14. RURAL ROAD NETWORK PLANNING

14.1 Methodology

Rural Roads are the roads which should satisfy various needs of people and socio-economic activities. It is necessary to consider and formulate network plans and development levels of rural roads from the following various perspectives/aspects:

- Population distribution (present and future populations including population distribution of returnees)
- Linkage between local government administration centres (district centre and sub-county centres)
- Access to health centres and schools from rural communities
- Access to health centres and schools from local government administration centres
- Access to trading centres from rural communities
- Trade linkage among rural trading centres, major trading centres, major national roads and the regional commercial centre (Gulu town)
- Access to agricultural development potential areas

In this chapter, firstly, these various needs of rural roads are considered one by one (in a separate manner) for rural road network planning. Secondly, those various needs for rural roads are incorporated to formulate an integrated rural road network for the future (year 2018 and year 2030). The general flow of rural road network planning is shown in Figure 14.1.1.

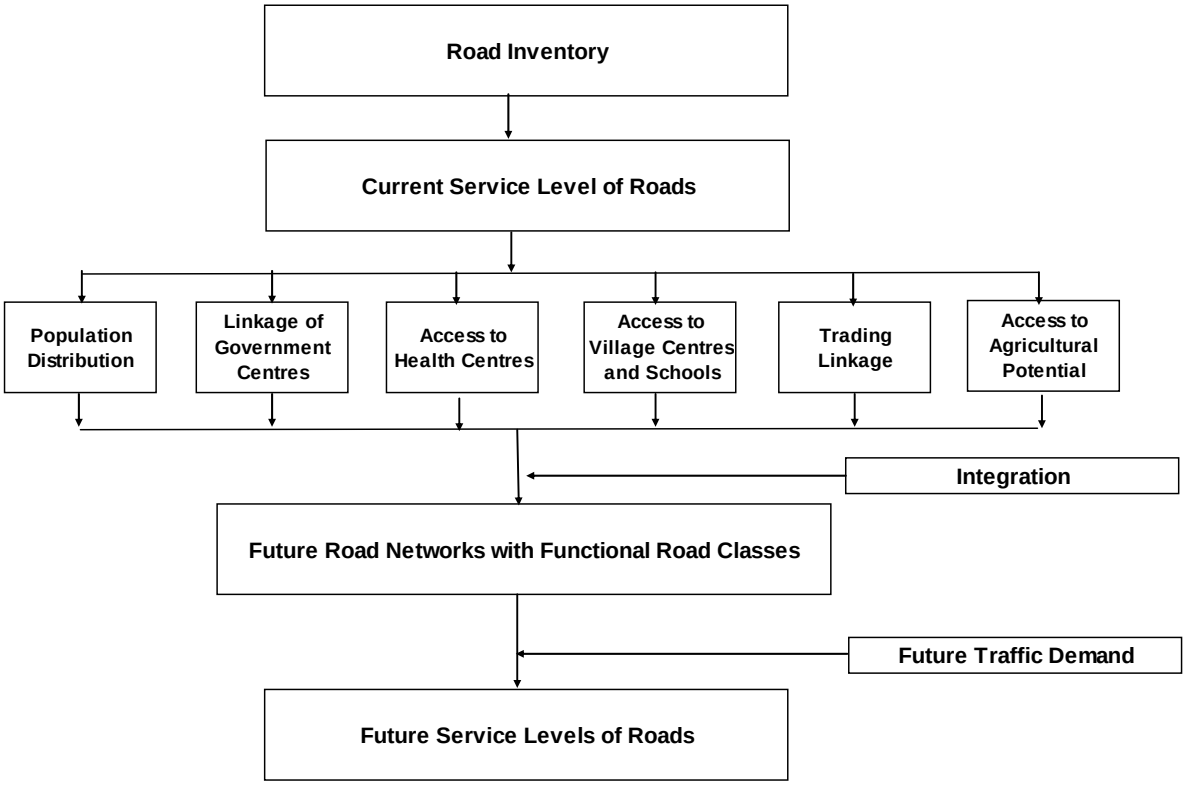
14.2 Different Perspectives for Rural Road Network Planning

(1) Population Distribution and Rural Roads

At present, people live near existing vehicle roads. Figure 14.2.1 shows population densities of villages and vehicle roads. In general, it is necessary to develop and maintain roads at higher levels in higher population density areas.

On the other hand, the return of IDPs to home villages and hamlets would necessitate extension of roads into remote areas. When more IDPs return to home villages and hamlets, the population will be distributed over a much wider area than is currently the case. In the future, it is expected that more people will live in the western parts of Amuru and Alero Sub-counties, as well as in the southern part of Koch Goma Sub-county. See Figure 14.2.2, which shows the projected population densities of villages in 2014. See also Figure 14.2.3, which

shows the increased village population between 2009 and 2014. In light of this, more vehicle roads should be provided and extended to these areas.



Source: JICA Study Team

Figure 14.1.1 General Flow of Rural Road Network Planning

(2) Government Administration Centres and Rural Roads

On the 1st of July 2010, the former Amuru District was divided into the new Amuru District and Nwoya District. The location of the headquarters of new Amuru District is Otwee, which is the same as that of the former Amuru District. The headquarters of the new Nwoya District is located at Anaka.

The district headquarters should be well connected to sub-county headquarters. At present, in Amuru District, there are four sub-counties, namely Amuru Sub-county, Lamogi Sub-county, Pabbo Sub-county and Attiak Sub-county. In Nwoya District, there are four sub-counties, namely Anaka Sub-county, Alero Sub-county, Purongo Sub-county and Koch Goma Sub-county. The location of the headquarters of the districts and sub-counties is shown in Figure 14.2.5.

The connection between these sub-county headquarters and the district headquarters is possible through the roads crossing main rivers, such as the Ayugi River, the Aswa River and the Ayago River. These roads should connect radial roads from Gulu town to each other.

There are proposals for new sub-counties, mostly from large sub-counties in Amuru and Nwoya Districts. Among those proposals are the following:

- Got Apwoyo Sub-county to be carved out of Purongo Sub-county
- Apar Sub-county to be carved out of Amuru and Pabbo Sub-counties

If these new sub-counties are realized, more road connections between the district centre and new sub-county headquarters should be improved.

(3) Health Centres and Rural Roads

In Amuru and Nwoya Districts, there are 36 health centres. These health centres are to be administered from two centres. One is Anaka Hospital. The other is Attiak Health Centre 4. To support this administrative relation between the health centres and Anaka/Attiak, it is necessary to improve roads from Anaka, as well as roads from Attiak. See Figure 14.2.6. This situation would be the same under the new districts.

In the future, more health centres will be operational, especially in presently under-populated areas, including the western part of Amuru Sub-county, the western part of Alero Sub-county, the southern part of Koch Goma Sub-county and the eastern part of Attiak Sub-county. Therefore, in the future, it will be necessary to extend roads to these areas.

(4) Primary Schools and Rural Roads

In Amuru and Nwoya Districts, primary schools are established in almost all villages. This situation is better than the standard specified by the central government.[1] It is probably because the population densities are much lower than the standard cases. As a result, district educational officers have to travel over longer distances to visit primary schools. School teachers also have to travel long distances to the district centre.

At present, vehicle roads reach almost all villages. See Figure 14.2.4. However, some villages have no direct vehicle road access. Some access roads to villages are in very poor conditions.

It is essential to provide access by vehicle roads (at least community access roads) to village centres and primary schools. See Figure 14.2.7.

(5) Home Hamlets and Rural Roads

Many IDPs have their home hamlets in areas remote from village centres.

Community access roads between home hamlets (original places) of returnees and main roads (district roads and national roads) are one of the key strategies towards sustaining the life of returned IDPs, as well as promoting IDP's return process.

For example, one of the essential social infrastructures for sustaining their lives at home hamlets is that of water supply, such as deep wells and protected springs. In the case of deep wells, vehicle roads and bridges are required to carry heavy equipment to necessary sites for construction of boreholes. Figure 14.2.8 shows villages which do not have deep wells.

However, it is not possible for local governments to open all necessary community roads by government and/or donor budgets. At the same time, it is not easy to systematically identify all necessary community access roads for these purposes from the district and sub-county levels.

It is necessary to establish an appropriate division of roles between community participation and local governments in construction of roads, culverts and bridges. For example, local governments or donor projects are in charge of construction of culverts and bridges, while communities are responsible for opening up earth roads by manual labour.

[1] One primary school for one parish is the standard set by the central government.

(6) Trading Centres and Rural Roads

Gulu town has the largest wholesale trading function for agricultural produce. There are over 500 produce shops in Gulu town. They buy agricultural produce through middlemen who are active in buying produce not only from farmers by visiting villages but also from trading centres. Therefore, road connections between those trading centres and Gulu town are essential.

Nearly 40 trading centres are located in Amuru and Nwoya Districts. At each trading centre, there are several producer shops, which are active in buying agricultural produce from local farmers and selling collected produce to middlemen. Those trading centres are former IDP camps and transit sites. Out of 40 trading centres, 15 are regarded as major trading centres, as shown in Figure 14.2.9.

Among them, the largest trading centre is Pabbo. Pabbo is located along one of the major national roads. In Pabbo, there are about 60 produce shops. Middlemen from Kampala, Lira and Sudan, as well as from Gulu come to buy produce at these produce shops in Pabbo.

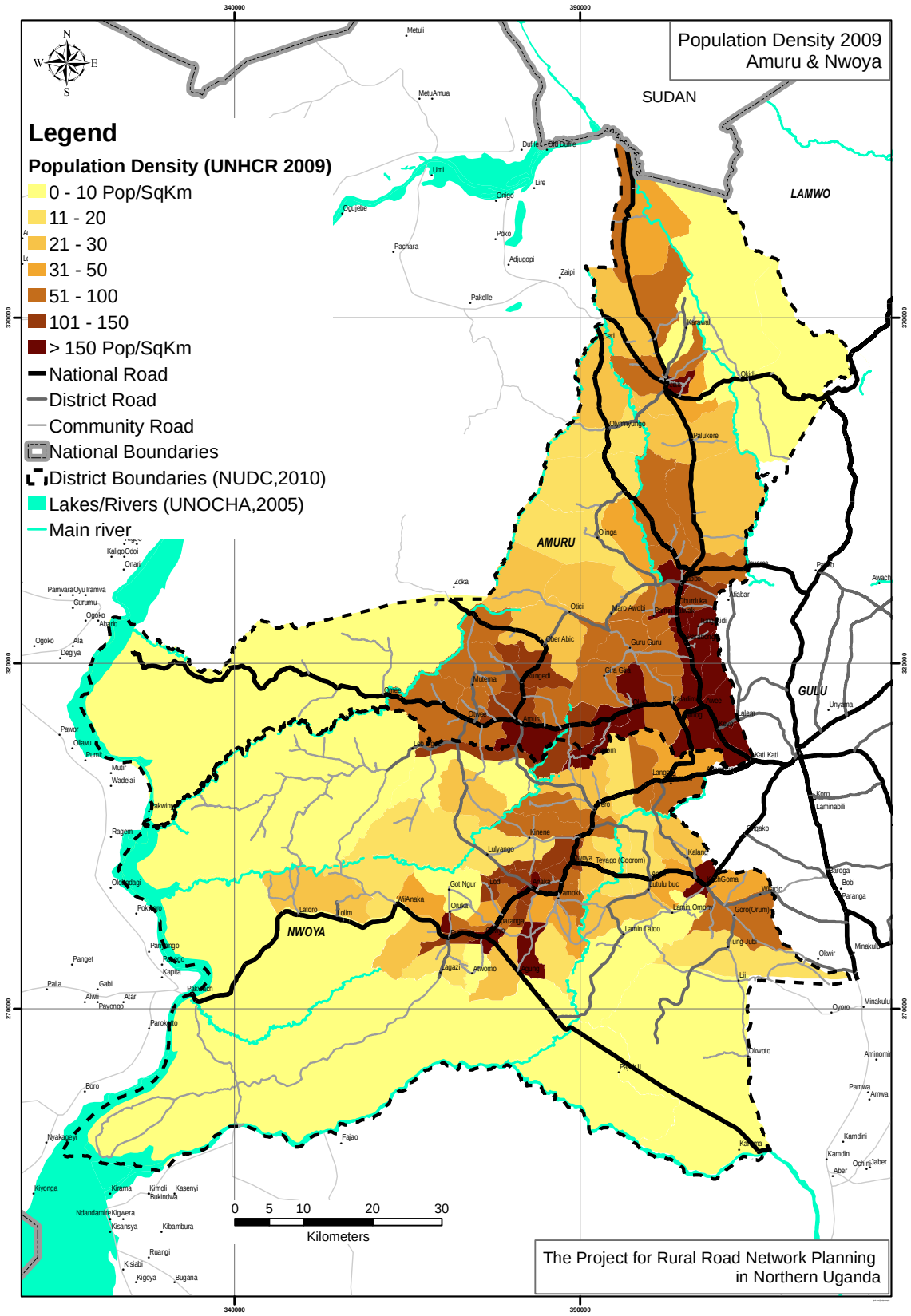
Anaka trading centre is also large and active. It is located near the paved national road to West Nile. Middlemen come from Kampala to buy produce at produce shops in trading centres along the national road.

