

PREPARATORY SURVEY
FOR
THE PROJECT FOR IMPLEMENTATION OF
INTELLIGENT TRANSPORT SYSTEM
IN
MOMBASA REGION

FINAL REPORT

October 2025

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

NIPPON KOEI ENERGY SOLUTIONS CO., LTD.
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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to a joint venture consisting of Nippon Koei Energy Solutions Co., Ltd., Katahira & Engineers International and Ingerousec Corporation.

The survey team held a series of discussions with the officials concerned of the Government of Kenya and conducted field investigations. As a result of further studies in Japan, this report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Kenya for their close cooperation extended to the survey team.

October 2025

Akihito SANJO
Director General,
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List of Abbreviations

A/P	: Authorization to Pay
ATCC	: Automatic Traffic Counter-com-Classifer
B/A	: Banking Arrangement
BRT	: Bus Rapid Transit
CCTV	: Close Circuit Camera System
CECM	: County Executive Committee Member
CGM	: County Government of Mombasa
CIDP	: County Integrated Development Plan
E/N	: Exchange of Note
FOB	: Free on Board
G/A	: Grant Agreement
ISUDP	: Integrated Strategic Urban Development Plan
ITS	: Intelligent Transport Systems
ITU	: International Telecommunication Union
JICA	: Japan International Cooperation Agency
KeNHA	: Kenya National Highways Authority
KMP	: Kenya Municipal Program
KPLC	: Kenya Power and Lighting Company
KURA	: Kenya Urban Roads Authority
MD	: Minute of Discussion
MGB	: Mombasa Gate Bridge
MPLS	: Multi-Protocol Label Switching
NEMA	: National Environment Management Authority
NMK	: National Museum of Kenya
NTP	: National Traffic Police
NTSA	: National Transport and Safety Authority
SGR	: Standard Gauge Rail
SCIDP	: Second County Integrated Development Plan
SUTP	: Sustainable Urban Transport Program
TICAD	: Tokyo International Conference on African Development
TMC	: Traffic Management Centre
TN	: Technical Note
O&M	: Operation and Maintenance
VMS	: Variable Message Sign

Chapter1. Background and Outline of the Project

1.1 Background of Grant Aid Project

The Government of the Republic of Kenya (hereinafter referred to as "GOK") has set economic development as one of the key areas in its national development plan "Vision 2030". The development of transport infrastructure was identified as one of the priority issues to be solved to achieve economic development in this plan. One of the most urgent issues for the development of transport infrastructure is the traffic congestion in the urban area, which was caused by rapid population growth and increase in the number of vehicles. In Mombasa, which has the largest international trade port in the East African region, the development of transport infrastructure could not keep up with the rapid growth of population (from 0.94 million in 2009 to 1.37 million in 2025, according to estimation by the Kenya National Bureau of Statistics) and the increase in the number of vehicles. Additionally, Mombasa has multiple plans to expand the Mombasa Port and develop the Mombasa Special Economic Zone in the region, which is expected to further increase the volume of traffic.

To handle such traffic volume growth and improve the access between the areas divided by the inlet, GOK is planning to develop roads around the Mombasa Port, Mombasa Gate Bridge, and the Second Nyeri Bridge. At the same time, the County Government of Mombasa (hereinafter referred to as "CGM") operates a road monitoring system using 90 roadside cameras.

However, most of the major intersections in the central Mombasa District (hereinafter referred to as "Mombasa City") are using roundabout system. It is generally accepted that roundabout system can handle traffic volumes of up to around 10,000 vehicles per day, but actual volumes at these sites far exceed that threshold (about 20,000 to 70,000 vehicles per day, according to the Japan International Cooperation Agency (JICA) survey 2015) and these intersections are already operating at saturation during peak hours.

It is strongly recommended to change the roundabout method in major intersections to signal controlled method. The need for signal control system at major intersections was also addressed in the JICA report, "Data Collection Survey on Intelligent Transport Systems (ITS) in Africa Region" (2020-2021).

GOK is expected to introduce not only the development of a new road network, but also area-wise traffic control and management system developed in Japan at major intersections that are bottlenecks in the existing road network in Mombasa, which is the gateway to the northern corridor, through "The Project for Implementation of Intelligent Transport System in Mombasa Region" (hereinafter referred to as "the Project"). An Official Request for a Grant Aid Project was issued by GOK on January 28th, 2022.

1.2 Outline of Grant Aid Project

(1) Objective of the Project

The Project aims to alleviate traffic congestion and enhance road safety in Mombasa through the installation of Intelligent Transport Systems (ITS) equipment and the improvement of major intersections, thereby contributing to the city's sustainable economic development.

(2) Scope of the Project

The Project consists of two main components: the Facility Portion and the ITS Equipment Portion.

(A) Facility Portion

This portion involves intersection improvements, including the conversion of roundabouts into signalized intersections, and the installation of road surface markings and traffic safety facilities such as guard posts and cones.

A total of 22 intersections (including 6 roundabouts) will be improved, applying compact

intersection designs with dedicated pedestrian areas and additional traffic lanes to increase capacity and safety.

(B) ITS Equipment Portion

This portion covers the supply and installation of traffic control and monitoring systems, including:

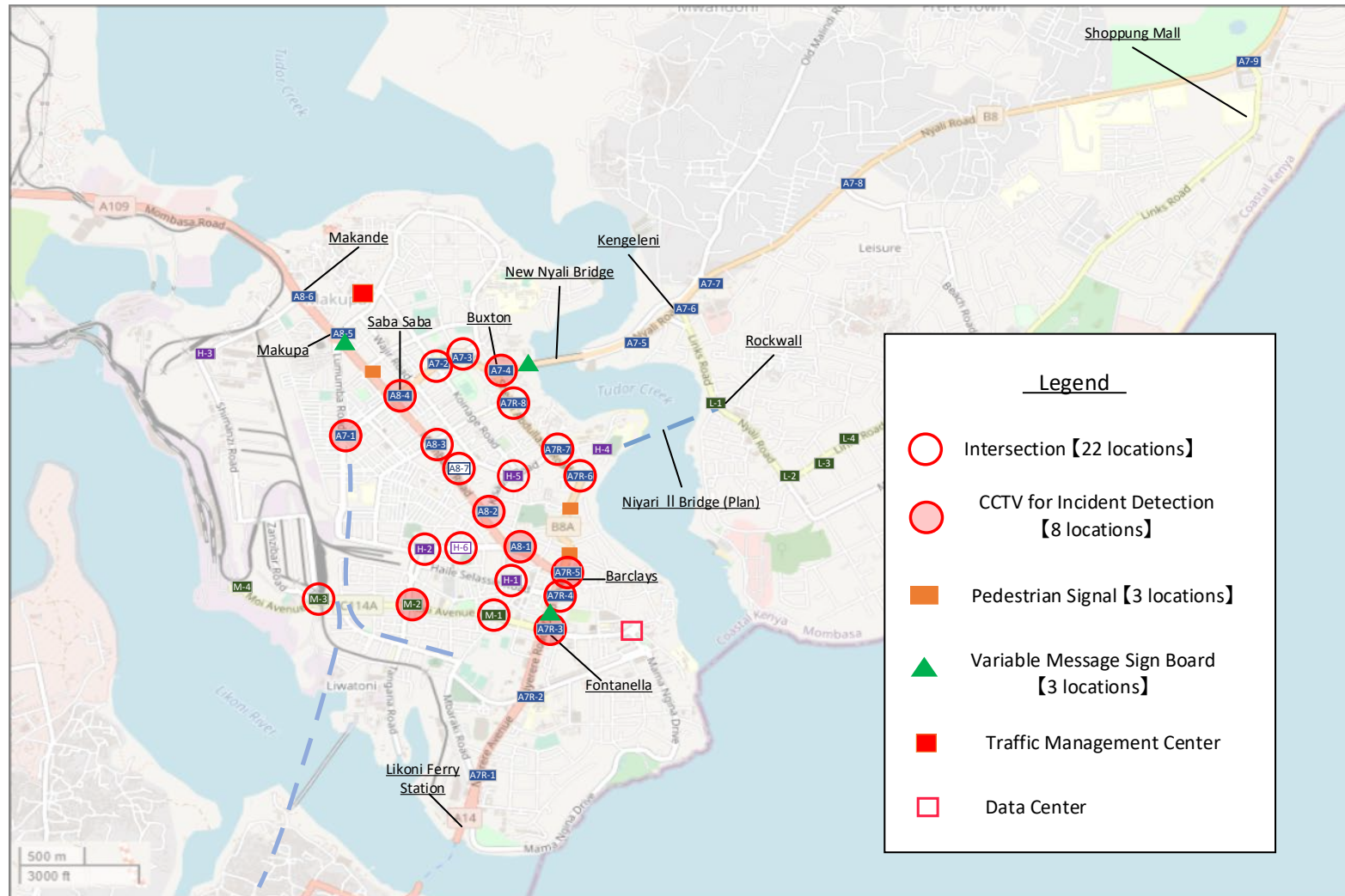
- Traffic Management Center System for data collection, CCTV monitoring, incident detection, and traffic information analysis;
- Signal Control Systems for 22 intersections, utilizing Japanese control technology that enables coordinated, data-driven signal timing;
- Variable Message Sign (VMS) System at three key entry points to the island to provide real-time traffic and travel information; and
- CCTV Camera Systems at eight critical intersections for enhanced traffic surveillance.

(3) Target Area

Mombasa City, Kenya

(4) Implementing Agency

County Government of Mombasa (CGM)



Source : JICA Study Team

Figure 1 Target Area of the Project

1.3 Traffic Survey

1.3.1 Target Intersection for the Survey

The traffic volume survey was conducted at 31 intersections and 2 locations on bridges connecting to Mombasa Island, which were selected based on the traffic situation, the impact of related projects, and discussions with C/P during the first field survey.

- Selected candidates (39 locations) for the purpose of smoothing traffic on major corridors, after the completion of the Mombasa Gate Bridge and the Second Nyari Bridge and easing traffic congestion in areas where congestion is currently significant.
- In the first field survey, we found non-intersection locations (A7-5, H-3, M-4, A7R-1) and intersections that are clearly not congested at present and are not expected to be congested in the future (L- 3, L-4) were excluded.
- Two intersections (H-4, L-1) were excluded because it was revealed that the construction of the Second Niyari Bridge construction project will not be completed for more than 10 years.

1.3.2 Outline of the Survey

Traffic surveys were conducted to grasp the traffic situation in Mombasa region. The items of the survey are shown in the table below.

Table 1 Items of Traffic Survey

Items	Outline/Purpose	Location	Survey Date
Traffic Volume Count	In order to understand the traffic volume of (1) to (3), the surveys each time zone shown below were conducted. ① Cross-section traffic volume count: 14 hours (6: 00-20: 00) ② Traffic volume count for each direction for peak hours: • Morning (7:00 to 10:00) • Noon (12:00 to 14:00) • Evening (16:00 to 19:00) ③ Crossing pedestrian volume count for peak hours: • Morning (7:00 to 10:00) • Noon (12:00 to 14:00) • Evening (16:00 to 19:00)	The main road intersections in Mombasa Island and the northern part of Mombasa Island were targeted. ① A total of 33 locations were targeted, including 31 intersections and 2 on the bridge. ② Targeted at about 31 intersections. ③ About 31 intersections were targeted.	9 intersections : 2021/9/13~18 10 intersections : 2021/9/20~25 14 intersections : 2021/9/27~10/2
Travel Speed	To understand the travel speed of the routes that are expected to be used by installing VMS. To understand the travel speed of the routes to access the ferry terminal, the Second Nyali Bridge, and the gate of Mombasa Port. The survey was conducted during the following peak hours: • Morning (7:00 to 10:00) • Noon (12:00 to 14:00) • Evening (16:00 to 19:00)	Targeting 6 routes considering the corridor.	2021/9/16~21

Pedestrian Crossing Time	It will be used to consider the space that pedestrians wait for signal safely. The survey was conducted during the following peak hours: • Morning (7:00 to 10:00) • Evening (16:00 to 19:00)	Targeting 5 intersections with pedestrian crossings.	2021/9/30
Queue Length	In order to understand the intersections with heavy traffic, a survey was conducted during the following peak hours: • Morning (7:00 to 10:00) • Evening (16:00 to 19:00)	Targeting 6 locations.	2021/9/23、24、 27

Source : JICA Study Team

1.3.3 Survey Methods

(1) Traffic Volume Count Survey

The traffic volume count survey covers 31 intersections and 2 locations on the bridge considering the traffic situation, the impact of related projects, and discussions with the counterpart (C/P) at the first meeting.

The detailed method is as follows:

- The traffic volume was counted by vehicle type and inflow/outflow directions at intersections.
- The traffic volume on bridges was counted by vehicle type and direction.
- 14-hour survey (6:00-20:00) was conducted since nighttime movements were restricted due to the COVID-19 pandemic.
- Traffic volume of each inflow/outflow was counted by vehicle type for the peak hours in the morning and evening (7:30-9:30, 16:30-18:30) and the off-peak hours during the day. (12:00-14:00).
- The survey was conducted on 5 weekdays and 1 holiday. Vehicle types were classified into nine categories: (1) passenger cars, (2) tuk-tuk, (3) small buses, (4) large buses, (5) trucks, (6) motorcycles, (7) bicycles, (8) pedestrians, and (9) other vehicles.



Traffic Count Survey(Pedestrian Crossing Volume Count)

○ : 13~18th,SEP(9locations)

Crossing Volume Count 16th ~22nd

The start of the Pedestrian Crossing Volume Count was delayed only 1st week, but the survey started at the same time in the other weeks.

○ : 20~25th,SEP(10locations)

○ : 27th,SEP~2nd,OCT(12locations)

○ : 27th,SEP~2nd,OCT (2locations)

Source: JICA Study Team

Figure 2 Target Intersections

(2) Travel Speed Survey

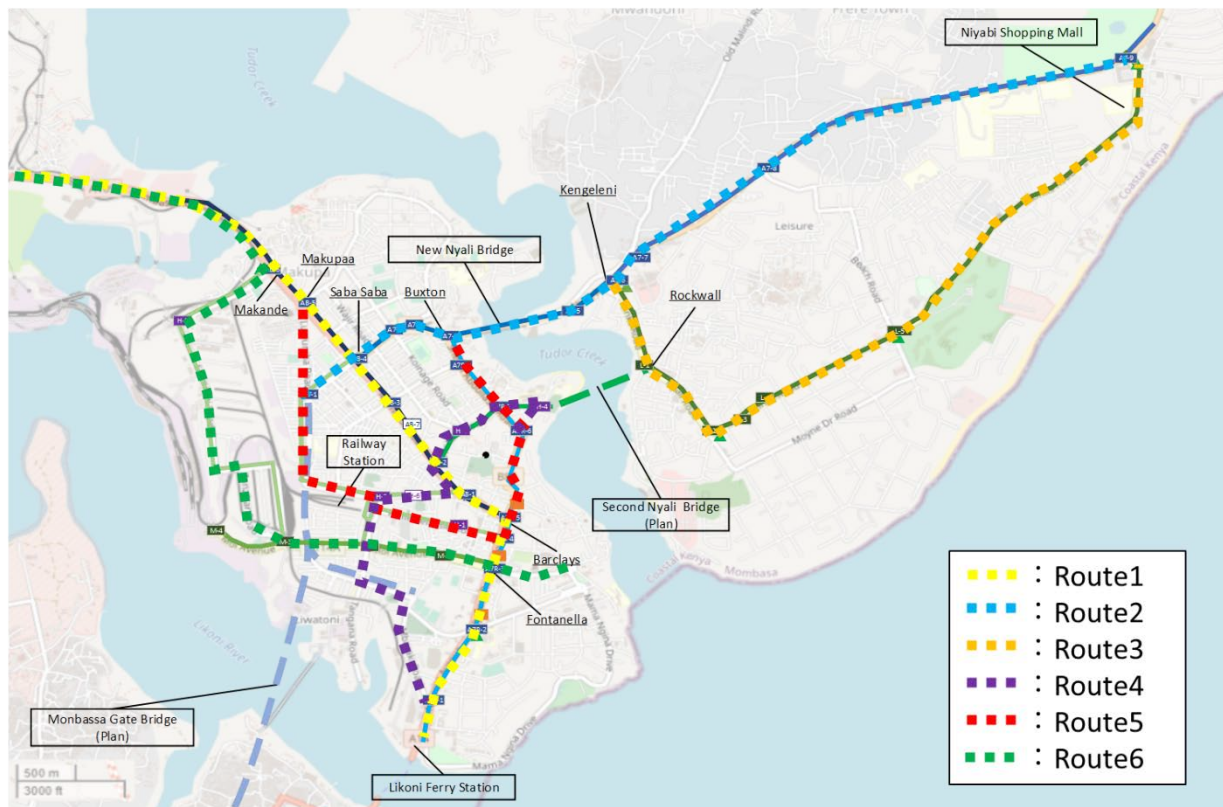
Travel speed survey was conducted along the routes expected to be improved by the installation of VMS. The access routes to the ferry terminal, the Second Nyali Bridge, and the gate of Mombasa Port were surveyed.

The survey was conducted in both directions during the following peak hours:

- Morning (7:00 to 10:00)
- Noon (12:00 to 14:00)
- Evening (16:00 to 19:00)

The survey [匠玉1] was conducted on 6 routes as follows:

- Route1: A8 road from the mainland to the ferry terminal
- Route2: A7 road from the Mombasa island via New Niyali Bridge to the Niyali Shopping Mall
- Route3: From the Kengelele intersection via Rockwall St. and Links road to the Niyali Shopping Mall
- Route4: From the Ferry terminal through the central part of the island
- Route5: From the Makupa roundabout via railway station and market to the Boxton intersection
- Route6: From the mainland via port area to the Administrative district



Source : JICA Study Team

Figure 3 Target Routes

(3) Pedestrian Crossing Time Survey

A pedestrian crossing time survey was conducted at five intersections on the main corridors with pedestrian crossings in Mombasa Island. Crossing times were summarized by gender and age group. It was conducted on weekdays for one day, and for one hour each during the morning and evening peak.



Source : JICA Study Team

Figure 4 Target Intersection for Pedestrian Crossing Time Survey

(4) Queue Length Survey

Queue length surveys were conducted at six intersections on major corridors considering the past surveys. The survey period is weekdays – 3 days during morning and evening peak times. Maximum queue length was measured every 15 minutes.

The Queue length generally refers to the distance from the rearmost vehicle to the stop line at the moment the signal changes from red to green. Currently, the signals are not functioning on Mombasa Island. Therefore, in this survey the distance from the most behind vehicle to the stop line was measured at the moment the traffic control by police officers changed.[匠玉2]



Source : JICA Study Team

Figure 5 Target Intersections for Queue Length Survey

1.3.4 Survey Results

(1) Traffic Volume Count Survey

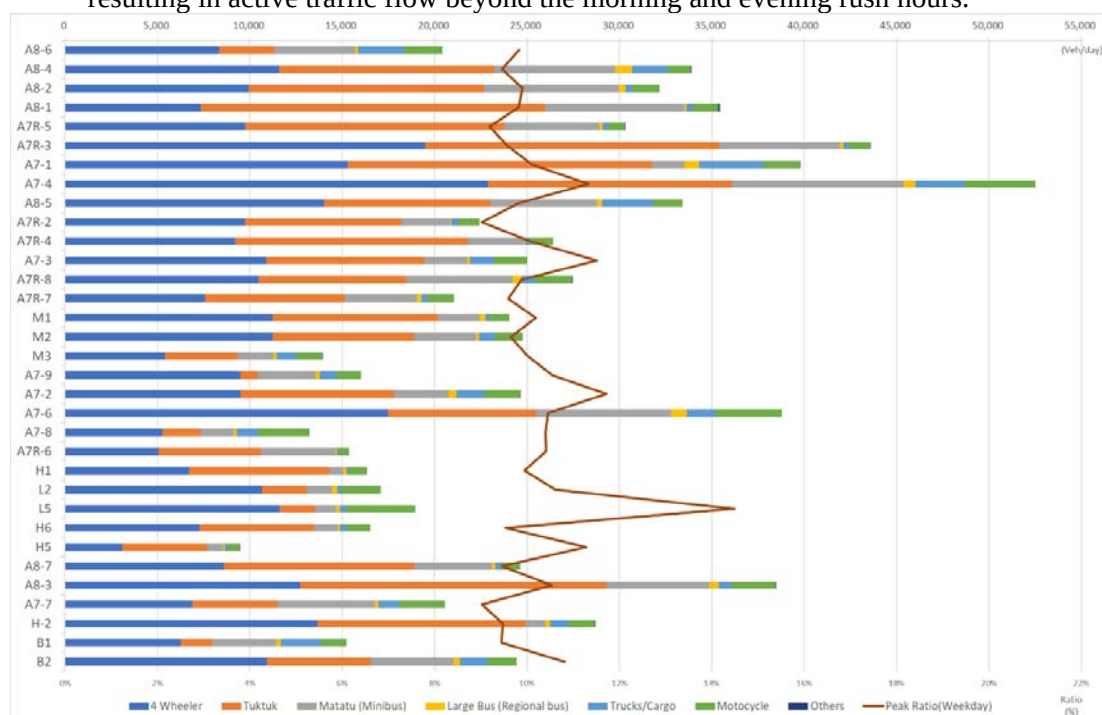
The results of the daily average (14 hours) of the inflow traffic at each intersection conducted during the five days on weekdays are shown below.

The A7-4 intersection had a particularly heavy traffic volume, and a large amount of traffic was also counted at the A7R-3 intersection, A7-1 intersection, A7-6 intersection, and A8-3 intersection.

A particularly large amount of traffic has been counted on the A8, A7, and A7R routes, indicating that it is the main arterial road.

The characteristic of traffic in Mombasa is that traffic such as that of *matatsu* and *tuk-tuk* account for more than half.

Most of intersections are Peak Ratio(12hrs) is around 10%. Only 3 intersections are over 10%. Within and around Mombasa Island, traffic volumes tend to be high even outside peak commuting hours. This is likely due to Mombasa being a commercial hub, resulting in active traffic flow beyond the morning and evening rush hours.



Source : JICA Study Team

Figure 6 Traffic Volume Count Result (Daily Average for 5-weekday (Veh/14 hours/day))



Source : JICA Study Team

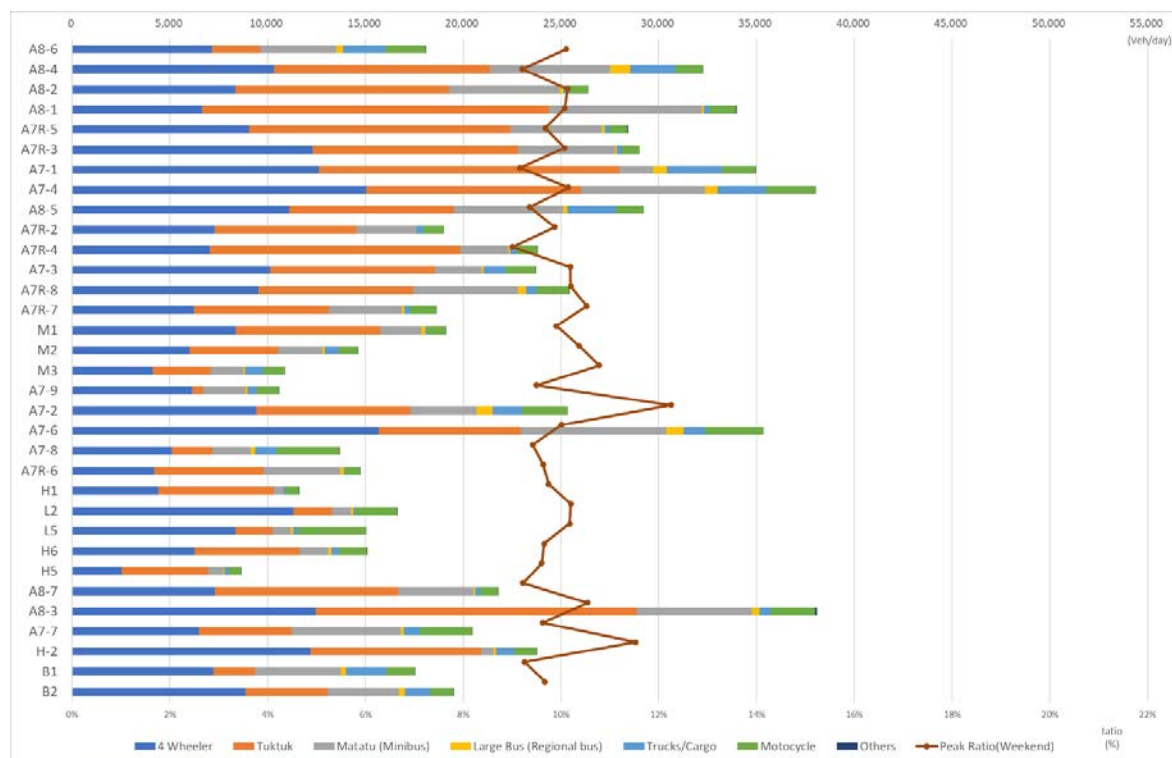
Figure 7 Traffic Volume Count Locations

The result of the daily average (14 hours/day) of the inflow traffic at each intersection conducted in one day on a holiday (Saturday) is shown below. Compared with the weekdays, traffic volume tends to be less overall.

The A7-4 intersection, A7-1 intersection, A7-6 intersection, and A8-3 intersection have the same heavy traffic as on weekdays, but the A7R-3 intersection, which had the second heaviest traffic on weekdays, has less traffic on holidays.

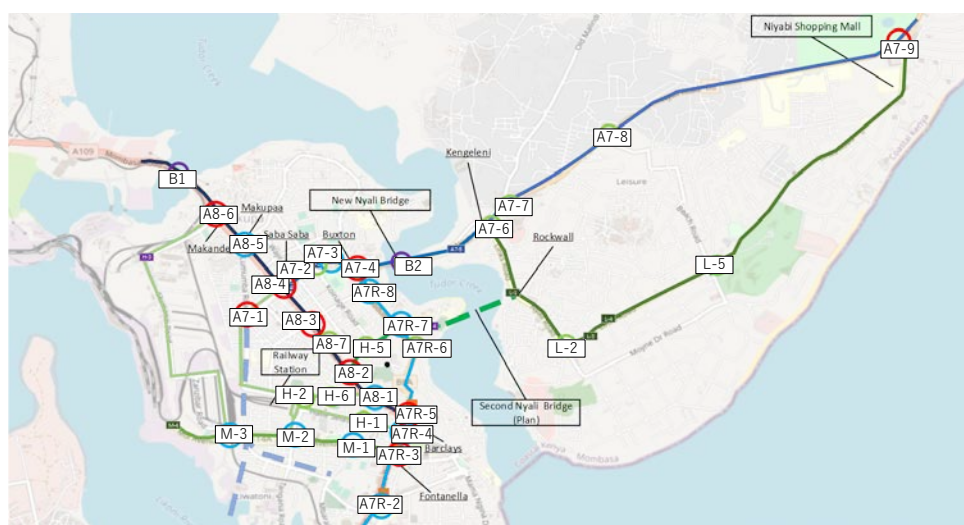
Since this is an intersection near the office district, it is thought that the impact of the decrease in commuting traffic is significant.

Peak Ratio is around 10% and same as weekday value approximately.



Source : JICA Study Team

Figure 8 Traffic Volume Count Result (Daily Average for One Holiday (Veh/14hours/day))



Source : JICA Study Team

Figure 9 Traffic Volume Count Locations

Then following figure shows the traffic volume (PCU) and direction ratio at 2 critical points on the bridge for access to Mombasa Island.

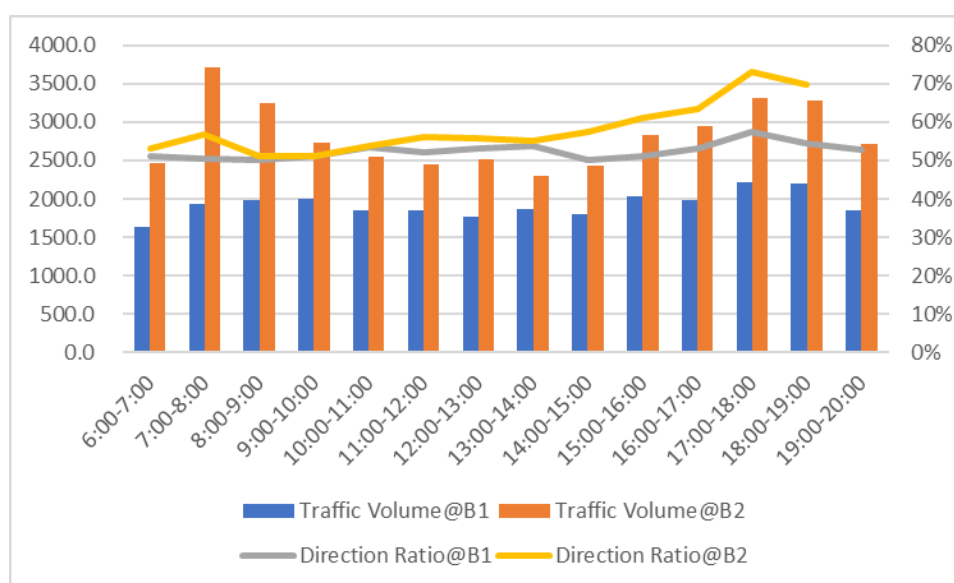
The peak hours in weekdays were observed at 7:00 to 8:00 and 17:00 to 18:00.

In the morning, traffic flows into Mombasa Island, causing congestion within the island. In the evening, traffic flows from Mombasa Island toward outside the island.

Table 2[匠玉4] Traffic Survey Result on Bridges (Weekdays)

	Morning Peak Hour			Evening Peak Hour		
	Time	Peak Ratio	Direction Ratio	Time	Peak Ratio	Direction Ratio
B1	9 to 10	8.5%	51%	17 to 18	9.4%	58%
B2	7 to 8	10.8%	57%	17 to 18	9.7%	73%

Source : JICA Study Team



Source : JICA Study Team

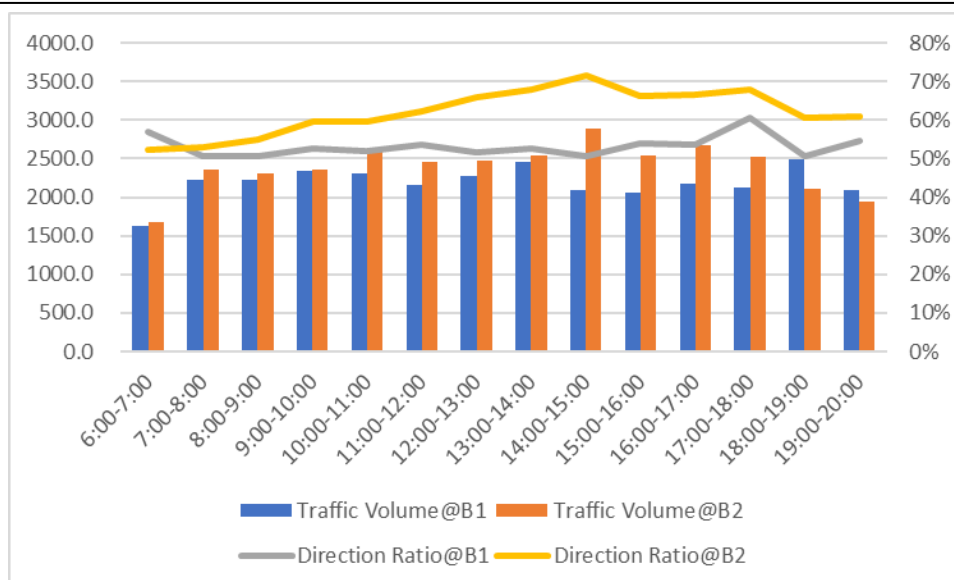
Figure 10 Traffic volume (PCU) and direction ratio (Weekdays)

Although the peak hours in holiday morning and evening were not observed compared to weekdays, there was a tendency for traffic leaving Mombasa Island to increase in the evening, similar to weekdays.

Table 3 Traffic Survey Result on Bridges (Holiday)

	Morning Peak Hour			Evening Peak Hour		
	Time	Peak Ratio	Direction Ratio	Time	Peak Ratio	Direction Ratio
B1	9 to 10	7.3%	53%	18 to 19	8.1%	51%
B2	10 to 11	8.7%	60%	14 to 15	9.7%	72%

Source : JICA Study Team



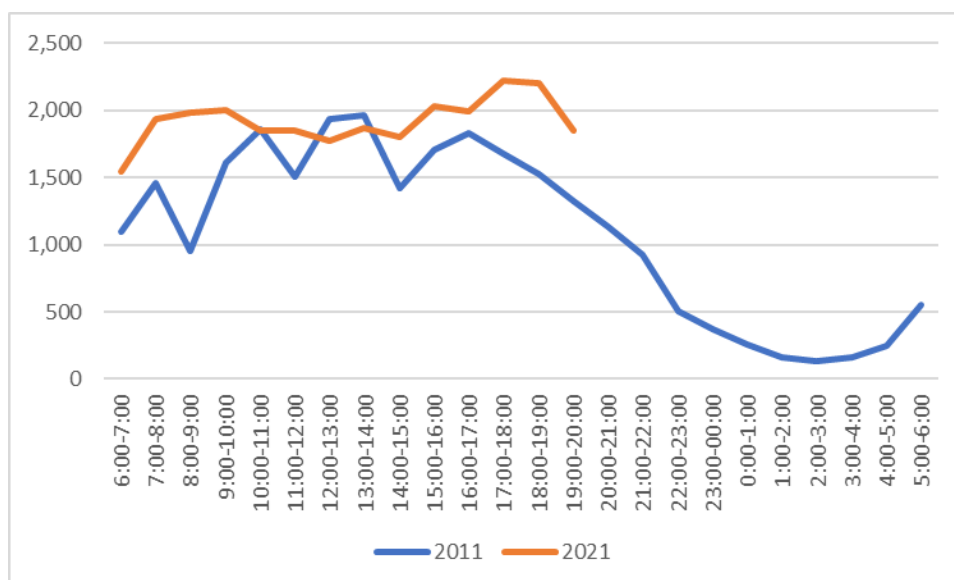
Source : JICA Study Team

Figure 11 Traffic volume (PCU) and direction ratio (Holiday)

At the time of this survey, restrictions on going out were in place due to the spread of the COVID19 infection, then 24-hour traffic survey could not be conducted.

Therefore, comparing the traffic count survey result in 2011 at B1 survey, which was conducted at the same location, and the 2021 results of this survey, traffic volume in 2011 peaked during the daytime, whereas traffic volume in 2021 peaked for morning and evening.

Considering that the daily traffic volume is about the same, it is thought that traffic during the restricted hours is concentrated in the morning and evening hours, pushing up the traffic volume.



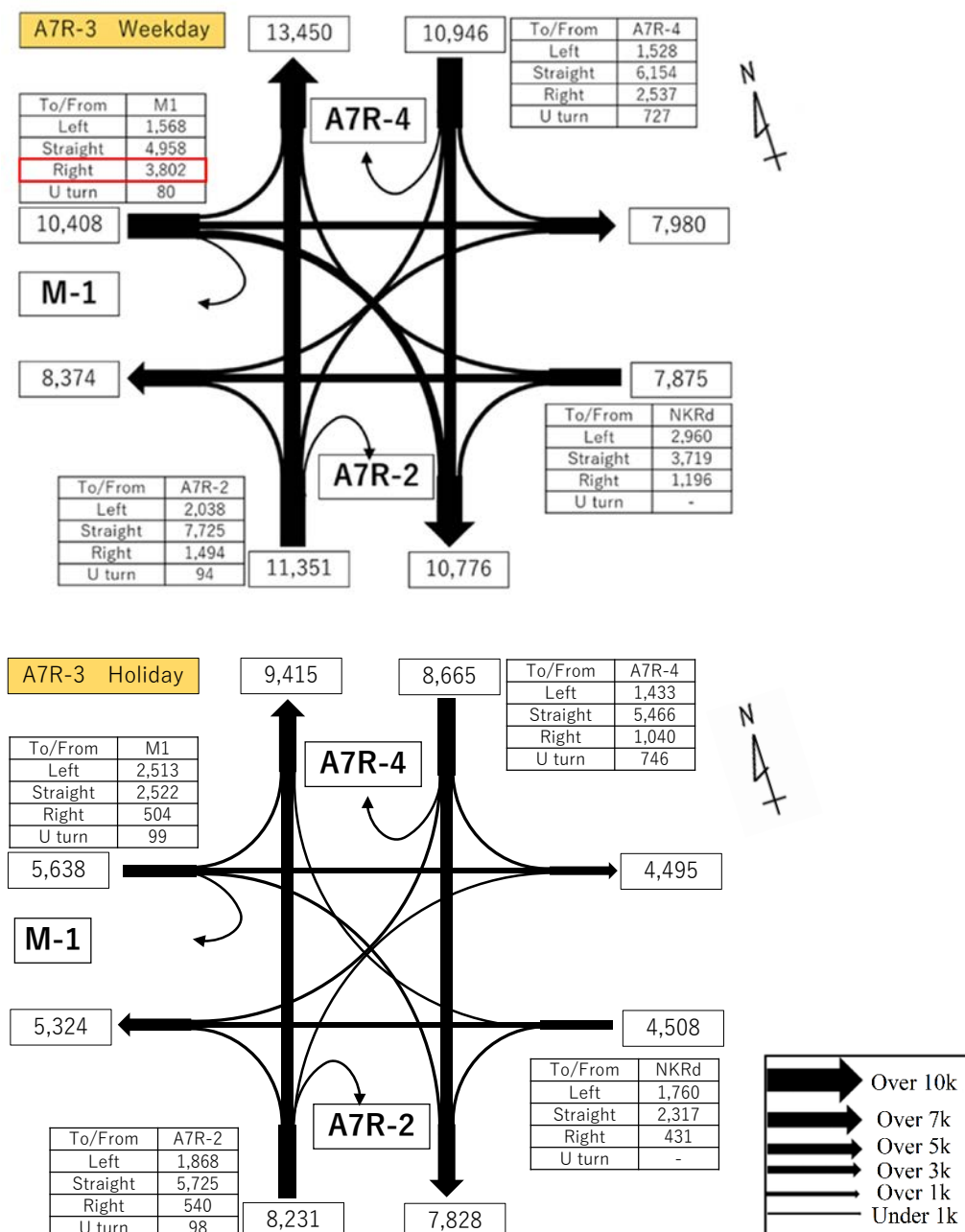
Source : PREPARATORY SURVEY ON MOMBASA CITY ROAD DEVELOPMENT PROJECT, JICA Study Team

Figure 12 Comparison of traffic volume by weekday in 2011 and 2021 (number of vehicles)

A traffic flow map (PCU conversion) of typical intersections are shown below. Traffic volume by direction was only counted in the morning (7:00 to 10:00), afternoon (12:00 to 14:00), and evening (16:00 to 19:00), then this traffic volume was calculated for 8 hours/day.

In addition to a large proportion of traffic turning left and right at roundabout intersections, there is also a large proportion of U-turns at intersections where separation strips have been installed. The size of intersections that are too small for these complex intersecting traffic flows and volumes is thought to be a contributing factor to traffic congestion.

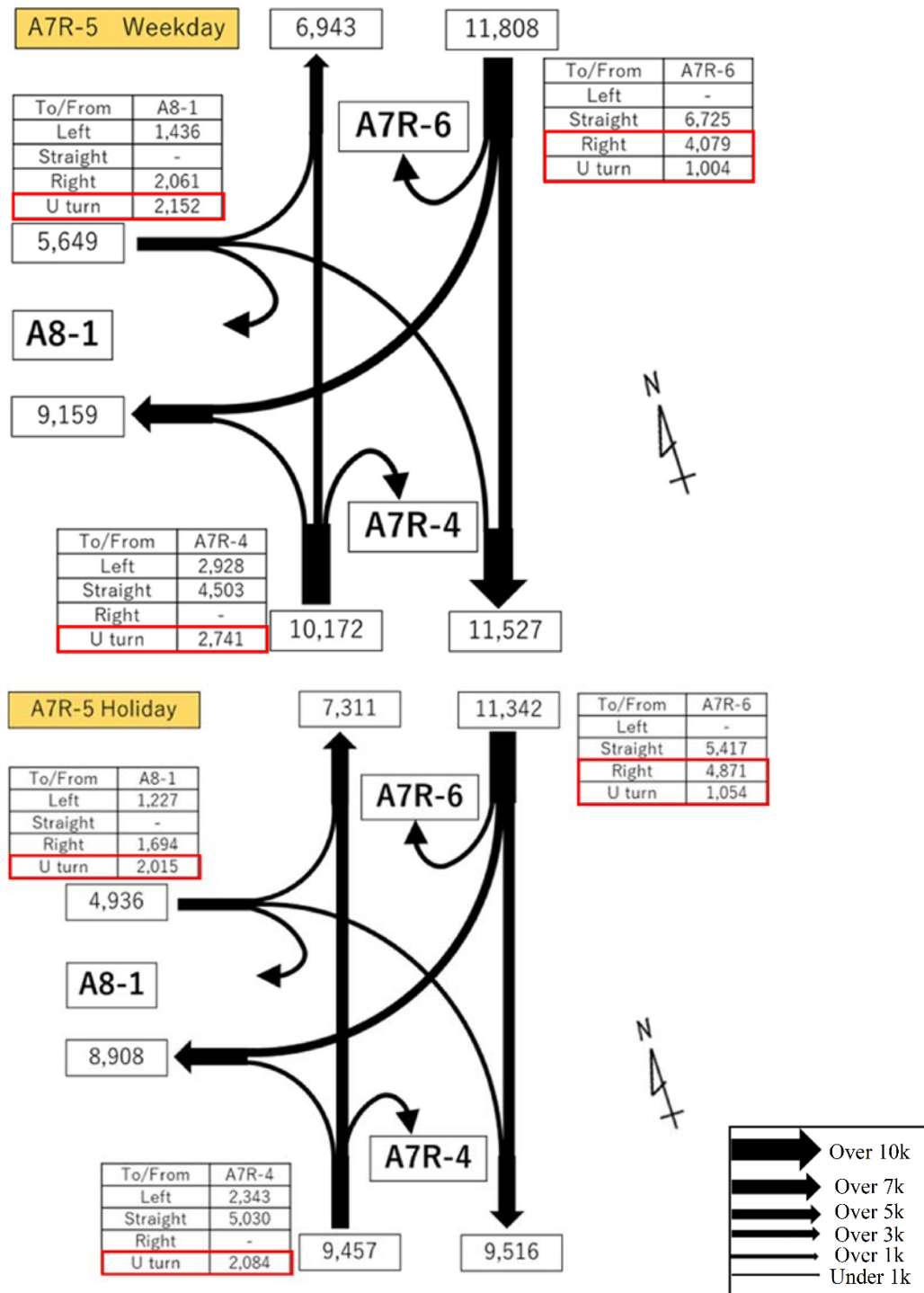
At the A7R-3 intersection, traffic volume is much in the north-south direction. Although there is less traffic in the east-west direction than in the north-south direction, there are more right turns coming from the M-1 direction on weekdays, causing traffic congestion.



Source : JICA Study Team

Figure 13 A7R-3 Traffic Flow Map

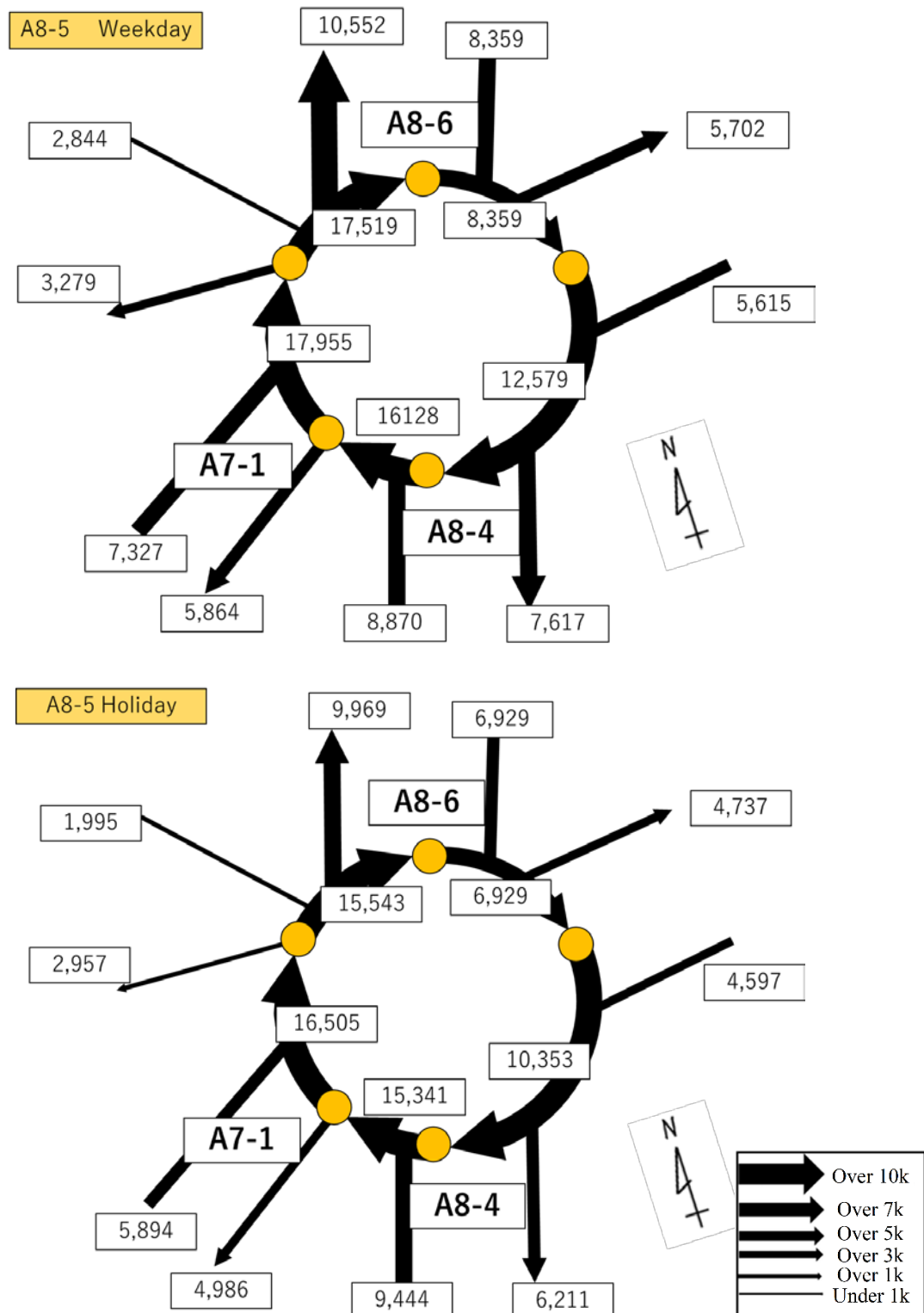
The A7R-5 intersection is a small roundabout with U-turn traffic in all directions. Additionally, there is a lot of right-turning traffic coming from the A7R-6 direction on weekdays and holidays addition to U-turning traffic, this is due to congestion.



Source : JICA Study Team

Figure 14 A7R-5 Traffic Flow Map

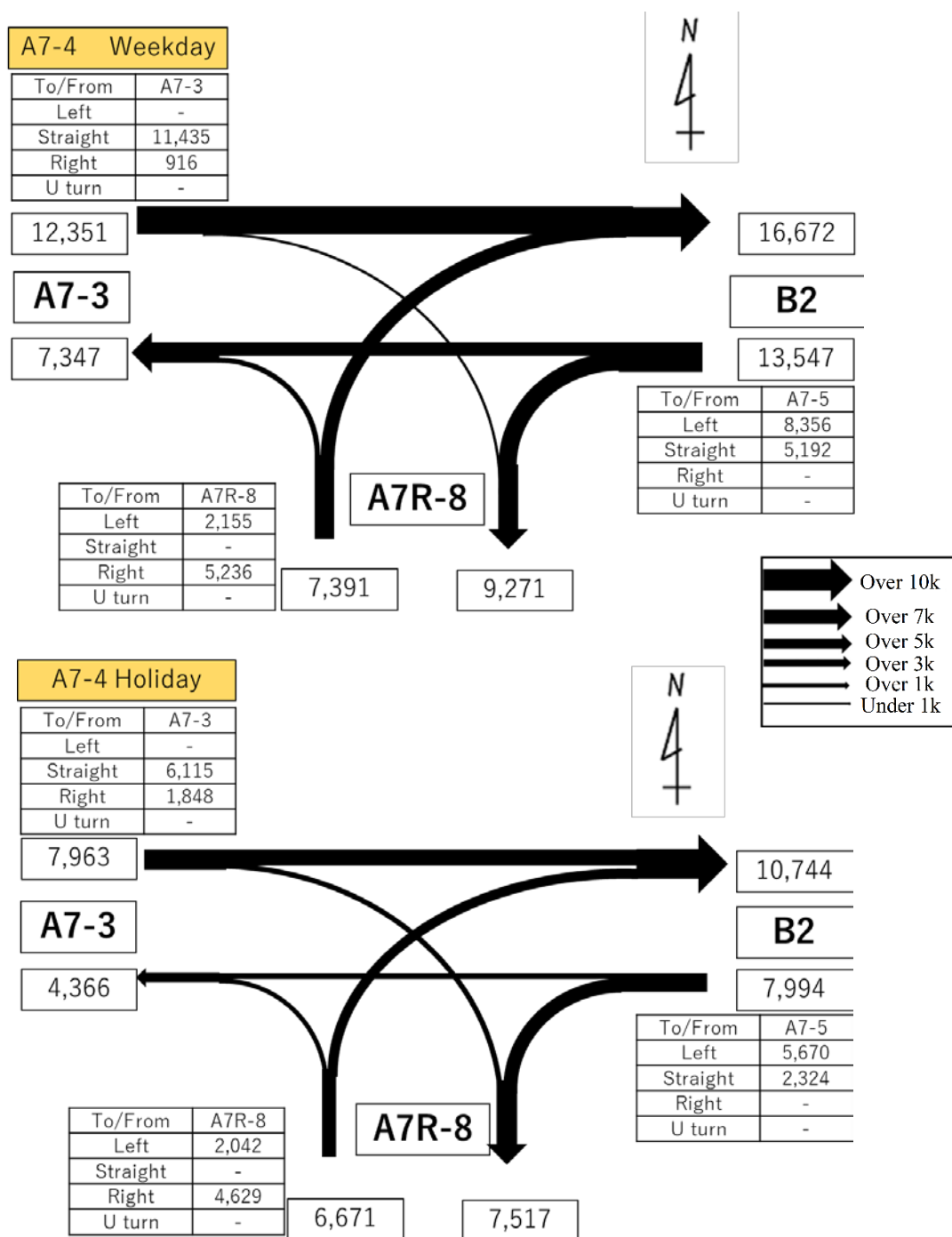
The A8-5 intersection is a large roundabout with five directions. The main traffic is on the A8 and A7 routes, but there is also traffic in the other two directions, resulting in complex intersections within the roundabout.



Source : JICA Study Team

Figure 15 A8-5 Traffic Flow Map

The A7-4 intersection is the intersection in front of Niyari Bridge, and because it is an intersection where traffic flows in and out of the island is concentrated, the traffic volume is higher than other intersections. In particular, traffic heading off the island merges from routes A7 and A7R, causing congestion. Traffic volume tends to be lower on holidays than on weekdays.



Source : JICA Study Team

Figure 16 A7-4 Traffic Flow Map

(2) Travel Speed Survey

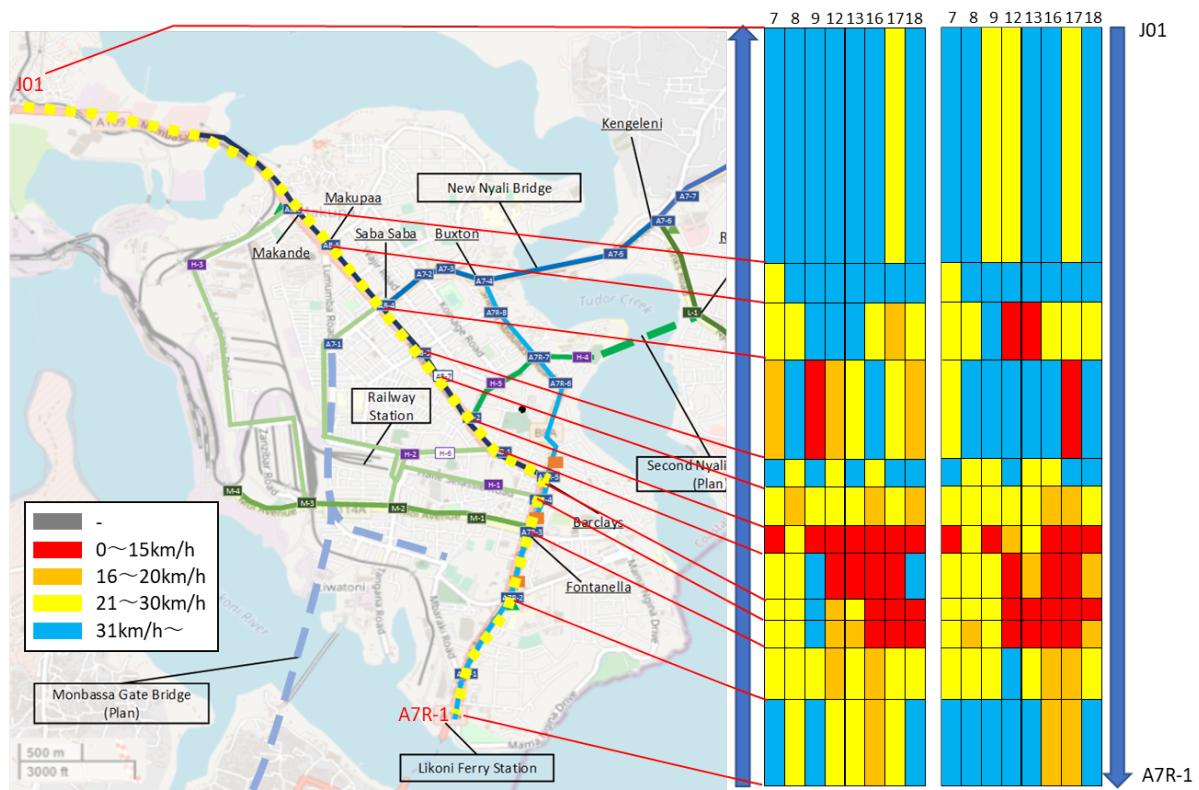
Travel speed survey was conducted on the six main corridors including detours that are expected to be used by installing VMS, and roads that are expected to be used for access to the ferry terminal, the Second Nyali Bridge, and the entrance to Mombasa Port.

The six routes include all the target intersections.

Travel time was measured by going back and forth on each route three times a day during peak hours in the morning and evening and off-peak hours during the day.

The results of the travel speed survey shown below indicate that traffic congestion has occurred in the sections where the travel speed is decreasing.

In Route 1, the travel speed decreased during the peak hours from morning to evening in the section from A8-3 to A7R-3. In addition, a speed decrease of less than 15 km/hr can be seen near A8-4.



Source : JICA Study Team

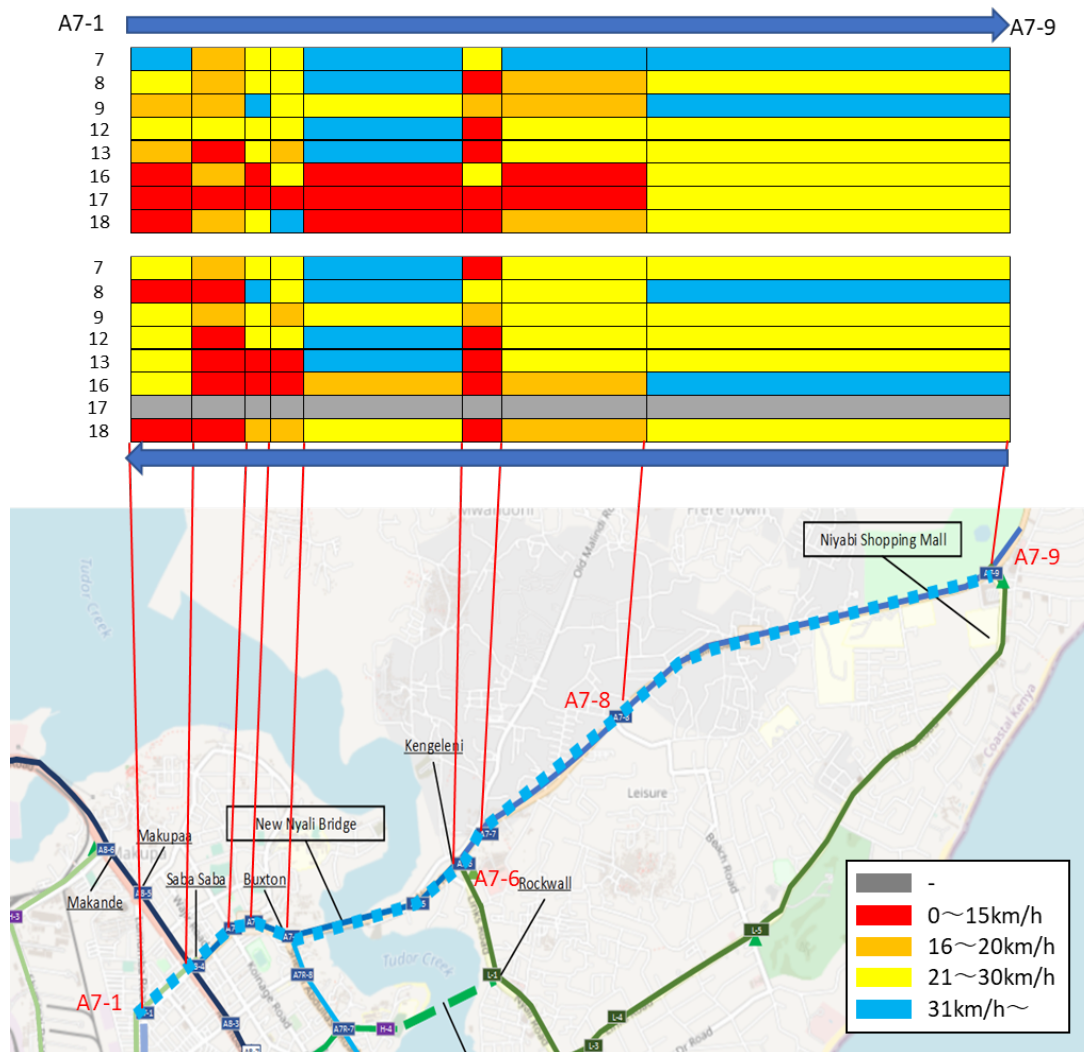
Figure 17 Speed by Route and Time Zone (Route 1)

In Route 2, [MO5][雄大6] a decline in travel speed was observed during the evening hours in the section between A7-1 and A7-8.

During the evening peak period, traffic heading toward Mombasa Island experiences reduced average travel speeds due to the one-way traffic control (“Happy Hour”) implemented by CGM, which limits traffic capacity and increases waiting times.

Conversely, although the traffic capacity in the outbound direction from Mombasa Island increases during the Happy Hour period, the survey results indicate that a reduction in travel speed still occurs.

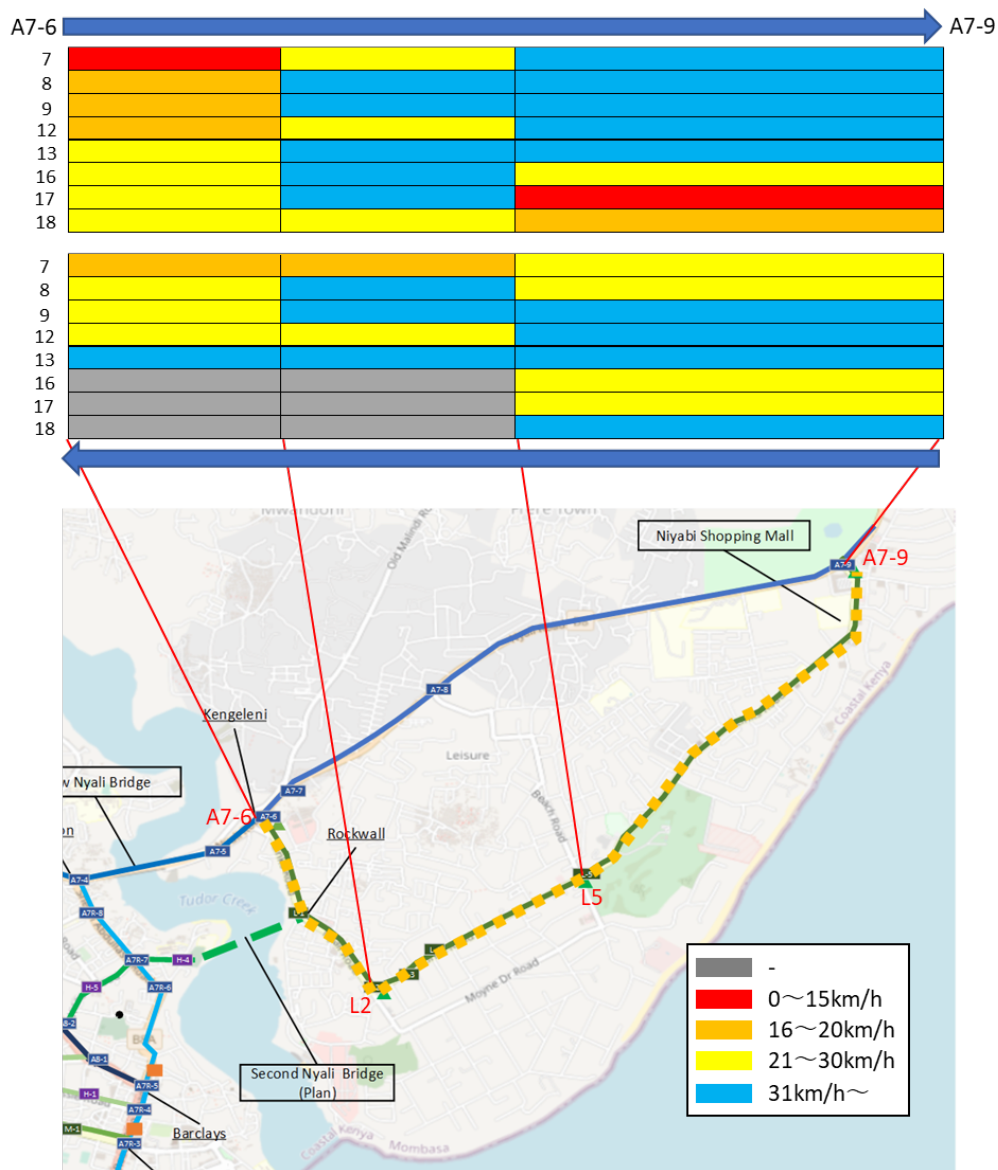
This suggests that even with traffic management measures in place, the traffic volume during peak hours far exceeds the available road capacity.



Source : JICA Study Team

Figure 18 Speed by Route and Time Zone (Route 2)

In Route 3, the travel speed decreased in the section from A7-6 to L2 in the morning time. This is also considered to be affected by traffic restrictions (happy hour) during peak hours in the morning. In addition, the speed decreases in the section from L5 to A7-9 in the evening. There are two large shopping malls located near A7-9, and it is thought that the traffic entering and exiting them is also affecting the speed.

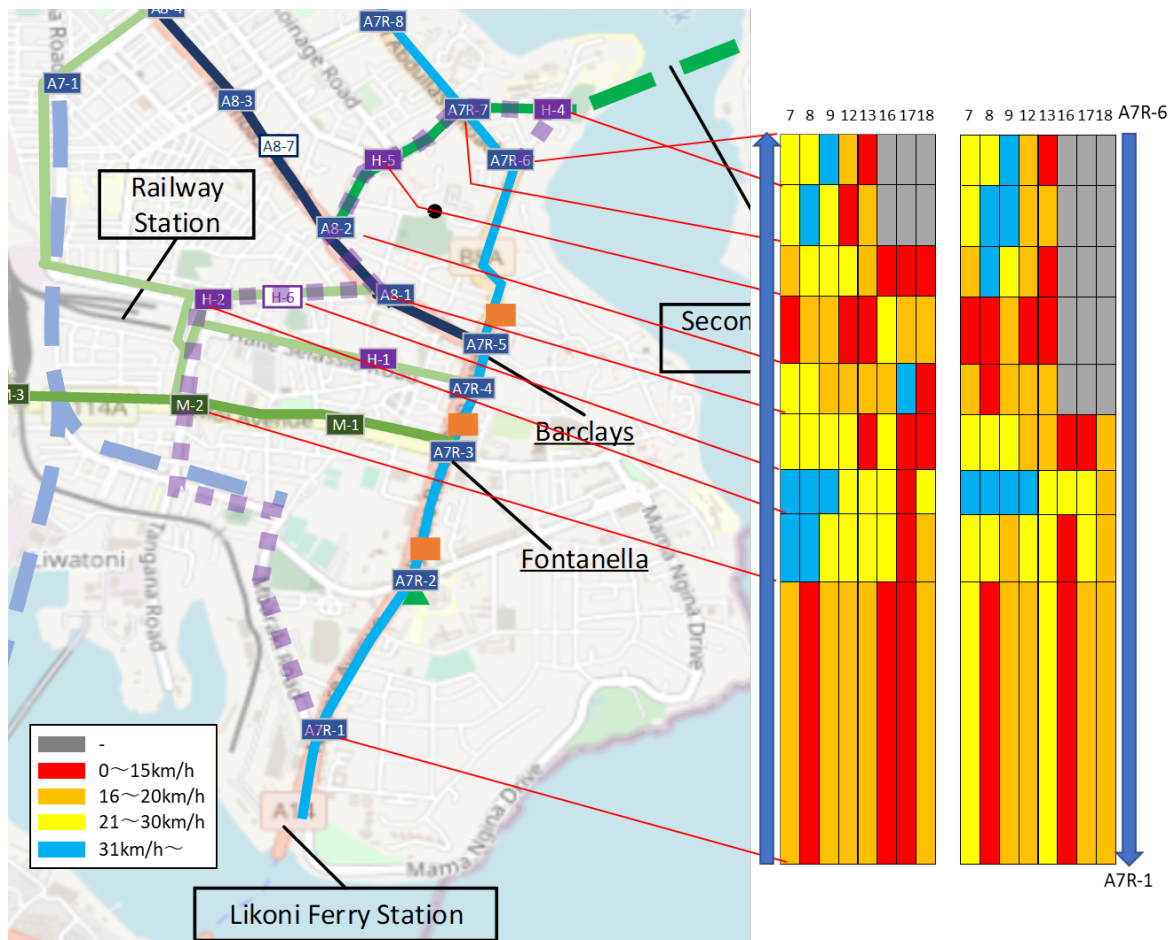


Source : JICA Study Team

Figure 19 Speed by Route and Time Zone (Route 3)

In Route 4, there is a one-way street between A8-2 and A7R-8 in the evening hours.

Due to the route connecting to the A8 and A7R, which have a lot of traffic, the travel speed tends to be slow overall. Many *matatsu* are parked near the A7R-1 to accommodate passengers of the ferry, which is a factor in slowing down the speed.

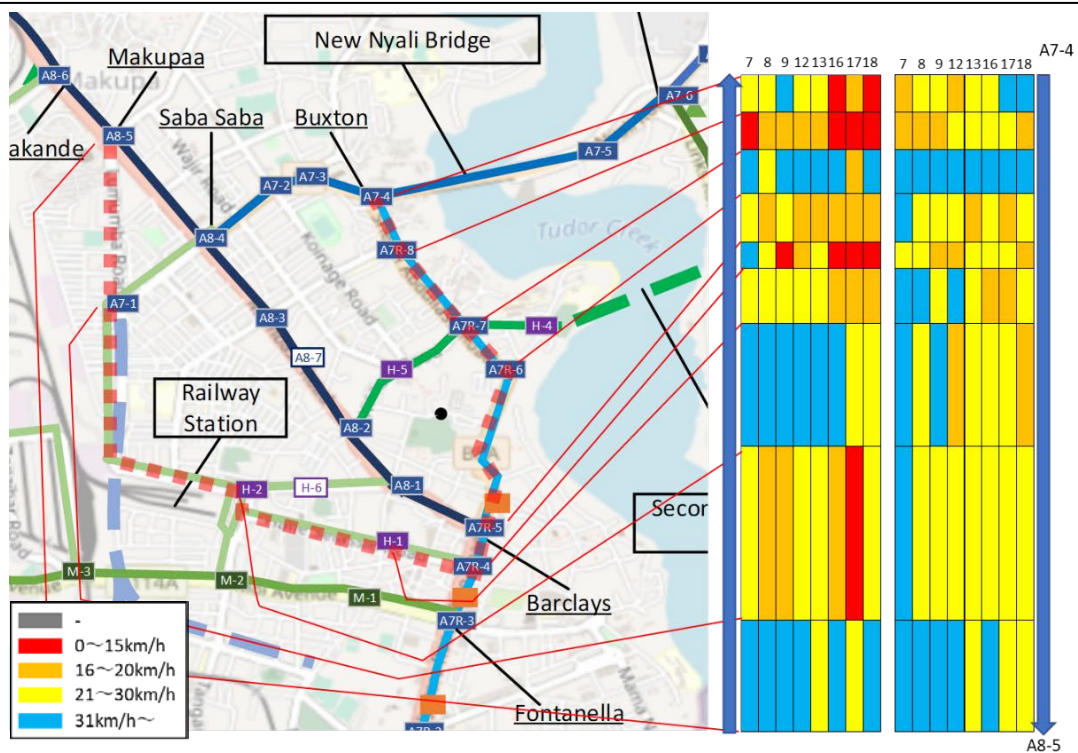


Source : JICA Study Team

Figure 20 Speed by Route and Time Zone (Route 4)

In Route 5, a noticeable decrease in speed is observed particularly during the evening hours between sections A7-4 and A7R-7. This is believed to be due to the heavy concentration of homebound traffic during that time. Although this section is designated as a traffic regulation zone (Happy Hour), and the traffic capacity for outbound traffic from Mombasa Island is increased during the Happy Hour, the traffic volume still exceeds the available capacity, resulting in reduced travel speeds.

