4.3 San Jose Bypass

The F/S alignment was judged generally appropriate, but minor adjustment of the alignment was made.

The F/S alignment was shifted 125m toward west between the section Nueva Ecija-Pangasinan Road and Tris Main Irrigation Canal in order to avoid the new concrete houses along the Nueva Ecija-Pangasinan Road and the approximately 300 meters long swampy area (see Figure 4.3-1).

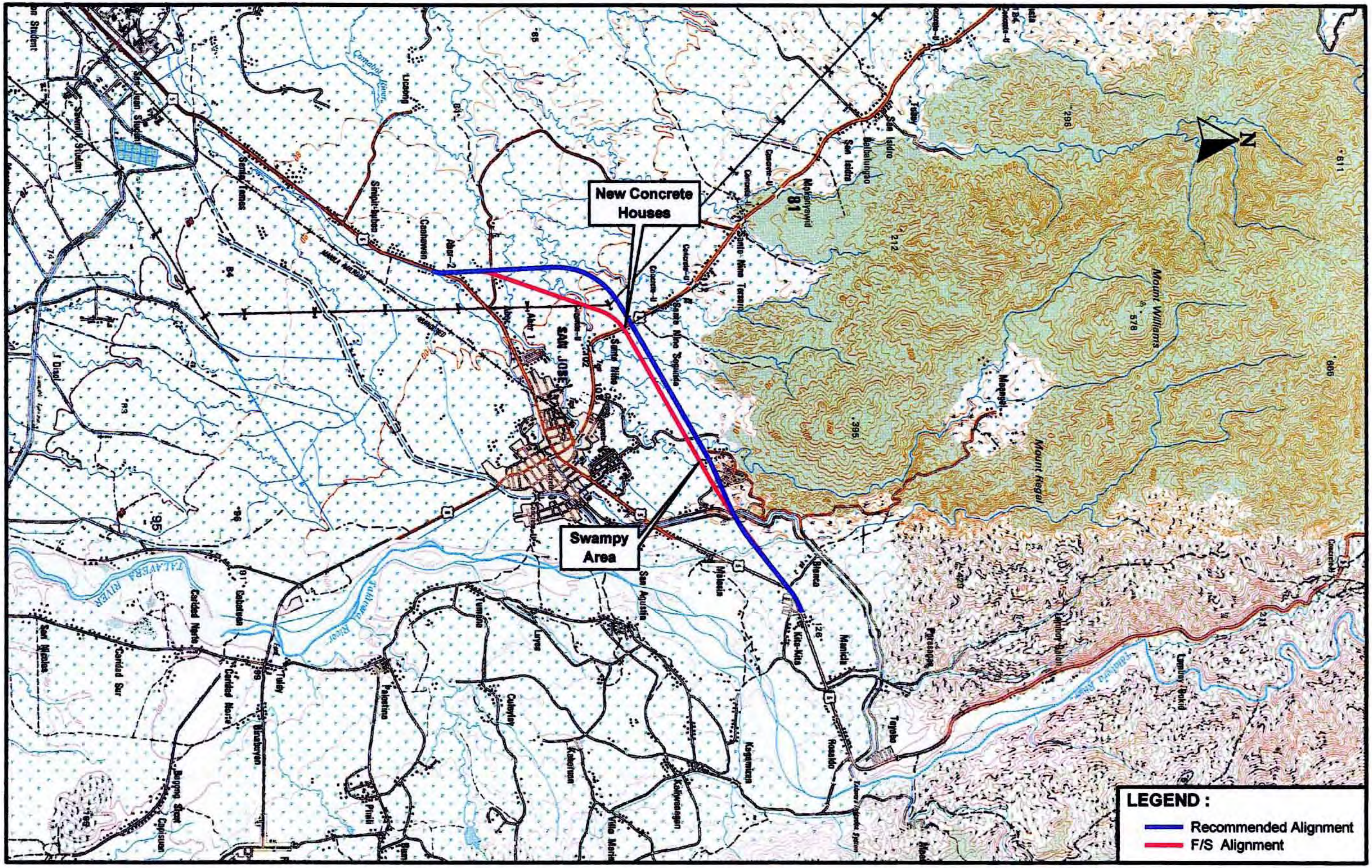


FIG. 4.3-1 RECOMMENDED ALIGNMENTS FOR SAN JOSE BYPASS

4.4 Comparative Study of Bridge Types for Long Bridges and NLE Overcrossing

Comparative studies of bridge types and alternative schemes were carried out to determine the most appropriate configurations of superstructures and substructures at each bridge location. The selection of optimum bridge scheme was undertaken following the flow of procedure shown in Figure 4.4-1.

