

JAPAN INTERNATIONAL  
COOPERATION AGENCY (JICA)

PREPARATORY SURVEY  
ON  
TRANS-GAMBIAN CORRIDOR UPGRADING PROJECT  
IN  
THE REPUBLIC OF SENEGAL

Final Report  
(Summary)

MARCH 2011

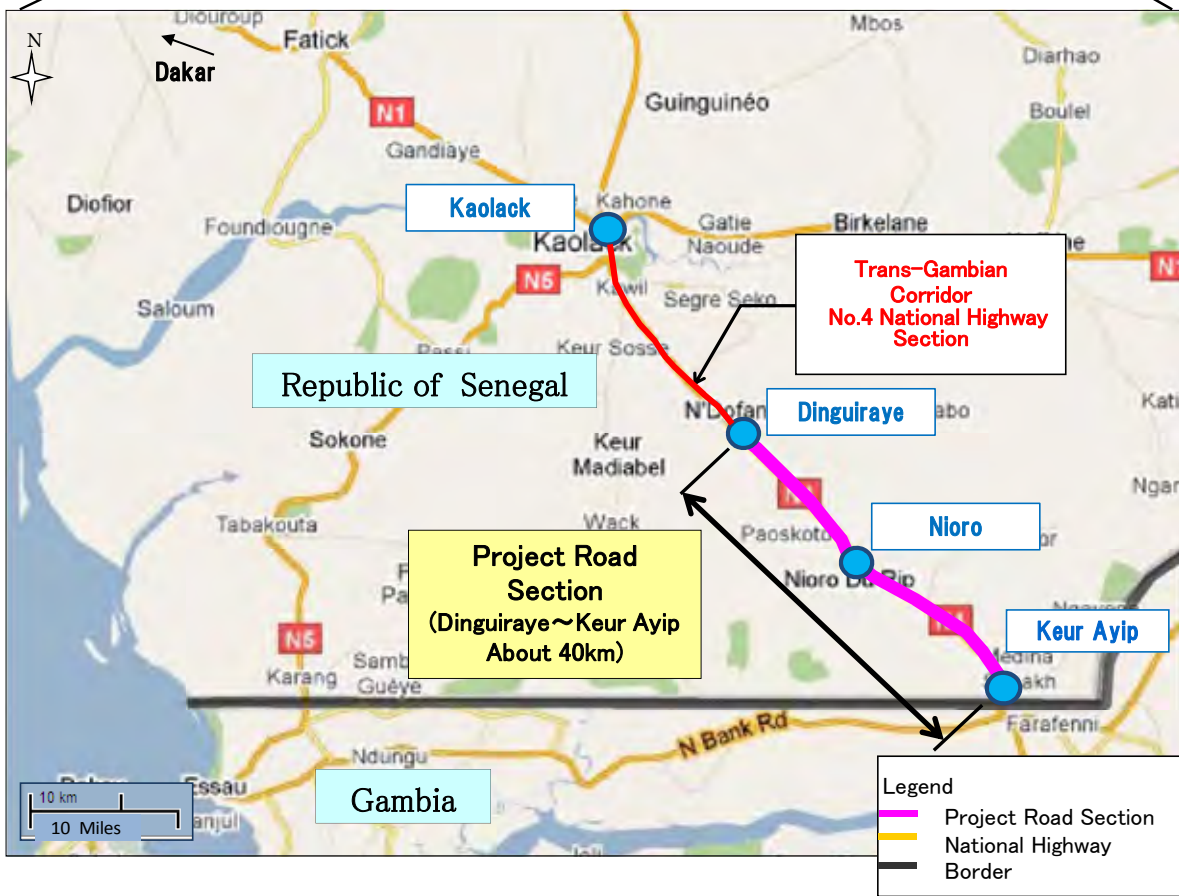
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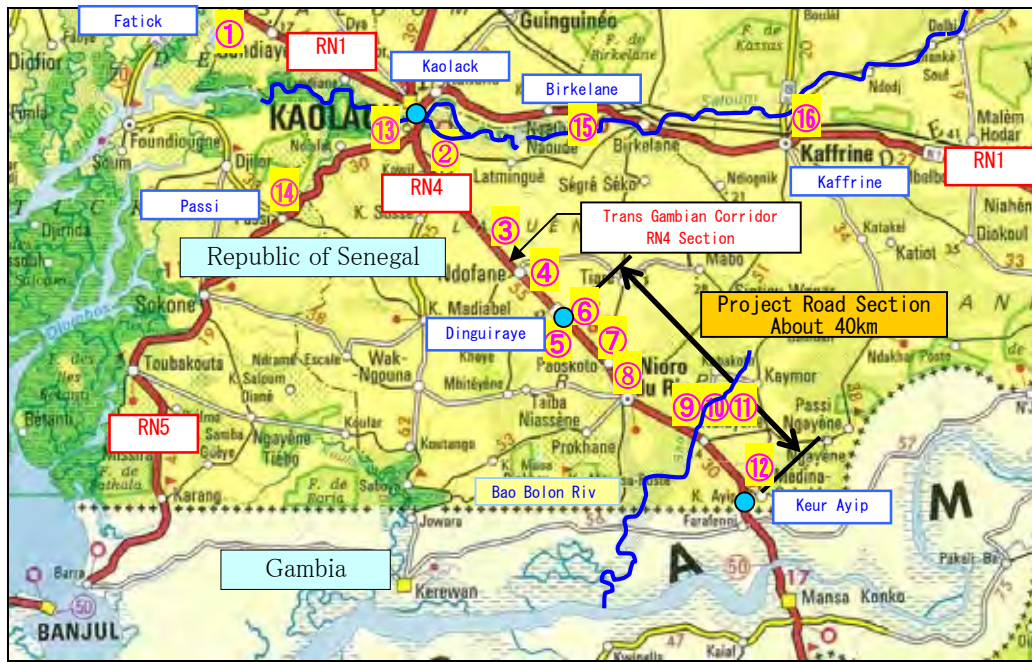
Republic of Senegal

- 1. AREA
- 2. POPULATION
- 3. CAPITAL
- 4. ETHNIES
- 5. LANGUAGES
- 6. RELIGION

197,161km<sup>2</sup> (50% OF JAPAN)  
 12,700,000 INHABITANTS AS FOR 2008 (UNFPA)  
 DAKAR  
 WOLOFS (44%)、PEULS (23%)、SERERES (15%)、OTHERS (18%)  
 FRENCH (OFFICIAL)、ETHNIC LANGUAGES  
 ISLAM (95%)、CHRISTIANITY (5%)



Location Map



①Fatick-Kaolack(RN1)	②Traffic condition in Kaolack	③Kaolack-Dinguiraye(RN4)	④Kaolack-Dinguiraye(RN4)
⑤Dinguiraye-Baobolon River(RN4)	⑥Dinguiraye-Baobolon River(RN4)	⑦Dinguiraye-Baobolon River(RN4)	⑧Dinguiraye-Baobolon River(RN4)
⑨Baobolon Riv. section(18/Sep/2010)	⑩Baobolon Riv. section(26/Nov/2010)	⑪Baobolon Riv. section (26/Nov/2010)	⑫Road condition in Keur Ayip
⑬Kaolack-Passi(RN5)	⑭Kaolack-Passi(RN5)	⑮Kaolack-Birkelane(RN1)	⑯Kaffrine(RN1)

Site Photos (18/Sep/2010, 26,27/Nov/2010)

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## **1. Background of the Project**

### **1-1 Background of the project**

As the importance of the economic integration in Africa is increasingly advocated mainly in relation with the New Partnership for African Development (NEPAD), the Republic of Senegal is in a position to act as an economic and social leader of West African countries. Its capital, Dakar, located in the westernmost part of the African Continent, has been developed into a good harbor city. For Senegal, it is highly important to have an access to inland areas in order to take advantage of its geographic features and further promote ongoing development. Senegal is a country where the road network has been relatively well developed among other West African countries. The network has a total length of 14,600km, while only 29% of roadways have a paved surface. Although the national highway network is a backbone of Senegal's wide area network that connects major domestic cities as well as those of neighbouring countries and has a total length of 3,350km with a pavement ratio of approximately 85%, only 35% of its total length is in good service condition without any hindrance to traffic. Meanwhile, recently in Senegal, the number of motor-vehicles registered has grown at a rate of 5% to 10% per year, which indicates that the movement of both people and goods has been on the rise. The necessity to develop and maintain roadways, particularly for national trunk roadways, has been increasing in order that Senegal economy will be developed in a sustainable manner thus promoting the regional integration in Africa.

The Trans Gambian Highway, a corridor running from Dakar passing the provincial city of Kaolack to a border town near Gambia, Keur Ayip, is an important and strategic road for commercial traffic between Senegal and Gambia. At the same time, the highway has another important role as part of the intraregional transportation network to connect the Senegalese capital of Dakar and Casamance region in southern Senegal behind Gambia.

The Trans Gambian Highway is in good condition with no hindrance to traffic along almost all of its total length as a result of the support provided by the African Development Bank (ADB) and other organizations. Only a section of the highway running about 40km from Dinguiraye to Nioro and to Keur Ayip, however, is heavily damaged. This fact forces traffic on the road to slow down greatly and hence negatively affects the distribution of goods and creates great concerns for the safety of vehicles as well.

### **1-2 General situation in Senegal**

Senegal is located in the west part of the African continent with an area of 197,161Km<sup>2</sup> (half of Japan). Its Population is about 12.7 millions and its GNI per capita was 970US\$ according to the 2008 World Bank report.

Although weather conditions in the northern and southern area are dry, annual rainfall around the estuary of Senegal River is about 500mm and annual rainfall in the southern area is 2000mm.

### **1-3 General situation of Kaolack region**

Kaolack is situated at the center of the peanut basin; it is limited in the north and the west by the region of Fatick, in the east by the new region of Kaffrine, in the northeast by the region of Diourbel and in the south by the Republic of Gambia.

The major industry of Kaolack is the production and processing of peanuts. Moreover, salt industry in the Saloum River is also active. RN1, RN4, and RN5 intersect in Kaolack, and these national roads have not only the function of national major arterial road but they also act as an international arterial road. Moreover, Kaolack has a port, where peanuts are transported.

## **1-4 General situation of the Road Sector in Senegal**

### **1-4-1 Administration and institution of the Road Sector**

AATR, established in 2000, is an organization specialized in the management of the road network. In 2010, AATR changed its name to AGENCE DES TRAVAUX ET DE GESTION DES ROUTES DU SENEGAL (hereinafter referred to as AGEROUTE). It enjoys certain autonomy, including staff and wages, and the right to manage the road network in a scientific and rational manner without undergoing the influence of politics. The maintenance of the road network executed by AATR had to be financed by the income derived from the use of the road, namely the taxes on fuel, and the tax on the possession of car, etc., but since 2008, the tax on fuel was assigned to AATR by the Ministry of Finance after funds had been cashed first by the public treasure; following the government's financial situation, the budget allocated to the maintenance of the road network proved to be insufficient. With the introduction, in 2009, of the "road Fund of the second generation (FERA)", the income derived from the use of the road, namely the tax on fuel collected by the newly established autonomous road maintenance Fund (hereinafter referred to as FERA) as the organization in charge of collecting the tax on fuel, and the resources composed of the traditional government funds enabled AATR to finalize a system for scheduling, constructing, and maintaining road infrastructures. This system benefitted at the time of its introduction of the support of donors, especially the World Bank, EU, and ADB. The establishment of FERA allowed to ensure that the tax on fuel paid by the road users supplies "directly" the road Fund as financial resources assigned to the maintenance of the truck driver network to be implemented by AGEROUTE, without passing by the public treasure with the risk of being diverted to other expenses.

