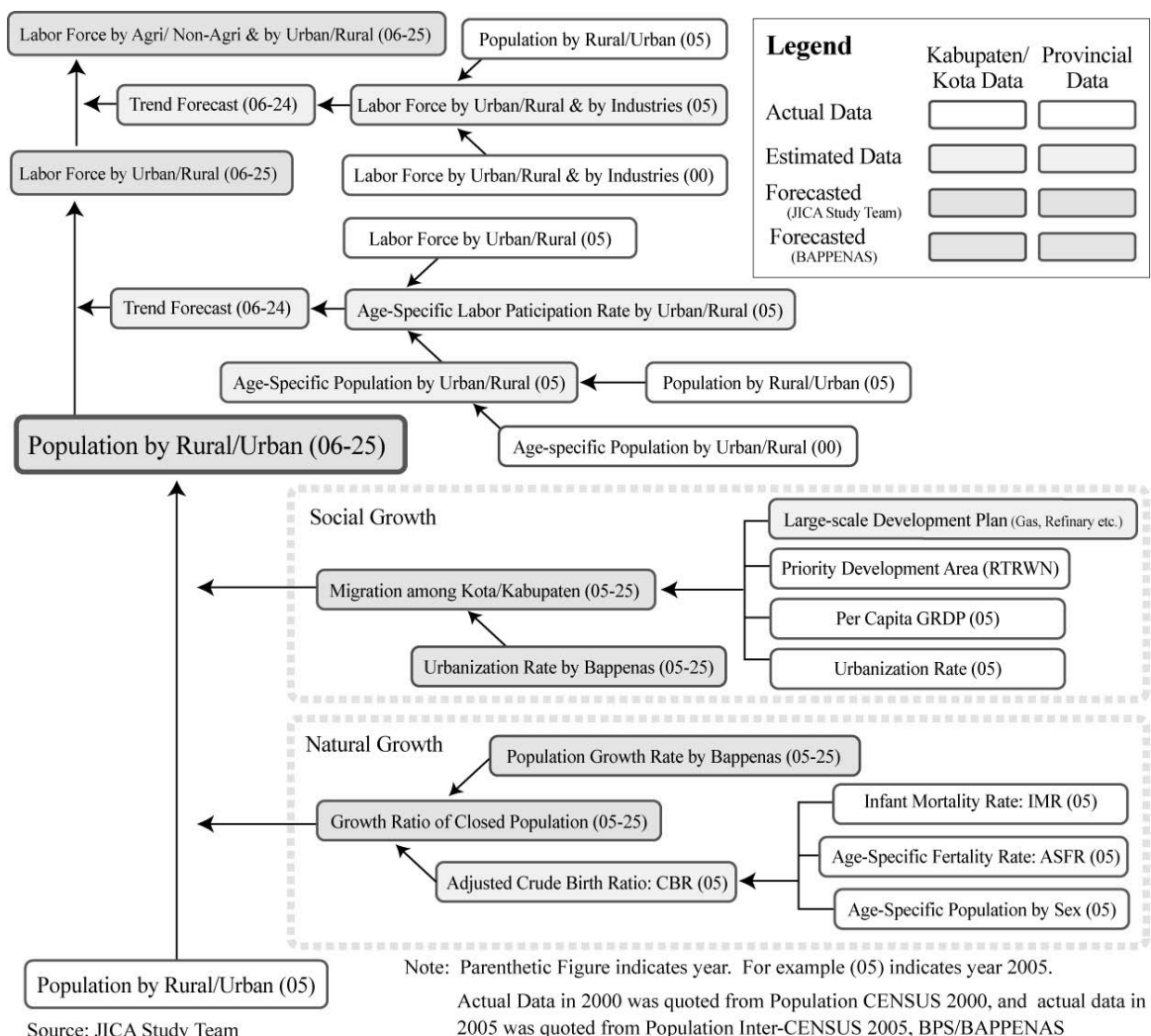


CHAPTER 6 SETTING OF SOCIO-ECONOMIC FRAMEWORK

(1) Population Forecasts

1) Population Forecast Methodology

Figure 6.1 shows the methodology for population forecast by regency. The forecasts were made based on the 2005 Intercensus and they cover the period 2006-2025. For the provincial level forecast, a population growth rate and speed of urbanization as those used in the BAPPENAS forecasts were adopted. The JICA Study Team's forecast can be broadly divided into three steps, namely: (1) estimate of closed populations, (b) estimate of migratory movements within provinces, and (3) estimate of the labor force.



Source: JICA Study Team
 Source: JICA Study Team

Figure 6.1 Flow Chart of Population and GRDP Forecasts

2) JICA Study Team's Population Forecasts by Regency

The total population of Sulawesi is estimated to reach 19.7 million by 2024, increasing by approximately 4.0 million from the 15.7 million in 2005, as shown in Table 6.1.

Population growth in 20 years is forecasted to be higher in the urban areas (2.8 million) and lower in rural areas (1.2 million). As a result, Sulawesi's urban population will increase from 28.0% in 2005 to 35.8% by 2024, which is still lower than the Indonesia average of 42.1% in 2005.

Similar to the BAPPENAS's forecast, the progress of urbanization in North Sulawesi (37.3% -> 52.3%) and Gorontalo (31.3% -> 53.2%) will be high, while rural populations will have declining rates. On the other hand, the net population increase in the rural areas of Central and Southeast Sulawesi from 2005-2024 had forecasts exceeding 500,000 as a result of transmigration.

Table 6.1 Urbanization and Net Population Increases

	Population (1,000)		Net Population Increase (1,000, 2005 - 2024)		
	2005	2024	Urban	Rural	Total
North Sulawesi	2,121	2,543	540	-118	422
Central Sulawesi	2,291	3,169	364	514	878
South Sulawesi	7,480	8,872	1,093	299	1,392
Southeast Sulawesi	1,961	2,997	481	555	1,036
Gorontalo	920	1,030	260	-150	110
West Sulawesi	968	1,120	100	52	152
Sulawesi Total	15,741	19,731	2,838	1,152	3,990

Source: JICA Study Team

3) Labor Force

The labor force in Sulawesi was forecasted to increase from 6.3 million to 9.8 million during 2005 - 2024, with an annual growth rate of 2.33%. Such high growth rate will result from increases in labor participation rates (labor participation rate above age 15 was assumed to increase from 60.3% in 2005 and 70.3% by 2024).

While the agriculture labor force would remain stagnant (from 3.14 million in 2005 to 3.83 million by 2024 with an annual growth rate of 1.05%), the nonagricultural labor force was seen to double (from 3.16 million in 2005 to 5.93 million by 2024 with a growth rate of 3.37%). As a result, the percentage of agricultural labor would decrease from 49.9% in 2005 to 39.3% by 2024.

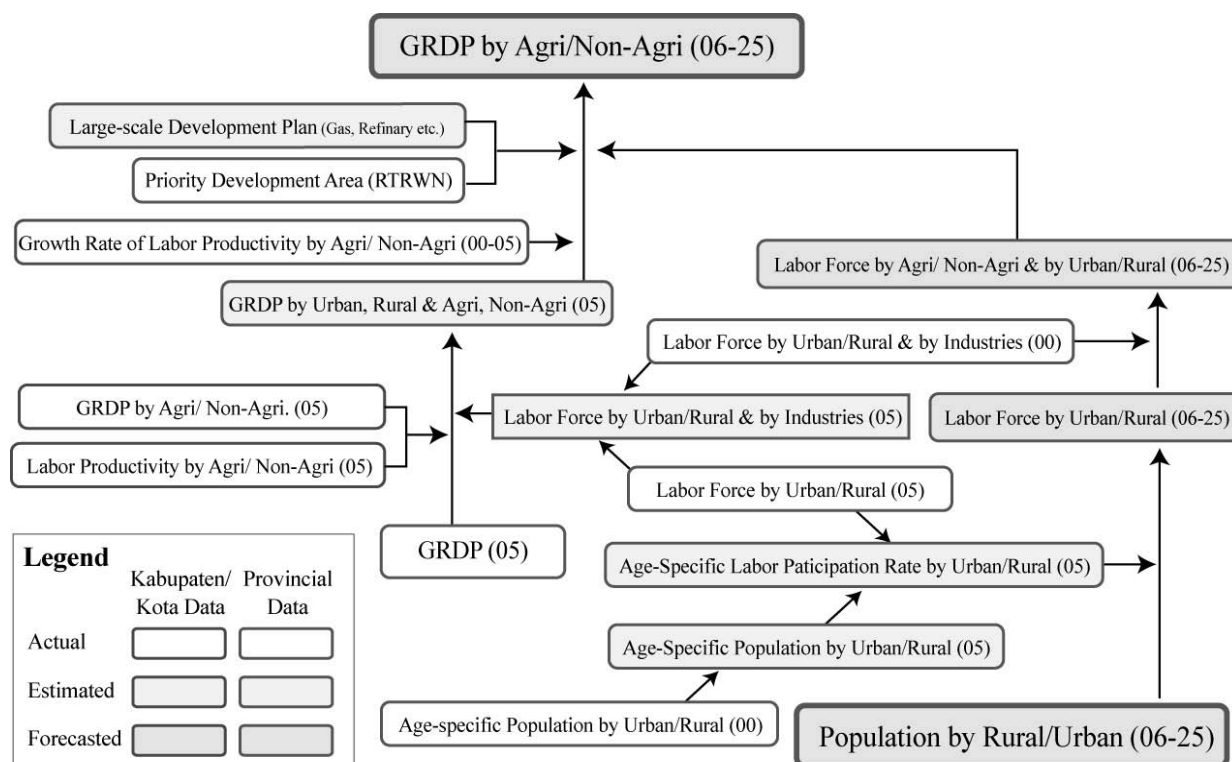
(2) GRDP Forecasts

1) JICA Study Team's Methodology for Long-term GRDP Forecasts

Long-term GRDP forecasts by regency were made by the JICA Study Team based on population and labor force forecasts. The JICA Study Team estimated the GRDP composition in 2005 by agricultural sector (including fishery, forestry, and livestock) and nonagricultural sector based on the labor productivities of each major industry in each province and the number of labor force by major industry in each regency in 2005, as quoted in the Intercensus 2005.

The GRDP forecasts were then made using the labor force and labor productivity forecasts for the agricultural and nonagricultural sectors. Growth rates of labor productivities in each regency were forecasted based on past trends as well as future development plans (including large-scale development plans such as gas & oil fields, the LNG terminal in Banggai regency in Central

Sulawesi, and the oil refinery in Parepare City in South Sulawesi) and the priority development areas designated in the National Spatial Plan. The methodology of the GRDP forecasts is shown in Figure 6.2.



Note: Parenthetic Figure indicates year. For example (05) indicates year 2005

Source: JICA Study Team

Figure 6.2 Flow Chart of GRDP Forecasts

2) JICA Study Team's Long-term GRDP Forecasts

Total GRDP in Sulawesi was forecasted to increase from Rp. 73,089 billion in 2005 to Rp. 265,150 billion in 2024 with an annual average growth rate of 7.02%. Growth rates will be higher in Central Sulawesi (7.79%) and Southeast Sulawesi (7.44%), but will be lower in South Sulawesi (6.78%) and North Sulawesi (6.69%).

Table 6.2 GRDP by Agricultural and Nonagricultural Sectors

	2005 (billion Rp.)				2024 (billion Rp.)			
	Agri'l (A)	Nonagri'l (B)	Total (C)	A / C	Agri'l (A')	Nonagri'l (B')	Total (C')	A'/C'
North Sulawesi	2,778	9,967	12,745	21.80%	5,377	38,236	43,614	12.33%
Central Sulawesi	5,348	5,808	11,156	47.94%	14,507	31,852	46,359	31.29%
South Sulawesi	11,032	25,392	36,424	30.29%	22,771	103,903	126,674	17.98%
Southeast Sulawesi	2,798	4,682	7,480	37.41%	8,024	21,228	29,252	27.43%
Gorontalo	624	1,401	2,025	30.83%	1,431	6,008	7,439	19.24%
West Sulawesi	1,727	1,532	3,259	52.99%	3,546	8,267	11,813	30.02%
Sulawesi Total	24,307	48,782	73,089	33.26%	55,656	209,494	265,150	20.99%

Source: JICA Study Team

3) Per-capita GRDP

The per-capita GRDP will increase by an average of 5.70%. As a result, the per-capita GRDP of Sulawesi will reach US\$ 1,703 in 2024 (2005 constant prices), which is 2.87 times bigger than the per-capita GRDP in 2005 (US\$ 594). Similar to 2005, North Sulawesi's per-capita GRDP will remain the biggest by 2024 and Gorontalo the smallest. However, the gap between these provinces will to some extent narrow from 2.41 times to 2.09 times. Also, regional disparities in per-capita GRDP will be reduced. The coefficient variation² of per-capita GRDP of all regencies in Sulawesi will decrease from 0.59 in 2005 to 0.47 by 2024.

Table 6.3 Per-capita GRDP Forecasts

	Rupiah		Rupiah		US Dollar	
	(2000 Constant Prices)		(2005 Constant Prices)		(2005 Constant Prices)	
	2005	2024	2005	2024	2005	2024
North Sulawesi	6,009	17,055	7,460	21,175	718.9	2,040.5
Central Sulawesi	4,870	14,426	6,491	19,230	625.5	1,853.1
South Sulawesi	4,870	14,196	6,555	19,108	631.7	1,841.3
Southeast Sulawesi	3,815	9,586	5,309	13,340	511.6	1,285.5
Gorontalo	2,201	7,200	3,093	10,117	298.1	974.9
West Sulawesi	3,365	10,514	4,057	12,675	390.9	1,221.4
Sulawesi Total	4,643	13,322	6,160	17,674	593.6	1,703.1

Source: JICA Study Team

² The coefficient variation describes the degree of variation of samples: its standard deviation divided by its mean. Bigger figure means bigger difference of samples, and smaller figure means smaller distribution of samples.

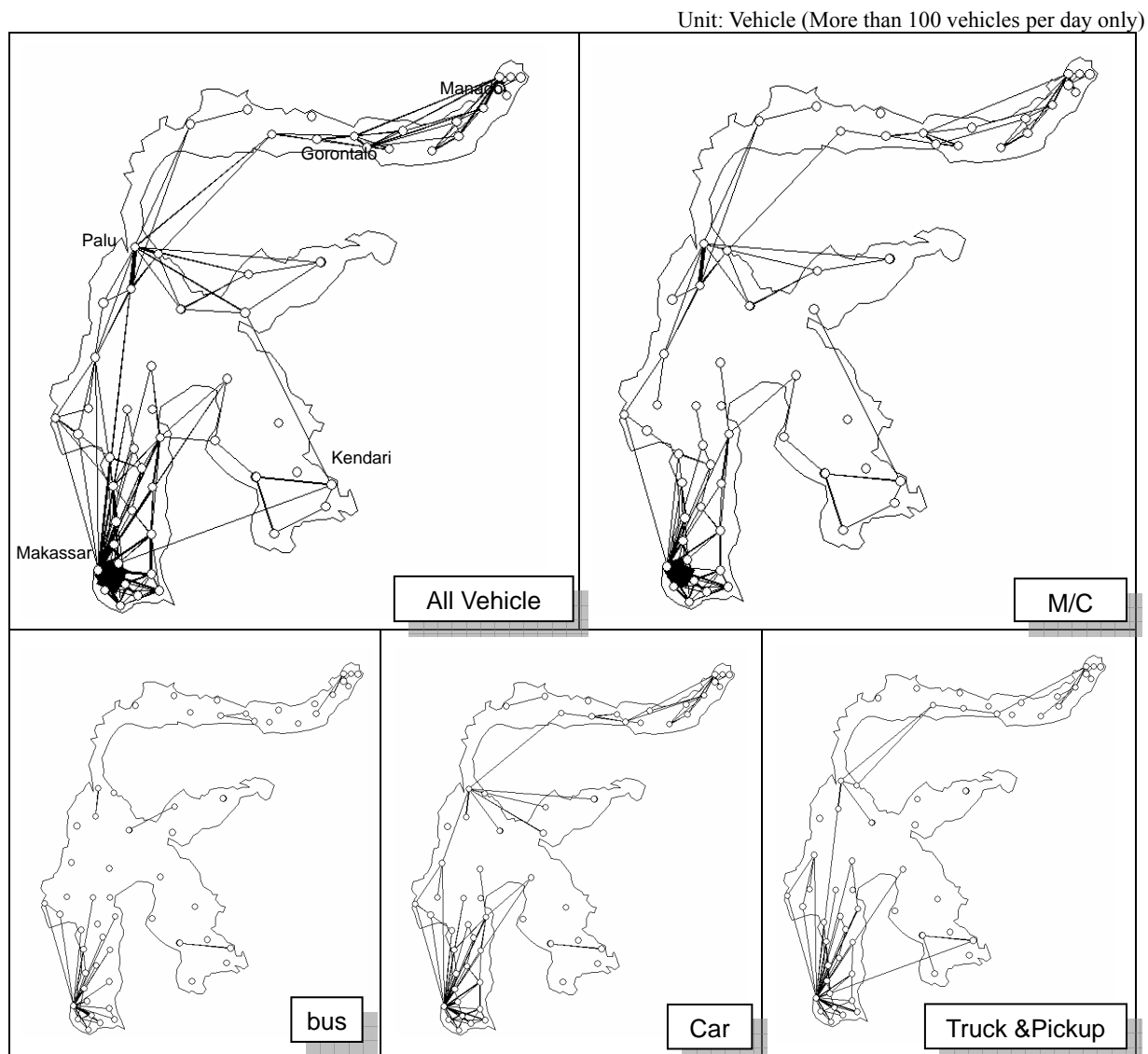
CHAPTER 7 TRAFFIC ANALYSIS

(1) Traffic Surveys

In order to collect up-to-date information, traffic surveys have been conducted by the JICA study team from January to April, 2007 in various places of Sulawesi. They are traffic count and interview surveys on road, port and ferry.

(2) Road Traffic Distribution

After compiling the data obtained by the field surveys, the present origin-destination (OD) tables have been prepared. The estimated trip distribution is illustrated in Figure 7.1. Overall, most of trips concentrate to city areas such as Makassar, Manado, Palu, Gorontalo and Kendari. Especially, the trip to/from Makassar City is outstanding. Long-distance inter-provincial trips, e.g. from Makassar City to Manado City, are very few.



Source: JICA Study Team

Figure 7.1 Trip Distribution in Sulawesi Island

(3) Inter-modal Relations among Road, Maritime and Air Transport

It is a difficult task to analyze the inter-modal relations and to extract meaningful results regarding the transportation in and around Sulawesi. Mainly due to the fact that air and maritime traffic in Sulawesi includes a significant percentage of inter-island and international movement, the overall modal choice by Sulawesi residents is hardly grasped in the limited availability of data and information.

Passenger Transport

Table 7.1 presents the inter-modal relation of passenger transport between Makassar and other provincial capital cities. Since the origin-destination data of maritime passengers is not available, this table compares the modal shares among air, provincial bus and other road traffic.

- For long-distance travel such as Makassar-Manado and Makassar- Gorontalo, air shares about 2/3 of the total traffic demand of passengers.
- In contrast, the share of air traffic decreases to below 1/4 for medium-distance travel.
- Provincial bus shoulders a certain role in inter-provincial travel with a share of 3-15%. As the travel distance becomes longer, the share tends to diminish.
- Other road traffic, mostly of private cars, becomes predominant in medium- to short-distance travel with a share of 2/3 or more.

Table 7.1 Intermodal Relation of Passenger Transport to/from Makassar

Makassar to/from:	Distance (km)		Air 2005			Provincial Bus 2006			Road 2007		Total	
	Road	Crow-fly	pass./day	%	fare (Rp.)	pass./day	%	fare (Rp.)	pass./day	%	pass./day	%
Manado	1,800	949	245	66	769,000	12	3	250,000	116	31	373	100
Gorontalo	1,454	746	85	66	739,000	13	10	200,000	31	24	129	100
Palu	837	468	189	23	639,000	71	8	175,000	576	69	836	100
Kendari	1,057	361	208	22	509,000	108	12	160,000	620	66	936	100
Mamuju	444	276	17	1	222,300	428	15	78,854	2,458	85	2903	100

Note 1) Maritime passenger OD data is not available.

2) Provincial bus between Makassar and Kendari uses ferry for Bajoe-Kolaka section.

Source: Air - JICA Study Team based on AP1 & AP2 information.

Provincial bus: JICA Study Team based on the data from Terminal Regional Daya.

Road: Traffic surveys conducted in this study.

Cargo Transport

Table 7.2 summarizes the inter-modal relation of cargo traffic for the same route as Table 7.1. Air transport was not considered in this table due to the negligibly small quantity of air cargoes.

- Maritime transport plays a dominant role in Makassar-Manado, Makassar-Gorontalo and Makassar-Kendari. This may be attributed to the transport distance and road condition.
- In Makassar-Palu and Makassar-Mamuju, most of the inter-provincial cargo is carried by road transport (trucks). In the case of Mamuju, cargo handling facilities at port may be insufficient.

Although the inter modal relation cannot be clearly determined in this limited analysis, maritime transport seems to be dominant when road distance becomes longer than 1,000 km.

Table 7.2 Intermodal Relation of Cargo Transport to/from Makassar

Makassar to/from:	Distance (km)		Maritime 2006		Road 2007		Total	
	Road	Crow-fly	ton/day	%	ton/day	%	ton/day	%
Manado	1,800	949	137	66	70	33	207	100
Gorontalo	1,454	746	151	100	0	0	151	100
Palu	837	468	68	17	312	82	380	100
Kendari	1,057	361	1,260	76	385	23	1645	100
Mamuju	444	276	0	0	465	100	465	100

Note: Air cargo volume is negligibly small.

Source: Maritime - JICA Study Team based on PELINDO data.

Road: Traffic surveys conducted in this study.

Role of Ferry

Based on the interview survey on the ferry of Bajoe – Kolaka and Pagimana - Gorontalo, the role of existing ferry was analyzed. The distribution of inter-provincial trips of both road user and ferry user for the former route is shown in the following figure. The conclusion of this analysis can be summarized as follows:

- The use of ferry is not so far significant between remote zones unless travel distance can be remarkably shortened by ferry to about 1/2 to 1/3. This is presumably due to the ferry tariff amounting to Rp.115,000 for motorcycle, Rp.832,000 for car, Rp.2,560,000 for bus and Rp.1,925,000-3,466,000 for truck. This is costly, being equivalent to the vehicle operating cost for 400 to 1,000 km.
- However, the role of ferry becomes significant between larger cities such as Makassar – Kendari, and particularly for car that is considered to have more cost-shouldering power than other vehicles

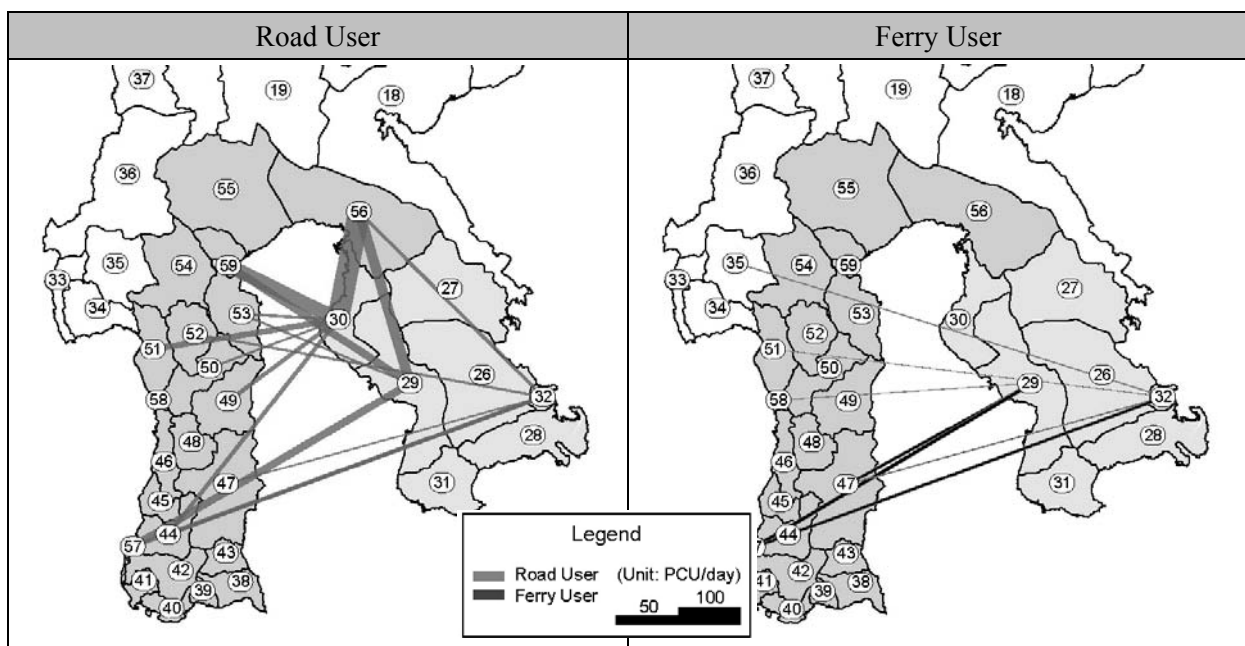


Figure 7.2 Distribution of Inter-provincial Trips by Road and by Ferry between Sulawesi Selatan and Sulawesi Tenggara

(4) Forecast of Future OD Tables

Future OD tables were prepared based on vehicle trips. The number of vehicle types is 7, i.e. motorcycle, passenger car, mini bus, bus, pickup, small truck and large truck. The base year is 2007 and the target years for the forecast are year 2014, 2019 and 2024 according to the long term national plan. The total number of trips was estimated after creating regression models. Future OD tables were forecasted by the present pattern method (Fratat Method). The highest growth ratio is 4.3% per year for passenger car until the year 2024 for 17 years. The growth ratio of motorcycle trips is 3.4% per year. All vehicle trips will be about more than 1.5 times in year 2024 as compared to the present. Note that these are only for inter zonal trips, and usually intra zonal trips increase more quickly. Therefore vehicle trips in cities will be growing more quickly upto about 2 times in the future. Forecasted future OD matrices by year are shown below.

Table 7.3 Forecasted Future OD Tables, 2024 (vehicular trips)

**) Symmetric matrix excluding intra zonal trips*

PCU in Year 2024	Utara	Gorontalo	Tengah	Tenggara	Barat	Selatan	Major Airports	Major Ports	Total
Utara	51,342	2,890	287	8	0	340	0	0	54,866
Gorontalo	2,890	6,870	1,251	9	0	30	0	2	11,052
Tengah	287	1,251	16,703	302	1,594	1,730	10	4,190	26,066
Tenggara	8	9	302	10,569	0	1,567	148	683	13,285
Barat	0	0	1,594	0	5,292	4,132	0	114	11,132
Selatan	340	30	1,730	1,567	4,132	176,655	890	15,255	200,598
Major Airports	0	0	10	148	0	890	0	0	1,047
Major Ports	0	2	4,190	683	114	15,255	0	0	20,243
Total	54,866	11,052	26,066	13,285	11,132	200,598	1,047	20,243	338,288

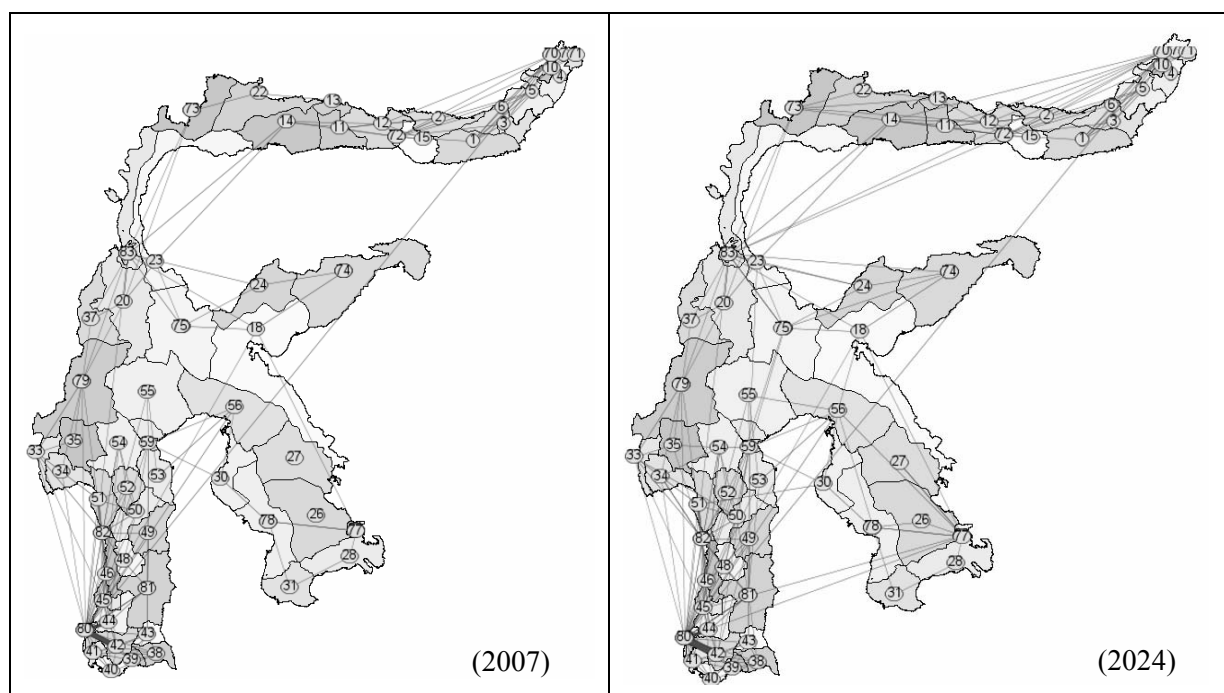


Figure 7.3 Desire Lines of Present and Future Vehicle Trips, 2007 and 2024

(5) Traffic Assignment of Future Demand on Existing Network (Do-Nothing Assumption)

Future traffic demand of 7 vehicle types was assigned onto the existing road network. The results of traffic assignment are shown in Figure 7.4. These are so-called Do-Nothing Case (or Without Case) without any improvement of the road network. This analysis is the basis of road planning because demand/supply relations of road space could be visibly quantified.

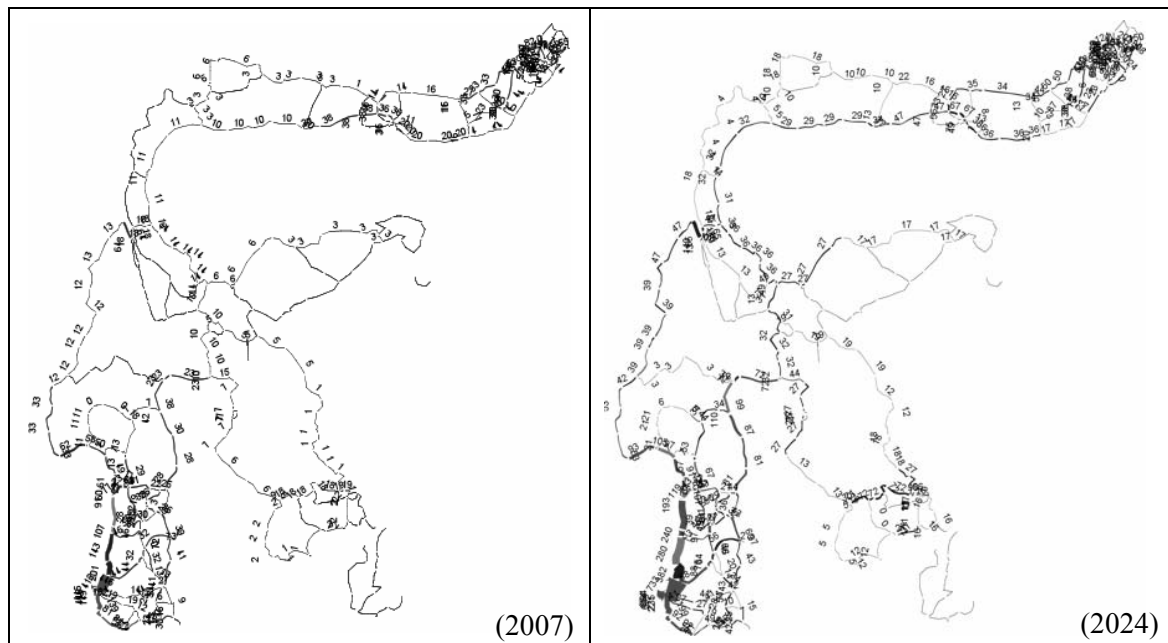


Figure 7.4 Traffic Assignment (Do-Nothing Case) by Year, 2007 and 2024

CHAPTER 8 DIRECTION OF TRANSPORT NETWORK DEVELOPMENT AND ESTABLISHMENT OF ROAD MASTER PLAN

(1) Direction of Transport Network Development

1) Review of National Transport Development Plans

Prior to the formulation of road development plan for Sulawesi, existing national transport development plans were reviewed. The basic directions and policies stated there form an integral part of the road network development plan to be proposed in this study.

The National Transport System (SISTRANAS, Departemen Perhubungan, 2005) is a government regulation declared as the guideline for transport development in Indonesia. This regulation aims to establish an efficient and effective nationwide transport system mainly from the standpoint of operation. It is conceptual in nature, and stresses efficiency and effectiveness of transport operation.

Brunei Darussalam, and provinces of Indonesia, Malaysia and the Philippines (BIMP) agreed in 1994 to form the ASEAN sub-regional growth area BIMP-EAGA. The major goal of BIMP-EAGA is to increase trade, tourism and investments in this under-developed sub-region. At present, various technical assistance projects are ongoing in BIMP-EAGA led by ADB and other international organizations. In the future, transport network development is expected to attract major investments on infrastructure, industries, tourism and so on.

National Long-Term Development Plan 2005-2025 (BAPPENAS, 2007) stipulates the basic long-term development policies of Indonesia in the form of act enacted under the name of the president. With regard to infrastructure, the role of the private sector is emphasized in the form of public-private partnership due to severe financial condition of the government. As for transport, an efficient and effective system is advocated, similarly to the SISTRANAS.

National Mid-Term Development Plan 2005-2009 (BAPPENAS, 2004) determines the basic mid-term development policies of Indonesia also in the form of act. Following general targets, the importance of formulating the road network master plan in Sulawesi is mentioned as one of the directions of road infrastructure development. In the road and bridge development program, and traffic facilities development program, Sulawesi is referred to as; 1. Primary arterial roads should be developed in major economic corridors including Trans Sulawesi (West, East and Central), 2. Road maintenance should be duly conducted in isolated areas such as Trans Sulawesi (East), and 3. Traffic safety facilities should be improved in South-east Sulawesi, Central Sulawesi and North Sulawesi. In addition, the possibility of water transport is pointed out. Airport development at Makassar is included in the program, but railway development is not mentioned.

The latest National Spatial Plan (RTRWN, National Spatial Planning Coordination Board, 2007) specifies the principles and strategies of land use. In relation to transport infrastructure development, references are made on toll road, port and airport development.

The Sulawesi Island Spatial Plan (Regional Development Coordination Board of Sulawesi (BKPRS), 2005) aims to promote regional development in Sulawesi in an efficient and balanced manner. With regard to transport infrastructure development, the proposed projects are listed in Table 8.1.

