Appendix 7

DISCUSSION PAPER ON STAGED ROAD DEVELOPMENT

Discussion Paper
On
Stage-wised Road Development of Standard 7 m-Travelway Specified in New Road Regulation (PP No 34 Year 2006)
For
Arterial and Collector Roads
In Sulawesi Island

1. Summary

The JICA Study Team has conducted "The Study on Arterial Road Network Development Plan for Sulawesi Island and Feasibility Study on Priority Arterial Road Development for South Sulawesi Province" since December 2007 in accordance with Terms of Reference/Scope of Works agreed between the GOJ and the GOI.

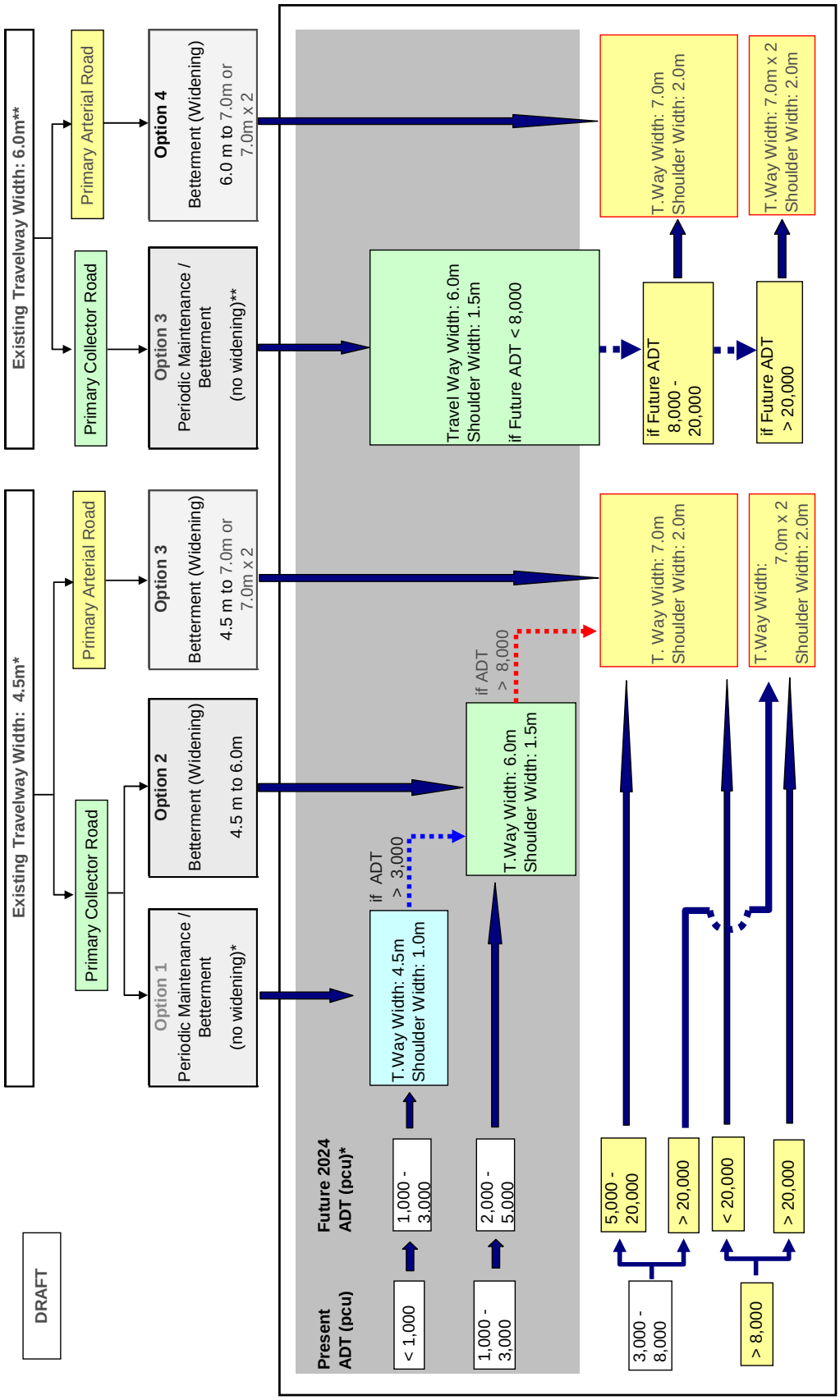
The GOI issued "Government Road Regulation / Peraturan Pemerintah Nomor 34 Tahun 2006 Tentang Jalan (PP No 34 Year 2006) replacing PP No 26 Year 1985. One of the major changes in the new regulation is roadway and travelway width. The new regulation specified 7 m-travelway width for medium road. While, relation of road width with traffic level has not yet been issued concerning PP No 34 Year 2006.

The JICA study team has been making an arterial road master plan for Sulawesi Island for target year of 2024. Approximately 90% of the national roads and 95% of the provincial roads are less than 7 m travelway width in Sulawesi. Approximately 66% of the national roads and 89% of provincial roads are travelway width of 3.0m – 5.4m.

The JICA Study Team made a study on application of the new regulation (new standard road width) based on a meeting with Directorate of Planning on 20th September 2007. This is a discussion paper on this issue, including technical aspects, economic aspects and recommending the following (refer to **Figure 1):**

- Primary arterial roads should be widened to standard 7.0 m travelway by year 2004.
- Primary collector roads should be widened to 7.0 m 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.

As this is a study on road links in Sulawesi, further study would be necessary for nation-wide policy establishment since traffic volume, characteristics, topography and cost may differ.



Notes: 1. * Exiting Travelway Width 3.0 - 5.4m, ** 5.5 - 6.5m
2. T.Way : Travelway
3. Standard travelway width of medium road is 7.0m for 2-lane/2-way road.

Figure 1 Recommendations on Staged Standard Travelway Width Development in PP No 34 Year 2006 by Target Year 2024

2. Travelway Width in New Road Regulation (PP 34 Year 2006)

The following **Table 1** shows travelway width comparison between PP No 26/1985 and PP No 34/2006. The travelway width for medium roads is 7.0 m.

Table 1 Travelway Width Standard in PP No 26/1985 and PP No 34/2006

Function of Road	Design Speed (Min)	Design Criteria									
		PP No 26, Year 1985				PP No 34, Year 2006					
		ADT (pcu)	Travelway Width (m)	Shoulder Width (m)	Roadway Width (m)	ADT (pcu)*	Road Class	Travelway Width (m)	Shoulder Width (m)	Median (m)	Roadway Width (m)
Arterial Road	60 km/hr	< 3000	4.5	1.0	6.5		Main Road	2 x 7.0	2.0	Applied	18.0
		3000 - 8000	6.0	1.5	9.0		Medium Roads	7.0	2.0	-	11.0
		8000 - 20000	7.0	2.0	11.0						
		> 20000	2 x 7.0	2.0	18.0	Not yet					
Collector Road	40 km/hr	< 3000	4.5	1.0	6.5	issued	Main Road	2 x 7.0	2.0	Applied	18.0
		3000 - 8000	6.0	1.5	9.0		Medium Roads	7.0	1.0	-	9.0
		8000 - 20000	7.0	2.0	11.0		Small Road	5.5	1.0	-	7.5
		> 20000	2 x 7.0	2.0	18.0						

Note: * Criteria of ADT in relation with travelway width has not been issued as of September 2007

3. Road Length by Travelway Width

Approximately 90% of the national roads and 95% of the provincial roads are less than 7 m travelway in Sulawesi. Approximately 66% of the national roads and 89% of provincial roads are travelway width of 3.0m – 5.4m as shown in **Table 2.**

Table 2 Length of National and Provincial Roads by Travelway Width

Status of Road	Travelway Width*					
	=<4.5m	4.6-5.4m	5.5-6.9m	7.0-9.9m	10-20m	Total
National Road	1,860	2,839	1,645	495	180	7,092
	26%	40%	23%	7%	3%	100%
	66%		23%	10%		
Provincial Road	4,374	415	321	79	167	5,355
	82%	8%	6%	1%	3%	100%
	89%		6%	5%		

Note: Approximate classification

It is estimated that Rp 16,330 billion is required for road development (widening) to attain 7 m standard travelway width as shown in **Table 3**. In addition, it will require approximately Rp 11,430 billion for periodic and routine maintenance of these road assets.

Table 3 Road Development (Widening) Cost for 7 m Standard Width

Status of Road	Length/ Cost	Existing Travelway Width					
		=<4.5m	4.6-5.4m	5.5-6.9m	7.0-9.9m	10-20m	Total
National Road	Length (km)	1,860	2,839	1,645	495	180	7,092
	Cost (Bil Rp)	2,880	4,200	2,190	0	0	9,270
Provincial Road	Length (km)	4,374	415	321	79	167	5,355
	Cost (Bil Rp)	6,120	560	380	0	0	7,060
Total Cost (Bil Rp)		9,000	4,760	2,570	0	0	16,330

Note: Unit Cost of road development for widening to 7.0 m standard road.

	National Road			Provincial Road		
Existing Width	W=4.5m	W=5.0m	W=6m	W=4.5m	W=5.0m	W=6m
Widening Cost (Mil Rp/km)	1,550	1,480	1,330	1,400	1,340	1,200

4. Topography and Geometric Design

Sulawesi Island has a very distinctive shape, dominated by four large peninsulas (south peninsula, Minahassa Peninsula in the north, east peninsula, and southeast peninsula) separated by three gulfs—Tomini in the northeast, Tolo in the southeast, and Bone in the south. The terrain is mostly mountainous, with many active volcanoes. All four peninsulas have mountains standing more than 2,500m above sea level. Due to its topography, the island has limited plains which are mostly scattered along coastlines. These plains are separated by precipitous mountains, gulfs, and the sea. Flat lands (below 50m) account only for 10.3% of the total land area.

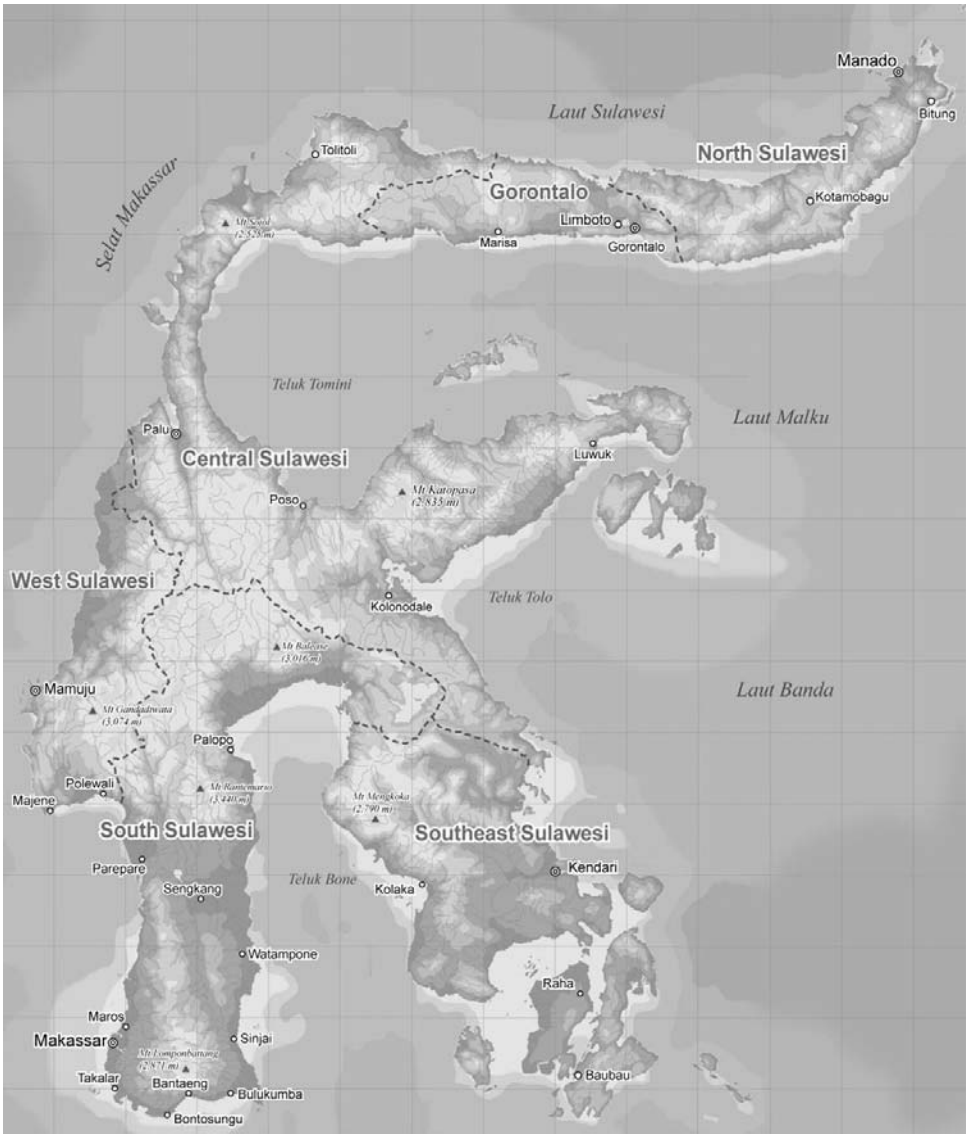


Figure 2 Topographic Map of Sulawesi Island

Approximately 70% of national and provincial roads are classified as flat and 30% as rolling/hilly topography under road design category (**Table 4**). Widening from the existing 4.5 m / 5.0 m road to 7 m standard road would be very costly in rolling and hilly terrains as it may require substantial realignment to keep the design speed, minimum radius of curve, appropriate slope, roadway/travelway width and other geometric requirements.

Table 4 Road Classification by Topography

Status of Road	Topography (Road Design)*			Total
	Flat (km)	Rolling (km)	Hilly (km)	(km)
National Road	5,320	920	850	7,090
	75%	13%	12%	100%
Provincial Road	3,070	830	1,070	4,970
	62%	17%	22%	100%
Total	8,390	1,750	1,920	12,060
	70%	15%	16%	100%

Note: Approximate classification

5. Traffic on National and Provincial Road Network

The JICA Study Team conducted traffic survey in order to obtain latest information/data on road traffic situation in Sulawesi Island, to analyze traffic characteristics through interview to road users, and to create a basis for transport demand forecast. **Figure 3** shows locations of the traffic survey.

The current traffic is as shown in **Figure 4**. The traffic volume at 35% of stations is less than 1,000 pcu/ day and 54% is less than 3,000 pcu/day as shown in **Table 5**.

Table 5 Classification of Traffic Volume Range

Traffic Volume Range (pcu)	Numbers of Stations	%	Remarks	Travelway Width*
<500	15	20.3%		
501 - 1000	11	14.9%		
1001 - 2000	8	10.8%		
2001 - 3000	6	8.1%	54.1%	4.5m
3001 - 4000	9	12.2%		
4001 - 5000	2	2.7%		
5001 - 6000	6	8.1%		
6001 - 7000		0.0%		
7001 - 8000	2	2.7%	25.7%	6.0m
8001 - 9000	2	2.7%		
9001 - 10000	2	2.7%		
10001 - 20000	7	9.5%	14.9%	7.0m
>20000	4	5.4%	5.4%	7m x 2

Note: * Minimum Travelway width in accordance with PP 26, Year 1985

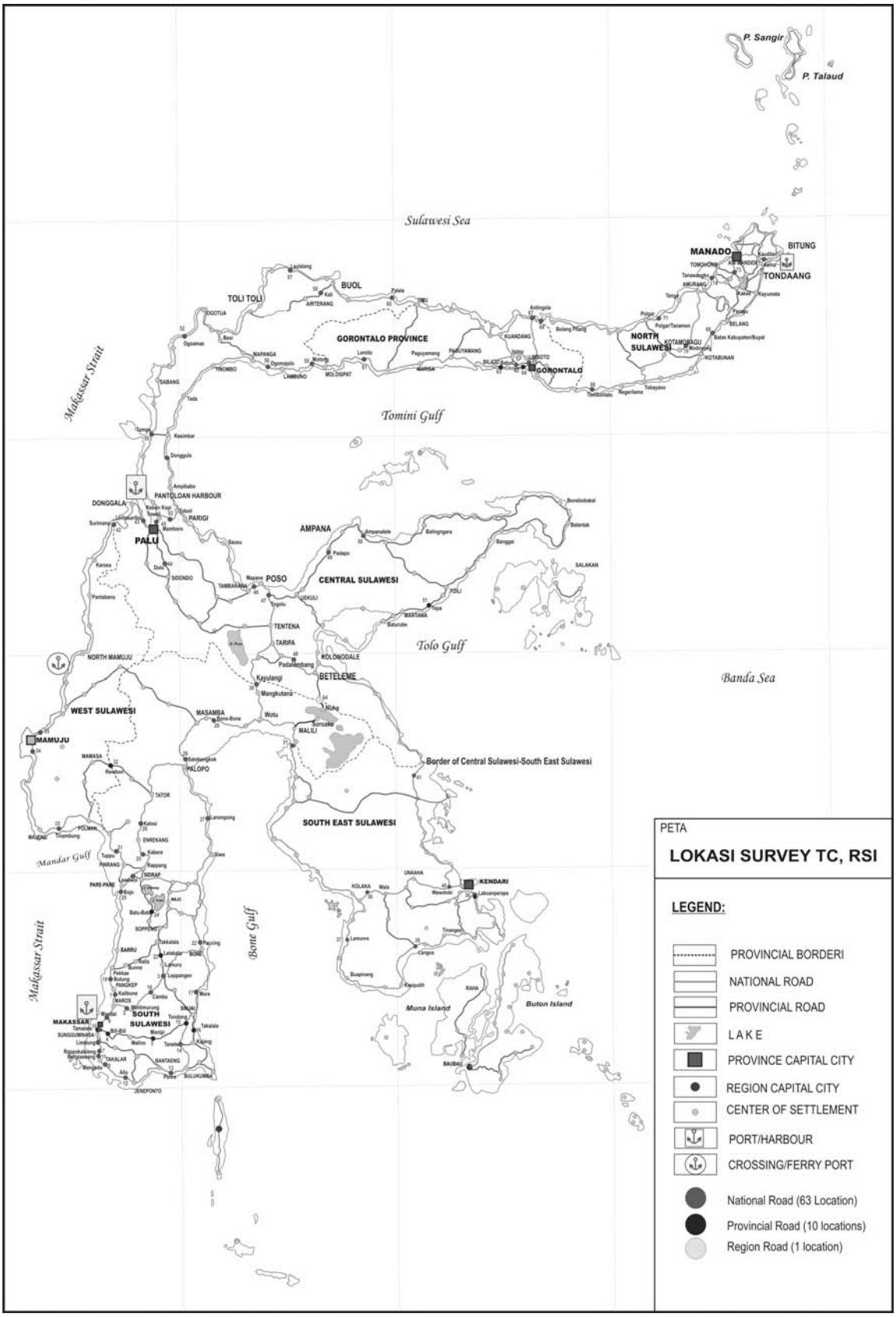


Figure 3 Traffic Survey Stations

Table 6 Present Traffic at Survey Stations

Unit: vehicle

Station	Traffic (Total)	M/C	Car	Small Bus	M & L Bus	Pick up	Small Truck	Large Truck
1	13,797	5,450	625	4,751	171	777	1,916	107
2	11,484	6,515	1,378	2,261	56	617	651	6
3	3,467	1,587	91	1,212	45	235	294	3
4	8,765	4,471	163	1,897	9	314	1,903	8
5	547	390	2	79	-	48	28	-
6	30,815	19,547	4,320	3,630	115	899	2,295	9
7	16,459	10,135	1,748	3,255	35	382	839	65
8	8,869	4,776	768	2,486	16	301	518	4
9	57,736	30,877	14,233	5,391	457	2,375	4,333	70
10	58,861	29,958	13,128	8,557	397	1,956	4,733	132
11	19,158	12,834	2,009	3,238	42	402	598	35
12	9,127	5,113	486	2,629	42	322	529	6
13	8,909	5,449	131	2,413	29	415	472	-
14	2,905	1,498	310	725	15	183	169	5
15	573	312	28	123	5	69	36	-
16	435	412	-	12	-	7	4	-
17	8,052	5,642	137	1,485	23	360	402	3
18	3,021	1,290	89	1,113	34	211	281	3
19	7,677	2,415	356	3,256	136	365	1,095	54
20	13,919	5,558	3,054	3,030	330	656	1,276	15
21	4,264	2,085	65	1,315	66	313	417	3
22	4,240	2,429	98	1,322	56	180	148	7
23	1,390	684	43	448	25	85	93	12
24	1,538	648	36	552	19	87	183	13
25	3,218	1,740	72	841	59	169	337	-
26	1,563	588	196	361	113	72	190	43
27	5,009	2,448	74	1,807	98	186	360	36
28	5,149	2,483	82	1,687	98	199	592	8
29	5,154	2,752	74	1,352	112	208	638	18
30	154	23	-	13	14	23	81	-
31	731	328	10	183	33	70	85	22
32	92	71	19	-	-	-	2	-
33	5,695	2,992	398	1,786	31	168	279	41
34	3,245	1,431	251	530	102	350	501	80
35	2,098	795	173	477	75	222	310	46
36	1,895	991	642	49	35	85	93	-
37	1,263	837	61	179	3	71	112	-
38	271	199	5	17	-	18	23	9
39	265	235	4	14	-	5	7	-
40	3,533	1,268	523	904	148	582	108	-
41	169	115	12	3	2	13	24	-
42	1,636	1,006	9	299	33	155	131	3
43	4,669	2,809	329	727	43	245	501	15
44	7,467	6,040	353	752	7	216	99	-
45	17,499	11,291	408	3,804	94	731	1,043	128
46	5,154	3,709	810	79	65	198	251	42
47	5,108	3,590	964	68	56	195	177	58
48	313	170	3	51	12	20	53	4
49	474	290	3	82	35	25	35	4
50	1,027	781	-	137	13	33	60	3
51	203	166	-	8	-	-	29	-
52	520	390	-	50	25	25	30	-
53	2,161	930	12	643	70	168	231	107
54	76	42	3	15	7	5	4	-
55	964	685	2	124	23	51	71	8
56	565	195	5	137	31	59	115	23
57	1,159	938	23	91	41	-	66	-
58	613	509	4	65	15	-	13	7
59	593	363	-	72	18	38	89	13
60	53	35	-	3	5	-	10	-
61	1,513	1,010	115	97	25	112	151	3
62	5,422	4,367	147	564	53	115	143	33
63	513	463	12	18	-	13	7	-
64	660	402	15	175	33	13	22	-
65	4,655	4,031	217	97	18	146	143	3
66	1,712	995	87	330	27	189	84	-
67	5,338	3,081	710	902	232	170	146	97
68	1,631	1,193	147	48	39	92	85	27
69	1,016	505	132	137	-	183	44	15
70	7,029	4,237	241	1,803	46	457	204	41
71	2,908	1,116	87	908	113	322	298	64
72	10,426	4,225	472	2,577	339	1,107	1,168	538
73	18,170	7,188	950	6,877	795	1,532	622	206
74	8,832	5,084	721	1,747	224	609	437	10

Source: JICA Study Team

Figure 4 shows traffic composition by traffic volume range. Approximately 55% of the traffic is motor cycles. Medium and large trucks are less than 10%.

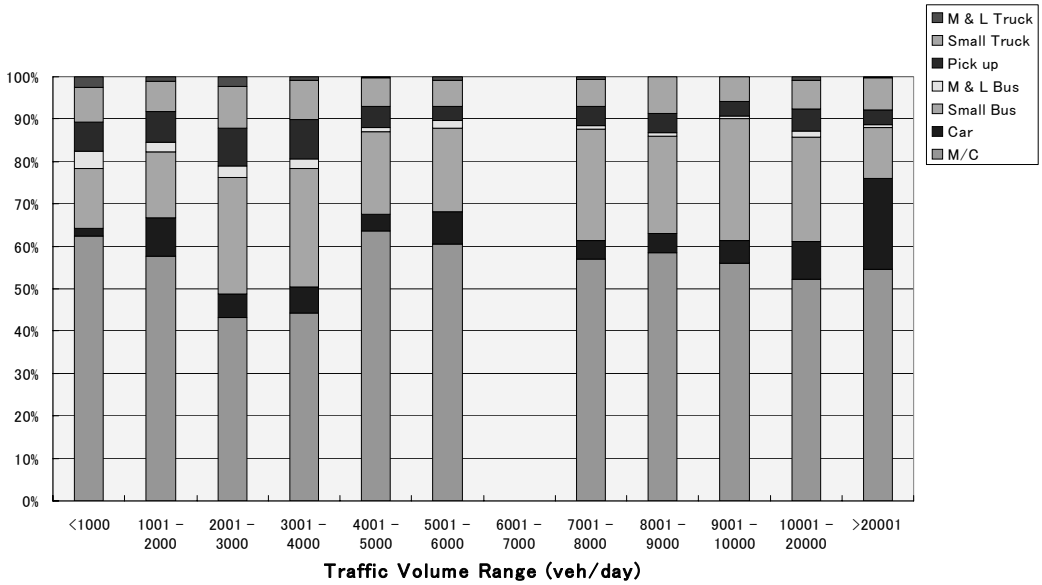
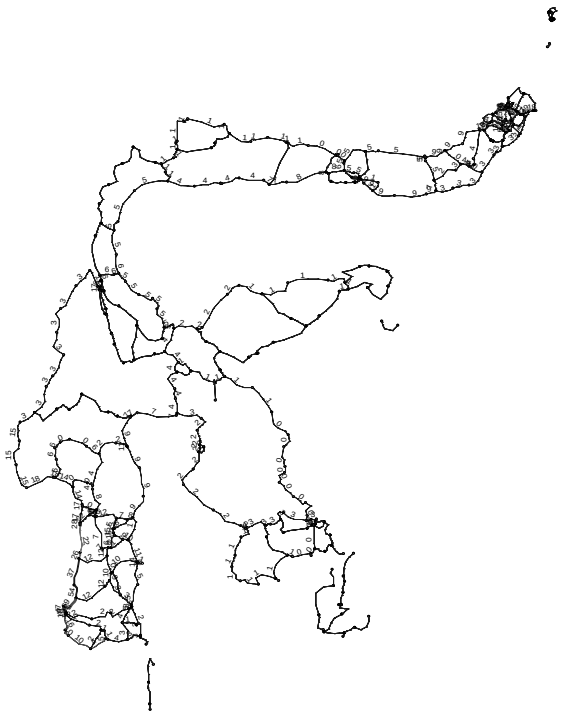
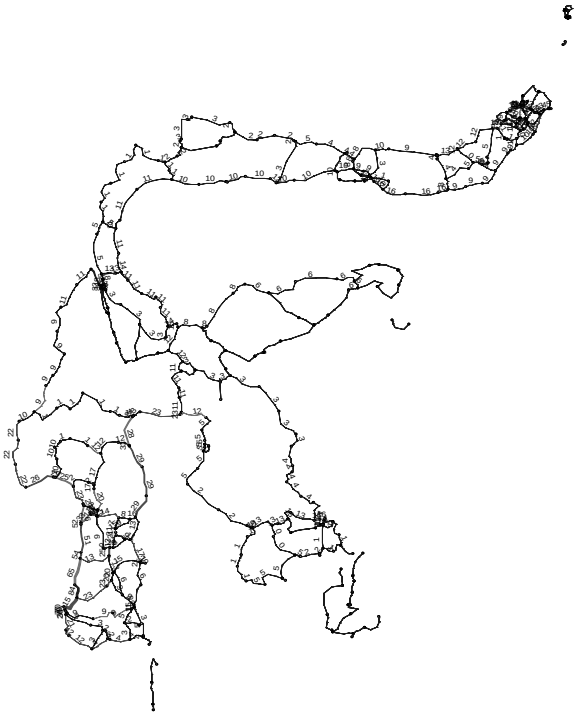


Figure 4 Composition of Vehicle Type by Traffic Volume Range

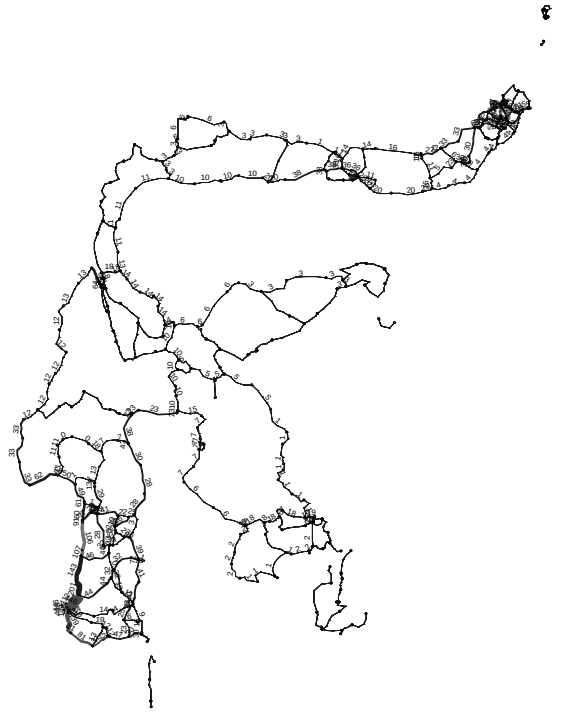
Figure 5 shows the current and future traffic in 2024. It indicates that there are many road links of which year 2024 traffic is still less than 1,000 pcu/day. Future truck traffic is very small on many road links.



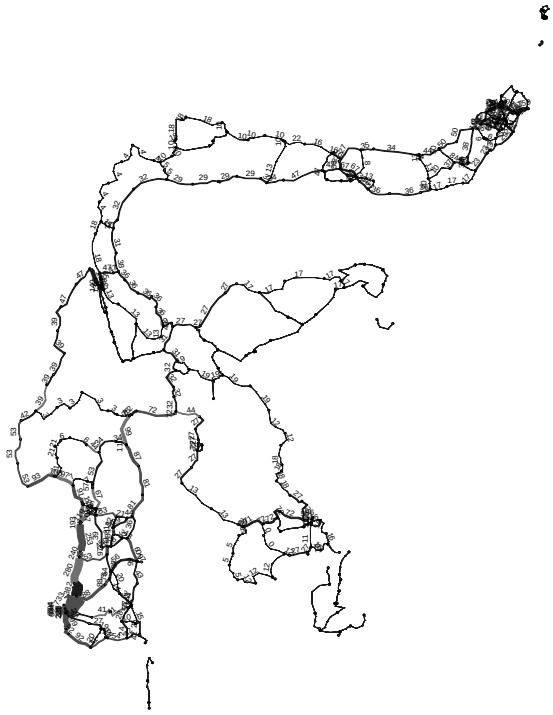
Year 2007 (Trucks)



Year 20024 (Trucks)



Year 2007 (All)



Year 20024 (All)

Figure 5 Current and Future Traffic without Project Case

6. Economic Evaluation for Stage-wised Application of the New Road Standard

6.1 Purpose of Evaluation

To investigate the possibility of application of the New Standard by Bina Marga for the improvement plan of the existing and future road network through the stage-wise method.

6.2 Methodology for Evaluation

(1) Assumptions

1) Road Length assumed: 30 km

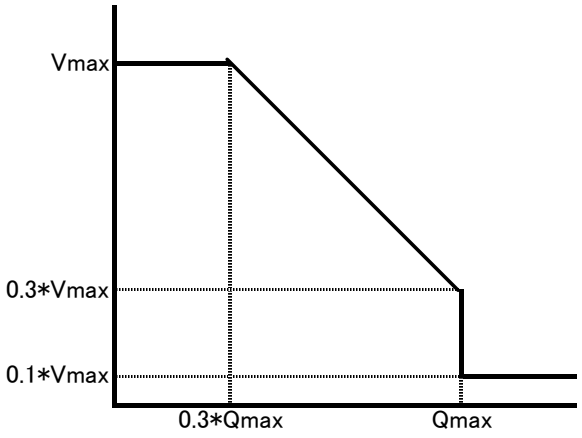
2) Evaluation Period: from 2007 to 2030

3) Traffic Volume: for the 5 cases of 500, 1000, 2000, 3000 and 4000 pcu per day started from 2007 with a growth rate of 5% per annum afterward up to 2030.

4) Road Roughness：IRI = 3 (fixed)

5) Q-V Formula

The following type of Q-V Formula (relationship between traffic volume (Q) and travel speed (V)) was applied changing both Vmax and Qmax (capacity) depending on the travel-way width (4.5m, 6.0m and 7.0m, respectively).



Width	Vmax (km/hr)	0.3 Vmax (km/hr)	Qmax (puc/day)	0.3Qmax(pcu/day)
4.5 m	40	12	3000	900
6.0 m	50	15	8000	2400
7.0 m	60	18	20000	6000

Figure 6 Q-V Formula used for Analysis

(2) Methodology for Evaluation

1) Evaluation Alternatives

Following eleven (11) cases were evaluated from the economic point of view applying the Cost Benefit Analysis and tested whether it is reasonable/ feasible to apply new road standard.

Evaluation Alternatives

Expansion of Width	Traffic Volume in 2007	Case No.
4.5 m to 6.0 m	500	1
	1000	2
	2000	3
	3000	4
4.5 m to 7.0 m	1000	5
	2000	6
	3000	7
6.0 m to 7.0 m	1000	8
	2000	9
	3000	10
	4000	11

2) Cost Estimation

The cost estimation was made for periodic maintenance, betterment (widening) and routine maintenance as indicated in **Table 7** (refer to **Appendix A** as to details). Land acquisition cost was excluded as most of the roads are located in rural areas and it is not substantial compared with road development and maintenance costs.

Table 7 Basis of Cost Estimation

Unit Price for Road Rehabilitation Case Study

Standard Case: ADT = 3,000 pcu Unit: Rp Mil./km

Item	Periodic Maintenance			Betterment (Widening from 4.5m to 6m or 7m)			Betterment (Widening from 6m to 7m)		
	W=4.5m	W=6m	W=7m	W=4.5m	W=6m	W=7m		W=6m	W=7m
Road	400	530	650	900	1,200	1,470		1,020	1,250
Bridge				70	70	80			80
Total	400	530	650	970	1,270	1,550		1,020	1,330

Notes:

1. Percentage for R. Maintenance: * Periodic Maintenance Cost : 2.35% / year on the average
   ** Betterment Cost : 1.66% / year on the average (see below)
2. Routine Maintenance Cost Distribution

2.1 Periodic Maintenance Project Unit: Rp Mil./km

Travelway Width	Year					Total	Average per year
	1	2	3	4	5		
	0.40%	1.61%	2.42%	3.25%	4.07%	11.75%	2.35%
W=4.5m	1.6	6	10	13	16	46.6	9
W=6m	2.1	9	13	17	22	63	13
W=7m	2.6	10	16	21	26	76	15

Note: Design period of periodic maintenance is for 5 years.

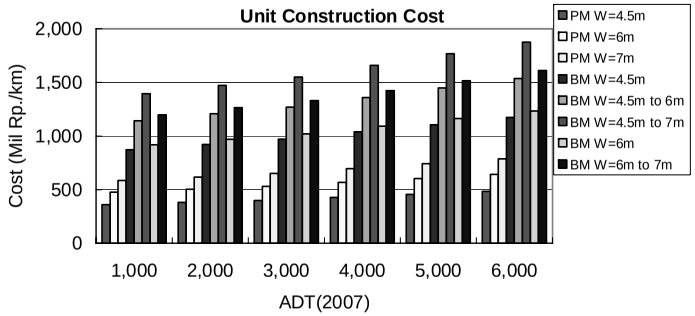
2.2 Betterment Project Unit: Rp Mil./km

Travelway Width	Year										Total	Average per year
	1	2	3	4	5	6	7	8	9	10		
	0.20%	0.60%	0.90%	1.21%	1.51%	1.81%	2.12%	2.43%	2.73%	3.04%	16.56%	1.66%
W=4.5m	2	6	9	12	15	18	21	24	27	30	164	16
W=6m	3	8	11	15	19	23	27	31	35	39	211	21
W=7m	3	9	14	19	23	28	33	38	42	47	257	26

Note: Design period of betterment is for 10 years.

Cost Adjustment Factor by ADT

ADT (pcu), 2007					
1,000	2,000	3,000	4,000	5,000	6,000
90%	95%	100%	107%	114%	121%



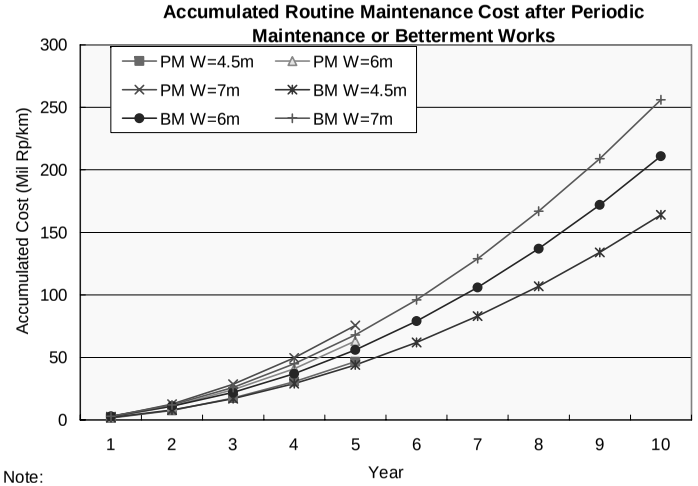
Rehabilitation and Maintenance Cost for a road section of : 30 km

Standard Case: ADT = 3,000 pcu Unit: Rp.Mil

Item	Periodic Maintenance			Betterment (Widening from 4.5m to 6m or 7m)			Betterment (Widening from 6m to 7m)		
	W=4.5m	W=6m	W=7m	W=4.5m	W=6m	W=7m		W=6m	W=7m
Road & Bridges	12,000	15,900	19,500	29,100	38,100	46,500		30,600	39,900

Routine Maintenance Cost Unit: Rp.Mil

Year	Periodic Maintenance Projects			Betterment Projects		
	W=4.5m	W=6m	W=7m	W=4.5m	W=6m	W=7m
1	48	63	78	60	90	90
2	180	270	300	180	240	270
3	300	390	480	270	330	420
4	390	510	630	360	450	570
5	480	660	780	450	570	690
6				540	690	840
7				630	810	990
8				720	930	1,140
9				810	1,050	1,260
10				900	1,170	1,410



Note:
PM: Periodic Maintenance, BM: Betterment

3) Benefit Estimation

Economic benefits estimated in this analysis were savings in Vehicle Operating Costs (VOC) due to the widening of travelway width applying the same unit values of VOCs prepared for IRMS as shown below:

- VOCi = BASEi * NDXi
- NDXi = k1i + k2i/Vi + k3i*Vi^2 + k4i*IRI + k5i*IRI^2

Table 8 VOC Coefficients and Base VOC

No.	Vehicle Type	K1	K2	K3	K4	K5	Base VOC (Rp/km)
1	Sedan	0.66707	22.23983	0.000006808	0.012937	0.00139	1.396.10
2	Utility Passenger	0.57932	20.34176	0.000018379	0.014087	0.00093	1.186.77
3	Utility Freight	0.58382	20.30049	0.000018278	0.013313	0.00079	1,414.64
4	Light Bus	0.32475	21.93222	0.000028582	0.068937	-0.00007	1,724.67
5	Large Bus	0.32985	22.26215	0.000053281	0.012930	0.00069	2,735.78
6	Light Truck	0.42258	20.52269	0.000027740	0.044006	-0.00006	1,592.41
7	Medium Truck	-0.17257	28.62223	0.000100534	0.061250	0.00016	2,444.33
8	Heavy Truck	0.11065	21.20004	0.000085612	0.044117	0.00041	3,481.37
9	Truck Trailer	0.29038	13.69068	0.000068153	0.053472	0.00027	5,447.68
10	Tractor Trailer	0.59807	10.02214	0.000021525	0.044723	0.00009	7,180.32
11	Motor cycle	1.05130	13.71763	-0.000009124	0.009024	0.00052	201.90

Source: IRMS: Updating the VOC Equation Coefficients, 2006

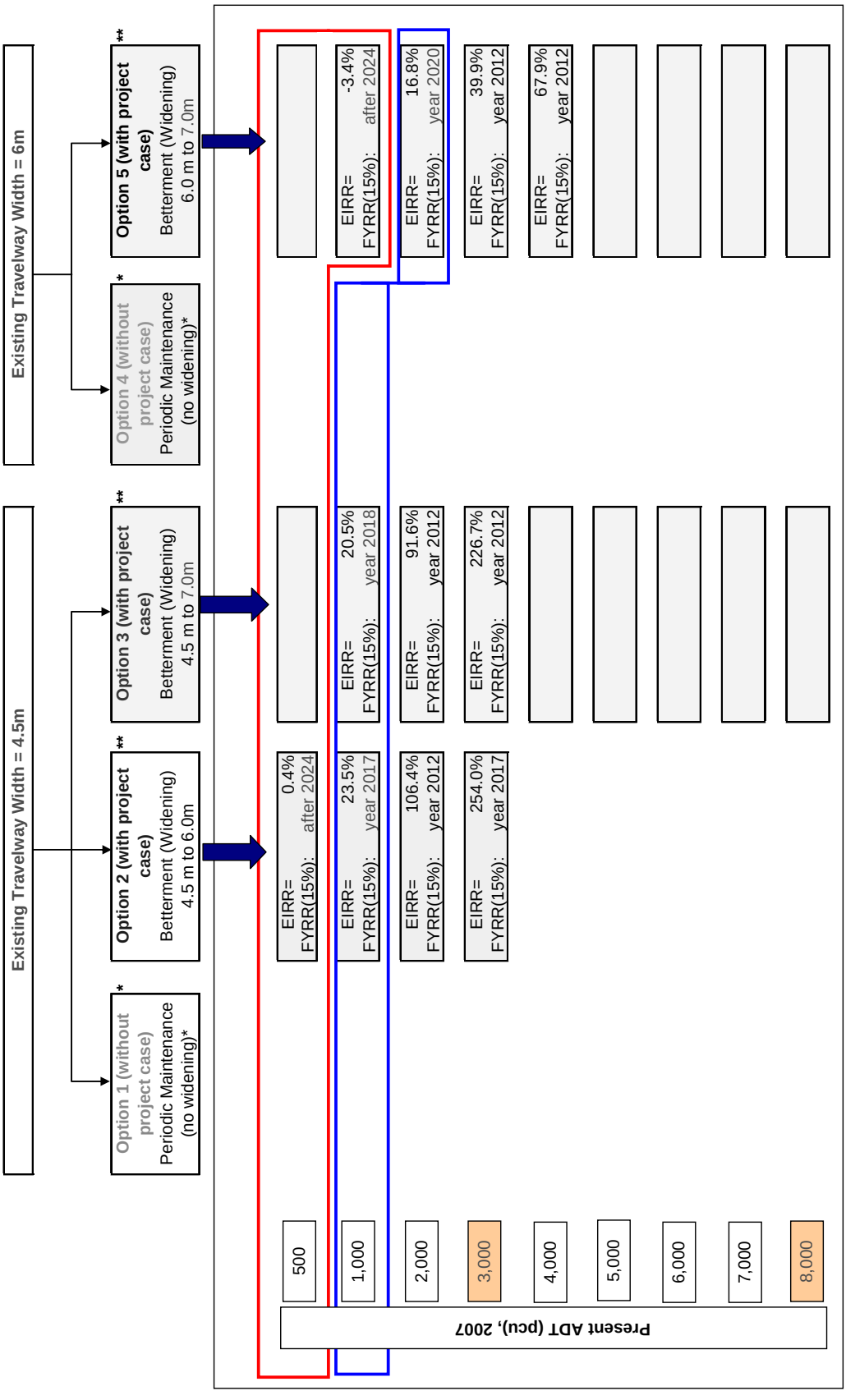
Where
VOCi : Unit VOC for vehicle type (i) in Rp/km
BASEi : Base VOC for vehicle type (i) in Rp/km under the "good condition" with roughness 3
NDXi : VOC index for vehicle type (i)
Vi : Vehicle speed for vehicle type (i) in km/hour
IRI : Road roughness (m/km)
K1---k5 : Coefficients by vehicle type

6.3 Results of Evaluation

Each alternative was evaluated with Economic Internal Rate of Return (EIRR) based on the VOC saving benefits comparing to costs for widening and maintenance as shown below (also refer to **Figure 8** as a summary and **Appendix B** as to details):

Evaluation Results

Widening of Width	Traffic Volume in 2007 and 2024	Case No.	EIRR (%)	Remarks
Existing 4.5 m to 6.0 m	500 (2007) – 1146 (2024)	1	0.4 %	No need to widen till 2024
	1000 (2007) – 2292 (2024)	2	23.5%	Feasible (best timing =2017)
	2000 (2007) – 4854 (2024)	3	> 100%	Quite feasible/ urgent
	3000 (2007) – 6876 (2024)	4	> 100%	Quite feasible/ urgent
Existing 4.5 m to 7.0 m	1000 (2007) – 2292 (2024)	5	20.5%	Feasible (best timing =2018)
	2000 (2007) – 4854 (2024)	6	91.6%	Quite feasible/ urgent
	3000 (2007) – 6876 (2024)	7	> 100%	Quite feasible/ urgent
Existing 6.0 m to 7.0 m	1000 (2007) – 2292 (2024)	8	-3.4%	No need to widen till 2024
	2000 (2007) – 4854 (2024)	9	16.8%	Feasible (best timing =2020)
	3000 (2007) – 6876 (2024)	10	39.9%	Quite feasible/ urgent
	4000 (2007) – 9168 (2024)	11	67.9%	Quite feasible/ urgent



Notes: * Without project case is periodic maintenance and routine maintenance work only.
** With project case is betterment work with widening of travelway/roadway.

