PART 3: PLANNING AND PREPARATION OF URGENT PROJECT IN ACHOLI SUB-REGION

SECTION 8: BACKGROUND AND CONTENTS OF THE URGENT PROJECT

27. BACKGROUND OF THE URGENT PROJECT

27.1 Background of the Request for Peace Building Grant Aid

27.1.1 Background of the Request

Northern Uganda has the largest proportion of people living in poverty in the country, estimated to account for 61 % of the region's population, or almost twice the national level. This high level of poverty can be attributed to the Lord's Resistance Army (LRA) insurgency. During the 20 year-conflict beginning in the 1980s, much of the basic social infrastructure was destroyed or abandoned and the local government became non-functional in the region.

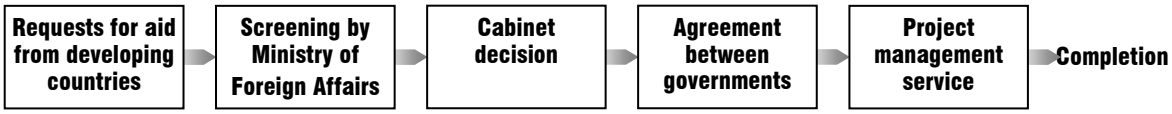
In particular, 90 % of the population were displaced (IDP: Internally Displaced Person) from Acholi Sub-region. Since the cease-fire agreement concluded between LRA and the Government of Uganda in August 2006, the Government of Uganda has emphasized and facilitated the return process of IDPs and prepared the National Peace Recovery and Development Plan (PRDP) in order to stabilize and recover Northern Uganda. The PRDP identifies 14 priority programmes such as rebuilding and empowering communities (health, education, water, livelihood support) and it emphasizes the importance of infrastructure rehabilitation and improvement of a trunk road network connecting the districts and a community access road network. Under these circumstances, the ten year District, Urban and Community Access Road Investment Plan (DUCARIP) has been prepared to provide a financing framework for investments in district, urban and community access roads. Though maintenance of high priority District Roads has been progressively undertaken in the framework, the improvements or new constructions of these roads have not been undertaken adequately. Furthermore, the budget from central government does not make allocations for maintenance, improvement or new construction of community access roads and this leads to a difficult situation where road improvement and new construction are to be undertaken by the districts themselves.

Consequently, although the necessity of the road improvement for the IDP return process seems to be of high priority, the implementation of the projects to improve the road network could not be started because of budgetary deficits.

27.1.2 Scheme of Japanese Grant Aid for Peace Building

Japanese Grant Aid for conflict prevention and peace building is intended to assist reintegration of former soldiers, helping recover small arms, and promoting ethnic reconciliation in developing countries. It provides funds for procuring the necessary equipment and services for conflict prevention and peace building programs in developing countries. This Grant Aid has been provided since FY2002 as a scheme within non-project grant aid procured by Japan International Cooperation System (JICS).

Since FY2002, in accordance with contracts with developing countries' governments, Japan International Cooperation System (JICS) has been serving as a procurement management agent, managing funds and overseeing and supporting activities appropriate to various program formats.



Source: JICS

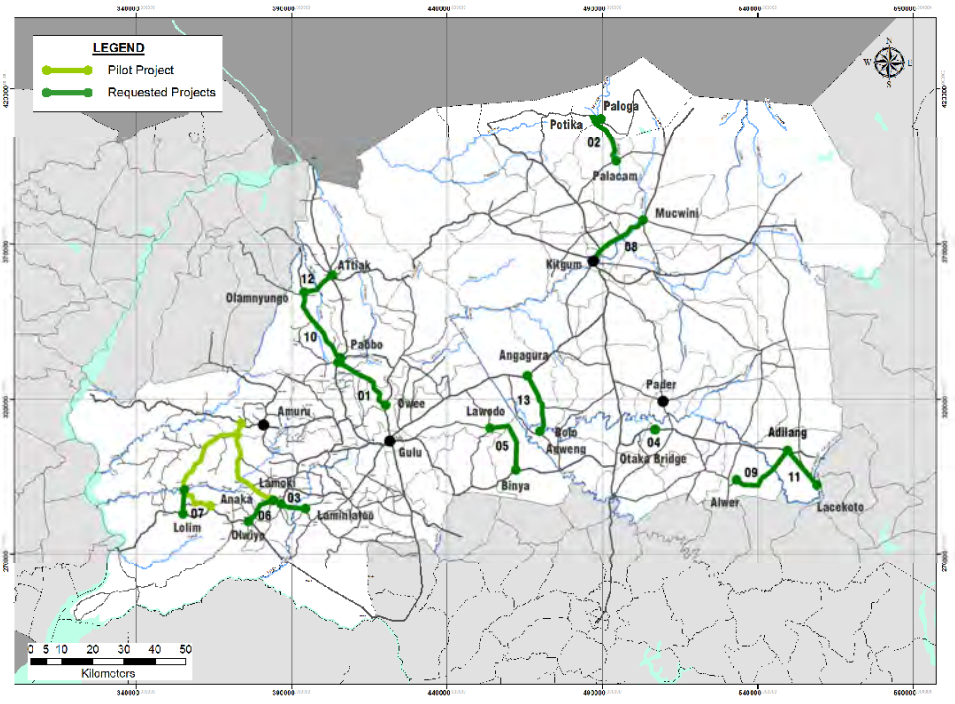
Figure 27.1.1 Flow of Operations

27.1.3 Outline of the Request

- Date of Application: December 2009
- Request Amount: 1.2 Billion Yen

The emergency development of social infrastructure in Acholi Sub-region, Northern Uganda: the area was impoverished by the 20 year-conflict. Since the cease-fire agreement concluded between LRA and the Government of Uganda in August 2006, construction of hospitals, schools and wells has been implemented by humanitarian assistance organizations. However, these facilities are not accessible enough and this could be considered as one of the reasons why the IDPs (Internally Displaced Persons) have been unable to return to their home villages.

Table 27.1.1 shows the requested projects from the Ugandan side and their priority levels. The Ugandan side had initially requested procurement of road maintenance equipment, which is currently insufficient in Uganda. It then decided however that the need for reconstruction assistance for roads and bridges superseded the need for road maintenance equipment. The Ugandan side will thus focus on the projects as shown in Table 27.1.1 as well as the development of human resources for implementation of these projects.



Source: JICA Study Team

Figure 27.1.2 Map showing Locations of the Requested Projects

Table 27.1.1 Components of the request

No	Project Name (District)	Road Class	Road Elements			Bridge Elements		
			Length (km)	Width (m)	Pave-ment	Name	Length (m)	Width (m)
1	Awoo-Pabbo Road Improvement (Gulu-Amuru)	CAR	23.8 km (Improvement)	6.0	Gravel	Atia Bar	15.0	6.0
2	Paloga-Potika-Palacam Road Improvement (Lamwo)	DR	20.7 km (Improvement)	6.0	Gravel	Arainga	15.0	6.0
3	Laminlatoo-Lamoki Road Improvement (Nwoya)	CAR	8.7 km (Improvement)	3.0	Gravel	Ayago	15.0	5.0
4	Otaka Bridge Reconstruction (Agago)	NR	0.2 km (Approach Road)	6.0	DBST	Otaka	15.0	7.0
5	Lawodo-Binya Road Improvement (Gulu)	DR	0.2 km (Approach Road)	6.0	Gravel	Lawodo	15.0	6.0
		CAR	23.4 km (Improvement)	6.0	Gravel	Chome	15.0	6.0
6	Anaka-Olwiyo Road Improvement (Nwoya)	NR	11.0 km (Improvement)	8.0	DBST	---	---	---
7	Aswa River-Lolim Road Improvement (Nwoya)	DR	8.0 km (New Construction)	6.0	Prime Coat	Anaka	15.0	5.0
8	Kitgum-Mucwini Road Improvement (Kitgum)	NR	11.0 km (Improvement)	6.0	DBST	Pakuba 1	15.0	10.0
						Pakuba 2	15.0	10.0
9	Olyelowidyel-Adilang Road Improvement (Agago)	DR	12.0 km (Improvement)	3.0	Gravel	Alwer	20.0	6.0
10	Pabbo-Olamnyungo Road Improvement (Amuru)	CAR	10.9 km (Improvement)	3.0	Gravel	Ayugi	15.0	5.0
11	Adilang-Lacekoto Bridge Reconstruction (Agago)	NR	0.25 km (Improvement)	6.0	Gravel	Lacekoto	15.0	5.0
12	Atiak- Olamnyungo Road Improvement (Amuru)	NR	11.0 km (Improvement)	6.0	Gravel	---	---	---
13	Bolo Agweng-Angagura Road Improvement (Pader)	CAR	10.0 km (Improvement)	6.0	Gravel	Agago	24.0	5.0

NR: National Road, DR: District Road, CAR: Community Access Road, DBST: Double Bituminous Surface Treatment (Low cost pavement)
Gravel pavement means about 200 mm thickness compaction of laterite stone (Murram).
District names are as of 2009 (before segmentation).
Source: JICA Study Team

27.2 Existing and Formulated Technical Assistance Programs

27.2.1 Assistance by Government of Japan

(1) Technical Cooperation

Table 27.2.1 Technical Cooperation and Loan Assistance from Japan in the Road Sector

Component	Year	Project Name	Outline
Development Study	2008 - 2009	The Feasibility Study on the Construction of A New Bridge across River Nile at Jinja	The feasibility study on the construction of a new bridge across River Nile at Jinja, about 80 km east of Kampala.
Development Study Style Technical Cooperation	2009 - 2011	Project for Rural Road Network Planning in Northern Uganda	Formation of road network master plan in Amuru District, Design and Implementation of the Pilot Project, Formulation of Urgent Project.
Development Study	2009 - 2010	The Study on Greater Kampala Road Network and Transport Improvement in the Republic of Uganda	Pre-Feasibility study on a road network and road operation plan, public transport plan and improvement plan for traffic safety in Greater Kampala (inside a 20 km radius of Kampala city center).
Loan Assistance	-	None	

Source: JICA Study team, compiled from JICA reports

(2) Grant Aid

Table 27.2.2 Grant Aid from Japan in the Road Sector

(Unit：Million Yen)

Year	Project Name	Amount of Grant Aid	Outline
1996 - 1997	The project for improvement of intersections at Kampala urban interface sections of the trunk road		The study on the improvement of intersections that have low traffic capacity, flooding during raining and aging pavement to clear up the traffic congestion in Kampala.
1998 - 1999	The project for Improvement of Trunk Roads in Kampala		ditto
2002 - 2004	The project for improvement of trunk roads in Kampala, phase-II	700	Improvement of Natete and Ggaba Road to expand the traffic capacity on the roads and at intersections and reduce the traffic jams in Kampala.
2005 - 2006	The project for improvement of traffic flow in Kampala City	778	Procurement of traffic facilities and equipment to improve the most congested six intersections and two roads

Source: JICA Study team, compiled from JICA reports

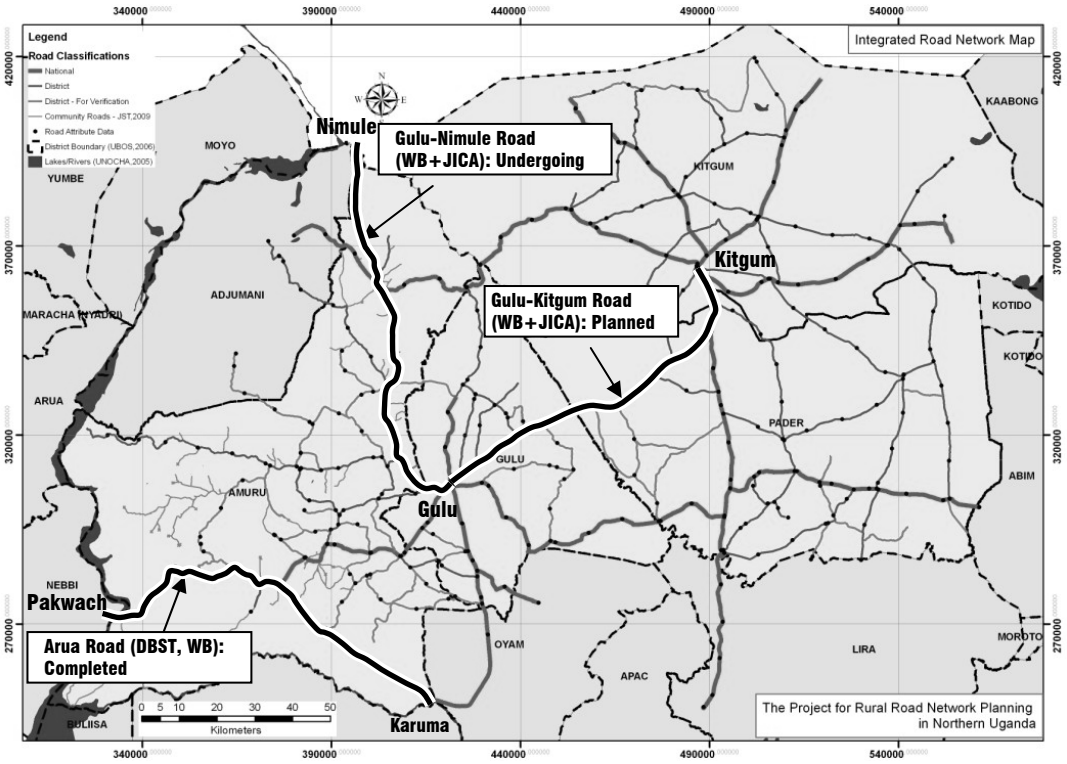
27.2.2 Assistances by other Donors

Table 27.2.3 shows the relationship with other donors in the road sector.

Table 27.2.3 International Cooperation Projects from Other Donors in the Road Sector

Year	Donor	Project Name	Scheme	Outline
	USAID	NUDIO		LBT project for rehabilitation of Community Access Road in Amuru (length: 1,000 km)
	UNHCR			Construction of access road in Amuru with ACTED and ACF
	NUREP		Grant Aid	Construction of Community Access Road in Kitgum
1993-	DANIDA	Countryside Road Improvement	Financial Cooperation	Improvement of District Roads for 9 districts in Northern Uganda with year mark budget
			Technical Cooperation	Construction of Community Access Road
	ACTED			Road improvement project in Amuru and Gulu
2004-2007	WB	Arua Road Improvement	Loan	Road improvement project between Karuma and Arua through Pakwach
2010-	WB & JICA	Gulu-Nimule Road Improvement	Loan	Road improvement project between Gulu and Nimule, which is a border city with Sudan
2010-	To be determined	Gulu-Kitgum Road Improvement		Road improvement project between Gulu and Kitgum

Source: JICA Study team, compiled from Donors reports



Source: Compiled by JICA Study Team

Figure 27.2.1 Other Projects in Northern Uganda

27.3 Current Conditions of the Project Site

27.3.1 Socio Economic Considerations of Acholi Sub-region

(1) Society

Acholi Sub-region is composed of seven districts, namely; Gulu, Kitgum, Lamwo, Pader, Agago, Amuru and Nwoya, and is located in northern Uganda. The sub-region borders with Karamoja Sub-region in the east, Lango in the south-east, Bunyoro in the south-west, West Nile in the west and Sudan in the north. Gulu District is 3,449.08 square km[1] in size, Kitgum (including Lamwo) District is 9,773.63 square km, Pader (including Agago) District is 6,929.2 square km while Amuru (including Nwoya) District is 9,022.28 square km. Total land area of Acholi Sub-region is thus 29,174.19 square km, which accounts for 12% of the total land area of Uganda. The major ethnic group in the sub-region is the Acholi.

Among them, Gulu District consists of 11 sub-counties under 2 counties and 4 municipal divisions under Gulu Municipality. Kitgum District is composed of 9 sub-counties under 1 county and 1 town council. Lamwo District is composed of 9 sub-counties. Pader District and Agago District have 8 and 9 sub-counties respectively. Both Amuru District and Nwoya District have 4 sub-counties each.

Other social characteristics and population data of Acholi Sub-region are stated in Chapter 2 of this report.

(2) Economy

Most of the people living in the sub-region are engaged in agriculture. Small scale subsistence farming is the most prominent agricultural activity followed by livestock keeping. These districts have almost the same characteristics as regards crop farming. Crop production by each district is shown in Chapter 2 of this report.

Some of the people live on employment income. Particularly, a significant portion of the Gulu population lives on employment income. Most of them are government employees or work for parastatal bodies. Others work for NGOs.

With the exception of Gulu Town, electricity is very limited, which affects the development of various industries in the sub-region. People use diesel and petrol generators. Alternative sources of power such as solar power are also utilised. Telephone networks are widely spread across the sub-region and major telephone companies are very active in business.

27.3.2 Current Situation in the Road Sector

(1) General

Almost all roads in Acholi Sub-region are unpaved with very few paved roads. Some Community Access Roads have sections that vehicles can not pass through because of overgrown vegetation and deficiencies of river crossing structures such as bridges and culverts. So there is need for a permanent road network that vehicles can use throughout the year.

The Operation agency for National Roads is the Uganda National Roads Authority (UNRA) while those in charge of District Roads and Community Access Roads are Districts and Sub-counties respectively. Though some of the District Roads and Community Access Roads in Amuru and Nwoya Districts have been upgraded to National Roads and District Roads, these districts do not have sufficient funds or technical capacity to improve the roads.

[1] Gulu DDP

(2) Road Inventory in Acholi Sub-region

1) District Road Inventory System in Uganda (Annual District Road Inventory & Condition Surveys (ADRICS))

The Annual District Road Inventory and Condition Surveys (ADRICS) have been introduced in the Planning Manuals for District Road Works. These surveys have been realized to facilitate identification of the core district road network and its condition. The results of the surveys shall be used to select and prioritise road-works which would be planned and performed during the forthcoming financial year in order to conserve the network condition that ensures basic yet reliable all weather access to economic and social services for the maximum possible number of road users.

Conservation of the district road network involves three principal activities including-

- Maintenance (both routine and periodic) of all roads to be maintained within the network,
- Spot repairs and/or rehabilitation of existing and/or potential bottlenecks on those core network roads where funds are adequate.
- Spot repairs and/or rehabilitation of existing and/or potential bottlenecks on those roads outside the core network

ADRICS, therefore, is a procedure that enables the District Local Government Engineer (DLGE) to collect all necessary data for subsequent use in the selecting and prioritising of those district road works most urgently required and to plan and budget for them accordingly.

The Planning Manual states the activities of ADRICS as follows,

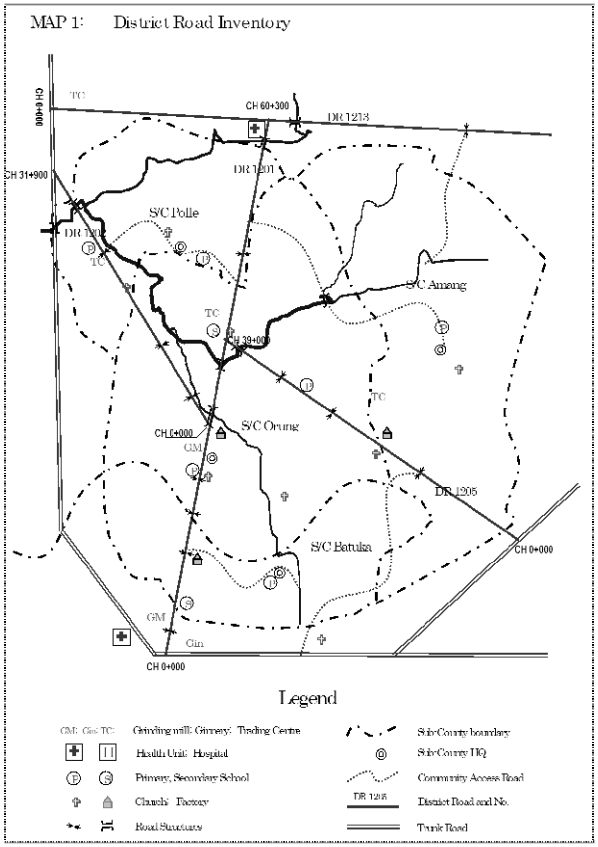
- A drive-through the entire district road network during the period of November/December by the DLGE, together with the Road Inspectors. This timing coincides with the annual planning cycle including the Local Government Budget Framework Paper (LGBFP) process and allows sufficient time for subsequent selecting and prioritizing of district road works and preparation of Work Plans for the forthcoming year.
- During this drive-through, the DLGE's Road Inspectors (RIs) undertake a detailed survey of each and every one of the district roads within the network recording, on forms provided for the purpose, such details as new road links and structures included in the network since the previous ADRICS, and the actual current condition of all existing roads and their drainage structures. During the drive through, information on major infrastructure (schools, clinics, markets, etc.) served by the roads is also recorded.
- Immediately following these surveys, the Road Inspectors update the district road maps to include all new district links and structures built since the last ADRICS, and the locations of all major infrastructure served by the roads.
- Concurrently with undertaking surveys of district roads, the DLGE and the Road Inspectors arrange meetings with all sub-counties in the district to determine sub-county preferences and/or priorities in terms of district roads and most important Community Access Roads (CARs) connecting thereto. This data will assist with the identification of the core district road network.
- Following these sub-county meetings, the district road maps are further updated to reflect the sub-county preferences and other relevant information.

On the completion of the ADRICS, there shall be a detailed record of all relevant data including;

- District map of scale 1:250,000 detailing the District Road Inventory including the locations of all trunk and district roads, their road numbers and start and end points, locations and type of structures, locations of material sources and other relevant information including locations of important socio-economic facilities such as schools, health units and markets
- A second district map sheet of scale of 1:250,000, detailing the actual condition of each link in the network and identifying those links which; (i) are in routinely maintainable condition, (ii) require periodic maintenance, (iii) require rehabilitation and (iv) are locations of bottlenecks. Included on the same maps are the Sub-County Preference for each and every link within the entire district road network, showing the priority of each district link from the sub-counties' perspectives, together with the location of those CARs identified as being most important by the sub-counties. Other relevant data collected during sub-county meetings will also be recorded on the map sheet.
- A sketch map of each sub-county, showing boundaries of the sub-county and parishes, together with the locations of sub-county headquarters, the district roads (including their gazetted numbers) within and in the vicinity of the sub-county, the main community access roads and their priority ranking as perceived by the sub-county, all essential socio-economic facilities and sub-county area population figures.
- Hand copies of all data collection formats filed by road number including details of sub-county meetings. Note that many district roads serve more than one sub-county and, therefore, all data from all the sub-counties served by a specific district road should be filed under that road number.

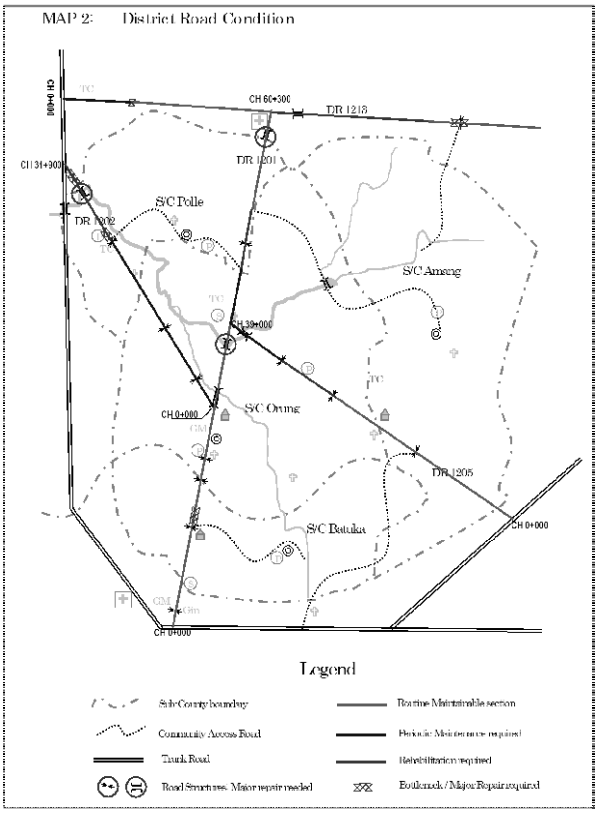
Following completion of subsequent selecting and prioritizing of district road works using the RAMPS, a third map sheet of scale 1:250,000 will be prepared showing the links included in the Core District Road Network, the actual condition of all links and locations of bottlenecks.

The three maps will be displayed in all offices of the DLGEs staff and used for planning, programming and monitoring of all works to be performed during the financial year.



Source: Planning Manuals for District Road Works

Figure 27.3.1 Sample of District Road Inventory (Map 1)



Source: Planning Manuals for District Road Works

Figure 27.3.2 Sample of District Road Inventory (Map 2)

Although ADRICS and its activities have been established and identified, the districts in the study area cannot afford to perform and update them accordingly due to financial and human resources constraints. Thus a simple methodology that doesn't necessitate use of special experts should be applied to enable proper management of road conditions.

2) Road Inventory Survey by the Study Team

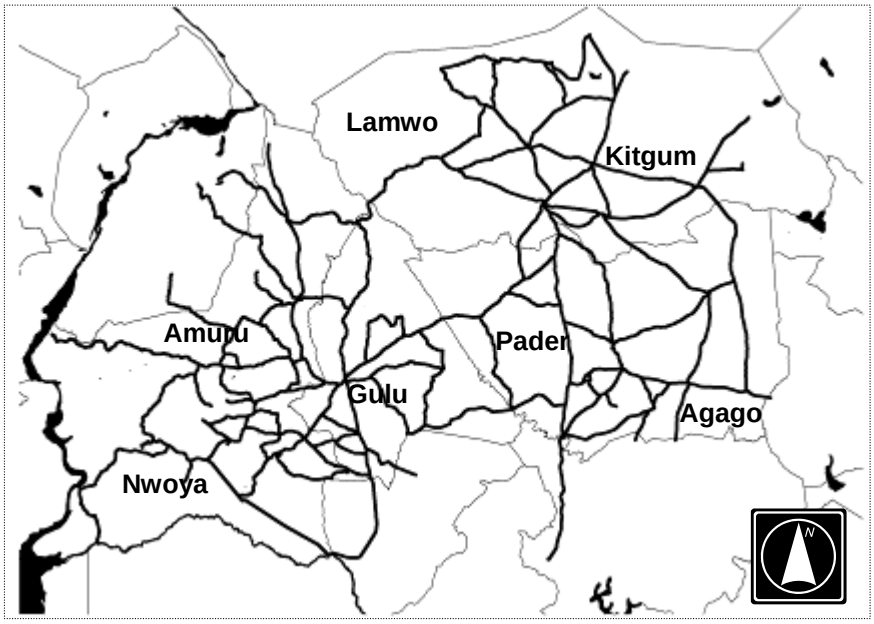
The Road Inventory Survey was conducted in September - October 2009 to collect information on road conditions (road width, road surface type and condition, etc).

a) Objective of Survey

The objective of the survey was to recognize road network conditions including maintenance in the study area and to collect necessary data for traffic forecasting in the Acholi sub –region which would be used for the formulation of the Urgent Projects and road maintenance plan in the sub-region.

b) Survey Roads

Survey roads, in general, were set to be district roads and national roads as well as other roads which were considered to be of significance as regards the regional road network in Gulu, Kitgum, Lamwo, Pader, Agago, Amuru and Nwoya Districts. The total length of the survey roads was approximately 2,500 km.



