## 1.3 On-going Projects

The road development plan in the Mamminasata spatial plan suggests various road projects. The projects actually under the implementation are listed as shown in the following figure. They include:.

- Takalar Access (Jl. Poros Takalar)
- Jl. Hertasning
- Jl. Ir. Sutami
- Jl. Perintis Kemerdekaan and Jl. Urip Sumoharjo
- Middle Ring Road

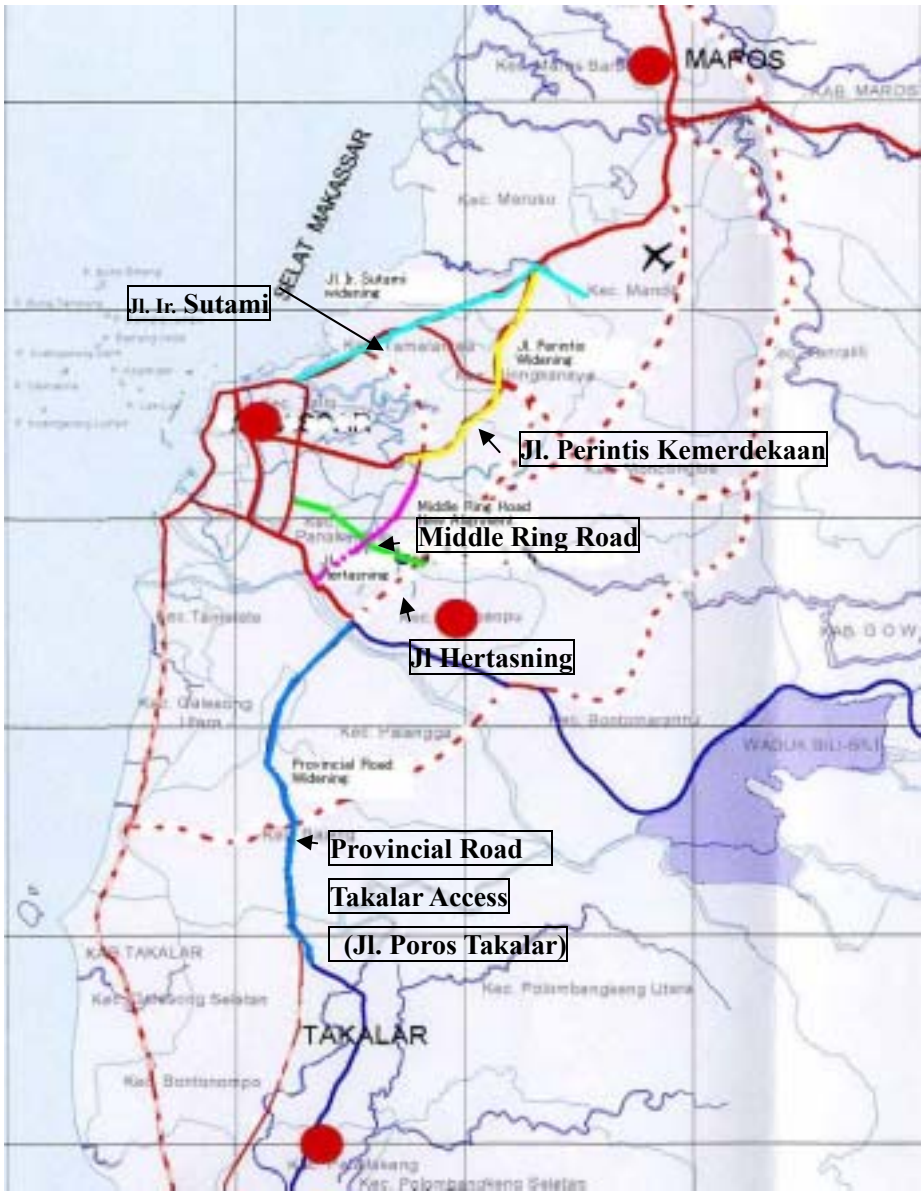


**Figure 1.9: Actual On-going Projects in 2005**

1) Takalar Access (Jl. Poros Takalar)

This road is a provincial collector road of 27 km in length. Provincial government is widening the section between Sungguminasa and Takalar into 4 lanes, and 4 km has been completed as of October 2005. ROW is ensured at almost all the sections of alignment. Traffic demand forecast shows that this will be one of the most important trunk roads, and an annual widening plan should be implemented at the earliest with proper financial arrangements.[6]

2) Jl. Hertasning

This is a radial road to the east of Makassar, starting from Jl. Pettarani. Extension is now on-going to Samata. It is scheduled to pave 3.8 km in 2005 (Rp 4.3 billion in budget). The land acquisition has been completed for about 7 km in length up to Samata. Although the road width is just 25m, this route is most practical for the busy city area. Further Extension is expected up to Malino road as a "radial road" in Mamminasata up to around 2020.

3) Jl. Ir. Sutami

This is a coastal route from Makassar City to the northern district running through the warehouse and factory area. Although the ROW of around 70 m has been ensured in most sections, the existing lane number is only 2 and the surface condition remains is poor. The traffic is always congested by heavy cargo trucks.

This road will be developed as a BOT toll road from the Tallo river bridge to the new airport terminal building (approximately 11 km in total length) including the widening of the bridge over Tallo river[7] that is under control of the central government. The construction period is scheduled for 1.5 years and expected to open in May of 2007[8].

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6 Expected construction schedule by JICA Study Team 2005 is as follows at latest;

| | - 2005 | -2010 | | -2015 |
|---|---|---|---|---|
| Section Name | T1 | T2 (6 km) | T3 (10 km) | T4 (7 km) |
| Accumulate length | 4 km | 10 km | 20 km | 2 1km |

7 Tallo River Bridge is 60 m length and 9.4 m width designed by central government. This means that the number of traffic lanes of this bridge is only two and total lane number for both directions will be 4 even if the existing old bridge is used. Its width does not corespond with the design of toll road section, and it is apparent that this bridge will be a bottleneck and result in traffic jam at this bridge.

8 Tendering of BOT was conducted on Aug 10, 2005 though the pre-qualification process.

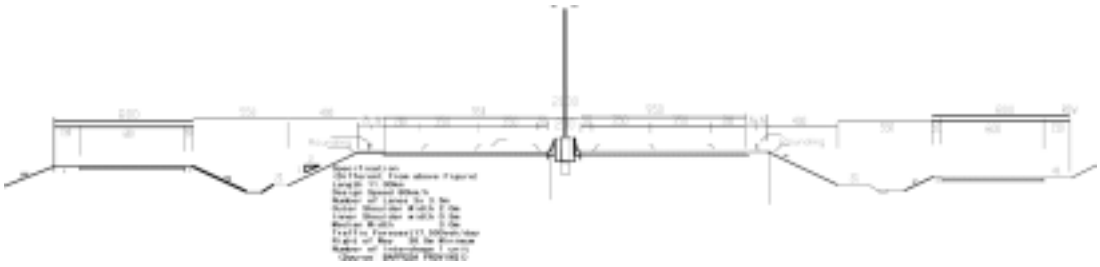


**Figure 1.10: Planned Cross Section of Jl. Ir. Sutami**

4) Jl. Perintis Kemerdekaan and Jl. Urip Sumoharjo

This is the most important access route from the airport to Makassar City (W=42m, L=12km). Although the ROW has been ensured for 42m in width, the exiting road is served with 4-6 lane as shown in Figure 12 (Upper). There are universities and offices on both sides of this road, and the road is one of the busiest streets with many "blue mini bus" called "Pete Pete" as a major public transportation mean.

The local government responsible for financial arrangement to the central government to widen this road to 8 lane (April of 2005). The estimated construction cost is Rp. 79 billion.