Figure 7 Summary of Economic Evaluation by Road Development Options

6. Recommendations

From the above analysis, the following stage-wised development for 7.0 travelway (carriageway) to meet PP No 34 Year 2006 is recommended (refer to **Figure 1**).

- **Primary arterial roads** should be widened to **7.0 m travelway by year 2004**
- **Primary collector roads** should be widened to **7.0 m by stages based on the present and future traffic demand** in accordance with the following criteria.

  Road Links of existing travelway width of 3.0 m – 5.4 m

  - ✧ If present ADT (pcu) is less that 1,000 and year 2024 ADT is 1,000 - 3,000, the existing 4.5 m or 5.0 m travelway be kept as they are. At the stage of ADT becomes more than 3,000, it is widened to 6.0 m. Then, its ADT becomes over 8,000, it is widened to 7.0 m.
  - ✧ If present ADT is 1,000 - 3,000 and year 2024 ADT is 2,000 - 5,000, it could be widened to 6 m. Then, its ADT becomes over 8,000, it is widened to 7.0 m.
  - ✧ If present ADT is 3,000 - 8,000 and year 2024 ADT is 5,000 – 20,000, it could be widened to 7 m. If year 2024 ADT is over 20,000, 2 travelway (7.0m x 2) separated by median could be used by categorizing it as a main road in PP No 34/2006.
  - ✧ If present ADT is over 8,000 and year 2024 ADT is less than 20,000, it could be widened to 7 m. If year 2024 ADT is over 20,000, 2 travelway (7.0m x 2) separated by median could be used by categorizing it as a main road in PP No 34/2006.

  Road Links of existing travelway width of 5.5 m – 6.9 m

  - ✧ If present ADT (pcu) is less that 3,000 and year 2024 ADT is less than 8,000, the existing 5.5 m – 6.9 m travelway be kept as they are. At the stage of ADT becomes more than 8,000, it is widened to 7.0 m.
  - ✧ If present ADT is 3,000 - 8,000 and year 2024 ADT is 5,000 – 20,000, it could be widened to 7 m. If year 2024 ADT is over 20,000, 2 travelway (7.0m x 2) separated by median could be constructed by categorizing it as a main road in PP No 34/2006.
  - ✧ If present ADT is over 8,000 and year 2024 ADT is less than 20,000, it could be widened to 7 m. If year 2024 ADT is over 20,000, 2 travelway (7.0 m x 2) separated by median could be used by categorizing it as a main road in PP No 34/2006.

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

Appendix 8

POSSIBILITY OF TUNNEL CONSTRUCTION IN LONG TERM VISION

Appendix 8 Possibility of Tunnel Construction in Long Term Vision

1. General

Indonesia is composed of many islands which has mountainous and hilly area. In spite of the severe terrain of the nation, the construction of road tunnel has been avoided due to its high construction and operation costs. On the other hand, the construction of road tunnel in developing countries is increasing in recent years. The merits and the possibility of the tunnel construction in Sulawesi and Indonesia are described in this section.

2. Advantages of Road Tunnel Construction

(1) Reduction of the Traveling Time and the Vehicle Operation Cost

The roads in mountainous area have bad alignment with small radius curve and steep gradient because of severe terrain. Therefore, the vehicle travels long distance with slow speed in mountainous area. The construction of road tunnel provides good horizontal alignment with straight or large radius curve and gentle gradient. It will reduce traveling time and vehicle operation cost drastically.

(2) Reduction of the Traffic Accidents

The alignment of the road in mountainous are improved by the construction of tunnel as described above. Besides, the drivers pay higher attention when they drive in tunnel. Thus, the accident ratio in tunnel is usually lower than other part of road. It is more prominent in mountainous area.

(3) Prevention of Disasters (Land Slide and Earthquake)

The construction of road in mountainous area often requires high cut of slope and it sometimes causes disasters such as landslide, slope failure and fall of big boulder. The tunnel is located under the ground and the cut and embankment volume for the road construction is reduced. Consequently, the road tunnel provides disaster free condition at its section.

Moreover, the tunnel is known as durable structure to earthquake. For example, the South Hyogo prefecture Earthquake (Kobe Earthquake) which was occurred in Japan in 1995 destroyed many bridges and buildings. In spite that many infrastructures were heavily damaged, there was no destroyed tunnel and minor repair was executed only for old 11 tunnels among 111 tunnels in the disaster area.

(4) Environmental Protection (Emission Gas, Landscape and National Park)

The environmental protection is recently becoming major topics and it must be taken into consideration for the road construction. The tunnel construction is effective in many aspects of environmental protection as follows.

1) Reduction of Emission Gas

The road with tunnel becomes gentle alignment and saves the distance for driving. Therefore, it also reduces the emission gas such as CO, CO2, NOx and SPM (soot particle material).

2) Protection of Landscape

The natural landscape of mountainous area is sometimes deteriorated by the large cut and slope protection for road construction. The tunnel construction mitigates the negative impact to the natural landscape.

3) Protection of National Park (Environment Protection for Wild Animals)

The road construction in mountainous area sometimes generates negative impact to the wild animals. The large cut and embankment divides the life range of wild animals. The tunnel construction minimizes the negative impact for the animals.

3. Present Situation of Road Tunnel in the World

The road tunnel construction had been limited in some countries and it has been avoided as special construction method in other countries because of its high construction cost. However, in order to solve economic loss and protect environment in mountainous area, the construction of road tunnel is spread to many countries.

(1) Europe and Japan

Most of the road tunnels in the world had been constructed in Europe and Japan. Many mountainous terrains exist in both regions. In order to develop economic and promote networks in the country, it has been inevitable to excavate tunnel for road construction. So far, the total length of road tunnels in Europe exceeded 2,300 km long and that in Japan was approximately 3,000 km long as of year 2004. In these days, the city road tunnel is also increasing in both regions because of high density in the city.

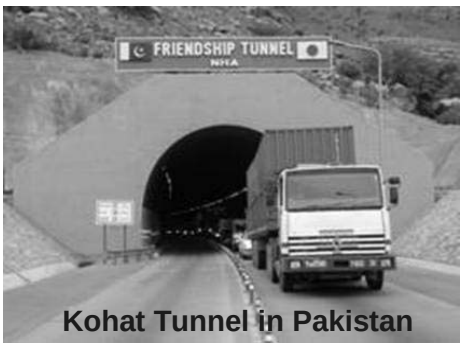
(2) China

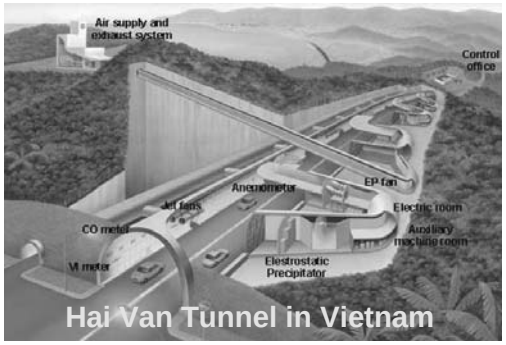
The tunnel construction in China had been limited to railway construction for a long time. However, the number of the road tunnel in China has been greatly increasing in recent 10 years in accordance with their economic growth. The total length of the road tunnel was more than 800 km as of year 2004.

(3) Other Areas and Countries

In Asia, some countries such as Malaysia, Singapore, Vietnam, India and Pakistan have already constructed and operated road tunnels and other countries like Thailand started to study and consider the road tunnel for future plan. It is also similar situation in South American countries such as Colombia, Brazil, etc. The construction of the road tunnel is rapidly diffused to all over

the world in recent ten years and it is not special construction method any longer.





Source: JICA Study Team

Figure A.8-1 Tunnels in Developing Countries by ODA of Japan (JBIC Loan)

4. Geological Condition and Tunnel

The geological condition is very important factor for the tunnel construction and its cost differs by the geological condition. It is believed that the construction of the tunnel would be very difficult or impossible if the geological condition is stable. However, the application of the tunneling method is widely carried out to various geological conditions from hard rock to highly weathered rock in mountainous area. Therefore, the construction of road tunnel could be applicable in Sulawesi and other areas in Indonesia, in spite of relatively worse geological condition.

5. Cost of Tunnel

(1) Comparison of Unit Cost (Bridge, Viaduct and Tunnel from Experience in Japan)

It is believed that the cost for the tunnel is extremely expensive compared with other construction. Usually, this concept is not based on the actual experience. According to the development of the tunneling technology, the cost for the tunnel is drastically reduced in recent years. The construction cost is varied in each country. It is difficult to compare with each other. However, the construction cost for “Nagano Shinkansen” which was bullet train in Japan and completed in 1997 is indicated in Figure A.8-2 for the comparison between the cost of tunnel and others.

From the experience of Nagano Shinkansen, the unit cost for tunnel was lower than those of the viaduct with high pier and bridges with long span. Moreover, the total cost for the tunnel section including the land acquisition cost was cheapest in all sections due to extreme high cost of land in Japan.

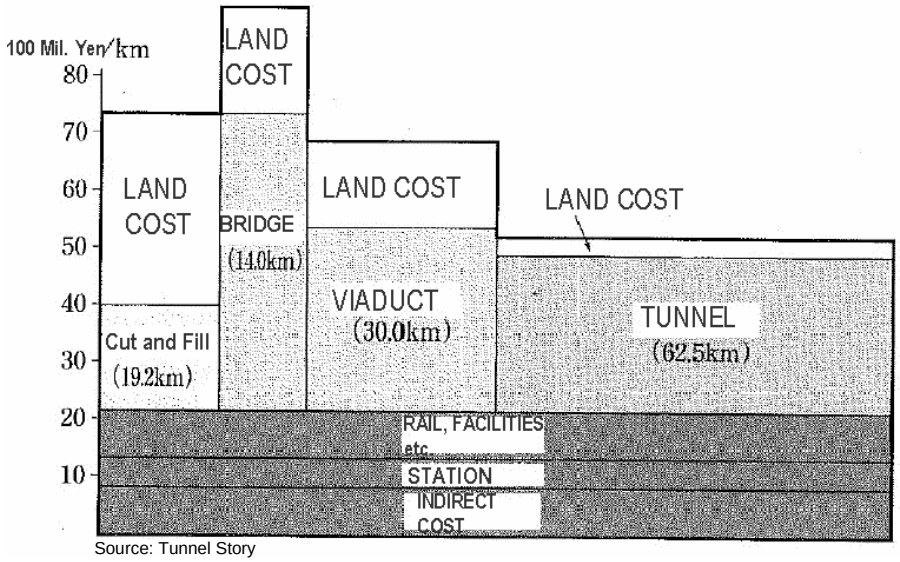


Figure A.8-2 Unit Cost of Bullet Train in Japan (Nagano Shinkansen)

(2) Unit Cost of Road Tunnel

The assumed typical cross section for the road tunnel with two lanes is indicated in Figure A.8-3, taking into consideration the condition of traffic in Sulawesi. The cost of this tunnel is assumed to be approximately 10,000-15,000 USD/m from experience in Vietnam which has relatively similar condition, though the cost for the road tunnel is varied and fluctuated according to the condition such as rock mass, traffic volume and tunnel length. This is nearly same cost of the bridges of middle span or viaduct with high pier and cheaper than bridges with long span. The adoption of the tunnel is reasonable and competitive.

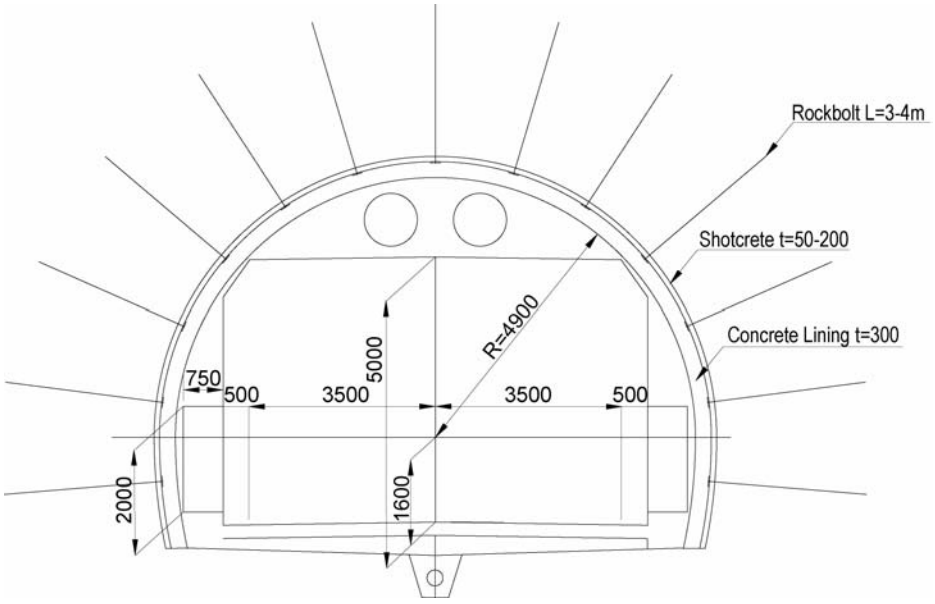


Figure A.8-3 Assumed Typical Cross Section for the Road Tunnel in Sulawesi

6. Candidate Area of the Road Tunnel in Sulawesi

There are many candidate routes appropriate for the road tunnel construction because the mountainous terrains dominate in Sulawesi and generate difficult and critical condition for the traffic. The Study Team reviewed the tunnels recommended in the "Road Network Study in Central and Southeast Sulawesi in the Republic of Indonesia, 1998, JICA". The Study Team has conducted road survey and identified many routes for which tunnel construction will be necessary for application of the new road standard (PP34/2006) and the heavy loaded road. Figure A.8-4 shows these candidate locations of future tunnel construction. However, most of them are premature because of low traffic volume. Among those, the most advantageous tunnel would be for the Maros-Watampone road in South Sulawesi Province to meet future traffic volume, ADT of heavy vehicles and road function (Arterial and Heavy Loaded Road).

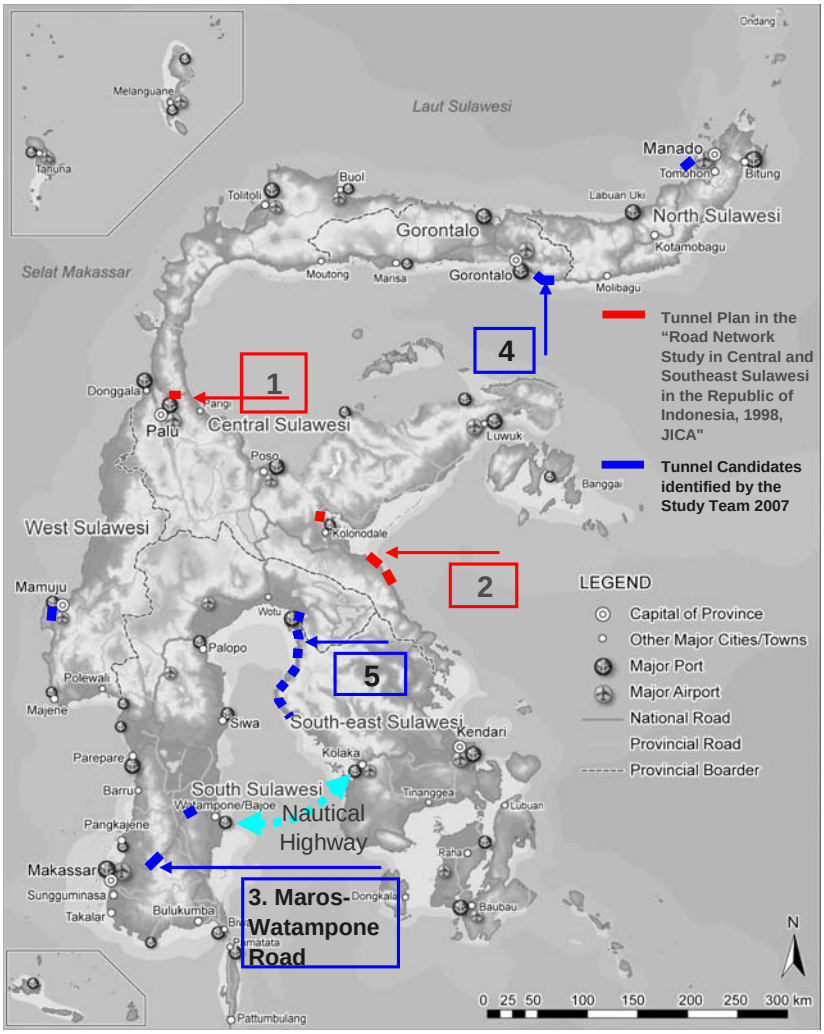


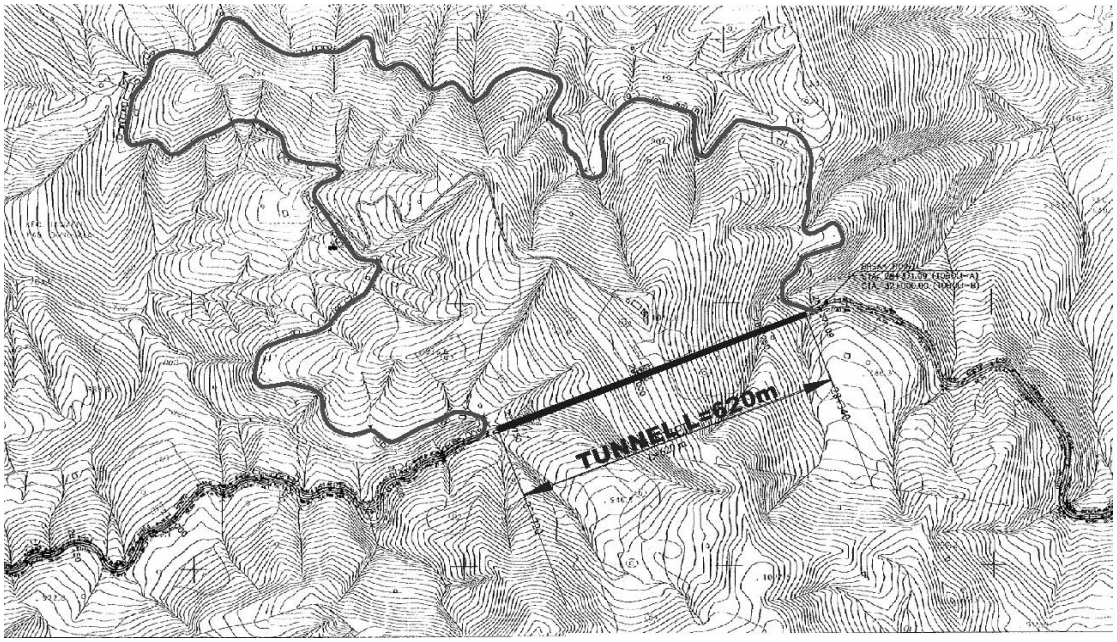
Figure A.8-4 Tunnel Candidates in Sulawesi

(1) Review of Road Network Study in Central and Southeast Sulawesi (Tawaeli-Toboli)

The feasibility study was carried out for the road from Tawaeli to Toboli in "Road Network Study in Central and Southeast Sulawesi in the Republic of Indonesia, 1998, JICA". The tunnel with 620 m long was planned on the studied road between Tawaeli and Toboli.

The study team carried out site reconnaissance of the tunnel location in order to confirm the site condition and traffic volume. The tunnel is located at approximately 28km from Tawaeli. The traffic volume of the route still remains at low level. The tunnel route will shorten more than 3km

from the existing route and it will save 3-5 minutes of the traveling time of the vehicles. The existing route has many sharp curves but the gradient of the route is relatively gentle. It is not very critical situation because of the low traffic volume on the route. Therefore, the tunnel construction is not an urgent issue though many unstable slopes are seen along the existing route.However, as this route connects the east and west coasts of Central Sulawesi Province, the tunnel will be useful to improve bad alignments if the traffic volume of heavy vehicle is increased in the future.



Source: Road Network Study in Central and Southeast Sulawesi in the Republic of Indonesia, 1998, JICA

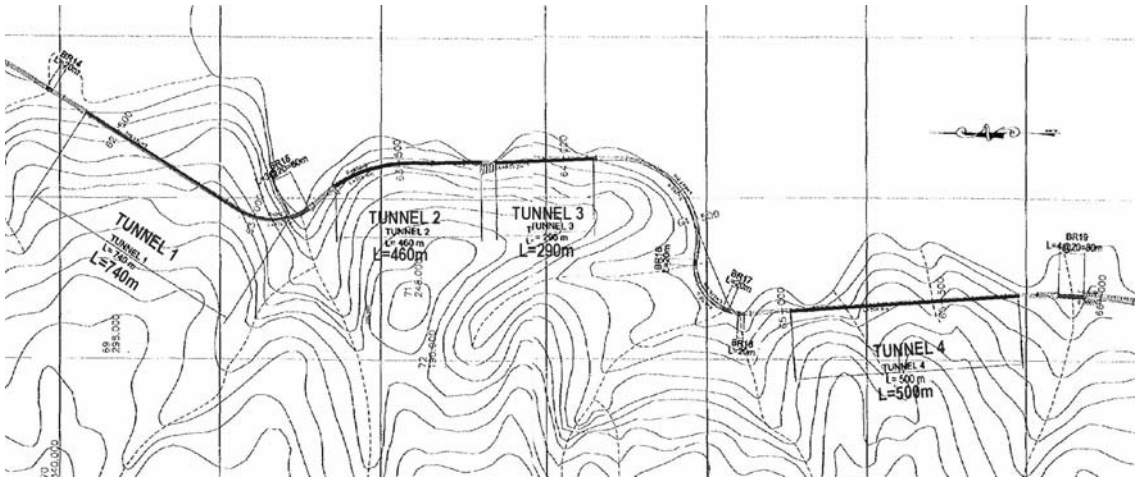
Figure A.8-5 Planned Tunnel Route on the Road between Tawaeli and Toboli

Figure A.8-6 Location of West Portal of Planned Tunnel

(2) Review of Road Network Study in Central and Southeast Sulawesi (Trans Sulawesi East Corridor)

There are 4 planned tunnels which are located between the station of 62 km +380 and 65km +740 in the study of "Road Network Study in Central and Southeast Sulawesi in the Republic of Indonesia, 1998, JICA".

As the traffic volume on this route is very small, tunnel construction would not be cost effective. However, the road alignment is situated along the coastline which tends to generate disaster such as slope failures and scouring of shore. In order to make disaster free road, the construction of the road tunnel will be one of the options in future.



Source: Road Network Study in Central and Southeast Sulawesi in the Republic of Indonesia, 1998, JICA

Figure A.8-7 Planned Tunnel on the Trans Sulawesi East Corridor

(3) Maros-Watampone route in South Sulawesi

The route between Maros and Watanmpone is arterial road to connect the west and east coasts of South Sulawesi Province. This is also the main route of traffic connecting Makassar and Kendari through nautical highway (ferry) between Bajoe Port and Kolaka Port. The traffic volume is not small and many heavy trucks pass on this route. This route has been designated as a heavy loaded road for container traffic. There are two severe terrains with steep gradient, one near Maros and the other near Watampone, and the former has high possibility of improvement by the tunnel construction.

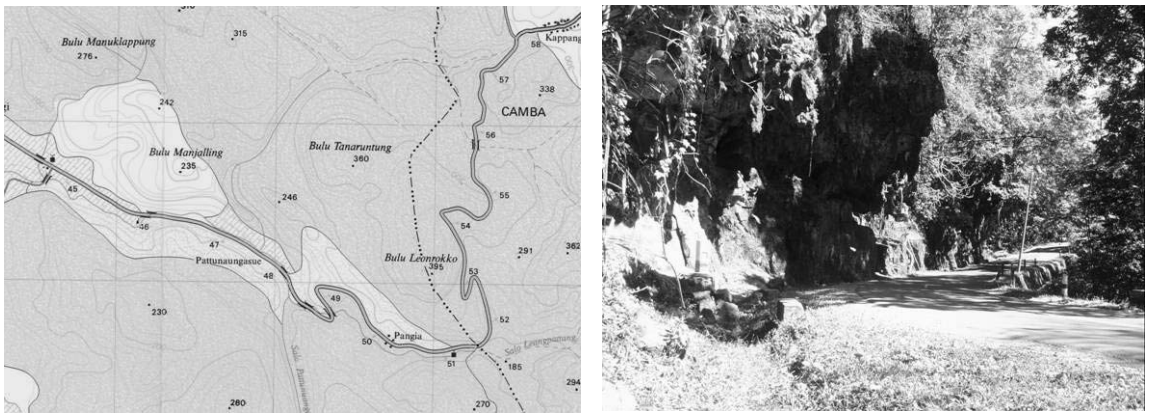


Figure A.8-8 Expected Location of Tunnel between Maros and Watampone

(4) Southern Coastline in North Sulawesi and Gorontalo

In the southern coast road from North Sulawesi to Gorontalo (Trans Sulawesi Central Corridor), the mountains range parallel with coastline. Therefore, many road sections with narrow curves and steep gradient exist along the coastline. In the aspect of protection from disaster and passage of trucks, several tunnels would be required in the future, especially in Gorontalo Province as shown in the following figure.

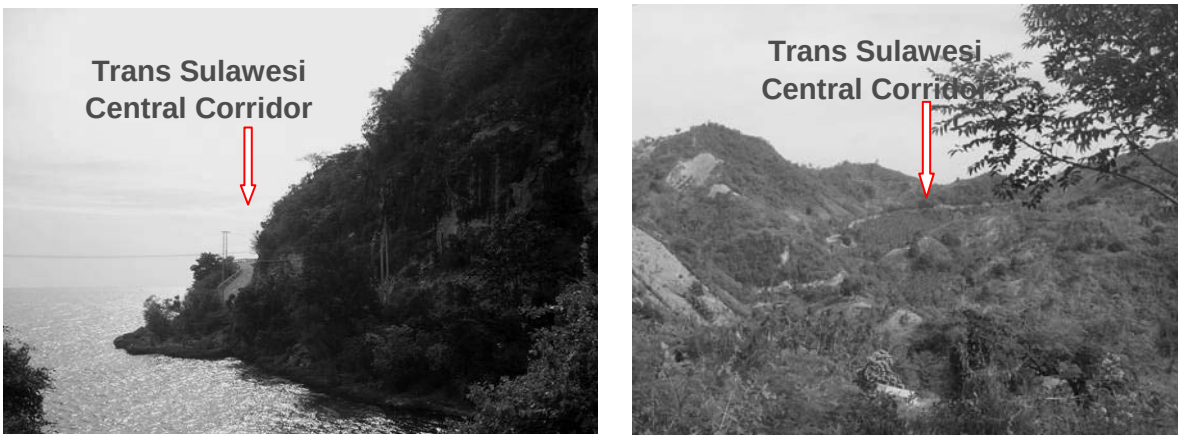


Figure A.8-9 Steep Terrain Road along the Southern Coastline of Gorontalo

(5) West Coastline in Southeast Sulawesi

The road along the west coastline between Malili in South Sulawesi and Kolaka in Southeast Sulawesi is in steep mountain range. The condition of the road alignments between the provincial boarder and Lasusua is extremely bad and its longitudinal gradient often exceeds 12% - 14%. Though this road is an arterial and heavy loaded route, it does not meet the standards and requirements for container traffic. Therefore, tunnels would be required in the future.

7. Recommendation on Road Tunnels in Sulawesi and Indonesia

There are many places in Sulawesi where the road tunnel will be required to improve the condition of road, but this is not an urgent issue at present because the heavy traffic volumes are still at low level and not much cost effective.

However, the demand of the tunnel construction will be raised in accordance with the growth of the traffic volume and economy. Besides, the tunnel construction would not be avoided for protection of environment and disaster. Therefore, as other South East Asian countries did or are doing, it is recommended to introduce the tunneling technology and plan the route with tunnels as a long term vision.

Appendix 9

ECONOMIC EVALUATION RESULTS

Cost Benefit Streams (Package No. TS 1-1)

Case No.	1
Package	TS-1-1

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	616,928	0	50,645	667,573	0	-667,573
	2011	616,928	0	50,645	667,573	0	-667,573
	2012	616,928	2,617	0	619,545	0	-619,545
	2013	616,928	7,969	0	624,897	0	-624,897
1	2014	0	12,229	0	12,229	2,338,678	2,326,449
2	2015	0	16,513	0	16,513	2,477,502	2,460,989
3	2016	0	20,198	0	20,198	2,616,326	2,596,128
4	2017	0	21,176	50,645	71,821	2,755,149	2,683,328
5	2018	0	24,943	50,645	75,588	2,893,973	2,818,385
6	2019	0	28,984	0	28,984	3,032,797	3,003,813
7	2020	0	32,911	0	32,911	3,177,756	3,144,844
8	2021	0	37,310	0	37,310	3,322,714	3,285,404
9	2022	0	2,227	507,631	509,858	3,467,673	2,957,815
10	2023	0	4,750	0	4,750	3,612,631	3,607,882
11	2024	0	7,671	50,645	58,316	3,757,590	3,699,274
12	2025	0	12,081	50,645	62,726	3,902,549	3,839,822
13	2026	0	16,122	0	16,122	4,047,507	4,031,385
14	2027	0	20,831	0	20,831	4,192,466	4,171,635
15	2028	0	1,710	507,631	509,341	4,337,424	3,828,084
16	2029	0	4,189	0	4,189	4,482,383	4,478,194
17	2030	0	10,460	0	10,460	4,627,342	4,616,882
18	2031	0	12,081	50,645	62,726	4,772,300	4,709,574
19	2032	0	15,848	50,645	66,493	4,917,259	4,850,766
20	2033	0	20,027	0	20,027	5,062,217	5,042,191
21	2034	0	1,078	507,631	508,709	5,207,176	4,698,467
22	2035	0	3,671	0	3,671	5,352,135	5,348,463
23	2036	0	9,899	0	9,899	5,497,093	5,487,195
24	2037	0	14,869	0	14,869	5,642,052	5,627,183
25	2038	0	15,848	50,645	66,493	5,787,010	5,720,518
26	2039	0	19,752	50,645	70,397	5,931,969	5,861,572
27	2040	0	274	507,631	507,905	6,076,928	5,569,022
28	2041	0	3,040	0	3,040	6,221,886	6,218,846
29	2042	0	9,381	0	9,381	6,366,845	6,357,464
30	2043	0	14,308	0	14,308	6,511,803	6,497,495
Total		2,467,713	424,967	2,536,975	5,429,655	132,389,133	126,959,478

EIRR	49.2%
NPV(*) (Rp.Million)	6,558,766
B/C(*)	5.74

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 1-2)

Case No.	2
Package	TS-1-2

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	249,885	0	39,242	289,127	0	-289,127
	2011	249,885	0	39,242	289,127	0	-289,127
	2012	249,885	1,503	0	251,388	0	-251,388
	2013	249,885	4,704	0	254,588	0	-254,588
1	2014	0	6,970	0	6,970	472,456	465,486
2	2015	0	9,423	0	9,423	524,215	514,792
3	2016	0	11,674	0	11,674	575,973	564,299
4	2017	0	11,524	39,242	50,766	627,732	576,966
5	2018	0	13,571	39,242	52,813	679,490	626,678
6	2019	0	15,833	0	15,833	731,249	715,416
7	2020	0	18,275	0	18,275	861,195	842,920
8	2021	0	20,793	0	20,793	991,141	970,348
9	2022	0	1,739	302,242	303,981	1,121,086	817,105
10	2023	0	2,909	67,902	70,811	1,251,032	1,180,221
11	2024	0	3,124	39,242	42,365	1,380,978	1,338,613
12	2025	0	5,741	39,242	44,983	1,510,924	1,465,941
13	2026	0	8,229	0	8,229	1,640,870	1,632,641
14	2027	0	10,949	0	10,949	1,770,815	1,759,866
15	2028	0	4,956	234,339	239,295	1,900,761	1,661,466
16	2029	0	2,451	67,902	70,354	2,030,707	1,960,353
17	2030	0	4,958	67,902	72,861	2,160,653	2,087,792
18	2031	0	4,745	39,242	43,987	2,290,599	2,246,612
19	2032	0	7,109	39,242	46,351	2,420,544	2,374,194
20	2033	0	9,622	0	9,622	2,550,490	2,540,868
21	2034	0	3,805	234,339	238,145	2,680,436	2,442,291
22	2035	0	5,667	0	5,667	2,810,382	2,804,714
23	2036	0	4,501	67,902	72,403	2,940,328	2,867,924
24	2037	0	6,580	67,902	74,482	3,070,273	2,995,791
25	2038	0	6,113	39,242	45,355	3,200,219	3,154,864
26	2039	0	8,502	39,242	47,744	3,330,165	3,282,421
27	2040	0	2,478	234,339	236,817	3,460,111	3,223,293
28	2041	0	4,517	0	4,517	3,590,057	3,585,539
29	2042	0	7,918	3,038	10,956	3,720,002	3,709,047
30	2043	0	6,540	73,370	79,909	3,849,948	3,770,039
Total		999,539	237,422	1,813,597	3,050,558	60,144,831	57,094,273

EIRR	35.0%
NPV(*) (Rp.Million)	1,888,702
B/C(*)	4.02

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 1-3)

Case No.	3
Package	TS-1-3

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	200,241	0	0	200,241	0	-200,241
	2011	200,241	0	0	200,241	0	-200,241
	2012	200,241	1,046	0	201,287	0	-201,287
	2013	200,241	3,138	0	203,378	0	-203,378
1	2014	0	4,881	0	4,881	166,020	161,139
2	2015	0	6,624	0	6,624	178,136	171,512
3	2016	0	8,019	0	8,019	190,252	182,234
4	2017	0	9,762	0	9,762	202,369	192,607
5	2018	0	11,505	0	11,505	214,485	202,980
6	2019	0	13,248	0	13,248	226,601	213,353
7	2020	0	14,643	0	14,643	243,978	229,335
8	2021	0	16,386	0	16,386	261,355	244,969
9	2022	0	0	296,342	296,342	278,733	-17,609
10	2023	0	906	0	906	296,110	295,203
11	2024	0	3,486	0	3,486	313,487	310,001
12	2025	0	5,578	0	5,578	330,864	325,286
13	2026	0	7,321	0	7,321	348,241	340,920
14	2027	0	9,065	0	9,065	365,619	356,554
15	2028	0	0	296,342	296,342	382,996	86,654
16	2029	0	906	0	906	400,373	399,467
17	2030	0	3,486	0	3,486	417,750	414,264
18	2031	0	5,578	0	5,578	435,127	429,549
19	2032	0	7,321	0	7,321	452,505	445,183
20	2033	0	9,065	0	9,065	469,882	460,817
21	2034	0	0	296,342	296,342	487,259	190,917
22	2035	0	906	0	906	504,636	503,730
23	2036	0	3,486	0	3,486	522,013	518,527
24	2037	0	5,578	0	5,578	539,391	533,812
25	2038	0	7,321	0	7,321	556,768	549,446
26	2039	0	9,065	0	9,065	574,145	565,080
27	2040	0	0	296,342	296,342	591,522	295,180
28	2041	0	906	0	906	608,899	607,993
29	2042	0	3,486	0	3,486	626,277	622,790
30	2043	0	5,578	0	5,578	643,654	638,076
Total		800,963	178,293	1,185,368	2,164,623	11,829,447	9,664,824

EIRR	19.6%
NPV(*) (Rp.Million)	182,727
B/C(*)	1.41

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 1-4)

Case No.	4
Package	TS-1-4

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	35,293	0	21,769	57,062	0	-57,062
	2011	35,293	0	21,769	57,062	0	-57,062
	2012	35,293	336	0	35,628	0	-35,628
	2013	35,293	1,164	0	36,457	0	-36,457
1	2014	0	1,753	0	1,753	88,966	87,213
2	2015	0	2,342	0	2,342	96,635	94,293
3	2016	0	2,917	0	2,917	104,303	101,386
4	2017	0	1,996	21,769	23,765	111,972	88,206
5	2018	0	2,353	21,769	24,122	119,640	95,518
6	2019	0	2,831	0	2,831	127,309	124,478
7	2020	0	3,517	0	3,517	134,978	131,461
8	2021	0	4,106	0	4,106	142,646	138,540
9	2022	0	987	60,603	61,590	150,315	88,725
10	2023	0	1,462	0	1,462	157,983	156,521
11	2024	0	713	21,769	22,482	165,652	143,170
12	2025	0	1,141	21,769	22,910	173,321	150,411
13	2026	0	1,619	0	1,619	180,989	179,370
14	2027	0	2,376	0	2,376	188,658	186,281
15	2028	0	755	60,603	61,358	196,326	134,968
16	2029	0	1,172	0	1,172	203,995	202,823
17	2030	0	1,990	0	1,990	211,663	209,673
18	2031	0	1,141	21,769	22,910	219,332	196,422
19	2032	0	1,497	21,769	23,266	227,001	203,734
20	2033	0	1,976	0	1,976	234,669	232,694
21	2034	0	522	60,603	61,126	242,338	181,212
22	2035	0	940	0	940	250,006	249,066
23	2036	0	1,700	0	1,700	257,675	255,975
24	2037	0	2,418	0	2,418	265,344	262,926
25	2038	0	1,497	21,769	23,266	273,012	249,746
26	2039	0	1,854	21,769	23,623	280,681	257,058
27	2040	0	122	60,603	60,725	288,349	227,624
28	2041	0	708	0	708	296,018	295,310
29	2042	0	8,683	108,845	117,529	303,686	186,158
30	2043	0	17,082	195,922	213,003	311,355	98,352
Total		141,170	75,669	764,871	981,711	6,004,816	5,023,106

EIRR	32.6%
NPV(*) (Rp.Million)	214,970
B/C(*)	2.76

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 1-5)

