資料 7.　その他の資料・情報

資料 7-1　技術覚書

Japan International Cooperation Agency (JICA)

THE BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF LIVINGSTONE CITY ROADS IN THE REPUBLIC OF ZAMBIA

6-Dce-2007

Memorandum

Subject: <u>Technical note of Design Value to be used for the Basic Design Study on the Project</u>

The JICA Study Team will propose the following principal standard for the design of captioned project.

Description		Units	Value
Design Speed		Km/hr	60
No. of Lanes		No.	2 [4]
Carriageway Width		m	6.1 [6.7,14.0]
Shoulder width		m	2.0
Maximum Gradient		%	8
Maximum Superelevation		%	6
Fill Slope	Granular soil	Angle	1:1.5～2.0 (depend on soil type)
Cut Slope	Hard Rock	Angle	1:0.5
	Decomposed Rock	Angle	1:0.75
	Other than Rock	Angle	1:1.0～1.5 (depend on soil type)
Design Period		-	10 Years

Note : ( ) = Minimum value、[ ] = Select lane case, and 4 Lane Case

Peter Lubambo
Director
Department of Infrastructure and Support Services
Ministry of Local Government and Housing (MLGH)

T. MASUI
Chief Consultant of JICA Study Team

(Witness)

Erasmus M. Chilundika
Acting Director & CEO
Road Development Agency

THE TECHNICAL NOTES ON THE BASIC DESIGN STUDY(I)
ON THE PROJECT FOR THE IMPROVEMENT OF
LIVINGSTONE CITY ROADS IN THE REPUBLIC OF ZAMBIA

The following issues were confirmed by Livingstone City Council(LCC), Road Development Agency(RDA) and JICA Study team.

5th December 2007

1. The proposed design prepared by JICA Study team after the field survey II in Japan principally follows the existing condition, such as the cross section as shown in the attachment-1, the horizontal curve, the vertical curve,the existing drainage facilities along the road, the existing sidewalk and so on.

2. The proposed design above mentioned shall refer to the memorandum of the joint inspection 26th November 2007 as shown in the attachment-2

3. The design of the project road shall be carried out in accordance with the SATCC design manuals as follows:

   - SATCC Draft Code of Practice for the Geometric Design of Trunk Roads, Sept 1998 (Reprinted July 2001)

   - SATCC Draft Code of Practice for the Geometric Design of Road Pavements, Sept 1998 (Reprinted July 2001)

   - SATCC Draft Code of Practice for the Rehabilitation of Road Pavement, Sept 1998 (Reprinted July 2001)

4. The pavement analysis shall be carried out in accordance with the AASHTO.

香野拓司

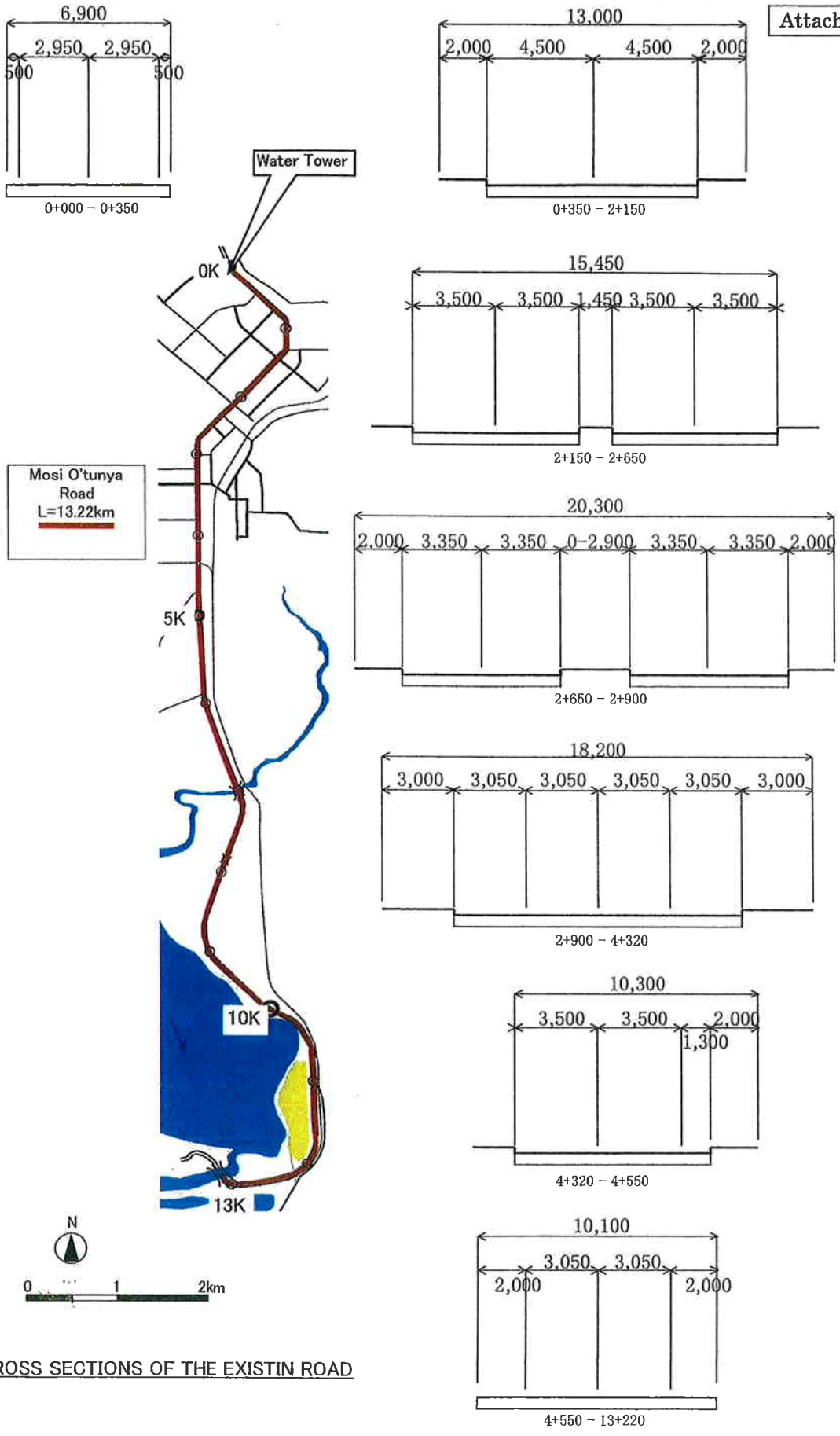
KONO TAKUJI
Design Engineer(I)
JICA Study Team

GEOFFREY

~~GOREE~~Y SINYWIBULULA
Director of Engineering Service
Livingstone City Council

LAZAROUS NYAWALI
Regional Engineer
Southern Province of
Road Development Agency

Attachment-1



CROSS SECTIONS OF THE EXISTIN ROAD

Attachment-2

MEMORUNDUM FOR JOINT SITE INSPECTION
WITH LCC, RDA AND JICA STUDY TEAM
ON THE PROJECT FOR IMPROVEMENT OF LIVINGSTONE CITY ROADS

DATE : 26th November 2007

TIME : AM8:30 – PM3:00

PARTICIPANTS :

Mr. Clement Mutale Chisanga	Director of City Planning (LCC)
Mr. Charles Sichzya	Deputy Director of Engineering Service (LCC)
Mr. Steven Mwiya	Technician of HMS(Highway Management System) of RDA, Southern Province
Mr. KONO Takuji	Road Designer I (JICA Study Team)
Mr. SHIMIZU Nouharu	Road Designer II (JICA Study Team)
Mr. HIROSE Sueo	Natural Condition Surveyor (JICA Study Team)
Mr. ONODA Shin	Construction Planner (JICA Study Team)

1. Purpose of Joint Inspection

The joint site inspection was held on 26th November 2007 for the purpose of discussing the following the points of view each other on site.

- Actual Situation of Existing Drainage and Subjects to be solved
- Confirmation of Typical Project Components
- Relocation of Utilities

2. Transverse Drainage

2-1 It was agreed by LCC, RDA (hereinafter referred as "Local Authority") that the existing drainage along the project road should be cleaned before commencement of construction.

2-2 It was confirmed that Local Authority shall carry out a field inspection on the existing drainage situation from maintenance point of view per a month. In addition, Local Authority shall prepare information on the cleaning program/routine maintenance of the drainage facilities on contract base in details.

2-3 It was requested by Local Authority that the diameter of pipes should be applied to 600mm in minimum, 900mm in standard in case of replacements.

2-4 It was confirmed that the existing drainage under good condition would be remained. However, the existing catch-basin along the shoulder should be replaced by new one (size 1.0m*1.0m) taking account into facilitating maintenance.