Table 8.1 Transport Infrastructure Developments included in the Sulawesi Island Spatial Plan, 2005

Sub-sector	High Priority	Medium Priority	Low Priority or Not Specified
Road	*Trans Sulawesi East	*Trans Sulawesi West *Trans Sulawesi Central *Feeder and peninsula-crossing roads	*Circular roads for remote islands
Railway	*Urban and suburban lines around Makassar and Manado	*Medium-distance lines near regional centers along Trans Sulawesi	*Medium to long distance lines connecting major cities along Trans Sulawesi
Water (shipping, ferry, etc.)			*Major lakes in Sulawesi *Inter-provincial and inter-island ferries within Sulawesi *Inter-island shipping lines between Sulawesi and external areas
Port	*International ports (4)	* National ports (27) * Local ports (17)	
Air	*Primary airports (2) *Secondary airports (3)	*Tertiary airports (2) *Other airports (15)	

The Five-Year Plan (Renstra 2005-2009, Ministry of Public Works) stipulates the public road development policy, strategy and targets for 2005 to 2009. In relation to road development, the following issues were identified:

- Lack of capacity and fund for road maintenance.
- Regional disparity between areas and poor access from production centers to market areas.
- Road infrastructures damaged by natural disaster, which leads to diversion of budget allocation from road maintenance to restoration from damages.

The vision of MPW in the five year plan is, in one word, to provide infrastructure reliable, beneficial and helpful to realize safe, peace, equal, democratic and more prosperous nation. The plan shows quantitative target for each of road development works by province of Sulawesi.

2) Development Directions for Integrated Transport Network

Based on the existing transport development plans described above and various analyses conducted earlier, the following directions have been identified to establish an integrated transport network for the entire island of Sulawesi:

- * The international linkage proposed in the concept of BIMP-EAGA should be strengthened by improving air and shipping services between northern Sulawesi (Manado and Gorontalo)

and Mindanao (Davao and General Santos) of the Philippines. This corridor has a tint of Christianity unlike other areas of Sulawesi, and will thus add a variety in tourism development of the region. The islands located in between such as Sangihe and Talaud have a large potential in trade, tourism and fishery. In addition, it is also important to integrate the arterial road network of Sulawesi as a part of the global transport network such as Asian/ASEAN Highway.

* The road network master plan proposed in this study will basically be more of a road improvement plan focusing on widening, realignment, rehabilitation, strengthening and maintenance coupled with some new projects with strategic importance. The road should be all-weather, ensuring accessibility throughout the year even for isolated areas.

* Energy-saving maritime transport should be effectively incorporated in the network considering the long winding coastlines. Since coastal shipping will play a major role in long-distance cargo transport also in the future, port facilities should be improved together with the feeder roads to/from the ports. In addition, an inter-peninsula nautical highway using RoRo ships is proposed to link the east coast of Sulawesi; Makassar - Bajoe(Siwa)=Kolaka - Kendari=Luwuk - Pagimana=Gorontalo - Manado. Although the traffic volume on the ferries is not large yet, it will grow if the nautical highway is operated more efficiently using modern ships and upgraded facilities. Alternative land route should be developed at the same time for the nautical highway that becomes nearly unnavigable during the rainy season.

* Long- and medium-distance passenger travel by air will grow in the light of lowering airfares due to the proliferation of LCCs (low-cost carriers). Airport development should be promoted as proposed.

* There are some railway projects proposed for Sulawesi. However, the estimated traffic demand for these railways is generally small, and their financial viability is quite doubtful even in the absence of financial analyses in past studies. Since inter-city roads have enough capacity at present to absorb increasing traffic demand, the implementation of railway projects should better be studied in the future when road capacity has been reached.

(2) Establishment of Sulawesi Road Master Plan (SRMP)

1) Road Development Policy

The objectives of road development master plan aim to formulate the Sulawesi Island arterial road master plan to support the regional and economical development of Sulawesi.

The Study team established 8 items of road development policies taking into consideration existing road conditions and traffic demand forecast. Each road development policy is related to the economic development strategy as shown in Table 8.2:

Table 8.2 Road Development Policy to be applied for Road Master Plan

Development Goal	Regional Development Strategy	Road Development Policy
[Goal 1] Development of Sulawesi as the Leading Island in East Indonesia and as the Gateway to other Asian Countries	[Strategy 1] Effective Economic Growth by Strengthening Inter-regional Linkages not only in Sulawesi but also with other Asian Countries	[Policy 1] Strengthening inter-regional transport network of six provinces in Sulawesi
	[Strategy 2] Economic Growth through Development of Processing Industry on the Basis of Potential Resources of Sulawesi	[Policy 2] Accommodation of increasing large traffic volume and heavy vehicle
[Goal 2] Development of Sulawesi as an Environmentally Friendly Island with Poverty Reduction	[Strategy 3] Alleviation of Social and Economic Disparities in Rural Area by Strengthening Public Administration Services through Integration of Priority Regional Center and Cities	[Policy 3] Improvement of accessibility to the potential resources areas
	[Strategy 4] Development of Sulawesi with due Consideration on Environment, Safety and Human Resources	[Policy 4] Strengthening the road network in rural area and isolated island
		[Policy 5] Reduction of environmental load in transport sector
		[Policy 6] Enhancement of Traffic Safety and Capacity of Suburban Arterial Roads
		[Policy 7] Development of road network paying due consideration on environment
		[Policy 8] Strengthening the road management including maintenance system

2) Road Development Plan and Possible Projects

The Study team sets up the road development plan according to the road development policy and possible projects are proposed taking into consideration the existing road condition as shown in the Table 8.3.

Table 8.3 Proposed Road Development Plan

Proposed Road Development Plan		Possible Major Projects identified by the Study team (Excluding on-going projects)	Province
[Policy 1] Inter-regional transport network of six provinces in Sulawesi in Sulawesi	(1-1) Strengthening the Trans Sulawesi Road (West, Central and East Corridors) as a backbone of transport network in Sulawesi	① West Corridor of TS between Mamuju - Palu including proposed re-alignment section of Mamuju - Tappalang	Central & West
		② Central Corridor of TS from Parepare - Palu Section	South & Central
		③ Central Corridor of TS from Gorontalo - Molibagu - Bitung	Gorontalo and North
		④ East Corridor of TS in the Poso - Ampana - Biak - Luwuk - Baturube - Kolonodale - Border of South East Sulawesi - Kendari	Central & Southeast
	(1-2) Strengthening peninsula crossing road connecting each Trans Sulawesi Corridor to complete the road network	① Capacity Expansion of Maros - Watampone (by Tunnel)	South
		② New construction of Mountong - Buol Road	Central
		③ Improvement and Upgrading of Kaluku - Sabbang Road	West
		④ Capacity Expansion of Tawaeli - Toboli Road by Tunnel	Central
		⑤ North Mountain Area Crossing Road	Southeast
[Policy 2] Accommodation to the Heavy Vehicle	(2) Reinforcement of access to/from port facilities to accommodate increasing large-sized container and over-loaded heavy truck.	① Makassar - Maros - Watampone/Bajoe Route and Kolaka - Kendari Route	South & Southeast
		② Mamuju - Parepare - Siwa Route and Palopo - Siwa Route	West, South
		③ Gorontalo - Isimu - Kwandang/Anggrek Port - Manado - Bitung Route	Gorontalo & North
[Policy 3] Improvement of accessibility to potential resource areas	(3) Strengthening the road to be in all weather conditions which connected with high potential resource areas to enhance regional development in rural area	① Lakahang - Tumongan Road : 85km (requesting upgrade to national road)	West
		② Kaluku - Tabang Road:168km (requesting upgrade to national road)	West
		③ Wonomulyo - Keppe: 95km	West
		④ Beteleme - Border of South Sulawesi - Nuha (requesting upgrade to national road) = Soroako (Lake Matano Crossing Ferry should be provided)	Central
		⑤ New development of north crossing road (Tatewatu - Routa - Porehu: 200km)	Southeast
[Policy 4] Strengthening the road network in rural areas and isolated islands	(4-1) Upgrading the road function to be higher classification which linked with major cities or new regency capitals and improvement of the road in accordance with the road classification	① Upgrading West Corridor of Trans Sulawesi Road from Mamuju to Palu to be arterial national road from collector national road	West & Central
		② Upgrading East Corridor of Trans Sulawesi Road (Poso - Luwuk - Baturube - Kolonodale) to be collector national road from collector provincial road	Central & Southeast
		③ Upgrading East Coast Buton Road (Pasar Wajo - Lasalimu -Bubu - Ronta;174km and Malingano - Ronta - Ereke:73km) and Road in Wakatobi Islands	Southeast
		④ Upgrading Lapoa - Poli pololia - Kolaka (90 km)	Southeast
		⑤ Upgrading ferry routes from Manado - Bitung - Melanguane and Tahuna	North
	(4-2) Improvement of access to the underdeveloped areas to be in trafficable condition by proper maintenance.	① Access roads to underdevelopment areas should be trafficable in all seasons under the road maintenance program	Six Provinces
[Policy 5] Reduction of environment load in transport sector	(5) Incorporation of energy-saving ferry transport in the road network system as a Nautical Highway to reduce the environmental load	① Watampone/Bajoe = Kolaka route	South & Southeast
		② Siwa = Kolaka route	South & Southeast
		③ Kolonodale = Baturube/Tokala Route across Tomori Bay (Need of New Ferry Service)	Central
		④ Kendari = Luwuk = Gorontalo	Central & Southeast
		⑤ Manado/Bitung = Tahuna = Melanguane = (Davao in Philippine)	North
		⑥ Kendari = Labuan = Baubau	Southeast
		⑦ Sinjai = Kambara - Raha	South & Southeast
[Policy 6] Improvement of traffic safety and expansion of road capacity	(6) Widening of congested suburban roads or construction of bypass/toll roads to cope up with increasing traffic demand and to improve the natural/living environment along the congested major roads	① Trans Sulawesi Mamminasata Road /Mamminasata Bypass	South
		② Manado Bypass and Manado Ring Road	North
		③ Palu Bypass	Central
		④ Kendari Bay Crossing Bridge	Southeast
		⑤ Gorontalo - Jalaluddin - Anggrek Port Bypass	Gorontalo
[Policy 7] Control of road development with due consideration to environment	(7-1) Reinforcement of disasters prevention measures for a flood and a landslide disasters	① East corridor of Trans Sulawesi (Luwuk - Toili - Baturube)	Central
		② Crossing roads from Mamuju to Toraja in West Sulawesi	West & South
	(7-2) Restriction of road development to maintain environmental preservation on natural resources and to protect isolated culture community	① Baturube - Kolonodale road should not be developed because of natural preservation of Morowali and appropriate ferry transport be provided instead of new road.	Central
[Policy 8] Road Management and Maintenance	(8) Strengthening road maintenance system and its management including traffic safety, capacity development and privatization, etc	① Improvement of road maintenance system including its organization, administration, capacity, fund, etc	Six Provinces
		② Enhancement of traffic management including traffic safety and control to cope up with increasing motorcycle and large sized vehicles	
		③ Road management (Reinforcement of land acquisitions and land use control, etc)	
		④ Capacity Development of regional government	
		⑤ Shifting to a private sector for implementation of toll road (Manado -Bitung Toll Road, Sutami Toll Road in Makassar)	
		⑥ Asset Management on Road and Bridge Facilities	

Source: JICA Study Team

3) Proposed Improvement Plan

The Study team proposed the road improvement measures and classified them into three categories of program as follows:

(i) New road construction

- * **New bypass:** New bypass road construction is required to improve suburban arterial road to mitigate traffic congestion.
- * **New road:** Construction of new road is required on missing links to complete the road connection
- * **Re-alignment:** Re-alignment of the existing road is required to improve horizontal alignment and road gradient.

(ii) Betterment

- * **Betterment I:** The work involves reconstruction of existing pavement without widening.
- * **Betterment II:** The work involves widening of existing travel-way 3.5m – 5.4m road to 6.0m to increase existing road capacity
- * **Betterment III:** The work involves widening of existing travel-way 6.0m road to 7.0m to increase existing road capacity
- * **Betterment IV:** The work involves widening of existing travel-way 6.0m to more than 7.0m or provides additional traffic lanes to increase

(iii) Maintenance

- * Periodic maintenance by overlay of existing road without widening
- * Routine maintenance by patching, cleaning, cutting glasses, etc

The above improvement measures are applied to all the existing road network of arterial and collector roads.

4) Upgrade of Road Classification

The functional and administrative classifications of the road were reviewed taking into consideration the traffic volume as well as change of administrative role of regional capitals from regional center to national center or by setting up of new regency and proposed the following change.

Case 1: Upgrade of functional classification from Collector Road to Arterial Road

Case 2: Upgrade of administrative classification from:

- Provincial Road to National Road, and
- Kabupaten Road to Provincial Road

Figure 8.1 shows the proposed upgrade plan of arterial and collector roads in Sulawesi.

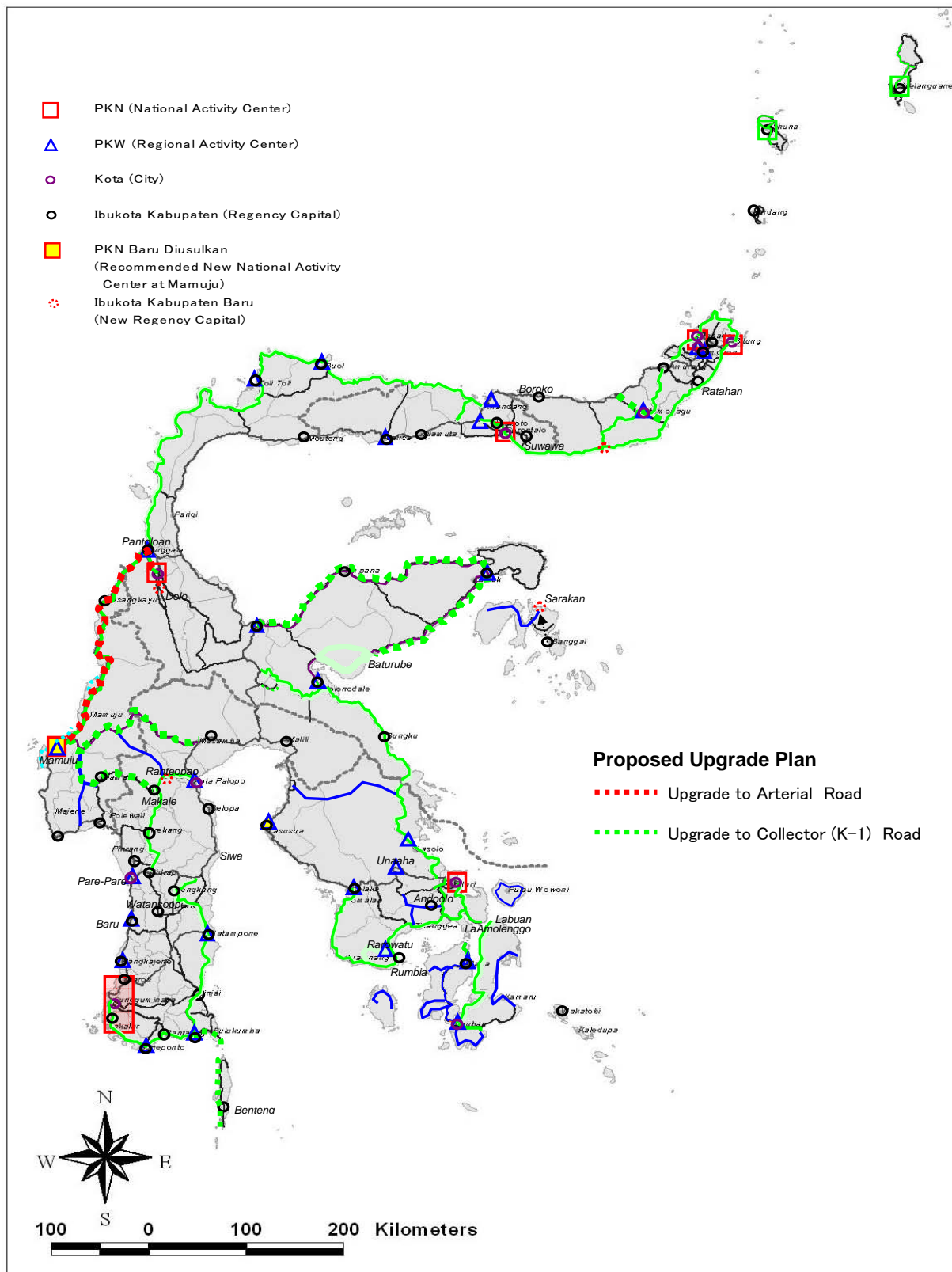


Figure 8.1 Proposed Upgrade Plan of Arterial and Collector Roads

5) Staged Application of New Road Standard Regulation

The GOI issued “Government Road Regulation/Peraturan Pemerintah Nomor No.34 Tahun 2006 Tentang Jalan (PP No. 34 Year 2006) replacing PP No. 26 Year 1985. One of the major changes in the new regulation is roadway and travel-way width.

The new regulation specified 7 m- travel-way width for medium road. While relation of road width with traffic level has not yet been issued concerning PP No.34 Year 2006.

The Study team prepared the proposal on “Stage-wised Road Development of Standard 7m Travel-way Specified in New Road Regulation (PP Mo 34 Year 2006) for Arterial Road and Collector Roads in Sulawesi Island” and submitted it to the Bina Marga as the Discussion Paper on October 5, 2007. for this study

Figure 8.2 shows the proposed stage-wised application on new road standard by type of existing road width, road classification and proposed improvement measures based on the present and future traffic demands and the following is the summary of recommendations:

- * Primary arterial roads should be widened to the standard 7.0m travel-way by the target year of 2024
- * Primary collector roads should be widened to 7.0m by stages based on the present and future traffic demand.

Periodic and routine maintenance should be given the first priority to sustain the national and provincial road assets.

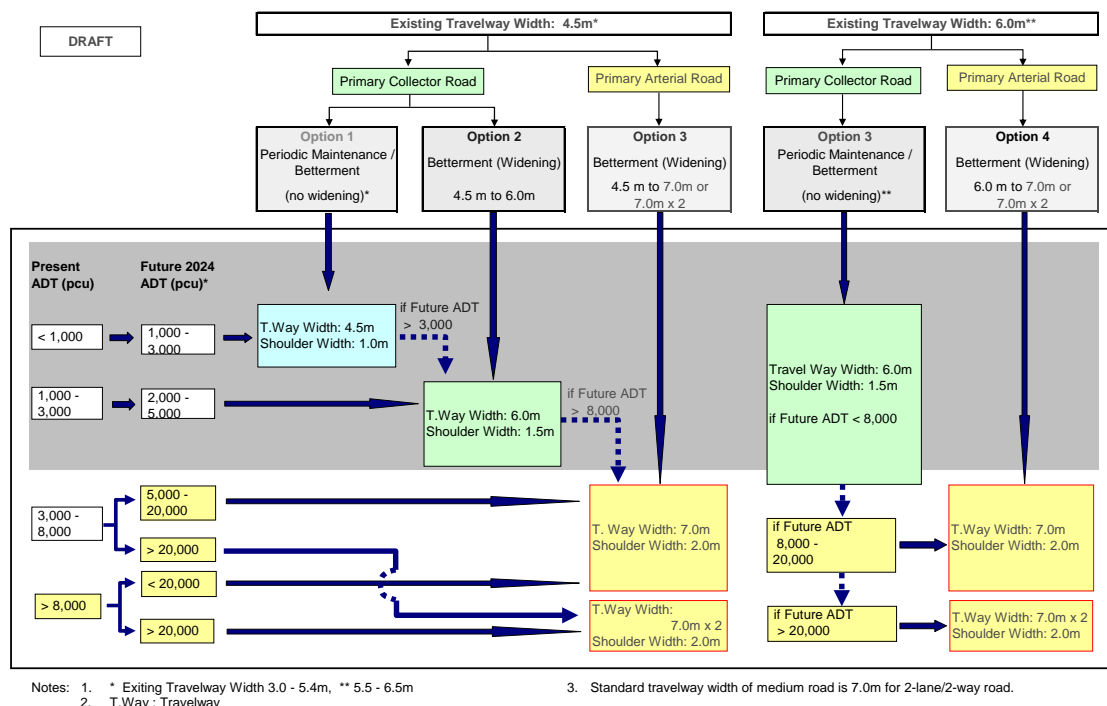


Figure 8.2 Proposed Stage-wised Application on New Road Standard

6) Needs for Capacity Expansion and Pavement Improvement

The Study team examined the traffic capacity of existing road to identify the needs for capacity expansion in case of without projects in 2024. The need for capacity expansion is determined applying the stage-wised application method of new road standard regulation which was recommended by the Study team.

Figure 8.3 (1) ~ Figure 8.3 (3) show the section of road by province where capacity expansion of existing road is necessary based on the category of existing carriageway road width.

The summary of capacity expansion plan covering the whole the road network in Sulawesi shows in **Figure 8.4** and capacity expansion by type of widening is summarized in Table 8.4.

Table 8.4 Needs for Capacity Expansion of Arterial and Collector Roads by 2024

unit: km

PROVINCE/ROAD CATEGORY	BETTERMENT					NEW ROAD	MTNCE ONLY	TOTAL
	I	II	III	IV	TOTAL			
NORTH SULAWESI PROVINCE								
NATIONAL ROAD	109	638	368	29	1,144	0	188	1,332
ARTERIAL	0	0	315	15	329	0	22	351
COLLECTOR 1	109	638	53	15	814	0	167	981
PROVINCIAL ROAD	276	50	18	0	344	30	516	890
TOTAL	384	688	386	29	1,488	30	704	2,222
GORONTALO PROVINCE								
NATIONAL ROAD	60	73	320	0	453	0	151	604
ARTERIAL	0	0	306	0	306	0	0	306
COLLECTOR 1	60	73	14	0	147	0	151	299
PROVINCIAL ROAD	262	0	0	0	262	0	123	385
TOTAL	322	73	320	0	715	0	274	989
CENTRAL SULAWESI PROVINCE								
NATIONAL ROAD	419	0	724	0	1,142	0	1,179	2,322
ARTERIAL	0	0	724	0	724	0	20	743
COLLECTOR 1	419	0	0	0	419	0	1,160	1,578
PROVINCIAL ROAD	624	0	0	0	624	0	803	1,426
TOTAL	1,043	0	724	0	1,766	0	1,982	3,748
WEST SULAWESI PROVINCE								
NATIONAL ROAD	219	100	512	0	831	0	2	833
ARTERIAL	0	0	512	0	512	0	2	514
COLLECTOR 1	219	100	0	0	319	0	0	319
PROVINCIAL ROAD	143	100	0	0	243	0	45	288
TOTAL	362	200	512	0	1,074	0	47	1,121
SOUTH SULAWESI PROVINCE								
NATIONAL ROAD	110	349	767	162	1,389	16	275	1,679
ARTERIAL	0	0	657	134	791	16	72	879
COLLECTOR 1	110	349	110	27	598	0	203	800
PROVINCIAL ROAD	73	319	43	0	436	70	602	1,108
TOTAL	183	669	811	162	1,824	86	877	2,787
SOUTHEAST SULAWESI PROVINCE								
NATIONAL ROAD	419	0	464	0	882	150	339	1,372
ARTERIAL	0	0	464	0	464	0	0	464
COLLECTOR 1	419	0	0	0	419	150	339	908
PROVINCIAL ROAD	335	0	0	0	335	0	354	689
TOTAL	753	0	464	0	1,217	150	694	2,060
TOTAL	3,046	1,630	3,215	191	8,083	266	4,577	12,926

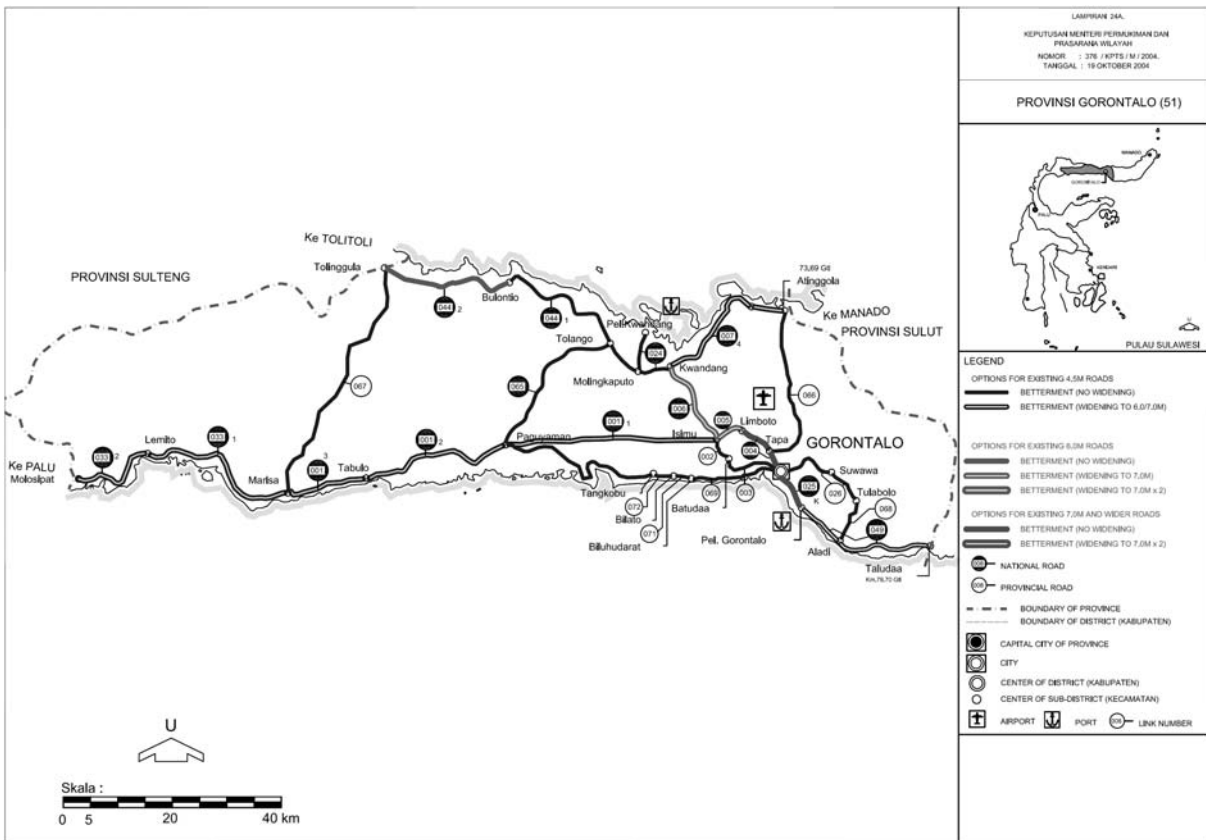
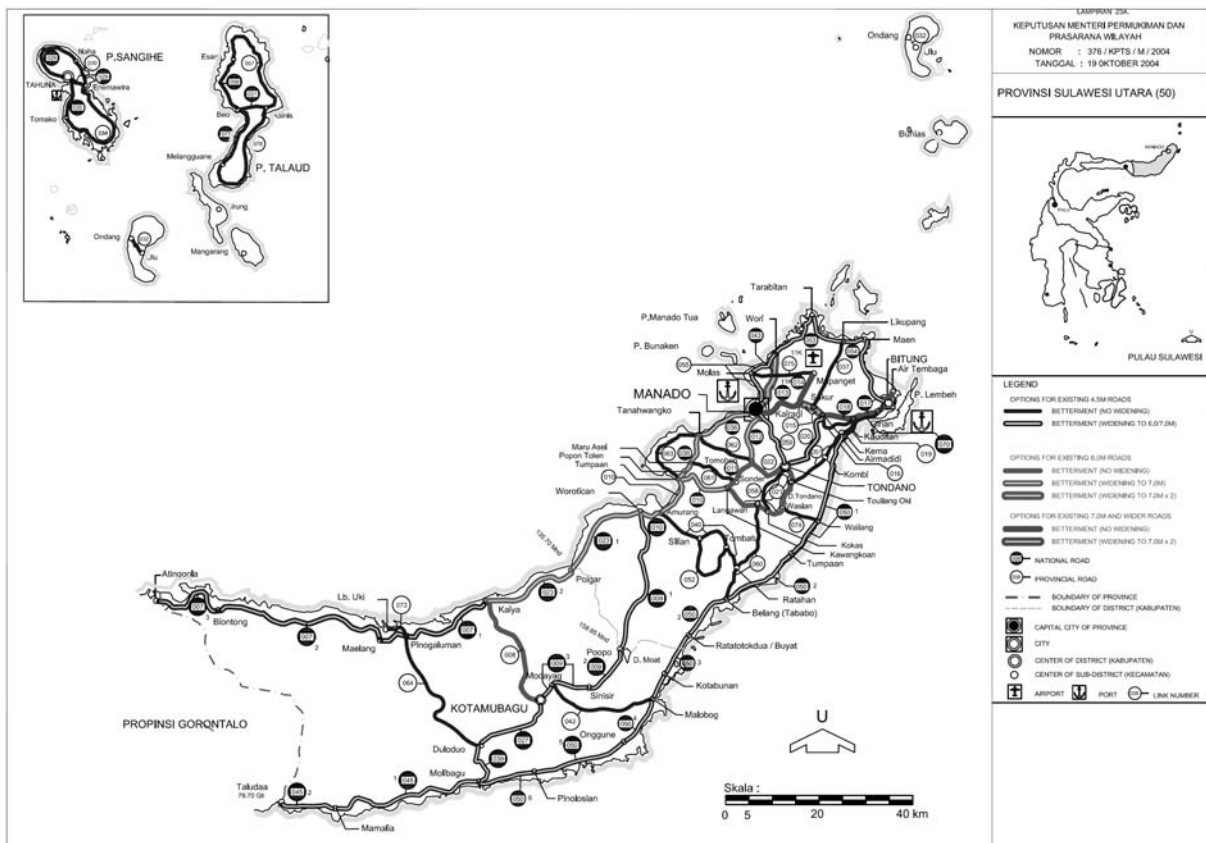


Figure 8.3 (1) Needs for Capacity Expansion of Existing Roads (North & Gorontalo)

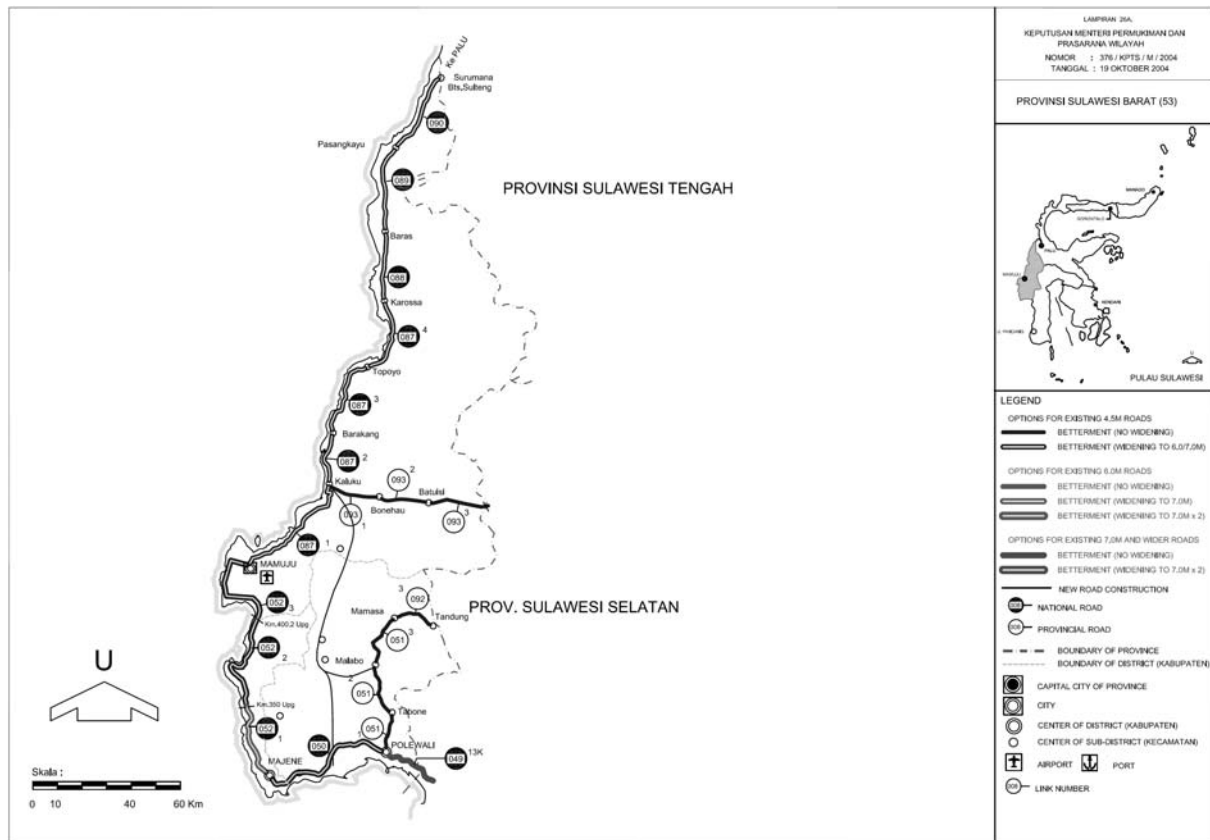
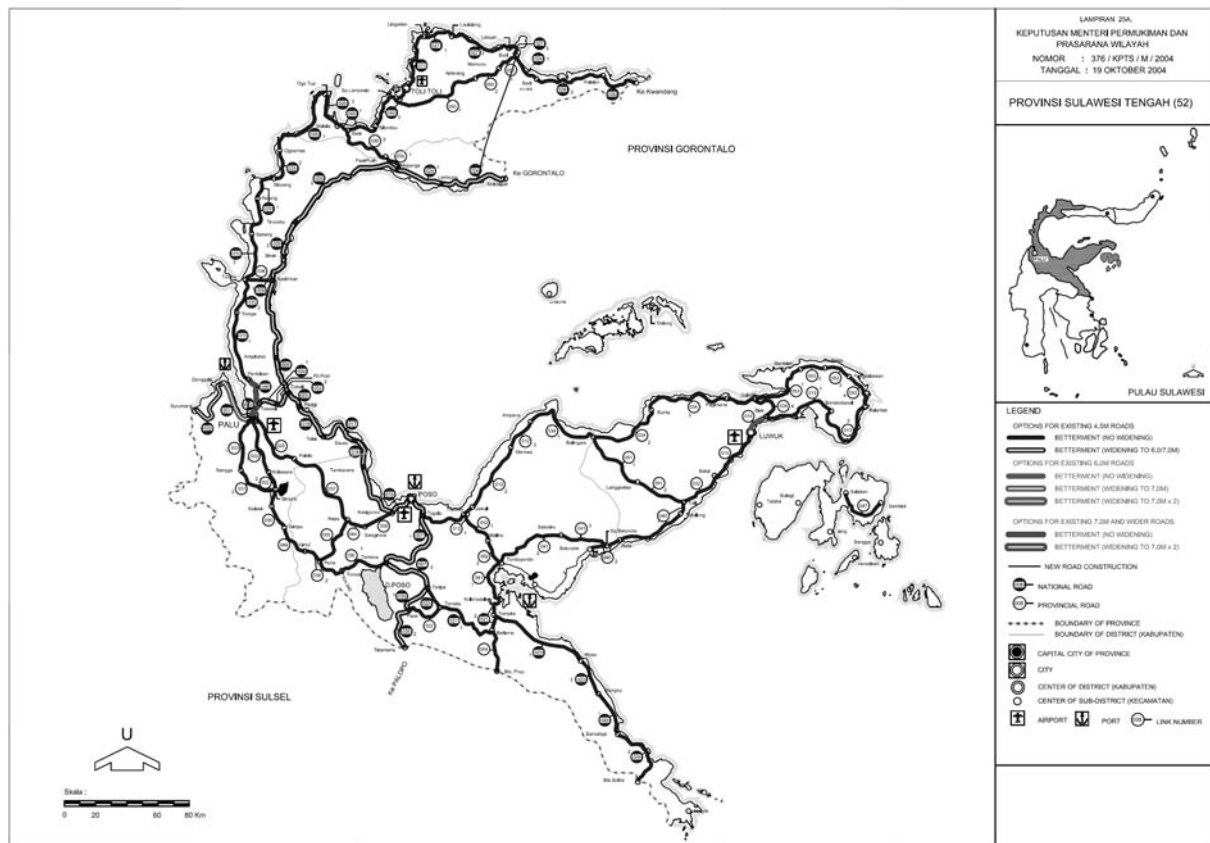


