Chapter 11

Environmental Survey for Pre-Feasibility Route

Chapter 11 ENVIRONMENTAL STUDY

11.1 Environmental Survey

11.1.1 Survey Objective

In this pre-feasibility study (Pre-F/S), environmental site survey was carried out in order to find the outline of the environmental conditions/settings of the objected road links which are located in Central and Southeast Sulawesi (total road length is approx. 1000km), to identify the potential negative and/or positive environmental impacts bring about by the project road development activities and to envisage the environmental items to be considered for the next feasibility study (F/S) stage and Environmental Impact Assessment (EIA) study.

Environmental survey was carried out based on existing data/information analysis, interview survey and site reconnaissance survey by using scoping assessment method which is defined by the JICA Environmental Guidelines.

The environmental survey results in each road link are described in Section 11.2, while, the scoping results and main points/items of the project which might cause environmental impact will be taken into account for the next step (F/S, EIA study, etc.) are surmised in Section 11.3 of this report.

11.1.2 Scope of Works

(1) Objected Road Links

Objected roads for the Pre-F/S area, which are selected in the master plan (M/P) stage of this study, composed of eight (8) road links; five (5) links from Central Sulawesi and three (3) links from Southeast Sulawesi. Table 11-1-1 shows the road links of Pre-F/S study area.

Table 11-1-1 Road Links for Pre-Feasibility Study Area

Road Link No.	Location		Road Length (km)
	Road Section	Province	
4	Toli Toli – Buol	Central Sulawesi	174.2
5	Buol – Umu	Central Sulawesi	141.0
15	Uekuli – Nuha	Central Sulawesi	174.0
16	Tompira – Bungku	Central Sulawesi	103.9
22	Bungku – Border of Province	Central Sulawesi	115.0
32	Pohara – Asera	Southeast Sulawesi	81.4
33	Asera – Border of Province	Southeast Sulawesi	76.0
31	Barru – Kasipute	Southeast Sulawesi	187.9
Total Road Length (km)			1,053.4

Source : Study Team

(2) Environmental Items to be Surveyed

Based on the result of Initial Environmental Examination (IEE) conducted in the Master Plan Study of this project, the survey was executed in focus to the environmental items marked (*) in Table 11-1-2. However, it is noted that most of the environmental items/factors listed in Table 11-1-2 are obliged to be considered in the process of AMDAL, which is settled by Indonesian Government.

Table 11-1-2 Environmental Items

Social Environment		Natural Environment		Environmental Pollution	
1	Resettlement *	10	Topography and Geology *	18	Air Pollution
2	Economic Activities *	11	Soil Erosion *	19	Water Pollution
3	Traffic and Public Facilities*	12	Groundwater *	20	Soil Contamination
4	Split of Communities	13	Hydrological Situation *	21	Noise and Vibration *
5	Cultural Property	14	Coastal Zone *	22	Land Subsidence
6	Rights of Common *	15	Fauna and Flora *	23	Offensive Odor
7	Public Health Conditions	16	Meteorology		
8	Waste *	17	Landscape *		
9	Hazard (Risk) *				

Source: JICA Environmental Guidelines

11.2 Present Environmental Conditions

11.2.1 Toli Toli - Buol (Link No. 4) and Buol – Umu (Link No. 5)

(1) Natural Environment

1) Meteorology

Central Sulawesi including study area, is located in tropical zone, therefore, in general rainfall intensity of this region is rather high. The monthly rainfall data in the last ten years taken from Toli Toli Meteorological Station is shown in Table 11-2-1.

Table 11-2-1 Monthly Rainfall

Year	Monthly Rainfall (mm)												Total (mm)
	1	2	3	4	5	6	7	8	9	10	11	12	
1987	132	149	59	29	74	59	36	58	81	113	241	89	1,119
1988	126	331	153	92	361	338	314	272	340	164	189	310	2,990
1989	226	244	263	234	132	186	200	106	89	261	168	144	2,253
1990	297	87	93	89	44	116	253	103	173	228	289	113	1,885
1991	117	69	8	51	213	132	110	65	58	34	15	169	1,041
1992	45	39	21	11	101	233	128	45	51	138	95	215	1,122
1993	111	96	61	34	85	432	187	70	49	163	127	86	1,501
1994	172	217	324	148	247	248	92	135	6	64	244	436	2,333
1995	304	352	192	238	176	288	278	413	204	113	258	200	3,014
1996	303	223	421	154	111	318	422	535	248	308	152	256	3,451
Average	183	181	160	108	154	235	202	180	130	159	178	202	2,072

Source : Toli Toli Meteorological Station

2) Topography

The project roads are located mainly along the seashores which are faced to Makassar sea in the west and Sulawesi sea in the north. Topographic feature of the study area is characterized flat and hilly in average, while some part of the road is situated at steep slopes with more than 25% of gradient.

Table 11-2-2 and Table 11-2-3 shows the topographic features in focus to the location of the hilly/sloping sections of each road links of the study area, link No.4 and link No.5.

Table 11-2-2 Topographic Features (hilly/sloping Section) of Link No. 4

Road Section	Road Length (km)	Topographic Features		
		8-15% (Wavy)	16-25% (Undulated)	> 25% (Hilly)
Toli Toli-Perintis	30	---	---	---
Perintis-Pinjan	62	Km 509 Km 519-529	Km 488 -- 503	---
Pinjan-Malolok	61	Pinjan area (2 km)	B. Dampelas – B. Bambalatung	Mbukit Pamantauan - Mb. Dampelas
Malolok-Buol	23	Km 593 - 590 Km 5711- 580	Km 599 – 600	---

Source : Site Survey by JICA Study Team

Table 11-2-3 Topographic Features (hilly/sloping Section) of Link No. 5

Road Section	Road Length (km)	Topographic Features		
		8-15% (Wavy)	16-25% (Undulated)	> 25% (Hilly)
Buol-Bunobogu	27	---	---	---
Bunobogu-Paleleh	66	---	Mbukit Buta Talokan - Lunguto Tangmas - Tidalom	Mbukit Besar Mbukit Oyale Tanggalan – Paleleh
Paleleh-Umu	48	---	Setelah Baturata	---

Source : Site Survey by JICA Study Team

3) Hydrological Situations

The study area belongs to the catchment area of Buol river. Characteristics of major rivers and streams in the study area are shown in the Table 11-2-4.

Table 11-2-4 River Characteristics in the Area of Link No.4 and No.5

No.	Name of Rivers	Location	Length (km)	Area (km^2)
1	S. Buol	Kp. Buol	87	239
2	S. Lantikadigo	Ds. Negerilama + 1 km	28	89
3	S. Kantanan	Ds. Kantanan	2.5	9.7
4	S. Tangdidi	Kota Bokat	1	1.2
5	S. Tangdoka	Kp. Tang, Ds. Doulan	1.5	4.5
6	S. Doulan	Ds. Doulan	1.5	3.2
7	S. Ponot	Ds. Mekar	1	1.6
8	S. Luno	Kp. Palas	n.a	n.a
9	S. Bunobogu	Kota Bunobogu	n.a	n.a
10	S. Poguloton	Ds. Kenamukan	1	1.4
11	S. Kopi	Ds. Inalatan	1.5	1.7
12	S. Inalatan	Ds. Inalatan	2.5	6.7
13	S. Nantu	Ds. Nantu	2.2	5.8
14	S. Doka/S. Matinan	Mbukit Besar	7.1	15.9
15	S. Binuang 1	Ds. Lokodoka	1	1.8
16	S. Binuang 2	Ds. Lokodoka	1	1.2
17	S. Imam	Ds. Lokodoka	1.5	1.6
18	S. Buladigun	Des. Lesi	4.7	24.6
19	S. Labingan	Before Mbukit Oyak	2.5	7.8
20	S. Bodi	Ds. Bodi	5.8	39.1
21	S. Pelamian	Kp. Pelamian	2.1	1.9
22	S. Talokan	Ds. Talokan	1.6	1.2
23	S. Bila	Kp. Bila	1.4	2.2
24	S. Lungutudoka	Kp. Lunguto	1.7	4.3
25	S. Lungutodidi	Kp. Tangmas	1	1.1
26	S. Tidolom	Kp. Tidolom	0.8	0.9
27	S. Timbulon	Ds. Bulano	6.2	51.2
28	S. Pokobo	Ds. Pokobo	0.5	0.7
29	S. Bungayon	Ds. Oyak	0.5	0.8
30	S. Matahari	Ds. Lintindu	1	1.0
31	S. Palelehtua	Kota Paleleh	3	9.3
32	S. Tolau	Kota paleleh	2.2	4.2
33	S. Dutuno	Ds. Dutuno	0.6	0.9
34	S. Tiamsaripa	Ds. Kualabesar	2	2.4
35	S. Doka	Ds. Kualabesar	n.a.	n.a.
36	S. Talaki	Ds. Talaki	n.a.	n.a

Source : Topographic Map and Site Survey by JICA Study Team, 1998

4) Natural Hazard (Earthquake)

The earthquake has been observed frequently in Sulawesi. Table 11-2-5 shows the number of earthquake occurred at Central Sulawesi between the year 1993 and 1995. The earthquake with the magnitude of more than four is less than 20% in numbers, and more than 80% are small ones of which are not able to be felt by human body.

Table 11-2-5 Earthquake in Central Sulawesi

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1995	322	574	403	633	1184	788	365	505	340	358	442	353
1994	370	218	283	254	297	314	359	320	344	539	348	470
1993	359	158	170	150	180	204	147	116	155	80	610	397
Average	350	317	285	346	554	435	290	314	280	326	467	407

Source: Mining Office in Palu

According to the record in the Meteorological Station in Palu, 4 times of strong earthquake between 5.1 to 6.8 in Richter scale were observed in the study area in 1997. The greatest one occurred in November 25th 1997, centered at 78km north-east of Gorontalo (in the sea).

At Toli Toli region, strong earthquake of 6.6 in Richter scale happened in July 22nd 1996. The center point of the earthquake was estimated in Kecamatan Dondo and Donpal.

5) Coastal Area

<Link No. 4>

At Toli Toli - Buol road section, some coral reefs can be observed along the project road. The project road sections which path through the coastal area are shown in Table 11-2-6.

Table 11-2-6 Project Road Sections path along the Coastal Area (Link No. 4)

Road Section	Road Length	Project Road Sections path through the Coastal Area
Toli Toli-Perintis	30 km	Tanjung Harapan – Cendana sub-village (coral reef) Aung sub-village – Tanjung Galumpang
Perintis-Pinjan	62 km	Perintis Tanjung Kanga – Teluk Mamuru Datulela sub-village Tanjung Kanoa Tanjung Ambotuban
Pinjan-Malolok	61 km	Binontoan village (swamp area) Tunggilio Paulyang, Manulipo
Malolok-Buol	23 km	Leok sub-village – Negeri Lama sub-village

Source : Site Survey by JICA Study Team

<Link No. 5>

At Buol - Umu road section, the mangrove forests and coral reefs can be observed along the project road. The project road sections which path through the coastal area are shown in Table 11-2-7.

Table 11-2-7 Project Road Sections path through the Coastal Area (Link No. 5)

Road Section	Road Length	Project Road Sections path through the Coastal Area
Buol – Bunobogu	27 km	Bodi sub-village – Negeri Lama sub-village Kantanan sub-village – Kambe sub-village Bunobogu (mangrove)
Bunobogu – Paleleh	66 km	Kenamukan sub-village – Mafatan sub-village (mangrove) Lokodidi, Lokodoka, Lesi, Riapatih sub-village (mangrove) Tunggilio Talokan – Tunggiio Tilang (coral reef) Tungilio Tanian – Loko Paleleh (coral reef)
Paleleh – Umu	48 km	Talaki sub-village – Lili sub-village (swamp)

Source : Site Survey by JICA Study Team

6) **Flora and Fauna**

a. **Flora**

Species of flora existing in the study area are: Uru (*Elmerillia sp*), Bungur (*Perospermum sp*), Kayu hitam (*Diospyros sp*), Damar (*Agathis sp*), Jambu-jambuan (*Eugenia sp*), Wanga (*Pigafeta filaris*), Kayu palapi (*Palaguium sp*), Kemiri hutan, etc. Among them, the protected flora is Kayu hitam (*Diospyros sp*).

b. **Fauna**

Species of fauna existing in the study area are: burung maleo (*Macrocephalaon maleo*), Monyet Hitam (*Macaca tonkeana*), Anoa (*Bubalus sp*), Babirosa (*Babyrousa babyrussa*), Tarsius (*Tarsius spectrum*), Musang Sulawesi (*Macrogalidia sp*), Kus-kus (*Palanger sp*), Kakaktua putih jambul kuning (*Cacatua sp*), etc. Among them, protected fauna are burung Maleo (*Macrocephalon maleo*), Monyet Hitam (*Macaca tonkeana*), Anoa (*Bubalus sp*), Babirosa (*Babyrousa babyrussa*), Tarsius (*Tarsius spectrum*) and Kus-kus (*Palanger sp*).

7) **Conservation Area**

In Kabupaten Buol Toli Toli (including both of the study area, Link No. 4 and No. 5), 608,345 hectares of forest exists in 1995. Among them, 51,760 hectares of forest are designated as Hutan Suaka Alam (Forest Reserve) and Hutan Wisata (Forest recreation area).

<Link No. 4>

In the study area of Link No.4, two nature conservation areas are designated: Suaka Margasatwa Pinjan/Tanjung Matop (Game Reserve) and Suaka Margasatwa Pulau Dolangon. The project road, Toli Toli - Buol road, paths through Suaka Margasatwa Pinjan/Tanjung Matop.

Suaka Margasatwa Pinjan/Tanjung Matop is located in the area of Pinjan and Binontoan village, Kecamatan Toli Toli Utara, Kabupaten Buol Toli Toli. While, Suaka Margasatwa Pulau Dolangon is located at Santigi village, Kecamatan Toli Toli Utara, Kabupaten Buol Toli Toli.

<Link No. 5>

In the study area of link No.5, no nature conservation area is designated.

(2) Social Environment

1) **Demography**

<Link No. 4>

The study area is administratively located at Kecamatan Toli Toli Utara, Dati II Kabupaten Buol Toli Toli, with its capital in Laulalang. Villages sitting along the project road are Lingadan, Laulalang, Leok and Buol. Population of Kecamatan Toli Toli Utara is 19,245

people and its area is 549.40 km^2 (7.2% of the area of Kabupaten Buol Toli Toli).

<Link No. 5>

The study area is administratively located at Kecamatan Paleleh, Dati II Kabupaten Buol Toli Toli, with its capital in Paleleh. Villages sitting along the project road ara Buol, Paleleh and Umum. Polulation of Kecamatan Paleleh is 12,246 people and its area is 586.50 m^2 (7.7% of the area of Kabupaten Buol Toli Toli).

2) Economic activities

Working population classified by the economic activities in the region of Kabupaten Buol Toli Toli is shown in Table 11-2-8. Major economic activity in this region is agriculture sector (51.8% of working population in engaged in this sector). Approx. 12.9% of the area of Kabupaten Buol Toli Toli, which is 98,000 hectare, is used for the farmland. While, agriculture sector consists of five activities, that is; food crops, plantation, forestry, cattle breeding and fishery.

