Study on Implementation of
Integrated Spatial Plan for
The Mamminasata Metropolitan Area

SECTOR STUDY (13)

TRAFFIC SURVEY
AND
DEMAND FORECAST

KRI International Corp.
Nippon Koei Co., Ltd

Table of Contents

PART A: TRAFFIC SURVEY

PART B: TRAFIC DEMAND FORECAST

PART A: TRAFFIC SURVEY

1. INTRODUCTION

1.1 Background and Objectives

To formulate the Integrated Spatial Plan, it is necessary to acquire reliable and useful information on present transport conditions. There are some traffic and transport data. "Ujung Pandang Area Highway Development Study (JICA 1989)" was conducted as comprehensive transport surveys including Home Interview Survey covering homes within the radius of approximately 30 km from Makassar's central area. However, it did not cover the Mamminasata Metropolitan Area. It is also necessary to forecast an economic growth and changes of people's behaviors for the next 16 years. More recently "Analisis Dampak Lalu Lintas Kawasan (PT.GMTD Tbk 2005)" was carried out as a traffic survey which included person trip survey, road inventory survey, roadside interview survey and travel speed survey. However, the survey focused only on KAWASAN GMTDC in Kecamatan Tamalate. Therefore, the existing data and information have been limited for the transport study on the Mamminasata Metropolitan Area.

Due to the lack of adequate traffic data for the Mamminasata Metropolitan Area, the collection of the latest transport information was needed. Therefore, traffic surveys were conducted to achieve the following:

(a) To obtain latest information/data on the transport situation in the Mamminasata Metropolitan Area,
(b) To understand transport characteristics by interviewing to private, public and freight transport users and public transport operators,
(c) To quantify existing transport movements in the Mamminasata Metropolitan Area, and
(d) To provide base data for traffic demand forecast.

1.2 Outline of Traffic Surveys

The outline of the traffic surveys conducted in the course of this Study is summarized in the following table.

Table 1.1: Outline of Traffic Surveys

Survey	Objectives	Coverage	Method
1. Traffic Count Survey	To grasp traffic volume and vehicle type at major road sections	29 stations	Traffic count (vehicles) 24/16 hours
2. Roadside OD Interview Survey	To capture trip information of vehicles at major road sections	27 stations	Direct interview to drivers at roadsides 16 hours
3. Intersection Traffic Count Survey	To obtain traffic volume at major intersections by turning direction	8 major intersections	Traffic count (vehicles) 2 hours * 2 time periods
4. Travel Speed Survey	To understand travel speed on major routes by section	5 routes	"Floating car" method 9 round trips by route by vehicle type 3 time periods (morning/evening peak and off-peak)
5. Freight Transport Survey	To grasp characteristics of freight vehicle transport	5 stations of port, airport, industrial park and warehouse	Traffic count and OD interview for trucks at gates 24 hours
6. Public Transport Operator Survey	To understand operational condition on current public transport	Major public transport operators	Direct interview to public transport operators
7. Road Inventory Survey	To collect information and data in terms of roads, bridges and intersections	MAMMINASATA Metropolitan area	To collect existing data To collect data through supplemental field survey
8. Public Transport Terminal Inventory Survey	To collect present bus terminal information	All bus terminals in MAMMINASATA Metropolitan area	Facility inventory survey

Source: JICA Study Team

2. TRAFFIC COUNT AND OD INTERVIEW SURVEYS

2.1 Outline of Survey

The traffic count survey was conducted to measure traffic volumes on main roads in the study area. The data can be used for expanding OD (origin and destination) matrices and for understanding present traffic condition in the study area.

The objective of the OD interview survey is to capture trip information of vehicle in the study area. The results obtained by the OD interview survey are utilized for preparation of present OD matrices.

1) Survey Items

- Vehicular traffic count
- Roadside interview

2) Survey Method

The traffic count survey was counted manually to get the hourly traffic volume by vehicle type and by direction. Categories of vehicle type were classified as follows:

(1) Bicycle	(4) Car/Taxi/Jeep	(7) Pickup
(2) Motorcycle	(5) Minibus (<=25 pax)	(8) Small Truck (2-axle)
(3) Becak	(6) Standard Bus(>25 pax)	(9) Large Truck (3 or more axle)

The OD interview survey was conducted to collect the following information:

(1) Survey Time	(6) Origin & Destination
(2) Vehicle Type	(7) Major Commodity (Pickup and Truck only)
(3) Seating Capacity	(8) Loading Capacity (Ton) (Pickup and Truck only)
(4) No. of Passengers on Board (incl. driver)	(9) Load Factor (Pickup and Truck only)
(5) Trip Purpose	(10) Estimated Travel Time (Minutes)

Above information was collected through interview to sampled vehicles at roadsides in cooperation with traffic police enforcers. The vehicle classification was applied same categories with the traffic count survey. Under proper traffic control by the traffic police enforcers, the interview survey was safely conducted at all survey stations without any accident or problem.

3) Survey Coverage

To grasp and quantify present traffic movements on main roads in the study area, the survey stations for the traffic count survey were selected as follows:

(a) 4 stations on boundaries of Mamminasata Metropolitan area
(b) 4 stations on boundaries of Kecamatan in Maros, Takalar and Gowa

(c) 4 stations on boundaries of Makassar city

(d) 15 stations on boundaries of Kecamatan in Makassar city

(e) 2 stations in Kecamatan Ujung Pandang

For the OD interview survey, the survey stations were chosen at the same location as the traffic count survey station (27 stations), except Station No.20 and No.29, since these two stations had too narrow roadside so that it was not secure enough to stop vehicles for the interview. The survey stations and their survey periods for both surveys are shown in the following table and figures.

Table 2.1: Survey Stations for Traffic Count and OD Interview Surveys

Station	Road Name	Location	Survey Period		Survey date
			Traffic Count	OD Interview	
1	Pekkae - Pangkajene Kepulauan (National Road)	Boundary of Kab.Maros & Kab.Pangkep	24 hrs	16 hrs	30/05/2005
2	Maros - Ujung Lamura (National Road)	Boundary of Kec.Turikale & Kec.Bantimurung	16 hrs	16 hrs	30/05/2005
3	Maros - Ujung Lamura (National Road)	Boundary of Kec.Cenrana & Kec.Camba	16 hrs	16 hrs	19/05/2005
4	Sungguminasa - Malino (Provincial Road)	Boundary of Kec.Somba Opu & Kec.Pattallassang	16 hrs	16 hrs	20/05/2005
5	Sungguminasa - Malino (Provincial Road)	Boundary of Kec.Parangloe & Kec.Tinggimoncong	16 hrs	16 hrs	20/05/2005
6	Sungguminasa - Takalar (National Road)	Boundary of Kec.Pallangga & Kec.Bajeng	16 hrs	16 hrs	20/05/2005
7	Sungguminasa - Takalar (National Road)	Boundary of Kab.Gowa & Kab.Takalar	16 hrs	16 hrs	27/05/2005
8	Takalar - Jeneponto (National Road)	Boundary of Kab.Takalar & Kab.Jeneponto	16 hrs	16 hrs	27/05/2005
9	Jl.Perintis Kemerdekaan	Boundary of Makassar City & Kab.Maros (Kec.Biringkanaya & Kec.Marusu)"	16 hrs	16 hrs	19/05/2005
10	Jl.Sultan Alaudin	Boundary of Makassar City & Kab.Gowa (Kec.Tamalate & Kec.Somba Opu)	24 hrs	16 hrs	20/05/2005
11	Makassar – Gowa (Kabupaten Road)	Boundary of Makassar City & Kab.Gowa (Kec.Tamalate & Kec.Baronmbong)	16 hrs	16 hrs	27/05/2005
12	Makassar – Takalar (Kabupaten Road)	Boundary of Kab.Makassar & Kab.Takalar (Kec.Tamalate & Kec.Gareson U)	16 hrs	16 hrs	27/05/2005
13	Jl.Kawasan	Boundary of Kec.Tamalanrea & Kec.Biringkanaya	16 hrs	16 hrs	23/05/2005
14	Jl.Perintis Kemerdekaan	Boundary of Kec.Tamalanrea & Kec.Manggala	16 hrs	16 hrs	23/05/2005
15	Jl.Ir.Sutami	Boundary of Kec.Tamalanrea & Kec.Tallo	16 hrs	16 hrs	23/05/2005
16	Tol Reformasi	Boundary of Kec.Ujungtanah & Kec.Wajo	16 hrs	16 hrs	23/05/2005
17	Jl.Tanampu	Boundary of Kec.Tallo & Kec.Ujungtanah	16 hrs	16 hrs	25/05/2005
18	Jl.Ujung Pang Dang	Boundary of Kec.Wajo & Kec.Ujung Pandang	16 hrs	16 hrs	25/05/2005
19	Jl.Urip Sumoharjo	Boundary of Kec.Panakkukang & Kec.Makassar	16 hrs	16 hrs	25/05/2005
20	Jl.Abu Bakar Lambodo	Boundary of Kec.Panakkukang & Kec.Makassar	16 hrs	-	25/05/2005
21	Jl.Andi Pangerang Pettarani	Boundary of Kec.Panakkukang & Kec.Rappocini	16 hrs	16 hrs	26/05/2005
22	Jl.Sultan Alaudin	Boundary of Kec.Rappocini & Kec.Tamalate	16 hrs	16 hrs	26/05/2005
23	Jl.Metro Tanjung Bunga	Boundary of Kec.Ujung Pandang & Kec.Tamalate	16 hrs	16 hrs	26/05/2005
24	Jl.Sungai Saddamg Baru	Boundary of Kec.Rappocini & Kec.Makassar	16 hrs	16 hrs	26/05/2005
25	Jl.Veteran Utara	Boundary of Kec.Bontoala & Kec.Makassar	24 hrs	16 hrs	30/05/2005
26	Jl.Cendrawasih	Boundary of Kec.Mamajang & Kec.Mariso	16 hrs	16 hrs	30/05/2005
27	Jl.Tamanagapa	Boundary of Makassar City & Kab.Gowa (Kec.Manggala & Kec.Somba Opu)	16 hrs	16 hrs	02/06/2005
28	Jl.Jendral Sudirman	Boundary of Kec.Wajo & Kec.Ujung Pandang	24 hrs	16 hrs	02/06/2005
29	Jl.Penghibur	In Kec.Ujung Pandang	16 hrs	-	02/06/2005

Note: 16hrs from 06:00 to 22:00
24hrs from 06:00 to 06:00 in the following morning
Source: JICA Study Team

Source: JICA Study Team

Figure 2.1: Survey Stations in MAMMINASATA Metropolitan Area

Source: JICA Study Team

Figure 2.2: Survey Stations in Makassar City

4) Zoning

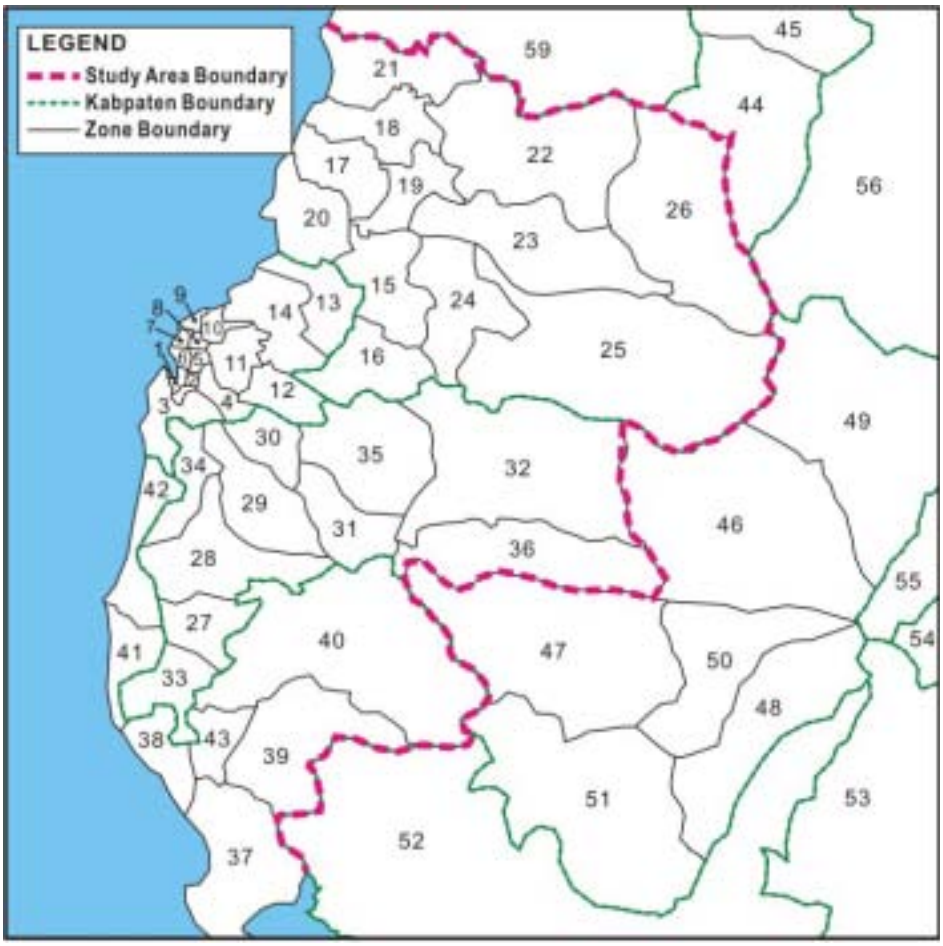
The study area consists of Makassar City and surrounding Kabupaten including Takalar, Maros, and Gowa. Based on Kecamantan, the study area has been divided into 43 zones. In addition to this, the outside of the study area was divided 17 zones. The traffic zones are shown in the following table and figure.

Table 2.2: Traffic Zones

Inside of Study Area		
No	Kabupaten	Kecamatan
1	Makassar	Mariso
2	Makassar	Mamajang
3	Makassar	Tamalate
4	Makassar	Rappocini
5	Makassar	Makassar
6	Makassar	Ujung Pandang
7	Makassar	Wajo
8	Makassar	Bontoala
9	Makassar	Ujung Tanah
10	Makassar	Tallo
11	Makassar	Panakkukang
12	Makassar	Manggala
13	Makassar	Biringkanaya
14	Makassar	Tamalanrea
15	Maros	Mandai
16	Maros	Moncongloe
17	Maros	Maros Baru
18	Maros	Lau
19	Maros	Turikale
20	Maros	Marusu
21	Maros	Bontoa
22	Maros	Bantimurung
23	Maros	Simbang
24	Maros	Tanralili
25	Maros	Tompobulu
26	Maros	Cenrana
27	Gowa	Bontonompo
28	Gowa	Bajeng
29	Gowa	Pallangga
30	Gowa	Somba Opu
31	Gowa	Bontomarannu
32	Gowa	Parangloe
33	Gowa	Bontonompo Selatan
34	Gowa	Barombong
35	Gowa	Pattallassang
36	Gowa	Manuju
37	Takalar	Mangarabombang
38	Takalar	Mappakasunggu
39	Takalar	Polombangkeng S.
40	Takalar	Polombangkeng U.
41	Takalar	Galesong S.
42	Takalar	Galesong U.
43	Takalar	Pattalassang

Outside of Study Area		
No	Kabupaten	Kecamatan
44	Maros	Camba
45	Maros	Mallawa
46	Gowa	Tinggimoncong
47	Gowa	Bungaya
48	Gowa	Tompobulu
49	Gowa	Tombolo Pao
50	Gowa	Bontolempangan
51	Gowa	Biringbulu
52	Jeneponto	All Kecamatan
53	Bantaeng	All Kecamatan
54	Bulukumba	All Kecamatan
55	Sinjai	All Kecamatan
56	Bone	All Kecamatan
57	Soppeng	All Kecamatan
58	Barru	All Kecamatan
59	Pangkep	All Kecamatan
60	Other Kabupaten	All Kecamatan

Source: JICA Study Team



Source: JICA Study Team

Figure 2.3: Traffic Zoning Map

2.2 Results of Traffic Count Survey

1) Establishment of PCU Factor

The Passenger Car Unit (PCU) conversion factor are contained in "The Study on Integrated Transportation Master Plan for Jabotabek (SITRAMP)" conducted by JICA in 2004 and "Indonesian Highway Capacity Manual (IHCM) 1997", as described below:

Table 2.3: PCU Factor

Vehicle Type	SITRAMP	IHCM
Motorcycle	0.33	0.50
Passenger Car	1.00	1.00
Van	1.00	1.00
Taxi	1.00	1.00
Mini-bus	1.20	1.00
Medium Bus	1.50	-
Large Bus	2.00	3.00
Pickup	1.00	1.00
Medium Truck	1.50	2.50
Large Truck	2.00	3.00

Source: SITRAMP, 2004
Indonesian Highway Capacity Manual, 1997

The above table does not specify the PCU for bicycle and becak. It is necessary to consider these vehicles which consist of 6% of all vehicle type according to the results of the traffic count survey. The following PCU factors are adopted in this study:

Table 2.4: PCU Factor for This Study

Vehicle Type	PCU Factor
Bicycle	0.20
Becak	0.50
Motorcycle	0.33
Car/Taxi/Jeep	1.00
Minibus	1.20
Standard Bus	2.00
Pickup	1.00
Small Truck (2-Axle)	1.50
Large Truck (3 or more axle)	2.00

Source: JICA Study Team

2) Traffic Volumes

The traffic volumes and the vehicle composition of both directions at 29 stations are shown in the following tables. Since the surveys at 26 stations were conducted with 16 hours period, the traffic volumes were expanded by using expansion factors obtained from 24 hours stations. The heaviest volume was 80,696 PCUs at Jl.Andi Pangerang Pettarani (Station 21), which is main road running from north to south. Meanwhile, Jl.Perintis Kemerdekaan (Station 14), which connects east and west, had the second heaviest volume. Regarding the vehicle composition, motorcycle constituted the major share of all traffic at 57%, followed by car/taxi/jeep at 19% and bus at 13%. Although truck and pickup had lower shares than other vehicle type, they had slightly higher shares outside Makassar city.

Table 2.5: Traffic Volumes at 29 Stations

Station No	Unit: Vehicle/24hrs							PCU
	Bicycle & Becak	Motorcycle	Car/Taxi/Jeep	Bus	Pickup	Truck	Motorized Vehicle Total	
Station 1	290	3,762	3,832	2,199	974	2,214	12,981	12,689
Station 2	1,180	5,770	1,476	2,035	524	630	10,435	7,849
Station 3	37	1,441	86	1,285	229	337	3,378	2,900
Station 4	397	7,717	1,080	1,849	414	2,488	13,548	10,474
Station 5	0	578	77	345	86	146	1,232	992
Station 6	3,724	20,296	3,524	3,468	718	2,154	30,160	19,294
Station 7	308	11,803	1,926	2,561	666	1,167	18,123	11,501
Station 8	134	2,218	304	2,291	251	551	5,615	5,011
Station 9	267	19,274	12,639	6,834	1,927	4,230	44,904	36,459
Station 10	8,559	51,693	11,918	7,575	1,495	4,849	77,530	49,567
Station 11	401	2,324	195	456	85	146	3,206	1,905
Station 12	1,066	3,833	177	474	214	105	4,803	2,610
Station 13	254	18,098	2,991	1,694	1,263	1,717	25,763	15,519
Station 14	708	79,650	20,268	20,590	1,785	2,229	124,522	76,889
Station 15	589	18,332	10,653	3,515	2,744	6,672	41,916	34,823
Station 16	0	0	2,560	3,757	983	2,703	10,003	12,749
Station 17	12,047	16,463	1,622	5,717	1,062	1,624	26,488	22,335
Station 18	3,206	20,255	11,449	4,114	853	820	37,491	26,471
Station 19	1,736	54,741	18,374	21,420	1,657	1,038	97,230	66,063
Station 20	3,977	16,599	1,097	1,280	894	620	20,490	11,596
Station 21	3,985	91,750	28,739	8,907	3,840	3,566	136,802	80,696
Station 22	7,277	43,924	7,297	19,905	966	695	72,787	50,578
Station 23	887	14,039	8,084	356	646	233	23,358	14,356
Station 24	3,872	34,561	20,554	122	1,839	574	57,650	36,378
Station 25	7,332	57,609	17,096	6,262	2,093	1,440	84,500	50,956
Station 26	4,768	25,135	5,597	6,596	838	445	38,611	25,412
Station 27	1,269	22,528	5,582	5,615	745	740	35,210	22,040
Station 28	902	28,261	15,847	11,762	1,394	141	57,405	41,204
Station 29	3,631	24,559	13,515	2,111	1,015	841	42,041	27,917

Source: JICA Study Team

Table 2.6: Vehicle Composition on 29 Stations

Unit: %

	Bicycle & Becak	Motorcycle	Car/Taxi/Jeep	Bus	Pickup	Truck	Total
Station 1	2.2	28.3	28.9	16.6	7.3	16.7	100.0
Station 2	10.2	49.7	12.7	17.5	4.5	5.4	100.0
Station 3	1.1	42.2	2.5	37.6	6.7	9.9	100.0
Station 4	2.8	55.3	7.7	13.3	3.0	17.8	100.0
Station 5	0.0	46.9	6.3	28.0	7.0	11.9	100.0
Station 6	11.0	59.9	10.4	10.2	2.1	6.4	100.0
Station 7	1.7	64.0	10.4	13.9	3.6	6.3	100.0
Station 8	2.3	38.6	5.3	39.9	4.4	9.6	100.0
Station 9	0.6	42.7	28.0	15.1	4.3	9.4	100.0
Station 10	9.9	60.0	13.8	8.8	1.7	5.6	100.0
Station 11	11.1	64.4	5.4	12.6	2.4	4.0	100.0
Station 12	18.2	65.3	3.0	8.1	3.6	1.8	100.0
Station 13	1.0	69.6	11.5	6.5	4.9	6.6	100.0
Station 14	0.6	63.6	16.2	16.4	1.4	1.8	100.0
Station 15	1.4	43.1	25.1	8.3	6.5	15.7	100.0
Station 16	0.0	0.0	25.6	37.6	9.8	27.0	100.0
Station 17	31.3	42.7	4.2	14.8	2.8	4.2	100.0
Station 18	7.9	49.8	28.1	10.1	2.1	2.0	100.0
Station 19	1.8	55.3	18.6	21.6	1.7	1.0	100.0
Station 20	16.3	67.8	4.5	5.2	3.7	2.5	100.0
Station 21	2.8	65.2	20.4	6.3	2.7	2.5	100.0
Station 22	9.1	54.9	9.1	24.9	1.2	0.9	100.0
Station 23	3.7	57.9	33.3	1.5	2.7	1.0	100.0
Station 24	6.3	56.2	33.4	0.2	3.0	0.9	100.0
Station 25	8.0	62.7	18.6	6.8	2.3	1.6	100.0
Station 26	11.0	57.9	12.9	15.2	1.9	1.0	100.0
Station 27	3.5	61.8	15.3	15.4	2.0	2.0	100.0
Station 28	1.5	48.5	27.2	20.2	2.4	0.2	100.0
Station 29	8.0	53.8	29.6	4.6	2.2	1.8	100.0
Total	5.9	56.6	18.6	12.6	2.6	3.7	100.0

Source: JICA Study Team

3) Traffic Condition in the Study Area

Based on the results of the traffic count survey, the traffic volumes on main roads in Mamminasata Area and Makassar City[1] are illustrated in the following figures,, respectively. From the study, it can be assumed that traffic concentrates in and around Makassar city. Heavy traffic was observed particularly on Jl.Urip Sumoharjo, Jl.Perintis Kemerdekaan and Jl.Andi Pangerang Pettarani.

[1] In order to show the traffic volumes in Makassar city, results of the intersection count survey were added as supplemental data after conversion to 24 hours traffic volumes.

Source: JICA Study Team

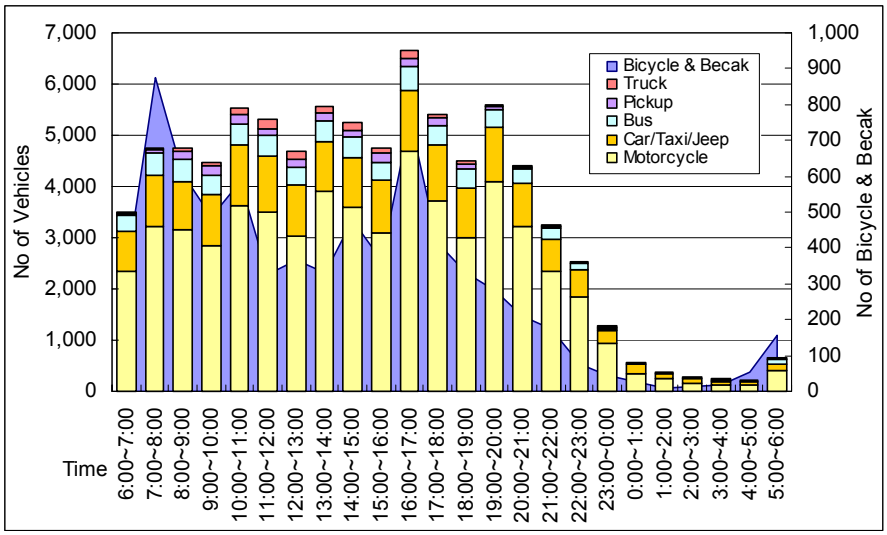
Figure 2.4: Traffic Volumes in MAMMINASATA

Source: JICA Study Team

Figure 2.5: Traffic Volumes in Makassar City

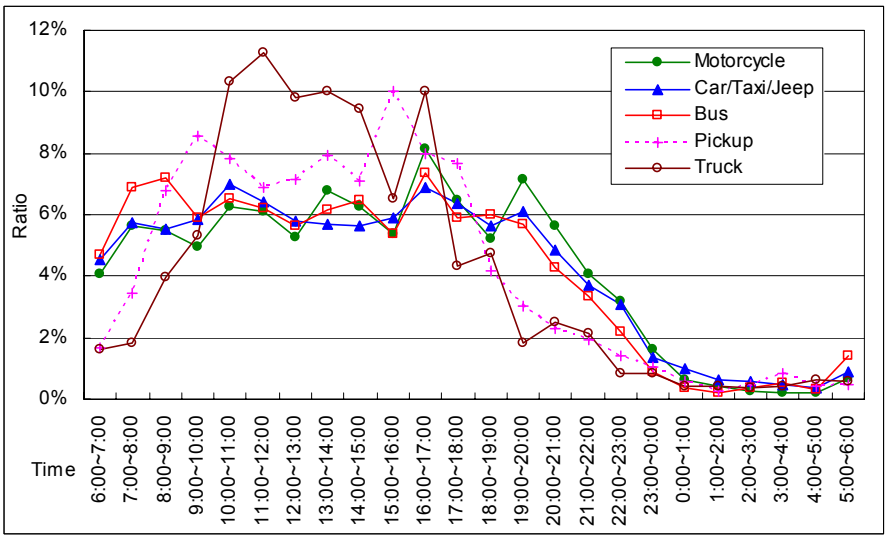
4) Hourly Fluctuation

To understand magnitude and peak hour of the traffic, the study reviewed the hourly fluctuation. The following figures show the hourly fluctuations of 24 hours at the surveyed stations. At Jl.Veteran Utara, which is one of main roads from north to south in center of Makassar city, the highest traffic volume was observed between 16:00 and 17:00 as evening peak. However, morning peak was not observed for the most of the mode except bicycle and becak. In contrast, constant traffic volumes were recorded from 06:00 to 18:00 at border between Kab.Maros and Kab.Pangkep.



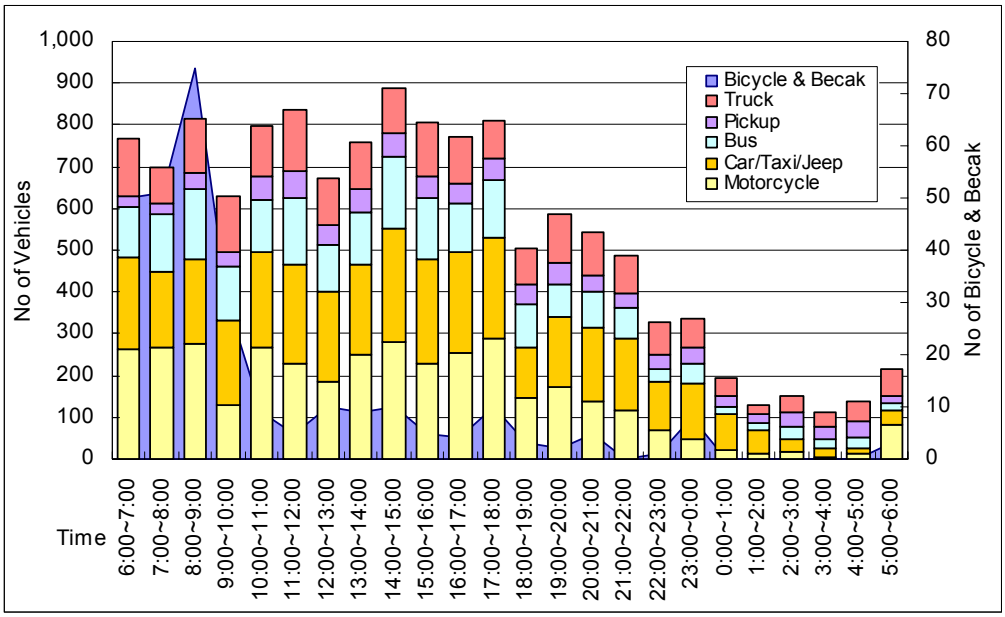
Source: JICA Study Team

Figure 2.6: Hourly Fluctuation on Jl.Veteran Utara (Station 25)



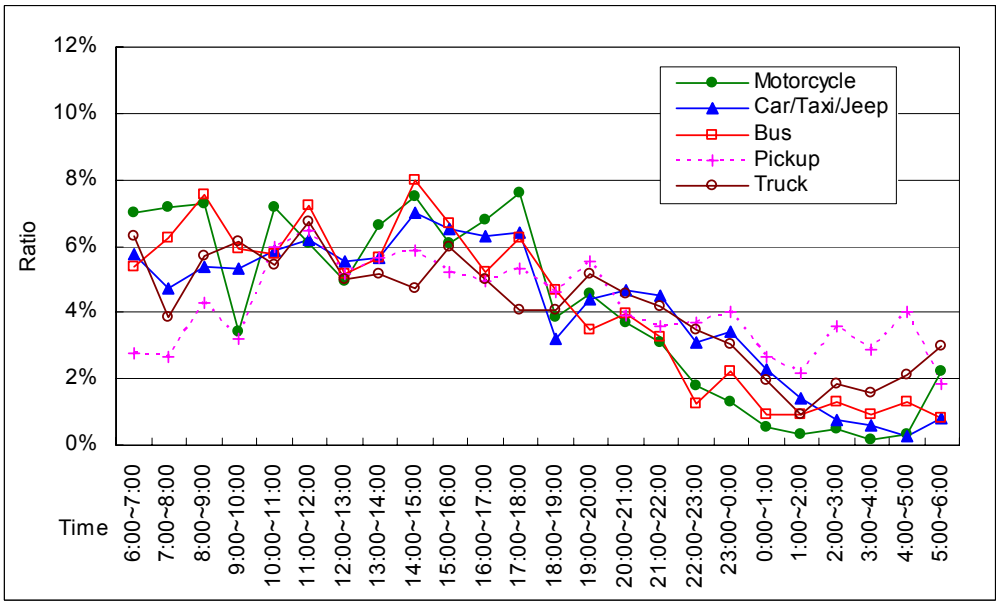
Source: JICA Study Team

Figure 2.7: Hourly Fluctuation by Vehicle Type on Jl.Veteran Utara (Station 25)



Source: JICA Study Team

Figure 2.8: Hourly Fluctuation on National Road between Kab.Maros and Kab.Pangkep (Station 1)

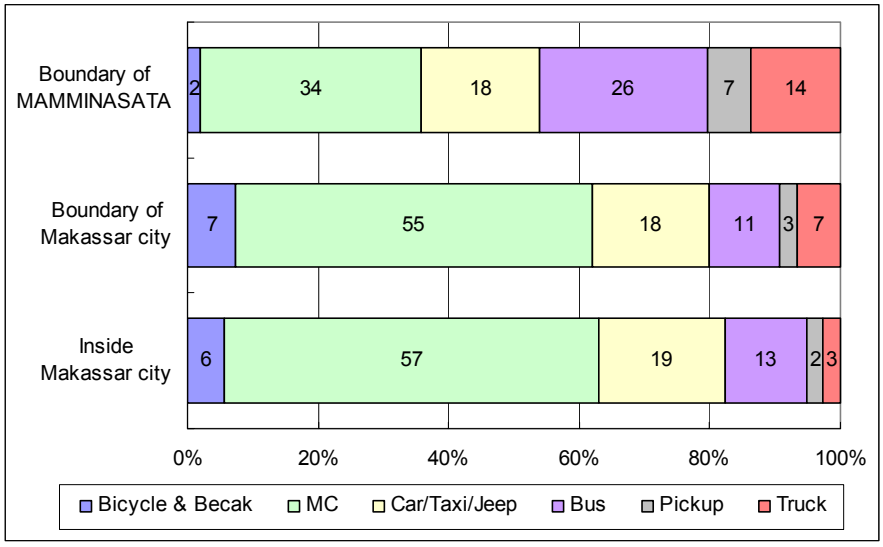


Source: JICA Study Team

Figure 2.9: Hourly Fluctuation by Vehicle Type on National Road between Kab.Maros and Kab.Pangkep (Station 1)

5) Vehicle Composition

Figure 2.3.7 illustrates vehicle composition of each area. Motorcycle had a substantial large share in and around Makassar city, while bus and truck had higher shares on national and provincial roads at boundary of Mamminasata. From the findings of the survey, private transport such as motorcycle and passenger car tends to be utilized in urban area. On the other hand, public transport and freight transport were relatively more active on intercity roads in suburban area.