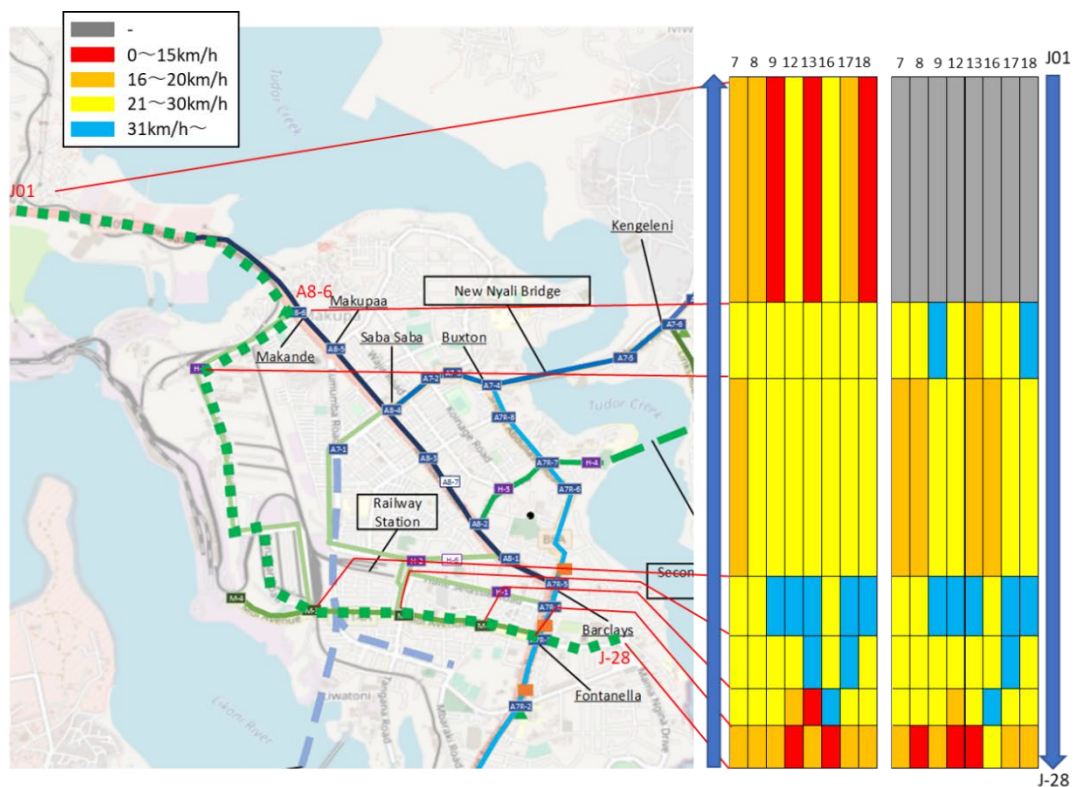
[MO7][雄大8]



Source : JICA Study Team

Figure 21 Speed by Route and Time Zone (Route 5)

In Route 6, there is a decrease in speed in the section from J01 to A8-6. It is considered that this is because the section is a construction section at the time of the survey.



Source : JICA Study Team

Figure 22 Speed by Route and Time Zone (Route 6)

(3) Pedestrian Crossing Time Survey

The summarized results of the pedestrian crossing time by attribute during the survey period are shown below.

There is not much difference in the crossing time by gender. Since the crossing time differs depending on the age, it is necessary to set the signal cycles considering the elderly.

Table 4 Result of the Pedestrian Crossing Time Survey

Average pedestrian crossing time (sec)						
Name	Male			Female		
	Young	Old	Child	Young	Old	Child
A8-1	15	20	16	17	24	18
A8-2	11	13	13	12	12	12
A8-4	24	34	46	25	36	48
A7R-3	19	20	20	18	20	20
A7R-5	17	21	16	18	21	18

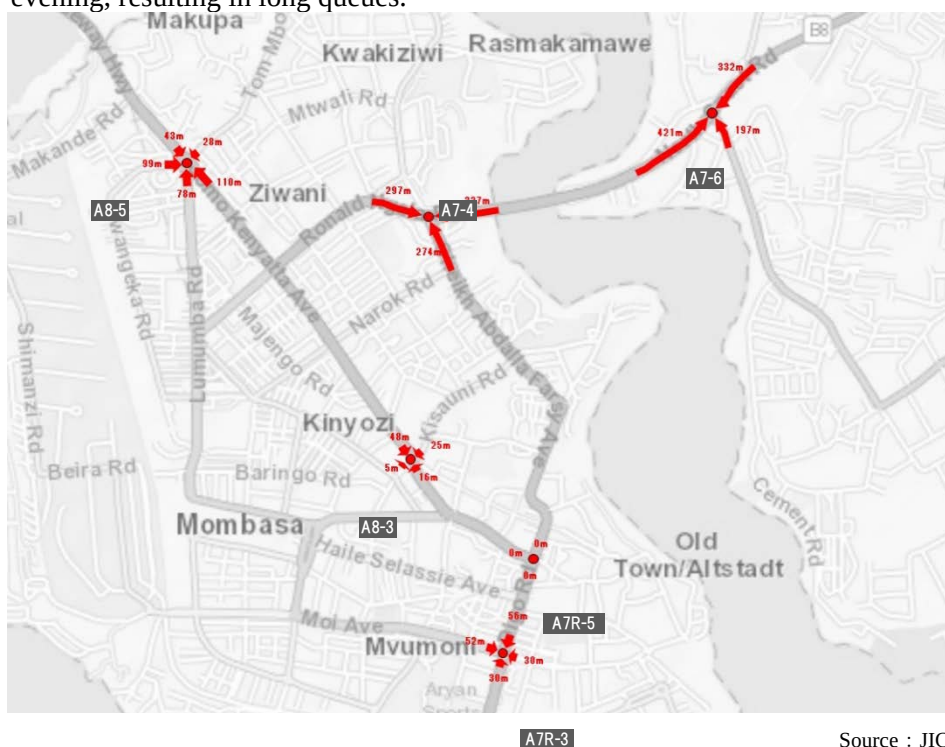
Source : JICA Study Team

(4) Queue Length Survey

The figure below shows the results of the queue length survey.

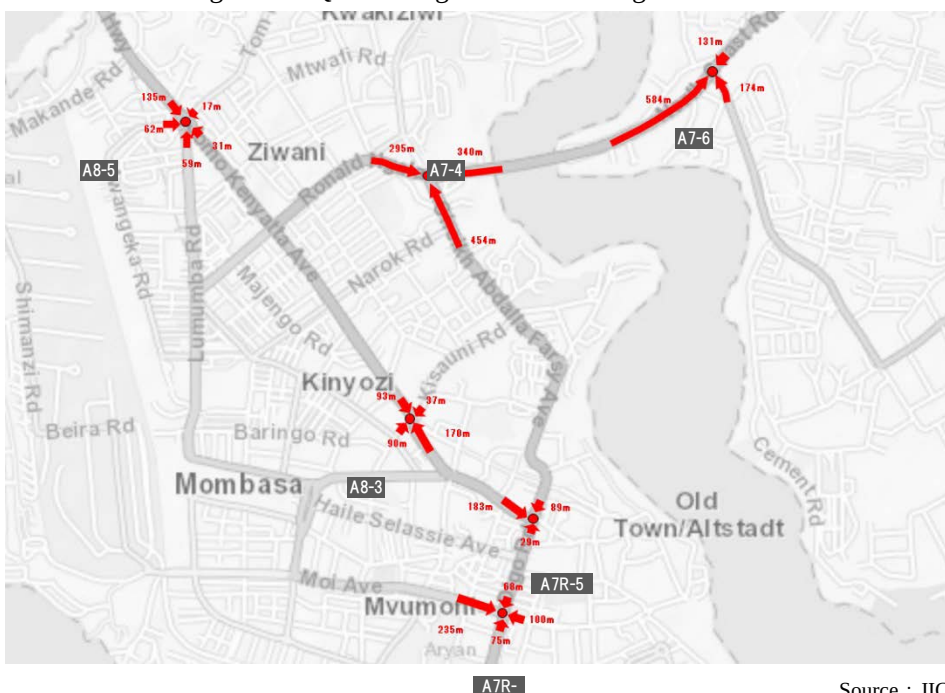
Since no signal was installed in Mombasa, the queue length was measured. It can be seen that the queue length is long at the intersections of A7-4 and A7-6. Other intersections have a short queue length. This is thought to be due to the short queue length of the stopped vehicles because the other intersections are roundabout intersections and the traffic is flowing without the vehicles stopping completely.

In addition, the A7-4 and A7-6 intersections are manually controlled by traffic police, and this section is implemented to a special traffic regulation called Happy Hour in every evening, resulting in long queues.



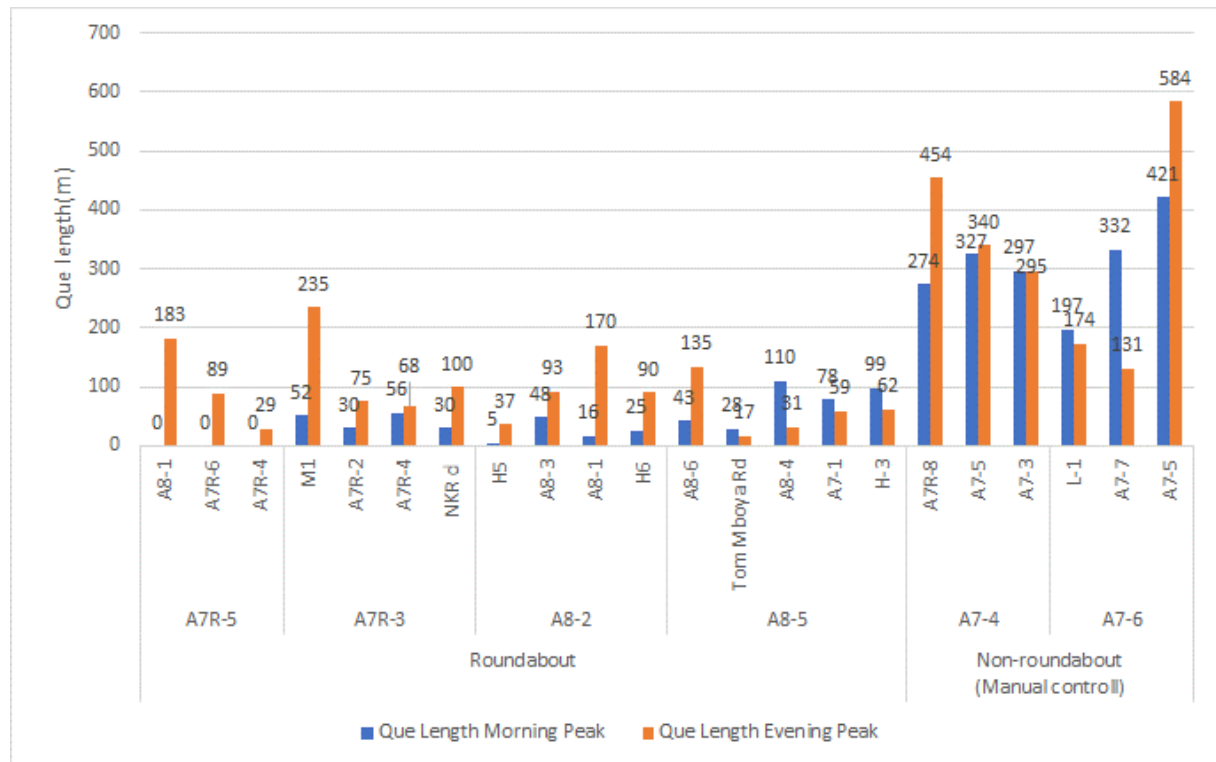
Source : JICA Study Team

Figure 23 Queue Length in the Morning Peak hours



Source : JICA Study Team

Figure 24 Queue Length in the Evening Peak hours



Source : JICA Study Team

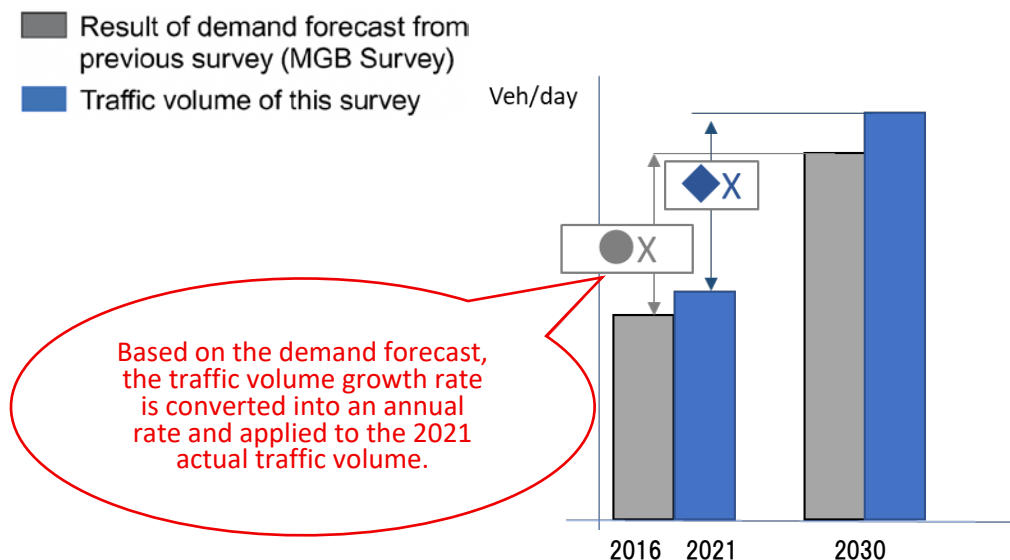
Figure 25 Queue Length in the Evening Peak hours

1.3.5 Future Traffic Forecast

(1) Precondition

Future traffic volume at each target intersections in 2030 is calculated using existing forecasted future traffic demand.

Since the base year of the existing forecasted future traffic demand is different from this survey, the growth rate will be converted to annual rate. Future traffic volume by direction is calculated by multiplying the current traffic volume observed in this study by the annual growth rate of traffic volume at each intersection calculated from the forecast results. The growth rate is calculated for each intersection.

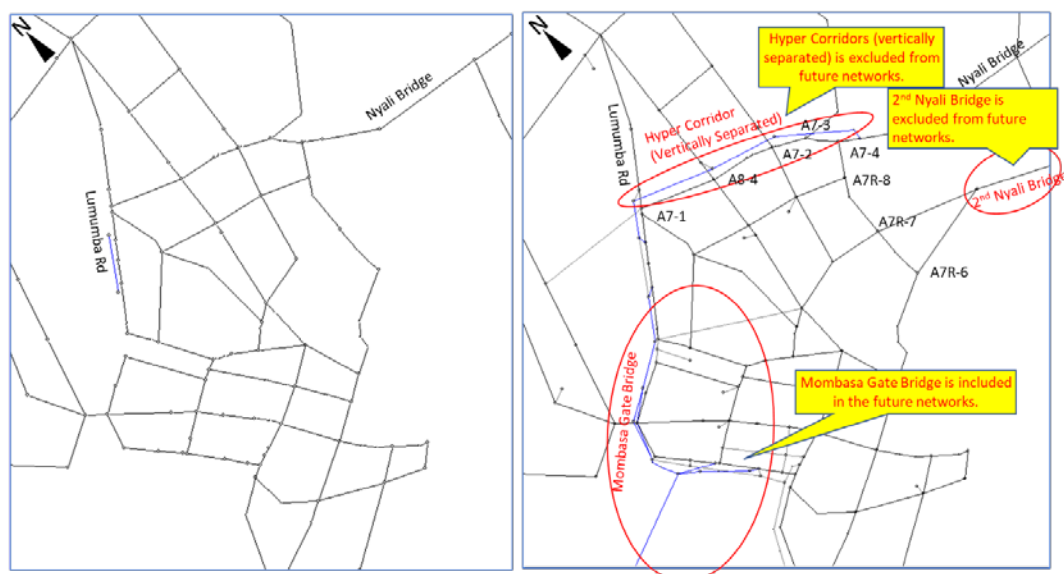


Source : JICA Study Team

Figure 26 Queue Length in the Evening Peak hours

Current(2021) and future network(2030) used for traffic forecasting is shown below. Considering feasibility, Only mombasa gate bridge out of new projects is included in future networks.

Therefore affection of completion of the mombasa gate bridge was reflected in future demand.



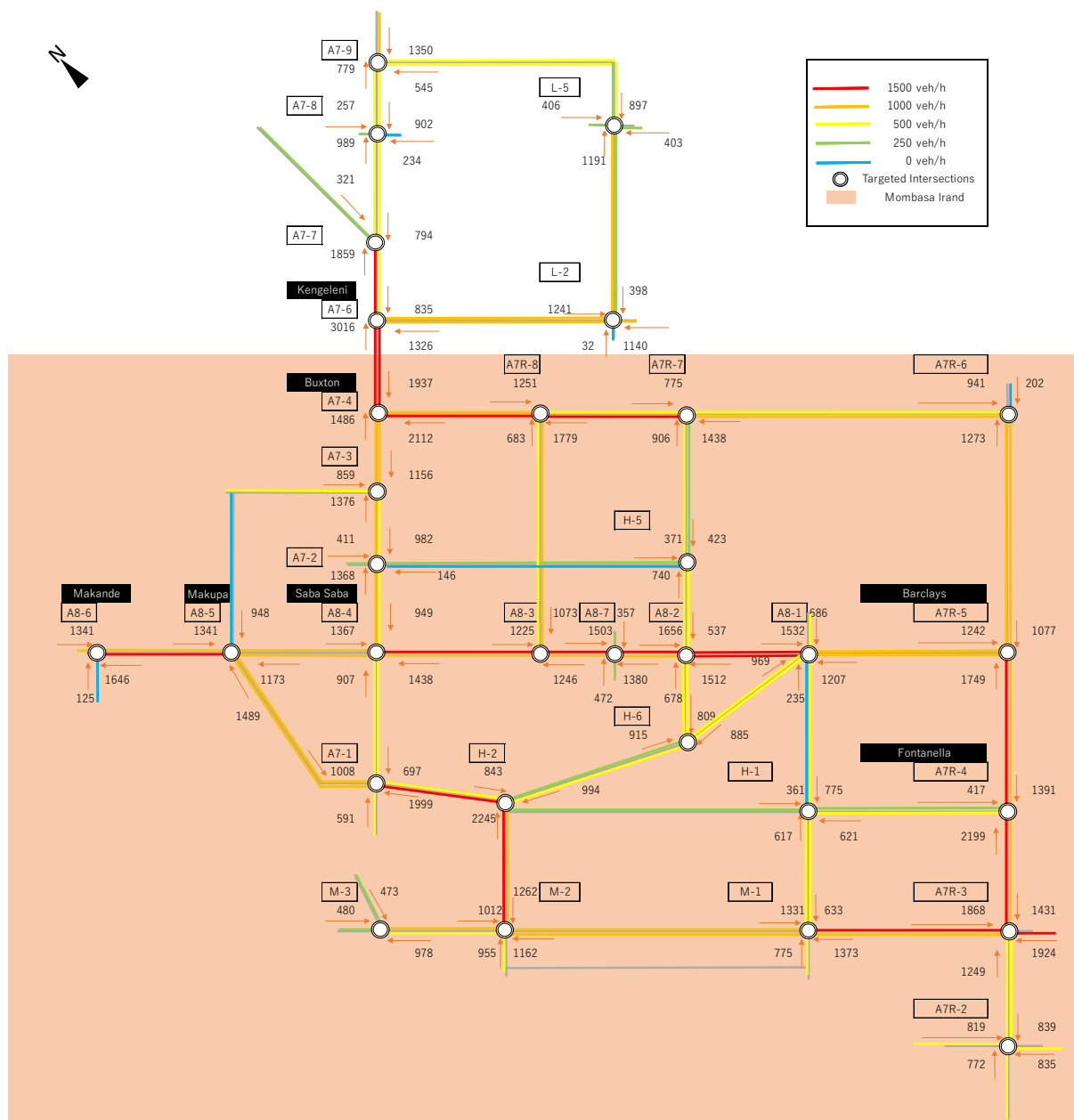
Source : JICA Study Team

Figure 27 Current(Left) and Future (Right) networks

The figure below shows the measured inflow traffic volume per hour at each intersection. The time zone were set at 7:00 and 16:00, when the traffic volume is the highest in the morning and evening.



Figure 29 Result of the Current Traffic Demand Forecast (2021, 7:00-8:00 in the morning)



Source : JICA Study Team

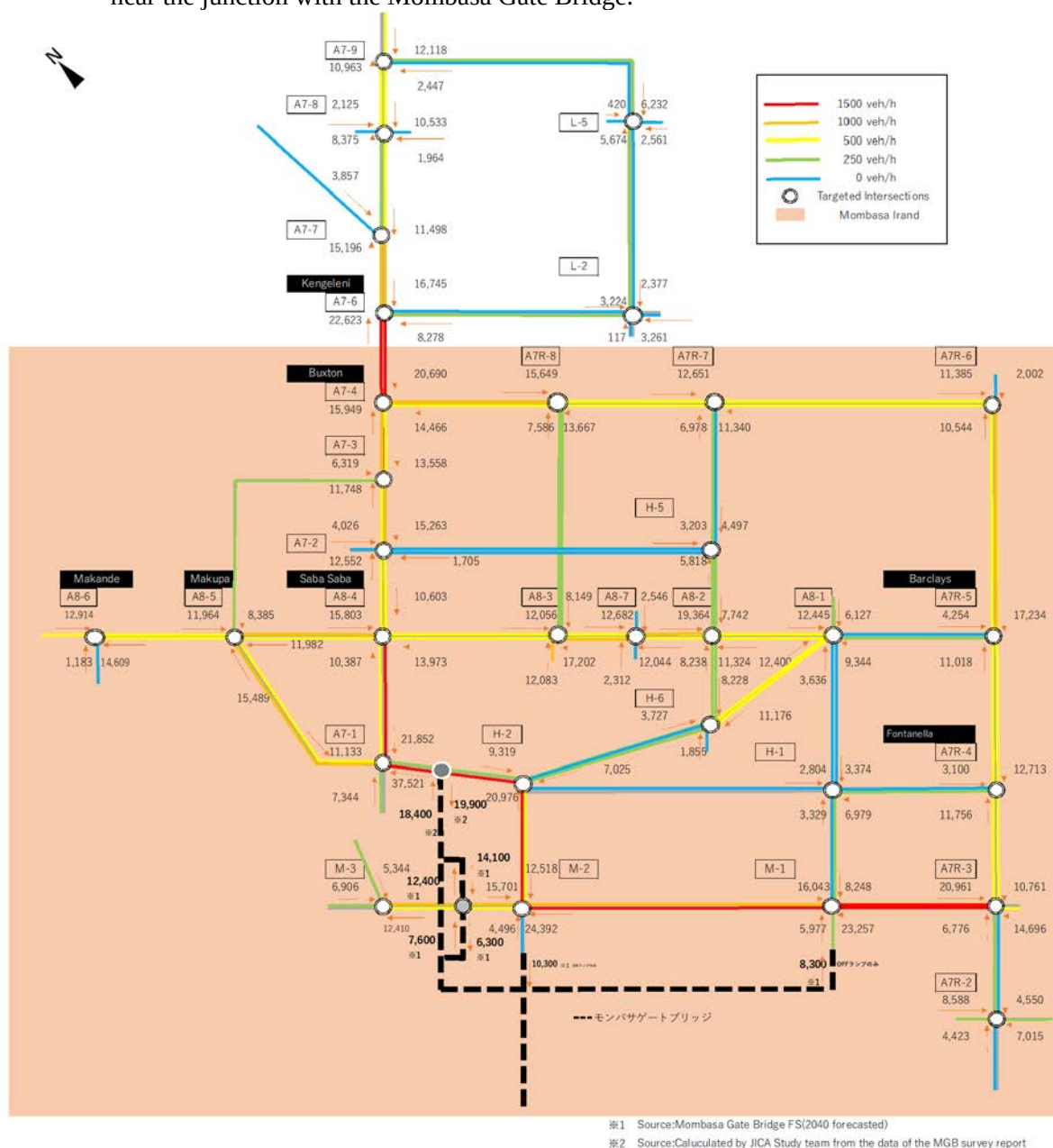
Figure 30 Result of the Current Traffic Volume(2021, 16:00-17:00 in the evening)

(3) Future traffic forecast result

1) Daily Traffic Volume

Traffic volume at each intersection, calculated by multiplying the current traffic volume at each intersection in 2021 by the traffic growth rate calculated from the demand forecast.

Traffic is concentrated between A8-4 and A7R-3, and it can be seen that the traffic flow has changed with the completion of the Mombasa Gate Bridge, and traffic is concentrated near the junction with the Mombasa Gate Bridge.

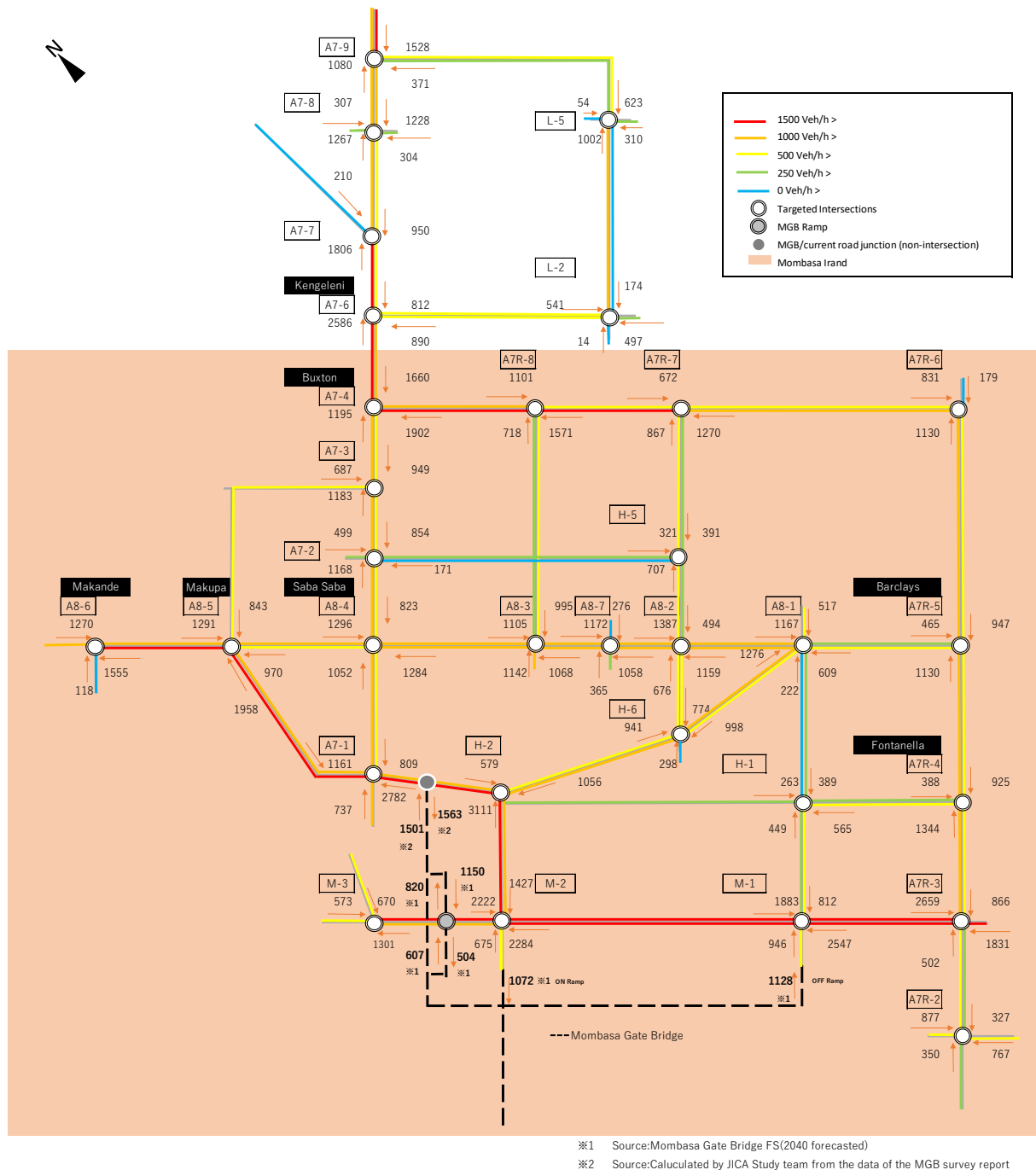


Figure[匠玉13][匠玉14] 31 Result of the Future Traffic Demand Forecast (2030, Week day, 14 hours)

The figure below shows the future traffic volume forecast results (2030) calculated by multiplying the current traffic volume at each intersection in 2021 by the traffic volume growth rate obtained from the demand forecast.



Figure 32 Result of the Future Traffic Demand Forecast (2030, 7:00-8:00 in the morning)



Source : JICA Study Team

Figure 33 Result of the Future Traffic Demand Forecast (2030, 16:00-17:00 in the evening)

Traffic volumes of 1,500 vehicles/h more were observed on the A8 route and A7R route, but in the future, traffic volumes of A8 route and A7R route will decrease. Instead, the A8-5 to A7-1, H2 to M2, and M routes are predicted increased traffic, and the completion of the MBG is expected to significantly change the traffic flow in Mombasa Island.

1.4 Communication Infrastructure Survey

(1) 2021 Survey Result

In the 2021 survey, an investigation was conducted on the optical fiber network that CGM had contracted with the local telecommunications provider, FIBRE LINK Co., Ltd. in Mombasa, for the operation of the existing CCTV road monitoring system.

1) Confirmation of Coverage Area

It was confirmed that the existing optical fiber network was available for connection at most of the intersections where installations are planned under this project.

Since the current network is only partially configured in a loop (redundant) structure, CGM requested that all routes connecting the target intersections be upgraded to form a fully redundant loop configuration. FIBRE LINK Co., Ltd. agreed to implement this modification.

2) Confirmation of Communication Quality and Maintenance Level

The survey team conducted a site visit to FIBRE LINK Co., Ltd to review its optical fiber fault detection system, automatic failure notification system, and maintenance team organization.

As a result of the visit, the team confirmed that FIBRE LINK Co., Ltd has established a maintenance and management framework that meets an acceptable technical standard.

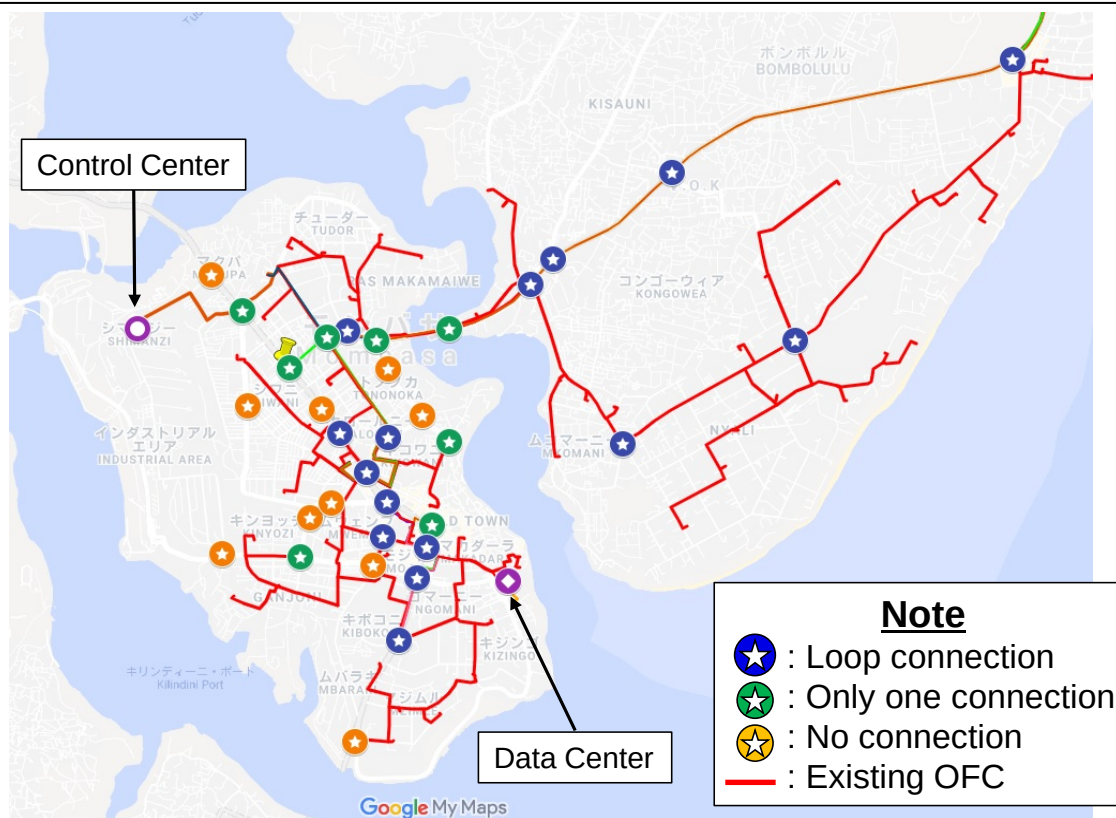
It was also verified that the company's maintenance contracts specify clear Service Level Agreements (SLAs).

3) Confirmation of Communication Line Installation Plan

The survey team reviewed the communication line installation plan and confirmed that a redundant design had been considered for the signal system due to its critical importance.

Since wired connections provide higher communication capacity and speed, the basic approach adopted was to use wired connections. Although the use of wireless communication as a backup option was also examined, considering wireless-specific issues such as interference, momentary disconnections, and higher operational costs, it was agreed between CGM and FIBRE LINK Co., Ltd that the signal system would be connected via wired (optical cable) communication lines, and that the optical cables would be configured in a physical loop structure to ensure redundancy.

The following shows the existing optical fiber network identified during the site survey and the connection availability status to intersections where signal installation is being considered.



Source : JICA Study Team

Figure 34 Results of the Communication Status Survey (CGM's Leased Optical Fiber Network from FIBRE LINK Co., Ltd.)

(2) 2025 Survey Result

As a result of the additional field survey conducted from May 24 to June 6, 2025, it was confirmed that the existing CCTV road monitoring system verified in the 2021 survey had either been dismantled or was no longer functional due to equipment deterioration. In the future, the monitoring functions will be taken over by newly installed CCTV cameras to be introduced under the Smart City Project currently being implemented by the Mombasa County Government.

Furthermore, it was confirmed that, under the same Smart City Project, Safaricom's optical fiber network had been selected as the communication infrastructure. Since the target area of that project overlaps with the area of this project, Mombasa County decided to utilize the same Safaricom network for this project as well, through an additional contract with the company.

The following summarizes the findings from the on-site survey and the discussions held with Safaricom.

1) Overview of Safaricom's Services

Safaricom is one of the largest telecommunications operators in Kenya, offering a wide range of services including voice communication, data transmission, and mobile money services (M-PESA). In recent years, the company has been actively developing high-speed fixed and mobile communication infrastructure and plays a vital role in advancing smart city initiatives and digital governance in Kenya.

Safaricom provides highly reliable communication services to both government agencies and private companies in major cities across Kenya, including Mombasa, while also offering diverse high-speed internet services for households. The company's key services are outlined below.

a) MPLS Services (for Government and Enterprise Use):

Safaricom provides MPLS (Multi-Protocol Label Switching) network services for government institutions and corporate clients. MPLS is a technology that efficiently handles multiple communication protocols and enables stable, low-latency communication through pre-established routes. A similar MPLS-based communication system will also be adopted in this project.

Safaricom's MPLS network is built on loop and mesh configurations within urban areas, ensuring redundancy and high availability. Furthermore, by using submarine cables such as EASSy and SEACOM as its backbone, the company enhances the overall reliability of its wide-area network.

In addition, MPLS services are provided with Service Level Agreements (SLAs) that guarantee service quality. These agreements include requirements for restoration within a specified time frame in the event of network disruptions, thereby ensuring business continuity.

From these observations, Safaricom's MPLS service is evaluated to meet the quality standards required for the communication infrastructure of this project.

b) Internet Services (for Households, Businesses, and Government Agencies)

Safaricom also offers FTTH (Fiber To The Home) and FTTB (Fiber To The Building) internet connection services using optical fiber, serving a wide range of users—from households and small to medium-sized enterprises to public institutions.

2) Confirmation of Coverage Area

It was confirmed that all intersections planned for installation under this project can be connected to Safaricom's MPLS optical fiber network. This allows for integrated use of the network across both the Smart City Project and this project.

3) Confirmation of Communication Quality and Maintenance Standards

Safaricom has already been contracted as the communication infrastructure provider for the Smart City Project, supplying 30 Mbps connections to 86 locations across the city and a 2.5 Gbps MPLS service linking those sites to the central monitoring center located within the Inspectrate.

The network is designed with loop and mesh redundancy structures centered around hub points in the city, ensuring stable communication performance.

Moreover, a Service Level Agreement (SLA) has been concluded between Mombasa County and Safaricom, clearly defining network availability and response times for fault resolution.

Under the SLA, the network's monthly operational uptime is required to be 99.0% or higher as a basic performance indicator. If this standard is not met, service credits (refunds) are applied to the monthly service fee based on the duration of the service downtime.

The following table shows the allowable downtime corresponding to different uptime

levels and the applicable compensation rates for corporate (including government institutions) and residential users. For example, if the uptime falls below 95% (equivalent to approximately 7.5 days or more of downtime per year), corporate users are entitled to a maximum refund of 25% of the monthly service fee.

Thus, Safaricom's communication services demonstrate a high level of performance in terms of communication quality, availability, and maintenance structure, and it has been confirmed that these meet the infrastructure requirements of this project.

Table 5 Safaricom Network Availability and Compensation Levels

Band	Network Availability Band Description – Non-Redundant Last Mile				Outage in Minutes	Service credits as a % of MAC	
						Corporate	Residential
1				> 99.0%	< 432	0%	0%
2	<	99.00%	>	98.64%	<588 & > 432	5%	0%
3	<	98.64%	>	97.43%	<1110 & >588	10%	0%
4	<	97.43%	>	96.21%	<1637 & >1110	15%	5%
5	<	96.21%	>	95.00%	<2160 & >1637	20%	10%
6	<	95%			>2160	25%	15%

Source: Safaricom

4) Confirmation of Communication Line Installation Plan

In this project, based on the contract established under the aforementioned Smart City Project, additional connections are planned for traffic event detection cameras at eight intersections and signal control communication lines at twenty-two intersections.

These additional connections will be implemented as extensions to Safaricom's MPLS optical fiber network, with the associated costs to be borne by the implementing agency on the client's side.

1.5 Existing Road Monitory System Survey

(1) 2021 Survey Result

The survey confirmed the methods, organizational structure, and technical capacity for maintenance and operation of the CCTV road monitoring system owned by CGM.

The following summarizes the findings obtained through the on-site survey.

1) Confirmation of the CCTV Road Monitoring System

Approximately 90 CCTV road monitoring cameras owned by CGM were confirmed to be installed in the central area of Mombasa City.

This CCTV Road monitoring system had been introduced since 2019 by a Proof of Concept (PoC) operator as part of a PoC project, with system operation managed by the CGM Department of Traffic Inspectorate (DTI).

2) Confirmation of CCTV Road Monitoring System Operation

At the DTI Monitoring Center, operations were conducted by a team of three personnel (one supervisor and two operators) working in two 12-hour shifts.

The operation involved functional responses such as monitoring traffic conditions via display screens, responding to phone calls from the public, issuing instructions to field patrol teams, and sharing information with the traffic police.

3) Confirmation of CCTV Road Monitoring System Maintenance and Management

At the time of the 2021 survey, the system was still under the PoC project phase, and no maintenance contract had been established. Maintenance activities were carried out by the PoC operator.

There were no provisions for regular maintenance or emergency response, and it was not possible to confirm whether maintenance activities were being appropriately implemented.

(2) 2025 Survey Result

As a result of the additional field survey conducted from May 24 to June 6, 2025, it was confirmed that the existing CCTV road monitoring system verified in the 2021 survey had already been dismantled or rendered non-functional due to equipment deterioration.

Going forward, the monitoring functions will be taken over by new CCTV cameras to be installed under the Smart City Project currently being implemented by the County Government of Mombasa (CGM).

1) Overview of the Smart City Project

The Smart City Project is a program implemented under the budget of Mombasa County and led by the Department of Lands, Housing & Urban Planning. The construction contractor was selected through an open bidding process, and the current contractor under this project is Active Tech Ltd., a Kenyan company.

Active Tech has subcontracted Dahua Technology (China) to supply and implement its technological solutions.

The project is scheduled for completion by September 2025 and aims to enhance security surveillance and traffic monitoring at major intersections across Mombasa Island

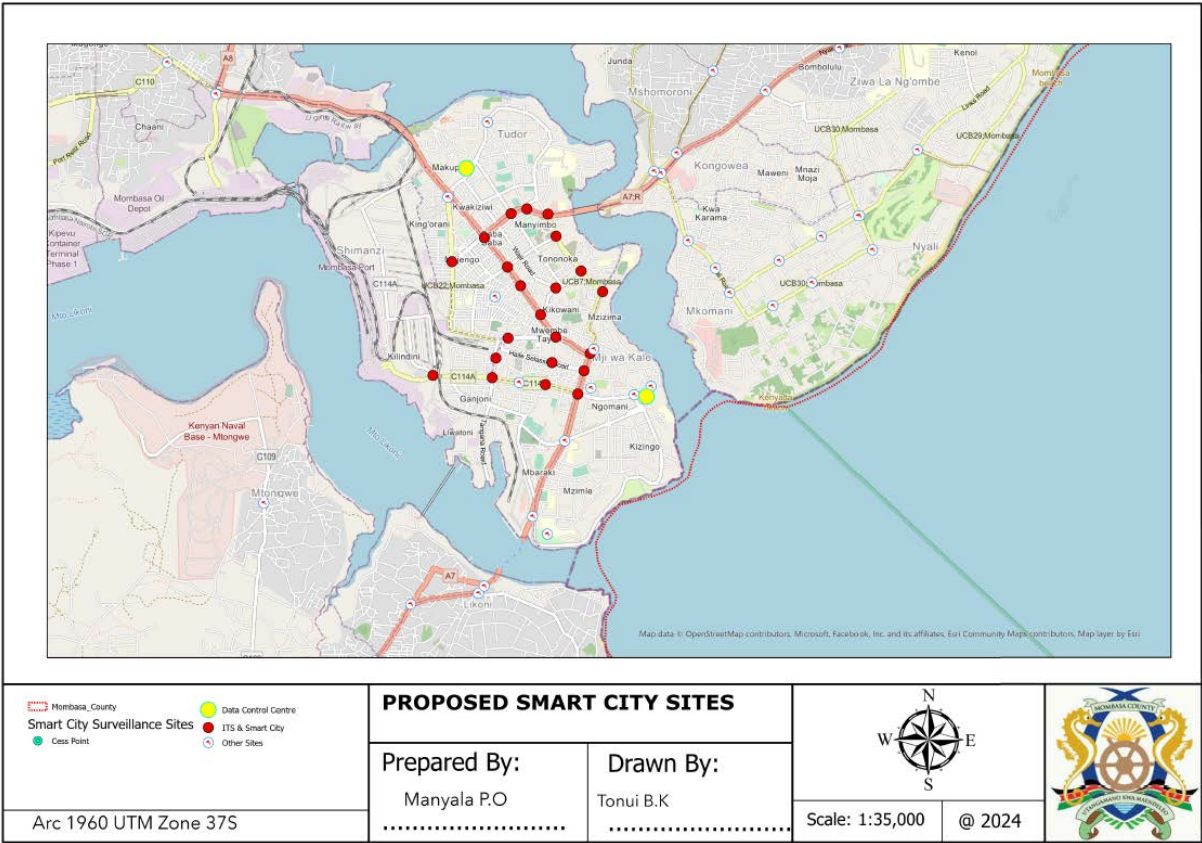
(including the target intersections of this project) as well as approximately 80 locations citywide, including the mainland.

The planned equipment includes PTZ cameras, panoramic PTZ cameras, facial recognition cameras, and automatic number plate recognition (ANPR) cameras, which are also expected to be utilized for revenue management purposes.

The Central Control Center will be equipped with servers, a video wall (height 320 mm, width 500 mm), and workstations, along with a low-voltage off-grid power supply including uninterruptible power supply (UPS) units.

Initially, the central control center will be operated on a temporary basis within the premises of the Inspectorate. However, upon commencement of the grant project, a new single-story building will be constructed to accommodate both the Traffic Management Center (TMC) of the grant project and the Central Control Center of the Smart City Project.

The figure below shows the locations covered under the Smart City Project. The red circles indicate the intersections that are also targeted under this project, all of which will be equipped with CCTV cameras through the Smart City Project.



Source: Mombasa County Government

Figure [匠玉16][雄大17]35 Locations of Smart City Project Target Sites

2) Control Center

Currently, the existing control center is in a transition phase from the former road monitoring system to the new surveillance system under the Smart City Project, and therefore it is not being actively used for monitoring operations.

However, public inquiry and communication response operations are still being carried out on the first floor of the same building on a 24-hour, three-shift basis, as before.

In line with the commencement of this project’s implementation stage, there are plans to demolish the warehouse adjacent to the existing control center and construct a new single-story building that will house both the Traffic Management Center (TMC) and the Central Control Center of the Smart City Project.

A standby generator with an output of approximately 50 kW is currently in use, but the installation of an additional emergency generator has been requested for the new control building.

The initial plan is to construct a single-story facility to house and operate both the control center and the central management center of the Smart City Project. Furthermore, a future plan has been proposed to add a second floor to this facility, which will be developed into a data center for integrated management and system operations.



Figure [匠玉18][雄大19]36 Current Situation of Traffic Control Center

1.6 Environment and Social Considerations

1.6.1 Project Components

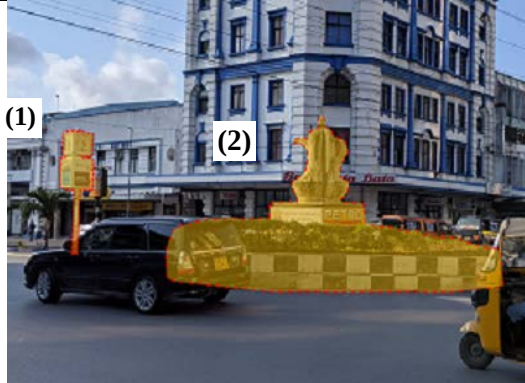
The project components and expected impacts are shown in the table below.

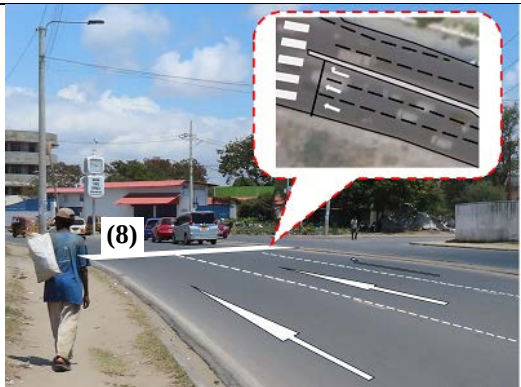
Table 6 Project Components and Expected Impact

Phase	Project Components	Expected Environmental and Social Impact
Before construction	Target intersection selection	If the project is not implemented within the right-of-way (RoW), land acquisition or resettlement is expected.
During construction	Removal of roundabout including superstructure and relocation of superstructure	- Increase of noise, vibration, air quality pollution, traffic congestion, and traffic accident is expected due to construction vehicles. - Risk of infectious diseases is increased. - Employment opportunity is created for construction work.
	Removal of electricity supply facility	
	Removal or improvement of median	
	Removal of other structures such as clock	
	Pavement	
	Installation of traffic light	
	Expansion or improvement of pedestrian path	
	Painting road marking	
Operation	Installation of crossing	- Economic activities are revitalized due to saving travel time and mitigation of traffic congestion. - Employment opportunities are created for maintenance work.
	Operation of traffic light	
	Maintenance of traffic light	
	Maintenance of road marking	
	Maintenance of damaged road	

Source: JICA Study Team

Table 7 Project Components and Image of Activities

 (1) Removal of other structures such as clock (2) Removal of roundabout including superstructure and relocation of superstructure	 (3) Removal or improvement of median (4) Expansion or improvement of pedestrian path (5) Installation of crossing (6) Installation of traffic light
---	--

 (7) Removal of electricity supply facility	 (8) Painting road marking
 (9) Pavement	

Source: JICA Study Team

1.6.2 Baseline Environmental and Social Conditions

1.6.2.1 Pollution Measures

(1) Air Quality

The Environmental Management and Coordination (Air Quality) Regulations, 2014 Arrangement of Regulations provides ambient air quality tolerance limits and emission limits from stationary emissions. Ambient air quality tolerance limits are shown in the table below. Baseline data is shown in below.

Table 8 Ambient Air Quality Tolerance Limits

Pollutants	Time-weighted Average	Industrial Area	Residential, Rural & Other Areas	Controlled Areas	WHO Guidelines
SO _x	Annual Average	80 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$	15 $\mu\text{g}/\text{m}^3$	
	24 hours	125 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$	30 $\mu\text{g}/\text{m}^3$	20 $\mu\text{g}/\text{m}^3$
	Annual Average		0.019 ppm/ 50 $\mu\text{g}/\text{m}^3$		
	24 hours		0.048 ppm/ 125 $\mu\text{g}/\text{m}^3$		
	Instant Peak		500 $\mu\text{g}/\text{m}^3$		
	Instant Peak (10 mins)		0.191 ppm		500 $\mu\text{g}/\text{m}^3$
NO _x	Annual Average	80 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$	15 $\mu\text{g}/\text{m}^3$	
	24 hours	150 $\mu\text{g}/\text{m}^3$	80 $\mu\text{g}/\text{m}^3$	30 $\mu\text{g}/\text{m}^3$	
	Annual Average		0.2 ppm		
	Month Average		0.3 ppm		
	24 hours		0.4 ppm		
	1 hour		0.8 ppm		
	Instant Peak		1.4 ppm		

Pollutants	Time-weighted Average	Industrial Area	Residential, Rural & Other Areas	Controlled Areas	WHO Guidelines
NO ₂	Annual Average	150 µg/m ³	0.05 ppm		40 µg/m ³
	Month Average		0.08 ppm		
	24 hours	100 µg/m ³	0.1 ppm		
	1 hour		0.2 ppm		200 µg/m ³
	Instant Peak		0.5 ppm		
SPM	Annual Average	360 µg/m ³	140 µg/m ³	70 µg/m ³	
	24 hours	500 µg/m ³	200 µg/m ³	100 µg/m ³	
	Annual Average		100 µg/m ³		
	24 hours		180 µg/m ³		
RPM	Annual Average	70 µg/m ³	50 µg/m ³	50 µg/m ³	20 µg/m ³
	24 hours	150 µg/m ³	100 µg/m ³	75 µg/m ³	50 µg/m ³
PM _{2.5}	Annual Average	35 µg/m ³			10 µg/m ³
	24 hours	75 µg/m ³			25 µg/m ³
Pb	Annual Average	1.0 µg/m ³	0.75 µg/m ³	0.50 µg/m ³	
	24 hours	1.5 µg/m ³	1.00 µg/m ³	0.75 µg/m ³	
	Month Average		2.5		
CO / CO ₂	8 hours	5.0 mg/m ³	2.0 mg/m ³	1.0 mg/m ³	
	1 hour	10.0 mg/m ³	4.0 mg/m ³	2.0 mg/m ³	
Hydrogen Sulphide	24 hours	150 µg/m ³			
Non-methane Hydrocarbons	Instant Peak	700 ppb			
Total VOC	24 hours	600 µg/m ³			
Ozone	1 hour	200 µg/m ³	0.12 ppm		
	8 hours (instant peak)	120 µg/m ³	1.25 ppm		100 µg/m ³

Source: 2014 Arrangement of Regulations, the Environmental Management and Coordination (Air Quality) Regulations, WHO Guidelines: Air Quality Guidelines - Global Update 2005 (WHO)

(2) Water Quality

The Environmental Management and Coordination (Water Quality) Regulations, 2006 provides water quality standards including domestic water, effluent discharge into the environment, effluent discharge into public sewers, irrigation water, and recreation waters; however, there are no environmental standards. Standards for effluent discharge into the environment are shown in the table below.

Table 9 Standards for Effluent Discharge into the Environment

Parameter	Maximum Allowable (Limits)
1,1,1-trichloroethane (mg/l)	3
1,1,2-trichloroethane (mg/l)	0.06
1,1-dichloroethylene	0.2
1,2-dichloroethane	0.04
1,3-dichloropropene (mg/l)	0.02
Alkyl Mercury compounds	Nd
Ammonia, ammonium compounds, NO ₃ compounds and NO ₂ compounds (Sum total of ammonia-N times 4 plus nitrate-N and Nitrite-N) (mg/l)	100
Arsenic (mg/l)	0.02
Arsenic and its compounds (mg/l)	0.1
Benzene (mg/l)	0.1
Biochemical Oxygen Demand (BOD 5 days at 20 °C) (mg/l)	30
Boron (mg/l)	1.0
Boron and its compounds – non marine (mg/l)	10
Boron and its compounds –marine (mg/l)	30
Cadmium (mg/l)	0.01

Parameter	Maximum Allowable (Limits)
Cadmium and its compounds (mg/l)	0.1
Carbon tetrachloride	0.02
Chemical Oxygen Demand (COD (mg/l))	50
Chromium VI (mg/l)	0.05
Chloride (mg/l)	250
Chlorine free residue	0.10
Chromium total	2
cis -1,2- dichloro ethylene	0.4
Copper (mg/l)	1.0
Dichloromethane (mg/l)	0.2
Dissolved Iron (mg/l)	10
Dissolved Manganese (mg/l)	10
E.coli (Counts / 100 ml)	Nil
Fluoride (mg/l)	1.5
Fluoride and its compounds (marine and non-marine) (mg/l)	8
Lead (mg/l)	0.01
Lead and its compounds (mg/l)	0.1
n-Hexane extracts (animal and vegetable fats) (mg/l)	30
n-Hexane extracts (mineral oil) (mg/l)	5
Oil and grease	Nil
Organo-Phosphorus compounds (parathion, methyl parathion, methyl demeton and Ethyl parantrophenyphenylphosphorothroate, EPN only) (mg/l)	1.0
Polychlorinated biphenyls, PCBs (mg/l)	0.003
pH (Hydrogen ion activity- marine)	5.0-9.0
pH (Hydrogen ion activity--non marine)	6.5-8.5
Phenols (mg/l)	0.001
Selenium (mg/l)	0.01
Selenium and its compounds (mg/l)	0.1
Hexavalent Chromium VI compounds (mg/l)	0.5
Sulphide (mg/l)	0.1
Simazine (mg/l)	0.03
Total Suspended Solids (mg/l)	30
Tetrachloroethylene (mg/l)	0.1
Thiobencarb (mg/l)	0.1
Temperature (in degrees Celsius) based on ambient temperature	± 3
Thiram (mg/l)	0.06
Total Coliforms (counts /100 ml)	30
Total Cyanogen (mg/l)	Nd
Total Nickel (mg/l)	0.3
Total Dissolved Solids (mg/l)	1200
Color in Hazen Units (H.U)	15
Detergents (mg/l)	Nil
Total Mercury (mg/l)	0.005
Trichloroethylene (mg/l)	0.3
Zinc (mg/l)	0.5
Whole effluent toxicity	-
Total Phosphorus (mg/l)	2 Guideline value
Total Nitrogen	2 Guideline value

Remarks: Standard values are daily/monthly average discharge values. Not detectable (nd) means that the pollution status is below the detectable level by the measurement methods established by the Authority.

Source: Third Schedule of the Environmental Management and Co-Ordination (Water Quality) Regulations, 2006

(3) Waste

According to the Mombasa County Solid Waste Management Bill 2021, solid waste generators are classified as shown in the table below and solid waste handling is stipulated as follows:

Separation of solid waste
(1) A waste generator shall separate waste at source into:
(a) dry waste; and
(b) wet waste
(2) A person who provides waste collection or transport service shall provide prescribed receptances appropriate for waste separation
Storage of solid waste
A person shall store the waste in appropriate receptacles
Disposal of waste generated
A person shall dispose of waste generated in a designed waste collection point
Waste collection in a premise
Waste collection from a premise may be undertaken by the private sector
Transfer of solid waste
Dry solid waste shall be transferred from a waste collection point to a waste transfer station for treatment and recovery
Transportation of solid waste
(1) Wet waste shall be transferred from a waste collection point to a composting facility or landfilling for disposal
(2) Waste from the transfer station shall be transported to the landfill for disposal

Table 10 Classification of Waste Generators

Classification	Description
Household	Waste food, glass, bottles, trash papers, food cans and packaging, junk waste, tree cuttings and e-waste
Commercial	Packages, waste foods, food cans, waste or expired products, trash papers, clothes cuttings, bottles, glass, e-waste, tires and junk furniture
Industrial	Plastics, paper shavings, pulp, paints; chemical solvents, e-waste, metal or wood cuttings and waste, pallets, paper boards, animal tissues, e-waste, whey and milk cream, and hides and skins
Market	Food waste, vegetables, fruits waste including peels and animal waste
Institutional (Schools, colleges and universities)	Food waste, paper cuttings, e-waste, food cans, packages and e-waste
Construction and demolition	Waste from construction or demolition or renovation sites and includes was debris, steel, timber, iron sheets
Outdoor events	Generation of paper, cans and food waste among others

Source: Mombasa County Solid Waste Management Bill 2021

(4) Noise and Vibrations

The Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009 provides maximum permissible noise levels, maximum permissible noise levels for constructions sites, and maximum permissible noise levels for mines and quarries. Maximum permissible noise levels and maximum permissible noise levels for constructions sites are shown in the tables below.

Table 11 Maximum Permissible Noise Levels

Zone		Sound Level Limits dB(A)		Noise Rating Level (NR)	
		(Leq, 14h)Day	Night	(Leq, 14h)Day	Night
A	Silent zone	40	35	30	25
B	Places of worship	40	35	30	25
C	Residential: Indoor	45	35	35	25
	Outdoor	50	35	40	25
D	Mixed residential (with some commercial and places of entertainment)	55	35	50	25
E	Commercial	60	35	55	25

Source: Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009

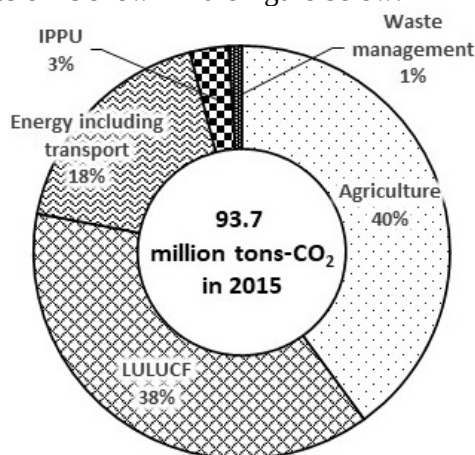
Table 12 Maximum Permissible Noise Levels for Constructions Sites

Zone		Sound Level Limits dB(A)	
		Day	Night
(i)	Health facilities, educational institutions, homes for disabled, etc.	60	35
(ii)	Residential	60	35
(iii)	Areas other than those prescribed in (i) and (ii)	75	65

Source: Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009

(5) GHG Emission

According to Kenya's updated Nationally Determined Contribution submitted on 24 December 2020, Kenya's total GHG emissions have increased from 56.8 million tons-CO₂ in 1995 to 93.7 million tons-CO₂ in 2015 and are projected to increase to 143 million tons-CO₂ by 2030 as the country pursues the Vision 2030 development agenda. Source of emission is shown in the figure below.



Source: Kenya's Updated Nationally Determined Contribution

Figure 37 GHG Emission of Kenya in 2015

1.6.2.2 Natural Environment

(1) Protected Area

According to the Wildlife Conservation and Management Act, 2013, there are three kinds of protected area in Kenya, i.e., national park, national reserve, and national sanctuary. The Mombasa Marine National Park and Mombasa Marine National Reserve are located in Mombasa County as shown in the figure below. The project is not implemented in these protected areas.



Source: JICA Study Team

Figure 38 Location of Protected Area in Mombasa County

(2) Ecosystem

According to the brochure of the Mombasa Marine National Park published by Kenya Wildlife Service, vegetation, marine life, and birds in the park are described as shown in the table below. However, the project is implemented in the existing intersection and there is no eco-sensitive area such as KBA and IBA in the project site and there is no endangered species as well.

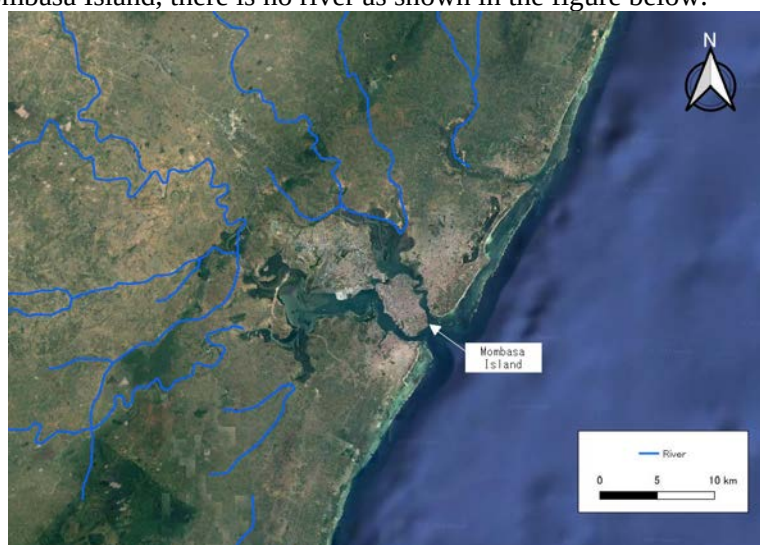
Table 13 Marine Life and Birds in the National Park

Vegetation	Sea grasses and marine algae
Marine life	Crabs, corals, sea urchins, jellyfish, sea stars, and sea cucumbers. Different varieties of coral species comprise <i>Acropora</i> , <i>Turbinaria</i> , and <i>Porites</i> .
Birds	There are many seabirds in large nesting colonies and internationally significant numbers of crab plovers and roseate tern.

Source: Brochure of the Mombasa Marine National Park

(3) Hydrology

In Mombasa Island, there is no river as shown in the figure below.

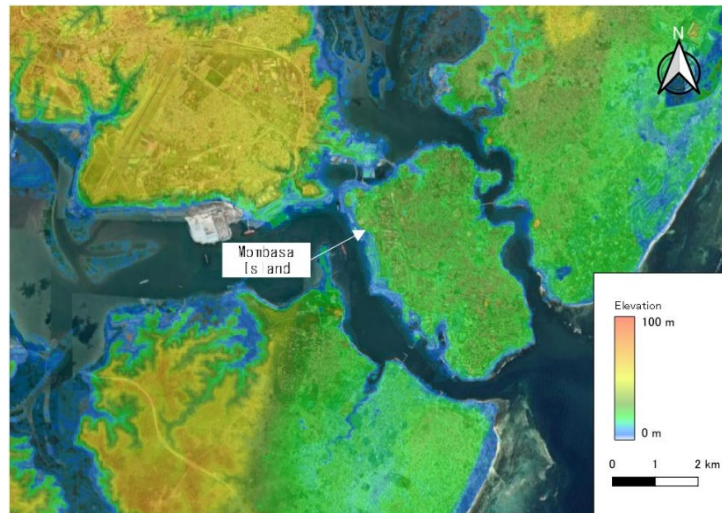


Source: JICA Study Team

Figure 39 Location of Rivers in Mombasa County

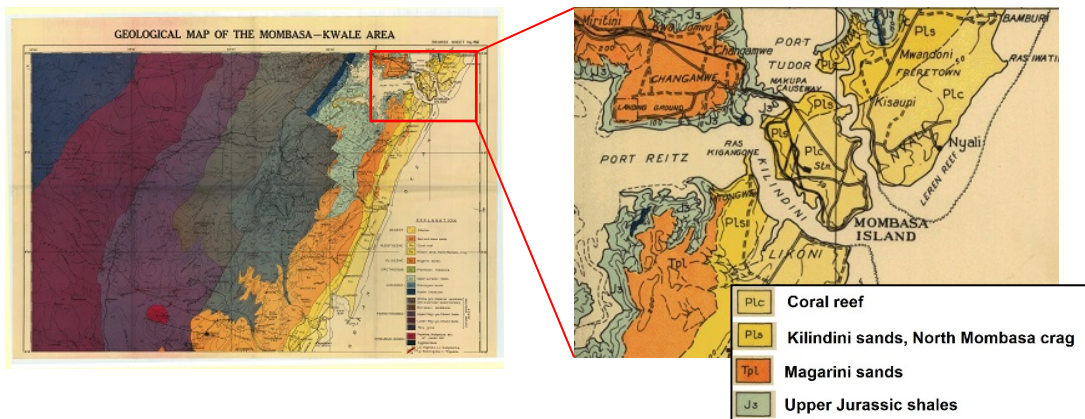
(4) Topography and Geology

Geographically, Mombasa Island is relatively flat as shown in the figure below. According to the geological map, the geology of Mombasa Island is mostly coral reef. The geology of the mainland around Mombasa Island is coral reef on the coast, Kilindini and Magarini sands inland, and Upper Jurassic shales in the bay as shown in the figure below.



Source: JICA Study Team

Figure 40 Topography Map of Mombasa County



Source: Geological Map of Mombasa

Figure 41 Geological Map of Mombasa County

1.6.2.3 Social Environment

(1) Population

[[真奥20][雄大21] According to the statistical data presented in the Third County Integrated Development Plan (2023–2027), Kenya’s population in 2022 was 50,622,914, while Mombasa County had a population of 1,283,933, consisting of 639,649 males, 644,284 females, and 30 intersex persons.

(2) Education

The table below shows statistical information on education in Mombasa County, as presented in the Third County Integrated Development Plan (2023–2027).

Table 14 Statistical Data on Education

Category	
Literacy rate (percentage of population able to read and write)	70% (Male: 75%, Female: 65%)
Percentage of population able to read	75%
Primary school enrollment rate	96%
Primary school attendance rate	98%
Secondary school enrollment rate	96%
Secondary school attendance rate	90%

Source: Third County Integrated Development Plan (2023–2027)

(3) Health

According to the statistical information provided in the Third County Integrated Development Plan (2023–2027), the most common diseases in Mombasa County are as follows:

For children under five years old — upper respiratory infections, lower respiratory infections, diarrhea, skin diseases, and pneumonia;

For individuals aged six and above — upper respiratory infections, lower respiratory infections, urinary tract infections, skin diseases, and diarrhea.

The infant mortality rate is 9.238089353 per 1,000 live births, and the average life expectancy is 66.4 years for males and 75.8 years for females.

(4) Poverty

According to the poverty data presented in the Third County Integrated Development Plan (2023–2027), the proportion of the population in Mombasa County living in absolute poverty — defined by the World Bank as living on less than USD 1.90 per day — is 34.8%.

(5) HIV/AIDS

With approximately 54,000 persons living with human immunodeficiency virus (HIV) (Kenya HIV Estimates 2014), the county ranks among the highest burdened in the country. New adult annual HIV infection rate remains unacceptably high at 1,609 people in the county. Similarly, despite gains made on Antenatal Care (ANC) and Prevention of Mother to Child Transmission (PMTCT), 171 newborn infants acquire HIV annually. In the year 2014, 71% of pregnant women living with HIV did not deliver in a health facility. Pediatric Antiretroviral

Therapy (ART) coverage remains low in Mombasa County at 42%. Despite the huge importance of HIV testing as a way of increasing prevention and treatment, about 73% of people in Mombasa County had never tested for HIV by 2009 (Kenya HIV County Profiles, 2014). Summary of key HIV and acquired immunodeficiency syndrome (AIDS) indicators is shown in the table below.

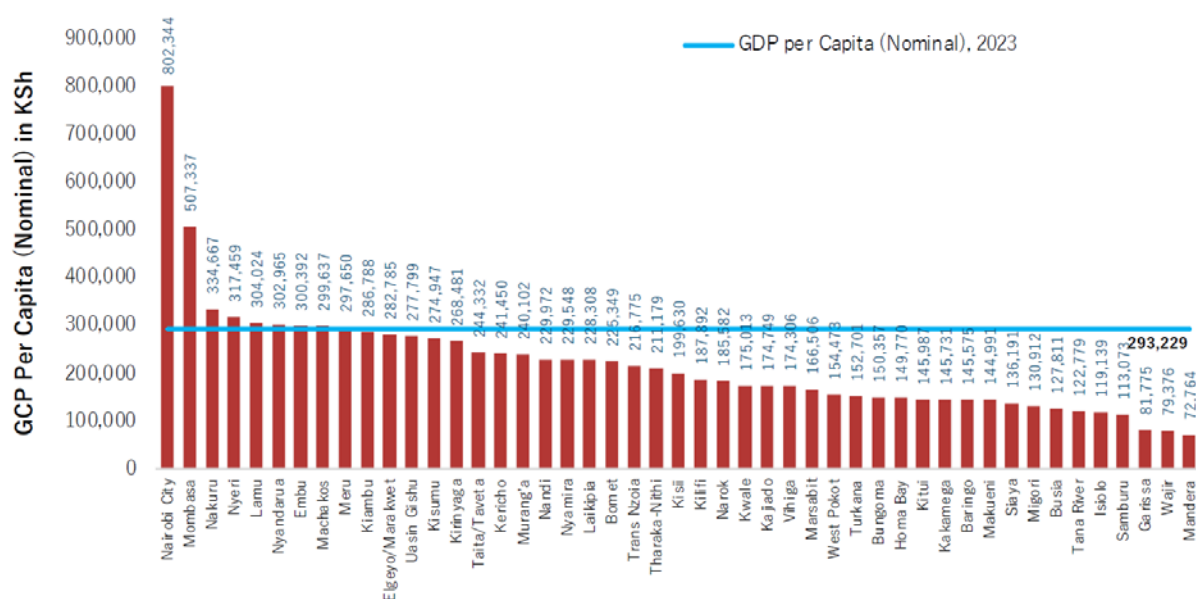
Table 15 Summary of Key HIV and AIDS Indicators

Indicator	Mombasa
Total Population (2013)	1,179,929
HIV adult prevalence (overall)	7.4%
HIV prevalence among women	10.5%
HIV prevalence among men	4.5%

Source: Mombasa County HIV and AIDS Strategic Plan 2016/2020

(6) Economy

The GCP[[Figure 4.23](#)] (Gross County Product) per capita for Mombasa County in 2023 was 507,337 KSh. It is the second largest county in Kenya after Nairobi, and its GCP per capita is approximately 1.7 times higher than the national average.



Source: Gross County Product 2024

Figure[[Figure 4.23](#)] 42 Economic Activity of Mombasa County

The breakdown of Mombasa County's GCP for 2023 is shown in the table below. Logistics and warehousing account for approximately 30% of GCP, while manufacturing accounts for approximately 25%.