Source: JICA Study Team

Figure 27.3.3 Survey Roads

c) Survey Method

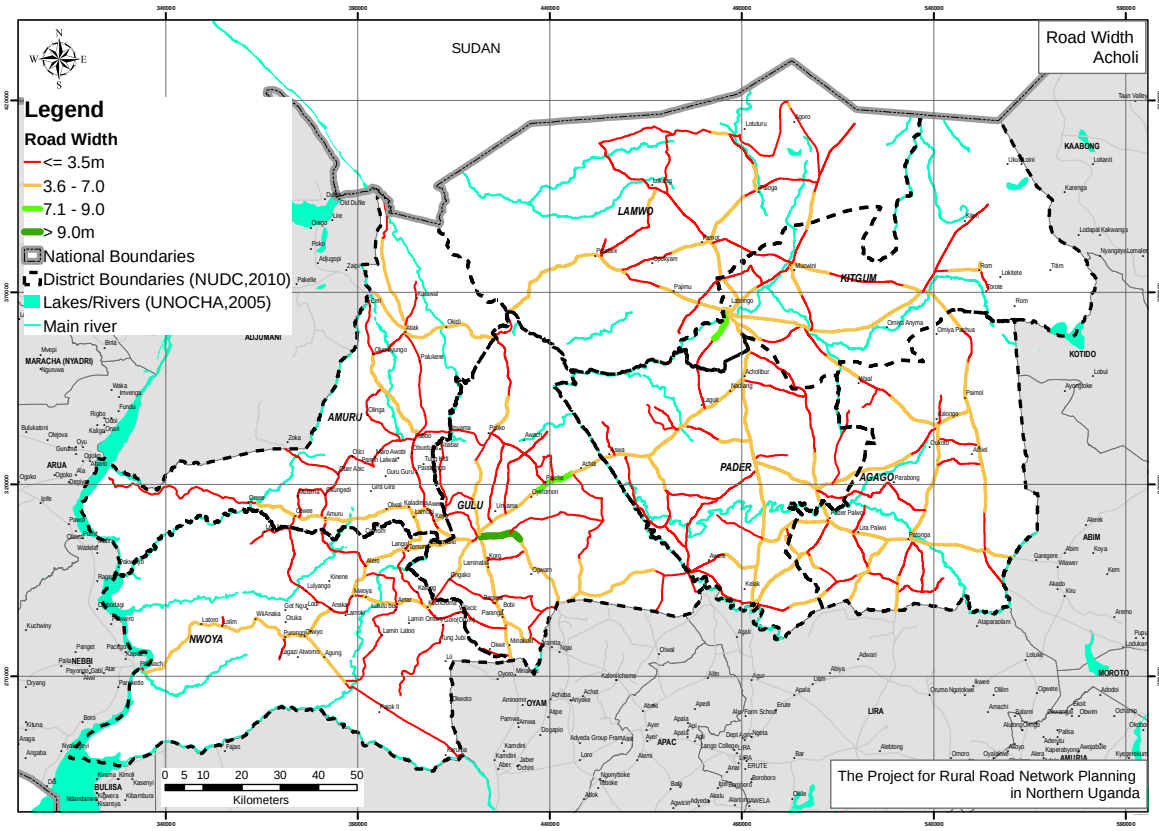
The survey was carried out using a GPS mapping system which recorded survey road tracks and survey points in the GPS, and the data collection on such items as road width, surface type and others was also carried out at every 10km. The results were recorded onto the sheet which was in accordance with that of the ADRICS with minor modifications and the collected information was entered into the GIS system.

Source: JICA Study Team

Figure 27.3.4 Photographs of Field Survey

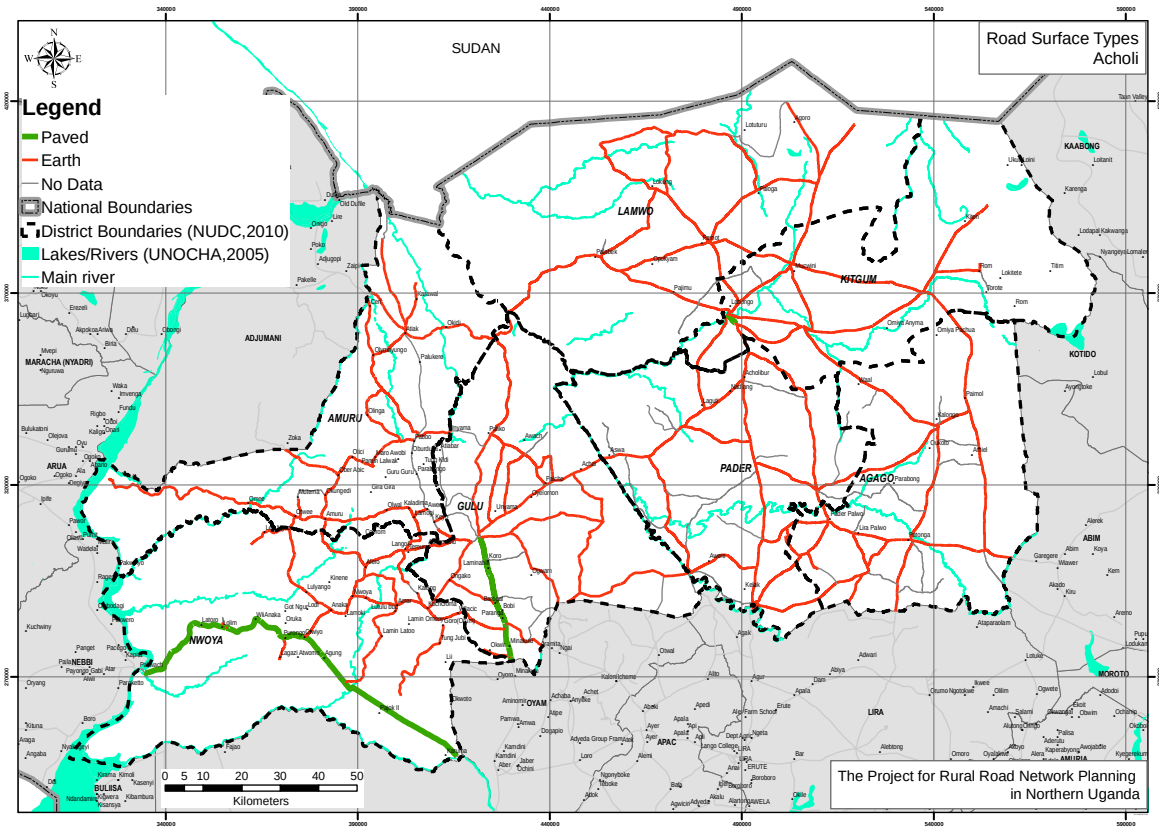
d) Survey Result

The survey results on carriageway width, surface type and surface condition were summarized visually by the GIS system as shown below. The district names used are those of 2009 before the recent district segmentation.



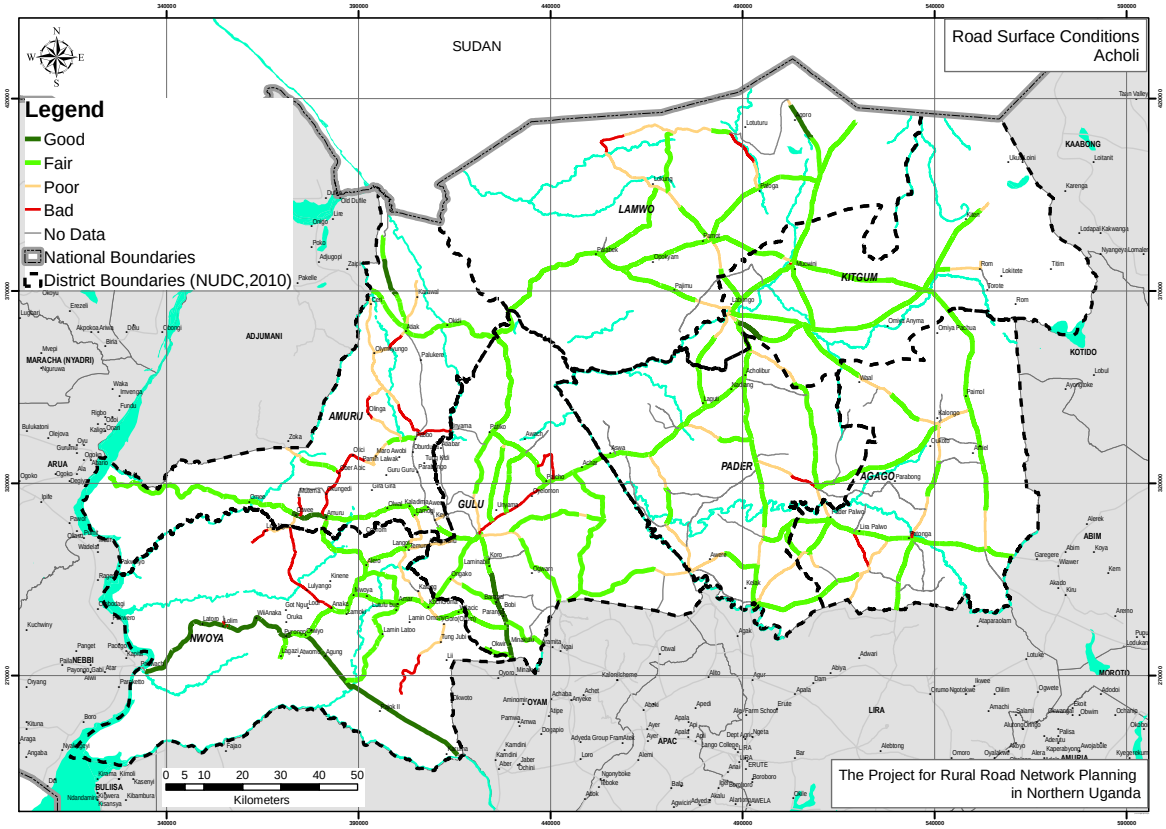
Source: JICA Study Team

Figure 27.3.5 Carriageway Width



Source: JICA Study Team

Figure 27.3.6 Road Surface Type



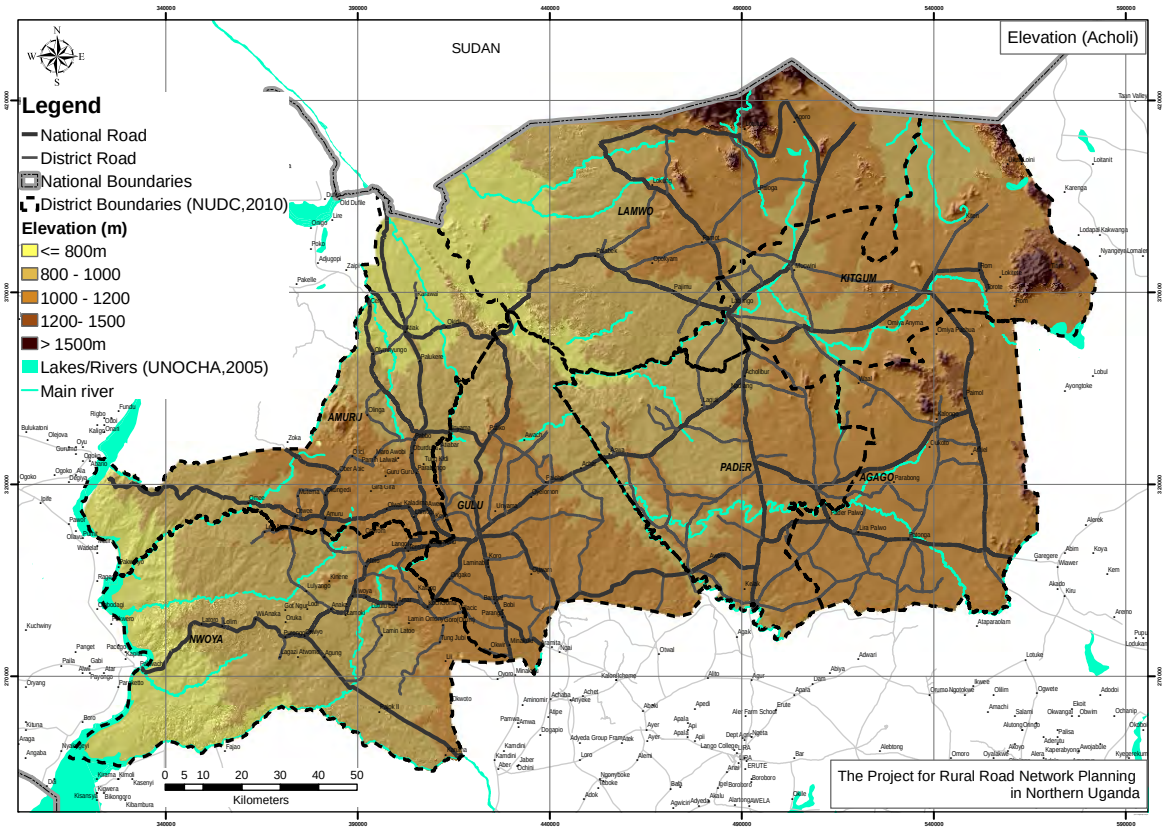
Source: JICA Study Team

Figure 27.3.7 Road Surface Condition

27.3.3 Natural Conditions in Acholi Sub-region

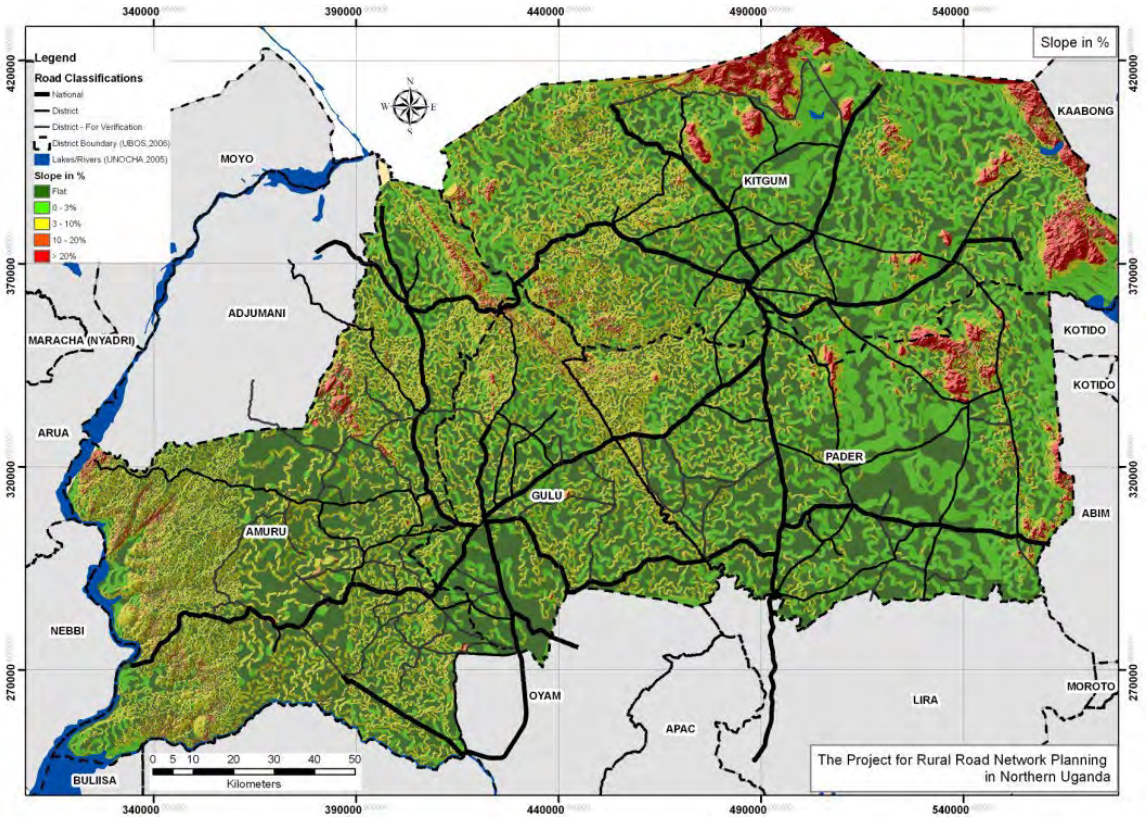
(1) Topography

Acholi Sub-region is located in Northern Uganda and its total land area is about 29,174.19 square km which is 12.1 % of that of Uganda. The altitude of the region ranges between 600 and 1,200 m above sea level as shown in Figure 27.3.8. The terrain is of a rolling nature with a traverse terrain slope of 5-20 %. The areas along Western Rift Valley and Achwa River are relatively low with altitudes ranging between 600 and 800 m above sea level. There are some highlands (more than 1,500 m above sea level) in Lamwo and Agago Districts and in the vicinity of these highland areas are Forest Reserves.



Source: JICA Study Team with data of UNOCHA

Figure 27.3.8 Topographic Map and Roads



Source: JICA Study Team with data of UNOCHA

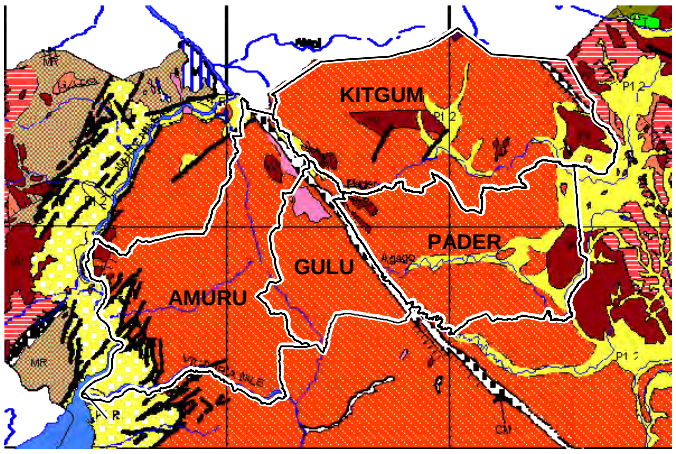
Figure 27.3.9 Terrain Condition and Roads

(2) Geology

1) General

Figure 27.3.10 shows the geology around Acholi Sub-region and it can be seen that the major part of it consists of undifferentiated gneisses including elements of granitized or metamorphosed formations and granulites facies rocks. The area that is composed of sediments from rivers flowing from lakes, the crust is generally easy to sink into and soft soil might be deposited.

The soil types of Acholi Sub-region vary with location but are generally well-drained sandy, clay, loam and sand clay in some places as shown in Figure 27.3.11.



LEGEND

Cainozoic

Pleistocene to Recent: Rift Valley sediments

Precambrian (Wholly granitized or high to medium grade metamorphic formations)

Granulite facies rocks including charnockites and enderbites and retrograded derivatives including the Watian of West Nile

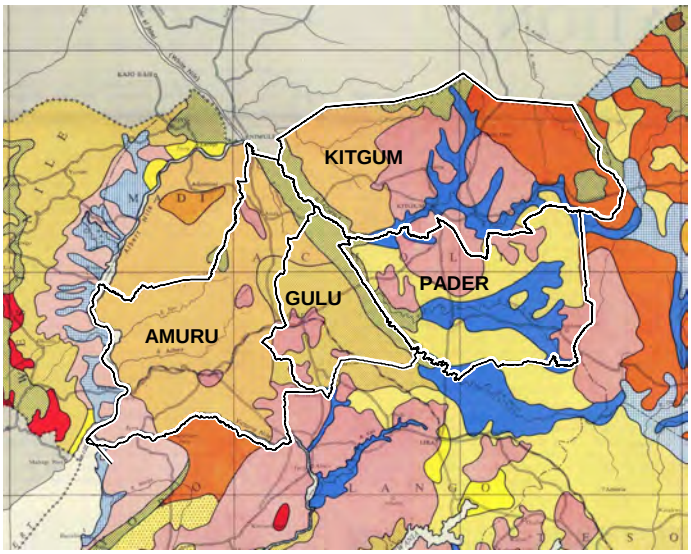
Undifferentiated gneisses including elements of granitized or metamorphosed formations and, in the north, granulites facies rocks (Basement Complex)

Other Rocks

Mobilized and intrusive granites

Source: Department of Geological Survey and Mines of Uganda

Figure 27.3.10 Geology Map around Acholi Sub-region



LEGEND

WEAKLY DEVELOPED SOILS
Lithosols
Bd Not differentiated

VERTISOLS
Topographic
Dj Not differentiated

PODSOLIC SOILS
Ea Not differentiated

EUTROPHIC SOILS OF TROPICAL REGIONS
Ha On volcanic ash
Hc On alluvial deposits

FERRUGINOUS TROPICAL SOILS
Jc On crystalline acid rocks
(a) Mainly freely drained
(b) Complex with Dj (Black clays)
(c) Complex with Bd (Lithosols)

FERRISOLS
Ka Not differentiated
Kb Crystalline basic rocks
Kc Humic of high altitudes

FERRALLITIC SOILS
Dominant colour yellowish
La On sandy sediments
Lc Not differentiated
(a) Mainly sandy loams
(b) Mainly sandy clay loams
Dominant colour red
Ll On loose sandy sediments
Ln Not differentiated
(a) Mainly sandy loams
(b) Mainly sandy clay loams
Humic ferrallitic soils of high altitudes
Ls Not differentiated
Ferrallitic soils with "dark horizons"
Lt Not differentiated

HALOMORPHIC SOILS
Mc Saline Soils

HYDROMORPHIC SOILS
Na Mineral hydromorphic soils

ORGANIC SOILS NON-HYDROMORPHIC
Oa Organic Soils of mountains

Source: Uganda Government

Figure 27.3.11 Soil Types in Acholi Sub-Region

2) Geological Survey

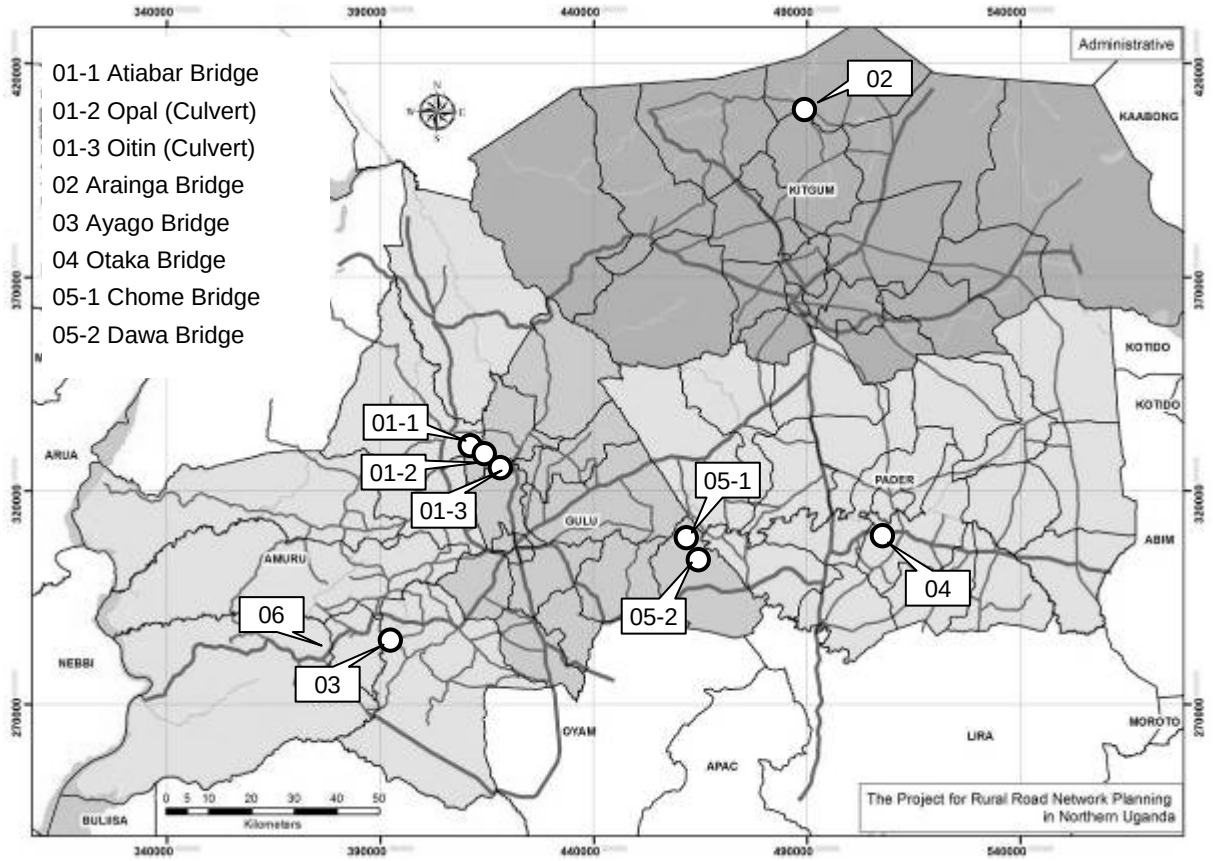
The following investigations and tests were carried out for the Urgent Projects which include the reconstruction of six bridges and road improvement works in Acholi Sub-region:

- Drilling investigation
- Standard Penetration Test (SPT)
- Laboratory Tests (using soil and rock samples recovered through drilling)

Figure 27.3.12 shows the locations of geological investigations including the thirteen (13) drilled boreholes at the six (6) project sites. Each borehole was to be drilled to a maximum 15.0 m depth, with Standard Penetration Tests (SPT) conducted in each of the boreholes at intervals of 1.0 m depth.

Based on these investigations, the following findings were obtained:

- The consistency of the strata soils generally varied from loose to very dense for the non-cohesive soil samples and from soft to stiff for the fairly cohesive soils.
- Allowable bearing capacities from field SPT N-values ranged from 45 kPa to > 700 kPa. The lowest value was obtained in BH 4-2 at 1.00-1.45 m depths at the Otaka Bridge site.
- Chemical tests on soil samples retrieved from the boreholes posted pH values ranging from 6.40 to 6.65. Sulphates and chlorides from soil samples obtained from both sites were in negligible quantities. This is considered safe for normal structural works.