Case No.	5
Package	TS-1-5

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	93,028	0	27,477	120,506	0	-120,506
	2011	93,028	0	27,477	120,506	0	-120,506
	2012	93,028	718	0	93,746	0	-93,746
	2013	93,028	2,220	0	95,249	0	-95,249
1	2014	0	3,190	0	3,190	145,606	142,416
2	2015	0	4,292	0	4,292	152,760	148,469
3	2016	0	5,410	0	5,410	159,915	154,504
4	2017	0	4,607	27,477	32,084	167,069	134,985
5	2018	0	5,416	27,477	32,893	174,224	141,331
6	2019	0	6,378	0	6,378	181,378	175,000
7	2020	0	7,636	0	7,636	188,533	180,897
8	2021	0	8,737	0	8,737	195,687	186,950
9	2022	0	1,246	146,667	147,912	202,841	54,929
10	2023	0	2,035	0	2,035	209,996	207,961
11	2024	0	1,749	27,477	29,226	217,150	187,924
12	2025	0	2,614	27,477	30,091	224,305	194,214
13	2026	0	3,576	0	3,576	231,459	227,883
14	2027	0	5,022	0	5,022	238,614	233,592
15	2028	0	953	146,667	147,619	245,768	98,149
16	2029	0	1,669	0	1,669	252,922	251,254
17	2030	0	3,361	0	3,361	260,077	256,716
18	2031	0	2,614	27,477	30,091	267,231	237,140
19	2032	0	3,422	27,477	30,900	274,386	243,486
20	2033	0	4,516	0	4,516	281,540	277,024
21	2034	0	659	146,667	147,326	288,695	141,368
22	2035	0	1,376	0	1,376	295,849	294,473
23	2036	0	2,994	0	2,994	303,003	300,009
24	2037	0	4,226	0	4,226	310,158	305,932
25	2038	0	3,422	27,477	30,900	317,312	286,413
26	2039	0	4,362	27,477	31,840	324,467	292,627
27	2040	0	154	146,667	146,821	331,621	184,800
28	2041	0	1,083	0	1,083	338,776	337,693
29	2042	0	3,524	12,412	15,936	345,930	329,994
30	2043	0	5,565	22,341	27,905	353,084	325,179
Total		372,114	108,745	896,192	1,377,050	7,480,356	6,103,306

EIRR	24.7%
NPV(*) (Rp.Million)	208,969
B/C(*)	1.80

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 1-6)

Case No.	6
Package	TS-1-6

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost	Benefit	BALANCE
			Routine	Periodic	(C)	(B)	(B-C)
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	83,700	0	0	83,700	0	-83,700
	2011	83,700	0	0	83,700	0	-83,700
	2012	83,700	540	0	84,240	0	-84,240
	2013	83,700	1,440	0	85,140	0	-85,140
1	2014	0	1,980	0	1,980	760,192	758,212
2	2015	0	2,700	0	2,700	804,501	801,801
3	2016	0	3,420	0	3,420	848,810	845,390
4	2017	0	4,140	0	4,140	893,118	888,978
5	2018	0	4,860	0	4,860	937,427	932,567
6	2019	0	5,580	0	5,580	981,736	976,156
7	2020	0	6,300	0	6,300	1,026,045	1,019,745
8	2021	0	7,020	0	7,020	1,070,354	1,063,334
9	2022	0	0	135,000	135,000	1,114,662	979,662
10	2023	0	378	0	378	1,158,971	1,158,593
11	2024	0	1,620	0	1,620	1,203,280	1,201,660
12	2025	0	2,340	0	2,340	1,247,589	1,245,249
13	2026	0	3,060	0	3,060	1,291,897	1,288,837
14	2027	0	3,960	0	3,960	1,336,206	1,332,246
15	2028	0	0	135,000	135,000	1,380,515	1,245,515
16	2029	0	378	0	378	1,424,824	1,424,446
17	2030	0	1,620	0	1,620	1,469,133	1,467,513
18	2031	0	2,340	0	2,340	1,513,441	1,511,101
19	2032	0	3,060	0	3,060	1,557,750	1,554,690
20	2033	0	3,960	0	3,960	1,602,059	1,598,099
21	2034	0	0	135,000	135,000	1,646,368	1,511,368
22	2035	0	378	0	378	1,690,677	1,690,299
23	2036	0	1,620	0	1,620	1,734,985	1,733,365
24	2037	0	2,340	0	2,340	1,779,294	1,776,954
25	2038	0	3,060	0	3,060	1,823,603	1,820,543
26	2039	0	3,960	0	3,960	1,867,912	1,863,952
27	2040	0	0	135,000	135,000	1,912,220	1,777,220
28	2041	0	378	0	378	1,956,529	1,956,151
29	2042	0	1,620	0	1,620	2,000,838	1,999,218
30	2043	0	2,340	0	2,340	2,045,147	2,042,807
Total		334,800	76,392	540,000	951,192	42,080,083	41,128,891

EIRR	80.8%
NPV(*) (Rp.Million)	2,364,937
B/C(*)	13.42

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 2-1)

Case No.	7
Package	TS-2-1

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	104,603	0	210,510	315,113	0	-315,113
	2011	104,603	0	210,510	315,113	0	-315,113
	2012	104,603	1,594	0	106,198	0	-106,198
	2013	104,603	5,705	0	110,309	0	-110,309
1	2014	0	8,910	0	8,910	95,664	86,754
2	2015	0	11,729	0	11,729	108,566	96,837
3	2016	0	14,615	0	14,615	121,469	106,854
4	2017	0	3,952	210,510	214,462	134,371	-80,091
5	2018	0	4,649	210,510	215,159	147,274	-67,885
6	2019	0	6,476	0	6,476	160,176	153,700
7	2020	0	10,354	0	10,354	196,193	185,839
8	2021	0	13,792	0	13,792	232,211	218,419
9	2022	0	9,172	69,736	78,908	268,228	189,320
10	2023	0	11,361	69,736	81,097	304,246	223,149
11	2024	0	372	210,510	210,882	340,263	129,381
12	2025	0	1,395	210,510	211,905	376,280	164,376
13	2026	0	3,454	0	3,454	412,298	408,844
14	2027	0	7,332	0	7,332	448,315	440,983
15	2028	0	10,770	0	10,770	484,333	473,563
16	2029	0	9,172	69,736	78,908	520,350	441,442
17	2030	0	11,361	69,736	81,097	556,367	475,271
18	2031	0	372	210,510	210,882	592,385	381,503
19	2032	0	1,395	210,510	211,905	628,402	416,497
20	2033	0	3,454	0	3,454	664,420	660,966
21	2034	0	7,332	0	7,332	700,437	693,105
22	2035	0	10,770	0	10,770	736,454	725,685
23	2036	0	9,172	69,736	78,908	772,472	693,564
24	2037	0	11,361	69,736	81,097	808,489	727,393
25	2038	0	372	210,510	210,882	844,507	633,625
26	2039	0	1,395	210,510	211,905	880,524	668,619
27	2040	0	3,454	0	3,454	916,541	913,087
28	2041	0	7,332	0	7,332	952,559	945,226
29	2042	0	12,978	33,316	46,295	988,576	942,282
30	2043	0	13,749	129,705	143,454	1,024,594	881,139
Total		418,414	229,302	2,686,535	3,334,251	15,416,964	12,082,713

EIRR	15.0%
NPV(*) (Rp.Million)	-1,869
B/C(*)	1.00

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 2-2)

Case No.	8
Package	TS-2-2

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	474,528	0	113,491	588,019	0	-588,019
	2011	474,528	0	113,491	588,019	0	-588,019
	2012	474,528	3,072	0	477,601	0	-477,601
	2013	474,528	9,567	0	484,096	0	-484,096
1	2014	0	14,381	0	14,381	450,601	436,220
2	2015	0	19,361	0	19,361	481,604	462,244
3	2016	0	23,949	0	23,949	512,608	488,659
4	2017	0	21,613	113,491	135,104	543,611	408,507
5	2018	0	25,444	113,491	138,935	574,615	435,680
6	2019	0	29,885	0	29,885	605,618	575,733
7	2020	0	35,011	0	35,011	641,659	606,648
8	2021	0	40,298	0	40,298	677,700	637,402
9	2022	0	4,960	586,591	591,551	713,741	122,190
10	2023	0	7,690	90,531	98,221	749,782	651,561
11	2024	0	6,504	113,491	119,995	785,823	665,828
12	2025	0	11,205	113,491	124,696	821,864	697,168
13	2026	0	15,948	0	15,948	857,905	841,957
14	2027	0	21,693	0	21,693	893,946	872,253
15	2028	0	8,640	496,060	504,699	929,987	425,288
16	2029	0	6,485	90,531	97,016	966,028	869,012
17	2030	0	12,187	90,531	102,718	1,002,069	899,351
18	2031	0	9,877	113,491	123,368	1,038,110	914,742
19	2032	0	14,130	113,491	127,621	1,074,151	946,530
20	2033	0	19,045	0	19,045	1,110,192	1,091,147
21	2034	0	6,278	496,060	502,337	1,146,233	643,896
22	2035	0	10,164	0	10,164	1,182,274	1,172,110
23	2036	0	10,982	90,531	101,513	1,218,315	1,116,802
24	2037	0	15,560	90,531	106,091	1,254,356	1,148,265
25	2038	0	12,802	113,491	126,294	1,290,397	1,164,103
26	2039	0	17,227	113,491	130,718	1,326,438	1,195,720
27	2040	0	3,629	496,060	499,688	1,362,479	862,791
28	2041	0	7,802	0	7,802	1,398,520	1,390,718
29	2042	0	17,303	39,852	57,155	1,434,561	1,377,406
30	2043	0	19,830	162,265	182,095	1,470,602	1,288,507
Total		1,898,113	482,523	3,864,453	6,245,089	28,515,789	22,270,700

EIRR	18.6%
NPV(*) (Rp.Million)	367,198
B/C(*)	1.29

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 2-3)

Case No.	9
Package	TS-2-3

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	74,416	0	2,145	76,561	0	-76,561
	2011	74,416	0	2,145	76,561	0	-76,561
	2012	74,416	492	0	74,908	0	-74,908
	2013	74,416	1,332	0	75,748	0	-75,748
1	2014	0	1,835	0	1,835	53,127	51,292
2	2015	0	2,498	0	2,498	57,269	54,772
3	2016	0	3,167	0	3,167	61,412	58,245
4	2017	0	3,681	2,145	5,826	65,554	59,728
5	2018	0	4,321	2,145	6,466	69,697	63,231
6	2019	0	4,973	0	4,973	73,839	68,866
7	2020	0	5,653	0	5,653	77,982	72,329
8	2021	0	6,316	0	6,316	82,124	75,808
9	2022	0	97	120,026	120,123	86,266	-33,857
10	2023	0	462	0	462	90,409	89,947
11	2024	0	1,440	2,145	3,585	94,551	90,966
12	2025	0	2,080	2,145	4,226	98,694	94,468
13	2026	0	2,733	0	2,733	102,836	100,104
14	2027	0	3,572	0	3,572	106,979	103,406
15	2028	0	74	120,026	120,100	111,121	-8,979
16	2029	0	433	0	433	115,263	114,830
17	2030	0	1,566	0	1,566	119,406	117,840
18	2031	0	2,080	2,145	4,226	123,548	119,323
19	2032	0	2,721	2,145	4,866	127,691	122,825
20	2033	0	3,533	0	3,533	131,833	128,300
21	2034	0	51	120,026	120,077	135,976	15,898
22	2035	0	410	0	410	140,118	139,708
23	2036	0	1,538	0	1,538	144,260	142,723
24	2037	0	2,206	0	2,206	148,403	146,197
25	2038	0	2,721	2,145	4,866	152,545	147,680
26	2039	0	3,521	2,145	5,666	156,688	151,022
27	2040	0	12	120,026	120,038	160,830	40,792
28	2041	0	388	0	388	164,973	164,585
29	2042	0	2,226	10,726	12,951	169,115	156,164
30	2043	0	3,651	19,306	22,958	173,257	150,300
Total		297,664	71,782	531,587	901,033	3,395,766	2,494,733

EIRR	16.6%
NPV(*) (Rp.Million)	21,360
B/C(*)	1.12

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 3-1)

Case No.	10
Package	TS-3-1

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	425,708	0	141,039	566,747	0	-566,747
	2011	425,708	0	141,039	566,747	0	-566,747
	2012	425,708	3,146	0	428,853	0	-428,853
	2013	425,708	9,914	0	435,621	0	-435,621
1	2014	0	14,622	0	14,622	391,778	377,156
2	2015	0	19,664	0	19,664	454,989	435,325
3	2016	0	24,570	0	24,570	518,200	493,630
4	2017	0	20,263	141,039	161,302	581,412	420,109
5	2018	0	23,845	141,039	164,884	644,623	479,739
6	2019	0	28,198	0	28,198	707,834	679,636
7	2020	0	33,793	0	33,793	771,045	737,252
8	2021	0	39,073	0	39,073	834,256	795,184
9	2022	0	6,401	572,999	579,400	897,468	318,067
10	2023	0	9,513	77,846	87,360	960,679	873,319
11	2024	0	6,295	142,669	148,964	1,023,890	874,926
12	2025	0	10,534	142,669	153,203	1,087,101	933,898
13	2026	0	15,138	0	15,138	1,150,312	1,135,175
14	2027	0	21,365	0	21,365	1,213,524	1,192,159
15	2028	0	9,001	495,153	504,154	1,276,735	772,581
16	2029	0	7,778	77,846	85,624	1,339,946	1,254,322
17	2030	0	13,864	77,846	91,710	1,403,157	1,311,447
18	2031	0	9,392	142,669	152,061	1,466,368	1,314,307
19	2032	0	13,320	142,669	155,989	1,529,580	1,373,590
20	2033	0	18,231	0	18,231	1,592,791	1,574,560
21	2034	0	6,508	495,153	501,661	1,656,002	1,154,341
22	2035	0	10,456	0	10,456	1,719,213	1,708,757
23	2036	0	12,203	77,846	90,049	1,782,424	1,692,375
24	2037	0	16,961	77,846	94,808	1,845,636	1,750,828
25	2038	0	12,178	142,669	154,848	1,908,847	1,753,999
26	2039	0	16,414	142,669	159,083	1,972,058	1,812,975
27	2040	0	3,375	495,153	498,527	2,035,269	1,536,742
28	2041	0	7,963	0	7,963	2,098,480	2,090,517
29	2042	0	21,929	106,313	128,241	2,161,692	2,033,450
30	2043	0	29,906	269,209	299,115	2,224,903	1,925,788
Total		1,702,832	495,812	4,243,382	6,442,025	39,250,212	32,808,187

EIRR	21.2%
NPV(*) (Rp.Million)	727,360
B/C(*)	1.60

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 3-2)

Case No.	11
Package	TS-3-2

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost	Benefit	BALANCE
			Routine	Periodic	(C)	(B)	(B-C)
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	302,833	0	120,714	423,548	0	-423,548
	2011	302,833	0	120,714	423,548	0	-423,548
	2012	302,833	2,155	0	304,989	0	-304,989
	2013	302,833	6,949	0	309,783	0	-309,783
1	2014	0	10,856	0	10,856	159,876	149,020
2	2015	0	14,527	0	14,527	207,935	193,408
3	2016	0	17,805	0	17,805	255,993	238,188
4	2017	0	13,831	120,714	134,545	304,052	169,507
5	2018	0	16,294	120,714	137,009	352,110	215,102
6	2019	0	19,402	0	19,402	400,169	380,767
7	2020	0	23,244	0	23,244	462,042	438,798
8	2021	0	27,317	0	27,317	523,915	496,598
9	2022	0	5,231	383,769	389,000	585,788	196,788
10	2023	0	7,459	50,104	57,563	647,661	590,098
11	2024	0	4,193	120,714	124,907	709,534	584,627
12	2025	0	7,283	120,714	127,997	771,407	643,410
13	2026	0	10,557	0	10,557	833,280	822,723
14	2027	0	14,792	0	14,792	895,153	880,361
15	2028	0	6,696	333,665	340,361	957,026	616,665
16	2029	0	6,252	50,104	56,355	1,018,899	962,544
17	2030	0	10,364	50,104	60,467	1,080,772	1,020,305
18	2031	0	6,548	120,714	127,262	1,142,645	1,015,383
19	2032	0	9,246	120,714	129,960	1,204,518	1,074,558
20	2033	0	12,520	0	12,520	1,266,391	1,253,871
21	2034	0	4,585	333,665	338,251	1,328,264	990,013
22	2035	0	7,717	0	7,717	1,390,137	1,382,420
23	2036	0	9,156	50,104	59,260	1,452,010	1,392,750
24	2037	0	12,719	50,104	62,823	1,513,883	1,451,060
25	2038	0	8,511	120,714	129,225	1,575,756	1,446,531
26	2039	0	11,208	120,714	131,923	1,637,629	1,505,706
27	2040	0	2,314	333,665	335,979	1,699,502	1,363,523
28	2041	0	5,606	0	5,606	1,761,375	1,755,769
29	2042	0	10,621	0	10,621	1,823,248	1,812,627
30	2043	0	11,512	50,104	61,616	1,885,121	1,823,505
Total		1,211,334	337,468	2,892,532	4,441,334	29,846,091	25,404,757

EIRR	18.6%
NPV(*) (Rp.Million)	341,769
B/C(*)	1.39

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 4-1)

Case No.	12
Package	TS-4-1

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost	Benefit	BALANCE
			Routine	Periodic	(C)	(B)	(B-C)
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	401,487	0	37,419	438,906	0	-438,906
	2011	401,487	0	37,419	438,906	0	-438,906
	2012	401,487	2,196	0	403,683	0	-403,683
	2013	401,487	6,749	0	408,236	0	-408,236
1	2014	0	10,213	0	10,213	190,036	179,823
2	2015	0	13,827	0	13,827	211,658	197,831
3	2016	0	16,962	0	16,962	233,280	216,318
4	2017	0	18,186	37,419	55,605	254,901	199,296
5	2018	0	21,424	37,419	58,843	276,523	217,680
6	2019	0	24,863	0	24,863	298,145	273,282
7	2020	0	28,173	0	28,173	322,240	294,067
8	2021	0	31,901	0	31,901	346,335	314,434
9	2022	0	1,628	494,964	496,592	370,430	-126,162
10	2023	0	3,285	79,299	82,584	394,525	311,941
11	2024	0	5,313	37,419	42,732	418,620	375,888
12	2025	0	9,410	37,419	46,830	442,715	395,885
13	2026	0	13,113	0	13,113	466,810	453,697
14	2027	0	16,913	0	16,913	490,905	473,992
15	2028	0	5,481	415,665	421,146	515,000	93,854
16	2029	0	2,900	79,299	82,199	539,095	456,896
17	2030	0	6,904	79,299	86,203	563,190	476,987
18	2031	0	8,247	37,419	45,667	587,285	541,618
19	2032	0	11,855	37,419	49,275	611,380	562,105
20	2033	0	15,558	0	15,558	635,475	619,917
21	2034	0	4,198	415,665	419,863	659,570	239,707
22	2035	0	6,753	0	6,753	683,665	676,912
23	2036	0	6,518	79,299	85,817	707,760	621,943
24	2037	0	9,838	79,299	89,137	731,855	642,718
25	2038	0	10,692	37,419	48,112	755,950	707,838
26	2039	0	14,300	37,419	51,720	780,045	728,325
27	2040	0	2,844	415,665	418,509	804,140	385,631
28	2041	0	5,470	0	5,470	828,235	822,765
29	2042	0	11,494	16,943	28,437	852,330	823,893
30	2043	0	11,780	109,796	121,576	876,425	754,849
Total		1,605,948	358,991	2,639,385	4,604,325	15,848,523	11,244,198

EIRR	13.1%
NPV(*) (Rp.Million)	-140,158
B/C(*)	0.85

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 4-2)

Case No.	13
Package	TS-4-2

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost	Benefit	BALANCE
			Routine	Periodic	(C)	(B)	(B-C)
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	236,598	0	92,752	329,350	0	-329,350
	2011	236,598	0	92,752	329,350	0	-329,350
	2012	236,598	1,914	0	238,512	0	-238,512
	2013	236,598	5,798	0	242,396	0	-242,396
1	2014	0	8,425	0	8,425	195,023	186,598
2	2015	0	11,305	0	11,305	207,629	196,324
3	2016	0	14,223	0	14,223	220,235	206,012
4	2017	0	11,105	92,752	103,857	232,841	128,984
5	2018	0	13,043	92,752	105,795	245,447	139,652
6	2019	0	15,481	0	15,481	258,053	242,572
7	2020	0	18,841	0	18,841	264,638	245,797
8	2021	0	21,961	0	21,961	271,223	249,262
9	2022	0	4,060	332,701	336,761	277,808	-58,953
10	2023	0	5,898	33,494	39,391	284,393	245,002
11	2024	0	3,766	92,752	96,518	290,978	194,460
12	2025	0	5,876	92,752	98,629	297,563	198,934
13	2026	0	8,426	0	8,426	304,148	295,722
14	2027	0	12,183	0	12,183	310,733	298,550
15	2028	0	4,906	299,207	304,113	317,318	13,205
16	2029	0	4,902	33,494	38,395	323,903	285,508
17	2030	0	8,644	33,494	42,137	330,488	288,351
18	2031	0	5,385	92,752	98,137	337,073	238,936
19	2032	0	7,480	92,752	100,232	343,658	243,426
20	2033	0	10,410	0	10,410	350,243	339,833
21	2034	0	3,389	299,207	302,596	356,828	54,232
22	2035	0	5,747	0	5,747	363,413	357,666
23	2036	0	7,648	33,494	41,141	369,998	328,857
24	2037	0	10,263	33,494	43,757	376,583	332,826
25	2038	0	6,988	92,752	99,741	383,168	283,427
26	2039	0	9,464	92,752	102,216	389,753	287,537
27	2040	0	1,617	299,207	300,824	396,338	95,514
28	2041	0	4,230	0	4,230	402,923	398,693
29	2042	0	10,171	25,307	35,478	409,508	374,030
30	2043	0	12,744	79,047	91,791	416,093	324,302
Total		946,392	276,290	2,429,666	3,652,348	9,528,000	5,875,652

EIRR	13.5%
NPV(*) (Rp.Million)	-65,376
B/C(*)	0.91

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 5-1)

Case No.	14
Package	TS-5-1

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost	Benefit	BALANCE
			Routine	Periodic	(C)	(B)	(B-C)
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	218,782	0	0	218,782	0	-218,782
	2011	218,782	0	0	218,782	0	-218,782
	2012	218,782	1,129	0	219,911	0	-219,911
	2013	218,782	3,388	0	222,170	0	-222,170
1	2014	0	5,209	0	5,209	103,830	98,621
2	2015	0	7,077	0	7,077	111,326	104,249
3	2016	0	8,598	0	8,598	118,821	110,224
4	2017	0	10,465	0	10,465	126,317	115,852
5	2018	0	12,332	0	12,332	133,812	121,481
6	2019	0	14,199	0	14,199	141,308	127,109
7	2020	0	15,720	0	15,720	148,804	133,084
8	2021	0	17,587	0	17,587	156,299	138,712
9	2022	0	0	307,799	307,799	163,795	-144,004
10	2023	0	900	13,716	14,616	171,290	156,675
11	2024	0	3,533	0	3,533	178,786	175,253
12	2025	0	5,810	0	5,810	187,399	181,589
13	2026	0	7,723	0	7,723	196,427	188,704
14	2027	0	9,590	0	9,590	205,889	196,299
15	2028	0	732	294,083	294,814	215,808	-79,007
16	2029	0	900	13,716	14,616	226,204	211,588
17	2030	0	3,460	13,716	17,176	237,101	219,925
18	2031	0	5,609	0	5,609	248,523	242,914
19	2032	0	7,540	0	7,540	260,496	252,956
20	2033	0	9,453	0	9,453	273,045	263,592
21	2034	0	594	294,083	294,677	286,198	-8,479
22	2035	0	1,631	0	1,631	299,986	298,355
23	2036	0	3,460	13,716	17,176	314,437	297,261
24	2037	0	5,536	13,716	19,252	329,585	310,333
25	2038	0	7,339	0	7,339	345,462	338,123
26	2039	0	9,270	0	9,270	362,104	352,835
27	2040	0	457	294,083	294,540	379,548	85,008
28	2041	0	1,494	0	1,494	397,833	396,339
29	2042	0	4,191	0	4,191	416,998	412,807
30	2043	0	5,536	13,716	19,252	437,086	417,835
Total		875,127	190,458	1,272,343	2,337,928	7,174,516	4,836,588

EIRR	12.0%
NPV(*) (Rp.Million)	-108,797
B/C(*)	0.78

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 5-2)

Case No.	15
Package	TS-5-2

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	202,856	0	156,863	359,719	22,269	-337,451
	2011	202,856	0	156,863	359,719	24,375	-335,344
	2012	202,856	1,703	0	204,559	26,680	-177,879
	2013	202,856	5,814	0	208,670	29,204	-179,466
1	2014	0	8,753	0	8,753	31,966	23,213
2	2015	0	11,715	0	11,715	36,661	24,946
3	2016	0	14,706	0	14,706	41,356	26,650
4	2017	0	7,571	156,863	164,434	46,052	-118,382
5	2018	0	8,930	156,863	165,793	50,747	-115,047
6	2019	0	11,133	0	11,133	55,442	44,309
7	2020	0	14,884	0	14,884	60,137	45,253
8	2021	0	18,270	0	18,270	64,832	46,562
9	2022	0	7,458	128,970	136,428	69,528	-66,901
10	2023	0	9,178	128,970	138,148	74,223	-63,925
11	2024	0	688	163,422	164,110	78,918	-85,192
12	2025	0	2,579	163,422	166,001	86,382	-79,619
13	2026	0	5,179	0	5,179	94,553	89,374
14	2027	0	8,980	0	8,980	103,496	94,515
15	2028	0	12,367	0	12,367	113,285	100,918
16	2029	0	7,143	128,970	136,114	124,000	-12,114
17	2030	0	8,880	128,970	137,851	135,728	-2,123
18	2031	0	688	163,422	164,110	148,565	-15,544
19	2032	0	2,579	163,422	166,001	162,617	-3,384
20	2033	0	5,179	0	5,179	177,998	172,819
21	2034	0	8,980	0	8,980	194,834	185,853
22	2035	0	12,367	0	12,367	213,262	200,895
23	2036	0	7,143	128,970	136,114	233,433	97,319
24	2037	0	8,880	128,970	137,851	255,511	117,661
25	2038	0	688	163,422	164,110	279,678	115,569
26	2039	0	2,579	163,422	166,001	306,131	140,130
27	2040	0	5,179	0	5,179	335,086	329,907
28	2041	0	8,980	0	8,980	366,780	357,799
29	2042	0	13,480	16,791	30,271	401,471	371,200
30	2043	0	9,450	159,193	168,644	439,443	270,800
Total		811,425	252,105	2,557,789	3,621,319	4,884,642	1,263,322

EIRR	2.8%
NPV(*) (Rp.Million)	-495,547
B/C(*)	0.31

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 5-3)

Case No.	16
Package	TS-5-3

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	123,066	0	22,334	145,400	20,734	-124,666
	2011	123,066	0	22,334	145,400	24,499	-120,901
	2012	123,066	515	0	123,581	28,264	-95,317
	2013	123,066	1,635	0	124,700	32,028	-92,672
1	2014	0	2,518	0	2,518	35,793	33,275
2	2015	0	3,651	0	3,651	39,395	35,744
3	2016	0	4,658	0	4,658	42,998	38,340
4	2017	0	4,314	22,334	26,648	46,600	19,952
5	2018	0	5,161	22,334	27,495	50,203	22,708
6	2019	0	6,127	0	6,127	53,805	47,678
7	2020	0	7,301	0	7,301	60,254	52,953
8	2021	0	8,445	0	8,445	66,702	58,257
9	2022	0	3,180	59,398	62,578	73,151	10,573
10	2023	0	3,656	59,398	63,054	79,599	16,545
11	2024	0	317	46,033	46,350	86,048	39,698
12	2025	0	1,188	46,033	47,221	92,497	45,276
13	2026	0	2,232	0	2,232	98,945	96,713
14	2027	0	3,589	0	3,589	105,394	101,804
15	2028	0	4,734	0	4,734	111,842	107,108
16	2029	0	2,042	59,398	61,440	118,291	56,851
17	2030	0	2,581	59,398	61,980	124,740	62,760
18	2031	0	317	46,033	46,350	131,188	84,838
19	2032	0	1,188	46,033	47,221	137,637	90,416
20	2033	0	2,232	0	2,232	144,085	141,854
21	2034	0	3,589	0	3,589	150,534	146,945
22	2035	0	4,734	0	4,734	156,983	152,249
23	2036	0	2,042	59,398	61,440	163,431	101,991
24	2037	0	2,581	59,398	61,980	169,880	107,900
25	2038	0	317	46,033	46,350	176,328	129,979
26	2039	0	1,188	46,033	47,221	182,777	135,556
27	2040	0	2,232	0	2,232	189,226	186,994
28	2041	0	3,589	0	3,589	195,674	192,085
29	2042	0	4,734	0	4,734	202,123	197,389
30	2043	0	2,042	59,398	61,440	208,571	147,131
Total		492,262	98,629	781,322	1,372,213	3,600,219	2,228,006

EIRR	10.2%
NPV(*) (Rp.Million)	-91,422
B/C(*)	0.70

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 5-4)

Case No.	17
Package	TS-5-4

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	159,404	0	227,558	386,962	29,605	-357,357
	2011	159,404	0	227,558	386,962	33,607	-353,355
	2012	159,404	1,923	0	161,327	37,608	-123,719
	2013	159,404	6,685	0	166,089	41,609	-124,480
1	2014	0	10,422	0	10,422	45,610	35,188
2	2015	0	13,761	0	13,761	53,498	39,737
3	2016	0	17,107	0	17,107	61,386	44,279
4	2017	0	6,022	227,558	233,580	69,274	-164,306
5	2018	0	7,085	227,558	234,643	77,162	-157,481
6	2019	0	9,362	0	9,362	85,050	75,688
7	2020	0	13,769	0	13,769	94,192	80,422
8	2021	0	17,861	0	17,861	103,334	85,473
9	2022	0	9,865	106,269	116,134	112,475	-3,659
10	2023	0	12,147	106,269	118,417	121,617	3,201
11	2024	0	567	227,558	228,125	130,759	-97,366
12	2025	0	2,125	227,558	229,683	142,505	-87,178
13	2026	0	4,756	0	4,756	155,307	150,550
14	2027	0	9,164	0	9,164	169,258	160,094
15	2028	0	13,256	0	13,256	184,463	171,207
16	2029	0	9,865	106,269	116,134	201,034	84,899
17	2030	0	12,147	106,269	118,417	219,093	100,676
18	2031	0	567	227,558	228,125	238,774	10,650
19	2032	0	2,125	227,558	229,683	260,224	30,541
20	2033	0	4,756	0	4,756	283,600	278,844
21	2034	0	9,164	0	9,164	309,077	299,912
22	2035	0	13,256	0	13,256	336,841	323,586
23	2036	0	9,865	106,269	116,134	367,101	250,966
24	2037	0	12,147	106,269	118,417	400,078	281,661
25	2038	0	567	227,558	228,125	436,018	207,893
26	2039	0	2,125	227,558	229,683	475,186	245,502
27	2040	0	4,756	0	4,756	517,873	513,116
28	2041	0	9,164	0	9,164	564,394	555,230
29	2042	0	13,256	0	13,256	615,094	601,839
30	2043	0	9,865	106,269	116,134	670,349	554,215
Total		637,616	269,503	3,019,465	3,926,585	7,643,054	3,716,470

EIRR	6.3%
NPV(*) (Rp.Million)	-411,539
B/C(*)	0.45

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 5-5)

Case No.	18
Package	TS-5-5

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	99,079	0	23,403	122,482	0	-122,482
	2011	99,079	0	23,403	122,482	0	-122,482
	2012	99,079	679	0	99,758	0	-99,758
	2013	99,079	2,145	0	101,224	0	-101,224
1	2014	0	3,277	0	3,277	48,731	45,454
2	2015	0	4,414	0	4,414	54,993	50,579
3	2016	0	5,422	0	5,422	61,255	55,832
4	2017	0	5,047	23,403	28,450	67,516	39,066
5	2018	0	5,946	23,403	29,349	73,778	44,429
6	2019	0	6,972	0	6,972	80,040	73,068
7	2020	0	8,091	0	8,091	90,036	81,944
8	2021	0	9,290	0	9,290	100,031	90,742
9	2022	0	1,024	138,992	140,016	110,027	-29,989
10	2023	0	1,638	19,764	21,402	120,022	98,620
11	2024	0	1,508	23,403	24,911	130,018	105,107
12	2025	0	2,640	23,403	26,043	140,014	113,971
13	2026	0	3,731	0	3,731	150,009	146,279
14	2027	0	4,991	0	4,991	160,005	155,014
15	2028	0	1,841	119,228	121,069	170,000	48,932
16	2029	0	1,388	19,764	21,152	179,996	158,844
17	2030	0	2,676	19,764	22,440	189,992	167,551
18	2031	0	2,350	23,403	25,753	199,987	174,235
19	2032	0	3,341	23,403	26,744	209,983	183,239
20	2033	0	4,432	0	4,432	219,978	215,547
21	2034	0	1,344	119,228	120,572	229,974	109,402
22	2035	0	2,205	0	2,205	239,970	237,764
23	2036	0	2,426	19,764	22,190	249,965	227,775
24	2037	0	3,518	19,764	23,282	259,961	236,679
25	2038	0	3,051	23,403	26,454	269,956	243,502
26	2039	0	4,042	23,403	27,445	279,952	252,507
27	2040	0	785	119,228	120,013	289,948	169,934
28	2041	0	1,708	0	1,708	299,943	298,235
29	2042	0	3,243	0	3,243	309,939	306,696
30	2043	0	3,268	19,764	23,032	319,934	296,902
Total		396,316	108,434	849,290	1,354,040	5,305,953	3,951,913

EIRR	14.0%
NPV(*) (Rp.Million)	-22,998
B/C(*)	0.91

(*): Discount Rate = 15%

Source: JICA Study Team

Cost Benefit Streams (Package No. TS 5-6)

Case No.	19
Package	TS-5-6

(Rp.Million)

No.	Year	Project Cost	O & M		Total Cost (C)	Benefit (B)	BALANCE (B-C)
			Routine	Periodic			
	2007	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2009	0	0	0	0	0	0
	2010	148,500	0	0	148,500	0	-148,500
	2011	148,500	0	0	148,500	0	-148,500
	2012	148,500	405	0	148,905	0	-148,905
	2013	148,500	1,080	0	149,580	0	-149,580
1	2014	0	1,485	0	1,485	3,910	2,425
2	2015	0	2,025	0	2,025	5,905	3,880
3	2016	0	2,565	0	2,565	7,901	5,336
4	2017	0	3,105	0	3,105	9,896	6,791
5	2018	0	3,645	0	3,645	11,892	8,247
6	2019	0	4,185	0	4,185	13,887	9,702
7	2020	0	4,725	0	4,725	15,882	11,157
8	2021	0	5,265	0	5,265	17,878	12,613
9	2022	0	0	101,250	101,250	19,873	-81,377
10	2023	0	284	0	284	21,869	21,585
11	2024	0	1,215	0	1,215	23,864	22,649
12	2025	0	1,755	0	1,755	28,596	26,841
13	2026	0	2,295	0	2,295	34,265	31,970
14	2027	0	2,970	0	2,970	41,059	38,089
15	2028	0	0	101,250	101,250	49,201	-52,049
16	2029	0	284	0	284	58,956	58,672
17	2030	0	1,215	0	1,215	70,645	69,430
18	2031	0	1,755	0	1,755	84,652	82,897
19	2032	0	2,295	0	2,295	101,437	99,142
20	2033	0	2,970	0	2,970	121,549	118,579
21	2034	0	0	101,250	101,250	145,650	44,400
22	2035	0	284	0	284	174,529	174,245
23	2036	0	1,215	0	1,215	209,133	207,918
24	2037	0	1,755	0	1,755	250,599	248,844
25	2038	0	2,295	0	2,295	300,287	297,992
26	2039	0	2,970	0	2,970	359,826	356,856
27	2040	0	0	101,250	101,250	431,171	329,921
28	2041	0	284	0	284	516,662	516,378
29	2042	0	1,215	0	1,215	619,103	617,888
30	2043	0	1,755	0	1,755	741,856	740,101
Total		594,000	57,294	405,000	1,056,294	4,491,934	3,435,640

EIRR	7.5%
NPV(*) (Rp.Million)	-224,952
B/C(*)	0.26

(*): Discount Rate = 15%

Source: JICA Study Team

Appendix 10

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

Appendix 10 A Study on Local Road Rehabilitation and Asbuton Utilization for Regional Development Support

1 Introduction

1.1 Background

The JICA Study Team has conducted the Arterial Road Network Development Plan 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.

In the Manado workshop in June 2007 and the Makassar Seminar in December 2007, some provinces proposed to include Kabupaten roads (local roads) and their development plan in the study. 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 polices.

According to the Study, high poverty areas are located in isolated inland and island areas as seen in the right figure (blue dots). As many areas located at where access by national/provincial roads (blue lines in **Figure A.10.1-1**) are difficult, local road (Kabupaten roads) rehabilitation is very important to improve the access to public services including school, hospitals, administrative offices, markets, etc. For example, though 9% (1.4 million) of the Sulawesi population live in islands, their access means are very limited. The local roads are also important for transport of agricultural and fishery products to markets or ports. Local road facility improvement combined with local port facilities would be one of the urgent issues taken care by the government.

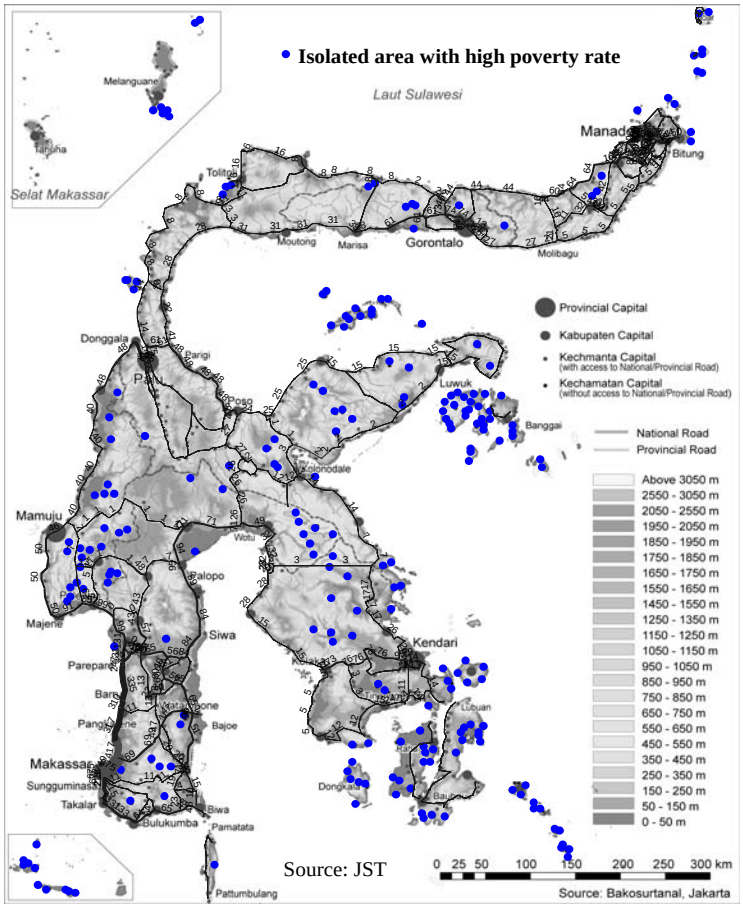


Figure A.10.1-1 Distribution of High Poverty Ratio

Approximately 600 million ton of Asbuton (Natural Asphalt) is deposited in Buton Island in Southeast Sulawesi Province. Asbuton was used for pavement throughout the country in 1980s. The oil-based asphalt became more popular for the pavement in

1990s because of its stable quality and cheaper costs. However, Asbuton has gained price advantage in the recent oil price increase since 2005. The Study Team suggested utilizing the Asbuton for regional development of the southern part of Southeast Sulawesi where many poor areas are located.

This study will make local road rehabilitation implementation plan for regional development support while utilizing Asbuton in Buton Island.

1.2 Objectives and Scope of the Study

The major objectives of the study are:

i) To formulate local road rehabilitation concept and implementation plan, and

ii) To suggest Asbuton utilization plan and its impact study on regional development and economy.

The study is expected to contribute to the poverty reduction through regional development. In particular, the study is expected to suggest a pilot regional development case in the Buton Island area.

The total length of Kabupaten road is 44,000 km. The study will make rehabilitation framework for poor and bad condition road estimated at 20,000 km and/or unpaved roads of 26,000 km.

Sample study has been conducted for representative 10 Kabupaten (regency) / Kota (municipality), including those in Buton Island, selected from the total 69 local governments.

The scope of study includes:

1) Collection and analysis of the existing socio-economic data including land use and products for selected Kabupaten and Kota
2) Existing condition of Kabupaten roads
3) Road and bridge condition survey by site reconnaissance and information collection from provincial and local governments
4) Study of the on-going EIRTP-2, including project implementation system, cost, financing, problems and measures
5) Collection of information on Asbuton, including deposit, production, access, technical specifications, price, national and regional polices and key issues
6) Impact study on regional development and economy
7) Formulation of Kabupaten road rehabilitation concept and maintenance plan
8) Formation of Kabupaten Road Rehabilitation Project Implementation Framework, covering 20,000 km (or 26,000 km)
9) Conclusion and recommendations
10) Report preparation.

