

7.2.5 Asera - Sandangpangan (Link No. 32)

(I) Natural Environment

1) Meteorology

The monthly rainfall data, between year 1990 to 1996, and the monthly temperature data, between 1992 to 1995, taken from Meteorological Station in Kendari Airport, kabupaten Kendari, is shown in Table 7-2-39 and Table 7-2-40, respectively.

Table 7-2-39 Monthly Rainfall

Month/ Year	1	2	3	4	5	6	7	8	9	10	11	12	Total (mm)
1990	194	128	170	185	218	32	42	27	0	10	0	376	1,378
1991	218	143	113	141	331	132	35	0	93	78	16	291	1,589
1992	509	212	441	392	392	192	89	2	2	0	130	238	2,596
1993	447	157	403	458	252	83	15	28	0	6	15	90	1,952
1994	394	253	290	94	217	276	241	52	43	38	122	149	2,169
1995	231	162	137	199	185	370	78	2	8	23	48	355	1,798
1996	95	69	379	277	343	133	67	67	0	22	11	374	1,837
Average	348	187	322	291	323	203	95	30	24	29	40	312	1,902

Source : Meteorological Station in Kendari Airport 1995

Table 7-2-40 Monthly Temperature

(Unit : °C)

Month/ Year	1	2	3	4	5	6	7	8	9	10	11	12
1992	25.9	25.9	25.7	26.0	26.3	26.0	25.8	26.1	26.3	26.4	26.4	26.6
1993	26.0	26.2	25.9	26.3	26.1	26.0	25.7	26.3	26.5	26.2	26.5	26.3
1994	25.9	26.1	26.1	25.8	26.0	26.2	25.9	26.0	26.1	26.0	26.1	26.1
1995	25.8	26.1	25.9	26.0	26.0	25.9	25.9	26.1	25.8	26.2	26.1	26.5
Average	25.9	26.0	25.9	26.0	26.1	26.0	25.8	26.1	26.2	26.2	26.3	26.4

Source : Meteorological Station in Kendari Airport 1995

2) Topography

The topographic feature of the road section of Sandangpangan - Tinobu is flat in general, however, at the road section located in the valley of Aloalo and Otipulu, between Tinobu - Asera, is undulating. The topographic feature of the project road link No.32 is summarised as given in Table 7-2-41.

Table 7-2-41 Topographic Feature of Link No.32

No.	Road Section	Road (Km)	0 - 8% (flat)		9 - 25% (wavy)		> 25% (hilly)	
			Km	%	Km	%	Km	%
1.	Sandangpangan- Tinobu	47.9	47.9	100			-	-
2.	Tinobu - Asera	33.6	18.7	55.7	14.9	44.3	-	-

Source: Study Team

3) Geology

The details of geological features of the study area have already been described in Chapter 4 of this report.

4) Hydrological Situations

Link No.32 consists of two road sections; that is, the road section of Asera – Tinobu and Tinobu – Sandangpangan. Some rivers tend to overflow in the rainy season. Characteristics of rivers and streams located in each road section are given in Table 7-2-42.

Table 7-2-42 River Characteristics

No	River Names	Catchment Area (Km ²)	Length (Km)	Width (m)	Average Flow (m ³ /sec)	Flowing Type	Water Usage
Asera – Tinobu							
1	S. Kokapi	78.1	12.7	12-16	2.7	Perennial	Domestic, Irrigation
2	S. Ala Pulu	43.4	8.6	8-12	---	Perennial	Domestic
3	S. Andolea	42.8	8.2	8-10	---	Perennial	
4	S. Belolo	20.6	6.1	4-6	---	Perennial	
5	S. Wowia	92.1	27.0	14-16	3.4	Perennial	Domestic, Irrigation
Tinobu – Sandangpangan							
6	S. Molawe	57.3	14.8	8-12	---	Perennial	Domestic
7	S. Anggomate	62.7	16.1	8-12	2.2	Perennial	Domestic
8	S. Woilongo	38.7	8.0	6-8	---	Perennial	Domestic, Irrigation

Source: Study Team

5) Coastal Area

The study area of link No.32 is mainly located along the coastal region, and the biodiversity of the coastal area can be observed in this region. The identified species inhabiting the coastal area are given in Table 7-2-43. The habitat of mangrove and coral reefs in the study area is shown in Figures 7-2-3 and 7-2-4.

Table 7-2-43 Species Inhabiting in Coastal Area

Mangrove Species	Coral Reef Species	Fish Species in Coral Reefs
<i>Avicenia alba</i> , <i>Avicenia marina</i> , <i>Avicenia officinalis</i> , <i>Campostenion philippinense</i> , <i>Rhizophora apiculata</i> , <i>Rhizophora mucronata</i> , <i>Sonneratia</i> , Nipah (<i>Nipa fruticans</i>), Waru laut (<i>Hibiscus tiliaceus</i>)	<i>Favia spp.</i> , <i>Labophyllia spp.</i> , <i>Porites spp.</i> , <i>Plastygira spp.</i> , <i>Azphithera spp.</i> , Astreopora, Karang batu (<i>Scleractina</i>), Lolak (<i>Trochus niloticus</i>), Karang mutiara (<i>Pinctada spp.</i>), Kimah (<i>Tridacna</i>). Rumput laut <i>Euchema spinosa</i> dan <i>Gracilari</i> .	Kuda laut belang (<i>Hippocampus kuda</i>), Paling berbintang (<i>Echidna nebulosa</i>), Tambra laut garisbiru (<i>Symphoricichthys spilurus</i>), Ikan belang putih (<i>Dascyllus trimaculatus</i>), Ikan karang bendera (<i>Heniochus acuminatus</i>), Ikan badut jingga (<i>Amphiprion ocellaris</i>), Ikan karang bermata dua (<i>Coradion melanopus</i>), Ikan katak (<i>Arotron areostaticus</i>), paling berekor hitam (<i>Moringua bicolor</i>), Ikan todak lorek hitam (<i>Hemirhamphus far</i>), Ikan pipih bentuk lidah (<i>Tetrasomus gibbosus</i>), Ikan kakatua merah-lempanyung (<i>Scarops rubroviolaceus</i>).

6) Flora and Fauna

a. Flora

Based on the Decree of Minister of Agriculture No. 54/Kpts/Um/2/1972, the Decree of Minister of Forestry No. 261/Kpts.IV/1990 and the Government Act No. 5 of 1990, the members of the lowland and highland forest ecosystem which belong to the endemic and protected species are:

- Lowland species: *Cratoxylon celebicus*, *Ficus varegata pterospermum celebicus*, *Vitex quinata*, Palm kipas (*Livistoma rotundaifolia*), Palm raksasa (*Pigafettafilaris*), etc.
- Highland species: *Agathis damara*, *Phyllacladus hypophyllus*, *Dracrycarpus spp*, *Vaccinium*, *Salmanila malabrica*, Pohon kuku alam (*Pericopsis mooniana*), *Garuga Floribunda*, *Kedondong (Spondias pinnata)*, *Benuang (Octomeles sumatrana)*, *Rambutan Hutan (Nephelium mutabile)*, *Durian (Durio spp)*, *Manggis (Garcinia hombroniana)*, *Keruing (Dipterocarpus merginata)*, etc.

The forest observed in kabupaten Kendari, including the study area of link No.32, is classified as shown in Table 7-2-44.

Table 7-2-44 Forest Classification in Kabupaten Kendari

No	Forest Classification	Area (ha)	Ratio (%)
1	Production forest (HPK: Hutan Produksi on Konversi)	577,666	44.9
2	Industry forest	441,100	34.3
3	Ordinary production forest (HPT: Hutan Produksi Terbatas)	47,000	3.7
4	Nature sanctuary forest (HL: Hutan Lindung)	10,797	0.1
5	Nature Conservation Rawa Aopa & Watumokai (CA: Cagar Alam)	72,023	5.6
6	Recreation forest	50,000	3.9
Total		1,287,486	100.0

Source: Study Team

b. Fauna

The endemic and protected fauna observed in the study area are as follows;

- Birds: Burung Maleo (*Macrocephalon maleo*), Gagang bayem (*Himantopus himantopus*), Burung Elang (*Spizaetus lanceolatus*), Burung Raja udang paruh hitam (*Pelagopsis melanorphyscha*), Rangkong (*Rhyticeros cassidix*), Nuri (*Eos hitrio*), Kakatua putih (*Cacatua alba*), Ayam hutan (*Gallus galus*).
- Insects: Belalang pemakan paku (*Karyndia gracilipes*).

- Mamalia: Anoa (*Bubalus guarlesi*), Musang raksasa (*Macrogalidia musschenbroekii*), Kelelawar pemakan serangga (*Miniopteris schreibersii*), Hipposideros diadema, Rhinolopus arcvatus, Megalerna spasma, Babyrousa (*Babyrousa*), Kucing bakau (*Felis spp.*), Ruasa (*Cervus timorensis*).
- Primates: Owa-owa (*Hylobater spp*), Monyet Sulawesi (*Macaca tonkeana*), Lutung (*Presbytis cristata*).

7) Conservation Area

Cagar Alam Lasoro Sampara (proposed nature reserve), Kawasan Suaka Margasatwa Tanjung Paropa (fauna and flora reserve) and Hutan Lindun (forest reserves) are located in the study area of link No.32, however, the project road does not cross these reserve area. Location of reserves are shown in Figure 7-2-4.

Cagar Alam Lasoro Sampara is located approximately 50km north-west of Kendari, kabupaten Kendari. The area is 45,000 hectares and elevation ranges between sea level 1,500m. It consist of a rich forested area of lowland and hill forests, with partly ultrabasic rock. The lowland areas are cultivated and distributed along the Lawe Solo river. There is a variety of wildlife including anoa, deer, pigs, monkeys, etc.

(2) Social Environment

1) Demography

The study area is located at Kecamatan Asera and Kecamatan Lasoro, in kabupaten Kendari. The capital city of Kecamatan Asera and Kecamatan Lasoro are Andowia and Tinobu, respectively. The demographic data of the study area is given in Table 7-2-45.

Table 7-2-45 Demographic Data of the Study Area

No.	Name of Kecamatan / Desa (village)	Area (km ²)	Population (Person)			House- hold (HH)	Population Density (Person/Km ²)
			Male	Female	Total		
Kecamatan Asera		2,077	7,768	6824	14,592	2,751	7
1.	Desa Asera	118	1,046	800	1,846	340	15
2.	Desa Tangguluri	90	138	145	283	65	3
3.	Desa Lambudoni	70	158	147	305	75	4
Kecamatan Lasolo		2,315	9,508	9541	19,049	3,967	8
1.	Desa Molawe	129	1,084	1047	2,131	389	17
2.	Desa Bandaeha	102	304	297	601	118	6
3.	Desa Otole	108	316	324	640	127	6
4.	Desa Waworaha	8	243	250	493	117	64
5.	Desa Tinobu	8	562	573	1,135	232	134
6.	Desa Andumowu	223	673	677	1,350	263	6
7.	Desa Belalo	26	371	370	741	144	29
8.	Desa Andeo	90	231	232	463	113	5
9.	Desa Toreo	91	324	335	659	127	7
10.	Desa Wawolesea	25	180	183	363	116	15
11.	Desa Lemobajo	91	656	689	1,345	262	15
12.	Desa Puulemo	62	404	412	816	179	13
13.	Desa Padaelu	79	409	411	820	172	10
14.	Desa Lembo	69	369	372	741	143	11
15.	Desa Bungguosu	59	213	209	422	115	7
16.	Desa Taipa	100	354	357	711	136	7
17.	Desa Sawa	233	611	698	1,209	249	5
18.	Desa Pudonggala	10	252	233	485	119	48
19.	Desa Kokapi	96	566	595	1161	247	12
Kab. Kendari		16,480	201,213	195,465	396,678	80,700	24

Source : Kec. Asera and Lasolo Dalam Angka 1995, and Kabupaten Kendari Dalam Angka 1995

The number of houses located along Asera – Sandanpangan road section is estimated approximately 3,600 units. Most of the houses, including school, religious facilities, hospital, etc., are situated about 5-15 meters away from both sides of the existing road edge. In accordance with the improvement of the project road alignment, some houses are relocated.

