F-2 Preliminary Design of Roadway and Intersections

F-2.1 Roadway Design

(1) General

The JICA Study Team has made preliminary designs for roadways, intersections, bridges, pavement and other structures for the Outer Ring Road in accordance with the design standards, road development concept, and route alignments established in Section F-1. The engineering design was based on the results of natural condition survey (topography) and hydrology study and geological condition analysis.

The design results are reflected to the Drawings in Volume 2-2 (Preliminary Design Drawings) of the Feasibility Study Report.

(2) Roadways

Preliminary design of the Outer Ring Road was made on the photo-mosaic map taken by aerial survey. Digital Terrain Model was prepared from the contours from ortho-photo but field topographic survey was not executed as this is a pre-F/S study. Cross section templates for each section of road were then created and applied for calculating the earthworks and other quantities.

(1) Preliminary Design of Horizontal Alignment

North Section

The road alignment starts from the Daya intersection on Perintis Kemerdekaan Road. The horizontal alignment design for the North Section is complied with the minimum design speed of 60 km/hr, this is new road. Major control points are a connection point to Perintis Kemerdekaan Road and Daya Market located at the start point. The road alignment follows the existing Daya road, where many houses and temporary market buildings are located, for about 500 m long. After the Daya market area, desirable horizontal alignments are planned through mostly vacant land along selected route corridor in Section F-1. The North Section will be developed to a 4 lane road with a wide median (10m) except the Daya section.

Middle Section

The horizontal alignment design of Middle Section complies with the design speed of 60 km/hr since this is a new road. Major control points are the Tallo River crossing or running along the planned road alignment and its flood basins.

South Section

Major control points for the South Section are lakes/swamps, Chinese cemetery, State Islam University under construction and crossing point of the Jeneberang River. The horizontal alignment of the South Section crosses Malino Road (provincial road) at approximately 3 km east of the Sungguminasa / Jl.Malino intersection where resettlement requirement is small.

From Malino Road the Our Ring Road is extended to the south crossing over the Jeneberang River and is connected to the Mamminasa Bypass passing through mostly paddy fields. After meeting with the Mamminasa Bypass, the Outer Ring Road and Mamminasa Bypass share the same road and connected to Tj Bunga Road.

(2) Preliminary Design of Vertical Alignment

The Outer Ring Road is located in flat terrain. The profile grade of the northern part of Outer Ring Road is controlled by elevation of the Tallo River Bridge (Sta. 3+850). The average embankment height of the Outer Ring Road is about 0.5m to 1.5m.

(3) Preliminary Design of Cross Section

Three typical cross sections are provided for the Outer Ring Road. The typical cross section for the North Section has 4 lanes (2 lanes in each direction) with lane arrangement of a lane width of 3.5m, sidewalk of 3m and drainage on both sides. Total ROW is 37m. Future widening to 6 lanes could be possible using a 10.0m median.
The typical cross section from Sta. 2+800 to Sta. 4+900 has 4 lanes (2 lanes in each direction) and a 10m median drainage at the center as this is located in wet and flood areas. For the Tallo River flood basin from Sta. 4+900 to Sta. 6+000, 2.0m-height embankment in 46.5 m ROW is constructed to avoid from flooding.

Typical cross section for the South Section is same as the northern section with 4 lane travelway (2 lanes in each direction), 3.5m sidewalk and 10 m width median. Total ROW is 37m.

F-2.2 Intersection Plan and Preliminary Design

Selection of intersection types will be made based on the number of lanes of crossroads and traffic volume. Based on traffic volume, existing site condition, land use plan and economic efficiency, appropriate intersection types are selected from the following lists:

* Grade separation with access
* At-grade intersection with signal control
* Roundabout without signal control
* At-grade intersection without signal control.

The location of intersections along the Outer Ring Road is given in Figure F-2.1. A total of 7 intersections have been identified as shown in the figure, which are named OR-1 through OR-7. An intersection for Ir Sutami Toll Road through the new Parangloe Warehouse and Industrial Area will be constructed by the BOT investor.

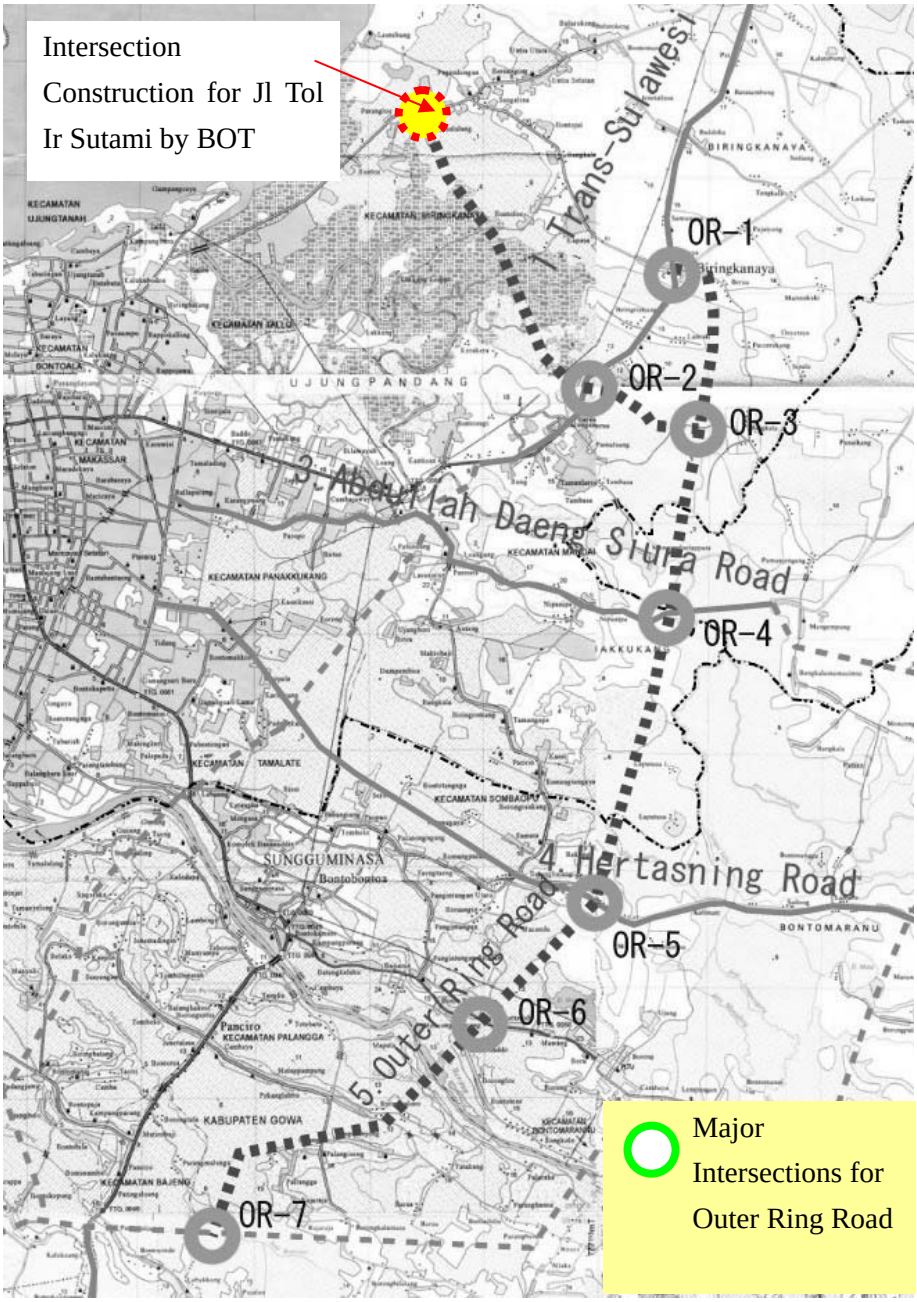


Figure F-2.1 Locations of Major Intersections on Outer Ring Road

The results of traffic forecast for the intersections are given in Figure F-2.2. The future traffic volume in 2023 is expressed in terms of PCUs/day for all vehicles.

At-grade intersection with signal control was recommended for the above major intersection under the pre-F/S except the interchange for Jl Tol Ir Sutami constructed by the BOT.

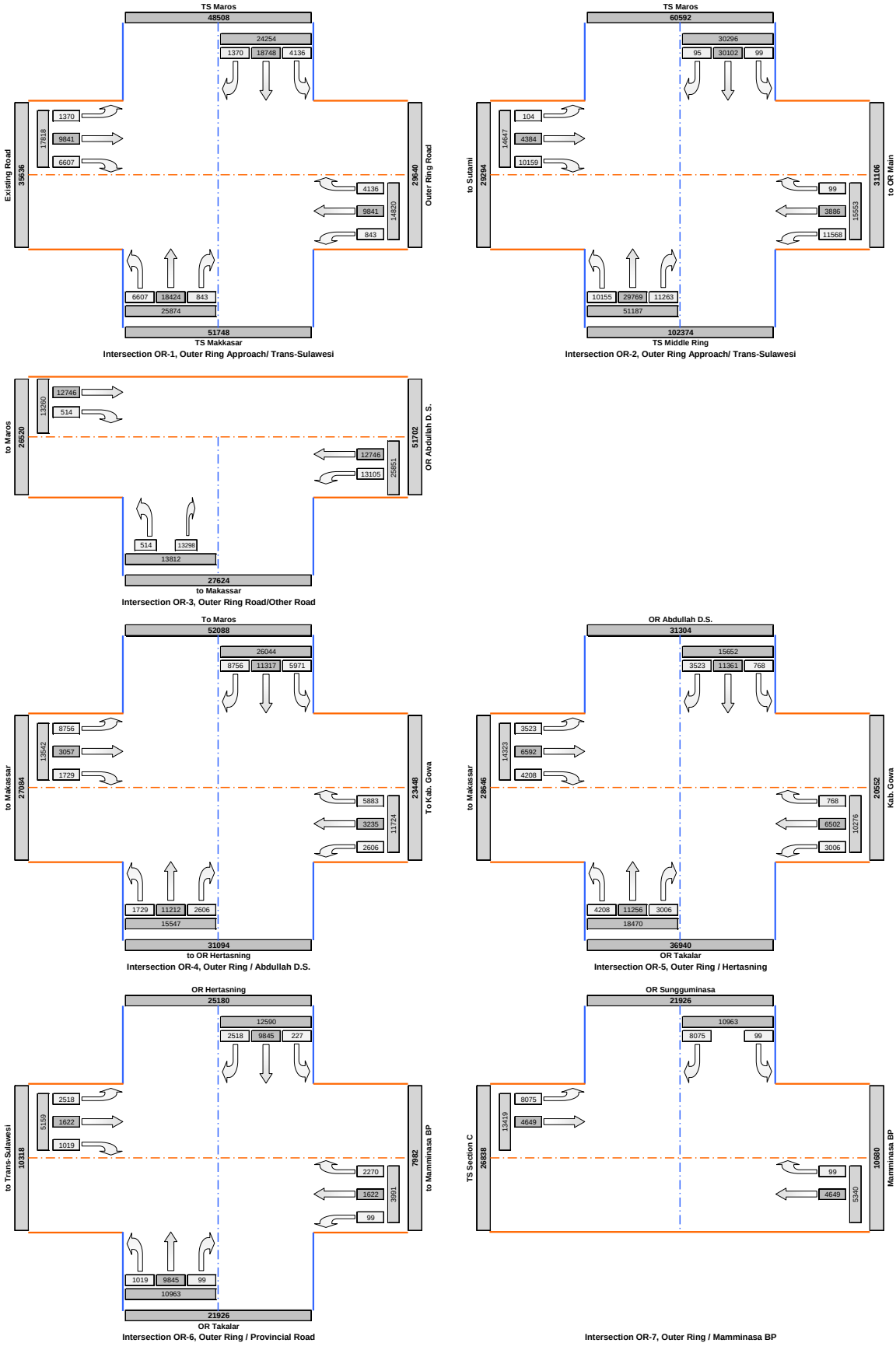


Figure F-2.2 Traffic Volume for Intersections on Outer Ring Road (PCUs/day, 2023)

Based on the estimated traffic volume, preliminary design and capacity analysis of intersections were conducted using the Indonesian Highway Capacity Manual. The results of the analysis are shown in Table F-2.1. Actual phasing pattern and cycle time should be designed in the detailed design stage.