2-5 It was confirmed that the existing catch-basin along the road between Kafubu Road and Dry Port should be replaced with a new one. And the transverse drainage shall be newly constructed around Dry Port.

2-6 It was confirmed that the corrugated steel pipe and drum steel pipe in town area (from B1 to P10) should be replaced by concrete pipes. And then the existing transverse drainage under pedestrian shall be replaced by the open drain ditch with cover plate instead of the existing pipe. And the inlet/outlet also shall be replaced with new ones, especially the sediment in the inlet shall be constructed soil sump.

2-7 It was confirmed that the open drain ditch should be constructed in the median strip in centre town for catchment basin with removable cover.

2-8 The open drain ditch with cover plate concrete made shall be constructed at the junction of access road as the case may be necessary.

2-9 A ditch shall be constructed along the road from the outlet of P31 to suitable area close to the site.

2-10 It was confirmed that the Local Authority do not dump rubbish/debris/silt producing from the cleaning of the existing/proposed drainage facilities beside them anymore. Products removed and should be dumped in a disposal area prepared by Local Authority

3. Road Structures

3-1 It was confirmed that the beginning of project (Km0+000) was set on the road according to the Tender Drawing Document between Zimba – Livingstone which authorized by the Ministry of Works and Supply.

Accordingly the following data will be prepared by Local Authority at the portion mentioned above;

- Horizontal curve
- Vertical curve and the elevation at the end of the project
- Cross section
- Pavement
- Others if required.

3-2 It was agreed by Local Authority to provide both documents of Urban Development Plan including the community development and SEED Project to JICA Study Team.

3-3 It was requested by the Local Authority that the proposed drainage direction should not go to the railway in the border area. In addition, the following were requested by NHCC at the site in the design;

- To utilize the existing drainage conditions of the site
- To protect the proposed drainage from being damaged by heavy vehicles
- To improve the Island in the parking space beside the Immigration Office to accommodate Tourists there.

3-4 It was agreed by the Local Authority that the access roads for private area shall be paved by chipping.

3-5 The width of the proposed pedestrian around border facility section shall be planned from 70cm to 100cm depending on the site condition.

3-6 The road structure (mound kerb/flat kerb) from the border facility to the end of the Project shall be maintained as it is actual. However, it should be examined as planed such as the heavy vehicle should not park on the shoulder.

3-7 It was agreed by the Local Authority that the existing drainage shall be rehabilitated and land granding along the service road which was requested accordingly by the Local Authority.

4. Existing Bridges

4-1 It was agreed by the Local Authority that the methodology of partial repairing works for existing bridges shall be rust proof treatment for corroded reinforcement after removing concrete.

4-2 It was requested by Local Authority that the safety facility shall be planned back and forth of existing bridges.

4-3 And it was confirmed by both the Local Authority and the consultant, the substructure of the bridge is still functioned enough.

4-4 Local Authority shall inform to the consultant about the design information of the bridge, such as the design life, the design load, the constructed year.

5. Relocation of Public Utilities

5-1 It was agreed by Local Authority to give the unit price of relocation of public utilities to JICA Study Team.

5-2 The Local Authority shall prepare the required information to estimate the quantities of them, such as the location map, layout map and the drawings to show their structure details.

6. Others

6-1 It was agreed by the Local Authority that it shall coordinate with related Authorities to obtain clearance and supporting letter for environmental issues (EPB).

6-2 Regarding on the items of 4-5(Additional Requests) in MD signed on 21st November 2007 in Lusaka, Local Authority shall prepare concrete evidence in detail for clearing the maintenance problems on them.

6-3 It was agreed by Local Authority that Local Authority shall give the information concerning place of base camp, disposal area, and borrow pit.

6-4 Local Authority will prepare plan/program to use the proposed facilities (Parking Area, Cycling Road, and the others) as requested by them under this project.

6-5 Local Authority will prepare suggestions to show the location of the proposed bus stop based on their community development plan to the Study team.

6-6 Local Authority will prepare a traffic control/management plan on Livingsutone city as a design refference.

Technical Notes

on the Basic Design Study

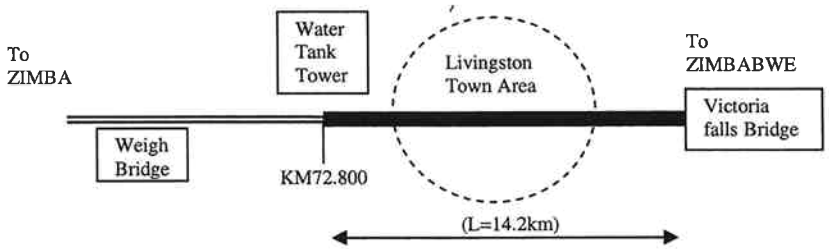
on the Project for Improvement of Livingstone City Roads in the Republic of Zambia

DATE : October 10, 2007

VENUE : Department of Infrastructure & Support Services, MLGH

The following issues were confirmed by the Road Development Agency (RDA), Ministry of Local Government and Housing (MLGH), Livingstone City Council (LCC) and JICA Study team.

1. Lusaka Head office of RDA under the Ministry of Works and Supply (MOWS) confirmed that the improvement on the requested section, as shown in the figure below, of T1 (Mosi O'Tunya road) under Japan Grand Aide is based on the request (Overlay) from LCC through MLGH submitted in July of 2006.



The requested section for the improvement

Note: KM72.8000 of T1 starting from Zimba to Livingston financed under 9th EU Fund

2. Accordingly, the existing weigh bridge was excluded from the improvement section above as the EU will fund works from Zimba to Water tank tower in Livingstone.

3. MLGH confirmed the request prepared by LCC in July of 2006 as shown in the attached Figure-1.

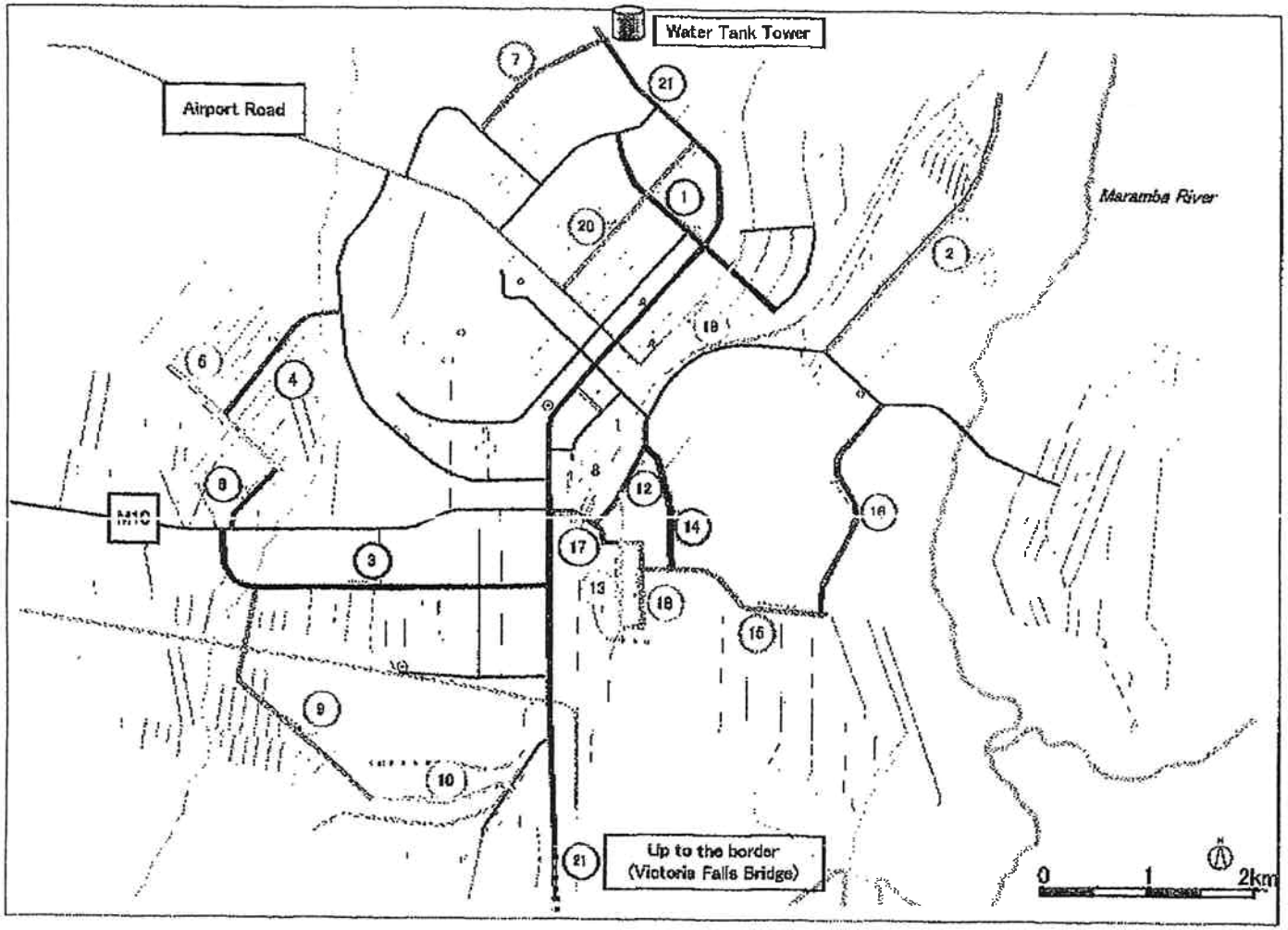
増井 徹美

Masui Tetsumi
Chief Consultant
JICA Study Team

10/10/07

Peter Lubambo
Director
Department of Infrastructure and Support Services
Ministry of Local Government and Housing