The number of houses, in the villages in the study area, are classified by the housing structure, i.e.; permanent, semi-permanent and wooden, and is given in Table 7-2-46.

Table 7-2-46 Number of Houses in the Study Area and Conditions (Link No.32)

No.	Kecamatan / Desa	Number of Houses (Unit) with Housing Conditions			
		Permanent	Semi-Permanent	Wood/Bamboo	Total
Kecamatan Asera		117	165	2,469	2,751
1.	Desa Asera	4	19	317	340
2.	Desa Tangguluri	-	-	65	65
3.	Desa Lambudoni			73	73
Sub-Total		4	19	455	478
Kecamatan Lasolo		1,355	457	1,913	3,725
1.	Desa Molawe	62	47	342	451
2.	Desa Bandacha	28	24	57	109
3.	Desa Otole	45	11	60	116
4.	Desa Waworaha	22	20	54	96
5.	Desa Tinobu *	97	-	95	192
6.	Desa Andumowu	165	21	76	262
7.	Desa Belalo	40	24	66	130
8.	Desa Andeo	15	11	67	93
9.	Desa Toreo	48	16	62	126
10.	Desa Wawolesea	29	12	35	76
11.	Desa Lemobajo	131	10	98	230
12.	Desa Puulemo	119	39	18	176
13.	Desa Padaelu	106	32	33	171
14.	Desa Lembo	110	30	7	147
15.	desa Bungguosu	67	3	16	86
16.	Desa Taipa	53	25	56	134
17.	Desa Sawa *	57	36	130	223
18.	Desa Pudonggala	49	9	47	105
19.	Desa Kokapi	78	43	106	227
Sub-Total		1,321	413	1,425	3,159
G. Total		1,325	432	1,880	3,637

Source : Kecamatan Asera dan Kecamatan Lasalo Dalam Angka 1995

Note : *) Most houses do not located along Asera - Sandangpangan road section.

Generally in Southeast Sulawesi, land acquisition caused by the project implementation has been carried out in conformity with the existing regulations, which are Presidential Decree No.55, 1993 and Regulation of the Minister of Agrarian Affairs No. 1, 1994, by the local regional administration of Panitia Pengadaan Tanah bagi Pelaksanaan Pembangunan untuk kepentingan Umum coordinated by Pemerintah Daerah TK.II in association with the project and related agencies.

The "Bajo" ethnic group, 1,345 person in 262 households, inhabits Lemobajo village, Kecamatan Lasolo. They build wooden houses above the sea along the seashore, with fishing and gathering as their main source of sustenance.

2) Economic Activities

Working population classified by the economic activities of the region of Kecamatan Asera and Kecamatan Lasolo, in kabupaten Kendari, is given in Table 7-2-47. The major economic activity in this region is the agriculture sector. The agriculture sector can be classified into five activities, i.e.; food crops, plantation, forestry, cattle breeding and fishery. Agricultural products in the study area are given in Tale 7-2-48.

Table 7-2-47 Classification of Economic Activities in Kec. Lasolo and Asera

No	Type of Job	Kec. Lasolo		Kec. Asera	
		Person	%	Person	%
1	Agriculture	8,078	88.5	4,871	53.3
2	Industry	106	1.2	--	--
3	Mining	--	--	--	--
4	Construction	39	0.4	35	0.4
5	Trade	217	2.4	182	2.0
6	Transportation	15	0.2	124	1.4
7	PNS/ABRI	510	5.6	440	4.8
8	Finance	71	0.8	119	1.3
9	Service	--	--	--	--
10	Others	92	1.0	3,386	37.1
Total		9,128	100.0	9,137	100.0

Source: PDRB Kabupaten Kendari in 1995

Table 7-2-48 Agricultural Products in Kec. Lasolo and Asera

No.	Types of crops	Kecamatan Asera			Kecamatan Lasolo		
		Area (ha)	Production (ton)	Average (ton/ha)	Area (ha)	Production (ton)	Average (ton/ha)
1	Rice-field paddy	447	1,118	2.5	193	676	3.5
2	Dry-land paddy	202	505	2.5	127	380	3.8
3	Corn	8	52	1.5	20	27	1.8
4	Cassava	8	60	7.5	33	266	11.9
5	Sweet potato	-	-	-	3	17	8.5
6	Peanuts	53	106	2.0	18	24	1.4
7	Soy-beans	34	41	1.2	9	10.8	1.2
8	Mung-beans	87	218	2.5	9	11.2	1.6
9	Coconut	868	34	0.03	45,496	62455	1.37
10	Cashew	1,710	135	0.07	393,117	48687	0.12
11	Cocoa	2,396	146	26.2	-	-	-
12	Coffee	286	7,488	-	1,689,325	55,672	0.03
13	Clove	-	-	-	48,615	29,251	0.60
14	Pepper	-	-	-	224,689	35,903	0.16
15	Kapok	-	-	-	14,880	17,292	1.16

Source : Kecamatan Asera dan Kecamatan Lasolo Dalam Angka, 1995

3) Transmigration

Number of transmigrants relocated in kabupaten Kendari since 1979/1980 - 1995/1996 are 24,001 (equivalent to 100,551 people). Transmigrants have arrived from various provinces of Sulawesi, West Java, Central Java, East Java and Bali. In the fiscal year of 1996/1997, 1,633 households (5,735 people) have moved to this region.

Along the Asera – Sandangpangan road section, there is one transmigration site named UPT Sawa. Table 7-2-49 gives the detail of UPT Sawa, and the location of it is shown in Figure 7-2-4.

Table 7-2-49 Transmigration in the Study Area

No	Name	Location	Year	Area (Ha)	Household	Population	Origin
1	Sawa	Kec. Lasolo	93/94	146	65	225	Central Jawa
	- ditto -	- ditto -	97/98	383	170	558	Bali, Jatim, Local

Source: Study Team

4) Tourism

The tourism spots located along Asera – Sandangpangan road section are “Wawolosea” and “Toreo”, in Kecamatan Lasolo, with the hot springs and camping, “Pemandangan Pantai Tanjung Taipa”, also in Kecamatan Lasolo, as a seashore recreation and the habitat of the Maleo bird and “Batu Gong Taipa” for the handicraft of the traditional boats. The location of each tourism spots is shown in Figure 7-2-4.

The development of tourism in the study area is rather weak compared with other areas such as Bunaken, Toraja, Bali, etc., due to lack of transportation facilities (accessibility), accommodation facilities and professionals and investors for its management.

(3) Environmental Pollution

There is almost no data available regarding to the environmental pollution; such as air pollution, water pollution, soil contamination, noise and vibration, land subsidence and offensive odor. However, taking into consideration of the contents of the project and its scale; i.e., low traffic volumes in the study area, no toxic substances produced, no groundwater pumping, etc., significant environmental pollution might not occurs a result of the project activities, except noise and vibration during construction.

(4) Scoping Assessment

The result of scoping assessment of the road link No.32 is given in Table 7-2-50.

Table 7-2-50 Scoping Result for Asera - Sandangpangan (Link No. 32)

No	Environmental Item/Factor	Evaluation	Reasons
A. Social Environment			
1.	Resettlement	D	Resettlement shall be taken into consideration due to improvement of the project road alignment
2.	Economic Activities	B (+)	Project scope is improvement of existing roads, therefore impacts on economic activities are small. Plus impacts on transmigrants are anticipated
3.	Traffic/Public Facilities	D	Project site is located at rural region
4.	Split of Communities	D	Notable impact regarding split communities not predicted
5.	Cultural Property	D	Cultural properties are few in the study area
6.	Water Rights and Rights of Common	D	Project road does not cross the nature and/or forest reserves
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	D	Large amount of surplus soil by cutting work are not produced in the project
9.	Hazards (Risk)	D	Study area is mainly located in flat/hilly region, therefore possibility of landslides are low
B. Natural Environment			
1.	Topography and Geology	D	No large scale topographic change is carried out in the project
2.	Soil Erosion	D	Soil erosion may not occur by the project
3.	Groundwater	D	Large scale excavation is not carried out in the project
4.	Hydrological Situation	B	Some impacts on river flow are anticipated by bridge construction
5.	Coastal Zone	B	Some project roads in the study area pass through the coastal zone
6.	Fauna and Flora	B	Protected/Endemic fauna and flora exist in the study area. Nature reserve exist in study area
7.	Meteorology	D	No meteorological impacts are predicted by the project
8.	Landscape	D	Notable impact regarding landscape not predicted
C. Pollution			
1.	Air Pollution	D	Predicted traffic volume in the study area is small
2.	Water Pollution	D	Impacts on water bodies by construction works etc. is negligible
3.	Soil Contamination	D	Toxic substances are not handled by the project
4.	Noise and Vibration	B	Noise and vibration may occur by construction equipment during construction stage
5.	Land Subsidence	D	No ground water pumping is carried out in the project
6.	Offensive Odor	D	There is no factor of offensive odor in the project

Source: "JICA Environmental Guidelines"

Note : Evaluation categories:

- A: Serious negative impact is expected.
- B: Some negative impact is expected.
- B(+): Some positive impact is expected.
- C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
- D: No impact is expected.

7.2.6 Uekuli – Tompira (Link No. 15)

(1) Natural Environment

1) Meteorology

The monthly rainfall data, between year 1990 to 1996, and the monthly temperature data, between 1992 to 1996, taken from Meteorological Station in Kasiguncu, kabupaten Poso, is given in Table 7-2-51 and Table 7-2-52, respectively.

Table 7-2-51 Monthly Rainfall

Month/ Year	1	2	3	4	5	6	7	8	9	10	11	12	Total (mm)
1990	387	81	183	276	293	280	188	76	170	214	144	348	2,640
1991	298	75	236	252	233	124	109	131	90	55	105	381	2,089
1992	150	171	257	322	158	309	59	216	70	157	265	170	2,304
1993	168	115	165	223	232	268	117	41	111	56	160	145	1,801
1994	273	65	11	211	274	212	107	47	50	83	135	239	1,707
1995	366	231	342	575	473	229	135	115	325	463	140	127	3,521
1996	181	488	131	242	128	339	222	197	52	219	107	111	2,417
Average	260	175	189	300	256	252	134	118	124	178	151	217	2,354

Source : Meteorological Station in Kasiguncu, Kabupaten Poso, 1997

Table 7-2-52 Monthly Temperature

(Unit : °C)

Month/ Year	1	2	3	4	5	6	7	8	9	10	11	12
1992	26.0	25.6	25.6	26.2	26.7	26.0	25.8	26.2	26.4	26.4	26.4	26.7
1993	26.4	26.2	26.2	26.2	26.6	26.2	26.2	25.7	25.4	26.4	26.5	26.3
1994	25.9	26.3	26.3	26.8	27.0	26.7	26.0	26.3	26.5	26.4	25.8	26.3
1995	26.2	25.9	24.4	25.5	26.7	26.0	25.8	25.8	26.3	26.2	26.4	25.6
1996	25.7	26.6	27.0	27.0	27.0	26.6	26.2	23.3	26.4	25.6	26.6	26.0
Average	26.0	26.1	25.9	26.3	26.8	26.3	25.8	25.9	26.2	26.2	26.3	26.2

Source : Meteorological Station in Kasiguncu, Kabupaten Poso, 1997

2) Topography

Link No.15 consist of five road sections; that is, the road section of Uekuli – Malign, Malign – Tambayoli, Tambayoli – Kolonadale, Kolonadale – Korololama and Korololama – Tompira.

