10.2.7 Pohara - Asera (Link No. 32)

(1) Route Description

The area covered by the project is within 100 km of Kolaka City, in which adjacent agricultural, fishing, and sightseeing developments have achieved some progress. The road concerned has been designated as a kabupaten road. This road is expected to have three functions: to serve as an access road to Kolaka, as a trunk road for regional industries and daily life, and as a road as part of the Trans-Sulawesi east route. This road can be divided into the three following sections according to the present state of the area concerned:

1) Pohara - Sandangpangan

The approximately 10 km section from Pohara to Beso runs through a developed area along the river and the adjacent land is used mostly for residences. The road is finished with simple pavement at 3.5 m in width and with a road site width of 6 m. However, the Beso - Sandangpangan section is a gravel road, with pavement work currently under way. As regards bridges, there is not much of a problem as almost all necessary bridges have been constructed. The road is constructed along the hills at the boundary of the flood plain which is dotted by private houses. The road is based on a low standard of design, with poor vertical alignment in the hill area. Cacao is cultivated in the adjacent land, and there is almost no virgin forest remaining.

2) Sandangpangan - Tinobu

In the area covered by the project, copra is cultivated on the strips of flat land along the shoreline, and cacao is cultivated in the hill area. Fishery is also active in the coastal area, which also has resources for tourism, such as singular natural phenomena of hot water springs and limestone, marine sports, etc., within the region. The road is a gravel road of about 6 m in width. In certain locations, small temporary bridges are used.

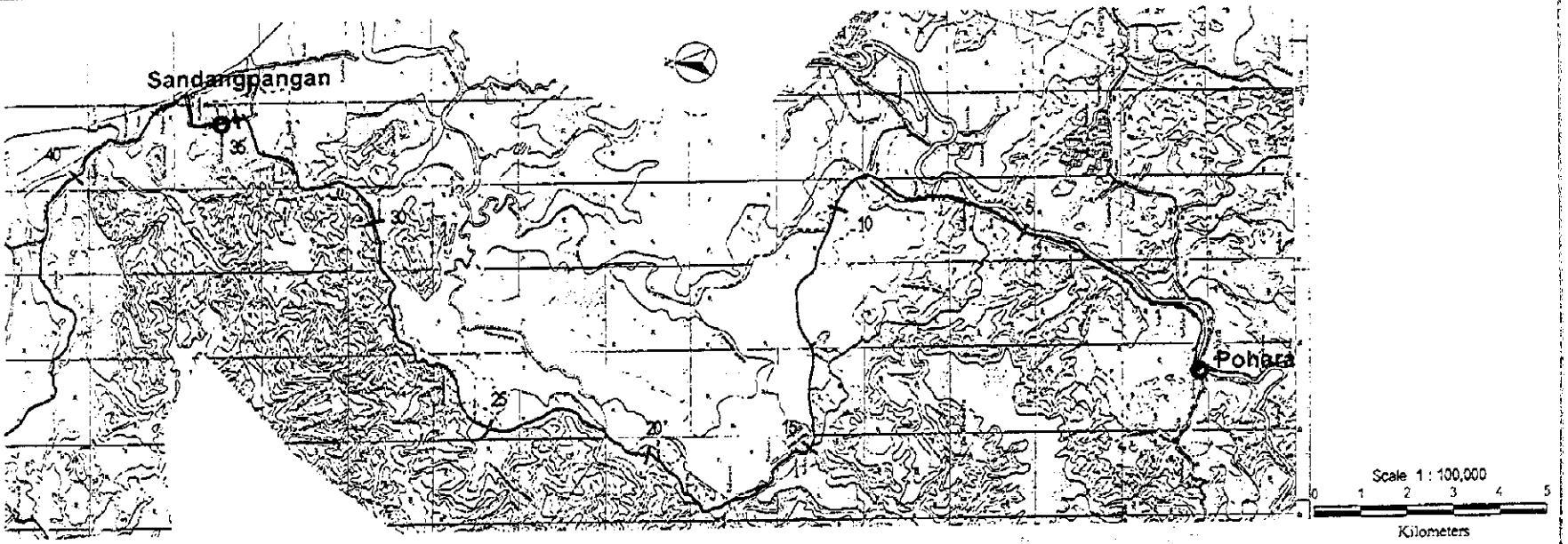
3) Tinobu-Asera

The area covered by the project consists mostly of land developed through new settlement. New developed land is used for agriculture based mainly on paddy fields. In the hill area, cacao cultivation is carried out on a small scale. Land other than developed land is predominantly virgin forest. The road is a gravel road 6 m in width, with bridges being mostly of temporary construction. Certain bridges are too damaged to be of much use.

Location of roads concerned

- Province: Southeast Sulawesi
- Kabupaten Kendari
- Kecamatens: Sampara, Lasolo, Asera
- Major cities and settlement: Pohara, Tinobu, Asera, Andowia
- Link length: 81.4 km

Link 32-1



Location Map

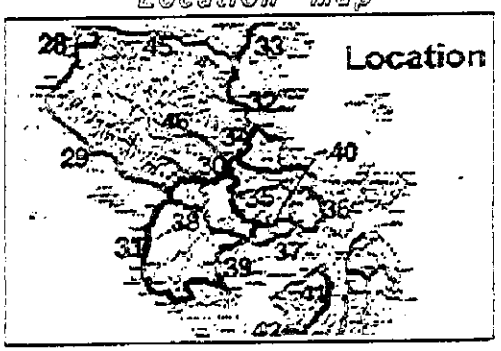
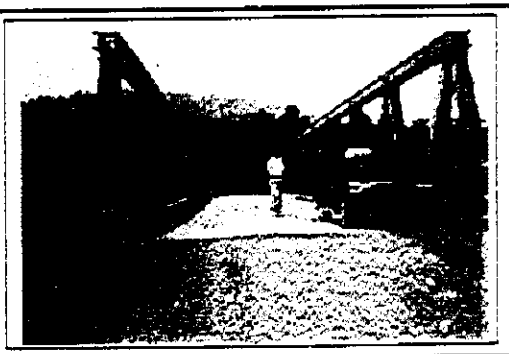
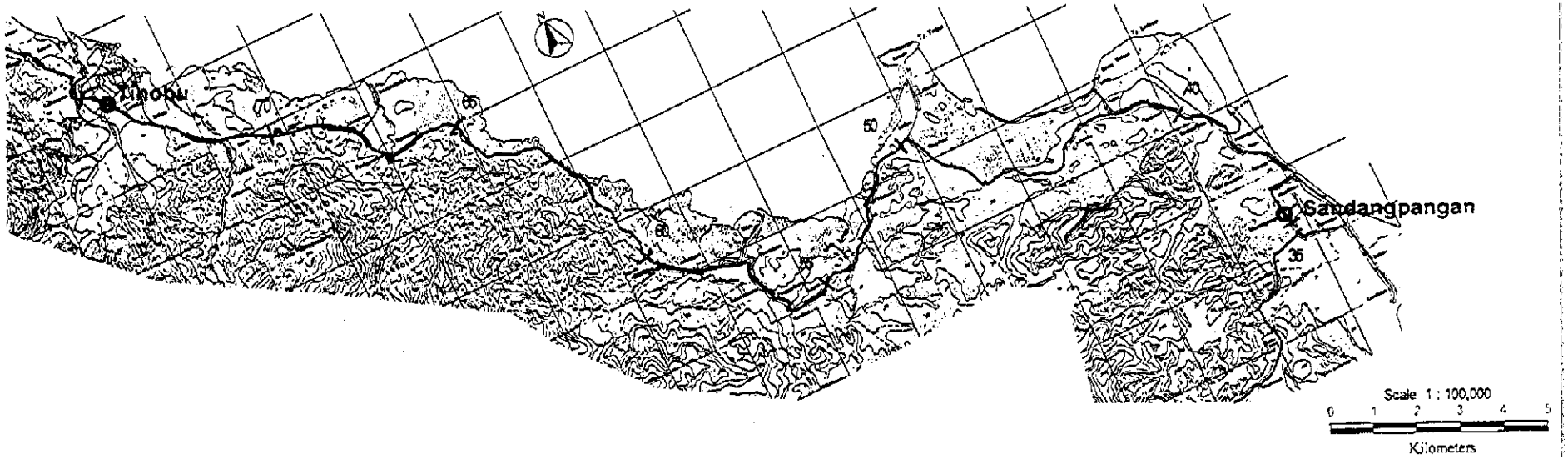
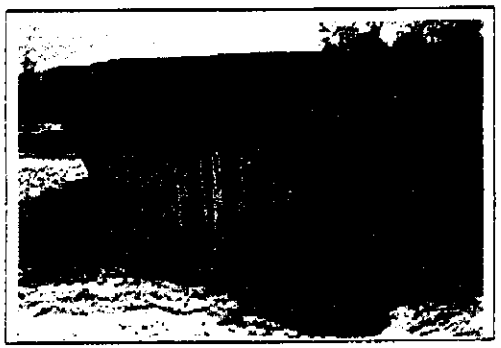


Figure 10-2-29 (1)



Link 32-2





Location Map

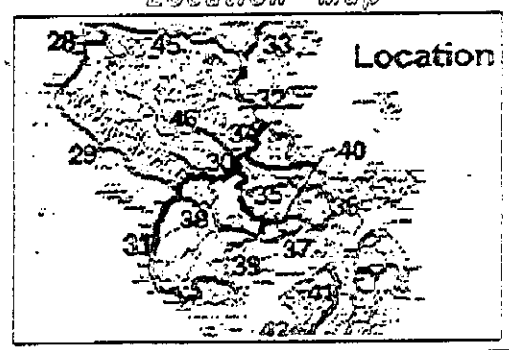
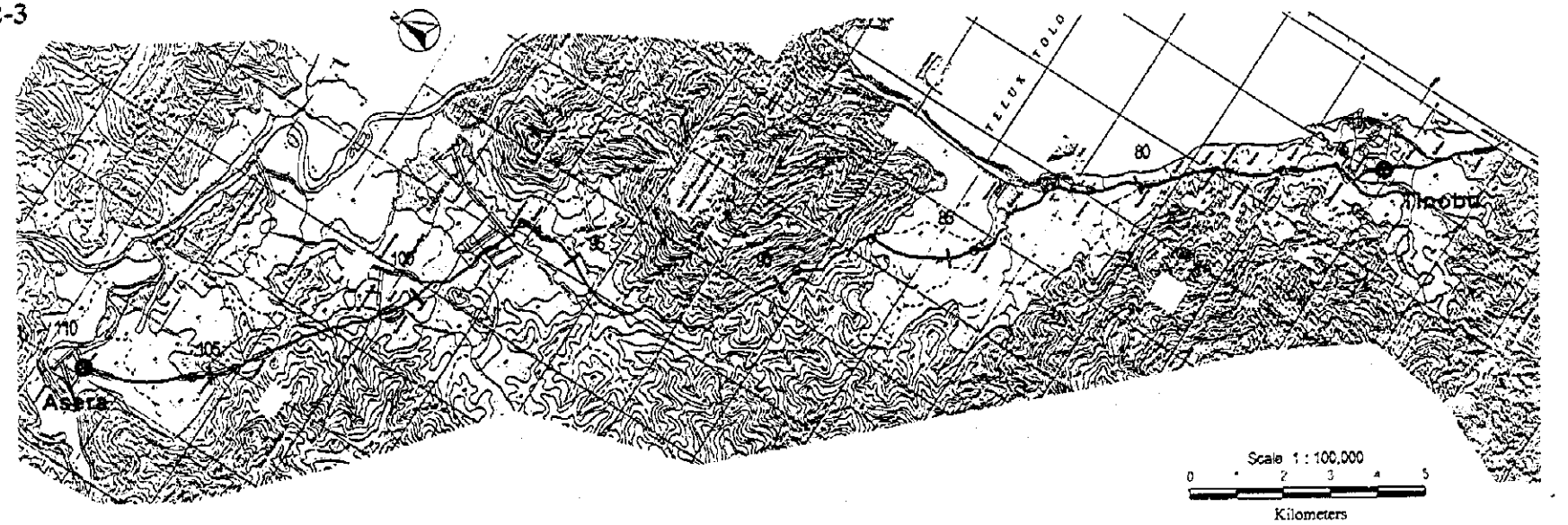
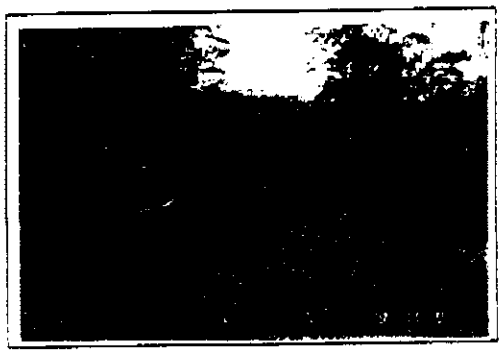


Figure 10-2-29 (2)

Link 32-3





Location Map

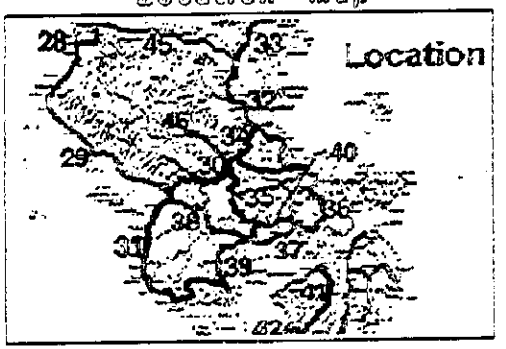


Figure 10-2-29 (3)

(2) Road Traffic (Link No. 32)

The future traffic demand of the road link are summarized as indicated in Table 10-2-41.

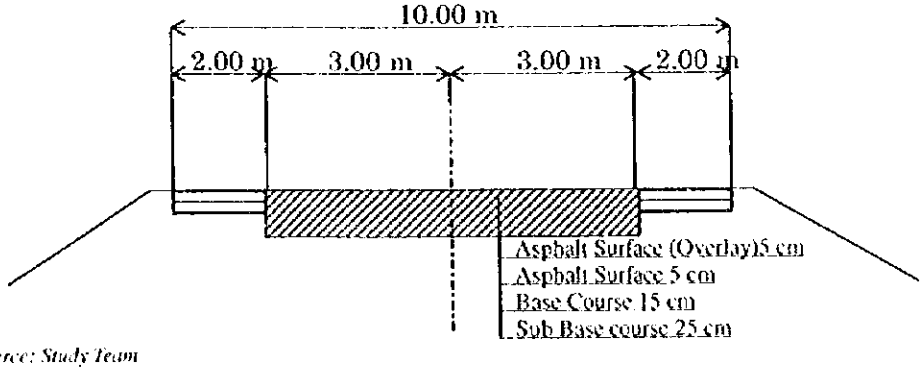
Table 10-2-41 Future Traffic Volume of Pohara - Asera

	Year 2003 (vehicle/day)	Year 2018 (vehicle/day)
Motorcycle	400	543
Passenger cars	176	239
Buses	415	417
Trucks	601	775
Total	1592	1974

Source: Study Team

(3) Typical Cross Section and Pavement (Link No. 32)

The total width will be 10 m (or 8 m in mountainous area), including 6.0 m for the pavement of carriage way and 2.00 m for shoulders in flat sections.



Source: Study Team

Figure 10-2-30 Typical Cross Section for Link No. 32

The pavement will be of A type of a surface thickness of 5 cm, asphalt treated base cpurse, 15 cm and subbase course, 25 cm. The plan also calls for an additional surface course of 5 cm as an overlay in seven years after road construction. The pavement thickness was decided based on the future traffic demand.

(4) Preparatory Engineering of Bridges (link No. 32)

Typical cross section of bridge is shown in Figure 10-2-14 and the bridge improvement concept is shown in Figure 10-2-15.

Existing bridge condition and bridge improvement plan on the road of link No.32 are listed in Table 10-2-42.

Quantity of bridge improvement on the road link No.32 is summarized in Table 10-2-43.