Table 11-2-8 Classification of Economic Activities in Kabupaten Buol Toli Toli

No.	Type of Jobs	Total (persons)	Ratio (%)
1.	Agriculture	47,900	51.8
2.	Mining and Quarry	2,668	2.9
3.	Industry	5,120	5.5
4.	Electric and Gas, Water	67	--
5.	Construction	2,460	2.7
6.	Trade	12,578	13.6
7.	Communications	2,284	2.5
8.	Finance	201	0.2
9.	Service	17,870	19.3
10	Others	1,397	1.5
	Total	92,545	100.0

Source : Kabupaten Buol Toli Toli dalam Angka 1995.

3) Transmigration

Table 11-2-9 shows the number of transmigrants in Kabupaten Buol Toli Toli, classified by Kecamatan, up to the Pelita V. In general, economic activities of transmigrants are food crops and plantation.

Table 11-2-9 Transmigration in Kabupaten Buol Toli Toli

Location	General		Self-motivated		Total	
	House H.	Person	House H.	Person	House H.	Person
Kecamatan Baolan						
1. Basi Dondo I	337	1534	--	--	337	1534
2. Basi Dondo V	355	1542	--	--	355	1542
3. Despot Janja	--	--	250	575	250	575
4. Despot Salusu P	--	--	100	374	100	374
5. Despot Silodow	--	--	100	333	100	333
Kecamatan Dondo						
1. Basi Dondo II	386	1563	--	--	386	1563
2. Basi Dondo III	200	798	--	--	200	798
3. Basi Dondo IV	260	837	--	--	260	837
4. Despot Buga	75	269	150	575	225	844
Kec. Momunu						
1. Puji Mulyo	56	272	--	--	56	272
2. Diat Momunu II	343	1437	--	--	343	1437
3. Diat Momunu III	350	1346	--	--	350	1346
4. Diat Momunu IV	300	1191	--	--	300	1191
5. UPT Despot P	--	--	100	350	100	350
6. Diat Momunu V	348	1355	--	--	348	1355
Kec. Bokat						
1. Bokat I sp.I	300	1360	--	--	300	1360
2. Despot Poongan	--	--	100	350	100	350
3. Bokat I sp.II	200	768	--	--	200	768
4. Bokat III	300	1181	--	--	300	1181

Source : Kantor Dep. Transmigrasi dan PPH Kabupaten Buol Toli Toli

4) Tourism

Tourism area in Kabupaten Buol Toli Toli; there were some recreational objects, such as Suaka Margasatwa (Wildlife Preserve), Cagar Alam (Nature Sanctuary), seashore, island, waterfall, etc. Table 11-2-10 shows tourism area located in Kabupaten Buol Toli Toli and its locations.

Table 11-2-10 Tourism Area in Kabupaten Buol Toli Toli

No	Tourism Area	Kecamatan	Desa
1	Suaka Margasatwa P. Dolangan	Toli Toli Utara	Dolangan
2	Suaka Margasatwa Pinjan/Tanjung Masap	Toli Toli Utara	Dolangan
3	Cagar Alam Gunung Doka	Baolan/Galang	Kalangkangan
4	Cagar Alam Gunung Sojol	Dampal Selatan	Kombo
5	Pantai Batu Bangsa	Galang	Lalos
6	Pulau Lutungan	Baolan	Nalu
7	Pulau Tumpangan	Baolan	Nalu
8	Pulau Koko	Dampal Utara	Ogotua
9	Pemandian Alam Pekasalo	Dampal Selatan	Soni
10	Pemandian air jatuh	Biau	Leok
11	Pemandian Kulango	Mamunu	Kulango
12	Tanjung Bajugan	Galang	Bajugan
13	Air jatuh Seladan	Baolan	Selatan
14	Air Terjun Puse	Dampal Selatan	Bangkir
15	Air Terjun Tolakan	Paleleh	Bodi
16	Air Panas Sajae	Dampal Selatan	Soni

Source : Kabupaten Buol Toli Toli dalam Angka tahun 1995

(3) Environment 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., lower traffic volume in the study area, no toxic substances produced, no groundwater pumping, etc., significant environmental pollution might not take place by any of the project activities, except noise and vibration during construction stage of the project.

11.2.2 Uekuli – Nuha (Link No. 15), Tompira – Bungku (Link No. 16) and Bungku - Border of Province (Link No. 22)

(1) Natural Environment

1) Meteorology

Central Sulawesi including study area is located in tropical zone. Therefore, rainfall intensity of this region is rather high. There are two seasons in Indonesia; that is, the wet season between December to May and dry season between June to November.

Meteorological data in this region was not available, therefore, for reference, refer to the data in Kendari shown in Section 11.2.4, Table 11-2-22 of this report.

2) Hydrological Situations

<Link No.15>

Link No.15 consists of five road sections; the road sections of Uekuli – Malino, Malino – Tambayoli, Tambayoli – Kolonadale, Kolonadale – Beteleme and Beteleme – Nuha.

In the rainy season, some rivers sometimes flood, while, the high-tide also cause the overflow of the rivers. Characteristics of major rivers located in the study area of Link No.15 are shown in Table 11-2-11.

Table 11-2-11 River Characteristics in the Area of Link No. 15

Road Section	Name of Rivers	Width (m)	River Flow
Ukuli – Malino	(no data available)		
Malino – Tambayoli	S. Karosamora	12	Perennial, flood in rainy season
	S. Sangga	16	Perennial flow
Tambayoli – Kolonadale	S. Tambayori	10	Perennial, flood in rainy season
Kolonadale – Beteleme	(no data available)		
Beteleme – Nuha	S. Karosakini	9	Perennial flow
	S. Karoolehaya	6	Perennial flow
	S. Koro Loa	6	intermittent flow

Source : Site Survey by JICA Study Team

<Link No.16>

Link No.16 consists of three road sections; these are the road sections of Tompira – Latunjaya, Latunjaya – Wasu and Wosu – Bungku.

In the rainy season, some rivers sometimes flood and affect the smooth traffic of these road sections. The high-tide also causes the overflow of the rivers. Characteristics of major rivers located in the study area along link No.16 are shown in Table 11-2-12.

Table 11-2-12 River Characteristics in the Area of Link No. 16

Road Section	Name of Rivers	Width (m)	River Flow
Tompira – Latunjaya	S. Koro Laa	24	Perennial, flood in rainy season
	S. Koro Langkai	8	Perennial flow
	S. Tambalaka	22	Perennial, flood in rainy season
	S. Solonsa	11	Perennial flow
	S. Lengkaya	19	Perennial, flood in rainy season
Latunjaya – Wosu	S. Karupa	14	Perennial, flood in rainy season
	S. Bahu Ambuno	12	Perennial, flood in rainy season
	S. Babo Maburu	6	Perennial flow
	S. Baho Wosu	12	Perennial, flood in rainy season
Wosu – Bungku	S. Bahoerakoreko	13	Perennial, flood in rainy season
	S. Bahoelanona	15	Perennial, flood in rainy season
	S. Bahoeipi	12	Perennial, flood in rainy season

Source : Site Survey by JICA Study Team

<Link No. 22>

Link No.22 consists of three road sections; these are the road sections of Bungku – Bahodopi, Bahodopi - Tongahu and Tongahu – Provincial Boundary.

Babolarangsangi river and Bahodopi river are sometimes influenced by the high-tide and cause the overflow. Characteristics of major rivers located in the study area along link No.22 are shown in Table 11-2-13.

Table 11-2-13 River Characteristics in the Area of Link No. 22

Road Section	Name of Rivers	Width (m)	River Flow
Bungku – Bahodopi	S. Bakolarangsangi	21	Perennial flow, overflowed by high-tide
	S. Bakomosi	9	Perennial flow
	S. Lasiumbatu	14	Perennial flow
	S. Bahokolanga	8	Perennial flow
	S. Bahodopi	16	Perennial flow, overflowed by high-tide
Bahodopi – Tongahu	S. Padabaho	8	Perennial flow
	S. Betebete	5	Perennial flow
Tongahu – Provincial Boudary	(no major rivers exist)		

Source : Site Survey by JICA Study Team

3) Biological Inventory

The project roads are mainly located at the coastal region, except part of link No.15 which paths near the Morowari Extension Nature Reserve. The biological inventory results of link No.15, No.16 and No.22 are shown in Table 11-2-14, Table 11-2-15 and Table 11-2-16, respectively.

Table 11-2-14 Biological Inventory of Link No. 15

Road Section	Length (km)	Biological Inventory
Uekuli – Malino	22	Limited production forest (HPT), Plantation/agriculture area
Malino – Tambayoli	21	Cagar Alam Morowari Extension, Conversion product forest (HPK), Industrial forest (HTI), Plantation area
Tambayoli – Kolonadale	7.8	Cagar Alam Morowari Extension, Plantation/agriculture area
Kolonadale – Beteleme	40	Limited production forest (HPT), Conversion protected forest (HPK), Coastal area
Beteleme – Nuha	38	Industrial forest (HTI), Plantation area
Total	128.8	

Source : Site Survey by JICA Study Team

Table 11-2-15 Biological Inventory of Link No. 16

Road Section	Length (km)	Biological Inventory
Tompira – Latunjaya	32	Limited production forest (HPT), Coastal area
Latunjaya – Wasu	40	Conversion production forest (HPK), Agriculture area, Coastal area
Wasu – Bungku	30	Conversion production forest (HPK), Agriculture area, Coastal area
Total	102	

Source : Site Survey by JICA Study Team

Table 11-2-16 Biological Inventory of Link No. 22

Road Section	Length (km)	Biological Inventory
Bongku – Bahodopi	46	Conversion protected forest (HPK), Agriculture area, Coastal area
Bahodopi – Tangofa	42	Conversion protected forest (HPK), Agriculture area, Coastal area
Tangofa – Provincial Boundary	27	Conversion protected forest (HPK), Agriculture area, Coastal area
Total	115	

Source : Site Survey by JICA Study Team

The forest observed in Kabupaten Poso, including the study area of the both link No.16 and No.22, and its classification are shown in Table 11-2-17.

Table 11-2-17 Forest Classification in Kabupaten Poso

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

Source : Dinas Kehutanan Kabupaten Poso 1996

4) Coastal Area

The study area is mainly located at the coastal area and the biodiversity can be observed in this area. The identified species inhabited at the coastal area are:

- Coral reef: Favia spp, Labophylia spp, Porites spp, Plastygira spp, Azphthera spp, Astreopora, Karang batu (*Scleractina*), Lolak (*Trochus niloticus*), Karang mutiara (*Pinctada spp*), Kimah (*Tridacna*), etc.

- Fish species observed at coral reef: Kuda laut belang (*Hippocampus kuda*), Paling Berbintang (*Echidua nebulosa*), Tambra laut garis biru (*Symphorichthys spilanus*), Ikan belang putih (*Dasyllus trimaculatus*), Ikan karang bendera (*Heniochus acuminatus*), Ikan badut jingga (*Amphiprion ocellaris*), Ikan karang bermata dua (*Coradion melanopus*), Ikan Katak (*Arotron areostaticus*), paling berekor hitam (*Moringua bicolor*), Ikan todak lorek hitam (*Hemirhampus far*), Ikan pipih bentuk lidah (*Tetrasomus gibbosus*), Ikan kakatua merah-lembayung (*Scarope rubroviolaceus*), etc.

- Mangrove: Avicunia alba, Avicenia marina, Avicenia officinalis, Campostenion philippinense, Rhizopora apiculata, Rhizopora mucronata, Sonneratia, etc.

5) **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 species as the occupants of the lowland and highland forest ecosystem which belong to the endemic and protected are as follows;

- Lowland species: Cratoxylon celebicus, Ficus varegata pterospermum calebicus, Vitex quinata, Palm kipas (*Livistoma rotunaifolia*), 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.

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*).

- Insects: Belalang pemakan paku (*Karyndia gracilipes*).

- Mammalia: Musang raksasa (*Macrogalidia musschenbroekii*), Kelelawar pemakan serangga (*Minipteris schreibersii*), Hipposideros diadema, Rhinolopus arcvatus, Megalerma spasma, Babyrousa (*Babyrousa*), Kucing bakau (*Felis spp.*)

6) Conservation Area

Cagar Alam Morowari Extension (Nature Reserve) is located in the study area near link No.15, while no nature reserve is designated in the study area of Link No.16 and No.22.

(2) Social Environment

1) Demography

<Link No. 15 & 16>

The study area is administratively located at Kecamatan Tajo, Kecamatan Mariatas, Kecamatan Petasia and Kecamatan Lembo, Kabupaten Poso. The demographic data of the study area are shown in Table 11-2-18.

Table 11-2-18 Demographic Data of the Study Area (Link No. 15 & 16)

Name of Kecamatan	Number of villages	Population (person)	Number of households
Kecamatan Tajo	24	19,340	3,911
Kecamatan Moriatas	19	10,869	2,369
Kecamatan Petasia	26	24,483	5,421
Kecamatan Lembo	18	15,066	3,334

Source: Kabupaten Poso dalam Angka 1995

<Link No. 22>

The study area is administratively located at Kecamatan Bungku Tengah and Kecamatan Bungku Selatan, Kabupaten Poso. The demographic data of the study area are shown in Table 11-2-19.

Table 11-2-19 Demographic Data of the Study Area (Link No. 22)

Name of Kecamatan	Number of villages	Population (person)	Number of households
Kecamatan Bungku Tengah	52	38,835	8,109
Kecamatan Bungku Selatan	38	20,107	4,409

Source: Kabupaten Poso dalam Angka 1995

2) Economic Activities

Working population classified by the economic activities in the region of Kabupaten Poso is shown in Table 11-2-20. Major economic activity in this region is the agriculture sector. While, agriculture sector can be classified in five activities, that is; food crops, plantation, forestry, cattle breeding and fishery.

Table 11-2-20 Classification of Economic Activities in Kabupaten Poso

No	Type of Job	Kabupaten Poso	
		Person	%
1	Agriculture	125,418	69.9
2	Industry	5,653	3.2
3	Mining and quarry	1,058	0.6
4	Construction	3,410	1.9
5	Trade	15,345	8.6
6	Communication	2,063	1.2
7	Finance	--	--
8	Service	23,708	13.2
9	Others	1,776	1.8
Total		179,477	100.0

Source: Kabupaten Poso dalam Angka 1995

3) Transmigration

Then number of transmigrants relocated in Kabupaten Poso since 1990/1991 - 1994/1995 is 6,091 households (equivalent to 22,968 people). Transmigrants have been derived 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) were relocated in this region. Table 11-2-21 shows the location of transmigrants and their household numbers.

Table 11-2-21 Transmigration in Kabupaten Poso

Kecamatan	Location of Transmigration	Number of Households
Kecamatan Petasia	UPT Malino I	600
	UPT Malino II	600
	UPT Tiu	400
	UPT Malino III	800
	UPT Bau	350
	UPT Tompira	390
	UPT Mohoni	576
	UPT Keuno	700
Kecamatan Bungku Tengah	UPT Ambbuno (PIR Trans III)	418
	UPT Bahometefe I	500
	UPT Bahometefa II	500
	UPT Solansa (PIR Trans II)	600
Kecamatan Bungku Selatan	UPT Bahodopi I	774
	UPT Bahodopi II	308
	UPT Labota	500
	UPT Lele	300

Source: Kantor Departmen Transumigrasi dan PPH Kabupaten Poso

4) Tourism

The development of tourism in the study area is rather weak compared with other areas such as Bunaken, Toraja, Bali, etc., because of less transportation facilities (accessibility), less accommodation facilities and less professionals and investors in 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., lower traffic volume in the study area, no toxic substances produced, no groundwater pumping, etc., significant environmental pollution might not take place by any of the project activities, except noise and vibration during construction stage of the project.