The topographic features of link No.15 varies. Northern part of the road section passes through a mountainous area, while, southern part mainly goes along the seashore line. The topographic feature of the project road link No.15 is summarised in Table 7-2-53.

Table 7-2-53 Topography Feature of Link No.15

No	Road Section	Road (Km)	0 - 8% (flat)		9 - 25% (wavy)		> 25 % (hilly)	
			Km	%	Km	%	Km	%
1.	Uekuli - Malino	30.1	15.5	51.3	14.6	48.7	-	-
2.	Malino - Tambajoli	22.0	18.2	82.7	2.8	12.7	1.0	4.5
3.	Tambajoli - Kolonadale *	48.0	9.8	20.4	28.2	58.8	-	-
4.	Kolonadale - Korololama	4.0	3.8	95.0	0.2	5.0	-	-
5.	Korololama - Tompira	10.0	9.2	92.0	0.8	8.0	-	-

Note: No road exist between Tondoyondo (close to Tambajoli) and Korololama.

3) Geology

The details of geological feature of the study area have already been described in Chapter 4 of this report.

4) Hydrological Situations

In the rainy season, some rivers sometimes flood, while, the high tide also causes the rivers to overflow. Characteristics of major rivers located in the study area of link No.15 are given in Table 7-2-54.

Table 7-2-54 River Characteristics

No	River Name	Catchment Area (Km ²)	Length (Km)	Width (m)	Average Flow (m ³ /sec)	Flowing Pattern of River	River Water Usage
Uekuli - Malino							
1	S. Gandalari	14.5	2.6	3	0.8	Perennial	Domestic
2	S. Oekuli	34.8	6.5	5	2.0	Perennial	Domestic, Irrigation
Malino - Tambajoli							
1	S. Sumara	700	38	25	40.0	Perennial *	Domestic, Irrigation
2	S. Sayo	59	-	30	-	Perennial	Domestic
3	S. Tambajoli	29	-	8	-	Perennial	Domestic
Tambajoli - Kolonadale							
1	S. Sumera	70	38	28	4.0	Perennial	Domestic, Irrigation
Kolonadale - Korololama							
	--	--	--	--	--		
Korololama - Tompira							

Source: Study Team

Note, * : flood in rainy season

5) Natural Hazard (Earthquake)

Earthquakes are observed frequently in Sulawesi, as described in Table 7-2-5.

6) Flora and Fauna

a. Flora

Based on the Decree of Minister of Agriculture No. 54/Kpts/Um/2/1972, the Decree of Minister of Forestry No. 261/Kpts.IV/1990 and the Government Act No. 5 of 1990, the members of the lowland and highland forest ecosystem which belong to the endemic and protected species are:

- Highland species: *Agathis damara*, *Phyllacladus hypophyllus*, *Draecyrcarpus* spp, *Vaccinium*, *Salmanila malabrica*, Pohon kuku alam (*Pericopsis mooniana*), *Garuga Floribunda*, Kedondong (*Spondias pinnata*), Benuang (*Octomeles sumatrana*), Rambutan Hutan (*Nephelium mutabile*), Durian (*Durio spp*), Manggis (*Garcinia hombroniana*), Keruing (*Dipterocarpus merginata*), etc.
- Lowland species: *Cratoxylon celebicus*, *Ficus varegata pterospermum celebicus*, *Vitex quinata*, Palm kipas (*Livistoma rotunaifolia*), Palm raksasa (*Pigafettafilaris*), etc.

The forest observed in kabupaten Poso, including the study area of link No.15, is classified in Table 7-2-55.

Table 7-2-55 Forest Classification in Kabupaten Poso

No	Classification	Area (ha)	Ratio (%)
1	Limited production forest (HPT)	755,776	35.0
2	Convertible production forest (HPK)	55,066	2.6
3	Ordinary production forest (FGHK or RTRW)	178,505	8.3
4	Nature sanctuary and recreation forest	373,320	17.3
5	Protection forest (HL)	795,980	36.9
	Total	2,158,647	100.0

Source: Study Team

b. Fauna

The endemic and protected fauna observed in the study area are as follows;

- Mamalias: Musang raksasa (*Macrogalidia musschenbroekii*), Kelelawar pemakan serangga (*Minipteris schreibersii*), *Hipposideros diadema*, *Rhinolopus arcvatus*, *Megalerma spasma*, *Babyrousa (Babyrousa)*, Kucing bakau (*Felis spp.*)
- Birds: Burung Maleo (*Macrocephalon maleo*), Gagang bayem (*Himantopus himantopus*), Burung Elang (*Spizuetus lanceolatus*), Burung Raja udang paruh hitam (*Pelagopsis melanorphyscha*).
- Insects: Belalang pemakan paku (*Karyndia gracilipes*).

7) Coastal Area

The road section between Tondoyondo (close to Tambajoli) and Kolonadale is mainly located along the coastal region, and typical bio-diversity of the coastal area can be observed in this

region. The identified species inhabiting the coastal area are given in Table 7-2-56. The location of habitat of mangrove and coral reefs in the study area is shown in Figure 7-2-1.

Table 7-2-56 Species Inhabiting in Coastal Area

Mangrove Species	Coral Reef Species	Fish Species in Coral Reefs
<i>Avicenia alba</i> , <i>Avicenia marina</i> , <i>Avicenia officinalis</i> , <i>Campostenion philippinense</i> , <i>Rhizophora apiculata</i> , <i>Rhizophora mucronata</i> , <i>Sonneratia</i> , Nipah (<i>Nipa fruticans</i>), Waru laut (<i>Hibiscus tiliaceus</i>)	<i>Favia spp.</i> , <i>Labophyllia spp.</i> , <i>Porites spp.</i> , <i>Plastygira spp.</i> , <i>Azphihera spp.</i> , <i>Astreopora</i> , Karang batu (<i>Scleractina</i>), Lolak (<i>Trochus niloticus</i>), Karang mutiara (<i>Pinctada spp.</i>), Kimah (<i>Tridacna</i>). Rumput laut <i>Euchema spinosa</i> dan <i>Gracilaria</i> .	Kuda laut belang (<i>Hippocampus kuda</i>), Paling berbintang (<i>Echidna nebulosa</i>), Tambra laut garisbiru (<i>Symphoricichthys spilurus</i>), Ikan belang putih (<i>Dascyllus trimaculatus</i>), Ikan karang bendera (<i>Heniochus acuminatus</i>), Ikan badut jingga (<i>Amphiprion ocellaris</i>), Ikan karang bermata dua (<i>Coradion melanopus</i>), Ikan katak (<i>Arotron areostaticus</i>), paling berekor hitam (<i>Moringua bicolor</i>), Ikan todak lorek hitam (<i>Hemirhamphus far</i>), Ikan pipih bentuk lidah (<i>Tetrasonus gibbosus</i>), Ikan kakatua merah-lembayung (<i>Scarops rubroviolaceus</i>).

Source: Study Team

8) Conservation Area

Protected forest (HL: Hutan Lindung) is located in the east and west sides of link No.15 near Malino, however, the road section does not cross HL.

(2) Social Environment

1) Demography

The study area is located at Kecamatan Tojo and Kecamatan Petasia in kabupaten Poso. The demographic data of villages (Desa) located in the study area is given in Table 7-2-57.

Table 7-2-57 Demographic Data of the Study Area (Link No.15)

No.	Name of Kecamatan / Desa (village)	Area (km ²)	Population	Number of House-hold (HH)	Population Density (person/Km ²)
Kecamatan Tojo		3,022	19,340	3,911	6
1	Uekuli	163	1,481	309	9
2	Tayawa	141	101	243	9
3	Korondoda	199	884	181	4
Sub-total		503	2,466	733	--
Kecamatan Petasia		1,983	25,433	5,772	13
1	Malino	101	521	129	5
2	Tambayoli	35	228	48	7
3	Tondoyondo	83	337	72	4
4	Tamainusi	83	221	48	3
5	Ganda-ganda	121	734	160	6
6	Bahoue	42	557	134	13
7	Bahontula	42	1,858	370	45
8	Kolonedale	42	1,855	339	44
9	Korololaki	42	508	115	12
10	Korololama	45	438	107	10
11	Koromatantu	69	586	119	8
12	Bunta	69	351	73	5
13	Tompira	55	1,058	245	19
Sub-total		871	9,252	1,959	--

Source : Kecamatan Tojo and Petasia Dalam Angka 1996

In accordance with the construction of new road and/or improvement of existing road alignment, some houses are relocated. Detailed road alignment of link No.15 is shown in Volume VI of this report.

2) Economic Activities

Working population classified by the economic activities in the region of Kecamatan Tojo and Kecamatan Petasia is given in Table 7-2-58. Major economic activity in this region is agriculture. The agriculture sector can be classified into five activities of food crops, plantations, forestry, cattle breeding and fisheries.

Table 7-2-58 Economic Activities in Kecamatan Tojo and Petasia

No	Type of Job	Kecamatan Tojo		Kecamatan Petasia	
		No. of Person	%	No. of Person	%
1	Agriculture	3,299	68.2	9,186	79.9
2	Cattle breeding	459	9.5	126	1.1
3	Fisherman	180	3.7	346	3.0
4	Businessman	11	0.2	9	0.1
5	Trader	87	1.8	484	4.2
6	Transportation	32	0.7	39	0.3
7	Civil servant	455	9.4	778	6.8
8	Army force (ABRI)	14	0.3	18	0.2
9	Government official	72	1.5	121	1.1
10	Services	--	--	--	--
11	Labor	85	1.8	262	2.3
12	Handicraftman/Industry	142	2.9	132	1.2
13	Others	--	--	--	--
Total		4,836		11,501	100.0

Source: Kecamatan Tojo and Petasia dalam angka 1995

Agricultural activity in Kecamatan Tojo and Petasia, kabupaten Poso, comprises several food crops and fruits. Table 7-2-59 gives the production of each crop and fruit, while, Table 7-2-60 gives the type and area of plantations in Kecamatan Tojo and Petasia.

Table 7-2-59 Agricultural Products in Kecamatan Tojo and Petasia

No	Food Crops and Fruit	Kecamatan Tojo		Kecamatan Petasia	
		Area (ha)	Product (ton/year)	Area (ha)	Product (ton/year)
Food Crops					
1	Mustard Green	--	--	28	203.5
2	Tomato	--	--	17	92.0
3	Cucumber	1	8.2	6	62.9
4	Green Bean	--	--	16	95.9
5	Red Pepper (Lombok)	--	--	13	43.1
6	Eggplant	--	--	11	43.4
7	Spinach	4	16.0	12	47.9
8	Leafy vegetables	2	12.3	4	25.7
Fruit					
1	Orange	--	--	7.7	16.3
2	Pineapple	--	--	0.3	0.3
3	Banana	7.9	63.7	6.4	6.4
4	Mango	--	--	7.1	7.1
5	Jambu	--	--	10.9	10.9
6	Langsat	--	--	9.4	9.4
7	Durian	--	--	11.1	11.1
8	Papaya	0.04	44.3	2.7	2.7
9	Avocado	--	--	0.5	0.5

Source: Kecamatan Tojo and Petasia dalam angka 1995

Table 7-2-60 Plantations in Kecamatan Tojo and Petasia

No.	Types of Plantation	Kecamatan Tojo		Kecamatan Petasia	
		Area (ha)	Production (ton/year)	Area (ha)	Production (ton/year)
1	Coconut	1,823	1,180	233	124
2	Coffee	150	3	159	17
3	Clove	165	6	54	12
4	Cocoa	360	41	126	30
5	Nutmeg	--	--	2	1
6	Cashew	--	--	168	10
7	Sago	--	--	270	28

Source: Kecamatan Tojo and Petasia dalam angka 1995

3) Transmigration

The number of transmigrants relocated to kabupaten Poso during 1990/1991 - 1994/1995 are 6,091 households (equivalent to 22,968 people). Transmigrants have been come from various provinces of Sulawesi, West Java, Central Java, East Java and Bali. In the fiscal year of 1994/1995, 981 households (3,663 people) have relocated to this region. Table 7-2-61 gives the detailed description of transmigrants into the study area. The location of transmigrants are shown in Figure 7-2-1.