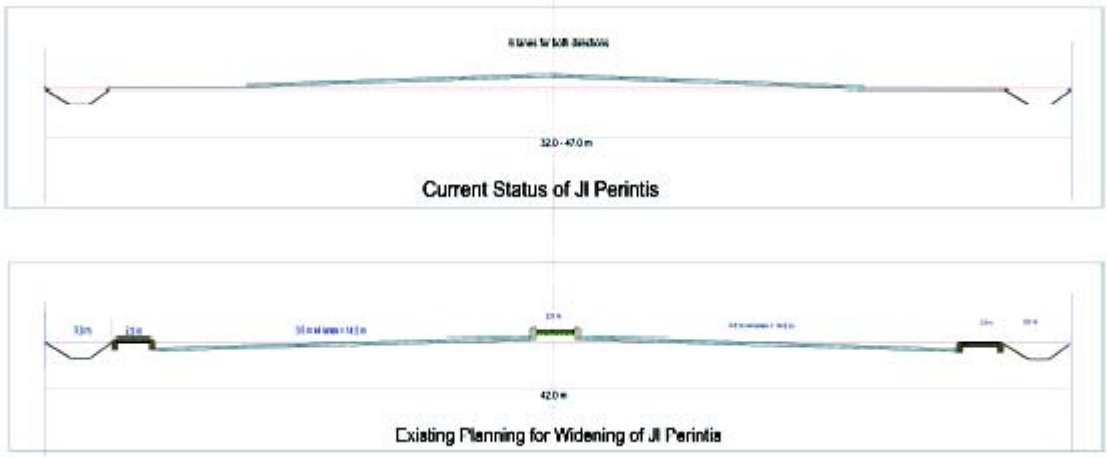



**Figure 1.11: Planned Cross Section of Perintis Road**

5) Middle Ring Road

The Middle Ring Road was proposed by the JICA Study 1989, and right-of-way (ROW) was staked out along the alignment.

- Layout: L=12. 92km W=42m、4 Bridges + 1 box culvert
- Estimated cost: Rp. 250-300 Billion.

For the implementation of this road under the "Build-Operation-Transfer (BOT)"

scheme, a new company was established by a consortium named "Regional Company of Bangun Sarana Makassar" formed by Makassar Government and PT. Karsa Buana Santika (JKT) in January, 2005. Its capital is Rp. 31.37 billion with Makassar City contributing 51% of equity in the form of land and PT. Karsa Buana Santika investing Rp. 15.37 billion (49% of equity) for implementation in three stages. Land acquisition is now under progress on the southern side of Jl. Perintis (Section 1, between Jl Alauddin and Jl. Perintis). However, the land acquisition on the northern side of Perintis Road (Section 2, the estuary area of the Tallo River) is not yet started.[9].

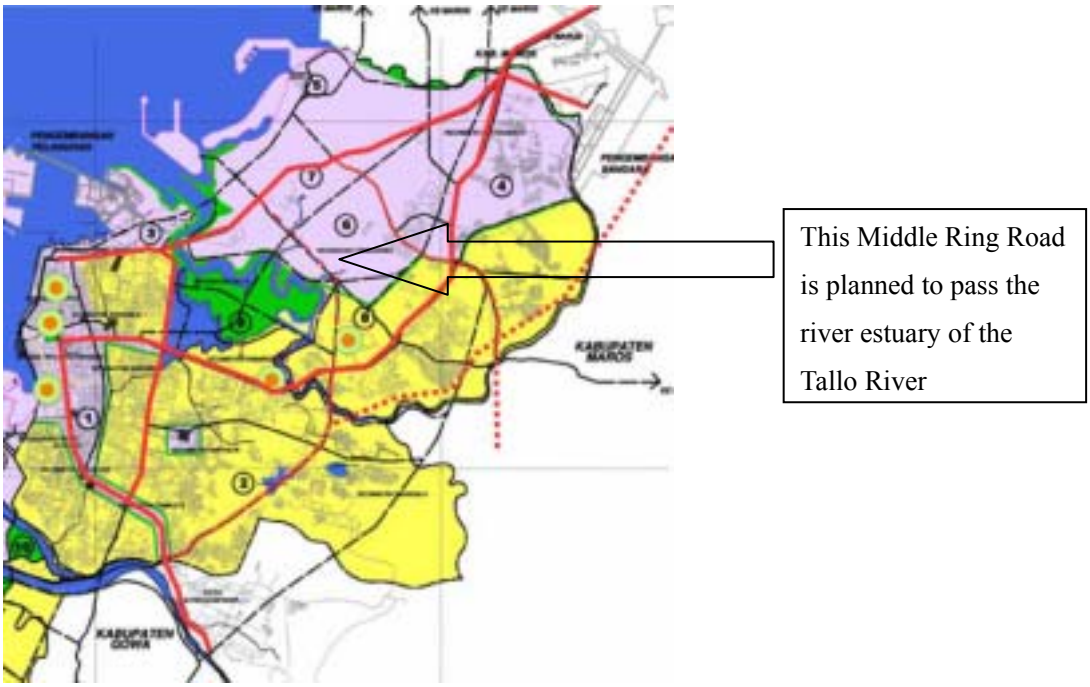



**Figure 1.12: Location of the Projects**

An environmental impact assessment (EIA) was conducted for the Middle Ring Road by the Hasanuddin University, 2002. However, it is effective only for case that this road is constructed as a freeway, and not for a toll road. Further, the EIA was conducted without the road construction design and it appears that further assessment is required on the impacts of large embankment works needed in the alluvial foundation.

[9] Source: the land acquisition drawing from the Makassar City.

# 2. ROAD SECTOR ISSUES

This Study aims at formulating a road network in the Mamminasata metropolitan area the under new social and economic conditions. Major tasks are summarized in the following table. The existing road network plans are reviewed in the light of the present road traffic and on-going improvement projects.

**Table 2.1: Tasks and Issues of the Road Sector**

| No. | Tasks | Subjective Issues |
|---|---|---|
| 1. | to modify the road network plan to cope with existing and expected traffic congestion | ✓ North-south trunk road between provinces: Trans-Sulawesi<br>✓ Congestion between Maros and Makassar: Jl. Sutami, Jl. Perintis (including Jl. Urp Sumoharjo)<br>✓ Congestion on the arterial road connecting Makassar and Takalar: Jl. Sultan Alaudin, Takalar Access,<br>✓ Industrial roads, and<br>✓ Congestion on east-west axles: new satellite access roads |
| 2. | to modify the road network plan to make it easy to implement acquire land | ✓ Alignment of "Outer Ring Road"<br>✓ "Inner Ring Extension" to the Jeneberang River |
| 3. | to modify the road network to contribute to environmental conservation, and to make the town more human friendly one | ✓ Middle ring road (section 2): This route runs through a planned reserved area<br>✓ Cross section design |

## 2.1 Traffic Congestion (2005 and 2020)

A traffic count survey was conducted at twenty-nine (29) spots in the course of this Study. The results are summarized in the following figures. It is clear that the present traffic concentrates in and around Makassar city. Particularly, the highest traffic volume is observed on the trunk roads along the north-south axle such as Jl.Urip Sumoharjo, Jl. Perintis Kemerdekaan, and the road along the east-west axle called Jl. Andi Pangerang Pettarani.


**Figure 2.1: Traffic Volumes in Mamminasata**

**Figure 2.2: Traffic Volumes in Makassar Municipality**

On the other hand, the following figure shows the traffic volume on roads[10] and a congestion ratio based on the traffic survey data in 2005 and the traffic forecast up to 2020.

Figure on the right side shows the traffic volume in 2020 in case that there is no road improvement. This reveals that Mamminasata will face seriously congestion on such roads as Perintis, Sutami, Takalar access, Sungguminasa area and Mamminasata Bypass area where new urban centers. Countermeasures should be worked out to solve such congestions.

**Table 2.2: Traffic Capacity**

| | No. of Lane | PCU/day /lane) | PCU /day |
|---|---|---|---|
| Toll Road | 4 | 18000 | 72000 |
| National road | 8 | 17000 | 136000 |
| | 6 | 17000 | 102000 |
| | 4 | 12000 | 48000 |
| | 4 | 10000 | 40000 |
| | 2 | 10000 | 20000 |
| | 2 | 6000 | 12000 |
| Provincial Rd | 4 | 12000 | 48000 |
| | 2 | 6000 | 12000 |
| Local Road | 2 | 5000 | 10000 |
| | 1.5 | 3150 | 6300 |