Source: JICA Study Team

Figure 2.10: Vehicle Composition by Each Area

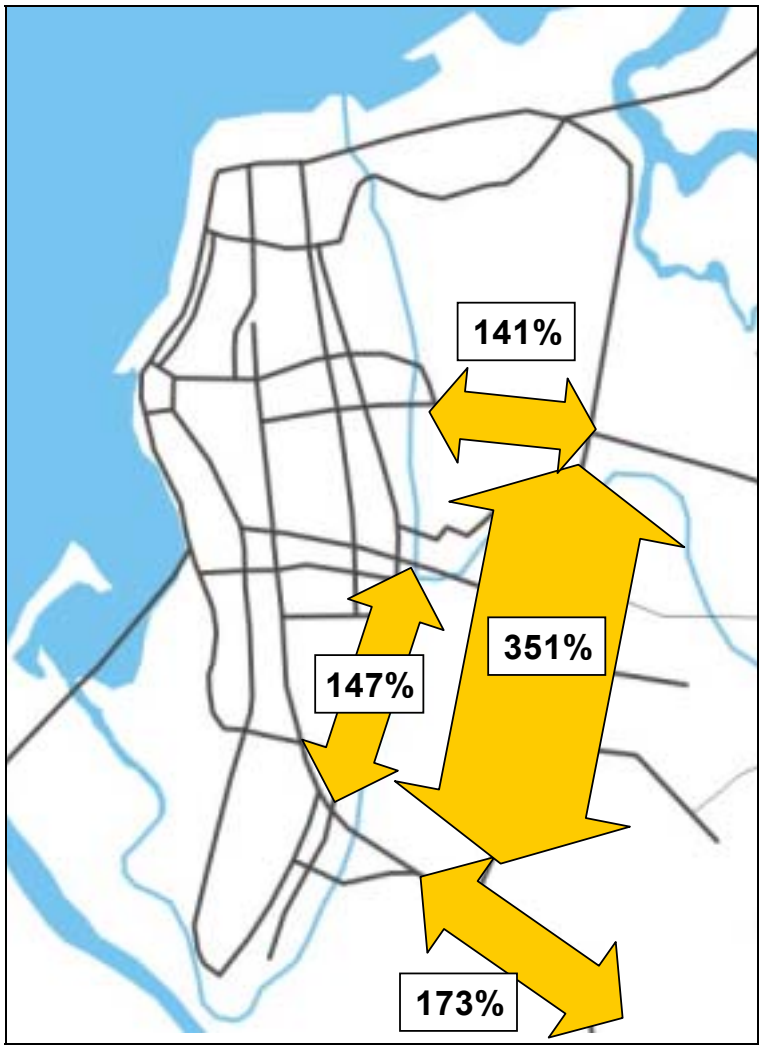
6) Comparison of Traffic Volumes between 1988 and 2005

According to "Ujung Pandang Area Highway Development Study (JICA 1989)", the traffic count survey was conducted in 1988 and it provided some traffic data. To grasp traffic changes between 1988 and 2005, the past traffic volumes on major roads in Makassar city were compared with the present one, as shown in the following table. The present traffic on Jl.Andi Pangerang Pettarani was drastically increased with 351% from 1988, and the traffic growth rate can be calculated at 8.2% per annum. The road which had highest traffic volume changed from Jl.Veteran Utara in 1988 to Jl.Andi Pangeran Pettrani in 2005. These changes indicate that the traffic movement to the hinterland of east direction had become more active due to advancement of urbanization in Makassar city.

Table 2.7: Traffic Change between 1988 and 2005

	Unit: 000 vehicles		2005/1988 (%)
	1988	2005	
Jl.Urip Sumoharjo	23.7 (26.9)	33.3 (40.5)	141% (151%)
Jl.Andi Pangerang Pettarani	10.2 (22.1)	35.8 (62.6)	351% (283%)
Jl.Sultan Alaudin	12.7 (19.4)	22.0 (35.1)	173% (181%)
Jl.Veteran Selatan	13.7 (20.6)	20.2 (45.1)	147% (219%)

Note: Figures in parentheses indicate number of motorcycle and becak.
Source: JICA Study Team and Ujung Pandang Area Highway Development Study (JICA 1989)



Source: JICA Study Team

Figure 2.11: Traffic Change between 1988 and 2005

2.3 Results of OD Interview Survey

1) Number of Samples

The number of samples[2] by each mode obtained through the OD interview survey is described in the following table. In terms of the collecting rate, Station 10, 14 and 21 are less than 2% due to heavier traffic in CBD, while Station 3, 8 and 12 were more than 10%. Although survey stations included heavy traffic sections in center of Makassar city, a total collecting rate gained 3.7% under cooperation of traffic police enforcers. The number of data can be considered enough to analyze and forecast for future traffic from statistical point of view.

[2] The number of samples was changed from 40,896 to 38,629 by deletion of invalid samples in logical and error checks.

Table 2.8: Number of Samples

Station	Number of Samples							Collecting Rate (%)
	Bicycle & Becak	Motorcycle	Car/Taxi/ Jeep	Bus	Pickup	Truck	Total	
1	10	342	201	222	114	211	1,100	8.3
2	80	435	108	195	45	51	914	7.9
3	11	107	33	137	36	60	384	11.2
4	23	512	63	126	27	129	880	6.3
5	0	51	6	33	8	15	113	9.2
6	155	1,008	228	238	91	188	1,908	5.6
7	19	741	136	223	64	89	1,272	6.9
8	2	223	78	272	76	139	790	13.7
9	45	606	226	301	129	166	1,473	3.3
10	162	639	168	304	111	140	1,524	1.8
11	28	387	40	39	29	29	552	15.3
12	107	502	53	75	49	29	815	13.9
13	17	860	220	149	78	135	1,459	5.6
14	94	938	340	473	165	150	2,160	1.7
15	10	681	307	139	122	222	1,481	3.5
16	0	0	162	172	124	217	675	6.7
17	536	789	90	327	60	93	1,895	4.9
18	230	672	347	165	105	93	1,612	4.0
19	45	1,284	518	806	81	21	2,755	2.8
21	87	1,120	413	396	111	63	2,190	1.6
22	243	1,089	438	672	108	33	2,583	3.2
23	75	812	569	42	35	10	1,543	6.4
24	96	685	429	7	117	36	1,370	2.2
25	148	909	436	321	94	60	1,968	2.1
26	200	790	344	432	47	30	1,843	4.2
27	44	804	251	233	75	63	1,470	4.0
28	3	761	579	531	26	0	1,900	3.3
Total	2,470	17,747	6,783	7,030	2,127	2,472	38,629	3.7

Source: JICA Study Team

2) Average Passenger Occupancy

The average occupancy rate by vehicle type obtained from the results of the OD interview survey is shown in the following table.

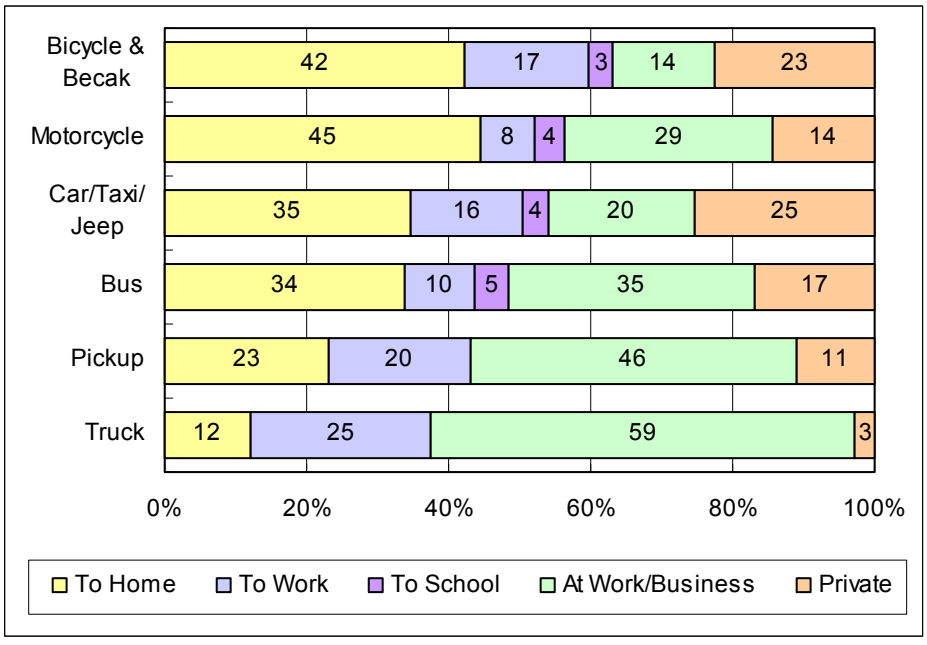
Table 2.9: Average Passenger Occupancy

Vehicle Type	Total Passengers	Number of Sample	Average Occupancy (passenger/vehicle)
Bicycle	1,406	1,314	1.07
Becak	2,186	1,156	1.89
Motorcycle	26,307	17,747	1.48
Car/Taxi/Jeep	17,160	6,783	2.53
Minibus	38,919	6,728	5.78
Large Bus	4,818	302	15.95
Pickup	4,354	2,127	2.05
Small Truck (2-Axle)	3,926	1,758	2.23
Large Truck (3 or more axle)	1,658	714	2.32

Note: Above figures are included drivers
Source: JICA Study Team

3) Trip Purpose

The trip purpose varied according to the vehicle type as illustrated in the following figure. The share of "To home" was the highest for bicycle/becak, motorcycle and car/taxi/jeep. For bus, pickup and truck, the highest share was "at work/business".



Source: JICA Study Team

Figure 2.12: Trip Purpose by Vehicle Type

4) Commodity Type

The following table shows the type of commodities carried by pickup and truck. Items of "construction" and "agriculture" have higher shares accounting for 21.0% and 20.8%, respectively. Trucks carrying "construction" goods were observed on

provincial road between Sungguminasa and Malino (Station 4), while those of "agriculture" were observed on national roads between Pekkae and Pangkajene Kepulauan and between Maros and Ujung Lamura (Station 2&3).

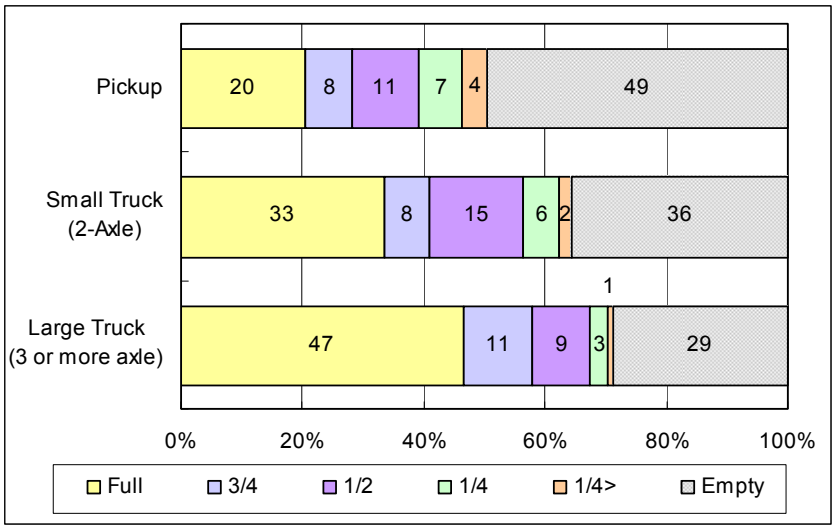
Table 2.10: Commodity Type

Type of Commodity	%
Construction (Sand, Gravel, Asphalt, Concrete, Re-Bar, Beam, etc.)	21.0
Agriculture (Rice, Corn, Vegetable, Fruit, etc.)	20.8
Miscellaneous Industry (Garment, Shoes, etc.)	9.5
Light Industry / Electronics (Machine Parts, IC, Electronic Appliances, etc.)	7.4
Forest (Log, Timber, Plywood, etc.)	6.2
Fishery (Fish, Shell, Seaweed, etc.)	6.0
Chemical (Petroleum, Alcohol, Acid, etc.)	5.1
Mineral (Coal, Copper, Iron, Salt, etc.)	4.0
Metal & Machine (Steel, Generator, Car & Bike, etc.)	2.5
Others	17.4
Total	100.0

Source: JICA Study Team

5) Loading Condition of Freight Transport

The following figure shows loading conditions by vehicle type. As vehicle size becomes larger, the loading condition tends to become higher in occupancy. Since some pickups were utilized as passenger transport, the share or empty ratio was also high, accounting for 49%.

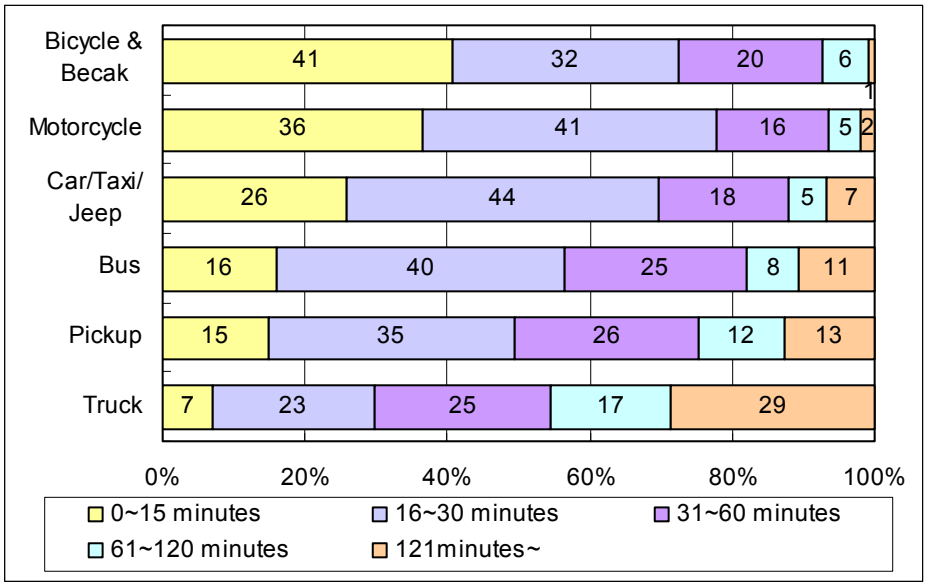


Source: JICA Study Team

Figure 2.13: Loading Condition by Vehicle Type

6) Travel Time

The following figure shows travel time by vehicle type. More than half of respondents except truck answered less than 30 minutes. This result implies that most of the respondents live and work within the area, which can be covered by 30 minutes. However, the trip length differs according to transportation mode even though the travel time is same.



Source: JICA Study Team

Figure 2.14: Travel Time by Vehicle Type

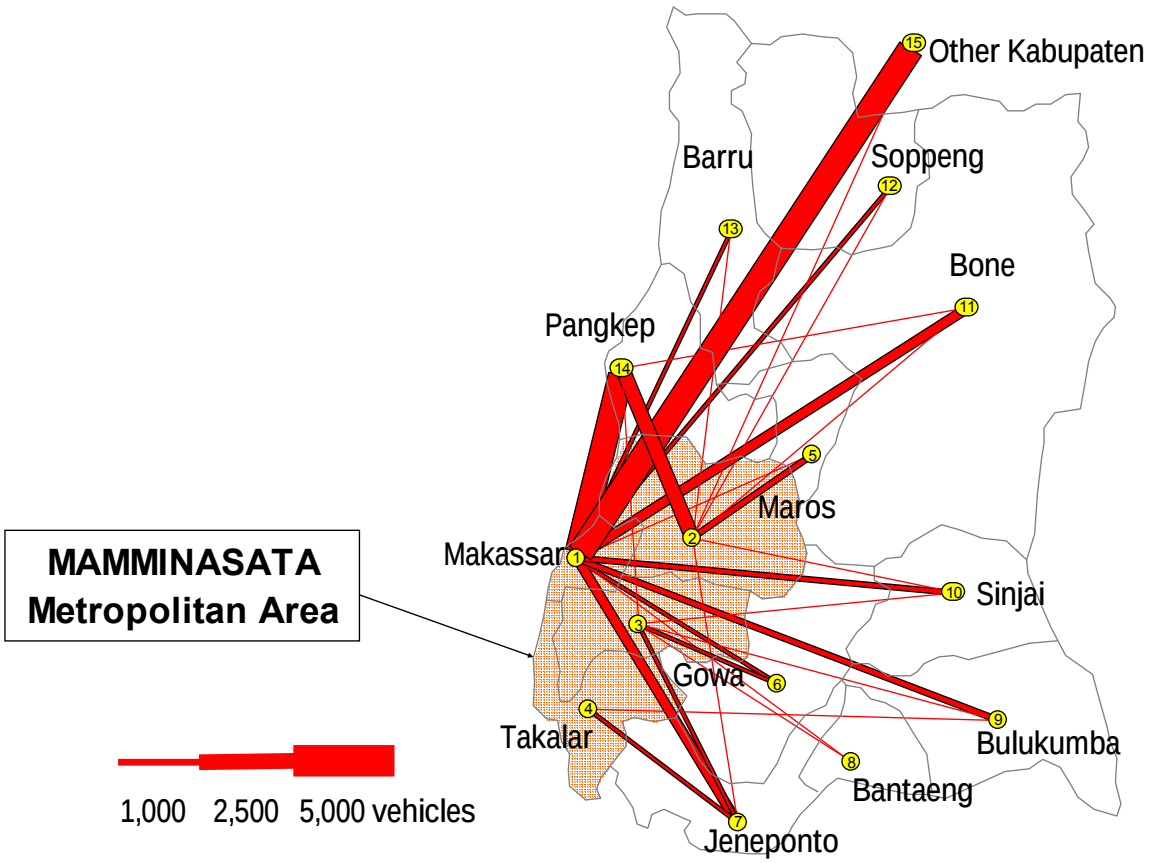
7) Transport Demand Characteristics across Mamminasata Metropolitan Area

Origin and destination data (sample data) obtained in the OD interview survey were expanded to adjust to total volumes by vehicle type and by direction in order to prepare the OD matrices for each station[3]. OD matrices across MAMMMINASATA Metropolitan Area were built based on data of Station 1, 3, 5, and 8. By using the OD matrices and zoning map, a desire line was drawn to represent the transport demand characteristics, as shown in the following figure.

Most of the traffic from/to outside Mamminasata Metropolitan Area had origin and destination in the area. There is scarcely few traffic passing through Mamminasata Metropolitan Area. Traffic from/to Pangkep is strongly connected with Makassar and Maros, which suggests that passengers and freight from/to Pangkep may be affected by future development of Mamminasata Metropolitan Area.

[3] The detail method of expansion for the OD matrices is explained in the traffic demand forecast.

In Mamminasata Metropolitan Area, Makassar city is the most attractive and generative place for passenger and freight transport and is connected not only surrounding Kabupaten but also other Kabupaten in Sulawesi Island. This result implies that Makassar city is playing a significant role in the Sulawesi Island. On the other hand, Maros, Gowa and Takalar have strong relationship with adjacent Kabupaten.



Note: Above volumes are excluded Bicycle and Becak.
Source: JICA Study Team

Figure 2.15: Desired Line across MAMMINASATA

7) Transport Demand Characteristics across Makassar City

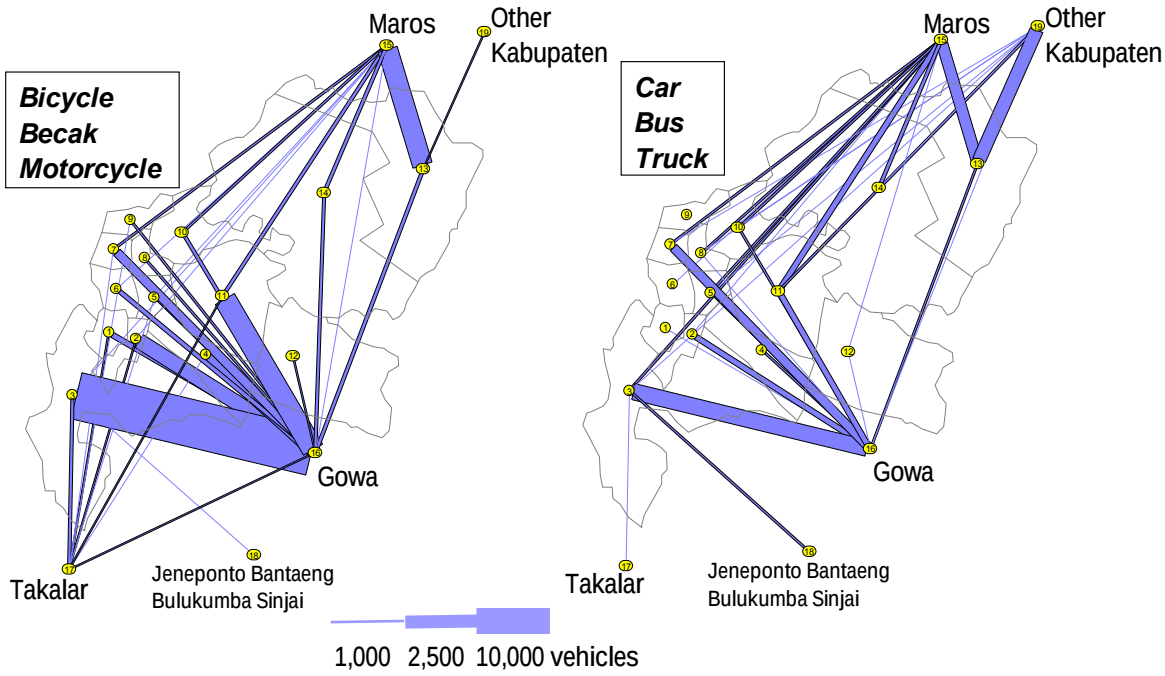
By using data of Station 9, 10, 11 and 12, OD matrices across Makassar City by vehicle type were built and represented in the following figure.

Maros and Gowa are strongly connected with north and south parts of Makassar City, respectively. Biringkanaya Kecamatan in Makassar city is strongly connected with Maros and Other Kabupaten, since there are KIMA Industrial park and Regional Daya bus terminal that attract trucks and buses.

It is noteworthy that motorcycle trips between Gowa and Kecamatan Tamalate in Makassar city is the most active. This is understandable that Kecamatan Tamalate has

wide area which includes KAWASAN GMTDC and commercial and residential area along Jl.Sultan Alauddin connecting to Gowa.

In terms of traffic between Takalar and Makassar city, bicycle and motorcycle from/to Takalar exist, while, car, bus and truck are significantly low. This result indicates that both passenger and freight transport from/to Takalar are not closely related to Makassar city to compare with those from/to Gowa and Maros.



Source: JICA Study Team

Figure 2.16: Transport Demand Characteristics across Makassar City

3. INTERSECTION TRAFFIC COUNT SURVEY

3.1 Outline of Survey

This survey aimed at identifying traffic movements in CBD of Makassar city during peak periods and to assess present operational efficiency of intersections. This result is conducive to future improvements plans such as construction of flyover and installation of optimal traffic signal control.

1) Survey Item

- Vehicular traffic count for each direction of intersections

2) Survey Method

The intersection traffic count survey was conducted to get the hourly traffic volume by vehicle type and by direction. The same vehicle classification as the traffic count survey was applied. Inventory sheets included sketches, name of roads and directions were prepared for each survey station and distributed to supervisors to properly allocate surveyors prior to the field survey.

3) Survey Coverage

8 intersections were selected considering present traffic congestions and possibilities for improving geometrical design as shown in the following table and figure.

The survey duration was 2 hours in each time period as described below:

- Morning Peak Hours (07:00-09:00)

- Evening Peak Hours (16:00-18:00)

Table 3.1: Survey Stations for Intersection Traffic Count Survey

Station No	Survey Location	Survey date
1	Jl.Urip Sumoharjo - Jl.Tol Reformasi - Jl.Andi Pangerang Pettarani	31/05/2005
2	Jl.Andi Pangerang Pettarani - Jl.Pelita Raya - Jl.Boulevard Pannakukang	31/05/2005
3	Jl.Andi Pangerang Pettarani - Jl.Hertasning	01/06/2005
4	Jl.Urip Sumoharjo - Jl.Veteran Utara	01/06/2005
5	Jl.Veteran Utara - Jl.Masjid Raya	01/06/2005
6	Jl.Bawakaraeng - Jl.Jendral Sudirman	03/06/2005
7	Jl.Sungai Saddang - Jl.Veteran Utara	03/06/2005
8	Jl.Veteran Selatan - Jl.Sultan Alaudin - Jl.Kumala - Jl.Sam Ratulangi	03/06/2005

Source: JICA Study Team

Source: JICA Study Team

Figure 3.1: Survey Stations for Intersection Traffic Count Survey

3.2 Results of Survey

The following tables show traffic volumes on morning and evening peak hours, respectively. The heaviest traffic was recorded at Station 2 in all intersections, which was counted 9,543 PCUs between 17:00 and 18:00. Based on the results, it can be confirmed that high traffic volumes were the intersections along Jl.Andi Pangerang Pettarani during both peak hours.

Table 3.2: Morning Peak Traffic Volumes

AM	Bicycle & Becak	MC	Car/Taxi/ Jeep	Bus	Pickup	Truck	Motorized Vehicle Total	PCU	Peak Time
Station 1	465	6,511	2,490	2,955	234	303	12,493	9,061	08~09
Station 2	913	8,052	4,054	1,145	220	249	13,720	8,989	07~08
Station 3	1,171	6,198	2,185	659	96	114	9,252	5,626	07~08
Station 4	985	5,412	1,814	1,615	181	148	9,170	6,305	08~09
Station 5	741	3,532	1,036	1,803	277	126	6,774	5,111	08~09
Station 6	482	3,120	1,075	1,557	191	30	5,973	4,408	08~09
Station 7	721	3,301	1,227	81	162	27	4,798	2,926	08~09
Station 8	1,514	4,798	1,002	1,430	76	21	7,327	4,957	07~08

Note: total of all directions
Source: JICA Study Team

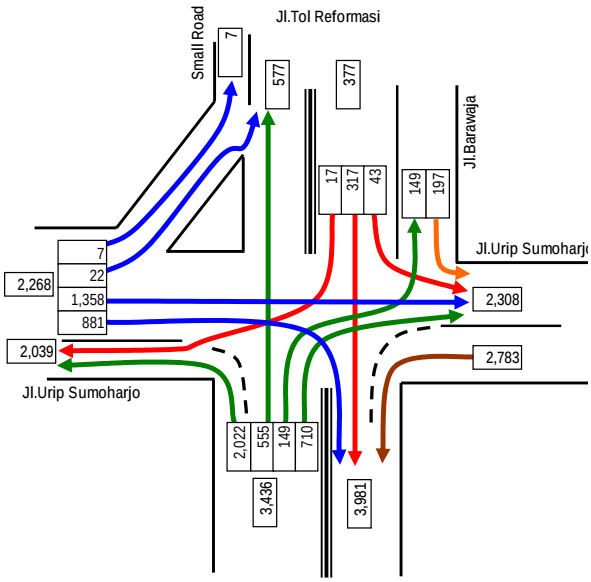
Table 3.3: Evening Peak Traffic Volumes

PM	Bicycle & Becak	MC	Car/Taxi/ Jeep	Bus	Pickup	Truck	Motorized Vehicle Total	PCU	Peak Time
Station 1	563	6,706	2,572	2,218	344	213	12,053	8,322	17~18
Station 2	552	9,589	4,218	902	393	300	15,402	9,543	17~18
Station 3	485	5,583	2,079	656	177	215	8,710	5,402	17~18
Station 4	528	4,828	1,408	1,439	343	157	8,175	5,506	17~18
Station 5	703	6,465	1,474	2,730	417	71	11,157	7,658	17~18
Station 6	546	4,941	1,941	1,459	272	101	8,714	5,970	17~18
Station 7	739	4,232	1,415	85	228	27	5,987	3,507	17~18
Station 8	934	4,510	1,010	1,504	198	88	7,310	4,953	16~17

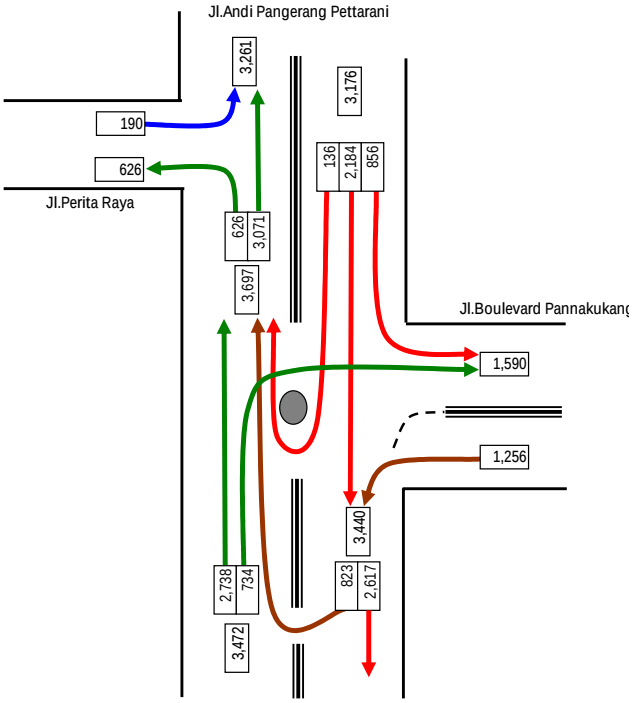
Note: total of all directions
Source: JICA Study Team

Directional traffic movements of all intersections during peak hour are illustrated in the following figures. Station 2 and 8 were circulated traffic without traffic signal, while other stations were signal controlled.