Table F-2.1 Intersection Capacity Analysis (1/2)

Intersection OR-1, Outer Ring Approach/ Trans-Sulawesi
PHF = 0.0.85 for City>1M 3-Phases

From Leg	Direction	To	PCU/hr	Phase	PCU/hrrev	RT lane	Prot/Opp	We	Lane	Qrt	Qrto	So	Fcs	Fsf	Fg	Fp	Frt	S	g/c	C	No of Lanes		Round	DegSat	Remarks
TS Makkasar	Left	Existing Road	562	0	562	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.30		1	0.30	
	Straight	TS Maros	1566	1	1638	y	o	10.5	3	250	250	4025	0.94	0.95	1	1	1	3594	0.50	1797	2.73	2.61	3	0.87	
	Right	Outer Ring Road	72	1		y	o	10.5	3	250	250	4025	0.94	0.95	1	1	1					0.12	1	0.12	RT lane only
Existing Road	Left	TS Maros	116	0	116	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.06		1	0.06	
	Straight	Outer Ring Road	836	2	836	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.25	469	1.78		2	0.89	
	Right	TS Makkasar	562	3	562	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.25	622	0.90		1	0.90	RT lane only
TS Maros	Left	Outer Ring Road	352	0	352	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.19		1	0.19	
	Straight	TS Makkasar	1594	1	1710	y	o	10.5	3	250	250	4025	0.94	0.95	1	1	1	3594	0.50	1797	2.85	2.66	3	0.89	
	Right	Existing Road	116	1		y	o	10.5	3	250	250	4025	0.94	0.95	1	1	1					0.19	1	0.19	RT lane only
Outer Ring Road	Left	TS Makkasar	72	0	72	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.04		1	0.04	
	Straight	Existing Road	836	2	836	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.25	469	1.78		2	0.89	
	Right	TS Maros	352	3	352	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.25	622	0.57		1	0.57	RT lane only

Intersection OR-2, Outer Ring Approach/ Trans-Sulawesi
PHF = 0.085 for City>1M 3-Phases

From Leg	Direction	To	PCU/hr	Phase	PCU/hrrev	RT lane	Prot/Opp	We	Lane	Qrt	Qrto	So	Fcs	Fsf	Fg	Fp	Frt	S	g/c	C	No of Lanes		Round	DegSat	Remarks
TS Middle Ring	Left	to Sutami	863	0	863	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.46		1	0.46	
	Straight	TS Maros	2530	1	2530	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.35	656	3.85		3	1.28	4 lanes reqd
	Right	to OR Main	957	2	957	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.25	622	1.54		1	1.54	RT lane only
to Sutami	Left	TS Maros	9	0	9	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.00		1	0.00	
	Straight	to OR Main	373	3	1237	y	o	7	2	250	10	3125	0.94	0.95	1	1	1	2791	0.40	1116	2.22	0.67	1	0.67	
	Right	TS Middle Ring	864	3		y	o	7	2	250	10	3125	0.94	0.95	1	1	1					1.55	1	1.55	2 lanes reqd
TS Maros	Left	to OR Main	8	0	8	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.00		1	0.00	
	Straight	TS Middle Ring	2559	1	2559	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.35	656	3.90		3	1.30	4 lanes reqd
	Right	to Sutami	8	2	8	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.25	622	0.01		1	0.01	RT lane only
to OR Main	Left	TS Middle Ring	983	0	983	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.52		1	0.52	
	Straight	to Sutami	330	3	338	y	o	7	2	10	250	1825	0.94	0.95	1	1	1	1630	0.40	652	1.04	1.01	1	1.01	
	Right	TS Maros	8	3		y	o	7	2	10	250	1825	0.94	0.95	1	1	1					0.02	1	0.02	RT lane only

Intersection OR-3, Outer Ring Road/Other Road
PHF = 0.085 for City>1M 3-Phases

From Leg	Direction	To	PCU/hr	Phase	PCU/hrrev	RT lane	Prot/Opp	We	Lane	Qrt	Qrto	So	Fcs	Fsf	Fg	Fp	Frt	S	g/c	C	No of Lanes		Round	DegSat	Remarks
to Makassar	Left	to Maros	44	0	44	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.02		1	0.02	
	Right	OR Abdullah D. S.	1130	1	1130	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.46	1145	0.99		1	0.99	
to Maros	Straight	OR Abdullah D. S.	1083	0	1083	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.58		2	0.29	
	Right	to Makassar	44	3	44	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.10	249	0.18		1	0.18	RT-lane only
OR Abdullah D. S.	Left	to Makassar	1114	0	1114	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.59		1	0.59	LT-lane
	Straight	to Maros	1083	2	1083	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.44	825	1.31		2	0.66	

Intersection OR-4, Outer Ring / Abdullah D.S.
PHF = 0.1 for City<1M 3-Phases

From Leg	Direction	To	PCU/hr	Phase	PCU/hrrev	RT lane	Prot/Opp	We	Lane	Qrt	Qrto	So	Fcs	Fsf	Fg	Fp	Frt	S	g/c	C	No of Lanes		Round	DegSat	Remarks
to OR Hertasning	Left	to Makassar	173	0	173	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.09		1	0.09	
	Straight	To Maros	1121	1	1121	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.31	581	1.93		1	1.93	extra lane reqd
	Right	To Kab. Gowa	261	2	261	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.31	772	0.34		1	0.34	RT lane only
to Makassar	Left	To Maros	876	0	876	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.47		1	0.47	
	Straight	To Kab. Gowa	306	3	479	y	o	7	2	175	250	2250	0.94	0.95	1	1	1	2009	0.38	764	1.25	0.80	1	0.80	
	Right	to OR Hertasning	173	3		y	o	7	2	175	250	2250	0.94	0.95	1	1	1					0.45	1	0.45	RT lane only
To Maros	Left	To Kab. Gowa	597	0	597	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.32		1	0.32	
	Straight	to OR Hertasning	1132	1	1132	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.31	581	1.95		1	1.95	extra lane reqd
	Right	to Makassar	876	2	876	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.31	772	1.14		1	1.14	RT lane only
To Kab. Gowa	Left	to OR Hertasning	261	0	261	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.14		1	0.14	
	Straight	to Makassar	324	3	912	y	o	7	2	250	175	2700	0.94	0.95	1	1	1	2411	0.38	916	1.99		1	1.00	share with RT
	Right	To Maros	588	3		y	o	7	2	250	175	2700	0.94	0.95	1	1	1						1	1.00	RT lane only

Intersection OR-5, Outer Ring / Hertasning
PHF = 0.1 for City<1M 3-Phases

From Leg	Direction	To	PCU/hr	Phase	PCU/hrrev	RT lane	Prot/Opp	We	Lane	Qrt	Qrto	So	Fcs	Fsf	Fg	Fp	Frt	S	g/c	C	No of Lanes		Round	DegSat	Remarks
OR Takalar	Left	to Makassar	421	0	421	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.22		1	0.22	
	Straight	OR Abdullah D.S.	1126	1	1126	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.45	844	1.33		1	1.33	extra lane reqd
	Right	Kab. Gowa	301	2	301	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.10	249	1.21		1	1.21	RT lane only
to Makassar	Left	OR Abdullah D.S.	352	0	352	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.19		1	0.19	
	Straight	Kab. Gowa	659	3	1080	y	o	7	2	250	250	2525	0.94	0.95	1	1	1	2255	0.45	1015	2.13	1.30	1	1.30	extra lane reqd
	Right	OR Takalar	421	3		y	o	7	2	250	250	2525	0.94	0.95	1	1	1					0.83	1	0.83	RT lane only
OR Abdullah D.S.	Left	Kab. Gowa	77	0	77	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.04		1	0.04	
	Straight	OR Takalar	1136	1	1136	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.45	844	1.35		1	1.35	extra lane reqd
	Right	to Makassar	352	2	352	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.15	373	0.94		1	0.94	RT lane only
Kab. Gowa	Left	OR Takalar	301	0	301	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.16		1	0.16	
	Straight	to Makassar	650	3	727	y	o	7	2	250	250	2525	0.94	0.95	1	1	1	2255	0.45	1015	1.43	1.28	1	1.28	extra lane reqd
	Right	OR Abdullah D.S.	77	3		y	o	7	2	250	250	2525	0.94	0.95	1	1	1					0.15	1	0.15	RT lane only

Note: For the details, please refer Indonesian Highway Capacity Manual

Table F-2.1 Intersections Capacity Analysis (2/2)

Intersection OR-6, Outer Ring / Provincial Road

Peak Hour Factor = 0.1 for Cit PHF=>> 0.1 3-Phases

From Leg	Direction	To	PCU/hr	Phase	PCU/hrrev	RT lane	Prot/Opp	We	Lane	Qrt	Qrto	So	Fcs	Fsf	Fg	Fp	Frt	S	g/c	C	No of Lanes		Round	DegSat	Remarks
OR Takalar	Left	to Trans-Sulawesi	102	0	102	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.05		1	0.05	
	Straight	OR Hertasning	985	1	985	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.60	1125	0.88		1	0.88	
	Right	to Mamminasa BP	10	2	10	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.10	249	0.04		1	0.04	RT lane only
to Trans-Sulawesi	Left	OR Hertasning	252	0	252	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.13		1	0.13	
	Straight	to Mamminasa BP	162	3	264	y	o	7	2	100	225	2100	0.94	0.95	1	1	1	1875	0.30	563	0.94	0.58	1	0.58	
	Right	OR Takalar	102	3		y	o	7	2	100	225	2100	0.94	0.95	1	1	1					0.36	1	0.36	RT lane only
OR Hertasning	Left	to Mamminasa BP	23	0	23	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.01		1	0.01	
	Straight	OR Takalar	985	1	985	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.60	1125	0.88		1	0.88	
	Right	to Trans-Sulawesi	252	2	252	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.15	373	0.67		1	0.67	RT lane only
to Mamminasa BP	Left	OR Takalar	10	0	10	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.01		1	0.01	
	Straight	to Trans-Sulawesi	162	3	389	y	o	7	2	225	100	2800	0.94	0.95	1	1	1	2500	0.30	750	1.04	0.43	1	0.43	
	Right	OR Hertasning	227	3		y	o	7	2	225	100	2800	0.94	0.95	1	1	1					0.61	1	0.61	RT lane only

Intersection OR-7, Outer Ring / Mamminasa BP

PHF = 0.1 for City<1M 3-Phases

From Leg	Direction	To	PCU/hr	Phase	PCU/hrrev	RT lane	Prot/Opp	We	Lane	Qrt	Qrto	So	Fcs	Fsf	Fg	Fp	Frt	S	g/c	C	No of Lanes		Round	DegSat	Remarks
OR Sungguminasa	Left	Mamminasa BP	13	0	13	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.01		1	0.01	
	Right	TS Section C	1083	1	1083	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.46	1145	0.95		1	0.95	
Mamminasa BP	Straight	TS Section C	524	0	524	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.28		1	0.28	
	Right	OR Sungguminasa	10	3	10	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1.33	2490	0.10	249	0.04		2	0.02	RT-lane only
TS Section C	Left	OR Sungguminasa	808	0	808	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	1.00	1875	0.43		1	0.43	LT-lane
	Straight	Mamminasa BP	534	2	534	y	p	3.5	1	0	0	2100	0.94	0.95	1	1	1	1875	0.44	825	0.65		2	0.32	

Where,

PCUrev = Revised PCU/hr for phasing pattern, eg, add turning volumes for same phase

Prot/Opp = protected or opposed

We = Approach width in m

Qrt = Right turn traffic volume

Qrto = Right turn traffic volume in opposing direction

So = Base Saturation Flow

Fcs = Adjustment factor for city size

Fsf = Adjustment factor for side friction

Fg = Adjustment factor for gradient

Fp = Adjustment factor for parking

Frt = Adjustment factor for right turns only for protected approach

S = Adjusted flow

g/c = Percentage green in each phase

C = Capacity for each group in the phase

DegSat = Approximate degree of saturation

The number of lanes required in each leg is then determined from the table. The preliminary lane arrangements for the intersections are illustrated in Figure F-2.3.