Table[[Figure 4.24](#)]16 Statistical Data on Economic Activity

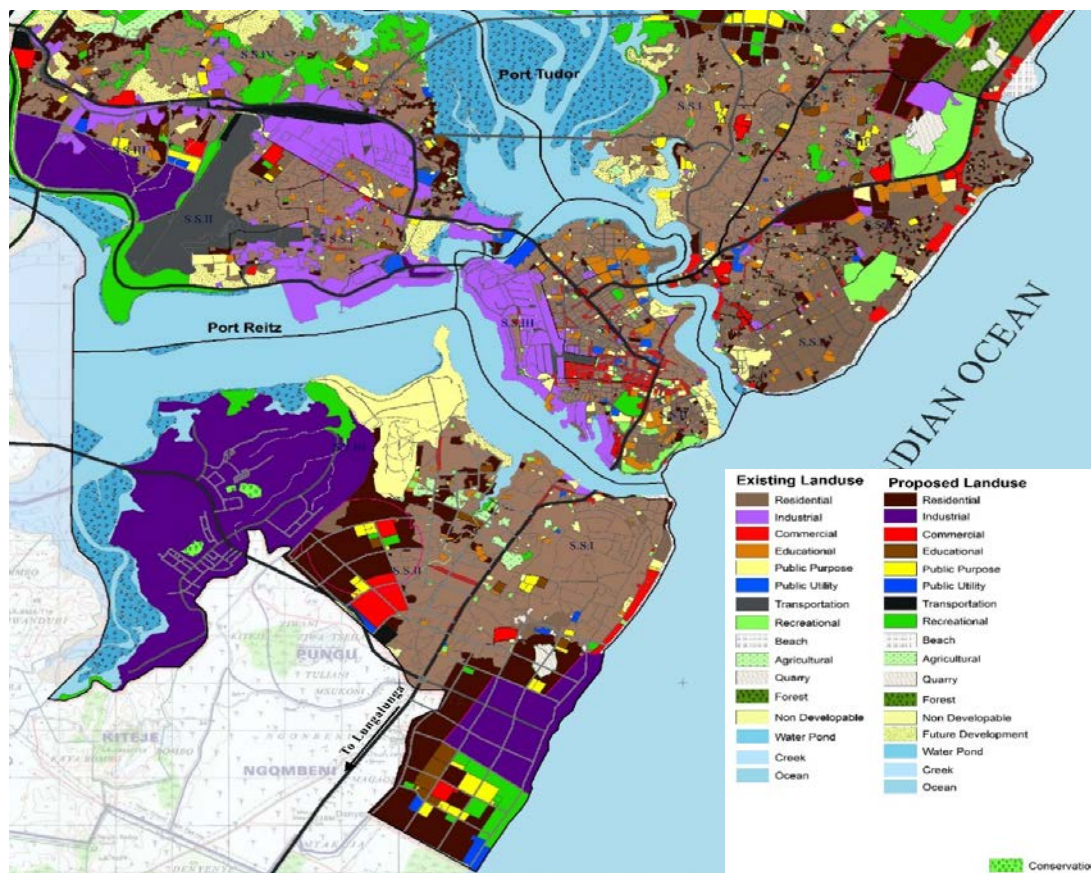
Category	GCP(million Khs)
Logistics and Warehousing	143,983
Manufacturing	119,767
Construction	85,764

Wholesale and Retail Trade, Automobile Repair	73,146
Accommodation and Food Service Activities	18,117
Information and Communications	16,998
Electric Power Supply	15,576
Agriculture, Forestry, and Fishing	4,777
Mining and Quarrying	1,802
Water Supply and Waste Collection	1,557

Source: Second County Integrated Development Plan 2024

(7) Land Use

The land use in Mombasa area is shown in the figure below. The project site in Mombasa Island is mainly industrial, residential, and commercial areas. The south mainland side is mainly residential and partially agricultural with areas for education.

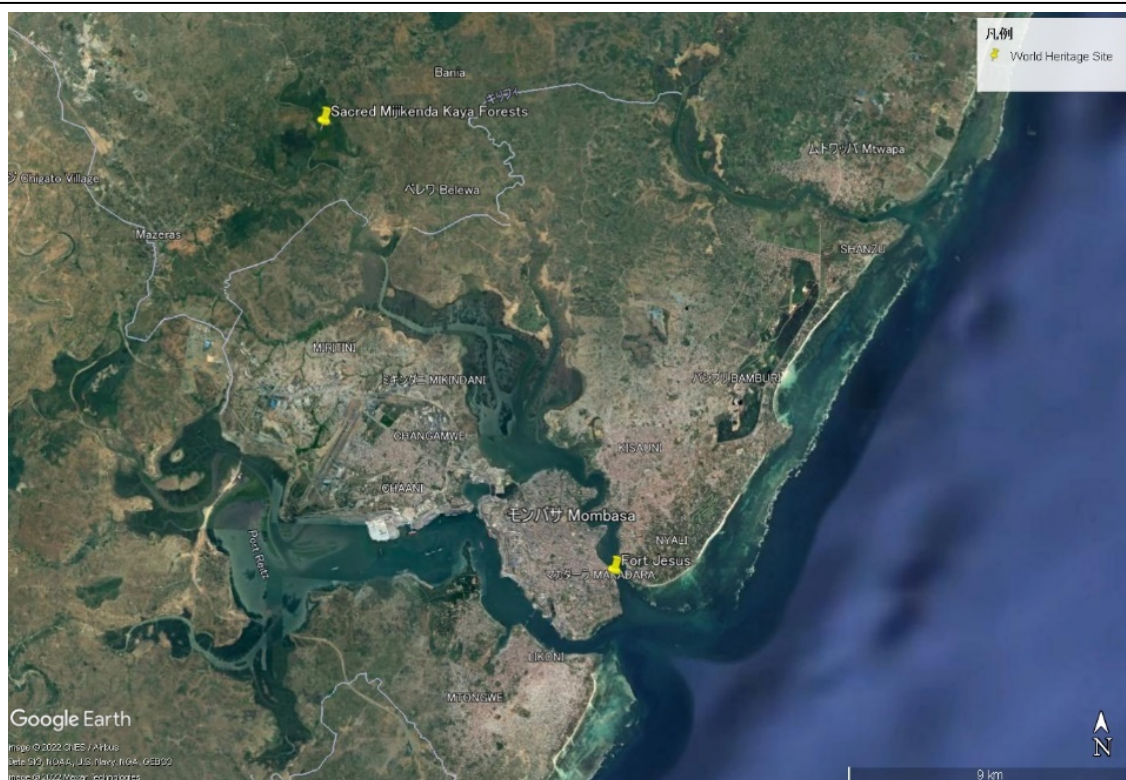


Source: Mombasa County

Figure 43 Land Use Map

(8) Cultural Heritage

In Mombasa County, there are two world heritage sites, namely: Fort Jesus and Sacred Mijikenda Kaya Forests. Location is shown in the figure below. These are not located within the project site.



Source: JICA Study Team

Figure 44 Location Map of World Heritage Sites in Mombasa County

(9) Ethnic Minorities and Indigenous People

In Kenya, the people who identify with the indigenous movements are mainly pastoralists and hunter-gatherers, as well as some fisher people and small farming communities.

Table 17 [匠玉25] Ethnic Minorities and Indigenous People

Pastoralist		Hunter-gatherers	
•Turkana	•Ilchamus	•Ogiek	•Boni (Bajuni)
•Rendille	•Somali	•Sengwer	•Malakote
•Borana	•Gabra	•Yaaku	•Wagoshi
•Maasai	•Pokot	•Waata	•Sanya
•Samburu	•Endorois	•El Molo	

Source: Indigenous peoples in Kenya, IWGA web site (<https://www.iwgia.org/en/kenya/655-indigenous-peoples-in-kenya>)

These people are mostly in the arid and semi-arid lands in northern Kenya and towards the border between Kenya and Tanzania in the south. Ethnic minorities and indigenous people are not included in the project site.

1.6.3 Institution and Organization for Environmental and Social Considerations in Kenya

1.6.3.1 Laws and Regulations

Laws and regulations related to environmental and social considerations are shown in the table below.

Table 18 Laws and Regulations Related to Environmental and Social Considerations

Name of Legislation	Outline	Year Established
Act		
Environmental Management and Co-ordination Act (EMCA)	The Act is the framework law on environmental management and conservation and provides for environmental protection through environmental impact assessment, environmental audit and monitoring, and environmental restoration orders, conservation orders, and easements. The Act stipulates the establishment of institutions such as the National Environment Management Authority (NEMA) for environmental management.	1999 2015(amended)
Land Act	This Act governs all three types of land in Kenya. It reflects the guiding principles of land policy enshrined in Art. 60(1) of the Constitution (equitable access to land; security of land rights; elimination of gender discrimination in law, customs and practices related to land and property in land, encouragement of communities to settle land disputes through recognized local community initiatives).	2012
Land Registration Act	This Act governs the registration of interests in public land, private land, and community land.	2012
National Land Commission Act[TA綾26][KR竜27]	An Act of Parliament to make further provision as to the functions and powers of the National Land Commission, qualifications and procedures for appointments to the Commission; to give effect to the objects and principles of devolved government in land management and administration, and for connected purposes	2012
Community Land Act	The Act aims to provide for, first, the recognition, protection and registration of community land rights. Second, the management and administration of community land. Third, the role of county governments in relation to unregistered community land and related matters.	2016
Land Value Index Laws (Amendment) Act	An Act of Parliament to amend the Land Act, the Land Registration Act and the Prevention, Protection and Assistance to Internally Displaced Persons and Affected Communities Act; to provide for the assessment of land value index in respect of compulsory acquisition of land; and for connected purposes	2019
Regulations		
The Environmental (Impact Assessment and Audit) Regulations	The regulations stipulate EIA and environmental audit and monitoring procedure. Any proponent of a project should conduct an EIA and prepare a report and submit to NEMA before the commencement of the project. An initial environmental audit and a control audit are conducted by a qualified and authorized environmental auditor or environmental inspector who is an expert or a firm of experts registered by NEMA.	2003 2009(amended)
The Environmental Management and Co-ordination (Water Quality) Regulations	Water Quality Regulations apply to water used for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for any other purposes. Different standards apply to different modes of usage. These regulations provide for the protection of lakes, rivers, streams, springs, wells and other water sources.	2006
The Environmental Management and Co-ordination (Waste Management) Regulations	Management of solid waste, industrial waste, hazardous waste, pesticide and toxic substances, biomedical waste, and radioactive substances is stipulated.	2006

Name of Legislation	Outline	Year Established
The Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, and Access to Genetic Resources and Benefits Sharing) Regulations	These regulations apply to access to genetic resources or parts of genetic resources, whether naturally occurring or naturalized, including genetic resources bred for or intended for commercial purposes within Kenya or for export, whether in in-situ conditions or ex-situ conditions.	2006
The Environmental Management and Co-ordination (Controlled Substances) Regulations	These regulations aim to regulate the production, trade and use of controlled substances and products; provide for a system of data collection to facilitate compliance with relevant reporting requirements under the Montreal Protocol on Substances that Deplete the Ozone Layer; promote the use of ozone friendly substances, products, equipment and technology; and ensure the elimination of substances and products that deplete the ozone layer.	2007
The Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution) (Control) Regulations	The regulations prescribe the maximum permissible noise levels from a facility or activity to which a person may be exposed to; provide for the control of noise; and provide for mitigating measures for the reduction of noise. The maximum permissible noise levels are based on the various zones as outlined in the regulations. These regulations apply even to workplaces.	2009
The Environmental Management and Co-ordination (Wetlands, Riverbanks, Lakeshores and Sea Shore Management) Regulations	This regulation seeks to ensure wetland resources are utilized in a sustainable manner compatible with the continued presence of wetlands and their ecological goods and services.	2009
The Environmental Management and Co-ordination (Air Quality) Regulations.	The regulations provide for the establishment of emission standards for various sources such as mobile sources and stationary sources. Emission limits for various areas and facilities have been set. The regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas.	2014

Source: JICA Study Team

1.6.3.2 Gap Analysis

Result of gap analysis is shown in the table below.

Table 19 Gap Analysis

Items	JICA Guidelines for Environmental and Social Considerations (April 2010)	Kenyan Law	Gaps and Gap Filling Policy
Basic Principles	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. [TA 綾28][KR 竜29] (JICA Guidelines Appendix 1)	There is no system to examine alternatives and mitigation measures at an early stage.	On this survey, stakeholder meetings will be held, and their opinions are reflected in the mitigation measures.
Information disclosure	- Environmental assessment reports, which may have different document names depending on the system, must be written in the official language or in a language widely used in the host country. When explaining the reports to local residents, written materials must be provided in a form understandable to them. (JICA Guidelines Appendix 2) - Environmental assessment reports are required to be made available in the host country, including for local residents. The environmental assessment reports are required to always be available for perusal by stakeholders such as local residents, and to be allowed to photocopy. (JICA Guidelines Appendix 2)	Language of EIA report is not designated. Official language is English, and EIA report will be written in English.	There is no gap about the language or information disclosure.
Stakeholder	- For projects with potentially significant	Stakeholder meetings	During the study, the survey

meeting	environmental and social impacts, 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 are examined. The outcome of such consultations must be incorporated into the project plans. (JICA Guidelines Appendix 1) - In preparing environmental assessment reports, consultations with stakeholders such as local residents must take place after sufficient information has been disclosed. Records of such consultations must be prepared. (JICA Guidelines Appendix 2) - Consultations with stakeholders such as local residents should take place throughout the preparation and implementation stages of the project as appropriate. It is desirable to hold the consultations especially regarding selection of items to be assessed as well as at the completion of the draft environmental assessment report (JICA Guidelines Appendix 2)	on affected areas and communities are compulsory during an EIA survey. At the stakeholder meetings, project outlines and impacts are explained, and opinions are gathered.	team held stakeholder meeting. The opinions expressed were taken into account.
Impact assessment items	- The impacts to be assessed regarding environmental and social considerations include impacts 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, biodiversity, and ecosystem services, including trans-boundary or global scale impacts. These also include social considerations such as: migration of population including involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor peoples and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. (JICA Guidelines Appendix 1) - In addition to the direct and immediate impacts of projects, derivative, secondary, and cumulative impacts as well as impacts associated with indivisible projects are also to be examined and assessed to a reasonable extent. It is also desirable to consider the impacts through a project life cycle. (JICA Guidelines Appendix 1)	For an EIA, survey items are not stipulated. The impacts throughout the project cycle are not considered.	Impact items of the JICA Guidelines are included in the EIA report.
Monitoring, grievance redress mechanism	- Project proponents should make efforts to make the monitoring results available to local stakeholders involved in the project. (JICA Guidelines Appendix 1) - When third parties point out specifically that environmental and social considerations are not being fully undertaken, project proponents should make efforts to reach an agreement on the procedures to resolve the problems, through forums for discussions and examinations of the countermeasures with participation of stakeholders involved in the	No regulation is established for monitoring result disclosure and management of complaints.	Monitoring result is disclosed in the website of CGM and CGM established a grievance mechanism.[TA綾30][KR竜31]

	projects, based on sufficient information disclosure. (JICA Guidelines Appendix 1)		
Ecosystem and biota	Projects must not involve significant conversion or significant degradation of critical habitats or critical forests. (JICA Guidelines Appendix 1)	GOK may declare a lakeshore, wetland, coastal zone or riverbank to be a protected area and impose such restrictions as deemed necessary, to protect the lakeshore, wetlands, coastal zone and riverbank from environmental degradation.	There is no gap.
Indigenous peoples	Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. If avoidance is not possible even after such examination, effective measures for indigenous peoples must be taken to minimize the impacts and to compensate for the losses. (JICA Guidelines Appendix 1)	The Constitution of Kenya describes obligation for needs of indigenous people.	In the event that the existence of indigenous people is confirmed in the project site, appropriate measurements will be applied.

Source: JICA Study Team

1.6.3.3 Organizations

(1) Ministry of Environment and Forestry

The Ministry of Environment and Forestry is in charge of protection, conservation and management of the natural resources for socio-economic development. The Directorates and Semi-Autonomous Government Agencies (SAGAs) under the ministry are shown in the tables below.

Table 20 Directorate under the Ministry of Environment and Forestry

Directorate	Mandate
Environment	The Directorate provides policy guidance, coordination, supervision and advice on issues connected to the environment and related statutes, their interpretation, application and implications. It provides coordination between the ministry and various agencies, regional and international bodies on environmental matters. The Directorate has the following departments ; - Department of Policy Formulation, Interpretation and Implementation - Department of Multilateral Environmental Agreements (MEAs) - Department of Programs, Projects and Strategic Initiatives - Department of Ecological Restorations - Kenya Meteorological Department
Forestry Conservation	The Directorate is mandated to formulate, interpret, monitor and coordinate forestry conservation strategic policies; develop, review, and monitor the implementation of the national forestry conservation and management strategy; ensure sustainable exploitation, utilization, management and conservation of forestry resources, and ensure equitable sharing of the accruing benefits.
Climate Change	The Directorate was established under the Climate Change Act of 2016, and is mandated to provide vision, leadership, guidance, and coordination on matters relating to climate change in the country. It is the lead agency of the government on national climate change plans and actions to deliver operational coordination.

Source: JICA Study Team

Table 21 SAGAs under the Ministry of Environment and Forestry

SAGAs	Description
National Environment Management Authority (NEMA)	NEMA is the principal instrument of the government for the implementation of all policies related to environment.
Kenya Water Towers	KWTA is established to coordinate and oversee the protection, rehabilitation, conservation

Agency (KwTA)	and sustainable management of all the critical water towers in Kenya.
Kenya Forest Service (KFS)	KFS is mandated to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socioeconomic development of the country and for related purposes.
Kenya Forest Research Institute (KEFRI)	KEFRI undertakes research and provides technologies and information for sustainable management, conservation and development of forests and allied natural resources.
National Environment Trust Fund (NETFUND)	NETFUND is mandated to facilitate research intended to further the requirements of environmental management, capacity building, environmental awards, environmental publications, scholarships, and grants.

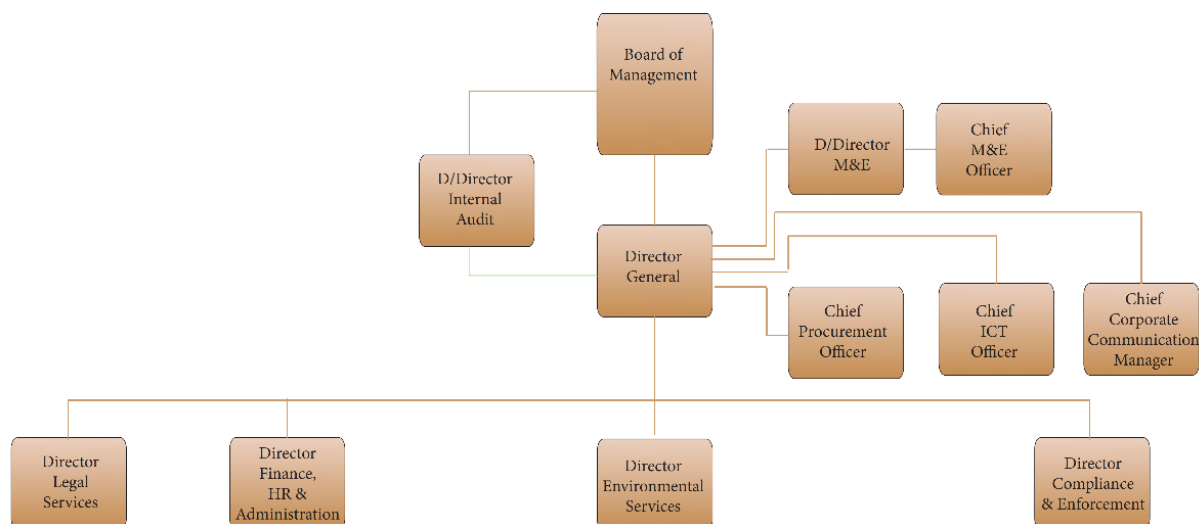
Source: JICA Study Team

(2) NEMA

The mandates of NEMA are stipulated in the Environmental Management and Co-ordination Act No. 8 of 1999 (EMCA) as follows:

- i) Coordinating environmental management activities being undertaken by the lead agencies.
- ii) Taking stock of natural resources.
- iii) Advising on land use planning.
- iv) Undertaking research, investigation and surveys in the field of environment and disseminating information on the findings.
- v) Mobilizing and monitoring the use of financial and human resources for environmental management.
- vi) Regulating, monitoring and assessing activities to ensure that the environment is not degraded.
- vii) Enforcing environmental standards.
- viii) Undertaking environmental education, public awareness and public participation programs; developing, publishing and disseminating manuals, codes or guidelines relating to environmental management; and
- ix) Preparing the state of the environment report and development and implementation of the national environment action plans.

The authority has a Board of Management that is responsible for policy and strategic guidance. The Director General (DG) is responsible for the day-to-day management of the authority. The authority has five departments, namely: Compliance and Enforcement, Environmental Services, Finance and Administration, Legal Services, and Directorate. The organization structure of NEMA is shown in the figure below. As of 2018[匠玉32], the authority has currently 417 employees against the required 1,385 as shown in the table below. County field offices are located in each county and Mombasa NEMA County Office is in charge of the project.



Source: JICA Study Team edited based on the NEMA Strategic Plan 2019-2024

Figure 45 Organization Structure of NEMA

Table 22 Optimal and Current Number of Staff in NEMA

Departments	Optimal	2018
Directorate	66	37
Legal Services	23	11
Finance, Human Resources and Administration	134	63
Environmental Services	411	50
Compliance, Enforcement and Field Operations	751	256
Total	1,385	417

Source: NEMA Strategic Plan 2019-2024

1.6.3.4 National Policy/ Plan in the Environmental Sector in Kenya

The national policy/ plan in the environmental sector in Kenya is shown in the table below.

Table 23 National Policy/ Plan in the Environmental Sector in Kenya

Policy	Content[cdv33]
Vision 2030	It is the long-term development blueprint for the country. Vision 2030 recognized the need to promote eco-tourism in forest areas and recognized the challenge of sustainable management of natural resources.
Big Four Agenda (2018-2022)	It establishes the Kenya government's priorities from 2018 to 2022. These include ensuring food security, affordable housing, increased manufacturing, and affordable universal healthcare. Restoration initiatives of degraded natural resources will contribute to the achievement of this agenda.
National Environment Policy, 2014	It was developed following the Vision 2030 and the Constitution of Kenya 2010. The policy supports the management of ecosystems and sustainable use of natural resources, encompassing forest ecosystems, freshwater and wetland ecosystems, coastal and marine ecosystems, mountain ecosystems, arid and semi-arid lands ecosystems, land, soils, minerals, biodiversity, wildlife resources, livestock, and fisheries.
Draft Forest Policy 2015	Introduces several initiatives to improve and develop the forest resource base through the integration of good governance, transparency, accountability, equity, and poverty reduction in the forestry sector. It aims to improve livelihood through sustainable use, conservation, and management of forests and promotes communities and other stakeholders in forest management. It also aims to conserve water catchment areas, create employment, reduce poverty, and ensure the sustainability of the forest sector.
East African Community Protocol on Environment and Natural Resources Management	The Protocol governs the partner states (the Republic of Burundi, the Republic of Kenya, the Republic of Rwanda, the United Republic of Tanzania, the Republic of Uganda, and the Republic of South Sudan) in their cooperation in the management of the environment and natural resources over areas within their jurisdiction including trans-boundary environment and natural resources.
Agricultural Sector Development Strategy (ASDS)	It was developed in line with the Kenya Vision 2030 to upscale the agricultural sector. Drawing from Vision 2030, under the economic and social pillars, it emphasizes the enhancement of crops and livestock, incomes, and food security and nutrition. ASDS outlines ways to transform the agricultural sector to encompass innovative, commercially oriented, and modern agricultural

	undertakings.
Kenya Green Economy Strategy and Implementation Plan, 2015	It acknowledges that climate change leads to adverse impacts across all the production sectors of the economy if proper management measures are not taken, a milestone towards promoting environment and natural resources governance.

Source: Kenya State of Environment Report 2019-2021

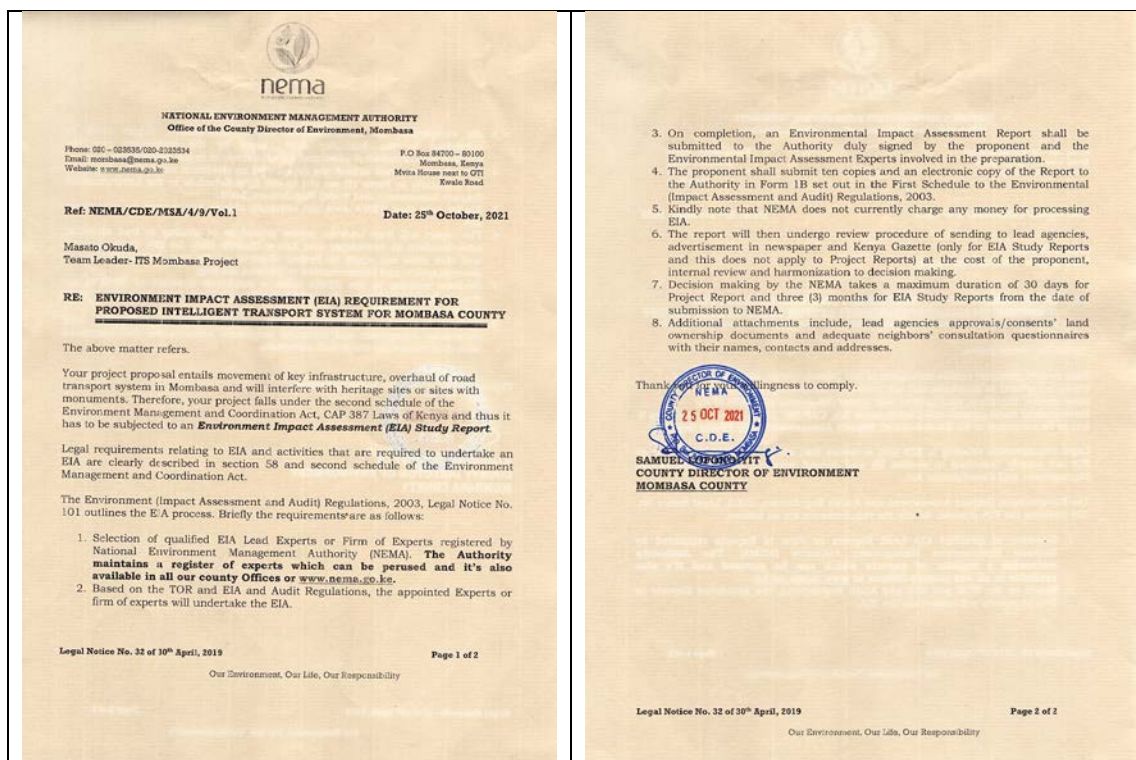
1.6.3.5 Approval and Licenses for Environmental and Social Considerations for Project Implementation

Based on the meeting, discussion, and survey as shown in the table below and in accordance with Legal Notice No. 32 The Environment (Impact Assessment and Audit) (Amendment) Regulation 2019, NEMA and the JICA Study Team confirmed the necessity of EIA approval for the project and NEMA issued the letter on EIA requirement on 25 October 2021 as shown in the figure below. The required EIA procedure is also shown in the figure below. The EIA will be reviewed and approved by NEMA and it takes three months for the review.

Table 24 Confirmation of EIA Requirement

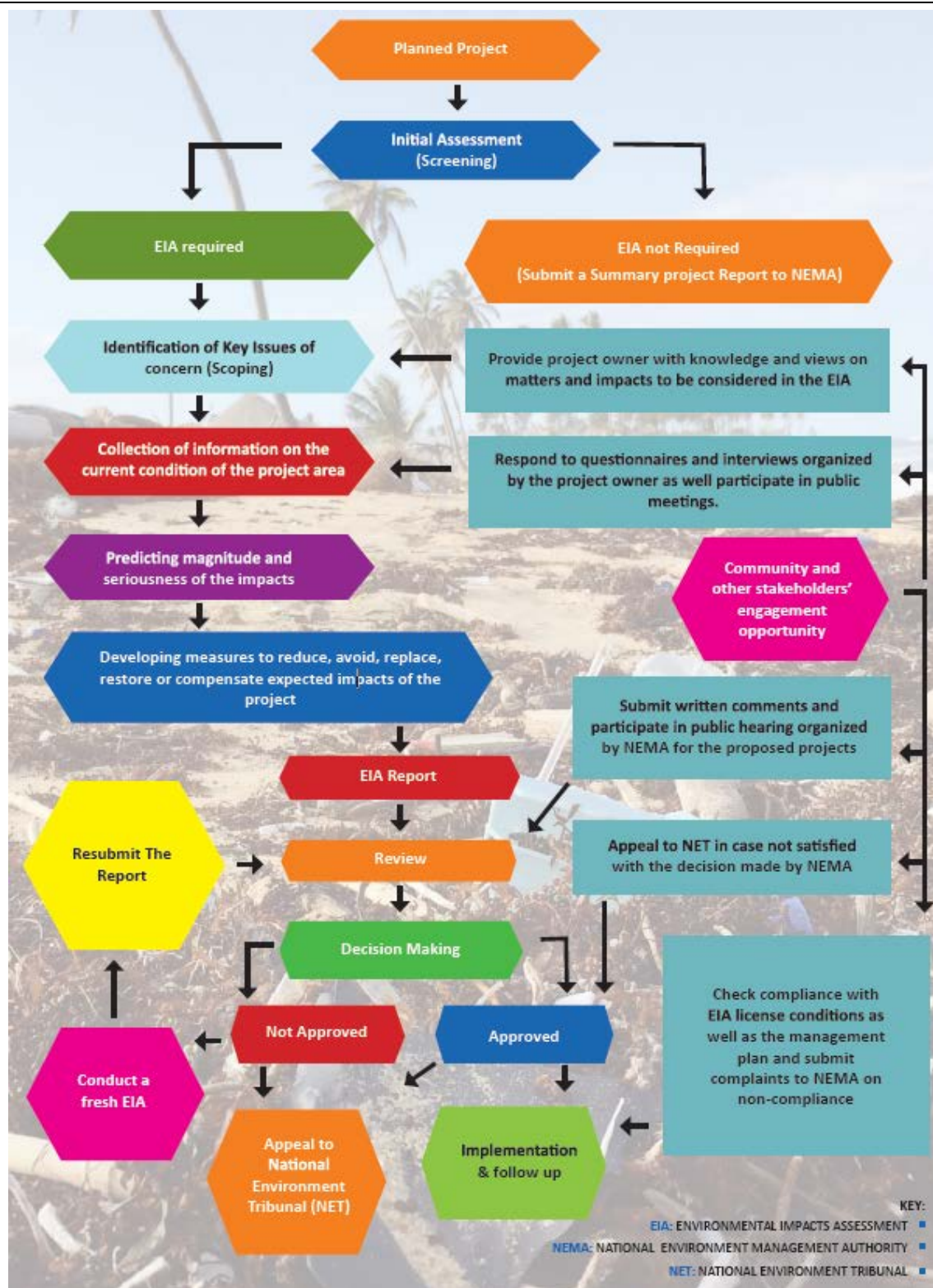
Date	Description
27 Sep. 2021	1. Explanation of outline of the project 2. Confirmation of EIA procedure for this project The JICA Study Team confirmed the following things with NEMA: - Since impact of this project may not be significant, this project is not categorized as high-risk project and categorized as low- or medium-risk project - Only certified consultants can submit the summary project report - Site observation with NEMA is necessary 3. Confirmation of contact person in NEMA
30 Sep. 2021	The JICA Study Team, including environment subcontractor and NEMA conducted site survey to confirm the current situation of target intersection and explanation of project activities on site. Five intersections (A8-1, A8-7, A8-4, A7-4, A7-6) are observed.
1 Oct. 2021	- On 27 September, NEMA was aware that the only activities related to the intersection improvement are installation of traffic signals, pedestrian crossing and road painting; and no environmental impact was expected. - However, it was found that the activities include the removal of the roundabout, excavation works; and the environmental impact of these activities has to be taken into account. - It is recommended to proceed with the EIA at this stage. - The preparation of an EIA is provided for in Legal Notice No. 32 The Environment (Impact Assessment and Audit) (Amendment) Regulation 2019. - The EIA for the project will be handled by NEMA Mombasa.
15 Oct. 2021	The JICA Study Team sent letter to NEMA regarding request for issuance of official letter to announce requirement of EIA.
25 Oct. 2021	NEMA issued the letter regarding EIA requirement for the project.

Source: JICA Study Team



Source: JICA Study Team

Figure 46 Letter on EIA Requirement from NEMA



Source: JICA Study Team

Figure 47 Letter on EIA Requirement from NEMA

1.6.4 Comparison of the Alternatives (Including “Without Project Scenario”)

The summary of comparison of alternatives is shown in the table below. At the beginning of the project, 30 intersections were listed as the candidate intersections and 22 intersections were selected as target intersections considering efficiency of improvement and environmental and social aspects.

Table 25 Summary of Comparison of the Alternatives

Items	Without Project Scenario	Plan A	Plan B
Number of improved intersections	0	22	30
Effectiveness for traffic congestion moderation	Traffic congestion is not moderated.	Traffic congestion is moderated by installation of traffic signal.	Traffic congestion is moderated by installation of traffic signal.
Environmental and social impact	- No resettlement is required. - Due to traffic congestion in some intersections, GHG emissions will increase along with increase in traffic volume.	- No resettlement is required. - Temporarily, there is an impact on air quality, noise, and vibration during construction. - Due to moderation of traffic congestion, GHG emission reduction is expected.	- Resettlement is required. - Temporarily, there is an impact on air quality, noise, and vibration during construction. - Due to moderation of traffic congestion, GHG emission reduction is expected.
Result of comparison	Not recommended	Recommend	Not recommended

Source: JICA Study Team

Detailed selection procedure is discussed as follows. Twenty-two intersections are selected from the 30 candidate intersections (long list) based on the following criteria. Results of selected target intersections are shown in the table below.

- (1) Intersections that are in the two main corridors A7 and A8; and formulating core loop by signal linkage.
- (2) Intersection with function of area control including core loop by signal linkage.
- (3) Intersection that will receive increased traffic from Mombasa Gate Bridge; and
- (4) Intersections that can contribute to smooth traffic of large and heavy vehicles (effects on port-related facility access, northern corridors, etc.)

At intersections not selected for improvement, the necessity for enhancement was re-evaluated; however, it was confirmed that the benefits of such improvements would be minimal for the following reasons.

- (A) At non-intersections (A7-5, H-3, M-4, A7R-1) and six intersections that are not currently and will not be obviously congested (L-3, L-4)
- (B) According to the current situation and plan of Second Nyali Bridge, the bridge is operated for more than ten years. Thus, 2 intersections (H-4, L-1) were not selected.
- (C) Intersections located on roads subject to the A7 road widening plan (A7-6, A7-7, A7-8, A7-9)
- (D) Intersection (A8-6) located on roads with plans for widening is excluded, considering the causeway bridging works

- (E) According to the observed traffic volume analysis result, the two roundabout intersections (A7R-2, A8-5) can receive future traffic volume.
- (F) The L-2 and L-5 signals on the mainland are independent of the coordinated signals on the island.

Table 26 Selection of Target Intersections

#	Criteria				Note	Environmental and Social Considerations	Select
	(1)	(2)	(3)	(4)			
A7-1		v	v	v			v
A7-2	v						v
A7-3	v						v
A7-4	v						v
A7-5					(A)		
A7-6					(C)	There is a possibility that some of the markets are located within RoW.	
A7-7					(C)		
A7-8					(C)		
A7-9					(C)		
A7R-1					(A)		
A7R-2					(E)		
A7R-3		v					v
A7R-4		v					v
A7R-5	v						v
A7R-6	v						v
A7R-7	v						v
A7R-8	v						v
A8-1	v						v
A8-2	v						v
A8-3	v						v
A8-4	v						v
A8-5					(E)		
A8-6					(D)		
A8-7	v						v
H-1		v					v
H-2		v		v			v
H-3					(A)		
H-4					(B)		
H-5		v					v
H-6		v					v
M-1			v				v
M-2			v	v			v
M-3			v	v			v
M-4					(A)		
L-1					(B)		
L-2					(F)	There is a street vendor who requires resettlement.	
L-3					(A)		
L-4					(A)		
L-5					(F)		

Source: JICA Study Team

1.6.5 Scoping and TOR for Survey for Environmental and Social Considerations

The main objective of this section is to make a provisional identification of environmental and social impacts based on the project description and overall environmental and social conditions in and around the project area, which need to be addressed in subsequent EIA studies. Since the scoping process is conducted before the detailed field survey, the information from the desk study by the JICA Study Team with preliminary assessment checklist/matrix depending on expert judgments was used to determine the assessment items, which are the most critical issues to study.

The potential impacts resulting from the project are preliminarily presented and analyzed in this section with respect to the following aspects:

- Pollution control measures;
- Natural environment;
- Social environment; and
- Others.

Environmental and social impact assessment items, in which the impact of the project is assumed or unknown, are marked with a 'v' separately for pre-construction stage (PCS), construction stage (CS), and operation stage (OS). For items marked 'v', reason for selection is described such as an assumed impact or necessity of investigation to clarify unknown impact. For items not marked with 'v', reason for non-selection is described such as no impact is assumed or only negligible impact is assumed. The result of scoping for environmental and social impact assessment is shown in the table below.

Table 27 Scoping Result

No.	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
Pollution Control				
1	Air Quality	v	-	[CS] Due to the use of construction machines for construction works such as removal of roundabout and pavement, and the construction vehicle for transportation of workers, construction machines, construction materials, etc., temporal air quality deterioration is predicted. [OS] No impact is predicted because the project is improving of existing intersections and does not cause air pollution.
2	Water Quality	-	-	[CS] During construction, water would be used for dust suppression. However, water is discharged into existing drainage system along the road because the amount of discharged water from construction is limited and also does not include hazardous matters.[TA綾34][KR竜35] Thus, the impact is negligible. [OS] No impact is predicted because any wastewater is not generated due to operation of intersection.
3	Waste	v	-	[CS] Certain amount of construction waste such as removed roundabout and removed existing pavement will be generated. [OS] No impact is predicted because any waste is not generated due to operation of intersection.
4	Soil Contamination	-	-	[CS] The construction work is focused on the improvement of existing intersections and implemented within RoW, which are already developed. Thus, construction does not cause soil contamination. [OS] No impact is predicted because any operation activities do not change the soil.
5	Noise and Vibration	v	-	[CS] Due to the construction vehicle transportation and use of construction machinery, temporal impact of noise and vibration is predicted.

No.	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
				[OS] No impact is predicted because the project is focused on the improvement of existing intersections and does not make loud noise and vibration level than the current condition.
6	Ground Subsidence	-	-	[CS] No impact is predicted because the construction work such as landfilling which likely to cause ground subsidence, is not included. [OS] No impact is predicted because the project is focused on the improvement of existing intersections and there are no operation activities to cause ground subsidence.
7	Offensive Odor	-	-	[CS] No impact is predicted because construction activities will not cause offensive odor. [OS] No impact is predicted because operation activities will not cause offensive odor.
8	Bottom Sediment	-	-	[CS/OS] No impact is predicted because surface water such as rivers and lake are not located in the Mombasa Island.
Natural Environment				
9	Protected Area	-	-	[CS/OS] No impact is predicted because the project is focused on the improvement of existing intersections and implemented within RoW, which are already developed.
10	Ecosystem	-	-	[CS/OS] No impact is predicted because the project is focused on the improvement of existing intersections and implemented within RoW, which are already developed.
11	Hydrology	-	-	[CS/OS] No impact is predicted because the project is focused on the improvement of existing intersections and the river is not located in Mombasa Island, and there are also no activities which cause change of hydrological condition.
12	Topography and Geology	-	-	[CS/OS] No impact is predicted because the project is focused on the improvement of existing intersections and implemented within RoW, which are already developed.
Social Environment				
13	Land Acquisition and Resettlement	v	-	[PCS] The project is implemented within RoW and the design will be prepared to avoid land acquisition and resettlement. However, there is possibility that a street vendor who requires resettlement exists within RoW. [OS] No impact is predicted because no land acquisition and resettlement are required due to operational activity.
14	Poverty	-	-	[CS] Positive impact such as job creation for construction work is expected. [OS] Intersections are managed by county government, and no impact is predicted.
15	Ethnic Minority and Indigenous People	-	-	[CS/OS] No impact is predicted because there are no ethnic minority and indigenous people in the project area.
16	Local Economy such as Employment and Livelihood	-	-	[CS] Positive impact such as job creation for construction work is expected. [OS] Intersections are managed by county government, and no impact is predicted.
17	Land Use and Usage of Local Resources	-	-	[CS/OS] No impact is predicted because the project is improvement of existing intersections and land use is not changed, and local resources is not utilized.
18	Water Usage	-	-	[CS/OS] No impact is predicted because the project is improving of existing intersections and does not cause change of water usage.
19	Existing Social Infrastructure and Services	v	-	[CS] During construction, traffic congestion is predicted due to construction works. [OS] Positive impact such as traffic moderation is expected because the project is focused on the improvement of existing intersections.
20	Social Institutions such	-	-	[CS/OS] No impact is predicted because the project is focused on the improvement of existing intersections.

No.	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
	as Socially Related Capital and Decision-making Organizations			
21	Misdistribution of Benefit and Damage	-	-	[CS/OS] No impact is predicted because the project is focused on the improvement of existing intersections.
22	Local Conflicts of Interest	-	-	[CS/OS] No impact is predicted because the project is focused on the improvement of existing intersections.
23	Cultural Heritage	v	-	[CS] Removal of roundabout is one of construction works and cultural value of superstructure is necessary to confirm. [OS] No impact is predicted because the project is focused on the improvement of existing intersections.
24	Landscape	v	-	[CS] There is possibility that removal of roundabout including superstructure will cause change of landscape. [OS] No impact is predicted because the project is focused on the improvement of existing intersections.
25	Gender	v	-	[CS] The project can provide additional employment opportunities during construction phase. However, there might be gaps on working conditions such as wage between men and women. [OS] No impact is predicted because the project is focused on the improvement of existing intersections.
26	Children's Right	v	-	[CS] There is a possibility of child labor. [OS] No impact is predicted because the project is focused on the improvement of existing intersections.
27	Infectious Diseases such as HIV/AIDS	v	-	[CS] Infectious diseases such as STDs and COVID-19 are possible to spread due to inflow of construction workers, operation workers or travelers. [OS] No impact is predicted because the project is focused on the improvement of existing intersections.
28	Labor Environment including Safety	v	-	[CS] Accident and harm to the health for workers in the construction area are predicted. [OS] No impact is predicted because the project is focused on the improvement of existing intersections.
Others				
29	Accident	v	-	[CS] There is a possibility of unexpected accident due to the operation of construction machinery in the construction yard. The number of traffic accidents may increase due to the construction. [OS] No impact is predicted because the project is improving of existing intersections.
30	Transboundary Impact and Climate Change	-	-	[CS] Temporary increase of GHG emission due to use of construction vehicles and machines is predicted, however, the impact is negligible. [OS] Reduction of GHG emission from vehicles is expected due to traffic moderation.

Source: JICA Study Team

Based on the result of scoping, a TOR in this project[匠玉36] is prepared to assess the impact as shown in the table below.

Table 28 TOR

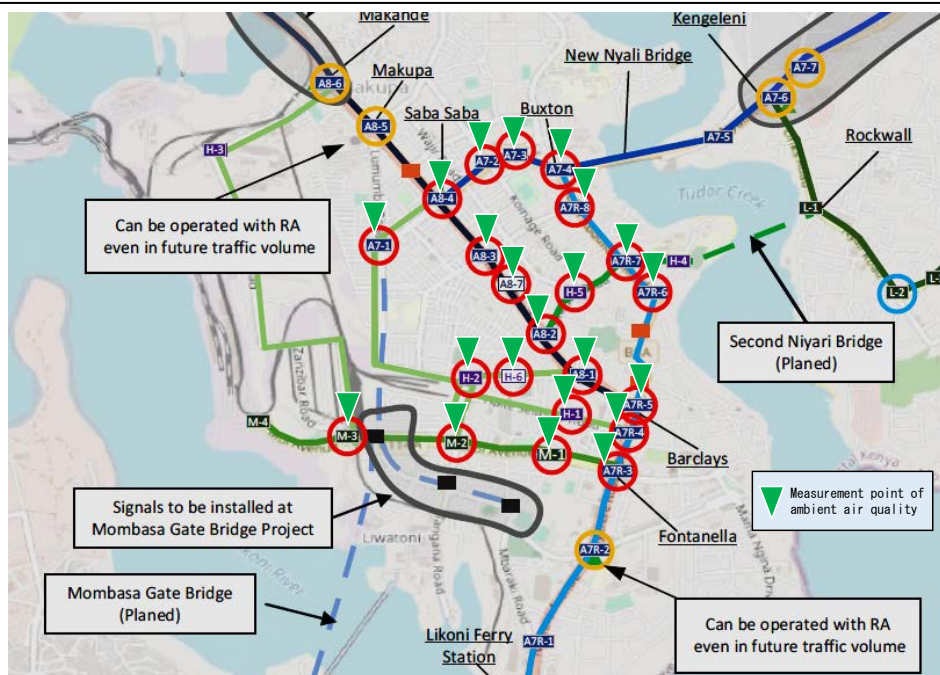
Item	Survey Item	Method
Air Quality	- Standard of air quality - Obtaining baseline data	- Information collection of legislation - Site survey
Waste	- Confirmation of waste management system	- Information collection of legislation
Noise and Vibration	- Standard of noise and vibration - Obtaining baseline data	- Information collection of legislation - Site survey
Land Acquisition and Resettlement	- Confirmation of land ownership	- Information collection of legislation - Site survey
Existing Social Infrastructure and Services	- Confirmation of public facilities in the project site	- Site survey
Cultural Heritage	- Confirmation of existence of cultural heritage in the project site	- Site survey - Opening hearing to related organization
Landscape	- Confirmation of existence of cultural heritage in the project site	- Site survey - Opening hearing to related organization
Gender	- Confirmation of impact on gender	- Information collection of legislation
Children's Right	- Confirmation of impact on children's rights	- Information collection of legislation
Infectious Diseases such as HIV/AIDS	- Confirmation of impact on infectious disease	- Information collection of legislation
Labor Environment including Safety	- Confirmation of safety measures	- Confirmation of contents of construction and considerations of measures
Accident	- Confirmation of traffic management during construction	- Confirmation of contents of construction and considerations of measures

Source: JICA Study Team

1.6.6 Survey Result of Environmental and Social Considerations

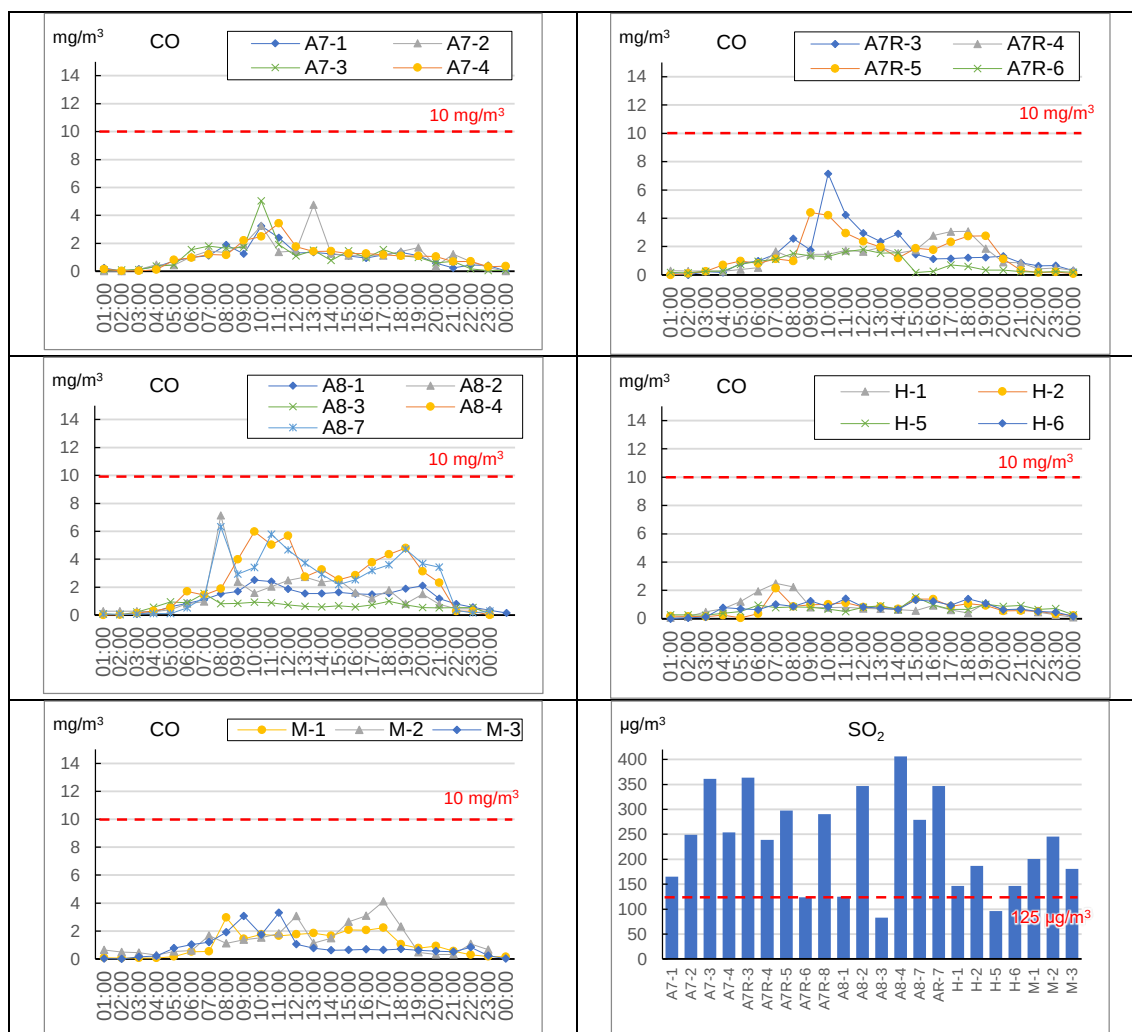
1.6.6.1 Air Quality

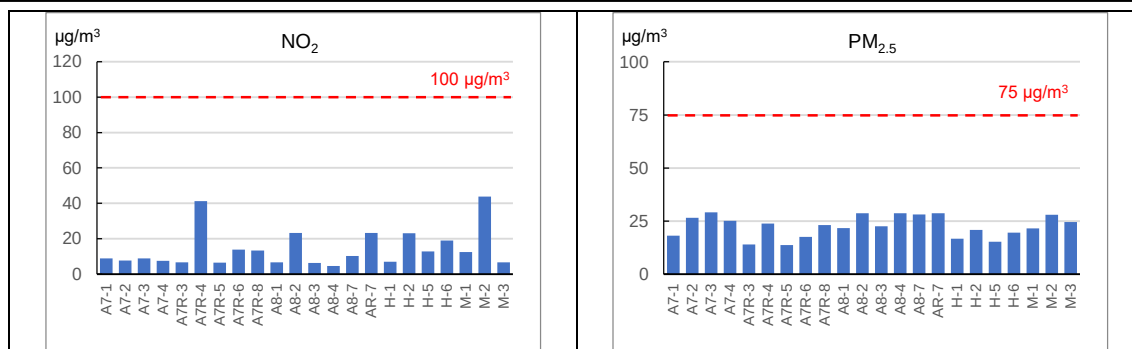
Ambient air quality is measured at 22 locations (target 22 intersections) to obtain baseline data as shown in the figure below during the period from March 24, 2022, to April 19, 2022.[匠玉37] The result comparing the Kenya standard value is shown also in the figure below. In all locations, the measured baseline data of NO₂, PM2.5 and CO meet the Kenya standard value. However, in almost all locations, the measured baseline data of SO₂ exceeds the Kenya standard value. Pollution source is emission from diesel engine vehicles. In Mombasa City, volume of traffic is high at the peak commute time in the morning and evening; thus, traffic congestion occurred. Due to high volume of traffic and traffic congestion, concentration of air pollution is high at the intersections and the baseline data exceeds the standard. During construction, emission from construction vehicle and machines will be additional pollution source. Baseline data already exceeds the Kenya standard value; however, during construction, mitigation measures shall be taken.



Source: JICA Study Team

Figure 48 Measurement Point of Ambient Air Quality





Source: JICA Study Team

Figure 49 Baseline Survey Result on Ambient Air Quality

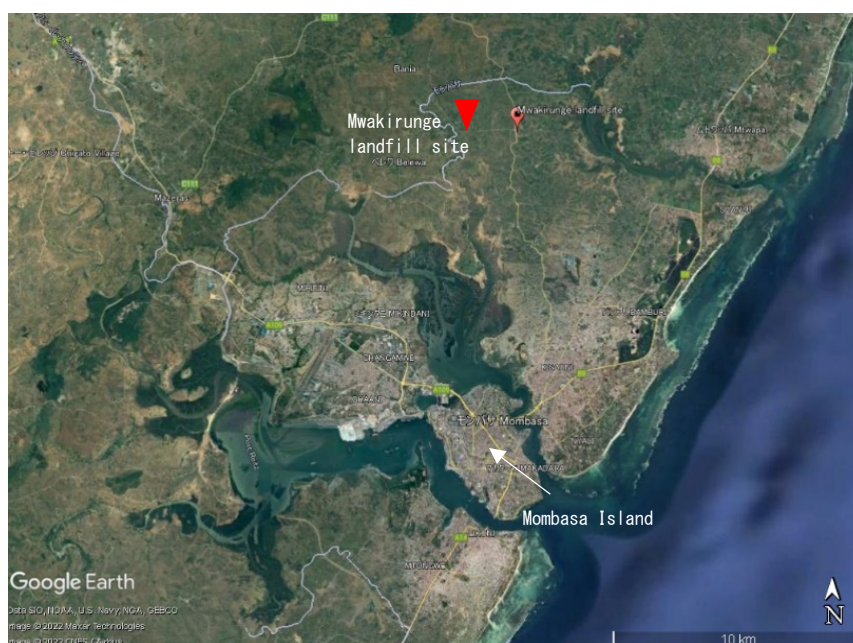
1.6.6.2 Waste

During construction, waste such as removed roundabout, pavement, and median will be generated. [TA綾38][KR竜39] The Mwakirunge landfill site is confirmed with CGM for disposing construction waste. The generated waste will be collected at the construction site and transported to the landfill site. The location is shown in the figure below. The estimated amount of waste from construction is shown in the table below. The area of Mwakirunge landfill site is 50 acres and it receives 270 t/day of waste. Assuming the generated waste is stacked 5 m high, 732 m² would be required. The required landfill area for the waste is approximately 0.36% of the whole area; thus, Mwakirunge has enough capacity for landfilling the waste.

Table 29 Estimated Amount of Waste

Construction Work		Amount	
Removal and disposal of pavement slabs		m ³	1,560
Concrete demolition and disposal	General Reinforced Structures	m ³	10
	Unreinforced Structure	m ³	2,090

Source: JICA Study Team



Source: JICA Study Team

Figure 50 Location of Mwakirunge Landfill Site

1.6.6.3 Noise and Vibration

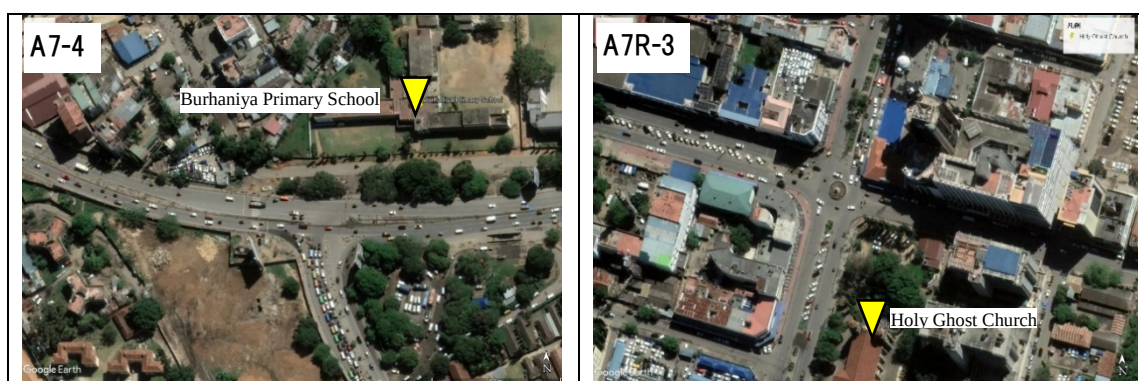
The main source of noise and vibration will be roundabout removal and excavation work. According to the Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009, the noise standard values of 75 dB in daytime and 65 dB in nighttime are applied for construction site. However, the standard of vibration is not established in Kenya; thus, the Japanese standard is applied for the project. The Japanese standard is shown in the table below. The project site is “residential/commercial/industrial area” and the vibration standard values of 70 dB in daytime and 65 dB in nighttime are applied. During construction, generated noise by roundabout removal and excavation work will exceed the standard. [TA綾40][KR竜41] According to the Environmental Management and Coordination (Noise And Excessive Vibration Pollution Control) Regulations, 2009, if noise exceeding permissible levels is generated, the project implementer (CGM) must apply for a permit from NEMA, and must minimise noise/ vibrations in excess of permissible levels is needed[TA綾42][KM43][匠玉44] and mitigation measures shall be taken to minimize the impact. In some of the intersections, sensitive receptor is identified as shown in the figure below and the distance from the source of noise/vibration to the sensitive receptor is shown in the table below. However, the impact is not significant because construction period is and the excess noise and vibration are temporary. The construction periods are 7.5 months for Package I, 3 months for Package II, and 2 months for Package III.

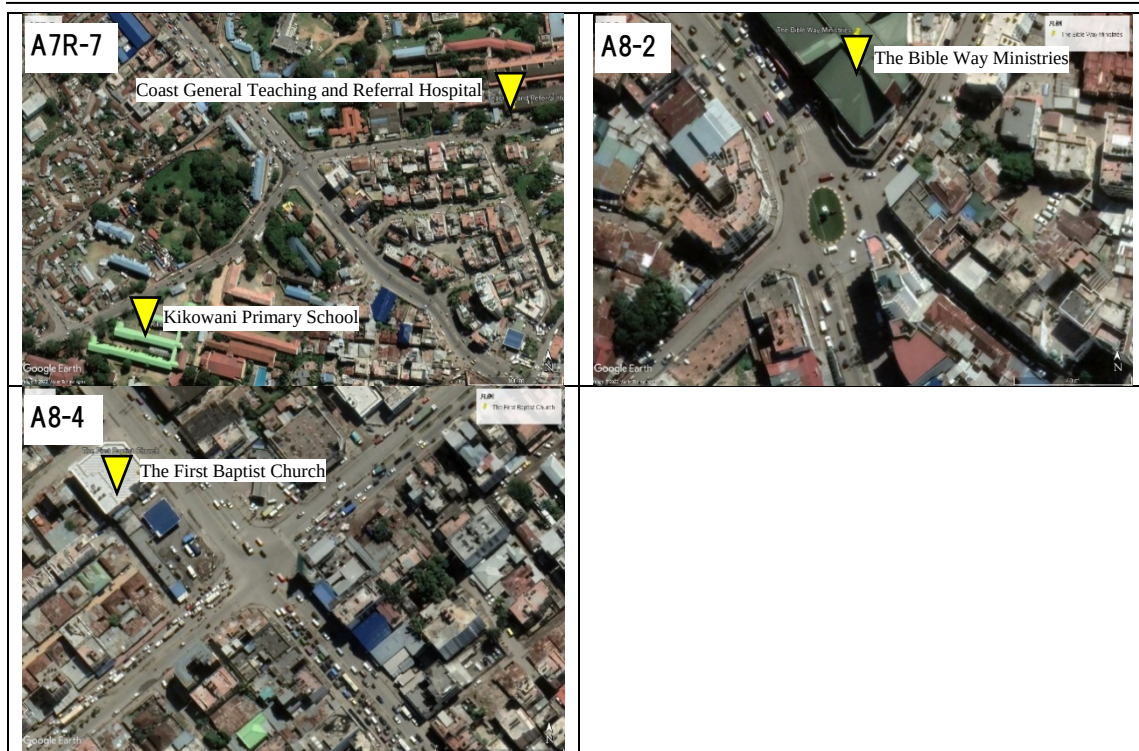
- Package I: Construction in 19 intersections (other than A7R-3, A7R-4, A7R-5) during daytime
- Package II: Construction in 19 intersections (other than A7R-3, A7R-4, A7R-5) during nighttime
- Package III: Construction in 3 intersections (A7R-3, A7R-4, A7R-5) during nighttime

Table 30 Limit of Road Traffic Vibration

Category	Day	Night
Silent area / Residential area	65 dB	60 dB
Residential / Commercial / Industrial area	70 dB	65 dB

Source: The Enforcement Regulation of Law of Vibration Regulation, MoE, J





Source: JICA Study Team

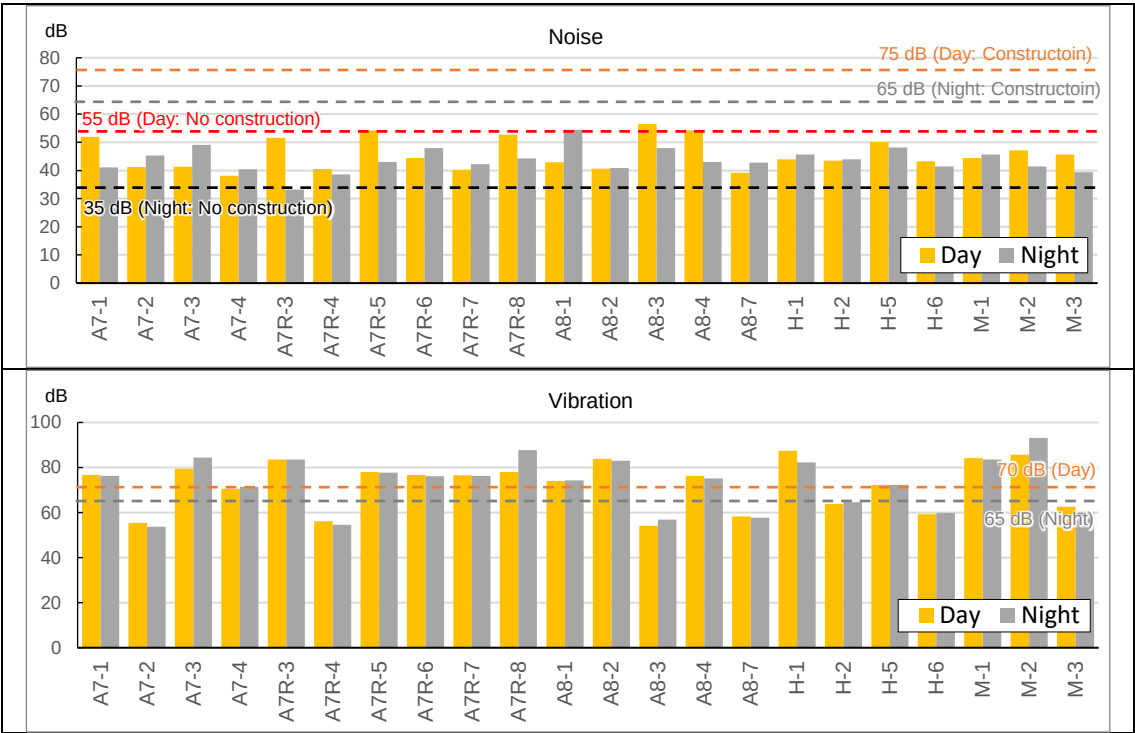
Figure 51 Location of Sensitive Receptor[TA綾47][KM48]

Table 31 Distance from Source of Noise/Vibration to Sensitive Receptor

Intersection	Distance	Description
A7-4	34 m	From the edge of road to the nearest point of facility to the road.
A7R-3	10 m	From the edge of road to the nearest point of facility to the road.
	69 m	From the edge of roundabout to the nearest point of facility to the road.
A7R-7	3 m	From the edge of road to the nearest point of facility (school) to the road.
	5 m	From the edge of road to the nearest point of facility (hospital) to the road.
A8-2	2 m	From the edge of road to the nearest point of facility to the road.
	13 m	From the edge of roundabout to the nearest point of facility to the road.
A8-4	3 m	From the edge of road to the nearest point of facility to the road.

Source: JICA Study Team

Noise and vibration levels are measured at 22 locations (target intersections) to obtain baseline data as shown in the figure below[cdv49]. The noise level at daytime does not exceed the standard in almost all intersections; however, the noise level at nighttime exceeds the standard in almost all intersections. Vibration level is shown in the figure below. Heavy vehicle is one of main sources of vibration and causes large value of vibration depending on the number of vehicles, travelling speed, and condition of pavement.

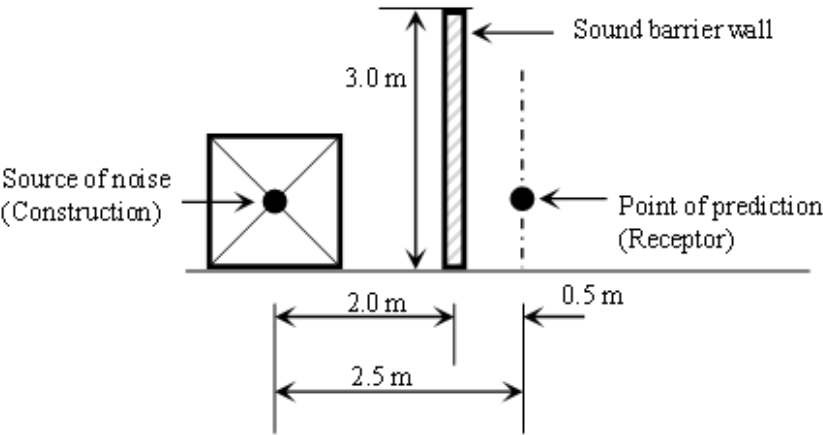


Note: Noise (Day: 6:01-18:00 Night: 20:01 -6:00), Vibration (Day: 8:00-19:00, Night: 19:00-8:00)

Source: JICA Study Team

Figure 52 Baseline Survey Result on Noise and Vibration

Increase of noise and vibration levels due to construction work is predicted and the result of prediction is shown in the tables below. Distance from the construction location (source of noise and vibration) to the receptor is assumed at 2.5 m and the noise and vibration level from 2.5 m away from the source of noise and vibration is predicted. Image of prediction is shown in the figure below. Although the period of construction work is limited and impact of noise is temporary, the predicted noise level will exceed the standard value even with the sound barrier wall. Regarding noise, use of concrete breaker, which is used for removal work, is the biggest source of vibration. The predicted vibration level will not exceed the standard values in daytime and nighttime.



Source: JICA Study Team

Figure 53 Image of Noise and Vibration Level Prediction

Table 32 Predicted Noise Level

Construction Work	Noise Level (dB)			Standard Value (dB)	
	Source of Noise*	Without Temporary Wall	With Temporary Wall	Day	Night
Excavation	113	105	85	75	65
Demolition	119	111	91		
Pavement	106	98	78		

Source: *ASJ Prediction Model 2007 for Construction Noise

Table 33 Predicted Vibration Level

Construction Machine	Vibration level (dB)		Standard Value (dB)	
	Source of Vibration	Predicted Vibration Level	Day	Night
Bulldozer	66**	60	70	65
Backhoe	63**	57		
Motor grader	54*	48		
Road roller	59*	53		
Vibration roller	69**	63		
Tire roller	48**	42		
Tamping machine	55**	49		
Asphalt finisher	64**	58		
Concrete breaker	70*	64		
Truck crane	40**	34		
Rough terrain crane	40**	34		

Source: *Handbook for Noise and Vibration Control Measures Associated with Construction Work, Third Edition (2001, Japan Construction Machinery Association)

**Survey and Test Report on Prevention and Elimination of Construction Noise and Vibration (1979, Public Works Research Institute, Ministry of Construction)

Regarding noise, application for a license to emit noise in excess of permissible levels is required. The license will be issued with condition of construction time and the measures are also stated in the license. It is important to install temporary walls, locate noisy machinery as far away as possible, and conduct maintenance such as lubricating and inspecting machinery, especially if sensitive receptors are located nearby. It is also necessary to inform sensitive receptors individually about working hours/periods to minimize the number of complaints.

1.6.6.4 Land Acquisition and Resettlement

The project is implemented within the RoW and the improvement plan considers avoiding land acquisition. Moreover, the project activity does not include expansion of the road width and the area of intersection will be narrow. Example of pedestrian path in target intersections is shown in the figure below. In all intersections, pedestrian path is already developed and not removed by the project. In the pedestrian path in some of the intersections, there are street vendors as shown in the figure below; however, they temporarily occupy pedestrian path for selling goods such as food and can move easily, if necessary. Thus, during construction, such street vendors can move away from the construction site temporarily[TA 續52][KR 竜53] and can continue their business. Therefore, resettlement and compensation for such people are not required. The construction periods are 7.5 months for Package I, 3 months for Package II, and 2 months for Package III; thus, street vendors need to move temporarily during the construction period.

- Package I: Construction in 19 intersections (other than A7R-3, A7R-4, A7R-5) during day

time

- Package II: Construction in 19 intersections (other than A7R-3, A7R-4, A7R-5) during night time
- Package III: Construction in 3 intersections (A7R-3, A7R-4, A7R-5) during night time



Figure 54 Example of Pedestrian Path (A8-7)

Source: JICA Study Team



Figure 55 Example of Street Vendors in Target Intersections

Source: JICA Study Team

During the site survey, the existence of street vendors who occupy the pedestrian path was observed. Almost all of them temporarily occupy the place and can move easily. The possibility that they can move or not is not determined visually; but as per interview conducted verbally at the site, they confirmed their willingness to move. [TA 綾54] [KR 竜55]

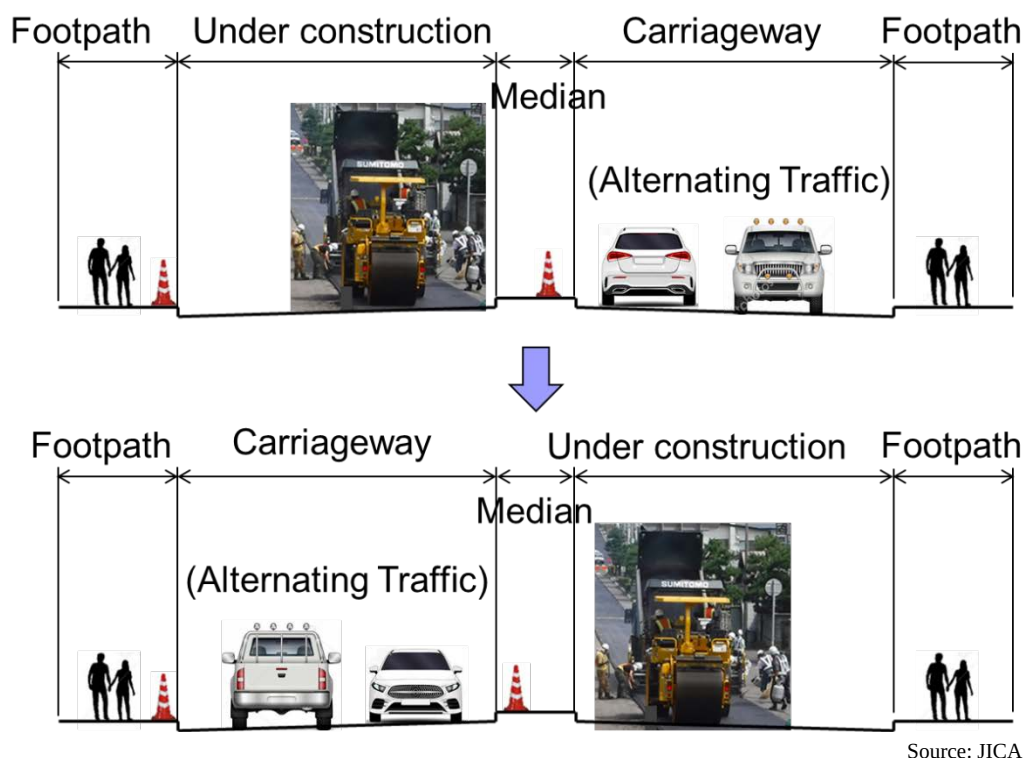


Source: JICA Study Team

Figure 56 Observed Street Vendors Who Temporarily Occupy the Place

1.6.6.5 Existing Social Infrastructure and Services

During construction, temporary traffic congestion is predicted. However, road and intersection are not blocked and one lane can be used even during construction as shown in the figure below. Thus, impact on existing traffic infrastructure is not significant but not negligible.