11.2.3 Pohara - Asera (Link No. 32) and Asera – Border of Province (Link No. 33)

(1) Natural Environment

1) Meteorology

Southeast Sulawesi, including study area is located in tropical zone, therefore rainfall intensity of this region is rather high. Two seasons; the wet season between December to May and dry season between June to November, are clearly observed in this region.

The monthly rainfall data between year 1990 to 1994, taken from Meteorological Station in Kendari Airport are shown in Table 11-2-22.

Table 11-2-22 Monthly Rainfall

Year	Monthly Rainfall (mm)												Total (mm)
	1	2	3	4	5	6	7	8	9	10	11	12	
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	1,737
Average	352	178	283	254	282	143	84	22	27	26	57	229	1,937

Source : Meteorological Station in Kendari Airport 1995

2) Hydrological Situations

<Link No.32>

Link No.32 consists of three road sections; these are the road sections of Pohara -- Matababu, Matababu – Tinobu and Tinobu – Asera.

Pohara-Matababu road section is located at the catchment area of Konawe Eho and Aala Muna river. In the rainy season, Konawe Eho river sometimes floods and affects the smooth traffic of this road section. Characteristics of rivers located in the study area along link No.32 are shown in Table 11-2-23.

Table 11-2-23 River Characteristics in the Area of Link No. 32

Road Section	Name of Rivers	Width (m)	River Flow
Pohara – Matababu	S. Konawe Eho	28	Perennial, flood in rainy season
	S. Ambaku	7	Perennial flow
	S. Kambu Kambu	6	Perennial/intermittent flow
Matababu – Tinobu	S. Kakapi	8	Perennial flow
	S. Andolia	6	Perennial/intermittent flow
Tinobu – Asera	S. Aala Solo	16	Perennial flow
	S. Aala Amolami	7	Perennial flow
	S. Anggomate	9	Perennial flow
	S. Aala Monapa	5	Perennial/intermittent flow
	S. Aala Bowiyu	11	Perennial flow

Source: Site Survey by JICA Study Team

<Link No. 33>

Link No.33 consists of two road sections; these are the road section of Asera – Kuratao and Kuratao – Provincial Boundary.

Sub-streams of Alala Lindu river cross the road section of Kuratao - Provincial Boundary in several places, the width of river crossing points are between 10-14 meters. Alala Lindu river sometimes overflowed in the rainy season. Characteristics of rivers located in the study area along link No.33 are shown in Table 11-2-24.

Table 11-2-24 River Characteristics in the Area of Link No. 33

Road Section	Name of Rivers	Width (m)	River Flow
Asera – Kuratao	S. Alala Lindu	---	Intermittent flow, flood in rainy season
Kuratao – Provincial Boundary	S. Alala Lindu (sub-stream)	10 – 14	Perennial flow
	S. Tanggu Napa	---	---

Source: Site Survey by JICA Study Team

3) Biological Inventory

The forest designated as protected forest and the nature reserve named Cagar Alam Lasoro Sampana is located in the study area of Link No.32. Protected forest is located in the study area of link No.33.

The biological inventory results of link No.32 and No.33 are shown in Table 11-2-25 and Table 11-2-26, respectively.

Table 11-2-25 Biological Inventory of Link No. 32

Road Section	Length (km)	Biological Inventory
Pohara – Matababu	28.4	Protected forest (HL), Production forest (HP) Agriculture area, Coastal area
Matababu – Tinobu	24.3	Protected forest (HL), Production forest (HP) Agriculture area, Coastal area
Tinobu – Asera	28.7	Protected forest (HL), Limited production forest (HPT), Production forest (HP), Agriculture area Cagar Alam Lasoro Sampana (Nature reserve)
Total	81.4	

Source: Site Survey by JICA Study Team

Table 11-2-26 Biological Inventory of Link No. 33

Road Section	Length (km)	Biological Inventory
Asera – Kuratao	40	Protected forest (HL), Limited production forest (HPT)
Kuratao – Provincial Boundary	36	Production forest (HP), Agricultural area
Total	76	

Source: Site Survey by JICA Study Team

The forest observed in Kabupaten Kendari, including the study area along the both link No.32 and No.33, and its classification are shown in Table 11-2-27.

Table 11-2-27 Forest Classification in Kabupaten Kendari

No	Forest Classification	Area (ha)	Ratio (%)
1	Production forest	577,666	44.9
2	Industry forest	441,100	34.3
3	Ordinary production forest	47,000	3.7
4	Nature sanctuary forest	10,797	0.1
5	Nature Conservation Rawa Aopa & Watumokai	72,023	5.6
6	Recreation forest	50,000	3.9
Total		1,287,486	100.0

Source: Dinas Kehutanan Kabupaten Kendari 1996

4) Coastal Area

The study area along link No.32 is mainly located at the coastal area and the biodiversity can be observed in this area. The identified species inhabited at the coastal area are:

- Coral reef: Favia spp, Labophylia spp, Porites spp, Plastygira spp, Azphthera spp, Astreopora, Karang batu (*Scleractina*), Lolak (*Trochus niloticus*), Karang mutiara (*Pinctada spp*), Kimah (*Tridacna*), etc.

- Fish species observed at coral reef: Kuda laut belang (*Hippocampus kuda*), Paling Berbintang (*Echidua nebulosa*), Tambra laut garis biru (*Symphorichthys spilanus*), Ikan belang putih (*Dasyllus trimaculatus*), Ikan karang bendera (*Heniochus acuminatus*), Ikan badut jingga (*Amphiprion ocellaris*), Ikan karang bermata dua (*Coradion melanopus*), Ikan Katak (*Arotron areostaticus*), paling berekor hitam (*Moringua bicolor*), Ikan todak lorek hitam (*Hemirhampus far*), Ikan pipih bentuk lidah (*Tetrasomus gibbosus*), Ikan kakatua merah-lembayung (*Scarope rubroviolaceus*), etc.

- Mangrove: Avicunia alba, Avicenia marina, Avicenia officinalis, Campostenion philippinense, Rhizopora apiculata, Rhizopora mucronata, Sonneratia, etc.

5) 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 species as the occupants of the lowland and highland forest ecosystem which belong to the endemic and protected flora are as follows;

- Lowland species: Cratoxylon celebicus, Ficus varegata pterospermum calebicus, Vitex quinata, Palm kipas (*Livistona rotunaifolia*), 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.

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*).

- Mammalia: Anoa (*Bubalus guarlesi*), Musang raksasa (*Macrogalidia musschenbroekii*), Kelelawar pemakan serangga (*Minipteris 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*).

6) Conservation Area

Cagar Alam Lasoro Sampana (Nature Reserve) is located in the study area of link No.32. No nature reserves is designated in the study area of link No.33.

(2) Social Environment

1) Demography

<Link No. 32>

The study area is administratively located at Kecamatan Asera, Kecamatan Lasoro and Kecamatan Sampara, Kabupaten Kendari, with its capital in Kendari. The demographic data of the study area is shown in Table 11-2-28.

Table 11-2-28 Demographic Data of the Study Area (Link No. 32)

Name of Kecamatan	Area (km^2)	Number of villages	Population (person)	Household	Pop. Density (person/km^2)
Asera	6,105	18	16,338	3,460	2
Lasolo	2,315	22	19,049	3,967	8
Sampara	1,095	22	21,244	4,187	19

Source: Kabupaten Kendari dalam Angka 1995

In Lemobajo village, Kecamatan Lasolo, *Bajo* ethnic group is inhabited. They build wooden houses above the sea along the seashore, fishing and gathering are their main source of sustenance. No reliable data regarding to their total population has been obtained.

<Link No. 33>

The study area is administratively located at Kecamatan Asera, Kabupaten Kendari. There are no cities along the project road, while some small villages and transmigration sites are located with population of approx. 300 to 2,000 people.

2) Economic Activities

Working population classified by the economic activities in the region of Kabupaten Kendari is shown in Table 11-2-29. Major economic activity in this region is the agriculture sector. Agriculture sector can be classified into five activities, these are food crops, plantation, forestry, cattle breeding and fishery.

Table 11-2-29 Classification of Economic Activities in Kabupaten Kendari

No	Type of Job	Kec. Sampara		Kec. Lasolo		Kec. Asera	
		Person	%	Person	%	person	%
1	Agriculture	2,427	58.0	8,078	88.5	4,871	53.3
2	Industry	232	5.5	106	1.2	--	--
3	Mining	37	0.9	--	--	--	--
4	Construction	1	0.02	39	0.4	35	0.4
5	Trade	323	7.7	217	2.4	182	2.0
6	Transportation	44	1.1	15	0.2	124	1.4
7	PNS/ABRI	418	10.0	510	5.6	440	4.8
8	Finance	279	6.6	71	0.8	119	1.3
9	Service	419	10.0	--	--	--	--
10	Others	10	0.2	92	1.0	3,386	37.1
Total		4,187	100.0	9,128	100.0	9,137	100.0

Source: PDRB Kabupaten Kendari in 1995

3) Transmigration

General description regarding to the transmigration of the study area has already been described in section 5.2.3 of this report, therefore, in this section transmigration in Kabupaten Kendari is reported briefly.

The number of transmigrants relocated in Kabupaten Kendari since 1979/1980 - 1995/1996 is 24,001 households (equivalent to 100,551 people). Transmigrants have been derived 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 relocated in this region.

4) Tourism

The tourism spots in the study area are Wawolosea and Toreo for the hot spring water, Pemandangan Pantai Tanjung Taipa for the seashore recreation and the habitat of Maleo bird and Batu Gong Taipa for the handicraft of the traditional boats.

However, the development of tourism in the study area are rather weak compared with other

areas such as Bunaken, Toraja, Bali, etc., because of less transportation facilities (accessibility), less accommodation facilities and less professionals and investors in 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., lower traffic volume in the study area, no toxic substances produced, no groundwater pumping, etc., significant environmental pollution might not take place by any of the project activities, except noise and vibration during construction stage of the project.

11.2.4 Barru – Kasipute (Link No. 31)

(1) Natural Environment

1) Meteorology

The study area is located in tropical zone, therefore rainfall intensity of this area is rather high. The monthly rainfall data in the last four years taken from Lanuda Wolter Monginsidi Meteorological Station is shown in Table 11-2-30.

Table 11-2-30 Monthly Rainfall in Kolaka

Year	Monthly Rainfall (mm)												Total (mm)
	1	2	3	4	5	6	7	8	9	10	11	12	
1993	354	336	230	324	229	410	132	46	80	320	325	152	2,938
1994	135	154	510	320	405	120	57	47	0	22	66	463	2,299
1995	91	474	359	278	277	391	260	179	46	79	211	89	2,734
1996	115	239	220	194	197	256	246	264	22	211	199	231	2,394
Average	174	301	330	279	277	294	174	134	37	158	200	234	2,591

Source : Lanuda Wolter Monginsidi Station

2) Topography

The project road is located mainly along the seashores which is Bone sea in the west and south. Topographic feature of the study area is characterized flat and hilly in average, while some part of the road is situated at steep slopes with more than 25% of gradient.

Table 11-2-31 shows the topographic features in focus to the location of the hilly/sloping sections of the project road.

Table 11-2-31 Topographic Features (hilly/sloping Section) of Link No. 31

Road Section	Road Length (km)	Topographic Features		
		8-15% (Wavy)	16-25% (Undulated)	> 25% (Hilly)
Kolaka-Matabondu	19	---	---	---
Matabondu-Tondowolio	51	---	---	---
Tondowolio-Ewolangka	--	---	---	---
Ewolangka-Teppoe	54	---	---	---
Teppoe-Pangkuri	39	---	Longori	Ds. Pusuea
Pangkuri-Kasipute	22	---	Ds. Ladumpi	---

Source: Site Survey by JICA Study Team

3) Geology

The study area is divided into three geo-morphological units; namely alluvial plain, coastal area and undulated hills.

The alluvial plain dominated by Alluvium formation (Qa), is located along Poleang river and other river banks. The coastal zone dominated by Buarra formation (Ql) which is characterized by coral reef, conglomerate and sandstone, is located on the south-western side of the study area. The undulated hills characterized by irregular relief formations, are located southern part of the study area.

4) Hydrological Situations

Characteristics of major rivers and streams located in the study area are shown in the Tale 11-2-32.

Table 11-2-32 River Characteristics in the Area of Link No. 31

No.	Names of Rivers	Location	Length (km)	Area (km^2)
1	S. Kolaka	Kota Kolaka	5,0	21,3
2	S. Balandete	Ds. Balandete	4,5	39,8
3	S. Sabilambo	Ds. Lakondole	8,0	47,5
4	S. Wunduloko	Kota Kowioha	9,0	17,4
5	S. Tikonu	Kota Kowioha	8,0	11,2
6	S. Mekongga	Ds. Modal	8,5	33,2
7	S. Hukohuko	Ds. Palosilae	7,2	49,4
8	S. Okooko	Ds. Okooko	20,0	112,5
9	S. Anaiwai	Ds. Pasirputih	0,4	0,5
10	S. Papalia	Ds. Oneha	2,1	13,2
11	S. Wolulu	Ds. Wolulu	31,0	127,2
12	S. Peoha	Ds. Watubangga	n.a	n.a
13	S. Toari	Ds. Toari Buton	3,5	62,5
14	S. Duhung-duhung	Ds. Matabundu	1	2,7
15	S. Timbala	Ds. Timbala	0,8	1,2
16	S. Paria	Ds. Mulaeno	4,5	24,6
17	S. Poleang	Ds. Teppoe	n.a	n.a
18	S. Bambaea	Kota Bambaca	7,1	45,1
19	S. lora	Ds. Poo	n.a.	n.a.
20	S. Rarompana	Ds. Saeyo	n.a.	n.a.

Source: Directorate General of Water Resources Development

5) Coastal Area

In some part of the project road along the seashore, a lot of mangrove trees in the form of mangrove forest can be observed. The project road sections which path along the coastal area are shown in Table 11-2-33.

