<<資　　料>>

１．調査団員氏名、所属

（１）第１次現地調査（2010 年 5 月 14 日～2010 年 6 月 12 日）

	氏　名	担　当	所　属
1	糸山　大志	総括	JICA 経済基盤開発部 運輸交通・情報通信第二課
2	山宿　　壮	業務主任／道路計画	片平エンジニアリング・インターナショナル
3	水越　和雄	交通計画／交差点計画	片平エンジニアリング・インターナショナル
4	大下　副武	道路設計Ⅰ	片平エンジニアリング・インターナショナル
5	藤原　英勝	道路設計Ⅱ	片平エンジニアリング・インターナショナル
6	久保野谷吉輝	自然条件調査	片平エンジニアリング・インターナショナル
7	三宅　義則	環境社会配慮	片平エンジニアリング・インターナショナル
8	佐藤　正	施工計画・調達／積算	片平エンジニアリング・インターナショナル
9	河尻　達男	道路設計照査	片平エンジニアリング･インターナショナル(自社)
10	中津原　勢司	交通調査・解析	片平エンジニアリング･インターナショナル(自社)

（２）第２次現地調査（2011 年 1 月 17 日～2011 年 1 月 22 日）

	氏　名	担　当	所　属
1	糸山　大志	総括	JICA 経済基盤開発部 運輸交通・情報通信第二課
2	山宿　　壮	業務主任／道路計画	片平エンジニアリング・インターナショナル
3	大下　副武	道路設計Ⅰ	片平エンジニアリング・インターナショナル

（３）概略設計概要説明（2011 年 3 月 15 日～2011 年 3 月 19 日）

	氏　名	担　当	所　属
1	讃井　一将	総括	JICA ケニア事務所
2	山宿　　壮	業務主任／道路計画	片平エンジニアリング・インターナショナル
3	大下　副武	道路設計Ⅰ	片平エンジニアリング・インターナショナル
4	三宅　義則	環境社会配慮	片平エンジニアリング・インターナショナル

Schedule of Outline Design Survey Team for Ngong Road Project (14,May-12,June,2010)

Name			Mr.Hiroshi ITOYAMA	Mr.Tsuyoshi YAMAJUKU	Mr.Kazuo MIZUKOSHI	Mr.Soemu OSHITA	Mr.Hidekatsu FUJIWARA	Mr.Yoshinori MIYAKE	Mr.Yoshiteru KUBONOYA	Mr.Tadashi SATO	Mr.Tatsuo KAWAJIRI	Mr.Seiji NAKATSUHARA
Position			Team Leader, Transportation and ICT Group Economic Infrastructure Department (JICA)	Chief Consultant / Road Planner. (Katahira & Engineers International)	Traffic / Junction Planner. (Katahira & Engineers International RF)	Road Designer 1. (Katahira & Engineers International)	Road Designer 2. (Katahira & Engineers International)	Environment & Social Specialist. (Katahira & Engineers International)	Natural Condition Surveyor. (Katahira & Engineers International)	Construction Planner / Cost Estimator. (Katahira & Engineers International)	Road Design Checker. (Katahira & Engineers International)	Traffic Survey / Traffic Analyst. (Katahira & Engineers International)
No.	Date	Day										
1	14-May-10	Fri		Haneda(19:55,JL185) → Kansai(21:20/23:15,JL5099) →								
2	15-May-10	Sat		→ Dubai (4:45/10:45,EK719) → Nairobi(14:45)								Narita (Japan) →
3	16-May-10	Sun		Site Survey								→ Nairobi (Kenya)
4	17-May-10	Mon	Narita → Dubai	(AM) Visit to KURA , (PM) Site Survey					Meeting with Local Consultants			Site Survery
5	18-May-10	Tue	Dubai → Nairobi	(AM) Meeting with KURA , (PM) Site Survey					Meeting with Local Consultants			Site Survery
6	19-May-10	Wed	(AM) Visit to EOJ / JICA, (PM) Visit to MOR / KURA						Supervision of Local Consultants			Site Survery
7	20-May-10	Thu	Meeting with Invetigation team , Site Survey						Supervision of Local Consultants	Narita (21:40 / JL5095) → Dubai(4:35)		Site Survery
8	21-May-10	Fri	Meeting with MOR / KURA		Site Survey	Meeting with MOR / KURA	Site Survey	Meeting with NEMA / KURA	Supervising of Traffic Survey	Dubai (10:45 / EK719) → Nairobi (14:45)		Supervising of Traffic Survey
9	22-May-10	Sat	Meeting with Invetigation team , Site Survey						Supervision of Local Consultants	Site Survery		Analysis of traffic survey
10	23-May-10	Sun	Site Survey						Supervising of Traffic Survey	Site Survery		Supervising of Traffic Survey
11	24-May-10	Mon	Site Survey					Meeting with Ngong Road forest Sanctuary Trust	Supervision of Local Consultants	Site Survery		Analysis of traffic survey
12	25-May-10	Tue	Site Survey					Meeting with MENR / Kenya Wildlife Services	Supervision of Local Consultants	Study of Loacal Contractor		Analysis of traffic survey
13	26-May-10	Wed	(AM) Signing of MD, Report to EOJ / JICA (PM) Nairobi→Dubai	(AM) Signing of MD, Report to EOJ / JICA (PM) Site Survey	Site Survey	(AM) Signing of MD, Report to EOJ / JICA (PM) Site Survey	Site Survey	Meeting with MENR / Forest Department	Supervision of Local Consultants	Study of Loacal Contractor	Narita (Japan) →	Reports Preparation
14	27-May-10	Thu	Dubai → Narita	Meeting with MOR / KURA	Site Survey	Meeting with MOR / KURA	Site Survey	Meeting with Ngong Road Stake Holder Organization	Supervision of Local Consultants	Study of Loacal Contractor	→ Nairobi (Kenya)	Reports Preparation
15	28-May-10	Fri		Technical Meeting with KURA #1				Meeting with Ngong Road Stake Holder Organization	Supervision of Local Consultants	Study of Loacal Contractor	Site Survey	Nairobi (Kenya) →
16	29-May-10	Sat		Site Survey					Supervision of Local Consultants	Planning Construction Method	Site Survey	→ HongKong →
17	30-May-10	Sun		Site Survey								→ Narita (Japan)
18	31-May-10	Mon		Meeting with MOR / KURA	Supervising of Traffic Survey	Meeting with MOR / KURA	Study of Drawing	Meeting with Ngong Road Stake Holder Organization	Supervising of Traffic Survey	Planning Construction Method	Study of Road Design	
19	01-Jun-10	Tue		Site Survey (Public Holiday)					Supervision of Local Consultants	Study of Cost Estimation	Study of Road Design	
20	02-Jun-10	Wed		Meeting with EU / WB	Supervising of Traffic Survey	Meeting with MOR / KURA	Study of Drawing	Meeting with NEMA / KURA	Supervising of Traffic Survey	Study of Cost Estimation	Study of Road Design	
21	03-Jun-10	Thu		Meeting with MOR / KURA	Study of Drawing	Meeting with MOR / KURA	Study of Drawing	Meeting with NEMA / KURA	Supervision of Local Consultants	Study of Cost Estimation	Study of Road Design	
22	04-Jun-10	Fri		Meeting with MOR / KURA	Preparation of Technical Note			Meeting with NEMA / KURA	Supervision of Local Consultants	Study of Cost Estimation	Study of Road Design	
23	05-Jun-10	Sat		Meeting with Invetigation team					Study of survey reports	Reports Preparation	Reports Preparation	
24	06-Jun-10	Sun		Reports Preparation							Nairobi (Kenya) →	
25	07-Jun-10	Mon		Meeting with KURA					Study of survey reports	Study of Loacal Contractor	→ Bankok →	
26	08-Jun-10	Tue		(AM) Stake Holder Meeting , (PM) Site Survey					Follow-up Drawings	Study of Loacal Contractor	→ Narita (Japan)	
27	09-Jun-10	Wed		(AM) Technical Meeting with KURA #2 / Signing of Technical Note , (PM) Reports Preparation					Follow-up Drawings	Reports Preparation		
28	10-Jun-10	Thu		(AM) Report to EOJ / JICA ,(PM) Site Survey								
29	11-Jun-10	Fri		(AM) Site Survey , (PM) Nairobi (16:40,EK720) → Dubai (22:40/03:15,JL5096) → Narita (18:00)								
30	12-Jun-10	Sat										

EOJ:Embassy of Japan
MOR:Ministry of Roads
NEMA:National Environment Management Authority
MOR:Ministry of Roads
KURA:Kenya Urban Road Authority
MENR:Ministry of Environment and Natural Resources

（２）第２次現地調査（2011 年 1 月 17 日～2011 年 1 月 22 日）

Schedule of Outline Design Survey Team for Ngong Road Project (17,Jan-22,Jan,2011)

Name			Mr.Hiroshi ITOYAMA	Mr.Tsuyoshi YAMAJUKU	Mr.Soemu OSHITA
Position			Team Leader, Transportation and ICT Group Economic Infrastructure Department (JICA)	Chief Consultant / Road Planner. (Katahira & Engineers International)	Road Designer 1. (Katahira & Engineers International)
No.	Date	Day			
1	17-Jan-11	Mon		Narita(22:00,JL5095) →	
2	18-Jan-11	Tue		Dubai (4:55/10:45,EK719) → Nairobi(14:55)	
3	19-Jan-11	Wed		Meeting with KURA / Site Survey	
4	20-Jan-11	Thu	Meeting with KURA		
5	21-Jan-11	Fri	(AM) Signing with MOR,KURA / Report to EOJ / JICA (PM) Nairobi (16:40,EK720) → Dubai (22:40/02:50,JL5096) → Narita (17:20)		
6	22-Jan-11	Sat			

EOJ:Embassy of Japan

MOR:Ministry of Roads

NEMA:National Environment Management Authority

（３）概略設計概要説明（2011 年 3 月 15 日～2011 年 3 月 19 日）

DBD Schedule of Outline Design Survey Team for Ngong Road Project (15,Mar-22,Mar,2011)

Name			Mr.Kazumasa SANUI	Mr.Tsuyoshi YAMAJUKU	Mr.Soemu OSHITA	Mr.Yoshinori MIYAKE
Position			Team Leader, Representative (JICA)	Chief Consultant / Road Planner. (Katahira & Engineers International)	Road Designer 1. (Katahira & Engineers International)	Environment & Social Specialist. (Katahira & Engineers International)
No.	Date	Day				
1	15-Mar-11	Tue		Narita(22:00,JL5095) →		
2	16-Mar-11	Wed		Dubai (4:55/10:45,EK719) → Nairobi(14:55)		
4	17-Mar-11	Thu	(AM) Meeting with MOR / KURA (PM) Signing with MOR / KURA			
5	18-Mar-11	Fri		(AM) Reort to EOJ / JICA. (PM) Nairobi (16:40,EK720) → Dubai (22:40/02:50,JL5096) → Narita (17:20)		
6	19-Mar-11	Sat				

EOJ:Embassy of Japan

MOR:Ministry of Roads

NEMA:National Environment Management Authority

３．関係者（面会者）リスト

（１）道路省（Ministry of Rods :MOR）

Eng. M.S.M.Kamau, CBS, HSC, Permanent Secretary

Eng. P.C.Kilimo, OGW, Roads Secretary

Eng. P.M.Nwinzi, Chief Engineer (Roads)

（２）地方自治省（Ministry of Local Government :MOLG）

Mr. Mutua P. Nzoka OGW (Director of Market Development Department)

（３）ケニア都市道路公社（Kenya Urban Roads Authority :KURA）

Eng. Joseph N.Nkadayo, Director General & CEO

Eng. Silas M. Kinoti, General Manager (Roads)

Eng. James W. Theuri, General Manager (Planning)

Eng. James M. Mwatu General Manager (Design & Construction)

Mr. Francis M. Kiminza Manager (Survey)

Mr. Wilson Lepartobiko Engineer (Planning)

（４）国立環境管理庁（National Environmental Management Authority :NEMA）

Mr. Malwa Langwen, Director (Compliance & Enforcement)

Ms. Irene Kamunge, Principal Legal Officer

（５）ナイロビ市役所（City Council of Nairobi :CCN）

Mr. Geoffrey Kihoro, Assistant Director (Parks and Open Spaces)

Mr. Izek Muraya, Assistant Director (Environmental Planning and Management)

（６）欧州連合（European Union :EU）

Eng. Andrew GITONGA Project Officer

（７）世界銀行（World Bank :WB）

Mr. Josphat Sasia Senior Economist

（８）在ケニア国日本大使館

岩谷　滋雄　特命全権大使

鈴木　武彦　一等書記官

（９）JICA ケニア事務所

加藤　正明　所長

中川　茂雄　次長

讃井　一将　職員

中澤　敏之　職員

Mr. Steve N. MOGERE

（１０）JICA アフリカ地域支援事務所

倉科　芳朗　所長

Minutes of Discussions

on

the Preparatory Survey

on

the Project for Dualling of Nairobi-Dagoreti Corner Road C60/C61

in the Republic of Kenya

Referring to the results of Preliminary Study conducted in September 2009, the Government of Japan decided to conduct a Preparatory Survey for Outline Design on the Project for Dualling of Nairobi-Dagoreti Corner Road C60/C61 (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Kenya the Preparatory Survey team for Outline Design (hereinafter referred to as "the Team") which is headed by Mr. Hiroshi ITOYAMA, Assistant Director of Economic Infrastructure Department, JICA, and is scheduled to stay in the country from May 18th to May 26th, 2010.

The Team held discussions with the concerned officials of the Government of Kenya. In the course of the discussions, both sides have confirmed the main items of described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Nairobi, May 26, 2010

Hiroshi ITOYAMA
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Eng. Michael S.M. KAMAU, CBS, HSC
Permanent Secretary
Ministry of Roads
Republic of Kenya

Eng. Joseph N. NKADAYO
Director General & CEO
Kenya Urban Roads Authority
Republic of Kenya

ATTACHMENT

1. Objective of the Project

The objective of the Project is to meet increasing transportation demand and contribute to reduction of traffic jam, especially in the West side of the City of Nairobi, through the expansion of Ngong Road in City of Nairobi in the Republic of Kenya.

2. Project Site

The site of the Project is shown in Annex-1.

3. Responsible and Implementing Organizations

3-1. The responsible organization is the Ministry of Roads (MOR).
3-2. The implementing organization is Kenya Urban Roads Authority (KURA).
3-3. The organization chart of MOR is as shown in Annex-2.
3-4. The organization chart of KURA is as shown in Annex-3.

4. Items Requested by the Government of Kenya

After discussions with the Team, the items described below were requested by the Kenyan side.

Expansion of Ngong Road: from the Junction on Ngong Road/Kenyatta Avenue to Adams Arcade (Elgeyo Marakwet Road Roundabout) (4 lanes will be implemented) (4.7km)

JICA will assess the appropriateness of the request and will report its findings to the Government of Japan. Implementation of the Project will be decided by the Government of Japan.

5. Japan's Grant Aid Scheme

5-1. The Kenyan side understands the Japan's Grant Aid scheme (for General Project) explained by the Team, as described in Annex-4.
5-2. The Kenyan side will take the necessary measures, as described in Annex-5, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

6. Schedule of the study

6-1. The consultants will proceed to further study in Kenya until June 11th, 2010.
6-2. JICA will prepare the draft report in English and dispatch a mission to Kenya in order to

explain its contents around October, 2010.

6-3. In case that the contents of the report is accepted in principle by the Government of Kenya, JICA will complete the final report in English and send it to the Government of Kenya by November, 2010.

7. Other Relevant Issues

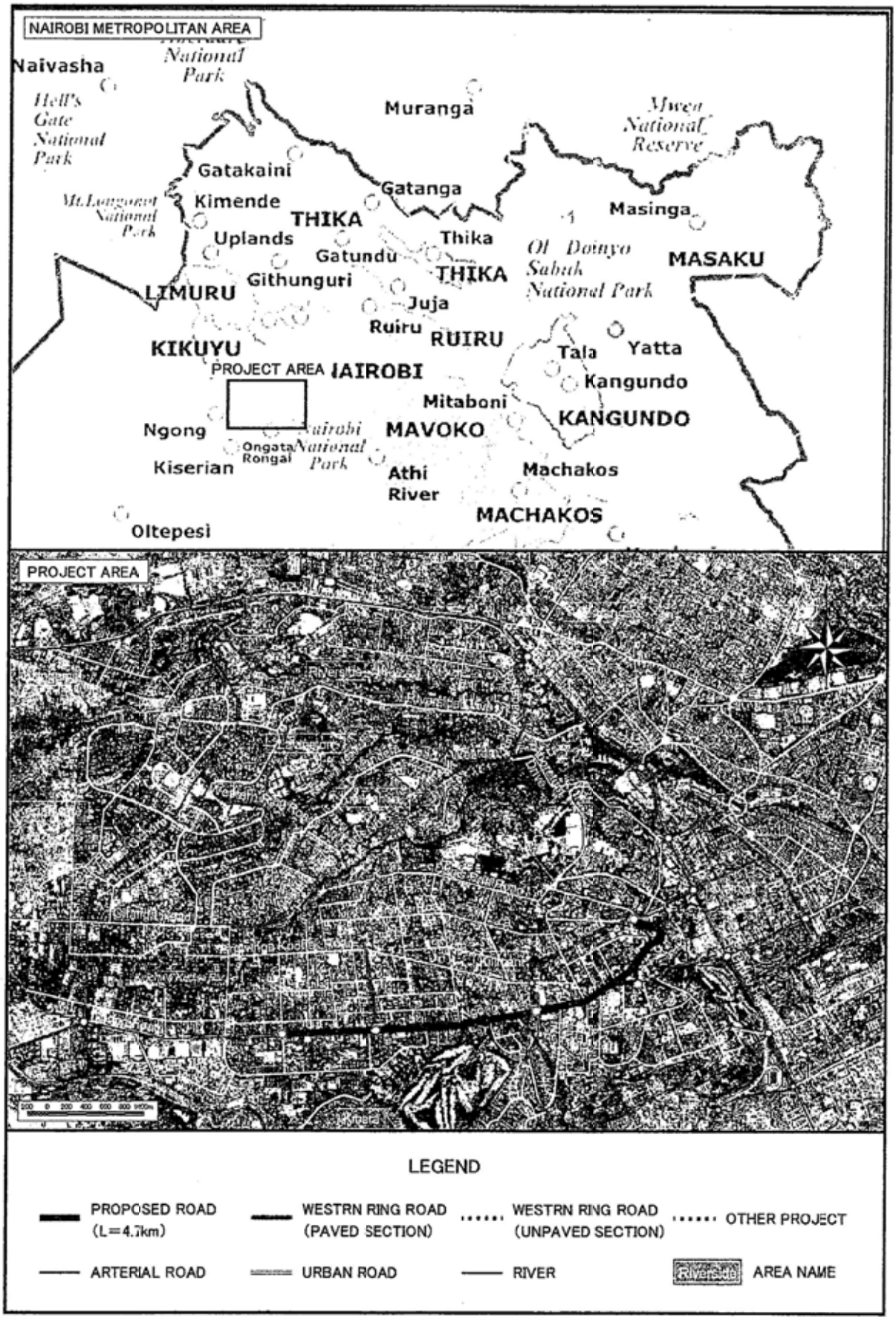
7-1. Both sides confirmed that the Kenyan side should conduct the necessary procedure concerning the environmental assessment (including stakeholder meetings for effective public participation about the outline of the Project, the EIA survey etc.) based on the domestic law of Kenya by the commencement of the construction.

7-2. Both sides confirmed that the Kenyan side shall secure the land necessary for the Project with its own expenses by the commencement of the construction.
Kenyan side confirmed that project affected people will be sufficiently compensated and supported regardless of their legal status to improve their standard of living, income opportunities and production levels, or at least to restore them to pre-project levels.

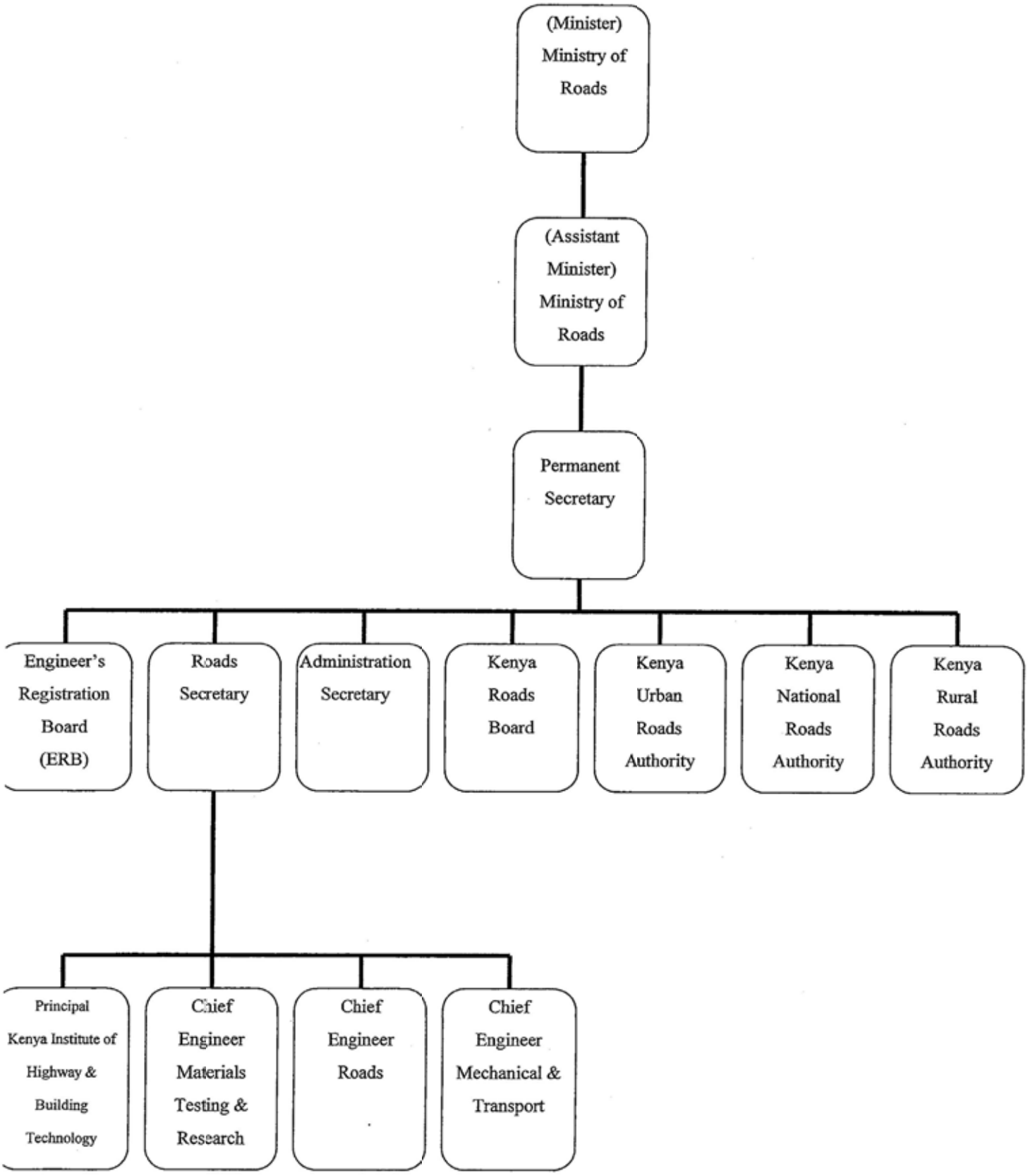
7-3. The Kenyan side confirmed that the following undertakings should be taken by the Kenyan side at the Kenyan expenses.
- Relocation of existing utilities (power, telecommunication lines, water lines, etc.),
- Budget allocation for the necessary tax exemption,
- Securing and clearance of the temporary yard,
- Securing of site for disposal of waste, and
- Maintaining the security at the sites and yards for the Project.

7-4. The Kenyan side shall secure enough budget and personnel necessary for the operation and maintenance of the facilities implemented by the Project, including the periodical maintenance work after the completion of the Project. The Kenyan side will make a budget request for next fiscal year, regardless of the progress of the Project.

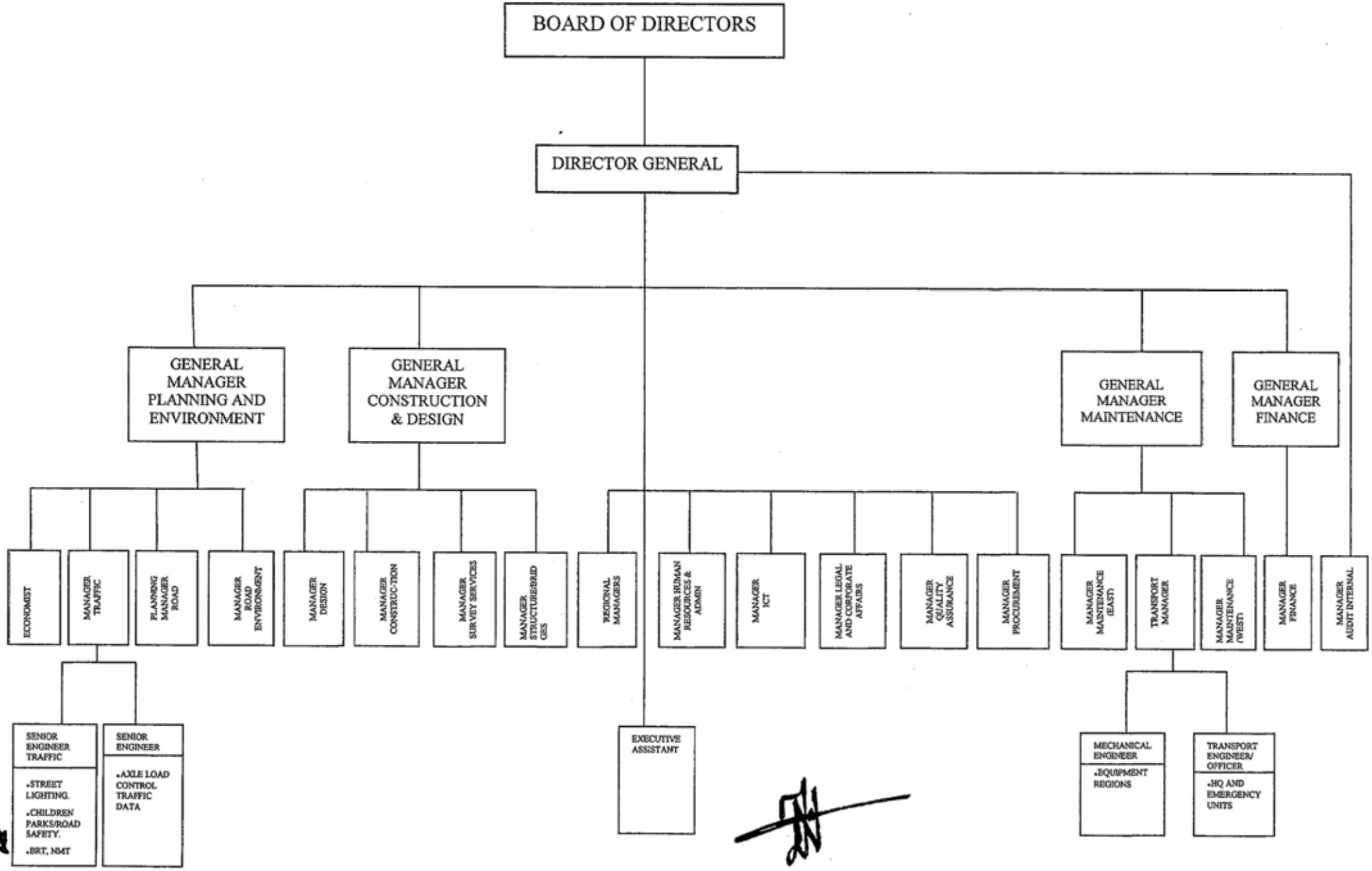
7-5. The Kenyan side understood that the Team is not in a position to guarantee implementation of the Project, regardless of the 6-2 and 6-3 above.



LOCATION MAP


(Minister) Ministry of Roads
(Assistant Minister) Ministry of Roads
Permanent Secretary
Engineer's Registration Board (ERB)
Roads Secretary
Administration Secretary
Kenya Roads Board
Kenya Urban Roads Authority
Kenya National Roads Authority
Kenya Rural Roads Authority
Principal Kenya Institute of Highway & Building Technology
Chief Engineer Materials Testing & Research
Chief Engineer Roads
Chief Engineer Mechanical & Transport

KURA ORGANIZATION STRUCTURE – HEADQUARTERS



JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as part of this realignment, JICA was reborn on October 1, 2008. After the rebirth of JICA, following the decision of the GOJ, Grant Aid for General Project is extended by JICA.

Grant Aid is non-reimbursable fund to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

Japanese Grant Aid is conducted as follows-

・Preparatory Survey (hereinafter referred to as "the Survey")
- The Survey conducted by JICA

・Appraisal &Approval
-Appraisal by The GOJ and JICA, and Approval by the Japanese Cabinet

・Determination of Implementation
-The Notes exchanged between the GOJ and a recipient country

・Grant Agreement (hereinafter referred to as "the G/A")
-Agreement concluded between JICA and a recipient country

・Implementation -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure 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 organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the E/N will be singed between the GOJ and the Government of the recipient country to make a plead for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport of those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex-5.

(6) "Proper Use"

The Government of recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.

(End)

Annex-5

Major Undertakings to be taken by Each Government

NO	Items	To be covered by the Grant	To be covered by Recipient side
1	To secure land		●
2	To clear, level and reclaim the site when needed		●
3	To construct gates and fences in and around the site		●
4	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
5	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine(Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		●
8	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
9	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		●

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

Minutes of Discussions

on

the Preparatory Survey

on

the Project for Dualling of Nairobi-Dagoreti Corner Road C60/C61

in the Republic of Kenya

Referring to the results of Preliminary Study conducted in September 2009, the Government of Japan decided to conduct a Preparatory Survey for Outline Design on the Project for Dualling of Nairobi-Dagoreti Corner Road C60/C61 (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA started the Preparatory Survey for Outline Design from May 2010, and the Government of Kenya sent their request letter to JICA Kenya Office regarding design on the City Mortuary Roundabout Junction in October 2010.

To confirm the design on the City Mortuary Roundabout Junction, JICA sent to Kenya the Survey team (hereinafter referred to as "the Team") which is headed by Mr. Hiroshi ITOYAMA, Deputy Director of Economic Infrastructure Department, JICA, and is scheduled to stay in the country from January 17th to January 21st, 2011.

The Team held discussions with the concerned officials of the Government of Kenya. In the course of the discussions, both sides have confirmed the main items described in the attached sheet. The Team will proceed to further works and prepare the Preparatory Survey Report.