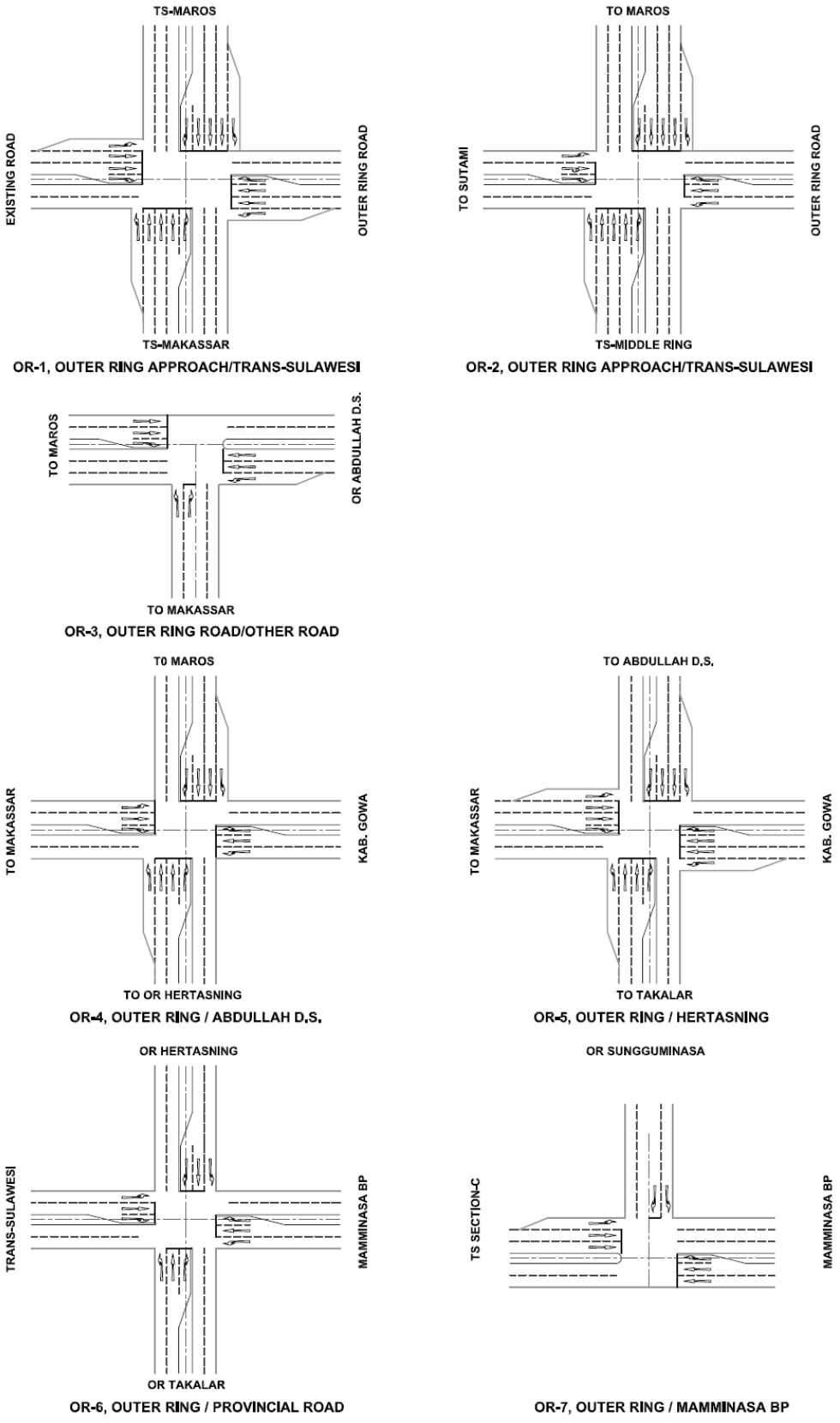


Figure F-2.3 Lane Arrangements for Major Intersections on Outer Ring Road

F-2.3 Pavement Design

Since geological engineering survey for the Outer Ring Road was not carried out because of pre-F/S, the pavement structure design was made referring to the Mamminasa Bypass as both site conditions are similar. The pavement structure in the following Table F-5.2 was adopted for the Outer Ring Road.

Table F-5.2 Summary of Pavement Design for F/S roads

Unit: cm

Road Link	Section	Surafce				Base and Subbase			Sub-grade CBR
		AC (W)	AC (B)	AC (base)	PCC	Class A	Class B	CTSB	
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	A Makkassar City	4	6			20	30		8%
	B Maros/Gowa Section	4	6			20	30		8%

Source: JICA Study Team

F-3 Bridge Plan and Preliminary Design

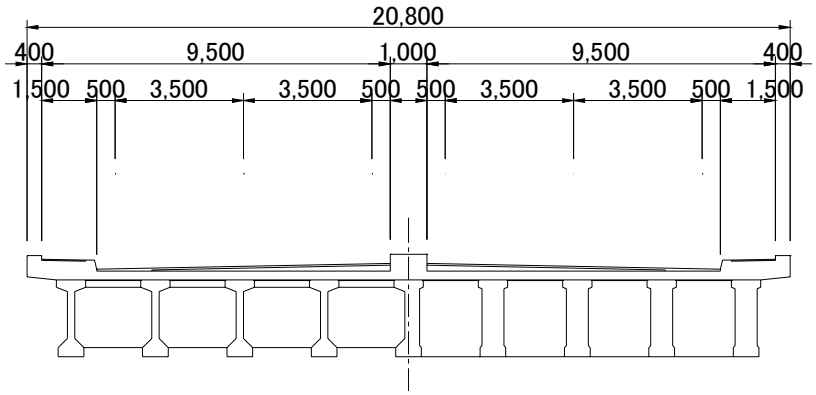
F-3.1 List and Location of Bridges

On the Outer Ring Road alignment, there are two major bridges crossing the Tallo River and the Jeneberang River as listed in **Table F-3.1** and their standard cross-section is shown in **Figure F-3.1**.

Table F-3.1 Bridge List on Outer Ring Road

Bridge No.	Survey No.	Section	Station	Across Object / Width (m)			Existing Lane	Request Lane
				Description	Length	Span		
5-1	---	5-A	3+600	Drainage Culvert	3	1	---	4
5-2	---	5-A	3+950	Tallo No.2 Bridge	120	4	---	4
5-3	---	5-A	4+600	Drainage Culvert	3	1	---	4
5-4	---	5-A	7+400	Drainage Culvert	3	1	---	4
5-5	---	5-A	9+300	Drainage Culvert	3	1	---	4
5-6	---	5-A	13+850	Drainage Culvert	3	1	---	4
5-7	---	5-B	15+400	Jeneberang No.3 Bridge	210	7	---	4
5-8	---	5-B	16+000	Canal	3	1	---	4
5-9	---	5-B	17+400	Canal	10	1	---	4
5-10	---	5-B	19+450	Bontoreo River	16	1	---	4
Total					371			

Source: JICA Study Team



Source: JICA Study Team

Figure F.3.1 Standard Cross Section of 4-Lane Bridges

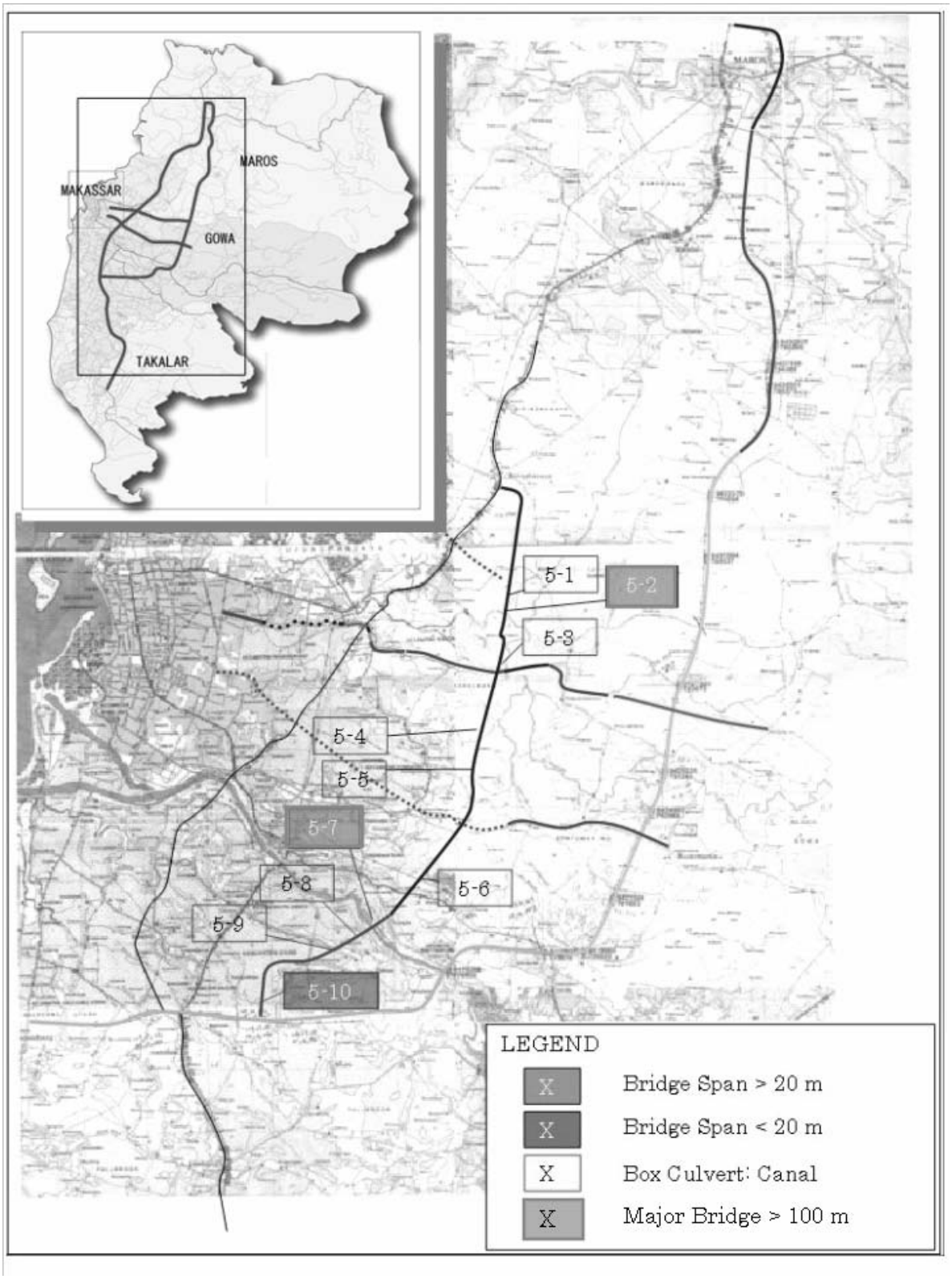


Figure F-3.2 Location Map of Bridge and Box Culvert

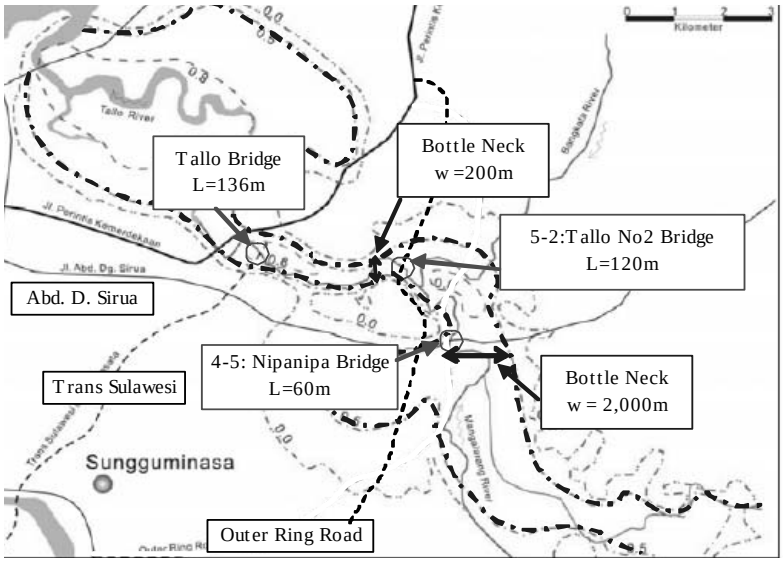
F-3.3 Major Bridges

(1) Site Condition

1) Tallo No2 Bridge

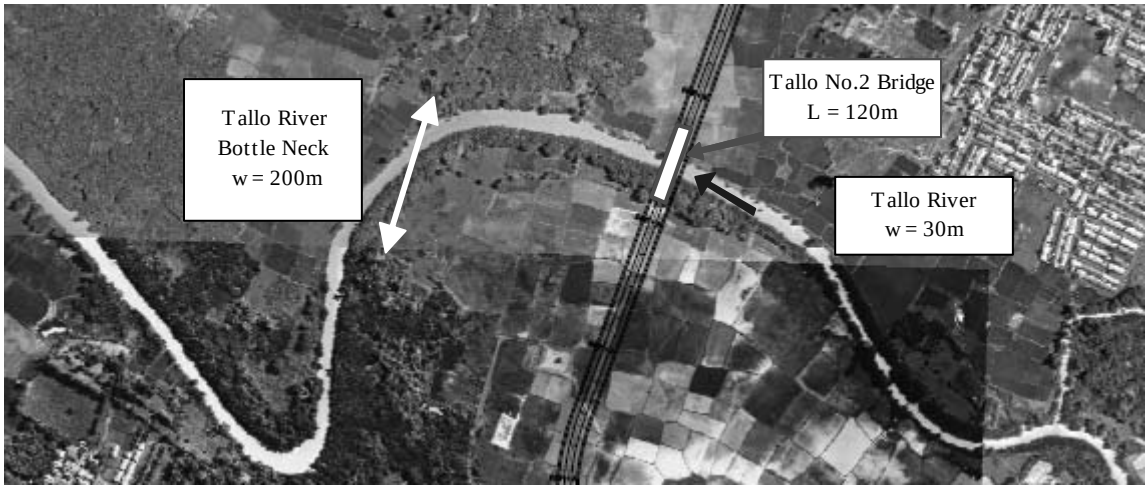
Three bridges planned on Tallo River under the F/S and Pre F/S roads are shown in **Figure F-3.3.** The narrowest point seemed to constitute a bottle neck for river flow of Tallo River is located between Tallo Bridge No 1 on Trans Sulawesi Road and Tallo Bridge No2 on Outer Ring Road. The river width is approximately 200m at this section. This bottle neck might be causing a flood retarder at upper stream.