### **1-4-2 Road classification**

The categories of roads in Senegal are following:

- National Road: Roads forming the road structure of the country.
- Regional Road: Roads linking between them the main urban areas
- Department Road: Roads inside one department
- The other road: Roads of access toward the villages in rural areas
- City road: Roads inside cities

Roads are distributed in 5 categories, and there are no categories of roads according to the traffic volume or the purpose of transportation. With the exception of urban road networks, all roads are under the control of AGEROUTE, but those whose maintenance is assured are national roads and regional roads. Road networks in cities are governed by small towns, but rehabilitation works are executed in collaboration with AGEROUTE. In the case of Dakar city, the major roads of the capital city are managed by AGEROUTE.

### **1-4-3 Road network**

Dakar being surrounded by several cities, the demographic density in the region is raised, and the density of the road network is also strong in proportion to the population. However, the planning of the freeway network in the metropolitan region of Dakar does not correspond to the needs, congestions are striking. The demographic density in the zones spreading from the rear country in the border areas with Mauritania, Mali and Guinea is weaker in relation to the coastline region, but the density of roads; there is higher than on the coast.

With regard to Senegalese freeway network, the radial routes leave from Dakar in 3 directions, and these road axes bifurcate in the main provincial urban zones. Besides, the radial roads that bifurcate in



the main provincial urban areas join neighbouring cities.

#### **1-4-4 State of the pavement of roads**

Among national roads, the rate of paved roads reached 85%. However, whereas 35% among them have a pavement in good state, for the remaining 65%, the pavement must be rehabilitated. Therefore, the national roads paved and in a good state are of 29.7%, which is little. Among the regional roads, the rate of paved roads is of 52%, and 34% among them have a pavement in good state. However, in relation with the total of regional roads, the rate of paved roads in good condition are 17.7%, which is even less than that of the national roads. Otherwise, among regional roads, the rate of paved roads is weak with 16%, and 36% among them have a pavement in good condition or 5.6% out of the total. That is, the pavement of roads is in an extremely poor condition on the whole. The traffic on national roads in provinces is weak with less than 500 vehicles per day, but the proportion of heavy goods vehicles, namely trucks, is extremely high. Otherwise, cars used are very old, and judging by road accidents, injuries attributable to the pavement of roads would also go up.

The pavement of roads whose traffic volume per day is lower than 500 vehicles consists of a pavement made of asphalt on a foundation strengthened by a mixture of laterite and cement, and this relatively costly pavement is used on numerous roads. Furthermore, no measure whatsoever to reinforce the pavement in the sections endowed with constructions crossing the roads or with problems of resistance at the level of the foundations has been planned. Therefore, in some sections many potholes are visible, and in certain places, even the initial pavement is missing.

#### **1-5 Development strategy and trend of road in Senegal**

The government of Senegal formulated in 2003 its Document on the Reduction of Poverty (DSRP).

The second Poverty Reduction Strategy Papers (PRSP II: 2006-2010) revised in 2006 has been presented to the boards of directors of IMF and the World Bank who approved it. The Senegalese government formulates its requests for assistance from donors for the development based on this Document. PRSP II focuses on the integration of the economic growth and development, and introduces 4 main axes, which are as follows: 1) wealth creation, 2) basic social services, 3) healthy public management and regional development, and 4) social protection, the prevention and the management of accidents.

Within the government, the Ministry of Economy, the Ministry of Finance and that of Plan and the Ministry of Equipment and Surface Transportat signed the Policy Letter for the Transport Sector (LPST) as the document of general policy for the development of the transportation sector according to PRSP. Considering the situation in which the transportation sector is, the LPST mentions the need to reorganize the institutional and legal framework in transportation, finance, and the public transportation, as well as the training of human resources. Improvements concerning infrastructures and basic social services as well as the action plan are indicated in a concrete manner as measures.

In the road sector, in response to the LPST, a list of 5-year projects within the Program for transportation sector (PST) is being developed under the supervision of the World Bank and other institutions. The third five-year Program (PST III) was worked out in April 2010 and is being currently discussed.

## 2. Circumstances surrounding the Project

### 2-1 Circumstances surrounding the Project Site

Road conditions in the surrounding area are shown in Table-1 below.

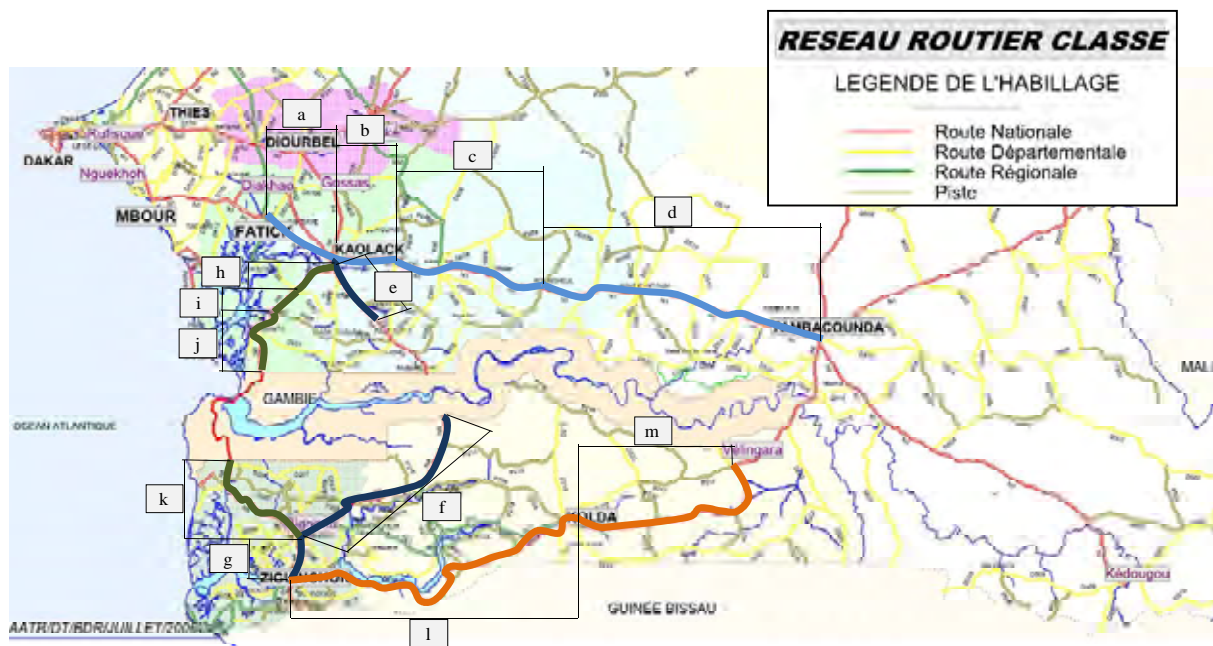
**Table-1 Road Conditions in the surrounding area**

	National Road	Section	Distance (km)	Pavement * <sup>1</sup>	Condition	Donor * <sup>2</sup>	Remarks
a	1	Fatick - Kaolack	42	AC	Deteriorated	AfDB	Completed in 2004
b	1	Kaolack - Birkelane	37	AC	Good	EDF	Completed in 2010
c	1	Birkelane - Kougheul	110	AC	Good	EDF	Completed in 2010
d	1	Kougheul - Tambacounda	127	AC	Good	EDF	Completed in 2010
e	4	Kaolack - Dinduiraye	46	AC	Good	AfDB	Completed in 2010
f	4	Senoba - Bignonal	114	DBST	Deteriorated		Completed in 1998
g	4	Bignona - Ziguinchor	30	DBST			Completed in 1998
h	5	Kaolack – Passi	18	AC	Good	AfDB	Completed in 2010
i	5	Passi - Sokone	24			EDF	
j	5	Sokone - Karang	40			EDF	Completed in 2003
k	5	Seleti - Bignona	70	DBST	Fair	EDF	Completed in 2003
l	6	Ziganchor - Kolda	183	AC	Deteriorated	MCA	Be completed in 2013
m	6	Kolda - Velingara	134	AC		MCA	Be completed in 2013

Source: AGEROUTE

Legend: \*1 AC=Asphalt Concrete, DBST=Double Bituminous Surface Treatment

\*2 ADB=African Development Bank, EDF=European Development Fund,  
MCA=Millenium Challenge Account



Source: AGEROUTE

**Figure-1 The Road Network Neighboring National Road 4**

## 2-2 Issues of the Project Road

### 1) Deterioration on the Surface of the Road

The condition of the section between Kaolack and Dinduiraye is now good due to the project of rehabilitation that was financed by ADB and completed in 2010. However, remaining section between Dinduiraye and Keur Ayip is still deteriorated.

### 2) Baobolong River Section

Baobolong River section was flooded by water level rising and this caused traffic blocking 48hours from 7<sup>th</sup> Oct. 2010 to 8<sup>th</sup> Oct. 2010. According to AGEROUTE Kaolack Office, flood does not occur every year, but the latest one occurred ten years ago.

### 3. Traffic Demand Analysis

#### 3-1 Present Traffic Conditions

##### 3-1-1 Present Traffic Volume

The present average daily traffic of the project road section (Dinguiraye - Nioro du Rip - Keur Ayip; 39km) is estimated with both results of the traffic survey by JICA Survey Team (2010, Nov. and Dec.) and traffic surveys by AGEROUTE (2010). The present traffic volume of the project road is illustrated in the Figure: In this traffic volume, motorcycles/bikes and animal carts are excluded.

-The traffic volume of NR4, at the section near Kaolack counted 3,244 veh./day in 2007. Average annual growth rate (AAGR) between 1996 and 2007 is 3.7%.

-The traffic volume between Dinguiraye and Nioro du Rip counted 850 veh./day in 2010.

-The traffic volume between Nioro du Rip and Grand BaoBôlong counted 938 veh./day in 2010. AAGR is 5.1% after 1996.

-The traffic volume of Grand BaoBôlong - Keur Ayip section counted 473 veh./day in 2010.