Nairobi, January 21, 2011

Mr. Hiroshi ITOYAMA
Leader
Preparatory Survey Team
Japan International Cooperation Agency

for: Eng. Michael S.M. KAMAU, CBS, HSC
Permanent Secretary
Ministry of Roads
Republic of Kenya

Eng. Joseph N. NKADAYO
Director General & CEO
Kenya Urban Roads Authority
Republic of Kenya

ATTACHMENT

1. Both sides confirmed that designing of a grade-separated junction at City Mortuary is not included as a Project component.

2. The Team explained that improvement of the roundabout proposed by the Team has a capacity to accommodate the expected traffic volume at City Mortuary junction up to 2022.

3. However, GOK referred to the necessity of the grade separation as an urgent Project. Both sides confirmed that JICA's proposal (intervention as item 2 above), provides one solution that enables later construction of a flyover interface at City Mortuary junction.

4. GOK agreed that any future implementation of the grade separation (flyover or underpass) should be done without demolishing any part of the Project.

（３）討議議事録(M/D)
ドラフト説明現地調査（2011年3月18日）

Minutes of Discussions
on the Preparatory Survey
on The Project for Dualling of Nairobi-Dagoreti Corner Road C60/C61
in the Republic of Kenya
(Explanation on Draft Report)

In May 2010, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched an Outline Design Study Team on the Project for Dualling of Nairobi-Dagoreti Corner Road C60/C61 (hereinafter referred to as "the Project") which covers the section of Ngong Road from All Saints Cathedral junction to Adams Arcade in the Republic of Kenya (hereinafter referred to as "Kenya"), and through discussion, field survey as well as after technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and consult with the officials of the Government of Kenya on the components of the draft report, JICA sent to Kenya the Outline Design Explanation Team (hereinafter referred to as "the Team") which is headed by Shigeo Nakagawa, Senior Representative, JICA Kenya Office from March 16 to March 18, 2011.

As the result of the discussion, both parties confirmed the main items described on the attached sheets hereto;

Nairobi, March 18, 2011

Mr. Shigeo Nakagawa
Leader
Outline Design Explanation Team
Japan International Cooperation Agency
Japan

Eng. Joseph N. Nkadayo
Director General & CEO
Kenya Urban Roads Authority (KURA)
The Republic of Kenya

Eng. Michael M.S. Kamau, CBS, HSC
Permanent Secretary
Ministry of Roads
The Republic of Kenya

Mr. Joseph Kinyua, CBS
Permanent Secretary
Ministry of Finance
The Republic of Kenya

THE PERMANENT SECRETARY
MINISTRY OF FINANCE,
P. O. Box 30007,
NAIROBI.

ATTACHMENT

1. **Contents of the Draft Report**

The Kenyan side agreed and accepted in principle the contents of the draft report explained by the Team.

2. **Japans' Grant Aid scheme**

The Kenyan side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Kenya as explained by the Team and described in Annex-1.

3. **Schedule of the Study**

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Kenya by April, 2011.

4. **Cost Estimation**

The Project Cost Estimation, as attached in Annex-2, is confidential and should never be duplicated or disclosed to any outside parties before the signing of all the contracts for the Project.

5. **Other Relevant Issues**

5-1. The Kenyan side shall secure enough budget and personnel necessary for operation and maintenance of the roads, bridges and relevant facilities constructed by the Project.

5-2. Monitoring for Environmental and Social considerations will be conducted by Kenya Urban Roads Authority. The results of monitoring will be provided to JICA by filling in the Monitoring Form attached as Annex-3, as part of progress reports before construction, during the construction phase, at completion of the Project and two years after completion of the Project.

5-3. The environmental and social considerations including major impacts and mitigation measure for the Project are summarized in the Environmental Checklist attached as Annex-4.

Annex-1: Major Undertakings to be taken by Each Government
Annex-2: Project Cost to be borne by Japan's Grant Aid
Annex-3: Monitoring Form
Annex-4: Environmental Checklist

Annex-1

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient side
1	To secure land		•
2	To clear all the obstructions from the site		•
3	Relocation, improvement and/or repair of existing utilities(power lines, telecommunication lines, water lines, etc.), if necessary		•
4	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
5	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine(Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	•	
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
7	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
8	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
9	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		•

Annex-2

CONFIDENTIAL

Project Cost to be Borne by Japan's Grant Aid

The total project cost necessary to implement the Project is estimated at 1,763.0 Million Yen. The costs to be borne by both governments, Japan and Kenya, as described in the draft report of the Outline Design Study and respective details are estimated as follows on the conditions shown in (3) below.

(1) Cost borne by the Government of Japan

Total Cost : approximately 1,763.0 Million Yen

Item			Estimated Cost (Million Yen)
Facility	Road	Total	1,677.2
		Earthwork	197.2
		Pavement	1,018.5
		Facility Structure	214.6
		Drainage	246.9
Detailed Design /			37.0
Construction & Supervision			48.8

Notes:

The cost estimates in the above table are provisional and will be further examined by the Government of Japan for the approval of the Grant.

(2) Cost borne by the Government of Kenya

Total Cost approximately 109.1 Million Ksh (Approximately 133.1 Million Yen)

1) Land Acquisition Cost	50.0 Million Ksh	(app. 61.0 Mil.Yen)
2) Social Cost for Relocation of Person	3.0 Million Ksh	(app. 3.7 Mil.Yen)
3) Utility Relocation Cost	47.0 Million Ksh	(app. 57.3 Mil.Yen)
4) Environmental Monitoring Cost	8.2 Million Ksh	(app. 10.0 Mil.Yen)
5) Bank Commission	0.9 Million Ksh	(app. 1.1 Mil.Yen)

(3) Conditions in Cost Estimate

1) Time of Cost Estimate : June, 2010

2) Exchange Rate : 1US Dollar = 92.12 Yen 1 Ksh= 1.22 Yen

3) Construction Period : approximately 16.0 months

4) Cost estimate is implemented in accordance with the guideline of Japan's Grant Aid.

Monitoring Plan

1. Responses/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
ex.) Responses/Actions to Comments and Guidance from Government Authorities	

2. Mitigation Measures

- Air Quality (Emission Gas / Ambient Air Quality)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
SO_2							To use NEMA registered expert in consultation with NEMA. Guidelines to be agreed with NEMA.
NO_2							Ditto
CO							Ditto
O_2							Ditto
Soot and dust							Ditto
SPM							Ditto
Dust							Ditto

- Water Quality (Effluent/Wastewater/Ambient Water Quality)

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
pH	Hydrogen ion			6.5 – 8.5	6.5 – 8.5	WHO	To use NEMA registered expert in consultation with NEMA. Guidelines to be agreed with NEMA.
SS (Suspended Solid)	Mg/l			30	30	WHO	Ditto
BOD/COD	Mg/l			30-50	30-50	WHO	Ditto

DO	Mg/l			-	-	WHO	Ditto
Total Nitrogen	Mg/l			2 – Guideline value	2 – Guideline value	WHO	Ditto
Total Phosphorus	Mg/l			2 – Guideline value	2 – Guideline value	WHO	Ditto
Heavy Metals	Mg/l			0.01	0.01	WHO	Ditto
Hydrocarbons / Mineral Oils	Mg/l			0.2	0.2	WHO	Ditto
Phenols	Mg/l			0.001	0.001	WHO	Ditto
Cyanide	Mg/l			2.0	2.0	WHO	Ditto
Temperature	Degree Celsius based on ambient temperature			+3 or - 3	+3 or - 3	WHO	Ditto

Source: Kenya subsidiary legislation 2006

- Waste

Monitoring Item	Monitoring Results during Report Period
Solid waste from domestic and industrial sources Excavated soil and other demolition waste	Amount of waste in tones transported to the damp site

- Noise

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Country's Standards	Standards for Contract	Referred International Standards	Remarks (Measurement Point, Frequency, Method, etc.)
Noise level construction	dB			Day time:75 Night Time: 65	Day time: 75 Night Time: 65		NEMA expert to monitor for KURA, with KURA taking responsibility.

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

3. Natural Environment

- Ecosystem

Monitoring Item	Monitoring Results during Report Period
Tree logging and reduced rate of green vegetation coverage	The number of trees necessary logging was confirmed in cooperation with the CCN Department of Environment, for impact reduction

4. Social Environment

- Resettlement

Monitoring Item	Monitoring Results during Report Period
PAPs along the corridor	The number of PAPs compensated/assisted/resettled

- Living / Livelihood

Monitoring Item	Monitoring Results during Report Period
Economic activities of PAPs	The level of income restoration achieved after resettlement/assistance/compensation

Environmental Checklist: 15. Roads and Railways (1)

Annex-4

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	① Have EIA reports been officially completed? ② Have EIA reports been approved by authorities of the host country's government? ③ Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? ④ In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	① The EIA reports have been completed. ②③ The EIA reports have been submitted to NEMA. Then, NEMA has reported its approval of the EIA to MOR on May 2010, MOR has paid the License fee. Therefore, NEMA has issued the license of EIA on 3 March,2011. ④ The permissions of borrow pits from the Nairobi City Council are required. The permissions are to be obtained by December 2011.
	(2) Explanation to the Public	① Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? ② Are proper responses made to comments from the public and regulatory authorities?	① The public consultation was conducted at the preliminary study stage in June 2009, and at the preparatory survey stage in June 2010. General consent of the local people has been obtained. ② KURA, the agency which implements this project, discloses information and accepts query from local people on its website at any time.
2 Mitigation Measures	(1) Air Quality	① Is there a possibility that air pollutants emitted from various sources, such as vehicle traffic will affect ambient air quality? Does ambient air quality comply with the country's ambient air quality standards? ② Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	① There is traffic congestion at the site of urban roads. It is expected to be reduced and the air quality to be better than now by implementing this project. ② There are no industrial areas near the route.
	(2) Water Quality	① 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? ② Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater? ③ Do effluents from various facilities, such as stations and 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 that do not comply with the country's ambient water quality standards?	① Filled and cutting soil will be protected by grouted riprap and turfing, so there is no possibility of soil runoff and water quality degradation in downstream water area. ② The surface runoff water from roads during operation period will be designed to be drained as public water, and periodical cleaning on the road is on menu. Influence of surface runoff water is little. Contamination of groundawter is negligible. ③ There is no facilities along the road.
	(3) Noise and Vibration	① Do noise and vibrations from vehicle and train traffic comply with the country's standards?	① During construction period, generation of noise and vibration can be minimized by the followings: using low noise heavy machineries and construction vehicles, prohibiting construction with noise and vibration in the early morning and at night, and making public announcement of construction plan prior to construction. During operation period, noise level in the area immediate to the road will be minimized through regulation on noise levels. The project may cause insignificant impact of vibration to community or structures.

Environmental Checklist: 15. Roads and Railways (2)

Annex-4

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
3 Natural Environment	(1) Protected Areas	① 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?	① There are no protected areas in and around the site.
	(2) Ecosystem	① Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? ② Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? ③ If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? ④ Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? ⑤ 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? ⑥ In cases where the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	① There are no ecological valuable habitats in and around the site. ② The habitats of endangered species have not been identified in the site and its downstream area. ③ The project will not affect the ecosystem significantly. ④ Species migrating through the site have not been identified. ⑤⑥ Since only extension of existing roads is planned, improving roads will not cause destruction of forest, wetland and no ecosystems of exotic species. Logging of trees will be minimized and compensating mitigation measures such as relocation or planting of tree nurseries will be taken place.
	(3) Hydrology	① Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	①Significant impact on surface and ground water will not occur.
	(4) Topography and Geology	① Is there a soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? ② 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? ③ 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?	①② There are some slope failures or landslides in and around the site. Actions including soil retaining against slope failures or landslides are required to be taken during and after construction. ③ Actions including soil retaining against soil run-off are required to be taken.

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
4 Social Environment	(1) Resettlement	① Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? ② Is adequate explanation on relocation and compensation given to affected persons prior to resettlement? ③ Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? ④ Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous people? ⑤ Are agreements with the affected persons obtained prior to resettlement? ⑥ Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? ⑦ Is a plan developed to monitor the impacts of resettlement?	① There are 6 Kiosk owners, approx. 20 small scale traders and 12 owners of plant within the project area who have to move their shops away from the area or resettle. ②③ The Kenyan side will form a simplified Resettlement Action Plan (RAP) and inform details of its content of the Project Affected Persons (PAPs). Compensation to restore their livelihood will be paid based on the confirmed PAPs inventory. ④ Particular attention to the vulnerable persons including children, women and the elderly is paid by the followings: establishing pedestrian crossings at key points of the corridor during construction, positioning traffic control personnel and making public announcement of construction plan prior to construction. ⑤⑥⑦ The Kenyan side will establish the organizational framework and secure a budget for compensation of above PAPs to restore their livelihood.
	(2) Living and Livelihood	① Where roads or railways 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? ② Is there a possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary? ③ Is there a possibility that diseases, including communicable diseases, such as HIV will be introduced due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? ④ Is there a possibility that the project will adversely affect road traffic in the surrounding areas (e.g., by causing increases in traffic congestion and traffic accidents)? ⑤ Is there a possibility that roads and railways will impede the movement of inhabitants? ⑥ Is there a possibility that structures associated with roads (such as bridges) will cause a sun shading and radio interference?	①②③④⑤ Since only extension of existing roads is planned, improving roads will not cause significant impacts on livelihood of the local people and road traffic. The road area is secured and people operating business around the existing road other than the above PAPs will be able to continue their business there after the completion of the construction. ⑥ Impacts such as sun shading and radio interference will not occur.
	(3) Heritage	① Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	① Although there is a cultural institution, Nairobi Club House, along the site, the construction will not affect it
	(4) Landscape	① Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	① Landscape will be altered slightly such as inevitable logging of trees. Logging of trees will be minimized and compensating mitigation measures such as relocation or planting of tree nurseries will be taken place.

Annex-4

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
4 Social Environment	(5) Ethnic Minorities and Indigenous People	① Where ethnic minorities and indigenous peoples are living in the rights-of-way, are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous people? ② Does the project comply with the country's laws for rights of ethnic minorities and indigenous people?	①② The site is not an area where ethnic minorities and indigenous people having unique culture and lifestyle are living.
5 Others	(1) Impacts during Construction	① Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? ② If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? ③ If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? ④ If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	① Yes. Adequate measures such as periodical water spray and sheet cover on track will be employed to reduce dust. ② Yes. The number of trees necessary logging was confirmed in cooperation with KURA and CCN department of envronment, for impact reduction. They will relocate or plant tree nurseries after logging. ③ Yes. KURA will be monitoring the level of income restoration achievd after resettlement, assistance, compensation for PAPs. ④ The contractor will provided health and safety education for project personal.
	(2) Monitoring	① Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? ② Are the items, methods and frequencies included in the monitoring program judged to be appropriate? ③ Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? ④ 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?	① Yes. Environmental monitoring programs including air quality, water quality, noise level, etc. ② Yes. JICA and KURA agreed the monitoring format, including the appropriate assignment / recruitment of the necessary staff. ③ Yes. KURA will prepare budget for establishing such Monitoring team. ④ Yes. Concrete measures are described in the monitoring format.
6 Note	Reference to Checklist of Other Sectors	① Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). ② 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).	–
	Note on Using Environmental Checklist	① 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).	–

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are made, if necessary.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan' experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Technical Note
The Preparatory Survey on
The Project for Dualling of Nairobi-Dagoreti Corner Road C60/61

JICA Survey Team (Consultants) and KURA has made technical discussions and confirmed the followings. It is understood that the confirmations/proposals might be revised in further analysis/discussion in Japan.

1. Design Standards
Kenyan design standards issued by Ministry of Roads will be basically adopted. Specifications of AASHTO (for pavement design), BS (for bridge design loads) Japan Road Association (for road design detail) are adopted supplementary.

2. Road Class
The project road class is Urban Collector.

3. Particular Design Criteria
(1) Design Period
The carriageway width and Pavement structure is designed to accommodate the traffic in the period of 2013-2022 (10 years period from opening in 2012).

(2) Geometric Standard
The proposed geometric standards are shown in Appendix-1.

4. Cross Sectional Component of Road (Typical Cross Sections)
The proposed typical cross sections are shown in Appendix-2.

5. Road Improvement Plan
Scheme of the road improvement plan including intersection improvement plans is shown in the separate sheet (Long size paper).

(1) Major Intersections
The intersection improvement plans will be further studied based on the traffic analysis. Intersection improvement by providing additional traffic lanes with adequate lengths will be proposed.

(2) Traffic signal lights
Additional traffic signal lights are proposed to be installed for the intersections with ML-7 and Hospital Road.

(3) Bus stops
The Bus stops will be maintained as they are. Additional bus stops are proposed to be installed in front of National Library and NHIF Building. Bus bays (Bus stop separated from the through traffic lanes by a barrier) are proposed for the bus stops at Kenyatta and Nairobi Hospital and NHIF Building.

(4) Crosswalk
Crosswalks will be provided at major intersections and bus stops

(5) Ngong River Bridge
Additional 3-lane road is proposed to be constructed at the downstream side of the existing road at the crossing of Ngong River. A box culvert is proposed for the additional 3-lane road to cross the river.

6. Other Items confirmed

(1) Beginning and ending point of the survey road
Beginning point (Sta. 0+000) of the survey road is the center of Adams Arcade Roundabout and All Saint Cathedral is the end point. Then the north direction of the plan will be located at the top side.

(2) Construction Limits
Sta.0-150m is the construction limit at the beginning point.

(3) Existing Roadside Car Park
The roadside car park in front of Ministry of Road will be removed to accommodate the widening of the road.

(4) ML-12 Intersection Plan
In the future, ML-12 will be connected with Ngong Road and ML-7. A detailed design drawing of the intersection to be connected with ML-12 will be provided by the Consultant in the detailed design stage.

(5) Utility Relocation
With consideration of future developments, all utilities in the ROW will be relocated to the edge of the ROW when this project will be implemented. KURA will be responsible for the relocation of utilities. The removal of existing street lights will be responsibility of KURA.

Noted by

June 9, 2010

Tsuyoshi Yamajuku
Chief Consultant
JICA Survey Team

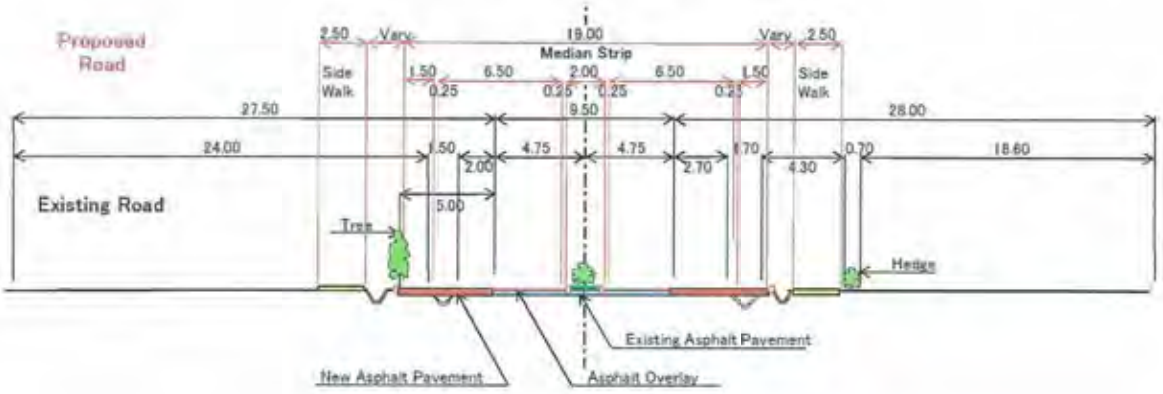
Eng. Joseph N.NKADAYO
Director General & CEO
Kenya Urban Roads Authority
Republic of Kenya

Appendix-1 Geometric Standard

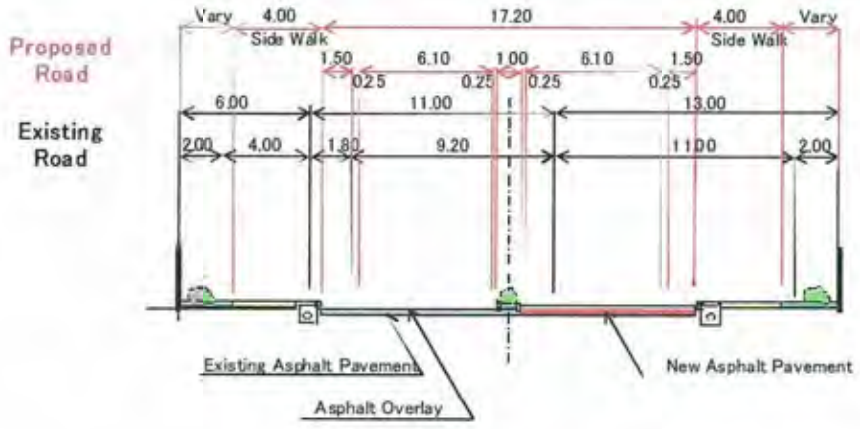
Item	Specification	
Road Section	Adams Arcade – City Mortuary	City Mortuary – All Saints Cathedral
Design Speed (km/h)	60	40
Maximum Grade (%)	6.0	8.0
Minimum Horizontal Curve Radius (m)	300	55
Stopping Sight Distance (m)	85	45
Minimum Vertical Curve Radius (Crest) (m)	800	400
Minimum Vertical Curve Radius (Sag) (m)	1800	800
Maximum Super-elevation (%)	2.0 (Normal Crown)	4.0
Carriageway Width (m)	3.25	3.05

Appendix-2 Typical Cross Section

From Adams Arcade to City Mortuary



From City Mortuary to All Saint Cathedral



６．環境許可書

Application Reference No. PR/7107
Registration No: 0008151
For official use

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT LICENCE

This is to certify that the Project Report/Environmental Impact Assessment Study Report received from ..THE PERMANENT SECRETARY, MINISTRY OF ROADS..... (Name of individual/firm) .....P.O. BOX 30260-00100, NAIROBI..... (Address) submitted to the National Environment Management Authority in accordance with the Environmental Impact Assessment & Audit Regulations regarding ..PROPOSED UPGRADING OF ALL SAINTS CATHEDRAL JUNCTION-CITY-MORTUARY-DAGORETTI CORNER-NGONG TOWN (C61/C60) ROADS-KAREN BOMAS ROADS (title of project) whose objective is to carry on .....EXPANSION OF THE ROAD INTO DUAL CARRIAGE THROUGHOUT..... .... (briefly describe purpose) located at ..CITY MORTUARY -DAGORETTI CORNER-NGONG TOWN(C61/C60) ROADS-KAREN- BOMAS ROADS..... (locality and district) has been reviewed and a licence is hereby issued for implementation of the project, subject to attached conditions.

Dated this.....3RD.....day....MAR..... of 20..11..

Signature.....

(SEAL)

Director General
The National Environment Management Authority

CONDITIONS OF LICENCE

1. This licence is valid for a period of ...24 MONTHS.... (time within which the project should commence) from the date

1.0 General Conditions

1.1 The license shall be valid for 24 months from the date of issue.

1.2 Without prejudice to the other conditions of this license, the proponent shall implement and maintain an environmental management system, organizational structure and allocate resources that are sufficient to achieve compliance with the requirements and conditions of this license.

1.3 The Authority shall take appropriate action against the proponent in the event of breach of any of the conditions stated herein or any contravention to the Environmental Management and Coordination Act, 1999 and regulations thereunder.

1.4 This license shall not be taken as statutory defence against charges of environmental degradation or pollution in respect of any manner of degradation/pollution not specified herein.

1.5 The proponent shall ensure that records on conditions of licenses/approval and project monitoring and evaluation shall be kept on the project site for inspection by NEMA's Environmental Inspectors.

1.6 The proponent shall submit an Environmental Audit report in the first year of occupation/operations/commissioning to confirm the efficacy and adequacy of the Environmental Management Plan.

1.7 The proponent shall comply with NEMA's improvement orders throughout the project cycle.

1.8 The proponent shall ensure strict adherence to the Environmental Management Plan developed throughout the project cycle.

2.0 Construction Conditions

2.1 The proponent shall ensure storm drainage systems are installed and maintained.

2.2 The proponent shall ensure where construction materials are sourced are rehabilitated.

2.3 The proponent shall ensure that all excavated material and debris is collected, re-used and where need be, disposed off as per the Environmental Management and Coordination (Waste Management) Regulations of 2006.

2.4 The proponent shall ensure strict adherence to the provisions of Environmental Management and Coordination (Noise and Excessive Vibrations Pollution Control) Regulations of 2009.

2.5 The proponent shall ensure strict adherence to the Occupational Safety and Health Act (OSHA), 2007.

2.6 The proponent shall ensure that construction workers are provided with adequate personal protection equipment (PPE), sanitary facilities as well as adequate training.

2.7 The proponent shall ensure that construction activities are undertaken during the day (and not at night) between 08.00 hrs and 17.00 hrs; and that transportation of construction material to site are undertaken during weekdays (and not weekends) off peak hours.

2.8 The proponent shall ensure strict adherence to the Environmental Management Plan developed throughout the project cycle.

2.9 The proponent shall ensure that the development adheres to zoning specifications issued for development of such a project within the jurisdiction of the City Council of Nairobi, with emphasis on approved land use for the area.

2.10 The proponent shall ensure the road reserves are planted with vegetation to prevent soil erosion.

3.0 Operational Conditions

3.1 The proponent shall ensure vegetation destroyed will be restored once the road works are completed.

3.2 The proponent shall ensure that all waste water is disposed as per the standards set out in the Environmental Management and Coordination (Water Quality) Regulations of 2006.

3.3 The proponent shall ensure that rain water harvesting facilities are provided to supplement surface and ground water.

3.4 The proponent shall ensure that the road is watered frequently and dust is not a source of nuisance to road users as well as the neighbourhood.

3.5 The proponent shall ensure that appropriate functional efficient air pollution control mechanisms are installed in the facility to control all air emissions.

3.6 The proponent shall ensure that all equipment used are well maintained in accordance with the Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations of 2009.

3.7 The proponent shall ensure that all solid waste is handled in accordance with the Environmental Management and Coordination (Waste Management) Regulations of 2006.

3.8 The proponent shall ensure that all workers are well protected and trained as per the Occupational Safety and Health Act (OSHA) of 2007.

3.9 The proponent shall comply with the relevant principal laws, by-laws and guidelines issued for development of such a project within the jurisdiction of the City Council of Nairobi, Ministry Roads and other relevant Authorities.

3.10 The proponent shall ensure that environmental protection facilities or measures to prevent pollution and ecological deterioration such as storm drains, sprinkling of the roads with water, creation of diversions for road users are employed simultaneously with the proposed project.

4.0 Notification Conditions

4.1 The proponent shall seek written approval from the Authority for any operational changes under this license.

4.2 The proponent shall ensure that the Authority is notified of any malfunction of any system within 12 hours on the NEMA hotline No. **020 6006041** and mitigation measures put in place.

4.3 The proponent shall keep a record of all pollution incidences and notify the Authority with 24 hours.

4.4 The proponent shall notify the Authority in writing of its intent to decommission the facility **three (3) months** in advance.

5.0 Decommissioning Conditions

5.1 The proponent shall ensure that a decommissioning plan is submitted to the Authority for approval at least three (3) months prior to decommissioning.

5.2 The proponent shall ensure that all pollutants and polluted material is contained and adequate mitigation measures provided during the phase.