Table 11-2-33 Project Road Sections path along the Coastal Area (Link No. 31)

Road Section	Project Road Sections path through the Coastal Area
Barru – Matabondu	---
Matabondu – Tondowalio	Dawi-Dawi village - Lomboato sub-village Lampedai sub-village - Tondowalio sub-village
Tondowalio – Ewolangko	Tondowalio sub-village to Wolinde sub-village (mangrove) Tondobaru sub-village, Watubangga village, Matabondu sub-village,Timbala sub-village
Ewolangko – Teppoe	All links with mangrove (except Wacamputang sub-village - Pesa Teppoe)
Teppoe – Pangkuni – Kasipute	Kasipute village

Source: Site Survey by JICA Study Team

6) Flora and Fauna

a. Flora

Species of flora existing in the study area are: Apu (*Gironier zubaequalis* Planch), Rambutan hutan (*Nephellium sp.*), Kolaka (*Pasinari corimbora*), Eha (*Castanopsis buruana* Miq.), Aren (*Arenga pinnata*), Belatung (*Nephelium lappaceum*), Bintangor (*Calophylum soukatri* Burm F.), Copeng-Copeng (*Tricalysia sp.*), Dama-Dama putih (*Satria laevigata* Bl), Cela dara (*Horsfielda sp.*), Hialuh/Morobite (*Drypetes longopoila*), Jambu (*Kokoona ochracea* Elm. Merr), Marduria (*Aglaia sp.*), Pangindehu (*Rapanea sp.*), Pondo (*Litsea odorifera* Val), and Satu lambu (*Sandoricum bomeense*). No protected flora can be observed in the study area..

b. Fauna

Species of fauna existing in the study area are: Kadal (*Mabuya multifasiata*), bunglon (*Draco volana*), biawak (*Varanus sp*), ular hijau (*Dryophis prasinus*), ular cobra (*Phyton malans*), katak (*Rana sp*), Musang (*Paradoxulurus hermaprodit*), tikus hutan (*Ratus sp*), kera abu-abu (*Macaca fascicularis*), babi hutan (*Sus vitattus*), Pipit (*Lonchura sp*), elang hitam (*Spizaetus chirrahatus*), perkutut (*Geopillia striata*), gereja (*Passer montanus*), layang-layang (*Hilunda rustica*) and tekukur (*Streptopella chinensis*). Among them, protected fauna are Elang hitam (*Spizaetus chirrahatus*) and perkutut (*Geopillia striata*).

7) Conservation Area

Cagar Alam Napa Melano (nature reserve) characterized as the lowland forest with specific species, is located in the study area.

In Kabupaten Kolaka, 790,169 hectares of forest are distributed. Among them, 17,667 hectares of forest are designated as Hutan Suaka Alam (forest reserve) and Hutan Wisata (forest recreation area). In Kabupaten Buton, 413,990 hectares of forest exist and 121,471 hectares of them are designated as forest reserve and forest recreation area.

(2) Social Environment

1) Demography

The study area is administratively located at two Kabupaten, Dati II Kabupaten Kolaka and Dati II Kabupaten Buton. Population of the study area in 1996 is shown in Table 11-2-34.

Table 11-2-34 Population in the Study Area (Link No. 31)

Kabupaten	Kecamatan	Population
Dati II Kabupaten Kolaka	Kecamatan Kolaka	36,131
	Kecamatan Poleang	21,767
Dati II Kabupaten Buton	Kecamatan Wundulako	19,708
	Kecamatan Poleang Timur	17,668

Source: Kecamatan Dalam Angka Kolaka, Poleang dan Poleang Timur 1995

2) Economic Activities

Major economic activity in this region, Kabupaten Kolaka and Buton is agriculture sector which consists of food crops, plantation, forestry, cattle feeding and fishery. In Kabupaten Kolaka, 69% of working population are engaged in agriculture sector, while in Kabupaten Buton, 48% are engaged.

3) Transmigration

Table 11-2-35 shows the number of transmigrants in Kabupaten Kolaka and Buton, classified by Kecamatan up to the Pelita V. In general, economic activities of transmigrants are food crops and plantation.

Table 11-2-35 Transmigration in Kabupaten Kolaka and Buton

Kabupaten/Kecamatan	Desa	Location of Transmigration
Kecamatan Wundulako (Kabupaten Kolaka)	D. Baula	Towuai I
	D. Tangkeda	Pewisoajaya, Tenggeda
	D. Anawoi	Wawoli, Tendebura, Peoho, Kukutio, Polinggona, Tanggeau I, II, Pundangi, Ranomentaa
Kecamatan Poleang and PoleangTimur (Kabupaten Buton)	D. Teppoe	Tampa Wulu, Tana Poleang
	D. Larote	Larote

Source: Kantor Departmen Transmigrasi dan PPH Kabupaten Kolaka dan Buton

4) Tourism

Tourism points located in the study area are as follows (all points are located at Kecamatan Wundulako, Kabupaten Kolaka):

- Cagar Alam Napa Nelano : Nature reserve
- Pantai Watubangga : Beach recreation
- Pantai Tangketada : Beach recreation
- Wisata perburuan : Game hunting park / Integrated recreational park

(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., lower traffic volume in the study area, no toxic substances produced, no groundwater pumping, etc., significant environmental pollution might not take place by any of the project activities, except noise and vibration during construction stage of the project.

11.3 Environmental Considerations for EIA Study

11.3.1 Scoping Assessment

Taking into consideration the results of Initial Environmental Examination (IEE) carried out in the master-plan (M/P) study stage and environmental site survey carried out in this pre-feasibility study (Pre-F/S) stage which described in Section 11.2 of this report, scoping assessment was carried out for each road link of Pre-F/S area.

The environmental items/factors are those specified in JICA Environmental Guidelines for Road Engineering, as shown in the following tables of this article. Four kinds of marks; A, B, C and D are used to identify the extent of impact on each environmental factor according to an analysis of environmental condition at the project site. As a result, *some impact* is predicted on 10 environmental factors (5 from the social environment, 4 from natural environment and 1 from environmental pollution) and *unknown impact* is anticipated on three environmental factors.

The results of scoping assessment of the study area are surmised in Table 11-3-1 and the scoping results of each road link are shown in Table 11-3-2 to Table 11-3-9 in the following manner;

Table No.	Road Links
Table 11-3-2	Link No. 4 : Toli Toli – Buol
Table 11-3-3	Link No. 5 : Buol – Umu
Table 11-3-4	Link No. 15 : Uekuni – Nuha
Table 11-3-5	Link No. 16 : Tompira – Bungku
Table 11-3-6	Link No. 22 : Bungku – Border of Province
Table 11-3-7	Link No. 32 : Pohara – Asera
Table 11-3-8	Link No. 33 : Asera – Border of Province
Table 11-3-9	Link No. 31 : Barru – Kasipute

Table 11-3-1 Summary of Scoping Results

No	Environmental Item/Factor	Link No.4	Link No.5	Link No.15	Link No.16	Link No.22	Link No.32	Link No.33	Link No.31	Overall Evaluation
A. Social Environment										
1.	Resettlement	B	B	C	B	C	B	C	B	(1) B
2.	Economic Activities	B	B	B	B	B	B	B	B	B
3.	Traffic/Public Facilities	D	D	D	D	D	D	D	D	D
4.	Split of Communities	D	D	D	D	D	D	D	D	D
5.	Cultural Property	D	D	D	D	D	D	D	D	D
6.	Water Rights and Rights of Common	B	C	B	C	C	B	C	C	B
7.	Public Health Condition	D	D	D	D	D	D	D	D	D
8.	Waste	B	B	B	D	B	D	D	D	B
9.	Hazards (Risk)	B	B	A	C	B	C	B	C	B
B. Natural Environment										
1.	Topography and Geology	D	D	B	D	C	D	D	D	(2) C
2.	Soil Erosion	B	B	B	D	B	D	D	D	B
3.	Groundwater	D	D	C	D	C	D	D	D	C
4.	Hydrological Situation	B	B	B	B	B	B	B	B	B
5.	Coastal Zone	B	B	B	B	B	B	D	B	B
6.	Fauna and Flora	B	B	B	B	B	B	B	B	B
7.	Meteorology	D	D	D	D	D	D	D	D	D
8.	Landscape	C	D	B	D	D	D	D	D	C
C. Pollution										
1.	Air Pollution	D	D	D	D	D	D	D	D	(3) D
2.	Water Pollution	D	D	D	D	D	D	D	D	D
3.	Soil Contamination	D	D	D	D	D	D	D	D	D
4.	Noise and Vibration	B	B	B	B	B	B	B	B	B
5.	Land Subsidence	D	D	D	D	D	D	D	D	D
6.	Offensive Odor	D	D	D	D	D	D	D	D	D

Source: "JICA Environmental Guidelines"

Note : Evaluation categories:

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

Table 11-3-2 Scoping Result for Toli Toli – Buol (Link No. 4)

No	Environmental Item/Factor	Evalu-ation	Reasons
A. Social Environment			
1.	Resettlement	B	Resettlement will be taken into consideration due to improvement of existing roads
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	B	Nature conservation area and forest protection area exist in the study area
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	B	Some amount of surplus soil by cutting work will be produced
9.	Hazards (Risk)	B	Some part of project road is located in hilly area and seashore cliff area, therefore a potentially hazardous area, especially landslides and/or cave-in. Also, flood is predicted in some area
B. Natural Environment			
1.	Topography and Geology	D	No large scale topographic change will be carried out in the project
2.	Soil Erosion	B	Soil erosion may occur during construction stage, due to earth works, etc., mainly in hilly and seashore cliff area
3.	Groundwater	D	Large scale excavation will not be carried out in the project
4.	Hydrological Situation	B	Some impacts on river flow are anticipated by bridge construction
5.	Coastal Zone	B	Project roads in the study area mainly pass through the coastal zone
6.	Fauna and Flora	B	Protected/Endemic fauna and flora exist in the study area Nature reserve and forest reserves exist in the study area
7.	Meteorology	D	No meteorological impacts are predicted by the project
8.	Landscape	C	Cut slopes in the seashore cliff area will cause some impacts
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 will not be 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 will be 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 impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
D: No impact is expected.

Table 11-3-3 Scoping Result for Buol – Umu (Link No. 5)

No	Environmental Item/Factor	Evalu-ation	Reasons
A. Social Environment			
1.	Resettlement	B	Resettlement will be taken into consideration due to improvement of existing roads
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	C	Forest protection areas exist in the study area
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	B	Some amount of surplus soil by cutting work will be produced
9.	Hazards (Risk)	B	Some part of project road is located in seashore cliff area, therefore a potentially hazardous area, especially landslides and cave-in
B. Natural Environment			
1.	Topography and Geology	D	No large scale topographic change will be carried out in the project
2.	Soil Erosion	B	Soil erosion may occur during construction stage, due to earth works, etc., mainly in seashore cliff area
3.	Groundwater	D	Large scale excavation will not be carried out in the project
4.	Hydrological Situation	B	Some impacts on river flow are anticipated by bridge construction
5.	Coastal Zone	B	Project roads in the study area mainly pass through the coastal zone
6.	Fauna and Flora	B	Protected/Endemic fauna 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 will not be 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 will be 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 impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
D: No impact is expected.

Table 11-3-4 Scoping Result for Uekuni -- Nuha (Link No. 15)

No	Environmental Item/Factor	Evalu-ation	Reasons
A. Social Environment			
1.	Resettlement	C	Resettlement will be taken into consideration due to construction of new roads and improvement of existing roads
2.	Economic Activities	B	Project scope is mainly 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	B	Project road path through the nature conservation area Forest protection areas exist in the study area
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	B	Large amount of surplus soil by cutting work will be produced
9.	Hazards (Risk)	A	Some part of project road is located in mountainous area and seashore cliff area, therefore a potentially hazardous area, especially landslides and/or cave-in. Also, flood is predicted in some area
B. Natural Environment			
1.	Topography and Geology	B	Many slopes will be cut to accommodates improvement of existing roads
2.	Soil Erosion	B	Soil erosion may occur during construction stage, due to earth works, cutting of forest, etc., mainly in mountainous area
3.	Groundwater	C	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. Nature reserve and forest reserves exist in the study area
7.	Meteorology	D	No meteorological impacts are predicted
8.	Landscape	B	Cut slopes in mountainous area and seashore cliff area will cause some impacts
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 will not be 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 will be 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 impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
D: No impact is expected.

Table 11-3-5 Scoping Result for Tompira – Bungku (Link No. 16)

No	Environmental Item/Factor	Evalu-ation	Reasons
A. Social Environment			
1.	Resettlement	B	Resettlement will be taken into consideration due to improvement of existing roads
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	C	Forest protection areas exist in the study area
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	D	Large amount of surplus soil by cutting work will not be produced in the project
9.	Hazards (Risk)	C	Flood is predicted in the study area
B. Natural Environment			
1.	Topography and Geology	D	No large scale topographic change will be carried out in the project
2.	Soil Erosion	D	Soil erosion may not occur by the project
3.	Groundwater	D	Large scale excavation will not be 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
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 will not be 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 will be 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 impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
D: No impact is expected.

Table 11-3-6 Scoping Result for Bungku -- Border of Province (Link No. 22)

No	Environmental Item/Factor	Evaluation	Reasons
A. Social Environment			
1.	Resettlement	C	Resettlement will be taken into consideration due to improvement of existing roads
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	C	Forest protection area exist in the study area
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	B	Some amount of surplus soil by cutting work will be produced
9.	Hazards (Risk)	B	Some part of project road is located in the seashore cliff area, therefore a potentially hazardous area, especially landslides and/or cave-in
B. Natural Environment			
1.	Topography and Geology	C	Some slopes will be cut to accommodates improvement of existing roads
2.	Soil Erosion	B	Soil erosion may occur during construction stage, due to earth works, etc., mainly in seashore cliff area
3.	Groundwater	C	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 will not be 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 will be 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 impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
D: No impact is expected.

Table 11-3-7 Scoping Result for Pohara – Asora (Link No. 32)

No	Environmental Item/Factor	Evalu-ation	Reasons
A. Social Environment			
1.	Resettlement	B	Resettlement will be taken into consideration due to improvement of existing roads
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	B	Nature conservation area exist in the study area
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	D	Large amount of surplus soil by cutting work will not be produced in the project
9.	Hazards (Risk)	C	Study area is mainly located in flat/hilly region, therefore possibility of landslides and/or cave-in is low However, flood is predicted in some area
B. Natural Environment			
1.	Topography and Geology	D	No large scale topographic change will be carried out in the project
2.	Soil Erosion	D	Soil erosion may not occur by the project
3.	Groundwater	D	Large scale excavation will not be 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 will not be 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 will be 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 impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
D: No impact is expected.

Table 11-3-8 Scoping Result for Asera -- Border of Province (Link No. 33)

No	Environmental Item/Factor	Evalu-ation	Reasons
A. Social Environment			
1.	Resettlement	C	Resettlement will be taken into consideration due to improvement of existing roads
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	C	Forest protection areas exist in the study area
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	D	Large amount of surplus soil by cutting work will not be produced in the project
9.	Hazards (Risk)	B	Flood is predicted in the study area
B. Natural Environment			
1.	Topography and Geology	D	No large scale topographic change will be carried out in the project
2.	Soil Erosion	D	Soil erosion may not occur by the project
3.	Groundwater	D	Large scale excavation will not be carried out in the project
4.	Hydrological Situation	B	Some impacts on river flow are anticipated by bridge construction
5.	Coastal Zone	D	Project roads does not pass through the coastal zone
6.	Fauna and Flora	B	Protected/Endemic fauna and flora exist in the study area. Forest reserves 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 will not be 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 will be 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 impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
D: No impact is expected.

