

### 3.4 Road-related Facility Development

In the implementation of the road network improvements, a tree-planting campaign is to be rolled out by utilizing the road spaces as much as possible. Young plant will be grown in the land acquired for the future road plan. The road side slope or median will be centered by green in order to attain a clean and eco-friendly metropolitan area.

The road facilities to be improved or developed in Mamminasata are as follows;

**Table 3.3: Road Facility Improvement**

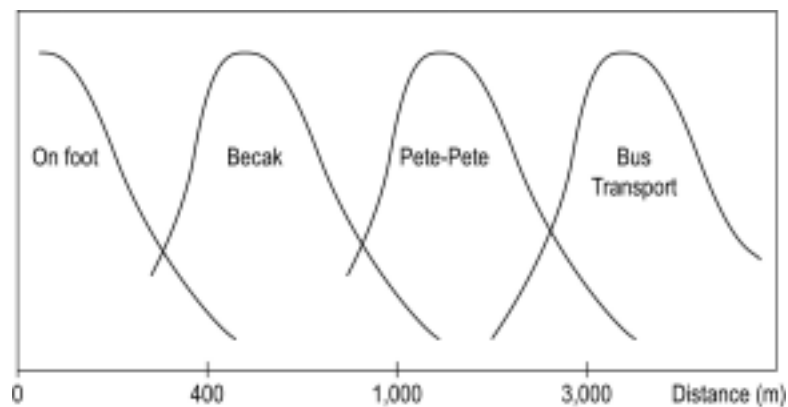
1) Construction of Flyover	<ul style="list-style-type: none"> <li>➤ Urip Sumoharjo x Pettarani</li> <li>➤ Perintis x Kapasa Raya (Daya)</li> <li>➤ Alauddin x Middle Ring Road</li> </ul>
2) Improvement of Intersection	<ul style="list-style-type: none"> <li>➤ Pettarani x Abdullah Daeng Sirua</li> <li>➤ Pettarani x Panakkukang</li> <li>➤ Pettarani x Hertasning</li> </ul>
3) Traffic Signal	<ul style="list-style-type: none"> <li>➤ Integration of Signaling system</li> <li>➤ Distribution of 2 system power line for power failure</li> </ul>
4) Traffic Information System	<ul style="list-style-type: none"> <li>➤ Setting of monitor camera at major intersections</li> <li>➤ Setting of public announcement board for traffic</li> </ul>
5) Road Lighting	<ul style="list-style-type: none"> <li>➤ As it is for the time being, because of lack of total power capacity.</li> </ul>
6) Division of traffic lanes	<ul style="list-style-type: none"> <li>➤ Exclusive lane for public transportation</li> <li>➤ Exclusive lane for motorbike as trial case</li> <li>➤ Setting of Bicycle lane.</li> <li>➤ ( all above first at Perintis, Pettarani and Alauddin)</li> </ul>
7) Improvement of sidewalk	<ul style="list-style-type: none"> <li>➤ Flat sidewalk with carriageway (separated by curbstone) “shall be barrier free”</li> <li>➤ Prohibit of usage of sidewalk by Vender or Shops</li> <li>➤ Side drainage to underground</li> </ul>
8) Parking Lot	<ul style="list-style-type: none"> <li>➤ Development of appropriate parking lot</li> <li>➤ Decreasing of total number of public parking lot at CBD<sup>18</sup></li> </ul>

### 3.5 Improvement in Public Transport System

The Mamminasata metropolitan area is served by large buses or Damri (about 30 vehicles), only for inter-city services, Pete Pete mini-buses (about 7,000), taxis (about 2,000) for both inter-city and intra-city services, and becak for intra-city

<sup>18</sup> Parking lot at CBD shall be decreased to reduce the usage of private car and to increase the usage of public transportation.

service. Each public transportation mode should play its respective role distinguished clearly according to travel distance, as illustrated herein, as their mixed roles and disorderly operation in the urban areas are causing traffic congestions.



**Figure 3.17: Illustrative Roles of Public Transportation Services**

To alleviate severe traffic congestions in the urban area, public transportation should be well managed in Mamminasata with a help of quality improvement of bus service and a definite demarcation of role by mode of transport. In this context, some issues are 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 services 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 encouraged to expand, making cross-boundary trips much easier

#### 1) Bus Transportation

Bus and Pete-Pete service are widely prevailing over the Mamminasata metropolitan area, and they are major transportation means now. Their role is expected to increase in order to avoid further aggravation of traffic congestion on the trunk road and in the urban area. A policy for modal shift from private cars, motorcycles to public transportation should be encouraged in Mamminasata.

(1) Bus industry

Vehicles used for public transportation services are registered as follows. Majority are pete-pete and small bus (capacity is 8 persons).

Damri (large bus):	approximately 30 vehicles
Taxi:	approximately 2,000 vehicles
Pete-pete:	approximately 7,000 vehicles

These buses are operated according to its operation categories:

- Inter city over the provincial boundary
- Inter city service within the province
- City service, village service
- Makassar city service

According to the service area, the Pete-Pete body has a different color (Blue: within Makassar city, Red: Gowa and Takalar, Yellow: Maros).

All these bus companies are under the jurisdiction of Organda: a king of private council of public transportation industry. And this council has a plan to replace pete-pete with medium and/or large buses by 2015. It will, however, require a huge amount of investment for replacement of vehicles that have been owned by individuals.

The longest distance bus (40 seats) service is between Makassar and Pare-Pare, requiring 3 hours at a charge of 15,000 Rp. The number of taxi in operation is higher than the normal break-even point (1 vehicle/1,000 people).

(2) Bus transportation service

Get-on and get-off anywhere use likes: It is convenient for users to get on and off the pete-pete wherever they want. Tropical hot weather makes this feature attractive to passengers since a tolerable walking distance is limited to about 200 ~ 300 meters. This requires frequent services with a short waiting time and as performed by the pete-pete services. If air-conditioned pete-pete can attract more passengers. However, it has a defect to cause traffic congestions by frequent roadside parking.

Services focused on the major roads: The service routes concentrate on the major trunk roads with a relatively wider road such as Jl. Perintis, Jl. Sultan Alaudin, Jl. Veteran Selatan etc., and feeder services are provided by becak. This role-sharing might be functioning well, implying that pete-pete can be replaced by medium-

and/or large-size buses to improve transportation efficiency.