Table 10-2-42 Existing Bridge and Bridge Improvement Plan for Road Link No.32

Road Link No	Bridge No	Location From	Km	Length (m)	Nos Span	Width (m)	Type of Super structure	Improvement Plan
32	1	Pohara	9 5	5 0	1	4 5	Concrete Plate	Widening
32	2	Pohara	12 1	3 0	1	4 5	Concrete Plate	Widening
32	3	Pohara	14 5	3 0	1	4 5	Concrete Plate	Widening
32	4	Pohara	15 9	10 0	1	4 5	Concrete Girder	Widening
32	5	Pohara	16 7	5 0	1	4 5	Concrete Plate	Widening
32	6	Pohara	17 4	3 0	1	4 5	Concrete Plate	Widening
32	7	Pohara	18 1	3 0	1	4 5	Concrete Plate	Widening
32	8	Pohara	18 5	3 0	1	4 5	Concrete Plate	Widening
32	9	Pohara	18 7	3 0	1	4 5	Concrete Plate	Widening
32	10	Pohara	19 0	5 0	1	4 5	Concrete Plate	Widening
32	11	Pohara	19 5	5 0	1	4 5	Concrete Plate	Widening
32	12	Pohara	19 8	3 0	1	4 5	Concrete Plate	Widening
32	13	Pohara	19 9	3 0	1	4 5	Concrete Plate	Widening
32	14	Pohara	20 4	3 0	1	4 5	Concrete Plate	Widening
32	15	Pohara	22 5	3 0	1	4 5	Concrete Plate	Widening
32	16	Pohara	23 7	3 0	1	4 5	Concrete Plate	Widening
32	17	Pohara	24 6	6 0	1	4 5	Concrete Plate	Widening
32	18	Pohara	25 3	5 0	1	4 5	Concrete Plate	Widening
32	19	Pohara	25 3	5 0	1	4 5	Concrete Plate	Widening
32	20	Pohara	25 6	3 0	1	4 5	Concrete Plate	Widening
32	21	Pohara	25 8	6 0	1	4 5	Concrete Plate	Widening
32	22	Pohara	26 0	3 0	1	4 5	Concrete Plate	Widening
32	23	Pohara	27 5	3 0	1	4 5	Concrete Plate	Widening
32	24	Pohara	27 7	6 0	1	4 5	Concrete Plate	Widening
32	25	Pohara	28 8	5 0	1	4 5	Concrete Plate	Widening
32	26	Pohara	29 0	6 0	1	4 5	Concrete Plate	Widening
32	27	Pohara	29 2	6 0	1	4 5	Concrete Plate	Widening
32	28	Pohara	30 5	4 0	1	4 5	Concrete Plate	Widening
32	29	Pohara	32 7	6 0	1	4 5	Concrete Plate	Widening
32	30	Pohara	32 9	5 0	1	4 5	Concrete Plate	Widening
32	31	Pohara	33 2	6 0	1	4 5	Concrete Plate	Widening
32	32	Pohara	33 3	5 0	1	4 5	Concrete Plate	Widening
32	33	Pohara	33 9	5 0	1	4 5	Concrete Plate	Widening
32	34	Pohara	36 6	6 0	1	4 5	Concrete Plate	Widening
32	35	Pohara	39 4	45 0	1	6 0	Steel Truss	Reatin existing
32	36	Pohara	44 1	6 0	1	4 5	Concrete Plate	Widening
32	37	Pohara	46 5	6 0	1	4 5	Concrete Plate	Widening
32	38	Pohara	53 1	10 0	1	4 5	Concrete Girder	Widening
32	39	Pohara	54 3	30 0	1	4 5	Bailey	Widening
32	40	Pohara	55 5	5 0	1	4 5	Concrete Plate	Widening
32	41	Pohara	58 1	5 0	1	4 5	Concrete Plate	Widening
32	42	Pohara	58 5	6 0	1	4 5	Concrete Plate	Widening
32	43	Pohara	61 1	5 0	1	4 5	Concrete Plate	Widening
32	44	Pohara	61 2	5 0	1	4 5	Concrete Plate	Widening
32	45	Pohara	61 3	5 0	1	4 5	Concrete Plate	Widening
32	46	Pohara	62 0	5 0	1	4 5	Concrete Plate	Widening
32	47	Pohara	66 7	30 0	1	6 0	Concrete Girder	Reatin existing
32	48	Pohara	67 1	6 0	1	4 5	Concrete Plate	Widening
32	49	Pohara	69 0	6 0	1	4 5	Concrete Plate	Widening
32	50	Pohara	69 8	5 0	1	4 5	Concrete Plate	Widening
32	51	Pohara	70 4	5 0	1	4 5	Concrete Plate	Widening
32	52	Pohara	71 6	6 0	1	4 5	Concrete Plate	Widening
32	53	Pohara	72 7	6 0	1	4 5	Concrete Plate	Widening
32	54	Pohara	73 4	3 0	1	4 5	Concrete Plate	Widening
32	55	Pohara	75 0	30 0	1	6 0	Steel Truss	Reatin existing
32	56	Pohara	76 5	5 0	1	4 5	Concrete Plate	Widening
32	57	Pohara	77 7	10 0	1	4 5	Concrete Girder	Widening
32	58	Pohara	79 3	5 0	1	4 5	Concrete Plate	Widening
32	59	Pohara	79 8	6 0	1	4 5	Concrete Plate	Widening
32	60	Pohara	80 0	10 0	1	4 5	Concrete Girder	Widening
32	61	Pohara	80 9	5 0	1	4 5	Concrete Plate	Widening
32	62	Pohara	81 1	5 0	1	4 5	Concrete Plate	Widening
32	63	Pohara	82 4	5 0	1	4 5	Concrete Plate	Widening
32	64	Pohara	83 1	30 0	1	6 0	Steel Truss	Reatin existing
32	65	Pohara	84 4	10 0	1	4 5	Concrete Girder	Widening
32	66	Pohara	87 1	6 0	1	4 5	Concrete Girder	Widening
32	67	Pohara	89 4	5 0	1	4 5	Concrete Plate	Widening
32	68	Pohara	95 6	10 0	1	4 5	Concrete Girder	Widening
32	69	Pohara	97 0	30 0	1	4 5	Bailey	Replace
32	70	Pohara	98 1	10 0	1	4 5	Concrete Girder	Widening
32	71	Pohara	100 1	6 0	1	4 5	Concrete Plate	Widening
32	72	Pohara	104 4	6 0	1	3 0	Bailey	Replace
32	73	Pohara	104 5	10 0	1	6 0	Concrete Girder	Reatin existing
32	74	Pohara	105 3	5 0	1	4 5	Concrete Plate	Widening
32	75	Pohara	127 3	10 0	1	6 0	Concrete Girder	Reatin existing
32	76	Pohara	109 1	120 0	1	6 0	Steel Truss	Reatin existing

Source: Bina Marga

Table 10-2-43 Summary of Quantity of Bridge Improvement for Road Link No.32

	LINK NAME		ROAD LENGTH (km)	QUANTITY OF BRIDGE CONSTRUCTION (m^2) CLASSIFICATION BY SPAN LENGTH : L(m)			
				L<=10m	10m<L<=20m	20m<L<=30m	L>30m
32	POHARA-ASERA						
	POHARA	BELALO	40.4	1,005	0	0	0
	BELALO	TINOBU	34.7	570	0	360	0
	TINOBU	ANDOWIA	24.5	503	0	180	0
	ANDOWIA	ASERA	12.2	135	0	0	0
	TOTAL 32		111.8	2,213	0	540	0

Source: Study Team

(5) Preparatory Engineering of Slope Protection Works (Link No. 32)

Slope protection works are constructed to protect the slopes from erosion or weathering by covering them with vegetation or structures and also to stabilize the slopes by means of drainage works or retaining structures. The following types of slope protection works are adopted for the pre-feasibility route considering the terrain and geology, as shown in Table 10-2-44.
Necessary length of slope protection works for each link is shown in Figure 10-2-30.

Table 10-2-44 Quantities of Slope Protection

	Cut			Fill
	Sprayed Concrete Cribwork(m^2)	Shotcrete (m^2)	Stone Masonry (m^2)	Mat Gabion (m^2)
Quantity	5,042	45,379	3,089	4,976

Source: Study Team

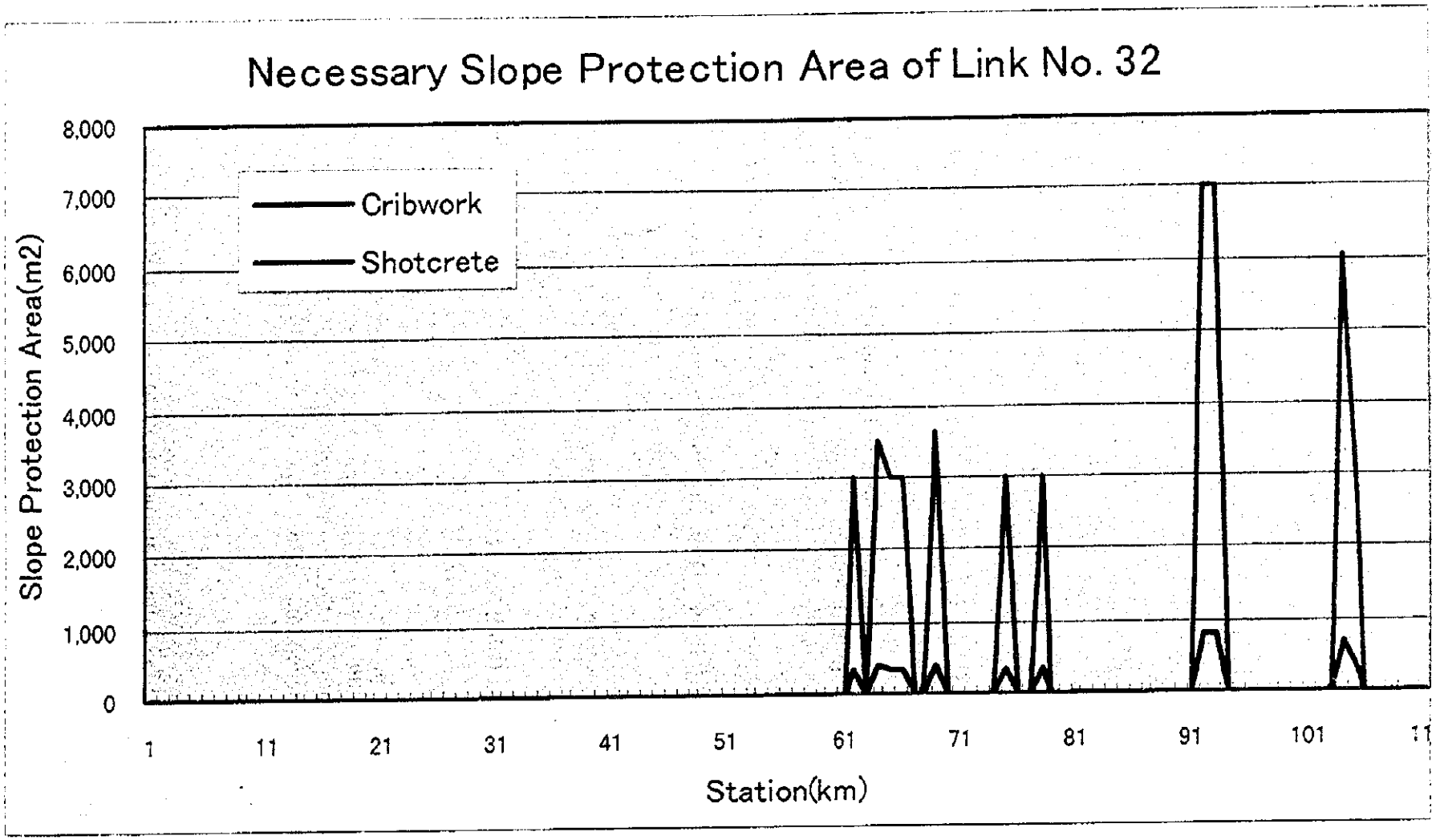
(6) Cost Estimation (Link No. 32)

1) Estimated Project Cost

Cost items consist of preparation works, pavement, earth work, drainage, bridge, slope protection and safety facilities works. The engineering service cost is estimated at 20% of the total cost of direct and indirect cost. A contingency allowance has been included in 10 % of total construction and engineering cost. Table 10-2-45 shows the result of estimated project cost.

2) Implementation Plan

As shown in Figure 10-2-32, the construction period was proposed to be 5 years consisting of one year for preparation of project for fund raising plan, 1.5 years for detailed design of the roads and 2.5 years for construction. Also, the investment plan is set in accordance with the construction plan.



Source: Study Team

Figure 10-2-31 Necessary Slope Protection Area

Table 10-2-45 Total Construction Cost for Pohara - Asera Road (Link No. 32)

Rate: 1US$ = 10.600 Rp. = 140 Yen

Item	Unit	Quantity	Unit Price			Total Price			
			Foreign (US$)	Financial (Rp)	Economic (Rp)	Foreign (US$)	Local Financial (Rp)	Local Economic (Rp)	Financial Total (Mill. Rp)
1. Preparation Works									
Clearing and Grubbing	m^2	224,852	0.23	1,867	2,099	51,716	419,798,495	471,964,135	968
2. Pavement									
Road Asphalt Concrete + Sub Base (Type A)	m	81,400	39.50	436,896	392,152	3,215,300	35,563,334,400	31,921,172,800	69,646
Road Asphalt Concrete + Sub Base (Type B)	m	0	31.76	351,336	315,832	0	0	0	0
Road Asphalt Concrete + Sub Base (Type C)	m	0	16.15	188,584	175,452	0	0	0	0
Transport for Pavement Material (L = 43 km)	m^3	164,755	2.56	19,121	22,308	422,448	3,150,257,289	3,675,300,171	7,628
Sub-2						3,637,748	38,713,591,689	35,596,472,971	77,274
3. Earth Work									
Excavation (Common)	m^3	356,531	0.92	7,407	8,213	328,009	2,640,825,117	2,928,189,103	6,118
Excavation (Sound Rock)	m^3	89,130	4.12	33,605	36,492	367,216	2,995,213,650	3,252,531,960	6,888
Disposal Soil (L = 5 km)	m^3	44,566	1.20	8,610	10,050	53,479	383,714,121	447,889,305	951
Sub-3						748,704	6,019,752,888	6,628,610,368	13,957
4. Drainage									
Pipe Culvert (D = 100 cm)	m	814	44.35	634,758	554,426	36,101	516,693,012	451,302,764	899
Box Culvert (B = 2.0 m, H = 2.0 m)	m	407	325.89	3,064,762	2,510,606	132,637	1,247,358,134	1,021,816,642	2,653
U-Ditch (U = 30 cm)	m	36,550	1.71	41,910	36,720	62,501	1,531,810,500	1,342,116,000	2,194
Sub-4						231,239	3,295,861,646	2,815,235,406	5,746
5. Slope Protection									
Sprayed Concrete Cribwork	m^2	5,042	14.68	127,197	88,984	74,017	641,327,274	448,657,328	1,426
Shotcrete Work	m^3	45,379	11.82	101,390	67,157	536,380	4,600,976,810	3,047,517,503	10,287
Stone Masonry	m^3	3,089	6.91	116,286	109,711	21,345	359,207,454	338,897,279	585
Mat Gabion	m^3	4,976	9.20	72,584	61,374	45,779	361,177,984	305,397,024	846
Sodding	m^2	19,904	0.08	3,238	2,851	1,592	64,449,152	56,746,304	81
Sub-5						679,113	6,027,138,674	4,197,215,438	13,225
6. Tunnel	m	0	3,500.00	22,400,000	17,920,000	0	0	0	0
7. Bridges									
L<=10 m	m^2	2,213	206.20	2,233,568	1,843,094	456,327	4,942,886,168	4,078,767,944	9,780
10 m<L<=20 m	m^2	0	287.55	2,506,242	2,008,820	0	0	0	0
20 m<L<=30 m	m^2	540	313.65	2,643,773	2,102,930	169,372	1,427,637,669	1,135,582,458	3,223
30 m<L	m^2	0	345.02	2,908,151	2,313,224	0	0	0	0
Sub-7						625,699	6,370,523,837	5,214,350,402	13,003
8. Safety Facilities Works									
Guard Railing	m	8,140	11.30	168,012	143,025	91,982	1,367,617,680	1,164,223,500	2,343
Traffic Sign	each	271	27.98	426,548	373,259	7,592	115,736,691	101,277,609	196
Line Marking	m	81,400	0.42	4,231	3,518	34,188	344,403,400	286,365,200	707
Sub-8						133,762	1,827,757,771	1,551,866,309	3,246
9. Mobilization & Temporally Works (20 % of Total Cost)						1,202,066	12,741,901,255	11,085,454,092	25,484
10. Sub-Total						7,310,047	75,416,326,255	67,561,169,121	152,903
11. Engineering Cost (20 % of 10)						2,019,471	14,270,929,406	11,416,743,525	35,677
12. Contingency (10 % of 10 + 11)						932,952	8,968,725,566	7,897,791,265	18,858
Ground Total Cost (10+ 11 + 12)						10,262,470	98,655,981,227	86,875,703,911	207,438

