

APPENDICES

APPENDICES

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Appendix 1 Member List of the Study Team

THE PROJECT FOR RECONSTRUCTION OF ATHI AND IKUTHA BRIDGES IN THE REPUBLIC OF KENYA

1-1 For the Study

Name	Job Title	Occupation
Mr. Masakazu FUKUWAKA	Leader	Senior Advisor, JICA
Mr. Hidetaka SAKABE	Project Coordinator	Staff, Grant Aid Management Department, JICA
Mr. Nobuhiro KUBOYA	Chief Consultant/ Road Traffic Planner	Oriental Consultants Co., Ltd.
Mr. Tadao ONO	Bridge Planning Engineer	Oriental Consultants Co., Ltd.
Mr. Jiro KOJIMA	Natural Condition Survey Engineer / (Topography / Geography)	Oriental Consultants Co., Ltd.
Mr. Nobuyuki OKABE	Natural Condition Survey Engineer / (Hydrology)	Oriental Consultants Co., Ltd.
Mr. Haruo YANAGAWA	Construction Planner / Cost Estimator	Japan Bridge & Structure Institute, Inc.

1-2 For Explanation Draft Final Report

Name	Job Title	Occupation
Mr. Takeshi NARUSE	Leader	Deputy Residential Representative, JICA Kenya Office
Mr. Hidetaka SAKABE	Project Coordinator	Staff, Grant Aid Management Department, JICA
Mr. Nobuhiro KUBOYA	Chief Consultant/ Road Traffic Planner	Oriental Consultants Co., Ltd.
Mr. Tadao ONO	Bridge Planning Engineer	Oriental Consultants Co., Ltd.

Appendix 2-1 Study Schedule (for the Site Survey)

No.	Date	Week	Official		Consultant							
			Mr. Fukuwaka	Mr. Sakabe	Mr. Kuboya	Mr. Ono	Mr. Okabe	Mr. Yanagawa	Mr. Kojima			
1	2/10	Sat.		12:40 Narita(BA008)→16:35 London 22:25 London (BA2069)→								
2	11	Sun.		→10:00 Nairobi (BA2069) Team Meeting								
3	12	Mon.		Courtesy Call to JICA Office, Embassy of Japan and MORPW								
4	13	Tue.		Explanation and Discussion of I/C Report								
5	14	Wed.		Discussion of I/C Report			Data Collection					
6	15	Thu.	Arrive. Nairobi	Team Meeting								
7	16	Fri.	Site Survey (Athi and Ikutha Bridge, Road B7)									
8	17	Sat.	Site Survey (Road B7)									
9	18	Sun.	Site Survey and Team Meeting									
10	19	Mon.	Report the Result Site Survey to MORPW									
11	20	Tue.	Discussion of the Minute with MORPW									
12	21	Wed.	Signing of the Minute, Report to JICA and Embassy of Japan				Data Collection					
			23:00 Nairobi (BA2068)		Data Collection							
13	22	Thu.	12:00 London (BA005)		Data Collection		Data Collection					
14	23	Fri.	8:45 Narita		Data Collection		Site Survey		Data Collection	Site Survey		
15	24	Sat.		Team Meeting								
16	25	Sun.		Data Collection		Data Collection and Review			Site Survey			
17	26	Mon.		Data Collection and Arrangement				Site Survey		Site Survey		
18	27	Tue.		Data Collection and Arrangement				Site Survey		Site Survey		
19	28	Wed.		Data Collection and Arrangement				Site Survey		Site Survey		
20	3/1	Thu.		Data Collection		Site Survey		Site Survey		Site Survey		
21	2	Fri.		Report to Embassy of Japan			Data Arrangement			Site Survey		
22	3	Sat.		Data Collection and Arrangement							Site Survey	
23	4	Sun.		Data Collection and Arrangement							Site Survey	
24	5	Mon.		Data Collection and Arrangement							Site Survey	
25	6	Tue.		Site Survey							Site Survey	
26	7	Wed.		Site Survey		Data Arrangement	Site Survey		Data Arrangement		Site Survey	
27	8	Thu.		Team Meeting							Site Survey	
28	9	Fri.		Data Collection			23:00BA2068→		Data Arrangement		Site Survey	
29	10	Sat.		Data Arrangement			4:55 London 12:00 London (BA005)		Data Arrangement		Site Survey	
30	11	Sun.		Data Arrangement			8:45 Narita		Data Collection		Site Survey	
31	12	Mon.		Discussion with MORPW					Discussion		Site Survey	
32	13	Tue.		Discussion with MORPW					Data Collection		Site Survey	
33	14	Wed.		Discussion with MORPW					Discussion		Site Survey	
34	15	Thu.		Discussion with MORPW					Data Collection		Site Survey	
35	16	Fri.		Discussion with MORPW					Discussion		Site Survey	
36	17	Sat.		Data Arrangement					Data Collection, Arrangement			
37	18	Sun.		Team Meeting					Team Meeting			
38	19	Mon.		Report to JICA 23:00 Nairobi (BA2068)					Report to JICA 23:00 Nairobi (BA2068)			
39	20	Tue.		4:55 London (BA2068) 12:00 London BA005)					4:55 London (BA2068) 12:00 London (BA005)			
40	21	Wed.		8:45 Narita					8:45 Narita			

Appendix 2-2 Study Schedule (for the Explanation Draft Final Report)