[10] by numbers of hundred and width of line

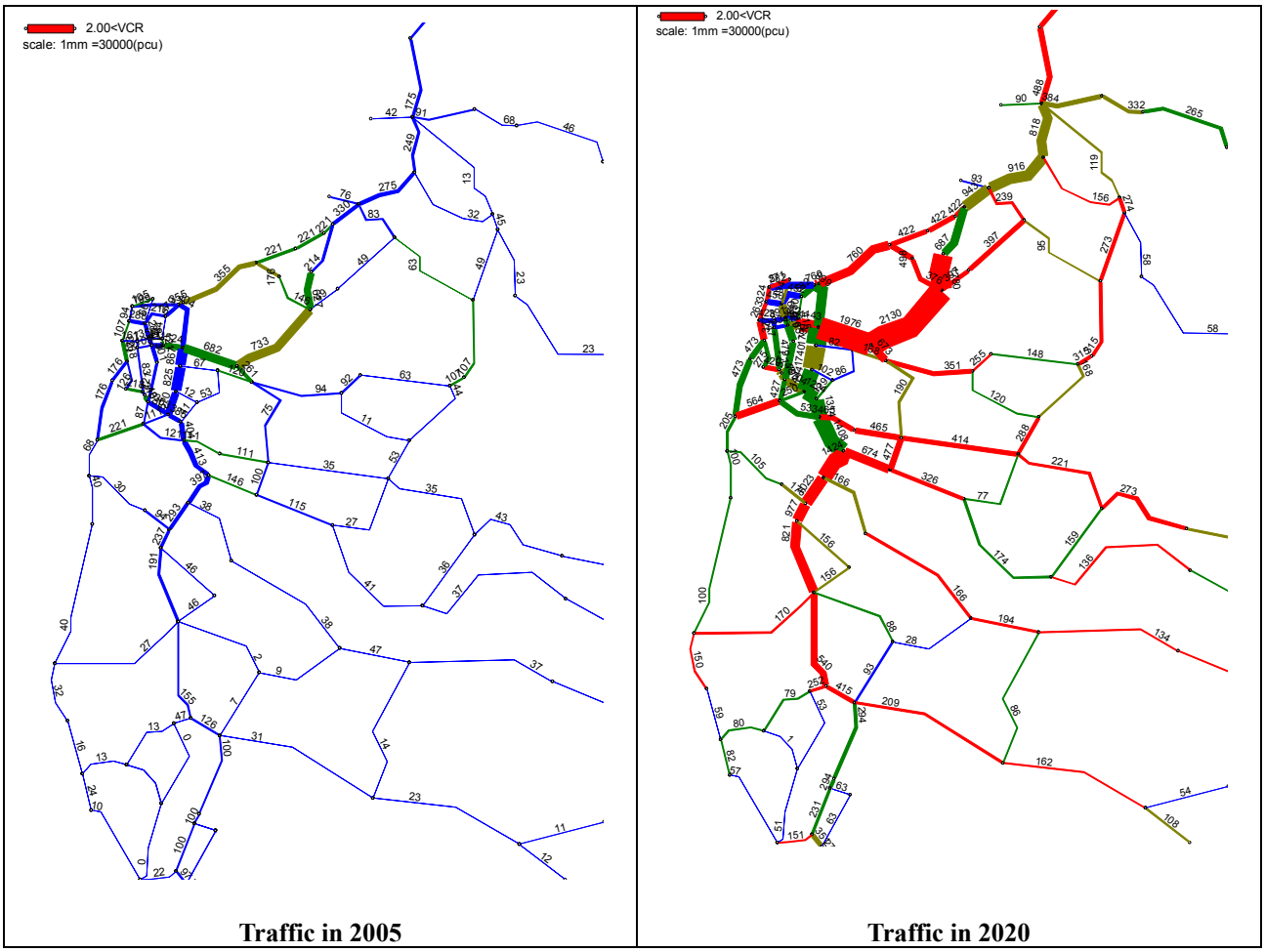



**Figure 2.3: Traffic Congestion Ratio by Road: 2005 and 2020**

## 2.2 Needs to Up-date Road Network Plan

1) Road Plans behind Actual Regional and Urban Development

The present traffic congestion is mainly attributable to slow road network development, as well as faster urban sprawl than expected. While a road network plan in Makassar is still based on the framework developed under the JICA Study 1989. The stagnating road network improvement has left Makassar City behind the growing traffic demand.

Road widening and new road construction has lagged behind the 1989 road network plan suggested by JICA. Of three ring roads recommended in that plan, only the "Inner Ring Road" has been completed, and land acquisition for the "Middle Ring Road" has been lagged for a long time. Of the five arterial road improvements planned up to 2009, only one road widening works has been commenced as of December 2005.

On the other hand, the traffic volume on major roads in Makassar has drastically increased since 1988 as shown in the following table. The present traffic on Jl.

Andi Pangerang Pettarani marks an increase by 351% from 1988, growing at the average rate of 8.2% per annum. The section of highest traffic was shifted from Jl. Veteran Utara in 1988 to Jl.Andi Pangerang Pettrani in 2005. Traffic movement to and from the eastern hinterland has been more noticeable because of progressing urbanization eastward.

**Table 2.3: Traffic Change between 1988 and 2005**

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

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

New road network plan is necessary to meet the actual traffic demand. Overloaded trunk roads mainly of the north-south axles should be widened urgently, and trunk axles in east-west direction are indispensable to connect newly developing urban centers. Further, the regional linkage is to be strengthened, by construction of the "Trans-Sulawesi Road" to induce regional development of not only whole Mamminasata but also wider economic spheres.

2) Lagged Land Acquisition for Road Projects

A delay in road network development is attributable to financial constraints. With the widening of "Inner Ring Road" (Jl. Pangerang Pettarani), explosive urban development towards east of old Makassar has occurred at a higher speed than expected, and urban sprawls are still continuing eastwards without any road network improvement plan.

The delay of land acquisition is apparent in case of the "Middle Ring Road" construction. The land acquisition has not yet completed for approximately 20 % of the section 1 (southern half). The section II (northern half) has not been initiated yet. The South Radial Road has been deadlocked because of land acquisition, and the construction of "Central Radial Road (east-west axles)" and "Outer Ring Road" have not started yet at all.

The delay in land acquisition has led a vicious circle in plan execution. Consequently, it is not practical implement road network development as suggested in the JICA Study 1989. Modification of the outdated plan into more

implementable and effective road network is required to meet present traffic demand.

## 2.3 Emphasis on Environmental Conservation

The Mamminasata spatial plan aims at making a clean and coordinated metropolitan area, inclusive of the road network harmonized with nature and town planning, paying due attention to the environmental conservation. Two factors i.e. road network itself and cross section design are taken into consideration for the environmental-friendly road improvement under this JICA Study.

1) Road Network

The estuary of the Tallo River now functions as a reservoir and many fishponds are operated there, facing Lakkang reserved area. It is recommended that this estuary be a green reserved area. However, the planned route of the "Middle Ring Road" (Section 2) runs cross the center of this environmentally sensitive area, and it is suggested that the function of this middle ring road section 2 be reviewed in the light of terms of the future traffic demand in the future and its significance to be whole road network, as well as the financial viability of the BOT Company.

It is suggested that this "Middle Ring Road" Section 2 be modified since it has little significance from the present urban development point of view and it requires huge amount of investments. The green conservation in the estuary would contribute more to the creation of the human friendly town.

2) Cross Section Design for Greening, Drainage, and Pedestrians

Some measures are proposed to improve the urban landscape to secure safer and easier walking for pedestrians. For instance, roadside tree has effect to create an image quiet and comfortable town. Especially for pedestrian, the roadside shades will make them less laborious to walk under the hot temperature. Roadside ditch facilities will be improved to prevent the inundation, and provide better sanitary environment.

The pedestrian pass will be facilitated to make the walking easier and safer. At present, the difference in elevation between the road surface and pedestrian pass surface is too high to serve for elder people in any cases.

All these improvement are sub-items for the road network development, but they would have a great impact to improve the town image to be more human friendly town. A suggested cross section for Jl. Perintis is shown in Figure 2.4.


**Figure 2.4: Proposed Cross Section for Jl. Perintis**

## 2.4 Few Alternative for Transport Policy in Makassar CBD

Roads in the central business district (CBD) are narrow and become a bottleneck to the commercial activities. The situation is further aggravated by a T-shaped road network that makes traffic flows un-efficient and slow. Roadside parking that occupies one or two lanes also aggravate traffic conditions.

The central business district (CBD) area has already been well developed, and there is no room for widening the roads, implying that the alternative policy to apply "Traffic Demand Management (TDM)" and better usage of public transportation. One way traffic has already introduced, and further modification is necessary to activate the commercial activities in CBD.

# 3. ROAD IMPROVEMENT AND NETWORK PLANNING

For the road improvement, principles will be discussed first, and then five necessary road improvements are identified with due consideration to the implementation. It will be followed by the prioritization of the listed projects.