Source: Study Team

Item	Unit	Quantity	1999	2000	2001	2002	2003	Total
1. Preparation of Project								
2. Survey and Design	km	81.4						
3. Construction								
Earth Work	m^3	445,661.0						
Slope Protection	m^2	-						
Tunnel	m	0.0						
Bridges	m	2,753.0						
Pavement	km	81.4						
Foreign (US$)				555,355	1,591,968	2,491,942	5,623,204	10,262,469
Local Financial Cost (Rp)				3,924,505,587	14,181,902,385	22,811,743,216	57,737,830,040	98,655,981,228
Local Economic Cost (Rp)				3,139,604,469	12,917,546,695	19,300,201,095	51,518,351,652	86,875,703,911
Total Financial Cost (Mill. Rp)				9,811	31,057	49,226	117,344	207,438
Total Economic Cost (Mill. Rp)				9,026	29,792	45,715	111,124	195,658

Source: Study Team

Figure 10-2-32 Implementation Schedule for Pohara - Asera Road (Link No. 32)

(7) Economic Analysis (Link No. 32)

1) Economic Project Costs

The economic investment costs are estimated in constant 1998 prices. The financial investment costs in terms of market price include the component of taxes. The economic costs for economic analysis are obtained by subtracting the portion of transfer payment such as taxes from financial costs. The financial and economic costs (initial investment and maintenance costs) are summarized in Table 10-2-46.

Table 10-2-46 Initial Investment and Maintenance Costs

(Million Rp.)

	Economic Prices
Initial Investment Cost (Construction)	195,657
Routine Maintenance Cost Per Year	148
Periodic Maintenance Cost Per Year	15,328

Source: Study Team

The maintenance cost of the proposed roads follows the engineering study results of the cost estimates. Besides, the maintenance cost of the proposed roads in the case of "without the improvement of the proposed roads" is treated as a negative cost.

2) Economic Benefits

Benefits are classified into two types, one is the direct benefit and the other is the indirect benefit or intangible benefit.

The direct benefits which would be realized from the implementation of the Project are defined as the savings in travel costs, composed of the vehicle operating cost and vehicle time cost when comparing the "With" and "Without" project conditions.

The benefit of vehicle operating costs is estimated as a difference of vehicle operating costs between "With" Project" case and "Without" Project" case. The vehicle operating cost is derived from the obtained daily vehicle-kilometers and the unit vehicle operating cost by vehicle type. In addition, traffic safety will be imoroved and accident costs reduced.

In this economic analysis, the above mentioned direct benefit, e.g. the vehicle operating cost saving is computed as a quantified benefit. The calculation of direct benefits are made for the planning year of 2003 and 2018.

As a result, the saving in vehicle operating cost is summarized as shown in Table 10-2-47.

Table 10-2-47 Estimated Economic Benefits

(Million Rp. at 1998 price)

Year	Benefit of Saving in VOC
2004	44,921
2018	97,322

Source: Study Team

3) Economic Cost-Benefit Analysis

The analysis follows the conventional discounted cash flow method in determining the economic internal rate of return (EIRR), the net present value (NPV) and the benefit cost ratio (B/C). (NPV and B/C are calculated at a discount rate of 15 percent.) The project life is assumed to be 20 years after the completion of the construction.

The benefits in the intermediate years were interpolated and those beyond 2018 were assumed to be fixed. The total economic project costs and benefits streams are presented in Table 10-2-48. The efficiency measures were calculated and the summary is as follows:

Table 10-2-48 Economic Analysis for Link No.32

(Million Rp.)

	Year	Benefits - VOC Saving	Total	Costs - Invest. Costs	Maint. Cost (With)	Total	Maint. Cost (Without)	Net Cash Flow
1	1999			0	0	0	0	0
2	2000			9,026	148	9,174	148	-9,026
3	2001			29,792	148	29,940	148	-29,792
4	2002			45,715	148	45,863	148	-45,715
5	2003	0	0	111,124	148	111,272	148	-111,124
6	2004	44,921	44,921	0	148	148	10,237	55,010
7	2005	48,664	48,664	0	148	148	148	48,664
8	2006	52,407	52,407	0	148	148	148	52,407
9	2007	56,150	56,150	0	148	148	148	56,150
10	2008	59,893	59,893	0	148	148	148	59,893
11	2009	63,636	63,636	0	148	148	10,237	73,725
12	2010	67,379	67,379	0	15,328	15,328	148	52,199
13	2011	71,122	71,122	0	148	148	148	71,122
14	2012	74,864	74,864	0	148	148	10,237	84,953
15	2013	78,607	78,607	0	148	148	148	78,607
16	2014	82,350	82,350	0	148	148	148	82,350
17	2015	86,093	86,093	0	148	148	10,237	96,182
18	2016	89,836	89,836	0	148	148	148	89,836
19	2017	93,579	93,579	0	15,328	15,328	148	78,399
20	2018	97,322	97,322	0	148	148	10,237	107,411
21	2019	97,322	97,322	0	148	148	148	97,322
22	2020	97,322	97,322	0	148	148	148	97,322
23	2021	97,322	97,322	0	148	148	10,237	107,411
24	2022	97,322	97,322	0	148	148	148	97,322
25	2023	97,322	97,322	0	148	148	148	97,322
				195,657	33,912	229,569	64,086	

Source: Study Team

Efficiency Measures	
EIRR	25.8 %
NPV (Million Rp.)	98,412
B/C	1.97

Source: Study Team

These results indicate that implementation of the Project (road development of link No.32) is economically feasible.

10.2.8 Asera - Border of province (Link No. 33)

(1) Route Description

The area covered by the project is an extensive settlement area in the basin of River Lindo, in which paddy fields are developed and palm, copra, and cacao are cultivated. The road concerned has been designated as a fabupaten road. The land configuration of the area is relatively flat, and many road sections pass through hill areas. The Landawe-Border route, which goes over the Border Pass, is based on a low standard level, including many steep sections. The road is either a gravel or dirt road of 6 m in width, but without sufficient bridges. At present, the road crosses River Lindo at three points. The river width at the three crossing points is about 120 m, and bridge construction is under way. Villages are distributed along the route and adjacent lands are currently being developed. It is essential that the road be improved as a regional trunk road. This road is also a part of the Trans-Sulawesi east route connecting to Southeast Sulawesi and will become a critical trunk road in the future.

Location of roads concerned

- Province: Southeast Sulawesi
- Kabupaten: Kolaka
- Kecamaten: Asera
- Major cities and settlement: Landowe, Lemonae, Asera,
- Link length: 76.0 km

(2) Road Traffic (Link No.33)

The future traffic demand of the road link are summarized as indicated in Table 10-2-49.

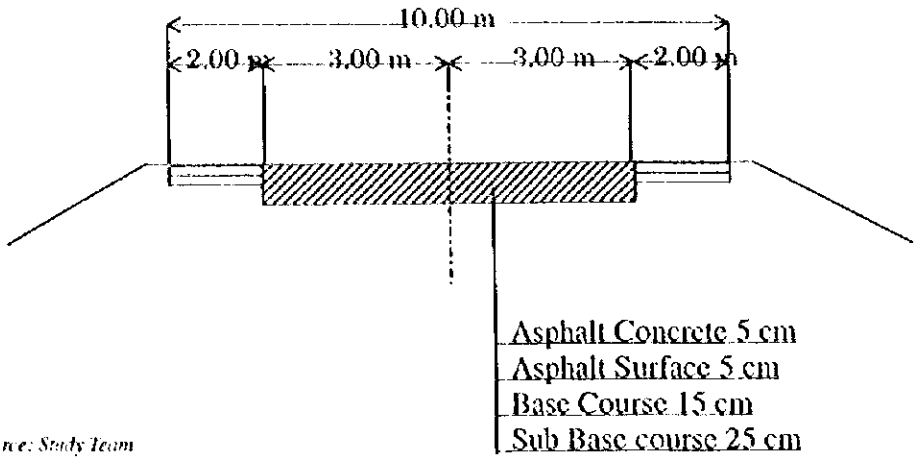
Table 10-2-49 Future Traffic Volume of Asera - Border of province

	Year 2003 (vehicle/day)	Year 2018 (vehicle/day)
Motorcycle	335	450
Passenger cars	162	230
Buses	333	352
Trucks	569	769
Total	1399	1801

Source: Study Team

(3) Typical Cross Section and Pavement (Link No. 33)

The total width will be 10 m (or 8 m in mountainous area), including 6.0 m for the pavement of carriage way and 2.00 m for shoulders in flat sections.



Source: Study Team

Figure 10-2-34 Typical Cross Section for Link No. 33

The pavement will be of A type of a surface thickness of 5 cm, asphalt treated base course, 15 cm and subbase course, 25 cm. The plan also calls for an additional surface course of 5 cm as an overlay in seven years after road construction. The pavement thickness was decided based on the future traffic demand.

(4) Preparatory Engineering of Bridges (Link No. 33)

Typical cross section of bridge is shown in Figure 10-2-14 and the bridge improvement concept is shown in Figure 10-2-15.

Existing bridge condition and bridge improvement plan on the road of link No.33 are listed in Table 10-2-50.

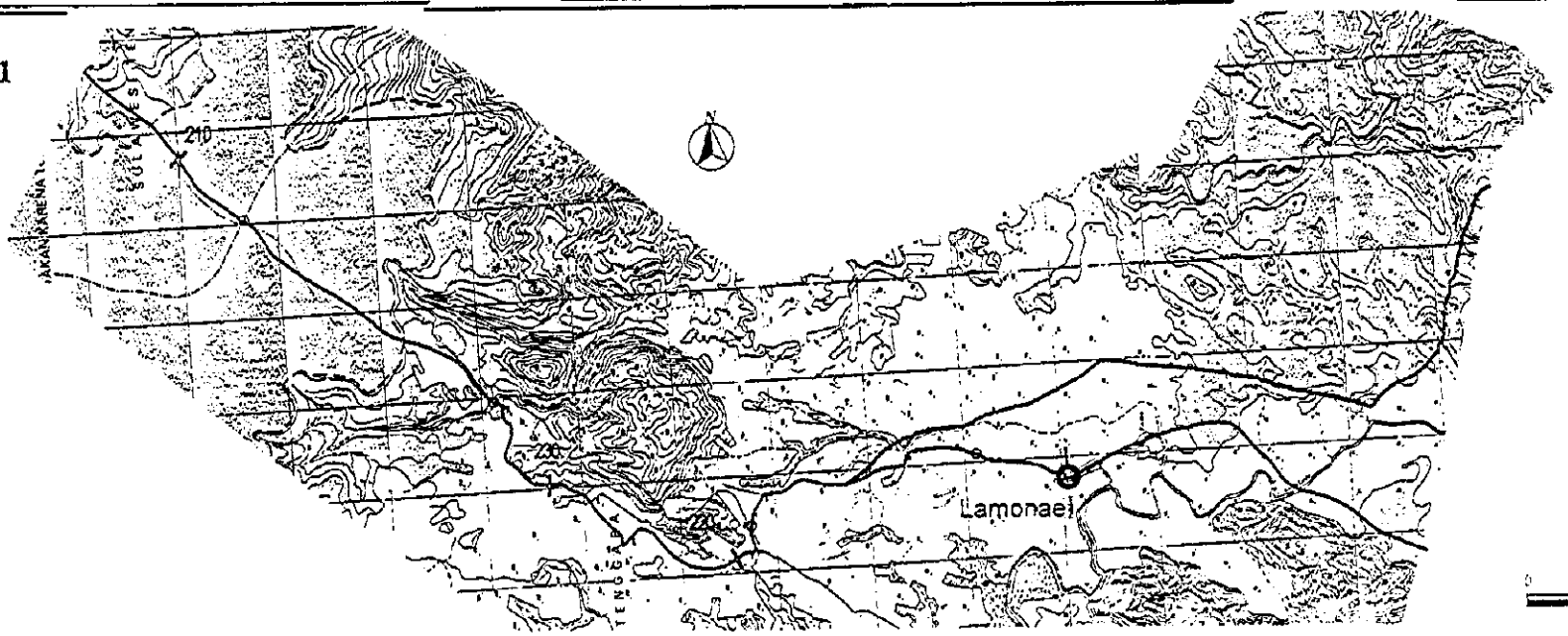
Quantity of bridge improvement on the road link No.33 is summarized in Table 10-2-51.