Table 7-2-61 Transmigration in the Study Area

No	Name	Location (Desa)	Year	Area (Ha)	Household	Population	Origin
1	B. Malino	Bau	--	3,650	149	549	Central & East Jawa, NTB, APPDT
2	Malino II	Malino	--	675	304	1,110	Central & East Jawa, NTB, Bali, APPDT
3	Malino I	Sumara	94/95	2,500	176	689	Central, East Jawa, NTB, APPDT
4	Tambayori (L. Sumara)	Sumara	94-95	5,000	198	893	Central and East Jawa, NTB, APPDT
5	Tiu	Matantu	--	675	186	714	Central, West & East Jawa, Bali

Source : Kanwil Departmen Transmigrasi on PHPA Suraweshi, Tengah, 1997

Note NTB: Nusa Tenggara Barat

APPDT: Transmigration from local district

4) Tourism

Natural panoramic place, designated as the natural park (Pari Wisata) by the local government, is at north of Colonadale along the seashore.

The development of tourism in the study area are rather weak compared with other areas in Sulawesi; such as Bunaken, Toraja, etc., because of less transportation facilities (accessibility), less accommodation facilities and less professionals and investors in its management.

5) Historical/Cultural Places

Several old caves with the "hand print" on the walls of caves are found in the inland forest along

seashore between Tamainusi and Tawi. However, project road does not pass these caves.

(5) Environmental Pollution

There is almost no data available regarding environmental pollution; such as air pollution, water pollution, soil contamination, noise and vibration, land subsidence and offensive odor. However, taking into consideration the project and its size; i.e., low traffic volumes in the study area, no toxic substances produced, no groundwater pumping, etc., significant environmental pollution does not result from any of the project activities, except noise and vibration during the construction stage.

(6) Scoping Assessment

The result of scoping assessment of the road link No.15 is given in Table 7-2-62.

Table 7-2-62 Scoping Result for Uekuli – Tompira (Link No. 15)

No	Environmental Item/Factor	Evaluation	Reasons
A. Social Environment			
1.	Resettlement	B	Resettlement shall be taken into consideration due to construction of new roads and improvement of existing road alignment
2.	Economic Activities	B(+)	Project scope is improvement of existing roads, therefore impacts on economic activities are small. Plus impacts on transmigrants are anticipated
3.	Traffic/Public Facilities	D	Project site is located at rural region
4.	Split of Communities	D	Notable impact regarding split communities not predicted
5.	Cultural Property	B	Hand print caves are exist in the study area
6.	Water Rights and Rights of Common	D	Project road doesn't cross out nature reserves and/or forest reserves
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	B	Some amount of surplus soil by cutting work are produced
9.	Hazards (Risk)	A	Some part of project road is located in the seashore cliff and mountainous area, therefore a potentially hazardous area, especially landslides and/or cave-in
B. Natural Environment			
1.	Topography and Geology	B	Some impact is anticipated by tunnel construction and/or large scale cut slopes
2.	Soil Erosion	B	Soil erosion may occur during construction stage, due to earth works, etc., mainly in seashore cliff and mountainous area
3.	Groundwater	B	Some impact is anticipated by tunnel construction
4.	Hydrological Situation	B	Some impacts on river flow are anticipated by bridge construction
5.	Coastal Zone	B	Some project roads in the study area pass through the coastal zone
6.	Fauna and Flora	B	Protected/Endemic fauna and flora exist in the study area.
7.	Meteorology	D	No meteorological impacts are predicted
8.	Landscape	D	Notable impact regarding landscape not predicted
C. Pollution			
1.	Air Pollution	D	Predicted traffic volume in the study area is small
2.	Water Pollution	D	Impacts on water bodies by construction works etc. is negligible
3.	Soil Contamination	D	Toxic substances are not handled by the project
4.	Noise and Vibration	B	Noise and vibration may occur by construction equipment during construction stage
5.	Land Subsidence	D	No ground water pumping is carried out in the project
6.	Offensive Odor	D	There is no factor of offensive odor in the project

Source: "JICA Environmental Guidelines"

Note : Evaluation categories:

- A: Serious negative impact is expected.
- B: Some negative impact is expected.
- B(+): Some positive impact is expected.
- C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
- D: No impact is expected.

7.3 Environmental Impact Analysis

7.3.1 Prediction and Evaluation of Major Impacts

Major environmental impacts/factors due to the implementation of Trans-Sulawesi East Road in each project stage; namely pre-construction, construction and post-construction stage, are given in Article 7.1 Table 7-1-2 the environmental examination matrix. Prediction and evaluation of these impacts/factors are described in the following articles.

(1) Pre-Construction Stage

- **Resettlement**

The project component consists of the improvement of the existing road and the construction of a new road. In the case of the improvement of existing road, and although the project road is located in the rural region with few houses along the road, due to the road widening and the improvement of the road alignment, some houses which are located along the existing road, mostly in the villages, are resettled/relocated. Therefore, it can be evaluated that the resettlement as the result of improvement of existing road is categorized as a potential impact.

While, in case the construction of new roads, in principle, it is not necessary to take into consideration the resettlement/relocation of the people, because almost no houses are exist along the new road alignment. New roads are planned to be constructed for the road section of Tondoyondo-Kampung Tengah (link No.15) and Kuratau-Linomoyo (link No.33), locations of which are shown in Figure 7-2-1 and Figure7-2-3.

- **Social unrest due to resettlement**

The determination of the road location and its alignment has potential impact on the social environment through unrest, especially for the people who might be affected by the project. Generally, the social unrest might occur due to the loss of living and economic foundations of the people due to land occupancy for the project and an anxiety of the people as not receiving compensation for the land, buildings and prime-agricultural land which is their source of economic activity. Therefore, it can be evaluated that the social unrest as a result of activities arising from the determination of the road location and its alignment is categorized as a potential impact.

- **Economic activity**

A Number of transmigration sites organized by the Indonesian Government are located along the project road as shown in Figures 7-2-1 to 7-2-4. Their major economic activity is agriculture. Transmigrants cultivate their own land which provided by the government or in some cases they join a plantation which is organized by some private sectors. Recently, access to the transmigration sites is rather difficult because the poor condition of the major road (provincial road) which provides access to the sites. Therefore, improvement of the existing provincial road proposed by the JICA Study may promote their living conditions and accordingly may support regional economic activities. It can be evaluated that the economic activity as the result of road improvement through the project is categorized as a

potential positive impact.

- **Cultural property**

Several old caves with the “hand print” on the wall of caves are found in the inland forest along the seashore between Tamainusi and Tawi (link No.15), its location is shown in Figure 7-2-1. It can be stated that these caves are “culture property”, even though they are not designated as such by the Indonesian Government. Due to the environmental site survey result, project road does not passing these caves, however, special attention should be paid to prevent interference of these caves in pre-construction stage of the project.

- **Nature reserves/Fauna and Flora**

The project road link No.22 passes through the forest reserve (HL: Hutan Lindung) which has been managed by the Ministry of Forest on the northern side of the provincial border. The new road length (new road alignment) in the forest reserve is approximately 4.5km. Location of the forest reserve is shown in Figure 7-2-3. Due to improvement to the steep longitudinal section of the existing road, most part of the new alignment of the improved road in the forest reserve is planned outside of the right of way of the existing road. Therefore, it is evaluated that interference to the forest reserve including the impact to fauna and flora as the result of improvements to the existing road is categorized as a potential impact.

- **Hazards (Risk)/Land slide**

Excavation activities may cause disturbance to slope stability and lead to the land slides and/or cave-in, especially in the potentially hazardous area; i.e. mountainous area and seashore cliff area. Locations are shown in Figures 7-2-1 to 7-2-4. Excavation activities sometimes cause land erosion, especially in hills and steep slopes, and where soil texture and structure is relatively sensitive to erosion. Therefore, it is evaluated that the risk arising as the result of activities of determination of the road location and its alignment is categorized as a potential impact.

(2) Construction Stage

- **Nature reserves/Fauna and flora**

Some of the project road links path through and/or adjacent the forest reserves (HL) and/or nature reserves (CA: Cagar Alam), as listed below, locations are shown in Figures 7-2-1 to 7-2-4. Project activities are basically improvement/widening of the existing roads, therefore, it can be considered, in principle, that the impacts on the surrounding environment are small. However, impacts on the ecosystem of the protected fauna and flora found in these areas have to be considered during the construction stage of the project.

- Link No.15 : Cagar Alam Morowari –Nature Reserve (adjacent at east)
- Link No.22 : Forest reserve (HL) (adjacent at south-west)
- Link No.22 : Forest reserve (HL) (path through)
- Link No.22 : Forest reserve (HL) (adjacent at Southeast)
- Link No.32 : Cagar Alam Lasoro Sampana –Nature Reserve (adjacent at south-west)

- Waste disposal

Much surplus soil resulting from construction waste are generated during the construction stage of the project, especially in the mountainous and seashore cliff areas. In executing road projects in this region, surplus soil is generally thrown down the down hill side along the road without any treatment. This has an adverse impact on the ecosystem of fauna and flora, especially in the nature reserves and/or forest reserves.

While, free haulage of surplus soil generated during the bridge and tunnel construction might happen the impact on ecosystem of mangrove forest and coral reefs at the lower reach area of rivers (most project links are adopted).

- Hazards (Risk)/Land slide/Soil erosion

Excavation activities may cause disturbance to the slope stability and lead to the land slides and/or cave-ins, especially where the project road is located in a potentially hazardous area; i.e. mountainous and seashore cliff areas. While, excavation activities sometimes cause the soil erosion, especially in hills and steep slopes, and where soil texture and structure is relatively sensitive to erosion. Their locations are shown in Figures 7-2-1 to 7-2-4. On the other hand, material mining in rivers disturbs the morphology of the river basin and cause river erosion, especially when it rains. Therefore, it can be evaluated that the risk for hazards arising during the project construction is categorized as a potential impact.

- Topography and Geology

Some impacts are anticipated for the topographic and/or geological feature, due to tunnel construction and/or large scale cut slopes.

- Groundwater

In general, it may be thought that there is possibility of some groundwater existing in the faults and along the strata, therefore, some water leakage must be predicted during the tunnel construction. However, almost no housing exists at the site of link No.15 where the tunnel is planned to be constructed (refer to Figure 7-2-1), therefore, impact for groundwater is small.

- Hydrological Situation

Project road crosses through many rivers, even though rivers scales are small to medium in size. In the study area, floods caused by heavy rain and/or high-tide, occur frequently, especially in rainy season. Therefore, special attention shall be paid to the hydrological situation of the study area.

- Coastal Zone

Most of the project road links are located in the coastal zone. Free haulage of surplus soil generated by bridge construction and/or road improvement and material mining in rivers cause some impact on ecosystem of mangrove forest and coral reefs found at the coastal

zone. The locations of coastal area with mangrove forest and coral reefs are shown in Figures 7-2-1 to 7-2-4.

- **Fauna and Flora**

At the forest reserves and/or nature conservation areas listed above, some protected species of fauna and flora have been observed and reported so far. As the project activities are basically improvement/widening of the existing roads, it can be considered, in principle, that impacts are small. However, the presence of activities of land clearing and cutting, including free haulage of surplus soil, is estimated to have an impact on fauna and flora. The impact is in the form of disturbance of fauna habitat by the noise and vibration from construction equipment and vehicles.

