8. URBAN INFRASTRUCTURE DEVELOPMENT

To realize a "creative, clean and coordinated metropolitan Mamminasata", it is necessary to improve the flooding and drainage conditions in the region, as well as to improve such social infrastructure as the water supply, sewerage and solid waste disposal systems in the Mamminasata area.

8.1 Flood Control and Drainage Improvement [1]

1) Major Issues

The major river systems in Mamminasata are the Jeneberang (catchment area of 762 km^2), Maros River (645 km^2), Tallo River (407 km^2), Pappa River (389 km^2) and Gamanti River (272 km^2), as shown on the following map.

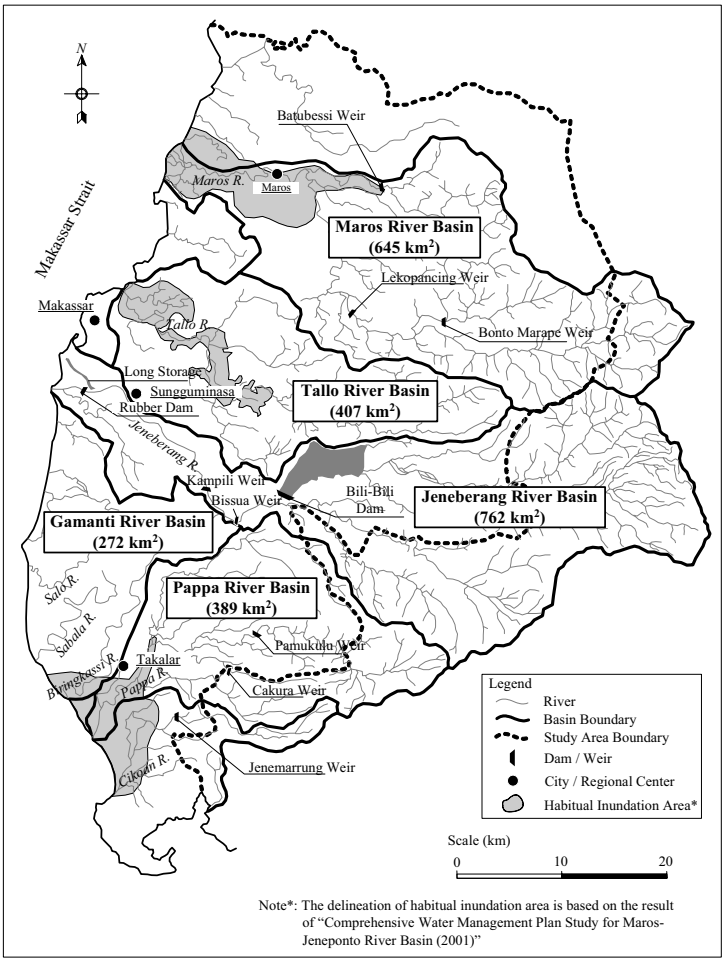


Figure 8.1: River Systems in the Study Area

Floods in the downstream reaches of the Jeneberang have been protected against a 50-year probable flood with the improvement works in the downstream and construction of the Bili Bili multipurpose dam. Periodic floods still occur in the downstream reaches of the Maros and Tallo rivers and countermeasures are to be taken in the medium and long terms. Floods occur in the downstream reaches of the Pappa and Gamanti rivers in Takalar, and some countermeasures are to be taken in the longer term.

For improvement of urban drainage, various improvement works have been implemented so far; e.g., (i) primary drainage canal improvement (Panampu,

[1] Refer to Sector Study Report (8) for detail.

Sinrijala and Jongaya) completed in 1994, (ii) primary drainage improvement with construction of a regulation pond and pumping facility completed in 2001, and (iii) secondary and tertiary drainage canal improvement. The primary drainage canal improvements are designed for a 20-year probable flood, while the secondary and tertiary canals are designed for a 2 to 5-year probable flood.

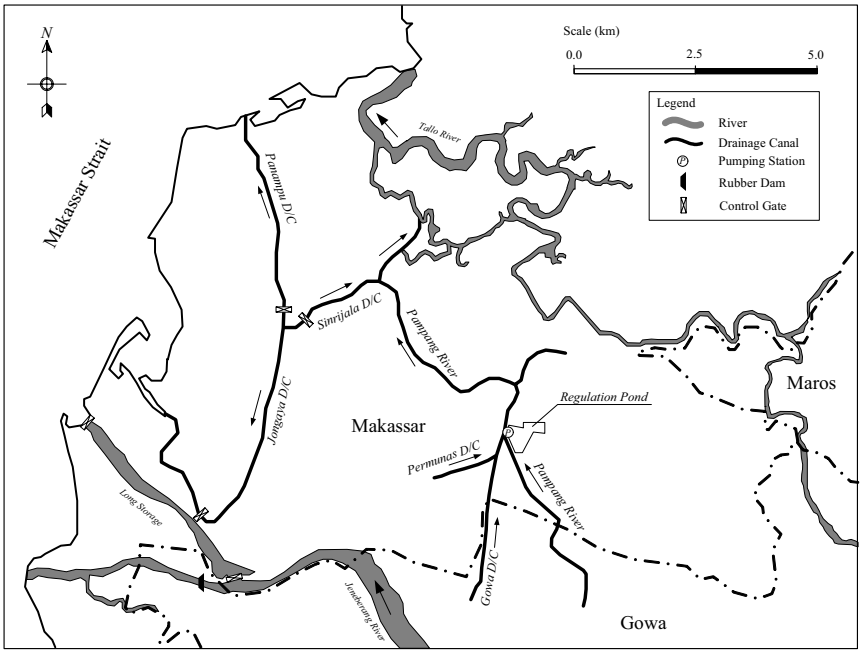


Figure 8.2: Existing Drainage Facilities

Although local inundation still occurs several times each rainy season at the low elevation areas due to a combination of heavy rainfall and high tide, it is reported that the duration of such inundation is 2 to 3 hours at the longest. Local inundation is more attributable to the fact that the existing drainage canals are inadequately maintained, particularly along the secondary and tertiary canals, as well as along ditches. Sedimentation and garbage becomes a bottleneck and hinders the smooth drainage of storm water. Although forced drainage employing pumps is conceivable, proper maintenance of drainage systems should be addressed first.

Drainage Canal in Makassar

Solid waste floating into main drainage canal

2) Flood Control and Drainage Improvement Strategy

For flood control in Mamminasata, two alternative measures are considered; i.e., (i) structural measures like storage dams/reservoirs, protection dikes, polders, etc. and (ii) non-structural measures like a flood warning system with flood risk maps, prohibition of dwellings in flood hazard areas, etc. Both measures are to be studied in the implementation of the Mamminasata spatial plan.

Design level of flood control in Maros, Tallo, Gamanti and Pappa rivers will be set as follows:

Table 8.1: Flood Control Design Level in Mamminasata

River	Protection Area (ha)	Target Town/City to be Protected	Population to be Protected	Design Level	Design Discharge (m^3/sec)
Maros	13,000	Maros	22,000	25-year	1,240
Tallo	4,600	Makassar	430,000	50-year	1,010
Gamanti	1,500	Takalar	6,300	10-year	130
Pappa					520

For drainage improvement, the North Jeneberang drainage area where drainage systems extend into urban areas, will be subdivided into nine zones as illustrated below.

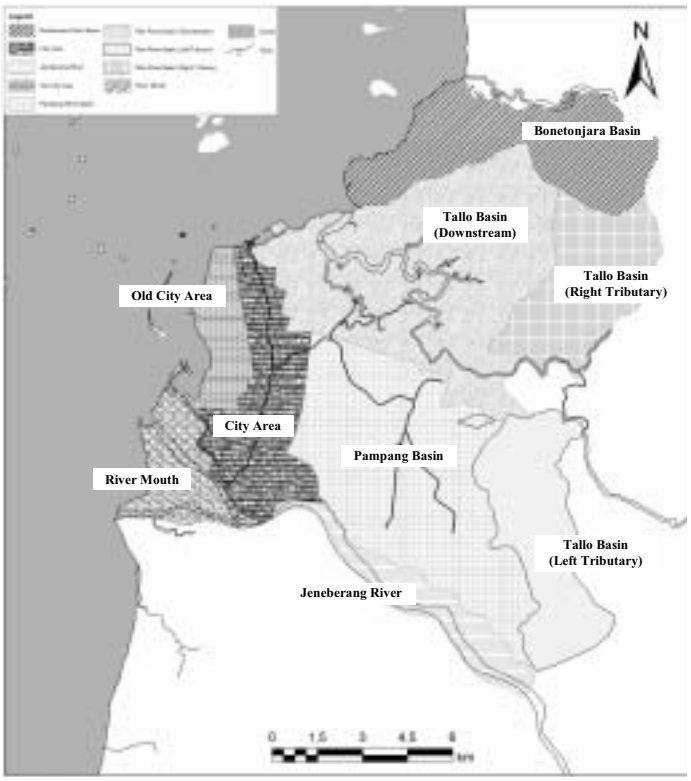


Figure 8.3: Drainage Zones of the North Jeneberang Drainage Area

Alternative solutions to protect against local inundations are usually based on the (i) drainage concept and (ii) storage concept. Forced drainage by pumping to drain inundated water is easily designed but it would require substantial investments. On

the other hand, storage in retarding basins is more economical but requires land acquisition. Under such circumstances, alternative measures are additionally conceived as follows:

(i) Introduction of controlled urbanization through land use regulations, especially in the low-lying areas, with a view to promote cost-effective disaster management; and

Temporary storage of storm water in public spaces for the few required hours. Such public spaces could be located in parks, schoolyards and government owned spaces in which the ground level is set at 20-50 cm lower than the high water level.

Adoptability of these alternatives will be further discussed and evaluated by the authorities concerned.

3) Plan Formulation and Implementation

For flood control of the Maros River, further study is required for preparation of a flood risk map and the conservation of the waterfront areas. It will be followed by the dissemination of flood information to the people dwelling in the riparian areas and by restriction of development in some areas upstream. Finally, some protective structures would be designed for construction during the period of 2015-2020. A conceivable layout of structural measures has been drafted in order to facilitate the land use zoning under the Mamminasata spatial plan as illustrated below. It will incorporate (i) river channel improvement of 6.0 km, including 1.6 km of shortcut channel, (ii) two retarding basins of about 30 km^2, and delineation of a restricted development area of about 15 km^2.

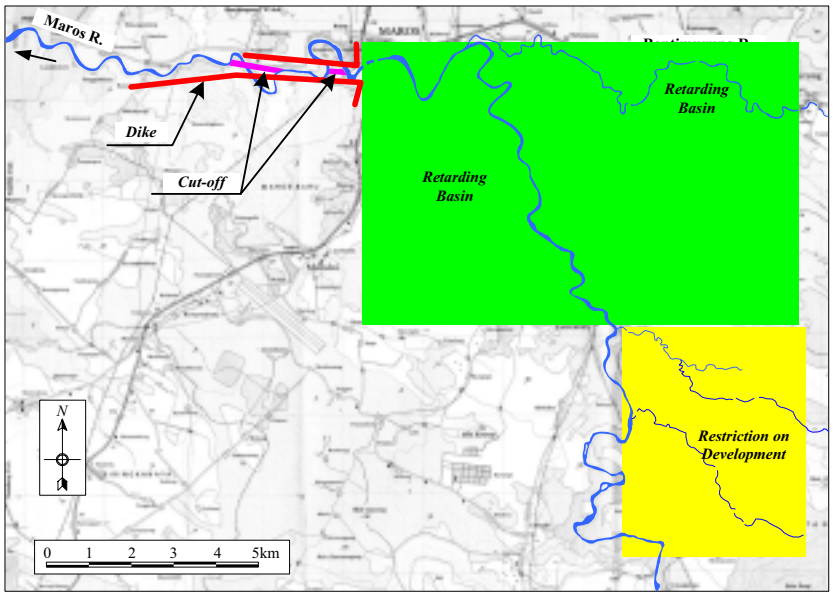


Figure 8.4: Conceptual Layout of Maros River Improvement

For flood control of the Tallo River, a similar concept is drawn up as illustrated in the following figure. It would incorporate (i) river channel improvement of 19.3 km including a shortcut channel of 2.0 km, (ii) flood retarding basin of about 4.7 km^2, and (iii) delineation of a restricted area of about 9 km^2. Such a concept is referred to in designating the land use zoning under the Mamminasata spatial plan.

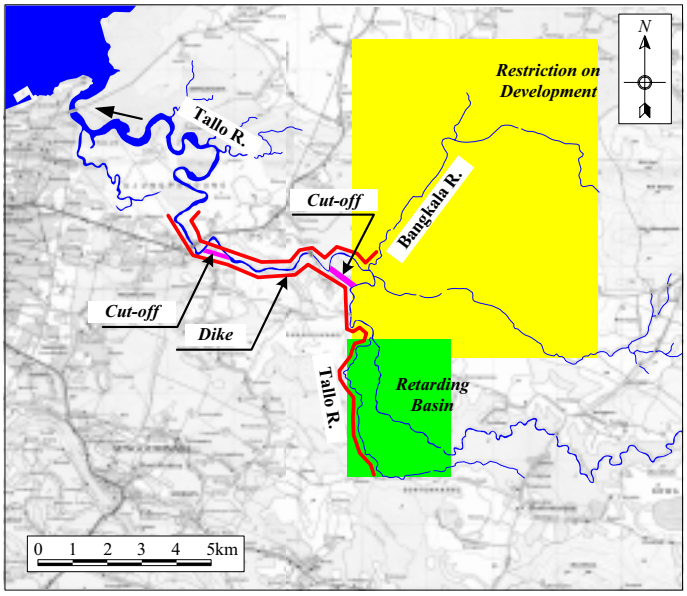


Figure 8.5: Conceptual Layout of Tallo River Improvement

Flood control in the Pappa and Gamanti rivers is less urgent if compared with the Tallo river flood control. Some 18 km^2 of land in the middle reach of Pappa River should be designated as restricted development areas under the land use zoning. It could be utilized for orchards, livestock breeding and other purposes.

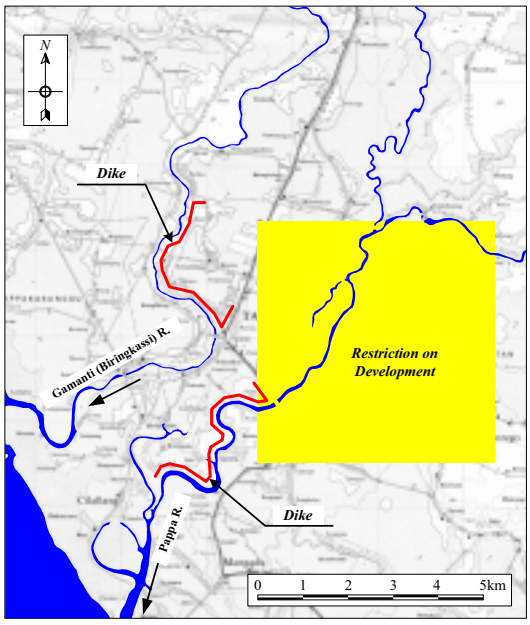


Figure 8.6: Conceptual Layout of Pappa and Gamanti River Improvement

A flood mitigation plan for Mamminasata will thus include the following programs. It is recommended that a flood risk map be prepared for the major rivers as a non-structural flood mitigation plan. The economic viability of dike and shortcut construction would not be high and such structural measures should be implemented in medium and long terms.

Table 8.2: Measures to be Included in the Flood Mitigation Plan

River	Structural Measures			Non-structural Measures		
	Dike	Shortcut	Retarding Basin	Restriction Area	Flood Information	Flood Risk Map
Maros	O	O	O	O	O	O
Tallo	O	O	O	O	O	O
Gamanti	O	-	-	-	O	O
Pappa	O	-	-	O	O	O

A case study on determination of storm water retention facilities is presented in the Sector Study Report (8), for reference.

For drainage improvement in the North Jeneberang drainage area, some non-structural measures and rehabilitation of drainage ditches are to be programmed for implementation in the short term. They would include the following action programs:

(i) Rehabilitation of existing ditches and channels, including the consolidation of an effective OMR routine for the drainage system:

(ii) Small-scale drainage facilities, like temporary storage of storm water in public spaces and temporary storage of storm rainfall on buildings/houses; and

(iii) Legal arrangement for prevention of local inundations due to urbanization, e.g.,

a. Land filling in the low-lying area shall be restricted to reduce inundation risks;

b. River basin adjustment shall be prohibited in principle;

c. Retention of storm water shall be executed in accordance with the scale of development;

d. Developers shall bear the responsibility for construction of storm water storage facilities in their area of development; and

e. Developers shall not commence land improvement works before completion of the storm water retention facility.

Some structural improvements will be designed and implemented in the mid term, with further studies on the following:

Table 8.3: Structural Drainage Improvement in North Jeneberang

Drainage Zone	Area (km^2)	River Improvement			Primary Channel		Secondary Channel		Tertiary Channel	
		River	Design Level	Length (km)	Design Level	Length (km)	Design Level	Length (km)	Design Level	Length (km)
Old City Area	8									
City Area	19									
Pampang	45						5-yr	19	2-yr	19
Jeneberang Mouth Area	10						5-yr	10	2-yr	10
Tallo (Downstream)	53	Tallo	50-yr		20-yr	10	5-yr	31	2-yr	32
Jeneberang (Right)	9						5-yr	9	2-yr	9
Bonetonjara	24	Boneto -njara	10-yr	7			5-yr	16	2-yr	19
Tallo (Right Tributary)	19	Tallo	50-yr				5-yr	11	2-yr	12
Tallo (Left Tributary)	21	Tallo	50-yr				5-yr	18	2-yr	18
Total	208			7		10		114		119

In relation to the flood control and drainage in the lower Tallo river basin, attention should be drawn to the fact that the land reclamation of flood plain, as planned under the Makassar City Spatial Plan, will have a serious negative impact on the storm water drainage condition in the densely urbanized area of Makassar city, because two out of four existing primary drainage channels (i.e. Sinrijala channel and Pampang river) have their outlets at the low-lying area of the Tallo river. The simulation analysis by means of the quasi-2-dimentional unsteady flow calculation also indicates that such land reclamation will make flood scale larger and its influence will extend to the upstream basin for more than 5 km. (Refer to Sector Study Report (8) for detail). It is therefore not recommended that the lower Tallo river basin be reclaimed for industrial and other uses.

A high school student from Gowa, named Chairil Abdi, B., paints an image of his town where citizens can enjoy fishing while the riverside streets are developed.

8.2 Water Supply and Sewerage Improvement [2]

1) Major Issues

Households in Mamminasata are served with treated drinking water and water from wells/springs as tabulated in the following. The population served by treated water in Mamminasata is 42%, ranging from 70% in Makassar to 9% in Maros, 11% in Gowa and 4% in Takalar.

Table 8.4: Drinking Water Supply to Households in Mamminasata

District / Municipality	Treated Water	Well/Spring	Others*
Makassar	83.7%	16.2%	0.1%
Maros	17.1%	70.6%	12.3%
Gowa	13.6%	86.4%	0.0%
Takalar	34.5%	64.0%	1.5%

Source: National Socioeconomic Survey 2001
Note*: Others; river water, rain water, etc.

Treated water is provided by PDAM (Perusahaan Daerah Air Minum, or the Regional Drinking Water Supply Company). The service area is 100% in Makassar (175.9 ㎢), 12% in Maros (188 ㎢), 4.2% in Gowa (80 ㎢) and 9.8% in Takalar (56 ㎢). The number of customers is around 143,400. While a total of about 75 MCM (million cubic meters) are produced by PDAM, only 34.4 MCM was sold in 2003. The ratio of unaccounted-for-water (UFW) is quite high, ranging from 48% in Makassar to 39% in Maros, 37% in Gowa and 50% in Takalar. The high UFW ratio is the most critical constraint in Mamminasata.

Treated water supplied by PDAM is illustrated in the following diagram. Five water treatment plants in Makassar are providing 2,340 lit/sec, while nine plants in Maros, Gowa and Takalar (including one in Malino located outside the Mamminasata area) are providing about 400 lit/sec. The Jeneberang River is the largest water source, accounting for about 55% of the total water supply.

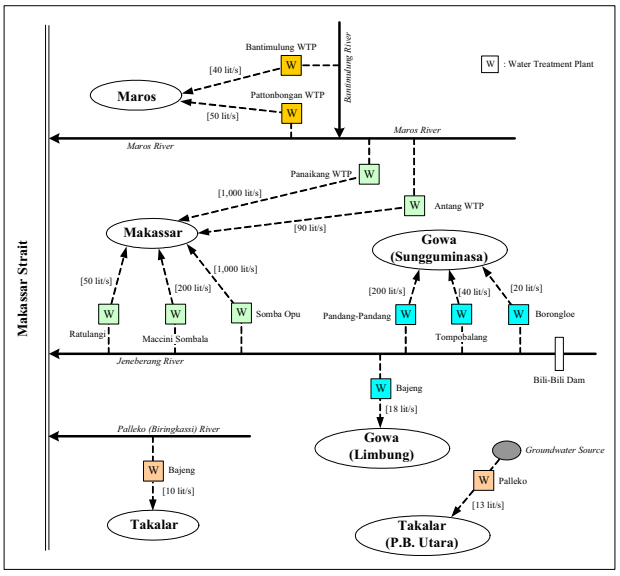


Figure 8.7: Diagram of Treated Water Supply by PDAMs

Constrains on water supply in Mamminasata, other than the high

[2] Refer to Sector Study Report (9) for detail.

UFW as noted above, include (i) water shortage at the Antang and Panaikang plants for Makassar, (ii) high turbidity of the Jeneberang river after the collapse of Mt. Bawakaraeng in March 2004, (iii) delayed distribution pipe construction in Gowa, and (iv) a water shortage in Bajeng and Paleko plants in Takalar.

Discharged wastewater from tempe industry

No sewerage treatment plant is installed in Mamminasata, except for KIMA industrial estate having a 3,000 m^3/day wastewater treatment plant. Septic tanks are installed in 85% of the households in Makassar, 23% in Maros, 42% in Gowa and 44% in Takalar. Blackwater is collected by PD (Perusahaan Daerah) on an on-call basis, and collected blackwater is transported to the existing Antang treatment plant located to the east of Makassar.

Graywater from households in Mamminasata is discharged into drainage ditches without any treatment. Water quality, therefore, in ditches and canals is aggravated, particularly in dry seasons. Retention of graywater in secondary and tertiary ditches and canals due to clogging by sedimentation and garbage are observed at many locations. Their impacts on groundwater quality should be monitored.

