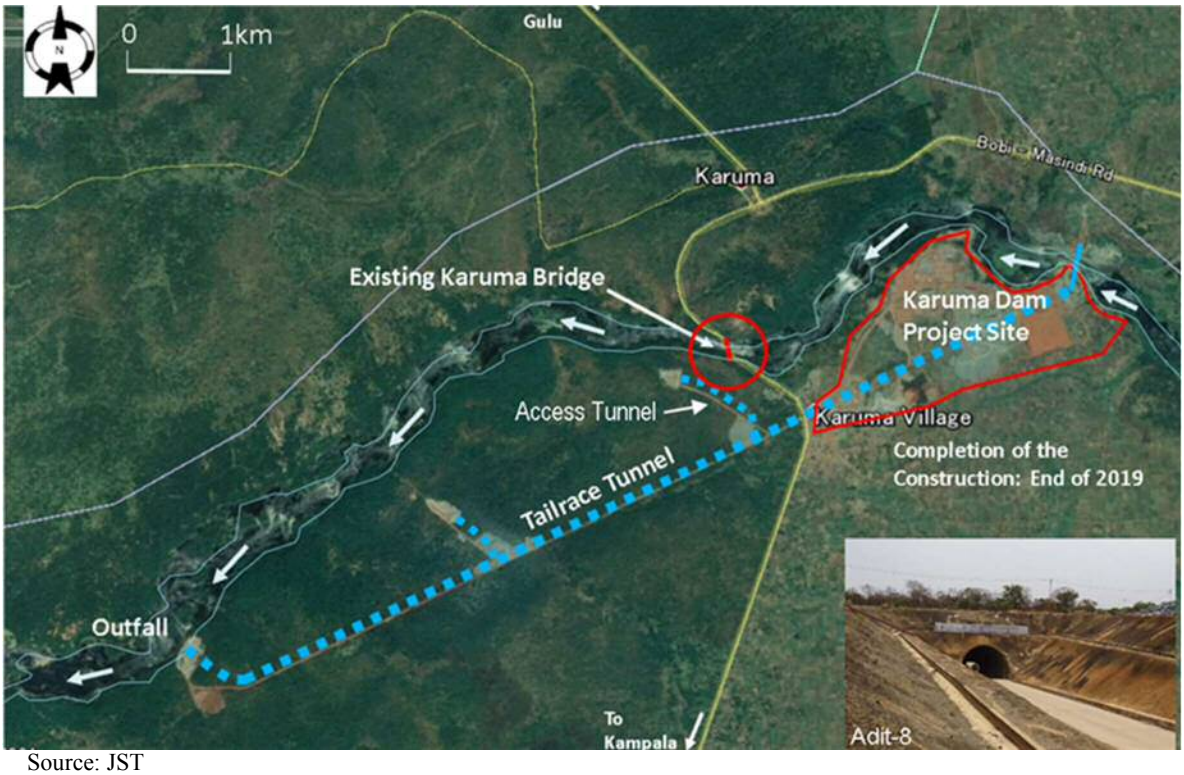
Major Public Transport Projects	Completion Target Year	
	by 2025	by 2035
Kampala BRT Pilot Project(3 routes)	✔	
Kampala BRT (6 corridors))		✔
Commuter Train on existing railway	✔	

Note: Mixed Railway on Standard Gauge Railway is planned by 2025, Light Rail Mass Transit-LRT on Standard Gauge Railway planned by 2035.
Source: JST

Figure 2 On-going and Planning Stage Project Map on Road and Public Transport Sector in Kampala

(2) On-going and Planning Stage Projects related New Karuma Bridge Project

There is a 600MW Karuma Hydropower Project on the River Nile as on-going related project to new Karuma bridge Project as shown in Figure 3. This project is expected to be operational by the end of 2019 making it the largest power generator in Uganda.



Source: JST

Figure 3 Karuma Hydro Power Project

6. Data Collection and Study on Kibuye-Busega Expressway Project

(1) Design of the Road

Geometric design of the Project was done in accordance with the parameters for a design road class of "1A paved", as specified in Vol. 1. Geometric Design of the MoWT Road Design Manual. A summary of applicable geometric design parameters for the Project is shown below. These parameters are same as the current design.

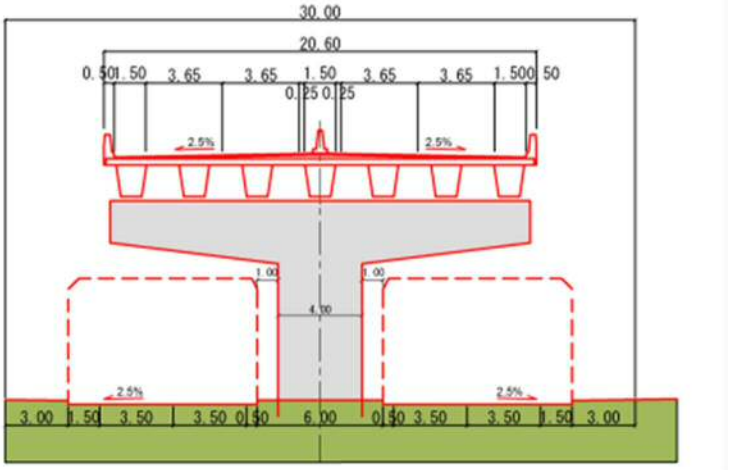
Table 4 Summary of Applicable Geometric Design Parameters for the Project

Design Element	Unit	Road way	Ramp
Road Class		1A Paved	
Design Speed	km/h	80	50
Min. Stopping Sight Distance	m	115	60
Min. Passing Sight Distance	m	545	345
Min. Horizontal Curve Radius	m	240	85
Max. Gradient (Desirable)	%	4	5
Max Gradient (absolute)	%	6	6
Crest Vertical Curve stopping	Kmin	9	
Sag Vertical Curve stopping	Kmin	11	
Normal Cross fall	%	2.5	

Source: Uganda Road Design Manual,

Typical Cross Sections of Kibuye-Busega Expressway are shown below.

4-lane



6-lane

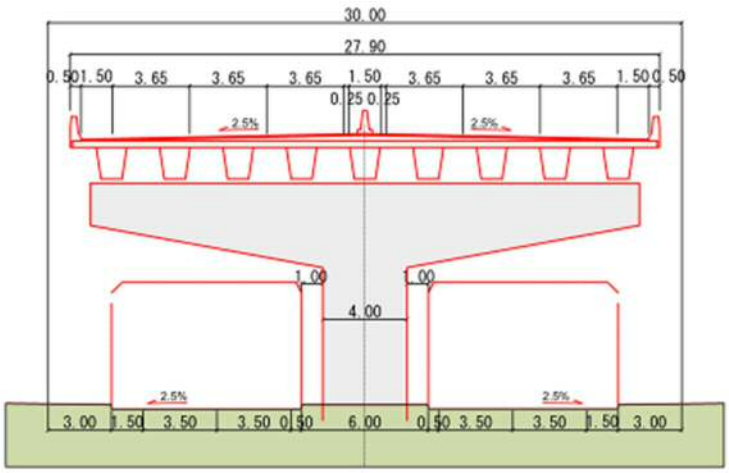


Figure 4 Typical Cross Sections of Kibuye-Busega Expressway

Three alternative plans in road alignment were set up and compared from several viewpoints. The alternatives were established after the site reconnaissance and the data collection for traffic movements, environmental regulations, related plans and development projects, existing road infrastructures, important facilities, built-up areas, statistics of socio-economic data and so on.

Table 5 Summary of Applicable Geometric Design Parameters for the Project

Item		Current design	Alternative-1	Alternative-2	Alternative-3
Road length		9,030m	9,015m	9,010m	9,030m
Viaduct length		4,500m	5,650m	5,660 m	6,300m
Existing Rd Widening Length		1,000m	4,000m	6,000m	6,800m
Minimum Curve Radius		400m	800m	250m	800m
Maximum Gradient		5%	4%	4%	4%
Road Area	4-lane	271,800m^2	271,100 m^2	270,900 m^2	271,500 m^2
	6-lane	285,800 m^2	285,100 m^2	284,900 m^2	285,500 m^2
Land Acquisition Area	4-lane	251,000 m^2	190,500 m^2	137,000 m^2	114,900 m^2
	6-lane	265,000 m^2	204,500 m^2	151,000 m^2	128,900 m^2
Affected Buildings	4-lane	1,160*	430**	310**	330**
	6-lane	1,190*	460**	340**	360**
Area of inside the ROW of Railway	4-lane	10,500 m^2	16,000 m^2	16,000 m^2	16,000 m^2
	6-lane	12,500 m^2	18,000 m^2	18,000 m^2	18,000 m^2
Affected Facilities		WFP, Power line, Nalukolongo Channel	Power line, Nalukolongo Channel	Power line, Nalukolongo Channel	Power line, Nalukolongo Channel

Note: * Based on the survey result in RAP (July 2015)
** Rough count based on satellite image and including all types of buildings
Source: JST

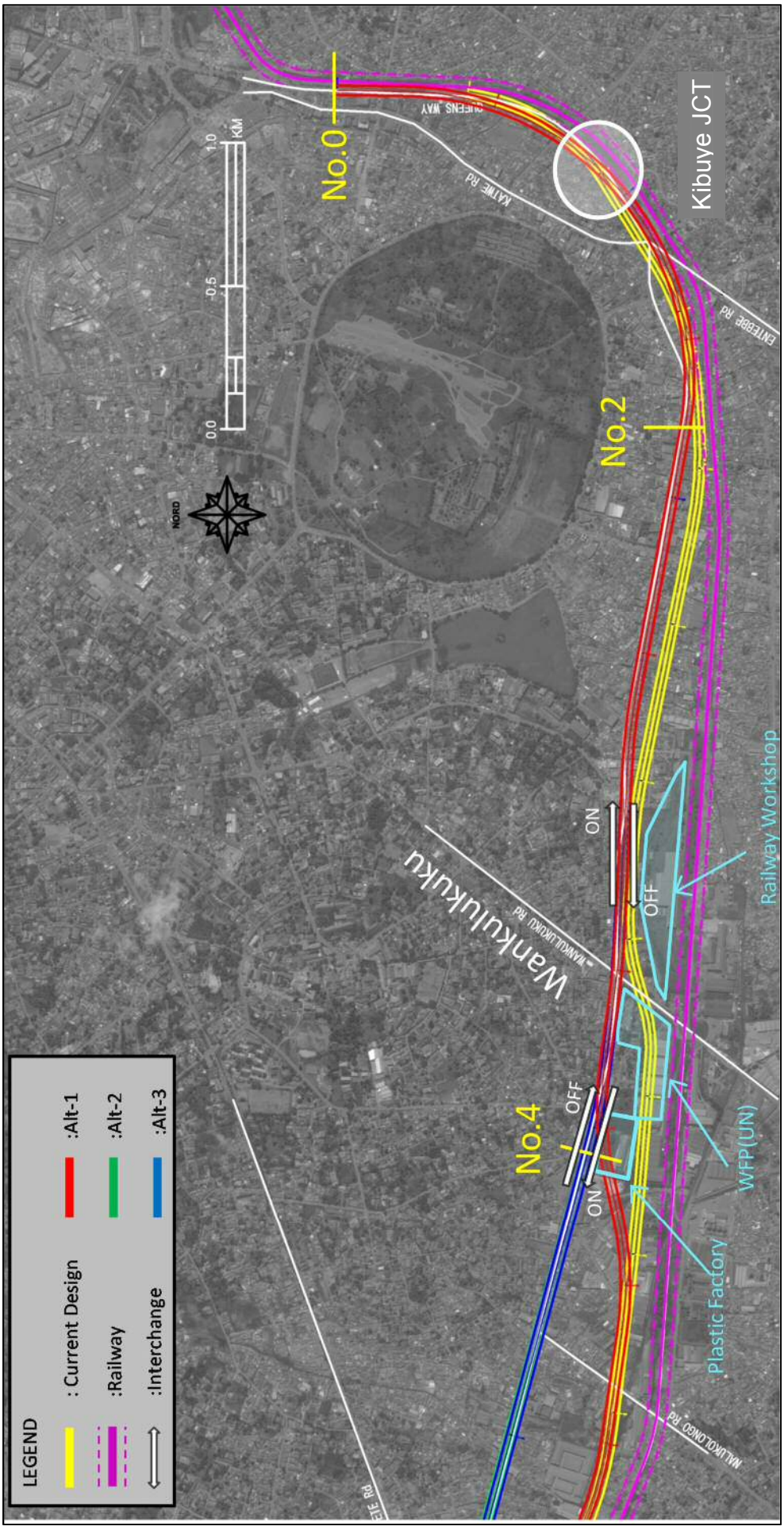


Figure 5 Horizontal Alignment of Alternative(1/2)

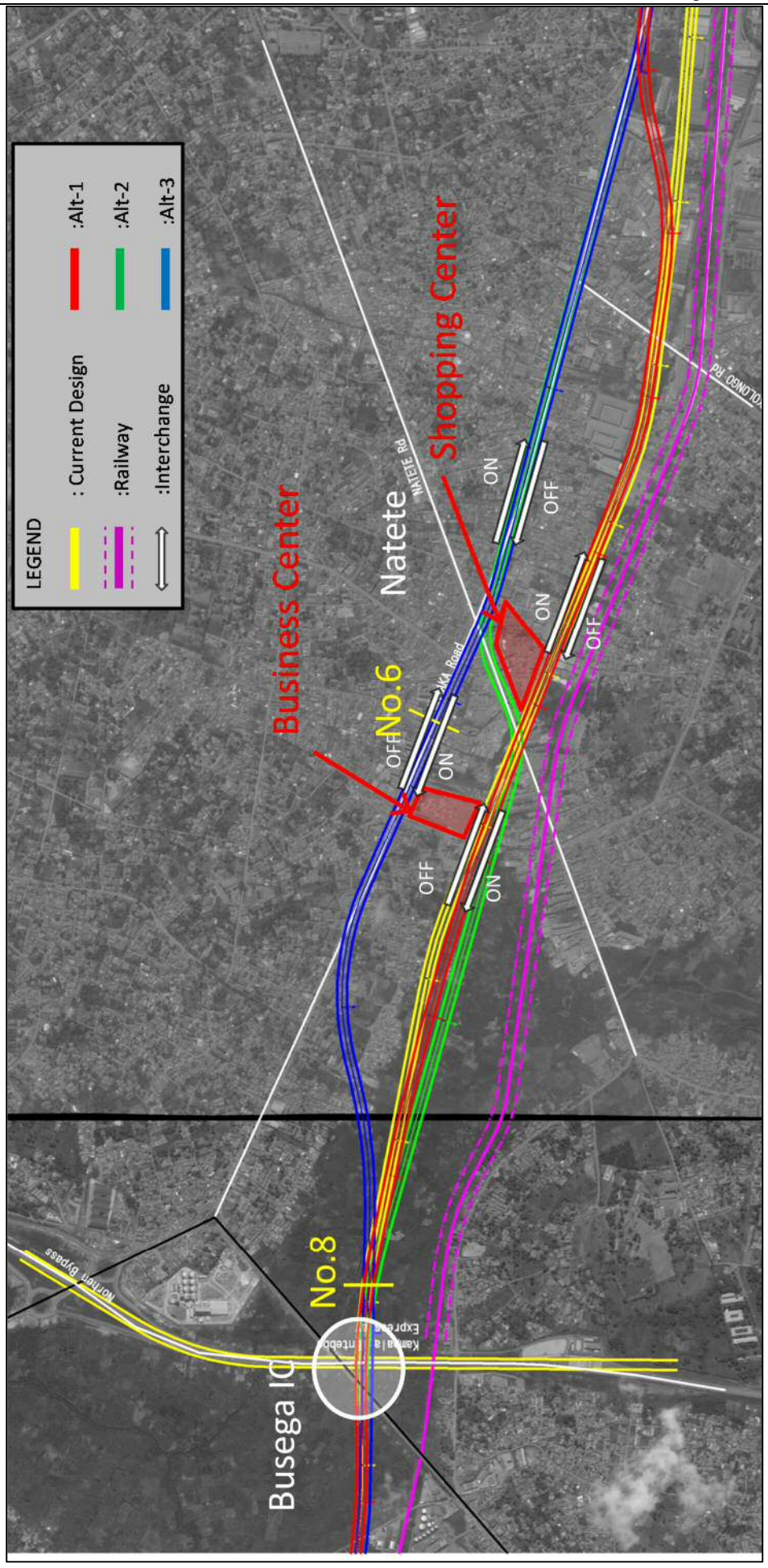


Figure 6 Horizontal Alignment of Alternative (2/2)

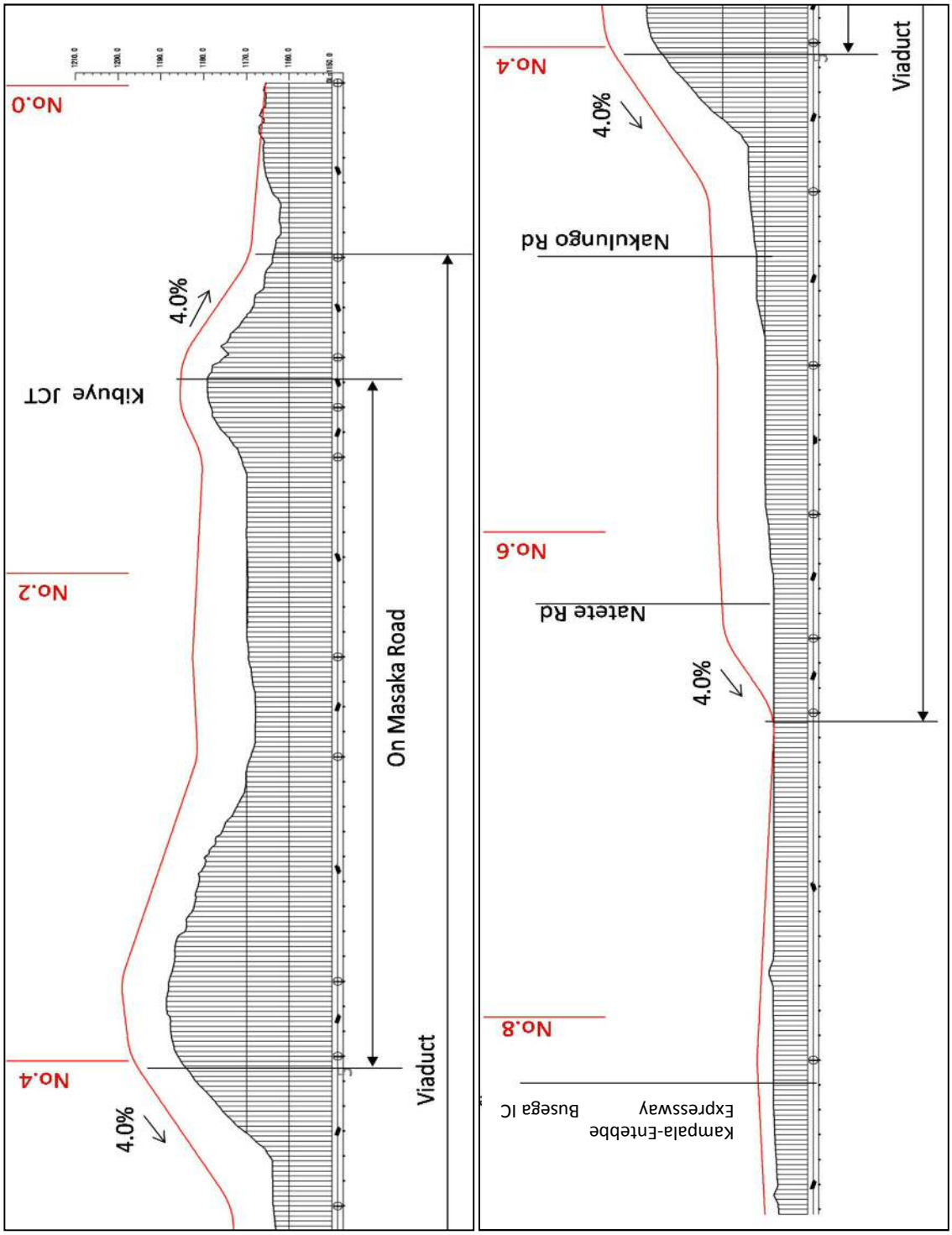


Figure 7 Vertical Alignment of Alternative-1

(2) Design of the Viaduct

Planning and design Standards for this study are shown in Table 6.

Table 6 Design Standards

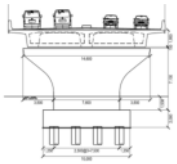
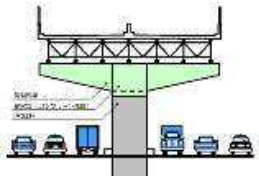
Design Standards	Eurocodes (EN) with UK National Annex Road Design Manual (RDM) of MoWT	Use of Eurocodes was instructed by UNRA. Supplemented by Japanese standards as necessary.

Source: JST and Design Criteria Report for KFCRUP

Selection of Piers

Cantilever length of beam for T-shaped piers will not go beyond 3m in general, hence, pier column (or wall) cannot be accommodated within limited central road medians in order to support wide bridge deck. Therefore, prestressed concrete and/or steel beams for pier head are suitable for viaduct to be constructed under land constrains. Table 7 presents four types of pier, with cost ratio, recommended for the project.

Table 7 Options for Piers

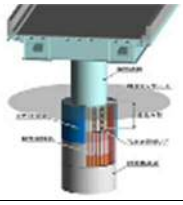
Method	Cost Ratio	Characteristics / Evaluation
Reinforced Concrete 	1.0	・Simple construction method. ・This pier should be applied for the sections where no at-grade road will be constructed underneath the viaduct.
Prestressed Concrete Beam 	1.2	・A pier column can be slimmer by prestressing a pier head beam. ・ This pier is effective for Masaka road where the space for accommodating piers is limited. Constructability of the pier is inferior to the others due to required temporary support and prestressing works.
Pierhead Rotation Method 	2.0	・The pier head, cast over the pier parallel to road axis, is turned 90-degree; therefore, it will not block the traffic flow during the construction of the piers. ・ Only one construction company which has a patent of this technology can implement this method. Therefore, in order to employ this method, the company should be appointed as a nominated Subcontractor.
Steel beam 	2.4	・ A steel pier head beam with steel or concrete column. The steel column will be slimmer than the concrete one. ・Applied in Kampala Flyover where the span or cantilever of the beam needs to be very long. Effective when construction should be done rapidly such as junctions.

Source: JST

Selection of Bridge Foundation

Options of pile foundations that can reduce construction area and period are presented in following Table

Table 8 Comparison of Bridge Foundation Types

Method	Cost Ratio	Characteristics / Evaluation
Cast-in-place concrete bored pile 	1.0	・Very common for bridge foundation ・Occupies large construction area. ・Wasted soil will be produced. ・Need to stabilize the wall of borehole. ・Bored pile can be constructed at sections with no land constrains.
Screwed Steel Pile 	1.05	・Bearing capacity per pile is larger for the same diameter of the pile due to the blade welded to the pile end. ・Size of the pile cap can be reduced. ・Environmentally friendly with no wasted soil. ・ No significant difference in cost with high constructability. Applied for Kampala Flyover.
Steel Pipe Soil Cement Composite  Pile	1.07	・Composite pile made of steel pipe and soil cement. ・Environmentally friendly with less wasted soil. ・Construction yard will become larger than the screwed steel pile. ・No significant difference in cost. Construction period may become longer depending on the size of the pile required and type of soil.
Prestressed Concrete Well 	1.30	・A kind of caisson foundation. Piling up precast cylindrical unit blocks by introducing prestress. The cylinder caisson will be press into the ground using ground anchors. ・The cylindrical unit will be a foundation as well as pier column. ・Area to be occupied by piers will be minimized by omitting the pile cap. ・Very little experience outside Japan. Implementation depends on availability of specialized contractor.
Integration of Steel Pier and Bored Pile 	3.07	・A large diameter bored pile integrated with steel pier column. ・Area to be occupied by piers will be minimized by omitting the pile cap. ・Construction period can be reduced. ・Very costly and will be effective for extremely narrow space.

Source: JST

Analysis of Estimated Cost for Current Design

Table 9 shows summary of Bill of Quantities and its breakdown of bridge construction cost of the Detailed Design of Kibuye–Busega Expressway of July 2015. According to this total cost and bridge area measured from the detailed design drawings which is equal to 118,602m^2, bridge construction cost per square-metre is calculated as approx. USD 960/m^2. This amount is considerably low compared to other two recent major viaduct/flyover projects in Kampala as shown in Table 10. If

those bridge costs per area is applied, the bridge cost for the KBEX current design would then be turned from USD 114 million to USD 380 million.

Table 9 Summary of Bill of Quantities and Breakdown of Bridge Construction Cost for Kibuye-Busega Expressway Detailed Design of July 2015

Series	Item	Amount in USD	% of Subtotal
1000	GENERAL	$814,000	0.5%
2000	DRAINAGE	$1,342,185	0.9%
3000	EARTHWORKS AND PAVEMENT LAYERS OF GRAVEL OR CRUSHED STONE	$19,605,575	13.1%
4000	BITUMINOUS LAYERS AND SEALS	$12,124,339	8.1%
5000	ANCILLARY ROADWORKS	$3,056,257	2.0%
6000	**STRUCTURES**	**$113,239,709**	**75.4%**
7000	TOLERANCES, TESTING AND QUALITY CONTROL	$33,000	0.0%
	SUBTOTAL	$150,215,065	100%
	PHYSICAL CONTINGENCIES	$15,017,107	
	TOTAL PROJECT COST	**$165,232,172**	

	Breakdown of Series 6000	Amount in USD
6100	FOUNDATIONS FOR STRUCTURES	$22,675,635
6200	FALSEWORK, FORMWORK AND FINISH	$5,642,390
6300	STEEL REINFORCEMENT FOR STRUCTURES	$30,348,939
6400	CONCRETE FOR STRUCTURES	$51,200,375
6600	NO-FINES CONCRETE; JOINTS; EARINGS; PARAPETS AND DRAINAGE FORSTRUCTURES	$1,399,620
6900	PAINTING	$1,972,750
1000/7000	GENERAL COSTS/TESITNG (proportionally allocated)	$638,511
	TOTAL BRIDGE CONSTRUCTION COST	**$113,878,220**

Source::Engineering Report and Review of Design and Build Contractor's Design Section 1 and 2 (Kibuye-Busega-Mpigi)（July 2015）

Table 10 Comparison of Bridge Construction Costs per Area

Project and Typical Bridge Types	Typical Span Length	Bridge Cost	Bridge Area	Cost per m^2
KBEX Detailed Design of July 2015 (Concrete Box Girder)	50m	$ 114 mil	118,602m^2	$ 960
VVIP (Post-tension Concrete Precast I girder & Steel Box)	30-35m 50-70m	$ 146 mil	45,000m^2	$ 3,200
Kampala Flyover Lot1 (Post-tension Concrete Void Slab)	25-30m	$ 12 mil	3,464m^2	$ 3,200

Source: BoQ of each project and calculated by JST

Roughly Estimated Direct Cost of Bridge Construction for Each Alternative Route

Estimated direct costs of bridge construction for each route are summarized in Table 11. Unit construction costs that are cost per square-metre for superstructures and per cubic-metre for substructures were established referring to outcomes of KFCRUP.

Piers to be placed at median strip of Masaka road and for junction flyovers were considered to be "Prestressed Concrete (PC) Beam with Reinforced Concrete (RC) Column," and ones for less land constrains are "RC Beam with RC column." For lane numbers, two cases i.e. four-lane (w=20.8m) and six-lane (w=27.9m) were considered. For the bridge foundation, 15 m deep Screwed Steel Pile was selected considering the advantages of the technologies suitable for the nature of this project as presented in Table 3.4.6.

Table 11 Estimated Direct Cost of Bridge Construction for Each Alternative Route

	Abut-ment	Piers		Superstructure		Cost			Total Bridge	Cost/ Area
		RC beam	PC beam	PC	Steel	Sub-structure	Super-structure	Ramps		
	(Nos)	(Nos)	(Nos)	(m^2)	(m^2)	(Million USD)				(USD/m^2)
Alt-1 (4-lane)	2	72	108	103,618	10,712	89	271	56	416	3200
Alt-2 (4-lane)	2	16	164	100,940	13,596	91	277	56	424	3264
Alt-3 (4-lane)	2	16	184	114,330	13,390	101	305	56	462	3230
Alt-1 (6-lane)	2	72	108	140,299	14,504	120	367	56	543	3187
Alt-2 (6-lane)	2	16	164	136,673	18,409	124	376	56	556	3253
Alt-3 (6-lane)	2	16	184	154,803	18,130	137	414	56	607	3219
Current Design	-	-	-	118,602	-	-	-	-	114	

Source: JST

(3) Environmental and Social Considerations

Major Findings on the Current ESIS Report

ESIS for Kibuye-Busega-Mpigi Expressway was prepared in June 2015 in accordance with the national policy and regulations related to ESIS and safeguard policies of African Development Bank. It was approved by National Environmental Management Authority (NEMA) in October 2015 with certain conditions. The approved ESIS report was reviewed with reference to JICA Guidelines for Environmental and Social Considerations issued in April 2010 (the JICA Guidelines). Major findings of the current ESIS are explained below.

- Need to include scoping results
- Need to clarify the implementing structure on monitoring and reporting at pre-construction, construction and operation phases respectively
- Need to add explanation of timing and methods of announcement of the stakeholder meetings, and comments raised by the participants and answers from UNRA during the meetings

Major Findings on the Current RAP Report

RAP for Kibuye-Busega-Mpigi Expressway was prepared in July 2015 in accordance with the national policy and regulations related to ESIS and safeguard policies of African Development Bank. The route between Kibuye and Busega was regarded as Section 1, and between Busega to Mpigi was regarded as Section 2. Major findings of the current RAP are explained below.

- Need to add scale of impact on relocation (i.e. number of households to be relocated)
- Need to clarify the calculation method of compensation in full replacement cost and to add the entitlement matrix
- Need to add explanation of timing and methods of announcement of consultation meetings, and comments raised by the participants and answers from UNRA during the meetings

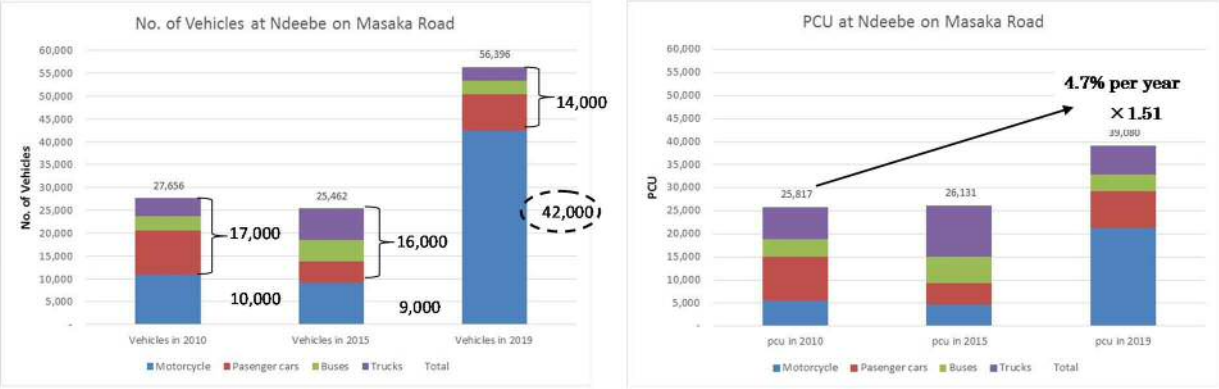
Environmental Concerns Associated with the Implementation of the Project

- Conducting census, socio-economic survey and asset inventory to the final alignment is necessary in the next study phase to identify impact potentially caused by land acquisition and resettlement.
- It was confirmed that UNRA would hold sufficient consultation with concerned authorities in the process of the project cycle. Accordingly, due consultation and facilitation with the concerned authorities to implement the project in the swamp area is necessary to examine and apply appropriate mitigation measures.
- Additional explanation for the items not yet described in the current ESIS and RAP is necessary.
- Renewing the ESIS is necessary in case that the project is not implemented within the designated duration (i.e. 5 years after the approval is issued).

(4) Traffic Demand

A) Current Situation and Trend of Traffic Demand

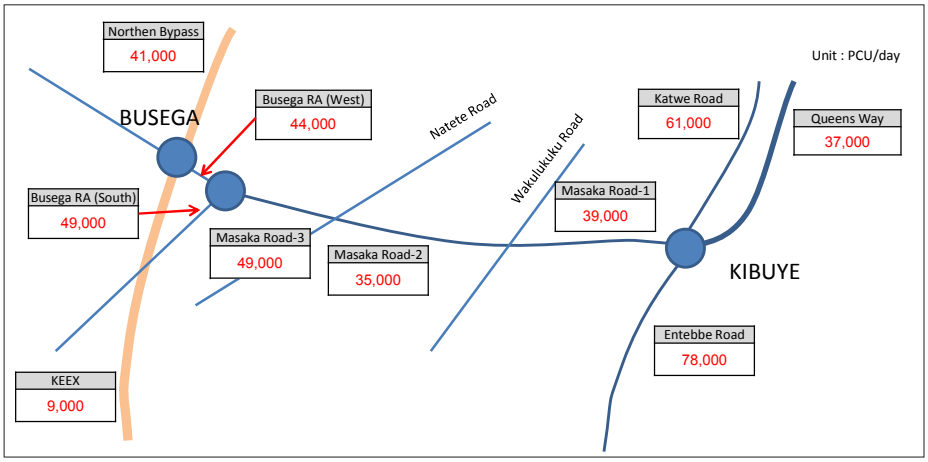
PCU/day of Traffic volume on Masaka road increased 1.4 times from 2015 to 2019. Notably, the volume of motorcycle increased most dramatically. Current traffic conditions of the traffic volume between 2010 and 2019 are shown below.



Source: Survey in Jan. 2010 by JICA Study, Survey in Jan. 2015 by Kibuye-Busega D/D Study

Figure 8 Comparison Traffic Survey

Traffic volumes (PCU/day) at each survey point are shown below.
The road with the largest traffic volume exceeding 70,000 PCU per day is Entebbe Road.
The section with the largest traffic volume along Masaka Road, around 50,000 PCU per day, is observed near the Busega Roundabout.



Source: JST

Figure 9 Result of Manual Classified Traffic Counts Survey (MCC)

B) Future Traffic Demand

Future traffic assignment was conducted for two alternative Cases in number of lane as shown in the following table.

Table 12 Case of Traffic Assignment

Case	Forecast year	Masaka Road	KBEX
Without	2024 & 2034	2-lane	2-lame
Case-1		4-lane	4-lane
Case-2		4-lane	6-lane

Growth Rate

The assumption of annual growth rates of traffic demand on Kibuye-Busega Expressway (KBEX) from 2019 to 2034 were set up from the analysis on the past trend data of population and GDP and the framework of related plans. The annual growth rates are as follows:

- Passenger types of vehicle such as motorcycle, minibus, bus, and passenger cars are assumed to increase between 2019 and 2034 by **3.5%** annually. The national trend of population growth rate between the 2002 and 2014 was 3.0% whereas that of the Central region was 3.1%, as shown in Table 2.5.1. In addition, Multi Modal Urban Transport master Plan published in 2018 assumes that the population of GKMA would be increased by 3.5% annually between 2014 and 2040. Therefore, it is reasonable that the future population growth rate of GKMA between 2017 and 2034 would be 3.5%.
- Freight types of vehicles such as truck and trailer are assumed to increase from 2019 to 2034 by **6.5%** annually. It is based on the trend of GDP growth rate in the past five years which was approximately 6.0%. The annual growth rate of GDP in GKMA would be higher than the national one because its activities including the capital city of Kampala and population growth GCMA are assumed to be higher than the national average rate. Therefore, it is reasonable that the future GDP growth rate of GKMA between 2019 and 2034 would be 6.5%.

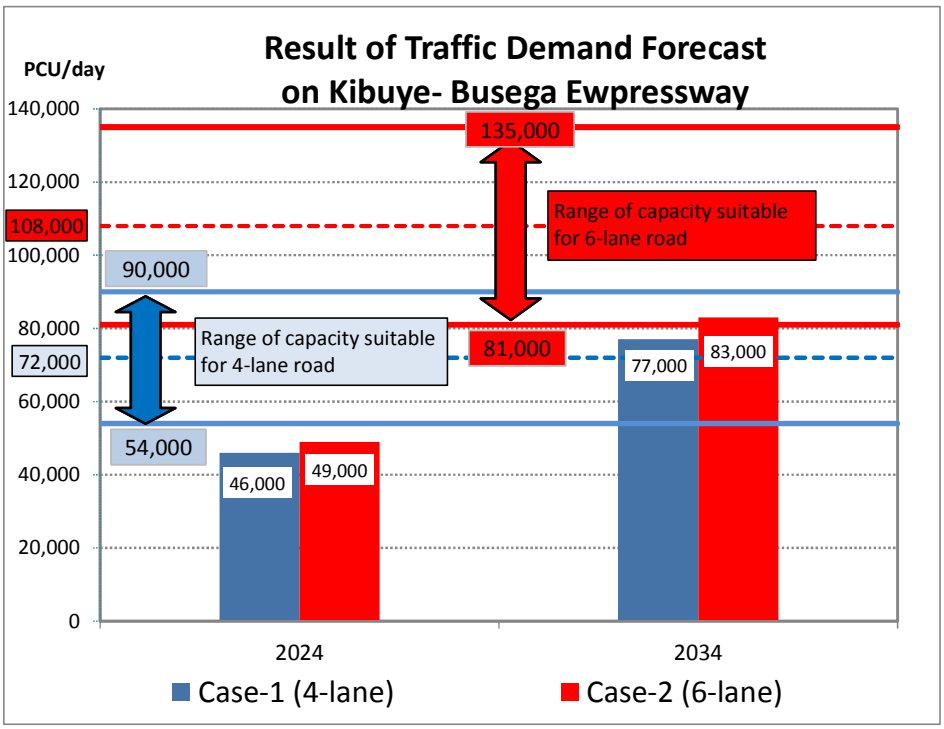
Network

The future transport networks of 2024 and 2034 were set up to estimate the maximum demand for KBEX under the limited supply of transport services. The both target year's networks are the same condition of supply in this demand forecast although the demand is increased from 2024 to 2034. The both networks include: Kampala FO, Busega-Mpigi Ex., Kampala-Jinja Ex., Nakasero-Northern BP Ex., Northern BP expansion, Southern BP which are completed by 2024. However, Outer ring road, Kampala-Bombo Expressway and Kampala-Busunju Expressway were not assumed to be supplied by 2034. In addition, the public transport improvement such as BRT and additional commuter railway service was also not assumed to be operated both in 2024 and 2034.

Result of Traffic Demand Forecast

Through the examination of the results of traffic demand forecast in 2024 and 2034, several implications about the future number of lanes are:

- Appropriate number of lanes should be four because future traffic on KBEX is forecast to be within the range of capacity suitable for 4-lane road in 2034.
- If the number of lanes changes from 4 to 6 lanes, the increase of traffic is forecast to be smaller than the increase of capacity. The capacity increases by 50%, but traffic on KBEX increases by only 8% in 2034. This means that the increase of capacity from 4 to 6 lanes is not sufficiently effective in this case. The other road network provision would probably be more effective to improve the whole level of service in Kampala.
- The comments above are confirmed through Cost–Benefit Analysis, to be discussed later.
- As far as long term forecast until 2044 is concerned, it is currently difficult to forecast the impact of nine BRT corridors, additional Commuter Railway services and other road construction under the future transport modal split. If these impacts are to be clearly clarified, additional studies including personal trip survey, vehicle OD survey, and other traffic surveys are desirable.



Note: Traffic volume on KBEX is the average of three links between Kibuye and Busega

Figure 10 Traffic Demand in 2024, 2034

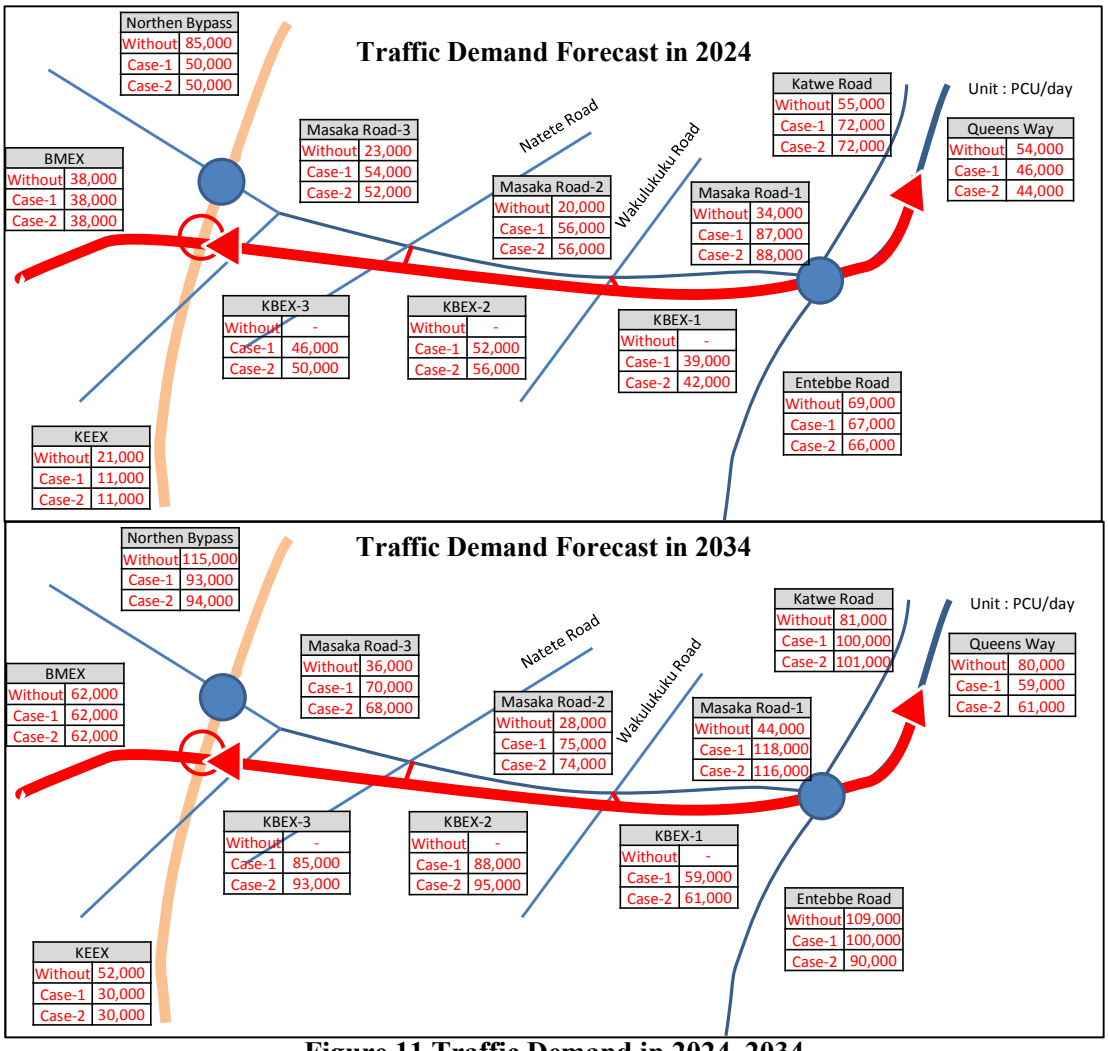


Figure 11 Traffic Demand in 2024, 2034

C) Public Transport effect in Road Network

BRT installation to Masaka Road is effective to alleviate traffic congestion

BRT and a commuter train will be operated between Kibuye and Busega based on Multi Modal Urban Transport Master Plan for GKMA published in 2018 and the information of URC. Both public transports will have a great impact on the modal shift from minibus and motorcycle to BRT and Railway.

The BRT and the commuter train are expected to make travel time more stable with the speed of 20km/h to 40km/h. Furthermore, higher amount of passenger demand can be dealt with by frequent operation like one-two minutes interval.

Based on the result by JST, the BRT and the commuter train will reduce the traffic from 75,000 pcu/day to 27,000 pcu/day between Wankulukuku Road and Natete Road on the Masaka road in 2034. It is corresponding to 64% reduction. Traffic volume of 27,000 pcu/day is dealt well with 2-lane capacity of a road. Thus, installation of the BRT and the commuter train service is recommended in the near future.

The figures are estimated under the assumption of the BRT with 1-2 minutes interval able to carry 250,000 passengers per day and the commuter railway operation with 10-20 minutes interval able to carry 100,000 passengers per day.

Table 13 Assumption of BRT and Railway operation to reduce traffic on Masaka Road

	BRT	Railway
Operation hours	5,00-23,00: 18hours	
Capacity per operation	150-180	1600-1900
	Bi-articulated bus	8-10 carriages
Number of Operation per direction per day	600-800	60-70
Average interval	1- 2 minutes	10-20 minutes
Capacity of Passengers per day	250,000	100,000

Table 14 Estimated Traffic demand with Public Transport Improvement on Masaka Road in 2034

	Before BRT	After BRT
Passengers/day	406,000	406,000
Passengers for BRT	0	250,000
Passengers for Railway	0	100,000
Traffic on Masaka Rd (pcu/day)	75,000	27,000
Ratio of Reduction in PCU		-64%

(5) Cost and Benefit Analysis

A) Cost

The project costs were estimated as one of the criteria for the comparative study of alternatives as well as initial economic analysis. Further cost survey and analysis are required to estimate construction cost more accurately. As a result, total project costs were estimated as shown in the following table.

Table 15 Estimated Project Cost

Project Cost		Construction Cost		Consultant Services	Land Acquisition/ Compensation Cost	Relocation Cost	Contingency Cost	TOTAL
		Bridge	Road					
4-lane	Alt-1	416	47	46	27	17	46	599
	Alt-2	424	59	48	22	25	48	626
	Alt-3	462	59	52	21	29	52	675
6-lane	Alt-1	543	54	60	30	17	60	764
	Alt-2	556	66	62	22	25	62	793
	Alt-3	607	65	67	23	29	67	858
Current Design		114	36	-	451	51	15	261

Source: JST

B) Benefit

Two kinds of economic benefits were estimated quantitatively in this Study as follows;

- Saving in Vehicle Operating Cost (VOC)
- Saving in Travel Time Cost (TTC)

Estimated time saving and cost saving benefits are summarized in Table 16.

Table 16 Estimated Travel Cost and Benefit

Unit: million USD /year

Case-1: 4lane	2024			2034		
	TTC	VOC	Total	TTC	VOC	Total
Case-1	914	1,702	2,617	3,266	2,986	6,252
Without	956	1,757	2,713	3,415	3,088	6,503
Benefit	42	55	96	149	102	251
Case-2: 6lane	**2024**			**2034**		
	TTC	VOC	Total	TTC	VOC	Total
Case-2	912	1,704	2,616	3,260	2,990	6,250
Without	956	1,757	2,713	3,415	3,088	6,503
Benefit	44	53	97	155	98	253

Source: JST

C) Cost Benefit Analysis

The preconditions were set for the cost-benefit analysis are as follows:

Table 17 Precondition of Cost and Benefit Analysis

Base Year	2019
Opening Year of the Project	2024
Evaluation Period	30 years from opening year
Opportunity Cost of Capital (Discount rate)	12% (World Bank Standard Value)
Residual Value	0

Note: To consider discount rate, since net value at end of evaluation period is about 1.5% of present net value, residual value is almost zero.

With the above preconditions, economic analyses were conducted by worksheet basis. Table 18 summarizes the result of economic analysis.

Table 18 Summary of Economic Analysis by Option

		Economical Cost (USD Million)	Benefit (USD Million/ year))		Base Case			Sensitive Analysis (Minimum Case)		
			2024	2034	EIRR (%)	NPV (USD Million)	B/C	EIRR (%)	NPV (USD Million)	B/C
4-lane	Alt-1	502	96	251	24%	642	2.7	19%	418.1	1.9
	Alt-2	525	96	251	23%	626	2.6	19%	398.8	1.8
	Alt-3	566	96	251	22%	596	2.4	18%	363.2	1.7
6-lane	Alt-1	639	97	253	20%	539	2.1	17%	325.0	1.6
	Alt-2	666	97	253	20%	520	2.0	16%	302.2	1.5
	Alt-3	719	97	253	19%	482	1.9	15%	256.6	1.4

Note: Case of Sensitive Analysis was conducted by cost +20%, benefit -20%.
Source: JST

D) Evaluation of Alternative

Above mentioned alternatives were compared and evaluated relatively for each evaluation items. Scoring criteria is given by comparative manner as shown in Table 19.

Table 19 Score for Criteria

Evaluation Category / Item		Criteria		
		Worse: 1	Middle: 2	Better: 3
1. Road Service				
Drivability and Safety	Horizontal alignment (Minimum radius)	240m ＞ X	240m ≦ X ＜ 400m	400m ≦ X
	Vertical alignment (Maximum Gradient)	X ＞6%	4% ＜ X ≦ 6%	X ≦4%
Road Capacity (PCU/day)		50,000 PCU＞ X	50,000 PCU ≦ X ＜ 100,000 PCU	100,000 PCU ≦ X
2. Environmental Impact				
Land Acquisition Area	Area of outside the RoW	X ＞170,000 m^2	130,000 m^2 ＜ X ≦ 170,000 m^2	X ≦ 130,000 m^2
Affected Buildings	Number of affected buildings	X ＞420	320＜ X ≦420	X ≦ 320
3/4. Constructability / Maintainability				
Techinical Issues	Viaduct length on existing Masaka road	X ＞ 6,500m	4,500m ＜ X≦ 6,500m	X ≦4,500m
	Viaduct width	X ＞30m	25m ＜ X ≦30m	X ≦25m
5. Economical Efficiency				
EIRR (%)		12% ＞ X	12% ≦ X ＜ 18%	18% ＜ X

As a result, Case-1 with Alt-1 and Alt-3 are higher evaluated among the alternatives. However, Alt-1 affects a lot of buildings and land, therefor this has a risk of longer period than other alternatives. In this regard, Alt-3 is seemed to be better than Alt-1. The result of the evaluation is shown in Table 19.

Table 20 Comparison of Alternative

Category	Evaluation Item	Case-1: 4-lane			Case-2: 6-lane		
		Alt-1	Alt-2	Alt-3	Alt-1	Alt-2	Alt-3
1. Road Service	Safety Drivability	3	2	3	3	2	3
	Road Capacity	2	2	2	3	3	3
2.Environmental Impact	Land Acquisition Area	2	2	3	1	2	3
	Affected Buildings	1	3	2	1	2	2
3. Constructability		3	2	2	2	2	1
4. Maintainability		3	2	2	2	2	1
5. Economical Efficiency	EIRR	3	3	3	2	2	2
Overall Evaluation		A	B	A	C	B	B

Note : As a relative comparison, 1 and C means worse, 2 and B mean average, 3 and A means better.
Overall evaluation is made on the basis of the average and standard deviation.
Source: JST

(6) Recommendation for KBEX Project

A) Reference opinions from experts on Scenarios and Issues for the project

In examining the scenario and future issues of the project, the JICA Study Team interviewed experts on transportation planning and logistics planning who are familiar with transport and logistics conditions in Africa, and obtained helpful comments. The key comments from the experts are summarised below as recommendations for the next phase:

- For long-term traffic demand management on Masaka road, in addition to the Kibuye-Busege Expressway project, BRT installation and the improvement of railway service along Masaka road shall be examined together with some kind of regulation or restriction for motorcycle taxi.
- GKMA is likely to be a city with 10 million population in the future, urban traffic based on motorcycles has its own limits, and bike-dependent is considered to be unable to realize a mobility environment where the entire citizen can move safely and conveniently. Mass transit is essential, and urgent public transport infrastructure improvement should be undertaken.
- The motorcycle taxi in the developing country passes through a car and a car, and moves anywhere with relatively stable speed and cheaper fare. The users can call the motorcycle taxi by the smartphone, anywhere and anytime. Moreover, it is not difficult for a youth to enter the business of motorcycle taxi. In order to compete for the share of transport among urban transport modes, the services of public transport such as a network density of the public transport, highly frequent operation, stable speed and cheap fare are enriched. In addition, it seems that it is impossible to expect the modal shift from motorcycle to public transport if there are not civic environmental awareness and agreement.
- Motorcycle taxis are rapidly emerging in recent years due to a combination of various factors. In order to collect data, analyse objectively, and take effective measures, it is necessary to grasp the actual people's behaviours in urban area. Data obtained ten years ago is not enough. It is considered necessary to carry out a survey of person trip survey as a regional survey based on the future expansion of the Kampala metropolitan area.
- In the expressway network, it is necessary to develop a truck terminal and an inland depot as a trans-shipment base near the junction of the radial and the ring road.
- Coexistence of bikes and heavy trucks on highways increases the risk of traffic accidents and also results in slowing down, so separation is desirable.

B) Proposal of Scenarios for the formulation of the Project

Financial Arrangement

In implementing the Kibuye–Busega Expressway project, JICA assistance is expected to play a considerable role because of the very complex engineering nature of the viaduct structure on the existing road. Nevertheless, the project cost is over 600 million USD and is estimated to be much higher than the past road infrastructure projects by Japanese ODA loan in Uganda.Therefore, some collaboration funding and phased project scheme might be necessary to be examined for the project. Other donors' and/or governmental funds shall be arranged with collaboration of Japanese ODA loan. If the phased funding is established as Lot-1 and Lot-2 as shown in Table 3.6.27, Lot-1 is estimated to be 292 million USD and Lot-2 ranging from 307 to 383 million USD for the four-lane KBEX option.

In case construction costs other than the designated ones for the Kibuye-Busega Expressway, such as road expansion cost of Masaka road, are not covered by Japanese ODA loan due to budget constrain, the Government of Uganda or KCCA will be requested to bear such excess cost.

Management of the Implementation Schedule

Kibuye-Busega Expressway has a great role to connect Kampala FO project with Kampala-Entebbe Expressway, Northern Bypass and Busega-Mpigi Expressway. If the missing link is not completed, the whole performance of the road network would become much lower. There are risks for the delay of the project implementation such as land acquisition and environmental issues. In this regard, the type of alignment like Alternative-3, which would not much affect the built up area along Masaka Road and the environment of Busega Swamp than the other alternatives, has relatively more advantage than the others as a lower risk plan in securing the implementation schedule.

Furthermore, design and implementation of the expansion project of Queen's way dual carriageway and BRT installation from Clock Tower Junction to Kibuye junction is urgently needed. It is necessary to complete connecting with the Kampala Flyover Project by 2024.

It is recommended that the following F/S and D/D for the Kibuye-Busega expressway project shall be urgently conducted as soon as possible. On the other hand, such the big project usually requires several years for preparation such as social and environmental issues. Therefore, not only JICA or other donor's fund for the study, it is another option that Uganda government itself give the fund for the study. That could proceed the project speedy and efficiently.

C) Remaining Issues

Environmental and Social Issues

[Major Findings on the Current ESIS Report]

- Need to include scoping results, to clarify the monitoring and reporting structure at pre-construction, construction and operation phases respectively, to add explanation of timing, methods of announcement, comments raised by the participants and answers from UNRA

[Major Findings on the Current RAP Report]

- Need to add scale of impact on relocation, to clarify compensation in full replacement cost and to add the entitlement matrix, to add explanation of timing, methods of announcement, comments raised by the participants and answers from UNRA

[Environmental Concerns for Implement the Project]

- Need to confirm scale of impact on relocation (i.e. numbers of relocation families/people)
- Due consultation with the concerned authorities to implement the project in the swamp area
- Need supplementary explanation of the items not described in the current ESIS

Traffic Demand Management

In order to manage traffic movement in peak hours, traffic demand management shall be introduced in addition to the transport infrastructure. For example, the following measures are seemed to be effective:

- Implementation of several measures to promote the modal shift from motorcycle and minibus to BRT and commuter train
- Provision of information on travel time by route from CBD to airport
- Restriction of motorcycle on the expressway
- Logistic/Distribution terminals in the suburbs shall be developed in order to transfer large-size truck to small-size trucks, and to reduce large-size freight traffic in the urban areas.

Coordination with BRT and Railway plans

As a missing link elimination project, the Kibuye-Busega Expressway Project will significantly enhance the performance of the trunk road network in Kampala in the long run, and will greatly contribute to the overall congestion mitigation and reduction of travel time. In particular, it greatly contributes to make access time shorter to the Entebbe airport from the city centre, commuting traffic between the city centre and the suburbs of Kampala, and shortening of the time for logistics between regions in Uganda.

Nevertheless, in order to alleviate the congestion on Masaka Road, which has many motorcycles and minibuses, it is necessary to promote a modal shift from these modes to BRT and railways. It is not clear when BRT is to be installed on Masaka Road, but Masaka Road will be considered to have six lanes including BRT lanes in the future and to develop transfer terminals where BRT and railway are connected and green space along Queen's Way for NMT network consisting of bicycles and pedestrians.

- BRT: The BRT Projects on Queen's Way and Masaka Road are urgently expected to be fixed in alignment and location of bus station in order to decide ROW or road width and space assignment.
- Railway: According to URC, an additional commuter railway operation would begin in the near future. A new railway station around the Kibuye junction is recommended to construct so as to connect Railway with BRT. It will also help to promote Transit Oriented Development around Kibuye junction where all transport modes can be connected with each other and a candidate of transport hub in the future.

Geotechnical surveys for foundation of viaducts and swamp area

Boring survey along candidates of road alignment should be conducted especially in the swamp area.

Source: JST

Figure 12 3D images of KBEX

7. Data Collection and Study on New Karuma Bridge Project

(1) Design of the Road

Summary of the applicable geometric design parameters for the Project is shown below.

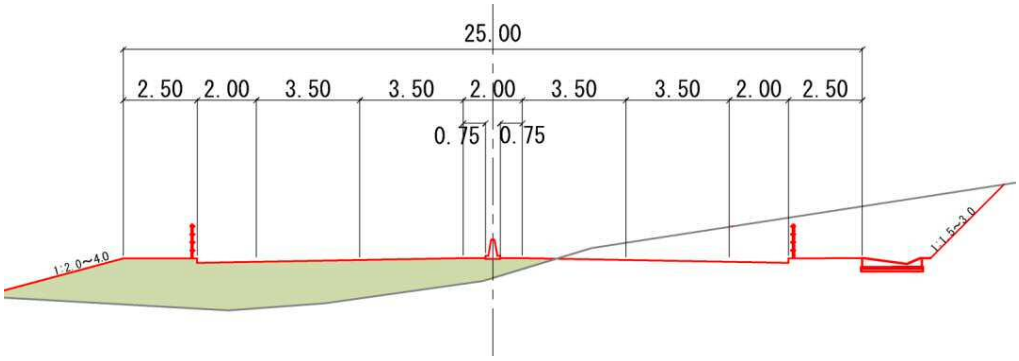
Table 21 Summary of Applicable Geometric Design Parameters for the Project

Design Element	Unit	Road	Exisiting Road
Road Class		2 Paved	-
Design Speed	km/h	70	50
Min. Stopping Sight Distance	m	95	-
Min. Passing Sight Distance	m	485	-
Min. Horizontal Curve Radius	m	185	80
Max. Gradient (Desirable)	%	5.5	6.0%
Max Gradient (absolute)	%	7.5	
Crest Vertical Curve stopping	Kmin	22	-
Sag Vertical Curve stopping	Kmin	20	-
Normal Cross fall	%	2.5	-

Source: Uganda Road Design Manual

Typical Cross Sections of New Karuma Bridge are shown below.

Road (Fill/Cut) Section



Bridge Section

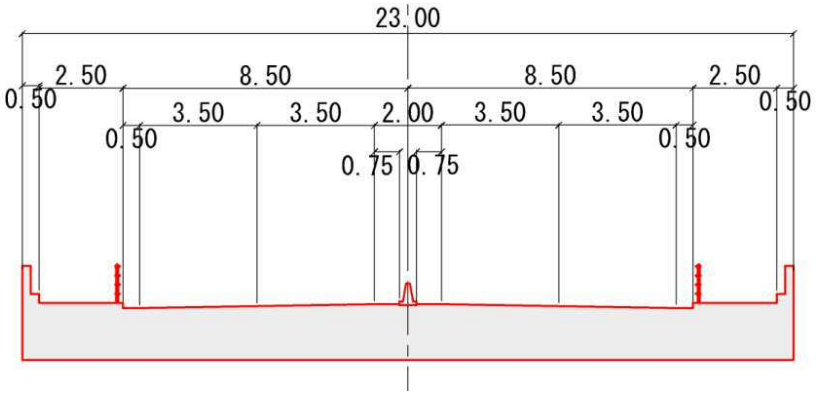


Figure 13 Typical Cross Sections of New Karuma Bridge

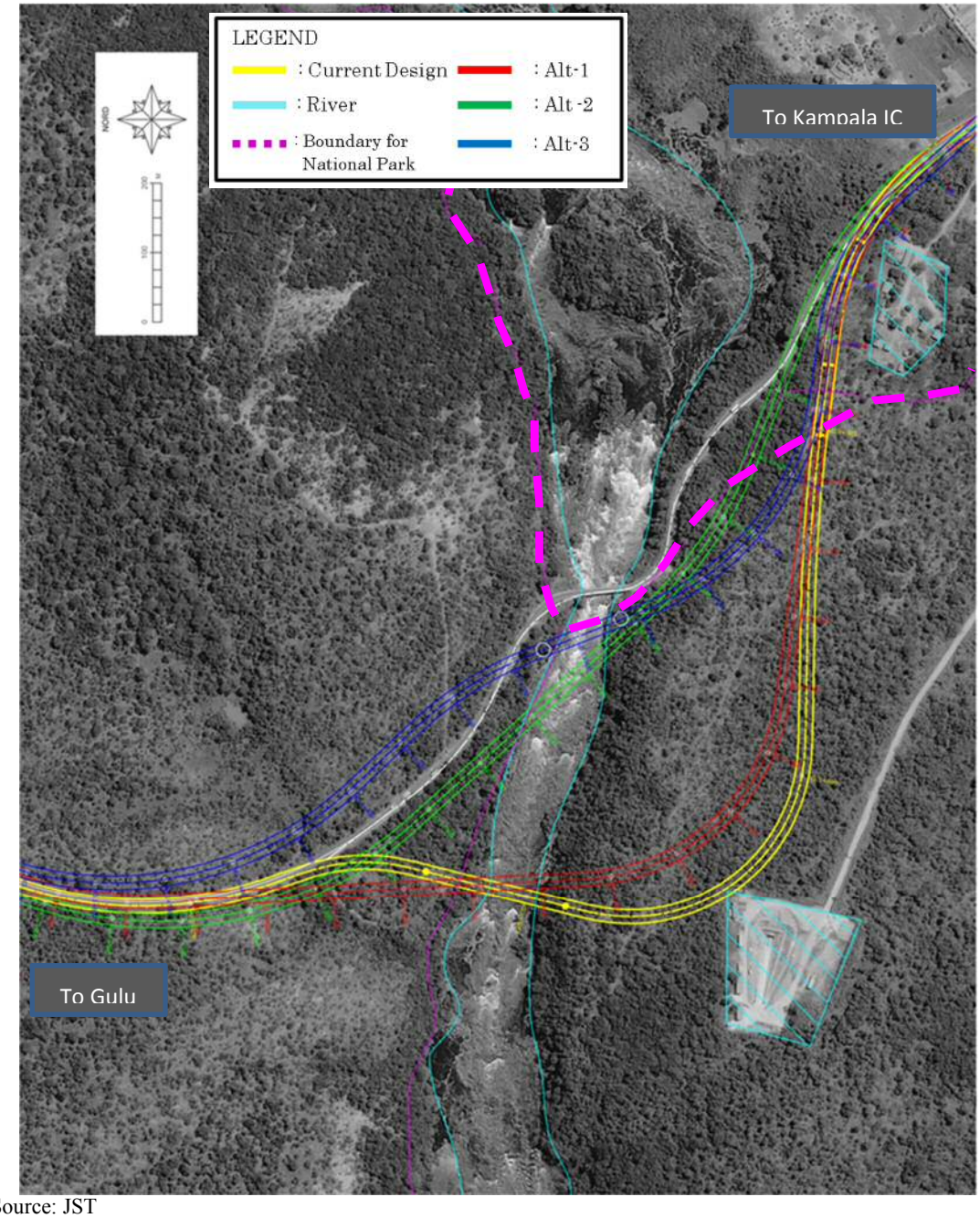
Alternative Routes

Two alternatives are established after the site reconnaissance , traffic data, environmental conditions, related plans, existing road infrastructures, and so on. Main features of each alternative are shown in the following table and figure.