No	Date	Week	Official		Consultant	
			Mr. Naruse	Mr. Sakabe	Mr. Kuboya	Mr. Ono
1	6/20	Wed.			12:40 Narita(BA008)→16:35 London 22:25 London (BA2069)→	
2	21	Thu.	Team Meeting	→ 10:00 Nairobi(BA2069) Courtesy Call to JICA Team Meeting	→10:00 Nairobi(BA2069) Courtesy Call to JICA Office Team Meeting	
3	22	Fri.		Courtesy Call to MORPW, MOFP、 Explanation of Draft Final Report		
4	23	Sat.			Team Meeting,	
5	24	Sun.		Data Arrangement	Site Survey	
6	25	Mon.	Discussion of the Report with MORPW			
7	26	Tue.	Discussion of the Report and the Minute with MORPW			
8	27	Wed.	Signing of Minute Report to JICA Office and Embassy of Japan	Signing of Minute of Discussion Report to JICA Office and Embassy of Japan 23:00 Nairobi (BA2068) →		
9	28	Thu.		→4:55 London (BA2068) → 12:00 London (BA005)		
10	29	Fri.		→ 8:45 Narita		

Appendix 3 List of Parties Concerned in Kenya

Ministry of Roads and Public Works

- | | |
|-----------------------|---------------------|
| 1. Eng. E.K. Mwongera | Permanent Secretary |
| 2. Eng. E.K. Wambura | Engineer of Chief |

Road Department, MOR&PW)

- | | |
|------------------------|---|
| 3. Eng. P. Wakori | Chief Superintending Engineer (Chief Engineer Road) |
| 4. Eng. M.O.A. Bajaber | Chief Superintending Engineer (Bridge) |
| 5. Eng. J. N. Nkandayo | Chief Superintending Engineer (T/R) |
| 6. Eng. H. Kiragu | Engineer (Bridge) |
| 7. Eng. C. W. Moria | Engineer (Bridge) |
| 8. Mr. Gouhei Tokunaga | JICA Expert (Bridge) |

Ministry of Finance and Planning

- | | |
|----------------------|---|
| 9. Mr. J. K. Kanithi | Under Secretary (External Resources Department) |
|----------------------|---|

District Works Office - Kitui

- | | |
|------------------------------|-----------|
| 10. Hon. Samuel Penitala Teo | Minister |
| 11. Mr. Lotoala Meita, | Secretary |

Ministry of Environment and Natural Resources

- | | |
|-----------------------|---------------------------|
| 12. Mr. C.B.K. Mbugua | Water Resources Database, |
| 13. Mr. Muikia D.M., | Senior Hydrologist, |

Embassy of Japan

- | | |
|--------------------------|-----------------|
| 14. Mr. Morihisa Aoki | Ambassador |
| 15. Mr. Yousike Matumiya | First Secretary |

JICA Office

- | | |
|--------------------------|-----------------------------------|
| 16. Mr. Eiji Hashimoto | Resident Representative |
| 17. Mr. Mitsuo Yoshitoku | Assistant Resident Representative |

NGO

- | | |
|----------------------------|---|
| 18. Mrs. Monicah MUTAMBUKI | Project Coordinator AA (Action Aid), Kibwezi |
| 19. Mr. Peter G. Karinge | Project Coordinator ARDA, Ikutha
(Adventist Development and Relief Agency) |

Appendix 4 Minutes of Discussions (M/D)

4-1 Site Survey

Minutes of Discussions On the Basic Design Study On the Project for Improvement of Rural Road Bridges in Eastern Province of the Republic of Kenya.

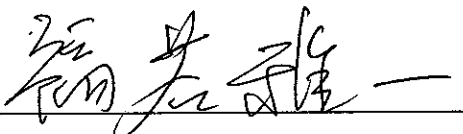
In response to a request from the Government of the Republic of Kenya (hereinafter referred to as "Kenya"), the Government of Japan decided to conduct a Basic Design Study on the project for Improvement of Rural Road Bridges in Eastern Province of Kenya (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Kenya the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Masakazu Fukuwaka, Senior Advisor, JICA, and is scheduled to stay in the country from February 11 to March 19, 2001.

The Team held discussions with the officials concerned of the Government of Kenya and conducted a field survey at the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Nairobi, February 21, 2001



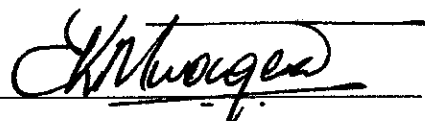
Masakazu Fukuwaka

Leader

Basic Design Study Team

Japan International Cooperation Agency

Japan



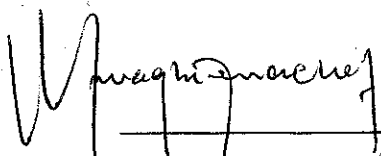
Eng. Erastus K. Mwongera EBS, OGW

Permanent Secretary

Ministry of Roads & Public Works

Republic of Kenya

Countersigned By



M. L. Oduor Otieno

Permanent Secretary

Ministry of Finance & Planning

Republic of Kenya

MWAGHAZI MWACHOFI

ATTACHMENT

1. Objective of the Project

The objective of the Project is to reconstruct 2 bridges, Athi Bridge and Ikutha Bridge, along the Route B7 to secure safe and smooth traffic on the national-trunk route between Embu and Kibwezi.

2. Project sites

The sites of the Project are shown in Annex-1.

3. Responsible and Implementing Agency

The responsible and implementing organization is Roads Department, Ministry of Roads & Public Works (MOR&PW).

The organization chart of Roads Department is shown in Annex-2.

4. Items requested by the Government of Kenya

After discussions with the Team, the components of the Project were finally requested by Kenyan side are as follows;

- Reconstruction of Athi bridge and Ikutha bridge
- River works for protection of bridges
- Construction of approach roads

JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5-1. Kenyan side understands the Japan's Grant Aid Scheme explained by the Team, as described in ANNEX-3.

5-2. Kenyan side will take the necessary measures, as described in Annex-4, 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 studies in Kenya until March 19.

