7.8 Intersection Plan

(1) General

Intersections are complex and severe individual locations because of many vehicular movements (through, left-turn and right-turn from each approach road) and pedestrian crossings. On the other hand, the project cost and more resettlement will be required if high-grade and over specification interchange types are applied. The study of intersection types is to control or manage the conflicts in a manner that ensures safety and efficient movement of both vehicles and pedestrians.

(2) Design Standards

Design standards used are "Standard Specifications for Geometric Design of Urban Roads, March 1992", "Guideline for Geometric Design of Inter-City Roads, September 1997" and "Indonesian Highway Capacity Manual (HCM) 1997" published by DGH/MPW. The items which are not included in the above standards were referred to the Road Geometric Design Standards in Japan and the Policy on Geometric Design of Highways and Streets, AASHTO.

(3) Design Traffic Volume

Intersection types are planned based on the peak hour traffic volume after 10 years from the opening of the project roads, in accordance with Indonesia road design standards. The opening of service for the F/S routes in this study is assumed to be in 2010, and the estimated future traffic volume in 2020 is adopted for the peak hour traffic volumes for the study.

(4) Selection of Intersection Types

Selection of intersection types is made based on the number of lanes of crossroads. The crossing with grade separation should be provided for Type I and Type II crossings with partial access control and crossing more than 4 lanes according to the Indonesian road design standards. However, grade separation requires a flyover bridge and it is very costly. Therefore, the traffic signal control type at-grade intersection was given priority as much as it can meet the traffic demand and traffic safety.

Alternative intersection plans are made for major intersection and evaluated on the technical, economical and environmental aspects based on the general evaluation criteria in Table 7.16.

Table 7.16 General Evaluation Criteria for Intersection Type Selection

Evaluation Items			Full Control Interchange	Grade Separation with Access	At-grade Intersection with Signal Control	Roundabout without Signal Control	At-grade Intersection without Signal Control
Technical Aspects	Traffic Capacity	Low Volume Traffic (ADT<40000)	P	P	G	F	B
		Medium Volume Traffic (ADT4000-60000)	G	F	F	P	B
		High Volume Traffic (ADT>60000)	VG	G	F	P	B
	Stage Application		B	P	F	VG	F
	Safety		VG	G	F	P	B
	Operation and Maintenance of Facilities		VG	G	F	G	G
	Others like multiple accesses		-	G	F	F	B
Economical Aspect	Construction Cost		B	P	G	G	VG
Environmental Aspect	Resettlement		B	P	G	F	G
	Pollution		VG	G	P	F	F

Note: VG:Very Good, G:Good, F:Fair, P:Poor, B:Bad
Source:JICA Study Team

(5) Locations of Major Intersections

The location map and list of the major intersections on the Trans-Sulawesi Mamminasata Road and Mamminasa Bypass are shown in **Figure 7.13**.

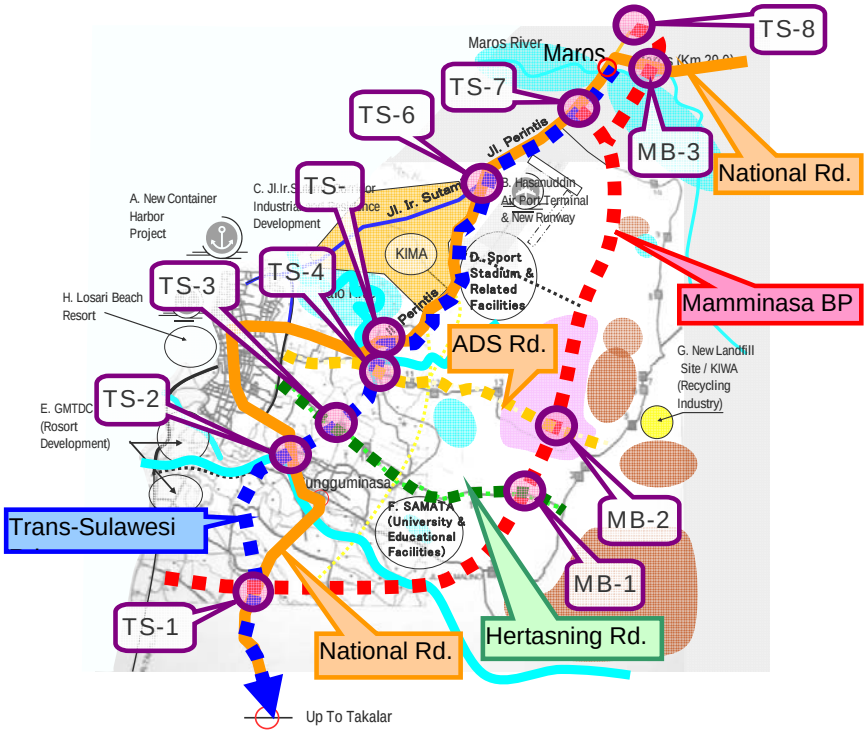
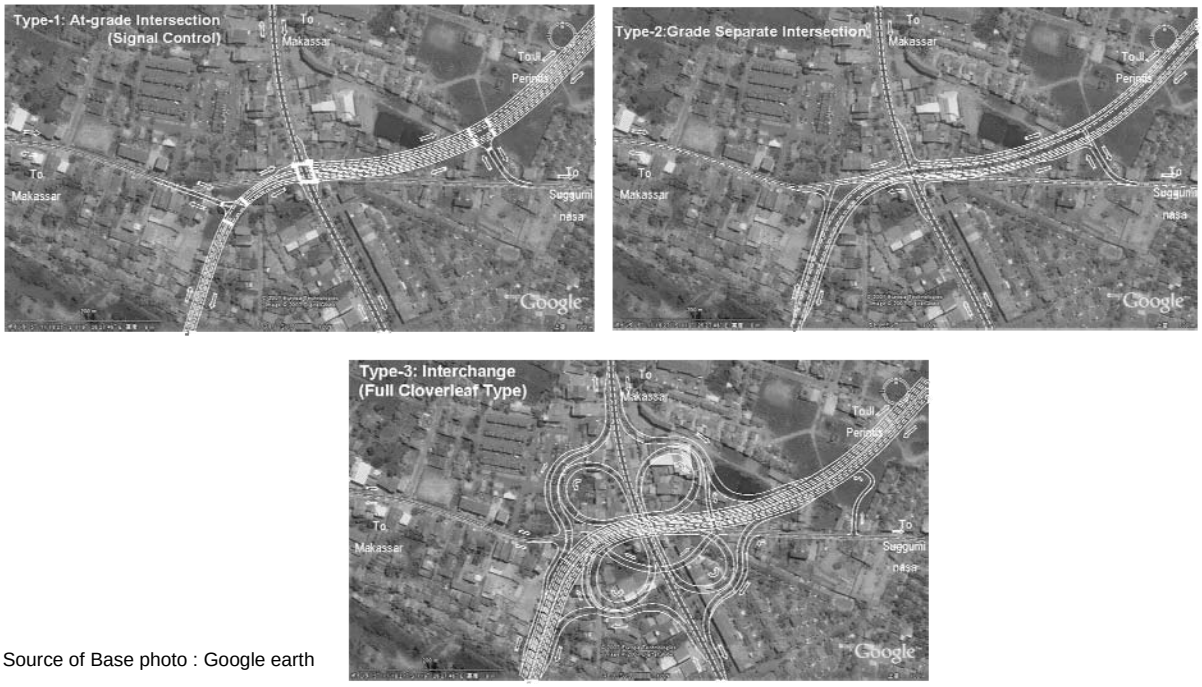


Figure 7.13 Location Map of Intersections and Identification No

(6) Intersection Plan for Representative Intersections

1) TS-2（Trans-Sulawesi Road / Sultan Alauddin Road)

This intersection is located at the border of Makassar City and Gowa Regency. Three roads (Trans-Sulawesi Road, Sultan Alauddin Road and Syeh Yusuf Road) cross at this intersection. The alternative intersections include signal-controlled at-grade intersection (Type-1), grade-separate intersection (Type-2) and full cloverleaf interchange (Type-3) as illusrated in **Figure 7.14**. The grade-separate intersection type is proposed because of large existing and future traffic volume.

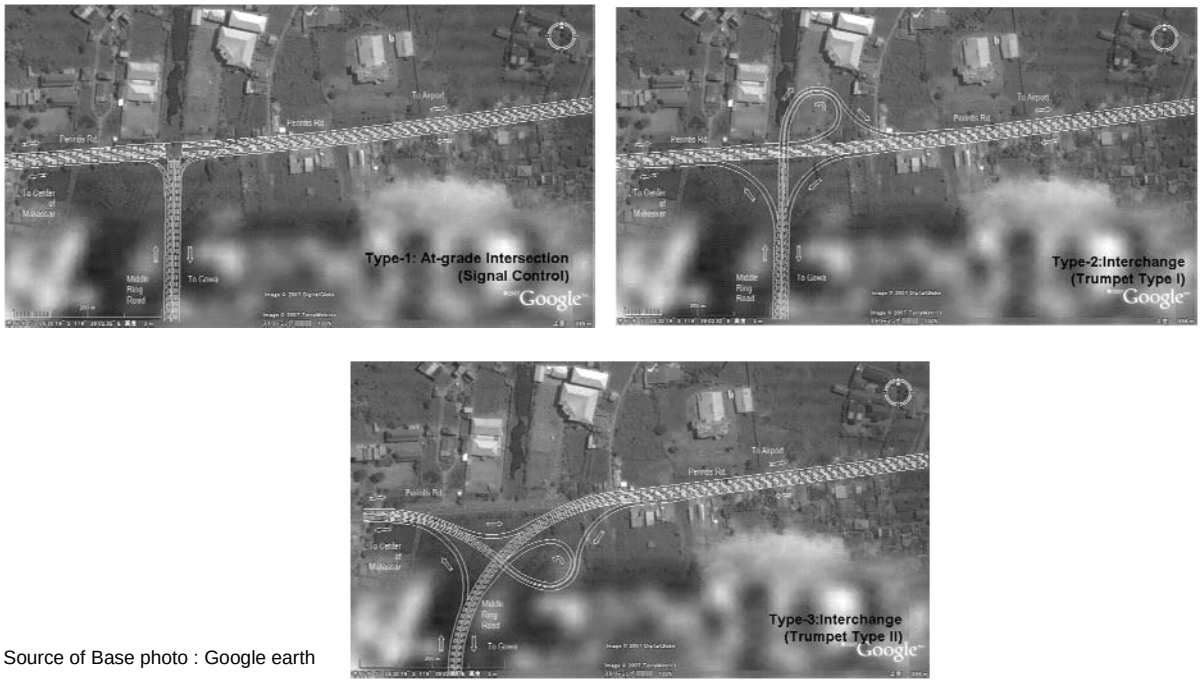


Source of Base photo : Google earth

Figure 7.14 Alternative Intersection Plans for TS-2 IC

2) TS-5 (Trans-Sulawesi Road / Perintis Kemerdekaan Road)

This intersection is a branch point of Trans-Sulawesi Road from Perintis Kemerdekaan Road to Middle Ring Road. The existing Perintis Kemerdekaan Road has a 4-lane road and it is under widening to 6 lanes by DGH. This intersection is surrounded by office buildings and a college campus in the north and an open swamp in the south. The alternative intersections planned are signal-controlled at-grade intersection and two trumpet type interchanges as illustrated in **Figure 7.15**. The at-grade intersection with signal control was proposed as it can take the traffic without saturation by the year 2023 and considering its lower construction cost. Upgrading of this intersection to a grade-separate intersection will be required in the future.

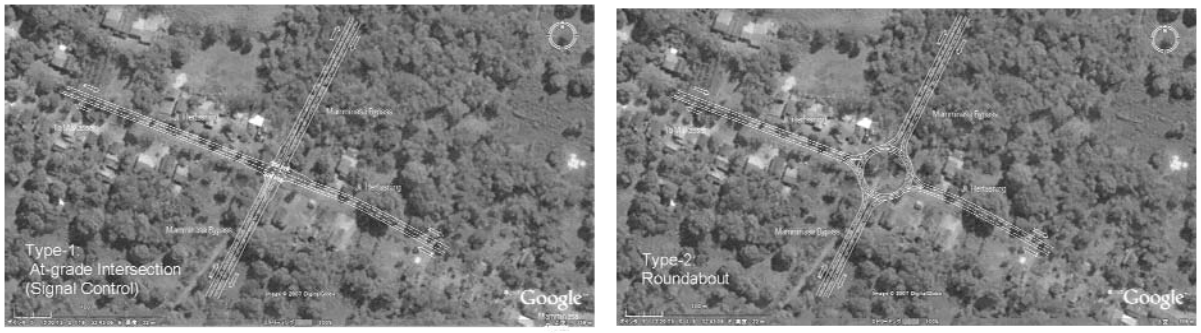


Source of Base photo : Google earth

Figure 7.15 Alternative Intersection Plan for TS-5 IC

3) MB-1 (Mamminasa Bypass / Hertasning Road) and MB-2 (Mamminasa Bypass / Abdullah Daeng Sirua Road)

Both the intersections MB-1 and MB-2 cross at Hertasning Road at approximately 15 km from the Makassar City center. These are located in a rural area. The planned alternative intersections are signal-controlled at-grade intersection (Type-1) and roundabout (Type-2) as illustrated in **Figure 7.16**. Roundabout type intersection was recommended taking operation and maintenance at the rural area into consideration.



Source of Base photo : Google earth

Figure 7.16 Alternative Intersection Plans for MB-1 IC

4) Evaluation and Selection of Type of Intersections

Alternative intersections are evaluated and the most advantageous type was selected for each intersection. In the case of evaluated scours are almost same, the most economical type was selected. **Table 7.17** shows the evaluation results.

Table 7.17 Summary of Intersection Type Evaluation and Selection

Main Road	Crossroad	IC No.	Location (Current Area Division)	Full Control Interchange	Grade Separation with Access	At-grade Intersection with Signal Control	Roundabout without Signal Control	At-grade Intersection without Signal Control
Trans-Sulawesi Mamminasata Road	National Rd. / Mamminasa BP	TS-1	Gowa (Rural)	29.5	**31.5**	**38.0**	**35.8**	24.3
	National Rd. / Local Rd.	TS-2	Makassar /Gowa (Urban)	**30.8**	**36.0**	**35.8**	**34.0**	**30.0**
	Hertasning Rd.	TS-3	Makassar (Urban)	**33.3**	**32.0**	**33.5**	**32.3**	**29.3**
	ADS Rd.	TS-4	Makassar (Urban)	**31.8**	**29.5**	**35.0**	**27.0**	**30.0**
	Perintis Rd.	TS-5	Makassar (Urban)	**33.0**	**33.0**	**33.5**	**32.5**	**29.3**
	Ir. Sutami Rd.	TS-6	Makassar (Urban)	-	-	-	-	-
	Mamminasa BP	TS-7	Maros (Semi-urban)	**29.3**	**33.0**	**34.3**	**33.0**	**29.5**
	Mamminasa BP	TS-8	Maros (Semi-urban)	**29.5**	**31.0**	**38.0**	**37.0**	**30.5**
Mamminasa Bypass	Hertasning Rd.	MB-1	Gowa (Rural)	**30.3**	**32.0**	**39.5**	**40.3**	**33.5**
	ADS Rd.	MB-2	Gowa (Rural)	**30.3**	**32.0**	**39.5**	**40.3**	**33.5**
	National Rd.	MB-3	Maros (Urban)	**24.5**	**26.0**	**37.3**	**36.3**	**30.3**

Notes: Selected Type
Source: JICA Study Team

7.9 Bridge Plan

(1) Number and Length of Bridges

On the routes of the Mamminasa Bypass, Abdullah Daeng Sirua Road, Hertasning Road and Trans-Sulawesi Mamminasata Road, there are a total of 34 bridges and 34 box culverts crossing over rivers or canals as summarized in the following table. A total length of the bridges and the box culverts is 167 m and 1,168 m respectively.

Table 7.18 Bridges and Box-culverts on the F/S Roads

Road Name	L<10m (Box Culvert)		L=10-100m (bridge)		L>100m (major bridge)		Total	
	Number	Length (m)	Number	Length (m)	Number	Length (m)	Number	Length (m)
Mamminasa Bypass	27	109	12	211	2	280	41	600
Trans-Sulawesi Road	3	25	13	46	2	529	18	600
Hertasning Road	1	10	1	20			2	30
A.D.Sirua Road	3	23	4	82			7	105
Total	34	167	30	359	4	809	68	1,335

The following four bridges having a length of more than 100 m were categorized as major bridges in the F/S and subjected to a structure scale examination and subjected to preliminary design:

- Bridge No.1-5, Maros Bridge (length 126 m) on Mamminasa Bypass
- Bridge No.1-15, Jeneberang No.1 Bridge (length 154 m) on Mamminasa Bypass
- Bridge No.2-6, Tallo Bridge (length 136 m) on Trans-Sulawesi Mamminasata Road
- BBridge No.2-10, Jeneberang No.2 Bridge (length 393 m) on Trans-Sulawesi Mamminasata Road.

The standard PC I girder is applied for the bridges of 10 – 100 m long. The standard box culverts were used for the structures of less than 10 m long.

(2) Design Standard

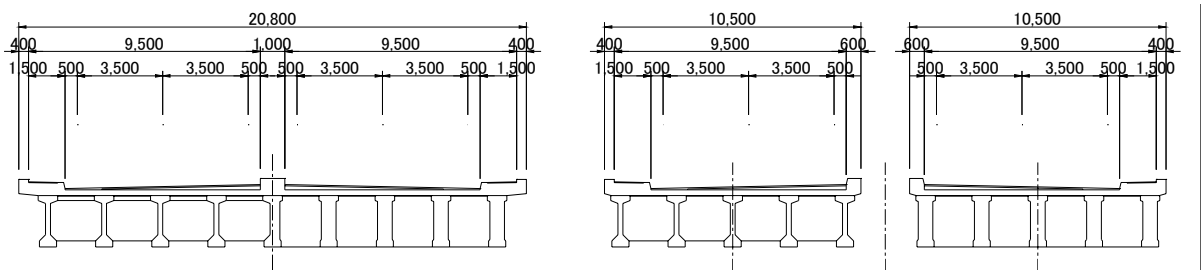
The Indonesian Standard "Bridge Design Code and Manual (BMS 1993)" was applied in bridge design for the F/S. The design loads and materials are followed to this Bridge Design Manual and other Indonesian standards.

The effect of an earthquake on simple structures can be simulated by an equivalent static load as described in Bridge Design Manual. Large, complex or important bridges require a full dynamic analysis. However, the structure type were examined and selected without dynamic analysis in the F/S stage.

(3) Standard Bridge Cross Section

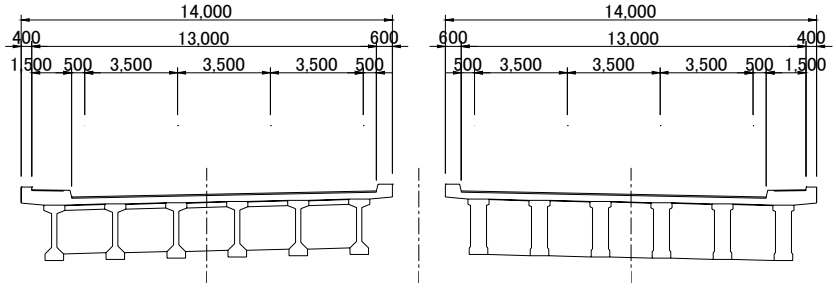
The following shows standard cross sections for major brides.

4-Lane Bridge



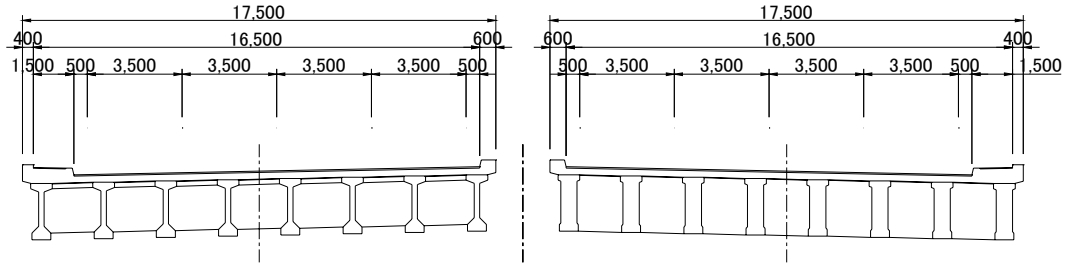
Source: JICA Study Team

6-Lane Bridge



Source: JICA Study Team

8-Lane Bridge



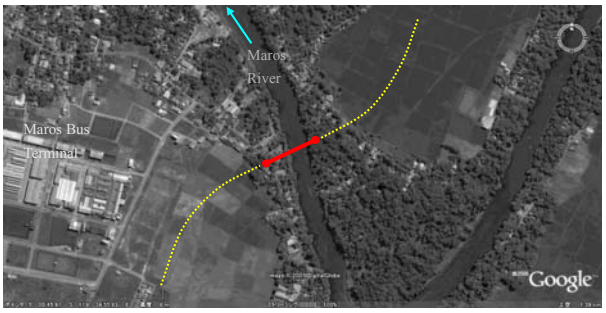
Source: JICA Study Team

Figure 7.17 Cross Section of Major Bridges

(4) Major Bridge Plan

1) Site Condition

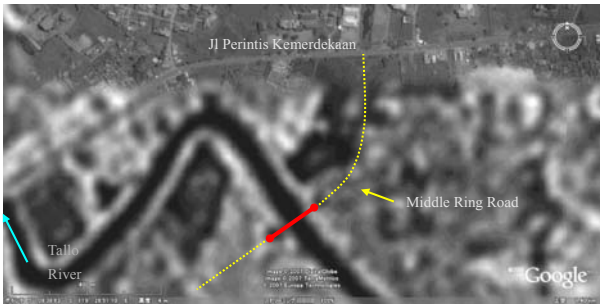
The following four bridges longer than 100 m were examined for their structure scale by preliminary design. The site conditions for those bridges are shown in Figures 7.18 to 7.21.