2) Water Supply and Sewerage Strategy

Targets for treated water supply are provisionally set to attain 100% in Makassar and 70% in Maros, Gowa and Takalar by 2020. At the same time, the UFW ratio is targeted to be lowered to 25% during the plan period. The UFW ratio is set in accordance with the "normal water loss level" defined by the Ministry of Public Works.

Per capita water consumption is estimated to be 200 lit/day, by referring to the water consumption for domestic use in major cities in Indonesia. On the other hand, commercial/service and industrial water demand is estimated on the basis of GRDP projections for the Mamminasata spatial plan. Consequently, the overall municipal water demand is estimated to increase from 161 MCM in 2005 to about 290 MCM in 2020, as tabulated in the following table.

Table 8.5: Estimated Municipal Water Demand in Mamminasata

(Unit: Million m^3/year)

Year	Maros	Makassar	Gowa	Takalar	Total
2005	4.3	147.6	6.8	2.5	161.2
2010	11.1	135.1	22.6	8.0	176.8
2015	26.0	142.7	39.4	13.5	221.6
2020	42.1	159.3	62.7	25.0	289.1

Countermeasures against UFW should be implemented without fail. A pilot project for overcoming water loss was conducted under the "Technical Aid on Leakage Reduction in the Service Area of PDAM Makassar" (November 2004) and recommended the following measures:

(i) Short-term Plan (with a target UFW ratio set at 30%)

- Establishment of water loss teams with capable team leaders;
- Establishment of several pilot zones to represent all service areas;
- Repair of all main meters to measure the actual distribution capacity;
- Preparation of an inventory of customer meters
- Reinstallation of customer meters more than 5 years old and recorded water usage of less than 5 ㎥/month; and
- Updating customer data by sweeping survey and recording in a database.

(ii) Mid-term Plan (with a target UFW ratio set at 25%)

- Enhancing the pressure in distribution pipe networks; and
- Rehabilitation of the pipe networks in each zone.

It is a matter of regret that sewerage system improvement has lagged, not only in Mamminasata, but also in other urban centers in Indonesia. (The sewerage service coverage in Indonesian urban areas was only 2%as of 2002.) Since the objectives of the Mamminasata spatial plan were set with the creation of an eco-friendly Metropolis, an appropriate sewerage system should be considered as necessary. Provisionally, the sewerage systems will be both on-site systems (leaching pit and/or septic tank) and off-site systems (sewerage treatment plant).

3) Plan Formulation and Implementation

Based on the demand for water supply towards 2020, the water supply production capacity is provisionally set as follows:

Table 8.6: Planned Water Supply Production Capacity in Mamminasata

(Unit: l/s)

Year	Maros	Makassar	Gowa	Takalar	Total
2005 (existing)	90	2,340	278	23	2,731
2010	354	4,286	716	254	5,611
2015	823	4,525	1,251	427	7,026
2020	1,338	5,052	1,986	794	9,170

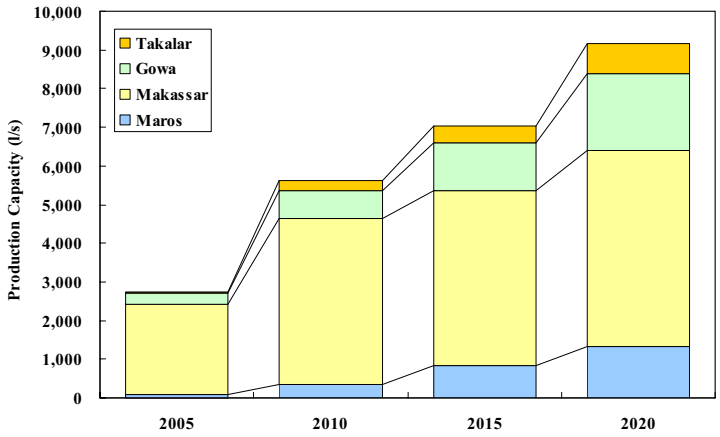


Figure 8.8: Stage-wise Expansion of Water Production Capacity in Mamminasata

The existing Somba Opu water treatment plant (1,000 lit/sec.) has been designed for possible expansion of 2,000 lit/sec. and its implementation will be required to cover the demand in Makassar. Since the Somba Opu plant is located in Gowa, water supply to the urban area in Sungguminasa should be incorporated into the expansion program. Water supply system in Maros and Takalar should be planned and implemented, with the view to attain the target level of 70% in treated water supply by 2020 (Refer to Chapter 11.1).[3]

Management of PDAM should be reviewed and strengthened in implementing the water supply expansion plans, including the recurrent costs for operations. For reference, the 5.38 PDAM employees per 1,000 connections are much higher than at the privatized Manila Water Co. in the Philippines (2.77 persons/1,000 connections) as shown in Figure 8.9.[4]

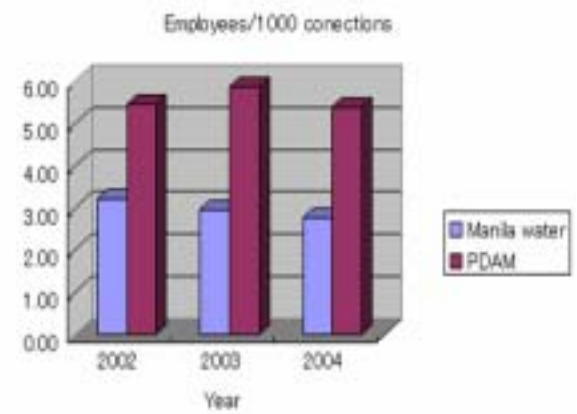


Figure 8.9: Comparison of Employees/1,000 Connections

Consequently, the programs to be implemented for the improvement of the water supply in Mamminasata will include the following:

(i) A program to reduce the UFW ratio to the level of 25%;

(ii) Expansion of the Somba Opu plant (by 2,000 lit/sec) to meet the demand in Makassar and part of Gowa;

(iii) Installation of new water treatment plants in Maros and Takalar; and

(iv) Strengthening the PDAM management.

[3] Refer to pre-feasibility study presented in a separate volume.
[4] Refer to Sector Study Report (14) on the comparison between PDAM and Manila Water Co.

On the other hand, wastewater in Mamminasata is estimated to increase rapidly in line with the improvement in water supply. Wastewater generation is estimated as shown in the following diagram:

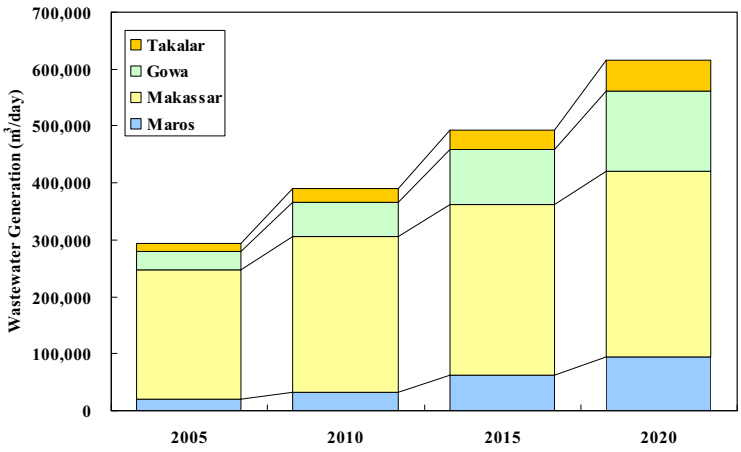


Figure 8.10: Wastewater Generation in Mamminasata

On the assumption that domestic graywater contains 168 mg/l of BOD, commercial/service wastewater contains 250 mg/l, and industrial wastewater 1,152 mg/l, the BOD pollution load would reach around 78,600 kg/day in Makassar, 36,800 kg/day in Gowa, 25,800 kg/day in Maros and 14,100 kg/day in Takalar. Such a pollution load should be mitigated with the improvement in sewerage.

Various sanitation targets have been set. The first, called the Minimum Level (ML) assumes that all residents will have access to flushing toilet facilities. The second, called the Comfort Level (CL) provides for treating blackwater and graywater to a level that will ensure that surface water within the subject area will not exceed 30 mg/l of BOD. This would be considered to provide satisfactory living conditions. The third is called the Amenity Level (AL), which provides for treating blackwater and graywater to a level that will produce surface water with less than 10 mg/l of BOD. This will allow the creation of waterfront

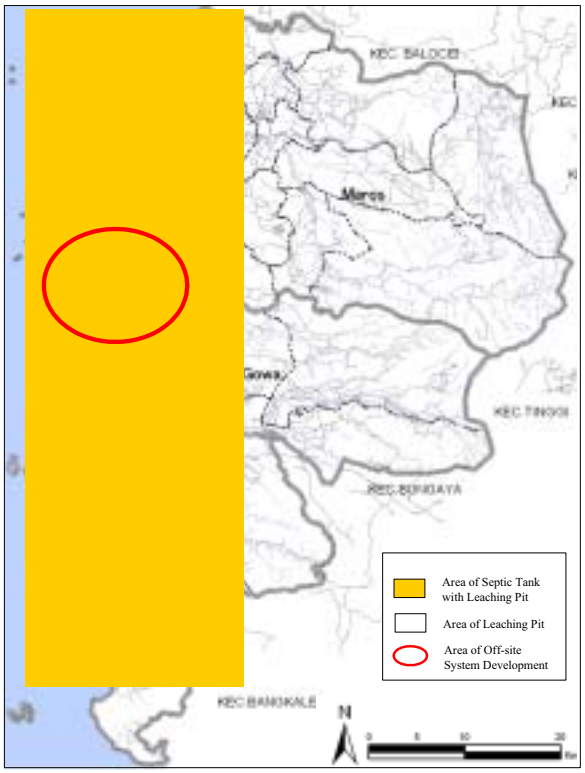


Figure 8.11: On-site and Off-site Options by Area

amenities that can be safely enjoyed by all. Eventually, the target level will be set at the AL in Mamminasata, but in the short term it will be set at the CL to ensure satisfactory implementation within the limited time available.

The area-wise plan for the sewerage systems is for (i) on-site systems for the areas with population densities of less than 100 person/ha, (ii) leaching pits for the areas with a groundwater depth of more than 4 m, (iii) septic tanks with leaching pits for the areas with a groundwater depth of less than 4 m, and (iv) off-site systems for the areas with population densities of more than 100 person/ha. The proposed plan is illustrated on the map.

For the sewerage treatment in Makassar, a short-term off-site system layout is proposed as shown in the following diagram.

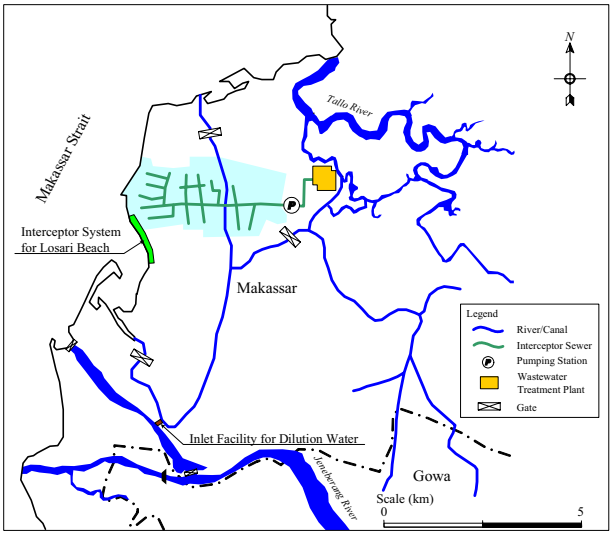


Figure 8.12: Short-term Off-site System

A long-term off-site sewerage system in Makassar is planed as illustrated below. It is proposed that the long-term plan would be initiated in 2012-2015 and completed by 2020.

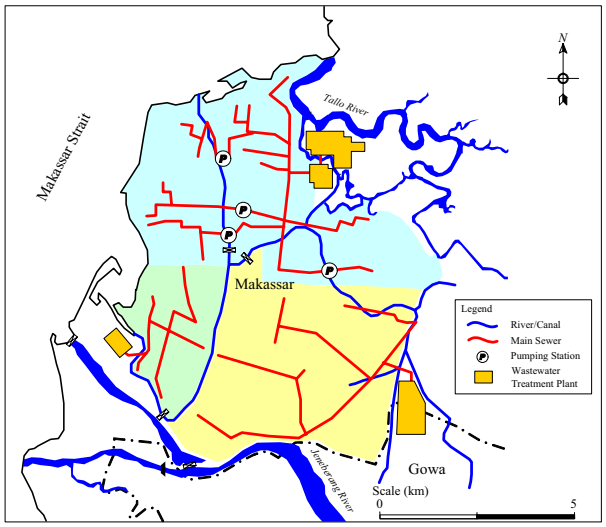


Figure 8.13: Long-term Off-site System

In addition to the off-site system for sewerage treatment, the following programs should be implemented in parallel:

(i) Cleaning and basic improvement of ditches and small drains with active community participation;

(ii) Cleaning of major drains and canals should be carried out by Dinas Kebersihan;

(iii) Screens for trapping coarse materials should be installed in ditches and drains, together with regular removal of trapped debris by the communities;

(iv) Promotion of septic tanks with leaching pits; and

(v) Legal framework for introduction of the modular development system.

8.3 Solid Waste Management [5]

1) Major Issues

For tourists and visitors, as well as for the people in Mamminasata, the natural beauty and landscape are hampered by the increasing amount of garbage scattered along the coast, rivers, drainage canals and roadsides. Solid waste management, in this context, is the most serious issue to be addressed in developing Mamminasata as a harmonized and eco-friendly Metropolis.

According to the survey conducted in the course of this Study, waste generation in Makassar is estimated to be around 1676 m^3/day, and it is around 420-540 m^3/day in other regencies, as tabulated below.

[5] Refer to Sector Study Report (10) for detail.

Table 8.7: Waste Generation in Mamminasata [m^3/day]

	Makassar	Maros	Gowa	Takalar
Household	1274	385	416	358
Commercial	178	64	67	41
Industry & Office	164	14	14	12
Others (Streets, etc)	60	14	40	10
Total	1676	477	537	421

Source: JICA Study Team

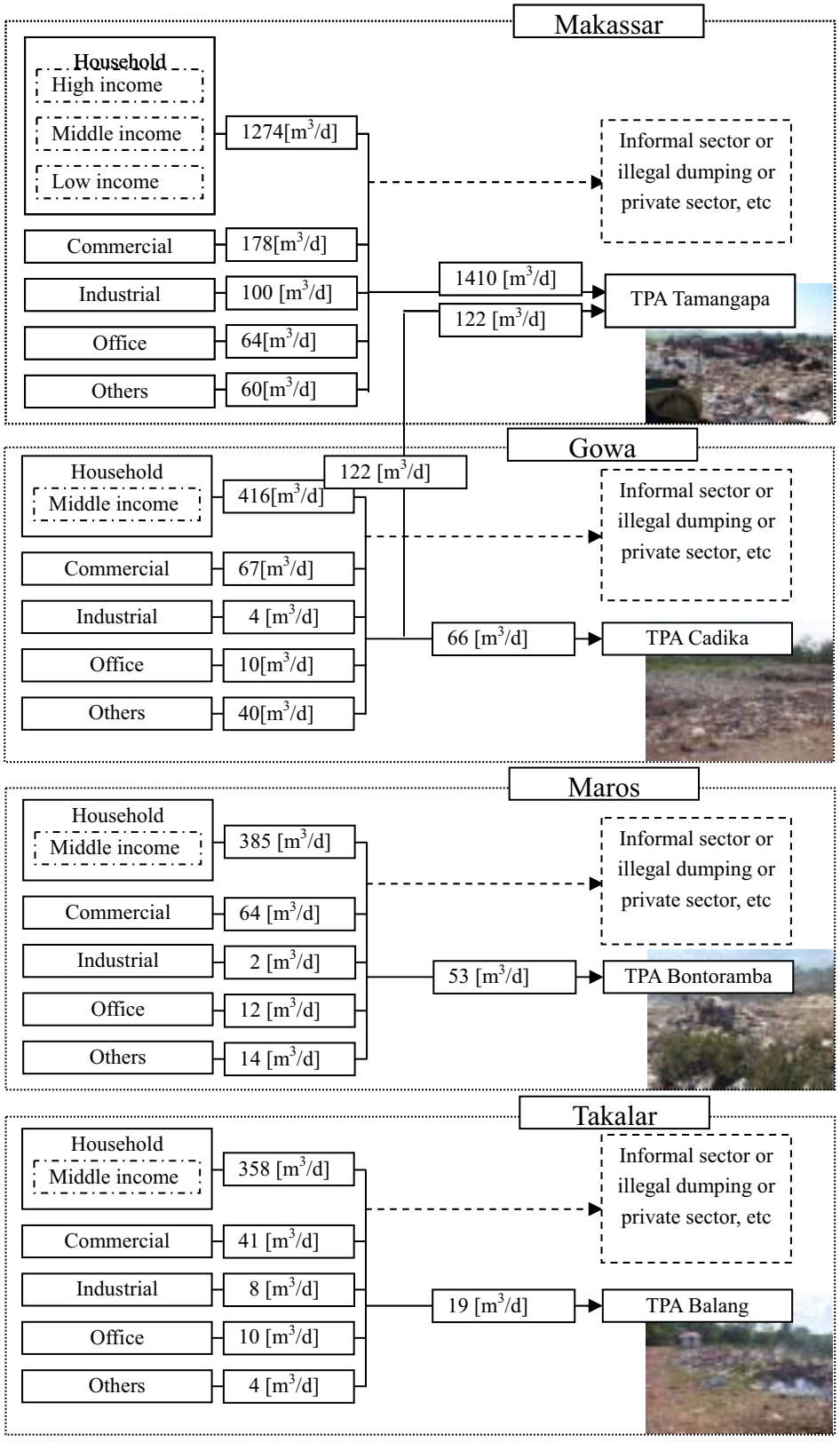
The survey also revealed that organic waste content is relatively high. About 70% of household waste and market waste are organic waste. Water content is 70-80% in household waste, restaurants, hotels and markets. The bulk density of household waste is greater (0.46 kg/l) if compared with the survey in 1996 (0.23 kg/k).

Table 8.8: Waste Characteristics in Mamminasata

		JICA study in 1996	The survey result of this Study					
		Household	Household	Restaurant	Hotel	Market	Office	Street
Physical composition [%]	Kitchen waste	57.96	70.7	73.1	60.3	70.9	47.7	10.9
	Textile	0.81	0.7	0.0	1.8	2.3	0.1	6.6
	Woods	0.96	0.5	0.1	0.0	0.0	0.7	5.2
	Plastic	11.24	11.6	11.7	9.0	15.5	18.6	23.4
	Rubber/leather	0.07	0.1	0.0	0.4	0.0	0.0	5.0
	Metal	2.49	1.0	1.4	3.3	1.2	0.8	6.6
	Glass	2.14	1.6	2.7	0.0	0.3	1.3	6.1
	Ceramics	0.84	0.1	0.0	1.1	0.0	0.0	0.0
	Soil	0.80	0.4	0.0	0.0	0.0	2.5	0.4
	Paper	14.71	10.0	11.0	24.1	7.3	24.7	9.0
	Others	7.98	3.3	0.0	0.0	2.5	3.7	26.9
Bulk density [kg/l]		0.232	0.46	0.42	0.21	0.41	0.20	0.29
Water contents [%]		55.02	77	81	79	78	82	-

Source: JICA Study Team
Note: "-" means that there is no data

Garbage collection service coverage is 87% in Makassar, 88% in Maros, and 75% in Gowa and Takalar. The volume and flow of solid waste in Mamminasata are revealed as illustrated in the following diagram:



Source: JICA Study Team

Figure 8.14: Waste Flow in Mamminasata

Currently available equipment for waste collection and transportation is shown in the following table.

Table 8.9: Equipment for Transportation





	Makassar	Gowa	Maros	Takalar
Handcart (1m^3)	299	-	10	0
Tipper truck (6m^3)	64	4	4	4
Arm roll truck (6m^3)	48	3	3	-
Arm roll truck (10m^3)	2	0	0	-
Compactor (6m^3)	4	0	0	-
Motor becak	6	3	0	0
Other vehicle	12	0	1	0

Source: Dinas Kebersihan in each regency and DK Makassar

Garbage in each district is dumped at respective landfill sites, and characteristics of such landfill sites are summarized as follows:

Table 8.10: Characteristics of Existing Landfill Sites in Mamminasata

		Makassar	Gowa	Maros	Takalar
Location		Tamangapa Kec. Manggala	Cadica Kec. Pallangga	Bontoramba Desa Bonto Matene Kec. Mandai	Balang Kec. Polombangkeng Selatan
Beginning year		1993	1997	1997	About 1985-
Area		14.3[ha]	2[ha]	2.8[ha]	2.8[ha]
Receiving waste [m^3]		810 [m^3]	14 [m^3]*	51[m^3]	17 [m^3]
Operation	Soil covering	Covering soil but Not periodically	No soil covering	No soil covering	Covering soil but Not periodically
Equipment	Bulldozer	4	1	0	Rental
	Wheel loader	0	0	2	Rental
	Excavator	1	0	1	Rental
Facility	Office	1	1	1	1
	Leachate pond	1 (not operated properly)	0	0	0
	Gas vent system	1	0	0	0
Activity by waste pickers	Number of waste pickers	178	10	20	8

Source: Dinas Keindahan Makassar and Dinas Kebarsihan in each regency
Note: "-" means that there is no data

The most critical landfill site is Tammangapa in Makassar. It is almost full and is maintained in unhealthy condition. Groundwater is being contaminated by infiltration of high water content garbage, and odor is a serious problem for dwellers around the landfill site. Makassar city has planned to construct a new landfill site in Gowa, but the plan was suspended. It is understandable that the Gowa people would not be happy if such a landfill was to be constructed in their vicinity.