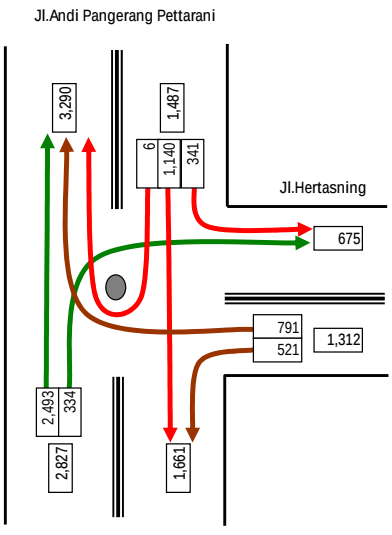
Unit: PCU



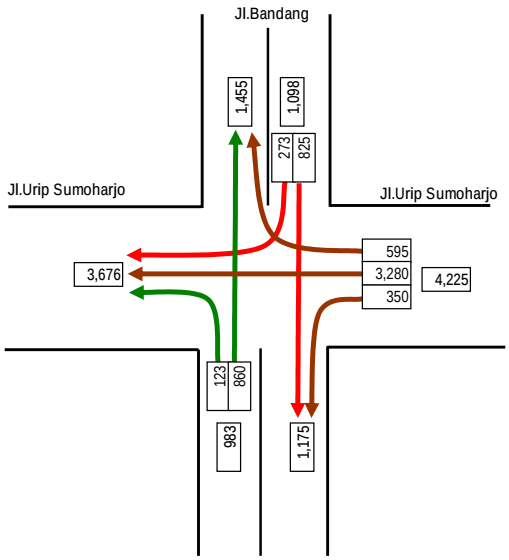
Station 1 (08:00 – 09:00)



Station 2 (17:00 – 18:00)



Station 3 (07:00 – 08:00)

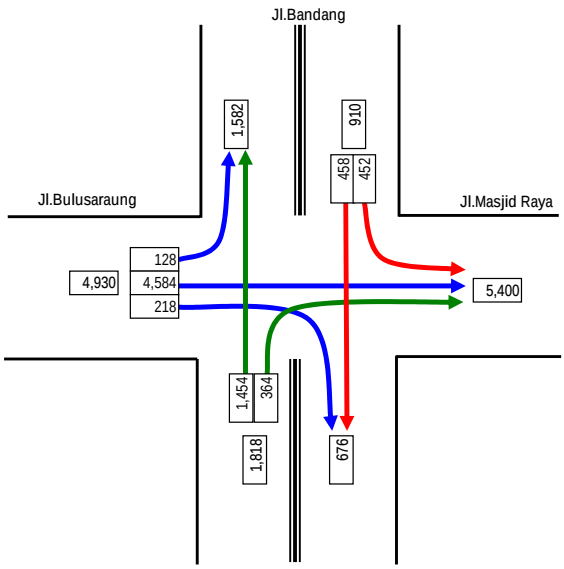


Station 4 (08:00 – 09:00)

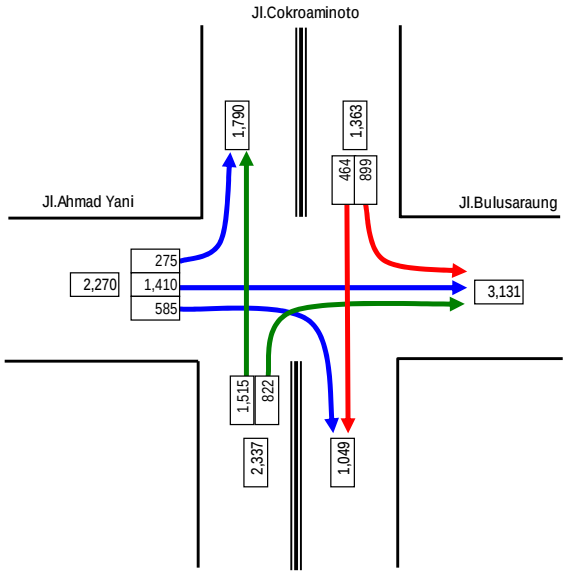
Source: JICA Study Team

Figure 3.2: Peak Hour Traffic by Direction (Station 1 - 4)

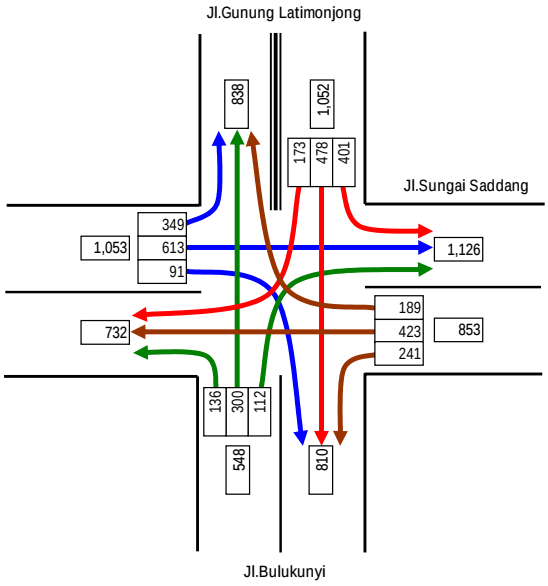
Unit: PCU



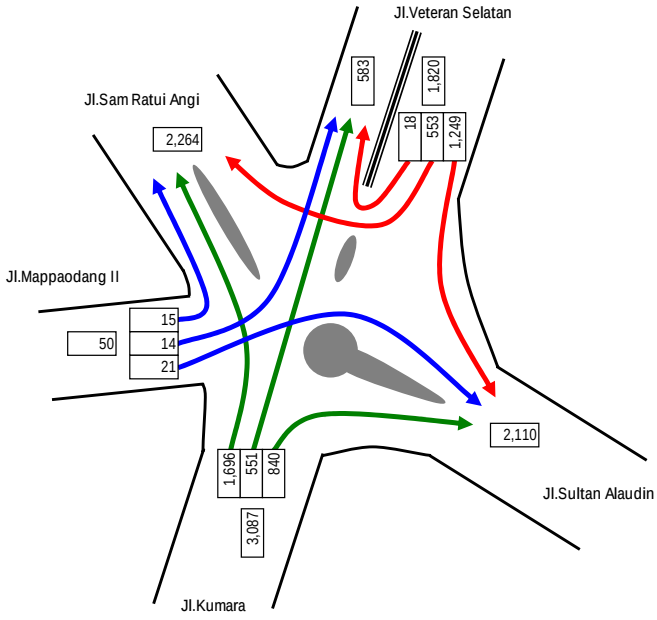
Station 5 (17:00 – 18:00)



Station 6 (17:00 – 18:00)



Station 7 (17:00 – 18:00)



Station 8 (07:00 – 08:00)

Source: JICA Study Team

Figure 3.3: Peak Hour Traffic by Direction (Station 5 - 8)

4. TRAVEL SPEED SURVEY

4.1 Outline of Survey

Travel speed survey aims at measuring average travel speed on selected routes in the study area. The results of the survey are essential for understanding the congested sections in the study area as well as for the setting of Q/V formulae of network links for traffic assignment in the traffic demand forecast.

1) Survey Item

Travel information on certain road sections: time of departure and arrival (start and end points of route), time of passing intersections, and time of stop/restart with reason of stopping.

2) Survey Method

The travel speed survey was conducted by the "floating car method", which requires the survey vehicle to keep the same position in the traffic flow; i.e. if the survey vehicle is overtaken by other vehicles, it should overtake the same number of vehicles. Due to one way operation of some roads in center of Makassar city, return trip differed from the first trip. This survey was carried out by passenger cars.

3) Survey Coverage

For this survey, 5 routes were identified to cover the major roads in the study area as shown in the following table and figure. For each route, 9 samples (round trip) were obtained in total, 3 samples per time period. The survey covered the following 3 time periods: (a) Morning Peak Hours (7:00-10:00), (b) Off Peak Hours (10:00-16:00) and (c) Evening Peak Hours (16:00-19:00).

Table 4.1: Survey Routes for Travel Speed Survey

No	Survey Route	Survey date
A	Intersection (Jl.Ahmad Yani & Jl.Jendral Sudirman) - Intersection (Karang Patigalloang)	31/5/2005
B	Intersection (Jl.Galangan Kapal & Jl.Sunu) - Gate of Maros City	01/06/2005
C	Entrance of Jl.Tol Reformasi - End of Jl.Cokroaminoto	02/06/2005
D	End of Jl.Rusa (Intersection Jl.Pasewang) - Intersection (Jl.Sunu)	03/06/2005
E	Intersection (Jl.Jendral Sudirman) - End of Kecamatan Bontonompo	06/06/2005

Source: JICA Study Team

Source: JICA Study Team

Figure 4.1: Survey Routes for Travel Speed Survey

4.2 Results of Survey

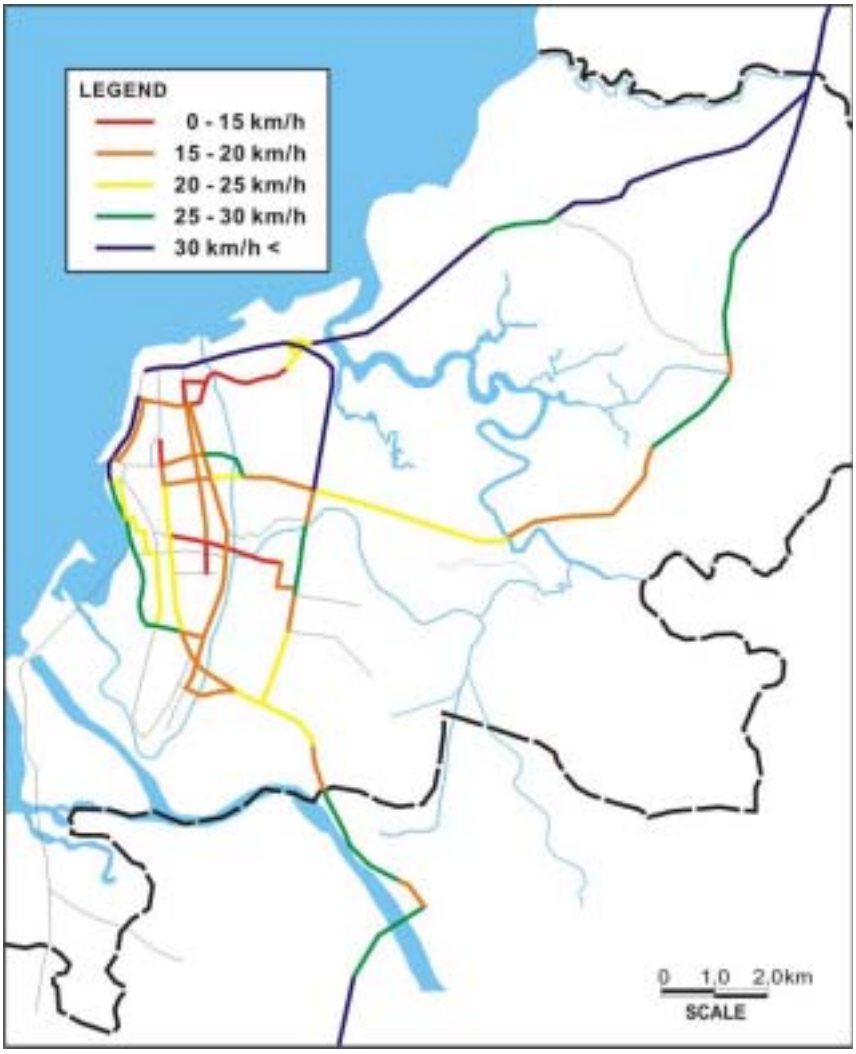
Results of the average travel speed by direction, by time period on each route are summarized in the following table. Route D which passes through center of Makassar city had the lowest average travel speed of all routes at 20km/h. In terms of time period, the lowest average travel speed was observed during the evening peak.

The average travel speed profile in the evening peak is shown in the following figure. The lowest average travel speed was observed on Jl.Tanampu and Jl.Sungai Saddang, which run through east and west direction. The average travel speed of the most roads surrounding Jl.Tol Reformasi and Jl.Pettarani are low. On the other hand, the average travel speed outside Makassar city was high, with more than 30km/h except for Sungguminasa.

Table 4.2: Summary of Travel Speed by Each Route

Route Name	Direction		Distance (Km)	Average Travel Speed (km/h)			
	From	To		AM	Off	PM	All day
A	Makassar Border	Jl.Ahmad Yani	19.5	26.1	29.3	26.5	27.2
	Jl.Ahmad Yani	Makassar Border	18.8	28.1	29.2	24.4	27.0
B	Maros City Border	Jl.Sunu	17.6	35.0	33.6	32.8	33.8
	Jl.Sunu	Maros City Border	18.5	33.0	40.5	36.1	36.3
C	Jl.Cokroaminoto	Jl.Tol Reformasi	16.4	31.1	30.0	27.6	29.5
	Jl.Tol Reformasi	Jl.Cokroaminoto	17.0	30.6	31.0	27.6	29.7
D	Jl.Sunu	Jl. Pasewang	17.2	20.0	20.9	19.6	20.2
	Jl. Pasewang	Jl.Sunu	17.9	22.3	19.8	19.2	20.3
E	End of Kec.Bontanompo	Jl. Jendral Sudirman	25.4	30.1	28.6	28.8	29.2
	Jl. Jendral Sudirman	End of Kec.Bontonompo	25.4	30.7	29.8	24.5	28.1
Total			-	28.1	28.3	25.9	27.4

Source: JICA Study Team



Source: JICA Study Team

Figure 4.2: Travel Speed Profile (PM Peak)

5. FREIGHT TRANSPORT SURVEY

5.1 Outline of Survey

The objective of the freight transport survey is to obtain an understanding of the movement of freight vehicles at their main generating/attracting areas, such as industrial park, port, and airport.

1) Survey Item

- Truck Traffic Count Survey

- Truck OD Interview Survey

2) Survey Method

The survey was divided into two parts, (1) truck traffic count survey and (2) truck OD interview survey.

a) Truck Traffic Count Survey was conducted at entrances and exit gates of port, airport, industrial park and warehouse. The hourly truck traffic volume by vehicle type and direction was counted.
b) Truck OD Interview Survey was conducted by interviewing the sampled drivers to obtain such information as origin and destination, commodity type, loading capacity, load factor, etc.

3) Survey Coverage

5 locations in the study area were selected through field reconnaissance. There were two companies handling containers along Jl.Ir Sutami. They lent only containers for shipping from/to Soekarno Hatta seaport to trucks. By interviewing their staffs, it was confirmed that on average, about 50 trucks a day come to rent the containers. Some companies were not selected for the survey due to low traffic and lack of significant goods.

There are three gates on roads from/to Kawasan Industri Makassar. The freight transport survey was conducted at only two gates, because traffic count and OD interview surveys were conducted at the remaining one gate on Kawasan road.

Both counting and interview were conducted for 24hours except for Station 4, since its gate closed at 06:00pm. The selected survey locations are shown in the following table and figure.

Table 5.1: Survey Stations for Freight Transport Survey

Station	Survey Station	Location	Survey Period	Survey Date
1	Soekarno Hatta seaport	Gate	24hrs	03/06/2005
2	Warehouse in Parangloe Indah	Gate	24hrs	03/06/2005
3	Kawasan Industri Makassar	Gate near Jl.Perintis Kemerdekaan	12hrs	03/06/2005
4	Kawasan Industri Makassar	Gate near Terminal Bis Daya	24hrs	03/06/2005
5	Hasanuddin Airport	Gate	24hrs	03/06/2005

Source: JICA Study Team

Source: JICA Study Team

Figure 5.1: Survey Stations for Freight Transport Survey

5.2 Results of Survey

The results of traffic volumes and sampling rate at 5 stations are shown in the following table. The highest traffic volume was at Soekarno Hatta seaport. In terms of vehicle composition, dominant share of Soekarno Hatta seaport was large truck, while that of other locations was small truck. The sampling rate of this survey shows higher than that of the OD interview survey due to low traffic.

Table 5.2: Traffic Volumes and Sampling Rate at 5 Stations

Station	vehicle/day				Sampling Rate (%)
	Pickup	Small Truck (2-axle)	Large Truck (3 or more axles)	Total	
1	678 (19.2)	1,338 (37.8)	1,524 (43.1)	3,540 (100.0)	13.3
2	92 (15.3)	334 (55.4)	177 (29.4)	603 (100.0)	39.1
3	555 (47.2)	570 (48.5)	51 (4.3)	1,176 (100.0)	9.7
4	954 (43.2)	1,015 (45.8)	246 (11.1)	2,215 (100.0)	27.8
5	95 (19.2)	399 (80.8)	0 (0.0)	494 (100.0)	33.0
Total	2,374 (29.6)	3,656 (45.5)	1,998 (24.9)	8,028 (100.0)	19.9

Note: Figures in parentheses indicate each share.
Source: JICA Study Team

Through the truck OD interview survey, the features on the commodity type by each location were appeared as shown in the following table and summarized below:

- The major commodity was agricultural products at Soekarno Hatta seaport,
- The commodity type varied from agricultural products, construction materials, fishery commodities to miscellaneous industrial goods at Kawasan Industri Makkasar,
- Chemical products were treated at warehouse in Parangloe Indah, and
- Hasanuddin Airport handled fishery as major commodity. Others (64%) included things such as foods for catering of air service, airmail and so on.

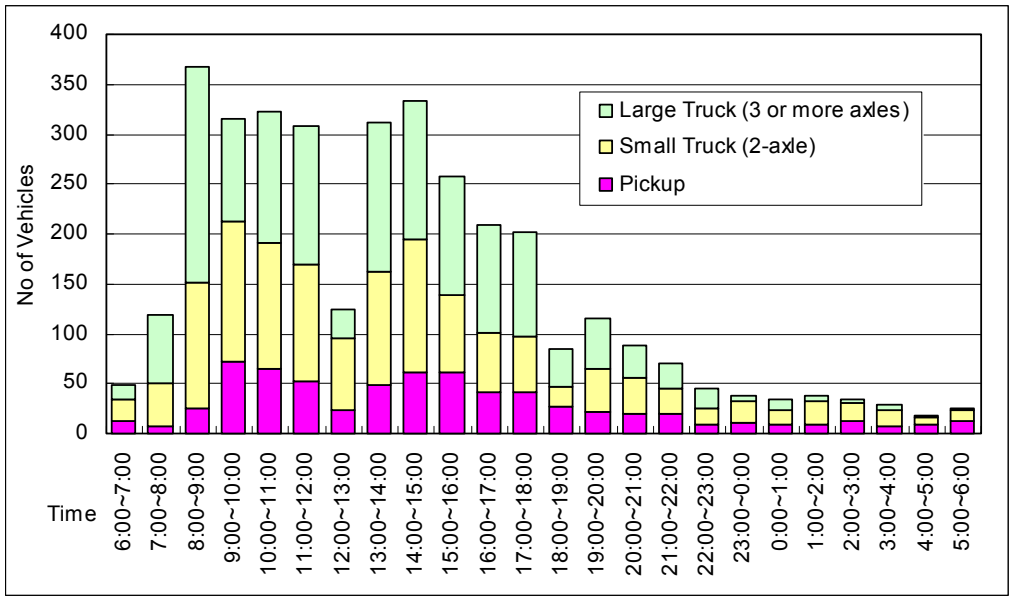
Table 5.3: Commodity Type by Each Location

Unit: %

Major Commodity	Soekarno Hatta Seaport	Warehouse in Parangloe Indah	Kawasan Industri Makassar	Hasanuddin Airport	Total
Agriculture	37.3	15.7	19.9	1.7	21.5
Construction	14.3	16.4	19.5	0.0	16.0
Miscellaneous Industry	11.5	9.4	10.6	1.7	10.6
Chemical	10.2	45.3	6.9	0.8	13.2
Mineral	7.5	0.0	6.7	0.0	4.9
Light Industry / Electronics	6.2	4.4	6.3	9.2	6.7
Forest	5.3	0.6	4.2	0.0	3.9
Fishery	3.1	0.0	14.8	22.7	9.3
Metal & Machine	3.1	6.3	4.0	0.0	3.8
Others	1.6	1.9	7.0	63.9	10.1
Total	100.0	100.0	100.0	100.0	100.0

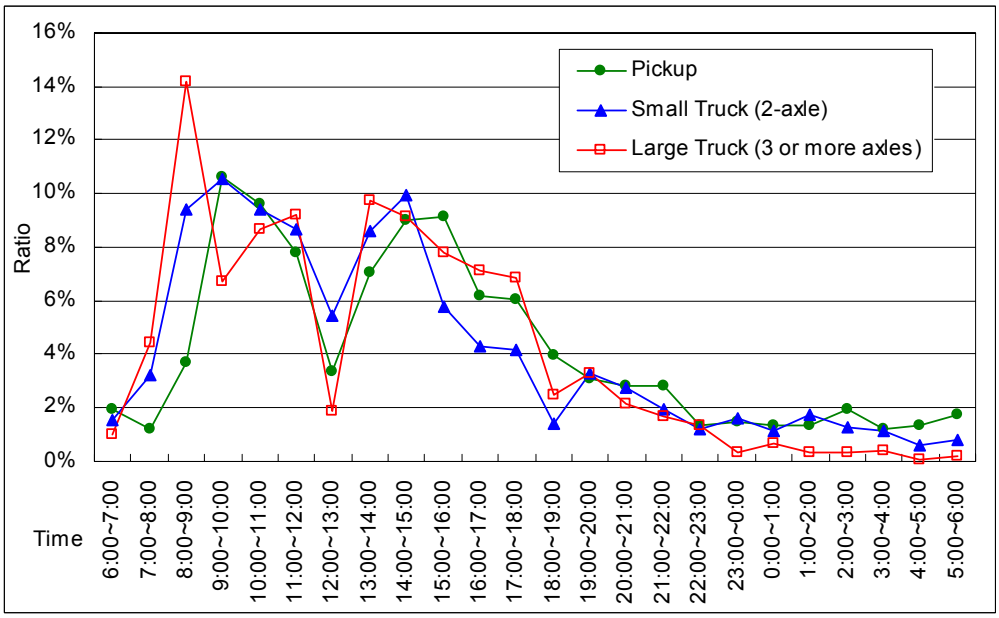
Note: The result of Station 13 in the OD interview survey was added to estimate above values for Kawasan Industri Makassar.
Source: JICA Study Team

The following figures show the hourly fluctuations at Soekarno Hatta seaport. It was clear that freight transport was active only daytime. The hourly share decreased less than 2% from 22:00 to 06:00. This tendency corresponds to that of Jl.Veteran Utara in the traffic count survey.



Source: JICA Study Team

Figure 5.2: Hourly Fluctuation at Soekarno Hatta Seaport



Source: JICA Study Team

Figure 5.3: Hourly Fluctuation by Vehicle Type at Soekarno Hatta Seaport

6. PUBLIC TRANSPORT OPERATOR SURVEY

6.1 Outline of Survey

The objective of the public transport operator survey is to obtain physical, operational, and financial information and understand the conditions on the public transport operators.

1) Survey Item

- Interview with public transport operators

2) Survey Method

This survey was conducted through direct interview with public transport operators such as operating and/or financial managers. The interview was conducted in accordance with the questionnaire form, which covered (a) company's operation status, (b) vehicle ownership, (c) history of operation, (d) operating information by route, (e) operation and maintenance activity, (f) employees conditions, and (g) financial performance. Furthermore, existing data on public transport were collected from relevant agencies.

3) Survey Coverage

Prior to the interview survey, 34 bus companies were randomly selected from a list of major bus companies which consist of 62 companies. Although the interview survey conducted 34 bus companies, 7 bus companies were not in the state of operation due to bankruptcy, merger, etc. Most of the bus companies except for Pete Pete operating companies locate their head offices in Makassar city and their branch or agent offices outside Makassar city.

Since most of the Pete Pete companies operate only a few numbers of Pete Petes in the study area, it was difficult to appropriately select the Pete Pete companies for the survey. In order to understand general conditions of the Pete Pete operation, two major Pete Pete companies in Makassar city were selected for the study.

As a result, the interview survey was conducted to 27 bus companies, which composed of 25 intercity bus companies and 2 Pete Pete companies, as described in the following table.

Table 6.1: Surveyed Bus Companies

No	Company Name	Address	Survey Date
1	Jabal Rahma	Jl. Kerung-kerung Makassar	07/06/05
2	Aneka Transport	Jl. Kerung-kerung Makassar	03/06/05
3	Cahaya Mujur	Jl. Kerung-kerung Makassar	02/06/05
4	2.3.7	Jl. Tinumbu N0.37 Makassar	03/06/05
5	Tomohon Indah	TRD Loket Dalam N0.23 Makassar	03/06/05
6	Liman	Jl. Urip Sumohardjo 26.A Makassar	03/06/05
7	Sartika	Jl. Cendrawasih Makassar	03/06/05
8	Toraja Ria	TRD Loket Dalam No.11 Makassar	03/06/05
9	Sumber Tani	TRD Loket Dalam Makassar	03/06/05
10	Bintang Prima	Jl.P. Kemerdekaan Makassar	02/06/05
11	Adhi Putra	Jl. Cakalang LR.II No.26 B Makassar	03/06/05
12	Piposs	Jl. Buru Makassar	03/06/05
13	Tiku Lembang	TRD Loket Dalam Makassar	03/06/05
14	Sabar Menanti	Jl. Kandea Makassar	03/06/05
15	Cahaya Solo	Jl. Butung 104 Makassar	03/06/05
16	Bintang Surabaya	Hartako Daya B. 2A 83 Makassar	03/06/05
17	GoldenToraja	Jl. Dirgantara N0.4 Makassar	03/06/05
18	Mega Mas	Ruko Puri Kencana Sari. B.AC.1 Makassar	02/06/05
19	Garuda	Jl. Petta Ponggawa No.59 Makassar	03/06/05
20	Liitha & Co	Jl. Urip Sumohardjo Makassar	03/06/05
21	Pelangi	TRD Loket Dalam Makassar	03/06/05
22	Cahaya Madinah	TRD Loket Dalam Makassar	03/06/05
23	Sinar Wahyu	TRD Loket Dalam Makassar	03/06/05
24	Prima	Jl. Kerung-kerung 23A Makassar	06/06/05
25	Salman	Tanete Bulukumba	06/06/05
26	Kakmu	Kampus UNHAS	08/06/05
27	CV. Ardi	Jl. Pattunuang I No.32	08/06/05

Source: JICA Study Team

6.2 Results of Survey

1) Intercity Bus

The following table shows the results of general profile obtained from 25 private intercity bus companies. In terms of intercity bus operations, the following matters were revealed:

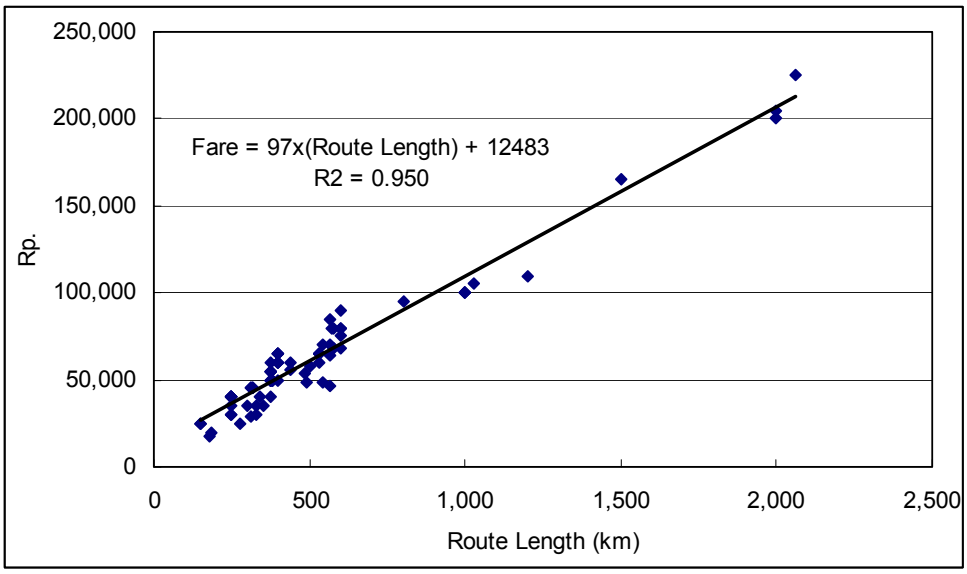
- More than half of the companies were newly established within 10 years,
- 60% of the companies operate less than 10 vehicles,
- More than 90% of the companies operate less than 5 routes, and
- The intercity buses cover the whole Sulawesi Island including Manado[4], Bitung, Gorontalo, etc.

Table 6.2: General Profile

		%
Year of establishment	1970 - 1980	14.8
	1981 - 1990	7.4
	1991 - 2000	33.3
	2001- 2005	25.9
No. of Bus	-10	60.0
	11 - 20	24.0
	21 - 30	8.0
	31 - 60	8.0
No. of Operated Routes	1 - 2	40.0
	3 - 5	52.0
	6 - 8	8.0
Route Length (Km)	0-200	5.4
	201-300	13.5
	301-400	36.5
	401-500	6.8
	501-1000	29.7
	1001-	8.1

Source: JICA Study Team

The relationship between route length and bus fare was estimated by linear regression analysis, as illustrated in the following table. The equation in the figure means that the bus fare is Rp.109,483 for 1,000 km (route length), and indicates the strong correlation of R-square at 0.95.



Source: JICA Study Team

Figure 6.1: Relationship between Route Length and Bus Fare

[4] The travel time between Makassar and Manado was 38 hours from the results of the interview.

2) Pete Pete

Pete Petes are operated by a lot of private companies including big and small companies. There were 14 Pete Pete routes in Makassar city (Table 6.3.2) and 9 routes in Maros, Takalar and Gowa, respectively within the study area. In Makassar City, the length of routes ranged from 7.4km to 24.0 km and the fare was set as Rp.1,500 as of June 2005. The operating hour was from 6:00 to 22:00. Although the frequency varied by each route, it was relatively high in the study area based on field reconnaissance.

The following figure shows the route map of Pete Pete in Makassar City. The routes covered most of the densely populated area inside Makassar City. Some Pete Pete routes are paralleled with each other on major roads. For instance, Route I, B-1, C-1 and F-1 compete each other on Jl.Urip Sumoharjo, the road which observed heavy traffic in the traffic count survey.

Although 14 routes in Makassar city are not connected to other Kabupaten, Pete Petes permitted in Maros, Gowa and Takalar operate routes between Makassar city and other Kabupaten.

In the traffic count survey, Pete Petes was observed on Jl.Penghibur. However the road is not permitted as a Pete Pete route. This implies that some Pete Petes do not exactly follow the permitted routes. This tendency was already observed in "Ujung Pandang Area Highway Development Study (JICA 1989)". In addition, it points out the possibility that some Pete Petes may be operating without a permission.[5].

[5] Pete Pete Route A and J are assigned 411 vehicles in total and passing through Jl.Jendral Sudirman on which Station 28 in the traffic count survey was conducted. Assuming that Pete Petes on the Route A and J can continuously drive at 15km/h from 6:00 to 22:00, the number of Pete Petes passing through Station 28 is approximately estimated 7,000vehicle/day. However, mini bus including Pete Pete was actually observed 11,700 vehicles at Station 28. It is difficult to explain that remaining 4,700 vehicles were other mini buses excluding Pete Petes, considering the vehicle composition and the traffic condition in Makassar city. Therefore, it is pointed out a possibility that some Pete Petes operate without the permission.

Table 6.3: Pete Pete Routes of Makassar City

Route Code	Route	Length of Route (Km)	No. of Pete Petes
A	BTN. Minasa Upa - Pasar Butung	12.1	189
B	TRM. Tamalate - Pasar ButungPasar Butung.	12.4	497
C	Makassar Mall - Tallo	7.4	247
D	Terminal Daya - Makassar Mall	15.0	1,089
E	Terminal Panakkukang - Makassar Mall	11.5	413
F	Term. Tamalate - Makassar Mall	10.5	331
G	Term. Daya – Pasar Butung	15.9	381
H	Perumnas Antang - Pasar Butung	15.5	356
I	Terminal Panakkukang - Pasar Baru	9.3	327
J	Terminal Panakkukang - Makassar Mall	10.2	222
B-1	Terminal Tamalate - Kampus Unhas	24.0	151
C-1	Tallo – UNHAS	20.4	38
E-1	Terminal Panakkukang - Kampus UNHAS	19.5	152
F-1	Terminal Tamalate - Kampus UNHAS	20.3	56
	Total		4,449

Source: Dinas Perhubungan Kota Makassar 2004 (Department of Transportation Makassar City)

Source: Dinas Perhubungan Kota Makassar 2004

Figure 6.2: Pete Pete Route Map in Makassar City[6]

[6] Based on a list of Pete Pete routes obtained from Dinas Perhubungan Kota Makassar, above route map was prepared.

7. ROAD INVENTORY SURVEY

7.1 Outline of Survey

The survey objective is to ensure basic data for road development and selection of projects for the pre-feasibility study by checking the current status of the existing road in the study area. The results are utilized for preparation of a road network model in the traffic demand forecast.