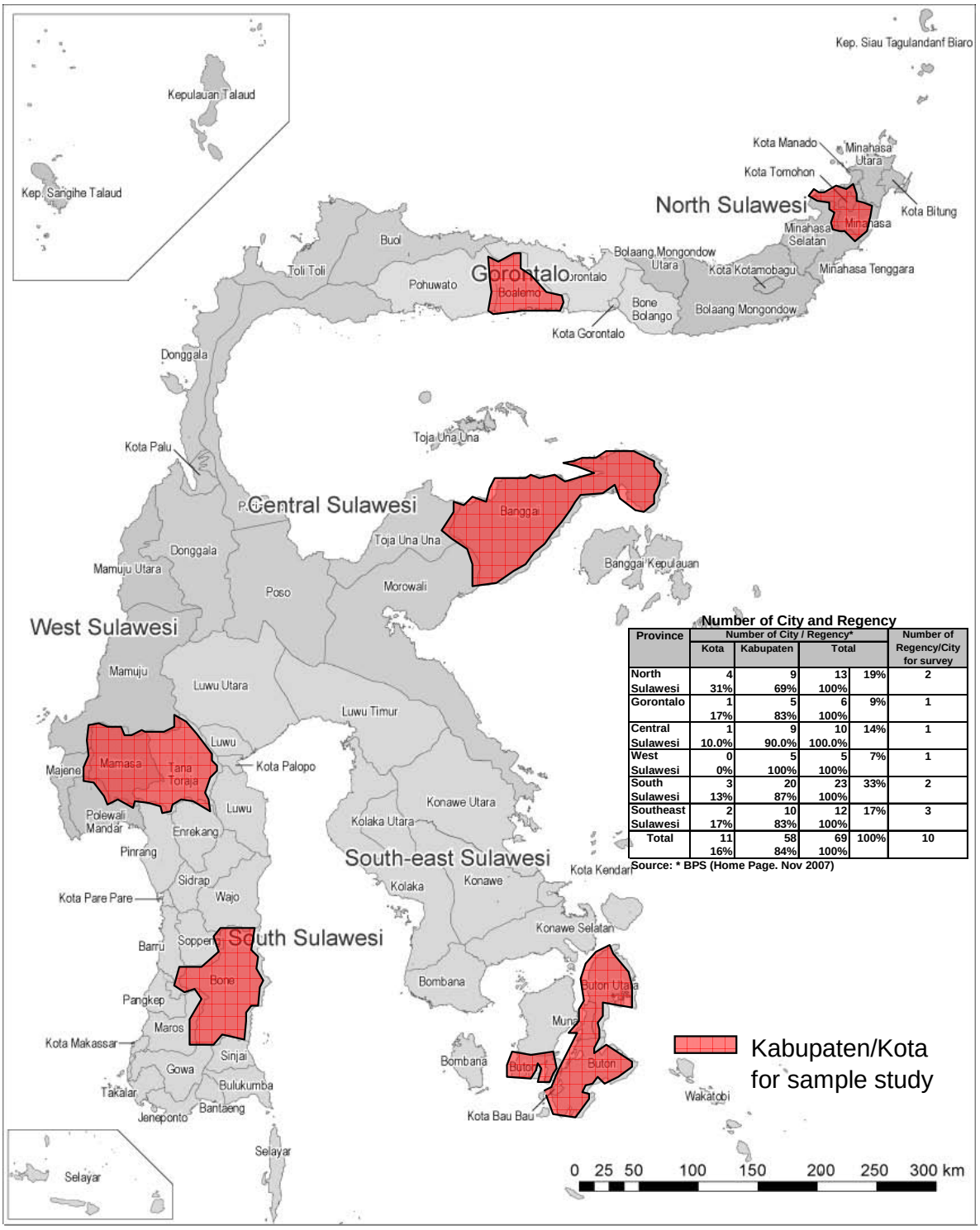
1.3 Selection of Kabupatens for Sample Study

The Study Team selected sample Kabupaten and Kota with consultation of provincial governments as shown in **Table A.10.1-1** and **Figure A.10.1-2**.

Table A.10.1-1 Cities and Regencies for Sample Study

Province	Kabupaten / Kota selected for Sample Study	Reason of Selection on Key Region Resources
North Sulawesi	1.Kota Tomohon	Regional activity center, inland activity center
	2.Minahasa	Tourism and coconuts production (Bio Diesel Fuel Potential)
Gorontalo	3.Boaremo	Corn production
Central Sulawesi	4.Banggai	Luwuk, natural gas development hinterland
West Sulawesi	5.Mamasa	Cacao production, inland Kabupaten
South Sulawesi	6.Bone	Rise and Cacao production, fishery, Bajoe ferry port
	7.Tana Toraja	Tourism support, coffee production
Southeast Sulawesi	8.Buton	Asbuton development, island, cashew nut
	9.Kota Baubau	Regional activity center and hub port
	10.Buton Utara（including part of Kabupaten Muha in Buton Island）	Island, difficult access

The Study Team visited provinces, selected regencies and cities on the above list 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.



Number of City and Regency

Province	Number of City / Regency*				Number of Regency/City for survey
	Kota	Kabupaten	Total		
North Sulawesi	4 31%	9 69%	13 100%	19%	2
Gorontalo	1 17%	5 83%	6 100%	9%	1
Central Sulawesi	1 10.0%	9 90.0%	10 100.0%	14%	1
West Sulawesi	0 0%	5 100%	5 100%	7%	1
South Sulawesi	3 13%	20 87%	23 100%	33%	2
Southeast Sulawesi	2 17%	10 83%	12 100%	17%	3
Total	11 16%	58 84%	69 100%	100%	10

Source: * BPS (Home Page. Nov 2007)

Figure A.10.1-2 Regency/City Administration Map for Sample Study

2 Socio-economic Condition

2.1 Regional Development Policy

The regional development policy for the local road development will meet the mission of RPJPN 2005-2025 and RPJMN 2004-2009. The local road development is expected to contribute to reducing regional disparity and poverty by improving access to various socio-economic facilities and opportunities while increasing incomes. The development of Sulawesi is expected as a spearhead for the development of the eastern region of Indonesia. The following **Figure A.10.2-1** shows a basic concept of the regional development plan and relation of the local road development and rehabilitation.

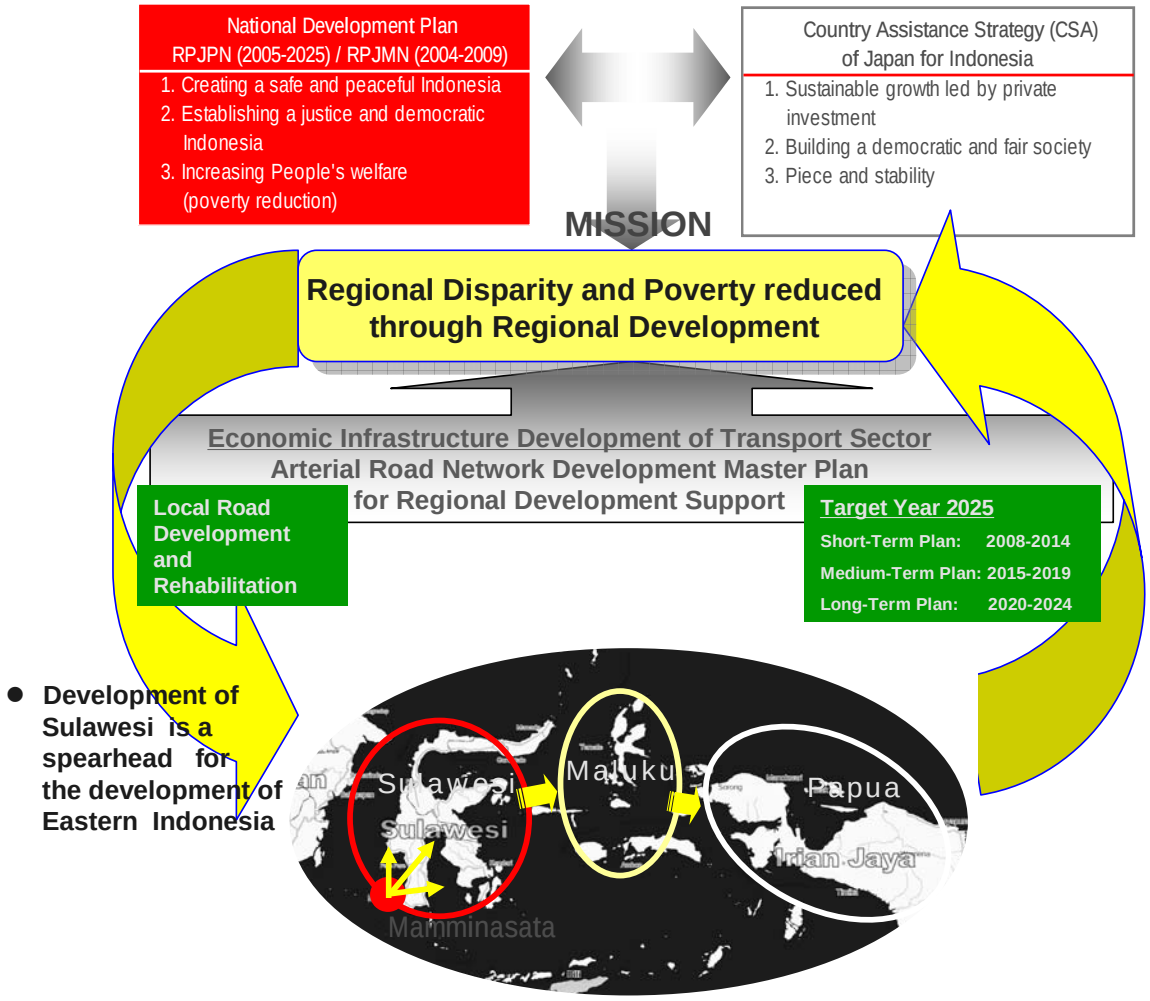


Figure A.10.2-1 Basic Concept of Regional Development Plan

2.2 Socio-economic Condition and Development Framework

(1) Population and Density

In 2005, the population of Sulawesi was 15,981,056, which is about 7.30% of Indonesia's total population. Population density in the island was 81.2 /km^2, lower than the national average of 115.8 /km^2 and higher than the outer-island average of 51.3 /km^2. Makassar is the biggest city in Sulawesi with a population of 1,195 thousand, followed by Manado with 406 thousand, Palu with 291 thousand, Kendari with 236 thousand, Gorontalo with 153 thousand, and Palopo with 129 thousand.

Population density was particularly higher in the southern part of South Sulawesi and the eastern part of North Sulawesi, it was lower in Central Sulawesi and Gorontalo. Makassar City had the highest population density with 7,749/km^2, followed by Gorontalo City with 2,557/km^2 and Manado City with 2,440/km^2.

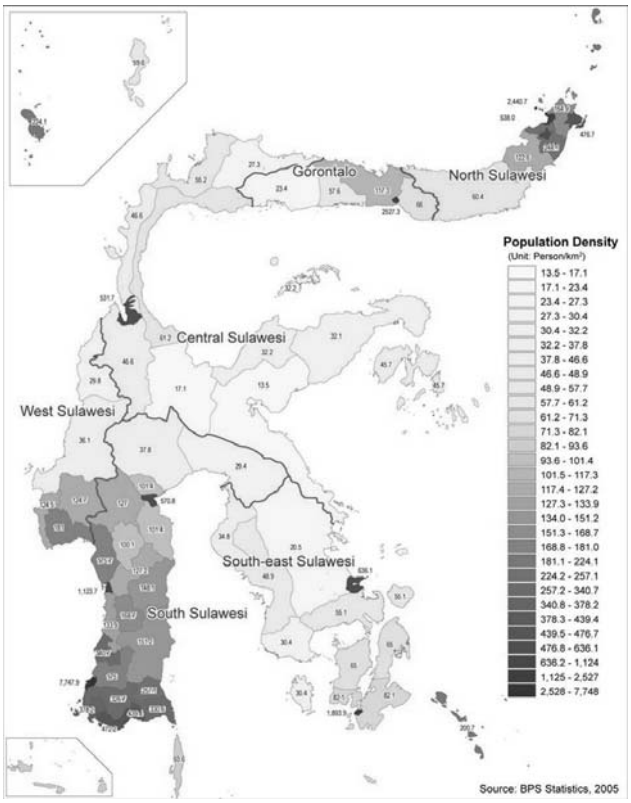


Figure A.10.2-2 Population Density by Regency/City

(2) Distribution of Poverty

According to the National Socio-economic Survey, the poverty ratio in Sulawesi was 18.9% in 2002, almost similar to the national average (18.2%) for the same year. The poverty ratios in Central Sulawesi, Gorontalo, southern West Sulawesi, and Southeast Sulawesi are higher than other areas. Particularly, the poverty ratio in Gorontalo (29.7% on average) was the highest among the provinces in Sulawesi. The poverty ratio in North Sulawesi (11.2% on average) and South Sulawesi (14.7%) was lower than the national average.

(3) Regional Economy and Industrial Structure

In 2005, total GRDP of Sulawesi was Rp 73,089 billion (in constant prices since 2000) contributing only 4.2% to the country's GDP (Rp 1,749,546 billion) while its population accounted for 7.30% of Indonesia's total population. Agriculture (including plantations, fishery, forestry, and livestock) plays a vital role in the economy of Sulawesi, contributing 9.7% to the national total for agriculture. On the other hand, manufacturing and financial/business respectively account for only 1.6% and 2.6% of the national total for these sectors.

Figure A.10.2-3 illustrates the amount of GRDP for each province and its proportion. The size of the diameter indicates the amount of GRDP. As shown in the figure, the GRDP of South Sulawesi is the outstanding in Sulawesi. Its GRDP solely accounted for more than half (57.8%) of the total GRDP of Sulawesi. North Sulawesi had 16.8%, Central Sulawesi 14.36%, and Southeast Sulawesi 10.3%. On the other hand, West Sulawesi and Gorontalo shared only 4.2% and 2.6% of the island's GRDP, respectively.

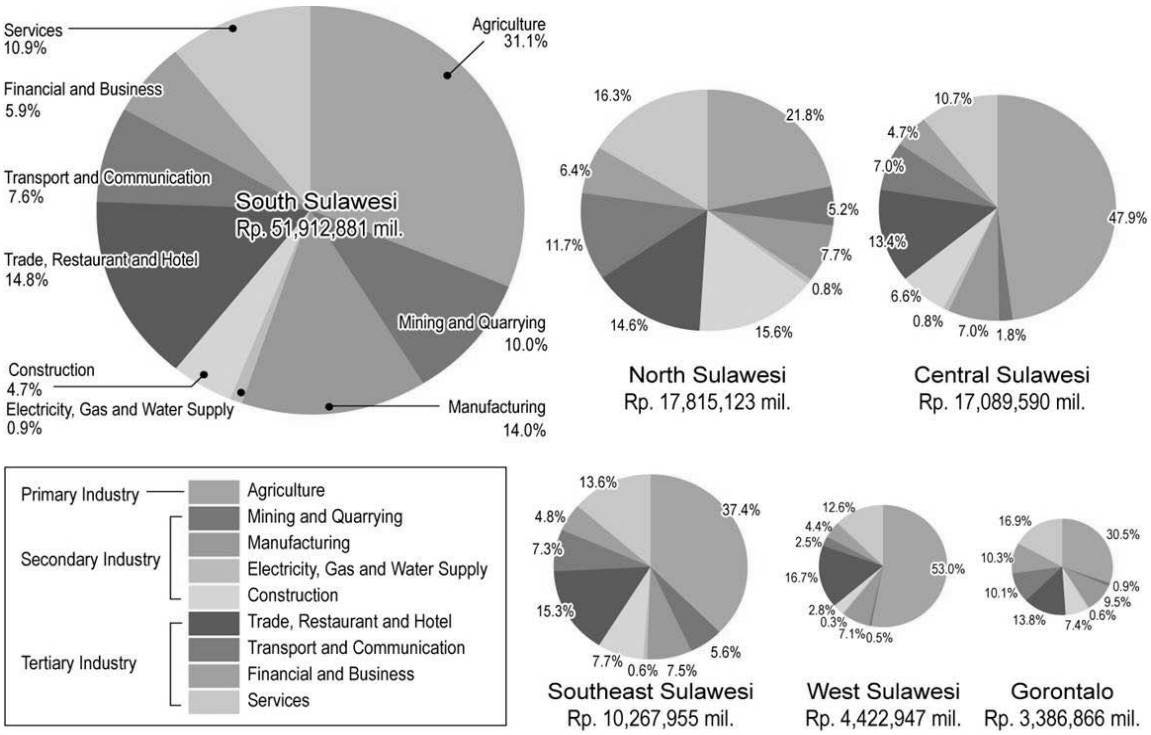
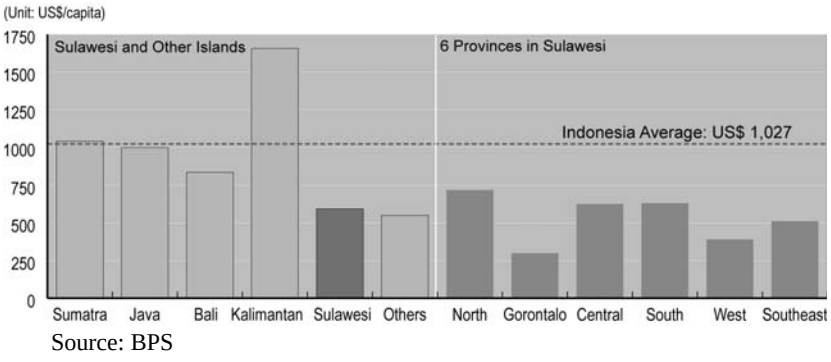


Figure A.10.2-3 GRDP of Sulawesi by Province, 2005 Current Prices

(4) Regional Economy and Structure

The Sulawesi economy remains at around 58% of the national average in terms of per-capita GRDP. Its contribution to the national economy remains at 4.2%.

Per-capita GRDP is low at US$ 300 in Gorontalo (29% of the national average) and at US$ 390 in West Sulawesi which is 38% of the national average.



Source: BPS

Figure A.10.2-4 Per-capita GRDP

Sulawesi's relatively weak economy is partly attributable to its great dependence on its agricultural sector. More than half of the economically active population is engaged in agriculture, livestock, and fisheries.

Agricultural population is high in West Sulawesi (75.1% in 2005), Central Sulawesi (65.4%), and Southeast Sulawesi (62.8%). Meanwhile, the manufacturing sector's contributions to the Sulawesi's economy are still limited, accounting from 6.2% to 11.5% of employment.

(5) Potential Regional Development Resources

The major agricultural products in Sulawesi are paddy, maize, coffee, cocoa, cashew nuts, etc as in **Table A.10.2-1**. These are potential materials for agro-industry and their cluster development.

Table A.10.2-1 Major Agricultural Products by Province

Unit: 1,000 Ton

Province	North	Central	South	Southeast	Gorontalo	West	Total	% to Indonesia
Paddy	433	717	3,390	340	167	327	5,373	9.9%
Maize	195	68	706	73	400	14	1,456	11.6%
Cassavas	68	48	464	257	12	85	934	4.8%
Soybeans	4	2	27	3	4	1	42	5.1%
Clove	13	12	25	2	1	1	53	-
Coffee	6	5	32	2	0	10	55	8.5%
Cocoa	3	113	215	2	1	84	417	71.2%
Coconuts	175	191	127	2	6	69	570	17.9%
Cashew Nut	0	5	28	19	0	1	53	45.1%

Aside from agriculture, Sulawesi is also rich in fishery resources. The main marine resources in Sulawesi are tuna, skipjacks, pelagics, seaweed, shrimps, crabs, sea cucumber, and lobsters. Aquaculture, involving such products as pearls, shrimps, seaweed, and sea cucumber, is a common local industry in various coastal areas.

Sulawesi also has many mineral resources such as nickel, gas, gold, limestone, marble, oil, and natural asphalt. The mining sector has the potential of becoming a much larger contributor to the island's economy and to overall regional development. However, except for the cement industry in South Sulawesi and the nickel industry in South and Southeast Sulawesi, the development of the mining sector is delayed. Asbuton in Southeast Sulawesi was produced approximately 500,000 tons and

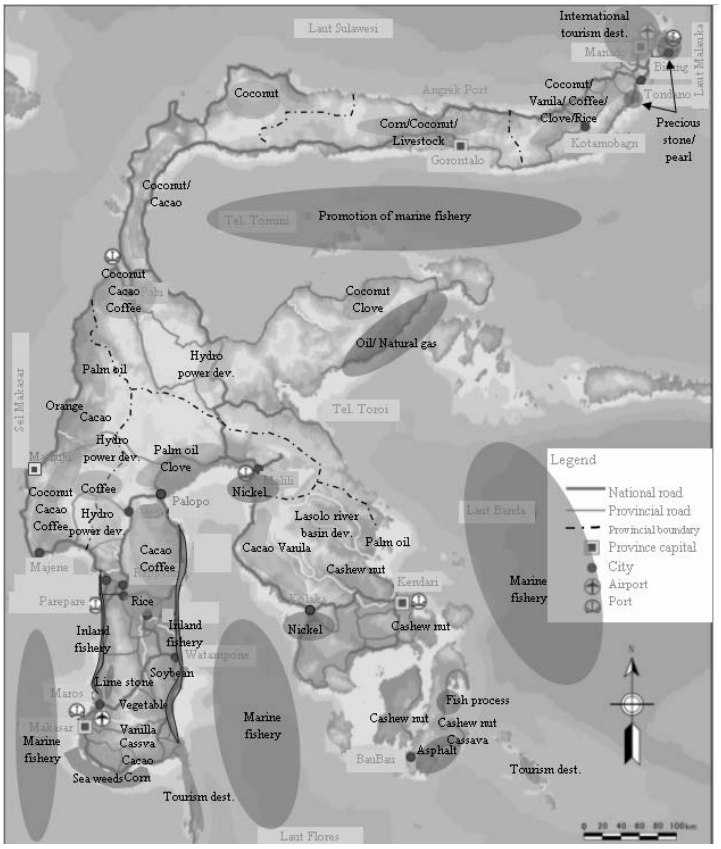


Figure A.10.2-5 Potential Regional Development

contributed to regional economy and employment in the middle of 1980s. However, Asbuton production was reduced to a minor level in 1990s because of loosing price competitiveness and quality problems.

2.3 Socio-economic Framework

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 **Figure A.10.2-6**. Population growth 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.

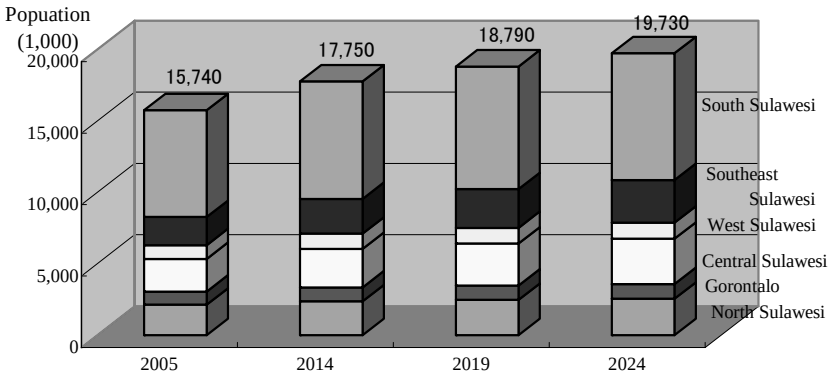


Figure A.10.2-6 Population Forecast (2024)

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 A.10.2-2 GRDP Forecast 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

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 variation of per-capita GRDP of all regencies in

Sulawesi will decrease from 0.59 in 2005 to 0.47 by 2024.

Table A.10.2-5 Per-capita GRDP Forecasts

	Rupiah (2000 Constant Prices)		Rupiah (2005 Constant Prices)		US Dollar (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

2.4 Socio-economic Conditions of Selected Regencies/Cities

The following Table **A.10.2-4** shows a summary of socio-economic conditions of the selected 10 regencies. The total population of these regencies is about 2.5 million (refer to Attachments to this Appendix 9 as to details).

Table A.10.2-4 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

3 Present Condition and Key Issues for Regency/City Roads

3.1 Road Function and System

The cities in Indonesia are classified into national activity center (PKN), regional activity center (PKW), local activity center (PKL), and other smaller cities according to the spatial plans (Rencana Tata Ruang Wilayah Nasional).

The functional and administrative classification of roads is specified in the Road Law (2004) and the Road Regulations (2006). **Table A.10.3-1** presents the interrelationship between the functional and the administrative classifications of roads. **Table A.10.3-2** shows the interrelation between road hierarchy and various activity centers.

Table A.10.3-1 Functional Classification and Administrative Responsibility

Road Network System	Functional Classification		Administrative Classification	Responsible Authority
Primary System	Arterial Road		Toll Road	Minister of Public Works
			National Road	
	Collector Road	K1		
		K2	Provincial Road	Governor
		K3		
		K4	Regecny and District Road	Kabupaten Governor
	Local Road (LP)			
	District Road			
Secondary System*	Arterial		Municipal Road	Mayor
	Collector			
	Local			
	District			

Note: * urban road system

Table A.10.3-2 Relation of Activity Center and Functional Classification

Urban Center	National Activity Center (PKN)	Regional Activity Center (PKW)	Local Activity Center (PKL)	District Center (PK-Ling)	Sub-District Activity Center (Inter Persil)
National Activity Center (PKN)	Arterial	Arterial	Collector	Local	District
Regional Activity Center (PKW)	Arterial	Collector	Collector	Local	District
Local Activity Center (PKL)	Collector	Collector	Local	Local	District
District Center (PK-Ling)	Local	Local	Local	Local	District
Subdistrict Activity Center (Persil)	District	District	District	District	District

Note: PKN and PKW are designated in RTRWN

The local roads are road links connecting between PKN/PKW and PKL/PK-Ling or PKL/PK-Ling and PKL/PK-Ling. Those are administrated by Kabupaten Governor or City Mayor.

3.2 Length and Condition of Regency/City Roads

The roads in Indonesia comprise of 35,000 km of national road, 40,000 km of provincial road, 320,000 km of Regency roads and unknown length of other roads (Desa /Kecamatan roads). The total length of regency roads is approximately 4 times of the national and provincial roads (see **Figure A.10.3-1**). The total length of Kabupaten roads has increased twice in the late 1980s to early 1990s. Japanese ODA (JBIC loans) contributed to these Kabupaten roads developments as one of the major supporters.

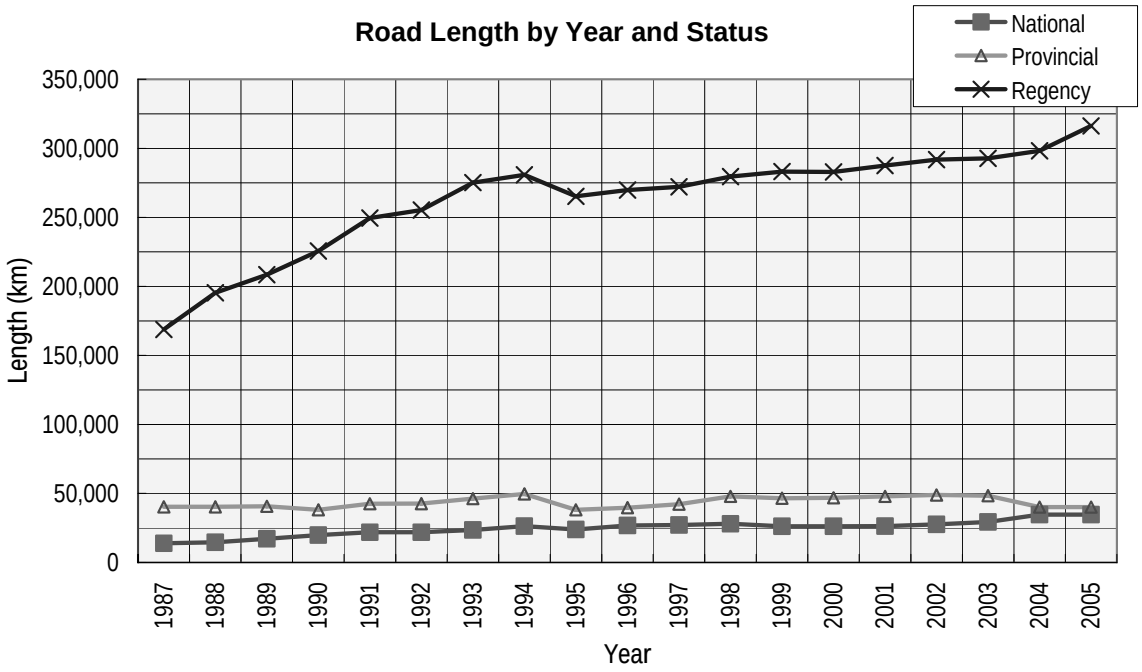


Figure A.10.3-1 Lengths of National, Provincial and Kabupaten Roads

Table A.10.3-3 summarizes lengths and condition of national, provincial and regency roads by province.

Table A.10.3-3 Road Length and Condition in Sulawesi

Unit: km

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

Source: Bina Marga, MOT

The national/provincial roads length in Sulawesi is 12,920 km in total as of 2007. The regency road length is 43,860 km, approximately 3 times of the national/provincial roads. The 78% of national roads and 60% of provincial roads is in good/fair condition. The 80% of the former and 70% of the latter are paved. The key issue for national roads is to improve the road quality by widening the current narrow 4.5-5.0m road to 6.0m/7.0m standard to meet the Road Law of 2004 and PP 34/2006. While the key issue of provincial roads is to increase paved and good/fair condition road length.

The 41% of regency roads are paved (**Table A.10.3-4**) and 44% are in poor/bad condition. Therefore, rehabilitation (battement and maintenance) of these roads is an urgent issue to support regional development and poverty reduction.

Table A.10.3-4 Pavement Condition of Regency Roads

Unit: km

Province	Surface Type				
	Asphalt	Gravel	Soil	Others	Total
North Sulawesi	2,334	1,040	116	0	3,490
	66.9%	29.8%	3.3%	0.0%	100.0%
Gorontalo	1,514	340	470	126	2,450
	61.8%	13.9%	19.2%	5.1%	100.0%
Central Sulawesi	2,924	2,853	1,920	309	8,006
	36.5%	35.6%	24.0%	3.9%	100.0%
West Sulawesi	961	1,432	2,408	0	4,801
	20.0%	29.8%	50.2%	0.0%	100.0%
South Sulawesi	8,475	5,132	4,389	830	18,826
	45.0%	27.3%	23.3%	4.4%	100.0%
Southeast Sulawesi	1,719	2,939	1,432	201	6,291
	27.3%	46.7%	22.8%	3.2%	100.0%
Total	17,927	13,736	10,735	1,466	43,864
	40.9%	31.3%	24.5%	3.3%	100.0%
	40.9%			**59.1%**	

Source: Transportation and Communication Statistics 2005, MOC

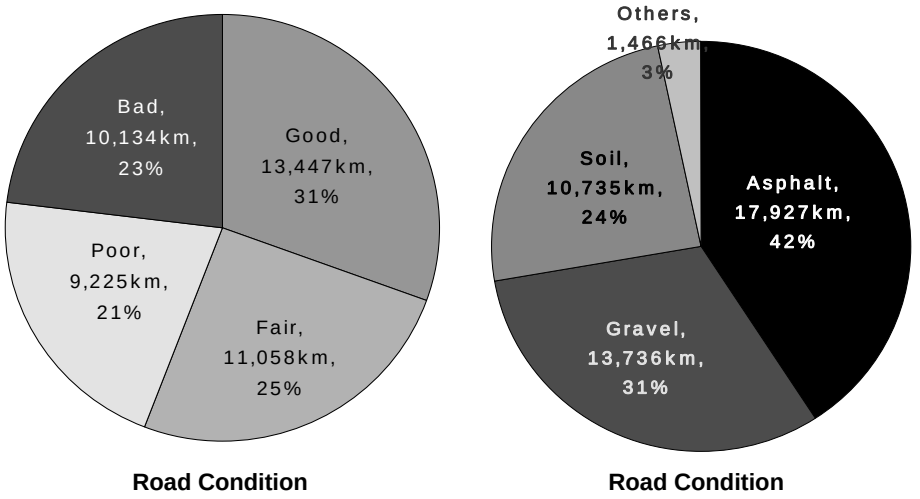


Figure A.10.3-2 Road Condition of Regency Roads

3.3 Length and Conditions of Regency Bridges

Complete bridge data are not available for most of the regency roads. Therefore, the Study Team roughly estimated number and length from the national, provincial and district bridge data as shown in **Table A.10.3-5**. The total number of bridges, including crossings without bridge, on regency roads is estimated at 12,970 and the total length at 120,000m.

Table A.10.3-5 Number of Bridges on Regency/City Roads

Province	National Road[a)]			Provincial Road[b)]			**Kabupaten Road[d)]**			Desa/ Kecamatan Road[c)]
	Road Length (km)	Total No of Bridges	No. of Bridges /km	Road Length (km)	Total No of Bridges	No. of Bridges/km	Road Length (km)	Total No of Bridges	No. of Bridges /km	Total No of Bridges
North Sulawesi	1,267	591	2.1	741	382	1.9	3,490 8%	1,140 9%	3.1	1,196
Gorontalo	616	284	2.2	315	54	5.8	2,450 6%	410 3%	6.0	376
Central Sulawesi	1,807	925	2.0	2,037	782	2.6	8,006 18%	2,340 18%	3.4	1,440
West Sulawesi	552	277	2.0	581	88	6.6	4,801 11%	740 6%	6.4	620
South Sulawesi	1,556	694	2.2	1,209	684	1.8	18,826 43%	6,260 48%	3.0	2,464
South East Sulawesi	1,294	573	2.3	943	533	1.8	6,291 14%	2,080 16%	3.0	1,564
Total	7,092	3,344	2.1	5,826	2,523	2.3	43,864 100%	12,970 100%	3.3	7,660

Source: a), b) Arterial Road Mater Plan study, JICA 2008
c) MPW Home Page
d) Estimate by the JICA Study Team

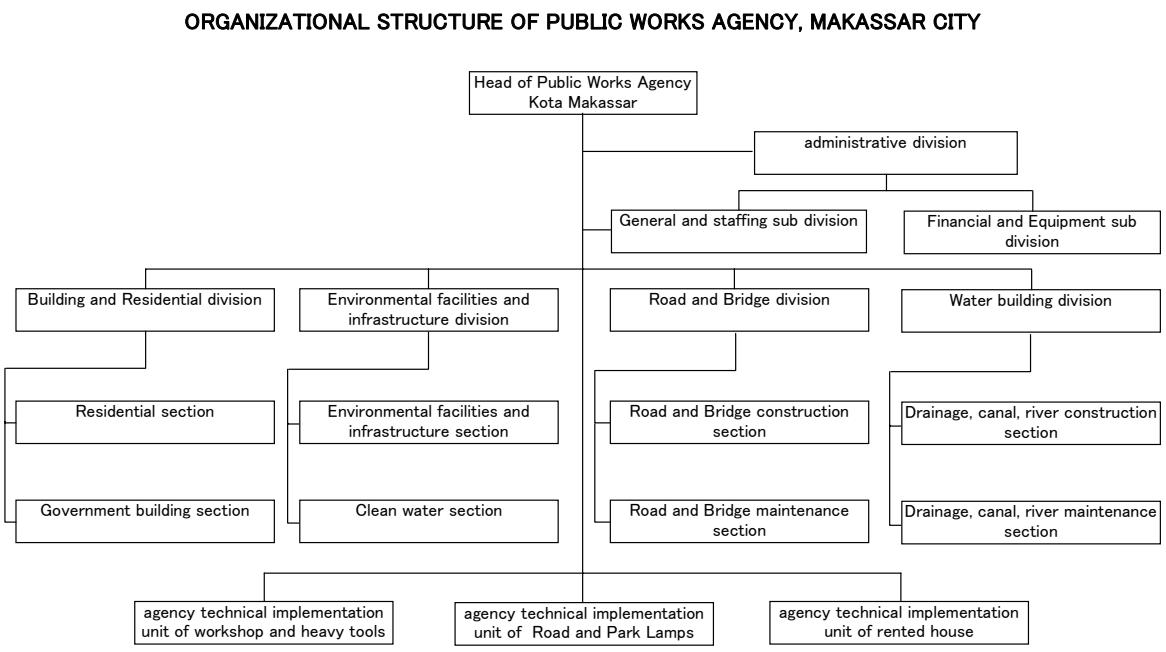
According to the Integrated Bridge Management System (IBMS), the conditions of exiting bridges are classified into the following 5 grades:

Grade 1: Good, Grade 2: Fair, Grade 3: Poor, Grade 4: Bad, Grade 5: Non-functional

Approximately 25% of the regency/city road bridges is seemed to be bad/non-functional, wooden and without bridges. Therefore, replacement or construction of these critical bridges is an urgent and important issue for securing regional access, community unity and welfare of the people.

3.4 Organization and Kabupaten Road Management System

Each Regency Government has its own Dinas PU who is responsible the development and maintenance of the public works in the regency. As illustrated in **Figure A.10.3-3** Division of Road and Bridge is responsible for the development and maintenance of the roads and bridges in the regency, which is one of the four divisions with others being Building and Residential Division, Environmental Facilities and Infrastructure (small roads and water supply facilities) Division and Water Building (drainage, canal, river) Division.



Source: Study Team

Figure A.10.3-3 Organization of Public Works Agency of Regency Government (Makassar City)

(2) Organization and Method of Road Maintenance

Maintenance section of Division of Road and Bridge is usually composed of formal government employees and contract based employees. **Table A.10.3-6** shows the number of the employees and the maintenance method of different regencies. It is common that periodic maintenance is conducted on sub contract basis while routine maintenance is mostly done directly by the maintenance section using contract labors.

Table A.10.3-6 Maintenance Force of Kota/Kabupaten

	No. of Maintenance Force (person)	Routine Maintenance	Periodic Maintenance
1. Makassar	15	Sub Contract	Sub Contract
2. Maros	30	Direct with contract labor	Sub Contract
3. Gowa	40	Fully Direct	Fully Direct
4. Takalar	9	Fully Direct	Sub Contract

Source: JICA Study Team

3.5 Budget of Regency and Road Sector

Table A.10.3-7 shows the total expenditure budget and the road sector budget of the sample Kabupaten/Kota of the Sulawesi Region for 2002-2006 as available. The total expenditure budget of the Kabupaten/Kota of the Sulawesi Region was Rp 18.8 Trillion and for 2006 and Rp 58.8 Trillion for the total of the last five years. 10 samples of Kabupaten/Kota were selected and the data for their road sector budget for the last five years were also collected.

The total road sector budget of the sample Kabupaten/Kota as available for the recent five year average has been about 7.4 % of their total regency expenditure. However, there is a possibility that

this ratio may include the Central Government level funding such as EIRTP-2.

Table A.10.3-7 Total Budget and Road Sector Budget of /Kabupaten/Kota (2006)

5 Year Total (2002-2006)

		(a) Total Budget Expenditure (Rp Billion)	(b) Road Sector Budget (Rp Billion)	(c) (b)/(a) %
North Sulawesi	Kota Tomohon	381	28	7.2%
	Minahasa	1,334	96	7.2%
Gorontalo	Boalemo	0	0	NA
Central Sulawesi	Banggai	1,255	55	4.4%
South Sulawesi	Bone	1,625	97	6.0%
	Tana Toraja	1,314	118	9.0%
West Sulawesi	Mamasa	958	69	7.2%
Southeast Sulawesi	Buton	988	121	12.3%
	Buton Utara	0	0	NA
	Kota Bau-Bau	0	0	NA
Sample Total		7,854	585	7.4%
Sulawesi Total		58,852	NA	NA

Source: Ministry of Finance and the Kabupatens/Kotas
Note: Not all kabupaten has the data of 2002-2006 as some are newly established.

4 On-going Kabupaten Road Development (EIRTP)

4.1 Outline of Regency Road Development in EIRTP 1 and EIRTP-2

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. The project is comprised of 80% of the road sector and 20% of the general transport sector. The execution agency is MPW (Ministry of Public Works). The project cost of EIRTP-2 is US$ 296 million of which US$ 200 million is from the World Bank.

EIRTP aims at supporting economic grown 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 primary forecasted on local road network and transport facilities.

The development objectives of EIRTP are:

- Improve condition of the strategic road network to reduce transport cost and enhance regional accessibility.
- Support decentralization of planning and management responsibility of civil works on provincial and Kabupaten roads to their respective governments.
- Increase the efficiency, quality and transparency of civil works procurement and implementation.

EIRTP-1 was implemented in 15 provinces. EIRTP-2 has been implemented in the 16 provinces and about 160 Kabupatens/Kotas (regencies and municipalities). The project is comprised of national roads/bridges, provincial roads/bridges, Kabupaten roads, improvement of transport

terminals and facilities and road sector capacity building (institutional build up and technical cooperation, including asset management and anti-corruption plan). The road treatment includes both betterment and periodic maintenance works.

The Kabupaten/Kota road sub-projects in Sulawesi are as given in **Table A.10.4-1**. The subjected road length is approximately 940 km in Central and South (/ West) Sulawesi Provinces.

Table A.10.4-1 Kabupaten and Kota Road Projects in Sulawesi

Province	Betterment		Periodic Maitenance		Total	Bridge
	AWP-1 (km)	AWP-2 (km)	AWP-1 (km)	AWP-2 (km)	(km)	(m)
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

4.2 Implementation System and Problems

(1) Implementation Organization

The Government has established an umbrella Steering Committee (SC) to guide and oversee the development of road infrastructure and road traffic and transport. The SC reports to the Minister-level Committee on Policy for the Acceleration o f Infrastructure Development, which is chaired by the Coordinating Minister for the Economy, through the Sub-committee on Planning and Investment. The Sub-committee is chaired by Bappenas's Deputy for Infrastructure, who also chairs the roads steering group. The Steering Committee has appointed the Directorate General of Highway (DGH) within MPW as the Executing Agency (EA) for the Project.

DGH as the lead Implementing Agency for the Project will form a Project Management Unit (PMU), chaired by the Director of Technical Affairs in DGH. The PMU will be responsible for managing all EIRTP-2 activities.