Figure 8.3 (2) Needs for Capacity Expansion of Existing Roads (Central & West)

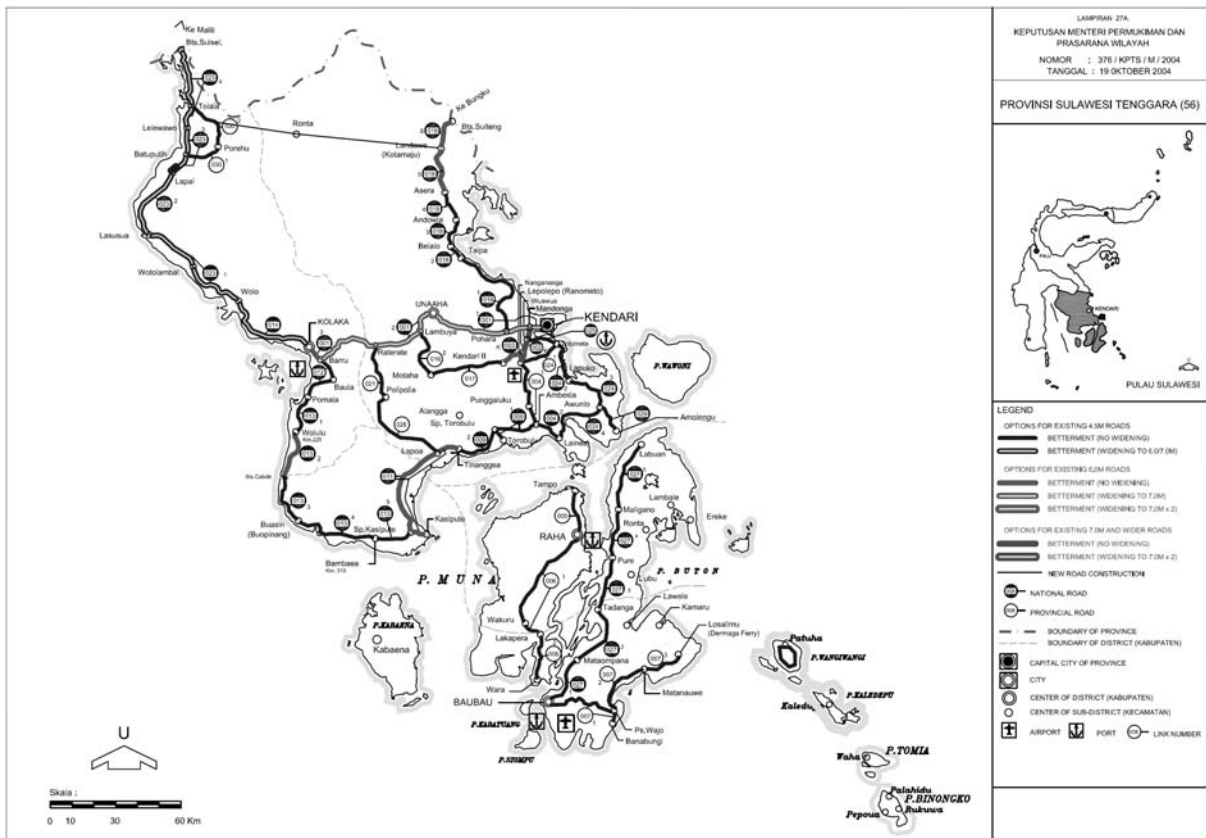
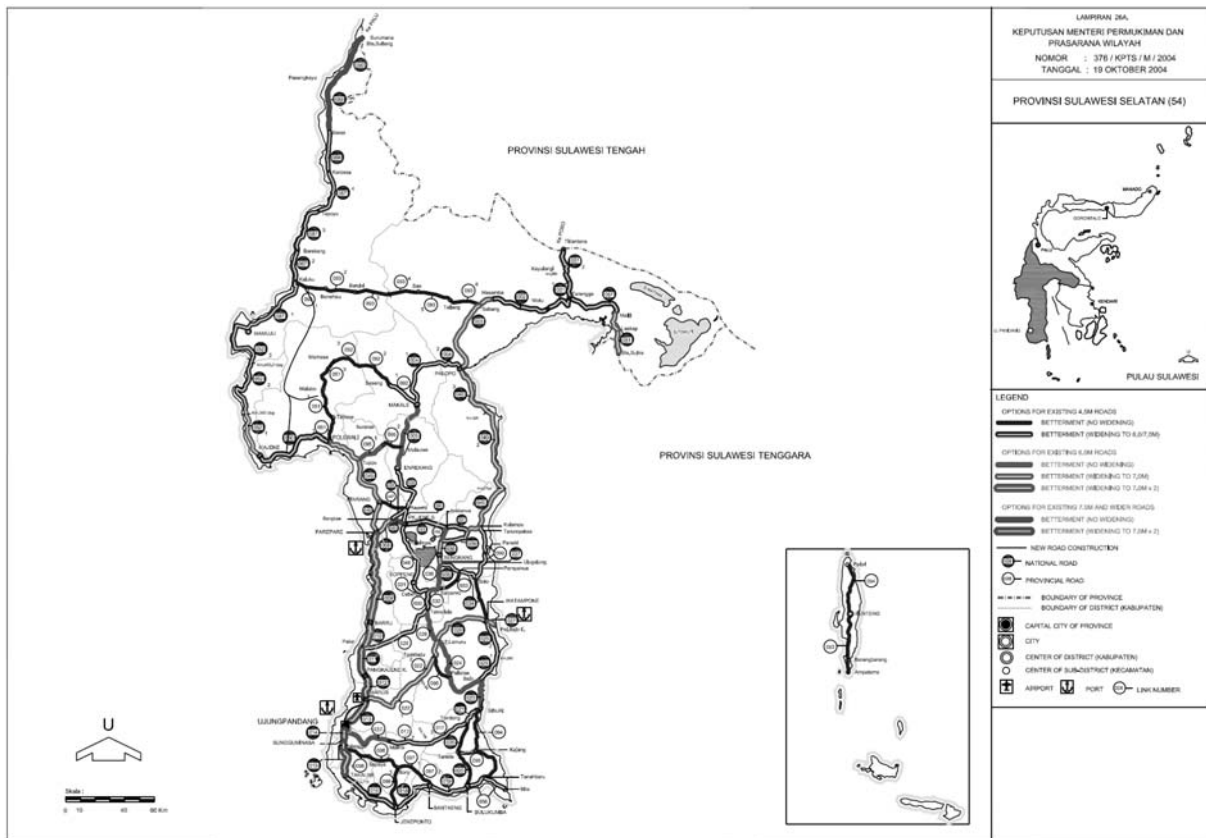


Figure 8.3 (3) Needs for Capacity Expansion of Existing Roads (South & Southeast)

7) Needs for Improvement of Pavement

Existing road conditions is classified into 4 degrees depending on the pavement condition as shown below:

Class I: Good, Class II: Fair, Class III: Poor, Class IV: Bad

The pavement improvement should be conducted taking into account the timing of widening for existing road in principle which is determined in line with stage-wised application method of new road standard regulation. However, the Study team proposes that the road sections which are in poor and bad conditions and classified into Class III and Class IV should be improved by either overlay or reconstruction in the Short-term Plan as much as possible taking into consideration the traffic safety as well as the road side environment condition.

The summary of pavement improvement is shown in **Table 8.5**.

Table 8.5 Needs for Pavement Improvement of Existing Road Network

Prog. No	Project	Section	Need for Pavement Improvement				
			Class I Good	Class II Fair	Class III Poor	Class IV Bad	Total
TS-1	West Corridor (South section)	Jeneponto – Makassar – Parepare – Mamuju – Palu	276	304	73	193	846
TS-2	West Corridor (North section)	Palu – Kwandang – Manado – Bitung	741	475	61	113	1,390
TS-3	Central Corridor (South section)	Jeneponto – Watampone – Tarregne – Poso – Tabori	507	405	38	1	951
TS-4	Central Corridor (North section)	Tabori – Gorontalo – Bitung	445	319	184	64	1,012
TS-5	East Corridor	Tarrence – Kolaka – Kendari – Tompira – Luwuk – Poso	378	1113	402	304	2,197
Total (1)			2,347	2,616	758	675	6,396
PR-1	North Sulawesi Province		492	455	260	152	1,359
PR-2	Gorontalo Province		151	102	219	4	476
PR-3	Central Sulawesi Province		92	633	293	177	1,195
PR-4	West Sulawesi Province		6	45	0	256	307
PR-5	South Sulawesi Province		401	839	241	165	1,646
PR-6	Southeast Sulawesi Province		276	174	20	227	697
Total (2)			1,418	2,248	1,033	981	5,680
			3,765	4,864	1,791	1,656	12,076

8) Bridge Improvement Plan

As for the bridge condition on national road, it is classified into 5 categories depending on the damages in according to the Integrated Bridge Management System (IBMS) as follows:

Grade 1: Good, Grade 2: Fair, Grade 3: Poor, Grade 4: Bad, Grade 5: Impassable

According to the present data of 3,344 bridges on national road, about 10% are Grade 4 “Bad”, Grade 5 “Impassable” and wooden bridges and about 16% of the provincial road bridges are also in bad, impassable and wooden bridges.

The Study team proposes that all bridges categorized in Grade 4 and Grade 5 should be improved to be permanent bridges as soon as possible to keep the road function as well as to minimize an impact on local socio-economic activities caused by collapse of bridge.

Table 8.6 and **Table 8.7** show the summary of bridge improvement plan by an urgent bridge repair program.

Table 8.6 Summary of Bridge Conditions on National Road

Province	No Damage /Good (Grade 1)	Fair/Poor (Grade 2 & 3)	Bad/Very Bad (Grade 4 & 5)	Wooden/Unknown	Total
North Sulawesi	399 (67.5%)	109 (18.4%)	41 (6.9%)	42 (7.1%)	591 (100%)
Gorontalo	271 (95.4%)	10 (3.5%)	3 (1.1%)	0 (0%)	284 (100%)
Central Sulawesi	496 (53.6%)	381 (41.2%)	40 (4.3%)	8 (0.9%)	925 (100%)
West Sulawesi	178 (64.3%)	43 (15.5%)	20 (7.2%)	36 (13.0%)	277 (100%)
South Sulawesi	489 (70.5%)	194 (28.0%)	11 (1.6%)	0 (0%)	694 (100%)
South East Sulawesi	308 (53.8%)	140 (24.4%)	75 (13.1%)	50 (8.7%)	573 (100%)
Total	2,141 (64.0%)	877 (26.2%)	190 (5.7%)	136 (4.1%)	3,344 (100%)
			326 (9.8%), 5,510m		

Source: JICA Study Team based on information form Dinas PU

Table 8.7 Summary of Bridge Conditions on Provincial Road

Province	No Damage /Good (Grade 1)	Fair/Poor (Grade 2 & 3)	Bad/Very Bad (Grade 4 & 5)	Wooden/Unknown	Total
North Sulawesi	272 (71.2%)	51 (13.4%)	1 (0.3%)	58 (15.2%)	382 (100%)
Gorontalo	21 (38.9%)	0 (0%)	33 (61.1%)	0 (0%)	54 (100%)
Central Sulawesi	726 (92.8%)	9 (1.2%)	0 (0%)	47 (6.0%)	782 (100%)
West Sulawesi	63 (71.6%)	22 (25.0%)	2 (2.3%)	1 (1.1%)	88 (100%)
South Sulawesi	476 (69.6%)	127 (18.6%)	56 (8.2%)	25 (3.6%)	684 (100%)
South East Sulawesi	242 (45.4%)	117 (22.0%)	69 (12.9%)	105 (19.7%)	533 (100%)
Total	1,800 (71.3%)	326 (12.9%)	161 (6.4%)	236 (9.4%)	2,523 (100%)
			397 (15.8%), 6,049m		

Source: JICA Study Team based on information form Dinas PU

9) Sulawesi Road Master Plan in 2024

The Study team establishes Sulawesi Road Master Plan in 2024 which covers the road network by road classification with the proposed improvement measures.

Development concept of the master plan is presented in Table 8.8 and the road network system of Sulawesi in 2024 is summarized in Table 8.9 and shown in Figure 8.4.

Upon completion of the road network system in 2024, following benefits would be expected;

- i) Harmonized Economic development in Sulawesi would be expected by strengthening of economic linkage between six provinces through completion of Trans Sulawesi Road with a high standard of all weather road condition.

- ii) Improvement of basic human needs as well as poverty alleviation would be expected in rural areas and isolated islands through strengthening road network system by completion of missing.
- iii) Development of processing industries utilizing potential resources in Sulawesi would be expected by increasing accessibility to the potential areas.
- iv) Natural environment and isolated culture community would be properly protected by road development with due consideration of environment.
- v) Increase of environmental load in Sulawesi would be minimized through incorporation of energy-saving transport ferry service in the road network system and strengthening the nautical highway network.

Table 8.8 Development Concept of Sulawesi Road Master Plan

Road Classification			Road Structure		Development Concept of Sulawesi Road Master Plan
			Nos. of Lane	Pavement Width	
I	National Road	Arterial Road	2 lanes	7.0 m	All arterial national road become 7.0m road regardless of traffic volume and will be improved to be all weather condition with sufficient capacity and standard
		Collector Road (K-1)	2 lanes	6.0m – 7.0 m	The road carrying the traffic more than 3,000 p.c.u/day – 8,000 p.c.u/day become 6.0 m road and the road more than 8,000 p.c.u/day become 7.0m road
			1.5 lanes	4.5m (3.5m–5.4m)	The road carrying the traffic less than 3,000 p.c.u/day will be the 1.5 lanes road but improved to be all weather condition road with asphaltic concrete
II	Provincial Road	Collector Road (K-2&3)	2 lanes	6.0m – 7.0 m	Same as Collector K-1 Road
			1.5 lanes	4.5m (3.5m–5.4m)	Same as Collector K-1 Road

Table 8.9 Summary of Sulawesi Road Master Plan in 2024

Unit: Km

Province	National Road			Provincial Road	Total
	Arterial Road	Collector K-1	Total	Collector K-2&3	
North Sulawesi Province	351	981	1,332	890	2,222
Gorontalo Province	306	299	604	385	989
Central Sulawesi Province	743	1,578	2,322	1,426	3,748
West Sulawesi Province	514	319	833	288	1,121
South Sulawesi Province	879	800	1,679	1,108	2,787
Southeast Sulawesi Province	464	908	1,371	689	2,060
Total	3,256	4,884	8,141	4,786	12,926

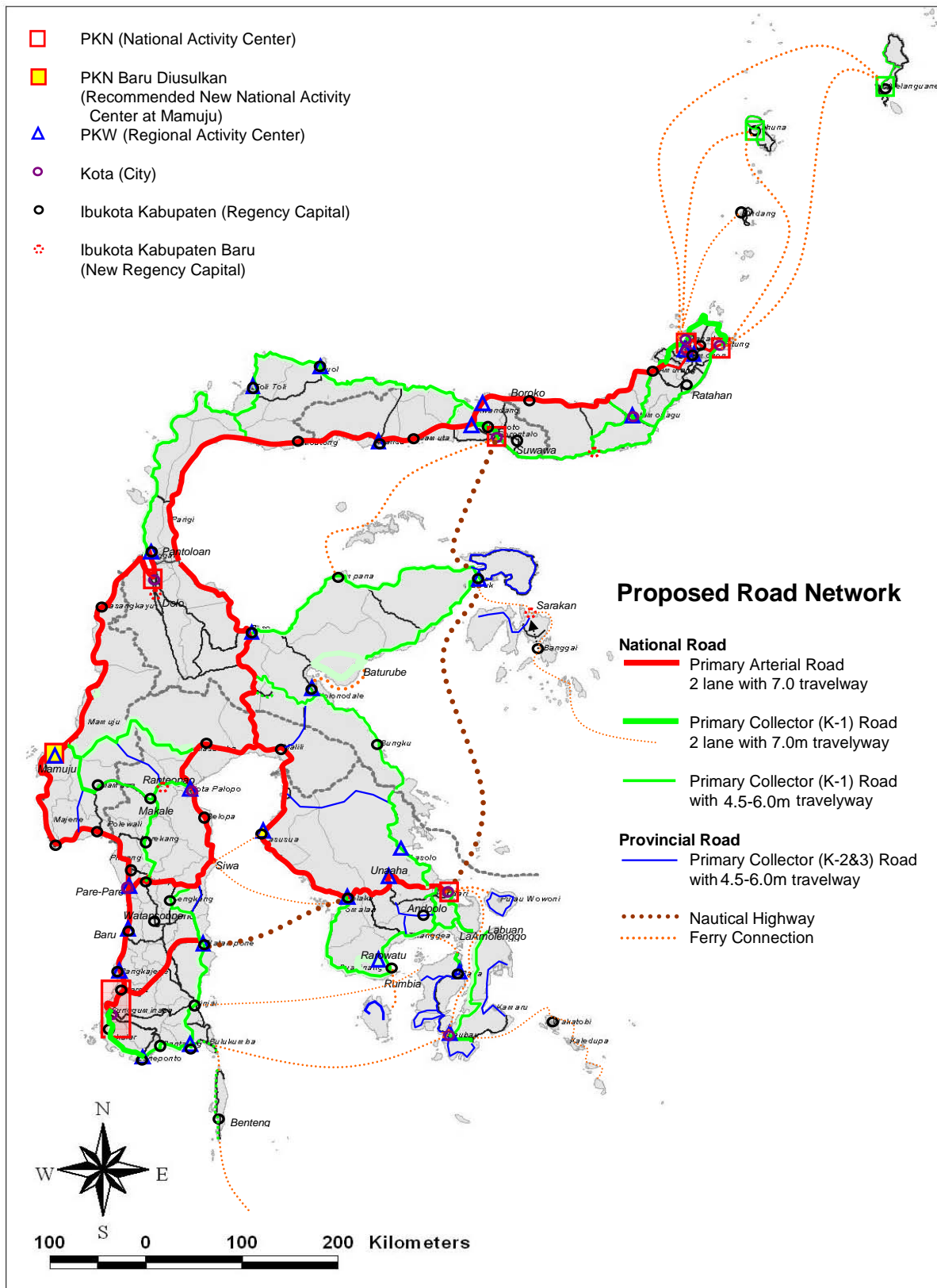


Figure 8.4 Sulawesi Road Master Plan in 2024 (SRMP)

CHAPTER 9 FUTURE TRAFFIC DEMAND FORECAST

(1) Traffic Assignment Cases

Projects Tested

The Trans Sulawesi Road consists of the West, Central and East Corridors. Each corridor was further divided into Projects taking into account the regional characteristics as well as the extension of road length. Figure 9.1 shows the projects proposed by the Study Team. These are:

TS-1 West Corridor (South): Jeneponto-Makassar-Parepare-Mamuju-Palu, 6 Projects

TS-2 West Corridor (North): Palu-Kuandang-Manado-Bitung, 3 Projects

TS-3 Central Corridor (South): Jeneponto-Watampone-Wotu-Poso-Toboli, 2 Projects

TS-4 Central Corridor (North): Toboli-Gorontalo-Bitung, 2 Projects

TS-5 East Corridor: Wotu-Kolaka-Kasiputih-Kendari-Kolonodale-Luwuk-Poso, 6 Projects

Note: Other national and provincial roads not indicated in Figure 9.1 are included in either of the above Projects.

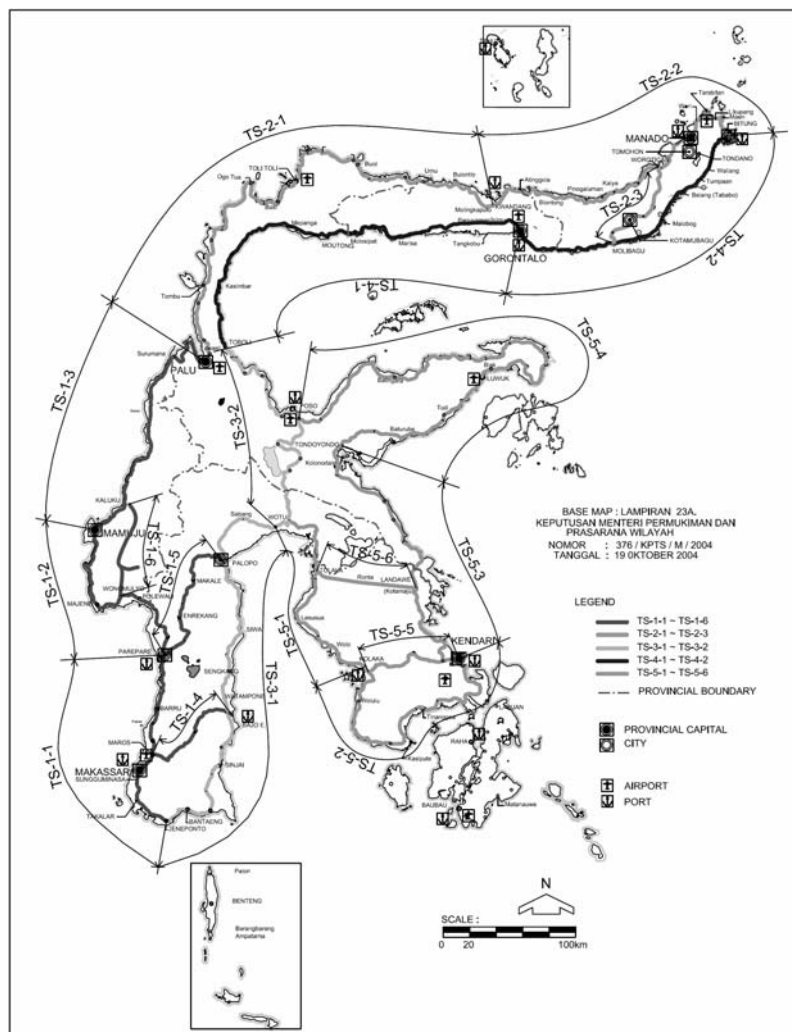


Figure 9.1 Proposed Corridors and Projects

Traffic Assignment Cases

Table 9.1 summarizes the traffic assignment cases conducted. Note that these traffic assignments are mainly for the assessment of network performance and, among others, the prioritization of the proposed projects. The actual implementation program is hereinafter discussed based on this exercise.

Table 9.1 Traffic Assignment Cases as Tested

	2007	2014	2019	2024
“Do-nothing” case	*	*	*	*
“With Project” case for each of 19 Projects		*	*	*
“Do-all” case assuming all 19 Projects	*	*	*	*

(2) Traffic Assignments Results

“Do-nothing” Case

This analysis was the basis for determining the planning directions of the arterial road network in Sulawesi. The result is shown in Chapter 7 of this report.

The distribution of traffic volume is concentrated around the major cities like Makassar, Manado, Palu and Kendari. Particularly around Makassar, traffic congestion which is currently only confined to the city will spread by 2024 to wider areas of South Sulawesi Province such as Parepare, Majene, Palopo and Masamba. However, in other areas traffic congestion will not be serious except for Manado and its vicinity.

The traffic volume on intercity roads of Sulawesi will increase up to 10,000 PCUs/day around Makassar by 2024. For the Makassar-Parepare section it will be large at 20,000-30,000 PCUs/day. Typically on other arterial roads in South Sulawesi Province, it will be 4,000-8,000. In other provinces, the traffic volume will exceed 5,000 PCUs/day by 2024 near provincial capital cities of Manado, Gorontalo, Palu, Mamuju and Kendari. However, it will still be small below 3,000 PCUs/day on most inter-provincial roads.

With regard to the nautical highway, the traffic volume is currently very small about 100 PCUs/day for Bajoe-Kolaka and about 30 PCUs/day for Pagimana-Gorontalo. In 2024, this volume will increase to about 450 PCUs/day and 100 PCUs/day respectively assuming the current modal shares (i.e. the same service level as at present).

“With Project” Case for Each of 19 Projects

A total of 57 traffic assignments were carried out in this practice. Each case assumes that one single project is completed while the other 18 projects remain unimplemented. Figure 9.2 exemplifies the

distribution of assigned traffic for Project TS-1-5 (Parepare-Palopo). The same figures were prepared for other projects, although they look quite similar to each other, because most projects are improvement of existing roads and they have not much difference in traffic distribution. Because of this they were omitted from this report.

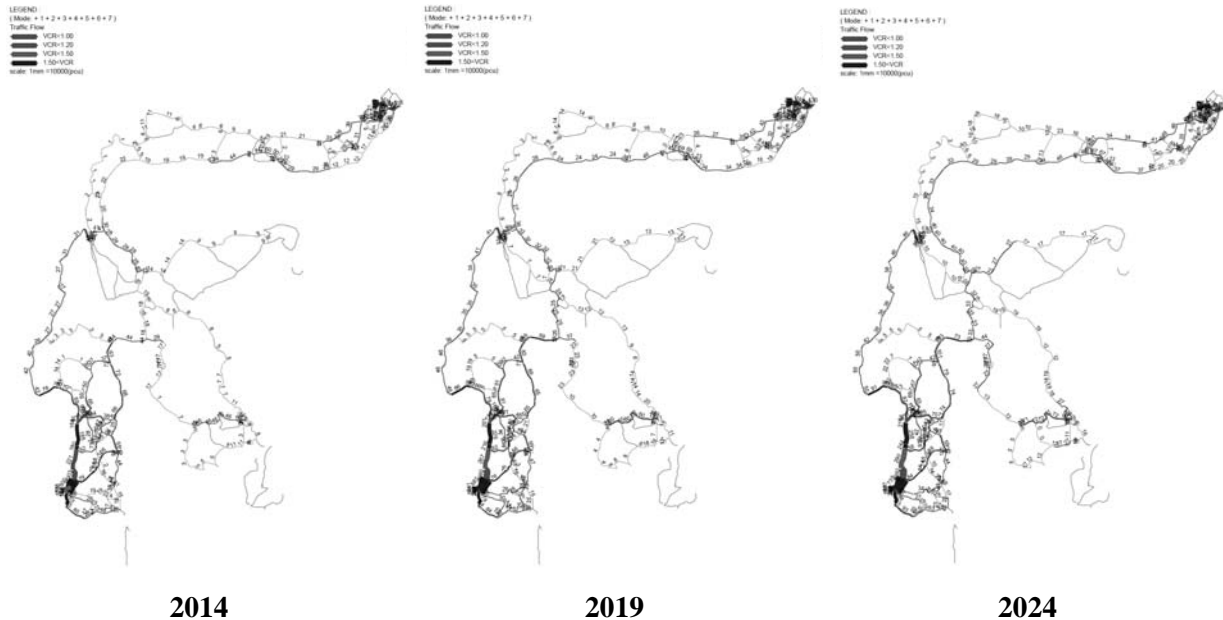


Figure 9.2 Result of Traffic Assignment (With Project TS-1-5)

“Do-all” Case with 19 Projects

Figure 9.3 presents the result of traffic assignment in the “Do-all” case. This may be considered as the Master Plan. As compared to the “Do-nothing” case or the “With Project” cases, traffic congestion is not foreseen except for the urban area in Makassar. Traffic distribution of traffic, however, does not differ much.

As for the nautical highway, the introduction of high-speed, large-capacities and low-cost RoRo ships are assumed. Although its future traffic volume is difficult to estimate due to uncertain charge levels, its share in total inter-provincial traffic will presumably double by 2024; i.e. 25% between South Sulawesi and Southeast Sulawesi and 6% between Central Sulawesi and Gorontalo/North Sulawesi. It is surmised traffic volume in 2024 will be 900 PCUs/day between Bajoe and Kolaka, and 200 PCUs/day between Gorontalo and Pagimana/Luwuk.

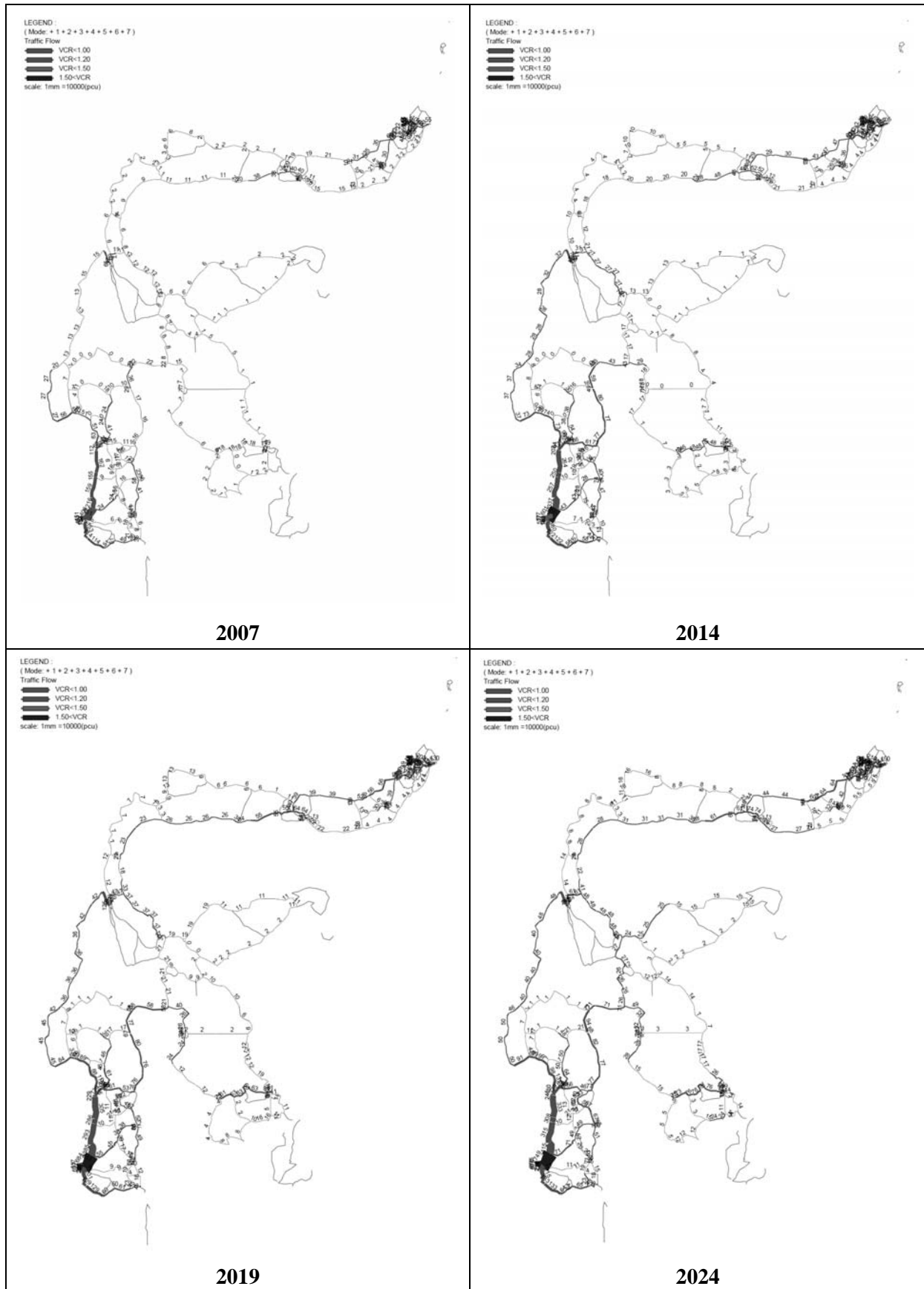


Figure 9.3 Result of Traffic Assignment (“Do-all” Case with 19 Projects)

CHAPTER 10 PRELIMINARY ENGINEERING STUDY AND COST ESTIMATES

(1) Preliminary Engineering Study

In order to estimate rough improvement costs and elaborate the priorities of implementation the preliminary engineering study covers not only the arterial roads but also the collector roads of Sulawesi road network. It was carried out based on the new design standards of the “Government Road Regulation/Peraturan Pemerintah Nomor No. 34 Tahun 2006.

1) Identification of Improvement Measures

The types of improvement works for the proposed road network were identified based on the existing road condition and the need to maintain the required service levels of each road category. The following measures were deemed necessary to improve and increase the efficiency of the road network.

Road network improvement

- * New road construction (new bypass and new road)
- * Betterment (re-construction of road structure and capacity expansion by widening)
- * Maintenance (Periodic maintenance (overlay) and Routine maintenance)

Upgrade of road classification

- * Upgrade of functional classification (arterial and collector)
- * Upgrade of administrative classification (national and provincial)

Staged application of new road standard regulation

As stated in the Chapter 8, “Staged application of new road standard regulation” is proposed in the development of the arterial and collector roads taking into account the existing road conditions and existing traffic volumes.

2) Proposed Design Standard and Typical Cross Section

This master plan study considered the current design standards on the planning of road network improvement as stated in the Chapter 3. Since target roads of this study were mainly inter-urban roads, the “Tata Cara Perencanaan Geometrik Jalan Antar Kota” and Decree No. 42/KPTS/Db/2007 corresponding to PP No.34/2006 under Act No. 38/2004 issued by the Department of Public Works, Directorate General of Highways were examined to set the typical cross sections and rough cost estimates.

3) Estimated Quantities

Taking the traffic volume for 2024 which were forecasted and distributed in Chapter 9 as well as

taking into account the new road standard regulations, road links were given optimum options (Betterment, new road construction or maintenance only) in the master plan. It is noted that “maintenance” works, including periodic maintenance (overlay) and routine maintenance, were necessary for all roads and were included in the cost estimates for the total length of the road network.

Considering the improvement measures mentioned above, the project quantity of this master plan is expressed in road length (km) and is shown in Table 10.1 below.

Table 10.1 Project Quantity (Road Length) by Improvement Measure and by Province

unit: km

PROVINCE/ROAD CATEGORY	BETTERMENT					NEW ROAD	MTNCE ONLY	TOTAL
	I	II	III	IV	TOTAL			
NORTH SULAWESI PROVINCE								
NATIONAL ROAD	109	638	368	29	1,144	0	188	1,332
ARTERIAL	0	0	315	15	329	0	22	351
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PROVINCIAL ROAD	276	50	18	0	344	30	516	890
TOTAL	384	688	386	29	1,488	30	704	2,222
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NATIONAL ROAD	60	73	320	0	453	0	151	604
ARTERIAL	0	0	306	0	306	0	0	306
COLLECTOR 1	60	73	14	0	147	0	151	299
PROVINCIAL ROAD	262	0	0	0	262	0	123	385
TOTAL	322	73	320	0	715	0	274	989
CENTRAL SULAWESI PROVINCE								
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ARTERIAL	0	0	724	0	724	0	20	743
COLLECTOR 1	419	0	0	0	419	0	1,160	1,578
PROVINCIAL ROAD	624	0	0	0	624	0	803	1,426
TOTAL	1,043	0	724	0	1,766	0	1,982	3,748
WEST SULAWESI PROVINCE								
NATIONAL ROAD	219	100	512	0	831	0	2	833
ARTERIAL	0	0	512	0	512	0	2	514
COLLECTOR 1	219	100	0	0	319	0	0	319
PROVINCIAL ROAD	143	100	0	0	243	0	45	288
TOTAL	362	200	512	0	1,074	0	47	1,121
SOUTH SULAWESI PROVINCE								
NATIONAL ROAD	110	349	767	162	1,389	16	275	1,679
ARTERIAL	0	0	657	134	791	16	72	879
COLLECTOR 1	110	349	110	27	598	0	203	800
PROVINCIAL ROAD	73	319	43	0	436	70	602	1,108
TOTAL	183	669	811	162	1,824	86	877	2,787
SOUTHEAST SULAWESI PROVINCE								
NATIONAL ROAD	419	0	464	0	882	150	339	1,372
ARTERIAL	0	0	464	0	464	0	0	464
COLLECTOR 1	419	0	0	0	419	150	339	908
PROVINCIAL ROAD	335	0	0	0	335	0	354	689
TOTAL	753	0	464	0	1,217	150	694	2,060
TOTAL	3,046	1,630	3,215	191	8,083	266	4,577	12,926

Betterment I: Re-construction without widening of road structure that is currently in poor condition

Betterment II: Widening from existing 3.5 – 5.4 m road to 6.0m

Betterment III: Widening from existing 6.0m road to 7.0m

Betterment IV: Widening from existing 6.0/7.0m road to 2 x 7.0m

New Roads include 6.0m roads, 7.0m roads and 2 x 7.0m roads.