Source: JICA Study team on Google Earth Photo

Figure 7.18 Maros Bridge on Mamminasa Bypass

Figure 7.19 Jeneberang No.1 Bridge on Mamminasa Bypass



Source: JICA Study team on Google Earth Photo

Figure 7.20 Tallo Bridge on Trans-Sulawesi Mamminasata Road

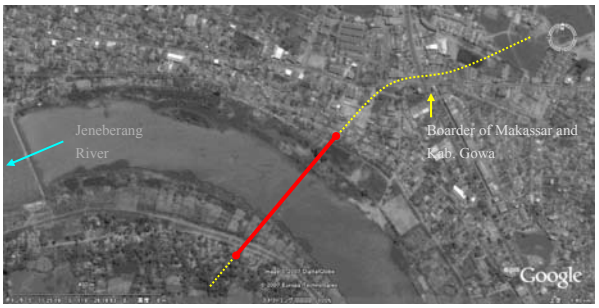


Figure 7.21 Jeneberang No.2 Bridge on Trans-Sulawesi Mamminasata Road

2) Selection of Structure Type for Major Bridges

Table 7.19 shows common structure types and applicable span length applicable for the project bridges. The span arrangement and alignment layout are the key elements to determine the superstructure types. The alternative superstructure types considered are Steel I girder, Steel box girder, Steel truss, Steel arch, PC I girder, PC U Girder, PC box girder and PC arch. A comparison study was made for bridge types including aesthetic aspects.

Table 7.19 Applicable Span Length by Bridge Type

Bridge Type		Applicable Span Length (m)
		0 20 40 60 80 100
Steel	I Girder	
	Box Girder	
	Truss	
	Arch	
PC	Voided Slab	
	I Girder	
	U Girder	
	Box Girder	
	Arch	
	Extra-dosed	

Source: Bridge Design Manual, Japan Pre-stressed Concrete Contractors Association, Japan Association of Steel Bridge Construction and some modification by the JICA Study Team for application in Indonesia

The major four major bridges studied are crossing rivers. Since there are no bridges planned with an abutment height of less than 5 m, a cantilever abutment (Reverse T type) was selected. The pile vent or a multi-column type should be avoided for piers of major bridges.

Pile foundation was selected because the depth of the bearing stratum is approximately from 10 to 20 m. Bored piles are used for the foundation of major bridges.

3) Alternative Bridge Plans

Alternative bridge plans and concept designs were made for the following four major bridges and evaluated on stability, construction easiness, maintenance, aesthetics and construction costs.

i) Maros Bridge, Mamminasa Bypass (See **Table 7.20**)
ii) Jeneberang No.1 Bridge, Mamminasa Bypass (See **Table 7.21**)
iii) Tallo Bridge, Trans Sulawesi Road (See **Table 7.22**)
iv) Jeneberang No.2 Bridge, Trans Sulawesi Road (See **Table 7.23**)

The Maros Bridge, Tallo Bridge and Jeneberang No.2 Bridge located in the Makassar urban area were subjected to aesthetic comparative study considering the landscape.

Table 7.20 Comparison of Bridge Types for Maros Bridge

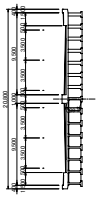
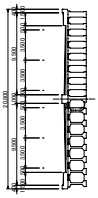
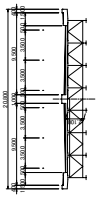
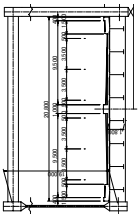
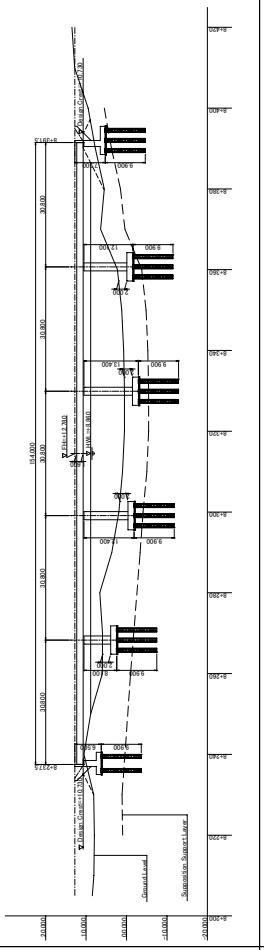
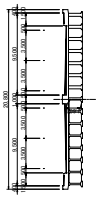
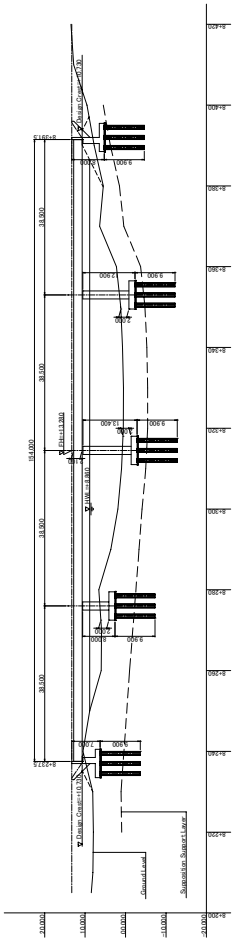
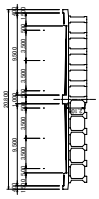
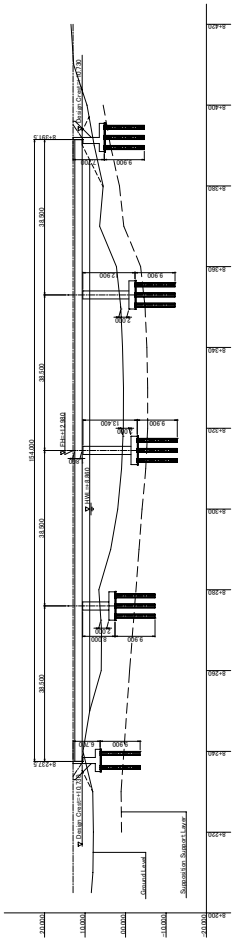
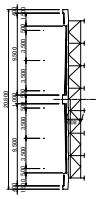
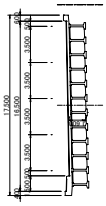
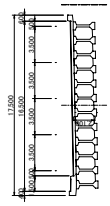
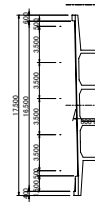
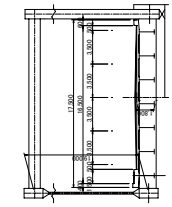
Layout of Maros Bridge (Bridge No.1-5)	Cross Section	Description	Evaluation
Alternative 1 PC 4span I Girder Bridge		Alternative 1 is PC I girder bridge. The main girder (length: 31.5m) can be controlled easily to ensure quality since it is a manufactured structure, but its transportation to the site is required. Cantilever abutment, single column pier and bored pile foundation are adopted for substructures since local contractors have much experience in the construction of this type. The total construction cost is the least. Cost Estimate (Thousand Rupiah) (1) Superstrucure 15,596,000 (2) Substructure 5,330,000 (3) Foundation 2,220,000 TOTAL 100% 23,146,000 Stability Construction Maintenance Aesthetics Cost Total 16 16 8 6 30 76 / 20 / 20 / 10 / 20 / 30 / 100	Best option
Alternative 2 PC 3span I Girder Bridge		Alternative 2 is PC I girder bridge with a longer span. The main girder (length: 42.0m) can be controlled easily to ensure quality since it is a manufactured structure, but its transportation to the site is required. However, since the girder is long, construction is difficult. As for substructures, the same construction method as that for Alternative 1 is adopted. Cost Estimate (Thousand Rupiah) (1) Superstrucure 23,324,000 (2) Substructure 4,197,000 (3) Foundation 1,800,000 TOTAL 127% 29,321,000 Stability Construction Maintenance Aesthetics Cost Total 16 14 8 8 24 70 / 20 / 20 / 10 / 20 / 30 / 100	Not recommended
Alternative 3 Steel I Girder Bridge		Alternative 3 is steel I girder bridge. The main girder (length: 42.0m) is excellent in the quality aspect since it is manufactured at factory, but its transportation to the site is required. Construction materials are to be procured overseas. The total construction cost is higher than Alternative 1. Cost Estimate (Thousand Rupiah) (1) Superstrucure 26,228,000 (2) Substructure 4,046,000 (3) Foundation 1,680,000 TOTAL 138% 31,954,000 Stability Construction Maintenance Aesthetics Cost Total 18 15 6 8 20 67 / 20 / 20 / 10 / 20 / 30 / 100	Not recommended from cost saving view point
Alternative 4 Nielsen-Lohse Bridge		Alternative 4 is Niesel-Lohse bridge. The main girder (length: 125.4m) is excellent in the quality aspect since it is manufactured at factory, but its transportation to the site is required. Construction materials are to be procured overseas. Since the span length is long, construction is difficult. The total construction cost is the highest. Cost Estimate (Thousand Rupiah) (1) Superstrucure 58,178,000 (2) Substructure 1,914,000 (3) Foundation 1,280,000 TOTAL 209% 61,372,000 Stability Construction Maintenance Aesthetics Cost Total 18 10 6 20 13 67 / 20 / 20 / 10 / 20 / 30 / 100	Recommended as an alternative on aesthetics view point as it is located in urban area

Table 7.21 Comparison of Bridge Types for Jeneberang No.1 Bridge

	Layout of Jeneberang No.1 Bridge (Bridge No.1-31)	Cross Section	Description	Evaluation
Alternative 1 PC 5span I Girder Bridge			Alternative 1 is PC I girder bridge. The main girder (length: 30.8m) can be controlled easily to ensure quality since it is a manufactured structure, but its transportation to the site is required. Cantilever abutment, single column pier and bored pile foundation are adopted for substructures since local contractors have much experience in the construction of this type. The total construction cost is the least. Cost Estimate (Thousand Rupiah) (1) Superstrucure 18,648,000 (2) Substructure 6,319,000 (3) Foundation 2,480,000 TOTAL 100% 27,447,000 Stability / Construction / Maintenance / Aesthetics / Cost / Total 12 / 16 / 8 / 4 / 40 / 80 / 20 / 20 / / 10 / / 40 / 100	Best option
Alternative 2 PC 4span I Girder Bridge			Alternative 2 is PC I girder bridge with a longer span. The main girder (length: 38.5m) can be controlled easily to ensure quality since it is a manufactured structure, but its transportation to the site is required. However, since the girder is long, construction is difficult. As for substructures, the same construction method as that for Alternative 1 is adopted. Cost Estimate (Thousand Rupiah) (1) Superstrucure 20,869,000 (2) Substructure 5,187,000 (3) Fourdation 2,220,000 TOTAL 103% 28,276,000 Stability / Construction / Maintenance / Aesthetics / Cost / Total 12 / 14 / 8 / 5 / 39 / 78 / 20 / 20 / / 10 / / 40 / 100	Not recommended
Alternative 3 Steel I Girder Bridge			Alternative 3 is steel I girder bridge. The main girder (length: 38.5m) is excellent in the quality aspect since it is manufactured at factory, but its transportation to the site is required. Construction materials are to be procured overseas. The total construction cost is the highest. Cost Estimate (Thousand Rupiah) (1) Superstrucure 29,884,000 (2) Substructure 4,826,000 (3) Foundation 1,880,000 TOTAL 133% 36,590,000 Stability / Construction / Maintenance / Aesthetics / Cost / Total 14 / 14 / 6 / 5 / 29 / 68 / 20 / 20 / / 10 / / 40 / 100	Not recommended from cost saving view point

Source: JICA Study Team

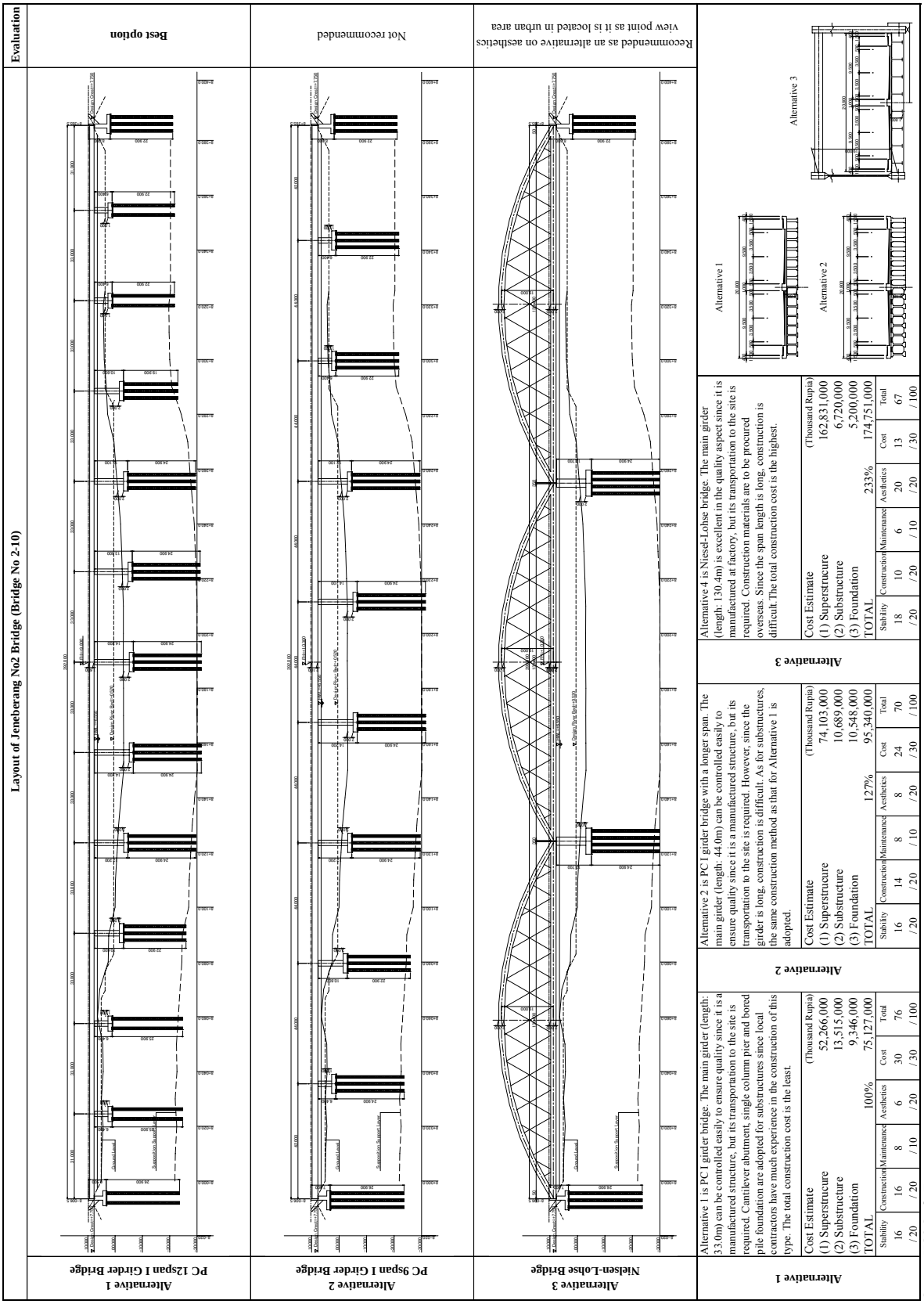
Table 7.22 Comparison of Bridge Types for Tallo Bridge

Layout of Tallo Bridge (Bridge No. 2-6)	Cross Section (one side bridge)	Description	Evaluation
Alternative 1 **PC 4span I Girder Bridge**		Alternative 1 is PC I girder bridge. The main girder (length: 34.0m) can be controlled easily to ensure quality since it is a manufactured structure, but its transportation to the site is required. Cantilever abutment, single column pier and bored pile foundation are adopted for substructures since local contractors have much experience in the construction of this type. The total construction cost is the least. Cost Estimate (Thousand Rupia) (1) Superstrucure 14,701,000 (2) Substructure 5,093,000 (3) Foundation 1,920,000 TOTAL 100% 21,714,000 Stability Construction Maintenance Aesthetics Cost Total 16 16 8 6 30 76 / 20 / 20 / 10 / 20 / 30 / 100	**Best option**
Alternative 2 **PC 3span I Girder Bridge**		Alternative 2 is PC I girder bridge with a longer span. The main girder (length: 46.0m) can be controlled easily to ensure quality since it is a manufactured structure, but its transportation to the site is required. However, since the girder is long, construction is difficult. As for substructures, the same construction method as that for Alternative 1 is adopted. Cost Estimate (Thousand Rupia) (1) Superstrucure 21,825,000 (2) Substructure 3,864,000 (3) Foundation 1,560,000 TOTAL 125% 27,249,000 Stability Construction Maintenance Aesthetics Cost Total 16 14 8 8 24 70 / 20 / 20 / 10 / 20 / 30 / 100	Not recommended
Alternative 3 **PC Box Girder Bridge**		Alternative 4 is PC box girder bridge. The main girder (center span length: 60.0m) is elected as the cantilever construction method in the site. Since the span length is long, construction is difficult. The total construction cost is the highest. Cost Estimate (Thousand Rupia) (1) Superstrucure 25,729,000 (2) Substructure 5,586,000 (3) Foundation 1,960,000 TOTAL 153% 33,275,000 Stability Construction Maintenance Aesthetics Cost Total 16 12 8 12 20 68 / 20 / 20 / 10 / 20 / 30 / 100	Not recommended from cost saving view point
Alternative 4 **Nielsen-Lohse Bridge**		Alternative 5 is Niesel-Lohse bridge. The main girder (length: 135.9m) is excellent in the quality aspect since it is manufactured at factory, but its transportation to the site is required. Construction materials are to be procured overseas. Since the span length is long, construction is difficult. The total construction cost is the highest. Cost Estimate (Thousand Rupia) (1) Superstrucure 47,473,000 (2) Substructure 1,404,000 (3) Foundation 840,000 TOTAL 229% 49,717,000 Stability Construction Maintenance Aesthetics Cost Total 18 10 6 20 13 67 / 20 / 20 / 10 / 20 / 30 / 100	Recommended as an alternative on aesthetics view point as it is located in urban area

Source: JICA Study Team

Table 7.23 Comparison of Bridge Types for Jeneberang No.2 Bridge

Layout of Jeneberang No2 Bridge (Bridge No 2-10)	Alternative 1 PC 12span I Girder Bridge	Alternative 2 PC 9span I Girder Bridge	Alternative 3 Nielsen-Lohse Bridge
Evaluation	Best option	Not recommended	Recommended as an alternative on aesthetics view point as it is located in urban area



Alternative 1

Alternative 1 is PC I girder bridge. The main girder (length: 33.0m) can be controlled easily to ensure quality since it is a manufactured structure, but its transportation to the site is required. Cantilever abutment, single column pier and bored pile foundation are adopted for substructures since local contractors have much experience in the construction of this type. The total construction cost is the least.

Cost Estimate	(Thousand Rupia)
(1) Superstrucure	52,266,000
(2) Substructure	13,515,000
(3) Foundation	9,346,000
TOTAL	75,127,000
	100%

Stability	Construction	Maintenance	Aesthetics	Cost	Total
16	16	8	6	30	76
/ 20	/ 20	/ 10	/ 20	/ 30	/ 100

Alternative 2

Alternative 2 is PC I girder bridge with a longer span. The main girder (length: 44.0m) can be controlled easily to ensure quality since it is a manufactured structure, but its transportation to the site is required. However, since the girder is long, construction is difficult. As for substructures, the same construction method as that for Alternative 1 is adopted.

Cost Estimate	(Thousand Rupia)
(1) Superstrucure	74,103,000
(2) Substructure	10,689,000
(3) Foundation	10,548,000
TOTAL	95,340,000
	127%

Stability	Construction	Maintenance	Aesthetics	Cost	Total
16	14	8	8	24	70
/ 20	/ 20	/ 10	/ 20	/ 30	/ 100

Alternative 3

Alternative 4 is Niesd-Lohse bridge. The main girder (length: 130.4m) is excellent in the quality aspect since it is manufactured at factory, but its transportation to the site is required. Construction materials are to be procured overseas. Since the span length is long, construction is difficult. The total construction cost is the highest.

Cost Estimate	(Thousand Rupia)
(1) Superstrucure	162,831,000
(2) Substructure	6,720,000
(3) Foundation	5,200,000
TOTAL	174,751,000
	233%

Stability	Construction	Maintenance	Aesthetics	Cost	Total
18	10	6	20	13	67
/ 20	/ 20	/ 10	/ 20	/ 30	/ 100

Alternative 1

Alternative 2

Alternative 3

Source: JICA Study Team

4) Evaluation of Alternative Bridge Plans

The PC-I girder was selected as the most appropriate type on its economic advantage and construction efficiency in **Table 7.24**. However, it would be possible to select arch bridge by giving priority on aesthetic aspects. Though construction cost of PC arch and steel arch is approximately 200% - 230% higher than PC I girder, their advantage might be justified as a monument of the urban area. The economic indicators (EIRR, NPV, B/C) would not be deteriorated much by bridge type as the project is evaluated as road development project.

Table 7.24 Evaluation of Alternative Bridge Type for Major Bridges

Maros Bridge

Bridge Length: 126m

Area / Alternative	Structure Types	Span	Stability	Construction	Maintenance	Aesthetics	Cost	Total
Urban			20%	20%	10%	20%	30%	100%
Alternative 1	PC I Girder	31.5m x 4	16%	16%	8%	6%	30%	76%
Alternative 2	PC I Girder	42m x 3	16%	14%	8%	8%	24%	70%
Alternative 3	Steel I Girder	42m x 3	18%	15%	6%	8%	20%	67%
Alternative 4	Nielsen Lose (Arch)	126m	18%	10%	6%	20%	13%	67%

Jeneberang No. 1 Bridge

Bridge Length: 154m

Area / Alternative	Structure Types	Span	Stability	Construction	Maintenance	Aesthetics	Cost	Total
Rural			20%	20%	10%	10%	40%	100%
Alternative 1	PC I Girder	30.8m x 5	12%	16%	8%	4%	40%	80%
Alternative 2	PC I Girder	38.5m x 4	12%	14%	8%	5%	39%	78%
Alternative 3	Steel I Girder	38.5m x 4	14%	14%	6%	5%	29%	68%

Source: JICA Study Team

Tallo Bridge

Bridge Length: 136m

Area / Alternative	Structure Types	Span	Stability	Construction	Maintenance	Aesthetics	Cost	Total
Urban			20%	20%	10%	20%	30%	100%
Alternative 1	PC I Girder	34m x 4	16%	16%	8%	6%	30%	76%
Alternative 2	PC I Girder	45m+46m+45m	16%	14%	8%	8%	24%	70%
Alternative 3	PC Box Girder	38m+60m+38m	16%	12%	8%	12%	20%	68%
Alternative 4	Nielsen Lose (Arch)	136m	18%	10%	6%	20%	13%	67%

Source: JICA Study Team

Jeneberang No. 2 Bridge

Bridge Length: 393m

Area / Alternative	Structure Types	Span	Stability	Construction	Maintenance	Aesthetics	Cost	Total
Urban			20%	20%	10%	20%	30%	100%
Alternative 1	PC I Girder	31mx2+33mx10	16%	16%	8%	6%	30%	76%
Alternative 2	PC I Girder	42mx2+44mx7	16%	14%	8%	8%	24%	70%
Alternative 3	Nielsen Lose (Arch)	130mx3	18%	10%	6%	20%	13%	67%

Source: JICA Study Team

(5) Minor Bridges

Superstructure types of minor bridges used for the project are box-culverts for less than 10m span, PC hollow slab for span length of 10-16m and PC I Girder for 16 - 35 m span common and economical structure types in Indonesia.

