JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
REPUBLIC OF THE PHILIPPINES

THE DETAILED DESIGN STUDY
ON
UPGRADING INTER-URBAN HIGHWAY SYSTEM
ALONG THE PAN-PHILIPPINE HIGHWAY
(PLARIDEL, CABANATUAN AND SAN JOSE BYPASSES)

FINAL REPORT

EXECUTIVE SUMMARY

December 2002

KATAHIRA & ENGINEERS INTERNATIONAL
YACHIYO ENGINEERING CO., LTD

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EXCHANGE RATE

23 August 2002

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Source: Central Bank of the Philippines

PREFACE

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct a Detailed Design Study on Upgrading Inter-Urban Highway System along the Pan-Philippine Highway (Plaridel, Cabanatuan and San Jose Bypasses) and entrusted the study to the Japan International Cooperation Agency (JICA).

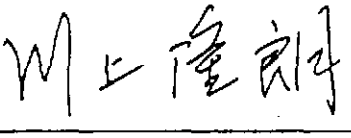
JICA selected and dispatched a study team headed by Mr. Mitsuo Kiuchi of Katahira & Engineers International, and consisting of Katahira & Engineers International and Yachiyo Engineering Co., Ltd, to the Philippines, three times between March 2001 and October 2002.

The team held discussions with the officials concerned of the Government of the Philippines and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the team.

December, 2002



TAKAO KAWAKAMI
President
Japan International Cooperation Agency

December 2002

Mr. TAKAO KAWAKAMI
President
Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

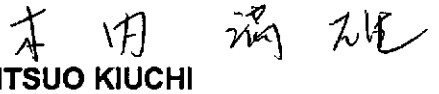
We are pleased to submit to you the Final Report of the detailed design study on Upgrading Inter-Urban Highway System along the Pan-Philippine Highway (Plaridel, Cabanatuan and San Jose Bypasses) in the Republic of the Philippines. The report reflects the advice and suggestions of the authorities concerned of the Government of Japan and your Agency.

This report presents the results of the Study which had the objectives of providing the new concept of upgrading measures for the highway system and applying it to the highway design, and carrying out a detailed design study on the three bypasses that were proposed for solving the present and future traffic congestions. This report is divided into six parts which include present condition of the project area, engineering surveys, detailed design, cost estimate, preparation of draft tender documents, project evaluation and implementation program.

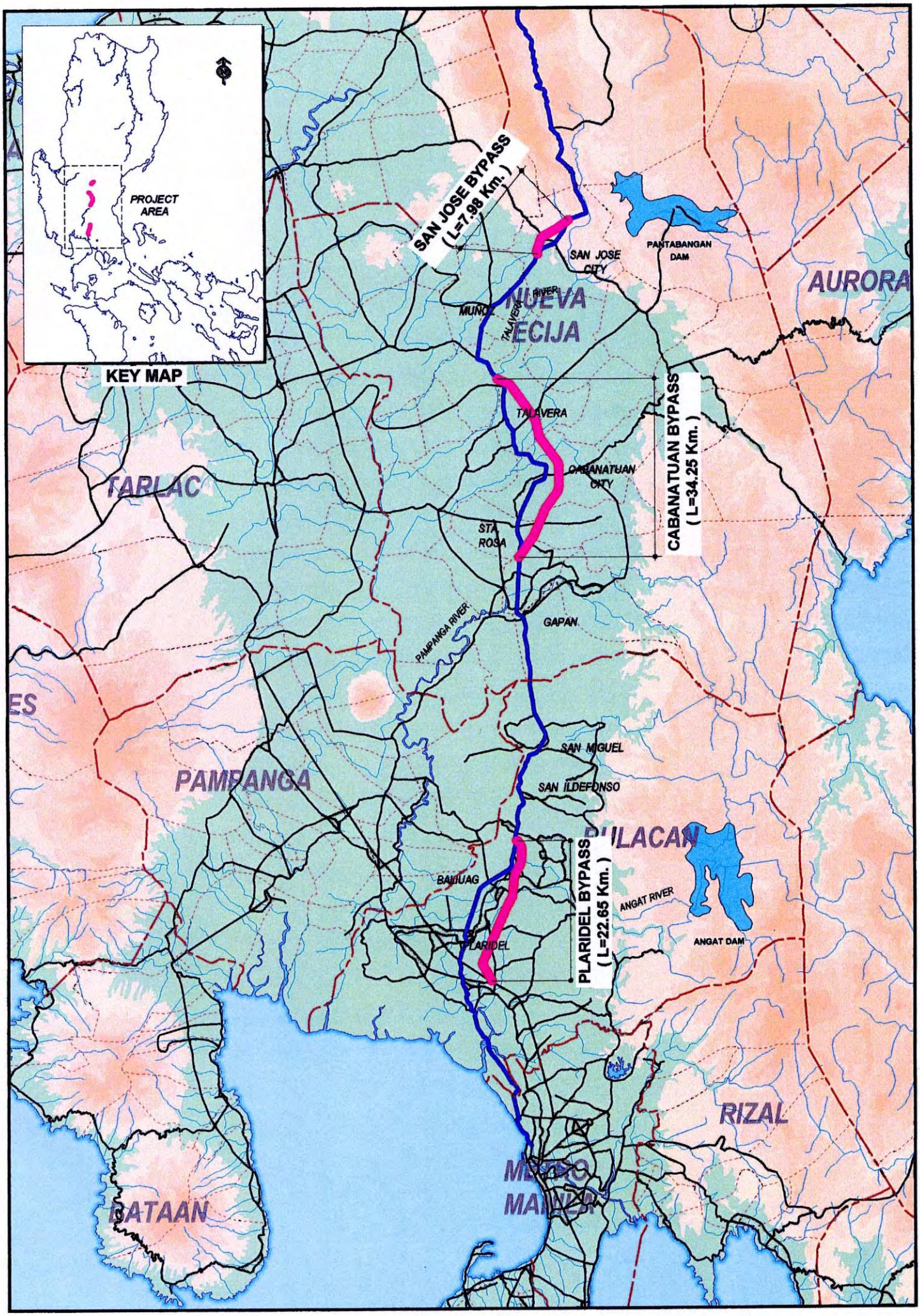
Considering the present and future traffic demand in the study area, this project is urgent and necessary for the Philippines. We recommend that the Government of the Philippines realizes this project with high priority.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Land, Infrastructure and Transport of Japan. We also wish to express our deep gratitude to the Department of Public Works and Highways and other authorities concerned of the Government of the Philippines for the close cooperation and assistance extended to us during the course of the Study.

Very truly yours,

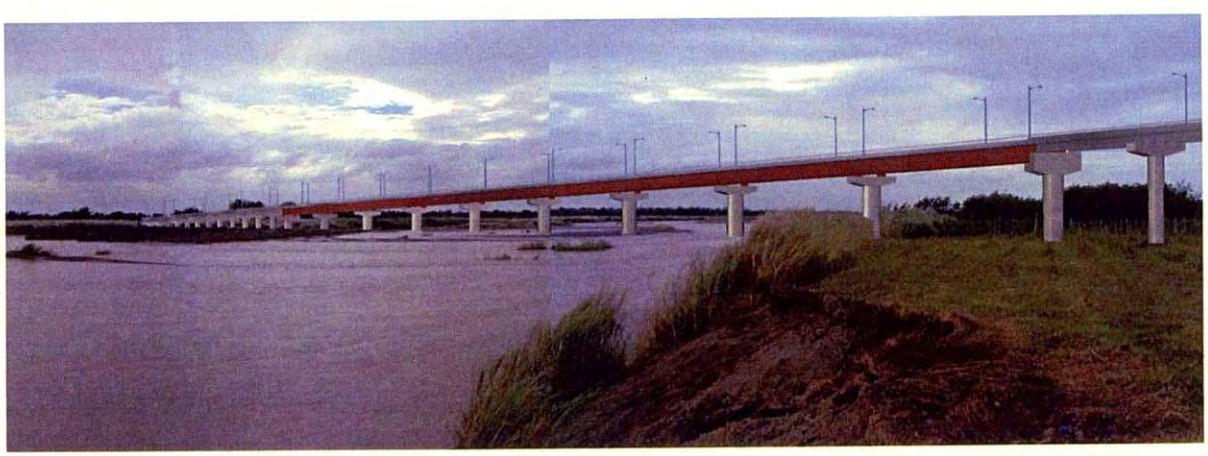


MITSUO KIUCHI
Team Leader
The Study Team for the Detailed Design
Study on Upgrading Inter-Urban Highway
System along the Pan-Philippine Highway
(Plaridel, Cabanatuan and San Jose Bypasses)