The road connections from inner areas of Amuru and Nwoya Districts to Pabbo and Anaka along the national roads are important. Farmers and small-scale middlemen would be better able to bring produce to these large trading centres along the national roads, if better road access were provided. Furthermore, agricultural produce would be purchased by middlemen at prices more favourable to farmers, if better road access were provided.

(7) Potential Areas for Agriculture and Rural Roads

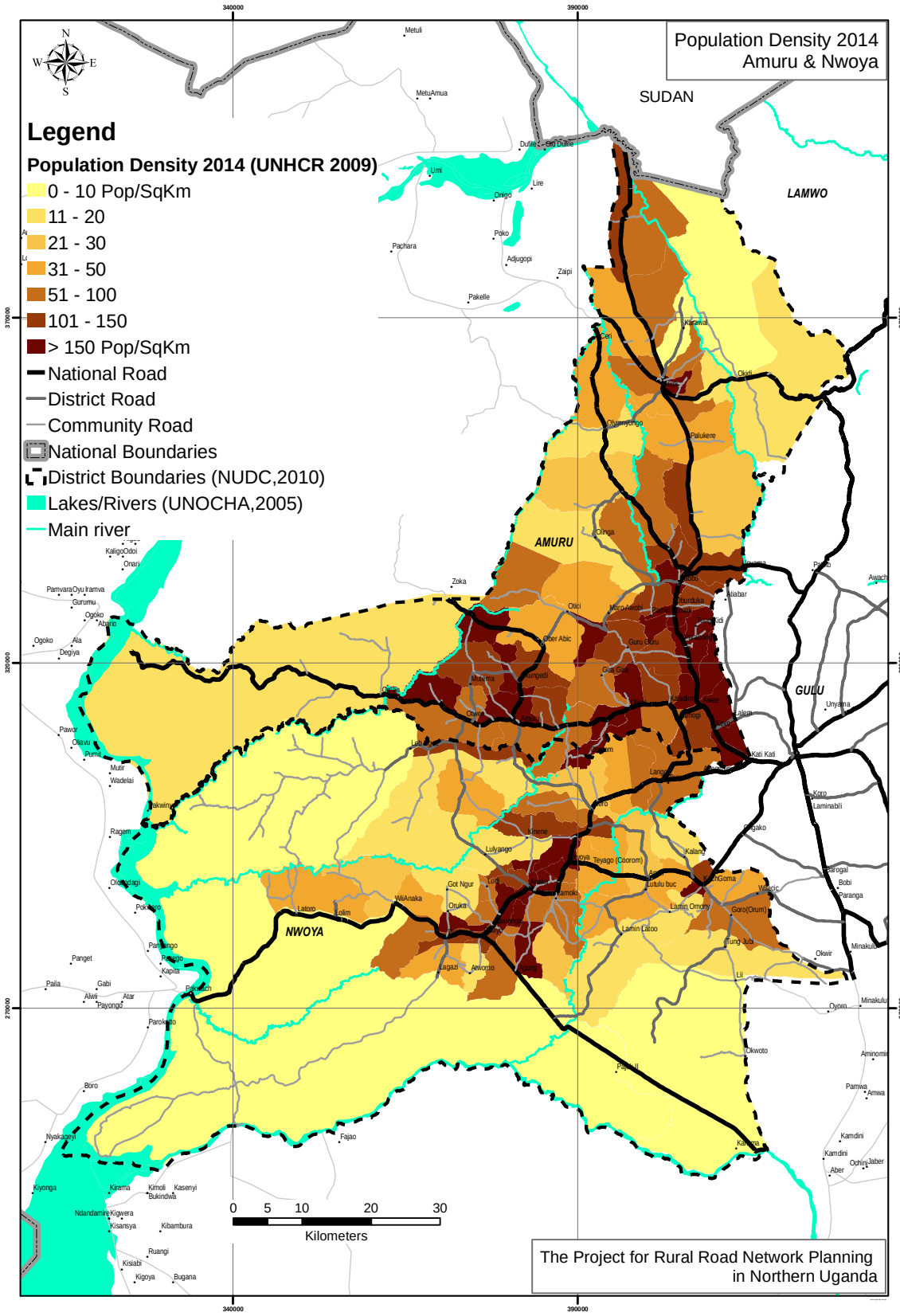
Amuru and Nwoya Districts still have vast potential areas for agriculture. Such agricultural potential lands are located in the western part of Amuru Sub-county, the western part of Alero Sub-county, the southern part of Koch Goma Sub-county and the eastern part of Attiak Sub-county.

In order to promote the utilization of these potential lands for agriculture, it is necessary to provide reasonable access to them by road. There are two strategies to achieve necessary road access improvement. One strategy is to provide bridges and roads connecting these agricultural potential areas to the national roads running nearby. The other strategy is to extend existing radial roads from Gulu town further to the agricultural potential areas. See Figure 14.2.10.



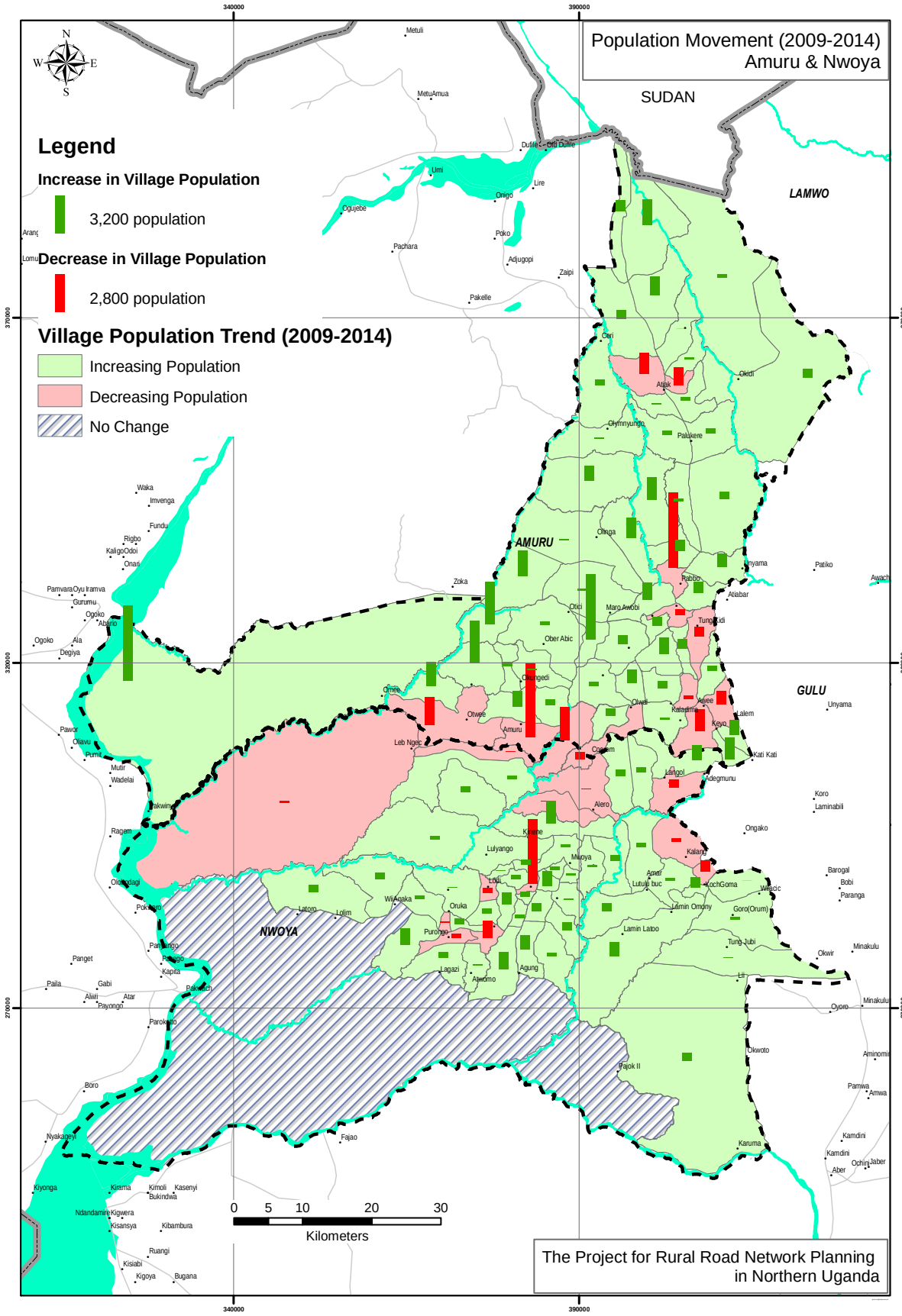
Source: Village population data, as of August 2009: UNHCR
Village boundary data: JICA Study Team for Project for Community Development for Promoting Return and Resettlement of IDP in Northern Uganda