Table 11-3-9 Scoping Result for Barru – Kasipute (Link No. 31)

No	Environmental Item/Factor	Evalu-ation	Reasons
A. Social Environment			
1.	Resettlement	B	Resettlement will be taken into consideration due to improvement of existing roads
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	C	Nature conservation area and forest protection areas exist in the study area
7.	Public Health Condition	D	No impact on public health conditions
8.	Waste	D	Large amount of surplus soil by cutting work will not be produced
9.	Hazards (Risk)	C	Part of project road is located in hilly region, therefore possibility for landslides is predicted
B. Natural Environment			
1.	Topography and Geology	D	No large scale topographic change will be carried out in the project
2.	Soil Erosion	D	Soil erosion may not occur by the project
3.	Groundwater	D	Large scale excavation will not be carried out in the project
4.	Hydrological Situation	B	Some impacts on river flow are anticipated by bridge construction
5.	Coastal Zone	B	Project roads in the study area mainly pass through the coastal zone
6.	Fauna and Flora	B	Protected/Endemic fauna exist in the study area. Nature reserve and forest reserves 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 will not be 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 will be 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 impact is expected.
B: Some impact is expected.
C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses).
D: No impact is expected.

11.3.2 Environmental Items to be Considered in EIA Study

Based on the evaluation result of scoping assessment described in Article 11.3.1, environmental consideration for the project was carried out for the following environmental items/factors, which are designated as A/B/C in Table 11-3-1. Itemized matters followed by sub-title, stated in Sub-article (1), (2) and (3), were clearly identified and necessary counter-measures taken into consideration, during the project's environmental site survey on the next feasibility study (F/S) stage and Environmental Impact Assessment (EIA/AMDAL) study.

(1) Social Environment

1) Resettlement

- Conditions of the inhabitants and/or minority races (such as Bajau etc.) surrounding the project sites
- Inventory for number of families/households and population required to be relocated from the project sites, quality of housing, religious status, occupation, income level, living standard, etc., including minority races (such as *Bajau*, etc.)
- Public facilities, if any, needed to be relocated from the project area. Evaluation of value and estimation of scale of influence on the related area
- Experience of resettlement and/or compensation in previous project, and the resettlement plan/idea which will be carried out by authorities concerned

2) Economic Activities

- Inventory of regional economic activities, such as agriculture, forest production, fisheries, etc.
- Characteristics of the transmigration, in view of the number of migrants in each location, religion, tribe, origins of the migrants, their main jobs, their activities related to environmental conservation, etc.
- Inventory of forest squatters, illegal settlement and cultivation
- Inventory of Pari Wisata (parks and/or recreation area including potential sites)

3) Water Rights and Rights of Common

- Location/distribution of national parks, nature conservation areas, forest reserves, etc., in the study area
- Domestic, agricultural and industrial uses of river/lake/spring/sea water.
- Existence of common land and its location (Special attention should be paid to old communities likely to have common forests or land.)

4) Waste Disposal

- Estimate the amount of solid waste, especially surplus soil produced by the project activities; such as slope-cutting works, and tunnel construction, etc.
- Plan of treatment and/or final disposal of such waste by the project

5) Hazards/Risk

- History of natural hazard/disaster, scale and its location in the study area such as landslides, high tidal waves, earthquakes and floods
- Potentially hazardous area in the study area concerning landslides, high tidal waves, earthquakes and floods
- Countermeasures for such natural hazards

(2) Natural Environment

1) Topography and Geology

- Topographic and geographic characteristics at the project site, related to natural hazards
- Meteorological data especially rainfall

2) Soil Erosion

- Investigation of soil texture of the project site, and the possible/predicted area of soil erosion
- Examination of the possibility of soil erosion by the project acivities

3) Groundwater

- Groundwater used by the people around the tunnel construction site
- Relationship between groundwater flow and tunnel construction

4) Hydrological Situation

- The following hydrological conditions: hydrology in terms of flow pattern, capacity of volume; existing drainage system of surface water; river and channel use which may be used for drainage; and river system and river usage
- Impacts on the river flow in case the construction of the bridge, etc., in the river
- River flow in case of the flood and high tide
- Possible/predicted area for the impacts on the river flow

5) Coastal Zone

- Examination of impact on the coastal environment; such as mangrove forest, coral reefs, etc., especially the earth flow and soil sedimentation by the river water running off into the coastal area during the project construction stage
- Identification of the possible/predicted area for impact on the coastal zone

6) Fauna and Flora

- Inventory of protected/endemic flora and fauna in the study area
- Location, classification and name of nature conservation areas, forest reserves, etc. and situational relation with project road links

7) Landscape

- Examination of impact on the natural, historical and cultural landscape by the road structure (especially in case the project road path through inside the nature reserves, etc.)

(3) Environmental Pollution

1) Noise and Vibration

- Noise and vibration caused by road construction with equipment, mainly during construction stage, shall be considered
- Inventory of houses, school, religious places, etc. located along the project road

2) Other Environmental Pollution Elements

Regarding the other environmental pollution elements; i.e. air and water pollution, soil contamination, land subsidence and offensive odor, no significant negative impact is anticipated from any of the project activities, taking into consideration of contents of the Project and its scale; i.e. lower traffic volume in the study area, no toxic substances produced, no groundwater pumping, etc. Therefore, these elements was not considered in the environmental impact assessment conducted for the project.

Chapter 12

Construction Planning and Estimation for Pre-Feasibility

Chapter 12 CONSTRUCTION PLANNING AND COST ESTIMATES

12.1 Precondition of Cost Estimates

12.1.1 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.

12.1.2 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.

12.1.3 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 embanked areas taking account of prevention of road 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 work

The number of tunnel construction is two; 300m long in Uekuuli – Nuha road (Link No.15) and 700 m long in Bungku – provincial border road (Link No.22) with a cross sectional area of 65 - 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) Bridge

Prestressed concrete I-girders of the standard span length of 10, 20 and 30 meters were planned to be produced at a factory near the construction site. PC-I girders will be launched by crane, which simplifies the work procedure. Cast-in-place concrete for slabs and substructure was planned to be carried into the site from the concrete plant.

(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.

(7) Plants

Asphalt and concrete plants were assumed to be installed at the locations as shown in Table 12-1-1.

Table 12-1-1 The Location of Plants for Concrete and Asphalt

No	Link Name	Plant Location
4	Toli Toli – Buol	Buol
5	Buol – Umu	Buol
8	Toboli - Poso	Toboli
15	Uekuuli – Nuha	Marino
16	Tompira – Bungku	Bungku
22	Bungku – Provincial Border	Bungku
31	Barru – Kasipute	Wolulu
32	Asera – Pohara	Asera
33	Asera – Provincial Border	Asera

Source : JICA Study Team

(8) Construction Equipment

Construction equipment was proposed to be carried into the site via Buol, Bungku and Kolaka and Kendari ports.

12.1.4 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).

12.1.5 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.

12.1.6 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.

12.2 Cost Estimates Process

12.2.1 Method

The cost estimates process are shown in Figure 12-2-1. 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.

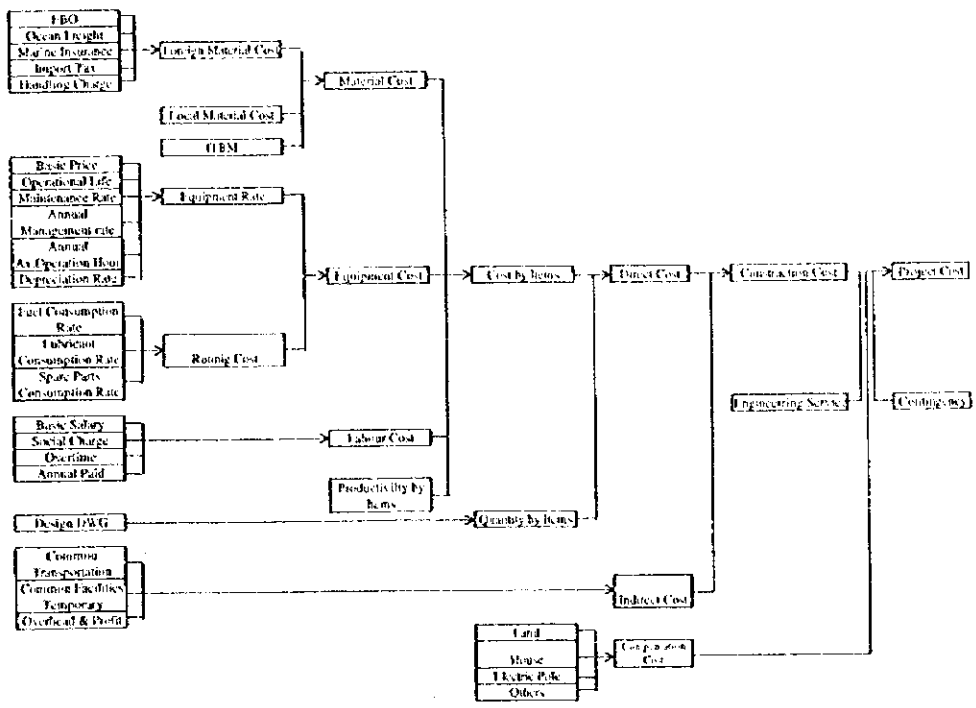

Figure 12-2-1 Cost Estimates Process

Source : JICA Study Team

12.2.2 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 12-2-1 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 : JICA Study Team

12.2.3 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, 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 12-2-2.

Table 12-2-2 Foreign Currency Portion in Raw Material

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	40.0	60.0
Diesel oil	600	l	50.0	50.0
Heavy oil	400	l	40.0	60.0
Electricity	105	kwh	0.0	100.0

Source : Bina Marga in Sulawesi

12.2.4 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 12-2-3 shows result of calculation for equipment cost per hour.

Table 12-2-3 Equipment Cost

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 : JICA Study Team

12.2.5 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 12-2-4.

Table 12-2-4 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	210
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 : JICA Study Team

12.2.6 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.

12.2.7 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.

12.3 Result of Cost Estimates

12.3.1 Cost Items

As the cost estimates of the present stage which suffices to assign investment priority order without determining detailed work conditions and specifications, 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 to cost items for unit price contracting. Plant product and site products 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 concrete of pavement is placed, compacted, finished and curing into surface of concrete pavement, which is a site product. Work item is for example a pavement consisting of site product: 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 through designing, in estimating each cost item.

12.3.2 Estimated Project Cost

The Summary of total construction costs for each road link (Nos. 4, 5, 8, 15, 22, 31, 32, 33) is shown in Table 12-3-1.

Table 12-3-1 Summary of Construction Cost for F/S Link Road

No.	Link Name	Length (km)	Foreign Currency (1000US$)	Local Currency		Total Financial Cost (Mill.Rp)	Total Economic Cost (Mill.Rp)
				Financial Cost (Mill.Rp)	Economic Cost (Mill.Rp)		
4	TOLI TORI-BUOL	174.2	10,969	106,830	97,852	223,100	214,122
5	BUOL-UMU	141.0	9,715	93,693	82,916	196,676	185,899
8	TOBOLI-POSO	146.8	10,528	105,169	96,050	216,763	207,645
15	UEKULI-NUHA	174.0	18,269	168,803	147,131	362,449	340,778
16	TOMPIRA-BUNGKU	103.9	11,703	112,461	98,583	236,511	222,634
22	BUNGKU-PROVINCIAL BORDER	115.0	22,220	198,214	170,551	433,747	406,084
31	BARRU-KASIPUTE	187.9	12,826	123,309	109,270	259,262	245,223
32	POHARA-ASERA	81.4	10,262	98,656	86,876	207,438	195,658
33	ASERA-PROVINCIAL BORDER	76.0	10,582	99,740	85,424	211,912	197,596

Source : JICA Study Team

12.4 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 ditch 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.

Chapter 13

Conclusion and Recommendation of Pre-Feasibility Study

Chapter 13 CONCLUSION AND RECOMMENDATION OF PRE-FEASIBILITY STUDY

13.1 General

The pre-feasibility study for road links with a total length of 1,200.2 km together with its environmental survey were conducted as shown in Chapter 10, Chapter 11, and Chapter 12 and the summary is shown as follows:

- Results of engineering and economic analysis are shown in Table 13-1-1.

Table 13-1-1 Major Findings of Engineering and Economic Analysis

Link No.	Length (km)	Construction Cost (Billion. Rp)	Unit Cost (Mill. Rp/km)	Bridges (m^2)	Slope Protection (m^2)	Tunnel (m)	E.I.R.R. (%)
4	174.2	223.10	1,280.7	2,381	27,808	0	0.0
5	141.0	196.68	1,394.9	5,467	15,107	0	0.0
8	146.8	216.76	1,476.6	1,683	0	0	64.7
15	174.0*	362.45	2,814.0	2,531	147,839	300	28.8
16	103.9	236.51	2,276.3	5,610	0	0	27.3
22	115.0	433.75	3,771.7	6,740	169,886	700	17.5
31	188.0	259.26	1,379.8	4,722	87,150	0	19.0
32	91.7	207.44	2,548.4	2,753	58,486	0	25.8
33	76.0	211.91	2,788.3	1,470	149,401	0	23.5
Total	1210.6	2347.86	2,032.8	33,357	655,677	1,000	-

Source : JICA Study Team

* A section of 128.8 km out of 174.0 km was estimated for the improvement.

- Link Nos. 15, 16, 22, 32 and 33 should be given top priority, considering traffic demand and economic evaluation (EIRR).
- Link Nos. 4, 5 and 31 should be given medium priority, considering the balance of factors, i.e., low traffic demand and low economic evaluation (EIRR),
- Link No. 8 should be given medium priority. It holds high traffic demand and high economic evaluation (EIRR), but was invested for the permanent pavement in 1994.

Further discussion is presented in the following sections.

13.2 Discussion and Conclusion

(1) Discussion

The feasibility study sections should be selected from the pre-feasibility study of about 1,200 km by taking into account seven items; 1) traffic demand, 2) land use of the adjacent area, 3) potential of regional development along roads, 4) road functions, 5) direct effects of improvement, 6) indirect effect of improvement and 7) impact on the environment of each package link.

1) Traffic demand

The traffic demand is high in link Nos. 15, 16, 22, 32 and 33 which form the Trans-Sulawesi East route in the future. In links 4, 5 and 31 the traffic volume is not high as cities on both ends are small in scale.

2) Land use of the adjacent area

Roadside development is in progress to some extent in links 16 and 32. In links 4 and 5, notable mountainous land configuration extends to the shoreline, except in settled areas, and the flat land is scarce. Link Nos. 22 and 33 contain many settlements currently being developed. Finally, in link No. 31, flat lands are distributed over a relatively wide area with area of cultivated land increasing along with progress of settlement.

3) Potential of roadside development

Link Nos.16, 33, 31 and 22 which are mostly flat, have wide flat lands and development through settlement is currently under way.

4) Road functions and hierarchy

Link Nos. 4 and 5 are a corridor for promotion of industries, connecting Toli Toli, Buol and Umu which are collection and distribution centers of regional agricultural products for shipment to North Sulawesi. Link No. 31 is a road connecting wayside villages to South Sulawesi. Link Nos. 15, 16, 22, 33 and 32 are expected to be future important roads to make up the Trans-Sulawesi East route.