Daniel Mulonga
Acting Manager-Planning & Design
Road Development Agency



Road No.	Road Name	Length of Road (km)	Width of Road (m)
1	Kapondo Street	0.3	7
2	Kaunda Road	1.7	7
3	Kafubu Road	2	7
4	Lenda Road	0.9	6.1
5	Botswana Road	1.1	6.1
6	Chipata Road	0.4	7
7	Nahumba Road	0.8	7
8	Mikambo Road	0.3	6.1
9	Sambono Road	1.9	7
10	Balewa Road	0.8	7
11	Obote Avenue	1.3	7
12	Tanzania Road	0.7	6.1
13	Nyanse Road	0.8	6.1
14	Chipembi Road	0.7	6.1
15	Siambalela Road	1.4	7
16	Linda Road	1.3	7
17	Nakatindi Road	0.6	7
18	Ngoma Road	0.5	6.1
19	Chimwemwe Way	1.1	6.1
20	Nehru Way	1.1	6.1x2
21	Mosi O'tunya Road	14.2	7.0-14.0 2 lane to 4 lane
	Total of Road Length	33.8	

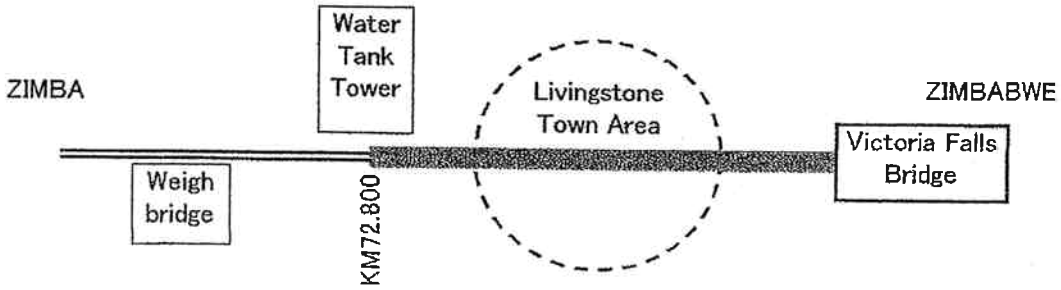
Figure-1 Requested Roads

THE TECHNICAL NOTES ON THE BASIC DESIGN STUDY(I) ON THE PROJECT FOR THE IMPROVEMENT OF LIVINGSTONE CITY ROADS IN REPUBLIC OF ZAMBIA

The following issues were confirmed by Road Development Agency(RDA), Livingstone City Council(LCC) and JICA Study team.

12th October , 2007

1. Southern province regional office of RDA confirmed that the improvement on the requested section, as shown in the figure below, of T1(Mosi O'Tunya road) under Japan Grand Aid is based on the request (Overlay) from LCC through Ministry of Local Government and Housing (MLGH) submitted in July of 2006



The requested section for the improvement

Note:KM72.800 taking from end point of the rehabilitation of Trunk road T1 Zimba to Livingstone financed under the 9th EU Fund.

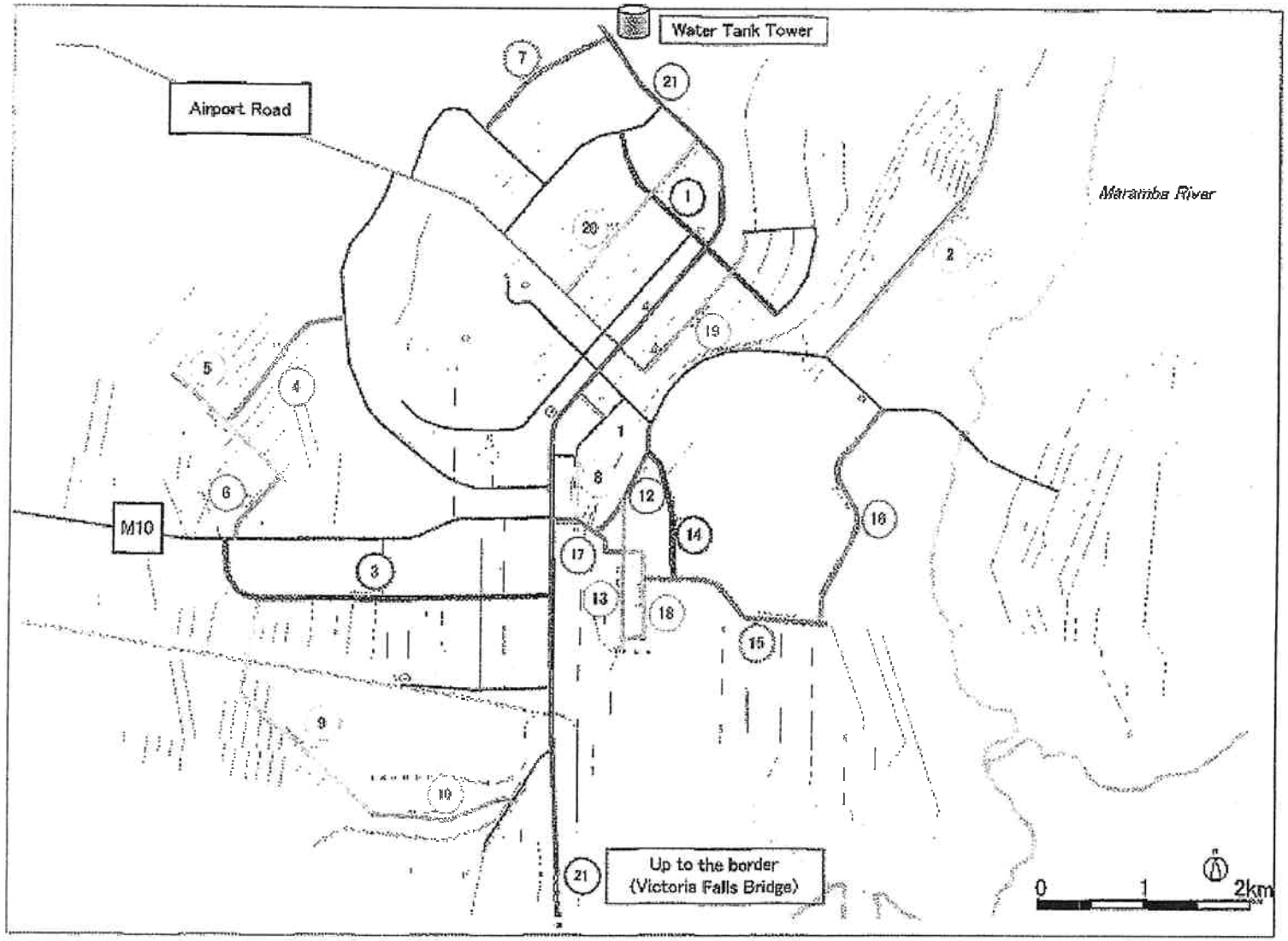
2. Accordingly, the existing weighbridge was excluded from the improvement section explained above.