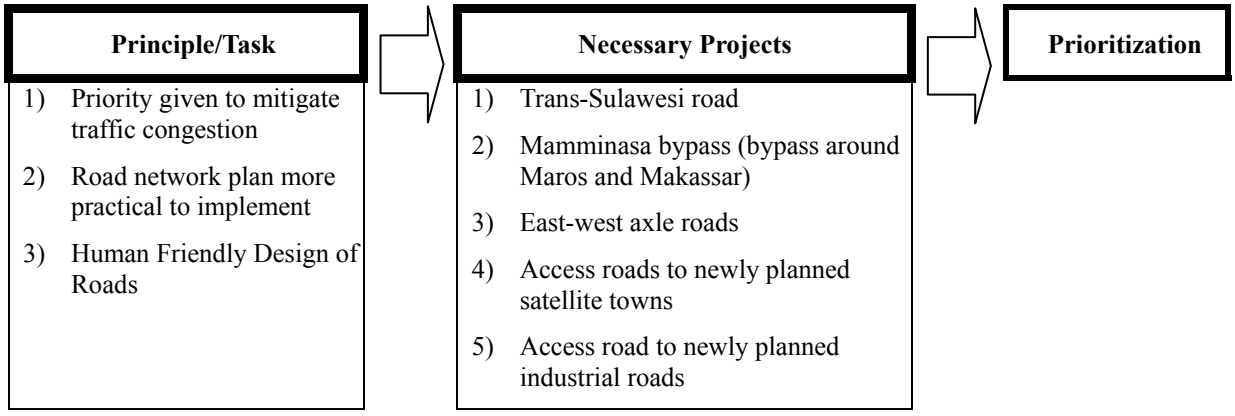



**Figure 3.1: Flow Diagram of Improvement Study**

## 3.1 Principles

In line with the objectives and strategies defined for the Mamminasata spatial plan, three principles are introduced in road improvement and road network planning for the Mamminasata metropolitan area.

1) Priority given to mitigate traffic congestion: Countermeasures are a road widening and new road constructions.

2) Road network plan more practical to implement

   This relates to the land acquisition issue. Practical measures are suggested to avoid a route that runs through an established and densely populated area, and detour those areas in the road network planning.

3) Human friendly and eco-friendly road design

   This is related with cross section design with greening area, drainage and pedestrian passes. It is also taken into account how to avoid a separation of the town functions due to a road widening and/or new road construction.

## 3.2 Road Network Development Schemes

Five schemes are suggested to form a major road network in the Mamminasata metropolitan area. Those are:

- Trans-Sulawesi road
- Mamminasa bypass (bypass around Maros and Makassar)
- East-west axle roads
- Access roads to newly planned satellite towns
- Access road to newly planned industrial roads

1) Trans-Sulawesi Road

Desirably, a traffic and cargo distribution system for all Sulawesi is delineated. To this end, the provincial government has a plan to develop the road network as shown in the figure. However there is no definite plan of Trans-Sulawesi road as a "Main Artery" of the Island's distribution system.

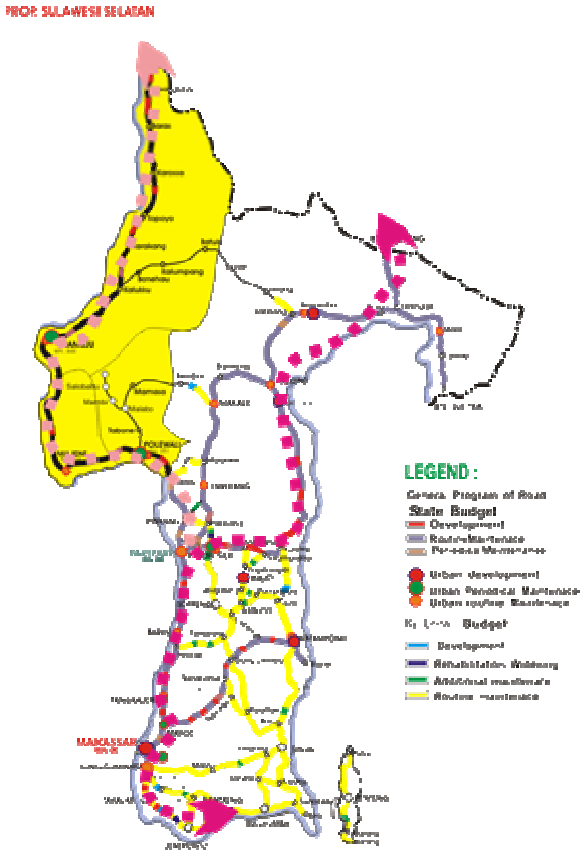



**Figure 3.2: Trans-Sulawesi Road Concept**

Two alternative Trans- Sulawesi routes are proposed on the following conditions;

(i) The design speed is 100 km/h or more.
(ii) "Freeway[11]" in grade
(iii) ROW is 100 m in width as shown in the following figure.
(iv) Preferably located outside of the city, but near the city.
(v) Stage construction is envisaged according to the traffic demand.

Freeway has a large function in increasing the traffic capacities, while it will give undesirable influences against the district along the road, such as vibration, noise and exhaust gas etc. It is desirable to construct the sideway or frontage road as

[11] Freeway: Road separated from other roads by the fence or by the grade separation and without signals.

shown in following figure.

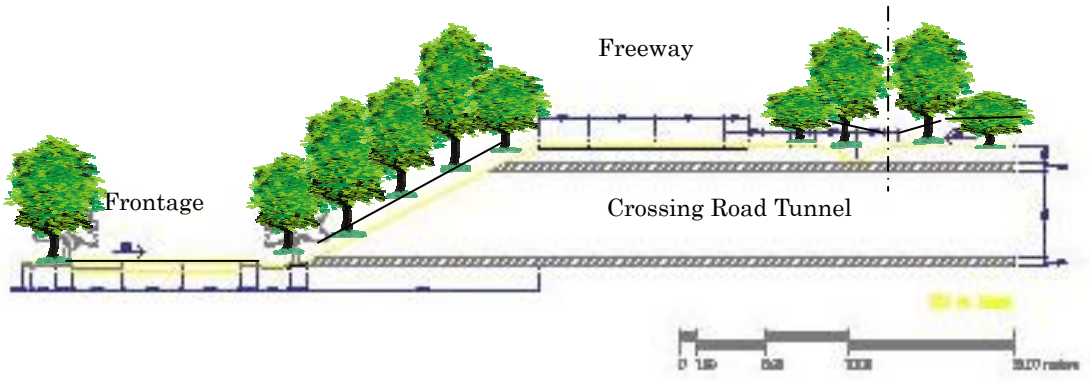



**Figure 3.3: Cross Section of Highway Road with Frontage Road**

In case of Mamminasata, two alternative routes will be considered for the Trans-Sulawesi Road running in Mamminasata as shown in right figure.

| | | |
|---|---|---|
| "A" route | Easy access to city area | The land near the city is difficult to ensure |
| "B" route | Easy to acquire land | In convenient to access to city are |

"A" route will be more appropriate since it can utilize the southern section of the "Middle Ring Road".

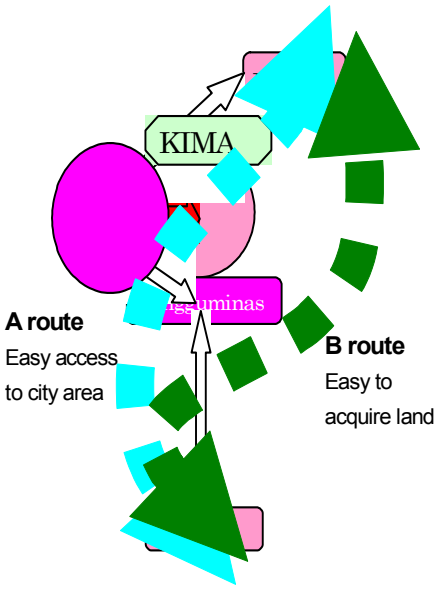



**Figure 3.4: Trans-Sulawesi Road Alternative Routes**

2) Mamminasata Bypass

Under the Mamminasata spatial plan, new urban centers and industrial complexes will be located around the Makassar city. Consequently, new access roads are required from the following point of view:

(a) Trans-Sulawesi Road will better be located within an appropriate distance (Route A as shown "blue" in Figure 3.4) to save the vehicle operation cost and to ensure the environmental conditions. The utilization of the land acquired for the Middle Ring Road is recommended. However the acquired land is not enough in width as the most important road in Sulawesi. Therefore route B shall be considered as an auxiliary road.

(b) A "green" link between the urban center and industrial estates will contribute to coordinated development in the area.

(c) Although this route is outside the Outer Ring Road, similar route is proposed under the Spatial Plan 2012.

(d) It will function as a "Mamminasa Bypass" when the cargo transportation increases in future to pass over the Makassar area.

(e) The traffic volume into Makassar will be reduced by establishing "regional terminals" near the intersection of this bypass.

(f) It has a function as a detour on the Route A trouble.

3) East-West Radial Roads Development

The main radial roads to the east are developed to improve commuter traffic between Makassar cities and new urban centers. The bus transportation should have a priority in this route. Two routes are expected as shown in the following figure, namely "Route A" and "Route B". Selection of the alignment and establishment of relevant regulation will be planned subsequently.