７．事業事前計画表（概略設計時）

事業事前計画表（概略設計時）

１．案件名
ケニア国ウゴング道路拡幅計画
２．要請の背景（協力の必要性・位置付け）
ケニア国内最大の都市であるナイロビ市においては、人口増加、通過交通の増加、環状道路の分断等による非効率な交通システム等により、渋滞が深刻化し、経済損失や、大気汚染・騒音等の自動車公害を引き起こしている。また、ナイロビ市内の移動は渋滞ピーク時には通常の 2 倍以上も時間を要し、時間・燃料の浪費といった車両運行費用・車両維持費の増加を招いている。ナイロビ市の人口は 2025 年には現在の 300 万人から 430 万人へ増加すると推測され、ナイロビ都市圏の交通渋滞はますます悪化することが予想される。 2008 年に発行された「ケ」国の長期開発計画「Vision2030」は、高い生活水準、国際的な競争力及び経済的繁栄を 2030 年までに達成することを国家目標としている。同計画では、「経済」、「社会」、「政治」を 3 本柱とし、「経済成長率 10%の維持」、「衛生的かつ安全な環境で人々が暮らし、平等で、公正、結束力のある社会」、「法に従い、すべての「ケ」国国民の人権と自由を守る政治の上に成り立つ民主政治のシステム」の実現を掲げている。インフラ開発は その 3 つの柱を支える基盤の一つとして位置づけられており、道路分野に関しては、道路整備、維持管理能力の向上、都市部の渋滞対策、過積載車両の増加への対策等を含む交通インフラ全般の整備に取り組むこととしている。 2000 年に策定された対ケニア国別援助計画では、経済インフラ整備を援助重点分野の一つとしており、輸送インフラ整備を開発課題として掲げている。具体的には、ナイロビ市内の渋滞解消、事故発生率の抑制を目的とした「ナイロビ都市圏交網改善プログラム」を実施しており、同プログラム内で「ケ」国実施機関の道路維持管理能力の向上のために、技術協力プロジェクト「道路維持管理プロジェクト」（2005～2008 年）を実施し、2010 年 4 月から、後続の「道路メンテナンス業務の外部委託化に関する監理能力向上プロジェクト」を開始した。 JICA は、2004 年～2006 年まで、ナイロビ首都圏の交通網の分析及び交通整備マスタープラン調査を実施し、特に早期に対応が必要な緊急プロジェクトの Pre-F/S を実施した。本件の対象地域であるウゴング道路は、ナイロビ市内で最も車両混雑が著しい地域であり、市内西部から中心部への物資・市民の移動に欠かせない生活道路となっているため、この Pre-F/S の対象となった。 本件は、ウゴング道路の整備を目的とした無償資金協力案件であり、2008 年にケニア国政府が我が国に要請していたものである。昨年より本件に先行する形で無償「ナイロビ西部環状道路建設計画」の調査を開始しており、同計画と本件を平行して実施することにより、市内でも最も車両混雑の著しい対象地域における物資及び市民の移動に係る利便性の確保、及び市内中心部の混雑緩和といった効果も期待されるなど、同市における経済・社会開発上の意義は高いと考えられる。

３．プロジェクト全体計画概要

（１）プロジェクト全体計画の目標

・ナイロビ市西部と市中心部・市内東部地域区間の安全でスムーズな交通量の確保

・渋滞緩和による輸送コストの削減

・歩道設置による労働者の移動の利便性、安全性確保

（２）プロジェクト全体計画の成果

・ウゴング道路のアダムスアーケード交差点からウゴング道路/ケニアッタ道路交差点（4.69km）区間の道路２車線から４車線への拡幅化及び整備

（３）プロジェクト全体計画の主要活動

・ウゴング道路のアダムスアーケード交差点からウゴング道路/ケニアッタ道路交差点（4.69km）を整備する

・道路整備後の維持管理を行う

（４）投入

ア　日本側：無償資金協力 17.63 億円

イ　「ケ」国側：

（ア）必要な人員：維持管理要員：約 20 名

（イ）施設の運営維持管理に係る経費：6.65 百万ケニアシリング

（５）実施体制

・主管官庁：道路省（MOR :Ministry of Roads）

・実施機関：ケニア都市道路公社（KURA :Kenya Urban Roads Authority）

４．無償資金協力案件の内容

（１）サイト

「ケ」国　ナイロビ市

（２）概要

・以下の道路の整備（アダムスアーケード RA～オールセイント交差点の既存２車線から４車線への拡幅、舗装〔車道・歩道〕、排水設備、照明設備、バス停の整備を含む）

ウゴング道路（アダムスアーケード RA～オールセイント交差点間：4.69km）

（３）相手国負担事項

①　プロジェクト用地確保、支障物（フェンス、看板、駐車場）移転

②　ユーティリティーの移設

（４）概略事業費

・概略事業費 18.96 億円（日本側負担 17.63 億円、「ケ」国側負担 1.33 億円）

（５）工期

・詳細設計・入札期間を含め約 22.0 ヶ月(予定)

（６）貧困、ジェンダー、環境および社会面の配慮

・道路用地内でのキオスク及び小規模商業活動者に対する移設補償を行う。

・EIA レポートに準拠し、樹木を撤去するため植樹を行う。

５．外部要因リスク（プロジェクト全体計画の目標達成に関して）

・当初想定よりも交通量が大幅に増加しない。

・異常気象により予想を超える降雨が発生しない。

６．過去の類似案件からの教訓の活用

・なし

７．プロジェクト全体計画の事後評価に係る提案

（１）プロジェクト全体計画の目標達成を示す成果指標

項目	2010 年	2013 年
対象路線（4.69km）の平均所要時間	ピーク時：29 分	ピーク時： 9 分
朝夕（朝 7:00～8:00、夕 17:00～18:00）の平均走行速度の向上	平均走行速度 10km/hr	平均 30km/hr 程度

（２）その他の成果指標

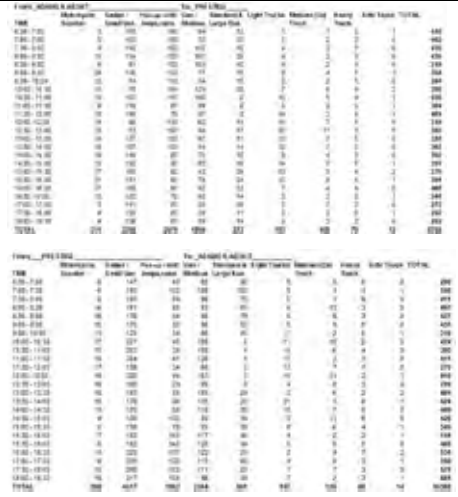
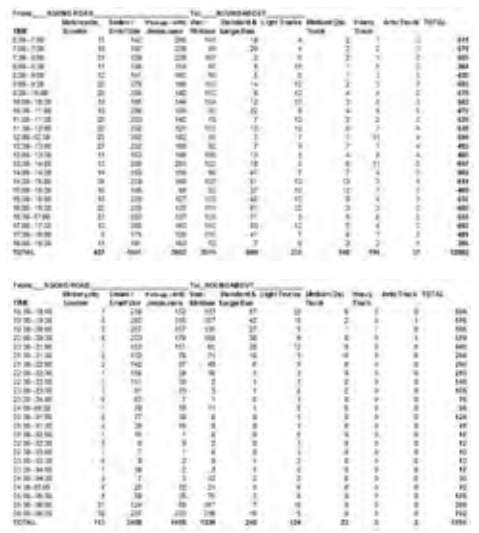
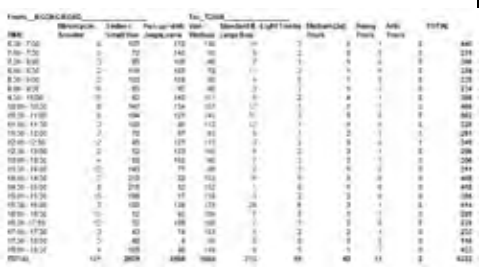
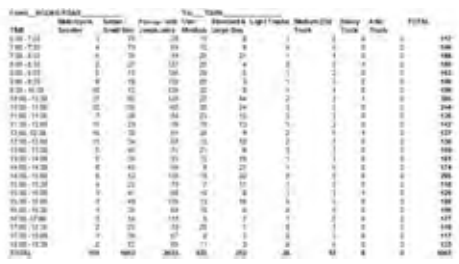
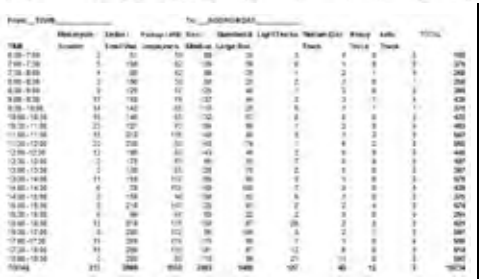
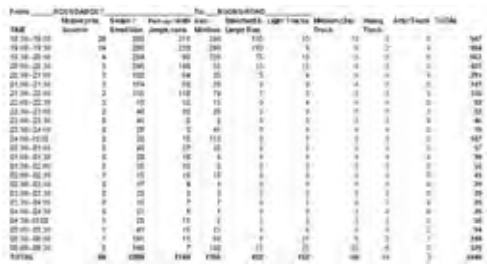
項目	2010 年	2013 年
マタツのナイロビ市中心部までの交通渋滞追加料金の解消による往復乗車料金	100 ケニアシリング	40 ケニアシリング

収 集 資 料 リ ス ト

調　査　名:　ケニア国　ウゴング道路拡幅計画準備調査（その２）

番号	資 料 の 名 称	形 態 図書・ビデオ 地図・写真等	オリジナル・コピー	発 行 機 関	発行年
1	EIA Draft Report	電子データ	コピー	ケニア都市道路公社	2009
2	WELL-BENG IN KENYA A Socio-Economic Profile	図書	オリジナル	地方自治省	2008
3	ECONOMIC SURVEY 2010	図書	オリジナル	国家統計局	2010
4	STATISTICAL ABSTRACT 2009	図書	オリジナル	国家統計局	2009
5	Kenya Urban Roads Authority Budget	図書	コピー	ケニア都市道路公社	2010
5	Cases of majority of Road Traffic Accidents	図書	コピー	ケニア都市道路公社	2009
6	PRELIMINARY AND DETAILED ENGINEERING DESIGN OF ALL SAINTS CATHEDRAL JUNCTION-CITY MOTRUARY-DAGORETTI CONER-NGONG TOWN(C60/C61) ROADS-KAREN-BOMAS ROADS PRELIMINARY DESIGN REPORT(MAIN REPORT)	図書	コピー	ケニア都市道路公社	2009
7	PRELIMINARY AND DETAILED ENGINEERING DESIGN OF ALL SAINTS CATHEDRAL JUNCTION-CITY MOTRUARY-DAGORETTI CONER-NGONG TOWN(C60/C61) ROADS-KAREN-BOMAS ROADS PRELIMINARY DESIGN REPORT(ASSESMENT REPORT)	図書	コピー	ケニア都市道路公社	2009
8	PRELIMINARY AND DETAILED ENGINEERING DESIGN OF ALL SAINTS CATHEDRAL JUNCTION-CITY MOTRUARY-DAGORETTI CONER-NGONG TOWN(C60/C61) ROADS-KAREN-BOMAS ROADS BOOK OF DRAWINGS	図書	コピー	ケニア都市道路公社	2009

交通量調査結果　　道路断面交通量調査（機動交通）

Adams Arcade (Sta. 0+450)	Kenya Baptist Church (Sta. 2+350)	Kenya Hospital (Sta. 3+000)	Transcom House (Sta. 3+850)
			
			
			
			

道路断面交通量（非機動交通）

Adams Arcade (Sta. 0+450)

From: PRESTIGE To: ADAMS

TIME	PEDESTRIAN	BICYCLES	CARTS	
6:30 - 7:00	392	17	0	
7:00 - 7:30	155	9	0	
7:30 - 8:00	66	9	0	
8:00 - 8:30	74	5	1	
8:30 - 9:00	25	9	0	
9:00 - 9:30	28	5	0	
9:30 - 10:00	47	8	1	
10:00 - 10:30	47	4	0	
10:30 - 11:00	48	8	0	
11:00 - 11:30	61	5	1	
11:30 - 12:00	26	6	0	
12:00 -12:30	91	4	0	
12:30 - 13:00	85	5	1	
13:00 - 13:30	74	6	1	
13:30 - 14:00	47	2	0	
14:00 - 14:30	25	0	1	
14:30 - 15:00	14	0	0	
15:00 - 15:30	20	2	0	
15:30 - 16:00	36	7	0	
16:00 - 16:30	74	1	0	
16:30 - 17:00	68	1	0	
17:00 - 17:30	76	8	0	
17:30 - 18:00	134	20	0	
18:00 - 18:30	92	15	0	
TOTAL	1730	171	6	

From: ADAMS ROUNDABOUT To: PRESTIGE

TIME	PEDESTRIAN	BICYCLES	CARTS	
6:30 - 7:00	30	11	0	
7:00 - 7:30	84	38	0	
7:30 - 8:00	141	36	0	
8:00 - 8:30	105	17	0	
8:30 - 9:00	66	13	0	
9:00 - 9:30	48	16	0	
9:30 - 10:00	46	8	0	
10:00 - 10:30	70	8	0	
10:30 - 11:00	85	5	0	
11:00 - 11:30	97	4	0	
11:30 - 12:00	72	13	0	
12:00 -12:30	93	4	1	
12:30 - 13:00	79	8	0	
13:00 - 13:30	114	10	1	
13:30 - 14:00	86	6	1	
14:00 - 14:30	75	8	0	
14:30 - 15:00	55	8	0	
15:00 - 15:30	69	3	0	
15:30 - 16:00	51	6	0	
16:00 - 16:30	67	17	0	
16:30 - 17:00	255	22	0	
17:00 - 17:30	170	17	0	
17:30 - 18:00	175	12	0	
18:00 - 18:30	145	18	0	
TOTAL	2268	311	3	

Kenya Baptist Church (Sta. 2+350)

From: NGONG ROAD To: TOWN

TIME	PEDESTRIAN	BICYCLES	CARTS	
6:30 - 7:00	253	3	0	
7:00 - 7:30	310	16	0	
7:30 - 8:00	734	23	0	
8:00 - 8:30	610	26	0	
8:30 - 9:00	398	13	0	
9:00 - 9:30	171	6	0	
9:30 - 10:00	190	9	0	
10:00 - 10:30	216	9	0	
10:30 - 11:00	198	7	0	
11:00 - 11:30	132	5	0	
11:30 - 12:00	128	5	0	
12:00 -12:30	115	5	0	
12:30 - 13:00	116	9	0	
13:00 - 13:30	79	5	0	
13:30 - 14:00	97	4	0	
14:00 - 14:30	73	9	0	
14:30 - 15:00	63	7	1	
15:00 - 15:30	61	7	1	
15:30 - 16:00	52	4	0	
16:00 - 16:30	84	0	0	
16:30 - 17:00	154	7	0	
17:00 - 17:30	300	28	0	
17:30 - 18:00	179	21	0	
18:00 - 18:30	98	11	0	
TOTAL	4810	239	2	

From: NGONG ROAD To: TOWN

TIME	PEDESTRIAN	BICYCLES	CARTS	
18:30 - 19:00	4624	3	0	
19:00 - 19:30	13	0	0	
19:30 - 20:00	17	0	0	
20:00 - 20:30	0	0	0	
20:30 - 21:00	1	0	0	
21:00 - 21:30	1	0	0	
21:30 - 22:00	5	0	0	
22:00 - 22:30	0	0	0	
22:30 - 23:00	5	0	0	
23:00 - 23:30	1	0	0	
23:30 - 24:00	2	0	0	
24:00 -00:30	0	0	0	
00:30 - 01:00	0	0	0	
01:00 - 01:30	1	0	0	
01:30 - 02:00	0	0	0	
02:00 - 02:30	0	0	0	
02:30 - 03:00	0	0	0	
03:00 - 03:30	3	0	0	
03:30 - 04:00	0	0	0	
04:00 - 04:30	0	0	0	
04:30 -05:00	3	0	0	
05:00 - 05:30	49	6	0	
05:30 - 06:00	221	29	0	
06:00 - 06:30	373	24	0	
TOTAL	5325	66	1	

From: ROUNDABOUT To: NGONG ROAD

TIME	PEDESTRIAN	BICYCLES	CARTS	
6:30 - 7:00	124	16	0	
7:00 - 7:30	192	14	0	
7:30 - 8:00	170	12	0	
8:00 - 8:30	99	11	0	
8:30 - 9:00	94	4	0	
9:00 - 9:30	52	3	0	
9:30 - 10:00	144	6	1	
10:00 - 10:30	108	10	3	
10:30 - 11:00	97	4	0	
11:00 - 11:30	98	3	0	
11:30 - 12:00	84	6	0	
12:00 -12:30	91	6	0	
12:30 - 13:00	108	5	0	
13:00 - 13:30	166	3	0	
13:30 - 14:00	96	4	1	
14:00 - 14:30	106	1	0	
14:30 - 15:00	150	4	0	
15:00 - 15:30	127	3	0	
15:30 - 16:00	168	9	0	
16:00 - 16:30	294	6	0	
16:30 - 17:00	341	27	0	
17:00 - 17:30	132	30	0	
17:30 - 18:00	896	30	0	
18:00 - 18:30	1101	29	0	
TOTAL	4582	249	5	

From: ROUNDABOUT To: NGONG ROAD

TIME	PEDESTRIAN	BICYCLES	CARTS	
18:30 - 19:00	4605	3	0	
19:00 - 19:30	152	3	0	
19:30 - 20:00	98	0	0	
20:00 - 20:30	73	3	0	
20:30 - 21:00	37	0	0	
21:00 - 21:30	7	1	0	
21:30 - 22:00	6	0	0	
22:00 - 22:30	3	3	0	
22:30 - 23:00	4	0	0	
23:00 - 23:30	3	0	0	
23:30 - 24:00	6	0	0	
24:00 -00:30	1	0	0	
00:30 - 01:00	0	1	0	
01:00 - 01:30	2	0	0	
01:30 - 02:00	2	0	0	
02:00 - 02:30	0	0	0	
02:30 - 03:00	0	0	0	
03:00 - 03:30	3	0	0	
03:30 - 04:00	0	0	0	
04:00 - 04:30	0	0	0	
04:30 -05:00	2	0	0	
05:00 - 05:30	11	0	0	
05:30 - 06:00	27	1	0	
06:00 - 06:30	79	10	0	
TOTAL	5057	41	0	

Kenya Hospital (Sta. 3+000)

FROM: NGONG ROAD TO: TOWN

TIME	PEDESTRIAN	BICYCLES	CARTS	
6:30 - 7:00	452	1	1	
7:00 - 7:30	505	3	1	
7:30 - 8:00	797	4	0	
8:00 - 8:30	289	3	2	
8:30 - 9:00	230	2	0	
9:00 - 9:30	124	0	0	
9:30 - 10:00	239	2	0	
10:00 - 10:30	74	0	0	
10:30 - 11:00	89	3	0	
11:00 - 11:30	102	0	0	
11:30 - 12:00	181	3	0	
12:00 -12:30	104	0	0	
12:30 - 13:00	74	1	1	
13:00 - 13:30	122	0	2	
13:30 - 14:00	36	1	0	
14:00 - 14:30	86	0	0	
14:30 - 15:00	151	2	0	
15:00 - 15:30	48	3	0	
15:30 - 16:00	128	0	0	
16:00 - 16:30	48	0	0	
16:30 - 17:00	53	0	0	
17:00 - 17:30	39	0	0	
17:30 - 18:00	225	6	0	
18:00 - 18:30	186	1	0	
TOTAL	4382	35	7	

From: TOWN To: NGONG ROAD

TIME	PEDESTRIAN	BICYCLES	CARTS	
6:30 - 7:00	149	26	0	
7:00 - 7:30	198	11	0	
7:30 - 8:00	140	8	0	
8:00 - 8:30	113	9	1	
8:30 - 9:00	126	16	0	
9:00 - 9:30	143	8	0	
9:30 - 10:00	50	2	0	
10:00 - 10:30	61	2	0	
10:30 - 11:00	127	6	0	
11:00 - 11:30	163	7	0	
11:30 - 12:00	127	8	0	
12:00 -12:30	188	3	0	
12:30 - 13:00	161	5	0	
13:00 - 13:30	179	5	0	
13:30 - 14:00	243	8	0	
14:00 - 14:30	163	4	0	
14:30 - 15:00	213	10	1	
15:00 - 15:30	259	6	0	
15:30 - 16:00	342	4	0	
16:00 - 16:30	375	13	1	
16:30 -17:00	627	21	0	
17:00 - 17:30	922	25	0	
17:30 - 18:00	581	20	0	
18:00 - 18:30	201	47	0	
TOTAL	5851	274	3	

Transcom House (Sta. 3+850)

From: NGONG ROAD To: TOWN

TIME	PEDESTRIAN	BICYCLES	CARTS	
6:30 - 7:00	107	2	0	
7:00 - 7:30	140	0	0	
7:30 - 8:00	366	6	0	
8:00 - 8:30	403	2	1	
8:30 - 9:00	332	1	1	
9:00 - 9:30	392	1	0	
9:30 - 10:00	363	1	1	
10:00 - 10:30	404	1	1	
10:30 - 11:00	544	0	1	
11:00 - 11:30	565	0	3	
11:30 - 12:00	405	2	0	
12:00 -12:30	64	0	0	
12:30 - 13:00	570	4	2	
13:00 - 13:30	740	2	0	
13:30 - 14:00	166	0	0	
14:00 - 14:30	462	1	0	
14:30 - 15:00	459	0	0	
15:00 - 15:30	226	0	0	
15:30 - 16:00	232	3	0	
16:00 - 16:30	384	4	0	
16:30 -17:00	327	3	0	
17:00 - 17:30	591	15	0	
17:30 - 18:00	597	6	0	
18:00 - 18:30	537	18	0	
TOTAL	9176	75	10	

From: TOWN To: NGONG
Surveyed by: Supervised by:

TIME	PEDESTRIAN	BICYCLES	CARTS	
6:30 - 7:00	431	3	1	
7:00 - 7:30	579	4	0	
7:30 - 8:00	597	0	0	
8:00 - 8:30	385	3	0	
8:30 - 9:00	280	2	0	
9:00 - 9:30	386	2	0	
9:30 - 10:00	209	0	1	
10:00 - 10:30	303	0	0	
10:30 - 11:00	359	0	0	
11:00 - 11:30	289	0	0	
11:30 - 12:00	263	0	0	
12:00 -12:30	269	0	0	
12:30 - 13:00	431	0	0	
13:00 - 13:30	275	0	0	
13:30 - 14:00	253	0	0	
14:00 - 14:30	342	0	0	
14:30 - 15:00	486	0	0	
15:00 - 15:30	282	0	0	
15:30 - 16:00	265	0	0	
16:00 - 16:30	235	0	0	
16:30 - 17:00	331	0	0	
17:00 - 17:30	498	0	0	
17:30 - 18:00	323	0	0	
18:00 - 18:30	167	0	0	
TOTAL	8238	14	2	

交差点交通量（ML7 Intersection: May 26, 2010）

From: ADAMS To: YAYA

TIME	Sedan / Pickup/ Van / Wagon	4 WD	Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	Walker
6:30 - 6:45		49		16		22		0	0	4	0	30
6:45 - 7:00		83		26		22		0	1	5	0	46
7:00 - 7:15		94		19		19		1	0	6	0	36
7:15 - 7:30		139		19		17		1	2	4	0	36
7:30 - 7:45		84		15		17		1	1	3	0	29
7:45 - 8:00		79		13		13		3	0	2	0	53
8:00 - 8:15		48		8		13		1	3	1	0	31
8:15 - 8:30		41		19		9		0	0	1	1	17
8:30 - 8:45		33		10		6		1	0	3	0	35
8:45 - 9:00		30		11		11		0	1	2	0	30
9:00 - 9:15		49		14		15		1	1	2	0	29
9:15 -9:30		31		8		17		0	2	2	0	27
16:00 - 16:15		59		16		11		2	2	0	0	15
16:15 - 16:30		43		12		11		2	1	2	0	18
16:30 - 16:45		61		15		14		0	1	0	0	10
16:45 - 17:00		41		10		16		2	1	2	0	13
17:00 - 17:15		46		13		13		1	0	0	0	15
17:15 - 17:30		32		8		9		0	2	0	0	8
17:30 - 17:45		40		25		8		1	1	3	0	31
17:45 - 18:00		47		14		9		1	0	1	0	26
18:00 - 18:15		49		15		13		1	0	1	0	11
18:15 - 18:30		34		17		13		1	1	3	0	15
18:30 - 18:45		36		13		11		0	0	3	0	17
18:45 - 19:00		38		13		13		0	1	0	0	8

From: YAYA To: ADAMS

TIME	Sedan / Pickup/ Van / Wagon	4 WD	Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		6		18		6		2	0	3	0	18
6:45 - 7:00		20		9		1		0	0	4	0	17
7:00 - 7:15		17		10		5		0	0	0	0	34
7:15 - 7:30		14		11		2		1	0	0	0	14
7:30 - 7:45		25		15		2		0	0	0	0	13
7:45 - 8:00		19		10		1		0	0	0	0	16
8:00 - 8:15		33		20		3		1	1	2	0	16
8:15 - 8:30		36		21		2		0	0	0	0	17
8:30 - 8:45		26		9		2		0	1	1	0	18
8:45 - 9:00		37		14		1		1	0	1	0	14
9:00 - 9:15		47		15		3		1	1	0	0	17
9:15 -9:30		36		10		1		0	1	1	0	18
16:00 - 16:15		35		10		0		1	2	0	0	20
16:15 - 16:30		38		8		1		0	2	1	0	26
16:30 - 16:45		43		13		3		0	5	1	0	46
16:45 - 17:00		53		16		3		1	2	4	0	51
17:00 - 17:15		37		10		1		0	0	3	1	55
17:15 - 17:30		57		12		0		0	2	1	0	63
17:30 - 17:45		51		8		1		0	1	3	0	76
17:45 - 18:00		64		13		2		0	1	7	0	79
18:00 - 18:15		76		13		3		0	0	10	0	205
18:15 - 18:30		72		13		0		0	0	6	1	234
18:30 - 18:45		62		11		2		0	2	8	1	53
18:45 - 19:00		63		15		1		0	4	5	0	99

From: ADAMS To: TOWN

TIME	Sedan / Pickup/ Van / Wagon	4 WD	Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		118		52		3		2	2	3	0	43
6:45 - 7:00		104		40		2		0	4	9	0	57
7:00 - 7:15		97		26		1		5	3	12	0	111
7:15 - 7:30		67		44		2		1	0	13	0	122
7:30 - 7:45		43		31		0		1	3	6	0	56
7:45 - 8:00		38		47		4		3	7	3	0	87
8:00 - 8:15		50		33		2		4	2	0	0	70
8:15 - 8:30		37		45		1		2	4	1	0	50
8:30 - 8:45		42		20		0		3	3	2	0	68
8:45 - 9:00		82		47		5		0	5	5	0	44
9:00 - 9:15		85		32		5		0	6	3	0	79
9:15 -9:30		92		36		9		0	8	4	0	83
16:00 - 16:15		92		33		6		3	11	3	0	4
16:15 - 16:30		72		34		2		8	10	1	0	21
16:30 - 16:45		60		37		7		8	5	4	1	51
16:45 - 17:00		46		24		4		5	7	2	0	46
17:00 - 17:15		73		20		5		4	6	3	0	42
17:15 - 17:30		57		11		2		3	3	13	0	47
17:30 - 17:45		62		24		5		8	8	13	0	72
17:45 - 18:00		84		14		4		11	5	8	0	65
18:00 - 18:15		88		23		6		6	4	3	0	60
18:15 - 18:30		68		28		2		5	5	6	0	50
18:30 - 18:45		92		27		10		6	3	5	0	36
18:45 - 19:00		52		24		2		7	5	3	0	27

From: TOWN To: ADAMS

TIME	Sedan / Pickup/ Van / Wagon	4 WD	Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		120		40		28		6	1	4	0	34
6:45 - 7:00		116		40		25		5	0	13	2	69
7:00 - 7:15		123		47		23		5	4	5	1	65
7:15 - 7:30		132		50		13		1	3	4	1	77
7:30 - 7:45		114		48		19		2	0	1	0	75
7:45 - 8:00		116		40		14		3	3	4	1	71
8:00 - 8:15		116		31		13		0	5	6	0	39
8:15 - 8:30		105		30		20		0	8	9	1	44
8:30 - 8:45		107		35		27		1	4	7	0	41
8:45 - 9:00		119		38		24		5	5	4	0	49
9:00 - 9:15		107		36		21		10	3	1	0	52
9:15 -9:30		124		45		15		7	10	3	0	74
16:00 - 16:15		147		39		12		0	10	6	0	80
16:15 - 16:30		143		49		21		2	12	6	1	96
16:30 - 16:45		172		35		12		3	5	5	0	120
16:45 - 17:00		121		30		8		2	4	12	0	116
17:00 - 17:15		140		42		14		4	5	13	1	139
17:15 - 17:30		125		31		5		6	3	17	1	200
17:30 - 17:45		151		33		8		9	9	19	0	268
17:45 - 18:00		140		23		8		6	8	25	4	277
18:00 - 18:15		150		29		8		4	4	31	1	313
18:15 - 18:30		148		30		17		4	10	25	1	258
18:30 - 18:45		149		19		18		2	5	19	0	257
18:45 - 19:00		157		33		15		3	5	33	1	256

From: TOWN To: YAYA

TIME	Sedan / Pickup/ Van / Wagon	4 WD	Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		6		3		0		0	0	1	0	747
6:45 - 7:00		12		0		1		0	0	1	0	635
7:00 - 7:15		16		0		2		0	0	0	0	376
7:15 - 7:30		22		0		0		1	1	1	1	384
7:30 - 7:45		24		1		0		0	0	0	1	286
7:45 - 8:00		31		2		0		0	2	0	0	225
8:00 - 8:15		25		0		0		0	0	0	0	292
8:15 - 8:30		21		1		0		0	0	0	0	166
8:30 - 8:45		29		0		0		0	1	0	0	151
8:45 - 9:00		29		0		0		0	1	0	0	133
9:00 - 9:15		29		0		0		0	2	0	0	96
9:15 -9:30		22		0		0		1	0	0	0	77
16:00 - 16:15		33		0		0		0	1	1	0	28
16:15 - 16:30		28		1		1		1	2	0	0	33
16:30 - 16:45		26		0		0		0	2	2	0	39
16:45 - 17:00		24		1		0		0	2	0	1	46
17:00 - 17:15		25		0		1		0	2	0	0	37
17:15 - 17:30		25		0		0		0	0	1	0	40
17:30 - 17:45		14		0		0		0	1	3	0	39
17:45 - 18:00		23		1		0		0	2	0	0	51
18:00 - 18:15		23		0		0		0	0	0	0	37
18:15 - 18:30		16		0		0		1	0	0	0	17
18:30 - 18:45		15		1		2		0	1	1	0	43
18:45 - 19:00		23		0		0		1	1	0	0	43

From: YAYA To: TOWN

TIME	Sedan / Pickup/ Van / Wagon	4 WD	Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		4		0		0		0	0	0	0	39
6:45 - 7:00		6		1		0		1	0	0	0	34
7:00 - 7:15		8		0		0		0	0	0	0	28
7:15 - 7:30		3		0		0		0	0	0	0	34
7:30 - 7:45		9		0		0		0	0	3	2	20
7:45 - 8:00		6		0		0		0	1	3	1	34
8:00 - 8:15		7		0		0		1	1	0	0	17
8:15 - 8:30		12		3		1		0	1	1	0	33
8:30 - 8:45		10		2		0		0	1	4	0	24
8:45 - 9:00		14		2		0		0	0	2	0	34
9:00 - 9:15		13		3		0		0	1	4	0	28
9:15 -9:30		23		6		2		0	1	2	0	26
16:00 - 16:15		16		0		0		0	1	1	0	26
16:15 - 16:30		20		0		0		0	0	0	0	23
16:30 - 16:45		23		1		0		0	3	2	0	27
16:45 - 17:00		10		0		0		0	2	3	0	20
17:00 - 17:15		22		0		0		0	0	4	0	38
17:15 - 17:30		17		2		0		0	1	2	0	46
17:30 - 17:45		14		3		0		0	0	0	0	21
17:45 - 18:00		14		0		0		0	0	0	0	14
18:00 - 18:15		21		1		0		0	0	2	0	25
18:15 - 18:30		14		1		0		0	0	0	0	7
18:30 - 18:45		26		0		1		0	2	0	0	15
18:45 - 19:00		18		0		0		0	0	1	0	8

交差点交通量（ML7 Intersection: May 25, 2010）

From: YANA To: ADAMS

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45												
6:45 - 7:00												
7:00 - 7:15												
7:15 - 7:30												
7:30 - 7:45												
7:45 - 8:00												
8:00 - 8:15												
8:15 - 8:30												
8:30 - 8:45												
8:45 - 9:00												
9:00 - 9:15												
9:15 - 9:30												
16:00 - 16:15	54		9		2		0	0	0	0		41
16:15 - 16:30	41		14		1		2	2	1	0		29
16:30 - 16:45	65		18		2		0	0	0	0		52
16:45 - 17:00	31		13		1		1	1	0	0		45
17:00 - 17:15	49		8		0		1	0	1	0		46
17:15 - 17:30	61		16		1		0	0	1	0		65
17:30 - 17:45	43		29		1		1	0	3	0		56
17:45 - 18:00	62		18		0		0	0	1	0		47
18:00 -18:15	36		12		1		1	0	1	0		21
18:15 - 18:30	54		18		5		0	1	1	0		24
18:30 - 18:45	67		18		4		1	2	0	0		18
18:45 - 19:00	55		17		0		0	0	0	0		0
TOTAL												