Reversed T type abutment is applied for the substructure and PC pile (tube and/or square) foundation is selected as the depth of the bearing stratum is approximately 10 to 30 m.

7.10 Preliminary Design of F/S Roads

(1) General

The Study Team has designed roadways, intersections, bridges, pavement, drainage and other structures for the F/S roads in accordance with the design standards, road development concept, and route alignments established in Sections 7.4 – 7.9. The engineering design was based on the results of natural condition survey (topography, hydrology and geotechnical conditions) and their analysis. Overall accuracy of preliminary designs is within 10 - 15% allowable for the F/S stage.

The design results are reflected to the Drawings in Volume 2-2 (Preliminary Design Drawings). The road sections which are currently under execution or going to be implemented by 2010 by DGH and/or regional governments were not included in the preliminary design.

(2) Roadways

The preliminary design of roadways was made for the F/S roads on the topographic survey maps. Topographic survey data, including the photo-mosaic of the road from aerial survey, were calibrated when drawing the horizontal alignments on the topographic maps. Digital Terrain Model was then prepared from the cross section survey point data and contours from ortho-photo after creating 3-dimensional features like existing road, existing ditches, canal, etc. and other road features. Typical cross section templates for the F/S road were created and used for calculating the earthworks and other works quantities.

(3) Intersections

Preliminary design of major intersections on the Trans-Sulawesi Mamminasata Road and the Mamminasa Bypass were conducted based on topographic survey, traffic forecasts, intersection capacity analysis by IHCM and road alignment design. The list and type of intersections are as shown in **Table 7.24**.

There are two flyover intersections crossing at Ir Sutami Toll Road and Sultan Alauddin Road. As the flyover of Ir Sutami Toll Road is constructed by the on-going BOT project, it was excluded in this F/S preliminary design.

Table 7.25 List and Type of Intersections

Road	ID	Location	Current Station	No.of Legs	Remarks
Trans-Sulawesi Mamminasata Road	TS-1	Existing National Road (Sungguminasa – Takalar Road)	34+840	3	At-grade with signal control
	TS-2	Existing National Road (Sultan Alauddin Road)	26+200	6	At-grade with flyover for Trans-Sulawesi Road
	TS-3	Hertasning Road	23+900	4	At-grade with signal control
	TS-4	Abdullah Daeng Sirua Road	20+325	4	At-grade with signal control
	TS-5	Perintis Kemerdekaan Road	19+100	3	At-grade with signal control
	TS-6	Ir. Sutami Toll Road	8+700	4	Flyover and at grade under on-going BOP project
Mamminasa Bypass	TS-7	Mamminasa Bypass(North) at national road of Maros-Pangkep	0+000	3	At-grade with signal control
	TS-8	Mamminasa Bypass(North) at national road of Makassar-Maros	0+000	3	At-grade with signal control
	MB-1	Hertasning Road	27+100	4	Roundabout
	MB-2	Abdullah Daeng Sirua Road	23+350	4	Roundabout
	MB-3	National Road	2+630	4	At-grade with signal control

Source: JICA Study Team

(4) Bridges

Preliminary design has been conducted for four bridges having a length of more than 100 m. General view drawings of the structures proposed as optimal are provided in Volume2-2: Preliminary Design Drawings.

(5) Pavement

1) Approach for Pavement Design

The pavement is one of the most essential parts of roadway and its cost is substantial. Bina Marga has RDS (Road Design System) as a module of the IRMS. However, as it is under a review, the JICA Study Team designed the pavement for the F/S roads based on "AASHTO Guide for Design of Pavement Structures, 1993".

Both flexible (asphalt concrete) and rigid pavement (Portland cement concrete pavement) are studied and evaluated.

2) Design Load

The design ESAL was estimated for a period of 10 years for flexible pavement and for 20 years for rigid pavement. Overloaded condition was not considered much as it should be controlled by weigh bridges located at inlets/outlets of the F/S roads.

3) Construction and Productivity

There would not be much difference in equipment requirements. Asphalt concrete pavement construction requires mixing plant, paver, trucks and compaction equipment while concrete pavement requires concrete mixing plant, trucks and paver. Major materials for the asphalt concrete are asphalt and aggregate. Those for the concrete pavement are cement, aggregate and steel bars. Daily construction productivity would not differ much if a slip form paver is used for the concrete pavement construction as it can produce 700-800 m^2 per day as experienced by the Ir Sutami Toll Road Project. The biggest difference is that asphalt concrete pavement can open to traffic just 1-2 hours after construction while the concrete pavement requires 14 days.

4) Evaluation of Pavement Types

The Study Team made an evaluation on the pavement types taking technical and economic points analyzed in the above into consideration. The life cycle cost of pavement consists of initial investment, periodic maintenance and routine maintenance costs. A turning point of the rigid pavement advantage seems to exist at 20 million CESA or at 7 million CESA for AC. This point is equivalent to 23 cm slab thickness of concrete pavement.

The rigid pavement is also has advantages if the CBR of available subgrade materials (borrowed materials) is less than 8%. The rigid pavement has advantages in the urban area if there are many accessed and traffic signals as flexible pavement is damaged by rutting, shoving and/or spilled oil by stop-start action of vehicles. The Study Team recommended the application of the flexible and rigid pavements for the F/S roads as shown in **Table 7.26**. Rigid pavement is recommended for the Maros-Jl.Ir.Sutami section and the Middle Ring Road section of the Trans-Sulawesi Mamminasata Road.

Table 7.26 Design Condition and Pavement Types for F/S Roads

Road Link	Section	Location	Cut or Fill	Subgrade Strength (CBR)	Design CESA ($10^{\wedge 6}$)		Type of Pavement	
					10 years period	20 years period	Flexible Pavement	Rigid Pavement
Trans-Sulawesi Mamminasata Road	A Maros-Jl.Ir.Sutami IC	Urban	Cut*/ Fill	8%		34.0		O
	B Middle Ring	Urban	Fill	6%		21.0		O
	C Middle Ring Access	Urban	Fill	8%	9.0		O	
	D Boka-Takalar	Semi-urban	Fill	8%	4.0		O	
Mamminasa Bypass	A North Section	Semi-urban	Fill	8%	4.0		O	
	B Middle Section	Urban	Cut*/ Fill	8%	4.0		O	
	C South Section	Semi-urban	Fill	8%	4.0		O	
Jl. Hertasning	Gowa Section	Semi-urban	Fill	8%	4.0		O	
Jl.Abdullah Daeng Sirua Road	A Makkassar City	Urban	Cut*/ Fill	8%	4.0		O	
	B Maros/Gowa Section	Semi-urban	Fill	8%	4.0		O	

Note: * improvement of subgrade to CBR 8% with replacing the top of subgrade for cur section with selected materials.
Source: JICA Study Team

5) Pavement Thickness Design

Table 7.27 summarizes the pavement structures for the F/S roads.

Table 7.27 Summary of Pavement Thickness for F/S roads

Road Link	Section	Surafce				Base and Subbase			Sub-grade CBR
		AC (W)	AC (B)	AC (base)	PCC	Class A	Class B	SCB	
Trans-Sulawesi Mamminasata Road	A Maros-Jl.Ir.Sutami IC				26		20	10	8%
	B Middle Ring				24		20	10	6%
	C Middle Ring Access	4	4	5		20	30		8%
	D Boka-Takalar	4	6			20	30		8%
Mamminasa Bypass	A North Section	4	6			20	30		8%
	B Middle Section	4	6			20	30		8%
	C South Section	4	6			20	30		8%
Jl. Hertasning	Gowa Section	4	6			20	30		8%
Jl.Abdullah Daeng Sirua Road	A Makkassar City	4	6			20	30		8%
	B Maros/Gowa Section	4	6			20	30		8%

Source: JICA Study Team

(6) Drainage and Other Structures

1) Drainage Design

Drainage design along the F/S roads was carried out based on the design run off from the adjacent areas. According to the drainage design standard of Indonesia, the design period for culverts along the arterial road is 10 years and 5years for roadside ditches.

Figures 7.22 and 7.23 show standard cross sections of road side ditch and drainage pipe and catch pit.

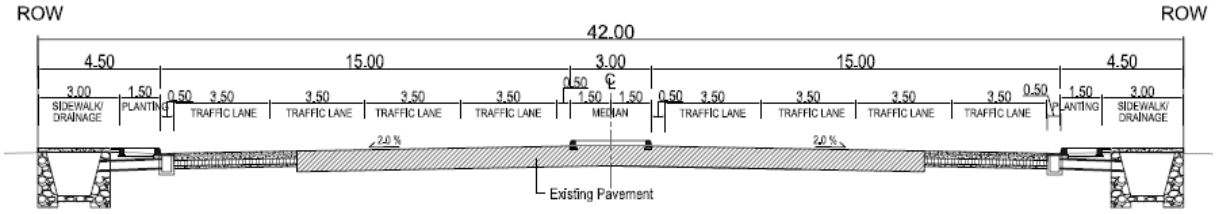


Figure 7.22 Standard Cross Section of Road Side Ditch

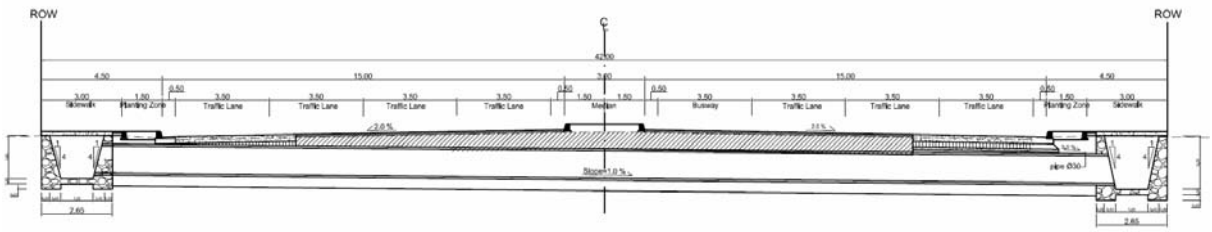


Figure 7.23 Standard Cross of Drainage Pipe and Catch Pit

2) Soft Ground Countermeasure Structures

A 470m-long deep soft ground is located in the Tallo swamp area at the entrance of Middle Ring Road from Jl. Perintis Kemerdekaan. RC slab on PC-piles is recommended as a soft ground countermeasure as illustrated in **Figure 7.24**.

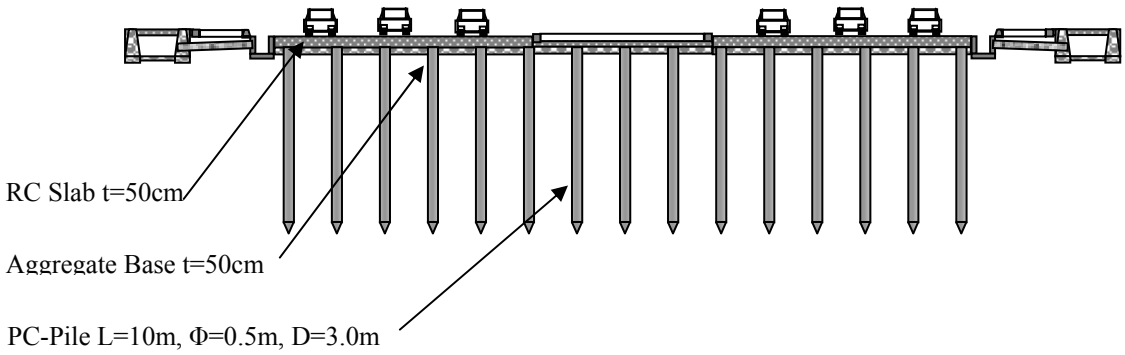


Figure 7.24 Soft Ground Countermeasures for Tallo River Swamp

3) Retaining Wall (Reinforced Earth Wall)

Reinforced earth retaining walls was planned at the flyover section between the Middle Ring Road/Jl. Sultan Alaudin intersection and Jeneberang River Bridge to properly arrange the vertical alignment and minimize resettlement.

(7) Miscellaneous

1) Grade Separated Pedestrian Crossing Facilities

Pedestrian bridges and box culverts are planned for safe pedestrian crossings. These are located at heavily traffic intersections near public facilities such as hospital, school and mosque. The box culverts are planned on embankment sections as alternative of the pedestrian bridge. The gentle access slopes will be planned for the pedestrian bridges for convenience to disabled peoples, senior citizens and cyclists.

2) Traffic Safety Facilities (Street Light, Markings and Road Signs)

Street light are installed at intersections and along urban road sections of the F/S roads. Location of the street light installation will be on the median, and the twin bulb type is recommended.

Road markings and traffic signs are deigned in compliance with the Indonesian standard and site conditions.

7.11 Construction Plan

(1) General

The construction methods widely used at the project area are adapted while paying attention to quality, period, cost, environmental influence and safety.

Table 7.28 shows major work items and estimated quantities by the F/S road based on the preliminary design.

Table 7.28 Major Construction Quantities

Item	Unit	Mamminasa Bypass	Trans Sulawesi	Hertasning Road	A.D. Sirua	Total
Mortared Stonework	m3	184,721	154,978	13,719	44,865	398,283
Common Excavation	m3	1,026,978	376,227	60,212	671,719	2,135,136
Common Embankment	m3	2,999,660	961,307	178,096	773,379	4,912,442
Selected Embankment	m3	18,469	25,447	892	3,814	48,622
Aggregate Base Class A	m3	149,737	91,640	14,984	44,146	300,507
Aggregate Base Class B	m3	233,357	193,751	23,352	68,798	519,258
Cement Treated Sub Base	m3	0	22,277	0	0	22,277
Asphaltic Concrete-Wearing Course (3-5cm)	m2	1,479,056	954,207	146,910	434,790	3,014,963
Asphaltic Concrete-Binder Course	m3	0	23,885	13,719	0	37,604
Asphaltic Concrete-Base Course	m3	0	15,036	6,624	0	21,660
Portland Cement Concrete Pavement	m3	0	62,655	0	0	62,655
Structural Concrete	m3	54,320	73,453	4,421	2,481	134,675
Precast Unit Type I Girder (16-35m)	nos	416	458	11	18	903
Reinforcing Steel	ton	2,296	3,032	154	268	5,750

Source: JICA Study Team

(2) Procurement Plan

The design and construction plans were made to use the construction materials available in or vicinity of the project areas as much as possible. Coarse and fine aggregate (sand) are available from the upstream of Bili0bili Dam. Borrow materials for embankment are also available along or vicinity of the F/S roads.

Steel materials are mostly brought from Surabaya. Cement is available from two cement producers (Bosowa Cement and Tonasa Cement) located between Maros and Pangkajene.

(3) Construction Procedures

The project is either the existing road widening or new construction. Major works are earth works for widening, drainage, bridges, pavement, and countermeasures against soft ground and road facilities. The common procedures used in the project area or Indonesia will be used.

7.12 Road Development Methods in Harmony with Urban Development

(1) Necessity of Applying Urban Development System for Road Development

The F/S and Pre-F/S roads were routed or aligned meandering through urbanized areas to avoid resettlement. However, some part of the roads needs to pass through the densely built-up areas. To solve land acquisition and resettlement conflict, urban development system could be applied in the course of road development so as to ease the frictions between road development (new or widening). A plan could be made to arrange (or adjust) the existing plots, buildings and infrastructure which would lead to benefiting both sides. The urban development system will contribute to a wider range of road routing alternatives and leading to effective and efficient urban road network establishment.

(2) Possible Frictions between Road Development and Urban Settlements

For optimistic road routes selection for part of Trans-Sulawesi Road, Outer Ring Road, Abdullah Daeng Road and Mamminasata Bypass, there are some areas where frictions with the existing urban built-up areas may take place. One of the methods avoiding these frictions would be application of land readjustment system for the urban development areas.

(3) Land Readjustment System for Road Development Method

The land readjustment system (LR system), which is basically defined as urban area-wide development system providing urban serviced land, has been considered to be one of the most effective systems for developing road network including arterial, collector and local roads. Because its system is designed not to evict the landholders and leaseholders from the project site so as to minimize the friction between road development and human settlement. The LR system is classified into the following 3 types:

- Area-wide Land Readjustment

- Roadside-LR Type Road Development
- Roadside-Improvement Road Development

The first one, "Area-wide Land Readjustment" is a LR full scale system to develop urban areas covering considerably a wider range of area, say 10 to several hundreds hectares, comprising urban land development and infrastructure. The second and third ones are systems more specified to arterial road development. The project areas are correspondingly limited to smaller areas where the arterial roads are planned to pass through. While "Roadside-LR type Road Development" focuses on some sections of arterial road belts, "Roadside-Improvement Road Development" covers land plots influenced by the arterial road construction.

(4) Indonesian Context and Sulawesi

"Land Readjustment system" or "Land consolidation system (K/T: Konsolidasi Tanah)" in Indonesia version, has been established and a number of projects have been implemented using this system throughout the country under the authority or responsibility of land administration, especially the National Land Agency (BPN). It might be possible to apply the existing LR system with some modification to secure the ROW and agreement of the affected communities for the projects to be implemented in the medium-long term.

8 ENVIRONMENTAL CONSIDERATIONS

8.1 Basic Approaches for Environmental Considerations

Both the Indonesian AMDAL (EIA) regulations and the JICA Guidelines for Environmental and Social Considerations have been applied for the environmental considerations studies for the F/S roads. IEE has been applied for the evaluation of the alternative routes and development concepts to select the most appropriate plan of the F/S roads. On the other hand, EIA is a more in-depth environmental impact survey based on the selection of the most appropriate route by using the IEE-level evaluation in terms of engineering, economic and environmental aspects.

8.2 Scope of the Study for EIA

The EIAs have been conducted for the selected routes as the best or the most practical ones through the IEEs. The EIAs for the F/S roads are classified into two groups: the 1st group is the Trans-Sulawesi Road Mamminasata Section, the national road or proposed national road with the highest priority, and the other group is the Mamminasa Bypass, Hertasning Road and Abdullah Daeng Sirua Road as shown in **Table 8.1**. The EIA report has been prepared for each group.

Table 8.1 Grouping of F/S Roads for EIA

Road Name	Group
(1) Trans-Sulawesi Road Mamminasata Section	Group 1
(1) Mamminasa Bypass (2) Hertasning Road (3) Abdullah Daeng Sirua Road	Group 2

8.3 Study Areas

The Study areas cover Kabupaten Maros, Kabupaten Gowa, Kabupaten Takalar and Makassar City in South Sulawesi Province. **Table 8.2** shows the location of the Study areas in the regencies concerned.

Table 8.2 Locations of Study Areas

No.	FS and Pre-FS Road		Regency (Kota / Kabupaten)			
			Makassar	Maros	Gowa	Takalar
1	Mamminasa Bypass			O	O	O
2	Trans-Sulawesi Mamminasata (Total Length: 58 km)	Maros-Middle Ring Road IC (Jl. Perintis)	O	O		
		Middle Ring Road	O			
		Middle Ring Road Access	O		O	
		Middle Ring Road Access - Takalar			O	O
3	Hertasning Road		**Works Completed**		O	
4	Abdullah Daeng Sirua Road		O	O	O	
5	Outer Ring Road		O	O	O	

Note: **O** The regency where the F/S roads pass through.

8.4 Results of EIA (AMDAL) Studies

The draft of the AMDAL Final Report (ANDAL, RKL and RPL) for the Group 1 project was presented and discussed in the AMDAL Committee/AMDAL Appraisal Technical Team Meeting on August 20th, 2007. The approval of those final AMDAL documents was stipulated by the Decree of Head of Bappedalda South Sulawesi Province No.660/746/II/Bapedalda, dated on September 28th, 2007.

On the other hand, the draft of the AMDAL TOR for the Group 2 project was presented and discussed in the AMDAL Committee/AMDAL Appraisal Technical Team Meeting on November 27th, 2007. The approval of those final AMDAL documents was stipulated by the degree of Head of Bappedalda South Sulawesi dated on December 7th 2007.

8.5 Results of EIA Studies (Trans-Sulawesi Road Mamminasata Section)

a) Pre-construction Stage

The major impact during the pre-construction stage is the land acquisition and resettlement required for the right of way of the planned road development. The estimated number of the PAPs for the resettlement is 2723 which is composed of 1115 houses, 1483 small shops and 125 public buildings alongside the planned road, as shown in Table 8.3. On the other hand, the area required for the land acquisition is estimated at 1.19 square km. The number is subject to change as a result of the final designing of the road.

Table 8.3 Estimated Number of PAPs
(Trans-Sulawesi Road Mamminasata Section)

Section		House (No.)	Shop (No.)	Public Building (No.)	Total (No.)
Section A	Maros - Jl. Sutami IC (Maros Section)	283	905	40	1228
	Maros - Jl. Sutami IC (Makassar Section)	37	178	27	242
	Perintis Road	0	0	0	0
Section B		92	16	2	110
Section C		42	10	2	54
Section D		661	374	54	1089
Total		1115	1483	125	2723

It seems that the impacts on the natural environment in the pre-construction stage are almost nothing. However, it is important to sufficiently consider the construction plan, schedule and mitigation measures in this stage.

b) Construction Stage

1) Air Pollution

As the number of construction machines and conveyance trucks and vehicles are limited, it seems that the impacts on the air quality are relatively small compared with the present condition. However, as the construction is mainly implemented during dry season, the countermeasures, sprinkling water, cleaning of road and so on are critical to reduce the dust and TSP.

2) Noise Level

Noise of the construction machines and vehicles can be reduced by the regular maintenance and efficiently scheduled operation. The noise around the construction areas should be monitored so that countermeasures can be taken timely. For example, the noise impact could be reduced by a proper schedule of the operating hours of construction machines, especially near the hospitals, schools and mosques.