3. LCC confirmed the request prepared by LCC in July of 2006 as shown in the attached Figure-1.

KONO TAKUJI
Road Design Engineer (I)
JICA Study Team

CHARLES SICHIZYA
Depty Director of Engineering
Service Livingstone City Council

MUBUYAETA KAPINDA
Regional Engineer
Southern Province of
Road Development Agency



Road No.	Road Name	Length of Road (km)	Width of Road (m)
1	Kapondo Street	0.18	7
2	Kaunda Road	1.81	7
3	Kafubu Road	2.07	7
4	Lenda Road	0.85	6.1
5	Botswana Road	0.91	6.1
6	Chipata Road	0.44	7
7	Nahumba Road	0.88	7
8	Mikambo Road	0.35	6.1
9	Sambono Road	1.52	7
10	Balewa Road	0.78	7
11	Obote Avenue	1.32	7
12	Tanzania Road	0.70	6.1
13	Nyansa Road	0.79	6.1
14	Chipembi Road	0.70	6.1
15	Siambelele Road	1.20	7
16	Linda Road	1.36	7
17	Nakatindi Road	0.45	7
18	Ngoma Road	0.68	6.1
19	Chimwemwe Way	0.98	6.1
20	Nehru Way	1.13	6.1x2
21	Mosi O'tunya Road	13.22	7.0-14.0
	Total of Road Length	32.32	

Figure-1 Requested Roads

資料 7-2　関係機関からの確認レター

NATIONAL HERITAGE CONSERVATION COMMISSION
SOUTH-WEST REGION
Chishimba Falls Road
P .O. Box 60124
Tel: 260-03-323662, Fax: 03-260-323653
E-mail: nhccsowe@zamnet.zm
Livingstone -Zambia

REPUBLIC OF ZAMBIA
LIVINGSTONE CITY COUNCIL
OFFICE OF THE DIRECTOR
8 NOV 2007
TOWN PLANNING
P.O. BOX 60029, LIVINGSTONE

Ref: NHCC/CONF/501/01/3

6th November, 2007

(終点付近の歩道拡幅に伴う切土に対する了解レター(NHCC))

The Town Clerk
Livingstone City Council
P.O. BOX 60029
LIVINGSTONE

ATTN: DIRECTOR CITY PLANNING

Dear Sir

RE: REHABILITATION OF MOSI-OA-TUNYA ROAD

Reference is made to your letter dated 20th October 2007 on the above subject wherein you were seeking guidance on how far the walk way should go and the width it should have.

Firstly, we would like to emphasis the fact that the area in question is indeed limited in size and is in the World Heritage Site and any significant excavation would result in the loss of wilderness value. Secondly, on the limited section is the last viewing point which is popular to foreign tourists.

In this regard and as discussed on the phone with you, we suggest that the walkway can go as far as the bridge at the width of 1.3 metres, but we advise that the envisaged excavation work should not reach the boundary wire fence of the National Monument.

Considering that some portion of earth will be scrapped away, we request through your office that the contractor can consider putting a reinforced fence to secure the National Monument boundary after walkway and drainage have been done.

We hope our suggestion will be valuable in your project design.

Yours Sincerely
NATIONAL HERITAGE CONSERVATION COMMISSION

MUYUMBWA NDIYOI
ACTING REGIONAL DIRECTOR
For/EXECUTIVE DIRECTOR

Cc: Acting Planner
Cc: Site Manager - VFWHS

Livingstone City Council

OFFICE OF THE TOWN CLERK
P.O BOX 60029
Telephone: 323847/323790
Fax: 260-3-322149
Telex: LCC ZA 24032

Town Clerk's office
Civic Centre
Livingstone
Zambia

(立木の伐採許可レター)

14th February 2008

Construction Project Consultants Inc
YSK Bldg 3-23-1 Takadanobaba Shinjuku-ku
Tokyo 169-0075
J A P A N

Attention: Mr Masui

Dear Sir

RE: IMPROVEMENT OF MUSI -OA- TUNYA ROAD - TREE CUTTING

As a follow up to the site visit we had with yourselves, we agree that the numbers of trees to be removed are as indicated below:-

1. Junction of Airport with Musi -Oa -Tunya – maximum number of trees to be removed is two (2).

2. Junction of M10 (Nakatindi road) with Musi -Oa- Tunya – maximum number of trees to be removed is four (4).

Yours faithfully
LIVINGSTONE CITY COUNCIL

FG **KALENGA**
TOWN CLERK/CHIEF EXECUTIVE

cc Town Clerk
cc Parks Superintendent
cc Director of Engineering Services

CC/ckb..

ALL CORRESPONDENCE TO BE ADDRESSED TO THE TOWN CLERK

NATIONAL HERITAGE CONSERVATION COMMISSION
SOUTH-WEST REGION
Chishimba Falls Road
P .O. Box 60124
Tel: 260-03-323662, Fax: 03-260-323653
E-mail: nhccswr@zamnet.zm
Livingstone -Zambia

(NHCC, 排水計画への了解レター)

NHCC/501/01/3

13th December, 2007

The Town Clerk
Livingstone City Council
P.O. Box 60029,
LIVINGSTONE.

Dear Sir.

REQUEST TO DRAIN STORM WATER THROUGH THE PROJECTED AREA AT THE VICTORIA FALLS BORDER

Reference is made to your letter referenced **LCC/103/29/07** dated 30th November 2007 on the above subject.

Your request to use the existing drainage and natural waterways is granted. However, we would like to indicate that the project should make every effort to enhance the natural environment rather than detract from it.

As discussed with your staff and consultants, the storm water should be allowed to spread and not to be concentrated.

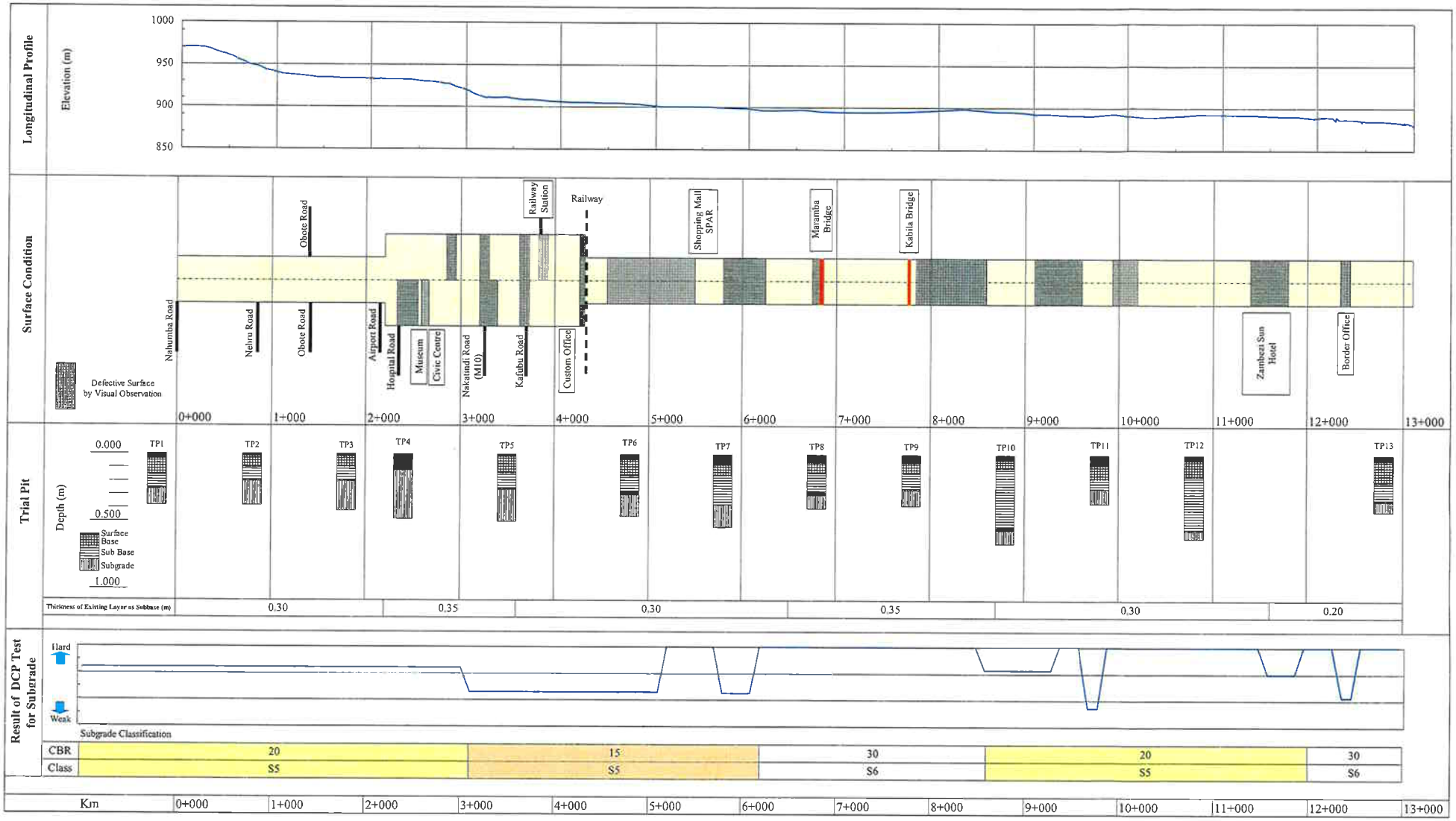
We hope our response will be valuable to the progress of the project.