- **Noise and vibration/Public facilities/Fauna**

Noise and vibration are caused during the project construction stage by the machinery /equipment and vehicles. Environmental impacts for surrounding living environment; i.e. regional social/religious activities of the people such as school, mosque, etc. and ecosystem of endemic fauna habitat nearby the forest reserves and/or nature reserves, by the noise and vibration caused by the construction equipment are predicted, even though the impact affect is only for a short period.

(3) Post-Construction Stage

- **Economic activity**

The completion of the Trans-Sulawesi East Road makes the distance shorter and accelerates the traffic flow on the east side of Sulawesi island. This supports development in Kendari and its surroundings. Therefore, operational activities of the Trans-Sulawesi East Road give a positive impact to support regional development and regional economic activities enhancement including livelihood of transmigrants and their activities.

- **Natural reserve/Fauna and flora**

As mentioned above already, the project road link No.22 passes through the forest reserve (HL: Hutan Lindung) at near the Provincial border. The new road alignment is approximately 4.5km long. In this forest reserve, some endangered species of fauna have been observed and reported so far, but they are living very deep in the reserve. The road section would be improved of in alignment and also widened by this project, accordingly some impacts on the ecosystem of the fauna and flora on the both sides of the road using may be taken into consideration. With this project description and this situation and "risk-benefit" approach in the development scheme, these impacts must be evaluated and assessed.

While, the road development makes easy access to the forest reserves and/or nature conservation areas, and illegal harvesting by "slash and burn" or settlement may occur. This reduces the number of protected fauna and flora.

- Land-slide/Soil erosion

Many part of Trans-Sulawesi East Road are on a mountainous or seashore cliff areas with steep terrain with soil property apt to collapse. Slope collapse may be caused by rain water erosion after deforestation, slope cutting. Appropriate protection measures for slope collapse/land slide are required.

- Groundwater

Generally, more and less, some water leakage would be considered after completion of the tunnel construction and during its operation.

7.3.2 Environmental Mitigation Measures

(I) Pre-Construction Stage

- Resettlement/Land acquisition

To those who have to be relocated, both permanent and temporary, an explanation about necessity of the relocation, its program and compensation must to given to the people with the following considerations;

- ⇒ Selection of the resettlement location
- ⇒ Sufficient compensation shall be taken into account
- ⇒ Resettle action plan (RAP) shall be established depending the scale

The management of a compensation for plantation, vegetable fields of the people and so on shall be carried out by;

- ⇒ Extension of the project purpose and its impact to the people who have land on which is affected by the project.
- ⇒ Extension of the project benefit (positive impact) which brings about the regional development, i.e. stable smooth traffic, increasing of goods flow, public services, working opportunities, etc.
- ⇒ Offering proper compensation and explanation of its procedures.

- Social unrest due to resettlement

- ⇒ The management of the social unrest have to be carried out by giving extension to local people concerning the planned project activities.
- ⇒ Management to the loss of people's livelihood as the result of change of the land appropriation: giving work opportunity to the people who are affected by land consolidation, by giving priority to those who have lost their livelihood.
- ⇒ Improvement of the living, social and economic situations of the relocated people.

- Nature reserves/Fauna and flora

- ⇒ Route alignment where the project road passes through the forest reserve shall be carefully planned by taking into account the impact on the endemic fauna and flora.
- ⇒ Ecologically significant forest areas, ensuring that the area is large enough to maintain

biological diversity and ecological processes.

- ⇒ With the project description and with a view of risk-benefit idea in the development scheme, evaluation and assessment made on the impacts.
- ⇒ Necessary coordination between Ministry of Public Works and Ministry of Forest shall be taken for the project implementation.

- Hazard (Risk)

- ⇒ Route alignment shall be carefully planned taking into account the topographic and geological features of the site.
- ⇒ Proper technical alternatives (slope protection, tunnel, etc.) shall be adopted in the plan to prevent the land slide and/or cave-in hazards.

(2) Construction Stage

- Nature reserves/Fauna and flora

Management to the impact is conducted by restricting the speed of vehicles, reducing the noise and vibration and the regulating solid waste, specially the surplus soil dumping in that area. Monitoring of the impact is executed on the condition of fauna, flora and habitat with following.

- ⇒ Educating the people of the region and the labors employed by the project.
- ⇒ Warning boards about protecting to the fauna and flora.

- Waste disposal (Surplus soil)

Surplus soil must be well managed as the following manner;

- ⇒ Excavated soil (surplus soil) should not be dumped or left as it is.
- ⇒ Dump sites of the surplus soil produced by the project excavation work shall be selected and properly operated.
- ⇒ Planting or seeding treatment of hauled surplus soil is recommended to be carried immediately.
- ⇒ Proper drainage facilities shall be constructed to prevent negative environmental impacts; such as water contamination, sedimentation, health effects and so on down stream of the site location.

- Hazard (Risk)/Soil erosion

Slope protection works for filling and cut slopes, such as sprayed concrete crib-work, shotcrete, stone masonry, mat-gabion and seeding/planting, shall be installed/constructed in order to prevent soil erosion and/or land slides, in the following manner.

- ⇒ Route alignment shall be carefully planned taking into account the topographic and geological feature of the site. Special attention shall be taken into the heavy rain regions.
- ⇒ To strengthen/stabilization of the filling and cut slopes structural countermeasures mentioned above shall be installed at certain locations.
- ⇒ Periodical monitoring shall be carried out to prevent land slide disasters.
- ⇒ Drainage system/culvert shall be installed to prevent the impact.
- ⇒ Route alignment shall be carefully planned to avoid inherently unstable areas.
- ⇒ Design of drainage works to minimize changes in surface flows and provide adequate

local conditions.

⇒ Periodical monitoring shall be carried out to avoid water back-up.

- Groundwater

⇒ Some considerations for the impact such as periodical monitoring etc. during the tunnel construction shall be carried out on the groundwater flow and leakage.

- Hydrological situation/Coastal zone

Proper implementation plan/process taking into account the impact to the hydrological condition of rivers and coastal zone shall be prepared and the construction activity shall be carried out by following it. Special attention shall be paid to:

⇒ Treatment of construction waste, including surplus soil.

⇒ Mining of the rocks and sand from the river.

⇒ Bridges construction activity at the river and during tunnel construction.

- Noise and vibration

Construction plan including daily time schedule of equipment operation shall be prepared taking into consideration:

⇒ Construction work shall cease during the period of religious activities and school time.

⇒ Blasting methods for slope cutting shall not be adopted in the areas of nature/forest reserves in order to prevent the disturbance to fauna habitat.

(3) Post-Construction Stage

- Nature reserve/Fauna and flora

In order to prevent the illegal harvesting/cultivation “slash and burn”, the increase in forest squatters and illegal settlements, especially in the nature/forest reserves, the following items are recommended to be considered.

⇒ Discipline and/or regulation to prevent forest squatters shall be established and applied in the selected areas.

⇒ Periodical patrol shall be carried out by officials concerned.

⇒ Signboard/warning-board shall be provided.

⇒ Strengthening existing agencies with management responsibility for nature reserves, forest protection and biological resources.

⇒ Establishing new institutions, procedures and regulations.

⇒ Establishing environmental and conservation education programs in the local schools.

⇒ Involve local leaders in protection to avoid illegal harvesting and/or settlement.

- Land slide/Soil erosion

⇒ Periodical monitoring shall be carried out to prevent land slide disasters and soil erosion, especially in rainy season.

7.4 Environmental Management

7.4.1 Environmental Management Plan

Environmental management is important in each stage of the Project, i.e. pre-construction stage, construction stage and post-construction stage. This includes not only the management of environmental issues related to the Project, but also those related to environmental improvement in the whole Central and Southeast Sulawesi.

(1) Organization for Environmental Management

Under the project head office which is to be organized by Bina Marga, Ministry of Public Works, there should be a branch office located at the construction site with at least one acting officer in charge of environmental management. This environmental branch shall make plans for environmental protection and improvement, and manage all activities related to the environment. Good coordination among the project head office, branch office, local government and environment agencies are very important.

(2) Management of Resettlement and Land Acquisition

Resettlement and land acquisition are very sensitive social impacts and have to be well managed. Some households may be involved in the resettlement program due to the project implementation. Careful inventory of their houses, lands and properties, economic activities, hearing of their opinion and desires are indispensable. Besides compensation, provision of locations for them to get new houses and economic activities are also very important. While, the practical status of the project road which enhances of regional economy and the transmigrant's activities shall be well managed.

(3) Environmental Surveillance of Construction Work

Construction work should follow environmental regulations settled by the Government. This needs a well organization of the work and also surveillance during the construction work. Dispute may occur with local residents on environmental related issues, or complaints may come to the project office or local government. These issues need to be resolved on the basis of environmental laws and regulations.

(4) Forest/Coastal Zone Environment Management

Forest/coastal zone environment management and improvements shall be considered during and after the project, especially where the project road is adjacent to, or passing through nature reserves and forest reserves and its surroundings. This includes reforestation, protection of endemic fauna and flora, mangrove and coral, garbage collection and regulating markets and other tourism/business activities, etc.

(5) Environmental Education

For an effective environment management, environmental and sanitary education is indispensable for raising public awareness of the importance of environment protection. The habit of using forest area as a receiver for all kinds of waste should be completely abandoned, and the creation of a comfortable and beautiful environment should be the target of all the residents in the study area and also in Central and Southeast Sulawesi. This needs a long term education program for people of all ages with strong administrative measures such as proposing new regulations including strict penalties for environmental contamination, etc.

7.4.2 Environmental Monitoring Plan

Environmental monitoring is important for understanding the environmental conditions before, during and after the Project. At the pre-construction stage, environmental monitoring aims to understanding the environmental settings of the study area as what has been done in Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) for the Project. At the construction stage, monitoring is for controlling the impacts on the environment, and at the post-construction stage, monitoring is for good operation and maintenance of facilities and expanding the effect of the project.

(1) Traffic Volume Monitoring

At the pre-construction stage, the traffic volume of Trans-Sulawesi East Road should be monitored to establish a reasonable transportation plan for the project, and during the construction, monitoring is necessary to check the project impacts.

(2) Noise and Vibration

Noise and vibration levels should be monitored during the project construction especially at the locations where local community/people complain about the impact, such as mosque, school, hospital, etc. By following monitoring results, work plan is to be modified and countermeasures taken.

(3) Groundwater Level

The tunnel construction may result in decrease in well water level in the related area. Therefore, groundwater level should be monitored, if necessary, and according to the monitoring results necessary countermeasures should be considered.

(4) Land-Slide/Soil Erosion Surveillance

Land-slide/soil erosion surveillance should be conducted during and after project construction at the site, especially in the steep mountainous areas and seashore cliff areas. Necessary measures should be considered for all the locations where land slide/soil erosion may occur.

(5) Post Resettlement Survey

As has been mentioned above, resettlement is a sensitive issue related to social impacts. The impacts are not only significant until people relocate to a new place but also continue for long period of time. Whether people are satisfied with their new living conditions, what kind of problem they are facing and what they want for the government to do for them should be understood. The post resettlement survey shall be conducted to investigate these people's conditions after resettlement and obtain their opinion and requests. The information should be reported to the related governmental organization.

Chapter 8

Road management and Maintenance Plan

CHAPTER 8 ROAD MANAGEMENT AND MAINTENANCE PLAN

8.1 Basic Concept

The purpose of road maintenance and operation is:

- To attain traffic safety, smooth traffic flows and riding comfort on the highway,
- To maintain the road structure and facilities as originally constructed or improved,
- To restore ordinary road conditions after the damaging effect of weather, vegetation growth, deterioration, traffic wear and tear, traffic accidents and disasters.