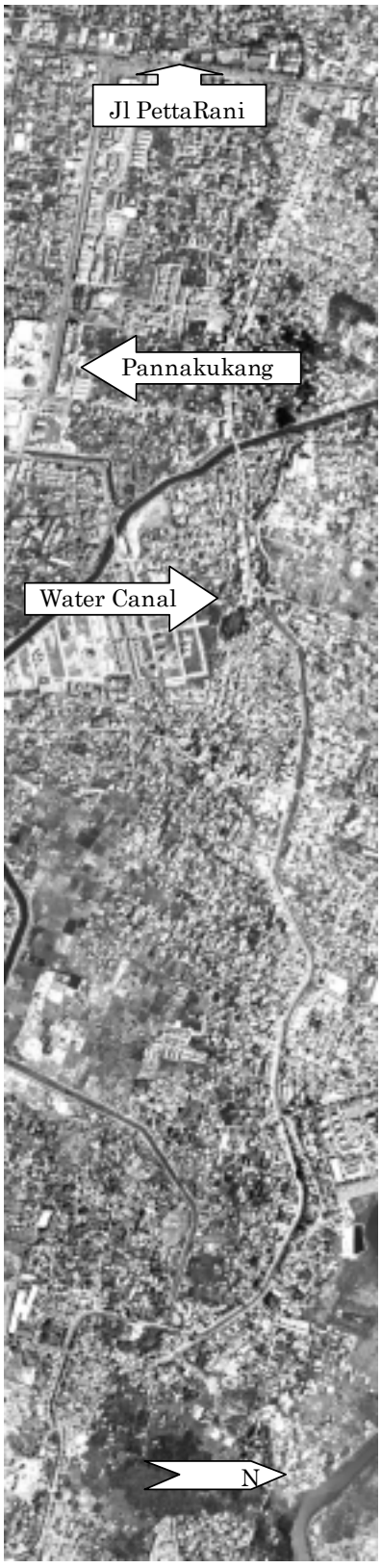



Figure 3.5: Aerophotograph

**Route A**

This route runs on the north side of Jl. Malino, connecting S3 and KIWA. It will be extended up to Malino Road in future. This route is an extension of Jl. Hertasning. Traffic congestion in Sungguminasa will be mitigated by this route.

**Route B**

This route locates between "Route A" and "Jl. Perintis". On completion of this route, the traffic volume from the expanding settlement areas in east Makassar into Jl. Perintis will be mitigated. Total length is about 15 km. Following two alternatives will be recommended.

**Extension of JL Panakkukang**

The length of Jl. Panakkukang is only about 1 km as shown in the aero photograph. There is a busy city center at the end. Utilization of this alignment as commute route is high in value.

**Improvement of Jl Abdullah Daeng Sirua**

1.5 km from Jl. Pettarani is a narrow road with 10m width. However water work canal (the Lekopancing River) is running to the east along the road from water purification plant (located about 300 m from the bridge over the Sungai Pampang). Garbage is thrown into this canal. It is not desirable as a drinking water source. Therefore the canal will be changed into the pipe culvert and the surface ground will be utilized as a road of 30m-50m in width.

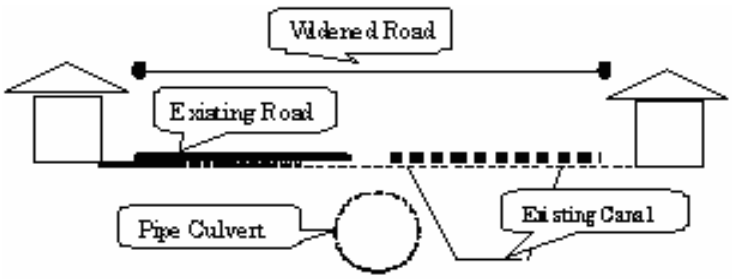



**Figure 3.6: Proposed Cross Section of Jl. Abdullah Daeng Sirua**

4) Access Roads to New Towns

The population in Mamminasata will increase from 22 million to 2.8 million in 15 years up to 2020. During this period, it is estimated that the number of vehicles will increase from 2 million to 4 million.[12]

It is proposed that three new satellite towns would be developed in Gowa and Maros with new 3 industrial areas (KIROS, KIWA, and KITA[13]). Their locations are diagrammatically shown in the figure.

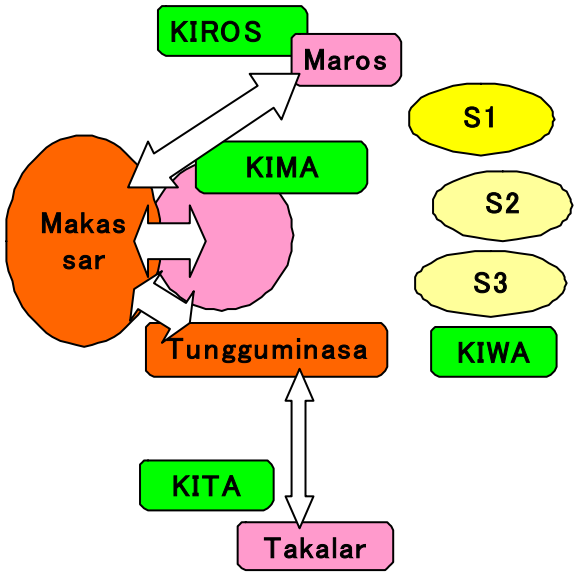



**Figure 3.7: Location of Strategic Sites**

In due consideration of the direction of current and future expansion of settlement areas, it is judged necessity that some radial roads to the east will be urgently required connecting to the Middle Ring Road (section 1: southern part).

5) Access Roads to New Industrial Estates

The policy of Mamminasata Spatial Plan intends is to create a human-centered city together with an industrial growth. Consequently, the industrial complexes will be connected with port by effective links. The roads for the transportation of agricultural products should also be taken into consideration. Salient feature of each industrial complex is summarized as follows:

[12] It is impossible for the development of social infrastructure to become double against these increasing numbers. It needs long term for the preparation of regulations related to the realization of spatial plan after establishing the land use plan and road development plan in New Maminasata Master Plan

[13] The location of KITA is not fixed yet.

**Table 3.1 Features of Planned Industrial Estates**

| | Main function | Necessary Access |
|---|---|---|
| KIMA | Mainly for product of groceries and warehouse<br>Current area is around 200 ha, and there is more 200 ha area to be developed. | Access to the port is most important |
| KIROS | Near to port and airport.<br>Main will be light industry and handicraft | Access measures to Airport and Seaport |
| KIWA | Agricultural products and its processing goods | Access measures to Seaport and Consumption area |
| KITA[14] | Agricultural, livestock farming and marine products and its processing goods | Access measures to Seaport and Consumption area |

Consequently the access route for cargo transportation will turn out to be as follows;

**Route MM**

Connection road between existing KIMA and Seaport is achieved by widening of Jl Ir. Sutami as a BOT tollway. However, factories and warehouses can not access directly to the toll road and they will make it through frontage roads. It is necessary to take care of it in the designing for the location of toll gates and their numbers.

In KIMA, northern half of the existing road (JL. Kapasa Raya) is required to be widened (Current ROW[15] is 23 – 40 m in width).

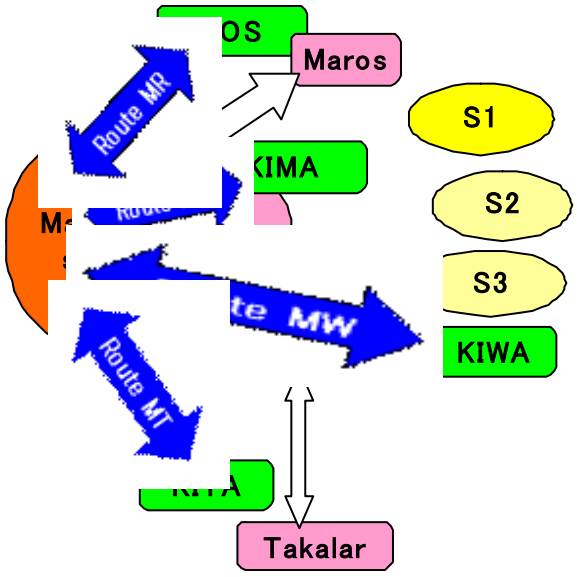



**Figure 3.8: Access to New Industrial Estates Roads**

**Route MR**

A new route is expected along the seashore to the north of Jl. Ir. Sutami connecting the port and south Maros City. Total length is about 12 km. This road will become expensive in construction because number of bridges are required to cross

[14] Location of KITA is not fixed yet and now the study is on going (by Takalar Government)
[15] ROW : Right of Way : Area planned or acquired for the exclusive use of the road.

river mouths. Therefore, the actual construction will be scheduled in line with the development of KIROS and traffic demand. As an alternative, construction of a branch road from Maros road[16]to KIROS is recommended if Jl. Sutami has enough traffic capacity of Jl. Sutami after its widening. The access to the airport will be facilitated via a branch road from Jl. Ir Sutami[17]

**Route MW**

This is a connection road between KIWA and the port. Total length will be 15-20 km. Widening/development of the southern part of the exiting KIMA road (JL. Kapasa Raya) becomes necessary. (Current ROW is 30 – 42m)

**Route MT**

This road is around 30 km in length. There are two alternatives. One is the widening of the existing Sungguminasa-Takalar road (Poros Takalar or Takalar Access). The traffic capacity could be increased to 40,000 – 50,000 pcu/day by widening is on going by the provincial government. The other is the construction of Trans-Sulawesi Road connecting the Middle Ring Road over Jeneberang River. (Yellow Route in Figure 3.8) This extension of Trans- Sulawesi Road to Takalar side will be constructed in line with the actual demand in the southern Mamminasata area.