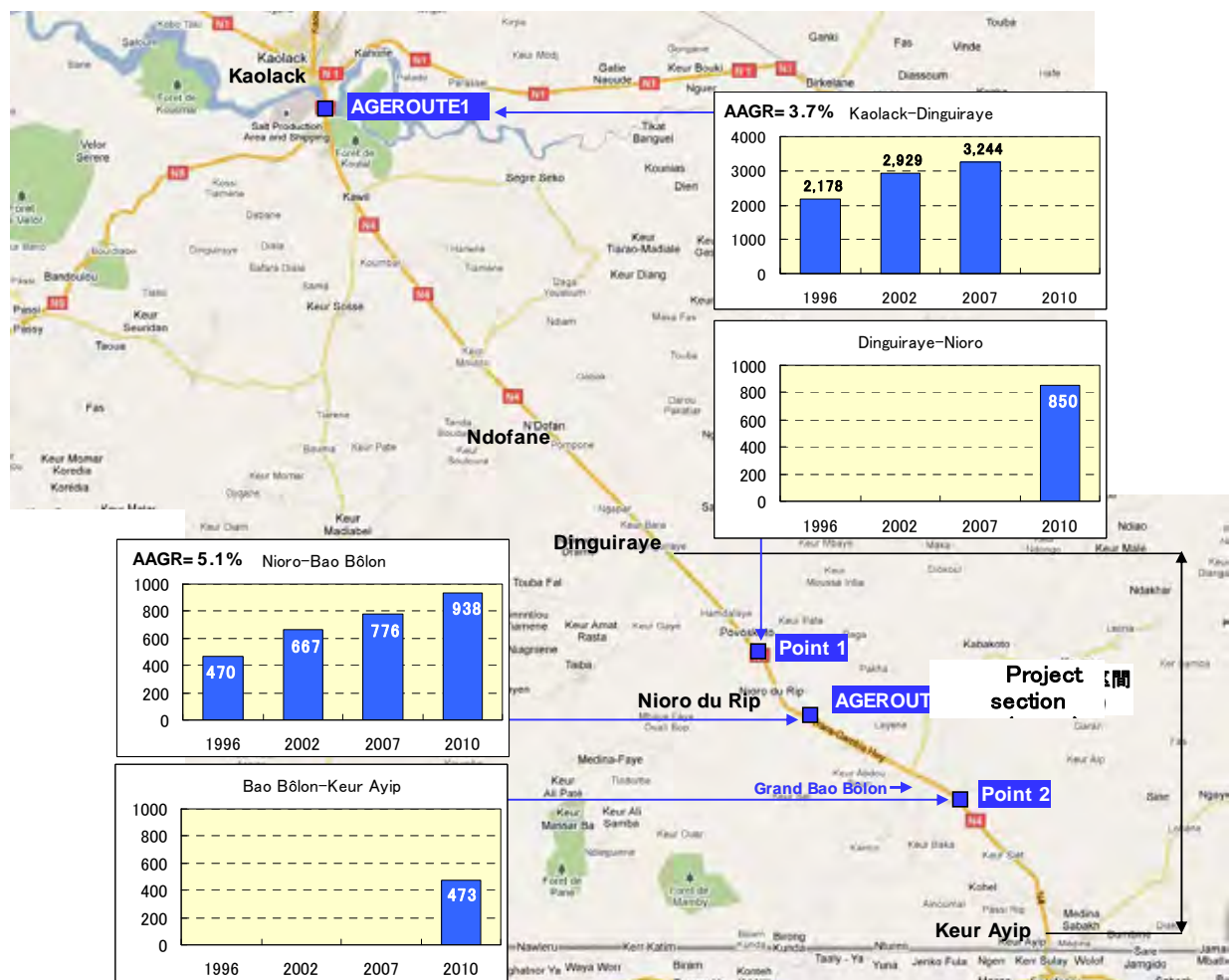


Figure-2 Present Traffic Volume

The average daily traffic of Dinguiraye - Nioro du Rip - Keur Ayip is estimated by the result of traffic survey. The result is obtained by the weighted average based on the distance and traffic volume of each section. As a result, the average daily traffic volume of the project road section is estimated 731veh./day in 2010.

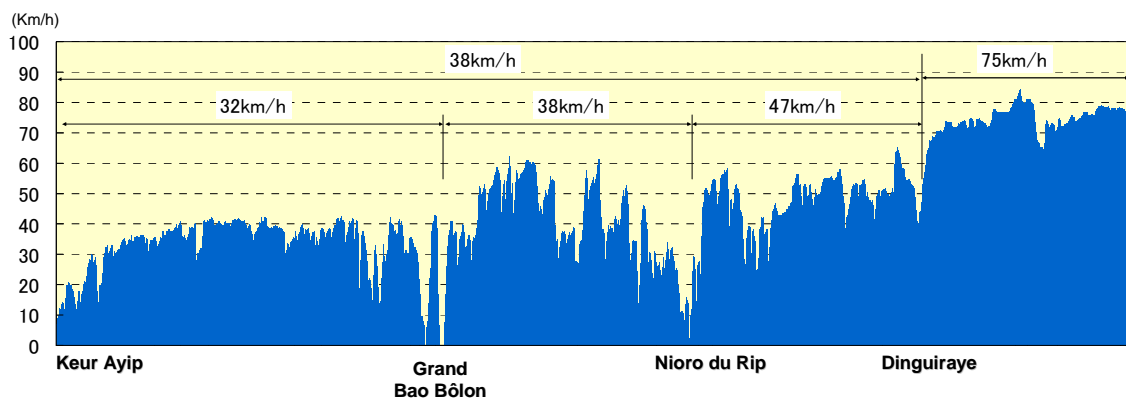
**Table-2 Average Daily Traffic of the Project Road Section (2010)**

Section	Distance (km)	Total	Passenger car		Freight car	
		Traffic Volume	Traffic Volume	Traffic volume X Distance	Traffic Volume	Traffic volume X Distance
Dinguiraye - Nioro	15	850	644	9,653	206	3,090
Nioro - Bao Bolon	10	938	732	7,322	206	2,058
Bao Bolon - Keur Ayip	15	473	344	5,153	130	1,943
<b>Total</b>	<b>40</b>	<b>730</b>	<b>553</b>	<b>22,127</b>	<b>177</b>	<b>7,091</b>

Source: JICA Survey team

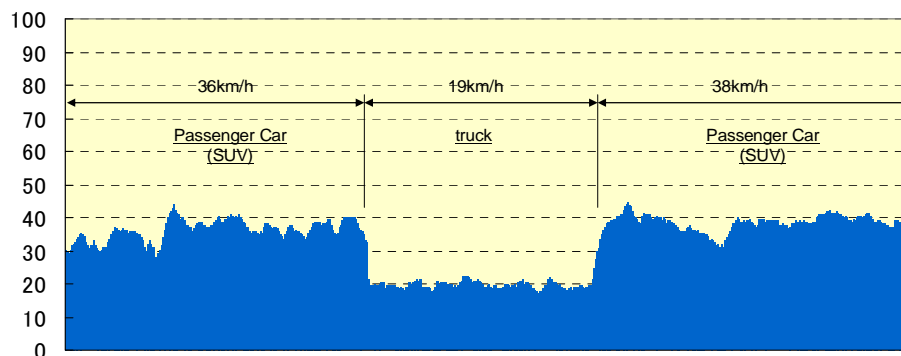
### 3-1-2 Travel speed

The travel speed is observed based on the driver's probe information that has been collected during traffic counting survey by JICA survey team. As a result, the average travel speed is 38km/h along entire the section. Accordingly, total travel time of the project road section (39 km) is estimated about 60 minutes by the result of the travel speed survey.



**Figure-3 Result of Travel Speed Survey (Passenger Car)**

Meanwhile, the travel speed of trucks is controlled at the low-speed of 19km/h even in the section where passenger cars can keep 36-38km/h. It is almost a half level of passenger car.



r). Section of truck; drive followed by surveyer's car. The survey section is about 5km (Keur Ayip to Bao Baôlon River

**Figure-4 Result of the Travel Speed Survey (Truck)**

### 3-2 Trends of Socio-economic Indicators related to Traffic demand

Some trends of socio-economic indicators of Senegal that have rather close relation to traffic demand are compiled. All indices are increasing and this growing tendency will continue in the future.

According to the Government of Senegal, although the projected growth rates in population and GDP are lower than what actual figures show, population will grow at a rate of 2.77% and GDP at 4.15%.

It is expected that the traffic demand will also increase in line with the growth in these indicators. In the following section, analysis is conducted on the relation between these indicators and traffic demand, and the future traffic demand is estimated.

**Table-3 Movements in Socio-economic Indicators**

Population	long term	1976	2008	AAGR	AAGR 2008–2012
		4,958,085	11,841,123	2.76%	
	short term	2,002	2,008	AAGR	2.77%
		9,858,482	11,841,123	3.10%	

GDP	long term	1980	2009	AAGR	AAGR 2008–2015
		1,905	4,746	3.20%	
	short term	2002	2009	AAGR	4.15%
		3,507	4,746	4.42%	

Number of Automobile ownership	long term	1990	2008	AAGR	-
		8,967	293,800	21.39%	
	short term	2002	2008	AAGR	
		138,134	293,800	13.40%	

Number of Automobile ownership par 1000people	long term	1990	2008	AAGR	-
		1	25	18.14%	
	short term	2002	2008	AAGR	
		14	25	9.99%	

Source: Agence Nationale de la Statistique et de la Demographie (ANSD)

Source: Memento des Transports Terrestres du SENEGAL 2009 by DTT, 2010

**3-3 Traffic Demand Analysis in Future**

**3-3-1 Basic idea of the traffic demand forecast**

In the estimate of the traffic demand, following traffic demands are basically assumed. In this preparatory survey, three categories of traffic demands are integrated, and the future traffic demand in the project road section will be assumed.

(1) Natural growth of traffic demand

This is a traffic demand actualized in accordance with population and economic growths. The main part of the traffic demand is occupied.

(2) Detoured traffic demands

Diverted traffic from other routes to the project route by road condition's improvement.

(3) Developed and generated traffic demands

This is a new traffic demand caused by development of the region/area or new facilities. In other words, this is a new traffic demand caused by decreased transport costs after road improvement.

Moreover, there is a possibility of traffic demands by the conversion of the traffic mode from nonmotorized, but it is not considered in this preparatory survey.

**3-3-2 Traffic Demand Analysis in Future**

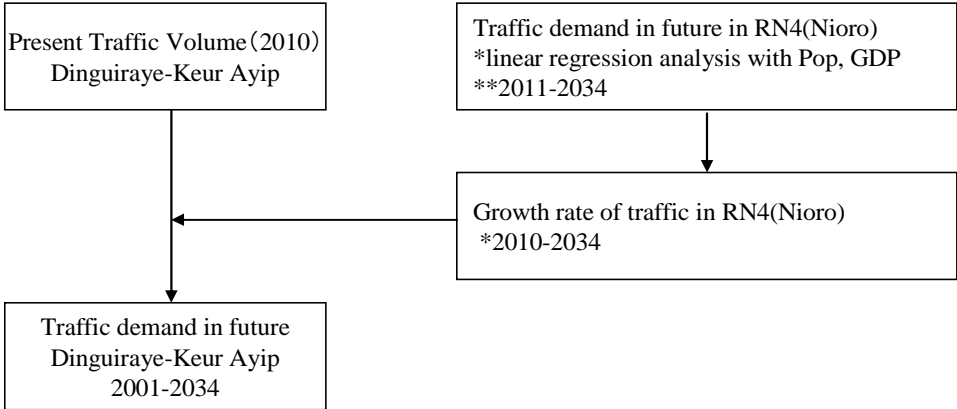
(1) Natural growth traffic demands

1) Basic idea

The growth of population, growth of GDP and growth of car ownership are indicators related to traffic growth. First of all, the relation between the indicators and traffic volume is clarified, and then the natural growth rate is analyzed. The analysis flow is shown below.

Traffic demand is expected to increase in line with population growth and economic development in the benefiting area of the target road. According to the results of the OD survey, the benefiting area covers a wide scope that includes the regions of Kaolack, Dakar, Fatick and Ziguinchor, etc. Accordingly, traffic demand in the target area is expected to continue increasing from now in line with population growth and economic growth in Senegal.