The organization of road maintenance uses the existing system. But basically all tasks of maintenance are on a contract basis. Components of road maintenance are inspection, maintenance and repairs.

8.2 Definition of The Maintenance System of Roads

The organization of road maintenance consists of the maintenance center (Provincial Office), maintenance office (regency office and Site office) under the Dinas PU.

At present, the provincial offices control the maintenance of the national and provincial roads. It is recommended in this study that the road maintenance works shall be divided into 3 levels, namely provincial level, regency (Kabupaten) level and site level, and that the level of each work shall be controlled by the corresponding level of organization using the present maintenance system.

Table 8-2-1 shows the main work items of each level of provincial Kabupaten and site offices. Provincial office (Dinas PU) shall co-ordinate with national government, establishing maintenance grade of the roads within their jurisdiction, and overall management of the implementation program of the maintenance works. The main works for the Kabupaten office shall be coordinated with provincial government and implementation planning for all the roads in the Kabupaten. Each site office shall conduct the implementation of the road maintenance and operations. The maintenance work, basically, shall be conducted on contract basis with a private company, except for routine maintenance and urgent countermeasures for damages caused by disaster.

Table 8-2-1 Main Tasks of Road Maintenance System and Responsible Office

Main Tasks	Activities	Responsible Office		
		Provincial office (Dinas PU)	Maintenance Office	
			Kabupaten office	Site office
1. Planning and Programming	a) Planning	○	○	
	b) Implementation programming	○	○	
2. Traffic Engineering and Safety	a) Road and Traffic engineering development and research	○		
	b) Traffic forecasts	○	○	
	c) Implementation of traffic survey		○	
	d) Statistical data processing		○	○
3. Maintenance and Operations	a) Setting of standards	○	○	
	b) Supervision and consultation works		○	
	c) Maintenance and operations			○
4. Coordination and Public relations	a) Coordination with relevant agencies	○	○	
	b) Response activity	○	○	
5. Administration	a) Personnel management, salary, welfare, etc	○		

Source : Study Team

8.3 Road Maintenance and Operations

There are three types of maintenance tasks. One is routine maintenance where task volumes are not affected by road standards or traffic volumes. Another one is periodic maintenance which is related to traffic volumes and lane width and is proportional to the number of lanes. The third is incidental maintenance which is basically the work to be conducted to prevent and to restore the road and related facilities to normal operating conditions after damage by road accident or natural causes.

- Routine maintenance
 - a. Patrol, inspection, removal of obstacles on road
 - b. Cleaning of surface, side ditch, canals, culverts
 - c. Vegetation control; grass cutting of slope and shoulder, taking care of roadside trees
 - d. Repairing and repainting of traffic safety and management facilities
 - e. Repairing lighting facilities
- Periodic maintenance
 - f. Renewal of traffic marking
 - g. Pavement maintenance and repair
 - h. Overlay
 - i. Maintenance and repair of bridges and culverts
- Incidental maintenance

j. Disaster restoration

“a” through “c” of the above maintenance and operations can be implemented by force account. However, the works of “d” through “j” are implemented on a contract basis except emergency countermeasures such collapse of slope due to heavy rainfall, cave-in of road due to erosion and roads damage from traffic accidents on national and provincial roads.

In line with improved pavements in the future, operations under direct road management control, such as monitoring of the road surface, etc., may increase. It is therefore desirable to establish a maintenance system based primarily on force account and the contracting of works other than those under force account.

8.4 Location of Offices

The roads in the study area run through two (2) provinces, Central Sulawesi and Southeast Sulawesi. The present Dinas PU and its kabupaten offices shall conduct the maintenance work for the roads in the study area.

Each maintenance office shall conduct the direct implementation of the maintenance works for the roads in the study area, and the offices will be located as follows:

- The present maintenance office at Kolondale shall control the link No. 15, with the existing office facility utilized.
- Link Nos. 16 and 22: A new maintenance office shall be provided in Bungku, which is located almost at the mid point of the road.
- Link Nos. 32 and 33: The existing provincial maintenance office in Asera shall be utilized.

8.5 Equipment and Workshop

The maintenance equipment are located at each site office charged with the maintenance and operation of about 250km of national and provincial roads.

The vehicles and equipment required for each site office are show on Table 8-5-1.

Table 8-5-1 Vehicles and Equipment for Road Maintenance

Site Office	Jurisdiction	Vehicles and Equipment (unit)			
		Pick up	Dump truck	Bulldozer	Loader
Kolonadare	Link No.15	15	2	1	1
Bungku	Link Nos. 16 & 22	15	2	1	1
Asera	Link Nos. 33 &32	20	2	1	1

Source: Study Team

8.6 Maintenance and Operation Cost

The annual maintenance and operation costs of the Trans-Sulawesi East Road was estimated to be Rp. 676million with over-lay (every 7years) cost of Rp. 60,011 million at July 1998 prices.

Table 8-6-1 Maintenance and Operation Cost of Trans-Sulawesi East Road

Road link No.	Location	Maintenance and Operation Cost except for Over-lay (Million Rp.)	Over-lay cost(every 7years) (Million Rp.)
15	Uekoli – Tompira	194	22,961
16 & 22	Umpanga – Provincial Border	249	29,481
33 & 32	Provincial Border - Sandangpangan	233	27,569

Source: Study Team

Chapter 9

Construction Planning and Cost Estimates

CHAPTER 9 CONSTRUCTION PLANNING AND COST ESTIMATES

9.1 Precondition of Cost Estimates

9.1.1 Contract Method

The construction consists of improvement and new construction of earthworks, pavements, bridges, slope protection works, tunnels and others.

Bina Marga has implemented construction projects by either force account or contract basis. Usually the contract method for large-scale construction projects such as long road pavement, long bridges and tunnel works is by general competition bid by international open tender.

9.1.2 Construction Method

Large scaled construction project including earth works of big amount excavation, tunnel works, etc. requires special techniques and various works of road construction with heavy construction equipment. Cost estimates were made, considering an efficient construction method and applying to use heavy construction equipment.

9.1.3 Work Methods

(1) Earth Work

The construction site includes steep mountainous areas and needs cutting and embankment of a large amount of earthworks. For the preservation of environment and prevention of disasters, excavated surplus materials should be controlled and treated so as to preserve environment. As the newly constructed road locates in a steep hill, the works is assumed to be started from the both ends using a pilot road taking account of preservation of environment. The excavated soils are disposed of in the site with a hauling distance of about 5 km on average.

(2) Slope Protection Work

Slope protection must be done by stabilizing cut and fill areas and by taking account of prevention of natural disasters and preservation of environment.

(3) Drainage Work

Drainage facilities are constructed on the hill side of cut section areas in order to prevent flooding of the roadbed and the damage of pavement. Concrete pipes of more than 60 cm in diameter are applied for the road crossing waterway to facilitate its maintenance.

(4) Tunnel Works

Tunnel construction amounts to 1990 m on the Uekuli-Tompira road (Link No.15), with a cross sectional area of 65 m² to 70 m². Regarding excavation method for tunnels, the concrete spraying and rock bolt method (NATM) is adopted. The excavation equipment are drill - jumbo, splayed machines etc. which are to be imported from overseas.

(5) Bridges

Prestressed concrete or reinforced concrete girders of standard span lengths of 15,20,30 and 40 meters will be produced at a factory in or near the concrete plant. They will be built up by crane or staging. This will simplify the work procedures. Cast-in-place concrete for slabs and substructure using mixed in the field or truck-mix site from the concrete plant. Bridge unit prices are classified into 12 kinds which depend on span lengths as shown in the following Table 9-1-1 and quantity of bridge for each link roads shown in the Table 9-1-2.

Table 9-1-1 Bridge Unit Cost

Bridge Length	Span	Type	Unit Price			
			Foreign (US\$)	Financial (Rp)	Economic (Rp)	Total Financial (Rp)
15m	Single	RC-T	27,774	261,527,863	211,611,397	555,932,379
20m	Single	RC-T	38,722	350,377,097	281,505,501	760,826,353
25m	Single	RC-T	49,798	440,632,893	352,542,113	968,496,251
30m	Single	PC-I	63,009	544,099,941	433,267,631	1,212,000,174
40m	Single	PC-I	97,405	807,455,924	638,120,844	1,839,950,111
40m	(2x20m)	RC-T	73,816	662,820,921	529,628,064	1,445,273,362
60m	(3x20m)	RC-T	108,911	975,264,746	777,750,628	2,129,720,371
60m	(2x30m)	PC-I	121,092	1,044,455,558	828,892,206	2,328,033,730
80m	(4x20m)	PC-I	144,006	1,287,708,570	1,025,873,192	2,814,167,379
90m	(3x30m)	PC-I	179,807	1,547,751,892	1,226,380,125	3,453,709,745
100m	(5x20m)	RC-T	179,100	1,600,152,395	1,273,995,756	3,498,614,388
120m	(3x40m)	PC-I	282,468	2,320,237,148	1,824,710,833	5,314,401,934
120m	(2x60m)	ST	582,642	3,676,322,874	2,895,319,240	9,852,331,477

Source: Study Team

Note: RC-T = Reinforced Concrete T-Girder
 PC-I = Prestressed Concrete I-Girder
 ST = Steel Truss

(6) Pavement Work

Bituminous asphalt was applied for surface course. Natural (Buton) asphalt was adopted for the asphalt treated base course. Mechanical stabilized crushed stone was planned for subbase course.

Table 9-1-2 Quantity of Bridges

Unit : bridge

Brige Length	Span	Type	Quantity				
			L-16	L22	L33	L32	L-15
15m	Single	RC-T	4	18	0	0	0
20m	Single	RC-T	7	48	15	38	23
25m	Single	RC-T	6	0	0	0	0
30m	Single	PC-I	3	20	4	16	0
40m	Single	PC-I	0	2	0	0	0
40m	(2x20m)	RC-T	0	6	0	1	1
60m	(3x20m)	RC-T	0	4	2	1	6
60m	(2x30m)	PC-I	0	4	0	0	0
80m	(4x20m)	PC-I	0	0	0	0	4
90m	(3x30m)	PC-I	0	2	0	0	0
100m	(5x20m)	RC-T	0	0	0	0	0
120m	(3x40m)	PC-I	0	1	0	0	0
120m	(2x60m)	ST	0	0	1	0	0
120m	(2x30+60m)	PC-ST-PC	0	0	1	0	0
Total			20	105	23	56	34

Source : Study Team

(7) Plants

Asphalt and concrete plants are installed in the locations as show in the below Table 9-1-3, with the asphalt and concrete produced in these plants being carried into the work site.

Table 9-1-3 The Location of Plants for Concrete and Asphalt

No	Link Name	Plant Location
16	Umpanga – Bungku	Umpanga
22	Bungku – Border of Province	Bungku
33	Border of Province – Asera	Border of Province
32	Asera – Tondowatu	Asera
15	Uekuuli – Tompira	Uekuuli

Source : Study Team

(8) Construction Equipment

Construction equipment is to be shipped the site via Bungku and Kendari ports.

9.1.4 Base Year for Cost Estimates

The construction cost was estimated based on foreign currency and local currency. The foreign component has been expressed in rupiah at July 1998 prices with an exchange rate of one (1) US dollar to 10,600 Rp. Cost calculations were based on the material cost, labor cost and equipment cost. Imported materials costs included all import taxes and rates (issued in October 1996 by directorate general of customs and excise in the Department of Finance).

9.1.5 Foreign and Local Currency

Classification into foreign and local currency component was based on the following principles.

(1) Foreign currency

- Wage of foreign personnel;
- Overheads and profit of foreign firms;
- Imported equipment, material and supplies; and
- Foreign component cost of material purchased in domestic market.

(2) Local currency

- Domestic equipment, materials and supplies
- Wages of local personnel;
- Overhead and profit of local firms; and
- Taxes.