1) Survey Item

- To collect information and data in terms of roads, bridges and intersections

2) Survey Method

Existing road inventory data from concerned agencies was collected prior to the site survey. Unavailable data through the data collection were supplemented by the site survey. Site surveyors recorded necessary information on existing road condition in survey sheet by site investigation. The following were collected information and data:

a) Road: road name, function, road width, road length, type of pavement, and condition.
b) Bridge: bridge name, length, width, and types of sub-structure and super-structure.
c) Intersection: shape, traffic signals, road marking, direction and road name.

3) Survey Coverage

The inventory survey for roads and bridges covered four types of road in the study area as described below:

Table 7.1: Survey Coverage for Road and Bridge

Area	Makassar	Takalar	Maros	Gowa
National Road	✓	✓	✓	✓
Provincial Road	✓	✓	✓	✓
Kabupaten/Kota Road	-	✓	✓	✓
Kota Road	✓	-	-	-

Source: JICA Study Team

The inventory survey for intersections was conducted at 45 intersections selected in center of Makassar city, as illustrated in the following figure.

Source: JICA Study Team

Figure 7.1: Surveyed Intersection

7.2 Results of Survey

1) Road Inventory

Based on existing data collection, the road inventory data were obtained Makassar city and Mamminasata Metropolitan Area, respectively. Since the data for Makassar city was prepared in 2004, it was updated by supplemental field survey.

2) Bridge Inventory

The data for bridges in the study area were collected based on existing data collection.

3) Intersection Inventory

Thorough field survey, the intersection inventory was conducted toward 45 intersections which comprised of 26 signalized intersections.

8. PUBLIC TRANSPORT TERMINAL SURVEY

8.1 Outline of Survey

The survey objective is to understand present condition of the public transport terminals in the study area and provide base data for the future improvement plan.

1) Survey Item

- To collect physical and operational information: area size, parking capacity, other related terminal facilities, etc.

2) Survey Method

Physical and operational information was collected through interview to terminal operators and site reconnaissance survey.

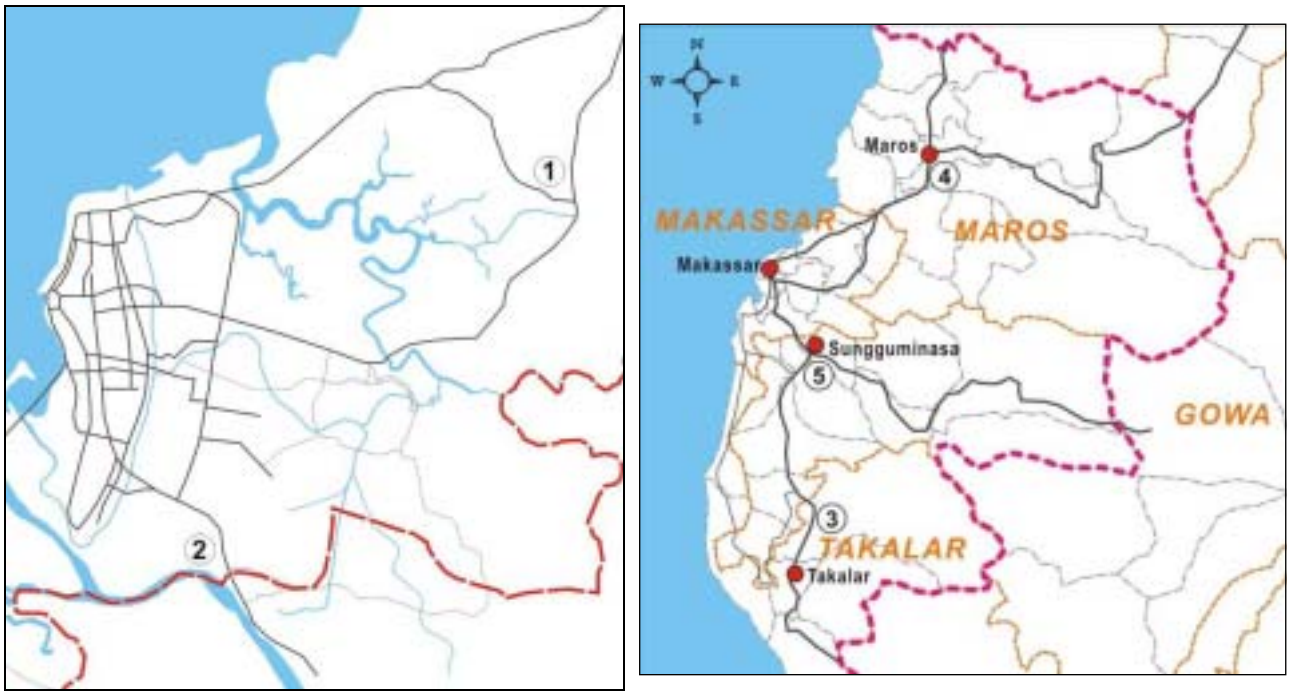
3) Survey Coverage

The survey was conducted at all bus terminals in the study area, as shown in the following table and figure.

Table 8.1: Survey Locations for Public Transport Terminal Survey

No	Terminal Name	Address	Survey Date
1	Regional Daya	Jl. Kapasa Raya No.33, Makassar	2/6/2005
2	Tamalate	Jl. Mallengkeri No. 18, Makassar	3/6/2005
3	Induk Pattalassang	Jl.Mappajalling 06 kawang, Takalar	3/6/2005
4	Induk Marusu	Jl. Jend. Sudirman No.1, Maros	4/6/2005
5	Cappa Bungaya	Jl. Poros Limbung-Takalar, Gowa	6/6/2005

Source: JICA Study Team



Source: JICA Study Team

Figure 8.2: Survey Locations for Public Transport Terminal Survey

8.2 Results of Survey

All terminals were mainly utilized for intercity bus and Pete Pete. The following table shows physical and operational conditions of public transport terminals. The terminals in Makassar city are larger than those in Maros, Takalar and Gowa in terms of scale.

Table 8.2: Physical and Operational Conditions of Public Transport Terminals

Terminal Name	Regional Daya (TRD) Makassar	Tamalate	Induk Pattalassang Takalar	Induk Marusu Maros	Cappa Bungaya Gowa
Total area (m^2)	120,000	28,000	14,000	20,000	4,800
Operating period	06:00-22:00	06:00-19:00	06:00-22:00	06:00-19:00	06:00-19:00
Parking Spaces (m^2)					
Large Bus	20,000	10,000	1,800	800	1,200
Small Bus	10,000	9,000	5,600	200	800
Taxi	2,000	6,000	-	-	800
Car	500	3,000	-	400	800
Terminal Facility					
Terminal building	✓	✓	✓	✓	✓
Management office	✓	✓	✓	✓	✓
Ticket office	✓	✓	✓	✓	✓
Waiting room	✓	✓	✓	✓	✓
Shop	✓	✓	✓	✓	✓
Public toilet	✓	✓	✓	✓	✓
Lighting facility	✓	✓	✓	✓	✓
Drainage facility	✓	✓	✓	✓	
Maintenance facility	✓			✓	
Refueling facility	✓			✓	
Pavement condition	Partially Asphalt	Asphalt	Asphalt	No Pavement	Asphalt

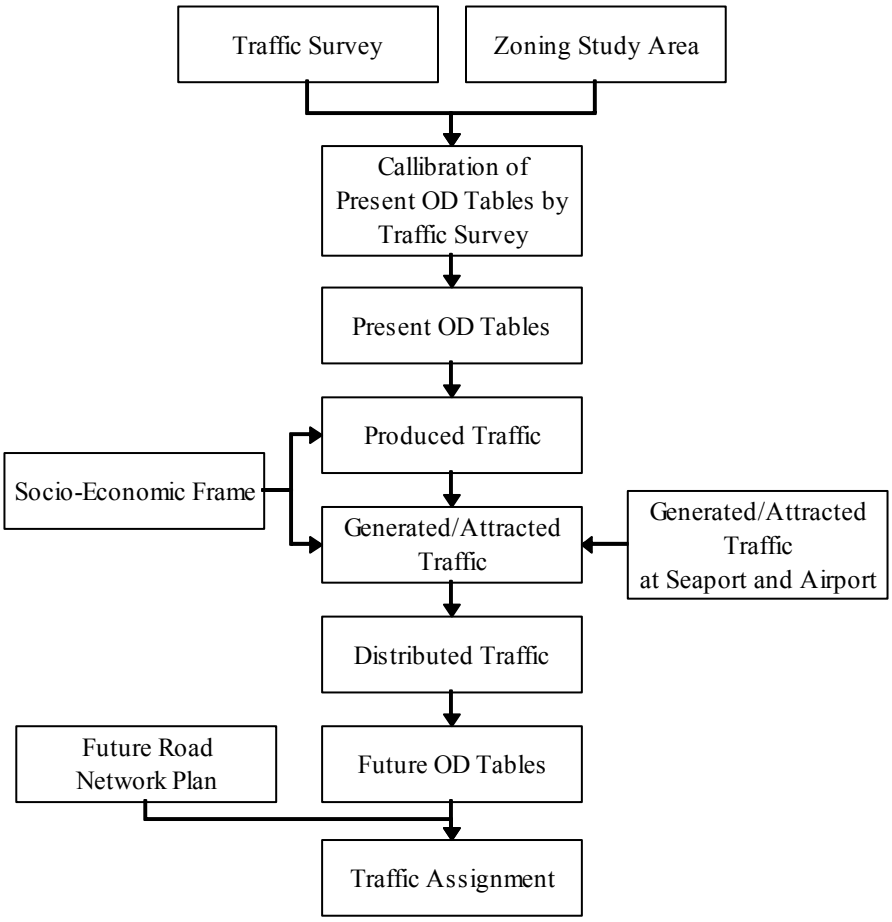
Source: JICA Study Team

PART B: TRAFFIC DEMAND FORECAST

9. OUTLINE OF DEMAND FORECAST

9.1 Methodology

The methodology for the traffic demand forecast of Mamminasata Metropolitan Area is based on socio-economic frame, existing transport and road data and results of traffic survey. The target year is set at the year 2020. As the intermediate target year, 2010 and 2015 are also considered. The flowchart for the traffic demand forecast is illustrated in the following figure.



Source: JICA Study Team

Figure 9.1: Flowchart for Demand Forecast

9.2 Zoning System

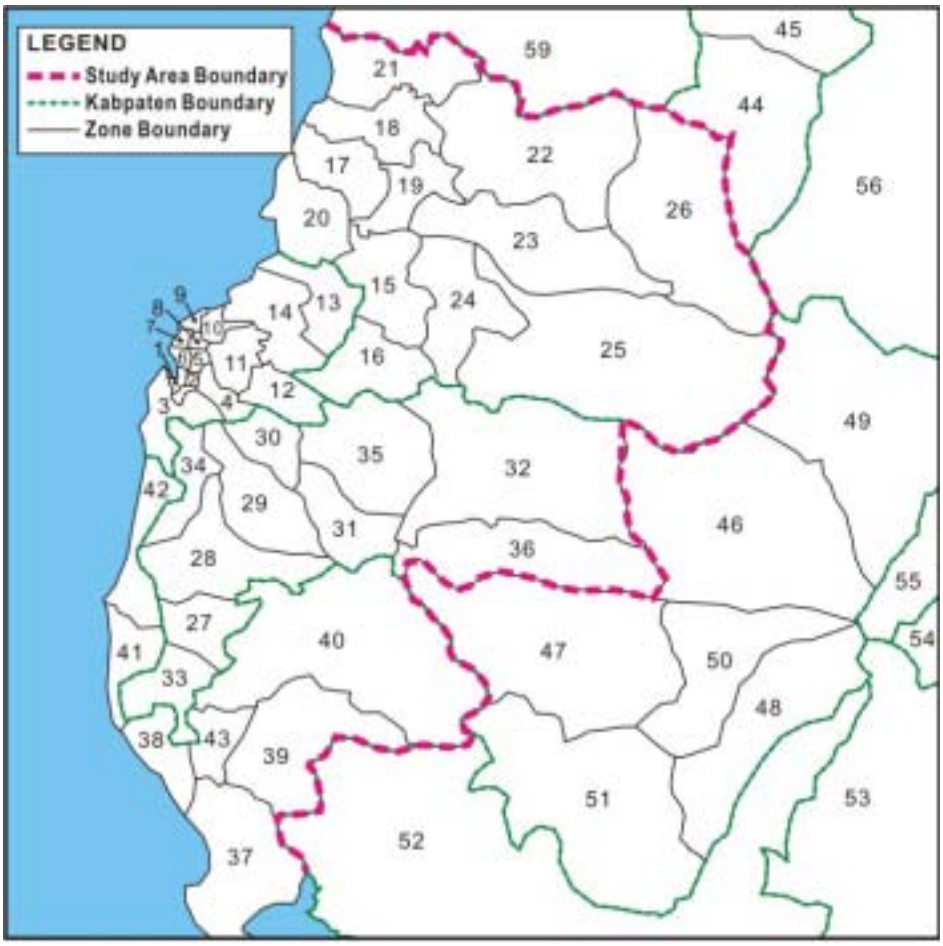
The study area was divided into sixty zone based on kecamatan/kabupaten administration boundaries for the South Sulawesi Province. The names of traffic zones and the zoning map are shown in the following table and figure.

Table 9.1: Traffic Zones

Inside of Study Area		
Zone No	Kabupaten	Kecamatan
1	Makassar	Mariso
2	Makassar	Mamajang
3	Makassar	Tamalate
4	Makassar	Rappocini
5	Makassar	Makassar
6	Makassar	Ujung Pandang
7	Makassar	Wajo
8	Makassar	Bontoala
9	Makassar	Ujung Tanah
10	Makassar	Tallo
11	Makassar	Panakkukang
12	Makassar	Manggala
13	Makassar	Biringkanaya
14	Makassar	Tamalanrea
15	Maros	Mandai
16	Maros	Moncongloe
17	Maros	Maros Baru
18	Maros	Lau
19	Maros	Turikale
20	Maros	Marusu
21	Maros	Bontoa
22	Maros	Bantimurung
23	Maros	Simbang
24	Maros	Tanralili
25	Maros	Tompobulu
26	Maros	Cenrana
27	Gowa	Bontonompo
28	Gowa	Bajeng
29	Gowa	Pallangga
30	Gowa	Somba Opu
31	Gowa	Bontomarannu
32	Gowa	Parangloe
33	Gowa	Bontonompo Selatan
34	Gowa	Barombong
35	Gowa	Pattallassang
36	Gowa	Manuju
37	Takalar	Mangarabombang
38	Takalar	Mappakasunggu
39	Takalar	Polombangkeng S.
40	Takalar	Polombangkeng U.
41	Takalar	Galesong S.
42	Takalar	Galesong U.
43	Takalar	Pattalassang

Outside of Study Area		
Zone No	Kabupaten	Kecamatan
44	Maros	Camba
45	Maros	Mallawa
46	Gowa	Tinggimoncong
47	Gowa	Bungaya
48	Gowa	Tompobulu
49	Gowa	Tombolo Pao
50	Gowa	Bontolempangan
51	Gowa	Biringbulu
52	Jeneponto	All Kecamatan
53	Bantaeng	All Kecamatan
54	Bulukumba	All Kecamatan
55	Sinjai	All Kecamatan
56	Bone	All Kecamatan
57	Soppeng	All Kecamatan
58	Barru	All Kecamatan
59	Pangkep	All Kecamatan
60	Other Kabupaten	All Kecamatan

Source: JICA Study Team



Source: JICA Study Team

Figure 9.2: Zoning Map

10. PRESENT OD TABLES AND ROAD NETWORK

10.1 Preparation of Present OD Tables

The initial present OD tables were prepared by using results of the traffic survey. The origin and destination patterns were derived from the results of OD interview survey, and expanded by considering sampling ratio at each survey station. The initial present OD tables were supplemented by building gravity model, because some OD pairs were difficult to obtain through OD interview survey. The formulas for the gravity model are as follows:

Passenger Vehicle

$PV_{ij} = K \cdot (P_i^{\alpha} \cdot P_j^{\beta})/D_j^{\gamma}$

Where PV_{ij} : Number of OD pairs by Vehicle Type between Zone i and Zone j

P_i : Population in Zone i

P_j: Population in Zone j

D_{ij}: Distance between Zone i and Zone j

K, α, β & γ : Coefficient

Freight Vehicle

$FV_{ij} = K \cdot (GRDP_i^{\alpha} \cdot GRDP_j^{\beta})/D_{ij}^{\gamma}$

Where FV_{ij} : Number of OD pairs by Vehicle Type between Zone i and Zone j

$GRDP_i$: Gross Regional Domestic Products in Zone i

$GRDP_j$: Gross Regional Domestic Products in Zone j

D_{ij}: Distance between Zone i and Zone j

K, α, β & γ : Coefficient

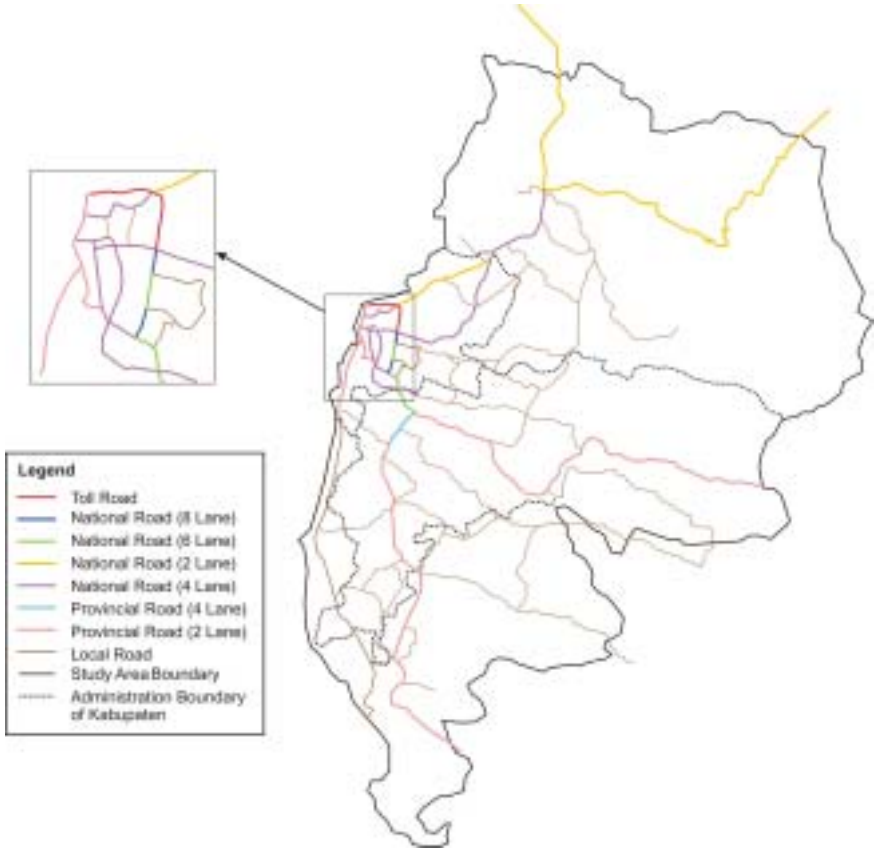
Table 10.1: Coefficient of Gravity Model by Vehicle Type

Vehicle Type		α	β	γ	K	Correlation Coefficient
Passenger Vehicle	Motorcycle	0.3099	0.2663	1.4273	36.1322	0.717
	Car/Jeep/Taxi	0.2823	0.2679	0.9004	3.7111	0.500
	Minibus	0.5975	0.4769	0.8752	0.0027	0.548
	Standard Bus	0.2027	0.1923	0.6248	15.6614	0.421
Freight Vehicle	Pickup	0.1706	0.156	0.6898	5.9403	0.641
	Small Truck (2 Axle)	0.0756	0.1252	0.4314	15.0454	0.431
	Large Truck (>2 Axle)	0.0408	0.164	0.5957	9.0836	0.338

Source: JICA Study Team

10.2 Preparation of Present Network

For the traffic demand forecast, the present network was established based on existing data and road inventory data obtained in the traffic survey as illustrated in the following figure. The existing road network in the study area is classified into i) toll road, ii) national road, iii) provincial road, iv) local road.



Source: JICA Study Team

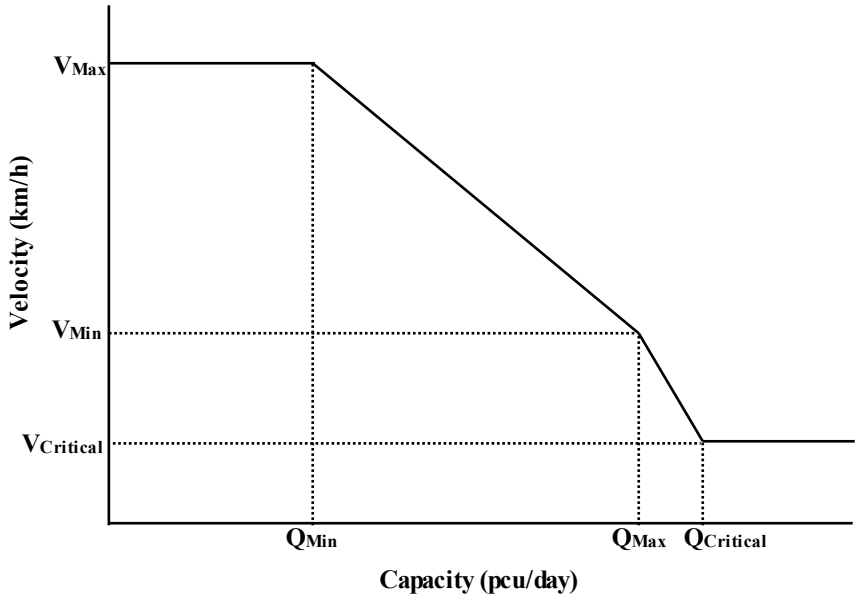
Figure 10.1: Road Network in Study Area

The present road network is composed of distance, capacity and travel speed as characteristics of each link. In addition, it is necessary to consider a relationship between traffic volume (capacity) and travel speed for traffic assignment. Therefore Q-V formula was set up, considering factors included i) maximum travel speed (designed speed), ii) minimum travel speed ($0.3 \cdot V_{max}$), iii) critical travel speed (5.0km/h), iv) minimum capacity ($0.2 \cdot Q_{max}$), v) maximum capacity (designed capacity), vi) critical capacity ($1.2 \cdot Q_{max}$). Table 2.2.1 and Figure 2.2.2 show each value by number of lanes by road type, which were assumed by referring "Urban Transportation of Jabotabek (JICA, 2002)", "Ujung Pandang Area Highway Development Study (JICA 1989)" and Indonesian Highway Capacity Manual.

Table 10.2: Q-V Formula Information

	No of Lane	V_{max} (km/h)	Qmax (pcu/day)
Toll Road	4	80	72,000
National Road	8	35	136,000
	6	35	102,000
	4	35	40,000~48,000
	2	30	20,000
Provincial Road	4	30	40,000~48,000
	2	25	12,000
Local Road	1.5~2.0	20	6,300~10,000

Source: JICA Study Team



Source: JICA Study Team

Figure 10.2: Q-V Formula

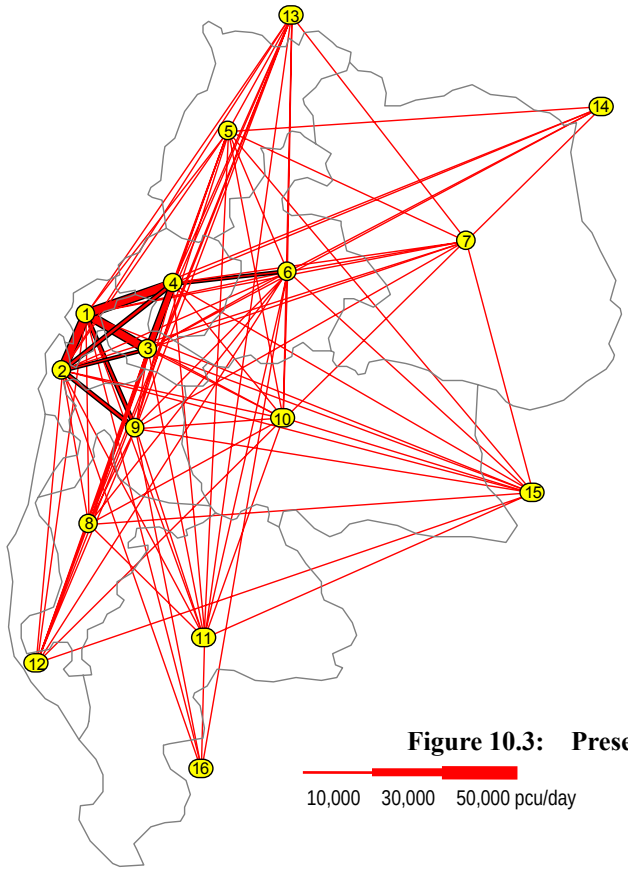
10.3 Validation of Present OD Tables

To confirm the consistency between assigned and observed traffic volumes, the present OD tables were assigned to present network. The observed traffic volumes at some survey locations defined as screen line were used the results of the traffic survey. The present OD tables were calibrated with the root mean square error minimizing model to approximately match with the observed traffic volumes. As shown in the following table , it is confirmed that the present OD tables are reproduced the present traffic condition from the results of comparison between assigned and observed traffic volumes. The following figures show present designed line and traffic volumes assigned to present network, respectively.

Table 10.3: Comparison between Observed and Assigned Traffic Volumes

No	Traffic Volume (pcu/day)		(a)/(b)	Station Number of Traffic Survey
	(a) Observed	(b) Assigned		
1	12,591	12,906	0.98	Station 1
2	7,352	6,795	1.08	Station 2
3	2,892	3,033	0.95	Station 3
4	10,390	11,502	0.90	Station 4
5	992	1,099	0.90	Station 5
6	18,481	19,065	0.97	Station 6
7	11,412	12,635	0.90	Station 7
8	4,972	5,995	0.83	Station 8
9	36,375	33,003	1.10	Station 9
10	47,713	41,319	1.15	Station 10
11	15,452	17,551	0.88	Station 13
12	76,690	73,277	1.05	Station 14
13	34,702	35,546	0.98	Station 15
14	12,749	19,910	0.64	Station 16
15	65,594	52,404	1.25	Station 19
16	79,359	82,452	0.96	Station 21
17	47,813	36,287	1.32	Station 22
18	14,179	17,566	0.81	Station 23

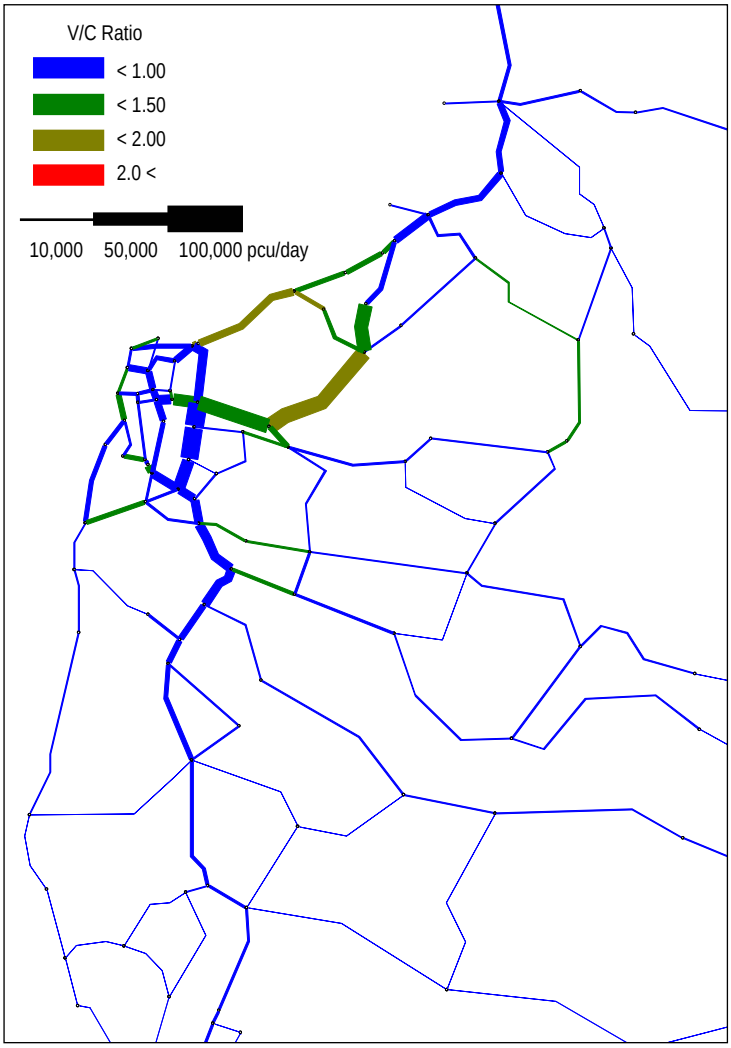
Source: JICA Study Team



Desired Line Zone	Traffic Zone
1	1,2,5,6,7,8,9,10
2	3,4
3	11,12
4	13,14
5	17,18,20,21
6	15,16,19,24
7	22,23,25,26
8	27,28,33
9	29,30,34
10	31,32,35,36
11	37,39,40,43
12	38,41,42
13	57,58,59,60
14	44,45,56
15	46,47,48,49,50,51,52,53,54,55
16	52

Source: JICA Study Team

Figure 10.3: Present Desired Line (2005)



Source: JICA Study Team

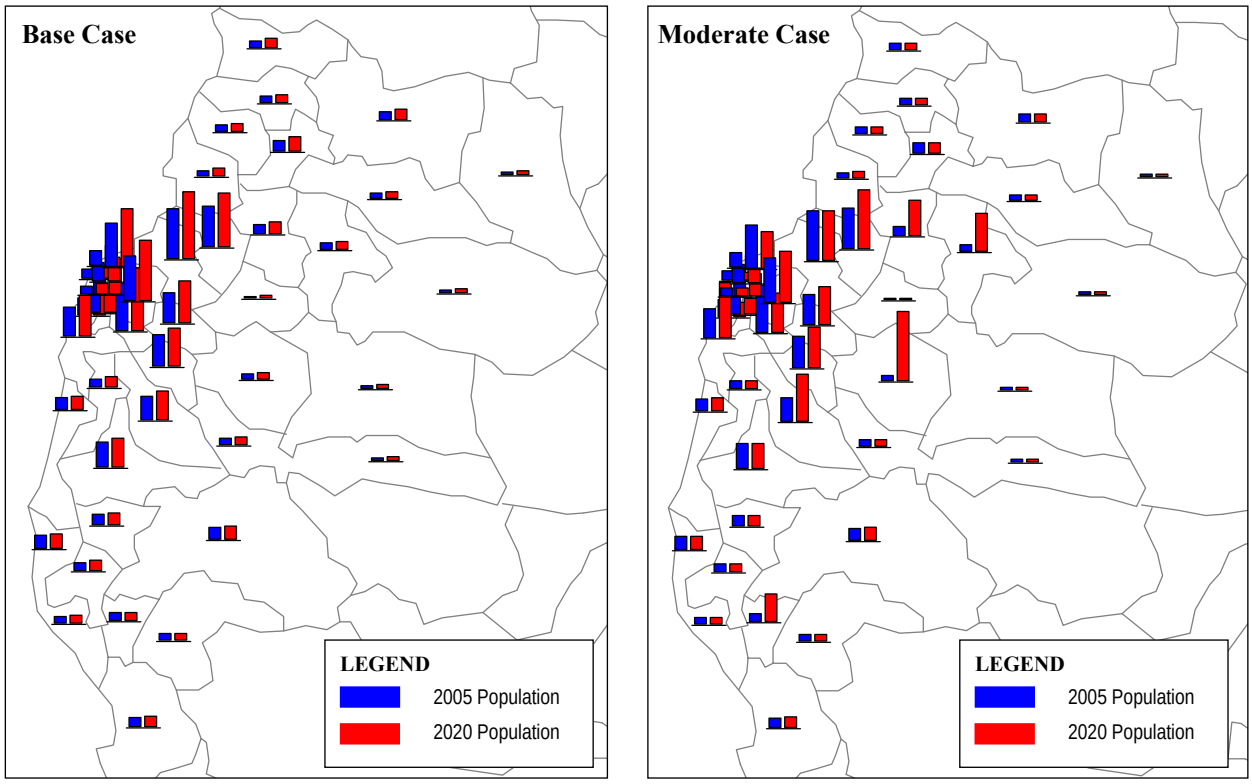
Figure 10.4: Present Traffic Volume (2005)

11. TRAFFIC DEMAND FORECAST

11.1 Socio-Economic Frame

The socio economic frame was established "Base Case" and "Moderate Case" for Mamminasata Metropolitan area, and composed of population and GRDP by Kecamatan as indices. The base case was premised on GRDP prepared by BAPPEDA and population projected by JICA Study Team, which were preliminarily formulated in Progress Report I. On the other hand, population and GRDP for the moderate case taken economic, social and physical developments for the integrated development of Mamminasata Metropolitan Area into account were projected by JICA Study Team. The following figures illustrate population and GRDP by each traffic zone by base and moderate cases in Mamminasata Metropolitan Area.