LOCATION MAP

PERSPECTIVE OF ANGAT RIVER BRIDGE



PERSPECTIVE OF PAMPANGA RIVER BRIDGE

SUMMARY

OBJECTIVES OF THE PROJECT

The Pan-Philippine Highway suffers serious traffic congestion in the urban sections, particularly in the Plaridel, Cabanatuan City and San Jose City sections in the provinces of Bulacan and Nueva Ecija of Region III. The Project aims to achieve the following by constructing bypasses at the said three sections:

- To restore the road function of the Pan-Philippine Highway,
- To provide a fast, safe, comfortable and reliable means of transportation,
- To mitigate serious traffic congestion of the exiting urban sections, and
- To improve the urban environment and amenity of the project areas

PROJECT ROADS

The project roads are the Plaridel Bypass, the Cabanatuan Bypass and the San Jose Bypass.

DESIGN POLICIES

To achieve the objectives of the project, the adopted design policies are:

- Mobility oriented highway design,
- Provisions for future urbanization along the bypass,
- Provisions of proper access roads between the urban center and the bypass,
- Appropriate measures for local traffic and its conveniences,
- Appropriate measures for communities and agricultural lands divided by the bypass,
- Preservation of the environment,
- Traffic safety, and
- Minimal adverse social impacts.

MEASURES ADOPTED IN THE DESIGN

The measures adopted in the design to reflect the design policies are:

- To adopt high geometric design standards (design speed of 80 km/hr.),
- To provide frontage roads along planned urban areas which separate through traffic from local traffic,
- To provide an appropriate distance between intersections,
- To provide new access roads,
- To provide underpass for farmers, and
- To select road alignments which will minimize relocation of the people.

SCOPE OF CIVIL WORK

	Plaridel Bypass	Cabanatuan Bypass	San Jose Bypass
Bypass Length (km)	22.65	34.25	7.98
No. of Lanes Initial	2	2	2
Ultimate	4	4	(Bike/Tricycle Road)
Road Section (km)	21.11	32.24	7.80
Bridge Section (km)	1.54	2.01	0.18
No. of Bridges	11	14	4
Section w/frontage Road	7.36	6.91	-
Interchange (n)	1	-	-
Major Intersection (n)	7	10	3
New Access Road (n,Km)	2 (3.31)	1 (2.40)	-
No. of Underpass (n)	9	19	-
No. of Cross Drainage			
RCPC (n)	104	197	47
RCBC (n)	18	12	9
Standard ROW Width (m)			
W/O frontage Road	35	35	35
W/frontage Road	50	50	-

NO. OF CONTRACT PACKAGES AND STAGE CONSTRUCTION

The number of contract packages (CP) was determined based on the construction period, construction cost, type of work, and material hauling route.

In view of the scale of the Project and the time required for the ROW acquisition, the stage construction is proposed:

Initial Stage : Construction of a 2-lane bypass
Phase I : Priority Contract Packages
Phase II : Remaining Contract Packages
Ultimate Stage: Widening to a 4-lane divided bypass

	No. of C.P.	Initial Stage		Ultimate Stage
		Phase I	Phase II	
Plaridel Bypass	4	CP-I	CP-II,III,IV	All section
Cabanatuan Bypass	4	CP-II & III	CP-I, IV	All Section
San Jose Bypass	1	-	CP I	All Section
Total	9	3 CP	6 CP	All Section

ESTIMATED PROJECT COST

Unit: Million P(2002 Prices)

Cost Item			Initial Stage Phase I	Initial Stage Phase II	Ultimate Stage
Construction Cost	Plaridel Bypass	CP-I	684.7	-	1,404.3
		CP-II	-	436.5	
		CP-III	-	700.7	
		CP-IV	-	251.9	
	Cabanatuan Bypass	CP-I	-	486.5	1,882.1
		CP-II	723.3	-	
		CP-III	734.9	-	
		CP-IV	-	818.9	
	San Jose Bypass	CP-I	-	431.9	257.0
	Sub-Total		2,142.9	3,126.4	3,543.4
ROW Acquisition			332.9	469.5	-
Consultancy Cost			234.0	327.5	353.4
Total			**2,709.8**	**3,923.4**	**3,896.8**

ECONOMIC EVALUATION

The Project is economically highly feasible.

Economic Indicator	Plaridel	Cabana-tuan	San Jose
EIRR (%)	37.5	38.1	76.4
B/C	2.67	4.54	9.76
NPV (Million P)	2,903	7,834	2,507

EFFECT OF THE PROJECT

Travel Time Reduction Unit: Minutes

		Year 2010 Plari-del	Year 2010 Cabana tuan	Year 2010 San Jose	Year 2020 Plari-del	Year 2020 Cabana tuan	Year 2020 San Jose
Travel Time	Without the Bypass	51.5	82.9	41.4	133.1	165.2	82.3
	With the Bypass						
	Pan-Phil.Highway	36.6	48.4	15.0	57.5	61.1	20.6
	Bypass Road	32.7	44.9	7.9	32.9	34.6	17.2
Travel Time Reduction							
	Pan-Phil. Highway	14.9	34.5	26.4	75.6	104.1	61.7
	Bypass Road	18.8	38.0	33.5	100.2	130.6	65.1