6-2. JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around June, 2001.

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 and send it to the Government of Kenya by November, 2001.



7. Other relevant issues

7-1. The land acquisition necessary for construction of bridges shall be secured. Therefore the Kenyan side shall complete the procedure for the acquisition of necessary land by the end of October, 2001.

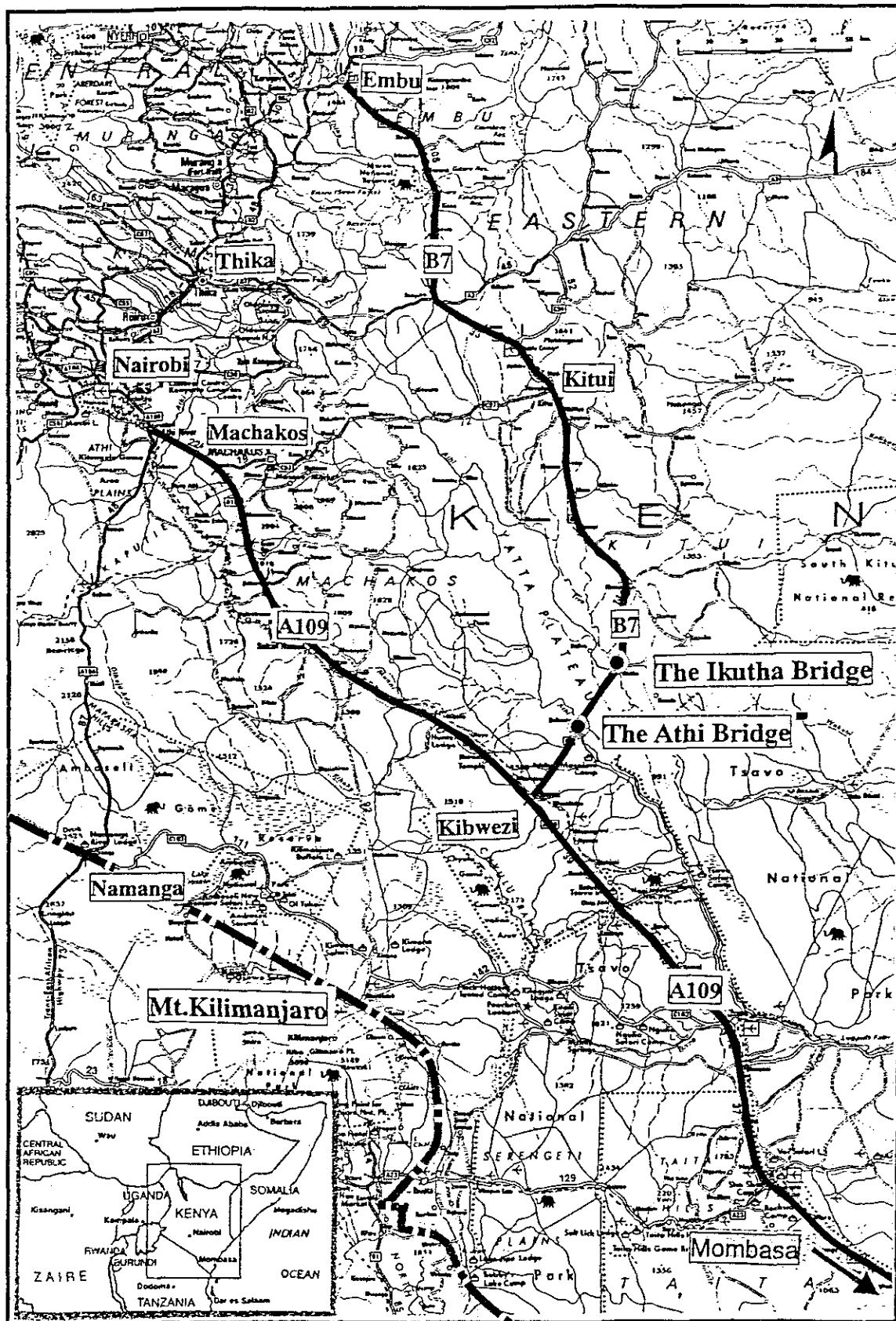
7-2. Both sides confirmed the relocation of the utilities (water lines, power lines etc.) is not necessary, since none is existing.

7-3. In case the position of new bridge is different from the old one, Kenyan side will demolish the old bridge by their own budget.

7-4. Both sides confirmed the necessary procedures for approval of EIA (Environmental Impact Assessment) will be implemented by Kenyan side and completed by early in June, 2001.