**Figure 3.9: Proposed Corridor Lines**

[16] Maros Road : (Poros Maros Raya) North direction road through Maros city from Jl. Perintis to the north side of Maros

[17] The traffic demand analysis shows that widening of Jl. Sutami could cover the traffic demand even without this new road alignment.

6) Planned Road Network

The following figure shows the road network proposed above. The road number shows the projects listed in the table. The route of Mamminasa Bypass (Route A or B) will be decided in the light of the future plan and actual progress in KITA.


**Figure 3.10: Planned Road Network in Mamminasata**

**Table 3.2: List of Planned Road Improvement**

| | Road Name | Works | Width | Length | |
|---|---|---|---|---|---|
| 1 | Perintis (+ Jl. Urip Sumoharjo | Widening | 42m | 14km | |
| | 2F/O | New | 30m | 200 | |
| 2 | Ir Sutami with 1 F/O | Widening | 70m | 11km | |
| 3 | Alauddin | Widening | 40m | 5km | |
| 4 | Malino Access | Widening | 30m | 9km | |
| 5 | Middle R/R | New | 40m | 8km | |
| 6 | KIMA (Jl. Kapasa Raya) | Widening | 40m | 5km | |
| 7 | Tanjung Bunga Access | New | 20m | 6km | |
| 8 | Takalar Access | Widening | 25m | (4+)23km | 4km completed already |
| 9 | Mamminasa Bypass | New | 100m | 30+10km | 10km is south side of Jeneberang |
| | Mamminasa Bypass Bridge | New | 50m | 350m | |
| 10 | Abdullah Daeng Sirua | New | 35m | 15km | |
| 11 | Around AirPort | Widening | 20m | 10km | |
| 12 | AirPort Access | New | 40m | 18km | |
| 13 | Trans Sulawesi | New | 90m | 30+5+20 | 30km: Northern part of Middle Ring Road 5+20km: Southern part of Jeneberang. River |
| | Trans Sulawesi Bridge | New | 40m | 400m | |
| 14 | Hertasning | New | 25m | 14+7km | 7km is further extension to East |
| 15 | KIWA Access | New | 40m | 13km | |
| 16 | Around Sungguminasa | Widening | 15m | 15km | |
| | **Total** | | | **268km** | |

## 3.3 Priority of Road Improvement

1) Evaluation Process

Based on the socio-economic framework and the results of traffic surveys, future traffic demand in Mamminasata has been projected in accordance with the following procedure.

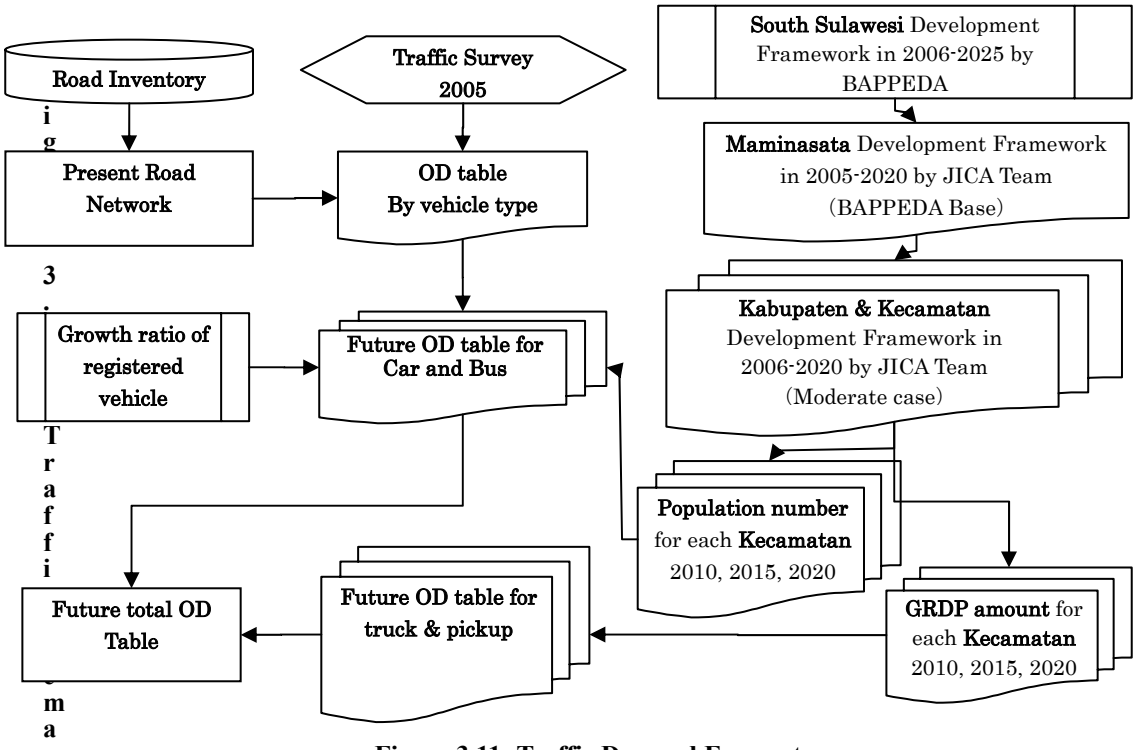



**Figure 3.11: Traffic Demand Forecast**

(1) Population and GRDP by "kecamatan" (district) are adopted from the socio-economic framework: 2010, 2015 and 2020.

(2) Present traffic volume is tabulated in the form of origin-destination (OD) tables by vehicle type based on the results of the Study Team's traffic survey in 2005.

(3) Present road network is established on the basis of existing road inventory data and the results of traffic survey (national, provincial, and local roads). The links of the road network comprise the distance between nodes, travel speed, and capacity.

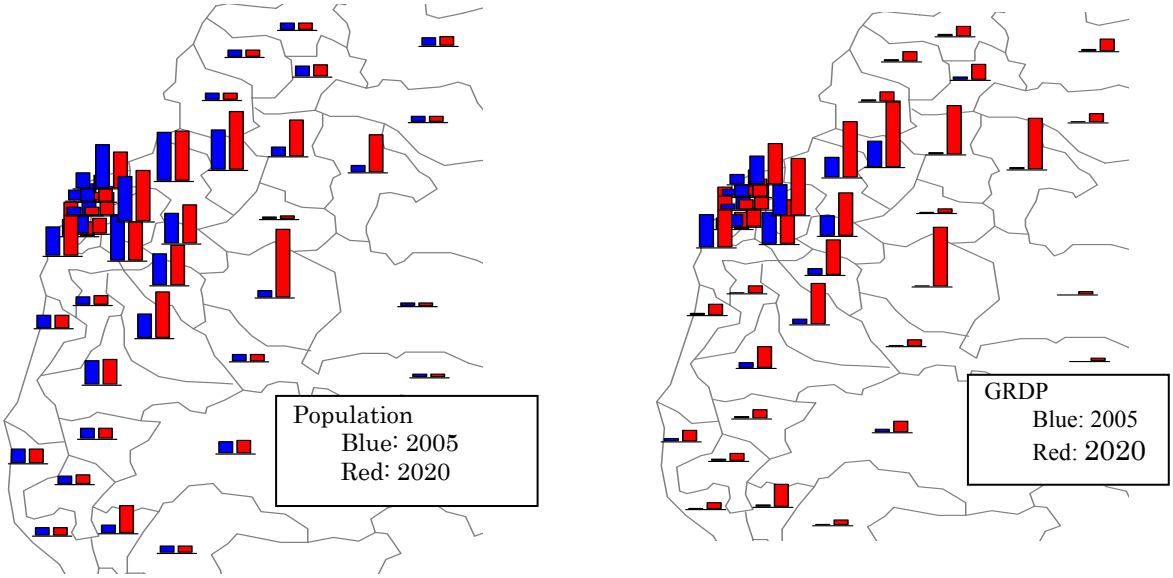



**Figure 3.12: Comparison of Population and GRDP: 2005 and 2020**

(4) The future OD tables (2010, 2015 and 2020) are established through conventional method, namely, production, generation/attraction, distribution, and assignment as follows:

(i) Produced traffic which is the control total of OD tables, is forecasted by using the growth ratio of registered vehicles,

(ii) Generated/Attracted traffic is forecasted by multiple regression models based on the number of population for car and bus and the amount of GRDP for truck and pickup,

(iii) Distributed traffic was obtained based on the present OD pattern and future generated and attracted traffic determined above, using the "present pattern method" through the convergence calculation of the Frator method,

(5) The traffic volumes are estimated by assigning the OD tables by vehicle type to the road network models.