In this preparatory survey, the relation between traffic increase and indicators that have an impact on traffic volume, i.e. population, GDP and car ownership, is clarified and the future traffic demand is analyzed. Moreover, in forecasting the traffic demand, other indicators are thought to have an impact, however, it was decided to use those three indicators for which data could be obtained.



**Figure-5 Flowchart, Natural Growth Traffic Demand Analysis**

Natural traffic demands and average annual growth rates (AAGR) for NR4 (Nioro) were calculated based on the above-mentioned forecasting model. The result is as follows:

**Table-4 Natural Traffic Demand and AAGR of NR4 (Nioro)**

year	Passenger car		Freight car		Total	
	Traffic Volume	AAGR	Traffic Volume	AAGR	Traffic Volume	AAGR
2010	709	-	209	-	918	-
2014	821	3.75%	265	6.12%	1,086	4.30%
2023	1,103	3.33%	422	5.30%	1,525	3.84%
2033	1,402	2.43%	561	2.90%	1,963	2.56%

4) Natural growth of the traffic demand in the section: Dinguiraye - Keur Ayip

The natural growth of the traffic demand in the section of Dinguiraye-Keur Ayip is calculated by multiplying AAGR of NR4 (Nioro) by the average daily traffic between Dinguiraye-Keur Ayip in 2010. The result is as follows.

**Table-5 Natural Growth Traffic Demand (AAGR) of Section: Dinguiraye-Keur Ayip**

year	Passenger car		Freight car		Total	
	Traffic Volume	AAGR	Traffic Volume	AAGR	Traffic Volume	AAGR
2010	553	-	177	-	730	-
2014	641	3.75%	226	6.30%	867	4.39%
2023	860	3.33%	360	5.31%	1,220	3.87%
2033	1,093	2.43%	480	2.92%	1,573	2.57%

(2) Detoured traffic demands

There are two routes from Kaolack to the southern area of Senegal out of NR4 Trans-Gambian Corridor. They are the competitive routes of NR4.

-NR5 route (Kaolack – Banjul - Ziguinchor)

-NR1 and NR6 route (Kaolack – Tambacounda - Ziguinchor)

According to the comparison of each distance, NR4 route is the shortest route compared with NR5 and NR1-NR6 route.

In the result of the roadside OD interview survey, there is no user of NR5 from Kaolack towards the southern area of Senegal. Therefore, the detoured traffic demand from NR5 is not expected even with the road improvement project.

**Table-6 Comparisons of the Distance in Competitive Routes between Kaolack-Ziguinchor**

		NR5	NR4	NR1-NR6
Road Distance	km	262	251	687
Time Distance	min	314	301	824
Time of ferry	min	30	10	—

\*Road distances are measured by map

(3) Developed and generated traffic demands

Developed and induced traffic demands were calculated using the following formula which indicates the relation between the ratio of running expenses before and after road development. This approach is mainly used in examination of other roads in Senegal and has thus been adopted in this study.



$$\frac{\Delta T}{T} = \left( \frac{\Delta C}{C} \right)^\alpha$$

$T$  = the traffic volume in the situation without case,

$C$  = VOC without case,

$\Delta C$  = the achieved economy on the operational costs of the vehicles,

$(\alpha)$  = the modulus of elasticity of the traffic demand,

$\Delta T$  = traffic demand developments.

**Table-7 Results of Estimated Developed/Induced Traffic**

	Passenger car	Bus	Truck (2axle)	Truck (more than 3axle)	Trailer	Total
VOC without case (FCFA/ km)	277.91	324.19	698.46	1,171.75	2,019.85	—
VOC with case (FCFA/ km)	190.70	253.72	548.87	920.70	1,582.91	—
Parameter ( $\alpha$ )	0.75	0.75	0.75	0.75	0.75	—
Natural growth traffic demand (2014)	514	127	60	66	100	867
Development and cause traffic demand (2014)	216	40	19	21	32	327

Source: AGEROUTE and JICA Survey team

#### (4) Developed traffic demand by Gambian River Bridge

In the study entitled 'Pont sur la Gambie Rapport final' by the Organisation pour la Mise en valeur du Fleuve Gambie (O.M.V.G) in 2010, the detoured traffic demands through Tambacounda were added as developed traffic.

The traffic volume is 64veh./day, about 40 percent of the total of the NR6-NR1 detoured traffic (159veh./day).

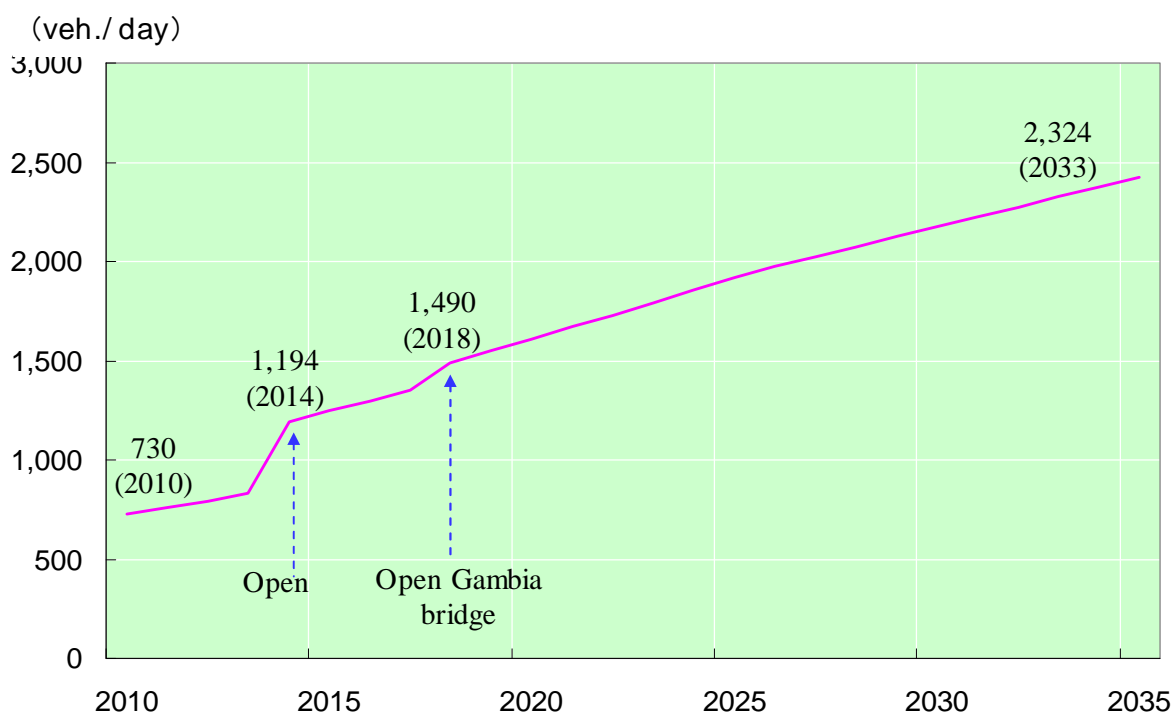
It is analyzed in this study that a lot of vehicles may avoid the loss of time crossing the Gambia River by ferry and the payment of some unforeseen traffic fee.

Moreover, it is clarified that 10% of the traffic makes a detour to NR1 and NR6 to avoid the Gambia River in the OD survey result which AGEROUTE executed in 2005. And this traffic volume was about 100veh./day in 2004.

In this preparatory survey, the traffic volume of 64veh./day (in 2010) is expected as developed traffic with the Gambia River bridge construction.

### 3-3-3 The future traffic demands

The traffic demand for the section Dinguiraye - Keur Ayip in the future is summarized as follows. The traffic demand in the future is assumed in total based on the natural growth traffic demand and the development and the cause of traffic demand. It is estimated to be 2,324 veh./day in 2033.



**Figure-6 Future Trends of Traffic Demand for the Section; Dinguiraye-Keur Ayip**

Source: JICA Survey team

**Table-8 Estimated Future Traffic Demands for Section; Dinguiraye-Keur Ayip**

year	2010	2014	2018	2023	2028	2033
Natural growth traffic volume	730	867	1,016	1,220	1,409	1,573
Development and cause traffic volume	-	327	386	470	545	609
Traffic volume by Gambian river bridge	-	-	88	103	121	142
Total	730	1,194	1,490	1,793	2,075	2,324
Remarks	Bench mark	Open of Dinguiraye-Keur Ayip	Open Gambian river bridge	10years after open	15years after open	20years after open

Source: JICA Survey team

### 3-4 Check to the study of AGEROUTE and Point

Checked Item	Study of AGEROUTE <Etudes Economiques de la rehabilitation des troncons routiers Nioro-Keur Ayip(RN4)>	Point and suggestion by JICA survey team
Present Traffic Volume (2010)	Basic data of traffic volume use only one survey result at Nioro in 2007.	Average data of three points should be applied. One point by
	Traffic volume in 2010 is the forecast estimated by the traffic volume in 2007 and by the annual growth rate (passenger car 4.5% and freight car 4.2%).	AGEROUTE in 2010, Two points by JICA survey team in 2010. Average daily traffic is calculated by the weighted average of traffic and of section distance.
	914 veh./day (2010).	730 veh./day (2010).
Future traffic demand	Traffic demand in the future is calculated by multiplying the AAGR and the average daily traffic of 2010.	Ditto
Natural growth traffic demand	Growth rate according to the type of car.	Ditto
	A different growth rate is set in 'the with case' or 'the without case'.	The same growth rate should be set in 'the with case' or 'the without case'. The impact by the project should consider it as a development traffic demand.
	Growth rate of passenger car: Calculation from the population growth rate 2.7% and from income growth rate 2% of 2002-2007. AAGR (2010-2033) is 4.8% or 5.8% or 6.4% by the three hypotheses.	Growth rate is calculated by applying the linear regression analysis of population of the whole country in Senegal. AAGR (2010-2033) is 3.0%.
	Growth rate of freight: Calculation from GDP growth rate 4.2% of 2001-2008. AAGR of 2010-2035 is 4.2% or 6.3% or 7.6% by the three hypotheses.	Growth rate is calculated by applying the linear regression analysis of GDP of the whole country in Senegal. AAGR (2010-2033) is 4.4%.
Developed and induced traffic demand	It is calculated from the difference of the ratio of the Vehicle Operation Cost before and after the road project 441 veh./day in 2010.	It is calculated from the difference of the ratio of the Vehicle Operation Cost before and after the road project 338 veh./day in 2010.
Detoured traffic demand	N.A.	There is no detoured traffic demand from the NR5.
Developed traffic demand by Gambian River Bridge	N.A.	Developed traffic is estimated 64 veh./day in 2010. It is based on the study by O.M.V.G.
Opening year	2015	2014
Estimate period	20 years (2013-2033)	20 years (2014-2033)
Future traffic	4,081 veh./day (2033) Less realistic 3,291 veh./day (2033) Less pessimistic	2,324 veh./day (2033)

## 4. Project Plan

### 4-1 Present Overall Plan

The table below shows a summary of the Project whose Technical Study was carried out in April 2010.