Yours faithfully,

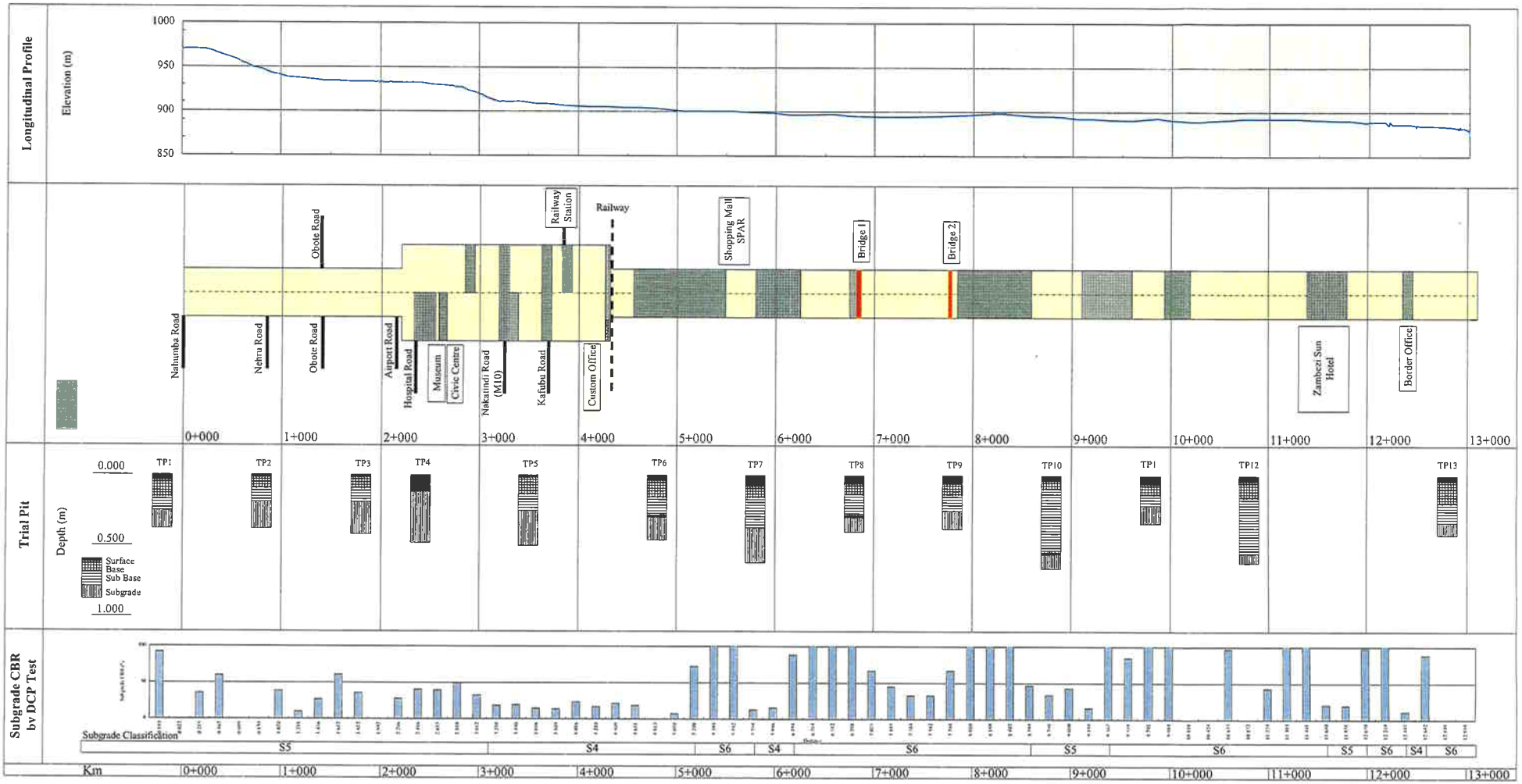
Muyumbwa Ndiyoi
Acting Regional Director

Cc. Executive Director
Act- Director Conservation Services
Site Manager - VF

資料 7-3　自然条件調査結果



Subgrade Classification
S1 : CBR 2
S2 : CBR 3-4
S3 : CBR 5-7
S4 : CBR 8-14
S5 : CBR 15-29
S6 : CBR >30


Longitudinal Profile
Elevation (m)
1000
950
900
850
Nahumba Road
Nehru Road
Obote Road
Obote Road
Airport Road
Hospital Road
Museum
Civic Centre
Nakasindi Road (M10)
Kafubu Road
Railway Station
Railway
Custom Office
Shopping Mall SPAR
Bridge 1
Bridge 2
Zambezi Sun Hotel
Border Office
0+000
1+000
2+000
3+000
4+000
5+000
6+000
7+000
8+000
9+000
10+000
11+000
12+000
13+000
Trial Pit
Depth (m)
0.000
0.500
1.000
Surface
Base
Sub Base
Subgrade
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP1
TP12
TP13
Subgrade CBR by DCP Test
Subgrade Classification
S5
S4
S6
S4
S6
S5
S6
S5
S6
S4
S6
Km
0+000
1+000
2+000
3+000
4+000
5+000
6+000
7+000
8+000
9+000
10+000
11+000
12+000
13+000

TP1 0-193 DCP1 EC Section

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.020	Wearing	Bituminous Chipping	0.020		
0.170	Base	Dense garvel (Stabilised)	0.150		
0.295	Subbase	Dense gravel (Not Stabilised)	0.125		
0.425	Subgrade	Sandy Clay soil	0.130		
1.000					

TP2 0+830 DCP6

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.040	Wearing	Bituminous Chipping	0.040		
0.140	Base	Curushed Stone	0.100		
0.270	Subbase	Dense Gravel	0.130		
0.470	Subgrade	Sandy Soil	0.200		
1.000					

TP3 1+812 DCP11 Near New Fair Mount Hotel

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.050	Wearing	Bituminous Chipping	0.050		
0.170	Base	Curushed Stone	0.120		
0.320	Subbase	Gravel (Stabilised)	0.150		
0.520	Subgrade	Dense Sandy Soil	0.200		
1.000					

TP4 2+416 DCP14 Center of Town

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.115	Wearing	Bituminous Chipping	0.115		
0.565	Subgrade	Sandy Material (Not Stabilised)	0.450		
1.000					

TP5	3+490	DCP19	in front of Ocean Bascket			
Depth (m)		Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000						
0.040		Wearing	Bituminous Chipping	0.040		
0.180		Base	Crushed Stone	0.140		
0.335		Subbase	Crushed Stone (Not Stabilised)	0.155		
0.650		Subgrade	Dense Sandy Clay Soil	0.150		
1.000						

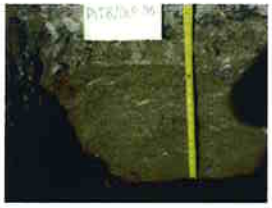
TP6	4+803	DCP26	Before SPAR			
Depth (m)		Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000						
0.050		Wearing	Bituminous Chipping	0.050		
0.200		Base	Crushed Stone	0.150		
0.350		Subbase	Crushed Stone	0.150		
0.375		Wearing	Bituminous Chipping	0.025		
0.575		Subgrade	Dense Gravel	0.200		
1.000						

TP7 5+798 DCP31 Near Sichanga Road

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.100	Wearing	Bituminous Chipping	0.100		
0.200	Base	Crushed Stone (Stabilised)	0.100		
	Subbase	Crushed Stone (Not Stabilised)	0.275		
0.475					
	Subgrade	Dense Sandy Clay Soil	0.200		
0.675					
1.000					

TP8 6+798 DCP36

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.400	Wearing	Bituminous Chipping	0.040		
	Base	Crushed Stone	0.105		
0.145					
	Subbase	Crushed Stone with Sand	0.277		
0.422					
0.449	Wearing	Bituminous Chipping	0.025		
0.520	Subgrade	Dense Gravel	0.071		
1.000					



TP9 7+794 DCP41

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.00					
0.060	Wearing	Bituminous Chipping	0.060		
0.180	Base	Crushed Stone (Stabilised)	0.120		
0.320	Subbase	Dense Sandy Clay Soil	0.140		
0.460	Subgrade	Crushed Stone	0.140		
1.000					

TP10 8+798 DCP46

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.050	Wearing	Bituminous Chipping	0.050		
0.130	Base	Crushed Stone (Stabilised)	0.080		
0.680	Subbase	Natural Soil	0.550		
0.690	Wearing	Bituminous Chipping	0.010		
0.820	Subgrade	Crushed Stone	0.130		
1.000					