THE SITES OF THE PROJECT

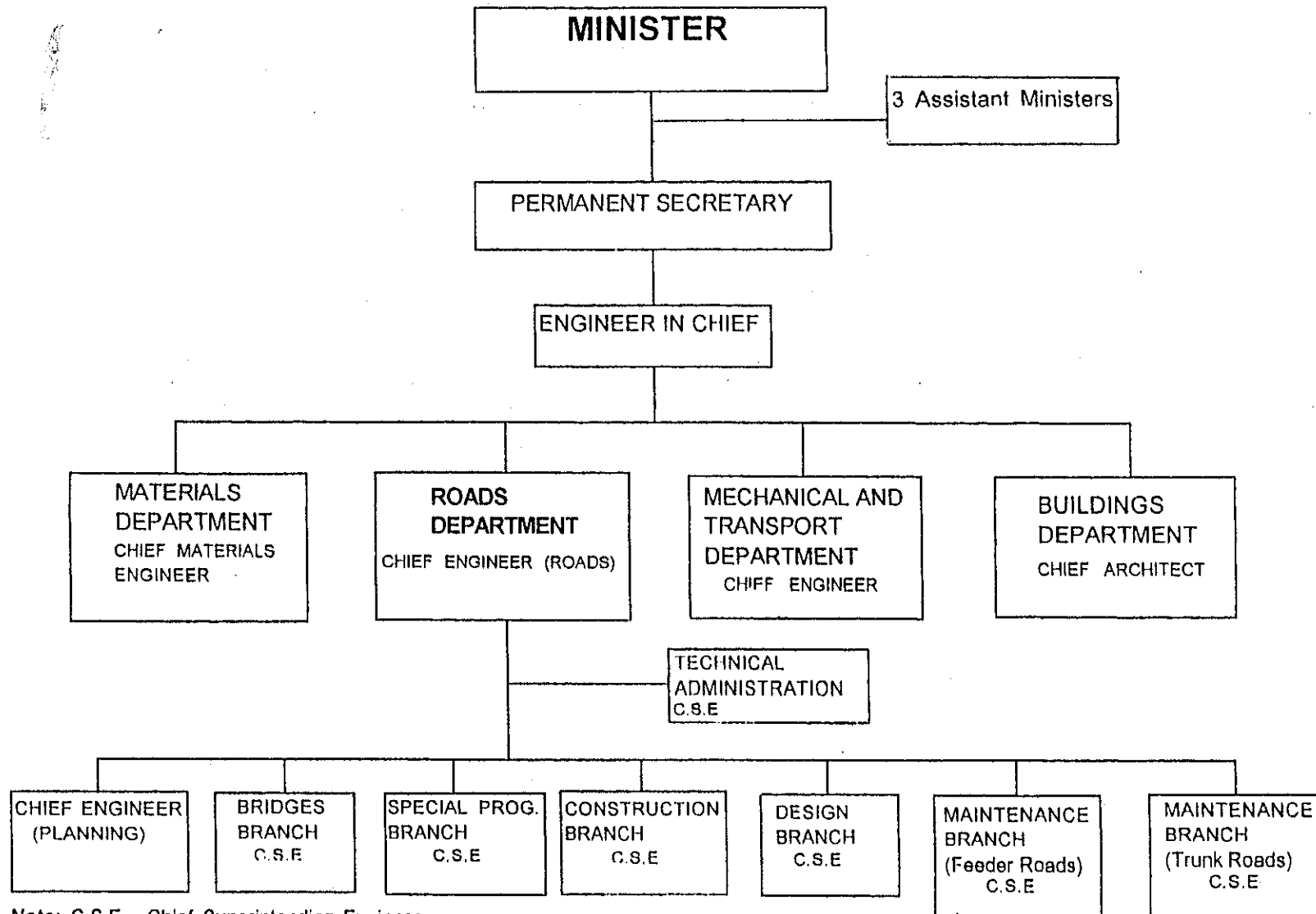


Ch

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MINISTRY OF ROADS AND PUBLIC WORKS

ORGANISATION STRUCTURE



Note: C.S.E - Chief Superintending Engineer

JAPAN'S GRANT AID SCHEME

The Grant Aid scheme provides a recipient country with non-reimbursable funds 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

Japan's Grant Aid Scheme is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for the Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Scheme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the recipient country.

- Project.
- Preparation of a Basic Design of the Project.
 - Estimation of cost of the Project.

The contents of the original request 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 Japan's Grant Aid Scheme.

The Government of Japan 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 Study, JICA uses registered consulting firms. JICA selects firms based on proposals submitted by interested firms. The firms selected carry out a Basic Design Study and write a report, based upon terms of reference set by JICA.

The consulting firms used for the Study are recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

1) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

2) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.

However, in case of delays in delivery, installation or construction due to unforeseen factors such as natural disaster, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

3) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments 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 consulting, constructing and procurement firms, 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 the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.



5) Undertakings required to 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 the following:

- a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction,
- b) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) To secure buildings prior to the procurement in case the installation of the equipment,
- d) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the verified Contracts,
- f) To accord Japanese nationals, whose services may be required in connection with supply of the products and services under the verified contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

6) "Proper Use"

The recipient country is required to operate and maintain the facilities constructed and 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) "Re-export"

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

8) Banking Arrangement (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"). The Government of Japan 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 the Government of Japan under an Authorization to Pay (A/P) issued by the Government of 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.



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 bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	a) Advising Commission of A/P		●
	b) Payment commission		●
3	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	a) Marine (Air) transportation of the products from Japan to the recipient country	●	
	b) Tax exemption and customs clearance of the products at the port of disembarkation		●
	c) Internal transportation from the port of disembarkation to the project site	●	
4	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		●
5	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		●
6	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
7	To bear all the expense, other than those to be borne by the Grant Aid, necessary for construction of the facilities		●




4-2 Explanation Draft Final Report

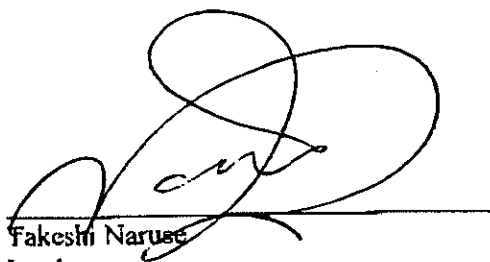
MINUTES OF DISCUSSIONS ON THE BASIC DESIGN STUDY ON THE PROJECT FOR RECONSTRUCTION OF ATHI AND IKUTHA BRIDGES (Improvement of Rural Road Bridges in Eastern Province) IN THE REPUBLIC OF KENYA (EXPLANATION OF DRAFT REPORT)

In February 2001, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on the Project for Reconstruction of Athi and Ikutha Bridges (hereinafter referred to as "the Project") to the Republic of Kenya (hereinafter referred to as "Kenya"), and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a Draft Report of the study.