After the implementation of this master plan, all national roads (arterial and collector K1) and provincial roads (collector K2/K3) in Sulawesi Island should have sufficient road widths that can accommodate future traffic volume (until the year of 2024) along with the required service levels.

4) Packaging of Proposed Links of the SRMP

The SRMP network structure comprises of the main trunk network and other network as follows.

- Main trunk network is the Trans Sulawesi Road Network (Trans Sulawesi Road main

routes) which functions as the main backbone of the Sulawesi road network, providing for inter-regional travel.

- Main trunk network also includes the Peninsula crossing routes which connects each Trans Sulawesi road
- Secondary network provides related routes throughout the length of Sulawesi, it provides for intra-regional travel.

The main trunk network is summarized in Table 10.2, and the same packaging was also used in the traffic demand forecast of this study as stated in Chapter 9.

13 packages for the Trans Sulawesi Road main routes and 6 packages for peninsula crossing roads are proposed in this master plan.

Table 10.2 List of Packages for the Main Trunk Network

TS No.	Corridor Name	Package Name	Category
TS-1	Trans Sulawesi West Corridor (South Sec.)	TS-1-1, TS-1-2, TS-1-3	Trans Sulawesi Main Routes
		TS-1-4, TS-1-5, TS-1-6	Peninsula Crossing Routes
TS-2	Trans Sulawesi West Corridor (North Sec.)	TS-2-1, TS-2-2	Trans Sulawesi Main Routes
		TS-2-3	Peninsula Crossing Routes
TS-3	Trans Sulawesi Central Corridor (South Sec.)	TS-3-1, TS-3-2	Trans Sulawesi Main Routes
TS-4	Trans Sulawesi Central Corridor (North Sec.)	TS-4-1, TS-4-2	Trans Sulawesi Main Routes
TS-5	Trans Sulawesi East Corridor	TS-5-1, TS-5-2, TS-5-3, TS-5-4	Trans Sulawesi Main Routes
		TS-5-5, TS-5-6	Peninsula Crossing Routes

In addition to the Main Trunk Network mentioned above, Secondary Network which supports the Main Trunk Network was also considered in the formulation of the master plan.

All arterial/collector roads other than the Trans Sulawesi Main Routes and the Peninsula Crossing Routes are relatively associated with the 19 packages and are included, as related roads, into the SRMP.

Table 10.3 shows the summary of road length of each package.

Table 10.3 Road Length by Package of Sulawesi Road Master Plan

NO.	PACKAGE	CATEGORY	TOTAL ROAD LENGTH (KM)			
			TOTAL	NATIONAL ROAD		PROVINCIAL ROAD
				Arterial	Collector 1	Collector 2 & 3
1	TS-1-1	TS MAIN CORRIDOR	229	150	79	0
		RELATED ROUTES	429	0	0	429
		TOTAL	658	150	79	429
2	TS-1-2	TS MAIN CORRIDOR	283	283	0	0
		RELATED ROUTES	409	0	117	291
		TOTAL	692	283	117	291
3	TS-1-3	TS MAIN CORRIDOR	348	348	0	0
		RELATED ROUTES	39	39	0	0
		TOTAL	387	387	0	0
4	TS-1-4	PENINSULA CROSSING	144	144	0	0
		RELATED ROUTES	0	0	0	0
		TOTAL	144	144	0	0
5	TS-1-5	PENINSULA CROSSING	223	12	211	0
		RELATED ROUTES	68	58	0	9
		TOTAL	290	70	211	9
6	TS-1-6	PENINSULA CROSSING	200	0	100	100
		RELATED ROUTES	0	0	0	0
		TOTAL	200	0	100	100
7	TS-2-1	TS MAIN CORRIDOR	895	20	875	0
		RELATED ROUTES	125	0	0	125
		TOTAL	1,019	20	875	125
8	TS-2-2	TS MAIN CORRIDOR	496	318	178	0
		RELATED ROUTES	903	98	212	594
		TOTAL	1,399	416	390	594
9	TS-2-3	PENINSULA CROSSING	184	0	184	0
		RELATED ROUTES	0	0	0	0
		TOTAL	184	0	184	0
10	TS-3-1	TS MAIN CORRIDOR	571	268	256	47
		RELATED ROUTES	881	6	356	519
		TOTAL	1,452	274	612	566
11	TS-3-2	TS MAIN CORRIDOR	381	381	0	0
		RELATED ROUTES	688	56	89	543
		TOTAL	1,069	436	89	543
12	TS-4-1	TS MAIN CORRIDOR	553	529	24	0
		RELATED ROUTES	420	0	60	360
		TOTAL	973	529	84	360
13	TS-4-2	TS MAIN CORRIDOR	464	0	459	5
		RELATED ROUTES	429	7	30	393
		TOTAL	893	7	489	398
14	TS-5-1	TS MAIN CORRIDOR	384	384	0	0
		RELATED ROUTES	51	0	0	51
		TOTAL	435	384	0	51
15	TS-5-2	TS MAIN CORRIDOR	415	0	415	0
		RELATED ROUTES	645	0	149	496
		TOTAL	1,060	0	564	496
16	TS-5-3	TS MAIN CORRIDOR	373	0	373	0
		RELATED ROUTES	0	0	0	0
		TOTAL	373	0	373	0
17	TS-5-4	TS MAIN CORRIDOR	970	0	503	466
		RELATED ROUTES	265	0	50	215
		TOTAL	1,235	0	554	681
18	TS-5-5	PENINSULA CROSSING	156	156	0	0
		RELATED ROUTES	156	0	14	142
		TOTAL	312	156	14	142
19	TS-5-6	PENINSULA CROSSING	150	0	150	0
		RELATED ROUTES	0	0	0	0
		TOTAL	150	0	150	0
TOTAL	TOTAL	TS MAIN CORRIDOR	6,361	2,681	3,163	518
		PENINSULA CROSSING	913	168	645	100
		RELATED ROUTES	5,652	408	1,077	4,167
TOTAL			12,926	3,256	4,885	4,785
				8,141		4,785

(2) Cost Estimates

1) Conditions of the Cost Estimates

Construction costs were estimated based on the results of the preliminary engineering study and their quantities. Conditions for the estimate were as follows:

- The SRMP projects are assumed to be executed by the contractor which has been selected through the competitive bidding. Accordingly unit prices used in this estimate were set through the examination of similar road improvement projects. However, cost data collected from each province and on-going projects were also referred.
- Unit costs include direct labor cost, equipment cost, material cost, and the indirect cost of overhead, tax (VAT) and the profit of the contractors.
- Unit costs do not include tax.
- Costs for land acquisition and compensation are not included in this estimate due to lack of information on roadside conditions
- Currency exchange rates used in this estimate were as follows:

USD 1 = Rp. 9,322 (Selling rate of Bank Indonesia on May, 16, 2007)

2) Unit Cost for Road Improvement

Through the examination of unit cost per km of similar past as well as on-going projects in Sulawesi Island, the unit cost for road improvement (with widening existing 4.5m road to 6.0m) was set at Rp. 1,560 Mil./km, while the unit cost for new road construction (6.0m) was set at Rp. 3,400 Mil./km. These were adopted as standard unit costs.

In addition to the above standard unit cost, bridge rehabilitation was also taken into consideration. The unit costs for the cost estimate were set up as shown in Table 10.4.

Table 10.4 Unit Costs for Cost Estimates

Category	Scope of Work	Unit Cost for Road Improve't (Mil. Rp./km)	Unit Cost for Br. Reconstruction (Mil. Rp./km)	Total Unit Cost (Mil. Rp./km)
BETTERMENT				
Betterment I	Reconstruc'n of 4.5m road w/o widening	1,500	300	1,800
	Reconstruc'n of 6.0m road w/o widening	1,800	350	2,150
	Reconstruc'n of 7.0m road w/o widening	2,000	400	2,400
Betterment II	Widening from 4.5m to 6.0m	1,560	300	1,860
Betterment III	Widening from 4.5m to 7.0m	1,920	400	2,320
	Widening from 6.0m to 7.0m	1,630	350	1,980
Betterment IV	Widening from 6.0m to 2 x 7.0m	4,000	800	4,800
	Widening from 7.0m to 2 x 7.0m	3,000	700	3,700
NEW ROAD CONSTRUCTION				
New Road 1	New Construction of 6.0m road	3,400	1,000	4,400
New Road 2	New Construction of 7.0m road	4,000	1,200	5,200
New Road 3	New Construction of 2 x 7.0m road	8,000	2,400	10,400

3) Unit Cost for Periodic Maintenance (Overlay)

Due to the traffic load which were mainly caused by heavy vehicles, the AC surface will be damaged through time and use, even if they are well constructed and there is sufficient maintenance. Accordingly, the appropriate periodic maintenance (overlay) is essential for the efficient use of road assets.

It was assumed that overlay works and periodic maintenance are to be made in a 10-years interval after the new construction and betterment and another 5-years interval after another overlay.

Table 10.5 shows unit cost for overlay adopted in this master plan.

Table 10.5 Unit Cost of Overlay (Mil. Rp./km)

Road Category	Unit Cost of Overlay
4.5m road	600
6.0m road	750
7.0m road	850
2 x 7.0m road	1,200

4) Unit Cost for Routine Maintenance

In the period of intervals between the betterment and overlay or the intervals between the two overlays, routine maintenance works including inspections, cleaning of road surface and drainage, cutting trees/grass and sealing/patching works should be done in the appropriate manner.

Table 10.6 shows the unit cost for routine maintenance as adopted in this master plan.

Table 10.6 Unit Cost of Routine Maintenance (Mil. Rp./km)

Year	4.5m road		6.0m road		7.0m road		2 x 7.0m road	
	After Better't	After Overlay	After Better't	After Overlay	After Better't	After Overlay	After Better't	After Overlay
1	2	2	3	2	3	3	6	5
2	6	6	8	9	9	10	18	20
3	8	10	11	13	14	16	28	32
4	11	13	15	17	19	21	38	42
5	14	16	19	22	23	26	46	52
6	17		23		28		56	
7	20		27		33		66	
8	23		31		38		76	
9	26		35		42		84	
10	29		39		47		94	

5) Total Project Cost until 2024

Based on the project quantity and unit costs discussed above, total project cost for this master plan was estimated as shown in Table 10.7.

Table 10.7 Total Project Cost until 2024

	Project Cost (Mil. Rp.)															
	Improvement Measure (Betterment/New Road Construction)				Periodic Maintenance				Routine Maintenance				Total Project Cost until 2024			
	TOTAL	Arterial	K 1	K 2/3	TOTAL	Arterial	K 1	K 2/3	TOTAL	Arterial	K 1	K 2/3	TOTAL	Arterial	K 1	K 2/3
TS-1-1	1,368,170	1,146,401	221,769	0	306,042	229,063	76,978	0	148,854	115,174	33,680	0	1,823,066	1,490,638	332,427	0
RELATED ROUTES	1,375,733	0	0	1,373,733	539,355	0	539,355	0	125,637	0	0	125,637	2,038,725	0	0	2,038,725
TOTAL	2,743,903	1,146,401	221,769	1,373,733	845,397	229,063	76,978	539,355	274,491	115,174	33,680	125,637	3,881,790	1,490,638	332,427	2,038,725
TS-1-2	605,540	605,540	0	0	242,632	242,632	0	0	89,062	89,062	0	0	937,234	937,234	0	0
RELATED ROUTES	505,060	0	212,740	292,320	386,649	0	74,574	312,075	72,463	0	23,977	48,487	1,901,406	937,234	311,290	652,882
TOTAL	1,110,599	605,540	212,740	292,320	629,281	242,632	74,574	312,075	629,281	89,062	23,977	48,487	3,802,812	2,434,468	642,587	727,757
TS-1-3	799,478	799,478	0	0	296,119	296,119	0	0	109,947	109,947	0	0	1,205,544	1,205,544	0	0
RELATED ROUTES	90,480	0	0	0	33,150	33,150	0	0	12,308	12,308	0	0	135,938	135,938	0	0
TOTAL	889,958	799,478	0	0	329,269	329,269	0	0	122,256	122,256	0	0	1,341,483	1,341,483	0	0
TS-1-4	156,856	156,856	0	0	188,276	188,276	0	0	33,142	33,142	0	0	378,274	378,274	0	0
RELATED ROUTES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	156,856	156,856	0	0	188,276	188,276	0	0	33,142	33,142	0	0	378,274	378,274	0	0
TS-1-5	277,786	23,241	254,545	0	251,477	9,777	241,500	0	51,671	3,705	47,967	0	580,934	36,923	544,011	0
RELATED ROUTES	135,674	118,339	0	17,335	64,137	57,147	0	6,990	19,160	17,036	0	2,433	219,271	192,512	26,759	0
TOTAL	413,460	354,585	254,545	17,335	315,614	67,125	241,500	6,990	71,131	20,731	47,967	2,433	800,205	229,435	544,011	26,759
TS-1-6	372,000	0	186,000	186,000	150,000	0	0	0	52,220	0	26,110	26,110	574,220	0	287,110	287,110
RELATED ROUTES	372,000	0	186,000	186,000	150,000	0	0	0	52,220	0	26,110	26,110	574,220	0	287,110	287,110
TOTAL	744,000	0	372,000	372,000	300,000	0	0	0	104,440	0	52,220	52,220	1,148,440	0	574,220	574,220
TS-2-1	191,700	0	273,204	0	1,233,268	37,018	1,196,250	0	121,528	2,492	119,037	0	1,628,001	39,510	1,588,491	0
RELATED ROUTES	464,904	0	273,204	0	1,324,468	37,018	1,196,250	0	22,097	2,492	119,037	0	1,932,998	39,510	1,588,491	304,997
TOTAL	656,604	0	546,408	0	2,557,736	74,036	2,392,500	0	143,626	4,984	238,074	0	3,560,999	79,020	3,481,971	304,997
TS-2-2	1,077,109	696,779	380,330	0	415,346	270,019	145,327	0	155,028	100,256	54,772	0	1,647,482	1,067,054	580,428	0
RELATED ROUTES	1,031,906	202,715	142,200	686,991	967,518	103,725	259,013	604,781	164,380	32,673	32,395	99,312	2,163,805	339,113	433,608	1,391,084
TOTAL	2,109,015	899,494	522,530	686,991	1,382,864	373,743	404,339	604,781	1,329,408	132,930	87,167	99,312	3,811,287	1,406,167	1,024,236	1,391,084
TS-2-3	330,738	0	330,738	0	145,280	0	0	0	47,230	0	0	0	523,247	0	523,247	0
RELATED ROUTES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	330,738	0	330,738	0	145,280	0	0	0	47,230	0	0	0	523,247	0	523,247	0
TS-3-1	1,015,316	551,683	376,361	87,271	910,808	227,504	248,114	35,190	157,318	84,471	60,597	12,251	1,683,443	863,658	685,072	134,712
RELATED ROUTES	876,719	12,803	531,137	332,780	997,715	5,496	302,651	689,568	159,945	2,041	67,053	90,852	2,034,379	20,339	900,841	1,113,999
TOTAL	1,892,035	564,486	907,499	420,051	1,908,523	233,000	550,765	724,758	317,264	86,512	127,650	103,102	3,717,822	883,998	1,586,913	1,247,911
TS-3-2	882,799	829,437	0	0	323,439	0	0	0	120,091	120,091	0	0	1,326,330	1,326,330	0	0
RELATED ROUTES	463,127	129,101	0	334,026	829,437	47,300	133,860	648,117	106,824	17,562	10,905	78,357	1,399,228	193,963	144,765	1,040,500
TOTAL	1,345,926	1,011,900	0	334,026	1,152,716	370,739	133,860	648,117	226,915	137,653	10,905	78,357	2,725,558	1,520,293	144,765	1,040,500
TS-4-1	1,255,727	1,227,473	28,255	0	480,675	449,121	30,955	0	172,749	166,979	5,771	0	1,909,151	1,844,172	64,980	0
RELATED ROUTES	528,660	0	108,000	420,660	365,280	0	36,000	329,280	70,207	11,196	59,011	0	964,147	964,147	0	0
TOTAL	1,784,387	1,227,473	136,255	420,660	845,955	449,121	66,955	329,280	242,956	166,979	16,967	59,011	2,873,298	1,844,172	220,176	808,951
TS-4-2	786,960	0	786,960	0	381,632	0	0	0	114,906	580	0	0	1,284,078	0	1,273,373	7,705
RELATED ROUTES	264,586	0	53,190	211,396	540,541	12,336	17,730	510,475	65,903	830	5,514	59,559	871,030	13,166	76,434	781,430
TOTAL	1,051,546	0	840,150	211,396	922,172	12,336	392,237	517,600	181,389	830	120,420	60,139	2,155,108	13,166	1,352,807	789,135
TS-5-1	880,923	880,923	0	0	326,759	326,759	0	0	121,324	121,324	0	0	1,329,005	1,329,005	0	0
RELATED ROUTES	91,440	0	0	0	30,480	0	0	0	9,479	0	0	0	131,399	0	131,399	0
TOTAL	972,363	880,923	0	0	357,239	326,759	0	0	130,803	121,324	0	0	1,460,405	1,329,005	131,399	0
TS-5-2	319,373	0	319,373	0	488,484	0	488,484	0	65,806	0	65,806	0	873,663	0	873,663	0
RELATED ROUTES	582,210	0	203,310	378,900	676,866	0	122,466	554,400	99,688	0	25,532	74,155	1,358,764	0	351,308	1,007,455
TOTAL	901,583	0	522,683	378,900	1,165,350	0	610,950	554,400	165,492	0	91,338	74,155	2,232,426	0	1,224,971	1,007,455
TS-5-3	546,958	0	546,958	0	282,406	0	282,406	0	68,714	0	68,714	0	895,078	0	895,078	0
RELATED ROUTES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	546,958	0	546,958	0	282,406	0	282,406	0	68,714	0	68,714	0	895,078	0	895,078	0
TS-5-4	493,200	0	196,200	297,000	2,101,061	0	659,246	550,815	136,391	0	68,794	67,597	1,839,652	0	924,240	915,412
RELATED ROUTES	215,262	0	215,262	0	2,101,061	0	75,000	214,704	40,120	0	6,159	33,961	545,686	0	81,759	463,927
TOTAL	708,462	0	411,462	297,000	4,202,122	0	734,846	765,519	176,511	0	74,953	101,558	2,385,338	0	1,005,999	1,379,339
TS-5-5	308,591	308,591	0	0	132,476	132,476	0	0	49,188	49,188	0	0	490,254	490,254	0	0
RELATED ROUTES	131,760	0	0	131,760	173,936	0	26,666	147,270	24,428	2,449	22,079	330,124	0	29,016	301,109	0
TOTAL	440,351	308,591	0	131,760	306,412	132,476	26,666	147,270	73,616	49,188	22,079	330,124	490,254	29,016	602,125	301,109
TS-5-6	660,000	0	660,000	0	112,500	0	112,500	0	33,315	0	33,315	0	805,815	0	805,815	0
RELATED ROUTES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	660,000	0	660,000	0	112,500	0	112,500	0	33,315	0	33,315	0	805,815	0	805,815	0
TOTAL	10,304,758	6,791,075	3,129,411	384,271	6,977,670	2,402,274	3,502,267	593,130	1,582,296	905,796	592,075	80,428	18,301,145	7,223,753	2,160,183	1,057,929
RELATED ROUTES	2,105,970	488,688	1,431,282	186,000	980,000	330,730	574,279	75,000	266,765	86,034	26,110	3,352,744	905,451	2,160,183	287,110	287,110
RELATED ROUTES	6,482,318	553,438	1,250,577	4,678,303	5,966,408	259,154	1,048,559	4,678,695	992,939	82,441	185,081	725,417	13,461,665	895,032	2,484,217	10,082,416
TOTAL	18,893,045	7,833,201	5,811,271	5,248,574	13,444,087	2,992,157	5,125,105	5,346,825	2,842,003	2,010,048	831,955	35,199,136	23,771,781	11,427,315	11,427,315	11,427,315

CHAPTER 11 PROJECT EVALUATIONS

(1) Packaging of Master Plan Road Network

For evaluation purposes the whole master plan road network in Sulawesi Island was divided and grouped into the 19 (nineteen) packages as shown below:

Table 11.1.1 Road Packages for Evaluation

Area category	Corridor	SQ	Package No.	Length	Location
		No.		(km)	
TS-1	Trans-Sulawesi(TS) Main Corridor (West-South Corridor)	1	TS-1-1	658	Jeneponto-Makkasar-Parepare
		2	TS-1-2	692	Parepare-Mamuju
		3	TS-1-3	387	Mamuju-Palu
	Crossing Roads in West-South area	4	TS-1-4	144	Maros-Bajoe
		5	TS-1-5	290	Parepare-Palopo
		6	TS-1-6	200	Wonomulyo-Kaluku
TS-2	TS Main Corridor (West-North Corridor)	7	TS-2-1	1,019	Palu-Kwandang
		8	TS-2-2	1,399	Kwandang-Manado-Bitung
	Crossing Road	9	TS-2-3	184	Molibagu-Worotican
TS-3	TS Main Corridor (Central-South Corridor)	10	TS-3-1	1,452	Jenoponto-Watampone-Wotu
		11	TS-3-2	1,069	Wotu-Poso-Tobori
TS-4	TS Main Corridor (Central-North Corridor)	12	TS-4-1	973	Tobori-Gorontalo
		13	TS-4-2	893	Gorontalo-Bitung
TS-5	TS Main Corridor (East Corridor)	14	TS-5-1	435	Wotu-Kolaka
		15	TS-5-2	1,060	Kolaka-Tinaggea-Kendari
		16	TS-5-3	373	Kendari-Tondoyondo
		17	TS-5-4	1,235	Tondoyondo-Luwuku-Poso
	Crossing Roads	18	TS-5-5	312	Kolaka-Kendari
Roads in East-South area	19	TS-5-6	150	Landawe-Tolala	
Total				12,925	

Source: JICA Study Team

(2) Conditions for Comparison

The main purpose of economic evaluation is to provide one of criteria for the prioritization of each road package. Comparisons among the packages were made based on the conditions summarized below:

- 1) Implementation Schedule: Detailed design and construction/improvement: 2010-2013 (4 years).
- 2) Evaluation period: 30 years after opening.
- 3) Annual disbursement during the implementation period: Total cost is equally allocated to the four-years implementation period.

(3) Economic Costs and Benefits

Economic costs were estimated with the exclusion of such transfer items as taxes and duties from market prices. Total economic cost of the road master plan for construction and improvement is estimated at Rp.17,003 billion using 2006 prices.

The following two types of benefits were quantitatively estimated through the following economic evaluation:

- 1) Savings in Vehicle Operating Costs (VOC savings), and
- 2) Savings in passenger Travel Time Costs (TTC Savings).

Basic data of VOC and TTC were obtained from the “Indonesian Road Management System (IRMS) 2006”.

(4) Economic Evaluation

In order to carry out the economic evaluation, the following preconditions were set.

- Price Level : Constant 2006 prices
- Evaluation Period : 30 years after opening to traffic
- Residual Value : No residual values were counted
- Opportunity Cost of Capital : 15%

The following three kinds of evaluation indicators were calculated

- 1) Economic Internal Rate of Return (EIRR)
- 2) Net Present Value (NPV)
- 3) Benefit/ Cost Ratio (B/C)

(5) Results of Economic Evaluations

The results of the economic evaluation for the 19 road packages are summarized as below:

Table 11.2 Results of Economic Evaluations

Package No.	EIRR (%)	NPV (*) (Rp. Million)	B/C (*)
TS-1-1	49.2%	6,558,766	5.74
TS-1-2	35.0%	1,888,702	4.02
TS-1-3	19.6%	182,727	1.41
TS-1-4	32.6%	214,970	2.76
TS-1-5	24.7%	208,969	1.80
TS-1-6	80.8%	2,364,937	13.42
TS-2-1	15.0%	-1,869	1.00
TS-2-2	18.6%	367,198	1.29
TS-2-3	16.6%	21,360	1.12
TS-3-1	21.2%	727,360	1.60
TS-3-2	18.6%	341,769	1.39
TS-4-1	13.1%	-140,158	0.85
TS-4-2	13.5%	-65,376	0.91
TS-5-1	12.0%	-108,797	0.78
TS-5-2	2.8%	-495,547	0.31
TS-5-3	10.2%	-91,422	0.70
TS-5-4	6.3%	-411,539	0.45
TS-5-5	14.0%	-22,998	0.91
TS-5-6	7.5%	-224,952	0.26

Source: JICA Study Team

(*): Discount Rate = 15%

The above results show that the Packages located in the West-South Corridor (TS-1 group),

West-North section (TS-2 group) and Central south section (TS-3 group) will have high economic returns.

It should be noted that the Packages that have low EIRRs in the above Table 11.2, such as TS-2-1, TS-4-1 to TS-5-6, will be improved if they are implemented in accordance with the Overall Implementation Schedule of the Master Plan as explained in Chapter 13. The revised results of the economic evaluation are summarized below:

Table 11.3 Revised Evaluations

Package No.	EIRR (%)	NPV (*) (Rp. Million)	B/C (*)
TS-2-1	26.7%	278,504	1.95
TS-4-1	14.6%	-25,301	0.97
TS-4-2	16.2%	43,168	1.08
TS-5-1	15.6%	12,769	1.05
TS-5-2	9.1%	-78,347	0.66
TS-5-3	16.7%	10,481	1.13
TS-5-4	19.5%	33,246	1.20
TS-5-5	20.8%	65,968	1.49
TS-5-6	10.2%	-24,353	0.56

Source: JICA Study Team

(*): Discount Rate = 15%

CHAPTER 12 ENVIRONMENTAL ASPECTS AND CONCERNS IN THE MASTER PLAN

(1) Basic Approaches of Strategic Environmental Assessment (SEA)

In conducting an environmental evaluation of the Master Plan, a strategic environmental assessment (SEA) was applied as a systematic process for comprehensively evaluating, at the earliest appropriate stage in the planning, a couple of alternative options for the overall road development program, thereby ensuring a full integration of the relevant biophysical, economic, and social aspects of the proposed Master Plan.

While a project-level environmental impact assessment (EIA) is implemented after specifying the detailed road development projects in the Master Plan, the SEA introduces early and strategic environmental considerations before the details on road alignments and their specifications are decided. In other words, the SEA method allows the Government of Indonesia to focus on the environmental effects for the optimum formulation of the Master Plan before specific road development projects are finalized. Thus, in comparison with a project-level EIA, the SEA can take into account a broader range of alternative options in the procedures of formulating the Master Plan.

(2) Results of SEA

1) Setting-up Alternative Options for SEA

The basic requirement of the SEA calls for a comparison of several alternative options including “Zero Option”. The candidates for the Master Plan have been compared with other possible alternative options including “Zero Option” in search of the best and optimum solution for the improvement of the island-wide road network plan.

- *Option 1 (Zero Option): The existing road network will be properly maintained without new investment in addition to the existing roads.*
- *Option 2 (Road Network Improvement): The road network will be improved with additional investment on the existing road network.*
- *Option 3 (Road Network plus Marine Transport Improvement): The road network will be improved together with the improvement of accessibility by the marine transport.*

Although the Master Plan for an arterial road network will be a road improvement plan focusing on realignment, upgrading, rehabilitation, strengthening, and maintenance associated with some strategically important new road development projects, it also includes the concept of a nautical highway, which is an energy-saving maritime transport effectively incorporated in the road network, considering the long winding coastlines as well as the traditionally high share of the said mode.

2) Formulation of Environmental Impact Matrix

Unlike the normal project-level EIA, an environmental impact matrix under the SEA is designed to roughly grasp the environmental impacts deriving from each alternative option. The benchmarks and weights for the environmental impact matrix under the SEA are streamlined below. The benchmarks include the global environmental items as well as local environmental items. Higher priorities are given to greenhouse effects, increase in energy consumption and impacts on air quality and on biodiversity.

Table 12.1 Benchmarks and Weights for Environmental Impact Matrix

Benchmarks	Weight
1. Global Environmental Items	
1-1 Greenhouse Effect	15%
1-2 Energy Consumption	15%
2. Local Environmental Items	
2-1 Impacts on Air Quality	15%
2-2 Impacts on Noise and Vibration	5%
2-3 Impacts on Biodiversity	15%
2-4 Improvement of BHN and Poverty Reduction	10%
2-5 Impacts on Isolated Ethnic	10%
2-6 Scale of Involuntary Resettlement	10%
2-7 Impacts on Exploitation of Mineral Resources, etc.	5%

3) Identification of Major Environmental Impacts

The major environmental impacts by the improvement of the road network are identified as below:

a) Air Pollution

The Study Team proposes the mathematical method estimating by the exhaust coefficient in total NOx volume of the overall road network. The effect of the proposed road network improvement (road improvement, some realignments and so on) is evaluated by comparing the NOx volume of the alternative options. By implementing the proposed road network improvement (road improvement etc.), the increase in average speeds (10 km/h up) is estimated along with the exceed reduction of NOx volume (14 %). In addition to these is the expected reduction of air pollution since bio diesel fuels (BDF) and bio-ethanol will be used for the construction machines, trucks and other vehicles.

b) Noise and Vibration

The Study Team proposes the multi regression analysis for the traffic volume, vehicle composition ratio, urbanization levels, and road grades in each survey point. Data of applied in the multi regression analysis was the result of an on-site noise survey in the Mamminasata area.

In the results around Manado, Palu, Makassar and Kendari City where traffic will be concentrated, it is assumed that peak noise levels will exceed 70 dB(A) environmental standard especially in and around commercial areas. It is assumed that traffic density will be increase in the future, thus the necessity for countermeasures especially for sensitive receptors such as hospitals and schools.

c) Biodiversity

If some unique species and/or other rare species are encountered during the construction phase of the road network improvement, it will be necessary to take the proper measures for such species of fauna and flora. Such measure will include proposing limited protection zones, transfer to other areas etc. For example, the Lore Lindu National Park and the Morowali Nature Reserve are typical conservation areas. The Master Plan designed not to affect these “conservation areas” in the region. There are several conservation areas which might be affected by the improvement of the road network, if those road development projects are not well designed to avoid negative environmental impacts.

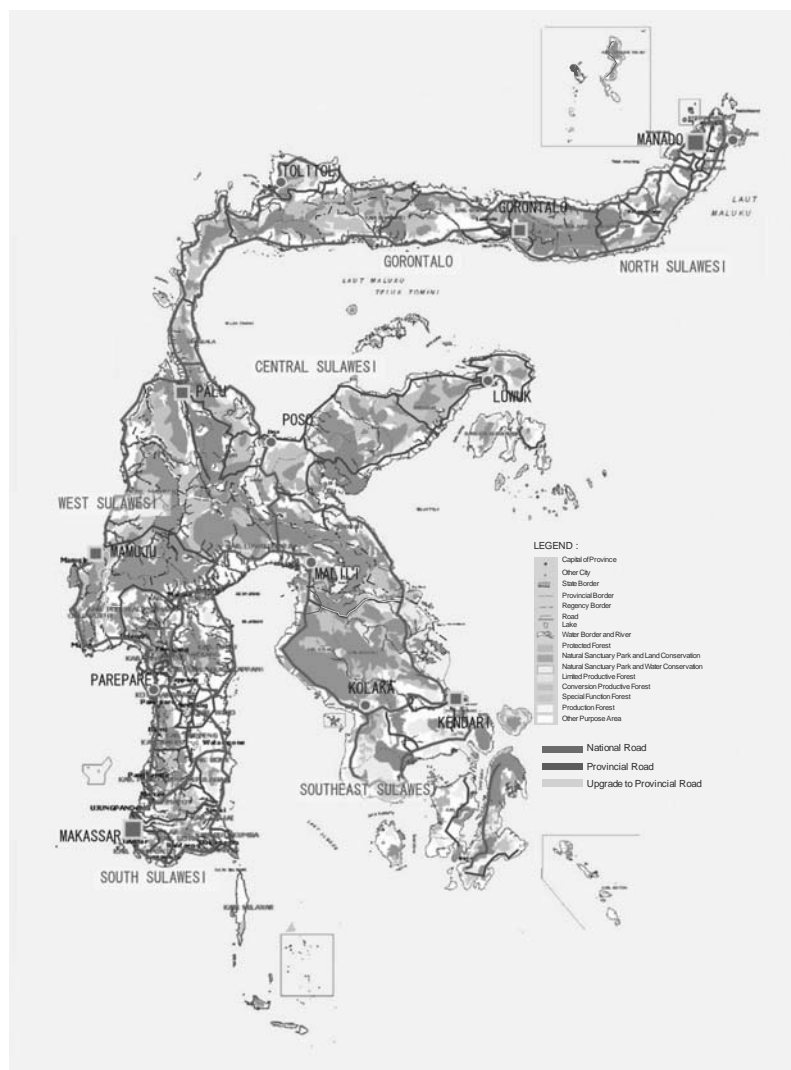


Figure 12.1 Forests, Conservation Areas and Road Network

d) Livelihood of Isolated People

The Master Plan is required to harmonize with the so-called “isolated people” in the region so as not to hamper the local culture of indigenous ethnic communities. Most of the inhabitants of Sulawesi identify themselves as belonging to a particular ethnic group. The term of “isolated people” is frequently associated with indigenous ethnic communities. According to the definition

by the Social Minister's Decree, No.5 of 1994, "isolated people" is referred to as the groups of people who live or are nomadic in geographically remote and isolated areas and are socially and culturally alienated and/or still underdeveloped compared to other Indonesian communities in general. Some of those ethnic groups are socially and economically isolated, and it is likely that those isolated communities are affected by influx of modernization and other technologies, goods and products which might convert traditional systems and ways of life, if new road developments are not carefully designed to avoid these impacts. For example, the indigenous Wana people live throughout the Molowari Reserve and consist of about 600 households who follow a traditional lifestyle.

If those isolated communities are willing to benefit from the improved road access associated with construction of feeder roads in addition to the improvement of the road network, a wide range of benefits will be delivered to those isolated communities. Even if this is not the case, the road network improvement of the Master Plan will not basically affect those isolated communities, since the road network is carefully designed so as not to affect those isolated communities.