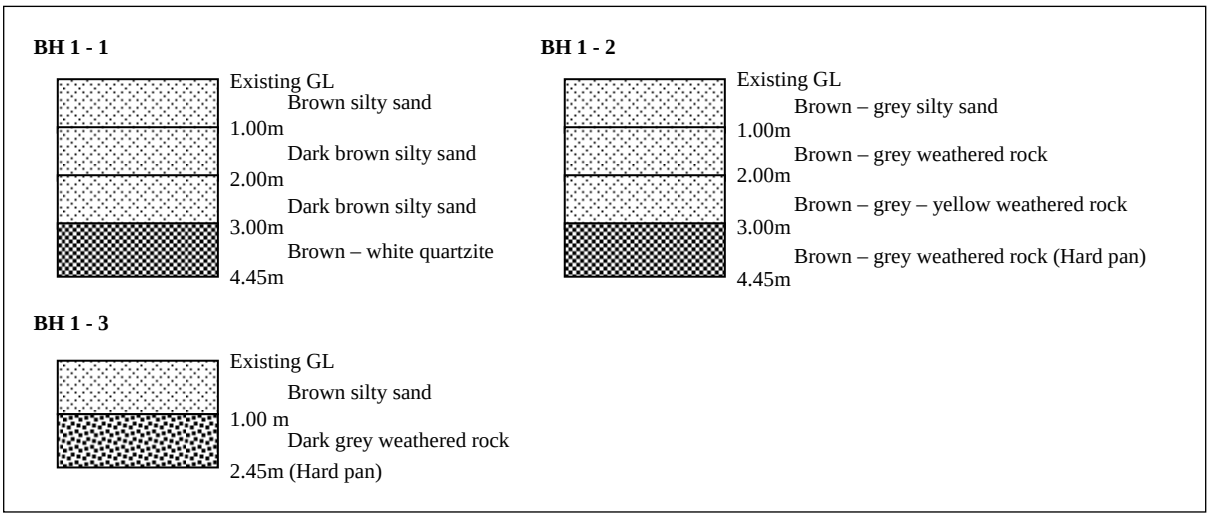


Source: JICA Study Team

Figure 27.3.12 Locations of Geological Investigations

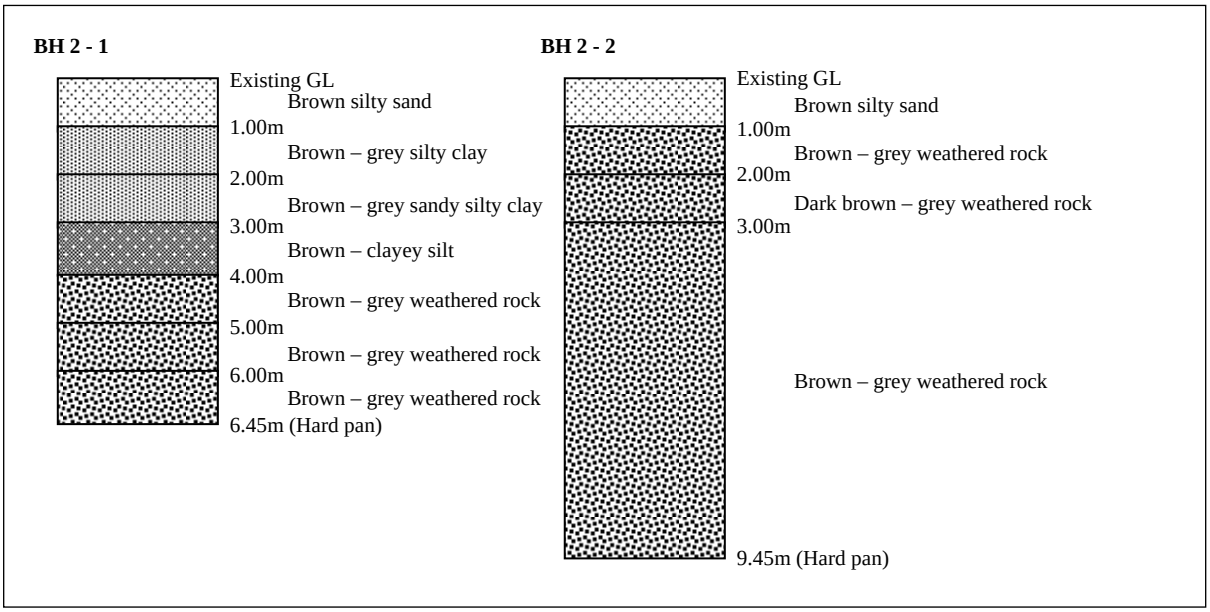
a) Drilling Investigation

Figures 27.3.13 to 27.3.17 show the findings of borehole logs.



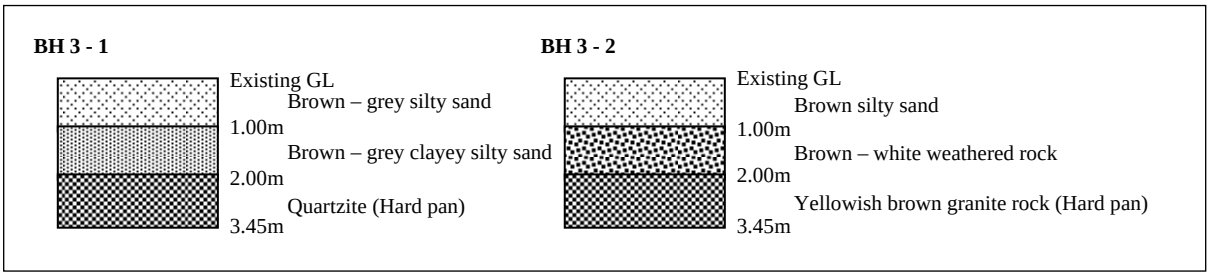
Source: JICA Study Team

Figure 27.3.13 Borehole log findings at Atiabar Bridge site



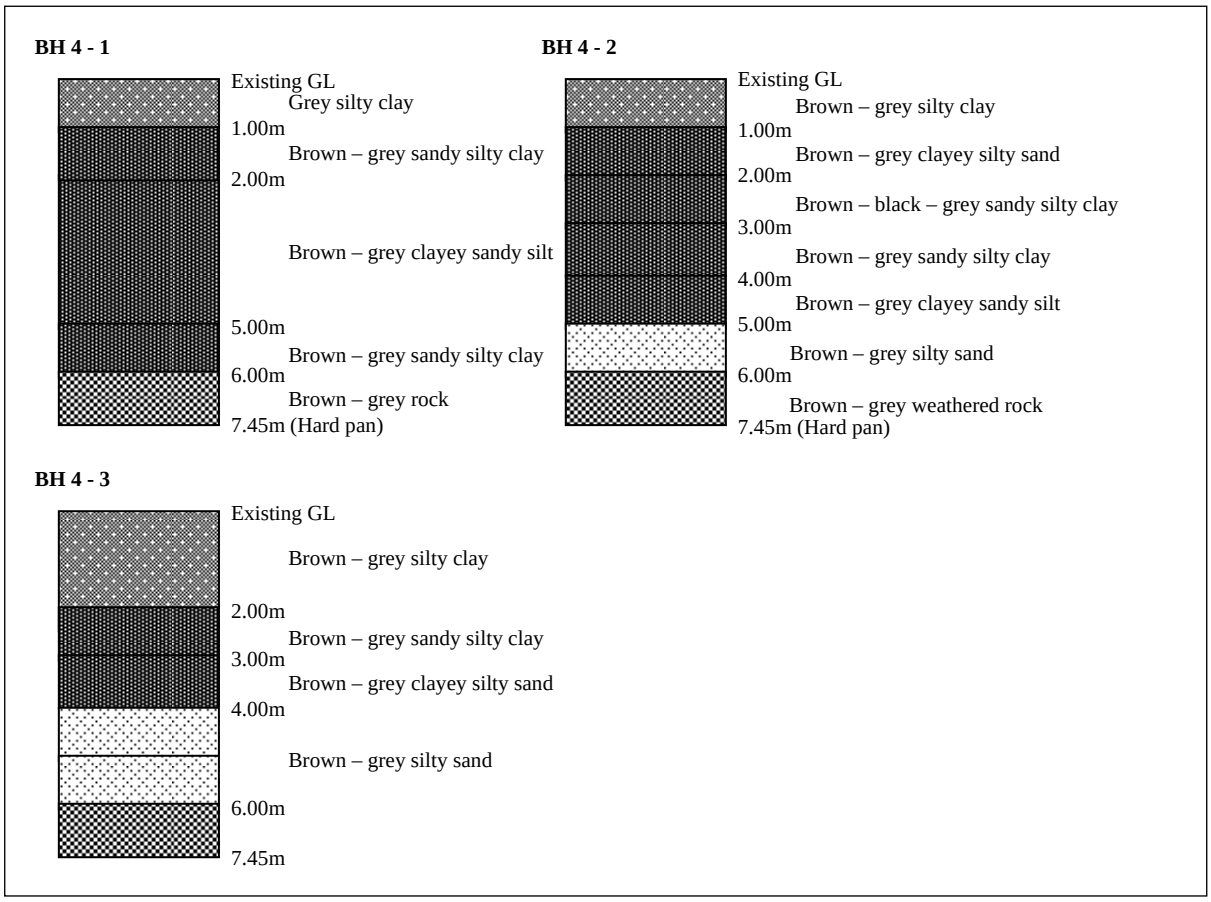
Source: JICA Study Team

Figure 27.3.14 Borehole log findings at Arainga Bridge site



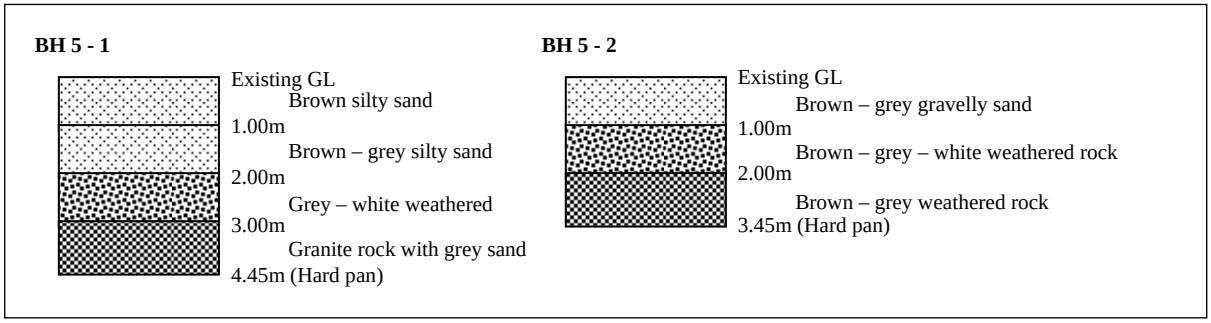
Source: JICA Study Team

Figure 27.3.15 Borehole log findings at Ayago Bridge site



Source: JICA Study Team

Figure 27.3.16 Borehole log findings at Otaka Bridge site



Source: JICA Study Team

Figure 27.3.17 Borehole log findings at Chome and Dawa Bridge site

b) Standard Penetration Test (SPT)

On the basis of the SPTs conducted in the boreholes, the profile of soils was categorized as shown in Table 27.3.1.

Table 27.3.1 SPT values of soil strata in the boreholes

BH Identification	Sampling Level	Depth (m)	SPT - N Values	Consistency	Soil Description
Atibar Bridge site – Amuru District and Gulu District					
BH 1 - 1	I	1.00	9	Loose	Silty sand
	II	2.00	6	Ditto	Ditto
	III	3.00	9	Ditto	Ditto
	IV	4.00	89	Very dense	Silty gravel
BH 1 - 2	I	1.00	7	Loose	Silty sand
	II	2.00	19	Medium dense	Silty gravel
	III	3.00	28	Ditto	Ditto
	IV	4.00	100	Very dense	Gravel
BH 1 - 3	I	1.00	6	Loose	Silty sand
	II	2.00	60	Very dense	Gravel
Arainga Bridge site – Lamwo District					
BH 2 - 1	I	1.00	9	Loose	Elastic silt
	II	2.00	12	Stiff	Lean clay with silt
	III	3.00	14	Ditto	Ditto
	IV	4.00	15	Medium dense	Clayey sand
	V	5.00	23	Ditto	Ditto
	VI	6.00	58	Very dense	Ditto
BH 2 - 2	I	1.00	15	Stiff - Medium dense	Lean clay with silt
	II	2.00	26	Ditto	Ditto
	III	3.00	25	Ditto	Silt
	IV	4.00	36	Dense	Elastic silt
	V	5.00	36	Ditto	Clayey sand
	VI	6.00	38	Ditto	Ditto
	VII	7.00	42	Ditto	Ditto
	VIII	8.00	49	Ditto	Ditto
	IX	9.00	55	Very dense	Ditto
Ayago Bridge site – Nwoya District					
BH 3 - 1	I	1.00	8	Loose	Silty sand
	II	2.00	12	Medium dense	Ditto
	III	3.00	61	Very dense	Gravel
BH 3 - 2	I	1.00	8	Loose	Silty sand
	II	2.00	34	Dense	Gravel
	III	3.00	55	Very dense	Ditto
Otaka Bridge site – Agago District					
BH 4 - 1	I	1.00	8	Firm	Elastic silt
	II	2.00	10	Stiff	Fat clay
	III	3.00	11	Medium dense	Lean clayey silt
	IV	4.00	10	Ditto	Silt
	V	5.00	9	Loose	Lean clayey silt
	VI	6.00	5	Firm	Fat clay
	VII	7.00	52	Very dense	Silty gravel
BH 4 - 2	I	1.00	4	Soft	Lean clay
	II	2.00	4	Very loose	Clayey sand
	III	3.00	12	Stiff	Lean clay
	IV	4.00	16	Very stiff	Ditto
	V	5.00	12	Medium dense	Silt
	VI	6.00	9	Loose	Clayey sand
	VII	7.00	54	Very dense	Ditto

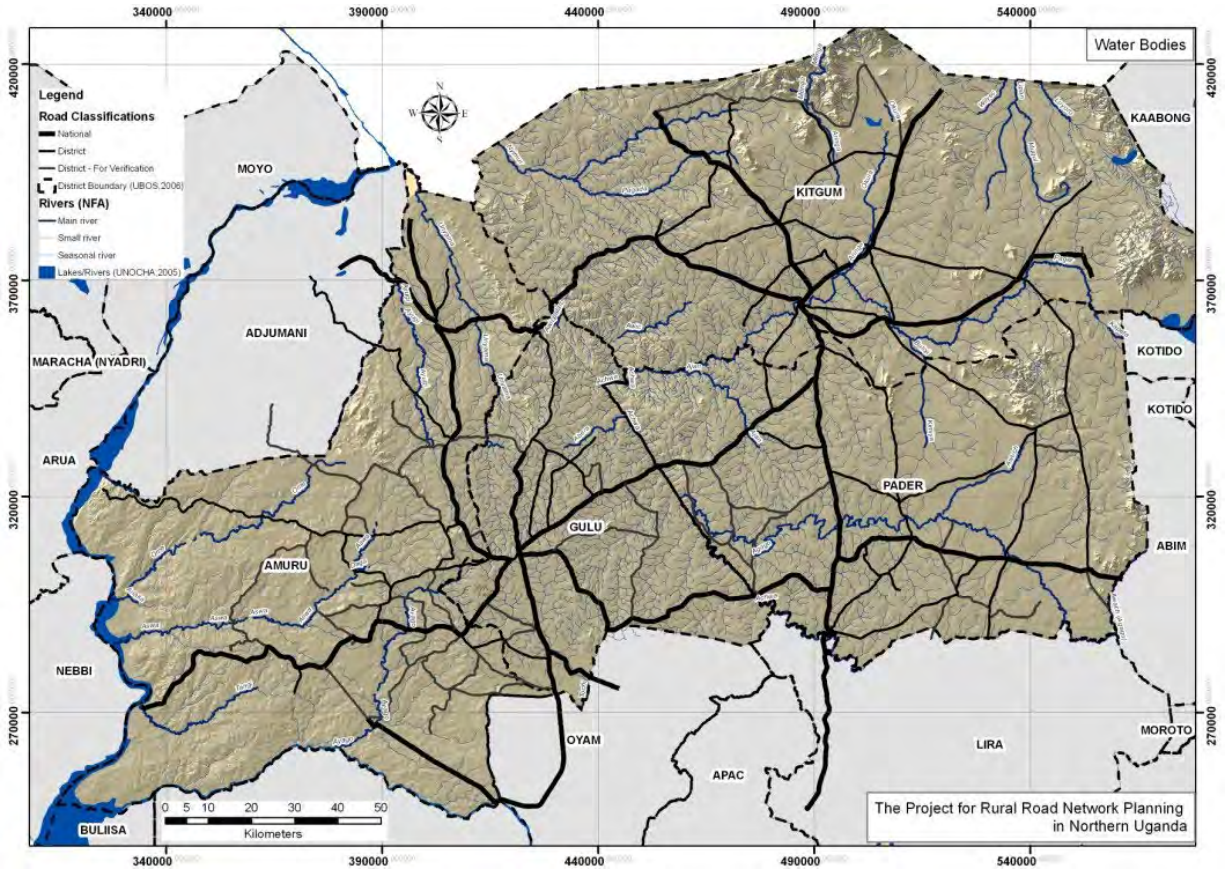
BH Identification	Sampling Level	Depth (m)	SPT - N Values	Consistency	Soil Description
BH 4 - 3	I	1.00	7	Loose - Firm	Elastic silt
	II	2.00	7	Ditto	Ditto
	III	3.00	9	Stiff	Fat clay
	IV	4.00	10	Stiff - Medium dense	Lean clay
	V	5.00	12	Ditto	Ditto
	VI	6.00	14	Ditto	Clayey gravel
	VII	7.00	56	Very dense	Ditto
Chome Bridge site – Gulu district					
BH 5 - 1	I	1.00	17	Medium dense	Silty sand
	II	2.00	18	Ditto	Ditto
	III	3.00	13	Ditto	Silty gravel
	IV	4.00	113	Very dense	Gravel
Dawa Bridge site – Gulu district					
BH 5 - 2	I	1.00	10	Medium dense	Clayey sand
	II	2.00	46	Dense	Ditto
	III	3.00	66	Very dense	Ditto

Source: JICA Study Team

(3) Rivers

Victoria Nile and Albert Nile flow along the Nwoya District southern and western borders while Albert Nile and Achwa River flow along the Amuru District border with Sudan. Many feeder streams in Lamwo and Amuru Districts run into these main rivers.

Achwa River is a major river in north-eastern Uganda. It flows north-west into Sudan and drains much of the north-eastern highland and northern plateau of Uganda. Like most rivers in the region, the flow of the Achwa is strongly influenced by the season and weather. It is prone to flooding at times. In 2000, it submerged the Aswa Bridge that connects the towns of Gulu and Kitgum. The reconstruction of this bridge is on-going.



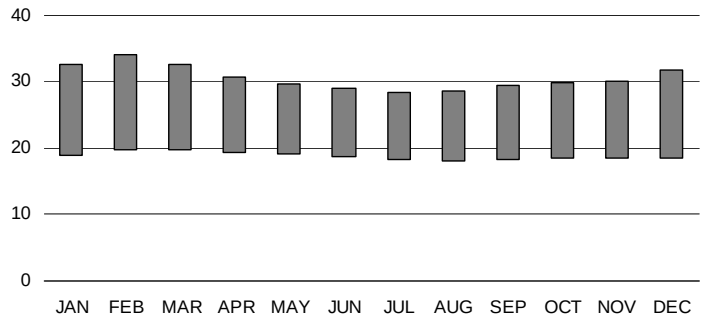
Source: JICA Study Team

Figure 27.3.18 Rivers in Acholi Sub-Region

(4) Climate

1) Temperature

The temperature in Northern Uganda averages a maximum of about 30 °C during the day and minimum of about 19 °C at night. The hottest months are from December to March, when the daytime maximum temperatures exceed 31 °C. The average monthly temperatures (1999-2008) are shown in Figure 27.3.19.

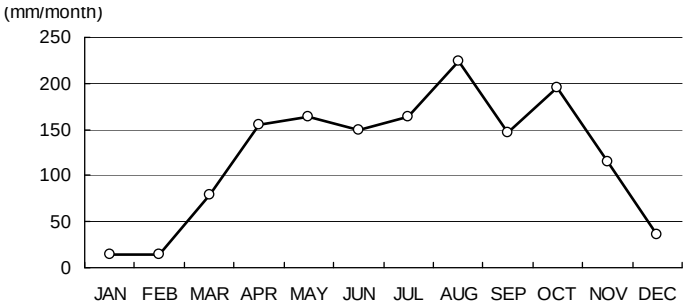


Source: Department of Meteorology, Ministry of Water and Environment

Figure 27.3.19 Monthly Temperatures in Gulu 1999-2008

2) Rainfall

The rainy season in the area runs from April to October. During the rainy season the average rainfall is 171 mm per month.

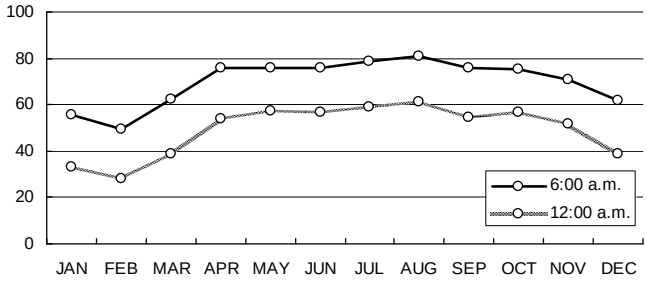


Source: Department of Meteorology, Ministry of Water and Environment

Figure 27.3.20 Monthly Rainfall in Gulu 1980-2008

3) Relative Humidity

The wet season runs from April to October while the dry season runs from November to March.



Source: Department of Meteorology, Ministry of Water and Environment

Figure 27.3.21 Average Relative Humidity in Gulu 1997-2008

28. CONTENTS OF THE PROJECT

28.1 Basic Concept of the Project

28.1.1 Overall Goal of the Project

The target of the project is improvement of National Roads and District Roads including Community Access Roads that will be upgraded to District Roads in Acholi Sub-region and important Community Access Roads in Nwoya and Amuru Districts. The overall goal of the project is to contribute to the IDP return process by bridge reconstruction and road improvement projects such as: reconstruction of bridges that are aging and/ or have narrow widths that limit vehicle passage as well as temporary wooden bridges and Bailey bridges and improvement of poorly maintained trunk roads that vehicles pass over at low speeds.

28.1.2 Selection of the Objective Project Sites

The Ugandan side had requested 13 projects to be undertaken by the Japanese side: these projects consisted of improvement of National Roads, District Roads and Community Access Roads (CAR). As the result of a field survey, it was recognized that these roads and bridges had the following problems and their improvement was critical.

- Deficiency of bridges necessary for river crossing (blocking road during rainy season)
- Deficiency of load bearing capacity of bridges (wooden bridge or temporary bailey bridge)
- Deficiency of bridge width (traffic bottle-neck)
- Deficiency of road maintenance (blocking road during Rainy season, low speed driving)

Although, the Japanese side recognized the necessity of improvement or new construction of all the requested roads and bridges, the degree of contribution to the return of IDPs, and the urgency and necessity were different for each location. Social environmental issues such as land acquisition and resettlement were also different at each location.

Consequently, selection of the project was carried out based on the following conditions and prioritized based on the criteria as shown in Table 28.1.1.

- High degree of contribution to return and resettlement of IDPs
- High degree of urgency
- Large benefits
- Minimal negative social environmental issues

Meanwhile, weights for the criteria were agreed upon with Ugandan side in such a way that the social environmental issues such as land acquisition and resettlement were assigned high

scores in consideration of the promptness of implementation as a peace-building grant aid project.

Table 28.1.1 The Criteria and Weights for prioritization

Item		Weight	
1	Degree of contribution for return and resettlement of IDPs (Weight: Moderate)	- High utilization for IDPs: - Moderate: - Low utilization for IDPs:	10 6 2
2	Urgency and necessity (Weight: Moderate)	- No bridge (without alternative route): - No bridge (with alternative route): - Temporary bridge (with fear of blocking the road by flood) or permanent bridge (Deficiency of width) - Temporary bridge (without fear of blocking the road by flood) or permanent bridge (with fear of blocking the road by flood) - Permanent bridge (enough width and without fear of blocking the road by flood):	10 8 6 4 2
3	Benefit (Weight: Moderate)	- Entire area of Acholi Sub-region: - District level: - Sub county level: - Parish level: - Village level:	10 8 6 4 2
4	Social environmental issues (Weight: Heavy)	- Small (without land acquisition and resettlement issues): - Moderate (with land acquisition issues): - Large (Difficult resettlement is expected):	15 9 3

Source: JICA Study Team

Table 28.1.2 shows the total scores and order of priorities of each of the requested projects.

Table 28.1.2 Priorities of the requested projects (Total Score and Order)

No.	Project Name	Distribution of marks				Total Score	Priority
		1. Degree of contribution to return and settlement of IDPs	2. Urgency and necessity	3. Benefit	4. Social environ-mental issues		
1	Awoo-Pabbo Road Improvement (Gulu-Amuru)	10	10	6	15	41	A
2	Paloga-Potika-Palacam Road Improvement (Lamwo)	10	6	8	15	39	A
3	Laminlatoo-Lamoki Road Improvement (Nwoya)	10	10	4	15	39	A
4	Otaka Bridge Reconstruction (Agago)	6	6	8	15	35	A
5	Lawodo-Binya Road Improvement (Gulu)	10	10	6	9	35	A
6	Anaka-Olwiyo Road Improvement (Nwoya)	6	6	8	15	35	A
7	Aswa River-Lolim Road Improvement (Nwoya)	6	8	6	9	29	B
8	Kitgum-Mucwini Road Improvement (Kitgum)	6	6	8	9	29	B
9	Olyelowidyel-Adilang Road Improvement (Agago)	10	10	6	3	29	B
10	Pabbo-Olamnyungo Road Improvement (Amuru)	10	10	6	3	29	B
11	Adilang-Lacekoto Bridge Reconstruction (Agago)	10	6	4	9	29	B
12	Atiak- Olamnyungo Road Improvement (Amuru)	6	6	6	9	27	B
13	Bolo Agweng- Angagura Road Improvement (Pader)	10	6	6	3	25	B

Priority A：More than 33　　Priority B：Less than 32
Source: JICA Study Team

Based on the prioritization, the six highest priority projects (Priority A : No.1-6) were selected. However, the low priority projects (Priority B) at the present stage were still requested by the Ugandan side. If social environmental issues were settled and the Japanese side confirmed it, the priorities of these projects would be re-examined.

28.2 Basic Design of the of the Requested Japanese Assistance

28.2.1 Design Policy

(1) Road Improvement Section

Improvement is proposed for the sections: (1) whose road width is deficient (such as District Road: less than 6 m, Community Access Road: less than 3 m) and (2) whose gravel pavement is damaged (Murram material is necessary) and (3) which is impassable for vehicles or traffic speed is less than 30 km/h.

(2) Road Width

National Road: more than or equal to 8 m, District Road: 6 m, Community Access Road: 3 m.