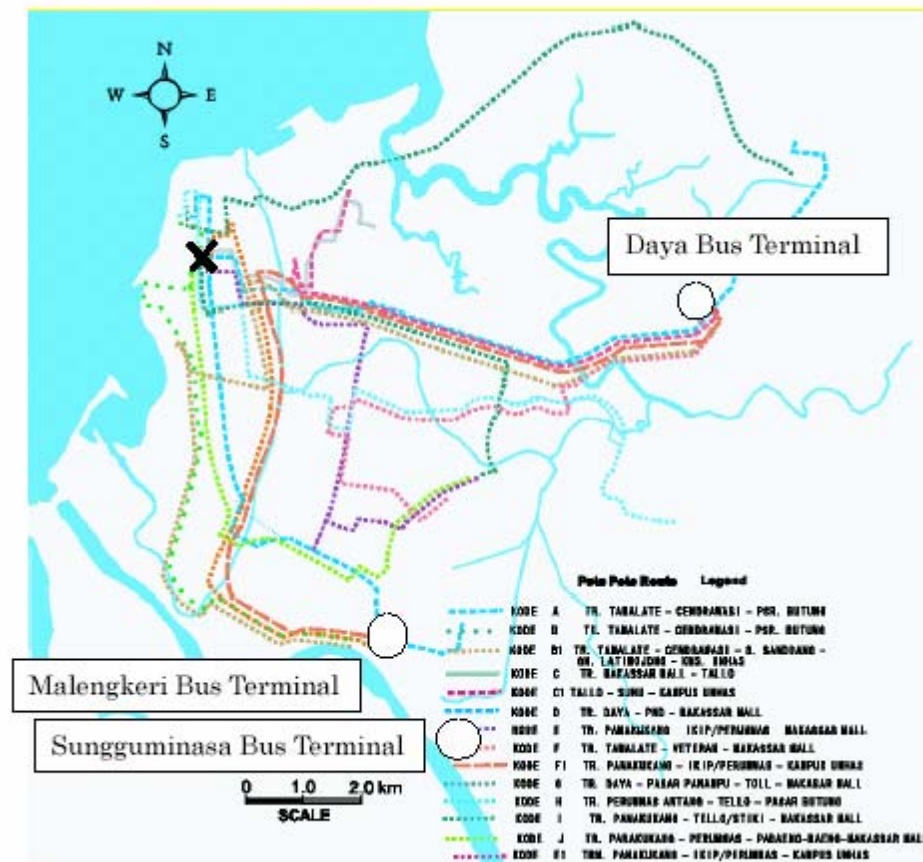


Figure 3.18: Existing Pete-Pete Route and Bus Terminals in Makassar

Arterial network: Pete-pete and bus service network is centered on the central bus terminals near Jl. Gokroaminoto in old Makassar, which is extending to the pete-pete terminals suburb: Daya, Malengkeri, and Sungguminasa, and there is few direct route service between suburb terminals. Location of bus/pete-pete terminal is shown in the above figure.

Bus Terminal Daya (Regional Bus, and Pete Pete)

Bus Terminal Malengeperi (Pete Pete)

Bus Terminal Makassar (Pete Pete, together with Kijang bus)

Service territory designation:

The pete-pete service area is limited within the city boundary, and they have to pay charge if they go beyond the city boundary. This result in an interrupted regional transportation, and passengers have to exchange buses whenever they make inter-city trips that are much more common in Mamminasata.

### (3) Issues on Bus Transportation

Need to modify service routes in future: Pete-pete service network should be modified according to the progress of road network development. Especially the number of inflow routes from Maros to Makassar will be tripled by construction of Trans-Mamminasata Road (a part of Trans-Sulawesi Road) and Mamminasata Bypass (bypass of Makassar central area and Maros), and Middle Ring Road (Section 1) as well as by the widening and extension of access roads: Jl. Abdullah Daeng Sirua and Jl. Hertasing. It will be an issue to be addressed after 2015.

More large buses shall be introduced to raise the transportation capacity of public transportation. Otherwise, small pete-pete vehicles will occupy the road, aggravating the traffic congestion level and requiring longer travel time. Shift into larger-scale bus is indispensable, and the Organda's long term vision to place pete-pete into large buses can be welcomed. This action should start as soon as possible. However, it is necessary to introduce some financial support arrangements for pete-pete owners to purchase new medium-/large-scale air conditioned bus. A loan system will be introduced in due course. It is reported that a similar system was applied when pete-pete was introduced by the vehicle sales company.

Regional bus service over city boundary shall be encouraged to make a trip beyond city boundary easier than now. And regional bus serviced shall be encouraged more, connecting bus/pete-pete terminals in the suburb: Daya, Makengkeri and Sungguminasa directly, or circulation bus route connecting these bus terminals. This contributes to lessen users' in-convenient exchange of buses during one trip to a final destination beyond city boundary. However, this must not increase the

Connectivity efficiency from regional bus to city shall be improved at the bus and/or pete-pete terminal. It is an issue of design and frequency of bus operation. And an introduction of season ticket and/or common ticket system can be an effective measure to relieve uncomfortable mess in the vehicles.

### (4) Necessary Actions for Bus Transportation System Improvement

#### Increase in Transport Capacity

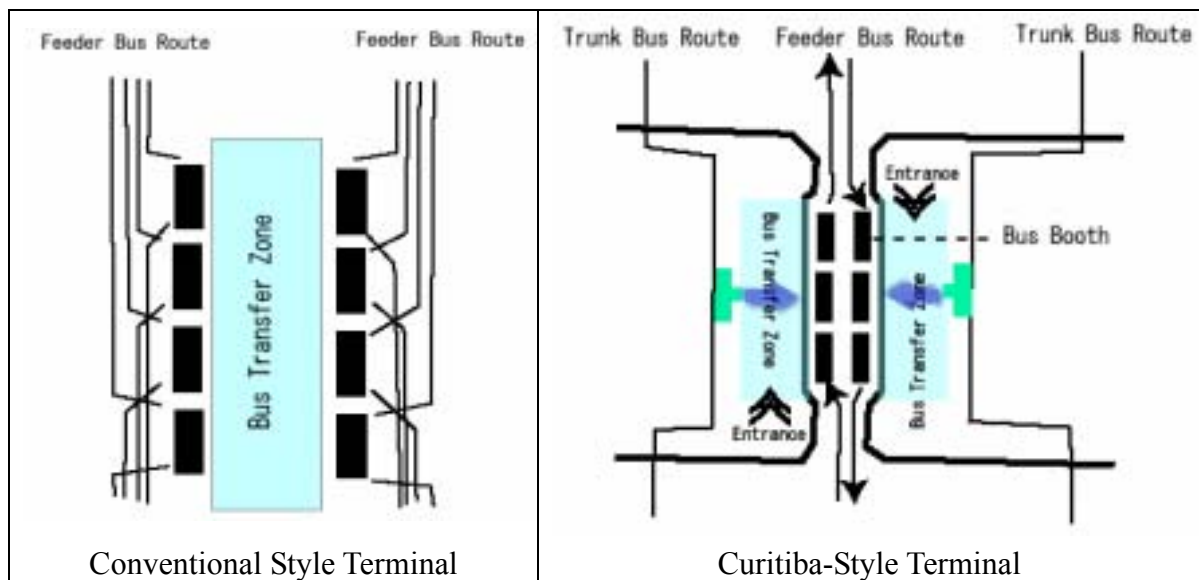
Introduction of medium-large-scale bus cum load system: Passenger capacity of medium bus ranges from 15 to 35 persons per vehicle, and large bus from 40 to 65 passengers, while pete-pete can carry only 8-12 persons. A simple calculation

