APPENDIX 11.2-1

Hydrological Characteristics of Watersheds and Related Discharges (San Jose Bypass)

Appendix 11.2-1 HYDROLOGICAL CHARACTERISTICS OF WATERSHEDS AND RELATED DISCHARGES (SAN JOSE BYPASS)

Catchment Area No.	Station Limits		Catchment Area (km^2)	Diff. in Elev., Δh (m)	Length (m)	Tc (min)	RAINFALL INTENSITY			Coefficient C	DISCHARGE, Q (cms)			PROPOSED DRAINAGE STRUCTURES			REMARKS
							2 yrs	10 yrs	25 yrs		2 yrs	10 yrs	25 yrs	STATION	RCPC/RCBC	CAPACITY (cms)	(General Recommendation)
1	156+000	156+170	0.007	1.00	100	5.00	145.20	253.20	307.20	0.60	0.17	0.30	0.36	155 + 978	2-1520	8.91	Irrigation Structure to be extended
														156 +060	1-910	1.60	Irrigation Structure
														156 + 122	1-910	0.75	Irrigation Structure
																11.27	**Total**
2	156+170	156+450	0.128	3.00	700	23.83	80.97	137.70	166.50	0.60	1.73	2.94	3.55	156 +200	1-910	1.22	Irrigation Structure
														156 +240	1-910	1.41	Irrigation Structure
														156 +314	1-910	1.03	Irrigation Structure
														156 +382	1-910	1.03	Irrigation Structure
																4.68	**Total**
3	156+450	156+710	0.025	1.50	250	9.52	115.90	199.00	241.00	0.60	0.49	0.84	1.01	156 +500	1-910	1.45	Storm Water Drainage
														156 +634	1-910	1.37	Irrigation Structure
																2.82	**Total**
4	156+710	157+210	3.181	17.00	6850	168.38	26.28	45.68	55.36	0.60	13.94	24.24	29.37	156 + 815	1-910	1.43	Irrigation Structure
														156 +842	1-910	1.24	Irrigation Structure
														157 +060	3-3.0x2.75	41.85	Irrigation Structure
														157 +210	1-1.80x1.50	7.92	Irrigation Structure
																52.44	**Total**
5	157+210	157+630	19.300	See Hydrology Report										157 +320	1-3.0x2.10	15.78	Storm Water Drainage
														157 +420	1-3.0x2.40	20.77	Storm Water Drainage
														157 +454.4		101.80	Proposed Bridge No. 1
																138.35	**Total**
6	157+630	157+835	0.017	4.00	450	12.83	103.52	176.90	214.08	0.50	0.25	0.42	0.51	157 +716	2-1070	4.40	Storm Water Drainage

Appendix 11.2-1 HYDROLOGICAL CHARACTERISTICS OF WATERSHEDS AND RELATED DISCHARGES (SAN JOSE BYPASS)

Catchment Area No.	Station Limits		Catchment Area (km^2)	Diff. in Elev., Δh (m)	Length (m)	Tc (min)	RAINFALL INTENSITY			Coefficient C	DISCHARGE, Q (cms)			PROPOSED DRAINAGE STRUCTURES			REMARKS
							2 yrs	10 yrs	25 yrs		2 yrs	10 yrs	25 yrs	STATION	RCPC/RCBC	CAPACITY (cms)	(General Recommendation)
7	157+835	158+360	0.058	4.00	350	9.61	115.32	197.88	239.71	0.50	0.93	1.60	1.93	158 +072	1-910	1.01	Irrigation Structure
														158 +350	1-910	1.86	Irrigation Structure
																2.88	**Total**
8	158+360	158+700	0.028	3.00	550	18.06	89.91	152.65	184.54	0.50	0.35	0.59	0.72	158 +500	2-910	2.33	Storm Water Drainage
9	158+700	159+091	0.065	3.50	250	6.87	133.08	230.76	279.82	0.50	1.20	2.08	2.53	158 +660	1-910	1.39	Storm Water Drainage
														158 +720	1-910	1.60	Storm Water Drainage
														158 +955	1-1070	1.49	Storm Water Drainage
																4.48	**Total**
10	159+091	159+400	0.099	6.50	450	10.65	110.67	189.46	229.42	0.50	1.52	2.61	3.16	159 +150	1-1.20x .60	0.70	Irrigation Structure
														159 +210	1-1070	2.59	Storm Water Drainage
																3.29	**Total**
11	159+400	159+540	0.024	2.50	250	7.82	126.93	219.36	265.92	0.50	0.42	0.73	0.89	159 +460	1-910	1.78	**Total**
12	159+540	159+820	1.209	194.00	1700	13.28	102.04	174.31	210.91	0.50	17.15	29.29	35.44	159 +630	2-3.0 x 3.0	53.10	Storm Water Drainage
														159 +770	1-910	1.03	Irrigation Structure
																54.13	**Total**
13	159+820	160+090	0.467	155.00	2100	18.46	89.06	151.11	182.68	0.50	5.78	9.81	11.86	159 +845	1-910	1.24	Irrigation Structure
														160 +000	1-2.40x2.40	14.82	Storm Water Drainage
																16.06	**Total**
14	160+090	160+680	0.074	8.00	600	13.68	100.72	172.00	208.09	0.50	1.04	1.77	2.14	160 +130	1-910	2.02	Irrigation Structure
														160 +340	1-910	2.44	Irrigation Structure
														160 +540	1-910	1.60	Storm Water Drainage
																6.06	**Total**

Appendix 11.2-1 HYDROLOGICAL CHARACTERISTICS OF WATERSHEDS AND RELATED DISCHARGES (SAN JOSE BYPASS)

Catchment Area No.	Station Limits		Catchment Area (km^2)	Diff. in Elev., Δh (m)	Length (m)	Tc (min)	RAINFALL INTENSITY			Coefficient C	DISCHARGE, Q (cms)			PROPOSED DRAINAGE STRUCTURES			REMARKS
							2 yrs	10 yrs	25 yrs		2 yrs	10 yrs	25 yrs	STATION	RCPC/RCBC	CAPACITY (cms)	(General Recommendation)
15	160+680	160+950	0.080	5.00	450	11.78	106.96	182.94	221.47	0.50	1.19	2.03	2.46				
														160 +740	1-910	1.75	Storm Water Drainage
														160 +855	1-910	1.99	Storm Water Drainage
														160 +925	1-910	0.98	Storm Water Drainage
																4.73	**Total**
16	160+950	161+200	0.014	3.00	150	5.00	145.20	253.20	307.20	0.50	0.28	0.49	0.60	160 +975	1-910	1.66	Storm Water Drainage
														161+049	1-910	1.68	Irrigation Structure
														161 +140	1-910	1.03	Irrigation Structure
														161 +210	1-910	1.62	Irrigation Structure
																5.98	**Total**
17	161+200	161+450	13.300	See Hydrology Report										161+374		148.10	Proposed Bridge No.2
18	161+450	162+200	0.576	26.00	1300	21.15	84.35	142.95	172.80	0.50	6.75	11.45	13.84	161 +455	1-3.0x2.10	14.14	Irrigation Structure
														161+518	1-3.0x2.10	14.82	Irrigation Structure
														161 +695	1-910	1.97	Irrigation Structure
														161 +880	1-910	1.99	Irrigation Structure
														161 +940	1-1070	1.66	Irrigation Structure
														162 +135	1-910	1.54	Irrigation Structure
																36.11	**Total**
19	162+200	162+260		See Hydrology Report (Irrigation Channel)										162+223.57			Proposed Bridge No.3
20	162+260	162+700	0.133	19.00	500	7.95	126.08	217.80	264.01	0.50	2.33	4.03	4.88	162 +340	1-910	0.98	Irrigation Structure
														162 +451	1-910	1.00	Storm Water Drainage
														162 +537	1-910	1.01	Irrigation Structure
														162 +700	1-910	1.89	
																4.88	**Total**

Appendix 11.2-1 HYDROLOGICAL CHARACTERISTICS OF WATERSHEDS AND RELATED DISCHARGES (SAN JOSE BYPASS)

Catchment Area No.	Station Limits		Catchment Area (km^2)	Diff. in Elev., Δh (m)	Length (m)	Tc (min)	RAINFALL INTENSITY			Coefficient C	DISCHARGE, Q (cms)			PROPOSED DRAINAGE STRUCTURES			REMARKS
							2 yrs	10 yrs	25 yrs		2 yrs	10 yrs	25 yrs	STATION	RCPC/RCBC	CAPACITY (cms)	(General Recommendation)
21	162+700	162+850	14.250	See Hydrology Report										162+786.04		165.00	Proposed Bridge No.4
22	6+850	163+120	0.088	4.00	400	11.21	108.83	186.23	225.48	0.50	1.33	2.28	2.76	162 +880	1-910	1.75	Irrigation Structure
														163 +000	1-910	1.60	Storm Water Drainage
																3.35	**Total**
23	162+850	163+540	0.079	5.50	450	11.35	108.42	185.42	224.49	0.50	1.19	2.04	2.47	163 +128	1-910	1.15	Irrigation Structure
														163 +176	1-910	1.70	Storm Water Drainage
														163 +371	1-910	1.09	Irrigation Structure
																3.94	**Total**
24	163+540	163+808	0.044	5.00	300	7.39	129.71	224.52	272.21	0.50	0.79	1.37	1.66	163 + 590	1-910	1.18	Existing to be maintained
														163 + 655	1-1070	1.47	Existing to be maintained
																2.65	**Total**

APPENDIX 11.3-1

Bridges – San Jose Bypass
(Initial & Ultimate Stage)

BRIDGE NO.1 (SAN JOSE BY PASS – INITIAL & ULTIMATE STAGE)

1. RIVER CONDITION

- Riverbed is composed mostly of sand & gravel with a mixture of clay & silt.
- Riverbank is composed of loosely consolidated silty fine sand overlying loose sandy gravel. However, dense trees and bamboos lining the riverbank make it more stable and less susceptible to scouring.
- The river is meandering heavily, thus orientation with respect to the bypass alignment skews at a large angle.
- Scouring/erosion observed at upstream.
- Evidence of drifts/debris during flooding was observed.
- The river discharge at 50 year return period is 101.80 cum/sec
- The river velocity at 50 years return period is 1.945 m/sec.
- The top river width at design flood level is 33.0 m.

2. SOIL / GROUND CONDITION

- The site is covered by 2.5m thick, brown to gray, medium dense silty sand uppermost layer (SM), followed by a thick very dense sand and gravel layer where the boreholes were terminated.
- N-value at the upper 3.0 to 4.0 meter depth ranged from 8 to 27, with low N-value of 3, and consistently hitting practical refusals (N>50) at subsequent depths towards the end of the boreholes.

3. DESCRIPTION OF BRIDGE

(1) SELECTION OF SPAN COMPOSITION AND BRIDGE TYPE

	INITIAL STAGE	ULTIMATE STAGE
BRIDGE LENGTH	40.86 m	40.86 m
CARRIAGEWAY WIDTH	(2 x 3.50m) + 0.50m Median	4.00m
SHOULDER WIDTH	2 x 2.50m	-
SIDEWALK WIDTH	2 x 0.60m	0.60 + 1.50m
SUPERSTRUCTURE TYPE	1-span, PCDG Type VI-Modified (40m)	1-span, PCDG Type VI-Modified (40m)
SUBSTRUCTURE TYPE	Closed-type Abutment	Seat-type Pile Bent Abutment
FOUNDATION TYPE	Spread Footing	ϕ 800 mm Bored Pile

(2) DETERMINATION OF FINAL SCHEME

- The top width of river during the design flood is 33.0 m. To minimize river encroachment considering abutment slope protection, the bridge length becomes 40.0m for a single-span bridge.

- A single Span bridge is proposed due to :

    1. Two-span bridge is not recommended since one pier will have to be located at the center of the river and may cause problems on river hydraulics.

    2. A three span bridge tends to be more expensive because of additional substructure cost.

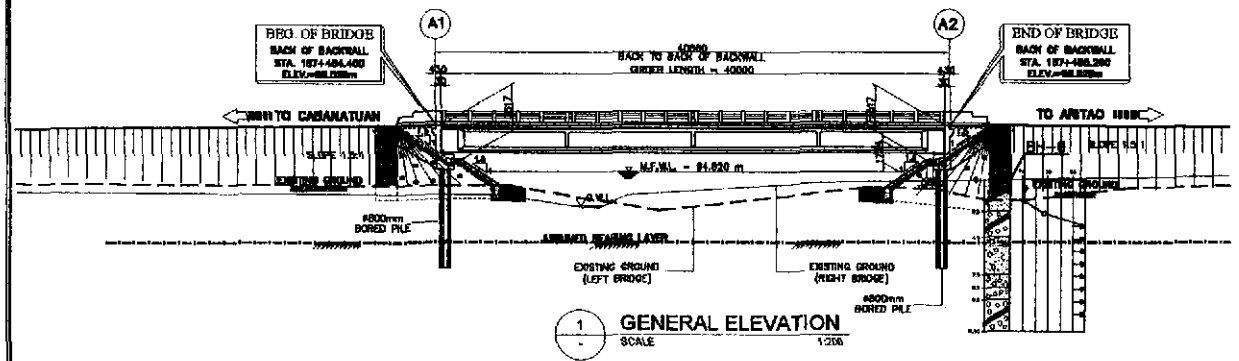
- For the Initial Stage, Spread footing was adopted for this bridge because of the presence of a shallow stable bearing stratum. This stratum is made of very dense sandy gravel with N-value greater than 50.
- For the Ultimate Stage, 800 mm diameter Bored Piles was adopted for the two adjacent bridge to be constructed to minimize disturbance to the foundation of Initial Stage Bridge.

(3) PROTECTION AGAINST SCOURING

- River flow less than 3.0 m/sec requires Grouted Riprap Riverbank protection along riverbank with toe protected by gabion mattress against scouring.

(4) RIVER REALIGNMENT

- The river realignment was proposed in anticipation of the meandering condition of the river and to improve the hydraulic condition of the river.



1 GENERAL ELEVATION
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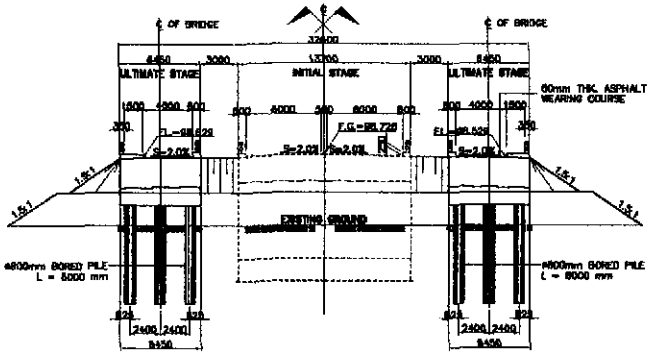
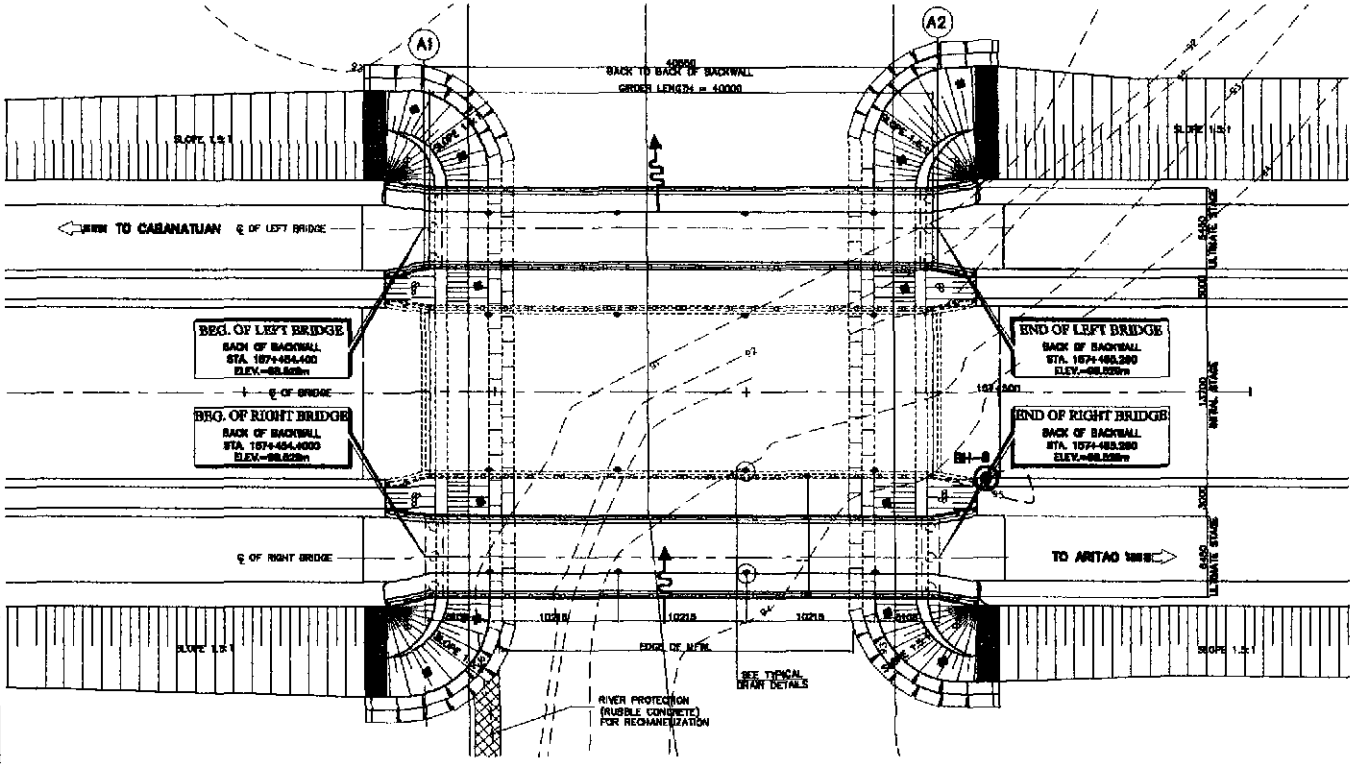
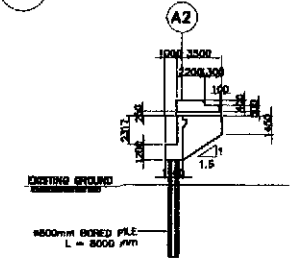


3A SECTION AT ABUTMENT A2
SCALE 1:200



2 GENERAL PLAN
SCALE 1:200



3B SIDE ELEVATION
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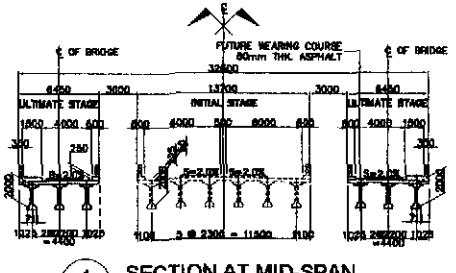


4 SECTION AT MID-SPAN
SCALE 1:200

HYDRAULIC DATA	
VELOCITY @ 50 YEARS, V50	1.940 m/sec
DISCHARGE @ 50 YEARS, Q50	101.800 cu.m/sec
CATCHMENT AREA, CA	19.300 sq. km

NOTE :
PRIOR TO CONSTRUCTION SOIL INVESTIGATION AT ABUTMENT A1 SHALL BE CONDUCTED FOR CONFIRMATION OF ASSUMED BEARING CAPACITY AND FOOTING ELEVATION.

A SAN JOSE BYPASS BRIDGE NO. 1
SCALE AS SHOWN

JICA
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD.