3) Water Pollution

The road construction will increase TSS in the near-by river bodies. However, it can be minimized by installing temporary sedimentation ponds at an early stage of the construction. Construction of bridge piers in river needs to adopt the steel sheet pile method or other similar methods in order to avoid turbid water. It is also important to enforce regular monitoring to evaluate the conditions against the river water standard.

4) Fauna and Flora

The endemic and protected species of fauna and flora are not mentioned in/around project site on the previous investigation reports. Only common species of fauna and flora are confirmed, and the precious diversity of biota is not discovered too.

If some unique species and/or other precious kinds to be conserved are found during construction and post-construction phase, it is necessary to take the proper measures for fauna and flora, i.e. limited protection zone, bedded in other place etc.

c) Post-Construction

1) Air Pollution

The forecasted air quality data is not exceeded the Environmental Standard except TSP. It is considered that the TSP can be controlled by spraying water, road side plantation, cleaning of road and maintenance of pavement.

It seems that the air quality in future will be not deteriorated so seriously comparing with Environmental Standard by the regulation of exhaust gas,

reduction of traffic jam and proper road maintenance etc.

2) Noise Level

After the completion of the project, noise will be caused by the operating vehicles on the road. In the future, as it is guessed that the traffic density will be increased certainly, countermeasures for hospital and schools along the target streets are necessary to be planned the protection against traffic noise impact.

3) Water Quality

During the operation phase, it is judged that there is no cause of wastewater discharge from target road.

8.6 Results of EIA Studies (Mamminasa Bypass, Hertasning and Abdullah Daeng Sirua Road)

a) Pre-construction Stage

The major impact during the pre-construction stage is the land acquisition and resettlement required for the right of way of the planned road development. The estimated number of the PAPs to be resettled is shown as **Table 8.4**. On the other hand, the area required for the land acquisition is estimated at 1.895 square km. The numbers are subject to change as a result of the final designing of the roads.

Table 8.4 Estimated Number of PAPs
(Maminassa Bypass, Hertasning Road, and Abdullah Sirua Road)

Name of Roads	House (No.)	Shop (No.)	Public Building (No.)	Total (No.)
Maminassa Bypass	56	9	0	65
Hertasning Road	283	25	8	316
Abdullah Daeng Sirua Road	205	63	8	276
Total	544	97	16	657

The impacts for natural environment in the pre-construction phase are almost nothing in the same manner as Trans-Sulawesi Road Mamminasata Section.

b) Construction Stage

The impacts and evaluations for natural environment during the construction phase also are almost same as Trans-Sulawesi Road Mamminasata Section.

c) Post-Construction Stage

1) Air Pollution

All air quality data do not exceed the Environmental Standard, but total suspended particulate (TSP) and PM10 are relatively high. It is considered that the TSP and PM10 can be controlled

by spraying water, road side plantation, cleaning of road and maintenance of pavement.

2) Noise Level

The peak noise levels of Mamminasa Bypass, Hertasning Road and Abdullah Daeng Sirua Road exceed Environmental Standard (70 dB(A)) in commercial and service area.

3) Water Quality

During the operation phase, it is judged that there is no cause of wastewater discharge from the planned road.

8.7 Mitigation Measures and Monitoring

Effective environmental management during pre-construction and construction requires the establishment of effective institutional arrangements for the implementation of the Environmental Management Plan (RKL) as well as the proper Environmental Monitoring Plan (RPL). The RKL has been prepared to deal with the following mitigation measures.

Pollution concerning this project are considered such as air pollution, noise, vibration and water pollution that directly caused by construction activities. In any case, the proper troubleshooting is essential to go forward with construction and operation favorably. For the operation phase, air pollution and noise level caused by the vehicles needs to be evaluated. The air quality and noise level do not deteriorate simply and immediately at the time of increasing the traffic density as main cause of air pollution and noise. Natural impacts caused by this project are estimated such as terrestrial biota (fauna and flora), aquatic biota (fish and aquatic plant) in and around project site. Landscape is not so significant for construction activities. The Environmental Monitoring Plan (RPL) has been also prepared to respond to these mitigation measures.

Table 8.5 Outline of Mitigation Measures

Environmental Impacts	Construction phase	Post-Construction phase
Air Pollution	-Sprinkling water along access road -Washing tires of trucks and construction machines -Using cover sheets for trucks -Regular maintenance -Efficient operation schedule -Using good quality fuel	-Sprinkling water along roads -Road cleaning -Reducing vehicles speed -Maintenance of pavement -Roadside plantation -Environmental buffer zone
Noise	-Reducing vehicles speed (especially nearby residential area) -Regular maintenance -Efficient operation schedule	-Reducing vehicles speed (especially nearby residential area) -Maintenance of pavement -Roadside plantation -Environmental buffer zone
Vibration	-Reducing vehicles speed (especially nearby residential area) -Regular maintenance -Efficient operation schedule	-Reducing vehicles speed (especially nearby residential area) -Maintenance of pavement -Roadside plantation -Environmental buffer zone

Water Pollution	-Considering to set up temporary sediment pond -Adopting the sheet pile method and so on for the construction -Prohibiting disposal of oil and grease, dumping of garbage -Setting up sewerage system for labor camp -Separate collection of litter and garbage in labor camp -Managing garbage disposal	No source of water pollution
Terrestrial Biota	-No endemic and protected species of fauna and flora (excluding the birds) <if endemic and/or protected species found> -Confirmation of existence of species -Report to public authorities -Implementation of removing and transplantation plan -Effective conservation and protection program	Not significant impacts of fauna and flora
Aquatic Biota	-No endemic and protected species of fauna and flora <if endemic and/or protected species found> -Confirmation of existence of species -Report to public authorities -Implementation of removing and transplantation plan -Effective conservation and protection program	Not significant impacts of aquatic fauna and flora
Landscape	-Green planting along the access road -Proper maintenance for trees and plant along the access road (adopt system etc.) -Encouragement to the green plantation for surrounding	-Proper maintenance for trees and plants along the road (adopt system etc.) -Encouragement of the green plantation for surrounding

Regarding the Mamminasa Bypass, Hertasning and Abdullah Daeng Sirua Roads, the mitigation measures against pollution factors are almost same as Trans-Sulawesi Road Mamminasata Section. On the other hand, almost of project area is cultivation land for paddy, vegetables and corn etc. But some parts of the project road area are remaining as copses, so it cannot be denied there is no possibility of natural habitat of endemic and protected fauna and flora. Therefore, if some unique species and/or other precious kinds to be conserved are found, it is necessary to take the proper measures, i.e. limited protection zone, bedded in other place etc.

Moreover, there are many fruit trees around the houses and in the project area. It is expected that as many fruits trees as possible are protected from the project. Because of these fruits trees are resource of money income for surrounding residents. It is very effective for eco-friendly road project to design the buffer zone including some existing copses.

8.8 Implementation of Public Consultations

In accordance with the regulations of the AMDAL consultation procedures, a series of public consultations including the following meetings have been held. The 3rd meeting for each project was held in response to the special requirement by the JICA Guidelines for Environmental and Social Considerations.

Table 8.6 Implementation of Public Consultations

No.	Schedule	No. of Participans	Participants
Trans Sulawesi Mamminasata Road Section			
1	April 2-9, 2007	249	Community, representatives of related villages, related institutions
2	May 8, 2007	51	Technical Team and Committee members
3	June 7, 2007	68	Related institutions and communities
4	August 20, 2007	51	Technical Team and Committee members
Mamminasa Bypass, Hertasning and Abdullah Daeng Sirua Road			
1	May 26 – June 7 2007	245	Community, representatives of related villages, related institutions
2	September 3, 2007	45	Technical Team and Committee members
3	September 11, 2007	112	Related institutions and communities
4	November 27, 2007	50	Technical Team and Committee members

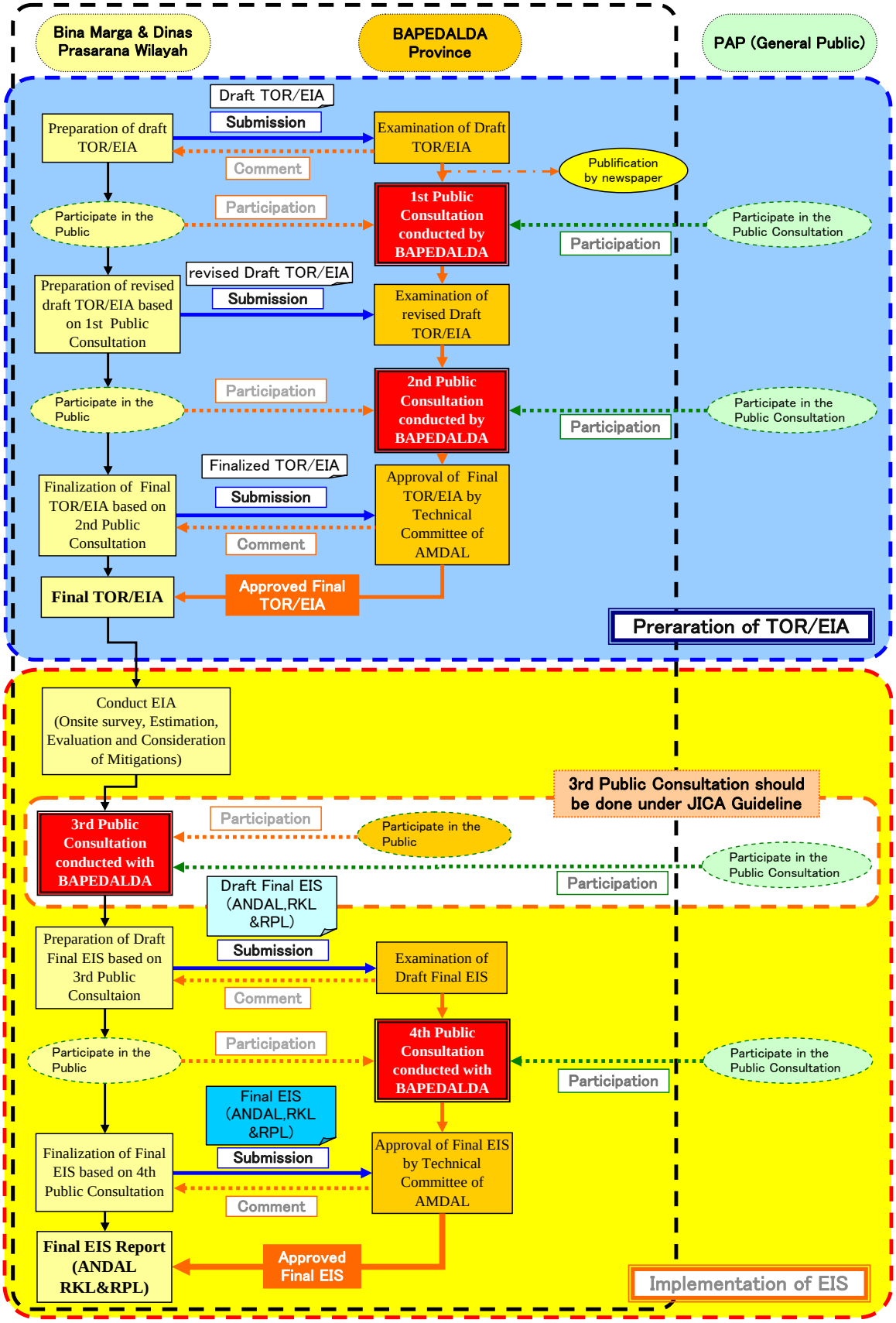


Figure 8.1 Procedure for Public Consultations

8.9 Preparation for LARAP Policy Framework

A Land Acquisition and Resettlement Action Plan (LARAP) is a document required for any project which results in the physical resettlement of people, and it must specify the procedures and actions it should take in order to properly resettle and compensate PAPs and communities. According to the basic concept of the JICA guidelines, a LARAP is required to ensure that their incomes and living standards of PAPs should be restored to at least pre-project levels and are not worse off than they would have been without the project. More specifically, a LARAP should be prepared as a detailed plan for mitigating the land acquisition impacts in an attempt:

- to ensure that the social and economic livelihood of PAPs is recovered at least the pre-project level;
- to provide policy and procedural guidelines for the acquisition of land and other assets, compensation, and resettlement;
- to identify households that will be adversely affected by the Project, where they are located, what compensation and related alleviating measures are to be provided and how and when these measures will be implemented; and
- to provide a plan on for the community participation of the PAPs could be involved in the various stages of the project, including the implementation of the RAP

Since the full-scale detailed LARAP for the Trans-Sulawesi Mamminasa Section will be formulated after the feasibility study, apart from the EIA reports, in an attempt to mitigate the negative impacts by the land acquisition and resettlement, the policy framework for the LARAP was formulated. In case of formulating the final full-scale LARAP, the following contents should be included as the full-scale LARAP.

- Results of Socio-economic Survey
- Outline of Land Acquisition and Compensation Package
- Institutional Set-up for LAC (Land Acquisition Committee)
- Budgetary Arrangement
- Public Consultations
- Grievance Mechanizm
- Monitoring and Evaluation

The required acquisition for the land and structures based on the results of the baseline survey of the LARAP policy framework are worked out as follows.

Table 8.7 **Estimated Required Land Acquisition and structures compensation for Trans-Sulawesi Mamminasa Section**

Section		Length (km)	Necessary Road Width (m)	House (No.)	Shop (No.)	Public Building (No.)	Total (No.)
Section A	Maros - Jl. Sutami IC (Maros Section)	4	12	283	905	40	1228
	Maros - Jl. Sutami IC (Makassar Section)	4	12	37	178	27	242
	Perintis Road	12	0	0	0	0	0
Section B		7	42	92	16	2	110
Section C		9	40	42	10	2	54
Section D		22	20	661	374	54	1089
Total		58		1115	1483	125	2723

The section of the Perintis Road is the on-going project of the Indonesian Government, and, therefore, this section is not included in the Trans-Sulawesi Road Project. As a result, the costs for the land acquisition and resettlement required for the Perintis Road would not be included in the project cost of the Trans-Sulawesi Road Project.

The difference of the compensation unit price between the public buildings and houses/stores is derived from the locations of those facilities. (The public buildings are normally located in the center of the towns.) In addition to the compensation for these properties, the compensation for the loss of business opportunities during the resettlement or relocation should be included in the final version of the LARAP in accordance with the compensation policies of the Indonesian Government.

The compensation package includes a wide range of compensation measures like cash compensation and institutional support provided to eligible PAPs. Major compensation packages include:

- Loss of land;
- Loss of structures;
- Loss of productive trees; and
- Loss of commune and public assets
- Allowances for socially vulnerable households

The amount of compensation for the land is determined based on the combination of land price for tax purposes (NJOP) and market price. According to the Regulation of Agrarian State Minister/Head of Land Agency No 1/1994 article 17, compensation for certificated land will be 100% of the agreement price, while compensation for non certificated land will be 90% of the agreement price.

The most important point on compensation and entitlement policies for PAPs under is the comprehensive and complete application of the concept of "Replacement Cost".

"Replacement Cost" is defined that it is an amount needed for obtaining or replacing acquired land or property with similar land or property with equivalent or better productive capacity at current market price/value without deduction of any salvage or depreciation and take no account of the influence by development project on the value of the acquired land or property, plus the cost of transferring or registering the rights to the new land or property.

9. COST ESTIMATE AND PROJECT EVALUATION

9.1 Cost Estimate

(1) Composition of Project Cost

The construction cost was estimated based on the result of the preliminary engineering design, quantities of major work items and assumptions on the percentages of overhead and profit of the contractor and physical contingency.

The components of the project cost are shown in **Figure 9.1**.

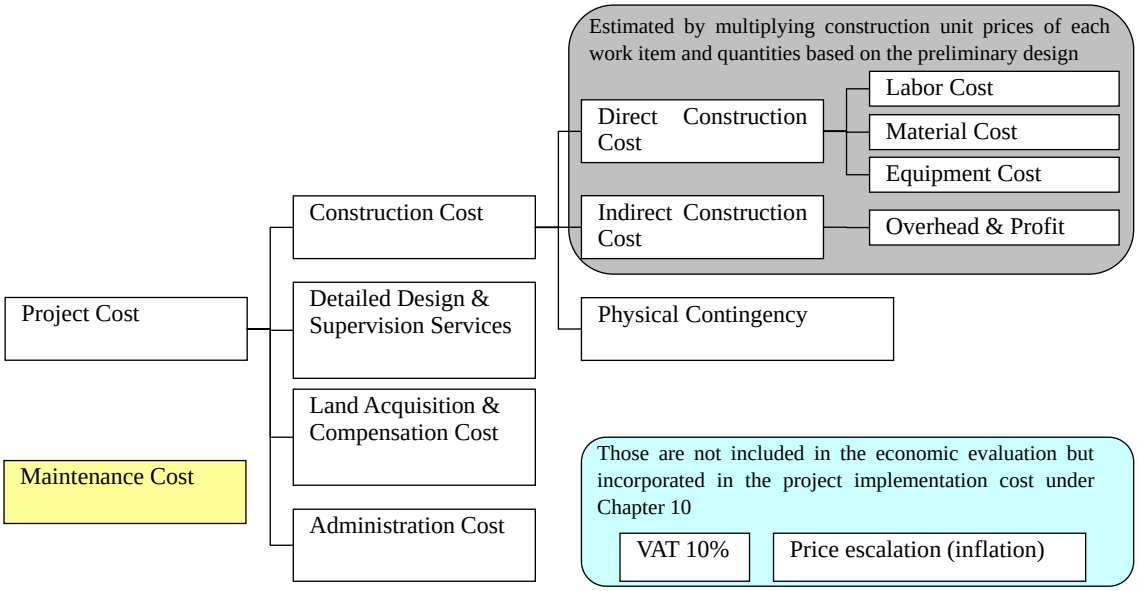


Figure 9.1 Project Cost Component

(2) Conditions of Cost Estimate

Cost estimate was made based on the following conditions:

i) Time of cost estimate: May 2007

ii) Foreign currency: US dollar

iii) Exchange rate: 1 US dollar = Rp. 9,322 (Bank of Indonesia, 16 May 2007)

iv) Taxes: Not included for the economic evaluation but included in the project implementation plan as a part of the project cost.

Construction unit prices applied to the cost estimate were set based on the standard unit prices in South Sulawesi Province (Harga Satuan Pokok Kegiatan (HSPK), 2006) and also referring to the contract unit prices in the past and on-going projects.

(3) Project Cost Estimation

The project cost was estimated by project and sub-section established in the implementation planning taking contract packaging or stage into account as illustrated in **Figure 9.2**.

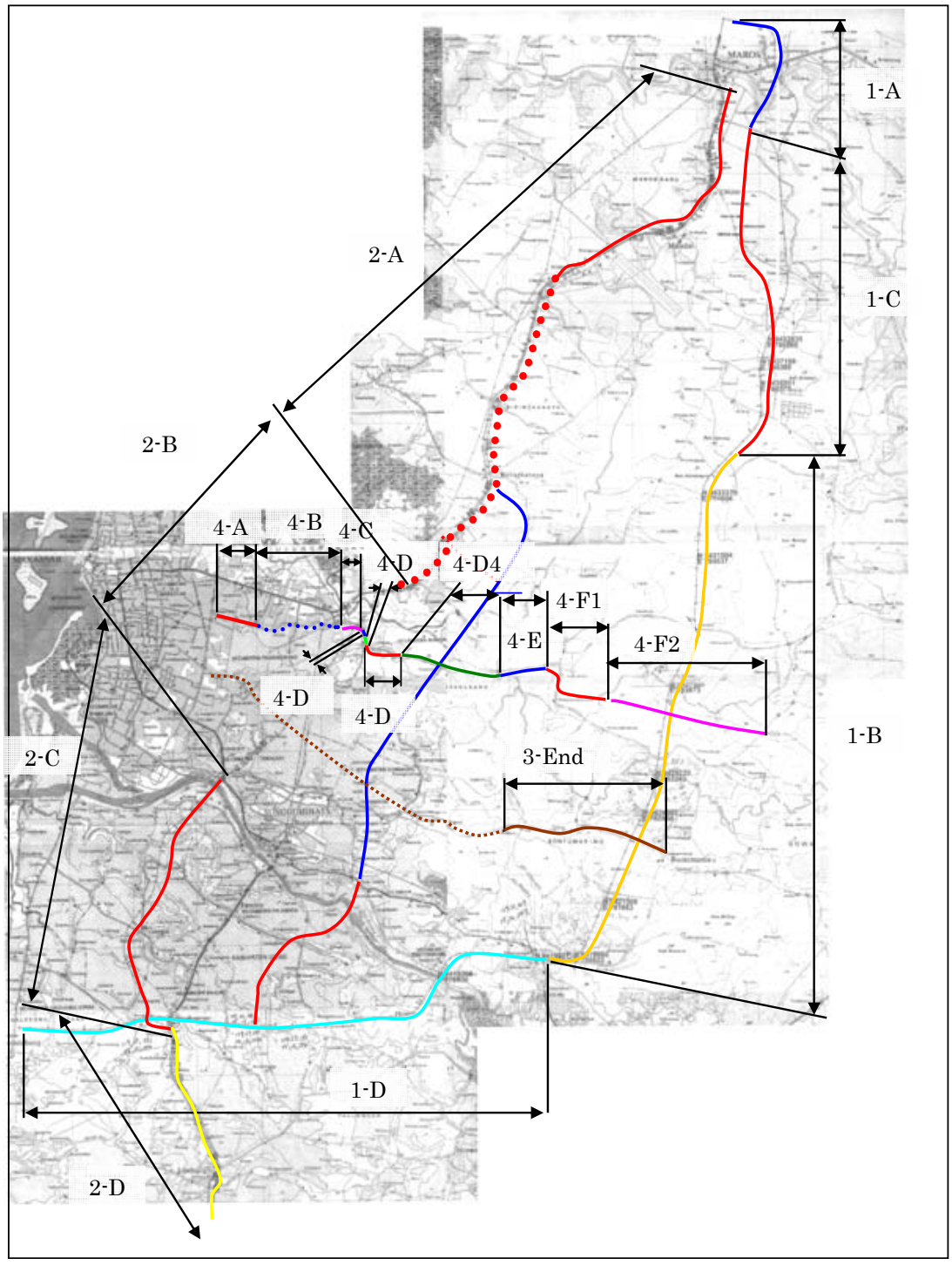


Figure 9.2 Sub-Sections of the Project Road for Cost Estimation

(4) Maintenance Cost

Road maintenance activities are divided into routine maintenance and periodic maintenance. The routine maintenance includes inspection and patrol, cleaning of road surface/drainage facilities, trimming/cutting of trees/grass, pothole patching and crack sealing and repairs of road facilities. The periodic maintenance includes overlay for AC pavement and partial reconstruction. Those costs are estimated and reflected to economic evaluation.