Source: JICA Study Team

Figure 57 Method of Construction Work to Avoid Blocking the Road

1.6.6.6 Cultural Heritage

According to the National Museum of Kenya, superstructures on the roundabout in the target intersections are not monument. As confirmed, there is no superstructure on the roundabout which is declared as a monument in the target intersections. Monument is defined in the National Museums and Heritage Act as follows:

- (a) A place or immovable structure of any age which, being of historical, cultural, scientific, architectural, technological or other human interest, has been and remains declared by the Minister under section 25(1)(b) to be a monument.
- (b) A rock-painting, carving or inscription made on an immovable object.
- € An ancient earthwork or other immovable object attributable to human activity.
- (d) A structure which is of public interest by reason of the historic, architectural, traditional, artistic or archaeological interest attached to it; and has been and remains declared by the Minister under section 25(1)(b) to be a monument; a€(e) A shipwreck more than fifty years old, and such adjoining land as may be required for maintenance thereof.

The list of superstructures on the roundabout, which was removed by the project, is shown in the table below. According to the Department of Youth, Gender, Sports and Cultural Affairs, these superstructures are beautification works.



Figure 58 List of Superstructures on the Roundabout Removed by the Project

Source: JICA Study Team

1.6.6.7 Landscape

Superstructures on the roundabout are not monuments but beautification works. Thus, even if the landscape of roundabout is changed due to the removal of the superstructures, impact is negligible and the project does not make the landscape worse.

1.6.6.8 Gender

The following points are potential issues on gender:

- Women may suffer from discrimination in employment or wages
- What lies behind the spread of sexually transmitted diseases is gender issues, such as the balance of power between men and women

In Kenya, the 2010 Constitution includes the following points considering gender issues and there are other related legislations as well. However, detailed guide / practice is not confirmed. Thus, to consider the abovementioned issues, appropriate measures should be taken.

- Equality in leadership with 33% as the critical mass preferred for women leadership
- Equality in marriage
- Equality in employment
- Equality in access to education
- All discriminatory customary practices are prohibited
- Matrimonial property is protected
- Women rights to inheritance and to own land is guaranteed
- Equal parental responsibility
- Requirement for both public and private entities to comply with the inclusion principles and gender, among others

1.6.6.9 Children's Right

According to the Kenya National Bureau of Statistics (KNBS), 8.5% of children, or 1.3 million, are engaged in child labor. The highest child labor rates, at more than 30%, are in the arid and semi-arid land (ASAL) counties. Here, many boys are sent out to herd livestock or harvest sand, while girls are married early or engaged in domestic work. The COVID-19 pandemic also created an impact – in April 2020, KNBS reported that around 1.72 million people in Kenya had lost their jobs since the start of the pandemic. With this significant loss of income, a growing number of families may resort to sending their children to work.

According to Kenya - Coast Province, Mombasa Multiple Indicator Cluster Survey 2009, in Mombasa informal settlements, more than six percent of the children aged 5-14 years are engaged in child labor. The incidence is much higher where mothers have no education (12 percent) compared with mothers educated up to secondary or above (5 percent). A similar negative association is observed between prevalence of child labor and household wealth index.

Table 34 Results of Child Labor by the Type of Work and Selected Characteristics

Table 11.2: Child labour (CP.2)					
Percentage of children aged 5-14 years who are involved in child labour activities by type of work, Mombasa Informal Settlement Survey, Kenya, 2009					
	Working outside household		Working for family business	Total child labour¹	Number of children aged 5-14 years
	Paid work	Unpaid work			
Sex					
Male	3.1	2.5	1.7	7.3	291
Female	1.0	3.1	1.9	5.6	309
Age					
5-11 years	2.0	3.8	2.4	7.9	449
12-14 years	2.0	0.0	0.0	2.0	150
Mother's education					
None	3.4	2.4	6.2	12.0	91
Primary	1.8	3.5	0.6	5.8	338
Secondary +	1.8	1.8	1.8	4.8	164
Wealth index					
Low	3.3	2.5	4.1	9.5	209
Medium	3.0	4.4	0.0	7.4	167
High	0.0	1.9	0.9	2.8	224
Religion of household head					
Christian	2.0	1.7	1.0	4.7	302
Muslim	1.4	3.4	2.6	7.1	287
Total	2.0	2.8	1.8	6.4	600
¹ MICS indicator 8.2 Note: 7 children with missing information on mother's education and 11 children belong to other religion are not shown separately.					

Source: Kenya - Coast Province, Mombasa Multiple Indicator Cluster Survey 2009

The law provides for the protection from child labor and armed conflict under The Children Act, No. 8 of 2001. Section 10 provides that every child shall be protected from¹:

- Economic exploitation;
- Any work that interferes with his/ her education, or is harmful to the child's health or physical, mental, spiritual, moral or social development; and
- Recruitment to hostilities, armed conflicts, and where armed conflict occurs.

In case a person considers any child to be employed in any activity which constitutes the worst form of child labor, Section 54 of the Employment Act provides for complaints and directs them to the labor officer or a police officer of the rank of an inspector and above. The labor officer or a police officer will then either carry out an investigation within seven days of reporting and submit the findings to the minister.

Section 64 declares an offence for any person who employs, engages, or uses a child in an industrial undertaking in contravention of the provisions of Part VII of the Employment Act. Such a person will be liable to a fine not exceeding KES 200,000 or to an imprisonment of not more than one year or both.

1.6.6.10 Infectious Diseases such as HIV/AIDS

Implementation of the project will generate a lot of construction workers. Considering the situation of HIV prevalence in Mombasa, enlightenment and education for the construction

workers to prevent expanding AIDS/HIV prevalence are required.

¹ <https://africapay.org/kenya/labour-laws/fair-treatment-at-work/children-at-work>

1.6.6.11 Labor Environment including Safety

Construction works include the use of heavy machines and carrying heavy materials. Such physical work is high risk for safety. Measures for protecting works are required.

1.6.6.12 Accident

Construction works include the use of heavy machines and carrying heavy materials. Such physical work is high risk for safety. Moreover, risk of traffic accident will be high because construction vehicles will increase.

The following safety measures are required at construction sites.

- Deployment of security guards (No unauthorised access to construction sites)
- Installation of signs and notices (e.g., No Entry)
- Ensure the pavement
- Regulating construction vehicle access times and routes[匠玉56]

1.6.6.13 Transboundary Impact and Climate Change

Due to improvement of intersections, traffic is moderated and the project will contribute to reduce GHG emission from vehicles. The positive impact is calculated as 803 t-CO₂/year reduction and is equivalent to annual carbon sink of 211 ha of moderate dryland forest.

1.6.7 Impact Assessment

The result of impact assessment is shown in the table below.

Table 35 Impact Assessment Result

No.	Item	Selection Status		Impact Assessment		Reasons for Evaluation
		PCS/CS	OS	PCS/CS	OS	
Pollution Control						
1	Air Quality	v	-	B-	N/A	[CS] Baseline data already exceeds Kenyan standard due to emission from vehicles especially at commuting peak time in the morning and evening. There is possibility that construction vehicles and machines will cause air quality deterioration, thus, mitigation measures shall be taken not to cause more air pollution.
2	Water Quality	-	-	N/A	N/A	-
3	Waste	v	-	B-	N/A	[CS] Generated waste is transported to Mwakirunge landfill site.
4	Soil Contamination	-	-	N/A	N/A	-
5	Noise and Vibration	v	-	B-	N/A	[CS] During construction, generated noise and vibration by roundabout removal and excavation work will exceed the standard. Thus, mitigation measures shall be taken to minimize the impact. However, the impact is not significant because construction period is limited, and exceeding noise and vibration is temporarily.
6	Ground Subsidence	-	-	N/A	N/A	-
7	Offensive Odor	-	-	N/A	N/A	-

No.	Item	Selection Status		Impact Assessment		Reasons for Evaluation
		PCS/CS	OS	PCS/CS	OS	
8	Bottom Sediment	-	-	N/A	N/A	-
Natural Environment						
9	Protected Area	-	-	N/A	N/A	-
10	Ecosystem	-	-	N/A	N/A	-
11	Hydrology	-	-	N/A	N/A	-
12	Topography and Geology	-	-	N/A	N/A	-
Social Environment						
13	Land Acquisition and Resettlement	v	-	D	N/A	[CS] The project is implemented within the RoW and street vendors can temporarily move out of the construction site and continue their business even during construction. There are no street vendors whose resettlement is required.[TA綾57][KR竜58] Construction period and location will be informed to the public before construction is started.
14	Poverty	-	-	B+	N/A	[CS] Positive impact is expected such as job creation for construction. Thus, the project generated job is expected to contribute to mitigating poverty.[TA綾59][KR竜60]
15	Ethnic Minority and Indigenous People	-	-	N/A	N/A	-
16	Local Economy such as Employment and Livelihood	-	-	B+	N/A	[CS] Positive impact is expected such as job creation for construction. Thus, the project generated job is expected to contribute to mitigating poverty.[TA綾61][KR竜62]
17	Land Use and Usage of Local Resources	-	-	N/A	N/A	-
18	Water Usage	-	-	N/A	N/A	-
19	Existing Social Infrastructure and Services	v	-	B-	B+	[CS] Existing social infrastructures and services are not stopped during construction and only temporal traffic congestions is predicted. Thus, the impact is limited. [OS] Intersection within the roundabout is changed to signalized intersection and the improvement will contribute to traffic moderation.
20	Social Institutions such as Socially Related Capital and Decision-making Organizations	-	-	N/A	N/A	-
21	Misdistribution of Benefit and Damage	-	-	N/A	N/A	-
22	Local Conflicts of Interest	-	-	N/A	N/A	-
23	Cultural Heritage	v	-	D	N/A	[CS] Superstructures on the roundabout in the target intersections are not monuments but beautification work. Thus, there is no impact on cultural heritage.

No.	Item	Selection Status		Impact Assessment		Reasons for Evaluation
		PCS/CS	OS	PCS/CS	OS	
24	Landscape	v	-	D	N/A	[CS] Superstructures on the roundabout in the target intersections are not monuments but beautification work. Thus, there is no impact on landscape.
25	Gender	v	-	B-	N/A	[CS] Same salary for same work and same job opportunity between male and female workers should be complied.
26	Children's Right	v	-	B-	N/A	[CS] Even child labor is prohibited as stipulated in the Children Act and Employment Act, a certain number of children are working currently. Measures should be taken to avoid child labor.
27	Infectious Diseases such as HIV/AIDS	v	-	B-	N/A	[CS] Due to increasing and inflow of workers in Mombasa City for construction works, risk of infectious disease such as HIV/AIDS and COVID-19 will be high. Measures should be taken regarding this matter.
28	Labor Environment including Safety	v	-	B-	N/A	[CS] Construction works including use of heavy machines and carrying heavy materials. Such physical work is high risk for safety. Measures for protecting work are required.
Others						
29	Accident	v	-	B-	N/A	[CS] Construction works include the use of heavy machines and carrying heavy materials. Such physical work is high risk for safety. Moreover, risk of traffic accidents will be high because construction vehicles increase. Measures for protecting work are required.
30	Transboundary Impact and Climate Change	-	-	N/A	B+	[OS] Due to the project, reduction of 803[MO63] t-CO ₂ /year is expected.

Source: JICA Study Team

Note: Project stage: PCS: Pre-construction stage, CS: Construction stage, OS: Operation stage

Impact: A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

D: No impact is expected.

N/A: Impact assessment is not conducted because the items were not checked v in the scoping phase.

1.6.8 Mitigation Measures and Cost

The Environment Management Plan is shown in the table below.

Table 36 Environment Management Plan

No.	Items	Environmental Management Plan	Implementing Organization	Responsible Organization	Cost
Pre-Construction Stage					
1	All	- Prior to construction, EIA approval is necessary. - Information on construction such as period and location is announced to the public	Consultant/ Contractor	CGM	To be determined
Construction Stage					
1	Air Quality	- Prepare and regular maintenance of construction machinery and vehicles to minimize air pollutants - Recommendation of idling stop activities - Water sprinkling to reduce particulate matter - Avoidance of long exposure	Contractor	CGM	Included in the construction cost

No.	Items	Environmental Management Plan	Implementing Organization	Responsible Organization	Cost
		- of stocked soil to strong winds by applying canvas covers - Periodically monitoring air quality to comply with air quality standards			
2	Waste	- Prepare the construction solid waste management plan in consideration with county's waste management system [TA 綾64][KR 竜65] (waste will be landfilled in Mwakirunge landfill site) - Proper handling of hazardous waste on site - Education on waste treatment for workers	Contractor	CGM	Included in the construction cost
3	Noise and Vibration	- Regular maintenance of construction machinery - Announcement of construction work to surround locators - To avoid disturbance of daily life, performing noisy activities during daytime, if possible - Adoption of lower noise and vibration construction method and machines - For hauling trucks, compliance with road weight limit standards to avoid ground vibration - Periodical monitoring of noise and vibration to comply with national standards - Installation of temporary wall	Contractor	CGM	Included in the construction cost
4	Existing Social Infrastructure and Services	- Coordination with CGM for the implementation of a traffic management scheme	Contractor	CGM	Included in the construction cost
5	Gender	- Positive employment of women for light works in construction activities such as cleaning with fair salary and other conditions - Prepare toilet and dressing spaces for women workers - Education on gender equality for workers	Contractor	CGM	Included in the construction cost
6	Children's Right	- Restrict child labor (workers under 14 years old) in contract with punishment - Report list of workers with their age information	Contractor	CGM	Included in the construction cost
7	Infectious Diseases such as HIV/AIDS	- Education on infectious diseases for workers - Preparation of occupational health management plan - Ensure COVID-19 protocol	Contractor	CGM	Included in the construction cost

No.	Items	Environmental Management Plan	Implementing Organization	Responsible Organization	Cost
		(Periodical PCR-Test)			
8	Labor Environment including Safety	- Education on occupational safety for workers - Provision of first-aid stations, safety equipment - Implementation of standard health and safety protocols, such as wearing proper and complete PPE	Contractor	CGM	Included in the construction cost
9	Accident	- Periodic maintenance of machinery and vehicles - Safety patrol - Sign boards	Contractor	CGM	Included in the construction cost
Operation Stage					
10	Air Quality	- Monitoring - Additional mitigation measures are considered if complains from local people is raised and report on health problem is reported	CGM	CGM	Monitoring cost only
11	Noise and Vibration	- Monitoring - Additional mitigation measures are considered if complains from local people is raised and report on health problem is reported	CGM	CGM	Monitoring cost only

Source: JICA Study Team

1.6.9 Monitoring Plan

The Environment Monitoring Plan is shown in the table below.

Table 37 Environment Monitoring Plan

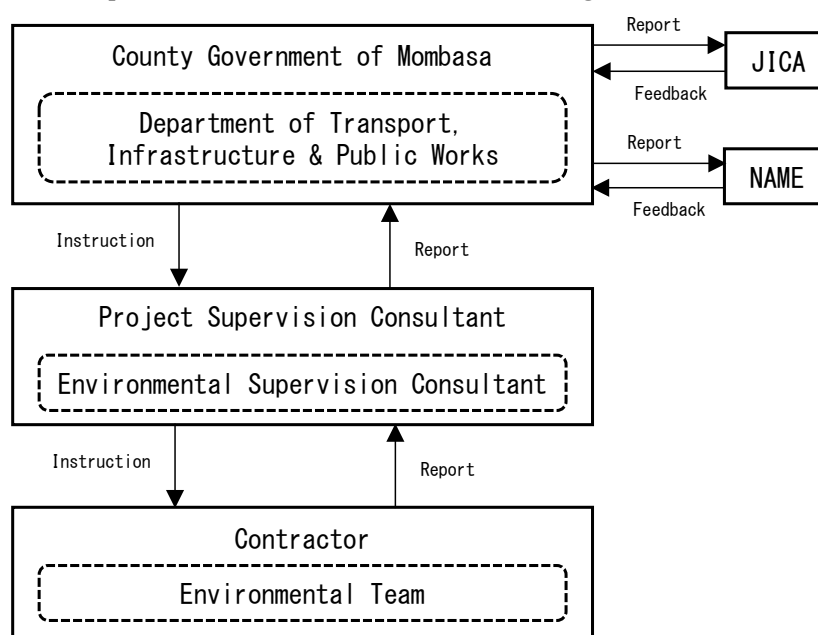
No	Environmental Item	Items	Location	Frequency	Responsible Agent	Supervisor	Cost
Construction Stage							
1	All	Visual check to confirm the implementation of mitigation measures	Construction sites	Daily or Weekly	Contractor	CGM	Included in the construction cost
2	Air Quality	PM10, PM2.5, SO ₂ , CO, NO ₂	Construction sites	Quarterly	Contractor	CGM	Included in the construction cost
3	Waste	Types and amount of solid waste	Temporal waste storage	Quarterly or collection period	Contractor	CGM	Included in the construction cost
4	Noise and Vibration	Sound level and vibration.	Construction sites	Quarterly	Contractor	CGM	Included in the construction cost
5	Infectious Diseases such as HIV/AIDS	Visible observation, interview, grievance record	Construction sites	Once a month	Contractor	CGM	Included in the construction cost

No	Environmental Item	Items	Location	Frequency	Responsible Agent	Supervisor	Cost
		s, record of education					
6	Labor Environment including Safety	Visible observation, interview, grievance records, record of education, record of safety patrol, sign boards	Construction sites	Once a month	Contractor	CGM	Included in the construction cost
7	Accident	Record of accident, record of education, sign boards	Construction sites and surrounding areas	Once a month, on demand	Contractor	CGM	Included in the construction cost
Operation Stage							
8	Air Quality	PM10, PM2.5, SO ₂ , CO, NO ₂	22 intersections	2 times (for warranty 1 year)	CGM	CGM	6,600,000 KES
9	Noise and Vibration	Sound level and vibration.	22 intersections	2 times (for warranty 1 year)	CGM	CGM	

Source: JICA Study Team

1.6.10 Implementation Structure

The County Government of Mombasa is the organization responsible for the monitoring and monitoring conducted by a contractor based on the instruction of the consultant. The result of monitoring is submitted from the County Government of Mombasa to NEMA and JICA. Feedback will be sent from NEMA and JICA to the County Government of Mombasa, if necessary. The implementation structure is shown in the figure below.



Source: JICA Study Team

Figure 59 Implementation Structure

1.6.11 Stakeholder Consultation Meeting

The stakeholder meeting for this study was conducted on 9 December 2021 at Sentrim Castle Royal Hotel. A total of 38 participants (male 31, female 7) joined the meeting. The summary is shown in the table below. [TA綾66][KR竜67] The main activity of the project is improvement of intersection by removal of roundabout; thus, the following organizations are identified as stakeholders of the project. Invitation letter is distributed from CGM one week before the meeting and a part of the meeting is facilitated by female staff of the local consultant and opinion from female attendees is considered.

- 1) Mombasa County Government
- 2) County Commissioners' Office
- 3) National Museums of Kenya, Mombasa
- 4) Kenya Forestry Service
- 5) Regional Traffic Office, Mombasa
- 6) Kenya Ports Authority- Operations Department
- 7) Tuk Association of Mombasa
- 8) Matatu Association of Mombasa
- 9) Mombasa Water and Sewerage Company
- 10) Kenya Power and Lighting Company, Mombasa
- 11) Kenya National Highways Authority, Mombasa
- 12) Kenya Urban Roads Authority, Mombasa
- 13) Kenya National Chambers of Commerce, Mombasa

Table 38 Summary of Stakeholder Meeting

Items		Contents	
Time & Date		10:35 a.m. – 12:18 p.m. 9 December,2021	
Venue		Sentrim Castle Royal Hotel	
Participants		National Museum of Kenya, Safaricom, MOWASCO, KPS, Mombasa Tuk Association, NEMA, KPS, Motor Owners Mombasa, KPA, County Government	
Agenda		1. Explanation of the project 2. QA session	
Record of Discussion			
S/N	Name	Questions/Concerns	Answers/Clarifications
1	Dennis Okoth-Kenya Transporters Association	The ITS project is a brilliant idea by the County Government of Mombasa and JICA which should ensure improving traffic flow and standards. The project should not rob people off their businesses rather it should revive the economic status of Mombasa County. (He gave an example of the recent stalemate between the government and truck drivers on SGR cargo transportation conditions.)	There will be no competition between trucks and SGR. JICA has invested heavily (around 3,4 billion [cdv68]) in developmental projects in Mombasa County. These projects will greatly increase job opportunities in Mombasa County and improve the economic status of Mombasa County. In the future, Mombasa will be an industrious county. Currently, all proposed projects in Mombasa are aimed at helping Mombasa people adjust for better times to come.
2	Mariam Mapenzi-Operations Manager MOWASCO	Has non-motorized traffic been taken care of? Will it be incorporated into the ITS?	The project is specified to improve intersections and does not include construction of new pedestrian walkways. ITS will have pedestrian crossing areas.
		Can information from these cameras be shared with other departments to control vandalism of infrastructures or littering in town? The images can be used as evidence to prosecute those littering the city. This will help in managing clean environment.	Sharing of information can be done in many ways as issues of data sharing are handled by legal policies. However, the information which could be shared would be discussed at a later stage of the project after further consultation.

3	Francis Mwangi – Base Commander Kenya Police Service	There are many PSV vehicles on the road. Some are transit vehicles being used locally or they have been sold but legal ownership transfer has not been done. How will the ITS project deal with such cases in case of road offenses in absence of traffic police officers?	Further consultation would be done with the Police Department to build synergy. Also, a multi-agency approach to traffic management will be put in place at the control center. Three main agencies will be at the control center, that is the County Traffic Unit, the NTSA, and the traffic police.
		Major challenge is that majority (about 45% of workers rely on walking as their primary form of transportation, and over a third (37%) rely on public transportation) of workers in Mombasa Walk to and from their working areas. As such, it is very difficult to control human traffic in the CBD using ITS. Another design challenge is on the location of the zebra crossing proposed in this project. The zebra crossing areas are located at the curve-end/edge around the intersection, which is unsafe to pedestrians because they cannot be easily seen by the motorists; and motorists tend to speed off at the curve areas. The zebra crossing should be moved far from the immediate corner/curves.	It is true that most of the time controlling different aspects of pedestrian behaviors, such as pedestrian walking speed, pedestrian delay, gap acceptance, signal compliance, route choice may be very difficult. The issue of location of crossways/zebra crossing is a design issue which will be discussed with the design team. The project is in its preparatory stage and the JICA Study Team is optimistic on several design revisions before implementation.
		Markings of the road should consider data from the NTSA. They have important data on road like blackspot areas.	Noted
		Road mappings are done on road surface instead of erecting signposts which are later stolen.	Noted
		The National Police Service has had problems in controlling traffic in Mwembe Tayari where vehicles park on the road. A parking area should be set outside CBD area to accommodate these vehicles, especially the long-distance PSV vehicles.	Noted
4	Nicodemus Wanjala-Safaricom	The main interest of Safaricom is in data cables and surveillance cameras located in the existing reserves which are mostly targeted by this project. Will the ITS project integrate existing cameras and data cables within the proposed project areas?	The ITS project does not intend to disrupt existing services in the CBD. The consultants will conduct an inventory of the project sites and develop ARAP to guide displacement of any asset whether for individual or corporate entity.
		Will there be a budget for potential damage or relocation of existing infrastructure?	An Abbreviated Resettlement Action Plan (ARAP) will be prepared, all affected structures will be identified, and a costed asset register will be prepared to aid in their compensation and replacement.
5	Ali Salim Bateg – Matatu Owners Association.	Members of Matatu owner's associates fully support these projects as these will reduce cost of movement in Mombasa County and also improve the economic status of Mombasa County.	Noted
6	Eng Jacob Kuria-	Some reticulation systems in Mombasa are too old with some running beneath existing roads. Water service	More consultations will be held with different stakeholders to help in identifying existing and proposed infrastructure in

	Engineer MOWASCO	institutions such as Mombasa water should be consulted to share their reticulation networks around Mombasa town to mitigate their destruction.	order to integrate them with ITS proposals in the feasibility study stage of the ITS project.
		Will the Bus Rapid Transit (BRT) be incorporated into this project?	The ITS project is aimed at improving intersections in Mombasa town and is not involved in the BRT project.
7	Stanislaus Jambo Harro-Archeologist National Museums of Kenya.	National Museum of Kenya (NMK) is the custodian of all human heritage in the country. The NMK office will need maps of the project area in order to incorporate them into their database and examine whether they touch on any of their active sites. NMK will advise on mitigation measures of the affected sites.[TA綾69][KR竜70][TA綾71]	The project intends to consult widely with all sectorial mandate holders. NMK plays a vital role in this project and further consultation will be held with NMK.

Source: JICA Study Team

1.6.12 Monitoring Form

Based on the monitoring plan, the organizations responsible shall conduct monitoring. The monitoring form is drafted as follows:

Construction Phase

1. Response/ Action to Comments and Instruction from Authorities and the Public

Comments or Instructions		Response/ Action Taken by the Contractor
Authority (Government)		
Public (Residents)		

*Please add table if necessary

2. Pollution

Air Quality

Measurement Point (Coordinates)			Location Description		
Measurement Date			(yyyy/mm/dd)		
Parameter	Unit	Measured Value	Kenya Standard Value	International Standard Value (WHO Guidelines 2021)	Note (Frequency, Source, Implant Recipients etc.)
[匠玉72]PM2.5	□g/m ³		75(24-hr)	*Average time 24 hrs 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (Interim target-4) 15 (Guideline)	
SO ₂	□g/m ³		125(24-hr)	*Average time 24 hrs 125 (Interim target-1) 50 (Interim target-2) 40 (Guideline)	
NO ₂	□g/m ³		150(24-hr)	*Average time 24 hrs 120 (Interim target-1) 50 (Interim target-2) 25 (Guideline)	
CO	mg/m ³		10(1-hr)	-	

*Please add table if necessary

Waste (Disposal Site)			
Item	Photo of the Disposal Site	Observations (e.g., Distance from the residence, messy/ tidy)	Note (Frequency, data source etc.)
Status of the Disposal Site			

*Please add table if necessary

Noise and Vibration					
Measurement Point (Coordinates)					Location Description
Measurement Date			(yyyy/mm/dd)		
Parameter	Unit	Measured Value	Applied Standard Value	International Standard Value (WB)	Note (Frequency, Source, Implant Recipients etc.)
Noise	dB	(Leq)	75 (Day time) 65 (Nighttime) *Kenya standard value	55 (Residential Area, Daytime)	
Vibration	dB	(L _{Max})	70 (Day time) 65 (Nighttime) *Japanese standard value	-	

*Please add table if necessary

3. Social

Existing Social Infrastructure and Service

Item	Village	Complaint	Measures to be Taken	Note
Complaints from surrounding communities				

*Please add table if necessary

Infectious Disease and HIV/AIDS

Item	Date	Location	Number of Participants	Description of Awareness Activity *Please attach material of awareness activity if any	Note
Awareness of					

Final Report

Infectious Disease					

*Please add table if necessary

Occupational Health and Safety

Item	Description of Accident	Causes for Accident	Note
Record of Accidents			

*Please add table if necessary

4. Others

Accident

Item	Description of Accident	Causes for Accident	Note
Record of Traffic Accident			
Caused by Construction Vehicles			

*Please add table if necessary

Operation Phase

1. Response/ Action to Comments and Instruction from Authorities and the Public

Comments or Instructions		Response/ Action Taken by the Project Proponent
Authority (Government)		
Public (Residents)		

*Please add table if necessary

2. Pollution

Air Quality

Measurement Point (Coordinates)			Location Description		
Measurement Date			(yyyy/mm/dd)		
Parameter	Unit	Measured Value	Kenya Standard Value	International Standard Value (WHO Guidelines 2021)[匠玉73]	Note (Frequency, Source, Implant Recipients etc.)
PM2.5	□g/m³		75(24-hr)	*Average time 24 hrs 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (Interim target-4) 15 (Guideline)	
SO₂	□g/m³		125(24-hr)	*Average time 24 hrs 125 (Interim target-1) 50 (Interim target-2) 40 (Guideline)	
NO₂	□g/m³		150(24-hr)	*Average time 24 hrs 120 (Interim target-1) 50 (Interim target-2) 25 (Guideline)	
CO	mg/m³		10(1-hr)	International Standard Value (WHO Guidelines 2021)	

*Please add table if necessary

Noise and Vibration

Measurement Point (Coordinates)			Location Description		
Measurement Date			(yyyy/mm/dd)		
Parameter	Unit	Measured Value	Applied Standard Value	International Standard Value (WB)	Note (Frequency, Source, Implant Recipients etc.)
Noise	dB	(Leq)	75 (Day time) 65 (Nighttime) *Kenya standard value	55 (Residential Area, Daytime)	
Vibration	dB	(L _{Max})	70 (Day time) 65 (Nighttime) *Japanese standard value	-	

*Please add table if necessary

1.6.13 Environmental Checklist [TA 綾74][KR 竜75]

The environmental checklist (road sector) was prepared as shown in the table below.

Table 39 Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) Y (d) N	(a) EIA report is required and is being prepared currently. It will be submitted during the study. (b) EIA is being prepared currently. (c) There is possibility that EIA approval will be issued with condition if NEMA identify any impact to be addressed. (d) Only EIA approval is required regarding environmental and social considerations.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the local stakeholders? (b) Have the comments from the stakeholders (such as local residents) been reflected in the project design?	(a) Y (b) N	(a) Stakeholder meeting was held to explain the project to the representatives' related organizations on 9 December 2021. Negative comments such as asking for cancellation of the project were not received. (b) During EIA reviewing procedure, EIA information is disclosed to the public and public comments will be collected.
	(3) Examination of Alternatives	(a) Have alternative plans for the project been examined with social and environmental considerations?	(a) Y	(a) Target intersections were selected from the long list with considerations on effectiveness of development and environmental and social impact as well.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic, will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	(a) Y (b) N	(a) Impact on air quality is temporally due to use of construction machines and vehicles. (b) In some of intersections, baseline air quality has already exceeded the standard. Thus, based on the Environment Management Plan, mitigation measures are necessary to be taken.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as parking areas/service areas, comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) N (b) N (c) N	(a) The project is conducted within the existing intersections and cutting and landfilling works are not included in the construction work. (b) Drained water from the surface of the road will be drained into drainage along the road and there is no impact to water resources such as groundwater. (c) The project is the improvement of existing intersections. Thus, wastewater is not generated in the project.
	(3) Wastes	(a) Are waste generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations?	(a) N	(a) The project is the improvement of existing intersections. Thus, waste is generated during only construction stage, and the construction waste is disposed to Mwakirunge landfill site.
	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) Y	(a) The project proponent shall comply with noise and vibration standard.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in the protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project is conducted within the existing intersections and there is no protected area.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impact on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accidents of wildlife and livestock? (e) Is there a possibility that installation of roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the project site is located in undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	(a) N (b) N (c) N (d) N (e) N (f) N	(a) The project is conducted within the existing intersections and there are no forest area and ecologically important habitat. (b) The project is conducted within the existing intersections and there is no ecologically important habitat. (c) The project is conducted within the existing intersections and there is no impact on ecosystem. (d) The project is conducted within the existing intersections and there is no impact on ecosystem. (e) The project is conducted within existing intersections and there is no impact on ecosystem. (f) The project is conducted within the existing intersections and there is no land that is newly developed.
	(3) Hydrology	(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) The project is conducted within the existing intersections and there is no impact on hydrology.
	(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cutting and fill areas, waste soil disposal sites, and borrowing sites? Are adequate measures taken to prevent soil runoff?	(a) N (b) N (c) N	(a) The project is conducted within the existing intersections and there is no risk on soft ground such as landslides. (b) The project is conducted within the existing intersections and cutting and landfill works are not included in the construction work. (c) The project is conducted within the existing intersections and cutting and landfill works are not included in the construction work.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is required, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in the document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secure to implement the plan? (i) Are any plans developed to monitor the impact of resettlement? (j) Is the grievance redress mechanism established?	(a) N (b) – (c) – (d) – (e) – (f) – (g) – (h) – (i) – (j) Y	(a) There are no people who require involuntary resettlement because the project is implemented within the existing intersections. (b) No resettlement is required. (c) No resettlement is required. (d) No resettlement is required. (e) No resettlement is required. (f) No resettlement is required. (g) No resettlement is required. (h) No resettlement is required. (i) No resettlement is required. (j) Grievance mechanism is established for the project.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Living and Livelihood	(a) Where roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any possibility that roads will impede the movement of inhabitants? (f) Is there any possibility that structures associated with roads (such as bridges) will cause sun shading and radio interference?	(a) N (b) N (c) Y (d) N (e) N (f) N	(a) The project is conducted within existing intersections and there is no land that is newly developed. (b) There are street vendors in target intersections however they can move easily, thus, they can move to out of construction area and continue their business during construction. (c) Risk of infectious disease such as COVID-19 and HIV/AIDS may become higher than usual due to increase of construction workers during construction. Measures such as distributing masks and condoms will be taken. (d) The project is improvement of intersection; thus, traffic congestion will be moderated. (e) The project is improvement of intersection; thus, traffic congestion will be moderated. (f) The project is improvement of intersection and no impact on sun shading and radio interference.
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There is no cultural heritage site within target intersections.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) There is no impact on landscape because the project is improvement of existing intersection.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?	(a) - (b) -	(a) There are no indigenous people and ethnic minority in the project area. (b) There are no indigenous people and ethnic minority in the project area.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers? (d) Are appropriate measures being taken to ensure that security guards are involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) The project proponent shall comply with legislation related to occupational health. (b) The project proponent shall conduct measures to protect workers. (c) The project proponent shall provide workers for safety. (d) During construction, staff who manage safety of traffic will take measures to protect local people from accident.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) N (c) N	(a) Mitigation measures are conducted based on the Environment Management Plan. (b) The project is conducted within the existing intersections, thus, no impact on ecosystem. (c) There are no people who require resettlement and land acquisition is also not required because the project is conducted within the existing intersections.
	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) - (c) Y (d) N[KR竜76]	(a) Environment Monitoring Plan is prepared based on study and responsible organizations for monitoring are also included in the plan. (b) Environment Monitoring Plan stipulates the items/parameters, methodology and frequency. (c) Implementation structures are considered for environmental and social considerations. (d) Monitoring requirement is stipulated in the Environmental (Impact Assessment and Audit) Regulations, 2003, however, monitoring form and frequency of the report are not stated in the regulation.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
6 Note	(1) Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects Checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines Checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a) – (b) -	(a) No deforestation is conducted in the project.(b) The project does not include Power Transmission and Distribution Lines Development.
	(2) Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) The project will contribute GHG emission reduction.

Source: JICA Study Team

Chapter2. Contents of the Project

2.1 Basic Concept of the Project

2.1.2 Objective of the Project

The objective of the Project is to alleviate traffic congestion and improve traffic safety through installation of ITS equipment and improvement of intersections, thereby contributing to the economic development of Mombasa.

2.1.3 Scope of the Project

This component covers intersection improvements including the conversion of roundabouts into signalized intersections, as well as the installation of road surface markings associated with traffic control equipment.

【Facility Portion】

Intersection improvements (change from roundabout to signalized intersection) and road surface markings associated with the installation of traffic control equipment.

Table 40 Scope of Facility Portion

Item	Contents
Intersection Improvement	22 intersections (including 6 Roundabout intersections)
Intersection Improvement Policy	Compact intersections Pedestrians waiting and egress areas to ensure safety
Lane arrangement	To increase traffic capacity, the number of lanes Dedicated right turn lanes should be secured.
Installation of Traffic Safety Facilities	Guard posts, cones Road marking

Source: JICA Study Team

【ITS Equipment Portion】

This component covers the supply and installation of traffic control systems including traffic signal units and signal control system for 22 target intersections, as well as traffic control center systems, variable message sign system (VMS), CCTV camera system etc.

Table 41 Scope of ITS Equipment Portion

Item	Contents	Location/etc
Traffic Management Center System	Collecting traffic data from vehicle detectors and providing traffic	22 intersections + 5 other locations for additional sensors

	information to road user	
	Monitoring traffic by CCTV	22 intersections
	Automatic incident detection	Important 8 intersections
	Analysis of Traffic information	Estimation of travel time
Signal System	Japanese signal control system, enables green time control by traffic data and coordinated/area wise control.	22 intersections
	Pedestrian Signal	3 locations
VMS	Provision of Traffic situation/travel time/accident location	Main 3 entrances to the island
CCTV Camera System	Addition of CCTV at intersections	Important 8 intersections out of 22 intersections

Source: JICA Study Team

2.1.4 Overview of Construction and Procurement Plan

2.1.4.1 Policy on Construction and Procurement

For the procurement of materials and construction works, the principle is to procure general materials locally, while for special equipment that is difficult to obtain locally, procurement from Japan or third countries will be considered. For major devices such as traffic control equipment, they are to be assembled and evaluated in Japan and then transported to the site for installation work.

For intersection improvement works, to minimize the impact on daytime traffic, the basic policy is to carry out work on one side of the lane during the day and to carry out works within intersections at night. For some intersections with heavy traffic (A7R-3 to 5), full road closure during nighttime construction will be implemented. During the construction period, daytime and nighttime work will be separated to ensure workers' health, public safety, and thorough implementation of security measures.

2.1.4.2 Policy on Construction and Procurement Supervision

Construction and procurement supervision under this project will be conducted by a Japanese consultant under a contract with the Mombasa County Government (CGM). Based on the results of the preparatory survey, consultations with CGM will clarify the project details, overall schedule, and the scope of works borne by CGM. Based on the Grant Aid scheme, the consultant will prepare bidding documents reflecting the detailed design and construction plan.

Regarding bidding, the consultant will be responsible for public notice, responding to

questions, witnessing bid submission, evaluation, assisting in contract negotiations, and witnessing contract signing. At the construction stage, the consultant will conduct consultations with stakeholders before construction begins, approve design drawings, conduct pre-shipment inspections of equipment, supervise construction at the site, prepare progress reports, verify interim progress payments, and carry out completion inspections and necessary procedures.

Upon completion, the consultant will issue the completion certificate, conduct handover procedures, and prepare the final report. To shorten the construction period, the policy is to conduct works simultaneously in multiple sections, for which local assistant staff will be hired to strengthen the procurement supervision system.

2.1.5 Overview of Counterpart Obligations

2.1.5.1 Before Bidding

Before bidding, the Kenyan side is required to obtain IEE/EIA approval from the National Environment Management Authority (NEMA), complete the Banking Arrangement procedures, obtain road usage permits, and secure camp yards and construction waste disposal sites. It is also necessary to secure installation sites for the Traffic Control Center and Data Center, including equipment such as lighting, air conditioning, security systems, and emergency power supplies. In addition, the Kenyan side must obtain building access permits and relocate or remove power facilities, monuments, parking lots, or other obstacles to intersection improvement works.

2.1.5.2 During Project Implementation

During project implementation, the Kenyan side must continue procedures related to tax exemptions, arrange and connect power and communication lines, report incidents or accidents to JICA, submit project monitoring reports (PMR), and prepare and submit the completion report. They are also responsible for ensuring the safety of local stakeholders, providing security and traffic control at project sites, informing residents, and implementing the Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP).

2.1.5.3 After Project Implementation

After project completion, the continuous implementation of the EMP and EMoP will be required. In addition, the Kenyan side will be responsible for securing maintenance costs for related facilities, conducting regular facility inspections, and establishing and operating the system for operation and maintenance.

2.2 Outline Design of the Japanese Assistance

2.2.1 Design Policy

2.2.1.1 Selection of Target Intersections for Installation of Signal System and Intersection Improvements

(1) Selection Process

The target intersections were selected based on effectiveness, consistency with existing policies and plans, and relevance to other road improvement projects.

The JICA Study team focused on improving terms of traffic facilitation in major corridors, increase in traffic volume after the completion of the Mombasa Gate Bridge and the Second Nyali Bridge, and areas where congestion is currently noticeable. Subsequently, based on the results of the field survey, some intersections with lower priority were excluded, and the final scope was set to cover 22 intersections.

a) Step1 : Narrowing down to 39 intersections (Before field survey)

Before conducting the 1st field survey, 39 intersections were pre-selected based on the following points:

- Intersections identified as potential traffic bottlenecks requiring improvement based on the preliminary survey report, Google Maps traffic data, and satellite imagery.
- Intersections along major corridors where significant congestion improvement effects are expected through signal system control.
- Adjacent intersections of roads flowing into candidate intersections along major corridors

b) Step2 : Narrowing down to 26 intersections out of 39 (Exclude 13 intersections)

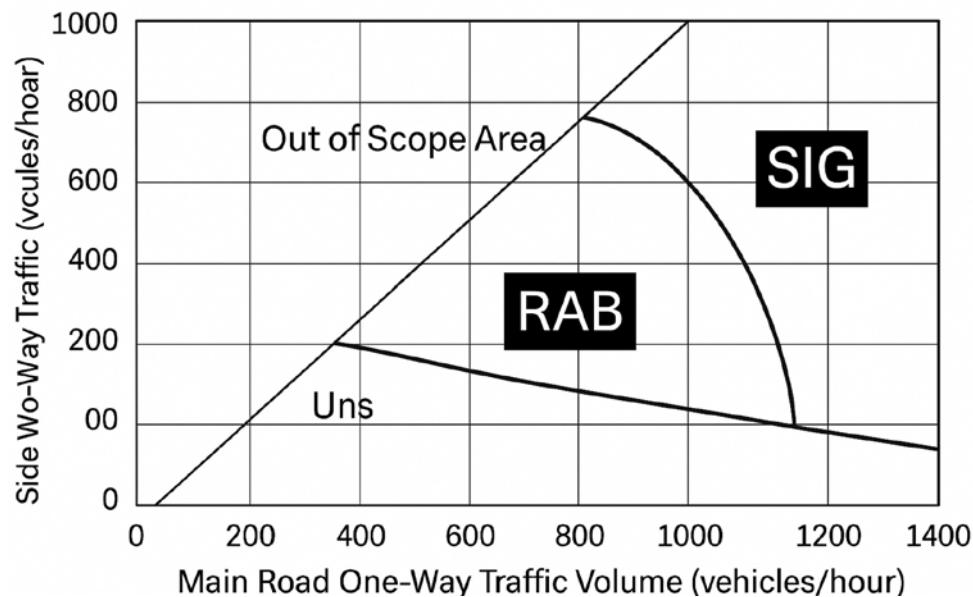
- ① Excluded six intersections in the first field survey: those that are not intersections (A7-5, H-3, M-4, A7R-1) and those that are not obviously congested at present and will not be in the future (L-3, L-4).
- ② Excluded two intersections (H-4, L-1) related to the Second Nyali Bridge, which was found to be in service for more than ten years after the interview of the current status and plan of the bridge.
- ③ Excluded four intersections (A7-6, A7-7, A7-8, A7-9) located on the A7 Road widening plan. *1
- ④ Excluded intersection (A8-6) located on a road with a widening plan, taking into account the construction of the Causeway Bridge. *1

*1: Due to the uncertainty of the construction plan and schedule, the implementation and operation are unclear, so it was excluded.

- c) Step3 : Finally Narrowing down to 22 intersections (Exclude 4 intersections)
- ① Excluded two intersections (A7R-2, A8-5) which can be handled with roundabouts*2 even with the current and future peak hour traffic volumes (with the anticipated Mombasa Gate Bridge), the two intersections were excluded, as roundabouts will be maintained.
 - ② Excluded two intersections (L-2, L-5) because they are isolated from the signal system on the island, and therefore not effective for area control.

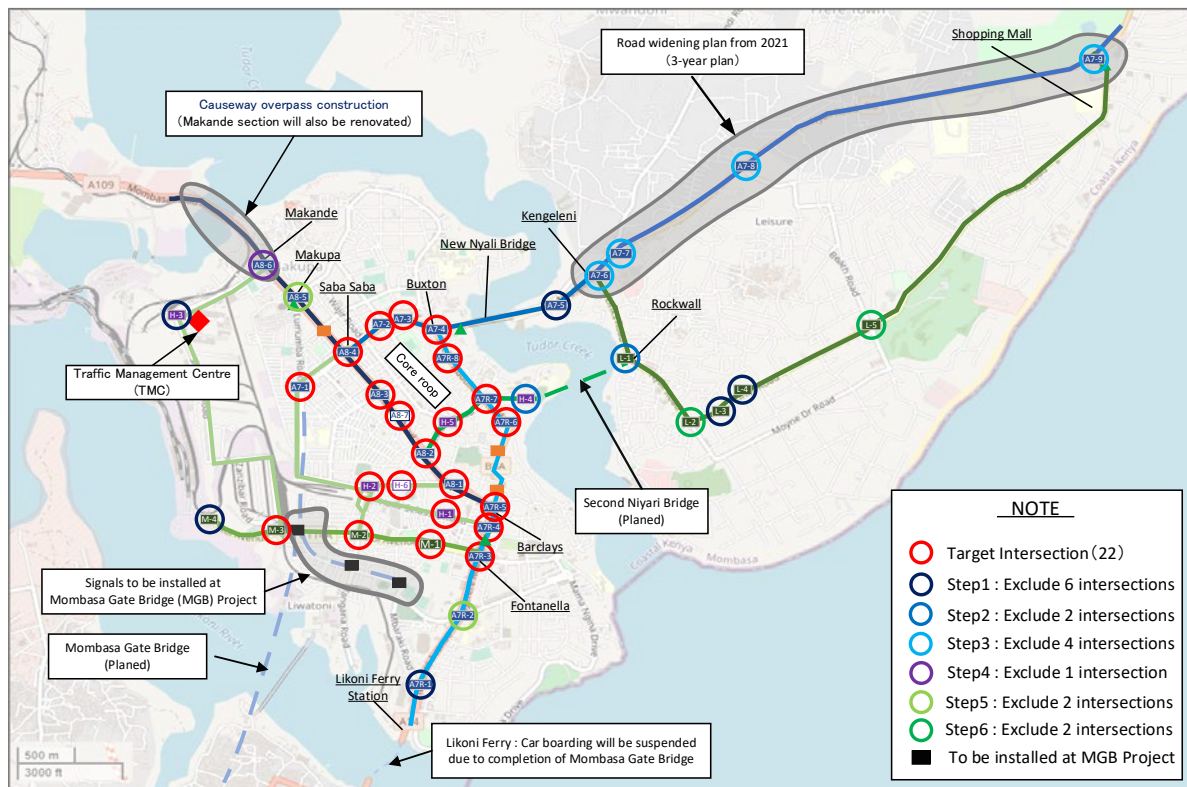
*2:Regarding traffic signal installation at intersections, the guidelines for signal installation (National Police of Japan notice) and the optimal control method based on average delay time specify the traffic volume at which signal installation is deemed effective.

Traffic volume at the two intersections (vehicles/hour) is 657 (main) and 403 (secondary) for A7R-2, and 986 (main) and 663 (secondary) for A8-5. It is determined that a roundabout (RAB) can handle this volume.



Source : Japanese National Police Agency

Figure 60 Intersection Control Method Selection



Source : JICA Study Team

Figure 61 Target Intersection Selection Policy

(2) Features of Selected 22 Intersections

a) Traffic facilitation by signal coordination to the core loop

In the central area of Mombasa City, trunk roads A7 and A8, together with A7R, which functions as a bypass, are connected at their starting and ending points to form a core loop that encircles the central part of the city. This core loop plays an important role in urban traffic management by reducing excessive inflow of major traffic into the city center, dispersing traffic from the outer areas, and providing detour routes in case of congestion, accidents, or disasters.

Along the core loop are commercial districts and office buildings, while within the loop there is a concentration of schools, commercial facilities, offices, and residential areas, making it a zone with a high demand for smooth traffic flow. By introducing coordinated signal control at intersections along the core loop, smooth processing of traffic flow can be achieved, which is expected to ease traffic congestion both inside and outside the loop.

The intersections that contribute to smoother traffic flow through coordinated signal control on the core loop are shown below. Their spatial relationships are illustrated in Figure 62.

- A7 Corridor (3 locations) ; A7-2, A7-3, A7-4
- A8 Corridor (5 locations) ; A8-1, A8-2, A8-7, A8-3, A8-4
- A7R Corridor (4 locations) ; A7R-5, A7R-6, A7R-7, A7R-8,

b) Traffic facilitation by area control including connecting intersections to core loop

The main road network on Mombasa Island is structured around the core loop that encircles the central area, with multiple roads connecting to it. Coordinated signal control in these connecting areas is a field in which Japanese traffic signal systems excel. By optimizing area-wide traffic control, it becomes possible to enhance the overall efficiency of traffic flow.

In particular, by introducing signal control at intersections on the roads connecting to the core loop where certain traffic volumes are observed, it is possible to maximize the effects of traffic congestion mitigation on a wider scale, beyond just controlling the core loop alone, and including the connecting roads as well.

The intersections contributing to smoother traffic flow through area-wide coordinated signal control—including those on roads connecting to the core loop—are shown below. Their spatial relationships are illustrated in Figure 62.

- Connection with A8-4 (1 location) ; A7-1
- Connection with A8-1 and A8-2 (2 locations) ; H-2, H-6
- Connection with A7R-5 (2 locations) ; A7R-4, A7R-3
- Connection with A8-2, A7R-7 (1 place) ; H-5
- Connection with A8-1 (1 location) ; H-1

c) Consideration in increased traffic when completing the Mombasa Gate Bridge

Traffic simulation results predict that the opening of the Mombasa Gate Bridge, scheduled for 2028, will cause a significant increase in traffic volume around its entrances and exits. To address this increase, the introduction of coordinated signal control at the relevant intersections will be effective and is expected to help mitigate traffic congestion throughout Mombasa Island even after the bridge opens.

The intersections related to the expected traffic volume increase due to the opening of the Mombasa Gate Bridge are shown below. Their spatial relationships are illustrated in Figure 62.

- Moi Corridor (3 locations) ; M-1, M-2, M-3
- Mombasa Gate Bridge Direct Access ; A7-1

d) Facilitation of heavy cargo traffic (effects on port-related facility access, northern corridor, etc.)

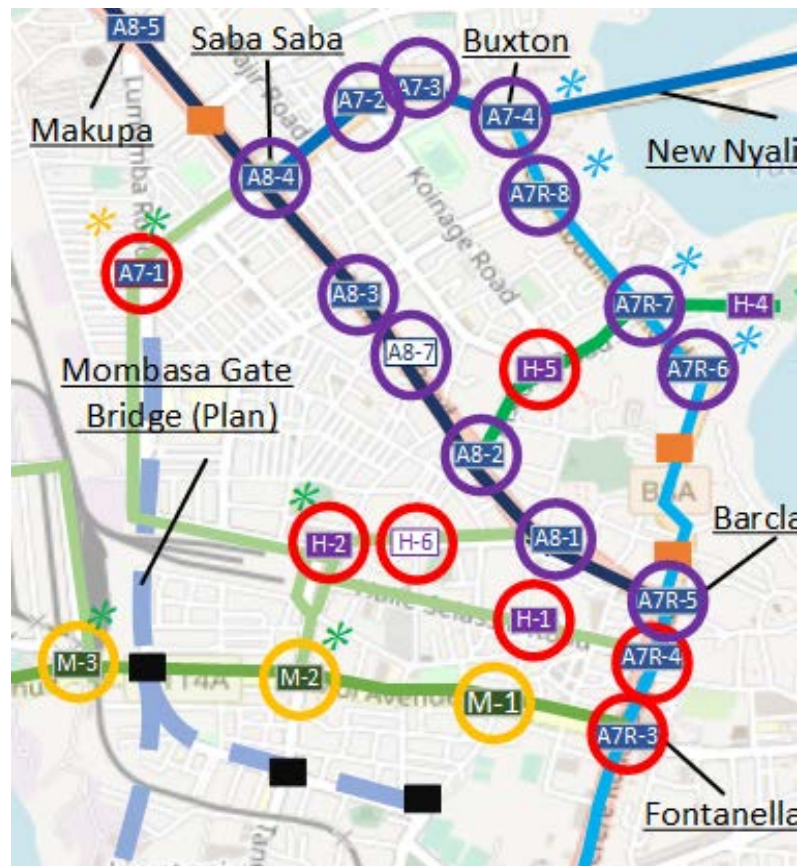
Cargo unloaded at the Port of Mombasa undergoes storage, quarantine, customs clearance, and other procedures at container yards on Mombasa Island. It is then transported to various parts of Africa via trunk roads on the island and the Northern Corridor.

Introducing signal control at key intersections used by this heavy cargo traffic will

contribute to improving the efficiency of transportation in port-related logistics and along the Northern Corridor.

The intersections related to heavy cargo traffic are shown below. Their spatial relationships are illustrated in Figure 62.

- A7-1, M-2, M-3, H-2



<u>Reason for Selection</u>	
1. Core Loop (12 Location)	○
2. Core Loop Connection (7 Location)	○
3. MGB Connection (3 Location)	○ <i>Re-print*1 Location</i>
4. Ports and Northern Corridor Connection	○ <i>Re-print*4 Location</i>

Source : JICA Study Team

Figure 62 Traffic Features of Selected Intersections

2.2.1.2 Selection Policy of ITS Components

Based on the issues and needs related to the current traffic control identified in the field survey, the ITS components to be included in the Project are listed below.

(1) Signal System

1) Necessity of Introduction

On Mombasa Island, traffic management through signals at major intersections is currently insufficient, with traffic flows at each intersection being handled in an ad hoc manner. In particular, during morning and evening peak hours and at locations with heavy traffic, the absence of signal control causes conflicting traffic flows within intersections, leading to congestion and reduced safety.

Moreover, traffic conditions change constantly depending on the time of day, day of the week, and the operational status of surrounding facilities. However, since no dynamic traffic control system is in place to respond to these variations, this has contributed to chronic congestion and reduced logistics efficiency. In particular, given the significant traffic volumes involving public transport and heavy cargo vehicles, the introduction of appropriate signal control systems to organize and coordinate traffic flows has become an urgent priority.

Against this background, the introduction of signal control at intersections is essential to achieving smoother urban traffic flow, improving safety, and optimizing the distribution of traffic volumes.

2) Expected Effects

The Japanese-style signal control system planned for introduction under this project will use information from vehicle detectors installed at each intersection to implement optimal signal control by time of day and traffic direction according to real-time traffic conditions. This will streamline traffic flows within the signal-controlled area, improve safety, and enhance the overall traffic function of the city.

Furthermore, by analyzing traffic information collected at each location and providing it to drivers through traffic information boards and other means, it will be possible to appropriately distribute and guide traffic volumes, contributing to congestion mitigation and optimal operation of the entire road network.

A major feature of the Japanese-style signal control system is its focus on "queue length" at major intersections along trunk roads. By adjusting signal splits based on queue length and controlling intersections with similar traffic characteristics as sub-areas, the system achieves smoother area-wide traffic flow. Unlike other systems such as SCATS (Australia) and SCOOT (UK), which automatically adjust signal timing based on real-time traffic flow changes, the Japanese system emphasizes minimizing the propagation of congestion, making it highly suitable for Mombasa's urban environment where traffic bottlenecks are prominent.

In addition, similar systems have already been deployed at more than 10,000 intersections in Japan, providing a wealth of operational experience and proven reliability. From a maintenance perspective, non-contact vehicle detectors will be primarily used rather than road-embedded sensors such as loop coils.

3) Target Area

Twenty-two (22) intersections on Mombasa city.

(2) Traffic Control Center System

1) Necessity of Introduction

At present, in Mombasa City, road administrators such as KeNHA and KURA, as well as the County Government of Mombasa (CGM), do not continuously accumulate or systematically provide traffic flow data. As a result, no mechanism exists to comprehensively and quantitatively monitor the overall urban traffic situation.

Currently, traffic control functions are limited to visual monitoring via surveillance cameras and responding to reports from road users by telephone. There is no real-time traffic data collection or analysis, no integrated traffic management or forecasting functions, and no systematic information provision to the public.

Against this background, the introduction of an advanced Traffic Control Center System is necessary to serve as a hub for integrated management and analysis of urban traffic across Mombasa Island.

2) Expected Effects

With the introduction of the Traffic Control Center System, it will become possible to collect, store, and analyze information on travel times, traffic volumes, accidents, and construction activities on major roads across Mombasa Island. This will enable the quantitative visualization of traffic conditions and the effective implementation of city-wide traffic management.

Specifically, continuous collection and storage of travel time data along each road section will allow for the identification of time periods and locations prone to congestion, as well as the assessment of the impact of traffic incidents on travel times. Insights derived from such statistical analyses will be useful for determining the optimal times and routes for maintenance works and road repairs, enabling the development of effective construction schedules with minimal impact on traffic.

Moreover, by analyzing variations in travel times, it will be possible to identify sections where congestion or accidents occur frequently, pinpointing so-called black spots and hot spots and determining their causes. This will provide essential data for future physical measures such as intersection improvements and road widening.

In addition, the accumulation and utilization of traffic data are expected to contribute to faster information collection and decision-making in the event of disasters or emergencies.

3) Target Area

A traffic control center will be established within the CGM Inspectorate premises.

(3) Variable Message Sign System

1) Necessity of Introduction

Currently, road users have no means of obtaining information on estimated travel times or traffic incidents while driving. Moreover, a unique traffic regulation called Happyhour^{*1} has been introduced, but drivers unfamiliar with it often do not know how to respond.

Given this situation, the introduction of a Variable Message System (VMS), which provides real-time information to road users through roadside information boards—such as travel times, congestion status, accident information, and traffic regulation updates—is essential for achieving smooth traffic flow. In particular, accurately communicating the start and end times of Happyhour regulations will help avoid

^{*1}: Happyhour: A traffic regulation introduced by CGM to reduce congestion on the

New Nyali Bridge during morning and evening peak hours.

In the evening: Traffic from the island toward the Nyali area (A7R-6 → A7R-4 → A7-6 → L-2 → L-5) becomes one-way in both lanes for 10 minutes × 3 intervals.

In the morning: The reverse direction becomes one-way for 10 minutes × 1 interval.

2) Expected Effects

By providing appropriate real-time traffic information to road users via the Variable Message System, drivers will be able to select routes to avoid congestion, thereby improving traffic flow. Additionally, information on Happyhour regulation times will be provided, helping to prevent confusion and ensure smoother traffic operations.

3) Target Area

Variable message boards will be installed at three intersections—A8-4, A7-4, and A7R-5—located just before the main entrances to the core loop from the major corridors (A7, A8, and A7R).

These locations serve as critical access points to the core loop that surrounds the Mombasa city center, where traffic from both inside and outside the island converges. Since the core loop is circular, drivers entering the loop must decide whether to proceed clockwise or counterclockwise.

By providing real-time traffic information—including congestion, accidents, and regulations—right before this decision point, drivers can choose safer and smoother routes within the loop. Moreover, enabling route selection in advance will help reduce traffic concentration and promote balanced traffic distribution both inside and outside the loop.

(4) CCTV System

1) Necessity of Introduction

The County Government of Mombasa (CGM) has requested that the CCTV equipment being introduced under the Smart City Project be effectively utilized for traffic monitoring at the 22 intersections targeted by this project.

In addition to this request, CGM has expressed the intention to introduce an advanced monitoring system at eight particularly critical intersections to enable not only conventional video surveillance but also the automatic detection of traffic incidents, such as accidents and illegal parking.

However, the CCTV cameras being deployed under the Smart City Project are of the PTZ (Pan-Tilt-Zoom) type. While these allow operators to remotely control the camera's direction, they are structurally limited in that they cannot provide continuous, fixed-point monitoring of the entire intersection. In particular, for areas within intersections where accidents or illegal parking frequently occur, these cameras cannot maintain constant visual coverage, making it difficult to ensure real-time incident detection and reliable event recording.

To address these issues, it is necessary to install high-performance fixed cameras dedicated to traffic incident detection under this project, in addition to the PTZ cameras deployed under the Smart City Project.

The eight particularly critical intersections are listed in Table 3.3. These intersections are characterized by high traffic volumes, complex intersection layouts, pedestrian inflows from nearby commercial and residential areas, operational risks after signal changes, and traffic regulations, all of which contribute to a high frequency of incidents and the broad impact of such incidents when they occur.

2) Expected Effects

By receiving video feeds from the Smart City Project's CCTV cameras, the system developed under this project will enable traffic monitoring at 22 intersections.

Moreover, by installing dedicated fixed cameras at the eight particularly critical intersections, it will be possible to implement an automatic traffic incident detection system to identify incidents such as accidents or illegal parking in real time.

3) Target Area

- 22 intersection where CCTV cameras installed in the smart city project can be effectively utilized.
- 8 particularly critical intersections where automatic traffic incident detection will be introduced.

(5) Traffic Incident Detection System

1) Necessity of Introduction

At present, at CGM's existing Traffic Control Center, operators manually monitor CCTV camera footage to identify traffic incidents such as accidents and illegal parking. However, it is physically impossible to display all camera feeds simultaneously on the monitors. Moreover, the cameras lack an automatic patrol function, requiring manual switching between camera views. Under the current limited staffing conditions, it is therefore extremely difficult to maintain real-time awareness of traffic conditions across all intersections.

Even if the number of operators were increased, the sheer number of cameras, the need for 24-hour operations, and the requirement for immediate response during emergencies mean that human monitoring alone faces inherent limitations. It would be impossible to completely eliminate the risks of human error or delayed response.

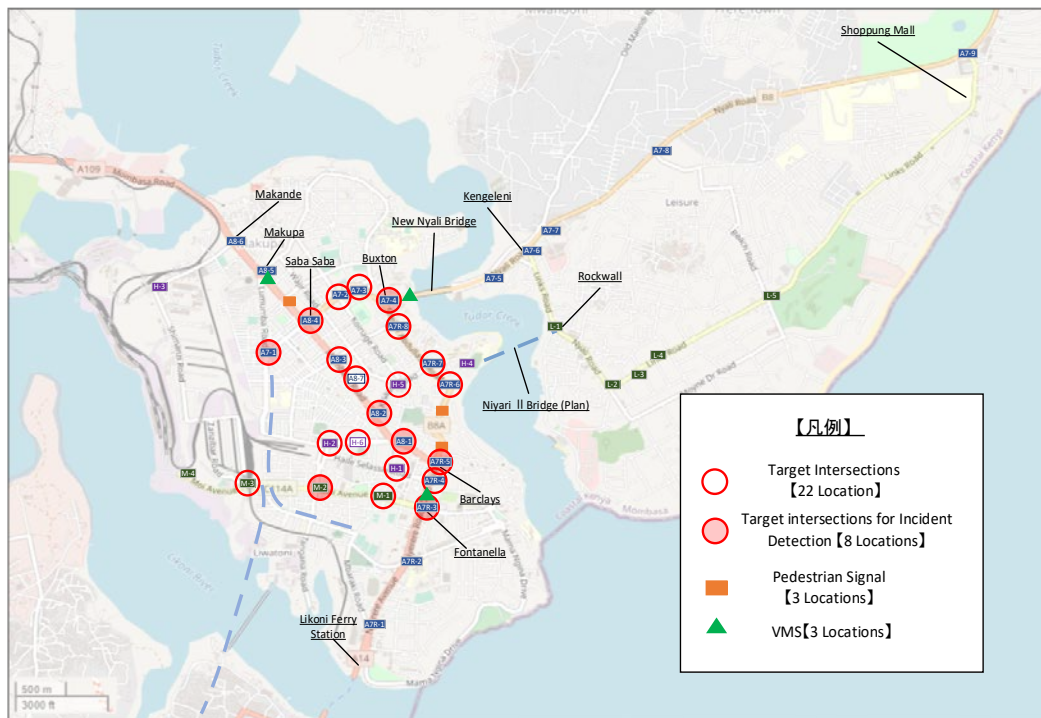
Given these circumstances, introducing a system that can automatically detect traffic incidents from CCTV footage will significantly enhance monitoring accuracy, prevent detection gaps, and ensure automatic recording of evidence. With this capability, a full range of measures—such as early detection of accidents, prevention of secondary accidents, and accident cause analysis—can be implemented, contributing to the overall advancement of traffic safety measures.

2) Expected Effects

The system will automatically detect traffic incidents at intersections, including illegal parking, stopping, low-speed or high-speed driving, wrong-way driving, and fallen objects, enabling early responses that improve safety and traffic flow.

3) Target Area

After consultation with CGM, eight intersections (A7-1, A8-1, A8-2, A7-4, M-2, A8-4, A7R-5, and A7R-3) were selected from the following selection criteria for which event detection functions should be implemented.



Source : JICA Study Team

Figure 63 Location of Incident Detection

【Selection Criteria for Target Areas】

- Intersection with heavy traffic
- Large-scale intersection
- A deformed intersection with a five-way intersection
- Intersection with many pedestrians
- Intersection with many parked vehicles

Table 42 List of Intersections where Traffic Incident Detection Systems are Installed

No.	ID	Reason for introduction[cdv77]
1	A7-1	- Significant increase in intersections in coming traffic is expected with the construction of the Mombasa Gate Bridge - After the Mombasa Gate Bridge is built, it will be an intersection where vehicles come off the elevated main line and vehicles on the existing road will merge, so it will be necessary to monitor the occurrence of events.
2	A8-1	- The removal of the existing roundabout will result in a 5-way deformed intersection, which will complicate the movement of vehicles within the intersection and require monitoring of the occurrence of events. - Frequent traffic congestion from A8-1 to Barclays with many <i>matatus</i> and rickshaws getting on and off. - Surrounded by commercial area with many pedestrians. - Many parked vehicles. - There is a vehicle making a sharp turn from directions A8-2 to -6.
3	A8-2	- The intersection geometry has been drastically changed with the removal of the large RA and the construction of a right-turn lane in the middle portion of the intersection, resulting in a significant change in vehicle movement within the intersection (deformed 5-way intersection). - Many people get in and out of <i>matatus</i> and rickshaws. - Surrounded by commercial area with many pedestrians. - Many parked vehicles.
4	A7-4	- It is a T-shaped intersection with heavy traffic, and the traffic police will switch the traffic signal from the previous traffic control to a traffic light. - Many pedestrians (more pedestrians will be added as new housing is built in the neighborhood) - During Happy Hour, the entire road is restricted in the direction of Nyali, so there is a high

		possibility of accidents occurring at the time of switching. In addition, there are vehicles that jump out before the regulation.
5	M-2	- Major changes to the intersection geometry, including the removal of the RA and the construction of a right-turn lane in the middle portion of the intersection, have significantly changed the movement of vehicles within the intersection. - Lots of <i>matatu</i> and rickshaw traffic. - In particular, the number of pedestrians will increase significantly while the floating bridge is open. - MGB development will significantly increase the amount of traffic entering the intersection
6	A8-4	- There could be a large number of vehicles that ignore the signal change and send out the signal at the right time. - Surrounded by commercial area with many pedestrians. - Because of the intersection of A-7 and A-8, collisions and other accidents in the intersection are likely to cause heavy traffic congestion. - There is a lot of traffic of large vehicles coming and going from the north to the Nyali Bridge side.
7	A7R-5	- Significant changes to the intersection geometry, including removal of the RA and the construction of a right-turn lane in the middle portion of the intersection, will significantly change the movement of vehicles within the intersection. - Surrounded by commercial area with many pedestrians.
8	A7R-3	- The shape of the intersection has been drastically changed with the removal of the RA and the construction of a right-turn lane in the middle portion of the intersection, resulting in a significant change in vehicle movement within the intersection. - Monitor vehicles illegally parking in the right turn lane in order to remove parking in the middle portion of the lot. - MGB development will significantly increase the amount of traffic entering the intersection.

Source : JICA Study Team

(6) Pedestrian Signals

1) Necessity of Introduction

Currently, there are few pedestrian crossings on Mombasa Island. As a result, pedestrians have to weave between vehicles to cross the road, which is a dangerous situation. Pedestrian crosswalks will be installed at the selected intersections in this project, but pedestrian signals will be more convenient and safer for pedestrians in areas where the distance between intersections is long.

In addition, a certain number of visually impaired residents were identified within Mombasa Island. Therefore, CGM has requested that acoustic signals be installed at locations that are likely to be used by the visually impaired (e.g., around hospitals and bus terminals), so that they can be notified when the traffic lights turn green.

2) Expected Effects

Improve convenience and safety for pedestrians crossing the road on single road sections. Convenience and safety for visually impaired pedestrians can be improved by using sound guidance to inform them of color changes in traffic signals.

3) Target Area

Based on the results of the site condition survey, locations where pedestrian signals should be installed were selected based on the degree of pedestrian traffic volume, presence of important facilities nearby, and distance from adjacent intersections.

The CGM does not manage accident data in a usable format, and we were unable to obtain accident data. However, when selecting locations for pedestrian signal installations, we took into account CGM's empirical knowledge regarding the frequency of pedestrian accidents.

The selected locations and the reasons for their selection are summarized in the table below.

Table 43 Pedestrian Signal Installation Locations

No.	ID	Reason for Introduction
1	Between A7R-5 and A7R-6	• 250 meters from A7R-5. • The area is a commercial district with supermarkets and other stores, and there is a lot of pedestrian traffic. • The road in the direction of A7R-6 is curved and visibility is poor.
2	Between A7R-5 and A7R-6	• Long distance between A7R-5 and A7R-6. • The surrounding area is commercial and has a lot of pedestrian traffic.
3	Between A8-4 and A8-5	• It is 300 m away from both A8-4 and A8-5. • There are hospitals and commercial facilities in the area, and there is a lot of pedestrian traffic.

Source : JICA Study Team

Table 44 List of Locations where Acoustic Signals are Installed

No.	ID	Reason for Introduction
1	A7-4	Near Malindi Kilifi Bus Terminal There is a high volume of pedestrian traffic, including users with visual impairments.
2	A8-1	Adjacent to Arusha-Moshi Bus Station Frequent boarding and alighting of matatus and rickshaws result in heavy pedestrian traffic.
3	A8-2	Close to Akamba Bus Station Extremely high pedestrian traffic combined with numerous parked and stopped vehicles in the surrounding area creates a heightened risk of vehicle-pedestrian contact.
4	M-2	Near The Nairobi Women's Hospital There is a high demand for pedestrian crossings, including visually impaired and elderly patients. Given the long crossing distances and heavy traffic volumes, audible pedestrian signals are required to ensure a safe walking environment.
5	H-2	Adjacent to Mombasa Railway Station There is significant pedestrian crossing demand from train passengers. Particularly during morning and evening peak hours, many pedestrians include visually impaired individuals and users carrying luggage, requiring audible pedestrian signals for safe crossing guidance.

Source : JICA Study Team

2.2.1.3 Data Accumulation and Utilization

With the introduction of the aforementioned signal systems and ITS components, it will become possible to collect and store a wide range of traffic data. These data will be utilized for purposes such as analyzing the causes of accidents and incidents, understanding fluctuations in traffic flow, and quantitatively assessing travel speeds and congestion trends.

The types of data to be stored, their intended uses, and their retention periods are presented in the following table.

Table 45 Data Item to be Accumulated ant the Usage

No.	Source of data	Usage	Storage period
1	CCTV	When accidents or damage to roads and ancillary facilities occur, the cause of the accident is identified based on CCTV image. Furthermore, the results of this analysis are utilized to implement countermeasures for infrastructure, signage, and other elements.	Store for 30 days and provide the images if requested by the police.
2	Traffic Incident Detection System	In addition to the above, we analyze changes in traffic flow due to time of day and various events and examine correlations with traffic flow. Based on these analyzes,they enableee prediction of traffic flow changes from each event by season and time. At intersections equipped with signal systems, they verify the effectiveness of the signal system by confirming the number of vehicles processed per hour. By enforcing illegal parking promptly and reducing the number of overlooked violations, we can decrease illegal parking.	Store for 1 year and provide the images if requested by the police.
3	Vehicle detector	Estimate travel speeds based on vehicle counts and speeds and display estimated arrival times to destinations via VMS. Examine the relationship between events, seasons, and occasions (such as festivals) and travel speeds (traffic congestion levels) to quantify congestion and crowding trends.	Store for 30 days.