**Table-9 Summary of the Project**

Item	Content
Length of Section	38.643km
Pavement Structure	Asphalt Concrete : 5cm (carriageway)
	Single Bituminous Surface Treatment : SBST(Shoulder)
	Base course 20cm (Laterite stabilized by Cement)
	Sub Base 20cm (Laterite stabilized by Cement)
Carriageway	10.2m (Carriageway 3.60m×2, Shoulder 1.5m×2) except Baobolong Section
	9.0m (Carriageway 3.00m×2, Shoulder 1.5m×2) for Baobolong Section
Road Drainage	Box Culvert 26 places (Total number of Existing Culvert 36) (Type 2000mm×1000mm, 4000mm×2000mm, 5000mm×3000mm)
Road Furniture	Lane marking, Crosswalk, Girdpost, Traffic Sign, Bus bay
Weigh bridge	Installation of Facilities

Source: 2010 Technical Survey (AGEROUTE)

### 4-2 Confirmation and Point of Review

#### 4-2-1 Confirmation of Pavement Structure

The pavement structure in the project is the general structure in Senegal. Aggregate is used as base course in other Countries, however aggregate for base course is not general since the existing quarries are situated far from the project area, thus long distance transport affects the project cost.

In addition, the pavement design standards are applied to the French pavement design, so that for comparison purpose, the pavement structure is examined by AASHTO Pavement design method which is applied generally in Africa. As a result of examination, this pavement structure is appropriate.

#### 4-2-2 Section of Baobolong River

##### (1) Actual Condition

Pavement works will be carried out only in the section of Baobolong River crossing (length 1.173km) for the project plan. However, as results of site visits, it was confirmed that the traffic was blocked for approximately 48 hours (from 7th October 2010 to 8th October 2010) due to flood caused by the rise of river water levels. According to Kaolack AGEROUTE Office, top of embankment was heightened 40cm with filling laterite material stabilized by cement. Taking into account the above situation, it is necessary to review the current design criteria in this section.



Before height of embankment 16<sup>th</sup> Sep. 2010



After height of embankment 26<sup>th</sup> Nov. 2010

(2) Measures to be proposed

Following measures are proposed for the Section of Baobolong river crossing.

- Pavement works shall be carried out based on the level of heightened embankment.
- Same width of carriageway and shoulder in accordance with ECOWAS shall be applied for other section. And the width of carriageway was considered based on the safety of pedestrian engaged in fishery and the secure visibility of traffic
- Existing cross culverts shall be replaced by new box culverts whose water flow capacity is more than the existing one.
- Slope protection for embankment such as gabion with mortar.

**4-3 Summary of the Proposed Project**

The proposed project contents and type of road crossing drainage are shown in Table below.

**Table-10 Summary of the Proposed Project**

Item	Content
Length of Section	38.643km
Pavement Structure	Asphalt Concrete : 5cm (carriageway)
	Single Bituminous Surface Treatment : SBST(Shoulder)
	Base course 20cm (Laterite stabilized by Cement)
	Sub Base 20cm (Laterite stabilized by Cement)
Carriageway	10.2m (Carriageway 3.60m×2, Shoulder1.5m×2) All Section
Slope Protection	Baobolong River Section 1.173km Masonry with mortar
Road Drainage	Box Culverts in 35 places (Total number of Existing Culverts 36) 2 cell Box Culverts 2000mm×1000mm 2 cell Box Culverts 4000mm×2000mm 2 cell Box Culvert 5000mm×3000mm
Road Furniture	Lane marking, Crosswalk, Guirdpost, Traffic Sign, Bus bay
Weigh bridge	Installation of Facilities

Source:2010 Technical Survey (AGEROUTE)

#### 4-4 Summary of the Modification in the Survey

The summary of the modification in this survey is shown in table below.

No.	Items	2010 Technical Survey (by AGEROUTE)	Modification and Suggestion by JICA Survey Team
1	Finish Level of the pavement in the section across Baobolong River	Finish level will be 25cm higher than the existing ground level. (before embankment by AGEROUTE in Oct.2010.)	Finish level will be 65cm higher than the existing ground level. (before embankment by AGEROUTE in Oct.2010.)
2	Road width in the section across Baobolong River	Road width : 9.0m (Carriageway 3.0m×2+Shoulder 1.5m×2)	Road width : 10.2m (Carriageway 3.6m×2+Shoulder 1.5m×2)
3	Drainage structures in the section across Baobolong River	The existing structures will be extended about 2m in combination with the widening of road.	After demolishing the existing structures, New box culverts will be constructed .
4	Slope in the section across Baobolong River	Slope gradient will be about 1:1.2 (same as the existing one).	Slope gradient will be about 1:2.0 for stability of the road structures, and the slope will be protected by concrete to prevent erosion.
5	Cost Estimation	<ul style="list-style-type: none"> <li>• BOQ does not include an item of SBST paving on the shoulder.</li> <li>• The project length in the estimation is different from the actual length.</li> </ul>	<ul style="list-style-type: none"> <li>• SBST is added in the estimation.</li> <li>• The volume of each item is recalculated by the actual length.</li> <li>• The modified plans of above mentioned drainage structures and slope are reflected to the cost estimation.</li> </ul>

Source: JICA Survey team







**Table-11 Breakdown of Cost for Consulting Services**

<b>A. Foreign Currency Portion</b>					
	Unit	Quantity	Rate(Yen)	Amount(Yen)	FCFA equiv.
1. Remuneration					
Expatriates	MM	72	2,630,000	189,360,000	1,113,882,353
Sub-Total				189,360,000	1,113,882,353
2. Direct Cost					
International Travel	R.T	8	500,000	4,000,000	23,529,412
International Communication	month	21	20,000	420,000	2,470,588
Sub-Total				4,420,000	26,000,000
Total				193,780,000	1,139,882,353
<b>B. Local Currency Portion</b>					
	Unit	Quantity	Rate(Yen)	Amount(Yen)	FCFA equiv.
1. Remuneration					
Enginners	MM	43	877,000	37,711,000	221,829,412
Training Engineer(AGEROUTE)	MM	20	68,000	1,360,000	8,000,000
Technicians	MM	34	59,500	2,023,000	11,900,000
Other Supporting Staff	MM	17	34,000	578,000	3,400,000
Sub-Total				41,672,000	245,129,412
2. Direct Cost					
Living allowance	month	135	25,500	3,442,500	20,250,000
Office Rental in Dakar	month	21	85,000	1,785,000	10,500,000
Office Rental in Kaolack	month	21	51,000	1,071,000	6,300,000
Office Operation	month	21	25,500	535,500	3,150,000
Office equipment	L.S.	1	850,000	850,000	5,000,000
Domestic communication	month	21	170,000	3,570,000	21,000,000
Reporting & Documentation	month	21	12,750	267,750	1,575,000
Transportation	month	21	450,000	9,450,000	55,588,235
Sub-Total				20,971,750	123,363,235
Total				62,643,750	368,492,647

## 7. Project Cost

### 7-1 Summary of Project Costs

The project cost consists of (A) Civil works, (B) Price Escalation, (C) Physical Contingency, (D) Environmental Consideration, (E) Consulting Services, (F) Administration Costs and (G) Land Acquisition.

The total cost of the project (including VAT) is estimated to have Foreign Currency portion of 311 million Yen and Local Currency portion of 15,068 million FCFA for a grand total equivalent to 2,872 million Yen as summarized below in Table-12.

**Table-12 Summary of Project Cost**

Items	Foreign Currency Portion(Yen)	Local Currency Portion(FCFA)		Total	
				(eq.Yen)	(eq.FCFA)
(A) Civil Works	94,085,689	12,362,126,312	(1,970,171,930)	2,195,647,162	12,915,571,541
(B) Price Escalation	3,156,681	1,087,918,403	(168,786,170)	188,102,810	1,106,487,115
(C) Physical Contingency	4,862,118	672,502,236	(106,947,905)	119,187,498	701,102,930
(D) Environmental Consideration	0	213,387,848	(32,550,689)	36,275,934	213,387,848
(E) Consulting Services	208,744,695	709,569,208	(295,547,671)	329,371,460	1,937,479,179
(F) Administration Costs	0	22,037,562	(3,361,662)	3,746,386	22,037,562
(G) Land Acquisition	0	0	(0)	0	0
<b>Grand Total</b>	<b>310,849,183</b>	<b>15,067,541,569</b>	<b>(2,577,366,029)</b>	<b>2,872,331,249</b>	<b>16,896,066,178</b>

Note:(Tax Portion)

### 7-2 Annual Financial Program

Summary of Annual Fund Requirement is shown in Table -13.

**Table-13 Summary of Annual Fund Requirement**

Year	Foreign Currency Portion		Local Currency Portion		Total	
	(eq.Yen)	(eq.FCFA)	(eq.Yen)	(eq.FCFA)	(eq.Yen)	(eq.FCFA)
1st Year 2012	132,724,727	780,733,688	643,729,045	3,786,641,442	776,453,772	4,567,375,133
2nd Year 2013	178,124,456	1,047,790,918	1,917,753,021	11,280,900,123	2,095,877,477	12,328,691,045
<b>Total</b>	<b>310,849,183</b>	<b>1,828,524,606</b>	<b>2,561,482,066</b>	<b>15,067,541,565</b>	<b>2,872,331,249</b>	<b>16,896,066,178</b>

## **8. Procurement**

### **8-1 Implementation Scheme**

#### (1) Borrower

The Borrower shall be the Government of Senegal.

#### (2) Executing Agency

The Project will be entirely administrated by AGEROUTE, an executing agency for trunk roads in Senegal.

### **8-2 Contract Package**

#### (1) Civil Works

The project will be implemented in one lot.

A construction period will be allowed commencing the date of Notice to Proceed.

The construction schedule is shown in Figure-7.

The prequalification for contractors may be called at once. The criterion shall be considered on the basis of project conditions such as cost, length of road, required equipment, and difficulty and so on for the project.

#### (2) Consulting Services

The stage for consulting service is assumed as one stage at present time as follows:

- 1) SV stage

#### (3) Method of Procurement

- 1) Civil Works

The method of procurement for civil works will be by International Competitive Bidding among prequalified contractor (s) in accordance with procurement procedures acceptable to AGEROUTE.

- 2) Consulting Services

It is recommended that the procurement for consulting services will be by International Competitive Bidding among international (expatriate) consultants in accordance with procurement procedures acceptable to AGEROUTE.

## 9. Economic Analysis

There is a full-scale feasibility study report on the proposed road rehabilitation project entitled 'ETUDES ECONOMIQUES DE LA REHABILITATION DES TRONCONS ROUTIERS NIORO-KEUR AYIP (RN4) ET PASSY-SOKONE (RN5)' which was completed in December, 2010 by AGEROUTE in order to examine a detailed economic feasibility on the road rehabilitation project between Dinguiraye-KeurAyip about 40kms on the NR4 in Kaolack region.

Since this feasibility study is most updated and proper information, our economic analysis was carried out through reviewing this study by applying our revised conditions.

### 9-1 Methodology and Modified Conditions

Since the economic study was done by AGEROUTE almost at the same timing as our survey, a review of economic analysis was conducted within a very limited extent;

- Applying the same HDM-IV model, using almost the same parameters, but
- Considering some factors revised in this survey:
  - i) Present and future traffic volumes,
  - ii) Investment costs,
  - iii) Maintenance costs, and
  - iv) Implementation schedule.