suggests that the traffic volume of bus might be reduced to one-second (1/2) to one-sixth (1/6), having a great impact on the traffic.

Single bus vehicle can be shifted into two bus vehicles, further expanding the bus transport capacity as experienced in Curitiba, Brazil (total passenger capacity reaches 270 persons). However, the first step applicable in Mamminasata might be an introduction of single medium-large-scale bus vehicle.

#### Connectivity improvement

Improvement in transfer terminal design is necessary, and a good example is found in Curitiba, which is designed to make bus transfer much easier and shorten in transfer time. Conventional and new Curitiba-style transfer terminal are shown in the following figure.



**Figure 3.19: Diagram of Bus Transfer Terminal: Conventional and Curitiba-Style**

Bus lines at the conventional bus terminal, like in Mamminasata, are complicated and cause traffic congestion at the terminal. The passenger flows have to seek for the bus to destinations by themselves and take a longer time. On the contrary, Curitiba-style terminal makes the bus and passenger flows quite simple and efficient, resulting in comfortable transfer. Layout of the present bus terminals in Mamminasata should better be improved in terms of the vehicle and passenger flows.

Another device to improve connectivity is a common ticket system and/or seasonal ticket which can reduce the time to purchase ticket in a crowded vehicle.

### Distinctive Role of trunk bus services and feeder bus services

Trunk bus services should be separated from feeder bus services with a well designed connecting facility for passengers. Trunk bus services can be shared by the large-scale bus for a long distance, while feeder services by small pete-pete or medium scale buses within a short distance. Preliminary bus route networks in the center of Makassar are delineated as shown in the following figure. In this feeder services bus network, circular services are designed and all feeder service buses run one direction to increase traffic capacity, and it is connected with a long distance bus services at the trunk road, as well as with becak services at narrow alley. All circular bus routes are designed to go around a circle within ten to fifteen minutes.



**Figure 3.20: Preliminary Plan of Bus Route Network**

The lanes for each vehicle should be separated, especially exclusive lane for pete-pete as experienced in Jakarta. This makes public transportation much more efficient.

### Further detail study on public transportation system

A preliminary plan has been presented, however, detail study at the feasibility study level should be conducted to prepare appropriate plan for bus transportation route and system. Such a study will include the following.

**Table 3.4: Study Items for New Bus System**

Analysis on effective operation	<ul style="list-style-type: none"> <li>● Formation of appropriate and effective bus routes: Left turn mono loop should be investigated in depth.</li> <li>● Formulation of integrated bus system of feeder, trunk buses</li> <li>● Necessary bus number and operation frequency</li> </ul>
Infrastructure improvement measures	<ul style="list-style-type: none"> <li>● Design and construction of bus bay and transfer terminals</li> </ul>
	Devices to secure high travel speed <ul style="list-style-type: none"> <li>● Exclusive bus lanes</li> </ul>
Comfort improvement devices	<ul style="list-style-type: none"> <li>● Air-condition facility</li> <li>● Cleanness</li> </ul>
Fare of bus	<ul style="list-style-type: none"> <li>● Introduction of common ticket system, and seasonal ticket with discount</li> </ul>
Regulations	<ul style="list-style-type: none"> <li>● Supporting measures by the Government to replace pete-pete with medium and large buses.</li> </ul>

Circular bus system shall be introduced together with traffic control that prevents ordinal car from going into this bus circular service area.

## 2) Rail Transportation

There was a railway in Makassar in the era of the Dutch colony. It was exploded at the time of the independence of Indonesia, and there is no usable heritage remained. The existing Mamminasata spatial plan proposes to construct railway network as shown in the following figure (3.21). The total length is around 60 km as an inter-regional railway and 120 km for metropolitan use. The total construction cost will exceed US\$ 10 billion.

Railway is a comprehensive system and it needs complicated preparation procedures, as shown in the following figure (3.22), if new system is to be established. Consequently, the railway system appears to be difficult in realization at this stage.

Land acquisition for the railway construction is not suggested, since its amount exceeds the investment that the government can afford. It is more useful to construct other urban infrastructure such as sewerage, solid waste disposal, and invest such a capital for improvement in the environment to create a clean metropolitan area of Mamminasata.





Figure 3.21: Rail Network Envisaged by Previous Plan

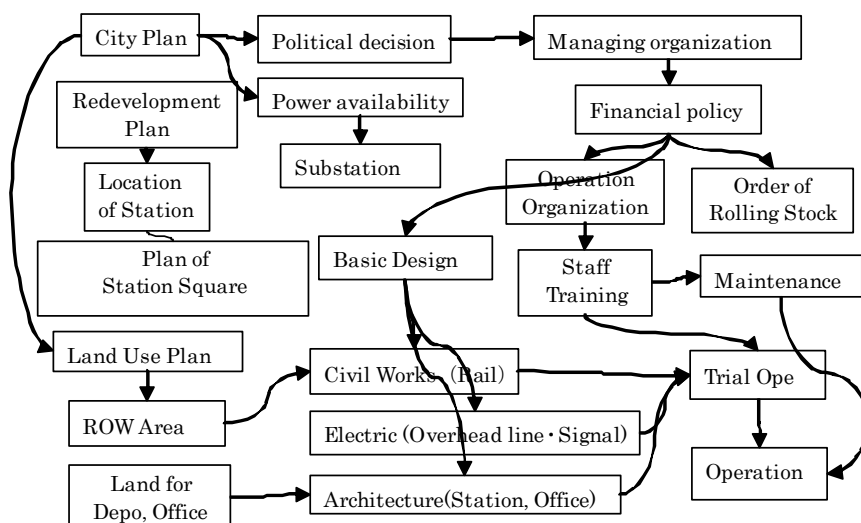


Figure 3.22: Works Flow for Rail Network Improvement

### 3) Inland Water Transportation

Inland waterway is serviceable as a punctual and cheap transportation mode in town such as Bangkok, where the canal network is well developed in the center of the city and when the road congestion was in a critical condition, thus inland waterway can attract passengers from road users. However, the condition of

Makassar is quite different from that of Bangkok. Navigation along two major rivers in Mamminasata is under the following conditions.