Solid waste recycling has been promoted to some extent. There are recycling factories for plastic (Luhur Plastik), aluminum (CV Andalas Jaya), Metal (PT.Barawaja), wood chips (PT.Batatex) and organic waste (PT.Orgi), though they are small in operation. Most recyclable materials are shipped to Surabaya for recycling. A general flow of recyclable waste is shown in the following diagram:

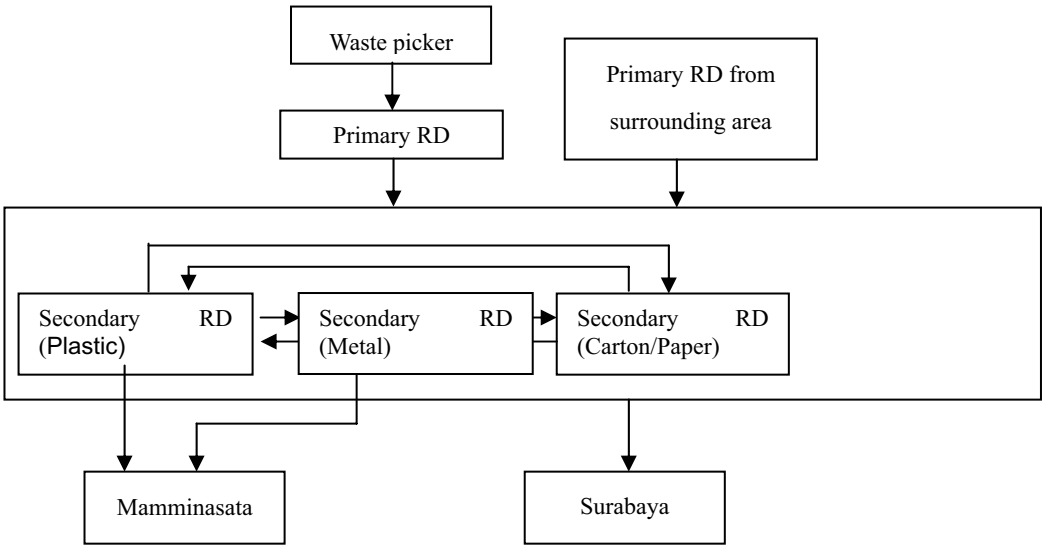


Figure 8.15: General Flow of Recyclable Waste Generated in Mamminasata

In summary, major issues of solid waste management in Mamminasata are identified as shown in the following diagram.

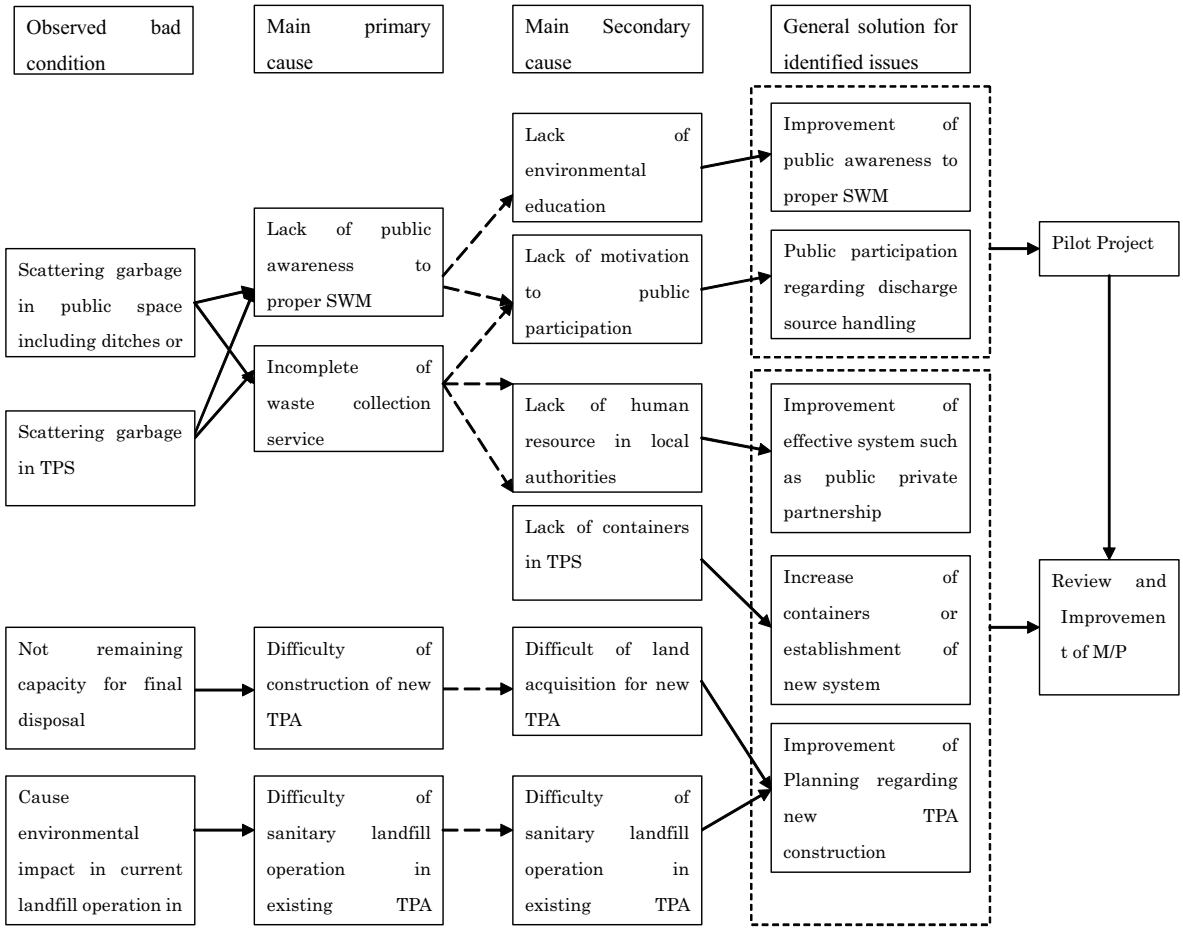


Figure 8.16: Identified Issues in Solid Waste Management and their Relations

A fundamental reason for the deterioration of the solid waste system in Mamminasata is a lack of public awareness. Unless the people are more aware of the environment, it will be difficult to turn Mamminasata to be an eco-friendly Metropolis.

2) Solid Waste Management Strategy

Several strategies are being worked out to solve the constraints of solid waste management in Mamminasata in order to restore the environment-friendly Metropolis. They will include, but are not limited to the following strategies:

(1) Improvement in Collection Services

Collection services are to be improved, particularly in the areas of low-income levels where roads are too narrow to be serviceable. A lesson learned in Curitiba will be referred to in formulating a plan for service improvement. Likewise, a separate collection system will be tested to determine if it is applicable in some selected residential areas.

(2) New Landfill Sites with Sanitary Disposal Methods

The existing landfill site in Makassar (TPA Tamangapa) is full, causing some pollution in and around the site. A new landfill site is needed, and it should be designed to operate using a sanitary disposal method to maintain the environment in and around the site and to get the support of the people nearby.

(3) Disposal of Hazardous and Poisonous Waste

With the economic growth, an increasing volume of hazardous and poisonous (B3) waste will be generated and it should be treated separately from domestic and non-hazardous waste. Its management should be licensed and strictly controlled under the GR No. 85/1999 and No. 70/2001. Basically, it must be self-disposed at the source of such hazardous waste.

(4) Implementation of Environmental Education

"Clean Metropolis" in Mamminasata is only attainable through environmental education, particularly to the younger generation that is engaged in basic education. Not only documental methods but also practice should be incorporated in this education. A pilot operation is proposed in the course of this Study.

(5) Promotion of 3R (Reduce, Reuse and Recycle)

To implement effective waste collection and transportation services, the promotion of 3R with public participation is necessary. Reduction of solid waste quantities due to enhanced public enlightenment will contribute to reduce the load on the responsible entity. Separate discharge for reuse and recycling relying on public participation will be promoted in line with the establishment of the separate collection system.

(6) Gradual Introduction of a Cycle-oriented Society

To create an eco-friendly Metropolis in Mamminasata in the longer term, it is necessary to gradually introduce a system of effectively utilizing cast off waste and thereby save the natural resources. Such a cycle-oriented system could be initiated by the industrial and commercial sector in view of the fact that waste disposal from such sectors are not usually mixed at the generation sources. In rural areas, promotion of integrated farming will also lead to the creation of a cycle-oriented society.

3) Plan Formulation and Implementation

The quantity of solid waste to be generated in Mamminasata is estimated on the basis of the social framework for household waste and the economic framework for industrial and commercial waste. The estimated future solid waste volume is summarized in the following table.

Table 8.11: Estimated Solid Waste Volume in Mamminasata [m^3 /day]

Regency/Municipality	2005	2010	2020
Makassar	1676	2023	2753
Maros	478	558	716
Gowa	538	616	772
Takalar	422	465	535

Source: JICA Study Team

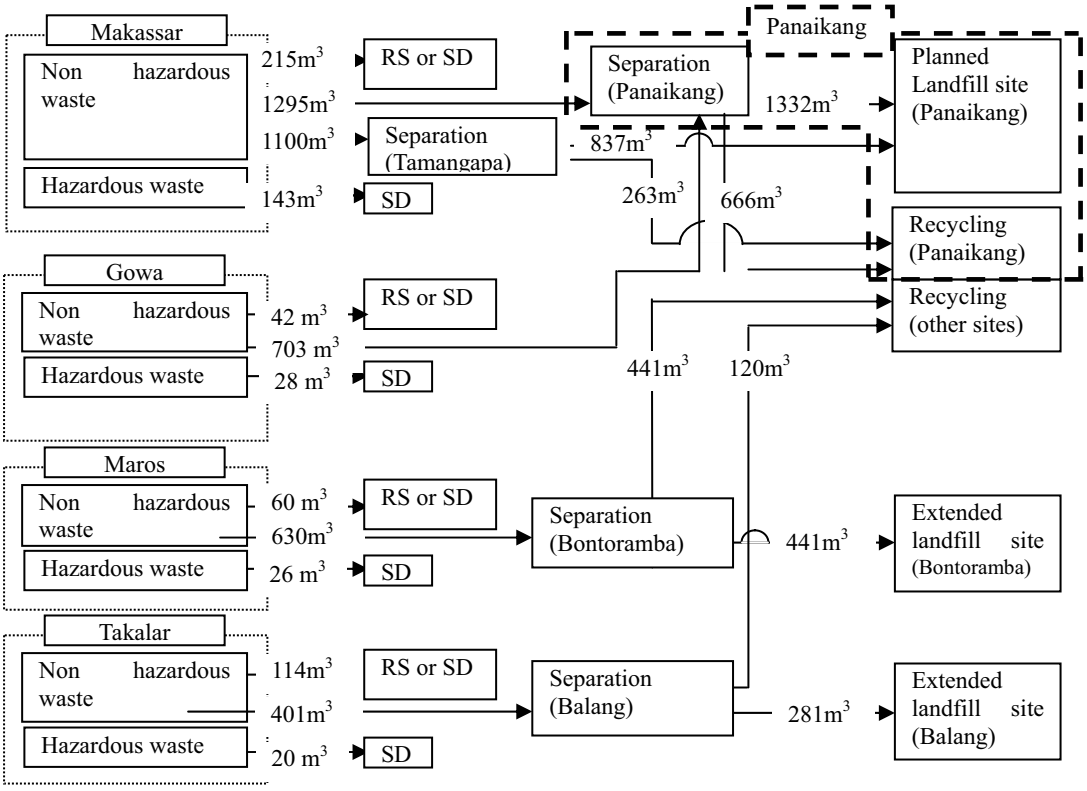
Likewise, the accumulated volume of solid waste is estimated on the assumption that a recycling/reduction rate would increase from 10% in 2005 to 30% in 2020.

Table 8.12: Accumulated Volume of Solid Waste in Mamminasata

Regency/Municipality	2005	2010	2020
Makassar	1.39	4.05	9.93
Maros	0.40	1.15	2.76
Gowa	0.47	1.34	3.14
Takalar	0.31	0.86	1.93

Source: JICA Study Team

The future solid waste stream in Mamminasata will be directed towards the flow as illustrated in the following figure.



Note: "RS": Recycling by Source Separation, "SD" : Self Disposal
Source: JICA Study Team

Figure 8.17: Future Waste Stream in Mamminasata towards 2020

In the event that the Pilot Project (P/P) for a "healthy exchange program" (collection by children and housewives in low income/slum areas and transportation by becak in narrow streets) has been carried out. In the implementation of process of P/P the

becak drivers have been selected as one example or waste collectors. Rice was selected as the material to be exchanged with solid waste as one of examples. In addition, it is clarified that financial source to secure future exchangeable material such as by local authorities or public and cooperative association of waste collectors will be needed for continuous operation and expansion, through final evaluation is underway now. It can be expanded to the other areas along the drainage canals and near the market sites in case of sufficient cooperation of local authorities and public in the future. For ordinary collection and transportation of solid wastes, the following system will be proposed.

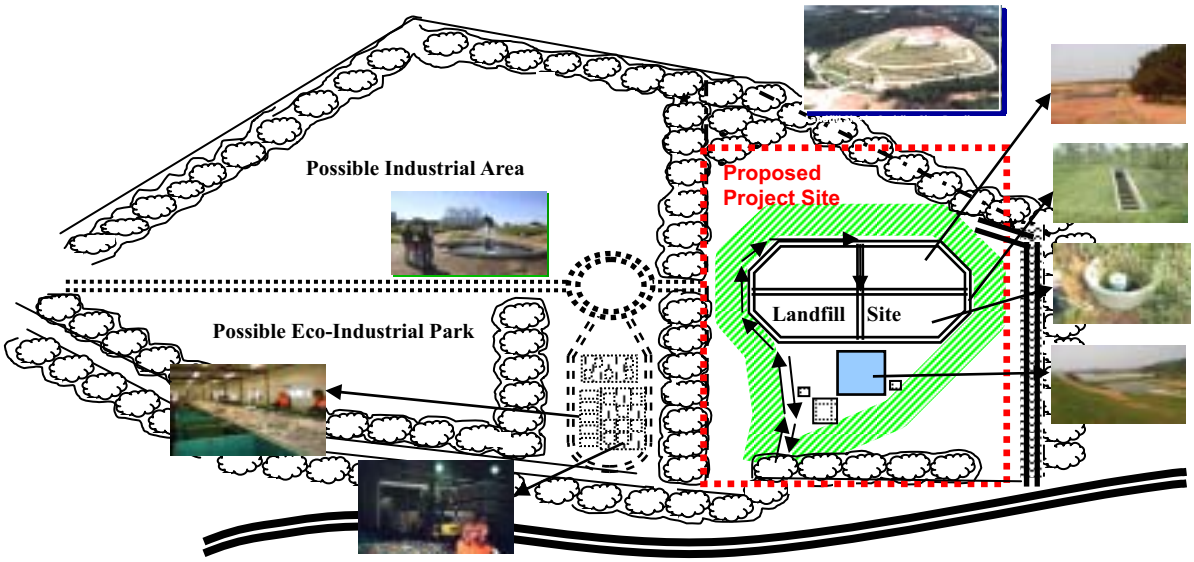
Table 8.13: Collection and Transportation System for Solid Waste

System	Target area	Collection frequency
Introduction of a primary collection and haul container system (with secondary collection by tippers or compactor vehicles)	For middle or high density population areas without sufficiently wide roads for collection vehicles	2 to 3 times per week for primary collection. Everyday or 2 to 3 days per week for secondary collection by vehicles
Introduction of primary collection (with secondary collection by tippers or compactor vehicles)	For middle density population areas without sufficiently wide roads for collection vehicles	2 to 3 times per week for primary and secondary collection.
Hauled container system	For the area along sufficiently wide roads for collection vehicles (Commercial areas, highly populated areas, business districts)	Everyday or every two days according to the area
Curbside collection by tippers	For middle or low density population areas	Every day to 3 times per week (at least one time per day)
Door to door collection by tippers	For commercial areas, business districts or high income areas	Every day

For collection and transportation of solid waste, Makassar municipality plans to subcontract all the work to the private sector. Such a plan should be carefully studied, not only from the viewpoint of efficiency and economy but also from the viewpoint of viability on the part of the municipality.

For the final disposal, a new landfill site is to be secured in addition to the improvement in operation and expansion of the existing landfill site. Since the existing Tamangapa site in Makassar is almost full, the new landfill site should be selected at the earliest. Among four alternative sites (Tammangapa, Samata, Cadica and Panaikang), the site at Panaikang in Gowa regency is the most desirable. The Panaikang site is on state land (about 220 ha) in Gowa regency reserved for possible development as an industrial estate. The surrounding area would also be available for

development. A conceptual plan for the new landfill site is shown in the following figure. (Refer to Chapter 11.2)[6]



Note: The photographs in the figure show images based on other countries.

Figure 8.18: An Image of Industrial Zone
(Eco-Industrial Park, Landfill Site and Industrial Area)

In parallel to the development of the landfill sites, it is recommended that some intermediate treatment plans be put into operation, including improvement of the composting plant and introduction of separating facilities in the short term.

Illegal dumping should be prohibited and monitored institutionally. A new system should be worked out through discussion among all stakeholders. Further, introduction of a deposit system or tariff system for packages should also be studied by stakeholders, such as (i) charging for plastic bags, (ii) my-bag-use system (both charging and stamp card), and (iii) charging deposits on packages.

Public awareness and environmental education should be promoted b y all means. The pilot programs conducted in the course of this study have proved that the participatory approach is effective and that they should be disseminated to the maximum extent. Salient results of the pilot programs are summarized as follows.

[6] Refer also to the pre-feasibility study presented in a separate volume.

(1) Environmental Education at Schools

Pilot environmental education programs have been executed in 5 model schools (3 in Makassar and each one in Maros, Gowa and Takalar) through collaboration among school and teachers, parents (PTA), garbage dealers and NGO. Characteristics and management of solid wastes have been taught at classes and separation of garbage has been practiced. Separated garbage has been sold to dealers (with an average revenue of Rp.40,000 per month per school). Model school in Takalar has been inspected by nearby schools under the local government guidance for dissemination.

Photo: Pupils are learning on garbage

Photo: School garbage separation program

The pilot models in environmental education have proved to be effective. Such models could be disseminated through visits and application by other schools under the initiative of local government. PTA is also expected to disseminate it in local community for garbage separation.

(2) Community-based Garbage Separation

Garbage separation has been pioneered at 6 communities at different levels, totaling about 240 households. At one community, composting of garbage has been executed at the same time to prove the reduction in garbage quantity for disposal. Since socialization has been well promoted by NGO in advance to the program execution, community members have been well aquatinted with the objective of garbage separation. Coordination with local authorities for garbage collection has also been maintained favorably, and awareness in the communities has been greatly enhanced.

Photo: Socialization at community

Photo: Community garbage bins for separation

(3) Health Exchange Program

This pilot project has been designed to collect garbage nearby drainage canals where low income level people is living and to improve sanitary conditions in and around such canals, as well as to improve nutrition of children in such a low income society. Garbage in and around canals is collected by villagers and transported by 30 becak drivers (each carrying 200 litters of garbage) to a collecting point twice a week where city garbage collection vehicle (6 m^3 in capacity) is served for collection. Garbages are exchanged for rice of 2 litters, which has been agreed by participating society through socialization among villagers, becak drivers, municipal garbage collection office, and NGO.

Photo: Healthy exchange program for low income level society along drainage canal

The pilot project is found to be effective, and it is expected to disseminate to several areas located along canals and other environment sensitive areas. Although rice was selected by participants in the program, it could be modified to other foodstuff that would contribute for nutrition and that could be produced by other environmental improvement projects.

Operation of these pilot projects has endorsed the fact that reduction, reuse and recycle of solid waste is practically applicable to the Mamminasata society if it is well organized by participation and collaboration of the concerned people in respective society.[7]

[7] Refer to Annex to Sector Study Report (10) for detail.

9. ECONOMIC INFRASTRUCTURE DEVELOPMENT

The spatial development pan is formulated in combination with improvement in the economic infrastructure for power and telecommunications as well as for transportation development in the region. Development of such economic infrastructure in Mamminasata is discussed herein.

9.1 Electric Power Supply [1]

1) Major Issues

Electrification has advanced in Mamminasata and the ward/village electrification ratio has reached 98.7% (as of April 2005). The household electrification ratio is 80.7%, which is comparatively high in Indonesia (58% in Java Island in 2002), though it varies by regency (90% in Makassar, 85% in Maros, 71% in Takalar and 65% in Gowa).

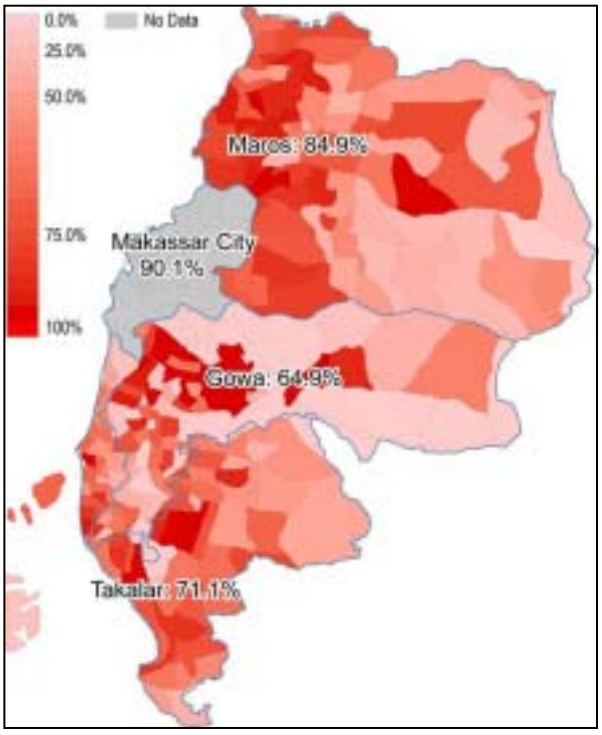


Figure 9.1: Household Electrification Ratio

Energy consumption in South Sulawesi has been increasing rapidly at the average annual rate of 9.2% (1995-2004). Peak load has increased from 227 MW in 1995 to 490 MW in 2004, as shown in the following table:

Table 9.1: Historical Energy Consumption and Peak Load in PLN Region VIII

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Energy (MWh)	857.0	1044.5	1194.1	1311.0	1451.4	1633.5	1846.7	1877.0	1949.4	2066.0
Residential	415.1	470.8	562.9	649.1	707.4	830.9	939.4	965.1	974.5	1090.4
Commercial	105.0	127.8	138.2	170.9	188.6	215.0	232.6	229.1	231.2	266.6
Public	105.9	122.8	143.8	147.2	139.4	147.0	148.4	149.5	158.2	183.3
Industry	231.1	323.1	349.2	343.8	416.0	440.5	526.2	533.3	585.5	525.8
Peak Load (MW)	226.6	260.1	296.2	334.6	379.1	419.7	444.6	463.0	478.0	489.5

Source: PLN Wilayah VIII

[1] Refer to Sector Study Report (11) for detail.