The procedures for the implementation of above projects are decided in the following manner:

**Selection of Procedure for Each Road**

The congestion ratios of each road segment at years 2010, 2015, and 2020 are identified through traffic assignment based on existing road network at each year, and heaviest congestion roads are selected for development.

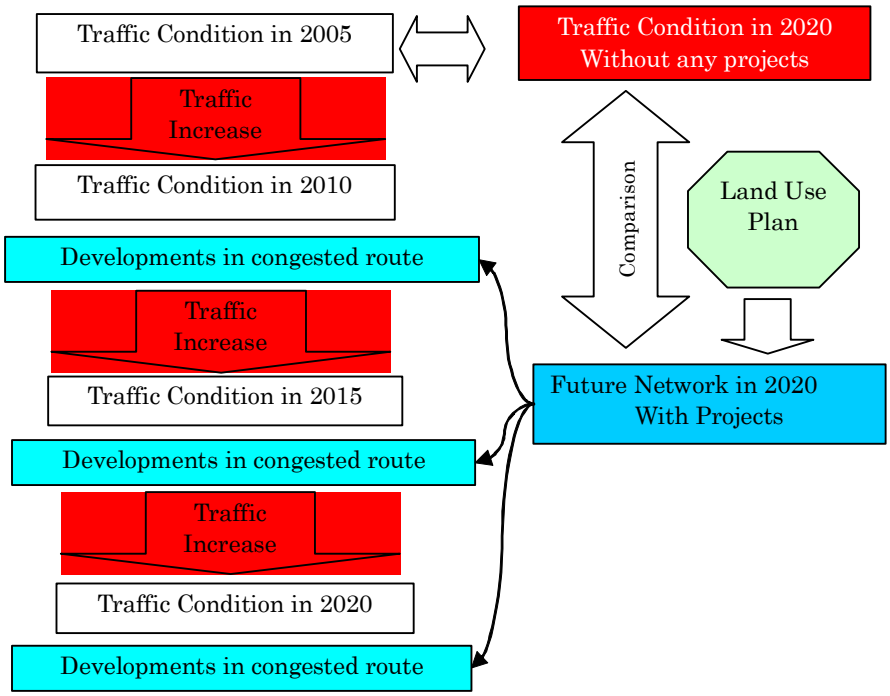



**Figure 3.13: Procedure of Priority Project Selection**

(a) The OD traffic volume, in 2010 for instance, is assigned on the road network (2010) without any road improvement, and the most congested segments are identified. Then road network is modified to reflect road improvement works. On these modified road networks, a try-and-error process is repeated many times. Finally, you can identify which road improvement can reduce the expected traffic congestion in 2010.

(b) Then, assuming that the necessary road improvement works are completed as designated by the 2010 the road network, OD traffic volume in 2015 is assigned on the 2010 road network to identify which segments will be most congested in 2015. It will clarify the most congested parts of the road network. To cope with this trraffic congestion, further road improvement plans are prepared to assess which road improvement can minimize the traffic congestion in 2015.

(c) Same procedure is repeated up to 2020, checking the appropriateness of road networks.

2) Priority Improvement up to 2010

The traffic volume in 2010 is assigned to the 2005 road network without any road improvement. Results identify those two roads: Jl. Sutami and Jl. Perints are the most congested and selected for road improvement. After the road improvement on these two roads, the traffic volume in 2010 is assigned on the modified road network as shown on the right side of the following figure. Results show how effective the road improvement in Jl. Sutami and Jl Perintis, endorsing the high priority status to be executed.

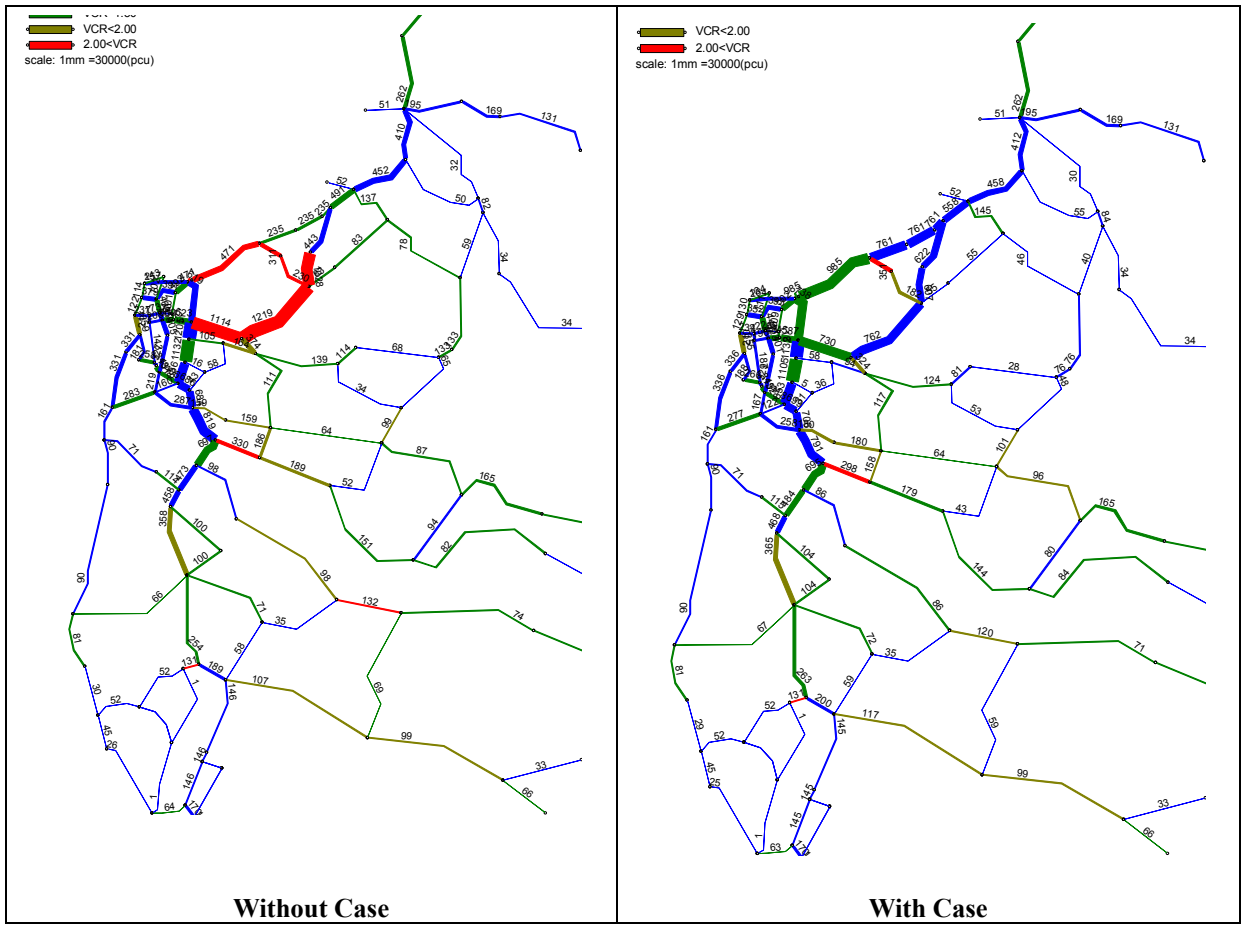



**Figure 3.14: Comparison of Traffic Conditions in 2010**

As an alternative method to improve the congestion of Jl. Perintis, development of Trans Sulawesi route could be considered. This alternative has an advantage that the land acquisition in early stage is easier judging from the current land use in this area. However it is not realistic to complete the construction of the Trans-Sulawesi within 5 years.