#### The Jeneberang River

- There is a rubber dam, making boat navigation impossible.
- Tanjung Bunga Road along the Jeneberang River is planned to serve more effectively for the traffic demand than inland waterway services since it serves door-to-door, and requires no waiting time.
- Inland waterway requires transportation from to and from the ferry wharf, thus requiring more transportation charges than bus and/or car. There is no attractiveness to convert passengers from the road transport.

#### The Tallo River

- Perintis road will be improved to have enough capacity to transport normal commuters by car and bus.
- The traffic demand generated along the river to its estuary is marginal according to the traffic simulation results.
- The Tallo River curves widely and a navigation time will make it less attractive.
- Inland water transportation will be higher in cost than bus transportation.
- It is judged that inland water transport is not an efficient mode of transport in Mamminasata.

### **3.6 Land Re-adjustment**

#### 1) Public and Private Initiative

Infrastructure development, including the road network construction, needs huge amount of investments. While the government suffers from the shortage in budget, the private sector is developing the suburban area into new settlements without appropriate infrastructure. Even though the people claim for the government to provide adequate infrastructure, the required land is occupied by the residents and high costs are needed to acquire.

The government is promoting BOT scheme due to the lack of fund, idea and wisdom. It is afraid that all arterial roads would become toll roads in future.

## 2) Land Acquisition under Established Law

In Mamminasata there remain a lot of spaces along the road side. It appears that the people is prohibited under the regulation to construct houses or buildings without defined spaces in front of new constructed building. This is a good procedure to ensure the land for social use.

When a new road is constructed, the area along the road will develop, and land prices will increase. If the landowner sells land, s/he can get a big profit. This is called the “windfall profit”. Part of the windfall profit should be returned to public as a tax. Currently, however, the land along the planned road is subject to land speculation. Any profit obtained through land transportation should be checked through sever inspection by the tax office, and the collected tax shall be returned to the road construction. The government can recover the road construction cost, if such procedures are well controlled<sup>19</sup>. When a land owner cooperates to the government by providing his/her, s/he will be exempted from the high tax. The land owner living along the new road will be protected, if he or his children will continue the same land use, such as agriculture.

The following diagram shows the procedure to return the windfall profit to the public. This regulation will be applied to the land of about 100m width from the edge of the road boundary (from ROW).

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<sup>19</sup> Sample Calculation 1

The land value before the road has not developed: Rp. 10,000-/m<sup>2</sup>

The land value after the road has developed: Rp 1,000,000-/m<sup>2</sup>

The windfall profit is 990,000-/m<sup>2</sup> and 990,000 x200=198,000,000-/m (100m for both side)

If the tax is 50% of the profit, the return is 99,000,000-/m

The road construction cost is Rp 1,000,000/m<sup>2</sup>x40m=40,000,000-/m

This is enough return for the road construction and land acquisition.

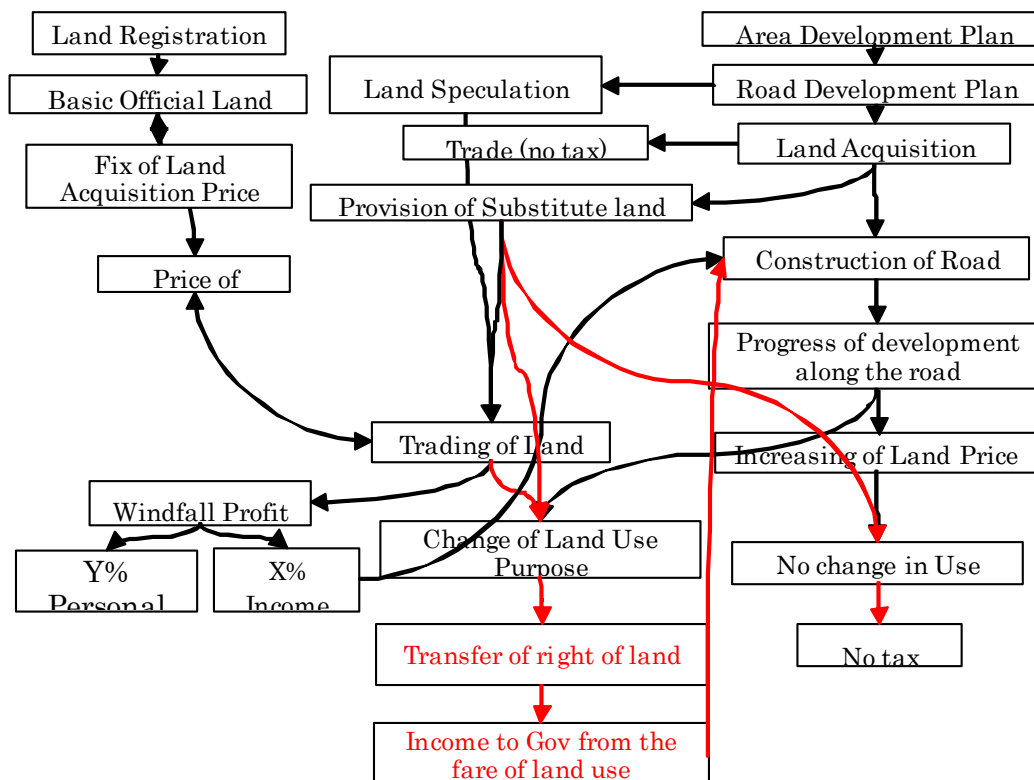


Figure 3.23: Mechanism of Land Re-adjustment

Another method is to divide the land value into two kinds (shown in red line on the above figure). One is the value of land itself, and the other is the value for land usage. If a land owner is changed, or purpose of the land usage is changed, the right of land use will be transferred to the government automatically. This method is more effective to ensure the road maintenance cost by annual land use fee<sup>20</sup>. However, the restriction of land use will be done against the intension of owner, and it would cause some restraints for development along the road.