Table 22 Summary of Applicable Geometric Design Parameters for the Project

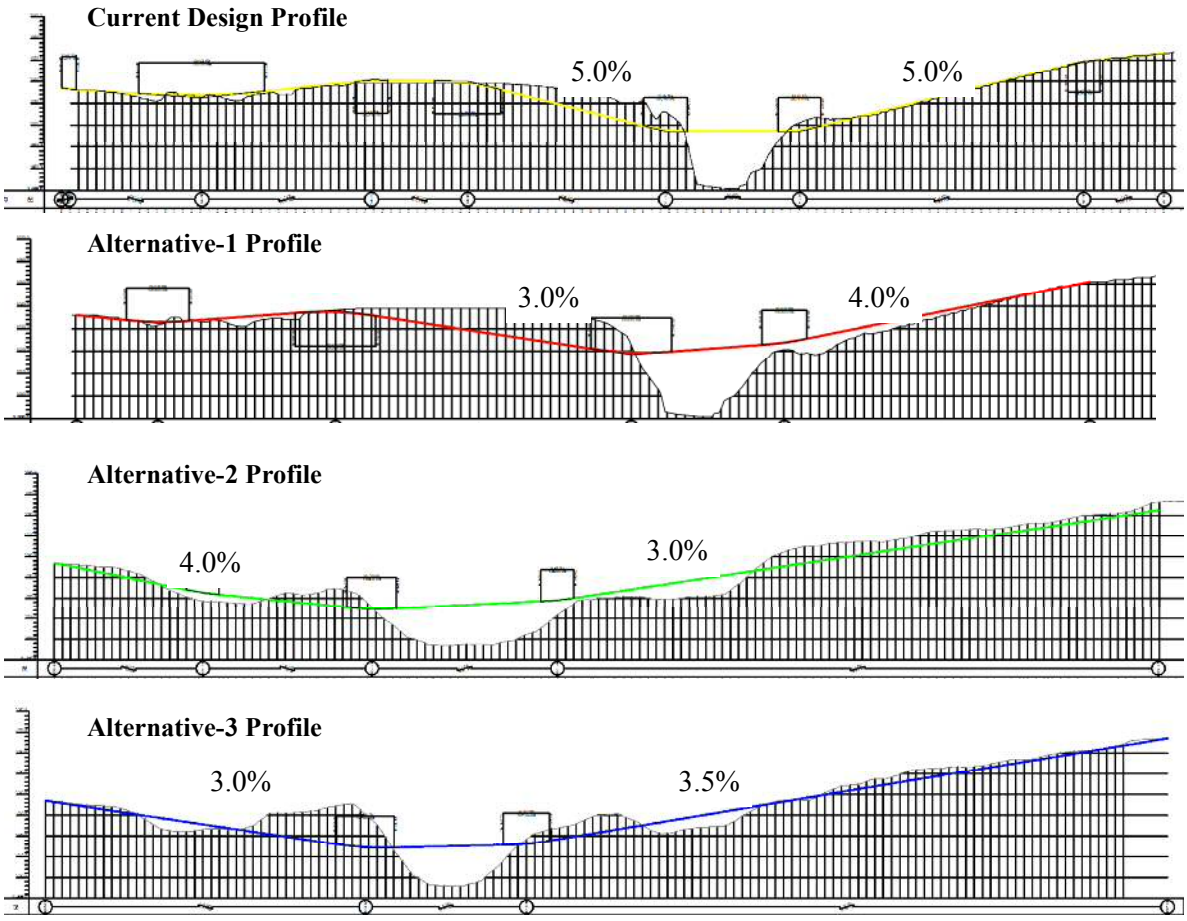
Item	Current Plan	Alternative-1	Alternative-2	Alternative-3
Road length	2,500m	2,400m	2,300m	2,200m
Horizontal Alignment	252m	300m	500m	300m
Vertical Alignment	5%	4%	4%	3.5%
Affected Facilities	Underground temporary tunnel	-	-	-

Source: JST



Source: JST

Figure 14 Horizontal Alignment of each alternative



Source: JST

Figure 15 Road Vertical Alignment for each alternative

(2) Design of the Bridge

Planning and design Standards for this study are shown in Table 23.

Table 23 Planning and Design Conditions

Design Standards	Eurocodes (EN) with UK National Annex Road Design Manual (RDM) of MoWT	Use of Eurocodes was instructed by UNRA. Supplemented by Japanese standards as necessary.

Source: JST

Selection of Bridge Types

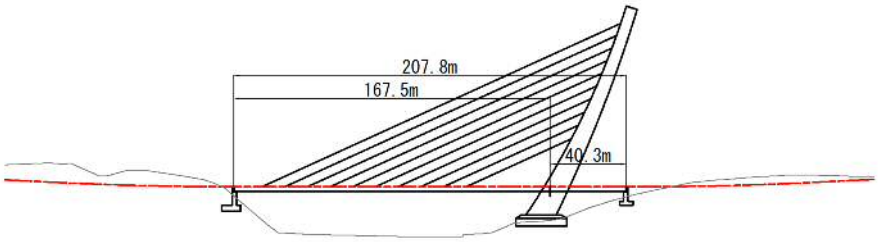
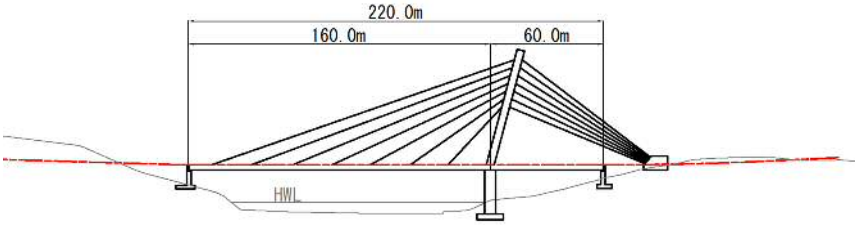
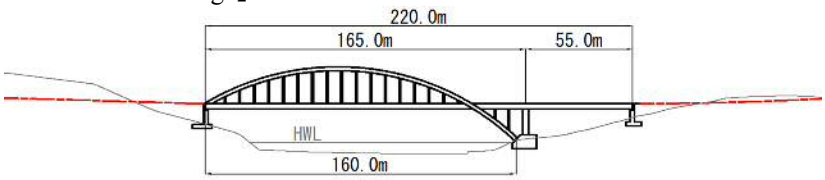
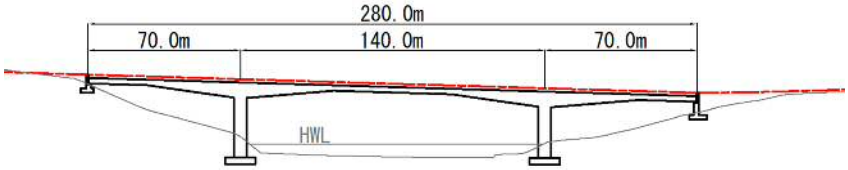
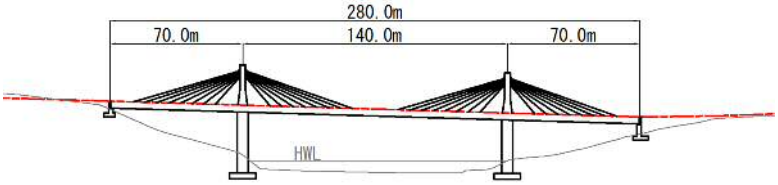
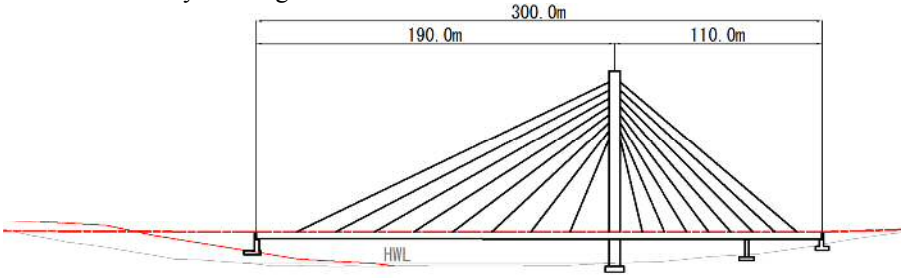
Images and characteristics of preliminary selected bridge types are shown in Table 23 and Figure 15.

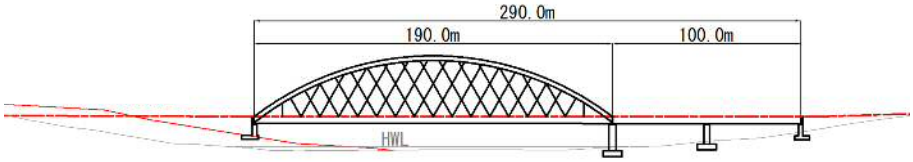
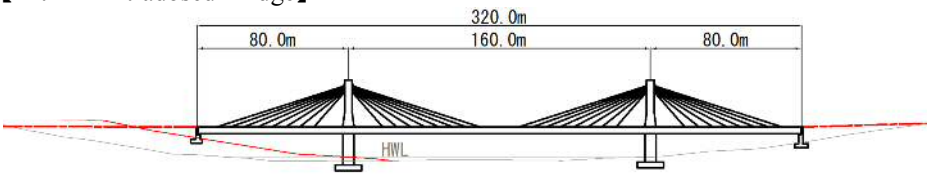
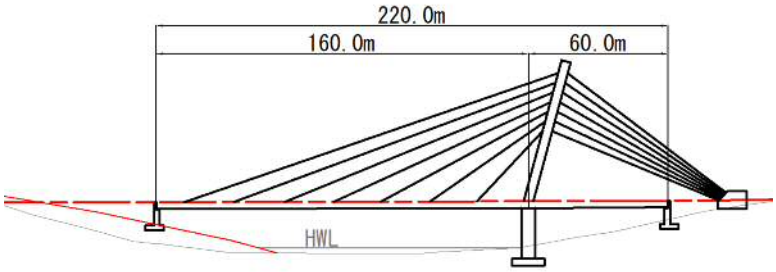
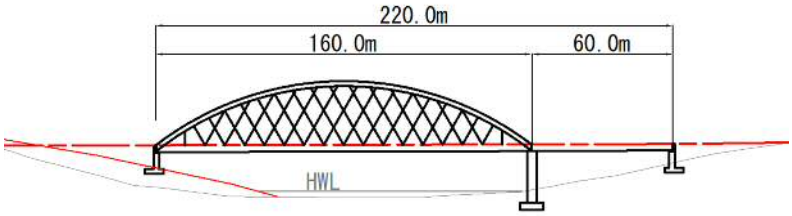
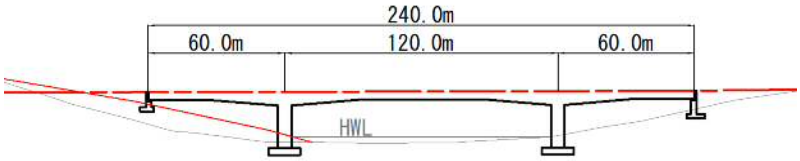
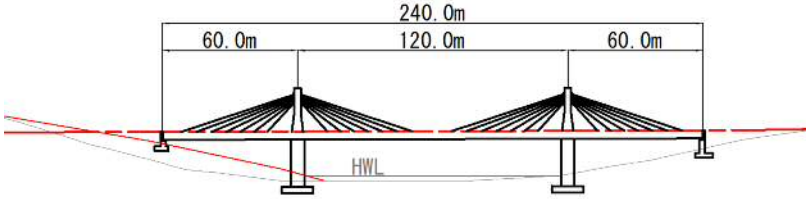
Table 24 Characteristics of Bridge Type Options.

Bridge Type	Image	Description
Cable-stayed (Current Design)		• Cable-stayed type with a double-column pylon. • Balanced by selfweight of the pilon and tension of cables. • Estimated cost UGX 211 b. (USD 58 m.) excluding contingencies.
Cable-stayed bridge / Centre cable type (Alternative type)		• Cable-stayed type with a single-column pylon. • The motive of Adungu (a local musical instrument) is maintained. • Construction volume of the main pylon is reduced by a single-plane cable and additional cable provided behind the main span.
Arch bridge (Alternative type)		• This type is typical for the site condition. • Eliminated in the currrent detailed design due to its appearance and constructability.
Extradosed bridge (Alternative type)		• Generally, one of the most economical option for this span length • Total bridge length would be longer due to its structural characteristics.

Source: JST

Table 25 Side View of Bridge Options

Side View	Remarks
【Cable-stayed Bridge – Current Design】 	Current design in the motif of Adungu harp.
【Alt-1－Cable-stayed Bridge】 	An alternative for the current design. The bridge length will become slightly longer than the original one due to the conditions for "Alt-1" route option. Piers are not placed inside the river course.
【Alt-1－Steel Arch Bridge】 	An option with arch alternative to the above cable-stayed. Piers are not placed inside the river course.
【Alt-1－Continuous Concrete Box Rigid Frame Bridge】 	The road profile is raised by adjusting to the topography to provide two intermediate piers. Piers are placed slightly inside the river flow.
【Alt-1－Extradosed Bridge 】 	Improve the above concrete box structure to extradosed. Structural depth of the girder is lower than the above option, which contributes to improving the appearance of the bridge.
【Alt-2－Cable-stayed Bridge】 	An option with cable-stayed bridge for Alt-2 route. Piers are not placed inside the river course. The side span was determined to be 110m from an example. Additional pier was provided at the side span for a provision of negative reaction.

Side View	Remarks
【Alt-2－Steel Arch Bridge】 	An option with arch alternative to the above cable-stayed. A steel girder bridge is recommended for the side spans.
【Alt-2－Extradosed Bridge】 	An option of extradosed bridge for Alt-2 route. Piers are not placed inside the river course.
【Alt-3－Cable-stayed Bridge】 	An alternative for the current design. The bridge length will become slightly longer than the original one due to the conditions for "Alt-3" route option. Piers are not placed inside the river course.
【Alt-3－Steel Arch Bridge】 	An option with arch alternative to the above cable-stayed. Piers are not placed inside the river course.
【Alt-3－Continuous Concrete Box Rigid Frame Bridge】 	The road profile is raised by adjusting to the topography to provide two intermediate piers. Piers are placed slightly inside the river flow.
【Alt-3－Extradosed Bridge 】 	Improve the above concrete box structure to extradosed. Structural depth of the girder is lower than the above option, which contributes to improving the appearance of the bridge.

Source: JST

Rough Estimation of Construction Cost

Based on the combination of road alignment alternatives and bridge structure alternatives, finally seven alternative plans were established. The seven kinds of plans were examined from several points of view.

As far as cost of each plan is concerned, roughly estimated construction costs for each plan are summarized in Table 26. The costs were estimated as one of the criteria for the comparative study of alternatives. The estimation was done considering unit costs adopted by the current detailed design, Kampala Flyover and actual construction costs of similar bridges. Further cost survey and analysis are required to estimate construction cost more accurately.

Table 26 Estimated Cost of Construction for Each Alternative Bridge Type

Options		Bridge		Consultant Service (8%)	Contingency Cost (10%)	Total	Road	
		Length	Cost				Length	Cost
		(m)	(USDm)	(USDm)	(USDm)	(USDm)	(m)	(USDm)
Alt -1	Cable-stayed	220	39	3.1	4.2	47	2,080	6.8
	Steel Arch	220	43	3.4	4.6	51	2,080	6.8
	Concrete Box	280	33	2.6	3.6	39	2,020	6.6
	Extradosed	280	41	3.3	4.4	48	2,020	6.6
Alt -2	Cable-stayed	300	50	4	5.4	59	1,800	5.9
	Steel Arch	290	58	4.7	6.3	69	1,810	5.9
	Extradosed	320	41	3.3	4.5	49	1,780	5.8
Alt -3	Cable-stayed	220	39	3.1	4.2	46	1,980	6.4
	Steel Arch	220	42	3.4	4.6	50	1,980	6.4
	Concrete Box	240	28	2.2	3.0	33	1,960	6.4
	Extradosed	240	34	2.7	3.7	40	1,960	6.4
Current DD (Cable-stayed)		208	45	3.6	9.7	58	2,300	6.1

*: 20% from Cost estaimated of current Detailed Design
Source: JST

(3) Environmental and Social Considerations

Major Findings on the Current ESIS Report

ESIS for the New Karuma Bridge was originally prepared in February 2015 in accordance with the national regulations and referring to the safeguard policies of World Bank (WB) and African Development Bank (AfDB) as they were the potential lenders to the Government of Uganda. ESIS was approved by NEMA in August 2016 under certain conditions. The approved ESIS report was reviewed with reference to the JICA Guidelines. Summary of review results and findings are explained below.

- Need to include scoping results
- Need to clarify the monitoring and reporting structure at pre-construction, construction and operation phases respectively
- Need to add explanation of timing, methods of public announcement, and comments raised by participants and answers from UNRA

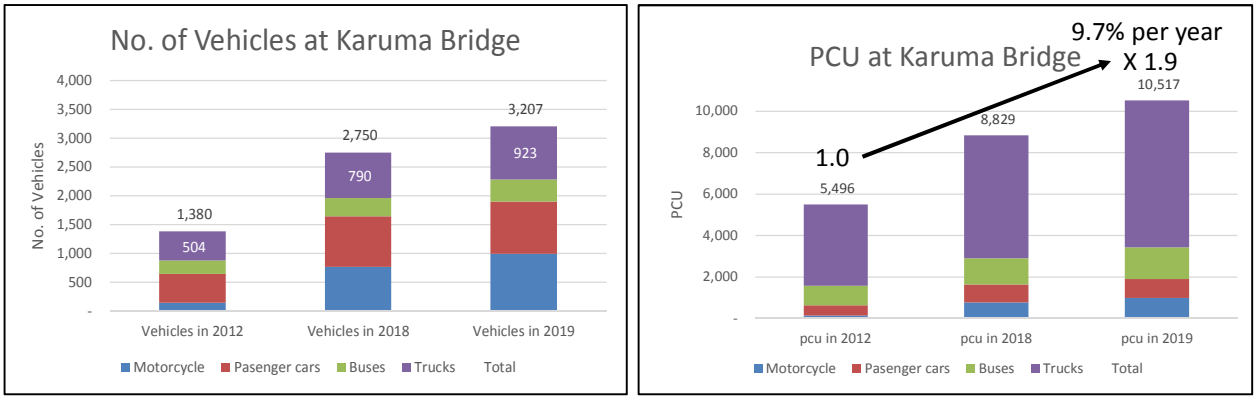
Environmental Concerns for Implement the Project

- It was confirmed that UNRA would hold sufficient consultation with concerned authorities in the process of the project cycle. Accordingly, due consultation and facilitation is necessary with the concerned authorities especially UWA for implementing the project in the protected area.
- Additional explanation for the items not yet described in the current ESIS is necessary.
- Renewing the ESIS in case that the projects are not implemented within the designated duration (i.e. 5 years after the approval is issued).

(4) Traffic Demand

A) Current Situation

PCU/day of Traffic volume in Karuma increased 1.9 times between 2012 and 2019. Details are shown in the figure below.



Source: (a) Detailed Design, PROME Consultant, 2014 (b) Feasibility Study, UNRA, 2018 (C) JST

Figure 16 Comparison Traffic Survey

B) Future Traffic Demand

Growth Rate

< Assumption of annual growth rate for Preliminary Future Demand Forecast >

The assumption of annual growth rates of traffic demand on New Karuma Bridge from 2019 to 2044 was set up from the analysis on the past trend data of population and GDP and the framework of related plans. The annual growth rates are as follows:

- Passenger types of vehicle such as motorcycle, minibus, bus and passenger car are assumed to increase from 2017 to 2044 by **3%** of annual growth rate based on the trend of population growth rate in the past five years
- Freight types of vehicles such as truck and trailer are assumed to increase from 2017 to 2044 by **6%** of annual growth rate based on the trend of GDP growth rate in the past five years

Table 27 Population and GDP in Uganda

Population and GDP in Uganda for the past five years

year / Indicators	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Population ('000')	33,990	34,964	35,885	36,904	37,942
Annual Growth rate of Population (%)	2.91	2.87	2.63	2.84	2.81
GDP (billion shillings) *1	50,651	53,279	55,826	57,983	61,361
Annual Growth rate of GDP (%)	5.11	5.19	4.78	3.86	5.83
GDP per capita (UGX,'000') *2	1,490	1,524	1,556	1,571	1,617
Annual GDP per capita growth rate(%)	2.14	2.26	2.09	1.00	2.93

Source: Uganda Bureau of Statistics
*1: GDP is at constant 2009/10 prices
*2: GDP per capita is at constant 2009/2010 prices

Assumption of Future Population and GDP in Uganda

year / Indicators	2019	2024	2029	2034	2039	2044
population ('000') estimated *1	40,252	46,663	54,096	62,712	72,700	84,279
population growth ratio from 2019	1.0	1.2	1.3	1.6	1.8	2.1
GDP (billion shillings) *2	68,945	92,264	123,470	165,231	221,117	295,904
GDP growth ratio from 2019	1.0	1.3	1.8	2.4	3.2	4.3
GDP per capita (UGX,'000') *3	1,713	1,977	2,282	2,635	3,042	3,511
GDP per capita growth ratio from 2019	1.0	1.2	1.3	1.5	1.8	2.0

Source: JICA Study team
*1: population is estimated with 3% of annual growth rate from 2017
*2: GDP is estimated with 6% of annual growth rate from 2017
*3: GDP per capita is caluculated using the above esimated figures

Result of Traffic Demand Forecast

Based on the growth rate set up in the previous section, the future traffic demand on the new Karuma Bridge in years 2024, 2034 and 2044 are forecast under the assumption that a new additional route between Kampala and Gulu would not be built until 2044. The future demand for the target years are 13 thousands per day in 2024, 22 thousands per day in 2034 and 37 thousands pcu per day in 2044. If the past growth trend at 9.7% of the annual growth rate between 2012 and 2019, shown in Figure 17, is applied for forecasting, the future demand would be 42 thousands pcu per day in 2034. It is then safe to assume that the demand in 2034 will be ranging between 22 and 42 thousands pcu per day.

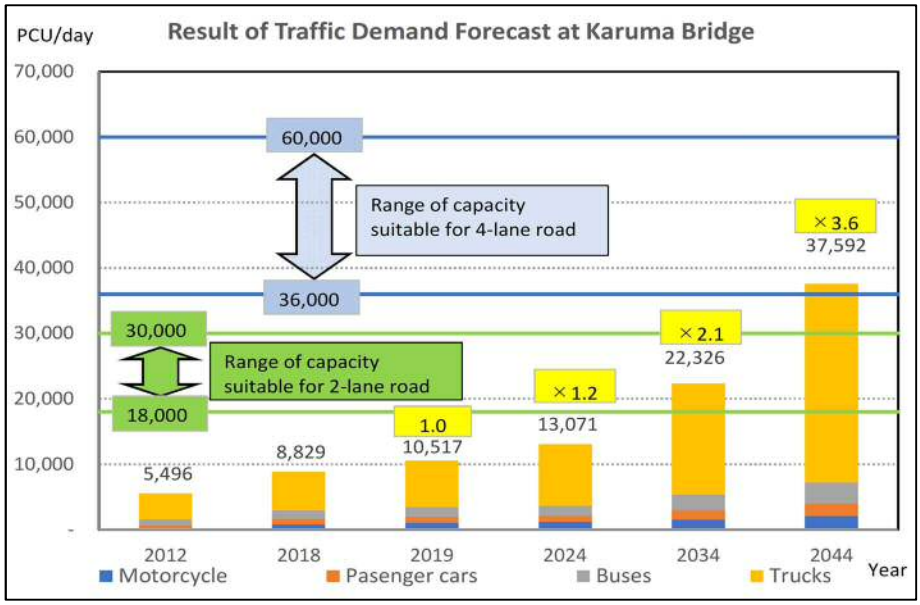
An appropriate range of capacity suitable for 4-lane road is assumed to be from 36thousands to 60thousands pcu per day. The range was calculated as a 4-lane road at minus 25% or plus 25% of the 48thousands pcu capacity per day. In case of 2-lane road, the capacity is assumed to be from 18thousands to 30thousands pcu per day. Therefore, it is estimated that the traffic demand would exceed the capacity of two lane road between 2034 and 2044.

There are two options for the number of lanes on the Karuma Bridge, which are *two* or *four*. If a two-lane option is selected, the project cost would be reduced compared to a four-lane option. It could also be easier to call for funds from donors. It would be completed more urgently than the other, and as a result, traffic accidents would be reduced at an earlier stage. Nevertheless, the risk for the two-lane option is the lack of capacity around the year of 2034, approximately 10 years after the provision. In this case, it is necessary to build an additional bridge over the Nile River the near site of the New Kaluma Bridge.

On the other hand, a four-lane option is said to be a reasonable one because it could provide sufficient road capacity in the long run and safer driving conditions than the two-lane option, specifically in that truck lane can be designated separately from lanes for passenger cars and motorcycles. Nevertheless, it would have several issues related to construction costs and maintenance, longer period of construction and greater difficulty to call for funding compared to the two-lane option.

Here, JICA study team assumed a four-lane option to be a better option. This is because the main objectives of the project are to alleviate the risk of traffic accidents and deal appropriately with the growing traffic demand in the long run at the same time. If the lack of capacity emerges, it will lead to additional risk of traffic accidents caused by congestion. Furthermore, the benefits of the project would spread to a wider area beyond the boundaries of South Sudan, DRC and Ethiopia as the New Karuma Bridge has a key role to deliver resources and goods to the wider area. Under uncertain assumptions for traffic demand forecast, it is a tentative suggestion for the issue on the number of lane.

The final decision about the number of lane will be done through the discussion among stakeholders in the following stage after this Data Collection Survey.



Source: (a) Detailed Design, PROME Consultant, 2014 (b) Feasibility Study, UNRA, 2018 (C) JST

Figure 17 Future Traffic Volume

(5) Evaluation of Alternatives

Each above-mentioned alternative was compared and evaluated relatively for each evaluation items. Score for criteria is given by comparative manner as shown in Table 28.

Table 28 Score for Criteria

Evaluation Category / Item	Criteria		
	Worse : 1	Middle: 2	Better: 3
1. Safety			
Horizontal alignment (Minimum radius)	X ＜ 300m	300m≦ X ＜ 500m	500m ≦ X
Vertical alignment (Maximum Gradient)	X ≧ 5.0%	4.0 % ＜ X ＜ 5.0%	X ≦4.0 %
2. Aesthetics			
Monumental Structure	Common	Moderate	Monumental
Harmony with surroundings	Unharmonized	Moderate	Harmonized
3. Environment			
Affected area enclosed by existing and new roads	X ≧ 200,000 ㎡	100,000 ㎡ ＜ X ＜ 200,000 ㎡	X≦ 100,000 ㎡
4. Constructability			
Special technology	Special Technology	International firm can implement	Conventional
Works in the river	Need cofferdam	Risk of necessity of cofferdam	No need cofferdam
5. Maintainability*			
Steel/Cable	Steel repainting/bolt	Outer cable	All concrete
6. Cost			
Construction Cost of bridge (million USD)	X ≧ 50	40 ＜ X ＜ 50	X ≦40

* Concrete bridges also require appropriate maintenance works

Note: As a relative comparison, 1 means worse, 2 mean average, 3 means better.

As a result, the extradosed bridge of Alternatives 2 & 3 were most highly evaluated for the project among all alternatives. The result of the evaluation is shown as follows:

Table 29 Comparison of Bridge Options

		Current	Alternative-1				Alternative-2			Alternative-3			
		Cable-stayed	Cable-stayed	Arch	Conc Box	Extra-dosed	Cable-stayed	Arch	Extra-dosed	Cable-stayed	Arch	Conc Box	Extra-dosed
Length (m)		208	220	220	280	280	300	300	320	220	220	240	240
Safety	Horizontal alignment	1	2	2	2	2	**3**	**3**	**3**	2	2	2	2
	Vertical alignment	1	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Aesthetics	Monumental	**3**	**3**	2	1	**3**	**3**	2	**3**	**3**	2	1	**3**
	Harmony	1	1	2	2	**3**	1	2	**3**	1	2	2	**3**
Environment	Affected Area	1	1	1	1	1	**3**	**3**	**3**	2	2	2	2
Constructability	Special technology	2	2	1	**3**	2	2	1	2	2	1	**3**	2
	Works in the river	**3**	**3**	**3**	1	1	**3**	**3**	2	**3**	**3**	2	2
Maintainability		2	2	2	**3**	**3**	2	2	**3**	2	2	**3**	**3**
Cost		1	2	1	**3**	2	1	1	2	2	1	**3**	**3**
Overall Evaluation		C	B	C	B	B	B	B	**A**	B	B	B	**A**

Note : As a relative comparison, 1 and C means worse, 2 and B mean average, 3 and A means better.
Overall evaluation is made on the basis of the average and standard deviation.
Source: JST

(6) Recommendation for New Karuma Bridge Project

A) Reference opinions from experts on Scenarios and Issues for the project

In examining the scenario and future issues of the project, the JICA Study Team interviewed experts on transportation planning and logistics planning who are familiar with transport and logistics conditions in Africa, and obtained helpful comments. The key comments from the experts are summarised below as recommendations for the next phase:

- Safe rest facilities and places for long distance drivers are required at regular intervals. It would be a good idea to have a truck rest facility near the Karma Bridge. In order to improve truck transportation, the development of new track station called "connect area" are put in practice in Japan. The connect area means the area utilizing a smart interchange as the site for changing drivers or trucks. The project aims at preventing the drive dozing by the long driving and realizing the 24-hour driving operation. As a method to utilize the expressway network more efficiently where long-distance truck logistics is supported by connect areas, logistic industries expect it greatly and urgently.
- An experiment with one driver driving of three large trucks in tandem has been conducting in Japan, as an application of automatic driving technology. This is an efficient operation that responds to the driver shortage, and has a high economic effect that can be expected to reduce transportation costs. The distance between vehicles is 10m, and it is set so that the passing vehicle cannot enter between the trucks. For developing a new roadside station near the New Karma Bridge, it is important to provide a large parking space, which is convenient for such convey operation of large trucks.
- It is worthwhile to consider establishing a truck priority lane. The truck priority lane can be effective to reduce the risk of a rear-end collision of a vehicle, contact with a pedestrian and falling off the road.
- In developing countries where truck demand is rapidly increasing, I think that a plan with four-lane on the New Karuma Bridge will not be an excessive investment. However, from the perspective of truck operation companies, it is strongly expected to ensure at least one detour when traffic is closed. Therefore, a plan of two routes with two lanes would be preferable rather than one route with four lanes.

B) Proposed Scenarios for Formulation of the Project

<u>Re-evaluation of Number of Lane on the Karuma Bridge</u>

As presented in 7 (4)., there are two options for the number of lanes on the New Karuma Bridge; two-lane and four-lane option. The tentative candidates are shown in Table. 30 including the cases of two-lane option.

As far as the construction cost of the bridge is concerned, the cost for the two-lane option would range between 23 and 35 million USD, whereas the four-lane options are from 33 to 49 million USD. As a result, the two-lane option would be lower than four-lane option by 10 to 14 million USD. Approximately 30% of construction cost could be reduced by the two-lane option. The reduction of the cost is greatly evaluated if a new Karuma Bridge is urgently required. Nevertheless it would impose risks of congestion in the long run, compared to the four-lane options.

Table.30. Estimated Cost Considering Two Lane Options

Options		Lane Nos.	Bridge		Consultant Service (8%)	Contingency Cost (10%)	Total	Road	
			Length	Cost				Length	Cost
			(m)	(USDm)	(USDm)	(USDm)	(USDm)	(m)	(USDm)
Alt -2	Extradosed	4	320	41	3.3	4.5	49	1,780	5.8
		2		29	2.3	3.2	35		4.2
Alt -3	Concrete Box	4	240	28	2.2	3.0	33	1,960	6.4
		2		19	1.6	2.1	23		4.6
	Extradosed	4	240	34	2.7	3.7	40	1,960	6.4
		2		25	2.0	2.7	30		4.6

Source: JST

An alternative idea to deal with increasing traffic demand in the future is to implement two-phased development process. In the first phase, the New Karuma Bridge with two lanes will be constructed as an urgent short term project. Afterward, in responding to the increase of traffic demand, another route development including an additional new bridge with two lanes will be constructed for the medium/long term. This plan can be regarded as a practical one because the future traffic demand by 2034 is estimated to be within the capacity of two- lane trunk road.

Moreover, from the long term view, regarding traffic accident and disaster response, let's compare “one four-lane route” with “two two-lane routes”. Developing “two two-lane routes” creates flexibility in traffic in uncertain circumstance, for example, when one route is closed due to a major traffic accident or natural disaster, another route works. Of course, another route shall be developed near to the first one. On the other hand, “one four-lane route” can be seen as an efficient transport project enable to deal with the long term traffic demand. Nevertheless, if something happens to close the traffic on the route, no route exist beside detour routes with an additional distance of more than 300km under the current situation. In this regard, “one-route with four lanes” has the disadvantage to the failsafe function.

Based on the above discussions it is necessary to think about which is better, “one four-lane route” or “two two-lane routes” in the next stage, in addition to the discussion on how to utilize the existing bridge.

Financial arrangement

To implement such the New Karuma Bridge project, JICA assistance through ODA loan or Grant Aid is effective and important. There are two scenarios in terms of the financial arrangement as follows.

First, if emphasis is placed on dealing with aging of the existing Karuma Bridge and urgently dealing with traffic accidents, selecting a low-cost structural bridge with two-lane which will relatively shorten the construction period is desirable. As a result, depending on the cost, there is the possibility of Grant Aid.

Second, as an important bridge over the River Nile, emphasizing landmark design, responding to the long-term increase in demand for trucks, and widening the New Karma Bridge in advance of the construction of trunk roads in the north-south direction. If emphasis is placed on such policies, it will be acceptable to select a relatively expensive structure type with four lane and with landmark design, and a relatively long construction period until the project is completed. As a result of this case, the possibility of ODA loan becomes higher.

Counterpart fund

If there is budget constraint, the project may be divided into phases. Since the main bridge construction cannot be divided into different phases, road construction works might be one of the phases of the project, and in such case, the Government of Uganda may be requested to bear the cost for the phases which will not be covered by the ODA.

Points to be noted for requesting financial assistance from the Japanese government

In order to adopt this project, the purpose of the project is clarified, and the alignment and bridge structure are selected in line with the purpose, and it is necessary to revise the EIA report and to approve it by NEMA to meet the level required by JICA.

Source: JST

Figure 18 3D image of New Karuma Bridge

C) Remaining Issues

Environmental and Social Issues

[Major Findings on the Current ESIS Report]

Need to include scoping results, to clarify the monitoring and reporting structure at pre-construction, construction and operation phases respectively, to add explanation of timing, methods of announcement, comments raised by the participants and answers from UNRA.

[Environmental Concerns for Implement the Project]

- Due consultation with the concerned authorities especially UWA to implement the project in the protected area
- Need supplementary explanation of the items not described in the current ESIS

Topographic survey

Topographic survey for Alternative-2 and Alternative-3 routes is necessary to carry out bridge planning more precisely.

Further cost survey and analysis

Further cost survey and analysis are required to estimate construction cost more accurately.

Viewing Spot

In order to enhance the touristic value of the site, it is recommended to provide sightseeing decks for viewing landscapes around the new Karuma Bridge as presented in the current detailed design drawings.

Road side Station in the Karuma area

Karuma bridge has a great demand of long-distance truck, long distance bus and business drivers between Kampala and Gulu or South Sudan. In fact, there are many traffic in midnight crossing the Karuma bridge. Karuma town would be a candidate for rest place for drivers of such vehicles. It is expected that such Roadside Station will be implemented by Northern Corridor Transit & Transport Coordination Authority. It is expected to provide petro station, car workshops, toilets, shops, restaurants, free parking space, information of transport, tourist spots, travel route, and so on. The location of roadside station shall be outside the national park and near towns.

The End of the Executive Summary

CHAPTER 1 INTRODUCTION

1.1 Background to the Study

The Republic of Uganda - a Land-Linked country located in east Africa - is a member state of EAC (East Africa Community) and COMESA (Common Market for Eastern and Southern Africa). EAC, established in 2005 as a custom union among the member states, has a strong internal economic tie as an economic zone, and has been promoting interregional trade activities every year. In this context, formulation of a regional road network is a challenge for the entire region. Uganda possesses an important location on the road connecting several neighbouring countries such as Rwanda, D.R.Congo, and South Sudan, etc. as well as coastal Eastern African countries, such as Kenya and Tanzania. Uganda's Economic Reform Policy called "Vision 2040" has set up a railway system with standard gauge railway (SGR) as an important policy. Yet, the SGR project has been delayed, and thus, more than 92% of cargo and passenger transportation still have to depend on road transport.

Transport infrastructure development is stated as one of the priorities in Uganda's National Development Plan (2015/16-2019/20) (NDP II: National Development Plan II). In 2008, the government of Uganda also formulated the "Uganda's National Transport Master Plan", which is a long-term strategy for the transport sector, and made a development framework for the transportation sector for the next 15 years (from 2008 to 2023). In addition, in 2017, under support by JICA, a "Master Plan on Logistics in Northern Economic Corridor" was developed as a regional development plan for Uganda, Rwanda, Burundi and D.R.Congo, starting from the Port of Mombasa of Kenya. The Kibuye-Busega Expressway and the New Karuma Bridge projects were stated as highly prioritized by the Government of Uganda based on the above-mentioned development and the Master Plans. The Government of Uganda has great expectations to receive Japan's support in these projects.

The survey for data collection will be conducted to confirm the viability of these projects by Japanese ODA loan or grant aid in consideration of the above-mentioned situation.

1.2 Objective of the Survey

The survey is to confirm each Project justification and direction of Supports and to collect necessary information for the formulation of each Project. The details are shown below.

(1) To collect relevant information on Urban Transport Plan in Kampala.

Especially, to collect and analyse Current Progress of the Projects based on Development Strategy, Road Sector Development Plan prepared by the Government of Uganda, Updated Donor/Development Partners' information, and clarify existing issues for the implementation of the Projects.

(2) To grasp existing study results such as F/S, D/D for Kibuye–Busega Expressway and New Karuma Bridge Construction Project, current traffic volumes, to consider the required support for the formulation of the Projects as the financial support by JICA.

1.3 Project Sites

Project Sites are shown in next two pages.

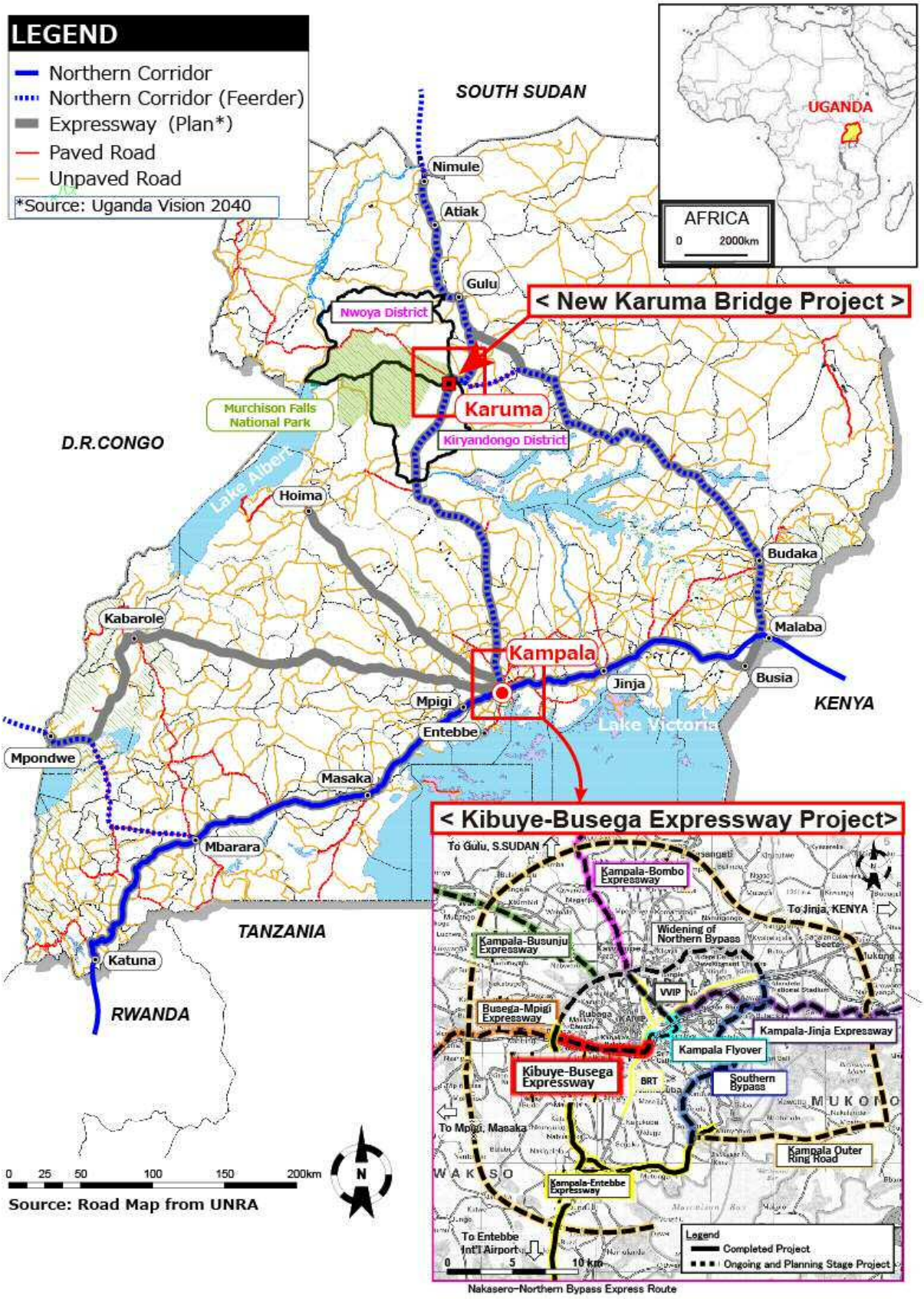
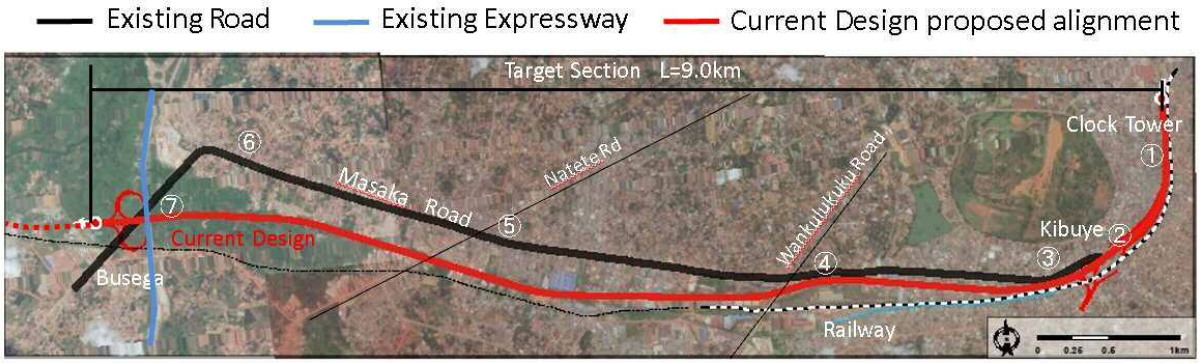
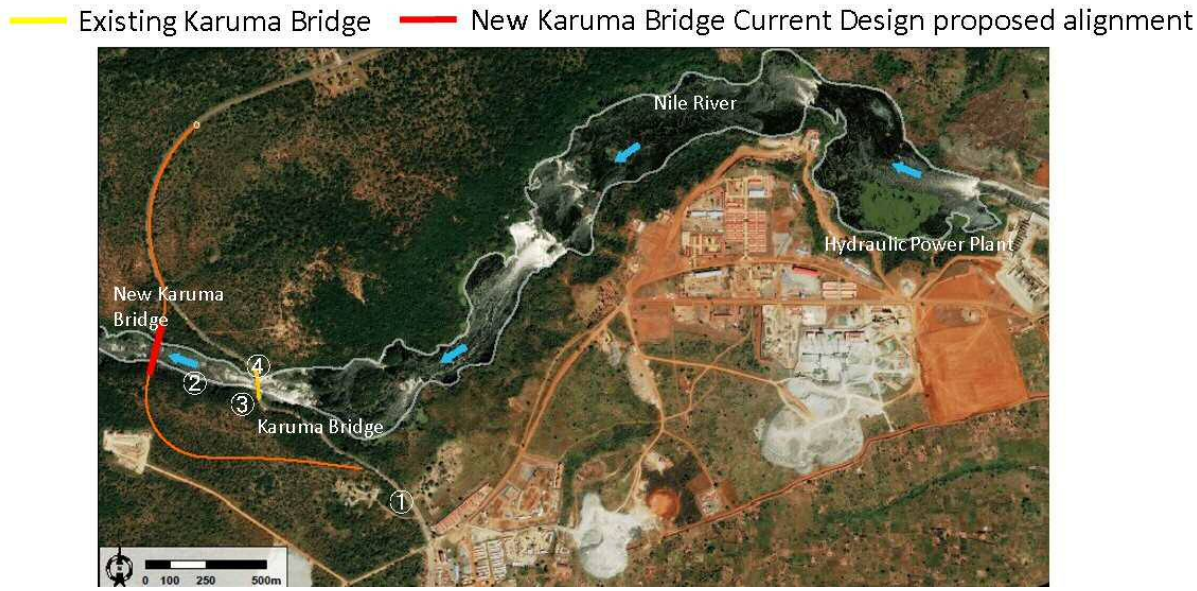


Figure 1.3.1 Project Sites (1/2)

< Kibuye - Busega Expressway>



< New Karuma Bridge >



Source: JST

Figure 1.3.2 Project Sites (2/2)

1.4 Survey Method

The Survey consists of Work in Uganda and Work in Japan, respectively. Contents of the work items in each work category are shown in the following table.

Table 1.4.1 Work Items for the Survey

Work Category	Schedule	Contents	
A. Work in Japan - (Preparation Work)	Middle of Feb, 2019	A-1	Collection and Analysis of Related Data and Information
		A-2	Preparation of Inception Report (Draft)
		A-3	Explanation and Finalization of Inception Report (Draft)
B. Work in Uganda - (Field Survey)	End of Feb. to Mar, 2019	B-1	Explanation of Scope of Works for the Survey to JICA Uganda Office and Embassy of Japan in Uganda
		B-2	Explanation of Scope of Works for the Survey to Related Agencies and Organization I Uganda
		B-3	Review of Government Development Policy and Development Plan in Uganda and Analysis of Evaluation of the target Projects
		B-4	Review of Basic Information on Urban Transport in Kampala and in Northern Corridor in Uganda
		B-5	Data Collection and Analysis of current programmes on transport sector prepared by the Uganda government and the donors
		B-6	Site Survey
		B-7	Traffic Survey and Traffic Demand Forecast
		B-8	Proposal of Support Scenario for the formulation of each project
		B-9	Proposal of Available Support including Japanese Grant Aid Project and co-finance with other donors
		B-10	Clarification and Consideration of anticipated Issues for the formulation of each project
C. Work in Japan (Analysis Work)	Mar-Apr, 2019	C-1	Preparation of Draft Final Report
D. Work in Uganda (Explanation of Survey Result/DFR)	Apr, 2019	D-1	Explanation of Draft Final Report (DFR) and receipt of the comments to DFR
E. Work in Japan (Finalization of FR)	May-Jun, 2019	E-1	Report of the survey results
		E-2	Finalization and Submission of Final Report

1.5 Survey Team Member

The following 6 experts were assigned for this Survey.

Table 1.5.1 Member List

No.	Name	Assignment
1.	Mr. Atsuyuki NAKASEKO	Team Leader / Urban Transport Plan
2.	Mr. Kentaro OKUNO	Bridge Plan / Bridge Design
3.	Mr. Hiroaki TAKAHASHI	Road Plan / Road Design
4.	Mr. Ryo SAITO	Traffic Survey
5.	Ms. Tomoko OTA	Natural and Social Environnemental Consideration
6.	Mr. Shinichi NII	Existing Facility Condition Survey / Natural Condition Analysis

1.6 Implementation Schedule

The Survey commenced mid-February, and continue to the beginning of July 2019.
Implementation schedule is shown in the following table.

- 1st Field Survey in Uganda for data collection: from February 25 to March 15, 2019
- 2nd Field Survey in Uganda for explanation of DFR: from April 17 to April 30, 2019

Table 1.6.1 Implementation Schedule

		2019 Feb	Mar	Apr	May	Jun
A-1	Collection of related data / information and Analysis					
A-2	Preparation of Inception Report (draft)					
A-3	Explanation and Finalization of Inception Report (draft)					
B-1	Explanation of Scope of Works for the Survey to JICA Uganda Office and Embassy of Japan in Uganda					
B-2	Explanation of Scope of Works for the Survey to Related Agencies and Organizations in Uganda					
B-3	Review of Government Development Policy and Development Plan in Uganda and Analysis of Evaluation of the Project Objective					
B-4	Review of Basic Information on Urban Transport in Kampala and in Northern Corridor in Uganda					
B-5	Data Collection and Analysis of current programmes on transport sector prepared by the Uganda government and the donors					
B-6	Site Survey					
B-7	Traffic Survey and Traffic Demand Forecast					
	1) Traffic Survey					
	2) Traffic Demand Forecast					
B-8	Proposal of Support Scenario for the formulation of each project					
B-9	Proposal of Available Support including Japanese Grant Aid Project and co-finance with other donors					
B-10	Clarification and Consideration of anticipated Issues for the formulation of each project					
C-1	Preparation of Draft Final Report					
D-1	Explanation of Draft Final Report (DFR) and receipt of the comments to DFR					
E-1	Report of the survey results					
E-2	Finalization of Final report					

Legend: Work in Uganda Work in Japan

1.7 Counterpart and Related Agencies

MoWT, UNRA, KCCA and MoFPED are the main C/Ps of the Survey.
The counterpart organizations and related agencies are as follows:

Table 1.7.1 Counterpart and Related Agencies

Main Counterparts	
	Ministry of Works and Transport (MoWT)
	Uganda National Roads Authority (UNRA)
	Ministry of Finance, Planning and Economic Development (MoFPED)
	Kampala Capital City Authority (KCCA)
Related Agencies	
	Uganda Railway Corporation (URC)
	MoWT Standard Gauge Railway (SGR) Project Office
	Uganda Police Force (UPF)
	Uganda Electricity Generation Company Limited (UEGCL)
	Uganda Electricity Transmission Company Limited (UETCL)
	National Water and Sewerage Corporation (NWSC)
	Uganda Wildlife Authority (UWA)
	World Bank (WB)
	African Development Bank (AfDB)

CHAPTER 2 BASIC INFORMATION ON INFRASTRUCTURE DEVELOPMENT ON NORTHERN ECONOMIC CORRIDOR IN UGANDA

2.1 Development Strategy and Master Plan in Uganda

Summary of Development Strategy and Master Plan in Uganda

There are several development plans and master plans in Uganda. The target projects such as Kibuye-Busega Expressway Project and New Karuma Bridge Project are considered as high priority in each plan shown in Table 2.1.1.

Table 2.1.1 Related Development Plan and Master Plan in Uganda

No.	Related Plan	Target Year	Organization	Published Year	Relationship with the Target Projects in this Survey	
					Kibuye-Busega Exp'way Project	New Karuma Bridge Project
(1)	Uganda Vision 2040	2013-2040	NPA	2010	**High Priority Project**	**High Priority Project**
(2)	Second National Development Plan (NDP II)	2015/16-2019/20	NPA	June 2015	**Priority Project** by the target year	-
(3)	Works and Transport Sector Development Plan (WTSDP) 2015/15-2019/20	2015/16-2019/20	MoWT	2017	Recommended the project implementation by PPP	-
(4)	National Transport Master Plan	2008-2023	MoWT/WB	August 2009	**High Priority Route,** Dual carriageway by year 2023, 6 lanes widening by year 2050	-
(5)	Kampala Physical Development Plan (KPDP)	2012-2022	KCCA/WB	November 2012	**Important West-East Axis Trunk Road** in Kampala	-
(6)	Master Plan on Logistics in Northern Economic Corridor	2017-2040	MoWT/JICA	March 2017	**Priority Project** on Northern Economic Corridor in Uganda	**Priority Project** on Northern Economic Corridor in Uganda
(7)	Multi Modal Urban Transport Master Plan (GKMA)	2018-2040	KCCA/WB	May 2018	LRT installation Plan	-

[Note]
NPA: National Planning Authority
MoWT: Ministry of Works & Transport
KCCA: Kampala Capital City Authority
WB: World Bank
JICA: Japan International Cooperation Agency

(1) Uganda Vision 2040

The Vision 2040 is the overarching planning framework for the country. Uganda Vision 2040 provides development paths and strategies to operationalize Uganda's Vision statement which is "A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years" as approved by Cabinet in 2007. It aims at transforming Uganda from a predominantly peasant and low income country to a competitive upper middle income country..

In this regard, the country will develop the road infrastructure to improve transport connectivity, effectiveness and efficiency to comparable levels of developed countries. The target is to have an average of paved road density of 100km per 1,000sq.km. The main strategies include: development of highways connecting Uganda to neighbouring countries, and connecting major productive centres within the country; and Multi-lane expressways connecting major cities, exit ports and economic zones. The UNRA strategic plan will seek to ensure that the country makes progress towards this Vision 2040.

Development indicators for Vision 2040 are shown in Table 2.1.2.

Table 2.1.2 Development Indicators for Vision 2040

Development Indicator		Baseline Status: 2010	Target 2040
Per capita income		USD 506	USD 9,500
Population Growth Rate(%)		3.2	2.4
Nominal GDP at Market Prices (USD, billions)		**Real GDP Growth Rate (%)**	
2010	17.0 billions	2012-2015	8.44%
2015	24.2 billions	2016-2020	8.58%
2020	41.2 billions	2021-2025	8.35%
2025	83.6 billions	2026-2030	8.22%
2030	167.2 billions	2031-2035	8.07%
2035	319.6 billions	2036-2040	7.83%
2040	580.5 billions		

Source: Vision 2040

(2) Second National Development Plan (NDP II) 2015/16-2019/20

This National Development Plan II (NDP II) is the second in a series of six five-year Plans aimed at achieving the Uganda Vision 2040. The goal of this Plan is to propel the country towards middle-income status by 2020 and recognises that an efficient transport system is a pre-requisite for economic and social transformation and thus prioritises the development of the National Road Network. The NDP II emphasises the development of road infrastructure as one of the critical factors necessary for achieving its goal due to the large multiplier effect from road infrastructure improvement, and has set a target of having 6,000km (30%) of the national roads paved by 2020. The NDP II has also targeted to ensure the fair to good condition of 85% of the paved road network and 75% of the unpaved road network.

The NDP II, as way of addressing the above constraints, emphasizes the need to develop an adequate, reliable and efficient multi-modal transport network, support the national construction industry, improve human resource capacities, and strengthen relevant policies, legal and regulatory frameworks.

Development strategy and plan for Roads & Bridges on Works and Transport Sector are described in NDP II as shown in Table 2.1.3.

Table 2.1.3 Development Strategy and Plan in NDP II

Objective		Outcome / Interventions by year 2020
Objective 1	**Develop adequate, reliable and efficient multi modal transport network in the country.**	i. Conduct a national study on multi-modal transport system. ii. Establish a Maritime Regulatory Authority iii. Rehabilitate and maintain the District, Urban, and Community Access (DUCA) road network. **iv. Construct new and rehabilitate old bridges.** v. Undertake periodic inspection of the pavement condition for national roads. vi. Standard gauge rail development (Uganda Section). vii. Develop inland water transport with special emphasis on hard-to-reach island areas. viii. Upgrade and expand Entebbe International Airport.

Objective		Outcome / Interventions by year 2020
		ix. Upgrade Air Navigation Services Infrastructure to achieve a globally interoperable air navigation system to provide a seamless service. x. Develop a Master Plan and Engineering Designs for Arua Airport. xi. Explore development and management concessions (PPP arrangements) for Arua, Kasese and Gulu airports. xii. Revive the National Airline to facilitate the development of Entebbe International Airport into a hub. **xiii. Establish Second Generation Road Fund to effectively control the revenue from Road User Charges for road maintenance.** **xiv. Develop and maintain the roads to tourism, mining and agriculture producing areas.** xv. Develop and implement mechanisms to ensure that the existing and future transport infrastructure is climate change resilient. xvi. Promote vehicle efficiency and technologies to reduce transport emissions. **xvii. Construct and rehabilitate national roads** xviii. Review the Roads Construction Designs and Standards to provide for public places of convenience and utilities
Objective 2	Improve human resources and institutional capacity of the Sector to efficiently execute planned interventions.	Vibrant and operational national construction industry
Objective 3	Improve the National Construction Industry.	Enhanced sector Implementation capacity
Objective 4	Increase safety of transport services.	Improved safety of transport services

Source: NDP II

Core Projects in Transport Sector on National Development Plan II are shown in Table 2.1.4. Kibuye-Busega Expressway is considered a core project in transport sector in Uganda.

Table 2.1.4 Core Projects in Transport Sector on NDP II

No.	Core Projects
1	Standard Gauge Railway
2	The Entebbe Airport Rehabilitation
3	Kampala-Jinja highway
4	**Kibuye-Busega**-Nabingo
5	Kampala Southern by-pass
6	Kampala-Bombo Express highway
7	Upgrading of Kapchorwa-Suam Road
8	**Kampala-Mpigi Expressway**
9	Rwekunye-Apac-Lira-Kitgum-Musingo Road
10	Road Construction Equipment

Source: NDP II

(3) Works and Transport Sector Development Plan (WTSDP) 2015/16-2019/20

The Works and Transport Sector Development Plan (WTSDP) 2015/16 – 2019/20 sets the medium term strategic direction, development priorities and implementation strategies of the Works and Transport Sector.

The theme of the WTSDP is "Development of Sustainable Inter-modal Transport Infrastructure and Services for Socio-Economic Transformation". This theme is in line with the NDP II theme of Strengthening Uganda's Competitiveness for Sustainable Wealth Creation, Employment and Inclusive Growth as well as the aspirations of Uganda's Vision 2040 of accelerating the transformation of Uganda from a farming society to a modern and prosperous country.

Development of efficient and sustainable inter-modal transport infrastructure and services supports the development of key growth sectors, reduces transport costs and improves competitiveness, as transport accounts for over 30% of the production cost. It leads to better access to markets and attracts Foreign Direct Investment, thus increasing the country's competitiveness to trade and contributing to economic growth and prosperity. It also provides employment and other social opportunities and benefits, all of which result in positive multipliers effects on the economy. Therefore, sustainable multi-modal transport infrastructure development and usage plays a key role in Uganda's pursuit for sustainable economic development.

The road network situation in Uganda mentioned in WTDSP is shown in Table 2.1.5.

Table 2.1.5 Road Network for each road classification in Uganda

Road Classification	Road Length	Paved Road Length	Data Source
National Road	20,544km (21,544km)	4,387km (21.4%) (4,551km(21.1%))	WTSDP ASPR2017/2018
District Road	35,566km (35,566km)	145km (0.4%) (145km(0.4%))	WTSDP ASPR2017/2018
Urban Road	10,108km (12,176km)	571km (5.6%) (610km(5.0%))	WTSDP ASPR2017/2018
Community Access Road	78,567km (78,567km)	Not paved (0.0%) (Not paved (0.0%))	WTSDP ASPR2017/2018
Total	144,785km (147,853km)	5,100km (3.5%) (5,306km(3.6%))	WTSDP ASPR2017/2018

Source: WTSDP, 2017 and Annual Sector Performance Report (ASPR)2017/2018, Sep.2018, WoWT

Table 2.1.6 Stock of National Roads since 2008

Financial Year	Paved Roads	
	Annual Increase (km)	Stock (km)
2008/09	159.00	3,034.60
2009/10	165.40	3,200.00
2010/11	64.10	3,264.10
2011/12	53.00	3,317.10
2012/13	172.50	3,489.60
2013/14	303.40	3,795.00
2014/15	185.88	3,981.00
2015/16	238.00	4,157.00
2016/17	230.00	4,387.00

Source: WTSDP

The overall rating of the condition of paved road network has generally improved over the past 10 years. However, the above rates still lag behind many developing countries as network conditions reflect low maintenance expenditures. This inadequate level of road maintenance results in lower travel speeds and higher operating costs. Hence, there is a need to increase funding for road maintenance in order to preserve the large investments being made by government in road development.

Table 2.1.7 Summary of Paved Road Condition

Year	Paved Roads Condition (km)				Paved Roads Condition (%)		
	Good	Fair	Poor	Total	Good	Fair	Poor
2009/10	1,230	1,180	709	3,119	39%	38%	23%
2010/11	1,742	680	843	3,264	53%	21%	26%
2011/12	1,717	856	744	3,317	52%	26%	22%
2012/13	1,794	893	803	3,490	51%	26%	23%
2013/14	2,505	531	759	3,795	66%	14%	20%
2014/15	2,707	478	796	3,981	68%	12%	20%
2015/16	2,040	913	1,204	4,157	61%	27%	12%

Source: WTSDP

Kampala City Roads

According to WTDSP reported on 2017 as final version, Kampala has an estimated network of 2,110km of roads, of which 578 km (27%) are paved and 1,532km km are unpaved, i.e. dirt or gravel (73%) as of June 2016. However, according to the 14th Joint Transport Sector Review Workshop Presentation on September 2018, the paved road length in Kampala was a little bit increased from 578km (27%) to 599km (28.3%). These figures were derived from a study commissioned by KCCA in 2013 to undertake a roads inventory and conditions assessment which established an accurate database/inventory of all road infrastructures within KCCA area of jurisdiction and their condition. Only 51% of the paved roads and 70% of unpaved roads were in fair to good condition.

Kampala's road network was constructed for less than 100,000 vehicles in the 1960s. Yet today, over 60% of vehicles in Uganda (about 900,000) use Kampala roads even though Kampala's aggregated road network is less than 1% of the total road length in Uganda. Hence, most roads have neared or exceeded their expectancy and need either complete reconstruction or asphalting (for non-major road corridor) and widening (for the major road corridors).

Table 2.1.8 Summary Inventory of KCCA's Road Network

Road Type	Length(km)		Road Condition – fair to good (%)	
	2011	2016	2011	2016
Paved	417	578	11	51
Unpaved	801	1,532	48	70
Total	1,218	2,110		

Source: WTSDP

(4) National Transport Master Plan (NTMP)

The National Transport Master Plan including Greater Kampala Metropolitan Area (NTMP/GKMA) sets out a framework for the development of the transport sector in Uganda between 2008 and 2023. The plan, commissioned by the Ministry of Works and undertaken by an International Consultant in 2004 and subject to several updates since then, recognises transport as a key facet of economic and social development throughout the country and within major cities, especially Kampala and its vicinity.

This NTMP/GKMA provides an analysis and a realistic 15-year sector investment plan, covering all transport modes including roads, railways, civil aviation, inland water transport, urban transport in

GKMA and other modes of transport, such as pipelines and non-motorised transport (NMT). Besides the investment plan, it also addresses the necessary management framework including institutional, legal, financial, land and environmental issues, and sets out a roadmap for the participation of relevant stakeholders.

The Key objectives of the NTMP/GKMA are:

i) to provide a long term multi-modal reference document giving a comprehensive framework within which consistent plans for individual modes can be developed;
ii) to serve as a key input for the overall national planning process spearheaded by the National Planning Authority(NPA);
iii) to serve also as a key input to regional transport planning at East African Community, COMESA and African Union levels;
iv) to create a framework within which informed investment decisions can be made by both public and private sectors;
v) to achieve establishment of a permanent high-quality long-term transport planning capability within MoWT, equipped to monitor and evaluate Plan performance, to undertake periodic updating of the Plan, and eventually to prepare subsequent National and GKMA Transport Master Plans.

Table 2.1.9 Population Estimates and Projections (2003–2023)

No.	Population (million)	2003	2008	2013	2018	2023
1	Central Region	6.776	7.751	8.971	10.303	11.718
2	Eastern Region	6.440	7.692	9.299	11.154	13.228
3	Northern Region	5.374	6.653	8.337	10.368	12.749
4	Western Region	6.500	7.497	8.751	10.136	11.609
Total, Uganda		25.089	29.593	35.357	41.961	49.304

Source: NTMP

Table 2.1.10 Population Projections for GKMA and Central Region (2003-2023)

No.	('000)	2003	2008	2013	2018	2023
1	Kampala	1,235.2	1,480.2	1,788.6	2,137.4	2,521.4
2	Mukono (GKMA)	93.5	119.3	152.3	189.8	233.1
3	Wakiso (GKMA)	718.6	904.1	1,142.9	1,424.3	1,749.6
GKMA		**2,047.3**	**2,503.6**	**3,083.8**	**3,751.5**	**4,504.1**
4	Mukono (GKMA)	725.3	809.9	911.3	1,014.2	1,119.8
5	Wakiso (non-GKMA)	227.7	254.1	286.6	320.6	357.5
6	Other Central Region	3,776.1	4,183.0	4,689.2	5,216.6	5,737.0
Total, non-GKMA		**4,729.1**	**5,247.0**	**5,887.1**	**6,551.4**	**7,214.3**
Total, Central Region		**6,776.4**	**7,750.6**	**8,970.9**	**10,302.9**	**11,718.4**

Source: NTMP

Table 2.1.11 GDP at Market Prices (2000-2007)

No.	Year	GDP at Current Prices	GDP at Constant Prices	Real Annual Growth Rate (%)
1	2000	10,030	10,297	-
2	2001	11,132	11,199	8.8
3	2002	11,990	11,900	7.1
4	2003	13,843	12,728	6.2
5	2004	15,271	13,467	5.8
6	2005	17,878	14,814	10.0
7	2006	20,166	15,859	7.0
8	2007	23,009	17,282	9.0

Source: NTMP

Table 2.1.12 Traffic Growth on Main Radial Routes from Kampala (2001-2008)

No. (0)	Route (1)	Length in Km (2)	Daily Traffic in '000 Veh-kms (3)		Growth Rate (% p.a.) (4)
			2001	2008	
1.	Kibuye - Entebbe Airport	36.9	383.3	733.6	9.7
2.	Kibuye - Masaka - Lyantonde	198.0	822.8	1,291.2	6.6
3.	Busega - Mubende - Kabarole Brd	177.9	166.2	431.3	14.6
4.	Nansana - Busunju - Lwamata	96.3	94.9	278.0	16.6
5.	Kalerwe - Lwero - Kafu Bridge	178.5	361.7	569.8	6.7
6.	Kalerwe - Gayaza - Kalagi	34.5	129.6	279.5	11.6
7.	Gayaza - Zirobwe*	31.5	53.8	56.6	0.7
8.	Mukono - Kayunga	33.8	65.4	102.1	6.6
9.	Kayunga - Galiraya*	77.5	75.5	60.1	-3.2
10.	Nakawa - Mukono - Njeru	71.4	455.1	923.6	10.6
Total	**Paved road only**	**827.2**	**2478.9**	**4,609.0**	**9.3**
Total	**Paved and unpaved roads**	**936.2**	**2608.3**	**4,725.7**	**8.9**

Note: * Unpaved Sections
Source: 'Traffic Census on National Road Links in Central Uganda ', Draft Final Report ; Prome Cousultants April 2008

(5) Kampala Physical Development Plan (KPDP)

KCCA formulated an updating Kampala Structure Plan and Upgrading Kampala GIS Unit to make a comprehensive urban plan of the Greater Kampala Metropolitan Area (GKMA)
Below are three scenarios for population projection.