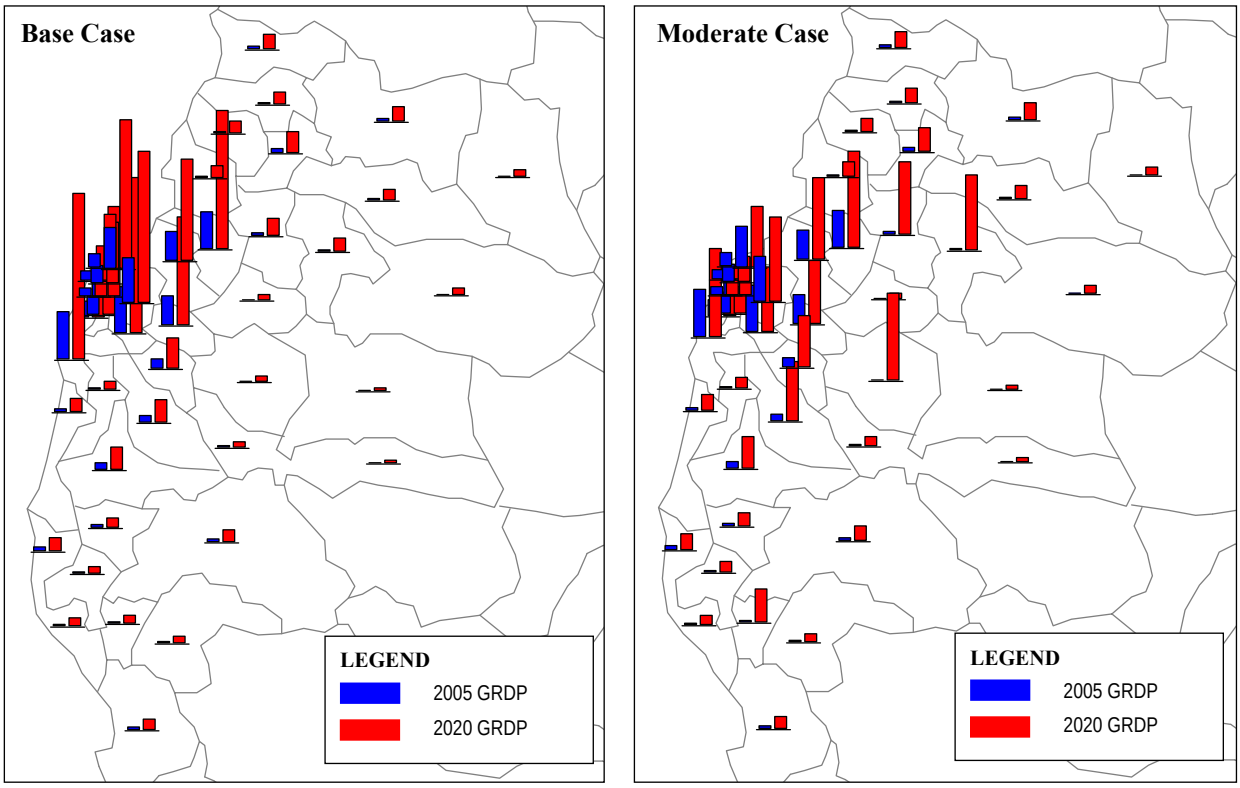
The future traffic demand for the moderate case was mainly forecasted in detail, while that for the base case was forecasted with simple method[7].



Source: JICA Study Team

Figure 11.1: Comparison of Population between 2005 and 2020

[7] The traffic demand for the base case was forecasted by directly applying future GRDP growth in generated/attracted traffic without using generation/attraction model.



Source: JICA Study Team

Figure 11.2: Comparison of GRDP between 2005 and 2020

11.2 Vehicle Type for Traffic Demand Forecast

In the traffic demand forecast, the vehicle types and their PCU factors were classified as shown in the following table. Motorcycle, car/taxi/jeep, minibus and standard bus are categorized as passenger transport vehicles, and the truck is freight transport vehicles[8]. Bicycle and becak which are non-motorized vehicles were not considered.

Table 11.1: Time Value by Vehicle Type

No	Vehicle Type	PCU Factor
1	Motorcycle	0.33
2	Car/Taxi/Jeep	1.00
3	Minibus (<=25 pax)	1.20
4	Standard Bus (>25 pax)	2.00
5	Pickup	1.00
6	Truck	2.00

Source: JICA Study Team

[8] Though present OD tables were prepared small truck and large truck separately, those were gathered as a truck OD table in the traffic demand forecast.

11.3 Produced Traffic

The produced traffic means control total of OD tables. In this study, it was assumed that the growth rate of the produced traffic is corresponded with that of the total number of the registered vehicles[9] included motorcycle, car/taxi/jeep, minibus, large bus, pickup, small truck and large truck. To estimate the registered vehicles, the following equation was established with GRDP and population[10] as explanatory variables:

$$RV = \alpha + \beta \cdot GRDP + \gamma \cdot POP$$

Where RV : Number of Registered Vehicle

GRDP : GRDP (Million Rp.)

POP : Population

α, β & γ : Coefficient

α	β	γ	R^2
0.0571	0.3453	-1496096	0.919

By adopting above equation and socio-economic frames, the growth rates for the total number of the registered vehicles were obtained base and moderate cases, respectively, as shown in the following table.

Table 11.2: Future Growth Ratio of Registered Vehicle in Mamminasata and Surrounding Area

Year	Base Case		Moderate Case	
	Estimated No. of Registered Vehicle	Growth Rate (%)	Estimated No. of Registered Vehicle	Growth Rate (%)
2005	677,482	-	677,482	-
2006	729,986	7.75	732,683	8.15
2007	785,161	7.56	790,966	7.95
2008	843,189	7.39	852,558	7.79
2009	904,264	7.24	917,706	7.64
2010	968,596	7.11	986,675	7.52
2011	1,037,557	7.12	1,051,310	6.55
2012	1,110,567	7.04	1,119,541	6.49
2013	1,187,922	6.97	1,191,613	6.44
2014	1,269,942	6.90	1,267,792	6.39
2015	1,356,970	6.85	1,348,361	6.36
2016	1,455,785	7.28	1,426,808	5.82
2017	1,561,678	7.27	1,508,960	5.76
2018	1,675,242	7.27	1,595,026	5.70
2019	1,797,115	7.28	1,685,233	5.66
2020	1,927,996	7.28	1,779,817	5.61

Source: JICA Study Team

[9] Past registered vehicle data (1994 - 2004) were obtained from Police office of South Sulawesi.

[10] GRDP and population are total amount or number of zone 1 ~ zone 59.

11.4 Generated/Attracted Traffic

In order to estimate future generated and attracted traffic at each zone, the methods for base and moderate cases were described below:

1) Generated/Attracted Traffic for Base Case

By applying future GRDP growth rates by each zone, tentative future volumes of generated and attracted traffic in each zone were estimated. The tentative volumes were adjusted proportionally to equal to the control total determined by produced traffic.

2) Generated/Attracted Traffic for Moderate Case

For the moderate case, generated/attracted traffic models by vehicle type were developed to consider future modal split. The models which called as "trip end model" determine the future modal share with characteristics of each zone such as population and GRDP[11]. After examining selection of explanatory variables, the following equations by vehicle type were established:

Passenger Model

$Gi, Ai = \alpha \cdot POPi + \beta \cdot Di + \gamma$

Where Gi and Ai : Vehicle Traffic (Motorcycle, Car, and Bus)
POPi : Population in zone i
Di : Dummy Variable
α, β & γ : Coefficient

Freight Model

$Gi, Ai = \alpha \cdot GRDPi + \beta \cdot Di + \gamma$

Where Gi and Ai : Truck Traffic
GRDPi : GRDP in zone i
Di : Dummy Variable
α, β & γ : Coefficient

Vehicle Type	α	β	γ	R^2
Motorcycle	0.09149	25872	-817	0.856
Car	0.01519	5573	360	0.820
Bus	0.01627	4235	-235	0.871
Truck	0.00155	642	289	0.807

[11] There are two methods which are called "trip end model" and "trip interchange model" to estimate the modal split. The trip end model is applied in production or generation/attraction models, while the trip interchange model is applied after estimation of distribution model.

In accordance with above equations, generated/attracted traffic by vehicle type in Makassar, Maros, Gowa and Takalar (traffic zone 1~51) were forecasted. The outside area (traffic zone 52~60) were forecasted by future GRDP growth rates which was estimated by BAPPEDA. After the process, the generated/attracted traffic was adjusted by the control total determined by produced traffic as the same with the base case.

In terms of shares between small and standard buses and between pickup and truck, it was assumed that the shares would be maintained in the future.

3) Generated/Attracted Traffic at Soekarno Hatta Seaport

Table 3.4.1 shows freight and passenger demands at the Soekarno Hatta Seaport. Based on the past data, the future freight demand was estimated by applying regression analysis with total GRDP of South Sulawesi as the explanatory variable. The passenger demand was drastically decreased according to the past trend. This reason can be explained that the passengers have diverted from ships to airplanes due to reduction of airfare in recent years. In this study, the future growth rate for passenger demand was assumed as 4.0% per annum, considering activation due to future expansion plan of the Soekarno Hatta Seaport.

The future demands for freight and passenger were taken as a part of generated/attracted traffic in traffic zone 7 and 9 in which the Soekarno Hatta Seaport is located, after converting the tonnage and the number of passenger into equivalent number of vehicle traffic.

Table 11.3: Freight and Passenger Demands at Soekarno Hatta Seaport

		Year					Average Annual Growth Rate (%)	
		1998	2004	2010	2015	2020	1998~2004	2004~2020
Freight Demand (000ton/year)	Unloaded Cargoes	3,228	5,012	8,334	12,992	20,375	7.6	9.2
	Loaded Cargoes	1,684	3,952	8,459	14,780	24,797	15.3	12.2
	Total	4,912	8,964	16,793	27,772	45,172	10.5	10.6
Passenger Demand (passenger/year)	Arrival	455,852	329,487	416,906	507,230	617,123	-5.3	4.0
	Departure	652,768	420,008	531,444	646,583	786,667	-7.1	4.0
	Total	1,108,620	749,495	948,350	1,153,813	1,403,790	-6.3	4.0

Note: Past freight and passenger data (1998 and 2004) were provided from Soekarno Hatta Seaport
Source: JICA Study Team

4) Generated/Attracted Traffic at Hasanuddin Airport

The following table (11.4) shows the past trend of freight and passenger demands at the Hasanuddin Airport during past six years. Since the both demands indicate quite high growth rates, it is too optimistic to directly adopt the trend as future growth rates. According to “Head Office of Hasanuddin Airport”, the future demands were estimated with future annual growth rates at 4.9% for freight and at 6.0% for

passenger.

Comparing with future demands estimated by the regression analysis with total GRDP of South Sulawesi as the explanatory variable, there were differences between those future demands, as shown in the following table (11.5). Consequently, medium value was adopted as moderate scenario in this study. The future demands of the medium value were taken as a part of generated/attracted traffic in traffic zone 15 in which the Hasanuddin Airport is located as the same with Soekarno Hatta Seaport.

Table 11.4: Past Trend of Freight and Passenger Demands at Hasanuddin Airport

		Year						Average Annual Growth Rate (%) (1999~2004)
		1999	2000	2001	2002	2003	2004	
Freight Demand (ton/year)	Unloaded Cargo	6,070	7,226	8,389	10,473	14,017	15,602	20.8
	Loaded Cargo	5,361	6,042	6,897	8,964	12,575	14,159	21.4
	Total	11,431	13,268	15,286	19,437	26,592	29,761	21.1
Passenger Demand (000passenger/year)	Arrival	343	430	527	700	991	1,390	32.3
	Departure	296	371	456	645	927	1,280	34.0
	Total	639	801	983	1,345	1,918	2,670	33.1

Source: Hasanuddin Airport

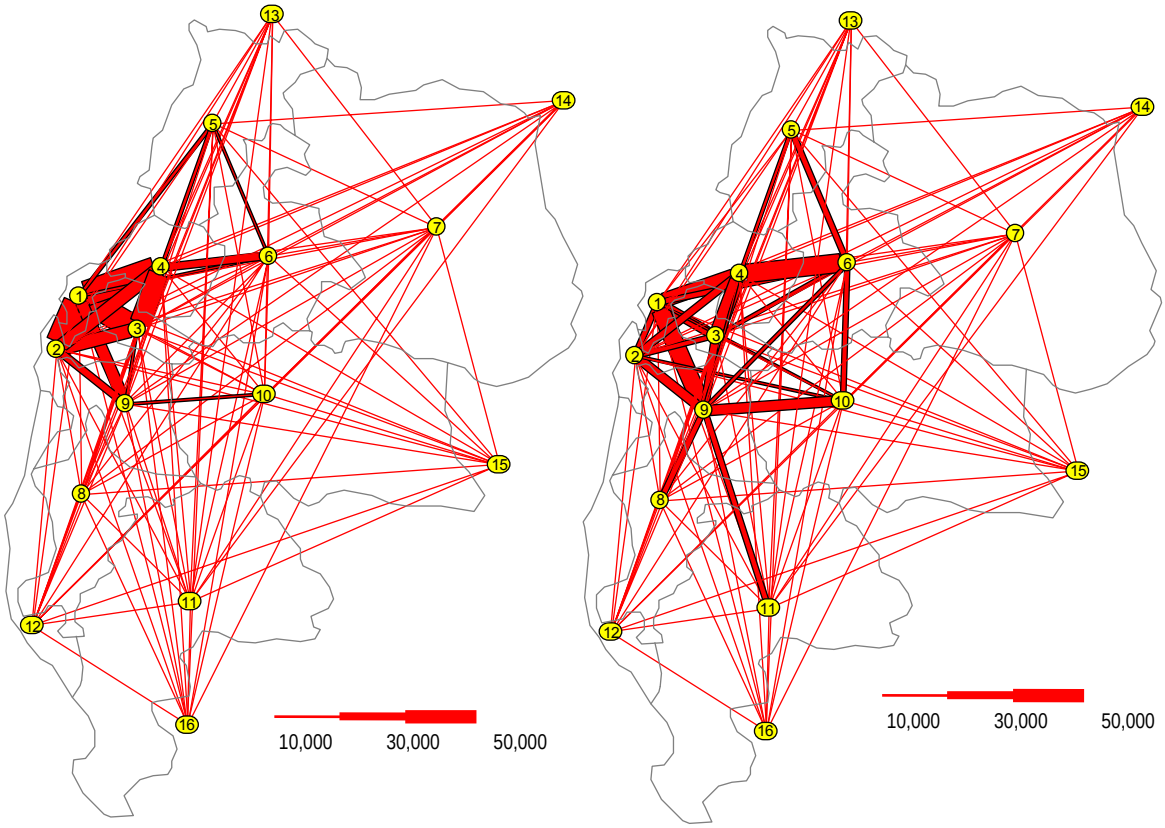
Table 11.5: Comparison of Future Freight and Passenger Demands

		(a) Head Office of Hasanuddin Airport			(b) Regression Analysis by GRDP			Medium Value between (a) and (b)		
		2010	2015	2020	2010	2015	2020	2010	2015	2020
Freight Demand (ton/year)	Unloaded Cargo	20,266	25,728	32,662	37,384	67,929	116,337	28,825	46,829	74,500
	Loaded Cargo	31,584	40,170	51,091	34,451	62,907	108,005	33,018	51,539	79,548
	Total	51,850	65,898	83,753	71,835	130,836	224,342	61,843	98,367	154,048
Passenger Demand (000passenger/year)	Arrival	-	-	-	3,547	6,573	11,367	3,161	5,065	7,743
	Departure	-	-	-	3,346	6,243	10,835	2,981	4,811	7,380
	Total	5,390	6,936	8,045	6,893	12,816	22,202	6,142	9,876	15,123

Note: Only total passengers were estimated by Head Office of Hasanuddin Airport.
Source: Head Office of Hasanuddin Airport and JICA Study Team

11.5 Distributed Traffic

Based on the present OD pattern in 2005 and future generated and attracted traffic determined above, future distributed traffic was forecasted by the iteration of which method is called “Present Pattern Method” by “Frator Method”. Figure 3.5.1 shows future desired line for base and moderate cases, respectively. The traffic of the base case was concentrated in Makassar City, while that of the moderate case was spread to wide area.



Base Case **Moderate Case**

Source: JICA Study Team

Figure 11.3: Future Desired Line (2020)

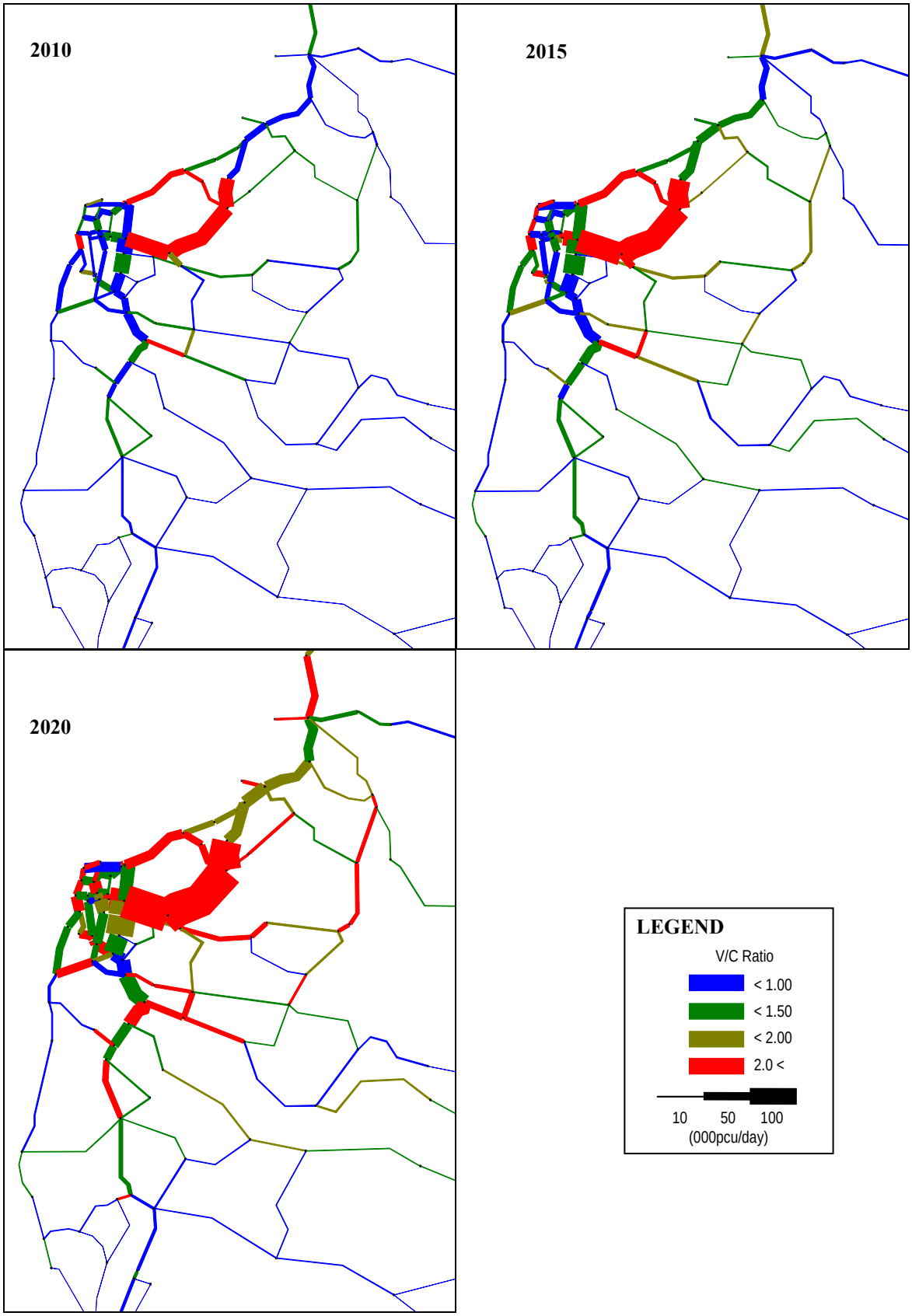
11.6 Future Traffic Volumes

The future traffic volumes for base and moderate cases in the year 2010, 2015 and 2020 were estimated by assigning the future OD tables to the road network. The following figures (Figure 11.4 ~ 11.6) illustrate the results of the assignments with and without future road network plan by base and moderate cases. From the results of each case, the following characteristics can be stated:

a) As for "without future road network plan" of base and moderate cases, Jl.Ir.Sutami, Jl.Urip Sumoharjo and Jl.Perintis Kemerdekaan in Makassar city are forecasted that the traffic volume against the capacity of those roads exceeds double in 2010.

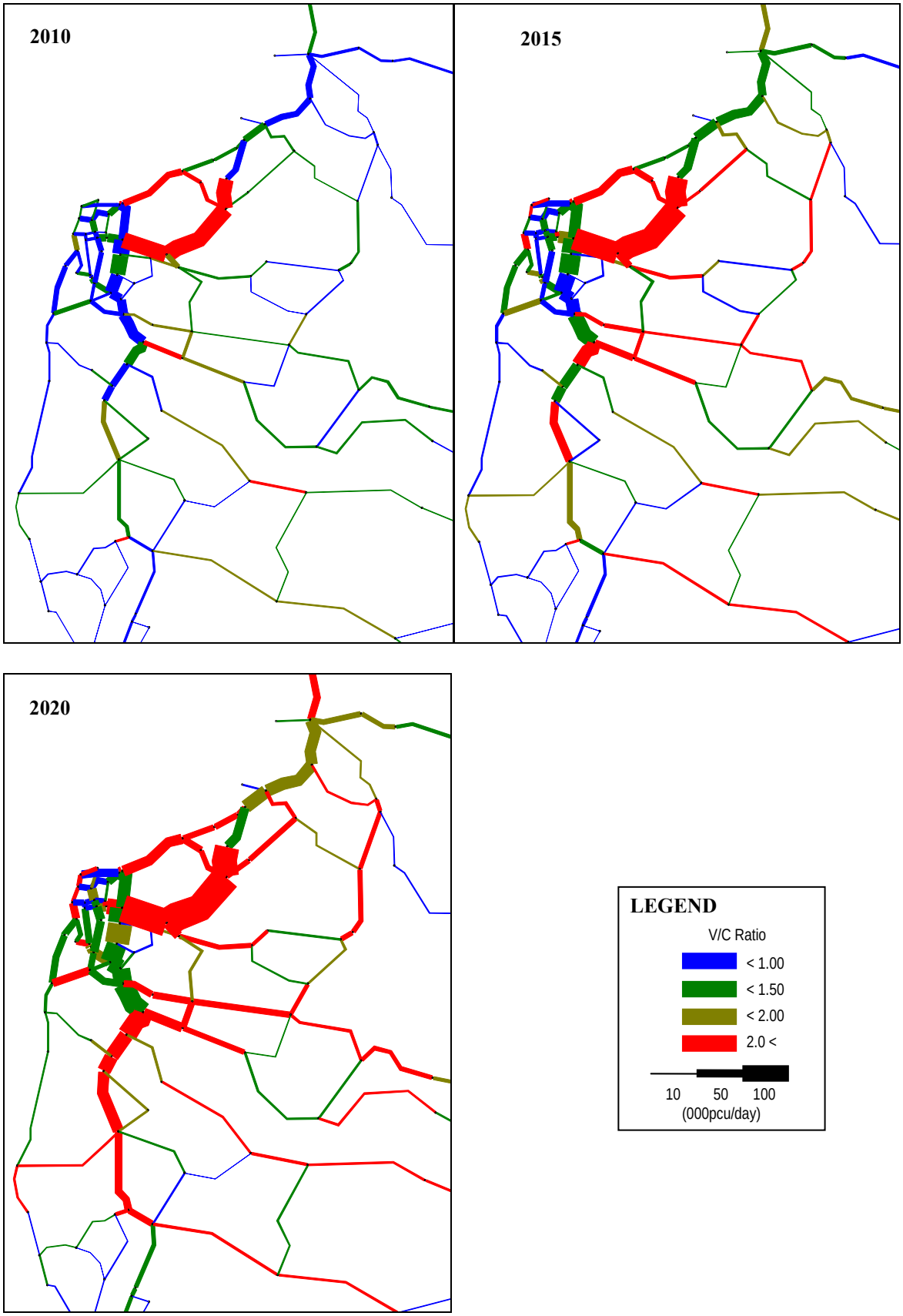
b) The future traffic volume of the base case is indicated to remarkably increase in Makassar city. On the other hand, that of the moderate case grows in Maros, Gowa and Takalar.

c) In case of "with future road network", traffic flows of base and moderate cases in 2020 are significantly improved outside center of Makassar city. However, roads over the capacity still remain in center of Makassar city.



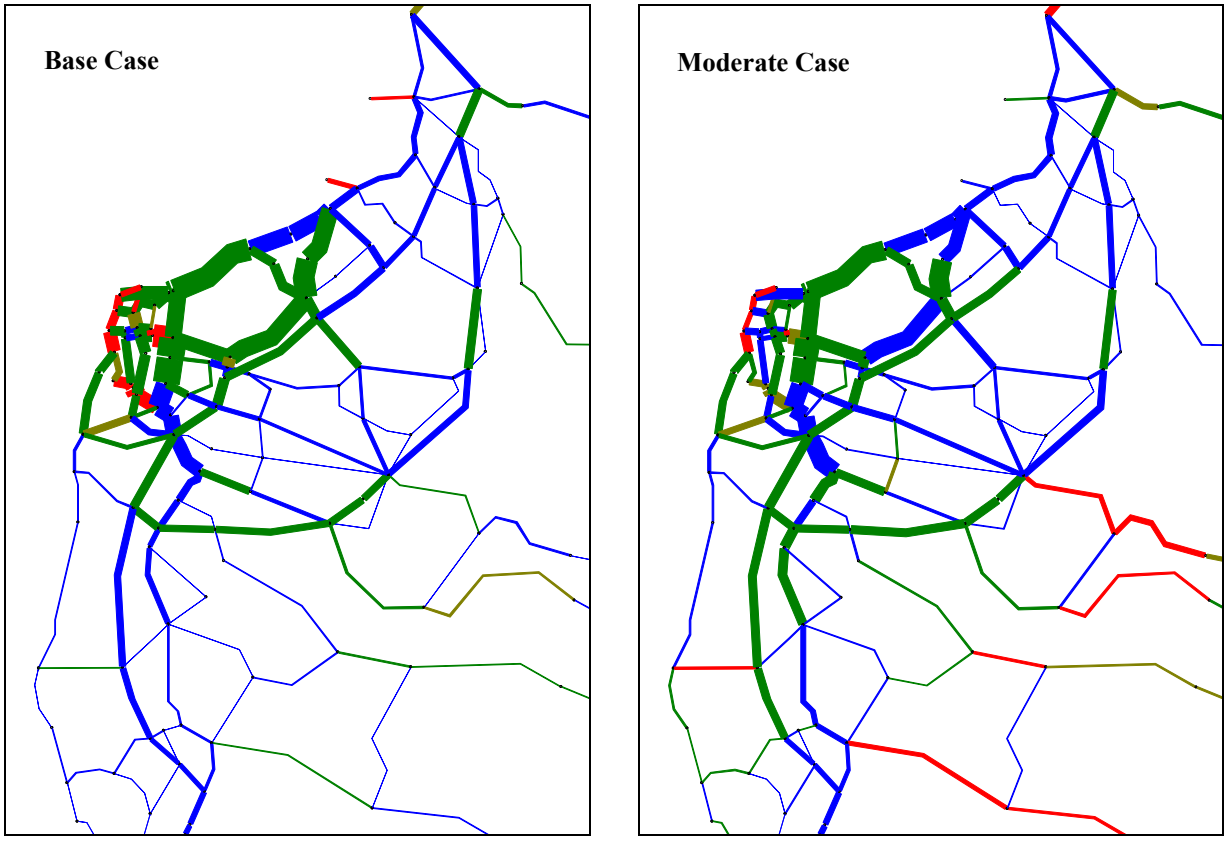
Source: JICA Study Team

Figure 11.4: Traffic Volume of Base Case (Without Future Road Network Plan)



Source: JICA Study Team

Figure 11.5: Traffic Volume of Moderate Case (Without Future Road Network Plan)



Source: JICA Study Team

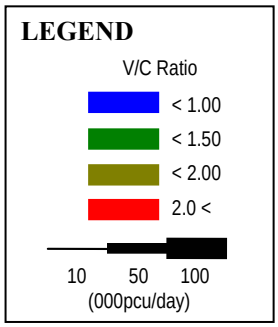


Figure 11.6: Traffic Volume in 2020 (With Future Road Network Plan)

Study on Implementation of
Integrated Spatial Plan for
The Mamminasata Metropolitan Area

SECTOR STUDY (14)

SEA PORT AND AVIATION STUDY

KRI International Corp.
Nippon Koei Co., Ltd

Table of Contents

PART A: SEA PORT SECTOR

PART B: AVIATION SECTOR

PART A: SEA PORT SECTOR

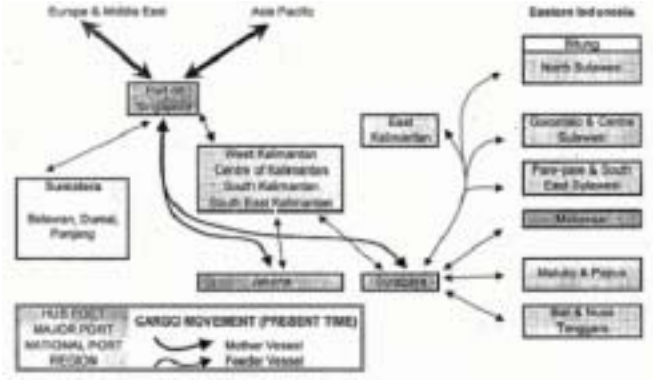
1. SEA PORT SECTOR IN MAMMINASATA

1.1 Present Status of Port in Mamminasata

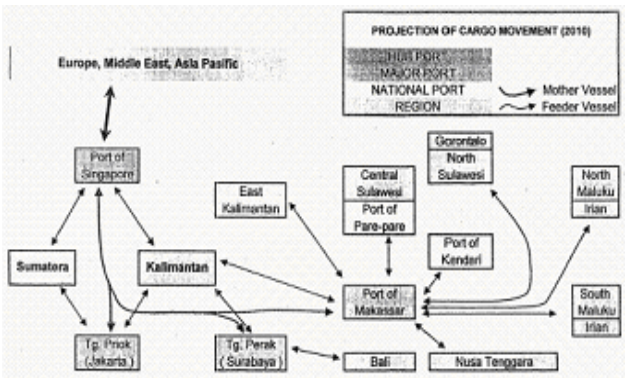
1) Hierarchy of Port and Port Network

Makassar Port is one of the main ports in Indonesia beside Port of Tanjung Priok, Tanjung Perak, and Belawan. It functions now as a hub port of the Eastern Indonesia.

In 2000, Makassar Port has less strong relationship in cargo collection and distribution with the ports in the surrounding area and each port has a shipping link with a nearest hub port in Surabaya. However, a shift in a cargo movement pattern is in progress as shown in figure below, and as of 2005, Makassar Port is in the transition period to be a new hub port in the region.