DESIGNED | CHECKED | SUBMITTED | DATE | SIGNATURE | TEAM LEADER

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

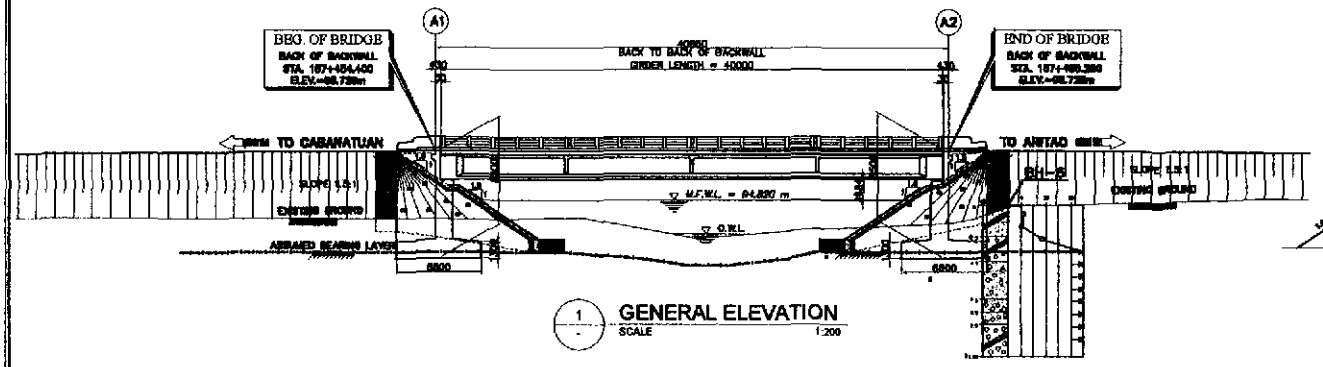
REG. - PMO	BUREAU OF DESIGN		OFFICE OF THE SECRETARY	
Submitted By	Reviewed By	Recommended By (See cover sheet for Signature)	Recommended By (See cover sheet for Signature/Approval)	Approved By (See cover sheet for Signature/Approval)
DANILO G. ERIVANO, Project Director	ARSENIO M. ORDAY, Chief, Bridges Division	GILBERTO S. REYES, Director IV (OIC)	EDUARDO V. MER, Undersecretary	EMERSON A. BATUMBAKAL, Secretary

PROJECT AND LOCATION :
DETAILED ENGINEERING DESIGN ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)

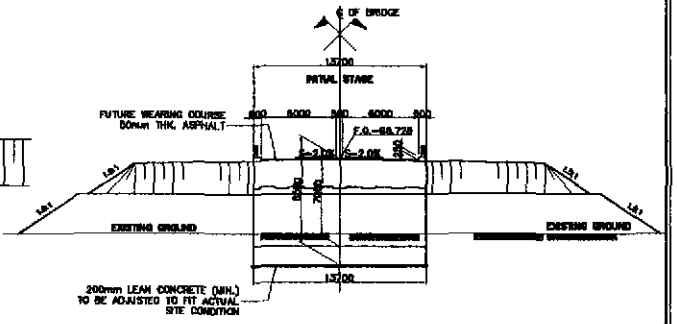
SCALE : FULL SIZE A1

SHEET CONTENTS :
SAN JOSE BYPASS
BRIDGE NO. 1 (ULTIMATE STAGE)
GENERAL PLAN, ELEVATION AND SECTIONS

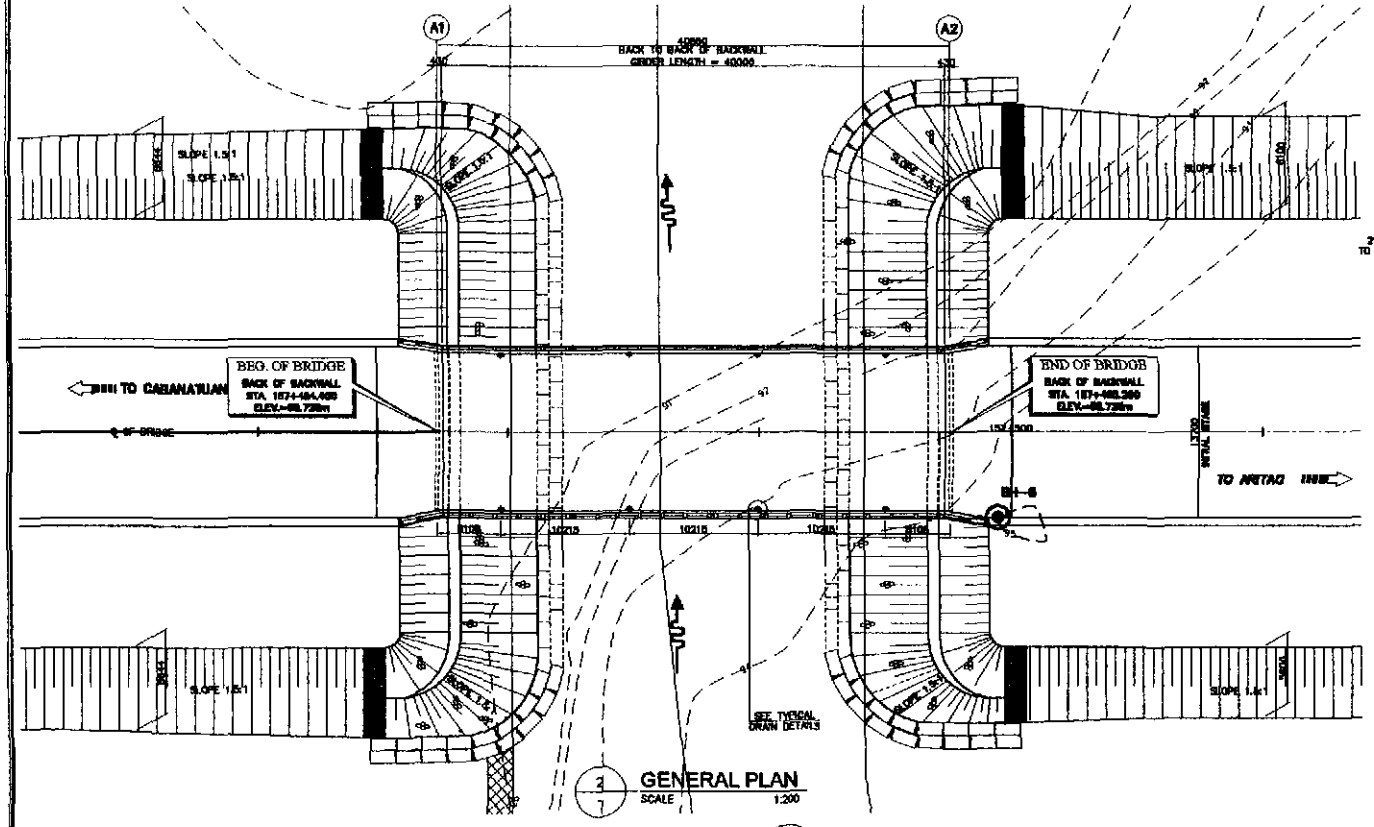
SHEET NO. : B-04



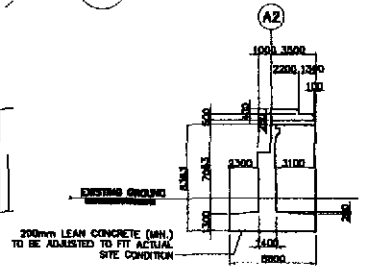
1 GENERAL ELEVATION
SCALE 1:200



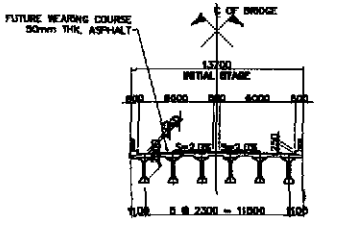
3A SECTION AT ABUTMENT A2
SCALE 1:200



3 GENERAL PLAN
SCALE 1:200



3B SIDE ELEVATION
SCALE 1:200



4 SECTION AT MID-SPAN
SCALE 1:200

HYDRAULIC DATA	
VELOCITY @ 50 YEARS, Vm	1.945 m/sec
DISCHARGE @ 50 YEARS, Qm	101.800 cu.m/sec
CATCHMENT AREA, CA	18.300 sq. km

NOTE :
PRIOR TO CONSTRUCTION SOIL INVESTIGATION AT ABUTMENT A1 SHALL BE CONDUCTED FOR CONFIRMATION OF ASSUMED BEARING CAPACITY AND FOOTING ELEVATION.

A SAN JOSE BYPASS BRIDGE NO. 1
SCALE AS SHOWN

JICA
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD.

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

	Submitted By	Reviewed By	Recommended By	Recommended By (See cover sheet for Signature)	Approved By (See cover sheet for Signature/Approval)
DPWH – PMO	DIOSDADO C. TIRAMAG, Project Director				
BUREAU OF DESIGN		ADRIANO M. DORIOT, Chief, Bridges Division	GILBERTO S. REYES, Director IV (OIC)		
OFFICE OF THE SECRETARY				EDMUNDO V. NIÑO, Undersecretary	RICARDO A. GUTIERREZ, Secretary

	DATE	SIGNATURE
REVISED		
CHECKED		
SUBMITTED		TEAM LEADER

PROJECT AND LOCATION :
DETAILED ENGINEERING DESIGN ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)

SCALE : FULL SIZE A1

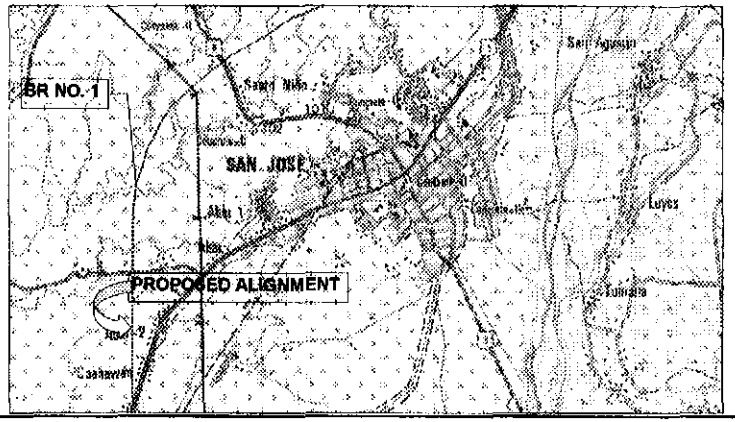
SHEET CONTENTS :
SAN JOSE BYPASS
BRIDGE NO.1 (INITIAL STAGE)
GENERAL PLAN, ELEVATION AND SECTIONS

SHEET NO. :
B-04

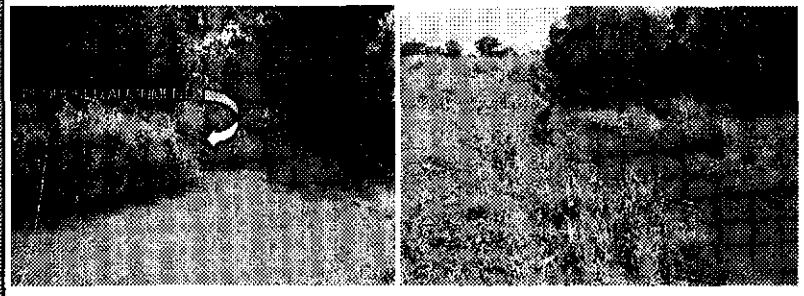
PROPOSED BRIDGE SITE SURVEY

Survey Date	14-Jun-01	Bridge No./Station	Bridge No. 1 / STA. 1+456.600
Bypass Name	SAN JOSE	Prepared by	RTD / ENS

Location — River Name :



Photograph



5	Land Use	☐ Commercial ☐ Industrial ☐ Residential ☑ Agricultural ☐ Others
6	Geographical Features / Terrain	☐ Mountenous area ☐ Alluvial ☑ Plain ☐ Others
7	Stream / River Type	☐ Straight ☑ Braided ☑ Meandering
8	Nearby Structures	Upstream: 24m long bridge at 600m from site. / Downstream:
9	Environmental Condition	☑ Trees/vegetation ☑ Fish & Fish Habitat
10	Water Level (During survey)	☐ 0 - 0.50m ☑ 0.50m - 1.0m ☐ 1.0m - 1.5m ☐ Others

River Condition

River Width (m) : 240

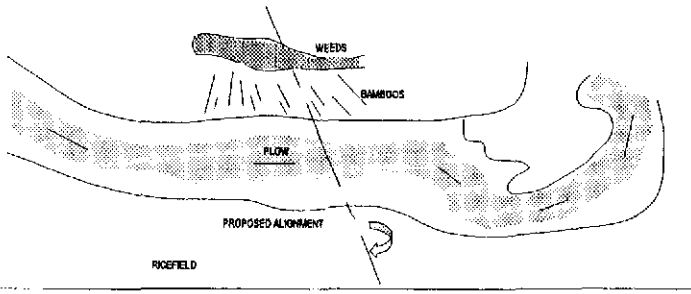
Stream Velocity (m/s) :
- Normal : 0.5
- During Flood : 1.2

Channel Slope (%) :
- Upstream : 0.5
- Downstream : 0.5

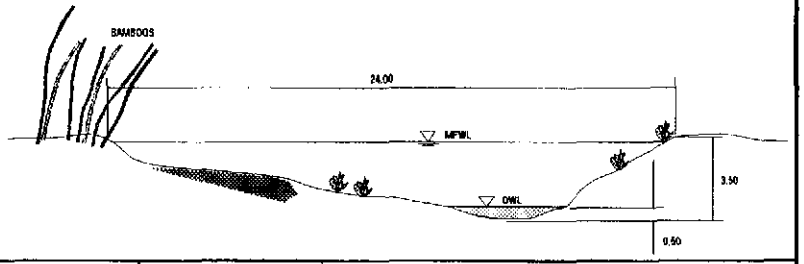
Site Access During Construction:
- ☑ Possible
- ☐ Difficult

Comments

a. Plan



b. Section / Elevation



11	Meander Situation	Upstream	☑ Existing ☐ None
		Downstream	☑ Existing ☐ None
12	Riverbed Material	☐ Large Gravel ☐ Gravel ☐ Sand ☑ Soil ☐ Others	
13	Riverside/Bank Condition	Upstream	☐ Stable - L R ☑ Scouring/Eroding - L R ☐ With Protection/Revetment - L R
		Downstream	☐ Stable - L R ☑ Scouring/Eroding - L R ☐ With Protection/Revetment - L R
14	Tendency to River Course and Riverbed Change	☐ Stable ☑ Scouring ☐ Aggradation ☐ Degradation ☐ Sediment Transport ☐ Others	
15	Flood signs	☐ None ☑ Existing -	
16	Evidence of Drift & Debris	☐ None ☑ Existing	Driftwoods, Φ = / Length = / Others : Bamboos, weeds
17	Maximum Flood Water Level ☑ Interview ☐ Flood Data ☑ Flood Marks	Height above bank (m)	L(-0.6) R(-0.5)
		Frequency (yrs)	10
		Cause	Typhoon
		Comments :	
17	Recommendation for Bridge	Verify maximum flood water level. Provide 1.5m clear from MFWL to soofit of superstructure.	
18	Recommendation for River Protection Works		
19	Comments / Others		

Table 3.4-31 Bridge No. 1 Site Condition

BRIDGE NO.2 (SAN JOSE BY PASS – INITIAL & ULTIMATE STAGE)

1. RIVER CONDITION

- The site of Bridge No.2 is located immediately after the river bends to the right (from the upstream side) after which it flows relatively straight before diverging into two channels.
- Minor scouring is observed on both its upstream and downstream side.
- No evidence of drift/debris observed during flooding.
- The river discharge at 50 year return period is 148.10 cum/sec
- The river velocity at 50 years return period is 3.147 m/sec.
- The top river width at design flood level is 33.0 m.

2. SOIL / GROUND CONDITION

- The riverbed consists of silts, sands, and unconsolidated and unsorted pebbles, cobbles and small boulders derived from older rocks.
- The site is covered by 2.5m thick, brown to gray, medium dense silty sand uppermost layer (SM), followed by a thick very dense sand and gravel layer where the boreholes were terminated.
- N-value at the upper 3.0 to 4.0 meter depth ranged from 8 to 27, with low value of 3, and consistently hitting practical refusals (N>50) at subsequent depths towards the end of the boreholes.

3. DESCRIPTION OF BRIDGE

(1) SELECTION OF SPAN COMPOSITION AND BRIDGE TYPE

	INITIAL STAGE	ULTIMATE STAGE
BRIDGE LENGTH	40.86 m	40.86 m
CARRIAGEWAY WIDTH	(2 x 3.50m) + 0.50m Median	4.00m
SHOULDER WIDTH	2 x 2.50m	-
SIDEWALK WIDTH	2 x 0.60m	0.60 + 1.50m
SUPERSTRUCTURE TYPE	1-span, PCDG Type VI-Modified (40m)	1-span, PCDG Type VI-Modified (40m)
SUBSTRUCTURE TYPE	Closed-type Abutment	Seat-type Pile Bent Abutment
FOUNDATION TYPE	Spread Footing	ϕ 800 mm Bored Pile

(2) DETERMINATION OF FINAL SCHEME

- The top width of river during design flood is 33.0 m. To minimize river encroachment considering abutment slope protection, the bridge length becomes 40.0m for a single-span bridge.

- A single Span bridge is proposed due to :

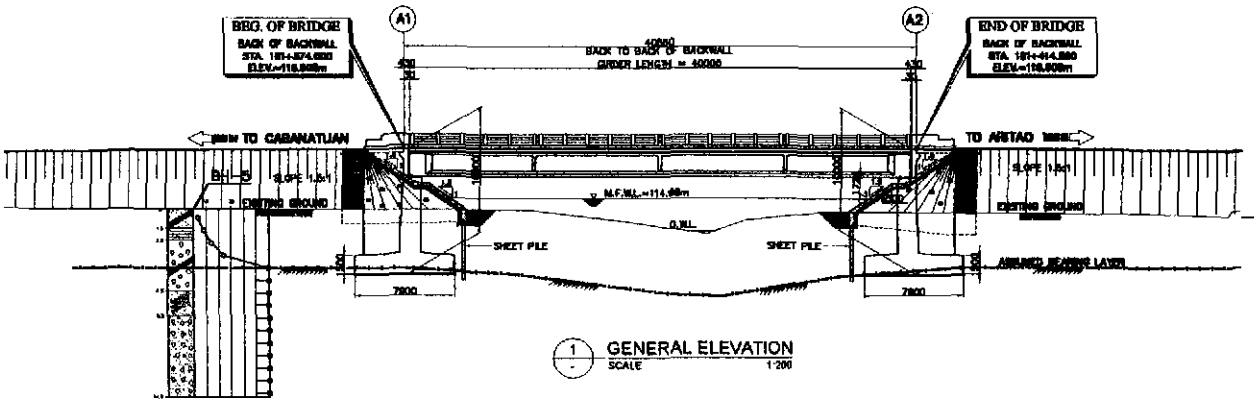
    1. Two-span bridge is not recommended because of relatively high water velocity which dissuaded the use of piers encroaching inside the river channel.

    2. A three span bridge tends to be more expensive because of additional substructure cost.

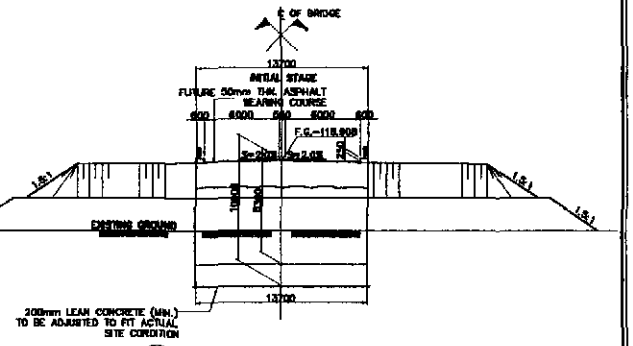
- For the Initial Stage, Spread footing was adopted for this bridge because of the presence of a shallow stable bearing stratum. This stratum is made of very dense sandy gravel with N-value greater than 50.
- For the Ultimate Stage, 800 mm diameter Bored Piles was adopted for the two adjacent bridge to be constructed to minimize disturbance to the foundation of Initial Stage Bridge.

(3) PROTECTION AGAINST SCOURING

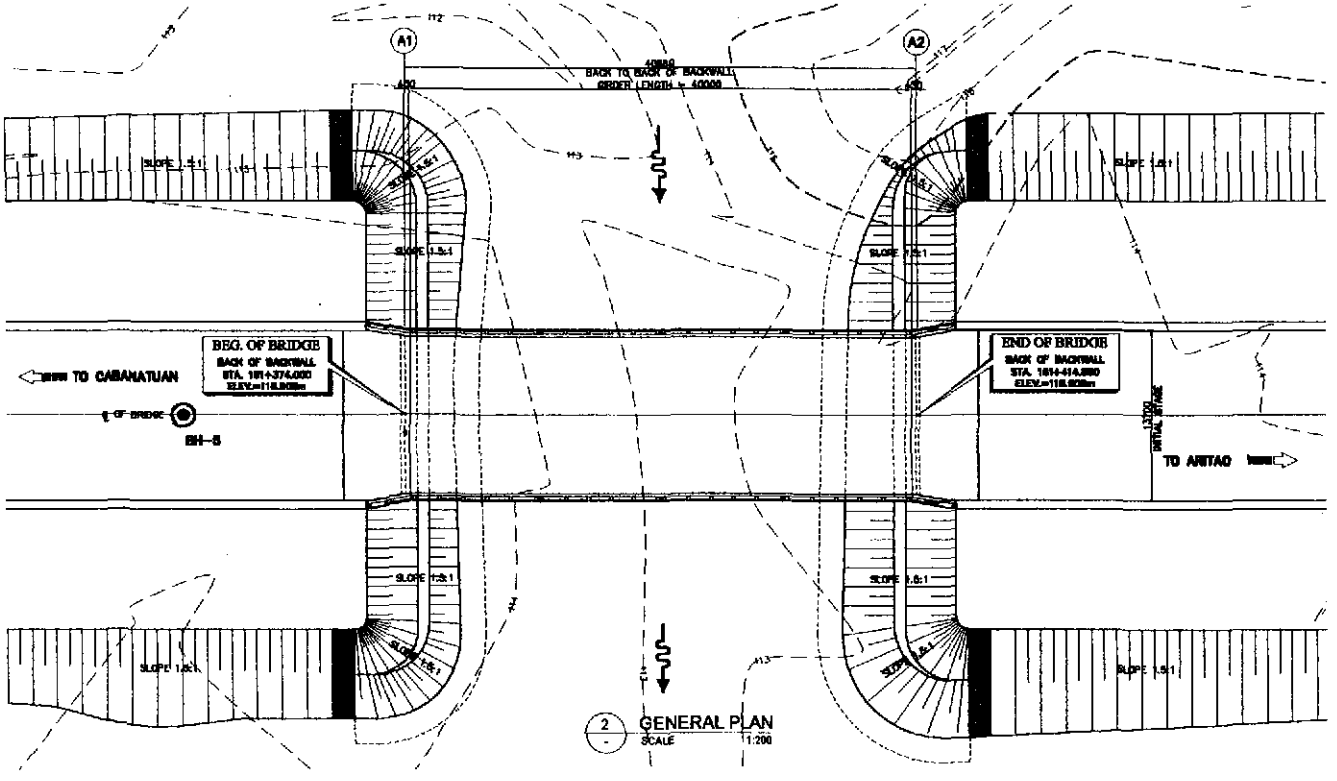
- DPWH criteria require that Rubble Concrete Riverbank Protection be utilized in case of river velocity is greater than 3.0 m/sec.
- The footing of the river bank protection shall be founded on steel sheet piles. While loose boulder apron at the toe will protect it from scouring.



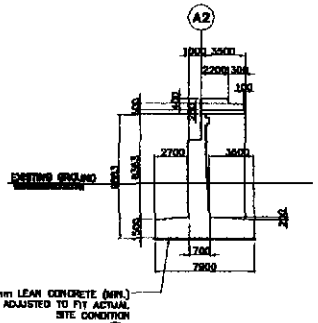
1 GENERAL ELEVATION
SCALE 1:200



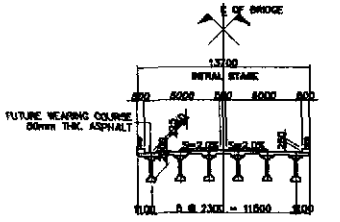
3A SECTION@ ABUTMENT A2
SCALE 1:200



2 GENERAL PLAN
SCALE 1:200



3B SIDE ELEVATION
SCALE 1:200



3C SECTION @ MID-SPAN
SCALE 1:200

HYDRAULIC DATA	
VELOCITY @ 50 YEARS, V50	3.147 m/sec
DISCHARGE @ 50 YEARS, Q50	148.100 cu.m/sec
CATCHMENT AREA, CA	13,300 sq. km

NOTE :

PRIOR TO CONSTRUCTION SOIL INVESTIGATION AT ABUTMENT A2 SHALL BE CONDUCTED FOR CONFIRMATION OF ASSUMED BEARING CAPACITY AND FOOTING ELEVATION.

A SAN JOSE BYPASS BRIDGE NO.2 (STA.161+374.000)
SCALE AS SHOWN

JICA
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KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD.