From: ADAMS To: YANA

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45												
6:45 - 7:00												
7:00 - 7:15												
7:15 - 7:30												
7:30 - 7:45												
7:45 - 8:00												
8:00 - 8:15												
8:15 - 8:30												
8:30 - 8:45												
8:45 - 9:00												
9:00 - 9:15												
9:15 - 9:30												
16:00 - 16:15	46		16		10		0	0	2	0		27
16:15 - 16:30	28		18		10		0	1	1	0		37
16:30 - 16:45	44		17		17		1	1	1	0		23
16:45 - 17:00	53		13		21		0	3	1	0		36
17:00 - 17:15	48		24		13		0	1	1	0		67
17:15 - 17:30	48		15		14		0	1	3	0		39
17:30 - 17:45	38		15		10		1	1	0	0		35
17:45 - 18:00	43		19		10		0	0	2	0		34
18:00 -18:15	31		16		12		0	1	0	0		18
18:15 - 18:30	25		11		5		0	0	1	0		35
18:30 - 18:45	15		13		11		0	0	0	0		7
18:45 - 19:00	9		8		5		0	0	0	0		3
TOTAL												

From: TOWN To: ADAMS

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45												
6:45 - 7:00												
7:00 - 7:15												
7:15 - 7:30												
7:30 - 7:45												
7:45 - 8:00												
8:00 - 8:15												
8:15 - 8:30												
8:30 - 8:45												
8:45 - 9:00												
9:00 - 9:15												
9:15 - 9:30												
16:00 - 16:15	142		45		16		5	5	7	0		95
16:15 - 16:30	140		40		12		0	6	3	11		99
16:30 - 16:45	148		47		12		3	3	4	0		121
16:45 - 17:00	134		32		8		2	7	1	0		157
17:00 - 17:15	102		32		9		6	4	7	0		153
17:15 - 17:30	124		23		7		7	4	11	0		244
17:30 - 17:45	107		24		12		2	3	16	0		191
17:45 - 18:00	91		24		12		4	2	17	0		222
18:00 -18:15	119		32		12		0	4	16	1		251
18:15 - 18:30	157		24		11		2	7	7	1		236
18:30 - 18:45	131		34		17		1	2	7	1		162
18:45 - 19:00	101		24		12		1	2	4	0		119
TOTAL												

From: TOWN To: YANA

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45												
6:45 - 7:00												
7:00 - 7:15												
7:15 - 7:30												
7:30 - 7:45												
7:45 - 8:00												
8:00 - 8:15												
8:15 - 8:30												
8:30 - 8:45												
8:45 - 9:00												
9:00 - 9:15												
9:15 - 9:30												
16:00 - 16:15	17		1		0		0	0	1	0		18
16:15 - 16:30	15		1		0		0	0	0	0		11
16:30 - 16:45	18		1		0		0	0	0	0		25
16:45 - 17:00	15		3		0		0	0	0	0		24
17:00 - 17:15	22		4		0		0	0	0	0		36
17:15 - 17:30	10		0		0		1	0	0	0		61
17:30 - 17:45	16		0		0		1	0	0	0		106
17:45 - 18:00	22		1		0		0	0	0	0		92
18:00 -18:15	8		0		0		0	0	0	0		86
18:15 - 18:30	6		0		0		0	0	0	0		47
18:30 - 18:45	12		0		0		0	0	0	0		18
18:45 - 19:00	8		0		0		0	0	0	0		22
TOTAL												

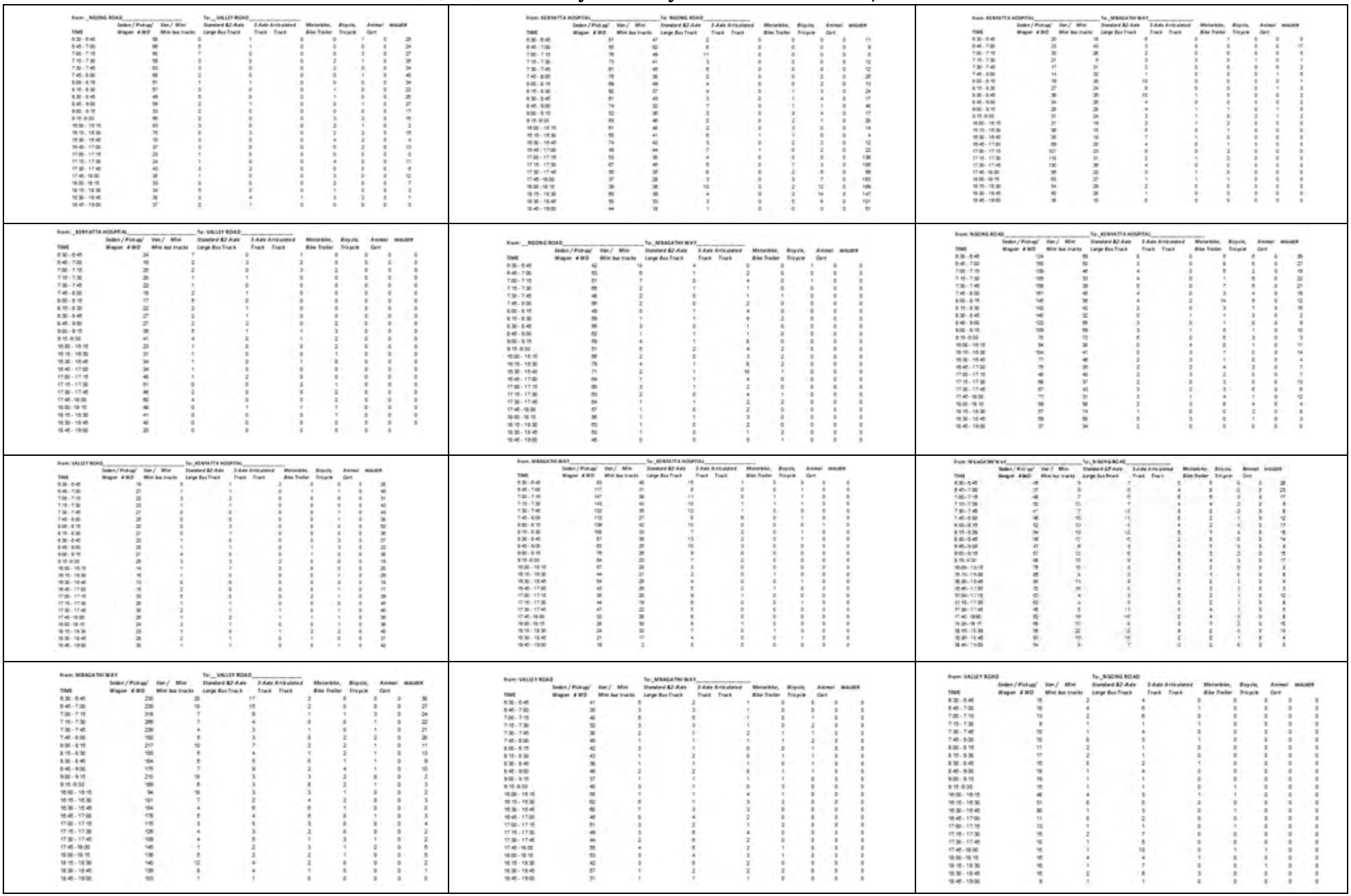
From: ADAMS To: TOWN

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45												
6:45 - 7:00												
7:00 - 7:15												
7:15 - 7:30												
7:30 - 7:45												
7:45 - 8:00												
8:00 - 8:15												
8:15 - 8:30												
8:30 - 8:45												
8:45 - 9:00												
9:00 - 9:15												
9:15 - 9:30												
16:00 - 16:15	89		42		8		2	4	0	0		57
16:15 - 16:30	75		39		1		1	3	0	0		61
16:30 - 16:45	66		47		5		2	5	2	0		54
16:45 - 17:00	88		33		4		5	3	1	0		72
17:00 - 17:15	68		32		9		1	4	0	0		88
17:15 - 17:30	71		26		2		1	6	2	0		101
17:30 - 17:45	67		29		1		4	3	5	0		104
17:45 - 18:00	80		12		2		4	1	0	0		157
18:00 -18:15	90		10		11		3	2	0	0		104
18:15 - 18:30	84		24		5		2	1	0	0		92
18:30 - 18:45	78		31		9		2	0	0	0		57
18:45 - 19:00	97		34		12		2	2	0			21
TOTAL												

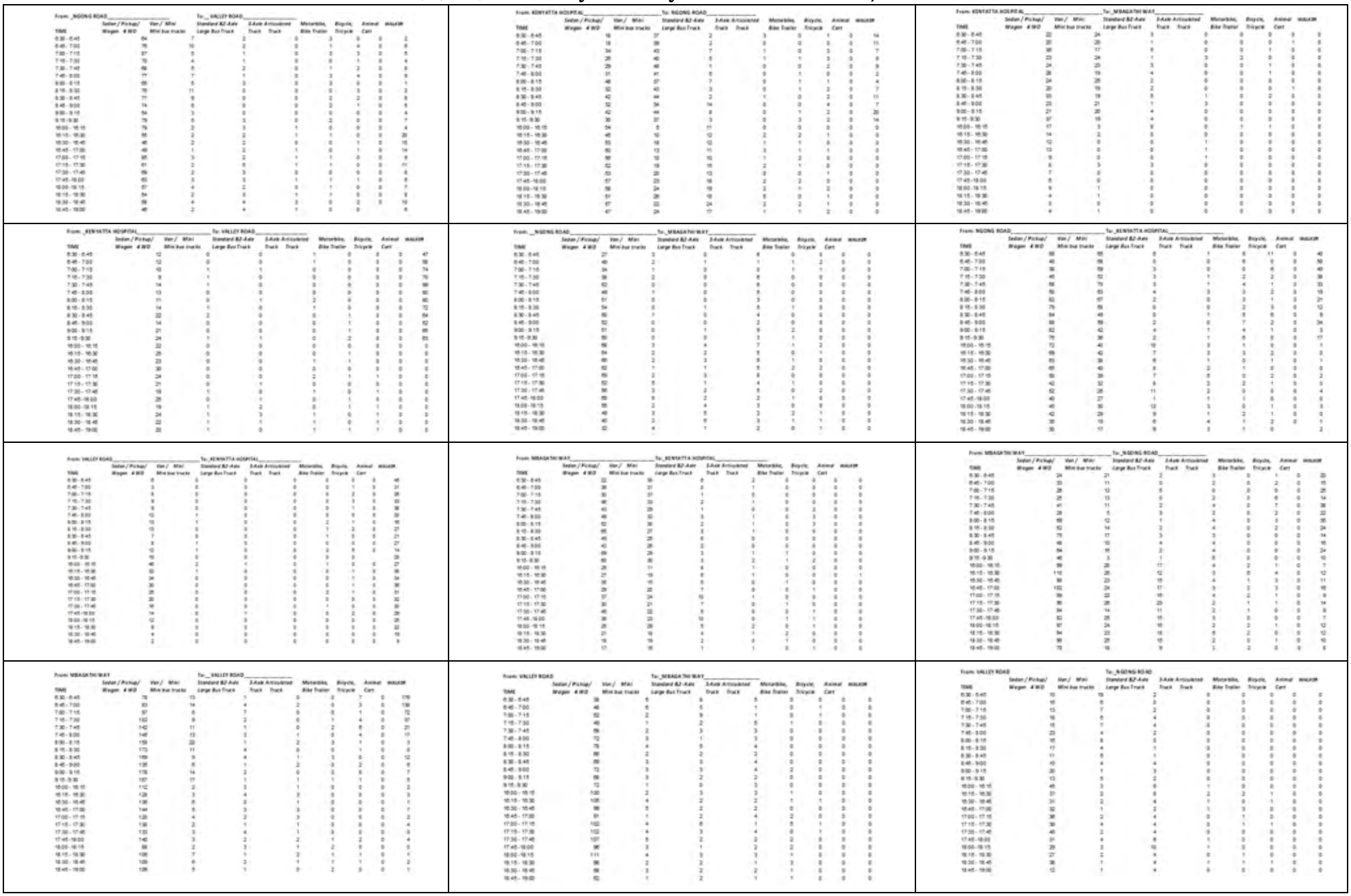
From: YANA To: TOWN

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45												
6:45 - 7:00												
7:00 - 7:15												
7:15 - 7:30												
7:30 - 7:45												
7:45 - 8:00												
8:00 - 8:15												
8:15 - 8:30												
8:30 - 8:45												
8:45 - 9:00												
9:00 - 9:15												
9:15 - 9:30												
16:00 - 16:15	20		1		0		0	0	0	0		29
16:15 - 16:30	9		0		0		0	0	1	0		59
16:30 - 16:45	19		0		0		0	0	1	0		90
16:45 - 17:00	18		0		0		0	0	0	0		219
17:00 - 17:15	28		1		0		0	0	0	1		315
17:15 - 17:30	21		1		0		0	0	1	0		287
17:30 - 17:45	29		2		0		0	0	1	0		458
17:45 - 18:00	28		1		0		1	0	3	0		281
18:00 -18:15	18		0		0		0	0	1	0		189
18:15 - 18:30	19		0		0		0	0	1	0		157
18:30 - 18:45	13		0		0		0	0	0	0		86
18:45 - 19:00	22		0		0		0	0	0	0		45
TOTAL												

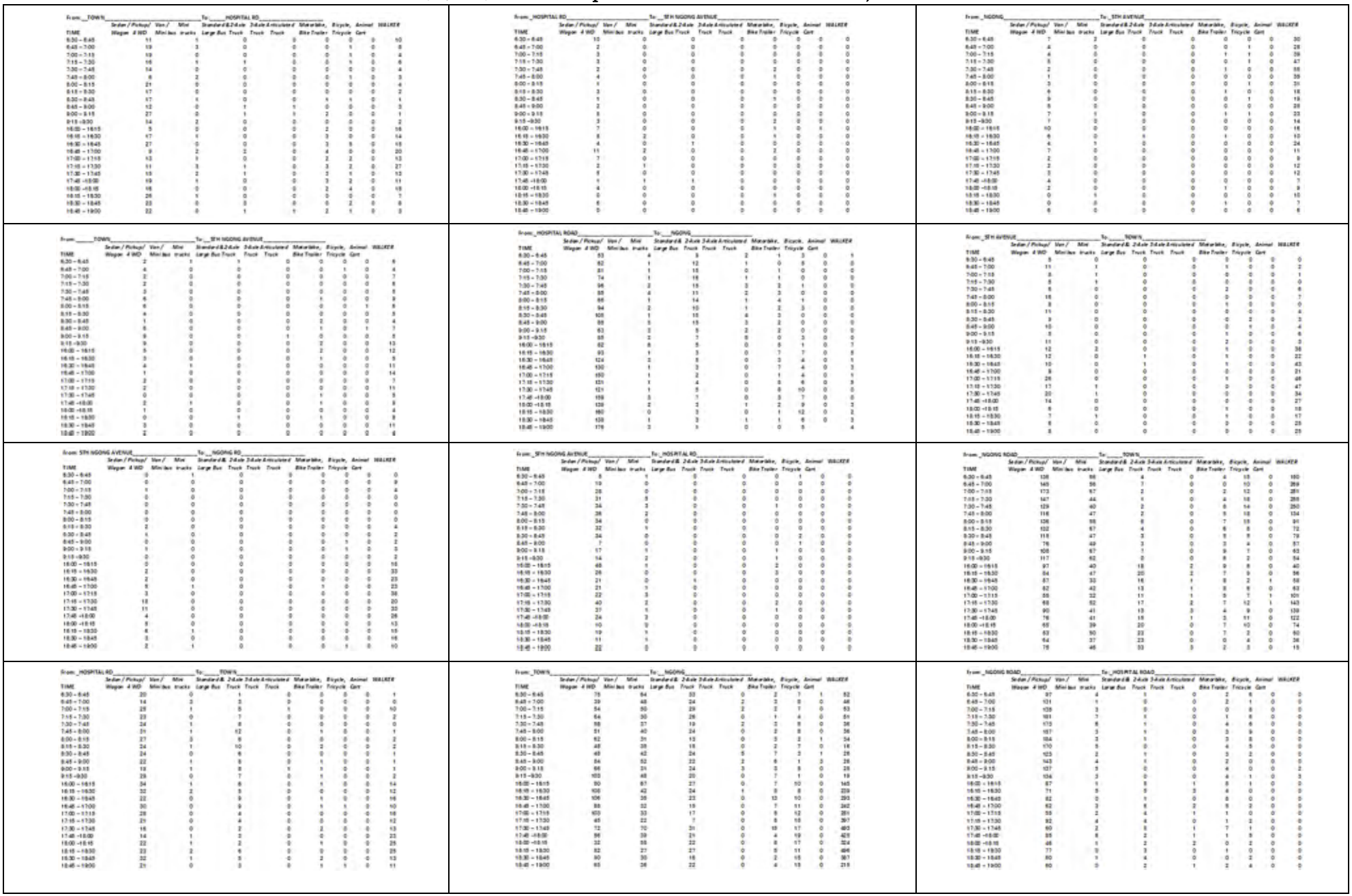
交差点交通量（City Mortuary Intersection: June 10, 2010）



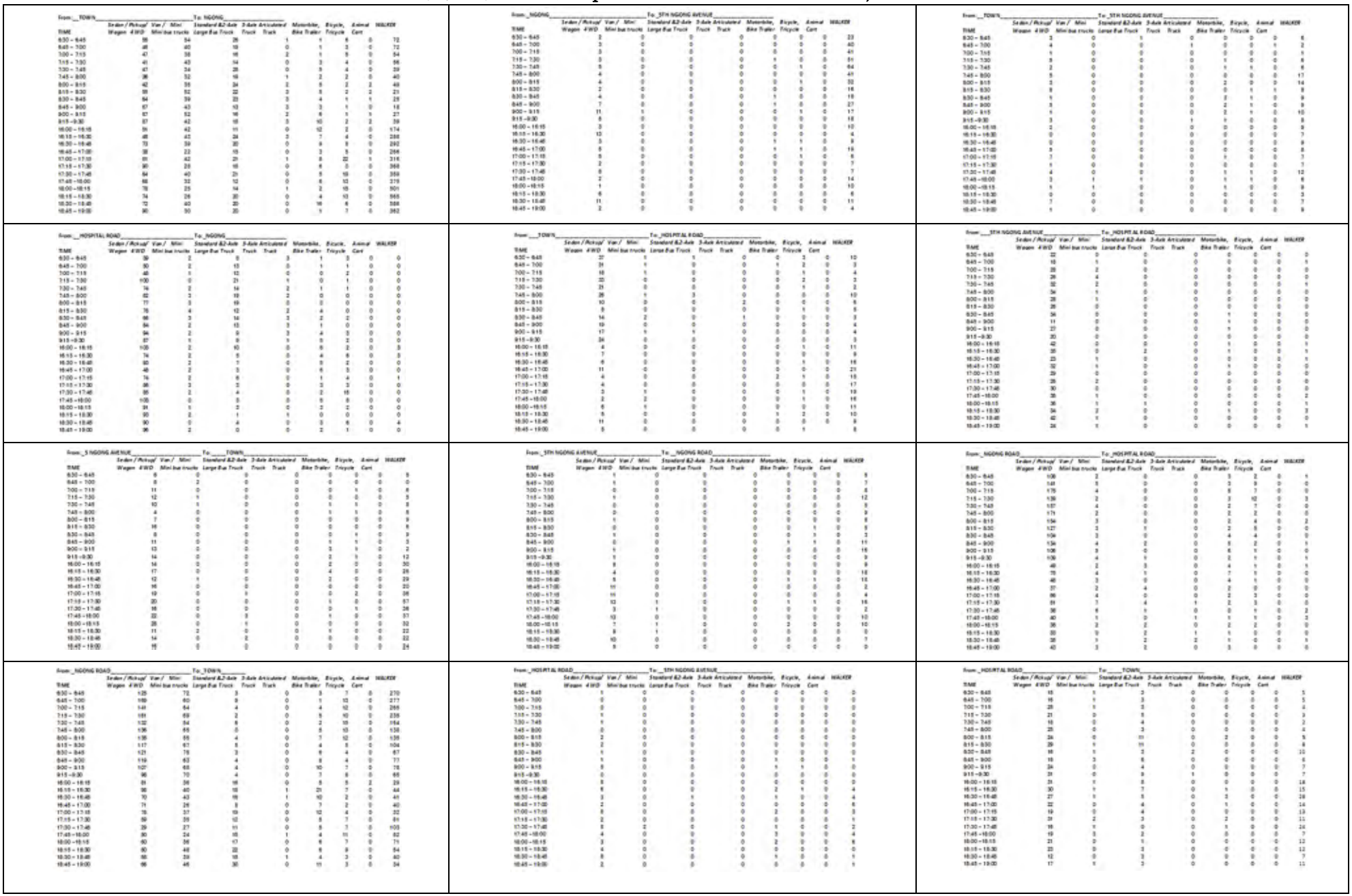
交差点交通量（City Mortuary Intersection: June 11, 2010）



交差点交通量（Hospital Road Intersection: June 2, 2010）



交差点交通量（Hospital Road Intersection: June 3, 2010）



交差点交通量（National Library Intersection: May 28, 2010）

From:_____NGONG ROAD_____ To:____3RD NGONG AVENUE_____

TIME	Sedan / Wagon	Pickup, Van / 4 WD	Mini bus	trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	Walker
6:30 - 6:45		7		0	0	0	0	0	0	0	0	3
6:45 - 7:00		12		0	1	0	0	1	0	0	1	
7:00 - 7:15		16		0	0	0	0	0	0	0	1	
7:15 - 7:30		6		0	0	0	0	1	0	0	0	
7:30 - 7:45		14		0	0	0	0	0	0	0	0	
7:45 - 8:00		8		0	0	0	0	1	0	0	2	
8:00 - 8:15		9		0	0	0	0	0	0	0	2	
8:15 - 8:30		5		1	0	0	0	0	0	0	1	
8:30 - 8:45		5		0	0	1	0	0	1	0	1	
8:45 - 9:00		7		0	0	0	0	1	0	0	0	
9:00 - 9:15		8		1	0	0	0	0	0	0	0	
9:15 -9:30		3		0	0	0	0	0	0	0	0	
16:00 - 16:15		15		4	1	0	3	1	1	1	0	
16:15 - 16:30		13		1	1	0	1	1	0	0	5	
16:30 - 16:45		11		0	0	0	1	0	0	0	8	
16:45 - 17:00		8		0	0	0	1	0	0	0	11	
17:00 - 17:15		12		0	0	0	0	0	0	0	3	
17:15 - 17:30		18		0	0	0	0	0	0	0	11	
17:30 - 17:45		6		1	1	0	0	0	0	0	8	
17:45 - 18:00		4		1	2	0	0	0	0	0	27	
18:00 -18:15		3		1	0	0	0	0	0	0	9	
18:15 - 18:30		2		0	0	0	0	0	0	0	8	
18:30 - 18:45		9		0	0	0	0	0	0	0	10	
18:45 - 19:00		4		0	0	0	0	0	0		7	

From:_HAILE SELASSIE_____ To:_____TOWN_____

TIME	Sedan / Wagon	Pickup, Van / 4 WD	Mini bus	trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		34		6	0	0	0	0	1	0	0	
6:45 - 7:00		61		4	0	0	0	0	0	0	0	
7:00 - 7:15		64		1	0	0	0	0	0	0	0	
7:15 - 7:30		42		5	0	0	0	0	0	0	0	
7:30 - 7:45		59		3	0	0	0	0	1	0	0	
7:45 - 8:00		43		3	0	0	0	0	3	0	0	
8:00 - 8:15		54		6	2	0	0	0	5	0	0	
8:15 - 8:30		67		9	0	0	0	0	2	1	0	
8:30 - 8:45		48		4	0	0	0	0	4	0	0	
8:45 - 9:00		53		5	0	0	0	0	6	1	0	
9:00 - 9:15		66		4	1	0	0	0	4	0	0	
9:15 -9:30		63		7	4	0	0	0	1	0	0	
16:00 - 16:15		36		15	0	0	0	0	1	0	0	
16:15 - 16:30		33		8	0	0	0	0	1	0	0	
16:30 - 16:45		36		9	1	0	0	0	4	1	1	
16:45 - 17:00		44		6	1	0	0	0	1	0	0	
17:00 - 17:15		58		13	0	0	0	0	4	0	0	
17:15 - 17:30		49		7	0	0	0	0	0	0	0	
17:30 - 17:45		54		11	0	0	0	0	2	0	0	
17:45 - 18:00		29		3	0	0	0	0	1	0	0	
18:00 -18:15		23		0	0	0	0	0	1	0	0	
18:15 - 18:30		22		0	0	0	0	0	0	0	0	
18:30 - 18:45		17		1	0	0	0	0	0	0	0	
18:45 - 19:00		13		0	0	0	0	0	0	0	0	

From:____3RD NGONG AVENUE_____ To:____TOWN_____

TIME	Sedan / Wagon	Pickup, Van / 4 WD	Mini bus	trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		5		0	1	0	0	0	0	0	0	
6:45 - 7:00		11		1	0	0	0	0	0	0	0	
7:00 - 7:15		8		1	0	0	0	0	0	0	0	
7:15 - 7:30		8		2	0	0	1	1	0	0	0	
7:30 - 7:45		9		0	0	0	0	0	0	0	0	
7:45 - 8:00		10		1	0	0	0	0	0	0	0	
8:00 - 8:15		13		2	0	0	0	0	0	0	0	
8:15 - 8:30		17		1	0	0	0	0	0	0	0	
8:30 - 8:45		15		2	0	0	0	0	0	0	0	
8:45 - 9:00		6		0	0	0	0	0	0	0	0	
9:00 - 9:15		7		0	0	0	0	0	0	0	0	
9:15 -9:30		11		0	0	0	0	0	0	0	0	
16:00 - 16:15		5		1	0	1	0	1	0	0	0	
16:15 - 16:30		13		1	1	0	0	0	0	0	0	
16:30 - 16:45		14		0	0	0	0	0	0	0	0	
16:45 - 17:00		9		2	0	0	1	0	0	0	0	
17:00 - 17:15		5		0	0	0	0	0	0	0	0	
17:15 - 17:30		10		2	0	0	0	0	0	0	0	
17:30 - 17:45		6		2	1	0	0	0	0	0	0	
17:45 - 18:00		0		0	0	0	0	0	0	0	0	
18:00 -18:15		11		1	0	0	0	0	0	0	0	
18:15 - 18:30		1		0	0	0	0	0	0	0	0	
18:30 - 18:45		7		1	0	0	0	0	0	0	0	
18:45 - 19:00		2		0	0	0	0	0	0	0	0	

From:_____NGONG _____ To:_____TOWN_____

TIME	Sedan / Wagon	Pickup, Van / 4 WD	Mini bus	trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		202		44	33	1	5	19	0	204		
6:45 - 7:00		173		46	31	2	5	17	0	193		
7:00 - 7:15		172		35	24	1	3	16	1	148		
7:15 - 7:30		217		42	31	0	8	16	1	135		
7:30 - 7:45		155		39	29	0	6	11	0	79		
7:45 - 8:00		154		61	41	1	10	6	0	77		
8:00 - 8:15		159		65	33	5	7	7	1	63		
8:15 - 8:30		150		53	26	2	2	7	0	79		
8:30 - 8:45		177		59	25	0	8	1	0	64		
8:45 - 9:00		136		44	21	3	13	4	1	81		
9:00 - 9:15		166		46	21	1	13	5	0	82		
9:15 -9:30		136		51	25	2	9	4	0	89		
16:00 - 16:15		142		35	28	2	8	2	0	18		
16:15 - 16:30		170		42	26	0	16	3	1	44		
16:30 - 16:45		194		50	36	2	5	6	1	27		
16:45 - 17:00		131		53	20	0	10	9	0	29		
17:00 - 17:15		139		31	25	0	7	6	0	15		
17:15 - 17:30		108		36	25	0	5	5	1	25		
17:30 - 17:45		134		52	29	3	6	6	0	27		
17:45 - 18:00		97		34	32	0	7	3	1	25		
18:00 -18:15		137		31	33	4	5	2	0	15		
18:15 - 18:30		120		59	34	2	2	0	0	12		
18:30 - 18:45		71		22	13	2	3	0	0	2		
18:45 - 19:00		88		60	30	0	1	0	0	2		

From:_____HAILE SELASSIE_____ To:_____NGONG_____

TIME	Sedan / Wagon	Pickup, Van / 4 WD	Mini bus	trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		80		31	15	0	5	7	2	120		
6:45 - 7:00		66		36	18	0	3	5	1	108		
7:00 - 7:15		58		48	26	0	1	3	0	74		
7:15 - 7:30		68		49	19	2	6	5	0	96		
7:30 - 7:45		40		35	21	0	4	1	1	60		
7:45 - 8:00		84		42	20	0	13	8	0	84		
8:00 - 8:15		102		49	17	1	5	1	0	61		
8:15 - 8:30		86		54	21	1	13	5	1	62		
8:30 - 8:45		85		48	17	1	7	4	0	84		
8:45 - 9:00		80		51	18	2	5	4	0	86		
9:00 - 9:15		89		51	21	2	6	2	3	98		
9:15 -9:30		61		15	10	0	2	4	1	56		
16:00 - 16:15		75		51	19	1	9	8	0	45		
16:15 - 16:30		50		18	8	2	5	5	0	39		
16:30 - 16:45		58		34	18	2	5	4	0	48		
16:45 - 17:00		82		28	17	1	14	2	1	43		
17:00 - 17:15		68		29	28	3	4	11	0	54		
17:15 - 17:30		50		11	16	2	3	7	0	90		
17:30 - 17:45		27		10	8	1	4	3	0	9		
17:45 - 18:00		39		27	16	0	3	4	0	45		
18:00 -18:15		57		35	22	0	5	8	0	54		
18:15 - 18:30		112		43	21	0	4	4	0	113		
18:30 - 18:45		63		46	44	1	8	3	0	67		
18:45 - 19:00		83		37	33	1	1	4	0	83		

From:_HAILE SELASSIE_____ To:____3RD NGONG AVENUE_____

TIME	Sedan / Wagon	Pickup, Van / 4 WD	Mini bus	trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		8		0	0	0	0	0	0	0	0	
6:45 - 7:00		8		1	0	0	0	0	0	0	0	
7:00 - 7:15		31		0	0	0	0	0	0	0	0	
7:15 - 7:30		11		0	0	0	0	2	0	0	0	
7:30 - 7:45		32		0	0	0	0	0	0	0	0	
7:45 - 8:00		15		0	0	0	0	0	0	0	0	
8:00 - 8:15		6		0	0	0	0	0	0	0	0	
8:15 - 8:30		14		0	0	0	0	0	0	0	0	
8:30 - 8:45		11		0	0	0	0	0	0	0	0	
8:45 - 9:00		7		0	0	0	0	0	0	0	0	
9:00 - 9:15		5		0	0	0	1	0	0	0	0	
9:15 -9:30		3		0	0	0	3	1	1	0	0	
16:00 - 16:15		15		4	1	0	1	1	0	0	0	
16:15 - 16:30		13		1	1	0	1	0	0	0	5	
16:30 - 16:45		11		0	0	0	1	0	0	0	8	
16:45 - 17:00		8		0	0	0	0	0	0	0	11	
17:00 - 17:15		12		0	0	0	0	0	0	0	3	
17:15 - 17:30		18		0	0	0	0	0	0	0	11	
17:30 - 17:45		6		1	1	0	0	0	0	0	8	
17:45 - 18:00		4		1	2	0	0	0	0	0	27	
18:00 -18:15		3		1	0	0	0	0	0	0	9	
18:15 - 18:30		2		0	0	0	1	0	0	0	8	
18:30 - 18:45		9		0	0	0	0	0	0	0	10	
18:45 - 19:00		4		0	0	0	0	0	0	0	7	