On the execution of Land Acquisition, two items shall be well considered. Establishment of Right: Right of Way shall be established in early stage with the announcement of spatial master plan.

In the process of land acquire, a priority shall be attached for the sections where require long construction period. Generally the land acquisition and resettlement of the residence will be conducted under the following procedures:

<sup>20</sup> Sample Calculation 2

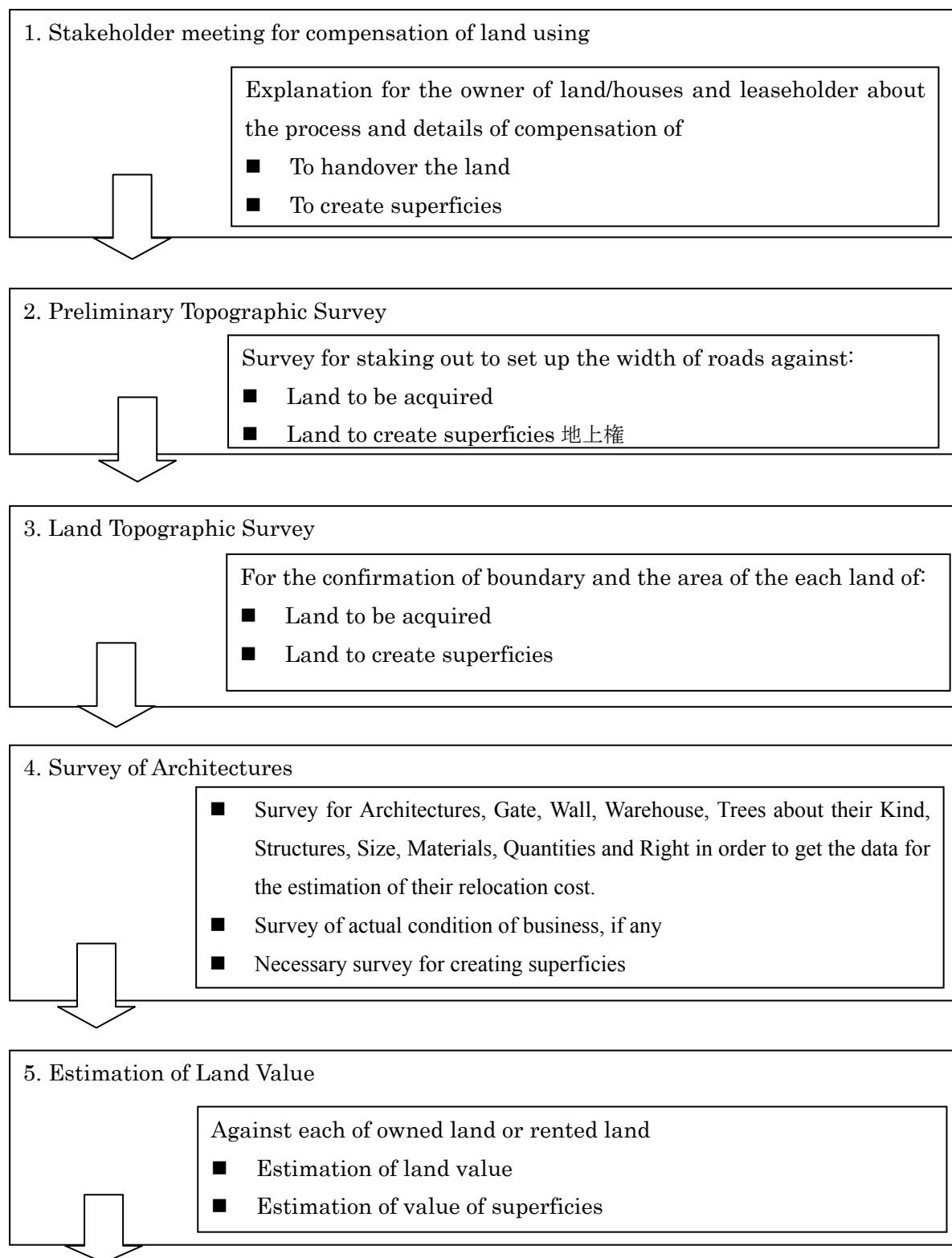
If the land value cost is half of the total cost. Rp 500,000-/m<sup>2</sup>

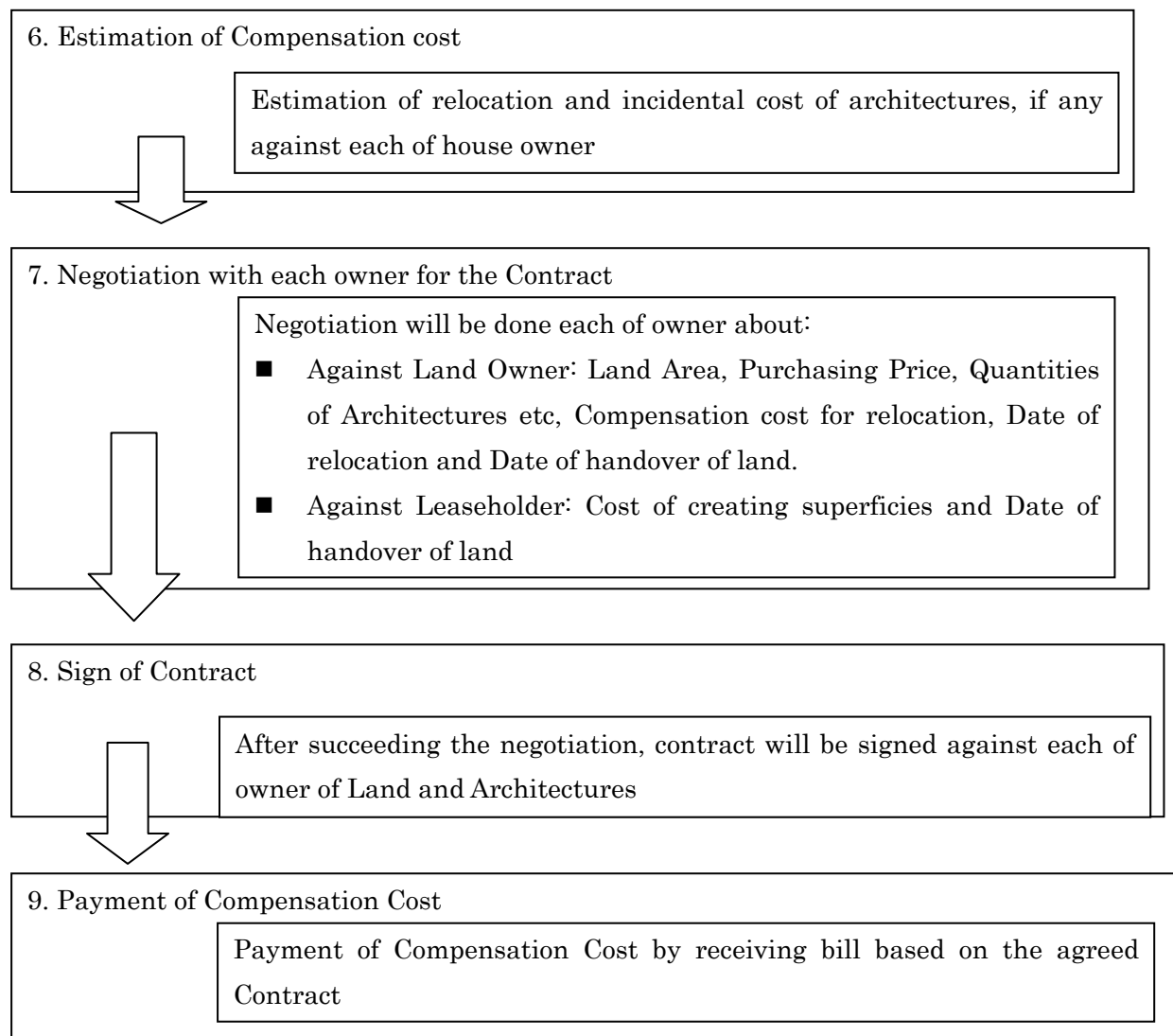
The annual value of land usage is assumed to be 5% of the value; Rp 25,000-/m<sup>2</sup>/year