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

	DATE	SIGNATURE
DESIGNED		
CHECKED		
SUBMITTED		TEAM LEADER

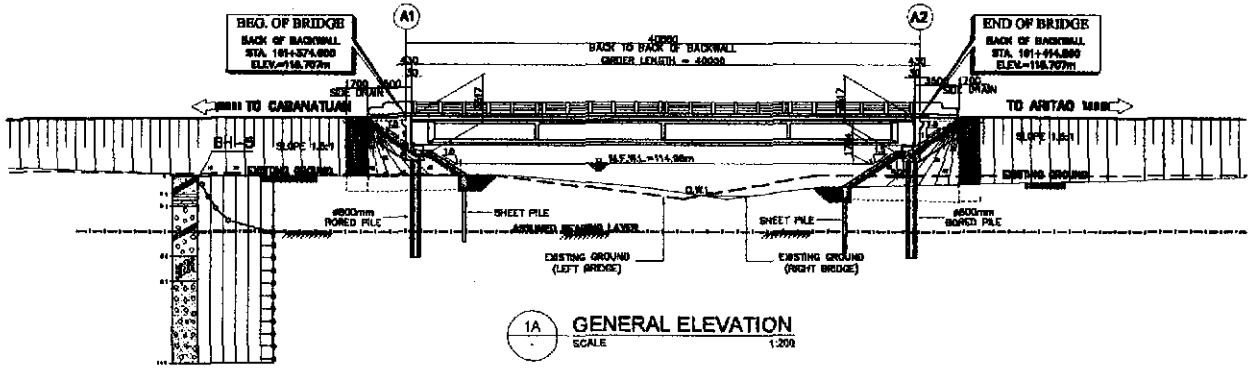
PMS - PMO	BUREAU OF WORKS		OFFICE OF THE SECRETARY	
Submitted By	Reviewed By	Recommended By	Recommended By (See cover sheet for Signature)	Approved By (See cover sheet for Signature / Approval)
DANILO C. TRIANO Project Director	AUSWIN M. CERVY Chief, Bridges Division	GILBERTO S. REYES Director IV (OIC)	EDUARDO V. NIÑO Undersecretary	SIMEON A. DATUMANONG Secretary

PROJECT AND LOCATION :
DETAILED ENGINEERING DESIGN ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)

SCALE :
FULL SIZE A1

SHEET CONTENTS :
SAN JOSE BYPASS
BRIDGE NO.2 (INITIAL STAGE)
GENERAL PLAN, ELEVATION AND SECTIONS

SHEET NO. :
B-15



1A GENERAL ELEVATION
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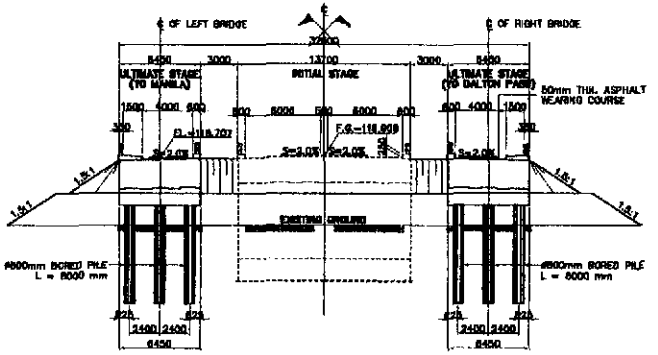
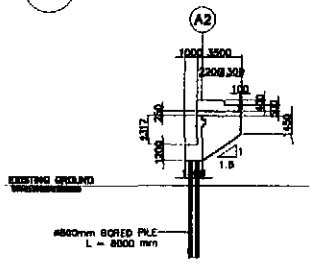
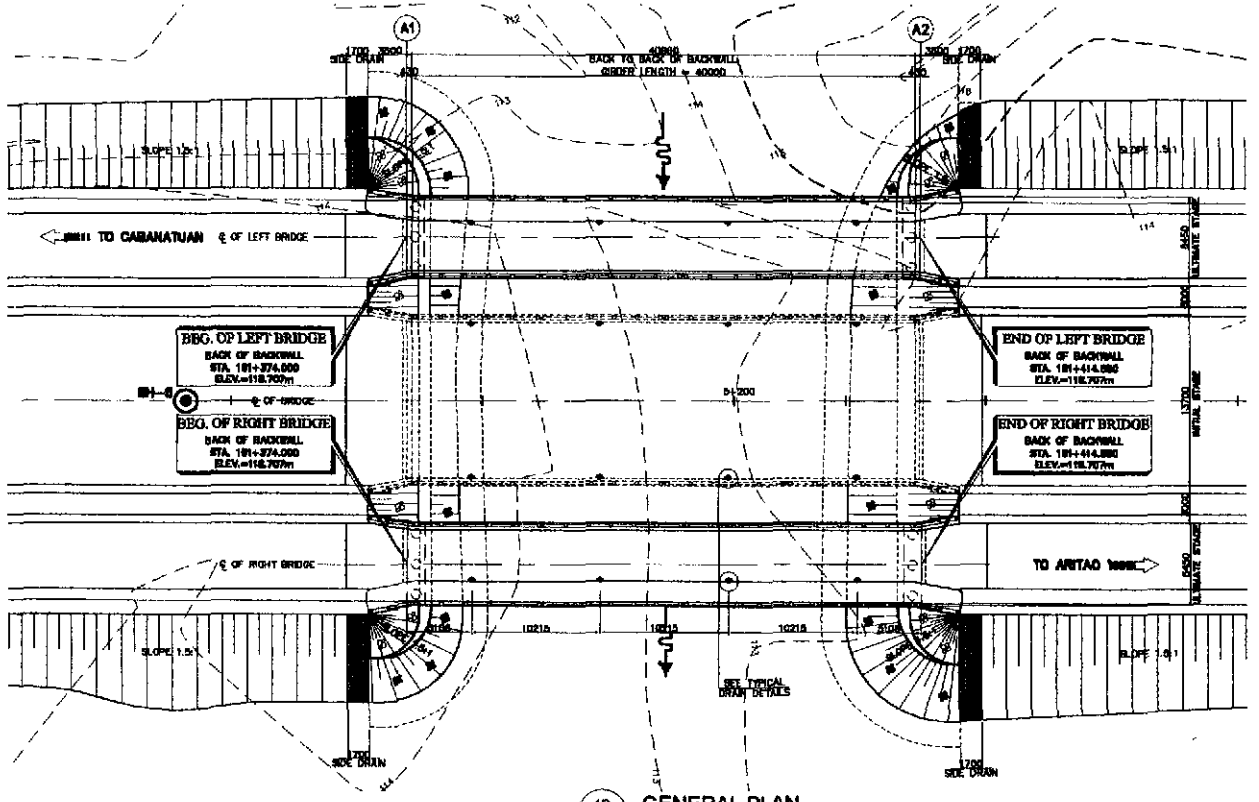


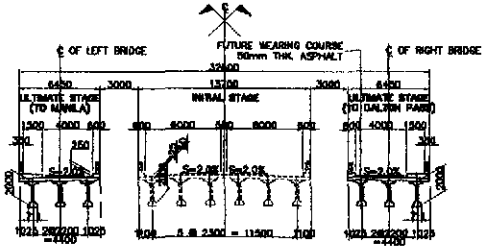
2A SECTION @ ABUTMENT A2
SCALE 1:200



2B SIDE ELEVATION
SCALE 1:200



1B GENERAL PLAN
SCALE 1:200



3 SECTION @ MID-SPAN
SCALE 1:200

1 SAN JOSE BYPASS BRIDGE NO.2
SCALE AS SHOWN

HYDRAULIC DATA	
VELOCITY @ 50 YEARS, Vso	3.147 m/sec
DISCHARGE @ 50 YEARS, Qso	146.109 cu.m/sec
CATCHMENT AREA, CA	13.300 sq. km

NOTE :
PRIOR TO CONSTRUCTION SOIL INVESTIGATION AT ABUTMENT A2 SHALL BE CONDUCTED FOR CONFIRMATION OF ASSUMED BEARING CAPACITY AND FOOTING ELEVATION.

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KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD.

DESIGNED | CHECKED | SUBMITTED | DATE | SIGNATURE | TEAM LEADER

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

Recommended by:	Bureau of Design		Office of the Secretary	
Submitted by:	Reviewed by:	Recommended by:	Recommended by: (See cover sheet for Signatures)	Approved by: (See cover sheet for Signatures/Approval)
DANILO C. TINAMPO, Project Director	ADONIS M. OGSIM, Chief, Bridge Division	GILBERTO B. REYES, Director IV (OIC)	EDUARDO V. MEI, Undersecretary	RUBEN A. DATUMANONG, Secretary

PROJECT AND LOCATION :
DETAILED ENGINEERING DESIGN ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)

SCALE : FULL SIZE A1

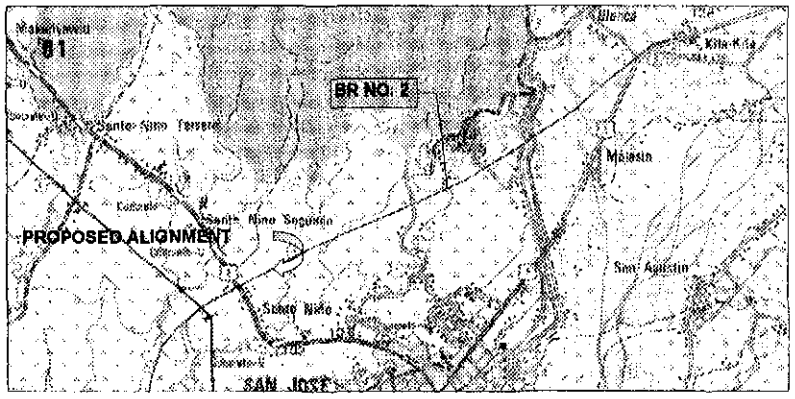
SHEET CONTENTS :
SAN JOSE BYPASS
BRIDGE NO. 2 (ULTIMATE STAGE)
GENERAL PLAN, ELEVATION AND SECTIONS

SHEET NO. :
B-16

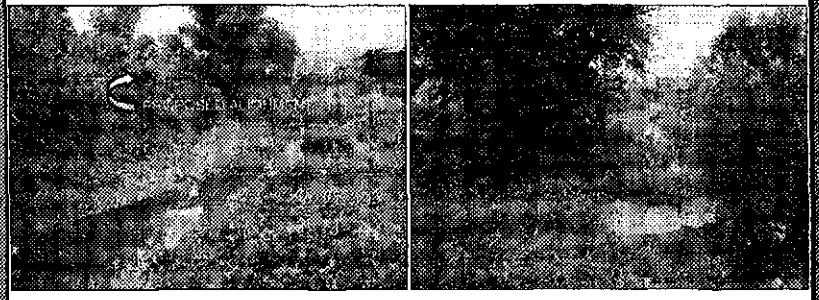
PROPOSED BRIDGE SITE SURVEY

Survey Date	14-Jun-01	Bridge No./Station	Bridge No. 2 / STA.5+381.600
Bypass Name	SAN JOSE	Prepared by	RTO / ENS

Location River Name :



Photograph



3	**Land Use**	☐ Commercial ☐ Industrial ☐ Residential ☑ Agricultural ☐ Others
4	**Geographical Features / Terrain**	☑ Mountenous area ☐ Alluvial ☑ Plain ☐ Others
5	**Stream / River Type**	☐ Straight ☐ Braided ☑ Meandering
6	**Nearby Structures**	Upstream Downstream: 14m long bridge at 750m from site.
7	**Environmental Condition**	☑ Trees/vegetation ☐ Fish & Fish Habitat
8	**Water Level (During survey)**	☐ 0 - 0.50m ☐ 0.50m - 1.0m ☑ 1.0m - 1.5m ☐ Others

River Condition

River Width (m) : 15.00

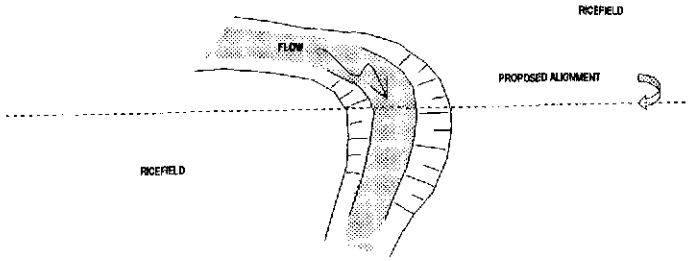
Stream Velocity (m/s) :
Normal : 0.30
During Flood : 1.50

Channel Slope (%) :
Upstream : 5
Downstream : 5

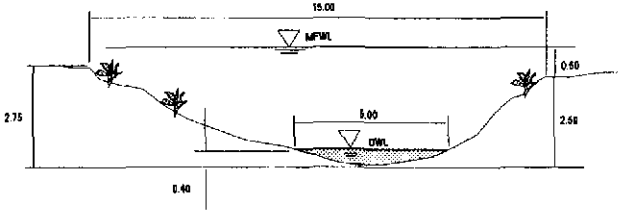
Site Access During Construction:
☑ Possible
☐ Difficult

Comments:

a. Plan



b. Section / Elevation



10	**Meander Situation**	Upstream	☑ Existing ☐ None
		Downstream	☑ Existing ☐ None
11	**Riverbed Material**	☐ Large Gravel ☐ Gravel ☐ Sand ☑ Soil ☐ Others	
12	**Riverside/Bank Condition**	Upstream	☑ Stable - ◯ ◯ ☐ Scouring/Eroding - L R ☐ With Protection/Revetment - L R
		Downstream	☑ Stable - ◯ ◯ ☐ Scouring/Eroding - L R ☐ With Protection/Revetment - L R
13	**Tendency to River Course and Riverbed Change**	☑ Stable ☐ Scouring ☐ Aggradation ☐ Degradation ☐ Sediment Transport ☐ Others	
14	**Flood signs**	☑ None ☐ Existing -	
15	**Evidence of Drift & Debris**	☑ None ☐ Existing	Driftwoods, Φ = Length = Others : Weeds, trees
16	**Maximum Flood Water Level** ☑ Interview ☐ Flood Data ☐ Flood Marks	Height above bank (m) : 0.8 Frequency (yrs) : 10 Cause : Typhoon	Comments :
17	**Recommendation for Bridge**	Verify maximum flood water level. Provide 1.5m clearance from MFWL.	
18	**Recommendation for River Protection Works**	Provide river bank slope protection.	
19	**Comments / Others**		

Table 3.4-32 Bridge No. 2 Site Condition

BRIDGE NO.3 (SAN JOSE BY PASS – INITIAL & ULTIMATE STAGE)

1. CANAL CONDITION

- This bridge cuts across an existing irrigation canal.
- Water flow of the irrigation canal is controlled by nearby sluice gate.
- The maximum river velocity is 1.945 m/sec.
- The top river width at design flood level is 15.8 m.
- The bridge is skewed 15° LF

2. SOIL CONDITION

- Bridge site is covered by an uppermost loose and medium stiff alluvium, followed by the dense to very dense gravel layer. Beneath these deposits is the andesitic Sandstone.
- Uppermost deposit is generally described as dark brown, slight to medium plastic, clayey Sand with little amount of gravel. N-value ranged from 4 to 10.
- Standard Penetration tests conducted on this layer revealed practical refusal (N>50), indicating that this bedrock layer of very dense state.

3. DESCRIPTION OF BRIDGE

(1) SELECTION OF SPAN COMPOSITION AND BRIDGE TYPE

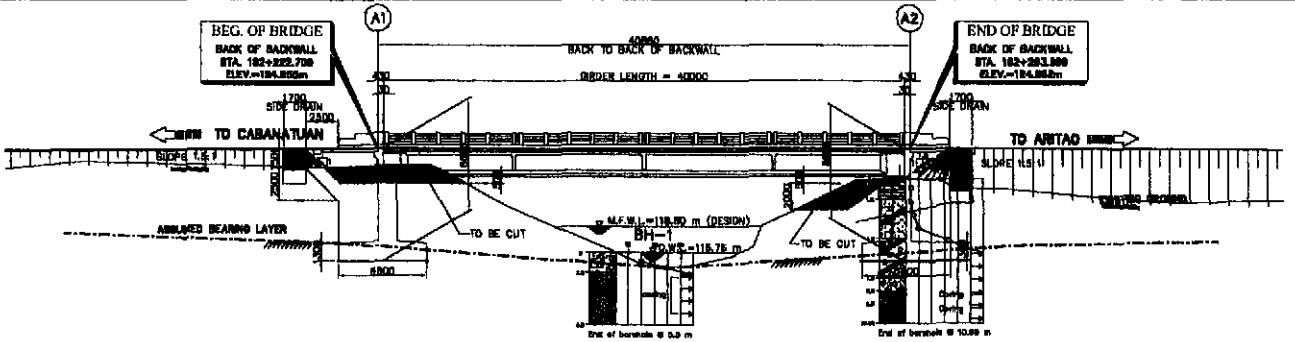
	INITIAL STAGE	ULTIMATE STAGE
BRIDGE LENGTH	40.86 m	40.86 m (LEFT FRONTAGE) 54.66 m (RIGHT FRONTAGE)
CARRIAGEWAY WIDTH	(2 x 3.50m) + 0.50m Median	4.00m
SHOULDER WIDTH	2 x 2.50m	
SIDEWALK WIDTH	2 x 0.60m	0.60 + 1.50m
SUPERSTRUCTURE TYPE	1-span, PCDG Type VI-Modified (40m)	1-span, PCDG Type VI-Modified (40m) (Left Frontage Road) 3-span, RCDG (15.0+24.0+15.0m=54.0m) (Right Frontage Road)
SUBSTRUCTURE TYPE	Closed-type Abutment	Seat-type Pile Bent Abutment (Left Frontage Road) Seat-type Pile Bent Abutment/One-Column Pier (Right Frontage Road)
FOUNDATION TYPE	Spread Footing	ϕ 800 mm Bored Pile Spread Footing (Right Frontage)

(2) DETERMINATION OF FINAL SCHEME

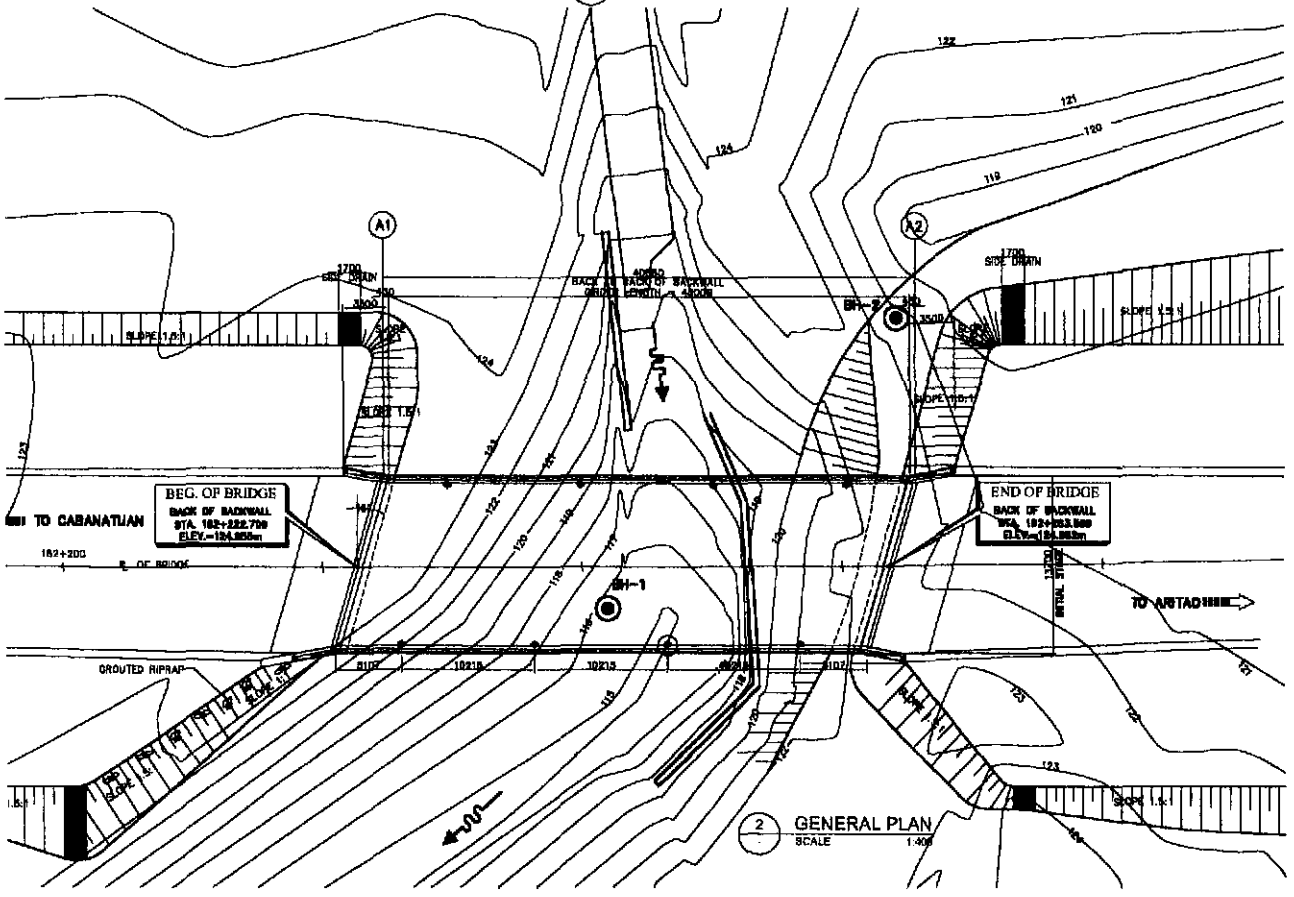
- A single span 40.0m bridge was required so as not to disturb the flow on the existing concrete lined irrigation canal and avoid disrupting the irrigational service during construction in case a pier is situated at the center of the waterway.
- For the Initial Stage, Spread footing foundation was adopted because of presence of sound bedrock at shallow depth.
- For the Ultimate Stage, 800 mm diameter Bored Piles was adopted for the two adjacent bridge abutments to minimize disturbance to the foundation of bridge constructed at during Initial Stage.
- For the Ultimate stage, a 3-span, 54.0m bridge was required at downstream side to accommodate the abrupt bending of the river channel at the bridge location.

(3) PROTECTION AGAINST SCOURING

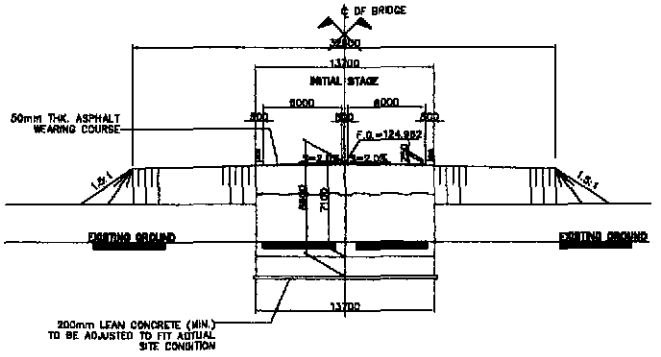
- Since the maximum water level at this site is controlled, no river bank protection was employed.
- Minor cutting of the original ground will be made to clear the way for the constructing of bridge superstructure.