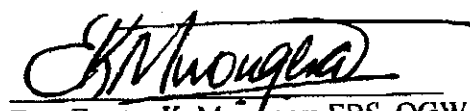
In order to explain and to consult the Government of Kenya on the components of the Draft Report, JICA sent to Kenya the Draft Report Explanation Team (hereinafter referred to as "the Team"), which was headed by Mr. Takeshi Naruse, Deputy Resident Representative, JICA Kenya Office, from June 21 to June 27, 2001.

As a result of discussions, both parties confirmed the main items described on the attached sheet.

Nairobi, June 27, 2001

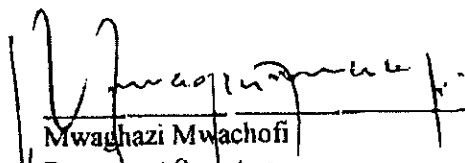


Takeshi Naruse
Leader
Basic Design Study Team
Japan International Cooperation Agency
Japan



Eng. Erastus K. Mwangera EBS, OGW
Permanent Secretary
Ministry of Roads & Public Works
Republic of Kenya

Counter-signed by:



Mwagazi Mwachofi
Permanent Secretary
Ministry of Finance & Planning
Republic of Kenya

ATTACHMENT

1.Components of the Draft Report

The Government of Kenya agreed and accepted in principle the components of the Draft Report explained by the Team.

2.Japan's 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-3 and Annex-4 of the Minutes of Discussions signed by both parties on February 21, 2001.

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 October 2001.

4. Other Relevant Issues

(1) Both sides confirmed that the Project name has changed from "Improvement of Rural Road Bridges in Eastern Province" to "Reconstruction of Athi and Ikutha Bridges".

(2) The Government of Kenya shall complete the necessary land acquisition based on the map indicated in the Draft Report, and as indicated in 7-1 of the Minutes of Discussions signed by both parties on February 21, 2001.

(3) The Team confirmed that the Draft Report of the Environment Impact Assessment (EIA) for the Project is in preparation by the Ministry of Roads and Public Works (MOR&PW), and would be ready by July 20, 2001.

It should be noted that the Government of Kenya promised to have the Final Report and Clearance Letter of the EIA ready by the end of November 2001.

(4) The Government of Kenya shall demolish the old bridges with its own budget in the sub-sequent financial year after the completion of the construction work of the new bridges.

(5) The approach road, which will extend 200m from Athi Bridge on the Kitui side (indicated in the Draft Report), will be constructed by the Government of Japan. The Government of Kenya will improve the remaining part (3km) of approach road during the construction of the bridge (using Fuel Levy Fund).

(6) To make the Project more effective, the Government of Kenya will improve the drifts between Athi Bridge and Ikutha Bridge on Route B7. Further, the Government of Kenya has intention of upgrading the whole Route B7.



Appendix 5. Cost Estimation Borne by Kenya

5-1 Cost Estimation for Land Acquisition

1) Area of land acquisition

The Right-of-way width 30m (30m both sides from road center)

Athi Bridge

Distance between new road center and old one is 30m

If existing road has 60 m wide right-of-way, 0 m width on old road side and 30m width on opposite side is required.

Ikutha Bridge

Distance between new road center and old one is 15m

If existing road has 60 m wide right-of-way, 0m width on old road side and 15m width on opposite side is required.

Athi Bridge (30m distance between new road center and old one)

$$(30+15)\text{m} \times (220+160)\text{m} + (30+15)\text{m} \times 100\text{m} / 2 = 12,900 \text{ m}^2$$

Ikutha Bridge (15m distance between new road center and old one)

$$\frac{(15+0)\text{m} \times (100+80)\text{m} + (15+0)\text{m} \times (180+120)}{2} = 4,950 \text{ m}^2$$

Total Approx. 17,850 m²

2) Unit cost land acquisition

Athi Bridge site and Ikutha Bridge site 5,000 Ksh /Acre = 1.235 Ksh /m²

3) Total Cost for land acquisition

Site	Cost Calculation	Cost (Ksh)
Athi Bridge site	12,900 m ² x 1.235 Ksh / m ²	16,000
Ikutha Bridge site	4,950 m ² x 1.235 Ksh / m ²	6,000
Total		22,000

5-2 Cost Estimation for Demolishment of old bridges

Demolishment of old bridges

Bridges	Superstructure	Substructure
Athi Bridge	Bailey bridge 108m long	Pier 3 no. Abutment 1 no.
Ikutha Bridge	Bailey bridge 75m long	Pier 3 no.

1) Volume of demolishment

Concrete Volume of Demolish Substructure (Athi Bridge)

Substructure	P1	P2	P4	A2(old)	Total
Volume	29.25	42.75	47.25	19.60	138.85 m3

Concrete Volume of Demolish Substructure (Ikutha Bridge)

Substructure	P1	P2	P4	-	Total
Volume	31.36	29.44	23.66	-	84.46 m3

2) Cost of demolishment

The cost of demolishment of existing Athi and Ikutha Bridges has been estimated 5,000,000 Ksh by MORPW.

5-3 Operation and maintenance costs

The content and costs of maintenance services expected for the ten years after completion of this project are shown in Table.