**Table-14 Modified Conditions for Economic Evaluation**

Items	Modified in this Survey (A)		The Economic Study (B)		Remarks (A/B)
	Pass. car	Truck	Pass. car	Truck	
i) Traffic Volumes					
In 2010	730veh./day		914 veh./day		0.80
In 2014	1,194 veh./day		1,474 veh./day X0.9		0.90
ii) Traffic Annual Growth Rates (from 2014 to 2033)	2.0-3.8%	2.4-6.5%	5.8%	6.3%	-
iii) Induced Traffic by Gambia River Bridge (Open in 2018)	Considered (1,490 veh./day)		Not considered		
iv) Investment Cost (fcfa million)	14,276.0		12,215.5		1.17
v) Implementation Schedule	Open in 2014		Open in2015		

### 9-2 Results

Economic feasibility of the project was examined by applying the revised conditions to the same HDM-IV model.

The result of the base case shows 17.7% of EIRR (Economic Internal Rate of Return) and 3.8 FCFA million of NPV (Net Present Value) under the 12% of social discount rate. This means the project is enough feasible from the viewpoint of economic analysis.

In addition to the base case, some alternatives were also examined in order to analyze sensitivities by fluctuations of cost and traffic volume.

**Table-15 Results of Sensitivity Analysis**

	Case	NPV	EIRR
0	Base Case	3.844million	17.7%
1	10% increase in cost	3.029million	16.1%
2	10% decrease in traffic volume	2.814million	16.2%
3	10% increase in cost and 10% decrease in traffic volume	1.999million	14.8%

### 9-3 Additional Considerations

A brief examination was conducted in comparing with the results in various other related studies and information on this project: such as,

- (1) Economic Study on Road Rehabilitation of Niore - Keur Ayip (NR4); 2010 December
- (2) *Request paper* on 'Dinguiraye – Niore – Keur Ayip Road Rehabilitation'; 2010 April
- (3) Study on 'Definition and Elaboration of Road Improvement, Gossas – Kaolack – Sokone / Niore Du Rip / Birkelane', Feasibility Study Report; 2005 January

Each report shows feasible IRRs of 25.2%, 15.3% and 15.9% respectively.

And other study results on national highway improvements in Senegal, NR2 and NR6, also show the ranges of IRR between 12.7% and 20.2%.

### 9-4 Other Provable Benefits by this Project

- (1) Improvements from Traffic-flow Block occurred by Natural Disaster

During this field survey, it was heard that a severe traffic blocking at the section (about 1.2 km) crossing Baobolong River, happened because of flood/rise in the water level.

Since our revised construction plan recommends necessity of some additional works in order to avoid such damages, the benefits of improvement from the flood can be expected.

- (2) Other Benefits

As there might be, moreover, several beneficial factors that are brought by the project, it is not possible to quantify these in Senegal, because of less theoretical data etc.

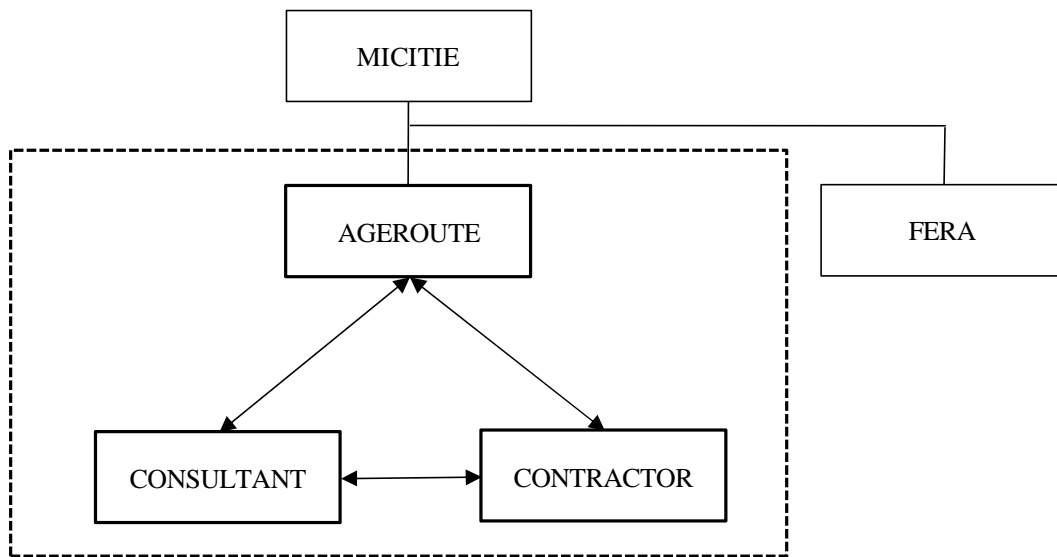
- Decrease in traffic accidents,
- Decrease in vehicle troubles,
- Decrease in traffic jam/congestion caused by the above two,
- Improvement of cargo damages by road surface roughness,
- Increase in vehicle passenger comfort,
- Increase in accessibilities to various public and social institutions/facilities,
- Increase in various land-use potentials along the project road, etc.

## 10. Project Implementation Structure and Maintenance Program

### 10-1 Project Implementation Structure

Considering the present institutional framework for the project implementation, the overall institutional framework for the Project implementation is shown in Fig-9.

Government agencies involved in the project implementation are AGERROUTE (AGENCE DES TRAVAUX ET DE GESTION DES ROUTES DU SENEGAL), MICITIE (MINISTERE DE LA COOPERATION INTERNATIONALE, DES TRANSPORTS AERIENS, DES INFRASTRUCTURES ET DE L'ENERGIE), and FERA (FONDS D'ENTRETIEN ROUTIER AUTONOME).



**Figure-9 Project Implementation Structure**

## 10-2 Maintenance Program

### (1) Evolution of the cost of road maintenance AGEROUTE

The cost of road maintenance is increasing relative to those before 2009 because the system of FERA was introduced in 2009. In the draft budget for coming years are expected 40.200 FCFA millions (plus the amount of 21,600 FCFA millions, the balance of 2010) for 2011 and 30.600 FCFA millions in 2012.

**Table-16 Budget for Maintenance, AGEROUTE**

Unite : FCFA million

Year	A Required Budget		B Composed Budget		C Implemented Budget		Implemented Rate	
							(C/A)	(C/B)
2005	20,000	proportion	15,000	proportion	10,053	proportion	50.3%	67.0%
2006	20,000	1.00	16,500	1.10	8,604	0.86	43.0%	52.1%
2007	30,000	1.50	18,000	1.09	13,100	1.52	43.7%	72.8%
2008	40,000	1.33	18,000	1.00	9,600	0.73	24.0%	53.3%
2009	45,000	1.13	37,000	2.06	32,066	3.34	71.3%	86.7%
2010	60,989	1.36	45,000	1.22	39,000	1.22	63.9%	86.7%
2011	40,242	0.66						
2012	30,586	0.76						

Source : AGEROUTE

**Table-17 Breakdown of the Maintenance Budget, 2010 & 2011**

	2010				
	Total		Kaolack		
	Budget (FCFA million)	Composition	Budget (FCFA million)	Composition	Share
Daily	15,258.30	25.0%	642.83	10.2%	4.2%
Periodical	38,585.47	63.3%	5,600.00	89.0%	14.5%
Others	7,145.07	11.7%	52.00	0.8%	0.7%
Total	60,988.84		6,294.83		10.3%

	2011				
	Totale		Kaolack/Kaffrine		
	Budget (FCFA million)	Composition	Budget (FCFA million)	Composition	Share
Daily	12,535.45	20.6%	280.00	4.4%	22.0%
Periodical	21,014.50	34.5%	1,320.00	21.0%	6.3%
Others	6,692.00	11.0%	0.00	0.0%	0.0%
Total	40,241.95		1,600.00		4.0%

Source : AGEROUTE

The above table shows that the cost of daily maintenance occupies the proportion of 20 to 30% and that of the periodic maintenance has the proportion of 50 to 60%.

The Dakar region where the capital is located occupies the largest proportion (16 to 19%) and the proportion for the Kaolack region where the road project is targeted is 10% in 2010, a relatively large proportion, but only 4% of the total budget in 2011.

(2) Configuration of the items of road maintenance

AGERROUTE configures the frequency of road maintenance on each item as shown below with and without project case.

**Table-18 Items of road maintenance with project case**

No.	Item	Frequency	Unit	Quantity/Km
1.1	Tree trimming, Weeding, Drain cleaning			1
	Rehabilitation of small structures, Supervision on site, etc	once a year	km	5
1.2	Cold asphalt mixture and crushed stone+DBST	once a year	m <sup>2</sup>	1
1.3	Drainage Work	once a year	km	1
1.4	Pavement Marking	once every 4 years	km	1
1.5	Road Sign	once every 4 years	km	1
1.6	Rehabilitation against potholes with construction machine	once every 5 years	m <sup>2</sup>	510
1.7	Surface treatment ( in case of over 30% degradation)	once every 5 years	m <sup>2</sup>	510
1.8	Replacement of surface course (in case of over IRI4)	once every 12 years	m <sup>2</sup>	510

Source: AGERROUTE

**Table-19 Items of road maintenance without project case**

No.	Item	Frequency	Unit	Quantity/Km
1.1	Tree trimming, Weeding, Drain cleaning			
	Rehabilitation of small structures, Supervision on site, etc	once a year	km	1
1.2	Cold asphalt mixture and crushed stone+DBST	once a year	m <sup>2</sup>	
1.3	Drainage Work	once a year	km	1
1.4	Shoulder rehabilitation 2×2	once every 5 years	m <sup>3</sup>	1000
1.5	Pavement Marking	once every 4 years	km	1
1.6	Road Sign	once every 4 years	km	1
1.7	Surface treatment ( in case of over 30% degradation)	once every 10 years	m <sup>2</sup>	350

Source: AGERROUTE



(3) Configuration of the Unit Prices of road maintenance

The unit prices for 2010 are established based on 2007 modified prices as shown by AGEROUTE.

Annual average growth rate of 7% applies to the modification from 2007 to 2010 prices. The growth rate is defined in consideration of the price fluctuation of materials in public project field.

**Table-20 Unit Prices of road maintenance**

Unit : FCFA

Items	Unit	Unit price of road maintenance (excluding VAT)		
		2007	Growth Rate	2010
Daily maintenance				
Tree trimming, Weeding, Drain cleaning			7%	
Rehabilitation of small structures, Supervision on site, etc	km	650,000	7%	796,278
Cold asphalt mixture and crushed stone+DBST	m <sup>2</sup>	15,000	7%	18,376
Drainage Work	Ft/km	1,050,000	7%	1,286,295
Pavement Marking	Ft/km	1,500,000	7%	1,837,565
Road Sign	Ft/km	1,000,000	7%	1,225,043
Rehabilitation against potholes with construction machine	km	600,000	7%	735,026
Periodic maintenance (rehabilitation)				
Cutting	Ft/km	800,000	7%	980,034
Base course	T	45,000	7%	55,127
Shoulder rehabilitation 2×2	m <sup>2</sup>	9,000	7%	11,025
Asphalt concrete (7cm)	T	81,000	7%	99,228
Shoulder (SBST)	m <sup>2</sup>	1,800	7%	2,205
Drainage Work	Ft/km	1,050,000	7%	1,286,295
Rehabilitation of civil structures	Ft/km	800,000	7%	980,034
Pavement Marking	Ft/km	1,500,00	7%	1,837,565
Road Sign	Ft/km	1,000,000	7%	1,225,043
Periodic maintenance (low-cost pavement)				
DBST	m <sup>2</sup>	3,557	7%	4,357
Asphalt concrete (4cm)	m <sup>2</sup>	7,657	7%	9,380
Asphalt concrete (5cm)	m <sup>2</sup>	9,682	7%	11,861
Asphalt concrete (7cm)	m <sup>2</sup>	13,732	7%	16,822

Source: AGEROUTE

## 11. Environmental and Social Considerations

### 11-1 Legal and Institutional Framework

The first Environmental Code (1983) had no enforcement order and did not define requirements for environmental evaluation in the framework of the authorization process. Decree No. 5295 (2 August 1999) aimed at coordinating the environmental approval process. Ministerial decree No. 1986 MH establishes a Cellule de Suivi des Impacts environnementaux du Projet Sectoriel Eau (a unit to monitor the environmental impacts of the water sector project). Eighteen years after the first code, the new Environmental Code and its enforcement orders make impact studies obligatory and set out their scope and content as well as the public consultation process. Projects are classified into two categories:

- Category 1. Installations or activities representing a danger to public health and hygiene, nature, and environment in general, or a nuisance for neighboring communities (projects likely to have considerable impact).
- Category 2. Installations or activities that do not cause such damage for the issues outlined above (projects with limited impacts which can be mitigated).