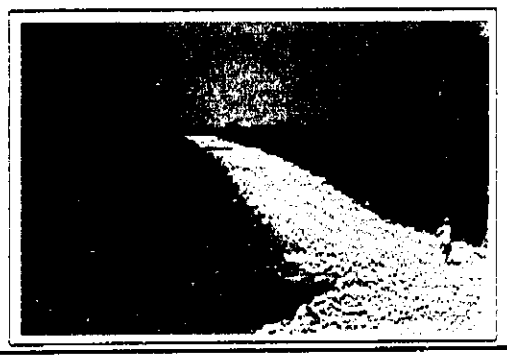
Table 10-2-50 Existing Bridge and Bridge Improvement Plan for Road Link No.33

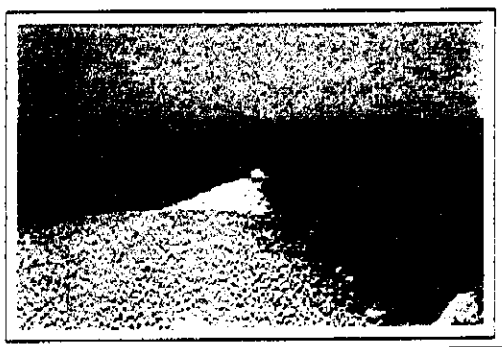
Road Link No	Bridge No	Location From	Location Km	Length (m)	Nos Span	Width (m)	Type of Super-structure	Improvement Plan
33	1	Pohara	110.1	5.0	1	3.0	Bailey	Replace
33	2	Pohara	117.2	5.0	1	3.0	Bailey	Replace
33	3	Pohara	119.8	5.0	1	3.0	Bailey	Replace
33	4	Pohara	120.5	5.0	1	3.0	Bailey	Replace
33	5	Pohara	122.9	5.0	1	3.0	Bailey	Replace
33	6	Pohara	124.6	5.0	1	4.5	Bailey	Replace
33	7	Pohara	129.1	120.0	2	6.0	Steel Truss	Retain existing
33	8	Pohara	132.9	15.0	1	XXX	xxx	New Construction
33	9	Pohara	140.3	20.0	1	XXX	xxx	New Construction
33	10	Pohara	143.6	5.0	1	XXX	xxx	New Construction
33	11	Pohara	158.4	120.0	2	6.0	Steel Truss	Retain existing
33	12	Pohara	161.2	5.0	1	3.0	Wooden Girder	Replace
33	13	Pohara	162.4	5.0	1	3.0	Wooden Girder	Replace
33	14	Pohara	163.7	5.0	1	3.0	Wooden Girder	Replace
33	15	Pohara	166.9	5.0	1	XXX	xxx	New Construction
33	16	Pohara	172.5	15.0	1	XXX	xxx	New Construction
33	17	Pohara	179.1	20.0	1	XXX	xxx	New Construction
33	18	Pohara	183.4	5.0	1	XXX	xxx	New Construction
33	19	Pohara	186.9	60.0	1	XXX	xxx	New Construction
33	20	Pohara	187.5	15.0	1	XXX	xxx	New Construction
33	21	Pohara	189.0	10.0	1	XXX	xxx	New Construction
33	22	Pohara	191.4	10.0	1	XXX	xxx	New Construction
33	23	Pohara	192.3	20.0	1	XXX	xxx	New Construction

Source: Study Team

Link 33-1







Location Map

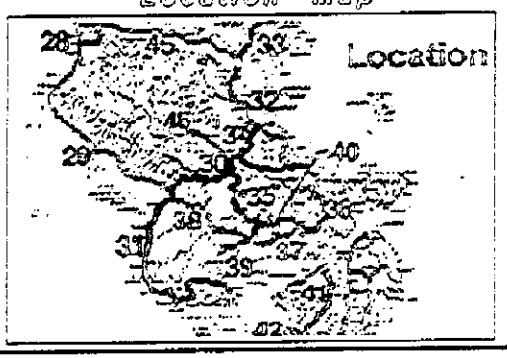
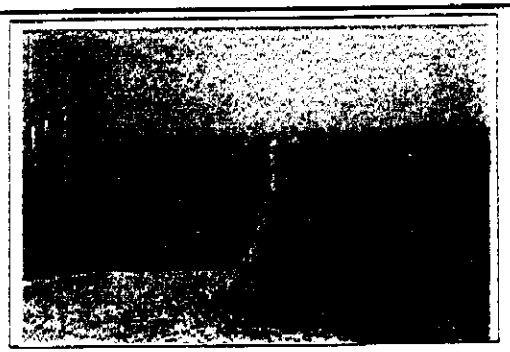
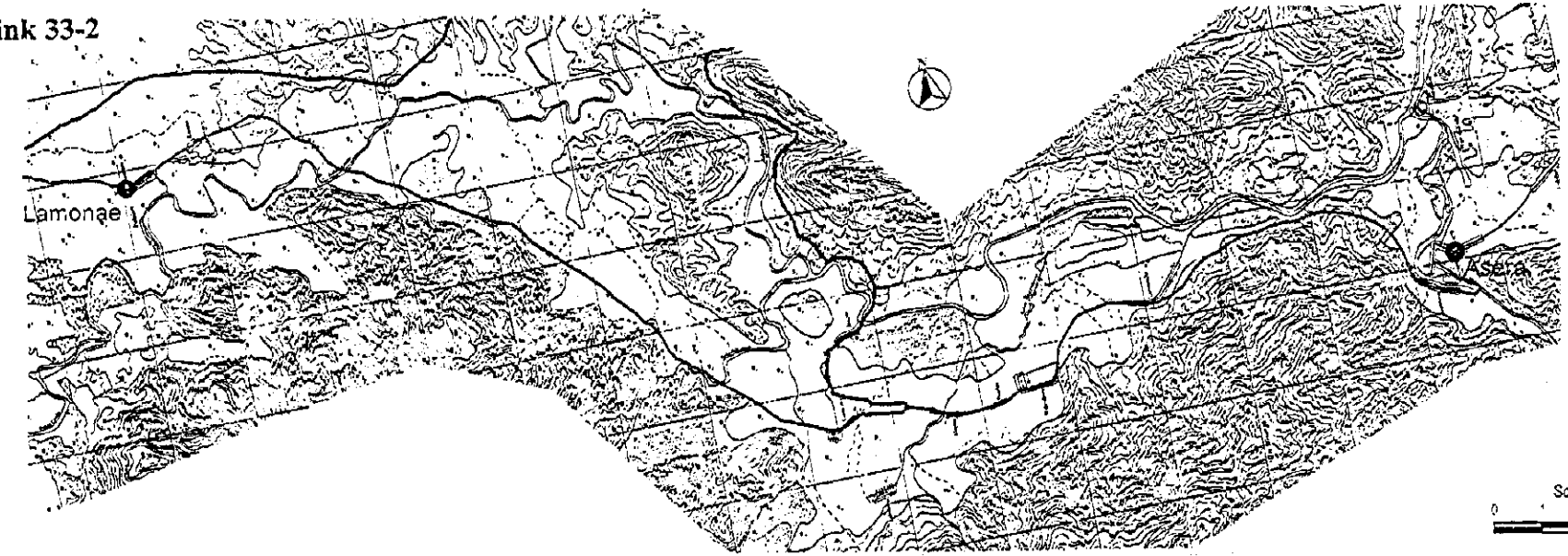


Figure 10-2-33 (1)





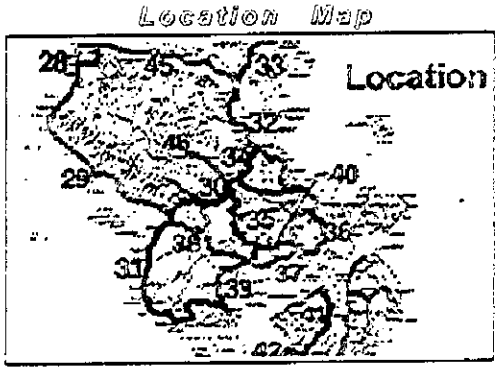


Figure 10-2-33 (2)

Table 10-2-51 Summary of Quantity of Bridge Improvement for Road Link No.33

	LINK NAME		ROAD LENGTH	QUANTITY OF BRIDGE CONSTRUCTION (m^2)			
				CLASSIFICATION BY SPAN LENGTH : L(m)			
			(km)	L<=10m	10m<L<=20m	20m<L<=30m	L>30m
33	ASERA-BTS.PRO.						
	ASERA	LANDAWE	40.5	210	210	0	0
	LANDAWE	BTS.PRO	35.5	270	420	0	360
	TOTAL 33		76.0	480	630	0	360

Source: Study Team

(5) Preparatory Engineering of Slope Protection Works Link No. 33)

1) Location and Height Each Slope Protection Types

Slope protection works are constructed to protect the slopes from erosion or weathering by covering them with vegetation or structures and also to stabilize the slopes by means of drainage works or retaining structures. The following types of slope protection works are adopted for the pre-feasibility route considering the terrain and geology, as shown in Table 10-2-52.

Table 10-2-52 Quantities of Slope Protection

	Cut			Fill
	Sprayed Concrete Cribwork(m^2)	Shotcrete (m^2)	Stone Masonry (m^2)	Mat Gabion (m^2)
Quantity	12,880	115,918	7,892	12,711

Source: Study Team

(6) Cost Estimation (Link No. 33)

1) Estimated Project Cost

Cost items consist of preparation works, pavement, earth work, drainage, bridge, slope protection and safety facilities works. The engineering service cost is estimated at 20% of the total cost of direct and indirect cost. A contingency allowance has been included in 10 % of total construction and engineering cost. Table 10-2-53 shows the result of estimated project cost.

2) Implementation Plan

As shown in Figure 10-2-35, the construction period was proposed to be 5 years consisting of one year for preparation of project for fund raising plan, 1.5 years for detailed design of the roads and 2.5 years for construction. Also, the investment plan is set in accordance with the construction plan.

Table 10-2-53 Total Construction Cost for Asera - Bts. Pro. Road (Link No. 33)

Rate: 1US$ = 10,600 Rp. = 140 Yen

Item	Unit	Quantity	Unit Price			Total Price			
			Foreign (US$)	Financial (Rp)	Economic (Rp)	Foreign (US$)	Local Financial (Rp)	Local Economic (Rp)	Financial Total (Mill. Rp)
1. Preparation Works									
Clearing and Grubbing	m^2	151,900	0.23	1,867	2,099	34,937	283,597,300	318,838,100	654
2. Pavement									
Road Asphalt Concrete + Sub Base (Type A)	m	76,000	39.50	436,896	392,152	3,002,000	33,204,096,000	29,803,552,000	65,025
Road Asphalt Concrete + Sub Base (Type B)	m	0	31.76	351,336	315,832	0	0	0	0
Road Asphalt Concrete + Sub Base (Type C)	m	0	16.15	188,584	175,452	0	0	0	0
Transport for Pavement Material (L = 43 km)	m^3	119,700	5.49	40,920	47,740	656,830	4,898,073,726	5,714,419,347	11,860
Sub-2						3,658,830	38,102,169,726	35,517,971,347	76,885
3. Earth Work									
Excavation (Common)	m^3	144,305	0.92	7,407	8,213	132,761	1,068,867,135	1,185,176,965	2,476
Excavation (Sound Rock)	m^3	7,395	4.12	33,605	36,492	30,467	248,508,972	269,858,340	571
Disposal Soil (L = 5 km)	m^3	15,170	1.20	8,610	10,050	18,204	130,613,700	152,458,500	324
Sub-3						181,432	1,447,989,807	1,607,493,805	3,371
4. Drainage									
Pipe Culvert (D = 100 cm)	m	760	44.35	634,758	554,426	33,706	482,416,080	421,363,760	840
Box Culvert (B = 2.0 m, H = 2.0 m)	m	380	325.89	3,064,762	2,510,606	123,838	1,164,609,560	954,030,280	2,477
U-Ditch (U = 30 cm)	m	18,987	1.71	41,910	36,720	32,468	795,745,170	697,202,640	1,140
Sub-4						190,012	2,442,770,810	2,072,596,680	4,457
5. Slope Protection									
Sprayed Concrete Cribwork	m^2	12,880	14.68	127,197	88,984	189,078	1,638,297,360	1,146,113,920	3,643
Shotcrete Work	m^2	115,918	11.82	101,390	67,157	1,370,151	11,752,926,020	7,784,705,126	26,277
Stone Masonry	m^2	7,892	6.91	116,286	109,711	54,534	917,729,112	865,839,212	1,496
Mat Gabion	m^2	12,711	9.20	72,584	61,374	116,941	922,615,224	780,124,914	2,162
Sodding	m^2	50,845	0.08	3,238	2,851	4,068	164,636,110	144,959,095	208
Sub-5						1,734,772	15,396,203,826	10,721,742,267	33,786
6. Tunnel	m	0	3,500.00	22,400,000	17,920,000	0	0	0	0
7. Bridges									
L<=10 m	m^2	480	206.20	2,233,568	1,843,094	98,977	1,072,112,680	884,685,320	2,121
10 m<L<=20 m	m^2	630	287.55	2,506,242	2,008,820	181,154	1,578,932,681	1,265,556,742	3,499
20 m<L<=30 m	m^2	0	313.65	2,643,773	2,102,930	0	0	0	0
30 m<L	m^2	360	345.02	2,908,151	2,313,224	124,206	1,046,934,291	832,760,469	2,364
Sub-7						404,337	3,697,979,652	2,983,002,531	7,984
8. Safety Facilities Works									
Guard Railing	m	7,600	11.30	168,012	143,025	85,880	1,276,891,200	1,086,990,000	2,187
Traffic Sign	each	253	27.98	426,548	373,259	7,088	108,058,827	94,558,947	183
Line Marking	m	76,000	0.42	4,231	3,518	31,920	321,556,000	267,368,000	660
Sub-8						124,888	1,706,506,027	1,448,916,947	3,030
9. Mobilization & Temporally Works (20 % of Total Cost)						1,227,989	13,016,682,283	11,324,513,586	26,033
10. Sub-Total						**7,557,197**	**76,093,899,431**	**65,995,075,263**	**156,200**
11. Engineering Cost (20 % of 10)						**2,063,021**	**14,578,684,157**	**11,662,947,326**	**36,447**
12. Contingency (10 % of 10 + 11)						**962,022**	**9,067,258,359**	**7,765,802,259**	**19,265**
Ground Total Cost (10+ 11 + 12)						**10,582,240**	**99,739,841,947**	**85,423,824,848**	**211,912**

Source: Study Team

Item	Unit	Quantity	1999	2000	2001	2002	2003	Total
1. Preparation of Project								
2. Survey and Design	km	76.0						
3. Construction								
Earth Work	m^3	151,700.0						
Slope Protection	m^2	-						
Tunnel	m	0.0						
Bridges	m	1,470.0						
Pavement	km	76.0						
Foreign (US$)				567,331	1,260,318	2,790,568	5,964,023	10,582,240
Local Financial Cost (Rp)				4,009,138,143	112,337,970,148	24,924,241,205	59,572,665,553	99,739,841,949
Local Economic Cost (Rp)				3,207,310,515	9,734,403,840	19,433,828,115	53,048,282,379	85,423,824,848
Total Financial Cost (Mill. Rp)				10,023	24,593	54,504	122,791	211,912
Total Economic Cost (Mill. Rp)				9,221	23,094	49,014	116,267	197,596

Source: Study Team

Figure 10-2-35 Implementation Schedule for Asera - Bts. Pro. Road (Link No. 33)

(7) Economic Analysis (Link No. 33)

1) Economic Project Costs

The economic investment costs are estimated in constant 1998 prices. The financial investment costs in terms of market price include the component of taxes. The economic costs for economic analysis are obtained by subtracting the portion of transfer payment such as taxes from financial costs. The financial and economic costs (initial investment and maintenance costs) are summarized in Table 10-2-54.

Table 10-2-54 Initial Investment and Maintenance Costs

(Million Rp.)

	Economic Prices
Initial Investment Cost (Construction)	197,596
Routine Maintenance Cost Per Year	138
Periodic Maintenance Cost Per Year	14,173

Source: Study Team

The maintenance cost of the proposed road follows the engineering study results of the cost estimates. Besides, the maintenance cost of the proposed road in the case of "without the improvement of the proposed road" is treated as a negative cost.

2) Economic Benefits

Benefits are classified into two types, one is the direct benefit and the other is the indirect benefit or intangible benefit.

The direct benefits which would be realized from the implementation of the Project are defined as the savings in travel costs, composed of the vehicle operating cost and vehicle time cost when comparing the "With" and "Without" project conditions.

The benefit of vehicle operating costs is estimated as a difference of vehicle operating costs between "With" Project" case and "Without" Project" case. The vehicle operating cost is derived from the obtained daily vehicle-kilometers and the unit vehicle operating cost by vehicle type. In addition, traffic safety will be improved and accident costs reduce.

In this economic analysis, the above mentioned direct benefit, e.g. the vehicle operating cost saving is computed as a quantified benefit. The calculation of direct benefits are made for the planning year of 2003 and 2018.

As a result, the saving in vehicle operating cost is summarized as shown in Table 10-2-55.

Table 10-2-55 Estimated Economic Benefits

(Million Rp. at 1998 price)

Year	Benefit of Saving in VOC
2004	35,222
2018	84,588

Source: Study Team

3) Economic Cost-Benefit Analysis

The analysis follows the conventional discounted cash flow method in determining the economic internal rate of return (EIRR), the net present value (NPV) and the benefit cost ratio (B/C). (NPV and B/C are calculated at a discount rate of 15 percent.) The project life is assumed to be 20 years after the completion of the construction.

The benefits in the intermediate years were interpolated and those beyond 2018 were assumed to be fixed. The total economic project costs and benefits streams are presented in Table 10-2-56. The efficiency measures were calculated and the summary is as follows:

Table 10-2-56 Economic Analysis for Link No. 33

(Million Rp.)