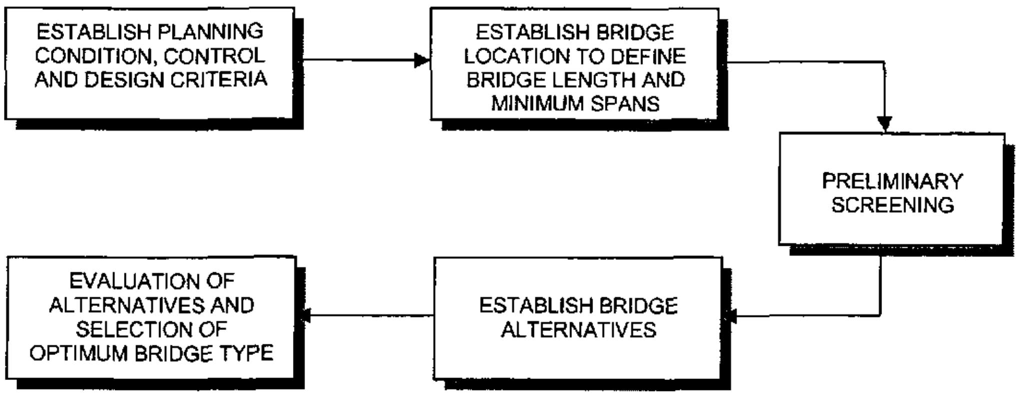


FIGURE 4.4-1 PROCEDURE FOR EVALUATING BRIDGE ALTERNATIVES

A set of evaluation criteria was established to guide in the selection of bridge types. Such evaluation criteria includes Construction Cost, Construction Difficulty, Construction Period, Structural Aspect, Use of Local Materials and Labor, Maintenance, River Hydraulics, Introduction of New Technology, Impact to Environment and Aesthetics. Corresponding point scores were given to the different alternatives following these criteria and the scheme with the highest rating is taken as the best alternative.

In selecting the superstructure types for the proposed river crossings, the following factors are considered:

- River requirement in terms of bridge location, maximum flood level, vertical clearances and minimum span,
- Conditions of existing bridges both upstream and downstream of the proposed bridge location,
- Support or pier requirements posing less obstruction to river course,
- Ease of construction and construction period,
- Availability of local materials and labor skill, and
- Structural aspect.

Similarly, the choice of foundation type is governed by the following factors:

- Type of soil layers predominant at the bridge location,
- Depth of bearing layer for the foundation,
- Construction aspect in terms of foundation applicability, cost and period of construction,
- Suitability with superstructure span length combinations, and
- Structural performance.

4.4.1 Bridge Type for Approach Bridge of Angat and Pampanga River Crossings

Three long bridges will cross major rivers – Angat River on Plaridel Bypass and Pampanga River and Talavera River on Cabanatuan Bypass.

These long bridges are configured to clear the minimum span requirement by river hydraulics and discharge on the main river course. However, the maximum flood water level for these bridge locations covers a wider flood area. As such, the main bridge span for long bridges will be provided with approach spans extending to the flood areas. Two of the bridge sites – Angat and Pampanga rivers, will require such approach spans.

Several factors are considered for the choice of schemes for the approach spans to long bridges:

- Minimum span length requirements based on river discharge (see Table 4.4-1)
- Span lengths compatible with main bridge spans so as not to pose obstruction to river discharges,
- Span lengths compatible with dynamic behavior of main bridge,
- Vertical clearance requirement for freeboard of 1.5m minimum,
- Applicable superstructure and substructure types for the proposed scheme, and
- Construction aspect.

TABLE 4.4-1 RIVER REQUIREMENTS FOR THE APPROACH SPANS

RIVER REQUIREMENT	*ANGAT RIVER*		*PAMPANGA RIVER*	
	APPROACH 1	APPROACH 2	APPROACH 1	APPROACH 2
50-year Discharge, **Q** (m^3/s)	1269.3	586.4	464.1	1015.1
Minimum Span, **S** (m) *S = 20 + 0.005Q*	27	23	23	26