Cargo Movement in 2000



Cargo Movement in 2010 (expected)

Source: Makassar Port Expansion Project, PT. (PERSERO) Pelabuhan Indonesia IV, December 2001.

Figure 1.1: Cargo Movement around Makassar Port (2000 and 2010)

2) Role of Makassar Port

Makassar Port is the biggest port in the Eastern Indonesia, facing an international shipping lanes through the Makassar strait. It now plays a role of hub port, and its increasing role is apparent. The port have facilitated and made Mamminasata a

logistic and trade hub in the Eastern Indonesia and has played a role of logistic gateway to the industrial estates in the hinterland of the Sulawesi Island.

Its handling performance has expanded constantly, and this role will never be replaced by any mode of cargo transportation. Both domestic and international cargoes have shown a constant trend of increase, and domestic cargo handling accounts for 78% of the whole cargo handled at the port. On the other hand, passenger shows a drastic drop in volume for both international and domestic trips. Its function has substantially changed after completion of the container terminals.

3) Handling Volume

Makassar Port has handled an increasing volume of general cargoes and containers, at the rate of 10% (unload: 7.7%, load: 14.1%) in 2000-2004, which is attributable to the rapid expansion of domestic cargo flows, rather than by the international trade. Increasing trend of cargo and container is expected to continue further in the future, and makes it necessary to expand the port facilities to meet the growing demand.

As for the container, its total tonnage recorded an annual growth rate of 19% since 2000. On the contrary, the number of passengers has declined at the rate of 12% during the same period. Passenger traffic by vessels had a peak in the year 1999, and followed by a continuous decline, reflecting a shift to the aviation services.

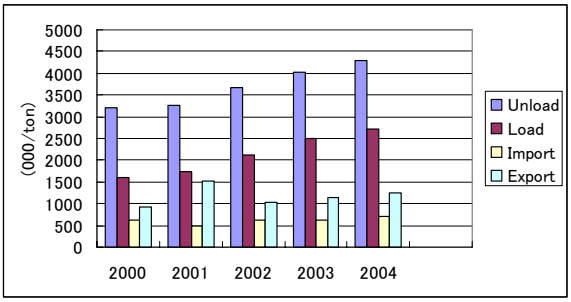


Figure 1.2: Cargo Flow at Makassar Port

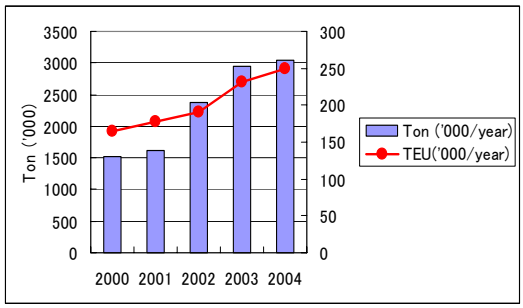


Figure 1.3: Container Flow at Makassar Port

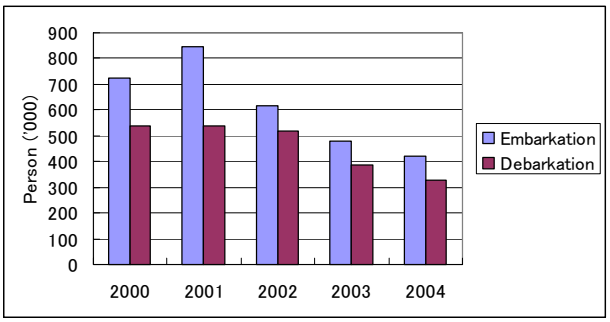


Figure 1.4: Passenger Flow at Makassar Port

Source: PT (Persero) Pelabuhan Indonesia IV, Branch of Makassar

4) Commodities Handled at the Port

Major commodities loaded at the port have not changed in the past: agricultural products that are unprocessed or primitively processed, and construction materials

such as cement, marble and clinker. Unloaded commodities are fertilizer, low materials such as mining and forestry products, and machines such as vehicle and its spare parts. This demonstrates a fact that manufacturing and/or processing industries are less developed in this region.

Table 1.1: Major Commodity Handled at Makassar Port

	Domestic Cargo (unloaded)	Domestic Cargo (loaded)	Import	Export
Commodity	Vehicle Fertilizer Coal Log wood Iron, Iron Sand Cement Sugar Gypsum	Cement Vehicle Rice Clinker Wheat Grist bran Sugar	Grist Sugar Vehicle Fertilizer Gypsum Asphalt Cement Spare part	Clinker Cocoa Cement Grist bran Plywood, Wood Marble Tapioca Dried Cassava

Source: PT (Persero) Pelabuhan Indonesia IV, Branch of Makassar

5) Facilities:

Layout of the existing Makassar Port is shown in Figure 1.5. It has two big terminals and one small one, facing the urban center of Makassar city behind.

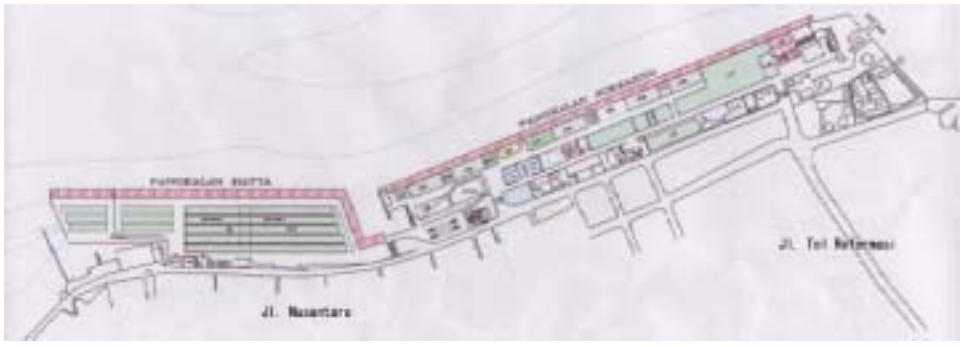


Figure 1.5 Layout of Existing Makassar Port

Terminal

Makassar Port has three (3) terminals, and its usage type is categorized as shown in Table 1.2. Each terminal has insufficient backyard to handle containers and passengers. In addition, the access road adjacent to the port is not wide enough to handle the passenger whenever ferry ships arrive and causes a traffic jam inside the port and on the access roads.

Table 1.2: Terminals, Major Functions and Physical Conditions

Terminal	Usage	Physical Condition
Suekarno Terminal:	Usage for passenger ships, wheat carriers, cement carriers, general cargo ships	- Backup yard is about 28 ha packed with various building for port facilities, offices, and factories - Access road are Nusantara Road with 20 meters wide, and Satando Road, linking with the toll road and industrial estates and airport beyond the city.

Hata Terminal:	Usage for container/ semi container, general cargoes at multipurpose berth	- Backup yard in only available for container and supporting facilities - Access roads are Nusantara Road and Riburane Road with 15-20 meter width
Paotere Terminal:	Usage for small Hokers/ traditional ships	- Backup yard is 3.5 ha filled with open storage yard, roads and offices. - Access road is Sabutung Road with 8-12 meters width

Building facilities

Existing building facilities are summarized as follows:

Table 1.3: Existing Building Facilities

Items	Suekarno Terminal	Hata Terminal	Paotere Terminal
Berthing Facilities	Moorings: 3,500 m in total		
	1,360 m	1,158 m	582 m
Goods Facilities	Wharves = 54,090 sq. m		
	26,112 sq. m	21,073 sq. m	6,905 sq. m
Transit Sheds	26,600 sq. m		
Open Storage Yard	180,000 sq. m in total		
	52,631 sq. m	114,446 sq. m	7,962 sq. m

Source: Perindo IV

Other facilities

Land cranes: 1 unit of 15 tones, 1 unit of 25 tones, 1 unit of 40 tones

Container Terminal Facilities: 5 units of rubber tire gantry crane

The access channel

The access channel to Makassar Port has the following characteristics:

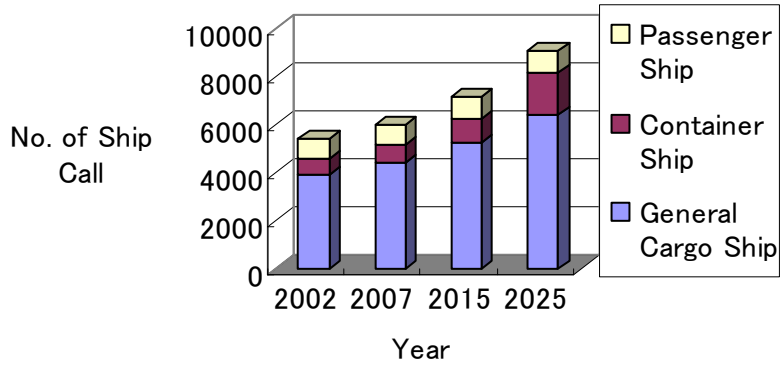
Length: 12 nautical miles
Width: 200 meters
Depth: -13.00 meters LWS

1.2 Demand Forecast of Makassar Port

In view of the recent increase in cargo flow, particularly in container cargo, the future traffic of passengers and cargoes has been forecasted by the PERINDO IV. However, any theoretical assumption of these forecast is unknown. In the light of the general economic growth of Mamminasata averaged at 7.1% per annum for a period of 2005-2020, the forecast figures appear to be below the economic growth ratio.

1) Shipping Movement Forecast

Fig. 1.6 shows shipping estimation and average Gross Tonnage (GRT), based on type of sailing. The growth rates are 2.1% for 2002-2007, 2.2 % for 2007-2015, and 2.4 % for 2015-2025, reflecting to a shift to larger ships.

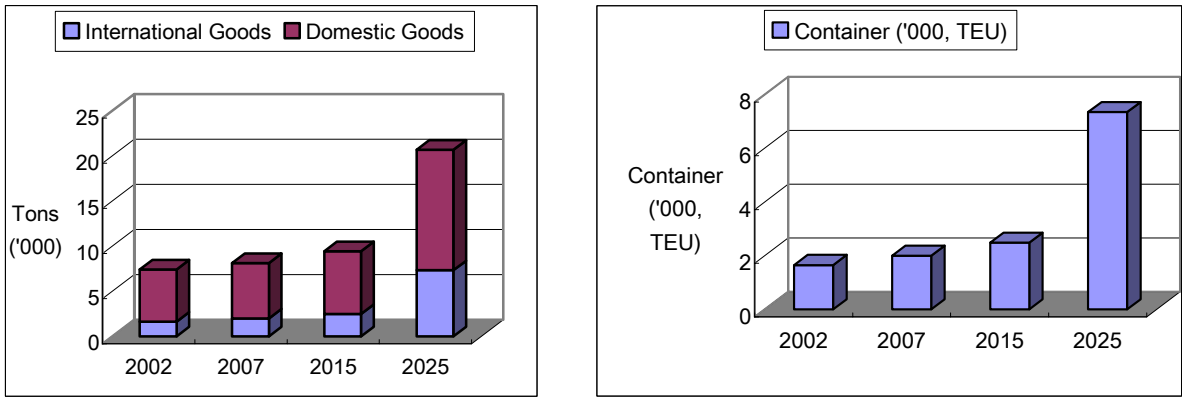


Source: Rencana nduk Pelabuhan Makassar, Propinsi Sulawesi Selatan

Figure 1.6: Forecast of Ship Call by Ship Type

2) Cargo Traffic Demand

Material traffic for 2002-2007 is projected to be 6.4 % on an annual average. In 2007–2025, the average growth of material traffic is lowered to 4.0 % per year.



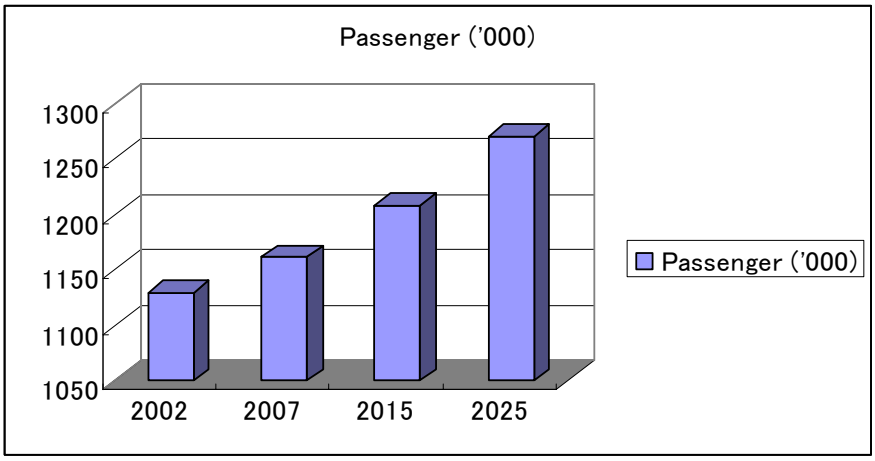
General Cargo ***Container***

Source: Rencana Induk Pelabuhan Makassar, Propinsi Sulawesi Selatan

Figure 1.7: Trend and Forecast of Cargo Flow at Makassar Port

3) Passenger Traffic Demand

Fig. 1.8 presents passenger traffic projection in Makassar with estimated shipping. The growth of passengers between 1990 and 2000 was more than 14% per year. Although a number of shipping has decreased these years due to the bigger and newer passenger ships, the passenger traffic may increase as it has been in the past.



Source: Rencana Induk Pelabuhan Makassar, Propinsi Sulawesi Selatan

Figure 1.8: Forecast of Passenger Traffic by Ship

2. ISSUES

2.1 Port Location

1) Blockage by Urban Center

Makassar Port was build at the best location on the edge of small Makassar town far prior to the 17th century. However, current Makassar City has expanded to block the port in every direction, and depresses its activities in terms of cargo transportation and expansion of the port itself. In addition, piecemeal expansion of Makassar Port in the past has resulted in un-efficient flows and congestion of commodities and passengers in and around the port. For instance, passenger terminal and general cargo terminal locate in the same place, causing a traffic congestion around the port.

Under these historical backgrounds, the existing port has faced serious constrains to perform and meet the users' demand, as summarized in the following.

<Constrains Outside the Port>

1) Location blocked by city
2) Inconvenient access road

<Constrains Inside the Port>

3) Narrow back-up land
4) Non-harmonious allocation of port facilities and buildings
5) Limited water depth in front of berthing area
6) Insufficient capacity of facility to support future demand of cargo
7) High handling charge

There is no room to expand the port area to any direction of the port. The western area is a harbor with limited turning basin. The southern area is recreational and housing area, which is being developed by the local government. The eastern area is the center of city, with business centers and residences. The northern area is occupied by the Oil Company (Pertamina) Base and Naval Base.

2) Inconvenient Access Roads

The other obstacle is an access road to/from the port. Currently, the main access road to/from the port, i.e. Nusantara Road, has very low capacity especially for heavy vehicles. It is difficult to widen the road because it is bounded by the business areas. If there is a traffic jam in any points of the road, all traffics to any sections of the port will be affected.

3) Narrow Back-up Land

This is closely related with 1) above, and there is no room for further expansion for the port facilities. Container yard has been full of containers, and many silos and the reserved tanks also block the removal of the facilities. In parallel with the handling efficiency of cargoes, wider back-up land is indispensable for smooth operation of the port.

2.2 Port Handling

1) Non-harmonious Allocation of Port Facilities and Buildings:

The passenger terminal locates in the center of Soekarno wharf designed for general cargos, and it is just beside special cargoes such as cement, wheat, and logs. Anytime when passengers embark/debark, traffic around the passenger terminal is jammed, limiting the activities in other parts of the wharf, especially general cargoes. Such a mixed allocation of facilities results in a cross of passenger and cargo flows.

2) Limited Water Depth in Berthing Area:

This is an obstacle for larger ships to anchor the Makassar Port, limiting the port to contribute to the cost efficient ship operation and lower transportation cost. The water depth in the front of the new Hatta Quay is 12 m, and in Soekarno Quay is 9~10 m. While, the Semi Panamax class (capacity: 3,400~4,000 TEUs) requires at least 14 m in water depth.

3) Low Container Handling Efficiency

The container terminal productivity m is remarkably low. Current productivity of 310 TEU at the existing container yard appears to be much lower than the modern

container port in the world. Figure 1.9 demonstrates the case of Kwai Chung Container Terminal in Hong Kong in 1998, revealing how handling efficiency is low at the Makassar Port.

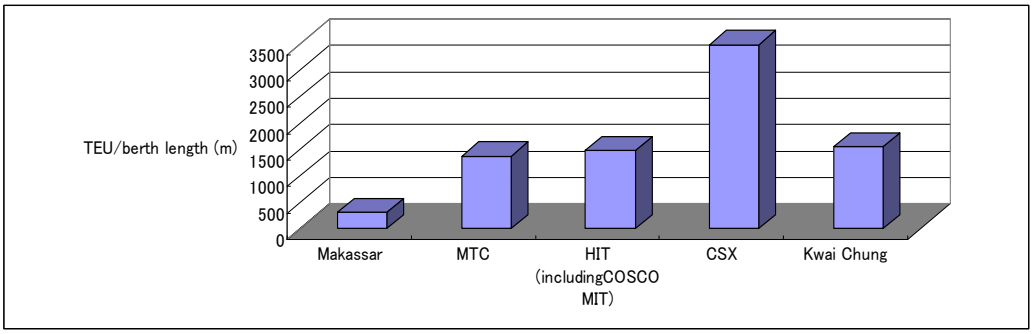


Figure 1.9 Comparison of Container Handling Efficiency

At the same time, the port management system should be reviewed judging from the claims raised by port users that the management system remains much to be improved, including the procedures and documentations required for shipments.

4) High Handling Charge

Last issue is that the foreign commercial society assesses that total cost of transportation for the cargo is rather higher than normal cost since special handling charge is sometimes levied, and this results in less competitiveness of the commodities from the Makassar in the international market. This kind of invisible trade obstacle has a negative impact to attract new investment for the port expansion.

3. PORT EXPANSION PLAN

3.1 Justification

The size of the existing container facilities at Hatta Anchorage is 7.5 hectares and the capacity is 350.000 TEUs. It is estimated that the port will reach its saturation point in or around 2008. In 2004, the flow of container reached 249.844 TEUs with an average growth rate is 10.98 % per year in the last five years.

Necessity of the port expansion is now an issue that gained a consensus. The major constrain is a financing plan since it requires huge amount of investment for land reclamation, development of access roads to avoid further traffic jam around the port, and reallocation of port facilities in an efficient manner in terms of cargo/passenger flows.

3.2 Outline of Expansion Plan

The proposed new site for expansion of Makassar Seaport (Makassar New Port I) locates in Kaluku Bodoa, east of the existing port.

Port expansion study was conducted in 2001, aiming at alleviating those constrains and coping with a rapidly increasing demand of cargo transportation. It is now at the final stage of approval by the central government. This master plan recommends the expansion of the Makassar Port and construction of new berth and yard to the north of the existing port, together with the access roads, in two stages (stage): 2007-2015 and stage II: 2015-2025). However, these port expansion plans is now facing a difficulty in financing. Build-Operate-Transfer (BOT) scheme has not attracted yet a private investor. Fig. 1.10 shows a general layout of the new port.

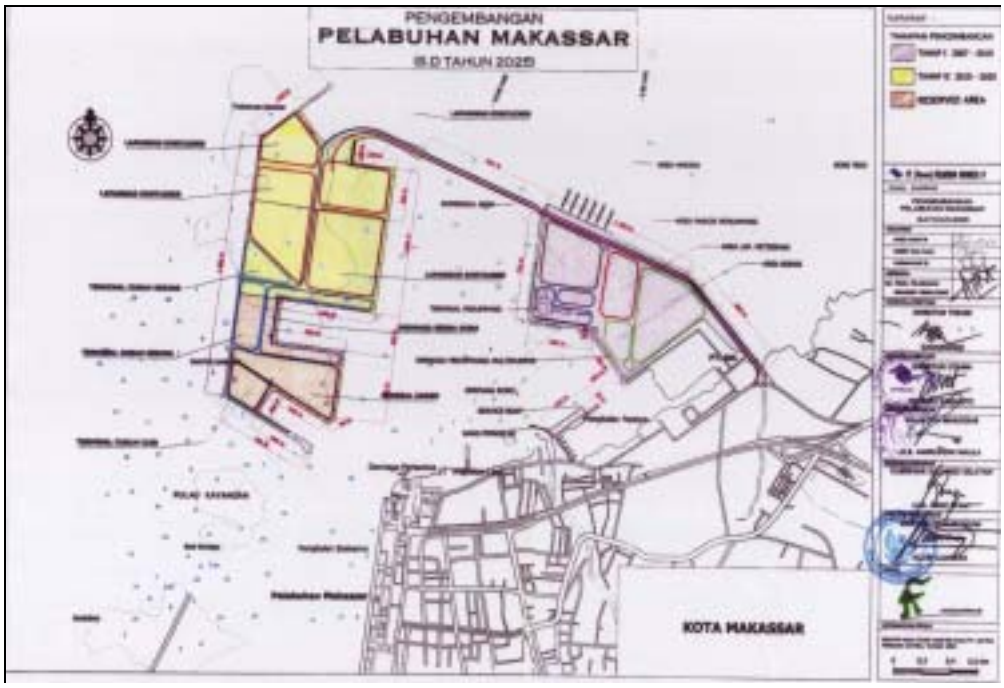


Figure 1.10: Expansion Plan of Makassar Port

3.3 Staged Development Plan

Phase 1 of the port expansion includes a construction of 1,030 meter for container berth and 2,090 meter for general cargo berth, development of warehouses, hotel, residential buildings and marina, on the reclaimed land of about 57 ha. PELINDO IV expects that the revenues from the real estate business would cover the construction cost of facilities for port expansion.

Stage I (2007 – 2015): Construction Period 2006 – 2008

1. Groundwork	3,200,000 M^3
2. Urugan	1,280,000 M^3
3. Dock	
a. passenger	600 M' (3 berth)
b. container	570 M' (3 berth)
c. gencar	360 M' (2 berth)
d. Ro-ro	140 M' (1 berth)
4. Port pond	128.64 hectare
5. Breakwater	3,270 M'
6. Piling park	
a. container park	100,000 M^2
b. general cargo park	100,000 M^2
7. Reefer facility	36 plugs
8. Warehouse / CFS	4,000 M^2
9. Road and office	60,000 M^2
10. Utilization and facility of electricity, sewage	1 set
11. Water supply and reservoir (2 x 1300 M^3)	1 set
12. Information system H/W	1 set
13. Back-up industry area	30 hectares
14. car terminal	15 hectares
15. marine / tourism area	5 hectares
Total	80 hectares

Stage II (2015 – 2025): Construction Period 2013 – 2015

1. Groundwork	5,290,112 M^3
2. Urugan	4,103,600 M^3
3. Dock	
a. bulk ship	650 M' (3 berth)
b. container ship	680 M' (3 berth)
c. gencar ship	360 M' (2 berth)
d. service ship (tug boat, etc.)	160 M' (2 berth)
4. Piling park	
a. container park	348,038 M^2
b. general cargo park	180,000 M^2
5. Reefer facility	36 plugs
6. Warehouse / CFS	4,000 M^2
7. Road and office	60,000 M^2
8. Utilization and facility of electricity, sewage	1 set
9. Water supply and reservoir (2 x 1300 M^3)	1 set
10. Information system H/W	1 set
11. Back-up industry area	30 hectares
12. Area break bulk (liquid and dry)	25 hectares
Total	102 hectares

Development of Makassar Seaport based on the Seaport Master Plan as agreed by the Minister of Transportation on January 23rd, 2004, will be implemented in two phases. The first phase (2007-2015) will develop 80 hectares and the second phase (2015-2025) 102 hectares. It is expected that by the year 2010 the new port would be ready for operation.

PELINDO IV is now preparing the tender documents for construction of the Phase 1 of the expansion on a BOT basis. Financing by the private investor is investigated. Investment return is estimated to be 12 % (FIRR) for the whole plan; however, few private investor has shown interest in this infrastructure development up to the present (June 2006).

3.4 Results of Initial Environmental Examination

Development of Makassar port in Paotere area would not have significant negative on the existing environment. However, counter measures for mitigation are needed as screened in the Table below.

Table 3.1: Results of Initial Environmental Examination

Impact	Description	Impact without prevention	Counter majors	Assessment
Social and economic aspect	Increasing population in location around the area of port development in the attempt of seeking for income in the sailing sector	2	Redesigning settlement area around the location of port development. Determining the rule application in planning settlement area. Control of issuing business and urban transport route license in the area of port development.	1
Biology aspect	The diversity of marine flora and fauna (plankton, bentos, nekton and others) and environmental function.	4	Proper management for endangered flora and fauna. Proper management for waste.	4
Technology aspect	Decreasing water quality due to technology application in port development/construction	3	Correct technology application (give little negative impact against water and air quality)	1
Natural panorama	Decreasing aesthetics condition	3	The development shall concern with aesthetics value. Attractive building design.	2

Note: 4: give high impact
3: give fair impact
2: give little impact
1: no worry

4. ACTION PLANS FOR SEA PORT IMPROVEMENT

General consensus for the expansion of Makassar Port is valid because of the increasing cargo volume and physically limited port area. Issues are where and when, to expand, and how to finance the investments.

4.1 Port Expansion and Improvement

1) More Detail Demand Forecast and Financial Plan

A BOT tender was planned at the end of 2005. This BOT tender, if realized, would have clarifie whether a private enterprise can run the port and real estate business. At this moment, however, it appears less expectable that a private enterprise would take large risks in doing the real estate business for port construction and management. Such an enterprise would see how profitable is the real estate business under such circumstances that a considerable number of hotel and residential tower construction plans are being promoted in the center of Makassar.

An alternative approach for the expansion of Makassar port is to introduce a joint finance by the public and private sectors, or a Public-Private-Partnership (PPP) scheme. While some parts of port facilities are implemented by the public sector, other part will be financed and managed by the private sector. Another conceivable alternative is to entrust the private sector in the operation and management of part of the existing container terminal so as to make it more attractive for the private sector to invest in the port expansion. Perind IV is suggested to study alternatives.

The financing scheme of Public-Private-Partnership (PPP) will be a potential alternative. By introducing this financing scheme, Perind IV could reality infrastructure in need while the private investor could lessen the investment burden and risks, and make it easier to ensure an investment return.

2) Clear Measure to Improve Low Productivity of Cargo Handling

This might lend to a new cargo handling system and equipment. It might be a determining factor of the expansion plan and schedule, because it would prolong the use of the existing container berth. Pelindo IV is suggested to conduct a defaulted study how to enhance the productivity of cargo handling in the existing port.

3) Improvement of Port Management System

As noted previously, there are claims by port users that the management system remains much to be improved. The procedures and documentations should be streamlined, and no additional charge should be imposed on port users. Without transparency and accountability, Makassar port would find it hard to be a regional hub port.

4.2 Port-related Facilities

1) Access Roads Improvement

In addition to the PERINDO Port Expansion Plan, a Master Plan of Makassar Municipality plans to establish a new warehouse zone on the reclamation land adjacent to the planned port expansion, which will be connected to the KIMA Industrial Zone and airport, running in parallel to Jl. Ir. Sutami. This conceptual plan would also invite to a financing problem in construction works.

Traffic jam might be increased with the traffic generated and attracted by the port. So more detail examination should be conducted how to connect the port to the access road, and analyze the impact on traffic conditions on the surrounding roads. This should be commenced soon after the port construction scheme is finalized with the investor and the design is fixed.

2) Coordination with Fishing Port

It is agreed among the authorities concerned that the current fishing port located in Makassar Port will be moved to Maros Port, but the implementation schedule is not yet finalized. This is a policy that aims at alleviating the traffic congestions around the existing port, and at the functional re-allocation of industry in rather less developed areas. Removal of the current ferry terminal is also investigated, from the existing Makassar Port to a new local port in Takalar, 30 km to the south. These schemes should be carefully assessed in terms of economic efficiency (time and transportation cost) by a feasibility study.

PART B: AVIATION SECTOR

5 OVERVIEW OF AVIATION SECTOR

Makassar Airport (Hasanuddin Airport) is a domestic airport, and it serves as a gateway to Sulawesi Island. It also plays a role of hub airport in Eastern Indonesia. Air traffic is constantly increasing in both passengers and cargoes. Almost all flights are at present fully booked. The Airport (Hasanuddin Airport) is located 22 km to the north of the center of Makassar, and its location has an advantage for industrial and trade development in terms of short distance to any destination.

5.1 Flight Network and Number

Air routes with an origin and destination in Makassar are shown in Figure 5.1, and the flight number is shown in Table 5.1.

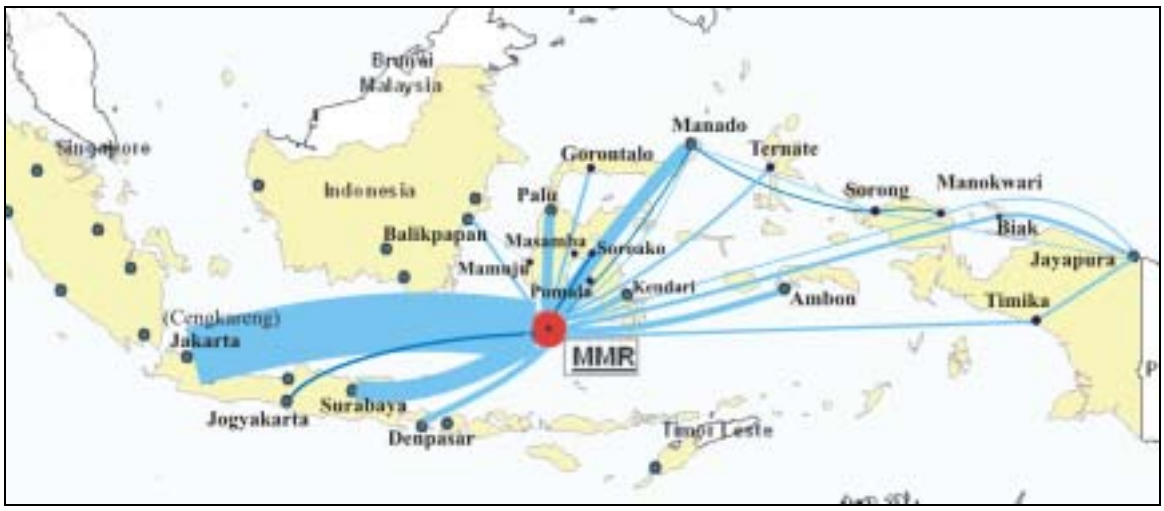


Figure 5.1: Aviation Network of Makassar Airport

Table 5.1: Number of Weekly Flight Services

(as of June 2005)

From Makassar to		No. of Flight
1	Ambon	14
2	Balikpapan	7
3	Biak-Jayapura	9
4	Cengkareng	120
5	Denpasar	14
6	Gorontalo	7
7	Jogjakarta	7
8	Kendari	14
9	Mamuju-Balikpapan	2
10	Manokwari-Jayapura	4
11	Masamba--Soroako	2
12	Menado	28
13	Menado-Sorong-Jayapura	3
14	Menado-Sorong-Manokwari	4
15	Palu	21
16	Pomalaa	5
17	Selayar	2
18	Soroako	6
19	Surabaya	42
20	Ternate	7
21	Timika-Jayapura	7
22	-	
23	-	
24	-	
25	-	
26	-	

To Makassar		No. of Flight
1	Ambon	21
2	Balikpapan	7
3	Jayapura-Biak	13
4	Cengkareng	120
5	Denpasar	14
6	Gorontalo	7
7	Jogjakarta	7
8	Kendari	14
9	Balikpapan-Mamuju	2
10	Jayapura-Manokwari	4
11	Soroako-Masamba	2
12	Menado	22
13	-	
14	-	
15	Palu	21
16	Pomalaa	5
17	Selayar	2
18	Soroako	6
19	Surabaya	35
20	-	
21	-	
22	Menado-Ternate	6
23	Jayapura-Menado	3
24	Jayapura-Sorong	3
25	Manokwari-Jayapura-Timika	7
26	Manokwari-Sorong	4

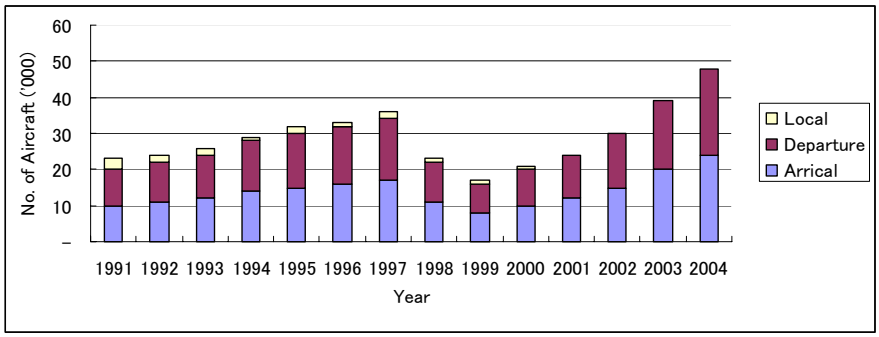
Source: PT. (Persero) Angkasa Pura I

Total flight number is 650 (arrival + departure) per week, of which Jakarta is the major origin and destination, accounting for 37 % of all flights, followed by Surabaya (12%), Menado (8%), Palu (6%), and Ambon (5%).