	Year	Benefits		Costs			Maint. Cost (Without)	Net Cash Flow
		VOC Saving	Total	Invest. Costs	Maint. Cost (With)	Total		
1	1999			0	0	0	0	0
2	2000			9,221	138	9,359	9,558	199
3	2001			23,094	138	23,232	138	-23,094
4	2002			49,014	138	49,152	138	-49,014
5	2003	0	0	116,267	138	116,405	138	-116,267
6	2004	35,222	35,222	0	138	138	138	35,222
7	2005	38,748	38,748	0	138	138	9,558	48,168
8	2006	42,274	42,274	0	138	138	138	42,274
9	2007	45,800	45,800	0	138	138	138	45,800
10	2008	49,326	49,326	0	138	138	138	49,326
11	2009	52,853	52,853	0	138	138	138	52,853
12	2010	56,379	56,379	0	14,311	14,311	9,558	51,626
13	2011	59,905	59,905	0	138	138	138	59,905
14	2012	63,431	63,431	0	138	138	138	63,431
15	2013	66,957	66,957	0	138	138	9,558	76,377
16	2014	70,484	70,484	0	138	138	138	70,484
17	2015	74,010	74,010	0	138	138	138	74,010
18	2016	77,536	77,536	0	138	138	9,558	86,956
19	2017	81,062	81,062	0	14,311	14,311	138	66,889
20	2018	84,588	84,588	0	138	138	138	84,588
21	2019	84,588	84,588	0	138	138	9,558	94,008
22	2020	84,588	84,588	0	138	138	138	84,588
23	2021	84,588	84,588	0	138	138	138	84,588
24	2022	84,588	84,588	0	138	138	9,558	94,008
25	2023	84,588	84,588	0	138	138	138	84,588
				197,596	31,658	229,254	69,252	

Source: Study Team

Efficiency Measures	
EIRR	23.5%
NPV (Million Rp.)	70,060
B/C	1.73

Source: Study Team

These results indicate that implementation of the Project (road development of link No.33) is economically feasible.

10.2.9 Barru – Kasipute (Link No. 31)

(1) Route Description

The planned road is a trunk road for development of the southwestern part of Southeast Sulawesi Province. This road is an arterial road connecting Kolaka and Kasipute, and an essential road for regional production activities and daily life. The entire route running through both kabupatens of Kolaka and Buton has been designated as a provincial road. The total length is 188 km. Except for the Bambnea - Kasipute section of Paleang Timar, Buton, the route runs on a flat diluvial layer along the shoreline. On the wayside flat land, agricultural production is active, based mainly on paddy fields. Land is currently being developed according to the migration program, which is expected to result in expansion of production in the future. Roads in Kabupaten Kolaka are 3.5 - 4.5 m in width and provided with a simple pavement of asubuton (natural asphalt) or penetration macadam. On the other hand, roads in Kabupaten Buton are mostly narrow gravel roads. There is not much of a drainage system, which is essential for road maintenance, resulting in poorly maintained road surface. In addition, the road crosses many rivers, and bridges are heavily damaged.

Location of roads concerned

- Province: Southeast Sulawesi
- Kabupatens: Kolaka, Buton
- Kecamatens: Watubangga, Pomalaa, Paleang, Paleang Timur, Rumbia,
- Major cities and settlement: Pomalaa, Watubangga, Boepiang, Watupute, Wolulu, Ewolangka Laea Bamboca Boapinang, Kashipute,
- Link Length: 188.0 km

(2) Road Traffic (Link No. 31)

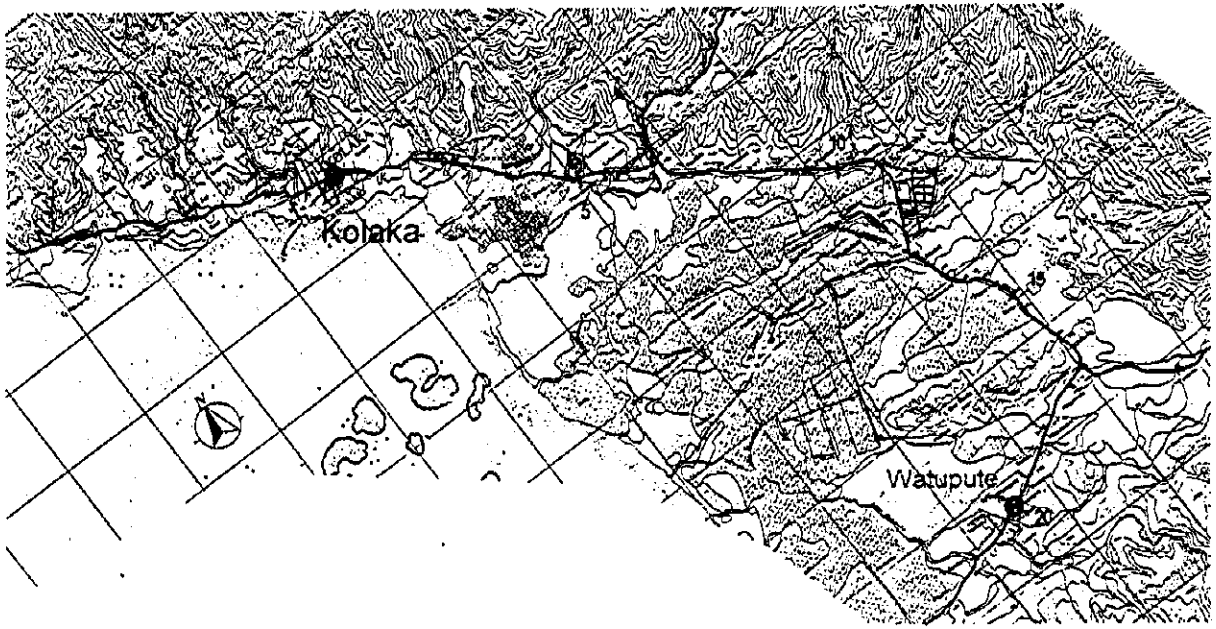
The future traffic demand of the road link are summerized as indicated in Table 10-2-57.

Table 10-2-57 Future Traffic Volume of Barru – Kasipute

	Year 2003 (vehicle/day)	Year 2018 (vehicle/day)
Motorcycle	70	313
Passenger cars	10	83
Buses	110	280
Trucks	142	464
Total	200	1140

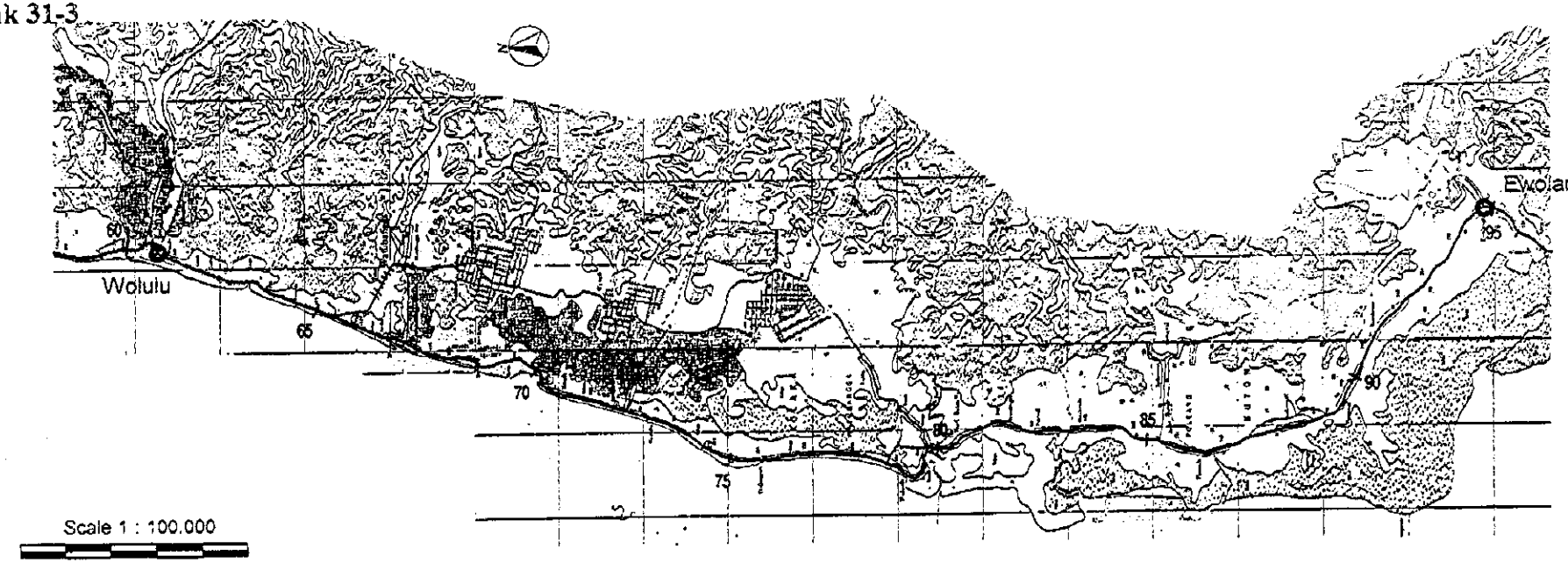
Source: Study Team

Link 31-1



Link 31-2

Figure 10-2-36 (1)



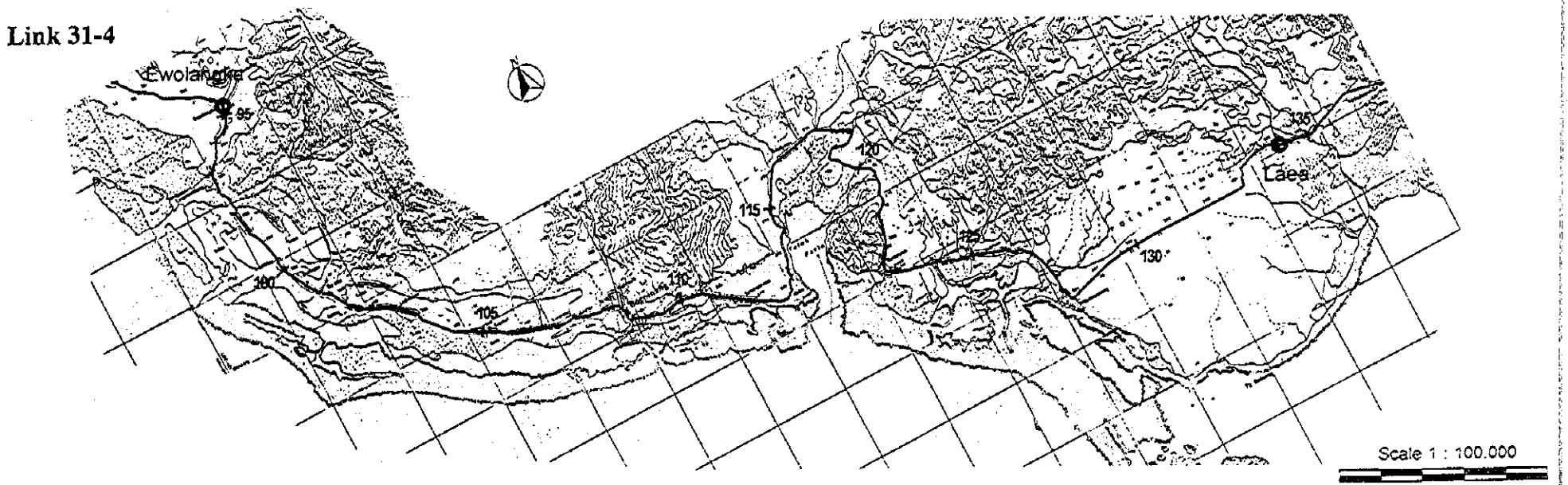


Figure 10-2-36 (2)

Link 31-5

Link 31-6

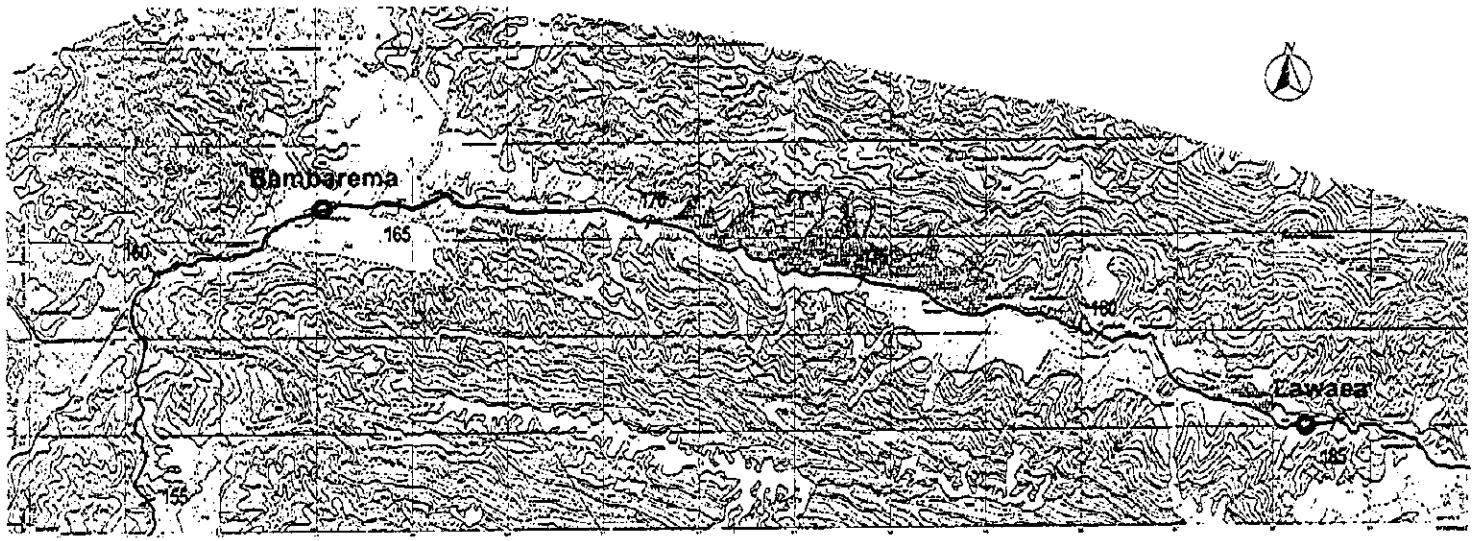
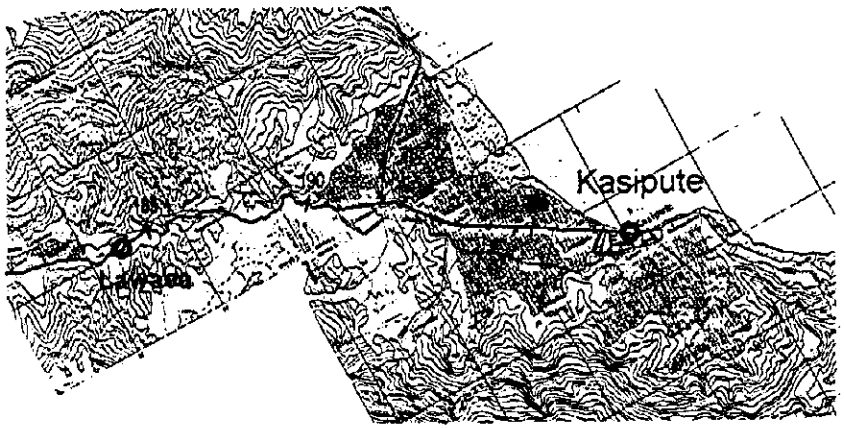


Figure 10-2-36 (3)

Link 31-7

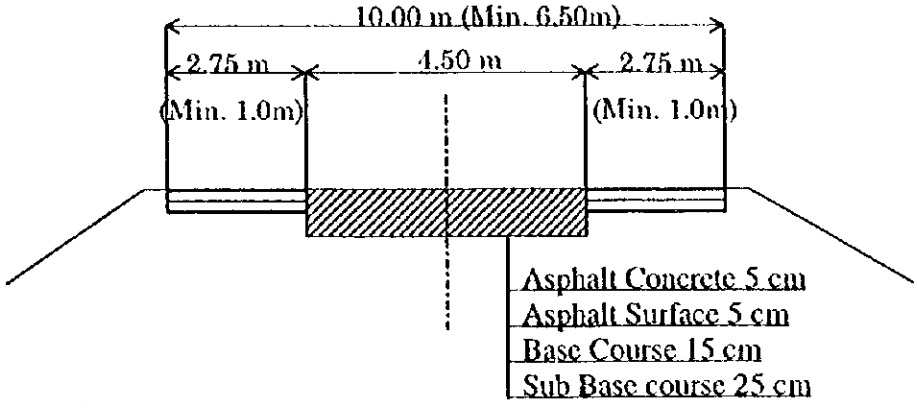


Scale 1 : 100.000

Figure10-2-36 (4)

(3) Typical Cross Section and Pavement (Link No. 31)

The total width will be 10 m (or 6.50m in mountainous area), including 4.5 m for the pavement of carriage way, 2.75 m for shoulders in flat area.