TP11 9+791 DCP51

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.00					
0.095	Wearing	Bituminous Chipping	0.095		
0.215	Base	Crushed Stone	0.120		
0.315	Subbase	Dense Sandy Clay Soil	0.100		
0.452	Subgrade	Dense Sandy Soil	0.137		
1.000					

TP12 10+832 DCP56

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.040	Wearing	Bituminous Chipping	0.040		
0.200	Base	Sand Stabilised	0.160		
0.700	Subbase	Dense Sandy Clay Soil	0.500		
0.780	Subgrade	Dense Sandy Soil	0.080		
1.000					

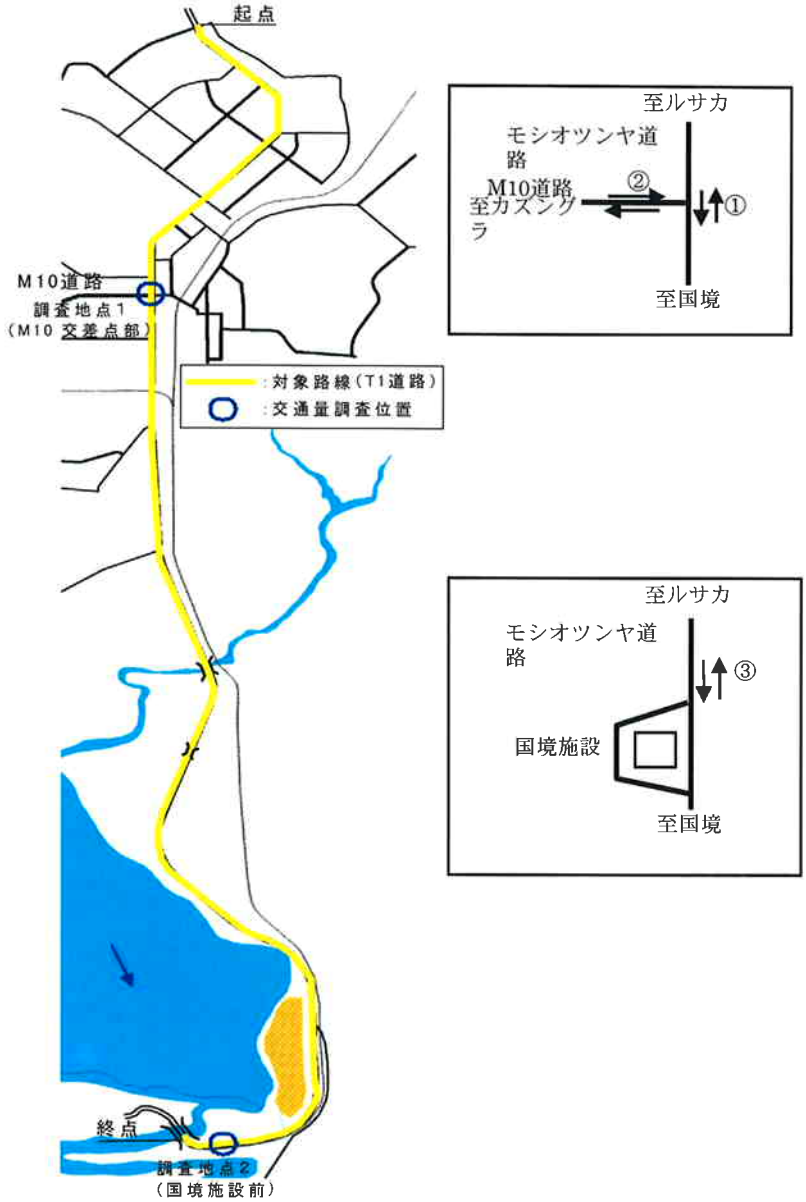
TP13 12+848 DCP66

Depth (m)	Layer	Material	Thickness (m)	Converted CBR by DCP (%)	CBR (Laboratory) (%)
0.000					
0.035	Wearing	Bituminous Chipping	0.035		
0.235	Base	Crushed Stone	0.200		
0.405	Subbase	Dense Sandy Soil	0.170		
0.510	Subgrade	Dense Sandy Clay	0.105		
1.000					