[Business as Usual Scenario – Base Case]
This case with ongoing trends resulting in a relatively more organised but distinctly Dual City with wide gaps and growing structural imbalance; this scenario is clearly undesirable but highly possible, if not probable;

[Worst Case Scenario – Low Case]
This case with accelerated in-migration leading to an unsustainable, unserviceable, unmanageable Mega City, languishing behind its competitors in East and Central Africa; this scenario constitutes a clear existential threat to be avoided at all costs;

[Best Case Scenario – High Case]
This case wherein determined intervention allows for Kampala to develop as a modern, functional, balanced Urban System leading Uganda and indeed the region towards the Vision defined in the NDP; this scenario is clear preferable but its fruition depends on significant intervention, investment and comprehensive structural reform.

Analysis of these scenarios clearly indicates that Kampala is at a critical crossroads and the strategic decisions and actions on the table today will determine the nature of the City for years to come.

Table 2.1.13 Population and No. of Household in GKMA for each Scenario

Assumption and Projection	2011 Estimate	Business as Usual 2040 (2022)*	Worst Case 2040 (2022) *	Best Case 2040 (22) *
Growth Assumption		Consistent at 4.75%	Increasing to 6.5% by 2040	Reducing to 3.5% by 2040
Natural Growth Assumption		Reducing to 2.0% by 2040	Reducing to 2.0% by 2040	Consistent at 2.25%
In- migration Assumption		Increasing to 2.75% by 2040	Increasing to 4.5% by 2040	Reducing to 1.25% by 2040
Population	3,150,000	12,000,000 (5,000,000)*	15,600,000 (6,000,000)*	10,000,000 (4,800,000)*
Kampala born	45%	46%	39%	55%
Household size	3.9	3.5	3.3	3.7
Households	800,000	3,430,000	4,730,000	2,700,000

Source：KPDP

Bringing this Vision to fruition requires concrete actions in a wide range of fields. To this end specific targets and goals need be set and appropriate policies defined, adopted and implemented. The Consultant's proposals for developmental targets, goals and policy cover the following fields:

Population - planning for some 5.8 million by 2022 in the Kampala Physical Development Framework (KPDF) and KPDP, with approximately half in the KCCA. This with long term GKMA capacity estimated at some 8 million; whilst improving housing and living conditions and ensuring Quality of Life for the City's inhabitants;

Table 2.1.14 GKMA Population Targets

Population & Households	2011	2022 Projection	2022 Target	Long Term Target
Population	3,150,000	5,000,000	5,800,000	8,000,000
Household Size	3.9	3.8	3.8	3.6
Households	800,000	1,300,000	1,500,000	2,200,000

Source：KPDP

The projected population distribution in the GKMA is presented in Table 2.1.15.

Table 2.1.15 Projected Population Distribution

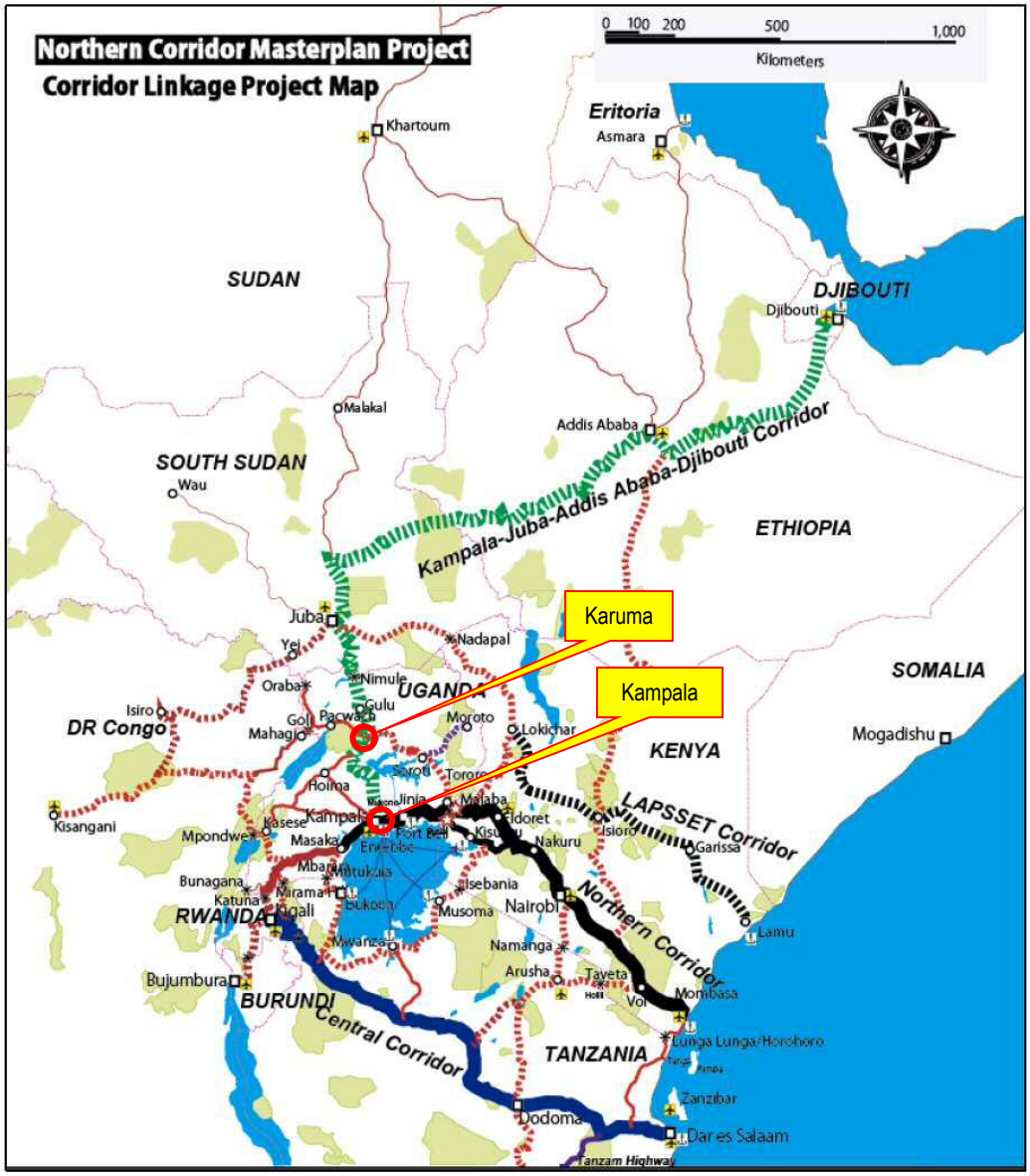
	2011		2022 Target		Long Term Target	
	Population	Ratio	Population	Ratio	Population	Ratio
KCCA	1,750,000	55%	2,850,000	49%	3,150,000	40%
KMTC	1,425,000	45%	3,000,000	51%	4,850,000	60%

Source：KPDP

(6) Master Plan on Logistics in Northern Economic Corridor

Master Plan on Logistics in Northern Economic Corridor was developed to formulate a Master Plan on Logistics for Northern Economic Corridor, along with integrated regional development strategy consistent with sub-regional development plans and national development plans, with 2030 as the target year in Kenya and Uganda according to JICA Study on March 2017.

Location map of Northern Corridor and other linked corridors such as Central Corridor and Kampala-Juba-Addis Ababa-Djibouti Corridor is shown in below. Karuma bridge is located on the Kampala-Juba-Addis Ababa-Djibouti Corridor.



Source : Master Plan on Logistics in Northern Economic Corridor, Report, JICA

Figure 2.1.1 Location Map of Northern Corridor Linkage Project

Population in Uganda is expected to increase to 55.1 million by 2030. The result of the projected population in Uganda is summarized in Table 2.1.16.

Table 2.1.16 Population Projection up to 2030 in Uganda

	2009 Census	2015 (Projection)	2020 (Projection)	2025 (Projection)	2030 (Projection)
Population (million)	34.9	35.8	40.5	47.1	55.1
Growth Rate (%)	-	2.58	2.47	2.94	3.35

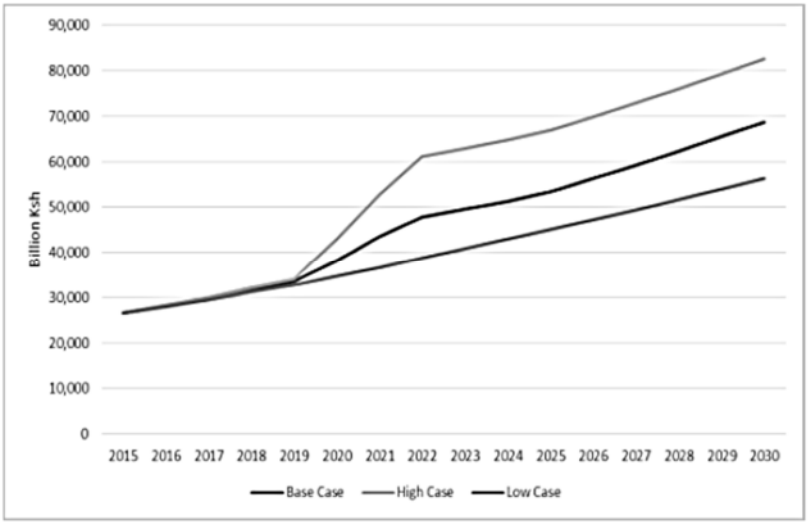
Source: Master Plan on Logistics in Northern Economic Corridor, Report, JICA

Uganda's economy is expected to grow by 5 to 6% in the medium term. It is assumed that oil production and refinery would commence from 2020 in base case scenario. However, crude oil export is not factored in the base case scenario due to the recent low oil price and uncertainty of oil pipeline through LAPSSET or Tanzania. In the high case scenario, both refined oil production and crude oil export are considered, which would significantly increase the real GDP at the beginning of oil production. On the other hand, it is assumed, in a low case scenario, that both refined oil production and crude oil export will not be materialized, as shown in Table 2.1.17 and Figure 2.1.2.

Table 2.1.17 GDP Projection in Uganda (2015-2030)

GDP/Sector	2015	2020	2025	2030
GDP growth (%, base case)	5.0	9.5	10.8	5.7
Agriculture (% of total)	13.4	10.0	7.1	8.2
Industry (% of total)	28.6	40.4	39.3	39.9
Service (% of total)	58.0	49.7	51.6	51.9

Source: Master Plan on Logistics in Northern Economic Corridor, Report, JICA



Source: Master Plan on Logistics in Northern Economic Corridor, Report, JICA

Figure 2.1.2 Projected GDP in Base, Low and High Cases (2015-2030)

(7) Multi Modal Urban Transport Master Plan

The Multi Modal Urban Transport Master plan for the GKMA was administered by the Government of Uganda through the Kampala Capital City Authority as part of phase 2 of the Kampala Institutional and Infrastructural Development Project (KIIDP). Funded by the World Bank, the project objective as stated in the terms of reference is "…to prepare a comprehensive, multi-modal transport master plan, which will lead to an environmentally friendly transport system and promote sustainable urban mobility to a level sufficient for a world class capital city".

Target year for multi modal urban transport master plan is year 2025 and year 2040.

The future land use scenarios' population characteristics in horizon years 2025 and 2040, for both KCCA and the GKMA are shown in Table 2.1.18.

Table 2.1.18 Future Land Use Scenarios' Population Characteristics

Scenario	Base	Physical Development Framework (PDF)		Realistic	
Year	2016	2025	2040	2025	2040
Total (in millions of residents)	4.14	6.51	9.42	6.95	9.42
KCCA (in millions of residents)	1.58	2.58	3.32	2.04	2.10
Rest of GKMA (in millions of residents)	2.55	3.93	6.10	4.91	7.32
% KCCA	38%	40%	35%	29%	22%
% GKMA	62%	60%	65%	71%	78%

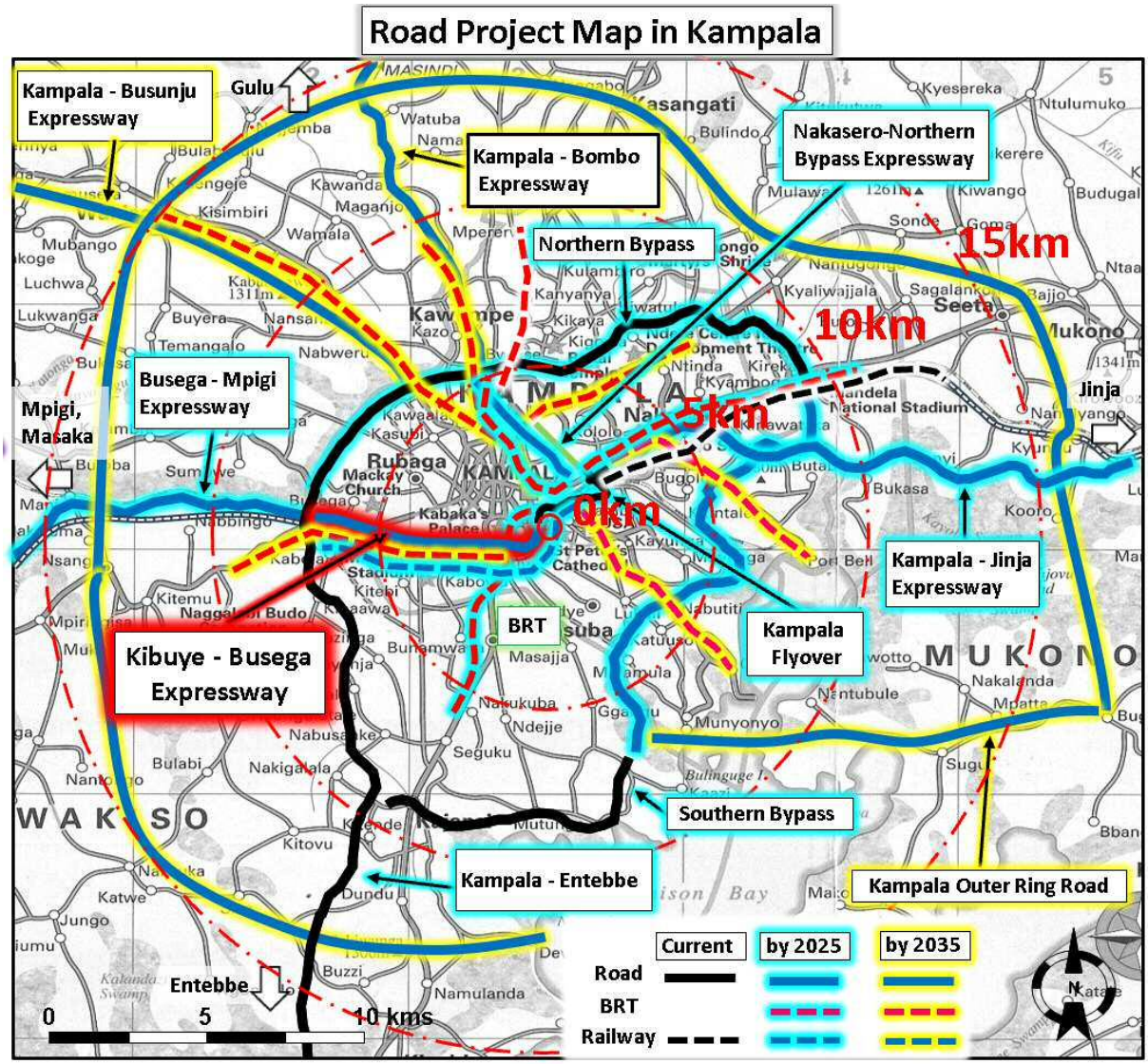
Source: Multi Modal Urban Transport Master Plan

2.2 Information of On-going Projects and Projects on Planning Stage

2.2.1 On-going and Planning Stage Projects related to Kibuye-Busega Expressway Project

(1) Road Sector

There are several on-going and planning stage projects related to Kibuye-Busega Expressway Project on road and public transport sector as shown in below.



Source: JST

Figure 2.2.1 On-going and Planning Staged Road Projects in Kampala

Table 2.2.1 On-going and Planning Staged Road Projects in Kampala

No.	Name of the Project	Status	Financing Institution	Remarks
R-1	Kampala Flyover Construction & Road Upgrading Project (KFCRUP)	Designs completed in 2017, works to commence in May 2019.	JICA	2&4lanes, L=4km
R-2	Nakasero-Northern Bypass Express Route (VVIP)	F/S and D/D completed by July 2018	Not yet determined	2&4lanes, L=4.08km

No.	Name of the Project	Status	Financing Institution	Remarks
R-3	Busega-Mpigi Expressway	Design completed, supervision consultant commence design review in Jan 2019,Construction work to commence by July 2019.	AfDB	4lanes, L-23km
R-4	Kampala-Entebbe Expressway	Works substantially completed. Toll collection to start within 2019.	China Exim Bank	4lanes, L=51km
R-5	Kampala-Jinja Expressway	Designs completed in 2014, under procurement for implementation as PPP. Works to commence in FY 2020/21	PPP, AFD, AfDB,	6 &8 lanes, L=77km
R-6	Widening of the Kampala Northern Bypass	Works ongoing	EU, EIB, GoU	From 2 to 4 lanes, L=17km
R-7	The Kampala Southern Bypass	Same status as Kampala-Jinja Expressway	PPP	4 lanes, L=18km
R-8	Kampala Outer Beltway	Design studies to be completed in June 2019, works to commence FY 2024/25	PPP	6 lanes, L=100km
R-9	Kampala-Bombo Expressway	Design studies to be completed in August 2019 works to commence FY 2024/25	PPP	4 lanes, L=32km
R-10	Kampala-Busunju Hoima Expressway	Design studies to commence in July 2019. Implementation to commence in FY 2029/30	PPP	4 lanes, L=56km
R-11	Widening of Masaka Road	Detailed engineering design was completed in 2016.	Not yet determined	
R-12	Kayemba-Katwe Tunnel	Detailed design completed January 2017	Not yet determined	

Source: Results of the hearing to UNRA engineer by JST on March 2019

A) Kampala Flyover Construction and Road Upgrading Project (KFCRUP)

This project employs flyovers at particularly congested major junctions, improves junctions such as Clock Tower Junction, Kitgum House Junction and widens existing road to improve and promote urban transportation in the centre of Kampala, the capital of Uganda, with the objective of improving the flow of goods and stimulating the economy in the Greater Kampala Metropolitan Area. The fund for this Project is from Japanese ODA loan.

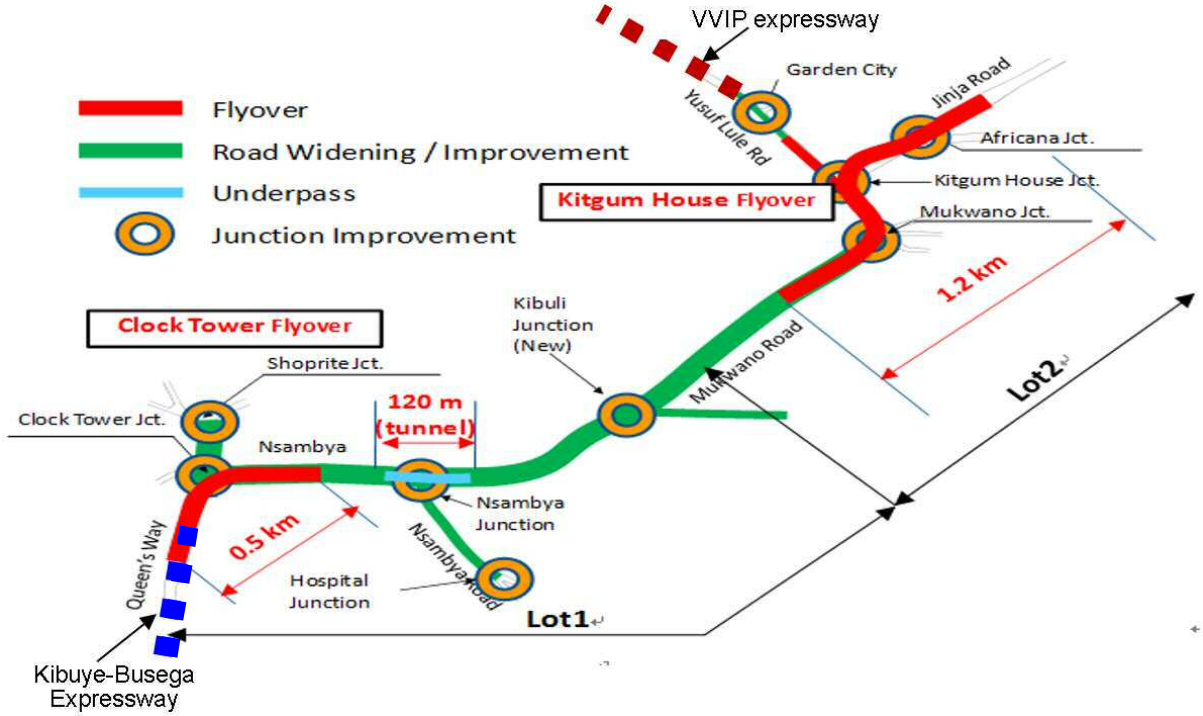
This Project consists of the following 2 Lots.Kibuye-Busega Expressway will join on Queen's way at the end point of the Kampala Flyover.

Table 2.2.2 Components of the KFCRUP

Lot	Lot1	Lot2
Flyover	- Construction of Clock Tower Flyover	- Construction of Kitgum House Flyover
Widening of Existing Road	- Widening of Nsambya Road - Widening of Nsambya and Mukwano Road	- Widening of Mukwano Road and Access Road
Improvement of Existing Road	- Improvement of Queen's Way	- Improvement of Jinja Road, Yusuf Lule Road and Nile Avenue

Lot	Lot1	Lot2
Improvement of Junction	- Improvement of Clock Tower Junction, Shoprite Junction - Improvement Nsambya Junction - Signalization of Kibuli Junction and Hospital Junction	- Improvement of Kitgum House Junction - Signalization of Mukwano Roundabout, Press House Junction, Africana Roundabout, and Garden City Roundabout
Construction of Underpass	- Construction of Underpass for Nsambya Junction	
Construction of pedestrian bridge	- Construction of Clock Tower Junction Pedestrian Bridge and Shoprite Junction, Pedestrian Bridge - Kibuli Junction Pedestrian Bridge	

Source: KFCRUP Report

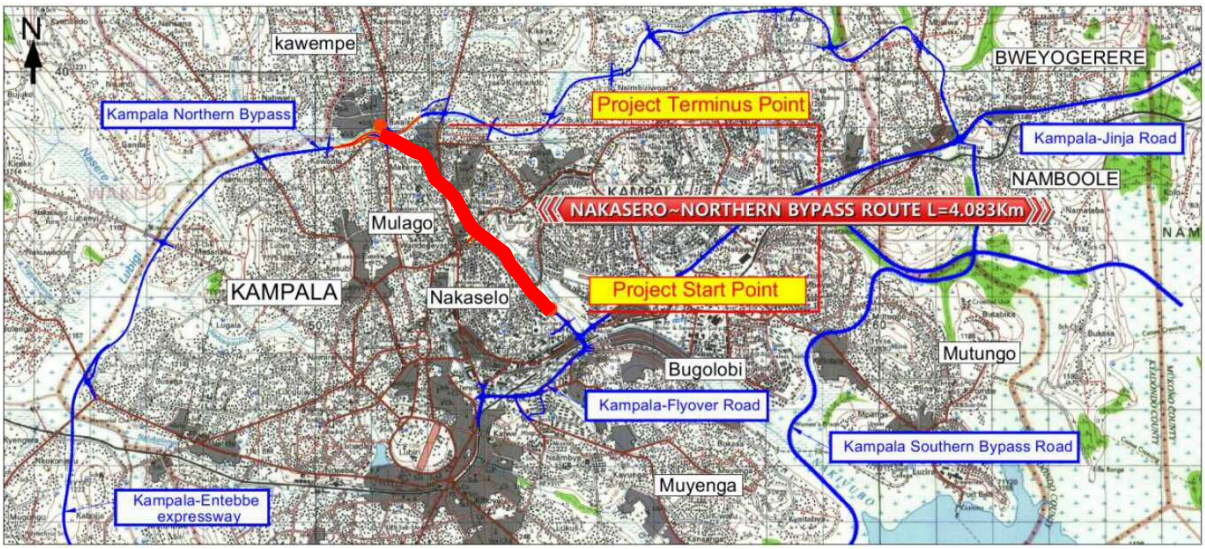


Source: KFCRUP

Figure 2.2.2 Summary of the KFCRUP

B) Nakasero – Northern Bypass Express Route (VVIP)

The proposed Nakasero - Northern Bypass Route (4.08km of main line) links the Kampala Northern Bypass with Nakasero through Bombo Road, Binaisa Road and Yusuf Lule road with connections to the Major hotels and conference centres within Nakasero area. The proposed Nakasero – Northern Bypass Route will also provide linkage with the Kampala Flyover Construction and Road Upgrading Project. F/S and D/D for VVIP were completed by July 2018 by Kunhwa Engineering & Consulting Co., Ltd. in association with Prome Consultants Ltd.
Location Map is shown in below.



Source: Final Feasibility and Preliminary Design Report, April 2018, UNRA

Figure 2.2.3 Location Map of VVIP

C) Kampala–Jinja Expressway

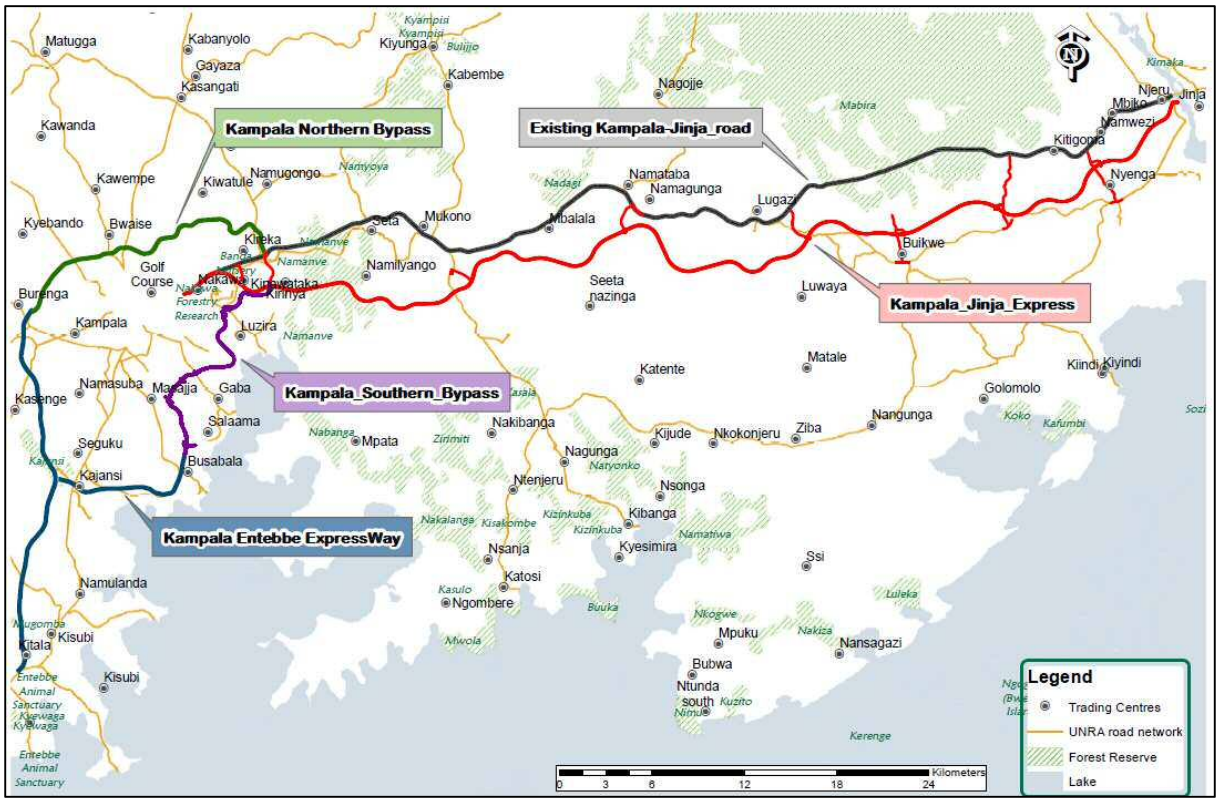
Kampala-Jinja Expressway (KJE) is one of five expressway projects in GKMA identified in the Vision 2040 and National Development Plan II as critical for the economic development of Uganda. In line with this aspiration, KJE was designed with a standard consistent with Government objectives and the country's expressway network. The expressways are being constructed to the same standard and together they will form a network that enables quick mobility of vehicles within and around Kampala and surrounding areas.

This Project is funded by AfDB, EU, AFD.

The base structure is to be implemented in two Lots as follows:

- Lot1: 35km of the Kampala-Jinja Mainline commencing at Kampala and terminating at Namagunga (Section 1) and the 18km Kampala Southern Bypass (Section 2), with Section 1 and Section 2 together being Lot1.
- Lot2: 41km of the Kampala – Jinja Mainline commencing at Namagunga and terminating at Jinja (Section 3).

This project will operate by 30 year availability-based design-build-finance-operate-maintain-and-transfer (DBFOMT) with a toll pass through to GoU.



Source: Kampala Jinja Expressway PPP Project Brief, UNRA, May 2018

Figure 2.2.4 Location Map of Kampala–Jinja Expressway, Southern Bypass, Northern Bypass and Kampala-Entebbe Expressway

D) Kampala-Entebbe Expressway

The Kampala-Entebbe Expressway is a 4 lane expressway (2 lane dual carriageway) supported by a loan from the China Exim Bank.

The Kampala-Entebbe Expressway is to be the 37.23 km of the road from Busega to Entebbe International Airport, 27km of which is limited access expressway with tolls at Busega, Kajjansi, and Mpala; Location Map of the Kampala-Entebbe Expressway is shown in Figure 2.2.4. Construction work for Kampala-Entebbe Expressway has been completed. Toll collection will start by year 2019.

E) Kampala Southern Bypass

The Southern Bypass is intended to provide a section of high standard road which, in conjunction with the forthcoming Kampala-Entebbe expressway project, will provide a complete bypass of the southern zone of Kampala city. Indeed, together with the Northern Bypass, and its upcoming improvements, the entire structure will form a complete city outer ring road.

Kampala Southern Bypass is to be the 14.13 km of the road from Kajjansi to Munyonyo through Lweza.

The commencement of the Southern Bypass project will be in the vicinity of Butabika, in the eastern outskirts of Kampala, where it will connect with the New Kampala-Jinja Road. The objective of the proposed roadway is to connect, in the vicinity of Munyonyo, with the forthcoming new Kampala-Entebbe road via a spur road which will be a component of that project. Location Map of the Proposed Kampala Southern Bypass is shown in Figure 2.2.4.

F) Kampala Northern Bypass

Kampala Northern Bypass which has length of approximately 22km connected west-east axis between Kampala Jinja Expressway and Busega Mpigi Expressway and passed through northern part of city center of Kampala opened to traffic by 2lanes carriageway on October 2009. Kampala Northern Bypass Project was funded by EU and Government of Uganda.

Widening from 2lanes to 4lanes carriageway of Kampala Northern Bypass for its entire length is ongoing funded by EU, European Investment Bank and Government of Uganda.

Location Map of the Kampala Northern Bypass is shown in Figure 2.2.5

G) Busega-Mpigi Expressway

Busega-Mpigi Expressway project is 23km 4 lanes expressway construction project funded by African Development Bank. Design stage was completed, and supervision consultant were commenced design review in Jan 2019, Construction work will be commenced by July 2019, according to the communication from UNRA engineer on March 2019.

H) Kampala-Bombo Expressway

Kampala-Bombo Expressway is approximately 32km 4 lanes expressway connecting the town of Bombo to central Kampala. According to the communication from UNRA engineer on March 2019, design studies will be completed in August 2019 and construction works will commence on FY 2024/25.

I) Kampala Outer Beltway

Kampala Outer Beltway is 100km road linking through Ggaba, Mukono, Seeta, Namugongo, Kira, Kasangati, Mutugga, Wakiso, Buloba and Nsangi. Ring roads funnel traffic out of the city center and benefit long distance trips with an emphasis on freight. Ring roads also create urban sprawl, allowing the city to continue to expand within and outside of the roadway which is a negative development for the region. According to the communication from UNRA engineer on March 2019, design studies will be completed in June 2019, and construction works will commence on FY 2024/25.

J) Kampala-Busunju Expressway

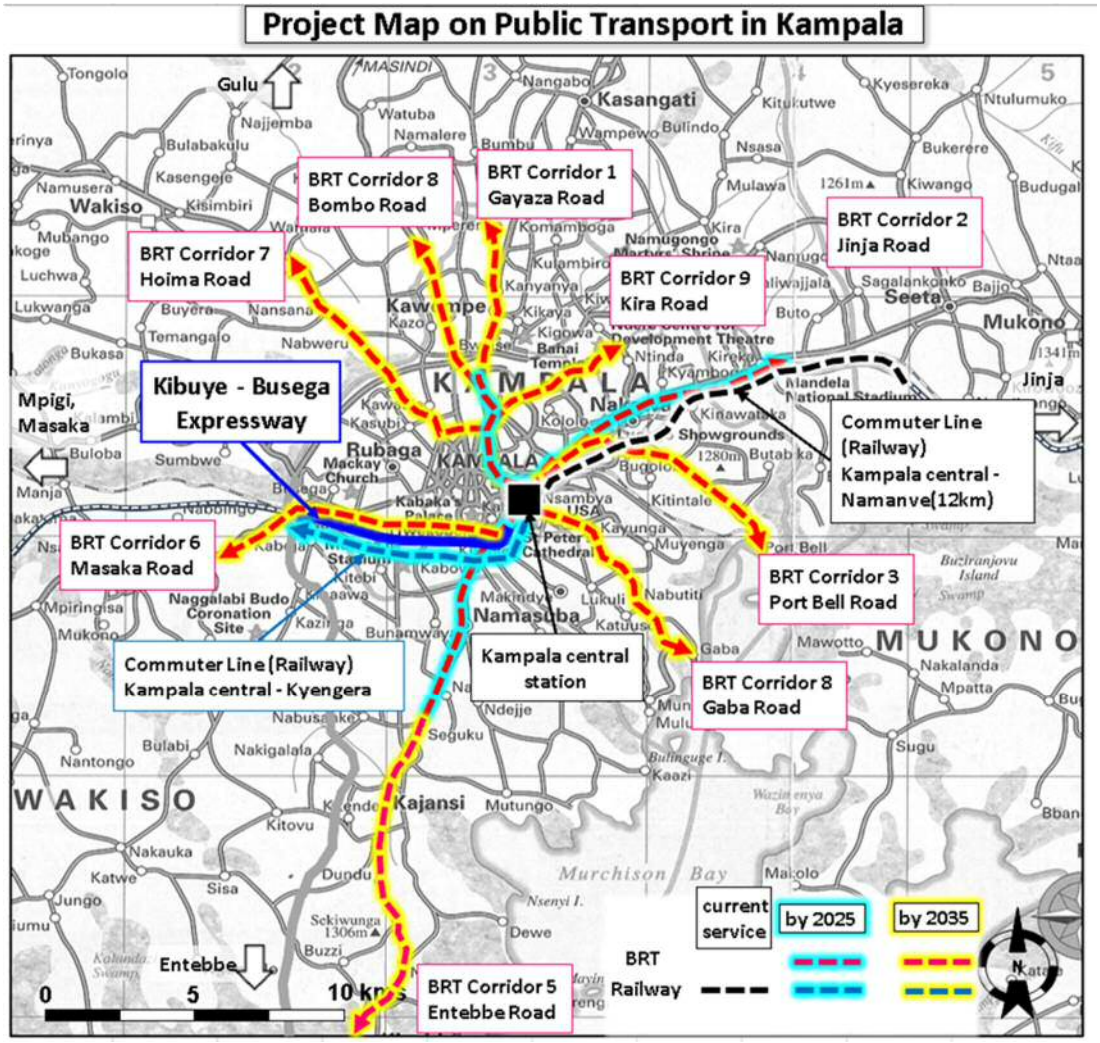
Kampala-Bujunju Expressway is 56km expressway connecting Kampala with the Busunju area. This road will replace the poor-quality existing Hoima-Kampala Road with a focus on increased mobility and improved safety. According to the hearing to UNRA engineer on March 2019, design studies will commence in July 2019. Implementation of Kampala-Busunju Expressway will commence in FY 2029/30.

(2) Public Transport Sector

Table 2.2.3 Ongoing and Planning Staged Projects on Public Transport Sector

No.	Project	Status
T-1	Kampala BRT (Bus Rapid Transit) Pilot Project	Designs completed in 2014, implementation pending for availability of funds.
T-2	Kampala BRT Project	9 corridor BRT routes planned by World Bank project
T-3	URC Commuter Train Service	Kampala – Namanve (L=12km) commuter train service started from 2018 Kampala – Kyengera (L=10km) commuter train service starts by 2022
T-4	Standard Gauge Railway Project	No detailed implementation plan after Kampala Central Station.
T-5	Kampala LRT Project	7 LRT routes proposed on MMUTMP. Operation of LRT 4 (Busega-Port Bell) will be expected after 2036. Operation of LRT 5 (Kira-Ggaba) will be expected after 2031. There are no detailed operation plans for other LRT lines.

Source: Results of the Interviews to World Bank, URC and SGR Project office by JST



Source: Results of the Interviews to World Bank, URC and SGR Project office by JST

Figure 2.2.5 Location Map of On-going and Planning Stage Projects on Public Transport Sector

Table 2.2.4 List of Public Transport Services in Kampala

Proposed BRT Operation										
BRT Network No.		1	2	3	4	5	6	7	8	Pilot Project
From-To		Kireka-Kanyana	Zana-Kireka	Zana-Bwaise	Port Bell-Kira	Kireka-Kawempe	Natete-Nabweru	Gaba-Nabweru	Zana-Kawempe	
Corridor-1	Kanyana Terminal	✔		✔						✔ (from Bwaise Terminal)
Corridor-2	Kireka Terminal	✔	✔			✔				✔ (from Kireka Terminal)
Corridor-3	Port Bell Terminal				✔					
Corridor-4	Gaba Terminal							✔		
Corridor-5	Zana Terminal		✔	✔						✔ (from Zana Terminal)
Corridor-6	Natete Terminal						✔			
Corridor-7	Nabweru Terminal						✔	✔		
Corridor-8	Kawempe Terminal					✔				
Corridor-9	Kira Terminal				✔					

Table 2.2.5 Commuter Railway Services Operated by URC

Commuter Railway Services operated by URC		
Commuter Railway Service	From	To
	Kampala Central Station	Namanve
	Kampala Central Station	Kyengera

A) BRT

MoWT plans to introduce a Bus Rapid Transit (BRT) system in the Greater Kampala Metropolitan Area (GKMA) to meet the growing demand for mobility. The World Bank, EU and AFD are considering financing the project by means of a loan.

The pilot phase (phase A) will focus on the implementation of the BRT corridors on Jinja Road, Gayaza Road and Entebbe Road. Phase B1 will comprise the extension of the Entebbe BRT corridor up to Kajjansi in parallel with Phase B2 for the BRT corridors on Port Bell Road and Kira Road as well as the BRT corridor on Yusufu Lule Road. Phase C1 will comprise the extension of the BRT in the northern direction along Gayaza Road and Bombo Road and Phase C2 will finalise the full BRT system with the BRT corridors on Masaka Road, Hoima Road and Gaba Road.

The proposed phasing of the BRT Network implementation is summarised in Table 2.2.6.

Proposed BRT full network corridors are shown in Figure 2.2.6.

Table 2.2.6 List of Proposed BRT Corridors

BRT Corridor		Implementation Phase				
		pilot	B1	B2	C1	C2
1A	Gayaza Road short	✔				
1B	Gayaza Road extended				✔	
2	Jinja Road	✔				
3	Port Bell Road			✔		
4	Gaba Road				✔	
5A	Entebbe Road short	✔				
5B	Entebbe Road extended		✔			
6	Masaka Road					✔
7	Hoima Road					✔
8	Bombo Road				✔	
9	Kira Road			✔		
10	Yusuf Lule Road			✔		

Source: Bus Rapid Transit for Greater Kampala Final Report, 18 October 2014, ROM, ARUP & AHC

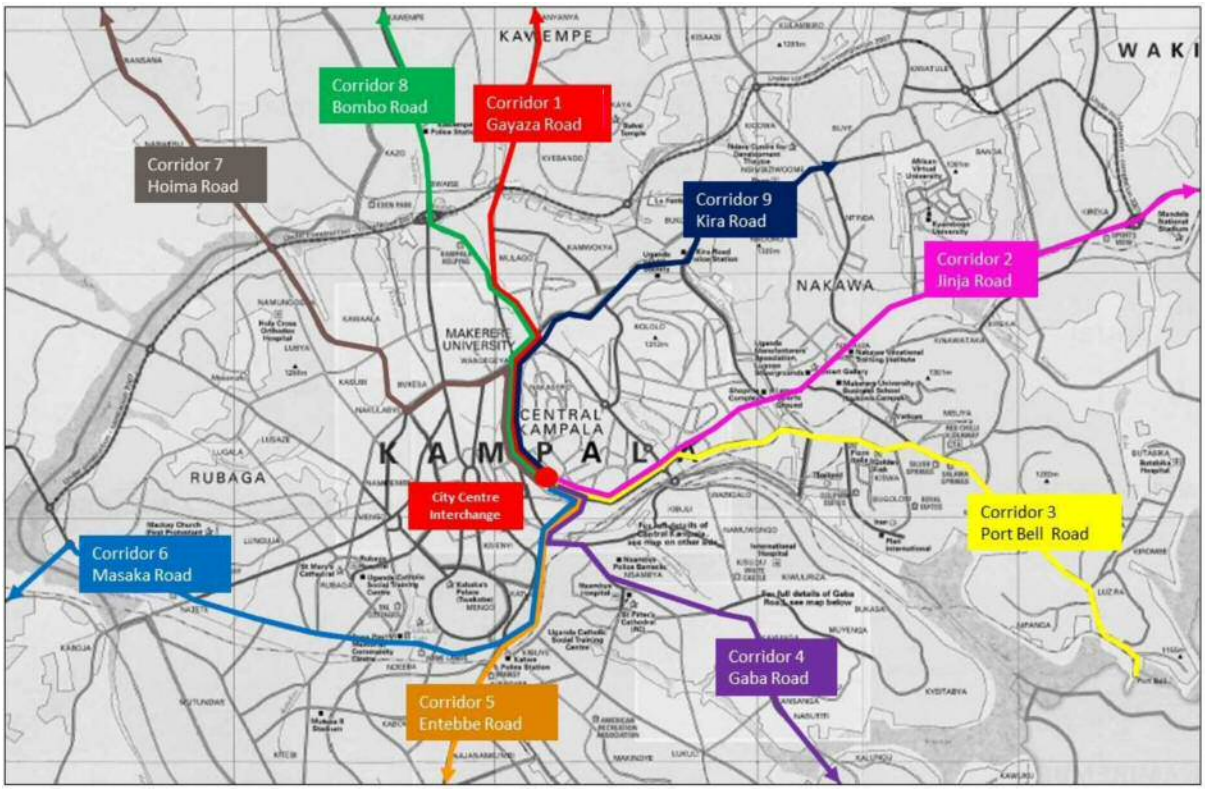


Figure 2.2.6 Proposed BRT Full Network Corridors

Source: Bus Rapid Transit for Greater Kampala Final Report, 18 October 2014, ROM, ARUP & AHC

Based on the projected future BRT corridors a blueprint has developed of a possible future BRT route network. The starting points for the network are as follows.

- route sections with more or less same passengers demand are combined to one line
- spreading of lines between Kampala Road and the Yusufu Lule Road
- providing convenient transfers between lines, where possible at the same station platform

The projected network consists of 7 BRT lines. An additional 8th line (Zana - Kawempe) can be added if demand is justified. The network is presented in Figure 2.2.7 and Table 2.2.7.

It should be noted that the route network is only presented as a sketch of a possible network. Different options can be considered. For now priority should be given to the development of the BRT Pilot Project. Based on the experiences gained with the operation of the BRT Pilot Project the route network can be further developed. The network development will be also dependent of the phasing of construction of BRT infrastructure as well as general infrastructure in Greater Kampala.

Source: Bus Rapid Transit for Greater Kampala Final Report, 18 October 2014, ROM, ARUP & AHC

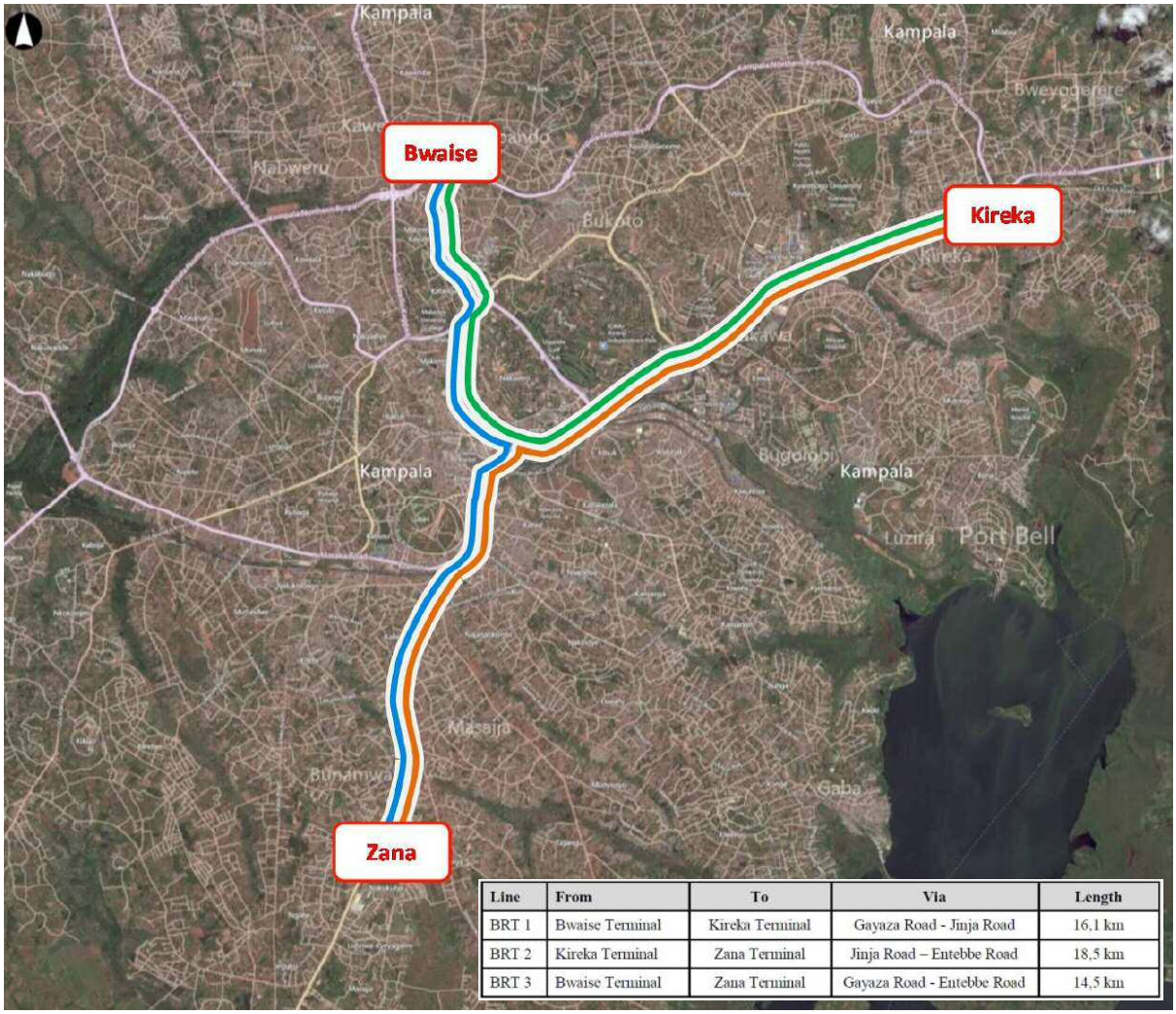
Figure 2.2.7 Future BRT Network Routes

Table 2.2.7 List of future BRT Network Routes

Line No.	From	To	Via		
			City Squire	Railway Station	Yusufu Lule Road
BRT 1	Kireka	Kanyana	✔	✔	
BRT 2	Zana	Kireka		✔	
BRT 3	Zana	Bwaise		✔	✔
BRT 4	Port Bell	Kira	✔	✔	
BRT 5	Kireka	Kawempe			✔
BRT 6	Natete	Nabweru	✔		
BRT 7	Gab a	Nabweru		✔	✔
BRT 8 (optional)	Zana	Kawemp	✔		

Source: Bus Rapid Transit for Greater Kampala Final Report, 18 October 2014, ROM, ARUP & AHC

The Y-shaped BRT pilot corridor will be served by three BRT lines. Each terminal and each branch will be served by 2 BRT lines. Since pilot phase (phase A) of the BRT runs along Gayaza road and Binaisa road, with the BRT corridor of phase A coinciding in part with the Nakasero – Northern Bypass Route. Given the magnitude of BRT and its 100m long stations, it would be difficult to plan the Nakasero – Northern Bypass Route on the same road without intruding into the proposed BRT corridor. The Consultant plans alignment options to minimize the impact of the BRT onto the Nakasero – Northern Bypass Route Project or vice versa. Pilot Project Routes are shown in Figure 2.2.8.



Source: Bus Rapid Transit for Greater Kampala Final Report, 18 October 2014, ROM, ARUP & AHC

Figure 2.2.8 BRT Pilot Project Route

B) LRT

There are 7 LRT routes proposed on the Multi-Modal Urban Transport Master Plan for Greater Kampala Metropolitan Area (GKMA) as shown in Table 2.2.8.LRT route map for LRT4,5,7 is shown in Figure 2.2.9.

However, regarding LRT4 along Masaka Road, the operation service of LRT4 along Masaka Road is not very feasible, because commuter passenger service by URC will be started by 2022, according to the interview to the engineer of World Bank,

Table 2.2.8 List of LRT Routes

No.	From	To	Length(km)
LRT1	Mukono	Kajjansi	35
LRT2	Mukono	Wakiso	44
LRT3	Kajjansi	Wakiso	34
LRT4	Busega	Port Bell	21
LRT5	Kira	Ggaba	24
LRT6	Kawempe	Ggaba	19
LRT7	Ggaba	Namboole	55

Source: Multi-Modal Urban Transport Master Plan for Greater Kampala Metropolitan Area (GKMA) Draft Final Report following Stakeholder Comments, 9 May 2018, ROM, Cambridge, TNM

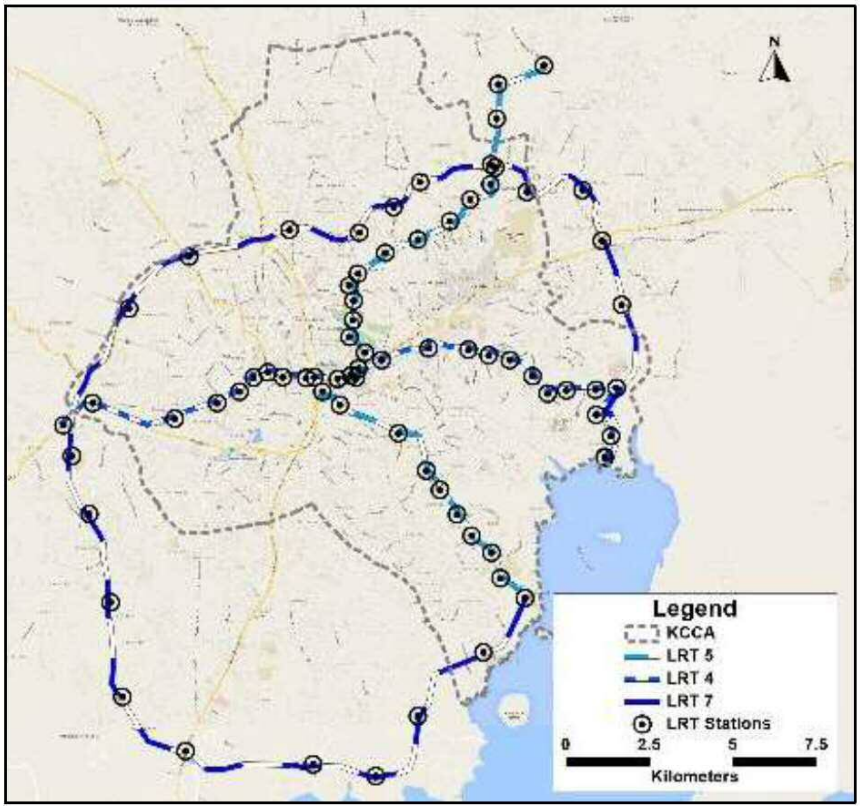


Figure 2.2.9 LRT Route Map

Source: KMMUTMP

C) URC Commuter Train Service

After reclaiming management of railway business from Rift Valley Railways (RVR), URC re-launched Commuter train service from February 26, 2018 from Kampala Central Terminal to Namanve railway station located 12km east of the capital. This commuter service is to be operated on existing meter gauge railway (MGR) line by trains with capacity of 1,000 passengers per trip, in morning and evening service. Train stops at Kampala, Nakawa, Kireka, Namboole and Namanve.

Studies by EU for passenger service suggested an extension of approx. 27km from Kampala Central Terminal to Kyengera and further west. This passenger service will be started by 2022.

Table 2.2.9 Kampala Commuter Train Time Table

Trip	Origin	Departure Time	Destination	Arrival Time
Morning	Namanve Station	6.30am	Kampala Station	7.20am
Afternoon	Kampala Station	5.30pm	Namanve Station	6.15pm

Source: URC

D) Standard Gauge Railway Project (SGR)

The Government of Uganda has proposed to implement a major SGR Project between Malaba and Kampala Central Station that will cost an estimated USD 2.3 bn.. within the next few years. The SGR Project is procured under an EPC/Turnkey contract with expected funding from China Exim Bank. Along the Western Route (Kampala-Kasese), in most areas, the SGR will share a corridor with the existing MGR with potential corridor widening in some areas.

On the other hand, there are no detailed implementation plan for the SGR after Kampala Central Station.

According to the comments from URC engineer, road alignment shall be determined so as not to affect the Right of way for the Railway whose width is 60m in total and the SGR planned structure clearance of 8m from top of the rail.

(3) Other Infrastructure Projects

Other infrastructure projects related to Kibuye-Busega Expressway project are shown in Table 2.2.10.

Table 2.2.10 Ongoing and Planning Projects on Other Infrastructure Sector

No.	Name of the Project	Status
O-1	Bukasa Inland Port Project	Dredging to commence July 2019
O-2	The Nalukolongo Channel Widening Project	D/D study completed

Source: JST

2.2.2 On-going and Planning Projects related to New Karuma Bridge Project

Karuma Hydropower Project

The 600MW Karuma Hydropower Project is located on the Nile River in Kiryandongo District in mid-northern Uganda, 110 km downstream of Lake Kyoga and approx. 250km downstream of Lake Victoria. The project is expected to be operational by the end of 2019 making it the largest power generator in Uganda.

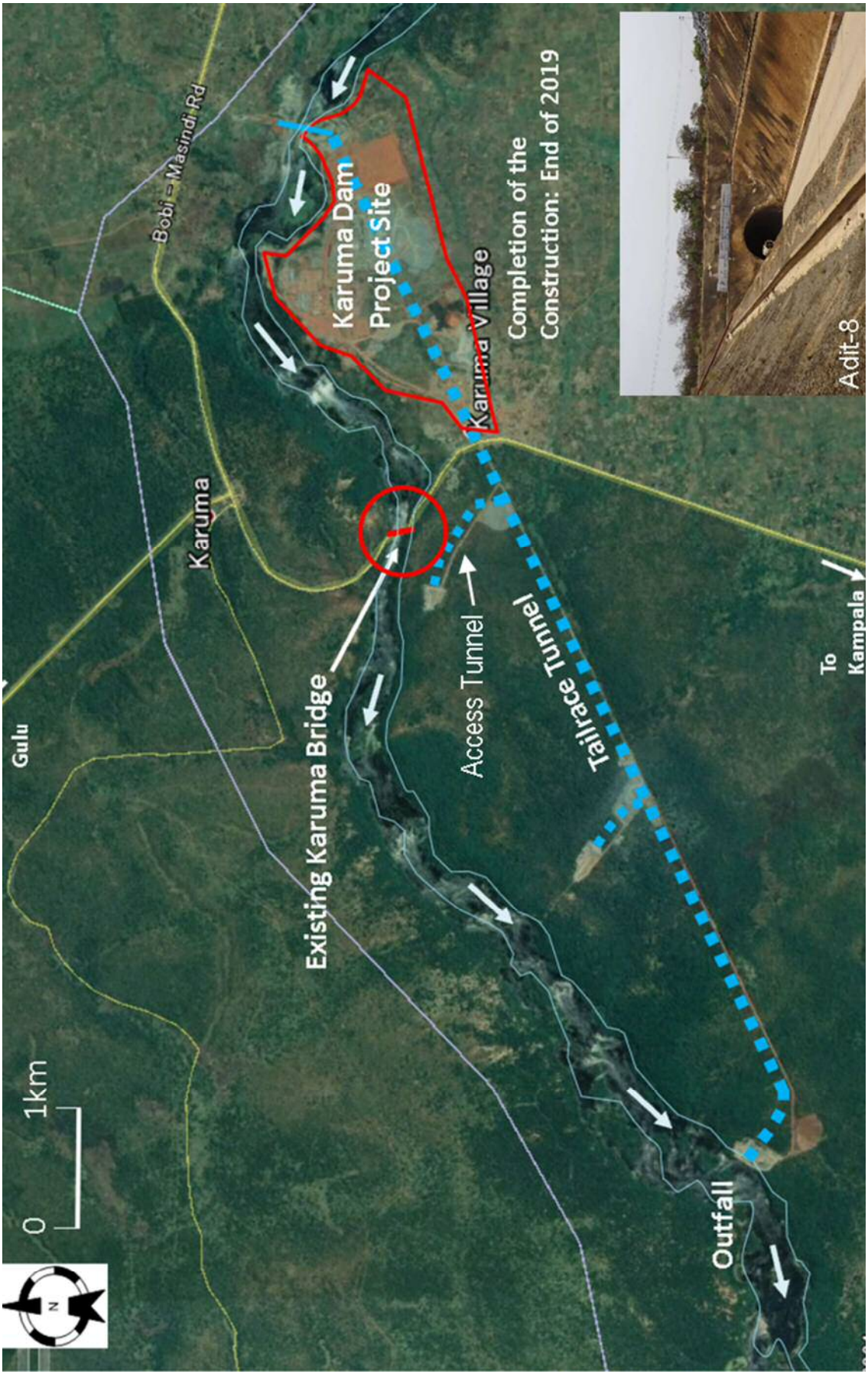
The facilities of the Dam consist of:

- 9 of 10 m wide by 8 m high spillway radial gates;
- 2 of 3 m wide by 4 m high flushing sluices fitted with radial gates;
- 1 of 12 m wide by 4 m high trash flushing sluice fitted with a vertical lift gate;
- 1 of 10 m wide by 5 m high ecological flow sluice; and
- 2 fish ladder gates.

Location map is shown in Figure 2.2.10 below.

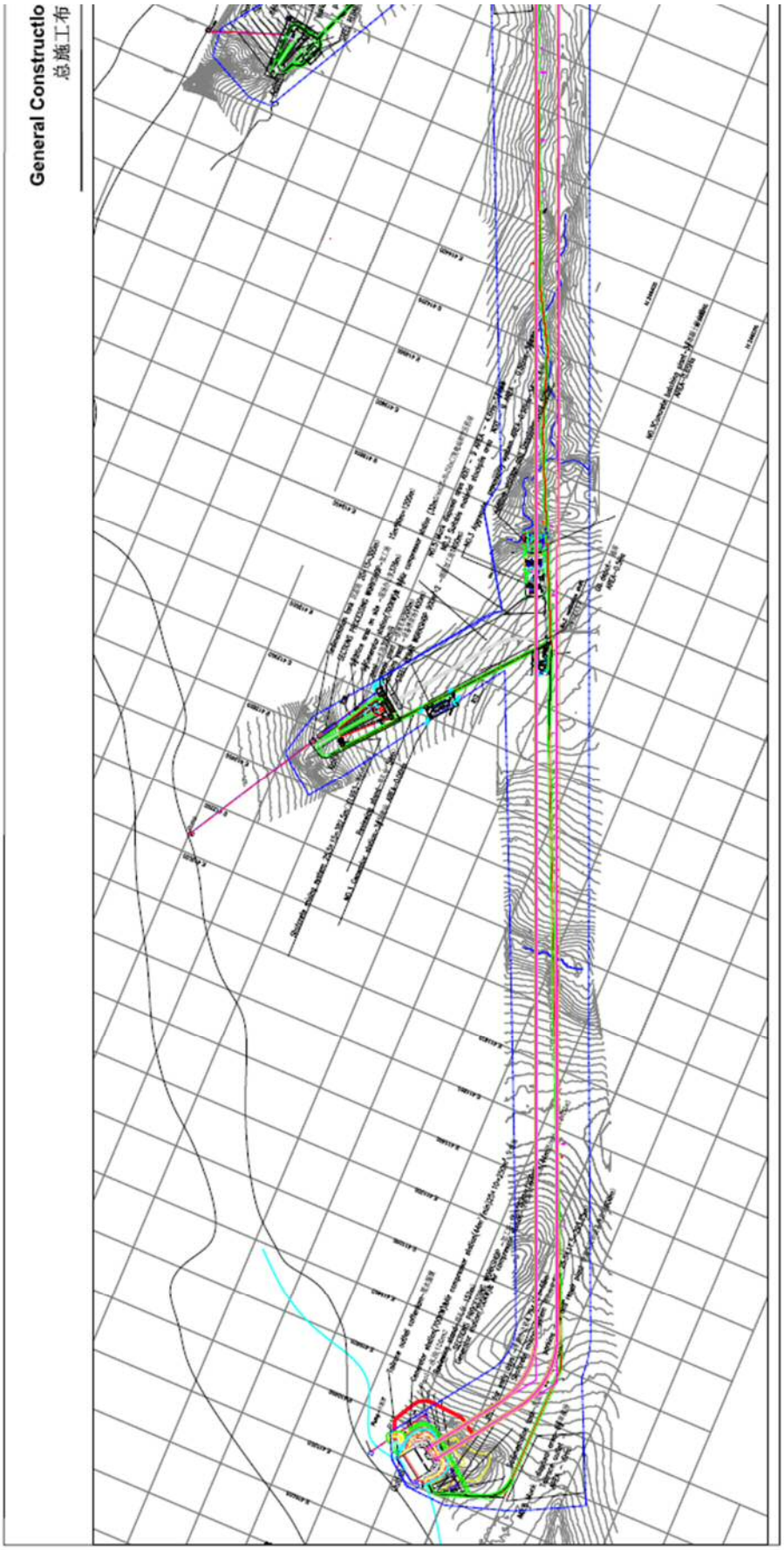
There is tailrace tunnel installed from power station to downstream as shown in the following figure.

Adit for access tunnel is located close to the alignment of new Karuma Bridge. According to a UEGCL engineer in Karuma, access tunnel only has temporary use during the construction of tailrace tunnel, and is not a permanent structure due to its lack of strength at the time of construction. For the above-mentioned reasons, proposed alignment of New Karuma Bridge should be kept away from the existing adit for access tunnel.