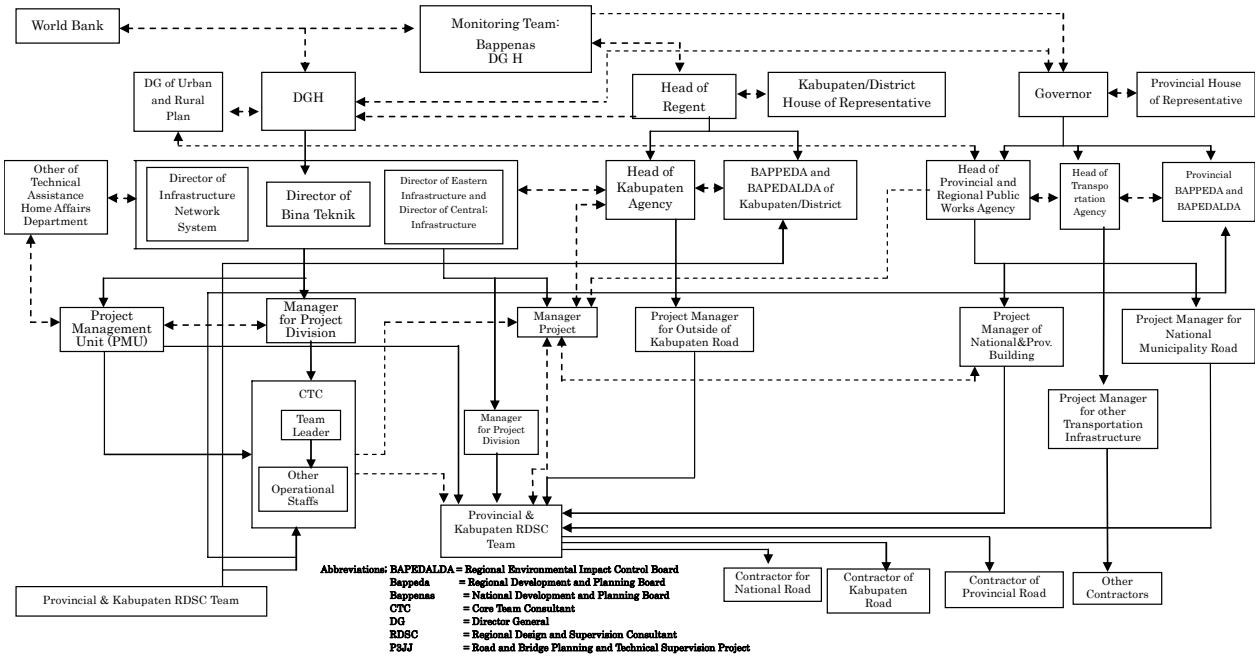
Project implementation will be undertaken under the management of Project Implementation Units (PIUs) established under the relevant National, Provincial or Kabupaten administrations. Regional Design and Supervision Consultants (RDSCs) will be appointed by DGH to assist the immediate Project Managers appointed by each level o f Government in all aspects o f the design, procurement and implementation o f the civil works to be carried out under the project. The RDSCs will be established in three regions (Kalimantan; Sulawesi and NTTMTB; Malukus and Papua), and will operate from Provincial and site offices to provide full regional support for the project.

The PMU will also have Provincial representation through a Provincial Project Management Office (PPMO) to be established in each Province. The PPMO will undertake an information collection, monitoring and reporting function, so as to ensure that the PMU's tasks of project and financial

management, monitoring and reporting are expedited. The PPMO will liaise with Project Managers, the RDSC and other government agencies (eg Bapedalda) at all levels to ensure that the project is efficiently and effectively managed.

The PMU will be supported by Core Team Consultants (CTC), who will assist with all aspects of project and financial management, monitoring and reporting, and ensure that they are properly undertaken in a timely fashion. The CTC consultants will undertake detailed project preparation for AWP-2 and AWP-3 of the project, and assist in the management and supervision of the RDSCs in the detailed design of these programs. CTC will provide staff to support the PPMO, and will maintain close liaison with RDSC and other TA consultants under the project (**Figure A.10.4-1**).

Balai Besar VI was established for the region in January 2007. However, its role in the EIRTP-2 project is minimal as the PPMO continues to play a coordination role at the regional level.



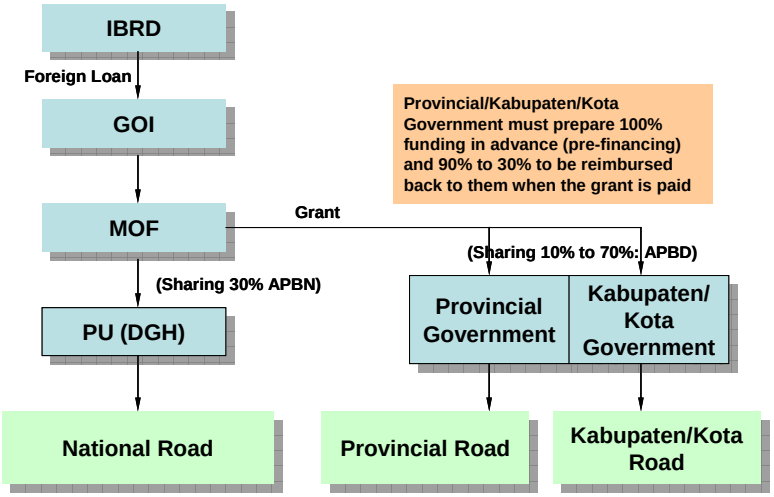
Source: DGH, EIRTP-2

Figure A.10.4-1 Organization of Implementation of EIRTP-2

(2) Financing Plan

The funding mechanism is illustrated in **Figure A.10.4-2** where IBRD provides loan to the Government of Indonesia and in turn GOI, namely the Ministry of Finance, provides fund to DGH as the executing agency with the provision that DGH should share 30% of the funding by its own APBN budget, and provides funds to the provincial and Kabupaten/Kota governments in the form of grant with the provision that the regional governments should share 10%, 40%, 70% of the funding by their own APBD budget depending on the fiscal capacity of the regional government. Another provision which is claimed to become a burden on the regional governments is that the governments should prepare 100% of the initial fund requirement (say, for the expenditure of the phase 1 of the project) beforehand (Pre-financing) in order to receive the grant. 90% to 30% of the

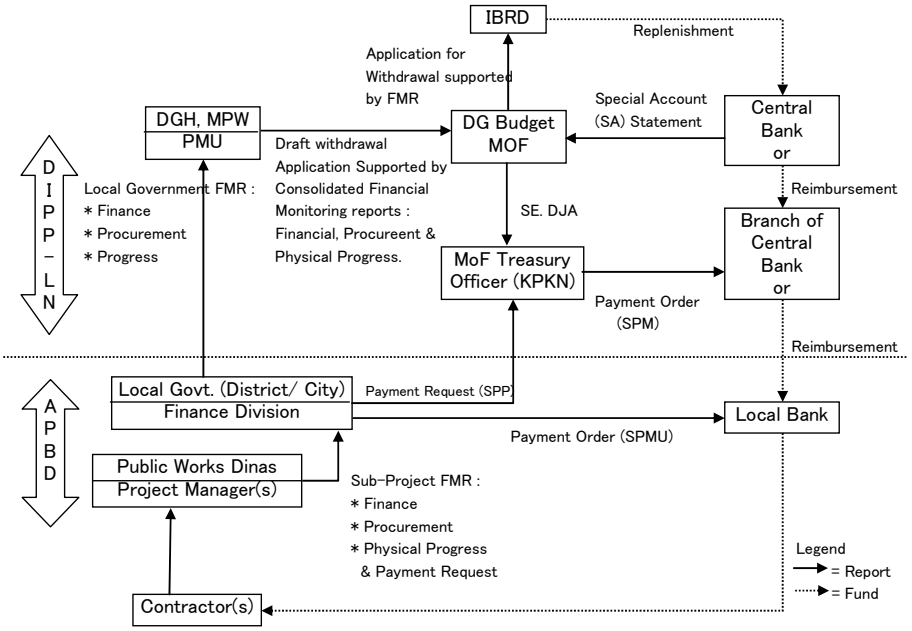
fund will then be reimbursed to them when the grant is provided by the Central Government (**Figure A.10.4-2**).



Source: JICA Study Team

Figure A.10.4-2 Financing Method of EIRTP 2

As illustrated in **Figure A.10.4-3** funding for the project implementation is handled on the basis of the project report submitted from each Public Works Dinas to its Finance Division who in turn submits Financial Management Report to PMU and a payment request to MOF Treasury Officer (KPKN). PMU submit Draft Withdrawal Application to MOF DG Budget who submits Application for Withdrawal to World Bank. After the approval by World Bank actual fund is channeled from the Central Bank or designated commercial bank through their branch offices to local bank which actually makes payment to the contractors.



Source: Project Appraisal Report for EIRTP-2

Figure A.10.4-3 Funding Flow for EIRTP 2

(3) Problems

In implementing the EIRTP-2 projects the following problems have been observed:

i) Pre-financing requirement

The pre-financing requirement which obligates the regional government to prepare 100% of project fund required in advance, at least for the initial phase, has become a heavy burden on the regional governments as such allocation of APBD for the EIRTP-2 project is likely to cloud out possible budget allocation to other areas of public service provision. For some regency governments even the regional obligation of 10% of the project cost could oppress its fiscal capacity.

ii) Limited expertise in project implementation at the regional level

The expertise required in implementing the projects such as tender document preparation, short listing, bid evaluation and approval is limited at the regional level in terms of both the government officials and the consultants.

iii) Time consuming process in change of contract

Since the consultants procured at the central government level control the change of contract, the change process tends to become time consuming and sometimes without adequately reflecting local conditions.

iv) Poor coordination between the regional government and the consultants procured by the central government in the programming and designing stages

Since adequate coordination between the regional government and the consultant procured by the central government is often missing in the programming and designing stages, local conditions are sometimes overlooked in the programming and the designing which may lead to the change of contract and consequently to slow project mobilization.

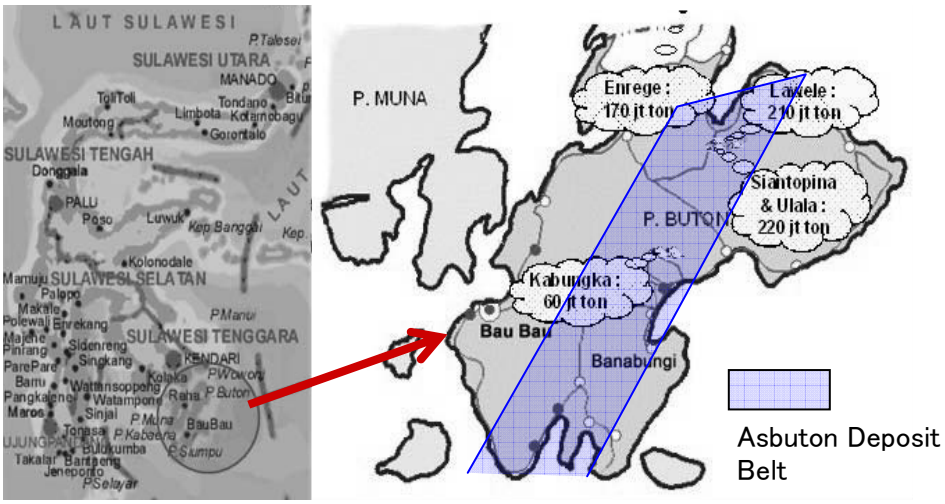
v) Slow mobilization of project implementation

Slow mobilization could be observed in several stages. One example is the slow assignment of consultants after a technical assistance contract (planning and designing) is signed even though the local project team is ready to start its operation. Other example is the long time gap between completion of designing and signing of loan (on-granting) agreement which slow down actual mobilization of the construction.

5 Development and Use of Asbuton (Natural Asphalt)

5.1 Deposit of Asbuton and its Characteristics

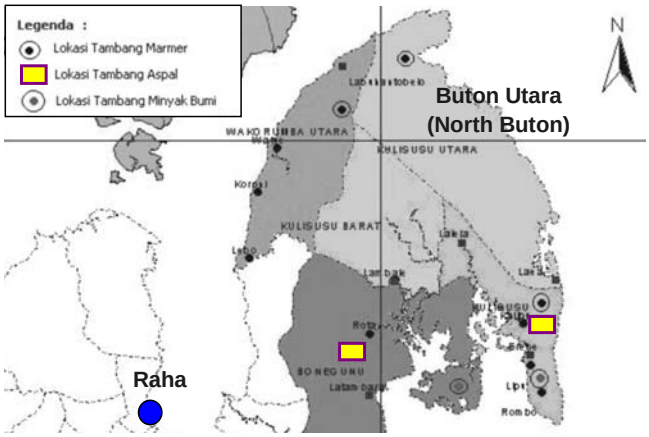
Buton asphalt (Asbuton) is natural asphalt (or called rock asphalt) deposited in Buton Island. The major Asbuton deposits have been found in four (4) locations in the southern half of Buton Island. The estimated deposit is approximately 660 million tons in total. The widest location is 70,000 ha in the south part of Lawele Bay. The bitumen contents vary 10% - 40%. Asbuton is laid in various thicknesses (10m-100m) under the top soil of 1.0-1.5 m thick.



Source: Bina Marga / PT Sarana Karya

Figure A.10.5-1 Asphalt Deposit and Estimated Quantity in Buton Regency

There is not much geological formation difference between the northern and southern parts of Buton Island. It is said that there are also Asbuton deposits in North Buton Regency, as indicated in the right figure, though no investigation has been carried out.



Source: Bapedda / Baubau City

Figure A.9.5-2 Asphalt Deposit in North Buton Regency

Asbuton is classified into two types; granular and mastic (sand) type asphalts. Asbuton is also classified by product: 1) Buton Granular Asphalt (BGA) and 2) Natural Mastic Asphalt (NMA). BGA is a processed material, crushed to 1.2 mm maximum diameter, of rock asphalt, represented in Kabungka/Lawere areas (bitumen content 15-30%). NMA is the mastic characteristic product of higher bitumen content of +/- 30%.

5.2 Research on Asbuton and Government Policy

Natural asphalt mining was started development by Holland before the World War II. It was taken over by the Ministry of Public Works in 1954. Perusahaan Asphal Negara (PAN), State Owned Asphalt Company, operated the asphalt mining in 1961-1984. PT Saraya Karya (SAKA), under the Ministry of BUMN (State Owned Company), took over PAN in 1984 and has continuously mined the natural asphalt (Asbuton).

Kokudo Doro Co.Ltd. of Japan assisted SAKA in research and development of Asbuton in the early 1980s. JICA conducted a study on "Natural Asphalt and Facility Development Study in 1986 and trial production and pavement construction were carried out.

The production and research was continued by SAKA at Buton Regency and the Road/Bridge Development Research Center of MPW at Bandung.

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 taking its price advantage and new technology development into consideration.

The Minister of MPW, Mr Djoko Kirmanto, expressed a new policy in August 2006 that Asbuton can be used widely as the raw material of road development, considering its abundant deposit and higher oil asphalt. He asked the Development and Research Board of Public Works Department to enact the result of the research concerning Asbuton, so that it is possible to know appropriate level of the daily traffic for application of Asbuton pavement.

The regional government of Southeast Sulawesi expects that use of Asbuton will contribute to regional development. The member of Regional Representative of Southeast Sulawesi has proposed that the utilization of Asbuton should become the government policy.

5.3 Technical Specifications

(1) Technical Guideline of Ministry of Public Works

The MPW's regulation Permen PU No.35/PRT/M/2006 concerning Asbuton Use was issued in December 2006. Technical guideline was given on type of mix, type of Asbuton, criteria (ADT and road category) for use and required asphalt mixing plant and finisher as in **Table A.10.5-1**.

Table A.10.5-1 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 granular Type 5/20, 15/20, 15/25, 20/25 and 30/25	Plan traffic < 1 million ESA or AADT< 1000 of vehicle and truck maximum 5 %
	Asbuton Macadam Penetration Layer	Asbuton granular Type 60/30, sand Asbuton (processed on site)	Plan traffic < 500.000 ESA or AADT < 500 of vehicle and truck maximum 5 %

Source: MPW (Puslitbang Bandung)

(2) Specification of Asbuton Products

Type of Asbuton products is classified into:

- Buton Granular Asphalt for Asbuton of Kabungka and its surroundings
- Semi-extraction for Asbuton Modifier/Pre-mix for Asbuton of Kabungka
- Full-extraction (Pure Asbuton-basis bitumen) for Lawele Deposit.

The latest research and trial construction has indicated that the stable quality and durability of asphalt pavement is attained by a hot mix of Asbuton and oil asphalt at an Asbuton mix of 17%-50% of the oil asphalt in weight in the case of Granular Asbuton.

Those are also classified by use to:

- Rock asphalt (Hot mix, warm mix and cold mix)
- Semi and full-extraction (hot mix).

Researches have been made development of full-extraction technology. If pure bitumen (100% bitumen content) is extracted from Asbuton, it can substitute the oil asphalt by 100%.

Granular Asbuton products, grain sizes of less than 2.36 mm, are classified into 4 types based on penetration and bitumen content as shown in **Table A.10.5-2**.

Table A.10.5-2 Type of Granular Asbuton

Asbuton Characteristics	Type 5/20	Type 15/20	Type 15/25	Type 20/25
Bitumen content of asbuton; %	18 -22	18 - 22	23 -27	23 - 27
Size of asbuton granular				
- Screening No 8 (2,36 mm); %	100	100	100	100
- Screening No 16 (1,18 mm); %	Min 95	Min 95	Min 95	Min 95
Water Content, %	Max 2	Max 2	Max 2	Max 2
Asphalt Penetration of asbuton at 25 ° C, 100 g, 5 second; 0,1 mm	- 10	10 - 18	10 - 18	19 - 22

Source: MPW (Puslitbang Bandung)

(3) Road Construction Specifications

The standard technical specification of Bina Marga/MPW has a section of Asphalt concrete made of Asbuton. The Asbuton specification was provided for pavement works in 1970s and has been revised several times taking construction experiments and results into consideration. The latest specification is the Year 2007 Version and Asbuton asphalt concrete (LASBUTAG AND LATASBUSIR) is specified in Section 6.4. It provides a mixture composed of Asbuton (natural rock asphalt), aggregate and modifiers, cold mixed at a central location, and spreading and compaction methods of the mixture on a prepared base.

However, as the Year 2007 Version is still for conventional Asbuton mixture, a new specification provided by the Road and Bridge Development Research Center should be applied for a new asphalt mix production of Asbuton with oil asphalt as a special specification.

5.4 Asbuton Mining and Asbuton Products

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

PT Saraya Karya has two kinds of products, one is bulk Asbuton (non-processed product) and the other is processed Asbuton products (BGA and LGA). The latter has two types; one is Buton Granular Asphalt (BGA) processed at Kabungka/Laware minings and the other at Lawele Granular Asphalt (LGA). The former is used as additive for asphalt concrete. The latter has higher bitumen content, has mastic characteristics and used for oil asphalt substitute.

PT Buton Asphalt Indonesia (BAI), a private company, has produced glandular Asbuton. The products can be used for both hot mix and cold mix for surface and base layers of the asphalt concrete pavement. The following is Asbuton specification and products by BAI.

Table A.10.5-3 Specifications and Product of BAI

Spesifikasi	Metode Pengujian	Tipe 5/20	Tipe 15/20	Tipe 15/25	Tipe 20/25
Kadar bitumen asbuton; %	SNI 03-3640-1994	18 - 22	18 - 22	23 - 27	23 - 27
Ukuran butir asbuton butir					
- Lolos Ayakan No. 4 (4,76 mm); %					100
- Lolos Ayakan No. 8 (2,36 mm); %	SNI 03-1968-1990	100	100	100	Min 95
- Lolos Ayakan No. 16 (1,18); %	SNI 03-1968-1990	Min 95	Min 95	Min 95	Min 75
Kadar Air, %	SNI 06-2490-1991	Maks. 2	Maks 2	Maks 2	Maks 2
Penetrasi aspal asbuton pada 25°C, 100 g, 5 detik, 0.1 mm	SNI 06-2456-1991	< 10	10 - 18	10 - 18	19 - 22

Source: PT Buton Asphalt Indonesia (BAI)

5.5 Comparison of Pavement Cost between Asbuton and Oil Asphalt

The unit construction cost of the asphalt concrete with Asbuton mixture was compared with oil asphalt mixture by PT Saraya Karya. 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 as given in **Table A.10.5-4**.

Table A.10.5-4 Comparison of Pavement Cost between Asbuton and Oil Asphalt

Hot Mix Asphalt Concrete (Oil Asphalt)						Hot Mix of Asbuton (LGA)					
No	Type	Unit	Quantity	Unit price	Amount	No	Type	Unit	Quantity	Unit Price	Total
I	Material					I	Material				
	Batu Pecah 1 x 1	m3	0.24	125,000.00	30,000.00		Batu Pecah 1 x 1	m3	0.24	125,000.00	30,000.00
	Batu Pecah 0.5 x 1	m3	0.22	125,000.00	27,500.00		Batu Pecah 0.5 x 1	m3	0.22	125,000.00	27,500.00
	Abu Batu	m3	0.17	125,000.00	21,250.00		Abu Batu	m3	0.13	125,000.00	16,250.00
	Pasir	m3	0.07	90,000.00	6,300.00		Pasir	m3			
	Aspal Minyak	kg	60.00	6,000.00	360,000.00		Asbuton LGA (10%)	kg	100.00	1,000.00	100,000.00
							Aspal Minyak (3%)	kg	30.00	6,000.00	180,000.00
II	Tenaga Kerja				-	II	Tenaga Kerja				-
III	Alat				-	III	Alat				-
				Total	445,050.00 Rp					Total	353,750.00 Rp

Difference : 91,300.00 Rp

21 %

5.6 Asbuton Pavement Constructions

Asbuton is conventionally used for two types of pavement surface; one is cold asphalt mixture for asphalt concrete (Lasbutag) and the other is for penetration macadam (Lapen). Those can not stand to heavy vehicle passage or long time. The cold mix Asbuton pavement is applicable for traffic < 1 million ESA, AADT < 1,000 vehicle and truck maximum 5 % or for traffic < 500,000 ESA , AADT < 500 vehicles and truck maximum 5 %.

The latest application experimented and recommended by the Road and Bridge Development Center is hot mix of Asbuton and Oil-asphalt (Bitumen) which can be used irrespective of AADT. The followings are requirements for hot-mix practice:

- AMP (Asphalt Mixing Plant): The supply of granular Asbuton should be made mechanically. The mixing temperature should be relatively higher and good temperature control is required.
- Mix Design: Job Mix Formula (JMF) should be in accordance with standard methods and stability at approximately 1000-1400 kg.
- Laboratory Equipment: Asphalt extraction and recovery equipment is required for quality control.

Construction experiment has been carried out in Java, Sulawesi (South Sulawesi, Gorontalo, and Southeast Sulawesi) and other areas on national and other roads.

Asphalt Mixing Plat at Jabotabek
Source: PT Saraya Karya

Asbuton Asphalt Construction at Jabotabek

Cibinong, Bogor December 2003

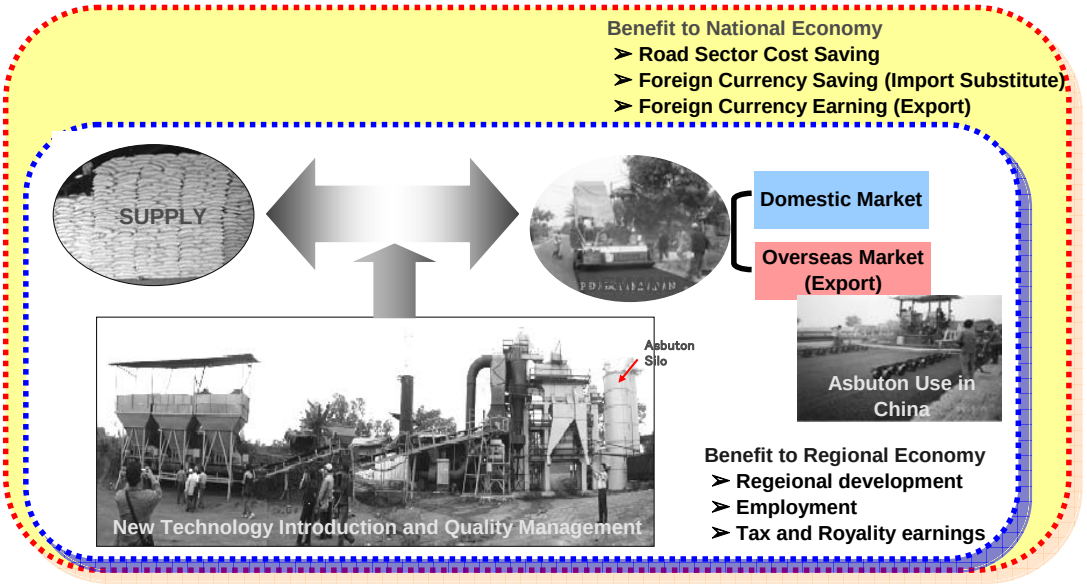
Figure A.10.5-3 Asbuton Asphalt Construction Experiment

5.7 Issues for Asbuton Development and Utilization Concept

(1) Basic 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.10.5-4** illustrates development and utilization concept of Asbuton.



Source: JICA Study Team

Figure A.10.5-4 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.

(1) Issues of Supply Sides

- Increase of production capacity: MPW ordered to use of 86,000 tons of Asbuton (BGA) for national roads in 2007. However, supply was only 4,000 – 5,000 tons as the supplier is not yet ready to produce it.
- Quality assurance of Asbuton products at plant
- Timely supply of Asbuton
- Old facilities for production, stocking and ship-loading for Kabungka (Banabungi port)
- No appropriate port and ship-loading facilities for Lawele (Nampo port)

Banabungi Port and Loading Facility | Banabungi Port and Loading Facilit | Asbuton Mining Equipment at Lawale | Nampo Port (Lawele)

Source: JICA Study Team

Figure A.10.5-5 Present Condition of Asbuton Mining and Shipping Facilities

- Insufficient competition and inappropriate management.

(2) 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

(3) Measures to be taken

- Financial support in renewing or improving production and transport capacity: The bulk Asbuton transportation was constrained by port capacity. It requires for minimum 30,000 DWT of port. The present capacity of Banabungi port is 10,000 tons for barge and 7,500 tons for cargo (vessel). While, that of Nampo port is only 5,000 tons for barge and 2,500 tons for cargo (vessel).
- Financial support in increasing transport and ship-loading capacity at both Banabungi and Nampo port, and also providing delivery ships.
- Assistance in capacity development in human resources by education and training.
- Development of refinery technology and plant: 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.

The Asbuton (BGA) has been exported to China by PT. Buton Asphalt Indonesia (BAI). However, it could not fulfill the demand for 5,000 tons per moth due to its relatively small production capacity. Notwithstanding this, China might be a favorable customer for Asbuton export. If refinery technology and plants are established, Asbuton markets would be extended further including India, the Philippines, Thailand, etc.

6 Outline of Selected Regencies

6.1 General

Desktop study and field survey were conducted for the 10 selected regencies and cities. The JICA 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.

Table A.10.6-1 Visit of Province and Regency/city by JICA Study Team

Province	Kabupaten / Kota selected for Sample Study	Period	Remarks
North Sulawesi	1.Kota Tomohon 2.Minahasa	28th January – 30th January 2008	
Gorontalo	3.Boaremo	31st January – 4th February 2008	
Central Sulawesi	4.Banggai	11th – 16th February, 2008	
West Sulawesi	5.Mamasa	11th – 16th February, 2008	
South Sulawesi	6.Bone 7.Tana Toraja	11th – 15th February, 2008	
Southeast Sulawesi	8.Buton 9.Kota Baubau 10. Buton Utara	29th January – 4th February 2008	As Buton Utara was not accessible, information was obtained at Raha

Socio-economic information, taken from BPS and hearings from provinces and regencies, are in the attachments at the end of this Appendix 9.

The JICA Study Team organized a workshop on "Local Road Rehabilitation Study and Asbuton Use", in accordance with the following schedule:

1. Place: Clarion Hotel, Makassar
2. Date: Tuesday, 19th February, 2008 (One Day)
3. Program:
   - Session 1: Outlook and Key Issues for Local Roads (Regency and City Roads)
   - Session 2: Presentation by Bappeda/PU of Representative Regency and City
   - Session 3: Presentation on Asbuton and its use for road projects
4. Participants: 60 in total (Central government, provincial governments, regency/city governments and others)

The contribution and information obtained at the workshop were reflected to this report.

6.2 Tomohon City in North Sulawesi Province

(1) Socio-economic Condition

Tomohon is a new city in North Sulawesi. Originally, Tomohon was a part of the Minahasa regency but it became an independent city in August 2003. Tomohon is the center of inland Minahasa area. Tomohon city is the entrance to the southern parts of Minahasa and other areas, connecting Manado city with Tondano and Amurang/Kotamobagu. National road connects Manado city with Tomohon city. The distance between Manado city and Tomohon city is 19.5 km and it takes approximately 1.0 hours by car.

The population is 87,000 and the area is 114 km^2 with density 669 /km^2 in 2005. The total GRDP is Rp 476 billion in 2005 and per-capita GRDP is 5.9 million at 2000 constant price, which is 98% of the average GRDP of North Sulawesi.

Tomohon is known for clove, palm sugar (aren) and vegetable cultivation which are for own consumption and supply to Manado City.

Tomohon city has several interesting tourism objects, which are Rurukan at the east of Tomohon, Amfitheater at Woloan, Bukit Boa at Woloan Tua, Linau Lake, Mt. Lokon and Mt. Mahawu and traditional cultural houses. Total number of hotels in Tomohon City is 18 or 265 rooms and these support for visiting tourists. There are two central hospitals at Tomohon city and it is the center of health cares for regional peoples.

(2) Transport System

A national road, Trans-Sulawesi West Corridor, connects Manado city with Tomohon city. The distance between Manado city and Tomohon city is 19.5 km and it takes approximately 0.5-0.6 hours. Bitung port is entrance and outlet of materials/products from and to outsides including export.

The distance between Sam Ratulangi Airport and Tomohon is around 30 km or 1.0 - 1.5 hours by car passing through Manado city.

(3) Road Condition

Figure A.10.6-1 shows road network in Tomohon City. The total length of city roads in Tomohon is 282 km. Of these, 39% (109 km) is in good, 23% (65 km) in fair, 15% (70 km) in poor and 25% (70 km) in bad condition (**Table A.10.6-2**). About 58 % (164 km) are paved.

As approximately 40% of roads are in poor/bad condition, those should be improved or rehabilitated to good/fair conditions.

Table A.10.6-2 City Road Length and Condition in Tomohon

Kota	Surface Type (km)					Condition (km)				
	Asphalt	Gravel	Soil	Other	Total	Good	Fair	Poor	Bad	Total
Tomohon	164	43	50	23	281	109	65	37	70	281
	58%	15%	19%	8%	100%	39%	23%	13%	25%	100%

Road Condition

Road Condition

Road Condition

Tomohon City

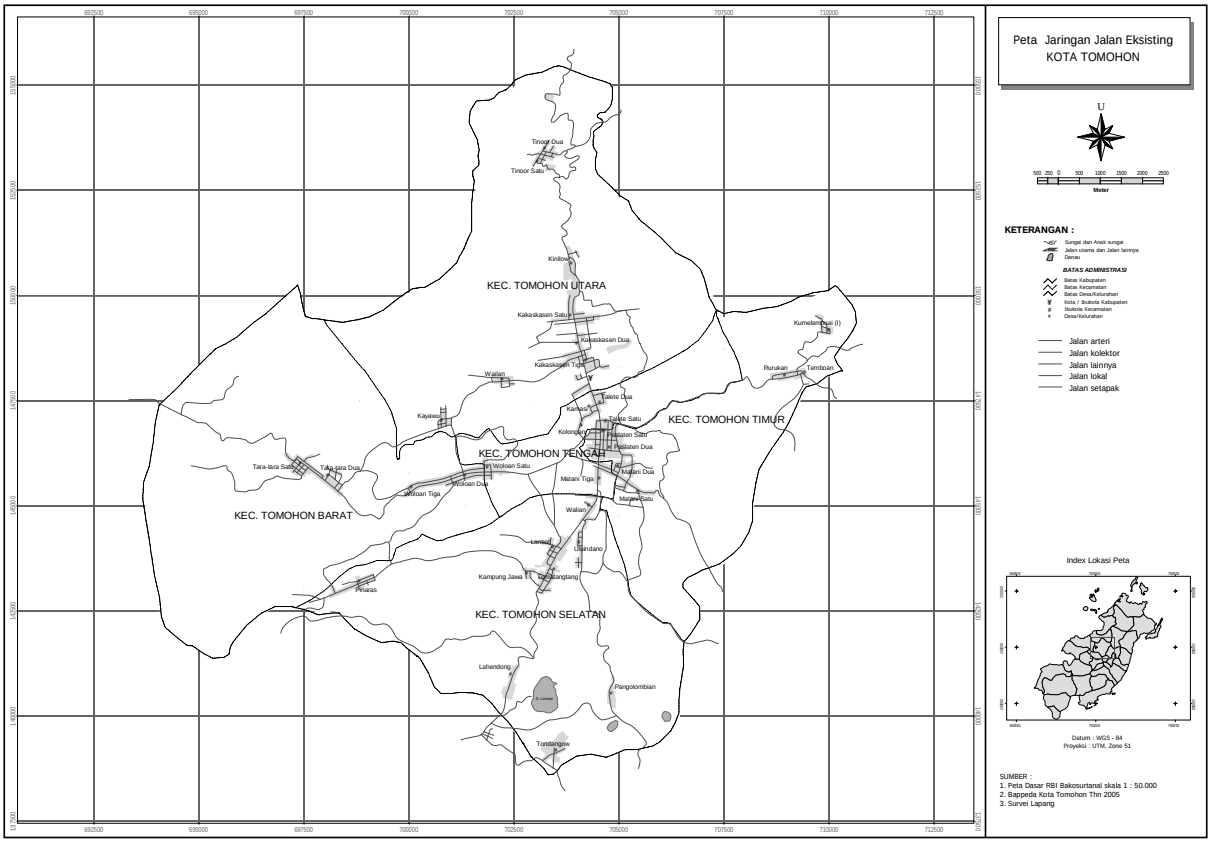


Figure A.10.6-1 Road Network Map for Tomohon City

6.3 Minahasa Regency in North Sulawesi Province

(1) Socio-economic Condition

North Sulawesi Province is divided into nine regencies, namely Bolaang Mongondow, Minahasa, North Bolaang Mongondow, North Minahasa, Sangihe Islands, Sitaro Islands, South Minahasa, Southeast Minahasa and Talaud Islands and four cities namely Bitung, Kotamobagu, Manado and Tomohon. In February 2003, Minahasa regency was divided to South Minahasa and Tomohon and it was further divided and North Minahasa regency was established in November 2004.

Regency capital of Minahasa is at Tondano, approximately 36 km from Manado city. The regency has 18 districts. The area of Minahasa is 1,030 km^2, 6.7% of North Sulawesi. The population is 293,000 with density of 258 /km^2 in 2005.

Most of the area of Minahasa regency is mountainous or hilly terrain. The most of plain terrains are located along coastal areas.

The total GRDP is Rp 2,517 billion at current price of 2006. The largest contribution is agriculture sector. The major estate crops are clove, 593 tons (21.2% of North Sulawesi), and coconuts, 14,687 tons (8% of North Sulawesi) in 2006. Vegetable oil production factories from coconuts are located at Amurang and Bitung. Clove and some coconut products are transported to Bitung Port for export. Per-capita GRDP is 8.5 million at 2006 current price.

Minahasa is one of the tourist attractive areas in North Sulawesi. The major tourist spots are Watu Pinabetengan, Bukit kasih (Hill of Love), Tondano lake, Kali waterfall, Tinggian Kolongan Beach, Arena Pacuan Kuda Tompaso, Japanase cave, Pulutan, Rafting and waterfall on Minanga river, Ranopaso, Sumaru Endo, Kora-Kora Beach, Tasik Ria Beach. A total of 14 hotels (145 rooms) in Minahasa Regency support visitors.

(2) Transport System

A national road connects Manado city with Minahasa regency. The distance between Manado city and Tondano is 25 km. The land trip route from Manado city to Tondano by car passes through Pineleng and Tomohon and it takes about 1.0-1.5 hours. The other route is passing through Airmadidi district on provincial roads and it also takes 2.0 hours. Bitung port is the entrance and outlet of materials/products from and to outsides of North Sulawesi, including for export. Trans Sulawesi Central Corridor passes along the south coastal line but its condition is unstable.

The distance between Sam Ratulangi Airport and Tondano is around 35 km or 1.5 - 2.0 hours by car passing through Manado city.

(3) Road Condition

Figure A.10.6-3 shows road network in the regency. The total length of regency roads is 614 km and average pavement width is 3.5m. Of these, 314 km (61%) is in good, 44 km (7%) in fair, 197

km (32%) km in poor/bad condition (**Table A.10.6-3**). 545km (88%) of roads are paved. The condition of regency/city roads is better than other regencies but maintenance efforts should be continued.

Table A.10.6-3 Regency Road Length and Condition in Minahasa Regency

Kabupaten	Surface Type (km)				Condition (km)			
	Asphalt	Gravel	Soil	Total	Good	Fair	Poor/Bad	Total
Minahasa	545	10	58	614	373	44	197	614
	88%	2%	10%	100%	61%	7 %	32 %	100 %

Road Condition

Bridge Condition

Tondano Lake

Clove Plantation

Figure A.10.6-2 Road Network Map for Minahasa Regency

6.4 Boalemo Regency in Gorontalo Province

(1) Socio-economic Condition

Boalemo Regency is one of the four regencies and one city in Gorontalo Province. Boalemo Regency is administratively divided into 7 districts and regency capital is at Tilamuta. Boalemo Regency has a total area of 2,248 km^2, 18.4% of Gorontalo. The population in 2006 is 118,082, 13% of the province, with population density of 53 /km^2 in 2006.

The total GRDP is Rp 438 billion in 2006, of which Rp 184 million (42%) is originated from agriculture sector, Rp 88 billion (20%) from service, and Rp 51 billion (12%) from trade, hotel and restaurant.

Food crops are the largest in the agriculture sub sector. The major products are paddy, maize, cassava, sweet potatoes, peanut and soybeans. Especially, Boalemo is known as maize and paddy producing region. The production of paddy was 39,778 tons and maize was 89,678 tons in 2006. Some of the maize is transported to Anggrek port for export.

Per-capita GRDP is Rp 3.7 million at 2006 current price. Per-capita GRDP is Rp 2.5 million in 2005 at 2000 constant price, which is higher than the provincial average of Rp 2.2 million, and it is expected to reach at Rp 8.1 million in 2024.

(2) Transport System

A national road connects Tilamuta with Gorontalo city in the north and Central Sulawesi province in the south. The distance between Gorontalo city and Tilamuta is approximately 170 km or 3.0 hours travel by car. The nearest cargo port is at Anggrek, approximately 126 km from Tilamuta through national road and it takes about 3.0 hours. The air port is located at Isimu, approximately 104 km to the north and it takes about 2.5 hours.

(3) Road Condition

Figure A.10.6-3 shows road network in Boalemo Regency. The total length of regency roads is 626 km. Only 11 % (70 km) are in good/fair, 8% (50 km) in poor and 81 % (507 km) in bad condition (**Table A.10.6-4**). Only 22 % (137 km) are paved and 78% are gravel or soil.

Gorontalo is the lowest per-capita GRDP province in 2005 and this situation may continue even in 2024 unless concrete support measures are taken. Policy coordination among central government, regional governments and other sectors are necessary to support and enhance regional development. Corn (maize) is one of the primary products in Boalemo regency. The current bad conditioned regency roads should be improved together with the access to Anggrek port through national road (Link No 51-065) for supporting local products price raise and input materials price reduction, by reducing transport cost (vehicle operation and maintenance cost).

Table A.10.6-4 Regency Road Length and Condition in Boalemo

Kabupaten	Surface Type (km)					Condition (km)				
	Asphalt	Gravel	Soil	Other	Total	Good	Fair	Poor	Bad	Total
Boalemo	137	127	360	3	626	70		50	507	626
	22%	20%	57 %	1%	100 %	11%		8%	81%	100%

Road Condition

Bridge Condition

Maize (Corn) Plantation

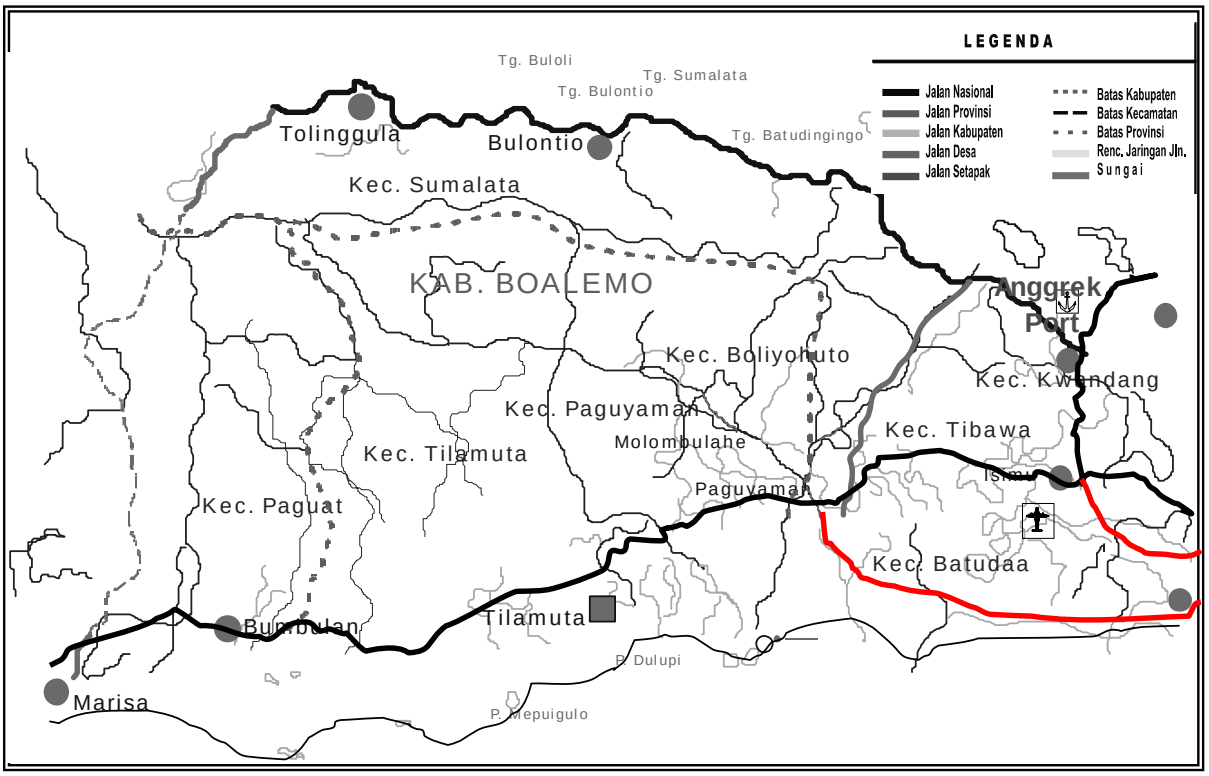


Figure A.10.6-3 Road Network Map for Boalemo Regency

6.5 Banggai Regency in Central Sulawesi Province

(1) Socio-economic Condition

Central Sulawesi Province is divided into nine regencies and one city. Banggai Regency resides at the most east tip of the province. Banggai Regency has 12 districts. And the regency capital is at Luwuk. The area of regency is 9,673 km^2, 14.2% of the total area of province. The population is 300,000 in 2006 with density of 31 /km^2. Central Sulawesi will be divided into two provinces in the near future and Luwuk will become the capital of new East Sulawesi Province.