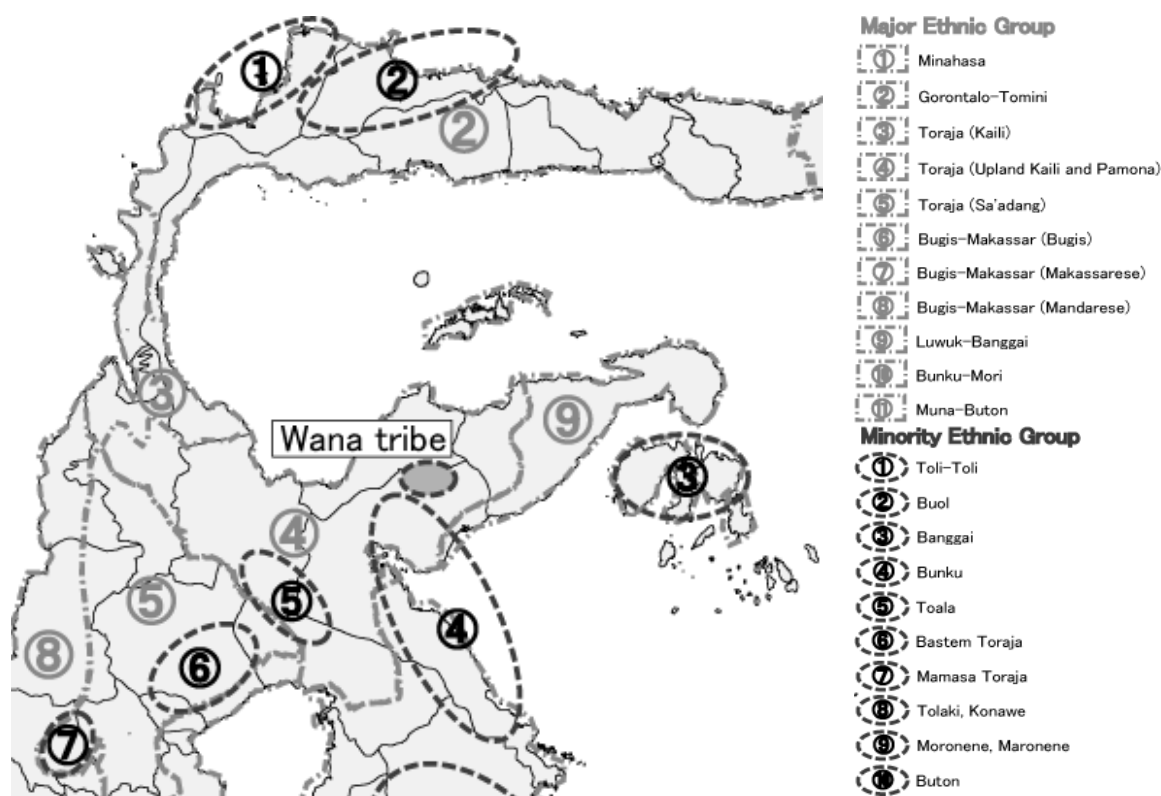


Figure 12.2 Ethnic Group in the Central Sulawesi

e) Impacts on Other Local Resources

(i) Shrimp Horticulture and Road Development

In the coastal zone of Sulawesi Island, there are a lot of shrimp horticulture ponds which are developed through cutting down mangrove forests. There are also many conversions from paddy fields to shrimp horticulture areas. Since the productivity of shrimp horticulture ponds decreases

after repeated productions, mangroves tend to be cut down for new developments of shrimp horticulture ponds. In this way, there is a possibility that the mangrove areas might be further affected by the road development under the Master Plan, and it should be monitored in the longer period.

(ii) Mineral Resources and Road Development

In Sulawesi Island, there are a wide range of mineral resources the majority of which remain undeveloped, and the potential amounts of those resources are still not clear. Mineral resources are abundant in the mountainous area of the north of Sulawesi Island. The potential mineral resources include gold, silver, nickel, zinc, crude oil, natural gas, etc. Although the mining sector in itself is not directly activated by the road development alone, it should be also monitored in the longer period.

(iii) Palm Tree Plantations and Road Development

Generally, palm trees are planted by the large-scale plantation method. Since palm trees should be processed into palm oils immediately after harvesting, palm oil processing factories are generally located near to the plantation area. Therefore, road development projects are closely linked to the extension of palm tree plantations. It has been recently criticized that plantations such as palm tree plantations would result in the expansion of deforestations. There is a possibility that the improvement of the road network under the Master Plan might accelerate the palm tree plantations.

4) Results of the Environmental Impact Matrix

The environmental impact matrix under the SEA through each road development package is shown in Annex 12.1 to 12.3, implying that the environmental impacts on roads along major cities are relatively more serious than in other rural areas. This is due to the large traffic volume on roads along major cities.

5) Results of the Multi-criteria Analysis (MCA)

The scope of the SEA is not limited to environmental effects alone. The SEA provides a number of potential links with the socio-economic assessments, thereby recognizing the idea of the SEA's interrelationships with socio-economic issues or sustainability concerns. The so-called multi-criteria analysis (MCA), which is a typical evaluation method that judges priorities under different development alternatives, was employed as a key methodology for the overall SEA assessment. Since a wide range of positive effects and negative impacts are included in the evaluation criteria in the MCA, the methodology allows evaluators to utilize more practical evaluation procedures. The MCA provides a comprehensive evaluation matrix with different weights for each evaluation item, thereby aiding in the selection of alternatives. More concretely, the MCA has been conducted through the following steps: (1) Selection and streamlining of evaluation items, (2) Fixing evaluation indices and rating evaluation scores based on the 5-grade

scoring system, (3) Calculating weights and total evaluation scores, and (4) Formulation of an MCA matrix.

The original MCA table has been slightly modified to simplify evaluation benchmarks. Higher priorities are given to the engineering items in the primary level, while higher priorities are given to the global and local environmental factors at the combined weight levels.

Table 12.2 Benchmarks and Weights of the Multi-criteria Analysis

Evaluation Benchmarks		Weight	Combined Weight
1. Engineering Items			
1-1	Consistency to Upper-level Plan		25%
1-2	Balance and Efficiency of Road Network	40%	25%
1-5	Responsiveness to Traffic Demand		50%
2. Economic and Financial Items			
2-1	Scale of Beneficiaries		25%
2-2	Investment Efficiency		25%
2-3	Contribution to Production and Investment	30%	25%
2-4	Improvement of Access to Public Infrastructures		25%
3. Environmental Items			
3-1	Global Environmental Factors		50%
3-2	Local Environmental Factors	30%	50%

6) Conclusion of Selection of Alternative Options by Multi-criteria Analysis

As shown in the Annex 12.4 to 12.6, “Option 3” obtained the highest scores among the three alternative options. In conclusion, “Option 3” was selected as the best solution. The detailed explanation for the conclusion is shown below.

- “Option 1” (Zero Option): Since “Option 1 (Zero Option)” just aims to maintain the existing road network without any new investment and will not significantly increase the responsiveness to the traffic volume, while negative impacts on the global and local environment in the region would be limited. At the same time, “Option 1” will not significantly contribute to production and investment in the region due to its capacity to respond to the increasing traffic demand.
- “Option 2” (Road Network Improvement Only): Since “Option 2” focuses on realignment, upgrading, rehabilitation, strengthening, and maintenance associated with some strategically important new projects without the improvement of accessibility through marine transport, the traffic volume on the road network in the region would be the largest among all the options. Because of this, the negative impacts on the global and local environment would be relatively larger than “Option 3”. The degree of the reduction in energy consumption and emission per traffic volume is relatively higher than “Option 3”.
- Road Network plus Marine Transport Improvement: Since “Option 3” focuses on realignment, upgrading, rehabilitation, strengthening, and maintenance associated with some strategically important new projects together with the improvement of accessibility through marine transport which is more environmentally friendly than the road network development

only, the traffic volume on the road network in the region would be relatively smaller than “Option 2”. Therefore, negative impacts on the global and local environment would be relatively smaller than “Option 2”. Since “Option 3” is a road improvement plan together with the concept of a nautical highway which is the improvement of accessibility through marine transport, the degree of the reduction in energy consumption and emission per traffic volume is relatively lower than “Option 2”. The evaluation on other benchmarks remains almost the same as that of “Option 2”.

7) Sensitivity Analysis by Variations of Weights

As a sensitivity analysis, the weights on the engineering items, economic/financial items and environmental items have been changed to 30%, 40% and 30%, respectively. At the same time, the weights have been changed to 30%, 30% and 40%, respectively. In conclusion, even in both variations, “Option 3” has been selected as the best alternative option for the Master Plan.

(3) Formulation of Mitigation Measures

The SEA should include measures to mitigate negative environmental impacts. The term “mitigation” refers to the elimination, reduction or control of negative environmental impacts which might be derived from the implementation of the Master Plan. In addition to the project-level mitigation measures during the implementation stage of the Master Plan, the reduction in the CO₂ volume would be an integral part of the mitigation measures in the road network improvement.

The CO₂ volume of total road network in Sulawesi Island, the coverage and the promotion of bio-fuels in the areas affected forest area by the project (road improvement etc.), as well as diversion of other traffic measurements are suggested for the indicators and/or mitigation measures of Global Warming.

1) CO₂ Volume Reduction by Improvement of Average Travel Speed

In general it is estimated that the CO₂ emission from the vehicles with the average travel speed of 60 km per hour is 40-percent less than those with 20 km per hour. The road improvements under the Master Plan make it possible to improve the average travel speed of vehicles, thereby contributing to the reduction of the emission of CO₂ from those vehicles.

The Study Team proposes the mathematical method estimated by the exhaust coefficient in total CO₂ volume of total road network. The effect of the proposed Master Plan (road improvement, some new road networks and so on) is evaluated by comparing the CO₂ volume of both cases (with and without-project). In case of with-project the rise of average speed by road improvement such as widening, alignment, pavement and so on is expected.

By implementing the project (road improvement etc.), the rise of average speed (10 km/h up) is estimated, at the same time the reduction of CO₂ volume (21.1 %) will be expected.

The improvement of the road network in the Sulawesi Island will contribute to the so-called “the concept of the “Carbon Neutral” through the reduction of CO₂ associated with the improvement of the average travel speed of vehicles. This positive effect derived from the improvement of the average travel speed of vehicles will also contribute to the reduction of other emissions such as NO_x.

Meanwhile, in Indonesia, there are many vehicles which are not compliance with the current standard stipulated by the inspection regulation and system. Special considerations should be given to this matter, since this might harm the positive effects generated from the improvement of the average travel speed of the vehicles and the promotion of the usage of bio-fuel gas.

2) Promotion of Use of Bio-fuel

The promotion of Bio-fuel in Indonesia is advanced by loosening the regulation, and it aims that Bio-fuel share will become 3% of all energy by 2010 and 20% by 2025. If the Government politics in energy goes smoothly, the 20% reduction of CO₂ will be expected in 2024 additionally.

3) Promotion of Reforestation

The affected forest area by implementation of widening and including some realignment partly is estimated 82 ha. In general, if 1-ha forests are cut down, (i) the reduction in the absorption amount of CO₂ by forests per annum is estimated at 58 ton per ha, and (ii) approximately 580 ton of CO₂ would be emitted into the air at the time of cutting trees. These general calculations lead to the conclusion that the reduction in the absorption amount of CO₂ by forests derived from the implementation of the road improvement projects under the MP is estimated at 4,756 ton (82ha x 58 ton). If the emission of CO₂ at the time of cutting trees is taken into account, the reduction in the absorption amount of CO₂ is further aggravated.

The countermeasures of forest reduction are proposed the reforestation in public and/or private space and roadside greening at the project implementation. It is also expected that new fascination is added to landscape characteristics, as the green planting program is executed along the road. This activity will steer the environment of road around the project area to be improved and comfortable for passengers and inhabitants. The plantation trees are effective in absorbing CO₂ and producing O₂, useful for food production to the residential people.

In addition to the general reforestation activities alongside the planned road, a small-scale reforestation project by using the CDM (Clean Development Mechanism) scheme under the Kyoto Protocol are also recommended as one of the mitigation measures, The operational rule for a small-scale reforestation under the CDM scheme was proposed in the COP9, and the simplified rule was approved in COP10. If the CDM scheme is effectively utilized, community-type small-scale reforestation projects involving NGOs will be promoted.

4) Diversion of Traffic System

The demand of ferry transportation is presently low level. If the demand of ferry transportation in proposed nautical highway increases in future, the suitable effect of CO₂ reduction will be expected. On the other hand, it is considered that in case of passing through Nature Reserve area and/or National Park the diversion to ferry system is very effective. Regarding the road improvement passing through Morowali Nature Reserve in Central Sulawesi, it seems that the innovation of ferry diversion is important and contributed to the conservation of wildlife and biodiversity.

(4) Conclusion and Recommendations

As a result of the comprehensive evaluation of the alternatives for the Master Plan by the MCA method, "Option 3" (Road Network plus Marine Transport Improvement) was selected as the best option for the Master Plan. "Option 3" is a road improvement plan together with the concept of a nautical highway which is the improvement of accessibility by the marine transport, It is critical to minimize negative impacts of the Master Plan through a wide range of mitigation measures such as (i) CO₂ volume reduction by the improvement of the average travel speed of vehicles, (ii) the promotion of the use of bio fuels, (iii) the promotion of reforestation projects alongside the roads, and (iv) the diversion of the traffic system into the ferry system in the environmentally critical area.

ANNEX 12.1 5-grade Scores (1: Smallest Positive Impacts/Largest Negative Impacts → 5: Largest Positive Impacts/Smallest Negative Impacts)

Road		Evaluation		Environmental Factors										
				Global Environmental Factors					Local Environmental Factors					
				Green House Gas Effect	Consumption of Energy	Air Quality	Noise/Vibration	Biodiversity	Improvement of Regional BHN/Poverty Reduction	Impacts on Ethnic Minorities	Scale of Unvoluntary Resettlement	Exploitation of Mineral Resources		
		0.15	0.15	0.15	0.05	0.15	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.05
	Weight													
TS-1	TS-1-1	Jeneponto – Makassar – Parepare	2	2	2	3	5	2	1	2	2	1	2	5
	TS-1-2	Parepare – Mamuju	3	3	3	4	3	3	1	3	2	1	2	4
	TS-1-3	Mamuju – Palu	3	3	2	4	4	3	1	3	3	1	3	4
	TS-1-4	Maros – Bajoe	3	3	3	4	4	3	1	3	2	1	2	4
	TS-1-5	Parepare – Palopo	4	4	4	4	3	4	3	4	4	3	4	4
	TS-1-6	Wonomulyo – Kaluku	4	4	4	4	3	4	2	2	4	2	4	4
TS-2	TS-2-1	Palu – Kwandang	4	4	5	5	2	3	2	3	4	2	4	2
	TS-2-2	Kwandang – Manado – Bitung	4	4	5	5	3	4	2	4	2	2	4	4
	TS-2-3	Molibagu – Worotican	4	4	5	5	2	3	2	3	4	2	4	3
TS-3	TS-3-1	Jenoponto – Watampone – Wotu	3	3	4	4	2	3	3	3	2	3	2	3
	TS-3-2	Wotu – Poso – Toboli	3	3	4	4	2	3	3	3	2	3	2	3
TS-4	TS-4-1	Toboli – Gorontalo	4	4	5	5	2	3	3	3	4	3	4	4
	TS-4-2	Gorontalo – Bitung	4	4	5	5	2	3	3	3	4	3	4	4
TS-5	TS-5-1	Wotu – Kolaka	4	4	5	5	3	4	4	4	4	4	4	4
	TS-5-2	Kolaka – Tinaggea – Kendari	4	4	5	5	3	4	4	4	4	4	4	3
	TS-5-3	Kendari – Tondoyondo	3	3	4	4	4	3	3	3	4	3	4	2
TS-5	TS-5-4	Tondoyondo – Luwuk – Poso	4	4	4	2	2	4	4	4	4	4	4	2
	TS-5-5	Kolaka – Kendari	4	4	5	5	2	3	3	3	4	3	4	3
	TS-5-6	Landawe – Tolala	4	4	5	5	2	3	3	3	4	3	4	3
Average			3.58	3.58	4.16	4.32	2.79	3.26	2.53	3.42	2.53	3.42	3.42	

ANNEX 12.2 Indicator (Score/Average Score: Average Score = 100)

Road	Evaluation Item	Weight	Environmental Factors										Average					
			Global Environmental Factors					Local Environmental Factors										
			Green House Gas Effect	Consumption of Energy	Air Quality	Noise/Vibration	Biodiversity	Improvement of Regional BHN/Poverty Reduction	Impacts on Ethnic Minorities	Scale of Unvoluntary Resettlement	Exploitation of Mineral Resources							
TS-1	TS-1-1	Jeneponito – Makassar – Parepare	0.56	0.56	0.48	0.70	1.79	0.61	0.40	0.58	0.70	0.05	0.10	0.10	0.10	0.10	0.05	0.70
	TS-1-2	Parepare – Mamuju	0.84	0.84	0.72	0.93	1.08	0.92	0.40	0.58	0.76	0.05	0.10	0.10	0.10	0.10	0.05	0.76
	TS-1-3	Mamuju – Palu	0.84	0.84	0.48	0.93	1.43	0.92	0.40	0.88	0.84	0.05	0.10	0.10	0.10	0.10	0.05	0.84
	TS-1-4	Maros – Bajoe	0.84	0.84	0.72	0.93	1.43	0.92	0.40	0.58	0.80	0.05	0.10	0.10	0.10	0.10	0.05	0.80
	TS-1-5	Parepare – Palopo	1.12	1.12	0.96	0.93	1.08	1.23	1.19	1.17	1.11	0.05	0.10	0.10	0.10	0.10	0.05	1.11
	TS-1-6	Wonomulyo – Kaluku	1.12	1.12	0.96	0.93	1.08	1.23	1.19	1.17	1.11	0.05	0.10	0.10	0.10	0.10	0.05	1.11
TS-2	TS-2-1	Palu – Kwardang	1.12	1.12	1.20	1.16	0.72	0.92	0.79	1.04	0.05	0.10	0.10	0.10	0.10	0.10	0.05	1.04
	TS-2-2	Kwardang – Manado – Bitung	1.12	1.12	1.20	1.16	1.08	1.23	0.79	1.11	0.05	0.10	0.10	0.10	0.10	0.10	0.05	1.11
	TS-2-3	Molibagu – Worotican	1.12	1.12	1.20	1.16	0.72	0.92	0.79	1.04	0.05	0.10	0.10	0.10	0.10	0.10	0.05	1.04
TS-3	TS-3-1	Jenoponto – Watampone – Wotu	0.84	0.84	0.96	0.93	0.72	0.92	0.79	0.84	0.05	0.10	0.10	0.10	0.10	0.10	0.05	0.84
	TS-3-2	Wotu – Poso – Toboli	0.84	0.84	0.96	0.93	0.72	0.92	0.79	0.84	0.05	0.10	0.10	0.10	0.10	0.10	0.05	0.84
TS-4	TS-4-1	Toboli – Gorontalo	1.12	1.12	1.20	1.16	0.72	0.92	0.79	1.04	0.05	0.10	0.10	0.10	0.10	0.10	0.05	1.04
	TS-4-2	Gorontalo – Bitung	1.12	1.12	1.20	1.16	0.72	0.92	0.79	1.04	0.05	0.10	0.10	0.10	0.10	0.10	0.05	1.04
TS-5	TS-5-1	Wotu – Kolaka	1.12	1.12	1.20	1.16	1.08	1.23	1.58	1.20	0.05	0.10	0.10	0.10	0.10	0.10	0.05	1.20
	TS-5-2	Kolaka – Tinaggea – Kendari	1.12	1.12	1.20	1.16	1.08	1.23	1.58	1.20	0.05	0.10	0.10	0.10	0.10	0.10	0.05	1.20
	TS-5-3	Kendari – Tondoyondo	0.84	0.84	0.96	0.93	1.43	0.92	1.19	1.17	1.05	0.05	0.10	0.10	0.10	0.10	0.05	1.05
	TS-5-4	Tondoyondo – Luwuk – Poso	1.12	1.12	0.96	0.46	0.72	1.23	1.58	1.17	1.06	0.05	0.10	0.10	0.10	0.10	0.05	1.06
	TS-5-5	Kolaka – Kendari	1.12	1.12	1.20	1.16	0.72	0.92	1.19	1.17	1.08	0.05	0.10	0.10	0.10	0.10	0.05	1.08
TS-5-6	Landawe – Tolala	1.12	1.12	1.20	1.16	0.72	0.92	1.19	1.17	1.08	0.05	0.10	0.10	0.10	0.10	0.05	1.08	
Average			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

ANNEX 12.3 Overall Scores with Weights

Road	Evaluation Items	Environmental Factors										Overall Scores with Weights
		Global Environmental Factors					Local Environmental Factors					
		Green House Gas Effect	Consumption of Energy	Air Quality	Noise/Vibration	Biodiversity	Improvement of Regional BHN/Poverty Reduction	Impacts on Ethnic Minorities	Scale of Unvoluntary Resettlement	Exploitation of Mineral Resources		
	Weight	0.15	0.15	0.15	0.05	0.15	0.10	0.10	0.10	0.05	0.05	0.73
TS-1	Jeneponto – Makassar – Parepare	0.08	0.08	0.07	0.03	0.27	0.06	0.04	0.06	0.03	0.03	0.73
	Parepare – Mamuju	0.13	0.13	0.11	0.05	0.16	0.09	0.04	0.06	0.03	0.03	0.79
	Mamuju – Palu	0.13	0.13	0.07	0.05	0.22	0.09	0.04	0.09	0.04	0.04	0.85
	Maros – Bajoe	0.13	0.13	0.11	0.05	0.22	0.09	0.04	0.06	0.03	0.03	0.84
	Parepare – Palopo	0.17	0.17	0.14	0.05	0.16	0.12	0.12	0.12	0.06	0.06	1.10
	Wonomulyo – Kaluku	0.17	0.17	0.14	0.05	0.16	0.12	0.08	0.12	0.06	0.06	1.06
TS-2	Palu – Kwandang	0.17	0.17	0.18	0.06	0.11	0.09	0.08	0.12	0.06	0.06	1.03
	Kwandang – Manado – Bitung	0.17	0.17	0.18	0.06	0.16	0.12	0.08	0.12	0.06	0.06	1.11
	Molibagu – Wotritan	0.17	0.17	0.18	0.06	0.11	0.09	0.08	0.12	0.06	0.06	1.03
TS-3	Jenoponto – Watampone – Wotu	0.13	0.13	0.14	0.05	0.11	0.09	0.12	0.06	0.03	0.03	0.85
	Wotu – Poso – Toboli	0.13	0.13	0.14	0.05	0.11	0.09	0.12	0.06	0.03	0.03	0.85
TS-4	Toboli – Gorontalo	0.17	0.17	0.18	0.06	0.11	0.09	0.12	0.12	0.06	0.06	1.07
	Gorontalo – Bitung	0.17	0.17	0.18	0.06	0.11	0.09	0.12	0.12	0.06	0.06	1.07
TS-5	Wotu – Kolaka	0.17	0.17	0.18	0.06	0.16	0.12	0.16	0.12	0.06	0.06	1.19
	Kolaka – Tinaggea – Kendari	0.17	0.17	0.18	0.06	0.16	0.12	0.16	0.12	0.06	0.06	1.19
	Kendari – Tondoyondo	0.13	0.13	0.14	0.05	0.22	0.09	0.12	0.12	0.06	0.06	1.04
	Tondoyondo – Luwuk – Poso	0.17	0.17	0.14	0.02	0.11	0.12	0.16	0.12	0.06	0.06	1.07
	Kolaka – Kendari	0.17	0.17	0.18	0.06	0.11	0.09	0.12	0.12	0.06	0.06	1.07
	Landawe – Tolala	0.17	0.17	0.18	0.06	0.11	0.09	0.12	0.12	0.06	0.06	1.07
Average		0.15	0.15	0.15	0.05	0.15	0.10	0.10	0.10	0.05	0.05	1.00

ANNEX 12.4 5-grade Scores (1: Lowest → 5: Highest)

Alternative	Evaluation Item	Weight			Alternatives			Average
		Primary Weight	Secondary Weight	Total Weight	Option 1 (Zero Option)	Option 2 (Road Network Only)	Option 3 (Road Network + Ferry Improvement)	
Engineering Items	1-1 Consistency for Upper-level Plan	0.40	0.25	0.10	3	3	4	3.33
	1-2 Balance and Efficiency of Road Network		0.25	0.10	3	3	4	3.33
	1-3 Responsiveness to Traffic Demand		0.50	0.20	2	3	4	3.00
Economic and Financial Items	2-1 Scale of Beneficiaries	0.30	0.25	0.08	1	3	4	2.67
	2-2 Investment Efficiency		0.25	0.08	2	3	3	2.67
	2-3 Contribution to		0.25	0.08	1	4	5	3.33
	2-4 Improvement of Access to Public Infrastructure		0.25	0.08	1	4	5	3.33
Environmental Items	3-1 Global Environmental Items	0.30	0.50	0.15	4	2	3	3.00
	3-2 Local Environmental Items		0.50	0.15	4	3	2	3.00
Total					2.33	3.11	3.78	3.07

ANNEX 12.5 Indicator (Score/Average Score, Average Score = 100)

Evaluation Item	Alternative	Weight			Alternatives		
		Primary Weight	Secondary Weight	Total Weight	Option 1 (Zero Option)	Option 2 (Road Network Only)	Option 3 (Road Network + Ferry Improvement)
Engineering Items	1-1 Consistency for Upper-level Plan	0.40	0.25	0.10	0.90	0.90	1.20
	1-2 Balance and Efficiency of Road Network		0.25		0.90	0.90	1.20
	1-3 Responsiveness to Traffic Demand		0.50		0.67	1.00	1.33
Economic and Financial Items	2-1 Scale of Beneficiaries	0.30	0.25	0.08	0.38	1.13	1.50
	2-2 Investment Efficiency		0.25		0.75	1.13	1.13
	2-3 Contribution to		0.25		0.30	1.20	1.50
Environmental Items	2-4 Improvement of Access to Public Infrastructure	0.30	0.25	0.08	0.30	1.20	1.50
	3-1 Global Environmental Items		0.50		1.33	0.67	1.00
Total	3-2 Local Environmental Items	0.30	0.50	0.15	1.33	1.00	0.67
					0.76	1.01	1.23

ANNEX 12.6 Overall Scores with Weights

Evaluation Item	Alternative	Weight			Alternatives		
		Primary Weight	Secondary Weight	Total Weight	Option 1 (Zero Option)	Option 2 (Road Network Only)	Option 3 (Road Network + Ferry Improvement)
Engineering Items	1-1 Consistency for Upper-level Plan	0.40	0.25	0.10	0.090	0.090	0.120
	1-2 Balance and Efficiency of Road Network		0.25		0.090	0.090	0.120
	1-3 Responsiveness to Traffic Demand		0.50		0.133	0.200	0.267
Economic and Financial Items	2-1 Scale of Beneficiaries	0.30	0.25	0.08	0.028	0.084	0.113
	2-2 Investment Efficiency		0.25		0.056	0.084	0.084
	2-3 Contribution to		0.25		0.023	0.090	0.113
Economic and Financial Items	2-4 Improvement of Access to Public Infrastructure		0.25	0.08	0.023	0.090	0.113
Environmental Items	3-1 Global Environmental Items	0.30	0.50	0.15	0.200	0.100	0.150
	3-2 Local Environmental Items		0.50		0.200	0.150	0.100
Total					0.843	0.979	1.179

CHAPTER 13 IMPLEMENTATION PROGRAM

(1) General

Sulawesi Road Master Plan is formulated at the target year 2024. The implementation program of the Master Plan is composed of the following terms:

- Short-term plan (7 years: 2008 - 2014)
- Medium-term plan (5 years: 2015 – 2019)
- Long-term plan (5 years: 2015 – 2024)

In order to establish a realistic and effective implementation program, the Study Team adopted the following conditions for the implementation program of the Master Plan as follows:

1) Implementation plan focused on the development programs

The arterial roads development programs are comprised of development and maintenance programs. However, since the target of the Master Plan is to upgrade the original function or strengthen the capacity of the existing road network, its implementation programs is mainly focused on the development programs.

2) Support for implementation of the high priority development programs

The Master Plan should support the realization of the “Northeastern Indonesia Regional Development Program”, therefore the Study team recommends that the implementation of “Trans Sulawesi Mamminasata Road (Maros-Takalar) will also be considered since the project was confirmed to be economically feasible with a high economic internal rate of return and the Environmental Impact Assessment was already completed in accordance with the JBIC guidelines and Indonesian AMDAL laws.

3) Earliest implementation of urgent bridge repair programs

Because the collapse of a bridge on a major road will have an adverse impact on local socio-economic activities, it is recommended that bridges identified as Grade IV “Bad”, Grade V “Impassable” and wooden bridges should be improved as soon as possible under the “Urgent Bridge Repair Program”.

(2) Project Prioritization

1) Methodology

The multi-criteria analysis (MCA) methodology was adopted in the prioritization of the 19 proposed projects. The analytical procedure is as follows:

- A. Selection of factors to be evaluated
- B. Allocation of weights to each factor
- C. 5-grade scoring of each factor
- D. Normalization of scores for each factor

- E. Calculation of weighted scores of each Project
- F. Ranking of Projects (prioritization)

Selection of items, weight allocation and scoring to each factor

The Study team selected 7 items of evaluation factors and made allocation of weight in consideration of the degree of the influence. 5-grade scoring was conducted according to the criteria as shown in Table 13.1.

Table 13.1 Evaluation Factors and Scoring to Each Factor

Grade	Economic Impacts			Environmental Impacts			Others	Total
	Economic Indicator (EIRR)	Accessibility to potential development area	Influenced population by Project (unit:Million)	Improvement of basic human needs	Negative impacts on social environment	Negative impacts on natural environment	Maturity of project/ existing initiative	
Weight allocation	30%	10%	10%	10%	10%	10%	20%	100%
5	40% or more	Possibility on linking national/ regional activity centers within 5 years	3.0 or more	Qualitative assessment based on per capita GRDP and poverty ratio	Qualitative assessment based on resettlement requirement, impacts on minority, need for disaster prevention	Qualitative assessment based on air quality, noise, bio-diversity, green gas emission	80% or more	
4	30%-40%		2.25 - 5.99				60%-79%	
3	20%-30%		1.50 - 2.24				40%-59%	
2	10%-20%		0.75 - 1.49				20%-39%	
1	less 10%		less 0.74				less 19%	

Normalization of scores, calculation of weighted score and ranking

The 5-grade scoring explained above is a factor-specific independent evaluation which did not consider possible biases which may exist between other factors. Thus, the initial scoring should be normalized so that average scores would be similar for all factors, which is a rather mathematical process. The final score by Project is calculated using the weight allocated for each factor and the normalized index scores. The proposed projects were ranked using the final score per project calculated above.

2) Prioritization of Proposed Projects

Table 13.2 shows the result of project prioritization. TS1-1 (Jeneponto – Makassar - Parepare) was ranked the highest, followed by TS3-1 (Jeneponto – Watampone – Wotu), TS1-6 (Wonomulyo – Kaluku), TS1-2 (Parepare - Mamuju) and TS1-4 (Maros – Bajoe). The peninsula-crossing roads and the arterial roads from Southeast Sulawesi generally attained lower ranking.

3) Sensitivity Test

A sensitivity test was carried out by changing the weights allocated to evaluation factors. The assumptions adopted were the following:

- 1) The weight of Economic Indicator (EIRR) changed from 30% (Base Case) to 20% and 10% downward, as well as from 40% to 50% upward.
- 2) The weight of Maturity/Existing Initiative was always fixed at 20%.

3) The remaining weights were equally shared by the other five factors.

Results were quite stable except for some projects that fluctuated several ranking. The Study team concluded that Base Case should be adopted in the master plan.

Table 13.2 Final Scores and Priority of the Proposed Projects

Project Road		Basic Profile				Evaluation Factors						Total Weighted Index (Index x Weight)	Priority Order		
		Total Length (km)	Width of Pavement (m)	Investment and Construction Cost (Rp. Million)	Traffic Volume (000PCUs/day)	Economic Factors			Environmental Factors						
						Economic Indicator (EIRR)	Accessibility to Potential Development Areas	Influenced Population by Project Roads	Improvement of Basic Human Needs	Negative Impacts on Social Environment	Negative Impacts on Natural Environment			Maturity / Existing Initiative	
Weight						0.30	0.10	0.10	0.10	0.10	0.10	0.20	1.00		
Link No.	TS-1	TS-1-1 Jenepono - Makassar - Parepare	658	3.0-16.9	3,740	2-70	60.64	15.08	19.79	6.13	2.75	14.34	23.33	142.06	1
		TS-1-2 Parepare - Mamuju	692	3.8-10.2	1,173	1-11	48.51	12.06	7.92	9.19	8.26	10.75	20.29	116.99	4
		TS-1-3 Mamuju - Palu	387	4.4-6.0	1,011	4-14	24.26	15.08	7.92	9.19	5.51	10.75	19.01	91.72	12
		TS-1-4 Maros - Bajoe	144	6.0-8.0	275	6-9	48.51	15.08	7.92	9.19	5.51	7.17	21.25	114.63	5
		TS-1-5 Parepare - Palopo	290	4.3-7.1	585	2-12	36.38	12.06	7.92	12.26	11.01	7.17	22.63	109.44	6
		TS-1-6 Wonomulyo - Kaluku	200	6.0	432	1	60.64	3.02	7.92	12.26	11.01	7.17	18.55	120.56	3
	TS-2	TS-2-1 Palu - Kwandang	1,019	3.4-8.4	1,043	1-7	24.26	15.08	11.88	9.19	13.77	10.75	21.55	106.48	7
		TS-2-2 Kwandang - Manado - Bitung	1,399	3.5-10.0	2,671	1-38	24.26	15.08	11.88	12.26	8.26	10.75	21.80	104.29	8
		TS-2-3 Molibagu - Worotican	184	4.5-8.4	393	2-4	24.26	9.05	7.92	9.19	13.77	7.17	19.58	90.93	14
	TS-3	TS-3-1 Jenepono - Watampone - Wotu	1,452	3.9-9.7	2,431	1-10	36.38	6.03	19.79	9.19	11.01	14.34	25.48	122.23	2
		TS-3-2 Wotu - Poso - Toboli	1,069	4.2-5.5	1,777	1-5	24.26	6.03	7.92	9.19	11.01	7.17	15.07	80.65	17
	TS-4	TS-4-1 Toboli - Gorontalo	973	4.0-7.0	1,860	1-7	24.26	9.05	11.88	9.19	11.01	10.75	19.04	95.18	10
		TS-4-2 Gorontalo - Bitung	893	3.5-11.0	1,433	1-15	24.26	9.05	11.88	9.19	11.01	10.75	19.99	96.13	9
	TS-5	TS-5-1 Wotu - Kolaka	435	3.9-5.6	1,053	1-4	24.26	3.02	7.92	12.26	8.26	14.34	19.20	89.25	15
		TS-5-2 Kolaka - Tinaggea - Kendari	1,060	4.2-17.8	1,090	1-3	12.13	9.05	7.92	12.26	8.26	10.75	19.70	80.06	18
		TS-5-3 Kendari - Tondoyondo	373	4.3-6.0	384	1-3	24.26	9.05	7.92	9.19	11.01	10.75	16.96	89.14	16
		TS-5-4 Tondoyondo - Luwuk - Poso	1,235	3.5-6.0	1,238	1-3	12.13	12.06	11.88	12.26	11.01	10.75	21.53	91.62	13
		TS-5-5 Kolaka - Kendari	312	4.5-6.7	465	1-9	24.26	12.06	7.92	9.19	13.77	7.17	19.48	93.85	11
TS-5-6 Landawe - Tolala		150	6.0	1,221	1	12.13	3.02	3.96	9.19	13.77	7.17	15.57	64.80	19	

(3) Executing Agencies and Implementing Organizations

1) Executing Agencies

National Road

The Directorate General of Highways (DGH: Bina Marga) of the Ministry of Public Works will be the executing agency responsible for the construction, operation as well as maintenance of the national road network. For the detailed design and construction stage, a Project Management Unit (PMU) will be established in Bina Marga in the case of donor supported projects. The PMU will represent the DGH and act as project employer.

Due to its character as regional representative of the DGH in technical matters, the Balai Besar VI was assigned the responsibility of planning and monitoring of construction, operation and maintenance, and quality assurance of the national roads and bridges and conducts periodic maintenance of the national road network on the Sulawesi Island. Routine maintenance is conducted by force account of each province or regency government using the APBN allocated by the DGH.

Provincial Roads

The Praswill and Dinas PU of each provincial government are responsible for the construction, operation and maintenance of the provincial road networks in each jurisdiction. The Praswil or Dinas PU, acts as the executing agency of each project. The planning and program execution of provincial road routine and their periodic maintenance are also conducted by the Praswill, or Dinas PU, of each province.