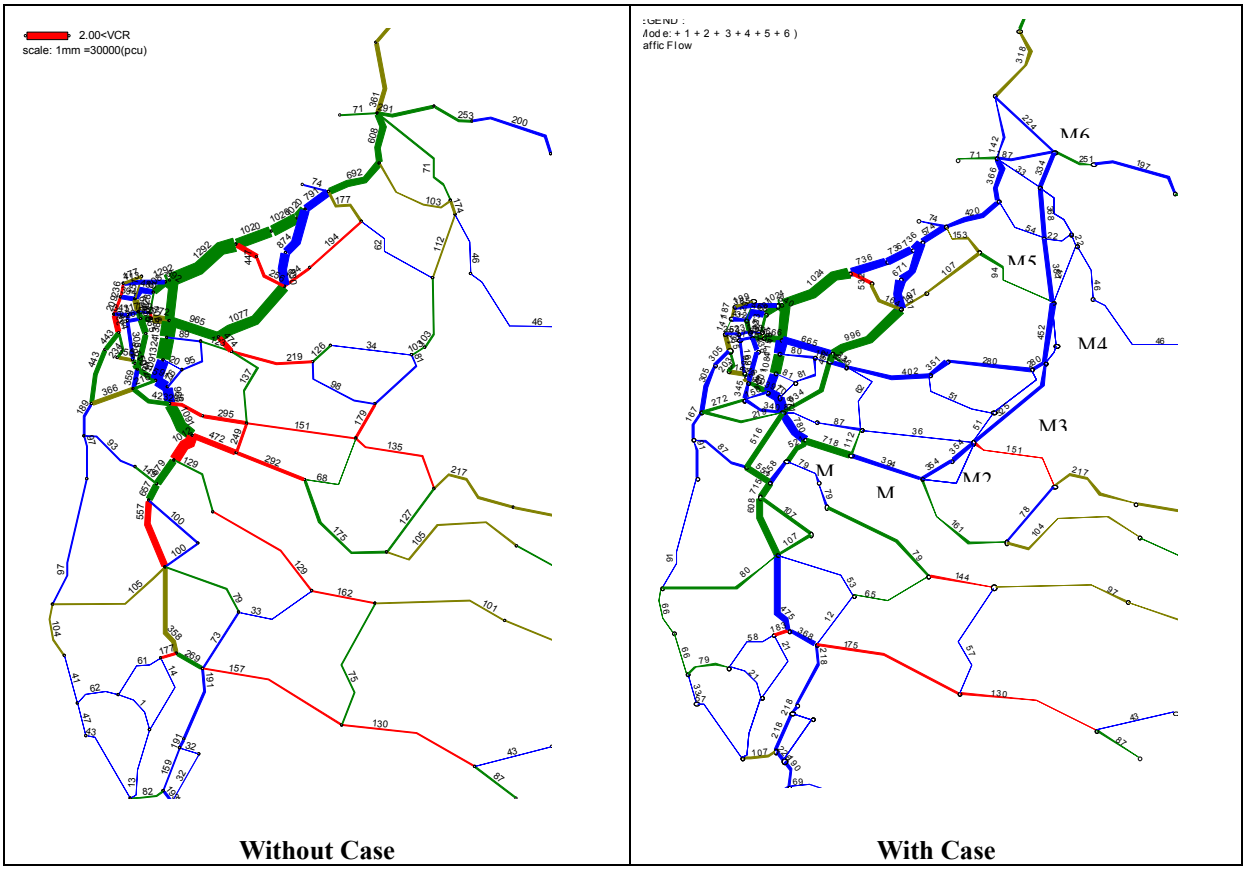
Improvement of Jl. Kapasa Raya in KIMA and Malino Access near Sungguminasa are also required up to 2010.

3) Priority Improvement up to 2015

After the completion of Jl. Sutami, Perintis and other few roads by 2010, the road conditions will be modified. However, the traffic volume will increase again, and traffic condition in 2015 becomes worse as shown on the left side of the following figure. For the solution of this condition, following road improvement are required up to 2015.

1) Middle Ring Road (Section 1, southern half)
2) Tanjung Bunga Access
3) Takalar Access T2,T3,T4
4) Trans Sulawesi (Jeneberang)
5) Mamminasa Bypass M2-M6
6) Abdullah Daeng Sirua
7) MalinoAccess 1, 2 (4 lanes)

As the result of above road improvements, traffic conditions in 2015 will be eased as shown on the right side in the following figure.




**Without Case** **With Case**

**Figure 3.15: Comparison of Traffic Conditions in 2015**

4) Priority Improvement up to 2020

Traffic volume will increase again toward 2020, and the traffic condition becomes worse again as shown in the following left figure. For the solution of this situation, following road improvements become necessary, if there is no traffic demand management.

1) Mamminasa Bypass M1 & Bridge
2) Trans Sulawesi (Takalar) (TST)
3) Trans Sulawesi (Makassar) (TSM)
4) Airport Cross Road (ACR)
5) Kima (Jl Kapasa Raya) (KR)
6) Kima~Kiwa (KK)
7) Hertasning (HRT)

However, still there is traffic congestion along the Losari beach, extension of Hertasning and Maros North road.

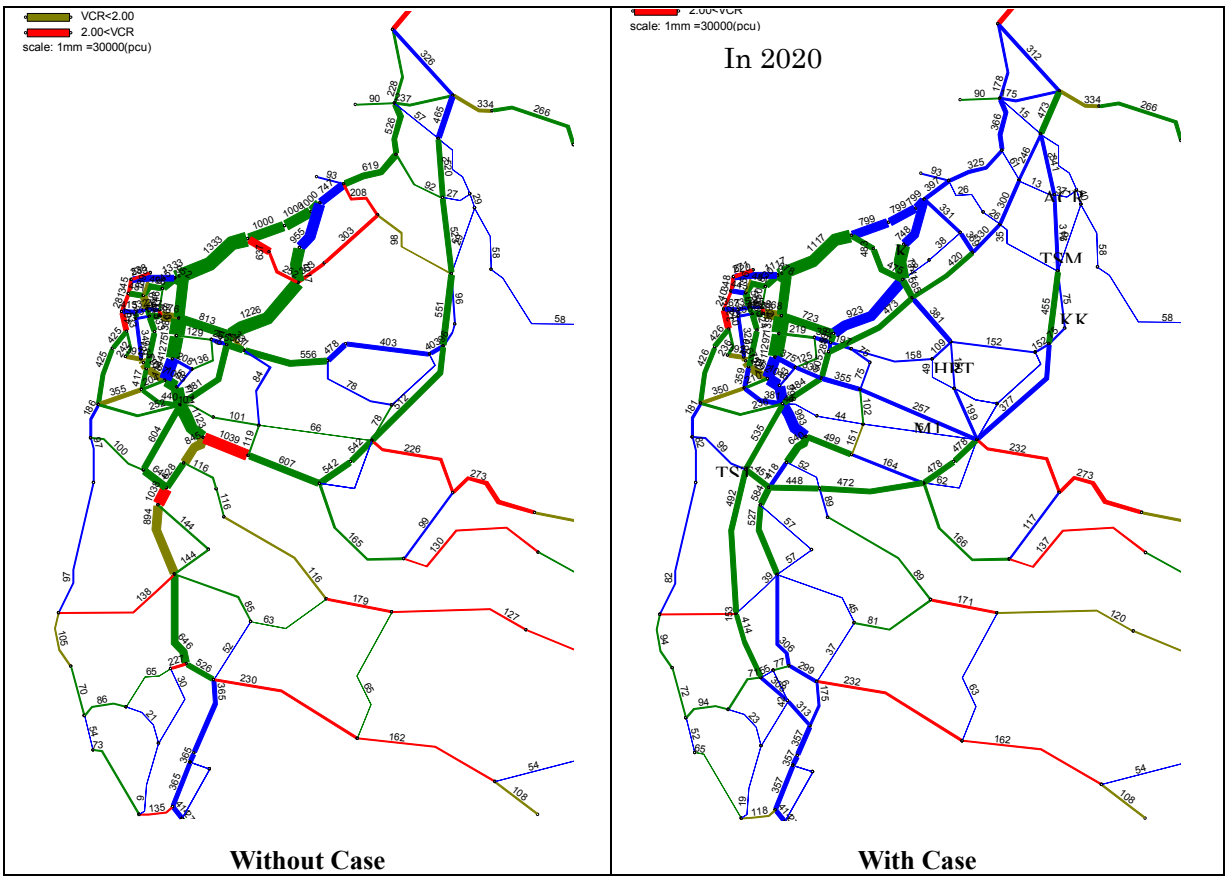



**Figure 3.16: Comparison of Traffic Conditions in 2020**