Source: JICA Survey Team

Figure 2.2.10 Karuma Hydropower Project Location Map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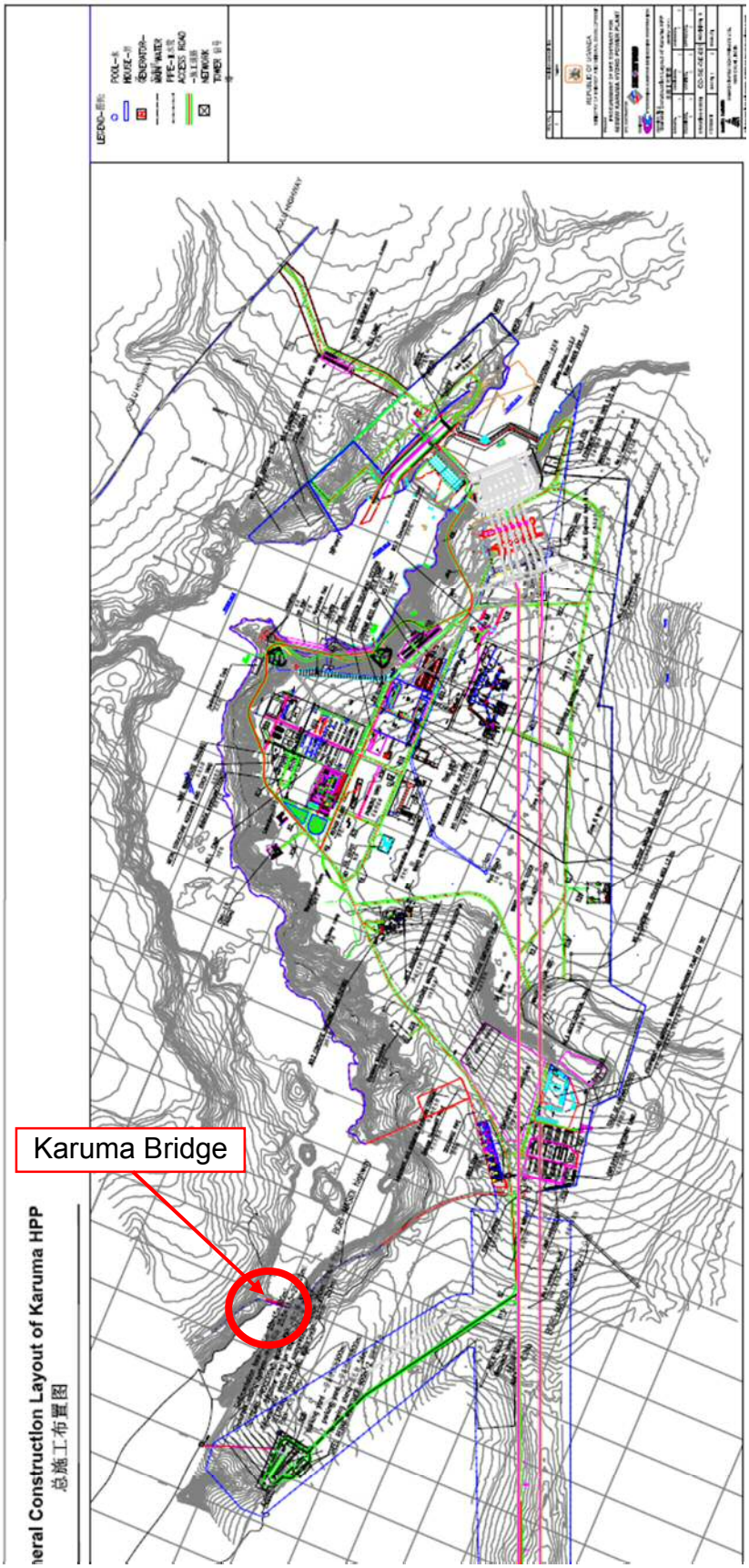


Source: UEGCL

Figure 2.2.11 General Construction Layout of Karuma Hydropower Project

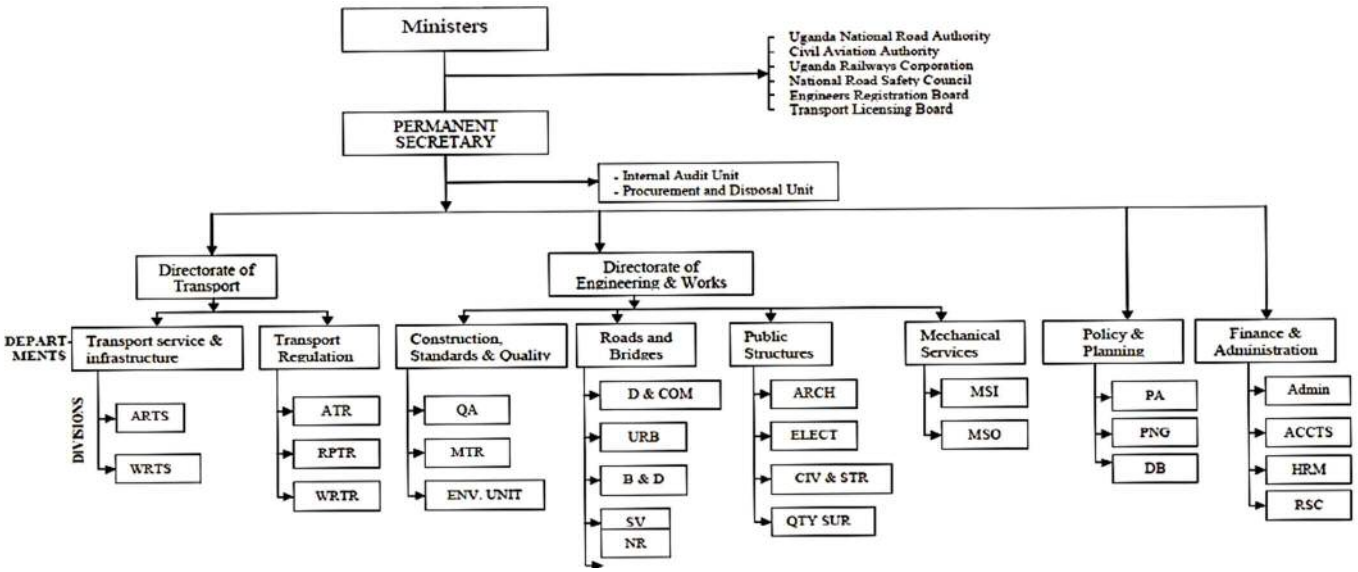
2.3 Review of Administration on Urban Transport and Road/Bridge Sector

(1) Ministry of Works and Transport (MoWT)

MoWT is engaged in monitoring and provisioning of transport infrastructure support functions, regulatory functions and research activities related to roads, rail, water or air transport & other engineering works. Key functions are shown below:

- Initiate, formulate and develop National Policies, Plans and Programmes for safe and efficient Public Transport Infrastructure and Services.
- Monitor and Evaluate the Implementation of National Policies, Plans and Programmes for safe and efficient Works, Public Transport Physical Infrastructure and Services.
- Initiate new and review existing Laws and Regulations on Works and Transport Infrastructure and Services.
- Set standards for the construction industry, transport infrastructure and services.
- Enforce compliance to national policies, laws regulations and guidelines on Works and Transport Infrastructure and Services.
- Monitoring and Evaluation of the performance of Transport Agencies.
- Inspect and license Public Transport Vehicles.
- Provide technical support for contract work, including construction and maintenance undertaken by other Government Ministries, Departments and Agencies (MDAs).
- Initiate and formulate plans and policies for management of public buildings.
- Set and monitor national standards on public buildings.
- Carry out research and develop local materials and technology for construction industry.

Organization structure of MoWT show in below.



Transport Services	Transport Regulation	Roads and Bridges	Public Structures	Policy & Planning
ARTS - Air & Road Transport Services WRTS- Water & Rail Transport Services	ATR - Air Transport Regulation RPTR - Roads & Pipeline Transport Regulation WRTD - Water & Rail Transport Regulation	D & COM - District & Comm. Roads URB - Urban Road SV - Surveying Section NR - National Roads	ARCH - Architecture ELECTR - Electrical engineering CIV & STR - Civil Structural eng. QTY SUR - Quality Surveying	PA - Policy Analysis PNG - Transport & Works Planning DB - Data Base Section
	Construction Standard and Quality Management QA - Quality Assurance MTR - Material Test & Research ENV. UNIT - Environment Unit	Mechanical Services MSI - Mechanical Services Inspection MSO - Mechanical Services Operations		Finance & Administration Admin - Administration HRM - Human Resource Management RSC - Resource Centre

Source: Ministerial Budget Policy Statement in FY2016/2017, March 2017

Figure 2.3.1 Organization Structure of MoWT

According to the Ministerial Budget Policy Statement in FY2016/2017, March 2017, there were 88 staff in Roads and Bridges department.

Table 2.3.1 MoWT Financial Performance FY2017/18

Expenditure Category / Item		Approved (Bn UGX)	Released (Bn UGX)	Spent (Bn UGX)	% Released	% Release Spent
Recurrent	Wage	9.182	9.182	9.149	100.0%	99.6%
	Non Wage	60.715	83.882	83.483	138.2%	99.7%
Development	GoU	154.299	150.584	150.492	97.6%	99.9%
	Ext. Financing	236.564	76.884	76.884	32.5%	100.0%
	Total GoU	224.197	243.648	243.300	108.7%	99.9%
	Total GoU + Donor	460.760	320.533	320.185	69.6%	99.9%

Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

Table 2.3.2 Physical Performance for FY 2017/18 – National Roads

S/N	Works Category	FY 2016/17	FY 2017/18			
		Achieved Quantity	Planned Quantity	Financed Quantity	Achieved Quantity	% of Financed Q'ty Achieved
1	Routine Maintenance					
	Manual (km)	15,584	16,847	16,847	16,783	99.60%
	Mechanized (km)	20,687	13,258	13,258	16,512	124.50%
2	Periodic Maintenance					
	Paved (km)	45.6	11	11	-	0%
	Unpaved (km)	1,112.3	588	588	1,564	266%
3	Bridges					
	Routine (No)	79	345	345	131	38%
	Periodic (No)	-	-	-	-	-
4	O&M of weighbridges	8	12	12	12	100%
5	O&M of ferries	7	13	13	13	100%

Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

Table 2.3.3 Physical Performance for FY 2017/18 – City Roads

S/N	Works Category	FY2016/17			FY 2017/18			
		Planned Quantity	Financed Quantity	Achieved Quantity	Planned Quantity	Financed Quantity	Achieved Quantity	% of Financed Q'ty Achieved
1	Routine Maintenance							
	Manual (km)							
2	Mechanized (km)	860	860	877	880	880	1,104	125.50%
	Periodic Maintenance							
	Paved (km)	4.9	4.0	2.0	3.7	3.7	2.8	75.70%
	Unpaved (km)	-	-	-	-	-	-	-

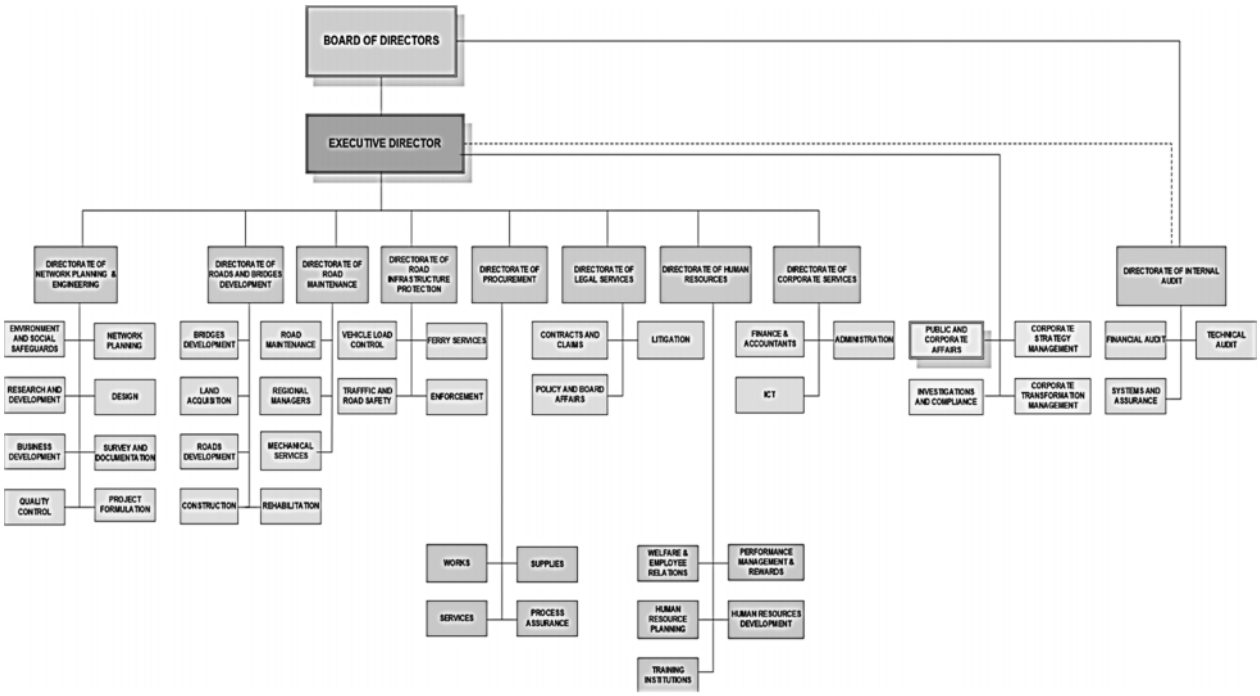
Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

(2) Uganda National Roads Authority (UNRA)

UNRA is a government agency mandated to develop and maintain the national roads network, advise the government on general roads policy, contribute to addressing national transport concerns, and perform other related functions. UNRA is charged with, among other things, the selection of contractors, the supervision of construction, the scheduling of maintenance, and the prioritization of national road works.

UNRA was established in 2006 by parliamentary enactment of the Uganda National Roads Authority Act. UNRA became fully operational on July 1st 2008.

The main source of funding comes from Project-based Donor Funds such as AfDB, EU, World Bank, Arab Bank for Economic Development in Africa: BADEA, JICA and China EXIM Bank, and subsidy by the Government of Uganda and Uganda Road Fund (URF). Organization structure of UNRA is shown in Figure 2.3.2.



Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

Figure 2.3.2 Organization Structure of UNRA

UNRA financial performance in FY 2017/18 is shown in Table 2.3.4.

Table 2.3.4 UNRA Financial Performance FY2017/18

		Approved Budget	Released Budget	Budget Spent	% Budget Released	% Budget Spent	% Release Spent
Recurrent	Wage	71.105	71.105	71.100	100.0%	100.0%	100.0%
	Non-Wage	29.140	22.842	22.764	78.4%	78.1%	99.7%
Road Development	GOU	1,517.800	1,532.800	1,532.800	101.0%	101.1%	100.0%
	Ext. Financing	1,971.542	907.499	457.386	46.0%	23.2%	50.4%
Total	GOU	1,618.045	1,626.747	1,626.506	100.5%	100.5%	100.0%
	GOU+Ext. Financing	3,589.588	2,534.546	2,083.892	70.6%	58.1%	82.2%
	Arrears	31.350	31.350	31.350	100.0%	100.0%	100.0%
	Road M'tce	267.900	267.900	265.010	100.0%	100.0%	98.9%

Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

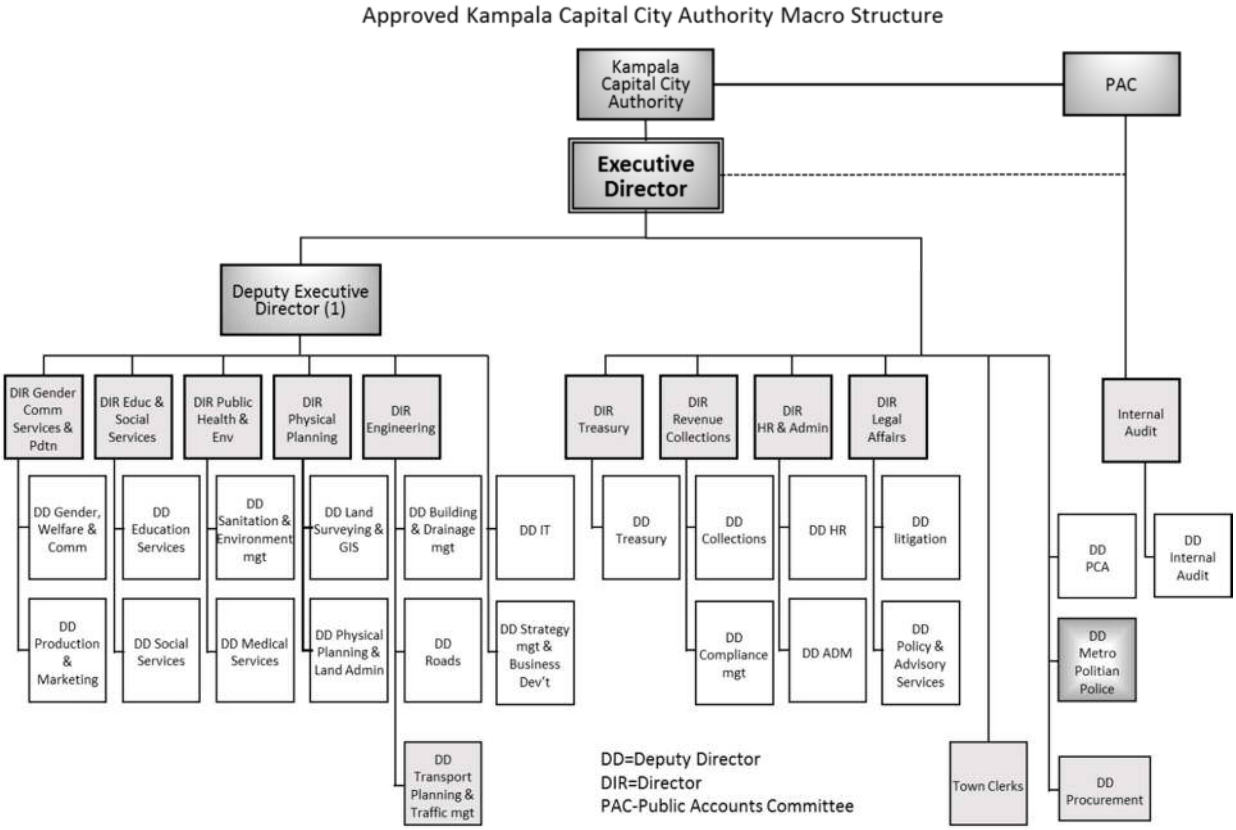
(3) Kampala Capital City Authority (KCCA)

Kampala Capital City Authority (KCCA) is the governing body of the Capital City and administers Capital City affairs on behalf of the central government.

Kampala is divided into five divisions, each headed by a popularly elected mayor. There are 1,332 engineers in KCCA.

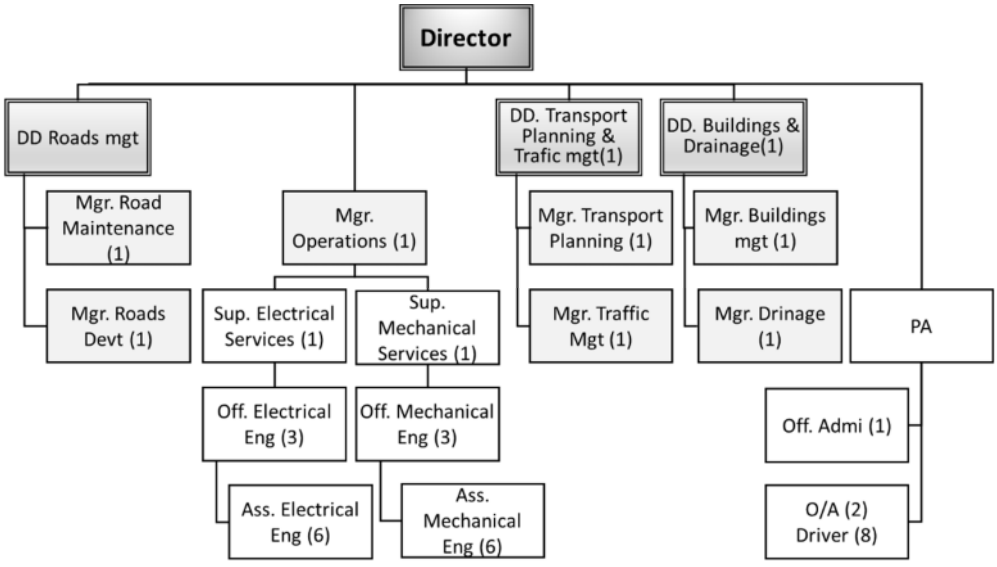
Organization structure of KCCA is shown in Figure 2.3.3.

Main activities of the Directorate of Engineering & Technical Service (DoETS) are to make plans for public transport, and road infrastructures including operation and maintenance, and to implement the road transport projects. Organization structure of KCCA is shown Figure 2.3.4.



Source: KCCA

Figure 2.3.3 KCCA Organization Structure



Source: KCCA

Figure 2.3.4 Organization Structure of Directorate of Engineering & Technical Service (DoETS)

Directorate of Engineering and Technical Services budget performance for FY 2017/18 is shown in Table 2.3.5. According to the report on 14th Joint Transport Sector review Workshop Presentations on September 27th-28th 2018, Kampala City has 2,110km of roads, of which only 599 km (28.3%) is paved and 1,511km (71.3%) is unpaved.

Table 2.3.5 KCCA Financial Performance FY2017/18

Directorate of Engineering and Technical Services Budget Performance for FY 2017/18 (UGX BN)					
Budget Item	Approved Budget	Released Budget	Total Expenditure	Unspent Balances	Absorption (%)
GOU	84.900	84.420	83.813	0.611	99%
NTR	2.286	0.230	0.228	0.002	99%
KIIDP2 Grant	172.790	99.250	47.694	51.560	48%
Grand Total	259.976	183.900	131.734	52.173	72%

Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

(4) Uganda Railway Corporation (URC)

URC is the parastatal railway of Uganda which is a corporate body reporting to the Ministry of Works and Transport. Mandate to URC is construction, operation and maintenance of railway, marine and road services both in and outside Uganda, for the carriage of passengers and goods.

In February 2015, Rift Valley Railways (RVR), in collaboration with KCCA, began testing commuter train service in Kampala and its suburbs, with a view to establish regular scheduled service beginning in March 2015. Those services were temporarily discontinued after RVR lost its concession in Uganda in October 2017. However, when URC took over the operations of the MGR system in Uganda in 2018, the service was restored in February 2018. Commuter train services appreciated the ease and reasonable fares of the rail transport, compared to the commuter taxis, with the attendant traffic jams. the new planned route from Kampala to Port Bell is planned to be added in the 2019/20 financial year. In the last paragraph, URC is in charge of all operational aspects of the commuter service. As of February 2018, RVR is no longer in operation. Additionally the Nalukolongo-Kyengera and Port Bell (Luzira) routes are not currently operational.The new planned route from Kampala to Port Bell is planned to be added in the 2019/20 financial year. In the last paragraph, URC is in charge of all operational aspects of the commuter service. As of February 2018, RVR is no longer in operation. Additionally, the Nalukolongo-Kyengera and Port Bell (Luzira) routes are not currently operational.

The trains with a capacity of 1,000 passengers per trip will provide a morning and evening service from Kampala central terminal to Namanve railway station, 12 kilometres east of the center of Kampala.

(5) Uganda Road Fund (URF)

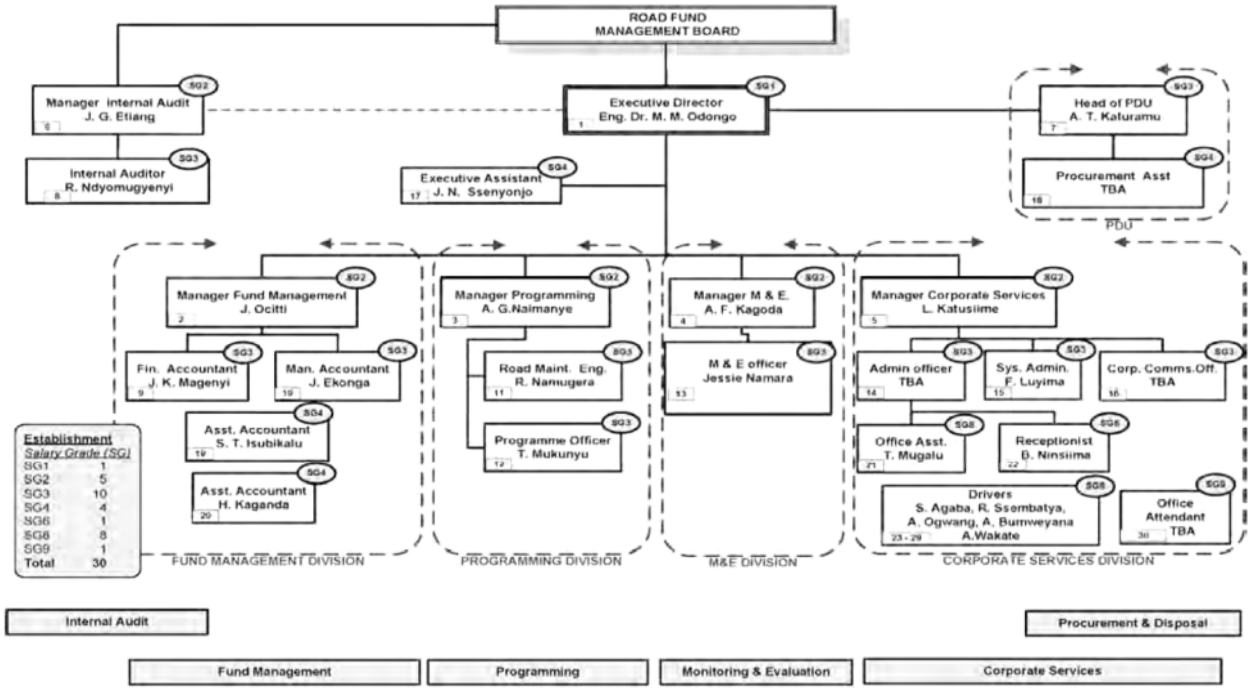
Uganda Road Fund (URF) was established by an Act of Parliament in 2008 to operate as a second generation Fund with the objective of financing routine and periodic maintenance of public roads in Uganda from mainly reserved road user charges. Within the East African Region, Uganda was the last country to launch a second-generation road fund. The Fund became operational in 2010.

The Fund has a duty to finance the implementation of the Annual Road Maintenance Programmes (ARMP) that are carried out by the Uganda National Roads Authority(UNRA), Kampala Capital City Authority (KCCA) and the other designated agencies responsible for District, Urban and Community Access Roads.

The sources of funds, listed in section 21 of the Act, include:

i. Road user charges, including:
ii. fuel levy
iii. transit fees
iv. road license
v. axle load fines
vi. tolls
vii. weight/distance charges;
viii. Traffic and road safety fines

Organization structure and budget of URF are shown below.



Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

Figure 2.3.5 Organization Structure of URF

Highlights of FY 2017/18 performance on related organization of transport sector are shown in Table 2.3.6. Overall sector budget increased by 28.88% from UGX 3,491.16 bn in FY2016/17 to UGX 4,499.47 bn. 75.7% of annual budget was disbursed, of which 86.6% was absorbed.

Table 2.3.6 Budget for Road Sector

Item	Approved Budget UGX bn	Allocation ratio	Released Budget UGX bn	% Budget Released
URF secretariat	10.618	2.5%	10.618	100%
Maintenance of National road-UNRA	267.917	64.2%	267.917	100%
KCCA	19.525	4.7%	19.525	100%
Maintenance of DUCAR network (121 DGLs, and 41 Mun. Councils)	119.334	28.6%	119.334	100%
Grand Total	**417.394**	**100.0%**	**417.394**	

Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

Table 2.3.7 Budget for Related Organization

Votes	Vote Names	Approved Budget (Ug shs billion)	Release (Ug shs billion)	Spent (Ug shs billion)	% Budget Released	% Budget Spent	% Release Spent
16	MoWT	461.11	423.33	417.08	91.8	90.5	98.5
113	UNRA	3,620.94	2,565.55	2,115.24	70.9	58.4	82.4
118	URF	417.42	417.39	417.36	100.0	100.0	100.0
	Total	4,499.47	3,406.27	2,949.68	75.7	65.6	86.6

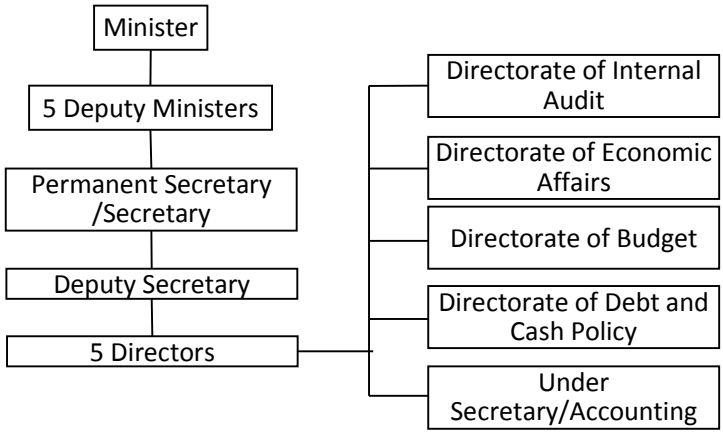
Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

(6) Ministry of Finance, Planning and Economic Development (MoFPED)

The Ministry of Finance, Planning and Economic Development (MoFPED) is a government ministry of Uganda. Its mandate is to formulate sound economic and fiscal policies, mobilize resources for the implementation of government programmes, disburse public resources as appropriated by Parliament, and account for their use in accordance with national laws and international best practices.

MoFPED monitors the budget for roads sub-sector annually.

Organization of MoFPED is shown in Figure 2.3.6.



Source: 14th Joint Transport Sector Review Workshop Presentations, MoWT, September 27-28, 2018

Figure 2.3.6 Organization Structure of MoFPED

2.4 Current Situation of Urban Transport in Uganda

(1) Current Urban Development Situation with Masaka Road

According to the interview with the engineers of Department of Physical Planning in KCCA on March 2019, there are some urban development along Masaka Road as shown in Figure 2.4.1. JST requested the engineers of Department of Physical Planning in KCCA, however, detailed information of these projects such as project location map, project brief, etc. were not yet provided to JST.

- Business Park -------- south-west side of Masaka/Natete intersection
- Shopping Center -----south-east side of Masaka/Natete intersection

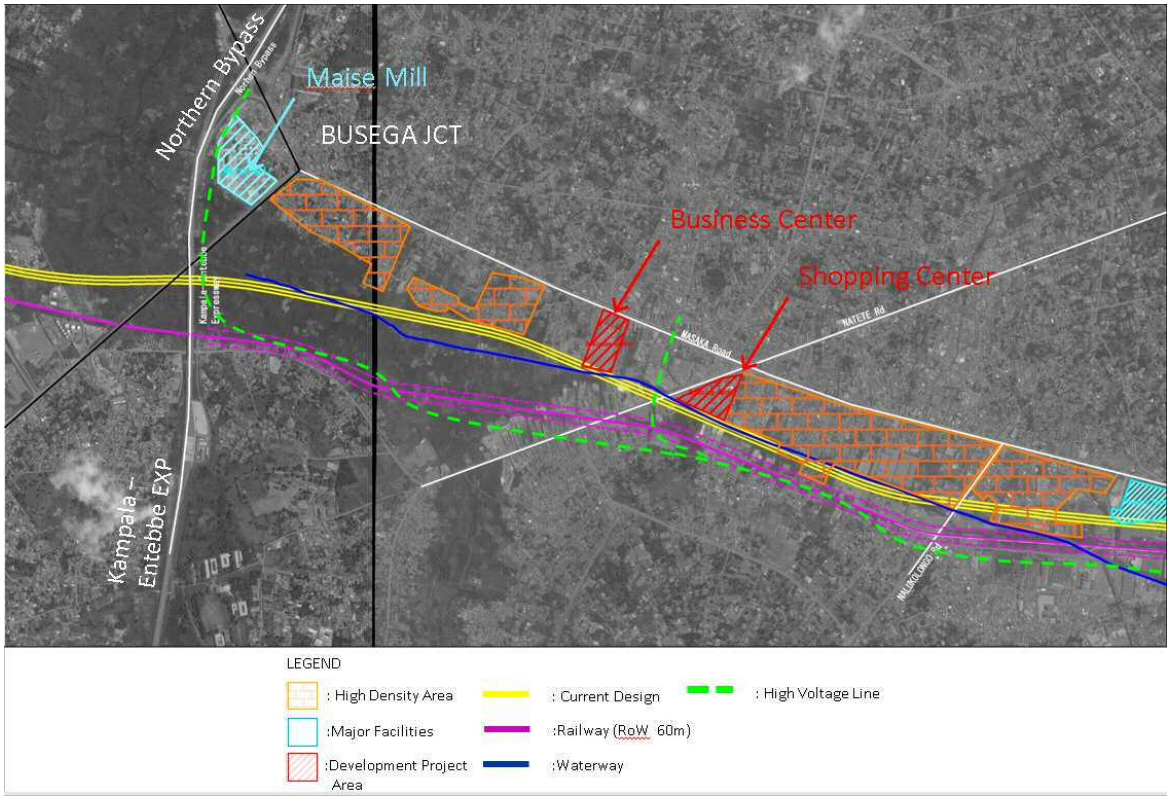


Figure 2.4.1 Urban Development along Masaka Road

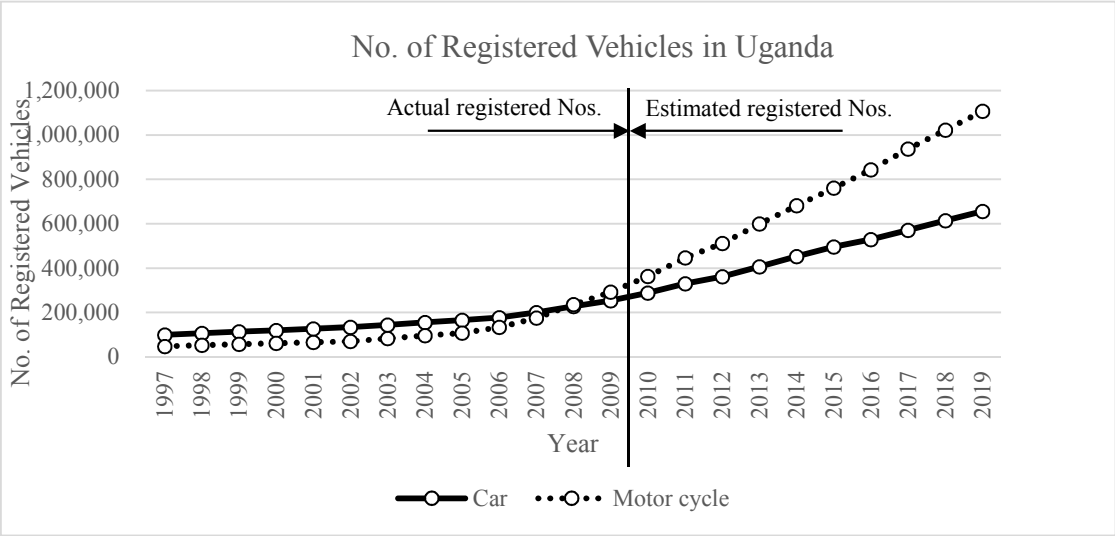
(2) No. of Registered Vehicles in Uganda

No. of registered vehicles and motorcycles in Uganda are shown in Table 2.4.1 and Figure 2.4.2.

Table 2.4.1 Numbers of Registered Vehicles in Uganda (1997-2019)

Year	Cars	4WD	Mini buses	Buses	Trucks	Total of Vehicles	Motor cycle	Remarks
1997	42,000	33,100	13,400	600	9,900	99,000	48,000	No. of registered vehicles from 1997 to 2009 are referred to the Kampala fly overt F/S Report, JICA
1998	44,400	35,600	14,300	600	11,100	106,000	52,600	
1999	46,900	38,100	15,200	700	12,200	113,100	57,300	
2000	49,300	40,500	16,200	700	13,400	120,100	61,900	
2001	51,600	43,000	17,100	800	14,500	127,000	66,600	
2002	54,200	45,500	18,000	800	15,700	134,200	71,200	
2003	58,000	48,100	21,200	800	16,700	144,800	83,500	
2004	61,700	50,600	24,400	900	17,700	155,300	95,900	
2005	65,500	53,200	27,600	900	18,700	165,900	108,200	
2006	70,700	53,200	32,000	900	20,500	177,300	134,000	
2007	81,300	56,000	39,500	1,000	23,300	201,100	176,500	
2008	90,900	58,300	49,200	1,200	28,500	228,100	236,500	
2009	96,600	59,700	62,300	1,500	33,400	253,500	292,300	
2010						288,629	363,395	No. of registered vehicles from 2010 to 2019 are estimated numbers by JST. Registered vehicle numbers were calculated by the accumulation of the newly registered numbers referred to Uganda Statistical Abstract 2018.
2011						330,139	447,403	
2012						362,085	512,055	
2013						407,254	600,831	
2014						452,814	682,669	
2015						496,151	761,534	
2016						529,901	844,665	
2017						571,906	937,692	
2018						613,906	1,022,692	
2019						655,906	1,107,692	

Source: Kampala Flyover F/S Report, JICA, Uganda Statistical Abstract 2018, Registered vehicle numbers from 2010 to 2019: estimated by JST



Source: Kampala Flyover F/S Report, JICA, Uganda Statistical Abstract 2018

Figure 2.4.2 Numbers of Registered Vehicles in Uganda (1997-2019)

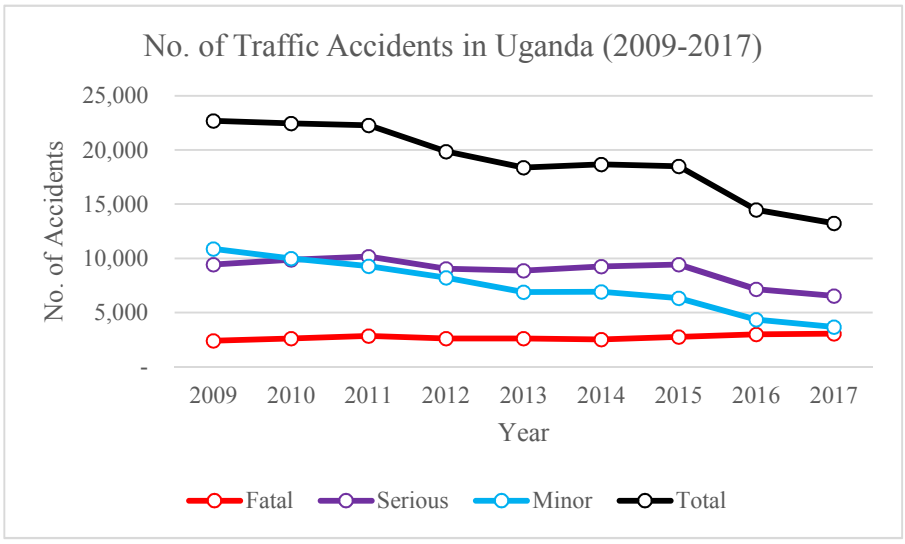
(3) No. of Traffic Accidents

Traffic safety is a very serious issue in Uganda. The number of traffic accidents in Uganda is shown in Table 2.4.2. The total number of traffic accidents has decreased in Uganda. However, fatality rates has not decreased.

Table 2.4.2 No. of Traffic Accidents in Uganda (2009-2017)

No. of Accidents	2009	2010	2011	2012	2013	2014	2015	2016	2017
Fatal	2,388	2,620	2,843	2,611	2,616	2,518	2,749	2,981	3,051
Serious	9,423	9,866	10,153	9,030	8,874	9,259	9,422	7,153	6,530
Minor	10,888	9,975	9,276	8,220	6,878	6,909	6,324	4,340	3,663
Total	22,699	22,461	22,272	19,861	18,368	18,686	18,495	14,474	13,244

Source: Uganda Statistical Abstract 2018

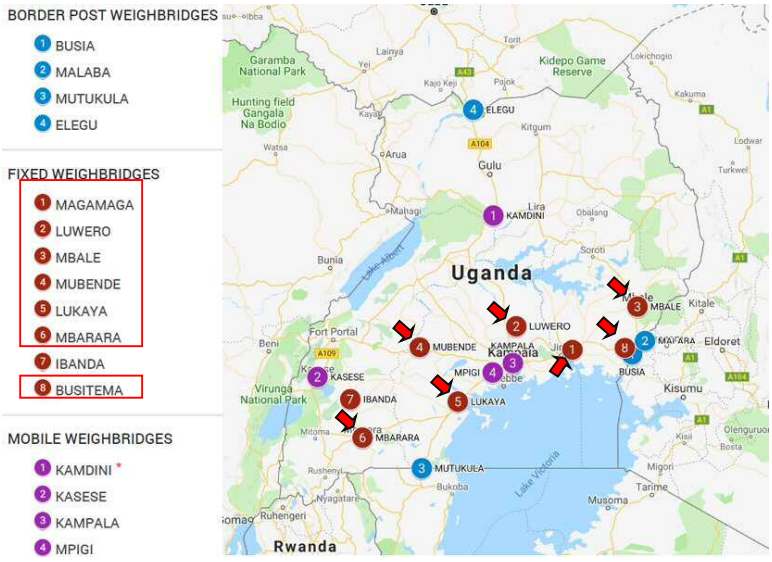


Source: Uganda Statistical Abstract 2018

Figure 2.4.3 No. of Traffic Accidents in Uganda (2009-2017)

(4) Axel Load Survey Data

There are 16 weighbridge stations managed by UNRA in Uganda. Location map of weighbridge stations is shown in below.



Axel load survey data on 7 fixed stations such as Busitema, Lukaya, Luwero, Magamaga, Mbale, Mbarara, Mubende from October 2018 to March 2019 were provided from UNRA.

There are some overloading vehicles checked at the weighbridge stations. Average ratio of overloading vehicles is 0.4% - 2.8% of Numbers of vehicles.

Detailed data for the Axel Load survey is shown in Appendix.

2.5 Socio-Economic Situation in Uganda and Kampala City

GKMA consists of Kampala Capital City, part of Wakiso District and Mukono District as shown in Figure 2.5.2. According to the National Population and Housing Census 2014, Uganda Bureau of Statistics, population of Uganda, Kampala City, Kampala City+Wakiso District+ Mukono District are shown in Table 2.5.1 and Figure 2.5.1. Average annual growth rate of Kampala City is 2.0%, however, population growth rate of surrounding areas such as Wakiso and Mukono district is 5.7% higher than Kampala City.

Population and GDP in Uganda for the past five years as socio-economic indicators is shown in Table 2.5.2.

Table 2.5.1 Population in Uganda and Kampala City

	National	Central Region	Kampala	Wakiso +Mukono	Kampala +Wakiso +Mukono
Population in 1991	16,671,705	4,843,594	774,241	882,321	1,656,562
Population in 2002	24,227,297	6,575,425	1,189,142	1,331,040	2,520,182
Population in 2014	34,634,650	9,529,227	1,507,080	2,594,222	4,101,302
The average annual population growth (2002-2014)	3.0%	3.1%	2.0%	5.7%	4.1%
Population density in 2014 (persons/sq.km)	173	546	7,928	684	1,032

Source: National Population and Housing Census 2014, Uganda Bureau of Statistics
National Population and Housing Census 2002, Uganda Bureau of Statistics

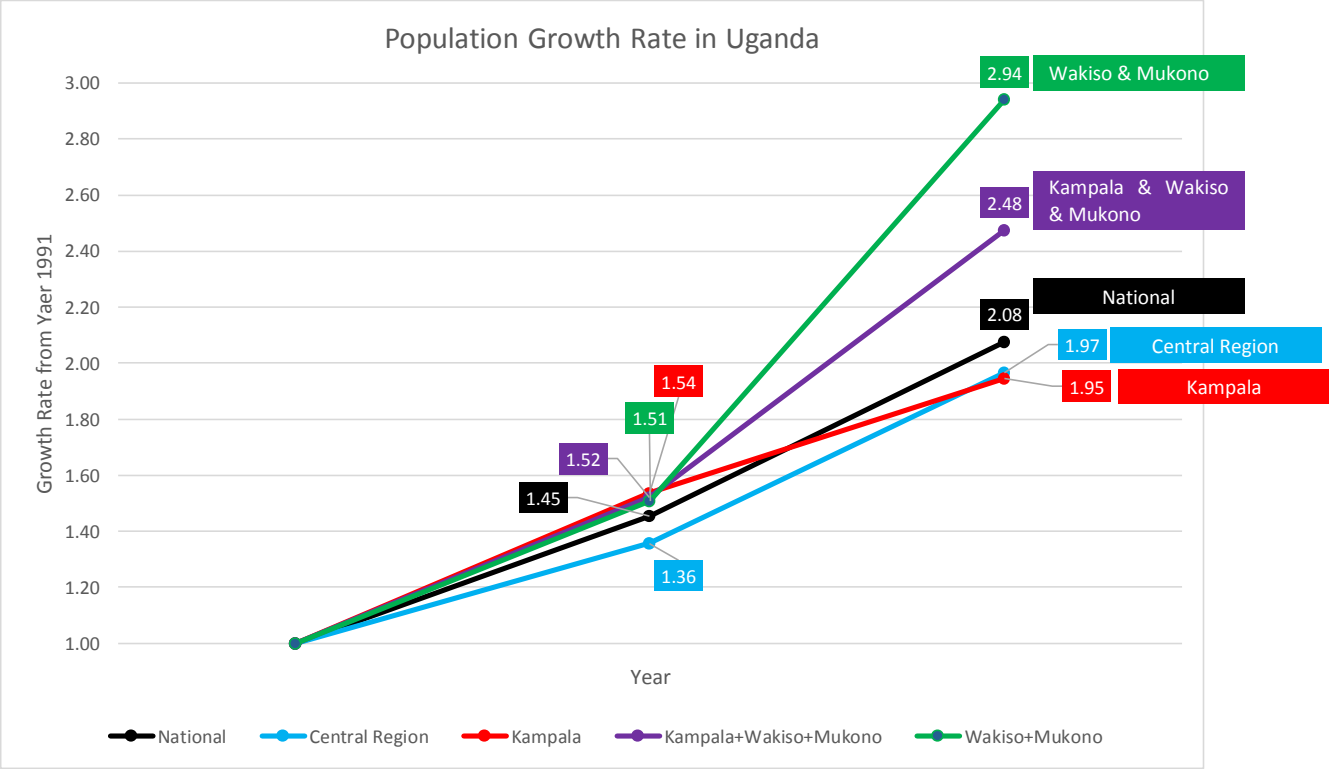
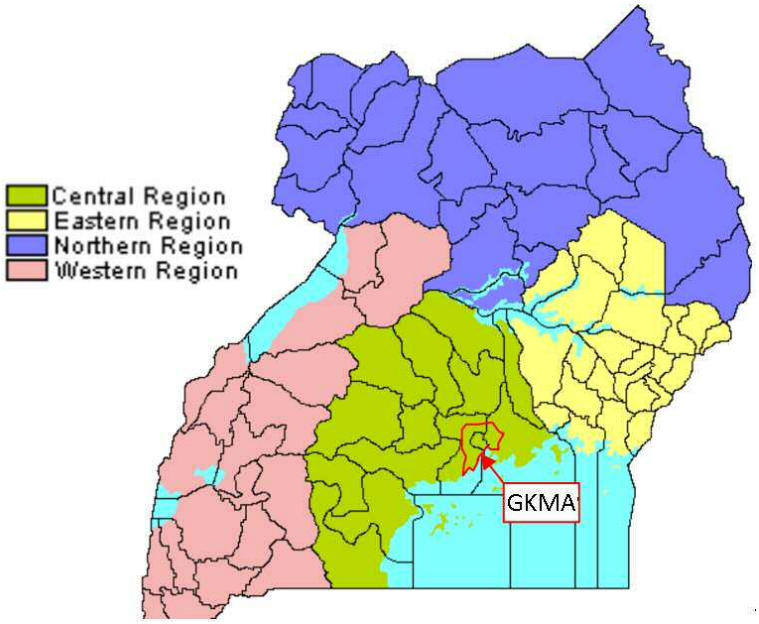


Figure 2.5.1 Population in Uganda, Central Region and Kampala (1980-2014)



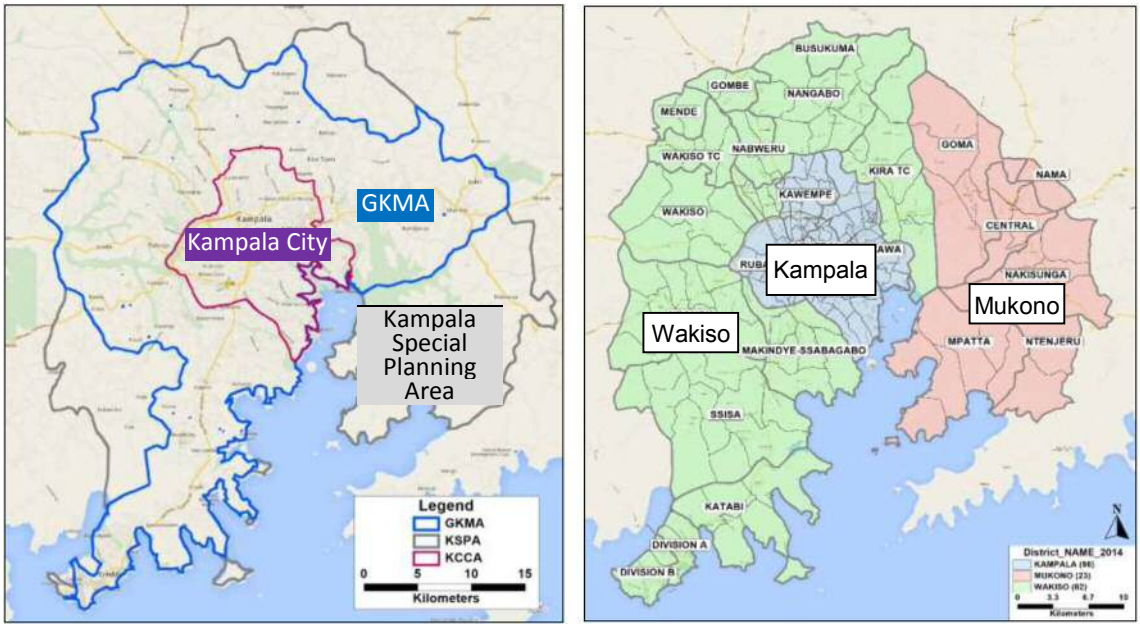


Figure 2.5.2 Location Map of Central Region, GKMA

Table 2.5.2 Population and GDP in Uganda for the past five years

Indicators \ year	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018
Population ('000')	33,990	34,964	35,885	36,904	37,942
Annual Growth rate of Population (%)	2.91	2.87	2.63	2.84	2.81
GDP (billion shillings) *1	50,651	53,279	55,826	57,983	61,361
Annual Growth rate of GDP (%)	5.11	5.19	4.78	3.86	5.83
GDP per capita (UGX,'000') *2	1,490	1,524	1,556	1,571	1,617
Annual GDP per capita growth rate(%)	2.14	2.26	2.09	1.00	2.93

Source: Uganda Bureau of Statistics
*1: GDP is at constant 2009/10 prices
*2: GDP per capita is at constant 2009/2010 prices

2.6 Environmental and Social Considerations for the Road Sector in Uganda

2.6.1 Environmental Impact Assessment (EIA)

(1) Legal Framework of EIA

Relevant Regulations of EIA

A) The National Environment Act (Chapter 153)

This is the fundamental regulation on environmental management by showing the institutional framework and stipulating criteria of projects for conducting EIA. This regulation stipulates roles and responsibilities of NEMA and lead agencies for sound environmental management.

B) Environmental Impact Assessment Regulations 1998

The regulations provide guidance on EIA preparation and approval procedure and also prescribe environmental audits after EIA approval as post assessment.

C) Environmental Impact Assessment Guidelines for Road Projects 2004

The Ministry of Works and Transport developed the Guideline for Environmental Impact Assessment Guidelines for Road Project in September 2004 (the MoWT Guidelines), and it is still used for the UNRA projects. The MoWT Guidelines summarizes flow and study contents of EIA from the initial stage (i.e. Project Brief) to the approval stage at each EIA category. In addition, the MoWT Guidelines consider socioeconomic, cultural impact assessment and public involvement as important. Accordingly, the MoWT Guidelines show the methods of consultation and stakeholder participations including socially vulnerable groups.

Environmental Standards

The following environmental standards on pollution control are still active as of March 2019. However, the Environmental Management Bill (the Bill) drafted in 2017 and its corresponding environmental regulations and standards are in the process of Parliament approval. Once the Bill is approved, environmental standards listed below may be renewed.

- National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations 1999
- The National Environment (Wetlands, River Banks and Lake Shores Management) Regulations 2000
- The National Environment (Noise Standards and Control) Regulations 2003
- National Environment (Waste Management) Regulations 1999
- Draft National Air Quality Standards 2006

National Red List for Uganda

National Red List for Uganda was developed in January 2016 referring to IUCN red list. The threat status in National Red List was applied in accordance with IUCN (International Union for Conservation of Nature) guidelines though some status were slightly different. Since its inception in 2016, it was not referred to when EIA for Kibuye-Busega Expressway and for New Karuma Bridge were studied.

(2) EIA Required Projects

The National Environmental Act (NEA) Cap 153 casts a project into one among these three categories: First Schedule, Second Schedule and Third Schedule, according to its extent of potential environmental impact. Table 2.6.1 summarizes clarification of each category though there is no specific requirement on project scale.

Table 2.6.1 Features of Each Category

Categories	Clarification
First Schedule	A project falling into this category is exempted from EIA.
Second Schedule	A project falling into this category is requested to be approved of mitigation measures.
Third Schedule	A project falling into this category is requested to conduct environmental impact assessment.

Source: JST

(3) EIA Approval Procedure

Project Brief Phase

A project proponent prepares and submits the Project Brief including information on project brief, background and project description for consideration of NEMA. After receiving the Project Brief, NEMA forwards it to the lead agency for requesting comments within 14 working days.

Screening Phase

If the lead agency considers the project to have significant environmental impact without describing sufficient mitigation measures in the Project Brief, the project is requested to conduct EIA. Meanwhile, if the lead agency considers the project to pose no significant environmental impact or the Project Brief has sufficient information on mitigation measures to cope with the anticipated impacts, a certificate of approval is issued for the project. Project screening will be done in 21 days.

Environmental Impact Study Phase

For the project required to conduct EIA, the scoping (i.e. identification of boundaries of the study area, preliminary alternatives, planned schedule of completion of the environmental study and public involvement) will be exercised, and TOR will be prepared based on the result of the scoping. The scoping and TOR will be approved by NEMA.

Decision Making Phase

Environmental impact assessment will be presented in EIA report, and it will be submitted to NEMA for review. NEMA will invite stakeholders and the public to comment on the report, and will issue a certificate of approval or reject the report. If the report is rejected, the project proponent is requested to revise it. Necessary duration for reviewing EIA report is less than 180 days.

According to the interview to the officer of NEMA, 1 to 2 months for approval of Project Brief, 7 to 14 working days for review and approval of TORs and, 1 to 3 months for review and approval of EIA report are practically required time to process such administrative tasks.

(4) Gap Analysis between JICA Guidelines for EIA Related Regulations in Uganda

Gap between JICA Guidelines for Environmental and Social Considerations issued in April 2010 (JICA Guidelines) and EIA related regulations in Uganda is examined as shown in Table 2.6.2.

Table 2.6.2 Gap Analysis between JICA Guidelines and EIA Related Regulations in Uganda

Items	JICA Guidelines	Uganda Regulations	Identified Gap
Underlying Principle	Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan. (JICA GL Appendix 1.1)	An environmental impact assessment shall be undertaken by the developer in the following cases: ➢ may have an impact on the environment, ➢ is like to have a significant impact on the environment, or ➢ will have a significant impact on the environment (Art. 19, The National Environment Act)	No difference
Disclosure	1) EIA reports must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them. 2) EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted. (JICA GL Appendix 2)	1) There is no description on language to be used in EIA reports. However, information disclosure shall be done in a language understood by the affected communities. (Art. 12, EIA Regulations) 2) The environmental impact statement shall be a public document and may be inspected at any reasonable hour by any person. (Art. 20, The National Environment Act)	There is no precise provision on permission of copying.

Items	JICA Guidelines	Uganda Regulations	Identified Gap
Consultation	1) For projects with potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans. (JICA GL Appendix 1.5) 2) Consultation with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stage of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared. (JICA GL Appendix 2)	1) and 2) After 14 days from information disclosure, holding meetings with the affected community to explain about the project and its possible impacts. Ensure that the venues and times of the meetings shall be convenient to the affected persons. (Art. 12, The EIA Regulations)	No difference
Study Items	1) The impact to be assessed with regard to environmental and social considerations include impact on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water use, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. 2) These also include social impacts, including migrating of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social infrastructures and services, vulnerable social groups, equality of benefits and losses and equality in the development progress, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases and working condition including occupational safety.	1) A project classified in First Schedule is required to study ecology, sustainable use, ecosystem maintenance, social considerations, landscape, and land use. 2) Social considerations include effect on employment in the area, social cohesion or disruption, effect on human health, immigration or emigration, communicate (roads opened up, closed, re-routed), local economy and effects on culture. Land uses includes effect on current land use, possibility of multiple use and effects on surrounding land use. (EIA Regulations)	There is no precise provision on examinations of impact on vulnerable groups, gender, children's rights, working condition including occupational safety.
Monitoring, Grievance	1) Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders. 2) When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems.	1) and 2) Conducting monitoring is stipulated, but there is no description on disclosing monitoring results.	There is no precise provision on disclosing the monitoring results.
Ecosystem and Biota	1) Project must not involve significant conversion or significant degradation of critical natural habitats and critical forests. (JICA	Not applicable	Although studying ecosystem and biota is required in EIA Guidelines,

Items	JICA Guidelines	Uganda Regulations	Identified Gap
	GL Appendix 1)		there is no precise provision on not involve significant conservation or degradation of ecosystem.
Indigenous People	When projects may have adverse impacts on indigenous people, all of their rights in relation to land and resources must be respected in accordance with the spirit of relevant international declarations and treaties. Efforts must be made to obtain the consent of indigenous peoples in a process of free, prior, and informed consultation. (JICA GL Appendix 1)	Every person in Uganda is entitled to the fundamental rights and freedoms of the individual whatever his race, place of origin, political opinions, colour, creed or sex. (Art. 21, Constitution)	There is no precise provision on the consent in a process of free, prior and informed consultation.

Source: JST

2.6.2 Institutional Framework of EIA for the Road Sector

(1) Ministry of Works and Transport (MoWT)

This is the lead ministry of the project which UNRA implements. MoWT is responsible for formulation and supervision of policies and standards on the road sector. The Environmental Liaison Committee will monitor the overall project implementation and compliance with the certificate of approval.

(2) National Environmental Management Authority (NEMA)

National Environmental Management Authority (NEMA) is the responsible authority to issue a certificate of EIA approval. NEMA has 9 departments, and Department of Environment Monitoring and Compliance has mandates to review EIA reports and to conduct environmental monitoring.

(3) Uganda Wildlife Authority (UWA)

In case a project is located inside a protected area, the project proponent is necessary to consult with UWA for adequate measures in a process of preparing EIA as well as implementing a project.

2.6.3 Environmental and Social Management System in UNRA

UNRA has the Environmental and Social Safeguards Department, which are composed of 3 units with the following mandates:

- Environmental and Social Compliance Monitoring Unit

This unit has the mandate of the followings: monitoring environmental and social management plan to be implemented by the contractor, prepare reports on environmental and social compliance monitoring results and undertaking environmental and social audits.

- RAP Unit:

This unit has the mandate of followings; monitoring to prepare and to implement RAP and preparing RAP reports.

- EIA Unit:

This unit has the mandate of followings; preparing EIA and reviewing EIA draft reports to be submitted by the EIA consultants.

UNRA developed Environmental and Social Management System (ESMS) in March 2017 for UNRA employees, contractors and subcontractors involved in the projects of UNRA. ESMS mainly deals with environmental and social impact assessment but does not cover land acquisition or resettlement. It shows the decision-making process, environmental and social obligations of UNRA to implement projects and commitment/measures/requirement of the potential risks and deals with 11 themes;

assessment and management of environmental and social impacts, occupational and community health and safety, gender, vulnerable people, HIV/AIDS awareness and prevention, stakeholder engagement and disclosure of information, grievance redress mechanism, labour and working conditions, sensitive ecosystem and the sustainable management of the environment, climate change, land acquisition, and involuntary resettlement cultural resources.

Although ESMS slightly refers to land acquisition and resettlement, no details are discussed. Thus, there is no comprehensive policy on land acquisition and resettlement in UNRA as of March 2019, but it is being developed as Land Acquisition and Resettlement Management System (LARMS) policy. LARMS deals with roles and responsibilities of each concerned party for preparing and implementing RAP, procedure and works of RAP preparation and implementation at each study/project including the post-construction phase and assistance for vulnerable people for physical displacement and livelihood restoration.

2.6.4 Resettlement Action Plan (RAP)

(1) Legal Framework of RAP

A) Relevant Regulations

The Land Acquisition Act, 1965 (Chapter 226)

It stipulates the procedure and methods of permanent and temporary land acquisition for public purposes. Detailed procedure of land acquisition including grievance is shown in (2) below. It secures that affected persons are paid with fair and adequate compensation before acquiring land.

The Land Act, 1998 (Chapter 227)

It stipulates the tenure system, land management system and dispute solution mechanism. The land in Uganda is classified into 4 categories: customary, freehold, mailo, and leasehold. Customary tenure land is held individually or communally in accordance with the customs, traditions and practices of the community concerned. Freehold tenure land is held perpetuity or for a period less than perpetuity. In addition, it is used and developed for any lawful purpose, taken and used any and all produce from the land, sold, leased, mortgaged or subdivided to other people, and disposed of land to any persons. Mailo tenure land is held perpetuity and permitted to separate land ownership. The holder of mailo tenure land exercises all power of ownership. Leasehold tenure land is that the landlord or lessor grants the tenant or lessee excluding possession of land. It is usually for a period defined and in returned for a rent.

Guidelines for Compensation Assessment under Land Acquisition (GCALA)

It is issued by Ministry of Lands, Housing and Urban Development (MoLHUD) in June 2017. It shows roles of each entity on compensation assessment, and summarizes assessment methods of land, structures, crops and trees, graves and cultural heritage, businesses and loss of income. Land is evaluated on the basis of its open market value without any increase or decrease attributable to the scheme of development, and structures is evaluated in replacement cost (i.e. market value and statutory disturbance allowance[1]).

B) Land Acquisition Procedure according to The Land Acquisition Act (Chapter 226) and Interview to KCCA

Once the final project design is approved, a declaration of land acquisition for the public purpose is made public. Then, necessary survey such as census, socio-economic and asset surveys are conducted

[1] Statutory disturbance allowance is the one-off lump-sum payment to compensate for expenses associated with involuntary resettlement or property acquisition. It includes transport cost and removal expenses.

for Project Affected persons (PAPs) to determine the extent of impact to be caused by a project. Census and socio-economic surveys are generally conducted by a consultant to be hired by a project. As for the asset survey, it is basically conducted by the licensed land assessor to be hired by a project since its result is connected to compensation amount officially paid to PAPs.

In the process of the asset survey, market price for land and structure is studied to determine the appropriate unit price. With respect to crops and trees, the district rate which is set annually based on the prevailing market value is applied as the unit price for compensation. The results of census and socio-economic survey and summary of the asset survey are compiled as RAP, while the complete result of land survey including compensation amount is compiled as the valuation report.

The valuation report is submitted to the Chief Government Valuer (CGV) to ascertain its consistency with the land acquisition and compensation laws and regulations in Uganda. Once the valuation report is approved by the CGV, the extent of impact and the valuation amount are publicised to PAPs as the notice. If PAPs raised grievance to the contents of the notice including valuation amount, the valuation team reviews and verifies the raised grievance by implementing the field survey. Chapter 226 secures at least 15 days (maximum 30 days) after publicizing the notice as the duration of objection to the contents of notice. If there is no objection or an objection is settled, the award is issued by the assessment officer to PAP. If an objection is not settled, it is handled at the High Court. Following the approval of the valuation report by CGV, it is returned to the project executing agency.

C) Gap Analysis between JICA Guidelines for RAP Related Regulations in Uganda

Gap between the JICA Guidelines and Uganda RAP related regulation is examined as shown in Table 2.6.3.

Table 2.6.3 Gap Analysis between JICA Guidelines and RAP Related Laws in Uganda

No.	JICA Guidelines	Laws of Uganda	Identified Gap
1.	Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives. (JICA GL)	➢ The laws do not precisely describe to exploring all viable alternatives to avoid involuntary resettlement. ➢ However, EIA Guidelines show that involuntary displacement should be avoided whenever feasible, and if not, at least minimized. (5.2 Resettlement, EIA Guidelines*)	There is no difference by applying EIA Guidelines.
2.	When population displacement is unavoidable, effective measures to minimize impact and to compensate for losses should be taken. (JICA GL)	If acquisition of property is required, prompt payment of fair and adequate compensation prior to acquisition of the property. (Art. 26, Constitution)	There is no difference.
3.	People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels. (JICA GL)	➢ Compensation shall be prompt payment of fair and adequate compensation (Art. 26, Constitution) ➢ Compensation is provided to land, buildings and standing crops. In addition, disturbance allowance of 15% or 30% is provided. (Art. 77, The Land Act) ➢ Resettlement plans must restore incomes which will be lost because of the road project. (5.2 Resettlement, EIA Guidelines*)	There is no difference in compensation. As for restoration of living standards, EIA Guidelines show provision to give opportunities to improve livelihood of displaced person though restoration of living standards is not precisely prescribed in the laws. By applying EIA Guidelines, there is no difference.
4.	Compensation must be based on the full replacement cost as much as possible. (JICA GL)	➢ Customary land owner: the open market value of the unimproved land. (Art. 77, The Land Act) ➢ Buildings: open market value for urban areas and depreciated	There is no difference by applying Guidelines.