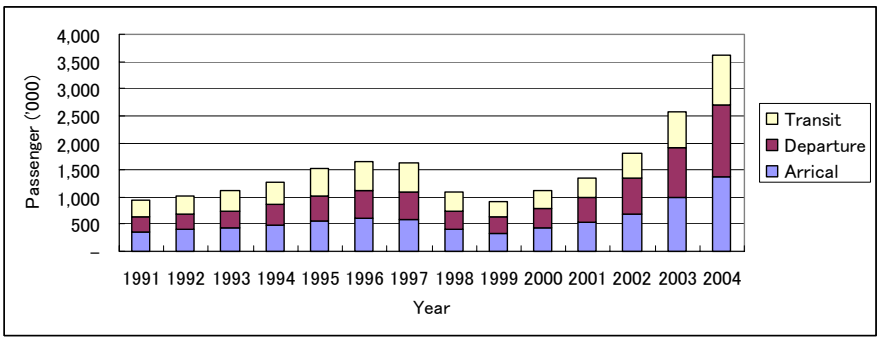
No international flight has been served since 2003 when the Silk Air (Singapore) ceased its operation, despite relatively high occupancy ratio (75%) for every three (3) flights per week. Another international carrier was the Malaysia Air Service (MAS), that ceased its service for three (3) flights a week in 2002 due to a low occupancy ratio (less than 50%). Aircraft used by both airlines was B737 with seats number between 146 - 153. Air force and civil aviation are now using the same runway and facilities.

5.2 Handling Volume

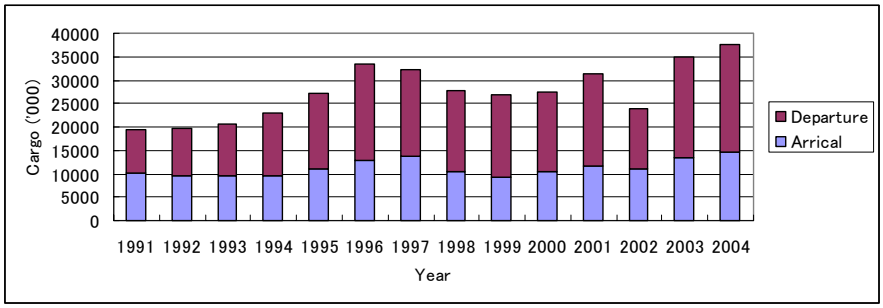
Actual performance of Makassar Airport (1991-2004) is illustrated in Figure 5.2. General trend are quite similar. Sudden drop in 1998, hitting a bottom in 1999, reflects the economic crisis in South-East Asia: however, it recovered in 2000 and shows a steady increase at the annual growth rate of 23% for aircraft, 34% for passengers, and 8% for cargo (2000-2004). (Annual growth rate was 5% for aircraft, and 5% for passenger for a whole period from 1991 to 2004).



Actual Aircraft Number



Actual Passenger Volume



Actual Cargo Handling Volume

Figure 5.2: Performance of Hasanuddin Airport

5.3 Facility Improvement in the Past

Airport facilities have been gradually upgraded, including the following works:

(i) Runway overlay, 1996

(ii) Trunking Radio operating in 1996

(iii) Installing the High Frequency (HF) - Regional Domestic Air Route Area (RDARA), Major World Air Route Area (MWARA) and Automatic Message Switching Center (AMSC) equipment, 1997.

(iv) Development of Hasanuddin Airport with the fund from the French Government as much as US $450 million. Major work is a construction of new Control Tower. The construction started in 1998 and was completed in 2003. The land acquisition has bow been done and paralleled taxiway has been constructed. However, a construction of new runway is a subject of new project.

6. ISSUES ON AVIATION IMPROVEMENT

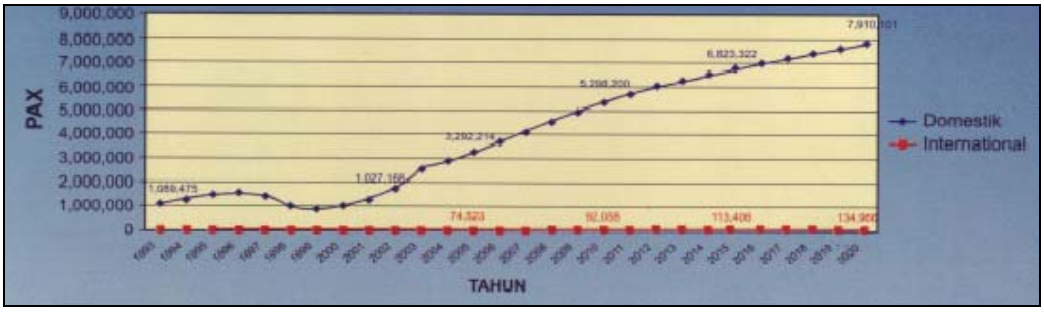
6.1 Future Air Service Demand

Demand forecast is available only in a graphical pamphlet entitled "Rencana Pengembangan Bandar Udara Hasanuddin-Makassar" and no actual number is available. Figure 6.1 is quoted from this available information. It shows an increase in passenger volume at a growth rate of 10 % during a period from 2005 to 2010, 5 % from 2011 to 2015, and 3 % from 2016 to 2020, reflecting a constant and rapid recovery after 2000. It appears rational if dynamic economic development is attainable at the average rate of 8 % per year up to 2020, as predicted by BAPPEDA, South Sulawesi.

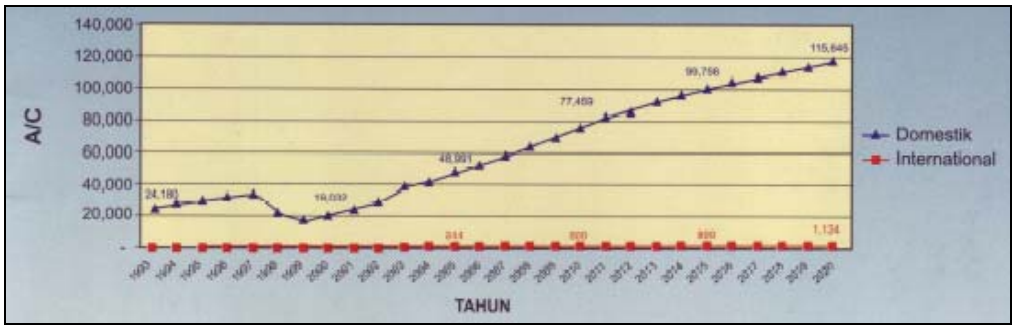
Aircraft increase is the same as the passenger forecast, showing a growth rate of 23 %, in spite of the actual average growth of 5 % from 1991 to 2004.

However, cargo demand forecast has not been made available at the office of PT (Persero) Angkasa Pura I, nor in the document of "Makassar Airport Development Project" , January 2005, under the name of "Directorate General of Communication and PT. (Perro) Angkasa Pura I. It appears that detail demand forecast has not been conducted up to 2005.

An annual growth rate of cargo handling in 1991-2004 was 5 %. When this long term growth rate is applied to the future demand forecast, the handling volume in 2020 would reach 2.3 times the value in 2005.



Passengers



Air Craft Movement

Figure 6.1: Demand Forecast for Hasanuddin Airport

6.2 Expansion Plan of Makassar Airport

Topographical conditions of the existing Makassar Airport, located of 3 km east of the sea coast and the hilly area behind, require high flight technique in landing/taking off.

A new expansion plan for improvement of the airport has already been prepared. Navigation system has been replaced with a new system. New access road to a new terminal is under construction and waiting for pavement works. This airport expansion plan aims at the following:

(i) To secure safety approach of the aircraft from/to the airport,

(ii) To cope with increasing number of passenger and cargo demand significantly, and now is nearly saturated. And for the larger aircraft, 3100 meter runway is indispensable to cope with an increasing demand.

(iii) To separate the operation of civil aviation and air force aviation, so it will enhance the degree of aviation safety

(iv) To accelerate economic development and increase the growth rate in eastern side of Indonesia, and

(v) To perform a role of domestic hub of many airlines in eastern side of Indonesia

This expansion plan has a long history, back to 1989 or more earlier. It has already got an authorization under the following documents:

(i) Ministry of Communications decree of Master Plan of Hasanuddin Makassar Airport

(ii) Ministry of Communications decree NO. 25/1989 of Obstacle Limitation Surfaces for Hasanuddin Makassar Airport

(iii) Ministry of Communications decree NO. 15/1995 of Environmental Assessment Impact IAMDAL) for the Hasanuddin Airport.

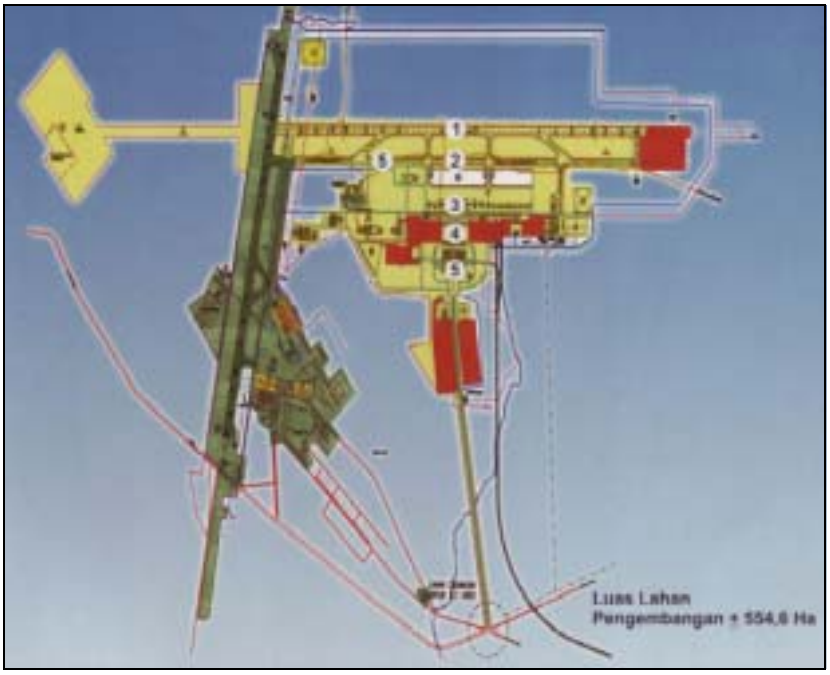
(iv) Review Study of Master Plan of Hasanuddin Makassar Airport, 2003

Unfortunately, the report entitled “Review Study (2003)” has not been made available to JICA.

Airport expansion entitled “Makassar Airport Development Project” is under progress. The land acquisition has already completed (554.6 ha). Layout of the Hasanuddin Airport at the final stage has been prepared as shown in Figure 6.4, and its major items are summarized in the following table.

Table 6.1: Features of Airport Expansion Project

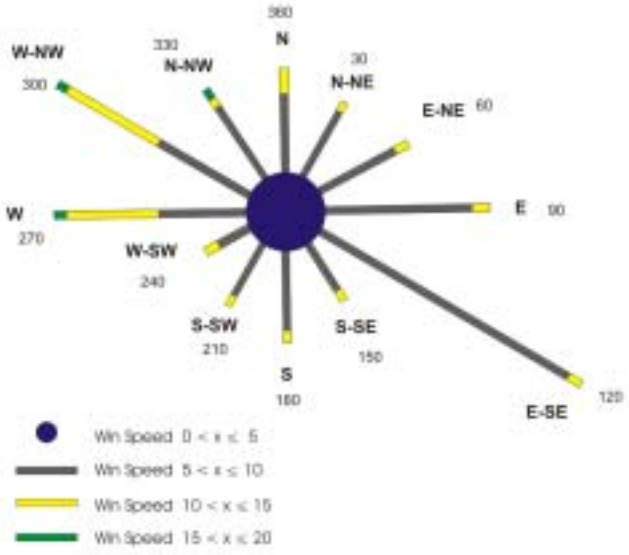
Item	Existing (2004)	Phase I (2005~2015)	Phase II (2016~2020)
Runway	2,500 m x 45 m	-	3,100 m x 45 m
Taxiway	823 m x 23 m	2,155 x 23 m	3,100 m x 23 m
Apron	16 ACs 69,147 sq.m	7 ACs 62,800 sq.m	17 ACs 155,200 sq.m
Passenger Terminal Building	10,800 sq.m	48,500 sq.m	48,500 sq. m
Jetway	--	2 unit	8 units
Parking	9,916 sq.m	-	32,500 sq.m
Cost	--	Rp. 400 billion (= US$ 45 million: 1 US$ = Rp. 9,000)	Rp. 444 billion (= US$ 49 million: 1 US$ = Rp. 9,000)
Financing	--	**Internal**: PT. Angkasa Pura 1, (Rp. 100 billion = US$11 million, 2005-06) **External:** Bank (Rp. 300 million, 2005-06), Bond?Medium Term Note/ Others (Rp.300 billion = US$ 33 million, 2007)	not available



Legend: 1: Runway (3,100 m x 45 m), 2: Parallel taxiway (3,100 m x 23 m) and Exit Taxiway (4), 3: Apron and Aircraft Parking Stand, 4: Passenger Terminal (48,500 sq.m), 5. Supporting Facilities
Source: Directorate General of Air Communication

Figure 6.2: Planned Airport Layout at the Final Stage

The annual wind direction is shown in the following Figure, which clarifies that the existing runway is the best, followed by the planned new runway: 30-210 degree direction.



Source: Directorate General of Air Communication

Figure 6.2: Wind Analysis at Hasanuddin Airport

Criteria for land use control have been managed in terms of either national or international standards. However, there is no explanation on the noise criteria in the report entitled "Detail Spatial Plan for Hasanuddin Airport", 2004. Conditions of landuse within the three noise levels can be seen in Table 6.2, and Figure 6.4.

Source: Detail Spatial Plan for Hasanuddin Airport", 2004

Figure 6.4: Noise Impact around the Hasanuddin Airport

Table 6.2: Spatial Plan and Noise Issues

Description	Noise Level I	Noise Level II	Noise Level III
1. Housing	Allowed	Conditioned II	Restricted
2. Hotel, motel	Allowed	Conditioned II	Restricted
3. Office, public building	Allowed	Conditioned III	Restricted
4. Trading area	Allowed	Allowed	Restricted
5. Social Facilities	Conditioned III	Restricted	Restricted
6. Cinema, auditorium	Conditioned III	Restricted	Restricted
7. Recreation	Allowed	Allowed	Restricted
8. Industry	Allowed	Allowed	Conditioned III
9. Intensive agriculture	Allowed	Allowed	Restricted
10. Sport hall	Allowed	Allowed	Restricted
11. Indoor sport facilities	Allowed	Allowed	Restricted
12. Airport supporting facilities	Allowed	Allowed	Conditioned I
13. Green belt	Allowed	Allowed	Conditioned IV
14. Commercial area	Allowed	Allowed	Restricted

Detail Spatial Plan for Hasanuddin Airport", 2004

7 RECOMMENDED MEASURES

Statistical data show a steady increase in demand for the air transport, both passenger and cargo transports. Thus there is no objection to expand the existing airport facilities to meet the growing demand. Development of the airport could have a great impact on the accelerated economic development in Mamminasata. Some recommendations are presented for the improvement of Makassar airport.

7.1 Better Services and Realistic Demand

1) International Service

International flight services were ceased in 2003 because the security had been threatened (according to Silk Air). There are some inconvenience for international passengers to access to Makassar and Mamminasata. Flights from/to Singapore might have potential demand and they would greatly contribute to further strengthening the integration of Mamminasata into the world economy. Further negotiation with Silk Air and MAS will be encouraged.

2) Reliable Demand Forecast

Available demand forecast is based on the past trend, and the forecast of cargo volume is unavailable. In addition, access to the Review Study of Makassar Airport Master Plan has not been allowed to clarify the latest demand forecast. The available demand forecast appear to have been conducted based on the simple trend analysis and does not reflect socio-economic frameworks of Mamminasata to enable the assessment of financial viability and economic feasibility of the large investment, either on the public or private basis. It is recommended that more scientific and concrete analysis be made on the traffic demand, both passengers and cargoes.

7.2 Physical Plan

1) Obstacles in Securing Safety Approach

The existing and newly planned runways cross each other, and the new runway is expanded into the south-west direction. However, there is a plan of new stadium construction with a strong lighting facility, locates at 2 km to the south-west of the newly planned runway. The light of this open air stadium will disturb a safety approach to the new runway. It is indispensable to confirm whether the light spread above the planned new stadium will disturb the safety approach to the airport or not.

Source: Baed map is quoted from "Rengana Detail Tata Ruang, Kawasan Bandara Hasanuddin Metropolitan Mamminasata, Tanun 2004".

Figure 7.1: Location of New Stadium and Approach Route of Aircraft

2) Noise Issue

Residential development has been expanding rapidly, and this trend is also seen in the vicinity of the airport. It is afraid that the noise is a problem for those residents. In this context, careful environmental impact assessment should be conducted. This issue must be included in the Review of the Hasanuddin Airport Master Plan", but it is necessary to confirm it before making any decision on the expansion plan.

3) Access Road

At present, the access road to the airport is congested especially peak hours both in the morning and afternoon. Expected increase in passengers and cargo transportation might aggravate the traffic situation. With an accurate data of demand forecast of traffic generated/attracted to the airport, it is necessary to assess the road capacity together with the on-going road improvement plan, inclusive its connection to the road network along the Mamminasata Bypass.

Study on Implementation of
Integrated Spatial Plan for
The Mamminasata Metropolitan Area

SECTOR STUDY (15)

FINANCIAL STUDY

KRI International Corp.
Nippon Koei Co., Ltd

Table of Contents

1. PUBLIC FINANCE

1.1. Central Government Finance and Public Expenditure

Fiscal revenue of the central government amounted to Rp.350 trillion in 2004, slightly increased from Rp.343 trillion in 2003. About 78% of total revenue was tax revenue, and 22% was non-tax revenue. Income tax (38.3%) and VAT (24.7%) are major tax revenue. On the other hand, total expenditure amounted to Rp.374.4 trillion, resulting in a fiscal deficit of Rp.24.4 trillion (improved from a deficit of Rp.34.4 trillion in 2003).

Out of total expenditure of the central government, routine expenditure amounted to Rp.184.4 trillion or 49.3% of total expenditure in 2004. Development expenditure at the central government amounted to Rp.70.9 trillion or 18.9% of total expenditure. This development expenditure is a fund available for development projects to be executed by the central government.

The national budget allocated Rp.119.0 trillion or 31.8% of total national expenditure for a transfer fund or balancing fund from the central government to regional governments in 2004 (more or less the same level of budge as allocated in 2003). This transfer fund system has been introduced since 1999 in line with the policy of regional autonomy (Law No.22, 1999). The Law of Fiscal Balance between the Central Government and the Regional Governments (Law No.25, 1999) stipulates that at least 25% of national budget is transferred to regional/local governments, aiming at (i) making public finance efficient, (ii) increasing in fiscal revenue, (iii) improving accountability of local budget execution, (iv) normalizing imbalanced budget, and (v) improving national social welfare.

The transfer fund comprises (i) the revenue sharing fund (DBH) that is allocated to regional governments to finance the implementation of decentralization, (ii) general allocation fund (DAU) allocated to regional governments for equitable financial distribution, and (iii) special allocation fund (DAK) allocated to certain regions to implement special activities in accordance with the national priorities. Under the transfer fund system, some resource-rich provinces (e.g., Reau and East Kalimantan) have increased their share in DAU, while resource-poor provinces (incl. South Sulawesi) have decreased their share in DAU. About 10% of the fund is transferred to provincial governments and 90% to Kabupaten governments.

The following table shows a national budget in 2003 and 2004.

Table 15.1 Indonesian National Budget

Budget Item	2003			2004		
	Rp. Trillion	GDP Ratio	Ratio	Rp. Trillion	GDP Ratio	Ratio
A. Revenue	342.8	19.1	100	349.9	17.5	100
1. Tax revenue	248.5	13.9	72.5	272.2	13.6	77.8
(Income Tax)	122.4	6.8	35.7	134	6.7	38.3
(BAT)	75.9	4.2	22.1	86.3	4.3	24.7
2. Non-tax Revenue	94	5.2	27.4	77.1	3.9	22
B. Expenditure	377.2	21.1	100	374.4	18.7	100
1. Central Gov. Expenditure	257.9	14.4	68.4	255.3	12.8	68.2
a. Routine expenditure	191.8	10.7	50.8	184.4	9.2	49.3
(Personnel expenditure)	50.4	2.8	13.4	56.7	2.8	15.1
b. Development expenditure	66.1	3.7	17.5	70.9	3.5	18.9
2. Transfer Fund	119.3	6.7	31.6	119	6	31.8
a. Revenue Sharing Fund	29.9	1.7	7.9	26.9	1.3	7.2
b. General Allocation Fund	77	4.3	20.4	82.1	4.1	21.9
c. Special Allocation Fund	3	0.2	0.8	3.1	0.2	0.8
C. Fiscal Balance (A-B)	-34.4	-1.9	-9.1	-24.4	-1.2	-6.5
D. Deficit Financing	34.4			24.4		
1. Domestic finance	31.5			40.5		
2. Foreign finance	2.9			-16.1		

(Source) Indonesia Economy after IMF -graduation

It is noted that the national fiscal budget was in a deficit of about Rp.54 trillion in 2001 while the regional fiscal budget was in a surplus of about Rp.16 trillion. The central government is in an opinion that the allocation to the transfer fund has been excessive from the viewpoint of national fiscal balance.

For the medium term development, BAPPENAS estimates that the required investments would total Rp.4,073 trillion for five years from 2005 to 2009. Of this total investment requirement, Rp.600 trillion (about 15%) will be met by the public investment or government expenditure, while Rp.3,473 trillion will be met by the private sector. The public investment is limited to around 3.7% of GDP on an average. For funding, the private sector saving will cover nearly 88% of the total funding, and net foreign saving is expected to be minus. The following table shows the national investment plan for 2005-2009 prepared by BAPPENAS.

Table 15.2 Medium Term National Investment Plan

(Rp. Trillion, %)

Investment plan	Targets					Total (2005-'09)
	20005	20006	20007	20008	20009	
Required investment amount total	529.3	652.9	805.5	962	1,123.40	4,073.00
Government sector	86.9	101.6	113.6	135.2	162.9	600.1
Private sector	442.5	551.3	691.9	826.8	960.5	3,472.90
Government (GDP ratio)	*3.4*	*3.6*	*3.6*	*3.8*	*4.1*	*3.7*
Private (GDP ratio)	*17.6*	*19.5*	*21.7*	*23.3*	*24.4*	*21.7*
Funding total	529.3	652.9	805.5	962	1,123.40	4,073.00
Government saving	61.7	76.9	97.3	126.2	160.9	523
Private sector saving	509.2	589.3	711.5	828.3	939.8	3,578.10
Foreign saving	-41.6	-13.4	-3.3	7.5	22.7	-28
Government (GDP ratio)	*2.4*	*2.7*	*3.1*	*3.5*	*4.1*	*3.3*
Private saving (GDP ratio)	*20.2*	*20.9*	*22.5*	*23.4*	*23.9*	*22.3*
Foreign saving (GDP ratio)	*-1.6*	*-0.6*	*-0.1*	*0.2*	*0.5*	*-0.2*

Source: BAPPENAS

1.2 South Sulawesi Government Finance and Public Expenditure

A revenue budget of South Sulawesi government was about Rp.850 billion in 2003**.** Own local revenues amounted to Rp.446 billion or 52% of total revenue, while Rp.404 billion or 48% was transferred from the central government in the forms of DAU (35% of total revenue), DAK (0.4%), and revenue sharing fund (12%). The following table shows the revenue budget of South Sulawesi government in 2000-2003.

Table 15.3 Revenue of South Sulawesi Government

Description	**Fiscal Year (billion Rp)**			
	2000	**2001**	**2002**	**2003**
Revenue	**367.2**	**524.4**	**700**	**849.2**
Local Own Revenues (PAD)	118.2	200.6	325.1	445.7
Local taxes	96.2	159.9	259.8	357.0
Local User Charges	6.6	9.5	32.3	43.5
Local Government Owned Company Profit	6.7	15.2	15.1	26.8
Others	8.7	16.0	17.9	18.4
INTERGOVERNMENTAL TRANSFER	249.0	323.9	374.9	403.5
Tax Revenue Sharing	24.7	53.0	69.2	94.1
Non Tax Revenue Sharing	34.6	24.6	48.2	7.8
General Allocation Fund (DAU)	67.5	246.3	257.5	298.2
Specific Allocation Fund (DAK)	122.1	-	-	3,400

Own revenue of South Sulawesi has increased from Rp.118 billion in 2000 to Rp.446 billion in 2003, and the own revenue ratio has increased from 32% in 2000 to 52% in 2003.

On the other hand, expenditures of South Sulawesi province were allocated 56.5% for routine expenditure and 34% for development expenditure during the period from 2000 to 2003. Out of routine expenditures, the personal wages accounted for as high as 56% (32% of total expenditures or around Rp.267 billion). Of development expenditures (34% of total expenditure), about 19.2% was allocated for trade sector (about Rp.71 billion), 14.0% for transportation sector (about 59 billion), 9.2% for education and culture (Rp.34 billion), 5.8% for agriculture and forestry, 4.0% for health, and 3.1% for housing, as shown in the following table. About 9.5% of total expenditure (or 21.9% of development expenditure or about Rp.81 billion)) was transferred to Kabupaten governments.

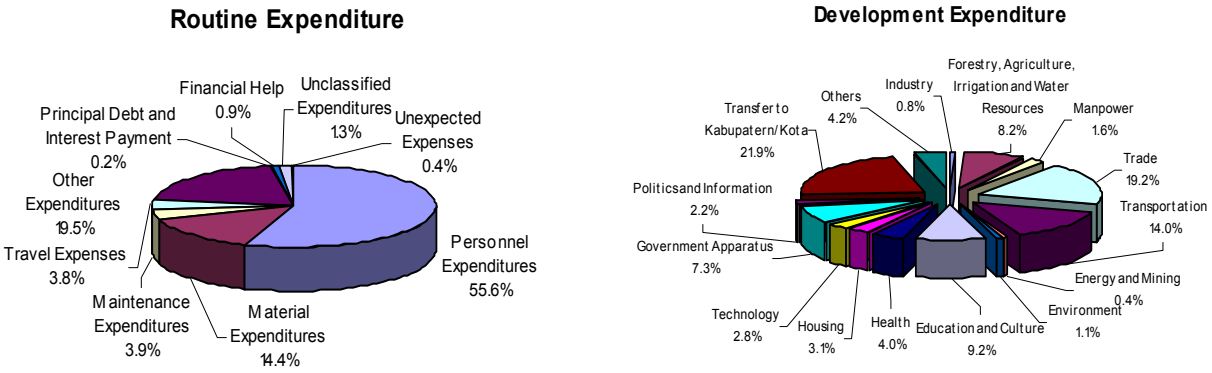


Figure 15.1 Expenditure of South Sulawesi Government

1.3 Mamminasata Finance

The Mamminasata Metropolitan area comprises Makassar city, Maros, Gowa and Takalar Kabupatens. Budgets of four local governments are summed up to see how the current financial position is for development of the Mamminasata area.

Total revenue of Mamminasata was about Rp.1,369 billion in 2004. The own fund was about 13% (inclusive of surplus from previous years), while the transfer fund amounted to 89% of total revenue (inclusive of transfer from South Sulawesi province), as shown in the following table.

Table 15.4 Revenue of Mamminasata Metropolitan Area

No	Description	FY 2004	
		(Billions Rp)	%
I	**Previous Year Surplus**	54.07	4%
II	**Part of Local revenue**	120.15	9%
a	*Local Taxes*	58.81	
b	*Local User charges*	42.28	
c	*Local Operating Profit Share*	2.50	
d	*Other Official Revenue*	15.05	
III	**Part of Profit Sharing**	981.26	72%
a	*Taxes Profit sharing*	96.59	7%
b	*Non Taxes Profit Sharing*	15.01	1%
c	***General Allocation Fund***	834.23	61%
d	*Regional Development Fund*	42.83	
	Special Allocation Fund	40.93	3%
IV	**Part of Local Loan**	0	0%
V	**Other Revenue**	213.65	15%
a	*Center Government Acceptance*	155.66	11%
b	*From Province*	51.60	
	Total I + II + III + IV + V	1,369.131	100%

It is clear from the above that the local revenue should be increased to be less dependent on the transfer fund from the central and provincial governments. Industrial development is a key to increase local revenues.

About 80% of the Mamminasata budget (totaling Rp. 1,369 billion) was allocated for routine expenditures. It is surprising that 65% of routine expenditure (52% to total expenditure) is used for personnel expenditure and 15% for subsidies for autonomies.

Table 15.5 Routine Expenditure of Mamminasata Area

Routine Expenditure (Average)	Per RX	Per Total Exp.
Routine Expenditure	**100%**	80.2%
a. Employee Expenditure	64.8%	51.9%
b. Goods Expenditure	9.0%	7.2%
c. Maintenance Expenditure	2.0%	1.6%
d. Official Travels Expenditure	1.1%	0.8%
e. Other Expenditure	5.2%	4.2%
f. Installment of loan expenditure	0.8%	0.7%
g. pension and onderstand	0.0%	0.0%
h. Financial Aid	0.3%	0.3%
i. Expenditure not Included in other parts	1.3%	1.0%
j. Un-expected Expenditure	0.0%	0.0%
k. Treasurer and Computation	0.0%	0.0%
l. Subsidy for Autonomy Region	15.0%	12.0%
m. O & M of General Infrastructure	0.5%	0.4%

For development projects in Mamminasata, only 20% of regional budget or Rp.280 billion was allocated. Allocation of development expenditures in the last few years is tabulated in the following.

Table 15.6 Proportion of Development Expenditure of Mamminasata Area

Development Expenditure (Average)	Per XD	Per Total Exp.
Development Expenditure	**100%**	19.8%
a. Industry Sector	0.7%	0.1%
b. Agriculture and Irrigation Sector	5.0%	1.0%
c. Irrigation and Water Resources sector	0.8%	0.2%
e. Labor Sector	0.4%	0.1%
f. Trade, Business Development, regional finance & Cooperative Sector	10.9%	2.2%
g. Transportation sector	16.4%	3.2%
h. Mining and energy sector	0.5%	0.1%
i. Tourism and Regional Telecomunication sector	2.7%	0.5%
j. Regional Development and Settlement Sector	17.9%	3.5%
k. Bio-environment and Spatial planning sector	2.3%	0.5%
l. Education, National civilization, belie/trusty on good, youth and sport sector	6.0%	1.2%
m. Population and prosperty family sector	0.3%	0.1%
n. Health,social welfaer, gender position, child and young Sectors	6.7%	1.3%
o. Housing Sector	11.2%	2.2%
p. Religion Sector	1.2%	0.2%
q. Science and Technology Sector	1.9%	0.4%
r. Law Sector	0.2%	0.0%
s. Government official and Monitoring Sector	14.3%	2.8%
t. Politics, Information, Communication and Public information sector	0.3%	0.1%
u. Defense and Security Sector	0.2%	0.0%
v. City/Regency Right Revenue Sector	0.1%	0.0%

Due to different categories in budget by regency, it is difficult to calculate the exact amount of expenditures. Major expenditures in 2004, however, are estimated as summarized in the following.