(5) Cost Estimate for Implementation Plan

1) Mamminasa Bypass

Mamminasa Bypass was divided into four (4) sub-sections taking the appropriate construction timing into consideration. The project cost and its disbursement was estimated by sub-section set out in the above and distributed in **Table 9.1**.

Table 9.1 Cost Distribution for Mamminasa Bypass Implementation

Item	Estimated Amount	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	(M. Rp.)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Mamminasa Bypass	**49.1 km**																		
Maros Bypass Section (North)	**5.0 km**																		
Land Acquisition and Compensation										20%	40%	40%							
Detailed Design and Supervision Services											30%	35%	35%						
Construction												50%	50%						
Administraition										25%	25%	25%	25%						
Maintenance Routine																			
Maintenance Overlay per 5 Years																			
Maros Bypass Section (North)																			
Land Acquisition and Compensation	10,763									2,153	4,305	4,305							
Detailed Design and Supervision Services	6,128										1,838	2,145	2,145						
Construction	87,543											43,771	43,771						
Administraition	1,751									438	438	438	438						
Maintenance Routine	1,233													206	206	206	206	206	206
Maintenance Overlay per 5 Years	4,112																	4,112	
Total	**111,529**									**2,590**	**6,581**	**50,659**	**46,354**	**206**	**206**	**206**	**206**	**4,317**	**206**
	100%									**2.3%**	**5.9%**	**45.4%**	**41.6%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**3.9%**	**0.2%**
Middle Section (KIMA Access-Jl. Malino) (Middle South)																			
	19.7 km																		
Land Acquisition and Compensation							20%	40%	40%										
Detailed Design and Supervision Services								25%	25%	25%	25%								
Construction									30%	40%	30%								
Administraition							20%	20%	20%	20%	20%								
Maintenance Routine																			
Maintenance Overlay per 5 Years																			
Land Acquisition and Compensatio	47,906						9,581	19,162	19,162										
Detailed Design and Supervision S	19,595							4,899	4,899	4,899	4,899								
Construction	279,929								83,979	111,972	83,979								
Administraition	5,599						1,120	1,120	1,120	1,120	1,120								
Maintenance Routine	2,508											314	314	314	314	314	314	314	314
Maintenance Overlay per 5 Years	6,271															6,271			
Total	**361,807**						**10,701**	**25,181**	**109,159**	**117,990**	**89,997**	**314**	**314**	**314**	**314**	**6,585**	**314**	**314**	**314**
	100%						**3.0%**	**7.0%**	**30.2%**	**32.6%**	**24.9%**	**0.1%**	**0.1%**	**0.1%**	**0.1%**	**1.8%**	**0.1%**	**0.1%**	**0.1%**
Maros-KIMA Access (Middle North)																			
	7.6 km																		
Land Acquisition and Compensation															20%	40%	40%		
Detailed Design and Supervision Services																25%	25%	25%	25%
Construction																	30%	40%	30%
Administraition															20%	20%	20%	20%	20%
Maintenance Routine																			
Maintenance Overlay per 5 Years																			
Land Acquisition and Compensation	15,169														3,034	6,068	6,068		
Detailed Design and Supervision Services	6,330															1,582	1,582	1,582	1,582
Construction	90,425																27,128	36,170	27,128
Administraition	1,809														362	362	362	362	362
Maintenance Routine																			
Maintenance Overlay per 5 Years																			
Total	**113,733**														**3,396**	**8,012**	**35,139**	**38,114**	**29,072**
	100%														**3.0%**	**7.0%**	**30.9%**	**33.5%**	**25.6%**
Jl. Malino- South Section (Jl.Tj.Bunga) (South)																			
	16.7 km																		
Land Acquisition and Compensation													20%	40%	40%				
Detailed Design and Supervision Services														17%	17%	17%	17%	17%	17%
Construction															20%	20%	20%	20%	20%
Administraition													14%	14%	14%	14%	14%	14%	14%
Maintenance Routine																			
Maintenance Overlay per 5 Years																			
Land Acquisition and Compensation	9,274												1,855	3,710	3,710				
Detailed Design and Supervision Services	17,487													2,915	2,915	2,915	2,915	2,915	2,915
Construction	249,819														49,964	49,964	49,964	49,964	49,964
Administraition	4,996												714	714	714	714	714	714	714
Maintenance Routine																			
Maintenance Overlay per 5 Years																			
Total	**281,576**												**2,569**	**7,338**	**57,302**	**53,592**	**53,592**	**53,592**	**53,592**
	100%												**0.9%**	**2.6%**	**20.4%**	**19.0%**	**19.0%**	**19.0%**	**19.0%**

2) Trans-Sulawesi Mamminasata Road

The three (3) evaluation scenarios (cases) as in Figure 9.3 were prepared for economic and financial evaluation for the Trans-Sulawesi Mamminasata Road. Case 1 is non-toll road and Case 2 is toll road. The cost estimate was made for each case to meet these scenarios.

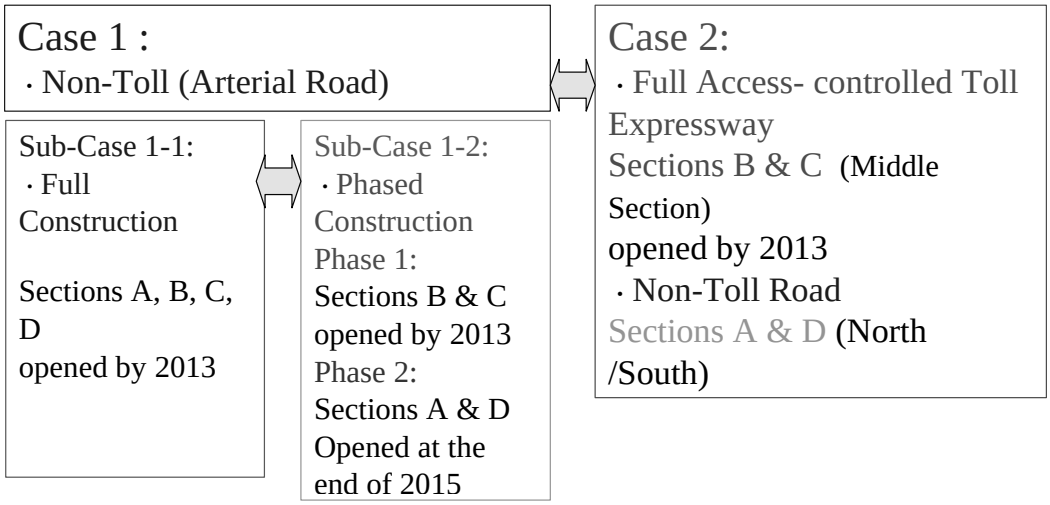


Figure 9.3 Economic Evaluation Scenarios for Trans-Sulawesi Mamminasata Road

Sub-case 1-1 (Alternative A)

The road is constructed as a non-toll road. The full length of project is implemented in one time. The project cost and its disbursement were estimated as given in the following table.

Table 9.2 Cost Distribution according to Implementation Plan for Alternative A

Item	Estimated Amount (M Rp.)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Section A, B, C & D	**47.1km**																	
Land Acquisition and Compensation		5.0%	30.0%	30.0%	35.0%													
Detailed Design and Supervision Services				40.0%	20.0%	20.0%	20.0%											
Construction					35.0%	35.0%	30.0%											
Administraition				25.0%	25.0%	25.0%	25.0%											
Maintenance																		
Section A, B, C & D																		
Land Acquisition and Compensation	260,338	13,017	78,101	78,101	91,118	0	0	0	0	0	0	0	0	0	0	0	0	0
Detailed Design and Supervision Services	58,789	0	0	23,515	11,758	11,758	11,758	0	0	0	0	0	0	0	0	0	0	0
Construction	839,838	0	0	0	293,943	293,943	251,951	0	0	0	0	0	0	0	0	0	0	0
Administraition	16,797	0	0	4,199	4,199	4,199	4,199	0	0	0	0	0	0	0	0	0	0	0
Routine Maintenance	99,902							9,082	9,082	9,082	9,082	9,082	9,082	9,082	9,082	9,082	9,082	9,082
Periodic Maintenance	60,294											30,147					30,147	
Total	**1,335,958 (100%)**	**13,017 (1.0%)**	**78,101 (5.8%)**	**105,816 (7.9%)**	**401,019 (30.0%)**	**309,900 (23.2%)**	**267,908 (20.1%)**	**9,082 (0.7%)**	**9,082 (0.7%)**	**9,082 (0.7%)**	**9,082 (0.7%)**	**39,229 (2.9%)**	**9,082 (0.7%)**	**9,082 (0.7%)**	**9,082 (0.7%)**	**9,082 (0.7%)**	**39,229 (2.9%)**	**9,082 (0.7%)**

Source: JICA Study Team

Source: JICA Study Team

Sub-case 1-2 (Alternative B)

The road is constructed as a non-toll road. The project is implemented in two phases. Phase I covers Section B (the Middle Ring Road) and Section C (Southern extension of the Middle Ring Road). Phase II covers Section A (Maros – Jl. Ir. Sutami IC) and Section D (Sungguminasa (Boka IC) – Takalar). The project cost and its disbursement were estimated as given in the following tables.

Table 9.3 Cost Distribution according to Implementation Plan for Alternative B

Item	Estimated Amount (M Rp.)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Phase I																		
Section B & C	**15.9km**																	
Land Acquisition and Compensation		5.0%	30.0%	30.0%	35.0%													
Detailed Design and Supervision Services				40.0%	20.0%	20.0%	20.0%											
Construction					35.0%	35.0%	30.0%											
Administraition				25.0%	25.0%	25.0%	25.0%											
Maintenance																		
Phase II																		
Section A & D	**31.2km**																	
Land Acquisition and Compensation					25.0%	25.0%	25.0%	25.0%										
Detailed Design and Supervision Services						8.0%	32.0%	20.0%	20.0%	20.0%								
Construction								33.3%	33.3%	33.3%								
Administraition						11.1%	22.2%	22.2%	22.2%	22.2%								
Maintenance																		
Phase I																		
Section B & C																		
Land Acquisition and Compensation	127,130	6,357	38,139	38,139	44,496	0	0	0	0	0	0	0	0	0	0	0	0	0
Detailed Design and Supervision Services	32,286	0	0	12,914	6,457	6,457	6,457	0	0	0	0	0	0	0	0	0	0	0
Construction	461,224	0	0	0	161,428	161,428	138,367	0	0	0	0	0	0	0	0	0	0	0
Administraition	9,224	0	0	2,306	2,306	2,306	2,306	0	0	0	0	0	0	0	0	0	0	0
Routine Maintenance	29,506							2,682	2,682	2,682	2,682	2,682	2,682	2,682	2,682	2,682	2,682	2,682
Periodic Maintenance	17,090											8,545					8,545	
Total	**676,460 (100%)**	**6,357 (0.9%)**	**38,139 (5.6%)**	**53,359 (7.9%)**	**214,687 (31.7%)**	**170,192 (25.2%)**	**147,130 (21.8%)**	**2,682 (0.4%)**	**2,682 (0.4%)**	**2,682 (0.4%)**	**2,682 (0.4%)**	**11,227 (1.7%)**	**2,682 (0.4%)**	**2,682 (0.4%)**	**2,682 (0.4%)**	**2,682 (0.4%)**	**11,227 (1.7%)**	**2,682 (0.4%)**
Phase II																		
Section A & D																		
Land Acquisition and Compensation	133,208	0	0	0	33,302	33,302	33,302	33,302	0	0	0	0	0	0	0	0	0	0
Detailed Design and Supervision Services	26,503	0	0	0	0	2,120	8,481	5,301	5,301	5,301	0	0	0	0	0	0	0	0
Construction	378,614	0	0	0	0	0	0	126,205	126,205	126,205	0	0	0	0	0	0	0	0
Administraition	7,572	0	0	0	0	841	1,683	1,683	1,683	1,683	0	0	0	0	0	0	0	0
Routine Maintenance	51,197										6,400	6,400	6,400	6,400	6,400	6,400	6,400	6,400
Periodic Maintenance	21,602														21,602			
Total	**618,696 (100%)**	**0 (0.0%)**	**0 (0.0%)**	**0 (0.0%)**	**33,302 (5.4%)**	**36,264 (5.9%)**	**43,466 (7.0%)**	**166,490 (26.9%)**	**133,188 (21.5%)**	**133,188 (21.5%)**	**6,400 (1.0%)**	**6,400 (1.0%)**	**6,400 (1.0%)**	**6,400 (1.0%)**	**28,002 (4.5%)**	**6,400 (1.0%)**	**6,400 (1.0%)**	**6,400 (1.0%)**
Grand Total	**1,295,157 (100%)**	**6,357 (0.5%)**	**38,139 (2.9%)**	**53,359 (4.1%)**	**247,989 (19.1%)**	**206,455 (15.9%)**	**190,596 (14.7%)**	**169,172 (13.1%)**	**135,870 (10.5%)**	**135,870 (10.5%)**	**9,082 (0.7%)**	**17,627 (1.4%)**	**9,082 (0.7%)**	**9,082 (0.7%)**	**30,684 (2.4%)**	**9,082 (0.7%)**	**17,627 (1.4%)**	**9,082 (0.7%)**

Source: JICA Study Team

Source: JICA Study Team

Case-2

Alternative C is the plan in which Section B (the Middle Ring Road section) and Section C (Southern extension of the Middle Ring Road) would be constructed as an express toll road with frontage roads along Section B in the period of Phase I. Section A (Maros – Jl. Ir. Sutami IC) and Section D (Sungguminasa (Boka IC) – Takalar) would be undertaken in Phase II. The project cost and its disbursement were estimated as given in the following tables.

Table 9.4 Cost Distribution according to Implementation Plan for Alternative C

Item	Estimated Amount (M Rp.)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Phase I																		
Section B & C (Toll Road	**15.9km**																	
Land Acquisition and Compensation	127,130	5.0%	30.0%	30.0%	35.0%													
Detailed Design and Supervision Services	35,514			40.0%	20.0%	20.0%	20.0%											
Construction	507,346				35.0%	35.0%	30.0%											
Administraition	10,147			25.0%	25.0%	25.0%	25.0%											
Maintenance																		
Section B (Frontage Road	**7.1km**																	
Land Acquisition and Compensation	0	5.0%	30.0%	30.0%	35.0%													
Detailed Design and Supervision Services	11,411			40.0%	20.0%	20.0%	20.0%											
Construction	163,010				35.0%	35.0%	30.0%											
Administraition	3,260			25.0%	25.0%	25.0%	25.0%											
Maintenance																		
Phase II																		
Section A & D	**31.2km**																	
Land Acquisition and Compensation	133,208				25.0%	25.0%	25.0%	25.0%										
Detailed Design and Supervision Services	26,503					8.0%	32.0%	20.0%	20.0%	20.0%								
Construction	378,614							33.3%	33.3%	33.3%								
Administraition	7,572					11.1%	22.2%	22.2%	22.2%	22.2%								
Maintenance																		

Phase I																		
Section B & C (Toll Road)																		
Land Acquisition and Compensation	127,130	6,357	38,139	38,139	44,496	0	0	0	0	0	0	0	0	0	0	0	0	0
Detailed Design and Supervision Services	35,514	0	0	14,206	7,103	7,103	7,103	0	0	0	0	0	0	0	0	0	0	0
Construction	507,346	0	0	0	177,571	177,571	152,204	0	0	0	0	0	0	0	0	0	0	0
Administraition	10,147	0	0	2,537	2,537	2,537	2,537	0	0	0	0	0	0	0	0	0	0	0
Routine Maintenance	101,469							9,224	9,224	9,224	9,224	9,224	9,224	9,224	9,224	9,224	9,224	9,224
Periodic Maintenance	55,347											27,673					27,673	
Total	**836,954 (100%)**	**6,357 (0.8%)**	**38,139 (4.6%)**	**54,881 (6.6%)**	**231,706 (27.7%)**	**187,211 (22.4%)**	**161,843 (19.3%)**	**9,224 (1.1%)**	**9,224 (1.1%)**	**9,224 (1.1%)**	**9,224 (1.1%)**	**36,898 (4.4%)**	**9,224 (1.1%)**	**9,224 (1.1%)**	**9,224 (1.1%)**	**9,224 (1.1%)**	**36,898 (4.4%)**	**9,224 (1.1%)**
Section B (Frontage Road)																		
Land Acquisition and Compensation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Detailed Design and Supervision Services	11,411	0	0	4,564	2,282	2,282	2,282	0	0	0	0	0	0	0	0	0	0	0
Construction	163,010	0	0	0	57,054	57,054	48,903	0	0	0	0	0	0	0	0	0	0	0
Administraition	3,260	0	0	815	815	815	815	0	0	0	0	0	0	0	0	0	0	0
Routine Maintenance	16,301							1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482	1,482
Periodic Maintenance	14,819											7,410					7,410	
Total	**208,801 (100%)**	**0 (0.0%)**	**0 (0.0%)**	**5,379 (2.6%)**	**60,151 (28.8%)**	**60,151 (28.8%)**	**52,000 (24.9%)**	**1,482 (0.7%)**	**1,482 (0.7%)**	**1,482 (0.7%)**	**1,482 (0.7%)**	**8,891 (4.3%)**	**1,482 (0.7%)**	**1,482 (0.7%)**	**1,482 (0.7%)**	**1,482 (0.7%)**	**8,891 (4.3%)**	**1,482 (0.7%)**
Phase II																		
Section A & D																		
Land Acquisition and Compensation	133,208	0	0	0	33,302	33,302	33,302	33,302	0	0	0	0	0	0	0	0	0	0
Detailed Design and Supervision Services	26,503	0	0	0	0	2,120	8,481	5,301	5,301	5,301	0	0	0	0	0	0	0	0
Construction	378,614	0	0	0	0	0	0	126,205	126,205	126,205	0	0	0	0	0	0	0	0
Administraition	7,572	0	0	0	0	841	1,683	1,683	1,683	1,683	0	0	0	0	0	0	0	0
Routine Maintenance	22,193										2,774	2,774	2,774	2,774	2,774	2,774	2,774	2,774
Periodic Maintenance	13,870														13,870			
Total	**581,961 (100%)**	**0 (0.0%)**	**0 (0.0%)**	**0 (0.0%)**	**33,302 (5.7%)**	**36,264 (6.2%)**	**43,466 (7.5%)**	**166,490 (28.6%)**	**133,188 (22.9%)**	**133,188 (22.9%)**	**2,774 (0.5%)**	**2,774 (0.5%)**	**2,774 (0.5%)**	**2,774 (0.5%)**	**16,645 (2.9%)**	**2,774 (0.5%)**	**2,774 (0.5%)**	**2,774 (0.5%)**
Grand Total	**1,627,716 (100%)**	**6,357 (0.4%)**	**38,139 (2.3%)**	**60,261 (3.7%)**	**325,159 (20.0%)**	**283,625 (17.4%)**	**257,309 (15.8%)**	**177,196 (10.9%)**	**143,894 (8.8%)**	**143,894 (8.8%)**	**13,480 (0.8%)**	**48,563 (3.0%)**	**13,480 (0.8%)**	**13,480 (0.8%)**	**27,351 (1.7%)**	**13,480 (0.8%)**	**48,563 (3.0%)**	**13,480 (0.8%)**

Source: JICA Study Team

Source: JICA Study Team

3) Hertasning Road

The project cost and its disbursement were estimated as given in the following **Table 9.5**.

Table 9.5 Cost Distribution for Implementation Plan of Hertasning Road

Item	Estimated Amount	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	(M. Rp.)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
3. Hertasning Road	**4.9 km**																		
Land Acquisition and Compensation		40%	50%	10%															
Detailed Design and Supervision Services			10%	30%	30%	30%													
Construction				30%	40%	30%													
Administraition			25%	25%	25%	25%													
Maintenance Routine																			
Maintenance Overlay per 5 Years																			
Land Acquisition and Compensation	9,833	3,933	4,917	983															
Detailed Design and Supervision Services	4,269		427	1,281	1,281	1,281													
Construction	60,989			18,297	24,396	18,297													
Administraition	1,220		305	305	305	305													
Maintenance Routine	2,627						202	202	202	202	202	202	202	202	202	202	202	202	202
Maintenance Overlay per 5 Years	8,082										4,041					4,041			
Total	**87,019**	**3,933**	**5,648**	**20,866**	**25,981**	**19,882**	**202**	**202**	**202**	**202**	**4,243**	**202**	**202**	**202**	**202**	**4,243**	**202**	**202**	**202**
	100%	**4.5%**	**6.5%**	**24.0%**	**29.9%**	**22.8%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**4.9%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**4.9%**	**0.2%**	**0.2%**	**0.2%**

Source: JICA Study Team estimation

4) Abdullah Daeng Sirua Road

The project cost and its disbursement were estimated as given in the following **Table 9.6**.