The government could get the tax by 50% of profit; 2-45,000-/m x 200m=45,000,000-/m

The annual income is 25,000-/m x 200m= 5,000,000-/m

### Diagram of Land Acquisition Procedure

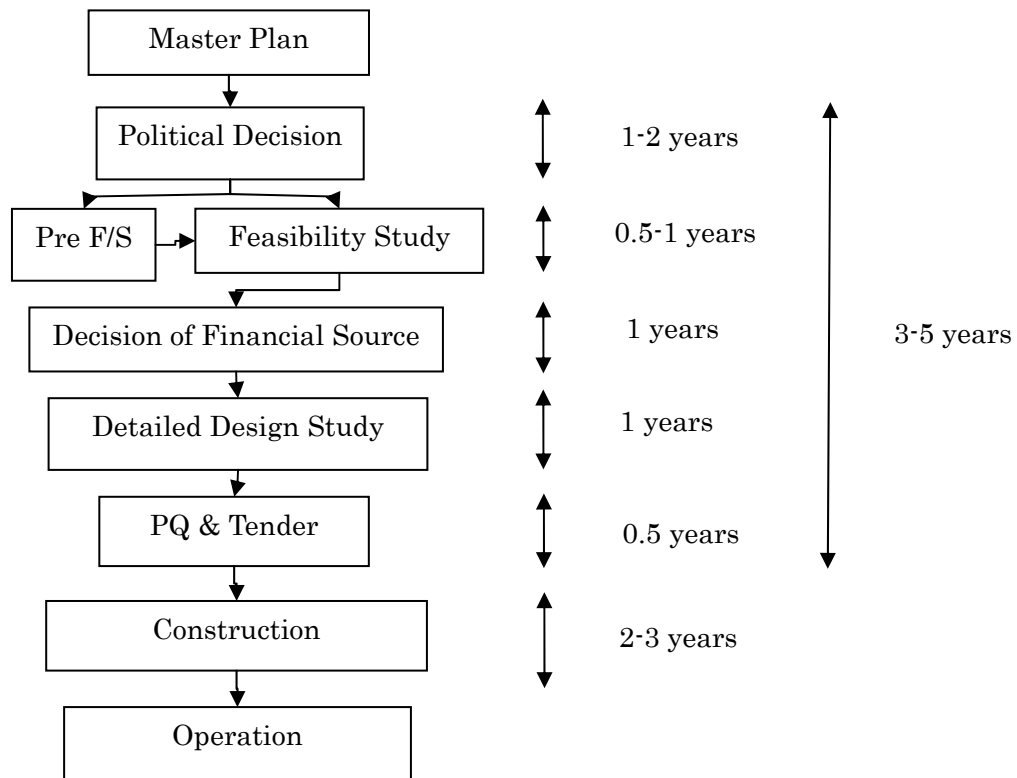




## 4. ACTION PROGRAM

### 4.1 Overall Implementation Program

The road construction/improvement works, in general, are implemented in the following manner.



**Figure 4.1: Flow of Road Work Implementation**

The first road project to be implemented in Mamminasata will be Sutami road widening under the BOT scheme. It will be followed by the improvement in Jl. Perintis for completion by 2010.

The road widening along the following roads should be prioritized.

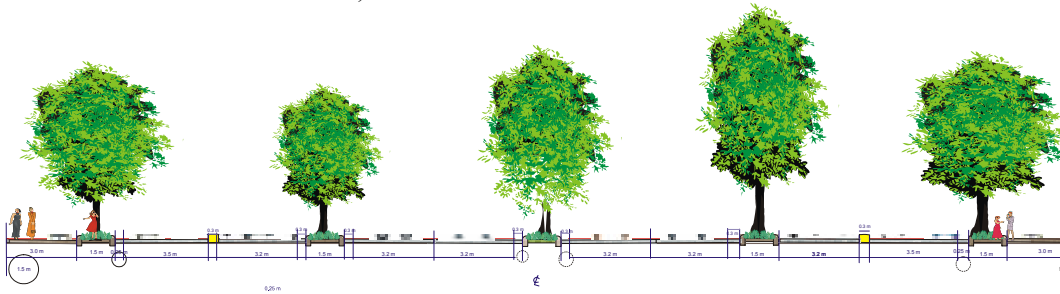
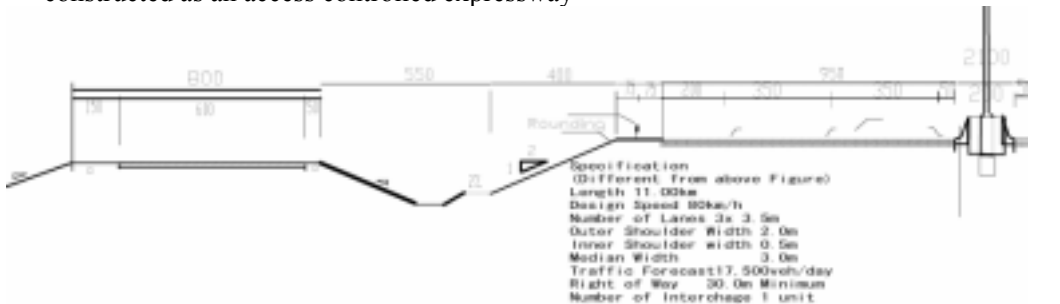
- (1) Alauddin road (from Pettarani to Sungguminasa)
- (2) Hertasning road extension
- (3) Malino road (from Sungguminasa to Malino direction)
- (4) Takalar access road (from Sungguminasa to Takalar direction)