This Project is identified as Category 1 in its scale.

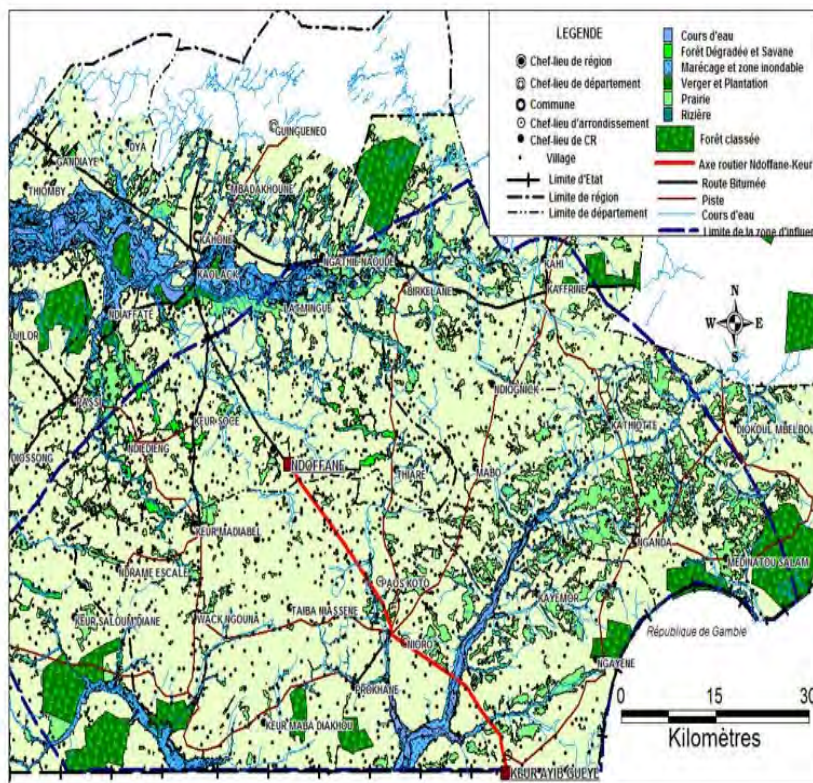
#### EIA Procedures

<u>Procedure</u>	<u>AGEROUTE</u>	<u>MEPNBRLA</u>
Category 1		EIA required
Category 2		Not required
TOR	Submittal →	Approval
↓		
<b>Stakeholder Meeting</b>		
↓		
EIA	Submittal →	Approval

**Figure-10 Flow of EIA Procedure**

## 11-2 Site Conditions of the Project

### (1) Biophysical Condition



Source: Etude D'Impact Environnemental et Social, Février 2010

**Figure-11 Location Map**

### (2) Socio-Economic Conditions

Different local communities crossed by the road alignment that will be therefore mostly concerned by the positive impact, but also by the negative impacts. They will be affected by different impacts bound to the realization of the infrastructure. Those are composed of 2 major towns (Ndoffane and Nioro), 3 farming communities (Koumbal, Paos Kotto and Médina Saakh) and 21 villages.

### 11-3 Consultation with Local Stakeholders

**Table-21 Minutes of Meeting held in December, 2010**

- *This Project is accepted by the local residents with expectations. Because, the road section is very important for regional economy, and plays a large role of an international trunk road.*
- *The detour under construction forms a long distance for a while, and continues at a long period. A respiratory inflammation may be caused by the dust on the road. Therefore, such cooperation with a local health center will be anticipated. The Project may leave the detour of a farm village as an agricultural road at the end of construction.*
- *Activity and movement of residents and livestock may be partly restricted during the works. Because, such farmland and social facilities (weekly market, health center, mosque, well, school, etc.) are built along the road in some area.*
- *Construction sites which a contractor installs may affect the lifestyle of the area during construction. In particular, health education will be needed to both the local community and laborers and sanitary goods be distributed to avoid the problem caused between laborers and local women namely HIV/AIDS.*
- *There is a possibility of accidents at the time of road crossing for the children or livestock during the*

construction.

- The flow of Baobolong River from branch rivers increases and overflows easily in the rainy season. It is necessary to review the estimated flood cycle (present is 100 years), the scale of a structure, etc. in view of the recent climate change. Also, monitoring the influence on a flow or fish will be required during/after construction. AGEROUTE takes charge of an internal monitoring and the Ministry of Environment (MEPNBRLA) takes an external.
- Details for the proposed site of the quarries/sand for the construction material along the existing road should be listed for the approval of Mineral-resources office. The end of construction, the contractor should level and conduct reforestation in consideration of its geology. Then, it can be used as pasturing space for livestock. These should be confirmed at the time of handover of construction works.
- Water salination is serious as the local water resources (surface water, groundwater) of the region. Watering works to the road under construction need clarification of the required quantity, independent on the residents' drinking water. Possible influence to the groundwater should be considered at the watering. The solid waste processing should also be monitored in the Project area.



Photo- Stakeholder Meeting

#### 11-4 Impacts of the Project on the Environment

##### Identification of Major Environmental Constraints

In the “Etude D’Impact Environnemental et Social Rapport Provisoire, Février 2010”, several outstanding matters relating to environmental and social considerations are mentioned for further inspection. Following it, the Study Team conducted a site investigation during the survey period, and the observation is identified in the table below as compared with both.

**Table-22 Site Investigation**

<b>Remarks in the Report of AGEROUTE</b>	<b>Observation by the Team</b>
In Nioro there are some risks to conduct the deforestation.	Only the low shrubs should be cut down.
Occupation is found of the space by the habitat and social facilities (weekly markets, sanitary structures, mosque, hydraulic infrastructures, schools etc.) that are in most cases constructed along the existing road. Concerning the weekly market at Keur Ayip, some kiosks should be moved in part or in total during the period of works.	The mini-market stands on the terminal point at Keur Ayip of the existing road section. They occupy a part of road side. Provisional measures for movement will be taken during construction.
There are some probabilities of use of private land to install the base camp of the contractor yard.	ROW (50m) is available for the contractor’s use including detour. When temporary use of residents’ assets is required, the due procedure

	will be taken subject to no land acquisition required.
Road section across the Baobolong River in the Firgui village should be reviewed on its width. Existing culverts will be improved to avoid flooding due to the recent climate change.	Since the present road width across the river is about 7m, additional expansion/banking by a few meters will be required. Although there are fishermen who are engaged for coastal fishery, a small number is counted. As a countermeasure against the flood damage suffered, double layers above the existing road were accumulated in October, 2010. Electric poles recently moved are not obstacles to the rehabilitation plan.
Communal forests in the farming communities of Paos Kotto, Koumbals and Médina Sabakhs occupy a surface of about 60,000 hectares.	Since there is the existing road, necessary permits were taken.
Fauna and flora of trees/fruits bring the real economic income for the community.	Some wild animals have been observed. A slight influence may be caused during and after construction.
The project may use the new quarries, or the existing ones in the project affected area. The exploitation of the quarries may locally cause negative effects on the quality of air. These effects will be negligible on the environment but they could cause a sanitary threat for workers and the community. Also, the exploitation of the quarries could destruct the present vegetation on the sites.	Following four places for the lateritic extraction are proposed. National highway No. 4. pk3+200 At Niore entrance, the national highway No. 4, pk10+00 From, 3.5-km, pk3+500 on Sinthiou Wanar road. National highway No. 4, pk28+600 Although some influences, such as air pollution, are considered, they are at the low level.
The mosque of Keur Ndary is under construction. The imam's stall is located within 10 m of the existing road.	Protection fence from the dust/noise will be constructed by citizens' participation in the community.
The water used for the road construction should be secured, avoiding the pollution to the ground water.	The specifications for the construction are to mitigate the possible impact. Monitoring will be conducted by the stakeholders.
	
Mini-markets at Keur Ayip	Baobolong River

## 11-5 Mitigation Measures against the Negative Impact Scoped

To reduce or to eliminate these impacts, the following mitigation is proposed in the Plan of Environmental and Social Management as suitable applicable measures.

**Table-23 Mitigation Measures**

Activities	Contents	Negative impacts	Mitigation Measures
Land Acquisition	<ul style="list-style-type: none"> <li>• Beaconing of works</li> <li>• Works mechanized of preparation of the land</li> </ul>	<ul style="list-style-type: none"> <li>• Erosion of soils</li> </ul>	<ul style="list-style-type: none"> <li>• Reforestation stabilization of the shoulders</li> </ul>
		<ul style="list-style-type: none"> <li>• Disruption of customs</li> <li>• Disruption riparian activities</li> </ul>	<ul style="list-style-type: none"> <li>• Information and Campaign</li> <li>• Social support</li> </ul>
		<ul style="list-style-type: none"> <li>• Dismissal disposal of the solid garbage and rubbles</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate disposal of the solid garbage and rubbles toward authorized sites</li> </ul>
		<ul style="list-style-type: none"> <li>• Disruption of the traffic</li> </ul>	<ul style="list-style-type: none"> <li>• Information and campaign</li> <li>• Temporary installation of traffic facility</li> <li>• Signaling, passages, footbridges,</li> <li>• Traffic control by the Police</li> </ul>
		<ul style="list-style-type: none"> <li>• Disruption of the public energy</li> </ul>	<ul style="list-style-type: none"> <li>• Coordination with the concerned services</li> <li>• Information of the people</li> <li>• Assiduous rehabilitation of the network</li> </ul>
Site Mobilization with living facilities	Occupation of forest zones	<ul style="list-style-type: none"> <li>• Deforestation and reduction of the plant land</li> </ul>	<ul style="list-style-type: none"> <li>• Implication of the forest Services</li> <li>• Compensatory reforestation</li> <li>• Recovering after works</li> </ul>
	Tipping of oils and waste waters Dismissal of solid garbage	<ul style="list-style-type: none"> <li>• Contamination of waters and soils</li> </ul>	<ul style="list-style-type: none"> <li>• Collection and reuse of the used oils</li> <li>• Collection and disposal of the solid garbage</li> <li>• Facilities of suitable sanitary</li> </ul>
	Occupation of private or agricultural land	<ul style="list-style-type: none"> <li>• Social and human conflicts</li> <li>• Loss of cultures or agricultural products</li> </ul>	<ul style="list-style-type: none"> <li>• Choice of the sites in relation with owners or local Communities</li> <li>• Recovery of the sites after use</li> </ul>
	Failure of safety protection of the workers	<ul style="list-style-type: none"> <li>• Affection/pollution by the noise, dust and gases</li> <li>• Accident during the work</li> </ul>	<ul style="list-style-type: none"> <li>• Responsible Hygiene Security (HSE)</li> <li>• Protective facilities</li> <li>• kit for the first care</li> <li>• Campaign of the workers</li> </ul>
	Improper signaling of the yard	<ul style="list-style-type: none"> <li>• Collision of the construction machine with other ordinary cars</li> </ul>	<ul style="list-style-type: none"> <li>• Signaling and campaign</li> </ul>
	Demobilization of yard	<ul style="list-style-type: none"> <li>• Social and human conflicts with communities</li> </ul>	<ul style="list-style-type: none"> <li>• Restoration of the site</li> <li>• Transfer of facilities</li> </ul>
Recruitment of yard workers	Presence of foreign workers outside the community	<ul style="list-style-type: none"> <li>• Social conflicts with local people</li> </ul>	<ul style="list-style-type: none"> <li>• Priority recruitment of the local people</li> <li>• Priority recruitment of unskilled workers</li> </ul>