5) Indirect effects of development road

The indirect effects will be considerable in link Nos. 16, 33, and 32 where the substantial traffic volume is expected and the construction cost per km is low. Link No. 15 is a route shorter by 30 km than the existing road and the road development will prove highly effective. Many people are migrating from Bangai Island of Central Sulawesi to Bungku and Southeast Sulawesi, and Bungku has a close historical connection with Southeast Sulawesi. When link Nos. 16, 22, 33 and 32 are developed as one package, Bungku and Kendari can be connected with a 300 km route, achieving the long-cherished dream of an integrated regional culture. Three bridges at Asera, Lindo and Landowe, which cross 150 m wide rivers are currently under construction between Bungku and Asera of Southeast Sulawesi. When these bridges are completed, Central Sulawesi can be connected to Southeast Sulawesi with a land route, though the road surface condition is poor. The distance from Bungku to Palu of Central Sulawesi is 600 km and takes two days by car to cover the distance. Apart from a part of province boundary, the adjacent terrain between Kendari and Bungku is rolling hills while the

route to Palu passes through mountainous area. The road structural standard is better in the former case. Improvement of link Nos 16, 22, 33 and 32 as one package will cause change in the physical flow while improving transport of products out of the region considerably, which should lead to expanded production.
Sightseeing areas in Southeast and Central Sulawesi have been under-estimated because of divided land routes, and only a few tourists have taken trouble to visit these areas. Development of links Nos. 16, 22, 33 and 32 as one package will connect sightseeing spots in Southeast and Central Sulawesi, making tourist promotion easier and increasing the number of visitors.

6) Impact on the environment

Since most of the roads already exist, road improvement will not exert much impact on the adjacent natural environment. Besides, there is no planned road within restricted zones, such as existing parks and forestry protection area, etc.
Sightseeing spots are found along the route, but they will not be affected directly by widening of the road.
Traffic volume is not so large as to cause pollution.
Relocation of residents due to the road widening and improvement work is minimized over the road links.

(2) Evaluation and Conclusion

Based on the above discussion, criteria for evaluation was established as shown in Table 13-2-1.

Table 13-2-2 shows the result of counts taken for each of above items. Based on the result, links Nos. 16, 22, 33 and 32 were selected for the feasibility study, considering the following reasons;

- Road link Nos. 16, 22, 33 and 32 of the east route of Central Sulawesi; and Southeast Sulawesi should be improved for continuity between Kendari to Poso. These links should be given priority as, they are part of the Trans-Sulawesi East route.

- Road link No.8 was already invested for the improvement within the past 5 years and has sufficient traffic capacity at present.

- The Tompira-Umpanga section of link 16 is already completely improved and thus excluded from the scope of feasibility study.

- For link 32, the Pohara-Sandangpangan section is currently under improvement and also excluded from the feasibility study.

Table 13-2-1 Criteria for Evaluation

Appraisal Items	Points
1. Traffic demand (heavy vehicles per day)	
a More than 3000	3
b From 200 to 3000	2
c Less than 200	1
2. Existing land use	
a Extremely high	3
b High	2
c Normal	1
3. Development possibilities	
a Extremely high	3
b High	2
c Normal	1
4. Hierarchy of the road network	
a Gross Corridor	3
b Sub-Gross Corridor	2
c Corridor	1
5. Direct effect (EIRR)	
a Extremely high (more than 20010)	3
b High (from 15% up to 20%)	2
c Normal (less than 15%)	1
6. Indirect effect	
a Extremely high	3
b High	2
c Normal	1
7. Environmental assessment	
a No impact	3
b Small impact	2
c Heavy impact	1

(Notes: Weight of points was decided by Study Team for reference)

Table 13-2-2 Evaluation for Pre-Feasibility Links

	Project Package Link No.								
Evaluation Items	4	5	8	15	16	22	31	32	33
1. Traffic Demand	1	1	3	2	2	2	1	2	2
2. Existing Land Use	1	1	3	1	2	1	2	1	1
3. Development of Possibilities	3	3	1	2	3	3	3	3	3
4. Road Hierarchy	2	2	3	3	3	3	2	3	3
5. Direct Effect (EIRR; %)	1 (-)	1 (-)	3 (65)	3 (29)	3 (27)	2 (18)	2 (19)	3 (26)	3 (24)
6. Indirect Effect	3	3	1	3	2	3	2	2	3
7. Environment	3	3	3	2	3	3	3	3	3
Total	14	14	17	16	18	17	15	17	18

Source : JICA Study Team

13.3 Recommendation for Feasibility Study

A road length totaling 300 km out of about 1,200 km road links was recommended for the next step of the Feasibility Study, as shown in Table 13-3-1.

Table 13-3-1 Recommended Road Links for Feasibility Study

Link No.	Link Length (km)	Location	Remarks
16	51	Umpanga – Bungku	Umpanga is located 53 km south of Tompira
22	115	Bungku - Border of Province	
33	76	Border of Province – Asera	
32	58	Asera – Sandangpangan	Sandangpangan is located 24 km north of Pohara
Total	300	-	-

Source : JICA Study Team

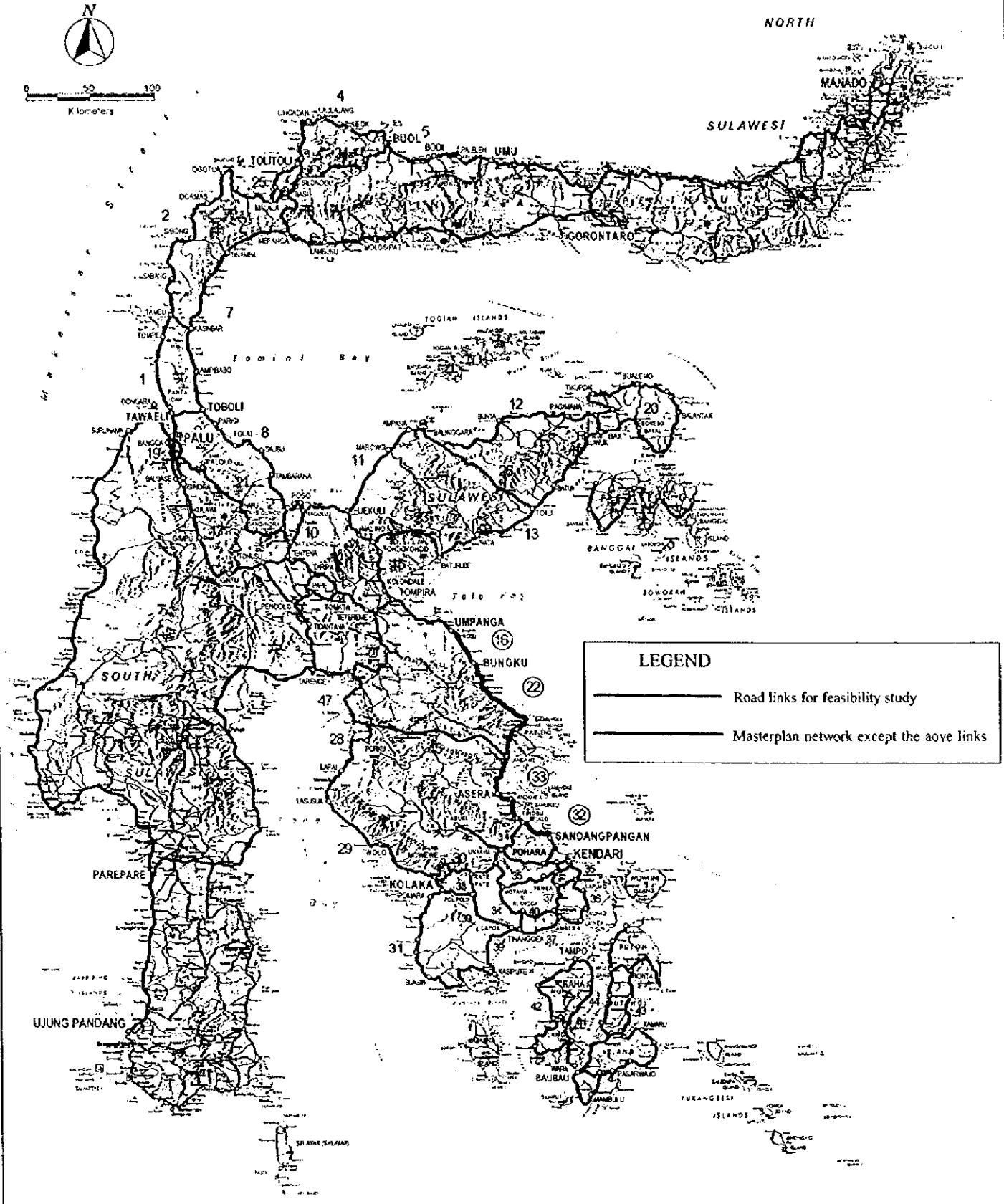

Fig. 13-3-1 Road Link Map of Feasibility Study

APENDICES

Table A4-1 1997 OD Matrix – Motorcycle

M Cycle 1997

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	3	32	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
3	0	3	6	8	19	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32
4	0	32	6	10	44	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95
5	0	7	19	30	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62
6	0	0	0	0	0	0	3	0	1	3	0	0	1	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	15
7	0	0	0	1	0	3	2	0	60	27	1	1	3	8	2	4	1	3	1	1	0	0	0	6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	4	1	133
8	0	0	0	0	0	0	0	0	2	1	0	1	2	5	1	2	1	1	1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	391
9	0	0	0	1	0	5	72	1	53	3	4	3	8	159	7	12	3	11	4	1	1	0	0	40	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	1	55
10	0	0	0	0	0	3	27	1	3	0	1	1	1	3	1	2	1	1	1	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2	1	45
11	0	0	0	0	0	0	1	0	17	1	0	1	2	6	2	3	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	48
12	0	0	0	0	0	0	1	1	3	1	1	0	24	4	2	2	1	1	1	1	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	100
13	0	0	0	0	0	1	3	2	8	1	2	24	0	15	6	5	2	1	1	1	0	0	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2	437
14	0	0	0	0	0	1	8	5	159	3	6	4	15	5	11	27	2	12	4	1	1	0	0	169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76	143
15	0	0	0	0	0	1	2	1	7	1	2	2	6	11	3	5	2	1	1	1	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	473
16	0	0	1	0	0	1	4	2	12	2	3	2	5	27	4	310	35	6	2	6	0	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	110
17	0	0	0	0	0	0	1	1	3	1	1	1	2	2	2	26	5	3	2	43	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	86
18	0	0	0	0	0	1	3	1	11	1	2	1	1	12	1	6	3	0	22	2	1	1	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	77
19	0	0	0	0	0	1	1	1	4	1	1	1	3	4	1	2	2	22	2	4	1	1	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	142
20	0	0	0	0	0	0	1	1	1	0	0	1	1	3	1	6	48	2	4	0	60	9	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	91
21	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	1	60	0	24	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	9	24	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	408
24	0	0	1	1	1	1	6	3	40	3	5	5	27	169	21	56	18	13	13	2	1	0	1	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	3	4	1	0	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	24	0	39	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	80
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	29	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
33	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	10	2	0	9	4	2	0	2	9	1	4	0	0	0	48
42	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	3	0	11	3	2	2	82	54	43	80	0	9	0	320
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9	162	0	2	9	38	5	4	90	0	0	269
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	1	0	3	0	1	1	43	4	0	7	0	2	0	72
45	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	23	0	2	4	86	90	7	11	0	1	0	168
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
47	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	1	3	15	1	1	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	9	1	2	1	0	0	0	27
48	0	0	0	0	0	1	4	0	1	2	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	91
	0	0	0	0	0	0	1	1	2	1	1	0	1	2	76	1	1	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5721

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
	0	32	30	85	77	19	144	21	391	55	30	48	102	437	162	472	127	85	78	142	93	55	25	388	2	37	60	36	15	2	79	2	10	12	102	177	5	669	61	277	48	311	307	22	198	25	28	91	5721

Table A4-2 1997 OD Matrix – Passenger Car

P Car 1997	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2	0	0	1	23	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26
3	0	1	0	2	10	0	0	0	1	0	3	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19
4	1	23	2	0	12	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48
5	0	2	10	4	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
6	0	0	0	0	0	0	2	0	2	16	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	8	0	50
7	0	0	0	1	0	2	0	2	20	2	1	0	1	3	1	1	0	1	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	16
8	0	0	0	0	0	0	2	0	1	0	0	0	1	2	3	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	124
9	0	0	1	1	1	1	23	1	11	8	5	1	1	41	4	3	0	4	2	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	22
10	0	0	0	0	0	26	2	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	33
11	0	0	3	1	1	0	1	0	5	0	0	0	1	4	1	1	0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
12	0	0	0	0	0	0	0	0	1	0	0	0	17	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
13	0	0	0	0	0	0	1	1	1	0	1	17	0	2	3	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	109
14	0	0	1	0	0	1	3	2	41	1	4	1	2	1	8	5	0	6	2	0	0	0	0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	26	124
15	0	0	0	0	0	0	1	3	4	0	1	1	3	8	0	4	1	0	1	0	0	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	39
16	0	0	0	0	0	0	1	1	3	0	1	0	1	5	4	7	3	0	0	1	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	39
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	19
18	0	0	0	0	0	0	1	0	4	0	1	0	0	6	1	0	0	0	15	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	32
19	0	0	0	0	0	0	1	0	2	0	1	0	0	2	0	0	0	15	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	35
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
24	0	0	1	2	0	1	4	4	19	1	2	1	3	32	70	12	11	2	9	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	182
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
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31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3	2	0	3	0	0	1	3	0	3	1	0	0	0	18
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	0	1	0	0	0	0	0	0	0	5
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	1	0	10	9	0	51	1	1	4	0	0	0	0	0	0	0	81
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	9	30	0	20	1	2	2	2	13	1	4	0	0	0	88
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	51	19	0	12	3	104	4	29	118	4	9	0	3	0	361
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	3	3	1	0	1	12	1	3	0	0	0	26
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	96	2	15	1	1	0	0	0	0	0	0	118
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	4	2	0	4	1	1	0	0	0	0	0	0	0	0	14
42	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	0	29	4	1	0	8	7	40	24	0	3	0	122
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	118	12	0	0	6	1	1	13	0	0	0	164
44	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1	0	2	1	1	0	40	1	0	4	0	1	0	55
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	9	3	0	0	24	13	4	1	0	0	0	59
46	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	18
47	0	0	0	1	0	0	8	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	1	0	0	1	0	32
48	0	0	0	0	0	0	0	1	1	0	1	0	0	1	26	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
	1	28	19	35	26	31	52	17	121	29	23	23	30	115	153	40	19	32	41	15	9	6	4	166	0	12	22	10	7	0	18	0	5	0	79	87	1	359	31	127	13	118	165	96	99	10	21	34	2232