Table 9.2: Growth Rate of Energy Consumption and Peak Load in PLN Region VIII

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average 1995-04
Energy	11.4%	21.9%	14.3%	9.8%	10.7%	12.5%	13.1%	1.6%	3.9%	6.0%	9.2%
Residential	14.3%	13.4%	19.6%	15.3%	9.0%	17.5%	13.1%	2.7%	1.0%	11.9%	10.1%
Commercial	19.8%	21.7%	8.2%	23.7%	10.4%	14.0%	8.2%	-1.5%	0.9%	15.3%	9.8%
Public	10.8%	16.0%	17.1%	2.3%	-5.3%	5.4%	1.0%	0.7%	5.8%	15.9%	5.6%
Industry	3.6%	39.8%	8.1%	-1.5%	21.0%	5.9%	19.4%	1.4%	9.8%	-10.2%	8.6%
Peak Load	18.2%	14.8%	13.9%	12.9%	13.3%	10.7%	5.9%	4.1%	3.2%	2.4%	18.2%

Source: PLN Wilayah VIII

Electric power supply was stable in the region up to July 2005, with a system average interruption duration index (SAIDI) of 2.23 hours/customer which was much lower than the average in Java (8.5 hours/customer) and the whole of Indonesia (17.5 hours/customer). Since July 2005, however, frequent load shedding has been applied, with 2-4 hour blackouts on 2-4 days a week. The load shedding has resulted in savings of about 490 MWh or 7.5% of the average without shedding. The main reasons for the frequent load shedding are (i) PLN's shortage of fuel oil, and (ii) lowered energy production at the Bakaru hydropower station.

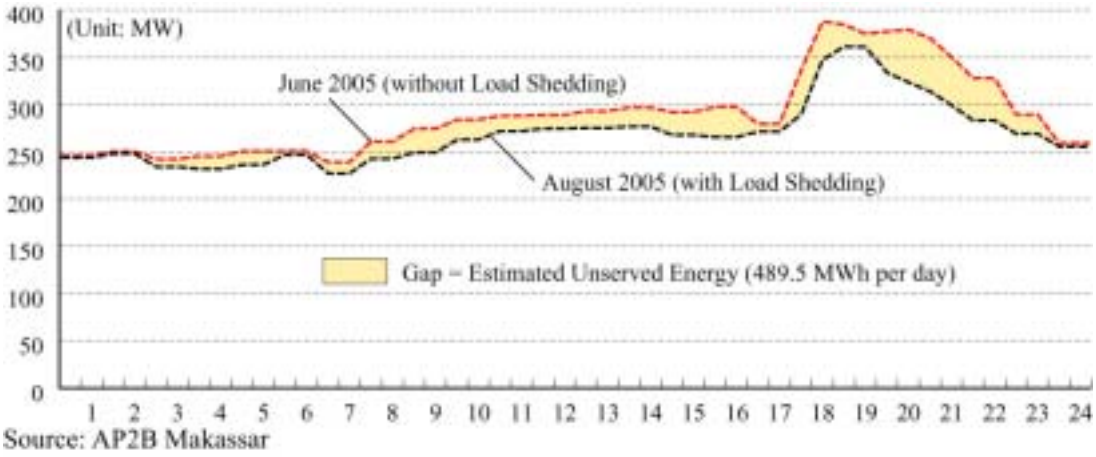


Figure 9.2: Estimated Unserved Energy due to Load Shedding

Electric power supply in Mamminasata and South Sulawesi is fed by PLN (64% of installed capacity and 45% of energy production) and independent power producers (IPPs). PLN has the Bakaru hydropower (128 MW), Tello steam power (25 MW), and other gas turbine and diesel power stations scattered over South Sulawesi (totaling around 200 MW). IPPs are PT Sengkang combined cycle gas turbine station (135 MW) and PT Suppa diesel power station (62.2 MW). A typical daily load curve and power dispatch shows that IPP Sengkang meets a fairly large portion of the base load while the PLN Bakaru hydropower meets the base load in the wet season and base and peak load in the dry season.

Table 9.3: Operational Conditions of Power Plants in 2004

Name		Type	Installed Capacity (kW)	Available Capacity (MW)	Peak Load (kW)	Energy Production (MWh)	Plant Load Factor (%)
PLN	Bakaru	Hydro	127,620	118,170	116,000	778,341	69.62%
	Tello	ST	25,000	18,500	6,000	20,761	9.48%
	Others	GT	122,716	93,000	70,000	131,128	12.20%
		Diesel	78,572	46,780	12,090	60,570	8.80%
PLN Total			353,908	276,450	-	990,801	31.96%
PT. Energi Sengkang		CCGT	135,000	135,000	139,000	1,002,974	84.81%
PT. MP. Suppa		Diesel	62,200	62,200	56,000	231,663	42.52%
IPP Total			197,200	197,200	-	1,234,637	71.47%
System Total			**551,108**	**473,650**	**399,090**	**2,225,438**	**46.10%**

*Note: ST= Steam Turbine, GT= Gas Turbine, CCGT= Combined Cycle Gas Turbine

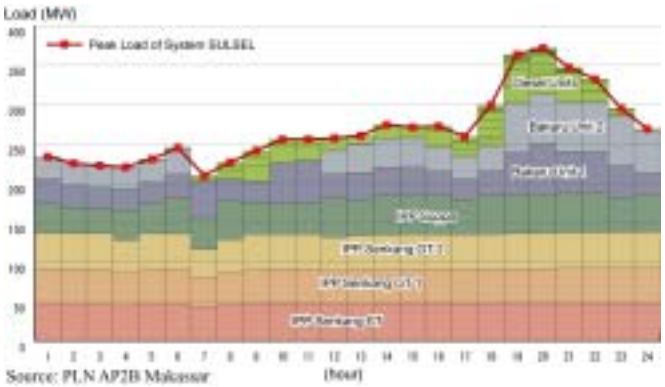


Figure 9.3: Typical Load Curve in Dry Season (19 Jun. 2004)

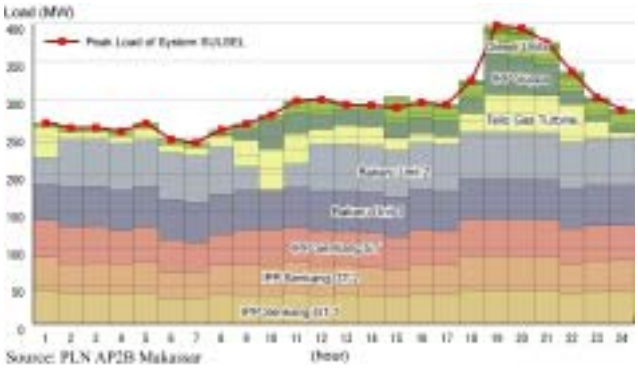


Figure 9.4: Typical Load Curve in Wet Season (17 Dec. 2004)

During 2004, Bakaru hydropower contributed 35% and the Sengkang CCGT 45% of the total power supplied to the grid. The decrease in energy production at Bakaru, which is considered to be one of the reasons for the load shedding, is attributable to unexpected sedimentation in the Bakaru reservoir, judging from the fact that the energy output was lower than the average by 26.2% while the inflow to the reservoir was lower than the average by 17.3% in January-August 2005.

A more serious reason for the load shedding and blackouts is the skyrocketing increase in the international oil prices and the resultant increase in fuel subsidies to PLN. Fuel oil allocation to South Sulawesi was decreased by 29% (from 120,000 kl to 85,500 kl).

Figure 9.5: Trend of International Spot Oil Price

Currently, Mamminasata is served by a grid composed of 150 kV (967 km in total length), 70 kV and 30 kV transmission lines, with a load dispatching center (AP2B) located in Makassar. Transmission and distribution loss of the system were 5.2% and 10.8%, respectively. While the transmission loss is greater than the PLN average (2.5%), distribution loss is comparable with the loss on Java Island (10.2%).

Figure 9.6: Grid Map of South Sulawesi

Figure 9.7: Grid System in Mamminasata

Transformers at substations are overloaded, with a load factor of more than 80% during peak load and even exceeding 100% sometimes, particularly at Daya, Tello, Panakkukang and Sungguminasa substations. For instance, the KIMA industrial estate is receiving electricity from the 70 kV Daya substation with a step down transformer of 20 MVA which is frequently overloaded during peak hours. Timely expansion of the transformer capacity is needed in the Mamminasata area.

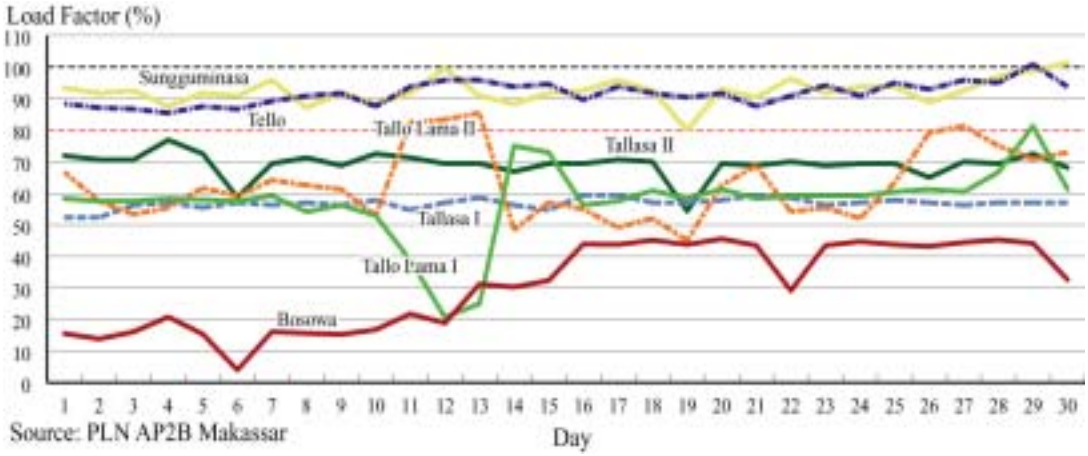


Figure 9.8: Load Factor of 150 kV Transformers in Mamminasata (April 2005)

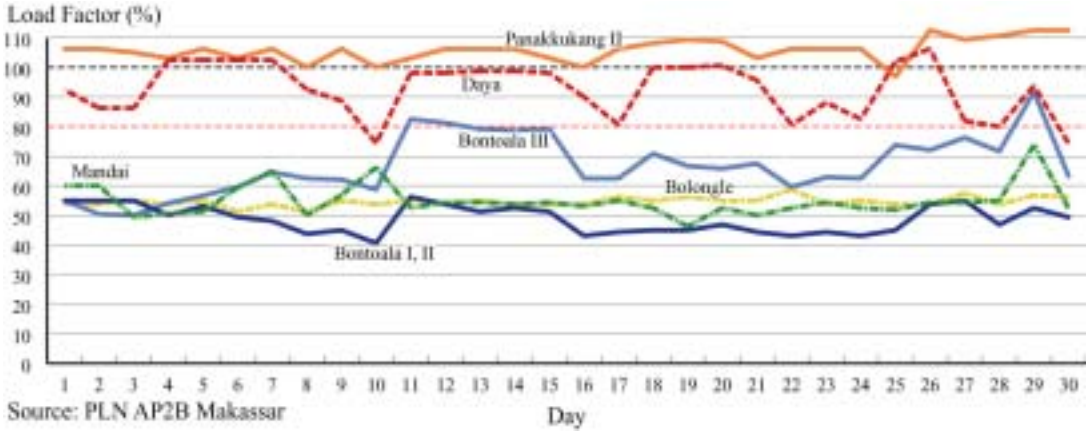


Figure 9.9: Load Factor of 70 kV Transformers in Mamminasata (April 2005)

2) Electric Power Development Strategy

PLN forecasts the future electric power demand on the basis of the growth of South Sulawesi GDP at the annual average rate of 7.7% in 2005-2015. Elasticity of energy demand to GDP is assumed to be 1.58 for residential use, 1.45 for commercial, and 1.38 for industrial use. The PLN medium scenario forecast indicates that the peak demand would increase at the rate of 11.6 % per annum around 2010 and the energy demand at the rate of 12.6 % in the mid-term. Accordingly, the peak demand will reach 680 MW in 2010 and 1,170 MW in 2015, as tabulated below.

Table 9.4: Energy and Peak Demand Forecast in South Sulawesi

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Peak Demand (MW)	399	405	452	493	542	605	676	755	843	941	1,050	1,173
Growth Ratio (%)	2.5	1.5	11.6	8.9	10.1	11.6	11.7	11.7	11.6	11.6	11.6	11.6
Energy Demand (GWh)	2,182	2,221	2,411	2,636	2,912	3,262	3,674	4,138	4,660	5,247	5,908	6,653
Growth Ratio (%)	4.2	1.8	8.6	9.3	10.5	12.0	12.6	12.6	12.6	12.6	12.6	12.6

Source: PLN Wilayah VIII

To cope with the increasing demand, PLN plans to develop several power stations, as shown in the following:

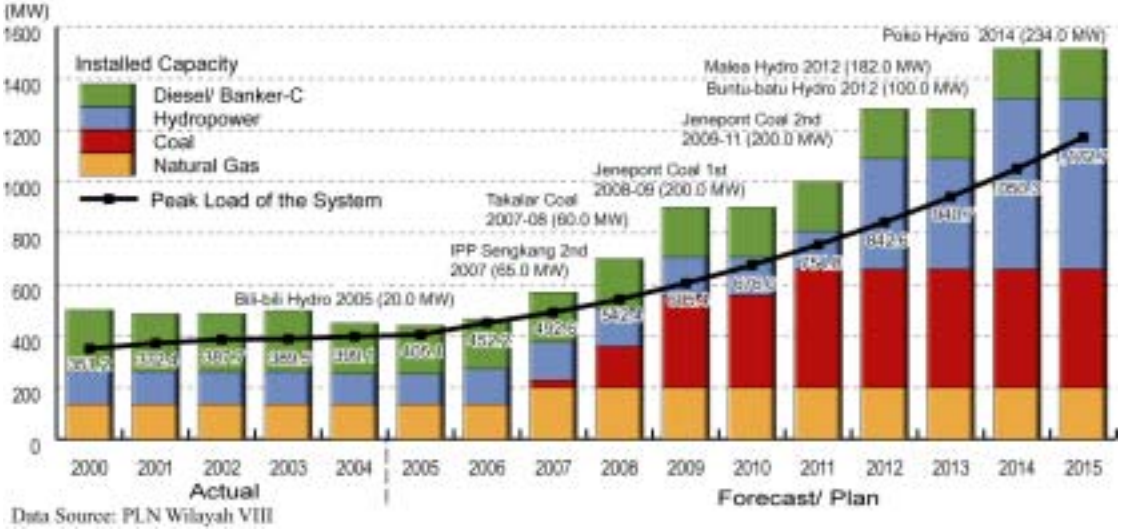


Figure 9.10: Power Development Plan by PLN South Sulawesi

IPP Sengkang CCGT Expansion (65 MW in 2007)

This is located near the Sengkang gas field which has a potential surplus for gas supply, and a new GT is planned for expansion by PT Sengkang. MOU from the central government is awaited at the moment.

Takalar (Kassa) coal-fired (30 MW in 2007 + 30 MW in 2008)

PT Kassa Listrindo has initiated an IPP scheme, starting with construction of a jetty for coal import, for scheduled completion in 2007 and 2008. Generated power is sold to PLN at Rs.464/kWh.

PLN Jeneponto coal-fired (200 MW in 2008-2009)

PLN intends to develop a 200 MW coal-fired power station in Jeneponto in line with the JICA study of 1996. PLN is expected to obtain MOU by the end of 2005 and construct it within 36 months with a supplier's credit from Spain.

IPP Jeneponto-2 coal-fired (200 MW in 2008-2011)

Bosowa group has obtained MOU to construct this IPP and sell the power to PLN at US 4.4 cents/kWh.

IPP Malea hydropower (191 MW in 2012)

This is located on the upper reach of the Sadang River, having a reliable discharge of 23 ㎥ (maximum discharge of 51.2 ㎥). Bukaka group has obtained MOU for this IPP, while several other groups are interested in this IPP.

Bonto-Batu hydropower (100 MW in 2012), and Poko hydropower (234 MW in 2014)

Bonto-Batu is located on the Matallo river, a tributary of the Sadang, while Poko is located upstream of Bakaru. Pre-feasibility level studies have been conducted for these schemes.

The coal-fired power generation schemes were planned prior to the increase in international coal prices, and they may be reviewed with the updated price forecasts.

For the expansion of the transmission line to the west cost of South Sulawesi, PLN started the construction of the 150 kV east coast Trunk Line in January 2005 for scheduled completion in May 2006. A supplier's credit has been extended by KfW. PLN also has a plan to strengthen the 150 kV West Coast Trunk Line by 2008. Another 150 kV tie line is planned for transmission of the proposed coal-fired power plants in Takalar and Jeneponto.

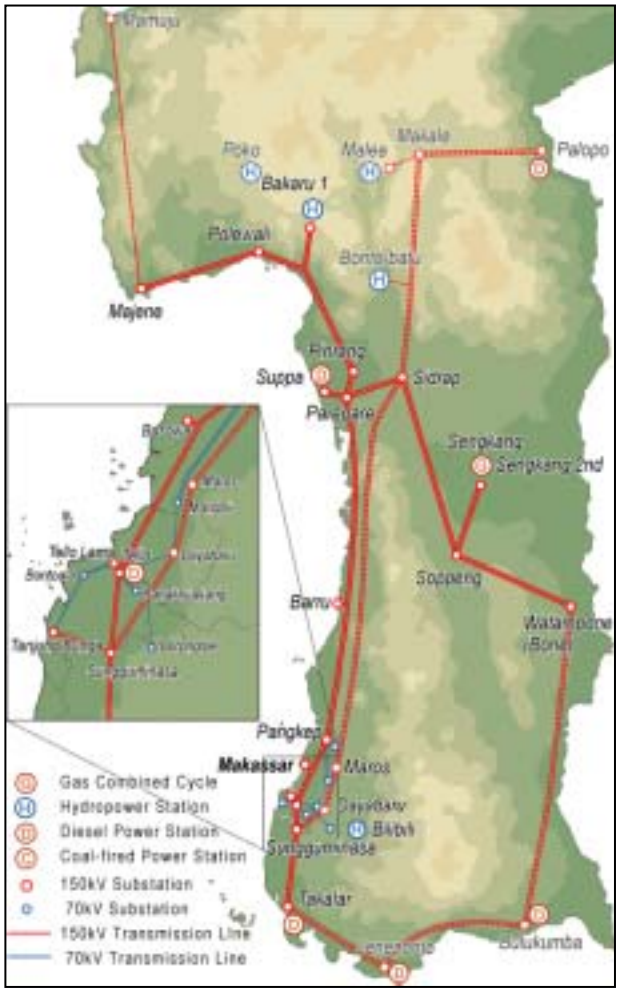


Figure 9.11: Future SULSEL System

Table 9.5: Transmission Development Plan

Section	Voltage	Conductor Size	Length	Progress	Completion
Watampone - Bulukumba	150 kV	1 x 240 mm DC	137 km	88.9%	Oct. 2005
Bulukumba – Jeneponto	150 kV	1 x 240 mm DC	46 km	87.2%	Dec. 2005
Jeneponto – Takalar Section 1	150 kV	1 x 240 mm DC	19 km	6.7%	Mar. 2006
Jeneponto – Takalar Section 1	150 kV	1 x 240 mm DC	25 km	59.0%	Dec. 2005
Sidrap – Makale	150 kV	1 x 430 mm DC	105 km	55.8%	Jun. 2006
Makale – Palopo	150 kV	1 x 240 mm DC	37 km	35.2%	May 2006
Sungguminasa – Tanjung Bunga	150 kV	1 x 430 mm DC	25 km	4.36%	May 2006
Tanjung Bunga – Bontoala	70 kV	2 x 300 mm DC	15 km	0.0%	2008
Sengkang P/S – Siwa	150 kV	2 x 240 mm DC	65 km	0.0%	2008
Sidrap – Maros – Sungguminasa	150 kV	2 x 430 mm DC	165 km	0.0%	2008
Polmas – Mamuju (Circuit II)	150 kV	1 x 240 mm SC	49 km	0.0%	2008
Tower 57 – Jeneponto P/S	150 kV	2 x 240 mm DC	10 km	0.0%	2009
Takalar – Takalar P/S	150 kV	2 x 300 mm DC	8 km	0.0%	2009
Siwa – Palopo – Wotu – Malili	70 kV	2 x 240 mm DC	230 km	0.0%	2009

Source: PLN Wilayah VIII Headquarter (SC: Single Circuit, DC: Double Circuit)

3) Alternative Development Options

As noted previously, PLN applied a GDP growth rate of 7.7% per annum over 2005-2015 in their demand forecasts and predicted that the peak demand would increase at the rate of 11.6% per annum to around the year 2010 and the energy demand at the rate of 12.6% per annum. Since the Mamminasata spatial plan will be formulated with a moderate GDP growth rate of around 7.1% per annum, a revised demand forecast has been prepared by the Study Team on the basis of residential, industrial, commercial and public/service demands. The result of our demand forecasts is summarized as tabulated below.

Table 9.6: Revised Power and Energy Demand Forecast

Index		2004	2005	2010	2015	2020	Ave. Growth
Energy Demand (GWh)	Residential	933.4	990.7	1,337.2	1,859.2	2,561.8	6.54%
	Industrial	540.6	580.0	936.2	1,566.8	2,763.0	10.97%
	Commercial	284.3	318.3	544.2	949.1	1,703.3	11.83%
	Public	176.2	189.0	274.8	405.6	613.3	8.16%
	Total	1,934.5	2,077.9	3,092.4	4,780.8	7,641.4	9.07%
Peak Demand (MW)		399.1	402.0	576.6	859.7	1,320.0	7.48%

Source: JICA Study Team

The revised demand forecast is more conservative than PLN forecasts. The energy demand would increase at the average rate of 9.1% per annum and reach around 7,640 GWh in 2020. The peak load would increase at the rate of 7.5% per annum and reach around 1,320 MW in 2020.

An alternative power development plan has been prepared on the basis of the revised demand forecast, as well as in view of the recent trends of fuel prices. PLN has taken

the sharply increasing fuel oil prices into account, but it appears desirable that the increase in coal prices in recent years also be considered as shown below.