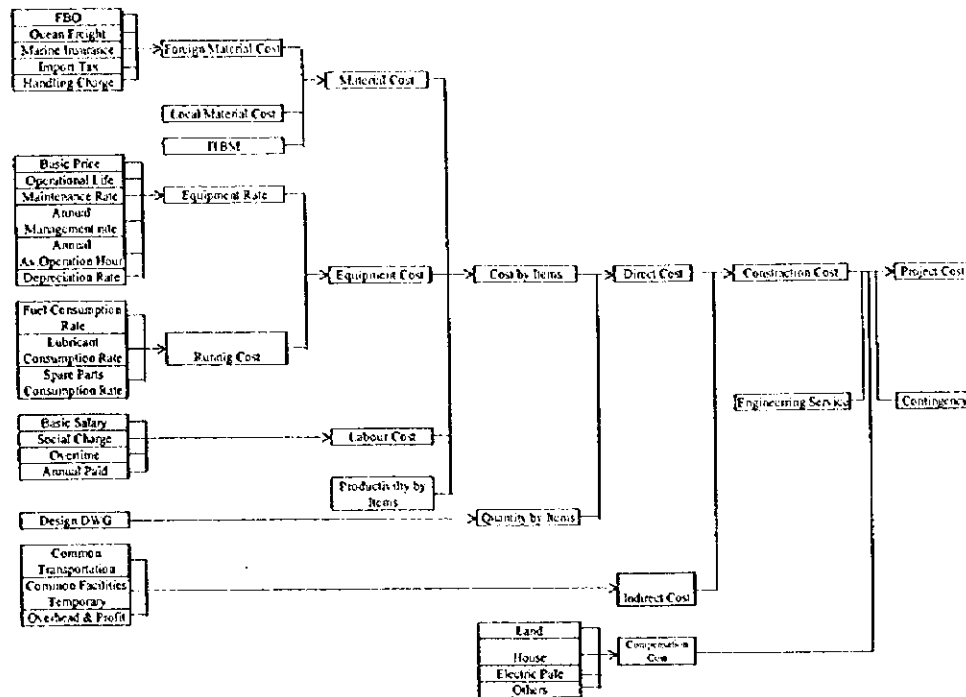
9.1.6 Economic Costs

To assist in the economic evaluation of the projects, economic costs have also been estimated by subtraction of transfer cost, taxes, etc. from the local component.

9.2 Cost Estimates Process

9.2.1 Method

The cost estimates process are shown in Figure 9-2-1. The direct construction costs of each work item were estimated by a method which combines the cost of labor, equipment and material. The indirect construction cost were calculated based on common expenses such as temporary works, over heads and profits. The project costs also included contingencies, land acquisition and compensation cost which were calculated and added separately.



Source : Study Team

Figure 9-2-1 Cost Estimates Process

9.2.2 Labor Cost

Basic salaries were calculated including social charges which account for 26% of the average unit wage. Labour cost is classified into 5 categories of driver, forman, operator, skilled labor and unskilled labor as shown in the following Table 12-2-1.

Table 9-2-1 Labor Cost

Categories	Unit	Foreign(US\$)	Local(Rp)
Driver	Hr	0	3865
Forman	Hr	0	4637
Operator	Hr	0	5670
Skilled Labour	Hr	0	4126
Unskilled Labour	Hr	0	2962

Source : Study Team

9.2.3 Material Cost

Material costs are divided into local and imported materials. The CIF (cost, insurance and freight) prices of imported materials which are not available in Sulawesi, are estimated from foreign prices. Material costs are estimated including import tax, handling charge and consumption tax in the country.

Where the selling price of imported materials are known, 25% of the selling prices is regarded as handling charge, of which 7.5% of the selling prices are transportation expenses. 50% of the transportation expenses are estimated as the foreign portion. Consumption tax of 10% is added to the material costs.

In case of the domestic product the majority of the cost component of raw materials are regarded to expenses of the production plants, equipment, transportation and fuel which would have been imported. The unit costs and assumed foreign and local currency portions for the major materials are shown in Table 9-2-2.

Table 9-2-2 Foreign Currency Portion in Raw Material (Financial)

Description	Unit Cost (Rp)	Unit	Foreign currency portion (%)	Local currency portion(%)
Cement	380,000	ton	60.0	40.0
Sand	30,000	m3	40.0	60.0
Crusher stone	37,000	m3	40.0	60.0
Steel	4,600,000	ton	80.0	20.0
Reinforcement	4,300,000	ton	80.0	20.0
Wood	350,000	m3	40.0	60.0
Concrete product	397,000	m3	60.0	40.0
Asphalt	1,700,000	ton	80.0	20.0
Gasoline	1,000	l	60.0	40.0
Diesel oil	600	l	60.0	40.0
Heavy oil	400	l	60.0	40.0
Electricity	105	kwh	0.0	100.0

Source : Bina Marga In Sulawesi

9.2.4 Equipment Cost

The construction equipment costs are estimated assuming that the equipment are assigned to other projects when not being used. All construction equipment could be supplied in Republic of Indonesia. Equipment costs include import tax, consumption tax and all other expenses except operator and driver costs, which are calculated in labor costs.

Equipment cost could be divided into rental cost and operation cost.

Rental cost per hour = ((basic price (1.0 - residual value ratio)) * depreciation rate + annual maintenance rate per hour + management rate per hour.

Depreciation rate = 1/(annual operation hour * operation life)

Operation cost are included for fuel, lubricant, spare part, wage of management and maintenance costs per hour.

Table 9-2-3 shows result of calculation for equipment cost per hour.

Table 9-2-3 Equipment Cost (Financial)

Equipment Name	Unit Cost (Hr./Rp)	Equipment Name	Unit Cost (Hr./Rp)
Agg. Spreader 2.3m	28,566	Vib-Roller 3.5t	171,831
Apron Feeder 30t	55,006	Watering Cart 5.5kl	94,096
Asphalt Plant 60t	665,242	Wheel Loader 1.4m3	127,704
Asp. Finisher 3m	383,909	Dump Truck 2t	30,293
Batching Plant	885,713	Dump Truck 6t	89,262
Belt Con. 0.35*10m	12,514	Dump Truck 11t	135,068
Belt Con. 0.6*15m	99,297	Earth Oager 0.45	149,076
Boring Machine 19kw	304,321	Engine Pump 4in	1,973
Breaker 1200kg	57,803	Grout Mixer	40,212
Bulldozer 11t	123,646	Grout Pump	27,501
Bulldozer 21t	264,819	Hand Hammer 1.1m3	4,873
Compressor 4.6m3	64,244	Hydro-Shovel 0.6m3	131,656
Compressor 9.6m3	133,871	Line Marker 90kg	20,297
Compressor 20m3	186,829	Mac. Roller 12t	154,100
Tandem Roller 10t	75,125	Motor Grader 3.7m	107,976
Tire Roller 15t	98,835	PC Jack	5,839
Conc. Bucket	17,969	Road Sweeper 1.8m	214,837
Truck 5t	56,634	Soil Compactor 0.05t	9,095
Truck 8t	74,513	Soil Compactor 0.2t	19,430
Crawler Crane 35t	497,468	Soil Mixing Plant 15	235,263
Truck Crane 40t	464,911	Spray Gun	134,577
Truck Crane 70t	1,187,467	Spray Gun for tunnel	282,298
Distributor 4kl	126,986	Sprayer 0.3kl	4,122
Drill Jumbo 49ps	1,594,176	Surf. Vibrator 1.5*0	9,482

Source : Study Team

9.2.5 Indirect costs

Temporary work costs which include transportation of equipment and plant, mobilization and demobilization, installation and removal of such temporary facilities as power supply, environmental protection, safety facilities, quality and progress control, utilities and field office maintenance. Field management cost includes wages, office supplies, and other expenses included at field offices, while general administration includes the overhead of the contractor's head office.

These indirect costs can vary substantially from one contractor to another and are also dependent on the scale of project, and a number of assumptions must be made for their estimates. Therefore, for simplicity of the estimates, indirect costs have been estimated to be 20% of direct cost from previously implemented projects. The foreign currency portion and the local currency portion of indirect costs are shown in Table 9-2-4.

Table 9-2-4 Indirect Cost Component

Unit : Percent			
Description	Foreign Portion	Local Portion	Total
1.Common Temporary Facilities			
1-1 Transportation	1.0 %	0.5 %	1.5 %
1-2 Mobilization	0.5	1.0	1.5
1-3 Temporary Facilities	0.5	1.0	1.5
1-4 Environment Control	0.5	0.5	1.0
1-5 Safety Facilities	0.5	0.5	2.10
1-6 Public Services Charge	0.0	0.5	0.5
1-7 Quality Control	1.0	0.5	1.5
1-8 Field Office Maintenance	0.5	1.5	2.0
Sub-total	5.0	5.0	10.0
2.Field Management	0.0	5.0	5.0
3.General Management	5.0	0.0	5.0
Total	10.0 %	10.0 %	20.0 %

Source : Study Team

9.2.6 Engineering Services Cost

Engineering service costs vary and depend on the scales of the project, tender processing and contract method. Based on previous experiences the engineering service costs are estimated at 20% of the total of direct and indirect costs. The currency portion of foreign and local allocated to same ratio of the total cost.

9.2.7 Contingency

A contingency allowance has been included in the total cost to allow for unexpected cost identified in the detail design and construction stage. In view of the point that the subject projects are to be implemented in rural areas where unexpected difficulties for resettlement of inhabitants and scope of construction of related road are highly possible, 10% of total construction and engineering service cost is assumed as physical contingency. Price contingency for cost escalation is considered separately in financial analysis.

9.2.8 Land Acquisition and Compensation

The cost of the land alone is relatively low compared to the civil works costs and basis of discussions with government agencies in Sulawesi, land cost of 20,000Rp/m² were assumed for irrigated area and residential area. For this project an allowance of Rp.15million /house was included for land acquisition/reconstruction/compensation costs.

It was assumed that land acquisition and compensation cost need not be included in the costs for public land such as right of way for roads and nationalized forest. The Quantity of land acquisition and compensation are shown in Table 9-2-5.

Table 9-2-5 Quantity of Land Acquisition and Compensation

No.	Link Name	Length (Km)	Total of Cost	
			Land acquisition (m2)	Compensation (house)
15	UEKUULI-TOMPIRA	114.1	554,000	20
16	UMPANGA - BUNGKI	35.8	30,000	9
22	BUNGKU-B.P	110.7	178,120	24
32	ASERA-TONDOWATI	81.5	176,000	2
33	B.P-ASERA	55.5	52,700	20
Total		397.5	990,820	75

Source: Study Team

9.3 Result of Cost Estimates

9.3.1 Cost Items

Cost items are grouped into those each of which can be expressed by finished work quantity such as unit price per square meter of pavement areas. For actual cost estimates, each cost item is conceived of in three stages: plant products, site products, and work items. The work items conform with cost items for unit price contracting. Plant product and site product are the items of the breakdown of each work items. Plant products are materials produced and delivered by a field plant, such as batching plant and asphalt mixture. The asphalt concrete pavement is placed, compacted, finished and cured, which is a site product. Work item is for example a pavement consisting of site product such as an aggregate sub base course, and expansion joint. The unit price of each work item, such as per square meter in the case of pavement, is multiplied by the quantity calculated from the design.

9.3.2 Estimated Project Cost

The summary of total construction costs for each road link (Nos. 16, 22, 32, 33 and 15) is shown in Table 9-3-1.