Source: Study Team

Figure 10-2-37 Typical Cross Section for Link No. 31

The pavement will be of C type with a surface thickness of 5 cm. The plan also calls for an additional surface course of 5 cm as an overlay in seven years after road construction. Pavement thickness was decided by the future traffic demand with traffic demand.

(4) Preparatory Engineering of Bridge (4) Preparatory Engineering of Bridges

Typical cross section of bridge is shown in Figure 10-2-4 and the bridge improvement concept is shown in Figure 10-2-5.

Existing bridge condition and bridge improvement plan on the road of link No.31 are listed in Table 10-2-58.

Quantity of bridge improvement on the road link No.31 is summarized in Table 10-2-59.

Table 10-2-58 Existing Bridge and Bridge Improvement Plan for Road Link No.31

Road Link No.	Bridge No.	Location From	Location Km	Length (m)	No. Span	Width (m)	Type of Superstructure	Improvement Plan
31	1	Barra	0.00	3.6	1	4.6	Concrete Plate	Retain existing
31	2	Barra	0.25	11.6	1	8.5	Concrete Girder	Retain existing
31	3	Barra	4.40	9.3	1	4.7	Concrete Plate	Retain existing
31	4	Barra	7.45	17.6	1	4.5	Concrete Girder	Replace
31	5	Barra	14.85	20.0	1	5.7	Wooden Girder	Replace
31	6	Barra	17.25	20.0	1	7.0	Concrete Girder	Retain existing
31	7	Barra	18.35	9.9	1	6.6	Concrete Girder	Retain existing
31	8	Barra	19.50	20.0	1	6.6	Concrete Girder	Retain existing
31	9	Barra	20.45	9.9	1	6.6	Concrete Girder	Retain existing
31	10	Barra	21.42	6.9	1	5.6	Concrete Plate	Retain existing
31	11	Barra	22.65	6.4	1	6.5	Concrete Plate	Retain existing
31	12	Barra	23.55	6.9	1	4.5	Concrete Girder	Retain existing
31	13	Barra	24.85	3.3	1	4.0	Concrete Plate	Retain existing
31	14	Barra	26.75	8.2	1	6.6	Concrete Girder	Retain existing
31	15	Barra	28.85	6.6	1	6.6	Concrete Girder	Retain existing
31	16	Barra	41.10	7.1	1	6.5	Concrete Plate	Retain existing
31	17	Barra	54.47	8.3	1	6.6	Concrete Girder	Retain existing
31	18	Barra	57.70	8.5	1	4.0	Concrete Girder	Replace
31	19	Barra	58.15	10.2	1	5.0	Concrete Girder	Replace
31	20	Barra	60.00	7.3	1	6.5	Concrete Girder	Retain existing
31	21	Barra	63.95	12.8	1	8.6	Concrete Girder	Retain existing
31	22	Barra	68.35	6.8	1	8.5	Concrete Girder	Retain existing
31	23	Barra	69.25	28.6	2	6.6	Concrete Girder	Retain existing
31	24	Barra	86.12	10.5	1	4.3	Concrete Girder	Replace
31	25	Barra	87.67	65.0	1	6.5	Steel Girder	Retain existing
31	26	Barra	78.11	12.8	1	8.6	Concrete Girder	Retain existing
31	27	Barra	73.30	11.4	1	4.2	Concrete Girder	Widening
31	28	Barra	74.00	30.0	2	8.2	Concrete Girder	Retain existing
31	29	Barra	74.25	11.5	1	4.2	Wooden Girder	Retain existing
31	30	Barra	78.05	61.2	5	4.6	Steel Girder	Replace
31	31	Barra	77.35	8.1	1	7.0	Concrete Girder	Retain existing
31	32	Barra	79.05	12.9	1	4.1	Concrete Girder	Replace
31	33	Barra	77.15	30.4	1	6.0	Steel Girder	Retain existing
31	34	Barra	80.90	10.5	1	4.3	Concrete Girder	Replace
31	35	Barra	82.11	8.3	1	4.3	Concrete Girder	Retain existing
31	36	Barra	83.65	9.9	1	4.3	Wooden Girder	Replace
31	37	Barra	84.25	7.6	1	4.6	Wooden Girder	Replace
31	38	Barra	85.71	7.9	1	4.5	Concrete Girder	Replace
31	39	Barra	87.25	14.5	1	4.2	Concrete Girder	Replace
31	40	Barra	88.95	8.7	1	4.3	Concrete Girder	Replace
31	41	Barra	89.67	7.0	1	4.3	Concrete Girder	Replace
31	42	Barra	90.35	5.4	1	4.5	Concrete Girder	Retain existing
31	43	Barra	91.96	9.8	1	4.5	Concrete Girder	Retain existing
31	44	Barra	93.11	12.0	1	6.6	Wooden Girder	Replace
31	45	Barra	94.75	8.3	1	6.1	Concrete Girder	Retain existing
31	46	Barra	96.36	7.0	1	4.2	Concrete Girder	Replace
31	47	Barra	98.41	8.8	1	6.0	Wooden Girder	Replace
31	48	Barra	99.25	11.5	1	6.0	Wooden Girder	Replace
31	49	Barra	100.49	13.0	1	6.0	Wooden Girder	Replace
31	50	Barra	104.55	6.8	1	6.3	Concrete Girder	Retain existing
31	51	Barra	102.99	8.8	1	7.0	Concrete Girder	Retain existing
31	52	Barra	103.60	25.4	1	4.0	Steel Girder	Replace
31	53	Barra	104.15	4.8	1	4.9	Wooden Girder	Replace
31	54	Barra	105.25	25.0	1	6.0	Wooden Girder	Replace
31	55	Barra	106.35	6.2	1	4.7	Concrete Girder	Retain existing
31	56	Barra	107.39	12.8	1	6.0	Concrete Girder	Retain existing
31	57	Barra	108.35	10.6	1	7.0	Concrete Girder	Retain existing
31	58	Barra	110.45	6.0	1	4.5	Concrete Girder	Replace
31	59	Barra	111.28	6.3	1	4.5	Concrete Girder	Replace
31	60	Barra	113.89	10.4	1	7.0	Concrete Girder	Retain existing
31	61	Barra	114.55	6.4	1	4.6	Concrete Girder	Replace
31	62	Barra	115.24	14.6	1	4.0	Concrete Girder	Retain existing
31	63	Barra	116.25	8.6	1	7.0	Concrete Girder	Retain existing
31	64	Barra	117.30	6.9	1	4.3	Concrete Girder	Retain existing
31	65	Barra	118.55	14.9	1	4.0	Concrete Girder	Replace
31	66	Barra	119.60	8.0	1	7.0	Concrete Girder	Retain existing
31	67	Barra	120.55	10.0	1	7.0	Concrete Girder	Retain existing
31	68	Barra	131.40	41.3	1	4.0	Steel Truss	Replace
31	69	Barra	132.32	8.8	1	7.0	Concrete Girder	Retain existing
31	70	Barra	133.34	8.8	1	7.0	Concrete Girder	Retain existing
31	71	Barra	134.25	10.8	1	7.0	Concrete Girder	Retain existing
31	72	Barra	135.30	10.0	1	4.0	Wooden Girder	Replace
31	73	Barra	136.38	10.8	1	7.0	Concrete Girder	Retain existing
31	74	Barra	137.55	20.8	1	7.0	Concrete Girder	Retain existing
31	75	Barra	138.25	8.0	1	6.0	Wooden Girder	Replace
31	76	Barra	139.55	8.0	1	6.0	Wooden Girder	Replace
31	77	Barra	140.75	8.8	1	7.0	Concrete Girder	Retain existing
31	78	Barra	141.35	12.0	1	4.0	Wooden Girder	Replace
31	79	Barra	142.85	25.5	1	4.5	Steel Girder	Retain existing
31	80	Barra	143.35	7.6	1	4.4	Concrete Girder	Retain existing
31	81	Barra	144.35	10.8	1	6.0	Wooden Girder	Retain existing
31	82	Barra	145.35	25.8	1	3.7	Bailey	Replace
31	83	Barra	147.55	7.8	1	4.3	Concrete Girder	Retain existing
31	84	Barra	148.82	6.1	1	4.6	Concrete Girder	Replace
31	85	Barra	150.15	7.0	1	6.0	Wooden Girder	Replace
31	86	Barra	151.15	25.8	1	3.0	Bailey	Replace
31	87	Barra	152.75	12.0	1	6.0	Wooden Girder	Replace
31	88	Barra	155.35	8.9	1	4.5	Concrete Girder	Retain existing
31	89	Barra	156.10	8.0	1	6.0	Wooden Girder	Replace
31	90	Barra	156.15	8.1	1	4.2	Concrete Girder	Retain existing
31	91	Barra	159.25	10.0	1	6.0	Wooden Girder	Replace
31	92	Barra	160.15	7.6	1	4.5	Concrete Girder	Retain existing
31	93	Barra	162.30	7.2	1	4.3	Concrete Girder	Retain existing
31	94	Barra	162.75	8.3	1	4.6	Concrete Girder	Retain existing
31	95	Barra	164.25	8.3	1	4.6	Concrete Girder	Retain existing
31	96	Barra	166.85	8.4	1	4.4	Concrete Girder	Replace
31	97	Barra	167.55	4.0	1	6.0	Wooden Girder	Replace
31	98	Barra	168.25	4.4	1	4.4	Concrete Girder	Retain existing
31	99	Barra	169.00	8.7	1	4.4	Concrete Girder	Retain existing
31	100	Barra	169.30	14.0	1	6.0	Wooden Girder	Replace
31	101	Barra	170.65	9.0	1	6.9	Wooden Girder	Replace
31	102	Barra	169.95	8.7	1	4.6	Concrete Girder	Retain existing
31	103	Barra	170.95	8.8	1	4.5	Concrete Girder	Replace
31	104	Barra	171.60	4.0	1	6.0	Wooden Girder	Replace
31	105	Barra	172.35	12.0	1	6.0	Wooden Girder	Replace
31	106	Barra	173.35	15.0	1	6.0	Wooden Girder	Replace
31	107	Barra	175.25	25.8	1	3.0	Bailey	Replace
31	108	Barra	177.55	12.0	1	6.0	Wooden Girder	Replace
31	109	Barra	177.65	7.6	1	6.5	Concrete Girder	Retain existing
31	110	Barra	178.95	7.6	1	6.4	Concrete Girder	Retain existing
31	111	Barra	179.55	36.3	1	6.0	Steel Truss	Retain existing
31	112	Barra	182.25	14.0	1	6.0	Wooden Girder	Replace
31	113	Barra	192.15	10.0	2	7.5	Wooden Girder	Replace

Source: Study Team

Table 10-2-59 Summary of Quantity of Bridge Improvement for Road Link No.31

	LINK NAME		ROAD LENGTH	QUANTITY OF BRIDGE CONSTRUCTION (m^2)			
				CLASSIFICATION BY SPAN LENGTH : L(m)			
			(km)	L<=10m	10m<L<=20m	20m<L<=30m	L>30m
31	BARRU-KASIPUTE						
	BARRU	POMALA	20.2	0	0	0	0
	POMALA	225KM	41.5	0	0	0	0
	225KM	BTS.CADIN	17.1	203	0	0	0
	BTS.CADIN	BUASIN	33.3	668	383	113	293
	BUASIN	315KM	40.8	570	225	413	189
	315KM	KASIPUTE	35.0	915	450	300	0
	TOTAL 31		187.9	2,356	1,058	826	482

Source: Study Team

(5) Preparatory Engineering of Slope Protection Works

Slope protection works are constructed to protect the slopes from erosion or weathering by covering them with vegetation or structures and also to stabilize the slopes by means of drainage works or retaining structures. The following types of slope protection works are adopted for the pre-feasibility route considering the terrain and geology, as shown in Table 10-2-60.

Table 10-2-60 Quantities of Slope Protection

	Cut		Fill	
	Sprayed Concrete Cribwork(m^2)	Shotcrete (m^2)	Stone Masonry (m^2)	Mat Gabion (m^2)
Quantity	7,513	67,619	4,603	7,415

Source: Study Team

(6) Cost Estimation (Link No. 31)

1) Estimated Project Cost

Cost items consist of preparation works, pavement, earth work, drainage, bridge, slope protection and safety facilities works. The engineering service cost is estimated at 20% of the total cost of direct and indirect cost. A contingency allowance has been included in 10 % of total construction and engineering cost. Table 10-2-61 shows the result of estimated project cost.

2) Implementation Plan

As shown in Figure 10-2- 38, the construction period was proposed to be 5 years consisting of one year for preparation of project for fund raising plan, 1.5 years for detailed design of the roads and 2.5 years for construction. Also, the investment plan is set in accordance with the construction plan.