Source : JICA Study Team

2.2.1.4 Policy for Natural Environmental Conditions

1) Temperature

Kenya is located just below the equator, and the Kenyan coast, where Mombasa City is located, has a low elevation and mild temperatures. Temperatures vary little from year to year, and the climate is temperate throughout the year. The average temperature is 26.7 °C (minimum 21.8 °C to maximum 31.5 °C).

Table 46 Average Temperature in Coastal Kenya (1991-2020)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Average Max Temperature (°C)	32.9	33.7	34.0	32.7	30.8	29.7	29.1	29.3	30.4	31.8	32.2	32.1	31.6
Average Min Temperature (°C)	22.3	22.5	23.2	23.2	22.1	21.0	20.0	21.0	20.3	21.6	22.4	22.3	21.8

Source : World Bank

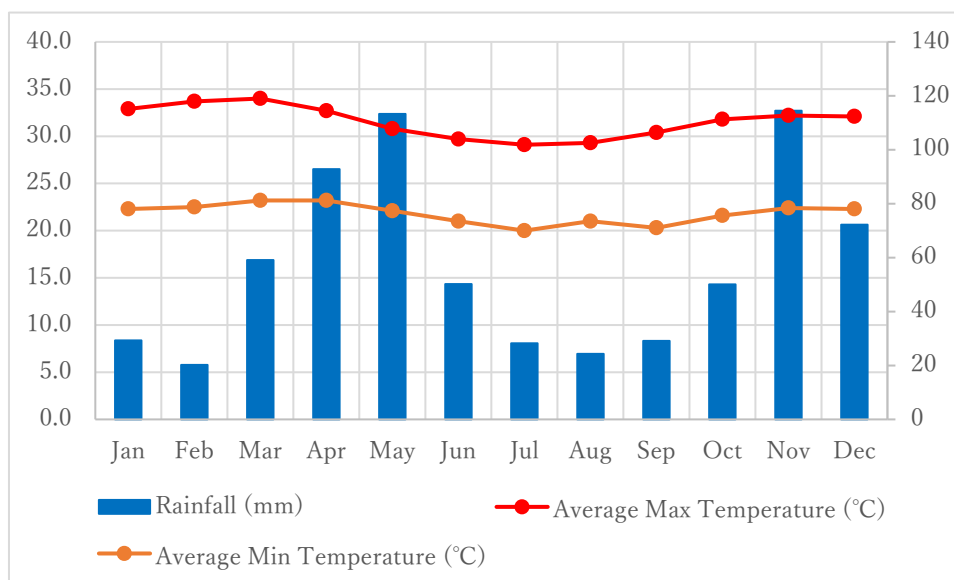
2) Rainfall

The Kenyan coastal area where Mombasa City is located receives relatively little rainfall, about 680 mm per year (about half that of Tokyo). There are two rainy seasons, from March to May and from October to December.

Table 47 Rainfall in Coastal Kenya (1991-2020)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Rainfall (mm)	29.3	20.2	59.1	92.8	113.3	50.2	28.2	24.3	29.1	50.1	114.5	72.2	683.3

Source : World Bank



Source : World Bank

Figure 64 Temperature and Rainfall Data for Coastal Kenya (1991-2020)

2.2.1.5 Policy for Socioeconomic Conditions

Signal systems to be implemented by the Project are intended for all road users, including automobiles, motorcycles, and pedestrians. Therefore, it is necessary to establish a system that takes into account the characteristics of road users in the target area.

The characteristics of road traffic in the target area, Mombasa City, and the policy for dealing with them are as follows:

1) Road Markings

In many cases, drivers do not follow traffic lanes and stop lines in the city due to inadequate or disappearing road markings. Therefore, the intersection improvements will include the painting of durable road markings in the target intersections.

2) Pedestrian Signal Maintenance

Most existing intersections do not have pedestrian signals, or even if they do, the green light duration is significantly shorter. In addition, vehicles ignore pedestrian signals and disturb pedestrians crossing. As a result, pedestrians are crossing with vehicle interruption regardless of the pedestrian signal. In the Project, pedestrian signals will be installed to improve the abovementioned situation.

2.2.1.6 Construction/Procurement or Industry Specifics/Policies on Business Practices

In Mombasa County, there is a leasing company for construction equipment and civil engineering materials and equipment, so materials and equipment used for construction can be procured. Therefore, there is no need to bring them in from Japan.

2.2.1.7 Policies Related to the Use of Local Contractors (Construction Companies, Consultants)

In Mombasa, local civil engineering companies can perform ordinary civil engineering works such as road rehabilitation and road improvement work. Telecommunications work can also be performed by local telecommunications companies. However, sufficient guidance by the construction supervisor is required for line alignment, and for the reflection and management of the completed drawings.

2.2.1.8 Policies for Utilization of Japanese Companies

Regarding intersection improvement, Japanese construction companies with work experience in Africa are expected to participate in the Project.

Regarding the procurement of equipment, since this project involves the introduction of Japanese-style signal systems, it is essential that Japanese signal manufacturers participate in the Project. In addition, other ITS equipment (VMS, CCTV, traffic incident detection, etc.) are also expected to be introduced by Japanese manufacturers.

2.2.1.9 Policy for Operation and Maintenance

1) Operation and Maintenance Responsibility Structure

Currently, traffic on Mombasa Island is monitored by an Inspectorate, a division of CGM, using 85 CCTV images installed on the island and monitored by three operators in the existing traffic control room.

CGM is the executing agency for the Project and will own and operate and maintain the system after its installation.

Table 48 Operation and Maintenance Management Responsibility Structure

Classification	Installation and Construction Implementation	Management	Maintenance	Owner
ITS Facilities	CGM (Transport Department)	CGM (Inspectorate)	CGM (Transport Department)	CGM
Improved Intersection	CGM (Transport Department)	-	KeNHA/KURA	KeNHA/KURA

Source : JICA Study Team

2) Technical Response Policy

Currently, the Inspectorate, a department of CGM, is in charge of traffic monitoring, but there is no department or specialist in charge of operating the signal system.

It is necessary to strengthen the system of the department in charge and to operate and maintain the system with appropriate technology at the same time as the introduction of the new system, and in addition to operation and operation guidance by the contractor, the technical assistant project will be introduced by JICA for CGM. In addition to the operation and operation guidance by the contractor, the project also aims to develop a manual for maintenance and management of the system and to improve the organizational maintenance and management capacity.

In addition, it is to be considered to outsource the maintenance and management of the system to the company that installed the system or to a local company that is a subcontractor of that company. This will ensure that the system is maintained and managed by engineers who are familiar with the system and that the technology is transferred to the Kenyan side.

2.2.1.10 Policies for Setting Grades for Facilities and Equipment

Failure of ITS-related equipment and software can seriously affect system operation. Therefore, high functionality and reliability are required.

For this reason, Japanese products with high reliability and advanced, flexible functions are assumed for the devices that make up the ITS system. Third-country products for signal lights are provided through market in Kenya, so from the perspective of future maintenance, such third-country products will be used.

For servers and network equipment, it is not necessary to specify the country of production, as long as the manufacturer is widely used.

Pillars and foundation materials for equipment installation shall be local products, as products that meet the specifications can be procured in Kenya.

2.2.1.11 Policies Related to Construction Methods, Procurement Methods, and Construction Schedule

In order to avoid the impact of traffic blockage, the intersection improvement work shall be carried out on one side of the roadway during the daytime, and the construction within the intersection shall be carried out during the nighttime in order not to interfere with the function of the intersection.

In addition, since construction will be carried out on one side of the road where there is heavy traffic and pedestrian traffic, the temporary construction plan should take safety measures for the constructor and third parties into consideration.

Furthermore, for nighttime work, a security system and the placement of security equipment should be considered in consideration of the local security situation.

2.2.2 Basic Plan

2.2.2.1 Overall Plan

A maintenance policy was developed for the 22 selected intersections based on the results of traffic volume studies, intersection conditions, and intersection infrastructure conditions.

(1) Intersection Improvement Policy

a) Basic Policy

Intersection improvements were broadly divided into roundabout intersections and non-roundabout intersections, each with the following key improvement policies:

Ensuring Safety

Emphasis will be placed on intersection compactness and the provision of pedestrian refuge areas. Here, “compactness” refers specifically to the appropriate setting of stop line distances within intersections. By avoiding unnecessary widening of the intersection space, it is possible to achieve vehicle speed control, shorter intersection crossing times, and prevention of traffic conflicts within the intersection. This also shortens pedestrian crossing distances, thereby improving safety.

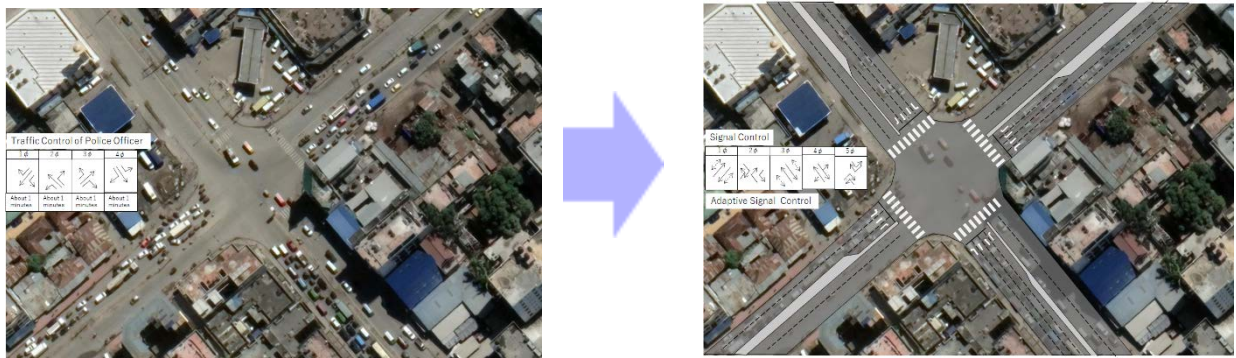
Improving Traffic Capacity

Based on ensuring the required number of lanes and installing dedicated right-turn lanes, measures such as adding right- and left-turn lanes or extending right-turn lanes will be implemented at intersections with high traffic demand, taking into account the Volume to Capacity (V/C) Ratio. These measures will help alleviate traffic queues and congestion caused by vehicles waiting within the intersection.

Roundabout crossing



Non-roundabout crossing



Source : JICA Study Team

b) Traffic Capacity Ratio Calculation

The Volume-to-Capacity (V/C) Ratio^{*1} calculations were performed for the 22 selected intersections and possible hard countermeasures were implemented. Below are the results for the four intersections where possible hard countermeasures were implemented but the traffic capacity ratio calculation results were above the standard value (capacity ratio: 1).

^{*1}: The Volume-to-Capacity (V/C) Ratio is calculated as incoming traffic volume / possible traffic capacity. The incoming traffic volume refers to the actual traffic entering the intersection, while the possible traffic capacity refers to the amount of traffic that can pass through the intersection. When the V/C ratio is 1.0 or higher, multiple signal cycles may be required for vehicles to pass through the intersection.

Table 49 Traffic Capacity Ratio Calculation

Intersection	Time	Inflow	Lane number (Lane management)	Traffic Demand Factor(V/C) (by direction)							NG/ OK	Traffic Demand Factor (V/C)	Countermeasure
				←	↑	→	←↑→	←↑	↑→	↔			
A7-1	Morning	RWAY	3(←↑·↑·→)		1.083	1.077		1.083			NG	1.083	Right Turn Lane was added from Khrd, but still V/C was NG Length of Right Turn Lane from RWAY extended to 135m. Control turn movement will be considered according to
		A8-4	3(←·↑·→)	0.655	0.153	0.823					OK	0.823	
		A8-5	3(←↑·↑·→)		0.702	0.030		0.702			OK	0.702	
		KhRd	2(←↑·→)			0.937		1.048			NG	1.048	
	Evening	RWAY	3(←↑·↑·→)		0.854	0.860		0.854			OK	0.860	
		A8-4	3(←·↑·→)	0.359	0.131	0.853					OK	0.853	
		A8-5	3(←↑·↑·→)		0.599	0.065		0.599			OK	0.599	
		KhRd	2(←↑·→)			0.501		0.430			OK	0.501	
A8-2	Morning	A8-1	3(←↑·↑·→)		1.008	1.063		1.008			NG	1.063	Left Turn Lane was added from 8-3, but still V/C was NG Length of Right Turn Lane from A8-1 extended to 135m. Control turn movement will be considered according to future traffic
		A8-3	4(←·←↑·↑·→)	0.264	1.061	0.299		1.061			NG	1.061	
		H-6	1(←↑→)					1.049			NG	1.049	
		H5	1(←↑→)					1.059			NG	1.059	
	Evening	A8-1	3(←↑·↑·→)		0.685	0.932		0.685			OK	0.932	
		A8-3	3(←↑·↑·→)		0.930	0.486		0.930			OK	0.930	
		H-6	1(←↑→)					0.950			OK	0.950	
		H5	1(←↑→)					0.938			OK	0.938	
A8-3	Morning	A8-2	3(←↑·↑·→)		0.892	1.168		0.892			NG	1.168	No space at median to add lane Length of Right Turn Lane from A8-2 extended to 115m. Control turn movement will be considered according to future traffic
		A8-4	3(←↑·↑·→)		1.150	0.587		1.150			NG	1.150	
		RWAY	1(←↑→)					1.135			NG	1.135	
		A7R-8	1(←↑→)					1.161			NG	1.161	
	Evening	A8-2	3(←↑·↑·→)		1.017	1.128		1.017			NG	1.128	
		A8-4	3(←↑·↑·→)		1.090	0.678		1.090			NG	1.090	
		RWAY	1(←↑→)					1.102			NG	1.102	
		A7R-8	1(←↑→)					1.110			NG	1.110	
A7R-3	Morning	A7R-2	3(←↑·↑·→)		0.562	0.323		0.562			OK	0.562	Left Turn Lane was added from M-1 but still V/C was NG Length of Right Turn Lane from A7R-4 extended to 75m Control turn movement will be considered according to future traffic
		A7R-4	3(←↑·↑·→)		1.021	1.006		1.021			NG	1.021	
		M1	4(←·←↑·↑·→)	0.981	0.520	1.000		0.520			NG	1.000	
		Nkrd	2(←↑·→)			1.000		1.022			NG	1.022	
	Evening	A7R-2	3(←↑·↑·→)		1.134	0.529		1.134			NG	1.134	
		A7R-4	3(←↑·↑·→)		1.128	1.157		1.128			NG	1.157	
		M1	4(←·←↑·↑·→)	0.611	0.324	0.935		0.324			OK	0.935	
		Nkrd	2(←↑·→)			1.130		1.170			NG	1.170	

Source : JICA Study Team

(2) Status of Intersection Infrastructure

There are power facilities and monuments at the intersection that will need to be removed or relocated by the destination government before the project starts.



Source : JICA Study Team

(3) Summary of Plan

Intersection improvement policies and infrastructure conditions for 22 intersections are summarized below.

Table 50 Intersection Improvement Plan

No	Intersection			CCTV	Incident detection	Signal System		Intersection Improvement			CGM Responsibility
	Number	Name	Type			Key Intersection	Acoustic Signal	Outline	Inflow	Lane Number (Lane management)	
1	A7 1		4way Intersection	●	●	●		Expansion of Sidewalk Cut median for Dedicated Right turn lane Add Right turn lane from Khrd	RWAY A8-4 A8-5 KhRd	3(← ↑ ↑ →) 3(← ↑ → →) 3(← ↑ ↑ →) 2(← ↑ →)	Remove Existing Signal
2	2		4way Intersection median in Intersection	Existing				Expansion of Sidewalk Remove median from intersection Expansion of Sidewalk	A7-3 H-5 A8-4 Koinange	3(← ↑ ↑ →) 1(← ↑ →) 3(← ↑ ↑ →) 1(← ↑ →)	
3	3		3 way Intersection	●				Expansion of Sidewalk Add Island Cut median for Dedicated Right turn lane	A8-4 A7-4 Timboya	3(← ↑ ↑ →) 3(↑ ↑ ↑ →) 2(← → →)	Move Clock
4	4	Buxton	3 way Intersection	Existing	●	●	●	Expansion of Sidewalk Add Island Cut median for Dedicated Right turn lane	A7-3 A7-5 A7R-8	3(↑ ↑ ↑ →) 4(← ← ↑ ↑ ↑) 3(← → → →)	
5	A7R 3	Fontenella	4 way RoundAbout	Existing	●	●		Remove RA Expansion of Sidewalk Cut median for Dedicated Right turn lane Add Light turn Lane from M-1	A7R-2 A7R-4 M1 Nkrd	3(← ↑ ↑ →) 3(← ↑ ↑ →) 4(← ← ↑ ↑ →) 2(← ↑ →)	Move Monument
6	4		Irregular 4way Intersection Median in Intersection	Existing				Remove median from intersection Expansion of Sidewalk Cut median for Dedicated Right turn lane	A7R-3 A7R-5 H1	2(← ↑ ↑) 3(↑ ↑ ↑ →) 2(← →)	Move Electric facility
7	5	Barclays	4way RoundAbout	Existing	●	●		Remove RA Expansion of Sidewalk Cut median for Dedicated Right turn lane	A8-1 A7R-4 A7R-6	3(← ↑ ↑ →) 3(← ↑ ↑ ↑) 3(← ↑ ↑ →)	Move Electric facility/ Clock
8	6		3 way Intersection	●				Expansion of Sidewalk Cut median for Dedicated Right turn lane	A7R-5 A7R-7 H-4	3(↑ ↑ ↑ →) 2(← ↑ ↑) 1(← →)	
9	7		4way Intersection	Existing				Expansion of Sidewalk Cut median for Dedicated Right turn lane	A7R-8 A7R-6 H5 H4	3(← ↑ ↑ →) 3(← ↑ ↑ →) 1(← ↑ →) 1(← ↑ →)	
10	8		3 way Intersection	●				Expansion of Sidewalk Cut median for Dedicated Right turn lane	A8-3 A7-4 A7R-7	1(← →) 3(↑ ↑ ↑ →) 2(← ↑ ↑)	
11	A8 1		5way RoundAbout	Existing	●		●	Remove RA Expansion of Sidewalk Cut median for Dedicated Right turn lane	A7R-5 A8-2 H6 R1-1 H1	3(← ↑ ↑ →) 3(← ↑ ↑ →) 2(← ↑ →) 1(← ↑ →) 1(← ↑ →)	Move Electric facility/ Monument Remove Light
12	2	Levanone	5way RoundAbout	Existing	●		●	Remove RA Expansion of Sidewalk Cut median for Dedicated Right turn lane Add Left turn Lane from A8-3	A8-1 A8-3 H-6 H5	3(← ↑ ↑ →) 4(← ← ↑ ↑ ↑) 1(← ↑ →) 1(← ↑ →)	Move Monument/Clock
13	3		4way Intersection median in Intersection	●				Remove median from intersection Expansion of Sidewalk Cut median for Dedicated Right turn lane	A8-2 A8-4 RWAY A7R-8	3(← ↑ ↑ →) 3(← ↑ ↑ →) 1(← ↑ →) 1(← ↑ →)	Move Electric facility
14	4	Saba Saba	4way Intersection	Existing	●	●		Expansion of Sidewalk Cut median for Dedicated Right turn lane	A8-3 A8-5 A7-1 A7-2	4(← ↑ ↑ →) 4(← ↑ ↑ →) 3(← ↑ ↑ →) 4(← ↑ → →)	
15	7		4way Intersection median in Intersection	Existing				Remove median from intersection Expansion of Sidewalk Cut median for Dedicated Right turn lane	Muslim A8-3 Tononoka A8-2	1(← ↑ →) 3(← ↑ ↑ →) 1(← ↑ →) 3(← ↑ ↑ →)	Move Electric facility
16	M 1		4way Intersection median in Intersection					Remove median from intersection Expansion of Sidewalk Cut median for Dedicated Right turn lane	M-2 Mnazi H-1 A7R-3	3(← ↑ ↑ →) 1(← ↑ →) 1(← ↑ →) 3(← ↑ ↑ →)	Move Electric facility
17	2	TOYOTA	4way RoundAbout	Existing	●	●	●	Remove RA Expansion of Sidewalk Cut median for Dedicated Right turn lane	M-3 Tangana H-2 M-1	3(← ↑ ↑ →) 1(← ↑) 1(← ↑ →) 3(← ↑ ↑ →)	Move Electric facility/Monument
18	3		4way RoundAbout					Remove RA Expansion of Sidewalk	M-2 M-4 H-3	2(↑ →) 2(← ↑ ↑) 1(← →)	Move Monument
19	H 1		4way Intersection median in Intersection					Remove median from intersection Expansion of Sidewalk Cut median for Dedicated Right turn lane	A7R-4 M-1 H-2 A8-1	3(← ↑ ↑ →) 1(← ↑ →) 3(← ↑ ↑ →) 1(← ↑ →)	Move Electric facility
20	2		Part of Big RA Irregular 4way Intersection				●	Expansion of Sidewalk Add island Dedicated Right turn lane	H- 1 H-6 A7-1	3(← ↑ ↑ →) 1(←) 2(← ↑)	
21	5		3way Intersection					Expansion of Sidewalk	A8-2 A7-2 A7R-7	1(← ↑) 1(← →) 1(← ↑)	
22	6		4way Intersection median/Parking in Intersection					Remove median from intersection Expansion of Sidewalk Cut median for Dedicated Right turn lane	A8-1 A8-2 Bajuni H-2	2(← ↑ →) 1(← ↑ →) 1(← ↑ →) 2(← ↑ →)	Move Electric facility Remove Parking space
			6 RoundAbout(RA)	5	8	6	5				

Source: JICA Study Team

2.2.2.2 Facility Planning

(1) Design Condition

a) Design Standard

The Kenyan design standards, "DESIGN MANUAL FOR ROADS & BRIDGES", shall be followed, with complementary reference to the Japanese Road Structure Ordinance and other standards.

b) Design Speed

Roads connecting to the subject intersection fall under the DU2~DU7 class of urban roads in the Kenyan standards.

A7, A7R, and A8, which are major arterial roads, fall under the DU2 class design speed of 60 km/h or 50 km/hr when constrained by residences. Therefore, they were set at 50 km/hr when constrained by residences. Moi Avenue and other roads are under the DU3~DU7 class design speed of 50 km/hr (40 km/hr in the case of residence and other restrictions), and therefore set at 40 km/hr in the case of residence restrictions.

Design Standard	Design Speed (km/hr)	
	Urban Type I	Urban Type II
DU1	90	70
DU2	60	50
DU3	50	40
DU4	50	40
DU5	50	40
DU6	50	40
DU7	50	40

Source: DESIGN MANUAL FOR ROADS & BRIDGES

c) Geometric Structure Criteria

The geometric structural criteria for the roads connecting to each intersection were set as shown in the table below, based on the criteria provided in the Kenyan Design Criteria.

Table 51 Geometric Structure Reference Value

Entry		Geometric Structure Criteria	
Design speed (km/hr)		50	40
Minimum plane curve radius (m)		90	55
Steepest profile (%)		7.0	10.0
Minimum Longitudinal Curve Radius K value	凸 (m)	9-10	5
	凹 (m)	11-12	8
Standard cross-gradient (%)		2.5	

Source: JICA Study Team

d) Road Lane Width

The lane width of the road shall be $W=3.5$ m or $W=3.0$ m in principle after consultation with CGM, KeNHA, and KURA, and if it is difficult to secure a lane width of 3.0 m, the lane width of the existing road shall be secured. If it is difficult to secure a lane width of 3.0 m, a lane width of more than the existing roadway shall be secured.

e) Design Vehicle and Construction Limits

The design vehicle and building limits for roads connecting to each intersection shall be as follows:

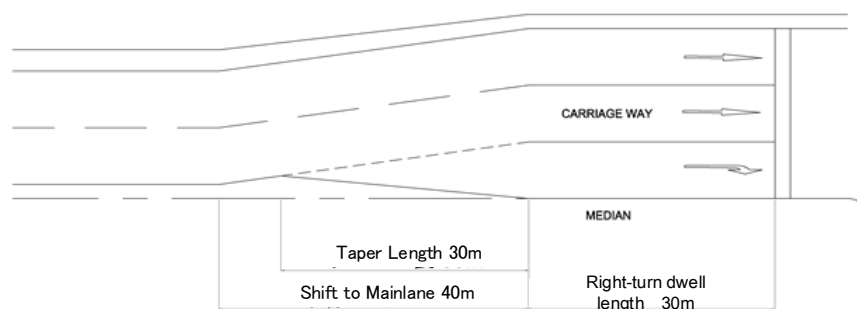
- A7, A7R, A8, Moi Avenue mutual design vehicles: semi-trailer
- Design vehicle for other roads: standard car
- Building limit $H=5.5$ m

f) Intersection Improvement Scope

The scope of improvements at each intersection was determined to be the minimum necessary requirements as follows:

(a) Intersecting roads with right and left turn lanes

It shall be from the stop line position to the position where the right and left turn lanes are sliding and the main line shift is completed.



Source: JICA Study Team

Figure 65 Sliding Right/Left Turn Lane

(b) Intersecting roads without a right turn lane

The section shall be 30 m from the stop line position.

(2) Design Principle

a) Intersection Improvements Overview

A summary of the intersection improvements is shown in the table below.

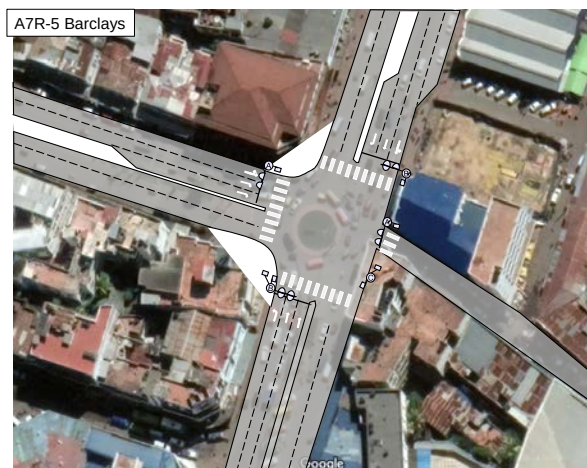
Table 52 Summary of the Intersection Improvements

entry	Improvement Method
(1) Lane Configuration	- Based on the saturation of the incoming traffic at each intersection calculated from the traffic volume survey results, a non-saturated lane configuration that can handle the maximum traffic volume during peak hours should be provided. (For example, if there is a large volume of right-turn traffic, provide a sufficient number of right-turn lanes to handle it) - If the number of lanes required cannot be secured due to barriers created by the existing median, consider securing the number of lanes by removing or relocating the existing median.
(2) Signal Ladder	- The basic design principles for the signal indication ladder shall be as follows: ➤ Opposing directions should be passed simultaneously to improve processing efficiency. ➤ To improve processing efficiency and ensure safety, a dedicated right-turn lane will be provided and the right and left sides of the road will be separated. ➤ Ensure pedestrian blue hours for pedestrians to safely cross the street. - When converting roundabouts to signalized intersections, consider making them one-way, depending on the size of the connecting road, since they may become multi-limbed intersections, making the present indication more complex and reducing processing efficiency.
(3) Road Markings	- Marking stop lines, lanes, lane divisions, conduit zones, and crosswalks. - Compact intersections with shorter distances between stop lines to limit vehicle movement at intersections to prevent accidents.
(4) Mainstreaming Gender and Universal Design	- Plan pedestrian blue hours that allow safe crossing for both men and women based on gender-specific crossing times obtained from traffic volume studies. - Provide an egress space for pedestrians to safely wait at traffic signals. - If there are obstructions (existing medians) preventing pedestrians from crossing, remove them. - Consider introducing the following methods to take into account vulnerable traffic (physically disabled, visually impaired, colorblind, etc.). - Consider appropriate crosswalk steps (steps at the boundary between the roadway and sidewalk) that can be raised and lowered with a wheelchair and checked with a white cane. - Consider adopting pedestrian signals with voice guidance for the visually impaired. - Consider adopting LED signal lights that are easy for colorblind people to distinguish.

Source : JICA Study Team



Before Improvement (Roundabout)



After Improvement (Signal Crossing)

Source : JICA Study Team

b) Pavement Improvement Overview

The scope of the pavement improvement shall include the removal of roundabouts, medians, traffic islands, and sidewalks from the existing roadway and the installation of new roadway pavement.

In addition, in the section where the existing roadway pavement is in poor condition and is impeding vehicular traffic, new surface pavement replacement will be performed.

Regarding the extent of new pavement improvement, it was decided that if the existing roadway pavement is concrete pavement, it will be improved with concrete pavement, and if the existing roadway pavement is asphalt pavement, it will be improved with modified asphalt pavement.

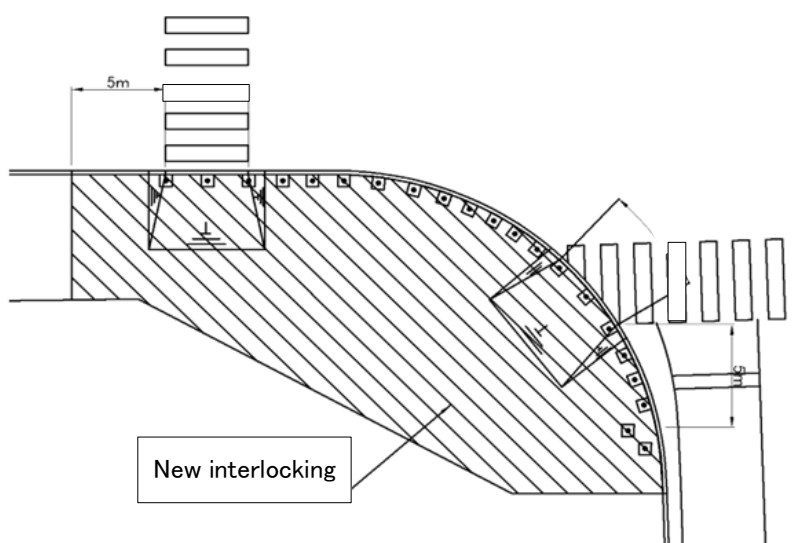
Table 53 Improvement Policy for Each Pavement Type

Existing Pavement	Pavement Condition	Additional Lane	Improvement Policy
Concrete Pavement	Good	Yes	Concrete Pavement
		No	No Improvement
	Bad	Yes	Concrete Pavement
		No	Concrete Pavement
Asphalt Pavement	Good	Yes	Modified Asphalt Pavement (polymer)
		No	No Improvement
	Bad	Yes	Modified Asphalt Pavement (polymer)
		No	Surface Replacement

Source : JICA Study Team

c) Sidewalk Pavement Improvement

The scope of the sidewalk pavement improvement policy was to install new interlocking blocks up to 5 m from the roll-in at each intersection inflow and from the edge of the cross walkway.



Source : JICA Study Team

Figure 66 Sidewalk Pavement Improvement

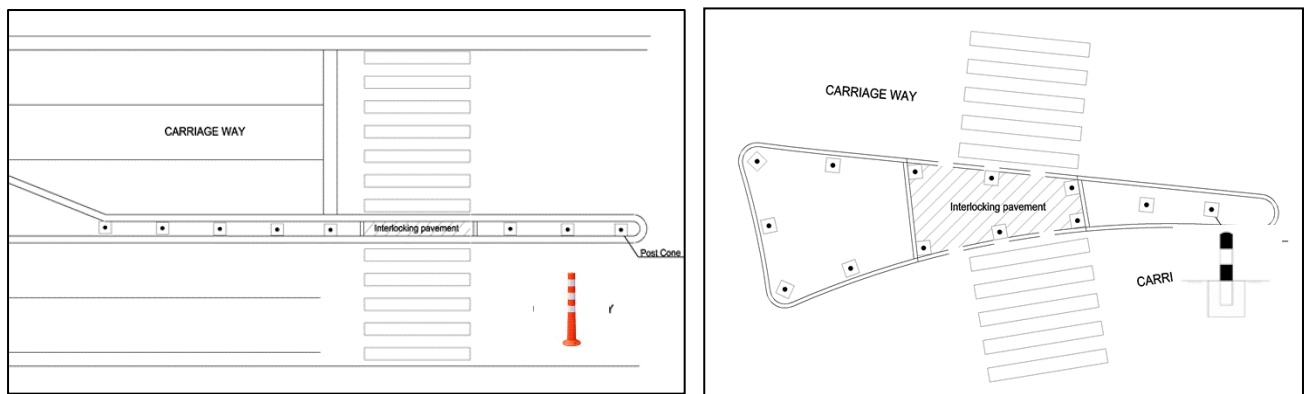
d) Installation of Traffic Safety Facilities

(a) Guard Post and Cone Placement

Guard posts will be installed at the boundaries of sidewalks and crosswalk openings within the sidewalk improvement area to prevent traffic accidents and to prevent parked vehicles from entering the sidewalks.

In addition, guard posts will be installed in front of utility poles, sign poles, lighting poles, and signal poles to protect them.

In addition, guard posts or cones shall be installed in median strips and traffic islands to prevent traffic accidents and to guide traffic eyes.



Source : JICA Study Team

Figure 67 Guard Post and Cone Placement

(b) Gender and vulnerable transportation measures

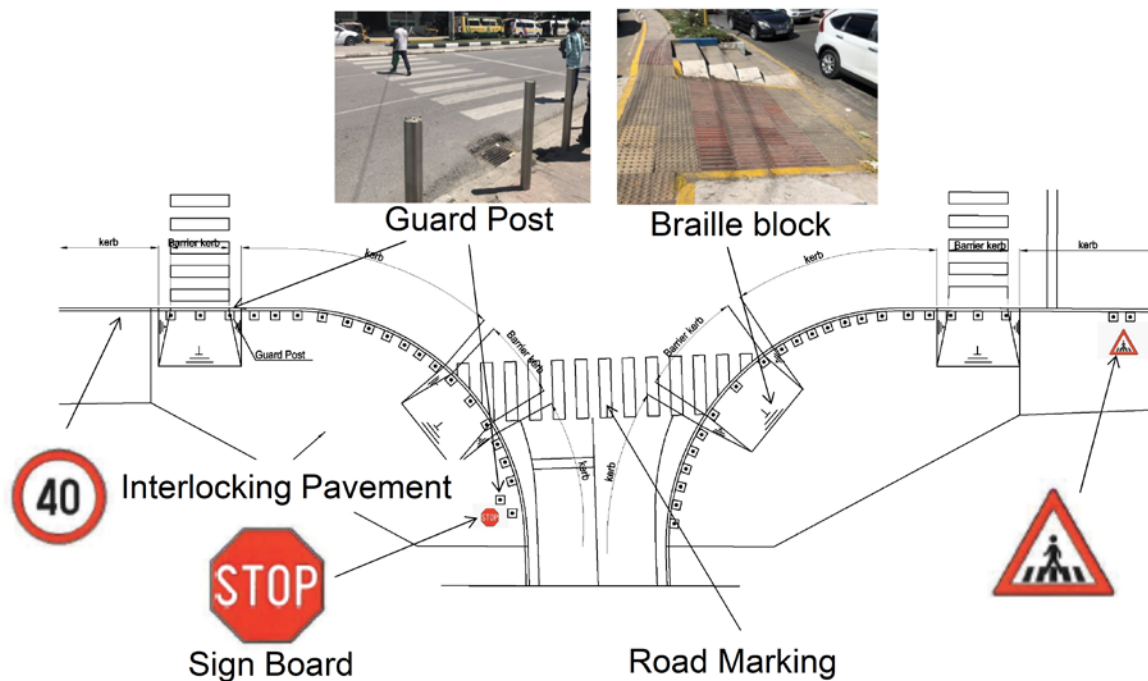
Taking into consideration the vulnerable traffic, pedestrian blue hours that allow safe pedestrian crossing shall be planned.

The pedestrian crossing openings will have boundary blocks without steps so that there are no obstacles for getting in and out of wheelchairs. Since there are existing Braille blocks on Route A8, Braille blocks will be installed in the sidewalk pavement improvement area, as they are expected to have a continuous effect with these existing blocks.

In addition, pedestrian signals with voice guidance for the visually impaired and LED signal lights that are easy to distinguish for the colorblind will be considered for adoption.

(c) Sign

Install various road signs to prevent traffic accidents (crosswalks, temporary stops, speed limits, obstructions present, etc.).



Source : JICA Study Team

Figure 68 Traffic Safety Facility Installation

2.2.2.3 Equipment/System Plan

(1) Design Condition

The design will be based on the Japanese design standards and specifications for ITS facilities, while referring to the Kenyan design standards, i.e., "DESIGN MANUAL FOR ROADS & BRIDGES".

(2) Design Principle

a) Outline

The design concept for each system component is shown in the table below. The overall system configuration diagram is shown in the figure below.

Table 54 System Planned to be Introduced

No.	System Name	Content	Solution
1	Traffic Management Center System	【1】 Basic Function Establishment of traffic management center to operate the ITS system to be introduced, analyze data for providing real-time information to road users and share information with related organizations, processing the data statistically and utilizing it for future planning.	Currently, the center's functions are limited to basic CCTV monitoring, with insufficient video storage and no integration with other systems. In contrast, the introduction of a centralized traffic control system will enable the integrated operation of various ITS functions, allowing real-time information sharing and effective utilization. This will result in a significant improvement in the city-wide traffic management capability.
		【 2 】 Traffic Incident Detection Function At major intersections where incidents are likely to occur, an incident detection system will be introduced which can capture the incidents at each intersection and detect the illegal parking. Especially when the traffic environment changes due to the intersection improvements and the operation of MGB, a system that can help to eliminate the obstruct the traffic flow such as illegal parking / accidents.	At present, accident data is not well organized, and manual identification of incidents faces clear limitations. By introducing automatic traffic incident detection, it will become possible to prevent missed incidents, quickly eliminate traffic disruptions, and enhance accident response capabilities.
		【 3 】 Traffic Information Analysis Function By introducing image processing vehicle detectors as a sensor of signal system, measuring travel speed becomes possible. As a result, providing traffic information to users can be possible by calculating travel time to destination, and utilize them for future planning of roads and other modes.	Currently, there are no signal systems equipped with sensors, and travel time information is not provided to road users. By introducing image sensors, it will be possible to obtain accurate traffic data, provide real-time information to road users, support route selection, and promote data-driven future planning.
2	Signal System	A system enables us to deal with high traffic volume by increasing the time efficiency of green light by detecting	At present, existing signals lack detection functions and rely heavily on manual traffic control by police

		the queue length with sensors installed upstream from the stop line of major intersections.	officers. Through sensor-based traffic signal control, signals can be adjusted according to actual traffic conditions, thereby improving traffic handling capacity, reducing waiting times, and mitigating traffic congestion.
3	CCTV Camera System	CCTV will be newly installed at the major intersections that are not being monitored among the intersections that will be improved and signalized this time, and the monitoring capacity will be improved.	The CCTV equipment introduced under the Smart City Project can be effectively utilized for traffic monitoring. By adding fixed cameras at critical locations, it will be possible to achieve continuous monitoring and automatic incident detection, thereby improving real-time monitoring accuracy and rapid response capabilities.
4	Incident Analysis System	A system that automatically identifies incidents by captured image analysis and organizes them by category. By introducing this system, accidents, illegal parking, etc. will not be overlooked, and the cause of the incident can be analyzed from the image.	Currently, even when accidents occur, insufficient data makes it difficult to implement effective countermeasures. Additionally, illegal parking near intersections often disrupts traffic flow. The introduction of a traffic incident detection system will prevent missed incident detection, enable rapid response, and allow systematic data accumulation for future countermeasure planning.
5	VMS	By installing a VMS, road users will be able to select an appropriate route during the on-trip. In addition, necessary traffic information such as the start time and end time of Happy Hour regulations can be grasped.	At present, traffic information such as congestion levels is not provided to road users, nor is information regarding Happy Hour traffic regulations available. As a result, users have no options for route selection either pre-trip or en route. By introducing a Variable Message System, it will be possible to provide road users with real-time traffic information, including congestion updates and Happy Hour regulation details—thereby enabling informed route choice decisions.

Source : JICA Study Team

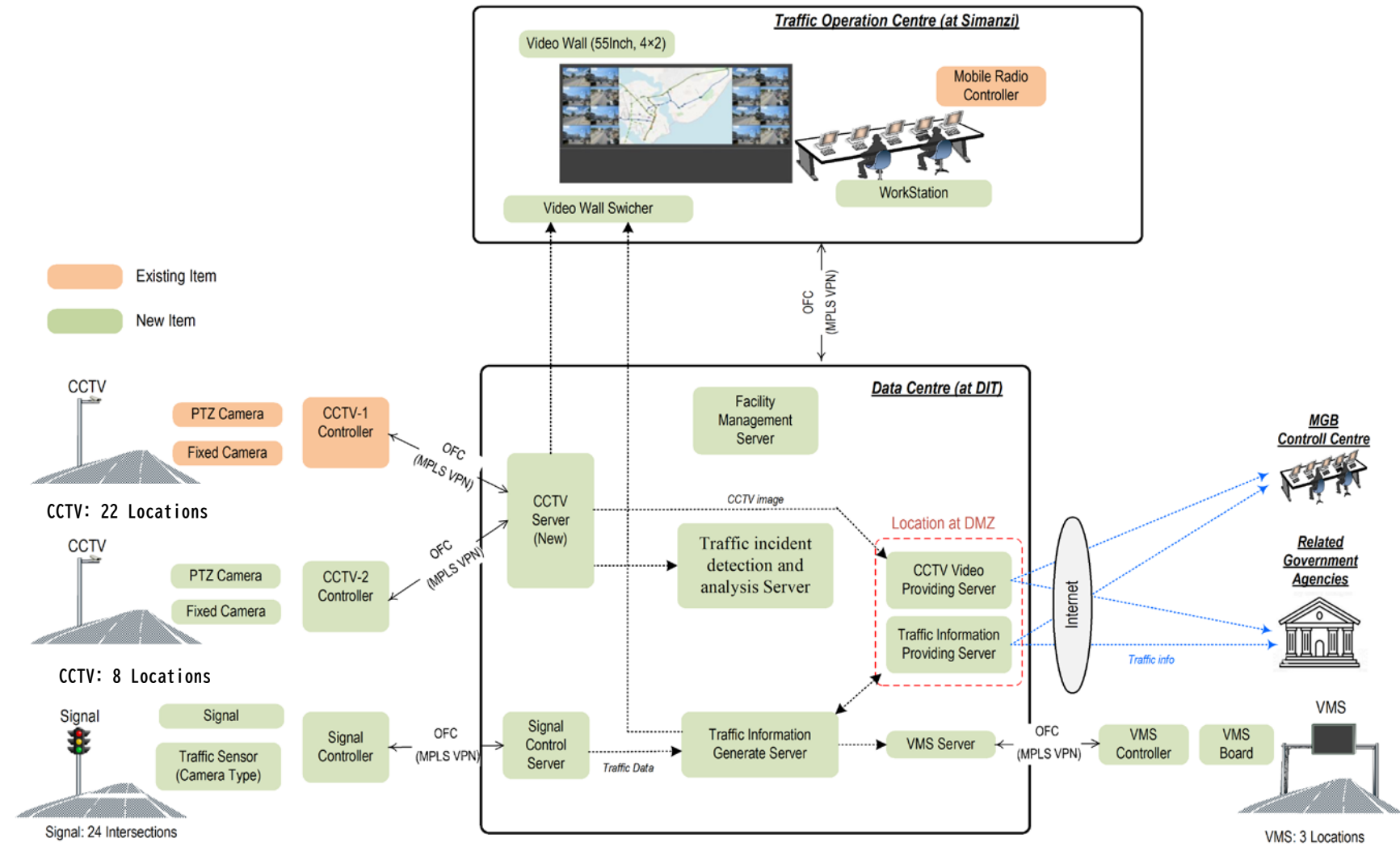


Figure 69 Overall System Configuration Diagram

Source : JICA Study Team

b) Traffic Management Center System

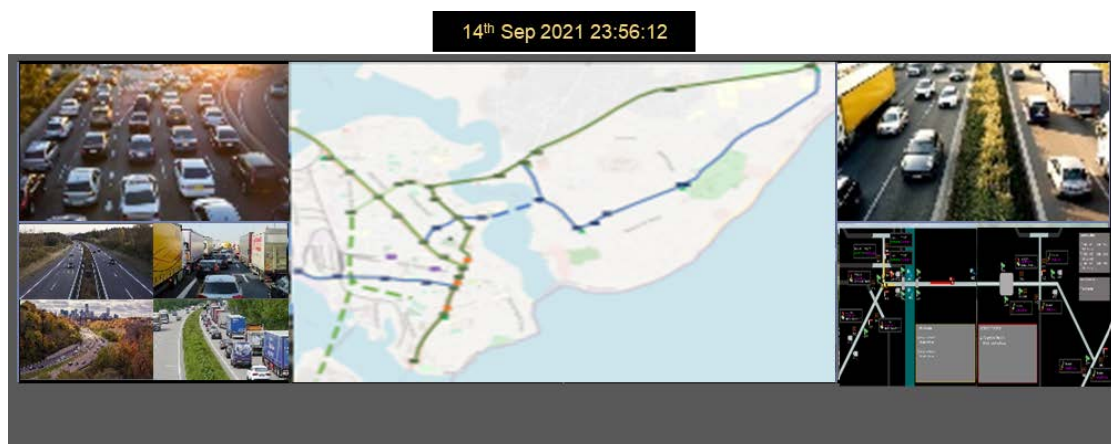
Table 55 Traffic Management Centre System Equipment

Equipment Name	Function
Traffic Information Generate Server	It enables the generation, storage, and inquiry of traffic information using various data collected from signal systems.
Facility Management Server	Centrally manage facilities and communication networks related to ITS
Traffic Information Providing Server	Providing traffic information generated by each system server to government agencies via the website
Video Wall	Displaying images captured by the CCTV camera.
Video Switcher	Changing the display image on the video wall and enlarging the designated image.
Operator Console for Video Wall	Operator console for video wall
Telephone Recording Device	A voice recorder that records the contents of conversation of telephone inquiries to the traffic management center.
Color Laser Printer	A device for color printing at the traffic management center
Black Laser Printer	A device for monochrome printing at the traffic management center
Network Data Storage	Storage of the data processed by the traffic management center for ten years.
Uninterruptible Power Supply (UPS)	Protects information and communication equipment in the event of a power outage or momentary voltage drop
19-inch Rack	For accommodating information and communication system equipment

Source : JICA Study Team

(Video Wall Image)

CGM's Traffic Management Center (TMC) and KeNHA's Mombasa Gate Bridge Center will be connected systematically, and both video walls are basically the same size and layout. Thus, each operator can understand the traffic conditions of each other from one monitor of the video wall.



Source : JICA Study Team

Figure70 Video Wall (The lower right shows the traffic status of MGB)

Various information such as traffic conditions and images presenting on VMS are displayed on the video wall, and by devising measures such as blinking icons when an

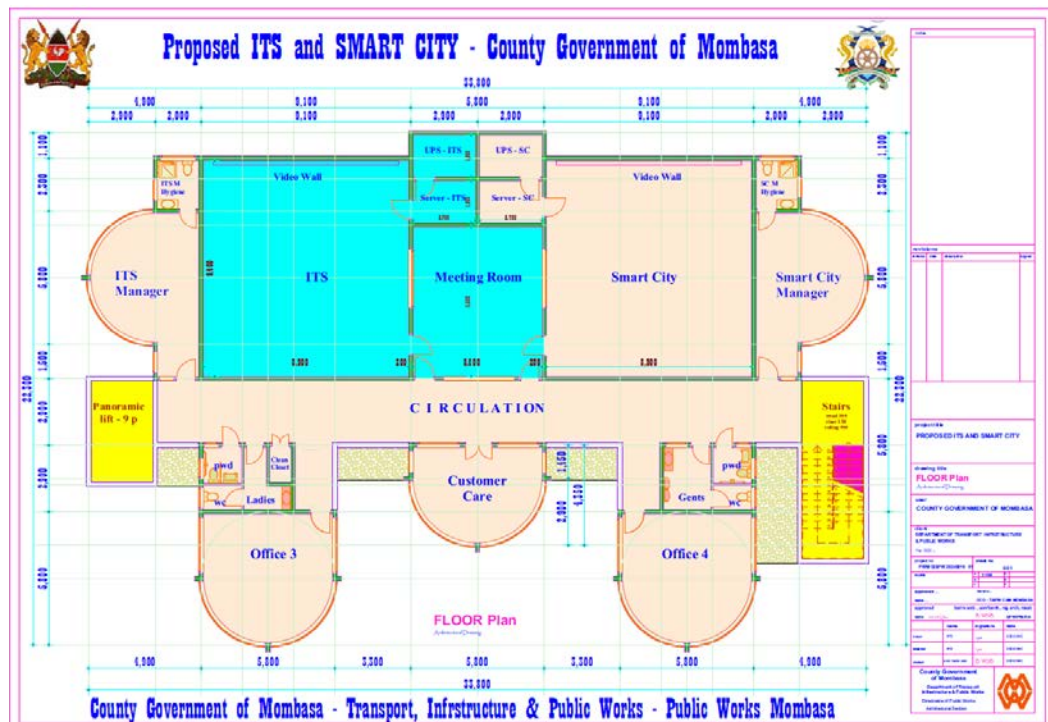
incident occurs, one can grasp the road conditions instantly.

KeNHA and KURA, the major road administrators in Mombasa City, will contact Traffic Management Center (TMC) in advance when implementing regulation for construction for the purpose of maintenance on the road. In addition, if long-term regulations such as widening work and flyover occur, report the regulation method and deploy traffic signs to the ITS Advisory Committee, and discuss the cooperation and regulation method to display on VMS.

(Things to consider when building a TMC)

Discussions with CGM, it was decided that the TMC building would be newly constructed within the Inspectorate site. CGM presented the following layout proposal, which divides the same floor between the Smart City Project and ITS project.

To make it dust-free, all windows in the center need to be removed and filled with robust material such as concrete. To maintain a constant temperature at all times, capable ACs are required. In addition, the Control Room and Server Room need to be raised floors where all wiring can be installed under the floor.



Source : CGM

Figure71 Floor Layout of the Traffic Management Center

c) Signal System

Table 56 Signal System Equipment

Equipment Name	Function
Central controller (Signal control unit)	A device that controls signal lamp indications using various control methods from vehicle sensor data. This device has a redundant configuration by duplication.
Central controller (Data storage unit)	Stores the collected information of the terminal device and the signal control information generated by the central controller (signal control unit).
Central controller (Web server)	Create a screen to be displayed on the signal control console (HMI device)
Signal control console (HMI device)	Device that can set terminal control, input traffic incidents such as accidents, and inquire data accumulated by the central control device (data storage unit).
Signal controller	A device that controls the signal lamp indication, which is located between the signal lamp and the central controller.
Signal lamp for vehicles (Both sides with right turn arrow)	Signal lamp for vehicular traffic. It has an arrow lamp for right-turning vehicles and has a structure with signal lamps on both sides.
Signal lamp for vehicles (One side with right turn arrow light)	Signal lamp for vehicular traffic. A structure that has an arrow lamp for right-turning vehicles and has a signal lamp only on one side.
Signal lamp for vehicles (Both sides without right turn arrow)	Traffic lights for vehicular traffic. It consists of only basic red, green, and yellow lamps, but has signal lamps on both sides.
Signal lamp for vehicles (One side without right turn arrow)	Signal lamp for vehicular traffic. A structure that has only basic red, green, and yellow lamps, and has a signal lamp only on one side.
Pedestrian signal lamp	Pedestrian signal lamp
Image Processing Vehicle Detector	Measures traffic information (number, speed, existence, etc.) by image processing
Acoustic traffic signal addition device (Including speakers)	A device that emits a guidance sound to notify the visually impaired that the signal lamp indication has turned green.
UPS	A device that supplies power as an alternative to the commercial power supplied to signal controllers, vehicle signal lamps, and pedestrian signal lamps installed at intersections, and provides a power-out-free environment for the above equipment.
Wireless device (master unit)	Information from an image processing vehicle detector is transmitted to the nearest intersection. This device is installed on the intersection side and receives information transmitted from the wireless device (slave unit) on the image processing vehicle detector side.
Wireless device (slave unit)	Information from an image processing vehicle detector is transmitted to the nearest intersection. This device is installed on the image processing vehicle detector side. Place and transmit information to the wireless device (master unit) on the intersection side

Source : JICA Study Team

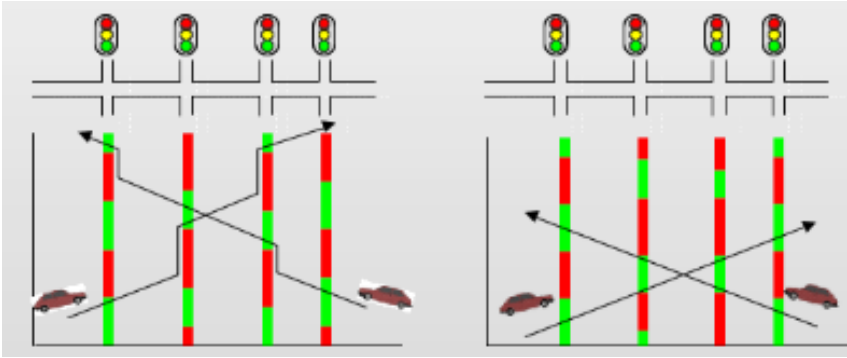
(Basic Function)

For the traffic conditions in Mombasa, the MODERATO traffic signal system is recommended since it is applicable for various traffic conditions. The outline of the MODERATO method is shown below.

- (a) The intersections where the arterial roads intersect are the key intersections, and the other intersections are the sub intersections. Control is performed according to the traffic conditions measured at the key intersections.
- (b) The traffic conditions of each approach road are calculated from the sensor that measures the traffic volume and queue length in each inflow direction of the key intersection, and the cycle time of the sub-area and the green indicating time (split) of the important intersection are calculated.
- (c) Centering on key intersections, intersections with similar traffic conditions are treated as the same group (sub-area), with the same cycle time, and the system control of adjacent traffic lamp indication is performed.

The following is a simple image diagram showing the difference between the presence and

absence of coordinated signal control.

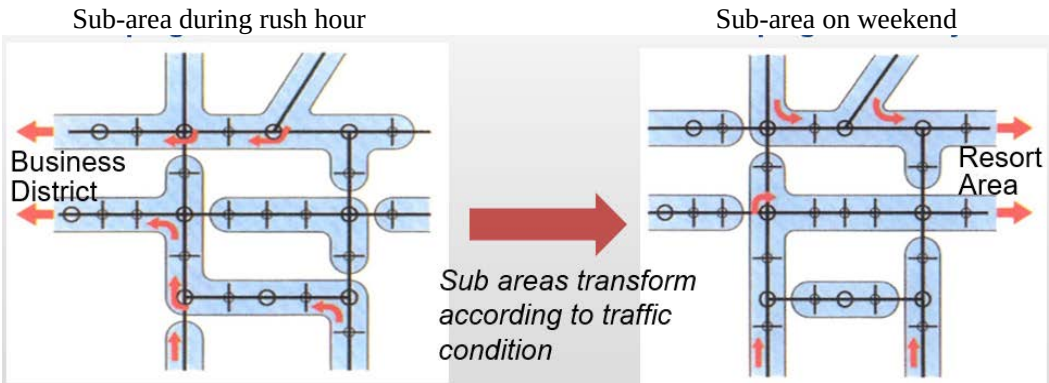


Source : JICA Study Team

Figure72 Travel Time can be Shortened by Increasing the Number of Vehicles Processed through Coordinated Signal (Shown in the figure on the right)

The above figure will be implemented not only on a single road but also in the area to reduce the waiting for traffic lights of as many vehicles as possible.

The cycle time of the traffic light in the sub-area is compared with that of the adjacent sub-area, and if the cycle time difference is small, it is combined, and if it is large, it is separated. Therefore, the sub-area changes according to the traffic condition as shown in the figure below.



Source : JICA Study Team

Figure73 Example of Sub-area transitions according to traffic conditions

d) CCTV Camera System

Table 57 CCTV Camera System Equipment

Equipment Name	Function
CCTV Server	Server for managed CCTV cameras (114 existing and 35 newly installed)
CCTV Video Providing Server	Server to allow outside agencies to view CCTV camera images
Operator Console (for CCTV System)	Console for operators
Fixed Camera	Camera for monitoring traffic conditions at intersections. Fixed angle of view type.
UPS	A device that supplies power as an alternative to the commercial power supplied to signal controllers, vehicle signal lamps, and pedestrian signal lamps installed at intersections, and provides a power-out-free environment for the above equipment.

Source : JICA Study Team

(Basic Function)

1. Fixed Camera

Fixed cameras are cameras that could not change the angle of view.

In this project, the main objective is to monitor the approach road to the intersection.

In this project, the main objective is to monitor the intersection.



Source : JICA Study Team

Figure 74 Existing Camera Installation

e) Traffic Incident Detection System

Table 58 Traffic Incident Detection System Equipment

Equipment Name	Function
Traffic incident detection and analysis server	Based on specific camera images of eight selected intersections where events are likely to occur, the system automatically classifies and groups events such as the shape of the captured vehicles, the number of vehicles in each direction of travel, vehicle stops, high-speed driving, falling objects, illegal parking in no-parking zones, etc. If an event is identified, an alarm is issued.

Source : JICA Study Team

(Basic Function)

The traffic incident detection system uses camera images of eight intersections where accidents are likely to occur due to various factors such as the volume of traffic, or where there is a high need to respond appropriately, such as illegal parking, to enable immediate response when an event occurs and it enables the analysis of events and consideration of countermeasures.

Basic detection functions of the traffic incident detection system are listed below.

- Detect the vehicle type (shape) per direction of travel
- Illegal parking : Detection of vehicle that parked in no-parking zones for longer than a certain amount of time
- Stop on the road : Detection of vehicle that stopped for a certain period of time on the road (detection of an accident, etc.)
- Falling objects : Detection of falling objects over a certain size
- High speed : Detection of vehicle that over speed.
- Alarm/pop-up when above events are detected

Statistical and analytical functions facilitate the analysis of events and enable the planning of countermeasures.

The required statistical and analytical functions are listed below.

- Manage occurrence IDs by event and build an image database by occurrence type.
- Search, edit, and analysis tools by occurrence ID and type. (Categorization of vehicle type, number of vehicles, and color of vehicles per direction of travel)

Search function



Search by color

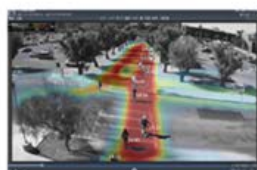


Search by size



Search by direction

Heatmap function


Heatmap of
people walked Area

Heatmap of
Congested area

Heatmap of
People walked flow

v

Source : BriefCam, Canon

Figure 75 Example of Various Video Analyses

f) Variable Message Board System (VMS)

Table 59 Variable Message Board System Equipment

Equipment Name	Function
VMS Server	The system distributes schematics maps, three rank classifications of vehicle speeds, and average travel times between locations generated by Traffic Information Generation Server to VMS installed on the road. Information distributed by the operator is stored in a file for a certain period of time.
Operator Console (for VMS)	Console for operator. It enables the operator to inquire about the contents of the VMS and various types of stored information, and to input text messages to be displayed on the VMS.
Variable Message Board System (VMS)	The system provides real-time information about traffic conditions, accidents, events, etc., for the major corridor.

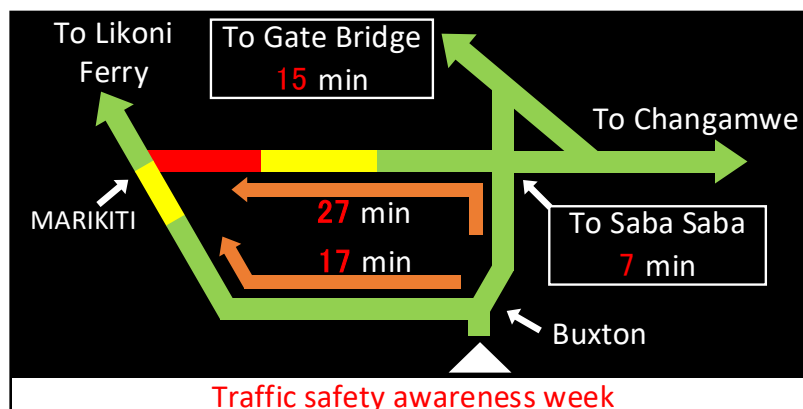
Source : JICA Study Team

(Display image)

The VMS displays real-time information about traffic conditions and travel time towards major intersections or destinations.

Congestion is indicated in colors on the route, with color coding for each area where the speed is below a certain level.

VMS display image and installation image are shown as below.



Source : JICA Study Team

Figure 76 VMS Display Image



Source : JICA Study Team

Figure 77 VMS Installation

2.2.3 **Outline Design Drawings[TT78]**

The following schematic design drawings were compiled in Attachment 2:

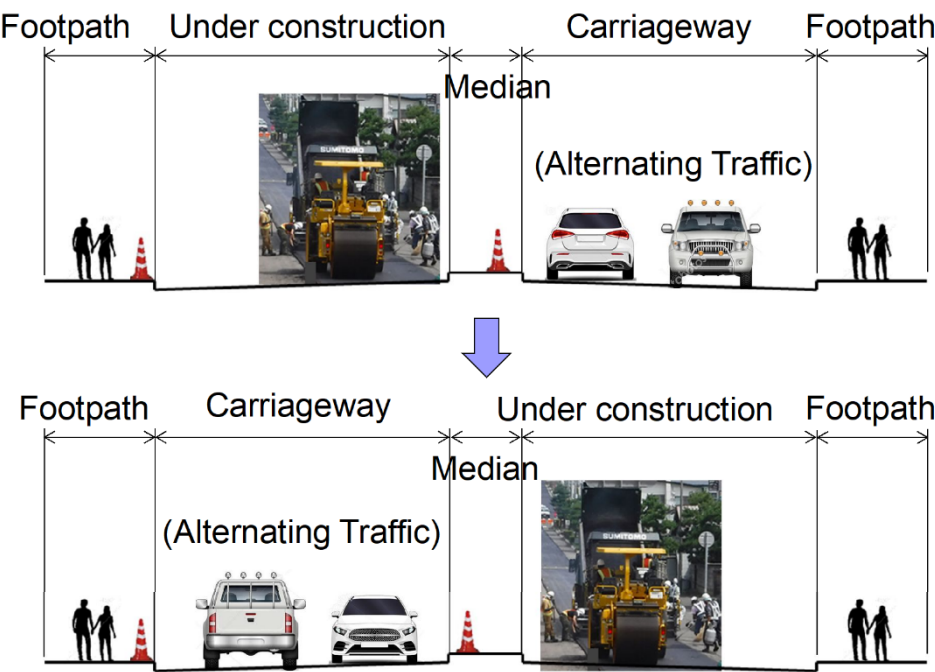
- 1) Detail Location of Traffic Signal
- 2) Pedestrian Signal Location
- 3) VMS Location
- 4) Typical Drawing of Signal
- 5) Typical Drawing of VMS
- 6) Civil engineering plans for each Intersections
- 7) Typical Drawing for Roadside Equipment

2.2.4 Implementation Plan**2.2.4.1** Implementation Policy**(1)** Intersection Improvement**a)** Basic Policy

The local road is used as a daily life road with a high concentration of public facilities such as hospitals and schools, tourist facilities such as hotels and museums, and convenient facilities such as markets, retail stores, post offices, and banks, so that the volume of traffic is always high during the daytime but decreases during the nighttime.

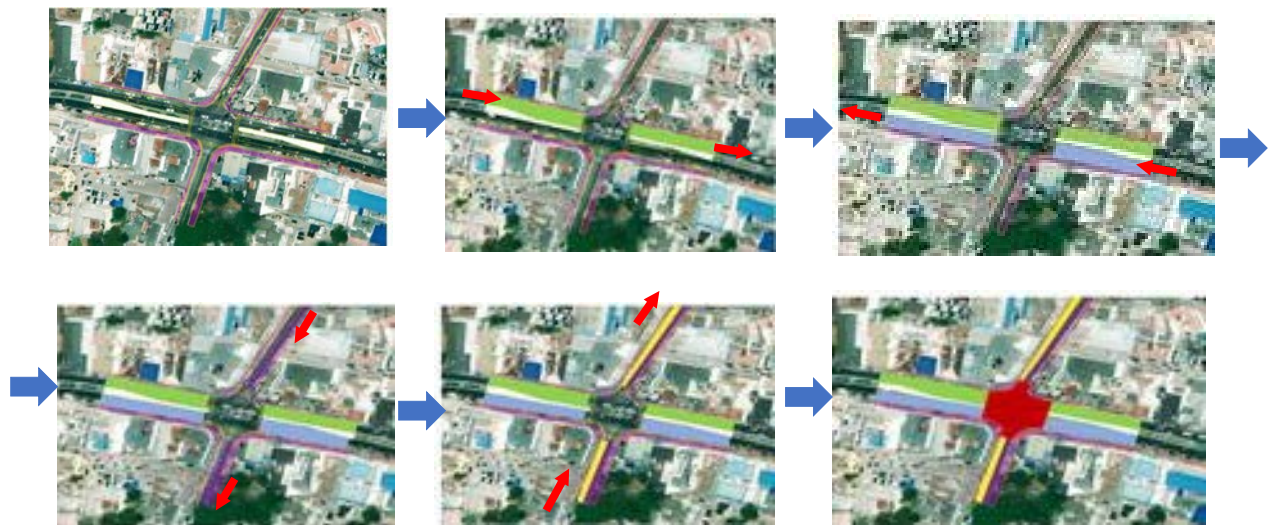
The construction method of the intersection improvement work was discussed with CGM and the road administrators (KeNHA and KURA) to confirm the construction policy for the intersection improvement work so as not to inconvenience the users of the daily life road during the daytime, and the following details were agreed upon:

- ① In order to take into consideration, the impact on the daily traffic, daytime construction will be performed on each side of the route during the daytime as shown in the construction procedure in the figure below. However, construction within intersections shall be performed at night in order not to interfere with the function of the intersection during the daytime.
- ② Nighttime construction within intersections should be avoided for multiple intersections in consideration of local security conditions.
- ③ Sections A7R-3, A7R-4, and A7R-5 should be constructed at night because they have more traffic than other intersections.
- ④ Regarding the construction period, in order to take into consideration, the health of construction supervisors, construction company staff, and workers, and to minimize the impact of local road closures on daily life, day and night construction will not be implemented, but will be separated into daytime and nighttime construction periods.
- ⑤ For nighttime work, a construction plan that takes into consideration the health of the construction manager and workers should be considered, as well as a security system and the placement of security equipment in consideration of the local security situation.
- ⑥ Since the work will be done on one side of a busy road with heavy traffic and pedestrians, safety measures on the part of the contractor and third parties should be fully considered.



Source : JICA Study Team

Figure 78 Intersection Improvement Construction Procedures



Source : JICA Study Team

Figure 79 Construction Procedure Plan of Intersection Improvements

b) Construction Procedure

The intersection improvement work will consist mainly of road surface milling and overlay paving of the existing pavement. The machine configuration for road surface milling will be a combination of a road surface milling machine and a dump truck as shown in the figure.

The road surface milling machine has a construction speed of 20 m/min, which is 1/3 to 1/4 of the human walking speed (60 m/min), and it cannot easily rotate within one lane.

As for the construction sections, the daytime construction section, the nighttime construction section within the intersection, and the sections A7R-3, A7R-4, and A7R-5 are considered as separate construction sections, and the construction procedure for each construction section is shown below.



Source : JICA Study Team

Figure 80 Road Surface Cutting by Road Surface Milling Machine

Construction Section I: Construction procedure by daytime construction at 19 intersections, excluding sections A7R-3, A7R-4, and A7R-5

- ① The single lane route cutting work, demolition of the median, and removal of the curb and L-shaped channel on the sidewalk side of the road. Construction will be continuous construction of multiple intersections in one direction. (2) The difference between the existing pavement that has not been removed and the road surface that has been milled shall be eliminated by abraded pavement.
- ② Install curb ramps on the single lane median separation side, curb ramps on the sidewalk side, and L-shaped swales.
- ③ Pavement of one lane and one sidewalk (interlocking blocks).
- ④ The remaining one lane of the single lane will be subject to line cutting, demolition of the median, and removal of the curb and L-shaped channel on the sidewalk side.
The construction will be a series of multiple intersections in one direction.
- ⑤ Install a mid-block curb, sidewalk curb, and L-shaped channel on the remaining one lane.
- ⑥ Paving of one of the remaining lanes and paving of one sidewalk (interlocking blocks) will be implemented.

Construction Section II: Construction procedure with nighttime construction at 19 intersections, excluding sections A7R-3, A7R-4, and A7R-5.

- ① Remove route cutting works, sidewalk side curbs, roundabouts and obstructive structures within the intersection.
- ② Install curbs and L-shaped swales on the sidewalk side within the intersection.
- ③ Pavement within the intersection and one sidewalk (interlocking blocks) shall be implemented.

Construction Section III: Construction procedure using nighttime construction in sections A7R-3, A7R-4, and A7R-5

The construction procedure will be carried out with the entire road being closed.

(2) Installation of Equipment/System

a) Basic Policy

Equipment installation work is divided into two types of work: indoor equipment installation work and outdoor equipment installation work. The following basic policies will be applied:

- ① Equipment and installation work shall be done during the daytime.
- ② In order to avoid day and night construction, the timing of implementation should not overlap with Construction Section II (night construction) of the intersection improvement project.
- ③ The signal installation work will begin after the road surface milling and removal of the intersection improvement work are completed.

Table 60 Machine Material According to the Payment Work

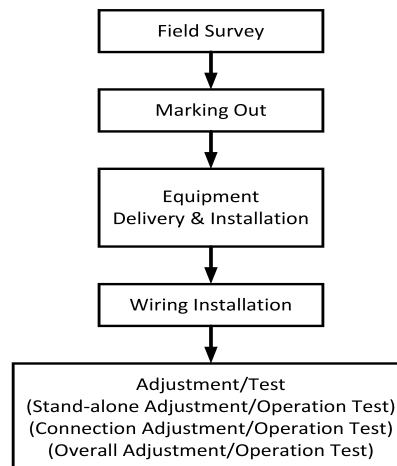
Classification	Job Type	Summary
Inhouse installation work	Center equipment installation	【Traffic Management Center】 Installation of video walls, consoles, etc. 【Data Center】 Installation of servers and network-related equipment for each system
Outside installation work	Signaling/camera equipment installation	【Target Intersections (22 locations)】 Installation of traffic signals, vehicle detectors, wireless communication equipment, and CCTV cameras (5 locations)
	Pedestrian signal installation	【Pedestrian Signal Locations (3 locations)】 Installation of pedestrian signals
	Variable information board installation	【Variable Information Board Locations (3 locations)】 Installation of variable information boards

Source : JICA Study Team

b) Construction Procedure

(a) Center equipment installation

The center equipment installation work is mainly carried out according to the procedure shown in the figure below. The connection adjustment/operation test shall be conducted after the installation and stand-alone operation test of the outdoor equipment are completed. Comprehensive adjustment/operation test will be conducted after all outdoor equipment have been installed.