(3) Pavement

Trunk National Road (where heavy vehicles would pass): DBST pavement, others: Gravel pavement.

(4) Bridge Length

The required length was decided based on the existing river width, evidence of flood, interviews and hydrological analysis.

(5) Structure Type

Reinforced Concrete (RC) Girder Bridge (RC structure could be constructed by local contractor and minimize imported materials) was applied.

(6) Span Length

As the reasonable length for the RC structure, span length shall be less than or equal to 15 m.

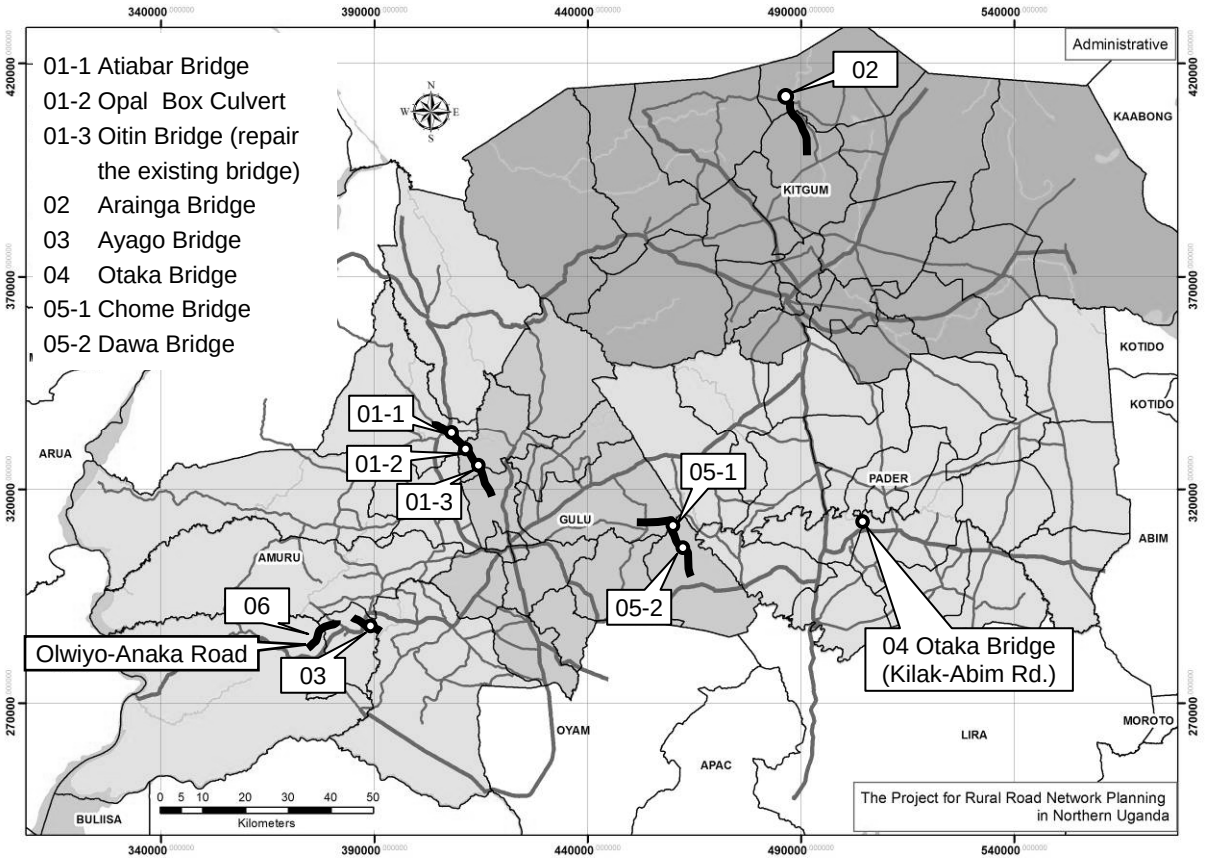
(7) Bridge Width

National Road: minimum 7 m, District Road: 6 m, Community Access Road: 5 m. For cases where Community Access Roads are planned to be upgraded to District Roads, the District standard shall be adopted in the design of bridges on these roads.

(8) Clearance under Bridge

No boat would pass under the bridges. Minimum clearance under bridge would be the high water level +150 mm - 1,000 mm (depending on the discharge) to provide clearance for driftwood.

Locations of the high priority projects are shown in Figure 28.2.1.



Source: JICA Study Team

Figure 28.2.1 Locations of High Priority Projects

28.2.2 Basic Plan

Based on the abovementioned design conditions, the proposed roads and bridges for high priority projects were planned as shown in Table 28.2.1.

Table 28.2.1 Specifications of the Proposed Roads and Bridges

Section No.		No.1	No.2	No.3	No.4	No.5	No.6
		New Bridge & Box Culvert Construction	Bridge Re-construction	New Bridge Construction	Bridge Re-construction	New Bridges Construction	Road Improvement
Location (District)		Gulu – Amuru	Lamwo	Nwoya	Agago	Gulu	Nwoya
Road Class		CA.Road (this is planned to be upgraded to a District Road)	District Road**	CA.Road	National Road (Design Class Road II)	District Road (Partly CAR, to be upgraded to District Road)	National Road (Design Class Road II)
Beginning Point		North of Coope IDP Camp	Palonga	Lamoki JCT	Approach Road only	District Road side JCT	Anaka Border (Gulu Side)
End Point		Pabo JCT	Palacam	Lutuk Satellite	Approach Road only	Acet JCT	Olwiyo JCT
Improvement Road Width (m)		6.0	6.0	3.0	9.0	6.0	9.0
Number of Carriageways on Improved Road		2	2	1	2	2	2
Pavement		Gravel	Gravel	Gravel	DBST	Gravel	DBST
Total Road Length (km, include bridge section)		22.8	19.8	7.9	0.6	23.0	11.0
	Improvement (km)	2.7	0.7	0.8	0.6	5.9	11.0
	Maintenance* (km)	20.1	19.1	7.1	-	17.1	-
Bridge Name		- Atiabar Br.	- Arainga Br.	- Ayago Br.	- Otaka Br.	- Chome Br. - Dawa Br.	-
Span Length (Number of Spans)		15.0 m (1)	15.0 m (1)	15 m (1)	15 m (3) total 45m	15.0 m (1) 15.0 m (1)	-
Superstructure Type		RC Girder Simple girder	RC Girder Simple girder	RC Girder Simple girder	RC Girder continuous girder	RC Girder Simple girder	-
Live Load Type		BS:HA JPN: A type	BS:HA JPN: A type	BS:HA JPN: A type	BS:HB JPN: B type	BS:HA JPN: A type	-
Bridge Width (m)		6.0 m	6.0 m	6.0 m	9.0 m***	6.0 m	-
Abutment	Abutment Type	Reversed T Type	Reversed T Type	Reversed T Type	Reversed T Type	Reversed T Type	-
	Foundation Type	Spread Foundation	Spread Foundation	Spread Foundation	Spread Foundation	Spread Foundation	-
Pier	Pier Type	None	None	None	Wall Type	None	-
	Foundation Type	-	-	-	Spread Foundation	-	-
River Bank Protection (Around Abutments)		Masonry Retaining Wall	Masonry Retaining Wall	Masonry Retaining Wall	Masonry Retaining Wall	Masonry Retaining Wall	-

CAR: Community Access Road, DBST: Double Bituminous Surface Treatment (Low cost pavement)

JPN: Japanese Bridge Speciation, A type (equivalent BS:HA) for District road, B type (equivalent BS:HB) for National road.

* Maintenance is spot maintenance work. It is basically for the works that construction vehicles can pass safely within the present road width.

** This is planned to be upgraded to a National Road

*** The standard width of Design Class Road II should be 9.0m.

Source: JICA Study Team

28.2.3 Design Conditions for Roads and Bridges

(1) Road Design Condition

Applicable design standards are as follows:

1) Trunk Road Design Manual for Uganda

Uganda has a road design manual, which consists of four (4) sets of volumes; a Geometric design manual, Hydrology and hydraulics design manual, Pavement design manual and Bridge design manual. The Geometric design manual is one part of the revised and developed version of the road design manual which was published in 1994. The manual has been used by all road planners and engineers to design rural roads in Uganda. In terms of urban roads, limited guidelines and explanations were provided in the manual. In addition, it was noted that the manuals are general rules such that some modifications may be required in some special cases.

2) District Road Design Manual

Although District Roads and Community Access Roads (CARs) are, institutionally, under the jurisdiction of the District Local Government and Sub-County (LC3), respectively, the Ministry of Public Works and Transport (MoWT) is in the position to give technical assistance and suggestions to the District and LC3 on maintenance and development.

The Ministry of Public Works & Housing (former MoWT) prepared District Road Manuals in May, 2004: they consisted of the following volumes.

Table 28.2.2 Composition of District Road Manuals

	Planning Manuals	
Volume 1	Manual A	Functional Road Classification System & Route Numbering
	Manual B	Annual District Road Inventory and Condition Surveys (ADRICS)
	Manual C	Rehabilitation and Maintenance Planning System (RAMPS)
	Manual D	Annual District Road Work Plan for Routine and Periodic Maintenance, Rehabilitation and Spot Repairs
	Manual E	GPS mapping Manual for RAMPS Module
Volume 2	Contract Documentation Manuals	
	Manual A1	Contract Document for Rehabilitation, Periodic Maintenance and Minor Works
	Manual A2	Technical Specifications for Rehabilitation, Periodic Maintenance and Minor Works
	Manual A3	Bills of Quantity (BoQ) for Rehabilitation, Periodic Maintenance and Minor Works
	Manual A4	Unit Rate Analysis for Rehabilitation, Periodic Maintenance and Minor Works
	Manual B	Contract Documentation & Procedures for Labour-Based Routine Maintenance
Volume 3	Implementation and Monitoring Manuals	
	Manual A	Contract Management and Administration
	Manual B	Preparation of Quarterly Progress Reports
Volume 4	Technical Manuals	
	Manual A	Technical Manuals
	Manual B	Standard Design Manual
Volume 5	District Administrative and Operational Guidelines	
	Manual A	Policy Document for Road Maintenance
	Manual B	Environmental Guidelines
	Manual C	Gender Guideline
	Manual D	HIV/AIDS Guidelines
	Manual E	Occupational Health and Workplace Safety Guidelines

Source: District Road Manuals by Ministry of Public Works & Housing

As for the road designing for District Roads and CAR, the Volumes 1 and 4 shall mainly be applied and referred to whereas the Road Design Manuals are applied as supplements and also referred to if necessary.

3) Other Manuals

The Southern Africa Transport and Communications Commission (SATCC) prepares codes of practice consisting of Geometric, Pavement, Bridge and Rehabilitation Design which are prepared for the road design work in SADC countries (Southern Africa Development Community; Tanzania, Zambia, Botswana, Mozambique, Angola, Zimbabwe, Lesotho, Swaziland, Malawi, Namibia, Mauritius, Congo and Madagascar and S.A.). Applying SATCC standard for the road design is common practice even in the countries which do not belong to SADC.

It was also recognized that the above-mentioned Ugandan road design manuals are, seemingly, prepared based on the SATCC standards such that the SATCC s' are available to be applied to the road design for the study roads if necessary. In addition AASHTO which has been recognized as the most popular and authorized design standard for road designers is also referred to in some cases.

(2) Road Classifications

1) Trunk Roads

a) Functional Road Classification System

Since there is no urban road standard in Uganda, the road classifications are prepared for rural roads only. The national roads in rural areas in Uganda are divided into the following 5 classes according to their major function in the road networks.

Table 28.2.3 Functional Road Classification System for Trunk Roads

Class	Roads	Function
A	International Trunk Road	Roads that link Internationally Important Centers. Connection between the national road system and those of neighboring countries. Major function is to provide mobility
B	National Trunk Road	Roads that link provincial capitals, main centres of population and nationally important centres. Major function is to provide mobility
C	Primary Roads	Roads linking provincially important centres to each other or to a higher class road (urban/rural centres). Linkage between districts local centres of population and development areas with higher class road. Major function is to provide both mobility and access
D	Secondary Road	Roads linking locally important centres to each other, or to more important centres, or to higher class roads (rural/market centres) and linkage between locally important traffic generators and their rural hinterland. Major function is to provide both mobility and access.
E	Minor Road	Any road link to a minor center (market/local center) and all other motorable roads. Major function is to provide access to land adjacent to the secondary road system.

Source: Geometric Design Manual in Uganda

b) Design Class Standard

In addition to the Functional Road Classification System, there is the Design Class which is divided into 7 classes, as follows.

Table 28.2.4 Design Classes for Trunk Roads

Design Class	Capacity [pcu x 1,000/day]	Road-way width[m]	Maximum Design speed Km/h			Functional Classification				
			Level	Rolling	Mountainous	A	B	C	D	E
Ia Paved	12 – 20	20.80 -24.60	120	100	80	✓				
Ib Paved	6 – 10	11.0	110	100	80	✓	✓			
II Paved	4 – 8	10.0	90	70	60	✓	✓	✓		
III Paved	2 – 6	8.6	80	70	50	✓	✓	✓		
A Gravel	4 – 8	10.0	90	80	70		✓	✓	✓	
B Gravel	2 – 6	8.6	80	60	50				✓	✓
C Gravel		6.4	60	50	40					✓

Source: Geometric Design Manual in Uganda

2) District Roads

a) Functional Road Classification System

Volume 1: Planning Manual, District Road Manual (MoWH) introduced the following functional classes for District Roads.

Table 28.2.5 Functional Road Classification System for District Roads

Class	Definition
District Class I Roads	District Class I roads serve national interests in that they satisfy criteria established for tertiary road systems of MoWT's Trunk Road Network. District Class I roads will be candidates for eventual upgrading to the Trunk Road network and become the responsibility of UNRA for maintenance and further development. District I roads, to qualify for upgrading to MoWT jurisdiction, need to be engineered and constructed to Trunk Road standards.
District Class II Roads	District Class II roads provide the basic internal transport needs of the district. District Class II roads connect to UNRA secondary or tertiary road systems, interconnect the district capital and county administrative centres, and provide direct access for district population centres to district health, educational, marketing and administrative facilities. Such roads generally have a gravel surface and carry, on average, twenty (20) or more motorized vehicles per day.
District Class III Roads	District Class III roads (including cul-de-sacs) are typically low motorized traffic volume roads extending into the district's lightly populated peripheral regions. District Class III roads may, at times, serve as connectors to and/or between district class II roads, but generally do not provide direct routing to major public activity centres. Such roads generally have an earth/gravel surface and carry, on average, less than twenty (20) motorized vehicles per day
Community Access Roads	In Uganda, the community access roads (CARS) network is comprised of an extensive system of low motorized traffic volume, usually dry weather only earth roads, serving primarily pedestrians, bicycles and animal drawn carts. Neither inventory/condition surveys detailing the actual extent and condition of this network, nor any clear definition of design class, nor did appropriate design standard exist at present. During implementation by district local government staff of their annual district road inventory and condition surveys (ADRICS), local authorities at sub-county level are provided the opportunity to identify those CARs considered most important for the survival and continued development of their communities. This process will, over time, enable identification of most important CARs and result in the development works. For complete details of the ADRICS procedure, refer to District Road Manuals Volume No. 1 Manual B.

Source: District Road Works, Volume 1 Planning Manual, Manual A: Functional Road Classification System & Route Numbering.

b) Design Class Standards

Design classes have been introduced in consideration of functional road class and numerical elements such as traffic volume.

Table 28.2.6 Design Class for District Roads

Design Class	Traffic Volume (vpd)	Max Grade (%)	Design Speed by Terrain Condition (km/hr)			Carriageway Width (m)	ROW (m)
			Flat	Rolling	Hilly		
I	> 50	10	70	60	50	6.0-7.4	15-30
II	20-50	12	60	50	40	4.5-5.8	15-25
III	< 20	15	50	40	30	4.0-5.4	15-18

Source:District Road Works, Volume 4 Technical Manuals, Manual A: Technical Manual, Section B Standard Design

(3) Design Criteria for National Roads

a) Olwiyo- Anaka Road (Olwiyo-Kitgum Rd.)

Olwiyo-Anaka Road is a part of Olwiyo-Kitgum Rd. being approximately 11km in length. Olwiyo-Kitgum Rd. crosses Acholi Sub-region from south west to north east. The existing condition of Olwiyo-Kitgum Rd, is unpaved road with poor drainage system, however the road is passable throughout the year.

Since the road passes Gulu Town, the regional industrial and commercial centre, the road is assigned to cater to domestic freight/passenger traffic to the northern part of the Sub-region. Moreover the road is assigned to cater to international freight traffic from/to Sudan and the Democratic Republic of Congo (DRC), since Gulu is the centre in the international trunk road network connecting both countries.

Olwiyo, the starting point of the road, is at a junction on Arua Road which connects Karuma and Pakwach and reaches DRC eventually. The road has been paved with DBST

UNRA has a plan for the entire Olwiyo-Kitgum Rd. to be bituminous pavement and the preliminary design work is underway as of July 2010. In the UNRA's Study, the road is identified as Design Class II road having 3.0m lane width and 1.5m shoulder width for both sides which results in total width of 9.0m.

UNRA also plans the upgrading of Gulu-Atiak-Nimule Rd. to be bituminous pavement with financial assistance of JICA and WB, and the procurement of the civil works is being processed as of July 2010 as well. When these plans are completed, the trunk road network in northern Uganda will significantly foster the high development potential in the agriculture and industrial sectors in northern Uganda.

b) Otaka Bridge (Kilak-Abim Rd.)

The road to projected Otaka Bridge branches off from the Kitgum-Lira Road which is identified as a national road. The road crosses Pader and Agago Districts from west to east. Along the road are some agricultural lands which have been developed with technical and financial support of USAID.

The Otaka Bridge is located approximately 12km from Kilak and crosses one of the major tributaries of Agago River. The geographical feature around the bridge is swamp and the river alignment seems unstable.

The existing bridge is 6m long with a single span and 4m width that creates a bottle neck along the road since the road width along the route of the bridge varies between 6-8m.

During the rainy season the over flow of the bridge occurs frequently which proves insufficient flow capacity of the bridge. Some relief pipe culverts with dia. of 600 mm have been provided either side of the bridge.


Source: JICA Study Team

Figure 28.2.2 Existing Otaka Bridge

The design class is set as Design Class II road since the road has similar features and traffic volume to the Olwiyo-Kitgum road.

(4) Geometric Design Requirement for National Roads

The following tables show the geometric design requirements for the Olwiyo- Anaka Road and approach road to the Otaka Bridge.

Table 28.2.7 Geometric Design Requirements for Olwiyo- Anaka Road

Design Element	Unit	Required Parameter	Design Parameter/Remarks
Road Name		Olwiyo –Anaka Road	-
Design Class		Paved II	Paved II
Design Terrain		Rolling	Rolling
Design Speed	Km/h	70	Design:70
Design Length	Km	Approx. 11.0	-
Min. Horizontal Curve Radius	m	185	To be designed
Max Gradient (desirable)	%	5.5	To be designed
Max Gradient(absolute)	%	7.5	
Min. Gradient in Cut	%	0.5	To be designed
Max. Super-elevation	%	7.0	To be designed
Carriageway Width	m	3.0+3.0=6.0	Design:6.0
Shoulder Width	m	1.5	Design:1.5
Walkway Width at Bridge	m	Nil	Nil
Normal Crossfall	%	2.5	Design:2.5
Shoulder Crossfall	%	4.0	Design:4.0
Right of Way	m	50	Design:50

Source: JICA Study Team

Table 28.2.8 Geometric Design Requirements for Approach Road to Otaka Bridge

Design Element	Unit	Required Parameter	Design Parameter/Remarks
Road Name		Approach Rd. to Otaka Bridge	-
Design Class		Paved II	
Design Terrain		Rolling	
Design Speed	Km/h	70	Design:70
Design Length	Km	0.605	Bridge Approach only
Min. Horizontal Curve Radius	m	185	Design Min.:280
Max Gradient (desirable)	%	5.5	Design Max:1.7
Max Gradient (absolute)	%	7.5	-
Min. Gradient in Cut	%	0.5	Design Min:0.5 on Fill
Max. Super-elevation	%	7.0	Design:3.9% on R280
Carriageway Width	m	3.0+3.0=6.0	Design:6.0
Shoulder Width	m	1.5	Design:1.5
Walkway Width at Bridge	m	Nil	Nil
Normal Crossfall	%	2.5	Design:2.5
Shoulder Crossfall	%	4.0	Design:4.0
Right of Way	m	50	Design:50

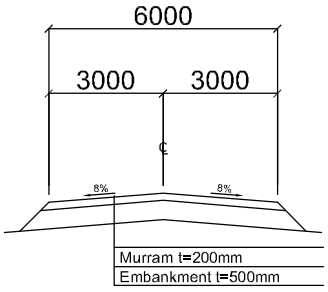
Source: JICA Study Team

(5) Typical Cross Sections

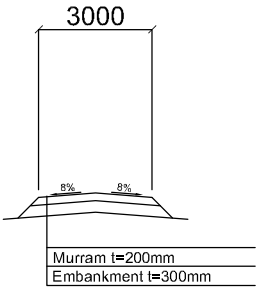
1) Typical Cross Section of Roads

According to the Design Standards described above and the Design Manuals mentioned below, the typical cross sections of Roads are designed as shown in Figure 28.2.3.

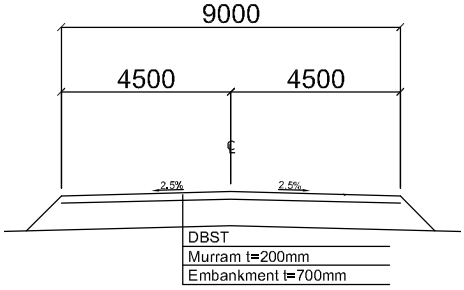
- Trunk Road Design Manual
- District Road Design Manual in Uganda



District Road: Section No. 1, 2, 5



Community Access Road: Section No. 3



National Road: Section No. 4, 6

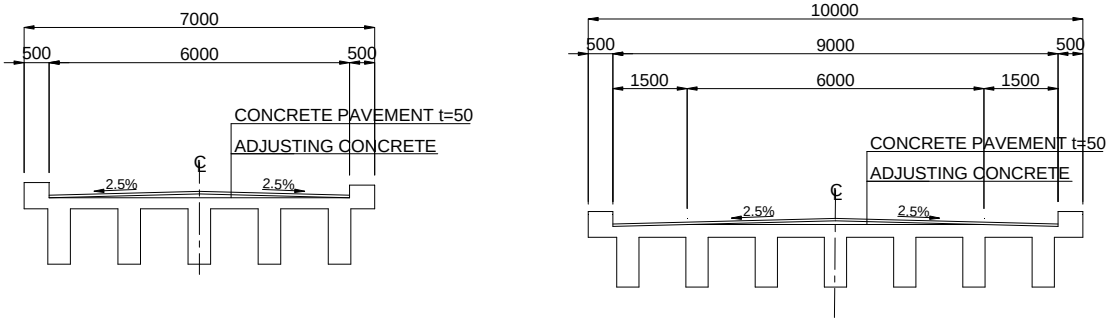
Source: JICA Study Team

Figure 28.2.3 Typical Cross Section for Roads

2) Typical Cross Section of Bridges

According to the design manuals mentioned below, typical cross sections of Bridges are designed as shown in Figure 28.2.4.

- Road Design Manual Volume 4 : Bridge Design, 2005 (Uganda)
- Overseas Road Note 9: A Design Manual for Small Bridges (TRL)
- British Standard BS 5400
- Specifications for Highway Bridges (Japan Road Association Part I, III, IV, V)



District Bridge: Section No. 1, 2, 5
Community Access Bridge: Section No. 3

National Bridge: Section No. 4

Source: JICA Study Team

Figure 28.2.4 Typical Cross Section for Bridges

(6) Bridge Design Conditions

1) Structure Type

Reinforced Concrete (RC) Girder Bridge was applied since RC structures can be constructed by local contractors and it minimizes need for imported materials.

2) Clearance under Bridge

Minimum clearance under bridge is approx. +1,000 mm (depending on the discharge) to maintain clearance for driftwood.

3) Live Load

- A type live load of Japan standard (equivalent to HA live load of BS) for District Road Bridge and Community Access Bridge.
- B type live load of Japan standard (equivalent to HB live load of BS) for National Road Bridge.

4) Dead Load

Table 28.2.9 shows the unit weight of bridge materials for the calculation of design dead load.

Table 28.2.9 Unit Weight for Bridge Materials

Material	Unit Weight (kN/m^3)	Material	Unit Weight (kN/m^3)
Steel	77.0	Cement mortar	21.0
Reinforced Concrete	24.5	Asphalt Concrete	22.5
Plain concrete	23.0	Wood	8.0

Source: JICA Study Team

5) Other Loads

The following loads shall also be considered in the bridge design.

- Impact Load (including break load)
- Creep of Concrete, Shrinkage of Concrete
- Earth Pressure
- Buoyancy or Lifting Pressure
- Seismic Load

6) Concrete Design Strength

Table 28.2.10 Design Strength of Concrete

Description	Design Strength (N/mm^2) (Cube strength)
Girder Concrete	30 or more
Slab Concrete	30 or more
Abutment, Pier	30 or more

Source: JICA Study Team

(7) Materials

1) Concrete

The compressive strength and maximum W/C ratio are shown in Table 28.2.11.

Table 28.2.11 Compressive Strength and maximum W/C ratio of Concrete

Type	Comprecive Strength (MPa)	Maximum W/C ratio
Leveling concrete	15	60
Substrucutre	20	50
Superstructure	20	50

Note-1: Spacement 150mm x 150mm x 150mm
Note-2: Admixture (water reducing agent, etc) shall be used
Source: JICA Study Team

2) Reinforcing Bar

Reinforcing bars shall be of the ribbed type (Type-2) and in accordance with BS 4449 and General Specifications for Road and Bridge Works. The properties and strength are shown in Table 28.2.12.