No.	JICA Guidelines	Laws of Uganda	Identified Gap
		replacement cost for the rural area. (Art. 77, The Land Act) ➢ Land should be compensated based on replacement value equated to the current market cost of the replacement land. (6.2, Guidelines for Compensation Assessment under Land Acquisition) ➢ Structure should be valuated at replacement cost to ensure fair and adequate compensation (6.4.1, Guidelines for Compensation Assessment under Land Acquisition)	
5.	Compensation and other kinds of assistance must be provided prior to displacement. (JICA GL)	If acquisition of property is required, prompt payment of fair and adequate compensation prior to acquisition of the property. (Art. 26, Constitution)	There is no difference.
6.	For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. (JICA GL)	➢ The laws do not precisely request to prepare resettlement plan. ➢ The developer is requested to develop a resettlement plans if a road project displaces people involuntarily (5.2.3, EIA Guidelines*)	There is no difference by applying Guidelines.
7.	In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. (JICA GL)	➢ The laws do not precisely request to prepare resettlement plan. ➢ The developer and EIA team must begin dialogue as soon as it becomes apparent that resettlement may be necessary (5.2.3, EIA Guidelines*)	There is no difference by applying Guidelines.
8.	When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people. (JICA GL)	Not applicable	There is no precise provision on manner and language to be used in consultations.
9.	Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans. (JICA GL)	➢ The notice on land acquisition is published to the affected persons. ➢ The developer and EIA team must begin dialogue as soon as it becomes apparent that resettlement may be necessary (5.2.3, EIA Guidelines*)	There is no difference by applying Guidelines.
10.	Appropriate and accessible grievance mechanisms must be established for the affected people and their communities. (JICA GL)	The affected persons are able to raise their objections to the contents of the notice, and the raised objections are to be handled by the High Court. (Art. 6, The Land Acquisition Act)	The procedure given in the legal context is direct settlement at the court.
11.	Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits. (WB OP4.12 Para.6)	Affected persons are identified, and the notice on land acquisition is published to them. (Arts. 3 & 4, The Land Acquisition Act)	The methods and timing to identify affected persons are not stipulated.
12.	Eligibility of benefits includes: PAPs with formal legal rights to land (including customary and traditional	Compensation for land is provided to those with formal tenure rights on land including customary and traditional land. (Arts. 26 and 237	Compensation for land to those who do not have formal tenure rights is not precisely described.

No.	JICA Guidelines	Laws of Uganda	Identified Gap
	land rights recognized under law), PAPs without formal legal rights to land at the time of census but have a claim to such land or assets, and PAPs without recognizable legal right to the land they are occupying. (WB OP4.12 Para.15)	(2), Constitution and Art. 42, The Land Act)	
13.	Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based. (WB OP4.12 Para.11)	Not applicable	There is no precise provision of compensation in land-based for displaced persons whose livelihood is land-based.
14.	Provide support for the transition period (between displacement and livelihood restoration). (WB OP4.12 Para.6)	Not applicable	There is no precise provision of support for the transition period. However, disturbance allowance is considered as similar to transition period.
15.	Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc. (WB OP4.12 Para.8)	➢ The laws do not precisely request to prepare resettlement plan. ➢ In a dialogue of community involvement on resettlement, participation from disadvantaged groups such as women, orphans or landless is required (5.2.3, EIA Guidelines*)	There is no difference by applying Guidelines.
16.	For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared. (WB OP4.12 Para.25)	Not applicable	There is no precise provision of preparation for abbreviated resettlement plan in case of entailing small scale land acquisition or involuntary resettlement.

* Environmental Impact Assessment Guidelines for Road Projects issued in 2004 by Ministry of Works, Housing and Communication
Source: JST

(2) Institutional Framework of RAP in the case of Projects located in Kampala City

A) Ministry of Lands, Housing and Urban Development (MoLHUD)

MoLHUD provides support and supervision to local governments and other agencies on matters regarding land administration including transfer, valuation rating and resettlement compensation.

B) The Office of Chief Government Valuer (CGV) in MoLHUD

The office is responsible for providing timely and reliable property valuation to the government, approving the valuation estimate and ascertaining the compensation rates and values of assets. The Chief Government Valuer is responsible for approving the district compensation rate and specific compensation amount evaluated for each project.

C) Kampala Capital City Authority (KCCA) and District Local Government

The administrative authorities are responsible for information dissemination, monitoring of compensation payment and grievance. District land board is responsible for establishing compensation rates for crops.

2.6.5 Experience of Environmental and Social Considerations in Uganda by Other Donor Agencies

An interview to a senior environmental specialist in the Uganda Country Office of WB was conducted to understand operation of safeguard issues for the projects in Uganda funded by WB. The followings were observed from the interview:

- Most of EIA studies concentrated to the liner components of the project (i.e. the proposed road alignment) but left out the associated felicities to support road development such as quarries and borrow pits.
- Planning of the closure and rehabilitation of road associated facilities, occupational health and safety of works and the surrounding communities is needed to be improved.
- Stakeholder engagements were not always adequate.
- Improvement of alternative analysis was necessary.
- Even though Environmental and Social Management Plan was prepared by the contractors, it was not necessarily implemented according to the prepared plan.
- Providing compensation and assistance (i.e. assistance for vulnerable groups or implementation of livelihood restoration program) was the challenge though they were committed in the document prepared by the project proponents.

2.6.6 Approaches of Socially Vulnerable Groups

It was confirmed with UNRA that socially vulnerable groups were identified during the survey on RAP. However, there was no additional support for them at this moment due to budget limitation. UNRA considered that the current situation might be improved once LARMS (Land Acquisition and Resettlement Management System) was approved since it required implementing assistance for vulnerable groups and livelihood restoration.

Another confirmation on socially vulnerable groups and livelihood restoration in the case of WB funded projects was made to the Uganda Country Office of WB. It was also found that support for socially vulnerable groups and implementation of livelihood restoration are the challenge though they are required in the Guidelines and committed in the document such as RAP.

Support for socially vulnerable groups and livelihood restoration is slightly different from compensation payment since it may generally include in-kind activities such as vocational training. The following approaches should be examined for the effective support for vulnerable groups and livelihood restoration.

- To define necessity of support for socially vulnerable groups and livelihood restoration in regulations
- To arrange sufficient budget for support for socially vulnerable groups and livelihood restoration as a part of RAP implementation
- To enhance cooperation with NGOs advocating for socially vulnerable groups or livelihood restoration in and around the project area
- To enhance mandates of the RAP Unit in Environmental and Social Safeguards Dept. in UNRA on the activities related to support for socially vulnerable groups or livelihood restoration

UNRA tries to implement and monitor livelihood restoration in the new project, namely Kampala-Jinja Expressway. Outcomes of the livelihood restoration needs to be examined to find the lessons-learnt from the next projects.

CHAPTER 3 DATA COLLECTION AND STUDY ON KIBUYE-BUSEGA EXPRESSWAY PROJECT

3.1 Current Condition of the Study Area

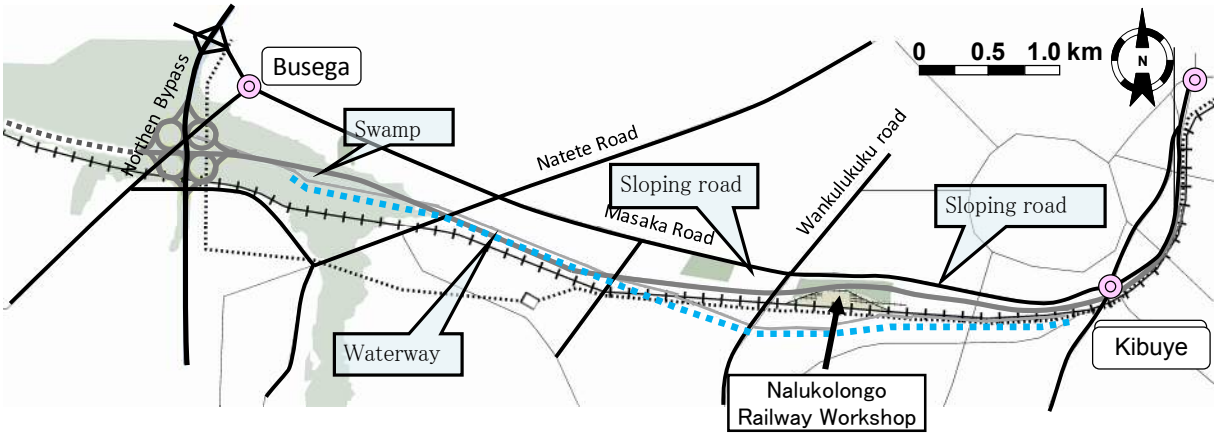
3.1.1 Geographical Condition

Kampala city is to the north of Lake Victoria. Of its area of 189 km^2, approximately 46% is hilly. The centre of the city is surrounded by hills and some swampy areas. These swampy areas function as cushioning flood control basin against flood peak. However, the growth of papyrus in these swamps seriously inhibits water flow. The Kibuye-Busega Expressway is located in the centre of Kampala city and planned on the geographical conditions described above. A field survey was conducted to understand the geographical condition of the proposed project area. The start point of this expressway at Queen's Way is an almost flat area that gradually climbs to the Kibuye roundabout which is at the top of the hill. On Masaka road near the Nalukolongo railway workshop, there is a considerable difference in elevation between the road and the workshop area. The western side from this point is a long down slope while the area around Natete junction is flat. The end point of this expressway is another swampy area that connects to the Northern bypass. Some photos and location of typical geographical features along Kibuye-Busega Expressway route are shown in Photo 3.1.1 and Figure 3.1.1.

		
【The station building near Masaka road】	【The long, downward slope】	【The swamp at the end point】
The difference of elevation between Masaka road and the railway workshop is large.	The western side form the railway workshop is a long down slope	The papyrus in the swamp

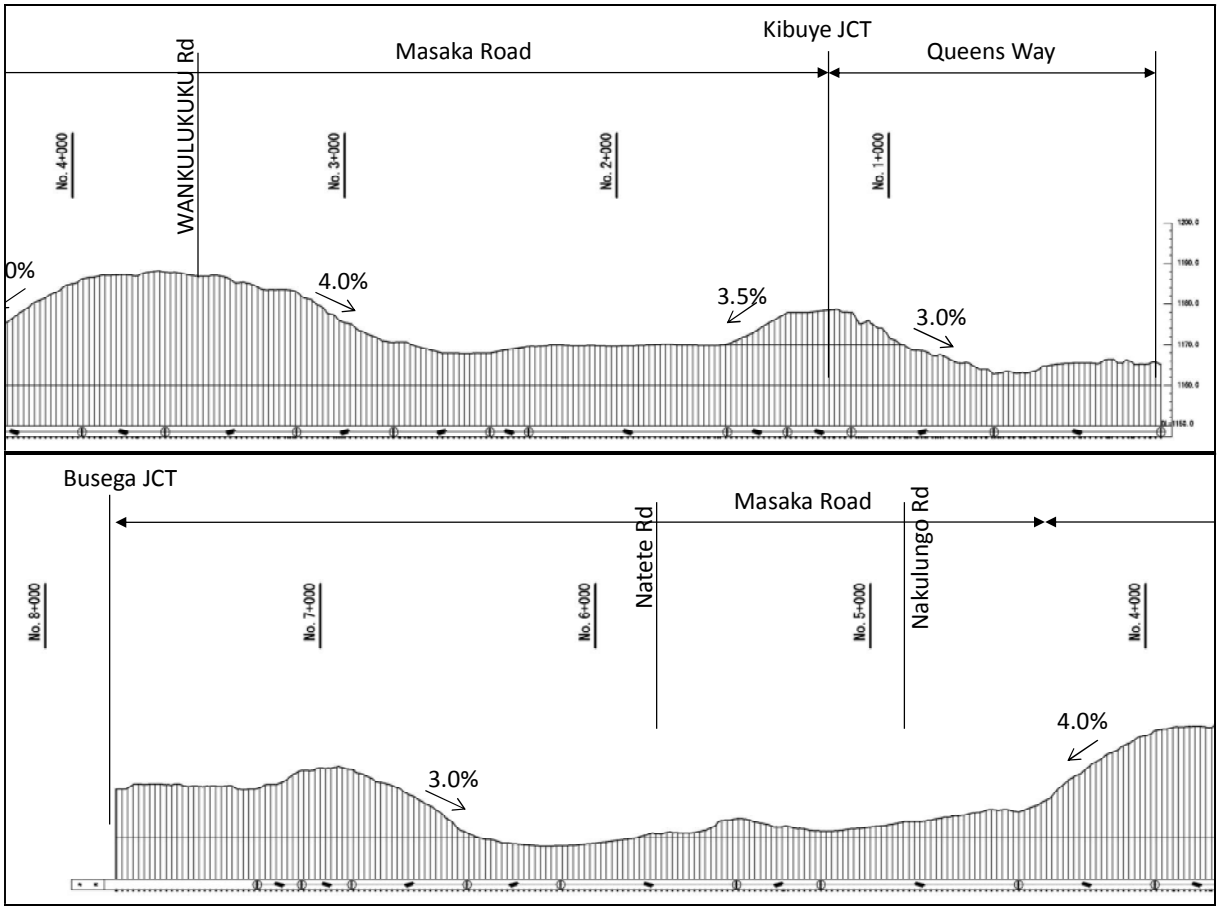
Source: JST

Photo 3.1.1 Typical geographical features along Kibuye-Busega Expressway route



Source: JST

Figure 3.1.1 Geographical features along Kibuye-Busega Expressway



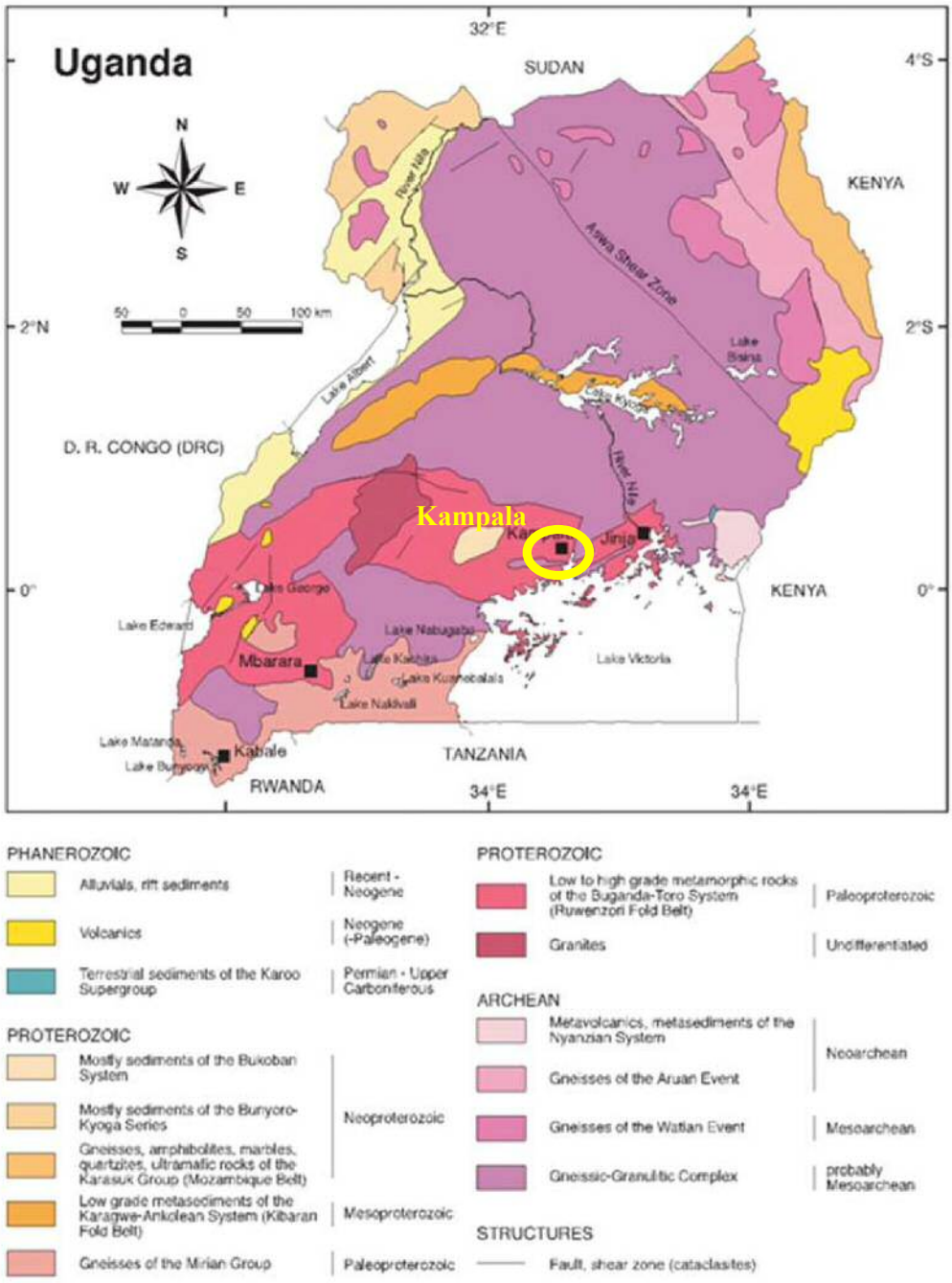
Source: JST

Figure 3.1.2 Vertical Alignment along Masaka Road

3.1.2 Geological Condition

(1) Outline of Geological Condition

The African continent essentially consists of five ancient Precambrian cratons - Kaapvaal, Zimbabwe, Tanzania, Congo, and West African, formed sometime between 3.6 billion and 2 billion years ago, and which have been tectonically stable. Most of Uganda (Figure 3.1.2) is occupied by a basement complex of Precambrian age. Only at the southern part of the country are a type of metamorphic rocks called Buganda-Toro System found. Near the eastern and western boundaries of the country, quaternary alluvial deposits and tertiary volcanic rocks are seen.

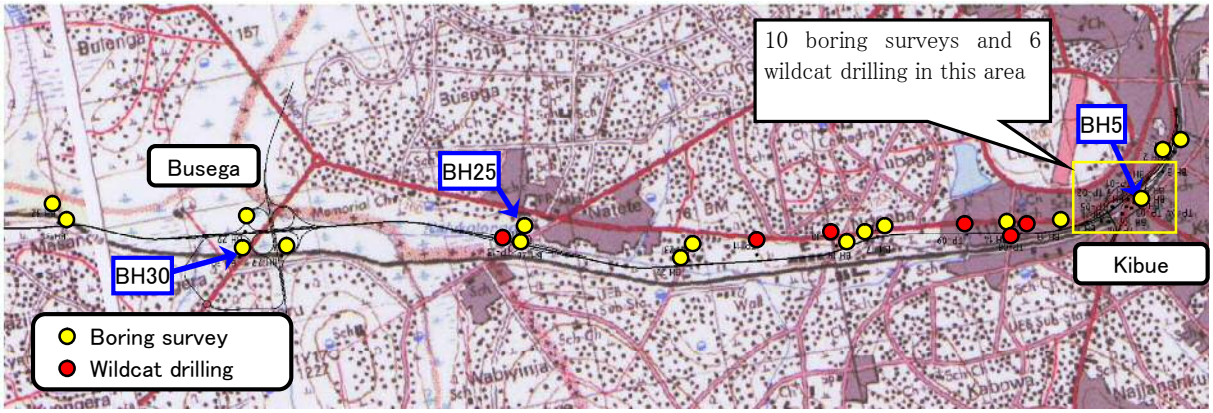


Source: Geological Atlas of Africa

Figure 3.1.3 Geological Map of Uganda

(2) Geological data along Kibuye-Busega Expressway

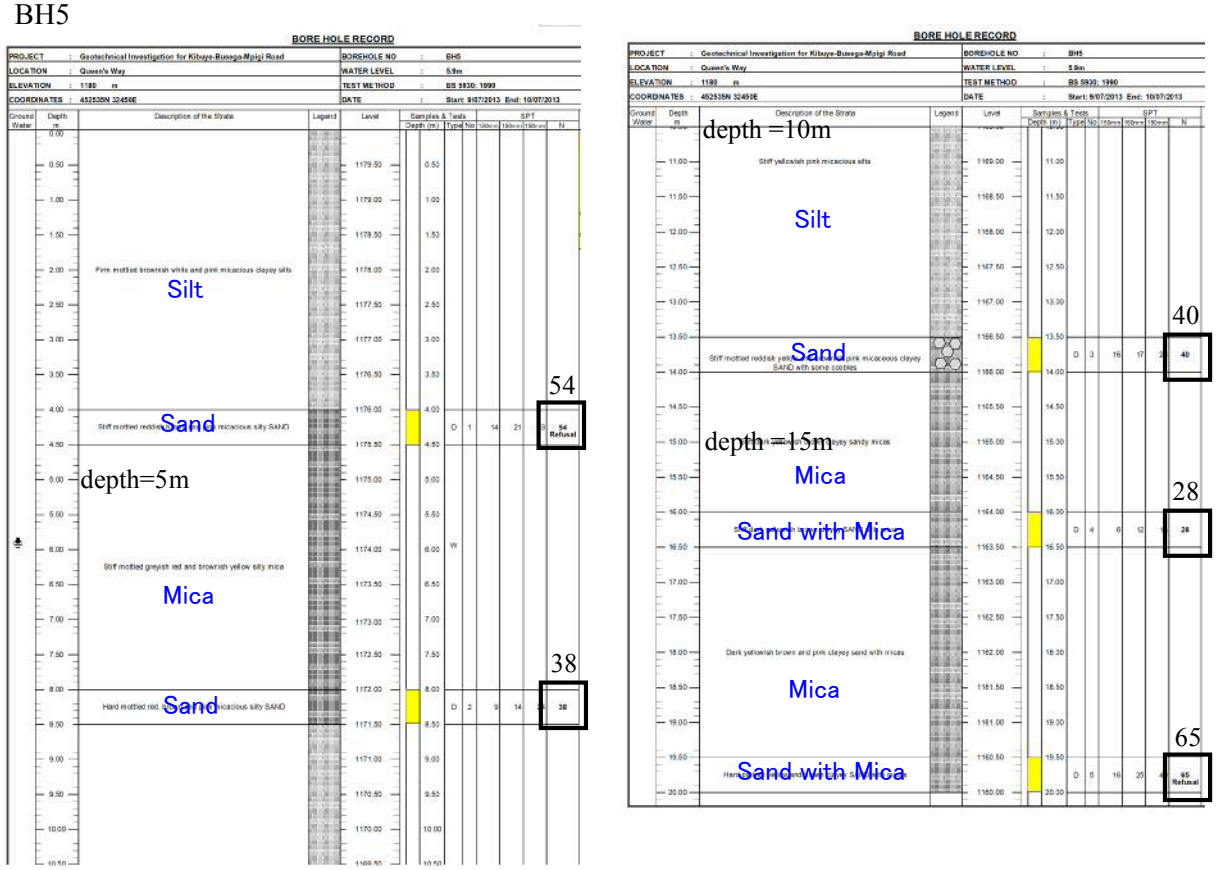
According to "The Soil and Material Factual and Interpretative Report, September 2013", 26 boring surveys and 12 test pit surveys were conducted. Figure 3.1.3 shows the investigation locations and Figures 3.1.4 and 3.1.5 show three borehole logs as an example.



Source: The Soil and Material Factual and Interpretative Report, issued September 2013

Figure 3.1.4 Location of Geographical Surveys along the Kibuye-Busega Expressway

BH5

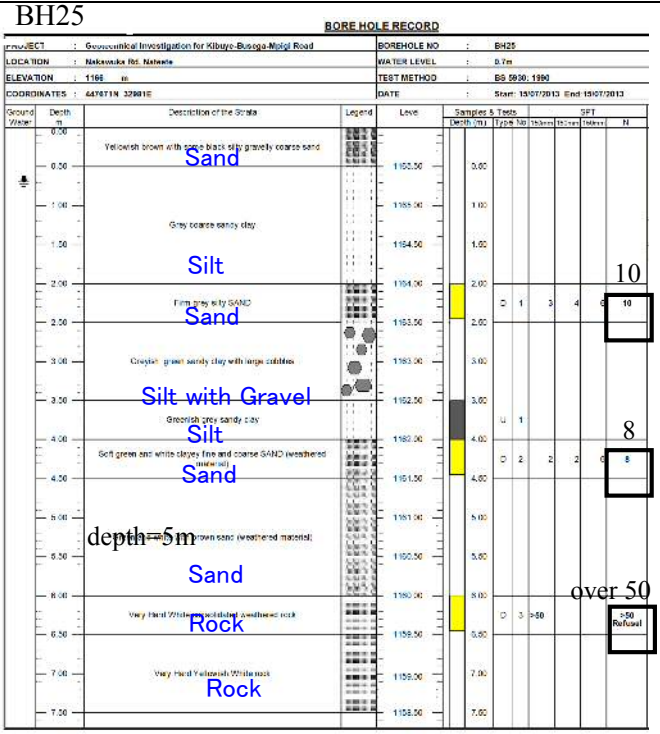


- The borihole depth is 20m. A sand layer with N value larger than 50 was recorded at 4m deep. The strength was not stable as another sand layer of N value of 65 was recorded at 20m depth.
- The support layer for the bridge is assumed to be at 20m depth because of the sand layer of N value of 65.

Source: The Soil and Material Factual and Interpretative Report, issued September 2013

Figure 3.1.5 Results of the Boring Survey at Kibuye Junction

BH25

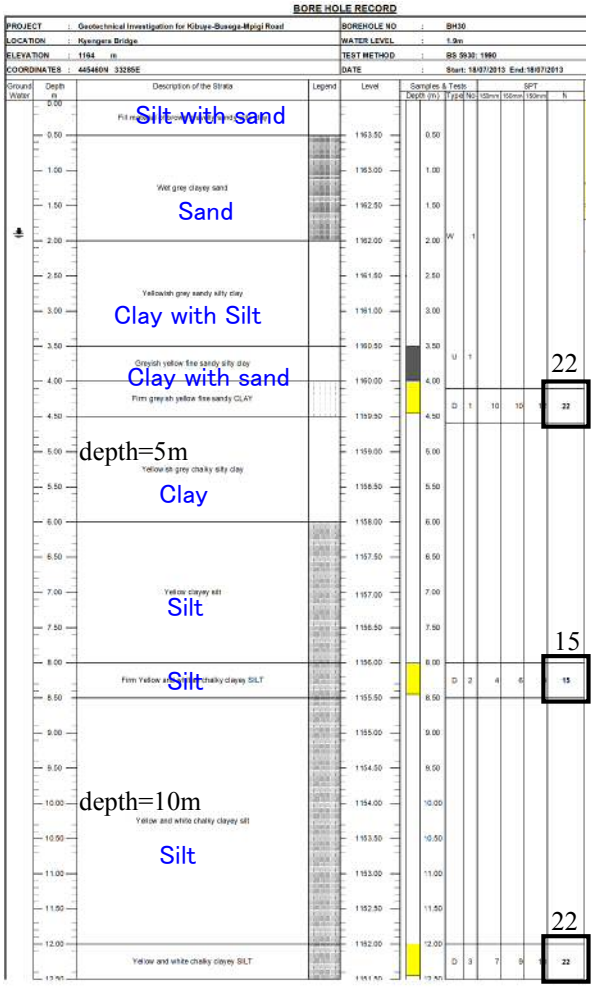


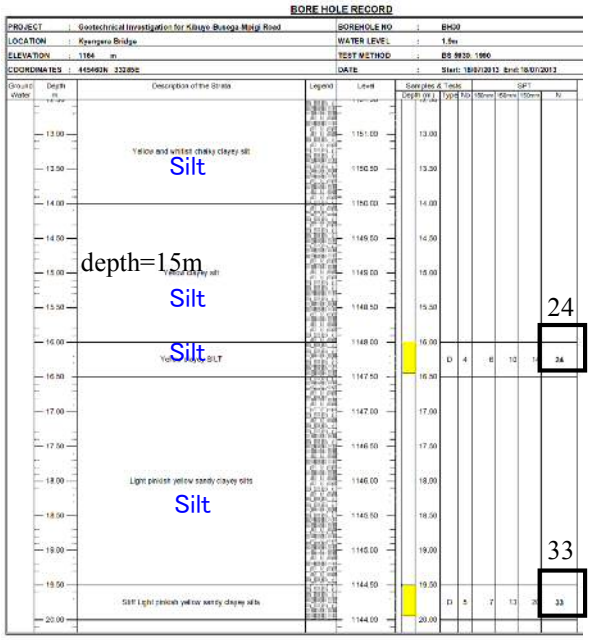
- The boring depth is 7.5m. The sand layer of 10 in N value was recorded at a depth of 2m, then a rock layer was observed at 6m depth.
- The rock layer at 6m depth is assumed as the support layer for the bridge.

Source: The Soil and Material Factual and Interpretative Report, issued September 2013

Figure 3.1.6 Results of Boring Surveys at Natete Road

BH30





- The boring depth is 20m. The clay layer of 22 in N value was recorded at 4m depth, then another the clay layer with 20 in N value was recorded.

Source: The Soil and Material Factual and Interpretative Report, issued September 2013

Figure 3.1.7 Results of Boring Surveys at Busega IC

3.1.3 Meteorology

Kampala is located in a tropical area and at 1,150m elevation, characterized by predominantly torrential rains and high humidity. The temperature in Kampala City is within a narrow range between 19°C and 31°C across the year, as shown in Table 3.1.1.

Table 3.1.1 Average Temperature in 2014–2018 (°C)

Location		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave	max	29.8	30.5	29.4	27.9	27.5	27.4	27.7	28.1	28.5	28.6	28.7	29.2	28.6
	min	21.0	20.4	19.9	19.5	19.9	19.5	19.1	18.9	19.1	20.5	19.2	19.4	19.7

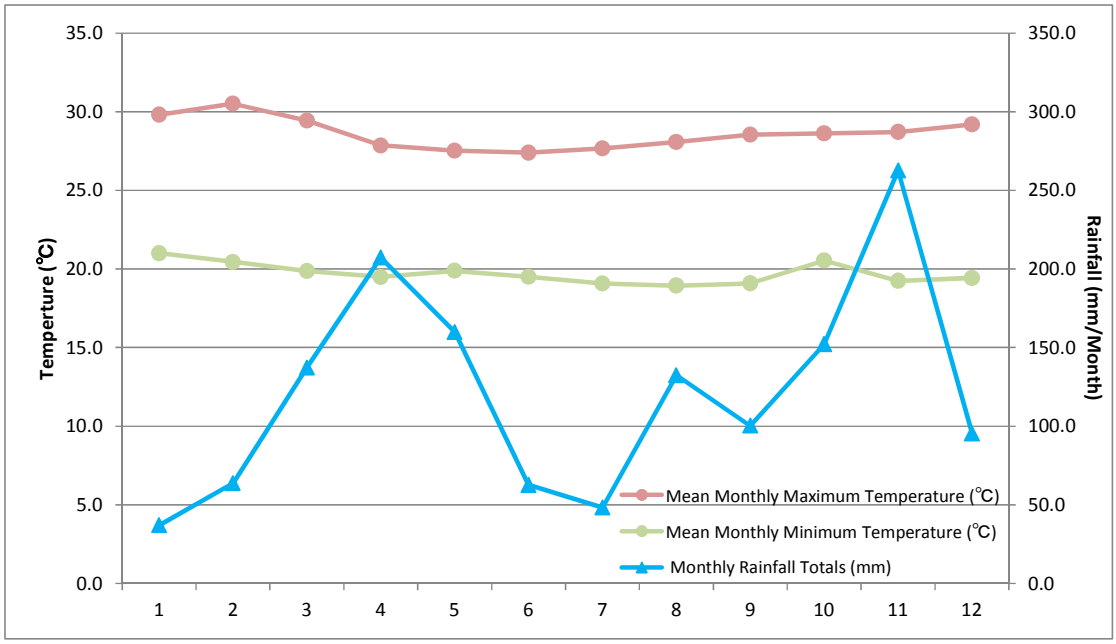
Source: Department of Meteorology, Uganda

The monthly rainfall in Kampala City is shown in Table 3.1.2. Kampala City has two tropical rainy seasons in a year, i.e., light rain season from March to May, and heavy rain season from September to December.

Table 3.1.2. Average Monthly Rainfall in 20012–2016(mm)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012-2016	37.0	63.7	137.2	207.2	159.9	62.7	48.3	132.4	100.3	152.2	262.6	95.3	1458

Source: Department of Meteorology, Uganda



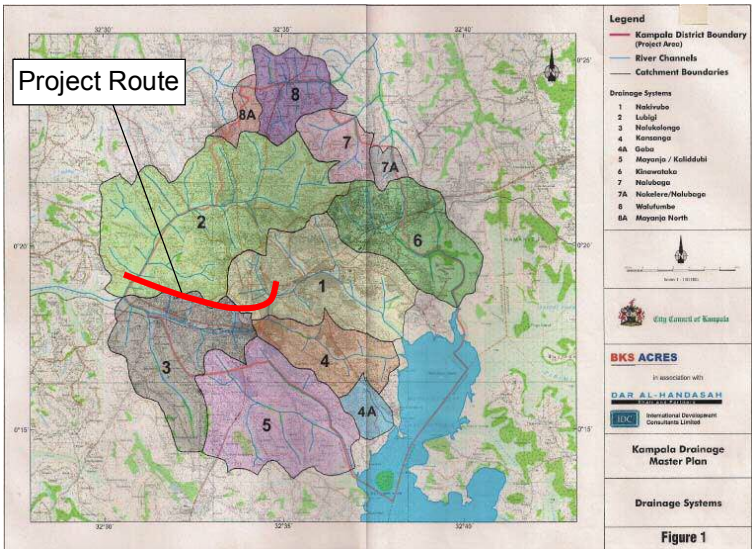
Source：Department of Meteorology, Uganda

Figure 3.1.8. Average Temperature and Rainfall in Kampala

3.1.4 Hydrological Condition

(1) Hydrological data in Kibue-Busega Expressway

According to "Nakivubo Channel Rehabilitation Project," there are eight main drainage systems in Kampala District. The catchment area of each drainage system is shown in Figure 3.1.8. A large part of the Kibuye-Busega Expressway lies within the Nalukolongo (No.3 in the figure) which has a catchment area of 32.8km^2.



No	Name	Area km^2
1	Nakivubo	37.9
2	Lubigi	65.8
3	Nalukolongo	32.8
4	Kansanga	17.1
4A	Gaba	2.1
5	Mayanja/Kaliddubi	41.1
6	Kinawataka	27.5
7	Nalubaga	11.0
7A	Nakelere/Nalubaga	2.5
8	Walufumbe	14.1
8A	Mayanja North	2.3

Source: Nakivubo Channel Rehabilitation Project (NCRP)

Figure3.1.9 Drainage area in Kampala City

(2) Existing Drainage Structures on Masaka Road

According to "Engineering Report and Review of Design and Build Contractor's Design (Kibuye–Busega–Mpigi), July 2015; Gauff Consultants Ltd.", existing pipe and box culverts along existing Masaka road were investigated, and it was determined that culverts of similar capacity are also necessary for the new roads. Table 3.1.3 shows the number of the exiting culverts along Masaka road.

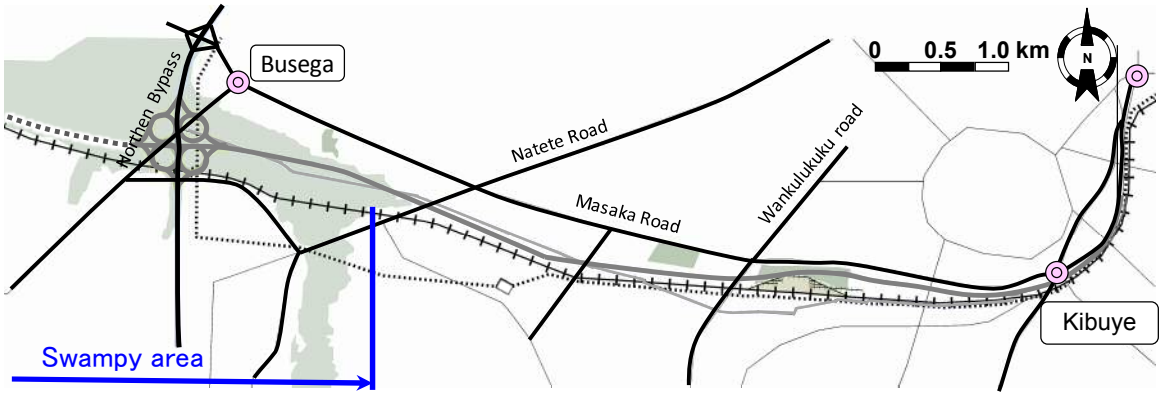
Table3.1.3 Existing Culverts on Masaka Road

Type	Transversal	Longitudinal (under access to the properties along the road)
Box Culvert	2	0
Steel pipe	32	8
Concrete pipe	67	162
Total	101	170

Source: Engineering Report and Review of Design and Build Contractor's Design (Kibuye – Busega – Mpigi), July 2015; Gauff Consultants Ltd.

(3) Swamp Treatment

According to "Engineering Report and Review of Design and Build Contractor's Design (Kibuye–Busega–Mpigi), July 2015; Gauff Consultants Ltd.," a soft soil improvement for swampy area along the project route as indicated in Figure 3.1.9, including soil replacement and sand drain, were recommended for the western side of Wankulukuku junction.



Source: JST

Figure 3.1.10 Swampy Area along the Project Route

3.2 Constrains in Road Alignment

3.2.1 Related Projects and Plans

Table 3.2.1 and Figure 3.2.1 shows related projects and plans in GKMA.

Table 3.2.1 Related Projects and Plans

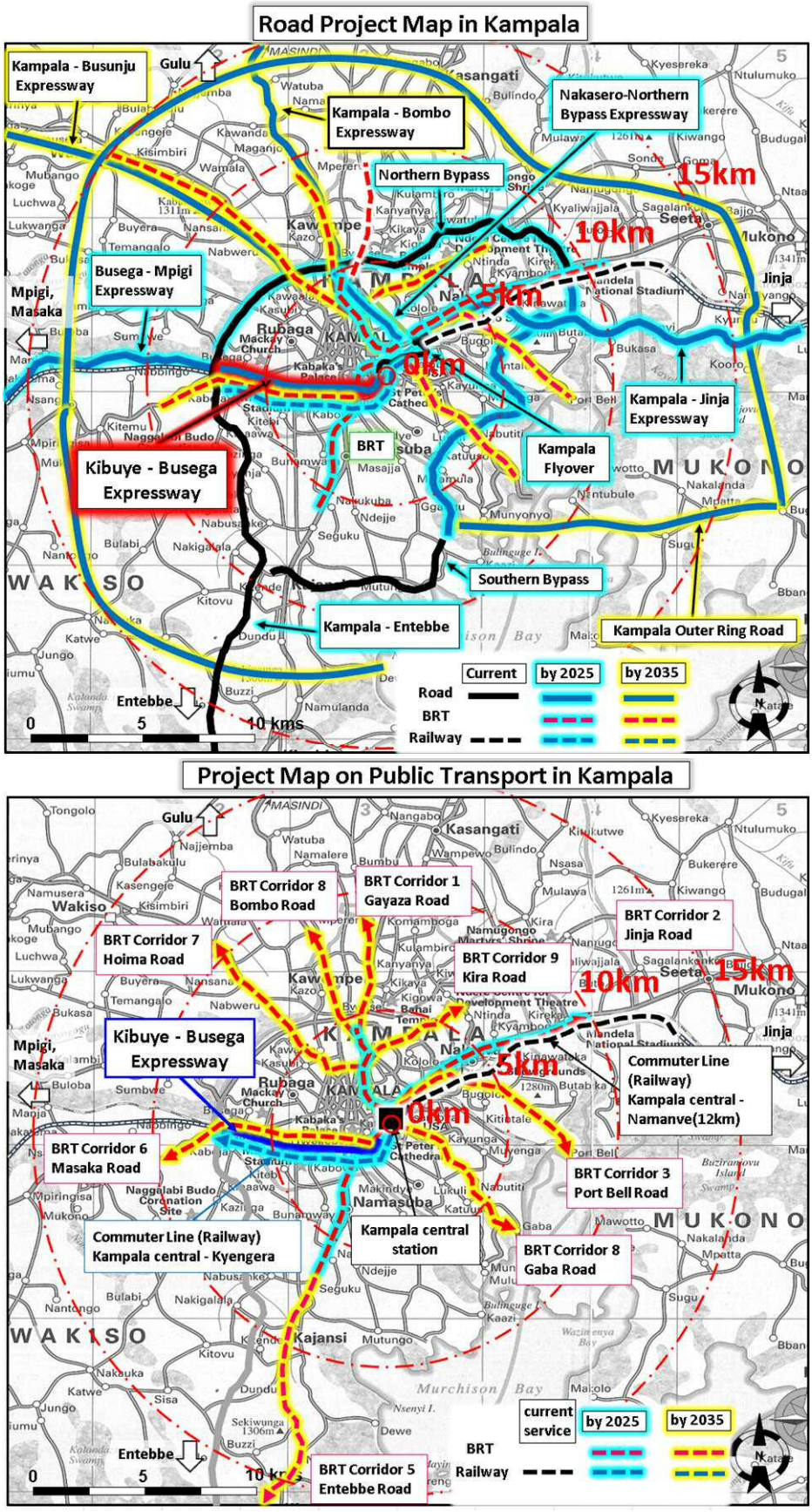
	Name	Organization	Completion Target Year		Remark
			by 2025	by 2035	
Road	Kampala Flyover Lot-1 (Clock Tower FO)	UNRA	✔		Ongoing
	Kampala Flyover Lot-2 (Kitgum House FO)	UNRA	✔		Works to commence in 2020/2021
	Busega-Mpigi Expressway	UNRA	✔		Work to commence in 2019
	Kampala-Entebbe Expressway	UNRA	Completed		Completed
	Northern BP	UNRA	✔		Ongoing
	Southern BP	UNRA	✔		Work to commence in 2020/21
	Kampala-Jinja Expressway	UNRA	✔		Work to commence in 2020/21
	Nakasero-Northern BP Expressway	UNRA	✔		
	Kampala Outer Beltway	UNRA		✔	Work to commence in 2024/25
	Kampala Bombo Expressway	UNRA		✔	Work to commence in 2024/25
	Kampala-Busunju Hoima Expressway	UNRA		✔	Work to commence in 2029/30
	Nsambya-Rosebury Road			✔	
	Kayemba-Katwe Tunnel	KCCA		✔	
Public Transport	Kampala BRT (Bus Rapid Transit) Pilot Project	WB	✔		3 route Designs completed
	Kampala BRT (Bus Rapid Transit) Full Network	WB		✔	6 route
	Commuter Train on existing railway	WB	✔		
Urban Development	Commercial Building near Natete JCT	KCCA	✔		Natete Rubaga Division
	Shops Development near Natete JCT	KCCA	✔		Natete Rubaga Division
Other	Bukasa Inland Port Project	MoWT	✔		Work to commence in 2019
	The Nalukolongo Channel Widening Project	KCCA	✔		

Source: JST

Kampala-Jinja Expressway and Kampala Flyover Project will be inaugurated by 2025 to connect the eastern part of Kampala city with the east side of Uganda. Busega-Mpigi Expressway will also be opened by 2025 to connect the western part of Kampala city with the west side of Uganda. There is a missing link between Kibuye at the end point of Kampala Flyover Project and Busega, which is the beginning point of Busega-Mpigi Expressway. It is desirable that Kibuye-Busega Expressway Project be completed to link between Kampala Flyover Project and Busega-Mpigi Expressway Project by 2025.

By 2025, major trunk roads including expressways within 10km from Kampala city will be opened for traffic as shown in Figure 3.2.1.

On the other hand, BRT corridor No.6 and westbound commuter train services from Kampala central station as new public transport systems will be introduced. Three types of urban transport modes, i.e. Kibuye-Busega Expressway, BRT and Railway services will be operated between Kibuye and Busega.



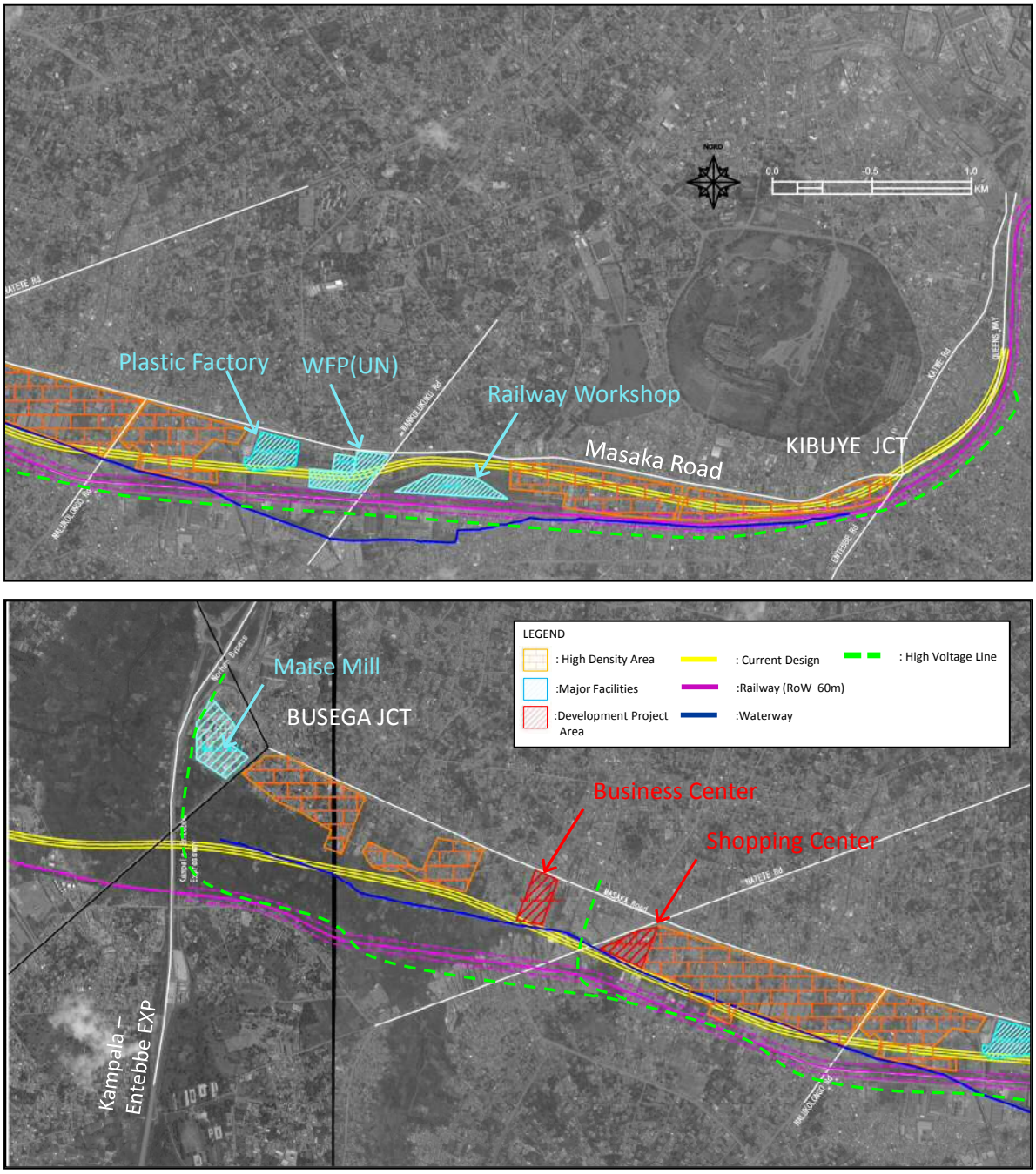
Source: JST

Figure 3.2.1 Related Main Road Projects and Public Transport

3.2.2 Built up Area and Facilities

Project area in KBEX has built up area of residential and commercial, facilities such as railway and water way and high voltage line. Figure 3.2.2 shows built up area and facilities.

Current Design alignment (yellow line) is obstructed by the facility of WFP (UN).



Source: JST

Figure 3.2.2 Current Situation

Table 3.2.2 Projects Area Photo

Railway along Queen's Way	Masaka road (near Kibuye Jct)
	
Railway Workshop	**World Food Programme (UN)**
	
High Voltage Line (near Natete Rd)	**Water Way (Natete Rd crossing)**
	
Busega Swamp (Interchange Site)	**Masaka Road (near Natete Road)**
	

3.2.3 Social Environmental Considerations

(1) Environmental Social Impact Statement (ESIS)

1) Current Conditions of ESIS Report

ESIS for Kibuye-Busega-Mpigi Expressway was prepared in June 2015 in accordance with the national policy and regulations related to ESIS and safeguard policies of African Development Bank. It was approved by National Environmental Management Authority (NEMA) in October 2015 with certain conditions. Major approval conditions related to ESIS report or environmental impacts are summarized below.

- Obtain all necessary approvals from relevant authorities before commencement of construction activities.
- Ensure full compensation payments to all affected persons/families in a transparent and timely manner according to the agreed compensation terms and rates.
- Carry environmental impact assessment for other auxiliary components that are not subject to the approved ESIS such as asphalt plant, borrow pits, temporary workers camp and construction yards.
- Have in place a road safety awareness program to sensitize the local community, load users school children on safety measures during construction and operation phases.
- Create awareness on the project activities to local communities with information leaflets in their local language to minimize conflict with the local communities.
- Put in place HIV/AIDS and STD awareness and prevention program to sensitize both the workers and the local communities.
- Fully implement Environmental and Social Management Plan.
- Minimize dust nuisance to the immediate neighbourhood and littering during construction works by applying appropriate measures.
- Ensure that workers are provided with appropriate personal protective equipment.

Followings were found from the interview to the officer of NEMA ESIS review section:

- Expiration of the ESIS approval is not precisely mentioned in the approval certificate issued in October 2015. Generally, the validity of ESIS approval is maximum 5 years from the approval date unless a project proponent requested NEMA for extension of approval. If a project is not implanted within the 5 years validity period, a new ESIS approval is necessary since the natural and social conditions in and around the project area might be changed.
- ESIS is required if the route is significantly modified from the one appearing in the approved ESIS. “Significantly modified” meant that the route passed to another area. If the modified route is still within the same area and possible adverse impact is not larger than the ones assessed in the approved ESIS, amendment of ESIS is not required.
- In case the project design is slightly modified, or the project is implemented within 5 years from the ESIS approval, the modified design has to be updated in the Environmental Management Plan, which is to be submitted before commencement of construction works.

2) Review Results of ESIS Report

The approved ESIS report was reviewed with reference to JICA Guidelines for Environmental and Social Considerations issued in April 2010 (the JICA Guidelines). Review results and findings are explained in Table. 3.2.3.

Table 3.2.3 Review Results of ESIS Report

JICA Guidelines	ESIS for Kibuye-Busega-Mpigi Expressway (June 2015)
1. Project Proponent	
Describe outline of proposed components which are targeted as the environmental and social considerations.	There is a description of project outline, and it is considered sufficient to examine possible environmental and social impacts.
2. Baseline data	
Describe below: a) Pollution control including the results of site measurement b) Natural environment c) Protected areas and culturally important area d) Land use e) Customary land, involuntary resettlement	a) Some points of water quality and noise exceeded the standard value. Air quality was measured but there was no comparison between measured value and standard value. Measurement points were described by the coordinate points or narratively. It might be easily understood if they were indicated on the map. b) There was a record of flora and fauna survey. However, identified location was not precisely explained. c) There was no protected area. As for culturally important area, pottery was found though location between the pottery founded area and the project site was not particularly explained. d) It was described that the project area was built-up urban area. e) There was description that the proposed alignment passed through "Buganda Kingdom" owned by the kingdom though the detained information was not explained.
3. Policy, legal and institutional framework	
Describe below: a) Regulations and standards related to ESIS and information disclosure b) Roles and responsibilities of relevant authorities	a) There was a description on ESIS related regulations and standards. However, there was no explanation on information disclosure. b) There was explanation of responsibilities on relevant authorities for the Project although explanation on monitoring during the construction and operation phases was not found.
4. Analysis of alternatives	
Compare feasible alternatives considering location, technology, design, cost, environmental/social considerations and operation including without project.	There was examination of route comparison including zero option though compared routes were not explained in detail. Alternatives were examined economically, technically and environmentally; however, the reason for the route selected as the optimum route was not clear.
5. Scoping and TOR for field survey	
Describe preliminary evaluation of possible impacts at pre-construction, construction and operation phases based on secondary data and site reconnaissance and show survey contents/measures (TOR)	Scoping was conducted but there was no description in the ESIS report.
6. Impact Assessment	
Describe likely positive and negative impacts in quantitative terms to the extent possible. Impacts for assessment should be both direct and indirect.	There was explanation about the timing for land acquisition or resettlement although the scale of land acquisition or resettlement was not explained. There was no explanation on impact to water use. As for possible impact to water quality, it was evaluated qualitatively only.
7. Environmental management and monitoring plan	
Describe below: a) concrete mitigation measures to the items evaluated as negative impacts, b) monitoring plan (parameters, location, frequency) at each project phase c) implementing and responsible organization for all mitigation measures and monitoring d) cost for mitigation measures and monitoring	There was no explanation on overall monitoring structure at each project phase, monitoring methods, monitoring points or monitoring forms. In the Environment and Social Management and Monitoring Plan (ESMMP) separately prepared shows reporting structure up to submission from Environmental Supervising Environmentalist in the construction phase, it was no explanation how the monitoring report would be submitted to the environmental and other relevant authorities and how the monitoring/reporting would be done in the operation phase.
8. Stakeholder analysis and holding stakeholder meetings	
a) Include a record of stakeholder meetings	There was no description about the timings of stakeholder meeting, methods of announcement or comments raised by participants.

Source: JST

(2) Resettlement Action Plan (RAP)

1) Current Conditions of RAP

RAP for Kibuye-Busega-Mpigi Expressway was prepared in July 2015 in accordance with the national policy and regulations related to ESIS and safeguard policies of African Development Bank. The route between Kibuye and Busega was regarded as Section 1, and between Busega to Mpigi was regarded as Section 2.

2) Review Results of RAP

The RAP was reviewed referring to JICA Guidelines for Environmental and Social Considerations issued in April 2010 (the JICA Guidelines). Review results and findings were explained in the table below.

Table 3.2.4 Review Results of RAP

	JICA Guidelines	RAP for Kibuye-Busega-Mpigi Expressway (July 2015)
1	Legal framework and institutional arrangement	Legal framework and institutional arrangement were explained. In addition, there was gap analysis between the policy of AfDB and domestic regulations in Uganda.
2	Necessity of resettlement	Explanations on purposes or methods of preparation RAP were given, but the necessity of resettlements was not explained.
3	Socio-economic survey	The result of socio-economic survey was explained. Cut-off date was set as 4 June 2015 which was explained during consultation meetings and census. However, impact on land acquisition such as numbers of families/people to be relocated was not described.
4	Policy of compensation and livelihood restoration	It was not sure whether the compensation was provided in full replacement cost although there was explanation on compensation policy. In addition, there was no explanation of entitlement matrix.
5	Plan for arrangement of the relocation site	Cash compensation was planned since the project site was located in the urban area. In addition, candidate sites for relocation of shops and schools were explained.
6	Grievance redress mechanism	There was explanation of grievance-redress mechanism.
7	Implementation schedule	There was explanation of implementation schedule.
8	Budget	There was explanation of budget though budget source was not explained.
9	Monitoring and evaluation	There was description of internal and external monitoring as well as evaluation though monitoring structure was not explained.
10	Public participation	Consultations were held with the affected persons although the timings of consultation meetings and the invitation methods were not explained.

Source: JST

3.3 Formulation of the Project: Road Design

3.3.1 Design Criteria of the Road

Geometric design of the Project has been carried out in accordance with the parameters for a design road class of paved 1A, as described in Vol. 1. Geometric Design of the MoWT Road Design Manual. The Summary of applicable geometric design parameters for the Project is shown below. These parameters are same as the current design.

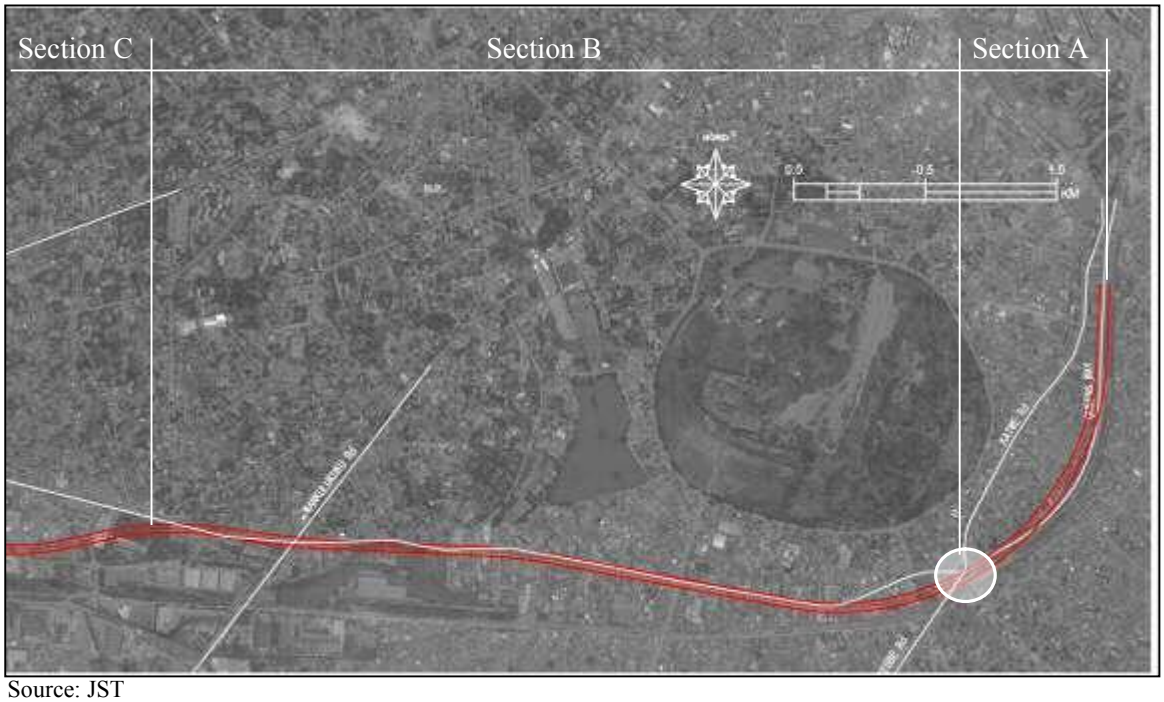
Table 3.3.1 Summary of Applicable Geometric Design Parameters for the Project

Design Element	Unit	Road way	Ramp
Road Class		1A Paved	
Design Speed	km/h	80	50
Min. Stopping Sight Distance	m	115	60
Min. Passing Sight Distance	m	545	345
Min. Horizontal Curve Radius	m	240	85
Max. Gradient (Desirable)	%	4	5
Max Gradient (absolute)	%	6	6
Crest Vertical Curve stopping	Kmin	9	
Sag Vertical Curve stopping	Kmin	11	
Normal Cross fall	%	2.5	

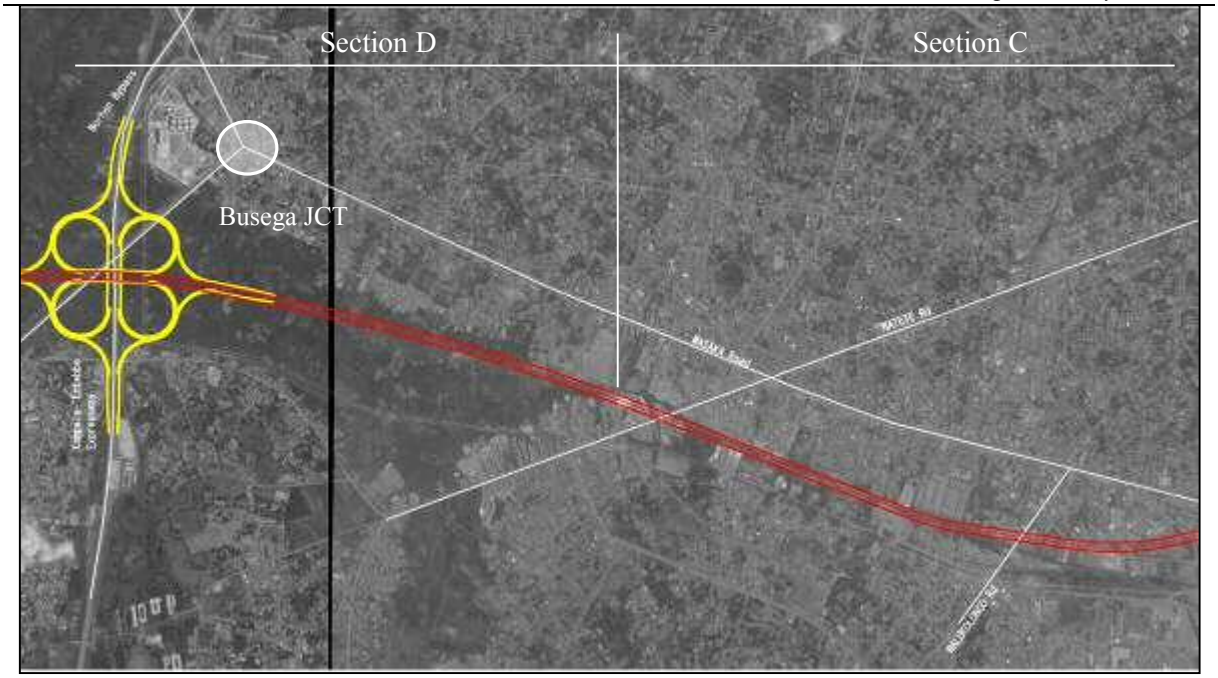
Source: Uganda Road Design Manual,

3.3.2 Plan of the Cross Section

A typical lane width of 3.65m, the same as IA paved class of Road Design manual, is recommended. The 1A paved class is defined as a road that functions as international Trunk Road, and is applied the access control in full and/or partially. As this survey area and route will be used together with both highways, a lane of at least 3.65m width is recommended. Typical Cross Sections are shown in the Figures below.