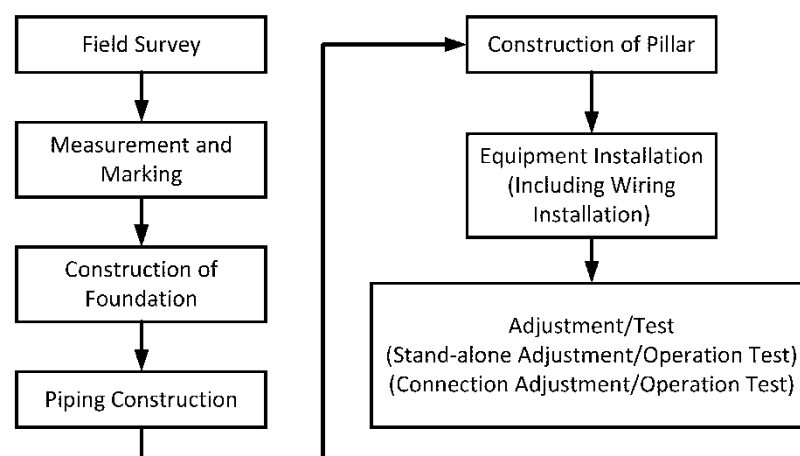


Source : JICA Study Team

Figure 81 Center equipment installation flow

(b) Signal equipment installation work, pedestrian signal installation work, and variable information board installation work

The signal installation, pedestrian signal installation, and variable information board installation are commonly carried out according to the following procedures:



Source : JICA Study Team

Figure 82 Site equipment installation flow

2.2.4.2 Considerations for implementation

(1) Security Measures During Construction

Mombasa County has just been lowered to Level 1 area on the Ministry of Foreign Affairs' risk assessment list in November 2023 and has been the site of repeated incidents of robberies,

carjackings, kidnappings, and other crimes involving the use of firearms by group of people. In implementing this project, the following measures should be taken with particular attention to security measures at construction sites, especially at night:

- The construction area shall be closed off by means of a construction-type fence.
- During the night, construction lighting equipment (security lights) should be arranged and powered to provide lighting for the construction work area without blind spots.
- Armed patrol officers will be posted during the night to prevent burglary and theft within the regulations, and patrols will be conducted without blind spots.
- At night, supervisors, workers, etc. shall wear self-luminous safety vests and helmets with reflective material and install construction lighting equipment.

(2) Traffic Safety Measures During Construction

The intersection to be improved is relatively busy and congested. Traffic is especially heavy during the morning and evening commute hours. Therefore, the following measures should be taken to ensure traffic safety during construction:

- Safety equipment (barricades, color cones, revolving lights) and guides will be placed before and after the restricted traffic zone and at intersections with access roads. In addition, since the number of construction vehicles will also increase, off-limits signs and construction information boards will be placed at the construction site to ensure safety and prevent problems by making local residents aware of the situation.
- Pedestrians and construction areas adjacent to each other shall be separated by barricades and safety ropes, and a guide shall be posted for monitoring purposes.
- Since the construction is to be carried out on a busy residential road and the work will be carried out at night, the placement of security guards and traffic guides will be considered and included in the project cost estimate.
- For nighttime construction, safety measures for construction (lighting facilities) and security measures (deployment of security guards and cooperation with local police) will be implemented. The nighttime lighting equipment will be included in the project cost estimate as Japanese procurement.



Floodlight



Balloon light

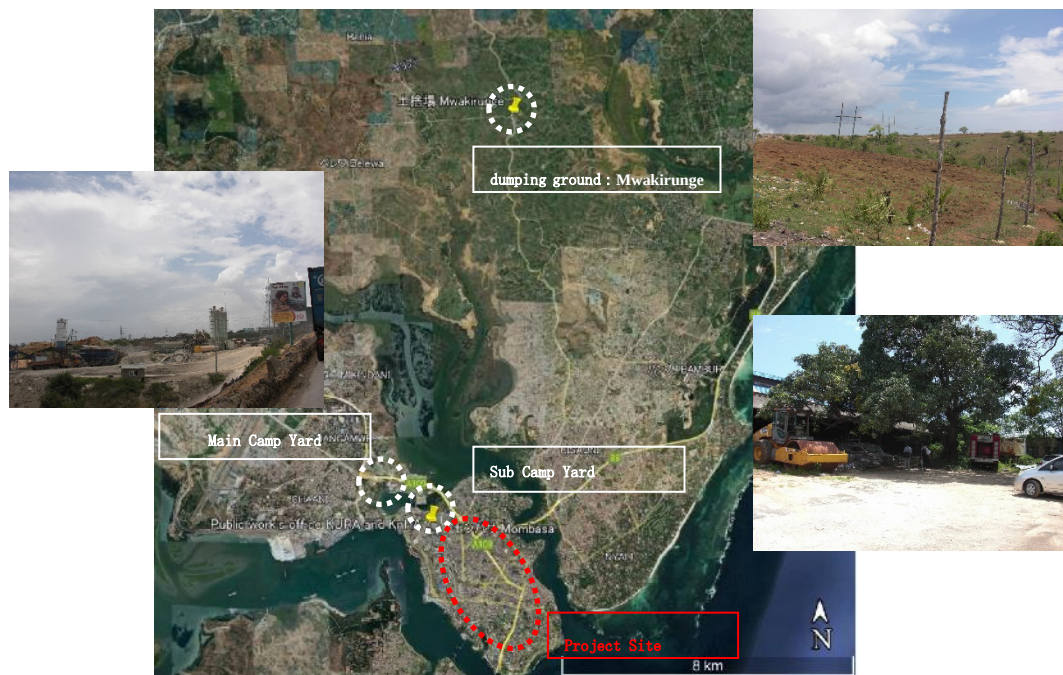
Source : JICA Study Team

Figure 83 Safety Equipment During Construction

(3) Camping Yard and Soil Dumping Area

As for the camp yard and soil dumping site, which are to be responsible by CGM, CGM was consulted that a candidate location of the main camp yard is located around the west side of the Causeway Bridge under construction and confirmed that the CGM Transportation Department site (approx. 30 m x 45 m) is available for the sub-camp yard (temporary storage area for machinery). As for the soil dumping area, it was confirmed that the Mwakirunge area is available. The potential sites for the camp yard and soil

dumping site are shown in the figure below.



Source : JICA Study Team

Note: The main camp yard shown in the figure is a current candidate site and to be finally selected by CGM before the bidding process.

Figure 84 Candidate Sites for Camp Yards and Soil Dumping Sites

2.2.4.3 Demarcation of Works

This project includes intersection improvement work and equipment installation work (traffic control center system, variable information system, signal system, CCTV system, and traffic incident detection system). The contractor and the client need to clarify the demarcation and work closely together in order to proceed with the project.

The project is divided into the following categories: construction, procurement, and installation.

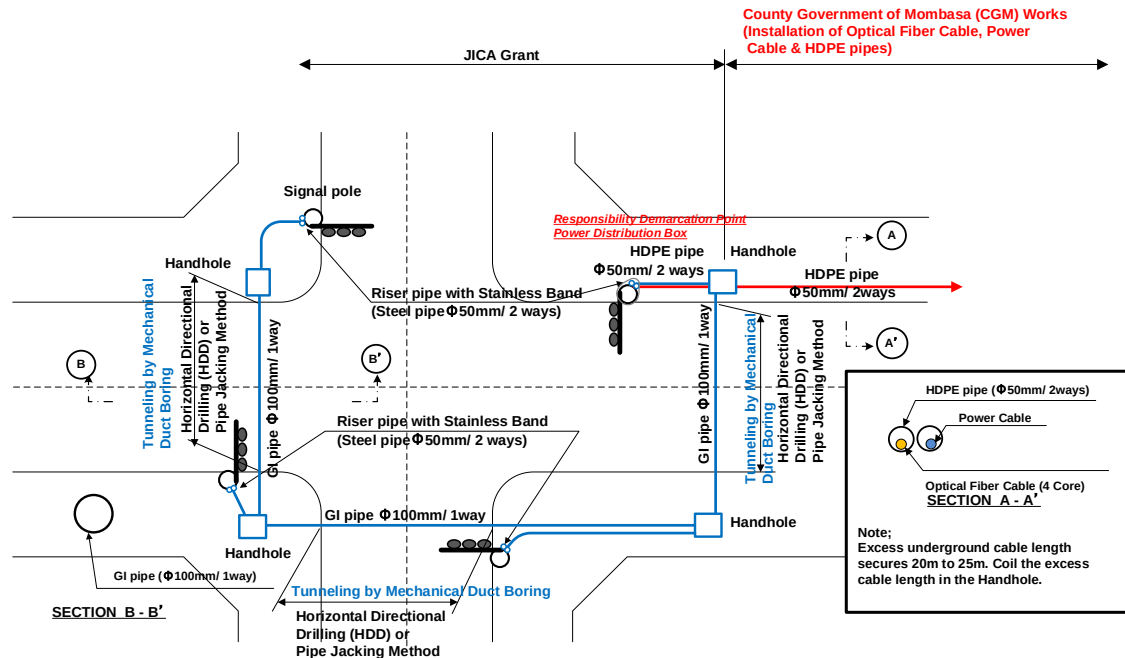
Table 61 Work demarcation between the Japanese Side and the Kenyan Side

Japanese Side	Kenyan Side
◎Cross-grounds improvement works (22 cross-grounds) ◎Installation of Traffic Management Center system (1 set) ◎Variable information system installation (3 locations) ◎Signaling system installation (22 locations) ◎The pedestrian signal equipment is used to pay for the work (3 buildings) ◎CCTV system installation (5 locations) ◎Installation of traffic event detection system (1 set)	◎Cleaning, repair and provision of equipment rooms ◎Coordination and application procedures with various related agencies ✓ Tax Exemptions and Customs Clearance ✓ Road Use Permit ✓ Obtaining other permits (building entry, water, gas, electricity, etc.) ◎Removal of existing equipment (power supply equipment, monuments, etc.) ◎Power supply, communication, pipeline to the equipment ◎Witness equipment installation/adjustment work (test run) ◎Witnessing inspections ◎Witness completion inspections ◎Assignment of counterpart personnel

Source : JICA Study Team

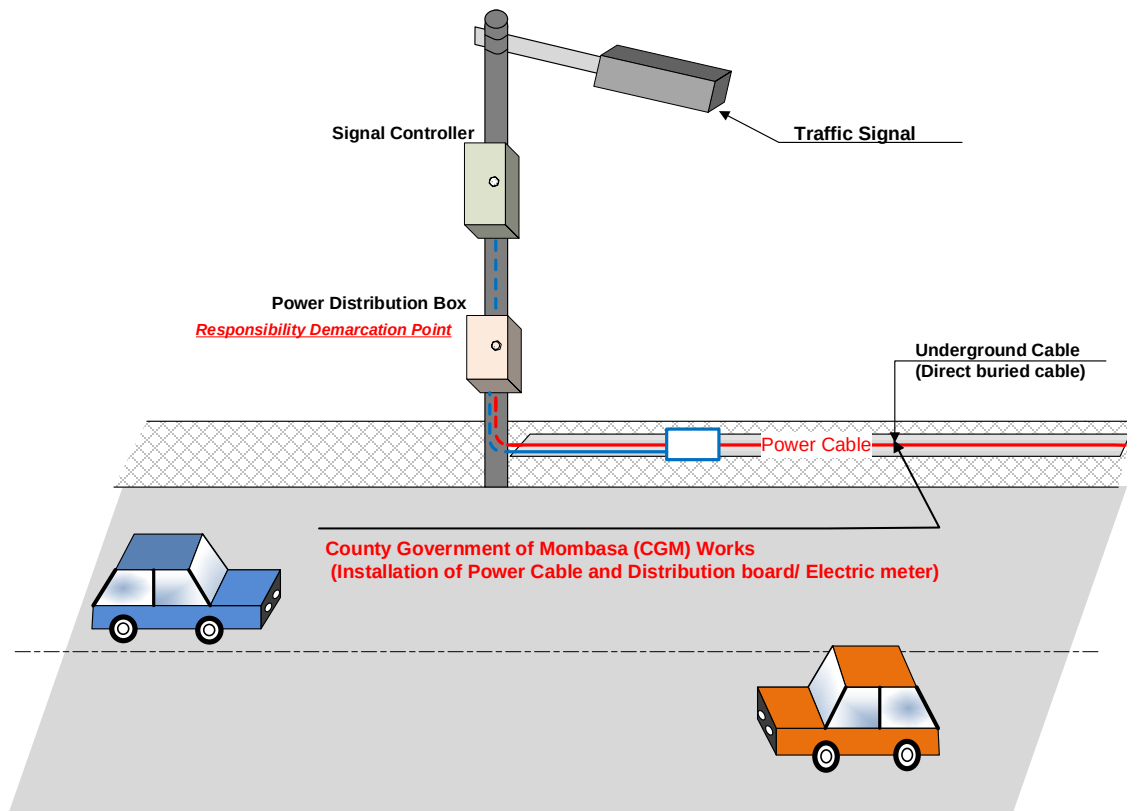
The contractor shall design, fabricate, factory test, export package, transport to site, and verify the performance of each system after installation according to the specifications prepared by the consultant, including civil works. During the construction and field testing, the contractor will also train personnel to transfer the technology to the Kenyan side.

The construction classification diagram for this project is shown below.



Source : JICA Study Team

Figure 85 Construction Demarcation (Piping and Wiring at intersection)



Source : JICA Study Team

Figure 86 Construction Demarcation (Power and Communication Lines to Signal Equipment)

2.2.4.4 Construction Supervision

(1) Design, Preparation of Bid document

A consultant services agreement will be signed between CGM and the Japanese consultant. The contents of the consultancy contract shall include the following:

- ① Consultation with Kenya
Based on the results of the preparatory study for cooperation, the contents of the project and the overall process will be confirmed through discussions with the Kenyan side, and the responsible work by the CGM will also be clarified.
- ② Preparation of bidding documents
The implementation design, construction plan, and bidding documents will be prepared in accordance with the grant aid program. The following personnel will be planned for the implementation design and preparation of bid documents by the consultant:
- ③ Bidding Services
Performs bid public announcements, questions and answers, witnesses bids, evaluates bid results, assists in contract negotiations, and witnesses vendor contracts.

Table 62 Draft Personnel Plan (Implementation Design Framework)

Name	Job Responsibilities
Team leader	Review of equipment specifications, etc., preparation of bidding documents (overall summary of work related to bidding), and final confirmation of plan contents, bidding service
Traffic Control System Design	Final confirmation of plan contents, bidding documents (technical specifications), bidding service
Signal System Design	Final confirmation of plan contents, bidding documents (technical specifications), bidding service
Roadside System Design	Final confirmation of plan contents, bidding documents (technical specifications), bidding service
Intersection Design	Final confirmation of plan contents, bidding documents (technical specifications), bidding service
Topographic/Underground utility survey	Final confirmation of plan contents, bidding documents (technical specifications), bidding service
Implementation Plan/Cost estimation (Civil)	Final confirmation of plan contents, preparation of cost estimate documents, and bidding service
Procurement Planning/Cost Estimation System)	Final confirmation of plan contents, preparation of cost estimate documents, and bidding service
Environmental and Social Considerations	Final confirmation of plan contents, bidding documents (technical specifications), bidding service

Source : JICA Study Team

(2) Construction Supervision

The construction supervision included in the consultant services contract is as follows:

① Supervisory Services

The project includes pre-commencement discussions with relevant parties, approval of design drawings, pre-shipment product inspections, on-site construction supervision, preparation of work reports during the construction period, issuance of interim workmanship certificates, and completion inspections and procedures.

② Completion of the Project

This includes the issuance of completion certificates, completion and handover procedural work, and final work reports. The personnel required for these tasks are as follows. In order to shorten the construction period, a local hired man shall be employed to assist in procurement supervision, as construction will be carried out simultaneously at several locations.

Table 63 Draft Personnel Plan (Construction/Procurement Supervision)

Name	Job Responsibilities
Team Leader	— Delivery witness
Resident Construction Supervision Technician (Civil)	— Stationed onsite throughout the on-site construction period to perform overall construction supervision. — Quality control, overall construction progress supervision, payment procedures, safety management, consultation/negotiation and reporting with the client country — Construction supervision for intersection improvement work
Resident Procurement Supervisory Engineer (Equipment)	— Stationed onsite throughout the on-site construction period to perform overall procurement supervision. — Quality control, overall construction progress supervision, payment procedures, safety management, consultation/negotiation and reporting with the client country — Supervision of construction related to ITS system
Construction Supervisor 1 (Pavement)	— Construction supervision for intersection improvement work — Witness acceptance inspection, completion inspection and handover
Procurement Supervisor 2 (Traffic Control Systems)	— Progress supervision of traffic control system construction, construction supervision, quality supervision, and safety management
Procurement Supervisor 3 (Signaling Systems)	— Progress supervision of signal system construction, construction supervision, quality supervision, and safety management
Inspection Technician 1	— Checking and verifying drawings of the entire ITS system, witnessing factory inspections and pre-shipment inspections
Inspection Technician 2	— Pre-shipment inspection

Source : JICA Study Team

2.2.4.5 Quality Control Plan

Quality control of materials, equipment, and construction work to be procured under the Project shall be carried out in the following manner:

(1) Drawing Review

Request the contractor to submit drawings for all materials and equipment and construction plans, and the consultant shall verify that their specifications and quality are consistent with the contract specifications.

(2) Factory Witness Inspections

After the contractor completes the manufacture of the equipment and purchase of materials, and when the overall operation of the system has been verified and the performance and quantities of the specifications have been satisfied, an on-site inspection shall be conducted at the factory to verify the quantities and performance of the system.

(3) Pre-shipment Equipment Verification Inspection by a Third Party

When the factory inspection is completed and the contractor has packed all the equipment and materials and is ready to ship, a third-party inspection is conducted. The packing list is used to inspect the quantity of equipment and materials packed, their packaging, shipping marks, etc., to ensure that the packaging is suitable for circular transportation and for sea and land transportation within Kenya.

(4) Field Test

The results of on-site installation work are verified through installation inspections and field tests. The field tests are divided into individual tests to verify the functionality of each piece of equipment and comprehensive tests to verify overall system functionality. The contractor will lead the field tests, which will be witnessed by the consultant and the person in charge of CGM. After the comprehensive test is conducted, an inspection completion report will be submitted to JICA and the Government of Kenya to certify the completion.

(5) Warranty Against Defects

The contractor shall guarantee the quality of materials and equipment for a period of one year after completion of the completion and delivery inspection and shall make every effort to restore any defects without delay.

2.2.4.6 Procurement Plan

(1) Civil Engineering Materials

a) Labor

Contractors eligible to receive construction projects in Kenya are registered with the National Construction Authority (NCA). Registered contractors are classified into seven levels based on the contract amount for each type of work. Many of them have extensive experience in various road construction projects in Kenya, including those of other donors, and their skilled workers have high practical skills. Therefore, it is considered to be possible for the company to subcontract the work to the construction company. However, if the project requires a type of work that would be difficult to handle with Kenyan

technical standards, the JICA Study Team will consider dispatching skilled workers from Japan or a third country.

b) Civil Engineering Materials

Based on the results of the field survey, the procurement categories for major construction materials were planned based on the following policies:

- ① Procure locally produced goods whenever possible.
- ② Where imports are permanently distributed in the Kenyan market, they shall be procured.
- ③ Materials that are difficult to procure locally shall be procured from Japan or a third country. Furthermore, the supplier shall be determined by due consideration of price, quality, delivery date, etc.

Table 64 Procurement Classification of Main Materials

Material Name	Modulation Distinction			Remarks
	Local	Japan	Third Country	
Lekkiin material	●			
Modifier		●		
Cement	●			
Aggregate for pavement	●			
Concrete Aggregate	●			
Rebar	●			
Wood (plywood, angle, lumber)	●			
Paint	●			
Steel pipe	●			
Nighttime security devices		●		

Source : JICA Study Team

c) Construction Machinery

Based on the field survey, Class 1 contractors own most of the road construction equipment, and inter-contractor leases are available. Procurement categories of major construction equipment are planned as shown in the table below.

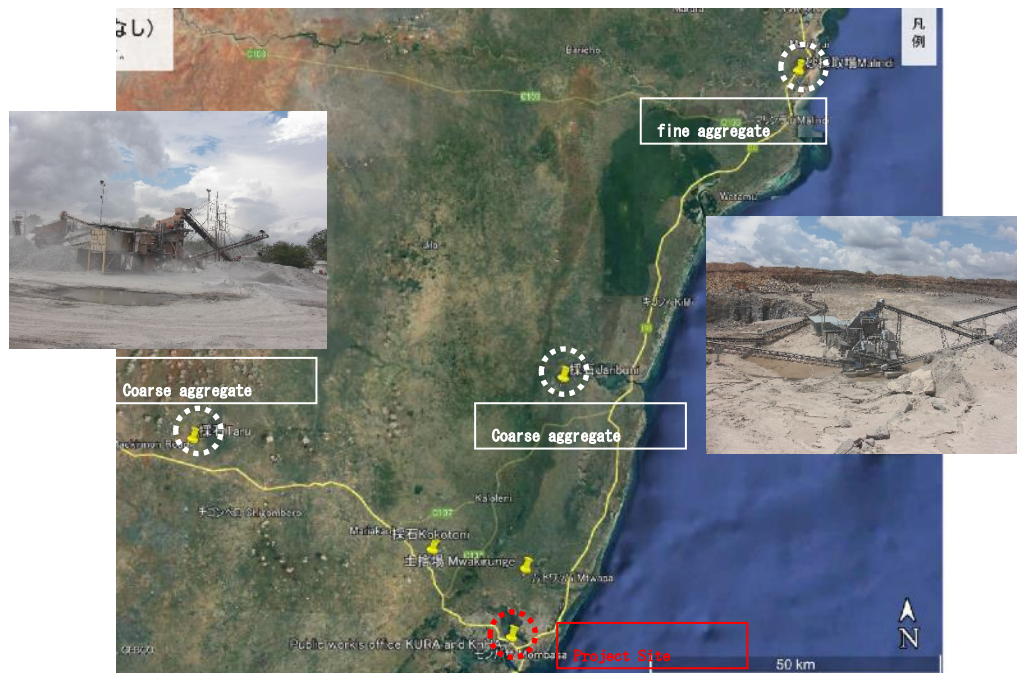
Table 65 Major Construction Equipment Procurement Categories

Machine Name	Standards, Specifications, etc.	Tadasian			Remarks
		Local	Japan	Third Country	
Bulldozer	15 t~21 t	●			
Backhoe	0.13 m ³ ~1.2 m ³	●			
Wheel loader	1.2 m ³ ~2.1 m ³	●			
Motor grader	3.1 m	●			
Road roller	Macadam10 t-12 t	●			
Vibration roller	0.8 t~1.1 t, 3 t~4 t	●			
Tire roller	8 t~20 t	●			
Tampa	60 kg~80 kg	●			
Asphalt finisher	2.4 m~6.0 m	●			
Asphalt distributor	6,000lit	●			
Line marker	Hand type	●			
Concrete cutter		●			
Ready-mixed concrete truck	4.4 m ³	●			
Concrete breaker	600 kg~800 kg	●			
Compressor	3.5 m ³ ~5.0 m ³	●			
Dump truck	4~10 t	●			
Semitrailer	20 t	●			
Truck crane	4.9t~16 t	●			
Rough terrain crane	4.9t~25 t	●			
Truck with crane	2~10 t	●			
Power generator	10~500 KVA	●			
Sprinkler truck	11,000 lit	●			
Concrete mixer	0.2 m ³	●			
Asphalt plant	60 ton/h	●			
Road cutting machine		●			

Source : JICA Study Team

d) Sources of Aggregates

Aggregates for concrete and asphalt concrete will be procured from the areas shown in the diagram below. The same aggregate is used in the Mombasa Port Development Project (Toyo Construction Co., Ltd.) and the Mombasa Special Economic Zone Development Project, both of which are being financed with yen loans from Japan, and material tests have been conducted for the Mombasa Gate Bridge Project, which is also a candidate supplier. As for the aggregate procurement for this project, the Malindi River will be used for fine aggregate and the Jaribuni area for coarse aggregate, as is the case with the project underway.



Source : JICA Study Team

Figure 87 Potential Aggregate Suppliers

(2) Equipment and Materials

a) Labor

Same as Civil.

But there are few companies in the communications and systems field, necessitating the implementation of training within the project.

b) Equipment and Materials

Based on the results of the field survey, equipment procurement categories were planned based on the following policies:

- ① The system server is an important piece of ITS equipment, which requires high quality and cannot be satisfied by procurement from the local market or a third country.
- ② Network-related equipment (routers, switches, storage devices, etc.) shall be made in Japan or a third country, since most of them are not only made in Japan but also in a third country (United States, Germany, etc.).
- ③ Since signal lights are expected to be replaced more frequently, they should be made in third countries (South Africa, Austria, etc.), which are widely distributed in Kenya, from the viewpoint of ease of procurement.
- ④ Installation materials, such as support columns and gantries, will be locally manufactured, as they can be procured in Kenya and are of acceptable quality.

Table 66 Equipment Procurement Classification

System Title	Equipment Name	Procurement Category		
		Local	Japan	Third Country
Traffic Control Center System	Facility management server		●	
	Traffic image management server		●	
	Traffic information generation server		●	
	Data linkage server		●	
	Data storage (for video)		●	●
	Data storage (for data)		●	●
	Video wall		●	
	Video switcher		●	
	Operator console (workstation)		●	
	IP telephone		●	●
	Telephone recorder		●	●
	Color laser printer		●	●
	SAN switch		●	●
	L2 Switch		●	●
	L3 Switch		●	●
	Uninterruptible power supply (for traffic control center)		●	●
	Storage rack (19-inch rack)		●	●
Variable Information System (VMS)	VMS server		●	
	variable indicator board		●	
	Controller		●	
	Uninterruptible power supply		●	●
	Cabinet		●	●
	Gantry	●		
Signaling System	Signal control server		●	
	Signal controller		●	
	(pedestrian) traffic light controller		●	
	Image-type vehicle detectors (for intersections)		●	
	Image-type vehicle detector (for single road section)		●	
	Vehicle signal lights (main)			●
	Vehicle signal lights (sub)			●
	(Pedestrian) Crosswalk signal light			●
	Wireless transmission equipment (parent unit)		●	
	Wireless transmission equipment (child unit)		●	
	Uninterruptible power supply (for signal intersection)		●	●
	Uninterruptible power supply (for pedestrian signals)		●	●
	Solar power generation equipment (including batteries)			●
	Cabinet (for signal controller)		●	●
	Cantilever pole (for main signal)	●		
	Standard pole (for sub-signal)	●		
	Cantilever pole (for detector)	●		
CCTV System	CCTV server		●	
	CCTV camera (fixed type)		●	●
	Uninterruptible power supply		●	●
	Cabinet		●	●
	Cantilever pole (for CCTV camera)	●		
Other	Firewall		●	●

(Data center)	IDS/IPS		●	●
	SAN switch		●	●
	L2 switch		●	●
	L3 switch		●	●
	Uninterruptible power supply (for data centers)		●	●

Source : JICA Study Team

(3) Transportation Route

In consideration of economy, safety, and transportation process, it is considered appropriate to unload the equipment at the Port of Mombasa, Kenya, and transport it by land to the main camp yard. After unloading and customs clearance at the Port of Mombasa, all equipment will be transported and stored at the main camp yard in Mombasa. Thereafter, the equipment and materials will be brought into the sub-camp yard according to the construction plan. The transportation plan is shown below.

Table 67 Transportation Plan

Marine Transport	Overland Transport	Target Materials
Transportation by container ship from Yokohama Port or equivalent to Mombasa Port in Kenya	After unloading and customs clearance at the port of Mombasa, Kenya, all equipment will be transported inland to the main warehouse in Mombasa. After that, the equipment and materials will be delivered to each site according to the construction plan.	Modified materials Japanese procured equipment above

Source : JICA Study Team

2.2.4.7 Initial Training Plan by the Contractor**(1) Initial training Plan**

In order to ensure continuous operation of the installed equipment over a long period of time, the plan is to provide operational guidance by Japanese contractor. The operational guidance will be provided by Japanese technicians of Japanese Contractor, which will also serve as on-the-job training. The Japanese engineers will provide guidance for both systems in parallel.

(2) Contents

Operational guidance will be provided by the contractor, and in addition to desktop training, guidance will be provided for the purpose of acquiring the following skills using actual equipment:

Japanese Side
1. Guidance on basic electrical, telecommunications, and ITS technologies
2. Operating technology
3. Inspection method
4. Defect detection method
5. How to deal with the defects
6. Method of operating the record book pertaining to maintenance

Source: JICA Study Team

2.2.4.8 Soft Component Plan

The basic operation of the system to be introduced will be the operation by Operators at the TMC (Traffic Management Center) and the activities of the Data Analysis Team, which analyzes traffic information and event analysis information and improves the system and traffic management. becomes important.

Operators are already in operation in the existing Operating Room at Inspectorate, which monitors traffic conditions at each intersection using a CCTV monitoring system, as well as operating a call center that provides telephone contact with related parties. Technical skills are required to support introducing the ITS system including VMS systems and event analysis systems.

CGM's Transport Infrastructure & Public Works (TI&PW) is the department responsible for improving systems and traffic management as part of the Data Analysis Team. It is the mainstay of the transportation bureau and requires the technical ability to adjust signal system parameters and improve traffic management based on traffic management technology and traffic information and event analysis information.

Maintenance and management will be carried out by the person in charge of maintenance management in CGM and a maintenance company with which CGM has a contract, but a maintenance company with ITS technology will be selected early and the services of the maintenance company will be managed by CGM personnel will be required.

In addition, in order to operate the system more effectively, the activities of "Inspectorate", which handles on-site regulations and enforcement, are important. Regarding regulations and enforcement at intersections using Inspectorate, it is necessary to learn traffic etiquette from a new perspective and provide guidance to residents using Inspectorate as traffic lights are installed and intersections are improved.

Furthermore, CGM needs technology and capability that can handle traffic information and utilize it for future traffic management and planning.

Soft Component has been carried out to ensure the smooth start of operation of the system being introduced, but it was decided that more organized and continuous capacity development will be required, and a separate Technology Cooperation Project is planned by JICA.

Therefore, the Soft Component will not be implemented for the Project.

2.2.4.9 Implementation Schedule

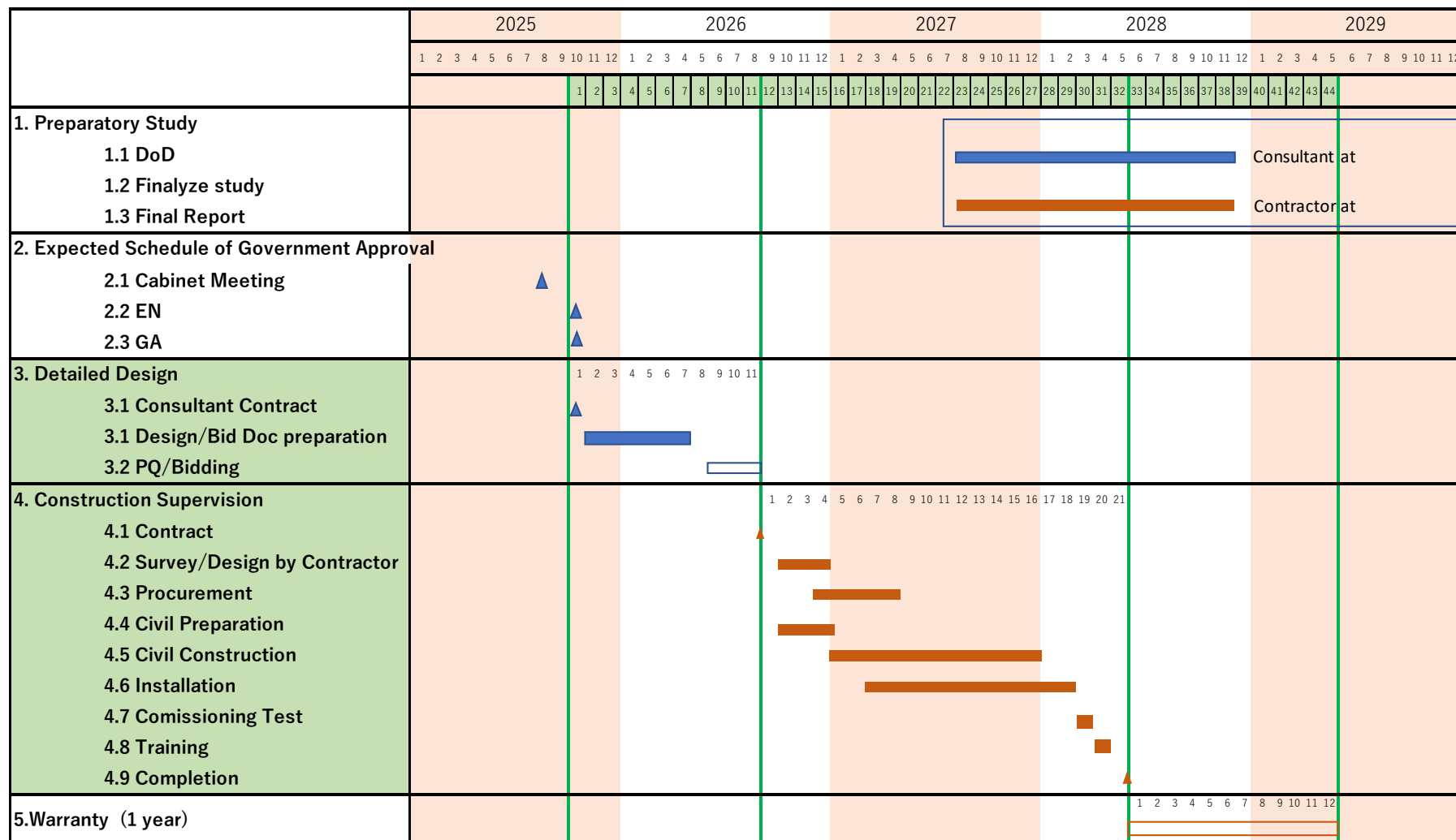
The implementation schedule should examine the construction capacity in consideration of the local security situation, road users being adjacent to the construction site, and third parties and construction workers. The following are points to be considered when reviewing the process plan:

- ① To take care of the local security situation and the health of the construction manager and workers, continuous construction during the day and night will not be conducted.
- ② The construction period is separated into three stages according to the difficulty of construction: Construction Section I period, Construction Section II period, and Construction Section III period, and the process is planned according to this order.
- ③ The number of parties for construction shall be one party in principle, and in order not to affect the local security situation and roads life, construction sites should not be dispersed.
- ④ Construction capacity will be considered from road surface milling, paving, curbing and other ancillary structures, and equipment installation.
- ⑤ For road surface milling and paving operations, the machine travel time (travel time to the next intersection) is considered.

- ⑥ Consideration shall be given to the changeover of construction type setup and traffic control.

The tentative Implementation Schedule is shown on the table below.

Table 68 Implementation Schedule



Source: JICA Study Team

2.3 [YO79]Security Plan

After surveying the security risks at the proposed project sites, a summary of the risks and the necessary safety measures are described below.

【Risks at Each Activity Location】

Each of the project's activity locations and the potential risks assumed at those location are listed below.

- Main camp yard (offices and equipment and materials): robbery (for employees), burglary or theft (in absence)
- Sub camp yards (equipment and materials): burglary or theft
- Accommodations/Residences: robbery, burglary or theft
- Construction site (daytime) (construction with traffic regulation): traffic accident, robbery, burglary or theft
- Construction sites (nighttime) (construction within road blocked): traffic accident, robbery, burglary or theft
- Transfer (nighttime) (between camp yards, construction sites and accommodations/residences): robbery, burglary or theft

2.3.1 Main Camp Yard

(1) Exterior walls around the area

The entire main camp yard will be covered with a concrete exterior wall.

An electric fence will be installed at the top of the exterior wall, but since it may not be usable in the event of a power outage, razor blade wire will be installed. In addition, the exterior wall shall be designed to make it difficult to see into the yard.

(2) Security gate

A security guard will be stationed at the security gate. A standard procedure is established and implemented whereby a security guard checks whether a visitor is pre-registered; checks his/her ID; confirms whether he/she plans to visit the destination; checks the interior, trunk, and bottom of the vehicle with a mirror; records the visitor's ID, vehicle number, and time of entry and leaving in a record book; and permits entry after giving the visitor a pass to enter the premises.

In addition, an alarm system and an emergency telephone should be installed to report any intruder or suspicious object found. A waiting booth that can be monitored by security guards will be set up at the entrance.

(3) Obstruction to prevent vehicle entry

A steel gate will be installed at the entrance of the exterior wall as an obstruction to prevent vehicle entry.

(4) Office

For the offices in the main camp yard where related personnel stay for long periods of time, the exterior walls of the facility itself shall be made of concrete, and the windows shall have metal lattices or shatterproof window film. The entrance and exit will have steel doors with double locks, intercom, and door scope monitors from the security gate. The lattice windows with metal frame will be installed as a measure against crime prevention and shatterproof window film will be installed as a measure against explosions.

(5) Safe haven in the office

A safe haven at the office in the main camp yard will be installed for the purpose of emergency barricade.

(6) Site surveillance/Security system

1) Watchtower

A watchtower will be installed in the main camp yard to monitor the site 24 hours a day.

2) Private security

The main camp yard will be arranged 24 hours a day by a security force including armed guards, who will guard the office entrances and patrol around the grounds of the yard.

3) Security control room and related equipment

The main camp yard will be equipped with a security operation room in the safe haven to allow for external monitoring and communication.

4) Detectors and metal detectors

The main camp yard will be equipped with metal detectors for pedestrians as attendance and baggage at the office entrance, which is a secondary line of defense.

5) Surveillance camera

Surveillance cameras will be installed to intimidate criminals, prevent crime, and watch criminals' movements.

6) Security lighting

Security lighting will be installed at intervals that will cover the main part of the main camp yard.

7) Alarm system

In the main camp yard, sensors will be installed in the ceilings and windows of office entrances, which are easily broken into at night, to establish a system that alerts the security to the occurrence of intruders.

8) Warehouse

A steel warehouse for storing materials in the container yard and stock yard will be installed. The lattice windows with metal frame and multiple locks on doors will be installed.

2.3.2 Sub Camp Yard

(1) Exterior wall around the area

The sub camp yard is located on the premises of CGM and an existing building and exterior wall are already in place, but other concrete exterior wall will be covered around the lease area so that the project can be controlled even if the security system is changed on the CGM side.

In addition, an electric fence will be installed at the top of the exterior wall; since it may not be usable in the event of a power outage, razor blade wire will be installed.

(2) Security gate

The sub camp yard has already been arranged by CGM's security guards; even if the security system is changed on the CGM side, a security guard will be stationed there for this project.

(3) Obstruction to prevent vehicle entry

A steel gate will be installed at the entrance of the exterior wall as an obstruction to prevent vehicle entry. The gate shall be closed and locked at all times.

(4) Office

The sub camp yard will be used for temporary storage of materials and equipment, and no office will be set up there.

(5) Safe haven in the office

The sub camp yard is not expected to have an office, and therefore will not have a safe haven.

(6) Site surveillance/Security system

1) Watchtower

Since the sub camp yard is located on the premises of the government, where the area is relatively small, no watchtower will be installed.

2) Private security

The sub camp yard will be arranged 24 hours a day by a security force including armed guards, who will guard the office entrances, patrol around the grounds of the yard, and alert support personnel in the event of an emergency.

3) Security control room and related equipment

The sub camp yard will have an evacuation area where security guards can stand by in case of an emergency and be able to see people entering and leaving through bulletproof glass.

4) Detectors and metal detectors

The sub camp yard will be equipped with metal detectors for pedestrians as attendance and baggage at security gate as the entrance.

5) Surveillance camera

Surveillance cameras will be installed to intimidate criminals, prevent crime, and watch criminals' movements.

6) Security lighting

Security lighting will be installed at intervals that will cover the main part of the sub camp yard.

7) Alarm system

In the sub camp yard, sensors will be installed in the ceiling and windows of the entrance of the warehouse to establish a system that alerts the security about the occurrence of intruders.

8) Warehouse

A steel warehouse will be installed in the sub camp yard on the leased premises for storing small equipment such as compressors, pumps, small compactors, tools such as hammers and saws, lumber, and other materials.

2.3.3 Accommodations/Residences

(1) Exterior wall around the area

An accommodation/residence will be selected that has exterior wall with an entrance located off site, interior lighting turned on/off, and security guard movements not visible from the outside. It should be desired that the exterior wall is made of concrete and has an electric fence and wire braid attached to the top of the exterior wall.

(2) Security gate

An accommodation/residence will be selected where security guards are stationed at the entrance and they open/shut its vehicle gates. In addition, the gates installed at the entrances from public roads are closed and locked at all times.

(3) Obstruction to prevent vehicle entry

The accommodation/residence will be selected so that steel or metal gates will be installed at the entrances from public road.

(4) Security system

1) Private security

The accommodation/residence where two security guards (2 shifts, 24 hours a day) will be assigned to control access to the dormitory and patrol the premises will be selected.

2) Security control room and related equipment

The accommodation/residence with surveillance camera monitors, fire alarm control panels, and a security operations room that can be used to broadcast the building and contact security forces in case of emergency will be selected.

3) Surveillance camera

Surveillance cameras are installed to intimidate intruders and criminals and prevent crimes, and not for responding to crimes that have occurred. The accommodation/residence will be selected wherein surveillance cameras have been installed in common areas such as entrances, exits, stairways, and hallways.

4) Security lighting

The accommodation/residence will be selected where indoor and outdoor security lighting has been installed.

5) Alarm system

The accommodation/residence will be selected where janitors control access to the building 24 hours a day or where motion sensors are installed.

2.3.4 Safety Measures at Construction Sites

In order to prevent increased risk of danger due to the dispersion of construction crews, construction should be performed at each intersection, rather than simultaneously at multiple locations by multiple crews.

The intersection to be improved is relatively busy and congested. Especially in the morning and evening during commuting hours, traffic becomes stagnant. Therefore, traffic controllers and traffic police officers are assigned to prevent accidents caused by vehicles running into traffic regulations, and evacuation sites at each site are checked on a daily basis. In addition, all parties will share their unsafe incidents experience in the field. Supervisory staff, field workers, operators, and traffic control personnel will conduct evacuation drills on a monthly basis.

The construction area will be closed by construction safety fences. Advanced construction warning sign will be installed to notify drivers that traffic restrictions are in place. During the night, the construction lighting equipment (security lamps) should be arranged and powered to provide lighting to the construction work area without any blind spots. To prevent robbery,

burglary or theft at the construction site, armed security guards will be deployed both daytime and nighttime to patrol the area without blind spots. The armed security guard shall establish and implement procedures when they recognize a suspicious person for requesting backup by radio and so on, and for guiding supervisors, workers, etc. to evacuate. In addition, the armed security guards who regularly undergo training in the handling of weapons and equipment and first aid training shall be assigned.

At night, supervisors, workers, operators, traffic wardens, traffic control officers, and armed security guards shall wear self-luminous safety vests and helmets with reflective material and construction lighting equipment shall be installed.

In addition, the construction area shall be clearly separated from the traffic zone by installing construction-type barriers (concrete, water tank barricades (Confirmed for use at a road construction site in Nairobi), rubber cones, etc.).

(1) Daytime traffic regulation (Prevention against traffic accident, robbery, burglary or theft)

Daytime traffic regulation should be considered for construction between 10:00 a.m. and 4:00 p.m., avoiding the morning and evening rush hours.

Within the traffic regulation, traffic wardens will be placed at the beginning of the regulation, traffic control officers will be arranged near the construction implementation, and armed security guards shall be posted to prevent robbery, burglary or theft within the traffic regulation area. The traffic warden will lead vehicles into the traffic zone and use buzzers, loudspeakers, and whistles to notify workers within the traffic regulation when there is a risk of a vehicle running into the traffic regulation and causing an accident. The traffic control officers will guide vehicles around the construction area, control and guide construction site traffic when they enter and exit the restricted area, patrol the restricted area, and correct any defects of construction regulation equipment. The armed security guards will constantly patrol the traffic regulation area in order to prevent against robbery, burglary, and theft within the construction area.

(2) Nighttime traffic regulation (Prevention against traffic accident, robbery, burglary or theft)

Within the traffic control section, traffic wardens will be placed at the beginning of the road blocked, one of whom shall provide detour guidance at the road closed section. Traffic control officers will be arranged near the construction implementation and armed security guards shall be posted to prevent robbery, burglary or theft within the traffic regulation area. Supervisors, workers, operators, traffic wardens, traffic control officers, armed security guards, and control personnel shall wear reflective self-luminous (LED) safety vests and helmets with reflective material.

To clearly indicate to passing vehicles that there are construction workers, construction lighting will be installed within the construction work area. Since commercial power supply is not expected to be secured, a generator and its fuel, extension cord drums for the construction site will be provided. Construction lighting will be installed at the beginning (1 lamp) and middle (1 lamp) of the traffic regulation section, and at the road closure point (1 lamp) in the traffic control section.

In addition to the above, construction lighting and generators will be installed for the construction area.

2.3.5 Mobility Management

(1) Vehicle, Drivers

To avoid becoming a target, 4WD vehicles shall be used and the movement routine shall be modified accordingly. Drivers who are familiar with local customs will be hired. Drivers will receive first aid training regularly and carry a first aid kit at all times. Since the Embassy has only one bulletproof vehicle, arranging for bulletproof vehicles shall not be required.

(2) Nighttime travel

During nighttime traffic control construction, to avoid damage from robbery when traveling between the camp yards, sites, and accommodation/residences, travel will be split into two or more vehicles and use a security escort service.

2.4 Obligations of Recipient Country

2.4.1 Important Procedures to be taken by the Government of Kenya

(1) Tax exemption

Under the Japanese Grant Assistance, to implement procedures for the exemption of Japanese nationals or Japanese corporations engaged in the Project from Kenyan customs duties, internal taxes, including value-added tax (VAT), and other other fiscal levies in Kenya with respect to the expedited duty-free treatment of equipment and materials purchased for the Project and the provision of equipment and services under the Customs Clearance and Certification Agreement.

Category	tax exemption	Procedure Overview	Required period
Corporate income tax for Japanese companies	Permitted	- Obtain a corporate registration PIN from the KRA. - Registered as the Kenya branch of a company headquartered in Japan. - Claim as exempt income under Section 71 of the Income Tax Act when filing your tax return. - Since the grant agreement stipulates a tax-exempt limit, contact the JICA office as necessary to obtain the documents required to certify the tax-exempt limit.	-
Corporate income tax for third-country companies	Permitted	Same as above.	-
Corporate income tax for Kenyan companies	Not permitted	The same as a regular corporate tax return.	-
Income Tax for Japanese employers	Partially permitted	- Non-residents (those who stay less than 183 days per year or averaging 122 days or less per year over a two-year period and having no taxable income): No procedures required. - Residents (those staying 183 days or more per year or averaging 123 days or more per year over a two-year period): Not eligible for tax exemption at the time of the survey; countermeasures are under consideration.	-
Income Tax for third-country employers	Partially permitted	Same as above.	-
Income Tax for Kenyan employers	Not permitted	The same as a regular income tax return.	-
Withholding tax for Japanese employers	Partially permitted	- Non-residents: No procedures required. - Residents: Not eligible for tax exemption at the time of the survey; countermeasures are under consideration.	-
Withholding tax for third-country employers	Partially permitted	Same as above.	-

Withholding tax for Kenyan employers	Not permitted	The same as a regular withholding tax return.	-
Value Added Tax (VAT)	Permitted (Pre-Tax Exemption)	Responsible Agency: EA (Implementing Agency), MM (Supervising Ministry), NTP (National Treasury), KRA (Kenya Revenue Authority) ① Contractors shall apply for tax exemption through EA. The application must include all required documents, such as a complete list of materials and equipment (master list). ② After receiving the documents from the contractor, EA requests MM to apply for tax exemption. ③ MM formally requests tax exemption from NTP. ④ NTP approves the application and issue the tax exemption certificate. ⑤ Contractors shall apply to KRA for VAT exemption prior to the actual procurement of materials and equipment, attaching the approved master list and pro forma invoice.	EA and MM : Approximately 2 months NTP : Approximately 2 months KRA : Approximately 2 to 3 months
Customs duties and other indirect taxes levied within Kenya	Permitted (Pre-Tax Exemption)	Responsible Agency: EA, MM, NTP, KRA ① Contractors shall apply for tax exemption through EA. The application must include all required documents, such as a complete list of materials and equipment (master list). ② After receiving the documents from the contractor, EA requests MM to apply for tax exemption. ③ MM formally requests tax exemption from NTP. ④ NTP approves the application and issue the tax exemption certificate. ⑤ Contractors shall apply to the KRA for duty exemption for each individual item scheduled for import, attaching the shipping documents and the approved master list. ⑥ KRA will issue a Duty-Free Note after verifying the documents.	EA and MM : Approximately 2 months NTP : Approximately 2 months KRA : Approximately 2 to 3 months

Source : JICA Study Team

(2) Provision of facilities

Provide Japanese nationals or Japanese corporations engaged in the Project with the necessary facilities for entry and stay in Kenya with respect to the provision of equipment, materials and services under the certification agreement.

(3) Banking arrangements, issuance of payment authorization

Process banking arrangements (B/A) for payments related to the contract and issue authorization for payment (A/P) and pay the associated fees.

2.5 Project[YO80] Operation Plan

In order to sustain this project, it is necessary to allocate appropriate personnel for the operation and maintenance of the system. Currently, the Inspectorate, which is a department of CGM, has a Traffic Control Room (TCR) and three operators are monitoring the traffic status captured by 85 CCTVs installed in many intersections.

The three are also engaged in wireless communication with inspectors who are cracking down on parking violations and guiding traffic at intersections and responding to telephone calls from outside. However, operation after introduction of new systems in this project requires a greater number of operators, and the current TCR will be narrower, and the status will hinder the effective use of the system. In TCR, two 80-inch LCD monitors show images of intersections, but each image is small and does not have a screen circulate function. If there is an intersection that the operator wants to check, the image will be enlarged, but the image will occupy the entire monitor screen. In the existing system, many incidents are overlooked because the discovery of incident has to rely on the operator's visual observation.



Source : JICA Study Team

Figure 88 Existing Traffic Control Room of CGM

2.5.1 Operation Status

The Traffic Management Center (TMC) will be under the jurisdiction of the Transport Department, which is in charge of planning, operation, and maintenance of CGM's ITS system, and will report directly to the Director-Transport.

The Director-Inspectorate will cooperate through the traffic control center to respond to incidents. In addition, the data collected on various traffic will be analyzed and statistically organized as needed by the Transport Department. Normal daily reporting work is carried out within Traffic Management Center (TMC).

On the other hand, regarding maintenance, daily management is carried out by the Traffic Management Center (TMC) operator, and if a system malfunction occurs or the system needs to be updated, the maintenance company is requested to handle it. If a problem that the maintenance company cannot handle is derived, the maintenance company will request the system supplier to handle it. The Director-ICT will handle any problems related to the network.

Since CCTV monitoring, contact with related parties, and call center functions will continue to be implemented, TCR operators will move to TMC and continue to carry out the operations.

2.5.1.1 Roles of the Staff Member of Traffic Management Center (TMC)

The operation policy of TMC will be decided by two directors, i.e., “Transport” and “Operation and Services”, since they have jurisdiction over TMC. In case of changing the roles and responsibilities such as data utilization for another purpose and/or adding new source for data analysis, these two directors will consult each other and if there is a significant change, they will raise the matter to the Advisory Committee for discussion which may/will be established for Technical Cooperation Project. The table below shows the work contents (roles and responsibilities) of each staff member working in TMC.

Table 69 Roles and Responsibilities of Each Staff Member

Position	Roles and Responsibilities	Work Hour
Manager	- Responsibility for managing and directing all activities of the Traffic Management Center - Final judgment of display on VMS (when consulted by operator 3) - Various coordination between the Traffic Management Center and other government agencies including the traffic police - Checking reports issued by the system - Request Director-Transport to edit and analyze data / information as required by CGM and at the request of government agencies. - Participate in the morning meeting at the shift change to the night shift meeting and give appropriate instructions to the team of the next shift.	Day work
Operator1 (In charge of Call Center)	- Receiving and answering questions from general users and related government agencies - Providing necessary information to related government agencies - Request to provide the information required by the Traffic Information Center to the relevant government agencies (mainly MGB) - Summary of contact information for the next shift team	2 shift/24hrs
Operator2 (In charge of CCTV + Video Wall)	- Monitoring by CCTV - If an alarm is issued, check what kind of event it is. If necessary, zoom in and grasp the incident with the PTZ camera at the same intersection. - Monitoring traffic conditions on a schematic map of the video wall - Contact Inspectorate. If necessary, contact the traffic police, ambulance, and fire department to request dispatch.	
Operator3 (In charge of VMS + Maintenance)	- Monitoring traffic conditions on a schematic map of the video wall - When an incident occurs, the displaying contents of VMS will be judged according to the priority. If it is difficult to make a decision, ask the instructions of the instructions. - Enter the required information in VMS (manual/premade input) - From the VMS display on the screen of the video wall, check if there is a difference in the displayed contents. - If a problem occurs in the signal system, traffic measurement system, event detection system, or VMS, contact the maintenance.	

Source : JICA Study Team

The table below shows the required qualifications of the Manager.

Table 70 Required Qualifications of a Manager

Position	Required Qualification
Manager	- Degree : Bachelor of Transportation or Civil Engineering - Work Experience : 10 years or over - Experience of Manager : 3 years or over - Language Capability : Fluent in English

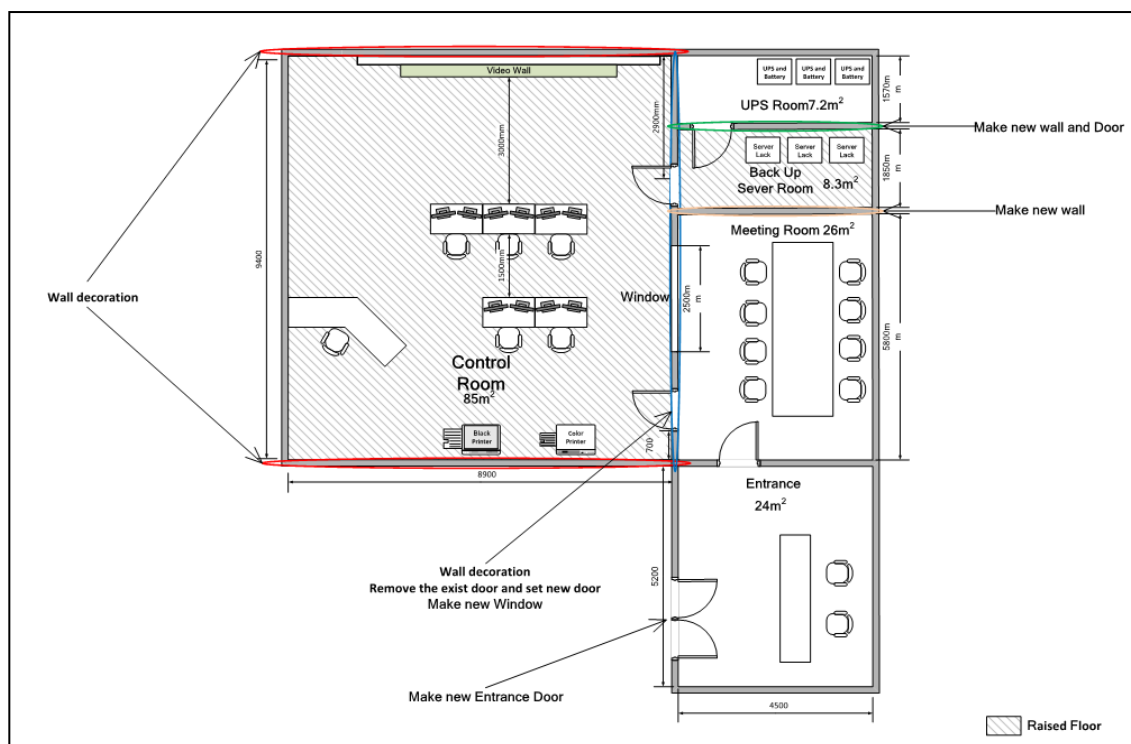
Source : JICA Study Team

2.5.1.2 Deployment of TMC Staffs

Each member of staff of TMC will carry out the work on the consoles arranged in two rows in front of the video wall. Each desk and height will be arranged in consideration of ergonomics due to the size and height of the video wall. In addition, two monitors will be installed on each console so that the operator can check multiple screens at the same time.

The manager constantly checks the video wall and the performance of the operator from behind and gives instructions as necessary.

Three (3) operators is required, and the remaining console will be a space for the Transport Engineer of the Data Analysis Team of the Transport Department and the staff in charge of maintenance to work as needed.



Source : JICA Study Team

Figure 89 Deployment of Staff of the Traffic Management Center

2.5.1.3 Shift of TMS Operators

The two (2)-shift system for 24 hours operation will be adopted so that operators can commute to work in a safe time zone, and a system of three (3) teams is recommended so that staff can takes two (2) shift off after one (1) shift work basically including backup. The manager will only work during the day, but will participate in meetings (takeover) at the time of shift change

It is important that all operators are familiar with all tasks and that regular training is essential.

Table 71 Shift Table

	Day1		Day2	
	Shift-1 8:00-20:00	Shift-2 20:00-8:00	Shift-1 8:00-20:00	Shift-2 20:00-8:00
Team1	On-duty	Off	Off	On-duty
Team2	Off	On-duty	Off	Off
Team3	Off	Off	On-duty	Off

Source : JICA Study Team

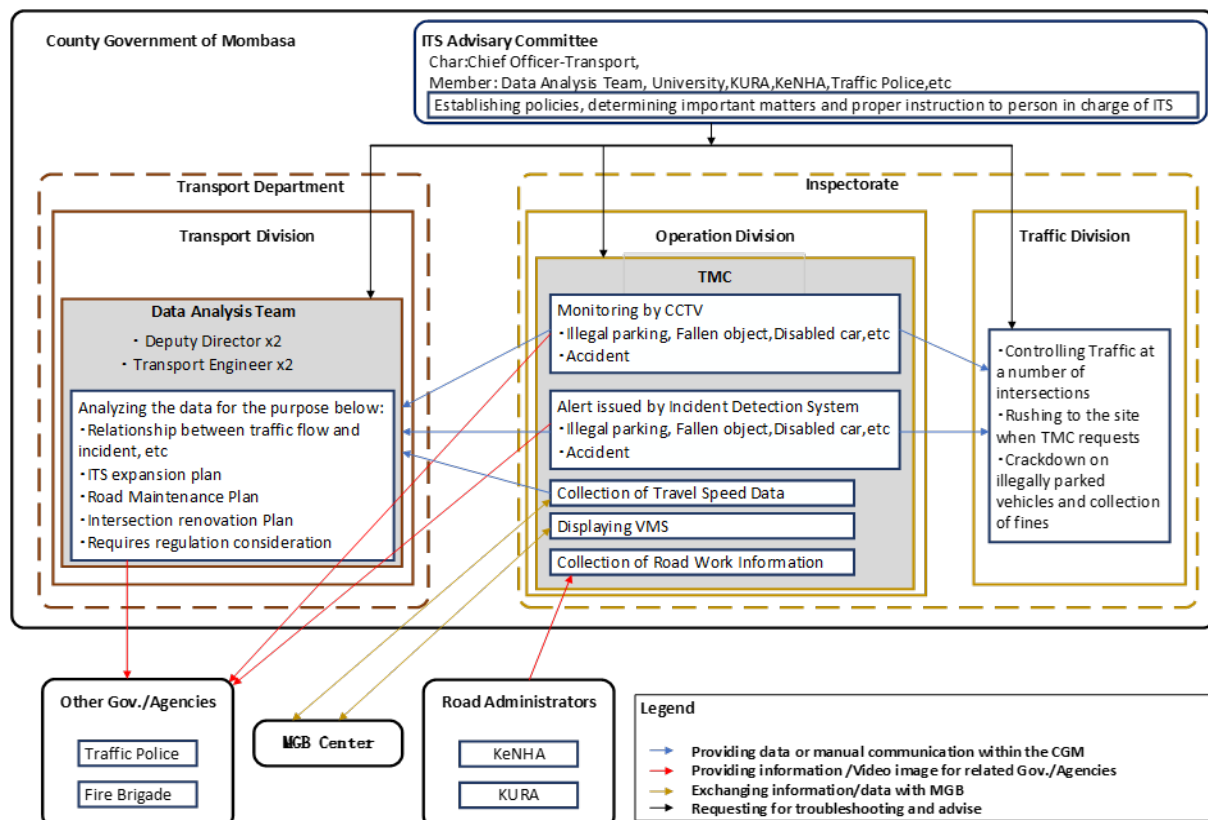
2.5.1.4 Relationship Between TMC and Organizations Within and Outside

This shows the relationships between TMC, internal organizations within CGM, and external organizations.

Within CGM, the proposal includes strengthening the TMC function within the Transport Division of the Inspectorate, establishing a Data Analysis Team within the Transportation Division of the Transport Department (Transport Infrastructure and Public Works), and outside CGM, creating a new ITS Advisory Committee involving universities and related institutions.

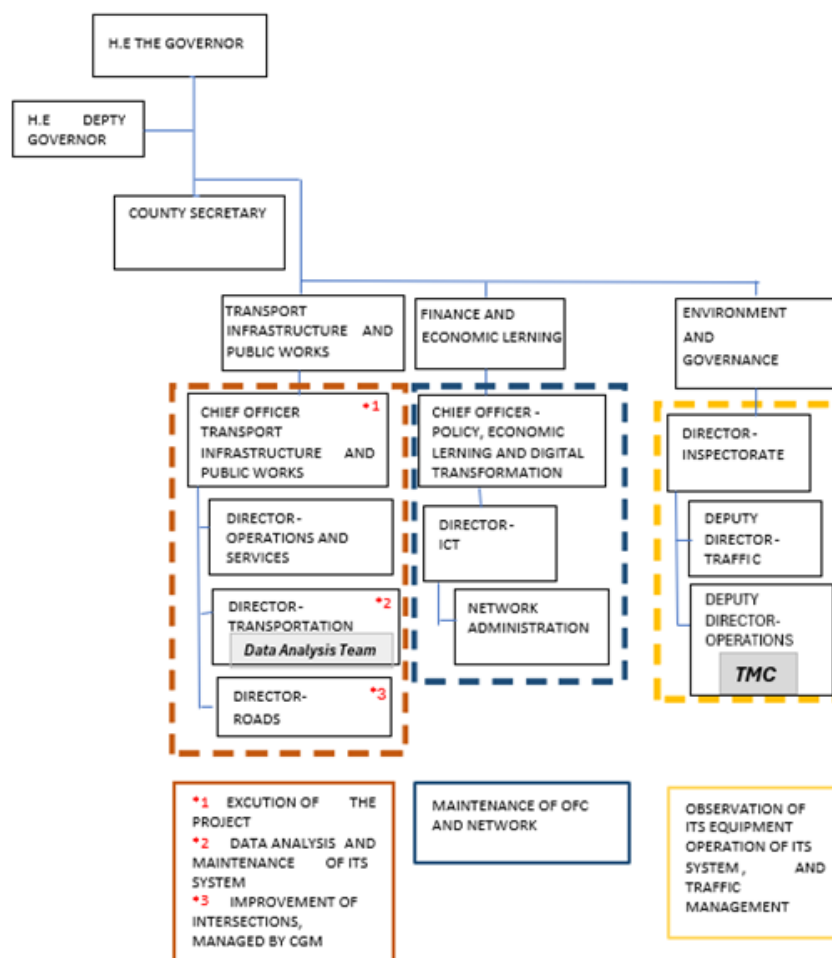
CGM has previous experience in traffic control operations through operators in the Operation Division of the Inspectorate, who have managed traffic in the Traffic Control Room (TCR). Therefore, they have a foundation in traffic control operations. However, for this project, it is necessary to strengthen the capacity of the Inspectorate's Operation Division to handle not only traffic control operations but also traffic management through the TMC, including VMS management and traffic information management.

Furthermore, a Data Analysis Team will be organized within the Transport Division of the Transport Department to strengthen the capacity to analyze, and process collected traffic information and effectively utilize it for transportation planning and related activities.



Source : JICA Study Team

Figure 90 TMC-Related Organizational Structure within CGM and Relationships with External Organizations



Source : JICA Study Team

Figure 91 Relevant Departments within the Current CGM Organization

(1) Establishment of ITS Advisory Committee

It is recommended to set up an “ITS Advisory Committee” that CGM holds regularly at the beginning of Technical Cooperation Project. The purposes of the committee are shown below.

- Establishment of policy
(e.g., halving accidents at monitored intersections within 5 years, etc.)
- Identify the factors of frequent traffic congestion and accidents by analyzing basic data
- Consideration of countermeasures for identified factors
- Consideration of major expansion of ITS (including introduction of new system)
- Consideration of necessary road regulations
(necessity of regulation, method of regulation, time and period of regulation, etc.)
- Proposal of basic materials for studying new road construction, widening, and intersection improvement planning for KeNHA and KURA.

The Committee assumes that the Chief Officer-Transport is the chair, and the members are as follows:

- CGM : Transport Department (Director Transport and Operation and Service, Data Analysis Team, TMC Manager)
- Academe: University traffic engineering professor, system engineering professor
- Road Administrator : KeNHA, KURA
- Police : Traffic police

(2) Relationship between TMC and organizations outside CGM

(a) Data Analysis Team

A Data Analysis Team will be set up within the Transport Department to analyze and utilize the data collected by TMC. The team consists of two(2) deputy directors and two(2) transport engineers. The team analyzes and statistically processes the data collected from TMC for the following roles:

(b) Roles of Data Analysis Team

- Understand the effects on traffic congestion and travel speed from the relationship between traffic flow and incidents, weather, road construction, etc.
- Planning for expansion of ITS facilities.
- By grasping the season and time zone when the influence on the traffic flow is small and proposing it to KeNHA and KURA, it will be utilized for road maintenance work.
- By grasping the influence of traffic flow by direction, day of the week, and hour for the improvement plan of the intersection and proposing it to KeNHA and KURA, it will be utilized for road maintenance work.
- Based on the relationship between traffic flow and the number of accidents, the JICA Study Team will propose to the traffic police to introduce traffic regulations as necessary.
- Consideration of utilization of other collected data.

(c) Qualification and Roles of Data Analysis Team

Table 72 Roles and Responsibilities of Data Analysis Team Members

No.	Position	Roles
1	Deputy Director 1 (Transport)	Head of the Data Analysis Team with over ten years of experience in similar transportation related work • Coordination with committee members • Determination of analysis items other than daily work and confirmation of analysis results • Consideration of utilization of big data • Consider expanding ITS as needed
2	Deputy Director 2	Over ten years of experience in operation and management • Confirmation of analysis results of daily analysis work • Communication coordination with MGB regarding information exchange • Consideration of introducing traffic regulations • Preparation of committee materials • Support for Deputy Director 1
3	Transport Engineer 1	More than five years of experience in similar transportation related work • Daily analysis work • Graph the transition of traffic flow from various viewpoints such as time and day of the week • Consideration of the relationship between events and traffic flows
4	Transport Engineer 2	The period of enrollment in Transport Department is three years or more • Support for Transport Engineer 1

Source : JICA Study Team

(d) Roles of Inspectorate Team (Same as present)

The Inspectorate will implement the following based on information and directives from

TMC, similar to what is being done at the current TCR:

- Carry out traffic control in the incident of a traffic accident or breakdown.
- If the TMC discovers an incident, it will respond by rushing to the site in accordance with the TMC's instructions.
- Crackdown on vehicles with parking violations and collection of fines.

(3) Relationship between TMC and organizations outside CGM

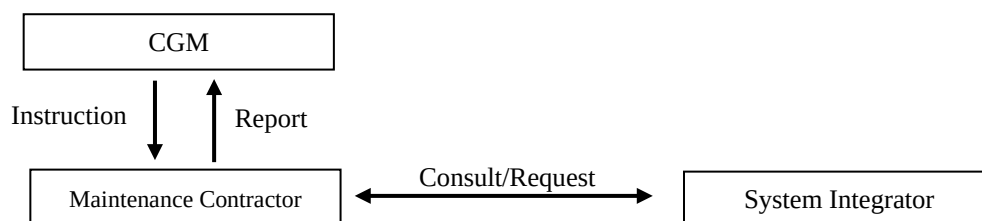
External organizations that are directly related to TMC's operational activities will be the traffic police and KeNHA's MGB Traffic Control Center. Even now, the traffic police may request TCR the captured images as needed (However, images that can be provided are limited because the TCR server stores only 48 hours)

The operational relationship with the traffic police is shown below.

- In the event of an accident, TMC will request the police to dispatch (in the case of a fire accident or a major accident, also request the fire department to dispatch).
- TMC provides police with video of the accident and collects information.
- The Data Analysis Team provides analysis of accident factors and statistical processing data as needed.
- If there is advice on information that should be provided to the police by the ITS Advisory Committee or information that CGM should collect from the police, it will be carried out according to the instructions.

2.5.1.5 Securing Maintenance Contractors

For maintenance, it is desirable to outsource to the company that introduced the system or a local company that is a subcontractor of that company.



Source : JICA Study Team

Figure 92 Maintenance Structure of the Traffic Management Center

1) Scope of the Maintenance Company

The Scope of the maintenance company necessary to sustain the traffic information system is shown below.

- Submission and implementation of maintenance work plan
- Submit necessary reports after repairing or checking system malfunctions
- Repair / cleaning of equipment and restoration of system
- Maintenance of spare parts
- Update of map information, etc.
- Compliance with SLA
- Permanent or temporary repairs will be carried out within 24 hours after receiving a notification of a malfunction of the traffic information system※.

※Includes center system, signal system, CCTV monitoring system, traffic volume measurement system, incident detection system and VMS system.

- If permanent restoration is the limit, confirm with the system supplier how to deal with the reason and the cause of the problem that can be identified or assumed, and promptly report to CGM with countermeasures.

2) Experience Level of the Maintenance Company

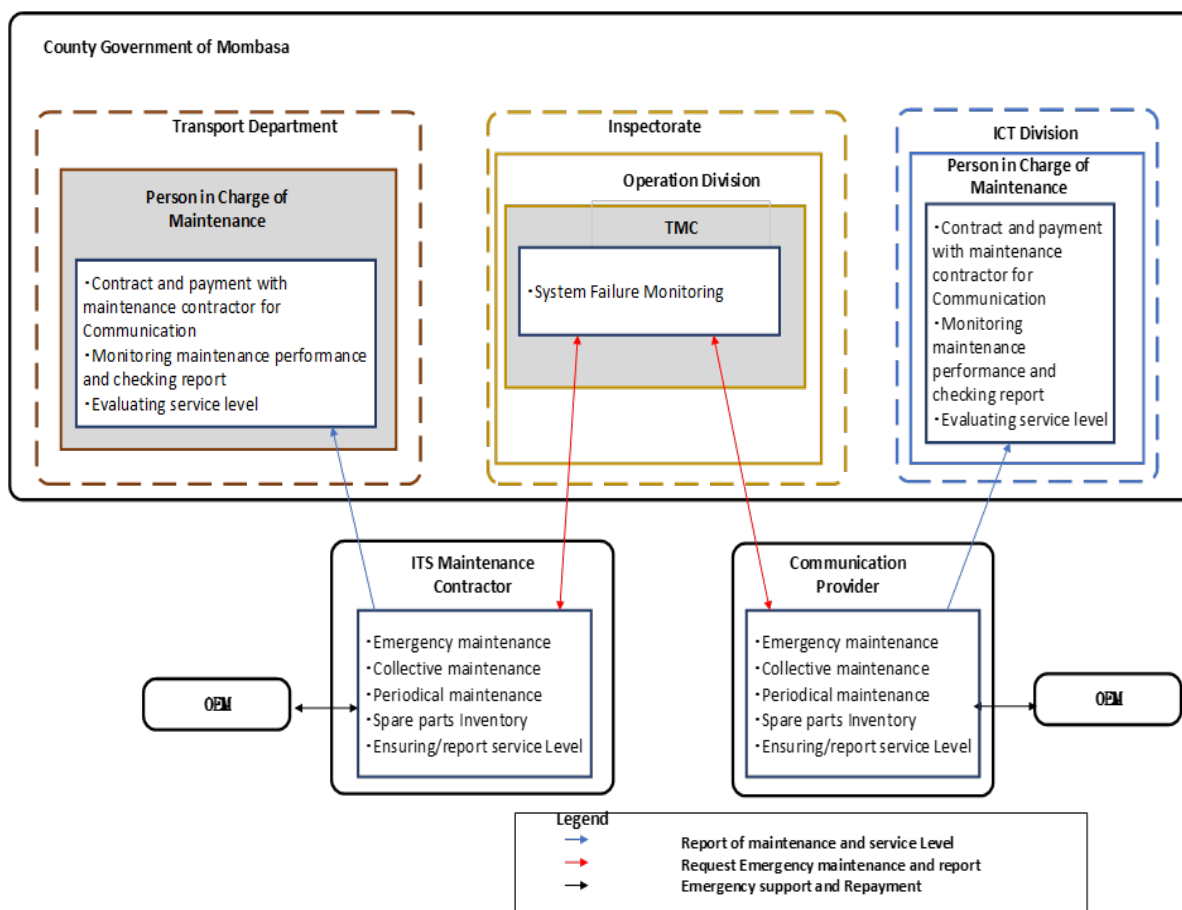
The JICA Study Team asked the leaders of the maintenance companies to have the experience shown in the table below.