2) Implementing Organizations

The Master Plan proposal involves comprehensive road network development of both national and provincial roads through an integrated manner and requires maximum utilization of resources at all possible levels for the implementation of the proposed master plan. A type of implementing organization for the donor supported national and provincial road project is as illustrated in **Figure 13.1** which facilitates the necessary coordinative efforts and the utilization of resources in both the central and the regional governments.

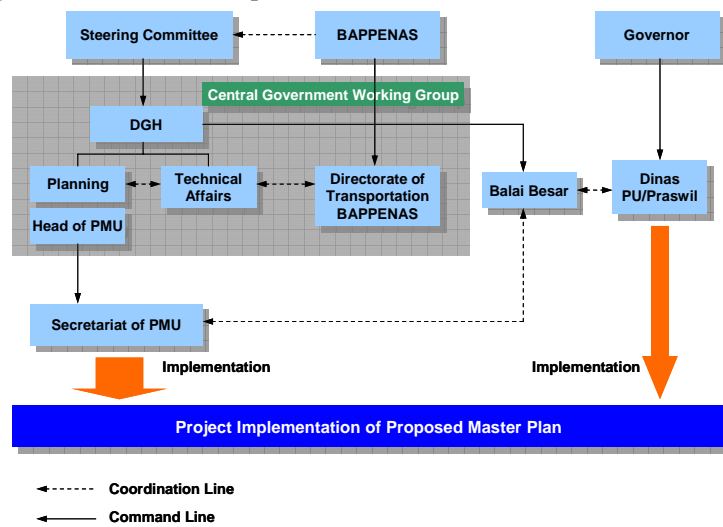


Figure 13.1 Possible Organization for Integrated Implementation of National and Provincial Road Project

(4) Maintenance Plans

1) Maintenance Issues

Necessity of Sufficient Budget for Road Maintenance

Sustainability of the road facilities after development, or betterment, is the most important issue. New, or rehabilitated roads, will deteriorate through vehicle loading, weathering and aging. The following figure illustrates a typical road surface deterioration having no maintenance and with proper maintenance for a typical road at approximately ADT 3,000 pcu.

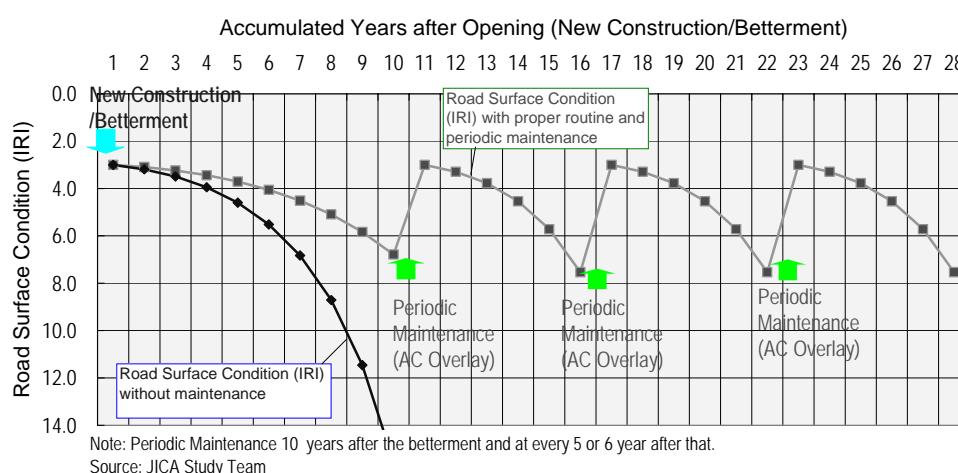


Figure 13.2 Typical Road Surface Deterioration With and Without Maintenance

The International Roughness Index (IRI) for a new pavement is approximately 3.0 and its deterioration accelerates after the IRI exceeds approximately 4-5 if no proper maintenance is made.

Insufficient maintenance budget allocation for the road maintenance, especially when there is economic or budget constraints causes serious road deterioration. Both development and maintenance budgets for national roads has increased substantially in the 2006 – 2008 budgets reflecting better central administration policy compared with the 2004 – 2005 budgets. However, it should be noted that insufficient budget is still the most critical issue for both provincial and regency roads. A total amount of Rp 386 - 579 billion, which is 1.0%-1.5% of the road asset values, is required annually for the routine maintenance of national, provincial and regency roads in Sulawesi as estimated in Table 13.3.

Table 13.3 Annual Budget Requirements for Routine Maintenance Work

Road Status	Length (km)	Estimated Road Asset Value		Required Budget (Bil. Rp)
		Bil Rp./km	Amount (Bi.Rp.)	1.0% – 1.5% of Asset
National Road	8,100	1.4	11,340	113 – 170
Provincial Road	4,800	1.1	5,280	53 – 79
Regency Road	44,000	0.5	22,000	220 – 330
Total	56,900		38,620	386 – 579

Source: JICA Study Team

Road Maintenance Capacity Development and Current Administration

Currently, the routine maintenance of the national roads was under the responsibility of the Dinas PU using the national budget (APBN). The responsibility was moved back to Balai Besar VI/MPW since January 2007, however routine maintenance works is still conducted by the force account of Dinas PU.

The routine maintenance for national roads is conducted through the normal budget accounts of the provincial or the regency government using the APBN (national budget). Routine maintenance for

provincial roads is conducted through the inherent budget accounts of the provincial or regency governments using the APBD I (provincial budget). The periodic maintenance for both national and provincial roads is contracted out to the private sector. Those for city and regency roads are executed by contracts or force accounts by the APBD II.

Besides budget concerns, insufficient capacities, including management, equipment and skills, is one of the most urgent issues in the national, provincial and regency road maintenance to overcome.

2) Approach for Asset Management and Road Fund

The Integrated Road Management System (IRMS) was locally introduced in the late 1980s and was periodically updated as a tool for systematic road management. With appropriate modification, the IRMS can be used as a tool for asset management. The Bridge Management System (BMS) was introduced in line with the development of the Road Design Systems in the early 1990s. However, the system has not been updated for a long time and its data are outmoded and could not be used for the planning and management. A new system should be developed for an efficient and effective bridge management.

The key factor in good maintenance practices is financial and budgeting sustainability which is based on an efficient and effective management system. Stable funding sources should be established to sustain maintenance program.

Two approaches can be used for this: budget approach and road fund approach. The former is a public expenditure that is covered by either the national or provincial budgets. The road fund is an instrument that is generally used a main source for financing road maintenance and other road expenditures.

This approach has been used in such countries as the USA, Japan, New Zealand Road since the mid-1950s is the most economical and efficient collection method since they are collected at refineries or at ports of import. In recent years, the road fund approach has become widespread and applied in many developing countries (more than 30 countries), and several countries have even attained a 90% collection rate for the required fund for maintenance. Sources from the road fund could also be used for road safety, overload control and others, including road asset management activities.

3) Overloaded Vehicle Control System

The decree from the Minister of the MOC, No.KM13 Year 2001, paved the way for the designation of road classification which is classified into Class I, II, IIIA, IIIB and IIIC as shown below and all national roads in Sulawesi were classified into either IIIA or IIIB. The maximum axel loads allowed on public roads is 8 tons.

Table 13.4 Axle Load Limit Criteria by Road Class

Class	Maximum Size of Vehicles	Maximum Axle Load (ton)
I	W= 2.5m, L=18m	>10
II	W=2.5m, L=18m	10
IIIA	W=2.5m, L=18m	8
IIIB	W=2.5m, L=12m	
IIIC	W=2.1m, L=9 m	

According to the axle load survey which was conducted in April 2007 as a part of traffic survey for the FS of priority roads in the Mamminasata Metropolitan Area, approximately 47% - 64% of trucks were overloaded, especially, overloaded were 3-axle trucks carrying construction materials (sand, gravel and soil), agricultural products and cement trucks. Overloading was significant with maximum axle loads reaching 25-28 tons.

Overloading has a highly negative effect on pavements, road safety and traffic capacity, therefore, the Study team recommends, in addition to the overloading control which includes improvement of axle and gross weight control methods and operations, increase the number of weighing stations at strategic points, strengthening education for vehicle owners and drivers, introduction of MST 10 ton routes (Class II roads) for heavy loaded road routes, an introducing a computer-assisted system at weighing stations.

(5) Funding Requirement and Financing Plans

1) Funding Requirements of the Proposed Master Plan

Funding requirements for implementing the entire Master Plan for 2008-2024, including the maintenance and development of both national and provincial road network is estimated at Rp 35,199 billion (National Road: Rp 23,771 billion and Provincial Road: Rp 11,428 billion) as shown in Table 13.5.

Table 13.5 Funding Requirement for Proposed Master Plan

Improvement measures	Total Project Cost			
	Arterial Road (km)	Collector Road (km)	Total (km)	Amount Rp Billion
A. National Road (Arterial road + Collector (K-1) road)				
Development Cost	3,123	2,946	6,069	13,644
Periodic and Routine Maintenance Costs	3,256	4,885	8,141	10,127
Total A				23,771
B. Provincial Road (Collector road K-2 & K-3)				
Development Cost	0	2,342	2,342	5,249
Periodic and Routine Maintenance Costs	0	4,785	4,785	6,179
Total B	0	7,127	7,127	11,428
Total A+B				35,199

2) Possible Budget Envelope

Recent Trends in Budget Allocations for National and Provincial Roads

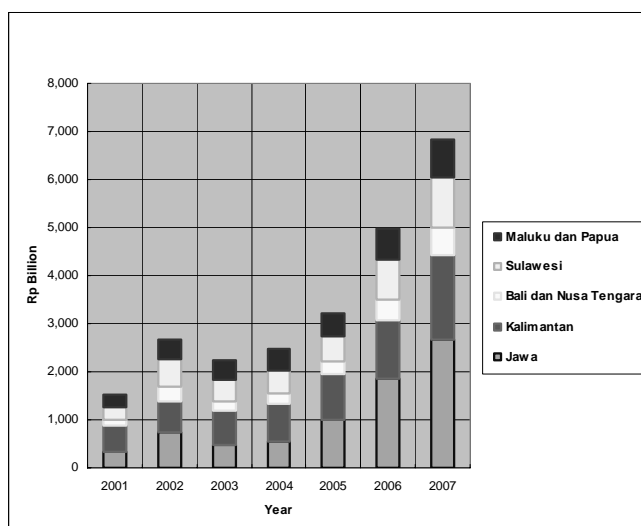
Development of the national road network has been funded by the APBN budget allocated through Bina Marga. The recent trend in budget allocation from Bina Marga to the Regions is shown in Figure 13.3. As shown in the figure the total Bina Marga budget has doubled since 2005.

However it should be noted that the transport sector budget of the GOI had experienced drastic decreases from 1993/1994 down to 1/6 to 1/7 in 2001³ in terms of GDP share due to the financial crisis and the decentralization policy of the central government. The current increase of the Bina Marga Budget may be considered as a reactionary process aimed at resuming the 1993-1994 budget levels based on the policy change of the current regime focusing on the development of the nation's infrastructure. In addition, Bina Marga is preparing a multi-year contract package for the comprehensive improvement of the Western Corridor of Sulawesi Island and other routes which will contribute again to a large increase of the national road budget of the Sulawesi Region in 2008 and 2009.

As for the provincial road development budgets the average annual growth rate has been about 6% from 2002-2007.

Possible Budget Envelope Estimates

Estimation of the Budget Envelope is conducted on the basis of project budget only (construction/betterment and periodic/routine maintenance), from which the general administration cost, headquarter cost (for DGH) and planning & control costs are excluded.



Source: Bina Marga
 Note: Sumatra Data is excluded

Figure 13.3 Trend of National Road Budget

Possible budget envelope is estimated based on the following conditions:

Budget Growth Assumptions:

Development Budget for National Roads: The multi-year package for the Western Corridor (2008-2009) will increase the Sulawesi Region's budget to Rp 2 trillion level⁴ in 2008 then keep the 2008 level for the Short-term. It will decrease by 30% decrease for the Medium-term and decrease by another 30% for the Long-term.

³ The ratio of total development expenditure against GDP was about 9% in 1993/94 which decreased down to about 3% in 2000. The ratio of development expenditure for Transport, Meteorology and Geophysics against GDP was about 1.5% in 1993/94 which decreased down to 0.2% in 2001.

⁴ The figure is based on the interview with Balai Besar VI.

Development Budget for Provincial Roads: Following the same pattern, the 2008 level will be maintained for the Short-term, then decrease by 30% for the Medium-term and decrease by another 30% for the Long-term.

Maintenance Budget for National Roads: Following the same pattern as above for the Short-term, but will increase by 30% for the Medium-term, and increase by another 30% for the Long-term.

Maintenance Budget for Provincial Roads: Follows the same pattern of the Maintenance Budget for National Roads.

The total possible budget envelope estimates is shown in **Table 13.6** and **Figure 13.4**. It is about Rp 35.4 trillion for the entire period (2008-2024), and includes the development and maintenance costs of both the national and provincial road networks of the Sulawesi Region.

Table 13.6 Possible Budget Envelopes for National and Provincial Roads

		Short-term			Increase Ratio	Medium-term			Increase Ratio	Long-term			Total Rp Bil.
		Rp Bil.	Years	Rp Bil.		Rp Bil.	Years	Rp Bil.		Rp Bil.	Years	Rp Bil.	
National Road	Dev. Budget	1,233	7	8,631	(-) 30%	863	5	4,316	(-) 30%	604	5	3,021	15,967
	Maintenance	680	7	4,760	(+) 30%	884	5	4,420	(+) 30%	1,149	5	5,746	14,926
	Total	1,913		13,391		1,747		8,736		1,753		8,767	30,893
Provincial Road	Dev. Budget	185	7	1,295	(-) 30%	130	5	648	(-) 30%	91	5	453	2,396
	Maintenance	96	7	672	(+) 30%	125	5	624	(+) 30%	162	5	811	2,107
	Total	281		1,967		254		1,272		253		1,264	4,503
Total	Dev. Budget	1,418	7	9,926		993	5	4,963		695	5	3,474	18,363
	Maintenance	776	7	5,432		1,009	5	5,044		1,311	5	6,557	17,033
	Total	2,194		15,358		2,001		10,007		2,006		10,031	35,396

Source: JICA Study Team

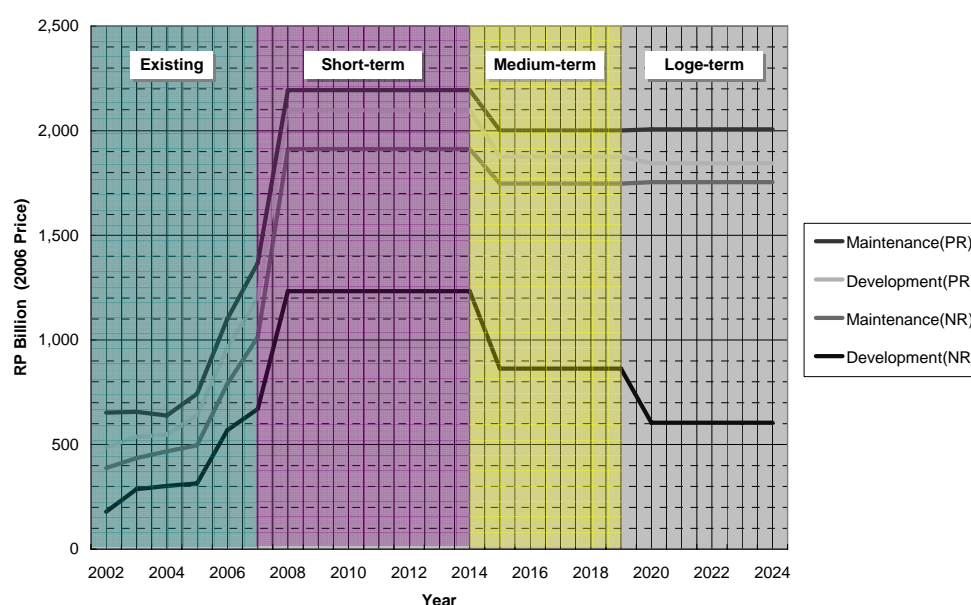


Figure 13.4 Possible Budget Envelope for National and Provincial Roads

3) Estimated Financing

Financing Methods

General Financing methods for the development and maintenance of national and provincial roads are illustrated in **Figure 13.5.4**. An external soft loan is applicable for the development of both national and provincial roads. According to the current practice of EIRTP-2 practice, the external soft loan for the development of provincial road is utilized on the basis of on-granting mechanism with an on-granting agreement between the MOF and the grant receiver (Province) and with the Ministry of Public Works as the implementing agency of the loan program.

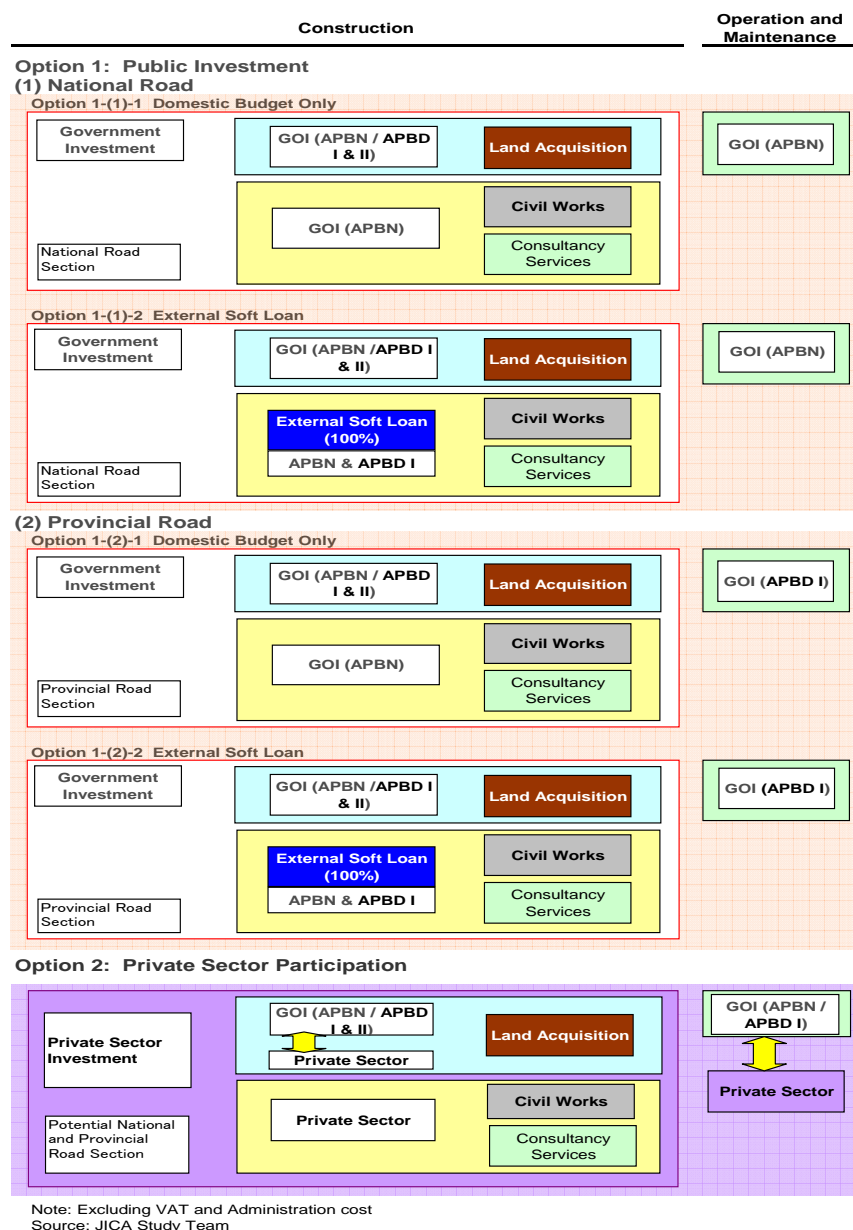


Figure 13.5 Financing Methods for National and Provincial Road

Potential Funding Sources for Provincial Road Development

The following are potential funding sources which could be utilized for the development of provincial roads:

National budget of Bina Marga is allocated for the development of a national road could be allocated for the development of Provincial Road on the proposal basis.

On-granting scheme or on-lending of the external loan to regional government

The on-granting program may be extended both to the Provincial and Kabupaten/Kota governments.

(ERITP 2 project is implemented on an on-granting basis)

Special allocation fund from GOI to regional government

It has been allocated to the road sector expenditures of the Kabupaten/Kota Governments in the last two years and started this year for the Provincial Governments based on the proposal from the Regional Governments.

General provincial budget is limited the major funding source for both the development/ improvement and maintenance of regional roads.

Private Funding: When traffic volume is large and toll charges can be applied for the road users, private funding may be tapped for the development and operation/maintenance of both national and provincial road sections.

(6) Implementation Schedules

1) Implementation Plan Concepts

To establish realistic and effective implementation schedules, the following concepts were applied:

Completion of on-going project in the short-term

All of the on-going improvement projects being implemented or committed by international funding agencies and domestic funds, such as the EINRIP by the AusAID, Road Improvement through a Multi Year Contract (2007-2009) by the Bina Marga, shall be completed in the short-term plan (2008 -2014).

Implementation of “Urgent Bridge Repair Program” in the short-term plan

“Urgent bridge repair program” should cover the whole network of national roads and provincial roads and should be implemented in the short-term plan taking into account the safety of traffic as well as the adverse impacts on local socio-economic activities.

Allocation of the project in accordance with order of priorities

The project shall be distributed in the short-term, medium-term and long-term in accordance with the order of priorities order which has been developed through the project evaluation in terms of economic feasibility, social and natural environmental impacts and maturity of the project.

2) Road Investment Plan

Based on the financing plan discussed in the Section 13.5, the Study Team prepared the road investment plans with three alternatives focused on development cost as follows:

- Case 1: Equal Investment Plan (Development cost is allocated equally in the short-term, medium-term and long-term).
- Case 2: Intermediate Investment Plan between Case 1 and Case 3.
- Case 3: Early Investment Plan (60% of development cost is allocated positively in the short-term plan).

The maintenance cost is allocated into the short-term (20%), medium-term (30%) and long-term (50%) taking into consideration the progress of the road improvement work through new construction and betterment. The above distribution patterns on maintenance costs are similarly applied to all cases.

Table 13.7 (1) to Table 13.7 (3) shows the road investment plan including the prospect of road budget in each term. The Study team recommends Case 3 as the most realistic and effective investment plan taking into consideration the right balance in investment costs and the budget in

all periods. It concludes as follows:

- (1) The road investment and prospect road budget in Case 3 are balanced if a current road budget for national road is secured continuously by the end of master plan in 2024. This means, that all the proposed roads in the master plan would be improved to the planned design and will be completed in accordance with the implementation of the schedule without delay.
- (2) The possibility of the national budget being used for national road would be sufficient, so that all the national roads will have all weather conditions with high design standards and sufficient traffic capacity by the year 2024. The balance of budget should be used for widening of the road where traffic volume increases more than expected and also for strengthening the existing road maintenance system and management system.
- (3) Prospects for budget of development and road maintenance always have constraints. The Study Team, therefore, recommends that the central government provides the strategic financial assistance to the provincial government in order to support the development of the provincial roads including the kabupaten roads. (Kabupaten road plays an important role as a means of local transport and spans 44,000km in Sulawesi, while national road and provincial road cover 12,900km in total)

3) Bridge Investment Plan

The total length of bridges on national and provincial roads is approximately 55,000m and 38,000m, respectively. As planned in Section 8, 326 numbers (5,510 m in length) and 397 numbers (6,050 m in length) of bad conditioned bridges will be replaced in the short-term plan (2008 -2014) irrespective traffic volumes to solve bottle necks in the arterial road network.

The required investment cost for “Urgent Bridge Repair Program” is included in either development or maintenance budget of the road investment plan.

**Table 13.7 (1) Proposed Investment Allocation & Financing Plan
 (Case 1: Equal Investment Plan)**

(1) Proposed Investment Allocation Plan US\$1.0 = Rp. 9,322, Rp 1.0 = ¥ 0.013

Improvement measures	Total Project Cost				Short-term (2008-2014)		Medium-term (2015-2019)		Long-term (2020-2024)		Remarks			
	Arterial Road	Collector Road	Total	Amount	Length	Amount	Length	Amount	Length	Amount				
	(km)	(km)	(km)	Rp Billion	(km)	(%)	Rp Billion	(km)	(%)	Rp Billion				
A. National Road (Arterial road + Collector (K-1) road)														
Development Cost	3,123	2,946	6,069	13,644	2,023	33%	4,835	2,023	33%	4,404	2,023	33%	4,404	Rp.431Billion of Urgent Bridge Repair on National Road (345Nos or 6,000m) is included in the short-term plan
Periodic and Routine Maintenance Costs	3,256	4,885	8,141	10,127	1,628	20%	2,025	2,442	30%	3,038	4,071	50%	5,064	Urgent overlay of pavement (675km) is required in the short-term
Total A				23,771	3,651		6,861			7,443			9,468	
B. Provincial Road (Collector road K-2 & K-3)														
Development Cost	0	2,342	2,342	5,249	781	33%	2,052	781	33%	1,598	781	33%	1,598	Rp.431Billion of Urgent Bridge Repair on Provincial Road (397Nos or 6,500m) is included in the short-term plan
Periodic and Routine Maintenance Costs	0	4,785	4,785	6,179	957	20%	1,236	1,436	30%	1,854	2,393	50%	3,090	Urgent overlay of pavement (982km) is required in the short-term
Total B	0	7,127	7,127	11,428	1,738		3,288			3,452			4,688	
Total A+B				35,199	10,149		10,895			14,156				

(2) Prospect of Road Budget

Expected Budget	Short-term (2008-2014)				Medium-term (2015-2020)		Long-term (2020-2024)		Remarks
	Total Amount				Total Amount		Total Amount		
	Development Budget	Maintenance Budget	Difference (surplus / ▲shortage)	Total (A)	Development Budget	Maintenance Budget	Difference (surplus / ▲shortage)	Total (B)	
A. National Road									
Development Budget	15,968			8,631	4,316		3,021		
Difference (surplus / ▲shortage)				3,796	▲ 88		▲ 1,383		
Maintenance Budget	14,926			4,760	4,420		5,746		
Difference (surplus / ▲shortage)				2,735	1,382		683		
Total (A)	30,894			13,391	8,736		8,767		
Difference (surplus / ▲shortage)				6,530	1,293		▲ 701		
B. Provincial Road									
Development Budget	2,396			1,295	648		453		
Difference (surplus / ▲shortage)				▲ 757	▲ 950		▲ 1,145		
Maintenance Budget	2,107			672	624		811		
Difference (surplus / ▲shortage)				▲ 564	▲ 1,230		▲ 2,279		
Total (B)	4,503			1,967	1,272		1,264		
Difference (surplus / ▲shortage)				▲ 1,321	▲ 2,180		▲ 3,424		
Total A+B	35,397			15,358	10,008		10,031		
Difference (surplus / ▲shortage)				198	5,209		▲ 887		▲ 4,125

**Table 13.7 (2) Proposed Investment Allocation & Financing Plan
 (Case 2: Intermediate Plan)**

(1) Proposed Investment Allocation Plan US\$1.0 = Rp. 9,322, Rp 1.0 = ¥ 0.013

Improvement measures	Total Project Cost				Short-term (2008-2014)		Medium-term (2015-2019)		Long-term (2020-2024)		Remarks			
	Arterial Road	Collector Road	Total	Amount	Length	Amount	Length	Amount	Length	Amount				
	(km)	(km)	(km)	Rp Billion	(km)	(%)	Rp Billion	(km)	(%)	Rp Billion				
A. National Road (Arterial road + Collector (K-1) road)														
Development Cost	3,123	2,946	6,069	13,644	3,035	50%	7,110	2,124	35%	4,632	910	15%	1,903	Rp.431Billion of Urgent Bridge Repair on National Road (345Nos or 6,000m) is included in the short-term plan
Periodic and Routine Maintenance Costs	3,256	4,885	8,141	10,127	1,628	20%	2,025	2,442	30%	3,038	4,071	50%	5,064	Urgent overlay of pavement (675km) is required in the short-term
Total A				23,771	4,663		9,135			7,670			6,967	
B. Provincial Road (Collector road K-2 & K-3)														
Development Cost	0	2,342	2,342	5,249	1,171	50%	2,927	820	35%	1,686	351	15%	636	Rp.431Billion of Urgent Bridge Repair on Provincial Road (397Nos or 6,500m) is included in the short-term plan
Periodic and Routine Maintenance Costs	0	4,785	4,785	6,179	957	20%	1,236	1,436	30%	1,854	2,393	50%	3,090	Urgent overlay of pavement (982km) is required in the short-term
Total B	0	7,127	7,127	11,428	2,128		4,163			3,540			3,726	
Total A+B				35,199	13,298		11,210			10,692				

(2) Prospect of Road Budget

Expected Budget	Short-term (2008-2014)				Medium-term (2015-2020)		Long-term (2020-2024)		Remarks
	Total Amount				Total Amount		Total Amount		
	Development Budget	Maintenance Budget	Difference (surplus / ▲shortage)	Total (A)	Development Budget	Maintenance Budget	Difference (surplus / ▲shortage)	Total (B)	
A. National Road									
Development Budget	15,968			8,631	4,316		3,021		
Difference (surplus / ▲shortage)				1,521	1,278		1,118		
Maintenance Budget	14,926			4,760	4,420		5,746		
Difference (surplus / ▲shortage)				2,735	1,382		683		
Total (A)	30,894			13,391	8,736		8,767		
Difference (surplus / ▲shortage)				4,256	1,066		1,800		
B. Provincial Road									
Development Budget	2,396			1,295	648		453		
Difference (surplus / ▲shortage)				▲ 1,632	▲ 1,038		▲ 183		
Maintenance Budget	2,107			672	624		811		
Difference (surplus / ▲shortage)				▲ 564	▲ 1,230		▲ 2,279		
Total (B)	4,503			1,967	1,272		1,264		
Difference (surplus / ▲shortage)				▲ 2,196	▲ 2,268		▲ 2,462		
Total A+B	35,397			15,358	10,008		10,031		
Difference (surplus / ▲shortage)				35,397	2,060		▲ 1,202		▲ 661

**Table 13.7 (3) Proposed Investment Allocation & Financing Plan
(Case 3: Early Investment Plan)**

(1) Proposed Investment Allocation Plan

US\$1.0 = Rp. 9,322, Rp 1.0 = ¥ 0.013

Improvement measures	Total Project Cost				Short-term (2008-2014)		Medium-term (2015-2019)		Long-term (2020-2024)		Remarks			
	Arterial Road	Collector Road	Total	Amount	Length	Amount	Length	Amount	Length	Amount				
	(km)	(km)	(km)	Rp Billion	(km)	(%)	Rp Billion	(km)	(%)	Rp Billion				
A. National Road (Arterial road + Collector (K-1) road)														
Development Cost	3,123	2,946	6,069	13,644	3,641	60%	8,402	1,821	30%	3,878	607	10%	1,364	Rp.431Billion of Urgent Bridge Repair on National Road (345Nos or 6,000m) is included in the short-term plan
Periodic and Routine Maintenance Costs	3,256	4,885	8,141	10,127	1,628	20%	2,025	2,442	30%	3,038	4,071	50%	5,064	Urgent overlay of pavement (675km) is required in the short-term
Total A				23,771	5,270		10,428			6,916			6,428	
B. Provincial Road (Collector road K-2 & K-3)														
Development Cost	0	2,342	2,342	5,249	1,405	60%	3,376	703	30%	1,348	234	10%	525	Rp.431Billion of Urgent Bridge Repair on Provincial Road (397Nos or 6,500m) is included in the short-term plan
Periodic and Routine Maintenance Costs	0	4,785	4,785	6,179	957	20%	1,236	1,436	30%	1,854	2,393	50%	3,090	Urgent overlay of pavement (982km) is required in the short-term
Total B	0	7,127	7,127	11,428	2,362		4,612			3,201			3,614	
Total A+B				35,199	15,040			10,117					10,042	

(2) Prospect of Road Budget

Expected Budget	Short-term (2008-2014)		Medium-term (2015-2020)		Long-term (2020-2024)		Remarks
	Total Amount		Total Amount		Total Amount		
A. National Road	Development Budget	15,968	8,631	4,316	3,021		
	Difference (surplus / ▲shortage)		229	438	1,657		
	Maintenance Budget	14,926	4,760	4,420	5,746		
	Difference (surplus / ▲shortage)		2,735	1,382	683		
	Total (A)	30,894	13,391	8,736	8,767		
Difference (surplus / ▲shortage)		2,983	1,820	2,339			
B. Provincial Road	Development Budget	2,396	1,295	648	453		
	Difference (surplus / ▲shortage)		▲ 2,081	▲ 700	▲ 72		
	Maintenance Budget	2,107	672	624	811		
	Difference (surplus / ▲shortage)		▲ 564	▲ 1,230	▲ 2,279		
	Total (B)	4,503	1,967	1,272	1,284		
Difference (surplus / ▲shortage)		▲ 2,645	▲ 1,929	▲ 2,350			
Total A+B	35,397	15,358	10,008	10,031			
Difference (surplus / ▲shortage)	198	318	▲ 109	▲ 11			

4) Implementation Plan of Proposed Project

Nineteen packages of the road project is allocated in the short-, medium-, and long-terms in accordance with the prioritization as well as the ceiling of the road investment plan (Case 3) and the results of the implementation plan, as shown in Table 13.9.

The following conditions were assumed in preparing for the implementation schedule:

- 1) The construction period is estimated taking into account the construction costs of each package as follows:

<u>Construction cost</u>	<u>Construction period</u>
Less than Rp. 500 Billion	2 years
Rp.500 Billion – Rp.1,000 Billion	3 years
Rp.1,000 Billion – Rp. 1,500 Billion	4 years
More than Rp. 1,500 Billion	5 years – 7 years

- 2) The construction costs of each package includes the development cost only, while the ceiling amount in each term is allocated based on the road investment plan of Case 3 as follows

Short-term	: Rp. 11,779 Billion
Medium-term	: Rp. 5,226 Billion
Long-term	: Rp. 1,889 Billion

3) Specific projects which were considered in the short-term plan

- (a) On-going projects:
 - EINRIP by AusAID (2007-2009), Road Improvement by multi-year contract (2007-2009) by DGH, Manado and Gorontalo Bypass and other important roads
- (b) Recommended priority development projects (Expected fund):
 - Priority road projects including urgent bridge repair program*
(Yen Loan, APBN, APBD, others)
 - Trans Sulawesi Mamminasata from Maros to Takalar
(Yen Loan, APBN, others)
 - Priority Arterial Roads in Mamminasata Metropolitan Area*
(Yen Loan, APBN, APBD, others)
 - Bridge Reconstruction Project in Southeast Province and others.

Notes: i) **In case of Yen Loan:** This is soft loan ODA and appropriate for implementing of large scale projects with an EIRR of more than 15%.

ii) **In case of Japanese Grant:** This aid is appropriate for implementing projects that contribute to basic human needs of the local people even if their EIRR is less than 15%. For the urgent bridge repair program by the Japanese grant, for example, the program should be for the road routes in islands and inland areas, where securing of access is important for community life (school, health care centers, markets, etc) and regional development, though economic priority is relatively low. The numbers of bridges subjected to the Urgent Bridge Repair Program are as shown in Table 13.6.3. About 40% of these bridges are located in Southeast Sulawesi Province and, therefore, the priority of implementation can be considered for this province in case of the Japanese grant.