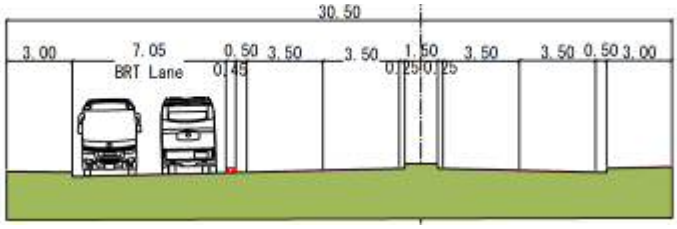
Source: JST



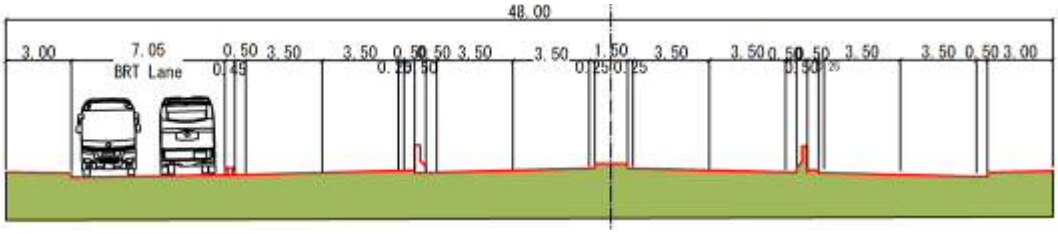
Source: JST

Figure 3.3.1 Section Plan in West side on KBEX

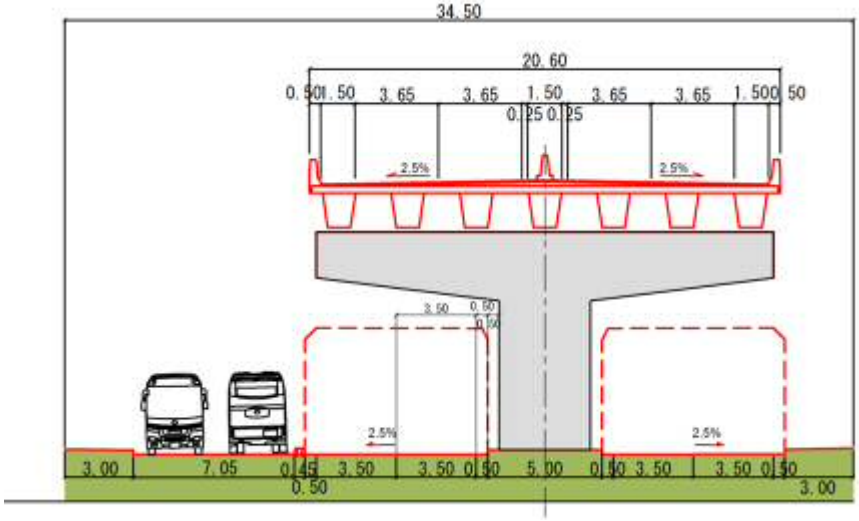
Section A-1: Queen's Way Standard Section (4-lane)



Section A-2: Queen's Way Approach Section (4-lane)



Section A-3 : Queen's Way Viaduct Section (4-lane)

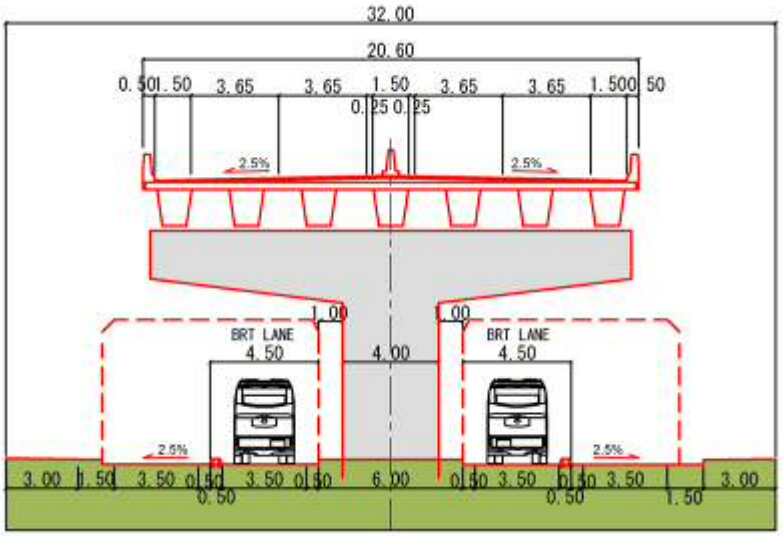


Source: JST

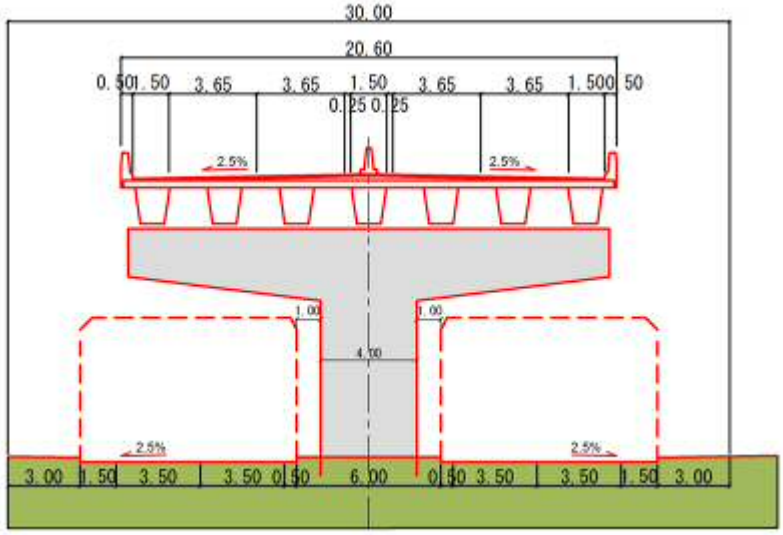
Figure 3.3.2 Typical Cross Section A (On Queen's way)

Section B: Kibuye-Busega Expressway Viaduct Section on Masaka Road (4-lane)

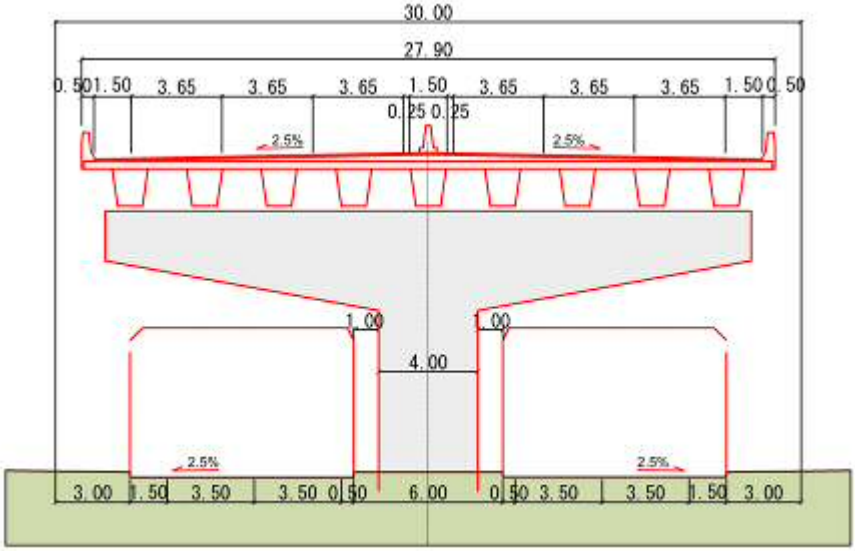
With BRT



Without BRT



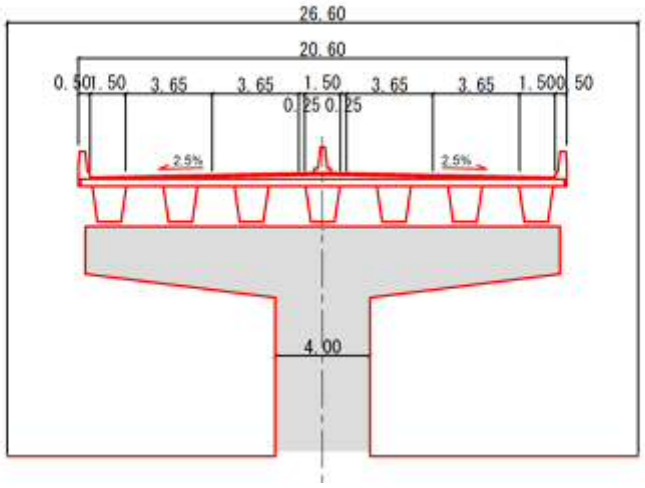
Reference Kibuye- Busega Expressway Viaduct Section (6-lane)



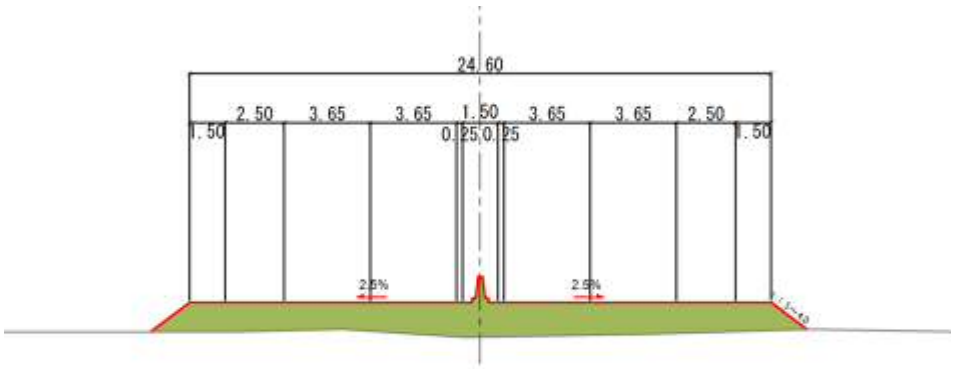
Source: JST

Figure 3.3.3 Typical Cross Section B (On Masaka Road)

Section C: Kibuye-Busega Expressway Viaduct Section (4-lane)



Section D: Kibuye-Busega Expressway Fill Section (4-lane)



Source: JST

Figure 3.3.4 Typical Cross Section B (Without Masaka Road)

3.3.3 Study on the Alignment through Comparison of Alternative

Road Alignment plans were established with 3 plan excluding the current design. The current design is planned by "Feasibility Study and Detailed Engineering Design, Tender Assistance and Project Management for Capacity Improvement Projects. Lot A: Kibuye–Busega–Mpigi Road, 2015"

Three alternative plans in road alignment were set up and compared from several viewpoints. The alternatives are established after the site reconnaissance and the data collection for traffic movements, environmental regulations, related plans and development projects, road infrastructures, important facilities, built-up areas, statistics of socio-economic data and so on. Figure 3.3.5and Figure 3.3.6 shows the horizontal alignment of each alternative. Vertical Alignment is similar in each alternative. As an example, Figure 3.3.7 shows vertical alignment of alternative-1.

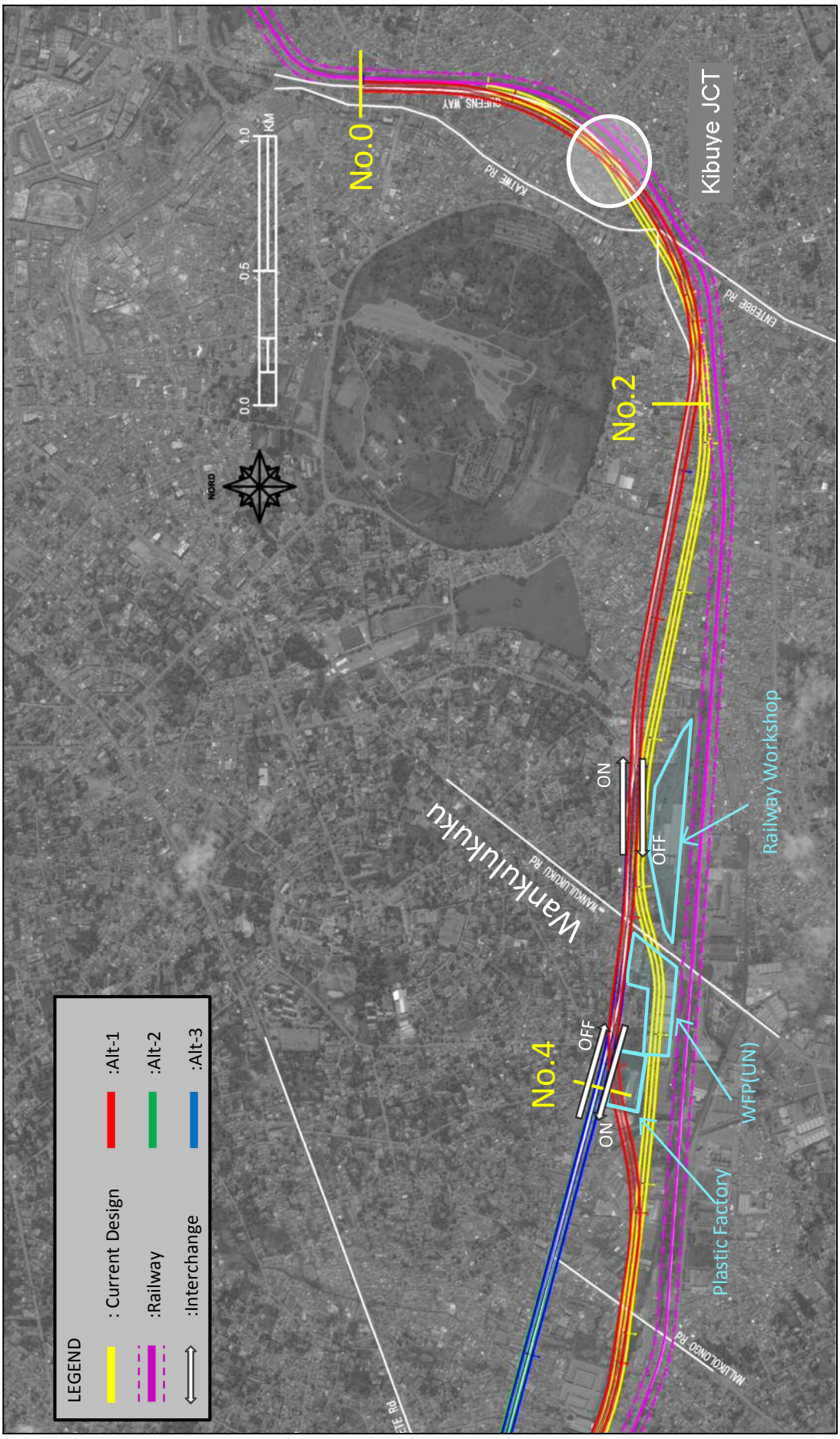
Feature of each alternative is shown following table.

- ✓ Alternative-1 flies over Masaka Road between Kibuye and the Plastic factory and diverges from the existing Masaka road onwards.
- ✓ Alternative-2 flies over Masaka Road between Kibuye and the Natete Road.
- ✓ Alternative-3 flies over Masaka Road between Kibuye and the point 1.0km before Busega JCT.

Table 3.3.2 Summary of Applicable Geometric Design Parameters for the Project

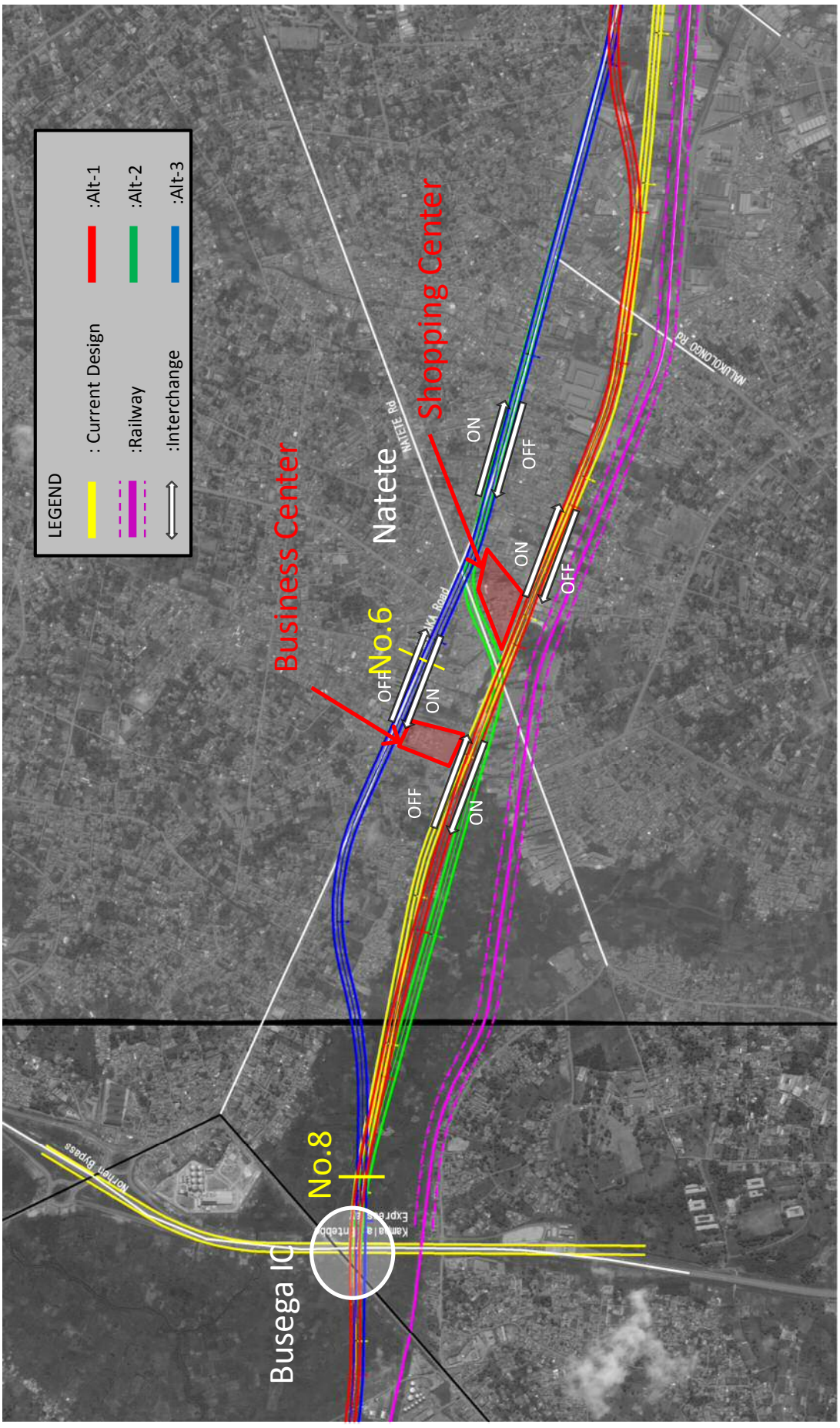
Item		Current design	Alternative-1	Alternative-2	Alternative-3
Road length		9,030m	9,015m	9,010m	9,030m
Viaduct length		4,500m	5,650m	5,660 m	6,300m
Existing Rd Widening Length		1,000m	4,000m	6,000m	6,800m
Minimum Curve Radius		400m	800m	250m	800m
Maximum Gradient		5%	4%	4%	4%
Road Area	4-lane	271,800 ㎡	271,100 ㎡	270,900 ㎡	271,500 ㎡
	6-lane	285,800 ㎡	285,100 ㎡	284,900 ㎡	285,500 ㎡
Land Acquisition Area	4-lane	251,000 ㎡	190,500 ㎡	137,000 ㎡	114,900 ㎡
	6-lane	265,000 ㎡	204,500 ㎡	151,000 ㎡	128,900 ㎡
Affected Buildings	4-lane	1,160*	430**	310**	330**
	6-lane	1,190*	460**	340**	360**
Area of inside the ROW of Railway	4-lane	10,500 ㎡	16,000 ㎡	16,000 ㎡	16,000 ㎡
	6-lane	12,500 ㎡	18,000 ㎡	18,000 ㎡	18,000
Affected Facilities		WFP, Power line, Nalukolongo Channel	Power line, Nalukolongo Channel	Power line, Nalukolongo Channel	Power line, Nalukolongo Channel

Note: * Based on the survey result in RAP (July 2015)
** Roughly counted any types of buildings within the road alignment identified on satellite image
Source: JST



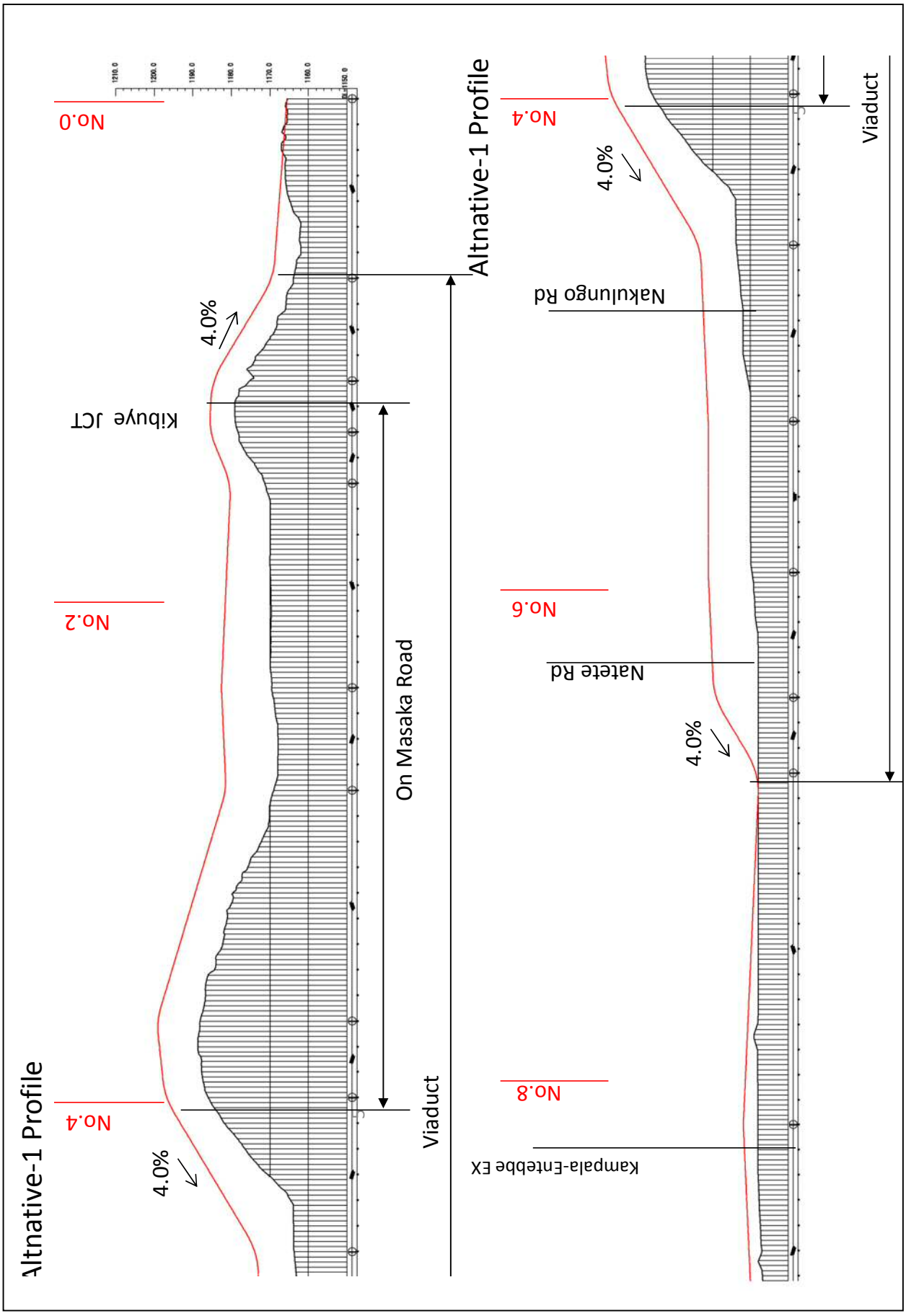
Source: JST

Figure 3.3.5. Horizontal Alignment of each alternative in East Side



Source: JST

Figure 3.3.6 Horizontal Alignment of each alternative in West Side



Source: JST

Figure 3.3.7 Vertical Alignment of Altrntive-1

3.3.4 Study on Junction/Ramp through Comparison of Alternatives

(1) Kibuye Junction

Kibuye Junction plan was established 3 options including the current plan. Table 3.3.3 shows plan options and existing Kibuye roundabout.

Table 3.3.3 Kibuye Junction Options

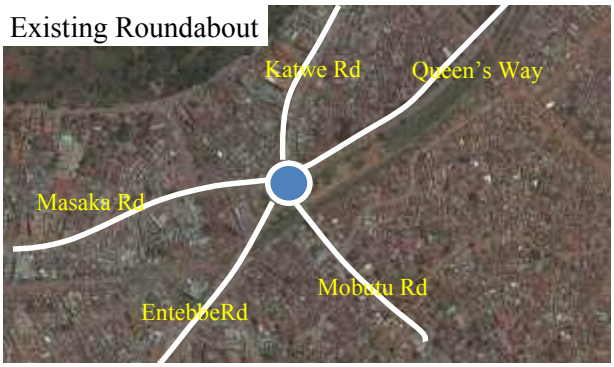
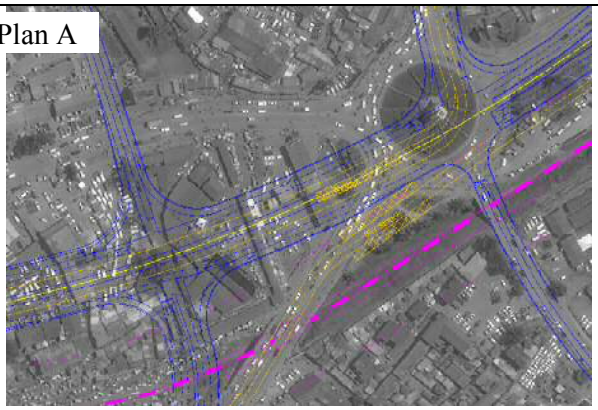
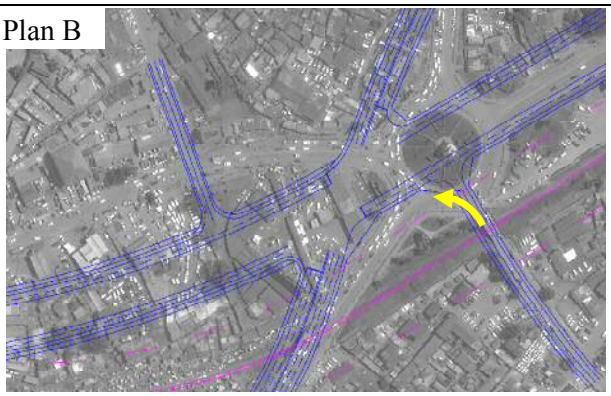
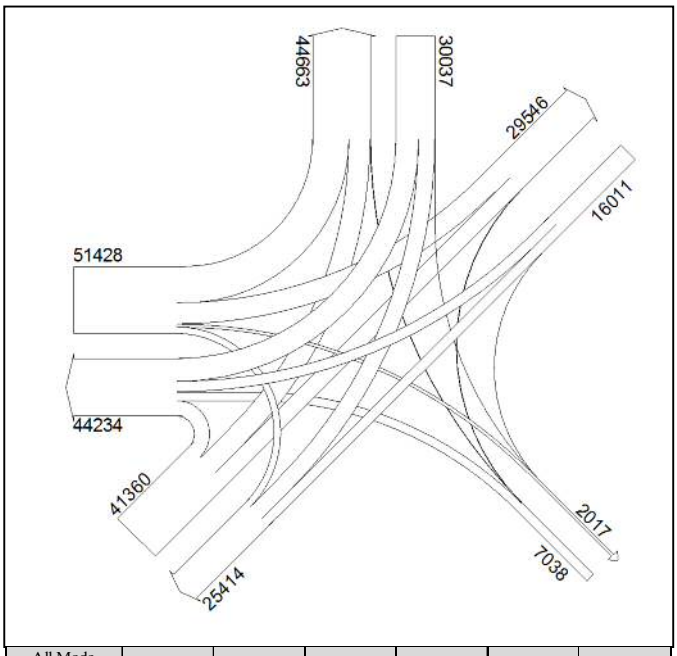
Option	Description
Existing Roundabout 	・One Roundabout junction: 5-way junction ・Junction Area: 5000m^2 Dia : 80m ・Added Land acquisition area: 0m^2 ・BRT: Impassable Kibuye JCT ・The existing roundabout is bottleneck
Current Plan 	・Two Roundabout junctions ・Junction Area-1: 3000m^2 Dia: 60m Junction Area-2: 3000m^2 Dia: 60m ・Added Land acquisition area: 25000m^2 ・BRT: Impassable Kibuye JCT
Plan A 	・Two traffic signal junctions ・Junction Area-1: 1500m^2 Junction Area-2: 2500m^2 ・Added Land acquisition area: 3000m^2 ・BRT: Passable Kibuye JCT
Plan B 	・1 traffic signal junctions ・Junction Area: 3000m^2 ・Added Land acquisition area: 3500m^2 ・BRT: Passable Kibuye JCT ・Direction control on Makindye Rd

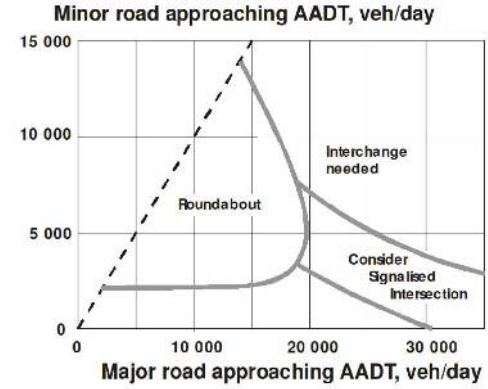
Figure 3.3.9 show result of traffic assignment considered KBEX at Kibuye JCT in 2024. The highest demand direction at Kibuye JCT is form Masaka Road to Katwe Road and total demand at Kibuye is 146,000 PCU/day. Kibuye is high demand intersection even after completed KBEX. Based on Figure 3.3.8, This intersection is not suitable for roundabout.



All Mode (PUC/day)	Mobutu Rd	Entebbe Rd	Masaka Rd	Katwe Rd	Queen's way	Total
Mobutu Rd	0	0	6,714	159	165	7,038
Entebbe Rd	0	0	11,957	16,478	12,925	41,360
Masaka Rd	1,940	5,006	0	28,026	16,456	51,428
Katwe Rd	72	12,570	17,395	0	0	30,037
Queen's way	5	7,838	8,168	0	0	16,011
Total	2,017	25,414	44,234	44,663	29,546	145,874

Source:JST

Figure 3.3.9 Traffic Flow at Kibuye JCT



Source: Road Degin Manual, MoWT

Figure 3.3.8 Selection of control intersection

The following figure shows 3D image of Plan A

Figure 3.3.10 3D image of Kibuye Junction

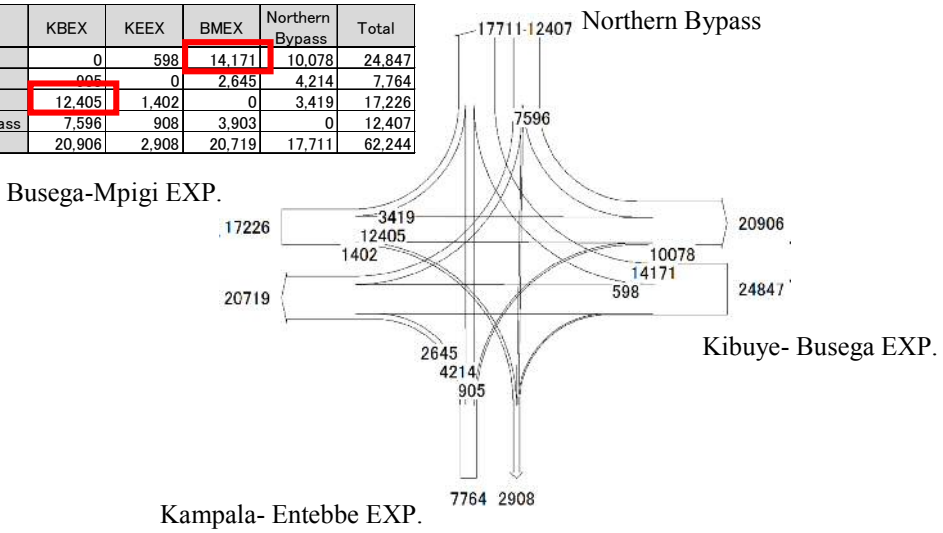
(2) Busega Interchange

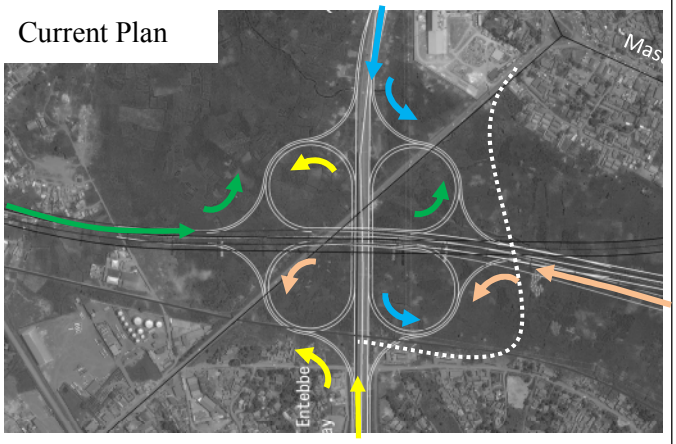
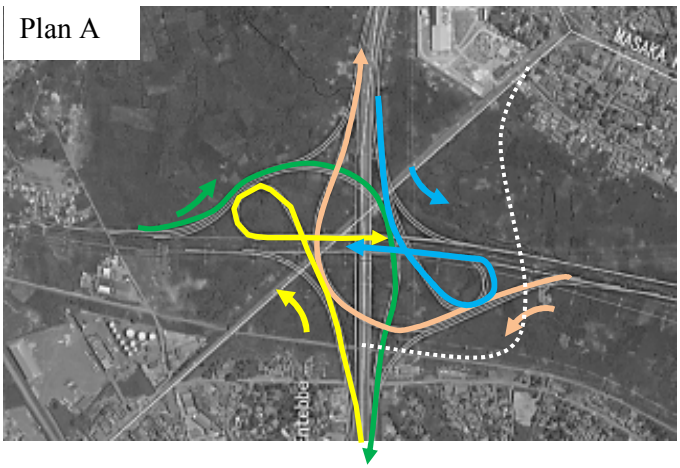
Busega Interchange plans consider 2 options including the current plan. Table 3.3.4 shows traffic flow and plan options. The highest demand direction at Busega IC is from KBEX to BMEX.

Table 3.3.4 Busega Interchange options

Result of Traffic Assignment at Busega IC in 2024

All Mode (PCU/day)	KBEX	KEEX	BMEX	Northern Bypass	Total
KBEX	0	598	14,171	10,078	24,847
KEEX	905	0	2,645	4,214	7,764
BMEX	12,405	1,402	0	3,419	17,226
Northern Bypass	7,596	908	3,903	0	12,407
Total	20,906	2,908	20,719	17,711	62,244

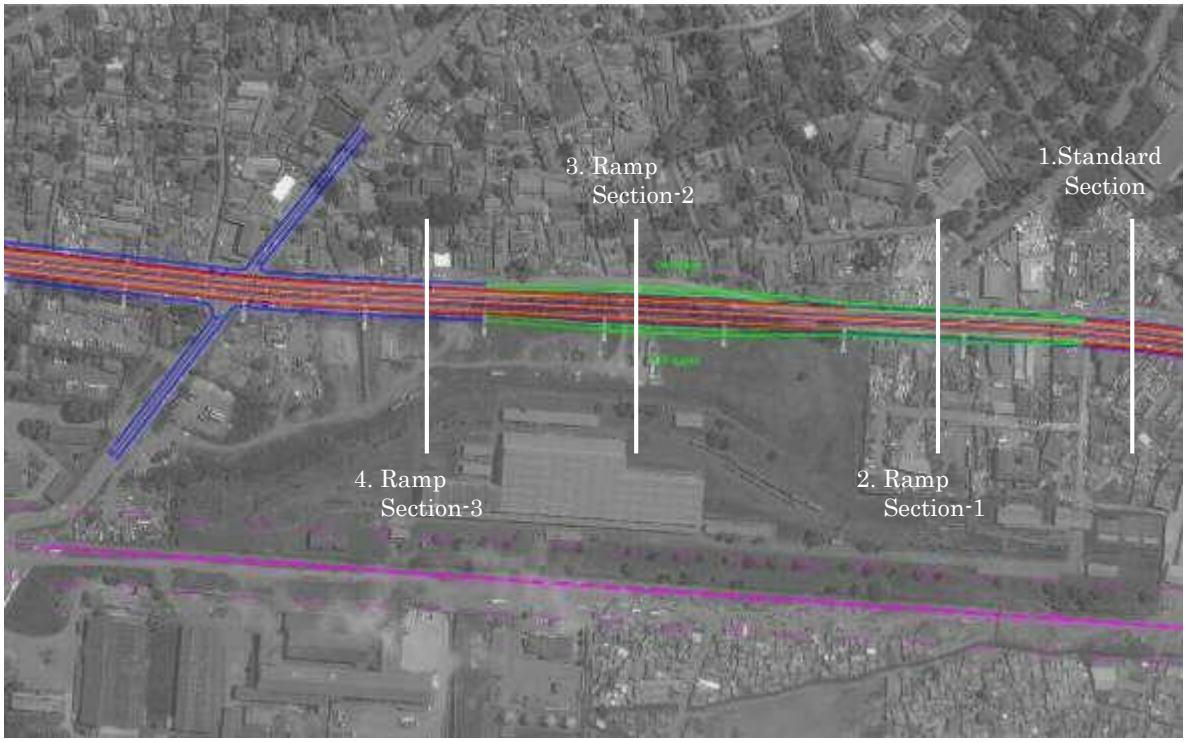


Option	Description
Current Plan 	・Grade separation ・Northern BP: Bridge: 2F ・Kibuye−Busega BP: 1F ・Ramp :1F – 2F ・Bridge Length: 800m ・To need weaving length by each ramps ・Weaving length form/to existing IC; Minimum length =120m (To satisfy Japanese Geometric Standard)
Plan A 	・Grade separation ・Northern BP:2F ・Kibuye−Busega BP: 1F ・Left Turn Ramp: 1F-2F ・Right Turn Ramp: 1F- 3F -2F ・Bridge Length: 4000m ・To need long bridge length ・Weaving length form/to existing IC; Minimum length =120m (To satisfy Japanese Geometric Standard)

Source: JST

(3) Ramp

2 ramps are considered in KBEX, near Wankulukuku and Natete Junctions. Ramp plan of Horizontal Alignment and cross section is shown below.



Source: JST

Figure 3.3.11 Horizontal Alignment for Ramp

The following figure shows 3D images of Ramps

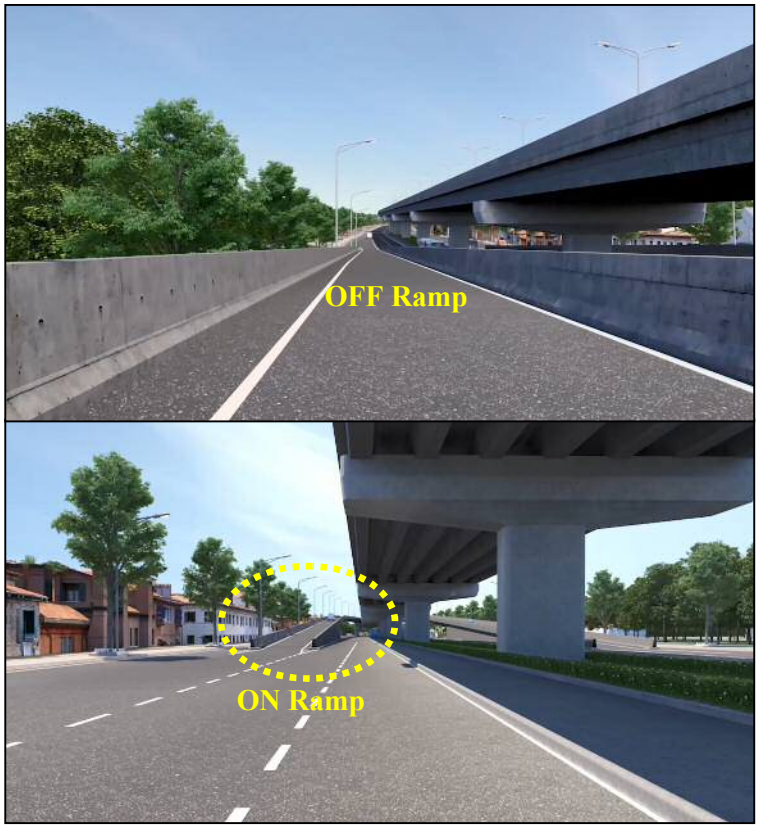
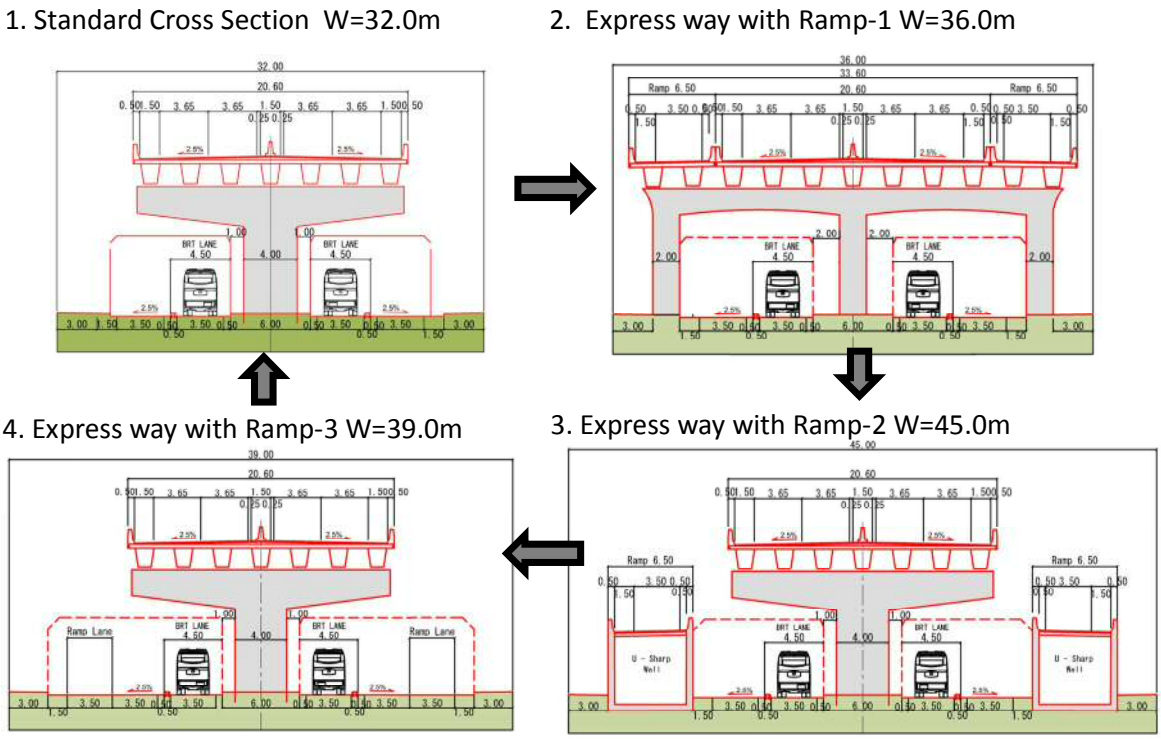


Figure 3.3.12 3D image of Ramp

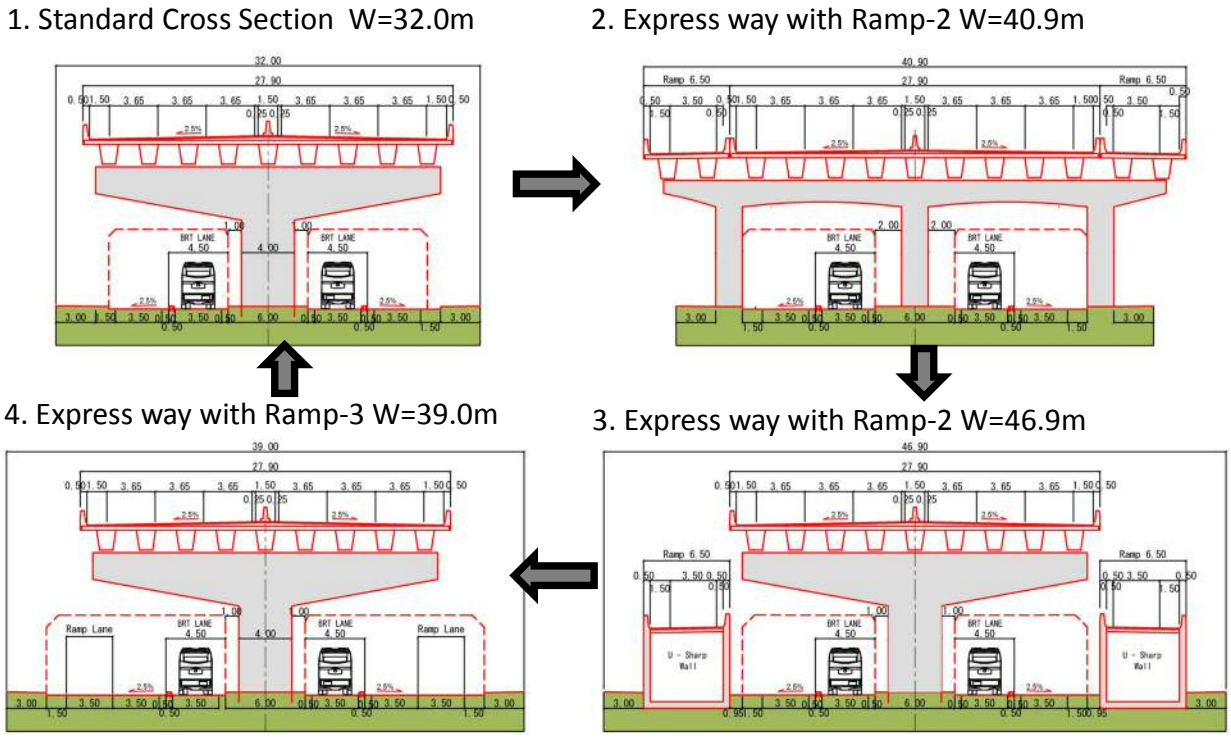
Figure 3.3.13 shows ramp cross section for 4-lane. The maximum road width is 45.0m at ramp section. This means road width exceeds the existing right of way by 15m.



Source: JST

Figure 3.3.13 Ramp Cross Section for 4-Lane

Figure 3.3.14 shows ramp cross section for 6-lane. The maximum road width is 46.9m at ramp section. This means road width exceeds the existing right of way by 16.9m.



Source: JST

Figure 3.3.14 Ramp Cross Section for 6-Lane

3.4 Formulation of the Project: Viaduct Structures

3.4.1 Bridge Planning and Design Conditions

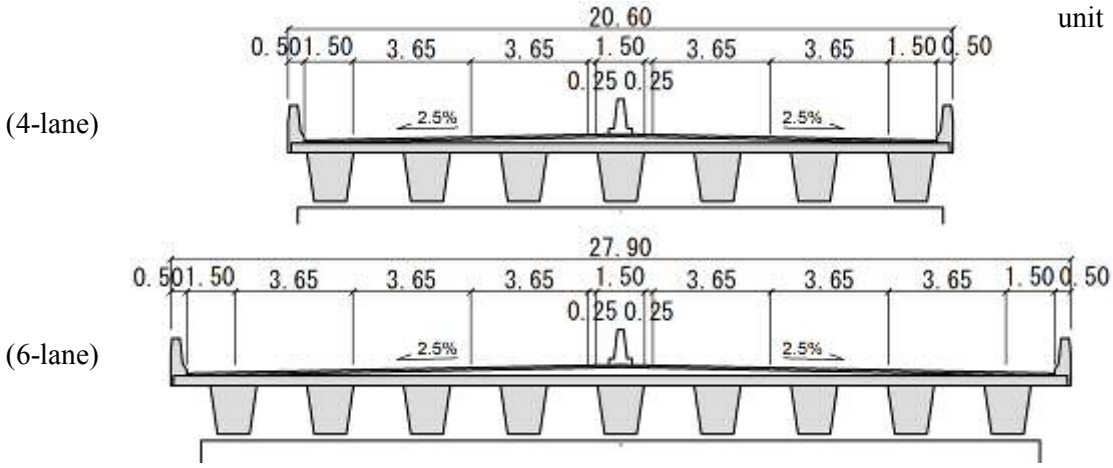
Planning and design conditions for this study are summarized in Table 3.4.1 below considering the ones applied in the Detailed Design for Kampala Flyover Construction and Road Upgrading Project conducted by the same joint venture as the JST.

Table 3.4.1 Planning and Design Conditions

Item	Description	Remarks
Design Standards	Eurocodes (EN) with UK National Annex Road Design Manual (RDM) of MoWT	Use of Eurocodes was instructed by UNRA. Supplemented by Japanese standards as necessary.
Design Life	120 years	EN (UK National Annex)
Lane Numbers	Following two options (see Figure 3.4.1): Four-lane Six-lane	
Unit Weights	Reinforced concrete: 25 kN/m^3 Unreinforced concrete: 23 kN/m^3 Steel: 78.5 kN/m^3 Asphalt concrete: 23.0 kN/m^3 Backfill soil: 20 kN/m^3 Water: 10kN/m^3	EN1991-1-1
Design Traffic Loads	TS and UDL (300kN,200kN,100kN,5.5kn/m2) Single Axle Load (400kN) Special Vehicle (165kN) Crowd Loading (5.0kN/m2)	EN 1991-1-1 NA to EN 1991-2
Peak Ground Acceleration Coefficient	0.09	The US Geological Survey, Seismic Design Considerations for East Arica (Arup, 2014) According to RDM, acceleration coefficient is obtained at 0.05 (Zone 3) for GKMA.
Other Loads	Wind, temperature, etc.	EN 1991-1-4 and/or EN 1991-1-5
Headroom	6.0m	A headroom of 5.2m had been applied for major roads but one of 6.0m was applied for KFCRUP considering recent accidents at Northern Bypass.
Geological Conditions	✓ Kibuye Junction: Bearing layer is observed at 20m below the surface. ✓ Natete Road: Bearing layer is observed at 7m below the surface. ✓ Busega swamp: Clay layer with N value of over 30 is observed.	

Source: JST and Design Criteria Report for KFCRUP

unit : m



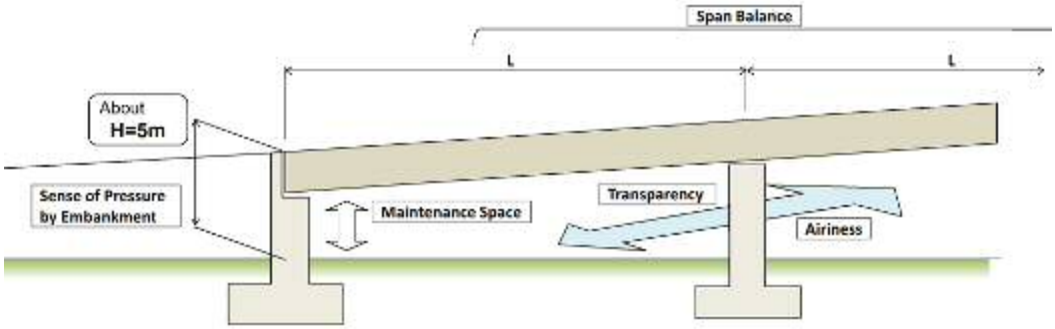
Source: JST

Figure 3.4.1 Proposed Cross Sections for Viaducts of Kibuye–Busega Expressway

3.4.2 Conceptual Plan for Viaducts

(1) Location of Abutments

According to the design report of KFCRUP, bridge abutments are placed at the point where the road elevation is about 5 meters as shown in Figure 3.4.2. Also, a headroom under girders shall be not less than 2 meters in order to secure the room for maintenance activity. The Survey Team recommends maintaining this concept for the Project.

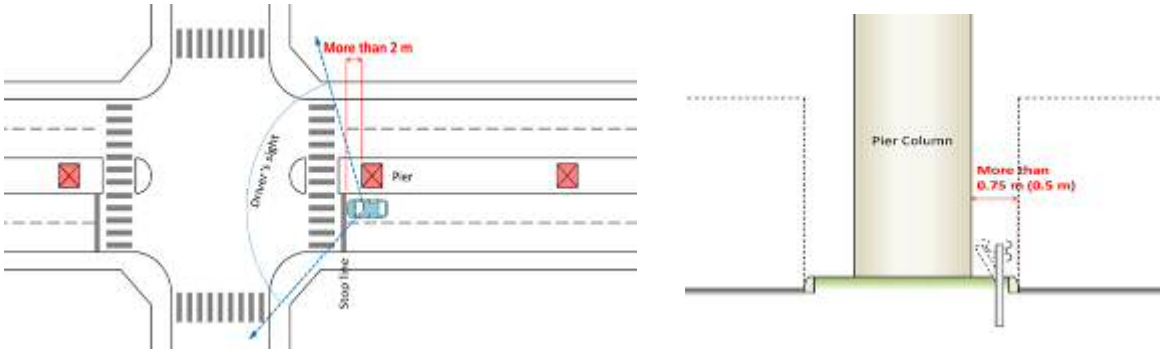


Source: Kampala Flyover Construction and Road Upgrading Project - Lot 2 Feasibility Study

Figure 3.4.2 Location of Abutment

(2) Location of Piers at Junction

According to the design report of KFCRUP, as shown in Figure 3.4.3, bridge piers are placed 2 meters behind the stop line at the junction in order to secure visibility of drivers. A minimum distance between carriageway and the piers is determined to be 0.75m considering deformation of guardrails The Survey Team recommends maintaining this concept for the Project.



Source: Kampala Flyover Construction and Road Upgrading Project - Lot 2 Feasibility Study

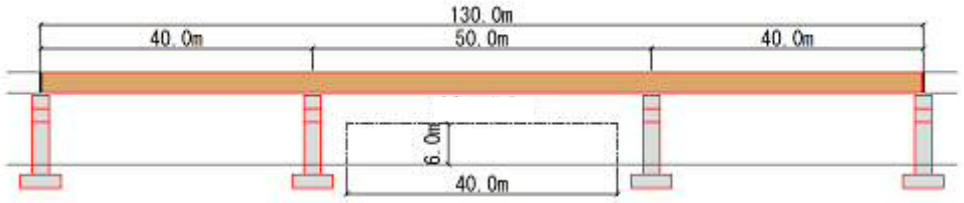
Figure 3.4.3. Location of Piers at Junctions

(3) Bridge Span Arrangement

Typical bridge sections can be categorized as: 1) Kibuye Junction Flyover, 2) Wankulukuku Road Flyover, 3) Nalukolongo Road Flyover, 4) continuous viaduct on Masaka Road, and 5) ramp bridges. Basic concepts for bridge span arrangements in this study are shown in Table 3.4.2 below.

Table 3.4.2 Span Arrangement Concept

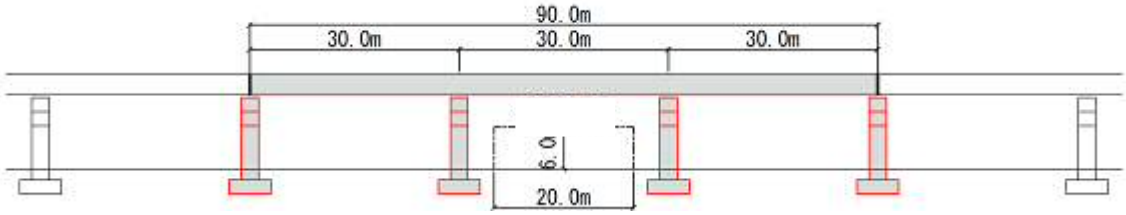
● Flyover sections for Wankululkuku Road, Nalukolongo Road and Natete Road



Note-1: Span length over the junctions are determined to be 50m for required horizontal clearance of 40m considering junction improvements

Note-2: Three-span continuous steel girder, which is advantageous to drivability, constructability, and cost, is proposed considering results of the feasibility study for KFCRUP. Prestressed concrete bridges will raise road elevation due to its larger structural depth, which affects drivability and aesthetic aspects, and raises overall construction cost.

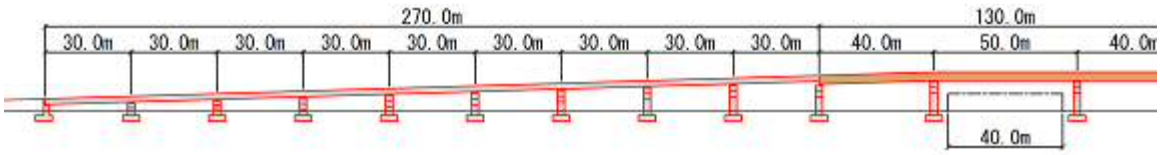
● Typical viaduct section over Masaka Road and minor road crossings



Note-1: The span length of 30m, which is advantageous to constructability and cost effectiveness, is selected.

Note-2: Precast prestressed concrete girders are selected for a typical viaduct section of Nakasero-Northern Bypass Expressway.

● Ramp and approach sections



Note-1: Length of approach ramp will be approximately 270m with 3% vertical slope.

Note-2: The span length of 30m, which is advantageous to constructability and cost effectiveness in general, is selected.

Source: JST

3.4.3 Bridge Type and Length for Each Route Option

Bridge arrangements for current design and three alternatives are summarized in Table 3.4.3 below.

Table 3.4.3 Bridge Type and Length for Each Route Option

Option	Road Stations	Bridge Length	Bridge Type	Remarks
Current Design	0+300～0+700 0+700～1+250 (Kibuye IC) 1+250～2+650 3+200～3+300 (Wankulukuku Rd.) 3+300～4+400 4+400～4+500 (Nalukolongo Rd.) 5+150～5+700 5+700～5+850 (Natete Rd.) 5+850～6+050	400m 550m 1,400m 100m 1,100m 100m 550m 150m 200m	PC PC PC PC PC PC PC PC PC	・ Massive interchange plan for Kibuye junction. ・ A level crossing for road at Sta. 3+850 is not considered. ・ Piers with 10m high were planned for Wankulukuku Rd. and Nalukolongo Rd. flyover crossings. ・ A deformed roundabout was planned at grade for a Natete Road flyover crossing.
Alt-1	0+800～1+070 (Approach bridge) 1+070～1+300 (Kibuye Jct) 1+300～3+460 3+460～3+590 (Wankulukuku Rd.) 3+590～4+160 4+160～4+250 (Minor road) 4+250～4+730 4+730～4+860 (Nalukolongo Rd.) 4+860～6+050 6+050～6+180 (Natete Rd.) 6+180～6+450 (Approach bridge)	270m 130m 2,160m 130m 570m 90m 480m 130m 1,190m 130m 270m	PC Steel PC Steel PC PC PC Steel PC Steel PC	・ Flyover bridges for Nalukolongo Rd., Natete Rd. and other junctions are 3-span continuous steel girder. ・ A 30m long simple span is adopted for a minor road crossing at Sta. 4+160～4+250.
Alt-2	0+800～1+070 (Approach bridge) 1+070～1+300 (Kibuye Jct) 1+300～3+460 3+460～3+590 (Wankulukuku Rd.) 3+590～4+610 4+610～4+740 (Nalukolongo Rd.) 4+740～5+700 5+700～5+830 (Natete Rd.) 5+830～6+190 6+190～6+460 (Approach bridge)	270m 130m 2,160m 130m 1,020m 130m 960m 130m 360m 270m	PC Steel PC Steel PC Steel PC Steel PC PC	・ Flyover bridges for Nalukolongo Rd., Natete Rd. and other junctions are 3-span continuous steel girder.
Alt-3	0+800～1+070 (Approach bridge) 1+070～1+300 (Kibuye Jct) 1+300～3+460 3+460～3+590 (Wankulukuku Rd.) 3+590～4+610 4+610～4+740 (Nalukolongo Rd.) 4+740～5+700 5+700～5+830 (Natete Rd.) 5+830～6+700 6+700～6+830 (Masaka Rd crossing) 6+830～7+100 (Approach bridge)	270m 130m 2,160m 130m 1,020m 130m 960m 130m 870m 130m 270m	PC Steel PC Steel PC Steel PC Steel PC Steel PC	・ Flyover bridges for Nalukolongo Rd., Natete Rd., Masaka Rd diversion crossing and other junctions are 3-span continuous steel girder.

Note: PC: Prestressed Concrete, IC: Interchange, Jct: Junction, Rd.: Road,

Source: JST

3.4.4 Construction Method

(1) Bridge Construction Methods for Each Route Option

Construction methods and considerations in bridge construction work for each route options are summarized in Table 3.4.4.

Table 3.4.4 Bridge Construction Methods and Considerations

Option	Road Station	Length･Type	Construction methods and considerations	Difficulty
Alt-1	0+800～1+070	270m・PC	Sufficient space for construction works. Cast in place concrete using temporary support can be implemented.	A
	1+070～1+300	130m・Steel	Works at congested Kibuye Junction.	C
	1+300～3+460	2,160m・PC	Works along congested Masaka Road.	C
	3+460～3+590	130m・Steel	Works at congested Wankulukuku raod junction.	C
	3+590～4+160	570m・PC	Works along congested Masaka Road.	C
	4+160～4+250	90m・PC	Flyover works for minor road crossing.	B
	4+250～4+730	480m・PC	Works out of existing roadway reserve.	A
	4+730～4+860	130m・Steel	Flyover works for congested Nalukolongo road crossing.	C
	4+860～6+050	1,190m・PC	Works out of existing roadway reserve along Nalukolongo channel. Cast in place concrete using temporary support can be implemented.	A
	6+050～6+180	130m・Steel	Flyover works for congested Natete road crossing.	C
	6+180～6+450	270m・PC	Works at swamp area. Relocation of transmission lines are required. Cast in place concrete using temporary support can be implemented.	B
Alt-2	0+800～1+070	270m・PC	Same as Alt-1.	A
	1+070～1+300	130m・Steel	Same as Alt-1.	C
	1+300～3+460	2,160m・PC	Same as Alt-1.	C
	3+460～3+590	130m・Steel	Same as Alt-1.	C
	3+590～4+610	1020m・PC	Works along congested Masaka Road.	C
	4+610～4+740	130m・Steel	Flyover works for congested Nalukolongo road crossing.	C
	4+740～5+700	960m・PC	Works along congested Masaka Road.	C
	5+700～5+830	130m・Steel	Flyover works at congested Natete junction.	C
	5+830～6+190	360m・PC	Works along congested Natete Road.	C
	6+190～6+460	270m・PC	Works at swamp area. Relocation of transmission lines are required. Cast in place concrete using temporary support can be implemented.	B
Alt-3	0+800～1+070	270m・PC	Same as Alt-1.	A
	1+070～1+300	130m・Steel	Same as Alt-1.	C
	1+300～3+460	2,160m・PC	Same as Alt-1.	C
	3+460～3+590	130m・Steel	Same as Alt-1.	C
	3+590～4+610	1,020m・PC	Same as Alt-2.	C
	4+610～4+740	130m・Steel	Same as Alt-2.	C
	4+740～5+700	960m・PC	Same as Alt-2.	C
	5+700～5+830	130m・Steel	Same as Alt-2.	C
	5+830～6+700	870m・PC	Works along congested Masaka Road.	C
	6+700～6+830	130m・Steel	Flyover works for diverting from Masaka Road.	C
	6+830～7+100	270m・PC	Works out of existing roadway reserve.	A

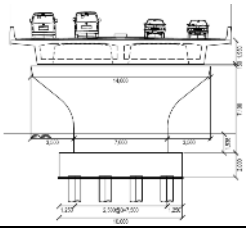
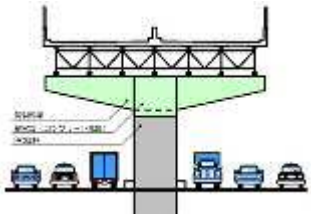
Note: Difficulty C > B > A No Difficulty

Source: JST

(2) Selection of Piers

Cantilever length of beam for T-shaped piers will not go beyond 3m in general, hence, pier column (or wall) cannot be accommodated within limited central road medians in order to support wide bridge deck. Therefore, prestressed concrete and/or steel beams for pier head are suitable for viaduct to be construction under land constrains. Table 3.4.5 presents four types of pier recommended for the project with cost ratio.

Table 3.4.5 Options for Piers

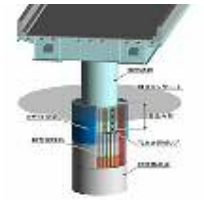
Method	Characteristics	Cost Ratio	Evaluation
Reinforced Concrete 	・Very common and reasonable structure. ・Occupies wider area. ・Simple construction method.	1.0	This pier should be applied for the sections where no at-grade road will be constructed underneath the viaduct.
Prestressed Concrete Beam 	・A pier column can be slimmer by prestressing a pier head beam. ・Temporary support will be required for constructing the prestressed bean, which has some impacts to the traffic underneath the beam during the construction. ・Construction period will be slightly longer than the reinforced concrete due to prestressing works.	1.2	This pier is effective for Masaka road where the space for accommodating piers is limited. Constructability of the pier is inferior to the others due to required temporary support and prestressing works.
Pierhead Rotation Method 	・The pier head, cast over the pier parallel to road axis, is turned 90-degree; therefore, it will not block the traffic flow during the construction of the piers. ・A hydraulic non-friction rotating jack enables rotating the pier head.	2.0	Only one construction company who has a patent of this technology can implement this method. Therefore, in order to employ this method, the company should be appointed as a nominated Subcontractor.
Steel beam 	・A steel pier head beam with steel or concrete column. The steel column will be slimmer than the concrete one. ・The steel beam will be prefabricated and attached with crane. No temporary support is necessary. ・Construction period is the shortest among all options. Erection can be done in one night.	2.4	Applied in Kampala Flyover where the span or cantilever of the beam needs to be very long. Effective when construction should be done rapidly such as junctions.

Source: JST

(3) Selection of Bridge Foundation

Options of pile foundations that can reduce construction area and period are presented in Table 3.4.6.

Table 3.4.6 Comparison of Bridge Foundation Types

Method	Characteristics	Cost Ratio	Const. Period	Evaluation
Cast-in-place concrete bored pile 	・Very common for bridge foundation ・Occupies large construction area. ・Wasted soil will be produced. ・Need to stabilize the wall of borehole.	1.0	100%	Bored pile can be constructed at sections with no land constrains.
Screwed Steel Pile 	・Bearing capacity per pile is larger for the same diameter of the pile due to the blade welded to the pile end. ・Size of the pile cap can be reduced. ・Environmentally friendly with no wasted soil.	1.05	45%	No significant difference in cost with high constructability. Applied for Kampala Flyover.
Steel Pipe Soil Cement Composite Pile 	・Composite pile made of steel pipe and soil cement. ・Environmentally friendly with less wasted soil. ・Construction yard will become larger than the screwed steel pile.	1.07	50% - 70%	No significant difference in cost. Construction period may become longer depending on the size of the pile required and type of soil.
Prestressed Concrete Well 	・A kind of caisson foundation. Piling up precast cylindrical unit blocks by introducing prestress. The cylinder caisson will be press into the ground using ground anchors. ・The cylindrical unit will be a foundation as well as pier column. ・Area to be occupied by piers will be minimized by omitting the pile cap.	1.30	60%	Very little experience outside Japan. Implementation depends on availability of specialized contractor.
Integration of Steel Pier and Bored Pile 	・A large diameter bored pile integrated with steel pier column. ・Area to be occupied by piers will be minimized by omitting the pile cap. ・Construction period can be reduced.	3.07	55%	Very costly and will be effective for extremely narrow space.

Source: JST

(4) Construction Method for Bridge Superstructure

1) Space under the bridge is available

Sections where the RoW is newly acquired for the Project will have no constrains at the construction site. In such a case, temporary support construction method (Figure 3.4.4) can be applied. This method was adopted for concrete bridge sections of Kampala Flyover project.

- Fixed temporary support method is a method conventional for reinforced concrete structure.
- Combination of different shaped frames, truss, wedge biding type support, etc. can be adopted for complicated bridge shapes and configuration of the ground.