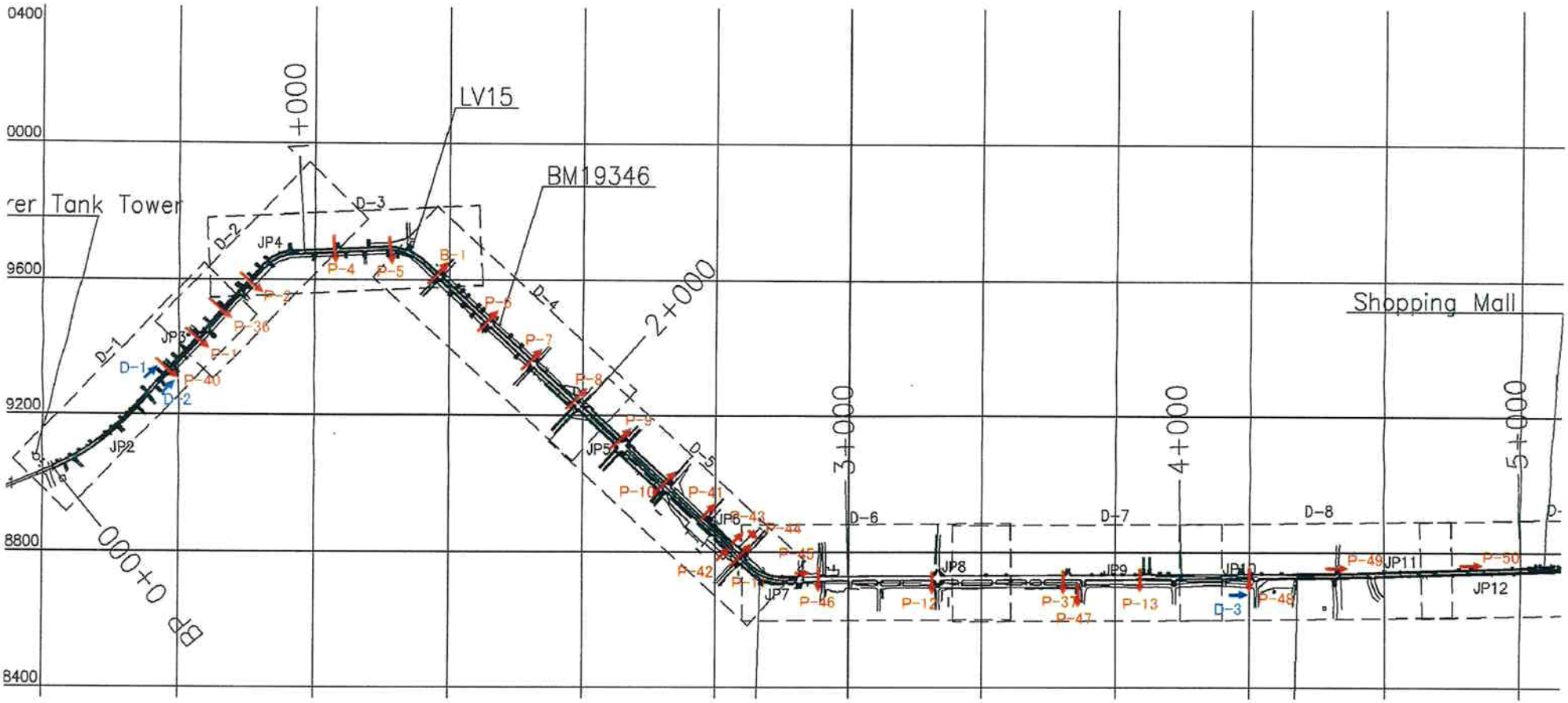
資料 7-4　交通量調査結果

Description		Motorcycle and Scooter	Light Motor Vehicles Cars	Micro Bus /Mini Bus Taxis approx. (9-15 seats)	Light Delivery Vehicle	Small Bus (25-40 seats)	Large Bus (50-70 seats)	Rigid Single Unit Truck	Rigid Single Unit Truck	Single Trailer Truck	Single Trailer	Multi Trailer Truck						Other Transport Bicycles, Cart, etc	Total	Total (Vehicle)	Heavy Vehicle	commercial vehicles ratio	
						2 axles	3 or 4 axles	2 axles	3 or 4 axles	5 axles	6 axles	5 axles	6 axles	7 axles	8 axles	9 axles						(%)	
T1 North Side	1-2/2-1	52	4,562	617	1,671	300	22	218	58	9	29	3	21	41	48	1	66	7,717	7,599	750	9.9	
	1-3/3-1	16	3,127	273	667	149	22	147	28	2	18	3	10	30	28	2	30	4,547	4,502	435	9.7	
Total		68	7,689	890	2,338	448	44	365	86	11	47	6	31	71	76	3	95	12,263	12,101	1,185	9.8	
T1 South Side	1-2/2-1	52	4,562	617	1,671	300	22	63	13	1	8	1	8	15	17	2	13	7,360	7,296	446	6.1	
	2-3/3-2	15	1,087	180	436	103	31	53	32	12	10	8	4	16	12	1	26	2,023	1,983	280	14.1	
Total		67	5,649	797	2,107	402	53	116	45	13	18	9	12	30	29	3	38	9,383	9,278	726	7.8	
T1 Average	1-2/2-1/	67	6,669	843	2,222	425	48	240	66	12	32	7	21	50	52	3	67	10,823	10,689	955	8.9	
	2-3/3-2																					
Total		67	6,669	843	2,222	425	48	240	66	12	32	7	21	50	52	3	67	10,823	10,689	955	8.9	①
%			62.4	7.9	20.8	4.0	0.4	2.2	0.6	0.1	0.3	0.1	0.2	0.5	0.5	0.0						
M10	1-3/3-1	16	3,127	273	667	149	22	147	28	2	18	3	10	30	28	2	30	4,547	4,502	435	9.7	
	2-3/3-2	15	1,087	180	436	103	31	104	42	14	20	9	8	24	22	1	66	2,159	2,079	376	18.1	
Total		31	4,214	453	1,102	251	52	250	70	16	38	12	18	54	49	3	95	6,706	6,580	811	12.3	②
%			64.0	6.9	16.7	3.8	0.8	3.8	1.1	0.2	0.6	0.2	0.3	0.8	0.7	0.0						
Border	1-2/2-1	10	762	195	216	73	8	42	23	6	19	2	22	30	33	1	41	1,477	1,428	255	17.8	
Total		10	762	195	216	73	8	42	23	6	19	2	22	30	33	1	41	1,477	1,428	255	17.8	③
%			53.3	13.6	15.1	5.1	0.5	2.9	1.6	0.4	1.3	0.1	1.5	2.1	2.3	0.0						

交通量調査測定位置


起点
M10道路
調査地点1
（M10 交差点部）
：対象路線（T1道路）
：交通量調査位置
終点
調査地点2
（国境施設前）
至ルサカ
モシオツンヤ道路
M10道路
至カズングラ
②
①
至国境
至ルサカ
モシオツンヤ道路
③
国境施設
至国境

資料 7-5　技術資料（排水構造物の検討資料）


0400
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8800
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1+000
LV15
BM19346
2+000
3+000
4+000
5+000
Shopping Mall
BP
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P-49
P-50

排水構造物の計画図

Account of drainage facilities (Check of discharge)

No.	Location	Catchment area	Discharge (Q)			Type	Coefficient of roughness (n)	Gradient PH			Area A (m^2)	Hydraulic mean depth R (m)	Discharge velocity V (m/s)	Discharge capacity Qc (m^3/s)	Evaluation	Remarks
			(m^3/s)	(m^3/s)	Total (m^3/s)			H1 (m)	H2 (m)	Slope (I) (%)						
D- 1	0+450 Left	A-1			0.037	U Drain 300×300	0.015			4.000	0.090	0.900	12.429	1.119	O.K	
2	0+450 Left	A-2			0.093	U Drain 300?300	0.015			4.000	0.090	0.900	12.429	1.119	O.K	
P- 40	0+450 Cross	A-1			0.043	Pipe Φ600	0.015			2.000	0.283	0.150	2.662	0.753	O.K	
1	0+580 Cross	A-3			0.014	Existing Pipe Φ350	0.015			2.000	0.096	0.087	1.851	0.178	O.K	
36	0+645 Cross	A-4			0.007	Existing Pipe Φ350	0.015			2.000	0.096	0.087	1.851	0.178	O.K	
2	0+805 Cross	A-5			0.018	Existing Pipe Φ300	0.015			2.000	0.096	0.087	1.851	0.178	O.K	
4	1+085 Cross	A-6			0.012	Existing Pipe Φ300	0.015			2.000	0.096	0.087	1.851	0.178	O.K	
5	1+245 Cross	A-7			0.018	Existing Pipe Φ300	0.015			2.000	0.096	0.087	1.851	0.178	O.K	
B- 1	1+420 Cross	A-8、C-1～C-4	0.360	5.447	5.807	Existing Box 1m×1m	0.015			0.500	1.000	3.000	9.806	9.806	O.K	
P- 6	1+625 Cross	A-9,C-5	0.019	0.396	0.415	Existing Pipe Φ600	0.015			2.000	0.283	0.150	2.662	0.753	O.K	
7	1+805 Cross	A-10,C-6	0.017	0.693	0.710	Existing Pipe Φ600	0.015			2.000	0.283	0.150	2.662	0.753	O.K	
8	Designed by SEED Project															
9	2+160 Cross	A-12,C-8	0.017	1.119	1.136	Pipe Φ900	0.015			2.000	0.636	0.235	3.590	2.283	O.K	
10	2+345 Cross	A-13,C-9	0.029	1.278	1.307	Pipe Φ900	0.015			2.000	0.636	0.235	3.590	2.283	O.K	
41	2+495 Cross	A-14			0.024	Pipe Φ600	0.015			2.000	0.283	0.150	2.662	0.753	O.K	
42	2+620 Cross	A-15			0.063	Pipe Φ600	0.015			2.000	0.283	0.150	2.662	0.753	O.K	
43	2+620 Cross	A-15,16			0.089	Pipe Φ600	0.015			2.000	0.283	0.150	2.662	0.753	O.K	
44	2+650 Left	A-15,16,17			0.121	Pipe Φ600	0.015			2.000	0.283	0.150	2.662	0.753	O.K	
11	2+650 Cross	C-10			1.584	Renewed Pipe Φ1000	0.015			2.000	0.785	0.250	3.742	2.937	O.K	
45	2+840 Left	C-18			0.030	Renewed Pipe Φ600	0.015			4.400	0.283	0.150	3.948	1.117	O.K	
46	2+915 Cross	C-18,19			0.042	Pipe Φ600	0.015			0.500	0.283	0.150	1.331	0.377	O.K	
12	3+250 Cross	C-20			0.053	Existing Pipe Φ600	0.015			0.500	0.283	0.150	1.331	0.377	O.K	
37	3+645 Cross	C-21			0.063	Existing Pipe Φ600	0.015			0.500	0.283	0.150	1.331	0.377	O.K	
13	3+880 Cross	C-22			0.037	Existing Pipe Φ600	0.015			0.500	0.283	0.150	1.331	0.377	O.K	
48	4+205 Cross	C-23			0.051	Pipe Φ600	0.015			0.500	0.283	0.150	1.331	0.377	O.K	
47	3+690 Right	C-24,25			0.151	Renewed Pipe Φ600	0.015			0.500	0.283	0.150	1.331	0.377	O.K	
D- 3	4+200 Right	C-26,27			0.181	Masonry Drain 1020×600×700	0.03			0.500	0.567	0.275	0.997	0.565	O.K	
P- 49	4+450 Left	C-28			0.040	Renewed Pipe Φ900	0.015			0.500	0.636	0.235	1.795	1.142	O.K	
50	4+850 Left	C-28,29			0.078	Renewed Pipe Φ900	0.015			0.500	0.636	0.235	1.795	1.142	O.K	