Table 13.8 Urgent Bridge Repair Program by Province

Province	No Damage/Good	Fair/Poor	Bad/ Very Bad	Wooden/ Unknown	Total	Bad, Very Bad & Wooden	
North Sulawesi	671 69%	160 16%	42 4%	100 10%	973 100%	142 15%	20%
Gorontalo	292 86%	10 3%	36 11%	0 0%	338 100%	36 11%	5%
Central Sulawesi	1,222 72%	390 23%	40 2%	55 3%	1,707 100%	95 6%	13%
West Sulawesi	241 66%	65 18%	22 6%	37 10%	365 100%	59 16%	8%
South Sulawesi	965 70%	321 23%	67 5%	25 2%	1,378 100%	92 7%	13%
South East Sulawesi	550 50%	257 23%	144 13%	155 14%	1,106 100%	299 27%	41%
Total	3,941 67%	1,203 21%	351 6%	372 6%	5,867 100%	723 12%	100%

Source: JICA Study Team

(c) Maintenance projects and programs:

- Urgent pavement repair program for road conditions of poor and bad.

(Yen Loan, APBN, APBD, others)

Notes: i) Bad conditioned road links (Class IV) will be given higher priority under the road maintenance programs irrespective of EIRR.

ii) Capacity development programs (equipment, methodology, staff capability, etc) for routine maintenance will also be implemented.

Based on the above conditions, the economic analysis was conducted for each case of the implementation program. As a result, the economic benefit, based on the VOC and TTC, derived from Case 3 of implementation plan and the master plan road network, is expected to be Rp. 338,082 Billion from 2012 to 2044 in total. It has the following economic indices:

Total project cost including maintenance cost	: Rp. 52,735 Billion
Accumulated benefit (Period: 2012 – 2044)	: Rp. 338,082 Billion
Economic internal rate of return (EIRR)	: 21.5%
Net Present Value	: Rp. 6,475 Billion
B/C ratio	: 1.58

The above indices justify that the projects proposed in the master plan are economically viable. Table 13.10 shows the result of economic calculation for Case 3 in the implementation program.

Table 13.10 Calculation of Economic Analysis (Case 3)

No.	Year	Development Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	963,360	108,602	297,870	1,369,832	0	-1,369,832
	2009	1,201,860	155,059	345,810	1,702,729	0	-1,702,729
	2010	1,389,060	155,858	913,830	2,458,748	0	-2,458,748
	2011	1,752,435	126,900	43,590	1,922,925	589,242	-1,333,683
	2012	1,852,560	159,857	482,070	2,494,487	745,025	-1,749,461
	2013	1,721,700	151,779	2,356,740	4,230,219	1,120,014	-3,110,206
	2014	1,719,293	159,857	450,105	2,329,254	1,178,561	-1,150,694
	2015	977,070	141,480	487,830	1,606,380	4,512,141	2,905,761
	2016	992,798	147,094	1,197,015	2,336,906	5,024,450	2,687,544
	2017	1,064,798	150,548	43,590	1,258,935	5,453,383	4,194,448
	2018	922,343	157,202	482,070	1,561,614	5,908,838	4,347,223
	2019	746,528	155,993	2,356,740	3,259,260	6,495,267	3,236,007
	2020	458,250	149,929	450,105	1,058,284	7,498,449	6,440,165
	2021	434,850	159,857	487,830	1,082,537	8,026,431	6,943,894
	2022	212,550	159,857	1,197,015	1,569,422	8,554,413	6,984,991
	2023	297,000	157,984	43,590	498,574	9,082,395	8,583,821
	2024	297,000	159,857	482,070	938,927	9,109,878	8,170,951
1	2025	0	159,857	2,356,740	2,516,597	9,503,145	6,986,548
2	2026	0	159,857	450,105	609,962	9,896,412	9,286,450
3	2027	0	159,857	487,830	647,687	10,289,679	9,641,992
4	2028	0	159,857	1,197,015	1,356,872	10,682,946	9,326,074
5	2029	0	159,857	43,590	203,447	11,076,213	10,872,766
6	2030	0	159,857	482,070	641,927	11,469,480	10,827,553
7	2031	0	159,857	2,356,740	2,516,597	11,862,747	9,346,150
8	2032	0	159,857	450,105	609,962	12,256,014	11,646,052
9	2033	0	159,857	487,830	647,687	12,649,281	12,001,594
10	2034	0	159,857	1,197,015	1,356,872	13,042,548	11,685,676
11	2035	0	159,857	43,590	203,447	13,435,815	13,232,368
12	2036	0	159,857	482,070	641,927	13,829,082	13,187,155
13	2037	0	159,857	2,356,740	2,516,597	14,222,349	11,705,752
14	2038	0	159,857	450,105	609,962	14,615,616	14,005,654
15	2039	0	159,857	487,830	647,687	15,008,883	14,361,196
16	2040	0	159,857	1,197,015	1,356,872	15,402,150	14,045,278
17	2041	0	159,857	43,590	203,447	15,795,417	15,591,970
18	2042	0	159,857	482,070	641,927	16,188,684	15,546,757
19	2043	0	159,857	2,356,740	2,516,597	16,581,951	14,065,354
20	2044	0	159,857	450,105	609,962	16,975,218	16,365,256
Total		17,003,453	5,754,848	29,976,765	52,735,065	338,082,117	285,347,052

Source * JICA Study Team

EIRR	21.5%
NPV (*): Rp. Million	6,475,266
B/C (*)	1.58

(*) Discount Rate=15%

CHAPTER 14 CONCLUSIONS AND RECOMMENDATIONS

(1) Conclusions

1) Regional Development

01 **Needs of Regional Development:** A review of the natural conditions as well as the demographic and economic situations of Sulawesi Island reveals that there remains much to be improved in the development of its economy and the enhancement of social welfare. For instance, the per-capita GRDP of the Sulawesi remains at of 60% of the national average. Such a gap should not increase in the planned period up to 2024. Likewise, regional development should not merely focus on economic activities and social welfare but include the protection of the environment since degradation has been observed in various parts of the island.

02 **Development Objectives of Sulawesi:** Sulawesi Island is expected to lead the development of Eastern Indonesia as touted at the central and regional planning levels. Because of its geographical location, human resources, and fundamentals for economic growth Sulawesi has enough potential to assume such a role. In order to spearhead the development of Eastern Indonesia and improve its, the overall objectives of the Sulawesi Island regional development should attain the following objectives i) balanced development of Sulawesi as the leading growth island in Eastern Indonesia and as a gateway to other Asian countries, and ii) sustainable development of an environment-friendly Sulawesi with less poverty and less potential of other risks.

03 **Spatial Structure:** The spatial development framework of Sulawesi Island has been discussed at the central and regional levels, as well as in the six provinces. The existing framework of the RTRWN (National Spatial Plan, Oct. 2007) is now part of the national activity centers of Makassar, Manado, Palu, Gorontalo and Kendari and the national strategic activity centers of Melonguane and Tahuna in North Sulawesi. Based on RTRWN, a spatial structure is discussed in the course of this Study from workshops and other discussions. It was also noted that Mamuju which has been designated as the regional activity center could be a national activity center. These national activity centers will be networked to form a cluster all over Sulawesi and it is further proposed that sub-clusters should be promoted in the northern, central, and southern economic linkages.

04 **Development Framework:** Social and economic development frameworks have been discussed and formulated. It has been forecasted that Sulawesi's population would increase from 15.7 million in 2005 to 19.7 million by 2024, at the average annual growth rate of 1.20%. A corresponding increase in its labor force is estimated to reach nearly 3.5 million. The urban population would increase from 28.0% in 2005 to 35.8% by 2024. Inter-provincial migration is predicted, particularly immigration to the international/inter-regional centers and, to lesser degree, to the intra-regional centers. The economic framework has been set in terms of the GRDP by province and regency. The overall economic growth rate is set at 7.0% on an annual average (4.5% in the agriculture sector and 8.0% in the non-agriculture sector).

2) Transport Development

05 Modal Shares in Passenger Transport: For long distance travel of more than about 500 km (as the crow flies) air transport will become dominant in the future. Considering the progress of airport development and the emerging LCCs (low-cost carriers), the modal share of air transport will reach 50% to 100%. Road transport will share less than 50 % in this distance range. The role of provincial buses will be limited, confined to around less than 30% of the road transport share. However, for short- to medium-distance travel of up to 500 km, road transport will play a major role with a share of 100% to 50%, although it decreases with distance. The share of public transport (provincial bus and small buses including the “petepete”) will be around 30% of the road transport share. The ferry mode will play an auxiliary but important role for some specific OD pairs such as Makassar-Kendari route. The ferry mode is regarded as a part of the road network in this study, with its share sometimes reaching more than 50% of all person trips for some zone pairs.

06 Modal Shares in Cargo Transport: Maritime transport will be dominant also in the future for long-distance transport of more than about 500 km (as the crow flies). Currently, its modal share is more than 60% for major routes. In the future, this modal share is expected to decrease slightly due to the expected increase of high-value products. The remaining 40% share will be shouldered by road transport (i.e. trucks). For short- to medium-distance transport of up to 500 km, road transport will play a major role along with passenger transport with a share of 100 to 40%, although they decreases with distance. As mentioned earlier, the ferry is considered part of the road network. Although ferries carry trucks loaded with cargoes, its role in cargo transport is not so significant at present. In the future, however, its role can be strengthened if the ferry system is upgraded.

07 Road Network: The road network of Sulawesi will basically be composed of two-lane roads. This is because at present the traffic volume of inter-city roads is mostly below 3,000 PCUs. Sulawesi needs an all-weather characteristics for its road network. Recently, huge efforts were made by several donors to maintain Sulawesi’s roads. Ideally, this should be continued in the future observing the principle of sustainable responsibility sharing among local governments. In order to realize the regional development plan of this study, strategic feeder roads are essential to link strategic points. Some existing roads may require additional improvements such as widening and pavement strengthening. Towns, villages, and other inhabited areas along the main roads of Sulawesi need traffic safety and environmental measures as local residents are potentially at risk by a rapid through traffic. Toll roads are proposed in Sulawesi, and the National Spatial Plan (Oct. 2007) included eight (8) freeways, i.e. Manado-Bitung, Manado-Tomohon, Maros-Mandai-Makassar, Makassar-Sungguminasa, Sungguminasa-Takalar, Limboto-Gorontalo, Ujung Pandang I and Makassar IV. Of these Ujung Pandang I and Makassar IV is either under operation or construction. The study covers Manado-Bitung, however, Manado-Tomohon and Limboto-Gorontalo were not included. Three (3) urban toll roads in the Mamminasata Metropolitan Area, were recommend to be urban arterials roads, not as freeways (see the Feasibility Study part of this study for details).

08 **Ferry and Passenger Shipping Service:** The demand for ferry and passenger ship services is still large. In 2005 inter-island passengers by air reached approximately 1.3 million, while passenger ships transported 1.9 million. However, intra-island travel by air transport has increased rapidly after the implementation of the “open-skies” policy, bringing down airfare rates to competitive levels. Ferry and passenger shipping services are both decreasing in terms of passenger number and cargo volume. Approximately 55% of intra-island passengers now travel by air, while the number of ferry passengers is decreasing. Second-hand ferry boats operating in Sulawesi are so superannuated that safe and on-time services become difficult. Safe and high-speed services will be necessary for the mode to recover and increase its demand.

09 **Railway:** The railway development plan for Sulawesi is indicated in the Sulawesi Island Spatial Plan. The two sections of Makassar - Parepare and Manado - Gorontalo are proposed as high priority projects, while other projects are given lower priority. The proposed routes are competing with the road projects that have been proposed already or are proposed in this study. According to the past studies, these railways were planned mainly for freight not for passengers,. Judging from the estimated volume of traffic demand, there are concerns that these railways would not be financially feasible (financial evaluation is not provided in the past studies) if implemented at present. These projects should thus be studied in detail in the near future when the capacity of existing transport infrastructure has been reached.

10 **Air:** With the “open skies” policy taking effect, it is expected that air will become the principal mode in long-distance passenger movement in Sulawesi as the economy further develops and incomes increase. At the same time, however, flight delays and a series of recent air mishaps have exposed poor safety standards of the aircrafts and this could have an adverse impact to the “open skies” policy. A safe and punctual operation is essential to increase inter- and intra-island air transport demand.

3) **Road Development and Sulawesi Road Master Plan**

11 **Road Development Policy:** This study aims to formulate the arterial road master plan and its implementation plan for the Sulawesi Island to support its regional and economical development. The Study Team established eight (8) development policies taking into consideration the existing road condition and the forecasted traffic demand. Each road development policy is related to one of the economic development strategies.

12 **Staged Application of New Road Design Standard:** The GOI had issued “Government Road Regulation/Peraturan Pemerintah Nomor No.34 Tahun 2006 Tentang Jalan (PP No. 34 Year 2006)” replacing PP No. 26 Year 1985. One of the major changes in the new regulation is roadway and carriageway widths. The Study Team judged that it was not financially and technically feasible to apply the new road regulation to all road projects. Therefore the Study Team recommends the following: 1) Primary arterial roads should be widened to the standard 7.0m carriageways by the target year of 2024, 2) Primary collector roads should be widened stage by stage to 7.0m based on

the present and future traffic demands, 3) Periodic and routine maintenance should be given first priority to sustain the national and provincial road assets.

13 Needs for Capacity Expansion, Pavement Improvement and Bridge Rehabilitation:

The Study Team examined the existing roads to identify the needs of capacity expansions in the “Do-nothing” case (Zero Option) for 2024. The sections that need widening were identified based on the road standard recommended by the Study Team through an analysis on demand/supply relations using the present road capacity and projected future traffic volumes. As a result, it revealed that out of 12,100 km of arterial and collector roads, 4,700 km needs widening to 6-7m, and 7,350 km require reconstruction without widening. The pavement condition was evaluated based on the existing road inventory data. The study revealed that about 33% or 3,900 km of the total length of existing roads were in poor, or bad, condition and needs urgent rehabilitation. The study also revealed that more than 12% of existing bridges were under bad, or impassable conditions, and likewise needed urgent repairs.

14 Sulawesi Road Master Plan: The Sulawesi road master plan was established based on the improvement plan of existing roads in terms of capacity expansion, pavement improvement and bridge rehabilitation. By completing the master plan road network by 2024, the following benefits are expected:

- i) A harmonized economic development in Sulawesi would be expected through the strengthening of economic linkages between the six provinces due to the completion of Trans-Sulawesi Road which will feature a high all weather standard.
- ii) Improvement of basic human needs as well as poverty alleviation would be expected in the rural areas and isolated islands through the strengthening of the road network system and the completion of missing links.
- iii) Development of processing industries utilizing potential resources in Sulawesi would be expected as a result of the increase in accessibility to potential areas.
- iv) The natural environment and isolated cultural communities would be properly protected by the road development with due consideration to proper environmental protection.
- v) The increase in environmental loads in Sulawesi would be minimized with the incorporation of energy-saving transport ferry services in the road network system (nautical highway).

15 Future Traffic Demand Forecasts: The distribution of traffic volumes are concentrated around the major cities such as Makassar, Manado, Palu and Kendari. Although in Makassar traffic current traffic congestion is only confined around the city by 2024 it will spread to a wider area such as Parepare, Majene, Palopo and Masamba. In other areas, however, traffic congestion will not be serious except for Manado and its vicinities.

16 **Preliminary Engineering Study:** The preliminary engineering study was conducted to estimate rough improvement costs as well as to determine priorities for project implementation. The road network is divided into 19 packages with proper consideration of the unique characteristics of the Trans Sulawesi Road as well as other existing roads. Unit costs for the improvement and maintenance works were estimated with references to similar projects recently implemented in Sulawesi. As a result, total investment cost was estimated at Rp. 35,200 billion. Of this amount the national roads, including arterial and collector K-1 roads, accounts for Rp. 23,770 Billion while the provincial roads accounts for Rp. 11,430 billion.

17 **Project Evaluation:** Economic evaluation was conducted to prioritize the proposed 19 projects and as a factor for project evaluation. The study revealed that the projects located on the West-South Corridor (TS-1 group), West-North corridor (TS-2 group) and Central-South corridor (TS-3 group) have high EIRRs of more than 15%, except for the TS-2-1. On the other hand, the projects located on the Central-North corridor (TS-4 group) and East corridor (TS-5 group) have a lower EIRR of less than 15%.

18 **Implementation program:** The implementation program has been prepared taking into consideration the cost requirement, result of prioritization and fund availability.

19 **Prospect on Road Budget:** In latter years, the road budgets have recovered rapidly to the budget scale of 1990's. However, it is not realistic to assume that the road budgets would increase continuously for a long term. Therefore, the Study Team considers that the road development budget will remain at present levels for the time being until 2024, which is the end of the long term. In other words, the road development budget will decrease according to the progress of the implementation of the improvement projects, but the maintenance budget will increase in tandem with the increase in improved road lengths. The total available budget is estimated at Rp. 35,400 Billion; Rp. 30,890 Billion for central government (national) and Rp. 4,500 Billion for provinces.

20 **Road Investment Plan:** The Study Team examined three alternative investment plans, namely: Case 1: Equal allocation type, Case 2: Intermediate type, and Case 3: Early Investment type. Case 3 was recommended due to the following reasons: 1) The estimated annual budget and expenditure are balanced, 2) Road improvement is realized earlier, and 3) Effects on regional development would be larger.

However, it was found that the estimated budget for development and maintenance for provincial road somewhat falls short in all the periods, while the national road budget seems sufficient. Financial support to the provincial government will be necessary to realize the proposed improvement of the provincial roads.

21 **Implementation Plan:** Implementation program was prepared based on the prioritization of projects as well as the road investment plans. In making the implementation plan, the Study Team considered the following factors: 1) All improvement projects being implemented or committed by international funding agencies and domestic funds, such as EINRIP by AusAID and Road

Improvement by Multi Year Contract (2007-2009) by Bina Marga, should be completed in the short-term plan (2008 -2014), and 2) “Urgent bridge repair program” should be implemented in the short-term plan.

22 **Economic Analysis in the Master Plan:** As a result of the economic analysis for implementing Case 3, it was recognized that the project is economically feasible and viable with a high economic EIRR at 21.5%, a B/C ratio at 1.58 and an NPV at Rp. 6,475 Billion.

4) **Environmental Consideration**

23 **Results of the SEA analysis:** As a result of the multi-criteria Analysis under the Strategic Environmental Assessment (SEA), the road network improvement, including the ferry improvement “Option 3” was selected as the best solution for the Master Plan. Since “Option 3” focuses on realignment, upgrading, rehabilitation, strengthening, and maintenance associated with some strategically important new projects together with the improvement of accessibility through marine transport which is more environmentally friendly than the road network development only (Option 2). Also, negative impacts on the global and local environment would be relatively smaller than “Option 2”. “Option 3” is a road improvement plan which includes an additional nautical highway concept resulting to a wholistic approach of improvement of accessibility by marine transport, reduction in energy consumptions and the decrease in emissions per traffic volume which is relatively lower than “Option 2”.

5) **Rural Road Development Plan and Asbuton Use**

24 **Local Road Study:** The arterial roads study subjected national and provincial roads. However, a study on local roads (regency and city roads) was proposed at the workshops and seminars. JICA accepted the proposal since improvement of local roads is also important for support of regional development. The Study Team has conducted a supplemental survey for local road development planning and use of natural asphalt produced in Buton Island as pavement materials for local roads.

25 **Issues of Local Roads:** The road network in Indonesia is comprised of national, provincial, local and other roads. The total length of national and provincial roads is 12,920 km in Sulawesi. The total length of local roads (regency and city roads) is 43,860 km, which is approximately 3 times of the national and provincial roads. As high poverty areas are located in isolated inland and island areas, local roads rehabilitation (betterment and periodic maintenance) is very important for support of regional economy by improving transport efficiency for agricultural inputs and outputs. The condition of local roads is worse and asphalt pavement ratio is lower than the national and provincial roads. A large part of the bridges on local roads are wooden bridges of bad condition and required urgent replacement. As the road budgets for most of the local governments are insufficient, support by the central government is necessary. Capacity development is also required for road asset management, planning, implementation and maintenance.

26 Road Rehabilitation Targets and Investment Cost: The Study Team has established two road development and rehabilitation targets for short term (2010-2014), medium term (2015-2019) and long term (2020-2024) on road condition and asphalt paved road length. The good conditioned roads will be increased from 56% to 85% by 2024. The asphalt paved road will be increased from 41% to 70% by 2024. A total of 6,000 km of road will be either upgraded from the current district road to regency road or constructed new. The total regency/city roads will become 50,000 km by 2024. The required total investment cost is estimated at Rp 20,270 billion including routine maintenance.

27 Natural Asphalt (Asbuton): Amount of the Asbuton deposit in Buton Island is estimated at 660 million tons and this is equivalent to 170 million tons of oil asphalt (bitumen). Approximately 500,000 of Asbuton was produced per year in the middle of 1980s and used for pavement through the nation. However, production was reduced in the 1990s due to its higher price compared with oil asphalt and technical problems (durability). However, oil asphalt price has substantially increased in line with the crude oil price increase as asphalt is by-product in the oil refinery processing. Indonesia imported about 600,000 tons of asphalt and the GOI intends to use Asbuton for substituting the imported asphalt. While, new technology has been developed to secure durability of Asbuton pavement.

(2) Recommendations

1) Regional Development

01 Direction of Industrial Development: The agricultural sector should focus on the further enhancement of productivity of any crops as the expansion of available lands is limited. Particularly, crops for product processing should be strategically promoted in addition to the enhancement of productivity of the staple food. Industrial development should focus on the agro-processing industries in order to enhance value-added in Sulawesi and secure employments especially for the younger generations who would flow out from the rural villages in the course of the planned period. Industries should be located in the growth poles and connected to the surrounding urban and rural areas. Trade should also be promoted more aggressively for exports of processed products, particularly to the ASEAN and BRIC countries. Transfer trade and inter-regional trade should also be promoted as a center for development of Eastern Indonesia.

02 Role of Energy Resource Development: Sulawesi could play two roles in the energy resource development of Indonesia. Firstly, Sulawesi should become one of the energy resource producer on the basis of its natural gas and oil production in the Central Province, especially in Luwuk. Moreover, bio-energy development such as bio-diesel fuel (BDF) from coconuts and/or *Jatropha* has a high potential of contributing to the energy problems and climate change issues. Secondly, Sulawesi should be a support center for the energy exploitation in eastern Indonesia through its geographical and sociological advantages in the region. Ample resources of labor forces, food, and construction materials in Sulawesi are prerequisite for the energy development in Kalimantan and Papua, wherein these resources are limited.

03 Necessity of Cluster Development: For regional development as well as industrial and trade development, clusters should be formed not only at the provincial level but also at the regional and island levels. Some examples of clusters have been discussed in the course of this study, including a cacao-based cluster, fruit-based cluster and bio-diesel fuel (BDF) clusters. Special attention has been paid to the BDF clusters, as they would promote linkages among the agricultural and industrial sectors as well as contribute to the reduction of pollutant emission that would otherwise increase in Sulawesi.

04 Infrastructure Development for Growth and Poverty Reduction: For development of growth poles and their network over the island, as well as the development of industries and trades, and for poverty eradication in the mountainous rural areas and remote islands, the improvements in infrastructure are prerequisites. Transportation should be improved to strengthen networking over Sulawesi and to enhance economic activities as well as social communication including welfare. In addition, the systems for energy supply and electric power supply should be secured and their environmental loads should be minimized.

05 Necessity of Institutional Enhancement: By activating the economy and improving the

infrastructure, it appears that the economic framework laid down for Sulawesi would be attainable though it should be further verified through the proper planning of respective development programs and projects. It should be additionally noted that the institutional settings for regional development should be further strengthened along with capacity development at all levels of the public and private sectors. It is therefore recommended that the proposed regional development would be implemented together with capacity development, inclusive of institutional building.

06 Utilization of Master Plan Study: The regional development as proposed in this study has been planned to show directions, frameworks and strategies for the development of Sulawesi Island. It could be sufficient for the formulation of an arterial road network over the island, as well as to guide any other regional development. It is expected that the proposed direction and framework would be referred to in the formulation of the provincial-level development plans, as well as in the inter-regional coordination for the development goals.

07 Necessity of Master Plan Review: Since the economic and other environments surrounding Sulawesi would change, it is recommended that the framework and strategy should be reviewed and updated after five years, or after the implementation of the short-term plan period. The development programs and projects under the mid-term plan should be formulated on the basis of the updated framework.

2) Transport Development

08 Consideration on International Linkage: The international linkage proposed in the concept of BIMP-EAGA should be strengthened by improving air and shipping services between Northern Sulawesi (Manado and Gorontalo) and Mindanao (Davao and General Santos) of the Philippines. The islands located in between these two points, such as Sangihe and Talaud, have large potentials for trade, tourism and fishery. The arterial road network of Sulawesi should be considered as an integral part of the global transport network such as Asian/ASEAN Highways.

09 Construction of All-weather Stable Road Network: The road network master plan proposed in this study should basically be more of a road improvement plan with a focus on widening, realignment, rehabilitation, strengthening and maintenance coupled with some new projects with strategic importance. The road should be all-weather, ensuring accessibility throughout the year even for isolated areas and islands. The durability of the roads, in terms of axle loads should also be considered based on the recommendation of the HLRIP study.

10 Nautical Highway (Upgraded Ferry Service): Energy-saving maritime transport should be effectively incorporated in the road network considering the long winding coastlines. Port facilities should be improved together with the feeder roads to/from the ports. In addition, an inter-peninsula nautical highway using high-speed low-cost RoRo ships should be developed to link the east coast of Sulawesi; Makassar - Bajoe(Siwa)=Kolaka - Kendari=Luwuk - Pagimana=Gorontalo - Manado. Although the traffic volume on the ferries is not large yet, this will grow if the nautical highway is operated more efficiently using modern ships and upgraded facilities. Alternative land routes

should be developed at the same time for the nautical highway because the latter nearly becomes unnavigable during the rainy season.

11 **Airport Development:** Long- and medium-distance passenger travel by air will grow rapidly because of the lowering airfares due to the proliferation of LCCs (low-cost carriers). Airport development should be promoted as proposed in the National Spatial Plan; Hasanuddin and Sam Ratulangi (primary), Djalaludin, Mutiara and Wolter Monginsidi (secondary), and Tanpa Padang, Melonguane and Bubung (tertiary).

12 **Railway Projects:** Some railway projects have been proposed for Sulawesi. However, the estimated traffic demand for these railways is generally small, and their financial viability is quite doubtful due to the absence of financial analyses in past studies. Since inter-city roads currently have enough capacity to absorb increasing traffic demands, the implementation of railway projects should better be studied in the future when road capacities has been met.

3) **Road Development and Sulawesi Road Master Plan**

13 **Necessity of Economic Evaluation Review:** Economic evaluation in this study was conducted in order to determine the priorities of the proposed projects. Therefore, it was done under the same conditions using future estimated traffic volumes by 2024. The Study Team advises that the feasibility of each project in terms of EIRR, B/C etc. should be evaluated again to justify project viability at the time when the project is being implemented.

14 **Control of Overloading Vehicles:** Sustainability of road facilities after development or betterment is one of the most important issues. Overloaded vehicles are one of the critical issues which significantly shortens pavement life. In addition to improvement measures such as stricter enforcement on axle load and gross weight, additional installation of weighing stations at strategic points, strengthening of education for vehicle owners and drivers, and the introduction of MST 10 ton routes (Class II roads) for the heavy loaded routes, the Study Team recommends the introduction of a computer-assisted system at weighing stations. When heavy vehicles pass on a weigh bridges, their gross weight is transmitted to a computer and the magnitude of overloading and the corresponding fines are instantly recorded and automatically shown on an electrical board. This tool will **bring** an effective impact for overloading controls.

15 **Introduction of Road Fund:** Insufficient maintenance budget allocation for road maintenance, especially during budgetary constraints, has caused serious road deterioration. Both development and maintenance budget for the national road has increased substantially in 2006 – 2008 reflecting the change in the central administration policy compared with the 2004 – 2005 budgets. However, insufficient budget is still the most critical issue for both provincial and regency roads. A total amount of Rp 374 - 562 billion, which is 1.0%-1.5% of the road asset values, is required annually for the routine maintenance of national, provincial and regency roads in Sulawesi. In order to overcome budget shortages, utilizing the road fund is one of the instruments that can generally be used as the main source of financing road maintenance and other road expenditures

Since the 1950s, this approach has been used in the USA, Japan, and New Zealand and is the most economical and efficient collection method since it allows the collection of levies at refineries or ports of import. In recent years, the road fund approach has been applied in many developing countries (more than 30 countries), and several of these countries have successfully collected 90% of the required fund for road maintenance. Some of the road fund could be used for road safety, overload controls, road asset management activities, etc.

16 Allocation of Road Budget to Provincial Roads: Budgetary insufficiency is a critical issue in maintaining road facilities and sustaining the road function, especially for the provincial and kabupaten roads. Although there are several potential funding sources which could be utilized for development and maintenance of these roads, for a realistic and reliable funding source the Study Team suggests the utilization of external soft loan for the development of provincial road based on on-grant mechanisms with on-grant agreements between the MOF and the grant receiver (Province) and the Ministry of Public Works as the executing agency of the loan program. The Study Team is convinced that this funding method is the best suitable source for making up the lack of provincial budgets not only for road development but also for periodic/routine maintenance of roads..

17 Support for Implementation of Existing Priority Development Program: The master plan study should support the realization of existing priority development program, especially the “Northeastern Indonesia Regional Development Program” which is being promoted in cooperation with both the Indonesian and Japanese governments. The road development plans recommended in this program should be included in the implementation program of this study. The Study Team recommends, among others, the early implementation of the “Trans Sulawesi Mamminasata Road (Maros-Takalar) since the project was confirmed to be economically feasible with a high EIRR and an Environmental Impact Assessment (AMDAL) was already approved by the Governor of South Sulawesi Province in September 2007.

18 Early Implementation of Poor Bridge Rehabilitation and Deteriorated Pavement: Although existing roads and bridges have been improved and rehabilitated in the past, many bridges still remain narrow and in poor condition. The reconstruction of these bridges is included as part of the betterment work in the master plan. However, the betterment of these roads in some sections belong to the medium- and long-term plans. But since potential collapses on major routes would have an adverse impact on local socio-economic activities, it is recommended that these bridges (identified as Grade IV “Bad” or Grade V ”Impassable” in addition to wooden bridges) should be reconstructed or replaced in the short-term plan, titled the “Urgent Bridge Repair Program”.

Rehabilitation of deteriorated pavements should also be implemented as soon as possible. Pavement conditions classified as Class III “Poor” or Class IV “Bad” should be removed either through overlays or reconstructions in the short-term plan as much as possible.

4) **Environmental Considerations**

19 **Environmental Mitigation Measures under the SEA analysis:** The SEA should include measures to mitigate negative environmental impacts brought about by the road network improvement plan. A couple of mitigation measures that will reduce CO₂ volumes of the total road network in Sulawesi Island are recommended. Those measures should include the coverage and the promotion of bio-fuels, the minimization of the affected forest areas by reforestation projects, and the diversion of other traffic measures. The reduction in the CO₂ volume will also help in fighting global warming.

5) **Rural Road Development Plan and Asbuton Utilization**

20 **Integrated Road Projects and Programs including Local Roads:** Integrated road projects and programs should be implemented for national, provincial and local roads for attaining synergy effects on regional development. The programs should include capacity development in management, planning, execution and maintenance. The ongoing EIRTP will be a project scheme to be referred with some improvement.

21 **Support by Central Government:** The financial basis of regional governments is weak and available own budget is limited. The Study Team recommends that the central government should support regional governments for attaining the road rehabilitation targets set planned in this study while the regional governments should bear part of the cost for retaining ownership.

22 **Development and Use of Natural Asphalt (Asbuton):** The development of Asbuton will make contribution to both national and regional economy. The central government should keep a stable policy on the use of Asbuton to assure the domestic demand. While, public financial assistance should be extended for capacity development of the state owned company for renewing the old facilities of Asbuton production, transport, stocking and shipment. Development of bitumen extraction technology from Asbuton and special plant is necessary for exporting the refined Asbuton to overseas markets. GOI should make appropriate policies and laws for inducing foreign investments as Asbuton refinery project requires a large amount of cost for plant development, installation and operation.

6) **Recommended Action Plan for Realization of the Project**

23 **Recommended Action Plan for Project Realization:** In order to realize the projects proposed in the master plan, the Study Team recommends that the Indonesian government should take an appropriate action to arrange the financial assistance of Japan as shown below, and/or other donor agencies in addition to an Indonesian budget:

- i) **In case of Yen Loan:** This aid is suitable for implementing large scale projects with an EIRR of more than 15%. It is necessary to conduct a SAPROF to determine the scope of work, selection of subjected road links, schedule and amount of loan, etc, before an appraisal of the Yen loan. The Study Team therefore recommends that the government

of Indonesia requests the Japanese government for the implementation of the SAPROF immediately after completion of this Master Plan Study. It is advised that the priority projects derived from the feasibility study on Priority Arterial Roads for South Sulawesi Province should be included in the scope of this loan. The Study team also advises that the road improvement plan should include not only national and provincial roads but also the kabupaten roads in order to enhance the regional development. The project should also include capacity development of regional governments and technical cooperation programs.

- ii) **In case of Japanese Grant:** This aid is suitable for implementing a project with an EIRR of less than 15% if the project contributes to basic human needs of the local people. The Study Team advises the application of this scheme for implementing the “Urgent bridge repair program” and recommends that the Indonesian government take the necessary actions to the Japanese government as soon as possible.

Appendix

A STUDY ON LOCAL ROAD REHABILITATION AND ASBUTON UTILIZATION FOR REGIONAL DEVELOPMENT SUPPORT

Appendix A Study on Local Road Rehabilitation and Asbuton Utilization for Regional Development Support

A.1 Introduction

(1) Background

The JICA Study Team has conducted the Arterial Road Network Development Plan Study for Sulawesi Island (The MP Study) in line with the objectives of “The Northeastern Indonesia Regional Development Program” undertaken by JICA. The Study covered national/provincial roads.

Some provinces proposed to include local roads (Kabupaten and Kota roads) and their development plan in the study at the workshops and seminars. JICA approved the proposal as Kabupaten roads rehabilitation (betterment and periodic maintenance) is also very important and an urgent issue for supporting regional development and poverty reduction policies.

Approximately 660 million tons of Asbuton (Natural Asphalt in Buton Island) is deposited in Buton Island in Southeast Sulawesi Province. The Study Team suggested utilizing Asbuton for regional development of the southern part of Southeast Sulawesi in where many high poverty areas are located.

The Study Team has conducted a supplemental study for Local Road Rehabilitation and Asbuton Utilization for Regional Development Support on the above background.