Figure 9.12: Change in International Coal Prices

It is additionally noted that a conventional coal-fired power generation will lead to an increase in gaseous atmospheric pollutants, waste materials and the environmental load in Mamminasata at a time when efforts are being made to minimize negative environmental impacts to create an environment-friendly region.

Therefore, it would be desirable to promote the implementation of hydropower development projects making use of the indigenous energy resources. Such approaches will include the application of the CDM scheme and implementation under the so-called private-public-partnership (PPP). According to our preliminary case study on the Malea hydropower project, for instance, the CDM, if applied, would significantly reduce the investment costs by nearly US$74 million during the CDM period of 21 years, or US$3.5 million per annum.

The application of PPP would also be worth studying further. PLN and private investors would set up a special purpose company (SPC), and a loan with a term equal to the length of the government granted concessions would be obtained through international financing agencies. A case study on the Malea hydropower project implies that the application of PPP would result in a favorable financial return with reasonable ROI (return on investment) and ROE (return on equity) at a reasonable sale price for the power thus generated. (For details, please refer to the Sector Study Report (11), Chapter 1.4)

Based on the above studies, a revised power development option is proposed as shown in the figure below.

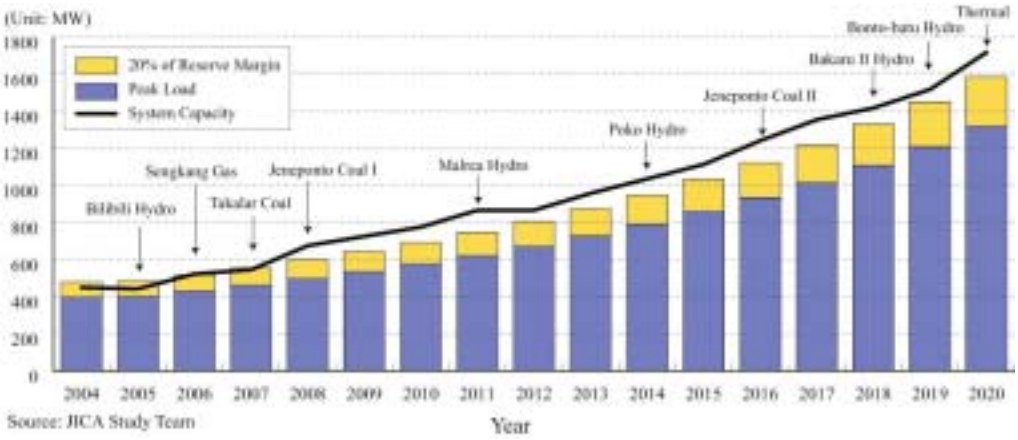


Figure 9.13: Alternative Power Development Option

4) Recommendations for Implementation

Based on the review of the current situation and PLN's plan for improvements, as well as in view of the alternative power development options as discussed above, the short-tem action programs and mid/long-term action programs in the power sector are proposed as summarized below.

<Short-term Action Program>

Earliest Possible Implementation of Sengkang and Takalar Power Plants

In view of the acute shortage in power generation capacity, it is recommended that the Sengkang gas combined-cycle power station (65 MW) and the Takalar coal-fired power station (60 MW) be implemented as soon as possible by private initiative (IPP).

Energy Conservation Campaign

On the demand side, a campaign for energy conservation should be promoted, not only by PLN, but also by all users in the public and private sectors. Such demand side management (DSM) should be implemented along with the campaign for creation of the environment-friendly region of Mamminasata.

Urgent Expansion/Rehabilitation of Transformer Capacity in Substations

As pointed out, load factors of 150 kV and 70 kV transformers at substations in Mamminasata exceed the standards, particularly at Daya, Tello, Panakkukang and Sungguminasa substations. The reason for power shortage in the KIMA industrial estate is attributable to the overload at the 70/20 kV transformer at Daya substation. The hourly loads at Daya, as shown below, will manifest the urgent requirement for expansion of transformer capacity. (Refer to Chapter 11.3)

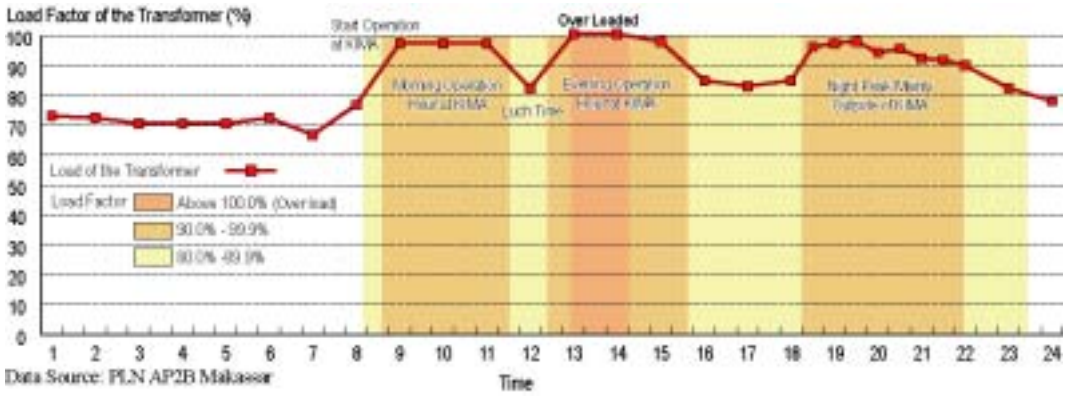


Figure 9.14: Hourly Loads of 20 MVA Transformer at Daya Substation (April 2005)

Rehabilitation/Upgrading of Distribution Lines

Since most power supply interruptions in Mamminasata (96% in 2004) are attributable to distribution line trouble, rehabilitation and upgrading of the distribution facilities should be implemented, along with capacity building for the maintenance crews. (Refer to Chapter 11.3)

Earliest Completion of Ring Transmission Networks

Since Mamminasata depends on the Bakalu and Sengkang power stations in the north for 80% of its energy supply, any risk of transmission failure over the 150 kV line should be mitigated. The earliest possible completion of both the East and West coast 150 kV lines trunk lines is recommended.

<Mid/Long-term Action Programs>

Earlier Construction of Hydropower Stations

Although PLN envisages implementation of three coal-fired power stations (Takalar, Jeneponto-1 and Jeneponto-2), it is recommended that the hydropower stations be implemented earlier than the PLN's current plans for installation. Implementation of the Malea hydro and Poko hydro plants should be accelerated to complete at the earliest possible date. Further, it is recommended that the possibility of applying the CDM scheme and PPP scheme be studied by the parties concerned.

Departure from Dependency on Fuel Oil

Oil-fired and diesel power stations should be replaced by hydro, gas and coal-fired power stations in Mamminasata, in order to reduce the burden on the regional/national economy, as well as on the environment of the region. The implementation of the Ring Transmission Network would also contribute to alleviating the dependency on fuel oil.

9.2 Telecommunication Service Improvement [2]

1) Major Issues

The telecommunication network configuration in South Sulawesi is composed of 1 trunk exchange, 1 tandem exchange, 2 local exchanges and 16 remote concentrator units, as illustrated herein. Additionally, an exchange for fixed wireless phones was installed in 2002. All switching facilities at exchanges have been digitalized since 1997.

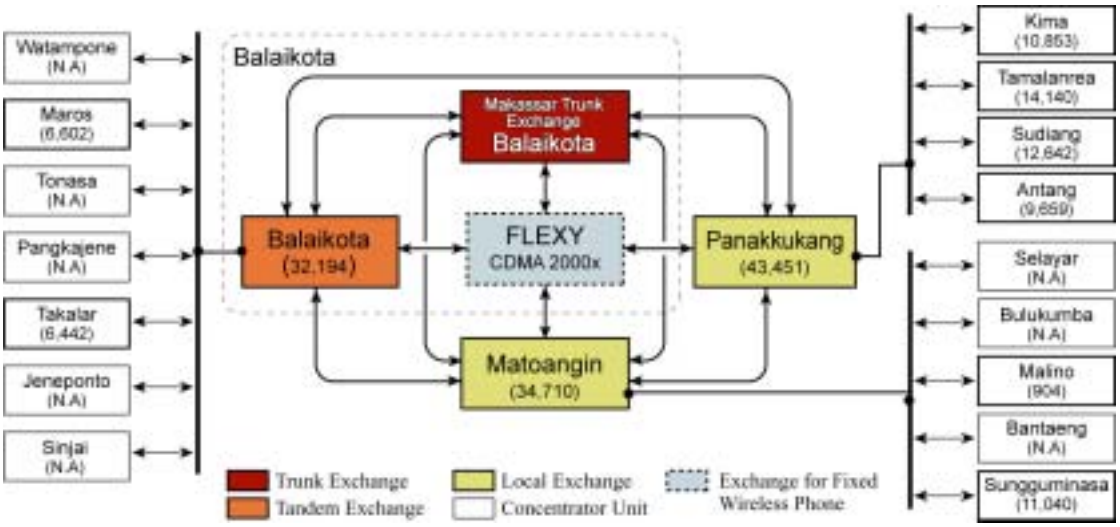


Figure 9.15: Telecommunications Network Configuration in Mamminasata

For fixed wireless and mobile phone networks using CDMA, a number of Base Transceiver Stations (BTS) have been installed in Makassar, Gowa and Maros, but not in Takalar. The total exchange capacity in Mamminasata is about 208,000 (as of May 2005), of which 60,700 are for the optical fiber network. Makassar city accounts for 76% of the total exchange capacity and Gowa for 18%. Exchange capacity in Maros and Takalar is limited to around 3%.

Telephone density in Mamminasata is 11.8%, which is higher than the national average (4.1% in 2004). Since May 2004, CDMA-based fixed telephone service has

Figure 9.16: Location of Telephone Exchanges

[2] Refer to Sector Study Report (11) for detail.

been initiated in Makassar and Gowa, and it was extended to Maros in July 2004. Takalar will have its services shortly. Fixed wireless telephone customers have been increasing rapidly, and it now accounts for 34% of total fixed phone subscribers.

The number of conventional fixed phone subscribers in Mamminasata has increased from 133,850 in December 2002 to 173,250 in May 2005. About 83% are residential customers, 11.2% are business customers and 4% are public telephones. The following table and figure show the current subscribers in Mamminasata.

Table 9.7: Subscribers of Conventional Fixed Phones in Mamminasata

	Business		Residential		Social		Public Phone		Others		Total
Makassar	18,985	(14.9%)	101,332	(79.7%)	476	(0.4%)	5,078	(4.0%)	1,293	(1.0%)	127,164
Gowa	818	(2.4%)	31,546	(92.3%)	70	(0.2%)	1,258	(3.7%)	472	(1.4%)	34,164
Maros	326	(5.2%)	5,738	(91.2%)	17	(0.3%)	190	(3.0%)	24	(0.4%)	6,295
Takalar	352	(6.3%)	5,098	(91.1%)	2	(0.0%)	123	(2.2%)	19	(0.3%)	5,594
Total	20,481	(11.8%)	143,714	(83.0%)	565	(0.3%)	6,649	(3.8%)	1,808	(1.0%)	173,217

Source: PT. TELKOM

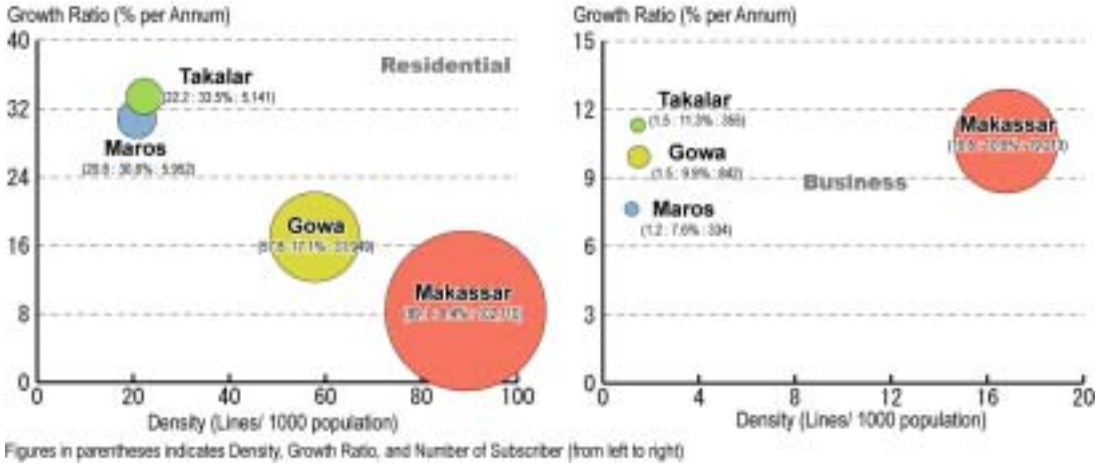


Figure 9.17: Growth Rate and Market Size of Residential and Business Customers

The Internet is currently served by phone-line dial-up (28.8 kbps) and ISDN dial-up (56.6 kbps) in Mamminasata. A high-speed internet access service, called TELKOM Speedy (384 to 512 kbps, using ADSL technology) is starting in September 2005. Seven Internet Service Providers (ISPs) are in operation, with a total number of subscribers of around 9,500. Since free subscription Internet service, called "TelkomNet Instan" is also available, there are no actual data available on the total number of Internet users.

One of the constraints in the Internet service is its high cost for the ordinary people. Considering the connection speed, Telkom's ADSL is much more expensive if compared with the costs in other OECD member countries. Unless reduction in

service charges is realized, high speed Internet service in Mamminasata would not be expected in the near future.

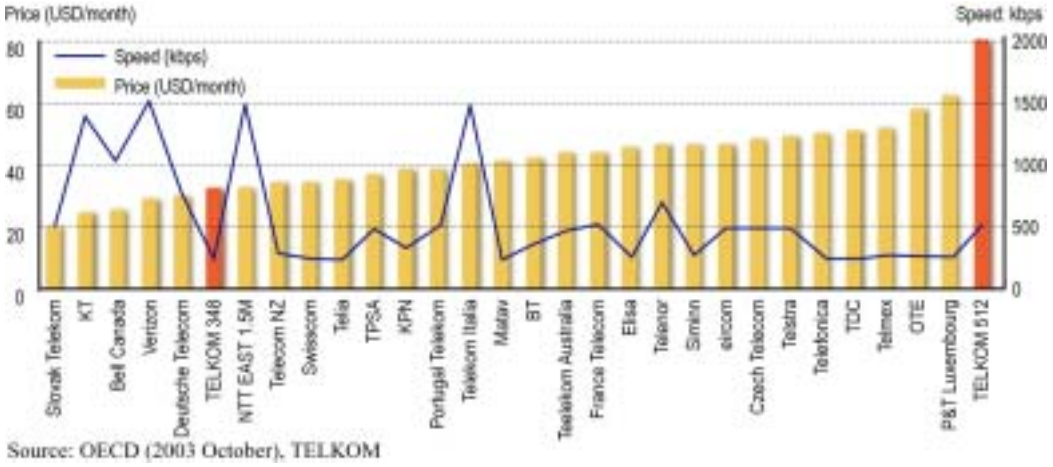


Figure 9.18: Comparison of Broad Band Services (Price and Connection Speed)

In Mamminasata, local calls and long-distance calls are still only available through service by TELKOM despite the New Communication Law (Law No.36/1999) and deregulation in the telecommunications sector in August 2002 (local call services) and August 2003 (long-distance services). On the other hand, the mobile phone market has turned out to be highly competitive among, at the moment, 3 mobile phone operators (i.e., TelkomSel, Indosat and Excelcomindo).

2) Telecommunications Strategy and Recommendations for Implementation

Since the introduction of the CDMA-based telephone service in May 2004, the number of subscribers has increased rapidly to nearly 90,000 (77,200 pre-paid and 12,300 billed), accounting for 34% of the total fixed phone subscribers. The fixed wireless telephone system using CDMA enables further expansion of services to subscribers. Digitalization of all switching facilities in Mamminasata has been completed and the service quality has been substantially improved with a comparatively low fault ratio (0.14-3.18).

The Internet services in Mamminasata still have much to be improved, though a high-speed access service is scheduled to start shortly. Reduction in service charges should be realized along with service quality improvement. Unless this is achieved, it will be rather difficult for Mamminasata to attain the objective of becoming a "logistical and trade hub" in Eastern Indonesia. The financial sector development in Mamminasata would also be hampered by the lack of telecommunications sector development.

For better services in telecommunications, some new systems (e.g., Revenue Sharing

Agreements., Joint Operation Schemes (KSO), and Joint Venture Companies) have been introduced. KSO has been applied to South Sulawesi, and a KSO agreement was concluded between Telkom division VI and PT Bukaka SingTel in January 1996. The Bukaka SingTel is operating and will be managing the telecommunications services up to 2010 for and on behalf of Telkom, and the revenues are shared between Bukaka SingTel (65%) and Telkom (35%).

Figure 9.19: Joint Operation Scheme (KSO) in South Sulawesi

Since the improvement in the telecommunication sector is to be promoted by the private sector, minimal intervention in planning and implementation is expected. However, in view of the relatively high cost of telecommunications and Internet services in Mamminasata, it is suggested that further competition among private enterprises should be encouraged for the best benefit of the people in Mamminasata.

A challenge to move towards e-government has been made in Mamminasata in response to the enactment of the New Regional Autonomy Law No.22/1999. General objectives of e-government are to build clean, transparent and efficient local governments and to utilize potential resources to the maximum extent for regional economies. Action is required to redefine business processes in local government, customize applications and train local government officers.

Several pilot projects were implemented in Takalar, including the “Development and Implementation of an Integrated Voice and Web-based Public Service System for Rural Community” which was conducted by Telkom with the support of JICA. The “System Information Management Satu Atap” (SIMTAP) is a web-based e-public service system developed by Telkom. The “Voice-based SIMTAP” has also been developed as an online public service system. After the pilot operations, web and voice-based e-public services are introduced in Takalar. It appears desirable that the performance of such operations be evaluated from the viewpoint of the objectives set for the introduction of e-government. It is also expected that Telkom will work out a plan for expansion and promotion of the e-government model for Mamminasata.

9.3 Transportation Service Improvement [3]

1) Major Issues

Transport networks in Mamminasata consist of road transport, sea transport, and air transport. Road transport is the major sub-sector to be improved for better transportation services in the region.

South Sulawesi province has national roads of 1,556 km in total length and provincial roads of 1,209 km under the jurisdiction of the South Sulawesi Road Department (Bina Marga). The road network runs along the east and west coast and crosses the central highlands in the peninsula.

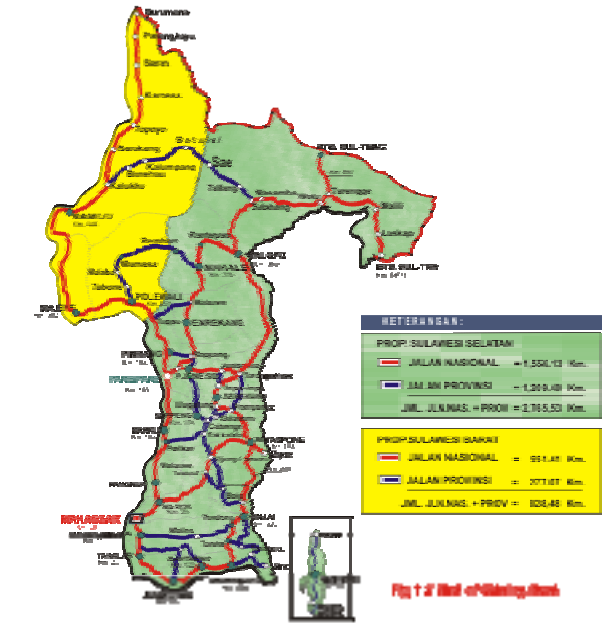


Figure 9.20: Road Network in South Sulawesi

Existing roads in Mamminasata are categorized in the following table.

Table 9.8: Existing Roads in Mamminasata

Kinds	Maros	Makassar	Gowa	Takalar	Total Length
National Roads	82.08 km	66.24 km	20.87 km	24.24 km	193.43 km
			(All are Arterial Roads)		
Provincial Roads	-	-	188.90 km	-	188.90 km
			(Collector Roads total 138.33km)		
Subtotal	82.08 km	66.24 km	209.77 km	24.24 km	382.33 km
Local Roads	892 km (177 rds)	765 km	2,196 km (573 rds)	755 km (384 rds)	

Source: Data Informasi, 2005, Dinas Prasarana Wilayah, Provinsi Sulawesi Selatan

[3] Refer to Sector Study Reports (12) and (13) for detail.

Road inventory data is available, though the accuracy of the data needs to be improved. The road design standards are defined under the Indonesian Highway Capacity Manual, the guideline for geometric plans for inter-city roads, and other standards. According to these standards and the road inventory, the existing road condition in Mamminasata is evaluated as summarized below.

Table 9.9: Existing Road Condition in Mamminasata

	Good Roads	Ordinal Roads	Slight Damage	Serious Damage
National Roads	31.4%	68.2%	0.6%	-
Provincial Roads	39.9%	33.6%	8.7%	17.8%

Source: Data Informasi, 2005, Dinas Prasarana Wilayah, Provinsi Sulawesi Selatan

Currently, public transportation services in Mamminasata are operated using mainly Damri or large buses (about 30), Pete Pete mini-buses (about 7,000 of 3 different classification), taxis (about 2,000), and becak. According to the traffic survey conducted in the course of this Study, vehicle composition in Mamminasata is as shown in the following figure.