Figure 14.2.1 Population Density by Village in Amuru and Nwoya Districts, 2009



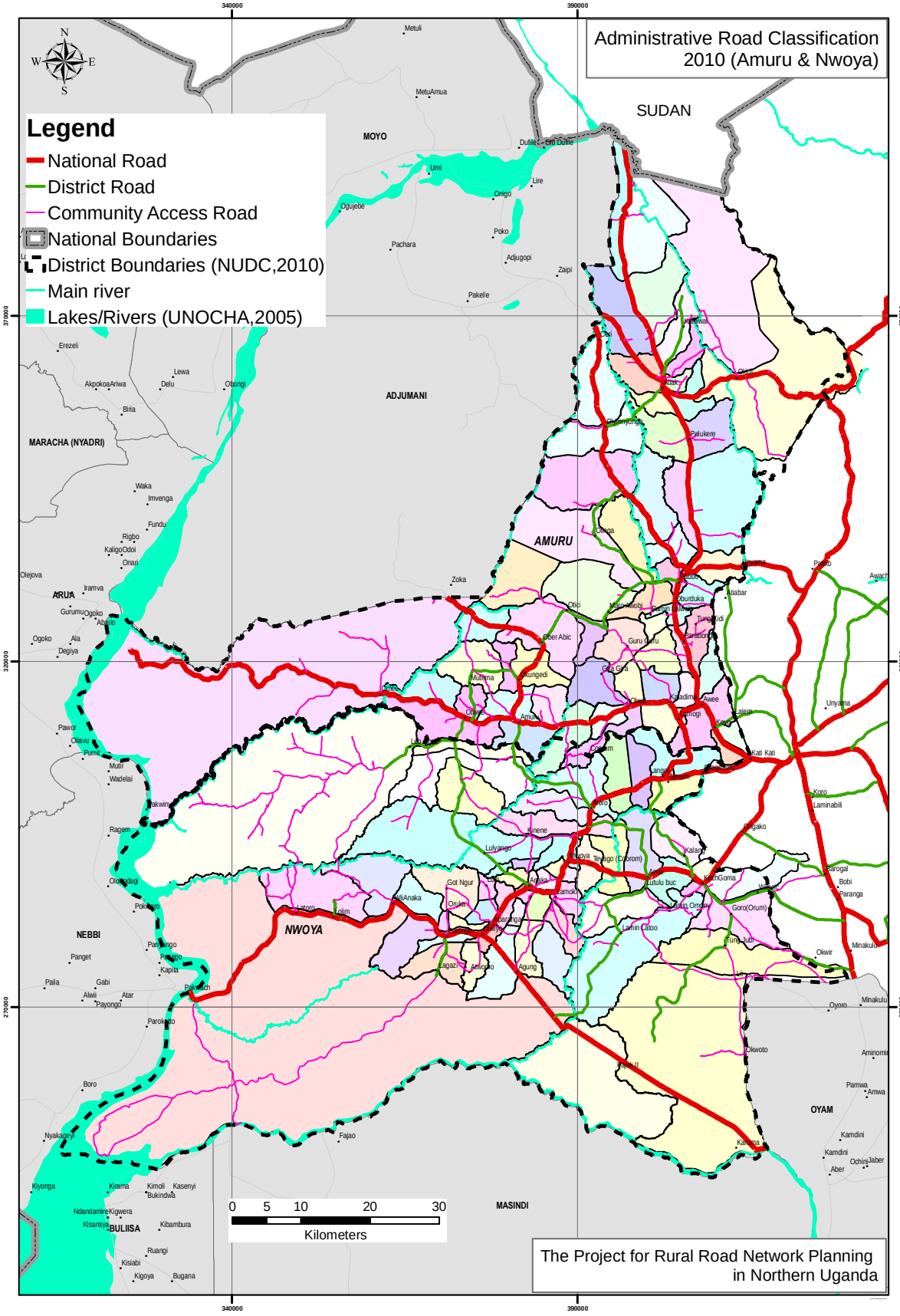
Source: Projected population by village in 2014 and Village boundary data: JICA Study Team for Project for Community Development for Promoting Return and Resettlement of IDP in Northern Uganda