Source: Japan Prestressed Concrete Contractors Association

Figure 3.4.4 Temporary Support Method for Concrete Bridges

2) Space under the bridge is not available (above junctions and roads)

Construction of flyovers for junctions and continuous viaduct along congested Masaka road will have constrains under the bridge during the construction. In such cases, for concrete girders, the erection girder method (Figure 3.4.5) is suitable. Prestressed concrete girders will be precast near the site in the yard or on the completed bridge deck and launched using erection girder. Steel girders can also be erected using erection girder but temporary support column will be required depending on the bridge length. If temporary support is required, conventional crane erection would be reasonable. Where temporary support is difficult to provide, launching girder method (Figure 3.4.6) would be suitable but reinforcement of the girder would be required during the launching process.

- Erection of post-tensioned girders using the erection girder.
- The girders are prefabricated in the yard vicinity of the site.

Source: Japan Prestressed Concrete Contractors Association

Figure 3.4.5. Erection Girder Construction Method for Prestressed Concrete Girder

- The Incremental Launching Method involves assembly of the bridge superstructure on one side of an obstacle to be crossed, and then push the superstructure longitudinally into its final position.
- To keep the bending moment low in the superstructure during construction, a launching nose is attached to the front of the girder.
- After completion of longitudinal movements, the girder will be placed on to the right position by descending and moving transversally.

Source: Japan Bridge Association

Figure 3.4.6 Incremental Launching Method of Steel Girders

3.4.5 Rough Estimation of Direct Construction Cost

(1) Analysis of Estimated Cost for Current Design

Table 3.4.7 shows summary of Bill of Quantities and its breakdown of bridge construction cost of the Detailed Design of Kibuye–Busega Expressway of July 2015. According to this total cost and bridge area measured from the detailed design drawings which is equal to 118,602m^2, bridge construction cost per square-metre is calculated as approx. USD 960/m^2. This amount is considerably low compared to other two recent major viaduct/flyover projects in Kampala as shown in Table 3.4.8. If those bridge costs per area is applied, the bridge cost for the KBEX current design would then be turned from USD 114 million to USD 380 million.

On another front, in the detailed design report of July 2017 introduced and reviewed the proposal submitted by the potential design and build contractor (China Communications Construction Company Ltd,; CCCC) for Kibuye - Busega section. The proposal has two options; Option 1 has only 100 m of bridge length in total and Option 2 has 2750 m of bridge sections. For both options, CCCC proposed different shaped Busega interchange, which was not agreed by the design consultant. Estimated costs for the Option 2 proposed by CCCC are summarized in Table 3.4.9

Table 3.4.7 Summary of Bill of Quantities and Breakdown of Bridge Construction Cost for Kibuye-Busega Expressway Detailed Design of July 2015

Series	Item	Amount in USD	% of Subtotal
1000	GENERAL	$814,000	0.5%
2000	DRAINAGE	$1,342,185	0.9%
3000	EARTHWORKS AND PAVEMENT LAYERS OF GRAVEL OR CRUSHED STONE	$19,605,575	13.1%
4000	BITUMINOUS LAYERS AND SEALS	$12,124,339	8.1%
5000	ANCILLARY ROADWORKS	$3,056,257	2.0%
6000	**STRUCTURES**	**$113,239,709**	**75.4%**
7000	TOLERANCES, TESTING AND QUALITY CONTROL	$33,000	0.0%
	SUBTOTAL	$150,215,065	100%
	PHYSICAL CONTINGENCIES	$15,017,107	
	TOTAL PROJECT COST	**$165,232,172**	

	Breakdown of Series 6000	Amount in USD
6100	FOUNDATIONS FOR STRUCTURES	$22,675,635
6200	FALSEWORK, FORMWORK AND FINISH	$5,642,390
6300	STEEL REINFORCEMENT FOR STRUCTURES	$30,348,939
6400	CONCRETE FOR STRUCTURES	$51,200,375
6600	NO-FINES CONCRETE; JOINTS; EARINGS; PARAPETS AND DRAINAGE FORSTRUCTURES	$1,399,620
6900	PAINTING	$1,972,750
1000/7000	GENERAL COSTS/TESITNG (proportionally allocated)	$638,511
	TOTAL BRIDGE CONSTRUCTION COST	**$113,878,220**

Source::Engineering Report and Review of Design and Build Contractor's Design Section 1 and 2 (Kibuye‐Busega-Mpigi)（July 2015）

Table 3.4.8 Comparison of Bridge Construction Costs per Area

Project and Typical Bridge Types	Typical Span Length	Bridge Cost	Bridge Area	Cost per m^2
KBEX Detailed Design of July 2015 (Concrete Box Girder)	50m	$ 114 mil	118,602m^2	$ 960
VVIP (Post-tension Concrete Precast I girder & Steel Box)	30-35m 50-70m	$ 146 mil	45,000m^2	$ 3,200
Kampala Flyover Lot1 (Post-tension Concrete Void Slab)	25-30m	$ 12 mil	3,464m^2	$ 3,200

Source: BoQ of each project and calculated by JST

Table 3.4.9 Cost Estimation Proposed by CCCC (Option 2)

Bill	Description	Amount (USD)
1	General Items	7,688,314
2	Subgrade, Embankment and Earthworks	40,379,384
3	Subbase, Base and Bituminous Layers and seals	42,456,785
4	Bridges	96,037,147
5	Drainage excluding bridges	20,867,898
6	Ancillaries including Illumination of 1-year warranty period	12,475,777
7	Design and Exploitation	9,162,721
Total		229,068,026

Source: KBEX Detailed Engineering Report and Review of D&B Contractors Design

(2) Roughly Estimated Direct Cost of Bridge Construction for Each Alternative Route

Estimated direct costs of bridge construction for each route are summarized in Table 3.4.10. Unit construction costs that are cost per square-metre for superstructures and per cubic-metre for substructures were established referring to outcomes of KFCRUP.

Piers to be placed at median strip of Masaka road and for junction flyovers were considered to be "Prestressed Concrete (PC) Beam with Reinforced Concrete (RC) Column," and ones for less land constrains are "RC Beam with RC column." For lane numbers, two cases i.e. four-lane (w=20.8m) and six-lane (w=27.9m) were considered. For the bridge foundation, 15 m deep Screwed Steel Pile was selected considering the advantages of the technologies suitable for the nature of this project as presented in Table 3.4.6.

Table 3.4.10 Estimated Direct Cost of Bridge Construction for Each Alternative Route

	Abut-ment	Piers		Superstructure		Cost			Total Bridge	Cost/ Area
		RC beam	PC beam	PC	Steel	Sub-structure	Super-structure	Ramps		
	(Nos)	(Nos)	(Nos)	(m^2)	(m^2)	(Million USD)				(USD/m^2)
Alt-1 (4-lane)	2	72	108	103,618	10,712	89	271	56	416	3200
Alt-2 (4-lane)	2	16	164	100,940	13,596	91	277	56	424	3264
Alt-3 (4-lane)	2	16	184	114,330	13,390	101	305	56	462	3230
Alt-1 (6-lane)	2	72	108	140,299	14,504	120	367	56	543	3187
Alt-2 (6-lane)	2	16	164	136,673	18,409	124	376	56	556	3253
Alt-3 (6-lane)	2	16	184	154,803	18,130	137	414	56	607	3219
Current Design	-	-	-	118,602	-	-	-	-	114	

Source: JST

3.5 Natural/ Social Environmental Considerations for Alternatives

Total 4 alternatives including the current design were initially considered for Kibuye-Busega Expressway as their routes were explained in Section 3.3.

(1) Natural Environmental Consideration

By the flora and fauna survey, several species classified as Least Concern or Nearly Threatened in IUCN red list were found in the project area although their habitation locations/points were not described. However, it was considered that the project site might not have significantly sensitive natural environment since all routes were located in the built-up developed urban area.
Under this condition, a point to bear in mind when examining possible environmental impacts is the impacts to the swamp area at the end point. The shortest road length will cause less impact than the longer length considering the land reclamation area. Based on this point, alternative -3 has the shortest length among 4 alternatives counting approx. 1.5 km in the swamp area while the current design and alternative -1 and alternative -2 will pass over approx. 2 km in the swamp area.

(2) Social Environmental Consideration

Although there might not be significant difference between possible impacts to natural environment among 4 alternatives, there will be difference on possible impacts to social environment since some of alternatives were designed by using the right of way of the existing roads in order to avoid impact on land acquisition and resettlement. Socio-economic survey was conducted only for the current design in the process of preparation of RAP in 2015. As for Alternative-1to 3, socio-economic information to examine possible impact on land acquisition and resettlement such as types of structures (e.g. houses, shops, improvements) or families along alternative routes were not available. Accordingly, level of impact examination was different between the current design and other alternatives due to extent of available information.

There was no exact number of houses or families possibly affected by the current design in RAP (July 2015). However, it was described that 63.4% of affected households were answered as living in the project area and the average family size in the district of the project was 4.2 persons per family. Based on given information in RAP (July 2015), it was assumed that 735 houses counting 3,087 persons were located in the project area in the current design.

Table 3.5.1 shows the possible impact on social impact based on the assumption with the conditions below listed.

Table 3.5.1 Assumed Impact at Each Alternative

	Current Design	Alternative-1	Alternative-2	Alternative-3
Affected area	81,000m^2	33,000m^2	15,000m^2	18,000m^2
Affected buildings	1,160 (a)	430 (b)	310 (b)	330 (b)
Affected houses among affected buildings	735 (c)	273 (d)	197 (d)	209 (d)
Number of living people in the project area	3,087 (e)	1,147 (e)	827 (e)	878 (e)

Note:

(a) It was based on the survey result in RAP (July 2015).

(b) It was roughly counted based on satellite image, and included all types of buildings.

(c) It was estimated based on the answer from affected household (i.e. 63.4% of affected households answered as living in the project area) described in RAP (July 2014).

(d) Based on No. 3 above, 63.4% of buildings were regarded as a house.

(e) It was explained in RAP (July 2015) that average family size per family was 4.2 in the district where the project is located. Thus, people living in the project area was assumed based on the number of house and average family size.

Source: JST

Actual number of PAPs shall be confirmed by conducting a field survey such as census, socio-economic survey and asset inventory once the route is fixed.

- Level of information was different from each alternative, accordingly, information on possible land acquisition area and number of affected buildings was obtained from satellite image. Information in RAP (July 2015) for the current design was used
- Number of affected houses and living people were based on assumption; i) roughly 63% of affected structures were regarded a house, and ii) 4.2 persons in average lived in a family.

(3) Concerns for Implementing the Project

Followings are considered as the concerns for implementing the Project.

ESIS Update

As explained in Chapter 3.2.3, update or renew ESIS is necessary in case that the project design is significantly changed (i.e. impact assessed in ESIS is significantly changed), or the project is not implemented within 5 years. Modification of alignment from the current design to the other alternatives may not be a significant change. Under this situation, milestone to renew ESIS or just extension of the current ESIS approval is depended on the schedule of project implementation though consultation with NEMA on ESIS update is important when the project design is fixed.

Impact on Land Acquisition and Resettlement

As explained in Chapter 3.5-(2), number of possibly affected houses was not identified for all alternatives including the current design since existing information was too limited. Therefore, examination of impact on land acquisition and resettlement shall be necessary by conducting census, socio-economic survey and asset inventory in the next study phase.

Consultation with Relevant Authorities for Implementing the Project in the Swamp Area

The field survey was conducted not only for the section between Kibuye to Busega but for the entire alignment including Busega to Mpigi according to the ESIS report. Therefore, possible impact on the swamp area was not precisely described. Since the all alternatives will pass through the swamp area, due consultation and facilitation with the concerned authorities for implementing the project will be necessary to examine and apply the appropriate mitigation measures.

Additional Explanation of Items Not Described in the Current ESIS or RAP

As the Tables 3.2.3 and 3.2.4 show, there were some items which were required in JICA Guidelines to explain but not described in the current ESIS or RAP. Additional explanation on those items are necessary to meet the requirements in JICA Guidelines.

Table 3.5.2 Description to be Added in the ESIS Report

JICA Guidelines	Need to Add
1. Project proponent	None
2. Baseline data	➢ Need to add the standard value of air quality for examination of the current air quality and need to add map to show the location of baseline survey points. ➢ Need to show the locations where vulnerable flora and fauna species were observed. ➢ Need to add explanation of the location where the pottery was excavated. ➢ Need to add explanation of the location on Buganda Kingdom if it is culturally important area.
3. Policy, legal and institutional framework	➢ Need to add explanation of relevant regulations on information disclosure. ➢ Need to add explanation below: - Responsibility of relevant departments in UNRA to implement environmental management and monitoring plan at each project phase

JICA Guidelines	Need to Add
	- Procedure of environmental management and monitoring at each project phase. For example at the project phase, the contractor prepare his own environmental management plan, and it will be approved by UNRA with technical support from the supervision consultant. Then, approved environmental management plan will be submitted to NEMA. Such procedure shall be explained at each project phase.
4. Analysis of alternatives	➢ Need to add explanation of outlines of each alternative route and the reason to select the optimum route.
5. Scoping and TOR for field survey	➢ Need to add the result of scoping.
6. Impact Assessment	➢ Need to add scale of land acquisition and resettlement, impact to water use, quantitative examination of items selected through scoping such as air quality, water quality, noise and vibration.
7. Environmental management and monitoring plan	➢ Need to add provisional monitoring parameters, frequency, location at each project phase including the operation phase. ➢ Need to add institutional procedure for preparation and submission of the monitoring report at each project phase. For example, the contractor will conduct monitoring and prepare monitoring report at the construction phase, but these activities will be done by the road management responsible agency at the operation phase.
8. Stakeholder analysis and holding stakeholder meetings	➢ Need to add number of participants, invitation methods and answer from the project proponent for the raised questions/comments.

Source: JST

Table 3.5.3 Description to be Added in the RAP Report

	JICA Guidelines	Need to be Added
1	Legal framework and institutional arrangement	Need to add gap analysis between the domestic regulations and JICA Guidelines.
2	Necessity of resettlement	Need to add explanation on necessity of land acquisition and resettlement.
3	Socio-economic survey	Need to add scale of resettlement quantitatively (i.e. number of families/households to be relocated).
4	Policy of compensation and livelihood restoration	Need to add the entitlement matrix showing the contents of compensation and assistance. In addition, need to add the calculation methods of compensation amount.
5	Plan for arrangement of the relocation site	None
6	Grievance redress mechanism	None
7	Implementation schedule	Need to update the implementation schedule in accordance with the latest project schedule.
8	Budget	Need to add the budget source
9	Monitoring and evaluation	Need to add monitoring structure
10	Public participation	Need to add the timing of consultation meeting and the invitation method.

Source: JST

3.6 Traffic Demand Forecast and Evaluation of the Alternative

3.6.1 Data Analysis on the Traffic Survey

(1) Objective

The major objectives of the traffic surveys in the Project are as follows:

- To update the result of the previous survey and evaluate the variation of traffic movement
- To analyse the effect of the Kampala-Entebbe Highway in Kampala City.
- To formulate the database for traffic forecast in 2034, 2044 2054.

A) Outline of the Traffic Surveys

3 types of traffic surveys have been conducted, as shown in Table 3.6.1.

Table 3.6.1 Summary of Traffic Survey in Kampala

	Study item	Contents	Target	Field Work
1	Traffic Volume Count	To capture traffic volume on weekday by counting number of vehicles	・10 points (16hr 1 day) ・1 point (24hr 1 day, 16hr 2 days)	March /2019
2	Intersection Directional Traffic Flow Counts	To capture directional traffic flow at intersection on weekday by counting number of vehicles	・2 places, 3 peak-2 hours (morning, noon and evening)	March /2019
3	Travel speed survey	To analyse travel speed by vehicles affected by traffic congestion on the Masaka roads during peak hours.	1 route, at 3 peak-hours (morning, noon and evening)	March /2019

Source: JST

B) Survey Location

The traffic survey includes 12 locations in Kampala city, as described in Table 3.6.2 and illustrated in Figure 3.6.1.

Table 3.6.2 List of Traffic Survey Points

Traffic Volume Count	No.	Objective Road	Remarks
24hrs count (1 weekday) & 16hrs count (2 weekdays) Total 3 days (continuous days)	TVC24-1	Masaka Road Near Kibuye JCT	Kibuye-Busega, Kampala
16hrs count (1 weekday)	TVC16-1	Queens Way	
	TVC16-2	Katwe Road	
	TVC16-3	Entebbe Road	
	TVC16-4	Masaka Road (Near the Rail Station)	
	TVC16-5	Masaka Road (Near Nalukolongo Road)	
	TVC16-6	Masaka Road (Busega JCT Eastside)	
	TVC16-7	Masaka Road (Busega JCT Westside)	
	TVC16-8	Masaka Road (Busega JCT Southside)	
	TVC16-9	Northern by-pass	
	TVC16-10	Kampala-Entebbe Highway	
Intersection Traffic Volume Counts	No.	Intersection	Remarks
Intersection traffic counts	J-1	Masaka road x Wankulukuku Road	Kibuye-Busega, Kampala
	J-2	Masaka road x Natete Road	
Travel speed survey	No.	Route	Remarks
Travel Speed	S-1	Kibuye → Busega on Masaka road	Kibuye-Busega, Kampala
	S-2	Kibuye ← Busega on Masaka road	

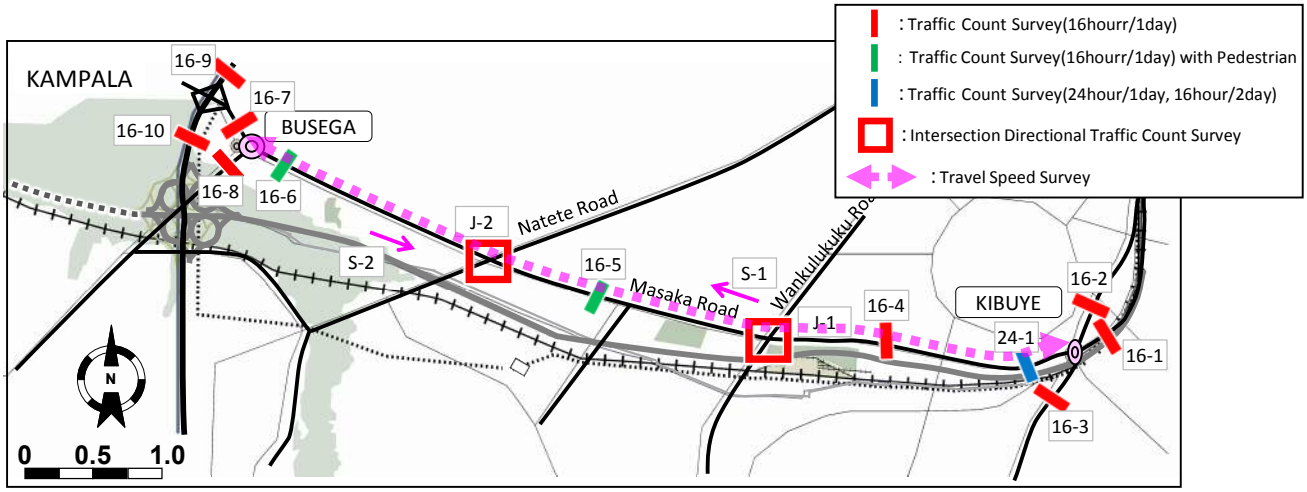
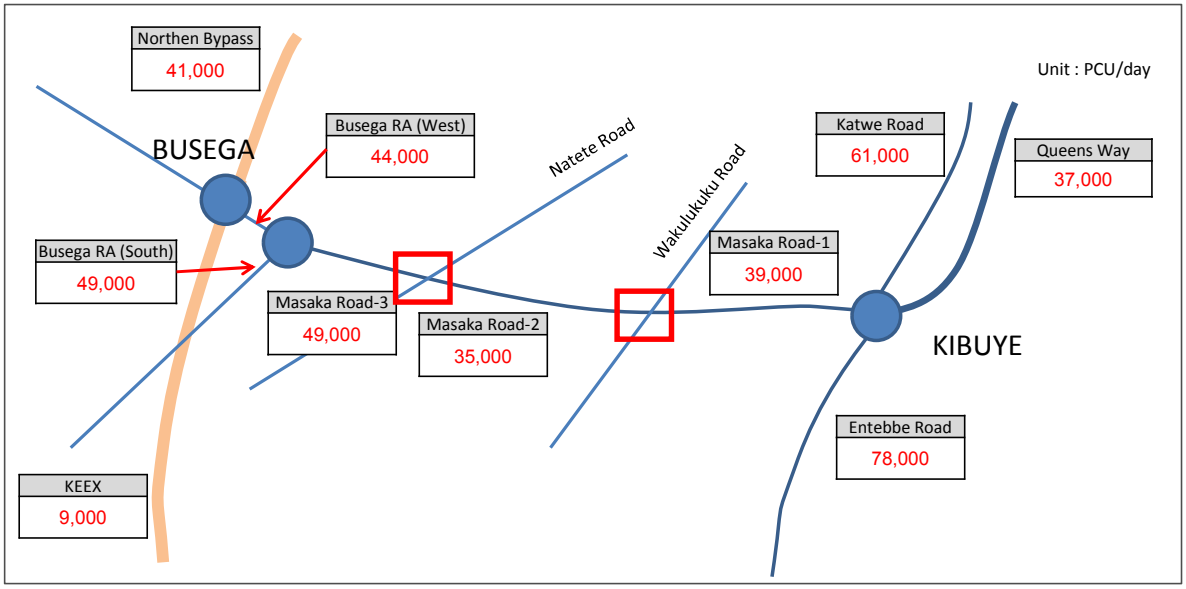


Figure 3.6.1 Traffic Survey Location Map

(2) Result of Traffic Survey in Kampala City

A) Traffic Volume

Traffic volumes (PCU/day) at each survey point are shown below.
The road with the largest traffic volume exceeding 70,000 PCU per day is Entebbe Road.
The section with the largest traffic volume along Masaka Road, around 50,000 PCU per day, is observed near the Busega Roundabout.



Source: JST

Figure 3.6.2 Result of Manual Classified Traffic Counts Survey (MCC)

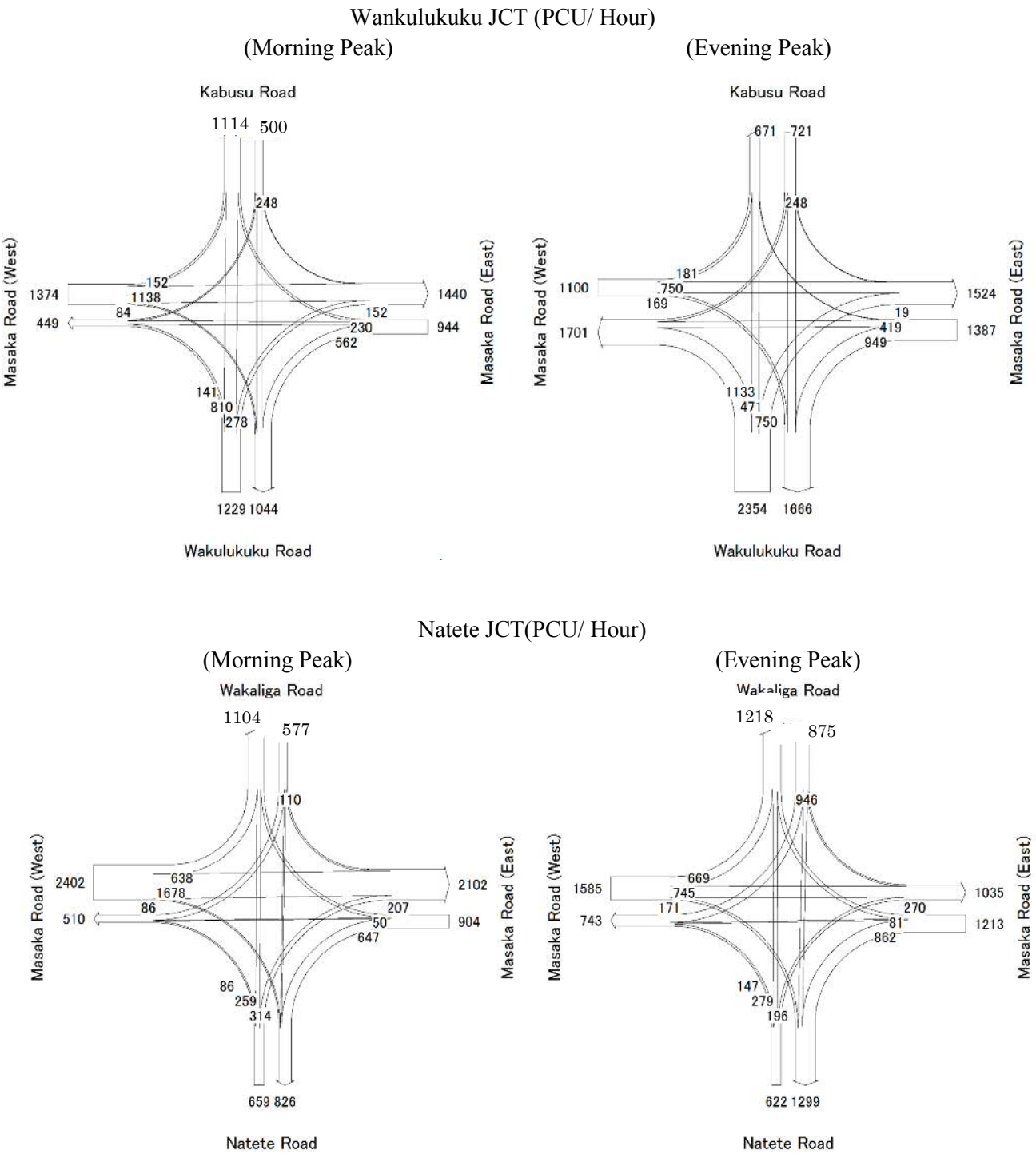
Table 3.6.3 Result of MCC

Type of Vehicle	Number of Vehicle/day									
	Queens Way	Katwe Road	Entebbe Road	Masaka Road-1	Masaka Road -2	Masaka Road -3	Busega West	Busega South	Northern Baypass	Kampala-Entebbe Highway
Car	9,180	16,292	22,492	7,999	6,690	9,321	10,264	8,619	12,593	6,049
Bus	7,221	16,664	15,404	3,006	4,914	7,297	4,359	6,692	5,104	410
Truck	1,409	1,658	3,281	2,962	2,583	3,595	4,841	3,339	4,770	1,303
M/C	31,971	41,274	60,724	42,429	34,955	46,057	37,915	46,379	19,193	7
Total	49,781	75,889	101,901	56,396	49,142	66,271	57,380	65,030	41,659	7,769
Type of Vehicle	Number of PCU/day									
	Queens Way	Katwe Road	Entebbe Road	Masaka Road-1	Masaka Road -2	Masaka Road -3	Busega West	Busega South	Northern Baypass	Kampala-Entebbe Highway
Car	9,180	16,292	22,492	7,999	6,690	9,321	10,264	8,619	12,593	6,049
Bus	8,729	20,056	18,646	3,652	5,940	8,965	5,307	8,228	6,193	520
Truck	2,862	3,715	6,955	6,215	5,080	8,151	9,798	9,316	12,303	2,842
M/C	15,986	20,637	30,362	21,215	17,477	23,029	18,958	23,189	9,596	4
Total	36,757	60,701	78,456	39,080	35,187	49,466	44,326	49,353	40,684	9,415
Type of Vehicle	Ratio of Vehicle Type of PCU									
	Queens Way	Katwe Road	Entebbe Road	Masaka Road-1	Masaka Road -2	Masaka Road -3	Busega West	Busega South	Northern Baypass	Kampala-Entebbe Highway
Car	25.0%	26.8%	28.7%	20.5%	19.0%	18.8%	23.2%	17.5%	31.0%	64.3%
Bus	23.7%	33.0%	23.8%	9.3%	16.9%	18.1%	12.0%	16.7%	15.2%	5.5%
Truck	7.8%	6.1%	8.9%	15.9%	14.4%	16.5%	22.1%	18.9%	30.2%	30.2%
M/C	43.5%	34.0%	38.7%	54.3%	49.7%	46.6%	42.8%	47.0%	23.6%	0.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: PCU Factor is Passenger car 1.0, Small-size Cargo 1.0, Minibus Bus 1.2, Large Size Bus 2.0, MGV 2.5, HGV 3.5, M/C 0.5

Source: JST

Intersection Directional Traffic Flow Counts were conducted at 2 point: Wankulukuku JCT and Natete JCT. Figure 3.6.3 shows Intersection Traffic Survey.



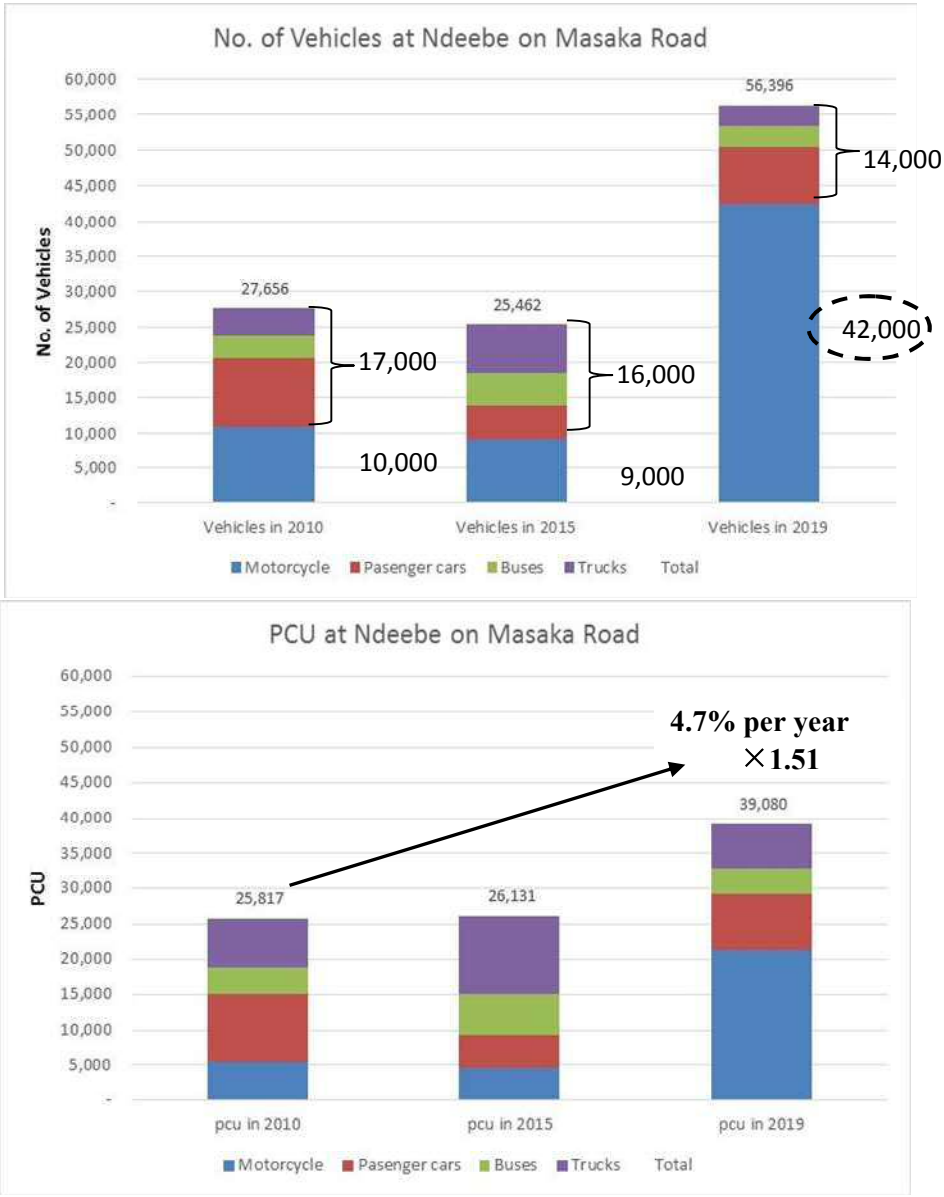
Source: JST

Figure 3.6.3 Result of Intersection Traffic Survey

B) Comparison between Previous and Current Surveys

PCU/day of Traffic volume on Masaka road increased 1.4 times from 2015 to 2019. Especially, volume of motorcycle increased most dramatically.

Current traffic condition of the traffic volume between 2010 and 2019 are shown below.



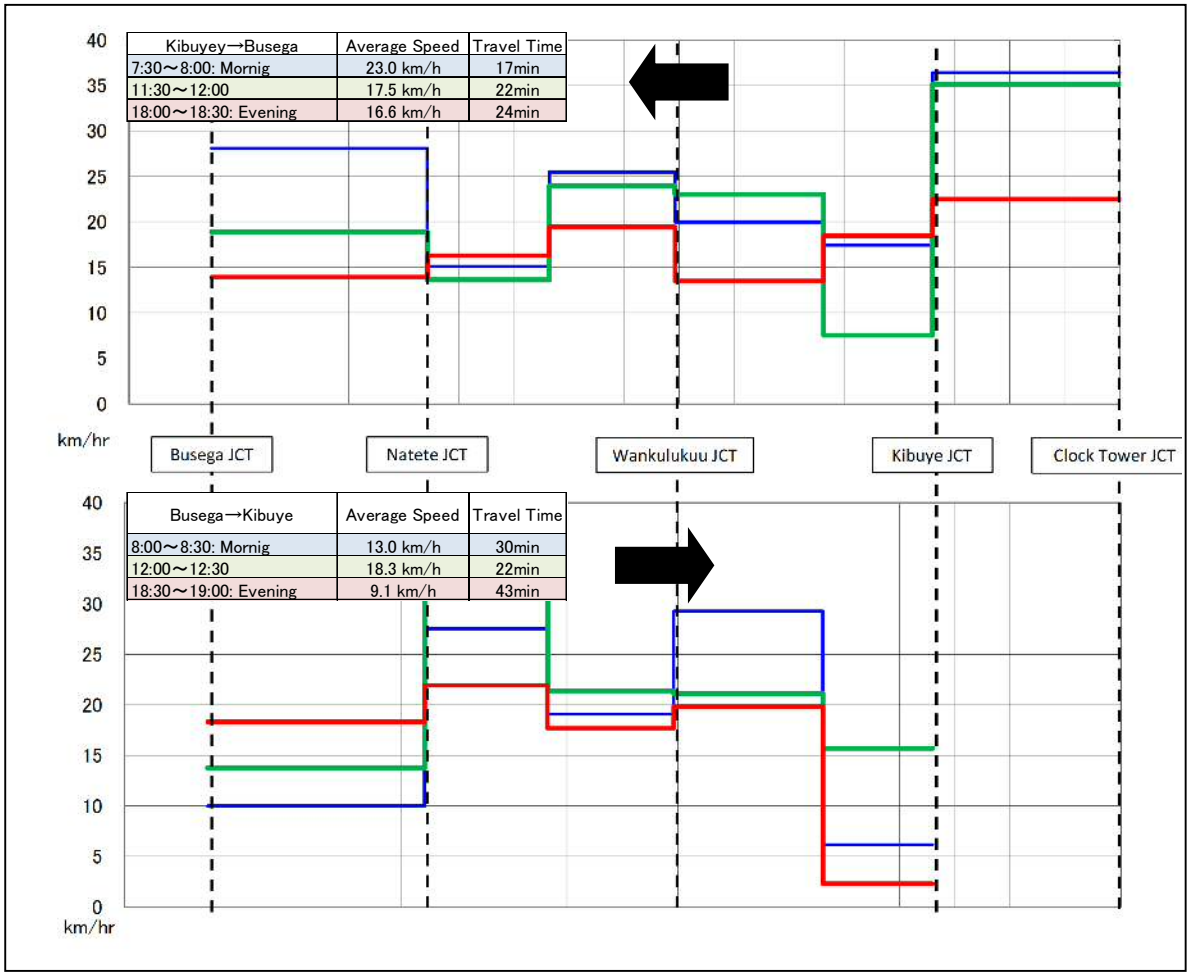
Source: Survey in Jan. 2010 by JICA Study, Survey in Jan. 2015 by Kibuye-Busega D/D Study

Figure 3.6.4 Comparison Traffic Survey

C) Travel Speed survey

Figure 3.6.5 shows results of the travel speed survey.

The lowest speed section is observed near the Kibuye JCT from Busega to Kibuye during evening time. As a result, the longest travel time between Kibuye and Busega is 43min during evening peak time.

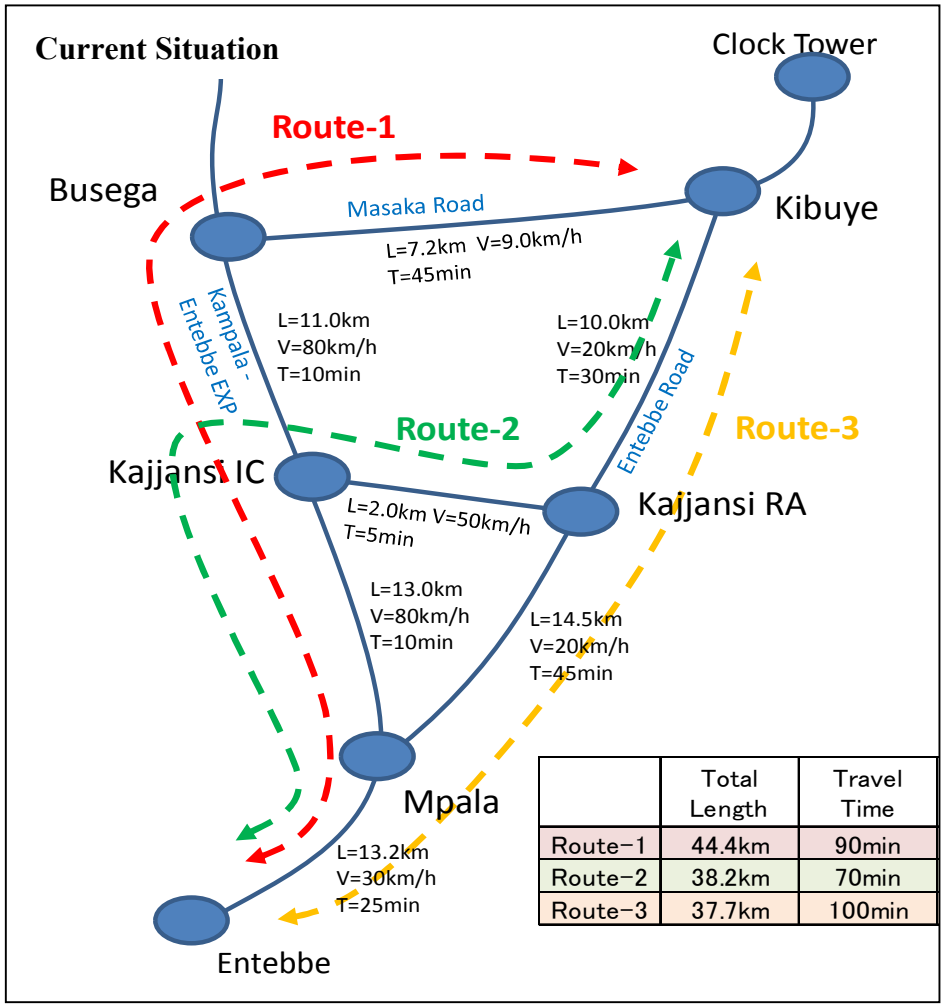


Source: JST

Figure 3.6.5 Result of Travel Speed Survey

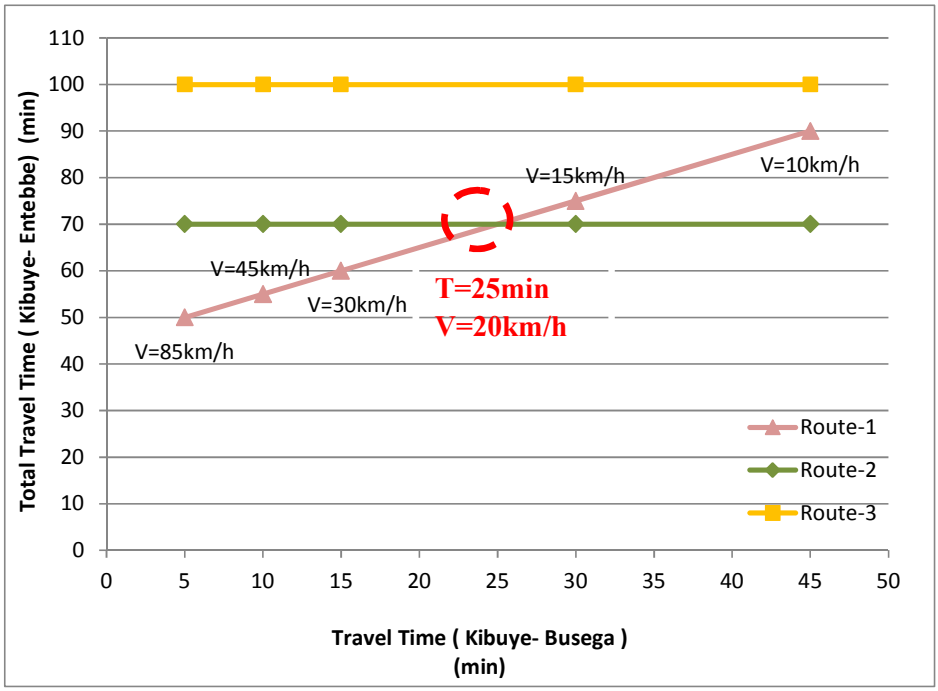
Travel time of each route are calculated by estimated average speed and length on each road in order to comprehend travel time of each route between Kibuye and Entebbe. Figure 3.6.6. shows Total Travel Time of Each Route. The minimum travel time route is The Route-2 as passing Entebbe Road and Kampala Entebbe Expressway in current situation.

Total Travel time of Route-1 was estimated in case of improved travel speed on the Masaka Road. As a result, if average travel speed is over 20km/h between Kibuye and Busega, Total travel time of route-1 exceeds the other routes. Figure 3.6.7 compares total travel time and travel time on the Masaka Road.



Source: JST

Figure 3.6.6 Total Travel Time by Each Route



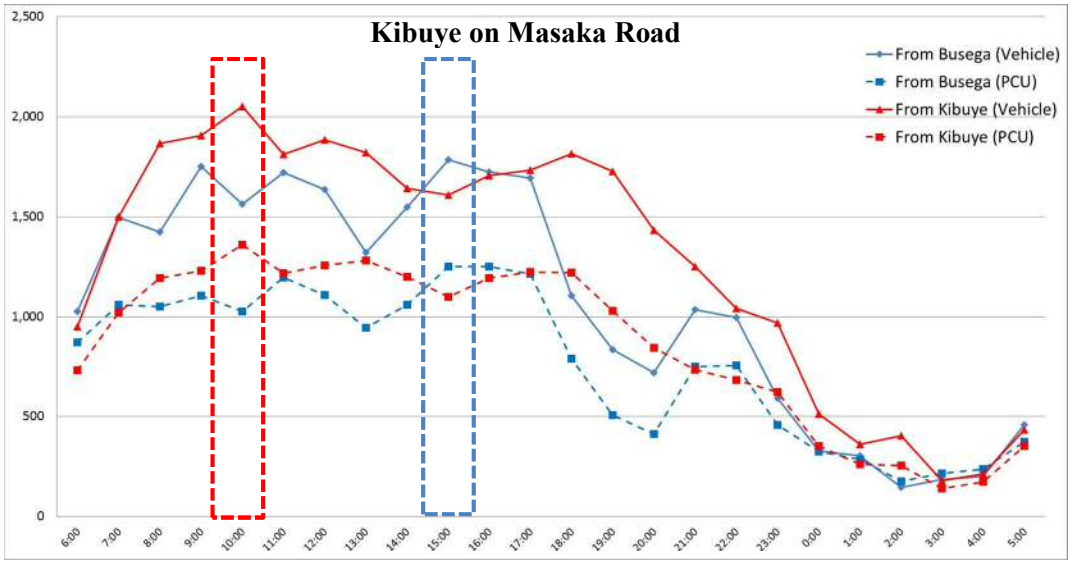
Source: JST

Figure 3.6.7 Compares the Total Travel Time and Travel Time on The Masaka Road

D) Hourly Variation/ Peak Ratio

Figure 3.6.8 shows hourly variation in traffic in- and out-flow in Kibuye on Masaka road. This figure indicates uneven traffic flows.

- ✓ From Busega to Kibuye: Peak Time 15:00～16:00, Peak Ratio 6.8% (1,250pcu/hour)
- ✓ From Kibuye to Busega: Peak Time 10:00～11:00, Peak Ratio 6.6% (1,359cu/hour)
- ✓ Total : Peak Time 16:00～17:00, Peak Ratio 6.3% (2,444pcu/hour)

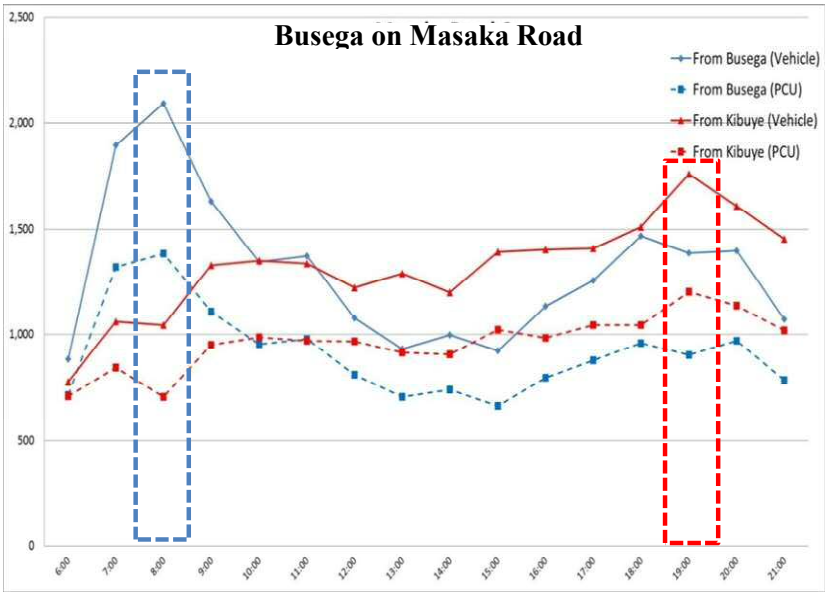


Source: JST

Figure 3.6.8 Hourly Variation / Peak Ratio in Kibuye on Masaka Road

Figure 3.6.9 shows hourly variation in traffic in- and out-flow in Busega on Masaka road. This figure indicates traffic flows towards the city centre during peak time in the morning.

- ✓ From Busega to Kibuye: Peak Time 8:00～9:00, Peak Ratio 8.1% (1,383pcu/hour)
- ✓ From Kibuye to Busega: Peak Time 19:00～20:00, Peak Ratio 6.2% (1,201pcu/hour)
- ✓ Total : Peak Time 7:00～8:00, Peak Ratio 6.7% (2,164pcu/hour)



Note: Peak ratio of the survey point was calculated by 24h/16h traffic ratio and survey date in 16h.
Source: JST

Figure 3.6.9 Hourly Variation / Peak Ratio in Busega on Masaka Road

E) NMT Volume

NMT Survey was conducted at 3 points on Masaka Road. Highest demand of pedestrian in Msaka road is on the eastside near Kibuye JCT. Also, the demand of bicycle is similar.

Table 3.6.4 Summary of NMT volume

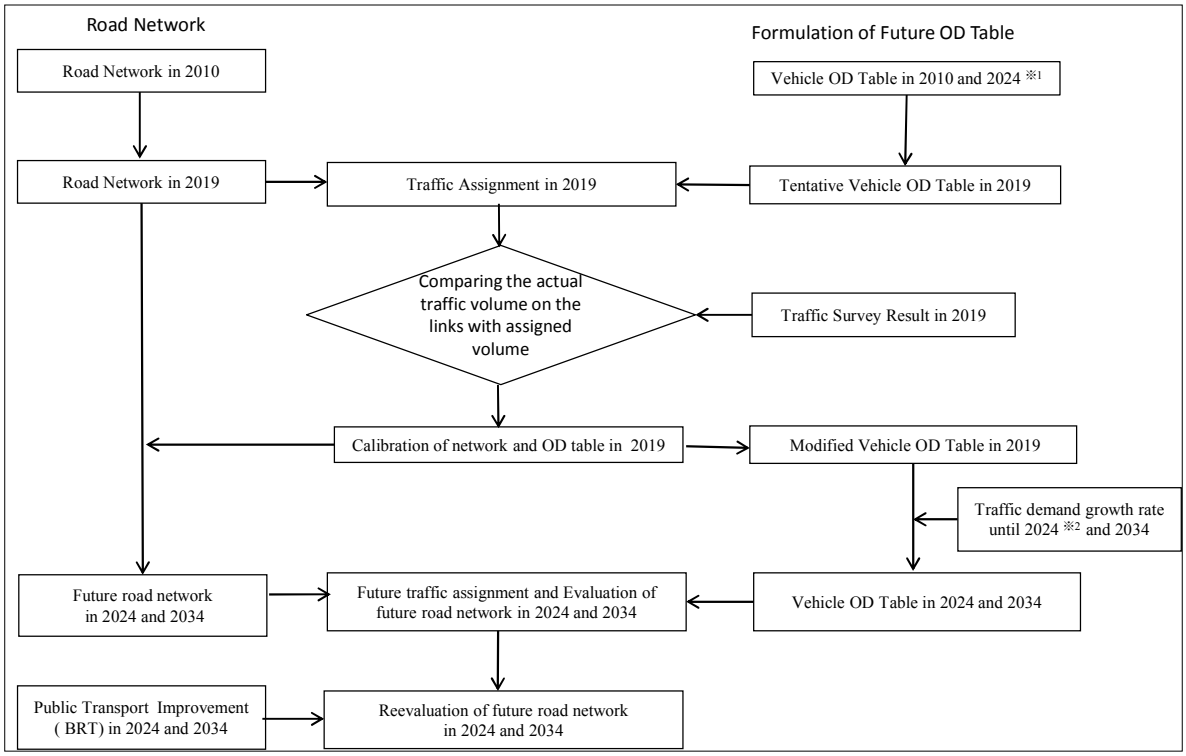
NMT volume in Masaka road (Number/day)			
Type	Busega	Nalukolongo JCT	Kibuye
Pedestrian	13,800	9,300	15,600
Bicycle	900	1,400	1,800

Source: JST

3.6.2 Traffic Demand Forecast

(1) Overall Procedure

The traffic demand forecast was conducted in order to evaluate the project development effects and propose an appropriate number of lanes for KBEX. The overall process of the traffic forecast is illustrated in Figure 3.6.10.



※1:Traffic survey conducted by THE STUDY ON GREATER KAMPALA ROAD NETWORK AND TRANSPORT IMPROVEMENT IN THE REPUBLIC OF UGANDA
※2: Target year is same with KAMPALA Fly Over Project

Source: JST

Figure 3.6.10 Traffic Demand Forecast Flow

(2) Development Scenario

A) Target Year

According to the construction schedule, the target year of demand forecast is set as follows:

- ✓ 2024 - Completion of Kampala Flyover construction
- ✓ 2034 - Ten years after opening of Kampala Flyover

B) Road Network

The future transport networks of 2024 and 2034 were set up to estimate the maximum demand for KBEX under the limited supply of transport services. The both target year's networks are the same condition of supply in this demand forecast although the demand is increased from 2024 to 2034. The both networks include: Kampala FO, Busega-Mpigi Ex., Kampala-Jinja Ex., Nakasero-Northern BP Ex., Northern BP expansion, Southern BP which are completed by 2024. However, Outer ring road, Kampala-Bombo Expressway and Kampala-Busunju Expressway were not assumed to be supplied by 2034. In addition, the public transport improvement such as BRT and additional commuter railway service was also not assumed to be operated both in 2024 and 2034.

A future road network in GKMA is assumed as shown in Table 3.6.5 and Figure 3.6.11 for future traffic demand forecast in consistency with the implementation schedule of related organizations.

Table 3.6.5 Development Plan in GKMA

	Road	Design Speed	Number of Lane	Toll	2019	2024, 2034	Remark
New road	Kampala Flyover Lot-1 (Clock Tower FO)	50 km/h	2 lane	×	×	○	Ongoing
	Kampala Flyover Lot-2 (KitgumHouse FO)	50 km/h	2 & 4 lane	×	×	○	Works to commence in 2020/2021
	Busega-Mpigi Expressway	80 km/h	4 lane	US$ 0.1/1km (P-Car)	×	○	Works to commence in 2019
	Kampala-Entebbe Expressway	80 km/h	4 lane	US$ 0.1/1km (P-Car)	○	○	Completed
	Northern BP	50 km/h	4 lane	×	○	○	Ongoing
	Southern BP	50 km/h	4 lane	×	×	○	Works to commence in 2020/21
	Kampala-Jinja Expressway	80 km/h	6 lane	×	×	○	Works to commence in 2020/21
	Nakasero-Northern BP Expressway	80 km/h	2 & 4 lane	×	×	○	

Source: UNRA

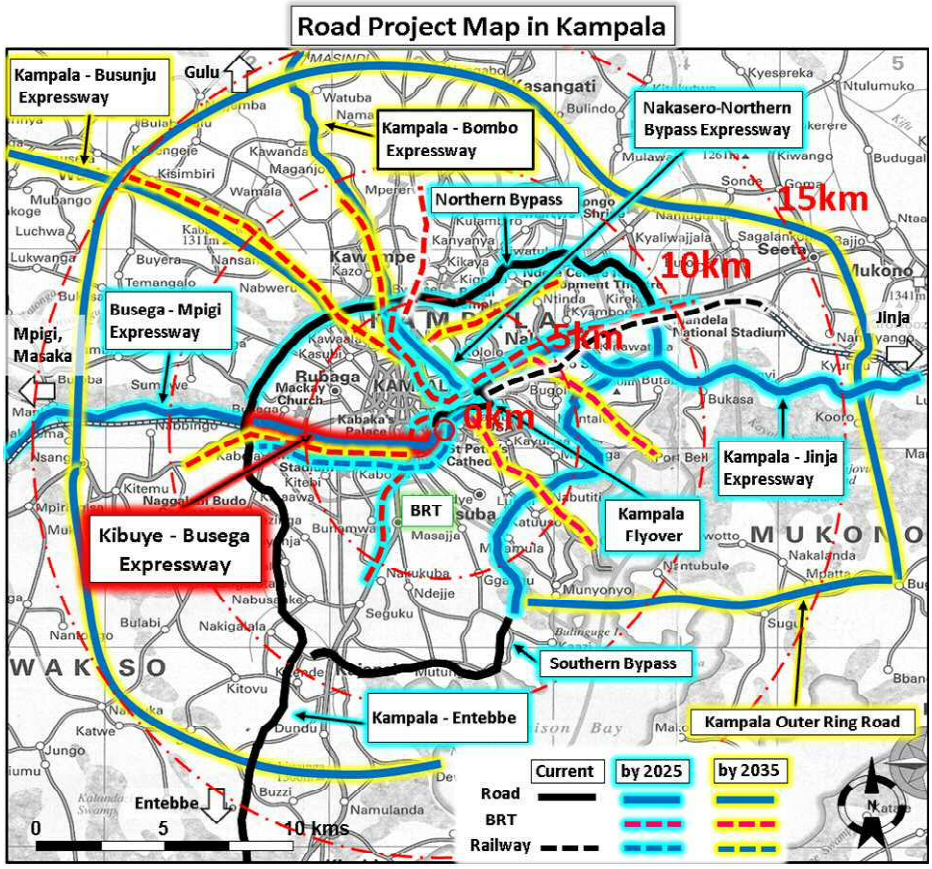


Figure 3.6.11 Project Map in GKMA

(3) Modelling

A) Assignment Model

The User Equilibrium Assignment Model was adopted to distribute the Vehicle OD table to the road network since it is the most common model for traffic demand forecast. The model is based on the principle that the traffic volume is distributed to the routes with equivalent travel time which is calculated through the Quantity-Velocity (Q-V) Model. The JICA-STRADA software was used for actual traffic assignment.

B) Zone and Network

Traffic zone for the demand forecast is the same as the zone defined for the Kampala Flyover Project. The entire road network was divided into links and data related to the link such as length, maximum velocity, capacity, and volume-delay function were coded.

Table 3.6.6 Basic Capacity and Free Speed of Links for the Assignment

Road Class	Pavement	Capacity (pcu/day)			Free Speed (km/h)		
		Number of Lane (both direction)			Number of Lane (both direction)		
		2	4	6	2	4	6
Highway	Paved	36,000	72,000	108,000	80	80	80
I	Paved	16,000	48,000	72,000	50	50	50
II	Paved	12,000	48,000	-	40	40	-
III	Paved	12,000	48,000	-	20~30	40	-
	Unpaved	8,000	-	-	15~30	-	-

Source: JST

Traffic volume by each vehicle type on the network is represented in terms of PCU. For that purpose, PCU equivalent factor taking into consideration of Geometric Design Manual of Uganda was applied to convert each vehicle type to passenger car. The PCU conversion factors employed in the Survey are shown in Table 3.6.7.

Table 3.6.7 PCU Equivalent

Vehicle Category	PCU Equivalent
Passenger car / 4 wheel Drive Vehicle	1.0
Small size Cargo Vehicle	1.0
Minibus Bus	1.2
Large Size Bus	2.0
Medium Goods Vehicle	2.5
Heavy Goods Vehicle	3.5
Motor Cycle	0.5

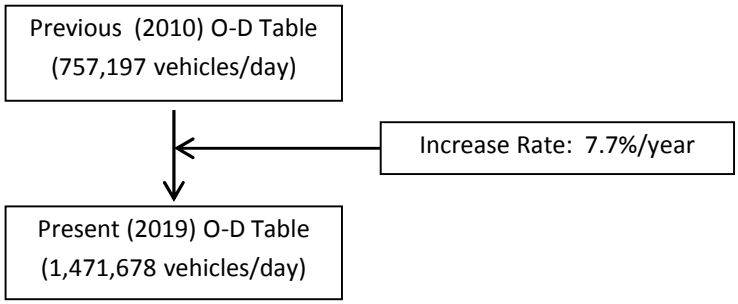
Source: MoWT Manual

C) Present Vehicle OD Calibration

The present vehicle OD table of 2019 were obtained by modifying the OD table established in the "THE STUDY ON GREATER KAMPALA ROAD NETWORK ANDTRANSPORT IMPROVEMENT IN THE REPUBLIC OF UGANDA" in 2010. OD Calibration Methods is as follows:

- ✓ The tentative vehicle OD table in 2019 was obtained from The Kampala Flyover Project OD tables in 2015 and 2024.
- ✓ The number of increased vehicle form 2019 to 2024 was fixed, and the value was divided proportionately by registered vehicle ration between motor vehicles and motorcycle.
- ✓ The Modified OD table in 2019 was obtained by applying an adjustment factor derived from the traffic count survey in 2019. Calibration rate is based on MCC data from Western Cordon Line.

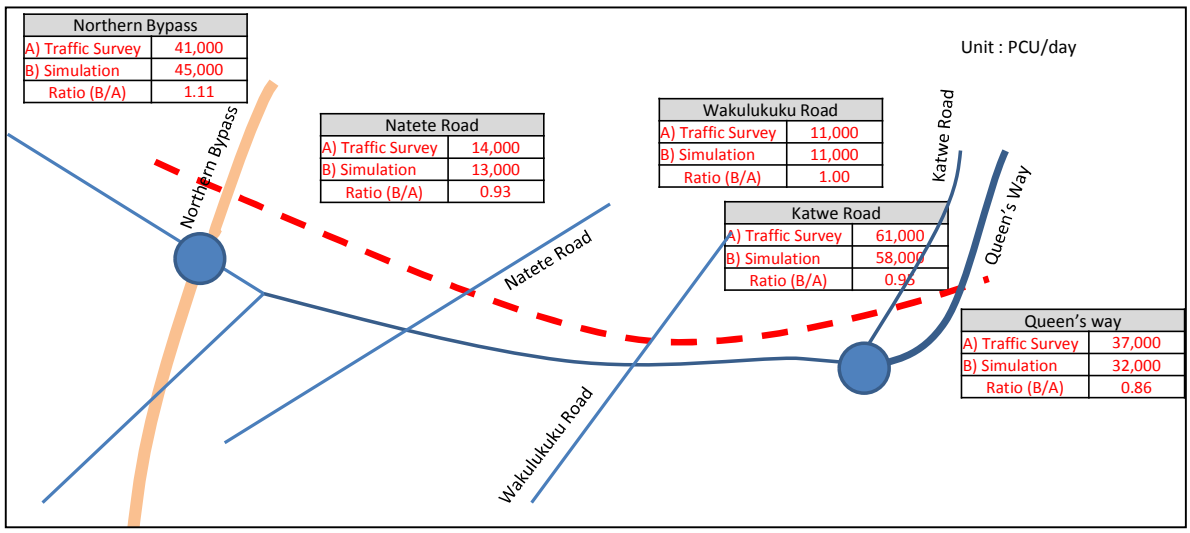
The total number of vehicle trips in GKMA in 2019 was estimated to be approximately 1,471,678 per day as shown in Figure 3.6.12.



Source: JST

Figure 3.6.12 Estimation of Present Vehicle Trips in 2019

Table 3.6.8 and Figure 3.6.13 show result of calibration by MCC data of Western Cordon Line. All data points obtained from simulations are within 15% deviation from MCC data.



Source: JST

Figure 3.6.13 Comparison of MCC and Simulation along Western Cordon in 2019

Table 3.6.8 Comparison of MCC and Simulation along Western Cordon in 2019

Type of Veh.	Unit	A: Result of Traffic Survey （PCU/24h）						
		Queens Way	Katwe Road	Northern Bypass	Wankulukuku	Natete	Total	
Car	PCU /24h	9,180	16,292	12,593	3,041	3,923	45,029	
Bus		8,729	20,056	6,193	2,795	3,605	41,377	
Truck		2,862	3,715	12,303	1,509	1,946	22,335	
M/C		15,986	20,637	9,596	3,693	4,763	54,675	
Total		37,000	61,000	41,000	11,000	14,000	163,000	
Type of Veh.	**Unit**	**B: Result of Traffic Simulation in 2019（PCU/24h）**						
		Queens Way	Katwe Road	Northern Bypass	Wankulukuku	Natete	Total	Ratio
Link No		1606	L14	L109	1755	1112	-	
Car	PCU /24h	8,984	16,488	10,323	3,551	3,537	42,883	0.95
Bus		9,078	14,375	12,747	85	2,593	38,878	0.94
Truck		4,073	3,411	13,853	590	403	22,330	1.00
M/C		9,476	23,497	8,250	6,364	6,806	54,393	0.99
Total		32,000	58,000	45,000	11,000	13,000	158,000	0.97
Ratio (B/A)		0.86	0.95	1.10	1.00	0.93	0.97	

Table 3.6.9 shows comparison of Traffic Survey and Simulation. All data points obtained from simulations are within 25% deviation from MCC data. Therefore, result of simulations in 2019 is accurate.

Table 3.6.9 Comparison of MCC and Simulation Each Survey Point in 2019

Type of Vehicle	A: Result of Traffic Survey （PCU/24h）									
	Queens Way	Katwe Road	Entebbe Road	Masaka Road (Kibuye West)	Masaka Road (Nalukolongo)	Masaka Road (Busega East)	Masaka Road (Busega West)	Masaka Road (Busega South)	Northern Baypass	Kampala-Entebbe Highway
Car	9,180	16,292	22,492	7,999	6,690	9,321	10,264	8,619	12,593	6,049
Bus	8,729	20,056	18,646	3,652	5,940	8,965	5,307	8,228	6,193	520
Truck	2,862	3,715	6,955	6,215	5,080	8,151	9,798	9,316	12,303	2,842
M/C	15,986	20,637	30,362	21,215	17,477	23,029	18,958	23,189	9,596	4
Total	36,757	60,701	78,456	39,080	35,187	49,466	44,326	49,353	40,684	9,415
Type of Vehicle	**B: Result of Simulation in 2019（PCU/24h）**									
	Queens Way	Katwe Road	Entebbe Road	Masaka Road (Kibuye West)	Masaka Road (Nalukolongo)	Masaka Road (Busega East)	Masaka Road (Busega West)	Masaka Road (Busega South)	Northern Baypass	Kampala-Entebbe Highway
Car	8,984	16,488	19,564	13,575	9,769	3,467	11,678	10,624	10,323	3,976
Bus	9,078	14,375	20,850	4,360	6,983	6,568	11,054	10,460	12,747	277
Truck	4,073	3,411	7,113	3,719	4,471	5,688	10,818	8,778	13,853	5,825
M/C	9,476	23,497	20,057	23,956	14,535	22,450	8,864	7,603	8,250	0
Total	31,611	57,771	67,584	45,609	35,758	38,173	42,414	37,465	45,173	10,078
Ratio (B/A)	0.86	0.95	0.86	1.17	1.02	0.77	0.96	0.76	1.11	1.07

Source: JST

3.6.3 Future Traffic Demand

(1) Growth Rate

The assumption of annual growth rates of traffic demand on Kibuye-Busega Expressway (KBEX) from 2019 to 2034 were set up from the analysis on the past trend data of population and GDP and the framework of related plans. The annual growth rates are as follows:

- Passenger types of vehicle such as motorcycle, minibus, bus, and passenger car are assumed to increase between 2019 and 2034 by **3.5%** annually. The national trend of population growth rate between the 2002 and 2014 was 3.0% whereas that of the Central region was 3.1%, as shown in the Table 2.5.1. In addition, Multi Modal Urban Transport Master Plan published in 2018 assumes that the population of GKMA would be increased by 3.5% annually between 2014 and 2040. Therefore, it is reasonable that the future population growth rate of GKMA between 2017 and 2034 would be 3.5%.
- Freight types of vehicles such as truck and trailer are assumed to increase from 2019 to 2034 by **6.5%** annually. It is based on the trend of GDP growth rate in the past five years which was approximately 6.0%. The annual growth rate of GDP in GKMA would be higher than the national one because its activities including the capital city of Kampala and population growth GCMA are assumed to be higher than the national average rate. Therefore it is reasonable that the future GDP growth rate of GKMA between 2019 and 2034 would be 6.5%.