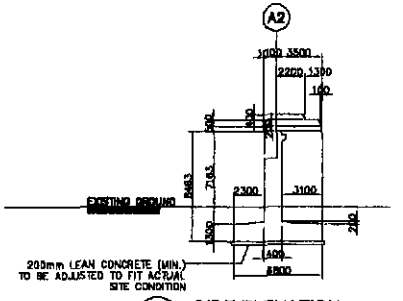
1 GENERAL ELEVATION
SCALE 1:400



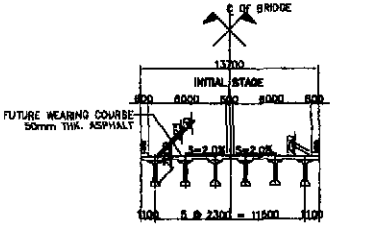
2 GENERAL PLAN
SCALE 1:400



3A SECTION @ ABUTMENT A2
SCALE 1:400



3B SIDE ELEVATION
SCALE 1:400



4 SECTION @ MID-SPAN
SCALE 1:400

HYDRAULIC DATA	
WITHIN IRRIGATION CANAL	

NOTE :

PRIOR TO CONSTRUCTION SOIL INVESTIGATION AT ABUTMENT A1 SHALL BE CONDUCTED FOR CONFIRMATION OF ASSUMED BEARING CAPACITY AND FOOTING ELEVATION.

A SAN JOSE BYPASS BRIDGE NO. 3 (STA.162+222.709)
SCALE AS SHOWN

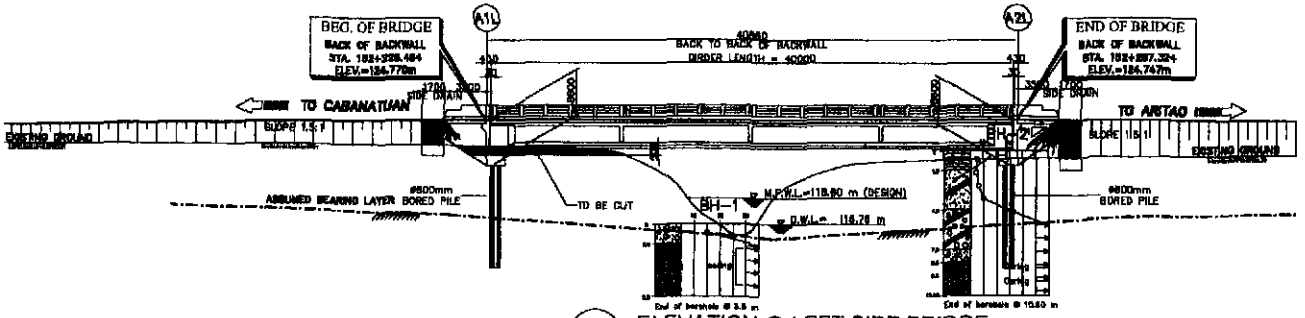
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD.

	DATE	SIGNATURE
DESIGNED		
CHECKED		
SUBMITTED		TEAM LEADER

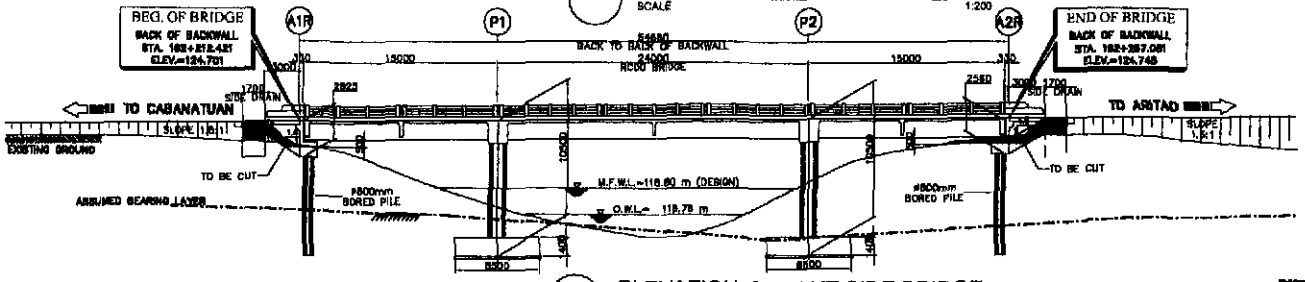
REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

Fld. – PMO	BUREAU OF DESIGN		OFFICE OF THE SECRETARY	
Submitted By:	Reviewed By:	Recommended By:	Recommended By: (See cover sheet for Signature)	Approved By: (See cover sheet for Signature/Approval)
DANILO O. TRIJANO Project Director	ARMAND M. DORDY Chief, Bridges Division	ALBERTO B. REYES Director IV (OIC)	EDMUNDO V. MIR Undersecretary	SIMEON A. DATUMANONG Secretary

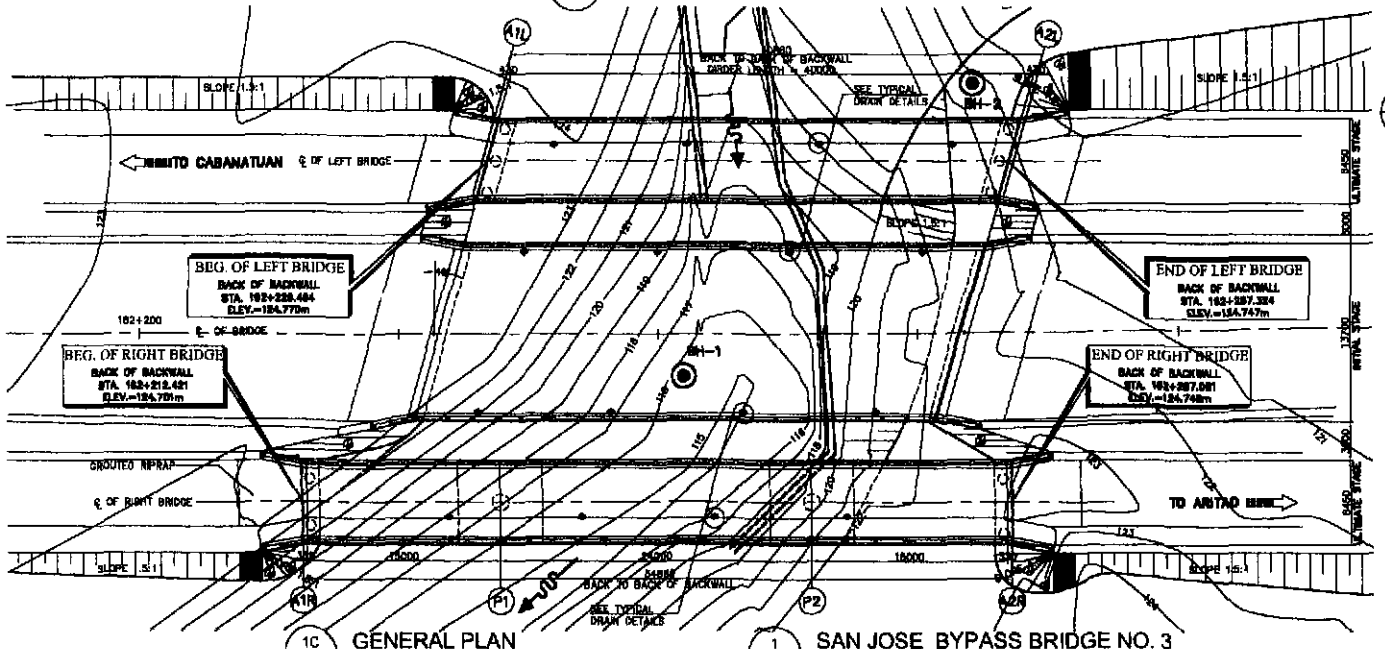
PROJECT AND LOCATION :	SCALE :	SHEET CONTENTS :	SHEET NO. :
DETAILED ENGINEERING DESIGN ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)	FULL SIZE A1	SAN JOSE BYPASS BRIDGE NO.3 (INITIAL STAGE) GENERAL PLAN, ELEVATION AND SECTIONS	B-26



1A ELEVATION @ LEFT SIDE BRIDGE
SCALE 1:200

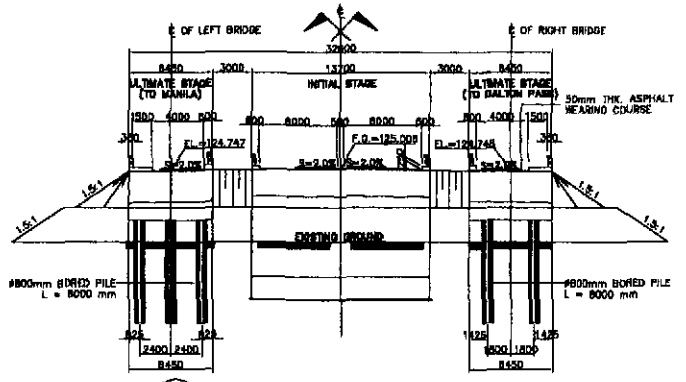


1B ELEVATION @ RIGHT SIDE BRIDGE
SCALE 1:200

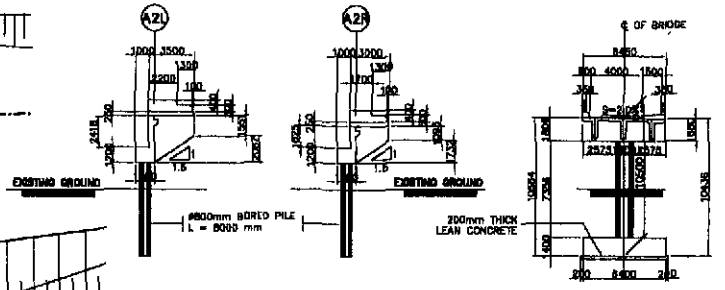


1C GENERAL PLAN
SCALE 1:200

1 SAN JOSE BYPASS BRIDGE NO. 3
SCALE AS SHOWN

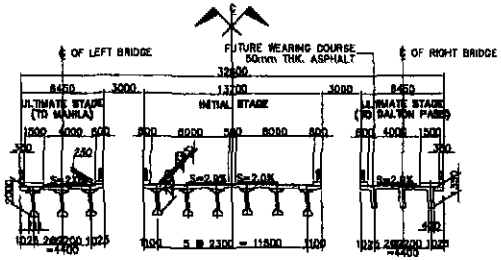


2A SECTION @ ABUTMENT A2
SCALE 1:200



2B SIDE ELEVATION
SCALE 1:200

3 SECTION @ PIER
SCALE 1:200



4 SECTION @ MIDSPAN
SCALE 1:200

HYDRAULIC DATA	
WITHIN IRRIGATION CANAL	-

NOTE :
PRIOR TO CONSTRUCTION SOIL INVESTIGATION AT ABUTMENT A1 SHALL BE CONDUCTED FOR CONFIRMATION OF ASSUMED BEARING CAPACITY AND FOOTING ELEVATION.

JICA
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD.

	DATE	SIGNATURE
DESIGNED		
CHECKED		
SUBMITTED		TEAM LEADER

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

FUNC. – PMO	BUREAU OF DESIGN		OFFICE OF THE SECRETARY	
Submitted By:	Reviewed By:	Recommended By:	Recommended By: (For approval signature by Secretary)	Approved By: (For approval/signature by Secretary)
DANILO C. TRAJANO, Project Director	ARMANDO M. DARDO, Chief, Bridges Division	VALENTIN B. REYES, Director IV (OIC)	EDMUNDO V. MIR, Undersecretary	SIMEON A. DATUMANONG, Secretary

PROJECT AND LOCATION :
DETAILED ENGINEERING DESIGN ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)

SCALE : FULL SIZE A1

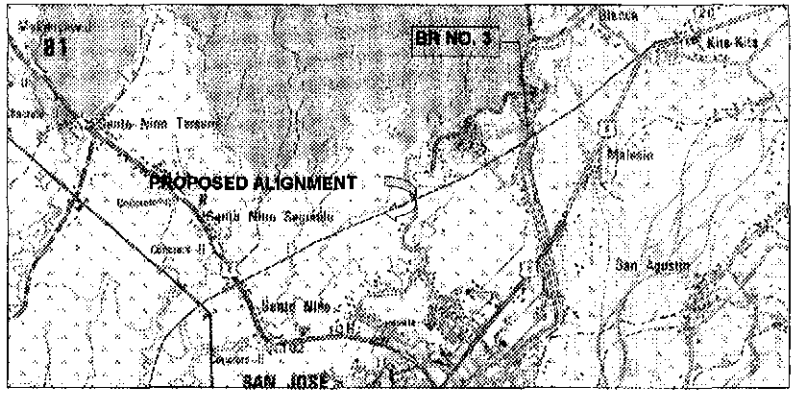
SHEET CONTENTS :
SAN JOSE BYPASS
BRIDGE NO.3 (ULTIMATE STAGE)
GENERAL PLAN, ELEVATION AND SECTIONS

SHEET NO. : B-28

PROPOSED BRIDGE SITE SURVEY

Survey Date	14-Jun-01	Bridge No./Station	Bridge No. 3 / STA.6+197.670
Bypass Name	SAN JOSE	Prepared by	RTD / ENS

1 Location — River Name : Irrigation Canal



2 Photograph

3	Land Use	☐ Commercial ☐ Industrial ☐ Residential ☑ Agricultural ☐ Others
4	Geographical Features / Terrain	☑ Mountenous area ☐ Alluvial ☐ Plain ☐ Others
5	Stream / River Type	☑ Straight ☐ Braided ☐ Meandering
6	Nearby Structures	Upstream; Downstream: 16m long bridge at 1.2km from site along Maharlika Highway.
7	Environmental Condition	☑ Trees/vegetation ☐ Fish & Fish Habitat
8	Water Level (During survey)	☐ 0 - 0.50m ☐ 0.50m - 1.0m ☑ 1.0m - 1.5m ☐ Others

9 River Condition

River Width (m) : 45.0

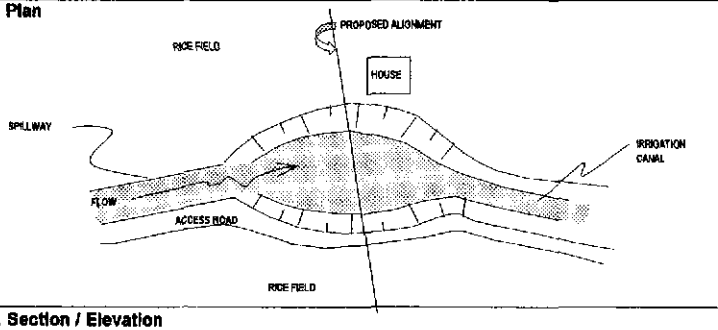
Stream Velocity (m/s) :
Normal : 1.0
During Flood : 2.0

Channel Slope (%) :
Upstream : 35
Downstream : 5

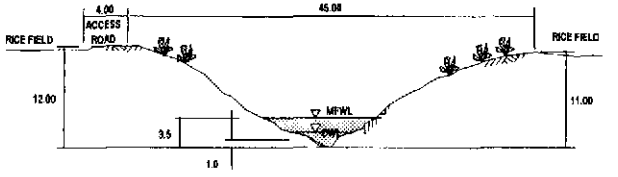
Site Access During Construction:
☑ Possible
☐ Difficult

Comments:

a. Plan



b. Section / Elevation



10	Meander Situation	Upstream	☐ Existing ☑ None
		Downstream	☐ Existing ☑ None
11	Riverbed Material	☐ Large Gravel ☐ Gravel ☐ Sand ☑ Soil ☐ Others	
12	Riverside/Bank Condition	Upstream	☑ Stable - L R ☐ Scouring/Eroding - L R ☑ With Protection/Revetment - L R
		Downstream	☑ Stable - L R ☐ Scouring/Eroding - L R ☐ With Protection/Revetment - L R
13	Tendency to River Course and Riverbed Change	☑ Stable ☐ Scouring ☐ Aggradation ☐ Degradation ☐ Sediment Transport ☐ Others	
14	Flood signs	☑ None ☐ Existing -	
15	Evidence of Drift & Debris	☑ None ☐ Existing	Driftwoods, Φ = Length = Others :
16	Maximum Flood Water Level ☑ Interview ☐ Flood Data ☐ Flood Marks	Height above bank (m)	No overflow
		Frequency (yrs)	
		Cause	
		Comments :	Canal discharge is controlled by gate upstream.
17	Recommendation for Bridge	Verify maximum flood water level. Provide 1.0m clear from MFWL and/or from top of bank.	
18	Recommendation for River Protection Works		
19	Comments / Others		

Table 3.4-33 Bridge No. 3 Site Condition

BRIDGE NO.4 (SAN JOSE BY PASS – INITIAL & ULTIMATE STAGE)

1. RIVER/CANAL CONDITION

- River at bridge site is slightly meandering and has a gentle riverbank slopes on each side.
- The river discharge at 50 year return period is 165.00 cum/sec
- The river velocity at 50 years return period is 3.448 m/sec.
- The top river width at design flood level is 46.50 m.
- The bridge is skewed 10° LF

2. SOIL CONDITION

- Site is underlain by thick cohesive deposits, followed by a very dense gravel deposits.
- N-values generally range from 2 to 8. Higher N-values was observed due to the presence of gravel materials.

3. DESCRIPTION OF BRIDGE

(1) SELECTION OF SPAN COMPOSITION AND BRIDGE TYPE

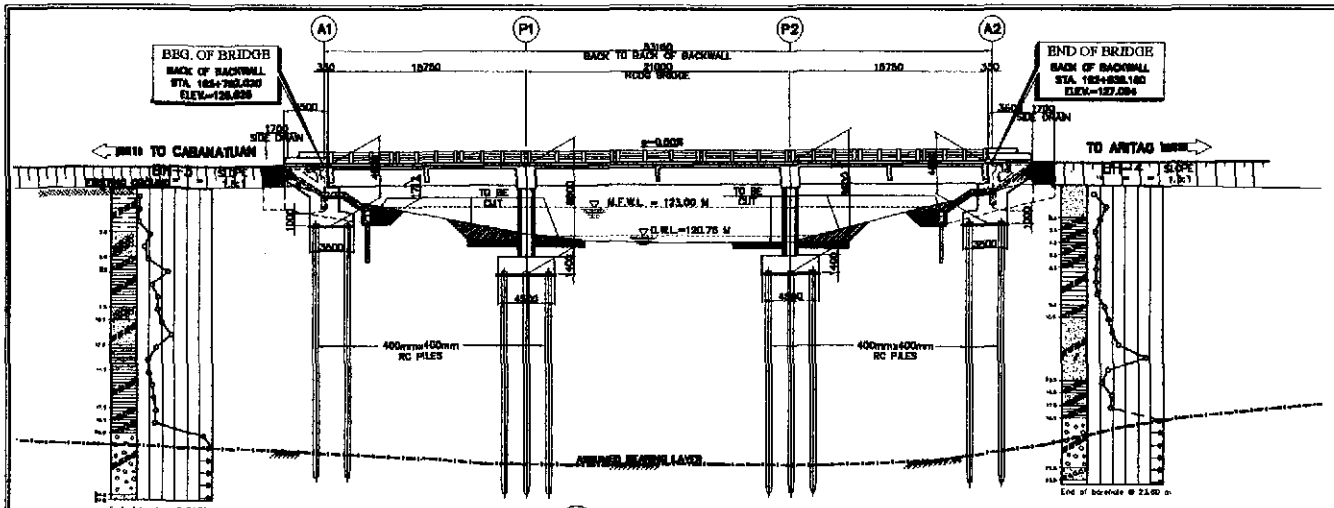
	INITIAL STAGE	ULTIMATE STAGE
BRIDGE LENGTH	53.16 m	53.16 m
CARRIAGEWAY WIDTH	(2 x 3.50m) + 0.50m Median	4.00m
SHOULDER WIDTH	2 x 2.50m	-
SIDEWALK WIDTH	2 x 0.60m	0.60 + 1.50m
SUPERSTRUCTURE TYPE	3-span, RCDG (15.75+21.00+15.75m = 52.50m)	3-span, RCDG (15.75+21.00+15.75m = 52.50m)
SUBSTRUCTURE TYPE	Closed-type Abutment / 2-Column Pier	Closed-type Abutment /One-Column Pier
FOUNDATION TYPE	400 x 400 RC Pile	400 x 400 RC Pile

(2) DETERMINATION OF FINAL SCHEME

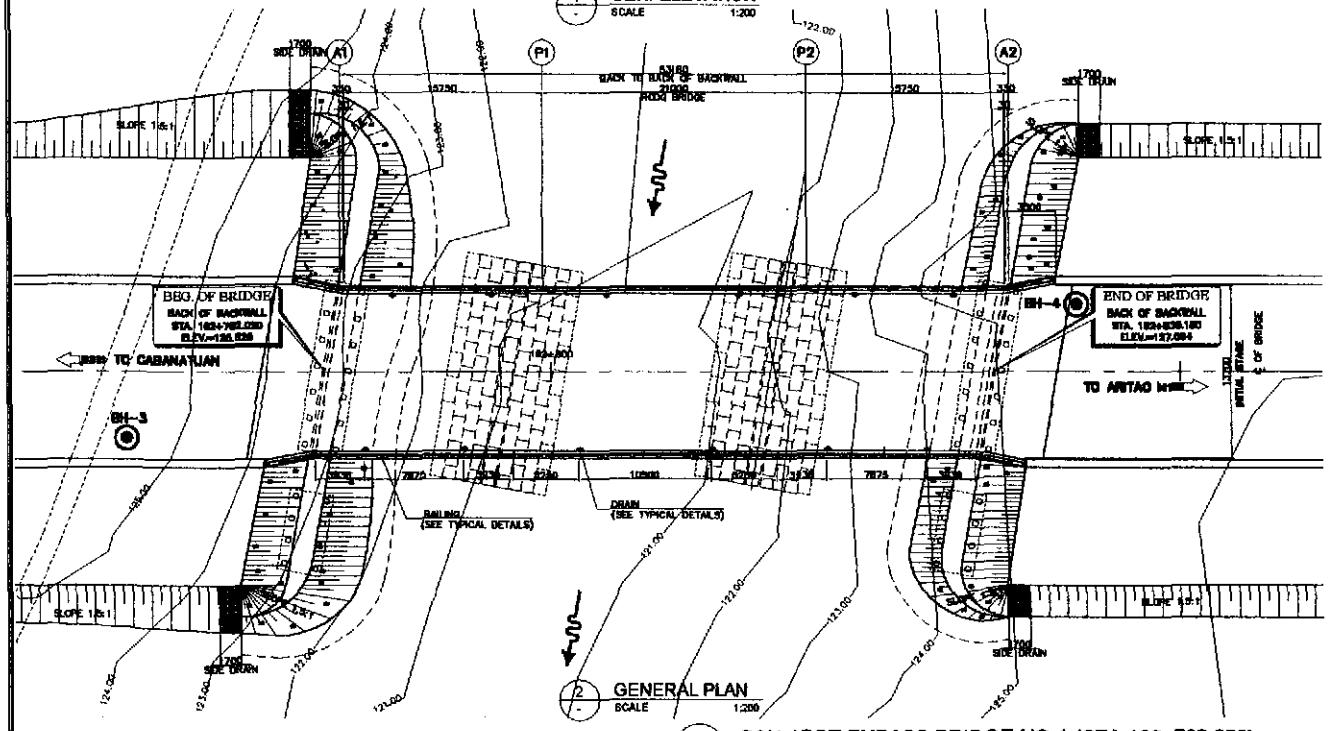
- A three-span bridge was proposed rather than a more economical two-span bridge to minimize debris collision to pier column and local scouring to foundations.
- Pile foundation was adopted because of soft soil layer condition.