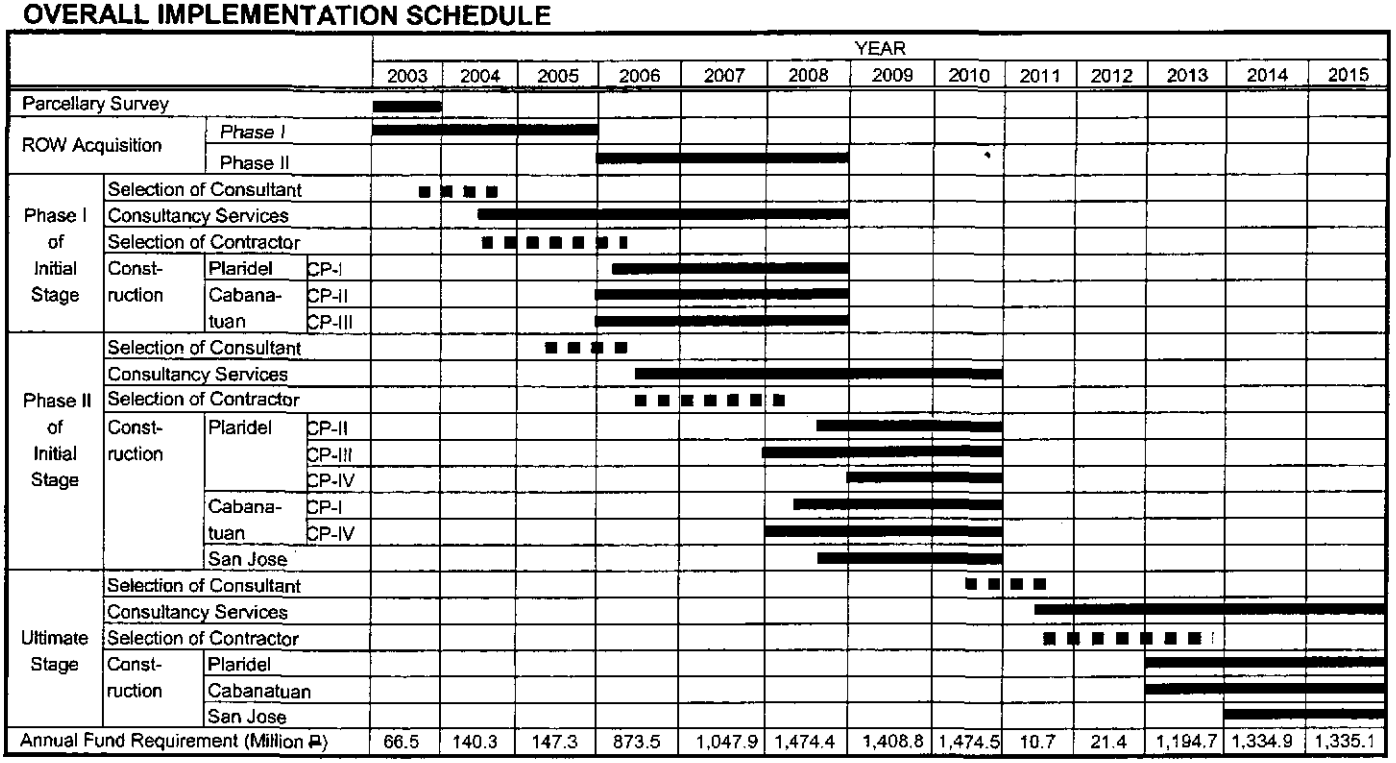
ENVIRONMENTAL IMPACT ASSESSMENT

Negative Impacts are expected in the ROW acquisition and resettlement of 327 families. However, fair land value and compensation cost should be assessed properly. Due to constant dialogue with the land owners and the affected families, the negative impact is made minimal. Other environmental impacts are evaluated to be highly positive.

RECOMMENDATIONS

- Acceleration of Project Implementation: Although the project is urgently needed, the rather prolonged implementation schedule is proposed considering the financial situation of the Government. If there is improvement, the project implementation should be accelerated.
- Early Completion of the ROW Acquisition : The ROW acquisition is the key issue for the success of this project. DPWH should expedite the ROW acquisition.
- Early Preparation of Resettlement Action Plan (RAP) : The initial RAP prepared under this Study should be detailed further during the parcellary survey which should be expedited as soon as possible.
- Task Force for the ROW Acquisition and RAP Implementation: The DPWH should organize a special task force for the ROW acquisition and RAP implementation.
- Strict Control of New Developments and Squattering within the ROW : The concerned LGUs should strictly control any new development within the ROW while the DPWH and the concerned LGUs should control squattering within the ROW.

OVERALL IMPLEMENTATION SCHEDULE



EXECUTIVE SUMMARY

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1. INTRODUCTION

1.1 Background

The road section from Sta. Rita, Plaridel to San Jose, Nueva Ecija of the Pan-Philippine Highway (about 40km north of Metro Manila and extending to about 123.5km) is seriously affected by the increase in both local and through traffic brought about by the recent years' economic growth.. Along this arterial road, urban centers at 10km interval are expanding as a ribbon type development where the traffic function of the highway is seriously affected by the high composition of slow and disorderly traffic such as tricycles and jeepneys.

In 1999, a study entitled "*Feasibility Study on Upgrading Inter-Urban Highway System along the Pan-Philippine Highway (Sta. Rita – San Jose Section)*" was conducted by the Department of Public Works and Highways (DPWH) with the assistance of the Japan International Cooperation Agency (JICA) to look into the arterial road traffic issues. The study identified and proposed three bypasses: Plaridel, Cabanatuan and San Jose Bypasses which are proposed to be constructed by stages with the initial stage targeted to be completed in the year 2010.

In view of the urgent need for the three bypasses, the GOP requested further technical assistance from the Government of Japan (GOJ) to conduct the *Detailed Design Study on Upgrading Inter-Urban Highway System Along the Pan-Philippine Highway (Plaridel, Cabanatuan and San Jose Bypasses)* referred to as the Study.

Thus, the GOJ granted to undertake the study under JICA and organized a Study Team to perform the Study. The JICA Study Team, in close collaboration with the DPWH Counterpart Team conducted the study from March 2001 to December 2002.

1.2 Objective of the Study

The objectives of the study are: (1) to conduct the Detailed Design Study for the Construction of Plaridel, Cabanatuan and San Jose Bypasses along the Pan-Philippine Highway, and (2) to transfer technology on highway development through the Study.

1.3 Study Area

The Study Area cover : (1) Plaridel Bypass (22.45km) from Burol Interchange (Km 033+025) to San Rafael (Km 055+672), (2) Cabanatuan Bypass (34.25km) from Tambo Adorable (Km 100+480) to Lomboy (Km 134+731), and (3) San Jose Bypass (7.98km) from Abar-2 (Km 155+828) to Kita-Kita (Km 163+808).

1.4 Reports

The final report is organized with the following documents:

- Executive Summary
- Main Text
- Appendix
- Drawings
- Draft Tender and Contract Documents

2. ALIGNMENT STUDY

2.1 Plaridel Bypass

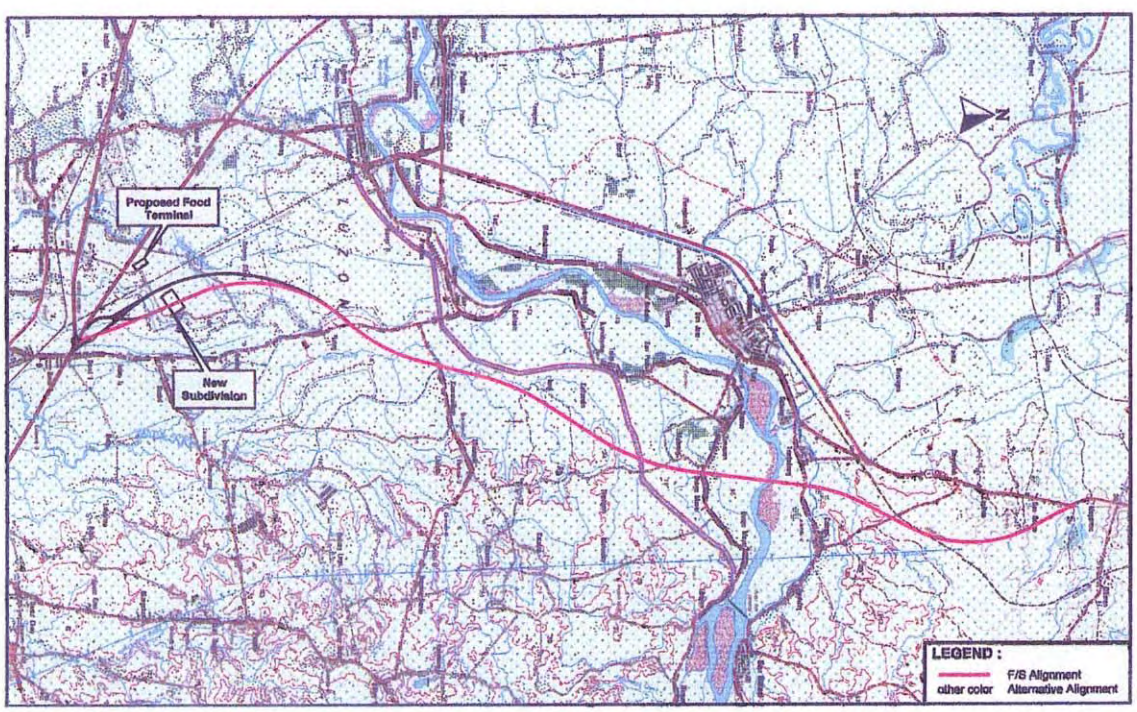
The Plaridel Bypass alignment basically follows the F/S proposed alignment except at the beginning point where it is necessary to modify the alignment due to:

- the location and type of the interchange between the North Luzon Expressway and the proposed bypass,
- the new subdivision under construction along the F/S proposed alignment, and
- the access to be provided at the interchange.