The total GRDP is Rp 1,939 billion at 2005 current price. About 58% is from the agricultural sector, 10% from the trade, hotel and restaurant, 8% from the manufacturing, and 7% from the construction. Per-capita GRDP is Rp 6.5 million at current market price (2006). Per-capita GRDP at 2000 constant price is Rp 4.5 million, 92 % of the provincial average (Rp 4.8 million).

The primary production of food crops are paddy (132,591 tons), maize (5,853 tons), cassava (4,848 tons) and peanuts (3,007 tons). Production of major estate crops are oil palm (57,345 tons), coconut (31,980 tons) and cocoa (6,060 tons). About 61% or 57,905 M^3 of logs in Central Sulawesi was produced in Banggai regency.

Banggai regency is known as an oil/natural gas producing region. The location of oil/natural gas fields spreads in several districts. Natural gas production by a joint operation of a Japanese company and Pertamina started recently. Other minerals found are nickel (export to china), iron seed, granite, sand and stone, limestone and marble.

(2) Transport System

The transportat system in Banggai Regency is comprised of land, sea and air transports. The Trans Sulawesi East Corridor passes through the regency along the coast lines but not yet passable to the south. Sea ports are at Luwuk, Bunta, Pagimana, and Panciang /Kintom. Luwuk port is for passenger, container (Tilong kabila port, route Luwuk – Benoa – Surabaya – Baubau – Gorontalo – Bitung - Morowali) and ferry (route Banggai – Banggai Archipelago). Bunta Sea port is for ferry service for passenger, goods and commodities (route Bunta – Gorontalo). Pagimana port is also ferry service for passenger, goods and commodities (route Pagimana – Gorontalo, Pagimana – Luwuk – Morowali). Panciang/Kintom port is for container. The air services are provided by using Fokker 100 of Merpati Nusantara Airlines for routes of Luwuk – Palu (4 times a week), Luwuk – Gorontalo (1 time a week), Luwuk – Makassar (3 times a week) and Luwuk – Manado (5 times a week).

(3) Road Condition

The total of regency roads is 1,133 km and **Table A.10.6-5** shows surface type and conditions. Only 4.5% (51 km) of regency road is in good, 67.1% (760 km) in fair, 14.1% (159 km) in poor, and 14.4% (163 km) in bad condition. While, 34.7% (393 km) is asphalt surfaced roads.

The province has proposed upgrading the Trans Sulawesi East Corridor from provincial to national road. The southern coastal road between Toili and Baturube is under construction. The Study Team recommended introduction of a ferry facility between Baturube and Kolonodale to avoid negative impacts on Morowali national reserve.

Table A.10.6-5 Regency Road Length and Condition in Banggai

Kabupaten	Surface Type					Condition				
	Asphalt	Gravel	Soil	Other	Total	Good	Fair	Poor	Bad	Total
Banggai	393	19	58	63	1,133	51	760	159	163	1,133
	34.7%	54.7%	5.1%	5.5%	100%	4.5%	67.1%	14.1%	14.4%	100%

Source: Bappeda Kabupaten Banggai, 2007

Bridge at Ondo-ondolu

Road Condition

Ferry Port at Banggai

Coconuts Plantation

Natural Gas at Sinorang

Rice Field at Batui

Bubung Airport

Luwuk Port

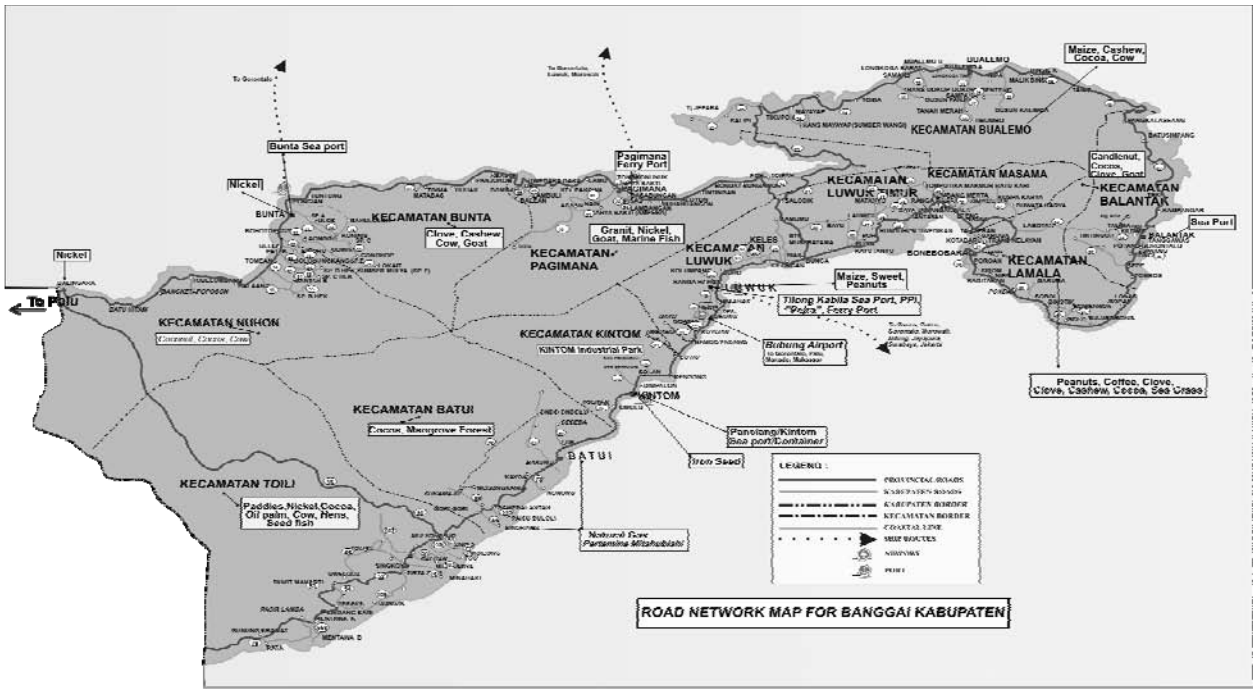


Figure A.10.6-4 Road Network Map and Other Information for Banggai Regency

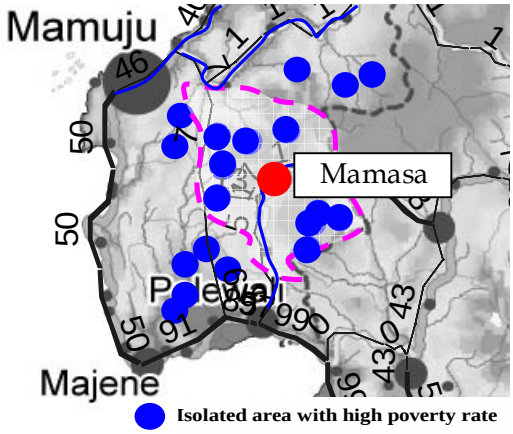
6.6 Mamasa Regency in West Sulawesi Province

(1) Socio-economic Condition

West Sulawesi Province became an independent province separated from South Sulawesi Province in 2004. Mamasa regency is one of the 6 regencies in West Sulawesi Province. The area of Mamasa regency is 2,759 km^2. The population is 123,400 in 2006, 17% of West Sulawesi Province. The population density is 45/km2 in 2006. The total GRDP is Rp 537 billion in 2006 at current market price. Agricultural sector contributes to 60%, service to 15% and trade, hotel and restaurant to 11% of the total GRDP. Per-capita GRDP is Rp 4.4 million at current market price. Per-capita GRDP at the 2000 constant price is Rp 3.8 million, which is 113% of the provincial average.

The major food crop production is paddy, cassava and sweet potato. The most of land in Mamasa regency are highland more than elevation 800 m and altitude of 50 % of land is more than 1,000 m. The climate of Mamasa regency is not suitable for semiannual paddy crop. The half of rice consumption in Mamasa regency is imported from the other province. The major estate products are arabica/robusta coffee, cacao and vanilla.

High poverty areas are located in isolated inland as seen in the right figure (blue dots). Development and rehabilitation of national, provincial and regency roads are an urgent issue improve the access to public services including school, hospitals, administrative offices, markets, etc.



Source: JICA Study Team

Figure A.9.6-5 High Poverty Ratio Area, Mamasa and its vicinity

(2) Transport System

There are no national roads for Mamasa. The current access is from Polewali for an approximate distance of 90 km of provincial road and it takes 7-8 hours by car in the rainy season as the road condition is very bad. A new road connecting Mamasa to Kaluke (Berang-berang port and Mamuju air port) is under construction.

(3) Road Condition

Total length of regency road is 869 km. Of these, 12% (102 km) are in good, 33% (284 km) in fair, 43% (374 km) in poor and 13% (43%) in bad conditions (refer **Table A.10.6-6**). Only 14% (122 km) of total length is paved 120km. Furthermore, according to the study for "Road data base, Mamasa regency Tahun Anggaran 2007" which is result of site survey conducted in July 2007 by

Mamasa regency, total length of "good" and "fair" condition of regency asphalt road is only 30km, 25% of asphalt pavement. The other 75% is "poor" or "bad" condition especially roads in mountain area.

Table A.10.6-6 Regency Road Length and Condition in Mamasa

Regency	Surface Type (km, %)					Condition (km, %)				
	Asphalt	Gravel	Soil	Other	Total	Good	Fair	Poor	Bad	Total
Mamasa	122	284	354	110	869	102	284	374	110	869
	14%	33%	41%	13%	100%	12%	33%	43%	13%	100%

Source: BPS Mamasa Dalam Angka 2006

The provincial road from Malabo to Mambie was improved as asphalt pavement road in 2002 under EIRTP-1. However, the most of asphalt pavement and base has been completely failed (right photo). Average travel speed of vehicle on these provincial roads is only 10-15 km/hr because of severely damaged road surface and steep slope of more than 7%.

Source: JICA Study Team

Road Condition

Source: JICA Study Team & Kabupaten Mamasa

Slope Failures

On the route of regency road from Tabone to Nosu of south-eastern of Mamasa regency, some section are closed to the traffic due to deep embankment depression and slope failures, especially in the rainy season.

<u>Priority road rehabilitation program, Kabupaten Mamasa Office</u>

Mamasa regency office has established a road rehabilitation program of 437 km with high priority (refer **Table A.10.6-7**), covering 67 km of provincial roads and 37 km of regency/ district roads.

Table A.10.6-7 Road Rehabilitation Program with High Priority in Mamasa Regency

Road Class	Provincial Road	Road linked to other Regency	Road linked to Districts	Total
Length	67 km	159 km	211 km	437km

Source: JICA Study Team & Mamasa Regency

6.7 Bone Regency in South Sulawesi Province

(1) Socio-economic Condition

Bone regency is one of the regencies in South Sulawesi Provinces and the regency capital is located in Watampone. Bone regency is consisted of 27 districts.

The land area of Bone regency is 4,559 km^2, 10% of South Sulawesi Province. The land use is for rice field (88,449 ha), fishpond (11,148 ha), estate crops (43,053 ha), forest (145,073 ha), dry land (120,524 ha) and others (10,503 ha).

Total population of Bone regency is 696,700 in 2006, with population density of 149 /km^2. The most densely district is Kecamatan Tanete Riattang in the south.

The total GRPD is Rp 3,328 billion at current market price in 2005. GRDP is originated from agriculture (56%), services (11%), manufacturing industry (9%) and other sectors. Regional economy of Bone regency is dominated by agricultural sector. The total rice field is 109,751 ha and its total production is 548,797 tons. As for estate crops, the major products are cacao (15,877 tons) and sugar cane (3,602 tons). Bone regency is famous in sugar cane production and sugar cane processing plants are located in Libureng sub district. Per-capita GRDP is Rp 3.3 million at current market price. Per-capita GRDP at 2000 constant price is Rp 3.3 million in 2005, 69% of the provincial average.

(2) Transport System

The transportation system in Bone is comprised of road and sea transports. Watampone is located at 174 km eastwards of Makssar and can be reached in approximately 4 hours by car on national road. Trans-Sulawesi East Corridor passes along Watampone. There are six ports (Bajoe, Patttiro Bajo, Tuju-tuju, Cenrana, Kading and Uloe) in Bone regency. The Bajoe port, a national port, is located at 7 km east of Watampone and ferries connect with Kolaka 3 times a day. Tuju-tuju port located near the boarder of Sinjai regency, is used for commodity transport by Pinisi ships which carry mostly rice to Baubau, Ambon in Maluku and Papua.

(3) Road Condition

Total length of regency roads is 2,483 km in 2006. The regency roads are 21.9% (543 km) in good, 18.4% (466 km) in fair, 24.3% (603 km) in poor and 35% (880 km) in bad condition as in **Table A.10.6-8**. Only 37% are asphalt surface roads. Northeastern part of the regency is located in wet lands and road conditions are in very bad and difficult to pass in the rainy season. Some roads are also not passable because of crossing bridges do not exist.

Bone regency has proposed priority programs of 1) road and bridge improvement (15 road links), 2) facility and equipment supply for road maintenance capacity building and 3) capacity building and human resources development through training and education.

Table A.10.6-8 Length and Condition of Regency Roads in Bone

Regency	Surface Type				Condition				
	Asphalt	Gravel	Soil	Total	Good	Fair	Poor	Bad	Total
Bone	923	783	777	2,483	543	466	603	880	2,483
	37.2%	31.5%	31.3%	100%	21.9%	18.4%	24.3%	35.5%	100%

Source: Bappeda Bone Regency, 2007

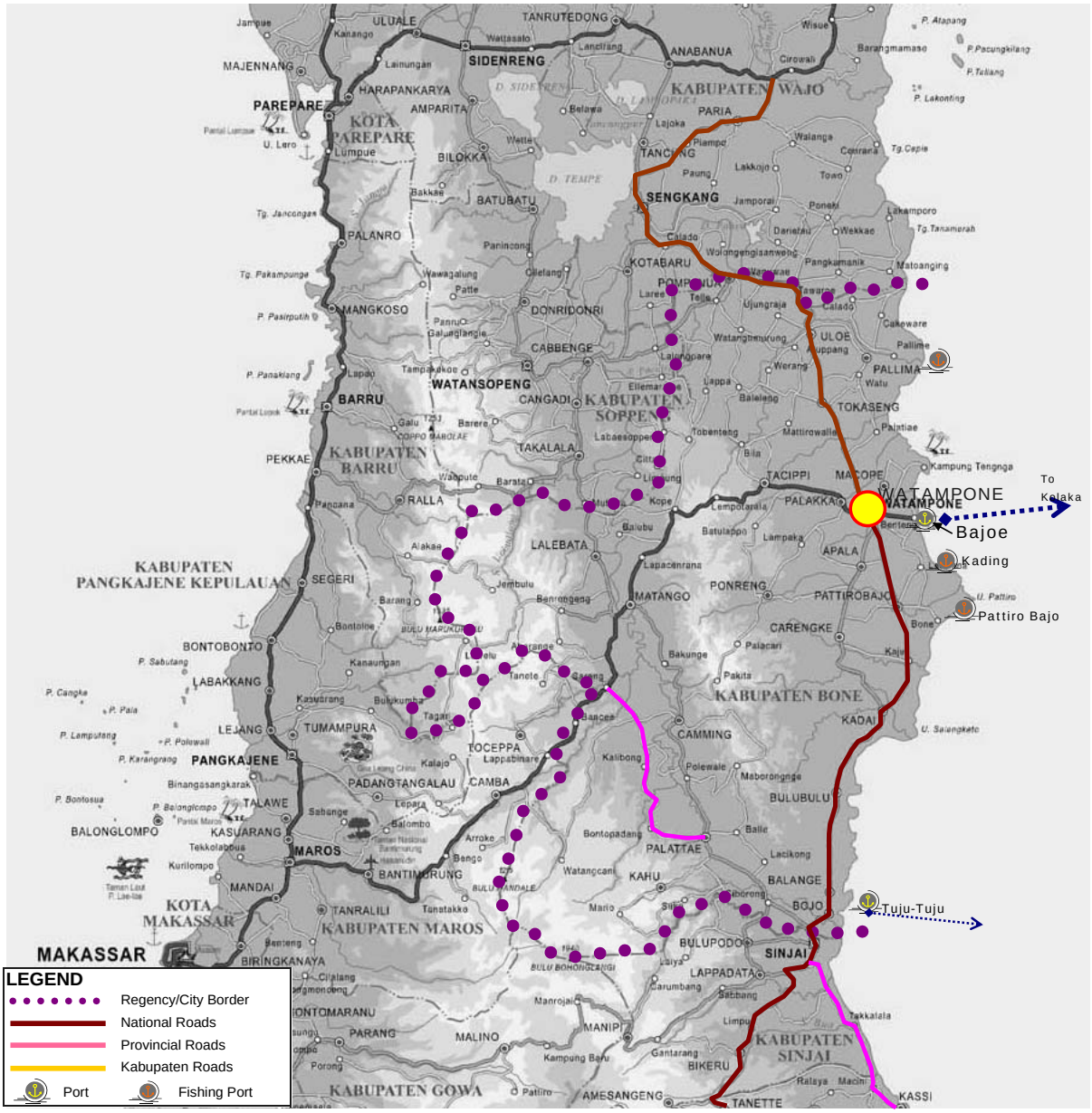


Figure A.10.6-6 Road Network Map for Bone Regency

6.8 Tana Toraja Regency in South Sulawesi Province

(1) Socio-economic Condition

South Sulawesi is divided into 20 regencies and three cities. Tana Toraja regency is located at the northern area of South Sulawesi Province. There are two town centers; one at Makale (regency capital) which has mostly administrative function and the other at Rantepao with commerce and trade, including tourism. The both towns are located at elevation of about 850 m above sea level and, therefore, it is cool climate. There is a plan that the northern area will become North Toraja Regency with its capital at Rantepao.

The area of Tana Toraja is 3,206 km^2 or 7.0% of South Sulawesi. The regency is located in mountainous – hilly topography. The population is 446,700, 6.0% of South Sulawesi and population density is 139 /km^2 in 2006.

The total GRDP is Rp 1,568 billion at 2006 current price. 48 % of the GRDP is contributed by agriculture sector, 18% by service, and 14% by trade, hotel & restaurant. The primary productions of food crops are paddy (133,161 tons), cassava (13,365 tons), sweet potatoes (2,814 tons) and maize (1,857 tons). Major production of estate crops are Arabica coffee (4,074 tons or 26.8% of provincial total), vanilla (243 tons or 20.7% of provincial total), Robusta coffee (1,505 tons or 9.0% of provincial total) and cacao (2,907 tons or 1.6% of provincial total). This regency has many tourist attractions in cultures, nature, terraced paddy fields and coffee plantation, etc. and would be an alternative tourist destination after Bali Island.

Per-capita GRDP is Rp 3.5 million, approximately a half of the South Sulawesi average, at 2006 current price. The per-capita GRDP was 2.3 million in 2005 and expected to reach at 7.1 million in 2024 at 2000 constant price.

(2) Transport System

Tana Toraja regency is inland regency. The distance between Makassar and Toraja regency is 350 km or 7-8 hours by car. There are two accesses by national roads; one passing through Enrekang and the other through Palopo. Access to the sea ports are either Palopo for about 2 hours or Parepare for about 4 hours. An access is envisaged from the north Tana Toraja to Berang-berang port, which is under construction, in West Sulawesi through high mountainous range. There is an air port at Makale, and the current service is two flights per week using Fokker.

(3) Road Condition

Total length of regency roads is 1,952 km in 2007. The regency roads are 11.5% (223 km) in good, 15.3% (298 km) in fair, 16.2% (316 km) in poor and 57% (1,114 km) in bad condition as in **Table A.10.6-10**. Only 32% are asphalt surface roads.

Many sections of regency roads are in steep terrain reflecting topography and in very bad

condition. The regency roads rehabilitation is urgent issue for support of isolated communities, especially in coffee and coconuts plantation farmers. The road rehabilitation is also important for tourism promotion.

It is noted that the improvement two routes of provincial roads connecting between Tana Toraja and Mamasa and Kaluku (Berang-berang port) in West Sulawesi Province is very urgent issues for providing outlet for agricultural products.

Table A.10.6-9 Regency Road Length and Condition for Tana Toraja Regency (km)

Regency	Surface Type				Condition				
	Asphalt	Gravel	Soil	Total	Good	Fair	Poor	Bad	Total
Tana	633	636	683	1,952	224	298	316	1,114	1,952
Toraja	32%	33%	35%	100%	11%	15%	16%	57%	100%

Source: Tana Toraja Public Work Agency, 2007

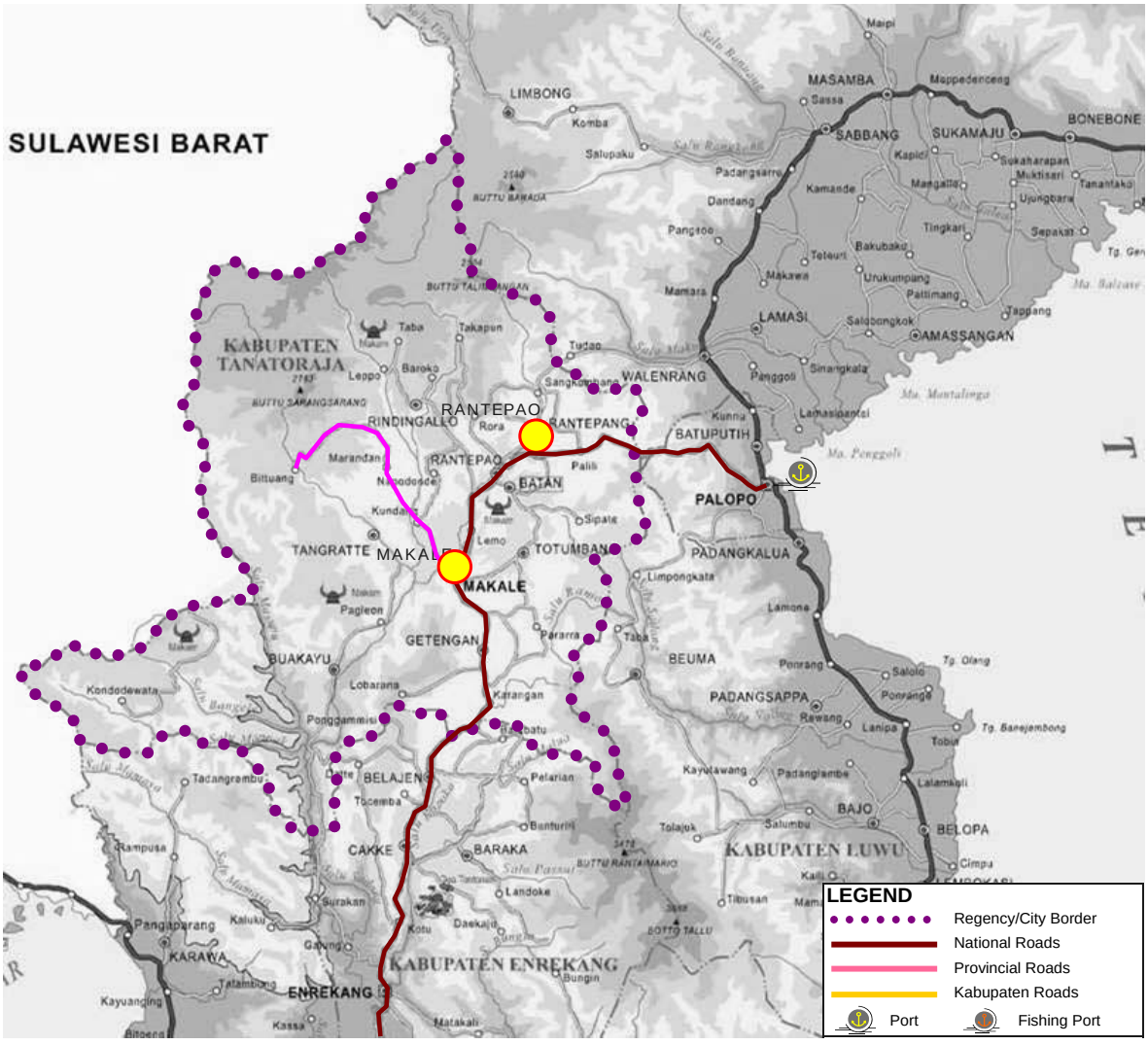


Figure A.10.6-7 Road Map and Information on Tana Toraja Regency

6.9 Buton Regency, Baubau City and North Buton Regency in Southeast Sulawesi

(1) Socio-economic Condition

The southern islands of Southeast Sulawesi Province were comprised of Buton and Muna Regencies by 2001. The latter was comprised of the southern part of Buton Island, the southern part of Muna Island, Tukangbusi Island and Kabaena Island by 2001. Baubau City separated in 2001. It was further separated to three regencies; Buton Regency, Wakatobi Regecy and Bombana Regency in 2003. North Buton Regency was separated from Raha Regency in 2007.

1) Buton Regency

The area of Buton Regency is 2,675 km^2, which is 7.0% of Southeast Sulawesi. Regency capital is at Pasarwajo. The population is 270,000, 14% of Southeast Province. The population density is 101/km^2 and this is twice of the provincial average. The total GRDP is Rp 1,168 billion. The major food crop production is paddy, cassava, maize and sweet potato. The major estate products are cashew nuts and coconuts. Fishery is also very prospective. Asbuton is produced in Kabunka and Lawele but current production is very low compared with huge deposit. Oil and gas exploitation by a Japanese firm (JPEC) is in progress.

Per-capita GRDP of Buton Regency at current market price is Rp 3.7 million. Per-capita GRDP is Rp 1.7 million at 2000 constant price, which is one of the lowest in Sulawesi.

2) Baubau City

The land area of Kota Baubau is 221 km^2 and consisted of six districts (kecamatan).Its population is 122,339 in 2006 with growth 1.53% per-annual. The population density is 552 /km^2.

Economic growth in 2005 – 2006 was dynamic enough, achieved 7.9% and 8.2% respectively. The total GRPD is Rp 893 billion at current price. Per-capita GRDP is Rp 7.4 million. Economic structure (GRDP) of Baubau is originated 23% from trade, hotels and restaurants, 23% from service, 18% from agriculture and 15% from construction sector.

3) North Buton Regency City

The area of North Buton Regency is 1,923 km^2 and population is 59,000. Kabupaten capital is designated at Bonegunu but currently the administrative office is set at Ereke Town. The major products are cacao, cashew nuts, coconuts and fishery. There are many people transmigrated from Java and Bali who are planting these cash crops and cultivating paddy at low lands. It is said that there is Asbuton deposit but its investigation has not yet conducted.

(2) Transport System

Transportation modes in Buton , Muna and other islands composed of land, maritime transportation and air transportation. Baubau city is the center of these island areas, including

commerce and trade. The Baubau port has a role of hub-port for surrounding islands and the eastern regions, including Kendari, Maluku, Nusatenggara and Papua. The passenger and cargo ships of PT. Pelni visit Baubau 28 times per month. Most of the local products are shipped out to Makassar or Surabaya through this port.

There is a local airport at Baubau and PT. Merpati provides services 3 flights per week. These flights connect to Makassar, Surabaya and Jakarta through Makassar.

Baubau is well connected with Kendari, Raha and Wakatobi islands by both ferry/speed boat or a combination of ferry and road. The current route from Baubau City to Kendari by car is 1) passing over Buton Straight by ferry (20 minutes) and goes to Tampo passing through Raha, 2) changing to ferry and goes to Torobulu passing over Toworo Straight (3 hours), 3) it takes approximately 2.5-3.0 hours from Torobulu to Kendari by car. The other route is a sea route by a speed boat stopping over Raha and it takes approximately 5 hours. A new ferry route has planned from the northern end (Labuan) of Buton Island to the main land.

The volume of unloading at Baubau port is 189,000 tons in 2005 and 217,000 tons in 2006. The volume of loading is 79,000 tons in 2005 and 84,000 tons in 2006. The total passengers are 400,000 in 2005 and 414,000 in 2006.

(3) Road Condition

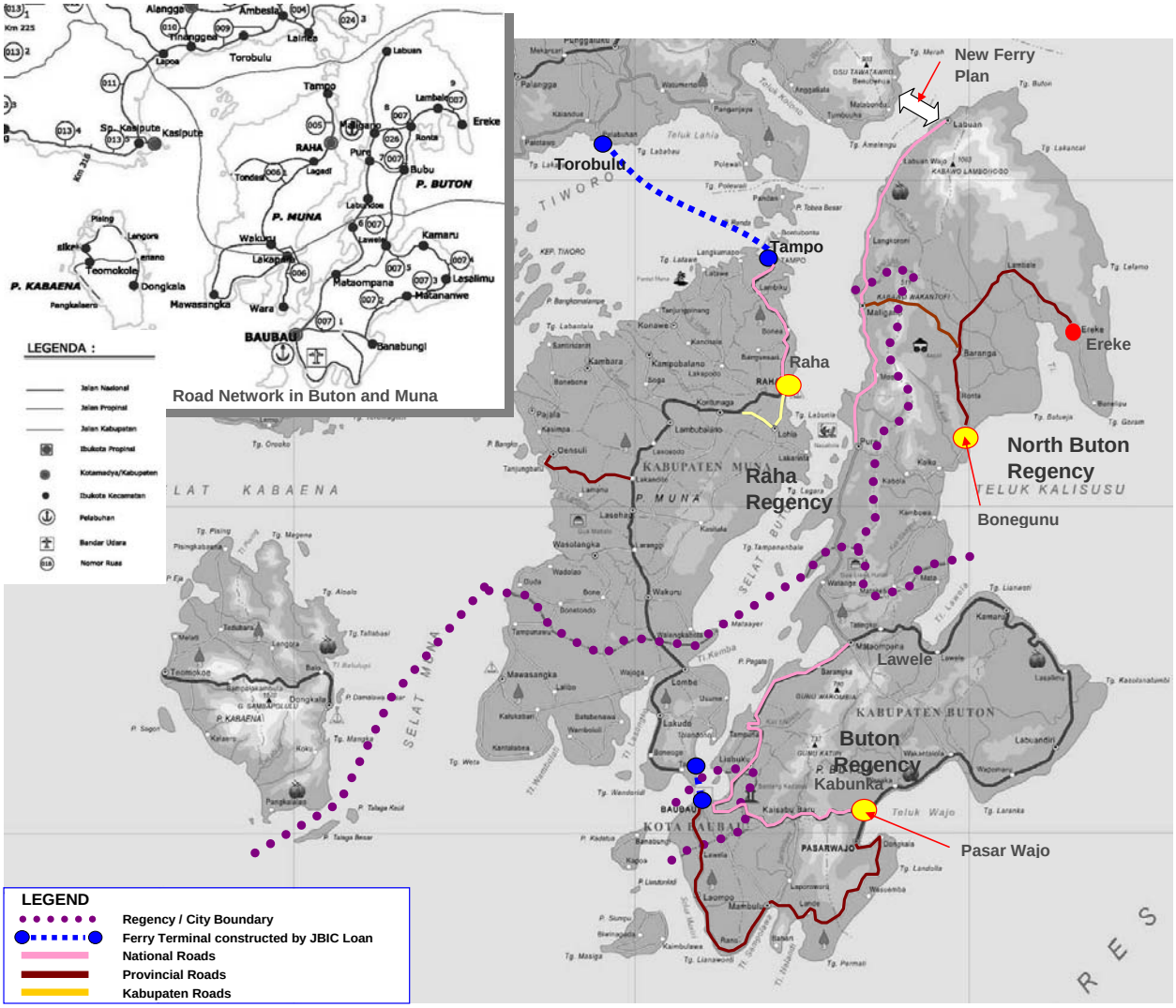
Two national roads in Buton Island start at Baubau City and one goes to the north along the west coast and the other goes to the east up to Pasar Wajo/Banabungi. **Figure A.10.6-8** shows road network in the study area. The roads in Buton Regency are 58% in good/fair condition and 42% in poor/bad conditions (**Table A.10.6-10**) but 82% are paved. The road in Muna Regency is 63% in good/fair condition and 37% in poor/bad conditions and 44% are paved. The road condition of Baubau city is 96% in good/fair condition.

Table A.10.6-10 Kabupaten/Kota Road Length and Condition in Buton, Muna and Baubau

Unit: km

Regency / City	Surface Type					Condition				
	Asphalt	Gravel	Soil	Other	Total	Good	Fair	Poor	Bad	Total
Buton	529	57	32	25	643	260	115	236	32	643
	82%	9%	5%	4%	100%	40%	18%	37%	5%	100%
Muna	434	345	214	0	993	399	226	190	178	993
	44%	35%	22%	0%	100%	40%	23%	19%	18%	100%
Kota Bau-	96	86	0	0	182	164	11	6	1	182
	53%	47%	0%	0%	100%	90%	6%	3%	1%	100%
Total	1,059	488	246	25	1,818	823	352	432	211	1,818
	58%	27%	14%	1%	100%	45%	19%	24%	12%	100%

Source: BPS, Dalam Angka 2007, Kota Baubau, Kabupaten Buton, Kabupaten Muna



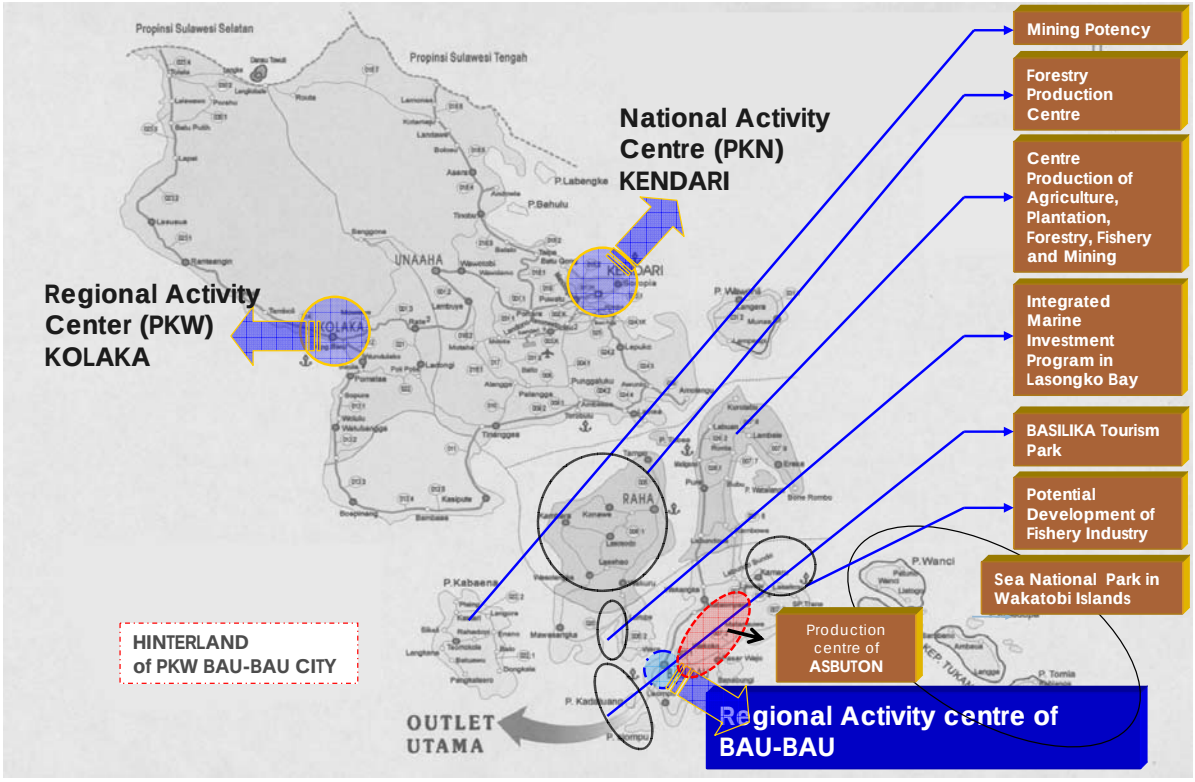
Source: JICA Study Team

FigureA.10.6-8 Road Network Map for Buton and Muna Islands

(4) Development Potentials and Transportation Infrastructure Development Plan

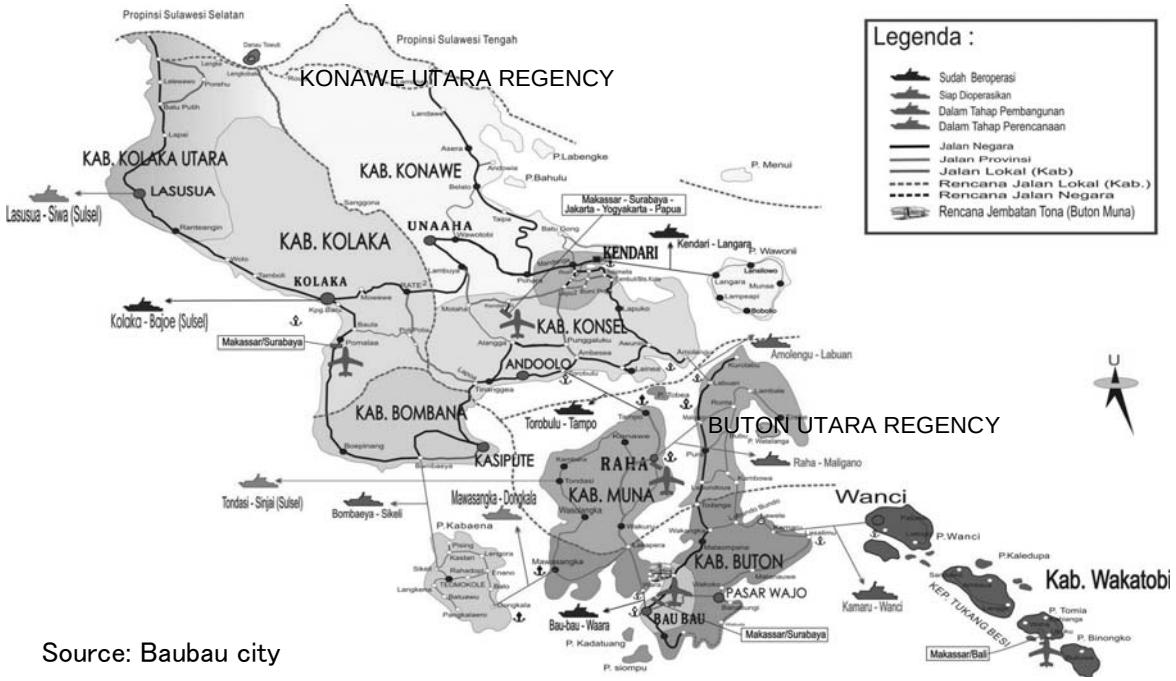
Figure A.10.6-9 shows potentials of Baubau city and its surroundings, including Buton, Muna, Kabaena and Wakatobi Islands. There are prosperous potentials in trade, commerce, mining, agriculture, fishery, manufacturing, tourism, etc. Asbuton (natural asphalt) in Buton Island should be fully utilized as suggested in Section 6. The 1st phase of Oil/Gas exploitation has started in Buton Island and the 2nd phase in under bidding. The fishery including seaweed and peals are under production and exported. Tourism will be another possibility for eco-tourism at Wakatobi Island and Buton Straits.

There is a plan that these areas will establish a new province in the future with new capital at Baubau City. **Figure A.10.6-10** shows transportation infrastructure development plan of Baubau and its surroundings.



Source: Bappeda, Baubau City

FigureA.10.6-9 Development Potentials for Baubau City and Surroundings



Source: Baubau city

FigureA.10.6-10 Transportation Infrastructure Development Plan for Baubau City and Surroundings

6.10 Conclusion on Field Survey on Regency and City Roads

The Study Team confirmed that sampled regencies and cities have own unique history, culture, geography, topography, products, tourism attractions, access and others. Though each regency or city has different and prospective development potentials, those are not yet utilized fully because of poor accesses, no investors recognized them, insufficient supports of central and provincial government and/or insufficient own efforts.

The road conditions of the sampled regency are as shown in **Table A.10.6-11**. 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. 40% of the roads are asphalt paved and others are gravel or soil. Those percentages are similar to the national statistics for Sulawesi.