Table 9-3-1 Summary of Construction Cost for F/S Link Road

No.	Link Name	Length (km)	Total of Cost			
			Foreign (US\$)	Financial (1000Rp)	Economic (1000Rp)	Total Financial (Mill. Rp)
15	UEKUULI-TOMPIRA	114.1	30,055,358	267,661,655	230,617,976	586,248
16	UMPANGA - BUNGKU	35.8	3,011,585	29,651,962	25,588,352	61,575
22	BUNGKU-B.P	110.7	24,267,621	225,313,448	198,734,972	482,550
32	ASERA-TONDOWATU	81.5	10,831,628	106,544,504	92,753,555	221,360
33	B.P-ASERA	55.5	6,541,740	60,927,185	52,619,028	130,270
Total		397.5	74,707,932	690,098,753	600,313,882	1,482,003

Source : Study Team

9.4 Maintenance Cost

Maintenance costs are necessary for the financial and economic analysis of the project. Maintenance work is classified into routine maintenance work and periodic maintenance work. Routine maintenance work is required irrespective of traffic volume and includes such as works as grass cutting and the cleaning of road side ditches or culverts. Periodic maintenance work is required depending on traffic volume and road surface condition and includes such works as overlay, patching, sealing, and other road surface repair, as well as the repair of bridge slabs. The existing roads employ macadam pavement, therefore they requires overlay every 3 to 5 years until the completion of road improvements, and upon completion of improvement, periodic maintenance will require overlay works every 7 years. For unit cost of maintenance works are shown in the Table 9-4-1.

Table 9-4-1 Unit Cost of Maintenance works

Type of Maintenance	Unit	Foreign (US\$)	Financial Local (1,000 Rp)	Financial Total (1,000 Rp)
Routine Maintenance Work	1 km/year	93	718	1,700
Periodic Maintenance Work before Improvement Construction	1 km/year	6,097	65,646	130,274
Periodic Maintenance Work after Improvement Construction	1 km/year	9,594	99,537	201,233

Source: Study Team

Chapter 10

Economic Project Analysis

CHAPTER 10 ECONOMIC PROJECT ANALYSIS

10.1 General

The main purpose of the economic project analysis is to show the effect of the development/improvement of the roads of link No. 15, 16, 22, 32 and 33 (the Projects) from the nation's economic well-being viewpoint and to assess the economic viability of the Project.

The evaluation of quantified economic costs and benefits follows the conventional discounted cash flow methodology in determining the economic internal rate of return (EIRR), net present value (NPV) and benefit cost ratio (B/C).

10.2 Economic Project Costs

The economic investment costs were 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. Implementations of roads of link Nos. 15, 16, 22, 32 and 33 are scheduled over four years from 2000 to 2003. The phased financial and economic investment costs (initial investment) for each road link are referred to Chapter 6. (As for link No. 15, refer to Appendix A-6.2.)

10.3 Economic Benefits

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

(1) Direct Benefits

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 this economic analysis, no benefit of savings in vehicle time cost is assumed as a direct benefit.) In addition, promotion of traffic safety and a saving in accident costs are anticipated.

(2) Indirect Benefits

Indirect benefits would be many possible intangible benefits of the project, e.g. additional employment, multiple effects, etc.

Additional employment (job creation) can be expected during the period of the construction stage. The realization of the road improvement leads not only better and easier access between the related area (both a resolution of limited traffic conditions and an assurance of twenty-four hour traffic), but it also induces so-called development effects such as the inducement of new and/or incremental industrial development along the corridor through the improvement of distribution of commodities.

(3) Benefits to be Treated

In this economic analysis, the above-mentioned direct benefits, e.g. the saving in vehicle operating cost was computed as a quantified benefit.

The calculation of direct benefits were made for the planning years of 2003 and 2018.

(4) Computation of Benefit of Saving in Vehicle Operating Cost

The unit vehicle operating costs were determined by both by speed and IRI (international roughness index) conditions in each road link.

The data of speed and IRI for each road link in the case of “without project” were based on the inventory data compiled by Bina Marga and reviewed by the study team. And those in the case of “with project” were assumed from the viewpoint of the engineering study by the study team.

The details of the assumption of unit vehicle operating costs and the estimation of vehicle operating costs are referred to the description in the chapter of “Economic Project Analysis” (Chapter 11) in the report of “Volume III : Feasibility Study of Tawaeli – Toboli Road”.

As a result, the saving in vehicle operating cost are estimated for the roads of link Nos. 15, 16, 22, 32 and 33, and the estimated results are referred to Chapter 6. (As for link No. 15, refer to Appendix A-6.2.)

10.4 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 was assumed to be 20 years after completion of each proposed road construction.

The benefits in the intermediate years were interpolated and those beyond 2018 were assumed to be fixed.

The tabulations of total economic project costs and benefits streams for each road link are referred to Chapter 6. (As for link No. 15, refer to Appendix A-6.2.)

Following the conventional discounted cash flow methodology, the efficiency measures were calculated and the results are summarized as follows:

Efficiency Measures	Link No. 15	Link No. 16	Link No. 22	Link No. 32	Link No. 33
EIRR	20.5%	40.9%	19.5%	30.4%	33.4%
NPV (Billion Rp.)	153	85	90	163	107
B/C	1.51	3.89	1.37	2.48	2.79

Source: Estimated by the Study Team.
 Note) EIRR: Economic Internal Rate of Return
 NPV: Net Present Value at discount rate of 15%
 B/C: Benefit Cost Ratio at discount rate of 15%

These results indicate that implementation of each Project (road improvement of link Nos. 15, 16, 22, 32 and 33) is economically feasible.

Chapter 11

Conclusion and Recommendation

CHAPTER 11 CONCLUSION AND RECOMMENDATION

11.1 Design Standard

The following design standard are recommended as shown in Table 11-1-1.

Table 11-1-1 Design Standard

Items	Design Standard		
1. Road Classification	Collector Road		
2. Design Speed	60 km/h (Flat & Rolling) 40 km/h (Mountainous)	Link No. 16, 22, 33 and 32	
	60 km/h (Flat & Rolling) 30 km/h (Mountainous)	Link No. 15	
3. Number of Lanes	Two (2) lane		
4. Road Width	3.0m x 2 (lane width) 2.0m (min. 1.0m) x 2 (shoulder width)		
5. Pavement Thickness	Link No. 15,16,22,33 and 32 Asphalt Surface: t=10cm Asphalt Treated Base: t=15cm Sub-Base Course: t=25cm		
6. Road Traffic	Link No.	1997	2018
	15	42 veh/d	1667 veh/d
	16	135 veh/d	1486 veh/d
	22	0 veh/d	1321 veh/d
	33	0 veh/d	1351 veh/d
	32	224 veh/d	1431 veh/d

Source: Study Team

11.2 Salient Features of Trans-Sulawesi Road

Table 11-2-1 Salient Features of Route

Items	Link No.				
	15	16	22	33	32
1. Planned Road Length (km)	114.1	35.8	110.7	55.5	81.5
2. Bridge Length (km)	1,360	675	3,000	1,050	1,464
3. Tunnel Length (km)	1,990	0	0	0	0
4. Slope Protection Works (m ²)	194,000	0	123,000	600	27,000
5. Earth Work (m ³)	1,282,000	31,000	1,551,000	115,000	372,000

Source: Study Team

Note: Link No. 15 was studied based on topographic map on a scale of 1:50,000 but other link Nos. 16, 22, 32 and 33 were studied based on topographic map on a scale of 1:5,000.

11.3 Environment

Improvement of the Trans-Sulawesi East Road will catalyze considerable positive impacts for society and persons residing in vicinity of the road as well as within the province. Therefore, the following point is to be considered:

- (1) Appropriate compensation should be made for land and structures affected by roads.

- (2) Impact on fauna and flora is to be mitigated by restricting the speed of vehicles, reducing the noise and vibration, prohibiting illegal cultivation and settlements in that area (Link No.22)
- (3) More Than 1,350,000 m³ of disposal soil for the Trans-Sulawesi East Road including Link No.15 will be produced by construction of the road due to the imbalance of cut and fill volume. The following points need to be heeded in regards to selection of dumping sites:
- Excavated soil should not be dumped or left as is in excessively rainy or dry seasons.
 - Dump sites in which exposed or graded surfaces of excavated soil can be minimized should be selected.
- (4) Slope protection works such as sprayed concrete cribwork, shotcrete work, stone masonry and mat gabions for fill and cut slopes should be constructed to prevent soil erosion and landslides.

11.4 Project Cost and Implementation Schedule

The estimated project cost (in July 1998 prices) and implementation schedule are shown in Figure 11-4-1.

Link No	Items	1999	2000	2001	2002	2003	
15, 16,	Preparation						
22, 33,	Design						
32	Construction						
15	F/C(Thousand US\$)		1,383	6,213	10,934	11,526	
	L/C (Billion Rp.)		16.03	56.42	87.11	108.11	
	Total(Billion Rp.)		30.69	122.27	203.01	230.29	
16	F/C(Thousand US\$)		145	400	989	1,478	
	L/C (Billion Rp.)		1.43	4.16	9.06	15.00	
	Total(Billion Rp.)		2.97	8.40	19.54	30.67	
22	F/C(Thousand US\$)		1,138	4,439	9,300	9,390	
	L/C (Billion Rp.)		10.20	40.95	81.42	92.74	
	Total(Billion Rp.)		22.26	88.01	180.00	192.28	
33	F/C(Thousand US\$)		307	883	2,273	3,078	
	L/C (Billion Rp.)		2.92	8.93	19.00	30.08	
	Total(Billion Rp.)		6.17	18.30	43.09	62.71	
32	F/C(Thousand US\$)		522	1,696	3,707	4,907	
	L/C (Billion Rp.)		5.64	17.63	33.59	49.68	
	Total(Billion Rp.)		11.18	35.61	72.89	101.69	
15, 16, 22, 33, 32	Grand Total	F/C(Thousand US\$)		3,495	13,631	27,203	30,379
		L/C(Billion Rp.)		36.22	128.09	230.18	295.61
		Total(Billion Rp.)		73.27	272.59	518.53	617.64

Exchange Rate: 1.0US\$=10,600Rp.

Source: Study Team

Note: Link No. 15 was studied based on topographic map on a scale of 1:50,000 but other link Nos. 16, 22, 32 and 33 were studied based on topographic map on a scale of 1:5,000.

Figure 11-4-1 Project Cost and Implementation Schedule for Trans-Sulawesi East Road

11.5 Economic Analysis

The economic cost and benefit calculation is as shown in Table 11-5-1.

Table 11-5-1 Result of Economic Analysis

Link No.	EIRR(%)	NPV(Million Rp)	B/C
15	20.5	152,563	1.51
16	40.9	84,660	3.89
22	19.5	89,869	1.37
33	33.4	106,586	2.79
32	30.4	163,407	2.48

Discount Rate: 15% p.a.

Source: Study Team

11.6 Conclusion and Recommendation

Link Nos. 16, 22, 33 and 32 are feasible with a high EIRR and will be constructed by the end of 2003, to complete the missing sections of the Trans-Sulawesi East Road:

- The road is two-lane with a design speed of 40 km/hr to 60 km/hr.
- The construction cost including ROW is 895.76 Billion Rp. with pavement work over 283.5 km, bridges totalling 6,190 m, slope protection works covering 150,752 m² and 912,000 m³ of disposal soils (at intervals of 10km on the average).
- Slope protection works such as sprayed concrete cribwork, shotcrete work, stone masonry and mat gabions for fill and cut slopes should be constructed to prevent soil erosion and landslides.
- Tunnel construction was recommended considering the following points:
 - Prevention of hazards on the road sections where the slope protection structure is not practical.
 - Ensuring of adequate road alignment by reducing sharp turns.

Link Nos. 15 is feasible with a high EIRR and will be constructed with two-lane and a design speed of 30 km/h to 60 km/h. However, the construction cost of the Trans-Sulawesi East road (1,482 Billion Rp.). Therefore, the construction of link No.15 may be deferred by five (5) years considering the availability of Bina Marga's budget.