Figure 14.2.2 Population Density by Village in Amuru and Nwoya Districts, 2014



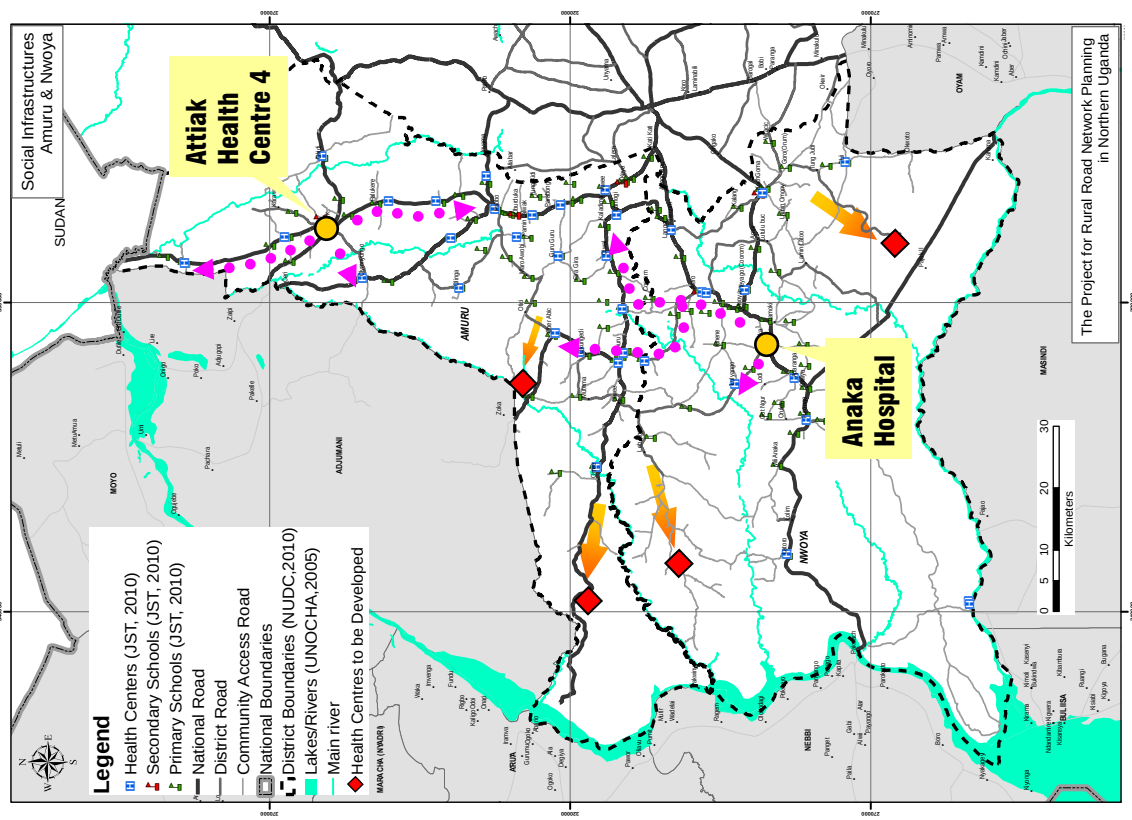
Source: Compiled by JICA Study Team

Figure 14.2.3 Population Increase by Village between 2009 and 2014



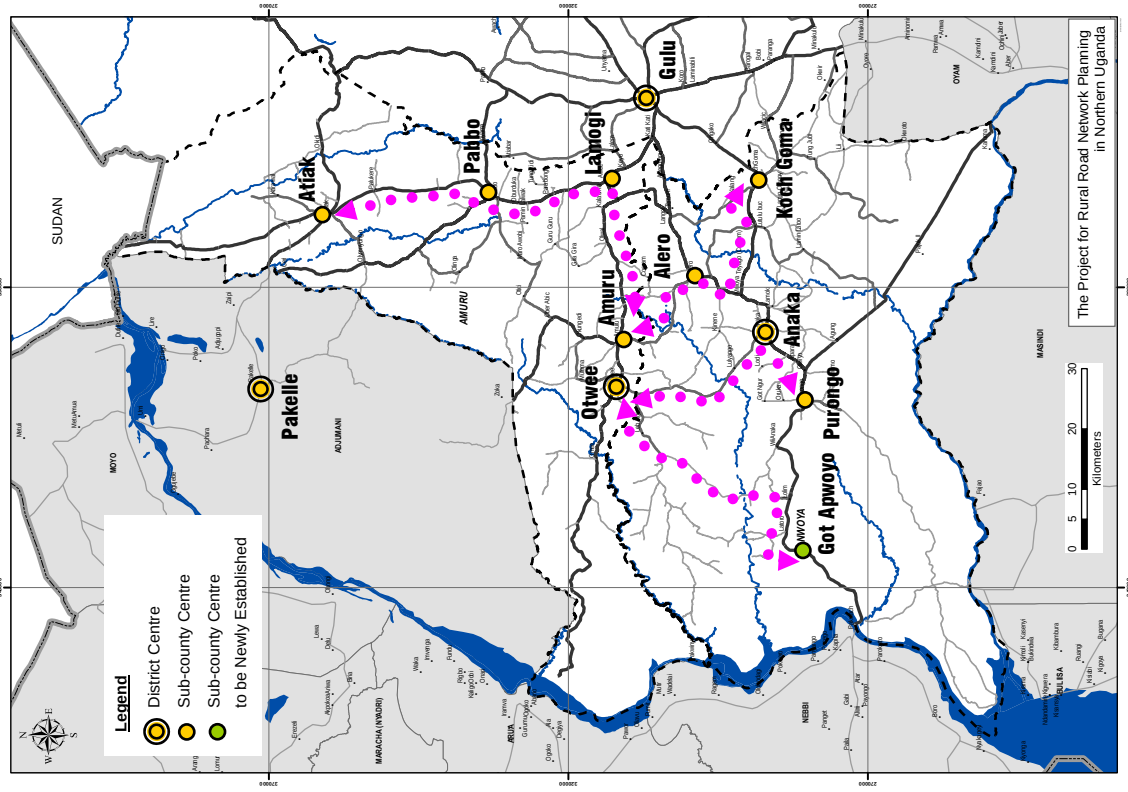
Source: Compiled by JICA Study Team

Figure 14.2.4 Villages and Vehicle Roads



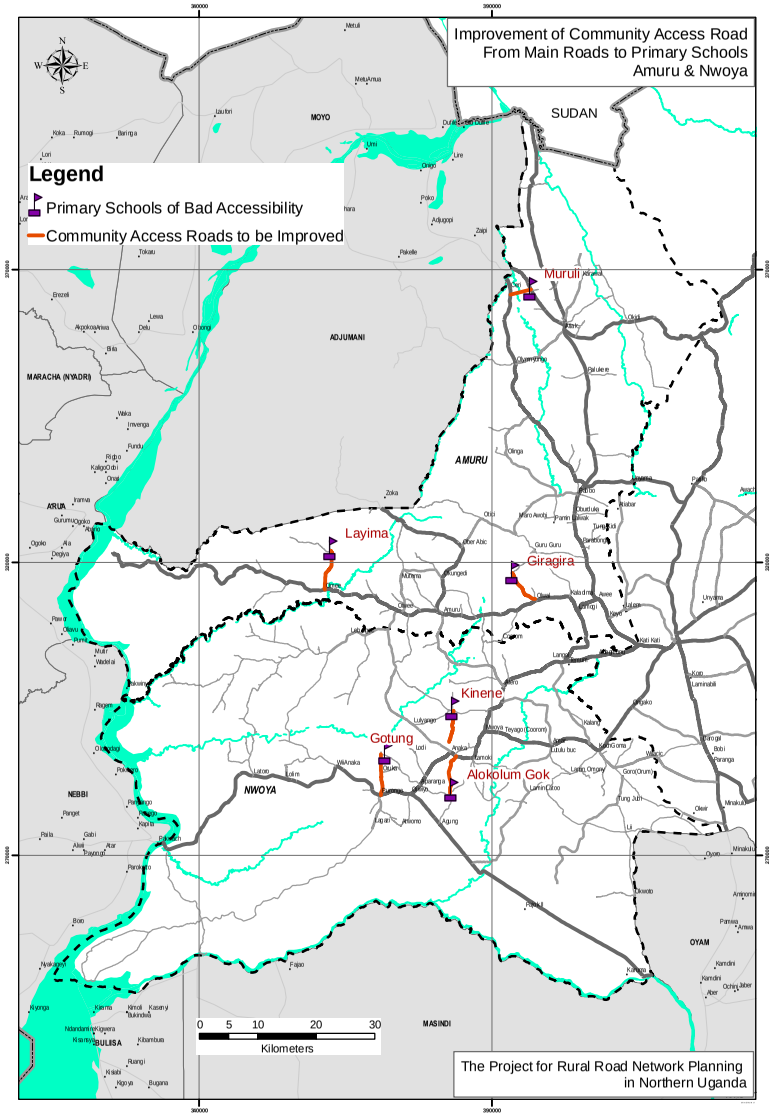
Source: Compiled by JICA Study Team

Figure 14.2.6 Linkage between Anaka/Attiak and Health Centres



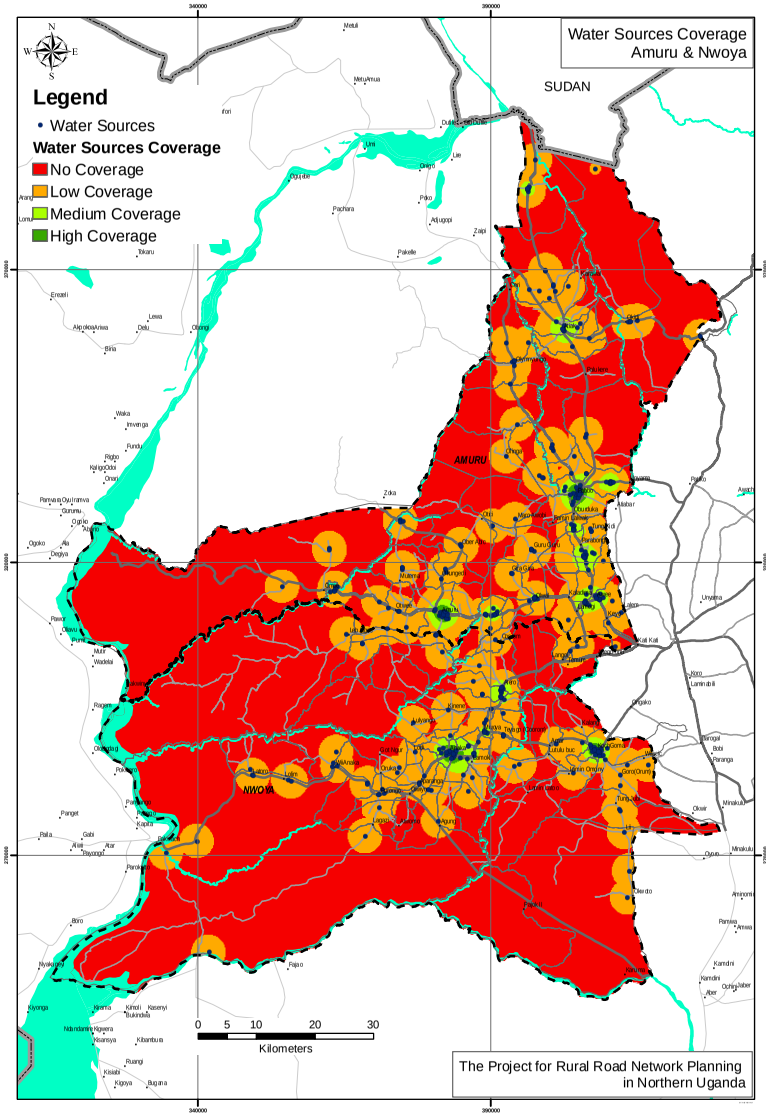
Source: Compiled by JICA Study Team

Figure 14.2.5 Linkage between Sub-county Centres and District Centre (Case of Former Amuru District)



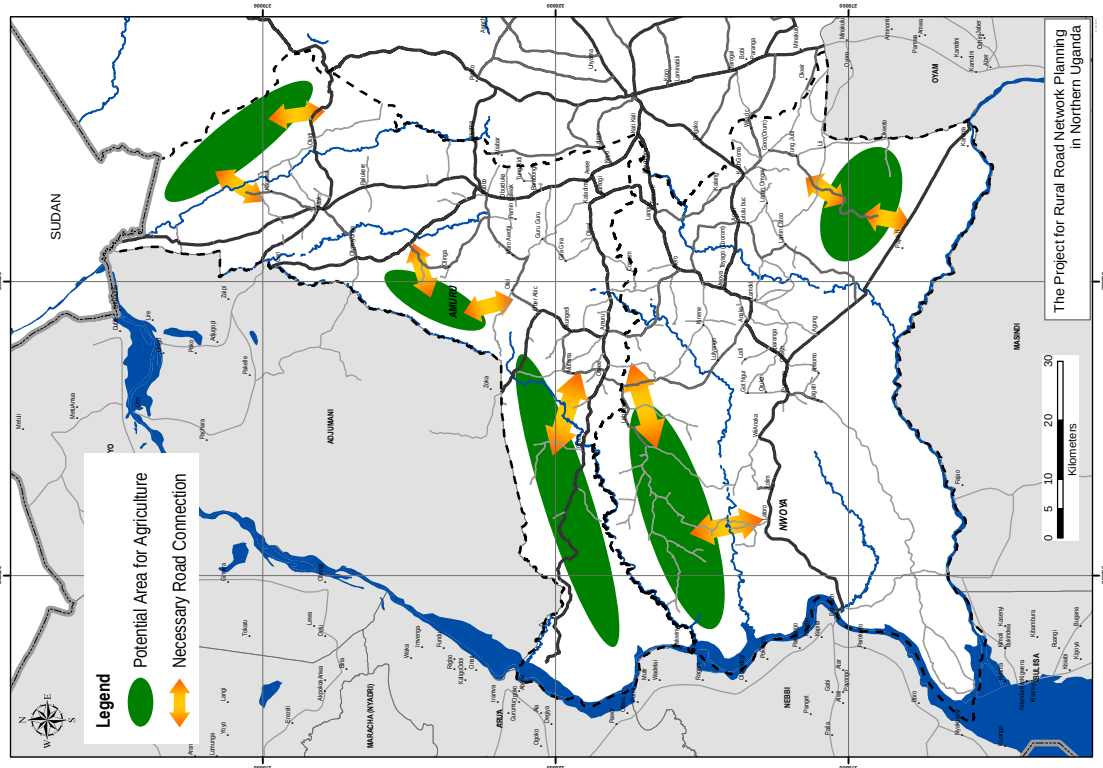
Source: Compiled by JICA Study Team

Figure 14.2.7 Access Roads to Primary Schools from Main Roads



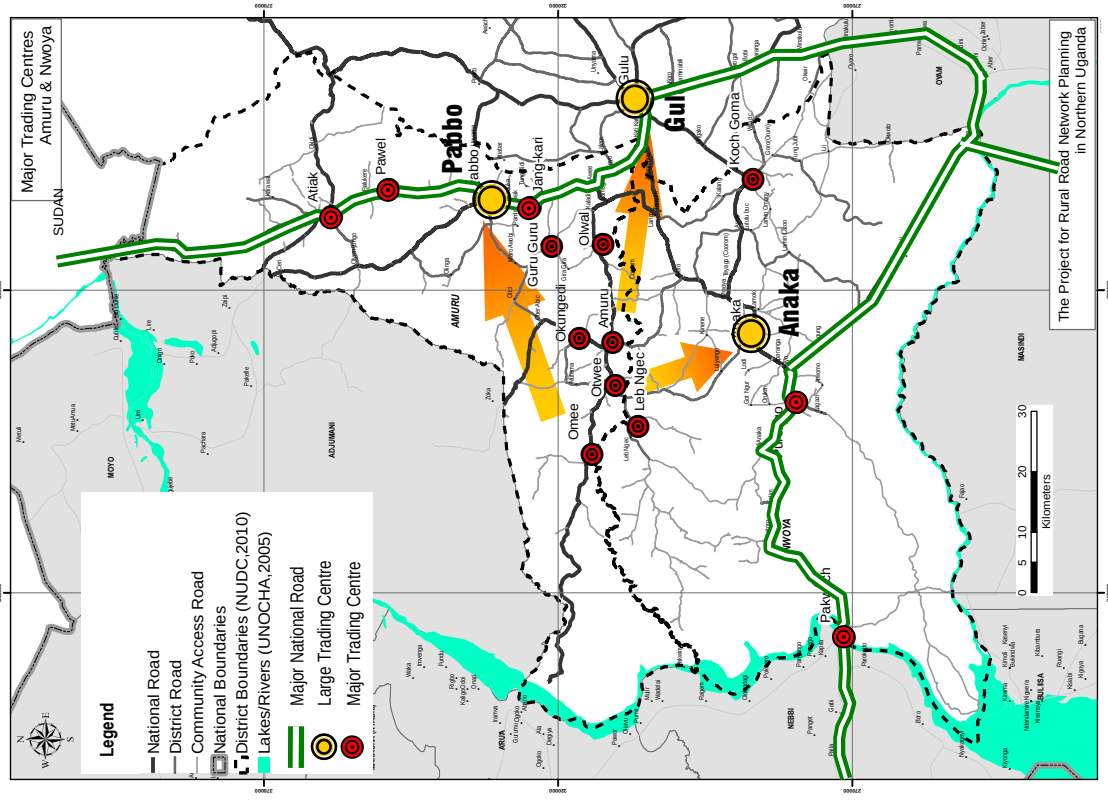
Source: Compiled by JICA Study Team

Figure 14.2.8 Need for Opening Community Access Roads within Villages with Low Water Coverage



Source: Compiled by JICA Study Team

Figure 14.2.10 Road Access for Potential Areas for Agriculture



Source: Compiled by JICA Study Team

Figure 14.2.9 Linkage of Trading Centres to Gulu Town, Pabbo and Anaka

14.3 Method of Integrating Existing Two Functional Road Classification Systems

14.3.1 Importance of Functional Road Classification

There are different kinds of road classifications as follows:

- Classification by jurisdictional status and administrative responsibility, such as national roads, district roads and private roads

- Classification by physical structure and condition of roads, such as paved roads, gravel roads and earth roads

- Classification by traffic function, such as trunk roads and feeder roads

Among these, the classification by function is very important for road network planning. The functional road classification shows a hierarchy of roads, as well as different roles and importance of roads. This functional road classification could be a tool for guiding the development and management of roads. The functional road classification constitutes a basis for road sub-sector policies.

There are two ways of using functional road classifications. One is for formulating road investment plans or master plans. The other is for identification of adequate design standards in order to design actual roads.

In Uganda, the application of the first case of functional road classifications is very limited. The latter case of utilisation of functional road classifications is more common.

14.3.2 Existing Two Functional Road Classification Systems

In Uganda, there are two systems of functional road classification. One is that prepared by MoWT for rural roads in Uganda. The other is for rural feeder roads (district roads).

(1) Functional Road Classification for Trunk Roads

The functional road classification for rural roads in Uganda is given in Vol. 1: Geometric Design, Road Design Manual (2005). See Table 14.3.1. This manual was a revised and developed version that was established in November 1994. Therefore, the description of road function includes a term “provincial”, although provinces do not exist at present in Uganda.