Two schemes are studied and compared to determine the type of Interchange:

- Scheme 1 – Connection with the existing Burol Interchange
- Scheme 2 – Separation from the existing Burol Interchange

Scheme 2 is selected as the more feasible type due to the existing overpass bridge which controls the expansion of the interchange. Moreover, the alignment is decided to pass through the eastern side of the new subdivision which has less social resistance.



ALTERNATIVE ALIGNMENTS OF PLARIDEL BYPASS

2.2 Cabanatuan Bypass

For the Cabanatuan Bypass, alternative studies are similarly conducted at the beginning of the bypass and at the Talavera river section.

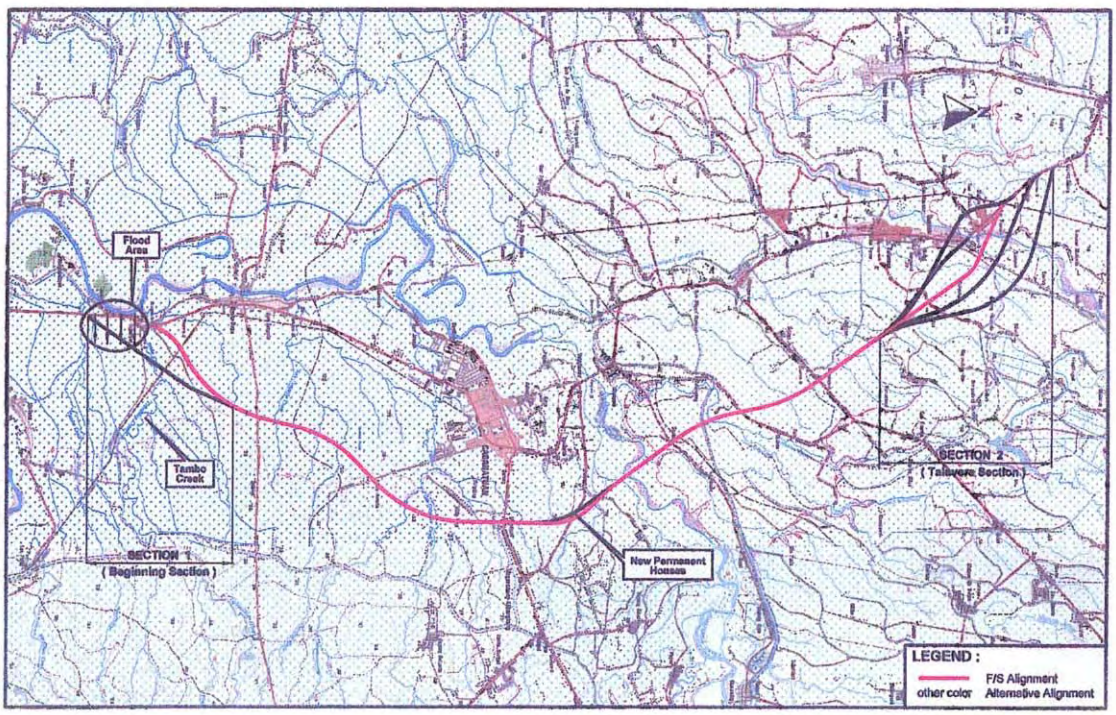
- Beginning of Bypass

  The F/S proposed alignment is located right after the flooded area of the Pan-Philippine Highway which is caused by the overflow of the Pampanga river and the Tambo creek. The final alignment is then moved before the Tambo creek flood area so that the bypass is still passable in the event of the Pampanga river overflow.

- Talavera River Section

The factors considered in the selection of the final alignment at the end of bypass includes: (a) bypassing Bgy. San Pascual, (b) termination of the bypass before Sicsican bridge, and (c) the most appropriate termination point.

In consideration of cost, social/environmental impact, river condition and the benefits of the alignment, the alternative with a bridge crossing 1km upstream of the existing Sicsican Bridge at the Talavera river is considered.

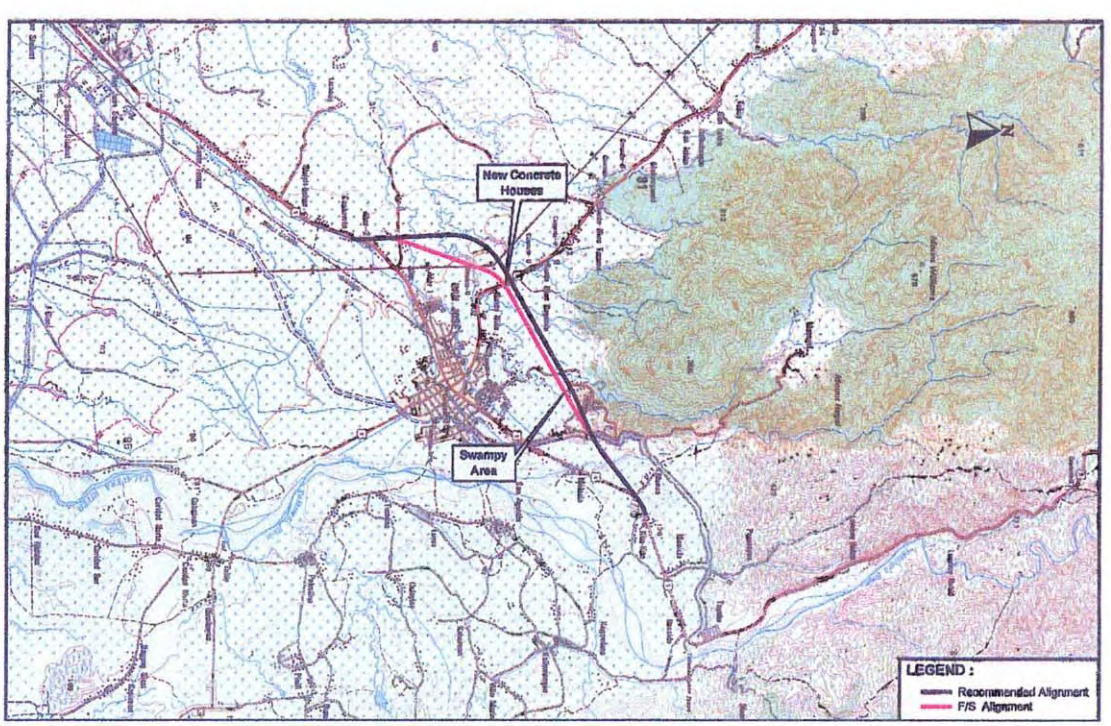


ALTERNATIVE ALIGNMENTS OF CABANATUAN BYPASS

2.3 San Jose Bypass

The F/S proposed alignment of San Jose Bypass is found generally appropriate with minor adjustments made due to:

- the presence of new houses along the Nueva Ecija-Pangasinan Road, and
- the approximately 300m swampy area near the end of the bypass.



ALTERNATIVE ALIGNMENTS OF SAN JOSE BYPASS

3. ENGINEERING SURVEY

3.1 Data Collection, Analysis and Review of the Feasibility Study

- Data Collection and Analysis

  The different data concerning the design of the proposed bypasses are collected and analyzed including the updated land use and development along the corridors, socio-economic data, hydrological data, the DPWH department orders, environmental impact and resettlement action plan requirements, construction materials and cost and the data on existing structures near the proposed bridge sites. Such collected data will be incorporated in the detailed design.

- Review of the Feasibility Study

  The feasibility study was reviewed focusing on the new developments along the proposed bypass, the design criteria, cost reduction, traffic demand, the hydraulic requirements for the proposed bridges and the possible ways to avoid the squatters within the road right-of-way to be acquired.

- Field Reconnaissance Survey Along the Proposed Bypass Corridors

  The field survey focusing on the present condition of the bypass route proposed during the Feasibility Study was undertaken to identify any new developments along the corridor, verify and check the different control points, identify the flooded areas and verify the bridge requirements along the irrigation canals, streams and rivers.