Table 73 Qualification of the Leader of a Maintenance Company

Position	Required Experience
Leader	• Degree : Bachelor of System or Electrical Engineering or approvement of CGM • Work Experience : 10 years or over • Experience of Manager : 3 years or over • Engineers involved in system construction • Language Capability : Fluent in English

Source : JICA Study Team

3) Relationship Between TMC and Organizations Within and Outside



Source : JICA Study Team

Figure 93 Relationship Diagram showing CGM's Internal and External Organizations Related to TMC Maintenance

1) Relationship between TMC and other units within CGM

Operator 3, in charge of maintenance of TMC, will contact the ITS maintenance contractor in the event of a defect, and the contractor will promptly repair the defect and restore the

system. One person in charge of maintenance is assigned inside the Transport Department, and is in charge of supporting the operation and maintenance of TMC through the following:

- Implementation of contracts and payments with ITS maintenance contractor (with SLA clauses and penalties)
- Monitoring the occurrence of equipment malfunctions and receiving contact from Operator 3 if defect occurs.
- Evaluation of contractor's performance including regular inspections, cleaning of equipment, and reporting.
- Conducting service level (SLA) assessment
- Submit a report to his supervisor as needed

TMC will contact the communication provider (FiberLink) immediately, which has a communication line contract with CGM, in case a device malfunction is identified as communication, or the communication cable is disconnected or damaged. Since the ICT Division is in charge of CGM communication and data center management, it supports the operation and maintenance of TMC by taking charge of the following:

- Implementation of contracts and payments with communication providers (with SLA clauses and penalties)
- Evaluation of the provider's performance, including routine inspections, cleaning, and reporting
- Conducting service level (SLA) assessment
- Submit a report to his supervisor as needed

2) Relationship between TMC and the Maintenance contractor/Communication Provider

The roles and responsibilities of the ITS maintenance contractor and communication provider are as follows:

- Prompt response and contact in case of emergency
- Prompt response when a problem occurs
- Periodic inspection and cleaning
- Management of spare parts inventory
- Maintaining and reporting system functionality and complying with service level terms

2.6 Project Cost Estimation

2.6.1 Initial Cost Estimation

1) Japanese Portion

This section is closed due to confidentiality.

2) Kenyan Portion

The following is the breakdown of the estimated cost of the Kenyan side: (1 KES = JPY 1.12).

Table 74 Estimated Cost of the Kenyan Portion

Item	Unit	Price (KES)	Price (JPY)
1) EIA report Commission Fee	Set	3,000,000	3,360,000
2) A/P Commission fee (Consultant)	Set	3,000,000	3,360,000
3) A/P Commission fee (Contractor)	Set	3,000,000	3,360,000
4) Replacement of Power Supply Facilities in Roundabout	Set	5,000,000	5,600,000
5) Redundant Fiber-optic Network Upgrade	Set	13,265,000	14,856,800
6) Renovation of Traffic Control Center	Set	3,000,000	3,360,000
7) Power Supply Connectivity Installation	Set	2,370,000	2,654,400
8) Communication Connectivity Installation	Set	2,770,000	3,102,400
9) Relocation of Existing Equipment of Existing Traffic Control Center	Set	300,000	336,000
10) Implementation of EoM for warranty one(1) year	Set	6,600,000	7,392,000
Total	Set	42,305,000	47,381,600

Source: JICA Study Team

2.6.2 Operation and Maintenance Cost

Operation and maintenance will require an annual cost of KES 20.6 million (JPY 25.0 million).
(1 KES = JPY 1.12).

Table 75 Estimated Cost of Kenyan Portion

Items	Price (KES/year)	Note
1) Maintenance	9,900,900	✓Periodic Inspection (2 times/year): KES 3,964,000 ✓Emergency Response for Center Side • Remote Service(48 times/year): KES 2,409,600 • On-site Service(1time/year):KES 105,000 ✓Emergency Response for Road Side (5times/year) : KES 2,522,300 ✓Administration Cost(10%) : KES 900,000
2) Communication Cost	10,693,069	
Total	20,593,969	

Source: JICA Study Team

Chapter3. Project Evaluation

3.1 Preconditions for Implementation of the Project

This project is a grant assistance project implemented by the CGM, not the central government. Therefore, the CGM, as the implementing agency, needs to understand the donor's burden in grant aid projects and implement them responsibly and promptly. As a prerequisite for the smooth implementation of this project, it is necessary to ensure the implementation of the items to be implemented by the Kenyan side as described in “Chapter 3: Obligations of Recipient Country” in this report.

(After G/A)

- Banking arrangement (B/A)
- Contract with consultant
- A/P issuance for consultant

(Prior to public announcement of bids)

- Secure project approvals from relevant authorities
- Relocation or removal of obstructive properties at intersections
- Establishment of a new Traffic Control Center and installation of required utilities, etc.
- Secure[真奥81][雄大82] land for camp site/equipment storage
- Installation of CCTV at 22 intersections under the Smart City Project

(Project in progress)

- Contract with contractor
- A/P issuance for contractor
- Contracts with power/communication companies for connection to equipment
- Publicize the project to local residents and ensure their understanding of the project
- To ensure traffic safety, educate road users and local residents about traffic safety
- Request for cooperation with the local police and other related agencies for burglarproof

(After completion of the project)

- To establish an organization for maintenance management
- To secure maintenance budget

3.2 Necessary Inputs by Recipient Country

In order to develop and sustain the effect and achieve the overall schedule of this project, the following items are needed to be addressed by the counterpart in the Kenyan side:

- In order to ensure the smooth implementation of this project, the budget of the Kenyan side as described in “Chapter 3: Obligations of Recipient Country” of this report should be secured in advance.
- To ensure the permanent functioning of the traffic control center and terminal facilities, CGM should establish an appropriate organization to perform the maintenance and management details described in “Chapter 4: Project Operation Plan” of this report.

3.3 Important Assumptions

The external prerequisite for developing and sustaining the project's effectiveness is the following:

- The Mombasa Gate Bridge Project and the North-South Road Project are running in parallel with this project. This project supposed that traffic flow into Mombasa Island should be improved by those projects.

3.4 Project Evaluation

3.4.1 Relevance

In "Kenya Vision 2030", which is a plan to rapidly industrialize and transform into a middle-income country by 2030, a country that is firmly interconnected by roads, railroads, ports, airports, waterways, communications is the target to be. In the Third Medium-Term Plan (MTP III) of this vision, it is assumed that priority will be given to strengthening and developing infrastructure and implementation means, including infrastructure, during the planning period from 2018 to 2022.

Therefore, the road sector is expected to play an important role in promoting the growth of housing, agriculture, manufacturing and healthcare envisioned in the government's development agenda of "Big 4".

In the "Mombasa Gate City Comprehensive Urban Development Master Plan Project", Mombasa Island is the center of Mombasa County, and based on the following strategy, emphasis is placed on alleviating traffic congestion and improving urban functions on Mombasa Island.

- Revitalize commercial and administrative activities as the center of Mombasa County
- Improving the living environment of the city
- Conserve historical and cultural heritage and contribute to tourism promotion

In addition, the Kenya Urban Road Authority (KURA) has announced the "KURA Strategic Plan 2018-2022", which has positioned five cities including Mombasa as priority cities next to Nairobi, which has already introduced a signaling system.

Based on the above, it is considered appropriate to implement this project, which contributes to mitigate traffic congestion and improving safety in Mombasa Island, which is the central city of Mombasa County and gateway to the northern corridor.

3.4.2 Effectiveness

(1) Quantitative Effectiveness

Table 76 Indicators of Quantitative Effects

Indication	Basic Value (2021)	Target Value(2030) 【2 years after completion】
Average travel time (minutes) at traffic peak hour ※1	Approx. 9.4 minutes	Approx. 6.5 minutes
Average travel speed (km/h) at traffic peak hour ※1	Approx. 12.3 <u>km/h</u>	Approx. 17.8 <u>km/h</u>
Overall benefits of the target intersection (million yen/year) ※2	—	Approx. JPY 480 million/year

Source: JICA Study Team

※1 : Saba Saba Intersection to Barclay intersection (approx. 2km). Evening peak.

※2 : Economic benefit of travel time reduction resulting from difference in estimated travel time between "With the Project Case" and "Without the Project Case" when the road improvement projects (Roads connecting Nairobi direction(A109) and Mombasa port area (A8 and A14) on Mombasa Island) are completed in 2030[真奥83].

The specific way is shown below.

(2) Quantitative Effect Estimation Method by Micro-simulation

The effect of installing a signal (MODERATO) is that the traffic flow becomes smoother by coordinating between the signals and improving the intersection. Therefore, the section from the A7R-5 intersection to the A8-4 intersection was built in a micro-simulation using the traffic simulator Aimsun*, and the effect was calculated.

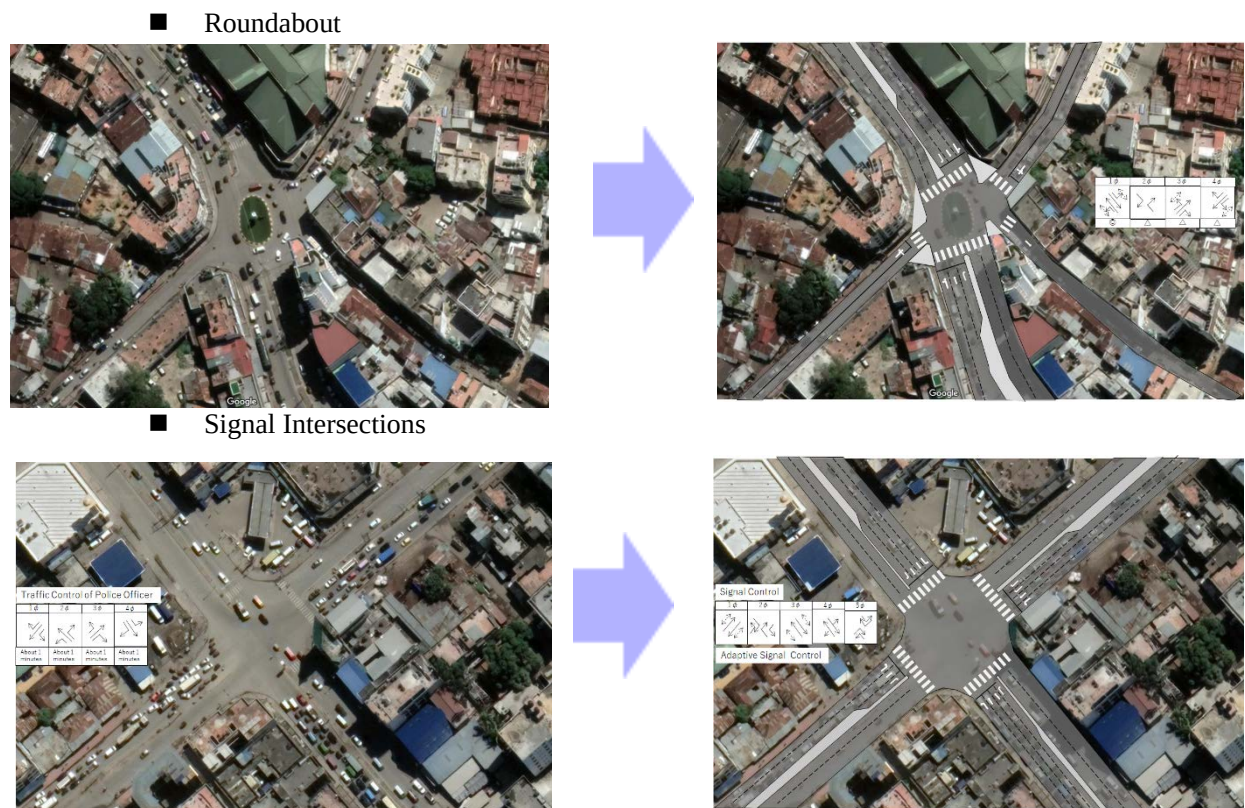
The future traffic volume (2030) was used, and the effect was clarified by comparing the presence or absence of countermeasures (signal installation, intersection improvement). Cases with countermeasures were named as "With Cases", and cases without countermeasures were named as "Without Cases".

Simulations of signal installation (WITH/WITHOUT cases) were conducted based on the following basic method.

- Currently, police officers provide manual signal at intersections, but manual signal cannot be reproduced in simulation, so in the WITHOUT case, the same signal phase and split are introduced.
- MODERATO automatically calculates control parameters according to traffic conditions, but in the simulation, the optimal parameter between adjacent intersections were set for the traffic volume of the input conditions manually.
- Six intersections were simulated in one.
- Unified the cycle length, set multiple patterns for split and offset, and extracted the parameter pattern that would give the highest overall average speed.

The following intersection improvements were assumed to be implemented.

- To ensure safety, make intersections more compact and secure evacuation areas for pedestrians.
- Securing the number of lanes and right-turn lanes to increase traffic capacity
- Additional right/left turn lanes and extension of right turn lanes based on traffic capacity ratio

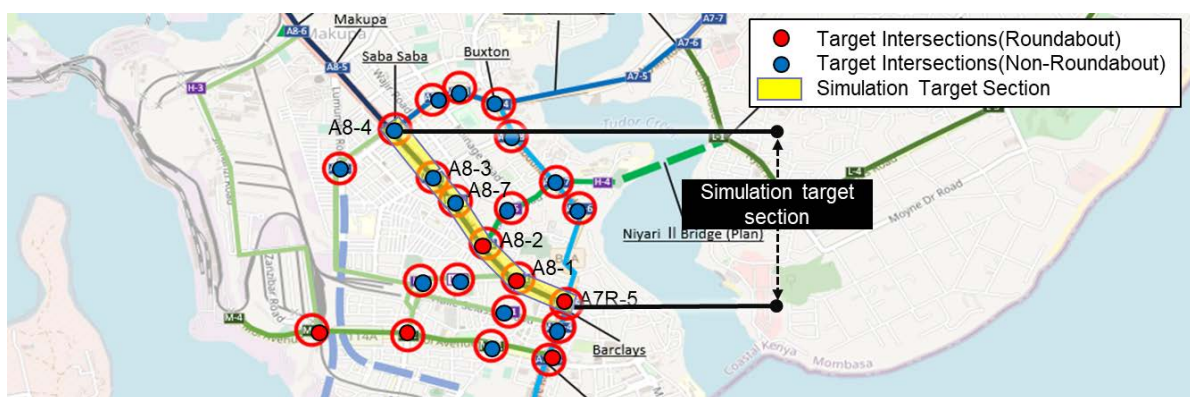


Source: JICA Study Team

Figure 94 Basic method of simulation

As an effect, based on the average travel time / average travel speed estimated by micro-simulation, the benefits of shortening the total travel time and the amount of greenhouse gas emissions were estimated.

※ * High-performance traffic simulator developed by TSS of Spain: Aimsun is a comprehensive traffic analysis platform that enables detailed simulations of road traffic such as automobiles and buses, including road trains, pedestrians, and bicycles. It is widely used to solve traffic problems such as traffic congestion measures, public transportation plans, and ITS introduction.



Source: JICA Study Team

Figure 95 Target Section for Micro-simulation

1) Simulation of average travel time/average travel speed

The effect of reducing the travel time/improving the travel speed was calculated by comparing the measured value of the average travel time/average travel speed (2021) of this survey with the 2030 With Case (with countermeasures) of the micro-simulation. For the traffic volume in the 2030 With Case, the traffic volume of the future traffic volume forecast results (morning peak 7:00 and 16:00) was used.

As a result, as shown below, the average travel time/travel speed was improved between the A7R-5 intersection and the A8-4 intersection.

- Morning peak time shortened by about 3.1 minutes (8.0 minutes → 4.9 minutes) / improved by about 9.0 km / h (14.6 km/h → 23.6 km/h)
- Reduced by about 2.9 minutes during the evening peak (9.4 minutes → 6.5 minutes) / improved by about 5.5 km/h (12.3 km/h → 17.8 km/h)

The hours of the index were set as the peak time of the evening when the traffic is heavy.

2) Benefit Estimation

The reduction of the total travel time cost was calculated from the following formula:

$$\begin{aligned} \text{Travel Time Cost(TTC)} \\ &= \Sigma \{ \text{Time Value per Vehicle} \times \text{Travel Distance} / \text{Travel Speed} \times \text{Traffic Volume} \} \\ \text{Benefit} \\ &= \text{TTC of Without Project Case} - \text{TTC of With Project Case} \end{aligned}$$

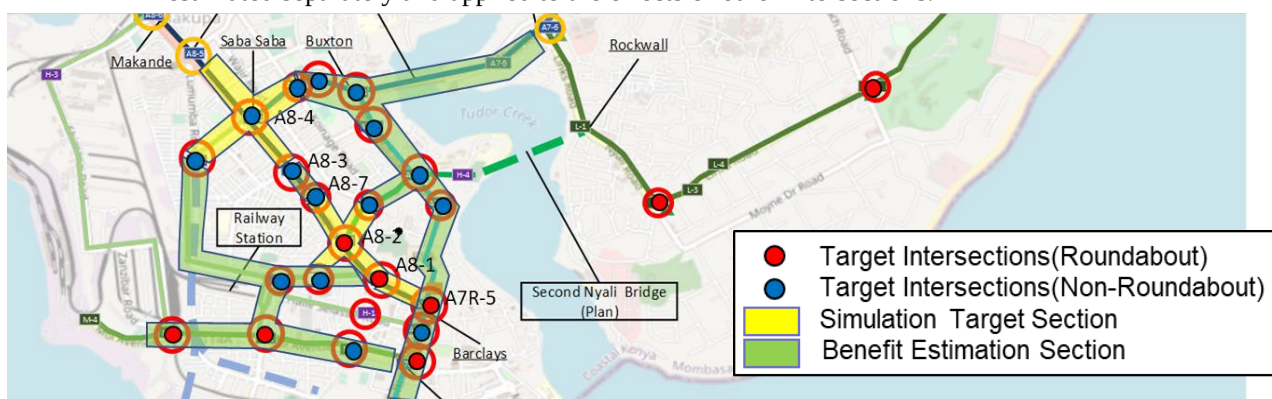
Travel speed was estimated by micro-simulation using the future traffic volume as of 2030.

In addition, since it is expected that the average travel speed of the entire road network will be improved by implementing the measures, the benefit of reducing the travel time in 1 hour in the morning and evening (2 hours in total) was estimated for the route shown in the figure below.

Travel speed is estimated by micro-simulation.

The target section of the micro-simulation was only the yellow section in the figure below, and the total effect was estimated assuming that the section shown in green had the same effect as the yellow section.

The average travel speed improvement rates for roundabouts and non-roundabouts are estimated separately and applied to the effects of other intersections.



Source: JICA Study Team

Figure 96 Target Section for Benefit Estimation[MO84]

The 2018 time value has been updated to the 2030 value, assuming that the intensity of the time value increases in proportion to the GDP growth rate.

The IMF's GDP forecast up to 2025 is used in this estimation. It is assumed that the growth rate of 2025 will continue until 2030 after 2026.

The time value for non-cargo vehicles is a weighted average based on the ratio of traffic volume for each vehicle type.

Table 77 Time Value per Vehicle in the Future (2030)

	2018	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030		
Real GDP per capita	179,088	184,790	191,638	198,156	204,497	211,145	218,009	225,096	232,413	239,968	247,769		
GDP Growth rate (Annual rate)	1.00	1.03	1.037	1.034	1.032	1.033	1.033	1.033	1.033	1.033	1.033	Ave	Vehicle type ratio
TTC/veh (USD/hour)	4 Wheeler	9.4	9.7	10.1	10.4	10.7	11.1	11.4	11.8	12.2	12.6	13.0	41 %
	Tuktuk	3.9	4.0	4.2	4.3	4.5	4.6	4.7	4.9	5.1	5.2	5.4	37 %
	Matatu (Minibus)	23.9	24.7	25.6	26.4	27.3	28.2	29.1	30.0	31.0	32.0	33.1	17 %
	Large Bus	23.9	24.7	25.6	26.4	27.3	28.2	29.1	30.0	31.0	32.0	33.1	1 %
	Trucks/Cargo	13.1	13.5	14.0	14.5	15.0	15.4	15.9	16.5	17.0	17.6	18.1	18.1 %

Source: TTC per unit : the value used in the Mombasa Gate Bridge FS Survey is applied mutatis mutandis.

Real GDP per capita : IMF-World Economic Database (October 2021) is applied mutatis mutandis.

As a result, the benefit of reducing the travel time was estimated at about JPY 480 million as of 2030.

Table 78 Benefits of Reduced Travel Time (Unit: JPY 1 million)

Without Case	1,822
With Case	1,344
Without-With	479

Source: JICA Study Team

(3) Qualitative Effectiveness

The qualitative effects (benefits) expected from the implementation of this project are listed below.

1) Increased economic activity

Urban transportation capacity is stimulated and economic activity will be activated by the mitigation of traffic congestion within Mombasa Island.

2) Promote safe, secure, and stable life on the island

Traffic convenience and safety for passing vehicles and pedestrians within Mombasa Island will be improved.

(4) Other Effectiveness

1) Reduction of greenhouse gases (CO₂ emissions)

The amount of CO₂ emission reduction was estimated using the CO₂ emission intensity for each vehicle type by average speed of the National Institute for Land and Infrastructure Management.

The requirements such as target section, target time zone (2 hours during morning and evening peak) for the analysis are the same as for the benefit estimation.

The travel speed was estimated in two cases, the 2030 With Project Case and the 2030 Without Project Case, using the same micro-simulation as the benefit estimation.

The calculation formula is shown below.

$$\text{CO}_2 \text{ emissions} = \Sigma (\text{section extension} \times \text{traffic volume by vehicle type} \times \text{CO}_2 \text{ emissions intensity for each vehicle type by average speed})$$

$$\text{Reduction of CO}_2 \text{ emissions} = \text{Without Project Case} - \text{With Project Case}$$

Table 79 CO₂ Emission Intensity for Each Vehicle Type by Average Speed

Average speed (km/hr)	CO ₂ (Small Vehicle)	CO ₂ (Large Vehicle)
20	209.8	1013.8
25	187.5	928.7
30	171.3	855.7
35	158.9	793.7
40	149.5	741.9
45	142.2	700.1
50	136.9	667.9
55	133.2	645.4
60	131.1	632.3
65	130.3	628.6
70	130.9	634.3
75	132.8	649.3
80	135.9	673.6
85	140.2	707.2
90	145.6	750.1

Source: National Institute for Land and Infrastructure Management (2010). A calculation standard for automobile emission intensity used for road environmental impact assessment.

As a result, annual CO₂ emission reduction was estimated at about 803 tons, as of 2030.

Table 80 Reduction in CO₂ Emissions (Unit: tons)

Without Case	6,110
With Case	5,306
Without-With	803

Source: JICA Study Team

2) Contribution of the development along the northern corridor

The improvement of urban transportation within Mombasa Island, coupled with the improvement of the Southern Bypass and Mombasa Gate Bridge, will contribute to the improvement of urban functions in Mombasa, which is the starting point of the northern corridor. The improvement of the northern corridor will not only facilitate logistics, but also create an industrial concentration along the corridor, forming a basic axis of economic growth.

The concrete survey results and contents are described below.

a) Current Status of the Northern Corridor

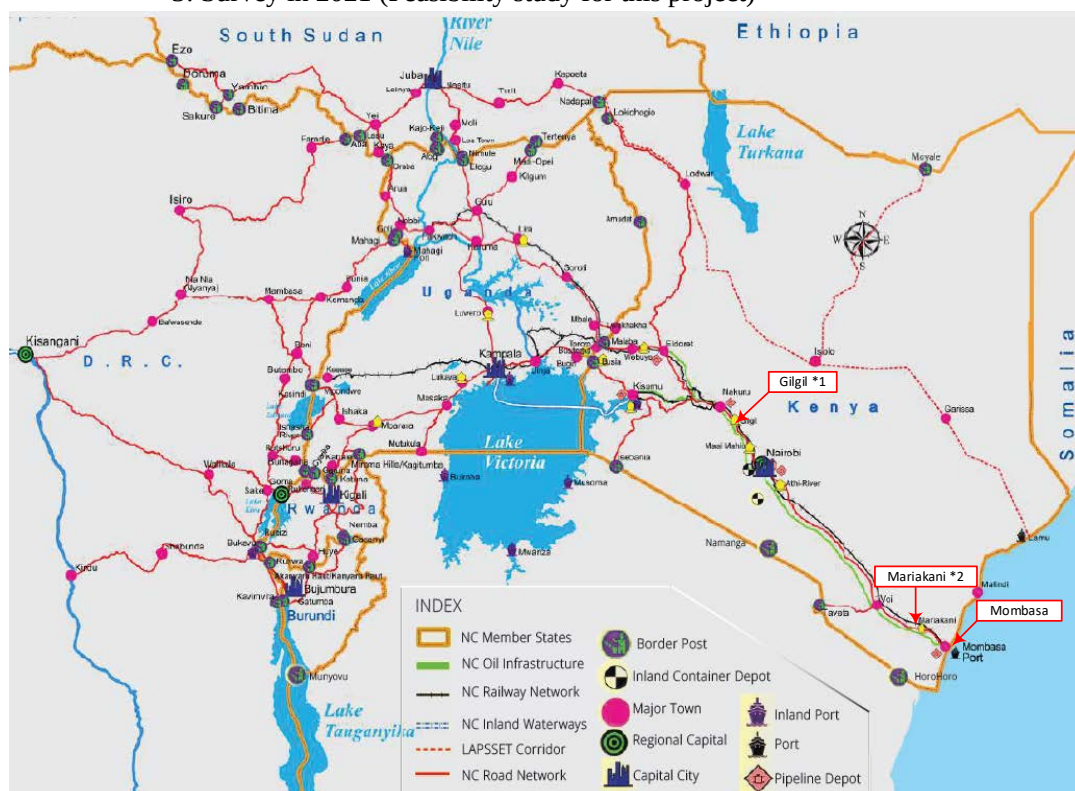
The northern corridor is a key logistics hub from Mombasa Port through Nairobi to inland areas such as Kenya, Uganda, Rwanda, Burundi, and the Democratic Republic of Congo (DRC).

Traffic volume in the northern corridor ranges from about 7,200 vehicles/day^{*1} to 12,900 vehicles/day^{*2}. At the connecting intersection from Mombasa Island to the northern corridor (Makande Intersection), the traffic volume is about 30,000 vehicles/day^{*3}, of which 16% (about 5,000 vehicles) are logistics vehicles.

*1: Survey in 2015, in Mariakani, in which 60% was logistics

*2: Survey in 2015, in Gilgil, in which 20% was logistics

*3: Survey in 2021 (Feasibility study for this project)



Source: NORTHERN CORRIDOR TRANSPORT OBSERVATRY REPORT (NCTTCA Jun 2021)
Figure 97 The Northern Corridor

Mombasa County is located at the gateway to the northern corridor and plays an important role as a "gateway" but suffers from traffic congestion caused by an increase in logistics trucks. This issue is not only for Mombasa County, but also a major bottleneck in the development along the northern corridor.

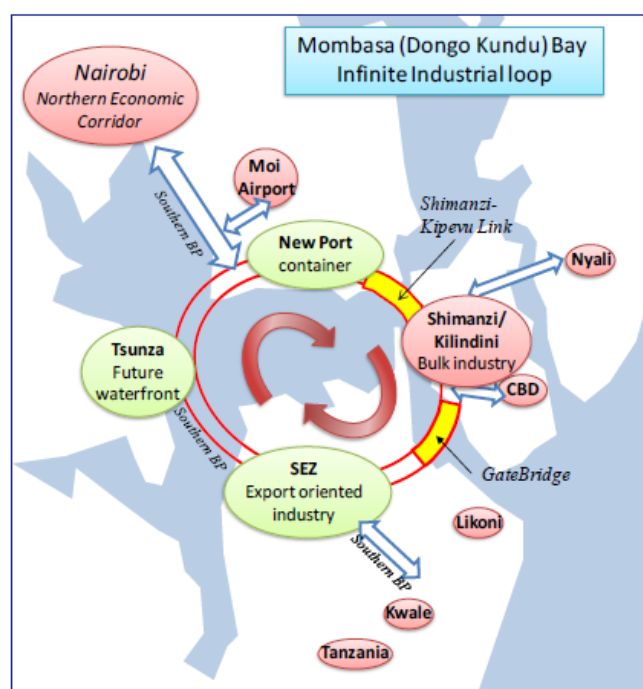
In addition, 12% of the population of Mombasa County is living in Mombasa Island,

which is the center of administrative and economic activities of commerce and industry in Mombasa County. Traffic congestion within Mombasa Island is one of the key challenges for Mombasa County, because not only the urban functions but also residential, commercial, industrial, and port functions are centralized in this island. Another reason for traffic congestion is that the transportation infrastructure is mainly land-abandoned and traffic management appropriate for increased traffic is not implemented yet.

b) Development Plan of Mombasa Country

For the decentralization of urban functions from Mombasa Island to outside of it, Japan has assisted to support the expansion of port bases on the mainland and the development of SEZ. Furthermore, for mitigation of logistics traffic within Mombasa Island and promotion of rural regional development, Japan is also supporting the development of wide-area transportation Network, such as the Southern Bypass and the Mombasa Gate Bridge.

At the same time, Mombasa Island will continue to serve as the administrative, commercial, and tourist center of Mombasa County, as well as the hub of the existing port facilities, and will continue to be an important role for the regional network.



Source: Mombasa Gate City Integrated Urban Development Master Plan Project
Figure 98 Wide-area Transportation Network in Mombasa Country

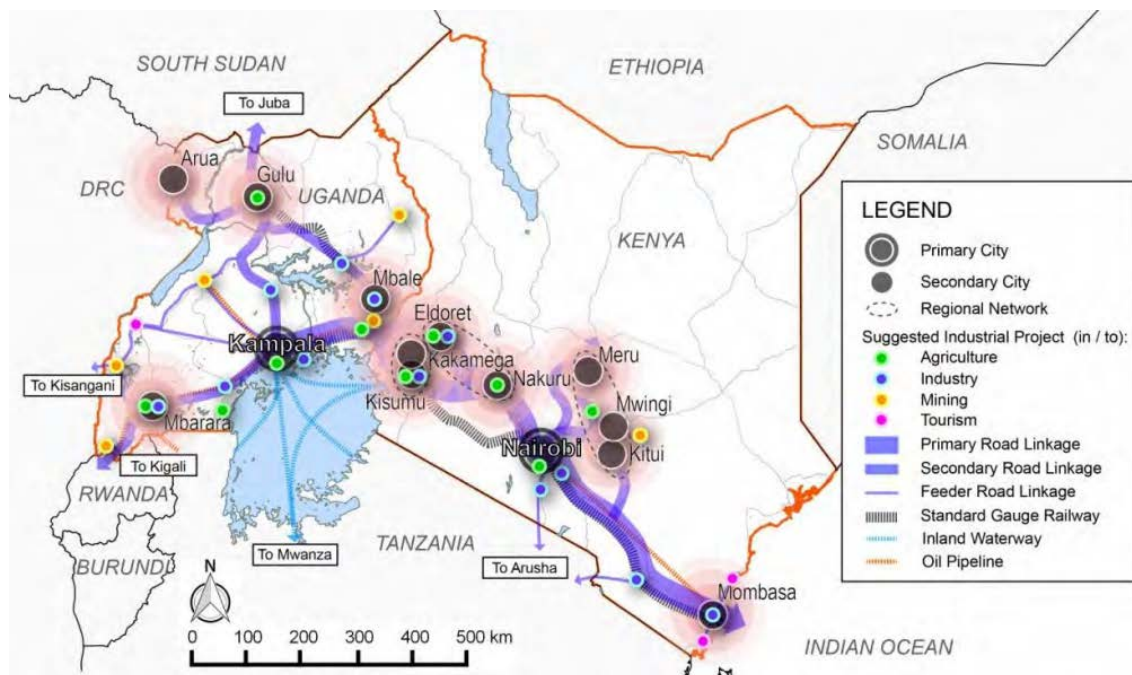
c) Spatial Planning of the Northern Economic Corridor

On the other hand, as spatial planning for the Northern Economic Corridor, multiple regional development plans in various sectors (strengthening urban functions combined with regional industrial systems) have been proposed, considering the main driver for each region. This spatial plan has the following characteristics:

1) Achieve well-balanced economic growth and efficient development in the logistics network in the Northern Economic Corridor region, through strengthening the urban functions of the 12 sub-cities.

2) Sub-cities that serve as regional centers provide urban services and logistics hub functions to its regions and link regional production centers with the metropolitan area as a consumption center.

The proposed spatial planning for the Northern Economic Corridor is expected to contribute to the smoother flow of products and goods, and to the well-balanced regional development along the Northern Economic Corridor.



Source: Master Plan Survey for the Northern Economic Corridor

Figure 99 Future Vision of the Regional Spatial Planning

d) Ultimate Beneficiary

Considering the effects on the Northern Corridor by the Project, the ultimate beneficiaries, including the population of cities along the Northern Corridor, are calculated to be approximately 11.1 million people.

Table 81 Population affected by the Northern Corridor

Area	City	Country	Population	Census
Kigali ~ Kampala	Kigali	Rwanda	1,132,686	2012 census
	Mbarara	Uganda	195,013	2014 census
	Kampala	Uganda	1,659,600	2011
Juba ~ Mbale	Juba	South Sudan	525,953	2017 estimate
	Arua	Uganda	61,962	2014 census
	Gulu	Uganda	152,276	2014 census
	Mbale	Uganda	96,189	2014 census
Kims ~ Nairobi	Kims	Kenya	397,957	2019 census
	Eldoret	Kenya	475,716	2019 census
	Kakamega	Kenya		No information
	Nakuru	Kenya	570,674	2019 census

Nairobi Mombasa	~	Nairobi	Kenya	4,397,073	2019 census
		Meru	Kenya	240,900	
		Mwingi	Kenya	15,970	2009 census
		Kitui	Kenya	29,062	2019 census
		Mombasa	Kenya	1,208,333	2019 census
Total				11,159,364	

Source: JICA Study Team

Appendix 1

Minutes of Discussion(M/D)

- 1.M/D for First Field Survey (September 2021)
- 2 .M/D for Second Field Survey (December 2021)
- 3 .M/D for Progress Meeting (April 2022)
- 4 .Exchange of Note for First Survey (October 2021)
5. Exchange of Note for Second Field Survey (December 2021)

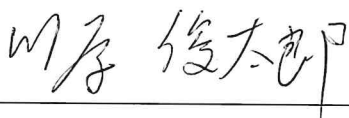
Appendix 2

Outline Design Drawings (*Volume II*)

Minutes of Discussions
on the Preparatory Survey for the Project for
Implementation of Intelligent Transport System in Mombasa Region

Based on the several preliminary discussions between the Government of Republic of Kenya (hereinafter referred to as “Kenya”) and Japan International Cooperation Agency (hereinafter referred to as “JICA”) Kenya Office, JICA dispatched the Preparatory Survey Team (hereinafter referred to as “the Team”) for the Outline Design of the Project for Implementation of Intelligent Transport System in Mombasa Region (hereinafter referred to as “the Project”) to Kenya. The Team held a series of discussions with the officials of the Government of Kenya and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Mombasa, September , 2021



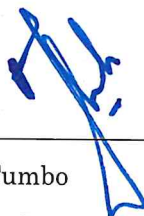
Kawahara Shuntaro

Leader

Preparatory Survey Team

Japan International Cooperation Agency

Japan



Joab Tumbo

County Secretary and Head of Public Service

County Government of Mombasa

The Republic of Kenya



ATTACHMENT

1. Objective of the Project

The objective of the Project is to ease traffic congestion and improve traffic safety through installation of ITS equipment and improvement of junctions, thereby contributing to economic development of Mombasa.

2. Title of the Preparatory Survey

Both sides confirmed the title of the Preparatory Survey as “the Preparatory Survey for the Project for Implementation of Intelligent Transport System in Mombasa Region”.

3. Project site

Both sides confirmed that the candidate sites of the Project are in Mombasa City, which is shown in Annex 1.

4. Responsible authority for the Project

Both sides confirmed the authorities responsible for the Project are as follows:

- 4-1. The County Government of Mombasa will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”). The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be managed by relevant authorities properly and on time. The organization chart is shown in Annex 2.

5. Items requested by the Government of Kenya

- 5-1. As a result of discussions, both sides confirmed that the items requested by the Government of Kenya are as follows:

-Installation of traffic signals controlled by MODERATO system to some intersections and junction improvements in Mombasa City

- 5-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

- 5-3. The Government of Kenya shall submit an official request to the Government of Japan through a diplomatic channel before December 2021.



6. Procedures and Basic Principles of Japanese Grant

6-1. The Kenyan side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as “the Grant”) as described in Annex 3 shall be applied to the Project.

As for the monitoring of the implementation of the Project, JICA requires Kenyan side to submit the Project Monitoring Report, the form of which is attached as Annex 4.

6-2. The Kenyan side agreed to take the necessary measures, as described in Annex 5, for smooth implementation of the Project. The contents of the Annex 5 will be elaborated and refined during the Preparatory Survey and be agreed in the mission dispatched for explanation of the Draft Preparatory Survey Report.

The contents of Annex 5 will be updated as the Preparatory Survey progresses, and eventually, will be used as an attachment to the Grant Agreement.

7. Schedule of the Survey

7-1. The Team will proceed with further survey in Kenya until beginning of October 2021.

7-2. The Team will conduct the second field survey in Kenya around middle of December 2021. The Team will decide a plan of targeted intersections of the Project.

7-3. An official request to the Government of Japan will be submitted before December, 2021.

7-3. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Kenya in order to explain its contents around the end of June 2022.

7-4. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Kenyan side, JICA will finalize the Preparatory Survey Report and send it to Kenya around November 2022.

7-5. The above schedule is tentative and subject to change.

8. Environmental and Social Considerations

8-1. The Kenya side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

8-2. The Project is categorized as “B” from the following considerations:

The project is not considered to be a large-scale road, is not located in a sensitive area, and has none of the sensitive characteristics under the JICA Guidelines for Environmental and Social Considerations (April, 2010), it is not likely to have a significant adverse impact on the environment.

The Kenyan side confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Environmental Impact Assessment (EIA) /Initial Environmental Examination (IEE) and information disclosure, etc.) and make EIA/IEE report of the Project, if the EIA/IEE of the Project is necessary in Kenya. The EIA/IEE approval shall be received from the responsible authorities and submitted to JICA by June 2022.

8-3. If the Project will result in involuntary resettlement, the Kenyan side confirmed to prepare a Resettlement Action Plan (RAP) /Abbreviated Resettlement Action Plan (ARAP) and make it available to the public. In addition, the Kenyan side confirmed to provide the affected people with sufficient compensation and/or support in accordance with RAP/ARAP, which is consistent with JICA Guidelines for Environmental and Social Considerations (April, 2010), in a timely manner.

9. Other Relevant Issues

9-1 Selection process of the target sites of the Project

By following procedure, the Study to decide the target locations for junction improvement will be implemented.

- 1) Listing up candidate sites based on the previous studies.
- 2) Conducting site survey including traffic survey at candidate sites.
- 3) Selecting target sites among candidates ones by benefit, cost, consistency in road improvement plans, social impact and other technical constraints by the second field survey.
- 4) With the result of the second mission in Kenya and following analysis in Japan, finalizing its draft design.

9-2 Operation and maintenance of the Project

The Team reiterated the importance of sustainable operation and maintenance of the Project, and it's critical factor for success of the Project. The Kenyan side agreed operation and management of the Project is implemented by following organizations;

-Operation and Maintenance of traffic signals and ITS control center; County



Government of Mombasa

- Routine Maintenance of the intersections; County Government of Mombasa
- Periodic Maintenance of the intersections: road management agencies such as KeNHA /KURA

The Kenyan side agreed the necessity of establishment of institutional and financial arrangement plan for sustainable operation and maintenance of the Project.

9-3 Gender Mainstreaming

Both sides confirmed that following gender elements shall be duly reflected in the scope of Preparatory Survey.

- 1) Collection of information and gender disaggregated data for assessment of gender needs.
- 2) Examination of gender-responsive measures based on the assessment, such as:
 - ✓ Facility design that reflects gender-specific needs.
 - ✓ Selection of equipment that reflects gender-specific needs and ensure usability by women.

9-4 Safety Measures

Both sides confirmed that County Government of Mombasa shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities during the Project period. Such security measures shall reasonably reflect needs of the Consultant/the Contractor engaging in the Project, as shown in Annex 5.

Both sides agreed that in case the additional security cost would be necessary for the implementation of the Project, such cost shall be borne by the Recipient without using the Grant.

9-5 Provision of Conveniences to the Team by Kenyan side

The Kenyan side shall, at its own expenses, provide the Team with the following items in cooperation with County Government of Mombasa and other organizations concerned.

- (1) Security-related information as well as measures to ensure the safety of the Team members;
- (2) Data and information necessary for the Study;
- (3) Counterpart personnel;
- (4) Credentials or identification cards if necessary;



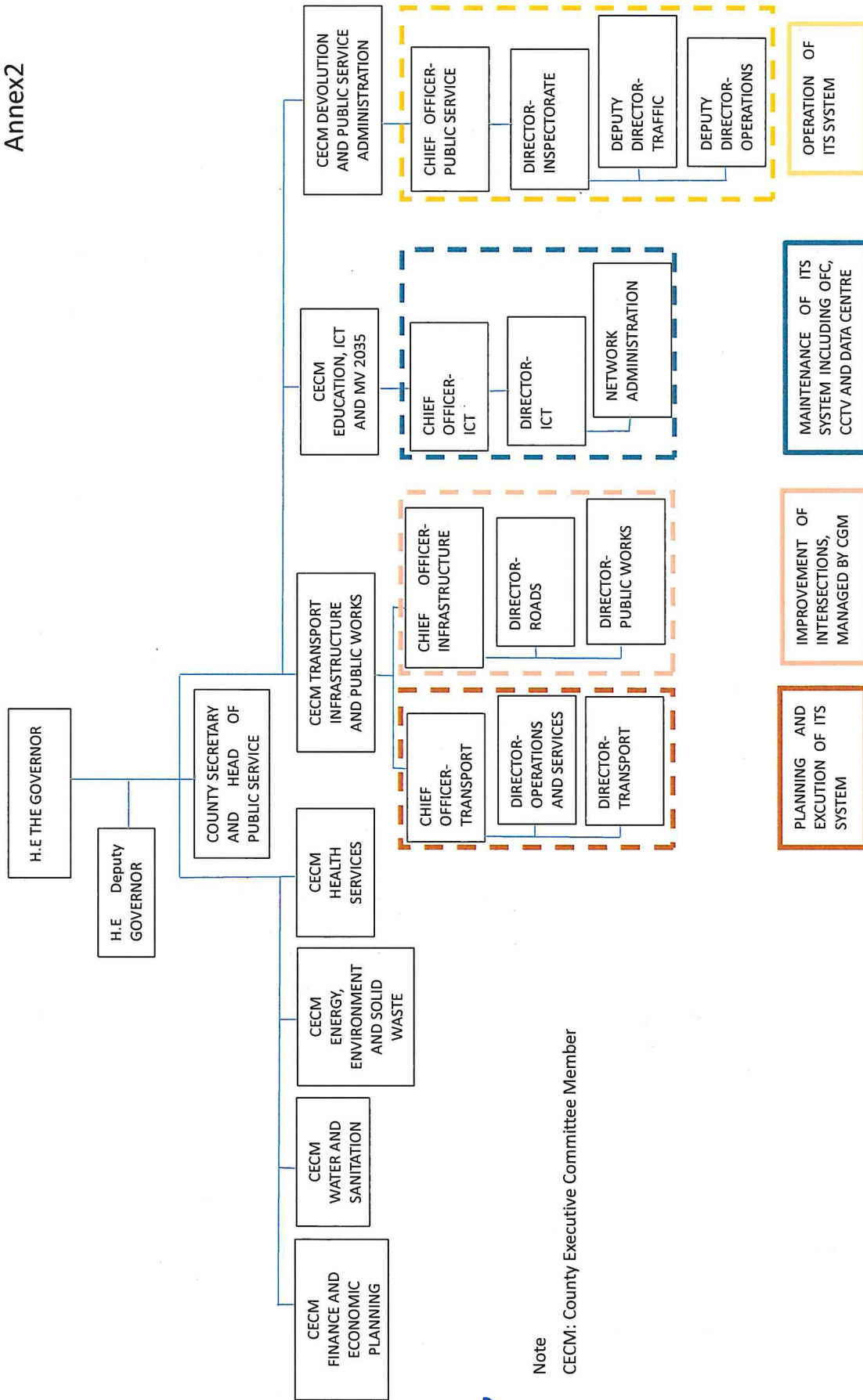
- (5) Appointments arrangement;
- (6) Entry permits necessary for the survey team members to conduct field surveys;
and
- (7) Support in obtaining other privileges and benefits if necessary.

- 【Annex 1】 Project Site
- 【Annex 2】 Organization Chart
- 【Annex 3】 Japanese Grant
- 【Annex 4】 Project Monitoring Report (template)
- 【Annex 5】 Major Undertakings to be taken by the Government of Kenya





Annex2



JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as “the Recipient”) to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as “Project Grants”).

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See “PROCEDURES OF JAPANESE GRANT” for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as “the Survey”) conducted by JICA

(2) Appraisal

- Appraisal by the government of Japan (hereinafter referred to as “GOJ”) and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

- The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as “the G/A”)

- Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as “the B/A”)

- Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as “the Bank”) to receive the grant

Construction works/procurement

- Implementation of the project (hereinafter referred to as “the Project”) on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

- Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of

relevant agencies of the Recipient necessary for the implementation of the Project.

- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as “the E/N”) will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the “General Terms and Conditions for Japanese Grant (January 2016).”



2) Banking Arrangements (B/A) (See “Financial Flow of Japanese Grant (A/P Type)” for details)

- a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.
- b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the “Meeting”) will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the



Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

- 1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.
- 2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.



4) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.

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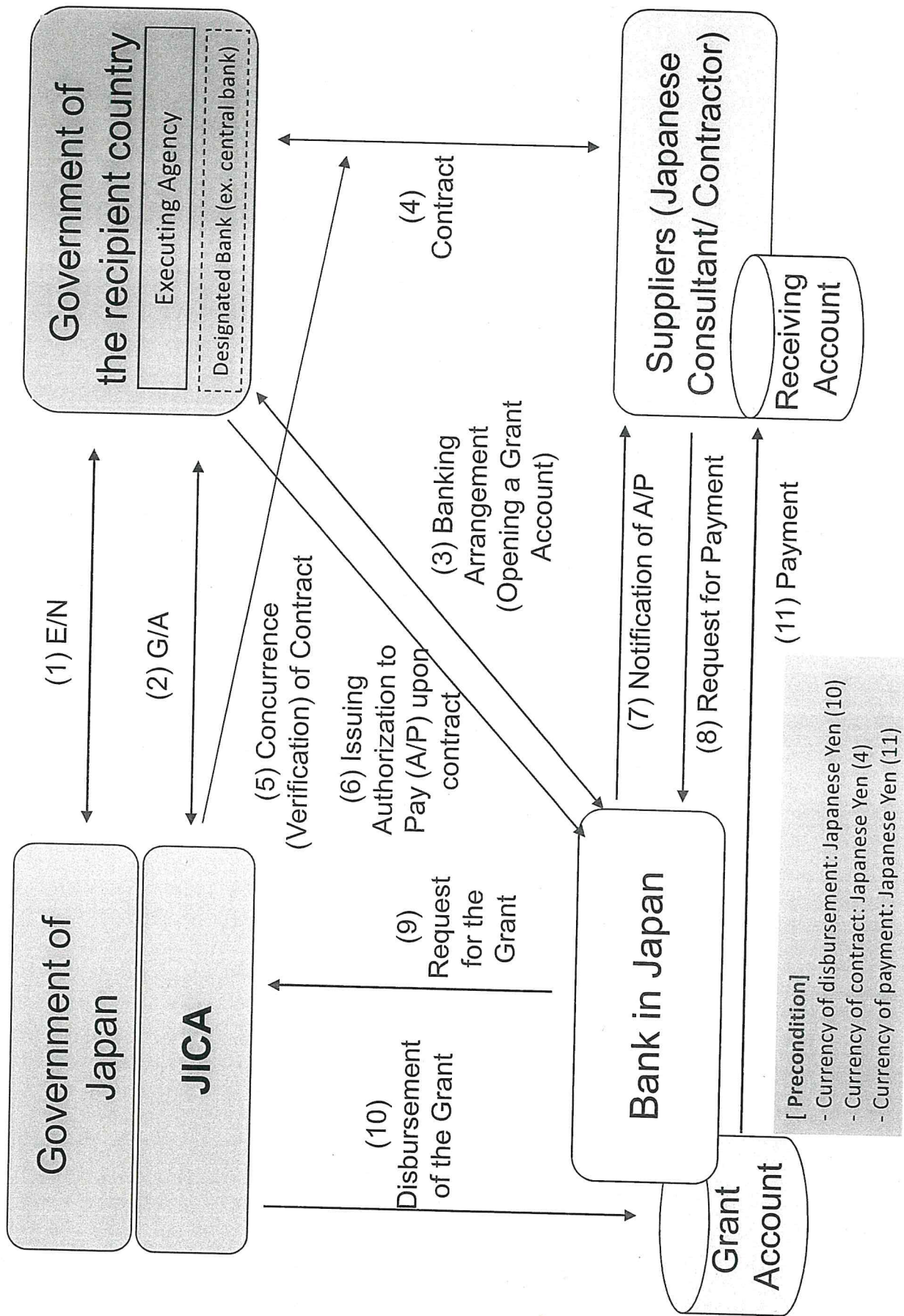
PROCEDURES OF JAPANESE GRANT

Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

notes:

1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.
2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Financial Flow of Japanese Grant (A/P Type)



Project Monitoring Report
on
Project Name
Grant Agreement No. XXXXXXXX
20XX, Month

Organizational Information

Signer of the G/A (Recipient)	Person in Charge	<u>(Designation)</u>
	Contacts	<u>Address:</u>
		<u>Phone/FAX:</u>
		<u>Email:</u>
Executing Agency	Person in Charge	<u>(Designation)</u>
	Contacts	<u>Address:</u>
		<u>Phone/FAX:</u>
		<u>Email:</u>
Line Ministry	Person in Charge	<u>(Designation)</u>
	Contacts	<u>Address:</u>
		<u>Phone/FAX:</u>
		<u>Email:</u>

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____



1: Project Description

1-1 Project Objective

--

1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

--

1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original (proposed in the outline design)	Actual
1.		

2-2 Scope of the work

Components	Original* (proposed in the outline design)	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

--

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	(at the time of signing the Grant Agreement)	

Reasons for any changes of the schedule, and their effects on the project (if any)

--

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
	1.			
Total				

Note: 1) Date of estimation:

2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original (at the time of outline design)

name:

role:

financial situation:

institutional and organizational arrangement (organogram):

human resources (number and ability of staff):

Actual (PMR)

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original (at the time of outline design)

Actual (PMR)

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original (at the time of outline design)

Actual (PMR)

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (at the time of outline design)

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

--

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

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5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

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Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant
- Appendix - Photocopy of Contractor's Progress Report (if any)
 - Consultant Member List
 - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
8. Pictures (by JPEG style by CD-R) (PMR (final) only)
9. Equipment List (PMR (final) only)
10. Drawing (PMR (final) only)
11. Report on RD (After project)



Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

Items of Specified Materials		Initial Volume A	Initial Unit Price (¥) B	Initial total Price $C=A \times B$	1% of Contract Price D	Condition of payment	
						Price (Decreased) $E=C-D$	Price (Increased) $F=C+D$
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

Items of Specified Materials		1st month, 2015	2nd month, 2015	3rd month, 2015	4th	5th	6th
1	Item 1	●	●	●			
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	

Major Undertakings to be taken by the Government of Kenya

1. Specific obligations of the Government of Kenya which will not be funded with the Grant**(1) Before the Tender**

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant	within 1 month after the signing of the G/A	MOF		
2	To issue A/P to the Agent Bank for the payment to the consultant	within 1 month after the signing of the contract(s)	MOF		
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	MOF		
	2) Payment commission for A/P	every payment	MOF		
4	To get approval for IEE/EIA(Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation for EMP and EMoP (and fulfilling conditions of approval, if any).	within 1 month after the signing of the G/A	CDM		
5	To secure the necessary budget and implement land acquisition and resettlement (including preparation of resettlement sites), and compensation with full replacement cost in accordance with RAP	before notice of the bidding documents	CDM		
6	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	until land acquisition and resettlement complete	CDM		
7	To secure and clear the following lands 1) right of way of the Project 2) temporary construction yard and stock yard near the Project area 3) borrow pit and disposal site near the Project area	before notice of the bidding documents	CDM		
8	To obtain the planning, zoning, building permit	before notice of the bidding documents	CDM		
9	To clear, level and reclaim the following sites 1) remove utilities 2) existing facilities	before notice of the bidding documents	CDM KeNHA KURRA		
10	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding documents	CDM		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

Note: CDM: Mombasa County Government

MOF:Ministry of Finance




KeNHA: Kenya National Highways Authority

KURA: Kenya Urban Roads Authority

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to the Agent Bank for the payment to the supplier and the contractor	within 1 month after the signing of the contract(s)	CDM		
2	To bear the following commissions to the Agent Bank for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	CDM		
	2) Payment commission for A/P	every payment	MOF CDM		
3	to ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	CDM		
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	CDM		
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the Project	CDM		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	CDM		
7	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction	CDM		
8	1) To submit Project Monitoring Report	every month	CDM		
	2) To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.)	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	CDM		
9	To submit a report concerning completion of the Project	within 6 months after completion of the Project	CDM		
10	To ensure the safety of persons engaged in the implementation of the Project	during the Project	CDM		
11	To take measure necessary for security and safety of the Project -traffic control around the site and on transportation routes of construction materials -public notification	during the construction	CDM		
12	To implement EMP and EMoP	during the construction	CDM		

13	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	CDM		
14	To implement RAP/ARAP (livelihood restoration program), if necessary	for a period based on livelihood restoration program	CDM		
15	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report - Period of the monitoring may be extended if affected persons' livelihoods are not sufficiently restored. Extension of the monitoring will be decided based on agreement between CDM and JICA.	- until the end of livelihood restoration program (In case that livelihood restoration program is provided) - for 2 years after land acquisition and resettlement complete (In case that livelihood restoration program is not provided)	CDM		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP	CDM		
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between CDM and JICA.	for 3 years after the Project	CDM		
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure Routine check/Periodic inspection	After completion of the construction	CDM		

2. Other obligations of the Government of Kenya funded with the Grant

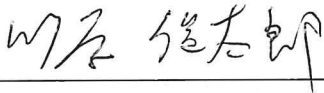
NO	Items	Deadline	Amount (Million Japanese Yen)*
1	Civil work and equipment procurement		
2	Detailed design and Supervisory Service		
3	Contingencies		
	Total		XXX

* The Amount is provisional. This is subject to the approval of the Government of Japan.

Minutes of Discussions
on the Preparatory Survey for the Project for
Implementation of Intelligent Transport System in Mombasa Region
(Second Field Survey)

Based on the several preliminary discussions between the Government of Republic of Kenya (hereinafter referred to as “Kenya”) and Japan International Cooperation Agency (hereinafter referred to as “JICA”) Kenya Office, JICA dispatched the Preparatory Survey Team (hereinafter referred to as “the Team”) for the Outline Design of the Project for Implementation of Intelligent Transport System in Mombasa Region (hereinafter referred to as “the Project”) to Kenya. The Team held a series of discussions with the officials of the Government of Kenya and conducted a field survey. In the course of the discussions, both sides have confirmed the main items described in the attached sheets.

Mombasa, December , 2021



Kawahara Shuntaro

Leader

Preparatory Survey Team

Japan International Cooperation Agency

Japan



Joab Tumbo

County Secretary and Head of Public Service

County Government of Mombasa

The Republic of Kenya

ATTACHMENT

1. Project Site

Both sides confirmed that the candidate sites of the Project are in Mombasa City, which is shown in Annex 1.

2. Items Requested by the Government of Kenya

2-1. As a result of discussions, both sides confirmed that the items requested by the Government of Kenya are as follows:

-Installation of traffic signals controlled by MODERATO system to some intersections and junction improvements in Mombasa City

2-2. JICA will assess the feasibility of the above requested items through the survey and will report the findings to the Government of Japan. The final scope of the Project will be decided by the Government of Japan.

2-3. The Government of Kenya shall submit an official request to the Government of Japan through a diplomatic channel before April 2022.

3. Schedule of the Survey

3-1. JICA will prepare a draft Preparatory Survey Report in English and dispatch a mission to Kenya in order to explain its contents around the end of June 2022.

3-2. If the contents of the draft Preparatory Survey Report is accepted and the undertakings for the Project are fully agreed by the Kenyan side, JICA will finalize the Preparatory Survey Report and send it to Kenya around November 2022.

3-3. The above schedule is tentative and subject to change.

4. Candidate Target Junctions of the Project

The Team explained that selection of the candidate target junction of the Project where improvement will be implemented or traffic signals and related equipment will be installed has been selected by following procedure.

1) Listing up candidate sites based on the previous studies.

2) Conducting site survey including traffic survey at candidate sites.

3) Selecting target sites among candidates ones by benefit, cost, consistency in road improvement plans, social impact and other technical constraints.

The Team explained candidate target junctions of the Project would be 24 junctions as shown in Annex 1, although the number of target junctions could be decreased,



considering effect and budget constraints, etc. The Kenyan side has understood that the Team would consider draft design and estimate necessary cost of the Project.

5. Installation of Fiber Cable Network

The Kenyan side explained that the installation of fiber cable network to some necessary sections would be implemented by Fiberlink Ltd.. The Team requested the Kenyan side, to share the basic consent between Fiberlink Ltd. and County Government of Mombasa (hereinafter referred to as "CGM"), to JICA Kenyan office by April 2022, as the installation of fiber cable network at an adequate timing is essential.

6. Relocation of Utilities

The Team emphasized that the delay of relocation of utilities could negatively affect the smooth implementation of the Project. In response to JICA's concern, the Kenyan side agreed that CGM would take necessary actions for the relocation of utilities before and during Project implementation.

CGM, with support of the Preparatory Survey team will find out the procedures, expected bottlenecks, and cost for the relocation of utilities, which will be reviewed by both sides at the timing of the mission for explanation on Draft Final Report of Preparatory Survey in June 2022.

7. Environmental and Social Considerations

7-1. The Kenyan side confirmed to give due environmental and social considerations before and during implementation, and after completion of the Project, in accordance with the JICA Guidelines for Environmental and Social Considerations (April, 2010).

7-2. The Project is categorized as "B" from the following considerations:

The project is not considered to be a large-scale road, is not located in a sensitive area, and has none of the sensitive characteristics under the JICA Guidelines for Environmental and Social Considerations (April, 2010), it is not likely to have a significant adverse impact on the environment.

The Kenyan side confirmed to conduct the necessary procedures concerning the environmental assessment (including stakeholder meetings, Environmental Impact Assessment (EIA) and information disclosure, etc. and make EIA report of the Project. The EIA approval shall be received from the responsible authorities and submitted to JICA by June 2022.

7-3. If the Project will result in involuntary resettlement, the Kenyan side confirmed to prepare a Resettlement Action Plan (RAP) /Abbreviated Resettlement Action Plan (ARAP) and make it available to the public. In addition, the Kenyan side confirmed to provide the affected people with sufficient compensation and/or support in accordance with RAP/ARAP, which is consistent with JICA Guidelines for Environmental and Social Considerations (April, 2010), in a timely manner.

8. Other Relevant Issues

8-1. Gender Mainstreaming

Both sides confirmed that the gender mainstreaming should be incorporated into the Project. In particular, both sides agreed on the following gender elements to be integrated into the Project.

- (a) In the selection of the target junctions of installation of pedestrian signals, usability of vulnerable road users should be considered.
- (b) In the construction, equal pay for equal work and facilities for female workers should be installed.
- (c) In the setting of traffic signals, safety crossing of vulnerable pedestrians should be considered.

8-2. Safety Measures

Both sides confirmed that County Government of Mombasa shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities during the Project period. Such security measures shall reasonably reflect needs of the Consultant/the Contractor engaging in the Project, as shown in Annex 2.

Both sides agreed that in case the additional security cost would be necessary for the implementation of the Project, such cost shall be borne by the Recipient without using the Grant.

【Annex 1】 Project Site

【Annex 2】 Major Undertakings to be taken by the Government of Kenya





Major Undertakings to be taken by the Government of Kenya

1. Specific obligations of the Government of Kenya which will not be funded with the Grant

(1) Before the Tender

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant	within 1 month after the signing of the G/A	CGM		
2	To issue A/P to the Agent Bank for the payment to the consultant	within 1 month after the signing of the contract(s)	CGM		
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	CGM		
	2) Payment commission for A/P	every payment	CGM		
4	To get approval for IEE/EIA(Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation for EMP and EMoP (and fulfilling conditions of approval, if any).	within 1 month after the signing of the G/A	CGM		
5	To secure the necessary budget and implement land acquisition and resettlement (including preparation of resettlement sites), and compensation with full replacement cost in accordance with RAP	before notice of the bidding documents	CGM		
6	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	until land acquisition and resettlement complete	CGM		
7	To secure and clear the following lands 1) right of way of the Project 2) temporary construction yard and stock yard near the Project area 3) borrow pit and disposal site near the Project area	before notice of the bidding documents	CGM		
8	To obtain the planning, zoning, building permit	before notice of the bidding documents	CGM		
9	To clear, level and reclaim the following sites 1) remove utilities 2) existing facilities	before notice of the bidding documents	CGM KeNHA KURRA Kenya Power		
10	To submit Project Monitoring Report (with the result of Detailed Design)	before preparation of the bidding documents	CGM		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

Note: CGM: Mombasa County Government

MOF: Ministry of Finance

KeNHA: Kenya National Highways Authority

KURA: Kenya Urban Roads Authority

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(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To issue A/P to the Agent Bank for the payment to the supplier and the contractor	within 1 month after the signing of the contract(s)	CGM		
2	To bear the following commissions to the Agent Bank for the banking services based upon the B/A				
	1) Advising commission of A/P	within 1 month after the signing of the contract(s)	CGM		
	2) Payment commission for A/P	every payment	CGM		
3	to ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	CGM		
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	CGM		
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted	during the Project	CGM		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	CGM		
7	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction	CGM		
8	1) To submit Project Monitoring Report	every month	CGM		
	2) To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.)	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	CGM		
9	To submit a report concerning completion of the Project	within 6 months after completion of the Project	CGM		
10	To ensure the safety of persons engaged in the implementation of the Project	during the Project	CGM		
11	To take measure necessary for security and safety of the Project -traffic control around the site and on transportation routes of construction materials -public notification	during the construction	CGM		
12	To implement EMP and EMoP	during the construction	CGM		
13	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	CGM		
14	To implement RAP/ARAP (livelihood restoration program), if necessary	for a period based on livelihood restoration	CGM		

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		program			
15	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report - Period of the monitoring may be extended if affected persons' livelihoods are not sufficiently restored. Extension of the monitoring will be decided based on agreement between CGM and JICA.	- until the end of livelihood restoration program (In case that livelihood restoration program is provided) - for 2 years after land acquisition and resettlement complete (In case that livelihood restoration program is not provided)	CGM		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	for a period based on EMP and EMoP	CGM		
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between CGM and JICA.	for 3 years after the Project	CGM		
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost 2) Operation and maintenance structure Routine check/Periodic inspection	After completion of the construction	CGM		

2. Other obligations of the Government of Kenya funded with the Grant

NO	Items	Deadline	Amount (Million Japanese Yen)*
1	Civil work and equipment procurement		
2	Detailed design and Supervisory Service		
3	Contingencies		
	Total		XXX

* The Amount is provisional. This is subject to the approval of the Government of Japan.

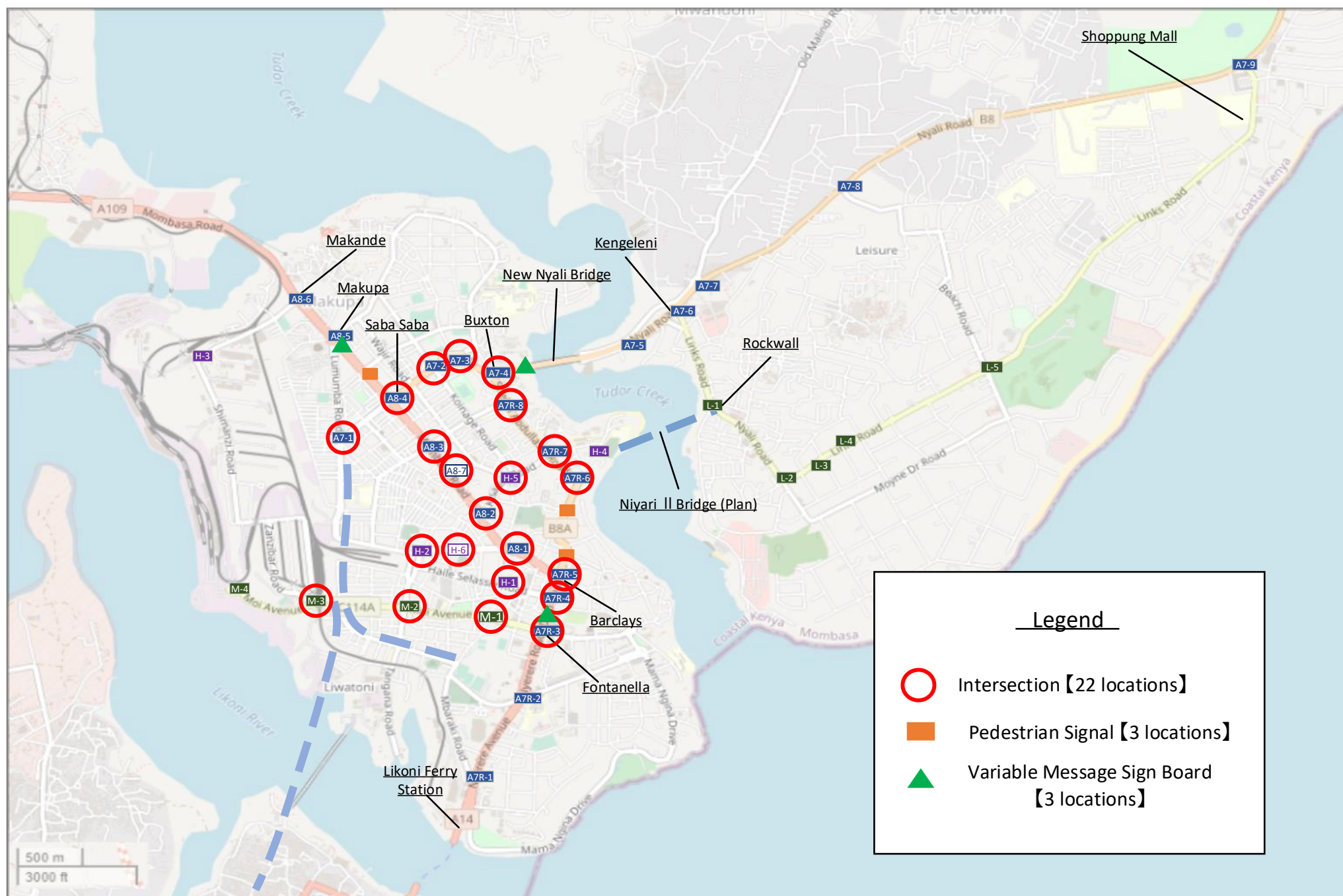
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Minutes of Discussions
on the Preparatory Survey for the Project for
Implementation of Intelligent Transport System in Mombasa Region
(Progress Meeting)

Based on the several preliminary discussions between the Government of Republic of Kenya (hereinafter referred to as “Kenya”) and Japan International Cooperation Agency (hereinafter referred to as “JICA”) Kenya Office, JICA side and Kenya side have confirmed the two items described below.

1. Both side confirmed that the one-way operation and closure of road which have effect on the Project for Implementation of Intelligent Transport System in Mombasa Region (hereinafter referred to as “the Project”), implemented by County Government of Mombasa, is a temporary operation, and this operation will be finished before commencement of the operation of traffic signals implemented by the Project.
2. Both side confirmed that intersection L-2, and L-5 are excluded from the scope of the Project. The candidate sites of the Project are shown in Annex1.

13 April, 2022



Minutes of Discussions
on the Preparatory Survey for the Project for
the Implementation of Intelligent Transport System in Mombasa Region
(Explanation on Draft Preparatory Survey Report)

With reference to the Minutes of Discussions signed between County Government of Mombasa (hereinafter referred to as “CGM”) and Japan International Cooperation Agency (hereinafter referred to as “JICA”) on September 30 2021 and December 8 2021, and in response to the request from the Government of Republic of Kenya (hereinafter referred to as “Kenya”) dated January 28, 2022, JICA organized the Preparatory Survey Team (hereinafter referred to as the “Team”) for the explanation of Draft Preparatory Survey Report (hereinafter referred to as the “Draft Report”) for the Project for the Implementation of Intelligent Transport System in Mombasa Region (hereinafter referred to as the “Project”).

As a result of the discussions, both sides agreed on the main items described in the attached sheets.

Mombasa, March 21, 2024



Kawahara Shuntaro

Leader

Preparatory Survey Team

Japan International Cooperation Agency

Japan



Jeizan Faruk

County Secretary and Head of Public Service

County Government of Mombasa

The Republic of Kenya

ATTACHEMENT

1. Objective of the Project

The objective of the Project is to ease traffic congestion and improve traffic safety through installation of ITS equipment and improvement of junctions, thereby contributing to economic development of Mombasa Region.

2. Title of the Project

Both sides confirmed the title of the Project is modified as the “Project for the Implementation of Intelligent Transport System in Mombasa County”.

3. Project Sites

Both sides confirmed that the sites of the Project are in Mombasa County, which is shown in Annex 1.