Table 14.3.1 Functional Road Classification System for Rural Roads in Uganda

	Road Class	Function
A	International Trunk Roads	Roads that link Internationally Important Centres. Connection between the national road system and those of neighbouring countries. Major function is to provide mobility
B	National Trunk Roads	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 roads. Major function is to provide both mobility and access
D	Secondary Roads	Roads linking locally important centres to each other, 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 Roads	Any road link to minor centres (market/local centres) and all other motorable roads. Major function is to provide access to land adjacent to the secondary road system.

Source: Road Design Manual, Vol.1 Geometric Design, Ministry of Works, Housing and Communications, the Republic of Uganda, July 2005.

More than a decade ago, MoWT tried to prepare a numbering system for national roads using the functional classes of A, B and C, like A-1, A-2, A-3, …, A-30, B-1, B-2, B-3, .., C-1, C-2, C-3, .. . However, the attempt was not completed. No code numbers have been given to national roads. It doest not seem that there is any list or map showing functional road classification of national roads/trunk roads in Uganda.

Table 14.3.2 Design Classes and Functional Classification for Rural Roads in Uganda

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: Road Design Manual, Vol.1 Geometric Design, Ministry of Works, Housing and Communications, the Republic of Uganda, July 2005.

Different design classes are set in response to different functional road classifications. See Table 14.3.2. In this table, a design class can be selected out of two to four design classes prompted by functional road classifications.

Even the design class of B Gravel is set for a traffic demand of over 2,000 pcu per day. Considering the existing traffic demand, "B Gravel" is too high a design standard for most major roads within Amuru and Nwoya Districts.

(2) Functional Road Classification for District Roads

Since 1997, the MoWHC has been responsible for technical guidance on district roads: the ministry has assisted district local governments or the Ministry of Local Government in establishing policies, functional road classification, design classes and standards of district road networks. As a result, in 2004, a series of the following technical manuals on district road works was established:

Volume 1: Planning Manuals

Volume 2: Contract Management Manuals

Volume 3: Implementation and Monitoring Manuals

Volume 4: Technical Manuals

Volume 5: District Administrative and Operational Guidelines

Out of these volumes, Volume 1 has "Manual A: Functional Road Classification System & Route Numbering", which provides a functional road classification system for district roads, as shown in Table 14.3.3.

The design standards for district roads are specified in this manual, as shown in Table 14.3.4. Contrary to the design classes for the trunk road system, a design class is specified to a functional road class.

Table 14.3.3 Functional Road Classification System for District Roads in Uganda

Class	Definition
District Class I Roads	District Class I roads serve national interests in that they satisfy criteria established for secondary and/or tertiary road systems of MoWT's Trunk Road Network. District Class I roads will be candidates for eventual upgrading to the Trunk Road network after which they 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 districts' 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 districts' 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 road (CARs) network comprises an extensive system of low motorized traffic volumes, 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 and 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 the most important CARs and result in development works on these CARs. For complete details of the ADRICS procedure, refer to the District Road Manuals Volume No. Manual B.

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

Table 14.3.4 Design Classes 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		
Class I	> 50	10	70	60	50	6.0-7.4	15-30
Class II	20-50	12	60	50	40	4.5-5.8	15-25
Class 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

14.3.3 Proposed Method of Integrating Existing Two Functional Road Classification Systems for Preparing Road Master Plans for Districts

In a district, there are two types of roads. One type is the national roads under the jurisdiction of MoWT and UNRA. The other type is the district roads and community access roads under the jurisdiction of local governments or the Ministry of Local Government. However, this division into national roads and district roads/community access roads is administrative.

As described in the previous section, there are two different functional road classification systems in Uganda. For rural road network planning for a particular district, it is necessary to utilize both classification systems.

However, in the former Amuru District (currently Amuru District and Nwoya District), there is no designation of any functional classes to either national roads or to district roads. For

example, in former Amuru District, none of the national roads were classified by functional classes (A, B, C, D and E). District roads were not classified into Class I, Class II and Class III Roads either. This situation is similar to that in other districts in the Acholi Sub-region.

In fact, it is not easy to use two different functional classification systems in one district. There is need for further clarification on how the functional classification systems can be used concomitantly.

Since the system of functional road classification is concerned with the traffic function of roads rather than the administrative status of roads, it is necessary to examine the genuine function of all roads in the district by initially disregarding the administrative status of the roads. At this step, we are faced with the difficulty of using two different classification systems. It is necessary to have an integrated system of functional road classification or a method of utilizing the two functional road classification systems in an integrated manner, for rural road network planning for a district.

The Study Team's understanding of the trunk road system is as follows:

- International Trunk Roads, National Trunk Roads and Primary Trunk Roads serve functionally at the national level.

- Other classes of trunk roads including Secondary Roads and Minor Roads serve sub-national traffic, including the traffic at the district level (within the district).

In detail, our proposed method of using both functional classification systems is based on the following understanding:

- National Trunk Roads are regarded as inter-regional trunk roads.

- Primary Roads are regarded as inter-district roads.

- Secondary Roads are regarded as district arterial roads (arterial roads at the district level).

- Minor Roads are regarded as district collector roads (collector roads at the district level).

Table 14.3.5 Proposed Method of Using the Existing Two Systems of Functional Road Classification in an Integrated Manner

	Integrated Method of Using Existing Two Systems of Functional Road Classification	Functional Classification for Rural Roads	Functional Classification for District Roads
A	International Trunk Road	International Trunk Road [A]	
B	Inter-regional Trunk Road	National Trunk Road [B]	
C	Inter-district Road	Primary Road [C]	District Class I Road
D	District-level Arterial Road	Secondary Road [D]	District Class II Road
E	District-level Collector Road	Minor Road [E]	District Class III Road
F	Important Community Access Road		(Important Community Access Roads)
G	Other Community Access Road		(Other Community Access Roads)

Source: JICA Study Team

Table 14.3.6 Major Functions of Functional Road Classes in Integrated Method of Using Existing Two Systems of Functional Road Classification

	Integrated Method of Using Existing Two Systems of Functional Road Classification	Major Function	Rural Road System	District Road System
A	International Trunk Road	High mobility between neighbouring countries and Uganda	[A] International Trunk Road	
B	Inter-regional Trunk Road	High mobility between regional centres	[B] National Trunk Road	
C	Inter-district Road	High mobility between district centres (major routes connecting district centres)	[C] Primary Road	District Class I Road
D	District-level Arterial Road	Relatively high mobility between district centre and other important centres (sub-county centres and other centres, such as major trading centres) within the district	[D] Secondary Road	District Class II Road
E	District-level Collector Road	Moderate mobility between sub-county centres and other centres High accessibility to village centres	[E] Minor Road	District Class III Road
F	Important Community Access Road	Accessibility to village centres		(Important Community Access Roads)
G	Other Community Access Road	Accessibility to local communities		(Other Community Access Roads)

Source: JICA Study Team

Table 14.3.7 Design Classes for Functional Road Classes in Integrated Method of Using the Existing Two Systems of Functional Road Classification

	Integrated Method of Using Existing Two Systems of Functional Road Classification	Trunk Road System	Design Class for Trunk Road System	District Road System	Design Class for District Road System
A	International Trunk Road	International Trunk Road	Ia Paved (W=20.8-24.6m) <12,000-20,000 pcu per day> Ib Paved (W=11.0m) <6,000-10,000 pcu per day> II Paved (W=10.0m) <4,000-8,000 pcu per day> III Paved (W=8.6m) <2,000-6,000 pcu per day>		
B	Inter-regional Trunk Road	National Trunk Road	Ib Paved (W=11.0m) <6,000-10,000 pcu per day> II Paved (W=10.0m) <4,000-8,000 pcu per day> III Paved (W=8.6m) <2,000-6,000 pcu per day> A Gravel (W=10.0m) <4,000-8,000 pcu per day>		
C	Inter-district Trunk Road	Primary Road	II Paved (W=10.0m) <4,000-8,000 pcu per day> III Paved (W=8.6m) <2,000-6,000 pcu per day> A Gravel (W=10.0m) <4,000-8,000 pcu per day>	District Class I Road	(W=9.4m=6+3.4) < >50 pcu/day >
D	District-level Arterial Road	Secondary Road	A Gravel (W=10.0m) <4,000-8,000 pcu per day> B Gravel (W=8.6m) <2,000-6,000 pcu per day> C Gravel (W=6.4m)	District Class II Road	(W=7.8m=5.4+2.4) <20-50 pcu/day>
E	District-level Collector Road	Minor Road	B Gravel (W=8.6m) <2,000-6,000 pcu per day> C Gravel (W=6.4m) D Gravel	District Class III Road	(W=6.5m=4+2.5) < <20 pcu/day >
F	Important Community Access Road			(Important Community Access Roads)	(W=3m)
G	Other Community Access Road			(Other Community Access Roads)	

Source: JICA Study Team

14.4 Proposed Road Networks for Amuru and Nwoya Districts

By using the proposed method of using the existing two systems of functional road classification, and by considering the new district spatial patterns, the JICA Study Team proposed two road network plans for Amuru and Nwoya Districts. One is for the long term (2030) and the other is for the mid term (2018). These road network plans show functional road classes for each case.

- Long-term (year 2030) Road Network with Functional Road Classes for Amuru and Nwoya Districts. See Figure 14.4.1.

- Mid-term (year 2018) Road Network with Functional Road Classes for Amuru and Nwoya Districts. See Figure 14.4.2.

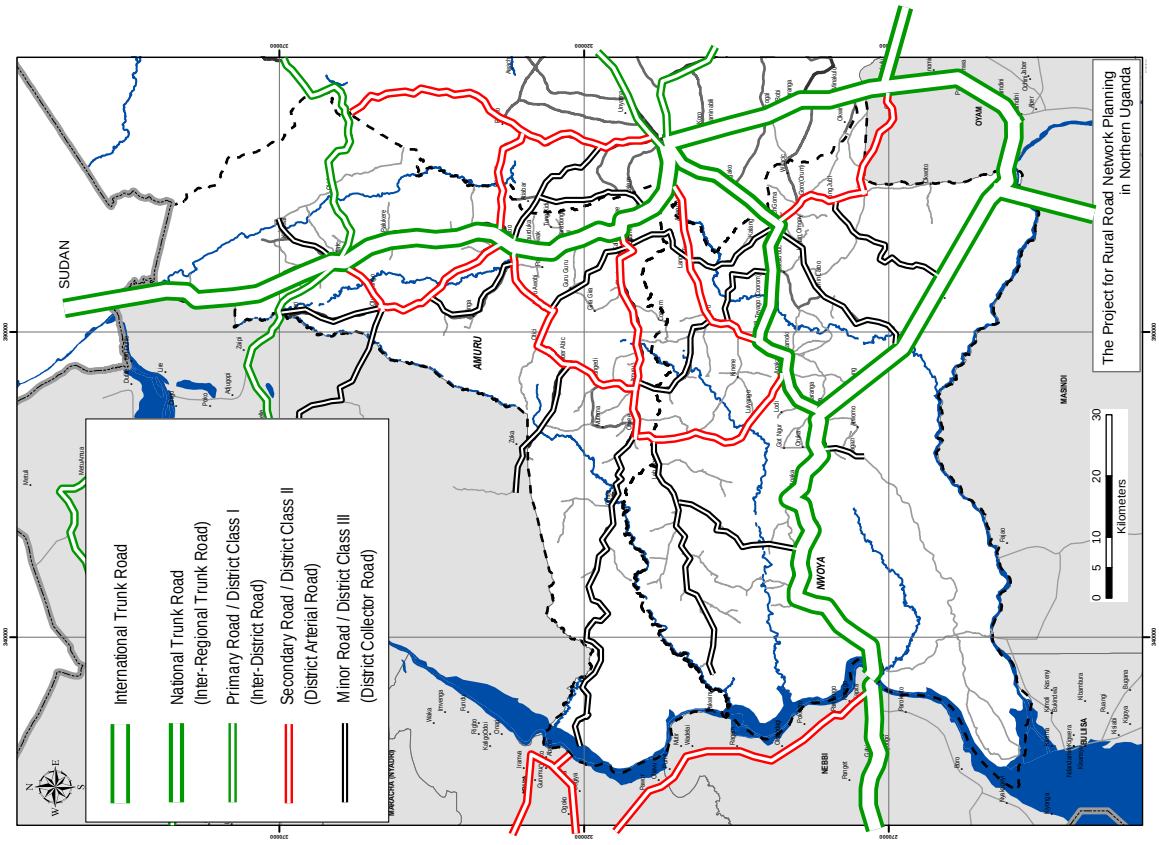
These figures do not show any administrative classifications, such as national and district roads.