Table 9.6 Cost Distribution for Implementation Schedule of Abdullah Daeng Sirua Road

Item	Amount	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
	(M. Rp.)		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
4. Abdullah Daeng Sirua Road	**15.3 km**																		
Makassar Section (West)	**7.0 km**																		
Land Acquisition and Compensa				50%	50%														
Detailed Design and Supervisio					33%	33%	33%												
Construction						50%	50%												
Administraition				25%	25%	25%	25%												
Maintenance Routine																			
Maintenance Overlay per 5 Yea																			
Makassar Section (West)																			
Land Acquisition and Compensa	31,451			15,725	15,725														
Detailed Design and Supervisio	6,386				2,129	2,129	2,129												
Construction	91,230					45,615	45,615												
Administraition	1,825			456	456	456	456												
Maintenance Routine	2,965							247	247	247	247	247	247	247	247	247	247	247	247
Maintenance Overlay per 5 Yea	9,884											4,942					4,942		
Sub-Total	**143,741**			**16,181**	**18,310**	**48,200**	**48,200**	**247**	**247**	**247**	**247**	**5,189**	**247**	**247**	**247**	**247**	**5,189**	**247**	**247**
	100%			**11.3%**	**12.7%**	**33.5%**	**33.5%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**3.6%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**3.6%**	**0.2%**	**0.2%**
Maros/Gowa Section (East)	**8.3 km**																		
Land Acquisition and Compensa						20%	40%	40%											
Detailed Design and Supervisio							20%	20%	20%	20%	20%								
Construction								25%	25%	25%	25%								
Administraition						17%	17%	17%	17%	17%	17%								
Maintenance Routine																			
Maintenance Overlay per 5 Yea																			
Maros/Gowa Section (East)																			
Land Acquisition and Compensa	5,424					1,085	2,170	2,170											
Detailed Design and Supervisio	8,694						1,739	1,739	1,739	1,739	1,739								
Construction	124,199							31,050	31,050	31,050	31,050								
Administraition	2,484					414	414	414	414	414	414								
Maintenance Routine	2,785											348	348	348	348	348	348	348	348
Maintenance Overlay per 5 Yea	6,963															6,963			
Sub-Total	**150,549**					**1,499**	**4,322**	**35,372**	**33,203**	**33,203**	**33,203**	**348**	**348**	**348**	**348**	**7,311**	**348**	**348**	**348**
	100%					**1.0%**	**2.9%**	**23.5%**	**22.1%**	**22.1%**	**22.1%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**4.9%**	**0.2%**	**0.2%**	**0.2%**
Total	**150,549**			**16,181**	**18,310**	**49,699**	**52,522**	**35,619**	**33,450**	**33,450**	**33,450**	**5,537**	**595**	**595**	**595**	**7,558**	**5,537**	**595**	**595**
	100%					**1.0%**	**2.9%**	**23.5%**	**22.1%**	**22.1%**	**22.1%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**4.9%**	**0.2%**	**0.2%**	**0.2%**

Source: JICA Study Team

9.2 Economic Evaluation

(1) Economic Costs

Economic evaluation for the 4 (four) target roads was carried out based on the comparison between economic project costs and economic benefits. The economic costs of target roads are shown as below:

Table 9.7 Economic Cost (Rp. Million, at 2006 Price)

Target Road	Length (km)	Economic Cost (Rp. Million)
R1: Mamminasa Bypass	48.6	854,521
R2: Trans-Sulawesi Mamminasata	47.3	
- Non-Toll		1,175,761
- Toll Expressway		1,382,835
R3: Hertasning Road	4.9	76,310
R4: Abd. Daeng Sirua Road	14.6	271,692

Source: JICA Study Team

The following three (3) evaluation scenarios were prepared for the Trans-Sulawesi Mamminasata Road:

Evaluation Scenarios for Trans-Sulawesi Mamminasata Road

Case 1:	Non-Toll	
	Sub-Case 1-1:	Non-Toll and Full construction (all sections open by 2013)
	Sub-Case 1-2	Non-Toll and Phases construction. Phase 1: opens by 2013 Phase 2: opens at the end of 2015
Case 2	Full access controlled Toll Expressway (Middle section) opens by 2013	

(2) Economic Benefit

Quantified economic benefits in the Study are:

1) Savings in Vehicle Operating Costs (VOC Savings)
2) Savings in Passenger Travel Time Costs (TTC Savings)

Basic data and parameters of unit costs of VOC and TTC were obtained from the "Indonesian Road Management System (IRMS) 2006".

(3) Economic Evaluation

Economic evaluation was carried out based on the following preconditions:

- Price level : Constant 2006 prices
- Evaluation period : 30 years after first opening to traffic
- Residual Value : No residual values were counted
- Opportunity Cost of Capital : 15% (and 12% for reference)

(4) Evaluation Results

Evaluation indicators (Economic Internal Rate of Return: EIRR, Net Present Value: NPV, and Benefit/ Cost Ratio: B/C) were calculated based on the Discount Cash Flow method as shown below:

Table 9.2.6 Results of Economic Evaluation

Target Roads	Evaluation Indicators		
	EIRR	NPV (Rp. million) (*)	B/C (*)
R1: Mamminasa Bypass	22.4%	171,550	1.97
R2: Trans-Sulawesi Mamminasata Road			
-(Non-Toll) 2013 simultaneous open	28.5%	768,273	2.30
-(Non-Toll) Phasing	30.2%	721,063	2.45
-(Toll Expressway)	26.7%	648,842	2.07
R3: Hertasning Road	33.8%	122,258	3.51
R4: Abd. Daeng Sirua Road	31.0%	110,466	1.96

Source: JICA Study Team
(*) Discount Rate = 15%

The above results show that the implementation of all target roads will be economically feasible and justified from the view point of national economy. Among the all target roads, Trans-Sulawesi Mamminasata Road (non-toll and phasing construction case), Abdullah Daeng Sirua Road and Hertasning Road indicate the higher EIRR of 30.7%, 31.0% and 33.8% respectively. NPV for the Trans-Sulawesi Mamminasata Road is the highest among FS roads.

9.3 Financial Evaluation

(1) Purpose of Evaluation

It is recommended that the Trans-Sulawesi Mamminasata Road should be implemented as a non-toll road based on the results of economic analysis shown above. On the other hand, Bina Marga conducted a freeway/toll road study for Sulawesi Island in 2006 and recommended implementing the Trans-Sulawesi Mamminasata Middle Section with PPP project. Under the circumstance, it is necessary to re-investigate the financial viability under the PPP scheme and to check the government burden in this JICA Study.

(2) Target Toll Road Sections for Financial Evaluation

Toll Expressway (fully access-controlled with ramps/interchanges) is assumed to be introduces at the section of the Middle Ring and its southern access road with a 15.9 km length as shown in the figure below:

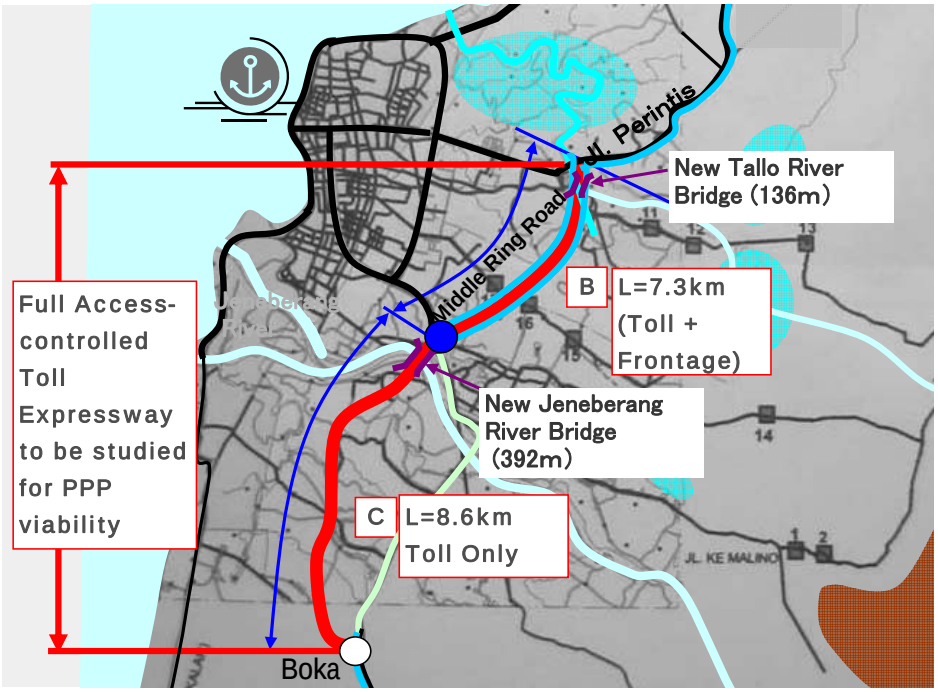


Figure 9.4 Target Road Sections for Fully Access Controlled Toll Expressway

(3) Financial Return on Investment and Government Burden

A comparison of toll revenue and project cost of the toll expressway shows that Financial Internal Rate of Return (FIRR) will be at 6.5% without any subsidies or other financial support from the Government. In general, a toll road project with such a low financial return should be implemented under the conventional public investment (see the following table).

Table 9.9 Financial Viability and Category of Financing Scheme

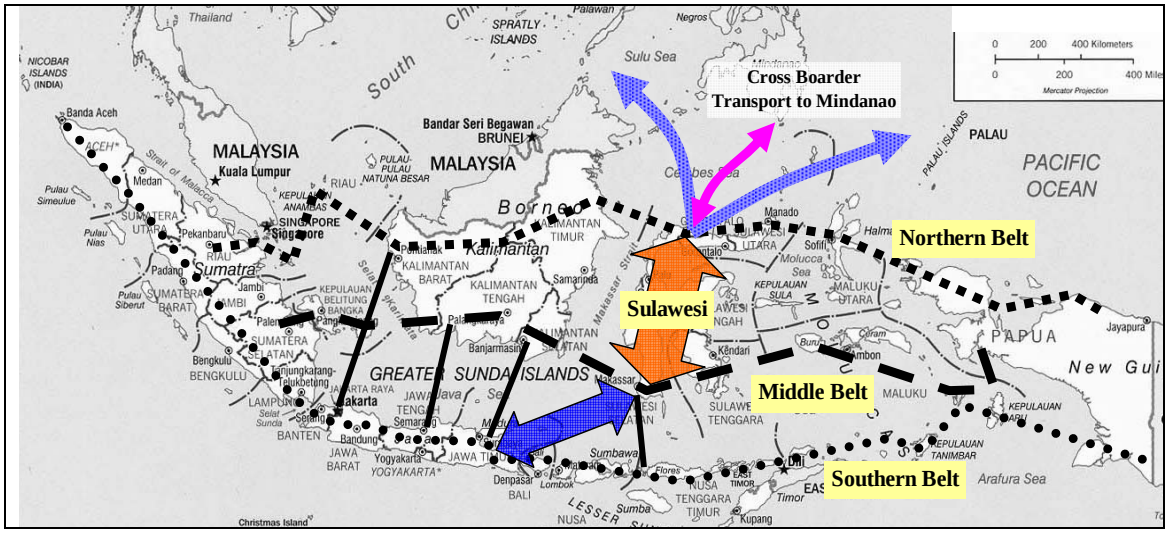
		Economic Feasibility		
		Good EIRR>18%	Marginal 12% - 18%	Bad EIRR< 12%
Financial Viability	Good FIRR>20%	BOT*	BOT*	-
	Marginal 10%-20%	PPP**	PPP**	-
	Bad FIRR<10%	Public Finance	Public Finance	-

Note: As FIRR of the project was estimated at 6.5%, it is categorized into Public Finance.

In order to attract a private sector to investment, it is necessary to achieve the minimum 20% of FIRR through the government subsidy on the initial investment. However, the necessary Government subsidy is estimated at 72.0% (Rp. 523,078 Million) of the total investment cost including the Land Acquisition. This percentage of government subsidy is too high comparing with the normal PPP schemes. Therefore, the project is recommended to be implemented under public finance.

9.4 Role of Mamminasata Metropolitan Area in the Sulawesi and Eastern Indonesia Regional Development

The national spatial plan defines three transport corridors throughout Indonesia. These are the Northern, Middle and Southern corridors, as shown in **Figure 9.5**. Sulawesi occupies a strategic location that could link the three development belts including the neighboring ASEAN countries.



Source: JICA Study Team

Figure 9.5 Proposed Linkage of Development Belts in Sulawesi

To promote industrial development, industrial centers should be enhanced in a manner that the investment environment for FDI and DDI are improved. To carry out regional development, which is "effective economic growth on the basis of the existing economic linkage," following development plans are proposed on the basis of Economic Linkage between South Sulawesi Province and Southeast Sulawesi Province.

The development on the basis of economic linkage between Makassar-Kendari is most important in the connection, utilization, and further promotion of concentrated populations and industries. Success of this development will contribute to the

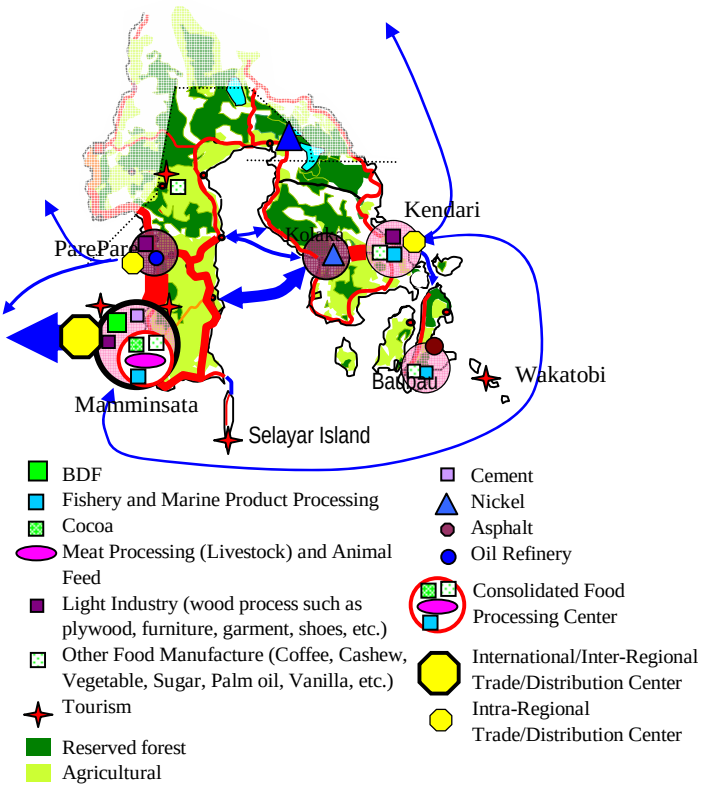


Figure 9.6 Development Plan on the basis of Economic Linkage between Makassar - Kendari

total economic growth of the island. Makassar will continuously function as the gateway for inter-island linkages. Both the neighboring Kalimantan energy base, Java Island and eastern Indonesia will be tightly linked with the Makassar and Parepare priority areas through the distribution and transportation of commodities and passengers.

9.5 Logistic Support for Trade and Investment Promotion

Within the Mamminasata Metropolitan Area, freight traffic is concentrated at present in the Makassar Industrial Estate (PT Kawasan Industri Makassar – KIMA). KIMA is located in the suburbs of Makassar City along Ir. Sutami Toll road, 15 km north of the Makassar Port and around 10 minutes drive from the Hasanuddin International Airport.

The comparative advantage of Sulawesi and Makassar in particular lies on their geographical location. However, this comparative advantage has not been realized well in business as well as in investment especially with the international market and foreign direct investment unless the following conditions are met:

i) Transport infrastructure combined with road, seaport and airport in an integrated way is available.

ii) Other infrastructures such as power supply, water supply, wastewater treatment, telecommunication, etc. are provided in complete set for modern industrial estates between the international seaport and airport.

iii) Containerization proceeds at a certain degree or more than 40% of goods produced and exported can be containerized.

The development of the F/S roads would enhance industrial development in South Sulawesi and in Mamminasata Metropolitan Areas in particular. The Trans-Sulawesi Mamminasata Road will function as a major land transport infrastructure for sourcing and collection of raw materials for manufacturing and processing of various kinds of industrial products at closest and proper location to the international seaport and airport.

10 IMPLEMENTATION PLAN

10.1 Overall Implementation Plan for Major Road Development in Mamminasata Metropolitan Area

The major on-going and future road developments in the Mamminasata Metropolitan Area is approximately twenty (20) links including the four F/S roads and one Pre-F/S road undertaken by the Study Team. These are part of the secondary arterial road network system in the Mamminasata Metropolitan Area and envisaged to implement by the year 2023.

The average amount of development investment required for 2007-2023 period is estimated at Rp 190-200 billion per year. As the budget being able to allocate for the road infrastructure development would be limited, the implementation schedule of those road infrastructures should be carefully planned to bring the maximum benefits for nation, region, local economy and communities.

10.2 Implementation Plan for the FS Roads

(1) Trans-Sulawesi Mamminasata Road

The investment required for the Trans-Sulawesi Road Project is estimated at approximately Rp 1,651-1,757 billion in total including civil works, consultancy services, ROW acquisition, administration and tax (VAT). If Japanese ODA facility (JBIC Loan) is used, 100% of civil works and consultancy service costs can be covered by a soft loan.

However, GOI needs to provide own finance for land acquisition, resettlement, administration and tax (VAT), which are not eligible for external loan. Land acquisition and resettlement costs for the Trans-Sulawesi Mamminasata Road are estimated at Rp 310 billion including inflation. The central and regional governments share the cost, allocate budget and complete the land acquisition and resettlement by commencement of the construction. As allocation of sufficient budget for the land acquisition and resettlement in period will be difficult, the Study Team made alternative implementation plans A and B.

Alternative A is implementation of the full length in one time and Alternative B is implementation in two phases. Phase 1 covers the Middle Ring Road and its south extension as these two sections are more urgently required in terms of traffic demand while less resettlement is required. Phase 2 covers the Maros-Jl.Ir.Sutami IC and Sungguminasa (Boka IC) - Takalar sections. **Table 10.1** shows basic concept of the alternative plans.

Table 10.1 Alternative Implementation Plans

Alternative Plans	Concept	Section	Length	Construction Period	Estimated Project Cost
A	Non-phased Implementation	Sections A, B, C and D	47.1 km	36 months (2010-2012)	Rp 1,625 billion
B	Phased Implementation	Phase 1: Sections B and C	16.0 km	36 months (2010-2012)	Rp 886 billion
		Phase 2: Sections A and D	31.1 km	36 months (2013-2015)	Rp 842 billion

Approximately Rp 99 billion will be required from 2008 to 2010 for the land acquisition and resettlement in the case of Alternative A. Annual budget requirement could be reduced to approximately Rp 55 billion from 2007 to 2013 as illustrated in **Figure 10.1** for Alternative B. It seems that Alternative B is more practicable and, therefore, it is recommended.

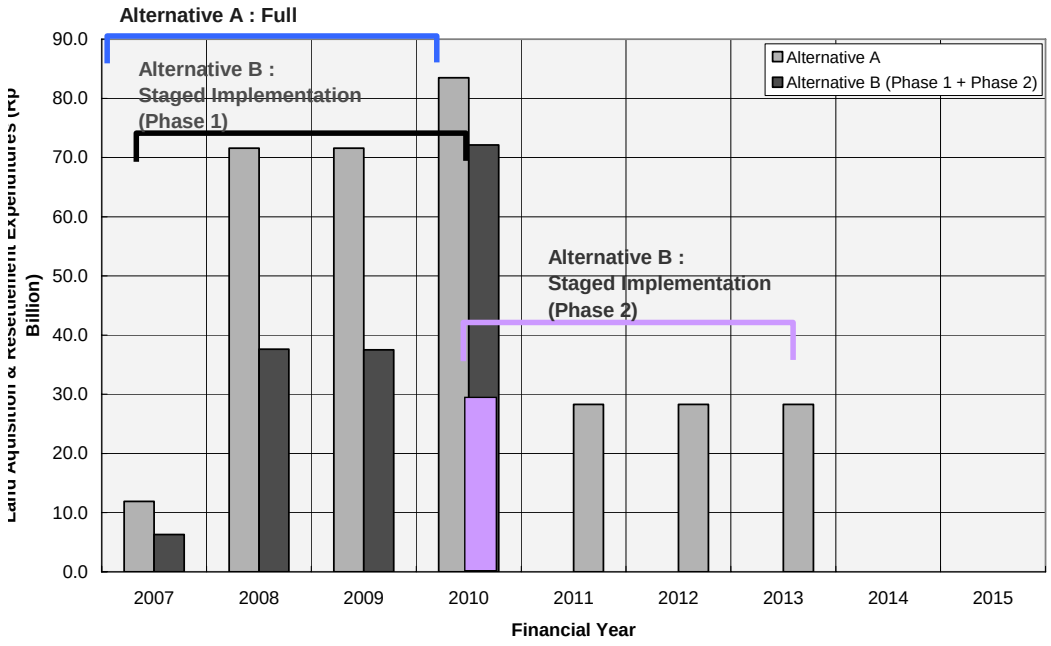


Figure 10.1 Land Acquisition and Resettlement Expenditures for Alternative Implementation Plans

There are many houses to be moved for the existing road widening along the project road, especially at Mandai in Kab.Maros (Section A) and Limbung in Kab.Gowa (Section D) and it needs considerable time for resettlement negotiations and arrangement. On the other hand, the ROW acquisition is in progress for the Middle Ring Road (Section B) and there are not so many houses to be moved for Section C. It is expected that land acquisition and resettlement for Sections A and D can be progressed and completed during the construction of Sections B and C.

(2) Mamminasa Bypass, Hertasning Road and Abdullah Daeng Sirua Road

1) Mamminasa Bypass

Four ring roads were planned for the Mamminasata Metropolitan Area namely the inner ring (Jl A.P.Pettarani/ Jl Tol Reformasi), middle ring, outer ring and outer-outer ring (Mamminasa Bypass). A general order of development requirement is from the inner ring to outside. However, as anticipated role and function of the Mamminasa Bypass are to induce/promote the creation of a new satellite town at the foot of Mt. Moncongloe (approximately 15 km east of the Makassar City center), the middle part of the bypass road, which is an arterial road for the new town, should be constructed earlier than the northern and southern sections.

2) Hertasning Road

The Hertasning Road (4-lane road) is under construction by the South Sulawesi Provincial Government. It is anticipated that the Provincial Government will continue the construction and complete this road by the end of 2010 using APBD I (provincial budget).

If budget availability is tight, staged implementation could be applied for Section D, 4.5 km long from the new campus of the State Islamic University to the intersection of the Kabupaten road. The 1st stage consists of widening the existing 4.5 m road to 7 m road, and the 2nd stage consists of further widening it to 4-lane road in the future.

3) Abdullah Daeng Sirua Road

A part of the Abdullah Daeng Sirua Road (Section B) is under construction by Makassar City (APBD II) and this should be continued up to the Makassar / Maros boarder.

The Maros / Gowa Regency section is a direct access from the Makassar City center to a planned new satellite town at the foot of Mt. Moncongloe (15 km east of the Makassar City center) and KIWA. The section should be constructed together with the middle section of Mamminasa Bypass.

10.3 Executing Agency

The execution agency for national roads shall be DGH. That for provincial roads is Praswil of South Sulawesi Province and that for the city roads are Makassar City. The executing agency of the F/S road project will be as given in the following table.