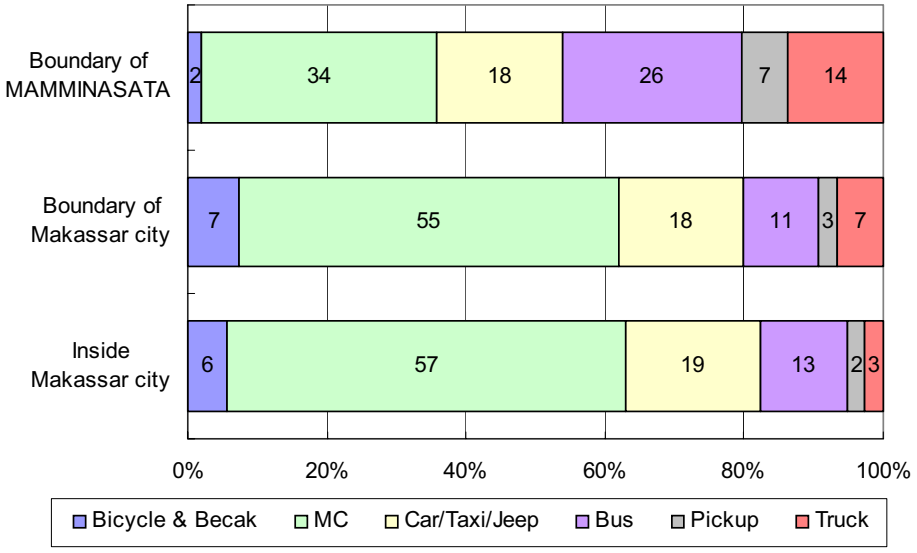


Figure 9.21: Vehicle Composition by Area in Mamminasata

The traffic volume on the major roads in Mamminasata has been counted in traffic surveys and is summarized in the following figures. (Details are reported separately)

Figure 9.22: Trafiic Volume in Mamminasata

Figure 9.23: Traffic Volume in Makassar

The hourly traffic fluctuation has also been determined along the major roads. The following figures show typical patterns of hourly fluctuation.

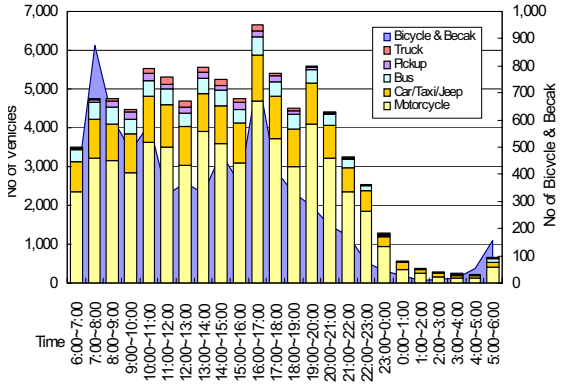


Figure 9.24: Hourly Fluctuation at Jl. Veteran Utara (Station No.25)

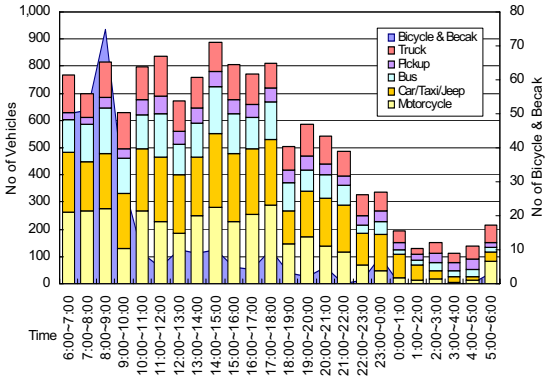


Figure 9.25: Hourly Fluctuation between Maros and Pangkep (St.No.1)

Compared with the traffic survey done in 1988, notable changes are observed on the major roads in Makassar. For instance, the traffic on Jl. Pettarani is now3.5 times heavier than what it was in the 1988 traffic survey.

Table 9.10: Traffic Change in Makassar 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 Alauddin	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 motorcycles and becak.
Source: JICA Study Team and Ujung Pandang Area Highway Development Study (JICA 1989)

2) Road Transport Development Strategy

Road development strategy aims at:

i) Alleviating present and anticipated traffic congestions,

ii) Strengthening economic linkage within the Mamminasata metropolitan area, anc contribute to initiate and/or accelerate economic growth in this region, and

iii) Offering equal opportunity to the growth by providing access to the market and working places all over the Mamminasata metropolitan area that covers four regencies, now showing a wide gap in the standard of living.

Based on the OD interview survey at 28 stations, a present OD table has been established. Desired lines across Mamminasata have been revealed as illustrated in the following.

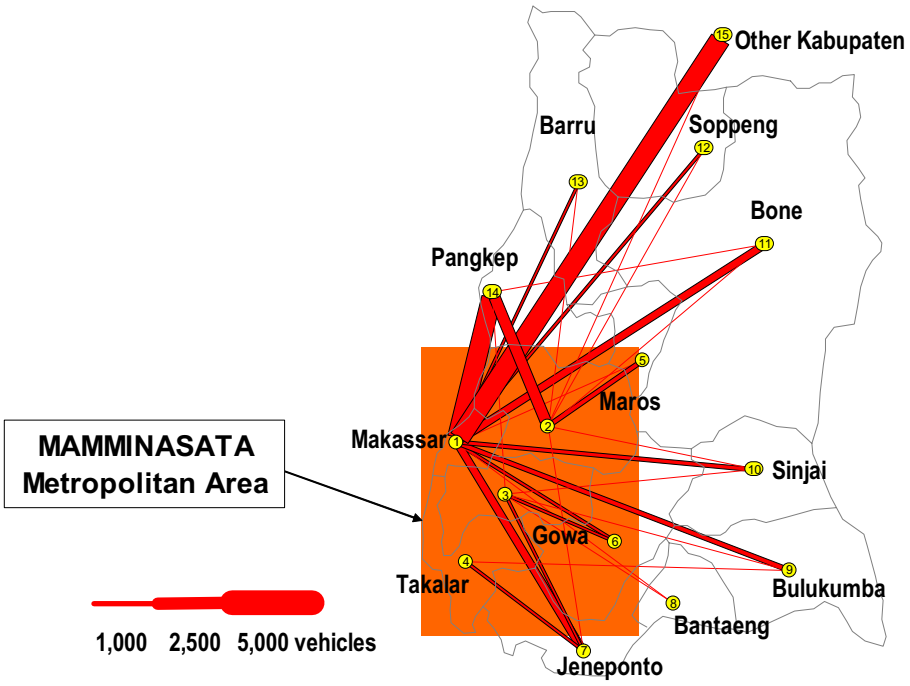
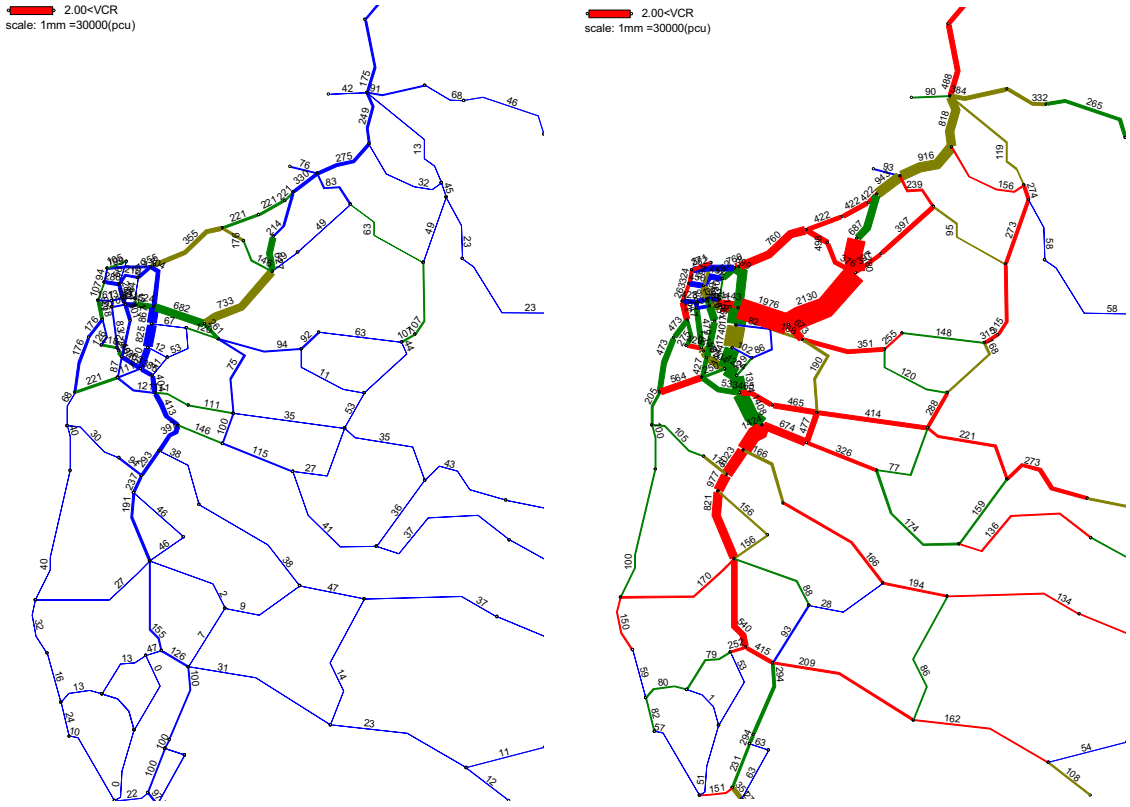


Figure 9.26: Desired Line across Mamminasata

A future OD table is calibrated on the basis of a four-step forecast procedure: (i) produced traffic based on the growth of registered vehicles, (ii) generated/attracted traffic estimated by multiple regression models, and (iii) distributed traffic based on the present pattern method through convergence calculation of the Frator method. The traffic volume along the major routes in 2005 and 2020 are compared in the following figures together with the degree of congestion in the event that no road network improvement is implemented.



2005 **2020**

Figure 9.27: Traffic Volume and Congestion Ratio without Improvement

Several road improvement plans have been established so far. The 1989 JICA study on the "Ujung Pandang Highway Development" recommended, among other things, construction of a series of ring roads in and around Makassar. The Mamminasata spatial plan formulated by the Mamminasata Metropolitan Development Board generally follows the ring road plan and recommended the improvement of inter-city road networks in Mamminasata. The Makassar City Development Plan for 2005~2025 also incorporated the ring road network as trunk roads into their plans.

Maros, Gowa and Takalar regencies have also formulated their plans for road service improvement. The Maros plan puts emphasis on the construction of a coastal road from Makassar port to northern Maros via new industrial areas at KIROS (KIMA2). Gowa regency proposes a new outer-outer-ring road to directly connect Gowa with Maros and Takalar. Takalar regency proposes to widen the Tanjung Bunga – Takalar road and to construct a new access road from midway of the existing Takalar road to the southern areas.

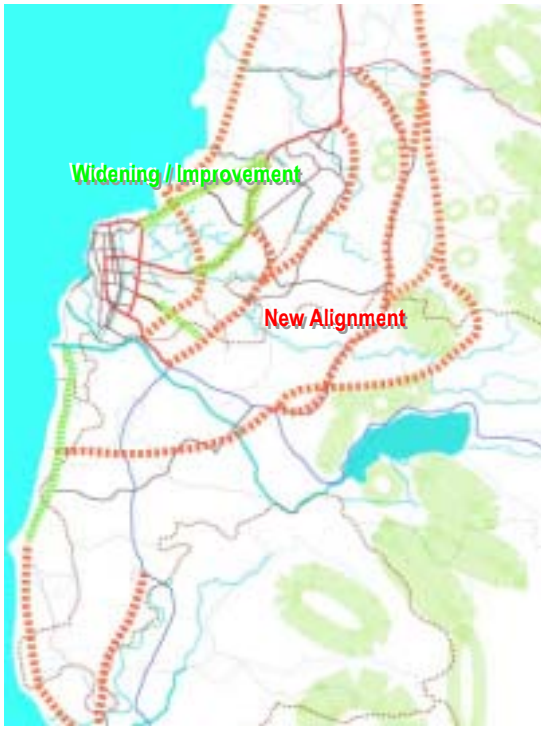


Figure 9.28: Existing Road Improvement Plans

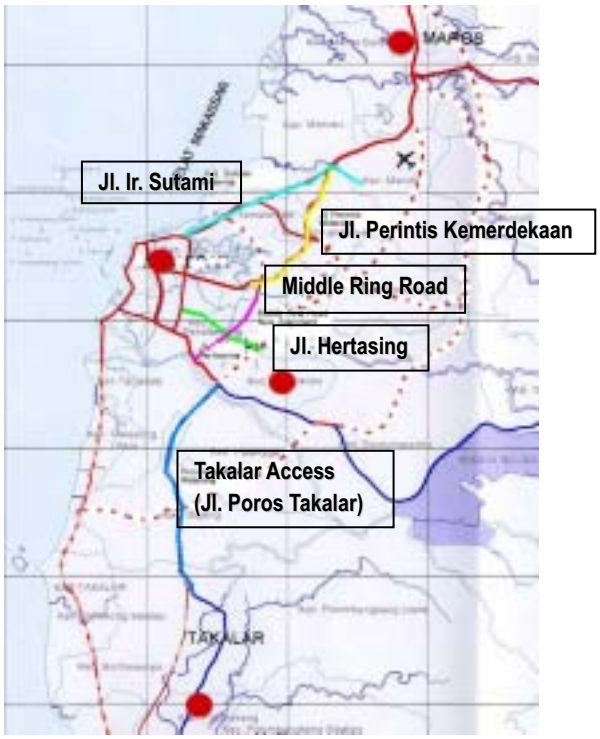


Figure 9.29: On-going Road Projects (2005)

Several road improvement projects are underway. They include the (i) Takalara access (Jl. Poros Takalar), (ii) J. Hertasning, (iii) J. Ir. Sutami (toll road), (iv) Jl. Perintis Kemerdekaan and J. Urip Sumoharjo, and (v) Middle ring road.

Prior to the formulation of the road improvement plan, some strategies in road network formation have been discussed regarding the following:

Trans-Sulawesi Road

In the longer term, a Trans-Sulawesi freeway will be planned and the Mamminasata spatial plan should envisage such a freeway. In Mamminasata, two alternative alignments of the Trans-Sulawesi road will be considered; (i) an alignment running to the east of Makassar for easier access to the city area, designated the "A route", and (ii) an alignment running to the west of Makassar for better services to the new urban centers, or the "B route". A comparative study shows that the "A route" would be preferable and it would make it possible to utilize the land acquired for the southern section of the Middle Ring Road.

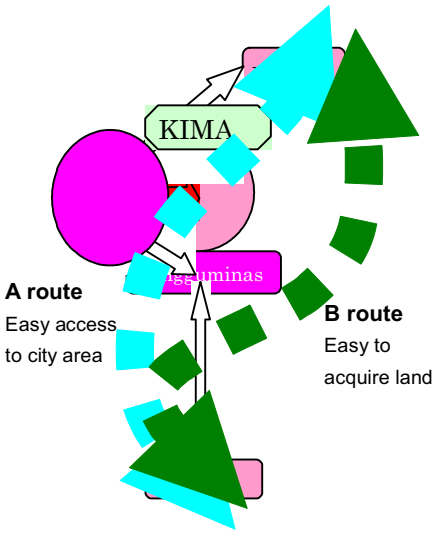


Figure 9.30: Alignment Alternatives

Mamminasata Bypass

To facilitate the new urban centers to be developed to the east of Makassar, a Mamminasata bypass road should be planned to the east of the existing location proposed for the Outer Ring Road. It would also serve to reduce traffic volume by constructing regional terminals on this bypass, as well as a detour of the Trans-Sulawesi, "A-route".

East-West Radial Roads

New radial roads from Makassar running to the east are necessary, particularly for development of the new urban centers. Three alignments are proposed; (i) improvement of Jl. Abdulla Daeng Sirua by diverting the water of the Lekopancing river to an underground pipe culvert to create space for a 30~50 m wide road, (ii) extension of J. Pannakukang as a commuter route, and (iii) extension of J. Hertasming running to the north of J. Malino to mitigate congestion in Sungguminasa (with future extension to Malino). The east-west radial roads should be improved in parallel with the new urban center development plans.

Access to New Industrial Zones

Road improvements will also be required for development of new industrial zones. Some alternative routes should be further studied on the basis of the implementation of such industrial development plans as KIMA, KIROS, KIWA and KITA.

Based on the existing road conditions and the traffic forecast, as well as the existing improvement plans, a long-list for road improvement projects is proposed as tabulated in the following.

Table 9.11: List of Identified Road Improvement Projects

	Road Name	Works	Width	Length	Land acquisition	Remarks
1	Perintis	Widening	42m	14km	>90%	
	2F/O	New	30m	200	>90%	
2	Ir Sutami with 1 F/O	Widening	70m	11km	>90%	
3	Alauddin	Widening	40m	5km	>90%	
4	Malino Access	Widening	30m	9km	n.a	
5	Middle R/R	New	40m	8km	>70%	
6	KIMA (Jl Kapasa Raya)	Widening	40m	5km	>90%	
7	Tanjung Bunga Access	New	20m	6km	0%	
8	Takalar Access	Widening	25m	(4+)23km	>90%	4km completed
9	Mamminasa Bypass	New	100m	30+10km	0%	10km is south of Jeneberang
	Mamminasa Bypass Bridge	New	50m	350m	0%	
10	Abdullah Daeng Sirua	New	35m	15km	>50%	
11	Around Airport	Widening	20m	10km	0%	
12	Airport Access	New	40m	18km	>50%	

	Road Name	Works	Width	Length	Land acquisition	Remarks
13	Trans Sulawesi	New	90m	30+5+20	0%	30km: Northern part of Middle Ring Road 5+20km: Southern part of Jeneberang. River
	Trans Sulawesi Bridge	New	40m	400m	0%	
14	Heltasning	New	25m	14+7km	>50%	7km is further extension to East
15	KIWA Access	New	40m	13km	0%	
16	Around Sungguminasa	Widening	15m	15km	0%	
	Total			268km		

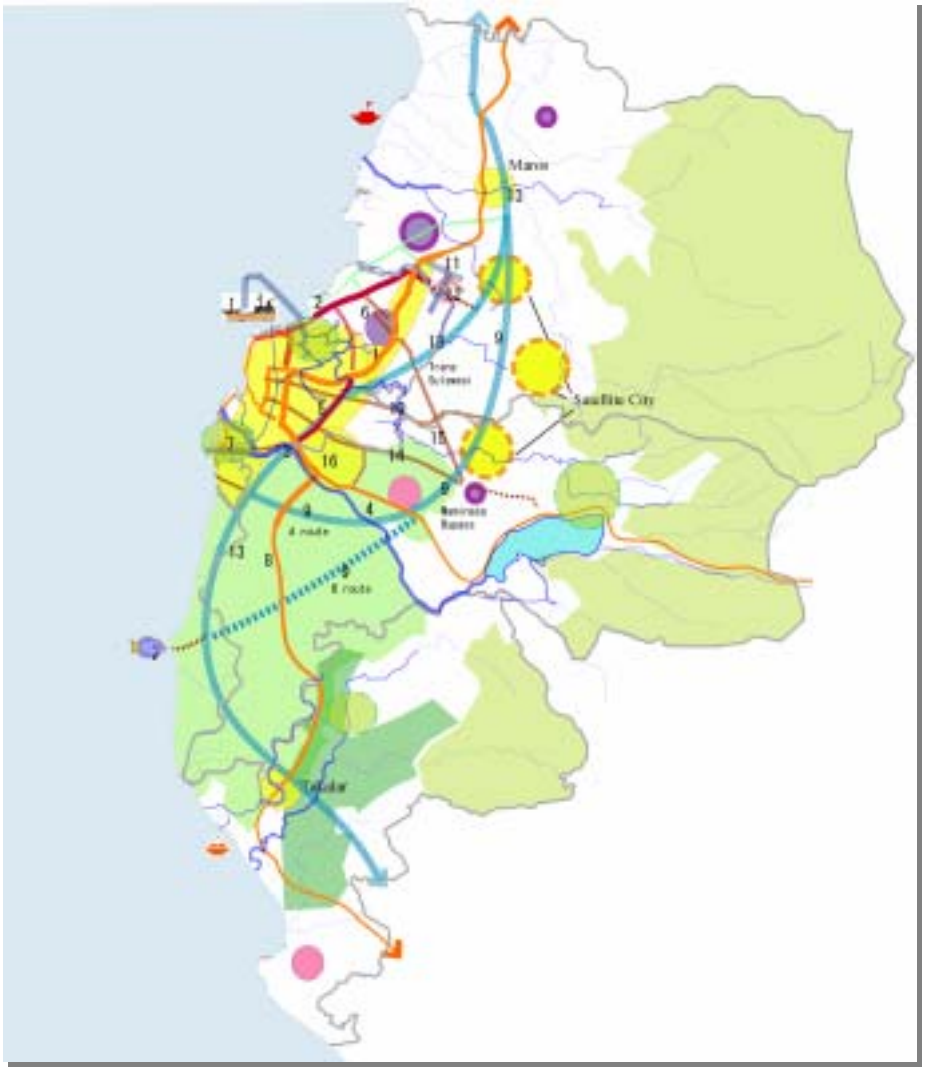


Figure 9.31: Proposed Road Network in Mamminasata

The existing plans were reviewed and the development strategies formulated on the basis of the traffic forecasts for 2010, 2015 and 2020.

A procedure of selecting the priority improvement sections of the road network is illustrated in Figure 9.32.

By the year 2010, traffic volume will increase and congestion will be aggravated if no improvements are made. Only if the improvements along Jl. Perintis and Jl. Sutami are completed, will the expected traffic congestion be alleviated as shown in the following figure.