Maintenance services and costs

Interval	Description	Cost (Ksh)
Every year	(1) Bridge surface repair	$2,032 \text{ m}^2 \times 200 = 406,400$
	(2) Revetment repair	50,000
	Sub total	456,400
Every five years	(1) Bridge surface repair	$2,032 \text{ m}^2 \times 500 = 1,016,000$
	(2) Medium scale repair of revetment	= 200,000
	(3) Bridge facility repair	= 200,000
	Sub total	1,416,000
Cost for ten years		7,396,000

Appendix 6-1 Hydraulic and Hydrologic Data

Fig. A-6-1 Annual maximum flood discharge at 3F02 on Athi River

Year	Month	Day	Flood Discharge (m ³ /s)	Year	Month	Day	Flood Discharge (m ³ /s)
1956	Nov	17	323	1973	-	-	-
1957	Apr	26	257	1974	Mar	31	465
1958	May	15	486	1975	Apr	17	877
1959	Nov	29	249	1976	Nov	28	282
1960	Mar	27	122	1977	Apr	10	877
1961	Nov	15	1800	1978	May	25	2110
1962	Jan	4	590	1979	Mar	5	496
1963	Dec	9	493	1980	May	8	202
1964	Jan	3	217	1981	Apr	13	721
1965	Nov	22	269	1982	Dec	4	877
1966	Apr	29	148	1983	Apr	29	211
1967	Apr	14	574	1984	Apr	11	132
1968	Apr	30	470	1985	Apr	17	496
1969	Nov	13	143	1986	Dec	7	1080
1970	Apr	24	364	1987	-	-	-
1971	Apr	27	751	1988	Apr	27	619
1972	May	12	187	1989	Apr	8	491

Source: The Study on The National Water Master Plan, July 1992, JICA

Note 1: Catchments Area = 10,132 km² Note 2: " - ": Not Available

Fig. A-6-1 Annual maximum flood discharge at 3F09 on Athi River

year	Month	Day	Water Level (m)	Flood Discharge (m ³ /s)	Lack data Period	year	Month	Day	Water Level (m)	Flood Discharge (m ³ /s)	Lack data Period
1980	May	08	1.94	364	Jan. - Mar.	1991	-	-	-	-	Jan. - Dec.
1981	Apr.	13	4.50	3,107	Nov. - Dec.	1992	-	-	-	-	Jan. - Dec
1982	Dec.	06	7.00	10,079	Jan., Jul. - Sep.	1993	-	-	-	-	Jan. - Dec
1983	Jan.	01	0.20	5.1	Feb. - Dec.	1994	-	-	-	-	Jan. - Dec
1984	Nov.	09	6.00	6,666	Jan. - Jul	1995	Apr.	25	4.40	2,928	Jan. -Mar. Sep.
1985	Apr.	21	3.20	1,279	Feb., Jul. - Oct.	1996	Apr.	08	3.10	1,179	Aug., Oct. - Dec.
1986	Jan.	11	0.80	48.7	May - Dec.	1997	-	-	-	-	Jan. - Dec.
1987	Nov.	24	1.64	243	Jan.	1998	-	-	-	-	Jan. - Dec.
1988	Apr.	28	3.70	1,861		1999	Nov.	30	5.90	6,373	Jan. - Oct.
1989	Apr.	09	3.91	2,149		2000	Nov.	29	4.00	2,281	Apr.. - Sep. Dec.

Source: Water Resources Database, Ministry of Environment and Natural Resources

Note : " - ": Not Available

Appendix 6-2 Boring Log

GEOLOGICAL RECORD OF BORING																
Project : Improvement Rural Road Bridge										Date of Drilling:		27-28/03/2001				
Bore Hole Number : ATHI BH1										Angle from the vertical:		0				
Ground Elevation : 706.18										Depth of Hole (m):		7.00				
Dia. of the hole (mm) : 153mm-131mm										Depth to the gr. water level (m):						
										Logged By:		LEWIS				
	Eleva- tion (m)	Depth (m)	Thick- ness (m)	Field Observations				Standard Penetration Test								
				Column	Soil / Rock		Description	Depth (m)		(N)	0	10	20	30	40	50
0.00	706.18	0.00	0.00	Section	Classifn.	Colour	Description	(m)								
0.50						Red brown	Soft very fine soil mixed with some sand	1.00								
1.00																
1.50	704.68	1.50	1.50													
2.00	703.98	2.20	0.70			Brown	As above;slightly more compact and grannular	2.00								
2.50	703.63	2.55	0.35			Gray/ brown	Coarse grained Biotite gneiss; weathered									
3.00	703.18	3.00	0.45			Brown	Fine grained sands	3.00								
3.50	702.98	3.20	0.20			Brown/ Grey	Fine grained Biotite Gneiss with Hornblend fine grained and fragmented									
4.00	702.28	3.90	0.70			Ditto	As above; foliated and fractured with minor intercalations of quartzo-feldspathic pegmatites	4.00								
4.50																
5.00						Gray	Leucocratic medium grained Biotite Gneiss, weathered and foliated with machine generated fractures.	5.00								
5.50	700.78	5.40	1.50													
6.00								6.00								
6.50						Gray	Medium to fine grained Biotite gneiss leucocratic as above with distinct foliationsand machine generated Fractures.									
7.00	699.18	7.00	1.60					7.00								
7.50																
8.00								8.00								
8.50																
9.00								9.00								
9.50																
10.00								10.00								
10.50																
11.00								11.00								
11.50																
12.00								12.00								
12.50																
13.00								13.00								
13.50																
14.00								14.00								
14.50																
15.00								15.00								
15.50																

GEOLOGICAL RECORD OF BORING

Project : Improvement Rural Road Bridges **Date of Drilling:** 5-10/03/2001
Bore Hole Number : Athi BH2 **Angle from the vertical:** 0
Ground Elevation : 701.48 **Depth of Hole (m):** 8.90
Dia. of the hole (mm) : 200mm-31mm-68mm **Depth to the gr. water level (m):**
Logged By: LEWIS