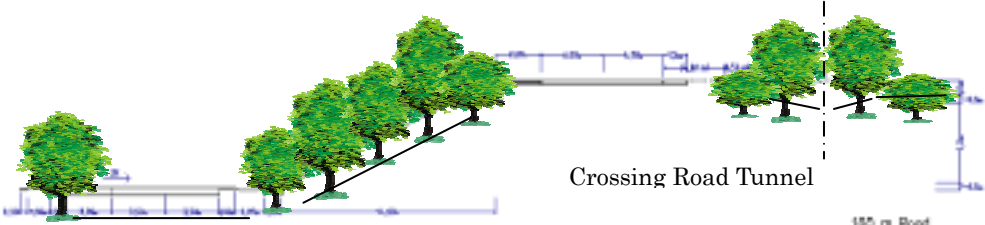
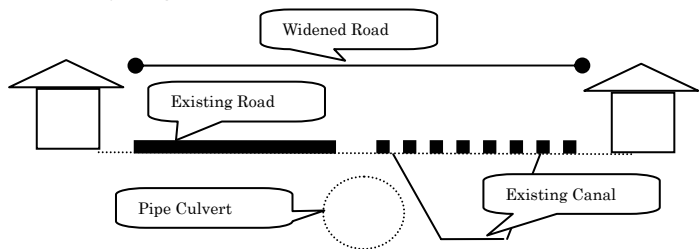
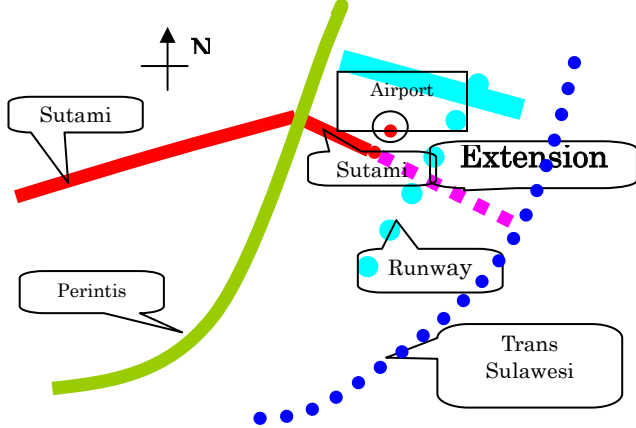
These road improvements should be conducted urgently within coming 5 years. The following figure shows a tentative schedule for improvement of road networks proposed in this Study, on the assumption that the traffic volume would increase as estimated in the traffic demand analysis and without any political restriction. The roads improvement after 2010 should be decided in the light of industrial and


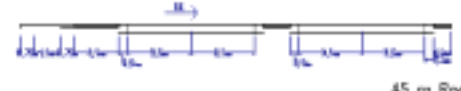




Outline of the priority road improvement works are presented in the following.

	Status & Planned Width	Brief description (Here: L/A means the ratio of completed land acquisition estimated by JICA team)
1	Existing Rd W:42m L:12+4km L/A>90%	Perintis is the most important road in the region. Both sides are already developed for residential and institutional use. (4 lane elevated express way may be constructed on the central divider in the future.) 
2	Existing, but as new road BOT W:70m L:11km L/A:>90%	Sutami is running through low land. Some developments for industrial use. 6-8 lanes would be enough for the region. But as this route may work as a bypass of route 1 and one of the most important trunk line in South Sulawesi, the central part of route 2 should be constructed as an access controlled expressway  <p>Specification (Different From above Figure) Length 11.00km Design Speed 90km/h Number of Lanes 3x3 Sm Outer Shoulder width 2.0m Inner Shoulder width 0.5m Median Width 3.0m Traffic Forecast 17,500veh/day Right of Way 50.0m Minimum Number of Interchange 1 unit (Source: RAPPADA PROVINCE)</p>
3	Existing W:40m L:5km L/A:>90%	Widening of Allaudding (from PettaRani to Sungguminasa) is one of the most congested road connecting Makassar and Sungguminasa, and urgent road to be widened and improved. Almost land acquisition is finished.
4	Existing W:30m L:9km	Improvement of existing Malino access highway (from Sungguminasa to Malino direction) shall be conducted to east together with route 14.
5	New, BOT W:40m L:8km L/A>70%	A part of "Middle Ring Road" as suggested by JICA study 89 as an important inland development road. South section is assumed to start in 2007. However the north section is not recommendable to remain the sanctuary for aquatic life. This road is desirable to connect with route 10 to down town. Then this route may be a good example to implement a land readjustment project.
6	Existing W:40m,L:5km L/A>90%	Jl. Kapasa Raya is center road of KIMA industrial area and has a function of service road to the seaport. It shall be improved in early stage considering the current status.
7	New W:20m L:6km	Tanjung Bunga Access is a riverside highway connecting Gowa and GMTC. It will contribute to avoid the traffic jam in the center of Makassar city through Rd Metro Tanjung Bunga.. It is expected to start before the alignment is occupied as the settlement area.