Table A4-3 1997 OD Matrix – Bus

Bus 1997	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	2	16	5	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	2	0	14	13	0	1	0	2	1	14	0	0	1	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
4	0	16	8	4	37	0	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	5	13	36	1	0	1	0	1	0	3	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	1	0	7	6	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1	1	1	1	2	0	39	3	3	0	0	3	0	2	0	2	1	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	3	2	0	0	1	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	173	
9	0	1	2	1	1	9	31	0	85	7	0	0	1	5	0	3	0	4	2	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	23	
10	0	0	1	0	0	6	3	0	4	0	1	0	0	1	0	1	0	1	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	43	
11	0	1	14	2	3	1	3	0	9	1	0	0	0	2	0	1	0	1	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	7
12	0	0	0	0	0	0	6	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13
13	0	0	0	0	0	0	0	0	1	0	1	7	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	216		
14	0	0	1	0	1	0	3	9	5	1	2	0	2	10	2	16	0	47	9	0	0	0	0	105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	136	142	
15	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	
16	0	0	1	1	0	0	2	3	3	1	1	0	0	16	1	24	21	9	0	2	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	
17	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	21	1	0	0	4	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	103		
18	0	0	1	0	0	0	2	0	4	1	1	0	0	47	2	0	0	2	31	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	78
19	0	0	1	0	0	0	1	0	2	1	1	0	0	9	0	0	0	31	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18
20	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	4	0	0	0	8	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	186	
24	0	0	1	2	1	1	3	13	6	1	3	0	0	105	2	14	10	11	5	1	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	13
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	3	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	235
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	1	0	1	0	1	0	0	2	0	0	0	5	38	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	1	0	0	5	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	25	46	78	65	18	60	28	172	23	44	7	11	219	144	91	38	105	79	18	14	8	0	194	0	0	0	0	0	0	79	0	0	0	11	241	152	5	893	65	227	56	380	303	105	180	39	15	136	4218

Table A4-4 1997 OD Matrix – Truck

Truck 1997	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
2	0	0	2	41	8	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54
3	0	2	0	8	12	0	1	0	2	1	21	0	1	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	100
4	0	41	4	7	29	0	1	0	2	0	2	0	0	1	2	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95
5	0	0	0	1	0	0	0	0	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	29
6	0	0	0	0	0	0	3	0	2	16	1	0	0	1	1	1	0	1	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	55	1	126
7	0	0	1	1	1	3	1	0	29	5	2	1	1	4	2	2	0	2	1	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	28
8	0	0	0	0	0	0	0	0	0	0	0	1	2	7	4	2	1	0	0	1	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15	1	116
9	0	1	2	1	1	3	28	0	9	2	5	1	2	12	5	3	0	4	2	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35
10	0	0	1	0	0	16	5	0	2	0	1	0	1	1	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8	1	60
11	0	1	21	2	4	1	2	0	5	1	1	0	1	2	2	1	0	1	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44
12	0	0	0	0	0	0	1	1	1	0	0	0	31	2	3	1	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	67
13	0	0	1	0	0	0	1	2	2	1	1	31	1	6	6	2	1	1	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	202
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44	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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46	0	0	0	2	0	0	1	0	1	0	1	0	0	2	0	0	0	0	47	1	1	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	1	1	1	6	0	1	55	1	15	3	7	0	0	1	0	2	0	1	5	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	1	1	0	1	0	1	3	52	1	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	54	51	112	69	29	122	28	126	35	59	44	64	210	177	123	54	67	109	32	24	10	7	295	0	44	62	25	5	0	112	4	4	8	143	131	2	501	72	203	49	226	252	81	124	76	130	66	4586

Table A4-5 2018 OD Matrix – Motorcycle

Motor Cycle 2018																																												
Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Total
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	5	68	23	1	7	1	10	3	3	1	3	7	4	4	3	2	2	4	3	1	1	8	0	1	1	1	0	0	1	0	0	0	2	1	0	4	1	2	1	3	3	2	0	0	0	0	167
3	0	5	0	12	23	1	8	1	13	3	9	1	2	7	3	4	2	2	2	3	2	1	0	8	0	1	1	1	0	0	1	0	0	0	2	1	0	3	1	2	1	3	3	1	0	0	0	0	133
4	0	68	12	0	78	2	13	1	20	6	7	2	5	13	7	8	6	5	4	7	5	3	1	15	0	1	2	1	1	0	2	0	0	0	4	2	0	6	2	4	2	6	6	3	0	5	0	0	335
5	0	23	23	78	0	2	15	1	23	6	10	2	5	14	7	9	7	6	4	7	5	3	1	16	0	1	2	1	1	0	2	0	0	0	4	2	0	6	2	4	2	6	6	3	0	0	0	0	308
6	0	1	1	2	2	0	7	1	7	7	1	1	2	4	2	3	2	1	1	2	1	1	0	5	0	1	1	0	0	0	1	0	0	0	2	1	0	4	1	2	2	3	4	1	0	0	5	0	82
7	0	7	8	13	15	7	0	8	251	29	11	7	15	60	21	25	19	15	12	18	13	6	2	49	0	3	5	2	1	0	5	0	1	1	7	4	0	13	3	8	5	15	13	9	0	0	19	5	730
8	0	1	1	1	1	1	8	0	9	2	1	2	3	8	7	6	4	3	2	3	2	1	0	20	0	0	1	0	0	0	1	0	0	0	1	0	0	1	0	1	1	2	1	1	0	0	5	0	102
9	0	10	13	20	23	7	251	9	0	35	20	11	25	125	35	43	32	26	19	28	21	9	4	85	0	3	6	3	1	0	6	0	1	1	9	5	0	16	4	9	6	18	15	11	0	5	0	0	979
10	0	3	3	6	6	2	29	2	35	0	1	2	6	17	7	9	7	5	4	7	5	2	1	10	0	1	2	1	1	0	3	0	0	0	4	3	0	8	2	5	3	7	8	4	0	0	9	5	244
11	0	3	9	7	10	1	11	1	20	4	0	1	3	9	4	6	4	3	2	4	3	1	1	9	0	1	1	1	0	0	1	0	0	0	2	1	0	3	1	2	1	3	3	2	0	5	0	5	147
12	0	1	1	2	2	1	7	2	11	2	1	0	88	18	19	15	9	6	4	7	4	2	1	65	0	1	1	1	0	0	1	0	0	0	1	1	0	2	0	1	1	3	2	2	0	0	0	0	284
13	0	3	2	5	6	2	15	5	25	5	3	88	0	45	53	37	21	12	9	16	10	5	2	214	0	1	2	1	0	0	2	0	0	1	3	1	0	4	1	3	2	5	4	3	0	0	0	5	620
14	0	7	7	13	14	4	60	8	125	17	9	18	45	0	67	80	56	52	29	36	27	11	4	198	0	3	5	2	1	0	5	0	1	1	7	4	0	12	3	7	4	13	11	8	0	5	5	9	992
15	0	4	3	7	7	2	21	7	35	7	4	19	53	67	0	66	30	18	13	23	14	6	2	416	0	2	3	2	1	0	3	0	0	1	4	2	0	6	1	3	2	7	6	4	0	0	0	354	1215
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17	0	3	3	6	7	2	19	4	32	7	4	9	21	55	30	147	0	55	25	50	21	8	3	80	0	2	3	1	1	0	3	0	0	1	4	2	0	6	1	4	2	8	6	4	0	5	0	5	649
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21	0	3	2	5	5	1	13	2	21	5	3	4	10	27	14	26	21	22	46	67	0	19	7	31	0	1	2	1	1	0	2	0	0	1	4	2	0	6	1	4	2	7	6	3	0	0	5	0	403
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24	0	8	8	15	16	5	49	10	85	16	9	65	214	198	416	170	80	40	31	32	31	14	5	0	0	4	6	3	1	0	6	0	1	1	8	4	0	13	3	7	5	16	13	10	0	0	5	14	1673
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28	0	1	0	1	1	0	2	0	3	1	1	1	1	2	2	2	1	1	1	2	1	1	0	3	0	13	62	0	4	0	3	0	2	2	5	3	0	8	2	4	2	7	7	2	0	0	0	0	154
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32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	6
33	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	2	6	2	3	0	1	1	0	0	3	1	0	3	1	2	1	3	3	1	0	0	0	38
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36	0	1	1	2	2	1	4	0	5	3	1	1	1	4	2	3	2	2	2	3	2	1	0	4	0	3	6	3	2	0	13	0	1	1	30	0	2	210	17	43	14	31	50	8	23	0	0	0	512
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	8	1	2	1	2	3	0	0	0	0	0	21
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39	0	1	1	2	2	1	3	0	4	2	1	0	1	3	1	2	1	1	1	2	1	1	0	3	0	2	4	2	1	0	16	0	1	1	59	19	1	67	0	46	7	33	76	7	0	0	0	0	366
40	0	2	2	4	4	2	8	1	9	5	2	1	3	7	3	4	4	3	3	5	4	2	1	7	0	5	9	4	2	0	25	0	2	2	59	43	2	141	46	0	20	79	185	16	9	0	5	0	740
41	0	1	1	2	2	1	5	1	6	3	1	1	2	4	2	3	2	2	2	3	2	1	0	5	0	2	4	2	1	0	7	0	1	1	14	14	1	41	7	20	0	19	27	5	19	0	0	0	238
42	0	3	3	6	6	2	15	2	18	7	3	3	5	13	7	9	8	5	5	9	7	4	2	16	0	8	15	7	4	0	43	1	3	3	87	31	2	94	33	79	19	0	260	65	373	0	42	0	1328
43	0	3	3	6	6	4	13	1	15	8	3	2	4	11	6	8	6	5	4	8	6	3	1	13	0	8	15	7	4	1	47	1	3	3	116	50	3	157	76	185	27	260	0	36	279	0	0	0	1417
44	0	2	1	3	3	1	9	1	11	4	2	2	3	8	4	5	4	3	3	5	3	2	1	10	0	3	5	2	1	0	10	0	1	1	17	8	0	22	7	16	5	65	36	0	33	0	9	0	331
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	23	0	107	0	9	19	373	279	33	51	0	5	0	922
46	0	0	0	0	0	0	0	0	5	0	5	0	0	5	0	5	5	1	70	5	5	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133
47	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	9	0	0	0	42	5	9	0	0	0	0	127
48	0	0	0	0	0	0	5	0	5	0	5	0	5	9	354	5	5	0	0	5	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	426
Total	0	187	133	339	398	85	730	102	984	148	147	284	620	992	1215	871	639	465	442	548	408	224	123	1673	0	139	270	154	60	3	386	6	38	40	667	512	21	1168	366	735	238	1328	1422	331	922	119	133	426	21258

Table A4-6 2018 OD Matrix – Passenger Car

Passenger Car 2018

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Total
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	3	24	8	2	4	1	6	2	3	1	1	5	6	2	3	2	2	1	0	0	0	6	0	0	1	0	0	0	1	0	0	0	2	1	0	3	1	2	1	3	3	2	0	0	0	0	100
3	0	3	0	6	7	1	4	1	7	2	6	1	1	4	5	1	1	1	2	1	0	0	0	5	0	0	1	0	0	0	0	0	0	0	1	1	0	2	1	1	0	2	2	2	0	0	0	0	72
4	0	24	6	0	17	2	6	1	9	3	6	1	2	7	8	2	1	2	3	1	1	0	0	8	0	1	1	0	0	0	1	0	0	0	2	2	0	4	1	2	1	4	4	3	0	0	0	0	134
5	0	8	7	17	0	2	4	1	8	2	6	1	1	6	0	2	1	2	2	1	0	0	0	6	0	1	1	0	0	0	1	0	0	0	2	2	0	5	1	3	1	4	4	2	0	0	0	0	79
6	0	2	1	2	2	0	5	1	7	6	2	1	1	5	5	1	1	2	2	1	0	0	0	5	0	1	1	0	0	0	1	0	0	0	2	2	0	5	1	3	1	4	4	2	0	0	0	0	79
7	0	4	4	5	4	5	0	5	60	10	6	3	4	19	17	5	3	5	6	2	1	1	0	18	0	1	2	1	1	0	1	0	0	0	3	3	0	6	2	3	1	7	6	6	0	0	36	0	266
8	0	1	1	1	1	1	5	0	6	2	1	2	2	6	11	2	1	2	2	1	0	0	0	13	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	1	0	2	2	2	0	0	5	5	82
9	0	6	7	9	8	7	60	6	0	15	12	6	7	45	33	9	5	10	12	3	2	1	1	37	0	1	3	1	1	0	2	0	1	0	5	4	0	10	3	5	2	11	9	9	0	5	5	5	382
10	0	2	2	3	2	6	10	2	15	0	3	1	2	8	8	2	1	2	3	1	1	0	0	9	0	1	1	0	0	0	1	0	0	0	3	2	0	6	1	3	1	6	6	4	0	0	5	0	129
11	0	3	6	5	6	2	6	1	12	3	0	1	2	7	7	2	1	2	3	1	1	0	0	7	0	0	1	0	0	0	0	0	0	0	2	1	0	3	1	2	1	3	3	2	0	0	0	5	101
12	0	1	1	1	1	1	3	2	5	1	1	0	16	8	16	3	1	2	3	1	0	0	0	23	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	1	0	2	1	2	0	0	0	0	100
13	0	1	1	2	1	1	4	2	7	2	2	16	0	12	27	6	2	3	4	1	1	0	0	44	0	0	1	0	0	0	0	0	0	0	1	1	0	2	1	1	0	2	2	2	0	0	0	0	151
14	0	6	4	7	6	5	19	6	45	8	7	8	12	0	65	15	8	17	10	4	3	1	1	71	0	1	2	1	1	0	1	0	0	0	4	3	0	7	2	4	1	8	7	7	0	5	0	5	381
15	0	6	5	8	6	5	17	11	33	8	7	16	27	55	0	23	10	16	17	6	3	2	1	256	0	2	3	1	1	0	2	0	1	0	6	4	0	9	2	5	2	11	9	9	0	6	0	118	726
16	0	2	1	2	2	1	5	2	9	2	2	3	5	15	23	0	8	10	8	2	1	1	0	30	0	0	1	0	0	0	0	0	0	0	1	1	0	3	1	1	0	3	3	3	0	0	0	5	156
17	0	1	1	1	1	1	3	1	6	1	1	1	2	8	10	8	0	6	5	2	1	0	0	12	0	0	0	0	0	0	0	0	0	0	1	1	0	2	0	1	0	2	2	1	0	0	5	0	86
18	0	2	1	2	2	2	5	2	10	2	2	2	3	17	15	10	6	9	15	3	2	1	0	18	0	0	1	0	0	0	1	0	0	0	2	1	0	3	1	2	1	3	3	3	0	9	0	0	152
19	0	2	2	3	2	2	6	2	12	3	3	3	4	16	17	8	5	15	0	6	4	1	1	19	0	1	1	0	0	0	1	0	0	0	2	2	0	4	1	2	1	4	4	3	0	41	5	0	208
20	0	1	1	1	1	1	2	1	3	1	1	1	1	4	6	2	2	3	6	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	2	1	1	0	0	0	0	53
21	0	0	0	1	0	0	1	0	2	1	1	0	1	3	3	1	1	2	4	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	29
22	0	0	0	0	0	0	1	0	1	0	0	0	0	1	2	1	0	1	1	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	16
23	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
24	0	6	5	8	6	5	18	13	37	9	7	23	44	71	256	30	12	18	19	6	3	2	1	0	0	2	3	1	1	0	2	0	1	0	5	4	0	9	2	5	2	11	9	9	0	9	5	14	693
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	1	0	1	1	0	1	1	0	0	0	1	2	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	2	1	0	3	1	2	0	3	3	2	0	0	0	0	37
27	0	1	1	1	1	1	2	0	3	1	1	0	1	2	3	1	0	1	1	0	0	0	0	3	0	5	0	7	3	0	1	0	1	0	4	3	0	6	2	3	1	6	6	3	0	0	0	0	75
28	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	2	7	0	1	0	0	0	0	0	2	1	0	2	1	1	0	2	2	1	0	0	0	0	27
29	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	3	1	0	0	0	0	1	0	1	1	0	2	1	1	0	2	2	1	0	0	0	0	22
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	1	0	1	1	1	1	0	2	1	0	0	0	1	2	0	0	1	1	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	10	3	0	7	3	4	1	8	8	3	0	0	0	0	69
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	1	1	0	2	0	1	0	2	2	1	0	0	0	0	15
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	2	1	2	2	2	3	1	5	3	2	1	1	4	5	1	1	2	2	1	0	0	0	5	0	2	4	2	1	0	10	0	1	0	0	15	0	32	20	20	3	33	40	12	0	0	0	0	241
36	0	1	1	2	1	2	3	1	4	2	1	1	1	3	4	1	1	1	2	1	0	0	0	4	0	1	3	1	1	0	3	0	1	0	15	9	0	81	10	20	4	18	26	8	18	0	0	0	247
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
38	0	3	2	4	3	6	6	2	10	5	3	2	2	7	9	3	2	3	4	1	1	1	0	9	0	3	8	2	2	0	7	0	2	0	32	81	1	0	22	45	9	40	58	17	41	0	14	0	469
39	0	1	1	1	1	1	2	0	3	1	1	0	1	2	2	1	0	1	1	0	0	0	0	2	0	1	2	1	1	0	3	0	0	0	20	10	0	22	0	16	2	15	28	6	14	0	0	0	163
40	0	1	1	2	2	2	3	1	5	3	2	1	1	4	6	1	1	2	2	1	0	0	0	5	0	2	3	1	1	0	4	0	1	0	20	20	0	45	16	0	4	30	57	11	0	0	0	0	262
41	0	1	0	1	1	1	1	0	2	1	1	0	0	1	2	0	0	1	1	0	0	0	0	2	0	0	1	0	0	0	1	0	0	0	3	4	0	9	2	4	0	5	6	2	0	0	0	0	53
42	0	3	2	4	3	4	7	2	11	5	3	2	2	8	11	3	2	3	4	2	1	1	0	11	0	3	6	2	2	0	8	0	2	0	33	18	0	40	15	30	5	0	89	40	109	0	14	0	510
43	0	3	2	4	3	4	6	2	9	5	3	1	2	7	9	3	2	3	4	1	1	1	0	9	0	3	6	2	2	0	8	0	2	0	40	26	0	68	28	67	6	89	0	24	59	0	0	0	494
44	0	2	2	3	2	2	6	2	9	4	2	2	2	7	9	3	1	3	3	1	1	1	0	9	0	2	3	1	1	0	3	0	1	0	12	8	0	17	6	11	2	40	24	0	18	0	5	0	230
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	41	14	0	0	109	59	18	5	0	0	0	269
46	0	0	0	0	0	0	0	0	5	0	0	0	0	5	0	0	0	0	9	41	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	83
47	0	0	0	6	0	0	36	5	9	6	5	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	5	41	0	0	0	14	0	5	0	0	5	0	149
48	0	0	0	0	0	0	0	0	0	0	6	0	0	6	118	6	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	157
Total	0	100	75	139	101	79	266	82	386	129	106	100	151	381	721	156	81	152	203	63	29	16	7	707	0	37	76	27	[illegible]	0	69	0	16	0	241	247	6	406	163	262	63	510	401	230	269	74	113	157	7768