4. Responsible authority for the Project

Both sides confirmed that CGM will be the executing agency for the Project (hereinafter referred to as “the Executing Agency”).

The Executing Agency shall coordinate with all the relevant authorities to ensure smooth implementation of the Project and ensure that the undertakings for the Project shall be taken care by relevant authorities properly and on time. The organization chart, which includes demarcation of task such as execution of the Project, data analysis, operation, and maintenance of the ITS system among relevant departments, is shown in Annex 2.

5. Contents of the Draft Report

After the explanation of the contents of the Draft Report by the Team, the Kenyan side agreed to its contents. JICA will finalize the Preparatory Survey Report based on the confirmed items. The report will be sent to the Kenyan side around July, 2024.

6. Cost estimate

Both sides confirmed that the cost estimation including the contingency explained by the Team is provisional and will be examined further by the Government of Japan for its approval. The contingency would cover the additional cost against natural disaster, unexpected natural conditions, etc.



7. Confidentiality of the cost estimate and technical specifications

Both sides confirmed that the cost estimate and technical specifications of the Project should never be disclosed to any third parties until all the contracts under the Project are concluded.

8. Procedures and Basic Principles of Japanese Grant

The Kenyan side agreed that the procedures and basic principles of Japanese Grant (hereinafter referred to as the "Grant") as described in Annex 3 shall be applied to the Project. In addition, the Kenyan side agreed to take necessary measures according to the procedures.

9. Timeline for the Project Implementation

The Team explained to the Kenyan side that the expected timeline for the project implementation is as attached in Annex 4.

10. Expected outcomes and indicators.

Both sides agreed that key indicators for expected outcomes are as follows. The Kenyan side will be responsible for the achievement of agreed key indicators targeted in year 2030 and shall monitor the progress for Ex-Post Evaluation based on those indicators.

[Quantitative indicators]

Indicator	Basic Value (2021)	Target (2030) [3 years after completion]
Average Travel time (minutes) at traffic peak hour *1	approx. 9.4 minutes	approx. 6.5 minutes
Average Travel speed (km/h) at traffic peak hour *1	approx. 12.3 km/h	approx. 17.8 km/h
Overall benefits of the target intersection (mill yen/year) *2	—	approx. 480 mill yen/year

*1 : Saba Saba Intersection to Barclay intersection (approx. 2km). Evening peak.

*2 : Economic benefit of travel time reduction resulting from difference in estimated travel time between "With the Project Case" and "Without the Project Case" when the road improvement projects (Roads connecting Nairobi direction(A109) and Mombasa port area (A8 and A14) on Mombasa Island) are completed in 2030.



[Qualitative indicators]

- 1) Mitigation of traffic congestion in Mombasa Island by the Project will contribute to vitalization of economic activity.
- 2) The convenience and safety of vehicles, passengers and pedestrians will be enhanced.

11. Ex-Post Evaluation

JICA will conduct ex-post evaluation after three (3) years from the project completion, in principle, with respect to six (6) evaluation criteria (Relevance, Coherence Effectiveness, Efficiency, Impact, Sustainability). The result of the evaluation will be publicized. The Kenyan side is required to provide necessary support for the data collection.

12. Undertakings of the Project

Both sides confirmed the undertakings of the Project as described in Annex 5. With regard to exemption of customs duties, internal taxes and other fiscal levies as stipulated in No. 5 of (2) During the Project Implementation of Annex 5, both sides confirmed that such customs duties, internal taxes and other fiscal levies shall be clarified in the bid documents by the Executing Agency during the implementation stage of the Project. Both sides confirmed general tax exemption procedure as is shown in the Annex 6. Detail contents and procedure of tax exemption will be formally agreed between the Government of Japan and the Government of Kenya.

The Kenyan side assured to take the necessary measures and coordination including allocation of the necessary budget which are preconditions of implementation of the Project. It is further agreed that the costs are indicative, i.e., at Outline Design level. More accurate costs will be calculated at the Detailed Design stage.

Both sides also confirmed that the Annex 5 will be used as an attachment of Grant Agreement (G/A).

Both sides confirmed that the Executing Agency shall take necessary measures to ensure and maintain the security of the Project site and the persons related to the implementation of the Project, in cooperation with relevant authorities such as police during the Project period. Such security measures shall reasonably reflect needs of the Consultant and the Contractor engaging in the Project, as shown in Annex 5.

Both sides agreed that in case the additional security cost would be necessary for the implementation of the Project, such cost shall be borne by the Recipient without using the Grant.



13. Monitoring during the implementation

The Project will be monitored by the Executing Agency and reported to JICA by using the form of Project Monitoring Report (hereinafter referred to as the “PMR”) attached as Annex 7. The timing of submission of the PMR is described in Annex 5.

14. Project completion

Both sides confirmed that the Project completes when all the facilities constructed, and equipment procured by the Grant are in operation. The completion of the Project will be reported to JICA promptly, but in any event not later than six (6) months after completion of the Project.

15. Items and measures to be considered for smooth implementation of the Project.

Both sides confirmed the items and measures to be considered for the smooth implementation of the Project as described in Annex5 and 8.

15-1. Installation of fiber cable network

Both sides confirmed that the Kenyan side explained that the installation of some sections of fiber cable network specified by the Draft Report would be implemented by the Executing Agency before announcement of the tender process as is described in Annex5.

15-2. Relocation of utilities and existing facilities.

the Executing Agency will coordinate relevant entities to complete relocation of utilities and existing facilities before announcement of the tender process.

15-3. Construction of the new traffic management center building

Both sides confirmed that the operation room for the equipment provided by the Project will be located at the new traffic management center building at the premise of Inspectorate Unit, and that its construction should be completed before announcement of the tender process of the Project as is described in Annex5. Kenyan side explained that its construction, of which budget is planned to be secured in fiscal year 2024-25, is expected to be completed in April 2025.

15-4. Operation and Maintenance

The Team explained necessary organizational structure and cost to ensure sustainable and effective operation and maintenance of the equipment implemented by the Project as is mentioned in the Draft Report and the Annex 8. Kenyan side assured to properly allocate necessary human and fiscal resources.



Both sides confirmed that capacity of operation and maintenance of the equipment is expected to be enhanced by the Technical Cooperation Project committed by the Government of Japan on May 23, 2022. Operation and Maintenance scheme of ITS equipment will be further elaborated in the course of the Technical Cooperation Project. In this connection, both sides confirmed that it is favorable that the Technical Cooperation Project will commence approximately 1.5 years prior to operation of the equipment provided by the Project.

Kenyan side explained that, as vandalism is one of crucial issues on operation and maintenance, it expects security patrol and existing CCTV and provided by the Project will mitigate vandalism.

16. Environmental and Social Considerations

16-1. General Issues

16-1-1. Environmental Guidelines and Environmental Category

The Team explained that ‘JICA Guidelines for Environmental and Social Considerations (April 2010)’ (hereinafter referred to as the “Guidelines”) is applicable for the Project. The Project is categorized as B because the Project is not considered to be a large-scale road, is not located in a sensitive area, and has none of the sensitive characteristics under the Guidelines, it is not likely to have a significant adverse impact on the environment.

16-1-2. Environmental Checklist

The environmental and social considerations including major impacts and relevant mitigation measures are summarized in the Environmental Checklist attached as Annex 9. Both sides confirmed that in case of major modification of the content of the Environmental Checklist, the Kenyan side shall submit the modified version to JICA in a timely manner.

16-2. Environmental Issues

16-2-1. Environmental Impact Assessment (EIA)

Both sides confirmed the Environmental Impact Assessment (hereinafter referred to as “EIA”) report will be approved by The National Environment Management Authority (hereinafter referred to as “NEMA”) in July 2024.

16-2-2. Environmental Management Plan and Environmental Monitoring Plan

Both sides confirmed Environmental Management Plan (EMP) and



Environmental Monitoring Plan (EMoP) of the Project is as Annex 10, respectively. Both side agreed that environmental mitigation measures and monitoring shall be conducted based on the EMP and EMoP, which may be updated during the detailed design stage.

16-3. Social Issues

16-3-1. Land Acquisition and Resettlement

Both sides confirmed that land acquisition and resettlement due to the Project would not be necessary and any households would not be relocated due to the implementation of the Project.

16-4. Environmental and Social Monitoring

16-4-1. Environmental Monitoring

Both sides agreed that the Kenyan side will submit results of environmental monitoring to JICA by using the monitoring form attached as Annex 11. The timing of submission of the monitoring form is described in Annex 5. In case JICA finds that there is a need for improvement in a situation with respect to environmental considerations after the agreed monitoring period, JICA may request to extend the period of monitoring and reporting until JICA confirms the issues have been properly addressed. The extension of the monitoring will be decided in accordance with the agreement between the Kenyan side and JICA.

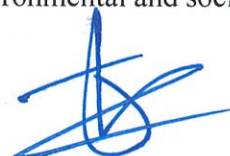
16-4-2. Social Monitoring

Both sides confirmed that the Kenyan side will implement social monitoring about complains, infections disease, occupational health, and traffic accident. Both sides agreed that the Executing Agency will submit results of social monitoring to JICA by using the monitoring form attached as Annex 11. In case there is a remaining issue that needs to be addressed, JICA may request to extend the period of monitoring and reporting until JICA confirms the issues have been properly addressed and solved. The extension of the monitoring will be decided in accordance with the agreement between the Kenyan side and JICA.

16-4-3. Information Disclosure of Monitoring Results

Both sides confirmed that the Kenyan side will disclose results of environmental and social monitoring to local stakeholders through their website / in their field offices.

The Kenyan side agreed JICA will disclose results of environmental and social



monitoring submitted by the Kenyan side as the monitoring forms attached as Annex11 on its website.

17. Other Relevant Issues

17-1. Disclosure of Information

Both sides confirmed that the Preparatory Survey Report from which project cost is excluded will be disclosed to the public after completion of the Preparatory Survey. The comprehensive report including the project cost will be disclosed to the public after all the contracts under the Project are concluded.

17-2. Gender Mainstreaming

Both sides confirmed that the gender mainstreaming should be incorporated into the Project. In particular, both sides agreed on the following gender elements to be integrated into the Project.

- (a) In the construction stage, workers should be equally paid for equal work, and the work office should be equipped with facilities for female workers.
- (b) In the setting of traffic signals, safety crossing of vulnerable pedestrians should be considered.

17-3. Climate Change Mitigation

Both sides confirmed that the Project contributes to climate change mitigation through the reduction of CO2 by improving traffic flow.

17-4. Safety Measures

Both sides confirmed that ensuring human safety and respect for basic human rights have the top priority in ODA construction works, and that the Kenyan side causes the stakeholders involved in the Project to follow “The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects” which has been published on JICA’s URL below.

https://www.jica.go.jp/english/our_work/types_of_assistance/c8h0vm00008zx0m8-att/guidance_en.pdf

17-5. Coordination with relevant agencies

Both sides confirmed that following coordination is required for the Kenyan side for the Project:

- Discussion on detailed function of the equipment provided by the Project with KeNHA and KURA before completion of detailed design of the Project;
- Preliminary approval of intersection improvement from KeNHA and KURA



before completion of detailed design of the Project;

- Coordination with KeNHA on additional signals to be installed for Mombasa Gate Bridge Project near future, which will be integrated to the signal system of the Project;
- Coordination with KeNHA on information exchange between Traffic Management Centre of the Project and Control Centre of Mombasa Gate Bridge Project which will be constructed near future;
- Type acceptance/approval from Communications Authority of Kenya (hereinafter referred to as "CA") of any electronic equipment that will be used in the Project; and
- Authorization from CA of any frequencies that will be used in the Project, if necessary.

17-6. Data Protection Impact Assessment

Kenyan side explained that Data Protection Impact Assessment (hereinafter referred to as the "DPIA") should be submitted at least 60 days prior to activation and collection of data. Both sides confirmed that the Executing Agency will carry out DPIA with support of Japanese experts dispatched through the new technical cooperation project.

17-7. Management of bank account of the Project

Both sides confirmed that the Executing Agency will be responsible for management of bank account of the Project subject to delegation of authority by the National Treasury.

17-8. Consultant during for the Project implementation stage

County Government of Mombasa should satisfy itself on the capacity of a consultant though due diligence, and also reserve the right to reject the consultant recommended by JICA.

17-9. Grant financing status

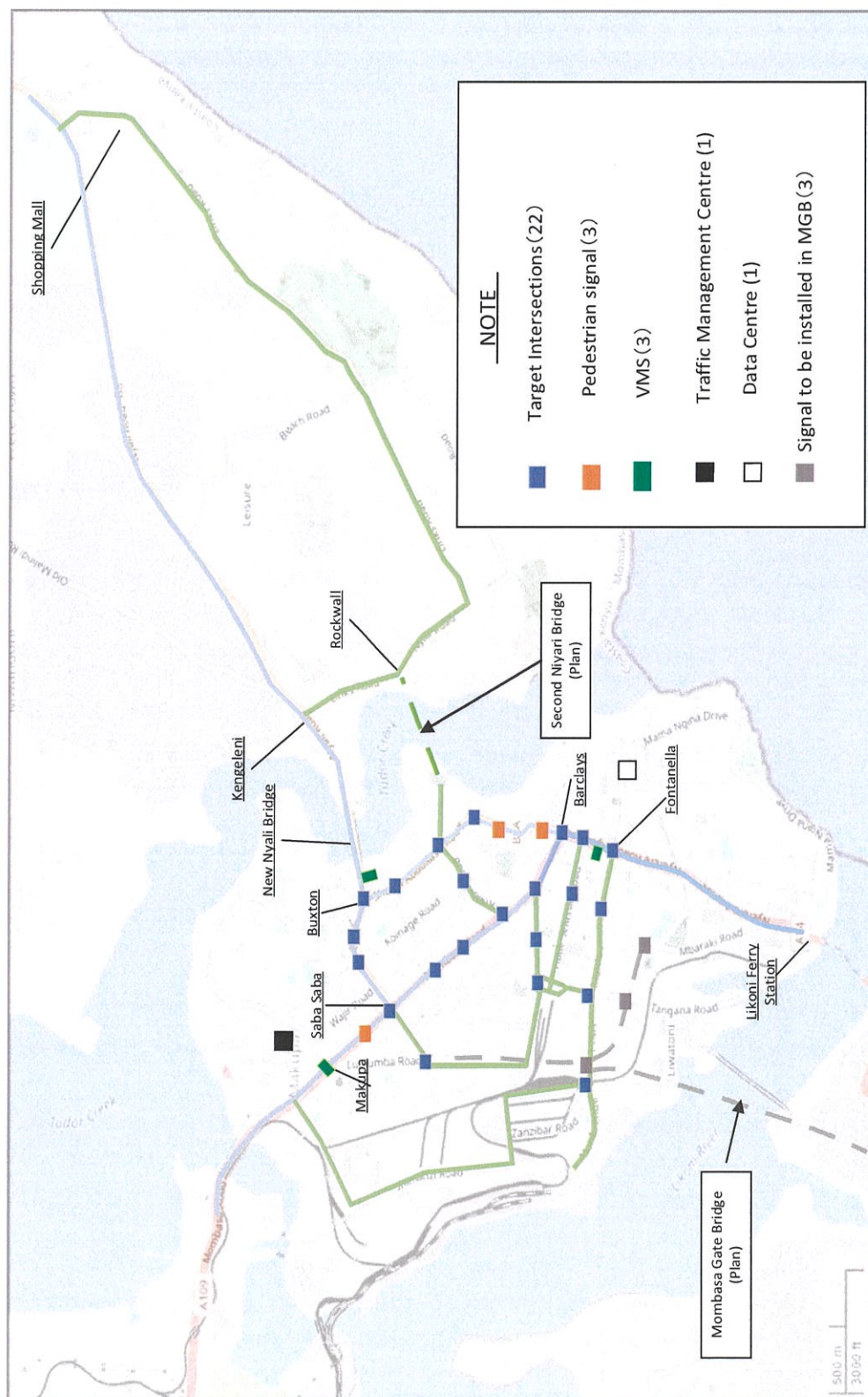
JICA requests for counterpart fund as described in Annex 5. However, both sides confirmed that such contribution by CGM and the Government of Kenya does not nullify the "a hundred percent grant status" of the project. The scope of the Project for consultancy, construction of facilities and procurement of equipment is 100% financed by Japanese grant.

End

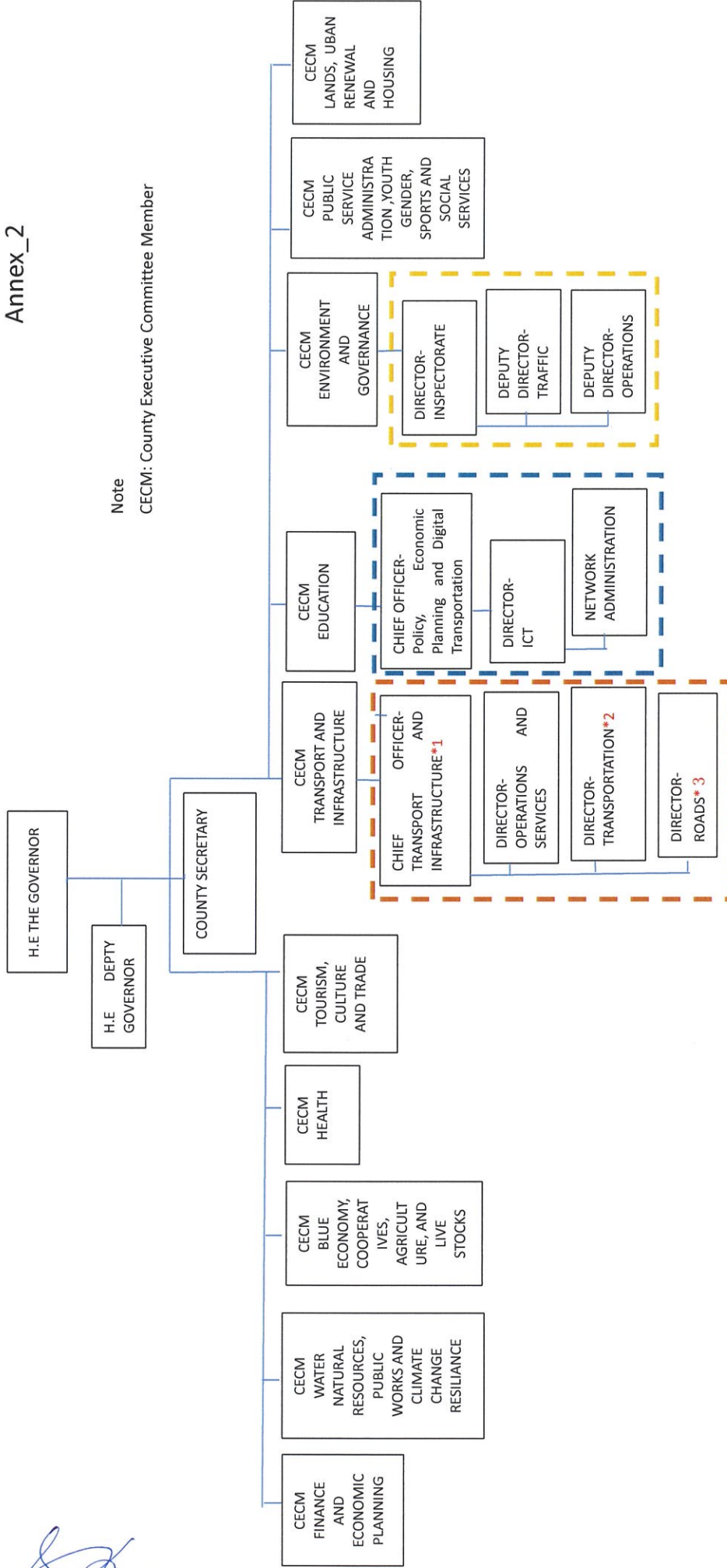


Annex 1: Project Site
Annex 2: Organization Chart
Annex 3: Japanese Grant
Annex 4: Project Implementation Schedule
Annex 5: Major Undertakings to be taken by the Government of Republic of Kenya
Annex 6: Procedure of Tax Exemption for Japanese Grand Aid Project
Annex 7: Project Monitoring Report (template)
Annex 8: Items and measures to be considered for smooth implementation of the Project
Annex 9: Environmental Check List
Annex 10: Environmental Management Plan / Environmental Monitoring Plan
Annex 11: Environmental and Social Monitoring Form





Annex_2



Note
CECM: County Executive Committee Member

*1 EXECUTION OF THE PROJECT
*2 DATA ANALYSIS AND MAINTENANCE OF ITS SYSTEM
*3 IMPROVEMENT OF INTERSECTIONS, MANAGED BY CGM

MAINTENANCE OF OFC AND NETWORK

OBSERVATION OF ITS EQUIPMENT OPERATION OF ITS SYSTEM, AND TRAFFIC MANAGEMENT

JAPANESE GRANT

The Japanese Grant is non-reimbursable fund provided to a recipient country (hereinafter referred to as “the Recipient”) to purchase the products and/or services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. Followings are the basic features of the project grants operated by JICA (hereinafter referred to as “Project Grants”).

1. Procedures of Project Grants

Project Grants are conducted through following procedures (See “PROCEDURES OF JAPANESE GRANT” for details):

(1) Preparation

- The Preparatory Survey (hereinafter referred to as “the Survey”) conducted by JICA

(2) Appraisal

- Appraisal by the government of Japan (hereinafter referred to as “GOJ”) and JICA, and Approval by the Japanese Cabinet

(3) Implementation

Exchange of Notes

- The Notes exchanged between the GOJ and the government of the Recipient

Grant Agreement (hereinafter referred to as “the G/A”)

- Agreement concluded between JICA and the Recipient

Banking Arrangement (hereinafter referred to as “the B/A”)

- Opening of bank account by the Recipient in a bank in Japan (hereinafter referred to as “the Bank”) to receive the grant

Construction works/procurement

- Implementation of the project (hereinafter referred to as “the Project”) on the basis of the G/A

(4) Ex-post Monitoring and Evaluation

- Monitoring and evaluation at post-implementation stage

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide basic documents necessary for the appraisal of the the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the Recipient necessary for the implementation of the Project.



- Evaluation of the feasibility of the Project to be implemented under the Japanese Grant from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.
- Confirmation of Environmental and Social Considerations

The contents of the original request by the Recipient are not necessarily approved in their initial form. The Outline Design of the Project is confirmed based on the guidelines of the Japanese Grant.

JICA requests the Recipient to take measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the executing agency of the Project. Therefore, the contents of the Project are confirmed by all relevant organizations of the Recipient based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA contracts with (a) consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the feasibility of the Project.

3. Basic Principles of Project Grants

(1) Implementation Stage

1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as “the E/N”) will be signed between the GOJ and the Government of the Recipient to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Recipient to define the necessary articles, in accordance with the E/N, to implement the Project, such as conditions of disbursement, responsibilities of the Recipient, and procurement conditions. The terms and conditions generally applicable to the Japanese Grant are stipulated in the “General Terms and Conditions for Japanese Grant (January 2016).”

2) Banking Arrangements (B/A) (See “Financial Flow of Japanese Grant (A/P Type)” for details)




a) The Recipient shall open an account or shall cause its designated authority to open an account under the name of the Recipient in the Bank, in principle. JICA will disburse the Japanese Grant in Japanese yen for the Recipient to cover the obligations incurred by the Recipient under the verified contracts.

b) The Japanese Grant will be disbursed when payment requests are submitted by the Bank to JICA under an Authorization to Pay (A/P) issued by the Recipient.

3) Procurement Procedure

The products and/or services necessary for the implementation of the Project shall be procured in accordance with JICA's procurement guidelines as stipulated in the G/A.

4) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the Recipient to continue to work on the Project's implementation after the E/N and G/A.

5) Eligible source country

In using the Japanese Grant disbursed by JICA for the purchase of products and/or services, the eligible source countries of such products and/or services shall be Japan and/or the Recipient. The Japanese Grant may be used for the purchase of the products and/or services of a third country as eligible, if necessary, taking into account the quality, competitiveness and economic rationality of products and/or services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm, which enter into contracts with the Recipient, are limited to "Japanese nationals", in principle.

6) Contracts and Concurrence by JICA

The Recipient will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be concurred by JICA in order to be verified as eligible for using the Japanese Grant.

7) Monitoring

The Recipient is required to take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and to regularly report to JICA about its status by using the Project Monitoring Report (PMR).

8) Safety Measures

The Recipient must ensure that the safety is highly observed during the implementation of the Project.

9) Construction Quality Control Meeting

Construction Quality Control Meeting (hereinafter referred to as the "Meeting") will be held for quality assurance and smooth implementation of the Works at each stage of the Works. The member of the Meeting will be composed by the Recipient (or executing agency), the Consultant, the Contractor and JICA. The functions of the Meeting are as

followings:

- a) Sharing information on the objective, concept and conditions of design from the Contractor, before start of construction.
- b) Discussing the issues affecting the Works such as modification of the design, test, inspection, safety control and the Client's obligation, during of construction.

(2) Ex-post Monitoring and Evaluation Stage

- 1) After the project completion, JICA will continue to keep in close contact with the Recipient in order to monitor that the outputs of the Project is used and maintained properly to attain its expected outcomes.
- 2) In principle, JICA will conduct ex-post evaluation of the Project after three years from the completion. It is required for the Recipient to furnish any necessary information as JICA may reasonably request.

(3) Others

1) Environmental and Social Considerations

The Recipient shall carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of the Recipient and JICA Guidelines for Environmental and Social Considerations (April, 2010).

2) Major undertakings to be taken by the Government of the Recipient

For the smooth and proper implementation of the Project, the Recipient is required to undertake necessary measures including land acquisition, and bear an advising commission of the A/P and payment commissions paid to the Bank as agreed with the GOJ and/or JICA. The Government of the Recipient shall ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the Recipient with respect to the purchase of the Products and/or the Services be exempted or be borne by its designated authority without using the Grant and its accrued interest, since the grant fund comes from the Japanese taxpayers.

3) Measures to ensure more efficient implementation of the Grant

- i) In the event that the E/N and the G/A concerning a project cannot be signed by the end of the following Japanese fiscal year of the cabinet decision concerned by the GOJ, the authorities concerned of the two Governments will discuss the cancellation of the project.
- ii) In the event that the period, specified in the G/A, during which the grant is available expires before the completion



of the disbursement, the authorities concerned of the GOJ will thoroughly review the status, situation and perspective of the implementation of the project concerned before extending the said period. The authorities concerned of the two Governments will discuss the termination of the project including a refund, unless there are concrete prospects for its completion.

iii) Regardless of the period mentioned in ii) above, the authorities concerned of the two Governments will, in the event that five years have passed since the cabinet decision concerned by the GOJ before the completion of the disbursement, except as otherwise confirmed between them, discuss the termination of a project including a refund, unless there are concrete prospects for its completion.

4) Proper Use

The Recipient is required to maintain and use properly and effectively the products and/or services under the Project (including the facilities constructed and the equipment purchased), to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japanese Grant.

5) Export and Re-export

The products purchased under the Japanese Grant should not be exported or re-exported from the Recipient.



PROCEDURES OF JAPANESE GRANT

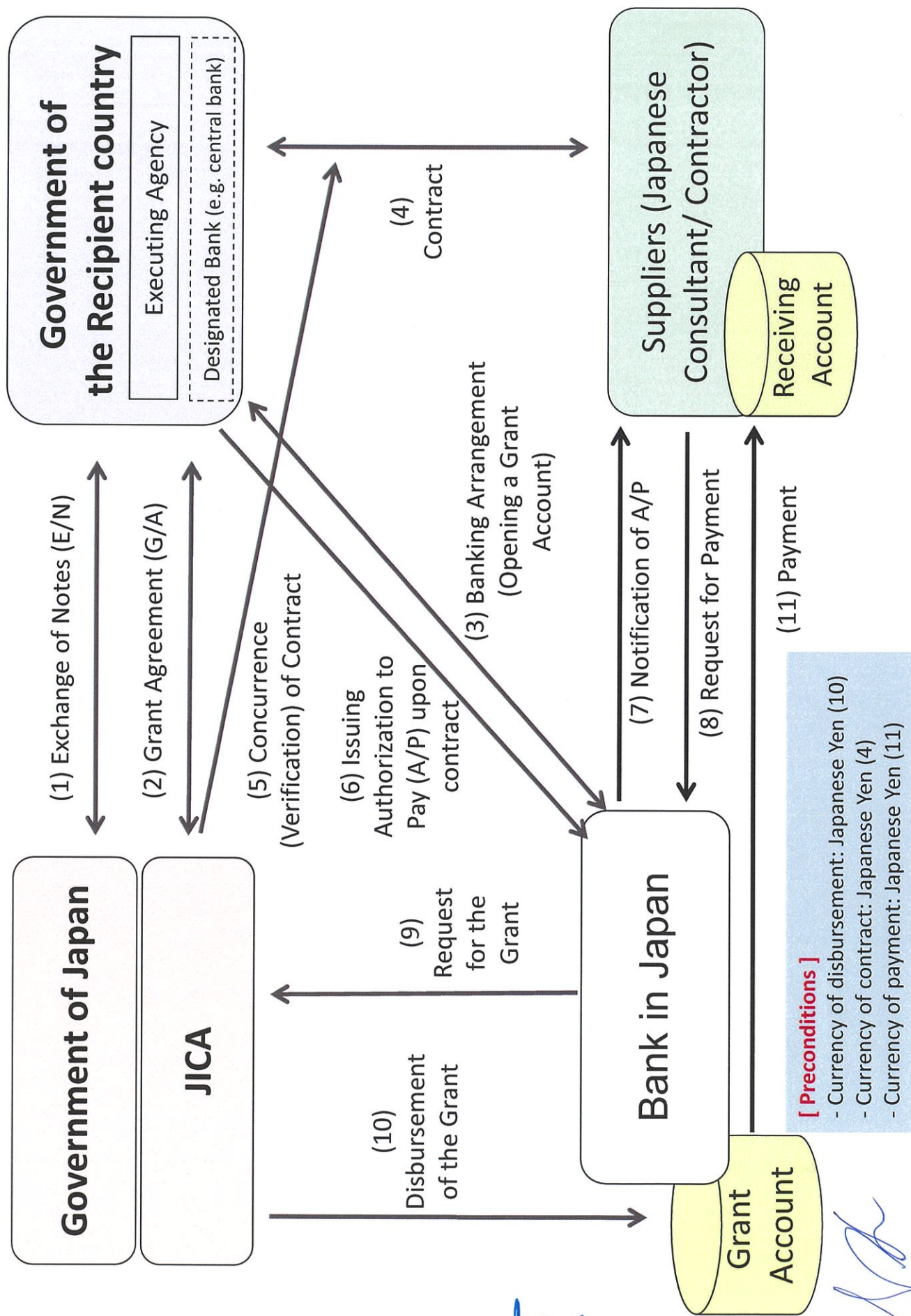
Stage	Procedures	Remarks	Recipient Government	Japanese Government	JICA	Consultants	Contractors	Agent Bank
Official Request	Request for grants through diplomatic channel	Request shall be submitted before appraisal stage.	x	x				
1. Preparation	(1) Preparatory Survey Preparation of outline design and cost estimate		x		x	x		
2. Appraisal	(2) Preparatory Survey Explanation of draft outline design, including cost estimate, undertakings, etc.		x		x	x		
	(3) Agreement on conditions for implementation	Conditions will be explained with the draft notes (E/N) and Grant Agreement (G/A) which will be signed before approval by Japanese government.	x	x (E/N)	x (G/A)			
	(4) Approval by the Japanese cabinet			x				
3. Implementation	(5) Exchange of Notes (E/N)		x	x				
	(6) Signing of Grant Agreement (G/A)		x		x			
	(7) Banking Arrangement (B/A)	Need to be informed to JICA	x					x
	(8) Contracting with consultant and issuance of Authorization to Pay (A/P)	Concurrence by JICA is required	x			x		x
	(9) Detail design (D/D)		x			x		
	(10) Preparation of bidding documents	Concurrence by JICA is required	x			x		
	(11) Bidding	Concurrence by JICA is required	x			x	x	
	(12) Contracting with contractor/supplier and issuance of A/P	Concurrence by JICA is required	x				x	x
	(13) Construction works/procurement	Concurrence by JICA is required for major modification of design and amendment of contracts.	x			x	x	
	(14) Completion certificate		x			x	x	
4. Ex-post monitoring & evaluation	(15) Ex-post monitoring	To be implemented generally after 1, 3, 10 years of completion, subject to change	x		x			
	(16) Ex-post evaluation	To be implemented basically after 3 years of completion	x		x			

notes:

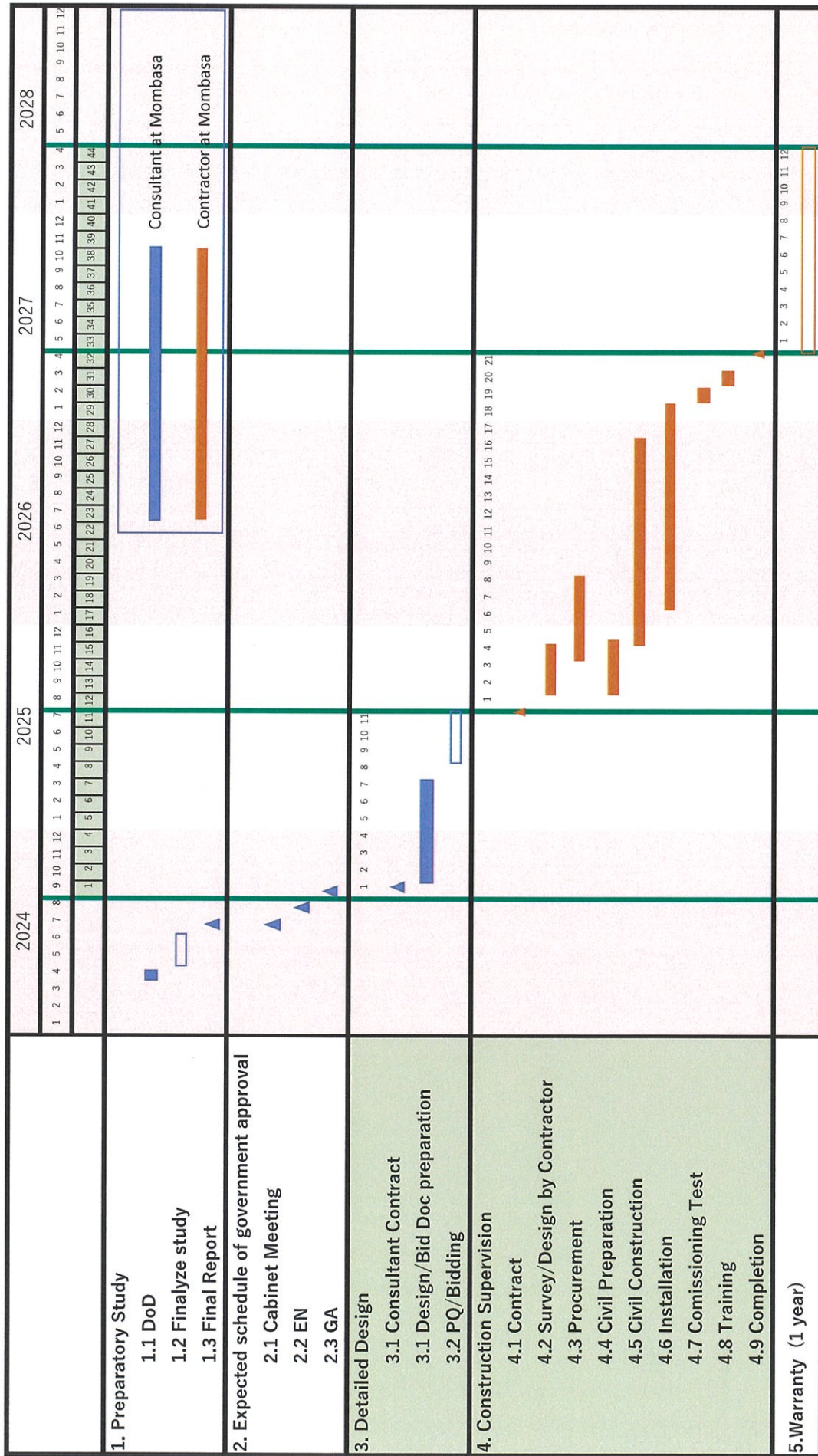
1. Project Monitoring Report and Report for Project Completion shall be submitted to JICA as agreed in the G/A.

2. Concurrence by JICA is required for allocation of grant for remaining amount and/or contingencies as agreed in the G/A.

Financial Flow of Japanese Grant (A/P Type)



Project Implementation Schedule



[Handwritten signature]

Major Undertakings to be taken by the Government of Republic of Kenya

1. Specific obligations of the Government of Republic of Kenya which will not be funded with the Grant**(1) Before the Tender**

NO	Items	Deadline	In charge	Estimated Cost (KES)	Ref.
1	To sign the banking arrangement (B/A) with a bank in Japan (the Agent Bank) to open bank account for the Grant	within 1 month after the signing of the G/A	CGM (NT)	approx. 3,000,000	
2	To issue A/P to the Agent Bank for the payment to the consultant	within 1 month after the signing of the contract(s)	CGM (NT)		
3	To bear the following commissions to the Agent Bank for the banking services based upon B/A				
	1) Advising commission of A/P Commissioning Fee	within 1 month after the signing of the contract(s)	CGM		
	2) Payment commission for A/P	every payment	CGM		
4	To approve EIA(Conditions of approval should be fulfilled, if any) and secure the necessary budget for implementation for EMP and EMoP (and fulfilling conditions of approval, if any). Commission Fee	until July, 2024	CGM	approx. 3,000,000	
5	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	until land acquisition and resettlement completion	CGM		
6	To secure and clear the following lands	before announcement of the tender process	CGM		
	1) main camp yard, temporary construction yard and stock yard near the Project area				
	2) borrow pit and disposal site near the Project area	before announcement of the tender process	CGM	3,000,000	
	3) To complete construction of new traffic management center building to accommodate the provided equipment, which will later include raised floor, air-conditioning system, electrical fittings, lighting fixtures and interior finishes.		CGM	13,265,000	
	4) Implementation of additional Optical Fiber network		CGM		
7	To discuss on intersection design	During detailed design	CGM KURA KeNHA		

8	To clear, level and reclaim the following sites 1) Removal of the ornament structures, power facilities, communication cables, advertisement board and lighting from the roundabouts with cooperation of the stakeholders.	before announcement of the tender process	CGM	5,000,000	
9	To submit Project Monitoring Report (with the result of Detailed Design)	before announcement of the tender process	CGM		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

Note: CGM : Mombasa County Government

NT : The National Treasury and Economic Planning

KeNHA : Kenya National Highways Authority

KURA: Kenya Urban Roads Authority

(2) During the Project Implementation

NO	Items	Deadline	In charge	Estimated Cost (KES)	Ref.
1	To issue A/P to the Agent Bank for the payment to the supplier and the contractor	within 1 month after the signing of the contract(s)	CGM (NT)	approx. 3,000,000	
2	To bear the following commissions to the Agent Bank for the banking services based upon the B/A 1) Advising commission of A/P	within 1 month after the signing of the contract(s)	CGM (NT)		
	2) Payment commission for A/P	every payment	CGM (NT)		
3	To ensure prompt unloading and customs clearance at ports of disembarkation in the country of the Recipient and to assist the Supplier(s) with internal transportation therein	during the Project	CGM		
4	To accord Japanese physical persons and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work	during the Project	CGM		
5	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted.	during the Project	CGM NT		
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project	during the Project	CGM		
7	To notify JICA promptly of any incident or accident, which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers.	during the construction	CGM		
8	1) To submit Project Monitoring Report	every month	CGM		
	2) To submit Project Monitoring Report (final) (including as-built drawings, equipment list, photographs, etc.)	within 1 month after issuance of Certificate of Completion for the works under the contract(s)	CGM		
9	To submit a report concerning completion of the Project	within 6 months after completion of the Project	CGM		

10	To provide Data Centre and Traffic Management Centre with facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s), 1) Electric power distributing line to the equipment.	before start of the equipment installation	CGM	2,370,000	
	2) Communication line to the equipment	Before start of the equipment installation	CGM (Fiber Link)	2,770,000	
	3) Relocating and adding Mobile Radio Communication System to new Traffic Management Centre.	During/before installation	CGM	300,000	
11	To ensure the safety of persons engaged in the implementation of the Project.	during the Project	CGM		
12	To take measures necessary for security and safety of the Project -traffic control around the site and on transportation routes of construction materials -public notification -immediate action in case of accident -information of security.	during the construction	CGM		
13	To implement EMP and EMoP	during the construction	CGM		
14	To submit results of environmental monitoring to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	CGM		
15	To implement social monitoring, and to submit the monitoring results to JICA, by using the monitoring form, on a quarterly basis as a part of Project Monitoring Report	during the construction	CGM		

(3) After the Project

NO	Items	Deadline	In charge	Estimated Cost	Ref.
1	To implement EMP and EMoP	during warranty period	CGM	6,600,000 1 year only	
2	To submit results of environmental monitoring to JICA, by using the monitoring form, semiannually - The period of environmental monitoring may be extended if any significant negative impacts on the environment are found. The extension of environmental monitoring will be decided based on the agreement between CGM and JICA.	for 3 years after completion of the Project	CGM		
3	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid 1) Allocation of maintenance cost Maintenance Contract fee Communication Bill 2) Operation and maintenance structure Maintenance Contract Assignment of personnel for Operation and maintenance	After completion of the construction	CGM	9,900,900 10,693,069 /Year	

Procedure of Tax Exemption for Japanese Grand Aid Project

Annex 6

Tax items	Measure	Relevant Authorities and Application procedure
Corporate Tax imposed on Japanese Companies	Exempt (Advanced)	[Case 1] There is an existing office in Kenya. ① Apply to found the branch for the project in the registered PIN to KRA. ② Submit copies of the E/N, G/A and contract and apply tax exemption to KRA. ③ Use the same PIN as the existing PIN for tax exemption. ④ Close the branch at the end of the project. Duration : 6 months [Case 2: No office in Kenya] ① Establish a company and apply a PIN to KRA. ② Apply for exemption application to CGM as the new company. ③ Tax exemption is made to KRA from NTP. Duration : 6 months
Income Tax for Japanese Nationals	Exempt (Advanced)	[Case-1] Apply by individual ① Obtain a stay permission and a foreigner registration certificate from Immigration Office. ② Obtain a PIN from KRA web site. ③ Submit copies of E/N, G/A and contract with the EA and apply tax exemption to KRA. Duration: 6 months [Case-2] Request CGM to do the procedure ① Submit the documents related to permission of stay (E/N, G/A and contract with the CGM) to CGM. ② Application of PIN will be made to KRA with a tax exemption letter from NTP. Duration : 6 months

【Abbreviations】 NTP: National Treasury and Planning / EA: Executing Agency / KRA : Kenya Revenue Authority/ PIN : Personal Identification Number / E/N: Exchange of Note / G/A : Grant Agreement

Tax items	Measure	Relevant Authorities and Application procedure
VAT for Normal Goods and Equipment	Exempt (Advanced)	① Contractor applies for the tax exemption through CGM with necessary documents, including the whole material/equipment list (i.e., master list). ② After receiving the documents from the contractor, CGM will make a request to MM for the tax exemption. ③ MM writes to NTP for request of the tax exemption. ④ NTP approves the request and issues a tax exemption certificate. ⑤ Before the actual procurement of the goods and equipment, contractor requests KRA for the exemption of VAT with proforma invoice with the approved master list. Duration: 2 months in EA and MM, 2 months in NTP, 2-3 months in KRA
All imported items which attract duties	Exempt (Advanced)	① Contractor applies for the tax exemption through CGM with necessary documents, including the whole material/equipment list (i.e., master list). ② After receiving the documents from the contractor, CGM writes to NTP for request of the tax exemption. ③ NTP approves the request and issue a tax exemption certificate. ④ Contractor requests KRA for the exemption of custom duties for the individual items to be imported with shipping documents and the approved master list. ⑤ KRA issues a duty free note upon verification of the documents. Duration: 2 months in CGM, 2 months in NTP, 2-3 months in KRA

【Abbreviations】 NTP: National Treasury and Planning / EA: Executing Agency / KRA : Kenya Revenue Authority/ PIN : Personal Identification Number / E/N: Exchange of Note / G/A : Grant Agreement



<u>Project Monitoring Report</u> on <u>Project Name</u> <u>Grant Agreement No. XXXXXXXX</u> 20XX, Month
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Organizational Information

Signer of the G/A (Recipient)	Person in Charge (Designation)
	Contacts Address: Phone/FAX: Email:
Executing Agency	Person in Charge (Designation)
	Contacts Address: Phone/FAX: Email:
Line Ministry	Person in Charge (Designation)
	Contacts Address: Phone/FAX: Email:

General Information:

Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:
Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____




1: Project Description

1-1 Project Objective

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1-2 Project Rationale

- Higher-level objectives to which the project contributes (national/regional/sectoral policies and strategies)
- Situation of the target groups to which the project addresses

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1-3 Indicators for measurement of "Effectiveness"

Quantitative indicators to measure the attainment of project objectives		
Indicators	Original (Yr)	Target (Yr)
Qualitative indicators to measure the attainment of project objectives		

2: Details of the Project

2-1 Location

Components	Original (proposed in the outline design)	Actual
1.		

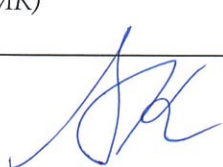
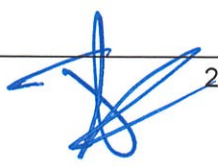
2-2 Scope of the work

Components	Original* (proposed in the outline design)	Actual*
1.		

Reasons for modification of scope (if any).

(PMR)

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  2

2-3 Implementation Schedule

Items	Original		Actual
	(proposed in the outline design)	(at the time of signing the Grant Agreement)	

Reasons for any changes of the schedule, and their effects on the project (if any)

2-4 Obligations by the Recipient

2-4-1 Progress of Specific Obligations

See Attachment 2.

2-4-2 Activities

See Attachment 3.

2-4-3 Report on RD

See Attachment 11.

2-5 Project Cost

2-5-1 Cost borne by the Grant(Confidential until the Bidding)

Components			Cost (Million Yen)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
	1.			
Total				

Note: 1) Date of estimation:

2) Exchange rate: 1 US Dollar = Yen

2-5-2 Cost borne by the Recipient

Components			Cost (1,000 Taka)	
	Original (proposed in the outline design)	Actual (in case of any modification)	Original ^{1),2)} (proposed in the outline design)	Actual
	1.			

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar =

Reasons for the remarkable gaps between the original and actual cost, and the countermeasures (if any)

(PMR)

2-6 Executing Agency

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original (at the time of outline design)

name:

role:

financial situation:

institutional and organizational arrangement (organogram):

human resources (number and ability of staff):

Actual (PMR)

2-7 Environmental and Social Impacts

- The results of environmental monitoring based on Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- The results of social monitoring based on in Attachment 5 (in accordance with Schedule 4 of the Grant Agreement).
- Disclosed information related to results of environmental and social monitoring to local stakeholders (whenever applicable).

3: Operation and Maintenance (O&M)

3-1 Physical Arrangement

- Plan for O&M (number and skills of the staff in the responsible division or section, availability of manuals and guidelines, availability of spareparts, etc.)

Original (at the time of outline design)

Actual (PMR)

3-2 Budgetary Arrangement

- Required O&M cost and actual budget allocation for O&M

Original (at the time of outline design)

Actual (PMR)

4: Potential Risks and Mitigation Measures

- Potential risks which may affect the project implementation, attainment of objectives, sustainability
- Mitigation measures corresponding to the potential risks

Assessment of Potential Risks (at the time of outline design)

Potential Risks	Assessment
1. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
2. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:
3. (Description of Risk)	Probability: High/Moderate/Low
	Impact: High/Moderate/Low
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action required during the implementation stage:

	Contingency Plan (if applicable):
Actual Situation and Countermeasures	
(PMR)	

5: Evaluation and Monitoring Plan (after the work completion)

5-1 Overall evaluation

Please describe your overall evaluation on the project.

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5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

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5-3 Monitoring Plan of the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

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Attachment

1. Project Location Map
2. Specific obligations of the Recipient which will not be funded with the Grant
3. Monthly Report submitted by the Consultant
- Appendix - Photocopy of Contractor's Progress Report (if any)
 - Consultant Member List
 - Contractor's Main Staff List
4. Check list for the Contract (including Record of Amendment of the Contract/Agreement and Schedule of Payment)
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries) (PMR (final) only)
8. Pictures (by JPEG style by CD-R) (PMR (final) only)
9. Equipment List (PMR (final) only)
10. Drawing (PMR (final) only)
11. Report on RD (After project)
12. Report on the Management of Safety for Construction Works



Monitoring sheet on price of specified materials

1. Initial Conditions (Confirmed)

Items of Specified Materials		Initial Volume A	Initial Unit Price (¥) B	Initial total Price C=A×B	1% of Contract Price D	Condition of payment	
						Price (Decreased) E=C-D	Price (Increased) F=C+D
1	Item 1	●●t	●	●	●	●	●
2	Item 2	●●t	●	●	●		
3	Item 3						
4	Item 4						
5	Item 5						

2. Monitoring of the Unit Price of Specified Materials

(1) Method of Monitoring : ●●

(2) Result of the Monitoring Survey on Unit Price for each specified materials

Items of Specified Materials		1st month, 2015	2nd month, 2015	3rd month, 2015	4th	5th	6th
1	Item 1	●	●	●			
2	Item 2						
3	Item 3						
4	Item 4						
5	Item 5						

(3) Summary of Discussion with Contractor (if necessary)

-
-
-



Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Actual Expenditure by Construction and Equipment each)

	Domestic Procurement (Recipient Country) A	Foreign Procurement (Japan) B	Foreign Procurement (Third Countries) C	Total D
Construction Cost	(A/D%)	(B/D%)	(C/D%)	
Direct Construction Cost	(A/D%)	(B/D%)	(C/D%)	
others	(A/D%)	(B/D%)	(C/D%)	
Equipment Cost	(A/D%)	(B/D%)	(C/D%)	
Design and Supervision Cost	(A/D%)	(B/D%)	(C/D%)	
Total	(A/D%)	(B/D%)	(C/D%)	



Report on the Management of Safety for Construction Works

Month/Year 2022 年 × 月	Cumulative number of labor 労働延人数	Cumulative number of public accident 公衆災害件数	Cumulative hours worked 延べ実労働時 間数	Number of deaths and injuries due to industrial accidents 労働災害による死傷者				Frequency rate 度数率	Severity rate 強度率
				Death and injuries 死傷者数	Aggregated number of calendar days absent 延べ休業日数	Aggregated number of work- days lost 延べ労働損失日数			
This Month 当月				Death 死者					
				More than 4 calendar days absent 休業 4 日以上					
				1 to 3 calendar days absent 休業 1～3 日					
				Total 計					
Total including this month 当月迄累計				Death 死者					
				More than 4 calendar days absent 休業 4 日以上					
				1 to 3 calendar days absent 休業 1～3 日					
				Total 計					
Note 注) 1. Frequency rate is the frequency of occurrence of industrial accidents. Frequency rate = (Number of deaths and injuries due to industrial accidents ÷ Cumulative hours worked) × 1,000,000 度数率 = (労働災害による死傷者数 ÷ 延べ実労働時間数) × 100 万時間 2. Severity rate is degree of seriousness of the industrial accident. Severity rate = (Aggregated number of work-days lost ÷ Cumulative hours worked) × 1,000 強度率 = (延べ労働損失日数 ÷ 延べ実労働時間数) 1000 時間 3. Aggregated number of work-days lost = Aggregated number of calendar days absent × (300 ÷ 365) Death (7,500 days) : death as a result of an industrial accident includes not only instantaneous death but also death as a result of occupational injury or disease. 延べ労働損失日数 = 延べ休業日数 × (300 ÷ 365) ・ ・ ・ 死亡 7500 日 (即死のほか負傷が原因で死亡したものを含む) 4. Frequency rate and severity rate are rounding off the third decimal place. 度数率・強度率は小数点第 3 位以下四捨五入									



Date:

Ref. No.

JAPAN INTERNATIONAL COOPERATION AGENCY

JICA KENYA OFFICE

[Address specified in the Article 5 of the Grant Agreement]

Attention: Chief Representative

Ladies and Gentlemen:

NOTICE CONCERNING PROGRESS OF PROJECT

Reference : Grant Agreement, dated 署名日(signed date of the G/A), for プロジェクト名(name of the Project)

In accordance to the Article 6 (3) of the Grant Agreement, we would like to report on the progress of the Project up to the following stages:

[Common]

- ☐ Preparation of bidding documents - result of detailed design
- ☐ Completion of final works under construction/procurement contract

[Construction]

- ☐ Monthly progress [Month/Year]

[Procurement of Equipment]

- ☐ Shipping/delivery, hand-over (take over) of equipment
- ☐ Installation works
- ☐ Operational training

- ☐ Other _____

Please see the details as per attached Project Monitoring Report (PMR).

Very truly yours,

[Signature]

[Name of the signer]

[Title of the signer]

[Name of the executing agency]



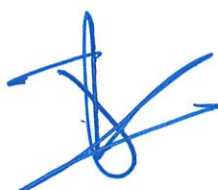
cc:

Director General

Financial Cooperation Implementation Department

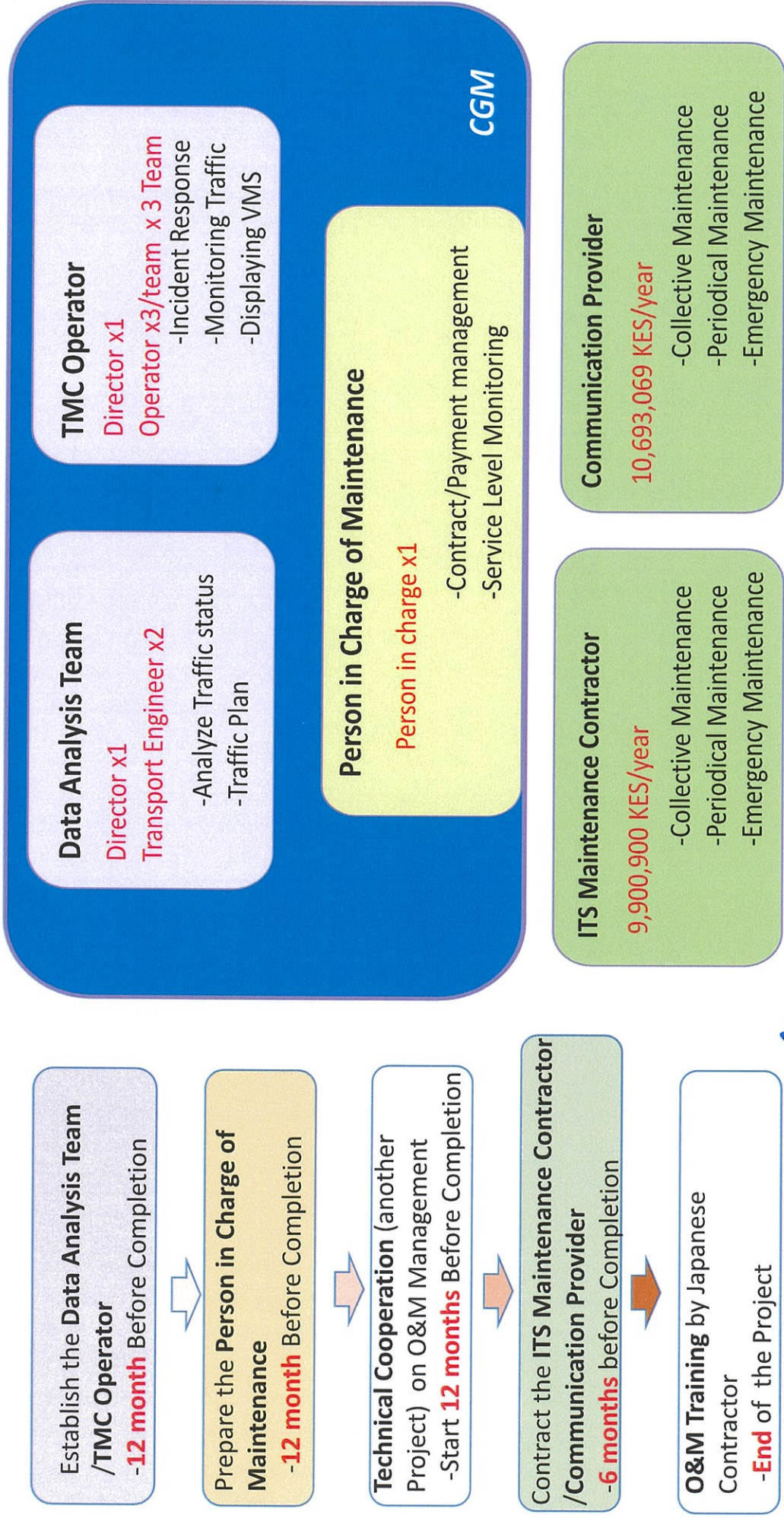
Japan International Cooperation Agency

[Address specified in the Article 5 of the Grant Agreement]



Items and measures to be considered for smooth implementation of the Project

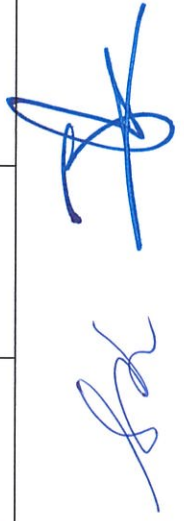
< O&M Structure to be established during the Project >



Annex_9

Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) N (b) N (c) Y (d) N	(a) EIA report is required and being prepared currently. It will be submitted during the study. (b) EIA is being prepared currently. (c) EIA approval will be issued with condition. (d) Only EIA approval is required regarding environmental and social considerations.
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) N	(a) Stakeholder meeting was held for explain the project to representatives related organizations on 9 December 2021. Negative comments such as asking cancellation of the project were not received. (b) During EIA reviewing procedure, EIA information is disclosed to the public and public comments will be collected.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Target intersections were selected from longlist with considerations on effectiveness of development and environmental and social impact as well.



2 Pollution Control	(1) Air Quality	(a) Is there a possibility that air pollutants emitted from the project related sources, such as vehicles traffic will affect ambient air quality? Does ambient air quality comply with the country's air quality standards? Are any mitigating measures taken? (b) Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	(a) Y (b) N	(a) Impact on air quality is temporally caused due to use of construction machines and vehicles. (b) In some of intersections, baseline air quality is already exceeded standard. Thus, based on the Environment Management Plan, mitigation measures is necessary to be taken.
	(2) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater? (c) Do effluents from various facilities, such as parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a) N (b) N (c) N	(a) The project is conducted within existing intersections and cutting and landfilling work is not included in the construction work. (b) Drained water from the surface of the road will be drained into drainage along the road and there is no impact to water resources such as ground water. (c) The project is improvement of existing intersections. Thus, wastewater is not generated in the project.
	(3) Wastes	(a) Are wastes generated from the project facilities, such as parking areas/service areas, properly treated and disposed of in accordance with the country's regulations?	(a) N	(a) The project is improvement of existing intersections. Thus, waste is generated during only construction stage and the construction waste is disposed to Mwakirunge landfill site.
	(4) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a) Y	(a) The project proponent shall comply with noise and vibration standard.



	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas? (a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a possibility that installation of roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the project site is located at undeveloped areas, is	(a) N (a) N (b) N (c) N (d) N (e) N (f) N	(a) The project is conducted within existing intersections and there is no protected area. (a) The project is conducted within existing intersections and there is no forest area and ecologically important habitat. (b) The project is conducted within existing intersections and there is no ecologically important habitat. (c) The project is conducted within existing intersections and there is no impact on ecosystem. (d) The project is conducted within existing intersections and there is no impact on ecosystem. (e) The project is conducted within existing intersections and there is no impact on ecosystem. (f) The project is conducted within existing intersections and there is no land that newly developed.
3 Natural Environment	(2) Ecosystem			



	there a possibility that the new development will result in extensive loss of natural environments?			
(3) Hydrology	(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) N	(a) The project is conducted within existing intersections and there is no impact on hydrology.	
(4) Topography and Geology	(a) Is there any soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a) N (b) N (c) N	(a) The project is conducted within existing intersections and there is no risk on soft-ground such as land slide. (b) The project is conducted within existing intersections and cutting and landfill work are not included in construction work. (c) The project is conducted within existing intersections and cutting and landfill work are not included in construction work.	



4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?(d) Are the compensations going to be paid prior to the resettlement?(e) Are the compensation policies prepared in document?(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?(g) Are agreements with the affected people obtained prior to resettlement?(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?(i) Are any plans developed to monitor the impacts of resettlement?(j) Is the grievance redress mechanism established?	(a) N(b) - (c) - (d) - (e) - (f) - (g) - (h) - (i) - (j) Y	(a) There is no people who require involuntary resettlement because the project is implemented within existing intersections. (b) No resettlement is required. (c) No resettlement is required. (d) No resettlement is required. (e) No resettlement is required. (f) No resettlement is required. (g) No resettlement is required. (h) No resettlement is required. (i) No resettlement is required. (j) Grievance mechanism is established for the project.
	(2) Living and Livelihood	(a) Where roads are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing	(a) N (b) N (c) Y (d) N	(a) The project is conducted within existing intersections and there is no land that newly developed. (b) There is street vendors in target intersections however they can move easily, thus, they can move to out of construction area and



		land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of the inhabitants other than the target population? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., increase of traffic congestion and traffic accidents)? (e) Is there any possibility that roads will impede the movement of inhabitants? (f) Is there any possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?	(e) N (f) N	continue their business during construction. (c) Risk of infectious disease such as COVID-19 and HIV/AIDS may become higher than usual due to increase of construction workers during construction. Measures such as distributing of masks and condom will be taken. (d) The project is improvement of intersection, thus, traffic congestions will be moderated. (e) The project is improvement of intersection, thus, traffic congestions will be moderated. (f) The project is improvement of intersection and no impact on a sun shading and radio interference.
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are	(a) N	(a) There is no cultural heritage site within target intersections.



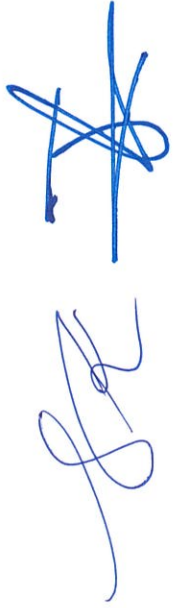
	adequate measures considered to protect these sites in accordance with the country's laws?			
(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) There is no impact on landscape because the project is improvement of existing intersection.	
(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?	(a) - (b) -	(a) There is no indigenous people and ethnic minority in the project area. (b) There is no indigenous people and ethnic minority in the project area.	
(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures being taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b) Y (c) Y (d) Y	(a) The project proponent shall comply with legislation related to occupational health. (b) The project proponent shall conduct measures to protect workers. (c) The project proponent shall provide workers for safety. (d) During construction, staffs who manage safety of traffic will take measures to protect local people from accident.	



	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?	(a) Y (b) N (c) N	(a) Mitigation measures are conducted based on Environment Management Plan. (b) The project is conducted within existing intersections, thus, no impact on ecosystem. (c) There is no people who require resettlement and land acquisition is also not required because the project is conducted within existing intersections.
5 Others	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) - (c) Y (d) Y	(a) Environment Monitoring plan is prepared based on study and responsible organizations for monitoring is also included in the plan. (b) Environment Monitoring plan stipulates items/parameters, methodology and frequency. (c) Implementation structures are considered for environmental and social considerations. (d) Environment Monitoring plan stipulates methodology and frequency of reporting.



6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a) - (b) -	(a) No deforestation is conducted in the project. (b) The project doesn't include Power Transmission and Distribution Lines development.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) The project will contribute GHG emission reduction.



Environment Management Plan (EMP)

No.	Items	Environmental Management Plan	Implementing Organization	Responsible Organization	Cost
Pre-Construction Stage					
1	All	- Prior to construction, EIA approval is necessary. - Information of construction such as period and location is announced to the public	Consultant/ Contractor	CGM	To be determined
Construction Stage					
1	Air Quality	- Prepare and regular maintenance of construction machineries and vehicles to minimize air pollutants - Recommendation of idling stop activities - Water sprinkling to reduce particulate matter - Avoidance of long exposure of stocked soil to strong winds by applying canvas covers - Periodical monitoring air quality to comply with air quality standards	Contractor	CGM	Included in the construction cost
2	Waste	- Prepare the construction solid waste management plan in consideration with County's waste management system (waste will be landfilled in Mwakirunge landfill site) - Proper handling of hazardous waste on site - Education on waste treatment for workers	Contractor	CGM	Included in the construction cost
3	Noise and Vibration	- Regular maintenance of construction machineries - Announcement of construction work to surround locators - To avoid disturbance of daily life, performing of noisy activities during daytime, if possible - Adoption of lower noise and vibration construction method and machines - For hauling trucks, compliance with road weight limit standards to avoid ground vibration - Periodical monitoring of noise and vibration to comply with national standards	Contractor	CGM	Included in the construction cost
4	Existing	- Coordination with CGM for the	Contractor	CGM	Included in




No.	Items	Environmental Management Plan	Implementing Organization	Responsible Organization	Cost
	Social Infrastructure and Services	implementation of a traffic management scheme			the construction cost
5	Gender	- Positive employment of women for light works in construction activities such as cleaning with fair salary and other conditions - Prepare toilet and dressing spaces for women workers - Education on gender equality for workers	Contractor	CGM	Included in the construction cost
6	Children's Right	- Restrict child labor (workers under 14 years old) in contract with punishment - Report list of workers with their age information	Contractor	CGM	Included in the construction cost
7	Infectious Diseases such as HIV/AIDS	- Education on infectious diseases for workers - Preparation of occupational health management plan - Ensure COVID-19 protocol (Periodical PCR-Test)	Contractor	CGM	Included in the construction cost
8	Labor Environment including Safety	- Education on occupational safety for workers - Provision of first-aid stations, safety equipment - Implementation of standard health and safety protocols, such as wearing of proper and complete PPE	Contractor	CGM	Included in the construction cost
9	Accident	- Periodic maintenance of machineries and vehicles - Safety patrol - Sign boards	Contractor	CGM	Included in the construction cost

Source:JST

Environment Monitoring Plan (EMoP)

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost
Construction Stage							
1	All	Visual Check to confirm the implementation of mitigation measures	Construction sites	Daily or Weekly	Contractor	CGM	Included in the construction cost
2	Air Quality	PM10, PM2.5, SO ₂ , CO, NO ₂	Construction sites	Quarterly	Contractor	CGM	Included in the construction cost

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost
3	Waste	Types and amount of solid waste	Temporal waste storage	Once every three-month or collection period	Contractor	CGM	Included in the construction cost
4	Noise and Vibration	Sound level and vibration.	Construction sites	Quarterly	Contractor	CGM	Included in the construction cost
5	Infectious Diseases such as HIV/AIDS	Visible observation, interview, grievance records, record of education	Construction sites	Once a month	Contractor	CGM	Included in the construction cost
6	Labor Environment including Safety	Visible observation, interview, grievance records, record of education, record of safety patrol, sign boards	Construction sites	Once a month	Contractor	CGM	Included in the construction cost
7	Accident	Record of accident, record of education, sign boards	Construction sites and surrounding areas	Once a month, on demand	Contractor	CGM	Included in the construction cost
Operation Stage							
8	Air Quality	PM10, PM2.5, SO ₂ , CO, NO ₂	22 intersections	Quarterly	CGM	CGM	CGM
9	Noise and Vibration	Sound level and vibration.	22 intersections	Quarterly	CGM	CGM	CGM

Source: JST



Monitoring Form**Construction Phase****1. Response/ Action to Comments and Instruction from Authorities and the Public**

Comments or Instructions		Response/ Action which was taken by contractor
Authority (Government)		
Public (Residents)		

*Please add table if necessary

2. Pollution**Air quality**

Measurement point (coordinate)		Location description			
Measurement date		(yyyy/mm/dd)			
Parameter	Unit	Measured Value	Kenya Standard Value	International Standard Value (WHO/WB)	Note (Frequency, Source, Implant Recipients etc.)
PM2.5	µg/m ³		75(24hr)	25(24hr)*WHO	
SO ₂	µg/m ³		125(24hr)	20(24hr)*WHO	
NO ₂	µg/m ³		150(24hr)	200(1hr) *WB	
CO	mg/m ³		10(1hr)	-	

*Please add table if necessary

Waste (Disposal Site)

Item	Photo of the disposal site	Observations (e.g. Distance from the residence, messy/ tidy)	Note (Frequency, data source etc.)
Status of the disposal site			

*Please add table if necessary



Noise & Vibration

Measurement point (coordinate)			Location description		
Measurement date			(yyyy/mm/dd)		
Parameter	Unit	Measured Value	Applied Standard Value	International Standard Value (WB)	Note (Frequency, Source, Implant Recipients etc.)
Noise	dB	(Leq)	75 (Day time) 65 (Night time) *Kenya standard value	55 (Residential Area, Daytime)	
Vibration	dB	(L _{Max})	70 (Day time) 65 (Night time) *Japanese standard value	-	

*Please add table if necessary

3. Social**Existing Social Infrastructure and Service**

Item	Village	Complain	Measures to be taken	Note
Complain from surrounding communities				

*Please add table if necessary

Infectious disease & HIV/AIDS

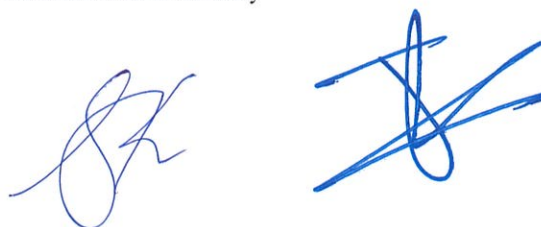
Item	Date	Location	Number of participants	Description of awareness activity *Please attach material of awareness activity if any	Note
Awareness of Infectious Disease					

*Please add table if necessary

Occupational Health & Safety

Item	Description of accident	Causes for accident	Note
Record of accidents			

*Please add table if necessary



4. Others

Accident

Item	Description of accident	Causes for accident	Note
Record of traffic accident caused by construction vehicles			

*Please add table if necessary

Operation Phase

1. Response/ Action to Comments and Instruction from Authorities and the Public

Comments or Instructions		Response/ Action which was taken by project proponent
Authority (Government)		
Public (Residents)		

*Please add table if necessary

2. Pollution

Air quality

Measurement point (coordinate)			Location description		
Measurement date			(yyyy/mm/dd)		
Parameter	Unit	Measured Value	Kenya Standard Value	International Standard Value (WHO/WB)	Note (Frequency, Source, Implant Recipients etc.)
PM2.5	µg/m ³		75(24hr)	25(24hr)*WHO	
SO ₂	µg/m ³		125(24hr)	20(24hr)*WHO	
NO ₂	µg/m ³		150(24hr)	200(1hr) *WB	
CO	mg/m ³		10(1hr)	-	

*Please add table if necessary

Noise & Vibration

Measurement point (coordinate)			Location description		
Measurement date			(yyyy/mm/dd)		
Parameter	Unit	Measured Value	Kenya Standard Value	International Standard Value (WB)	Note (Frequency, Source, Implant Recipients etc.)
Noise	dB	(Leq)	75 (Day time) 65 (Night time)	55 (Residential Area, Daytime)	

			*Kenya standard value		
Vibration	dB	(L _{Max})	70 (Day time) 65 (Night time) *Japanese standard value	-	

*Please add table if necessary

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