交差点交通量（National Library Intersection: May 31, 2010）

From:__HAILE SELASSIE_____ To:___TOWN_____

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		27		1		2		0	1	0	0	4
6:45 - 7:00		41		0		1		0	0	0	0	5
7:00 - 7:15		59		2		2		1	1	0	0	2
7:15 - 7:30		39		0		0		0	0	0	0	5
7:30 - 7:45		62		0		1		0	0	0	0	3
7:45 - 8:00		69		5		8		3	0	2	0	10
8:00 - 8:15		61		2		1		2	1	0	0	9
8:15 - 8:30		63		1		1		1	3	1	0	17
8:30 - 8:45		61		1		4		1	1	0	0	3
8:45 - 9:00		53		2		4		1	3	1	0	4
9:00 - 9:15		40		4		3		2	2	0	0	6
9:15 -9:30		41		4		4		0	1	0	0	5
16:00 - 16:15												
16:15 - 16:30												
16:30 - 16:45												
16:45 - 17:00												
17:00 - 17:15												
17:15 - 17:30												
17:30 - 17:45												
17:45 - 18:00												
18:00 -18:15												
18:15 - 18:30												
18:30 - 18:45												
18:45 - 19:00												

From:__NGONG ROAD_____ To:__3RD AVENUE(NGONG)_____

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		7		0		0		0	0	0	0	1
6:45 - 7:00		9		0		0		0	0	0	0	4
7:00 - 7:15		14		0		0		0	0	0	0	0
7:15 - 7:30		5		0		0		0	0	0	0	2
7:30 - 7:45		6		0		0		0	0	1	0	1
7:45 - 8:00		13		0		0		0	0	0	0	1
8:00 - 8:15		6		0		0		0	0	0	0	2
8:15 - 8:30		4		0		0		0	0	0	0	0
8:30 - 8:45		4		0		0		0	0	0	0	0
8:45 - 9:00		2		0		0		0	0	0	0	0
9:00 - 9:15		5		0		0		0	0	0	0	1
9:15 -9:30		6		0		0		0	0	1	0	1
16:00 - 16:15												
16:15 - 16:30												
16:30 - 16:45												
16:45 - 17:00												
17:00 - 17:15												
17:15 - 17:30												
17:30 - 17:45												
17:45 - 18:00												
18:00 -18:15												
18:15 - 18:30												
18:30 - 18:45												
18:45 - 19:00												

From:_HAILE SELASSIE_____ To:___NGONG_____

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		47		44		20		0	4	2	0	71
6:45 - 7:00		83		59		18		0	2	4	0	54
7:00 - 7:15		71		31		21		1	1	4	0	29
7:15 - 7:30		79		41		21		0	2	8	0	30
7:30 - 7:45		65		33		24		0	2	7	0	37
7:45 - 8:00		65		44		28		0	3	5	0	34
8:00 - 8:15		38		49		28		0	7	10	0	53
8:15 - 8:30		67		48		18		1	6	6	0	39
8:30 - 8:45		84		58		26		0	4	7	1	38
8:45 - 9:00		80		53		30		0	9	5	0	33
9:00 - 9:15		60		55		24		1	3	2	0	32
9:15 -9:30		84		52		20		0	9	4	0	48
16:00 - 16:15												
16:15 - 16:30												
16:30 - 16:45												
16:45 - 17:00												
17:00 - 17:15												
17:15 - 17:30												
17:30 - 17:45												
17:45 - 18:00												
18:00 -18:15												
18:15 - 18:30												
18:30 - 18:45												
18:45 - 19:00												

From:_____HAILE SELASSIE_____ To:____3RD NGONG AVENUE_____

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		11		1		0		0	0	0	1	12
6:45 - 7:00		9		0		0		0	0	0	0	8
7:00 - 7:15		17		0		0		0	0	0	0	9
7:15 - 7:30		13		0		0		0	0	0	0	11
7:30 - 7:45		14		0		0		0	0	0	0	5
7:45 - 8:00		20		0		0		0	0	0	0	10
8:00 - 8:15		20		0		0		0	1	0	0	12
8:15 - 8:30		3		0		0		0	0	0	1	7
8:30 - 8:45		6		0		0		0	2	1	0	5
8:45 - 9:00		3		0		0		0	0	0	0	3
9:00 - 9:15		7		0		0		0	0	0	1	8
9:15 -9:30		4		0		0		0	0	0	0	13
16:00 - 16:15												
16:15 - 16:30												
16:30 - 16:45												
16:45 - 17:00												
17:00 - 17:15												
17:15 - 17:30												
17:30 - 17:45												
17:45 - 18:00												
18:00 -18:15												
18:15 - 18:30												
18:30 - 18:45												
18:45 - 19:00												

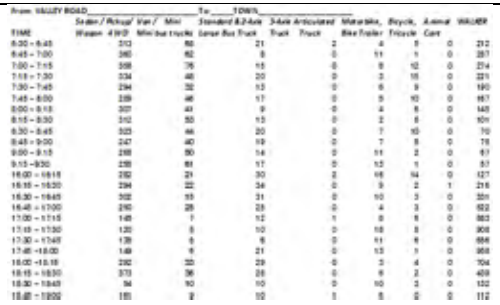
From:__NGONG_____ To:_____TOWN_____

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		190		64		36		0	4	15	0	159
6:45 - 7:00		140		50		34		1	4	11	0	137
7:00 - 7:15		176		39		28		3	12	2	0	166
7:15 - 7:30		190		48		26		2	2	9	0	245
7:30 - 7:45		206		43		26		1	7	15	1	158
7:45 - 8:00		192		42		27		1	1	19	0	217
8:00 - 8:15		190		56		32		0	4	12	0	164
8:15 - 8:30		179		61		48		0	7	6	0	134
8:30 - 8:45		147		53		35		0	10	8	0	141
8:45 - 9:00		137		48		31		1	13	4	0	86
9:00 - 9:15		133		61		26		1	9	7	1	90
9:15 -9:30		142		40		29		2	9	2	0	78
14:00 - 16:15												
16:15 - 16:30												
16:30 - 16:45												
16:45 - 17:00												
17:00 - 17:15												
17:15 - 17:30												
17:30 - 17:45												
17:45 -18:00												
18:00 -18:15												
18:15 - 18:30												
18:30 - 18:45												
18:45 - 19:00												

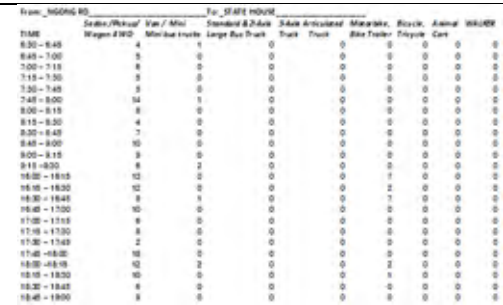
From:__NGONG 3RD AVENUE_____ To:____TOWN_____

TIME	Sedan / Wagon	Pickup/ 4 WD	Van / Mini bus	Mini trucks	Standard & Large Bus	2-Axle Truck	3-Axle Truck	Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 - 6:45		5		0		0		0	1	1	0	6
6:45 - 7:00		7		3		0		0	0	0	0	2
7:00 - 7:15		7		1		0		0	0	0	0	3
7:15 - 7:30		8		1		1		0	0	0	0	3
7:30 - 7:45		3		1		0		0	0	0	0	8
7:45 - 8:00		12		0		1		0	0	0	0	4
8:00 - 8:15		4		0		0		0	1	1	0	3
8:15 - 8:30		6		0		1		0	0	0	0	3
8:30 - 8:45		5		0		1		0	0	0	0	4
8:45 - 9:00		8		0		0		1	3	0	0	4
9:00 - 9:15		6		1		0		0	0	0	0	3
9:15 -9:30		4		0		0		0	0	0	1	5
16:00 - 16:15												
16:15 - 16:30												
16:30 - 16:45												
16:45 - 17:00												
17:00 - 17:15												
17:15 - 17:30												
17:30 - 17:45												
17:45 -18:00												
18:00 -18:15												
18:15 - 18:30												
18:30 - 18:45												
18:45 - 19:00												

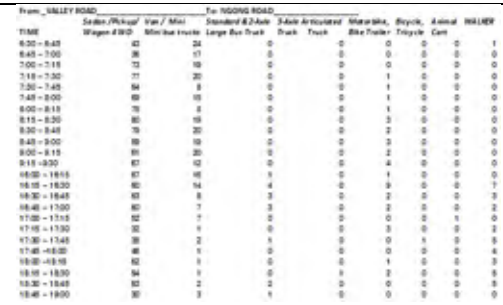
交差点交通量（All Saint Cathedral Intersection: June 2, 2010）



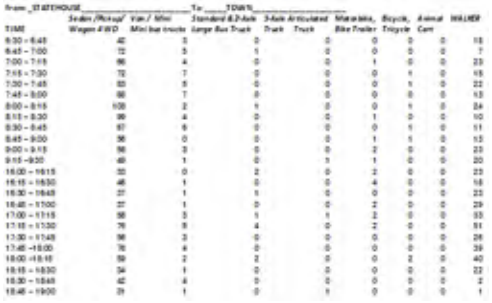
TIME	Sedan / Pickup / Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	312	50	21	2	4	1	0	212		
6:45 – 7:00	340	62	8	0	11	1	0	257		
7:00 – 7:15	338	76	15	0	9	12	0	214		
7:15 – 7:30	334	48	20	0	3	15	0	221		
7:30 – 7:45	294	52	13	0	6	9	0	190		
7:45 – 8:00	289	46	17	0	5	10	0	167		
8:00 – 8:15	307	43	9	0	4	8	0	148		
8:15 – 8:30	312	53	13	0	2	8	0	101		
8:30 – 8:45	323	46	20	0	7	10	0	70		
8:45 – 9:00	247	40	19	0	7	8	0	78		
9:00 – 9:15	288	50	14	0	11	2	0	61		
9:15 –9:30	238	61	17	0	13	1	0	51		
16:00 – 16:15	292	21	30	2	16	14	0	127		
16:15 – 16:30	294	22	34	0	9	2	1	216		
16:30 – 16:45	302	15	31	0	10	3	0	201		
16:45 – 17:00	290	28	28	0	4	3	0	152		
17:00 – 17:15	148	7	12	1	8	8	0	863		
17:15 – 17:30	130	9	10	0	16	8	0	908		
17:30 – 17:45	138	6	6	0	11	6	0	956		
17:45 –18:00	149	6	21	0	13	1	0	958		
18:00 –18:15	292	33	29	0	3	4	0	704		
18:15 – 18:30	373	36	28	0	6	2	0	409		
18:30 – 18:45	94	10	10	0	10	3	0	152		
18:45 – 19:00	151	9	10	1	5	0	0	112		



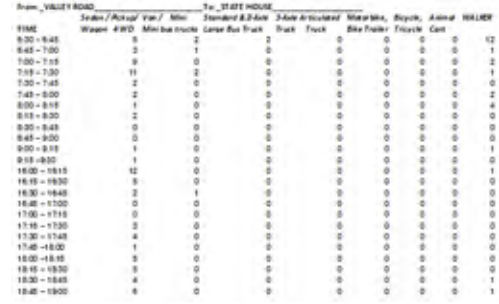
TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	4	1	0	0	0	0	0	0		
6:45 – 7:00	5	0	0	0	0	0	0	0		
7:00 – 7:15	8	0	0	0	0	0	0	0		
7:15 – 7:30	5	0	0	0	0	0	0	0		
7:30 – 7:45	5	0	0	0	0	0	0	0		
7:45 – 8:00	14	1	0	0	0	0	0	0		
8:00 – 8:15	8	0	0	0	0	0	0	0		
8:15 – 8:30	4	0	0	0	0	0	0	0		
8:30 – 8:45	7	0	0	0	0	0	0	0		
8:45 – 9:00	10	0	0	0	0	0	0	0		
9:00 – 9:15	9	0	0	0	0	0	0	0		
9:15 –9:30	8	2	0	0	0	0	0	0		
16:00 – 16:15	13	0	0	0	0	1	0	0		
16:15 – 16:30	12	0	0	0	0	2	0	0		
16:30 – 16:45	9	1	0	0	0	1	0	0		
16:45 – 17:00	10	0	0	0	0	0	0	0		
17:00 – 17:15	9	0	0	0	0	0	0	0		
17:15 – 17:30	8	0	0	0	0	0	0	0		
17:30 – 17:45	2	0	0	0	0	0	0	0		
17:45 –18:00	10	0	0	0	0	0	0	0		
18:00 –18:15	12	2	0	0	0	2	0	0		
18:15 – 18:30	10	0	0	0	0	1	0	0		
18:30 – 18:45	6	0	0	0	0	0	0	0		
18:45 – 19:00	9	0	0	0	0	0	0	0		



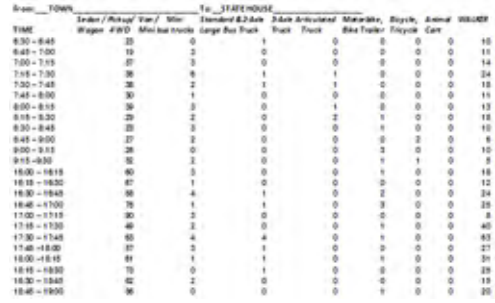
TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	42	24	0	0	0	0	0	1		
6:45 – 7:00	36	17	0	0	0	0	0	0		
7:00 – 7:15	73	19	0	0	0	0	0	0		
7:15 – 7:30	77	20	0	0	0	1	0	0		
7:30 – 7:45	64	8	0	0	0	1	0	0		
7:45 – 8:00	69	15	0	0	0	1	0	0		
8:00 – 8:15	78	8	0	0	0	1	0	0		
8:15 – 8:30	80	16	0	0	0	3	0	0		
8:30 – 8:45	79	20	0	0	0	2	0	0		
8:45 – 9:00	89	19	0	0	0	3	0	0		
9:00 – 9:15	91	20	0	0	0	2	0	0		
9:15 –9:30	87	12	0	0	0	4	0	0		
16:00 – 16:15	87	16	1	0	0	1	0	0		
16:15 – 16:30	80	14	4	0	0	9	0	1		
16:30 – 16:45	83	8	3	0	0	2	0	3		
16:45 – 17:00	80	7	3	0	0	2	0	2		
17:00 – 17:15	82	7	0	0	0	0	1	0		
17:15 – 17:30	92	9	0	0	0	3	0	3		
17:30 – 17:45	88	2	1	0	0	1	0	5		
17:45 –18:00	86	5	0	0	0	0	0	4		
18:00 –18:15	82	1	0	0	0	1	0	3		
18:15 – 18:30	94	1	0	0	0	2	0	5		
18:30 – 18:45	93	2	2	0	0	0	0	0		
18:45 – 19:00	90	3	1	0	0	0	0	0		



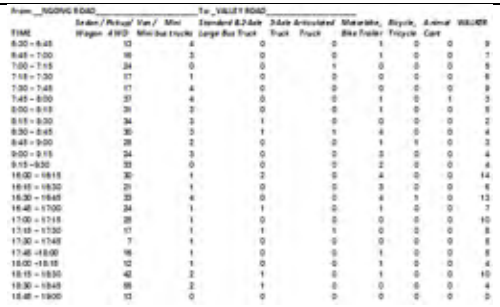
TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	42	5	0	0	0	0	0	18		
6:45 – 7:00	72	5	1	0	0	0	0	7		
7:00 – 7:15	66	4	0	0	1	0	0	23		
7:15 – 7:30	72	7	0	0	0	0	0	18		
7:30 – 7:45	63	5	0	0	0	1	0	22		
7:45 – 8:00	66	7	0	0	0	0	0	13		
8:00 – 8:15	108	2	1	0	0	1	0	24		
8:15 – 8:30	99	4	0	0	1	0	0	10		
8:30 – 8:45	67	6	0	0	0	0	0	11		
8:45 – 9:00	96	0	0	0	1	1	0	15		
9:00 – 9:15	96	3	0	0	0	2	0	23		
9:15 –9:30	60	1	0	0	1	1	0	20		
16:00 – 16:15	33	0	2	0	0	2	0	23		
16:15 – 16:30	46	1	0	0	0	4	0	18		
16:30 – 16:45	37	1	1	0	0	0	0	23		
16:45 – 17:00	37	1	0	0	0	2	0	29		
17:00 – 17:15	56	3	1	0	1	2	0	33		
17:15 – 17:30	79	5	4	0	0	2	0	51		
17:30 – 17:45	96	3	0	0	0	0	0	28		
17:45 –18:00	76	4	0	0	0	0	0	39		
18:00 –18:15	59	2	2	0	0	2	0	40		
18:15 – 18:30	54	1	0	0	0	0	0	22		
18:30 – 18:45	42	4	0	0	0	0	0	2		
18:45 – 19:00	31	1	0	0	1	0	0	1		



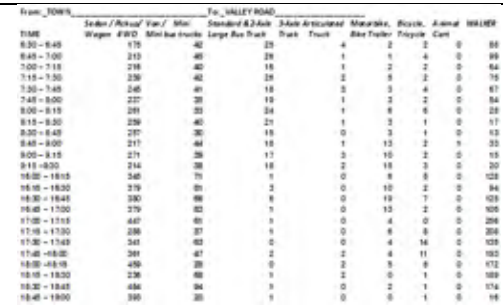
TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	5	2	2	0	0	0	0	12		
6:45 – 7:00	3	1	0	0	0	0	0	1		
7:00 – 7:15	9	0	0	0	0	0	0	2		
7:15 – 7:30	11	2	0	0	0	0	0	1		
7:30 – 7:45	2	0	0	0	0	0	0	0		
7:45 – 8:00	2	0	0	0	0	0	0	2		
8:00 – 8:15	1	0	0	0	0	0	0	4		
8:15 – 8:30	2	0	0	0	0	0	0	0		
8:30 – 8:45	0	0	0	0	0	0	0	0		
8:45 – 9:00	0	0	0	0	0	0	0	0		
9:00 – 9:15	1	0	0	0	0	0	0	1		
9:15 –9:30	1	0	0	0	0	0	0	0		
16:00 – 16:15	12	0	0	0	0	0	0	1		
16:15 – 16:30	5	0	0	0	0	0	0	0		
16:30 – 16:45	2	1	0	0	0	0	0	0		
16:45 – 17:00	0	0	0	0	0	0	0	0		
17:00 – 17:15	0	0	0	0	0	0	0	0		
17:15 – 17:30	3	0	0	0	0	0	0	0		
17:30 – 17:45	4	0	0	0	0	0	0	0		
17:45 –18:00	1	0	0	0	0	0	0	0		
18:00 –18:15	5	0	0	0	0	0	0	0		
18:15 – 18:30	5	0	0	0	0	0	0	0		
18:30 – 18:45	4	0	0	0	0	0	0	1		
18:45 – 19:00	6	0	0	0	0	0	0	1		



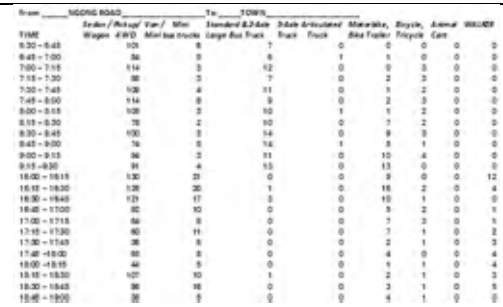
TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	23	0	1	0	0	0	0	10		
6:45 – 7:00	19	3	0	0	0	0	0	11		
7:00 – 7:15	37	3	0	0	0	0	0	14		
7:15 – 7:30	39	6	1	1	1	0	0	24		
7:30 – 7:45	38	2	1	1	0	0	0	15		
7:45 – 8:00	30	1	0	0	0	0	0	11		
8:00 – 8:15	39	3	0	1	0	0	0	13		
8:15 – 8:30	29	2	0	0	2	1	0	18		
8:30 – 8:45	23	3	0	0	0	1	0	13		
8:45 – 9:00	27	2	0	0	0	2	0	6		
9:00 – 9:15	28	0	0	0	3	0	0	10		
9:15 –9:30	52	3	0	0	0	1	0	8		
16:00 – 16:15	60	3	0	0	0	1	0	16		
16:15 – 16:30	67	1	0	0	0	0	0	12		
16:30 – 16:45	58	4	1	0	0	2	0	24		
16:45 – 17:00	76	1	1	0	0	3	0	28		
17:00 – 17:15	80	3	0	0	0	0	0	8		
17:15 – 17:30	49	3	0	0	0	1	0	40		
17:30 – 17:45	65	4	4	0	0	1	0	63		
17:45 –18:00	57	3	1	0	0	0	0	27		
18:00 –18:15	61	1	1	0	0	1	0	31		
18:15 – 18:30	73	0	1	0	0	0	0	28		
18:30 – 18:45	62	2	0	0	0	0	0	15		
18:45 – 19:00	56	0	0	0	0	1	0	0	20	



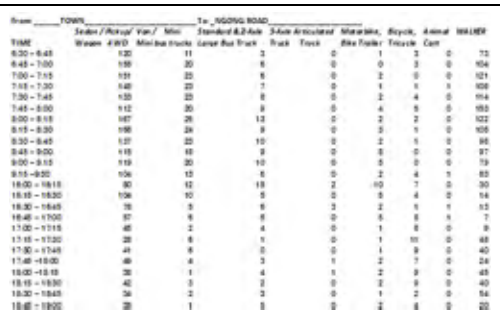
TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	13	4	0	0	1	0	0	9		
6:45 – 7:00	16	3	0	0	1	0	0	7		
7:00 – 7:15	24	0	0	1	0	0	0	8		
7:15 – 7:30	17	1	0	0	0	0	0	9		
7:30 – 7:45	17	4	0	0	0	0	0	9		
7:45 – 8:00	37	4	0	0	1	0	1	3		
8:00 – 8:15	31	2	0	0	1	0	0	5		
8:15 – 8:30	34	3	1	1	0	0	0	4		
8:30 – 8:45	30	3	1	1	4	0	0	4		
8:45 – 9:00	28	2	0	0	1	1	0	3		
9:00 – 9:15	24	3	0	0	3	0	0	4		
9:15 –9:30	33	0	0	0	2	0	0	4		
16:00 – 16:15	30	1	2	0	4	0	0	14		
16:15 – 16:30	21	1	0	0	3	0	0	5		
16:30 – 16:45	33	4	0	0	4	1	0	13		
16:45 – 17:00	24	1	1	0	1	0	0	7		
17:00 – 17:15	28	1	0	0	0	0	0	10		
17:15 – 17:30	17	1	1	1	0	0	0	8		
17:30 – 17:45	7	1	0	0	0	0	0	5		
17:45 –18:00	16	1	0	0	1	0	0	8		
18:00 –18:15	12	1	0	0	1	0	0	4		
18:15 – 18:30	42	2	1	0	0	0	0	10		
18:30 – 18:45	16	2	1	0	0	0	0	4		
18:45 – 19:00	13	0	0	0	0	0	0	0		



TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	175	42	25	4	2	2	0	86		
6:45 – 7:00	213	46	28	1	1	4	0	99		
7:00 – 7:15	218	40	18	1	2	2	0	84		
7:15 – 7:30	239	42	28	2	5	2	0	76		
7:30 – 7:45	245	41	18	5	3	4	0	67		
7:45 – 8:00	227	35	19	1	3	2	0	54		
8:00 – 8:15	261	33	24	1	6	6	0	28		
8:15 – 8:30	239	40	21	1	3	1	0	17		
8:30 – 8:45	237	30	15	0	3	1	0	13		
8:45 – 9:00	217	44	18	1	13	2	1	33		
9:00 – 9:15	271	39	17	3	10	2	0	15		
9:15 –9:30	214	38	18	2	15	3	0	20		
16:00 – 16:15	348	71	1	0	8	8	0	128		
16:15 – 16:30	379	51	3	0	10	2	0	94		
16:30 – 16:45	390	66	5	0	19	7	0	125		
16:45 – 17:00	379	63	1	0	13	2	0	105		
17:00 – 17:15	447	61	1	0	4	0	0	256		
17:15 – 17:30	286	37	1	0	6	6	0	206		
17:30 – 17:45	341	63	0	0	4	14	0	135		
17:45 –18:00	391	47	2	2	4	11	0	183		
18:00 –18:15	459	39	0	2	5	9	0	172		
18:15 – 18:30	236	66	1	2	0	1	0	169		
18:30 – 18:45	484	94	1	0	2	1	0	174		
18:45 – 19:00	396	35	1	0	0	1	0	16		

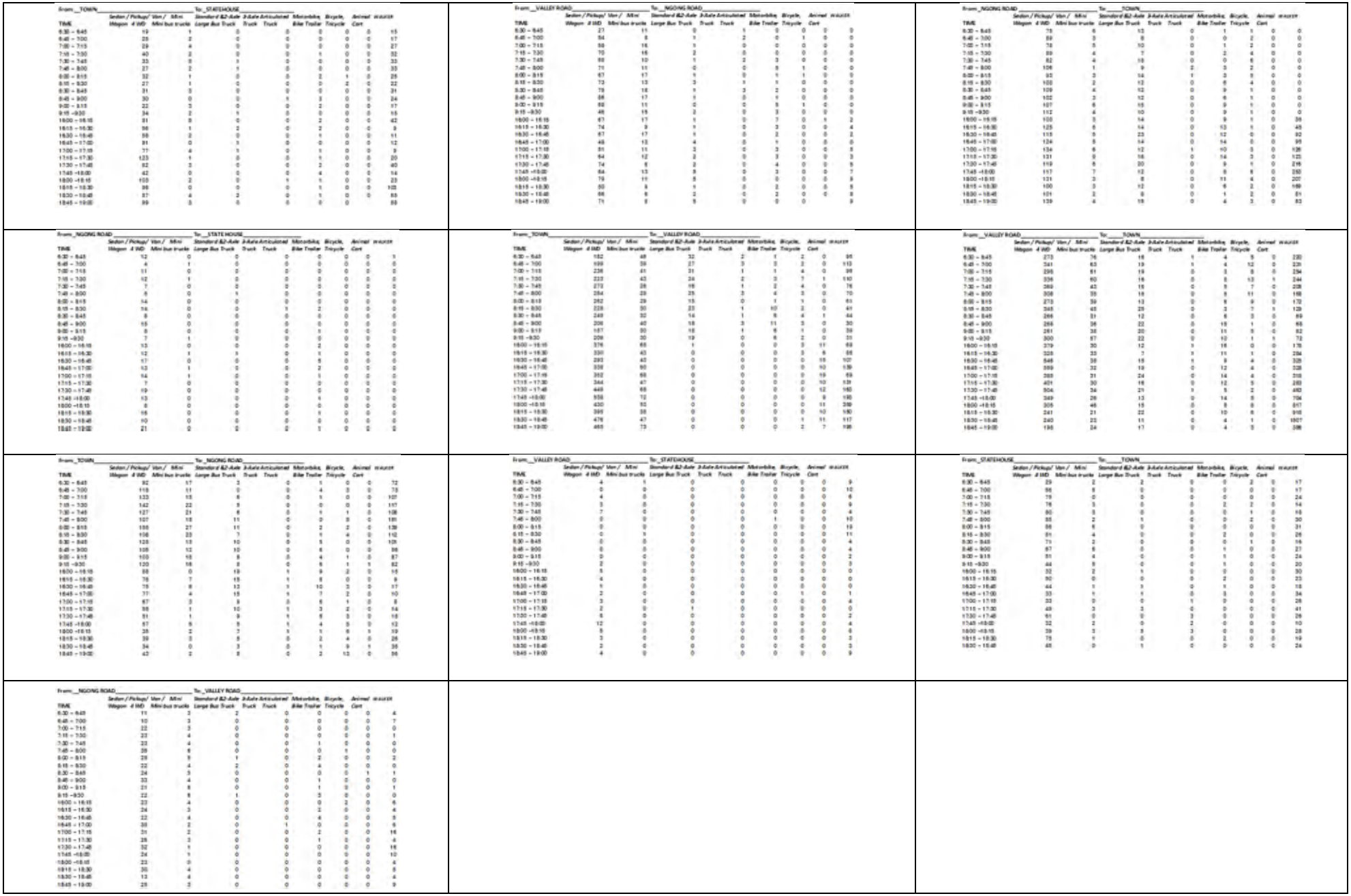


TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	103	6	7	0	0	0	0	0		
6:45 – 7:00	84	5	6	1	1	0	0	0		
7:00 – 7:15	114	3	12	0	0	3	0	0		
7:15 – 7:30	98	3	7	0	2	3	0	0		
7:30 – 7:45	109	4	11	0	1	2	0	0		
7:45 – 8:00	114	6	9	0	2	3	0	0		
8:00 – 8:15	109	2	10	1	1	2	0	0		
8:15 – 8:30	78	2	10	0	2	0	0	0		
8:30 – 8:45	100	5	14	0	9	3	0	0		
8:45 – 9:00	74	5	14	1	5	1	0	0		
9:00 – 9:15	94	3	11	0	10	4	0	0		
9:15 –9:30	91	4	10	0	13	0	0	0		
16:00 – 16:15	130	20	2	0	9	0	0	12		
16:15 – 16:30	128	20	1	0	16	2	0	4		
16:30 – 16:45	121	17	3	0	10	1	0	0		
16:45 – 17:00	92	10	0	0	9	2	0	1		
17:00 – 17:15	84	8	0	0	7	1	0	1		
17:15 – 17:30	90	11	0	0	7	1	0	2		
17:30 – 17:45	36	5	0	0	2	1	0	3		
17:45 –18:00	60	6	0	0	4	0	0	4		
18:00 –18:15	44	5	0	0	1	1	0	4		
18:15 – 18:30	107	10	1	0	2	1	0	3		
18:30 – 18:45	96	16	0	0	3	1	0	5		
18:45 – 19:00	92	8	0	0	4	1	0	0		