Table A4-7 2018 OD Matrix – Bus

Bus 2018 Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Total
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	6	31	11	1	2	1	4	1	3	0	0	4	3	2	1	3	2	0	0	0	0	6	0	0	0	0	0	0	1	0	0	0	2	1	0	2	1	2	1	3	3	3	0	0	0	0	98
3	0	6	0	19	26	2	6	2	11	3	18	0	1	11	8	4	2	7	6	1	1	0	0	11	0	0	1	0	0	0	3	0	0	0	3	2	0	4	1	3	2	6	5	6	0	0	0	0	179
4	0	31	19	0	66	2	8	3	13	3	12	1	1	14	12	6	3	9	7	2	1	1	0	16	0	1	1	0	0	0	4	0	0	1	6	2	0	7	2	6	4	9	8	9	0	0	4	0	281
5	0	11	26	66	0	2	7	2	12	3	13	0	1	13	10	5	3	8	6	1	1	1	0	14	0	0	1	0	0	0	3	0	0	1	4	2	0	6	2	4	3	7	6	8	0	0	0	0	241
6	0	1	2	2	2	0	3	1	4	3	2	0	0	4	3	2	1	3	2	0	0	0	0	4	0	0	0	0	0	0	2	0	0	0	2	1	0	3	1	2	2	4	4	5	0	0	0	0	63
7	0	2	6	8	7	3	0	6	47	6	8	1	1	24	14	7	4	12	8	2	1	1	0	20	0	0	1	0	0	0	3	0	0	1	4	2	0	6	2	4	4	9	7	10	0	4	19	0	264
8	0	1	2	3	2	1	6	0	7	1	2	1	1	10	14	6	2	6	4	1	1	0	0	22	0	0	0	0	0	0	1	0	0	0	2	1	0	2	1	2	1	3	3	4	0	0	0	0	112
9	0	4	11	13	12	4	47	7	0	8	15	1	2	50	26	12	7	21	14	3	2	1	0	38	0	1	1	0	0	0	5	0	0	1	6	3	0	8	3	6	5	12	9	13	0	4	4	0	378
10	0	1	3	3	3	3	6	1	8	0	3	0	0	7	5	2	1	4	3	1	0	0	0	7	0	0	0	0	0	0	2	0	0	0	2	1	0	3	1	2	2	4	4	5	0	0	4	0	90
11	0	3	18	12	13	2	8	2	15	3	0	0	1	13	9	4	2	7	5	1	1	0	0	13	0	0	1	0	0	0	3	0	0	0	3	2	0	4	1	3	3	6	5	6	0	4	0	0	173
12	0	0	0	1	0	0	1	1	1	0	0	0	1	3	4	1	1	2	1	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	27
13	0	0	1	1	1	0	1	1	2	0	1	1	0	4	7	2	1	2	1	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	1	0	0	0	0	46
14	0	4	11	14	13	4	24	10	50	7	13	3	4	0	69	32	16	59	31	5	4	2	0	119	0	1	1	0	0	0	6	0	0	1	7	4	0	10	3	7	6	15	11	16	0	7	4	0	593
15	0	3	8	12	10	3	14	14	25	5	9	4	7	69	0	35	14	36	23	5	3	2	0	313	0	1	1	0	0	0	6	0	0	1	6	3	0	9	3	6	5	13	10	14	0	0	0	505	1196
16	0	2	4	6	5	2	7	5	12	2	4	1	2	32	35	0	20	41	18	4	2	1	0	61	0	0	1	0	0	0	3	0	0	1	3	2	0	4	1	3	2	6	5	7	0	0	0	0	304
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18	0	3	7	9	8	3	12	6	21	4	7	2	2	59	36	41	24	0	58	6	5	2	0	56	0	1	1	0	0	0	4	0	0	1	6	3	0	7	2	5	4	11	8	11	0	19	0	0	462
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20	0	0	1	2	1	0	2	1	3	1	1	0	0	5	5	4	3	9	8	0	2	0	0	7	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	1	2	2	2	0	0	0	0	64
21	0	0	1	1	1	0	1	1	2	0	1	0	0	4	3	2	1	5	8	2	0	1	0	6	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	1	2	1	2	0	0	0	0	49
22	0	0	0	1	1	0	1	0	1	0	0	0	0	2	2	1	1	2	2	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	21
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	5	11	16	14	4	20	22	38	7	13	8	16	119	313	61	22	65	33	7	5	2	0	0	0	1	2	0	0	0	7	0	0	2	8	4	0	11	4	8	7	17	13	19	0	0	7	0	901
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	2	1	0	2	1	1	2	2	2	0	0	0	0	25
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35	0	2	3	5	4	2	4	2	6	2	3	0	0	7	6	3	2	6	4	1	1	0	0	8	0	2	3	1	0	0	52	0	0	2	0	17	1	46	36	35	14	61	67	28	0	0	0	0	436
36	0	1	2	2	2	1	2	1	3	1	2	0	0	4	3	2	1	3	2	1	0	0	0	4	0	1	1	0	0	0	10	0	0	1	17	0	1	79	12	23	11	22	28	12	26	0	0	0	281
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	5	1	2	1	2	2	1	0	0	0	0	17
38	0	2	4	7	6	3	6	2	8	3	4	0	1	10	9	4	2	7	5	1	1	1	0	11	0	2	3	1	0	0	28	0	0	2	46	29	5	0	33	66	32	91	80	32	89	4	11	0	672
39	0	1	1	2	2	1	2	1	3	1	1	0	0	3	3	1	1	2	2	0	0	0	0	4	0	1	1	0	0	0	15	0	0	1	36	12	1	33	0	29	8	28	49	13	33	0	0	0	291
40	0	2	3	5	4	2	4	2	6	2	3	0	0	7	6	3	2	5	4	1	1	0	0	8	0	1	2	0	0	0	21	0	0	2	35	23	2	66	29	0	19	55	97	26	0	0	0	0	448
41	0	1	2	4	3	2	4	1	5	2	3	0	0	6	5	2	1	6	3	1	1	0	0	7	0	1	1	0	0	0	10	0	0	1	14	11	1	32	8	19	0	23	26	13	0	0	0	0	217
42	0	3	6	9	7	4	9	3	12	4	6	1	1	15	13	6	4	11	9	2	2	1	0	17	0	2	4	1	0	0	41	0	0	3	61	22	2	61	28	65	23	0	160	102	267	0	0	0	977
43	0	3	5	8	6	4	7	3	9	4	5	0	1	11	10	5	3	8	7	2	1	1	0	13	0	2	3	1	0	0	38	0	0	3	67	28	2	80	49	97	26	160	0	56	178	0	0	0	905
44	0	3	6	9	8	3	10	4	13	4	6	1	1	16	14	7	4	11	9	2	2	1	0	19	0	2	3	1	0	0	21	0	0	2	28	12	1	32	13	26	13	102	55	0	41	0	0	0	505
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46	0	0	0	0	0	0	4	0	4	0	4	0	0	7	0	0	0	19	104	0	0	0	0	4	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	150
47	0	0	0	4	0	0	19	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	53
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	605	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	605
Total	0	98	179	281	241	63	264	112	378	90	173	27	46	569	1196	364	162	452	407	64	49	21	0	905	0	25	40	6	0	0	323	0	0	31	435	281	17	672	291	448	217	977	905	505	667	146	57	505	12649

Table A4-8 2018 OD Matrix – Truck

Truck 2018

Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	Total
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	7	39	12	2	8	2	10	3	7	2	4	9	10	5	3	4	6	2	1	1	0	14	0	2	3	1	0	0	6	0	0	0	4	3	0	8	3	4	3	8	8	4	0	0	5	0	212
3	0	7	0	18	13	2	10	2	12	3	13	3	4	10	11	5	3	4	7	2	2	1	0	15	0	2	3	1	0	0	5	0	0	0	4	3	0	8	3	3	3	8	7	4	0	0	0	0	201
4	0	39	18	0	33	4	18	4	20	6	15	5	7	18	21	10	7	8	13	4	3	2	1	29	0	4	6	2	0	0	10	0	0	1	8	7	0	16	5	7	5	16	15	9	0	5	24	0	424
5	0	12	13	33	0	2	10	2	12	3	10	3	4	10	12	5	4	5	7	2	2	1	0	16	0	2	3	1	0	0	6	0	0	0	4	4	0	8	3	4	3	9	8	5	0	0	0	0	228
6	0	2	2	4	2	0	7	1	6	3	3	1	2	5	6	3	2	2	4	1	1	0	0	8	0	1	2	1	0	0	4	0	0	0	3	3	0	7	2	3	2	6	6	3	0	0	5	0	113
7	0	8	10	18	10	7	0	7	57	10	14	7	10	30	30	13	9	12	17	5	4	2	1	42	0	4	6	2	0	0	11	0	0	1	9	8	0	17	6	8	6	19	16	11	0	5	206	5	723
8	0	2	2	4	2	1	7	0	7	2	3	3	4	7	12	6	3	3	4	1	1	1	0	18	0	1	1	1	0	0	3	0	0	0	2	2	0	4	1	2	1	4	4	2	0	0	5	5	130
9	0	10	12	20	12	6	57	7	0	10	17	8	12	41	36	16	11	14	20	6	4	2	1	62	0	5	7	3	0	0	12	0	0	1	9	8	0	18	6	8	6	20	17	11	0	5	73	5	588
10	0	3	3	6	3	3	10	2	10	0	4	2	3	8	8	4	3	2	5	1	1	1	0	12	0	2	2	1	0	0	4	0	0	0	3	3	0	7	2	3	2	7	6	4	0	0	16	0	156
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12	0	2	3	5	3	1	7	3	8	2	3	0	21	13	23	8	5	5	7	2	2	1	0	38	0	1	2	1	0	0	4	0	0	0	3	2	0	6	2	2	2	6	5	3	0	0	9	0	200
13	0	4	4	7	4	2	10	4	12	3	6	21	0	19	37	12	7	8	11	3	2	1	1	68	0	2	3	1	0	0	6	0	0	0	4	3	0	7	2	3	2	8	7	4	0	5	5	6	311
14	0	9	10	18	10	6	30	7	41	8	13	13	19	0	58	20	16	23	28	7	6	3	1	92	0	5	7	3	0	0	11	0	0	1	9	7	0	17	6	7	6	19	16	11	0	10	5	15	597
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22	0	1	1	2	1	0	2	1	2	1	1	1	1	3	3	2	1	2	3	1	1	0	1	5	0	1	1	0	0	0	1	0	0	0	1	1	0	2	1	1	1	2	2	1	0	0	0	0	61
23	0	0	0	1	0	0	1	0	1	0	1	0	1	1	2	1	1	1	2	0	0	1	0	2	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	1	1	0	0	0	0	22
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25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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42	0	8	8	16	9	6	19	4	20	7	9	6	8	19	23	11	7	9	15	6	3	2	1	31	0	11	16	6	1	0	48	1	1	2	44	29	1	60	28	36	17	0	110	42	121	0	5	0	831
43	0	8	7	15	8	6	10	4	17	6	9	6	7	16	20	9	6	8	13	4	3	2	1	27	0	10	15	6	1	0	47	1	1	2	49	35	1	82	42	53	19	110	0	29	252	0	0	0	972
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45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	5	39	0	92	39	5	10	121	252	19	0	0	0	0	601
46	0	0	0	10	0	0	5	0	5	0	5	0	0	10	0	0	0	29	228	5	6	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	34	0	375
47	5	5	5	29	0	5	266	5	73	15	34	0	0	5	0	10	0	5	0	0	0	0	0	77	0	0	0	0	0	0	5	0	0	0	6	0	0	165	0	10	0	29	5	5	0	39	5	0	807
48	0	0	0	0	0	0	5	5	5	0	6	0	5	15	252	5	5	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	321
Total	5	212	206	434	228	113	723	130	588	156	277	200	301	597	1063	369	234	317	623	124	96	51	22	1194	0	150	216	89	6	0	471	10	11	25	417	391	3	963	335	370	208	855	977	336	601	370	662	321	16039