On the other hand, Figures 14.4.3 and 14.4.4 clarify the difference between national roads and non-national roads (district roads and community access roads) for the proposed road networks.

Table 14.4.1 Road Length by Functional Class of Road Network Plans for Amuru and Nwoya Districts (Long-term and Mid-term Plans)

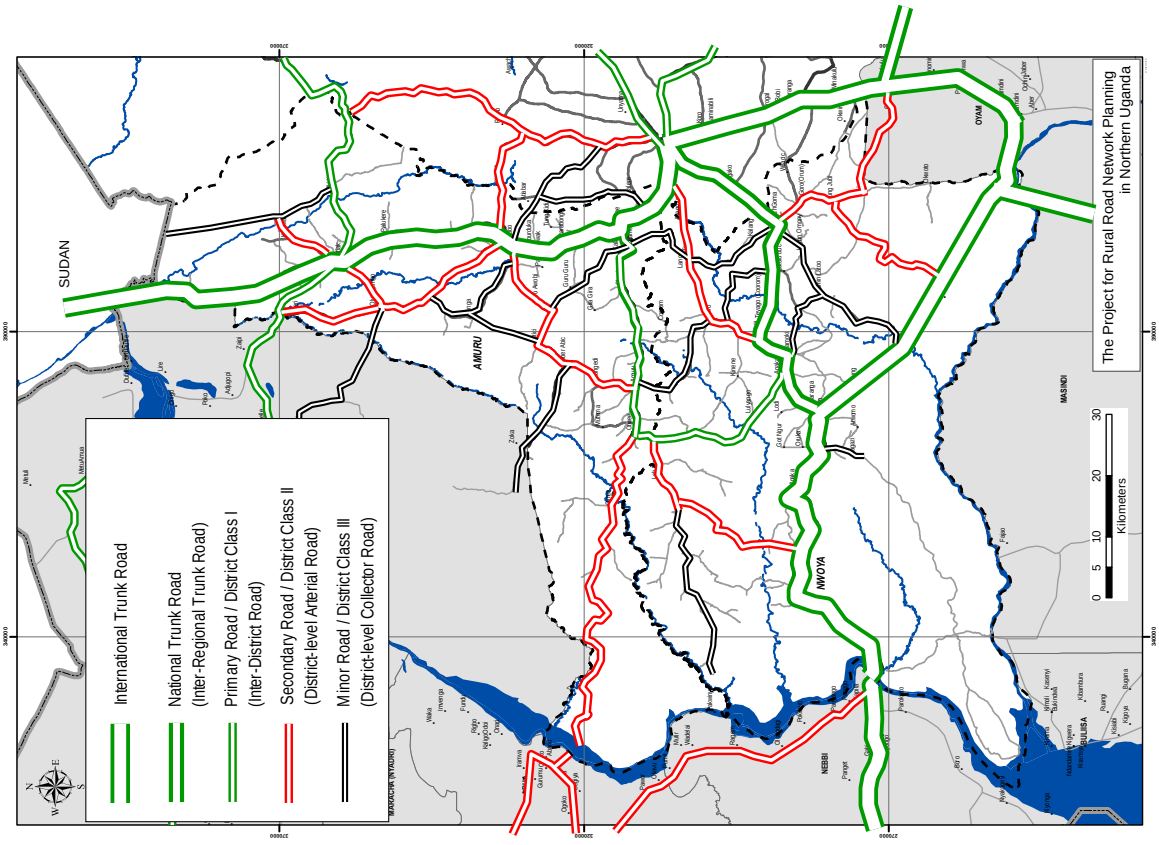
District	Functional Road Classification	Length (km)	
		Mid Term (2018)	Long Term (2030)
Amuru	International Trunk Road	97.5	97.5
	National Trunk Road (Inter-regional Trunk Road)	0.0	0.0
	Primary Road / District Class I Road (Inter-District Road)	41.7	83.7
	Secondary Road / District Class II Road (District-level Arterial Road)	147.4	175.8
	Minor Road / District Class III Road (District-Level Collector Road)	146.6	118.9
	Others	301.1	258.4
	Total	734.2	734.2
Nwoya	International Trunk Road	109.8	109.8
	National Trunk Road (Inter-regional Trunk Road)	42.9	42.9
	Primary Road / District Class I Road (Inter-District Road)	0.0	27.7
	Secondary Road / District Class II Road (District-level Arterial Road)	77.0	113.4
	Minor Road / District Class III Road (District-Level Collector Road)	172.7	143.4
	Others	530.4	495.8
	Total	932.8	932.8

Source: JICA Study Team



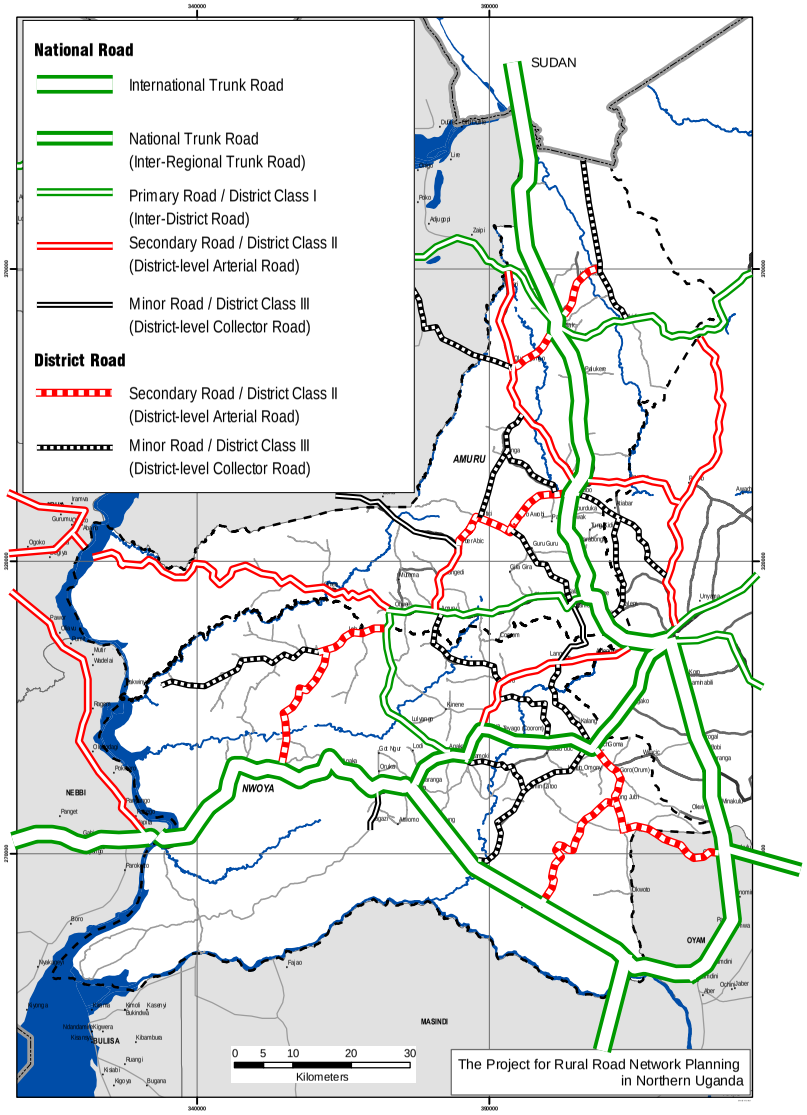
Source: JICA Study Team

Figure 14.4.2 Mid-term (Year 2018) Road Network Plan with Functional Road Classes for Amuru and Nwoya Districts



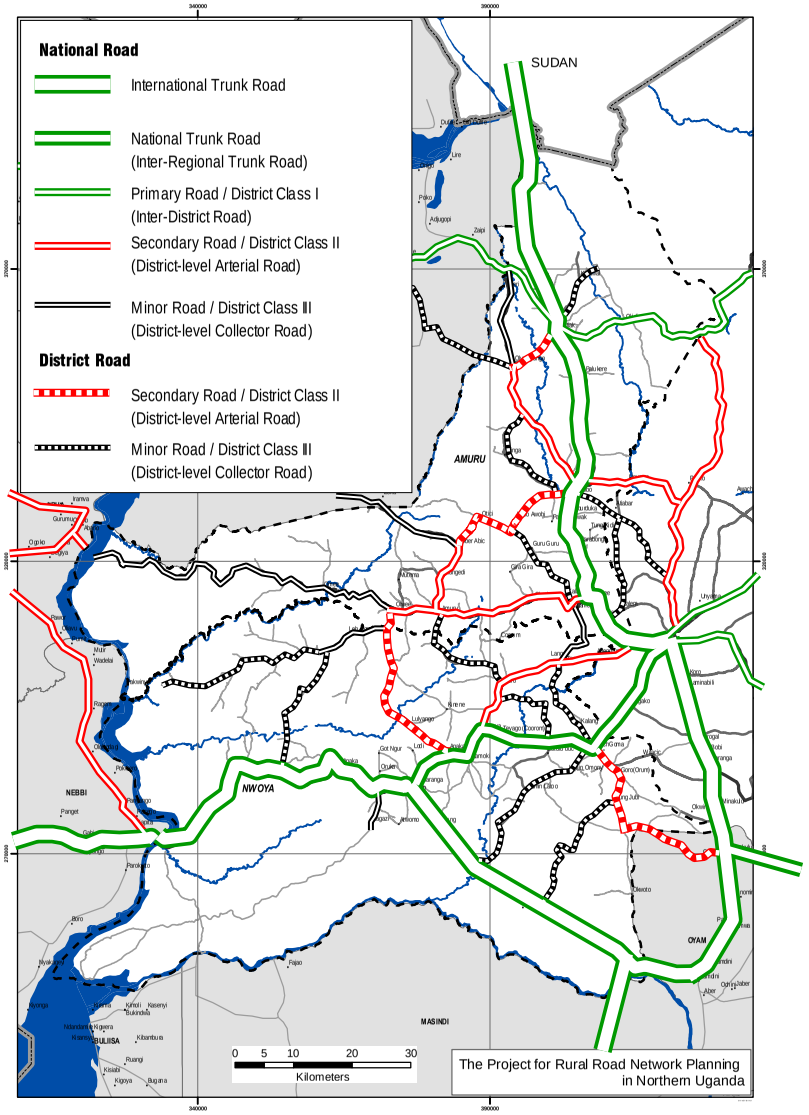
Source: JICA Study Team

Figure 14.4.1 Long-term (Year 2030) Road Network Plan with Functional Road Classes for Amuru and Nwoya Districts