- Supplemental Traffic Survey

  The Roadside and Intersection traffic count surveys were performed at eight (8) stations in Bulacan and Nueva Ecija to update the traffic data. The data gathered are used in the design of roads and intersections.

3.2 Topographic Survey

The following topographic surveys were undertaken under this study:

- Topographic survey along the proposed bypass alignment including centerline stake-out, profile survey and cross-section survey,
- Bridge site topographic survey,
- River profile and cross-section survey,
- Interchange/Intersection topographic survey,
- Access road topographic survey, and
- Box culvert sites topographic survey

3.3 Geotechnical, Soils and Material Survey

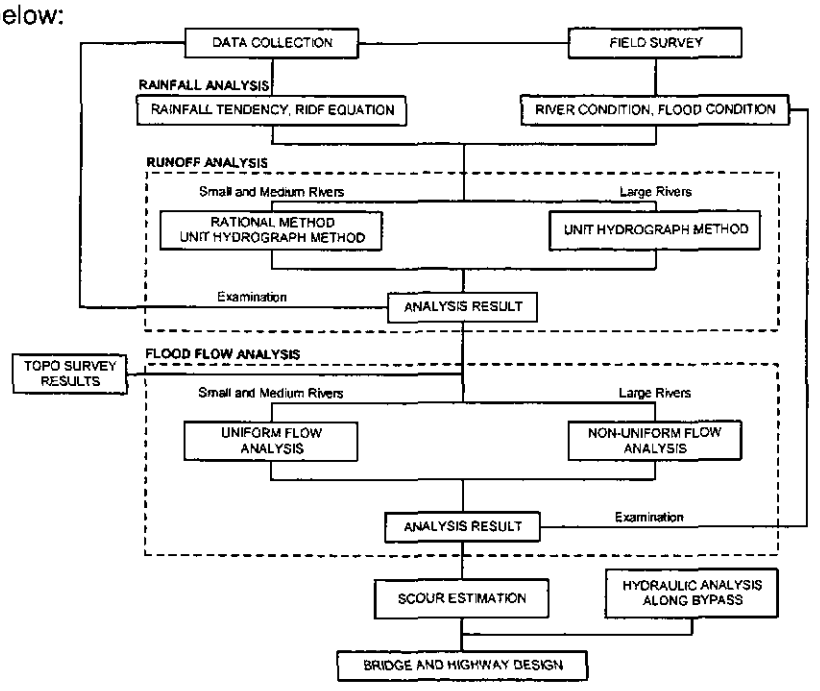
The geotechnical surveys including borings, Standard Penetration Test (SPT), Dynamic Sounding Test (DPH) and the corresponding laboratory tests for the disturbed and undisturbed samples were undertaken at the proposed bridge sites. At the large river sites (Angat and Pampanga), gravel layers were encountered at depths of 5m to 10m from the ground surface. Deep cohesive soil layers are encountered at the proposed Interchange site and the Talavera river site.

In addition, the Cone Penetration Test (CPT) was undertaken along the three bypasses at an interval of 200m along the bypass alignment.

The Material Source Survey was also conducted to identify the borrow material sources for the road requirements. One test pitting per bypass and the corresponding laboratory tests, including CBR tests, were undertaken.

4. HYDROLOGICAL INVESTIGATION

- Analysis Procedure. The analysis procedure for the hydrologic and hydraulic analysis is shown below:



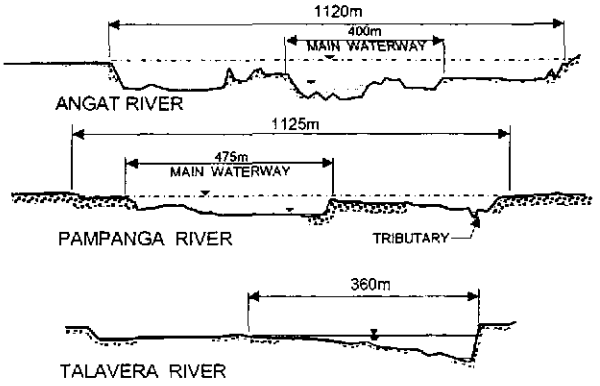
- Results of Analysis. The results of hydraulic analysis for the rivers are presented in the Tables below.

Small and Medium Rivers

	Bridge Number	Beginning Station	50 - Year Design Hydraulics					River Width, W (m)
			M.F.W.L. from Field Survey	Calculated Flood Elevation	Designed Flood Elevation	Discharge Q (m^3/s)	Velocity V (m/s)	
PLARIDEL	1	40+355.300	9.200	8.857	9.200	125.40	2.700	28.70
	2	41+323.369	10.800	10.728	10.800	124.90	2.800	19.20
	3	41+635.069	11.800	10.500	11.400	IRRIGATION		11.70
	4	41+968.103	11.400	11.041	11.400	109.20	3.624	17.20
	5	45+316.742	14.100	14.858	14.100	85.60	1.300	11.70
	6	45+624.690	15.000	12.700	15.000	IRRIGATION		28.20
	7	46+706.109	17.200	16.477	17.200	14.70	1.160	38.70
	8	48+124.650	15.300	ANGAT RIVER BRIDGE				
	9	49+347.898	17.800	16.329	18.800	119.80	1.924	29.00
	10	50+224.207	18.800	17.058	17.058	101.40	2.133	27.20
CABANATUAN	1	102+925.552	22.800	22.922	22.922	92.70	1.578	41.90
	2	104+998.328	23.700	22.154	23.700	512.80	3.046	44.60
	3	110+672.232	27.400	27.470	27.470	40.60	2.235	30.40
	4	113+177.170	30.700	30.845	30.845	98.70	2.726	16.40
	5	114+078.990	30.900	31.177	31.177	63.40	1.937	12.50
	6	115+304.526	31.100	31.231	31.231	69.00	2.900	17.90
	7	116+790.758	33.700	-	33.700	IRRIGATION		24.40
	8	118+448.026	33.700	33.610	33.700	32.30	2.677	11.40
	9	118+582.028	36.900	33.657	36.000	65.00	2.097	54.90
	10	119+534.178	32.300	PAMPANGA RIVER BRIDGE				
	11	122+359.060	38.400	-	38.400	IRRIGATION		28.60
	12	122+581.868	34.300	34.422	34.422	736.60	4.353	50.30
	13	125+614.096	40.200	39.520	40.200	IRRIGATION		13.00
	14	132+632.444	43.25	TALAVERA RIVER				
SAN JOSE	1	157+454.000	94.800	94.820	94.824	101.60	1.945	26.20
	2	161+374.000	114.800	114.959	114.959	148.10	3.147	27.10
	3	162+222.710	121.700	119.800	118.800	IRRIGATION		21.80
	4	162+782.020	122.700	123.000	123.000	165.00	3.448	35.80

Large Rivers

River Name	Return Period	Discharge (m^3/sec)	At Proposed Bridge Section		Maximum Flood Water Level By Observation	Recommended Bridge Design Water Level
			Water Level (E.L.+m)	Velocity (m/sec.)	(E.L.+m)	(E.L.+m)
Angat River	100 years	5,460	14.712	0.591	15.3	15.3
	50 years	5,020	14.298	0.573		
	25 years	4,620	13.902	0.555		
	10 years	3,950	13.210	0.523		
	5 years	3,130	12.302	0.478		
Pampanga River	100 years	8,000	31.708	1.500	32.3	32.3
	50 years	6,990	31.306	1.446		
	25 years	6,060	30.954	1.379		
	10 years	4,610	30.318	1.281		
	5 years	3,580	29.797	1.211		
Talavera River	100 years	1,790	43.089	1.901	43.25	43.25
	50 years	1,570	42.849	1.834		
	25 years	1,340	42.589	1.756		
	10 years	1,050	42.207	1.672		
	5 years	810	41.780	1.598		