Tallo No.2 bridge length was tentatively assumed to be 120m though the existing river width is 30m only. Further detailed investigation, flood analysis by non-uniform flow method and required bridge opening length analysis are required at detail design stage.



Source: JICA Study Team

Figure F-3.3 Bridge Location Map on Tallo River



Source: JICA Study Team

Figure F-3.4 Aerial Photo of Tall No.2 Bridge

2) Jeneberang No.3 Bridge (Bridge No.5-7)

The Jeneberang No.3 Bridge is planned at a stable river section and at where the least resettlement is required. The bridge location is at semi-urban area, approximately 2.5 km from the Sungguminasa Town. The planned bridge length is 210m.

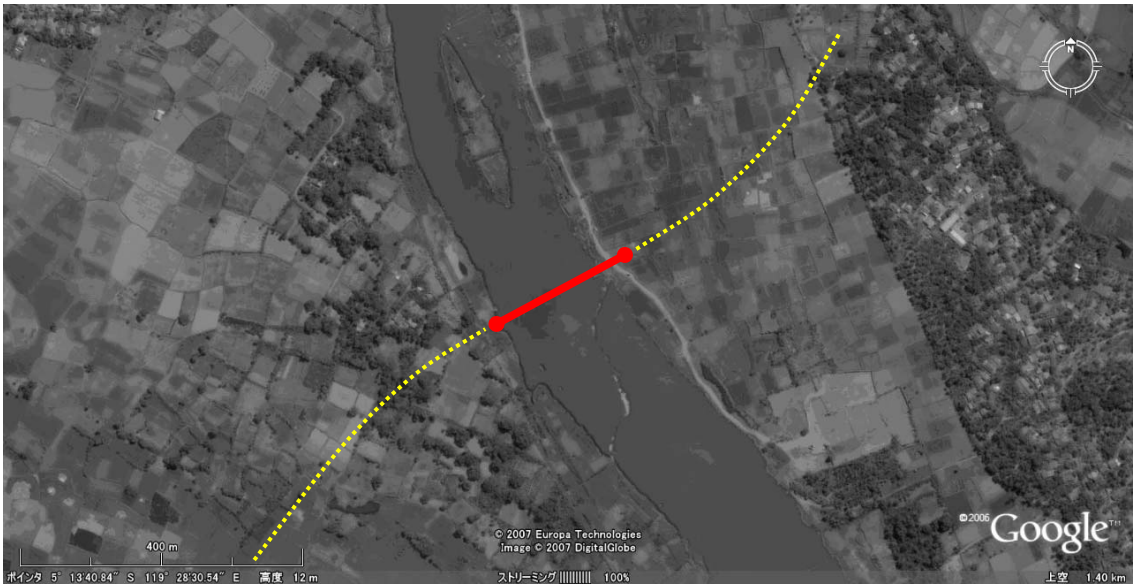
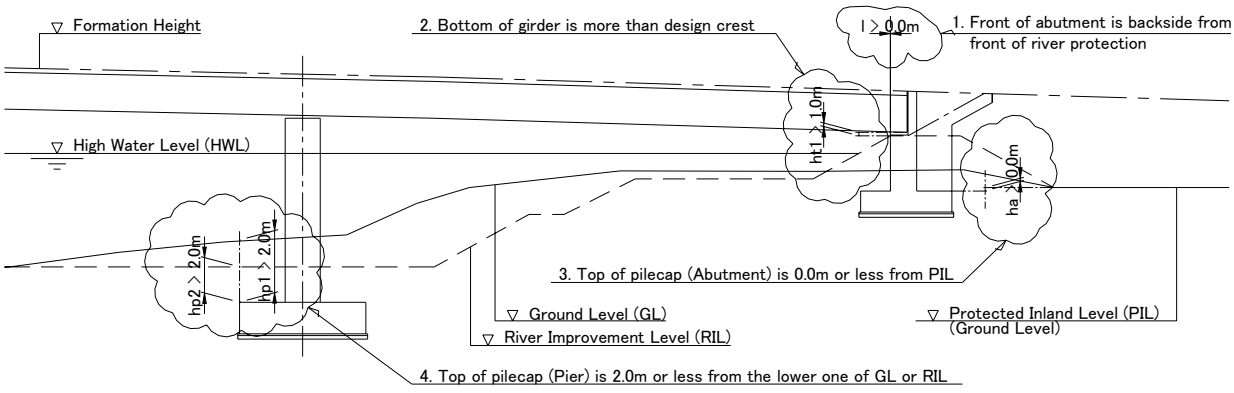


Figure F-3.5 Plane Photo of Jeneberang No.3 Bridge

(2) Bridge Layout Plan

The Water Resources Department of MPW has river improvement and training plans for the Tallo River has. Therefore bridge plan should consider both the present flow and after-improvement flow including the water level and topography.

As the Jeneberang River was already improved and well controlled by the Bili-bili dam, it would not cause any more floods. The bridge plan is studied based on the current condition. The studied bridge plans are shown in **Figure F-3.6**.



Source: JICA Study Team

Figure F-3.6 Model of Bridge Layout Plan

(3) Comparative Study of Bridge Type

1) Tallo No.2 Bridge (Bridge No. 5-2)

Three alternatives were set up for Tallo No.2 Bridge planning as indicated in **Table F-3.2**. Alternative 1 is PC I girder bridge with main girder span of 30.0m. Cantilever abutment, single column pier and bored pile foundation are adopted for substructures taking local contractors capacity and the least construction cost into account.

Alternative 2 is PC I girder bridge with a longer span of 40.0m. Since the girder is longer, construction is more difficult compared with Alternative 1. The same substructures and foundation with Alternative 1 are adopted.

Alternative 3 is steel I girder bridge of 40.0m spans. The total construction cost is the highest among those alternatives.

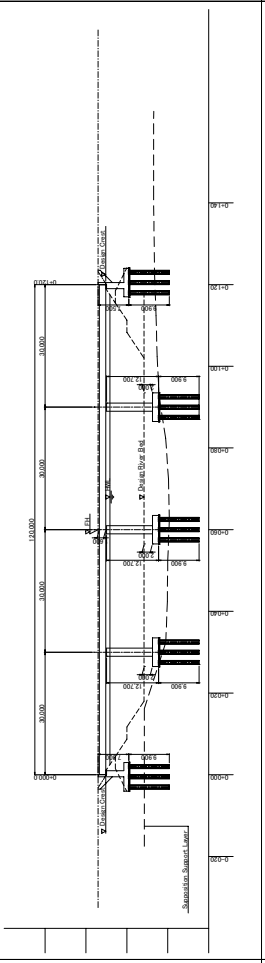
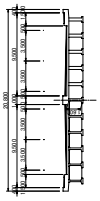
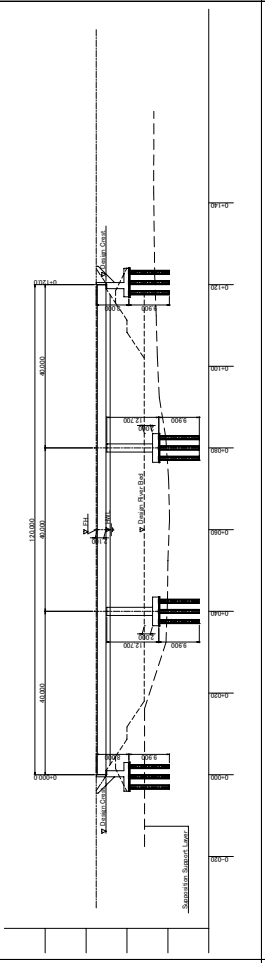
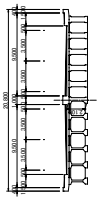
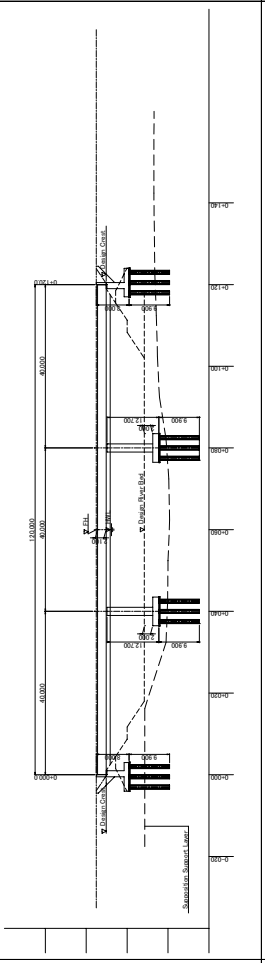
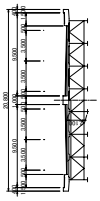
2) Jeneberang No.3 Bridge (Bridge No. 5-7) (See **Table F-3.3**)

Three alternatives were set up for Jeneberang No.3 Bridge planning as indicated in **Table F-3.3**. Alternative 1 is PC I girder bridge with main girder span of 30.0m. Cantilever abutment, single column pier and bored pile foundation are adopted for substructures taking local contractors capacity and the least construction cost into account.

Alternative 2 is PC I girder bridge with a longer span of 42.0m. Since the girder is longer, construction is more difficult compared with Alternative 1. The same substructures and foundation with Alternative 1 are adopted.

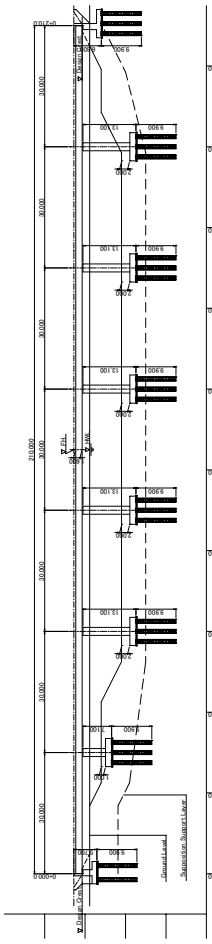
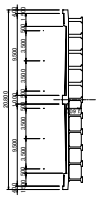
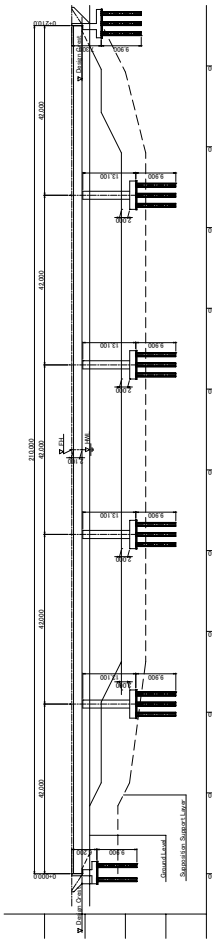
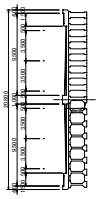
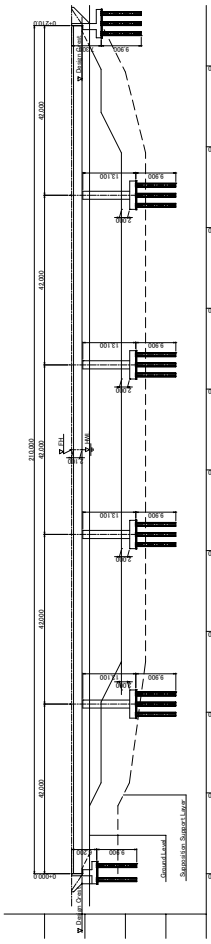
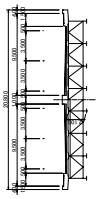
Alternative 3 is steel I girder bridge of 42.0m spans. The total construction cost is the highest among those alternatives.