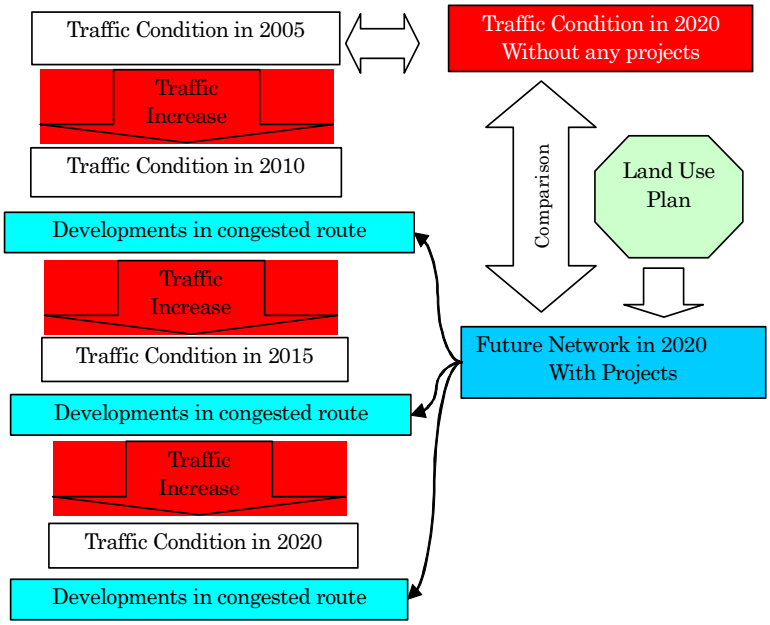
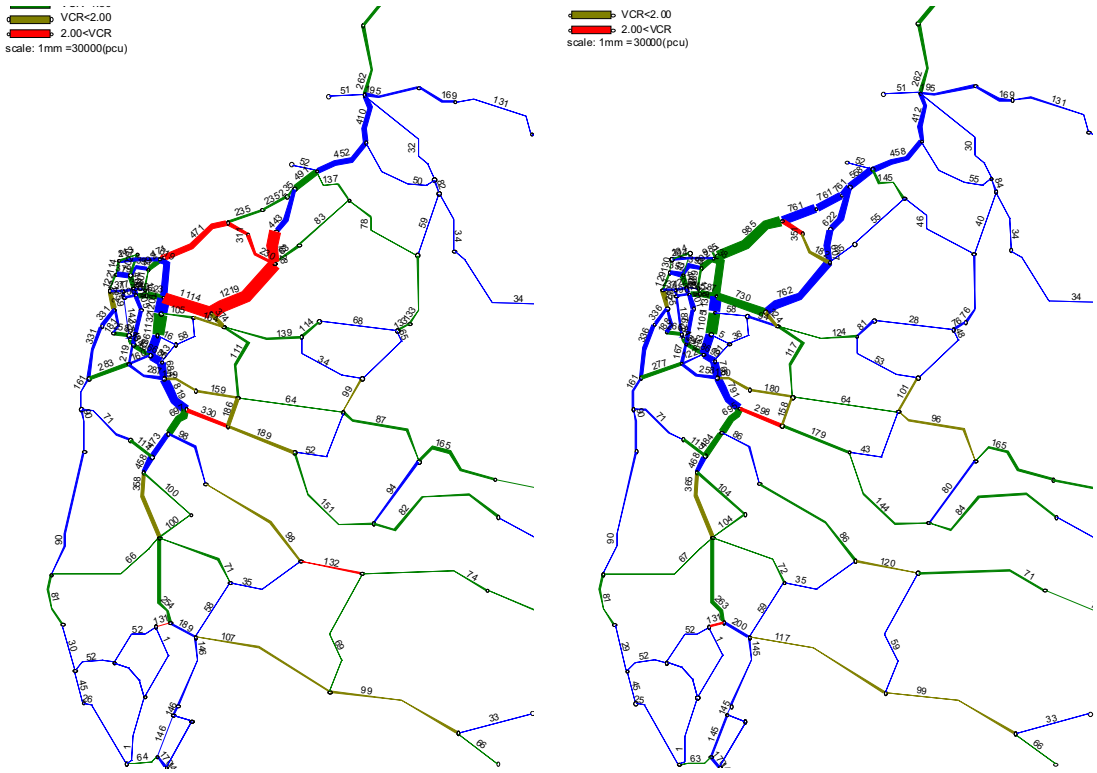


Figure 9.32: A Procedure in Selecting Priority Improvement Sections

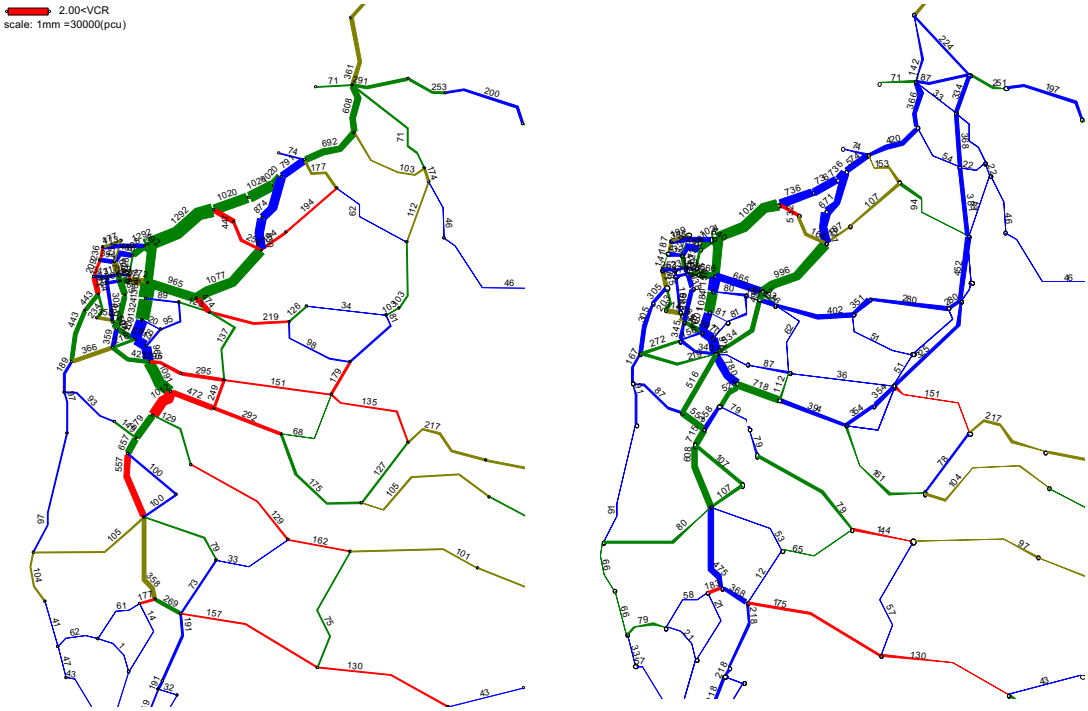


Without Case With Case

Figure 9.33: Traffic Without and With Improvements in 2010

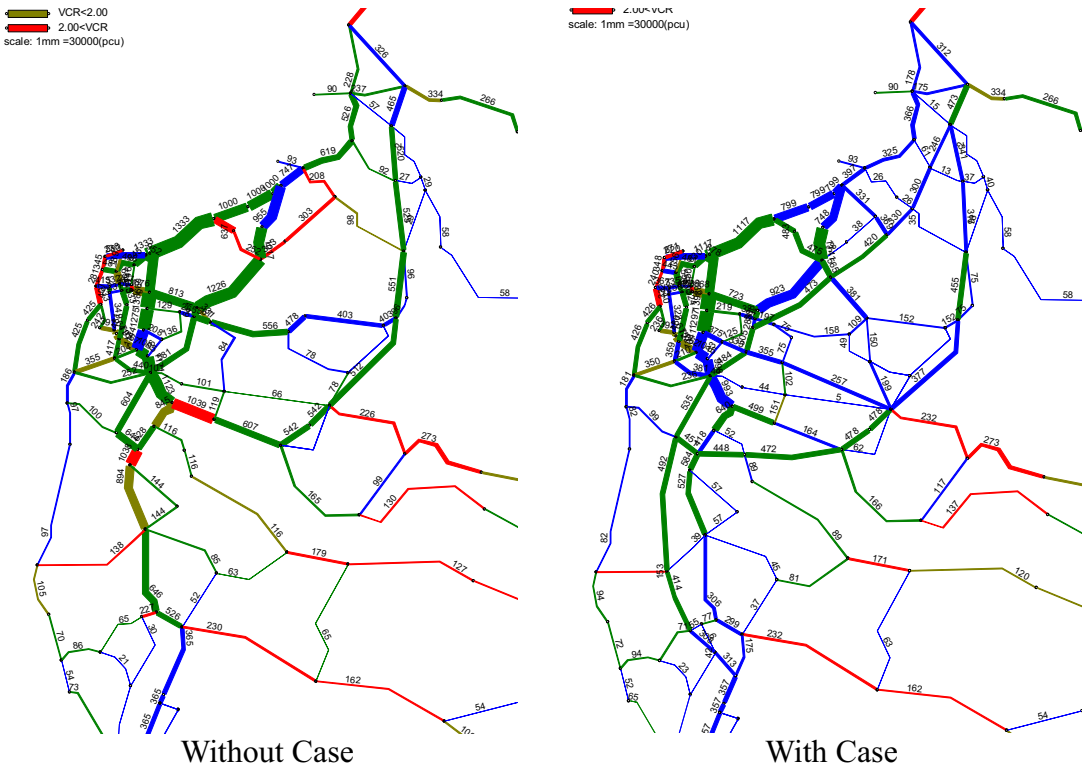
By 2015, traffic volume will further increase and additional improvements will be required. Such improvements will include: (i) the southern section of the middle ring

road, (ii) Tanjung Bunga access, (iii) Takalar access, (iv) Trans-Sulawesi (Jeneberang), (v) Mamminasata bypasses, (vi) Abdullah Daeng Sirua, and (vii) Malino access. If these road improvements are implemented, the road traffic will turn out as illustrated in the following figures.



Without Case With Case

Figure 9.34: Traffic Without and With Improvement in 2015



Without Case With Case

Figure 9.35: Traffic Without and With Improvement in 2020

By 2020, additional road improvements will be required, including (i) Mamminasata bypass, (ii) Trans-Sulawesi highways, (iii) airport cross road, (iv) J. Kapasa Raya (KIMA), (v) KIMA and KIWA industrial estates connection, and (vi) Hertasming. The road traffic conditions with and without road network improvement are compared in the above figures.[4]

The above simulations of the traffic assignment on an improved road network present the basis for road development in Mamminasata, as planned in the following.

Figure 9.36: Overall Road Network Plan in Mamminasata

It is noted that the Middle Ring Road (MRR) is planned for construction through private initiative. Makassar city has nearly completed the land acquisition for the

[4] Refer to Sector Study Report (13) for detail.

southern section of the MMR and invested in it as equity through a Joint Venture with P.T. Karsa Buana Santika. However, it is not recommended to construct the northern section of the MRR that traverses the Tallo river estuary in view of the above traffic simulation as well as the negative environmental impacts and the larger investments required for the embankment on the soft base. The environmental examination indicates that the construction of the northern section of the MRR would have serious negative impacts.

3) Road Development Plan Formulation and Implementation

(1) Priority Road Improvement

Based on the simulation for prioritization in road improvements, it is clear that the following improvements should be implemented before 2010.

<Most Urgent Improvements>

1. Jl. Sutami toll road between Makassar port and Hassanuddin airport
2. Jl. Perintis together with Jl. Urip Sumoharjo (Refer to Chapter 11.4)[5]

<Most Urgent Study>

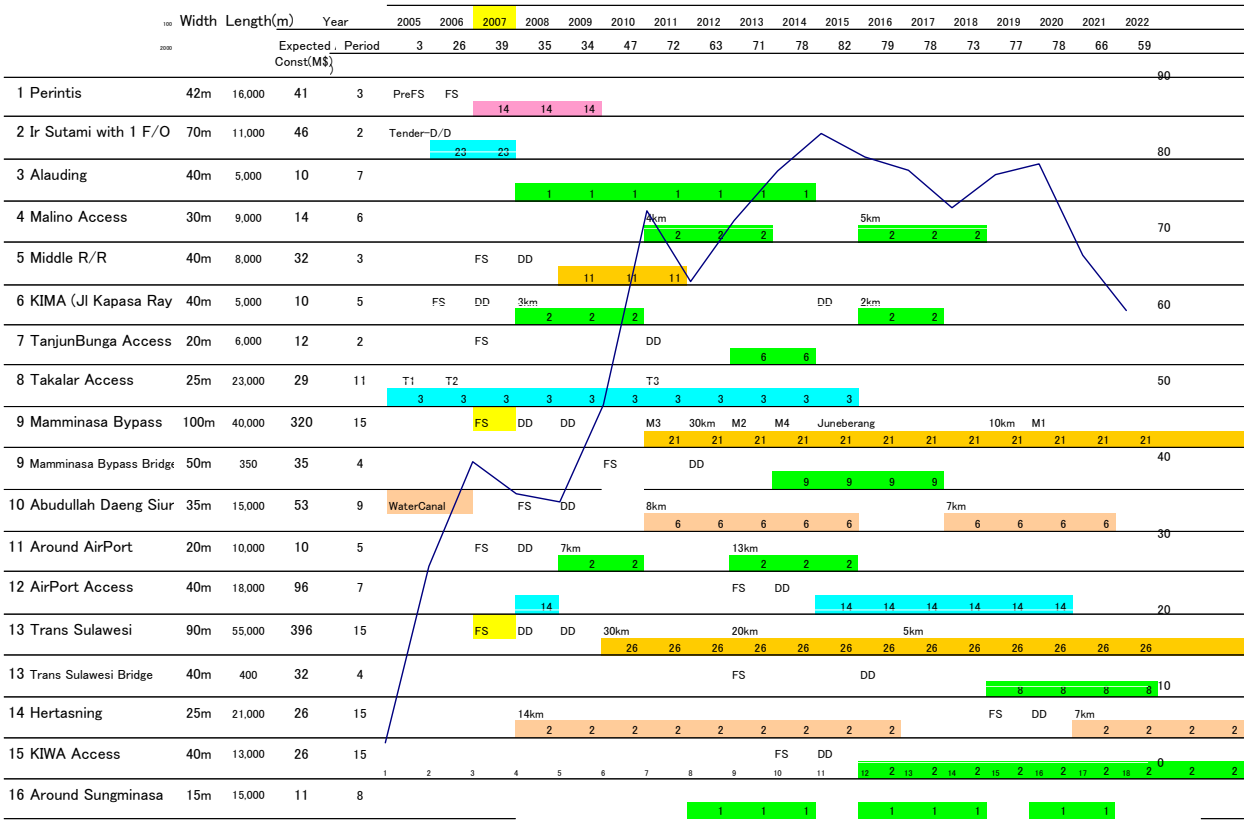
3. Trans-Sulawesi Road and Mamminasa Bypass

<Short-term improvements for completion before 2010>

4. Alauddin road from Pettrani to Sungguminasa
5. Hertasning road extension
6. Malino road from Sungguminasa
7. Takalar access road from Sungguminasa

For the road improvements thereafter, requirements and priority should be reviewed in the light of the progress in residential and industrial development. Provisionally, the road improvement projects envisaged for implementation under this study are tabulated in the following figure.

[5] Refer also to a pre-feasibility study presented in a separate volume.



Note: Total schedule is adjusted allow execution within the financial limits of each annual budget.

1. Perintis widening is expected soon.
2. Sutami is assumed to start in 2006 as BOT.
3/4. Widening shall be conducted from the section where possible (minimum 500m).
5. The Middle Ring Road (south section) is assumed to start in 2007. The north section is not recommended for construction.
6. KIMA (Jl. Kapasa Raya) shall be improved at an early stage considering the current status.
7. Tanjung Bunga Access is expected to start before the alignment is occupied as a settlement area.
8. Takalar access shall continue with the present widening work.
9. Mamminasa bypass shall be conducted as a 20 year project, beginning at the frontage road.
10. Abdullah Daeng Sirua. The water canal improvement is expected to start at an early stage.
11. The road around the airport shall be improved according to the development. (Two roads)
12. Airport Access. The first stage shall be by Sutami BOT. The second stage shall be completed at the same time as the new runway.
13. Trans Sulawesi will be completed as a 30 year project, beginning at the frontage road.
14. Hertasning is expected to continue with the current extension work.

15.16. These shall start with land acquisition at an early stage, or this route will become impossible.

Figure 9.36: Implementation of Road Improvement Projects (Provisional)

(2) Better Cross Section Design

The cross section of the road improvements along Jl. Pettarani and Jl Sutami (implementation by BOT) has not been finalized yet. In their cross section design, it is suggested that lanes should be clearly demarcated for respective traffic and that lanes be separated by greenbelts as illustrated in the following figure.

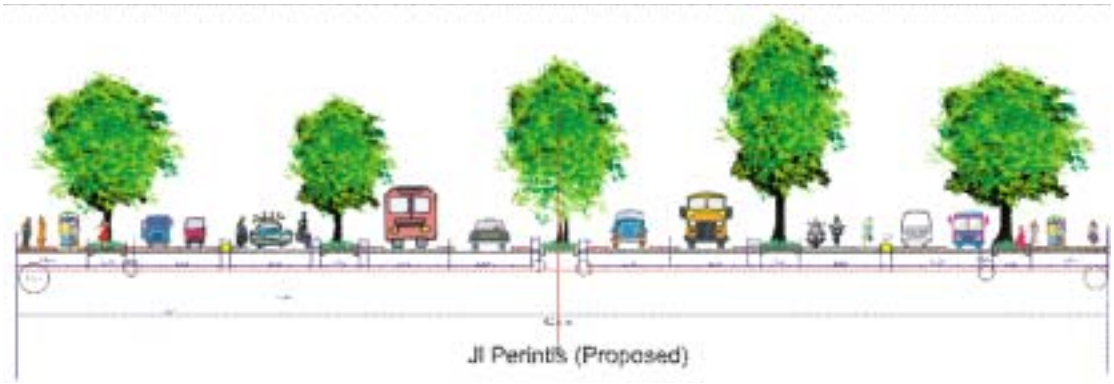


Figure 9.37: Conceptual Design of Cross Section along Jl. Perintis

(3) Road Facility Improvement

Combined with the road improvement and traffic demand management, road facilities are to be improved in and around Makassar. It is provisionally envisaged that such road facilities would include the following.

Table 9.12: Improvement of Road Facilities (Preliminary)

1) Construction of Flyovers	● Ulip Sumoharjo x Pettarani ● Perintis x Kapasa Raya (Daya) ● Alauddin x Middle Ring Road
2) Improvement of Intersections	● Pettarani x Abdullah Daeng Sirua ● Pettarani x Panakkukang ● Pettarani x Hertasning
3) Traffic Signals	● Integration of Signaling system ● Distribution of 2 system power line in case of power failure
4) Traffic Information System	● Setting of monitor cameras at major intersections ● Setting of public announcement boards for traffic
5) Road Lighting	● Status quo for the time being because of lack of total power capacity.
6) Division of traffic lanes	● Excusive lane for public transportation ● Exclusive lane for motorbikes as a trial ● Exclusive Bicycle lanes. (all the above first instituted at Perintis, Pettarani and Alauddin)
7) Improvement of sidewalks	● Flat sidewalk with carriageway (separated by curbstone) "shall be barrier free" ● Prohibit usage of sidewalks by Venders or Shops ● Side drainage to underground sewers
8) Parking Lots	● Development of appropriate parking lots ● Decrease total number of public parking lots in CBD

* Parking lot spaces in CBD would reduce the use of private cars and increase the use of public transportation.

(4) Public Transportation Service

As noted previously, the Mamminasata metropolitan area is served by large buses or Damri (about 30 vehicles), for an inter-city services alone, Pete-Pete mini-buses

(about 7,000), taxis (about 2,000) for both inter-city and intra-city services, and becak for intra-city service. Each public transportation mode should play its respective role distinguished clearly according to travel distance, as illustrated herein, but their mixed roles and disorderly operation in the urban areas have caused traffic congestions.

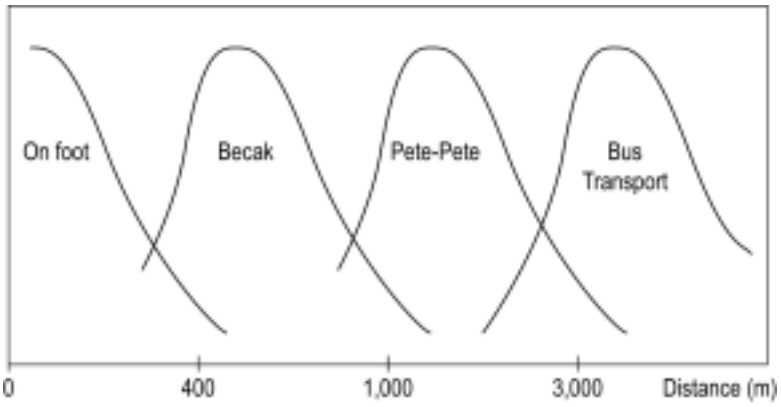


Figure 9.38: Illustrative Roles of Public Transportation Services

For alleviating sever traffic congestion in the urban area, public transportation can play a more significant role in Mamminasata with a help of quality improvement of bus service and a definite demarcation of role by mode. In this context, some issues have to be addressed, including:

(i) The pete-pete service network should be modified in line with the improvement in the road network;

(ii) More large buses with better service will be needed to increase the transportation capacity;

(iii) Connections from regional bus services to city services should be improved by designing new layout of bus and/or pete-pete terminals; and

(iv) Cross-boundary regional bus services should be improved encouraged to expand, making cross-boundary trips much easier

For the improvement of urban transportation services and to mitigate the traffic congestion in Mamminasata, it is recommended that bus transportation services be improved in the following manner.

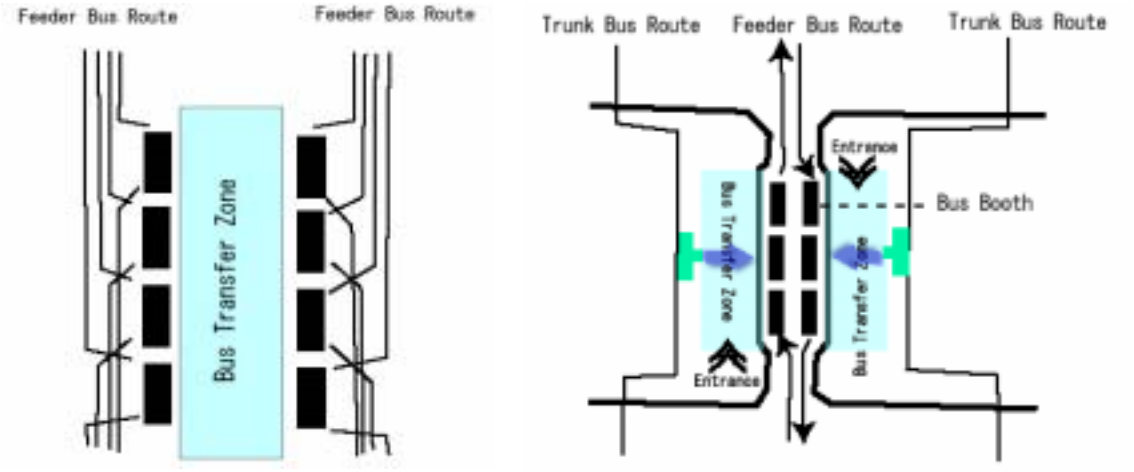
(i) Increase in transport capacity by medium-scale buses (up to around 35 passengers) and large-scale buses (40~65 passengers), preferably air-conditioned.

(ii) The distinct role of trunk bus services and feeder bus services with well designed an inter-modal transfer facilities for passengers should be established. Trunk bus services will be served by large-scale buses for long

distance travel while feeder service will be provided using medium-scale buses or pete-pete mini buses.