(3) PROTECTION AGAINST SCOURING

- Pier foundation is surrounded by gabion mattress deterring any potential scouring which may cause damage.
- River bank will be protected by rubble concrete and steel sheet piles due to scouring velocity of river flow during flooding.

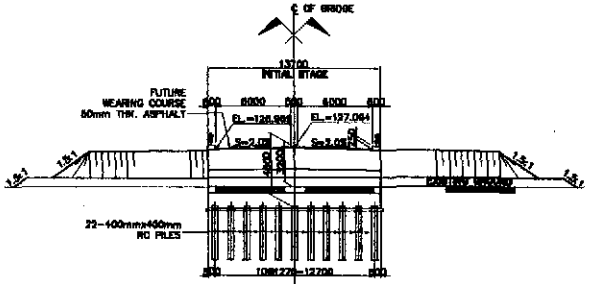


1 - GEN. ELEVATION
SCALE 1:200

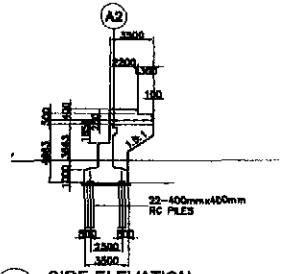


2 - GENERAL PLAN
SCALE 1:200

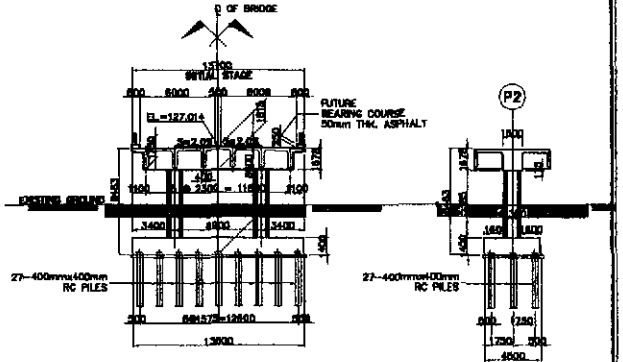
A - SAN JOSE BYPASS BRIDGE NO.4 (STA.162+782.020)
SCALE AS SHOWN



3 - SECTION @ ABUTMENT A2
SCALE 1:200



3A - SIDE ELEVATION
SCALE 1:200



4 - SECTION @ PIER P2
SCALE 1:200

4A - SIDE ELEVATION
SCALE 1:200

NOTES :
PRIOR TO CONSTRUCTION SOIL INVESTIGATION AT PIER P1 SHALL BE CONDUCTED FOR CONFIRMATION OF ASSUMED BEARING CAPACITY AND FOOTING ELEVATION.

THE PILE LENGTH RECOMMENDED ARE MINIMUM. SHOULD THE SOIL AT THE RECOMMENDED LENGTH IS NOT ADEQUATE BEARING MATERIAL, LENGTH SHALL BE INCREASED. THE MINIMUM SOCKET LENGTH INTO ADEQUATE SOIL FOR 400 x 400 RC PILE IS 1000 mm.

HYDRAULIC DATA	
VELOCITY @ 50 YEARS, V 50	3.448 m/sec
DISCHARGE @ 50 YEARS, Q 50	165.000 cu.m/sec
CATCHMENT AREA, CA	14.259 sq. km

JICA
JAPAN INTERNATIONAL COOPERATION AGENCY
KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD.

DESIGNED | CHECKED | SUBMITTED | DATE | SIGNATURE | TEAM LEADER

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

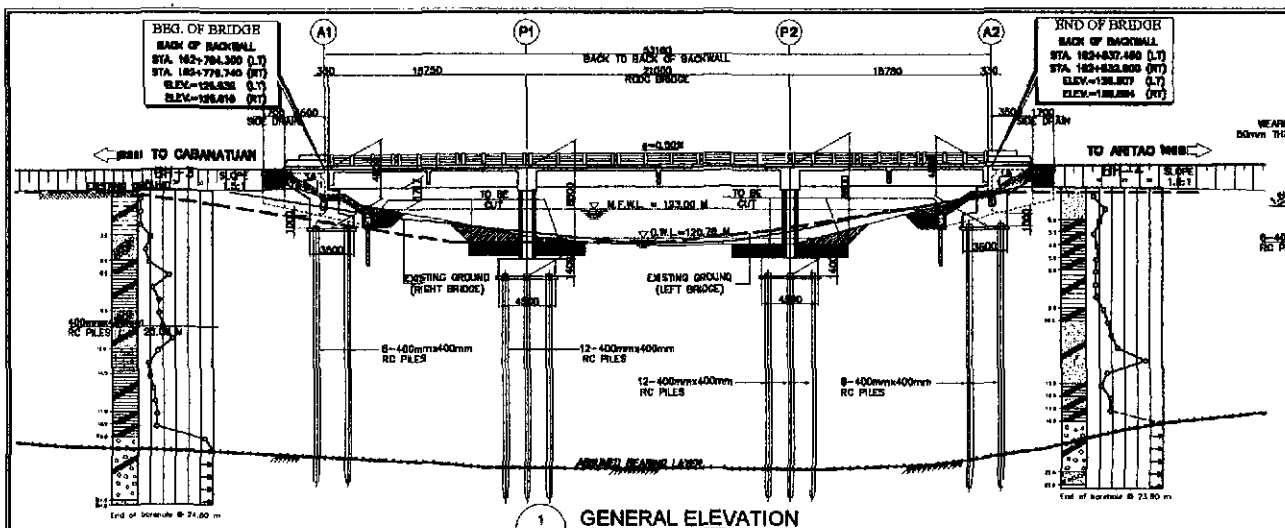
FOR. – DPWH	BUREAU OF DESIGN		OFFICE OF THE SECRETARY	
Submitted By	Reviewed By	Recommended By	Reviewed By (See cover sheet for Signature)	Approved By (See cover sheet for Signature/Approval)
EMILIO O. TRAMINO, Project Director	ADRIANO M. DOROY, Chief, Bridges Division	GILBERTO S. REYES, Director IV (OIC)	EDMUNDO V. MIR, Undersecretary	RUBEN A. TORRES, Secretary

PROJECT AND LOCATION :
DETAILED ENGINEERING DESIGN ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)

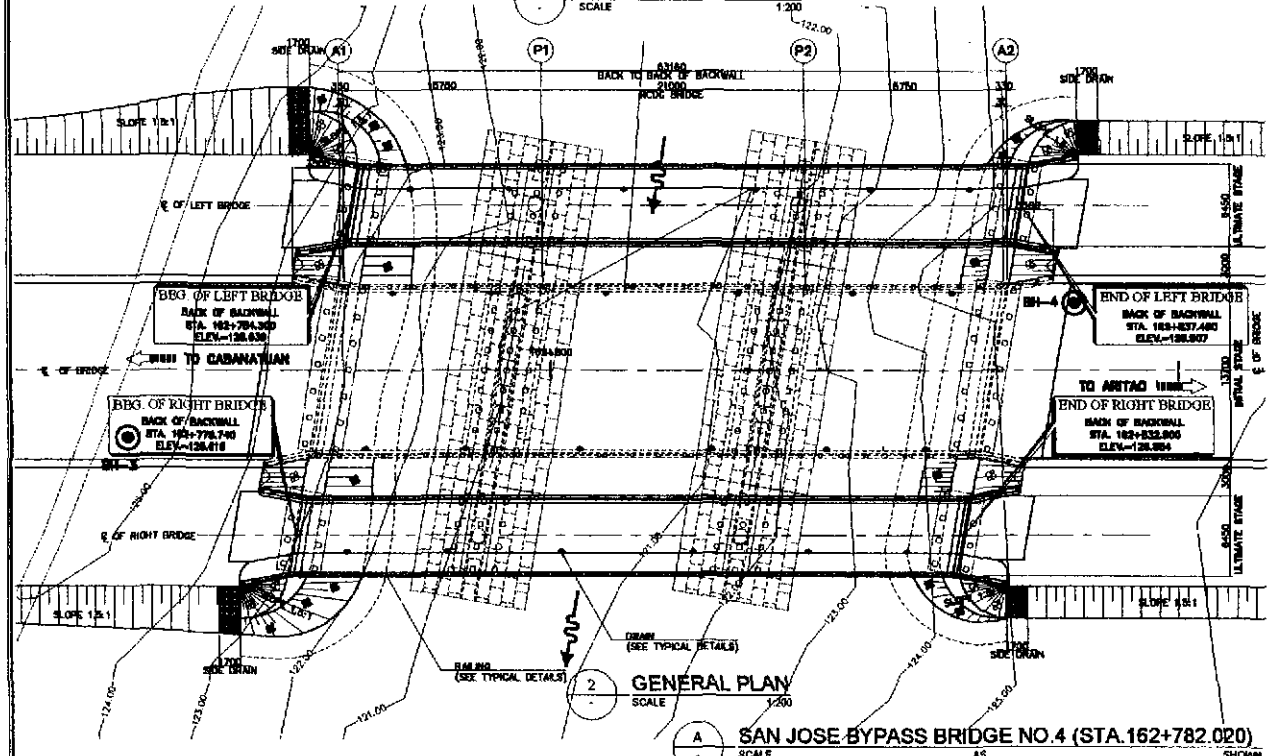
SCALE : FULL SIZE A1

SHEET CONTENTS :
SAN JOSE BYPASS
BRIDGE NO. 4 (INITIAL STAGE)
GENERAL PLAN, ELEVATION AND SECTIONS

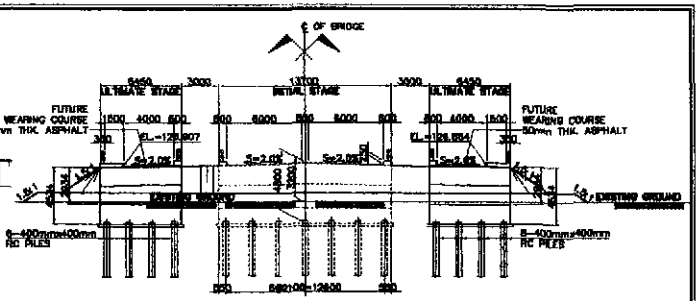
B-38



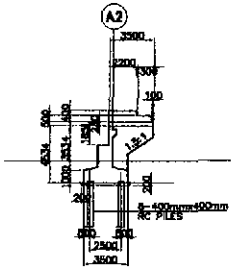
1 GENERAL ELEVATION
SCALE 1:200



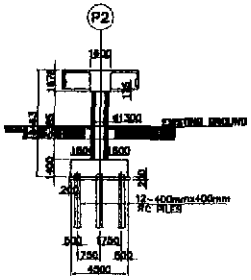
2 GENERAL PLAN
SCALE 1:200



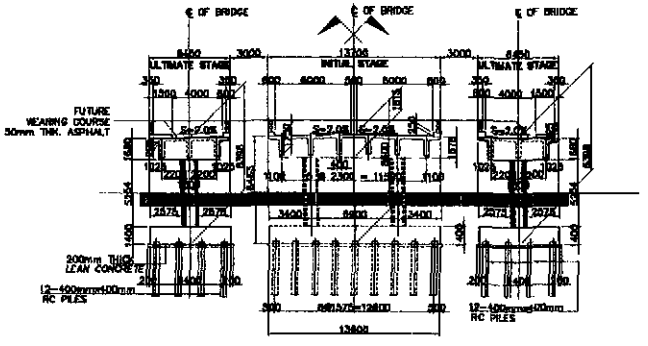
3 SECTION @ ABUTMENT A2
SCALE 1:200



3A SIDE ELEVATION @ ABUTMENT
SCALE 1:200



4A SIDE ELEVATION @ PIER
SCALE 1:200



4 SECTION @ PIER P2
SCALE 1:200

NOTES :

PRIOR TO CONSTRUCTION SOIL INVESTIGATION AT PIER P1 SHALL BE CONDUCTED FOR CONFIRMATION OF ASSUMED BEARING CAPACITY AND FOOTING ELEVATION.

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HYDRAULIC DATA		
VELOCITY @ 50 YEARS, V	50	3.448 m/sec
DISCHARGE @ 50 YEARS, Q	50	165.000 cu.m/sec
CATCHMENT AREA, CA		14.250 sq. km

A SAN JOSE BYPASS BRIDGE NO.4 (STA.162+782.020)
SCALE AS SHOWN

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YACHIYO ENGINEERING CO., LTD.

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BUREAU OF WORKS

DESIGNED		
CHECKED		
SUBMITTED		TEAM LEADER

Submitted By	Reviewed By	Recommended By	Recommended By (See cover sheet for Signature)	Approved By (See cover sheet for Signature of Secretary)
DANILO C. TRIANO, Project Director	ARMANDO M. DORDY, Chief, Bridges Division	GILBERTO S. REYES, Director IV (OIC)	DOMINGO N. MIR, Undersecretary	ERNESTO A. SOLMAMEDIO, Secretary

PROJECT AND LOCATION : DETAILED ENGINEERING DESIGN ON UPGRADING INTER-URBAN HIGHWAY SYSTEM ALONG THE PAN-PHILIPPINE HIGHWAY (Plaridel, Cabanatuan and San Jose Bypasses)

SCALE : FULL SIZE A1

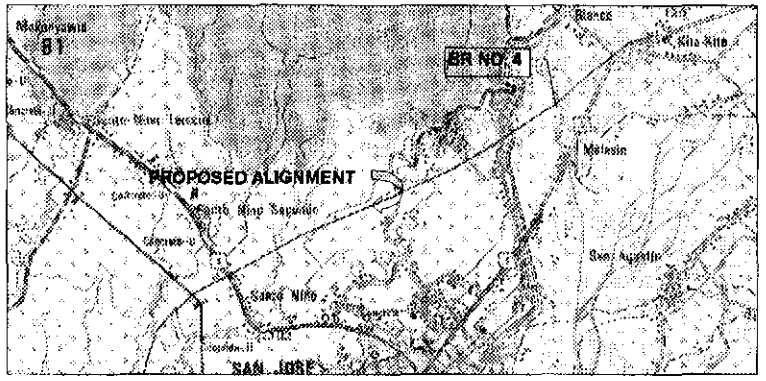
SHEET CONTENTS : SAN JOSE BYPASS BRIDGE NO. 4 (ULTIMATE STAGE) GENERAL PLAN, ELEVATION AND SECTIONS

SHEET NO. : B-51

PROPOSED BRIDGE SITE SURVEY

Survey Date	14-Jun-01	Bridge No./Station	Bridge No. 4 / STA.6+771.000
Bypass Name	SAN JOSE	Prepared by	RTD / ENS

Location River Name :



Photograph

Land Use	☐ Commercial ☐ Industrial ☐ Residential ☑ Agricultural ☐ Others
Geographical Features / Terrain	☑ Mountenous area ☐ Alluvial ☐ Plain ☐ Others
Stream / River Type	☐ Straight ☑ Braided ☑ Meandering
Nearby Structures	Upstream: 24m long bridge (2-span) at 775m from site. Downstream: 35m long bridge (3-span) at 700m from site.
Environmental Condition	☑ Trees/Vegetation ☐ Fish & Fish Habitat
Water Level (During survey)	☑ 0 - 0.50m ☐ 0.50m - 1.0m ☐ 1.0m - 1.5m ☐ Others

River Condition

River Width (m) : 45.0

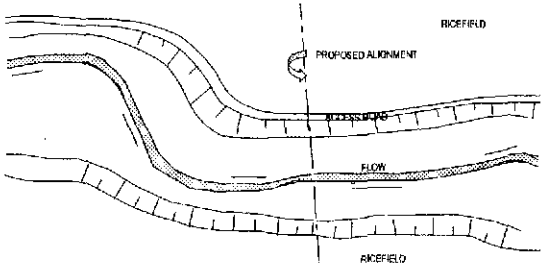
Stream Velocity (m/s) :
Normal : 0.30
During Flood : 1.50

Channel Slope (%) :
Upstream : 5
Downstream : 5

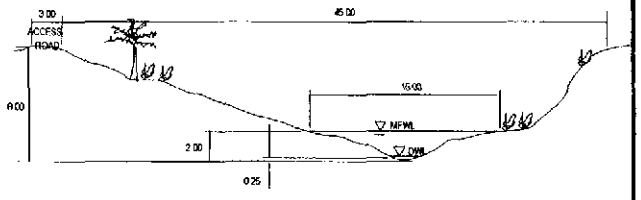
Site Access During Construction:
☑ Possible
☐ Difficult

Comments:

a. Plan



b. Section / Elevation



Meander Situation	Upstream	☑ Existing ☐ None
	Downstream	☑ Existing ☐ None
Riverbed Material	☐ Large Gravel ☐ Gravel ☐ Sand ☑ Soil ☐ Others	
Riverside/Bank Condition	Upstream	☑ Stable - ◯ L ◯ R ☐ Scouring/Eroding - L R ☐ With Protection/Revetment - L R
	Downstream	☑ Stable - ◯ L ◯ R ☑ Scouring/Eroding - ◯ L ◯ R ☐ With Protection/Revetment - L R
Tendency to River Course and Riverbed Change	☑ Stable ☑ Scouring ☐ Aggradation ☐ Degradation ☐ Sediment Transport ☐ Others	
Flood signs	☑ None ☐ Existing -	
Evidence of Drift & Debris	☑ None ☐ Existing	Driftwoods, Φ = Length =
		Others : Trees, weeds.
Maximum Flood Water Level	☑ Interview ☐ Flood Data ☐ Flood Marks	Height above bank (m): No overflow Frequency (yrs): Cause:
		Comments :
Recommendation for Bridge	Verify maximum flood water level. Provide 1.5m clearance from MFWL.	
Recommendation for River Protection Works		
Comments / Others		

Table 3.4-34 Bridge No. 4 Site Condition

APPENDIX 14.2-1

Consultancy Services Cost

PROPOSED MANNING SCHEDULE : PRE-CONSTRUCTION STAGE
PHASE I OF INITIAL STAGE

	Position	Month																			Man-Month
		1	2	3	4	5	6	7	8	9	10	11	12	11	12	13	14	15	16	17	18	
KEY STAFF	Project Manager (*)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6
	Deputy Proj. Manager	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12
	Sr. Cost Estimator					—	—	—	—	—	—											5
	Tender Document Spec.		—	—	—	—																4
	ROW/RAP Specialist			—	—	—	—	—	—	—												6
	Sub-total																					**33**
SUPPORT STAFF	Secretary	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12
	Encoder	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12
	Copy Machine Operator	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12
	Sub-total																					**36**

Note: (*) Foreign Expatriate

PRE-CONSTRUCTION STAGE

PHASE I OF INITIAL STAGE

		Unit	Unit Price (JPY/PHP)	Quantity	Amount (JPY/PHP)
A.	**Foreign Currency Component (JPY)**				
A-1	***Remuneration***				
1)	Professional (A)	M/M	2,500,000	6.0	15,000,000
2)	Professional (B)	M/M	350,000	27.0	9,450,000
A-2	**Reimbursable Cost**				
1)	International Travel	RT	200,000	3.0	600,000
2)	International Communication	Months	50,000	18.0	900,000
3)	Subsistence Allowance	M/M	200,000	6.0	1,200,000
4)	Vehicle Rental	Veh/Mo.	160,000	18.0	2,880,000
5)	Office Rental / Maintenance	Months	200,000	18.0	3,600,000
6)	Office Equipment / Supply	Months	200,000	18.0	3,600,000
7)	Printing Cost	Months	200,000	18.0	3,600,000
8)	ROW/RAP Assistance	L.S.	0	0	4,000,000
	Sub-total				**44,830,000**
B.	**Local Currency Portion (PHP)**				
B-1	**Remuneration**				
1)	Support Staff	M/M	35,000	36.0	1,260,000
B-2	**Reimbursable Cost**				
1)	Field Allowance	M/M	20,000	5.0	100,000
	Sub-total				**1,360,000**
Base Cost Total in JPY					**47,958,000**
	(in PHP)				(20,851,300)
Value Added Tax in PHP					**536,870**
				PHP	**21,388,170**

Exchange Rate : PHP 1 = JPY 2.30

VAT includes 10% of Remuneration of Professional (B) and Support Staff, and 10% of survey cost.

PROPOSED MANNING SCHEDULE : CONSTRUCTION SUPERVISION STAGE
PHASE I OF INITIAL STAGE

	Position	Year 1												Year 2												Year 3												Man-Month
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
KEY STAFF	Project Manager (*)																																					36.0
	Deputy Proj. Manager																																					36.0
	Sr. Highway Engr. (*)																																					22.0
	Sr. Bridge Engr. (*)																																					22.0
	Sr. Highway Engr.																																					26.0
	Sr. Bridge Engr.																																					26.0
	3 - Resident Engr.																																					104.0
	3 - Material Engr.																																					104.0
	3 - Quantity Engr.																																					104.0
	Environmental Specialist																																					6.0
	Sub-total																																					**486.0**
SUPPORT STAFF	6 - Inspector																																					208.0
	3 - CAD Operator																																					104.0
	3 - Secretary																																					104.0
	3 - Encoder																																					104.0
	3 - Copy Mach. Operator																																					104.0
	Sub-total																																					**624.0**

Note: (*) Foreign Expatriate

CONSTRUCTION SUPERVISION STAGE

PHASE I OF INITIAL STAGE

		Unit	Unit Price (JPY/PHP)	Quantity	Amount (JPY/PHP)
A.	**Foreign Currency Component (JPY)**				
A-1	**Remuneration**				
1)	Professional (A)	M/M	2,500,000	80.0	200,000,000
2)	Professional (B)	M/M	350,000	406.0	142,100,000
A-2	**Reimbursable Cost**				
1)	International Travel	RT	200,000	5.0	1,000,000
2)	International Communication	Months	50,000	36.0	1,800,000
3)	Subsistence Allowance	M/M	200,000	80.0	16,000,000
4)	Vehicle Rental	Veh/Mo.	160,000	72.0	11,520,000
5)	Office Rental / Maintenance	Months	150,000	36.0	5,400,000
6)	Office Equipment / Supply	Months	200,000	36.0	7,200,000
7)	Printing Cost	Months	300,000	36.0	10,800,000
8)	Environmental Survey	L.S.	0	0	5,000,000
	Sub-total				**400,820,000**
B.	**Local Currency Portion (PHP)**				
B-1	**Remuneration**				
1)	Support Staff	M/M	35,000	624.0	21,840,000
B-2	**Reimbursable Cost**				
1)	Field Allowance	M/M	20,000	406.0	8,120,000
	Sub-total				**29,960,000**
Base Cost Total in JPY					**469,728,000**
	(in PHP)				(204,230,000)
Value Added Tax in PHP					**8,362,000**
				PHP	**212,592,000**

Exchange Rate : PHP 1 = JPY 2.30
VAT includes 10% of Remuneration of Professional (B) and Support Staff, and 10% of survey cost.