Table F-3.2 Comparison Study of Tallo No.2 Bridge (Bridge No. 5-2)

	Layout of No. 5-2 Bridge	Cross Section	Description	Evaluation
Alternative 1 PC 4span I Girder Bridge			Alternative 1 is PC I girder bridge. The main girder (length: 30.0m) 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 Rupiah) (1) Superstrucure 16,969,000 (2) Substructure 5,426,000 (3) Foundation 2,220,000 TOTAL 100% 24,615,000 Stability / Construction / Maintenance / Aesthetics / Cost / Total 12 / 16 / 8 / 4 / 40 / 80 / 20 / / 20 / / 10 / / 10 / / 40 / / 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: 40.0m) 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 23,381,000 (2) Substructure 4,168,000 (3) Foundation 1,800,000 TOTAL 119% 29,349,000 Stability / Construction / Maintenance / Aesthetics / Cost / Total 12 / 12 / 8 / 5 / 34 / 71 / 20 / / 20 / / 10 / / 10 / / 40 / / 100	Not recommended
Alternative 3 Steel I Girder Bridge			Alternative 3 is steel I girder bridge. The main girder (length: 40.0m) 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 the highest. Cost Estimate (Thousand Rupiah) (1) Superstrucure 30,854,000 (2) Substructure 4,020,000 (3) Foundation 1,680,000 TOTAL 149% 36,554,000 Stability / Construction / Maintenance / Aesthetics / Cost / Total 14 / 14 / 6 / 5 / 27 / 66 / 20 / / 20 / / 10 / / 10 / / 40 / / 100	Not recommended from cost saving view point

Source: JICA Study Team

Table F-3.3 Comparison Study of Jeneberang No.3 Bridge (Bridge No. 5-7)

	Layout of No. 5-7 Bridge	Cross Section	Description	Evaluation
Alternative 1 PC 7span I Girder Bridge			Alternative 1 is PC I girder bridge. The main girder (length: 30.0m) 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 Rupiah) (1) Superstructure 29,617,000 (2) Substructure 8,796,000 (3) Foundation 3,320,000 TOTAL 100% 41,733,000 Stability: Construction 12 / 20, Maintenance 16 / 20, Aesthetics 8 / 10, Cost 40 / 40, Total 80 / 100	Best option
Alternative 2 PC 5span 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) Superstructure 41,303,000 (2) Substructure 6,550,000 (3) Foundation 2,480,000 TOTAL 121% 50,333,000 Stability: Construction 12 / 20, Maintenance 12 / 20, Aesthetics 5 / 10, Cost 34 / 40, Total 71 / 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 the highest. Cost Estimate (Thousand Rupiah) (1) Superstructure 55,699,000 (2) Substructure 6,246,000 (3) Foundation 2,200,000 TOTAL 154% 64,145,000 Stability: Construction 14 / 20, Maintenance 14 / 20, Aesthetics 6 / 10, Cost 26 / 40, Total 65 / 100	Not recommended from cost saving view point

Source: JICA Study Team

3) Summary of Evaluation

Based on the comparison study, the PC-I girder bridge type was selected as the most appropriate for both Tallo River and Jeneberang River on the economic and construction efficiency aspects as in Tables F-3.4 and F-3.5.

Table F-3.4 Summary of Bridge Type Evaluation for Tallo Bridge No.2

Bridge Length: 120m

Area / Alternative	Structure Types	Span	Stability	Construction	Maintenance	Aesthetics	Cost	Total
Rural Area			20%	20%	10%	10%	40%	100%
Alternative 1	PC I Girder	30m x 4	12%	16%	8%	4%	40%	80%
Alternative 2	PC I Girder	40m x 3	12%	12%	8%	5%	34%	71%
Alternative 3	Steel I Girder	40m x 3	14%	14%	6%	5%	27%	66%

Source: JICA Study Team

Table F-3.5 Summary of Bridge Type Evaluation for Jeneberang Bridge No.3

Bridge Length: 210m

Area / Alternative	Structure Types	Span	Stability	Construction	Maintenance	Aesthetics	Cost	Total
Rural Area			20%	20%	10%	10%	40%	100%
Alternative 1	PC I Girder	30m x 7	12%	16%	8%	4%	40%	80%
Alternative 2	PC I Girder	42m x 5	12%	12%	8%	5%	34%	71%
Alternative 3	Steel I Girder	42m x 5	14%	14%	6%	5%	26%	65%

Source: JICA Study Team

F-3.4 Minor Bridges

The most economical and common structure types in Indonesia are box-culverts for less than 10m span, PC hollow slab bridge for span length of 10-16m and PC I Girder Bridge for 16 - 35 m span. Those common types of structures are used for the minor bridges on the Outer Ring Road.

Abutments of reversed T type were applied for the substructure of minor bridges. Pile foundation was selected because the depth of the bearing stratum is approximately from 10 to 30 m. PC pile was selected as the type of foundation from both economical aspect and engineering practice in the project area.

F-4 IEE for Route Selection

(1) IEE and Route Evaluation Method

The objective of Initial Environmental Examination (IEE) is conducting an initial impact assessment on the alternative plans of the Pre-F/S routes for Outer Ring Road. IEE has been carried out based on the existing data, the data collected for the F/S roads, and site reconnaissance survey. It evaluates both negative and positive environmental impacts without prejudice (refer to Attachments F.2, F.3 and F.4 for IEE Matrix).

Multi Criteria Analysis (MCA), which is comprised of engineering, economical and environmental elements (IEE results), is used for evaluation of the alternatives.

(2) Stakeholder Meetings

The stakeholder meetings for IEE are held 3 times in total. The 1st stakeholder meeting was organized for selection of the most appropriate route on 15th June 2007 at Kabupaten Gowa, 24th June 2007 at Kota Makassar, and 31st June 2007 at BAPEDA of South Sulawesi Province with participation of Bina Marga (central office), Bappeda, Dinas Praswil, and concerned regional government offices. The 2nd Stakeholder Meeting was held on 11th September 2007 in the 2nd workshop in Makassar. The 3rd Stakeholder Meeting was held on 13th December 2007 at the time of the 2nd seminar in Makassar.

(3) Legal Framework

The environmental study shall be conducted in accordance with the JICA guidelines. The JICA guidelines require the IEE for pre-F/S but there is no legal framework of IEE in the planning stage (route selection) in Indonesia. The Study Team and concerned agencies of Indonesia have agreed to conduct IEE for the alternative route selection on environmental consideration.

(4) IEE Procedures

The IEE study has been conducted in accordance with the methods established and used for the F/S road route selection in February – March 2007. Though a common IEE does not include MCA, the Study Team combined MCA and IEE to evaluate alternative plans in an integrated way.

(5) Summary of IEE

1) North Section

Alternative Route 1 for the north section of Outer Ring Road between Jl.Tol.Ir.Sutami and Jl.Perintis Kemerdekaan passes through the estuary of Tallo River where exist mostly fish ponds, paddy fields, swamp and a few villages. There is a new industrial area (Parangloe Indah) facing at Jl.Tol.Ir.Sutami and Hasanuddin University at Jl.Perintis Kemerdekaan. Fish cultivation, agriculture and commerce are currently main regional economic activities of the residents. The

most of land owners expect the urbanization and industrial development in this area for stable life in the future. Therefore, natural urbanization is unavoidable in this area.

The UNHAS, Daya Hospital and other government office are located along Jl.Perintis Kemerdekaan, and the new residential area development (BTP) is progressing at the east of national road.

North Section of Outer Ring Road
(Near Parangloe Indah)

Outer Ring Road Route
(East Part of BTP)

Alternative 2 of Pre-FS route crosses Jl. Perintis Kemerdekaan (national road) at Jl.Daya. There are many houses, small shops and local market around the Daya intersection. The Daya Bus Terminal is also located at the west.

As the population density is still relatively low, the public facilities and lifeline are not yet well provided except near the Daya junction. Because of relatively small sized wetland and no existence of forest, the biodiversity along the proposed route seems to be low. Common species of fauna and flora are found out around this area. However, as the existing data is limited, EIA should be conducted by project owner at the time of feasibility study.

The significant negative impacts (A-) for Alternative 2 (2nd recommended Pre-F/S route) are anticipated in both resettlement (estimated number: around 100 houses) and safety for children. Some negative impacts (B-) are anticipated in 8 items equally for all alternatives. Land acquisition and resettlement in the pre-construction stage will be the most essential issue on social environmental considerations, especially for Alternative 2. The soil erosion during construction stage was screened out in the natural environmental category. Water contamination and noise are also anticipated by operation of heavy equipments (machines and trucks etc.). As the traffic will increase in the future, the air quality and noise will become worse compared with the present condition. While, the positive impacts on local economy, land use and utilization of local resources are expected. The traffic jam on the existing road will be reduced while the fatal traffic jam is anticipated as the traffic volume will exceed the capacity in the without-project case.

2) Middle Section

The proposed Pre-F/S route for the middle section of Outer Ring Road passes through the rural area in Makassar City and Gowa Regency. The route crosses on the middle reach of Tallo River. The Pre-F/S routes for all alternatives avoid the most of villages and a planned flood retarding basin for the Tallo River. Paddy field on the low land and crop cultivation area on the rolling terrain are spread around the Pre-F/S route. The cross points with Jl.Abdullah Daeng Sirua and Jl.Hertasning from Makassar to Pattallassang in Gowa exist on the proposed route.

Middle Section of Outer Ring Road
(Middle Stream at Tallo River Bridge)

This middle section passes through the area of low population density. Around the cross points with existing roads, there are some houses (less than 50) required resettlement. Along this route, the lifeline is not yet developed well. It is assumed that the biodiversity is relatively low. However, some paddy field becomes swamps in the rainy season, it is necessary to investigate biodiversity at the EIA study phase.

Middle Section in Makassar
(Middle Stream of Tallo River)

There is no significant negative impact (A-) for all alternatives. Relative negative impacts (B-) are anticipated in 10 - 11 items for each alternative. Land acquisition and resettlement for only Alternative 2 at the pre-construction stage will be the most essential issue. Natural environmental condition and pollution are almost same as the above north section. Minor soil erosion, effecting on surface water and water contamination in the Tallo River, might occur in the construction stage. Especially Alternative 1 (the recommended Pre-F/S route) passes through along the middle reach for about 1 km. The noise is anticipated in the construction stage. However, it seems that influence to the resident will be a little, as the population density is low. Air quality and noise will become worse compared with the without-project case. Significant positive impacts on local economic activities, land use and utilization of local resources are expected. The traffic jam will be improved. The road is also expected to contribute to inducing ordered urbanization in the eastern part of Makassar City and Gowa Regency.

Middle Section in Kab. Gowa
(Around planned Flood Retarding Basin)

3) South Section

The planned alternative routes for the south section of Outer Ring Road pass the periphery of Sungguminasa Town, Gowa Regency avoiding some swamps and access to the town center except Alternative 1. Alternative 1 (the recommended route) was planned avoiding high density residential area and to connect to the Mamminasa Bypass. This route crosses over the Jeneberang River and mostly passes through the paddy field after that.

Other three alternatives (Alternatives 2 to 4) approach to the center of Sungguminasa and passes through the existing urban and dense residential area. It is assumed that the biodiversity is relatively low and common species of fauna and flora are dominated in this area. However, as some paddy fields are changed to swamps in the rainy season, especially near Tamangapa (TPA Makasar) and Samata in Gowa, it is necessary to survey biodiversity at the EIA study stage.

South Section of Outer Ring Road
(Around Tamangapa Area)

Two significant negative impacts (A-) on resettlement (estimated number: more than 200 houses) and safety for children are anticipated for Alternatives 2 and 4 because those two routes pass through the current urban zone in Sungguminasa. Relatively negative impacts (B-) are anticipated in 8 and 10 items for each alternative. Land acquisition and resettlement are the most essential issue among these items, especially for Alternatives 2 and 4. In the natural environmental category, soil erosion and effect on the water for the Jeneberang River in the construction stage are anticipated in the case of Alternative 1. Water pollution and noise may occur during construction. As the traffic volume will increase in the future, air quality and noise will become worse compared with the present condition. However, the significant positive impacts on local economy, land use and utilization of local resources, solving traffic jam etc. are expected.

ORR in South Section
(Around Samata/Kab.Gowa)

(6) Summary of MCA for Pre-F/S Road Route Selection

The alternatives were subjected to Multiple Criteria Analysis and the results are described in Section F-1.6. MCA matrix was shown in Tables F-1.3, F-1.4 and F-1.5.

F-5 Cost Estimate

F-5.1 Composition of Project Cost

The project cost consists of construction cost, detailed design and supervision cots, land acquisition and compensation cots and administration cots. 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 value added tax (VAT) of 10% and inflation (price escalation) were excluded for the economic evaluation but included in the financing plan under Chapter 9, Project Implementation Plan. The maintenance cost for periodic maintenance and routine maintenance was also estimated.

The components of the project cost are shown in **Figure F-5.1**.