		<ul style="list-style-type: none"> <li>Poaching / lumbering</li> </ul>	<ul style="list-style-type: none"> <li>Campaign of the yard worker</li> <li>Monitoring by the forest services</li> </ul>
		<ul style="list-style-type: none"> <li>Propagation of the ISTS / AIDS</li> </ul>	<ul style="list-style-type: none"> <li>Campaign (workers / community)</li> <li>Distribution of condoms (yard)</li> </ul>
Installation of the facility of asphalt and crushing	<ul style="list-style-type: none"> <li>Occupation of agricultural / forest zones</li> <li>Spread of the noise, gas and dust</li> <li>Disposal of Liquid and solid wastes</li> <li>Proximity with dwelling zone</li> </ul>	<ul style="list-style-type: none"> <li>Destruction of the plant land</li> </ul>	<ul style="list-style-type: none"> <li>Proper choice of the site</li> <li>Implication of the forest Services</li> <li>Compensatory reforestation</li> </ul>
		<ul style="list-style-type: none"> <li>Reduction of the arable areas</li> </ul>	<ul style="list-style-type: none"> <li>Proper choice of the authorized sites</li> <li>Recovery of the sites after works</li> </ul>
		<ul style="list-style-type: none"> <li>Atmospheric pollution</li> <li>Respiratory affections</li> </ul>	<ul style="list-style-type: none"> <li>Proper choice of the site</li> <li>Protection of the workers</li> <li>Campaign of the road side residents</li> </ul>
		<ul style="list-style-type: none"> <li>Contamination of waters and soil</li> </ul>	<ul style="list-style-type: none"> <li>Protective measures and collection of oil</li> </ul>
Opening and exploitation of the zones of Quarry	Deforestation	<ul style="list-style-type: none"> <li>Reduction of the plant</li> <li>Erosions of soils exposed</li> </ul>	<ul style="list-style-type: none"> <li>Exploitation of the quarry allowed</li> </ul>
	Improper signaling	<ul style="list-style-type: none"> <li>Risks of accidents</li> </ul>	<ul style="list-style-type: none"> <li>Signaling and campaign</li> </ul>
	Spread of dust	<ul style="list-style-type: none"> <li>Respiratory affections</li> </ul>	<ul style="list-style-type: none"> <li>Protection of the workers</li> <li>Regular watering of the distribution (crushing site)</li> </ul>
	Occupation of private or agricultural sites	<ul style="list-style-type: none"> <li>Deterioration of agricultural land</li> <li>Social conflicts</li> </ul>	<ul style="list-style-type: none"> <li>Exploitation of the quarry allowed</li> <li>Prior agreement of the land owners</li> <li>Rehabilitation after works</li> </ul>
Detour	<ul style="list-style-type: none"> <li>Destruction of vegetation and agricultural lands</li> </ul>	<ul style="list-style-type: none"> <li>Reduction of the plant land</li> <li>Reduction of the arable areas</li> </ul>	<ul style="list-style-type: none"> <li>Implication of the forest Services</li> <li>Compensatory reforestation</li> <li>Proper choice of the route</li> <li>Recovery of the sites after works</li> </ul>
Excavations, preparatory works, leveling, paving and facility construction	Spread of the particles of dust	<ul style="list-style-type: none"> <li>Atmospheric pollution risk</li> </ul>	<ul style="list-style-type: none"> <li>Protection of the workers</li> <li>Regular maintenance of the machinery</li> <li>Regular watering of the road</li> </ul>
	Operation of construction machinery	<ul style="list-style-type: none"> <li>Erosion of soils</li> <li>Deterioration of cultivated area</li> </ul>	<ul style="list-style-type: none"> <li>Limited operation of the machinery</li> <li>Monitoring and campaign</li> </ul>
	Disposal of fuel	<ul style="list-style-type: none"> <li>Contamination of waters and soils</li> </ul>	<ul style="list-style-type: none"> <li>Protective measures and collection of oil</li> </ul>
	Demolition of the culverts and scouring	<ul style="list-style-type: none"> <li>Pollution by the illegal disposal of the solid garbage</li> </ul>	<ul style="list-style-type: none"> <li>Collection and disposal toward the allowed location in the community</li> </ul>

	Risk of river banking	<ul style="list-style-type: none"> <li>Disruption of the drinking for the livestock</li> </ul>	<ul style="list-style-type: none"> <li>To avoid destruction of the pools</li> <li>To improve the pools for effective use</li> <li>To dig new pools to avoid the accidents at the time of crossing the road.</li> </ul>
	Improper signaling of the yard	<ul style="list-style-type: none"> <li>Disruption of the local traffic</li> <li>Risks of accidents</li> </ul>	<ul style="list-style-type: none"> <li>Signaling and campaign</li> </ul>
Transportation of the materials	Spread of dust Improper behavior of the drivers	<ul style="list-style-type: none"> <li>Atmospheric pollution risk</li> <li>Risk of accidents</li> </ul>	<ul style="list-style-type: none"> <li>Protection of the vehicles</li> <li>Monitoring of the transportation at the bypass and diversion</li> <li>Campaign of the drivers</li> </ul>
Use after the construction	Increase of the traffic Increase of users (all the sections)	<ul style="list-style-type: none"> <li>Pollution of exhaust gases and noise</li> </ul>	<ul style="list-style-type: none"> <li>Landscape planning around the shoulders</li> <li>Plantation of alignment tree</li> </ul>
		<ul style="list-style-type: none"> <li>Risks of accident</li> <li>Insecurity and risk of aggression</li> </ul>	<ul style="list-style-type: none"> <li>Regular inspection of the road</li> <li>Installation of Humps/Road crossing</li> <li>Speed limit</li> <li>Police control</li> <li>Campaigns of road safety for drivers and residents</li> <li>Lighting and regular police monitoring</li> </ul>

## 11-6 Review of Monitoring Plan

**Table-24 Monitoring Plan during Construction Works**

Items and Indicators	Methods and Devices of monitoring	Responsible	Period
<b>Waters</b> Pollution	Monitoring of the procedures and installation of dismissal of the waste waters Control of the underground waters and surface around the project area Monitoring of the use of surface waters Monitoring of measures taken for the control of the erosion	Environment Expert AGEROUTE Hydraulic service DREEC Townships of Kaolack	Entire works
<b>Soils</b> Erosion / refinement / Pollution / deterioration	Visual assessment of the measures of control of the erosion of soils Permit of authorization of opening the borrow pits and quarries Verification of the adequacy of the site Number of quarries recovered and afforested Existence of system of garbage treatment	Environment Expert AGEROUTE Hydraulic service DREEC Townships	Beginning, mid-course and after operation infrastructure in exploitation
<b>Vegetation fauna</b> Rate of deterioration Rate of reforestation Plantations in the street	Visual assessment of the vegetation deterioration Visual assessment of the measures of reforestation / plantations Control of clearing activities Control and monitoring of sensitive zones	Environment Expert AGEROUTE Foresters Communes Service	Beginning, mid-course and after operation



<p><b>Human environment</b> Living life Socio-economic activities Occupation of land</p>	<p>Monitoring of dwelling / expropriation acquisition, private land / of verges and other agricultural fields Priority of employment of local people Preservation of the cultural facility Monitoring of land use Monitoring of the sources of economic income Information of administrative and local authorities Campaign of local people Monitoring of the land use (fields, private property, etc.) Compensation for the use of private property Priority of employment of local people Consideration to sacred, cultural and archaeological sites Agreement on the use of local water resources</p>	<p>Environment Expert AGEROUTE DREEC Communes</p>	<p>Beginning, mid-course and after operation</p>
<p>Hygiene and health Contamination and Pollution Safety in the yards</p>	<p><u>Verification:</u> The presence of disease vectors and the apparition of illnesses by the works Various illnesses in the projects (IST / VIH / AIDS, bilharzias, malaria, etc.) Observation of hygiene measures on the site Consistent of the practices of management of biomedical garbage (the whole process), availability of management plan</p>	<p>Environment Expert AGEROUTE DREEC Service of hygiene Townships</p>	<p>Beginning, mid-course and after operation; infrastructure in exploitation</p>
	<p><u>Verification:</u> Availability of safety orders in case of accident Existence of a suitable signaling Observation of traffic control Observation of the speed control Protective use of safety wears</p>	<p>Office of control</p>	<p>monthly</p>

## 11-7 Conclusion

In the Project area, a seriously protective measure or the particular activities of monitoring will not be required. Moreover, it will not be necessary to relocate houses to implement the works. Some negative impacts in the phase of construction will affect natural resources (namely the existing waters, soils, and air), and the life and the economic activities of communities along the road. One could also fear the risks of accidents during the construction works and the illegal disposal of the yard garbage, namely in the existing rivers. However, effects will be easily controllable if arrangements of the monitoring are conducted.

The road may give negative impacts in terms of pollutions, noise, and accident of the road. But these risks can be avoided or greatly reduced with the application of simple measures of signaling, campaigning, monitoring and management. The measures recommended for the reduction of negative impacts are globally in conformity with the national requirements concerning the management of natural resources and the environment protection.

The rehabilitation of this road will accentuate the transformation of the entire region of Kaolack and its vicinity and will play a real socio-economic development role. The project is to improve the conditions of life and existence of the local community, to improve the socio-economic condition of the inhabitants of the area and to permit an optimal exploitation of potentialities and local resources.

In conclusion, the study shows that the negative impacts identified and analyzed on the environment will be of an extensively acceptable level to socio-economic advantages generated, provided environmental and social measures are taken effectively in consideration of the implementation of the Project,

JICA classifies projects into four categories according to the extent of environmental and social impacts, taking into account an outline of project, scale, site condition, etc. As their potential adverse impacts on the environment and society are less adverse than those of Category A projects. Generally, they are site-specific; few if any are irreversible; and in most cases, normal mitigation measures can be designed more readily. Hence, the proposed project may be classified as Category B.