Table 28.2.12 Properties and Strength of Reinforcing Bars

Type	Yield Strength f_{y} (MPa)	Tensile Strength $f_{u, min}$ (MPa)	Modulus of Elasticity (MPa)
Grade 250	250	287.5	200,000
Grade 460A	460	483.0	200,000
Grade 460B	460	496.8	200,000

Note-1: Plain round steel bars in Grade 250, deformed (Type-2) high yield steel bars in Grade 460
Note-2: Grade 460 steel bars are in two ductility categories, 460A and 460B.
Source: JICA Study Team

(8) Design Drawings

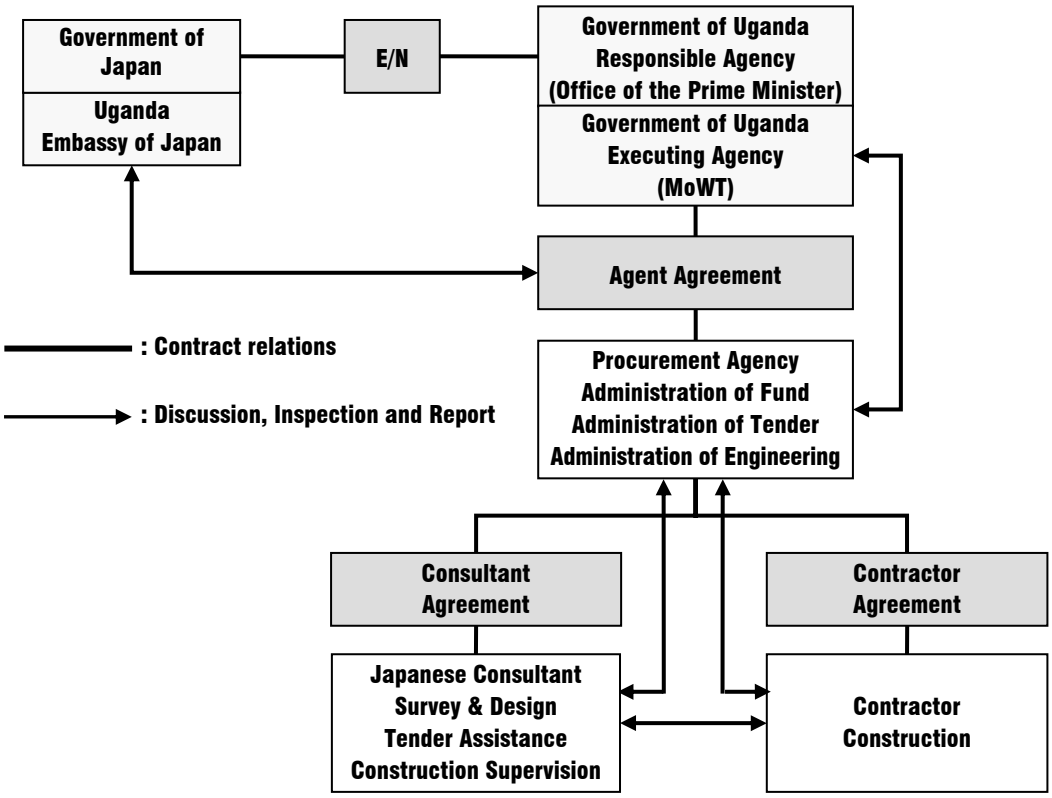
Basic Design level drawings are shown in the Appendix.

28.2.4 Implementation Plan

(1) Implementation Structure

The responsible organization is the Office of the Prime Minister (OPM) and the execution Agency is the Ministry of Works and Transport (MoWT). After close discussions and coordination with UNRA and the 5 Districts in Acholi Sub-region, (Gulu, Lamwo, Agago, Amuru Nwoya), the implementation of the project proceeded. After completion of the project, maintenance of National Roads will be done by UNRA, and that of District Roads and Community Access Road will be done by each District.

After signing of the Exchange of Notes (E/N), the executing agency of Uganda (MoWT) and the procurement agency of Japan (JICS) concluded an Agent Agreement. The Japanese procurement agency would conduct the detailed design together with Japanese consultants and would oversee the construction by contractor after tendering as shown in Figure 28.2.5.



Source: JICA Study Team

Figure 28.2.5 The Flow of the Construction and Procurement by Procurement Agency

(2) Formation of Procurement Plan

1) Construction Materials

Cement, aggregates and sand are available in the Ugandan domestic market. However, reinforcement bars, asphalt material and bridge bearings had to be imported from a third country, mainly Kenya by land through Nairobi – Tororo – Kampala. Although, steel products are available in Nairobi, they are not produced in Kenya but are imported from producer countries such as South Africa, Turkey and Indonesia through Mombasa Port.

The cement produced in Uganda is mainly Pozzolan cement that has a slow rate of strength gain. If Portland cement is not available, it will be imported from Kenya.

Table 28.2.13 Procurement Countries for Major Construction Materials

Item		Procurement Countries			Supplier, route for procurement
Name	Specification	Uganda	Japan	Third	
Materials for Structure					
Portland cement	50 kg per bag	✓		(✓)	Uganda (Tororo), Kenya
Reinforcement bars				✓	Kenya
Coarse aggregate for concrete		✓			Uganda (Gulu)
Fine aggregate for concrete		✓			Uganda (Masaka)
Admixture	Water reducing			✓	Kenya
Slender rubber bearing	270 × 220 × 59 mm			✓	South Africa
Joint filler	25 × 50 mm			✓	South Africa
Steel bridge railing	D = 115 mm			✓	Kenya
Gabion	2 x 1 x 1 m			✓	Kenya
Cobblestone		✓			Uganda (Acholi)
PVC pipe	D = 100 mm			✓	Kenya
Corrugated steel pipe	D = 900 mm			✓	Kenya
Base coarse material	Murram	✓			Uganda (Acholi)
Bitumen (Prime coat)	MC-30			✓	Kenya
Aggregate for DBST		✓			Uganda (Nakasongola)
Materials for Temporary Works					
Fuel, oils				✓	Kenya
Timber for framework		✓		✓	Uganda
Plywood for framework				✓	Kenya
Staging, supporting		✓		✓	Uganda
Release agent				✓	Kenya
Welding electrode				✓	Kenya
Oxygen, acetylene				✓	Kenya

Source: JICA Study Team

Concrete mixing plants for the project were installed at each construction site because there weren't any concrete mixing plants nearby. Trial mixing and quality control (compressive strength test) was done at the MoWT laboratory in Gulu.

There aren't any stationary concrete batching plants or asphalt plants nearby. A 0.5 cubic meter mobile mixer was made available for the construction of concrete structures and low-cost pavement such as DBST that does not require the use of a large asphalt plant. The quarrying plant in Nakasongola is about 170 km south of Gulu.

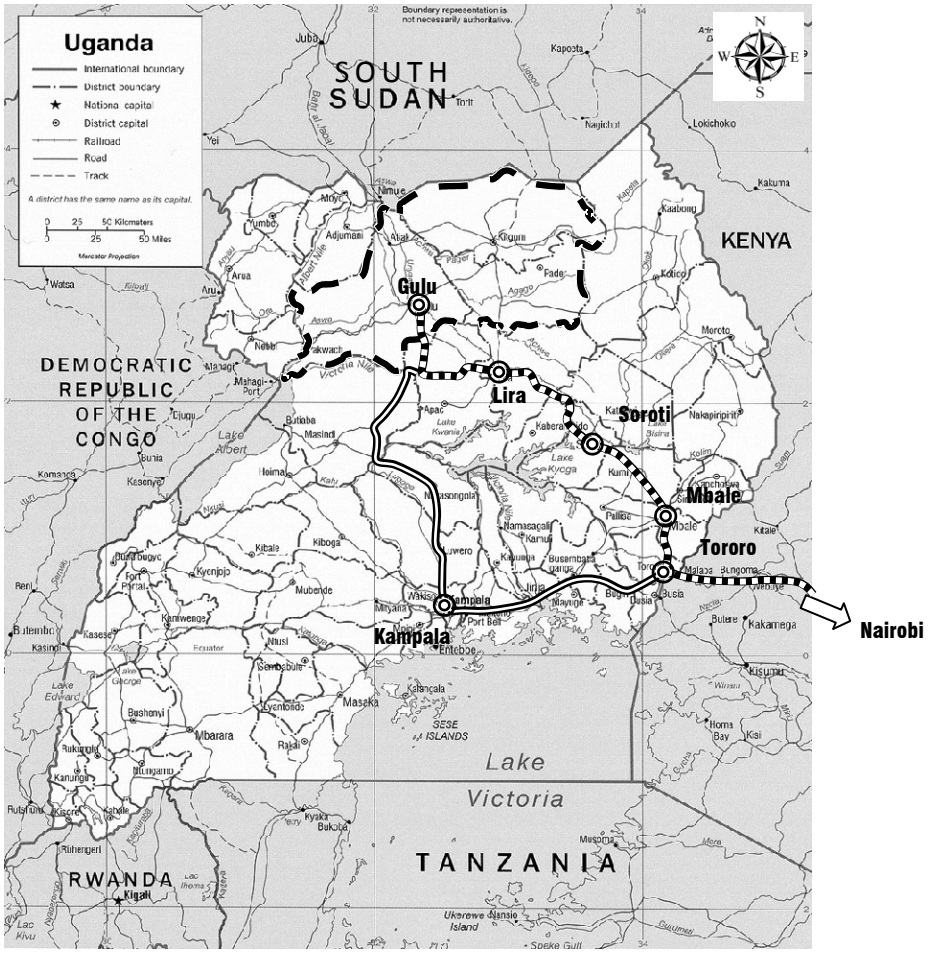
With the exception of plant facilities, upper class contractors have heavy vehicles that are necessary for construction of short and medium span bridges and road improvement works. These could be transported from Kampala by truck trailer.

Table 28.2.14 Distance and Days of Transport from Mombasa Port, Kenya to Gulu

Section	Road Condition	Distance	Days
Mombasa - Nairobi	Asphalt Pavement	500 km	1 day
Nairobi - Kampala	Asphalt Pavement	660 km	1 day
Kampala - Gulu	Asphalt Pavement	320 km	5 hours

Source: JICA Study Team

The route through Mbale is the shortest route from Tororo, border city between Uganda and Kenya, to Northern Uganda. The section from Lira to Soroti is under construction such that the route does not play the role of a main transport route. If the construction of this section was completed, with the entire section paved, the route would be 110 km shorter than the route through Kampala and would thus become the main transport route between Northern Uganda and Kenya.



Source: JICA Study Team

Figure 28.2.6 Main Transit Route to Each Site

2) Labour Arrangement

Civil Engineer

MoWT classifies the 167 domestic contractors as Class A+ (12 companies), Class A (21), Class B (25), Class C (55) and Class D (54) based on their experience in construction and financial scales. Seven companies ranked above Class B have experience in bridge construction such that the construction work of the project could only be done by the engineers from such companies.

Civil Workers

There are no contractors around Acholi Sub-region that have experience in bridge construction; they are only Class C contractors that can construct small buildings or conduct road improvements. Therefore, experienced bridge workers (framework, steel setters, concrete work) shall be resourced from Kampala. Although experienced operators of heavy equipment for earthworks are available around Gulu, they belong to Class C contractors that could not be short-listed as candidates for the project. The prime contractor could assign such contractors as sub contractors for construction of earthworks sections or resource heavy equipment operators from Kampala. For the civil works that do not require high levels of experience, the workers may be resourced from neighbouring communities as locally-hired workers.

Regulations and Labour Conditions under Labour Standards Law in Uganda

It is regulated in the "District Road Works" manual of MoWT (Contract Documentation Manuals A1: Contract Documents for Rehabilitation, Periodic Maintenance and Minor Works) to pay more than minimum wage and to accommodate employees from the local workforce for countryside road construction in Uganda. The Client referred to this manual for tender document preparation and setting of concrete numerical targets for the remuneration rate for local employees.

Other regulations

Labour Based Technology (LBT) has been used to give local residents opportunities for income generation under DANIDA's countryside road construction projects (DANIDA: Danish International Development Assistance). The specification of LBT is regulated in the "District Road Works" manual of MoWT (Contract Documentation Manuals A2: Technical Specifications for Rehabilitation, Periodic Maintenance and Minor Works)

(3) Scope of Works

The scope of works for urgent projects is shown in the Table 28.2.1.

(4) Detailed Design and Construction Supervision

1) Survey and Design

The Consultant would have to enter into an agreement with the procurement agency after signing of E/N. The major works for the consultant are as shown below:

Site Survey

The site survey would have to be carried out to collect information that would be necessary for detailed design after review of the development study report. The following information would complement and update the data that was collected at the development study stage.

- Supplementary topographic survey
- Supplementary geographic survey

Based on the development study report, the consultant would discuss with relevant organizations on the Ugandan side and obtain consensus on the terms and conditions for detailed design. The following would have to be paid attention to at this stage:

- Changes of natural condition at the project site from development study stage
- Cost changes of construction equipment and materials
- Changes and the development of exchange rates

Detailed Design

The detailed design for the project would be carried out based on the result of the development study, site survey and discussions with relevant agencies of Uganda.

Preparation/Approval of Bidding Documents

Tender documents such as the following documents and related documents would be prepared by the consultant and would require approval by the Government of Uganda through discussions with the procurement agency.

- Bid notice
- Instruction to bidders
- Bidding forms
- Contract forms (General conditions, special conditions)
- Specifications
- Bills of quantities
- Drawings

Tender Assistance

The Consultant would have to carry out the following in the stead of the executing agency of Uganda.

- Announcement of bidding qualification
- Evaluation of bidders' qualification
- Orientation sessions for bidding
- Evaluation of bidding

Appropriate discussions with the procurement agency would take place before implementation of tender assistance work. The Consultant would promptly release the information as pertains to the result of the discussions for the procurement agency and executing agency of Uganda.

The bidding would be by international or local tender.

Organization for Detailed Design Work

A team for the detailed design work would be established to ensure its smooth progress.

2) Construction Supervision

Construction supervisors would have to mainly carry out the following:

- **Approval of construction plan and working drawings**: Consultants would have to evaluate whether the construction plan document, schedule and drawings complied with the agreement, agreement drawings and specifications and approve them.
- **Construction schedule control**: The consultant would receive construction progress reports from the contractor and would promptly advise them to finish the construction work as scheduled.

- **Quality control**: The consultant would have to inspect to determine whether the construction materials and qualities complied with the agreement drawings and specifications and approve them.
- **Inspection of construction progress**: The consultant would inspect to determine whether the completed work was aligned with the control standards and confirm the quantities.
- **Issuance of certificate**: The consultant would issue necessary certificates for the payment to the contractor at the completion of construction.
- **Submission of report**: The consultant would be required to inspect monthly progress reports, as-built drawings and completion photographs prepared by the contractor, and would submit them to relevant organizations of Uganda, the District office and the procurement agency together with the project completion report.
- **Coordination with relevant organizations**: The consultant would act as coordinator on the project between relevant organizations of Uganda, the Embassy of Japan, the procurement agency and the contractor.

Organization for Construction Supervision

Two project offices for the consultant would be necessary; one in Gulu for the main office and another in Kitgum for a sub office, since the target project is widely spread out in Acholi Sub-region.

(5) Scheme of Execution

1) Construction Plan

The Contractor will have to carry out the construction work as shown below.

Preparation of Construction Plan & Schedule

The contractor will have to submit the construction plan and schedule to the consultant after receiving the Terms of Reference. These documents will have to be prepared under consideration of climate conditions, national holidays and working conditions in Uganda. Furthermore, the schedule will have to be planned such that the procurement of equipment and material from a third country will not affect the schedule.

Technical Control Plan (Quality, Workmanship, Schedule, Progress)

Quality control will be carried out by a quality control engineer and inspector based on the conditions of contract and quality control plan. Several tests will be conducted concurrently with technical transfer to local civil engineer(s) carried out under the instruction of the quality control engineer. Civil engineers will control the workmanship, schedule and progress of the construction, and a site director will control the whole project through these engineers.

Construction Machine Control

A Mechanical engineer will be assigned for maintenance and inspection of the construction equipment and facilities.

Equipment and Material Control

Project offices for the contractor are necessary at each of the construction sites because the target project is widely spread out in Acholi Sub-region. Each project office will have to procure equipment and materials separately and will also have to control delivery of equipment and materials daily.

Labour Control

Although, skilled workers will be resourced by the Gulu main office, unskilled workers will be resourced from neighbouring communities as much as possible. Each site office will have to carry out the labour control daily while the main office will oversee all of the site offices.

Safety Control

Safety control for workers and third parties will have to be paid attention to because the traffic volume on the roads over large areas of Acholi Sub-region is still low and as such the consciousness of local residents towards traffic safety has deteriorated while roadside bushes at some sections are too dense to see through. Education and provision of traffic safety instruction to workers will be required to cope with these issues before the start of construction works.

Safety Control for workers

- **Implementation of Safety Control for workers**: Safety training for all workers will have to be given and records kept since consciousness of workers for safety is generally low.
- **Inspection of Clothes and Equipment**: Daily inspection before works to ensure that helmets and safety belts for working in high places are worn will be necessary. Furthermore, inspection during working will also be important.
- **Physical Condition Check**: Education for HIV programs will take place when the workers are hired. Physical condition check for workers will also take place daily.
- **Daily Safety Check (Activity for Prediction of Danger)**: As part of the technical transfer program on construction safety, the consultant will introduce the concept of danger prediction that has been used in Japan and the method will be conducted at the start of work each day.
- **Implementation of Periodic Safety Competitions and Safety Patrols**: Safety patrols during safety competitions will be conducted periodically and the results will be recorded.
- **Notice of the Dangerous Points**: Sign boards calling for caution and warning of danger will be installed at various dangerous points in the construction yards to prevent accidents.
- **Assignment of the traffic control staffs:** If a temporary road for traffic is installed to construct a bridge, traffic control staff will have to be assigned and will control both through traffic vehicles and construction vehicles.
- **Precautions for Machines**: Construction machines will have to be used under the specified rules and regulations of Uganda; such as the prohibition of entry into the crane working area during operation.
- **Security for Third Parties**:
    i. Traffic Safety: Traffic safety for third parties will have to be secured during detour road construction for temporary traffic regulation. Police cooperation will have to be sought where necessary.
    ii. Procurement of Safety Equipment: Barricade and sign boards will be installed appropriately based on the regulation for safety facility installation in Uganda depending on the degree of traffic control.
    iii. Safety for residents: Safety facilities such as barricades and pedestrian bypasses will be installed to secure the safety of residents along the side of the construction yard.

2) Construction Management

Project offices for the contractor will be established in Gulu town for the main office and at each of the project sites for site offices because the target project is widely spread out in Acholi Sub-region.

28.3 Obligations of the Recipient Country

Table 28.3.1 shows the undertakings of the Ugandan side. The MoWT, which is the executing agency for the project, will cover all of these costs. However, each district will cover the costs of land acquisition for District Roads and Community Access Roads.

Table 28.3.1 Undertakings for Ugandan Side

	Contents	Remarks
To prepare the land for the construction site	The Japanese side will improve roads with existing road width. If the existing road width is too narrow (District Road: less than 6 m, Community Access Road: less than 3 m), the Japanese side will widen it to the standard width and Ugandan side will have to bear the land acquisition costs.	
To Provide information on land mines & UXO	Ugandan side will have to provide information on unexploded ordinance (UXO) and land mines in the Project site. If found during the survey or construction stage, the Ugandan side will have to give advice on how to handle the situation.	In case UXO are detected, Uganda Mine Action Centre (UMAC) will have to clear it.
To finalize Agent agreement with Japanese procurement agency	After signing of the exchange of notes (E/N), the Ugandan executing agency will finalize an Agent Agreement with the Japanese procurement agency. The Japanese procurement agency will then finalize a contract for procurement with Japanese consultants for detailed design, tender assistance and construction supervision and with the contractor for construction.	
To conduct Banking Arrangements (B/A), to issue an Authorization to Pay (A/P) and to bear the bank charges	The Ugandan side will have to conduct banking arrangements (B/A) for Japanese executing agency and issue an Authorization of Pay (A/P) and bear the bank charges.	
To provide exemption from import tax for construction material	Ugandan side will have to exempt customs duties, custom clearance fees, VAT and internal taxes and assume the taxes if necessary.	
To accord entry of Japanese nationals into Uganda and stay therein	To accord the entry of Japanese nationals into Uganda and stay therein for the performance of their work.	
To exempt Japanese nationals from customs duties	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies and assume their taxes if necessary.	
Proper use of facilities	The Uganda side will be required to operate and maintain the facilities constructed 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.	
To bear the cost for necessary expenses not covered by the Grant Aid	To bear the cost for necessary expenses (including VAT) related to the construction of facilities but not covered by the Grant Aid.	
Environmental Impact Assessment (NEMA)	To carry out an EIA according to the regulations of NEMA if necessary. (Resettlement was not assumed in this project because this project consisted of mainly improvement of existing roads and bridges.)	
To secure the budget	To secure the budget for abovementioned costs such as land acquisition, bank charges, and tax exemptions.	

Source: JICA Study Team

28.4 Project Operation Plan

28.4.1 Operation and Maintenance System

Operation and maintenance of roads in Uganda has been covered by the Uganda Road Fund (URF) that was established by congressional approval in January 2007. Table 28.4.1 shows the budget of MoWT. The fund covers maintenance only of the entire road network in Uganda but not new construction or improvement.

Table 28.4.1 The Budget from URF

Unit: Billion Ushs.

ITEMS	2006/07	2007/08		% of requirements
	Budget	Request	Budget	
1. National Roads Maintenance	73.88	127.79	127.79	100 %
2. District Roads Maintenance	17.75	49.00	29.27	60 %
3. Kampala Roads Maintenance	0.56	15.00	15.00	100 %
4. Urban Roads Maintenance	4.10	23.00	11.55	50 %
5. UNRA Operational costs	0.00	16.00	14.00	88 %
6. Road Fund Administration	0.00	4.34	3.60	83 %
TOTAL	96.29	235.13	201.21	86 %

Source: Uganda Road Fund

The proposed bridge type is reinforced concrete structure and maintenance for it is basically unnecessary. So the major routine maintenance work will be to clean the bridge decks and the piers underwater as well as maintenance of the approach roads. On the other hand, the proposed road pavement is a low-cost pavement for National Roads and gravel pavement for District Roads and Community Access Roads. These pavement structures are widely used in Acholi Sub-region and a large maintenance budget or special techniques are not required. Though, the operation and maintenance work for the project is a burden for MoWT and each district, assistance for the work is necessary to cope with the deficit of budget, staff and equipment as well as maintain and improve the level of technique.

Table 28.4.2 shows the annual maintenance costs for Northern Uganda.

Table 28.4.2 The Annual Maintenance Costs for Northern Uganda

Item	Length (km)	Budget (USD)
Routine Maintenance	1,714	1,285,500
Periodic Maintenance	1,300	1,949,250
District Road Rehabilitation	1,349	20,227,500
Community Access Road Rehabilitation	2,846	5,691,600
Required Budget		29,153,850

Source: Peace, Recovery and Development Plan for Northern Uganda

As regards the objective bridges, large-scale repair works will not be necessary until 20 to 30 years after completion of the bridges unless the main structural members are deformed or damaged by vehicle collision. However, replacement of expansion joints and rubber bearings will be necessary in the future (about 15 years later for expansion joints and 30 years later for rubber bearings) depending on the level of deterioration due to the increasing traffic volume. The pavements for No.4 and No.6 roads are planned as Double Bituminous Surface Treatment (DBST) pavements which are less durable than the conventional asphalt concrete pavements. Therefore, the Ugandan side has to pay special attention to the maintenance of the road

pavement, such as timely fixing of potholes, in order to keep these road sections in fair condition.

28.4.2 Operation and Maintenance Method

(1) Periodical Inspection and Maintenance for Bridges

A standard schedule of periodical inspection and maintenance for the bridges is shown in Table 28.4.3. It is important to keep records (date of inspection, location of inspection, result of inspection and name of inspector) of periodical checking in the road register and grasp the condition of damage in order to establish the repair schedule and its scale. Therefore, the periodical checking system must be established at an early stage.

(2) Maintenance of Asphalt Pavement and Murram Road

The following repairing works shown in Table 28.4.3 will be required in a timely manner, as well as minor maintenance works (patching, smoothing).

Table 28.4.3 Schedule of Periodical Inspection and Maintenance

Facility		Maintenance and Repairing Works	Inspection Frequency
Bridges	Drainage pipe	Cleaning of sediments	3 months
	Expansion joint	Repair of damaged members	3 months
	Handrail	Repairing damage from traffic accidents	3 months
	Bearings	Removal of earth deposit	6 months
	RC slab and Kerb	Repair of cracks and stripping	1 year
	Main structure, Slab system, Lateral bracing	Repair of damaged members	1 year
	Substructure	Repair of cracks and stripping	1 year
	Revetment	Repair of scour	1 year
Roads	Road surface	Patching and smoothing	1 month
	Shoulder and Slope	Surface treatment, vegetation, additional embankment	1 month
	Side drainage	Removal of earth deposit	1 month
	Marking	Repainting	1 month
	Guard rail	Repainting and replacement	6 months
	Retaining wall	Repair of cracks and stripping	Yearly

Source: JICA Study Team

(3) Implementation of Maintenance Activities

The Labour-Based Technology (LBT) could be appropriately applied for implementation of these maintenance works. LBT will contribute to the local economy through a direct increase in household incomes and personal expenditures.

(4) Issues on Maintenance Activities

Maintenance activities are basically to be implemented by force account from 2008. Although District Offices in Acholi Sub-Region require maintenance equipment and manpower for

maintenance by force account, the maintenance budget allocated by the central government is not adequate. A cumbersome procedure of application for subsidies and the diversion of maintenance budget to operations would cause the inadequacy of maintenance budget at the district level.

Furthermore, although Gulu District, which is the commercial hub in the region, has some equipment for maintenance work, the other three (3) districts, namely; Amuru, Kitgum and Pader, do not have enough equipment.

In addition, every District Office faces the problem of low level of employee retention which causes difficulty in maintaining skill level and engineering techniques in District Offices.

Maintenance activities for District Roads are based on the Rehabilitation and Maintenance Planning System (RAMPS) and Quarterly Progress Reporting System (QPRS) which were developed by DANIDA. However, the GIS system for RAMPS is relatively obsolete due to the difficulties in handling and therefore, the planning of actual road maintenance activities are carried out manually by engineers' individual judgments rather than using the GIS system. It is necessary to improve these systems in cooperation with DANIDA.

28.5 Project Cost Estimation

28.5.1 Initial Cost Estimation

(1) General

The urgent project cost estimate was made on the basis of the basic design, the quantity of each work item, and the construction planning for the urgent projects. The Capital Cost Estimate Method was used to estimate costs.

Unit cost of construction work for the urgent projects was calculated on the basis of Japanese Standard of Cost Estimation by quotation of unit price for labour, materials and machinery from local contractors.

(2) Contingency and Engineering Cost

Contingency cost was estimated for BOQ cost estimates.

- Contingency Cost: 15% of Total Construction Cost

(3) Result of the Urgent Projects Cost Estimate

The result of the Estimate was submitted to JICA by the end of June 2010.

28.5.2 Operation and Maintenance Costs

(1) Periodical Inspection and Maintenance

The periodical inspection, minor repairing/maintenance will be carried out under direct management of UNRA or each district office of the objective area. The normal costs for operation and maintenance per year were estimated as shown below. The total cost for operation and maintenance accounted for 5.6 % of the investment for maintenance in 2007/8 (177.66 Million Ushs.: Total URF (Uganda Road Fund) budget for road maintenance except for urban roads) such that implementation of significant maintenance works can be carried out. In addition minor maintenance works such as cutting grass or bush, clearing drainage ways, etc must be done by LBT.