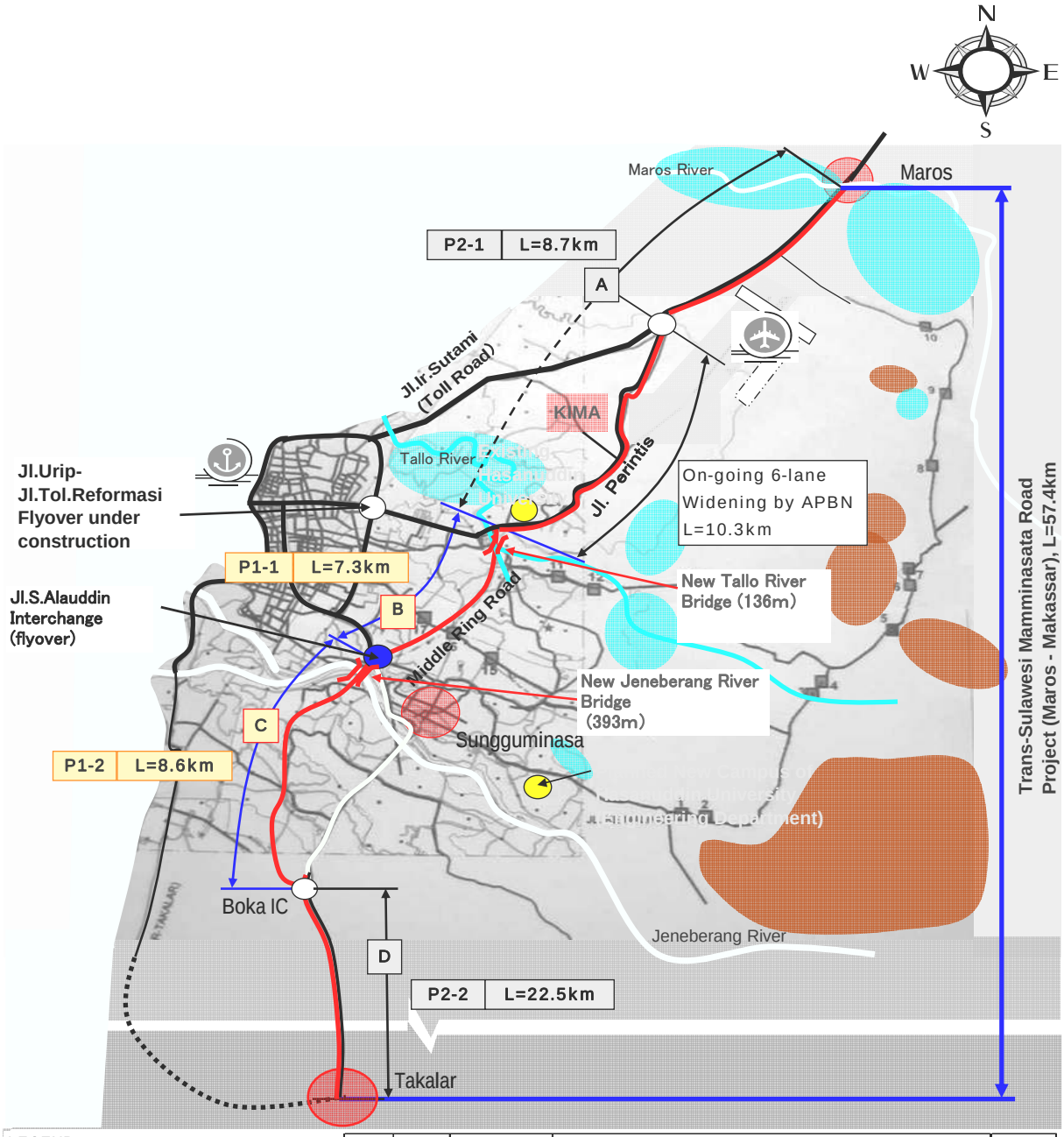
Table 10.2 Executing Agency

Project	Sub-Section	Administrative Status of Road	Executing Agency
Trans-Sulawesi Mamminasata Road	-	National	DGH/MPW
Mamminasa Bypass	North Section	Provincial	Praswil, South Sulawesi Province
	Middle Section	Provincial	Praswil, South Sulawesi Province
	South Section	Provincial	Praswil, South Sulawesi Province
Hertasning Road	Section D	Provincial	Praswil, South Sulawesi Province
Abdullah Daeng Sirua Road	Makassar Section	Makassar City	PU, Makassar City
	Maros / Gowa Section	Provincial	Praswil, South Sulawesi Province

10.4 Contract Packaging

(1) Trans-Sulawesi Mamminasata Road

The project should be implemented with appropriate contract packages to be determined taking into consideration the size of contracts (amount and quantity), characteristics of the section, technical difficulty, construction period, funding source and competition in bidding. **Figure 10.2** shows the packaging and scope of work for alternative implementation plans A and B.



LEGEND

P1-1 P1-2 Phase 1 Contracts

P2-1 P2-2 Phase 2 Contracts

Trans-Sulawesi Mamminasata Road

Section No.	Contract Package No.	Section Name	Scope of Works							Remarks
			Length (km)	Number of Lanes		Roadway	Pavement	Flyover Interchange	Major River Bridge (m)	
				Existing	Plan*					
A	P2-1	Maros - Jl.Ir.Sutami IC	8.7	4	6	Widening	Concrete Pavement			
		Jl.Ir.Sutami IC-Middle Ring Road (Jl.Perintis)	-	4	6 (8)	On-going Widening by GOI (APBN)	Concrete Pavement			Only pedestrian bridges
B	P1-1	Middle Ring Road	7.3	-	6 (8)	New Road	Concrete Pavement	Jl.Sultan Alauddin IC	Tallo River Bridge (136m)	
C	P1-2	Middle Ring Road Access	8.6	-	4 (6)	New Road	AC Pavement	-	Jeneberang River Bridge (393m)	
D	P2-2	Boka IC -Takalar (national road)	22.5	2	4	Widening	AC Pavement	-		
		Total:	47.1							

Note: the figure in ( ) shows a future plan.

Source: JICA Study Team

Figure 10.2 Implementation Plan B and Contract Packaging for Trans-Sulawesi Mamminasata Road

(2) Mamminasa Bypass, Hertasning Road, A.D. Sirua Road

1) Mamminasa Bypass

The Mamminasa Bypass was divided into four (4) sections as indicated in **Table 10.3** taking the appropriate construction timing into consideration.

Table 10.3 Implementation Section of Mamminasa Bypass

Section No.*	Section Name	Road Length	Major Bridge Length	Construction Period	Estimated Construction Cost
1-A	Maros Bypass Section	5.7 km	Maros Bridge (126m)	24 months (2016-2017)	Rp 88 billion
1-C	Middle Section (KIMA Access – Jl Malino)	6.9 km		36 months (2013-2015)	Rp 90 billion
1-B	Maros-KIMA Access	19.7 km		36 months (2021-2023)	Rp 280 billion
1-D	Jl Malino – South Section (Jl Tj Bunga)	16.7 km	Jeneberang Bridge (154m)	60 months 2019-2023	Rp 250 bullion
Total		49.1 km	280m		Rp 708 billion

Note: Order of sections from the north (Matos) to the south
Source: JICA Study Team

Of the above, it is assumed that an external soft loan would be applied for Section B, Middle Section (KIMA Access – Jl Malino), as this section should be constructed earlier than other sections according to the strategy of inducing the creation of a new satellite town along this road section. The construction should be carried out in one or two contract packages taking the estimated project cost and work characteristics into account.

2) Hertasning Road

The JICA Study Team studied only Section D (4.9 km) of the Hertasning Road. Application of a single contract package would be appropriate for the construction of this road section.

3) Abdullah Daeng Sirua Road

Section B of the Abdullah Daeng Sirua Road is under construction and, therefore, Sections C and D within the territory of Makassar City should be implemented with appropriate contract packaging determined by Dinas PU. For the construction of Sections E and F in the territory of Kabupaten Maros and Gowa, it is recommended to use an external soft loan as these sections should be connected to the Mamminasa Bypass to induce the new satellite town. Considering the estimated project cost, application of one or two contract packages would be appropriate for the

construction of these sections.

Table 10.4 Implementation Section of Abdullah Daeng Sirua Road

Section No.	Section Name	Road Length	Long Bridge Length	Construction Period	Estimated Construction Cost
4-A, 4-C and 4-D	Makassar City Section	7.0km		48 months (2010-2013)	Rp 91 billion
4-E and 4-F	Kabupaten Maros & Gowa Section	8.3km	Tallo Bridge (60m)	36 months (2013-2015)	Rp 124 billion
Total		15.3km			Rp 315 billion

Source: JICA Study Team

10.5 Implementation Schedule

(1) Trans-Sulawesi Mamminasata Road

1) Pre-construction Schedule and Action Plan

A joint financing by GOI and an external source (either Japanese ODA scheme or other donor agency) will be appropriate for implementation of the project. **Figure 10.3** shows planned schedule (implementation plan for Phase 1 project of Alternative Implementation Plan B) and action plan for the use of the Japanese ODA facility for earliest project implementation. Similar procedures will be required in the case of using other external funding. The phase 2 project also should be implemented in the same way as the phase 1.

The DGH needs to make internal project screening and submit the project proposal to Bappenas through MOW for Blue Book listing. Financial arrangements of GOI (APBN/ABPD) are also necessary for the cost not covered by the external loan like land acquisition, resettlement and administration costs.

AMDAL (EIA) for the project was approved by the Governor of South Sulawesi Province in September 2007. The LARAP policy frame required for project appraisal was also prepared by the JICA Study Team.

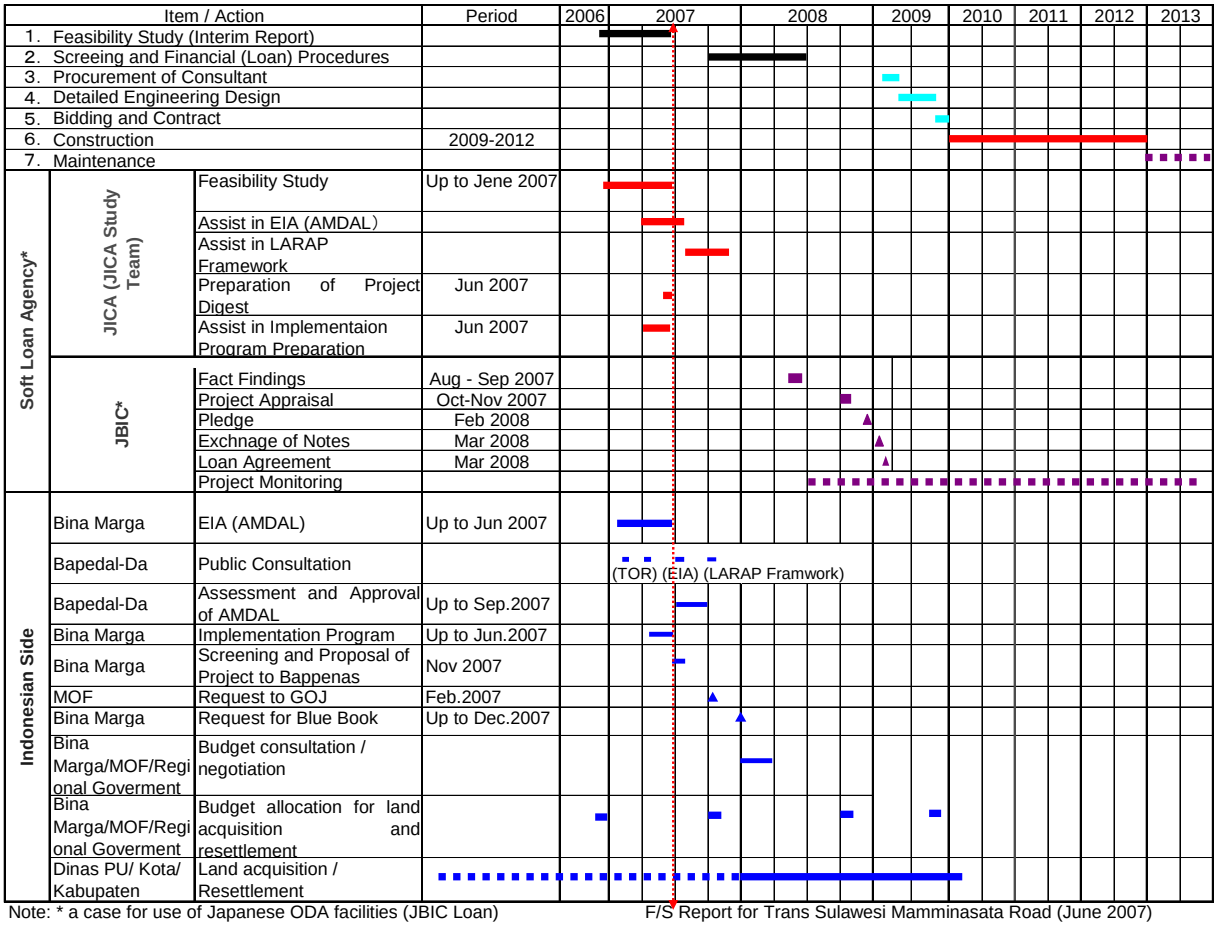


Figure 10.3 Implementation Schedule and Action Plan for Trans-Sulawesi Mamminasata Road Project (Case of Japanese ODA Facility)

2) Construction Stage

The construction period is estimated to be 36 months. The required period for the roadway and bridge construction is estimated based on the work quantities in Section 9.1, daily productivity, number of work-units, and seasonal working days.

3) Post-construction Stage

Maintenance of for warranty period (one year) is the responsibility of the contractors. After that, the project road will be maintained by DGH. If operation and maintenance works are contracted out, they are under the responsibility of operator/contractors. The project execution will be continually monitored by the executing agency.

(2) Mamminasa Bypass, Hertasning Road, A.D. Sirua Road

The implementation schedule of the Mamminasa Bypass, Hertasning Road and Abdullah Daeng Sirua Road would differ by financing source and availability. The anticipated or assumed financial source and implementation schedule are as shown in **Figure 10.4**.

Road	Length* (km)	Financial Source*	Period	2006-2010					2011-2015					2016-2020					2021-2023		
				2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
● Mamminasa Bypass																					
- Maros Bypass Section	5.0	APBN	2016-2017																		
- Maros-KIMA Access	7.6	APBN/ APBD I	2021-2023																		
- Middle Section (KIMA Access-Jl. Malino)	19.4	External Loan or Private Investor	2013-2015																		
- Jl. Malino- South Section (Jl.Tj.Bunga)	16.7	APBN/ APBD I	2019-2023																		
● Hertasning Road																					
- Secions C	3.4	APBD I	Up to 2008																		
- Secions D	4.9	APBD I	2008-2010																		
● Abdullah Daeng Sirua Road																					
- Makassar Section (Section B)	2.5	APBD II	Up to 2009																		
- Makassar Section (Sections A, C, D)	7.4	APBD II	2010-2011																		
- Maros/Gowa Section (Section E and F)	7.2	External Loan or Private Investor	2012-2015																		

Source: JICA Study Team

Figure 10.4 Construction Schedule of Mamminasa Bypass, Hertasning Road and Abdullah Daeng Sirua Road

10.6 Operation and Maintenance Plan

(1) Key Maintenance Issues and Financing Sources

Sustainability of the road facilities after development is the most important issue. The asset management approach should be applied.

The road maintenance work consists of routine maintenance and periodic maintenance. The management, planning and execution of the maintenance work for national roads are under the responsibility of DGH. The routine maintenance is conducted by force account of provincial or regency governments using APBN allocated by DGH. The periodic maintenance is contracted out.

The planning and execution of the maintenance work for provincial roads is under the responsibility of Praswil of South Sulawesi Province using APBD I, while for city or Kabupaten roads they are under the responsibility of Dinas PU of city or regency governments using by APBD II.

The key issue for the maintenance is the lack of financial and budgetary sustainability and/or insufficient budget allocation. A stable funding source should be established for maintenance financing. There are two approaches: budget approach and road fund approach. In the first approach, the road costs are considered as public expenditures to be covered by national or provincial budget. The revenue from fuel taxes, vehicle registration fees and others levies is used to cover such road costs. In the second approach, road users pay for the road costs. The former is the current practice in Indonesia and the establishment of road fund is one of the future challenges.

(2) Trans-Sulawesi Mamminasata Road

The operation and maintenance cost required for the Trans-Sulawesi Mamminasata Road is estimated to be Rp 9,000 million per year for routine maintenance. Periodic maintenance is also required at a certain interval. In order to secure the sustainability of the Trans-Sulawesi Mamminasata Road after construction, a funding mechanism to finance operation and maintenance cost should be instituted. There will be three methods: the operation and maintenance by force account of DGH; by contractors under supervision of DGH (Balai Besar VI); and by participation of the private sector. The former two involve public financing and the last one involves financing by the private sector.

The Study Team recommended to collect low user charges at the toll gates installed at access points, Tallo River Bridge and Jeneberang River Bridges, to Makassar City indicated in **Figure 10.5** could raise a sufficient fund for covering the maintenance costs required for the TSMR.

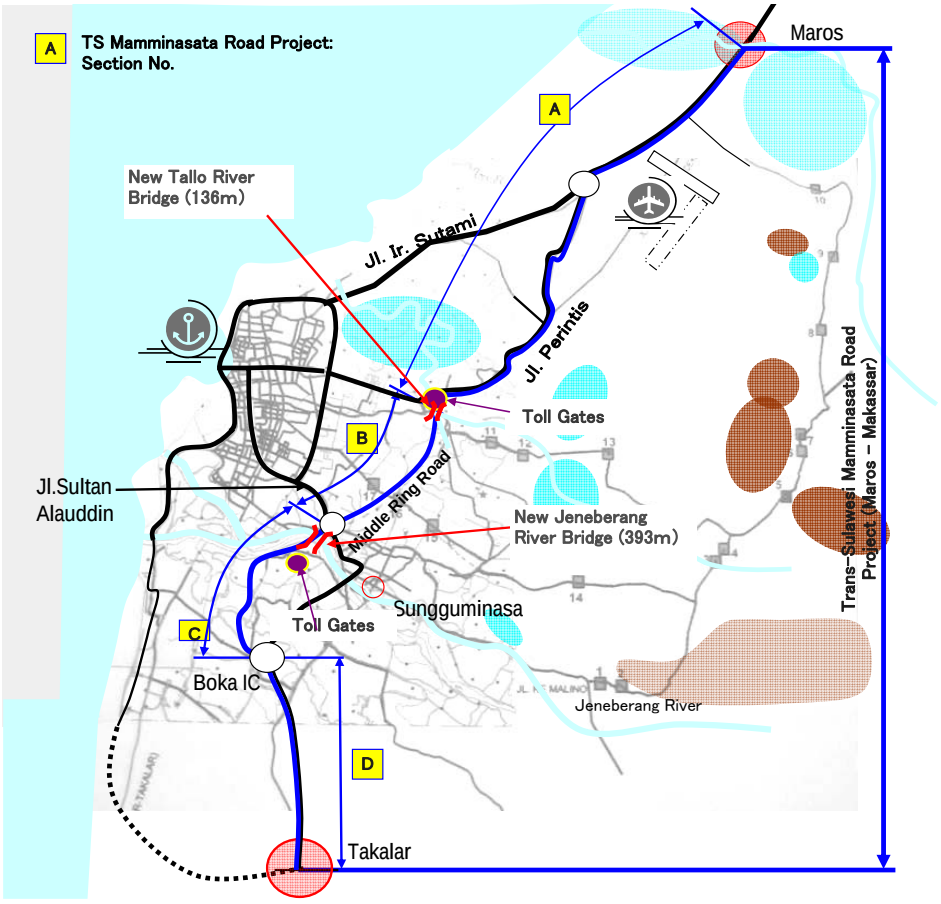


Figure 10.5 Location of Toll Gates for O&M Cost Recovery

(3) Mamminasa Bypass, Hertasning Road and Abdullah Daeng Sirua Road

The road maintenance work for the Mamminasa Bypass, Hertasning Road, Abdullah Daeng Sirua Road consists of routine maintenance and periodic maintenance. The management, planning and execution of the maintenance work for these roads are under

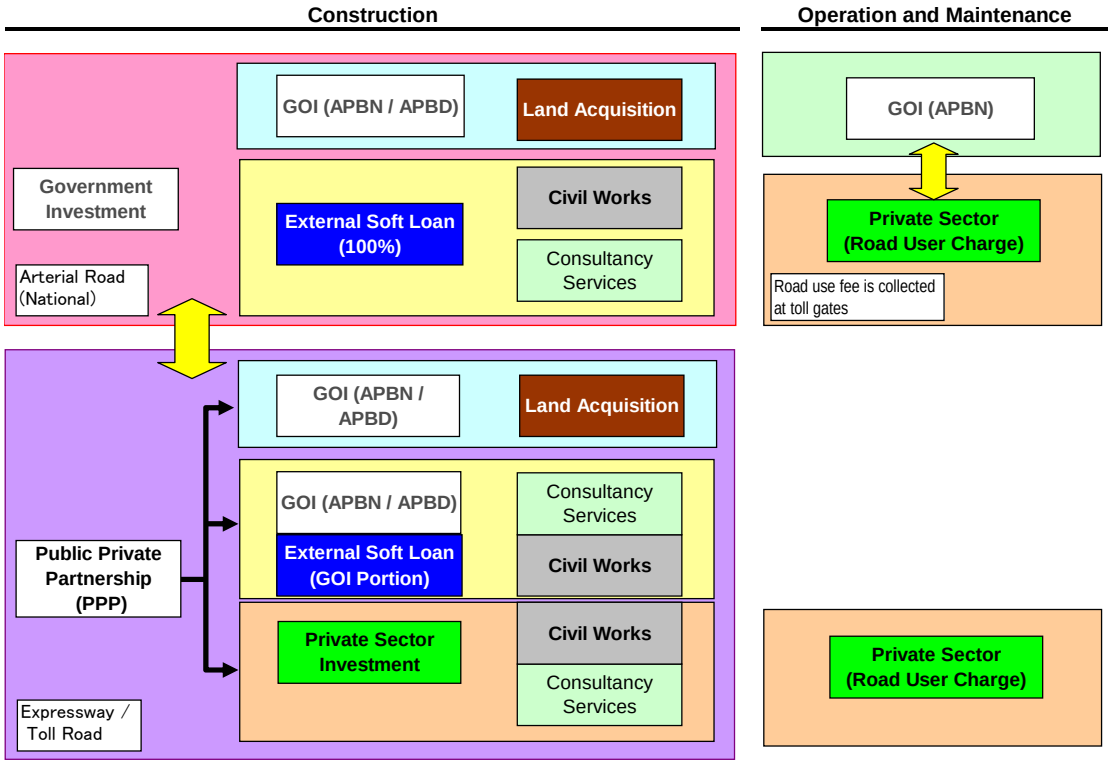
the responsibility of Praswil of South Sulawesi Province using APBD I or Dinas PU of Makassar City using APBD II.