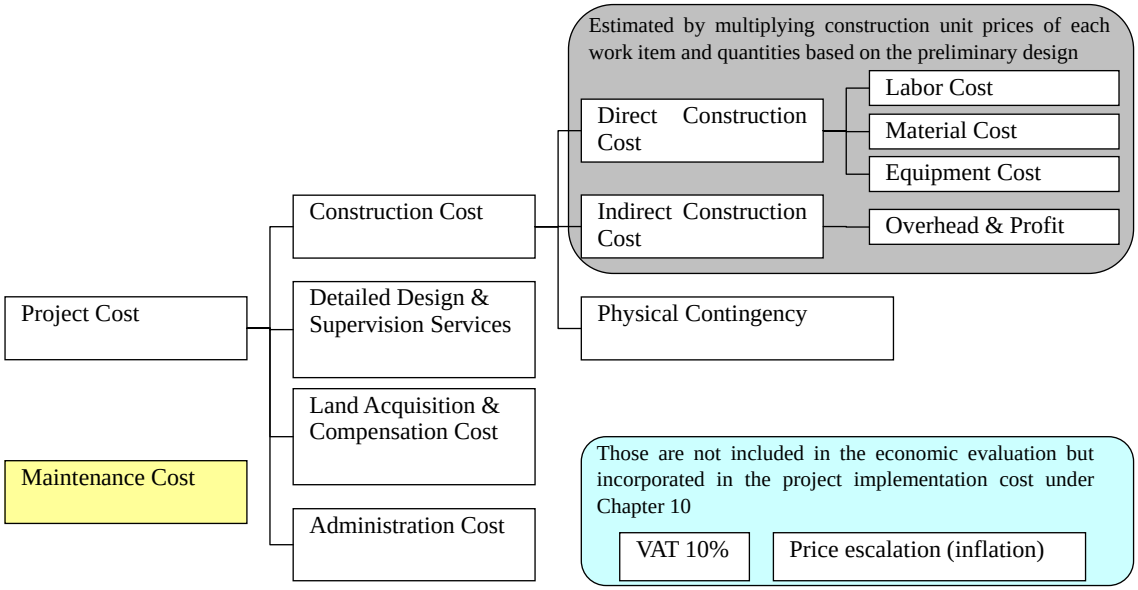


Figure F-5.1 Project Cost Component

F.5.2 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 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.

(1) Construction Cost

1) General

Construction Cost is composed of direct construction cost, indirect construction cost and physical contingency. The direct construction cost consists of labor cost, material cost and equipment cost. The construction cost was estimated by multiplying construction unit prices and quantities calculated based on the preliminary design and physical contingency was considered to be 10%. Estimation was made by major work items quoted from standard specifications of DGH, Indonesia, since it can be considered to be the most general categorization of work item in this country.

2) Construction Unit Prices

Construction unit prices for every work item include direct construction cost and indirect construction cost. Direct construction cost is composed of labor cost, material cost and equipment cost, including all the relevant expenditures necessary to conduct the work, such as taxes on the procurement of materials, operation costs of equipments and so on. Indirect construction cost includes overhead and profit margin of the contractor.

Construction unit prices applied to the cost estimate were set based on the standard unit prices in South Sulawesi Province (Harga Satuan Pokok Kegiantan (HSPK), 2006) and also on the comparison result of contract unit prices in the past and on-going projects. The project sites of all the projects referred to were located in the Mamminasata area, and the contracts of which were made in the period of 2005-2007.

Unit prices of major pay items applied for cost estimation are shown in shown in **Table F-5.1**.

Table F-5.1 Major Construction Quantities

Item	Unit	Unit Price (Rp. per unit)
Mortared Stonework	m3	334,361
Common Excavation	m3	25,337
Common Embankment	m3	25,337
Selected Embankment	m3	63,654
Aggregate Base Class A	m3	230,015
Aggregate Base Class B	m3	205,723
Asphalt Concrete-Wearing Course (5cm)	m2	55,374
Structural Concrete Class K250	m3	659,436
Precast Unit Type I Girder (31m)	nos	189,264,348
Reinforcing Steel	kg	7,807

Source: JICA Study Team design

3) Indirect Construction Cost

Overhead and profit was assumed to be twenty (20) % of the estimated direct construction cost.

(2) Detailed Design and Supervision Services

Detailed design and supervision services cost was assumed to be seven (7) % of the estimated construction cost.

(3) Land Acquisition and Compensation Cost

Fund sources for land acquisition and compensation would be coming from APBN and/or APBD depending on the agreement by both central and regional governments. On the basis of the current procedure of land acquisition and compensation in Indonesia, the transaction prices and *Nilai Jual Objek Pajak (NJOP)* prices heard from each Kota/Kabupaten, land acquisition and compensation costs were estimated as shown in the following tables.

Table F-5.2 Land Acquisition and Compensation Cost of Outer Ring Road

No.	Item	Section 5-A Maros, Gowa (M Rp.)	Section 5-B Gowa (M Rp.)	Total (M Rp.)
1	Land Acquisition	57,080	11,378	**68,458**
2	Building Compensation	1,725	345	**2,070**
Total		**58,805**	**11,723**	**70,528**

Source: JICA Study Team estimation

(4) Administration Cost

Administration cost was assumed to be two (2) % of the estimated construction cost.

F-5.3 Project Cost

(1) Section of Outer Ring Road for Project Implementation

The project road was divided into two sections as shown in **Figure F-5.2**.

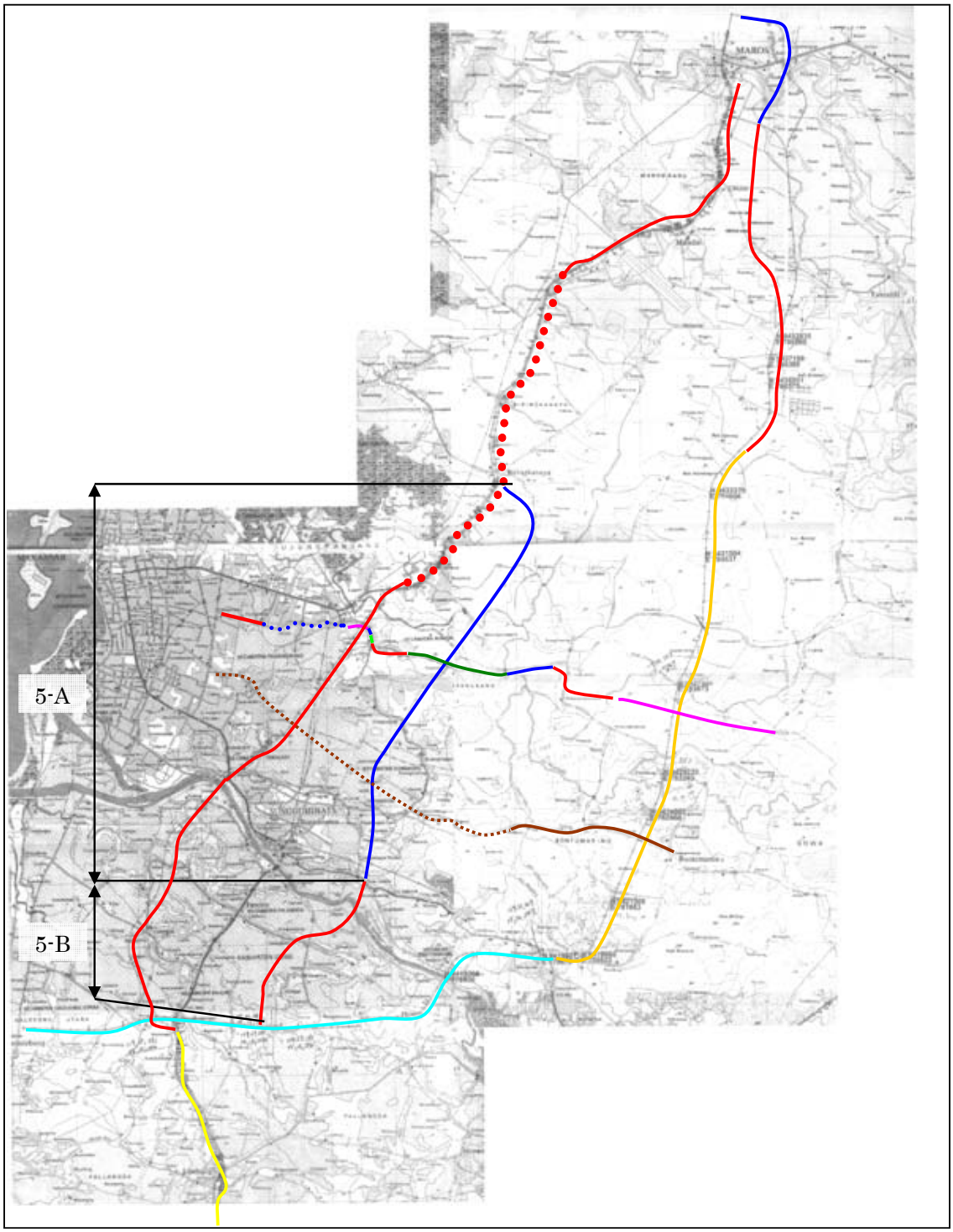


Figure F-5.2 Sections of the Project Road

(2) Major Construction Quantities

The estimated major construction quantities are shown in **Table F-5.3.**

Table F-5.3 Major Construction Quantities

Item	Unit	Section 5-A	Section 5-B	Total
Mortared Stonework	m3	53,065	21,618	74,683
Common Excavation	m3	261,070	100,582	361,652
Common Embankment	m3	867,974	484,941	1,352,915
Selected Embankment	m3	3,363	5,755	9,118
Aggregate Base Class A	m3	43,952	17,522	61,474
Aggregate Base Class B	m3	68,496	27,307	95,803
Asphalt Concrete -Wearing & Binder Course (5cm)	m2	432,420	178,318	610,738
Structural Concrete Class K250	m3	14,158	9,693	23,851
Precast Unit Type I Girder (16-35m)	nos	44	86	130
Reinforcing Steel	ton	525	810	1,335

Source: JICA Study Team design

Based on the unit prices and construction quantities from preliminary design, the project construction cost was estimated at as shown in **Table F-5.4.**

Table F-5.4 Construction Cost of the Project

Division No.	Item	Section 5-A (M Rp.)	Section 5-B (M Rp.)	Total (M Rp.)	Percentage
1	General	3,380	2,029	5,409	**1.9%**
2	Drainage	20,393	8,706	29,099	**10.4%**
3	Earthworks	62,413	34,355	96,768	**34.6%**
5	Granular Pavement	24,201	9,648	33,849	**12.1%**
6	Asphalt Pavement	30,552	12,575	43,127	**15.4%**
7	Structures	26,222	34,089	60,311	**21.5%**
8	Reinstatement and Minor Works	4,702	1,881	6,583	**2.4%**
10	Routine Maintenance Works	497	198	696	**0.2%**
-	Public Utility Relocation	3,025	1,206	4,232	**1.5%**
Total		**175,385**	**104,688**	**280,073**	**100.0%**
Physical Contingency (10%)		17,538	10,469	28,007	-
Total of Construction Cost		**192,923**	**115,157**	**308,080**	**-**
Percentage		**62.6%**	**37.4%**	**100.0%**	-

Source: JICA Study Team estimation

F-5.4 Maintenance Cost

Road maintenance activities are generally divided into two categories as listed below.

i) Routine Maintenance including;

* Inspection and patrol,
* Cleaning of road surface/drainage facilities,
* Trimming/cutting of trees/grass,
* Pothole patching and crack sealing for AC pavement, and
* Minor repairs of miscellaneous facilities.

ii) Periodic Maintenance including;

* Overlay for AC pavement at 5-year intervals, and

F-5.5 Cost Estimate for the Implementation Plan

The project cost distribution by fiscal year and contract packaging in accordance with the planned implementation schedule are shown in **Table F-5.5**.

Table F-5.5 Cost Distribution for Implementation Schedule

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
Outer Ring Road	**20.4 km**																		
Jl.Perintis-Jl.Malino (North)	**14.7 km**																		
Land Acquisition and Compensation									30%	40%	30%								
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																			
Jl.Perintis-Jl.Malino (North)																			
Land Acquisition and Compensation	58,805								17,642	23,522	17,642								
Detailed Design and Supervision Services	13,505									3,376	3,376	3,376	3,376						
Construction	192,923										57,877	77,169	57,877						
Administraition	3,858								772	772	772	772	772						
Maintenance Routine	3,556													593	593	593	593	593	593
Maintenance Overlay per 5 Years	11,853																	11,853	
Total	**284,500**								**18,413**	**27,670**	**79,666**	**81,317**	**62,025**	**593**	**593**	**593**	**593**	**12,445**	**593**
	100%								**6.5%**	**9.7%**	**28.0%**	**28.6%**	**21.8%**	**0.2%**	**0.2%**	**0.2%**	**0.2%**	**4.4%**	**0.2%**
Jl.Malino-M. Bypass Section (South)																			
	5.7 km																		
Land Acquisition and Compensation															30%	40%	30%		
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	11,723														3,517	4,689	3,517		
Detailed Design and Supervision Services	8,061															2,015	2,015	2,015	2,015
Construction	115,157																34,547	46,063	34,547
Administraition	2,303														461	461	461	461	461
Maintenance Routine																			
Maintenance Overlay per 5 Years																			
Total	**137,244**														**3,978**	**7,165**	**40,540**	**48,539**	**37,023**
	100%														**2.9%**	**5.2%**	**29.5%**	**35.4%**	**27.0%**

F-6 Economic Evaluation

(1) Evaluation Methodology and Applied Data

Economic evaluation of the Outer Ring Road was carried out with the same methodology and applying the same basic data for benefit estimation as explained in the Chapter 9 (Section 9.2).