PROPOSED MANNING SCHEDULE : PRE-CONSTRUCTION STAGE
PHASE II OF INITIAL STAGE

	Position	Month																		Man-Month
		1	2	3	4	5	6	7	8	9	10	11	12	11	12	13	14	15	16	17	18	
KEY STAFF	Project Manager (*)																					9
	Deputy Proj. Manager																					18
	Sr. Cost Estimator																					7
	Tender Document Spec.																					5
	ROW/RAP Specialist																					10
	Sub-total																					**49**
SUPPORT STAFF	Secretary																					18
	Encoder																					18
	Copy Machine Operator																					18
	Sub-total																					**54**

Note: (*) Foreign Expatriate

PRE-CONSTRUCTION STAGE

PHASE II OF INITIAL STAGE

		Unit	Unit Price (JPY/PHP)	Quantity	Amount (JPY/PHP)
A.	**Foreign Currency Component (JPY)**				
A-1	**Remuneration**				
1)	Professional (A)	M/M	2,500,000	9.0	22,500,000
2)	Professional (B)	M/M	350,000	40.0	14,000,000
A-2	**Reimbursable Cost**				
1)	International Travel	RT	200,000	4.0	800,000
2)	International Communication	Months	50,000	18.0	900,000
3)	Subsistence Allowance	M/M	200,000	9.0	1,800,000
4)	Vehicle Rental	Veh/Mo.	160,000	18.0	2,880,000
5)	Office Rental / Maintenance	Months	200,000	18.0	3,600,000
6)	Office Equipment / Supply	Months	300,000	18.0	5,400,000
7)	Printing Cost	Months	350,000	18.0	6,300,000
8)	ROW/RAP Assistance	L.S.	0	0	6,000,000
	Sub-total				**64,180,000**
B.	***Local Currency Portion (PHP)***				
B-1	**Remuneration**				
1)	Support Staff	M/M	35,000	54.0	1,890,000
B-2	**Reimbursable Cost**				
1)	Field Allowance	M/M	20,000	8.0	160,000
	Sub-total				**2,050,000**
Base Cost Total in JPY					**68,895,000**
	(in PHP)				(29,954,000)
Value Added Tax in PHP					**798,000**
				PHP	**30,752,000**

Exchange Rate : PHP 1 = JPY 2.30

VAT includes 10% of Remuneration of Professional (B) and Support Staff, and 10% of survey cost.

PROPOSED MANNING SCHEDULE : CONSTRUCTION SUPERVISION STAGE
PHASE II OF INITIAL STAGE

	Position	Year 1												Year 2												Year 3												Man-Month
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
KEY STAFF	Project Manager (*)																																					36.0
	Deputy Proj. Manager																																					36.0
	Sr. Highway Engr. (*)																																					25.0
	Sr. Bridge Engr. (*)																																					25.0
	2 - Sr. Highway Engr.																																					52.0
	2 - Sr. Bridge Engr.																																					52.0
	6 - Resident Engr.																																					184.0
	6 - Material Engr.																																					184.0
	6 - Quantity Engr.																																					184.0
	Environmental Specialist																																					8.0
	Sub-total																																					**786.0**
SUPPORT STAFF	12 - Inspector																																					368.0
	6 - CAD Operator																																					184.0
	6 - Secretary																																					184.0
	6 - Encoder																																					184.0
	6 - Copy Mach. Operator																																					184.0
	Sub-total																																					**1,104.0**

Note: (*) Foreign Expatriate

CONSTRUCTION SUPERVISION STAGE

PHASE II OF INITIAL STAGE

		Unit	Unit Price (JPY/PHP)	Quantity	Amount (JPY/PHP)
A.	**Foreign Currency Component (JPY)**				
A-1	**Remuneration**				
	1) Professional (A)	M/M	2,500,000	86.0	215,000,000
	2) Professional (B)	M/M	350,000	700.0	245,000,000
A-2	***Reimbursable Cost***				
	1) International Travel	RT	200,000	3.0	600,000
	2) International Communication	Months	50,000	36.0	1,800,000
	3) Subsistence Allowance	M/M	200,000	86.0	17,200,000
	4) Vehicle Rental	Veh/Mo.	160,000	72.0	11,520,000
	5) Office Rental / Maintenance	Months	150,000	36.0	5,400,000
	6) Office Equipment / Supply	Months	300,000	36.0	10,800,000
	7) Printing Cost	Months	350,000	36.0	12,600,000
	8) Environmental Survey	L.S.	0	0	8,000,000
	Sub-total				**527,920,000**
B.	**Local Currency Portion (PHP)**				
B-1	**Remuneration**				
	1) Support Staff	M/M	35,000	1104.0	38,640,000
B-2	**Reimbursable Cost**				
	1) Field Allowance	M/M	20,000	700.0	14,000,000
	Sub-total				**52,640,000**
Base Cost Total in JPY					**648,992,000**
	(in PHP)				(282,170,000)
Value Added Tax in PHP					**14,516,000**
				PHP	**296,686,000**

Exchange Rate : PHP 1 = JPY 2.30

VAT includes 10% of Remuneration of Professional (B) and Support Staff, and 10% of survey cost.

PROPOSED MANNING SCHEDULE : REVIEW OF D/D AND PRE-CONSTRUCTION STAGE
ULTIMATE STAGE

	Position	Month																		Man-Month
		1	2	3	4	5	6	7	8	9	10	11	12	11	12	13	14	15	16	17	18	
KEY STAFF	Project Manager (*)																					10.0
	Deputy Proj. Manager																					18.0
	Sr. Highway Engr.																					6.0
	Sr. Bridge Engr.																					6.0
	Sr. Drainage Engr.																					6.0
	Highway Engr.																					6.0
	Bridge Engr.																					6.0
	Sr. Cost Estimator																					7.0
	Tender Document Spec.																					5.0
	Sub-total																					**70.0**
SUPPORT STAFF	Secretary																					18.0
	Encoder																					18.0
	Copy Machine Operator																					18.0
	6-CAD Operator																					36.0
	Sub-total																					**90.0**

Note: (*) Foreign Expatriate

PRE-CONSTRUCTION STAGE

ULTIMATE STAGE

		Unit	Unit Price (JPY/PHP)	Quantity	Amount (JPY/PHP)
A.	**Foreign Currency Component (JPY)**				
A-1	**Remuneration**				
1)	Professional (A)	M/M	2,500,000	10.0	25,000,000
2)	Professional (B)	M/M	350,000	60.0	21,000,000
A-2	**Reimbursable Cost**				
1)	International Travel	RT	200,000	4.0	800,000
2)	International Communication	Months	50,000	18.0	900,000
3)	Subsistence Allowance	M/M	200,000	10.0	2,000,000
4)	Vehicle Rental	Veh/Mo.	160,000	18.0	2,880,000
5)	Office Rental / Maintenance	Months	200,000	18.0	3,600,000
6)	Office Equipment / Supply	Months	300,000	18.0	5,400,000
7)	Printing Cost	Months	350,000	18.0	6,300,000
	Sub-total				**67,880,000**
B.	**Local Currency Portion (PHP)**				
B-1	***Remuneration***				
1)	Support Staff	M/M	35,000	90.0	3,150,000
B-2	**Reimbursable Cost**				
1)	Field Allowance	M/M	20,000	12.0	240,000
	Sub-total				**3,390,000**
Base Cost Total in JPY					**75,677,000**
	(in PHP)				(32,903,000)
Value Added Tax in PHP					**1,228,000**
				PHP	**34,131,000**

Exchange Rate : PHP 1 = JPY 2.30

VAT includes 10% of Remuneration of Professional (B) and Support Staff, and 10% of survey cost.

PROPOSED MANNING SCHEDULE : CONSTRUCTION SUPERVISION STAGE
ULTIMATE STAGE

	Position	Year 1												Year 2												Year 3												Man-Month
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
KEY STAFF	Project Manager (*)																																					36.0
	Deputy Proj. Manager																																					36.0
	Sr. Highway Engr. (*)																																					27.0
	Sr. Bridge Engr. (*)																																					27.0
	2 - Sr. Highway Engr.																																					58.0
	2 - Sr. Bridge Engr.																																					58.0
	6 - Resident Engr.																																					204.0
	6 - Material Engr.																																					204.0
	6 - Quantity Engr.																																					204.0
	Environmental Specialist																																					8.0
	Sub-total																																					**862.0**
SUPPORT STAFF	12 - Inspector																																					408.0
	6 - CAD Operator																																					204.0
	6 - Secretary																																					204.0
	6 - Encoder																																					204.0
	6 - Copy Mach. Operator																																					204.0
	Sub-total																																					**1,224.0**

Note: (*) Foreign Expatriate

CONSTRUCTION SUPERVISION STAGE

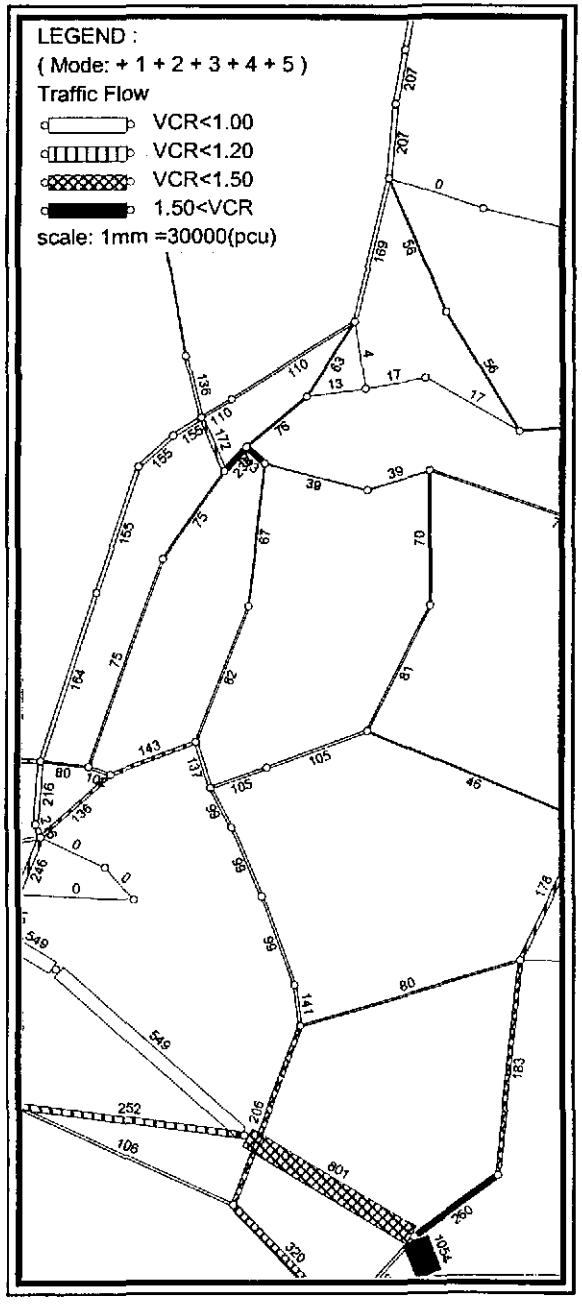
ULTIMATE STAGE

		Unit	Unit Price (JPY/PHP)	Quantity	Amount (JPY/PHP)
A.	**Foreign Currency Component (JPY)**				
A-1	**Remuneration**				
1)	Professional (A)	M/M	2,500,000	90.0	225,000,000
2)	Professional (B)	M/M	350,000	772.0	270,200,000
A-2	**Reimbursable Cost**				
1)	International Travel	RT	200,000	3.0	600,000
2)	International Communication	Months	50,000	36.0	1,800,000
3)	Subsistence Allowance	M/M	200,000	90.0	18,000,000
4)	Vehicle Rental	Veh/Mo.	160,000	72.0	11,520,000
5)	Office Rental / Maintenance	Months	150,000	36.0	5,400,000
6)	Office Equipment / Supply	Months	300,000	36.0	10,800,000
7)	Printing Cost	Months	350,000	36.0	12,600,000
8)	Environmental Survey	L.S.	0	0	8,000,000
	Sub-total				**563,920,000**
B.	**Local Currency Portion (PHP)**				
B-1	**Remuneration**				
1)	Support Staff	M/M	35,000	1224.0	42,840,000
B-2	**Reimbursable Cost**				
1)	Field Allowance	M/M	20,000	760.0	15,200,000
	Sub-total				**58,040,000**
Base Cost Total in JPY					**697,412,000**
	(in PHP)				(303,223,000)
Value Added Tax in PHP					**16,032,000**
				PHP	**319,255,000**

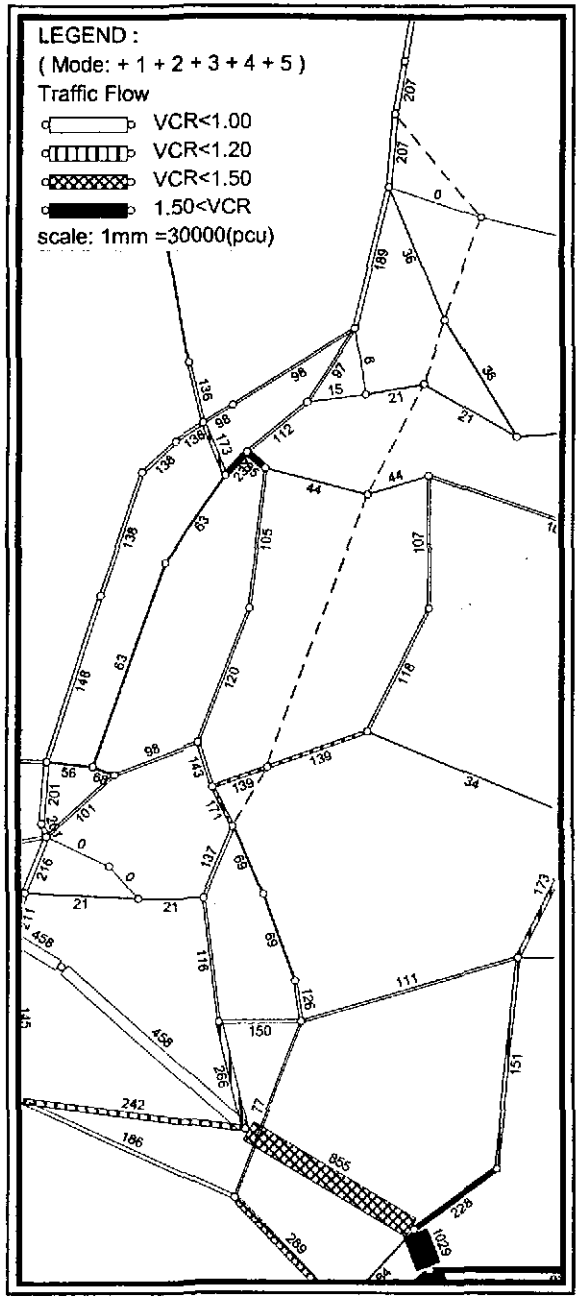
Exchange Rate : PHP 1 = JPY 2.30
VAT includes 10% of Remuneration of Professional (B) and Support Staff, and 10% of survey cost.

APPENDIX 17.1-1

Link Traffic Volume



PLARIDEL BYPASS
Year 2005, Without Bypass



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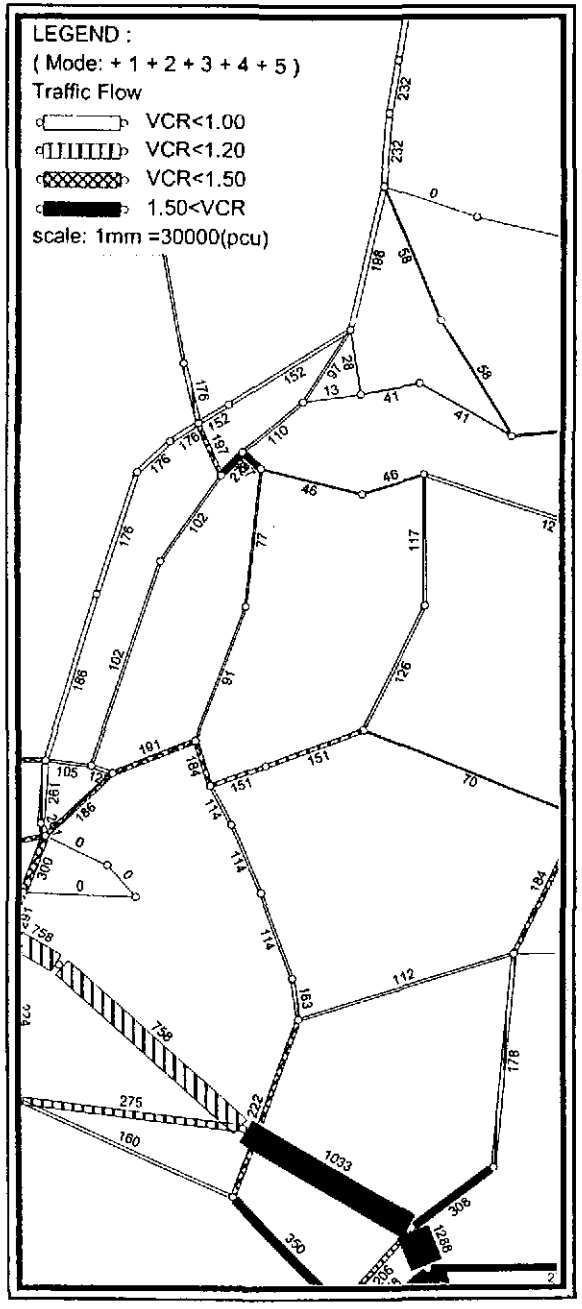
Year 2005, Initial Stage, Phase 1



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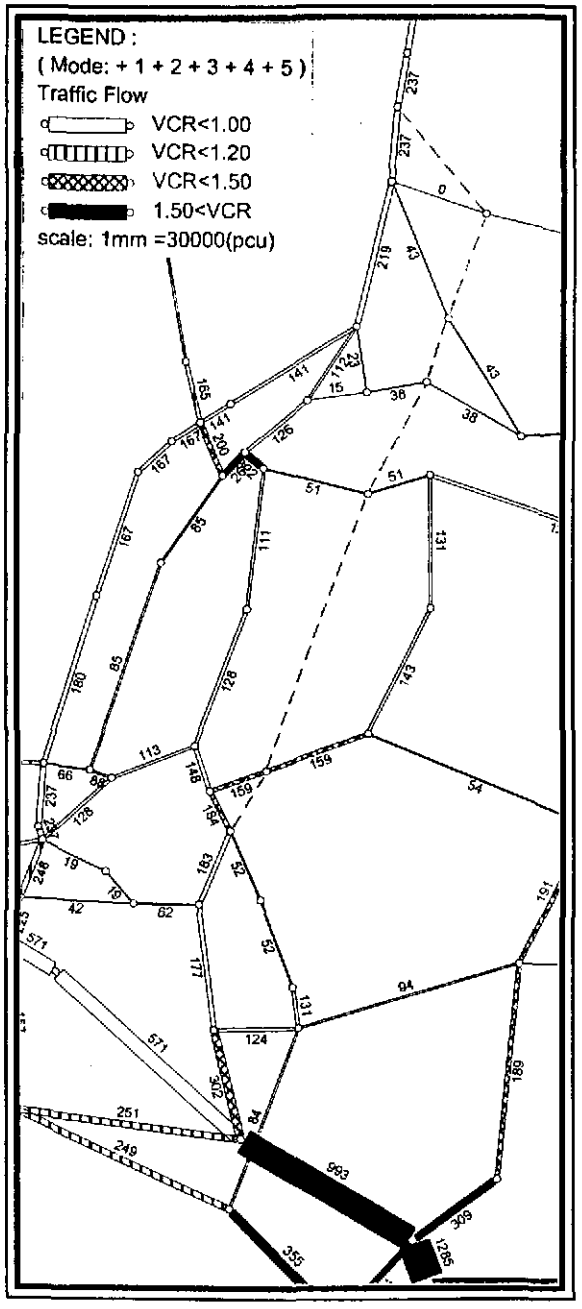

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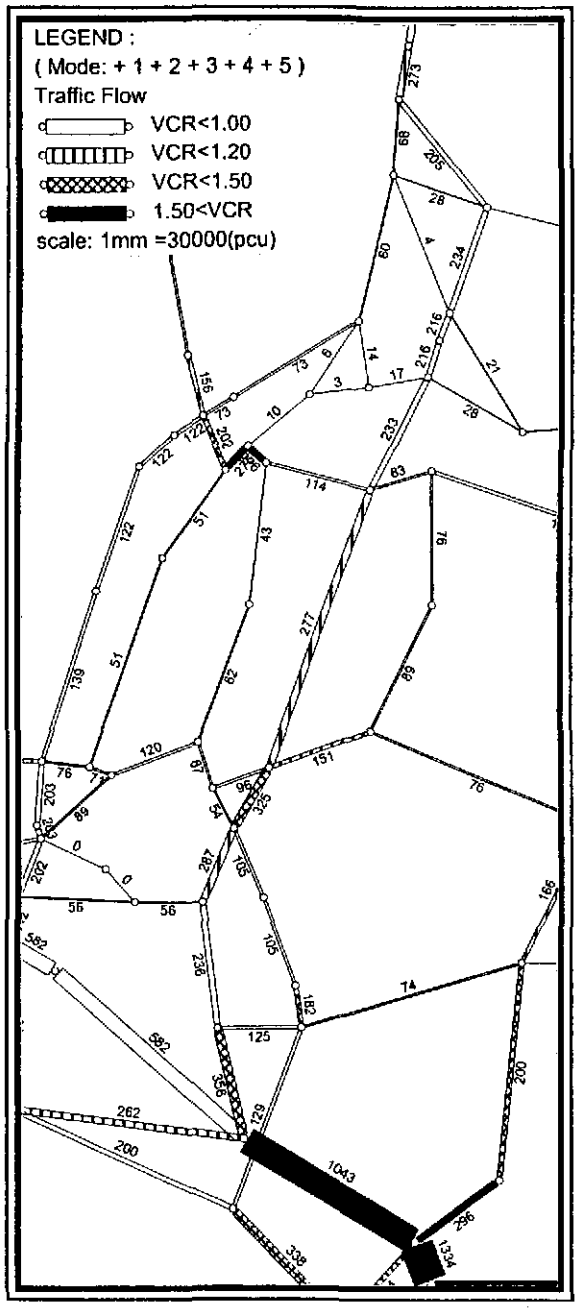