Table 15.7 Estimated Budget Amount of Mamminasata Area

Major expenditure items	Possible Budget (Rp Billion)
a. Employee Expenditure	711.2
f. Trade, Business Development, regional finance & Cooperative Sector	29.5
g. Transportation sector	44.4
j. Regional Development and Settlement Sector	48.5
l. Education, National civilization, belie/trusty on good, youth and sport sector	16.3
n. Health social welfare, gender position, child and young Sectors	18.2
o. Housing Sector	30.4
s. Government official and Monitoring Sector	38.6

1.4 Public Investment in Development

For development of the Mamminasata Metropolitan area, public investment funds will be made available from the national budget, provincial budget and municipal/regency budgets. From the financial situation as reviewed above, these budgets are in the following magnitude.

(i) National development budget in the order of Rp.71 trillion a year (18.9% of national total expenditure). However, in view of the budgetary deficit, it could be used only for priority projects at national level, like the case of national roads.

(ii) Provincial development budget is relatively small or about Rp.290 billion a year (34% of provincial budget) and it should be utilized for the benefit of the people in South Sulawesi province.

(iii) Development budget of four local governments in Mamminasata will amount to approximately Rp.280 billion a year (about 20% of Mamminasata expenditure). Most of public investments should be earmarked by the local budget in Mamminasata.

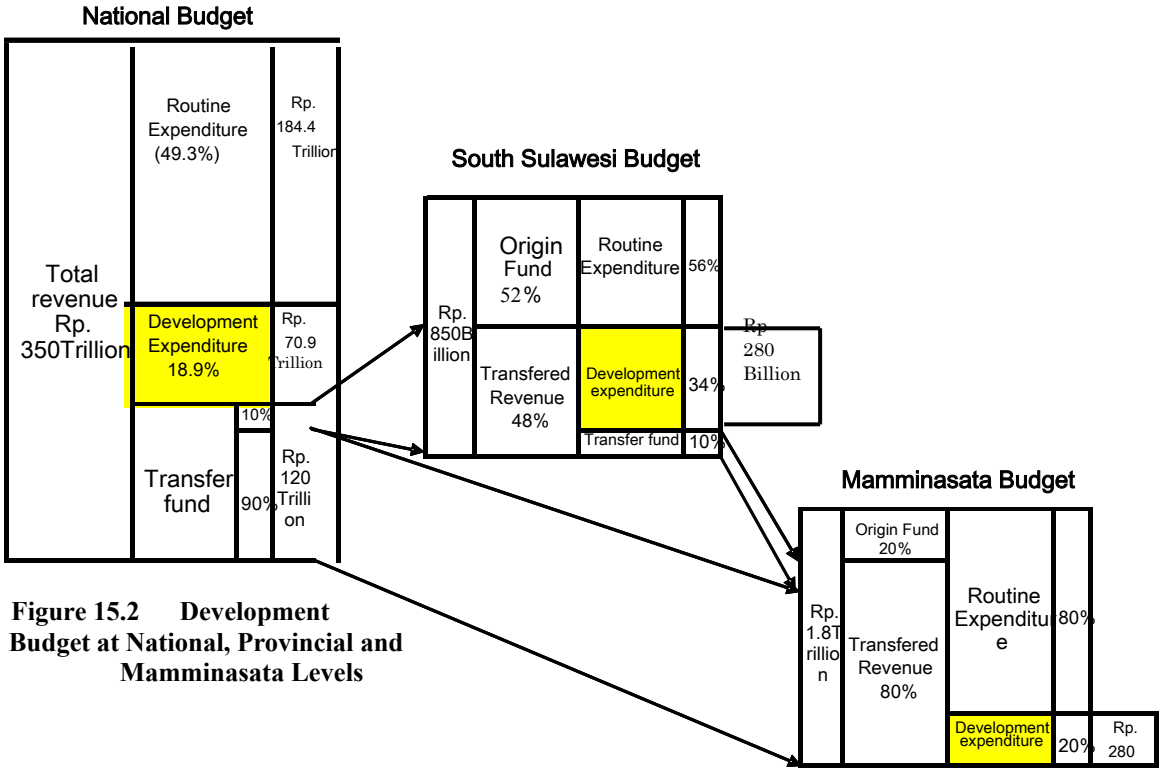


Figure 15.2 Development Budget at National, Provincial and Mamminasata Levels

Under such public finance situation, implementation of integrated spatial plan for the Mamminasata area should take the following into account.

(i) Makassar municipality, Maros, Gowa and Takalar regencies should better reduce the routine expenditure that accounts for 80% of total expenditure, particularly wage expenditure (65% of routine expenditure or 52% of total expenditure), in order to allocate more funds for development of spatial plan.

(ii) Private investments should be encourages so that the private sector would play an increasing role in Mamminasata development.

(iii) Public and private partnership (PPP) should also be encouraged in development finance, demarcating the roles and responsibility of partnership.

(iv) Semi-public corporation and special company (e.g., PELINDO for port, PT.AP-I for airport) should implement the expansion projects at their own finance or at PPP.

(v) Public investment should be minimized phasing out the implementation of development projects in accordance with the demand for such services.

(vi) Loans on concessional terms (soft loans) should be secured in order to lessen financial burdens.

2. INFRASTRUCTURE DEVELOPMENT FINANCE

Various development projects have been proposed for improvements in social and economic infrastructure in Mamminasata, including water supply, sewerage and solid waste disposal, as well as land, sea and air transport, electric power, and telecommunications. Since the telecommunication sector is totally managed by the private sector, it will be precluded from the financial plan.

2.1. Water Supply, Sewerage, and Solid Waste Sector

Following projects have been proposed for implementation as priority projects:

Table 15.8 Required Finance for Water Supply, Sewerage and Solid Waste Projects

	Investment (Rp.billion)	
	1st Priority	2nd Priority
Water Supply		
(i)Somba Opu water treatment plant expansion	295	
(ii)Rural water supply in Maros (incl. UFW program)	166	
(iii) Rural water supply in Takalar (incl. UFW program)	17	
Sewerage Treatment		
(i) Sewerage treatment Phase-1	250	
Solid Waste Landfill		
(i) Landfill site at Pattalasang	315	
(ii)Promotion of Reduction, Reuse & Recycling	40	
Total	1,083	

Service providers of water supply are PDAM-Makassar and PDAMs-Kabupaten. Financial position of PDAM-Makassar has been in deficit for three consecutive years since 2002, due mainly to high unaccounted for water (UFW) and a high operational expenditure compared to its revenues. Although the financial position will improve with the new tariff, the management of PDAM-Makassar should be improved in implementing the proposed projects. Rural water supply in Maros, Gowa and Takalar regencies are required to improve the access to fresh water under the MDG. With certain conditions for improvements, expansion of Somba Opu water treatment plant combined with the reduction in UFW should be implemented with a loan on concessional terms. A preliminary analysis indicates that PDAM-Makassar could be self-financed with proper management reform. It is desirable that rural water supply in Maros, Gowa and Takalar would be integrated into PDAM-Mamminasata. (For reference, financial position of PDAM-Makassar and Manila Water Co. Ltd. is presented in ANNEX to this Sector Report.)

Though sewerage treatment has not been executed in Mamminasata, it is planned for implementation to create a clean and environment-friendly metropolitan area of Mamminasata. It will be implemented in phase, and the first phase model area for off-site system is proposed

as discussed in Section 8.2. Although it is desirable that sewerage treatment would be operated in combination with water supply, the financial viability on the combined water supply – sewerage operation should be further studied.

Solid waste is currently managed by the City Beautification Department (DK) and garbage collection and transportation will be turned to the private operation with a concession period of 5 years up to 2010. Difficulty in private operation is the construction and management of landfill site at the proposed site in Pattallassang. The public investment in the construction of landfill site is required, with a soft loan to lessen the financial burden.

Consequently, the water supply, sewerage, and solid waste sector would require local public finance in the amount of Rp.1,083 billion. There remains a future possibility of PDAM privatization.

2.2 Electric Power Sector

A series of power generation projects are proposed for improvement in electricity supply in Mamminasata, as discussed in Sector Report (11). Most of power generation schemes could be implemented on an IPP basis by the private initiative. On the other hand, public investments are required to support PLN in power transmission, substations, and distribution network.

Table 15.9 Required Finance in Electric Power Projects

Power Generation	Scheme	Investment (Rp.Billion)	1st Priority	2nd Priority
1.Sengkang gas	IPP	340	340	
2.Takalar coal	IPP	460	460	
3.Jenepont-2, coal	IPP	2,200	2,200	
4.Malea hydro	IPP	2,840	2,840	
5.Poko hydro	IPP	5,380		5,380
6.Jenepont-1, coal	PLN	1,100		1,100
7.Bakaru hydro	IPP	3,050		3,050
Total	PLN	1,100	-	1,100
Total	IPP	14,270	5,840	8,430
Power Transmission/Substation				
1.Transformers	PLN	51	51	-
2.Distribution	PLN	57	57	-
Total	PLN	108	108	-
Grand Total	PLN	1,208	108	1,100
	IPP	14,270	5,840	8,430

Most of the power generation schemes could be implemented on a private IPP basis. The critical issue is whether the public investment is made through PLN on the Jenepont 1 coal-fired power plant. On the assumption that PLN would invest in Jenepont power plant (1st stage of 100 MW), the public investments are required in the order of Rp. 1,300 billion for the first priority scheme implementation.

2.3 Road Transport Sector

A series of road improvement projects have been proposed for implementation as discussed in Sector Study (12). Major projects are cited in the following.

Table 15.10 Required Finance for Road Transport Projects

Road/Section	Scheme	Investment (Rp. Billion)	1st Priority	2nd Priority
1. Sutami Toll road	BOT	460		
2. Perintis expansion	P(N)	360	360	
3. Alauddin	P(P)	100		100
4. Malino access	P(P)	140		140
5. Middle ring road (sect. 1 only)	BOT	320		
6. KIMA road	P(P)	100		100
7. T. Bung access	P(P)	120		120
8. Takalar access	P(P)	290		290
9. Mamminasata Bypass / Bridge	P(N)	3,550	3,550	
10. Abdulla Dg. Sirua	P(P)	530	530	
11. Around Airport	P(P)	100		100
12. Airport access	P(N)	960		960
13. Trans-Sulawesi / Bridge	BOT	4,280		
14. Hertasning	P(P)	260	260	
15. KIWA Access	P(P)	260		260
16. Around Sungguminasa	P(P)	110		110
Total	BOT	5,060		
Total	Public	6,880	4,700	2,180
Total	P(National)	4,870	3,910	960
	P(Province/ Regency)	2,010	790	1,220

For the improvement of road network in Mamminasata, a total public investment of around Rp.6,880 billion would be required, and it would be budgeted by the central and provincial/regency government. Toll roads will be constructed for Ir.Sutami (expansion), middle ring road (southern section) and Trans-Sulawesi road. A feasibility study is to be made on this Trans-Sulawesi road to assess its financial viability on private initiative or under PPP.

2.4 Seaport and Airport Sector

For the expansion of the Makassar port, PELINDO-IV intends to reclaim the new land and construct new wharfs on a BOT basis. Preliminary estimate of the construction cost would be around Rp.1,000 billion for port facilities.

As discussed in Sector Report (14), it is uncertain yet if BOT-based port-cum-business area development is implementable by a successful bidder. Fortunately, both PELINDO-IV and Makassar Port maintain good financial position, rated “AA”, and it would be further enhanced if and when the container handling capacity is improved up to around 500,000 TEU per annum. An alternative measure for port expansion would be examined for the case of investment by PELINDO-IV or by PPP for port expansion through the feasibility study by

outside independent consultant. Such a detailed study should include (i) detailed demand estimate of container shipment, (ii) detailed plan to improve container handling efficiency up to around 1,000 TEU/berth meter, (iii) detailed engineering study on port expansion plans, and (iv) professional financial advice on project implementation.

For the improvement of Hassanudin Airport, PT.AP-I (special company) has been implementing the construction of new terminals and new runway construction. The financial position of AP-I is quite favorable, with profit after tax of 22% in 2002, 14% in 2003 and 23% in 2004. Total asset in 2004 was Rp.3.6 trillion and the shareholders equity was Rp.2.88 trillion. The cash and deposit balance was over Rp.1 trillion.

The first phase improvement of terminal building, taxiway and apron is underway by AP-1 with an estimated cost of about Rp. 640 billion. The financial arrangement for construction of runway has not been made yet.

2.5 Basic Principle for Finance Plan

For financial plan, infrastructure development will be classified into three categories as follows:

(i)	Profitable sector:	Business can be financially profitable and operated by the private sector.
(ii)	Semi-profitable sector:	Management will require public financial support now, but it could be reformed to be profitable and manageable by the private sector in the future.
(iii)	Non-profitable sector:	Business can't be financially viable and it should be operated in principle by the public sector.

The following tables present basic principle for financing the infrastructure development projects contemplated under the Mamminasata spatial plan.

Table 15.11 Financing for Profitable Sector

	Infra Sector	Service Provider	The method of private participation now and future	Management reform needed for regional government/Special company	Tariff strategy	Program for the poor	Financing plan		
							Equity or Tax	Loan possibility	Others
Profitable sector	Power generation	PT.PLN-VIII (SC) + IPP	IPP		Improve back margin		Self finance		IPO, CDM
	Communication	PT.Telkom + Singtel (KSO)	KSO		Improve back margin		Self finance		Listed
	Toll road	PT. Bimamarga (SC) BOT Projects	BOT				Investor Fund + Regional Gov fund		
	Bus service	Private Sector (Organda)	–	Inter/Intra trank Transportation	Tariff revision	Tariff table			
	Seaport	PT. PELINDO-IV (SC)	Concession, Long term lease	Improve Container handling efficiency	Repeal informal tariff		Expecting investmen t from Real Estate developer		
	Airport	PT. AP-I (SC)	Privatization						
	Office Building	Private Sector Developer	–	–			Self finance		PPP
	Housing	Private Sector Developer	–	–			Self finance		PPP

Table 15.12 Financing for Semi-Profitable and Non-Profitable Sectors

	Infra Sector	Service Provider	The method of private participation now and future	Management reform needed for regional government/Special company	Tariff strategy	Program for the poor	Financing plan		
							Equity or Tax	Loan possibility	Others
Semi- and Non - Profitable Sector	Flood control & drainage improvement	Province/City Dinas	–	–			Public finance	0	
	Water supply/ sewerage	Water supply, Kabupaten/Kota PDAM, Sewerage, No service provider actually	Privatization	Firstly cuts cost and NRW for making it profitable. Then merge 4 PDAMs for making integrated PDAM-Mamminasata profitable. Finally PDAM-Mamminasata expands into sewerage business	Tariff revision	Tariff table	Accumulated Retained Earning by management reform	0	
	Solid Waste	City Beautification Dinas (DK), Special co. (PDK)	*Management-Concession in garbage collection transportation * BOOT-Concession in organic waste recycling into organic fertilizer * BOT-Concession in garbage power generation	*General administration cost reduction * Planning integrated PSP scheme * Setting up expenditure covering ratio after PSP	Tariff revision	Tariff table		0	
	Transmission	PT PLN-VIII (SC)						0	
	Distribution	PT PLN-VIII (SC)						0	
	Arterial road	Province/City Dinas	–	–			Public finance		
	Health	Province/City Dinas	–	–			Public finance		
	Education	Province/City Dinas					Public finance		
	Environment	Province/City Dinas	–	–			Public finance		

Further, as discussed in Section 4.5 of Main Report, a macroeconomic framework for public investment should be observed to the maximum extent. A target of the public investment would be 3~4% of GRDP. This implies that the public investments in infrastructure development in Mamminasata to be completed by 2020 would be around Rp.20 trillion or around 1,300~1,400 billion per annum.

2.6 Required Public Investment

For the infrastructure development in Mamminasata, as discussed above, the following public investment would be required.

Table 15.13 Required Public Investment for Mamminasata

Infrastructure	Total Public Investment	Priority Investment	Annual Budget
Water supply, sewerage, solid waste	1,083	1,083	36
Electric power sector	1,208	108	4
Road transport sector	6,880	4,700	157
Total	9,171	5,891	196

Note: Annual budget is estimated at 1/30 of investment on the assumption that loans on concessional terms are made available with a repayment period of 30 years.

On the assumption that the annual budget for development expenditure in Mamminasata (Rp.280 billion in 2004) and in South Sulawesi province (about Rp. 280 million) remains at the same level (totaling Rp.560 billion), the above estimated total annual budget requirement (Rp.196 billion) will be equivalent to around 35%. If the two large investments in national roads (Perintis of 360 billion and Mamminasata bypass/bridge of 3,550 billion) are executed by the national budget and excluded from regional funding, the annual budget requirement would be Rp.66 billion or 12% of required budget. Such an estimated annual budget for infrastructure development would appear to be rational and reasonable. Likewise, the total investment amount (Rp.9,171 billion) would be within the macroeconomic framework of PIP (Rp.20 trillion in 2005-2020).

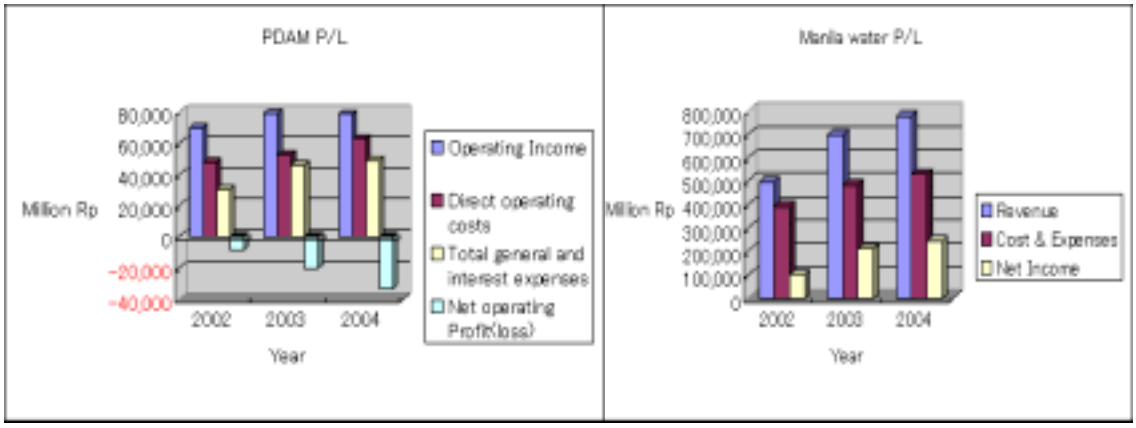
It is added to note that, in making public investment in infrastructure development, some conditions are to be imposed for better management of the executing agency, inclusive of the reduction in cost of wages and administration. For investment in water supply through PDAM, for instance, the management system improvement (e.g., reduction in UFW rate, in general expenses, and in the rate of employees per 1,000 connections) should be conditioned under the loan agreement or memorandum of understanding.

Preliminary Financial Analysis on PDAM-Makassar
---- Comparison with Manila Water Co., Ltd. ----

This paper presents a comparative analysis between PDAM Makassar and Manila Water Co. Ltd., through preliminary as it is.

1. P/L

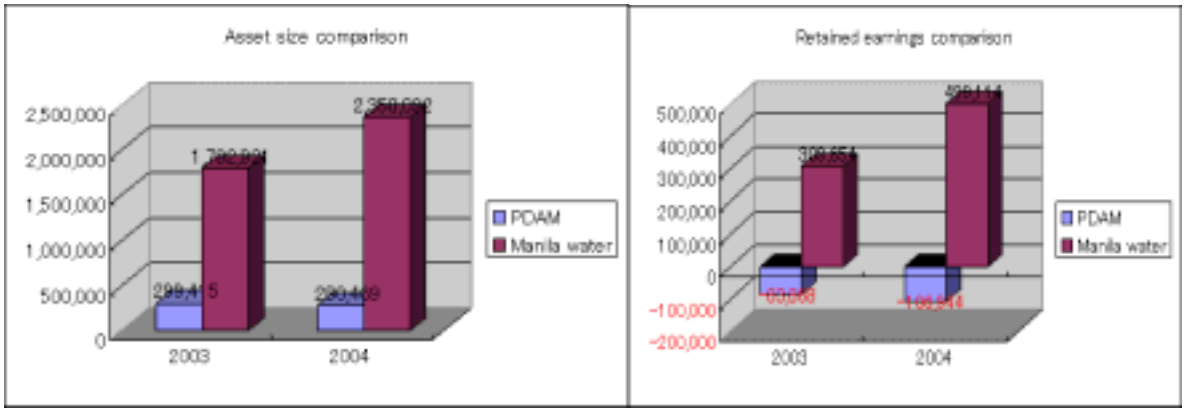
   PDAM has posted 3-consecutive-year operating losses since 2002, while Manila Water has increased its income before tax since 2002. Manila Water's sales amount is 10 times bigger than PDAM's sales, and the current water tariff is more or less at the same level. A ratio of general and maintenance/operation expenditure to revenue is clearly too high in PDAM, as shown in the following figures.



Source: JICA Study Team

Figure 15A-1 Comparison of P/L

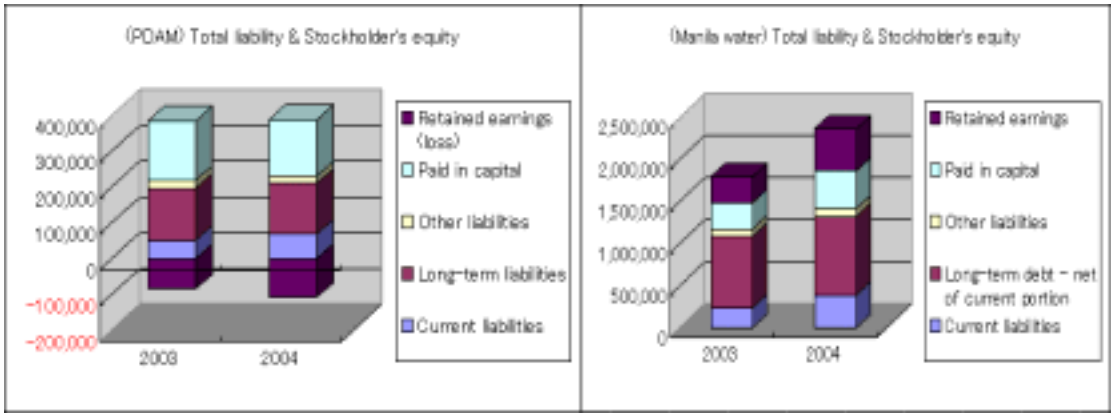
2. B/S



Source: JICA Study Team

Figure 15A-2 Asset Size and Retained Earnings Comparison

Manila Water is 8.4 times bigger than PDAM in total asset size. Manila Water's total asset has increased by 30% (Rp. 2.35 trillion in equivalence), while PDAM decreased its total asset by 9%. Manila Water increased its retained earnings by 60%, while PDAM increased its accumulated losses by 27% in recent 2 years.



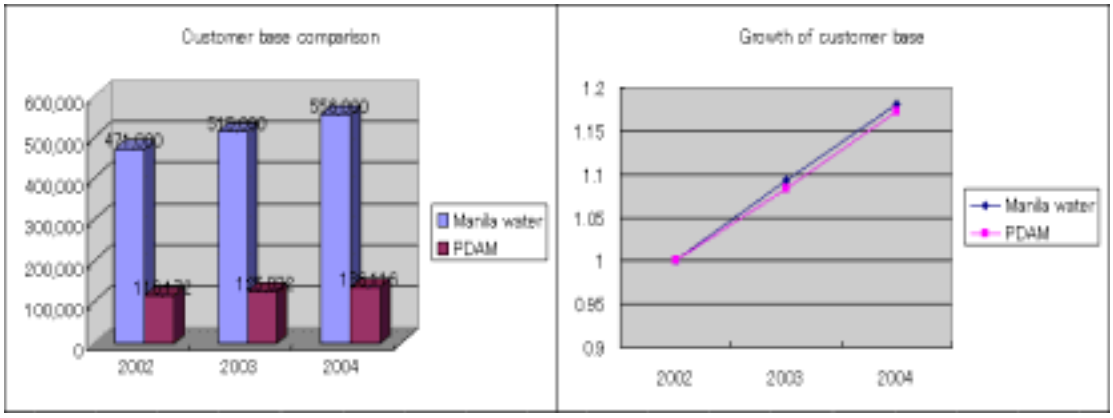
Source: JICA Study Team

Figure 15A-3 Comparison on Total Liability and Stockholder's Equity

Although PDAM's paid-in capital accounts for 56% of its total asset, its capital-asset ratio has been eroded to 18%. Manila Water, on the other hand, increased its capital-asset ratio to the level of 40% by piling up retained earnings. Further, more than half of its shareholder's account is retained earnings.

3. Customer Base

Following graphs show that PDAM's customer base is 1/4 of Manila Water but the ratio of recent increase is just alike.



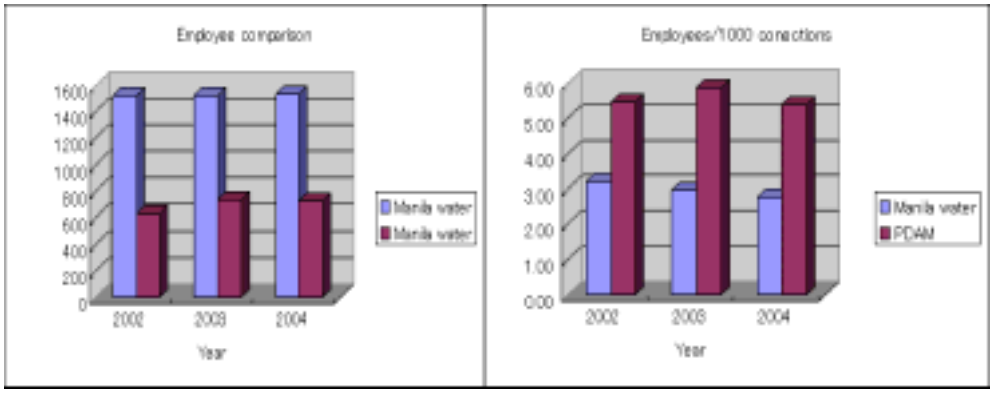
Source: JICA Study Team

Figure 15A-4 Customer base

4. Number of Employee

PDAM is 1/4 of Manila Water in customer base, but 1/2 in number of employees. Accordingly, the number of employees per 1,000 connections is 5.38 for PDAM and

2.77 for Manila Water. PDAM leaves much more room of improvement for PDAM in employee number / 1000 connection.

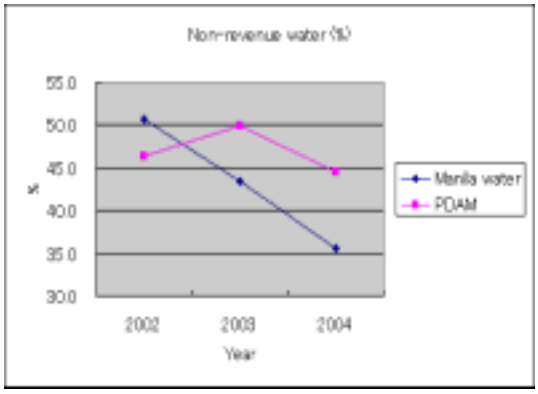


Source: JICA Study Team

Figure 15A-5 Number of Employee and Number of Employee/1000 Connection

5. Unaccounted-for-Water Ratio (UFW)

Reduction of UFW is the most effective measure for increasing income. PDAM is planning that its current UFW (45%) should be reduced by 20% to the level of 25% during the planned period. Manila Water recorded 65% of UFW at its starting year of privatization (1997), and they improved to the level of 50% in 2002, 43% in 2003 and 35.6% in 2004. PDAM's target (reduction by 20%) should be remarked as attainable, if you consider the case of Manila Water.



Source: JICA Study Team

Figure 15A-6 Unaccounted-for-Water Ratio

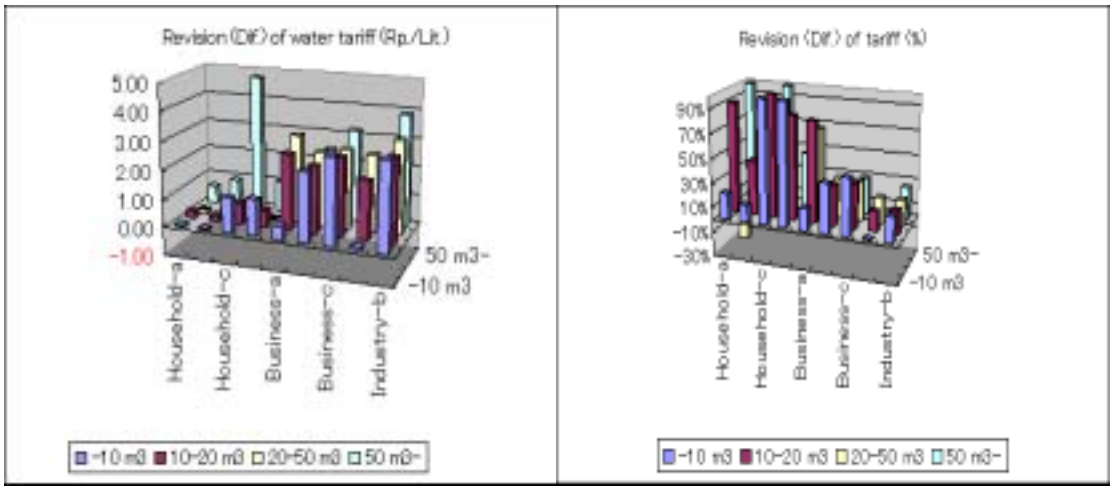
6. Tariff

PDAM's tariff table consists of by-customer kind and by-consumption volume. The tariff table has been modified for the first time in 5 years and approved in December 2005. Its revision owes heavily to high consuming households in terms of revision spread and to commercial & industrial sector in terms of revision percentage. Tariff changes from 1.59Rp./Litter to 2.23Rp./Litter by 40% in terms of consumption weighted average. The revised tariff level is at the same level of Manila Water' tariff.

Table 15A-1 Revised Tariff Table

(Rp/Litter)

Customer class	-10 m3	10-20 m3	20-50 m3	50 m3-	Number of Customers
Household-a	0.13	0.95	1.35	3.11	25,830
Household-b	0.17	1.18	1.70	3.73	69,021
Household-c	1.37	1.84	2.52	6.21	20,079
Household-d	1.47	1.89	2.95	6.84	2,061
Business-a	2.95	5.90	7.30	9.32	7,165
Business-b	8.39	9.32	10.58	12.43	1,008
Business-c	9.32	10.25	11.19	13.98	240
Industry-a	2.85	5.28	7.15	9.94	32
Industry-b	10.56	11.90	13.22	15.86	87

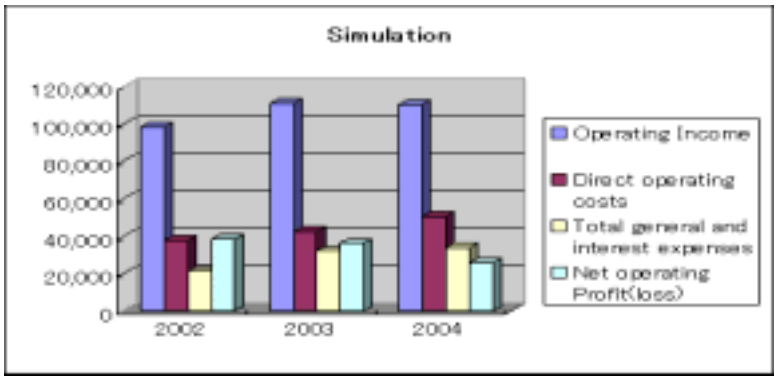


Source: JICA Study Team

Figure 15A-7 Water Tariff Comparison

7. Expected Management Reform

PDAM could have recorded a net operating profit of Rp. 20-40 billion/year for the last 3 years, if PDAM increased its revenue by 40% (30% by reduction in UFW and 10% by tariff raise), cut general administration expense by 30% and save 20% of maintenance & operation expenditure by reducing the ratio of employee number / 1000 connection".



Source: JICA Study Team

Figure 15A-8 Simulation of PDAM's Management