An annual expected cost for operation and maintenance per site is shown in Table 28.5.1.

Personal expenses (1 engineer: 1 day)	: 2,600,000 Ushs.×1/30×12 months	=	1,040,000 Ushs.
Personal expenses (2 workers: 1 day)	: 4,500 Ushs.×16 hr ×12 months	=	864,000 Ushs.
Miscellaneous materials cost	: Lump-sum (labor cost×150%)	=	2,856,000 Ushs.
Vehicle hire charge	: 1,115,000 Ushs.×1/30 ×12 months	=	446,000 Ushs.
TOTAL			5,206,000 Ushs. (≒5,200,000 Ushs.)

Table 28.5.1 Approximate Costs for Operation and Maintenance per Site

Maintenance and Repair Works		Inspection Frequency per Year	Facility	Approximate Cost (Ushs.)
Bridges	Cleaning of sediment	4 times	Drainage pipe	170,000
	Repair of damaged members	4 times	Expansion joint	170,000
	Repairing damage from traffic accidents	4 times	Handrail	170,000
	Removal of earth deposits	Twice	Bearings	370,000
	Repair of cracks and stripping	Once	RC slab and Kerb	750,000
	Repair of damaged members	Once	Main structure, Slab system, Lateral bracing	750,000
	Repair of cracks and stripping	Once	Substructure	750,000
	Repair of scour	Once	Revetment	750,000
Roads	Patching and smoothing	12 times	Road surface	50,000
	Surface treatment, vegetation, additional embankment	12 times	Shoulder and Slope	50,000
	Removal of earth deposits	12 times	Side drainage	50,000
	Repainting	12 times	Marking	50,000
	Repainting and replacement	Twice	Guard rail	370,000
	Repair of cracks and stripping	Once	Retaining wall	750,000
The normal cost for operation and maintenance per year				5,200,000

Source: JICA Study Team

(2) Maintenance of Asphalt Pavement

In Northern Uganda, a mobile asphalt plant is generally required for each road improvement project since there isn't any permanent asphalt plant in the area. Therefore, a low-cost pavement called DBST is applicable because the pavement does not require an asphalt plant. The cost of yearly maintenance work for each site is shown in Table 28.5.2, with the assumption that the total maintenance costs every ten years are about the same as the pavement over-lay works by a local contractor every ten years. Of course, routine and periodic maintenance of roads are the most important factors in preserving road condition.

Table 28.5.2 Maintenance Costs for Asphalt Pavement

Bridge/Road Name	Road Overlay Area (m^2)	Maintenance Costs per Year (×1,000Ushs.)
Otaka (L=0.2km)	1,200	20,400
Anaka (L=11.0km)	88,000	1,496,000
Total		1,516,400

Source: JICA Study Team

(3) Costs for Operation and Maintenance for each District

Approximate costs for operation and maintenance for each district per year are shown in Table 28.5.3.

Table 28.5.3 Costs for Operation and Maintenance for each District

District	Approximate Yearly Cost for Operation and Maintenance(Ushs.)
Gulu	26,000,000
Kitgum and Lamwo	5,200,000
Pader and Agago	25,600,000
Amuru and Nwoya	1,506,400,000
Total	1,563,200,000

Source: JICA Study Team

SECTION 9: PROJECT EVALUATION AND RECOMMENDATIONS

29. PROJECT EVALUATION AND RECOMMENDATIONS

29.1 Environmental and Social Consideration of the Projects

Environmental and Social Consideration of the Urgent Projects are stated in Appendix 4 "Project Brief for Urgent Projects".

29.2 Project Evaluation

29.2.1 Traffic Demand Forecast and Economic Analysis

(1) Traffic Demand Forecast

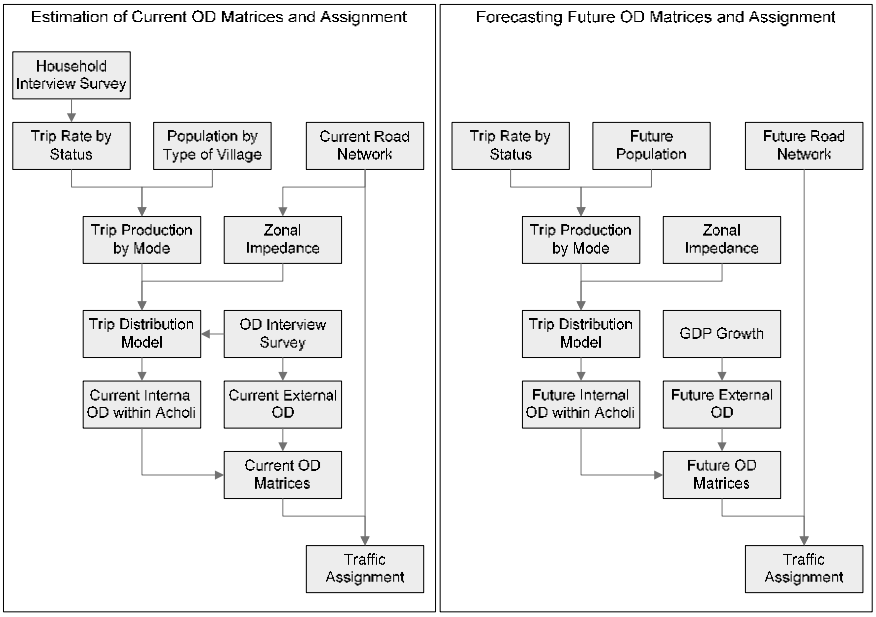
1) Objective and Methodology

The objective of the traffic demand forecast was the projection of the future traffic volume for evaluation of urgent projects in Acholi Sub-region and priority projects proposed in the master plan study in Amuru and Nwoya Districts. The target year for the demand forecast was set as 2018.

The future traffic demand was forecast based on the current traffic demand estimated by the results of a roadside traffic count and driver interview survey and population projection by UBOS and UNHCR. The methodology applied for the estimation of the current traffic demand and projection of the future demand is illustrated in the following diagram.

Current zonal trip production was calculated from the trip ratio based on the results of a household interview survey and population. Trip distribution within Acholi Sub-region was estimated by using a trip distribution model based on the results of the roadside OD interview survey, zonal impedance and estimated trip production. Current OD matrices within Acholi Sub-region and current external OD were estimated based on the results of the roadside interview survey at the cordon points, namely, the boundary of Acholi Sub-region. The traffic volume of each road section was calculated by the traffic assignment model using JICA STRADA.

Future OD matrices within Acholi Sub-region were forecast by using trip rate, future population and trip distribution models. Future external trips were expanded by the elasticity of the traffic volume and GDP growth rate.



Source: JICA Study Team

Figure 29.2.1 Work Flow for Traffic Demand Forecast

2) Zone System and Road Network

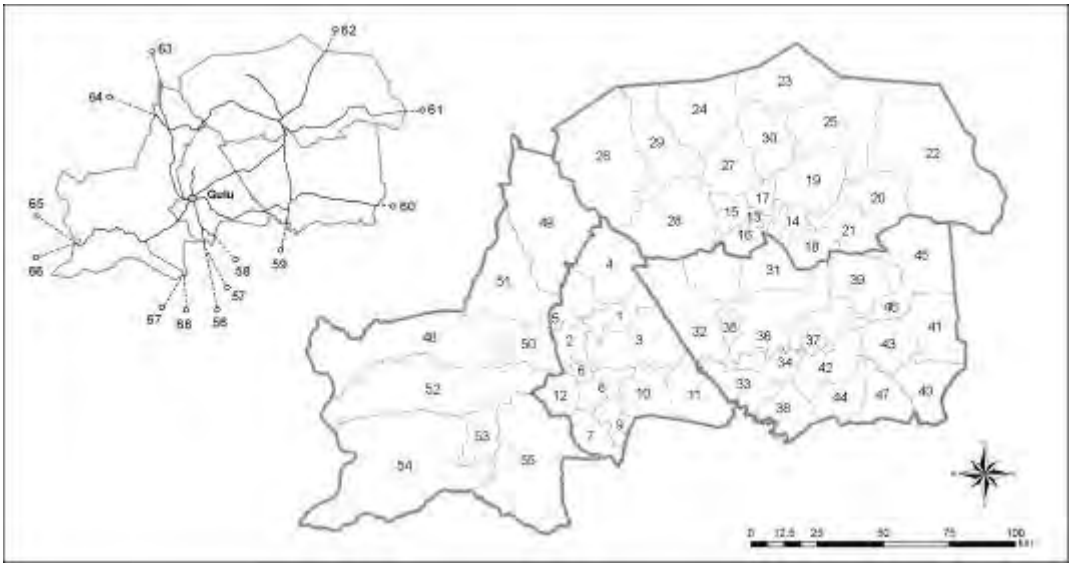
a) Zone System

Traffic zones, geographical units of the traffic demand analysis, were developed based on the administrative territories of the sub-county in Acholi Sub-region (before segmentation of districts in 2010) and were defined as shown in Table 29.2.1 and Figure 29.2.2. There are 55 zones in Acholi Sub-region and 13 external zones at all major roads crossing Acholi boundary.

Table 29.2.1 Zone System and Definition

No.	Zone Name	District	No.	Zone Name	District
1	AWACH	GULU	35	LAGUTI	PADER
2	BUNGATIRA		36	LAPUL, PAJULE	
3	PAICHO		37	PADER TC	
4	PALARO		38	PURANGA	
5	PATIKO		39	WOL	
6	GULU MUNICIPALITY		40	ADILANG	
7	BOBI		41	LAPONO	
8	KORO		42	LIRA PALWO	
9	LAKWANA		43	LUKOLE	
10	LALOGI		44	OMOT	
11	ODEK		45	PAIMOL	
12	ONGAKO		46	PARABONGO	
13	KITGUM TC	KITGUM	47	PATONGO	
14	KITIGUM MATIDI		48	AMURU	AMURU
15	LABONGO AKWANG		49	ATIAK	
16	LABONGO AMIDA		50	LAMOGI	
17	LABONGO LAYAMO		51	PABBO	
18	LAGORO		52	ALERO	
19	MUCWINI		53	ANAKA	
20	NAMOKORA		54	PURONGO	
21	OMIYA ANYIMA		55	KOCH GOMA	
22	OROM		56	UGANDA SOUTH	EXTERNAL
23	AGORO		57	OTHER COUNTRIES (KENYA, TANZANIA)	
24	LOKUNG		58	UGANDA SOUTH (OYAM)	
25	MADI OPEI		59	UGANDA SOUTH (LIRA)	
26	PALABEK OGILI		60	UGANDA NORTH-EAST	
27	PADIBE EAST, PADIBE WEST		61	UGANDA NORTH-EAST	
28	PALABEK GEM		62	SUDAN EAST	
29	PALABEK KAL		63	SUDAN WEST (JUBA)	
30	PALOGA		64	UGANDA NORTH-WEST	
31	ACHOLIBUR	PADER	65	ARUA ROAD : UGANDA NORTH-WEST	
32	ATANGA		66	ARUA ROAD : OTHER COUNTRIES	
33	AWER		67	ARUA ROAD : UGANDA SOUTH	
34	KILAK		68	ARUA ROAD : OTHER COUNTRIES	

Source: JICA Study Team



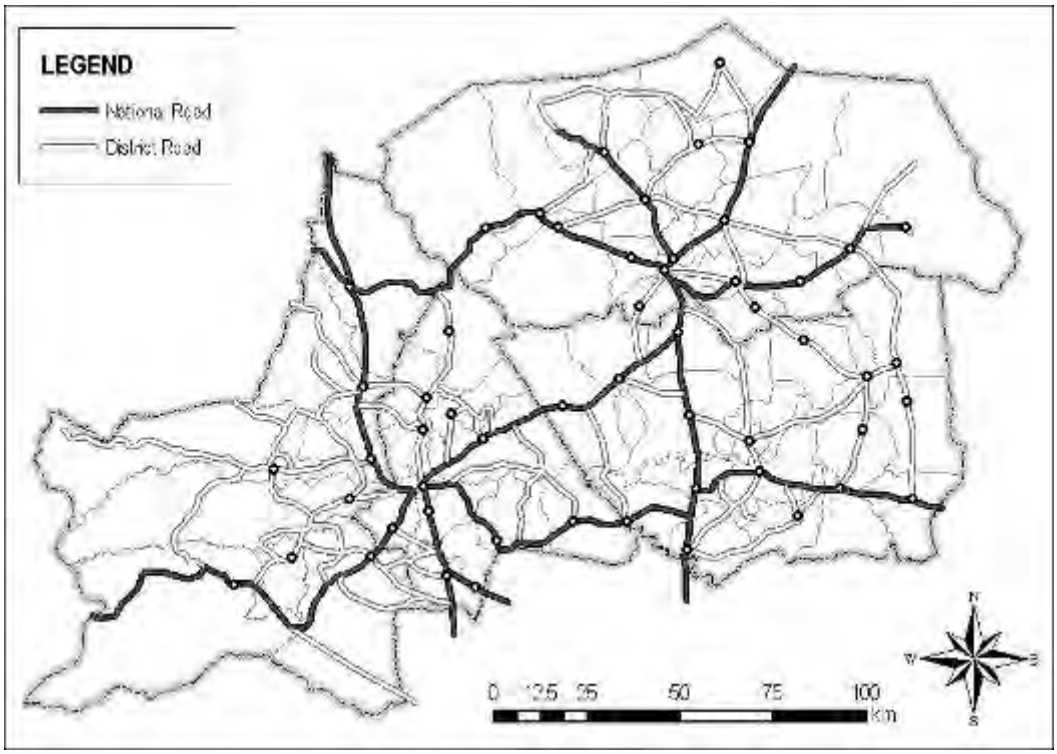
Source: JICA Study Team

Figure 29.2.2 Traffic Zone System (before segmentation of districts in 2010)

3) Road Network

a) Existing Road Network

A road network for the traffic demand forecast including current and future national roads and district roads is as shown in Figure 29.2.3. The total network length examined for the traffic demand forecast is about 2,500 km.



Source: JICA Study Team

Figure 29.2.3 Road Network for Traffic Demand Forecast

b) Existing Road Network Condition

For the traffic assignment, the road network condition was defined as follows. Free flow speed was determined from the road surface condition based on the road inventory survey using GPS equipment at major road sections.

Table 29.2.2 Definition of Free Flow Speed in Road Network

Road Pavement	Surface Condition	Free Flow Speed (km/h)
Paved	Good	80
Earth	Fair	60
	Poor	40
	Bad	20

Source: JICA Study Team

Link capacity was defined as shown in Table 29.2.3 considering the following conditions:

- Basic capacities applied to this analysis were 1,200 pcu/hour for one-lane (carriageway width less than 3.5m) links and 2,500 pcu/hour for two-way (carriageway width 3.5m and more) links.

- Adjustment factors by road surface type were defined as 1.00 (paved), 0.75 (unpaved-fair), 0.5 (unpaved-poor) and 0.25 (unpaved-bad).
- The peak ratio to 24 hours is 8.4% (average of traffic count survey at major 15 survey locations).
- The average heavy vehicle ratio including large bus, medium truck and trailer is about 29% by the traffic count survey at major 15 survey locations. The adjustment factor for road capacity by heavy vehicles is 0.78 calculated by the following formula.

$$\gamma_T = 100 \times \frac{100}{(100 - T) + E_t} \times T$$

where,

γ_T : Adjustment factor for heavy vehicles.

T : Ratio of heavy vehicles (%).

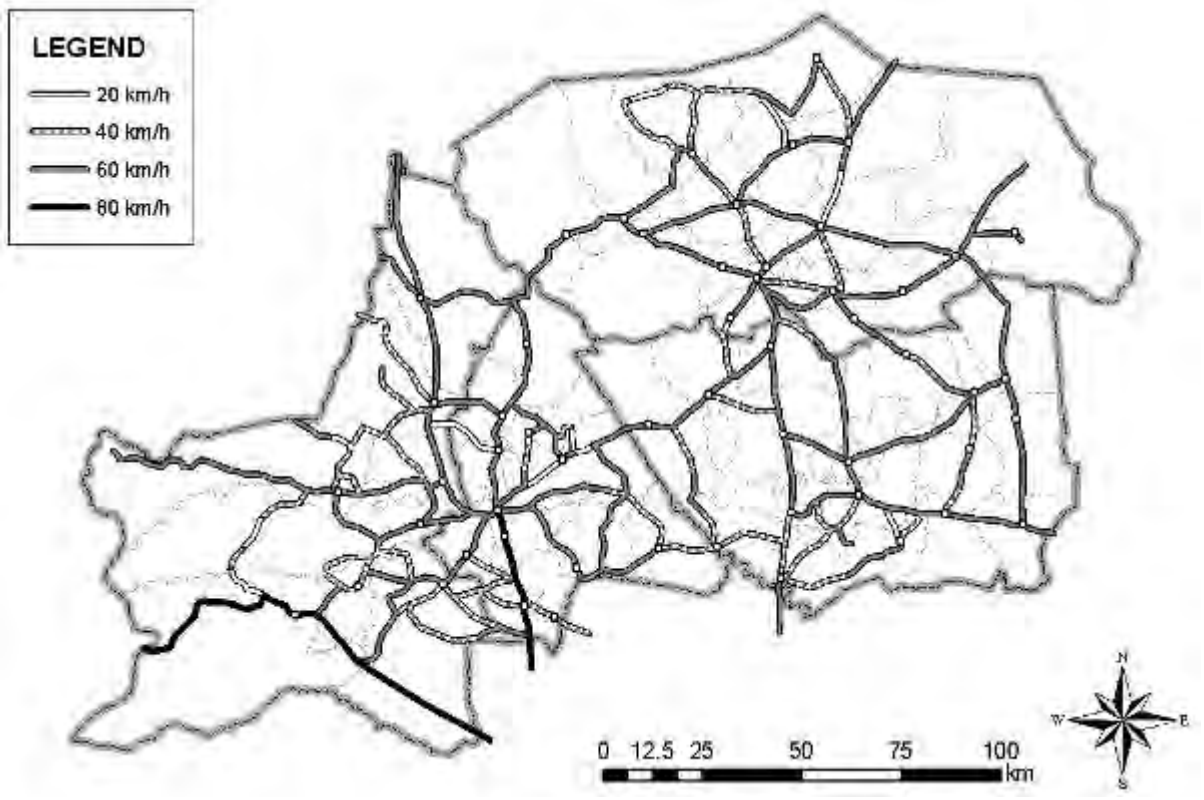
E_t: Passenger Car Unit (PCU) of heavy vehicles.

Table 29.2.3 Definition of Capacity (pcu/day)

Road Pavement	Surface Condition	Carriageway Width	
		Less than 3.5 m (1 lane road)	3.5 m and more (2 lane road)
Paved	Good	-	23,200
Earth	Fair	8,400	17,400
	Poor	5,600	11,600
	Bad	2,800	5,800

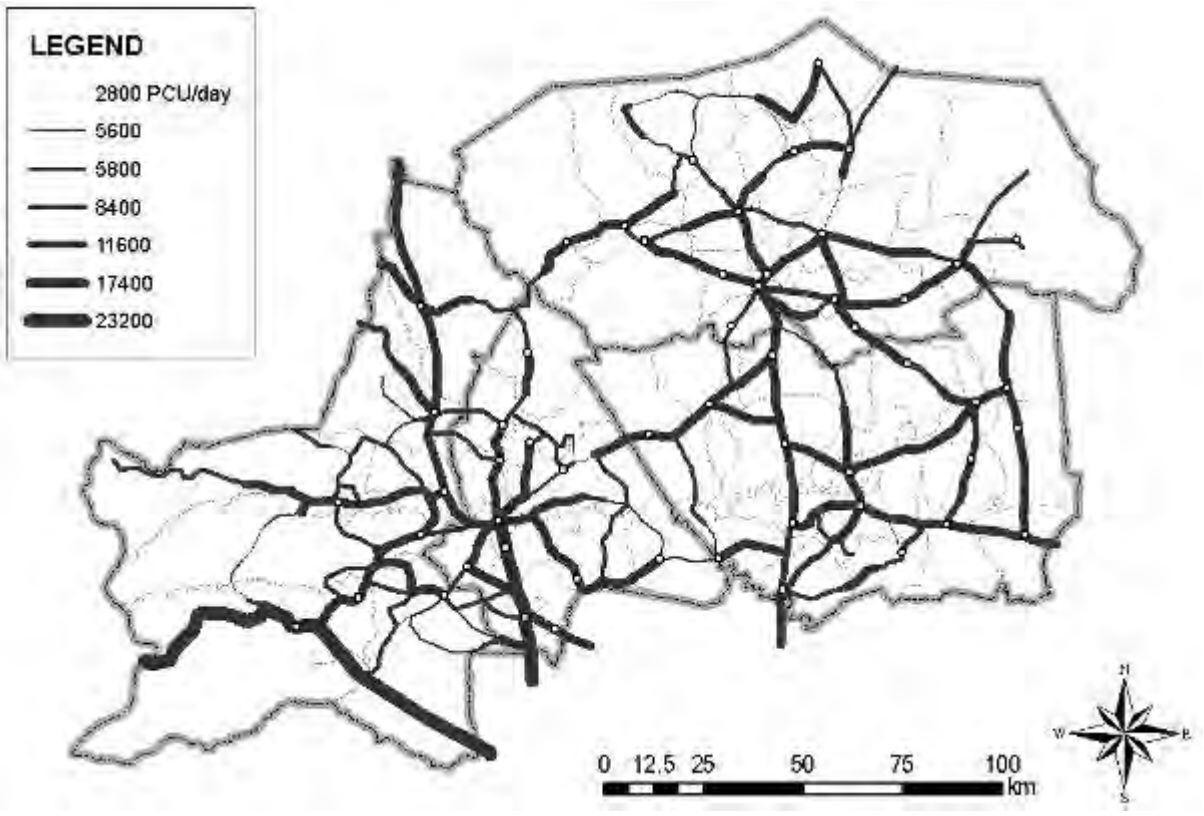
Source: JICA Study Team

Figures 29.2.4 and 29.2.5 show defined free flow speed and road capacity of the road network tested for the traffic demand forecast.



Source: JICA Study Team

Figure 29.2.4 Defined Current Free Flow Speed



Source: JICA Study Team

Figure 29.2.5 Defined Road Capacity

4) Current Traffic Demand Estimation

a) Trip Production Rate

Based on the results of the household interview survey, gross daily personal trip production rates by mode/employment status were estimated as shown in Table 29.2.4. This indicates more trips (2.84 trips/person) are made by the workers and fewer trips (2.47 trips/person) by the unemployed.

Table 29.2.4 Estimated Gross Personal Trip Production Rate (trip/person/day)

Status	On Foot	Bicycle	Motorcycle	Passenger Car	Small Bus (Matatu)	Large Bus	Truck	Total
Unemployed	2.01	0.27	0.12	0.02	0.03	0.00	0.02	2.47
Student	1.85	0.22	0.11	0.01	0.04	0.02	0.00	2.25
Worker	1.89	0.54	0.28	0.04	0.04	0.01	0.04	2.84

Note: Gross trip rate is average number of trips per population including non-trip makers.
Source: JICA Study Team

b) Trip Production by Mode

The current zonal population by type of village was estimated by the population projected by UBOS and the share of population by village type was estimated by UNHCR as of Aug. 2009. The component ratio of status by type of village was computed based on the household interview survey. Current zonal population by status was calculated as shown in Table 29.2.5.

Table 29.2.5 Estimated Population in 2009

	Population in 2009 ('000)				Population by Status in 2009 ('000)			
	Total	Home Village	Transit Site	Camp	Below 5 years Old	Un-employed	Student	Worker
Gulu	357.3	305.2	30.1	22.0	116.5	88.0	110.2	42.7
Kitgum and Lamwo	364.8	235.4	68.6	60.8	130.3	94.3	99.9	40.3
Pader and Agago	449.9	319.8	87.9	42.2	159.3	113.9	123.3	53.5
Amuru and Nwoya	210.6	120.9	30.0	59.7	76.7	55.7	57.5	20.8
Total	1,382.6	981.3	216.6	184.7	482.7	351.9	390.8	157.2

Source: JICA Study Team

Table 29.2.6 shows a summary of estimated daily trip production by population and gross trip rate. The non-motorized modes of traffic, namely; by foot and bicycles accounts for about 90% of current personal trip production and the share of motorized trips was estimated at only 10%.

Table 29.2.6 Estimated Personal Trip Production in 2009

	Personal Trip Production ('000 trip/day)								Total of Motorized Trips
	Total	By foot	Bicycle	Motor-cycle	Car	Small Bus	Large Bus	Truck	
Gulu	586.5	461.4	71.1	34.6	4.6	8.7	2.6	3.5	54.0
Kitgum and Lamwo	572.1	450.5	69.2	33.6	4.5	8.4	2.4	3.5	52.4
Pader and Agago	710.7	558.1	86.8	42.2	5.7	10.5	3.0	4.4	65.8
Amuru and Nwoya	325.9	257.6	38.9	18.8	2.5	4.8	1.4	2.0	29.5
Total	2,195.2	1,727.5	265.9	129.3	17.3	32.5	9.4	13.4	201.8

Source: JICA Study Team

c) Internal Trip Ratio

Based on the household interview survey, the trip ratio within a traffic zone was estimated as shown in Table 29.2.7. A total of 73% of motorcycle trips and 58% of passenger car trips start and end within the same traffic zone. Trucks are used for long distance trips and the internal trip ratio was estimated at only 5%. Like trucks, the internal trip ratio of large buses, including large school buses, is small and was estimated at only 19%.

Table 29.2.7 Internal Trip Ratio by Mode

Mode	By foot	Bicycle	Motorcycle	Passenger Car	Small Bus Matatu	Large Bus	Truck
Internal Trip Ratio	95.2%	84.4%	73.0%	58.0%	88.7%	19.0%	5.3%

Source: JICA Study Team

d) Trip Distribution Model

A trip distribution model to estimate trips within Acholi sub-region was developed based on the following gravity model by transport mode. Parameters of this model were estimated by regression analysis using the existing OD volume based on the results of the cordon point survey, estimated trip production and distance between origin and destination.

$$T_{ij} = K \times P_i^{\alpha} \times A_j^{\beta} \times D_{ij}^{\gamma}$$

where,

T_{ij}: Person or vehicle trip from zone i to zone j.

P_i: Personal trip production in zone i.

A_j: Person trip attraction (equal to trip production) in zone j.

D_{ij}: Travel distance between zone i-j (km)

K, α, β, γ: Parameters shown in Table 29.2.8.