Source: JICA Study Team

Figure 14.4.3 Long-term (Year 2030) Road Network Plan with Functional Road Classes and Administrative Statuses for Amuru and Nwoya Districts



Source: JICA Study Team

Figure 14.4.4 Mid-term (Year 2018) Road Network Plan with Functional Road Classes and Administrative Statuses for Amuru and Nwoya Districts

Table 14.4.2 Road Length by Functional Class and Administrative Status of Road Network Plans for Amuru and Nwoya Districts (Long-term and Mid-term Plans)

District	Functional Road Classification	Mid Term (2018)					Long Term (2030)				
		Length by Administrative Road Classification (km)					Length by Administrative Road Classification (km)				
		National Road	District Road	Community Access Road	Others	Total	National Road	District Road	Community Access Road	Others	Total
Amuru	International Trunk Road	97.5	0.0	0.0	0.0	97.5	97.5	0.0	0.0	0.0	97.5
	National Trunk Road (Inter-regional Trunk Road)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Primary Road / District Class I Road (Inter-District Road)	41.7	0.0	0.0	0.0	41.7	80.2	3.5	0.0	0.0	83.7
	Secondary Road / District Class II Road (District-level Arterial Road)	103.6	42.2	1.7	0.0	147.4	124.4	46.5	4.9	0.0	175.8
	Minor Road / District Class III Road (District-Level Collector Road)	80.3	35.2	31.1	0.0	146.6	20.9	27.4	39.9	30.7	118.9
	Others	0.0	19.8	250.5	30.7	301.1	0.0	19.8	238.5	0.0	258.4
	Total	323.0	97.2	283.3	30.7	734.2	323.0	97.2	283.3	30.7	734.2
Nwoya	International Trunk Road	108.5	0.0	0.0	1.3	109.8	108.5	0.0	0.0	1.3	109.8
	National Trunk Road (Inter-regional Trunk Road)	42.9	0.0	0.0	0.0	42.9	42.9	0.0	0.0	0.0	42.9
	Primary Road / District Class I Road (Inter-District Road)	0.0	0.0	0.0	0.0	0.0	0.0	27.7	0.0	0.0	27.7
	Secondary Road / District Class II Road (District-level Arterial Road)	27.4	38.7	10.9	0.0	77.0	27.4	50.2	35.7	0.0	113.4
	Minor Road / District Class III Road (District-Level Collector Road)	7.0	107.4	58.3	0.0	172.7	7.0	94.3	42.1	0.0	143.4
	Others	0.0	46.9	483.5	0.0	530.4	0.0	20.8	475.0	0.0	495.8
	Total	185.9	193.0	552.7	1.3	932.8	185.9	193.0	552.7	1.3	932.8

Source: JICA Study Team

14.5 Desirable Service Level of Roads in Amuru and Nwoya Districts

(1) Current Service Level of Roads

In order to assess investment costs for achieving the desirable service level of roads, the current service level of roads was examined. This was done using the data from the road inventory, presented in Section 11.1. Figure 14.5.1 shows the Current Service Level of roads. Figure 14.5.2 shows road sections that require embankment works to prevent deterioration of the road surface by rainwater and streams.

Table 14.5.1 Classes for Current Service Level of Roads

Class Code	Earth or Gravel Road	Graded or Not Graded	Road Width
0	Earth Footpath	Not Graded	<1.5 m
1	Earth Road	Not Graded	3.0 m
2	Earth Road	Not Graded	4.5 m
3	Earth Road	Graded	4.5 m
4	Earth Road	Graded	6.0 m
5	Gravel Road	Graded	6.0 m

Source: JICA Study Team

(2) Desirable Service Level of Roads

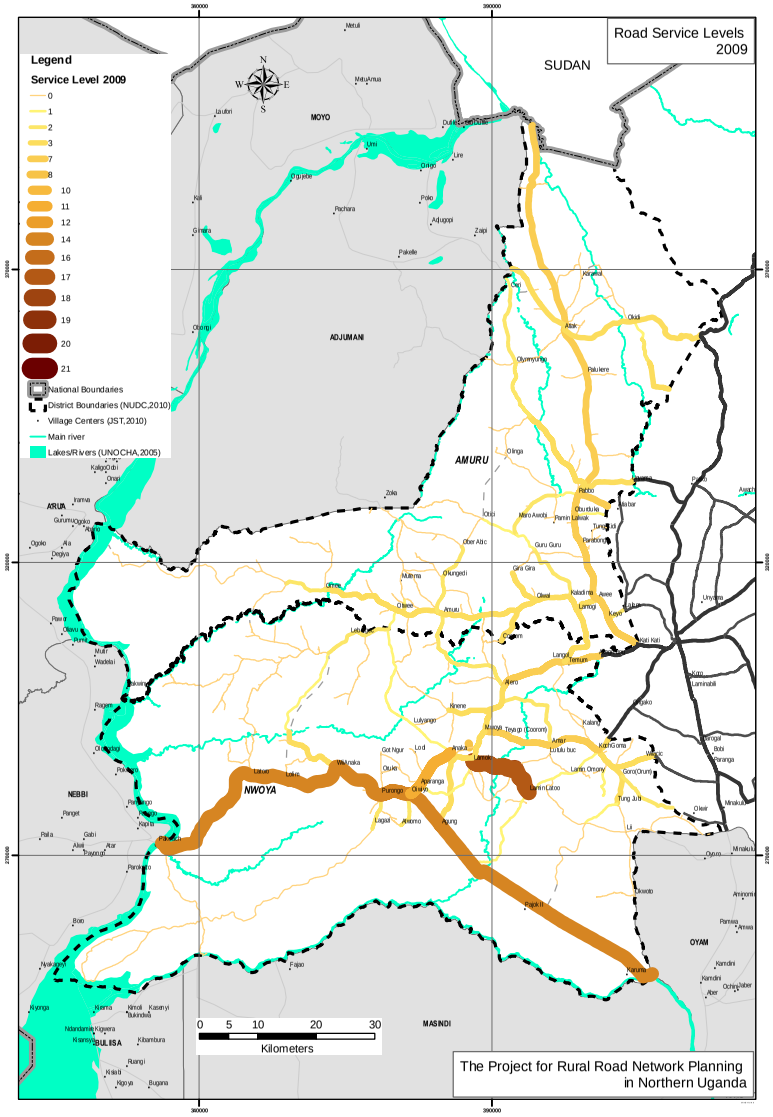
Desirable service levels of roads for years 2018 and 2030 were proposed by using the design standards which are in accordance with the proposed functional classes. Figures 14.5.3 and 14.5.4 show the desirable service levels for the Mid Term (2018) and the Long Term (2030) respectively on maps.

Table 14.5.2 shows a list of service levels of roads which are used for the future road network plans. The class codes in Table 14.5.2 are used to show the service level of roads in the proposed future road network plans.

Table 14.5.2 Classes for Service Level of Roads in the Future Road Network Plans

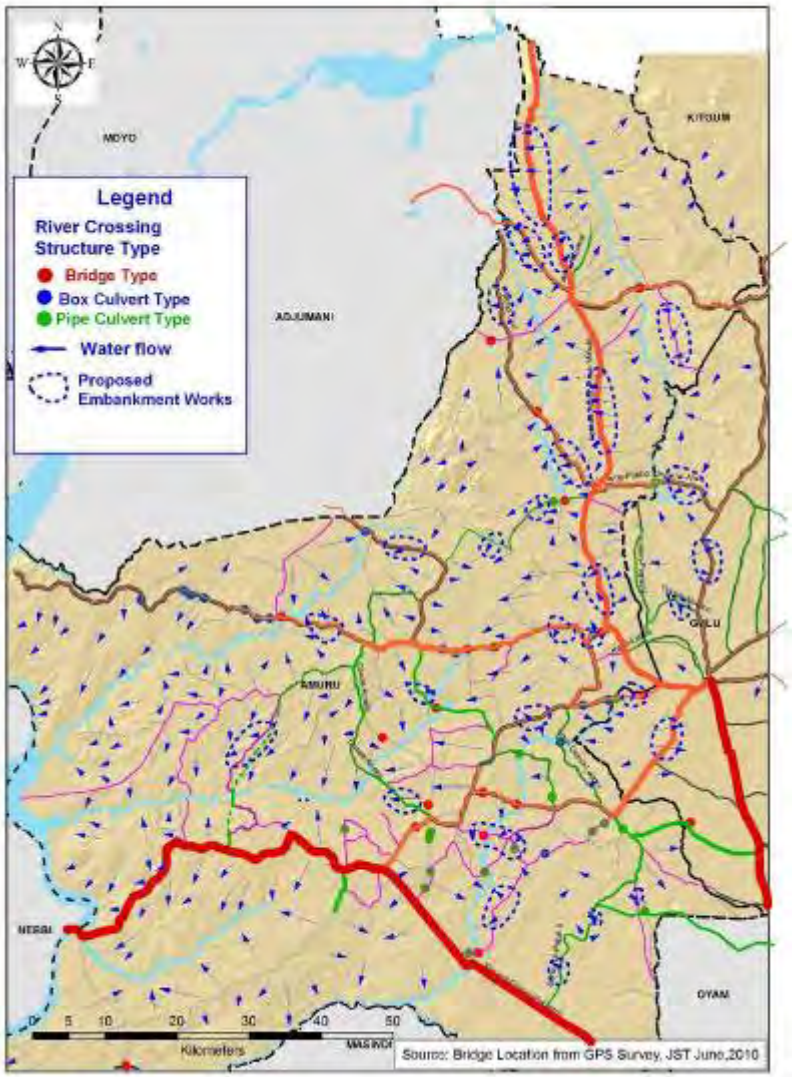
Class Code	Design Class	Road Width	Carriageway Width
6	Community Access Road	3.0m	3.0m
7	District Class III	6.5m	4.0m
8	District Class II	7.8m	5.4m
9	District Class I	9,4m	6.0m
10	C Gravel	6.4m	4.0m
11	B Gravel	8.6m	5.6m
12	A Gravel	10.0m	6.0m
13	III Paved	8.6m	5.6m
14	II Paved	10.0m	6.0m
15	Ib Paved	11.0m	7.0m
16	District Class III in Embankment Sections	Over 6.5m	4.0m
17	District Class II in Embankment Sections	Over 7.8m	5.4m
18	District Class I in Embankment Sections	Over 9,4m	6.0m
19	C Gravel in Embankment Sections	Over 6.4m	4.0m
20	B Gravel in Embankment Sections	Over 8.6m	5.6m
21	A Gravel in Embankment Sections	Over 10.0m	6.0m
22	III Paved in Embankment Sections	Over 8.6m	5.6m
23	II Paved in Embankment Sections	Over 10.0m	6.0m
24	Ib Paved in Embankment Sections	Over 11.0m	7.0m