PLARIDEL BYPASS
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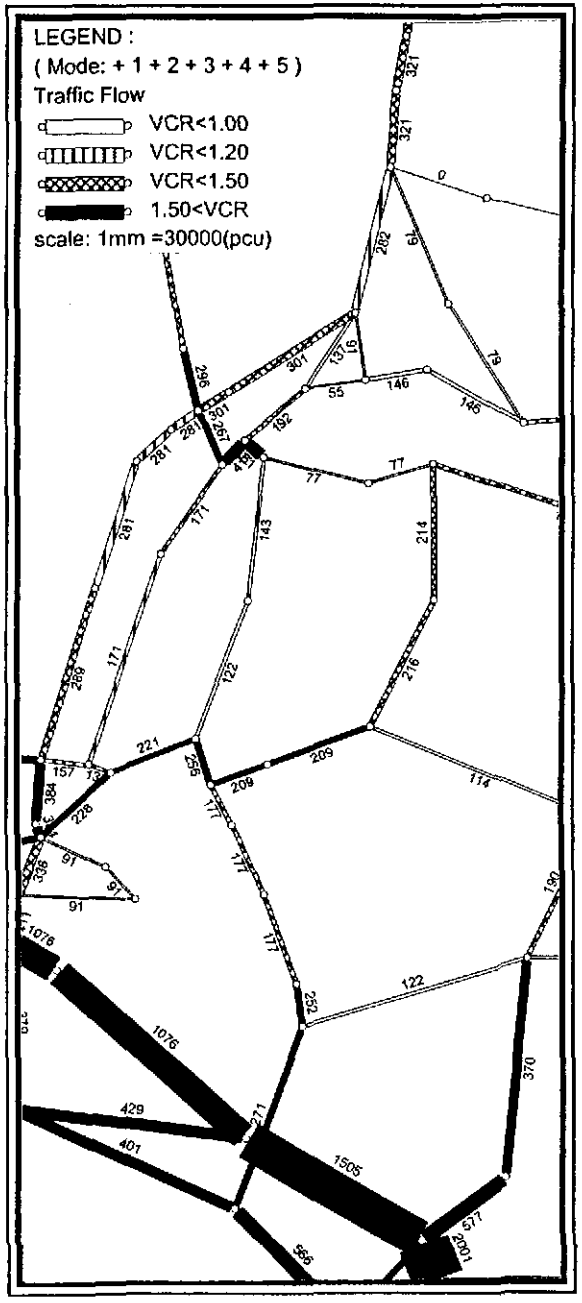
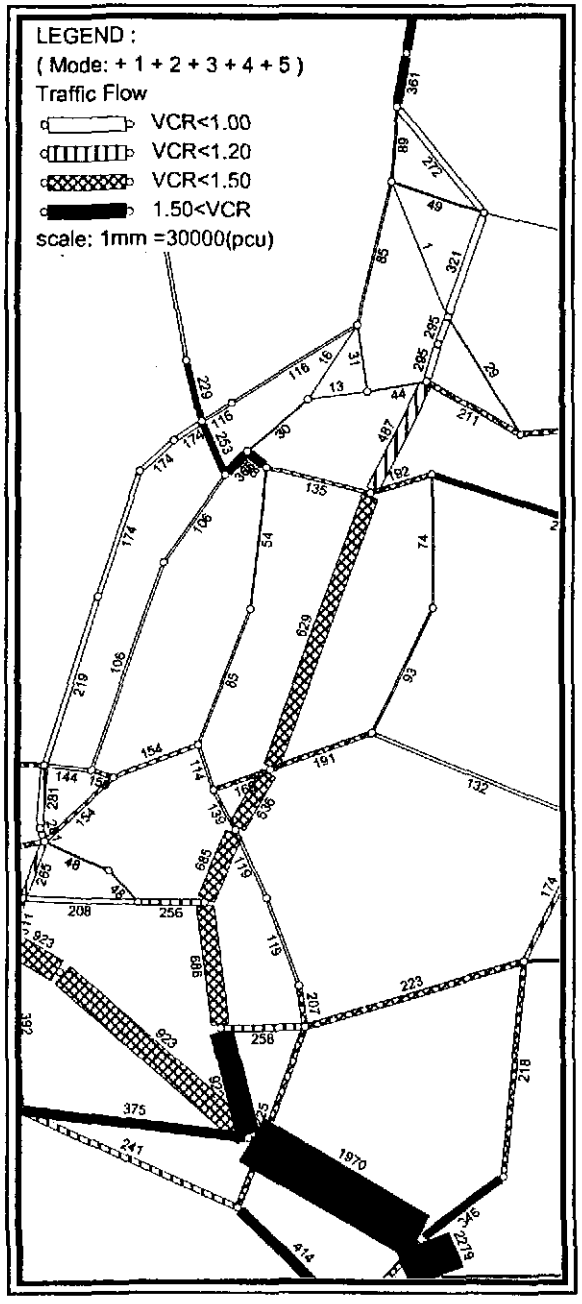
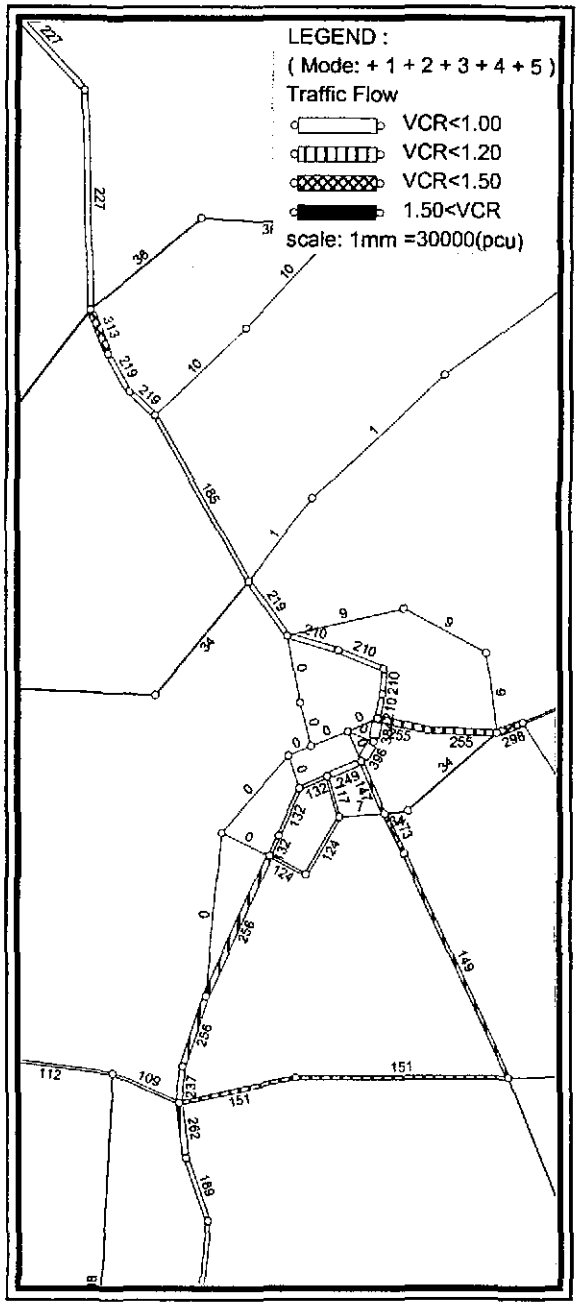


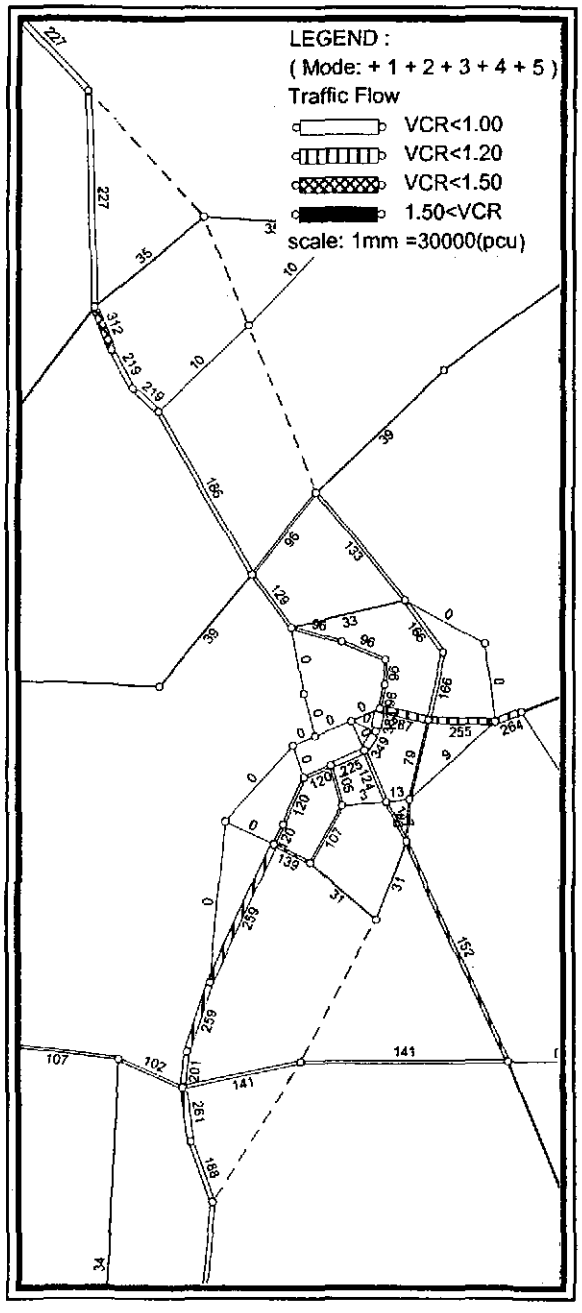
PLARIDEL BYPASS
Year 2020, Without Bypass



PLARIDEL BYPASS
Year 2020, Ultimate Stage



CABANATUAN BYPASS
Year 2005, Without Bypass



CABANATUAN BYPASS
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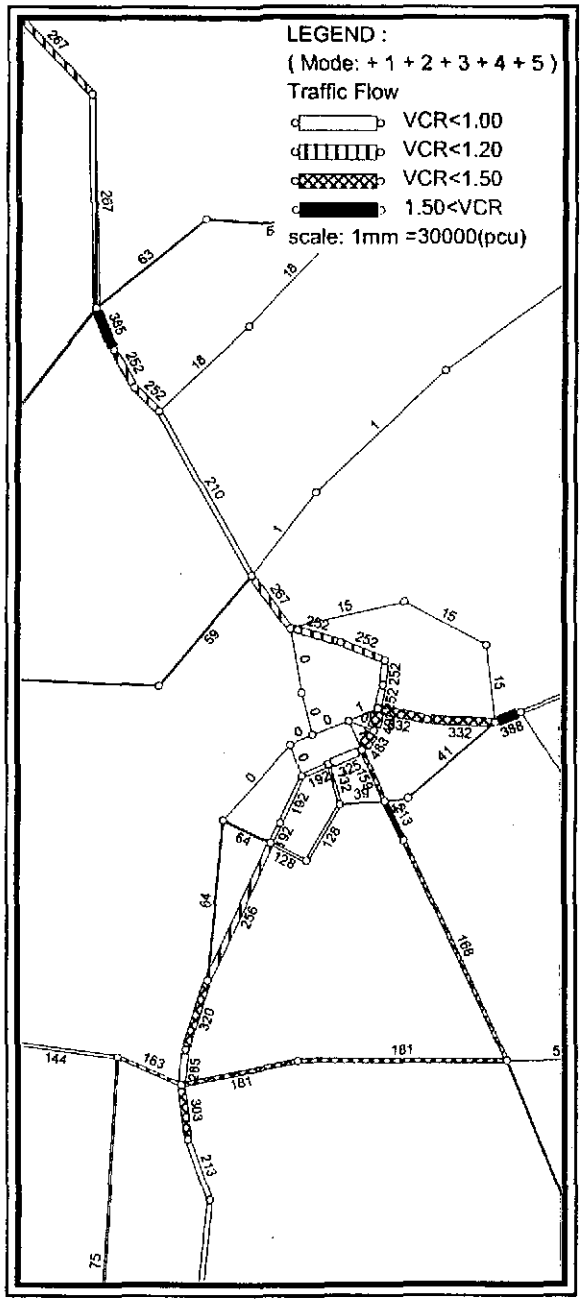

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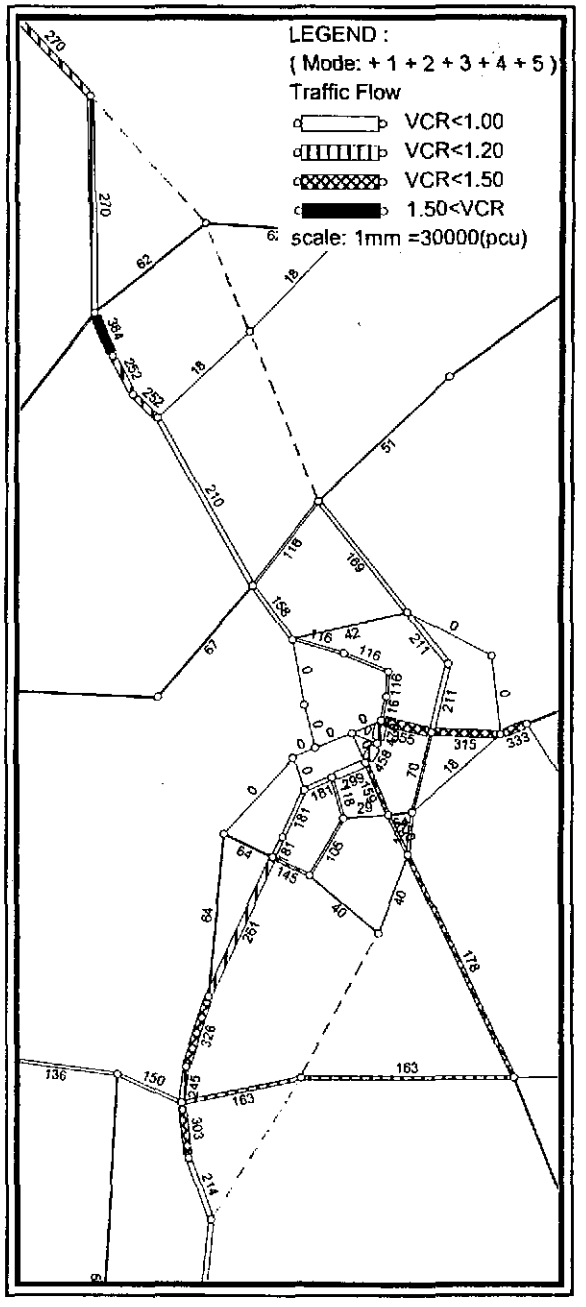
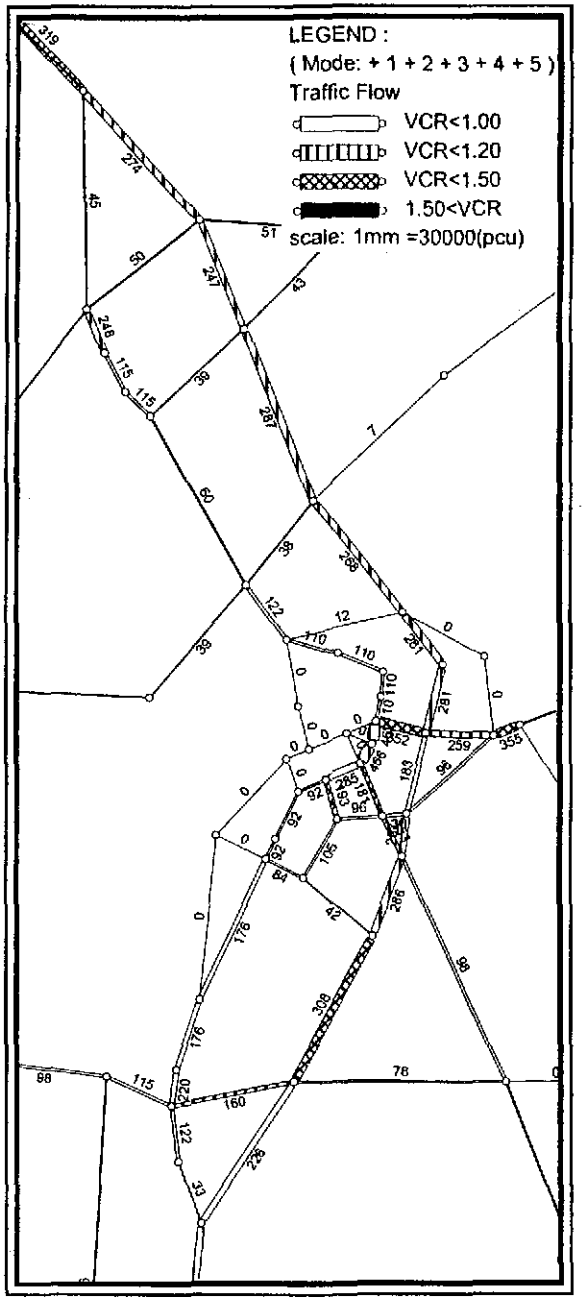
Year 2010, Without Bypass



CABANATUAN BYPASS
Year 2010, Initial Stage, Phase 1



CABANATUAN BYPASS
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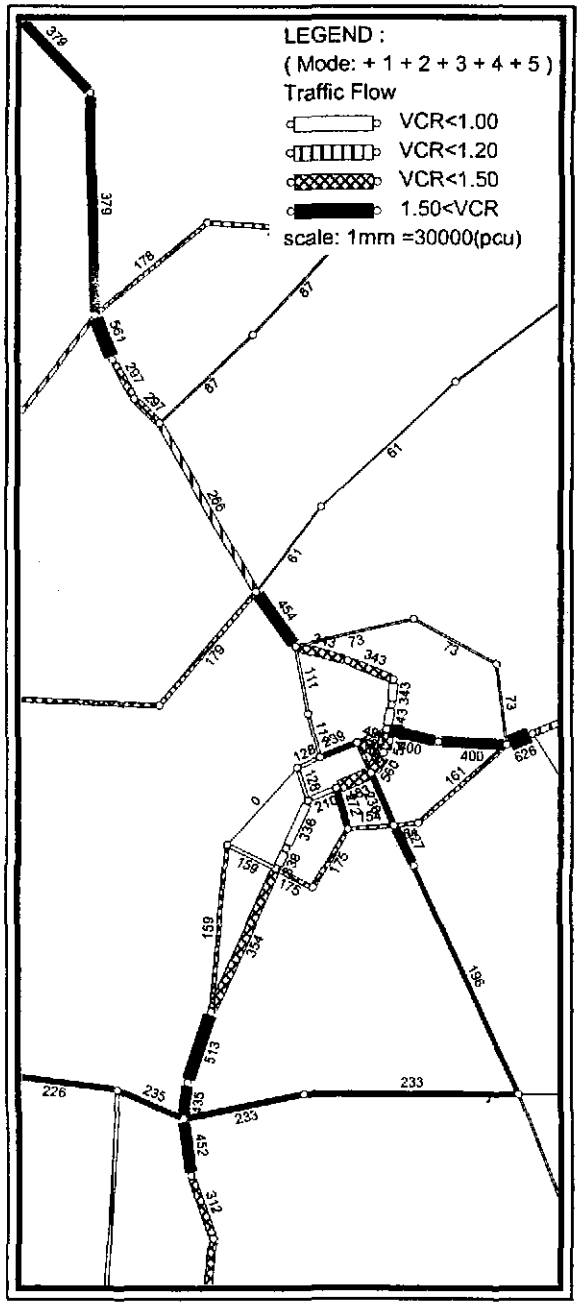
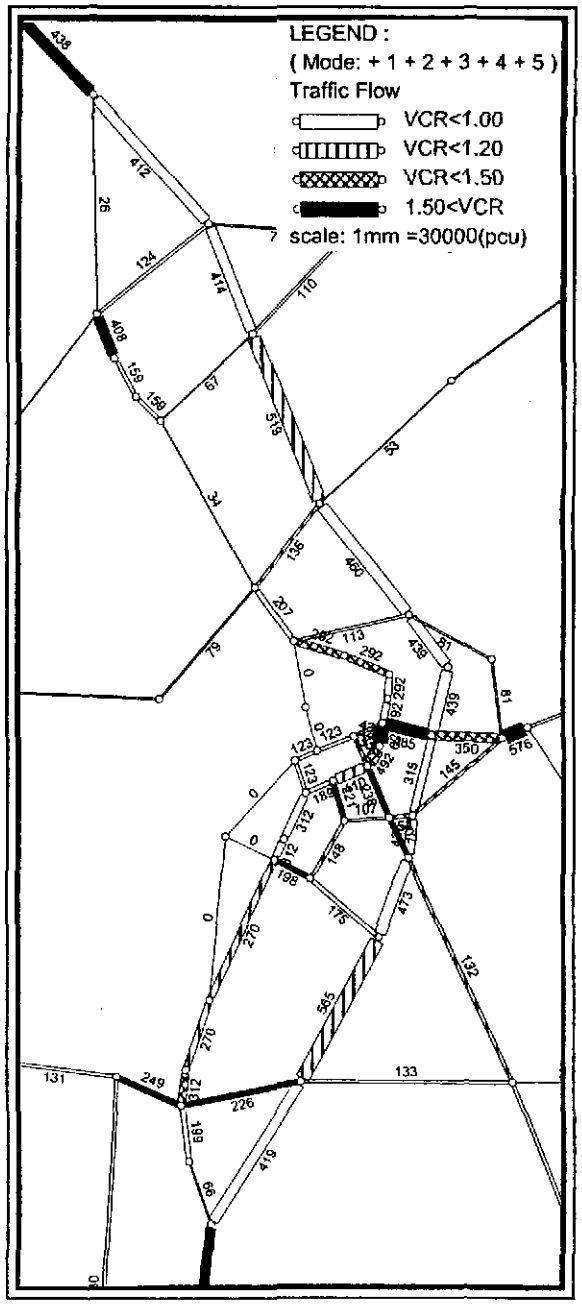
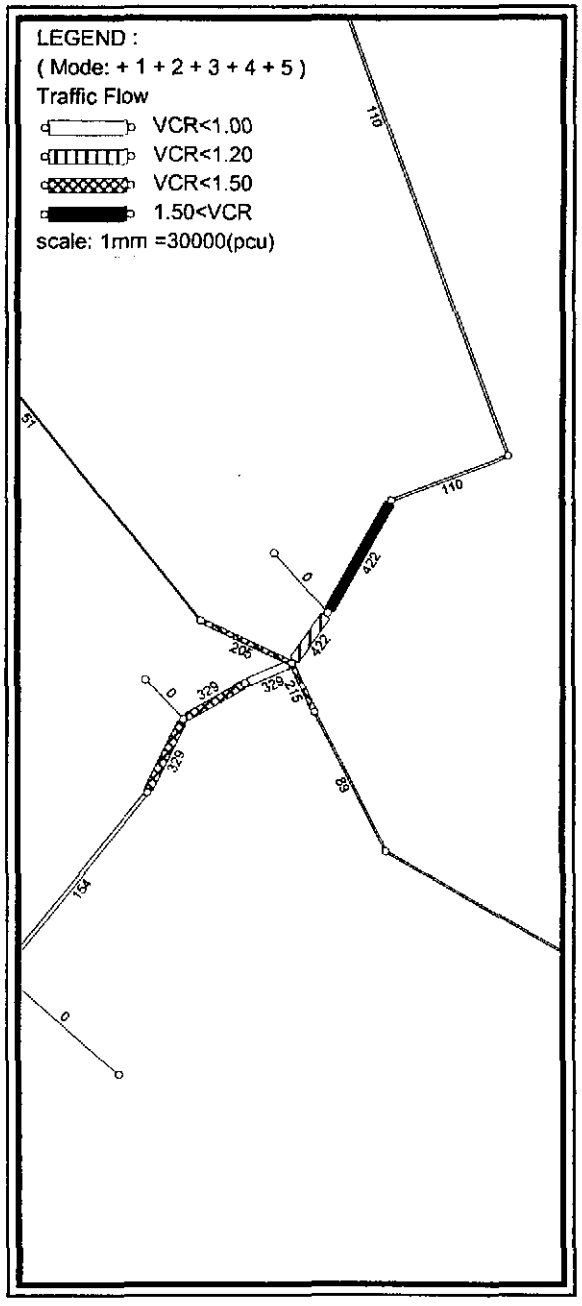