The northern road section of the Outer Ring Road from Perintis Kemerdekaan Road to Ir Sutami Toll Road (5.6 km in length) is under construction by a private sector and it will be opened by year 2012. As this part is an on-going project, it is excluded from the economic evaluation. As the existing road (1.5 km in length) in the BTP has already 4 lanes, though it will require some improvement, this section was also excluded from the economic evaluation.

(2) Economic Cost

According to the overall implementation schedule, the construction of the Outer Ring Road is divided into two (2) phases as below:

1) Phase 1: Jl. Perintis – Jl. Malino (14.7 km), 2013-2017
2) Phase 2: Jl. Malino – Mamminasa Bypass (5.7 km), 2019-2023

The disbursement schedule in terms of economic costs including the land acquisition and detail design for both phases is shown below (**Table F-6.1**)

Table F-6.1 Disbursement Schedule
(Rp. million)

Year	Economic Cost
2013	18,413
2014	27,670
2015	79,666
2016	81,317
2017	62,025
2018	
2019	3,978
2020	7,165
2021	40,540
2022	48,539
2023	37,023
Total	406,335

Source: JICA Study Team

(3) Economic Benefit

1) Quantified Economic Benefits

The quantified economic benefits which will be generated from the Outer Ring Road consist of the following two (2) types of road users' benefits:

- Savings in Vehicle Operating Cost (VOC Savings); and
- Savings in passenger Travel Time Cost (TTC Savings).

These above benefits were estimated quantitatively based on the "With and Without Project comparison method". The same input data of unit VOC (Rp/km) and unit TTC (Rp/hour) which were used for the evaluation of other target roads such as Mamminasa Bypass, Trans-Sulawesi Mamminasata Road, Hertasning Road and Abdullah Daeng Sirua Road was also applied for the evaluation of Outer Ring Road.

2) Total Benefits Estimated

The results of estimation of economic benefits of the Outer Ring Road are shown in **Table F-6.2.**

Table F-6.2 Estimated Economic Benefits
(Unit: Rp. million)

	Year	Economic Benefit		Total
		VOC Savings	Travel Time Cost Savings	
R5: Outer Ring Road	2018	24,420	24,585	49,005
	2020	54,086	40,572	94,658
	2023	98,585	64,553	163,138

Source: JICA Study Team

(4) Economic Evaluation

1) Premises for the Evaluation

For the purpose of the economic evaluation, the following preconditions were established:

- Price Level	: Constant 2006 prices
- Evaluation Period	: 30 years after the first opening to traffic
- Disbursement Schedule	: Assumed in accordance with the construction plan
- Residual Value	: No residual values were counted
- Opportunity Cost of Capital	: 15% (and 12% for reference)

2) Economic Cash Flow and Evaluation Indicators

The cost and benefit cash flows are presented in **Table F-6.3.** The following three kinds of evaluation indicators were calculated based on the traditional Discount Cash Flow method (DCF):

- Economic Internal Rate of Return (EIRR)
- Net Present Value (NPV)
- Benefit/ Cost Ratio (B/C)

Table F-6.3 Cost Benefit Cash Flow (Outer Ring Road)
(Rp. million)

SQ No.	Year	Cost (C)			Benefit (B)	Balance B-C
		Project Cost (incl.LA)	O & M	Total Cost		
	2006			0	0	0
	2007			0	0	0
	2008			0	0	0
	2009			0	0	0
	2010			0	0	0
	2011			0	0	0
	2012			0	0	0
	2013	18,413		18,413	0	-18,413
	2014	27,670		27,670	0	-27,670
	2015	79,666		79,666	0	-79,666
	2016	81,317		81,317	0	-81,317
	2017	62,025		62,025	0	-62,025
1	2018	0	593	593	49,005	48,412
2	2019	3,978	593	4,570	71,831	67,261
3	2020	7,165	593	7,758	94,658	86,900
4	2021	40,540	593	41,133	117,485	76,352
5	2022	48,539	12,445	60,984	140,311	79,327
6	2023	37,023	593	37,616	163,138	125,522
7	2024		1,185	1,185	174,551	173,366
8	2025		1,185	1,185	185,965	184,779
9	2026		1,185	1,185	197,378	196,193
10	2027		13,038	13,038	208,791	195,753
11	2028		5,554	5,554	220,205	214,650
12	2029		1,185	1,185	231,618	230,433
13	2030		1,185	1,185	243,031	241,846
14	2031		1,185	1,185	254,445	253,259
15	2032		13,038	13,038	265,858	252,820
16	2033		5,554	5,554	277,271	271,717
17	2034		1,185	1,185	288,685	287,499
18	2035		1,185	1,185	300,098	298,913
19	2036		1,185	1,185	311,511	310,326
20	2037		13,038	13,038	322,925	309,887
21	2038		5,554	5,554	334,338	328,784
22	2039		1,185	1,185	345,751	344,566
23	2040		1,185	1,185	357,165	355,979
24	2041		1,185	1,185	368,578	367,393
25	2042		13,038	13,038	379,991	366,953
26	2043		5,554	5,554	391,405	385,850
27	2044		1,185	1,185	402,818	401,633
28	2045		1,185	1,185	414,231	413,046
29	2046		1,185	1,185	425,645	424,459
30	2047		13,038	13,038	437,058	424,020
		406,335	120,595	526,931	7,975,740	7,448,809

EIRR		26.8%
NPV (Rp million)	Discount Rate 15%	114,227
	Discount Rate 12%	248,119
B/C	Discount Rate 15%	2.44
	Discount Rate 12%	3.27

Source: JICA Study Team

The results of evaluation are summarized in **Table F-6.4**.

Table F-6.4 Results of Economic Evaluation

Evaluation Indicators	Value
EIRR (%)	26.8%
NPV (Rp. million) (*)	114,227
B/C (*)	2.44

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

The above results indicate that implementation of the Outer Ring Road is economically feasible with values of EIRR sufficiently higher than the opportunity cost of capital (discount rate) (>15%), positive NPV (>0) and higher B/C ratio than unity (>1).

(5) Sensitivity Analysis

The robustness of economic feasibility of the Outer Ring Road was tested by changing related factors within a probable range. The prepared test cases in this sensitivity analysis are as follows:

- Test 1: Project Cost: 10% up, Project Benefit: 10% down simultaneously
- Test 2: Project Cost: 20% up, Project Benefit: 20% down simultaneously
- Test 3: Evaluation Period: 20 years after opening instead of 30 years

Results of the three tests are summarized as below:

Table F-6.5 Results of Sensitivity Analysis

Test Cases	EIRR (%)	NPV (*) (Rp. million)	B/C (*)
Original Case	26.8	114,227	2.44
Test 1: Cost 10% up & Benefit 10% down	23.7	86,915	1.99
Test 2: Cost 20% up & Benefit 20% down	20.9	59,603	1.63
Test 3: Evaluation Period: 20 years	26.4	93,085	2.18

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

The above results indicate the robustness of the economic feasibility of the Outer Ring Road showing that the values of EIRR are higher than 15%, positive figures of NPV (>0), and higher B/C ratios than unity (>1) in any cases prepared for the sensitivity analysis.

(6) Conclusions of Economic Analysis

It is judged that the implementation of the Outer Ring Road will be economically feasible and justified from a point of view of national economy.

The service direction of the Outer Ring Road is north-south direction like the Trans-Sulawesi Mamminasata Road and the Mamminasa Bypass. The estimated value of EIRR of the Outer Ring Road (26.8%) is higher than that of the Mamminasa Bypass (22.4%). However, net present value (NPV) of the Outer Ring Road (Rp. 114,227 million) is lower than the Mamminasa Bypass (Rp. 171,550 million). If the magnitude of net contribution to the national economy is taken into account, the Mamminasa Bypass is more preferable than the Outer Ring Road (although both roads are planned to be implemented by 2023). In addition, to induce a planned new satellite town

along the Mamminasa Bypass, the construction of the middle section of the Bypass (KIMA Access – Jl.Malino) and Abdullah Daeng Sirua Road are important infrastructures. Hence, higher priority should be given to the middle section of the Mamminasa Bypass than the Outer Ring Road.

F-7 Implementation Plan

The executing agency will be Praswil South Sulawesi Province as the Outer Ring Road passes through Makassar City, Kabupaten Mars and Kabupaten Gowa.

The following figure shows an implementation schedule for the Outer Ring Road. The north section between Jr.Tol.Ir.Sutami and Jl.Kemerdekaan through Parangloe Indah (New Industrial Area) is on-going project and expected to be completed by 2010.

A series of steps will be required for other sections of the Outer Ring Road, including feasibility study/EIA, detailed engineering design, land acquisition and resettlement before the construction. The project is implemented in 2 phases; Phase 1 from the Daya IC to Jl. Malino and Phase 2 from Jl Malino to the Mamminasa Bypass.

Activity	Length (km)	Financial Source	2007-2010				2011-2015					2016-2020					2021-2023		
			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Pre-FS by JICA Study Team																			
Feasibility Study / EIA																			
Detailed Engineering Design																			
Land Acquisition and Resettlement																			
Construction																			
- North Section (Jl.Tol.Ir.Sutami - Jl.Perintis Kemerdekaan)	7.7	Private Investor																	
- North/Middle Section (Daya IC - Jl.Malino)	14.7	APBN/ APBD																	
- South Section (Jl.Malino-Mamminasa Bypass)	5.7	APBN/ APBD																	

Source: JICA Study Team

Figure F-7.1 Implementation Schedule of Outer Ring Road

F-8 Conclusion and recommendations

(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 the South Sulawesi Province to/from KIMA, Makassar Port, new industrial areas along Jl.Tol.Ir.Sutami
- 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 Sungguminasa and Mamminasa Bypass. The Outer Ring Road and Mamminasa Bypass share the same road at their southern part to connect to Tj. Bunga Development Area.

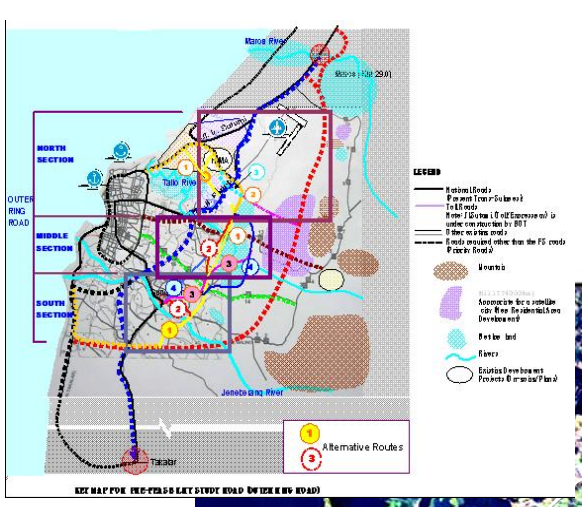
(3) The northern section between Jl.Tol.Ir.Sutami and Jl. Perintis Kemerdekaan through New Industrial Area (Kawasan Pergudangan dan Industri Parangloe Indah) is under construction by a private investor and be completed as it planned.

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

(5) The route of on-going north section should keep a 500-700 m buffer zone from the Tallo River to avoid negative effects to the Tallo River environment.

(6) As the project is vital on both technical and economic aspects (EIRR: 26.8%), it is recommended to conduct a feasibility study for implementation including EIA.

(7) The regional governments should control housing and other development on the planned route of Outer Ring Road.