Source: JICA Study Team



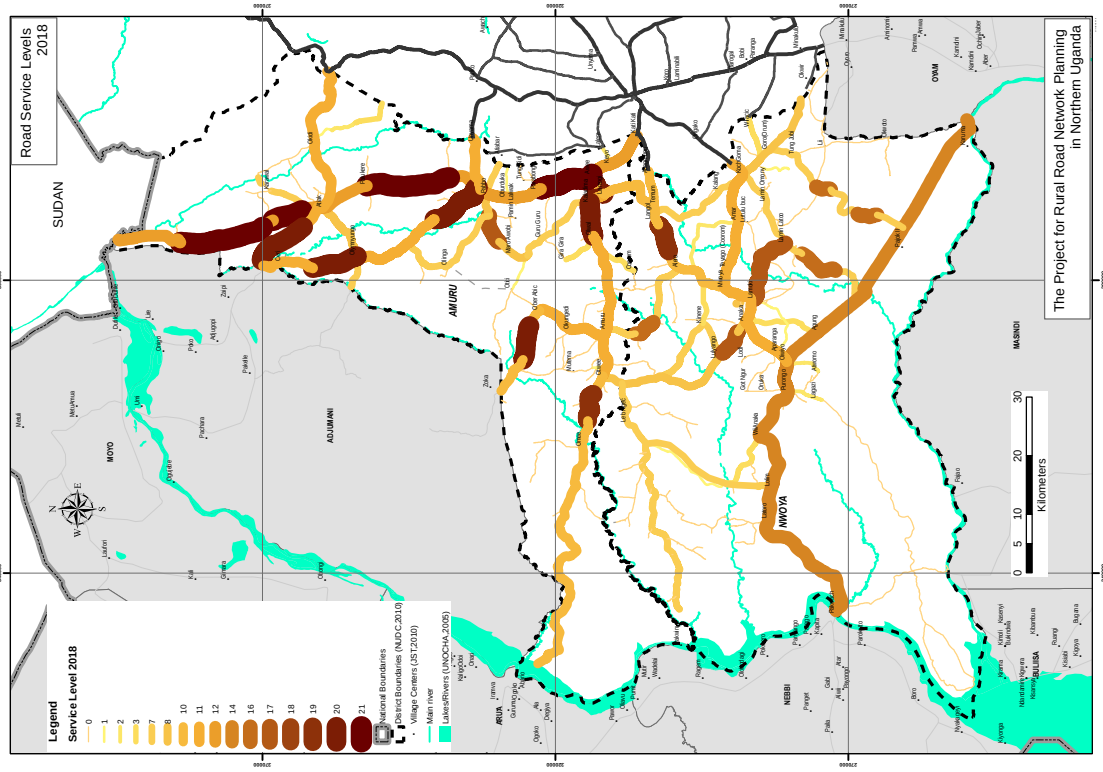
Source: JICA Study Team

Figure 14.5.1 Current Service Level of Roads in Amuru and Nwoya Districts



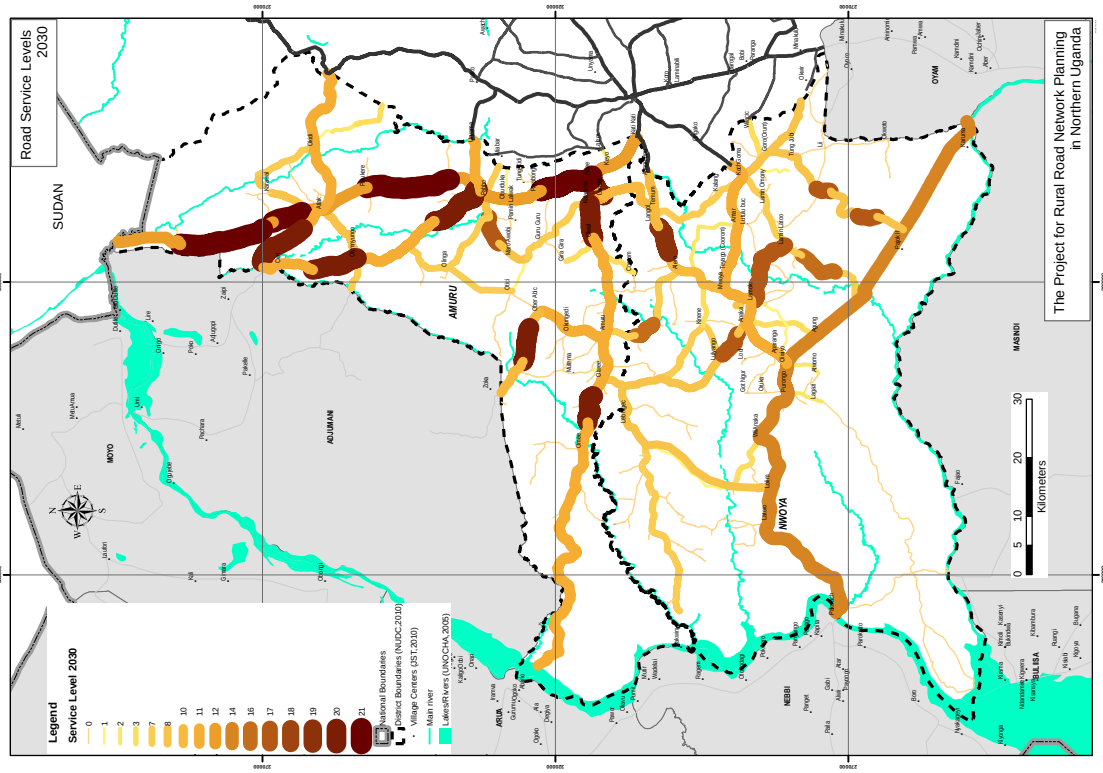
Source: JICA Study Team

Figure 14.5.2 Road Sections Requiring Embankment Works in Amuru and Nwoya Districts



Source: JICA Study Team

Figure 14.5.4 Long-term Future (Year 2030) Desirable Service Level of Roads in Amuru and Nwoya Districts



Source: JICA Study Team

Figure 14.5.3 Mid-term Future (Year 2018) Desirable Service Level of Roads in Amuru and Nwoya Districts

Table 14.5.3 Activities Required for Attaining Different Design Classes

Item	Unit	Service Level / Design Class	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			Existing						CARs	District Road			National Road					
										Typical Section			Typical Section					
			Footpath	0+Widen to 3m	1+Widen to 4.5m	2+Grading	2+Widen to 6.0m	2+Base Course	CARs	District Class III / Important	District Class II	District Class I	National Class C Gravel	National Class B Gravel	National Class A Gravel	National Class III Paved	National Class II Paved	National Class I Paved
General	m	Carriage way	1.50	3.00	4.50	4.50	6.00	4.50	1.50	4.00	5.40	6.00	4.00	5.60	6.00	5.60	6.00	7.00
	m	Shoulder	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.25	1.20	1.70	1.20	1.50	2.00	1.50	2.00	2.00
	m	Total Width without Drainage	1.50	3.00	4.50	4.50	6.00	4.50	2.50	6.50	7.80	9.40	6.40	8.60	10.00	8.60	10.00	11.00
	-	Pavement Type	E	E	E	E	E	G	E	G	G	G	G	G	G	LCS	LCS	LCS
Bush Cutting	sq. m		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Grading	sq. m					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Embankment	cu. m	t=150cm average																
Grass Cutting	cu. m	t=50cm average								✓	✓	✓	✓	✓	✓	✓	✓	✓
Sub-grade	cu. m	t=50cm											✓	✓	✓	✓	✓	✓
Sub-base course	sq. m															✓	✓	✓
Base course	sq. m	t=20cm						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Side ditch	m	Earth Drain							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Crossing Pipe	m									✓	✓	✓	✓	✓	✓	✓	✓	✓
DBST	sq. m															✓	✓	✓
As Concrete	sq. m	t=5cm																
In Direct Cost (%)			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

E: Earth
G: Gravel
LCS: Low Cost road Surfacing

Source: JICA Study Team

Table 14.5.4 Relationship of Road Design Classes and Functional Road Classes

	Functional Classification / Rank	Trunk Road System	District Road System	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
				Existing						CARs	District Road			National Road						District Road			National Road						District Road			National Road					
											Full Improvement			Full Improvement						Rehabilitation			Rehabilitation						Embankment Section			Embankment Section					
				Footpath	0+Widen to 3m	1+Widen to 4.5m	2+Grading	2+Widen to 6.0m	2+Base Course	CARs	District Class III / Important	District Class II	District Class I	National Class C Gravel	National Class B Gravel	National Class A Gravel	National Class III Paved	National Class II Paved	National Class I Paved	District Class III / Important	District Class II	District Class I	National Class C Gravel	National Class B Gravel	National Class A Gravel	National Class III Paved	National Class II Paved	National Class I Paved	District Class III / Important	District Class II	District Class I	National Class C Gravel	National Class B Gravel	National Class A Gravel	National Class III Paved	National Class II Paved	National Class I Paved
A	International Trunk Road	International Trunk Road		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A	N/A				N/A	N/A	N/A	N/A	N/A	N/A			
B	National Trunk Road	National Trunk Road		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A					N/A	N/A	N/A	N/A	N/A					N/A	N/A	N/A	N/A	N/A				
C	Inter-District Trunk Road	Primary Trunk Road	District Road I	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A				N/A	N/A	N/A		N/A	N/A				N/A	N/A		N/A	N/A				N/A
D	District Arterial Road	Secondary Road	District Road II	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A			N/A	N/A	N/A	N/A		N/A	N/A			N/A	N/A	N/A	N/A		N/A	N/A			N/A	N/A
E	District Feeder Road	Minor Road	District Road III	N/A	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A			N/A	N/A	N/A	N/A		N/A	N/A			N/A	N/A	N/A	N/A		N/A	N/A			N/A	N/A	N/A
F	Community Access Road		Community Access Road	N/A	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Existing									N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Carriageway			1.50	3.00	4.50	4.50	6.00	4.50	1.50	4.00	5.40	6.00	4.00	5.60	6.00	5.60	6.00	7.00	4.00	5.40	6.00	4.00	5.60	6.00	5.60	6.00	7.00	4.00	5.40	6.00	4.00	5.60	6.00	5.60	6.00	7.00
	Shoulder			0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.25	1.20	1.70	1.20	1.50	2.00	1.50	2.00	2.00	1.25	1.20	1.70	1.20	1.50	2.00	1.50	2.00	2.00	1.25	1.20	1.70	1.20	1.50	2.00	1.50	2.00	2.00
	Total Width			1.50	3.00	4.50	4.50	6.00	4.50	2.50	6.50	7.80	9.40	6.40	8.60	10.00	8.60	10.00	11.00	6.50	7.80	9.40	6.40	8.60	10.00	8.60	10.00	11.00	6.50	7.80	9.40	6.40	8.60	10.00	8.60	10.00	11.00
	Pavement Type			E	E	E	E	E	G	E	G	G	G	G	G	G	LCS	LCS	LCS	G	G	G	G	G	G	LCS	LCS	LCS	G	G	G	G	G	G	LCS	LCS	LCS

E: Earth
G: Gravel
LCS: Low Cost road Surfacing

1 USD = 1,948 Ushs = 96.7 JPY

General Unit Price	District	15,000 USD/km	=	29.22	Mil. Ushs	=	1,450,500 JPY
(According to Interview)	Nat_Reclassified	17,000 USD/km	=	33.12	Mil. Ushs	=	1,643,900 JPY

Source: JICA Study Team