Table 10-2-61 Total Construction Cost for Barru - Kasipute Road (Link No. 31)

Rate: 1US$ = 10,600 Rp. = 140 Yen

Item	Unit	Quantity	Unit Price			Total Price			
			Foreign (US$)	Financial (Rp)	Economic (Rp)	Foreign (US$)	Local Financial (Rp)	Local Economic (Rp)	Financial Total (Mill. Rp)
1. Preparation Works									
Clearing and Grubbing	m²	363,400	0.23	1,867	2,099	83,582	678,467,800	762,776,600	1,564
2. Pavement									
Road Asphalt Concrete + Sub Base (Type A)	m	0	39.50	436,896	392,152	0	0	0	0
Road Asphalt Concrete + Sub Base (Type B)	m	0	31.76	351,336	315,832	0	0	0	0
Road Asphalt Concrete + Sub Base (Type C)	m	187,900	16.15	188,584	175,452	3,034,585	35,434,933,600	32,967,430,800	67,602
Transport for Pavement Material (L = 43 km)	m³	181,324	5.92	44,138	51,494	1,073,227	8,003,204,059	9,337,071,402	19,379
Sub-2						4,107,812	43,438,137,659	42,304,502,202	86,981
3. Earth Work									
Excavation (Common)	m³	345,183	0.92	7,407	8,213	317,568	2,556,770,481	2,834,987,979	5,923
Excavation (Sound Rock)	m³	18,167	4.12	33,605	36,492	74,848	610,502,035	662,950,164	1,404
Disposal Soil (L = 5 km)	m³	36,335	1.20	8,610	10,050	43,602	312,844,350	365,166,750	775
Sub-3						436,018	3,480,116,866	3,863,104,893	8,102
4. Drainage									
Pipe Culvert (D = 100 cm)	m	1,879	44.35	634,758	554,426	83,334	1,192,710,282	1,041,766,454	2,076
Box Culvert (B = 2.0 m, H = 2.0 m)	m	940	325.89	3,064,762	2,510,606	306,174	2,879,343,899	2,358,714,537	6,125
U-Ditch (U = 30 cm)	m	46,995	1.71	41,910	36,720	80,361	1,969,560,450	1,725,656,400	2,821
Sub-4						469,869	6,041,614,631	5,126,137,191	11,022
5. Slope Protection									
Sprayed Concrete Cribwork	m²	7,513	14.68	127,197	88,984	110,291	955,631,061	668,536,792	2,125
Shotcrete Work	m²	67,619	11.82	101,390	67,157	799,257	6,855,890,410	4,541,089,183	15,328
Stone Masonry	m²	4,603	6.91	116,286	109,711	31,807	535,264,458	504,999,733	872
Mat Gabion	m²	7,415	9.20	72,584	61,374	68,218	538,210,360	455,088,210	1,261
Sodding	m²	29,659	0.08	3,238	2,851	2,373	96,035,842	84,557,809	121
Sub-5						1,011,946	8,981,032,131	6,254,271,727	19,707
6. Tunnel	m	0	3,500.00	22,400,000	17,920,000	0	0	0	0
7. Bridges									
L<=10 m	m²	2,356	206.20	2,233,568	1,843,094	485,814	5,262,286,404	4,342,330,446	10,412
10 m<L<=20 m	m²	1,058	287.55	2,506,242	2,008,820	304,224	2,651,604,406	2,125,331,798	5,876
20 m<L<=30 m	m²	826	313.65	2,643,773	2,102,930	259,076	2,183,756,879	1,737,020,575	4,930
30 m<L	m²	482	345.02	2,908,151	2,313,224	166,298	1,401,728,689	1,114,973,739	3,164
Sub-7						1,215,412	11,499,376,378	9,319,656,558	24,382
8. Safety Facilities Works									
Guard Railing	m	18,790	11.30	168,012	143,025	212,327	3,156,945,480	2,687,439,750	5,408
Traffic Sign	each	626	27.98	426,548	373,259	17,525	267,161,231	233,784,554	453
Line Marking	m	187,900	0.42	4,231	3,518	78,918	795,004,900	661,032,200	1,632
Sub-8						308,770	4,219,111,611	3,582,256,504	7,493
9. Mobilization & Temporally Works (20 % of Total Cost)						1,502,377	15,925,497,384	13,854,921,724	31,850
10. Sub-Total						**9,135,786**	**94,263,354,460**	**85,067,627,399**	**191,101**
11. Engineering Cost (20 % of 10)						**2,523,994**	**17,836,221,070**	**14,268,976,856**	**44,591**
12. Contingency (10 % of 10 + 11)						**1,165,978**	**11,209,927,553**	**9,933,660,425**	**23,569**
Ground Total Cost (10+ 11 + 12)						**12,825,758**	**123,309,503,083**	**109,270,264,680**	**259,261**

Source: Study Team

Item	Unit	Quantity	2002	2003	2004	2005	2006	Total
1. Preparation of Project								
2. Survey and Design	km	187.9						
3. Construction								
Earth Work	m^3	363,350.0						
Slope Protection	m^2	-						
Tunnel	m	0.0						
Bridges	m	4,722.0						
Pavement	km	187.9						
Foreign (US$)				694,098	1,835,148	3,376,603	6,919,907	12,825,756
Local Financial Cost (Rp)				4,904,960,794	16,727,466,738	31,000,118,398	70,676,657,152	123,309,203,082
Local Economic Cost (Rp)				3,923,968,635	14,787,244,007	25,369,070,489	65,189,981,548	109,270,264,680
Total Financial Cost (Mill. Rp)				12,262	36,180	66,792	144,028	259,262
Total Economic Cost (Mill. Rp)				11,281	34,240	61,161	138,541	245,223

Source: Study Team

Figure 10-2-38 Implementation Schedule for Barru - Kasipute Road (Link No. 31)

(7) Economic Analysis (Link No. 31)

1) Economic Project Costs

The economic investment costs are estimated in constant 1998 prices. The financial investment costs in terms of market price include the component of taxes. The economic costs for economic analysis are obtained by subtracting the portion of transfer payment such as taxes from financial costs. The financial and economic costs (initial investment and maintenance costs) are summarized in Table 10-2-62.

Table 10-2-62 Initial Investment and Maintenance Costs

(Million Rp.)

	Economic Prices
Initial Investment Cost (Construction)	245,223
Routine Maintenance Cost Per Year	341
Periodic Maintenance Cost Per Year	27,296

Source: Study Team

The maintenance cost of the proposed road follows the engineering study results of the cost estimates. Besides, the maintenance cost of the proposed road in the case of "without the improvement of the proposed road" is treated as a negative cost.

2) Economic Benefits

Benefits are classified into two types, one is the direct benefit and the other is the indirect benefit or intangible benefit.

The direct benefits which would be realized from the implementation of the Project are defined as the savings in travel costs, composed of the vehicle operating cost and vehicle time cost when comparing the "With" and "Without" project conditions.

The benefit of vehicle operating costs is estimated as a difference of vehicle operating costs between "With" Project" case and "Without" Project" case. The vehicle operating cost is derived from the obtained daily vehicle-kilometers and the unit vehicle operating cost by vehicle type. In addition, traffic safety will be improved and accident costs reduced.

In this economic analysis, the above mentioned direct benefit, e.g. the vehicle operating cost saving is computed as a quantified benefit. The calculation of direct benefits are made for the planning year of 2003 and 2018.

As a result, the saving in vehicle operating cost is summarized as shown in Table 10-2-63.

Table 10-2-63 Estimated Economic Benefits

(Million Rp. at 1998 price)

Year	Benefit of Saving in VOC
2007	38,949
2018	60,884

Source: Study Team

3) Economic Cost-Benefit Analysis

The analysis follows the conventional discounted cash flow method in determining the economic internal rate of return (EIRR), the net present value (NPV) and the benefit cost ratio (B/C). (NPV and B/C are calculated at a discount rate of 15 percent.) The project life is assumed to be 20 years after the completion of the construction.

The benefits in the intermediate years were interpolated and those beyond 2018 were assumed to be fixed. The total economic project costs and benefits streams are presented in Table 10-2-64. The efficiency measures were calculated and the summary is as follows:

Table 10-2-64 Economic Analysis for Link No. 31

(Million Rp.)

	Year	Benefits		Costs			Maint. Cost (Without)	Net Cash Flow
		VOC Saving	Total	Invest. Costs	Maint. Cost (With)	Total		
1	1999			0	0	0	0	0
2	2000			0	0	0	0	0
3	2001			0	0	0	0	0
4	2002			0	0	0	0	0
5	2003	0	0	11,281	341	11,622	341	-11,281
6	2004	0	0	34,240	341	34,581	341	-34,240
7	2005	0	0	61,161	341	61,502	341	-61,161
8	2006	0	0	138,541	341	138,882	23,643	-115,239
9	2007	38,949	38,949	0	341	341	341	38,949
10	2008	40,943	40,943	0	341	341	341	40,943
11	2009	42,937	42,937	0	341	341	341	42,937
12	2010	44,931	44,931	0	341	341	341	44,931
13	2011	46,925	46,925	0	341	341	23,643	70,227
14	2012	48,919	48,919	0	341	341	341	48,919
15	2013	50,914	50,914	0	27,296	27,296	341	23,959
16	2014	52,908	52,908	0	341	341	23,643	76,210
17	2015	54,902	54,902	0	341	341	341	54,902
18	2016	56,896	56,896	0	341	341	341	56,896
19	2017	58,890	58,890	0	341	341	23,643	82,192
20	2018	60,884	60,884	0	341	341	341	60,884
21	2019	60,884	60,884	0	341	341	341	60,884
22	2020	60,884	60,884	0	27,296	27,296	23,643	57,231
23	2021	60,884	60,884	0	341	341	341	60,884
24	2022	60,884	60,884	0	341	341	341	60,884
25	2023	60,884	60,884	0	341	341	23,643	84,186
26	2024	60,884	60,884	0	341	341	341	60,884
27	2025	60,884	60,884	0	341	341	341	60,884
28	2026	60,884	60,884	0	341	341	23,643	84,186
				245,223	62,094	307,317	171,298	

Source: Study Team

Efficiency Measures	
EIRR	19.0 %
NPV (Million Rp.)	24,051
B/C	1.32

Source: Study Team

These results indicate that implementation of the Project (road development of link No.31) is economically feasible.

10.2.10 Toboli – Poso (Link No.8)

(1) Route Description

This Trans-Sulawesi road, which runs through Sulawesi Island, is the most important road connecting principal cities of South, Southeast, Central, and North Sulawesi. The existing road is 146.5 km long and finished with asphalt concrete pavement. It is 4.5 m wide and the shoulder width is 1.5 m over the entire route. Except for a few sections where the road surface has been damaged considerably due to faulty drainage, the route as a whole is in satisfactory condition. This route is located on a relatively flat alluvial layer along the coast. The adjacent land is used for paddy fields and coconuts in the flat land area.

Location of roads concerned

- Province: Central Sulawesi
- Kabupaten: Donggala, Poso
- Kecamatans: Parigi, Kasiguncu, Poso
- Major cities and settlement: Parigi, Kasiguncu, Poso
- Link length 146.8 km

(2) Road Traffic (Link No. 8)

The future traffic demand of the road link are summarized as indicated in Table 10-2-65.

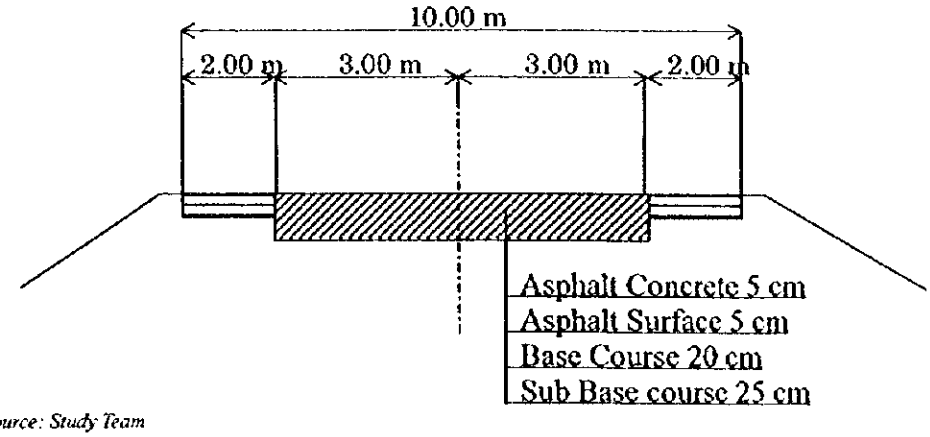
Table 10-2-65 Future Traffic Volume of Toboli - Poso

	Year 2003 (vehicle/day)	Year 2018 (vehicle/day)
Motorcycle	934	2664
Passenger cars	318	1115
Buses	454	1593
Trucks	768	2788
Total	2474	8160

Source: Study Team

(3) Typical Cross Section and Pavement (Link No. 16)

The total width will be 10 m (or 8 m in mountainous area), including 6.0 m for the pavement of carriage way and 2.00 m for shoulders in flat sections.



Source: Study Team

Figure 10-2-39 Typical Cross Section for Link No. 8

The pavement will be of AA type of a surface thickness of 5 cm, asphalt treated base cpurse, 20 cm and subbase course, 25 cm. The plan also calls for an additional surface course of 5 cm as an overlay in seven years after road construction. The pavement thickness was decided based on the future traffic demand.

(4) Preparatory Engineering of Bridges

Typical cross section of bridge is shown in Figure 10-2-14 and the bridge improvement concept is shown in Figure 10-2-15.

Existing bridge condition and bridge improvement plan on the road of link No.8 are listed in Table 10-2-66.

Quantity of bridge improvement on the road link No.8 is summarized in Table 10-2-67.

Table 10-2-66 Existing Bridge and Bridge Improvement Plan for Road Link No.8

Road Link No.	Bridge No.	Location		Length (m)	Nos. Span	Width (m)	Type of Superstructure	Improvement Plan
		From	Km					
8	1	Tobuk	0.00	5.9	1	6.0	Concrete Plate	Retain existing
8	2	Tobuk	0.34	60.2	2	3.5	Steel Truss	Widening
8	3	Tobuk	3.95	5.0	1	7.5	Concrete Plate	Retain existing
8	4	Tobuk	4.65	10.8	1	7.0	Steel Girder	Retain existing
8	5	Tobuk	6.95	41.7	1	4.5	Steel Truss	Widening
8	6	Tobuk	8.95	15.2	1	7.0	Concrete Girder	Retain existing
8	7	Tobuk	9.25	15.7	1	7.0	Concrete Girder	Retain existing
8	8	Tobuk	12.35	6.3	1	6.0	Concrete Plate	Retain existing
8	9	Tobuk	13.35	60.2	2	3.5	Steel Truss	Widening
8	10	Tobuk	13.15	5.0	1	7.0	Concrete Plate	Retain existing
8	11	Tobuk	14.91	5.0	1	7.0	Concrete Plate	Retain existing
8	12	Tobuk	15.55	5.0	1	7.0	Concrete Plate	Retain existing
8	13	Tobuk	15.95	8.6	1	7.0	Concrete Girder	Retain existing
8	14	Tobuk	19.25	25.0	1	4.0	Steel Girder	Retain existing
8	15	Tobuk	20.97	26.5	1	6.0	PC Girder	Retain existing
8	16	Tobuk	22.75	100.6	2	4.9	Steel Truss	Retain existing
8	17	Tobuk	26.25	6.0	1	8.0	Concrete Plate	Retain existing
8	18	Tobuk	28.15	15.6	1	6.0	PC Girder	Retain existing
8	19	Tobuk	29.65	8.0	1	6.0	Concrete Plate	Retain existing
8	20	Tobuk	31.35	8.3	1	6.2	Concrete Plate	Retain existing
8	21	Tobuk	37.35	53.3	2	8.1	Steel Girder	Retain existing
8	22	Tobuk	40.15	13.4	1	6.3	Concrete Plate	Retain existing
8	23	Tobuk	42.20	103.0	2	8.0	Steel Truss	Retain existing
8	24	Tobuk	47.65	25.4	1	8.0	Steel Girder	Retain existing
8	25	Tobuk	49.75	8.3	1	6.2	Concrete Plate	Retain existing
8	26	Tobuk	51.20	23.5	1	6.1	Concrete Plate	Retain existing
8	27	Tobuk	56.35	10.3	1	6.3	Concrete Plate	Retain existing
8	28	Tobuk	56.55	13.4	1	6.2	Concrete Plate	Retain existing
8	29	Tobuk	57.85	8.3	1	6.0	Concrete Plate	Retain existing
8	30	Tobuk	61.75	100.0	2	8.0	Steel Truss	Retain existing
8	31	Tobuk	64.00	5.0	1	4.0	Wooden Girder	Replace
8	32	Tobuk	64.05	8.3	1	6.3	Concrete Plate	Retain existing
8	33	Tobuk	67.05	32.0	1	6.0	PC Girder	Retain existing
8	34	Tobuk	68.61	8.4	1	6.2	Concrete Plate	Retain existing
8	35	Tobuk	69.15	10.3	1	6.3	Concrete Plate	Retain existing
8	36	Tobuk	69.35	29.0	1	6.0	PC Girder	Retain existing
8	37	Tobuk	74.55	29.3	1	6.1	PC Girder	Retain existing
8	38	Tobuk	76.85	8.4	1	6.3	Concrete Plate	Retain existing
8	39	Tobuk	77.85	13.5	1	8.1	Concrete Plate	Retain existing
8	40	Tobuk	79.15	8.5	1	6.0	Concrete Plate	Retain existing
8	41	Tobuk	80.65	8.3	1	6.2	Concrete Plate	Retain existing
8	42	Tobuk	81.95	10.4	1	6.1	Concrete Plate	Retain existing
8	43	Tobuk	82.95	8.4	1	6.2	Concrete Plate	Retain existing
8	44	Tobuk	85.05	8.4	1	6.2	Concrete Plate	Retain existing
8	45	Tobuk	86.00	17.4	1	6.1	PC Girder	Retain existing
8	46	Tobuk	88.15	16.8	1	6.1	PC Girder	Retain existing
8	47	Tobuk	90.95	8.4	1	6.1	Concrete Plate	Retain existing
8	48	Tobuk	91.95	17.3	1	6.0	PC Girder	Retain existing
8	49	Tobuk	93.85	8.4	1	6.1	Concrete Plate	Retain existing
8	50	Tobuk	96.25	17.3	1	6.3	PC Girder	Retain existing
8	51	Tobuk	100.35	96.0	3	3.7	Bailey	Replace
8	52	Tobuk	101.75	13.4	1	6.2	Concrete Plate	Retain existing
8	53	Tobuk	102.45	5.0	1	4.5	Concrete Plate	Widening
8	54	Tobuk	104.55	13.5	1	6.3	Concrete Plate	Retain existing
8	55	Tobuk	105.65	32.2	1	6.2	PC Girder	Retain existing
8	56	Tobuk	106.75	10.3	1	6.2	Concrete Plate	Retain existing
8	57	Tobuk	107.70	8.4	1	6.0	Concrete Plate	Retain existing
8	58	Tobuk	109.75	10.4	1	6.1	Concrete Plate	Retain existing
8	59	Tobuk	110.80	13.4	1	6.4	Concrete Plate	Retain existing
8	60	Tobuk	110.35	10.3	1	6.1	Concrete Plate	Retain existing
8	61	Tobuk	111.05	10.3	1	6.0	Concrete Plate	Retain existing
8	62	Tobuk	113.05	10.3	1	6.0	Concrete Plate	Retain existing
8	63	Tobuk	113.85	39.2	2	6.0	PC Girder	Retain existing
8	64	Tobuk	114.35	64.0	2	3.5	Bailey	Replace
8	65	Tobuk	115.95	39.2	2	6.0	PC Girder	Retain existing
8	66	Tobuk	119.65	35.0	4	3.5	Bailey	Replace
8	67	Tobuk	120.65	13.4	1	8.5	Concrete Plate	Retain existing
8	68	Tobuk	122.75	13.3	1	6.1	Concrete Plate	Retain existing
8	69	Tobuk	126.55	13.3	1	6.1	Concrete Plate	Retain existing
8	70	Tobuk	128.35	23.5	1	6.5	PC Girder	Retain existing
8	71	Tobuk	132.65	10.4	1	6.1	Concrete Plate	Retain existing
8	72	Tobuk	135.15	29.4	1	6.1	PC Girder	Retain existing
8	73	Tobuk	136.85	124.4	4	3.5	Bailey	Replace
8	74	Tobuk	139.15	10.8	1	5.9	Concrete Girder	Retain existing
8	75	Tobuk	141.55	33.8	2	6.1	Concrete Girder	Retain existing
8	76	Tobuk	142.85	8.3	1	6.1	Concrete Plate	Retain existing
8	77	Tobuk	142.85	14.0	1	6.1	PC Girder	Retain existing
8	78	Tobuk	143.15	13.3	1	6.3	Concrete Plate	Retain existing
8	79	Tobuk	143.35	33.9	1	6.1	PC Girder	Retain existing
8	80	Tobuk	144.65	8.7	1	6.0	Concrete Girder	Retain existing
8	81	Tobuk	145.45	8.7	1	6.2	Concrete Girder	Retain existing
8	82	Tobuk	145.65	8.4	1	6.2	Concrete Plate	Retain existing
8	83	Tobuk	146.35	33.9	1	6.2	PC Girder	Retain existing
8	84	Tobuk	146.55	10.3	1	6.2	Concrete Plate	Retain existing
8	85	Tobuk	147.95	10.4	1	6.3	Concrete Plate	Retain existing
8	86	Tobuk	148.25	30.9	1	6.5	Concrete Girder	Retain existing
8	87	Tobuk	148.45	8.3	1	6.2	Concrete Plate	Retain existing
8	88	Tobuk	149.45	14.1	1	6.5	PC Girder	Retain existing
8	89	Tobuk	149.65	6.0	1	8.0	Concrete Plate	Retain existing
8	90	Tobuk	149.90	14.5	1	6.5	PC Girder	Retain existing
8	91	Tobuk	150.25	8.3	1	8.1	Concrete Plate	Retain existing
8	92	Tobuk	151.00	8.8	1	6.5	Concrete Girder	Retain existing
8	93	Tobuk	151.85	23.5	1	7.5	PC Girder	Retain existing
8	94	Tobuk	152.45	6.9	1	7.1	Stone Arch	Retain existing
8	95	Tobuk	153.25	129.1	4	6.9	PC Girder	Retain existing