TIME	Sedan /Pickup/ Wagon 4WD	Van / Mini Bus	Mini bus trucks	Standard & 2-Axle Large Bus	3-Axle Articulated Truck	4-Axle Articulated Truck	Motorbike, Bike Trailer	Bicycle, Tricycle	Animal Cart	WALKER
6:30 – 6:45	120	11	3	0	1	3	0	73		
6:45 – 7:00	159	20	6	0	0	3	0	104		
7:00 – 7:15	151	23	6	0	2	0	0	121		
7:15 – 7:30	148	23	7	0	1	1	1	108		
7:30 – 7:45	133	23	8	0	2	4	0	114		
7:45 – 8:00	112	26	9	0	4	5	0	153		
8:00 – 8:15	147	26	13	0	2	2	0	122		
8:15 – 8:30	156	24	9	0	3	1	0	106		
8:30 – 8:45	137	22	10	0	2	1	0	86		
8:45 – 9:00	116	18	8	0	5	0	0	87		
9:00 – 9:15	119	20	10	0	5	0	0	79		
9:15 –9:30	106	13	6	0	2	4	1	83		
16:00 – 16:15	80	12	19	2	10	7	0	30		
16:15 – 16:30	104	10	5	0	5	4	0	14		
16:30 – 16:45	76	5	6	3	2	1	1	13		
16:45 – 17:00	57	6	6	0	5	5	1	7		
17:00 – 17:15	46	2	4	0	1	0	0	9		
17:15 – 17:30	28	6	1	0	1	10	0	48		
17:30 – 17:45	41	6	0	0	1	9	0	40		
17:45 –18:00	46	4	3	1	2	7	0	24		
18:00 –18:15	36	1	4	1	2	9	0	48		
18:15 – 18:30	42	3	2	0	2	9	0	40		
18:30 – 18:45	34	2	2	0	1	2	0	14		
18:45 – 19:00	38	1	5	0	2	6	0	20		

交差点交通量（All Saint Cathedral Intersection: June 3, 2010）

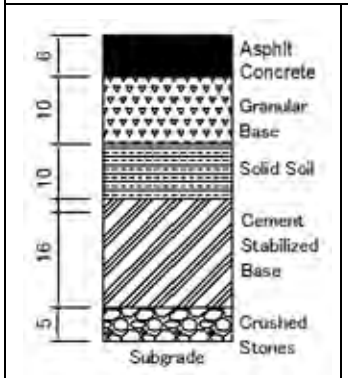
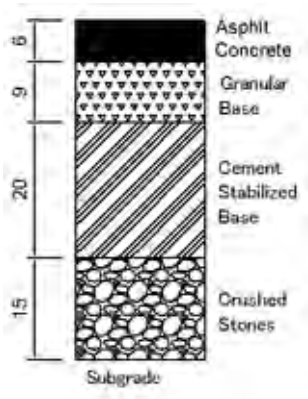
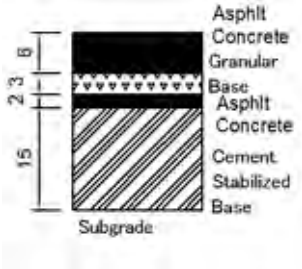
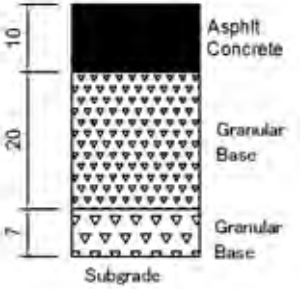
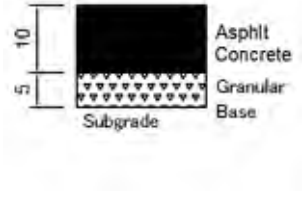


土質試験結果

(1) ベンケルマンビーム試験結果

CHAINAGE	SIDE	DMAX (1/100mm)	Moving Ave. (1/100mm)
0+100	R	36	25
0+100	L	36	24
0+300	R	22	24
0+300	L	14	25
0+500	R	36	26
0+500	L	26	25
0+700	R	16	24
0+700	L	18	25
0+900	R	30	25
0+900	L	20	24
1+100	R	20	25
1+100	L	18	25
1+300	R	24	25
1+300	L	36	25
1+500	R	30	25
1+500	L	15	24
1+700	R	26	24
1+700	L	20	24
1+900	R	20	24
1+900	L	30	25
2+100	R	26	25
2+100	L	28	25
2+300	R	30	25
2+300	L	32	24
2+500	R	32	23
2+500	L	28	23
2+700	R	20	22
2+700	L	18	22
2+900	R	20	23
2+900	L	22	23
3+100	R	22	23
3+100	L	25	23
3+300	R	22	23
3+300	L	28	23
3+500	R	14	22
3+500	L	14	23
3+700	R	20	24
3+700	L	35	24
3+900	R	30	23
3+900	L	28	22
4+100	R	32	21
4+100	L	20	19
4+300	R	14	19
4+300	L	18	20
4+500	R	26	21
4+500	L	16	16

(2)　既存舗装構造調査結果

Sta. 0+550		Sta. 1+200		Sta. 1+750	
					
Sta. 2+900		**Sta. 3+800**			
					

(3) 動的コーン貫入試験（DCP 試験）結果

MINISTRY OF ROADS
MATERIALS TESTING & RESEARCH DEPARTMENT

Project Name		**Ngong Road**		**Client**	**Across Africa consultants**	
DCP Tests Summary Report						
Test No.	Test Date	Chainage (km)	Location	Offset (m)	Surface Moisture	Subgrade CBR	SNP
1	28/05/2010	0.08	Lane 1	5	Moderate	3	0
2	28/05/2010	0.1	Lane 2	5	Wet	7	0.94
3	28/05/2010	0.2	Lane 1	5	Moderate	16	1.56
4	28/05/2010	0.2	Lane 2	5	Moderate	16	1.56
5	28/05/2010	0.3	Lane 1	8	Moderate	6	0.81
6	28/05/2010	0.5	Lane 1	6.5	Wet	4	0.23
7	29/05/2010	0.7	Lane 1	5	Wet	7	0.97
8	29/05/2010	0.9	Lane 2	7.2	Wet	11	1.29
9	29/05/2010	1.1	Lane 2	5	Wet	4	0.38
10	29/05/2010	1.3	Lane 2	5	Moderate	3	0.16
11	29/05/2010	1.5	Lane 1	5	Moderate	9	1.12
12	29/05/2010	1.7	Lane 1	8.1	Moderate	4	0.5
13	29/05/2010	1.9	Lane 1	4.5	Moderate	15	1.53
14	29/05/2010	2.1	Lane 2	5	Moderate	36	1.97
15	29/05/2010	2.3	Lane 2	5	Moderate	7	0.98
16	28/05/2010	2.55	Lane 2	5	Moderate	6	0.7
17	28/05/2010	2.7	Lane 2	20	Moderate	6	0.86
18	28/05/2010	2.9	Lane 2	20	Moderate	13	1.43
19	28/05/2010	3.1	Lane 1	5	Moderate	5	0.66
20	28/05/2010	3.3	Lane 1	6	Moderate	14	1.5
21	28/05/2010	3.7	Lane 2	5	Moderate	3	0
22	28/05/2010	3.9	Lane 1	10	Moderate	9	1.11
23	28/05/2010	4.1	Lane 1	6	Moderate	38	1.99
24	28/05/2010	4.3	Lane 2	6	Moderate	10	1.23
25	28/05/2010	4.5	Lane 2	7	Moderate	7	0.9

Date of Report: 9/8/2010 0:00

PSE(PIPM)
9/6/2010

SPSE(RSPM)
9/6/2010

(4) 路床土の CBR 試験結果

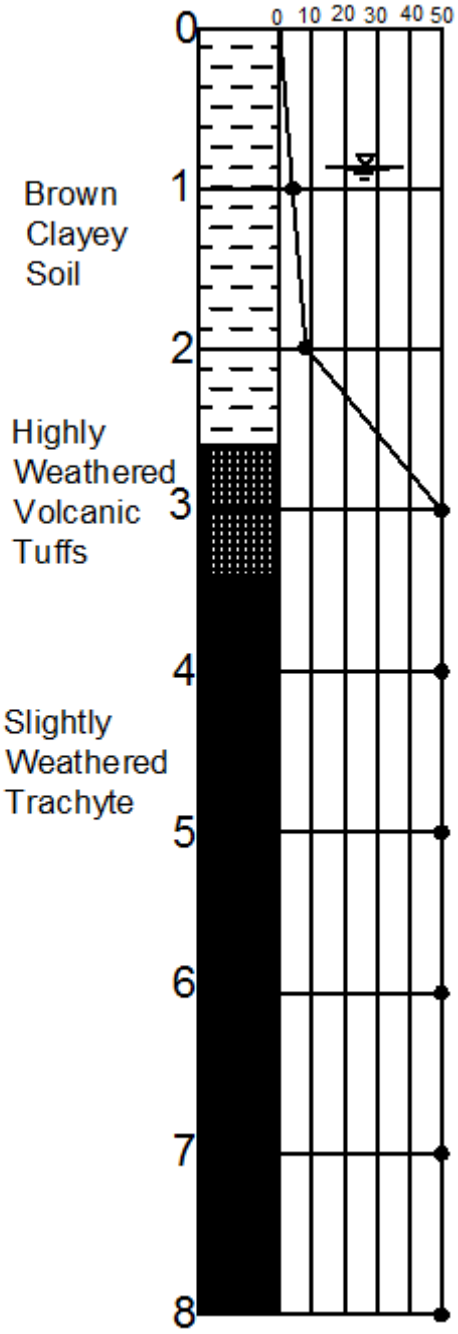
路床土掘削位置の地層構成の考察を次頁に示す。

Sample No	Reference	Reference	GRADING								Atterberg Limits					Compaction T99/T180			
			% passing Sieve								LL	PL	PI	LS	PM	MDD	OMC	4day soak	Swell
			20 mm	14mm	10mm	5mm	2mm	1mm	425 μm	75 μm	(%)	(%)	(%)	(%)		(Kg/m^3)	(%)		
141/s/010	0+150 RHS (C1)	Red latteritic gravel	100	99	84	74	69	50	47	32	38	21	18	9	846	1540	22.4	9	
150/s/010	0+200LHS (C10)	Grey soil	100	98	86	78	50	45	37	22	40	18	22	11	814	1470	21.4	9	
218/s/010	0+3000RHS(C13)	Brown soil	100	100	100	100	90	80	70	59	38	21	17	9	1190	1590	18.0	4	
142/s/010	0+550LHS (C2)	Black cotton	100	100	100	100	96	85	73	64	52	25	27	14	1971	1285	27.0	2	
219/s/010	0+700LHS(C14)	Black cotton	100	100	100	100	96	85	73	64	52	25	27	14	1971	1250	19.0	1	
143/s/010	0+950RHS (C3)	Black cotton	100	100	100	100	95	85	77	70	55	23	32	16	2464	1255	26.6	2	
220/s/010	1+200RHS(C15)	Brown soil	100	100	100	100	95	85	77	70	55	23	32	16	2464	1320	18.9	1	
144/s/010	1+350LHS (C4)	Black cotton	100	100	100	100	81	70	62	57	58	24	34	17	2108	1250	29.0	1	
221/s/010	1+500RHS(C16)	Black cotton	100	100	100	100	81	70	62	57	58	24	34	17	2108	1065	19.0	1	
145/s/010	1+750LHS (C5)	Black cotton	100	100	100	100	95	89	85	71	46	19	27	14	2295	1270	26.7	2	
222/s/010	1+900LHS(C17)	Brown soil	100	100	100	100	52	44	39	34	46	19	27	14	1053	1610	16.6	8	
146/s/010	2+100RHS (C6)	Red latteritic gravel	100	99	87	83	72	64	50	42	36	20	15	7	600	1550	18.9	12	
223/s/010	2+300RHS(C18)	Brown soft rock	100	100	100	100	80	74	66	58	39	23	16	8	1056	1500	22.0	9	
147/s/010	2+550RHS (C7)	Brown gravel+blck cotton	100	99	87	76	52	45	35	25	47	24	23	12	805	1650	16.4	5	
224/s/010	2+700RHS(C19)	Brown soil+Black cotton	100	100	100	100	94	86	76	63	39	25	14	7	1064	1540	21.0	2	
148/s/010	3+000RHS (C8)	Brown soft rock	100	98	94	84	79	64	50	45	38	20	18	9	900	1540	18.4	10	
225/s/010	3+300RHS(C20)	Brown soil	100	100	100	100	88	76	65	56	38	20	18	9	1170	1580	18.8	4	
149/s/010	3+450RHS(C9)	Red latteritic gravel	100	98	94	89	45	40	36	21	52	34	18	9	648	1560	22.6	8	
226/s/010	3+700RHS(C21)	Red soil	100	100	100	100	90	77	58	44	48	28	20	10	1160	1500	23.8	27	
151/s/010	4+050LHS(C11)	Black cotton	100	100	100	100	99	97	88	64	53	25	28	14	2464	1285	22.3	2	
227/s/010	4+300RHS(C22)	Brown soil	100	100	100	100	84	71	61	49	31	21	10	5	610	1640	14.4	7	
152/s/10	4+500RHS(12)	Red coffee soil	100	100	100	100	99	96	87	64	47	24	23	11	2001	1250	22.5	2	

(5) 路床土掘削位置の地層構成の考察

Hole No.	Chainage	SOIL PROFILE Depth	Offset		LITHOLOGY
C1	Km0+150RHS	0.2M	5M		Over burden
		1.1M			Red latteritic gravel
C2	Km0+550 LHS	0.3M	6.2M		Over burden
		0.9M			Black cotton soil
		0.9M			Nairobi Tuff
C3	Km 0+950 RHS	0.3M	7.2M		Over burden
		1.0M			Black cotton soil
C4	Km 1+350LHS	0.5M	5.5M		Over burden
		1.0M			Black cotton soil
C5	Km1+750LHS	0.3M	6.0M		Over burden
		1.1M			Black cotton soil
		1.1M			Homogeneous Rock
C6	Km 2+100RHS	0.3M	5.5M		Over burden
		0.8M			Red soil
		1.1M			Red latteritic Gravel
C7	Km 2+550 RHS	0.7M	5.7M		Overburden
		1.0M			Brown gravel mixed with black cotton
		1.0M			Homogeneuos Rock
C8	Km 3+000RHS	0.5M	9.0M		Over burden
		0.9M			Brown soft rock
		0.9M			Homogeneous Rock
C9	Km3+500LHS	0.7M	5.5M		Over burden
		1.1M			Red latteritic gravel
C10	Km 0+200LHS	0.6M	5.0M		Over burden
		1.0M			Grey soil
C11	Km4+50LHS	0.4M	7M		Over burden
		1.0M			Black cotton soil
C12	Km4+500RHS	1M	5.0M		Over burden
		1.3M			Red coffee soil

(6)　渡河地点の地質調査（ウゴング川位置）



舗装構造設計

交通量調査位置と大型車の車種別交通量（台／日）

Design Section	Traffic Count Station	Station	Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck
-	Adamas Arcade	Sta. 0+450	1,748	543	347	198	37
1	ML7 Intersection	Sta. 0+950	2,334	624	338	188	44
2	Kenya Baptist Church	Sta. 2+350	2,920	705	328	178	51
3	Kenya Hospital	Sta. 3+000	2,429	266	124	36	6
4	Transcom House	Sta. 3+850	1,902	86	50	13	1

Note: ADT at ML7 intersection is obtained by assuming that ADT vary linearly between Adams Arcade and Kenya Baptist Church.

設計期間（2013-2022）に通過する大型車交通量

なお、４車線道路の１車線には片側大型車交通量の 80%が通過すると仮定する。

地点：西部環状交差点（区間-1）

Year	Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck	Grouth Rate
2010	934	250	135	75	18	
2011	1,014	271	147	82	19	1.09
2012	1,088	291	157	88	21	1.07
2013	1,156	309	167	93	22	1.06
2014	1,218	326	176	98	23	1.05
2015	1,277	341	185	103	24	1.05
2016	1,331	356	193	107	25	1.04
2017	1,383	370	200	112	26	1.04
2018	1,431	382	207	115	27	1.03
2019	1,477	395	214	119	28	1.03
2020	1,520	406	220	123	29	1.03
2021	1,562	417	226	126	29	1.03
2022	1,601	428	231	129	30	1.03
Total	4,395,886	1,174,943	635,673	354,555	82,993	

Note: Total = (2013 -2022) x (265 + 100 x 0.5)

地点：ケニアバプチスト協会前（区間-2）

Year	Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck	Grouth Rate
2010	1,168	282	131	71	20	
2011	1,269	306	143	77	22	1.09
2012	1,361	329	153	83	24	1.07
2013	1,446	349	162	88	25	1.06
2014	1,524	368	171	93	27	1.05
2015	1,597	386	179	97	28	1.05
2016	1,666	402	187	102	29	1.04
2017	1,730	418	194	105	30	1.04
2018	1,790	432	201	109	31	1.03
2019	1,848	446	208	113	32	1.03
2020	1,902	459	214	116	33	1.03
2021	1,954	472	219	119	34	1.03
2022	2,003	484	225	122	35	1.03
2013 - 2022	5,499,716	1,327,842	617,776	335,257	96,057	

Note: Total = (2013 -2022) x (265 + 100 x 0.5)

地点：ケニア病院前（区間-3）

Year	Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck	Grouth Rate
2010	972	106	50	14	2	
2011	1,056	115	54	16	2	1.09
2012	1,132	124	58	17	3	1.07
2013	1,203	132	62	18	3	1.06
2014	1,268	139	65	19	3	1.05
2015	1,329	145	68	20	3	1.05
2016	1,386	152	71	20	3	1.04
2017	1,439	157	74	21	3	1.04
2018	1,489	163	76	22	4	1.03
2019	1,537	168	79	23	4	1.03
2020	1,582	173	81	23	4	1.03
2021	1,625	178	83	24	4	1.03
2022	1,666	182	85	24	4	1.03
2013 - 2022	4,574,988	500,263	233,994	67,240	10,758	

Note: Total = (2013 -2022) x (265 + 100 x 0.5)

地点：道路省前（区間-4）

Year	Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck	Grouth Rate
2010	951	43	25	6	1	
2011	1,033	47	27	7	1	1.09
2012	1,108	50	29	7	1	1.07
2013	1,177	53	31	8	1	1.06
2014	1,241	56	33	8	1	1.05
2015	1,301	59	34	9	1	1.05
2016	1,356	61	36	9	1	1.04
2017	1,409	63	37	10	1	1.04
2018	1,458	66	38	10	1	1.03
2019	1,504	68	40	10	1	1.03
2020	1,549	70	41	10	1	1.03
2021	1,591	72	42	11	1	1.03
2022	1,631	73	43	11	1	1.03
2013 - 2022	4,478,163	201,719	117,669	30,258	3,362	

Note: Total = (2013 -2022) x (265 + 100 x 0.5)

車種別の 18 キロポンド単軸重等価換算値

ESAL per Axle

Axle Load				ESAL (SN=3)		
Kip	Range in Ton			Single	Tandem	Triple
2	0.0	~	1.4	0.000	0.000	0.000
4	1.4	~	2.3	0.002	0.000	0.000
6	2.3	~	3.2	0.011	0.001	0.000
8	3.2	~	4.1	0.036	0.003	0.001
10	4.1	~	5.0	0.090	0.008	0.002
12	5.0	~	5.9	0.189	0.016	0.004
14	5.9	~	6.8	0.354	0.029	0.007
16	6.8	~	7.7	0.613	0.050	0.012
18	7.7	~	8.6	1.000	0.081	0.019
20	8.6	~	9.5	1.560	0.124	0.029
22	9.5	~	10.4	2.350	0.183	0.042
24	10.4	~	11.4	3.430	0.260	0.060
26	11.4	~	12.3	4.880	0.360	0.083
28	12.3	~	13.2	6.780	0.487	0.113
30	13.2	~	14.1	9.200	0.646	0.149
32	14.1	~	15.0	12.400	0.843	0.194
34	15.0	~	15.9	16.300	1.080	0.248
36	15.9	~	16.8	21.200	1.380	0.313
38	16.8	~	17.7	27.100	1.730	0.390
40	17.7	~	18.6	34.300	2.150	0.481
42	18.6	~	19.5	43.000	2.640	0.587
44	19.5	~	20.4	53.400	3.230	0.710

Source: AASHTO Pavement Design Gude 1993

ESAL per Vehicle

Vehicle Type	Rear Axle	Mid-Axle	Front Axle	Total
Sedan / Wagon / Pick-up / 4WD	W=0.5 ton E=0.000	-	W=0.5 ton E=0.000	0.000
Van / Mini Bus	W=1 ton E=0.000	-	W=1 ton E=0.000	0.000
Standard & Large Bus	W=5 ton E=0.189	-	W=3 ton E=0.011	0.200
Mini Truck	W=3 ton E=0.011	-	W=2 ton E=0.002	0.012
2-Axle Truck	W=6 ton E=0.345	-	W=4 ton W=0.036	0.381
3-Axle Truck	W=15 ton E=1.080	-	W=5 ton E=0.189	1.269
Articulated Truck	W=15 ton E=1.080	W=15 ton E=1.080	W=5 ton E=0.189	2.349

Note: The axle loads above were guesstimated based on the observation of the traffic along the survey road.

設計交通荷重（18 キロポンド単軸重等価換算値）

地点：西部環状交差点（区間-1）

		Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck	Total
Traffic 2013 - 2022		4,395,886	1,174,943	635,673	354,555	82,993	
ESAL per Vehicle		0.200	0.012	0.381	1.269	2.349	
ESAL		879,177	14,099	242,191	449,930	194,951	1,780,348

地点：ケニアバブチスト協会前（区間-2）

		Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck	Total
Traffic 2013 - 2022		5,499,716	1,327,842	617,776	335,257	96,057	
ESAL per Vehicle		0.200	0.012	0.381	1.269	2.349	
ESAL		1,099,943	15,934	235,373	425,441	225,637	2,002,328

地点：ケニア病院前（区間-3）

		Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck	Total
Traffic 2013 - 2022		4,574,988	500,263	233,994	67,240	10,758	
ESAL per Vehicle		0.200	0.012	0.381	1.269	2.349	
ESAL		914,998	6,003	89,152	85,327	25,271	1,120,751

地点：道路省前（区間-4）

		Standard & Large Bus	Mini Truck	Medium (2a) Truck	Heavy (3a) Truck	Articulated Truck	Total
Traffic 2013 - 2022		4,478,163	201,719	117,669	30,258	3,362	
ESAL per Vehicle		0.200	0.012	0.381	1.269	2.349	
ESAL		895,633	2,421	44,832	38,397	7,897	989,180

設計 CBR

Pavement Desing Section	Station	CBR Test Result	Desing CBR	Remarks
Secton-1	0+150	9	6	
	0+200	9		
	0+300	4		
	0+550	2		Soft soil is replaced by selected soil (CBR>6).
	0+700	1		Soft soil is replaced by selected soil (CBR>6).
	0+950	2		Soft soil is replaced by selected soil (CBR>6).
Secton-2	1+200	1		Soft soil is replaced by selected soil (CBR>6).
	1+350	1		Soft soil is replaced by selected soil (CBR>6).
	1+500	1		Soft soil is replaced by selected soil (CBR>6).
	1+750	2		Soft soil is replaced by selected soil (CBR>6).
	1+900	8		
	2+100	12		
	2+300	9		
	2+550	5		Embankment (CBR>6) section
Secton-3	2+700	2	6	Soft soil is replaced by selected soil (CBR>6).
	3+000	10		CBR ave. - Standard Deviation = 8 - 2 = 6
	3+300	4		
	3+450	8		
	3+700	10		
Secton-4	4+050	2	6	Embankment (CBR>6) section
	4+300	7		
	4+500	2		

必要舗装構造厚の計算

必要舗装構造指数

舗装構造設計区間		1	2	3	4
18kip等価単軸載荷荷重	W18	1,788,888	2,000,000	1,120,000	989,000
信頼性係数	R (%)	85	85	85	85
標準偏差	ZR	-1.037	-1.037	-1.037	-1.037
荷重及び舗装強度の標準誤差	S0	0.45	0.45	0.45	0.45
初期供用指数	P0	4.2	4.2	4.2	4.2
終局供用指数	P1	2.0	2.0	2.0	2.0
供用指数の差 (P0-P1)	ΔPSI	2.2	2.2	2.2	2.2
路床土CBR値 (%)	CBR	5	5	5	5
路床土復元弾性係数	MR	7,500	7,500	7,500	7,500
舗装厚に必要な目標構造指数	SN	3.489	3.546	3.253	3.193

ここに、 $Log_{10}(W_{18})=Z_R\times S_0+9.36\times Log_{10}(SN+1)-0.20+\{Log10[\triangle PSI/(4.2-1.5)]/[0.40+1094/(SN+1)^{5.19}]+2.32\times Log_{10}(M_R)-8.07$

仮計算値 log10(W18)=	6.253	6.301	6.049	5.995
右辺計算値=	6.253	6.301	6.049	5.995

提案する新設舗装構造の構造指数

舗装構成 (新設)	排水係数 (m)	層指数 (a)				
舗装構造設計区間			N1	N2	N3	N4
アスコン表層	-	0.440	10.0	10.0	10.0	10.0
粒状上層路盤	1.0	0.140	15.0	15.0	15.0	15.0
粒状下層路盤	1.0	0.110	25.0	25.0	20.0	20.0
提案舗装厚の構造指数 (SN)			3.64	3.64	3.43	3.43

ここに、 SN=a1*D1+a2*m2*D2+a3*m3*D3

提案するオーバーレイ厚の構造指数

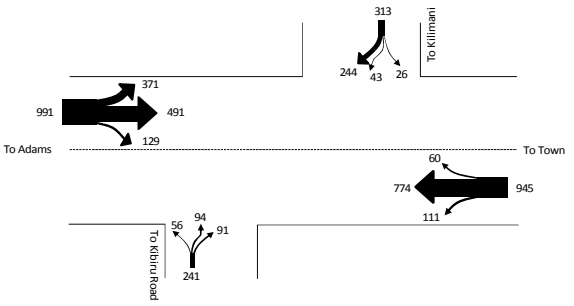
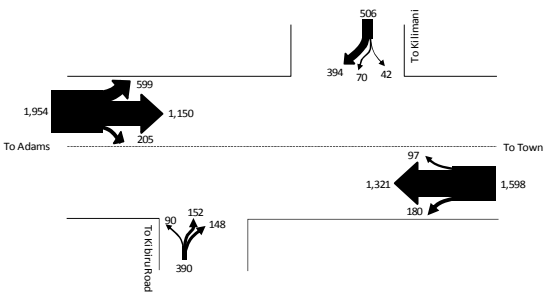
舗装構成 (オーバーレイ)	排水係数 (m)	層指数 (a)				
舗装構造設計区間			1	2	3	4
アスコン表層	-	0.440	5.0	5.0	5.0	5.0
アスコン表層(既存)	-	0.390	5.0	5.0	10.0	10.0
粒状上層路盤(既存)	1.0	0.130	10.0	10.0	10.0	10.0
セメント安定処理路盤(既存)	1.0	0.250	15.0	15.0	0.0	0.0
粒状下層路盤厚(既存)	1.0	0.100	10.00	10.00	10.00	10.00
提案オーバーレイの構造指数 (SN)			4.02	4.02	3.31	3.31

ここに、 SN=a1*D1+a2*m2*D2+a3*m3*D3+a4*m4:D4

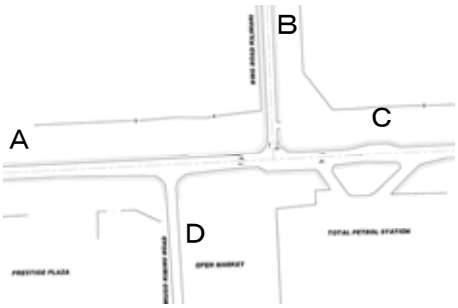
交差点解析

1) **ML-7 Intersection**

Design Traffic Volume of ML-7 Intersection (pcu/h)

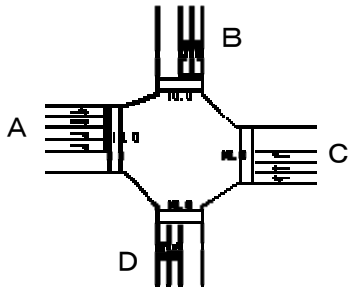
Present (2010)	Future (2022)
	

Evaluation of Present Condition and Improvement Scheme of ML-7 Intersection

					Capacity against present traffic volume (2010): -No signal operation is inadequate. -Signal operation is adequate..					
Operation		Present: Non signal				Improvement Scheme: Signalization				
Saturation Ratio		—				0.876				
		V/C Ratio			Queue length	V/C Ratio			Queue length	
Approach	A	TR	0.92 (2,309 < 2,500*)	OK	—	LT TH RT	: 0.956	OK	LT TH RT	: —
		RT	0.30	OK	—					
	B	TH	2.12	NG	—	LT TH RT	: 0.994	OK	LT TH RT	: —
		RT	0.46	OK	—					
	C	TH	0.66 (1,660 < 2,500*)	OK	—	LT TH RT	: 0.677	OK	LT TH RT	: —
		RT	0.09	OK	—					
	D	TH	2.14	NG	—	LT TH RT	: 0.719	OK	LT TH RT	: —
		RT	0.48	OK	—					

Note: 2,500* (pcu/h) is the traffic capacity of 2-lane (for 2 direction) road.
TR: Through lane, LT: Left turn lane, RT: Right turn lane

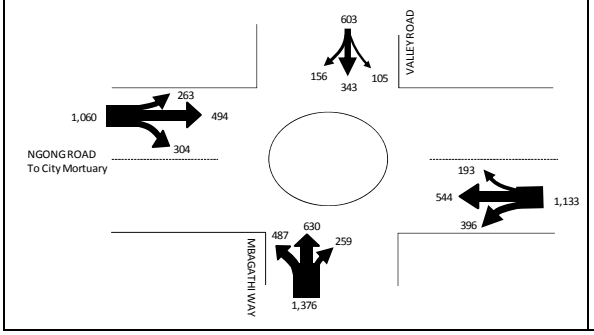
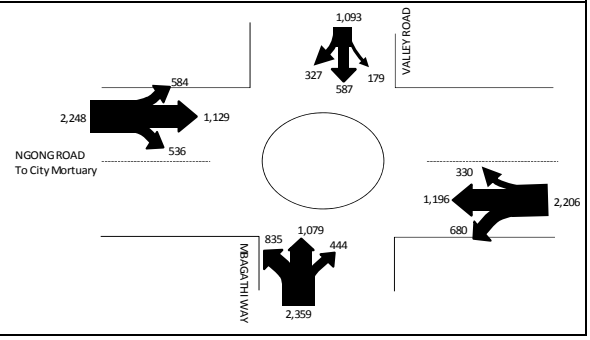
Evaluation of Improvement Schemes against Future Traffic of ML-7 Intersection

					Capacity against future traffic volume (2022): -No signal operation is inadequate. -Signal operation is adequate. 2-lane right turn is necessary for approach A. Other approaches need a right turn lane.				
Operation		Future: No Signal			Future: Signal Operation				
Saturation Ratio		—			0．895				
		V/C Ratio		Queue length	V/C Ratio			Queue length (m)	
Approach	A	TR	0.50 (4,372 < 8,800**)	OK	—	LT+TH TH	: 0.997	OK	LT+TH TH	: —
		RT	1.25	NG	—	RT2	: 0.995	OK	RT2	: 42.6
	B	TH	21.1	NG	—	LT+TH	: 0.419	OK	LT+TH	: —
		RT	7.15	NG	—	RT	: 0.992	OK	RT	: 137.3
	C	TH	0.38 (3,338 < 8,800**)	OK	—	LT+TH TH	: 0.829	OK	LT+TH TH	: —
		RT	0.31	OK	—	RT	: 0.729	OK	RT	: 40.4
	D	TH	46.5	NG	—	LT+TH	: 0.988	OK	LT+TH	: —
		RT	3.43	NG	—	RT	: 0.348	OK	RT	: 55.4

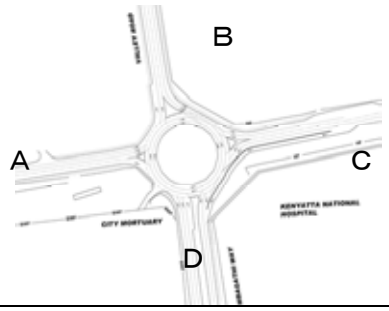
Note: 8,800** (pcu/h) means traffic capacity 2,200 pcu/h per lane x 4 lanes

2) **City Mortuary Intersection**

Design Traffic Volume of City Mortuary Intersection (pcu/h)

Present (2010)	Future (2022)
	

Evaluation of Present Condition and Improvement Scheme of City Mortuary Intersection



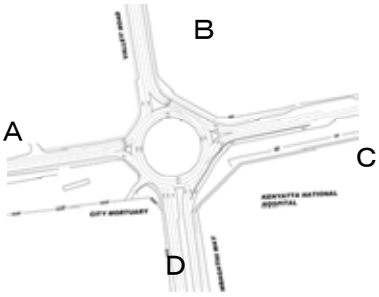
Operation		Present Operation: Signal Operation		
Saturation Ratio		0.890		
		V/C Ratio		Queue length
Approach	A	LT TH RT : 0.907	OK	–
	B	LT TH RT : 0.895	OK	–
	C	TH RT : 0.814	OK	–
	D	LT : 0.506 TH RT : 0.937	OK OK	176.0 –

Capacity against present traffic volume (2010):

-Demand ratio 0.890 is almost saturated.