	Eleva- tion (m)	Depth (m)	Thick- ness (m)	Field Observations				Standard Penetration Test								
				Column Section	Soil / Rock Classifn.	Colour	Description	Depth (m)	(N)	0	10	20	30	40	50	
0.00	701.48	0.00	0.00													
0.50																
1.00								1.00								
1.50																
2.00								2.00								
2.50																
3.00						Light brown	Medium to fine grained sands almost entirely composed of quartzofeldspathic detritals	3.00								
3.50																
4.00								4.00								
4.50																
5.00								5.00								
5.50																
6.00	695.78	5.70	5.70				massive hard rock with little amount of Biotite.	6.00								
6.50	694.98	6.50	0.80			White / Gray	Coarse grained with no visible signs of weathering.									
7.00								7.00								
7.50																
8.00						Gray	signs of weathering . Has machine broken fractures along foliation planes.	8.00								
8.50																
9.00	692.58	8.90	2.40					9.00								
9.50																
10.00								10.00								
10.50																
11.00								11.00								
11.50																
12.00								12.00								
12.50																
13.00								13.00								
13.50																
14.00								14.00								
14.50																
15.00								15.00								
15.50																

GEOLOGICAL RECORD OF BORING

Project : Improvement Rural Road Bridges
Bore Hole Number : Athi-BH3
Ground Elevation :
Dia. of the hole (mm) : 151mm-101mm-76mm

Date of Drilling: 10-13/03/2001
Angle from the vertical: 0
Depth of Hole (m): 12.70
Depth to the gr. water level (m):
Logged By: LEWIS

	Eleva- tion (m)	Depth (m)	Thick- ness (m)	Field Observations				Standard Penetration Test										
				Column Section	Soil / Rock Classifn.	Colour	Description	Depth (m)	(N)	0	10	20	30	40	50			
0.00	701.82	0.00	0.00															
0.50	701.32	0.50	0.50			Brown	Medium grained sands.											
1.00						Brown	Sand with gravel.	1.00										
1.50	700.32	1.50	1.00															
2.00																		
2.50						Brown/ Gray	Coarse sand with gravel as above.	2.00										
3.00																		
3.50	698.32	3.50	2.00															
4.00						Brown/ Gray	Clayish sand medium grained.	4.00										
4.50	697.32	4.50	1.00															
5.00																		
5.50	696.32	5.50	1.00				As above ; but pebbly.	5.00										
6.00							Sands with little amounts of clay.	6.00										
6.50	695.32	6.50	1.00															
7.00																		
7.50						Gray/ brown	Sands with some clay in the range of medium grained to almost coarse.	7.00										
8.00																		
8.50																		
9.00									It also has some organic mattter and Biotite/ muscovite flakes.	9.00								
9.50	692.27	9.55	3.05															
10.00						Gray/ Black	Migmatilised Gneiss with intimate mixture of light and dark coloured minerals	10.00										
10.50																		
11.00																		
11.50																		
12.00																		
12.50																		
13.00	689.12	12.70	3.15															
13.50																		
14.00																		
14.50																		
15.00																		
15.50																		

GEOLOGICAL RECORD OF BORING

Project : Improvement Rural Road Bridges
Bore Hole Number : Athi-BH4
Ground Elevation : 706.02
Dia. of the hole (mm) : 150mm-101mm-76mm
Date of Drilling: 2-4/03/2001
Angle from the vertical: 0
Depth of Hole (m): 8.50
Depth to the gr. water level (m):
Logged By: LEWIS

	Eleva- tion (m)	Depth (m)	Thick- ness (m)	Field Observations				Standard Penetration Test								
				Column Section	Soil / Rock Classifn.	Colour	Description	Depth (m)	(N)	0	10	20	30	40	50	
0.00	706.02	0.00	0.00													
0.50																
1.00																
1.50																
2.00						Light Brown/ Gray	Fine grained almost silty soil with alittle quartz and a little clay.									
2.50																
3.00																
3.50																
4.00	702.02	4.00	4.00													
4.50																
5.00						Red/ Brown	Completely weathered Gneiss;partly intact, residual rock is mainly composed of quartz and feldspars .									
5.50	700.37	5.65	1.65				Less weathered gneiss & section of the core is completely fragmented consisting of almost entirely quartz and feldspars with little Biotite.									
6.00	700.37	5.65														
6.50						Brown	Fragmented core consisting of quartzo-felds. Gneiss with machine broken fractures and brown coated fragments.									
7.00																
7.50																
8.00	698.27	7.75	2.10													
8.50	697.52	8.50	0.75			Grey	Fresh looking Gneiss showing no signs of weathering with natural and machine broken fractures.									
9.00																
9.50																
10.00																
10.50																
11.00																
11.50																
12.00																
12.50																
13.00																
13.50																
14.00																
14.50																
15.00																
15.50																

GEOLOGICAL RECORD OF BORING

Project :	Improvement Rural Road Bridges	Date of Drilling:	17-18/03/2001
Bore Hole Number :	Tiva BH-1	Angle from the vertical:	0
Ground Elevation :	657.66	Depth of Hole (m):	8.30
Dia. of the hole (mm) :	150-131-76mm	Depth to the gr. water level (m):	
		Logged By:	LEWIS

	Eleva- tion (m)	Depth (m)	Thick- ness (m)	Field Observations				Standard Penetration Test							
				Column Section	Soil / Rock Classifn.	Colour	Description	Depth (m)	(N)	0	10	20	30	40	50
0.00	657.66	0.00	0.00												
0.50	657.16	0.50													
1.00	656.66	1.00						1.00							
1.50							Biotite Gneiss; well foliated moderately to slightly weathered and non intact. With machine generated fractures along foliation planes.								
2.00								2.00							
2.50															
3.00								3.00							
3.50						Grey									
4.00								4.00							
4.50	653.21	4.45													
5.00								5.00							
5.50															
6.00							6.00								
6.50															
7.00		7.00				Gray	with machine generated fractures.	7.00							
7.50															
8.00								8.00							
8.50	649.36	8.30													
9.00								9.00							
9.50															
10.00								10.00							
10.50															
11.00								11.00							
11.50															
12.00								12.00							
12.50															
13.00								13.00							
13.50															
14.00								14.00							
14.50															
15.00								15.00							
15.50															