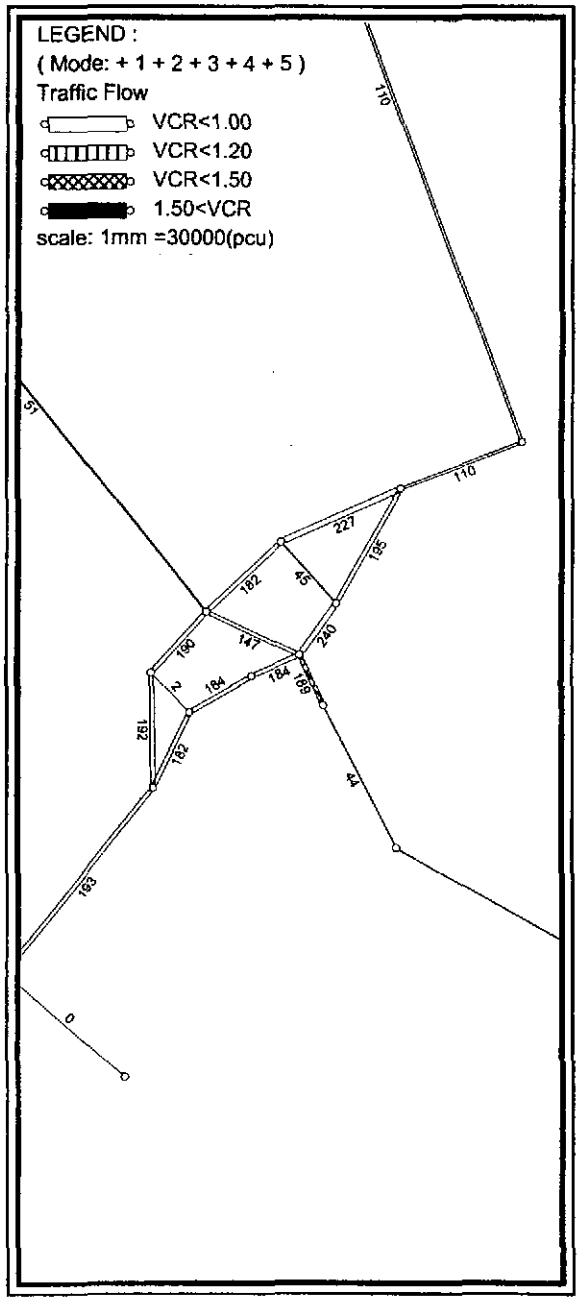
CABANATUAN BYPASS
Year 2020, Without Bypass



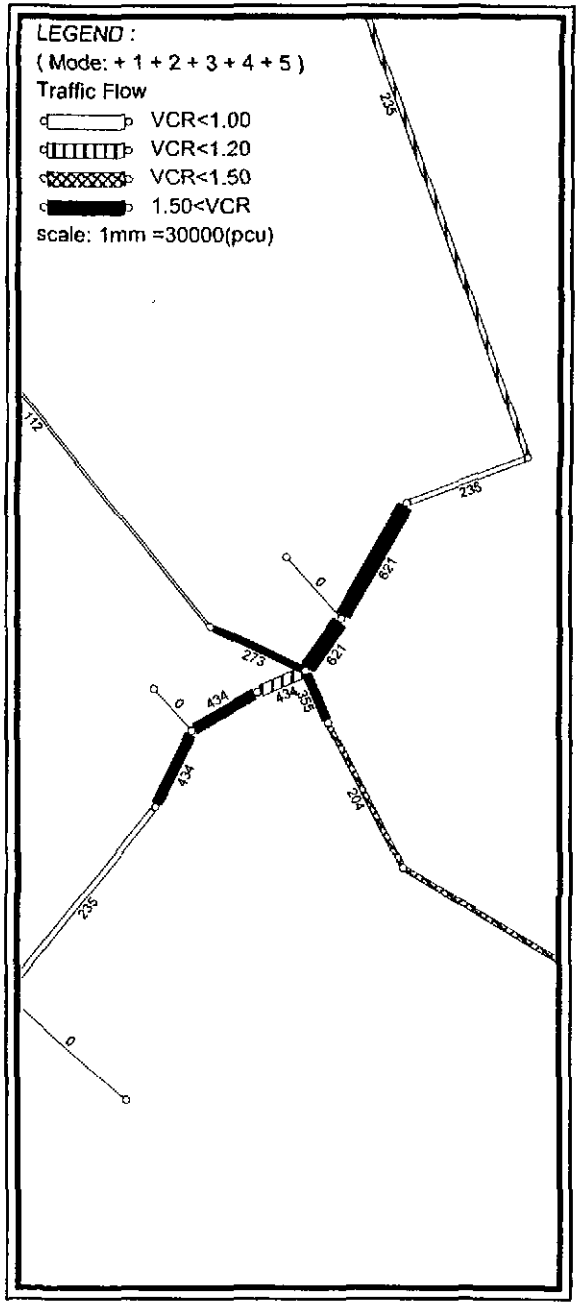
CABANATUAN BYPASS
Year 2020, Ultimate Stage



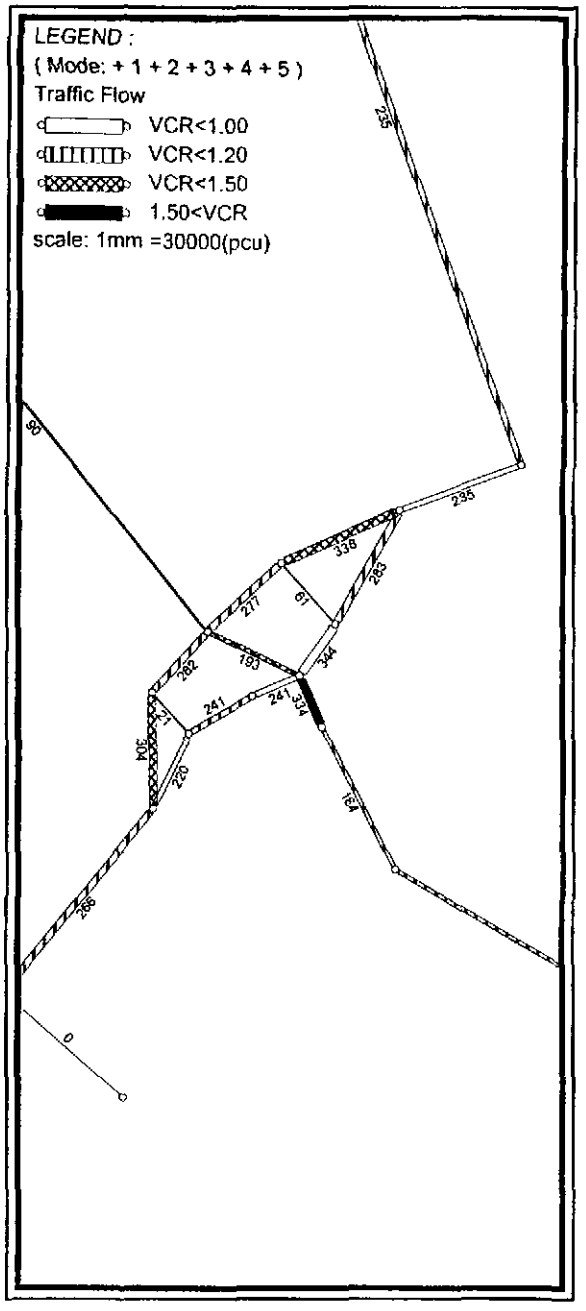
SAN JOSE BYPASS
Year 2010, Without Bypass



SAN JOSE BYPASS
Year 2010, Initial Stage, Phase 2



SAN JOSE BYPASS
Year 2020, Without Bypass



SAN JOSE BYPASS
Year 2020, Ultimate Stage

APPENDIX 17.1-2

Cost Benefit Stream

Cost - Benefit Analysis, Plaridel Bypass

Base Case

Year	Cash Flow Totals						Discount at 15%	
	Cost	*Benefit*				*Net Total*	*Discounted Cost*	*Discounted Benefit*
		VOCD (Running)	VOCT (Fixed)	TTC	Total			
2004	(71,360,000.00)					(71,360,000.00)	(71,360,000.00)	0.00
2005	(71,360,000.00)					(71,360,000.00)	(62,052,173.91)	0.00
2006	(317,197,300.00)					(317,197,300.00)	(239,846,729.68)	0.00
2007	(362,484,200.00)					(362,484,200.00)	(238,339,245.50)	0.00
2008	(452,006,300.00)					(452,006,300.00)	(258,436,069.05)	0.00
2009	(550,780,600.00)	123,735,316.29	347,380,495.75	308,620,910.61	779,736,722.66	228,956,122.66	(273,835,300.57)	387,666,958.16
2010	(601,584,900.00)	151,817,254.81	518,696,011.73	490,398,312.84	1,160,911,579.38	559,326,679.38	(260,081,753.55)	501,894,112.18
2011	0.00	128,690,904.06	499,792,885.30	486,304,355.64	1,114,788,145.00	1,114,788,145.00	0.00	419,090,155.37
2012	0.00	105,564,553.31	480,889,758.87	482,210,398.44	1,068,664,710.62	1,068,664,710.62	0.00	349,348,389.55
2013	(445,285,000.00)	82,438,202.56	461,986,632.44	478,116,441.23	1,022,541,276.24	577,256,276.24	(126,577,788.15)	290,670,049.59
2014	(445,285,000.00)	59,311,851.81	443,083,506.01	474,022,484.03	976,417,841.85	531,132,841.85	(110,067,641.87)	241,355,557.29
2015	(445,370,300.00)	41,518,296.27	310,158,454.21	331,815,738.82	683,492,489.30	238,122,189.30	(95,729,327.58)	146,912,078.35
2016	0.00	35,068,085.81	1,022,282,683.91	1,104,351,826.84	2,161,702,596.56	2,161,702,596.56	0.00	404,037,671.87
2017	0.00	(29,053,607.31)	1,025,035,313.99	1,160,011,368.17	2,155,993,074.85	2,155,993,074.85	0.00	350,409,149.08
2018	0.00	(93,175,300.44)	1,027,787,944.07	1,215,670,909.50	2,150,283,553.14	2,150,283,553.14	0.00	303,896,688.86
2019	0.00	(157,296,993.56)	1,030,540,574.16	1,271,330,450.84	2,144,574,031.43	2,144,574,031.43	0.00	263,556,321.58
2020	0.00	(221,418,686.68)	1,033,293,204.24	1,326,989,992.17	2,138,864,509.72	2,138,864,509.72	0.00	228,569,263.34
2021	0.00	(304,102,255.85)	979,400,537.31	1,312,946,921.54	1,988,245,203.00	1,988,245,203.00	0.00	184,759,448.53
2022	0.00	(386,785,825.03)	925,507,870.38	1,298,903,850.91	1,837,625,896.27	1,837,625,896.27	0.00	148,489,579.04
2023	0.00	(469,469,394.20)	871,615,203.45	1,284,860,780.29	1,687,006,589.55	1,687,006,589.55	0.00	118,538,059.18
2024	0.00	(552,152,963.37)	817,722,536.53	1,270,817,709.66	1,536,387,282.82	1,536,387,282.82	0.00	93,873,691.54
2025	0.00	(634,836,532.54)	763,829,869.60	1,256,774,639.04	1,385,767,976.10	1,385,767,976.10	0.00	73,626,791.21
2026	0.00	(717,520,101.71)	709,937,202.67	1,242,731,568.41	1,235,148,669.37	1,235,148,669.37	0.00	57,064,596.02
2027	0.00	(800,203,670.88)	656,044,535.74	1,228,688,497.79	1,084,529,362.64	1,084,529,362.64	0.00	43,570,343.77
2028	0.00	(882,887,240.05)	602,151,868.81	1,214,645,427.16	933,910,055.92	933,910,055.92	0.00	32,625,477.99
	(3,762,713,600.00)	(8,879,142,758.62)	16,396,817,895.14	23,958,363,586.32	31,476,038,722.83	27,713,325,122.83	(1,736,326,029.87)	**4,639,954,382.50**
					IRR =	**37.54%**		
					NPV @ 15% =	**2,903,628,352.64**		
					B/C =	**2.67**		

Cost - Benefit Analysis, Cabanatuan Bypass

Base Case

Year	Cash Flow Totals						Discount at 15%	
	Cost	Benefit				Net Total	Discounted Cost	Discounted Benefit
		VOCD (Running)	VOCT (Fixed)	TTC	Total			
2004	(95,090,000.00)					(95,090,000.00)	(95,090,000.00)	0.00
2005	(95,090,000.00)					(95,090,000.00)	(82,686,956.52)	0.00
2006	(468,020,100.00)					(468,020,100.00)	(353,890,434.78)	0.00
2007	(562,822,100.00)					(562,822,100.00)	(370,064,666.72)	0.00
2008	(694,917,400.00)					(694,917,400.00)	(397,321,278.87)	0.00
2009	(507,560,300.00)	(211,047,569.80)	165,838,445.56	340,952,064.46	295,742,940.22	(211,817,359.78)	(252,347,172.92)	147,036,509.51
2010	(507,560,300.00)	(253,257,083.75)	199,006,134.67	409,142,477.35	354,891,528.26	(152,668,771.74)	(219,432,324.28)	153,429,401.22
2011	0.00	(62,392,341.93)	489,476,568.22	1,142,599,318.74	1,569,683,545.03	1,569,683,545.03	0.00	590,102,185.53
2012	0.00	(59,809,890.33)	544,365,336.99	1,303,392,223.00	1,787,947,671.66	1,787,947,671.66	0.00	584,483,265.41
2013	(590,284,500.00)	(57,227,438.72)	599,254,109.76	1,464,185,127.26	2,006,211,798.29	1,415,927,298.29	(167,795,695.76)	570,290,604.85
2014	(590,284,500.00)	(54,644,987.12)	654,142,880.53	1,624,978,031.52	2,224,475,924.92	1,634,191,424.92	(145,909,300.66)	549,856,427.78
2015	(590,369,800.00)	(143,748,927.54)	1,053,625,801.76	2,535,832,554.68	3,445,709,428.90	2,855,339,628.90	(126,895,987.41)	740,631,889.19
2016	0.00	(135,847,516.49)	1,142,907,620.88	2,774,181,160.06	3,781,441,264.44	3,781,441,264.44	0.00	706,778,410.34
2017	0.00	(127,546,105.45)	1,232,189,440.00	3,012,529,765.43	4,117,173,099.98	4,117,173,099.98	0.00	669,155,731.25
2018	0.00	(119,444,694.41)	1,321,471,259.12	3,250,878,370.81	4,452,904,935.53	4,452,904,935.53	0.00	629,323,078.68
2019	0.00	(111,343,283.36)	1,410,753,078.25	3,489,226,976.18	4,788,636,771.07	4,788,636,771.07	0.00	588,497,050.82
2020	0.00	(103,241,872.32)	1,500,034,897.37	3,727,575,581.56	5,124,368,606.61	5,124,368,606.61	0.00	547,614,471.23
2021	0.00	48,516,048.86	1,684,450,946.70	4,004,545,606.04	5,737,512,601.60	5,737,512,601.60	0.00	533,163,446.15
2022	0.00	200,273,970.03	1,868,866,996.04	4,281,515,630.53	6,350,656,596.60	6,350,656,596.60	0.00	513,165,561.37
2023	0.00	352,031,891.21	2,053,283,045.37	4,558,485,655.01	6,963,800,591.59	6,963,800,591.59	0.00	489,313,682.43
2024	0.00	503,789,812.38	2,237,699,094.71	4,835,455,679.50	7,576,944,586.59	7,576,944,586.59	0.00	462,953,427.76
2025	0.00	655,547,733.55	2,422,115,144.05	5,112,425,703.98	8,190,088,581.58	8,190,088,581.58	0.00	435,144,953.81
2026	0.00	807,305,654.73	2,606,531,193.38	5,389,395,728.47	8,803,232,576.58	8,803,232,576.58	0.00	406,714,530.06
2027	0.00	959,063,575.90	2,790,947,242.72	5,666,365,752.95	9,416,376,571.57	9,416,376,571.57	0.00	378,297,516.32
2028	0.00	1,110,821,497.07	2,975,363,292.05	5,943,335,777.44	10,029,520,566.56	10,029,520,566.56	0.00	350,374,107.73
	(4,701,999,000.00)	9,158,863,672.53	42,897,936,191.70	91,410,042,539.55	129,995,320,726.48	125,293,321,726.48	(2,211,433,817.92)	**10,046,326,251.42**
						IRR =	**38.05%**	
						NPV @ 15% =	**7,834,892,433.50**	
						B/C =	**4.54**	

Cost - Benefit Analysis, San Jose Bypass

Base Case

Year	Cash Flow Totals						Discount at 15%	
	Cost	Benefit				Net Total	Discounted Cost	Discounted Benefit
		VOCD (Running)	VOCT (Fixed)	TTC	Total			
2004	0.00					0.00	0.00	0.00
2005	0.00					0.00	0.00	0.00
2006	(24,815,000.00)					(24,815,000.00)	(18,763,705.10)	0.00
2007	(24,815,000.00)					(24,815,000.00)	(16,316,265.31)	0.00
2008	(40,888,100.00)					(40,888,100.00)	(23,377,903.88)	0.00
2009	(180,029,000.00)					(180,029,000.00)	(89,506,230.48)	0.00
2010	(188,219,800.00)					(188,219,800.00)	(81,372,613.64)	0.00
2011	0.00	96,353,492.46	217,562,139.25	406,869,701.40	720,785,333.12	720,785,333.12	0.00	270,969,904.55
2012	0.00	105,069,633.37	229,646,178.65	435,383,810.10	770,099,622.12	770,099,622.12	0.00	251,746,932.51
2013	0.00	113,785,774.28	241,730,218.04	463,897,918.80	819,413,911.12	819,413,911.12	0.00	232,928,574.83
2014	(122,834,900.00)	122,501,915.19	253,814,257.43	492,412,027.50	868,728,200.12	745,893,300.12	(30,362,908.66)	214,736,324.85
2015	(122,834,900.00)	134,579,068.18	270,172,907.15	527,695,606.94	932,447,582.28	809,612,682.28	(26,402,529.27)	200,423,288.35
2016	0.00	136,212,156.92	281,934,415.00	558,212,070.98	976,358,642.90	976,358,642.90	0.00	182,488,411.50
2017	0.00	137,845,245.66	293,695,922.84	588,728,535.02	1,020,269,703.53	1,020,269,703.53	0.00	165,822,350.18
2018	0.00	139,478,334.40	305,457,430.68	619,244,999.07	1,064,180,764.15	1,064,180,764.15	0.00	150,399,239.25
2019	0.00	141,111,423.14	317,218,938.53	649,761,463.11	1,108,091,824.78	1,108,091,824.78	0.00	136,178,374.37
2020	0.00	142,744,511.88	328,980,446.37	680,277,927.15	1,152,002,885.40	1,152,002,885.40	0.00	123,108,523.09
2021	0.00	167,889,291.93	377,301,437.73	779,130,197.59	1,324,320,927.25	1,324,320,927.25	0.00	123,063,696.49
2022	0.00	193,034,071.98	425,622,429.09	877,982,468.03	1,496,638,969.11	1,496,638,969.11	0.00	120,936,089.85
2023	0.00	218,178,852.03	473,943,420.45	976,834,738.47	1,668,957,010.96	1,668,957,010.96	0.00	117,269,799.75
2024	0.00	243,323,632.09	522,264,411.81	1,075,687,008.92	1,841,275,052.81	1,841,275,052.81	0.00	112,502,419.33
2025	0.00	268,468,412.14	570,585,403.17	1,174,539,279.36	2,013,593,094.67	2,013,593,094.67	0.00	106,983,565.01
2026	0.00	293,613,192.19	618,906,394.53	1,273,391,549.80	2,185,911,136.52	2,185,911,136.52	0.00	100,990,381.99
2027	0.00	318,757,972.24	667,227,385.89	1,372,243,820.24	2,358,229,178.37	2,358,229,178.37	0.00	94,740,501.75
2028	0.00	343,902,752.29	715,548,377.25	1,471,096,090.68	2,530,547,220.22	2,530,547,220.22	0.00	88,402,852.21
	(704,436,700.00)	4,943,908,542.07	10,457,015,536.44	21,296,296,280.32	36,697,220,358.84	35,992,783,658.84	(286,102,156.33)	**2,793,691,229.85**
					IRR =	**76.43%**		
					NPV @ 15% =	**2,507,589,073.52**		
					B/C =	***9.76***		