(2) Objectives and Scope of the Supplemental Study

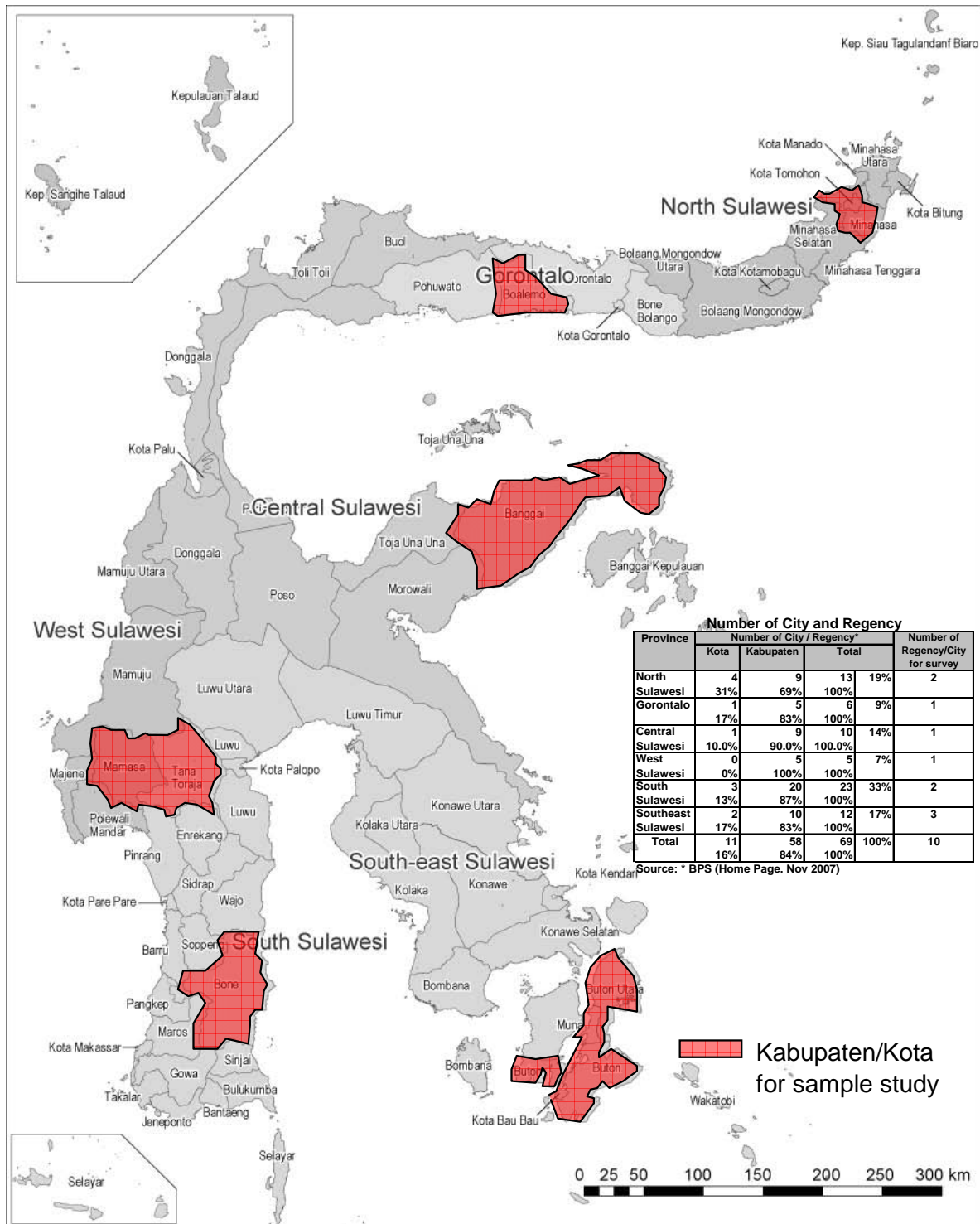
The major objectives of the supplemental study are:

- To formulate local road rehabilitation concept and implementation plan, and
- To suggest Asbuton utilization plan and study on its impacts on regional development and economy.

The total length of local roads is 44,000 km. The study will make rehabilitation framework for poor and bad conditioned roads of 20,000 km and/or unpaved roads of 26,000 km.

(3) Selection of Regencies and Cities for Sample Study

The Study Team sampled 10 Kabupaten and Kota with consultation of provincial governments as shown in **Figure A.1**. The Study Team visited provinces, selected regencies and cities and discussed with Bappda and Dinas PU on the rehabilitation of regency / city roads for support of regional developments. The Study Team also inspected Asbuton production site and facilities, including ports and warehouses, in Buton Island for study.



Source: JICA Study Team

Figure A.1 Regency/City Administration Map for Sample Study

A.2 Socio-economic Condition

The following **Table A.1** shows a summary of socio-economic conditions of the selected 10 regencies. The total population of these regencies is about 2.5 million.

Table A.1 Area and Socio-economic Conditions of Selected Regencies/Cities

No	Regency/City	Area km ²	Population (1,000)	Population Density /km ²	GRDP Bil.Rp	Per-capita GRDP Mil Rp.	Road Length km
1	Kota Tomohon	114	87	669	476	5.9	281
2	Minahasa	1,030	292	262	2,517	8.6	614
3	Boaremo	2,248	118	53	438	3.7	627
4	Banggai	9,673	300	31	1,939	6.5	1,133
5	Mamasa	2,759	123	45	537	4.4	870
6	Bone	4,559	697	149	3,328	4.8	2,482
7	Tana Toraja	3,206	447	139	1,568	3.5	1,952
8	Buton	2,675	270	101	1,168	3.7	643
9	Kota Baubau	221	122	552	893	7.4	182
10	Buton Utara	1,923	59	31	-	-	-

Note: GRDP and Per-capita GRDP at year 2005/2006 current price, except Tomohon of which 2005 GRDP is based on year 2000 constant price.

Source: JICA Study Team based on BPS of Regency and City, 2006

A.3 Present Condition and Key Issues of Regency/City Roads

Table A.2 summarizes lengths and condition of national, provincial and local roads (regency and city roads) by province.

Table A.2 Road Length and Condition in Sulawesi

Province	National Road (2007)					Provincial Road (2007)					Regency Road (2005)					Unit: km
	Good	Fair	Poor	Bad	Total	Good	Fair	Poor	Bad	Total	Good	Fair	Poor	Bad	Total	
North Sulawesi	886 69.9%	137 10.8%	193 15.2%	51 4.1%	1,267 100.0%	342 46.2%	143 19.3%	223 30.1%	33 4.5%	741 100.0%	1,108 31.7%	1,216 34.8%	899 25.8%	267 7.7%	3,490 100.0%	
Gorontalo	180 29.2%	358 58.1%	25 4.1%	53 8.6%	616 100.0%	72 22.8%	48 15.2%	91 28.9%	104 33.2%	315 100.0%	1,114 45.5%	140 5.7%	448 18.3%	748 30.5%	2,450 100.0%	
Central Sulawesi	687 38.0%	589 32.6%	351 19.4%	181 10.0%	1,807 100.0%	243 11.9%	1,044 51.3%	302 14.8%	448 22.0%	2,037 100.0%	3,085 38.5%	1,825 22.8%	1,410 17.6%	1,686 21.1%	8,006 100.0%	
West Sulawesi	160 29.1%	137 24.9%	64 11.6%	190 34.5%	552 100.0%	150 25.7%	126 21.8%	100 17.2%	205 35.3%	581 100.0%	760 15.8%	731 15.2%	2,155 44.9%	1,154 24.0%	4,801 100.0%	
South Sulawesi	997 64.1%	496 31.9%	42 2.7%	21 1.3%	1,556 100.0%	238 19.6%	545 45.0%	238 19.7%	189 15.6%	1,209 100.0%	5,389 28.6%	5,390 28.6%	3,255 17.3%	4,793 25.5%	18,826 100.0%	
Southeast Sulawesi	380 29.3%	514 39.7%	276 21.4%	124 9.6%	1,294 100.0%	136 14.4%	386 40.9%	262 27.8%	159 16.9%	943 100.0%	1,991 31.6%	1,756 27.9%	1,058 16.8%	1,486 23.6%	6,291 100.0%	
Total	3,290 46.4%	2,230 31.5%	951 13.4%	620 8.7%	7,092 100.0%	1,180 20.3%	2,292 39.3%	1,216 20.9%	1,138 19.5%	5,826 100.0%	13,447 30.7%	11,058 25.2%	9,225 21.0%	10,134 23.1%	43,864 100.0%	
		77.8%		22.2%			59.6%		40.4%			55.9%		44.1%		

Source: Bina Marga, MOT

As the 56% of regency roads are not yet paved and 44% are in poor/bad condition, rehabilitation (betterment and maintenance) of these roads is an urgent issue to support regional development and poverty reduction.

A.4 On-going Local Road Development (EIRTP)

The Eastern Indonesia Region Transport Project (EIRTP) has been implemented in two phases, EIRTP-1 (2001-2006) and EIRTP-2 (2004-2009) under financial cooperation of the World Bank.

EIRTP aims at supporting economic growth and improvement of social welfare in the eastern regions. EIRTP-1 is mostly forecasted on the preservation and development of primary arterial and other strategic road links. EIRTP-2 is primarily forecasted on local road network and transport facilities. The Kabupaten/Kota road sub-projects in Sulawesi are as given in **Table A.3**. The subjected road length is approximately 940 km in Central and South (/ West) Sulawesi Provinces.

Table A.3 Kabupaten and Kota Road Projects in Sulawesi by EIRTP-2

Province	Betterment		Periodic Maintenance		Total (km)	Bridge (m)
	AWP-1 (km)	AWP-2 (km)	AWP-1 (km)	AWP-2 (km)		
North Sulawesi	-	-	-	-	0.0	-
Gorontalo	-	-	-	-	0.0	-
Central Sulawesi	55.6	116.4	71.8	109.5	353.3	40
South Sulawesi*	105.4	235.0	166.6	80.0	587.0	211
Southeast Sulawesi	-	-	-	-	0.0	-
Total	161.0	351.4	238.4	189.5	940.3	251

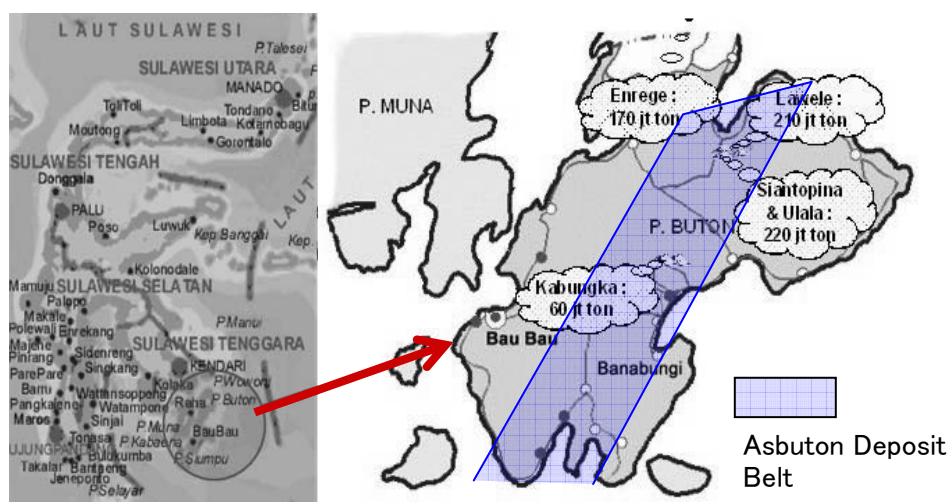
Note: * including West Sulawesi Province

Source: JICA Study Team

A.5 Development and Use of Asbuton (Natural Asphalt)

(1) Deposit of Asbuton and Government Policy

Buton asphalt (Asbuton) is natural asphalt (or called rock asphalt in general) deposited in Buton Island. The estimated deposit is approximately 660 million tons in total.



Source: Bina Marga / PT Sarana Karya

Figure A.2 Asphalt Deposit Locations and Estimated Quantity in Buton Regency

(2) Guidance of MPW on Asbuton Use

Asbuton production increased from 1967 and it reached the highest level of approximately 500,000 tons per year around 1983-1985. However, Asbuton production decreased in 1990s because of its higher price compared with the oil asphalt and quality problems.

An oil price rise in the world market has caused an increase of Bitumen price as it is a by-product of oil refinery. MPW has made a new policy for use of Asbuton for pavement construction. MPW issued a technical guideline on use of Asbuton (Permen PU No.35/PRT/M/2006) as in **Table A.4**.

Table A.4 Technical Guideline for Asbuton Use (PU No 35/PRT/M/2006)

No	TYPE OF MIX	TYPE OF ASBUTON	CRITERIA FOR USE
1.	Hot mix with Asbuton	Asbuton granular Type 5/20, 15/20, 15/25 Liquid Asbuton: Full extraction, semi extraction	Plan traffic > 10 million ESA or AADT > 2000 of vehicle and truck more than 15 %
2.	Warm Mix with Asbuton	Asbuton granular Type 5/20, 15/20, 15/25, 20/25 and 30/25	Plan traffic > 1-10 million ESA or AADT < 2000 of vehicle and maximum truck is 15 %
3.	Cold Mix with Asbuton and emulsion asphalt rejuvenation Asbuton Macadam Penetration Layer	Asbuton granular Type 5/20, 15/20, 15/25, 20/25 and 30/25 Asbuton granular Type 60/30, sand Asbuton (processed on site)	Plan traffic < 1 million ESA or AADT < 1000 of vehicle and truck maximum 5 % Plan traffic < 500.000 ESA or AADT < 500 of vehicle and truck maximum 5 %

Source: MPW (Puslitbang Bandung)

(3) Asbuton Products and Price Comparison

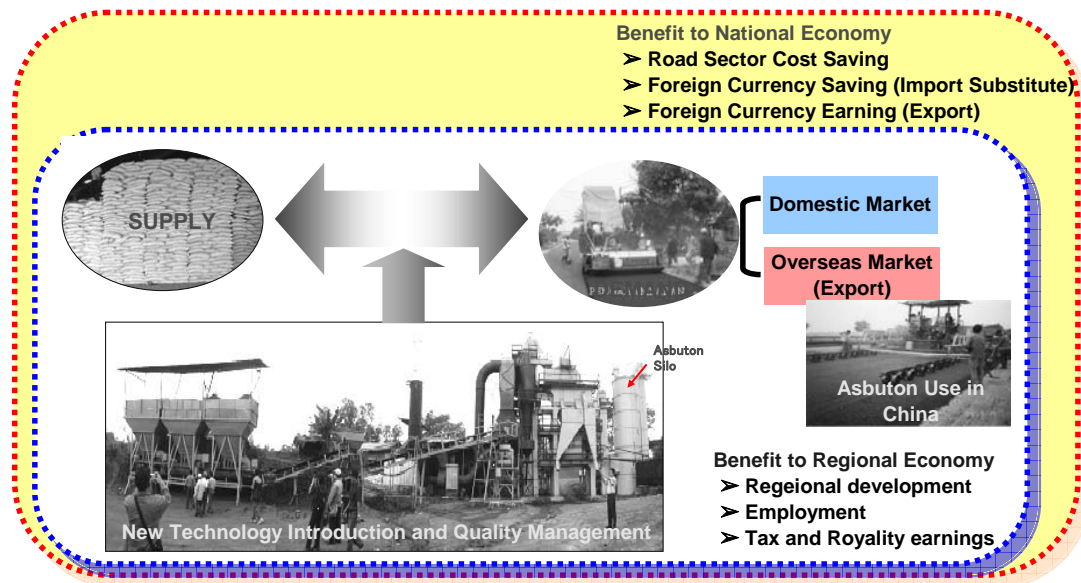
The Buton Asphalt mining has been conducted by PT Saraya Karya Ltd in long time. However, there are other firms who obtained mining licenses. PT Olah Bumi andiri (OBM), a private company, started mining and produced RETONA (Refined Buton Asphalt) since 2002. PT Buton Asphalt Indonesia (BAI) has produced glandular Asbuton products.

The unit price of the Asbuton asphalt concrete was compared with the oil asphalt mixture. The results indicated that the Asbuton mixture, 3% of oil asphalt and 3% bitumen equivalent Asbuton, is approximately 21% cheaper than the pure oil asphalt concrete mixture.

(4) Issues for Asbuton Development and Utilization Concept

Asbuton deposit is huge and it should be utilized under the current high oil price environments. Use of Asbuton will contribute to both foreign exchange saving and regional economy development.

The following **Figure A.3** illustrates development and utilization concept of Asbuton.



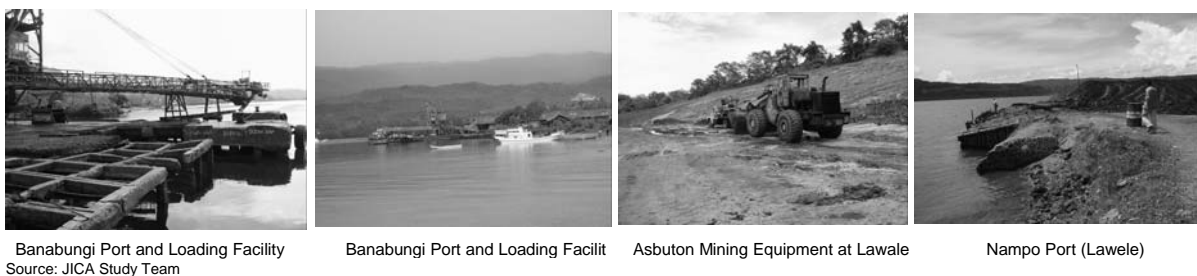
Source: JICA Study Team

Figure A.3 Asbuton Development and Utilization Concept

There are several issues to be cleared or solved by both supply and demand sides for the efficient and effective use of Asbuton.

Issues of Supply Sides

- Increase of production capacity and quality assurance of Asbuton products at plant
- Timely supply of Asbuton
- Insufficient competition and inappropriate management
- Old facilities for production, stocking and ship-loading at Kabungka (Banabungi port)
- No appropriate port and ship-loading facilities at Lawele (Nampo port)



Banabungi Port and Loading Facility Banabungi Port and Loading Facility Asbuton Mining Equipment at Lawale Nampo Port (Lawele)
 Source: JICA Study Team

Figure A.4 Present Condition of Asbuton Mining and Shipping Facilities

Issues of Demand Sides

- Stable policy on Asbuton use

- Technical support for design and construction, including field quality management
- Financial support for renew of the exiting old facilities and improvement of ports
- Guidance on use of hot-mix Asbuton

Concrete measures should be taken including financial support in renewing or improving production and transport capacity and assistance in capacity development of human resources by education and training. As a large investment will be required for bitumen extraction plant development, installation and operation, the governments should provide policy and laws which encourage foreign investors to participate in Asbuton development and production.

A.6 Road Conditions in Selected Regencies

The Study Team confirmed that sampled regencies and cities have own unique history, culture, geography, topography, products, tourism attractions, access, etc. Though each regency or city has prospective development potentials, those are not yet utilized fully because of poor accesses, insufficient efforts on advertisement, insufficient supports of central and provincial governments and/or insufficient own efforts.

The Study Team also recognized that there are many tourist attractions which have not been paid much attention by local communities and governments, like examples in the following photographs. Those need to be supported by good accessibility, by roads, sea and air.



Figure A.5 valuable Potentials for Foreign Tourists (Example)

The road conditions of the sampled regencies are as shown in **Table A.5**. The total length of regency and city roads is 8,784 km, approximately 20% of Sulawesi. Those roads are 22% in good, 23% in fair, 21% in poor and 34% in bad conditions and worse a little than the average of Sulawesi. 40% of the roads are asphalt paved and 60% are gravel or soil and these are almost same as the average of Sulawesi.

Table A.5 Summary of Local Road Conditions of Sampled Regencies and Cities

No	Regency/City	Road Length (km)	Road Surface (km)		Road Condition (km)			
			Asphalt paved	Not paved	Good	Fair	Poor	Bad
1	Kota Tomohon	281	164	117	109	65	37	70
		100%	58%	42%	39%	23%	13%	25%
2	Minahasa	614	545	69	373	44	99	99
		100%	89%	11%	61%	7%	16%	16%
3	Boaremo	627	137	490	70	0	50	507
		100%	22%	78%	11%	0%	8%	81%
4	Banggai	1,133	393	740	51	760	159	163
		100%	35%	65%	5%	67%	14%	14%
5	Mamasa	870	122	748	102	284	374	110
		100%	14%	86%	12%	33%	43%	13%
6	Bone	2,482	923	1,559	543	466	603	870
		100%	37%	63%	22%	19%	24%	35%
7	Tana Toraja	1,952	633	1,319	224	298	316	1,114
		100%	32%	68%	11%	15%	16%	57%
8	Buton	643	529	114	260	115	236	32
		100%	82%	18%	40%	18%	37%	5%
9	Buton Utara							
10	Kota Baubau	182	96	86	164	11	6	1
		100%	53%	47%	90%	6%	3%	1%
Total		8,784	3,542	5,242	1,896	2,043	1,880	2,966
		100%	40%	60%	22%	23%	21%	34%
All Sulawesi		43,864	17,927	25,937	13,447	11,058	9,225	10,134
		100%	41%	59%	31%	25%	21%	23%

Source: JICA study Team Based on BPS of Regency and City, 2006

A.7 Concept of Local Road Development and Maintenance

Local road development framework (betterment, maintenance and new/upgrading) is formulated aiming at the target year 2024 for the following terms:

- Short-term (5years: 2010 - 2014)
- Medium-term (5 years: 2015 – 2019)
- Long-term (5 years: 2015 – 2024)

Two targets were set up for local road development and rehabilitation. One is improvement of road condition from 56% to 85% in good/fair by 2024 by stage. The road classified into bad will be reduced from 23% in 2005 to 6% by 2024. The other is increasing of asphalt pavement surface from the current 41% to 70% by 2024 by stage. Approximately 6,000 km of district (Desa/Kecamatan) roads will be upgraded to regency roads by 2024. The total regency roads will become 50,000 km.

Table A.6 Targets of Local Road Development by 2024 in Sulawesi

Year	Road Condition				Pavement			Unit: KM	
	Good/Fair	Poor	Bad	Total	Asphalt	Gravel/ Soil	Total	Length of New/Up-grading	Total Length
2005	24,505	9,225	10,134	43,864	17,927	25,937	43,864	-	43,864
2010-2014	28,891	7,470	7,502	43,864	21,512	22,352	43,864	1,227	45,091
2015-2019	33,278	5,716	4,870	43,864	25,815	18,049	43,864	1,411	46,502
2020-2024	37,226	3,961	2,677	43,864	30,720	13,144	43,864	3,498	50,000

Source: JICA Study Team

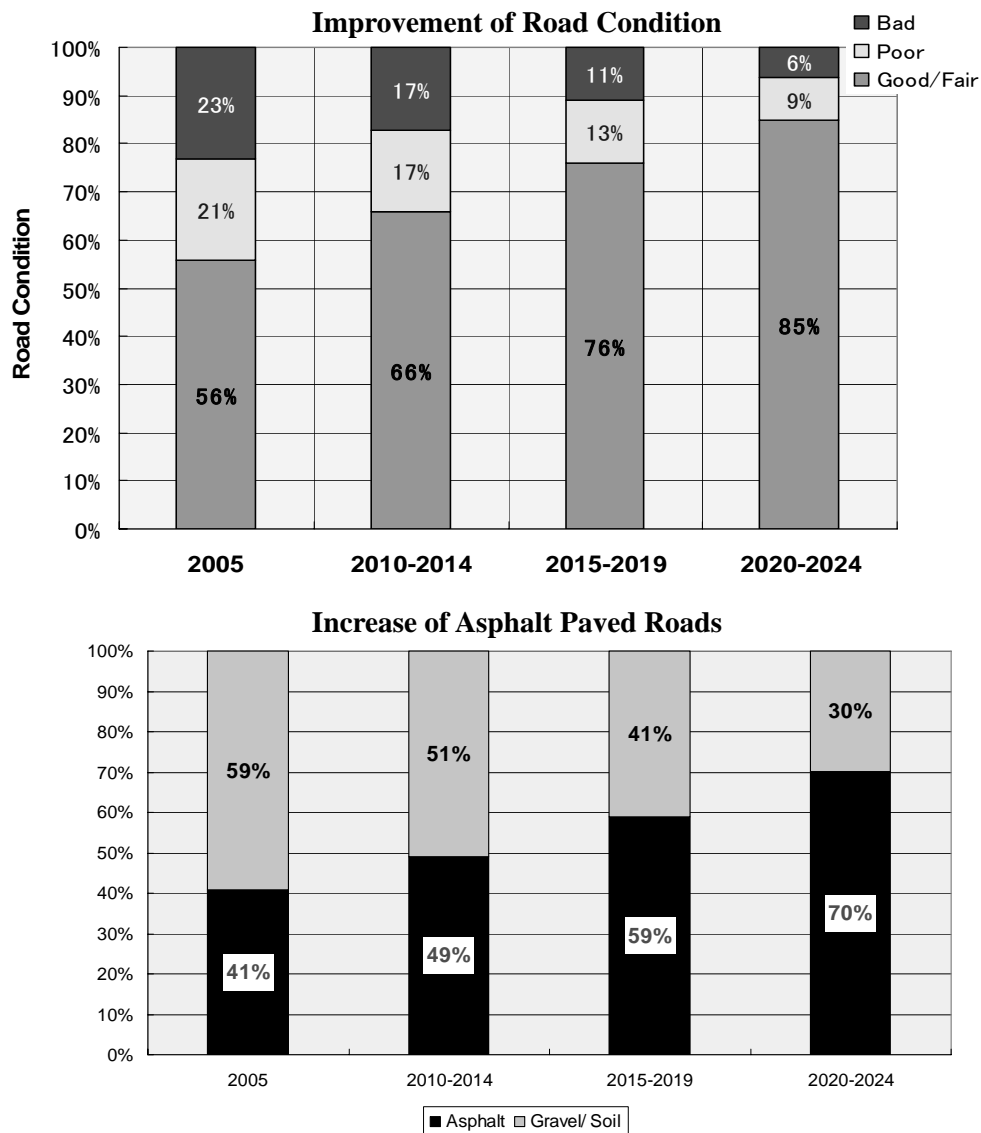


Figure A.6 Targets of Road Condition Improvement and Asphalt-Paved Road Increase

Besides the budget, insufficient capacity, including planning, management, equipment and skill, corruption prevention, etc is the most important issues for regency/city road development and maintenance. Capacity development is required to overcome these issues.

A.8 Cost Estimate and Implementation Plan

(1) Cost Estimates

Unit costs of the local road rehabilitation (betterment, periodic maintenance and up-grading) were established based on the past and on-going similar projects, as in **Table A.7**. It also requires Rp 220 billion per year for routine maintenance of regency/city roads.

Table A.7 Unit Cost for Project Cost Estimation

Classification of Works	Road Condition	Unit Price (Rp Million / km)
Betterment Periodic Maintenance	Bad	680
	Fair	270
	Poor	270
Up-grading / New*		750
Bridge Construction		8 million/m ²

Note: * upgrading from district road to Kabupaten road
 or new construction

The total investment costs required for the regency / city road rehabilitation and maintenance is estimated at Rp 20,270 billion (Rp 6,416 billion for short-term, Rp 6,711 billion for medium-term and Rp 7,142 billion for long-term) by the year 2024 as given in **Table A.8**.

Table A.8 Investment Requirements for Local Road Development and Maintenance

Unit: Bill Rp.

Category	Short-Term (2010-2014)	Medium-Term (2015-2019)	Long-Term (2020-2024)	Total
Betterment	3,101	2,412	1,378	6,891
P.Maintenance	1,295	2,141	2,041	5,476
R.Maintenance	1,100	1,100	1,100	3,300
Upgrading/New	920	1,058	2,623	4,602
Total	6,416	6,711	7,142	20,270
Annual Average	1,283	1,342	1,428	

Note: Increase 105% 106%

Source: JICA Study Team

(2) Financing Plan

Since the local road development should be effectively integrated with comprehensive road network development of both national and provincial roads, a type of implementation organization would be similar to EIRTP-2.

The funding requirement for the proposed local road development Plan is estimated to be about Rp 20,270 billion for the entire period including Betterment, Periodic Maintenance, Routine Maintenance and Upgrading/New Construction. The total budget was estimated as Rp 18,040 billion. The estimated potential budget is smaller than the funding requirement of the proposed plan for the entire period by about Rp 2,200 billion. It can use Japanese ODA, IBRD, ADB and/ or other sources for co-financing the development and periodic maintenance projects.

Table A.9 Possible Budget Envelope forecasted for Regency/City Roads

Category	Unit: Bill Rp.			
	Short-Term (2010-2014)	Medium-Term (2015-2019)	Long-Term (2020-2024)	Total
Potential Budget	5,717	6,009	6,315	18,041
Annual Average	1,143	1,202	1,263	

Note: Increase

105%

105%

Source: JICA Study Team

(3) Implementation Schedule

The regency / city roads will be rehabilitated in the short, medium and long-term as shown in **Figure A.7** to achieve the development targets. The routine maintenance will be continued irrespective of term to sustain the current road assets as much as possible.

Category	Investment Cost (Bill Rp.)	Preparation (2008-2009)	Short-Term (2010-2014)	Medium-Term (2015-2019)	Long-Term (2020-2024)
Project Preparation					
Betterment	6,891	APBD Programs and EIRTP 2			
P.Maintenance	5,476				
R.Maintenance	3,300				
Upgrading/New	4,602				
Urgent Bridge Replacement and Construction	4,603				
Capacity Development					

Source: JICA Study Team

Figure A.7 Implementation Schedule

A.9 Effect of Local Road Development and Action Plan

The total demand of asphalt in Indonesia has been estimated at about 1.2 million tons per annum for which about 600,000 tons are supplied by Pertamina and the rest is imported. The imported portion which is about 600,000 tons per annum is the target for replacement by the production of Asbuton.

Asbuton development in Buton Island will have a considerable effect on the Regional Economy in terms of new industrial development, employment increase, increase of Regency income, increase of foreign currency based income in the Region and indirectly on the saving of foreign currency expenditure on the National Expenditure Account of the Government of Indonesia.

The local road (Regency and City roads) rehabilitation will contribute to:

- Improve the access to public services including school, hospitals, administrative offices, markets, etc.
- Raise of local products price and down of input materials price, especially in agricultural sector by reducing transport cost (vehicle operation and maintenance cost)

- Enhance local construction industry and provide local employment opportunities
- Regional development and poverty reduction.

The project formulation and preparation is required for the local road rehabilitation. The Study Team recommends that “Integrated Road Projects and Programs for Support of Regional Development” for national, provincial and local roads should formulated for implementation. The basic project and programs concept will be similar to EIRTP-2. The projects and programs need to include capacity development of local governments in planning, management and implementation.

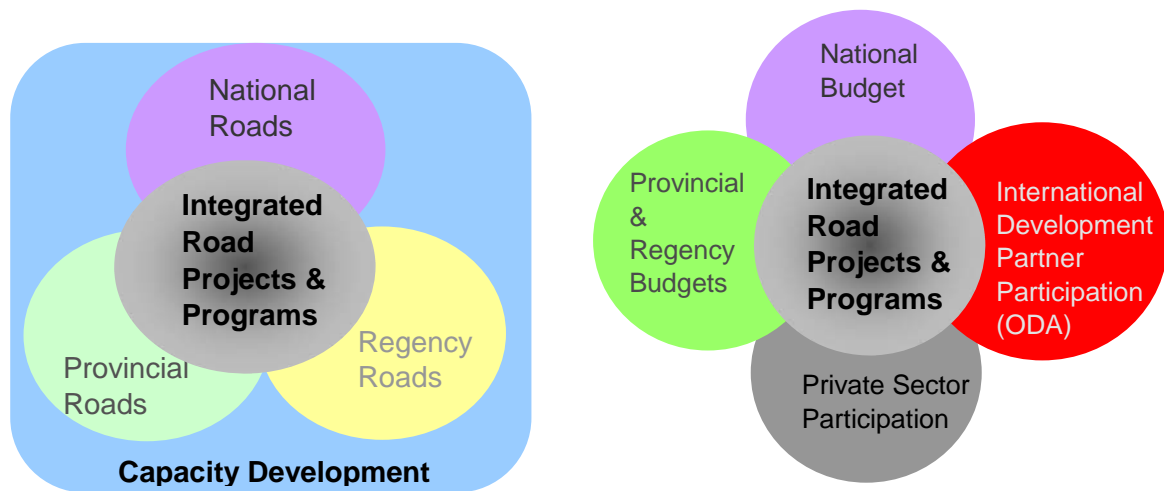
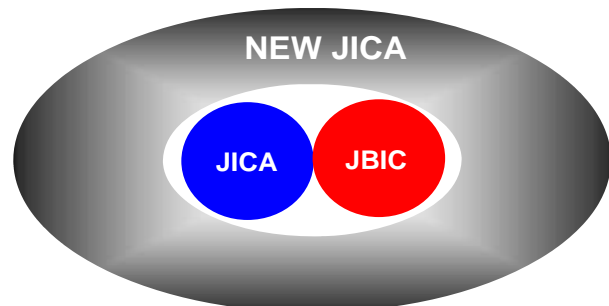


Figure A.8 Project Implementation Plan

The integrated projects and programs are financed by national budget (APBN), provincial and regency/city budgets (APBD I/II) and international development partner’s participation (ODA). The ODA facilities of GOJ are available as one of the options for implementation of the “Integrated Road Projects and Programs” for national, provincial and regency/city road and capacity development:

- Grant (JICA)
- Technical Cooperation (JICA)
- Development Study (JICA)
- Soft Loan (JBIC)
- SAPROF/SAPI Grant (JBIC)



As JICA and JBIC are merged to one organization in October 2008, more efficient and speedy project/program implementation will become possible. DGH and regional governments need to propose Bappenas for list up the “Integrated Road Projects and Programs for Support of Regional

Development” in blue book as a candidate project for international cooperation.

A.10 Conclusion and Recommendations

(1) Conclusion

1) Local Road Study: The arterial roads study subjected national and provincial roads. However, a study on local roads (Kabupaten and Kota roads) was proposed at the workshops and seminars. JICA accepted the proposal since improvement of local roads is also important for support of regional development. The Study Team has conducted a supplemental survey for local road development plan and use of natural asphalt produced in Buton Island as pavement materials for local roads.

2) Issues of Local Roads: The road network in Indonesia is comprised of national, provincial, local and other roads. The length of national and provincial roads is 12,920 km in Sulawesi in total. The total length of local roads (regency and city roads) is 43,860 km, which is approximately 3 times of the national and provincial roads. As high poverty areas are located in isolated inland and island areas, local roads rehabilitation is very important for support of regional economy by improving transport efficiency for agricultural inputs and outputs.

The condition of local roads is worse and asphalt pavement ratio is lower than the national and provincial roads. A large part of the bridges on local roads are wooden bridges of bad condition and required urgent replacement. As the road budgets of most of the local governments are insufficient, support by the central government is necessary. Capacity development is also required for local road asset management, including planning, implementation, maintenance (equipment and system) and staff capacity.

3) Road Rehabilitation Targets and Investment Cost: The Study Team established two road development and rehabilitation targets for short term (2010-2014), medium term (2015-2019) and long term (2020-2024) on road condition and asphalt paved road length. The good conditioned road condition will increase from 56% to 85% by 2024. The asphalt paved road will increase from 41% to 70% by 2024. A total of 6,000 km of road will be upgraded from the current district road to regency road or constructed new. The total regency/city roads will become 50,000 km by 2024. The required total investment cost is estimated at Rp 20,270 billion including routine maintenance.

4) Natural Asphalt (Asbuton): Asbuton deposit in Buton Island is estimated at 660 million tons and this is equivalent to 170 million tons of oil asphalt (bitumen). Approximately 500,000 of Asbuton was produced per year in the middle of 1980s and used for pavement through the nation. However, production was reduced in the 1990s due to its higher price compared with oil asphalt and technical problems (durability). However, oil asphalt price has substantially increased in line with the crude oil price increase as asphalt is by-product in the refinery process. Indonesia imported about 600,000 tons of asphalt and the GOI intends to use Asbuton for substitute of imported asphalt. While, new technology has been developed to secure durability.

(2) Recommendations

- 1) Integrated Road Project and Programs including Local Roads:** Integrated road programs and programs should be implemented for national, provincial and local roads for attaining synergy effects on regional development. Capacity development should be made in planning, execution, maintenance and staff capability. The ongoing EIRTP will be a project scheme to be referred with some improvement.
- 2) Support of Central Government:** The financial basis of regional governments is weak and available own budget is limited. The Study Team recommends that the central government should support regional government for attaining the road rehabilitation targets set out in this report while the regional government should bear some cost for retaining ownership. The Study Team recommends that soft loans, either from Japanese ODA or other donors, should be used for road rehabilitation of local roads and capacity development regional governments.
- 3) Development and Use of Natural Asphalt (Asbuton):** Development of Asbuton will contribute to both national and regional economy. The central government should keep a stable policy on Asbuton use to secure the local demand. While, public financial assistance will be necessary for capacity development of the state owned company for renewing production, transport, stocking and shipment facilities. Development of bitumen extraction technology from Asbuton and special plant is necessary for overseas markets (export). GOI should make appropriate policies and laws for inducing foreign investments as Asbuton development requires a large amount of cost for plant development, installation and operation.