- Flood at Beginning of Cabanatuan Bypass

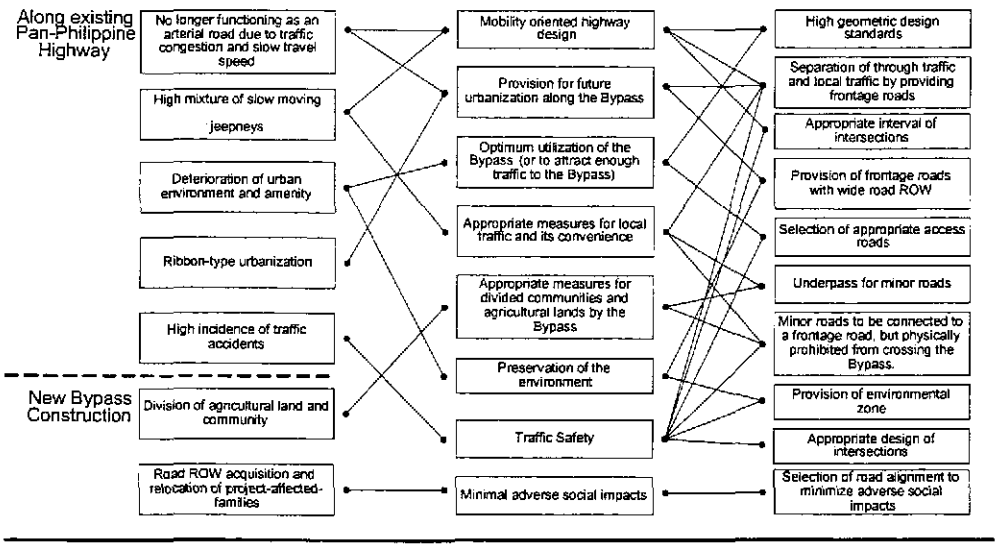
The area of the Pan-Philippine Highway right before the proposed F/S beginning point suffers from perennial flood due to the swelling and overflow of the Pampanga river. In order to avoid this area and make the bypass passable during flood, the beginning point of the Cabanatuan Bypass is shifted back 3.5km which is just before the flooded area.

5. DESIGN POLICY AND DESIGN CRITERIA

- ***Highway Design Policy***

The basic design policy is focused on the problems associated with the existing Pan-Philippine Highway and the measures adopted to resolve these problems.

HIGHWAY DESIGN POLICY



- ***Stage Construction***

In view of the scale of the project, the traffic demand forecast and the budgetary framework of the DPWH, the project is recommended to be implemented in stages which includes the construction of a 2-lane bypass in the Initial Stage and the widening of the bypass to 4-lanes in the Ultimate Stage as shown in the figures of typical sections.

- ***Highway Design Criteria***

The design of highway basically follows the recommendations of the DPWH, the AASHTO and the JRA Design Guidelines. The design speed for the bypass and the frontage roads are 80km/hr and 50km/hr respectively, while the new access roads have the design speed of 60km/hr. The frontage roads are provided in urban areas to give priority to through traffic.

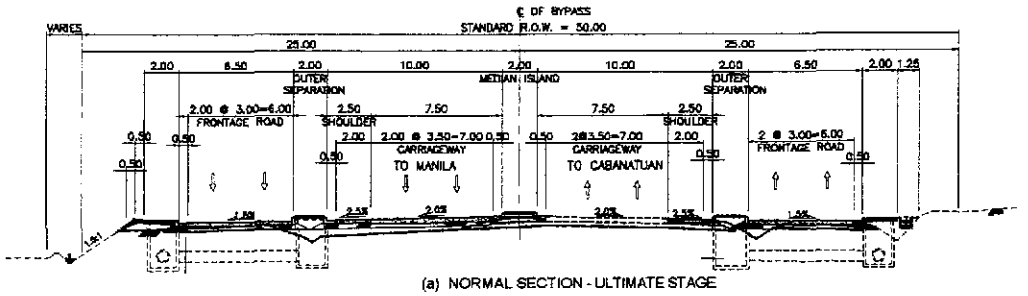
- ***Bridge Design Criteria***

Similarly, the design of bridges basically follows the recommendations of the DPWH, the NSCP, the AASHTO and the JRA Design Guidelines. The minimum span requirement is determined based on the river discharge at 50-year return period. The design under earthquake follows the AASHTO Seismic Design procedures using the Peak Ground Acceleration (PGA) of A=0.4 for the Plaridel and the Cabanatuan Bypass and A=0.55 for the San Jose Bypass.

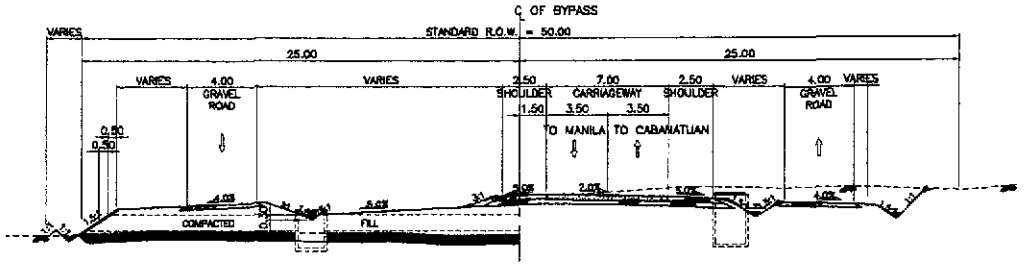
- ***Drainage Design Criteria***

The design guidelines adopted for the design of drainage structures are the same as for the highway and bridges. The drainage design frequencies adopted are based on the DPWH Design Guidelines as follows:

Type of Structure	*Return Period*
Bridge	1 in 50 years
Box Culverts	1 in 25 years
Road Embankment	1 in 10 years
Drain Pipes and Pipe Culverts	1 in 10 years
Side ditches	1 in 2 years
Surface drainage	1 in 2 years