-Capacity ration of all approaches are almost their capacity.

Evaluation against Future Traffic of City Mortuary Intersection

<table>
<tr><td colspan="2"></td><td colspan="3"> 
</td><td rowspan="8">Capacity against future traffic volume (2022):
-Present operation is not adequate.
-Intersection improvement is necessary.</td></tr>
<tr><td colspan="2">Operation</td><td colspan="3">Future Operation: Signal Operation (same as present)</td></tr>
<tr><td colspan="2">Saturation Ratio</td><td colspan="3">1.748</td></tr>
<tr><td colspan="2"></td><td colspan="2">V/C Ratio</td><td>Queue length</td></tr>
<tr><td rowspan="4">Approach</td><td>A</td><td>LT
TH
RT</td><td>: 2.466</td><td>NG</td><td>－</td></tr>
<tr><td>B</td><td>LT
TH
RT</td><td>: 2.287</td><td>NG</td><td>－</td></tr>
<tr><td>C</td><td>TH
RT</td><td>: 2.278</td><td>NG</td><td>－</td></tr>
<tr><td>D</td><td>LT
TH
RT</td><td>: 1.106
: 1.528</td><td>NG
NG</td><td>278.6
－</td></tr>
</table>

The Improvement schemes with increased approach lanes are compared:

Scheme A: Roundabout + Present signal operation

Scheme B: Roundabout + Revised signal operation (2-direction+RT= 4 phases)

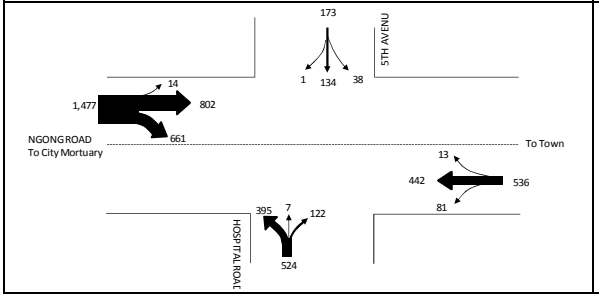
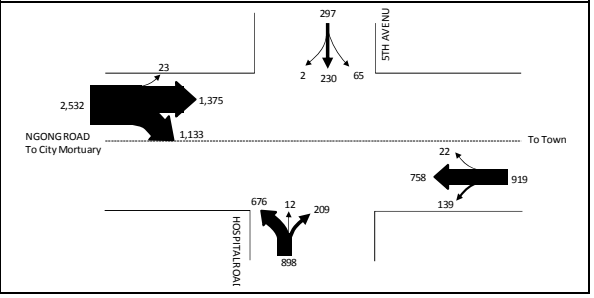
Scheme C: Cross Intersection

Comparison of Improvement Schemes against Future Traffic of City Mortuary Intersection

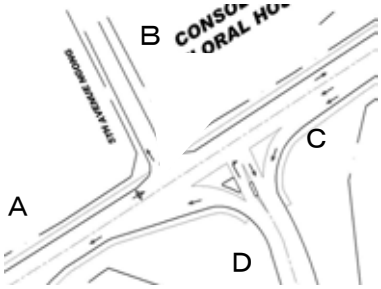
Scheme	Description	Demand Ratio, V/C Ratio				Evaluation
A	Signal Operation: Same as existing Roundabout Approach A&D:TH(2-lane) + RT (2-lane) Approach C: TH(2-lane) All approach LT is free	Demand Ratio		1.064 > 0.9		-Not adequate.
		A	TH2	1.014 >1.0	NG	
			RT2	0.554 <1.0	OK	
		B	TH	2.066 >1.0	NG	
			RT	1.301 >1.0	NG	
		C	TH2	1.578 >1.0	NG	
			RT	0.943 <1.0	OK	
		D	TH2	0.937 <1.0	OK	
			RT2	0.442 <1.0	OK	
B	Same as Scheme A except signalization. Signalization: 2 direction + RT = 4 phase	Demand Ratio		0.806 < 0.9		-Adequate
		A	TH2	0.924 <1.0	OK	
			RT2	0.943 <1.0	OK	
		B	TH	0.972 <1.0	OK	
			RT	0.980 <1.0	OK	
		C	TH2	0.975 <1.0	OK	
			RT	0.943 <1.0	OK	
		D	TH2	0.882 <1.0	OK	
			RT2	0.739 <1.0	OK	
C	Same as Scheme B, except Scheme C is Cross intersection. (Cross intersection can reduce signal clearance time.)	Demand Ratio		0.806 < 0.9		-Adequate -V/C ratios are less than Scheme B.
		A	TH2	0.849 <1.0	OK	
			RT2	0.774 <1.0	OK	
		B	TH	0.894 <1.0	OK	
			RT	0.896 <1.0	OK	
		C	TH2	0.896 <1.0	OK	
			RT	0.792 <1.0	OK	
		D	TH2	0.811 <1.0	OK	
			RT2	0.669 <1.0	OK	

3) **Nairobi Hospital Intersection**

Design Traffic Volume of Nairobi Hospital Intersection (pcu/h)

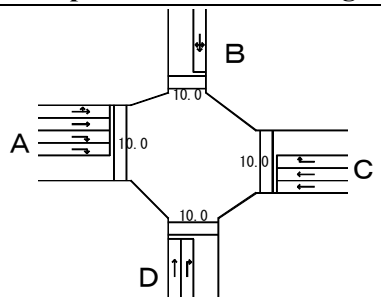
Present (2010)	Future (2022)
	

Evaluation of Present Condition and Improvement Scheme of Nairobi Hospital Intersection

<table>
<tr><td colspan="2"></td><td colspan="4"> 
</td><td colspan="4">Capacity against present traffic volume (2010):
-No signal operation is inadequate.
-Signal operation is adequate.</td></tr>
<tr><td colspan="2">Operation</td><td colspan="4">Present: No signal</td><td colspan="4">Improvement Scheme: Signal</td></tr>
<tr><td colspan="2">Saturation Ratio</td><td colspan="4">－</td><td colspan="4">0．857</td></tr>
<tr><td colspan="2"></td><td colspan="3">V/C Ratio</td><td>Queue length</td><td colspan="3">V/C Ratio</td><td>Queue length (m)</td></tr>
<tr><td rowspan="8">Approach</td><td rowspan="2">A</td><td>TH</td><td>1.07
(2,681 > 2,500*)</td><td>NG</td><td>－</td><td>LT
TH</td><td>: 0.994</td><td>OK</td><td>LT
TH : －</td></tr>
<tr><td>RT</td><td>0.81</td><td>OK</td><td>－</td><td>RT</td><td>: 0.978</td><td>OK</td><td>RT : －</td></tr>
<tr><td rowspan="2">B</td><td>TH</td><td>1.33</td><td>NG</td><td>－</td><td>LT
TH</td><td>: 0.966</td><td>OK</td><td>LT
TH : －</td></tr>
<tr><td>RT</td><td>0.00</td><td>OK</td><td>－</td><td>RT</td><td></td><td></td><td>RT</td></tr>
<tr><td rowspan="2">C</td><td>TH</td><td>0.66
(1,764 < 2,500*)</td><td>OK</td><td>－</td><td>TH</td><td>: 0.608</td><td>OK</td><td>TH : －</td></tr>
<tr><td>RT</td><td>0.02</td><td>OK</td><td>－</td><td>RT</td><td>: 0.448</td><td>OK</td><td>RT : －</td></tr>
<tr><td rowspan="2">D</td><td>TH</td><td>0.14</td><td>OK</td><td>－</td><td>TH
RT</td><td>: 0.772</td><td>OK</td><td>TH
RT : －</td></tr>
<tr><td>RT</td><td>1.55</td><td>NG</td><td>－</td></tr>
</table>

Note: 2,500* (pcu/h) is the traffic capacity of 2-lane (for 2 direction) road.

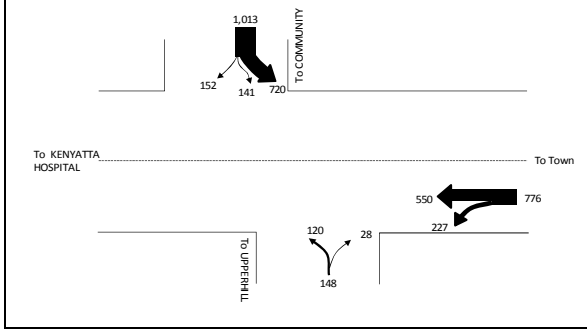
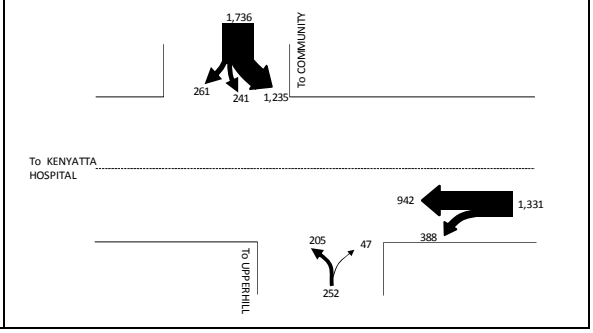
Comparison of Improvement Schemes against Future Traffic of Nairobi Hospital Intersection

					Capacity against future traffic volume (2022): -No signal operation is inadequate. -Signal operation is adequate. 2-lane right turn is necessary for approach A. Other approaches need additional lanes as shown in the left figure.					
Operation		Future: No Signal			Future: Signal Operation					
Saturation Ratio		—			0．767					
		V/C Ratio		Queue length	V/C Ratio			Queue length (m)		
Approach	A	TH	0.52 (4,596 < 8,800**)	OK	—	LT TH	: 0.681	OK	LT TH	: —
		RT	2.30	NG	—	RT2	: 0.984	OK	RT2	: 141.9
	B	TH	12.8	NG	—	LT TH	: 0.920	OK	LT TH	: —
		RT	0.02	OK	—	RT			RT	
	C	TH	0.34 (3,023 < 8,800**)	OK	—	TH2	: 0.986	OK	TH2	: —
		RT	0.07	OK	—	RT	: 0.122	OK	RT	: 8.1
	D	TH	2.40	NG	—	LT	: 0.035	OK	LT	: —
		RT	14.0	NG	—	RT	: 0.977	OK	RT	: 70.9

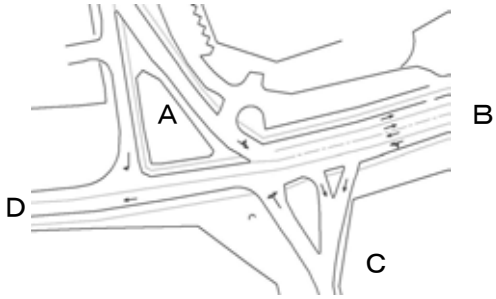
Note: 8,800** (pcu/h) means traffic capacity 2,200 pcu/h per lane x 4 lanes

4) **National Library Intersection**

Design Traffic Volume of National Library Intersection (pcu/h)

Present (2010)	Future (2022)
	

Evaluation of Present Condition and Improvement Scheme of ML-7 Intersection



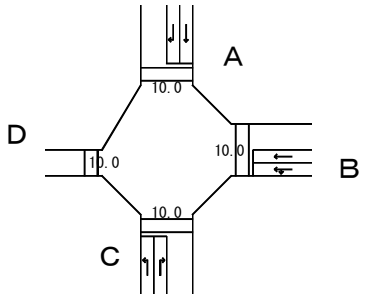
Operation		Present: No signal		
Saturation Ratio		—		
		V/C Ratio		Queue length
Approach	A	TH 0.79 RT —	OK —	— —
	B	TH 0.22 (1,899 < 8,800**) RT —	OK —	— —
	C	— — RT 0.14	— OK	— —
	D	—		

Capacity against present traffic volume (2010):

-No signal operation is adequate for present traffic.

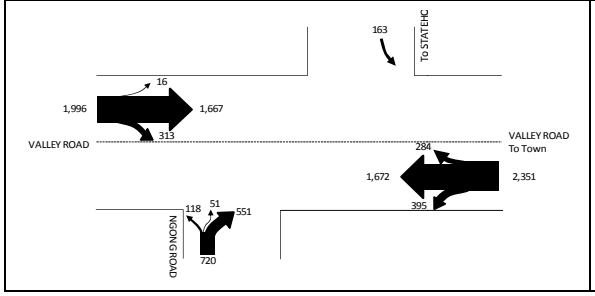
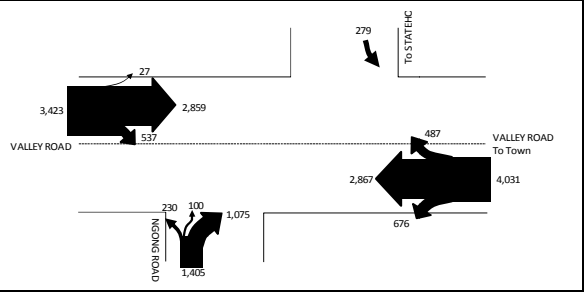
Note: 8,800** (pcu/h) means traffic capacity 2,200 pcu/h per lane x 4 lanes

Comparison of Improvement Schemes against Future Traffic of Nairobi Hospital Intersection

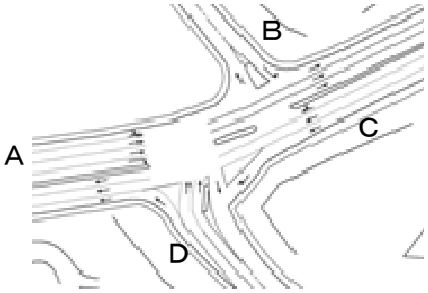
					Capacity against future traffic volume (2022): -Signal operation is necessary against the future traffic volume. -Left Turn of Approach A is free to go.				
Operation		Future: No signal			Improvement: Signal Operation				
Saturation Ratio		—			0.895				
		V/C Ratio		Queue length	V/C Ratio			Queue length (m)	
Approach	A	TH 2.80 RT —	NG —	— —	TH : 0.685 RT : 0.492	OK OK		TH : — RT : 37.3	
	B	TH 0.37 (3,254 < 8,800**) RT —	OK —	— —	LT TH : 0.0.744	OK		LT TH : —	
	C	— — RT 0.80	— OK	— —	LT : 0.599 RT : 0.395	OK OK		LT : 29.3 RT : 6.7	
	D	—			—				

5) **All Saint Intersection**

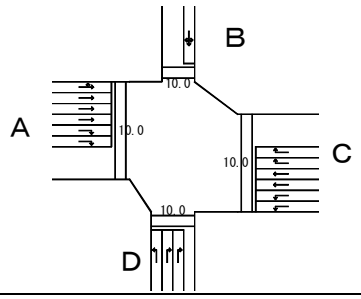
Design Traffic Volume of All Saint Intersection (pcu/h)

Present (2010)	Future (2022)
	

Evaluation of Present Condition and Improvement Scheme of Nairobi Hospital Intersection

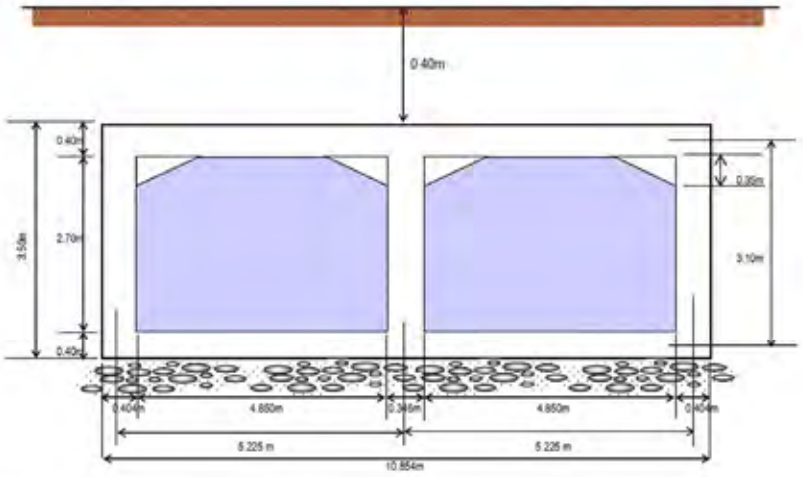
					Capacity against present traffic volume (2010): -If improve Approach A to be LT/TH+TH+RT2 and Approach C added 1-lane of RT, the intersection capacity become adequate				
Operation		Present: Signal Operation			Improvement: Signal Operation				
Saturation Ratio		0.905			0.818				
		V/C Ratio		Queue length	V/C Ratio			Queue length (m)	
Approach	A	LT TH	: 1.141	NG	—	LT TH	: 0.790	OK	LT TH : —
		RT	: 1.597	NG	77.3	RT2	: 0.960	OK	RT2 : 62.8
	B	LT	: 0.815	OK	47.3	LT	: 0.564	OK	LT : 61.1
	C	LT TH	: 0.920	OK	—	LT TH	: 0.946	OK	LT TH : —
		RT	: 0.317	OK	73.1	RT2	: 0.574	OK	RT2 : 55.9
	D	LT	: 0.593	OK	36.1	LT	: 0.408	OK	LT : 49.5
		RT 2	: 1.437	NG	77.4	RT2	: 0.951	OK	RT2 : 104.8

Comparison of Improvement Schemes against Future Traffic of All Saint Intersection

						Capacity against future traffic volume (2022): -Grade separation is necessary for future traffic. -Necessary lane numbers of Ngong Road is as shown in the left figure. Existing lanes of Ngong Road is adequate for the future traffic.				
Operation		Future: Signal Operation				Future: Signal Operation + Grade Separation				
Saturation Ratio		1.195				0.711				
		V/C Ratio			Queue length	V/C Ratio			Queue length (m)	
Approach	A	LT TH3	: 1.323	NG	—	LT	: 0.061	OK	LT	11.9
		RT2	: 0.959	OK	88.4	RT2	: 0.959	OK	RT2	88.4
	B	LT TH RT	: 0.955	OK	—	LT TH RT	: 0.955	OK	LT TH RT	—
	C	LT2	: 0.828	OK	114.5	LT2	: 0.828	OK	LT2	114.5
		TH2	: 2.537	NG	—					
		RT2	: 0.859	OK	78.6	RT2	: 0.859	OK	RT2	78.6
	D	LT	: 0.799	OK	74.9	LT	: 0.799	OK	LT	74.9
		RT2	: 0.717	OK	187.4	RT2	: 0.717	OK	RT2	187.4

ボックスカルバートの構造設計

1.0 TOPOLOGY

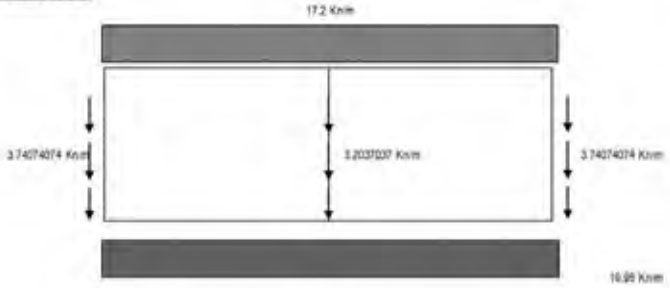


2.0 BOX CULVERT LOADINGS

A. DEAD LOAD

Soil Wt. at Top of Culvert	= 0.40m x 18 kn/m^3	=	7.2 Kn/m
Wt. of Top Slab	= 0.40m x 25 kn/m^3	=	10 Kn/m
Wt. of Outer Walls	= 0.404m x 25 kn/m^3	=	10.1 Kn/m
Wt. of Inner Wall	= 0.346m x 25 kn/m^3	=	8.65 Kn/m
Equivalent Soil Pressure	= 7.2 + 10 + (27.27x2 + 23.36)/10.45	=	19.96 Kn/m

Dead Load Diagram



B. LIVE LOAD

BS HA Loading

Vehicle Lane 1 Width = 3250 mm

UDL = 336 (1/L)$^{0.67}$

L = 5.225 m

Nominal Uniformly Distributed Live Load (UDL)

W= 110.97 kn/m (per lane)

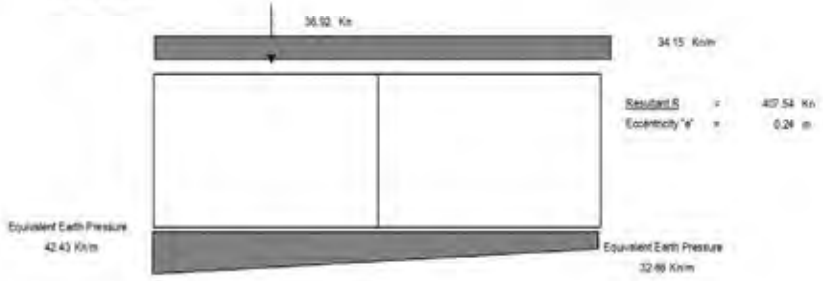
W= 34.15 kn/m (per m width)

Nominal Knife Edge Load (KEL)

P= 120 kn (per lane)

P= 36.92 kn (per m width)

Live Load Diagram

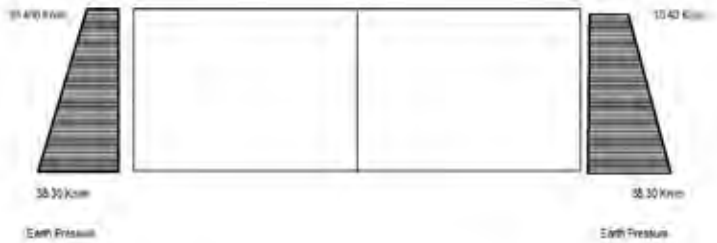


C. SOIL PRESSURE

(a) SOIL PARAMETERS

Unit weight of soil, γ_{soil}	=	18 Kn/m^3
Height of soil face, h	=	3.90 m
Horizontal Static Earth Pressure Coefficient, H_0	=	0.5
Surcharge Load	=	10 Kpa
Depth of Top Slab	=	0.40 m
Depth of Bottom Slab	=	3.70 m
Earth Pressure at center of top slab = 0.5 x ((18 Kn/m^3 x 0.6 m) +10 kpa)	=	10.40 Kn/m
Earth Pressure at the bottom slab = 0.5 x ((18 Kn/m^3 x 3.7 m) +10 kpa)	=	38.30 Kn/m

Static Earth Pressure Diagram



3.0 MATERIAL SPECIFICATIONS

Concrete Strength @ 28 days, fc'	=	34.0 Mpa
Reinforcing Steel Yield Stress (Grade 60), fy	=	550.0 Mpa
Density of concrete, γc	=	25.0 kN/m^3
Density of soil, γs	=	18.0 kN/m^3

4.0 LOADING COMBINATIONS

(AASHTO Load Factor Desing)

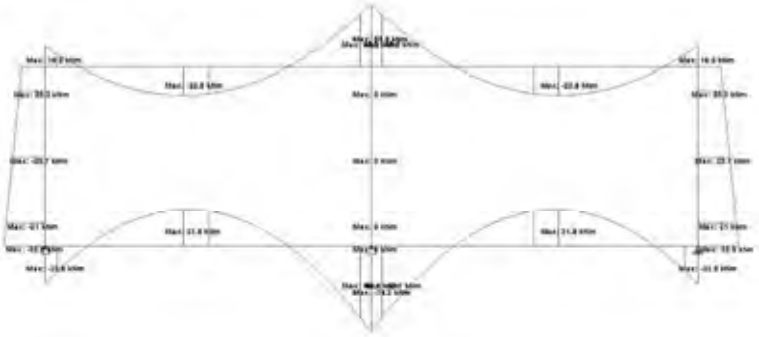
Load Case I: 1.3 (Dead Load + 1.67 Live Load + 1.3 Earth Pressure)

Load Case II: 1.3 (Dead Load + 1.67 Live Load + 0.5 Earth Pressure)

Load Case III: 1.3 (Dead Load + 1.3 Earth Pressure)

5.0 MOMENT AND AXIAL FORCE DIAGRAM

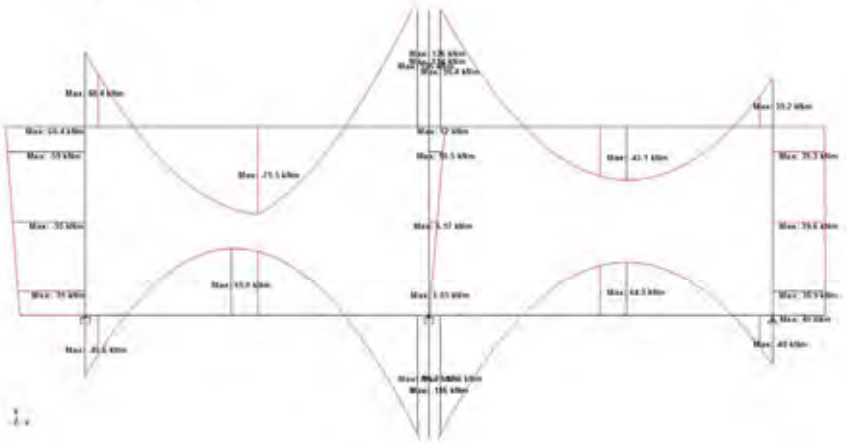
Load 1: ALL DEAD LOADS



MOMENT DIAGRAM

AXIAL FORCE DIAGRAM

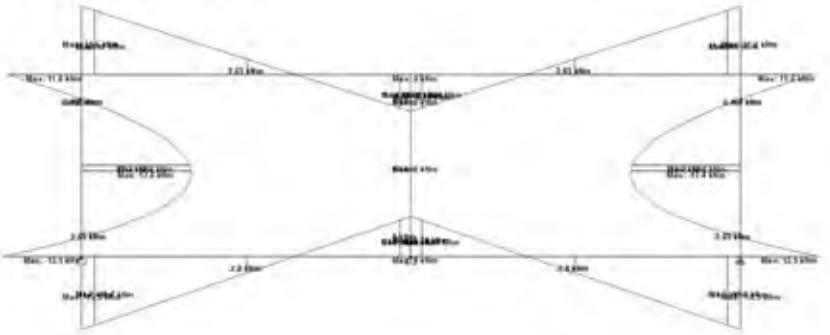
Load 2: ALL LIVE LOADS



MOMENT DIAGRAM

AXIAL FORCE DIAGRAM

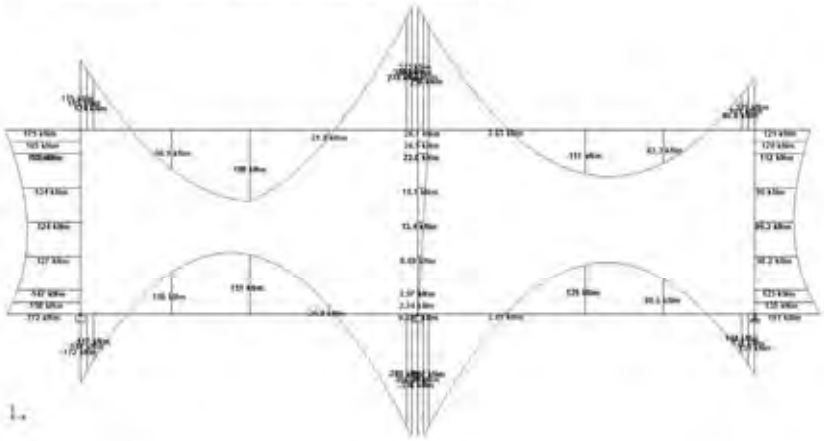
Load 3: EARTH PRESSURE



MOMENT DIAGRAM

AXIAL FORCE DIAGRAM

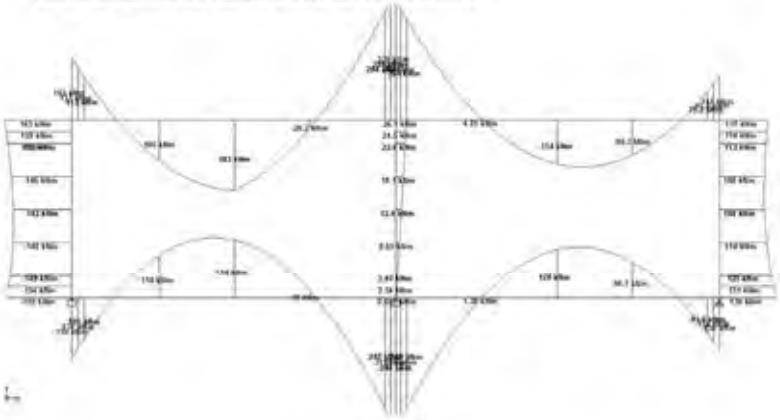
Load Combination I: 1.3 (Dead Load + 1.67 Live Load + 1.3 Earth Pressure)