Table 29.2.8 Trip Distribution Model

Mode	Variable	Coefficient	t - value	R^2
Passenger Car (Person Trip / day)	K	0.650	-0.33	0.67
	α	0.412	4.14	
	β	0.344	3.29	
	γ	-0.307	-3.45	
Small Bus (Matatu) (Person Trip / day)	K	0.013	-0.67	0.73
	α	1.258	2.36	
	β	0.831	1.76	
	γ	-1.749	-1.45	
Light Truck (Vehicle Trip / day)	K	$5.98*10^{-6}$	-4.74	0.67
	α	0.931	4.02	
	β	1.477	5.56	
	γ	-0.535	-2.28	
Heavy Truck (Vehicle Trip / day)	K	$1.205*10^{-5}$	-8.27	0.95
	α	1.126	9.77	
	β	1.099	9.28	
	γ	-0.459	-6.48	
Motorcycle (Person Trip / day)	K	0.001	-4.54	0.72
	α	0.930	6.89	
	β	0.656	5.64	
	γ	-0.667	-3.75	

Note: Large buses with more than 50 seats are operated in only Gulu Mun. – Kitgum TC, therefore it is forecast by current patterns.

Source: JICA Study Team

e) Vehicle Occupancy Rate and PCU

Average vehicle occupancy including a driver shown in Table 29.2.9 was computed using the results of the cordon point survey. Estimated person trip OD was converted into vehicle OD by vehicle occupancy rate and the number of vehicles was converted into PCU in the traffic assignment calculation.

Table 29.2.9 Average Vehicle Occupancy and PCU

Vehicle Type	Occupancy (person / veh.)	PCU
Passenger Car (Sedan, Pick-up, Van, 4WD)	3.79	1.0
Small Bus (less than 50 seats)	12.07	1.2
Large Bus (50 seats and more)	48.58	2.0
Light Truck (2 axle truck)	4.97	1.7
Heavy Truck (3 and more axles, trailer)	3.33	2.5
Motorcycle	1.58	0.3

Source: JICA Study Team

f) Traffic Demand

Current internal trips within Acholi sub-region estimated by the trip production model and trip distribution model were calibrated by the actual traffic count volume at cordon points on each district boundary. Current OD matrices were prepared totalling calibrated OD within Acholi Sub-region and external OD.

Figure 29.2.6 shows desire lines of all motorized vehicles in 2009. The largest traffic volume was observed between Kampala and Gulu. Through traffic between Kampala and Northwest areas such as Arua, Nebbi or Juba and Sudan was observed to be of significant proportion.

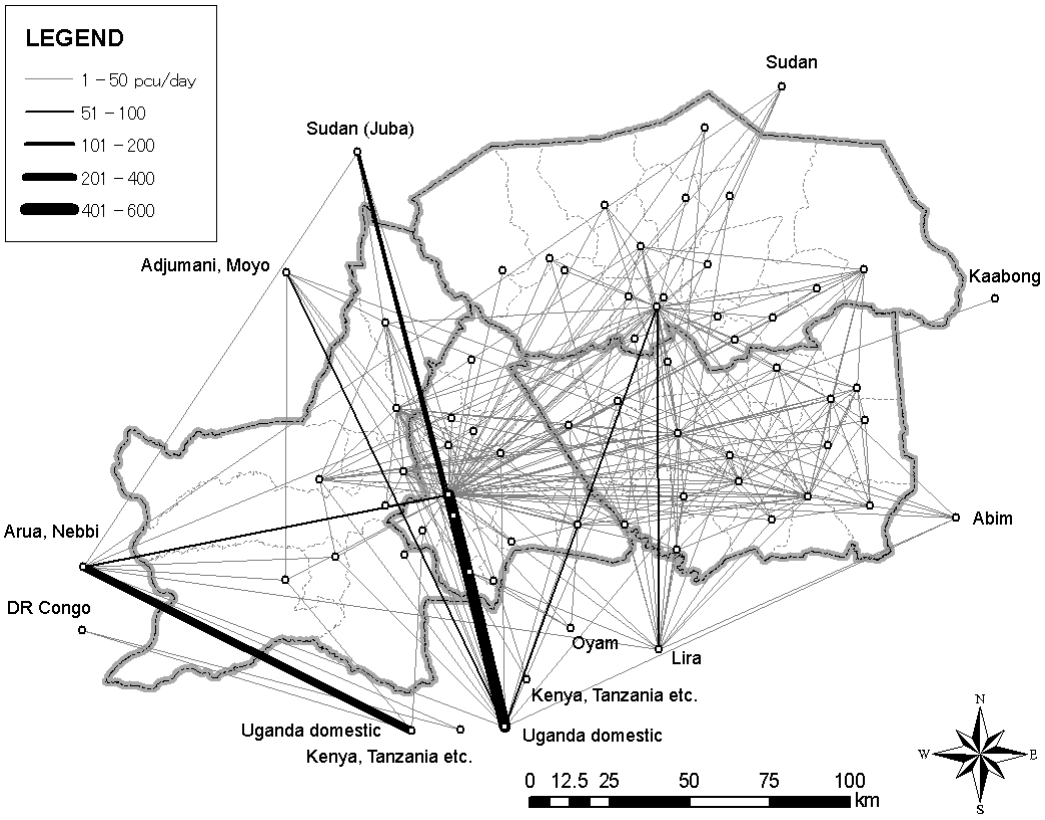


Figure 29.2.6 Desire Lines in 2009 (Total of all vehicles)

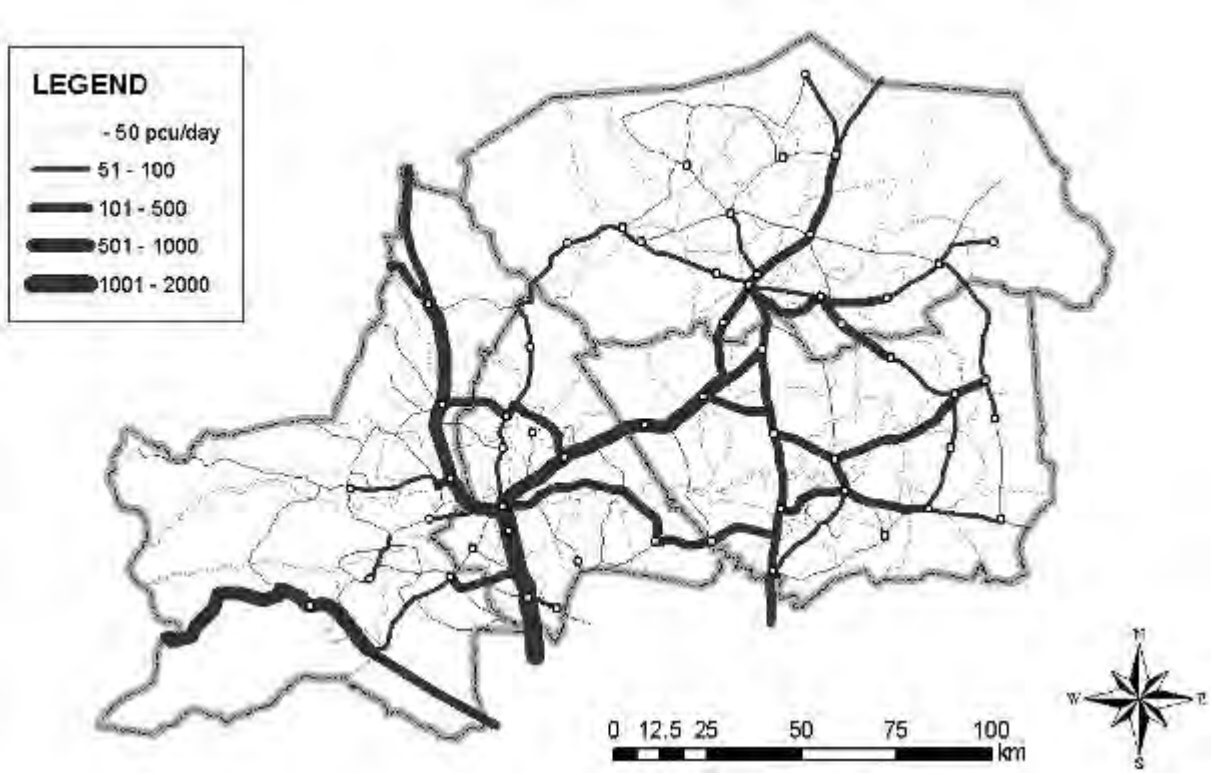
g) Traffic Volume by Assignment

Table 29.2.10 and Figure 29.2.7 show the results of traffic assignment, using JICA STRADA. More traffic was observed along three corridors, namely; Kampala – Gulu – Juba, Arua Road and Gulu – Kitgum Road.

Table 29.2.10 Results of Traffic Assignment

	Veh*km	Veh*hour
Passenger Car	127,214	2,265.3
Small Bus	5,286	82.3
Large Bus	6,737	111.4
Light Truck	16,075	278.0
Heavy Truck	62,360	1,044.9
Motorcycle	209,283	4,153.0

Source: JICA Study Team



Source: JICA Study Team

Figure 29.2.7 Assigned Traffic Volumes in 2009 (Total of all vehicles)

5) Future Road Network

The future road network for the traffic demand forecast and evaluation was prepared based on proposed urgent projects, including road and bridge rehabilitation along district roads and national roads. As shown in Figure 29.2.8, eight urgent projects were proposed and projected onto the road network.

Urgent Project	Section	Existing Road Condition	Improvement Plan
1-1	Lira - Pader - Kitgum	Unpaved / 2lane / Fair-Poor	Paved (DBST) / 2 lane / Good
1-2	Gulu - Pader - Kitgum	Unpaved / 2lane / Fair-Bad	Paved (DBST) / 2 lane / Good
2-1		Unpaved / 2lane / Fair-Poor	Unpaved / 2lane / Fair
2-2		Unpaved / 2lane / Poor	Unpaved / 2lane / Fair
2-5		Unpaved / 2lane / Bad	Unpaved / 2lane / Fair
2-6		Unpaved / 2lane / Poor	Unpaved / 2lane / Fair
2-7		Unpaved / 2lane / Fair-Poor-Bad	Unpaved / 2lane / Fair
2-8		Unpaved / 2lane / Bad	Unpaved / 2lane / Fair

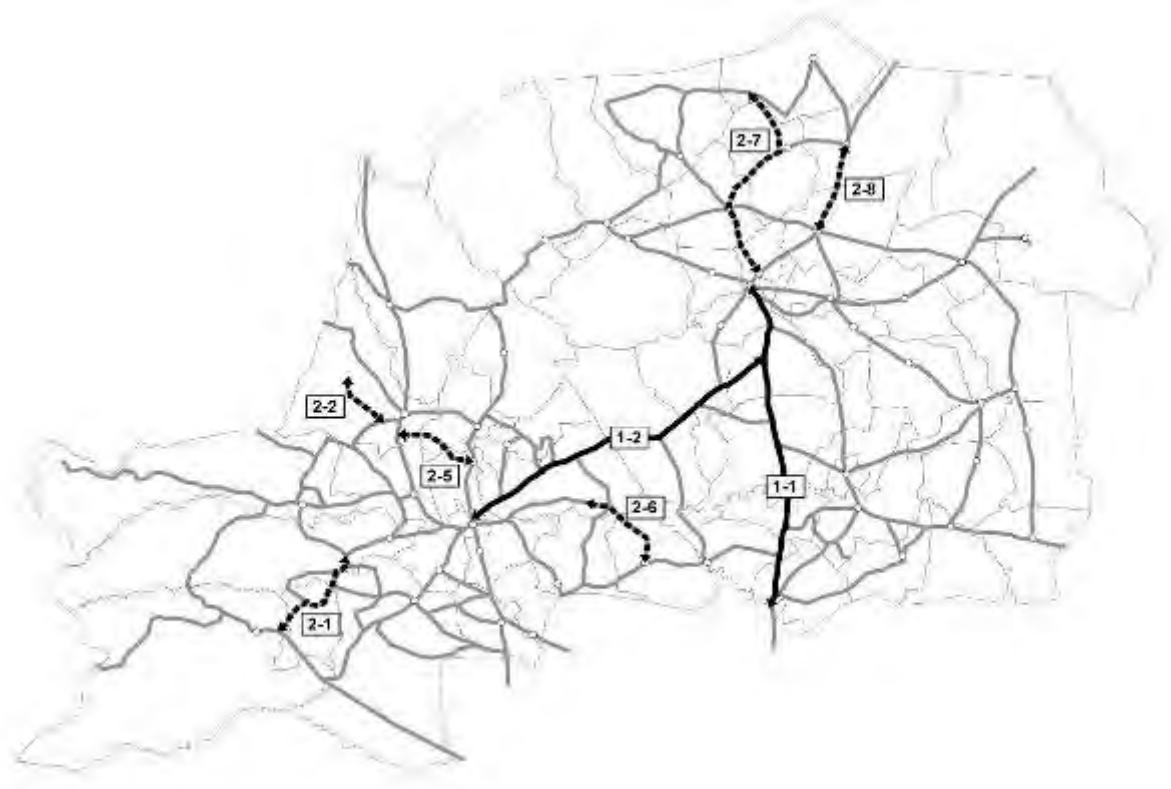


Figure 29.2.8 Demand Forecast for Urgent Projects

6) Future Traffic Demand Forecasting

a) Future Trip Production by Mode

Based on the population forecast by UBOS (till 2017) and the growth rate in 2016-17, population in 2018 was estimated as shown in Table 29.2.11. By 2018, it's forecast that all IDPs would have returned to their original home villages. Population by status in 2018 was estimated using current composition of village type as established by the household interview survey.

Table 29.2.11 Forecast Population in 2018

	Population in 2018 ('000)				Population by Status in 2018 (‘000)			
	Total	Home Village	Transit Site	Camp	Less than 5 years Old	Un-employed	Student	Worker
Gulu	462.7	462.7	-	-	166.6	103.0	135.5	57.7
Kitgum	523.1	523.1	-	-	188.3	119.5	141.6	73.7
Pader	704.0	704.0	-	-	253.5	160.9	190.6	99.1
Amuru	270.9	270.9	-	-	97.5	61.9	73.4	38.2
TOTAL	1,960.7	1,960.7	-	-	705.9	445.3	541.1	268.6

Source: JICA Study Team

Table 29.2.12 shows the forecast future trip production based on the gross trip rate of home villages in 2009 and future population by status. In 2018, the growth rates of bicycles and motorized trips such as motorcycles and passenger cars are expected to exceed walking trips.

Table 29.2.12 Forecast Personal Trip Production in 2018

	Personal Trip Production ('000 trip/day)								Total of Motorized Trips
	Total	By foot	Bicycle	Motor-cycle	Car	Small Bus	Large Bus	Truck	
Gulu	723.0	566.6	88.7	43.4	5.7	10.9	3.3	4.4	67.7
Kitgum	823.1	641.4	103.2	50.6	6.8	12.2	3.6	5.3	78.4
Pader	1,107.7	863.3	138.9	68.0	9.1	16.4	4.8	7.2	105.5
Amuru	426.3	332.2	53.5	26.2	3.5	6.3	1.8	2.8	40.6
Total	3,080.1	2,403.6	384.3	188.2	25.1	45.8	13.5	19.7	292.2

Source: JICA Study Team

Table 29.2.13 Personal Trip Production Growth in 2018/2009

	Person Trip Production 2018 / 2009								Motorized
	Total	By foot	Bicycle	Motor-cycle	Car	Small Bus	Large Bus	Truck	
Gulu	1.233	1.228	1.249	1.254	1.253	1.241	1.252	1.259	1.252
Kitgum	1.439	1.424	1.492	1.506	1.507	1.443	1.498	1.519	1.496
Pader	1.559	1.547	1.601	1.611	1.608	1.565	1.595	1.621	1.603
Amuru	1.308	1.290	1.375	1.391	1.381	1.316	1.363	1.421	1.378
Total	1.403	1.391	1.445	1.456	1.454	1.409	1.441	1.471	1.448

Source: JICA Study Team

b) Future External Trips

Future external trips were estimated by expanding the current traffic demand by the elasticity of the GDP growth and rate of increase of vehicle registration. Table 29.2.14 shows the number of registered vehicles and average annual growth rates from 1998 to 2005. On the other hand, real GDP growth in Uganda was 6.0% in 1998 to 2005 as shown in Table 29.2.15.

Based on the elasticity of the growth rate of registered vehicles and GDP growth as shown in Tables 29.2.16, and projected GDP growth rate in the future as shown in Table 29.2.17, expansion factors to 2018 were calculated as shown in Table 29.2.18.

Table 29.2.14 Registered Number of Vehicles by Type

Type	1998	2000	2003	2005	Annual Growth Rates 1998 - 2005(%)
Motorcycle	61,044	64,305	80,088	103,525	7.8%
Car	46,930	49,016	56,837	69,807	5.8%
Utility	37,199	42,443	48,528	60,130	7.1%
Bus	686	800	846	1,021	5.8%
Minibus	15,143	15,523	19,726	23,833	6.7%
Truck	11,451	13,240	16,122	15,858	4.8%
Others	3,711	3,778	4,044	-	-
Total	176,164	189,105	226,191	274,174	6.5%

Source: Uganda Revenue Authority (URA)

Table 29.2.15 Gross Domestic Products of Uganda

	1998	2000	2003	2005	Annual Growth Rates 1998 - 2005(%)
GDP (billion Ush)	7,835.60	8,932.29	10,445.54	11,779.22	6.0%

Note: GDP is year 2000 based constant price.
Source: International Monetary Fund, World Economic Outlook Database, October 2007.

Table 29.2.16 Elasticity of Vehicle Registration and GDP Growth by Mode

	Motorcycle	Car	Utility	Bus	Minibus	Truck
Vehicle Registration Growth Rate 1998 – 2005 (%)	7.8%	5.8%	7.1%	5.8%	6.7%	4.8%
GDP Growth Rate 1998 – 2005 (%)	6.0 %					
Elasticity	1.31	0.97	1.18	0.97	1.12	0.79

Source: JICA Study Team

Table 29.2.17 Projected Future Annual GDP Growth Rates

	2009	2010	2011	2012 - 2018
Annual Real GDP Growth (%)	6.5	6.8	7.1	6.0

Source: International Monetary Fund, Country Report, January 2007

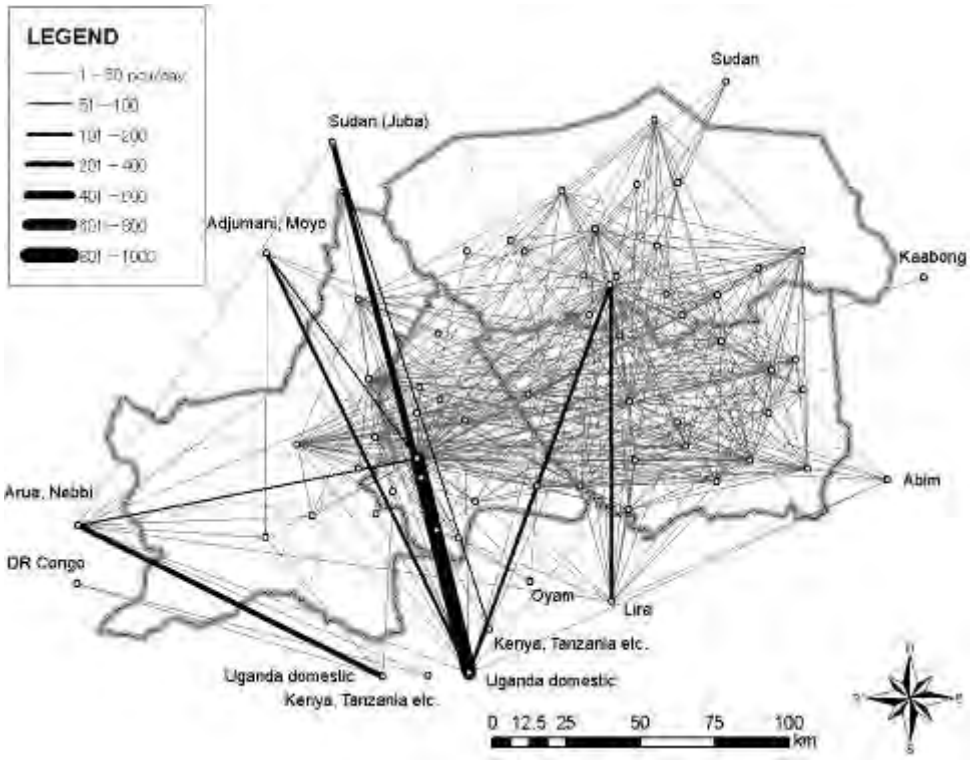
Table 29.2.18 Expansion Factors 2009 - 2018

	Motorcycle	Car & Utility	Bus	Minibus	Truck
Expansion Factors (2009/2018)	2.02	1.78	1.70	1.83	1.54

Source: JICA Study Team

c) Future Traffic Demand

A model-based forecast future demand within Acholi sub-region and external trip demand were combined into the future traffic demand in 2018. Figure 29.2.9 shows the forecast desire lines in 2018.



Source: JICA Study Team

Figure 29.2.9 Desire Lines in 2018 (Total of all vehicles)

7) Future Traffic Assignment Results

a) Assignment Cases

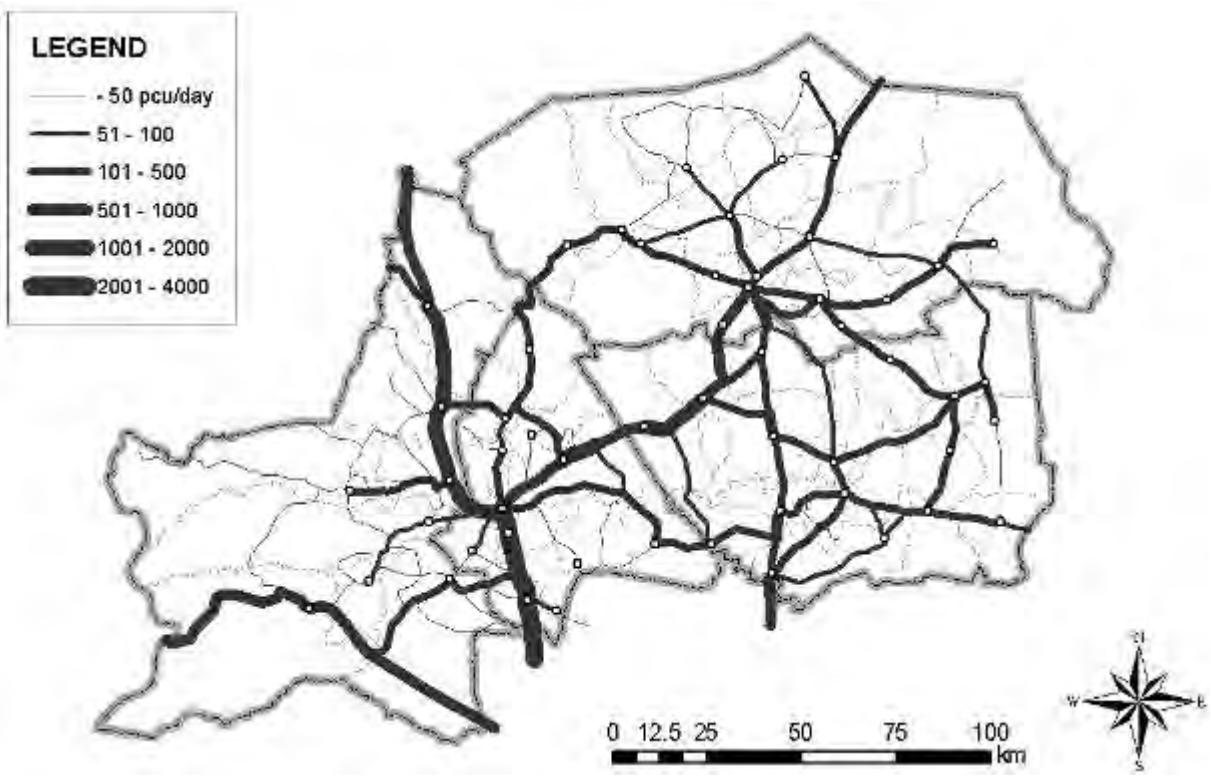
One of the purposes of the traffic demand forecast is evaluation of urgent projects, especially those along the national roads. Table 29.2.19 shows defined assignment cases to evaluate two national road improvement projects, namely; Lira-Kitgum Road and Gulu-Kitgum Road.

Figures 29.2.10 to 29.2.13 show the results of traffic assignment on the road network while Table 29.2.20 shows the summarized results of the network evaluation.