KEC MAP FOR (RE-FEASIBILITY STUDY ROAD OUTER RING ROAD)

KECAMATAN MARUSU

Ir.Sutami Toll Road

New Airport and Runway

KECAMATAN MANDAI

M1

Golf Course

Parangloe New Industrial Area

KIMA

KECAMATAN BIRINGKANAYA

Stadion

Daya Bus Termina

PDAM Canal

Original Outer Ring Road Route

KECAMATAN TALLO

KECAMATAN MAKASSAR

Hasanuddin University

Secured ROW (12.5km)

KECAMATAN PANAKKUKANG

KECAMATAN TAMALANREA

Abdullah Daeng Sirua Road

Perintis Kemerdekaan Road

Tallo River

New Tallo Bridge

Mountain Moncongloe

Bypass Mamminasa

Boulevard Panakkukang Road

Central Ring Road

Border of Makassar City/ Kab.Maros

Flooding Area

Hertasning Road

Middle Ring Road

KECAMATAN MONCONGLOE

Planned New Satellite Town

KECAMATAN RAPPOCINI

AP. Pettarani Road

KECAMATAN MANGGALA

KECAMATAN TAMALATE

Hertasning Total Length =15.7km

Boarder Makassar / Gowa

Gowa Industrial Area Planned (KIWA)

Flood Retarding Area

Middle Ring Road

KECAMATAN SOMBA OPU

Sultan Alauddin Road

Chinese Cemetery

Islam University

Pond

KECAMATAN PATTALLASSANG

Sungguminasa Bridge

Terminal Bus

Islamic Cemetery

Lake Mawang

KECAMATAN PALLANGGA

New Jeneberang Bridge

KECAMATAN BONTOMARANNU

Ex Pabrik Kertas Gowa (Fakultas Teknik Unhas)

KECAMATAN BAJENG

BOKA IC

Jeneberang River

To Takalar

Ke Malino

N
W
E
S

Legend :
Kabupaten Border
Kecamatan Border

Attachment F.1 Alternative Route Study for Outer Ring Road

Attachment F.2 IEE Matrix for Outer Ring Road North-Section

		Item / Description	Alternative 1 Access through BTP to Jl.Ir.Sutami/ KIMA (length 9.3km)					Alternative 2 Access through Jl. Daya to Jl.Ir.Sutami (Original), Llength 3.3km					Alternative 3 Access through Jl. Daya to Jl.Ir.Sutami (New Plan), Length 3.8km					Alternative 4 (Zero-Option) Existing road, Length 8.5km				
					Construction Stage					Construction Stage					Construction					Construction		
			Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage
Social Environment	1	Migration of Populations Involuntary Resettlement	B-	B-	-	-	-	A-	A-	-	-	-	B-	B-	-	-	-	-				
		a. Number of houses / building to be moved (no)		12	-	-	-		100	-	-	-		8	-	-	-	0				
		b. Area of land acquisition required (ha)		25	-	-	-		11	-	-	-		13	-	-	-					
	2	Impact on Local Economy (Employment, Livelihood, etc.)	A+	-	B+	-	A+	A+	-	B+	-	A+	B+	-	B+	-	B+	B-				
	3	Utilization of Land and Local Resources	A+	-	-	-	A+	B+	-	-	-	B+	B+	-	-	-	B+	-				
	4	Social Institutions (Social Capital and Local Decision-making institution)	B+	-	-	-	B+	B+	-	-	-	B+	-	-	-	-	-	-				
	5	Existing Social Infrastructure and Services	B+	-	B-	-	B+	B+	-	B-	-	B+	C+	-	B-	-	B+	-				
	6	Vulnerable Social Groups	C-	C-	-	-	-	B-	B-	-	-	-	C-	C-	-	-	-	-				
	7	Equality of Benefits and Losses and Equality in Development process	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	-				
	8	Local Conflicts of Interests	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	-				
	9	Gender	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	10	Children's Rights (interruption of children's schooling and increase in the number of children's traffic accidents, etc.)	B-	-	-	-	B-	A-	-	-	-	A-	B-	-	-	-	B-	B-				
	11	Cultural Heritage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	12	Infectious Diseases (HIV/AIDS)	B-	-	B-	-	-	B-	-	B-	-	-	B-	-	B-	-	-	-				
	13	Traffic Jam	A+	-	-	-	A+	B+	-	-	-	B+	B+	-	-	-	B+	A-				
	14	Traffic accidents	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	-	-	B-	B-				
Natural Environment	15	Geographical Conditions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	16	Geological Conditions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	17	Soil Erosion	B-	-	B-	-	-	B-	-	B-	-	-	B-	-	B-	-	-	-				
	18	Fauna Ecology	C-	-	C-	-	-	-	-	-	-	-	C-	-	C-	-	-	-				
	19	Flora Ecology	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	20	Effects on the Ground Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	21	Effect on the Surface Water Body (River, Lakes, etc)	-	-	-	-	-	-	-	-	-	-	C-	-	-	-	-	-				
	22	Effect on the Coastal Environment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	23	Oceanographic Changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	24	Effect on the Natural/Ecological Reserves and Sanctuaries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	25	Localised Climatic Changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	26	Effect on the Global Warming Issues	C-	-	-	-	C-	C-	-	-	-	C-	C-	-	-	-	C-	B-				
	27	Effect on Drainage and Floods	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	-				
Pollution	28	Air Pollution	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	C-				
	29	Water Pollution	C-	-	C-	-	-	C-	-	C-	-	-	C-	-	C-	-	-	-				
	30	Soil Pollution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	31	Solid Waste and/or Industrial Discharge Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	32	Noise and Vibration	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	B-	-	B-	C-				
	33	Large Scale Ground Settlement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	34	Emanating Odour	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	35	Pollution on the Water Bottom/Sludge and Its Effect on the Aquatic Life	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				

Notes: A: Significant changes expected, B: Relatively significant changes expected, C: Not significant but subject to further study, "-": Neglectable impact,
A+, B+, C+ indicates relatively positive changes, A-, B-, C- indicates relatively negative changes.

Attachment F.3 IEE Matrix for Outer Ring Road Middle-Section

		Item / Description	Alternative 1 Road construction with Flood control works / dykes (West Bank Route), Length 7.3km					Alternative 2 Pass through wet land in Makassar （West Bank Route), Length 7.5km					Alternative 3 Pass in flood retarding area (East Bank Route), Length 8.6km					Alternative 4 Pass avoiding flood retarding area (East Bank Route), Length 11.8km					Alternative 5 (Zero-Option) Existing road, Length 7.0km				
					Construction Stage					Construction Stage						Construction					Construction						Construction	
			Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage
Social Environment	1	Migration of Populations Involuntary Resettlement	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	-				
		a. Number of houses / building to be moved (no)		10	-	-	-		50	-	-	-		19	-	-	-		19	-	-	-	0				
		b. Area of land acquisition required (ha)		22	-	-	-		23	-	-	-		27	-	-	-		38	-	-	-					
	2	Impact on Local Economy (Employment, Livelihood, etc.)	A+	-	B+	B+	A+	A+	-	B+	B+	A+	B+	-	B+	B+	B+	B+	-	B+	B+	B+	B-				
	3	Utilization of Land and Local Resources	A+	-	-	-	A+	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	-				
	4	Social Institutions (Social Capital and Local Decision-making institution)	B+	-	-	-	B+	B+	-	-	-	B+	-	-	-	-	-	-	-	-	-	-	-				
	5	Existing Social Infrastructure and Services	B+	-	B-	-	B+	B+	-	B-	-	B+	C+	-	B-	-	B+	C+	-	B-	-	B+	-				
	6	Vulnerable Social Groups	C-	C-	-	-	-	B-	B-	-	-	-	C-	C-	-	-	-	C-	C-	-	-	-	-				
	7	Equality of Benefits and Losses and Equality in Development process	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	-				
	8	Local Conflicts of Interests	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	-				
	9	Gender	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	10	Children's Rights (interruption of children's schooling and increase in the number of children's traffic accidents, etc.)	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-				
	11	Cultural Heritage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	12	Infectious Diseases (HIV/AIDS)	B-	-	B-	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	-				
	13	Traffic Jam	A+	-	-	-	A+	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	B-				
	14	Traffic accidents	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-				
Natural Environment	15	Geographical Conditions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	16	Geological Conditions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	17	Soil Erosion	B-	-	B-	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	-				
	18	Fauna Ecology	C-	-	C-	C-	-	C-	-	C-	C-	-	C-	-	C-	C-	-	C-	-	C-	C-	-	-				
	19	Flora Ecology	C-	-	C-	C-	-	C-	-	C-	C-	-	C-	-	C-	C-	-	C-	-	C-	C-	-	-				
	20	Effects on the Ground Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	21	Effect on the Surface Water Body (River, Lakes, etc)	B-	-	-	B-	-	B-	-	-	B-	-	B-	-	-	B-	-	B-	-	-	B-	-	-				
	22	Effect on the Coastal Environment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	23	Oceanographic Changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	24	Effect on the Natural/Ecological Reserves and Sanctuaries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	25	Localised Climatic Changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	26	Effect on the Global Warming Issues	C-	-	-	-	C-	C-	-	-	-	C-	C-	-	-	-	C-	C-	-	-	-	C-	B-				
	27	Effect on Drainage and Floods	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	-				
Pollution	28	Air Pollution	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-				
	29	Water Pollution	B-	-	B-	B-	-	B-	-	-	B-	-	B-	-	C-	B-	-	B-	-	C-	B-	-	-				
	30	Soil Pollution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	31	Solid Waste and/or Industrial Discharge Management	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	32	Noise and Vibration	B-	-	B-	B-	B-	B-	-	B-	B-	B-	B-	-	B-	B-	B-	B-	-	B-	B-	B-	B-				
	33	Large Scale Ground Settlement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	34	Emanating Odour	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	35	Pollution on the Water Bottom/Sludge and Its Effect on the Aquatic Life	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				

Notes: A: Significant changes expected, B: Relatively significant changes expected, C: Not significant but subject to further study, "-": Neglectable impac
A+, B+, C+ indicates relatively positive changes, A-, B-, C- indicates relatively negative changes.

Attachment F.4 IEE Matrix for Outer Ring Road South-Section

		Item / Description	Alternative 1 New road passing through the 3.5km east of Sungguminasa and connect to M.Bypass, Length 9.8km					Alternative 2 Connection to Sungguminasa through Malino Road, Length 8.5km					Alternative 3 Pass in flood retarding area (East Bank Route), Length 7.7km					Alternative 4 Original Plan (connection to Sungguminasa), Length 7.2km					Alternative 4 (Zero-Option) Existing road (length 6.3km)				
					Construction Stage					Construction Stage					Construction					Construction						Construction		
			Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage	Overall Evaluation	Pre-construction Stage	Roadway Construction	Bridge Construction	Post-construction Stage
Social Environment	1	Migration of Populations Involuntary Resettlement	B-	B-	-	-	-	A-	A-	-	-	-	B-	B-	-	-	-	A-	A-	-	-	-	-				
		a. Number of houses / building to be moved (no)		5	-	-	-		320	-	-	-		80	-	-	-		220	-	-	-					
		b. Area of land acquisition required (ha)		33	-	-	-		28	-	-	-		25	-	-	-		23	-	-	-					
	2	Impact on Local Economy (Employment, Livelihood, etc.)	A+	-	B+	B+	A+	A+	-	B+	-	A+	B+	-	B+	-	B+	B+	-	B+	-	B+	B-				
	3	Utilization of Land and Local Resources	A+	-	-	-	A+	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	-				
	4	Social Institutions (Social Capital and Local Decision-making institution)	B+	-	-	-	B+	B+	-	-	-	B+	-	-	-	-	-	-	-	-	-	-	-				
	5	Existing Social Infrastructure and Services	B+	-	B-	-	B+	B+	-	B-	-	B+	C+	-	B-	-	B+	C+	-	B-	-	B+	-				
	6	Vulnerable Social Groups	C-	C-	-	-	-	B-	B-	-	-	-	C-	C-	-	-	-	B-	B-	-	-	-	-				
	7	Equality of Benefits and Losses and Equality in Development process	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	-				
	8	Local Conflicts of Interests	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	B-	B-	-	-	B-	-				
	9	Gender	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	10	Children's Rights (interruption of children's schooling and increase in the number of children's traffic accidents, etc.)	B-	-	-	-	B-	A-	-	-	-	A-	B-	-	-	-	B-	A-	-	-	-	A-	A-				
	11	Cultural Heritage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	12	Infectious Diseases (HIV/AIDS)	B-	-	B-	B-	-	B-	-	B-	-	-	B-	-	B-	-	-	B-	-	B-	-	-	-				
	13	Traffic Jam	A+	-	-	-	A+	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	A-				
	14	Traffic accidents	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-				
Natural Environment	15	Geographical Conditions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	16	Geological Conditions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	17	Soil Erosion	B-	-	B-	B-	-	B-	-	B-	-	-	B-	-	B-	-	-	B-	-	B-	-	-	-				
	18	Fauna Ecology	C-	-	C-	C-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	19	Flora Ecology	C-	-	C-	C-	-	C-	-	C-	-	-	C-	-	C-	-	-	-	-	-	-	-	-				
	20	Effects on the Ground Water	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	21	Effect on the Surface Water Body (River, Lakes, etc)	B-	-	-	B-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	22	Effect on the Coastal Environment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	23	Oceanographic Changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	24	Effect on the Natural/Ecological Reserves and Sanctuaries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	25	Localised Climatic Changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	26	Effect on the Global Warming Issues	C-	-	-	-	C-	C-	-	-	-	C-	C-	-	-	-	C-	C-	-	-	-	C-	B-				
	27	Effect on Drainage and Floods	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	B+	-	-	-	B+	-				
Pollution	28	Air Pollution	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	B-	-	-	-	B-	C-				
	29	Water Pollution	B-	-	C-	B-	-	C-	-	C-	-	-	C-	-	C-	-	-	-	-	-	-	-	-				
	30	Soil Pollution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	31	Solid Waste and/or Industrial Discharge Management	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	32	Noise and Vibration	B-	-	B-	B-	B-	B-	-	B-	-	B-	B-	-	B-	-	B-	B-	-	B-	-	B-	C-				
	33	Large Scale Ground Settlement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	34	Emanating Odour	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	35	Pollution on the Water Bottom/Sludge and Its Effect on the Aquatic Life	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				

Notes: A: Significant changes expected, B: Relatively significant changes expected, C: Not significant but subject to further study, "-": Neglectable impac
A+, B+, C+ indicates relatively positive changes, A-, B-, C- indicates relatively negative changes.