(iii) The lanes for each type of vehicle should be clearly separated, particularly the exclusive lanes for pete-pete.

(iv) Connections at terminals should be improved to make a change of bus much easier. An efficient Curitiba-style transfer terminal is suggested to replace the present conventional terminals, as illustrated in the following figure.



<Conventional Style Terminal> <Curitiba-Style Terminal>

Figure 9.39: Diagram of Bus Transfer Terminal (Conventional and Curitiba-style)

A preliminary bus service network in and around Makassar is illustrated in Figure 9.40.

(v) All these modification in bus services should be conducted in a framework of traffic demand management as a policy guideline specialized for .urban transportation improvement.

Figure 9.40: Preliminary Plan of Bus Route Network

(5) Introduction of Traffic Demand Management in Makassar

Since this Study is to formulate a spatial plan for Mamminasata, detailed studies have not been made on the traffic management in Makassar. However, traffic congestion in the city is aggravating, and some measures need to be taken under an integrated policy package for traffic demand management (TDM). Policies reflected in this Study are:

i) Access control by type of vehicle, by road under a legal framework
ii) Town design based on traffic facility
iii) Multiple core town development
iv) Installation of bus exclusive lane (only design of Perintis Road)
v) Improvement of inter-modal facilities (bus terminal)
vi) Bypass, flyover, road network itself
vii) Establishment of new satellite town concept

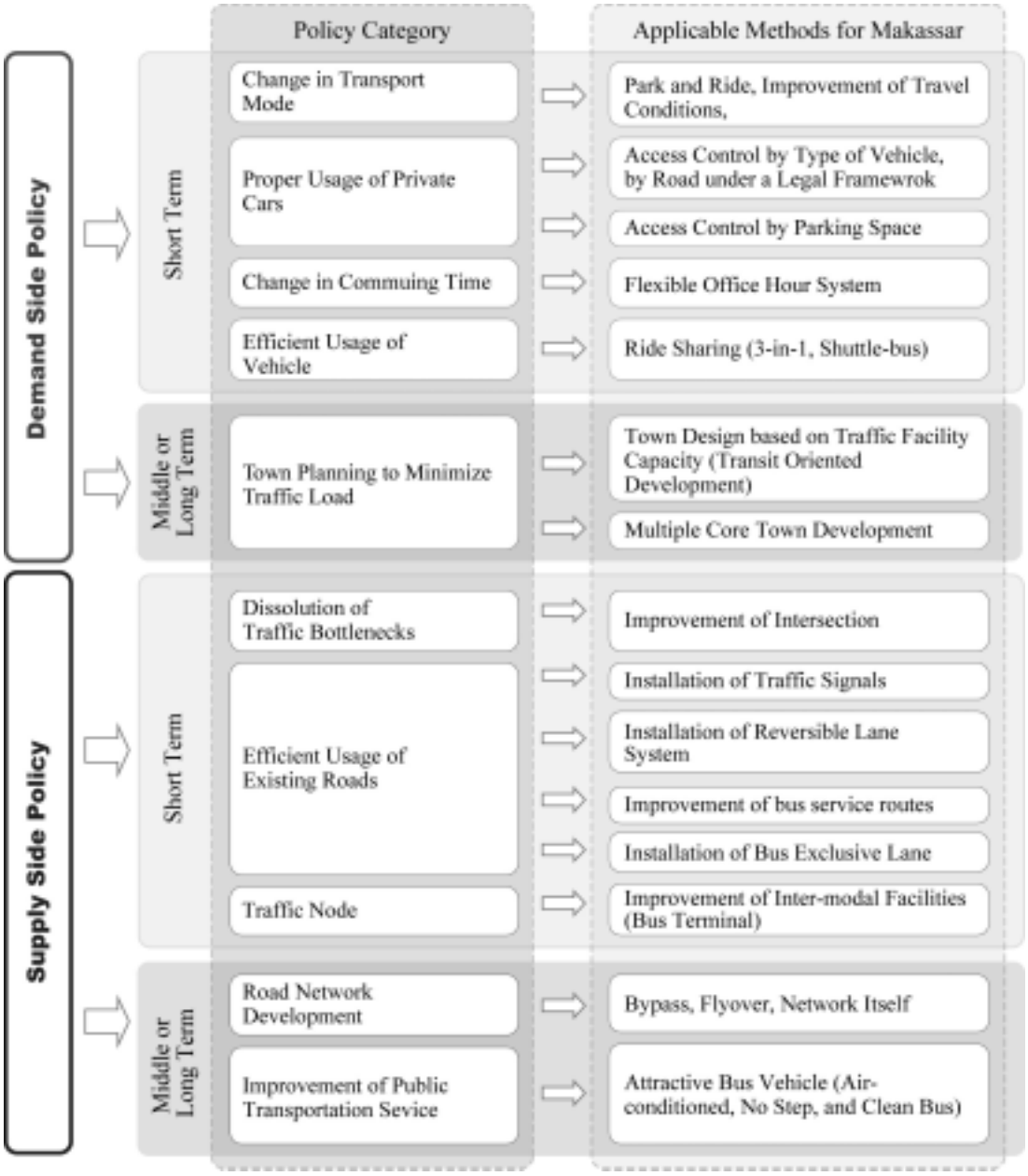


Figure 9.41: Approaches to Traffic Demand Management in Makassar

(6) "Land Readjustment Method" for Acquisition

The proposed road improvement plans will require land acquisition for implementation. In addition to acquisition under the existing laws, it is proposed that "Land Readjustment Method" be introduced for the Mamminasata spatial plan implementation. Such readjustment methods would include property exchanges at equivalent values, incentives for better utilization of lands, some impositions on the change in land value accruable from the road construction and so forth.

(7) New Method of Land Acquisition

It is evident that the land acquisition has been the most stubborn and difficult task for the road development as the case of the Middle Ring Road (Section 1, southern part) has taken to complete more than ten years for land acquisition and is still in progress. Besides an introduction of "Land Readjustment Method", a scheme of private participation-cum-exclusive privilege to develop the land designated by the public authority such as the Government of Regency or the Provincial Government. This scheme can make it possible to develop the road network by the private capital by legally permit to develop new town, for instance, that is planned in this Study, with a population of more than 300,000 up to the year 2020. Similar scheme has been executed in Japan by the private railway companies. This new scheme, so called road development-cum-town development, can assure both of new road construction and town development. This kind of method can be a break-through for further infrastructure development, and thus further study on this scheme is suggested.

(8) Rail and Inland Water Transportation

The existing Mamminasata spatial plan envisaged construction of a railway transportation network in Mamminasata as well as inland navigation along the major rivers. The railway transport and inland navigation, however, are found to be not recommendable for the following reasons:

(i) The railway transport plan envisaged 120 km of rail for metropolitan use and 60 km for inter-regional use. Construction costs of these railways would exceed US$10 billion and they would not be financially viable.

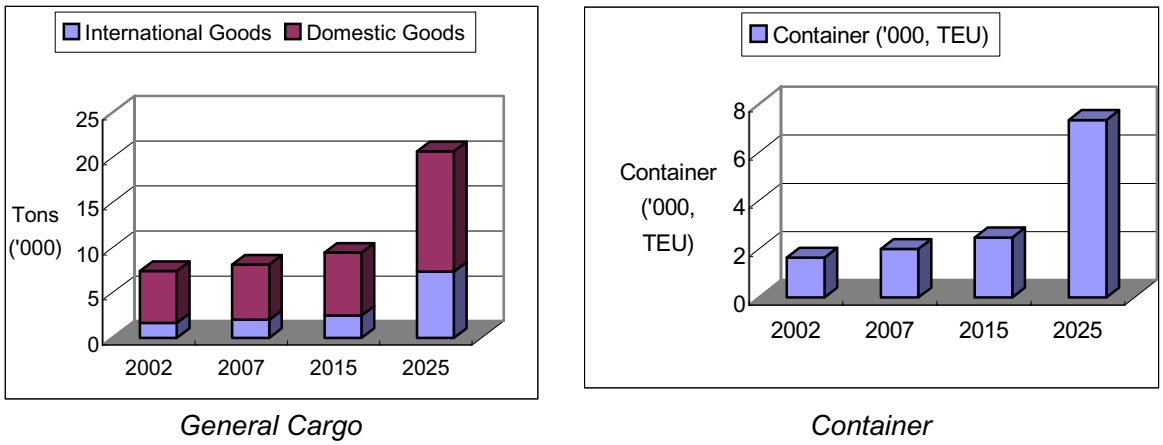
(ii) Land acquisition for railways will be additional to that figure, and such a financial burden will not be affordable for Mamminasata.

(iii) Navigability along the Jenneberang River has been limited by construction of a weir in the downstream reaches for flood control.

(iv) Demand for inland water transport will be limited in volume in the event that the proposed road network is improved (e.g., Perintis road and east-west roads).

4) Seaport Improvement[6]

Makassar port is the largest port in Eastern Indonesia, and its function has substantially changed since completion of the container terminals. It is expected that the port will make Mamminasata a logistical and trade hub in the region. In view of the recent increase in cargo flow, particularly in container cargo, as well as the projection of future traffic as forecast below, there is no reason that Makassar port should not be expanded sometime before 2020.



General Cargo *Container*

Source: Rencana Induk Pelabuhan Makassar, Propinsi Sulawesi Selatan

Figure 9.42: Trend and Forecast of Cargo Flow at Makassar Port

Currently, Makassar port has constraints in meeting the increasing demand. Such constraints include, but are not limited to the following.

(i) Port location blocked by urbanization in all directions on the land side;

(ii) Inconvenient and limited access roads to the port, though substantial improvement has been made with the completion of Jl. Sutami toll road along the coast;

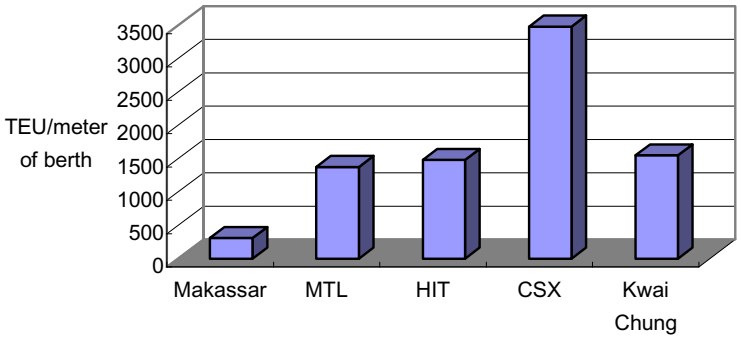
(iii) Only a narrow strip of back-up land exists in the port compound;

(iv) Uncoordinated distribution of port facilities, for example, passenger embarkation/debarkation and general cargo flows cross one another;

(v) Limited water depth in the berthing area (12 m at Hatta Quay, and 9 to 10 m at Soekarno Quay).

In addition to the physical constraints above, the operational deficiency is noticeable. For instance, the current container terminal productivity (around 310 TEU per meter in berth length) is quite low if compared with other modern international ports, like Kwai Chung Container Terminal in Hong Kong (data from 1998), as illustrated in the following.

[6] Refer to Sector Study Report (14) for detail.



Note: HIT includes COSCO HIT

Figure 9.43: Container Terminal Productivity in Makassar and Other Major Ports

At the same time, a number of port users claim that the procedures and documentation for shipments are laborious and often require additional handling charges, making the port management notorious. Continued efforts should be made to improve the operational and managerial issues to provide the best service for development of Mamminasata and Eastern Indonesia.

Currently, the Makassar City Plan and the port expansion plan formulated by Pelindo IV envisage a large expansion of the port complex as shown in the following figure. Pelindo IV is now preparing tender documents for construction of Phase 1 of the expansion to be contracted to a private entity on a BOT basis. Phase 1 will include construction of 1,030 meters of container berthing and 2,090 meters of general cargo berthing, development of warehouses, a hotel, residential buildings, and a marina, on about 57ha of reclaimed land. Pelindo IV expects that the revenues from real estate development will cover the construction cost of the facilities for port expansion.

Source: Pelindo IV

Figure 9.44: Expansion Plan of Makassar Port (Final Stage)

A BOT tender is planned at the end of 2005 based on 100% financing by private investors. But it has not yet executed as of February 2006, and only one foreign port authority visited the site for investigation and has not yet clarified clear intention to participate for tender. This BOT tender, if successful, will determine whether a private enterprise can run the business of a port and real estate development. At this moment, it appears unlikely that a private enterprise would take such large risks in undertaking the real estate business for port construction and management. Such an enterprise would show how profitable the real estate business is at a time when construction of a considerable number of hotels and residential towers is being promoted in the center of Makassar.

Viability of the BOT-based Makassar port expansion should be further examined or the result of the scheduled tender should be awaited to determine the interest of investors in the port and real estate business. It should be noted that the BOT plan is based on the cargo forecast at the master plan level that appears to be adequate for this stage of spatial planning but insufficient to decide the viability of investments.

Pelindo IV explains that the location and layout of the new port expansion has been selected from 11 alternative plans. Although details have not been revealed, it appears that such alternative plans might not have included an option that the existing container terminal would be partly or wholly transferred to private management. As noted previously, improvement in the existing container terminal should be further studied in detail.

With the above situation in view, it is recommended that a feasibility or pre-investment study be made by an independent consultant to clarify in detail the following aspects:

(i) Estimate of cargo traffic volume in enough detail and with enough certainty to be adequate for investment decisions;

(ii) Engineering design and cost estimate in enough detail and with enough certainty to be adequate for investment decisions;

(iii) Study the possibility of joint investment under a public-private partnership (PPP) scheme;

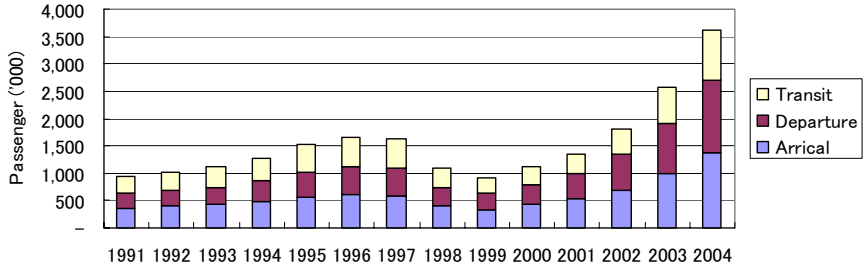
(iv) Execute a financial viability analysis and risk analysis adequate for investment decision making; and

(v) Study and execute the improvement in port management system, including measures for cargo handling capacity improvement and transparency in management.

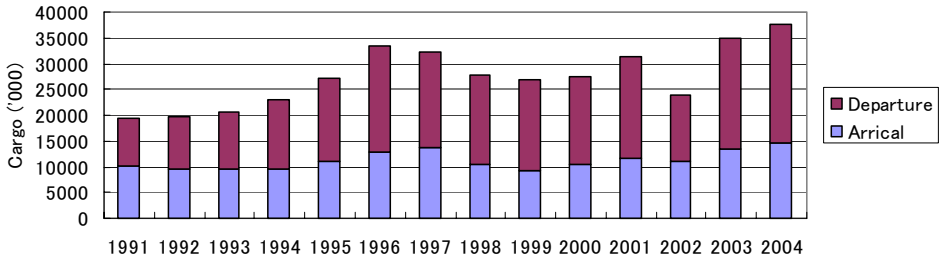
5) Aviation Sector

Currently, the airport has a runway of 2,500 meters in an east-west direction. Expansion of the runway in the same direction is found difficult due to navigational clearance, particularly the mountainous range to the east. No taxi way is provided and apron area is limited. Terminal building is hardly serviceable for passenger and cargo handling.

Currently, the Makassar airport is serving domestic passengers and cargo. There are a total of 650 flights (arrivals + departures) per week, destined for Jakarta (37%), Surabaya (12%), MJenado (8%), Palu (6%) and Ambon (5%). Singapore-based Silk Air and Malaysian Air Service (MAS) had direct flights to Makassar, but they ceased their services (three flights a week) in 2003. The annual passenger and cargo handling volumes are shown in the following figure.



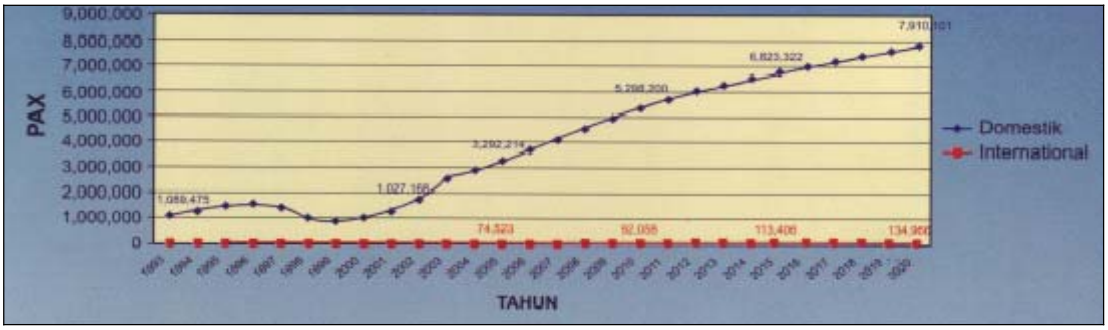
Actual Passenger Volume



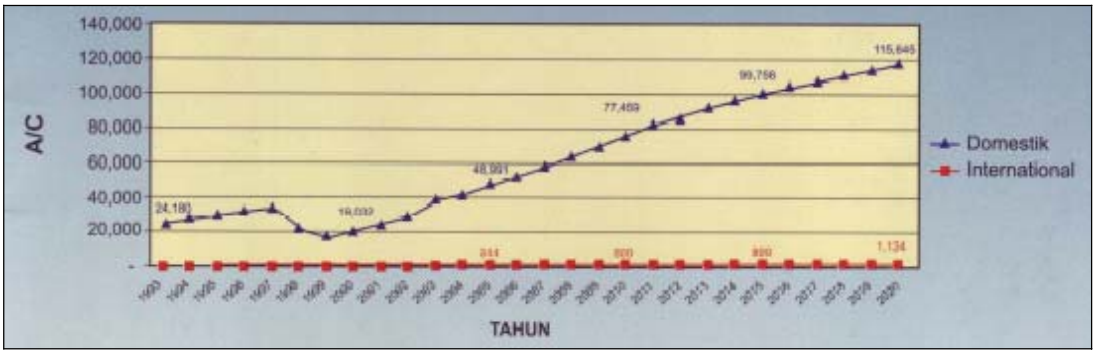
Actual Cargo Handling Volume

Figure 9.45: Annual Traffic at Makassar Airport

The authorities concerned predict that the passenger and cargo traffic will steadily increase at Makassar airport, as shown in the following figure.



Passenger Volume



Air Cargo Handling Volume

Figure 9.46: Demand Forecast for Hasannudin Airport

The above demand forecast may have been based on the trends in the past. Although a report entitled the "Review Study of Makassar Airport Master Plan" was prepared in 2003, details of the forecast are unknown. For the implementation of the new expansion plan, confirmation of such basic data is indispensable, particularly in assessing the financial viability of investments.

A layout of the airport expansion has been drafted as shown in the following figure. The expansion plan includes a new runway (3,100 m x 45 m), taxiway (3,100 m x 23 m), apron for parking 17 aircraft (155,200 ㎡), passenger terminal building (48,500 ㎡) and other facilities. Some improvement works related to the airport expansion are currently being implemented. Nav-aid systems are being improved under French cooperation. A new access road to the airport is being constructed from the junction of Jl. Perintis and Jl. Sutami. A BOT tender for expansion of Jl. Sutami also envisages a toll road connection to the airport terminal area.

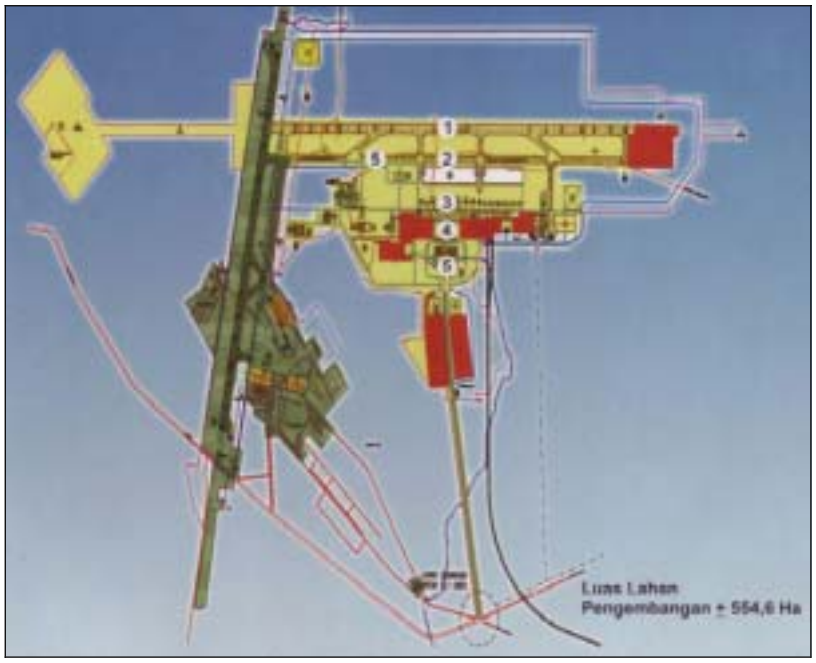


Figure 9.47: Planned Airport Layout at the Final Stage

PT. (Persero) Angkasa Pura I is implementing the expansion works of Makassar airport by its own fund raising, which includes terminal, taxi way, parking space except runway. However, the construction of a 3,100-meter long runway, which would require as investment of over $60 million, is considered less probable.

Again, a possible financial scheme needs to be worked out for the implementation of the expansion at Makassar airport. Further study and discussion is to be made on possible solutions in financing, including a PPP scheme as in the case of the Makassar port expansion. The securing of financial arrangements is a key for realization of such a large investment project.

To realize the Makassar airport expansion, the following issues should be further addressed in parallel with the financial arrangements.[7]

(i) International flight services to the ASEAN capital cities should be encouraged to resume;

(ii) Air space obstacles , including the proposed open stadium to the south of the runway, should be cleared to secure safe approach;

(iii) Noise levels should be assessed as urbanization is in progress in the surrounding area;

(iv) Connection of the airport access road to the planned Mamminasata Bypass road should be studied prior to the construction of the new runway.

(v) A thorough EIA should investigate the environmental impacts, including a simulation of noise levels.

[7] Refer to Sector Study Report (14) for detail.