Discharge Capacity

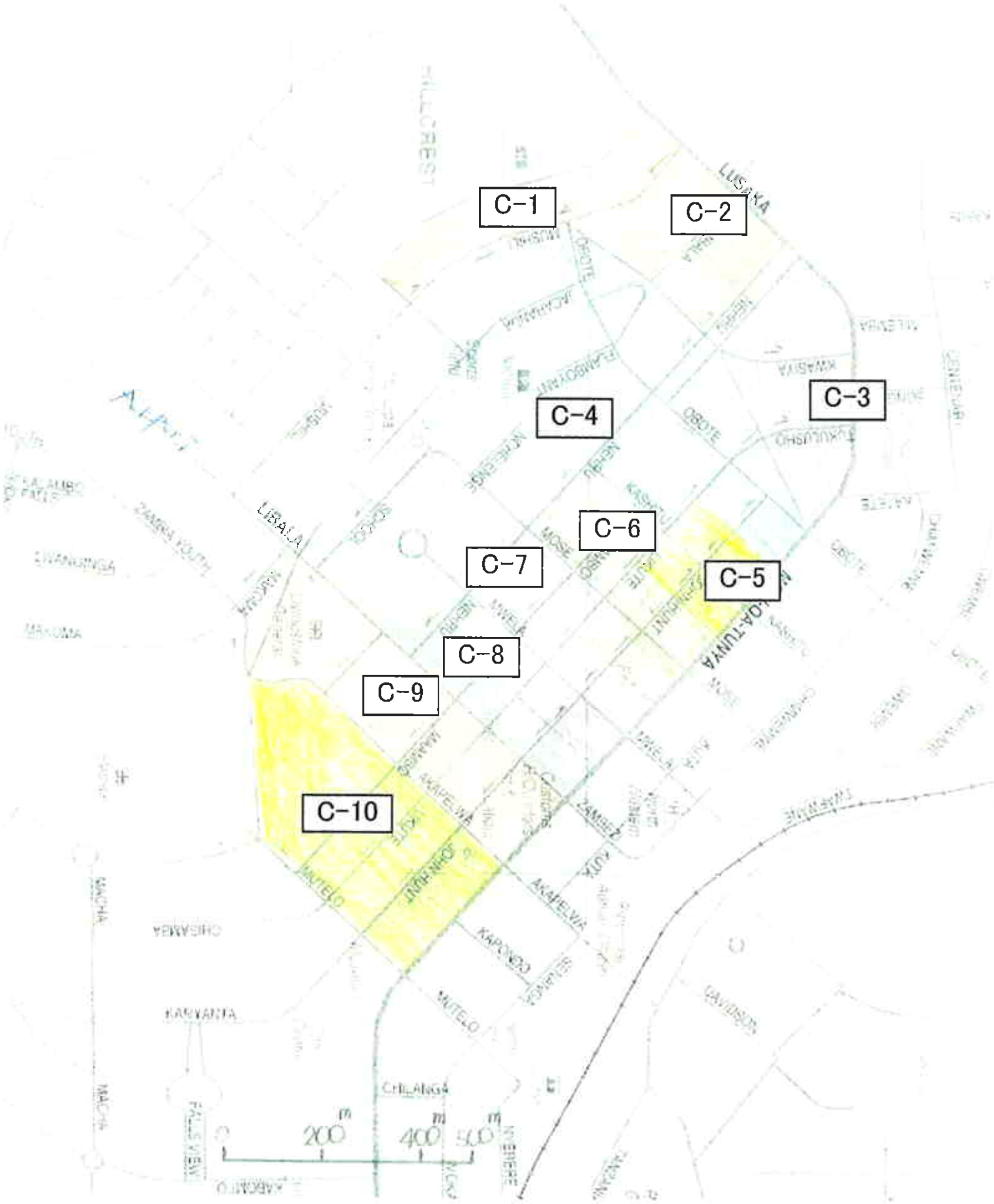
Manning's formula

$V=1/n\times R^{2/3}\times I^{1/2}$

n : Coefficient of roughness
R : Hydraulic mean depth
I : Slope

$Qc=A\times V$

	A	R
Φ300	0.075	0.071
Φ350	0.096	0.087
Φ600	0.283	0.150
Φ900	0.636	0.235
Φ1000	0.785	0.250
Φ1200	1.131	0.300


C-1
C-2
C-3
C-4
C-5
C-6
C-7
C-8
C-9
C-10
LUSAKA
OBOTE
LIBALA
MOSI-OA-TUNYA
AKAPELWA
KAPONDO
MUTELO
CHILANGA
KANYANTA
MACHA
200
400
500

隣接地流域図

Catchment Areas (Adjacent Areas)

No.	Catchment Area (m^3)	Discharge Coefficient	Discharge of Open Drain		Discharge of Culvert		Remarks
			Rainfall Intensity (mm/hr)	Discharge (m^3/s)	Rainfall Intensity (mm/hr)	Discharge (m^3/s)	
C- 1	65,000	0.5	61.8	0.558	71.3	0.644	
C- 2	73,000	0.5	61.8	0.627	71.3	0.723	
C- 3	104,000	0.5	61.8	0.893	71.3	1.030	
C- 4	308,000	0.5	61.8	2.644	71.3	3.050	
C- 5	40,000	0.5	61.8	0.343	71.3	0.396	
C- 6	70,000	0.5	61.8	0.601	71.3	0.693	
C- 7	135,000	0.5	61.8	1.159	71.3	1.337	
C- 8	113,000	0.5	61.8	0.970	71.3	1.119	
C- 9	129,000	0.5	61.8	1.107	71.3	1.277	
C- 10	160,000	0.5	61.8	1.373	71.3	1.584	

Discharge capacity

Rationali's formula

$Q=(1/3.6\times10^{6})\times C\times \gamma \times a$

C : Discharge Coefficient
γ : Rainfall Intensity (mm/hr)
a : Catchment Area

Catchment Areas (Carriageway)

Location								Length (m)	breadth (m)	Catchment Area (m^3)	Discharge Coefficient	Discharge of Open Drain		Discharge of Culvert		Remarks
												Rainfall Intensity (mm/hr)	Discharge (m^3/s)	Rainfall Intensity (mm/hr)	Discharge (m^3/s)	
A- 1	0	+	0	~	0	+	450 Left	450	6	2,700	0.8	61.8	0.037	71.3	0.043	
A- 2	0	+	0	~	0	+	450 Right	450	15	6,750	0.8	61.8	0.093	71.3	0.107	
A- 3	0	+	450	~	0	+	580 Left	130	7	910	0.8	61.8	0.012	71.3	0.014	
A- 4	0	+	580	~	0	+	645 Left	65	7	455	0.8	61.8	0.006	71.3	0.007	
A- 5	0	+	645	~	0	+	805 Left	160	7	1,120	0.8	61.8	0.015	71.3	0.018	
A- 6	0	+	980	~	1	+	85 Left	105	7	735	0.8	61.8	0.010	71.3	0.012	
A- 7	1	+	85	~	1	+	245 Left	160	7	1,120	0.8	61.8	0.015	71.3	0.018	
A- 8	0	+	0	~	1	+	420	1420	16	22,720	0.8	61.8	0.312	71.3	0.360	
A- 9	1	+	420	~	1	+	625 Right	205	6	1,230	0.8	61.8	0.017	71.3	0.019	
A- 10	1	+	625	~	1	+	805 Right	180	6	1,080	0.8	61.8	0.015	71.3	0.017	
A- 11	1	+	805	~	1	+	980 Right	175	6	1,050	0.8	61.8	0.014	71.3	0.017	
A- 12	1	+	980	~	2	+	160 Right	180	6	1,080	0.8	61.8	0.015	71.3	0.017	
A- 13	2	+	160	~	2	+	345 Right	185	10	1,850	0.8	61.8	0.025	71.3	0.029	
A- 14	2	+	345	~	2	+	495 Right	150	10	1,500	0.8	61.8	0.021	71.3	0.024	
A- 15	2	+	380	~	2	+	620	Parking		4,000	0.8	61.8	0.055	71.3	0.063	
A- 16	2	+	495	~	2	+	620 Right	125	10	1,250	0.8	61.8	0.017	71.3	0.020	
A- 17	2	+	495	~	2	+	620 Left	125	16	2,000	0.8	61.8	0.027	71.3	0.032	
A- 18	2	+	650	~	2	+	840 Left	190	10	1,900	0.8	61.8	0.026	71.3	0.030	
A- 19	2	+	840	~	2	+	915 Left	75	10	750	0.8	61.8	0.010	71.3	0.012	
A- 20	2	+	915	~	3	+	250 Left	335	10	3,350	0.8	61.8	0.046	71.3	0.053	
A- 21	3	+	250	~	3	+	645 Left	395	10	3,950	0.8	61.8	0.054	71.3	0.063	
A- 22	3	+	645	~	3	+	880 Left	235	10	2,350	0.8	61.8	0.032	71.3	0.037	
A- 23	3	+	880	~	4	+	205 Left	325	10	3,250	0.8	61.8	0.045	71.3	0.051	
A- 24	3	+	280	~	3	+	690	410	17	6,970	0.8	61.8	0.096	71.3	0.110	
A- 25	3	+	280	~	3	+	690	410	20	8,200	0.25	61.8	0.035	71.3	0.041	
A- 26	3	+	710	~	4	+	200	490	17	8,330	0.8	61.8	0.114	71.3	0.132	
A- 27	3	+	710	~	4	+	200	490	20	9,800	0.25	61.8	0.042	71.3	0.049	
A- 28	4	+	200	~	4	+	450 Left	250	10	2,500	0.8	61.8	0.034	71.3	0.040	
A- 29	4		450		4		850 Left	400	6	2,400	0.8	61.8	0.033	71.3	0.038	