Source: Bina Marga

Table 10-2-67 Summary of Quantity of Bridge Improvement for Road Link No.8

	LINK NAME		ROAD LENGTH (km)	QUANTITY OF BRIDGE CONSTRUCTION (m^2) CLASSIFICATION BY SPAN LENGTH : L(m)			
				L<=10m	10m<L<=20m	20m<L<=30m	L>30m
8	TAWALI-POSO						
	TOBOLI	PARIGI	15.5	0	0	0	609
	PARIGI	TOLAI	29.8	0	0	0	0
	TOLAI	SAUSU	28.4	60	0	0	0
	SAUSU	TAMBARANA	21.5	0	0	0	600
	TAMBARANA	POSO	51.6	23	0	0	1,440
	TOTAL 8		146.8	83	0	0	2,649

Source: Bina Marga

(5) Cost Estimation (Link No.8)

1) Estimated Project Cost

Cost items consist of preparation works, pavement, earth work, drainage, bridge, slope protection and safety facilities works. The engineering service cost is estimated at 20% of the total cost of direct and indirect cost. A contingency allowance has been included in 10 % of total construction and engineering cost. Table 10-2-68 shows the result of estimated project cost.

2) Implementation Plan

As shown in Figure 10-2-40, the construction period was proposed to be 5 years consisting of one year for preparation of project for fund raising plan, 1.5 years for detailed design of the roads and 2.5 years for construction. Also, the investment plan is set in accordance with the construction plan.

Table 10-2-68 Total Construction Cost for Toboli - Poso Road (Link No. 8)

Rate: 1US$ = 10,600 Rp. = 140 Yen

Item	Unit	Quantity	Unit Price			Total Price			
			Foreign (US$)	Financial (Rp)	Economic (Rp)	Foreign (US$)	Local Financial (Rp)	Local Economic (Rp)	Financial Total (Mill. Rp)
1. Preparation Works									
Clearing and Grubbing	m^2	256,500	0.23	1,867	2,099	58,995	478,885,500	538,393,500	1,104
2. Pavement									
Road Asphalt Concrete + Sub Base (Type A)	m^2	367,000	6.21	80,585	78,851	2,279,070	29,574,695,000	28,938,317,000	53,733
Asphalt and Overlay (T = 5 cm)	m^2	1,027,810	1.16	12,056	10,284	1,192,260	12,391,277,360	10,569,998,040	25,029
Transport for Pavement Material (L = 37 km)	m^3	216,541	4.62	34,483	40,231	1,001,329	7,467,052,596	8,711,561,362	18,081
Sub-2						4,472,659	49,433,024,956	48,219,876,402	96,845
3. Earth Work									
Excavation (Common)	m^3	231,000	0.92	7,407	8,213	212,520	1,711,017,000	1,897,203,000	1,777
Excavation (Sound Rock)	m^3	23,000	4.12	33,605	36,492	94,760	772,915,000	839,316,000	542
Disposal Soil (L = 5 km)	m^3	25,400	1.20	8,610	10,050	30,480	218,694,000	255,270,000	6,283
Sub-3						337,760	2,702,626,000	2,991,789,000	0
4. Drainage									
Pipe Culvert (D = 100 cm)	m	1,468	44.35	634,758	554,426	65,106	931,824,744	813,897,368	4,785
Box Culvert (B = 2.0 m, H = 2.0 m)	m	734	325.89	3,064,762	2,510,606	239,203	2,249,535,308	1,842,784,804	2,938
U-Ditch (U = 30 cm)	m	48,940	1.71	41,910	36,720	83,687	2,051,075,400	1,797,076,800	9,345
Sub-4						387,996	5,232,435,452	4,453,758,972	0
5. Slope Protection									
Sprayed Concrete Cribwork	m^2	1,543	14.68	127,197	88,984	22,651	196,264,971	137,302,312	3,148
Shotcrete Work	m^2	13,886	11.82	101,390	67,157	164,133	1,407,901,540	932,542,102	179
Stone Masonry	m^2	945	6.91	116,286	109,711	6,530	109,890,270	103,676,895	259
Mat Gabion	m^2	1,523	9.20	72,584	61,374	14,012	110,545,432	93,472,602	25
Sodding	m^2	6,091	0.08	3,238	2,851	487	19,722,658	17,365,441	4,047
Sub-5		17,897				207,813	1,844,324,871	1,284,359,352	0
6. Tunnel	m	0	3,500.00	22,400,000	17,920,000	0	0	0	0
7. Bridges									
L<=10 m	m^2	366	206.20	2,233,568	1,843,094	75,470	817,485,919	674,572,557	2,111
10 m<L<=20 m	m^2	380	287.55	2,506,242	2,008,820	109,268	952,372,093	763,351,686	0
20 m<L<=30 m	m^2	0	313.65	2,643,773	2,102,930	0	0	0	6,152
30 m<L	m^2	937	345.02	2,908,151	2,313,224	323,280	2,724,937,306	2,167,490,443	9,880
Sub-7		1,683				508,018	4,494,795,318	3,605,414,686	0
8. Safety Facilities Works									
Guard Railing	m	14,680	11.30	168,012	143,025	165,884	2,466,416,160	2,099,607,000	354
Traffic Sign	each	489	27.98	426,548	373,259	13,692	208,724,155	182,648,071	1,275
Line Marking	m	146,800	0.42	4,231	3,518	61,656	621,110,800	516,442,400	5,853
Sub-8						241,232	3,296,251,115	2,798,697,471	0
9. Mobilization & Temporally Works (20 % of Total Cost)						1,247,656	13,225,151,617	11,505,881,907	26,450
10. Sub-Total						**7,462,129**	**80,707,494,829**	**75,398,171,290**	**159,806**
11. Engineering Cost (20 % of 10)						**2,108,563**	**14,900,508,411**	**11,920,406,729**	**37,251**
12. Contingency (10 % of 10 + 11)						**957,069**	**9,560,800,324**	**8,731,857,802**	**19,706**
Ground Total Cost (10+ 11 + 12)						**10,527,761**	**105,168,803,564**	**96,050,435,821**	**216,763**

Source: Study Team

Item	Unit	Quantity	2004	2005	2006	2007	2008	Total
1. Preparation of Project								
2. Survey and Design	km	146.8						
3. Construction								
Earth Work	m^3	254,000.0						
Slope Protection	m^2	-						
Tunnel	m	0.0						
Bridges	m	1,683.0						
Pavement	km	146.8						
Foreign (US$)				579,855	1,501,389	1,961,437	6,485,079	10,527,760
Local Financial Cost (Rp)				4,097,639,813	13,837,919,921	17,959,834,010	69,273,409,820	105,168,803,564
Local Economic Cost (Rp)				3,278,111,850	12,184,219,451	15,177,820,895	65,410,283,624	96,050,435,820
Total Financial Cost (Mill. Rp)				10,244	29,753	38,751	138,015	216,763
Total Economic Cost (Mill. Rp)				9,425	28,099	35,969	134,152	207,645

Source: Study Team

Figure 10-2-43 Implementation Schedule for Toboli - Poso Road (Link No. 8)

(6) Economic Analysis (Link No.8)

1) Economic Project Costs

The economic investment costs are estimated in constant 1998 prices. The financial investment costs in terms of market price include the component of taxes. The economic costs for economic analysis are obtained by subtracting the portion of transfer payment such as taxes from financial costs. The financial and economic costs (initial investment and maintenance costs) are summarized in Table 10-2-69.

Table 10-2-69 Initial Investment and Maintenance Costs

(Million Rp.)

	Economic Prices
Initial Investment Cost (Construction)	207,645
Routine Maintenance Cost Per Year	267
Periodic Maintenance Cost Per Year	27,643

Source : Study Team

The maintenance cost of the proposed road follows the engineering study results of the cost estimates. Besides, the maintenance cost of the proposed road in the case of "without the improvement of the proposed road" is treated as a negative cost.

2) Economic Benefits

Benefits are classified into two types, one is the direct benefit and the other is the indirect benefit or intangible benefit.

The direct benefits which would be realized from the implementation of the Project are defined as the savings in travel costs, composed of the vehicle operating cost and vehicle time cost when comparing the "With" and "Without" project conditions.

The benefit of vehicle operating costs is estimated as a difference of vehicle operating costs between "With" Project" case and "Without" Project" case. The vehicle operating cost is derived from the obtained daily vehicle-kilometers and the unit vehicle operating cost by vehicle type. In addition, traffic safety will be improved and accident costs reduce.

In this economic analysis, the above mentioned direct benefit, e.g. the vehicle operating cost saving is computed as a quantified benefit. The calculation of direct benefits are made for the planning year of 2003 and 2018.

As a result, the saving in vehicle operating cost is summarized as shown in Table 10-2-70.

Table 10-2-70 Estimated Economic Benefits

(Million Rp. at 1998 price)

Year	Benefit of Saving in VOC
2009	132,917
2018	332,292

Source : Study Team

3) Economic Cost-Benefit Analysis

The analysis follows the conventional discounted cash flow method in determining the economic internal rate of return (EIRR), the net present value (NPV) and the benefit cost ratio (B/C). (NPV and B/C are calculated at a discount rate of 15 percent.) The project life is assumed to be 20 years after the completion of the construction.

The benefits in the intermediate years were interpolated and those beyond 2018 were assumed to be fixed. The total economic project costs and benefits streams are presented in Table 10-2-70. The efficiency measures were calculated and the summary is as follows:

Table 10-2-71 Economic Analysis for Link No. 8

(Million Rp.)

	Year	Benefits		Costs			Maint. Cost (Without)	Net Cash Flow
		VOC Saving	Total	Invest. Costs	Maint. Cost (With)	Total		
1	1999			0	0	0	0	0
2	2000			0	0	0	0	0
3	2001			0	0	0	0	0
4	2002			0	0	0	0	0
5	2003	0	0	0	0	0	0	0
6	2004	0	0	0	0	0	0	0
7	2005	0	0	9,425	267	9,692	267	-9,425
8	2006	0	0	28,099	267	28,366	18,461	-9,905
9	2007	0	0	35,969	267	36,236	267	-35,969
10	2008	0	0	134,152	267	134,419	267	-134,152
11	2009	132,917	132,917	0	267	267	267	132,917
12	2010	155,070	155,070	0	267	267	267	155,070
13	2011	177,222	177,222	0	267	267	18,461	195,416
14	2012	199,375	199,375	0	267	267	267	199,375
15	2013	221,528	221,528	0	267	267	267	221,528
16	2014	243,681	243,681	0	267	267	18,461	261,875
17	2015	265,834	265,834	0	267	267	267	265,834
18	2016	287,986	287,986	0	27,643	27,643	267	260,610
19	2017	310,139	310,139	0	267	267	18,461	328,333
20	2018	332,292	332,292	0	267	267	267	332,292
21	2019	332,292	332,292	0	267	267	267	332,292
22	2020	332,292	332,292	0	267	267	18,461	350,486
23	2021	332,292	332,292	0	267	267	267	352,292
24	2022	332,292	332,292	0	267	267	267	332,292
25	2023	332,292	332,292	0	27,643	27,643	18,461	323,110
26	2024	332,292	332,292	0	267	267	267	332,292
27	2025	332,292	332,292	0	267	267	267	332,292
28	2026	332,292	332,292	0	267	267	18,461	350,486
29	2027	332,292	332,292	0	267	267	267	332,292
30	2028	332,292	332,292	0	267	267	267	332,292
				207,645	61,160	268,805	133,766	

Source : Study Team

Efficiency Measures	
EIRR	64.7 %
NPV (Million Rp.)	314,492
B/C	7.95

Source : Study Team

These results indicate that implementation of the Project (road development of link No.8) is economically feasible.