GEOLOGICAL RECORD OF BORING

Project : Improvement Rural Road Bridges **Date of Drilling:** 16-17/03/2001
Bore Hole Number : Tiva BH-2 **Angle from the vertical:** 0
Ground Elevation : 651.11 **Depth of Hole (m):** 7.60
Dia. of the hole (mm) : 150-101-76mm **Depth to the gr. water level (m):**
Logged By: LEWIS

	Eleva- tion (m)	Depth (m)	Thick- ness (m)	Field Observations				Standard Penetration Test										
				Column Section	Soil / Rock Classifn.	Colour	Description	Depth (m)	(N)	0	10	20	30	40	50			
0.00	651.11	0.00																
0.50																		
1.00								1.00										
1.50																		
2.00						Brown	Sands with high amounts of quartz and feldspars; and some still. I.e. river sand.	2.00										
2.50																		
3.00	648.11	3.00						3.00										
3.50						Gray	Biotite Gneiss with bands of quartz and feldspar rich sections; has machine broken fractures.											
4.00	647.16	3.95						4.00										
4.50																		
5.00								5.00										
5.50																		
6.00						Gray	feldspathic intercalations fresh and unwethered; Leucooratic gray	6.00										
6.50																		
7.00								7.00										
7.50	643.51	7.60																
8.00								8.00										
8.50																		
9.00								9.00										
9.50																		
10.00								10.00										
10.50																		
11.00								11.00										
11.50																		
12.00								12.00										
12.50																		
13.00								13.00										
13.50																		
14.00								14.00										
14.50																		
15.00								15.00										
15.50																		

GEOLOGICAL RECORD OF BORING

Project : Improvement Rural Road Bridges **Date of Drilling:** 09-16/03/2001
Bore Hole Number : Tiva BH-3 **Angle from the vertical:** 0
Ground Elevation : 651.93 **Depth of Hole (m):** 7.60
Dia. of the hole (mm) : 151-131-101-76mm **Depth to the gr. water level (m):**
Logged By: LEWIS

	Eleva- tion (m)	Depth (m)	Thick- ness (m)	Field Observations				Standard Penetration Test								
				Column Section	Soil / Rock Classifn.	Colour	Description	Depth (m)	(N)	0	10	20	30	40	50	
0.00	651.93	0.00	0.00													
0.50						Light Brown/ Gray										
1.00	650.93	1.00	1.00					1.00								
1.50																
2.00	649.93	2.00	1.00			Grey/ Black	Sandy clay	2.00								
2.50																
3.00	648.93	3.00	1.00			Grey/ Black	Sand with high amounts of clay (clayey sand)	3.00								
3.50																
4.00						Brown/ Gray	Coarse grained sands	4.00								
4.50	647.73	4.20	1.20			Brown/ Gray	Weathered Biotite Gneiss with machine broken fractures; foliated	5.00								
5.00	647.23	4.70	0.50													
5.50	646.53	5.40	0.70			Gray	Biotite Gneiss with slight degree of weathering and machine brocken fractures.	6.00								
6.00								6.00								
6.50																
7.00						Gray	A compact hard rock medium grained and not foileted.	7.00								
7.50	644.33	7.60	2.20													
8.00								8.00								
8.50																
9.00								9.00								
9.50																
10.00								10.00								
10.50																
11.00								11.00								
11.50																
12.00								12.00								
12.50																
13.00								13.00								
13.50																
14.00								14.00								
14.50																
15.00								15.00								
15.50																

GEOLOGICAL RECORD OF BORING																			
Project : Improvement Rural Road Bridges						Date of Drilling:		06-08/03/2001											
Bore Hole Number : Tiva BH-4						Angle from the vertical:		0											
Ground Elevation : 655.92						Depth of Hole (m):		9.80											
Dia. of the hole (mm) : 150-131-101mm						Depth to the gr. water level (m):													
						Logged By:		LEWIS											
Eleva- tion (m)	Depth (m)	Thick- ness (m)	Field Observations				Standard Penetration Test												
			Column Section	Soil / Rock Classifn.	Colour	Description	Depth (m)	(N)	0	10	20	30	40	50					
0.00	655.92	0.00	0.00																
0.50																			
1.00						Light/ Brown	Fine grained sandy soil with minor amounts of clay	1.00											
1.50																			
2.00	653.92	2.00	2.00					2.00											
2.50																			
3.00																			
3.50																			
4.00						Brown	Silty sands grading to pure coarse grained Quartzo-feldspathic sands	4.00											
4.50																			
5.00																			
5.50	650.52	5.40	3.40																
6.00																			
6.50																			
7.00						Yellow	Weathered Biotite Gneiss that is rich in Biotite. The top portion is highly decomposed. The subsequent portions are altered with Biotite altering to vermiculite.	7.00											
7.50																			
8.00	648.07	7.85	2.45					8.00											
8.50																			
9.00																			
9.50																			
10.00	646.12	9.80	1.95			Gray	Biotite Gneiss showing no sings of weathering with randomly oriented Biotite rich pockets The core is meedium grained, compacts.	10.00											
10.50																			
11.00																			
11.50																			
12.00																			
12.50																			
13.00																			
13.50																			
14.00																			
14.50																			
15.00																			
15.50																			

Appendix 7 References

No		References	year	Published by
1		Development Plan, Statistics		
1		Economic Survey	2000	Ministry of finance and Planning