(2) Future Traffic Volume

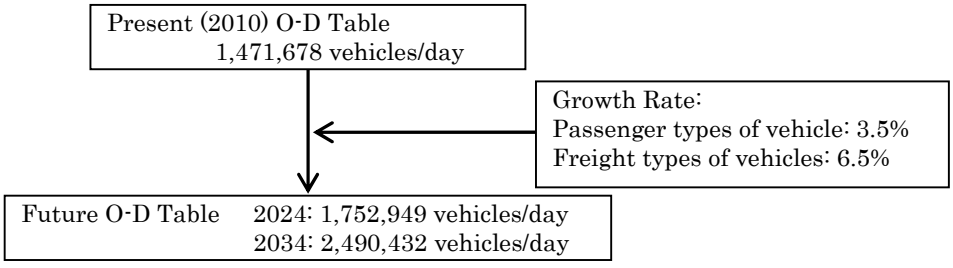
In the Survey, the results of the demand forecast in 2024, 2034 are used for the evaluation of the expressway. Table 3.6.10 and Figure 3.6.14 Result of Future Traffic Volume Forecast in GKMA show the estimated future traffic volume. As a result, the total numbers of trips in GKMA in 2024, 2034 are estimated at approximately 1.7 and 2.5 million per day, respectively.

Table 3.6.10 Future Traffic Volume in GKMA

Unit: Number of Vehicle/ day

year	P-Car	Small Cargo	Mini bus	Large bus	MGV	HGV	Motor cycle	Total
2019	223,523	15,224	118,565	2,135	24,577	3,152	1,084,503	1,471,678
2024	265,475	18,081	140,818	2,536	33,672	4,319	1,288,049	1,752,949
Ratio	1.19	1.19	1.19	1.19	1.37	1.37	1.19	1.19
per year	3.5%	3.5%	3.5%	3.5%	6.5%	6.5%	3.5%	3.6%
year	**P-Car**	**Small Cargo**	**Mini bus**	**Large bus**	**MGV**	**HGV**	**Motor cycle**	**Total**
2024	265,475	18,081	140,818	2,536	33,672	4,319	1,288,049	1,752,949
2034	374,479	25,505	198,637	3,577	63,207	8,106	1,816,920	2,490,432
Ratio	1.68	1.68	1.68	1.68	2.57	2.57	1.68	1.69
per year	3.5%	3.5%	3.5%	3.5%	6.5%	6.5%	3.5%	5.4%

Source: JST



Source: JST

Figure 3.6.14 Result of Future Traffic Volume Forecast in GKMA

(3) Traffic Assignment in GKMA

Future traffic assignment was conducted for two alternative cases in number of lane as shown in the following table.

Table 3.6.11 Case of Traffic Assignment

Case	Forecast year	Masaka Road	KBEX	Road Network
Without	2024, 2034	Existing 2 lane	-	Refer to Chapter 3.6.2
Case-1		4 lane	4 lane	
Case-2		4 lane	6 lane	

Source: JST

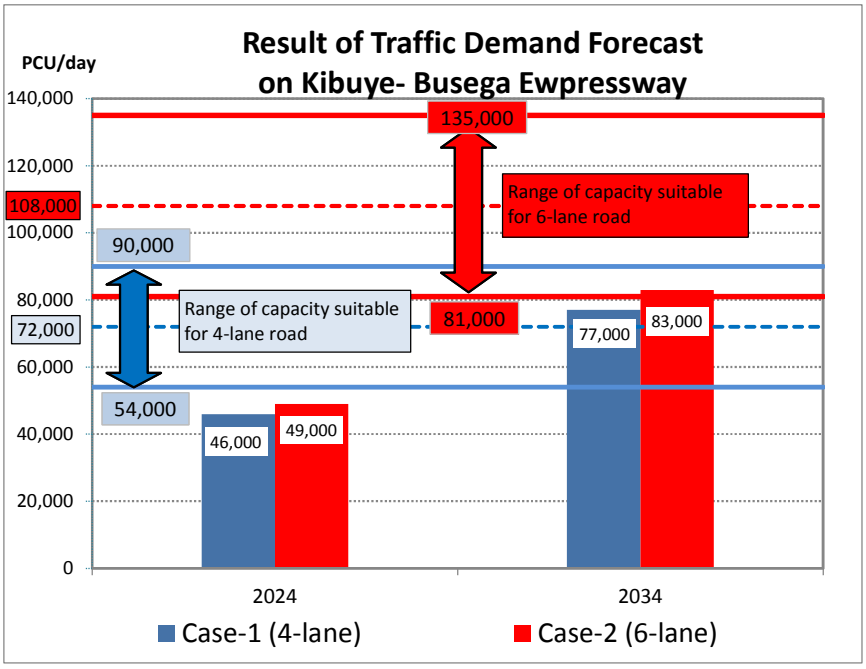
Owing to the following reasons, M/C and minibus are not allowed on KBEX in future traffic demand forecast. For details of traffic mode variation on KBEX, refer to annex-4.

- In order to secure quick-delivery and punctuality for KBEX users.
- To shift from minibus and M/C to public transport on Masaka Road (Refer to 3.6.3 (5))

Examining the results of traffic demand forecast in 2024 and 2034, several implications about the future number of lanes are:

- Appropriate number of lanes is thought to be four because the future traffic on KBEX is forecasted to be within the range of capacity suitable for 4-lane road in 2034.
- If number of lanes changes from 4 lanes to 6lanes, the increase of traffic is forecasted to be smaller than the increase of capacity. The capacity increases by 50%, but traffic on KBEX increases by only 8% in 2034. This means that the increase of capacity from 4 to 6 lanes is not sufficiently effective in this case. Probably, the other road network provision would be more effective to improve the whole level of service in Kampala.
- The comments above are confirmed through Cost –Benefit Analysis later.
- As far as the long term forecast until 2044 is concerned, it is currently difficult to forecast the impact of nine BRT corridors, additional Commuter Railway services and other road construction under the future transport modal split. If clarifying these impacts clearly, additional studies including personal trip survey, vehicle OD survey, other traffic surveys are desirable.

The results obtained from the traffic assignment are shown in the following table and figure.



Source: JST

Figure 3.6.15 Result of Future Traffic Assignment

Table 3.6.12 Traffic Volume in Case-1 (4-lane) on Main Road in 2024 and 2034

Type	Result of Traffic Assignment in 2024（PCU/24h）										
	KBEX (East)	KBEX (West)	Queens Way	Katwe Road	Entebbe Road	Masaka Road (Kibuye)	Masaka Road (Nalukolongo)	Masaka Road (Busega)	BMEX	Northern Bypass	Kampala-Entebbe Highway
Car	20,689	18,412	9,091	14,671	15,932	15,704	1,464	3,205	17,540	12,561	5,195
Bus	1,867	2,086	13,748	23,109	24,436	18,217	19,652	12,351	1,087	10,486	44
Truck	16,357	25,252	2,196	4,606	7,460	3,393	385	5,271	19,317	11,808	5,433
M/C	0	0	20,522	29,769	18,942	50,175	34,760	32,970	0	15,363	0
Total	38,913	45,750	45,557	72,155	66,770	87,487	56,261	53,797	37,944	50,218	10,672
Type	**Result of Traffic Assignment in 2034（PCU/24h）**										
	KBEX (East)	KBEX (West)	Queens Way	Katwe Road	Entebbe Road	Masaka Road (Kibuye)	Masaka Road (Nalukolongo)	Masaka Road (Busega)	BMEX	Northern Bypass	Kampala-Entebbe Highway
Car	29,372	34,145	10,413	19,341	19,747	19,975	2,305	3,589	24,755	23,711	15,962
Bus	2,569	2,895	18,480	31,761	28,388	19,024	25,138	13,452	1,531	16,380	163
Truck	24,875	48,251	3,214	7,257	12,740	8,004	701	9,417	36,200	29,957	13,794
M/C	0	0	29,195	41,995	30,403	69,301	46,702	43,220	0	23,067	0
Total	56,816	85,291	61,302	100,354	91,278	116,303	74,846	69,678	62,486	93,115	29,919

Source: JST

Table 3.6.13 Traffic Volume in Case-2 (6-lane) on Main Road in 2024 and 2034

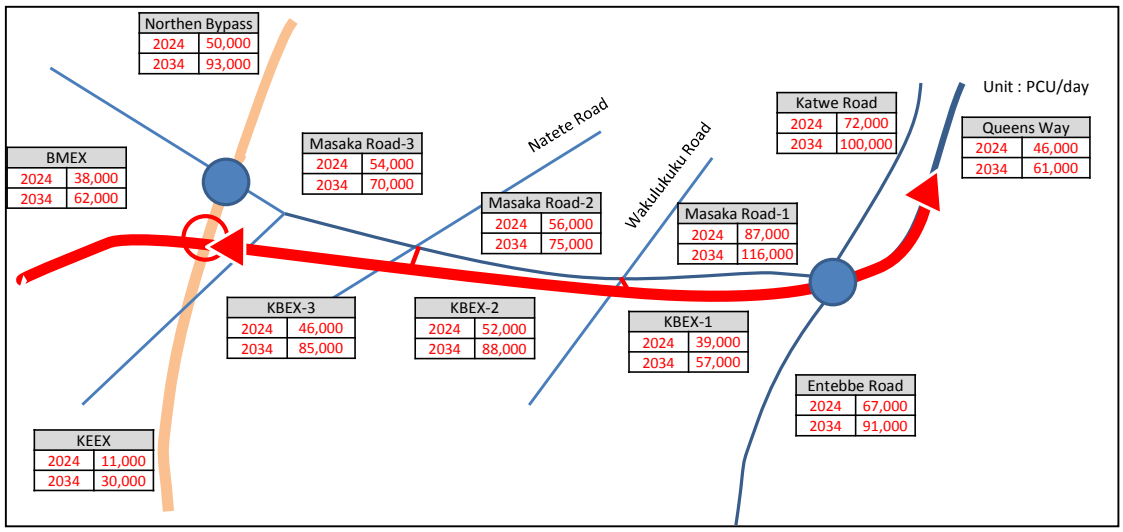
Type	Result of Traffic Assignment in 2024（PCU/24h）										
	KBEX (Kibuye)	KBEX (Busega)	Queens Way	Katwe Road	Entebbe Road	Masaka Road (Kibuye)	Masaka Road (Nalukolongo)	Masaka Road (Busega)	BMEX	Northern Bypass	Kampala-Entebbe Highway
Car	22,515	21,340	8,316	14,712	15,834	15,998	1,369	2,310	17,540	12,990	5,317
Bus	1,959	2,167	13,620	22,906	24,382	18,026	19,467	12,370	1,087	10,397	44
Truck	17,579	26,924	1,954	4,694	7,438	3,547	344	4,925	19,317	10,980	5,416
M/C	0	0	20,204	29,741	18,812	50,105	34,463	32,797	0	15,221	0
Total	42,053	50,431	44,094	72,053	66,466	87,675	55,643	52,402	37,944	49,588	10,777
Type	**Result of Traffic Assignment in 2034（PCU/24h）**										
	KBEX (Kibuye)	KBEX (Busega)	Queens Way	Katwe Road	Entebbe Road	Masaka Road (Kibuye)	Masaka Road (Nalukolongo)	Masaka Road (Busega)	BMEX	Northern Bypass	Kampala-Entebbe Highway
Car	31,592	38,499	9,837	19,363	19,615	19,631	2,234	3,253	24,755	23,936	16,233
Bus	2,799	3,148	17,957	31,678	28,180	18,796	24,860	12,853	1,531	16,779	163
Truck	26,914	51,466	3,008	7,439	12,612	7,917	689	8,142	36,200	30,100	13,568
M/C	0	0	27,703	42,186	29,848	69,419	45,916	43,330	0	23,196	0
Total	61,305	93,113	58,505	100,666	90,255	115,762	73,699	67,578	62,486	94,011	29,964

Source: JST

Table 3.6.14 Traffic Volume Without on Main Road in 2024 and 2034

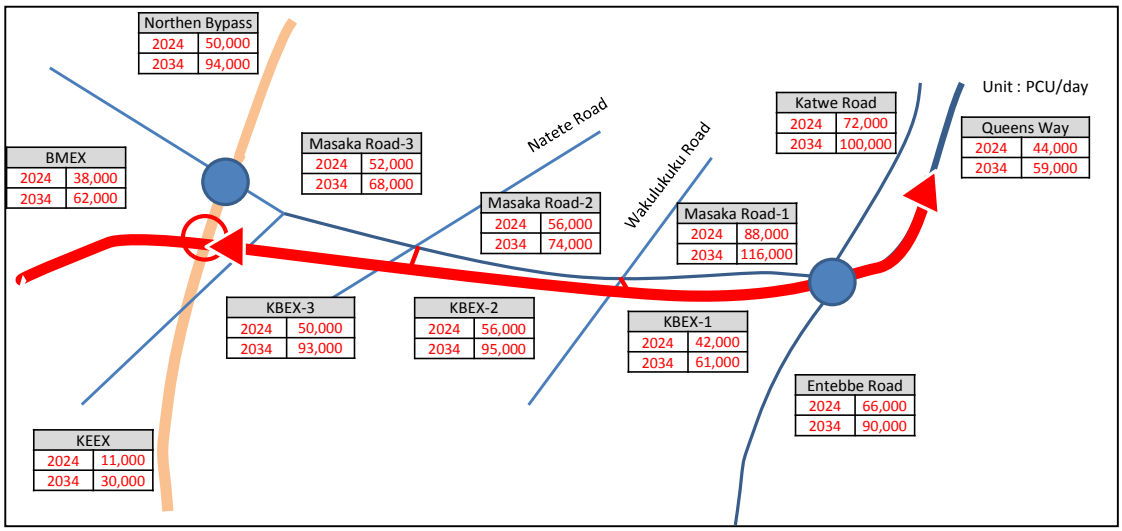
Type	Result of Traffic Assignment in 2024（PCU/24h）										
	KBEX (Kibuye)	KBEX (Busega)	Queens Way	Katwe Road	Entebbe Road	Masaka Road (Kibuye)	Masaka Road (Nalukolongo)	Masaka Road (Busega)	BMEX	Northern Bypass	Kampala-Entebbe Highway
Car	0	0	16,501	13,564	19,092	10,853	6,256	4,289	17,540	16,332	9,741
Bus	0	0	12,313	17,972	20,179	1,414	1,435	1,521	1,087	23,739	115
Truck	0	0	3,665	2,472	6,454	2,606	368	4,555	19,317	26,767	11,512
M/C	0	0	21,621	21,466	24,210	19,292	11,852	12,977	0	18,110	0
Total	0	0	54,100	55,474	69,935	34,164	19,911	23,342	37,944	84,948	21,368
Type	**Result of Traffic Assignment in 2034（PCU/24h）**										
	KBEX (Kibuye)	KBEX (Busega)	Queens Way	Katwe Road	Entebbe Road	Masaka Road (Kibuye)	Masaka Road (Nalukolongo)	Masaka Road (Busega)	BMEX	Northern Bypass	Kampala-Entebbe Highway
Car	0	0	22,607	19,465	28,816	13,217	8,315	6,772	24,755	22,605	20,981
Bus	0	0	19,856	25,176	30,627	1,591	2,202	2,032	1,531	27,089	1,107
Truck	0	0	8,280	6,225	15,780	4,918	1,988	8,456	36,200	42,842	29,730
M/C	0	0	28,894	29,887	33,984	24,588	15,904	18,284	0	22,868	0
Total	0	0	79,637	80,753	109,207	44,313	28,409	35,544	62,486	115,404	51,818

Source: JST



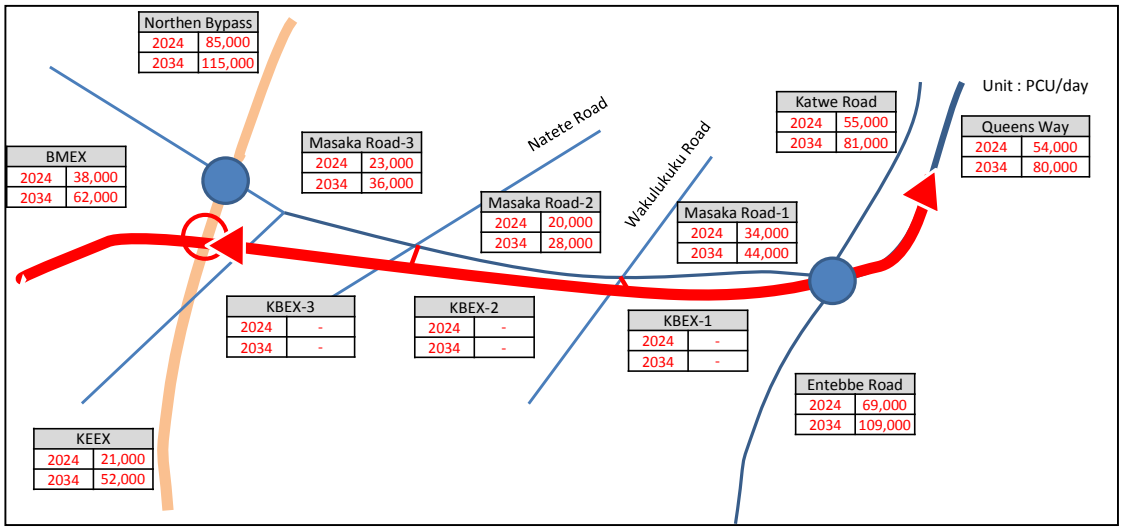
Source: JST

Figure 3.6.15 Result of Future Traffic Assignment in Case-1 (4-lane) in 2024 and 2034



Source: JST

Figure 3.6.16 Result of Future Traffic Assignment in Case-2 (6-lane) in 2024 and 2034



Source: JST

Figure 3.6.17. Result of Future Traffic Assignment without Case in 2024 and 2034

(4) Confirmation of Road Capacity on KBEX

In order to alleviate traffic congestion, traffic volume has to fall below road capacity. Hourly road capacity by the Highway Capacity Manual, US Transport Research Board, is shown in Table 3.6.15 Capacity of Project Road.

Table 3.6.15 Capacity of Project Road

Number of Lanes (One Directions)	Capacity (pcu/hour)
2	4,100 (2,050/lane)
3	6,150 (2,050/lane)

Source: Highway Capacity Manual 2000 (US Transport Research Board)

According to traffic count survey in 2019 the highest peak hour ratio (peak hour traffic volume/24 hour volume) on Masaka Road was 8.1%. Based on the future demand forecast, daily traffic was converted to peak hour traffic. Table 3.6.16 shows V/C ratio (Volume Capacity Ratio) by highest traffic volume in 2024, 2034. As a result, road capacity exceeds traffic volume in 2024 and 2034.

Table 3.6.16 V/C Ratio of KBEX in 2024 and 2034

Case-1: 4-lane		KBEX (Busega)	KBEX (Nalukolongo)	KBEX (Kibuye)
Number of lane (One Direction)		2		
Capacity (One Direction)		4,100PCU/ hour		
Peak Ratio		8.1%		
2024				
Traffic Volume	PCU / day	22,875	25,998	19,457
	PCU / hour	1,853	2,106	1,576
V/C Ratio		0.45	0.51	0.38
2034				
Traffic Volume	PCU / day	42,646 PCU/ day	43,980 PCU/ day	28,408 PCU/ day
	PCU / hour	3,454 PCU/ hour	3,562 PCU/ hour	2,301 PCU/ hour
V/C Ratio		0.84	0.87	0.56

Case-2: 6-lane		KBEX (Busega)	KBEX (Nalukolongo)	KBEX (Kibuye)
Number of lane (One Directions)		3		
Capacity (One Directions)		6,150PCU/ hour		
Peak Ratio		8.1%		
2024				
Traffic Volume	PCU / day	25,216	28,183	21,027
	PCU / hour	2,042	2,283	1,703
V/C Ratio		0.33	0.37	0.28
2034				
Traffic Volume	PCU / day	46,557	47,496	30,653
	PCU / hour	3,771	3,847	2,483
V/C Ratio		0.61	0.63	0.40

(5) Confirmation of Traffic Demand on Masaka Road

A) Public Transport Effect on Masaka Road

BRT and Commuter Train will be operated between Kibuye and Busega based on Multi Modal Urban Transport Master Plan published in 2018 and the information of URC. Both public transports will have a great impact on the modal shift from minibus and motorcycle to BRT and Railway.

BRT and Commuter Train are expected to make travel time more stable with the speed of 20km/h to 40km/h. Furthermore higher amount of passenger demand can be dealt with by frequent operation like one-two minutes interval. In order to evaluate the impact, two Cases are set up as follows;

Case-1 (PT Case-1), which assumes that

- ✓ BRT would cause the modal shift of 50% from M/C and Minibus, 70% from Large bus and 10% from Car,
- ✓ Commuter train would cause the modal shift of 10% in 2024, 20% in 2034 from M/C, Mini Bus, Large Bus and Car.

Case-2 (PT Case-2)

- ✓ BRT would cause the modal shift of 70% from M/C, Minibus and Large bus and 10% from Car.
- ✓ Commuter train would cause the modal shift of 10% in 2024, 20% in 2034 from M/C, Mini Bus, Large Bus and Car.

Table 3.6.17 Case of Shift Ratio / Assumption of operation of BRT and railway

Shift Ratio	2024				2034			
	PT Case-1		PT Case-2		PT Case-1		PT Case-2	
	BRT	Train	BRT	Train	BRT	Train	BRT	Train
Motorcycle	50%	10%	70%	10%	50%	20%	70%	20%
Mini Bus	50%	10%	70%	10%	50%	20%	70%	20%
Large Bus	70%	10%	70%	10%	70%	20%	70%	20%
Car	10%	10%	10%	10%	10%	20%	10%	20%
Assumption of operation	PT Case-1				PT Case-2			
	BRT		Railway		BRT		Railway	
Operation hours	6,00-23,00: 17hours				5,00-23,00: 18hours			
Capacity per operation	150-180		1600-1900		150-180		1600-1900	
	Bi-articulated bus		Eight-carriage		Bi-articulated bus		8-10 carriages	
Number of Operation per direction per day	500		25		600-800		60-70	
Average interval	2 minutes		30 minutes		1- 2 minutes		10-20 minutes	
Capacity of Passengers per day	180,000		90,000		250,000		100,000	

Source: JST

BRT and Commuter Train in PT Case-1 will reduce the traffic from 56,000 pcu/day to 31,000 pcu/day between Wankulukuku Road and Natete Road on the Masaka road in 2024. It is corresponding to a 45% reduction. The Table 3.6.19 shows that the traffic in 2034 is reduced from 75,000 pcu/day to 46,000 pcu/day, a reduction ratio of 39%. Case-1 is not enough to reduce traffic congestion in the future. In PT Case-2, a higher reduction ratio could be expected. Based on the result of PT Case-2, BRT and Commuter Train will reduce the traffic from 75,000 pcu/day to 27,000 pcu/day in 2034. It is corresponding to 64% reduction. Traffic volume of 27,000 pcu/day is dealt well with 2 lane capacity of road. Installation of BRT and Commuter Train service is recommended in the near future.

Table 3.6.18 Result of Public Transport Effect in 2024

	1) Passenger /vehicle	2) PCU conversion factor	Traffic on Masaka Road in 2024 without BRT		
			3) Vehicle/day	4) PCU/day	5) Number of passengers
Motorcycle	1.0	0.5	70,000	35,000	70,000
Mini Bus	10.0	1.2	15,833	19,000	158,333
Large Bus	60.0	2.0	0	0	0
Car	3.0	1.0	1,400	1,400	4,200
Small Cargo	2.0	1.0	100	100	200
MGV	2.0	2.5	160	400	320
HGV	2.0	3.5	29	100	57
BRT	150.0	4.0	0	0	0
Railway	1200.0	-	-	-	-
Total			87,522	56,000 (100%)	233,110

2024	PT Case-1			PT Case-2		
	6) Number of passengers	7) Number of Vehicles	8) PCU/day	6) Number of passengers	7) Number of Vehicles	8) PCU/day
Motorcycle	28,000	28,000	14,000	14,000	14,000	7,000
Mini Bus	63,333	6,333	7,600	31,667	3,167	3,800
Large Bus	0	0	0	0	0	0
Car	3,360	1,120	1,120	3,360	1,120	1,120
Small Cargo	2,000	1,000	1,000	2,000	1,000	1,000
MGV	3,200	1,600	4,000	3,200	1,600	4,000
HGV	57	29	100	57	29	100
BRT	114,587	764	3,056	160,253	1,068	4,273
Railway	23,253	19	-	23,253	19	-
Total	237,790	38,846	30,876 (55%)	237,790	21,984	21,293 (38%)

Source: JST

Table 3.6.19 Result of Public Transport Effect in 2034

	1) Passenger /vehicle	2) PCU conversion factor	Traffic on Masaka Road in 2024 without BRT		
			3) Vehicle/day	4) PCU/day in Road	5) Number of passengers
Motorcycle	1.0	0.5	120,000	47,000	120,000
Mini Bus	10.0	1.2	15,833	25,000	158,333
Large Bus	60.0	2.0	1,500	0	75,000
Car	3.0	1.0	16,000	2,000	48,000
Small Cargo	2.0	1.0	1,000	200	1,000
MGV	2.0	2.5	3,600	700	3,600
HGV	2.0	3.5	229	100	229
BRT	150.0	4.0	0	0	0
Railway	1200.0	-	-	-	-
Total			158,162	75,000	406,162

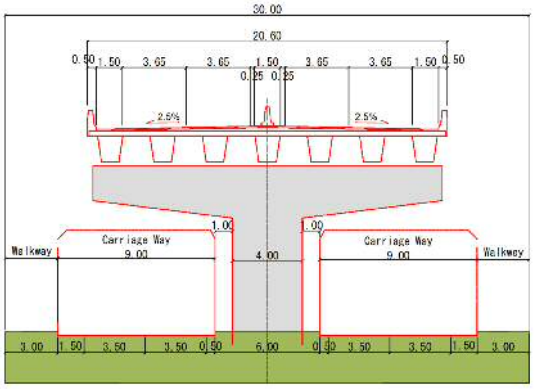
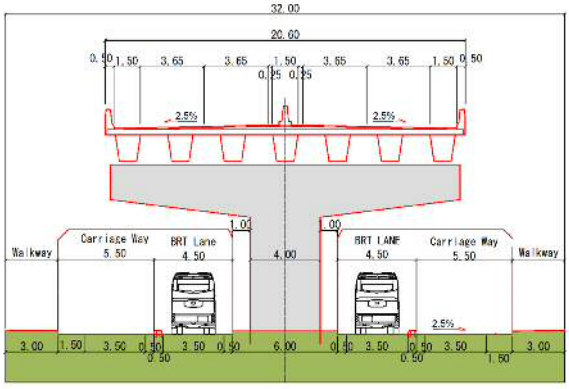
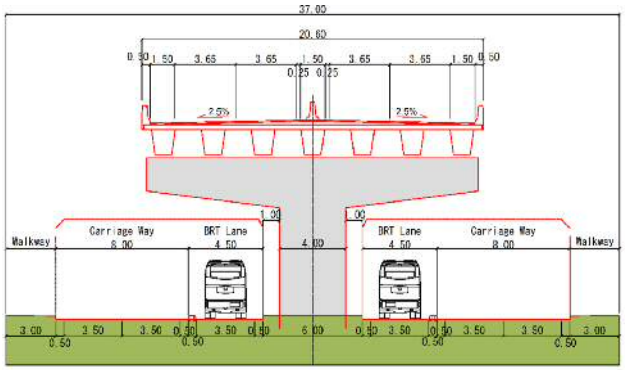
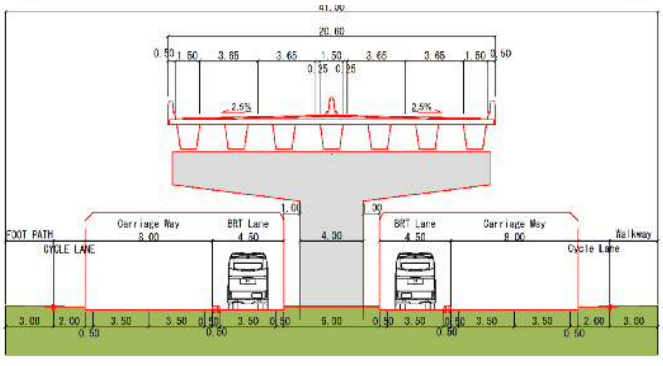
2034	PT Case-1			PT Case-2		
	6) Number of passengers	7) Number of Vehicles	8) PCU/day	6) Number of passengers	7) Number of Vehicles	8) PCU/day
Motorcycle	36,000	36,000	18,000	6,000	6,000	3,000
Mini Bus	47,500	4,750	5,700	7,917	792	950
Large Bus	7,500	125	250	3,750	63	125
Car	33,600	11,200	11,200	31,200	10,400	10,400
Small Cargo	1,000	500	500	1,000	500	500
MGV	3,600	1,800	4,500	3,600	1,800	4,500
HGV	229	114	400	229	114	400
BRT	196,467	1,310	5,239	252,133	1,681	6,724
Railway	80,267	50	-	100,333	63	-
Total	406,162	55,799	45,789 (61%)	406,162	21,349	26,599 (36%)

Source: JST

B) Alternative Cross Section of Masaka Road

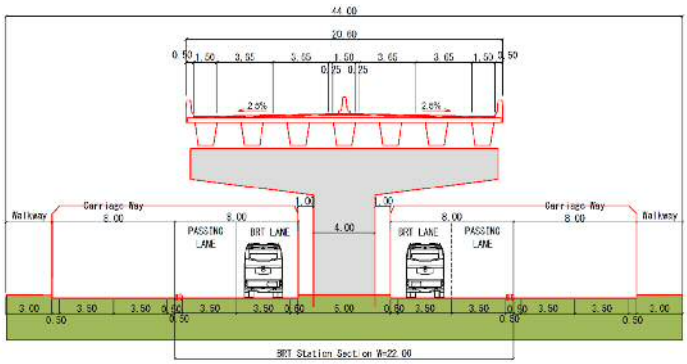
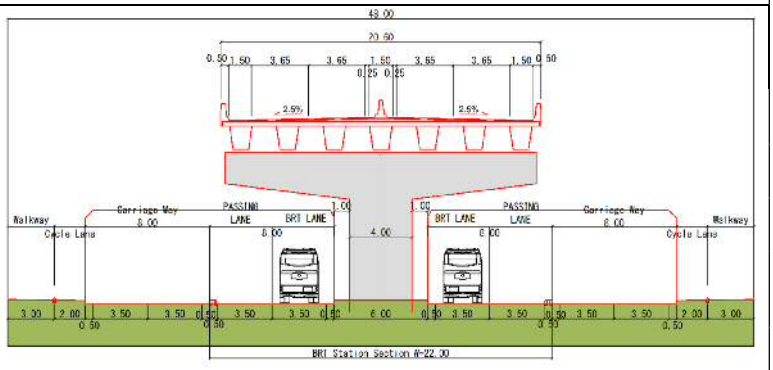
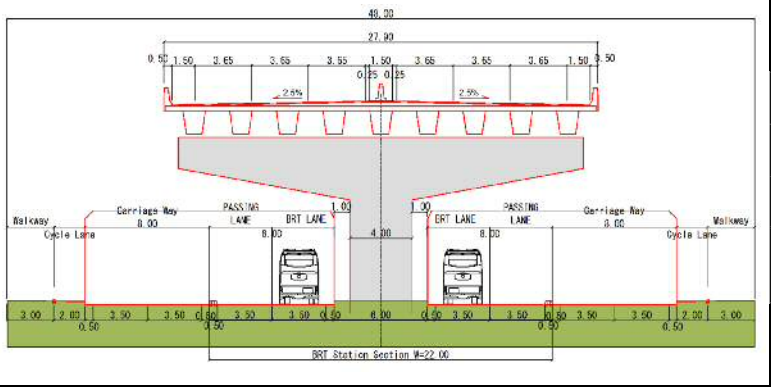
Based on the results of traffic demand forecast, alternative-3 and alternative-S3 are desirable in that they have higher passenger capacity than the other options, and provide fair services for all users. There are several issues in implementing such a desirable option because the empty land for road expansion is limited and land acquisition cost is higher in the populated area between Kibuye and Busega. Therefore, the demarcation of the expensive project cost shall be considered according to the objectives of KBEX and BRT projects and their respective schedules. KBEX and BRT installation can be considered under different funds. Nevertheless, from an early stage, the cross section pattern of Masaka road for KBEX and BRT installation shall be coordinated and decided to implement them efficiently. Therefore, JICA Study team suggests several patterns of cross-section as shown in Table 3.6.20 and 3.6.21. In the next stage, an appropriate pattern among all these cross section patterns shall be finalised.

Table 3.6.20 Alternative Cross Section on Masaka Road

Cross Section (W=30m)	
KBEX	4- lane
Masaka Road:	4- lane
BRT	Without
NMT	Walkway w=3m
Alternative-1 (W=32m)	
KBEX	4- lane
Masaka Road	4- lane
BRT	With(2-lane)
NMT	Walkway w=3m
Alternative-2 (W=37m)	
KBEX	4-lane
Masaka Road	6-lane
BRT	With (2-lane)
NMT	Walkway w=3m
Alternative-3 (W=41m)	
KBEX	4-lane
Masaka Road	6-lane
BRT	With (2-lane)
NMT	Walkway: w=3m Cycle lane：w=2m

Source: JST

Table 3.6.21 Alternative Cross Section with BRT Station on Masaka Road

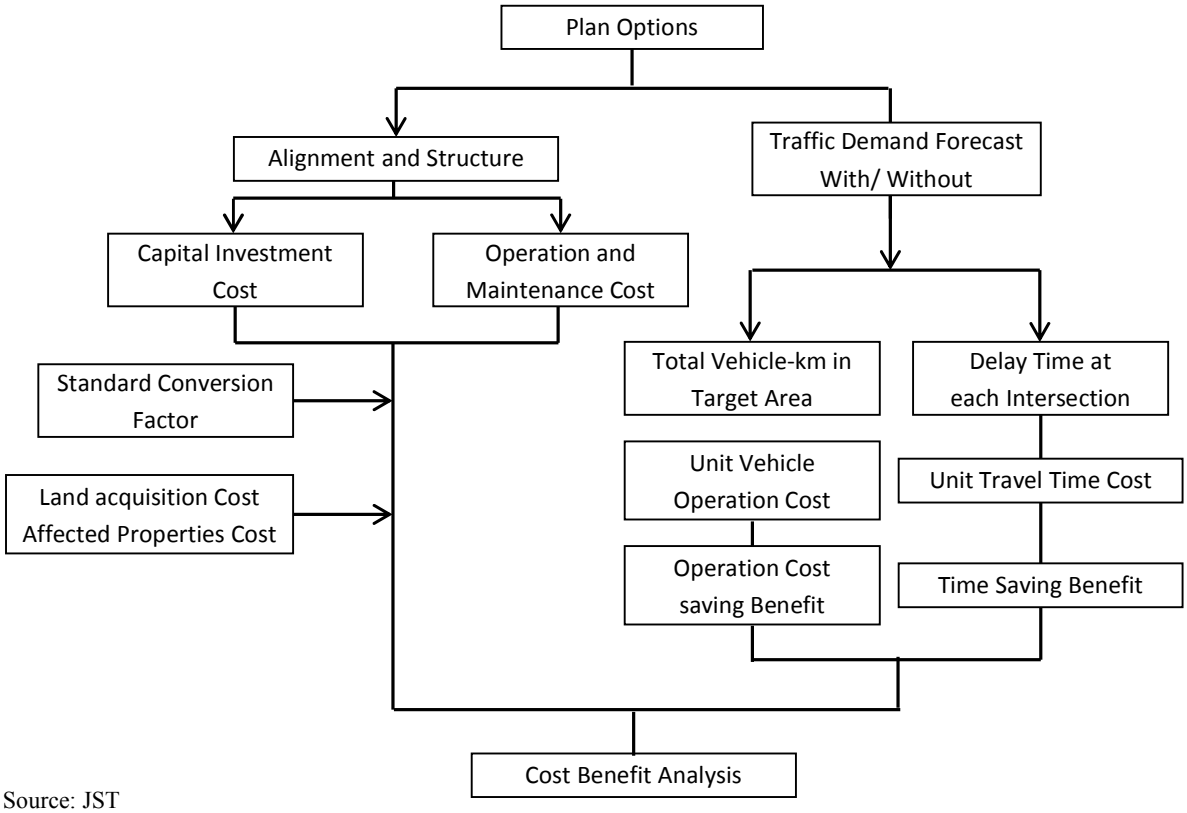
Alternative-S1 (W=44m)		
KBEX	4- lane	
Masaka Road:	8- lane	
BRT	With(4-lane)	
NMT	Walkway w=3m	
Alternative-S2 (W=48m)		
KBEX	4- lane	
Masaka Road	8- lane	
BRT	With(4-lane)	
NMT	Walkway: w=3m Cycle lane：w=2m	
Alternative-S3 (W=48m)		
KBEX	6- lane	
Masaka Road	8- lane	
BRT	With(4-lane)	
NMT	Walkway: w=3m Cycle lane：w=2m	

Source: JST

3.6.4 Cost and Benefit Analysis

(1) General

An economic analysis was conducted to verify the feasibility of the proposed project based on Cost-Benefit analysis. The general procedure of economic analysis is shown in Figure 3.6.18 General Flowchart of Economic Analysis. Method for analysis is described as follows:



Source: JST

Figure 3.6.18 General Flowchart of Economic Analysis

(2) Cost

The project costs were estimated as one of the criteria for the comparative study of alternatives as well as initial economic analysis. Further cost survey and analysis are required to estimate construction cost more accurately.

A) Construction Cost

Roughly estimated construction direct costs for each option are summarized in Table 3.6.22. The estimation was done considering unit costs adopted by the current detailed design, KFRUP (Kampala Flyover and Road Upgrading Project).

Table 3.6.22 Construction Cost for Each Alternative

Civil Works		Unit	Unit Cost (USD)	Alt-1 4-lane		Alt-2 4-lane		Alt-3 4-lane	
				Qty	Cost(million USD)	Qty	Cost(million USD)	Qty	Cost(million USD)
Superstructure	Steel	m2	4,256	10,712	45.6	13,596	57.9	13,390	57.0
	PC	m2	2,173	103,618	225.2	100,940	219.3	114,330	248.4
Substructure	Abutment	nos	700,000	2	1.4	2	1.4	2	1.4
	RC Piers	nos	458,200	72	33.0	16	7.3	16	7.3
	PC Piers	nos	502,600	108	54.3	164	82.4	184	92.5
Ramp	PC	m2	2,173	15,600	33.9	15,600	33.9	15,600	33.9
	RC Piers	nos	458,200	48	22.0	48	22.0	48	22.0
Road Construction		m2	281	82,779	23.3	82,410	23.2	67,158	18.9
Masaka Road widening		m2	221	104,000	23.0	156,000	34.5	176,800	39.1
Traffic signal		nos	350,000	2	0.7	4	1.4	4	1.4
Constraction Cost Total					462		483		522
Civil Works		Unit	Unit Cost (USD)	Alt-1 6-lane		Alt-2 6-lane		Alt-3 6-lane	
				Qty	Cost(million USD)	Qty	Cost(million USD)	Qty	Cost(million USD)
Superstructure	Steel	m2	4,256	14,504	61.7	18,409	78.3	18,130	77.2
	PC	m2	2,173	140,299	304.9	136,673	297.0	154,803	336.4
Substructure	Abutment	nos	947,800	2	1.9	2	1.9	2	1.9
	RC Piers	nos	620,403	72	44.7	16	9.9	16	9.9
	PC Piers	nos	680,520	108	73.5	164	111.6	184	125.2
Ramp	PC	m2	2,173	15,600	33.9	15,600	33.9	15,600	33.9
	RC Piers	nos	458,200	48	22.0	48	22.0	48	22.0
Road Construction		m2	281	107,344	30.2	106,865	30.0	87,087	24.5
Masaka Road widening		m2	221	104,000	23.0	156,000	34.5	176,800	39.1
Traffic signal		nos	350,000	2	0.7	4	1.4	4	1.4
Constraction Cost Total					596		621		671

Source: KFRUP ,JST

B) Operation and maintenance Cost

The operation and maintenance costs of the project were estimated based on the KFRUP used unit cost. The operation and maintenance cost consists of the annual cost and the periodic cost.

Table 3.6.23 Operation and Maintenance Cost

No of Lane	Annual cost (million USD)	Periodic cost (million USD)			
		Every 3 year	Every 10 year	Every 25 year	Every 30 year
4-lane	1.2	2.3	53.2	22.8	57.8
6-lane	1.5	3.0	68.5	29.4	74.4

Source: KFRUP ,JST

C) Land Acquisition Cost and Compensation Cost

Land acquisition and Compensation cost of the project were estimated based on data provided by KCCA.

Table 3.6.24 Land acquisition Cost and Compensation Cost

4-lane	Unit	Unit Cost (USD)	Alt-1		Alt-2		Alt-3	
			Qty	Cost (million USD)	Qty	Cost (million USD)	Qty	Cost (million USD)
Land Acquisition Cost	m2	-	190,500	24.0	137,000	19.0	114,900	18.0
Compensation Cost	Nos	7,700	430	3.0	310	2.5	330	2.5
Total				27.0		21.5		20.5
6-lane	Unit	Unit Cost (USD)	Alt-1		Alt-2		Alt-3	
			Qty	Cost (million USD)	Qty	Cost (million USD)	Qty	Cost (million USD)
Land Acquisition Cost	m2	-	204,500	26.0	151,000	21.0	128,900	20.0
Compensation Cost	Nos	7,700	460	3.5	340	2.5	370	3.0
Total				30.0		24.0		23.0

Source: KCCA, KFRUP ,JST

D) Other Key Item

Other key item for project cost is as follows. These costs are also referred to the KFRUP.

- Consultant Services : 10% of Construction Cost
- Relocation Cost : Unit Cost of KFRUP X Widening section length of Masaka Road
- Contingency Cost : 10% of Construction Cost

Table 3.6.25 Other Cost

Unit: million USD

Item	4-lane			6-lane		
	Alt-1	Alt-2	Alt-3	Alt-1	Alt-2	Alt-3
Consultant Services	46.0	48.0	52.0	60.0	62.0	67.0
Relocation Cost [1]	17.0	25.0	29.0	17.0	25.0	29.0
Contingency Cost	46.0	48.0	52.0	60.0	62.0	67.0

Note 1: The rates include costs for relocation of utilities such as telecommunication line, electricity line and National Water and Sewerage line etc

Source: JST

E) Total Project Cost

Table 3.6.26 Estimated Project Cost

Unit: million USD

Project Cost		Construction Cost		Consultant Services	Land Acquisition/ Compensation Cost	Relocation Cost	Contingency Cost	TOTAL
		Bridge	Road					
4-lane	Alt-1	416	47	46	27	17	46	599
	Alt-2	424	59	48	22	25	48	626
	Alt-3	462	59	52	21	29	52	675
6-lane	Alt-1	543	54	60	30	17	60	764
	Alt-2	556	66	62	22	25	62	793
	Alt-3	607	65	67	23	29	67	858
Current Design		114	36	-	451	51	15	261

Note 1 : Land Acquisition/ Compensation Cost and Relocation Cost were estimated by JST

Source: JST

The project costs are divided by Lot-1 and Lot-2, because KBEX has a considerable length, approximately 9.0km. Lot-1 is the east section form Queen's way to Wankulukuku JCT. Lot-2 is the west section form Wankulukuku JCT to Busega IC.

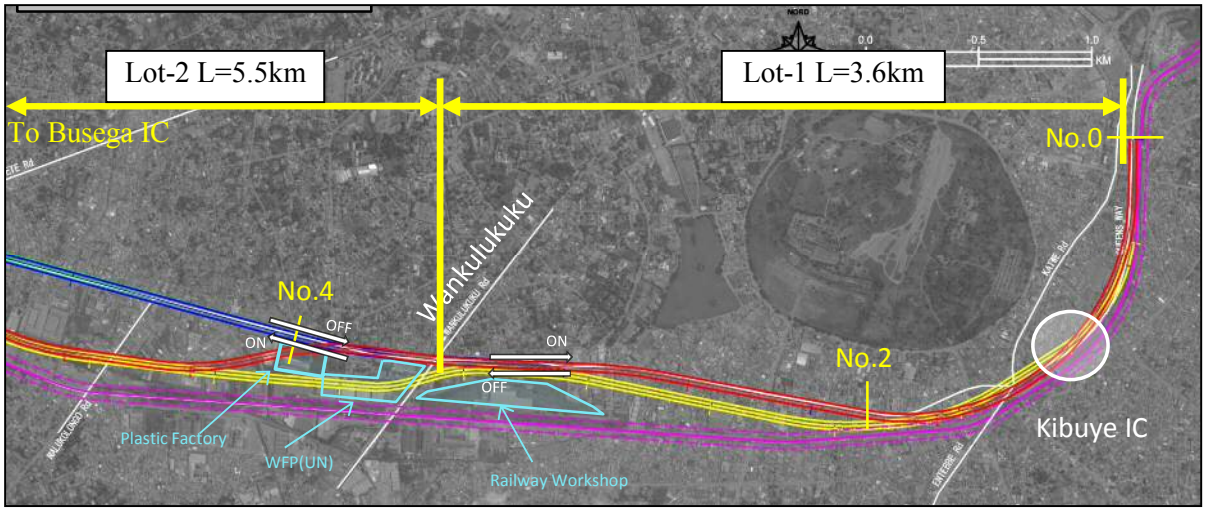


Figure 3.6.19 Location Map of Lot-1 and Lot-2

Table 3.6.27 Estimated Project Cost in Lot-1 and Lot-2

Unit: million USD

Project Cost 4-lane	Construction Cost		Consultant Services (10%)	Land Acquisition/ Compensation Cost	Relocation Cost	Contingency Cost (10%)	TOTAL
	Bridge	Road					
Lot-1	196	21	22	16	15	22	292
Lot-2 (Alt-1)	220	26	24	11	2	24	307
Lot-2 (Alt-2)	228	38	26	6	10	26	334
Lot-2 (Alt-3)	266	39	30	5	14	30	383
Project Cost 6-lane	**Construction Cost**		**Consultant Services (10%)**	**Land Acquisition/ Compensation Cost**	**Relocation Cost**	**Contingency Cost (10%)**	**TOTAL**
	Bridge	**Road**					
Lot-1	240	21	28	19	15	28	351
Lot-2 (Alt-1)	303	33	32	11	2	32	413
Lot-2 (Alt-2)	316	45	34	3	10	34	442
Lot-2 (Alt-3)	367	44	39	4	14	39	507

Source: JST

F) Standard Conversion Factor (SCF)

The economic costs are calculated by removing transfer items such as import duties and taxes from the financial costs (at market prices) so as to convert them into real resource values. For the conversion from financial cost to economic cost, the Standard Conversion Factor (SCF) is applied. In the Preparatory Survey on the Greater Kampala Roads Improvement Project in the Republic of Uganda (hereinafter JICA F/S), Standard Conversion Factor (SCF=0.9) was decided with reference to "Procedural Guide to Economic Road Feasibility Studies (Updated), March 2006, Road Agency Formation Unit (RAFU)". The same value is applied in the analysis.

G) Economical Cost

As a result, Economical costs are estimated following table

Table 3.6.28 Estimated Economical Cost

Unit: million USD

	4-lane	6-lane
Alt-1	502	639
Alt-2	525	666
Alt-3	566	719

Source: JST

(3) Benefit

The following two kinds of economic benefits were estimated quantitatively in this Study:

- Saving in Vehicle Operating Cost (VOC)
- Saving in Travel Time Cost (TTC)

When the road improvement projects are completed, those who are obliged to take longer detour routes to avoid congested area will return to the proper routes. This type of benefit is estimated as the savings in VOC and TTC attributed to the shorter travel distance. The increase or decrease in

total vehicle-km and vehicle-hour in the road network are calculated by the comparison of "with project" and "without project".

A) Vehicle Operating Cost Unit

VOC is a unit cost of vehicle operation, expressed in terms of USD/km/vehicle. Since the fuel consumption differs by running speed, unit VOC is given by speed ranges.

The vehicle operating cost saving benefit was estimated based on the reduced vehicle-km by option, by comparing the vehicle-km of the "with" and "without" option cases. In the Preparatory Survey, in order to obtain the unit VOC (USD/km/vehicle), the HDM-4 (VOC Module) was applied, and for the input indices for the HDM-4, Guidelines for LCCA Calibration Parameters and Key Assumptions for Long-Term Investment Planning, Version 1.0 (Draft, April 2013, UNRA) was referred to. The obtained vehicle operating cost by vehicle type and by travel speed is summarized in Table 3.6.29 below.

Table 3.6.29 Unit Vehicle Operating Cost (VOC) in 2017 price

Unit USD

Speed (km/hr)	Motor-cycle	Passenger Car / Small Cargo	Mini Bus	Large bus	Truck
5	0.3476	0.3481	0.8193	0.9042	0.072
10	0.3476	0.5837	0.8193	0.9042	0.072
15	0.3476	0.5837	0.8193	0.9042	0.072
20	0.3476	0.5837	0.8193	0.9042	0.072
25	0.3306	0.5569	0.7823	0.8708	0.0687
30	0.303	0.5125	0.7211	0.8172	0.0636
35	0.2842	0.4833	0.6808	0.7832	0.0606
40	0.271	0.464	0.654	0.7621	0.059
45	0.2618	0.4516	0.6367	0.4942	0.0585
50	0.2554	0.4443	0.6265	0.4899	0.0588
55	0.2954	0.6951	1.0164	0.5296	0.1068
60	0.2915	0.677	0.9872	0.5316	0.1077

Source: JST

B) Travel Time Cost

Unit TTC is a unit cost of time for driver and passengers on a vehicle expressed in terms of USD/hour/vehicle. Unit TTC is constant regardless of vehicle speed.

Travel time is considered to be reduced by the completion of the flyover project. The saved time is obtained by comparing the "without improvement" and the "with improvement" scenarios. Time saving benefit is acquired by applying Unit TTC (Travel Time Cost) to the total saved time.

Table 3.6.30 shows the unit travel time cost by vehicle type in Kampala Flyover Project. These time values are used to estimate the time saving benefit by option, by year and by vehicle type.

Table 3.6.30 Unit Travel Time Cost (TTC) by Vehicle Type in 2017 price

Unit USD

	Motor-cycle	Passenger Car / Small Cargo	Mini Bus	Large bus	Truck
$/hour-vehicle	2.5	7.5	20	17.5	0.33
$/Minute-vehicle	0.0417	0.125	0.3333	0.2917	0.0055

Source: JST

C) Vehicle Operation Cost Saving Benefit and Time Saving Benefit

VOC and TTC saving benefits are obtained by applying the above unit values to the vehicle travel distance (vehicle-km) and vehicle travel time (vehicle-hour) obtained from the results of traffic demand forecasts for each option and "without project" cases.

D) Estimated Benefit

Estimated time saving and cost saving benefits were summarized in Table 3.6.31.

Table 3.6.31 Estimated Travel Cost and Benefit

Unit: million USD /year

Case-1: 4lane	2024			2034		
	TTC	VOC	Total	TTC	VOC	Total
Case-1	914	1,702	2,617	3,266	2,986	6,252
Without	956	1,757	2,713	3,415	3,088	6,503
Benefit (Case1- Without)	42	55	96	149	102	251
Case-2: 6lane	**2024**			**2034**		
	TTC	**VOC**	**Total**	**TTC**	**VOC**	**Total**
Case-2	912	1,704	2,616	3,260	2,990	6,250
Without	956	1,757	2,713	3,415	3,088	6,503
Benefit (Case2- Without)	44	53	97	155	98	253

Source: JST

(4) Economic Indicators

Based on the estimated economic cost and benefit, economic analysis is conducted to obtain indicators for economic evaluation as shown below:

A) EIRR: Economic Internal Rate of Return

The EIRR is a discount rate, which makes the total net benefit of the project in present value to be equal to total cost. The EIRR indicates an investment efficiency of the project in terms of the national economy. The EIRR satisfies the following equation.

$$\sum_{i=1}^{k}\{(Net\ Benefit\ of\ i^{th}\ year)/(1+EIRR)^{i}\}=0$$

whereby k is the number of years of the project life.

B) NPV: Net Present Value

The NPV is a gross volume of annual net benefit discounted by the social discount rate of the nation. This value indicates an amount of social surplus of the project to the economy.

C) B/C: Benefit Cost Ratio

The B/C is a ratio of total benefit against total cost of the project. The benefit and the cost are discounted by the social discount rate of the economy. This value denotes the efficiency of the project as well as the EIRR.

Generally speaking, the EIRR and the B/C indicates an efficiency of the project, while the NPV shows an amount of net surplus of the project to the economy. If the scale of a project is large enough, the NPV has a tendency to become bigger, even if its EIRR is low. On the contrary, if the scale of the project is small, the NPV may be small, even if its EIRR is high.

(5) Cost Benefit Analysis

A) Precondition

The preconditions set for the cost-benefit analysis are as follows:

Table 3.6.32 Estimated Travel Cost and Benefit

Base Year :	2019
Opening Year of the Project:	2024
Evaluation Period:	30 years from opening year
Opportunity Cost of Capital (Discount rate)	12% （World Bank Standard Value）
Residual Value	0

Note: To consider discount rate, Since net value at end of evaluation period is about 1.5% of present net value, Residual value is almost zero.

(6) Result of Analysis

On the above preconditions, economic analyses were conducted by a worksheet basis. Table 3.6.33 summarizes the result of economic analysis.

Table 3.6.33 Summary of Economic Analysis by Option

		Cost (USD Million)	Benefit (USD Million / year)		Base Case			Sensitive Analysis (Minimum Case)		
			2024	2034	EIRR (%)	NPV (USD Million)	B/C	EIRR (%)	NPV (USD Million)	B/C
4-lane	Alt-1	502	96	251	24%	642	2.7	19%	418.1	1.9
	Alt-2	525	96	251	23%	626	2.6	19%	398.8	1.8
	Alt-3	566	96	251	22%	596	2.4	18%	363.2	1.7
6-lane	Alt-1	639	97	253	20%	539	2.1	17%	325.0	1.6
	Alt-2	666	97	253	20%	520	2.0	16%	302.2	1.5
	Alt-3	719	97	253	19%	482	1.9	15%	256.6	1.4

Note: Case of Sensitive Analysis was conducted by cost +20%, benefit -20%.

Source: JST

3.6.5 Evaluation of Alternative

Above mentioned alternatives were compared and evaluated relatively for each evaluation items. Evaluation items were established as follows:

Road Service

Drivability and Safety
Drivability and safety are evaluated by horizontal and vertical road alignment. These items in alt-2 are lower than those in the other alternatives because minimum radius and revers crave in down slope are applied.

Road Capacity and Travel Time Saving
Road capacity and travel time saving are evaluated by the number of lane and result of traffic assignment, respectively.

Environmental Impact: Land Acquisition Area, Affected Buildings
Environmental impact is evaluated by the number of affected buildings and area outside the RoW of road.

Constructability: Techinical Issues, Construction Period
Constructability is evaluated by the viaduct length on existing Masaka road and width.

Maintainability
Maintainability is evaluated by viaduct length on Masaka road and width.

Economical Efficiency:
Economic efficiency is evaluated by the total cost, EIRR, NPV. Refer to 3.6.4 for these indicators.

Scoring criteria is given by comparative manner as shown in Table 3.6.34.

Table 3.6.34 Scoring for Criteria

Evaluation Category / Item		Criteria		
		Worse : 1	Middle: 2	Better: 3
1.Road Service				
Drivability and Safety	Horizontal alignment (Minimum radius)	240m > X	240m ≦ X < 400m	400m ≦ X
	Vertical alignment (Maximum Gradient)	X >6%	4% < X ≦ 6%	X ≦4%
Road Capacity (PCU/day)		50,000 PCU> X	50,000 PCU ≦ X < 100,000 PCU	100,000 PCU ≦ X
2.Environmental Impact				
Land Acquisition Area	Area of outside the RoW	X >170,000 m^2	130,000 m^2 < X ≦ 170,000 m^2	X ≦ 130,000 m^2
Affected Buildings	Number of affected buildings	X >420	320< X ≦420	X ≦ 320
3/4. Constructability / Maintainability				
Techinical Issues	Viaduct length on existing Masaka road	X > 6,500m	4,500m < X≦ 6,500m	X ≦4,500m
	Viaduct width	X >30m	25m < X ≦30m	X ≦25m
5.Economical Efficiency				
EIRR of Sensitive Analysis		12% > X	12% ≦ X <18%	18% < X

As a result, Case-1&Alt-1 and Alt3 are higher evaluated among the alternatives. However, Alt-1 affect a lot of buildings and land, therefor this has a risk of longer period than other alternatives. In this regard, Alt-3 is seemed to be better than Alt-1. The result of the evaluation is shown in Table 3.6.35.

Table 3.6.35 Comparison of Alternatives

Category	Evaluation Item	Case-1: 4-lane			Case-2: 6-lane		
		Alt-1	Alt-2	Alt-3	Alt-1	Alt-2	Alt-3
1. Road Service	Safety Drivability	3	2	3	3	2	3
	Road Capacity	2	2	2	3	3	3
2.Environmental Impact	Land Acquisition Area	2	2	3	1	2	3
	Affected Buildings	1	3	2	1	2	2
3. Constructability		3	2	2	2	2	1
4. Maintainability		3	2	2	2	2	1
5. Economical Efficiency	EIRR	3	3	3	2	2	2
Overall Evaluation		A	B	A	C	B	B

Note : As a relative comparison, 1 and C means worse, 2 and B mean average, 3 and A means better.
Overall evaluation is made on the basis of the average and standard deviation.
Source: JST

3.7 Recommendations for Kibuye-Busega Expressway Project

3.7.1 Reference Opinions from Experts on Scenarios and Issues for the Project

In examining the scenario and future issues of the project, the JICA Study Team interviewed experts on transportation planning and logistics planning who are familiar with transport and logistics conditions in Africa, and obtained helpful comments. The members of the expert are:

- Professor Tetsuro Hyodo, Doctor of Engineering, Department of Logistics & Information Engineering, Tokyo University of Marine Science and Technology
- Professor Shinya Hanaoka, Doctor of Information Science, Department of International Development Engineering, Tokyo Institute of Technology
- Mr. Kazuharu Oide, Senior Consultant, Nittsu Research Institute and Consulting lnc.

The key comments from the experts are summarised below as recommendations for the next phase:

- For long-term traffic demand management on Masaka road, in addition to the Kibuye-Busage Expressway project, BRT installation and the improvement of railway service along Masaka road shall be examined together with some kind of regulation or restriction for motorcycle taxi.
- GKMA is likely to be a city with 10 million population in the future, urban traffic based on motorcycles has its own limits, and bike-dependent is considered to be unable to realize a mobility environment where the entire citizen can move safely and conveniently. Mass transit is essential, and urgent public transport infrastructure improvement should be undertaken.
- The motorcycle taxi in the developing country passes through a car and a car, and moves anywhere with relatively stable speed and cheaper fare. The users can call the motorcycle taxi by the smartphone, anywhere and anytime. Moreover, it is not difficult for a youth to enter the business of motorcycle taxi. In order to compete for the share of transport among urban transport modes, the services of public transport such as a network density of the public transport, highly frequent operation, stable speed and cheap fare are enriched. In addition, it seems that it is impossible to expect the modal shift from motorcycle to public transport if there are not civic environmental awareness and agreement.
- Motorcycle taxis are rapidly emerging in recent years due to a combination of various factors. In order to collect data, analyse objectively, and take effective measures, it is necessary to grasp the actual people's behaviours in urban area. Data obtained ten years ago is not enough. It is considered necessary to carry out a survey of person trip survey as a regional survey based on the future expansion of the Kampala metropolitan area.
- In the expressway network, it is necessary to develop a truck terminal and an inland depot as a trans-shipment base near the junction of the radial and the ring road.
- Coexistence of bikes and heavy trucks on highways increases the risk of traffic accidents and also results in slowing down, so separation is desirable.

3.7.2 Proposal of Scenarios for the Formulation of the Project

(1) Financial Arrangement

In implementing the Kibuye–Busega Expressway project, JICA assistance is expected to play a considerable role because of the very complex engineering nature of the viaduct structure on the existing road. Nevertheless, the project cost is over 600 million USD and is estimated to be much higher than the past road infrastructure projects by Japanese ODA loan in Uganda.Therefore, some collaboration funding and phased project scheme might be necessary to be examined for the project. Other donors' and/or governmental funds shall be arranged with collaboration of Japanese ODA loan.

If the phased funding is established as Lot-1 and Lot-2 as shown in Table 3.6.27, Lot-1 is estimated to be 292 million USD and Lot-2 ranging from 307 to 383 million USD for the four-lane KBEX option.

In case construction costs other than the designated ones for the Kibuye-Busega Expressway, such as road expansion cost of Masaka road, are not covered by Japanese ODA loan due to budget constrain, the Government of Uganda or KCCA will be requested to bear such excess cost.

(2) Management of the Implementation Schedule

Kibuye-Busega Expressway has a great role to connect Kampala FO project with Kampala-Entebbe Expressway, Northern Bypass and Busega-Mpigi Expressway. If the missing link is not completed, the whole performance of the road network would become much lower. There are risks for the delay of the project implementation such as land acquisition and environmental issues. In this regard, the type of alignment like Alternative-3, which would not much affect the built up area along Masaka Road and the environment of Busega Swamp than the other alternatives, has relatively more advantage than the others as a lower risk plan in securing the implementation schedule.

Furthermore, design and implementation of the expansion project of Queen's way dual carriageway and BRT installation from Clock Tower Junction to Kibuye junction is urgently needed. It is necessary to complete connecting with the Kampala Flyover Project by 2024.

It is recommended that the following F/S and D/D for the Kibuye-Busega expressway project shall be urgently conducted as soon as possible. On the other hand, such the big project usually requires several years for preparation such as social and environmental issues. Therefore, not only JICA or other donor's fund for the study, it is another option that Uganda government itself give the fund for the study. That could proceed the project speedy and efficiently.

3.7.3 Remaining Issues

(1) Environmental and Social Issues

[Major Findings on the Current ESIS Report]

- Need to include scoping results, to clarify the monitoring and reporting structure at pre-construction, construction and operation phases respectively, to add explanation of timing, methods of announcement, comments raised by the participants and answers from UNRA

[Major Findings on the Current RAP Report]

- Need to add scale of impact on relocation, to clarify compensation in full replacement cost and to add the entitlement matrix, to add explanation of timing, methods of announcement, comments raised by the participants and answers from UNRA

[Environmental Concerns for Implement the Project]

- Need to confirm scale of impact on relocation (i.e. numbers of relocation families/people)
- Due consultation with the concerned authorities to implement the project in the swamp area
- Need supplementary explanation of the items not described in the current ESIS

(2) Traffic Demand Management

In order to manage traffic movement in peak hours, traffic demand management shall be introduced in addition to the transport infrastructure. For example, the following measures are seemed to be effective:

- Implementation of several measures to promote the modal shift from motorcycle and minibus to BRT and commuter train
- Provision of information on travel time by route from CBD to airport
- Restriction of motorcycle on the expressway

- Logistic/Distribution terminals in the suburbs shall be developed in order to transfer large-size truck to small-size trucks, and to reduce large-size freight traffic in the urban areas.

(3) Coordination with BRT and Railway plans

As a missing link elimination project, the Kibuye-Busega Expressway Project will significantly enhance the performance of the trunk road network in Kampala in the long run, and will greatly contribute to the overall congestion mitigation and reduction of travel time. In particular, it greatly contributes to make access time shorter to the Entebbe airport from the city centre, commuting traffic between the city centre and the suburbs of Kampala, and shortening of the time for logistics between regions in Uganda.

Nevertheless, in order to alleviate the congestion on Masaka Road, which has many motorcycles and minibuses, it is necessary to promote a modal shift from these modes to BRT and railways. It is not clear when BRT is to be installed on Masaka Road, but Masaka Road will be considered to have six lanes including BRT lanes in the future and to develop transfer terminals where BRT and railway are connected and green space along Queen's Way for NMT network consisting of bicycles and pedestrians.

- BRT: The BRT Projects on Queen's Way and Masaka Road are urgently expected to be fixed in alignment and location of bus station in order to decide ROW or road width and space assignment.
- Railway: According to URC, an additional commuter railway operation would begin in the near future. A new railway station around the Kibuye junction is recommended to construct so as to connect Railway with BRT. It will also help to promote Transit Oriented Development around Kibuye junction where all transport modes can be connected with each other and a candidate of transport hub in the future.

(4) Geotechnical surveys for foundation of viaducts and swamp area

Boring survey along candidates of road alignment should be conducted especially in the swamp area.

Source: JST

Figure 3.7.1 3D image of Kibuye- Busega Expressway