Table A.10.6-11 Summary of 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

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

Mangrove by Community
Source: JICA Study Team

Ship-building (Bulukumba)

Roadside Durian Shops

Fresh Fish Market at Baubau

7 Concept of Regency / City Road Development and Maintenance

7.1 Development Concept and Development Plan

(1) Development Plan

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

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

Two targets were set up for Kabupaten road development and rehabilitation. One is improvement of road condition from 56% to 85% in good/fair by 2025 by stage. The road classified into bad will be reduced from 23% in 2005 to 6% in 2024. The other is increasing of asphalt pavement surface from the current 41% to 70% in 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.10.7-1 Regency and City Roads in Sulawesi in 2024

Unit: KM

Year	Road Condition				Pavement			Length of New/Up-grading	Total Length
	Good/Fair	Poor	Bad	Total	Asphalt	Gravel/ Soil	Total		
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

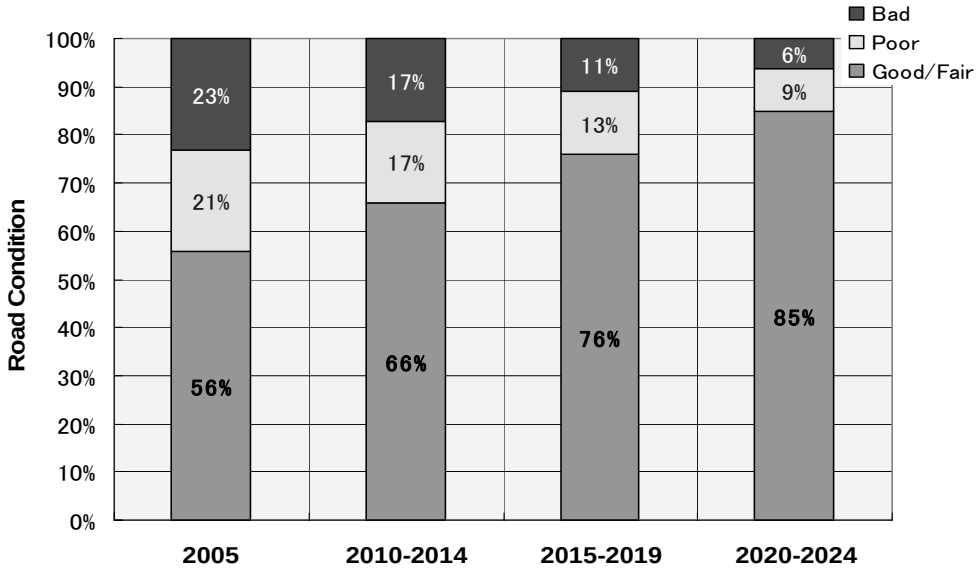


Figure A.10.7-1 Improvement of Road Condition

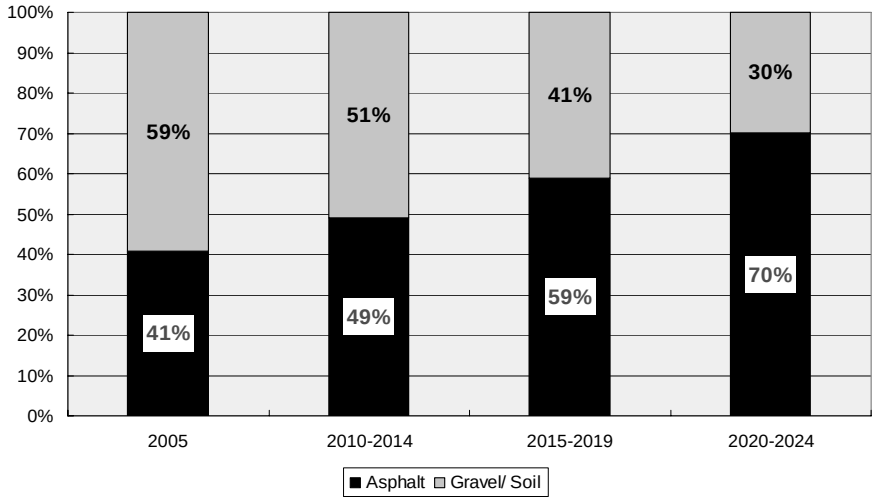


Figure A.10.7-2 Increase of Asphalt Pavement Surface

(2) Design Standards

The GOI issued "Government Road Regulation/Peraturaan 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 5.5 m travel-way width for local road. While relation of road width with traffic level has not yet been issued concerning PP No.34 Year 2006.

Table A.10.7-2 New Road Standard for Kabupaten Road (Collector Road)

Classification	Road Width (m)					
	42/KPTS/Db/2007 Standard			Transition Period		
	Left Shoulder	Travelway Width	Right Shoulder	Left Shoulder	Travelway Width	Right Shoulder
Arterial	2	7	2	2.5	6	2.5
				2	6	2
Collector	1.5	6	1.5	2	5	2
				2.5	4.5	2.5
Local (Kabupaten)	1	5.5	1	1.5	4.5	1.5
				2	3.5	2

The travelway with for most of Kabupaten roads is 4.0 m. The Study team judged that it is not feasible technically and economically to apply the new road regulation to all road projects under current budgets and traffic volume on the Kabupaten roads. The Study team recommended staged-wised application based on the present and future traffic demand.

(3) Bridge Replacement and Construction

The bridges of bad, non-functional and wooden will be replaced in the short-medium term. New bridges will be constructed for the crossings without bridges by 2024. As bridges are bottle neck for the road transport, these can be replaced or constructed in advance to the road improvement

under budget constraints.

Table A.10.7-3 Bridge Replacement and Construction Plan

Province	Road Length (km)	Total No of Bridges *	No. of Bridges /km	Bad, No-functional, Wooden and No-bridge (2005)*		Bad, Very Bad, Wooden and No-bridge (2024)	
North Sulawesi	3,490	1,140	3.1	240	21%		
Gorontalo	2,450	410	6.0	210	51%		
Central Sulawesi	8,006	2,340	3.4	690	30%		
West Sulawesi	4,801	740	6.4	200	27%		
South Sulawesi	18,826	6,260	3.0	1,050	17%		
South East Sulawesi	6,291	2,080	3.0	850	41%		
Total	43,864	12,970	3.3	3,240	25%	160	5%

Note: * Estimate by the JICA Study Team

7.2 Maintenance Plan

Sustainability of the road facilities after development or betterment is the most important issue. The new or rehabilitated roads will deteriorate by vehicle loading, weathering and aging. The maintenance reduces the rate of pavement deterioration, lowers the vehicle operation costs, saving time costs, and provides continuous service for the road users and communities. The maintenance should be supported in a system of information (data), planning, budgeting, and practice with sound techniques.

Insufficient maintenance budget allocation for the road maintenance, especially during the economic crisis, has caused serious road deterioration. Both development and maintenance budget for the national road has increased substantially in 2006 – 2008 reflecting 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 220 billion, which is 1.0% of the Kabupaten/Kota road asset values, is required annually for routine maintenance of local roads.

The road maintenance consists of routine maintenance, periodic maintenance and emergency works. Routine maintenance is the activity that needs to be undertaken each year. It is mostly labor intensive work compared with the periodic maintenance that is equipment basis. As deign period for new/betterment project is for 10 years, the 1st periodic maintenance is required 10 years after the opining. As the design life of periodic maintenance is 5 years in principle, it needs to be repeated at every 6-8 years depending on traffic level. The required maintenance activities are for pavement, shoulders, drainage, drainage facilities, etc. the physical activities need equipment, materials, tools, personnel and budget.

The management, planning and execution of maintenance for regency/city roads are currently under responsibility of Dinas PU of Regency/City governments. The routine maintenance for regency/city roads is conducted by force account of regency/city governments using APBD II

(regency/city budget) and special budget allocated from APBN through DGH. The periodic maintenance is either contracted out to the private sector or carried out by force account by APBD II or APBN special allocation.

The key factor for the good maintenance is financial and budgeting sustainability based on an efficient and effective management system. Stable funding source should be established for maintenance finance. There are two approaches, budget approach and road fund approach. The former is a public expenditure that will be covered by national or provincial budget. Fuel taxes, vehicle registration fees and others levies are taken as general taxes and allocated as road sector budget. The latter is road fund approach that road users should pay for the cost of roads and that revenue generated should be applied to cover road cost. The former is current practice in Indonesia and the latter, road fund, is one of the envisaged future challenges.

A study was made in Indonesia on appropriateness of establishing road fund under the World Bank's financial cooperation (EIRTP-1). However, as its application has not yet started, it needs strengthening the current approach for a while to secure the maintenance cost.

7.3 Human Resources and Capacity Development

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

The Local Road Improvement Projects I-III was implemented in 1981-2000 under the OECF/JBIC's soft loan finance. The project components were betterment (2,700 km), periodic maintenance (5,800 km in Sulawesi) and capacity building for routine maintenance by providing equipment.

In line with development of regional autonomy, further human resources development and capacity building, including equipment replacement, will be required.

8 Cost Estimate and Implementation Plan

8.1 Cost Estimate and Implementation Plan

(1) Unit Cost of Development, Rehabilitation and Maintenance

Unit costs of the regency/city road rehabilitation (betterment, periodic maintenance and up-grading) were sestablsihed based on the past and on-going similar projects, as follows:

Table A.10.8-1 Unit Cost for Project Cost Estimation

Classification of Works	Road Condition	Unit Price (Rp Million / km)
Betterment	Bad	680
Periodic Maintenance	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 above unit cost includes civil works cost, consultancy service cost, administration cost and taxes but not includes land acquisition.

The routine maintenance cost is estimated at approximately 1.0% - 1.5% of the asset value per year on the average. Therefore, it requires Rp 220 billion per year for regency/city roads.

Table A.10.8-2 Maintenance Cost of Regency Roads

Road Status	Length (km)	Estimated Road Asset Value		Required Budget (Bill Rp/year)
		Bill Rp/Km	Amount (Bill Rp)	1.0% - 1.5% of Asset
National	7,100	1.4	9,940	99 - 149
Provincial	5,000	1.1	5,500	55 - 83
Regency/ City	44,000	0.5	22,000	220
Total	56,100		37,440	374 - 452

Source: JICA Study Team

(2) Betterment, Periodic Maintenance and Up-grading/New Construction Costs

The betterment (reconstruction) is required for bad conditioned roads of approximately 10,134 km. A total of Rp 6,891 billion (Rp 3,101 billion for short-term, Rp 2,412 billion for medium-term and Rp 1,378 billion for long-term) is required up to year 2024 as given in **Figure A.10.8-3**.

Table A.10.8-3 Betterment Cost of Regency Roads

Province	Road Length of Bad Condition km	Total Development Cost			Short-Term (2010-2014) Bill Rp	Medium-Term (2015-2019) Bill Rp	Long-Tterm (2020-2024) Bill Rp
		Unit Cost Mill Rp/km	Amount Bil Rp	Share (%)			
North Sulawesi	267	680	182	2.6%	82 45%	64 35%	36 20%
Gorontalo	748	680	509	7.4%	229 45%	178 35%	102 20%
Central Sulawesi	1,686	680	1,146	16.6%	516 45%	401 35%	229 20%
West Sulawesi	1,154	680	785	11.4%	353 45%	275 35%	157 20%
South Sulawesi	4,793	680	3,259	47.3%	1,467 45%	1,141 35%	652 20%
Southeast Sulawesi	1,486	680	1,010	14.7%	455 45%	354 35%	202 20%
Total	10,134		6,891	100.0%	3,101 45%	2,412 35%	1,378 20%

Note: Unit Cost 680 Mill Rp./km

Periodic maintenance is required for both fair and poor conditioned roads of 20,283 km. A total of Rp 5,476 billion (Rp 1,295 billion for short-term, Rp 2,141 billion for medium-term and Rp 2,041 billion for long-term) is required up to year 2024 as given in **Figure A.10.8-4.**

Table A.10.8-4 Periodic Maintenance Cost of Regency Roads

Province	Road Length km	Periodic Maintenance Cost			Short-Term (2010-2014) Bill Rp	Medium-Term (2015-2019) Bill Rp	Long-Term (2020-2024) Bill Rp
		Unit Cost Mill Rp/km	Amount Bil Rp	Share (%)			
Poor Condition Road							
North Sulawesi	899	270	243	9.7%	97 40%	92 38%	53 22%
Gorontalo	448	270	121	4.9%	48 40%	46 38%	27 22%
Central Sulawesi	1,410	270	381	15.3%	152 40%	145 38%	84 22%
West Sulawesi	2,155	270	582	23.4%	233 40%	221 38%	128 22%
South Sulawesi	3,255	270	879	35.3%	352 40%	334 38%	193 22%
Southeast Sulawesi	1,058	270	286	11.5%	114 40%	109 38%	63 22%
Sub-Total	9,225		2,491	100.0%	996 40%	946 38%	548 22%
Fair Condition Road							
North Sulawesi	1,216	270	328	11.0%	33 10%	131 40%	164 50%
Gorontalo	140	270	38	1.3%	4 10%	15 40%	19 50%
Central Sulawesi	1,825	270	493	16.5%	49 10%	197 40%	246 50%
West Sulawesi	731	270	197	6.6%	20 10%	79 40%	99 50%
South Sulawesi	5,390	270	1,455	48.7%	146 10%	582 40%	728 50%
Southeast Sulawesi	1,756	270	474	15.9%	47 10%	190 40%	237 50%
Sub-Total	11,058		2,986	100.0%	299 10%	1,194 40%	1,493 50%
Total	20,283		5,476		1,295 24%	2,141 39%	2,041 37%

Note: Unit Cost 270 Mill Rp./km

Up-grading from district road to regency road or new road construction is planned for 6,136 km, a total length of 50,000 km of regency/city roads in 2024. A total of Rp 4,602 billion is required up to year 2024 as given in **Figure A.10.8-5.**

Table A.10.8-5 Upgrading Cost of Regency Roads

Province	Road Length in 2005	Assumed Road Length in 2024[3]	Upgrading / New Road by 2024[2]	Total Development Cost			Short-Term (2010-2014)	Medium-Term (2015-2019)	Long-Term (2020-2024)
				Unit Cost[1]	Amount	Share			
	km	km	km	Mill Rp/km	Bil Rp	(%)	Bill Rp	Bill Rp	Bill Rp
North Sulawesi	3,490	3,980	490	750	368	8.0%	74 20%	85 23%	209 57%
Gorontalo	2,450	2,790	340	750	255	5.5%	51 20%	59 23%	145 57%
Central Sulawesi	8,006	9,130	1,124	750	843	18.3%	169 20%	194 23%	481 57%
West Sulawesi	4,801	5,470	669	750	502	10.9%	100 20%	115 23%	286 57%
South Sulawesi	18,826	21,460	2,634	750	1,975	42.9%	395 20%	454 23%	1,126 57%
Southeast Sulawesi	6,291	7,170	879	750	659	14.3%	132 20%	152 23%	376 57%
Total	43,864	50,000	6,136 (14% increase)		4,602	100.0%	920 20%	1,058 23%	2,623 57%

Notes: 1) Unit Cost 750 Mill Rp./km
2) Upgrading from district roads (Desa and Kecamatan)
3) Increase to the road length of year 2005

(3) Routine Maintenance Cost

A total of Rp 3,300 billion (Rp 1,100 billion for each short, medium and long-term) is required up to year 2024 for routine maintenance.

(4) Bridge Replacement and Construction Costs

A total number of 3,240 bridges (or 32,400 m long), which are bad, non functional and without bridge, are subjected to replacement or reconstruction in the short-term. The required investment cost is estimated at Rp 1,430 billion and it was included in the road rehabilitation costs.

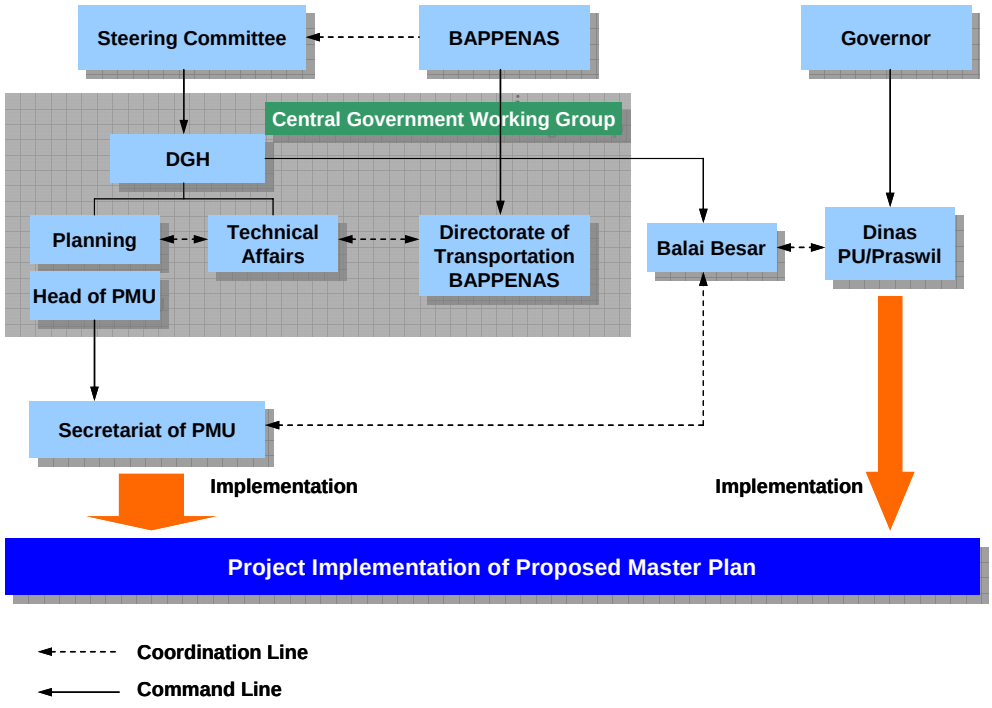
Total Number of Bridge:		12,970	(100%)
With bad/non-function/wooden bridge and without bridge:		3,240	(25%)
Estimated Length:		10	m/bridge
Estimated Total Length required for		32,400	m
Planned With of bridge:		5.5	m
Total Area of Bridge:		178,200	m^2
Unit Cost:	Rp	8	million/m^2
Total Cost:	**Rp**	**1,430**	**billion**

8.2 Implementation Plan

(1) Implementation Organization

Since the Regency Road Development should be effectively integrated with comprehensive road network development of both national and provincial roads, a type of implementation organization would be required as illustrated in **Figure A.10.8-1** which facilitates necessary coordination and utilization of resources of both the central and the regional governments.

In this type of organization, a working group would be set up at the central government level with a steering committee to monitor the activities of the working group. The working group is composed of DGH (including the head of PMU of the project) of Ministry of Public Works and the Directorate of Transportation of BAPPENAS and would function as a center of the inter-governmental coordination for the project implementation using the Balai Besar and possibly the BAPPEDA as a regional channel and the PMU as the project implementation body. Close coordination should be required at the regional level between the Balai Besar and the Dinas PU of Kabupaten/Kota and possibly between the working group, through MPW and BAPPENAS, and the Kabupaten/Kota Governors.



Source: JICA Study Team

Figure A.10.8-1 Possible Organization for Integrated Implementation

Since various problems arise due to the lack of expertise in project implementation at both the regional government level and the local consultant level in the implementation of EIRTP-2, both the human resources and monetary resources should be properly allocated to supporting and monitoring the project preparation and implementation of Kabupaten/Kota governments.

(2) Financing Plan

1) Funding Requirement

The funding requirement for the proposed Kabupaten Road Development Plan is estimated to be about Rp 20.3 Trillion for the entire period including Betterment, Periodic Maintenance, Routine Maintenance and Upgrading/New Construction. Annual average requirement will be Rp 1.3 to 1.4 Trillion.

Table A.10.8-6 Funding Requirement for Kabupaten Road Development

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.Maitenance	**1,295**	**2,141**	**2,041**	**5,476**
R.Maitenance	**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) Possible Budget Envelope

Possible budget envelope for the Kabupaten Road Development in the future has been estimated as shown in **Table A.10.8-7**. The total budget was estimated as Rp 18,041 Billion for the entire period including Betterment, Periodic Maintenance, Routine Maintenance and Upgrading/New Construction, on the basis of the following assumptions:

a) Total expenditure budget of all Kabupaten/Kota of the Sulawesi Region: Rp 18.8Trillion for 2006 was used for the basis of the forecast.

b) Average share of the road sector budget of each Kabupaten/Kota in their total expenditure budget for 2002-2006 has been calculated as 7.4%. However, this may include some Central Government level funding such as EIRTP-2, thus the ratio reduced to 80%, which is 5.9% was used for conservative forecast.

c) Annual growth rate of 1.0% was applied for the growth of the budget.

In summary, the estimated potential budget is smaller than the funding requirement of the proposed plan for the entire period by about Rp 2.2 Trillion.

Table A.10.8-7 Possible Budget Envelope

Unit: Bill Rp.

Category	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) Financing Plan

On-granting system which is similar to that of EIRTP-2 shall be applied to the proposed Kabupaten Road Development in which ODA soft loan is extended to GOI with DGH as the executing agency and the loan is on-granted to selected Regency governments with certain local cost sharing on the basis of agreement signed between the head of Regency and the Ministry of Finance with DGH functioning as a project monitoring entity. The project cost sharing of regency will differ depending on the fiscal capability of the concerned regency. As pre-financing requirement which is adopted to EIRTP-2 was heavy burden on the regencies, such requirement should not be applied to the proposed system and also adequate degree of local cost sharing shall be examined.

(3) Implementation Schedule

The regency / city roads will be rehabilitated in the short, medium and long-term as shown in **Figure A.10.8-2** to achieve the development targets provided in Section 7. 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-	Long-Term (2020-2024)
Project Preparation					
Betterment	6,891	APBD Programs and EIRTP 2			
P.Maitenance	5,476				
R.Maitenance	3,300				
Upgrading/New	4,602				
Urgent Bridge Replacement and Construction	4,603				
Capacity Development					

Source: JICA Study Team

Figure A.10.8-2 Implementation Schedule

9 Effect of Regency Road Development

9.1 Effect of Asbuton Development on Regional Economy

(1) Demand and Supply of Asphalt in Indonesia

The total demand of asphalt in Indonesia has been estimated at about 1.2 million tons per annum[1] for which about 600,000 tons are supplied by Pertamina and the rest is imported. Since Bina Marga requests Pertamina to produce the above volume[2] annually the imported portion which is about 600,000 tons per annum is the target for replacement by the production of Asbuton.

(2) Current Asbuton Production

Current production volume of Asbuton as raw material was 120,000 tons in 2007 with the 2008 plan of 125,000 tons per annum. If the grading of 30 % of Bitumen content is assumed for the raw material of Asbuton, the net Bitumen volume may be calculated to be about 3,6,000 tons per annum which is only 6% of the above-mentioned imported portion.

(3) Effect of Asbuton Development on Regional Economy

1) Category of Asbuton Products

The Asbuton business can be classified into the following three categories on the basis of product form:

i) Asbuton Raw Material

PT. Sarana Karya is at a moment only producer of the Asbuton raw material although other concessionaires for the mining of Asbuton exist.

ii) Asbuton Granular Asphalt

Asbuton Granular Asphalt (AGA) is currently the final product of Asbuton being produced by private producers. AGA is based on the Kabungka Asbuton whereas the product based on the Lawele Asbuton is called Lawele Granular Asphalt (LGA). PT. Sarana Karya is not producing these products at a moment but is planning to construct the production plant for producing these products. Bitumen contents of these products are similar to the raw material.

iii) Extracted Asphalt

Extraction of asphalt from Asbuton is technically feasible but no business for this product has been established.

2) Direction of Asbuton Utilization Policy and its Potential

[1] Website of Dina Bina Marga Province Jawa Tengh and the interview with Association of Asphalt Concrete of Indonesia (AABI)
[2] AABI

Utilization of Asbuton can be focused on the development and the maintenance of Provincial and Kabupaten/Kota roads as they require lower specification as compared to National roads. If the government policy is adopted for the utilization of Asbuton for those regional roads, out of the above mentioned volume target of 600,000 tons per annum, 300,000 tons (50% for Provincial road and 50% for Kabupaten/Kota road) could be utilized since the total asphalt demand for the national road is estimated as 900,000 tons per annum[3].

When the net Bitumen volume of 300,000 tons is needed the required volume of Asbuton production will be in the order of 1,000,000 tons per annum.

Table A.10.9-1 shows the Bitumen demand estimated for the proposed development plan which will require about 100,000 tons of Bitumen per year. The above production volume of Asbuton will cover one third of the total volume required for the proposed development plan as far as the development of Kabupaten/Kota Roads are concerned..

Table A.10.9-1 Bitumen Demand Estimated for Kabupaten/Kota Road in Sulawesi

Unit: Ton

Category	Short-Term (2010-2014)	Medium-Term (2015-2019)	Long-Term (2020-2024)	Total	Remarks
Betterment	**156,732**	**121,903**	**69,659**	**348,293**	22%
P.Maitenance	**164,826**	**272,500**	**259,776**	**697,101**	45%
R.Maitenance	**103,273**	**103,273**	**103,273**	**309,818**	20%
Upgrading/New	**42,177**	**48,504**	**120,205**	**210,887**	13%
Total	**467,007**	**546,178**	**552,913**	**1,566,099**	100%
Annual Average	**93,401**	**109,236**	**110,583**	**104,407**	

Note: Bitumen content = 6.5% of the hot mix.

Source: JICA Study Team

3) Effect on Regional Economy

If the 1,000,000 tons of Asbuton production is materialized significant effect will be created on the regional economy in the following aspects:

i) Total Sales Proceeds

Sales proceeds of the following products will be created:

a. Asbuton Raw Material: 1,000,000 tons x Rp 260,000/ton = Rp 260 Billion/Year

b. Granular Asbuton: 1,000,000 tons x Rp 1,000,000/ton = Rp 1,000 Billion/Year

ii) Size of Employment

PT. Sarana Karya employed 840 persons in 1985 when the production reached 500,000 tons per year, out of which 770 persons were the residents of Buton Island. Therefore, if the production of 1,000,000 tons of raw material is materialized, employment of about 1,500 persons will be created

[3] Bina Marga Highway News and AABI

for the raw material production. In addition to this a considerable size of employment will also be created since some of the plants for the production of AGA and LGA are likely to be located in Buton Island.

iii) Income of Mineral Resource Royalty

As 32 % of the mineral resource royalty paid to the government is allocated to the regency where the resource is located, Buton Regency and possibly North Buton Regency will receive the royalty income of about Rp XXX Billion.

iv) Substitution of Imported Asphalt

If the imported asphalt of 300,000 tons per annum is to be substituted by Asbuton, US$ 120 Million[4] per annum of foreign currency would be saved on the National Expenditure Account.

v) Potential of Additional Foreign Currency Based Income for the Region

As PT. Buton Asphalt Indonesia (BAI) is already exporting Asbuton to China[5] the development of Asbuton is likely to bring an additional increase of foreign currency based income into the Region. When the extraction business of Bitumen from Asbuton is materialized in the future, it will become a considerable part of the foreign currency earning industry in Sulawesi Region such as the agro-related industry (Clove, Cashew Nuts, Copra and Cacao), the mining industry (Nickel, Gold and Others) and the tourism industry.

In summary, 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.

9.2 Effect of Regency Road Development on Regional Economy

The local road (Kabupaten and Kota roads) rehabilitation will contribute to:

- Improve the access to public services including school, hospitals, administrative offices, markets, etc.
- Local products price raise and input materials price reduction, 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.

[4] The price of US$ 400/ton is assumed.
[5] BAI is said to have signed the agreement to export 9,000 tons /month of Asbuton to China, based on the interview with PT. Hutama Prima.

9.3 Action Plan

(1) Formulation of "Integrated Road Projects and Programs"

The project formulation and preparation is required for the local road rehabilitation. The Study Team recommends that "Integrated Road Projects and Programs" 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 include capacity development of local governments in planning, management and implementation. The maintenance capacity will be improved by proving equipment and tools and training both management and working staff. The project will also involve capacity development or improvement for Asbuton production, transportation facilities (port and related facilities), quality control and overall management.

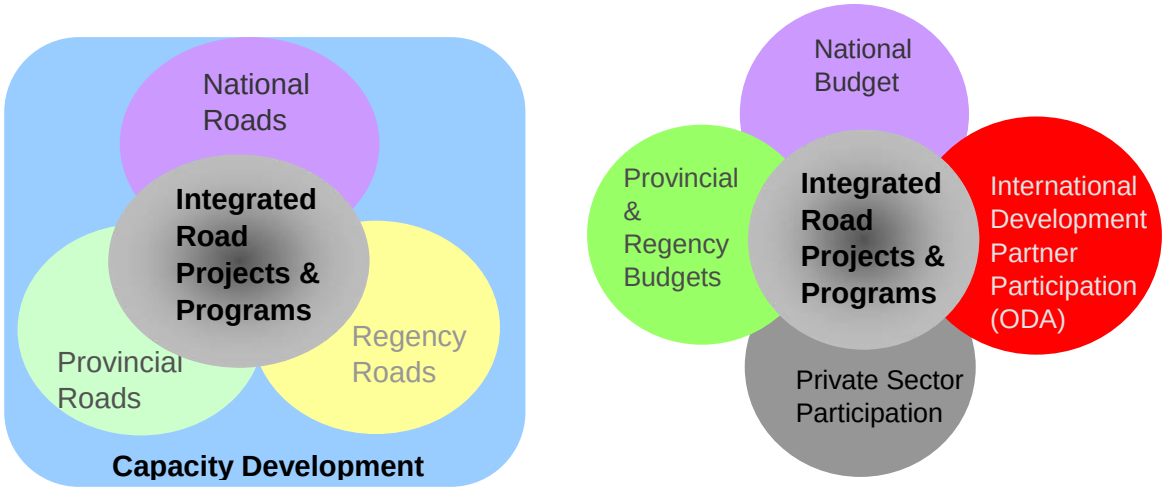
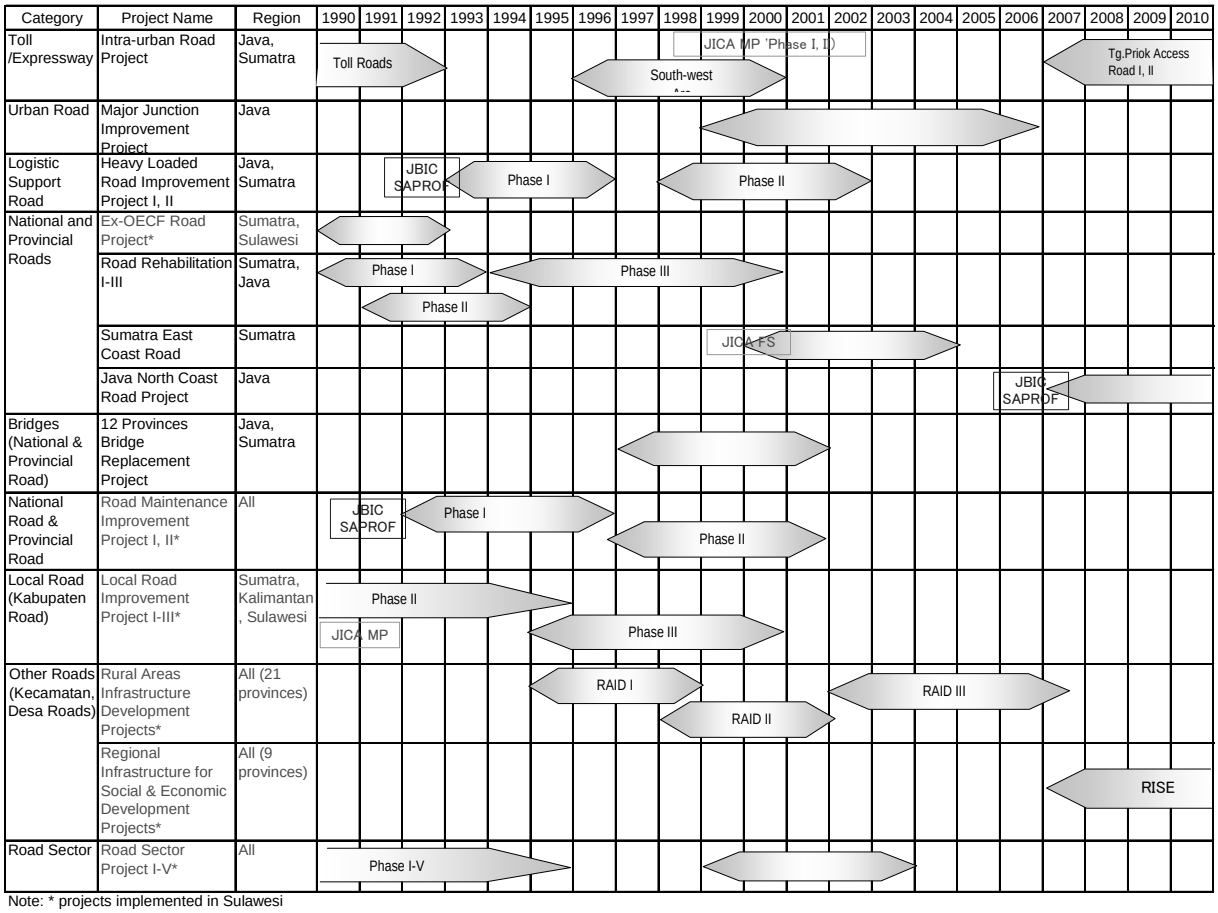


Figure A.10.9-1 Implementation Schedule

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). For donor support, those project/programs are integrated to a specified project/program in collaboration with different level administrations and regions.

(2) ODA Facilities of Japanese Government

The Japanese ODA (soft loan) was used in various levels of the road sector projects and programs, including toll roads, urban roads, bridge replacement, national and provincial roads, local roads, district roads, road maintenance capacity building and development study. **Figure A.10.9-2** shows the JBIC loans and JICA development study conducted since year 1990 and **Table A.10.9-2** shows Japanese ODA related to the local road and bridges implemented in Sulawesi.



Note: * projects implemented in Sulawesi

Figure A.10.9-2 Japanese ODA (Soft Loan) for Road Sector

Table A.10.9-2 Japanese ODA (Soft Loan) related to Local Roads in Sulawesi

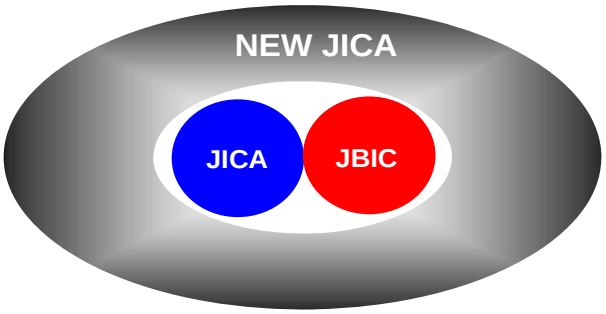
OECF/JBIC/JICA Projects	Loan Amount (Bill Yen)	Implementation Period	Road Length (Betterment+ P.Maitenance)	Number of Provinces subjected to project		Provinces subjected to implementation in Sulawesi				
				Total	Sulawesi	North Sulawesi / Gorontalo	Central Sulawesi	West Sulawesi	South/ West Sulawesi	Southeast Sulawesi
OECF/JBIC (Yen-Loan)										
Local Road I	2.3	1980-1985	2,000 km	7	3	O			O	O
Local Road IIa	12.9	1988-1991	2,171 km	10	3	O			O	O
Local Road IIb	9.3	1991-1995	1,189 km	10	3	O			O	O
Local Road III (including maintenance equipment)	16.3	1996-2000	5,154 km	10	4	O	O		O	O
RAID I	21.0	1995-1997	**	21	4	O	O		O	O
RAID II	29.7	1998-2000	2,000 km*	21	4	O	O		O	O
RAID III (including road and bridges)	20.0	2002-2005	**	14	1				O	
Road Maintenance I	40.4	1992-1995	-	27	4	O	O		O	O
Road Maintenance II (Equipment Supply,etc)	73.0	1997-2001	-	27	4	O	O		O	O
RISE	23.5	2008-	**	9	2			O	O	
JICA										
Bridge Grant I		2002-2005		2	2	O	O			
Bridge Grant II		2008 (Plan)		1	1					O

Note: * estimated length, ** no data available

(3) Action Plan for Applying Japanese ODA Facilities

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)
- SSAPROF/SAPI Grant (JBIC)
- Others.



As JICA and JBIC are merged to one organization in October 2008, more efficient and speedy project/program implementation will become possible. The DGH and regional governments need to propose Bappenas for list up the "Integrated Road Projects and Programs" in blue book as a candidate project for international cooperation.

10 Conclusion and Recommendations

10.1 Conclusion

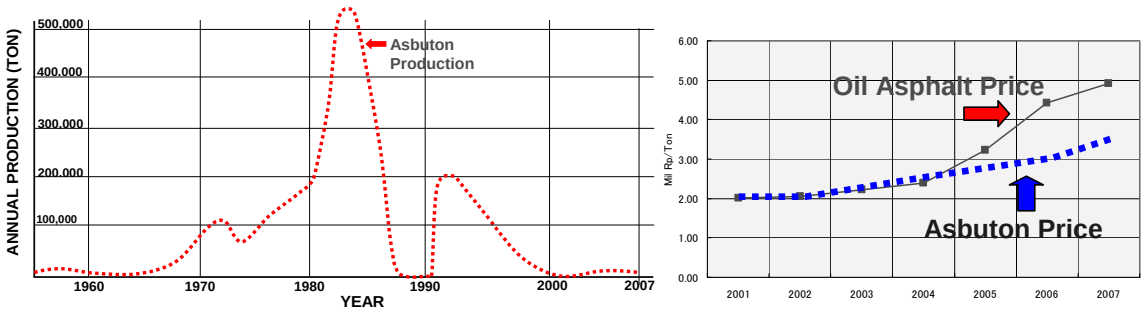
(1) Local Road Study: The arterial roads study subjected national and provincial roads. However, a study on local roads (Kabupaten and Kota roads) was proposed at the workshops and seminars. JICA accepted the proposal since improvement of local roads is also important for support of regional development. 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 Target 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 road condition ratio will increase from 56% to 85% by 2024. The asphalt paved road ratio 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.



Source: JICA Study Team

Figure A.10.10-1 Asbuton Production and Asbuton Price Comparison

10.2 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 refinery technology and plant is necessary for overseas markets (export). The GOI should make appropriate policies and laws for inducing foreign investors as Asbuton development requires a large amount of cost for plant development, installation and operation.

Attachment: Socio-economic Data

Province : North Sulawesi
Kota : Tomohon

Geography and Government (2005)

Area:	114 km2	(0.74% of North Sulawesi Province)
Capital (Ibukota):	Tomohon	
Number of District (kecamatan):	5	

No data for Gross Regional Domestic Products (GRDP)

Gross Regional Domestic Products (GRDP)

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000.Rp)	To Provincial Average	To Sulawesi Average
Year 2005	81	395	476	5,905	98%	127%
Year 2024	110	1,655	1,765	16,462	97%	124%
AA Growth Rate (%)	1.6%	7.8%	7.1%	5.5%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population

Population: Year	2000	2001	2002	2003	2004
(1'000)	76	77	79	84	87
% to the North Province	3.82%	3.80%	3.87%	3.93%	4.04%
Population Growth Rate: 2000-2004		3.29% / ann			

Population Density:	2004
Pop/km^2	669

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)
Kindergarten	70	161	1,316	8.2	10.1
Elementary	65	754	9,000	11.9	14.8
Junior High	15	311	4,164	13.4	14.3
Senior High	14	142	4,669	32.9	14.9
University	5	457	13,611	29.8	*

Note : * No Data available

Health Facilities:	Hospital	Public Health Centers	Sub Public Health Center	Land Mobile Public Health center	Village Health center
(Number)	2	5	11	6	6
(% to Provincial Total)	7%	4%	2%	9%	2%

Medicals/Paramedical:	Specialist Physicians	General Physicians	Dents Physicians	Pharmacists	Medical Personnel	Total
(Number)	17	14	2	1	56	90
(% to Provincial Total)	8%	2%	3%	5%	1%	2%

Agriculture and Forestry

Production of Food Crops	Paddies	Maize	Cassava	Sweet Potato	Peanuts
(Ton)	6,995	5,535	693	1,971	117
(% to Provincial Total)	2%	4%	1%	6%	2%
Harvested are (Ha)	1,494	1,299	38	110	130
(% to Provincial Total)	2%	2%	1%	3%	3%

Production of Food Crops	Coconut	Sugar palm	coffee
(Ton)	729	306	45
(% to Provincial Total)	0.42%	1.82%	0.76%

Animal Husbandry:	Cattle	Horses	Goat	Pig
(Number)	2,304	1,764	218	12,843
(% to Provincial Total)	1.85%	18.95%	0.49%	5.28%

Fisheries Products:	Production (Ton)
	216
(% to Provincial Total)	1.65%

Manufacturing, Trade, Hotels

Industry	Establishment	Employee	Investment Value (Mil	Production Value (Mil
Agricultural, Forestry Miscellaneous, Metal Machine and Chemical Manufactures	121	753	3,960	18,573
Agricultural and Forestry Manufactures	102	664	3,419	15,550
Miscellaneous, Metal Machine and Chemical Manufactures	19	89	540	3,022

Number of Hotel, Room and Bed	Hotel	Room	Bed
(Number)	18	265	530

Source: BPS Sulawesi Utara and Tomohon Dalam Angka 2004/2005

Attachment: Socio-economic Data

Province : North Sulawesi
Kabupaten : Minahasa

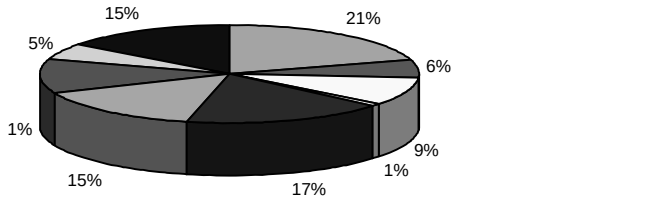
Geography and Government (2005)

Area: 1,030 km2 (6.70% of North Sulawesi Provin
Capital (Ibukota): Tondano
Number of District (kecamatan): 26

Gross Regional Domestic Products (GRDP)

GRDP by industrial origin at current Market Price (Bill Rp)

Origin	2006
Agriculture	511
Mining	147
Manufacturing	235
Electricity, Water Supply	23
Construction	436
Trade, Hotel & Restaurant	378
Transport & Communication	284
Financial	131
Service	372
Total	2,517



Per-capita GRDP: 8.59 Million Rp. at 2006 current price.