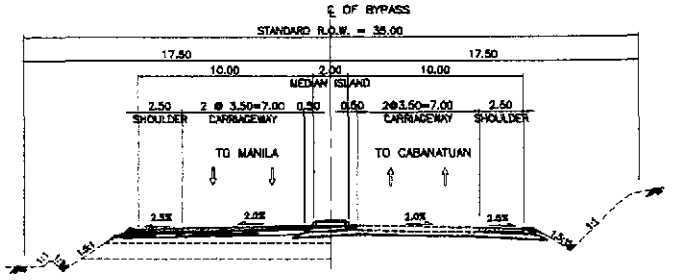


(a) NORMAL SECTION - ULTIMATE STAGE

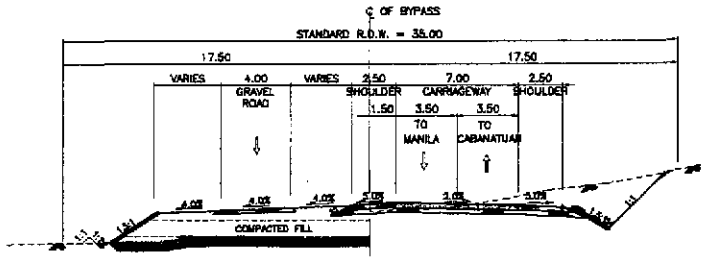


(b) NORMAL SECTION - INITIAL STAGE

TYPICAL SECTIONS FOR PLARIDEL AND CABANATUAN BYPASS - WITH FRONTAGE ROAD

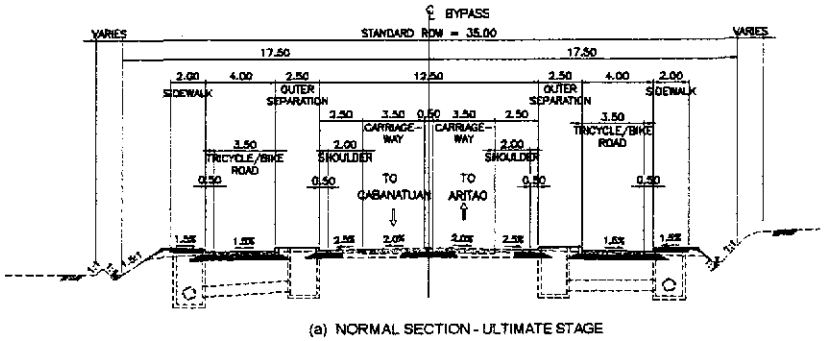


(a) NORMAL SECTION - ULTIMATE STAGE

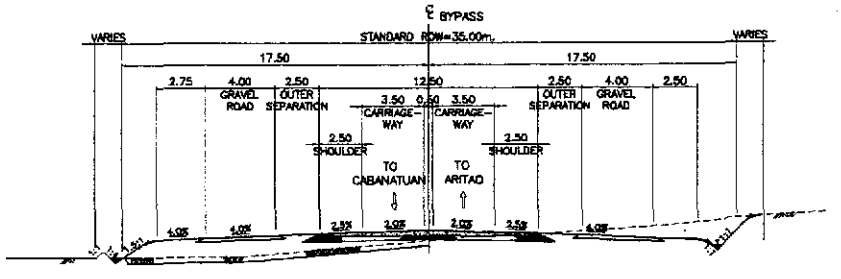


(b) NORMAL SECTION - INITIAL STAGE

TYPICAL SECTIONS FOR PLARIDEL AND CABANATUAN BYPASS - WITHOUT FRONTAGE ROAD



(a) NORMAL SECTION - ULTIMATE STAGE



(b) NORMAL SECTION - INITIAL STAGE

TYPICAL SECTIONS FOR SAN JOSE BYPASS

6. DETAILED DESIGN OF PLARIDEL BYPASS

- ***Design Policy***

The detailed design policy of the Plaridel Bypass includes: (a) providing importance to traffic mobility, (b) segregation of through traffic with the local traffic by providing frontage roads, (c) providing at-grade intersections considering the road network, (d) providing connections on either side of the bypass using underpasses for vehicles and pedestrians/farmers, and (e) providing an all-weather bridge crossing streams, rivers and irrigation canals.

- ***Alignment***

The bypass alignment including the locations of intersections and bridges are shown in the accompanying figure while the scope of civil works are summarized below:

PLARIDEL BYPASS CIVIL WORKS SCOPE		
Total Length of Bypass, km		22.65
Road Length, km		21.11
Bridge Length, km		1.54
Frontage Road Length, km		7.36
New Access Roads, km		3.31
At-grade Intersection Positions	Major	7
	Minor	26
	Under Box	10
Drainage	RCPC	143
	RCBC	45

SECTION GEOMETRY				
Section	*Road Width With Frontage Road*		*Road Width W/O Frontage Road*	
	Initial Stage	Ultimate Stage	Initial Stage	Ultimate Stage
Main Carriageway, m	2 @3.5 = 7.0	4 @ 3.5 = 14.0	2 @ 3.5 = 7.0	4 @ 3.5 = 14.0
Frontage Road, m	-	4 @ 3.0 = 12.0	-	-
Shoulder, m	2 @2.5 = 5.0	2 @ 2.0 = 4.0	2 @ 2.5 = 5.0	2 @ 2.5 = 5.0
Center Median, m	-	1 @ 2.0 = 2.0	-	1 @ 2.0 = 2.0
Separator Median, m	-	2 @ 2.0 = 4.0	-	-
Sidewalk, m	-	2 @ 2.0 = 4.0	-	-
Gravel Road, m	2 @ 4.0 = 8.0	-	1 @ 4.0 = 4.0	-
ROW	50.0	50.0	35.0	35.0

- ***Intersections***

Plaridel Bypass has 43 intersections. The intersections are designed based on the forecasted directional traffic volumes, the class of crossing roads, the intervals of intersections and the road networks. The major intersections basically provide through and exclusive left/right turn movements while the minor intersections provide shared lanes for the approach of a crossing road.

- ***Interchange***

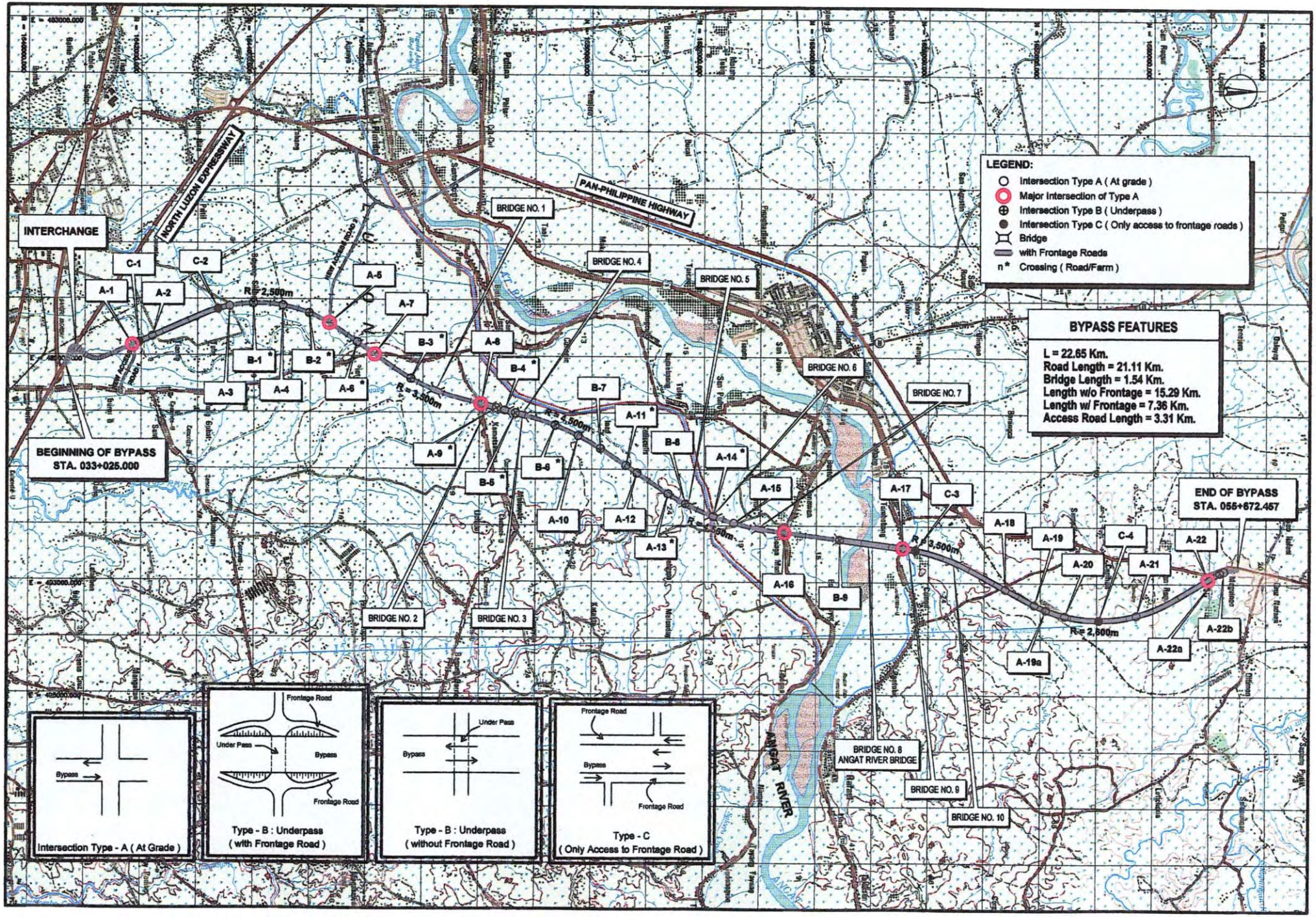
To provide the Plaridel Bypass with a connection to the North Luzon Expressway, a Y-type Interchange is proposed 500m west of Burol Interchange. The proposed Interchange will provide the ingress and egress access to/from the bypass and includes two additional ramps with a 90m bridge overcrossing and the improvement of the existing two ramps.