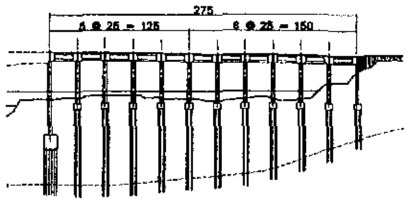
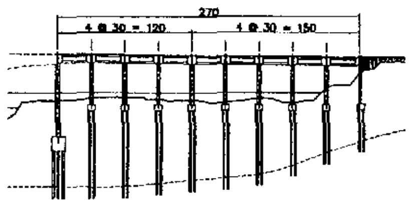
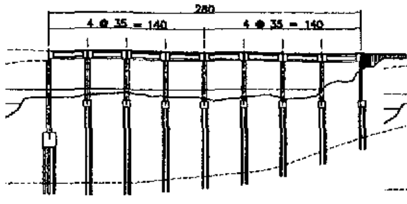
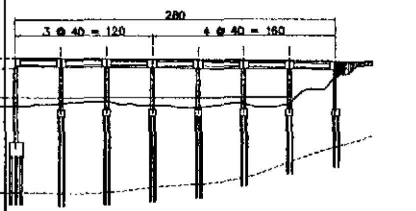
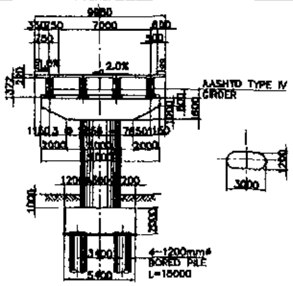
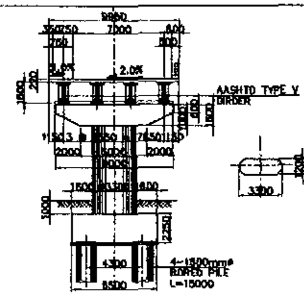
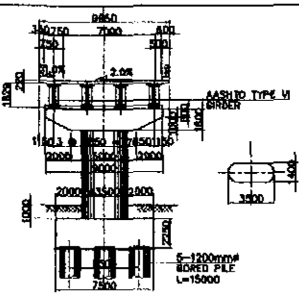
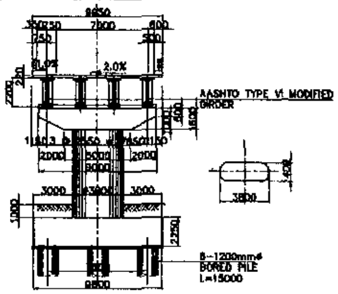
ITEMS		SCHEME 1 TYPE IV AASHTO GIRDER (SPAN = 25 M)		SCHEME 2 TYPE V AASHTO GIRDER (SPAN = 30 M)		SCHEME 3 TYPE VI AASHTO GIRDER (SPAN = 35 M)		SCHEME 4 TYPE VI MODIFIED (SPAN = 40 M)	
ELEVATION									
SECTION									
EVALUATION CRITERIA			POINTS		POINTS		POINTS		POINTS
CONSTRUCTION COST (₱)	Superstructure	0.199 M/ linear meter.	48	0.217 M/ linear meter.	50	0.237 M/ linear meter.	45	0.254 M/ linear meter.	40
	Substructure	0.190 M/ linear meter.		0.161 M/ linear meter.		0.161 M/ linear meter.		0.162 M/ linear meter.	
	Total	0.389 M/ linear meter.		0.378 M/ linear meter.		0.398 M/ linear meter.		0.416 M/ linear meter.	
CONSTRUCTION METHODOLOGY AND PERIOD		LONGEST CONSTRUCTION PERIOD DUE TO MORE SPANS AND MORE PIERS.	19	SHORTER CONSTRUCTION PERIOD THAN SCHEME 1 BECAUSE OF LESSER NUMBER OF PIERS.	21	SHORTER CONSTRUCTION PERIOD THAN SCHEME 1 AND 2 BECAUSE OF LESSER NUMBER OF PIERS.	23	BECAUSE IT HAS THE LEAST NUMBER OF PIERS, IT IS CONSIDERED AS SHORTEST IN TERMS OF CONSTRUCTION PERIOD.	25
RIVER HYDRAULICS		PIERS ARE SPACED CLOSELY THUS POSING GREATER OBSTRUCTION TO RIVER DISCHARGE.	19	LESSER OBSTRUCTION TO RIVER DISCHARGE THAN SHEME 1.	21	LESSER OBTRUCTION TO RIVER DISCHARGE THAN SCHEME 1 AND 2.	23	HAS THE LEAST OBSTRUCTION TO RIVER DISCHARGE.	25
OVERALL EVALUATION/ TOTAL POINTS			86		92		91		90
RANK		4		1		2		3	

FIGURE 4.4-2 COMPARISON OF ALTERNATIVES FOR APPROACHES OF LONG SPAN BRIDGES (ANGAT AND PAMPANGA RIVER CROSSING)

Alternatives for the approach spans of long bridges are configured and shown in Figure 4.4-2 considering spans of 25m, 30m 35m and 40m. The spans are intentionally longer to be in proportion with the main bridge spans and to minimize obstruction to river flow during flood discharges. AASHTO type girders are taken as most appropriate superstructure considering span lengths, cost and ease of construction. In addition, wall type piers on bored piles are considered appropriate substructures for the approaches.