Table 29.2.19 Traffic Assignment Cases

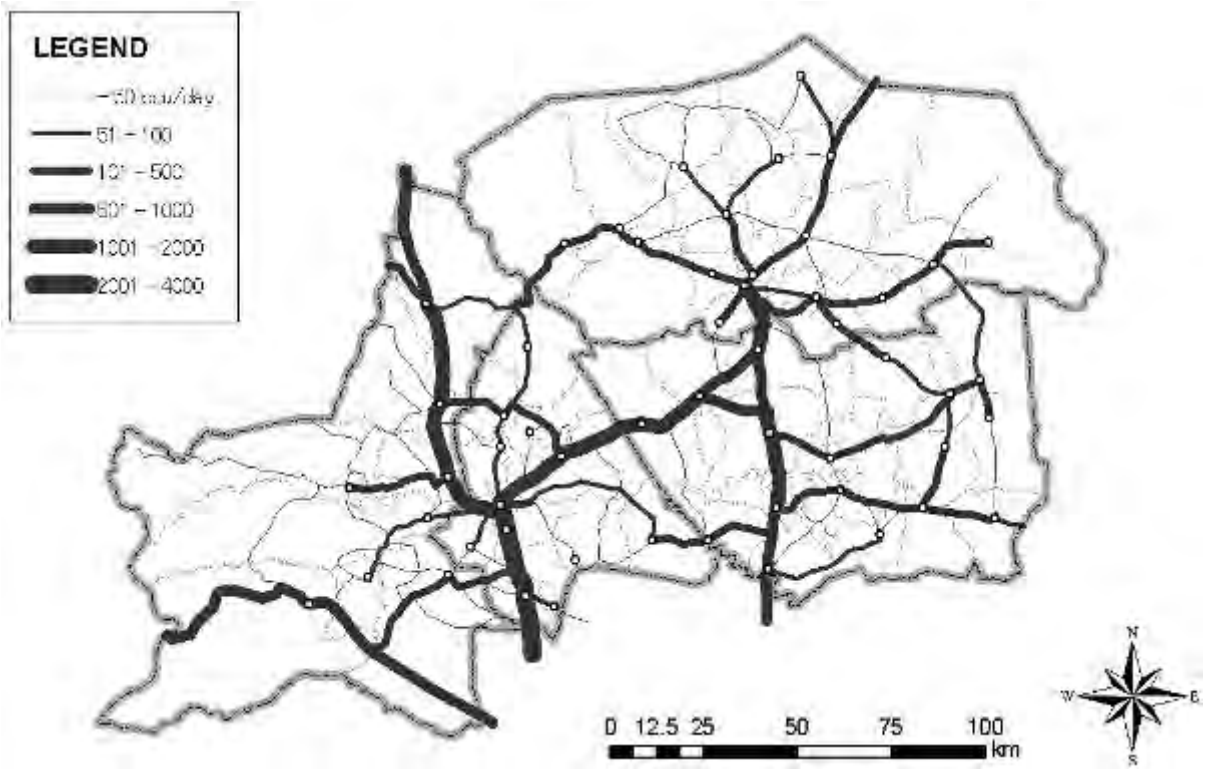
Case	Description	Road Network	Traffic Demand
Existing		2009 Network	2009 Existing
Without Project	Without urgent projects.	2009 Network	2018 Future
With Lira-Kitgum Rd.	For economic analysis for Lira – Pader – Kitgum improvement project.	2009 Network + Lira – Pader - Kitgum	
With Gulu – Kitgum Rd.	For economic analysis for Gulu – Pader - Kitgum improvement project.	2009 Network + Gulu – Pader - Kitgum	
All Urgent Project	Fully improved by urgent projects in Acholi region.	2018 Network	

b) Traffic Assignment Results



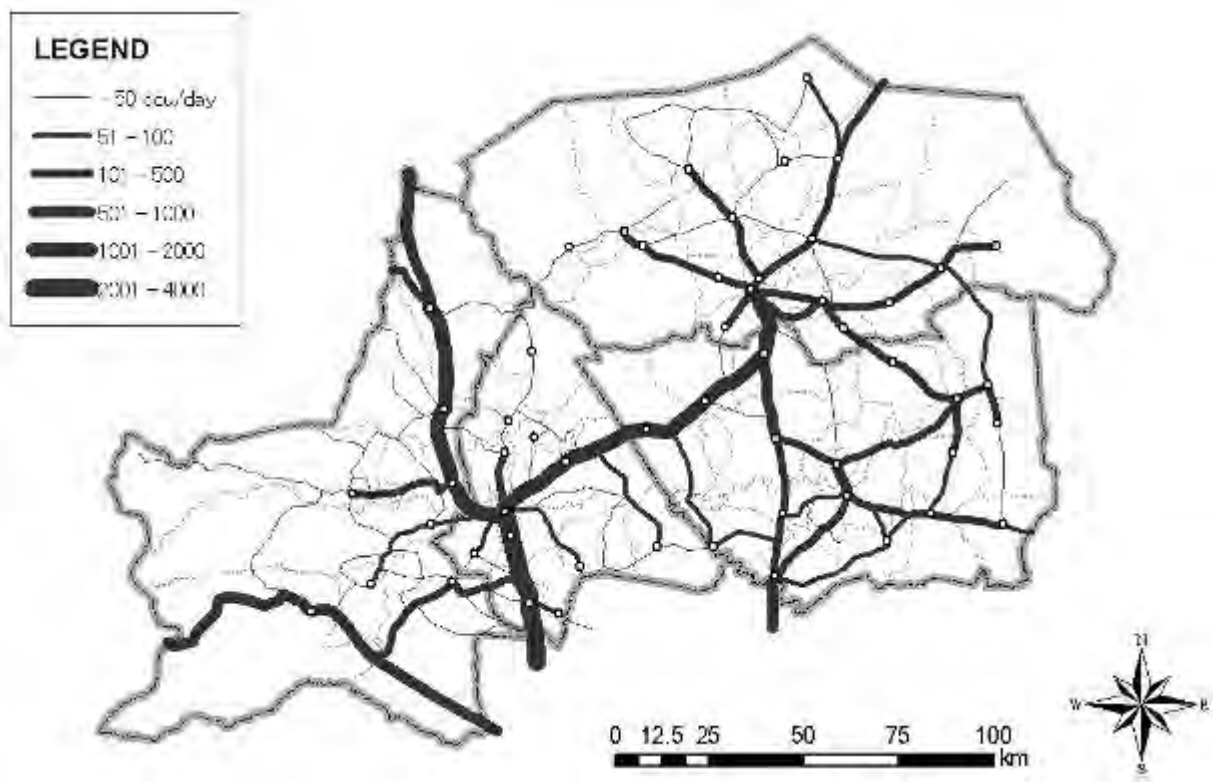
Source: JICA Study Team

Figure 29.2.10 Assigned Traffic Volumes in 2018 Without Projects (Total of all vehicles)



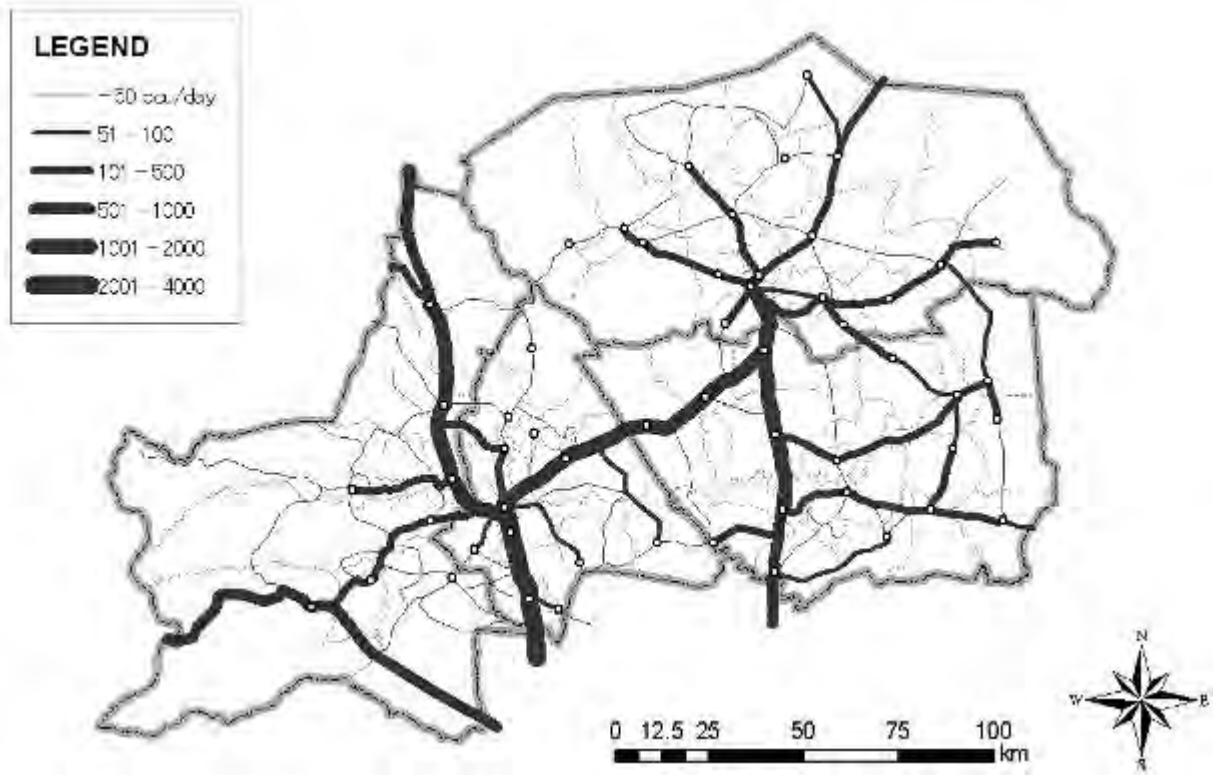
Source: JICA Study Team

Figure 29.2.11 Assigned Traffic Volumes in 2018 with Lira - Kitgum (Total of all vehicles)



Source: JICA Study Team

Figure 29.2.12 Assigned Traffic Volumes in 2018 with Gulu - Kitgum (Total of all vehicles)



Source: JICA Study Team

Figure 29.2.13 Assigned Traffic Volumes in 2018 with All Urgent Projects (Total of all vehicles)

Table 29.2.20 Assignment Results

	2009		2018 without projects		2018 with Lira – Kitgum only		2018 with Gulu – Kitgum only		2018 with All Urgent Projects	
	Veh*km	Veh*hour	Veh*km	Veh*hour	Veh*km	Veh*hour	Veh*km	Veh*hour	Veh*km	Veh*hour
Car/ Sedan	127,214	2,265.3	215,803	3,820.5	222,618	3,769.7	226,226	3,464.1	228,930	3,255.1
Small Bus	5,286	82.3	9,478	147.0	9,537	145.3	9,573	142.8	9,654	138.3
Large Bus	6,737	111.4	11,182	183.4	11,319	179.8	11,276	159.9	11,348	158.7
Light Truck	16,075	278.0	26,423	461.7	27,198	438.7	27,185	440.5	27,784	409.9
Heavy Truck	62,360	1,044.9	97,903	1,648.6	99,872	1,614.7	100,695	1,517.5	101,623	1,448.1
Motorcycle	209,283	4,153.0	338,579	6,695.7	356,333	6,668.3	368,040	6,010.0	382,806	5,749.3
Total (PCU)	393,044	6,918	640,789	11,279	659,518	11,087	668,629	10,301	679,344	9,780

Source: JICA Study Team

(2) Economic Analysis

1) General

The primary objective of the economic analysis was to examine the effects of the project investment. The following discussion reveals the economic validity of the Urgent Projects by the conventional economic analysis – Cost Benefit Ratio, Net Present Value and Economic Internal Rate of Return. It should be noted that the urgent projects tested in this analysis were limited to the road rehabilitation and bridge construction along the national roads.

2) Basic Assumptions

a) "With project" and "Without Project"

"With Project" implies the situation where the proposed urgent projects are implemented, and "Without Project" implies where no investment takes place. The quantified economic benefits generated from the implementation of the project were defined as savings in Vehicle Operating Costs (VOC) and Travel Time Costs (TTC) derived from the difference between "With Project" and "Without Project".

b) Implementation Schedule

The implementation schedule was assumed as follows: the urgent projects would commence in 2010 and be completed by 2012 after 3 years. The opening of the projects to traffic is expected in 2013.

c) Evaluation Period for Economic Evaluation

The period of the economic evaluation for the urgent projects was set at 30 years after the completion of the projects.

d) Prices

A base year price was prepared based on the exchange rates in the first quarter of the fiscal year 2009/10 (between June and August) and exchange rates applied to this analysis were set as follows:

USD 1.0 = Yen 90.0 = Ushs. 1,900.0

3) Traffic Demand Forecast

The traffic demand in Acholi sub-region was forecast, and the summary of the estimated 'vehicle-km' and 'vehicle-hour' under different network conditions of 'With' and 'Without' project, is shown in Table 29.2.21. The traffic demand after 2018 was estimated based on the growth rate of the demand forecast between year 2009 and year 2018.

Table 29.2.21 Forecast Average Daily Traffic Volume, Vehicle-Km and Vehicle-Hour

Case	Note	Vehicle * Distance Travelled (Vehicle*km)						Vehicle * Travel Time (Vehicle *hour)					
		Passenger Car	Small Bus	Large Bus	Light Truck	Heavy Truck	Motor-cycle	Passenger Car	Small Bus	Large Bus	Light Truck	Heavy Truck	Motor-cycle
Base Year (2009)	(1)	127,214	5,286	6,737	16,075	62,360	209,283	2,265	82	111	278	1,045	4,153
Base Year (2009)	(2)	128,261	5,326	6,745	16,149	62,657	214,184	2,306	84	112	281	1,057	4,322
Without Projects (2018)	(3)	215,803	9,478	11,182	26,423	97,903	338,579	3,821	147	183	462	1,649	6,696
Without Projects (2018)	(4)	217,477	9,568	11,197	26,587	98,405	346,751	3,885	150	184	468	1,668	6,977
With Projects (2018)	(5)	231,088	9,659	11,348	27,790	101,990	383,826	3,397	141	159	418	1,490	5,962

Note: Figures of (1) were calculated under the assumption that all proposed bridges are passable. (2) all proposed bridges are impassable. (3) all proposed bridges are passable. (4) all proposed bridges are impassable. (5) all proposed bridges are passable.
Source: JICA Study Team

4) Economic Benefits of Project

a) Estimation of the Benefit

The future traffic demand was forecast under road network conditions of "With" and "Without" project cases. The "With" case scenario assumed that all project roads were rehabilitated and all the proposed bridges were newly constructed and passable, while the "Without" case scenario assumed that all roads were left without any rehabilitation works and bridges were not passable for 2 weeks in a year (e.g., floods in the rainy season).

Savings were derived from the comparison between costs ("With" case scenario) of road users who would enjoy good-conditioned roads and bridges and costs ("Without" case scenario) of those who would expend considerable time/costs by using deteriorated roads and sometimes bypassing a route when the bridge was not passable. Those savings are composed of:

- Vehicle Operating Costs (Both distance and time related costs);
- Travel Time Costs (Savings in passenger travel time for users of Motorcycles, Sedans, Mini Buses and Large Buses); and
- Initial Investment, Operation and Maintenance Costs.

b) Vehicle Operating Costs

Vehicle operating costs estimated in the previous JICA study (the Feasibility Study on the Construction of a New Bridge across River Nile at Jinja) were applied to this analysis. These vehicle operating costs are summarized in Table 29.2.22.

Table 29.2.22 Vehicle Operating Costs by Vehicle Type (at Economic Prices)

Items		Motorcycle	Sedan	Mini Bus	Large Bus	Truck	Trailer
Time Related VOC(USD/yr)	Crew cost	-	-	1,647	8,943	19,357	19,357
	Maintenance Cost	13.3	107.9	161.8	313.8	313.8	313.8
	Insurance Cost	328	496	613	580	357	357
	Depreciation Cost	128	722	1,299	2,438	2,244	3,456
	Sub-Total	469	2,809	3,721	12,275	22,272	23,483
	Overhead Cost	-	-	372	1228	2227	2348
	Total	469	2,809	4,093	13,503	24,499	25,831
USD / Hour		0.063	0.375	0.547	1.803	3.272	3.450
Distance Related VOC(USD/yr)	Fuel Cost	269.7	4,247.2	4,853.9	12,973.1	11,892.0	12,973.1
	Lubricant Cost	19.0	42.8	76.0	582.7	662.3	722.5
	Tyre Cost	25.7	207.3	173.3	582.8	884.1	2,818.1
	Maintenance Cost	21.8	136.2	263.0	774.1	591.4	910.5
	Depreciation Cost	237	1,341	2,413	4,529	4,168	6,417
	Sub-Total	573.1	5,974.8	7,778.9	19,441.3	18,197.9	23,841.7
	Overhead Cost	-	-	777.9	1,944.1	1,819.8	2,384.2
	Total	573.1	5,974.8	8,556.7	21,385.4	20,017.7	26,225.9
USD / 1000km,		*34.4*	*159.3*	*213.9*	*356.4*	*364.0*	*437.1*

Source: JICA (2009) The Feasibility Study on the Construction of a New Bridge across River Nile at Jinja

c) Travel Time Costs

Passenger's travel time costs were also estimated in the previous JICA study (the Feasibility Study on the Construction of a New Bridge across River Nile at Jinja) and applied to this economic analysis. Table 29.2.23 shows the summary of Travel Time Costs of passengers at 2009 prices.

Table 29.2.23 Travel Time Costs by Vehicle Type for Passenger Vehicles

Items	Motorcycle	Sedan	Mini Bus	Large Bus
No. of Average PAX/ Vehicle *1	1.46	2.51	13.03	46.36
Time Value (USD)/PAX /Month *2	119.4	119.4	119.4	119.4
Aggregated Time Value (USD)/Month/Vehicle	174.4	299.1	1,555.3	5,534.4
Aggregated Time Value (USD) /Hour/Vehicle	0.96	1.64	8.55	30.41

Source: JICA (2009) The Feasibility Study on the Construction of a New Bridge across River Nile at Jinja
Note*1: Based on Traffic Survey in Jinja; *2: Estimates from Uganda National Household Survey 2005/2006 and Consumer Price Index (CPI) source: Bank of Uganda

5) Economic Project Cost

a) Estimation of Economic Project Cost

The project costs in terms of financial prices were estimated in this Study. For the economic analysis, financial costs were converted to economic costs by deducting the tax portion and applying a standard conversion factor to the portion of non-trade goods.

All the costs of the urgent projects, excluding tax, were classified as non-trade goods as all the construction materials were available in Uganda. In this Study, the following conversion factors were applied;

- For tax, conversion factor of zero was applied and
- For construction and administration costs (e.g., land acquisition and compensation), a standard conversion factor was applied.

The standard conversion factor (SCF) is an index, which converts domestic prices to border prices by adjusting for the distortion of prices in the domestic market. The SCF is estimated based on the following equation:

$$SCF = \frac{M + X}{(M + T_m) + (X - T_x - S_x)}$$

Where:

M : Total value of imports (CIF)
X : Total value of exports (FOB)
T_m : Total value of import duty
T_x : Total value of export duty
S_x : Total value of export subsidies

Based on statistical data on foreign trade and governmental revenues in Uganda, the SCF was estimated at 0.90 as shown in Table 29.2.24.

Table 29.2.24 Calculation of Standard Conversion Factor

Financial Year	2005/06
Export (Million USD)	889.8
Import (Million USD)	1,991.4
Tax on Imports (Billion Ushs.)	
Duties - non-oil products	171.5
Excise taxes	
Petroleum products	362.6
Other imports	57.6
Total import taxes (Billion Ushs.)	591.7
Exchange rate (Ushs./USD)	1,825.2
Total import taxes (Million USD)	324.2
SCF	0.90

Source: Uganda Bureau of Statistics

The total economic project costs, consisting of 'Local Administration Cost', 'Engineering Cost' and 'Construction Cost', in economic prices were estimated to be 72.5 Million USD as shown in Table 29.2.25.

Table 29.2.25 Estimated Project Costs

Unit: 1000 USD

Cost Item	Project 1-1	Project 1-2	Project 1-3	Project 1-4	Project 1-5	Total
(1) Construction Cost						
Road Construction	32,921.3	27,471.9	0.0	0.0	393.3	60,786.5
Bridge Construction	1,404.5	1,404.5	741.6	1,573.0	707.9	5,831.5
Tax	3,432.6	2,887.6	74.2	157.3	110.1	6,661.8
Contingency	3,432.6	2,887.6	74.2	157.3	110.1	6,661.8
(2) Engineering Costs	2,643.1	2,223.5	57.1	121.1	84.8	5,129.6
(3) Local Administration Costs	1,132.8	952.9	24.5	51.9	36.3	2,198.4
Total Project Cost	44,966.9	37,828.1	971.5	2,060.7	1,442.5	87,269.6
Economic Project Cost	37,380.8	31,446.4	807.6	1,713.0	1,199.1	72,547.0

Source: JICA Study Team

b) Operation and Maintenance Costs of the Project

The operation and maintenance costs for the proposed projects in terms of financial prices were provided based on the unit costs described in the PRDP. Table 29.2.26 shows the routine and periodic maintenance costs for both roads and bridges.

Table 29.2.26 Routine and Periodic Maintenance Costs

Unit: 1000 USD

Activity	Unit Cost (1,000 USD/km)	Note
Routine Maintenance	0.37	Every year
Periodic Maintenance	1.50	Every 4 years

Source: JICA Study Team

6) Cost Benefit Analysis

As mentioned earlier, the cost benefit analysis, comparing costs and benefits generated from the projects, determines the economic validity of the projects. Investment of the projects and operation and maintenance costs were analyzed as cost factors while the savings in both Vehicle Operating Costs and Travel Time Costs were estimated as benefit factors as shown in Table 29.2.27. This cost benefit analysis was tested under the following assumptions:

- In the 'Without' Project case, all the roads, without any maintenance, were assumed to be deteriorated and the level of service of the roads would worsen (i.e., the travel speeds on the deteriorated roads would fall to half the value of the current speeds)
- In the 'With' Project case, the level of service of the project roads would improve while that of the rest of the roads would remain at the current service levels.

Accordingly, operation and maintenance costs were estimated based on the total road length of all the serviceable roads in Acholi sub-region. As a result, costs and benefits were analyzed, concluding that three indicators of the economic evaluation slightly substantiated the economic viability of the project investment, with EIRR of 12.7 %, B/C Ratio of 1.07 and ample positive NPV of 4,095 thousand USD.

Table 29.2.27 Cost Benefit Items of the Project for Economic Analysis

	For Supplier		For User		Net Cash Flow for the Cases
	Cash-Out	Cash-In	Cash-Out	Cash-In	
Case: [Without] Project					
			VOC Travel Time Costs		-VOC -Travel Time Costs
Case: [With] Project					
	Investment & O&M		VOC Travel Time Costs		-Investment -O&M -VOC -Travel Time Costs
					Cash-In items -Savings in VOCs -Savings in Travel Time Costs **Cash-Out items** -Investment -O&M

Source: JICA Study Team

Table 29.2.28 Estimated Net Cash Flow for Economic Evaluation of the Project

Unit: 1000 USD (Economic Price)

Year		Cash-out			Cash-in				Net Cash Flow
		Project		Total	Users' Cost Savings			Total	
		Investment	O&M		VOC (D)[1]	VOC (T)[2]	TTC		
-3	2009	0	0	0	0	0	0	0	0
-2	2010	24,182	0	24,182	0	0	0	0	-24,182
-1	2011	24,182	0	24,182	0	0	0	0	-24,182
0	2012	24,182	0	24,182	0	0	0	0	-24,182
1	2013	0	563	563	-1,767	2,921	6,011	7,165	6,602
2	2014	0	563	563	-1,865	3,080	6,357	7,572	7,009
3	2015	0	563	563	-1,969	3,248	6,724	8,002	7,440
4	2016	0	1,125	1,125	-2,079	3,425	7,111	8,457	7,332
5	2017	0	563	563	-2,195	3,611	7,521	8,937	8,375
6	2018	0	563	563	-2,317	3,808	7,954	9,445	8,883
7	2019	0	563	563	-2,317	3,808	8,413	9,904	9,341
8	2020	0	1,125	1,125	-2,583	4,234	8,898	10,549	9,424
9	2021	0	563	563	-2,727	4,465	9,411	11,149	10,586
10	2022	0	563	563	-2,879	4,708	9,953	11,782	11,220
11	2023	0	563	563	-3,039	4,965	10,527	12,452	11,890
12	2024	0	1,125	1,125	-3,209	5,235	11,133	13,160	12,035
13	2025	0	563	563	-3,388	5,521	11,775	13,908	13,345
14	2026	0	563	563	-3,577	5,821	12,454	14,698	14,136
15	2027	0	563	563	-3,776	6,138	13,171	15,534	14,972
16	2028	0	1,125	1,125	-3,986	6,473	13,931	16,417	15,292
17	2029	0	563	563	-4,209	6,825	14,734	17,350	16,788
18	2030	0	563	563	-4,443	7,197	15,583	18,337	17,774
19	2031	0	563	563	-4,691	7,589	16,481	19,379	18,817
20	2032	0	1,125	1,125	-4,952	8,003	17,431	20,481	19,357
21	2033	0	563	563	-5,228	8,439	18,435	21,646	21,083
22	2034	0	563	563	-5,520	8,899	19,498	22,877	22,314
23	2035	0	563	563	-5,827	9,383	20,622	24,178	23,615
24	2036	0	1,125	1,125	-6,152	9,895	21,810	25,553	24,428
25	2037	0	563	563	-6,495	10,434	23,067	27,006	26,443
26	2038	0	563	563	-6,857	11,002	24,397	28,542	27,979
27	2039	0	563	563	-7,239	11,601	25,803	30,165	29,602
28	2040	0	1,125	1,125	-7,643	12,233	27,290	31,881	30,756
29	2041	0	563	563	-8,069	12,900	28,863	33,694	33,132
30	2042	0	563	563	-8,518	13,602	30,527	35,611	35,048
	Total	72,547	20,811	93,358	-129,518	209,466	455,882	535,830	442,472
	NPV	51,859	3,477	55,335	-14,469	23,629	50,270	59,430	4,095
	B/C	Discount Rate		12%					1.07
	EIRR								12.7%

Notes: VOC (D)[1] means Distance related vehicle operating costs
VOC (D)[2] means Time related vehicle operating costs
Source: JICA Study Team

7) Overall Evaluation of the Project

Major economic benefits derived from the proposed project are composed of savings in time-related vehicle operating costs and travel time costs. Savings in the distance-related vehicle operating costs show negative gains since the road users will travel longer distances when they divert from their current routes to the project roads when the level of service of the project roads improves. The projected EIRR was estimated at 12.7 %. Assuming a social discount rate of 12% per annum, it can be concluded that the proposed urgent projects are slightly economically feasible; however any adverse effects, such as increase in the project cost and/or reduction in the traffic demand, would turn them into economically invalid projects.

29.2.2 Other Significant Benefits from the Project

(1) Direct Benefits

Thanks to the bridge construction and road improvement, year round vehicle traffic would be possible where in the past vehicle traffic could not cross over a river due to the deficiency of the bridge.

Safety for pedestrians and vehicles would be improved because the temporary wooden bridge, which presents a danger to pedestrians that could fall into the river and/or the bridge could be broken by a flood or heavy vehicle loading, will be replaced by a permanent bridge that is higher than the high water level and can bear heavy vehicle traffic.

Convenience for the traffic would also be improved because the bottleneck narrow width bridge will be changed to a 2-lane width bridge.

The risk of flooding upstream of the bridge would decrease because the cross sectional area of river flow under the bridge would be widened.

(2) Indirect Benefits

The IDP return process would be facilitated because the access between IDP camps and the original villages would be secured all year-round.

The possibility for IDP returnees to earn income would increase while the resettlement of returnees would be accelerated because the commercial trucks that demand agricultural crops and livestock would be able to travel from urban cities or Sudan.

Regional economy where reconstruction has been delayed would be stimulated because the bottleneck narrow width bridge would be reconstructed and traffic volumes would increase.

29.3 Recommendations

Based on the abovementioned study, the features of this project are summarized as shown below.

- Although selected projects are only slightly economically feasible, they have other significant benefits such as mentioned in 29.2.2. Furthermore, they have higher urgency for implementation among the projects requested by OPM in January 2010 given that they would contribute to IDP return.
- Implementation of the three (3) projects (No.1 Awoo-Pabbo Road, No.3 Laminlatoo-Lamoki Road and No.6 Anaka-Olwiyo Road) from among the six (6) projects could generate synergetic effects with pilot projects in Amuru and Nwoya Districts, which were implemented by the “Project for Rural Road Network Planning in Northern Uganda” and

"The Project for Community Development for Promoting Return and Resettlement of IDP in Northern Uganda".

- It is expected that technical capacity for Ugandan local contractors would be enhanced since the urgent projects, as well as the pilot project, would be implemented by local contractors.

Consequently, the selected six projects are recommended to be implemented under the scheme of Japanese Grant Aid for conflict prevention and peace building. For smooth implementation of the projects, the Ugandan side shall solve the issues on land acquisition and land mines/UXO, if any, with the assistance of the Japanese side before the tender phase of the project.