MOMENT DIAGRAM

AXIAL FORCE DIAGRAM

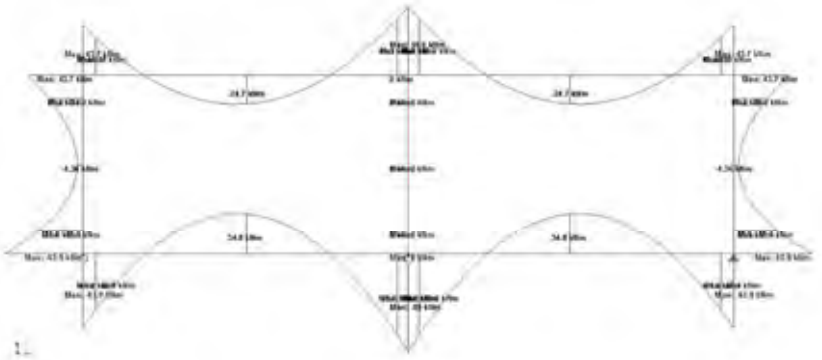
Load Combination II: 1.3 (Dead Load + 1.67 Live Load + 0.5 Earth Pressure)



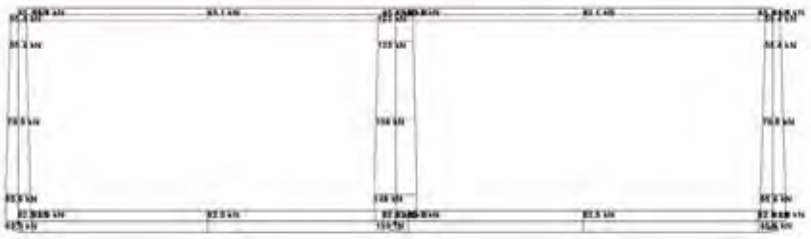
MOMENT DIAGRAM

AXIAL FORCE DIAGRAM

Load Combination III: 1.3 (Dead Load + 1.3 Earth Pressure)

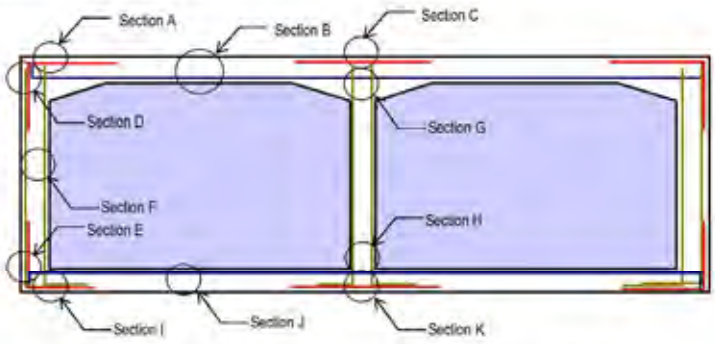


MOMENT DIAGRAM



AXIAL FORCE DIAGRAM

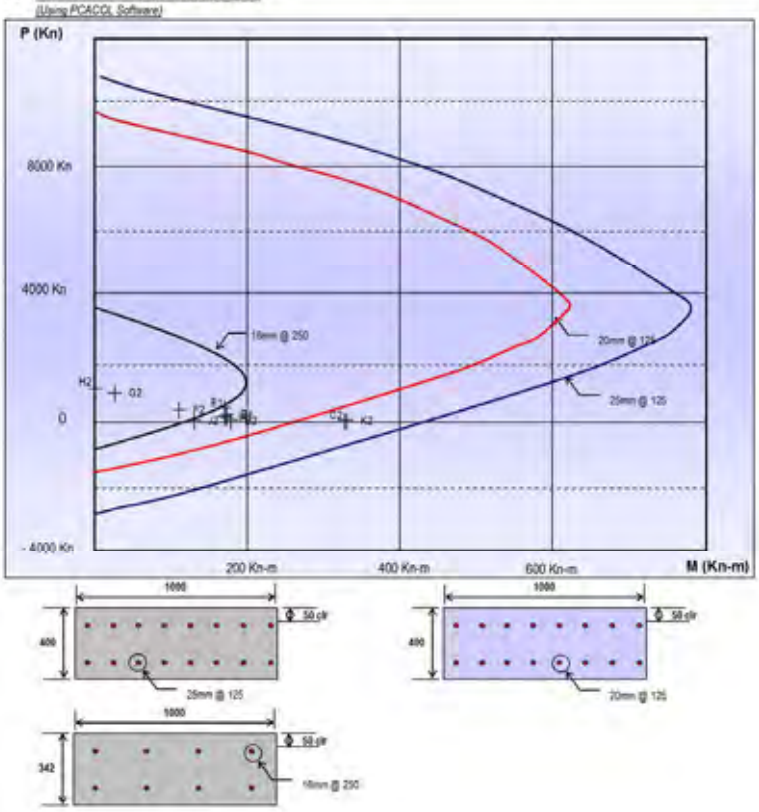
6.0 *SUMMARY OF FORCES PER SECTION*



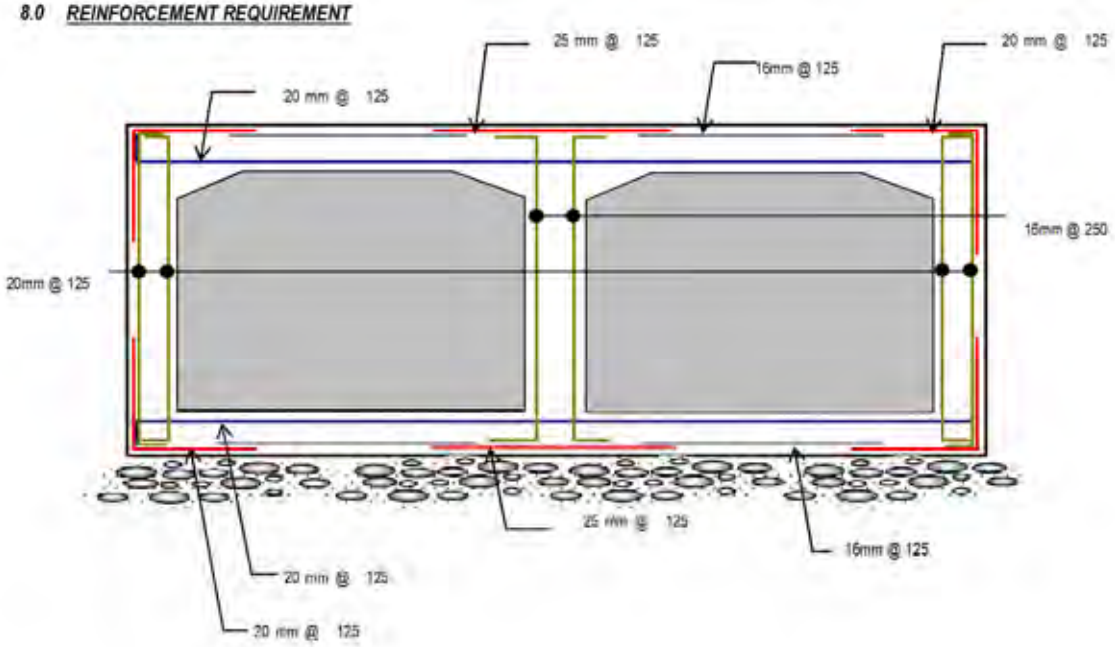
SECTION		LOAD COMB 1		LOAD COMB 2		LOAD COMB 3	
		Mu (Kn-m)	P (Kn)	Mu (Kn-m)	P (Kn)	Mu (Kn-m)	P (Kn)
A	Top Corner Slab (Outside Bars)	178.00 kNm	52.70 kN	183.00 kNm	21.20 kN	43.70 kNm	45.10 kN
B	Top Slab at Midspan (Bottom Bars)	160.00 kNm	52.70 kN	183.00 kNm	21.20 kN	24.70 kNm	45.10 kN
C	Top Slab at Mid Support (Top Bars)	333.00 kNm	52.70 kN	338.00 kNm	21.20 kN	59.50 kNm	45.10 kN
D	Outer Wall at Top (Inner and Outer Bars)	178.00 kNm	282.00 kN	183.00 kNm	268.00 kN	42.70 kNm	65.40 kN
E	Outer Wall at Bot. (Inner and Outer Bars)	172.00 kNm	292.00 kN	159.00 kNm	288.00 kN	53.00 kNm	85.80 kN
F	Outer Wall at Mid Ht. (Inner and Outer Bars)	124.00 kNm	277.00 kN	142.00 kNm	273.00 kN	4.36 kNm	70.50 kN
G	Inner Wall at Top (Inner and Outer Bars)	26.10 kNm	609.00 kN	26.10 kNm	618.00 kN	0.00 kNm	123.00 kN
H	Inner Wall at Bot. (Inner and Outer Bars)	0.00 kNm	822.00 kN	0.00 kNm	829.00 kN	0.00 kNm	136.00 kN
I	Bottom Corner Slab (Outside Bars)	172.00 kNm	74.90 kN	159.00 kNm	27.00 kN	53.90 kNm	82.50 kN
J	Bottom Slab at Midspan (Top Bars)	151.00 kNm	74.90 kN	154.00 kNm	27.00 kN	34.80 kNm	82.50 kN
K	Bottom Slab at Mid Support (Bot. Bars)	336.00 kNm	74.90 kN	342.00 kNm	27.90 kN	66.00 kNm	82.50 kN

7.0 INTERACTION DIAGRAM AND SECTION

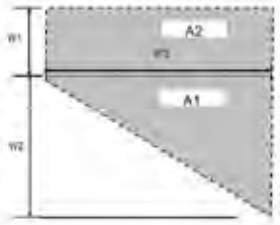
(Using PCACOL Software)

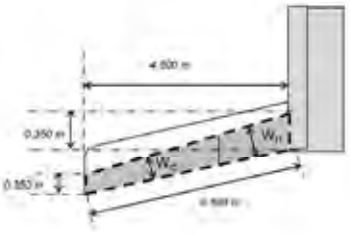


8.0 REINFORCEMENT REQUIREMENT



DESIGN OF WINGWALL



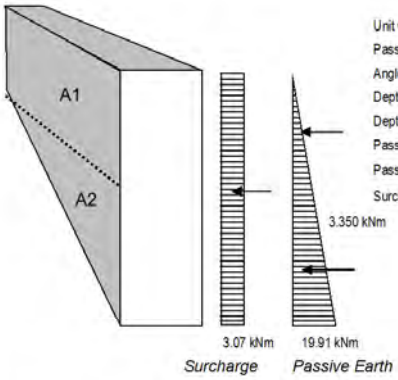


1.0 TOPOLOGY

W_1	0.700 m
W_2	3.462 m
W_3	4.500 m
$W_{1\,(avg)}$	0.350 m
$W_{2\,(avg)}$	0.350 m

2.0 MATERIALS SPECIFICATION

Concrete Strength @ 28 days, f_c'	24 Mpa
Reinforcing Steel Yield Stress, fy	350 Mpa
Unit Wt. of concrete, $\gamma_{concrete}$	23 Kn/m^3
Unit Wt. of Steel, γ_{steel}	77.1 Kn/m^3
Unit Wt. of Wearing Surface, $\gamma_{wearing}$	22 Kn/m^3



Unit weight of soil, γ_{soil}	=	18 Kn/m^3
Passive Earth Pressure Coefficient, K_a	=	0.307
Angle of Internal Friction, ϕ	=	30 deg
Depth of Wingwall (Top Portion), h_1	=	0.7 m
Depth of Wingwall (Lower Portion), h_2	=	4.16 m
Passive Earth Press. 1, $Kp_1 = h_1 \times 0.307 \times 18Kn/m^3 x\cos\phi$	=	3.350 Kn/m
Passive Earth Press. 2, $Kp_2 = h_2 x\ 0.307 \times 18Kn/m^3 x\cos\phi$	=	19.908 Kn/m
Surcharge Earth Press. 1, Sp = 10 kpa x 0.307	=	3.070 Kn/m

Considering Full Height of Wingwall

DESIGN FORCES	Fh (Kn)	y (m)	M (Kn-m)
1.0 Earth Pressure (E)			
Passive Earth Pressure			
Block A1: 3.35 Kn/m / 2 x 4.5m x 0.7	*5.28 kN*	*2.25 m*	*11.87 kN-m*
Block A2: (3.35 Kn/m + 23 Kn/m) / 2 x 4.5m x 0.7 x 3.46m / 2	*90.59 kN*	*1.50 m*	*135.88 kN-m*

2.0 Surcharge, S			
Block A1: 3.07 Kn/m x 4.5 x 0.7	9.67 kN	2.25 m	21.76 kN-m
Block A2: 3.07 Kn/m x 4.5 x 3.46 m / 2	23.91 kN	1.50 m	35.87 kN-m

Considering Lower Portion of Wingwall Only (A2)

Load Comb.	ΣFh (Kn)	ΣM (Kn-m)
Load Case 1		
1.3x 1.3 x (E + S)	193.50 kN	290.25 kN

Reinforcement Requirement

Concrete Strength @ 28 days, fc' = 24 Mpa
Reinforcing Steel Yield Stress, fy = 350 Mpa
Concrete Cover, cc = 0.075 m
Main Reinforcement Bar, d_b = 20 mm
Secondary Reinforcement Bar, d_b = 16 mm
Bending reduction Factor, ϕ = 0.9
Shear reduction Factor, ϕ = 0.85
β = 0.85

Main Bars (Horizontal Bars at Near Fill Face)

$R_n = Mu/\phi\, bd^2$
R_n = 1.22

$\rho = 0.85\, fc'/fy\, [\, 1 - sqrt(\, 1 - 2Rn/0.85fc'\,)\,]$
ρ = 0.0036
ρ_{bal} = 0.85 β fc'/fy [600/ (fy +600)] = 0.031
ρ_{max} = 0.75 ρ_{bal} = 0.023

ρ_{actual} > ρ min **Use :** ρ **actual**

For ρ_{min} :
fr = 0.70 $\sqrt{fc'}$ = 3.429 Mpa
Ig = $B * T^3 / 12$ = 0.0036 m^4
y = T / 2 = 0.175 m
M_{cr} = fr Ig / y = 70.01 Kn-m
M_{cr} min = 1.20 M_{cr} = 84.02 Kn-m
R_{cr} = $M_{cr} / \phi\, bd^2$ = 1.03 Mpa
ρ_{min} = $0.85*fc'/fy * [\, 1-(\sqrt{1-2R_{cr} / 0.85fc'}\,)\,]$
ρ_{min} = 0.003017

Area of Steel Required, A_{req} = 950.7027 mm^2
Using 20 mm at 200 mm spacing = 1570.796 mm^2

As_{prov} > As_{reqd} **ok !!!**

Temperature Bars (Vertical Bars at Far Fill and Near Fill Face)

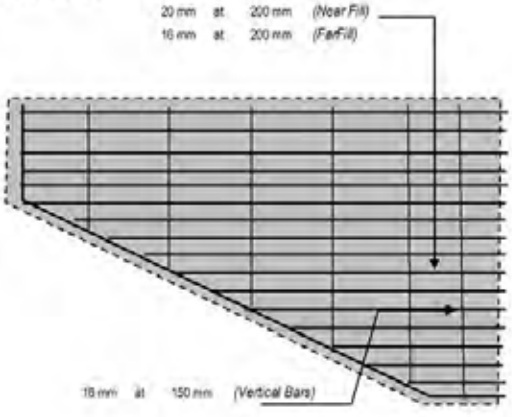
Area of Steel Required, A_{req} = 265mm^2/m
Area of Steel Required, A_{req} = 1192.5 mm^2
Using 16 mm at 150 mm spacing = 1340.413 mm^2

As_{prov} > As_{reqd} **ok !!!**

Check for Shear
Vu = 193.50 Kn ϕ Vc = ϕ 0.17(sqrt (fc') bd (Shear Capacity) ϕ Vc = 291.4893 Kn

Vu < ϕ Vc ok, shear reinforcement not required

3.0 REINFORCEMENT DETAILS



ボックスカルバートの流出解析

(1) Design Discharge

Design discharge (m3/s) is derived using Rational Formula. The constants given in Road Drain Specification issued by Japanese Road Association are referred.

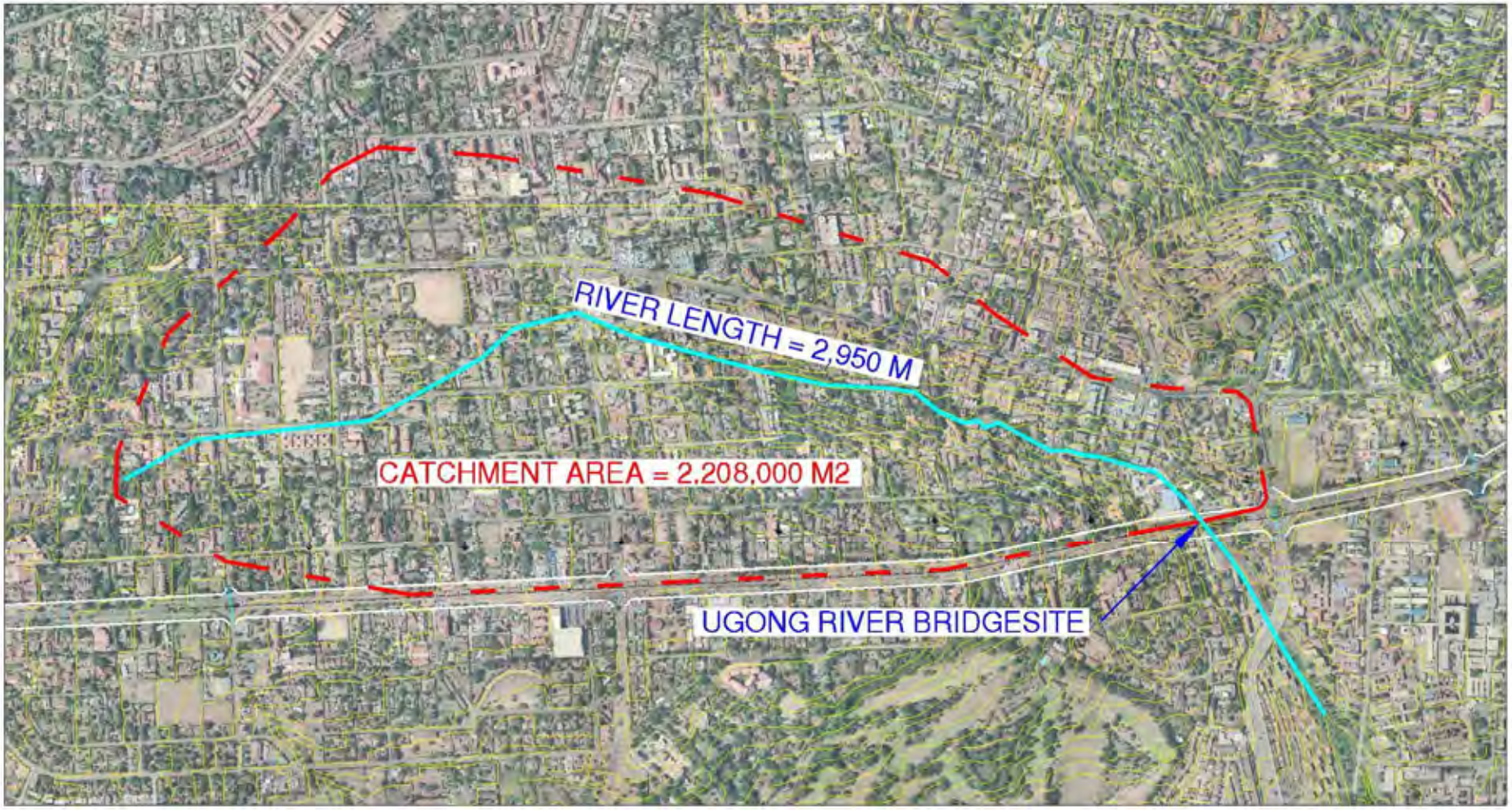
Design Rainfall, R= 127 mm/day (see rainfall data shown in Chapter 2)
Catchment Area, A= 2,208,000 m2 (see catchment area map in the following page)
River Length, L= 2950 m
EL(bridge site)=1728m
EL(top of river)=1770m
H/L=(1770-1728)/2950=1/70
Velocity, V=72(H/L)^0.6 (Bayern Formula) =72(1/70)^0.6=5.6 km/h (=1.6 m/s)
Peak Arrival Time, T=L/V=2.95/5.6=0.53h
Average Rainfall Intensity, r= R/24(24/T)^(2/3) (Mononobe formula)
=127/24(24/0.53)^(2/3)=67mm/h
Run-off coefficient, f =0.7 (residence area)
Design Discharge, Q=0.2778frA=0.2778x0.7x67x2.208=28.8 m3/s

(2) Hydrology

The hydrology (flood velocity and depth) are simulated using Maning Formula.
Velocity, V=1/n(R^2/3)(I^1/2)

n=Channel roughness coefficient=0.03 (natural surface)
Hydraulic Depth, R=A(sectional area)/P(wet perimeter)
Slope, I=0.005 (0.5%)
When, Depth =1.65 m and Width= 4.0 x 2 (double barrel),
R= 1.65 x 4.0 / (1.65 +4.0+1.65) = 0.904
V = 1/0.03 x 0.904^2/3 x 0.005^1/2 = 2.2 m/s
Q = AV= 1.65 x 4.0 x 2 x 2.2 = 29.0 = 28.8 (assumed depth 1.65 is OK)

Therefore, required height of the box is 1.65 x 1.2 (20% allowance) = 1.98 m
Box culvert with the size of W=4.0m x 2 barrel, H=2.5m is adequate to discharge the floods.



ボックスカルバートの流域図

資料3-7 道路排水の流量計算および排水容量の計算

Left Side												1 /2	
Check point		Catchment Area	Q=0.278 C.I.A.						Qc(m3/s)			Qc > Q	Remarks
			C	I(mm/h)	W(m)	L(m)	A(m2)	Q(m3/s)	Structure	I (%)	Qc(m3/s)		
<1>	0+590		0.8	90.3	30.0	590	17,700	0.355		min.			
										0.96%			
		total	0.8	90.3			17,700	0.355	DV-A				
									(TypeA-2)	0.96%	0.459	ok	
			0.8	90.3	30.0	150	4,500	0.090	CP-D0.30	0.96%	0.093	ok	
			0.8	90.3	30.0	450	13,500	0.271	CP-D0.45	0.96%	0.273	ok	
			0.8	90.3	30.0	590	17,700	0.355	CP-D0.60	0.96%	0.588	ok	
<2>	0+590	<1>	0.8	102.9	30.0	590	17,700	0.405					
Cross Pipe									CP-D0.60	0.50%	0.424	ok	
<3>	0+890		0.8	90.3	30.0	300	9,000	0.181	DV-A				
									(TypeA-2)	0.72%	0.397	ok	
			0.8	90.3	30.0	130	3,900	0.078	CP-D0.30	0.72%	0.080	ok	
			0.8	90.3	30.0	300	9,000	0.181	CP-D0.45	0.72%	0.236	ok	
<4>	0+890	<3>	0.8	102.9	30.0	300	9,000	0.206					
Cross Pipe									CP-D0.60	0.30%	0.329	ok	
<5>	1+460		0.8	90.3	30.0	570	17,100	0.343	DV-A				
									(TypeA-2)	0.42%	0.379	ok	
			0.8	90.3	30.0	100	3,000	0.060	CP-D0.30	0.42%	0.061	ok	
			0.8	90.3	30.0	300	9,000	0.181	CP-D0.45	0.42%	0.181	ok	
			0.8	90.3	30.0	570	17,100	0.343	CP-D0.60	0.42%	0.389	ok	
<6>	1+790	<5>						0.343	DV-A				
			0.8	90.3	30.0	330	9,900	0.199					
		total						0.542	(TypeA-1)	0.82%	1.131	ok	
			0.8	90.3	30.0	330	9,900	0.542	CP-D0.60	0.82%	0.543	ok	
<7>	2+250	<6>						0.542	DV-A				
			0.8	90.3	30.0	460	13,800	0.277	(TypeA-2)	3.10%	0.825	ok	
		total						0.819	CP-D0.60	3.10%	1.057	ok	
<8>	2+440	<7>						0.819					
			0.8	90.3	30.0	190	5,700	0.114	DV-A				
		total						0.934	(TypeA-2)	5.70%	1.118	ok	
			0.8	90.3	30.0	460	13,800	1.097	CP-D0.60	5.70%	1.433	ok	
<9>	2+440		0.8	90.3	30.0	180	5,400	0.108	DV-A				
									(TypeA-2)	2.90%	0.797	ok	
									CP-D0.30	2.90%	0.161	ok	
<10>	3+120		0.8	90.3	22.5	500	11,250	0.226	DV-A				
									(TypeA-2)	1.90%	0.646	ok	
			0.8	90.3	22.5	300	6,750	0.136	CP-D0.30	1.90%	0.130	ok	
			0.8	90.3	22.5	500	11,250	0.226	CP-D0.45	1.90%	0.384	ok	

Left Side												2	/2
Check point		Catchment Area	Q=0.278 C.I.A.						Qc(m3/s)			Qc > Q	Remarks
			C	I(mm/h)	W(m)	L(m)	A(m2)	Q(m3/s)	Structure	I (%)	Qc(m3/s)		
<11>	3+460	<10>						0.226	DV-A				
			0.8	90.3	22.5	240	5,400	0.108	(TypeA-2)	1.60%	0.592	ok	
		total						0.334					
			0.8	90.3	22.5	240	5,400	0.334	CP-D0.45	1.60%	0.353	ok	
<12>	3+710	<11>						0.334	DV-A				
			0.8	90.3	11.0	250	2,750	0.055	(TypeA-2)	1.20%	0.513	ok	
		total						0.390	CP-D0.60	1.20%	0.657	ok	
<13>	3+710	<12>	0.8	102.9			19,400	0.444	CP-D0.60	0.60%	0.465	ok	
Cross Pipe													
<14>	3+710		0.8	90.3	11.0	250	2,750	0.055	DV-A				
									(TypeA-2)	1.20%	0.513	ok	
									CP-D0.30	1.20%	0.104	ok	
<15>		<13>						0.444					
		<14>						0.055	DV-A				
			0.8	90.3	23.0	160	3,680	0.074	(TypeA-2)	1.70%	0.611	ok	
		total						0.573	CP-D0.60	1.70%	0.783	ok	
<16>	4+020		0.8	90.3	15.0	310	4,650	0.093	CP-D0.30	3.10%	0.104	ok	
<17>	4+390		0.8	90.3	14.0	370	5,180	0.104	U-0.45x0.23	3.80%	0.253	ok	

Right Side												1 /2	
Check point		Catchment Area	Q=0.278 C.I.A.						Qc(m3/s)			Qc > Q	Remarks
			C	I(mm/h)	W(m)	L(m)	A(m2)	Q(m3/s)	Structure	I (%)	Qc(m3/s)		
(1)	0+590		0.8	90.3	30.0	590	17,700	0.355		min.			
										0.96%			
		total	0.8	90.3			17,700	0.355	DV-A				
									(TypeA-2)	0.96%	0.459	ok	
			0.8	90.3	30.0	150	4,500	0.090	CP-D0.30	0.96%	0.093	ok	
			0.8	90.3	30.0	450	13,500	0.271	CP-D0.45	0.96%	0.273	ok	
			0.8	90.3	30.0	590	17,700	0.355	CP-D0.60	0.96%	0.588	ok	
(2)	0+890		0.8	90.3	30.0	300	9,000	0.181	DV-A				
									(TypeA-2)	0.72%	0.397	ok	
		total						0.181					
			0.8	90.3	30.0	130	3,900	0.078	CP-D0.30	0.72%	0.080	ok	
			0.8	90.3	30.0	300	9,000	0.181	CP-D0.45	0.72%	0.236	ok	
(3)	1+460		0.8	90.3	30.0	570	17,100	0.343	DV-A				
									(TypeA-2)	0.42%	0.379	ok	
		total						0.343					
			0.8	90.3	30.0	100	3,000	0.060	CP-D0.30	0.42%	0.061	ok	
			0.8	90.3	30.0	300	9,000	0.181	CP-D0.45	0.42%	0.181	ok	
			0.8	90.3	30.0	570	17,100	0.343	CP-D0.60	0.42%	0.389	ok	
(4)	1+790		0.8	90.3	30.0	330	9,900	0.199	DV-A				
									(TypeA-2)	0.82%	0.424	ok	
		total						0.199					
			0.8	90.3	30.0	140	4,200	0.084	CP-D0.30	0.82%	0.086	ok	
			0.8	90.3	30.0	330	9,900	0.199	CP-D0.45	0.82%	0.252	ok	
(5)	2+250	(4)						0.199	DV-A				
			0.8	90.3	30.0	460	13,800	0.277	(TypeA-2)	3.10%	0.825	ok	
		total						0.476	CP-D0.45	3.10%	0.491	ok	
(6)	2+440	(5)						0.476	DV-A				
			0.8	90.3	30.0	190	5,700	0.114	(TypeA-2)	5.70%	1.118	ok	
		total						0.590	CP-D0.45	5.70%	0.665	ok	
(7)	2+440		0.8	90.3	30.0	180	5,400	0.108	DV-A				
									(TypeA-2)	2.90%	0.797	ok	
									CP-D0.30	2.90%	0.161	ok	
(8)	3+120		0.8	90.3	22.5	500	11,250	0.226	DV-A				
									(TypeA-2)	1.90%	0.646	ok	
			0.8	90.3	22.5	280	6,300	0.127	CP-D0.30	1.90%	0.130	ok	
			0.8	90.3	22.5	500	11,250	0.226	CP-D0.45	1.90%	0.384	ok	

Right Side | 2 /2

Check point		Catchment Area	Q=0.278 C.I.A.						Qc(m3/s)			Qc > Q	Remarks
			C	I(mm/h)			A(m2)	Q(m3/s)	Structure	I (%)	Qc(m3/s)		
(9)	3+460	(8)						0.226	DV-A				
	(0+000)		0.8	90.3	22.5	240	5,400	0.108	(TypeA-2)	1.60%	0.592	ok	
		total						0.334	CP-D0.45	1.60%	0.353	ok	
(10)	0+280	(9)						0.334					
			0.8	90.3	15.0	270	4,050	0.081	DV-A				
		total						0.416	(TypeA-2)	3.00%	0.811	ok	
									CP-D0.30	3.00%	0.164	ok	
			0.8	90.3	15.0	270	4,050	0.416	CP-D0.45	3.00%	0.483	ok	
(11)	0+360	<15>						0.573					
		(10)						0.416	DV-A				
			0.8	90.3	15.0	80	1,200	0.024	(TypeA-2)	3.00%	1.014	ok	
		total						1.013	CP-D0.60	3.00%	1.040	ok	
(12)	4+020		0.8	90.3	15.0	310	4,650	0.093	CP-D0.30	3.10%	0.104	ok	
(13)	4+390		0.8	90.3	14.0	370	5,180	0.104	U-0.45x0.23	3.80%	0.253	ok	