- ***Bridges***

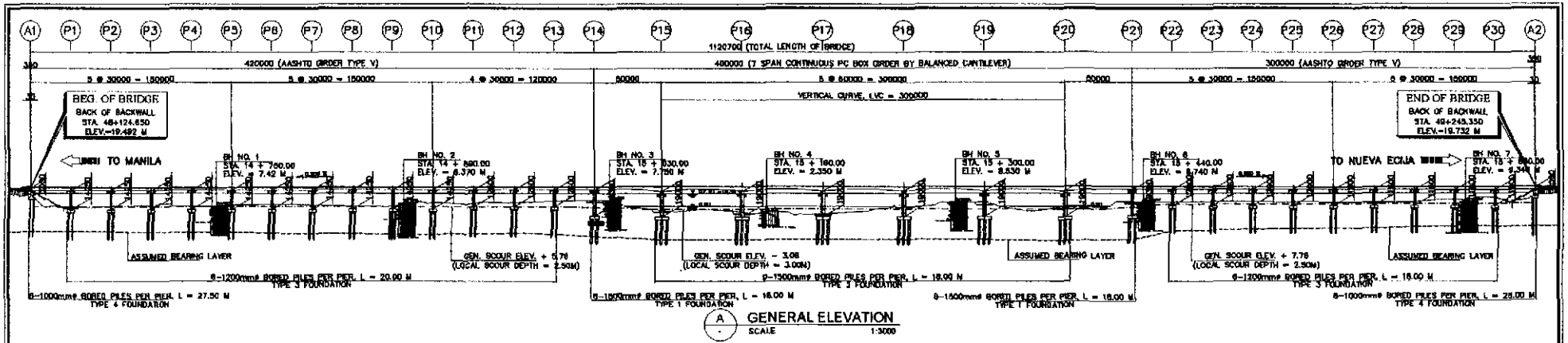
The bridge requirements for the bypass totals 1534m long with the features described below:

BRIDGES FOR PLARIDEL BYPASS							
BRIDGE NO.	*TYPE OF WATERWAY*	*STATION*	*BRIDGE TYPE*	*NO. SPANS*	*LENGTH (m)*	*FOUNDATION TYPE*	*REMARKS*
-			-	-	-	-	-
1	River	40+355.30	PCDG	1	35.86	RCP 450 x 450	NORMAL
2	River	41+322.369	PCDG	1	34.36	RCP 450 x 450	SKEWED 15°
3	Irrigation	41+365.069	PCDG	1	30.86	RCP 450 x 450	SKEWED 15°
4	River	41+968.103	PCDG	1	24.86	RCP 450 x 450	SKEWED 15°
5	River	45+316.742	PCDG	1	34.36	RCP 450 x 450	SKEWED 15°
6	Irrigation	45+824.69	PCDG	1	40.86	RCP 450 x 450	SKEWED 15°
7	River	46+706.109	RCDG	3	45.66	RCP 400 x 400	SKEWED 15°
8	River	48+124.65	PCDG/PCBG	30	1,120	CCP ϕ 1200 & CCP ϕ 1500	ANGAT RIVER
9	River	49+347.898	PCDG	1	40.86	RCP 450 x 450	SKEWED 15°
10	River	50+224.207	PCDG	1	36.86	RCP 450 x 450	SKEWED 15°
Interchange	Expressway	33+370.647	VOIDED SLAB	4	90	CCP ϕ 1200	RAMP C

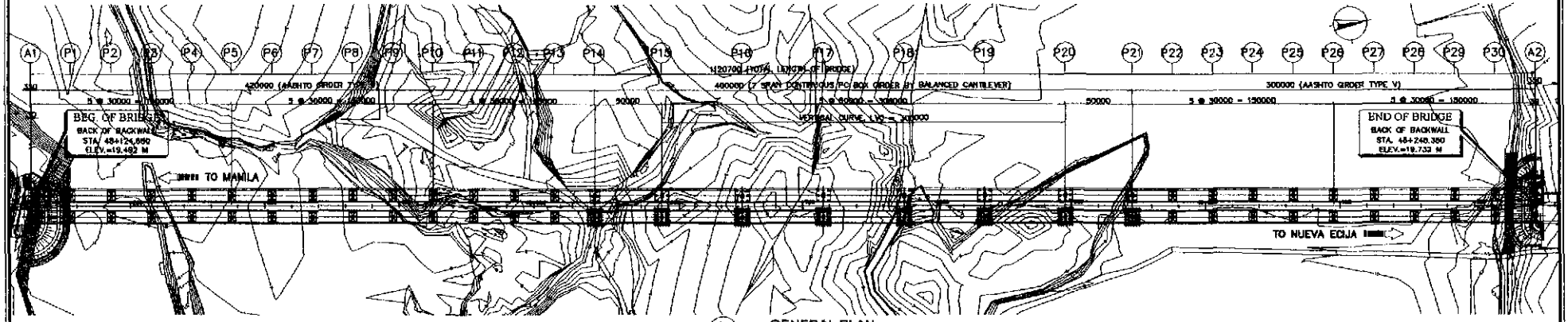
RCDG : Reinforced Concrete Deck Girder
PCDG : Prestressed Concrete Deck Girder
PCBG : Prestressed Concrete Box Girder
2SPG : 2 - Steel Plate Girder
RCP : Precast Reinforced Concrete Pile
CCP : Cast-in-Place Concrete Pile
RCS : Reinforced Concrete Slab
B.P. : Bored Pile



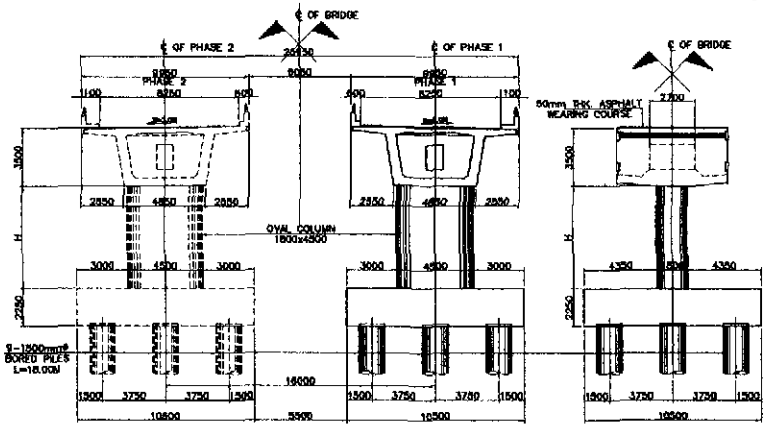
ALIGNMENT OF PLARIDEL BYPASS



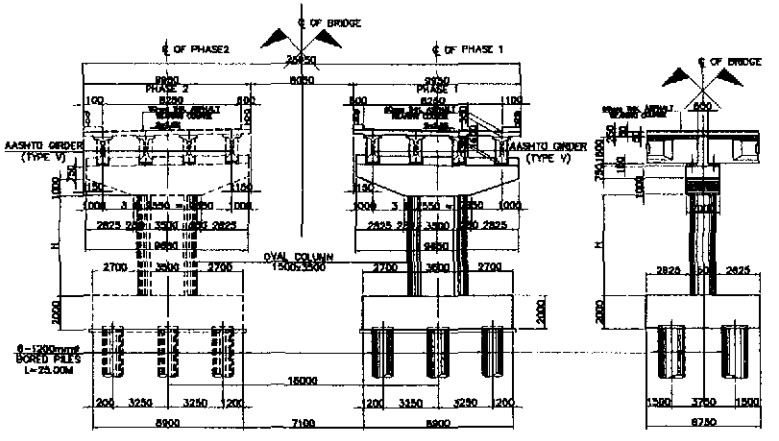
A GENERAL ELEVATION
SCALE 1:3000



B GENERAL PLAN
SCALE 1:3000



C SECTIONS @ MAIN BRIDGE
SCALE 1:300



D SECTIONS @ APPROACH BRIDGE
SCALE 1:300

PROPOSED ANGAT RIVER BRIDGE CROSSING