8	Existing W:25m L:27km	<p>Takalar access is on going project section by section from Sungguminasa to Takalar direction. Widening of 4km section has finished and further widening to the south is under planning. Route 13 will work as a bypass of this existing road.</p> <p>Expected construction schedule by JICA Study Team 2005 is as follows at latest;</p> <table border="1" data-bbox="411 416 1425 562"> <tr> <td></td> <td>- 2005</td> <td>-2010</td> <td></td> <td>-2015</td> </tr> <tr> <td>Section Name</td> <td>T1</td> <td>T2 (6km)</td> <td>T3 (10km)</td> <td>T4 (7km)</td> </tr> <tr> <td>Accumulate length</td> <td>4km</td> <td>10km</td> <td>20km</td> <td>21km</td> </tr> </table>		- 2005	-2010		-2015	Section Name	T1	T2 (6km)	T3 (10km)	T4 (7km)	Accumulate length	4km	10km	20km	21km
	- 2005	-2010		-2015													
Section Name	T1	T2 (6km)	T3 (10km)	T4 (7km)													
Accumulate length	4km	10km	20km	21km													
9	New W:100m L:30+10km (10km is Southside of Jeneberang.)	<p>An alternative of outer ring, so called "Mamminasa Bypass". It is expected to acquire the right of way while land price is cheap for ensuring smooth future road development. Maminasa Bypass will be 20 years project. It may start from the construction of frontage road. Track terminals are expected to be constructed along this road. (Chapter 5-5-2)</p> 															
10	Improvement New W:35m L:15km L/A>50%	<p>Abdullah Daeng Sirua will be an important route to the east. This is an urgent development road. This may be also expected to improve the environment of the water supply canal to purification plant by replacing the river by under ground structure. The water canal improvement is expected start in early stage</p> 															
11	existing W:20m: 10km	<p>Improvement of two of service roads for the area around the airport. It shall be improved according to the development.</p>															
12	new W:40m: L:18km L/A:>50%	<p>Airport Access. First stage is expected to be conducted by Sutami BOT. It is desirable to extend the road beyond the airport terminal area considering the further utilization of total road network system.</p> <p>Second stage shall be with new runway construction. It shall be by underpass for the new planned runway.</p> <p>Tunnel construction is a urgent matters of new runway. which are now on going.</p> 															

13	<p>New</p> <p>W:90m 30+5+20km</p> <p>(30km: Northern part of Middle Ring Road</p> <p>5+20km: Southern part of Jeneberang River)</p>	<p>Trans-Sulawesi expressway is important route to connect Makassar and central Sulawesi. Expressway and railway can be contained in the right of way. Large new town projects can be implemented along the route. It will be a long span project of more than 20 years . It may start first from frontage road.</p> 
14	<p>New</p> <p>W:25m 14+7km</p>	<p>Heltasing route is now under developing by the local budget and should be constructed together with new satellite town projects. This will assist the function of route 4.</p>
15	<p>New</p> <p>W:40m L:13km</p>	<p>Access route from a Satellite town to Port through KIWA. This route works as seaport access and develop industrial parks along the road in GOWA.</p> 
16	<p>Existing</p> <p>W:15m L:15km</p>	<p>A few of existing roads shall be improved for the mitigation of future traffic jam around Sungguminasa.</p>

## 4.2 Recommendation for Implementation

### 1) Perintis Road

Traffic volume on the Perintis Road is expected to exceed its road capacity, while the Sutami Road will face an over-capacity in traffic, as predicted in the traffic demand forecast. The trunk road that divide into two: Sutami Road and Perintis Road, should be made available to connect Makassar and Mamminasata with northern area and the airport.

By 2010, it is expected in the traffic forecast that the volume-capacity ratio (VCR) exceeds 2.0 i.e. two time higher than the road capacity, resulting in heavy traffic jam in Makassar. This situation will be aggravated by a dynamic progress in urbanization in surrounding areas as well as by the airport expansion. This road expansion to 8 lanes, therefore, has been attached with the highest priority.

2) Trans-Sulawesi Road and Mamminasa Bypass

Sulawesi Island has no truck road to connect the regional towns with Makassar. The existing road is 2-lanes and is under the poor road surface conditions. Transport demand of mining and local industry is expected to increase as predicted in the traffic demand forecast.

This Trans-Sulawesi Road and Mamminasa Bypass can function as a trunk road to link with industrial estates and new towns with the population of more than 300,000. In view of the progress of urbanization along the planned road, a study should be commenced as soon as possible, along with the land acquisition. The study on this road will be accorded with the second priority under this Master Plan Study.

3) Jl . Abdullah Daeng Sirua and Jl. Hertasning

These roads will connect the city center with Mamminasa Bypass that run through the eastern part of Mamminasata where dynamic urbanization is expected. They would function to ease the traffic jam in the city center by providing east-west axle roads, since there is only one east-west axle road at present. They will also function as arterial roads from the center of Makassar city to the new industrial estates and new towns planned under this Master Plan.

Jl. Abdullah Daeng Sirua is a road along the water canal (Lekopancing River). Garbage is thrown into this canal. The canal is used for swimming by children. It is not desirable to serve as a source of drinking water. Laying the canal underground will keep the water less polluted and the surface ground of the pipe culvert will be utilized as the road space of 30 m – 50 m in width. Expected timing of construction of this road is scheduled as follows.

	-2010	-2015	-2020
Water Pipe Work	(4km)		
Road Work	-	(8km)	(7km)



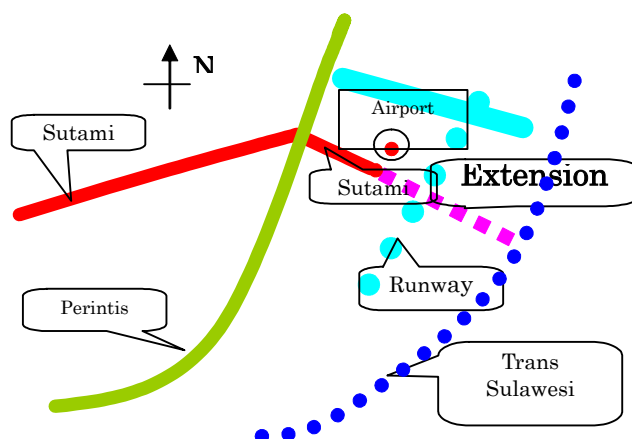


Figure 4.4: Planned Routes near Hasanuddin Airport

### 4.3 Environmental Measures

Road construction is often said to be an example of environmental destruction. However, in the study on Mamminasata spatial plan, the road construction is expected to be a measure to contribute to the environmental betterment and creation of a clean metropolitan area. Tree planting is one of the most realizable measures in the implementation of the road improvements.

The center median, sidewalks, side slopes and all available area of the roads will be utilized for the green movement, though there are some disadvantages on planting trees along the road. Such disadvantages as listed below could however be solved by means of good maintenance works.

- (i) Not easy to use the sidewalk and access buildings on the road side.
- (ii) Decrease in sight distance.
- (iii) Indistinguishable road signals and reduce the intensity of road lighting.
- (iv) It takes about 10 years until the trees become big enough, and maintenance work is requested during that period.