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000.Rp)	To Provincial Average	To Sulawesi Average
Year 2005	419	1,106	1,525	5,282	88%	114%
Year 2024	743	4,100	4,843	14,560	85%	109%
AA Growth Rate (%)	3.1%	7.1%	6.3%	5.5%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population and Labour

Population: Year	2000	2001	2002	2003	2004	2005	2006
(1'000)	788	795	802	828	835	289	293
% to the total North Sulaw	39.38%	39.33%	39.22%	38.91%	38.74%	13.60%	13.81%

Population Growth Rate: 2000-2004 1.45% / ann 2005-2006: 1.55% / ann

Population Density:	2000	2001	2002	2003	2004	2005	2006
Pop/km^2	705	712	718	741	747	258	262

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)
Kindergarten	173	363	3,763	10	10
Elementary	339	2,360	32,830	14	15
Junior High	82	1,341	12,216	9	14
Senior High	31	719	8,393	12	15
University	1	-	12,266	-	-

Note : * No Data available

Health Facilities:	Hospital	Public Health Centers	Sub Public Health Center	Land Mobile Public Health center	Public health center with beds	Village Health center
(Number)	4	16	65	8	7	48
(% to Provincial Total)	14%	13%	12%	12%	11%	13%

Medicals/Paramedical:	Specialist Physicians	General Physicians	Dents Physicians	Pharmacists	Health master	Medical Personnel	Total
(Number)	9	71	5	4	12	515	616
(% to Provincial Total)	4%	10%	8%	19%	17%	11%	11%

Agriculture and Forestry

Production of Food Crops:	Paddies	Maize	Cassava	Sweet Potato	Peanuts
(Ton)	57,784	643,030	4,725	6,315	1,535

Planted Area of Estate :	2006	To Provincial Total
Coconut (Ha)	17,599	7%
Clove (Ha)	23,862	34%
Coffee (Ha)	550	6%
Vanila (Ha)	775	15%
Sugar palm (Ha)	716	12%

Estate production:	2006	To Provincial Total
Coconut (Ton)	14,687	8%
Clove (Ton)	593	5%
Coffee (Ton)	135	2%
Vanila (Ton)	114	10%
Sugar palm (Ton)	2,945	17%

Note : BPS North Sulawesi 2005

Animal Husbandry:	Cattle	Goats	Pig	Horse	Hens
(Number)	21,720	3,439	100,568	5,845	536,136
(% to Provincial Total)	18%	8%	39%	69%	29%

Note : BPS North Sulawesi 2005

Fisheries Products:	Production (Ton)
	2,003
(% to Provincial Total)	15%

Manufacturing, Trade, Hotels

Development Industry Sector	Kind of industry	Establishment	Investment Value (Mil Rp)
Small industry	16	75	26,177
Clothing Small	3	22	182
Metal and electronic	11	214	3,962
Handicraft small	6	19	396

Chemical Small & Materia Building manufactures	Establishment	Employee	Investment Value (Mil Rp)
(Number)	92	528	2,685

Number of Hotel, Room and Bed	Hotel	Room	Bed
(Number)	25	489	514

Number of Restauran	Restaurant
(Number)	37

Source: BPS Sulawesi Utara and Minahasa Dalam Angka 2005/2006

Attachment: Socio-economic Data
Province: Gorontalo
Kabupaten: Boalemo

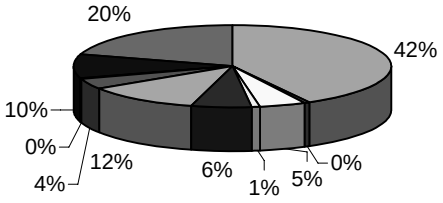
Geography and Government (2005)

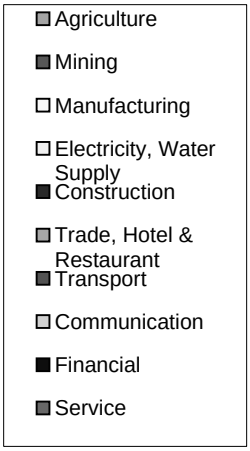
Area:	2,248	km2	(18.4% of Gorontalo Province)
Capital (Ibukota):	Tilamuta		
Number of District (kecamatan):		7	

Gross Regional Domestic Products (GRDP)

GRDP by industrial origin at current Market Price (Bill Rp)

Origin	2006
Agriculture	184
Mining	2
Manufacturing	22
Electricity, Water Supply	3
Construction	27
Trade, Hotel & Restaurant	51
Transport	18
Communication	2
Financial	42
Service	88
Total	438





Per-capita GRDP: 3.71 Million Rp. at 2005 current price.

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000.Rp)	To Provincial Average	To Sulawesi Average
Year 2005	114	165	279	2,473	112%	53%
Year 2024	276	724	1,000	8,074	112%	61%
AA Growth Rate (%)	4.8%	8.1%	8.0%	6.4%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population and Labour

Population: Year	2004	2005	2006
(1'000)	106	161	118
% to the total Gorontalo	12%	18%	13%
Population Growth Rate:	2004-2006:	5.5% /ann	

Population Density:	2004	2005	2006
Pop/km^2	47	72	53

Activity by Sex for Population 10 years of Age and Over:	Male	Female	Total	Ratio to Total
Economically Active (1,000)	36	15	51	56%
- Working	34	12	46	50%
- Looking for Works	2	3	5	6%
Not Economically Active (1,000)			40	44%
- School	8	9	17	19%
- House Keeping	0	19	19	21%
- Others	2	2	4	4%
Total	35.61	15	91.066	100%

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)
Kindergarten	62	36	2,584	72	13
Elementary	123	548	17,495	32	21
Junior High					
- Public	34	275	4,633	17	10
- Private					
Senior High					
- Public	12	142	2,373	17	12
- Private					
University	-	-	-	-	-

Health Facilities:	Hospital	Public Health center	Public Health sub center	Mobile Health center
(Number)	1	8	39	8
(% to Provincial Total)	5%	17%	36%	1%

Medicals/Paramedical:	Doctor	Nurse	Midwife	Total
(Number)	28	69	41	138
(% to Provincial Total)	22%	6%	4%	10%

Worship Place:	Mosque	Church	Temple
(Number)	277	20	16

Agriculture and Forestry

Land use:	Agricultural	Non Agricultural	Total
(Ha)	3,981	257,794	261,775
	2%	98%	100%

Production and Harvested	Paddies	Maize	Cassava	Sweet Potato	Peanuts	Soybeans
Production (Ton)	39,778	89,678	1,160	380	140	36
(% to Provincial Total)	21%	22%	12%	11%	5%	1%

Estate Production:	2006	To Provincial Total (2006)
Coconut (Ton)	6,994	6%
Cacao (Ton)	213	3%
Coffee (Ton)	85	6%

Animal Husbandry:	Cow	Horse	Goat	Pig
(Number)	15,460	161	3,232	913
(% to Provincial Total)	7%	2%	3%	12%

Fisheries Products:	Production (Ton)
	7,885
(% to Provincial Total)	14%

Wood Product:	Log	Rattans
(m^3)	1,866	2,395
(% to Provincial Total)	2%	26%

Manufacturing, Mining,Trade, Hotels

Large/Medium Scale Industry:	Number of Establishment	Employees
	938	792
(% to Provincial Total)	18%	4%

Number of Hotel, Room and Bed	Hotel	Room	Bed
	3	25	64

Source: BPS Gorontalo 2007& Kabupaten Boalemo Dalam Angka 2006.

Attachment: Socio-economic Data

Province : Central Sulawesi
Kabupaten : Banggai

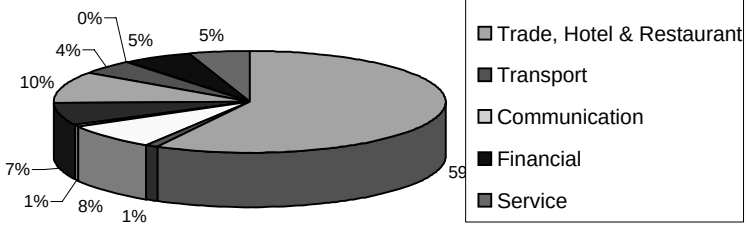
Geography and Government (2006)

Area: 9,673 km2 (14.22% of Central Sulawesi Province)
Capital (Ibukota): Luwuk
Number of District (kecamatan): 12

Gross Regional Domestic Products (GRDP)

GRDP by industrial origin at current Market Price (Bill Rp)

Origin	2006**
Agriculture	1,118
Mining	21
Manufacturing	160
Electricity, Water Supply	10
Construction	140
Trade, Hotel & Restaurant	195
Transport	86
Communication	4
Financial	105
Service	99
Total	1,939



Per-capita GRDP: 6.54 Million Rp. at 2006 current price.

GRDP Growth at Year 2000 Constant Price

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000.Rp)	To Provincial Average	To Sulawesi Average
Year 2005	822	470	1,293	4,482	92%	97%
Year 2024	2,068	5,140	7,208	17,380	120%	130%
AA Growth Rate (%)	5.0%	13.4%	9.5%	7.4%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population and Labour

Population: Year	2002	2003	2004	2005	2006
(1'000)	281	284	293	296	300
% to the total Central Sulawesi				12.98%	
Population Growth Rate:	2002-2004:	2.14% /ann		2004-2006:	1.26% /ann

Population Density:	2004	2005	2006
Pop/km^2	30	31	31

Activity by Sex for Population 10 years of Age and Over:	Male	Female	Total	Ratio to Total
Economically Active (1,000)	97	51	147	61%
- Working	91	76	167	69%
- Looking for Works	9	24	33	14%
Not Economically Active (1,000)	28	68	96	39%
- School	76	27	103	42%
- House Keeping	4	66	70	29%
- Others	21	7	28	11%
Total	124	119	243	100%

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)
Kindergarten	100	440	3,790	8.6	9.0
Elementary	353	2,312	42,497	18.4	16.5
Junior High					
- Public	35	602	9,748	16.2	15.1
- Private	40	488	3,617	7.4	24.3
Senior High					
- Public	17	539	7,182	13.3	17.6
- Private	17	261	1,652	6.3	9.6
University	2	311	5,420	17.4	11.4

Health Facilities:	Hospital	Public Health	Clinic/Posyandu
(Number)	3	144	346
(% to Provincial Total)	14%	17%	13%

Medicals/Paramedical:	Doctor	Specialist	Dentist	Apothecaries	Master of Public Health	Mide-Wife	Nurse
(Number)	45	6	7	19	20	184	218
(% to Provincial Total)	18%	18%	12%	25%	13%	12%	15%

Medicals/Paramedical:	Other	Total
(Number)	58	499
(% to Provincial Total)	17%	9%

Worship Place:	Mosque	Church	Temple	Vihara
(Number)	517	177	40	4

Agriculture and Forestry

Production of Food Crops:	Paddies	Maize	Cassava	Sweet Potato	Peanuts	Soybeans
(Ton)	132,591	5,853	4,848	2,303	3,007	964
(% to Provincial Total)	18%	9%	9%	9%	29%	36%

Production of Estate Crops	Coconut	Coffee	Clove	Oil Palm	Cocoa
(Ton)	31,980	504	254	57,345	6,060
(% to Provincial Total)	17%	10%	3%	48%	4%
Planted area (Ha)	34,732	1,062	1,317	8,709	10,795
(% to Provincial Total)	20%	9%	3%	21%	6%

Forestry area :	Protection forest	Definitive production forest	Limited Production Forest	Convertion forest	Natural park & reserve forest	Total
Area (Ha)	150,923	53,441	289,669	61,528	17,030	572,592
(% to Provincial Total)	10%	11%	20%	24%	3%	13%

Forestry production:	Logs	Sawn wood	Rattan
(M^3)	57,905	58,926	2,225
(% to Provincial Total)	61%	20%	11%

Animal Husbandry:	Buffalo	Cow	Horse	Goat	Pig
(Number)	56	39,442	168	31,541	34,180
(% to Provincial Total)	1%	21%	5%	16%	18%

Fish cultured of brackish water pond	Area (Ha)	Traditional	Semi Intensif	Intensif
Shrimp, Milkfish	1,137	339.2	80	620

Fish cultured of Fresh water	Area (Ha)	Production
Gold fish, Nile fish	41	630

Seed fisheries	Area (M2)	Production (Number/Head)
	17,689	3,023,000

Manufacturing, Mining, Trade, Hotels

Kind of industry	Number of Establishment	Employees	Investment value (Mil rp)	Production value (Mil rp)
Wood industrial and wooden goods	5	52	1,495	2,616,815
Prossesing industria	2	83	389	3,538
Total	7	135	1,884	2,620,353

Kind of Mining	Potentia	Location	Explanatior
Natural gas	3.4 Trillion Cubic Foots	Block Matindak	exploration by Pertamina
	2.6 Trillion Cubic Foots	8 well, in Batui and Toili	JOB-Expan Tomori
Nickel	3.400 Ha 2.000 Ha 200 Ha 2.800 Ha	Pagimana Bunta Balingara Toili	

Number of Hotel, Room and Bed	Hotel	Room	Bed
	21	264	320

Source: BPS Sulawesi Tengah dan Banggai Dalam Angka 2006/2007.

Attachment: Socio-economic Data

Province: West Sulawesi

Kabupaten: Mamasa

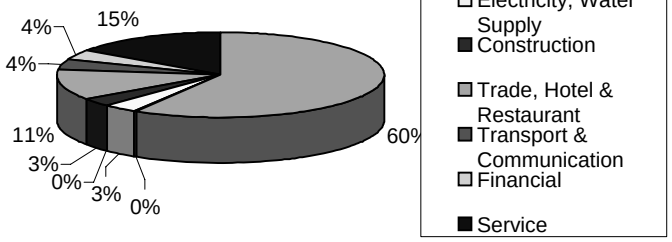
Geography and Government (2005)

Area: 2,759 km2 (17.18% of West Sulawesi Province)
Capital (Ibukota): Mamasa
Number of District (kecamatan): 15

Gross Regional Domestic Products (GRDP)

GRDP by industrial origin at current Market Price (Bill Rp)

Origin	2005
Agriculture	314
Mining	2
Manufacturing	17
Electricity, Water Supply	0
Construction	17
Trade, Hotel & Restaurant	62
Transport & Communicatio	21
Financial	21
Service	82
Total	537



Per-capita GRDP: 4.39 Million Rp. at 2005 current price.

GRDP Growth at Year 2000 Constant Price

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000Rp)	To Provincial Average	To Sulawesi Average
Year 2005	294	166	460	3,815	113%	82%
Year 2024	605	1,254	1,411	11,166	106%	84%
A.Average Growth Rate (%)	3.9%	8.7%	6.1%	6.6%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population and Labour

Population: Year	2005	2006
(1'000)	122	123
% to the total West Sulawe	13%	12%

Population Growth Rate: 2005-2006: 0.85% /ann

Population Density:	2005	2006
Pop/km^2	44	45

Activity by Sex for Population 10 years of Age and Over:	Total	Ratio to Total
Economically Active (1,000)	57	65%
- Working	50	57%
- Looking for Works	7	8%
Not Economically Active (1,000)	31	35%
- School	16	18%
- House Keeping	12	1%
- Others	3	0%
Total	88	100%

(Source: West Sulawesi in Figure, 2007)

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)
Kindergarten	49	101	144	1.4	15.4
Elementary	167	928	20,966	22.6	14.8
Junior High					
- Public	17	122	4,268	35.0	11.3
- Private	17		2,029	16.6	
Senior High					
- Public	5	244	1,307	5.4	10.1
- Private	5		499	2.0	
University	-	-	-	-	-

Health Facilities:	Hospital	Public Health	Public Health Sub-center
(Number)	2	13	20
(% to Provincial Total)	33%	12%	4%

Medicals/Paramedical:	Specialist Physicians	General Physicians	Dents Physicians	Apothecaries	Others
(Number)	0	15	2	2	33
(% to Provincial Total)	-	9%	4%	9%	29%

Worship Place:	Mosque	Church	Temple
(Number)	71	397	3

Agriculture and Forestry

Landuse:	Farm Land	Non Farm Land	Total
(Ha)	12,066	263,827	275,893
	4%	96%	100%

Production of Food Crops:	Paddies	Maize	Cassava	Sweet Potato
(Ton)	100,744	20	7,393	22,191
(% to Provincial Total)	35%	0%	17%	393%

Estate Production:	2001	To Provincia Total (2007)
Arabican coffe (Ton)	2,959	88%
Robust coffe (Ton)	4,534	82%
Cacao (Ton)	4,452	4%
Coconut (Ton)	12,028	24%

Animal Husbandry:	Cow	Horse	Buffalo
(Number)	1,490	1,993	4,769
(% to Provincial Total)	2%	23%	33%

Fisheries Products:	Production (To	Value (Mil Rp)		Wood Produc	Teak & Others	Rattans
	637	-		(m^3)	1,248	508
(% to Provincial Total)	15%	-	(% to Provincial Total)		1%	6%

Manufacturing, Mining, Trade, Hotels

Large/Medium Scale Industry:	Number of Establishment	Employees	Total Wages (Mil Rp)	Gross Output Values (Mil Rp)
	65	-	-	-
(% to Provincial Total)	0%	-	-	-

Industry Classification and Output:	Chemical, Agro, Forestry Industry	Machine, Based Metals, Electronic,	Total
Number of Establishment	14	7	21
(% to Provincial Total)	0%	0%	0%

Source: BPS West Sulawesi 2006

Split Stone Mining:	2000	2001	2002	2003
Production (Ton)	125,943	139,397	141,375	155,512
Gross Output (Rp)	121,500	135,000	150,000	165,000

Number of Hotel, Room and Bed	Hotel	Room	Bed
	10	97	170

Source: BPS Sulawesi Barat and Kabupaten Mamasa Dalam Angka 2006

Attachment: Socio-economic Data

Province: South Sulawesi

Kabupaten: Bone

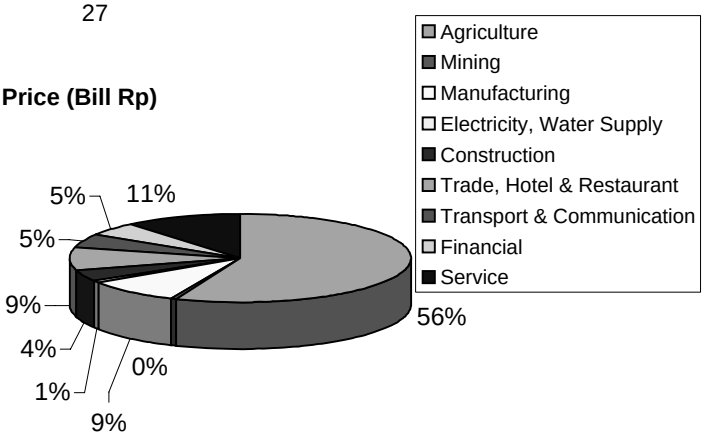
Geography and Government (2005)

Area: 4,559 km2 (10% of South Sulawesi Province)
Capital (Ibukota): Watampone
Number of District (kecamatan): 27

Gross Regional Domestic Products (GRDP)

GRDP by industrial origin at current Market Price (Bill Rp)

Origin	2005
Agriculture	1,869
Mining	14
Manufacturing	299
Electricity, Water Supply	30
Construction	133
Trade, Hotel & Restaurant	284
Transport & Communicatio	164
Financial	163
Service	372
Total	3,328



Per-capita GRDP: 4.78 Million Rp. at 2005 current price.

GRDP Growth at Year 2000 Constant Price

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000Rp)	To Provincial Average	To Sulawesi Average
Year 2005	1,749	544	2,293	3,338	69%	72%
Year 2024	3,641	2,576	6,217	7,857	55%	59%
A.Average Growth Rate (%)	3.9%	8.5%	5.4%	4.6%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population and Labour

Population: Year	2002	2003	2004	2005	2006
(1'000)	654	680	687	694	697
% to the total South Sulaw	9.27%	9.34%	9.31%	9.26%	

Population Growth Rate: 2002-2004: 2.47% /ann 2004-2006: 0.71% /ann

Population Density:	2005	2006
Pop/km^2	143	149

Activity by Sex for Population 10 years of Age and Over:	Male	Female	Total	Ratio to Total
Economically Active (1,000)	198	122	320	57%
- Working	181	83	264	47%
- Looking for Works	17	39	56	10%
Not Economically Active (1,000)	55	186	241	43%
- School	39	44	83	15%
- House Keeping	1	118	118	21%
- Others	15	24	39	7%
Total			561	100%

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)
Kindergarten	369	1,262	15,142	12	15
Elementary	752	5,970	99,784	17	27
Junior High					14
- Public	127	2,412	27,509	11	
- Private					
Senior High					15
- Public	35	1,184	15,581	13	
- Private					
University	5	468	5,080	11	8

Health Facilities:	Hospital	Public Health center	Public Health sub center	Posyandu
(Number)	1	36	67	838
(% to Provincial Total)	4%	10%	6%	81%

Medicals/Paramedical:	General Medical Doctor	Midwives	Pharmacy	Others	Total
(Number)	45	134	17	30	226
(% to Provincial Total)	5.75%	7%	2%	2%	2%

Worship Place:	Mosque	Church	Temple
(Number)	1,050	3	1

Agriculture and Forestry

Landuse:	Farm Land	Non Farm Land	Total
(Ha)	-	-	-

Production of Food Crops:	Wetland Paddy	Maize	Sweet Potatoes	Cassava	Peanuts	Soyabeans
(Ton)	548,797	95,360	3,162	5,842	22,850	7,624
(% to Provincial Total)	16%	14%	6%	1%	58%	28%

Estate Production:	Production	To Provincial Total (2007)
Coconut	13,792	22%
Cocoa	15,877	9%
Cundlenut	6,587	26%
Cashew nut	2,863	12%
Sugar cane	3,602	14%

Animal Husbandry:	Cows	Goats	Buffalo	Horses	Hens + Broiler	Duck
(Number)	135,482	8,012	4,730	8,209	1,415,483	99,996
(% to Provincial Total)	22%	2%	3%	7%	86%	8%

Fisheries Products:	Production (Ton)	Value (Mil Rp)	Wood Product	Teak
	91,158	-	(m^3)	6,400
(% to Provincial Total)	3%	-	(% to Provincial Total)	7%

Manufacturing, Mining, Trade, Hotels

Large/Medium Scale Industry:	Number of Establishment	Employees	Total Wages (Mil Rp)	Gross Output Values (Mil Rp)
	65	-	-	-
(% to Provincial Total)	0%	-	-	-

Industry Classification and Output:	Chemical, Agro, Forestry Industry	Machine, Based Metals, Electronic,	Total
Number of	3488	1565	5053
(% to Provincial Total)	9%	6%	8%

Source: BPS South Sulawesi 2006

Mining:	2006
Production (Ton)	-
Gross Output (Rp)	-

Number of Hotel, Room and Bed	Hotel	Room	Bed
	19	264	390

Source: BPS Sulawesi Selatan and Kabupaten Bone Dalam Angka 2007

Attachment: Socio-economic Data
Province: South Sulawesi
Kabupaten: Tana Toraja

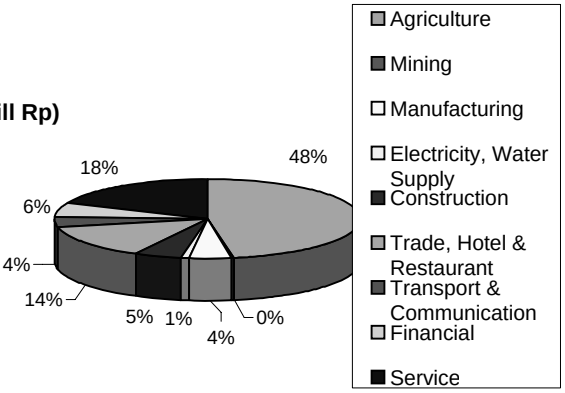
Geography and Government (2007)

Area: 3,206 km2 (7.0% of South Sulawesi Province)
Capital (Ibukota): Makale
Number of District (kecamatan): 40

Gross Regional Domestic Products (GRDP)

GRDP by industrial origin at current Market Price (Bill Rp)

Origin	2005	2006
Agriculture	681	739
Mining	6	7
Manufacturing	59	70
Electricity, Water Supply	9	10
Construction	67	79
Trade, Hotel & Restaurant	180	221
Transport & Communicatio	55	65
Financial	79	91
Service	265	286
Total	1,401	1,568



Per-capita GRDP: 3.51 Million Rp. at 2006 current price.

GRDP Growth at Year 2000 Constant Price

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000Rp)	To Provincial Average	To Sulawesi Average
Year 2005	463	550	1,013	2,318	48%	50%
Year 2024	1,007	2,606	3,613	7,101	50%	53%
A.Average Growth Rate (%)	4.2%	8.5%	6.9%	6.1%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population and Labour

Population: Year	2002	2003	2004	2005	2006
(1'000)	414	426	430	435	447
% to the total South Sulawesi	6.03%	5.90%	5.90%	5.96%	
Population Growth Rate: 2002-2004 :	1.84% /ann		2004-2006:	1.94% /ann	

Population Density:	2002	2003	2004	2005	2006
Pop/km^2	129	133	134	136	139

Activity by Sex for Population 10 years of Age and Ove	Male	Female	Total	Ratio to Total
Economically Active (1,000)	117	55	188	57%
- Working	107	40	141	43%
- Looking for Works	11	15	48	14%
Not Economically Active (1,000)	43	111	141	43%
- School	25	23	76	23%
- House Keeping	2	71	47	14%
- Others	17	17	17	5%
Total	161	166	329	100%

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)*
Kindergarten	101	300	3,404	11.3	15.0
Elementary	387	3,091	76,027	24.6	26.4
Junior High					
- Public	57	982	16,614	16.9	12.9
- Private	34	358	6,474	18.1	
Senior High					
- Public	20	707	9,491	13.4	14.4
- Private	35	666	8,630	13.0	
University	5	167	2,974	17.8	-

Note : * BPS South Sulawesi Province 2006

Health Facilities:	Hospital	Public Health plus	Public Health	Public Health Sub-center
(Number)	4	59	28	67
(% to Provincial Total)*	7%	30%	8%	6%

Note : * BPS South Sulawesi Province 2006

Medicals/Paramedical:	General Medical Doctor	Dentist	Medical specialist	Midwives	Nurse
(Number)	38	11	9	170	319
(% to Provincial Total)*	4.85%	3%	1%	9%	6%

Note : * BPS South Sulawesi Province 2006

Worship Place:	Mosque	Church	Temple
(Number)	149	1533	1

Agriculture and Forestry

Landuse:	Wetland	Estate	Forest	Savanna	Others	Total
(Ha)	21,721	67,038	85,398	17,683	108,264	300,104
	7%	22%	28%	6%	36%	100%

Production of Food Crops:	Paddies	Maize	Cassava	Sweet Potato	Peanuts	Soybeans
(Ton)	133,161	1,857	13,365	2,814	969	20
(% to Provincial Total)*	4%	0%	3%	5%	2%	0%

Note : * BPS South Sulawesi Province 2006

Estate Production:	2002	2003	2004	2005	2006	To Provincial Total*
Arabican Coffee	3,301	3,310	3,586	3,837	4,074	7%
Robust Coffee	1,390	1,382	1,455	1,493	1,505	2%
Cacao	3,159	3,162	2,808	2,918	2,907	1%

Note : * BPS South Sulawesi Province 2006

Animal Husbandry:	Hens	Duck	Pig	Buffalo
(Number)	603,654	49,165	448,260	49,364
(% to Provincial Total)*	8%	4%	-	1%

Note : * BPS South Sulawesi Province 2006

Fisheries Products:	Production (Ton)	Value (Mil Rp)	Wood Product:	Timber
	2,589	-	(m^3)	95,916
(% to Provincial Total)*	1%	-	(% to Provincial Total)*	65%

Note : * BPS South Sulawesi Province 2006 Note : * BPS South Sulawesi Province 200

Manufacturing, Mining, Trade, Hotels

Large/Medium Scale Industry:	Number of Establishment
	25
(% to Provincial Total)*	9%

Note : * BPS South Sulawesi Province 2006

Industry Classification and Output:	Chemical, Agro, Forestry Industry	Machine, Based Metals, Electronic,	Total
Number of Establishmen	1775	900	2,675
(% to Provincial Total)*	5%	3%	4%

Note : * BPS South Sulawesi Province 2006

Mining:	Limestone	Weigths	Crushed stone	River stone	Sand
Production (Ton)	17,255	8,251	7,550	7,457	164,909

Number of Hotel, Room and Bed	Hotel	Room	Bed
	61	1263	2370

Source: BPS Sulawesi Selatan 2006 and Kabupaten Toraja Dalam Angka 2007

Attachment: Socio-economic Data

Province: Southeast Sulawesi

Kabupaten: Buton

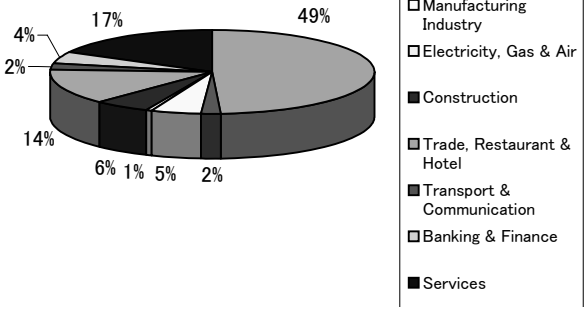
Geography and Government (2005)

Area: 2,675 ` (7.0% of Southeast Sulawesi Province)
Capital (Ibukota): Pasarwajo
Number of District (kecamatan): 21

Gross Regional Domestic Products (GRDP)

GRDP by Industrial Origin at Current Market Price (Bil Rp)

Origin	2005	2006*
Agriculture	484	575
Mining	20	30
Manufacturing Industry	48	54
Electricity, Gas & Air	5	5
Construction	57	61
Trade, Restaurant & Hotel	133	171
Transport & Communicatior	24	28
Banking & Finance	44	60
Services	170	184
Total	985	1,168



Note: * estimate
Per-capita GRDP: 3.65 Million Rp. at 2005 current price.

GRDP Growth at Year 2000 Constraint Price

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000Rp)	To Provincial Average	To Sulawesi Average
Year 2005	217	230	447	1,676	44%	36%
Year 2024	666	1,254	1,920	4,798	50%	36%
A.Average Growth Rate (%)	6.1%	9.4%	8.0%	5.7%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population and Labour

Population: Year	1990	2000	2005
(1'000)	394	533	270
% to the total Southeast Sulawesi		27%	14%

Population Growth Rate: 1990-2000: 3.06%/ann 2000-2005: -12.72% /ann

Population Density:	1990	2000	2005
Pop/km^2	61	199	101

Activity by Sex for Population 10 years of Age and Over:	Male	Female	Total	Ratio to Total
Economically Active (1,000)	67	47	114	59%
- Working	63	38	101	52%
- Looking for Works	4	9	13	7%
Not Economically Active (1,000)	27	53	80	41%
- School	21	20	41	21%
- House Keeping	2	29	31	16%
- Others	4	4	8	4%
Total	94	100	194	100%

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)
Kindergarten	78	101	3,315	32.8	13.3
Elementary	247	1,609	45,316	28.2	24.2
Junior High					
- Public	34	866	11,870	13.7	16.1
- Private	1	11	197	17.9	9.2
Senior High					
- Public	14	195	3,389	17.4	17.2
- Private	5	180	1,421	7.9	9.2
University	-	-	-	-	-

Health Facilities:	Hospital	Public Health plus	Public Health	Public Health Sub-center
(Number)	1	13	8	132
(% to Provincial Total)	5%	28%	7%	24%

Medicals/Paramedical:	Specialist Physicians	General Physicians	Dents Physicians	Apothecaries	Others	Total
(Number)	0	15	2	2	33	52
(% to Provincial Total)	-	9%	4%	9%	29%	14%

Worship Place:	Mosque	Church	Temple
(Number)	490	10	35

Agriculture and Forestry

Landuse:	Wasteland	Temporarily Fallow Land	Forest	Estates	Others	Total
(Ha)	25,500	39,962	79,732	33,487	70,121	248,802
	10%	16%	32%	13%	28%	100%

Production of Food Crops:	Paddies	Maize	Cassava	Sweet Potato	Peanuts	Soybeans
(Ton)	10,208	14,345	99,055	6,370	253	204
(% to Provincial Total)	3%	20%	39%	26%	4%	7%

Estate Production:	2001	2002	2003	2004	2005	To Provincial Total (2005)
Coconut (Ton)	10,233	7,458	7,391	1,284	1,093	4%
Cashew nut (Ton)	6,102	9,689	8,216	5,618	5,501	16%
Cacao (Ton)	7,511	4,735	4,361	679	631	0%

Animal Husbandry:	Cattle	Goats	Pig	Fowls
(Number)	4,054	13,700	321	431,800
(% to Provincial Total)	2%	16%	1%	5%

Fisheries Products:	Production (Ton)	Value (Mil Rp)
	31,800	113,452
(% to Provincial Total)	16%	9%

Wood Product:	Teak & Others	Rattans
(m^3)	1,248	508
(% to Provincial Total)	1%	6%

Manufacturing, Mining, Trade, Hotels

Large/Medium Scale Industry:	Number of Establishment	Employees	Total Wages (Mil Rp)	Gross Output Values (Mil Rp)
	21	787	2,335	28,633
(% to Provincial Total)	27%	15%	3%	3%

Industry Classification and Output:	Chemical Manufacturing Industry	Machine and Based Metals	Miscellaneous	Agro Industry	Small Scale industry	Total
Number of Establishment	139	204	303	387	1,033	2,066
(% to Provincial Total)	8%	17%	18%	6%	9%	9%
Gross Output (Mil Rp)	7,634	11,220	16,714	21,340	49,274	106,182
(% to Provincial Total)	4%	2%	13%	2%	3%	3%

Asphalt Mining:	2000	2001	2002	2003	2,004
Production (Ton)	8,671	1,004	976	1,851	20,000
Gross Output (Mil Rp)	1,372	204	238	555	9,280

Number of Hotel, Room and Bed	Hotel	Room	Bed
	8	41	57

Source: BPS Sulawesi Tenggara and Kabupaten Buton Dalam Angka 2005/2006

Attachment: Socio-economic Data
Province: Southeast Sulawesi
Kabupaten: Buton Utara

Geography and Government (2005)

Area:	1,923	km2	(0,12 % of Southeast Sulawesi Province)
Capital (Ibukota):	Buranga		
Number of District (kecamatan):		6	

District (Kecamatan)	Area (km2)
Kalisusu	173
Kambowa	303
Bonegunu	491
Kalisusu Barat	370
Wakorumba	245
Kalisusu Utara	340

No data for Gross Regional Domestic Products (GRDP)

Population and Labour

Population: Year	2006
	59,000
% to the total Southeast Sulawesi	20.32%
Population density	31

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher	(Province Average)
Kindergarten	33	50	690	14	13
Elementary	69	301	9,880	33	24
Junior High					
- Public	13	203	3,497	17	16
Senior High					
- Public	6	143	1,808	13	17
- Private	2	11	164	15	9

Note : no data Health facilities and paramedical

Health Facilities:	Public Health center	Public Health Sub-center	Public Health Plus
(Number)	5	27	1
(% to Provincial Total)	11%	25%	0%

Medicals/Paramedical:	General Doctor	Others	Total
(Number)	3	82	85
(% to Kabupaten Total)	4%	96%	100%

Worship Place:	Mosque	Church	Temple
(Number)	89	7	9

Agriculture and Forestry

Landuse:	Wet land	House compound	Wasteland	Unused swamp	Dykes and water ponds
(Ha)	1,215	3,012	17,592	5	4
	1%	2%	9%	0%	0%

Landuse:	Temporary unused	Forest	Estates	Others	Total
(Ha)	34,946	99,946	18,661	12,341	187,717
	19%	53%	10%	7%	100%

Estate Production:	2006	To Provincial Total (2006)
Coconut (Ton)	3,210	10.71%
Cashew nut (Ton)	3,153	8.10%

Animal Husbandry:	Cows	Goats	Pig
(Number)	2,648	1,685	65
(% to Provincial Total)	1%	2%	0%

Fisheries Products:	Production (Ton)	Value (Mil Rp)
	7,044	281,128
(% to Provincial Total)	3%	20%

Wood Product:	Teak & Others	Rattans
(m^3)	23,047	892
(% to Provincial Total)	26%	10%

No data for Manufacturing and Trade

Source: BPS Sulawesi Tenggara Dalam Angka 2006/2007

Attachment: Socio-economic Data
Province: Southeast Sulawesi
Kota: Bau-bau

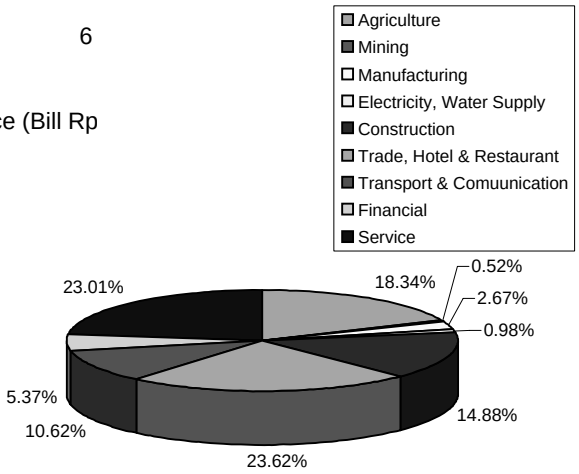
Geography and Government (2006)

Area: 221 km2 (0.58 % of Southeast Sulawesi Province)
Capital (Ibukota): Bau-Bau
Number of District (kecamatan): 6

Gross Regional Domestic Products (GRDP)

GRDP by industrial origin at current Market Price (Bill Rp

Origin	2005
Agriculture	164
Mining	5
Manufacturing	24
Electricity, Water Supply	9
Construction	133
Trade, Hotel & Restaurant	211
Transport & Comuunicatio	95
Financial	48
Service	205
Total	893



Per-capita GRDP: 7.38 Million Rp. at 2005 current price.

GRDP Growth at Year 2000 Constraint Price

	GRDP Agricultural (Bil Rp)	GRDP Non-Agricultural (Bil Rp)	Total GRDP (Bil Rp)	Per-capita GRDP (1000.Rp)	To Provincial Average	To Sulawesi Average
Year 2005	19	449	468	3,934	103%	85%
Year 2024	16	2,293	2,309	10,762	112%	81%
AA Growth Rate (%)	-1.2%	9.0%	8.8%	5.4%		

(Source: Arterial Road MP, JICA Study Team, 2007)

Population and Labour

Population: Year	1990	2000	2005	2006
(1'000)	77	106	121	122
% to the total Southeast Sulawesi	6%	6%	6%	6%

Population Growth Rate: 1990 - 2000 3.22% %/ann 2000 - 2006 0.83% %/ann

Population Density:	1990	2000	2005	2006
Pop/km^2	252	346	395	552

Activity by Sex for Population 10 years of Age and Over:	Male	Female	Total	Ratio to Total
Economically Active (1,000)	32	21	53	63%
- Working	29	17	46	55%
- Looking for Works	3	4	7	8%
Not Economically Active (1,000)	7	24	31	37%
- School	5	6	11	13%
- House Keeping	0	15	15	18%
- Others	2	3	5	6%
Total	39	45	84	100%

Social

Education Service:	School	Teacher	Pupil	Ratio of Pupil to Teacher
Kindergarten	55	280	2,257	8
Elementary	73	1,069	18,115	17
Junior High	26	804	8,493	11
Senior High	16	516	7,030	14
University	6	320	4,894	15

Health Facilities:	Hospital	Public Health Center	Public Health Sub-center	Mobile Public Health	Public Health Plus
(Number)	2	12	13	12	3
(% to Provincial Total)*	9%	26%	12%	2%	1%

Note : * BPS South Sulawesi Province 2006

Medicals/Paramedical:	Specialist Physicians	General Physicians	Dents Physicians	Apothecaries	Nurse	Others
(Number)	6	23	6	5	185	25
(% to Provincial Total)*	29%	14%	13%	23%	7%	6%

Note : * BPS South Sulawesi Province 2006

Worship Place:	Mosque	Church	Temple
(Number)	97	7	1

Agriculture and Forestry

Landuse:	Wetlands	Temporariliy Fallow Land	Forest	Estates	Others	Total
(Ha)	985	220	9,543	1,901	8,539	21,188
	5%	1%	45%	9%	40%	100%

Food Crops:	Paddies	Maize	Cassava	Sweet Potato	Peanuts	Soybeans
(Ton)	11,164	1,212	2,241	354	14	25
(% to Provincial Total)*	3%	2%	1%	1%	0%	1%

Note : * BPS South Sulawesi Province 2006

Estate Production:	2002	2003	2004	2005	2006	To Province Total*
Cashew nut	241	241	196	93	22	61.84%
Candlenut	76	60	104	204	214	16.21%
Cacao	6,345	80	142	214	45	0.04%

Note : * BPS South Sulawesi Province 2006

Animal Husbandry:	Cows	Goats	Pig
(Number)	1,506	1,037	1,307
(% to Provincial Total)*	7%	4%	12%

Note : * BPS South Sulawesi Province 2006

Fisheries Products:	Production (Ton)	Value (Mil Rp)
	6,025	60
(% to Provincial Total)*	133%	167%

Note : * BPS South Sulawesi Province 2006

Wood Product	Rattans
(m^3)	243
(% to Provincial Total)*	3%

Note : * BPS South Sulawesi Province 2006

Manufacturing, Mining, Trade, Hotels

Large/Medium Scale Industry:	Number of Establishment	Employees	Total Wages (Mil Rp)	Gross Output Values (Mil Rp)
	5	640	-	-
(% to Provincial Total)*	6%	12%	-	-

Note : * BPS South Sulawesi Province 2006

Industry Classification and Output:	Chemical Manufacturing Industry	Machine and Based Metals	Miscellaneous	Agroindustry
Number of	23	83	500	95
(% to Provincial Total)*	1%	7%	30%	1%

Note : * BPS South Sulawesi Province 2006

Number of Hotel, Room and Bed	Hotel	Room	Bed
	24	388	628

Source: BPS Sulawesi Tenggara 2005/2006 and Bau-bau Dalam Angka 2006/2007