As the central section of the Mamminasa Bypass and the Maros/Gowa section of Abdullah Daeng Sirua Road are for the service of a new satellite town, the maintenance obligation might be transferred to the private investors who participate in the new town development.

10.7 Financing Plan and Annual Fund Requirements

(1) Trans-Sulawesi Mamminasata Road Project

Figure 10.6 summarizes the general financing methods studied for the Trans-Sulawesi Mamminasata Road Project.



Note: Excluding VAT and Administration cost
Source: JICA Study Team

Figure 10.6 Financing Methods for Trans-Sulawesi Mamminasata Road Project

There will be two financing methods for implementation of the project. One is financing by the public sector and the other is co-financing with the private sector (Public Private Partnership). In both methods it is possible to use a soft loan facility either from Japan or other sources. However, PPP will be difficult to apply as the Project's FIRR is too low. Hence, public finance was recommended.

Table 10.5 indicate the financing plan for the project in the case of amplification of Japanese ODA facility (JBIC soft loan) by alternative implementation plan with assumptions that:

* 100% of the costs of civil works, consulting services and contingencies are financed by an external soft loan

* GOI finances the land acquisition/resettlement, administration cost and tax (VAT), which are not eligible for the JBIC loan

* The assumed the currency exchange rate is of US$ 1.00=¥120=Rp.9,322 (as of May 2007).

The total project cost is estimated at Rp 888 billion and Rp 869 billion for Phase 1 and Phase 2 of Alternative B, respectively. The loan amount for the project, which is the total of the civil works, the consulting services and contingencies, is estimated to be US$ 72.7 million for Phase 1 and US$ 67.7 million for Phase 2. The rest of the project cost will be financed by the local budget (APBN and APBD). The loan cover 71% - 75% of the project cost.

Table 10.5 Project Cost and Loan Amount by Alternative Implementation Plan

	Alternative A	Alternative B			Actual Implementaion for Phase 1*
		Phase 1	Phase 2	Total	
External Soft Loan (US $ million)					
- Civil Works	112.7	61.9	57.6	119.5	61.9
- Consulting Services	8.4	4.6	4.3	8.9	5.7
- Contingencies	11.3	6.2	5.8	11.9	6.2
Total	132.3	72.7	67.7	140.4	73.8
GOI APBN / APBD (Rp billion)					
- Land Acquisition	283.8	148.9	156.6	305.5	148.9
- Administration Cost	16.8	9.2	7.6	16.8	9.2
- Tax (VAT)	121.7	66.8	62.2	129.0	67.8
Total	422.3	224.9	226.3	451.3	225.9
Grand Total (Rp billion)	1,625.4	885.7	841.6	1,727.2	896.7

Note: * The detailed design for Phase 2 will be carried out during the Phase 1 work.
Source: JICA Study Team

(2) Mamminasa Bypass Project, Hertasning Road Project and Abdullah Daeng Sirua Road Project

The Mamminasata Bypass, the Hertasning Road and Maros/Gowa section of the Abdullah Daeng Sirua Road will be developed as a provincial roads, the construction and consultancy services will be financed by APBD I (the provincial budget) in principle and possibly by APBN as these are arterial road links in the Mamminasata Metropolitan Area. External soft loan may be used for the development of the Mamminasa Bypass Project possibly covering a substantial part on a granting basis from the central government. Maintenance will be financed by APBD I since the roads are provincial roads.

There are following potential funding sources which could be utilized for the development of regional roads:

i) **Funding from the Line Ministry (APBN):** The national budget of Bina Marga for the road

sector (APBN) is allocated mainly for the development of national roads, but sometimes it is allocated for the development of provincial roads.

ii) **External Loan/Grant via the same route as above (APBN):** The Ministry of Finance has already prepared the decrees on both case of granting external loan from the GOI to regional governments (PMK 52 /2006: Peraturan Menteri Keuangan, Nomor 52/PMK 010 /2006) and lending external loan (PMK 53 /2006). However, due to the limited financial capacity of the regional governments, only the external loan granting practice has been adopted so far. External loan granting may be extended to both provincial and Kabupaten/Kota governments. The ERITP II project is implemented on the On-granting basis with 30% - 90% of the project cost being provided by the central government.

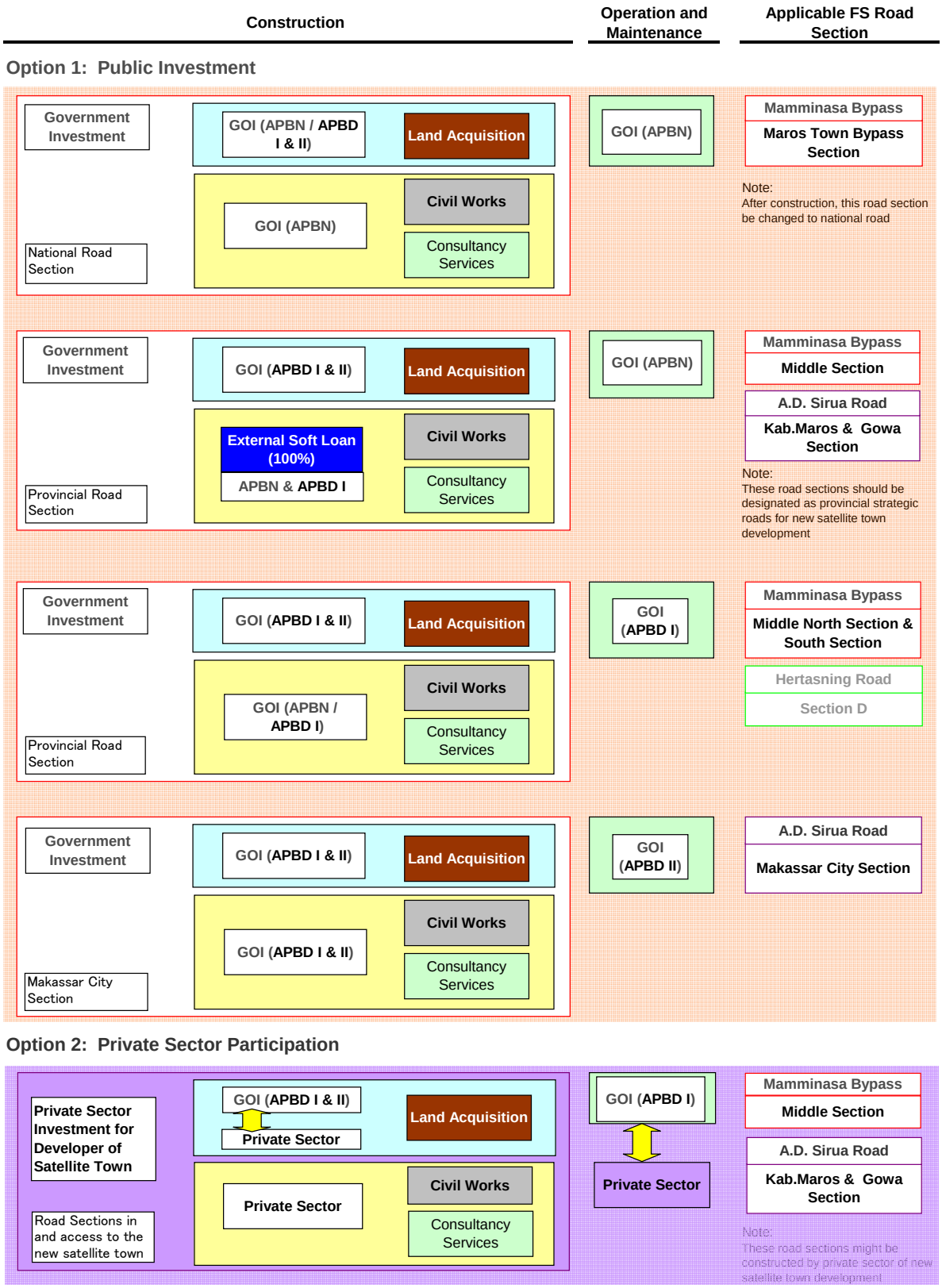
ii) **DAK (Special Allocation Fund: APBD):** DAK is one category of balancing fund from GOI to regional governments. DAK has been allocated to cover the road sector expenditures of Kabupaten/Kota governments in the last two years based on the proposal from these governments. However, DAK allocated to the road sector should be used in accordance with PU's instruction (Peraturan Menteri Pekerjaan Umum Nomor: 39 /PRT/M/2006), that is 70% for the maintenance and 30% for the improvement/construction.

iii) **General Regional Budget (APBD I: Province and APBD II: Kabupaten/Kota): The** General Regional Budget (APBD I and APBD II) is although limited the major funding source for both the development/improvement and maintenance of regional roads. APBD I and APDB II are financed by own regional tax/levy revenue and the balancing fund from GOI such as the Revenue Sharing, the General Allocation Fund (DAU) and the Special Allocation Fund (DAK).

iv) **Mamminasata Metropolitan Area:** Strategic and priority infrastructures in the Mamminasata Metropolitan Area might be financed by the national budget in future.

Figure 10.7 shows the optional financing methods applicable for the Mamminasa Bypass, Hertasning Road and Abdullah Daeng Sirua Road projects. If preferable incentives and conditions are given and secured, private investors may participate in some part of the road development.

It may be possible to introduce an external soft loan for the central section of Mamminasa Bypass and the Kabupaten Maros/Gowa section of Abdullah Daeng Sirua Road as those are for inducing a new satellite town in accordance with the Mamminasata Spatial Plan.



Note: Excluding VAT and Administration cost
Source: JICA Study Team

Figure 10.7 Optional Financing Methods for Mamminasa Bypass, Hertasning Road and Abdullah Daeng Sirua Road Project

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions on F/S Roads

(1) Trans-Sulawesi Mamminasata Road

1) The Study Team identified that the Trans-Sulawesi Mamminasata Road (TSMR) is the highest priority road link among the four F/S roads. It will directly contribute to the development of the Mamminasata Metropolitan Area by:

   - improving the present urban road network;
   - coping with the increasing traffic demand;
   - enhancing regional development; and
   - supporting logistic flow for inducing trade, investment and industrial development.

   It also will indirectly contribute to:

   - expanding development to the whole eastern regions of Indonesia; and
   - reducing poverty and regional development gaps.

2) The feasibility study for the TSMR has shown that the Project is highly viable in both technical and economic aspects (EIRR: 28.5-30.2%). Therefore, it is recommended that the Project be implemented at an earliest date for the benefit of national and regional economy.

3) As to the construction plan, a full access-controlled express highway for the Middle Ring Road section under PPP (Public Private Partnership) scheme is judged not feasible because its FIRR is only 6.5%. Thus this project should better be implemented in the category of public financing (Government) projects.

4) Collection of low user charges at the toll gates installed at access points (Tallo River Bridge and Jeneberang River Bridges) to Makassar City could raise a sufficient fund for covering the maintenance costs required for the TSMR.

5) The current progress of ROW acquisition for the Middle Ring Road (Section B) is approximately 60-70%.

6) EIA (AMDAL) report on the TSMR Project was approved by the Governor of South Sulawesi Province in September 2007.

(2) Mamminasa Bypass

1) The Study Team identified that the Mamminasa Bypass is the second highest priority road link among the four F/S roads.

2) The Mamminasa Bypass should be constructed as a new road. The appropriate route is that passing through appropriate topography and location where a new satellite town can be developed. The north section of the Mamminasa Bypass should be planned as a bypass for Maros Town while avoiding a planned flood retarding basin of the Maros River. The southern route should be connected to Jl.Tj.Metro Bunga where many development projects are in progress or under planning.

3) It will directly contribute to the development of the Mamminasata Metropolitan Area by:

- inducing a new satellite town at the east of Makassar City and the west foot of Mt. Moncongloe, where flood free 4,000 ha of land could be available for regulated urban development; and
- enhancing regional development, especially contributing to the development of KIWA (planned new industrial area of Gowa Regency).

4) The feasibility study for the Mamminasa Bypass has shown that the Project is viable on both technical and economic aspects (EIRR: 22.4%). Therefore, it is recommended that the Project be implemented at an earliest date for the benefit of national and regional economy.

5) As the middle section of the Mamminasa Bypass and the Maros/Gowa Regency section of the Abdullah Daeng Sirua Road are intended to serve directly the planned new satellite town, they might be constructed with cooperation of private investors who will participate in the new satellite town development.

6) EIA (AMDAL) report on the Mamminasa Bypass Project needs to be approved by the Governor of South Sulawesi Province.

(3) Hertasning Road

1) The Study Team identified that the Hertasning Road is an important arterial road link for the Mamminasata Metropolitan Area.

2) The Hertasning Road construction project is an ongoing development project under South Sulawesi Government. It is divided into four sections: Sections A, B, C and D. Section A has already been completed and Section B is under construction. The detailed design for Section C has been completed. Therefore, only Section D was subject to F/S.

3) The Hertasning Road has the following functions:

- Direct access road from the east suburbs to the Makassar City center as one of the radial roads.
- A main access road to TPA (new final waste disposal area planned at Pattallassang in Gowa Regency).
- Enhancement of regional development, especially contributing to the development of KIWA (new industrial area of Gowa Regency).
- A short cut route for the Bili-bili Dam and Malino.

4) The feasibility study for the Hertasning Road has shown that the Project is viable on both technical and economic aspects (EIRR: 33.8%) and it will contribute to national and regional economy.

(4) Abdullah Daeng Sirua Road

1) The Study Team identified that the Abdullah Daeng Sirua Road is one of the important arterial road links for the Mamminasata Metropolitan Area.

2) The Abdullah Daeng Sirua Road construction project is an ongoing development project under Makassar City. It is divided into six sections: Sections A, B, C, D, E and F, and Section B is under construction. Sections E and F are in the Maros/Gowa Regency

3) It will directly contribute to the development of the Mamminasata Metropolitan Area by:

- inducing a new satellite town at the east of Makassar City and the west foot of Mt. Moncongloe, where flood free 4,000 ha of land could be available for regulated urban development;
- providing direct access for the residents staying in the east suburbs of Makassar City; and
- enhancing regional development, especially contributing to the development of KIWA (new industrial area of Gowa Regency).

4) The feasibility study for the Abdullah Daeng Sirua Road has shown that the Project is viable on both technical and economic aspects (EIRR: 31.0%). Therefore, it is recommended that the Project be continued for the benefit of national and regional economy.

5) As the Maros and Gowa Regency sections are intended to serve directly the planned new satellite town, they might be constructed with cooperation of private investors who will participate in the new satellite town development.

11.2 Recommendations on F/S Roads

(1) Trans-Sulawesi Mamminasata Road

1) The Trans-Sulawesi Mamminasata Road Project (the TSMRP) should be implemented as a national strategic road link since it is a part of the Trans-Sulawesi West Corridor and an arterial road for the Mamminasata Metropolitan Area.

2) The TSMRP should be implemented in two phases: Phase 1 for Sections B and C (Middle Ring Road and its southern extension), and Phase 2 for Section A (Maros-Jl.Tol.Ir.Sutami IC) and Section D (Sungguminasa - Takalar).

3) The Directorate General of Highways (DGH) should request Bappenas to list the TSMRP in the Blue Book for foreign funding assistance.

4) DGH should conduct an appropriate project evaluation process and propose, preferably to the Government of Japan, for extension of a soft loan for the implementation of the TSMRP, through PU, Bappenas and MOF as soon as possible.

5) The central and regional governments should negotiate and allocate sufficient budget required for ROW acquisition and resettlement for the project preparation. The ROW acquisition for the Middle Ring Road should be continued.

6) DGH should make environmental management and monitoring in accordance with the environmental management and monitoring plans established in the EIA Report in cooperation with the agencies concerned.

(2) Mamminasa Bypass

1) The Mamminasa Bypass Project (the MBP) should be implemented as a provincial strategic road or a national strategic road since it is an arterial road for inducing the creation of a new satellite town for the Mamminasata Metropolitan Area.

2) The MBP should be implemented in four phases. The middle part of the Mamminasa Bypass should be constructed in the first phase since it is an arterial road for the planned new satellite town.

3) An external funding would be necessary and, therefore, South Sulawesi Government should request Bappenas to list the MBP in the Blue Book.

4) A separate study should be conducted for establishment of a satellite town development plan. The private sector should be encouraged to participate in the required infrastructure construction, including access road for the new satellite town development.

5) The regional governments should control housing and other development on the route of

the Mamminasa Bypass and the planned new town area to secure the land for these developments.

6) The regional governments should make environmental management and monitoring in accordance with the environmental management and monitoring plans established in the EIA Report in cooperation with the agencies concerned.

(3) Hertasning Road

1) Implementation of the Hertasning Road Project (the HRP) should be continued by South Sulawesi Province as a provincial strategic road since it is an arterial road of the Mamminasata Metropolitan Area.

2) The remaining sections of the HRP (Sections C and D) might be implemental as an access road for TPA (new final waste disposal area planned at Pattallassang in Gowa Regency).

3) A stage construction approach might be applied for Sections C and D of HRP taking tight budget required for both ROW acquisition and construction into consideration. The 1st Stage is widening of the existing 4.5m travelway (carriageway) to a 7.0 m standard road. The 2nd stage is further widening from 2 lanes to 4 lanes with a median.

4) The regional governments should control housing and other developments within the planned ROW.

5) The regional governments should make environmental management and monitoring in accordance with the environmental management and monitoring plans etablished in the EIA Report in cooperation with the agencies concerned.

(4) Abdullah Daeng Sirua Road

1) Makassar City Section

i) Implementation of the Abdullah Daeng Sirua Road Project (the ADSRP) should be continued by Makassar City up to the border of Makassar City and Gowa Regency as a strategic road.

ii) Financial assistance by both provincial and central governments should be made since this is an arterial road of the Mamminasata Metropolitan Area.

iii) As ROW acquisition is difficult for the beginning section of the ADSRP (Section A) which is located in a densely populated urban area, one-way traffic control should be applied rather than widening it to a 4-lane road, considering the environmental aspect.

iv) The construction of the road sections in the semi-urban and residential area should be made by utilizing the ROW of PDAM as much as possible. However, the PDAM canal

should be kept open as much as possible for securing a green and water front environment.

v) The regional governments should make environmental management and monitoring in accordance with the environmental management and monitoring plans established in the EIA Report in cooperation with the agencies concerned.

2) Maros/Gowa Regency Section

i) The ADSRP in the Maros/Gowa Regency section should be implemented as a provincial strategic road or a national strategic road since it is an arterial road for inducing the creation of a new satellite town for the Mamminasata Metropolitan Area.

ii) An external funding would be necessary for the Maros/Gowa Regency section and, therefore, South Sulawesi Government should request Bappenas to list up the ADSRP on the Blue Book, as a package with the middle part of the Mamminasa Bypass.

iii) The regional governments should control housing and other developments within the planned ROW.

iv) The regional governments should make environmental management and monitoring in accordance with the environmental management and monitoring plans established in the EIA Report in cooperation with the agencies concerned.

11.3 Conclusion and Recommendations on Other Roads

(1) Outer Ring Road

1) The Outer Ring Road is one of the important links in the Mamminasata Metropolitan Area arterial road network and its expected functions are as follows:

- Ring road to contribute to harmonizing urban development;
- Logistic route for the coming in and out traffic from/to the southern area of South Sulawesi Province to/from KIMA, Makassar Port, new industrial areas along Jl.Tol.Ir.Sutami; and
- Connection between the north educational center and the south educational center.

2) The Outer Ring Road consists of three parts. The north section is the part accessing to KIMA, Jl.Tol.Ir.Sutami and Makassar Port. The middle section runs along the Tallo River and the south section is a connection to the Sungguminasa and Mamminasa Bypass. The Outer Ring Road and the Mamminasa Bypass share the same road at their southern part to connect to the Tj. Bunga Development Area.

3) The northern section between Jl.Tol.Ir.Sutami and Jl. Perintis Kemerdekaan through the New Industrial Area (Kawasan Pergudangan dan Industri Parangloe Indah) is under

construction by a private investor and will be completed as planned.

4) Intersections for Jl.Tol.Ir.Sutami and the Outer Ring Road should be constructed under the on-going BOT project.

5) A 500-700 m buffer zone should be provided between the route of the on-going north section and the Tallo River to avoid negative effects to the river environment.

6) As the project is vital on both technical and economic aspects (EIRR: 27%), it is recommended to conduct a feasibility study including EIA for its implementation.

(2) Tj.Bunga – Takalar Road (Jalan Lintas Barat Makassar - Takalar)

1) As floods do not occur at the Jeneberang River estuary after the Bili-bili dam construction, many development projects have been implemented. Since the completion of a bridge at the mouth of the Jeneberang River in 2005, development has expanded to the south. An earliest improvement of the Tj.Bunga - Takalar Road (Lintas Barat) is recommended to regulate the sprawled urban development in the area.

2) This road link constitutes one of the radial roads (south radial road) in the Mamminasata Urban Arterial Road Network System and it connects the Galesong Port in Takalar. It is recommended to upgrade this road status from Kabupaten road to provincial road as it connects Makassar City to Takalar (Capital of Takalar Regency) along the west coast.

3) This road will be an alternative route of the Trans-Sulawesi Road from/to Makassar City to/from the southern part of South Sulawesi Province and contribute to reducing the traffic jam at Sungguminasa.

4) As the economic analysis has shown a very high EIRR of 41.4%, it is recommended that the Project be implemented for the benefit of national and regional economy

5) Financing for the project implementation should be made by both provincial and central governments since this is an arterial road of the Mamminasata Metropolitan Area.

11.4 Recommendation on Establishment of Coordination Committee for Project Implementation of the F/S Roads

The Study Team understands that good cooperation and coordination between the central governments (Bappenas, MOF and MPW) and regional governments (South Sulawesi Province, Makassar City and Regencies of Maros, Gowa and Takalar) are very important for implementation of the F/S road projects as these are part of the arterial road network for the Mamminasata Metropolitan Area.

The Study Team recommends establishment of a “Project Implementation Committee for Arterial Road Network Development for the Mamminasata Metropolitan Area”. The committee, comprised of the representatives of concerned central and regional governments,

holds periodic meetings for monitoring progress of the project implementation, discusses on problems and measures to solve and takes required actions for smooth implementation of the projects.