As seen on Figure 4.4-2, the 30m-span AASHTO girder scheme is recommended as most appropriate for the approaches.

4.4.2 Bridge Scheme for Angat River Bridge Crossing

The proposed bridge will span the Angat river with a bank to bank distance of about 1120m and a main river waterway width of about 400m as shown in Figure 4.4-3. Therefore, the bridge scheme alternatives to be considered for this location will include a main bridge spanning the 400m main waterway and approach bridges covering the flood area.

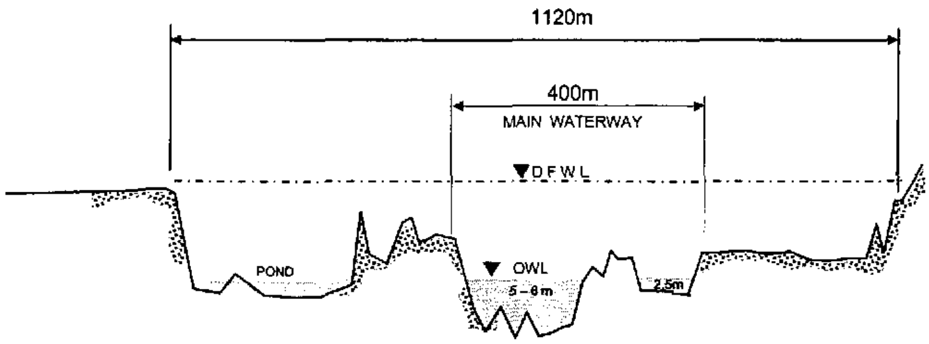


FIGURE 4.4-3 ANGAT RIVER SECTION AT PROPOSED SITE LOCATION

The river hydraulics for the proposed bridge is presented in Table 4.4-2 below.

TABLE 4.4-2 RIVER HYDRAULICS FOR ANGAT RIVER CROSSING

50-year Discharge, **Q_{50}** (m^3/s)	5,020
Minimum Span, **S** (m) *S = 30 + 0.005Q*	56
Flow Velocity, **V_{50}** (m^3/s)	0.79
Design Flood Water Level, (EL +m)	15.30
Catchment Area , **CA** (km^2)	889.1

Considering the above river requirements, a preliminary screening was conducted to determine appropriate bridge schemes that can be used for a more detailed comparison. Figure 4.4-4 is used to determine the costs of the different components of the main bridge for this river condition.

The preliminary screening of bridge alternatives is presented in Table 4.4-3. Three bridge scheme alternatives with the highest ranks - two with 7-span prestressed box girder and one 2-steel plate girder bridge, are taken for a more detailed comparison following the criteria mentioned earlier.

As seen in Tables 4.4-4a and 4b, Scheme 2 which is a 7-Span Continuous Prestressed Box Girder Scheme (with span configuration of 50m + 5 @ 60m + 50m) is taken as the most appropriate scheme due to:

- The minimum span requirement for river discharge is complied with,
- The balanced cantilever method of construction is more appropriate due to river condition with an average ordinary water level height of 6m, The temporary works for the construction of steel plate girder tends to be more difficult and more expensive.
- The side-span to inner-span ratio is more balanced structurally. In addition, the side span is shorter and easier to construct than Scheme 1.

The final scheme for the bridge crossing the Angat river is shown in Figure 4.4-5. The proposed bridge is 1120m long with 420m + 300m long approaches using AASHTO Girders and 400m long 7-span continuous prestressed box girder constructed by balanced cantilever method.

4.4.3 Bridge Scheme for Pampanga River Bridge Crossing

The Pampanga river at the proposed bridge site has a flood area of about 1120m width and a main river waterway about 475m wide as shown in Figure 4.4-6. The bridge scheme for this bridge will then have to span at least 500m of main waterway and approaches to cover the flood areas.

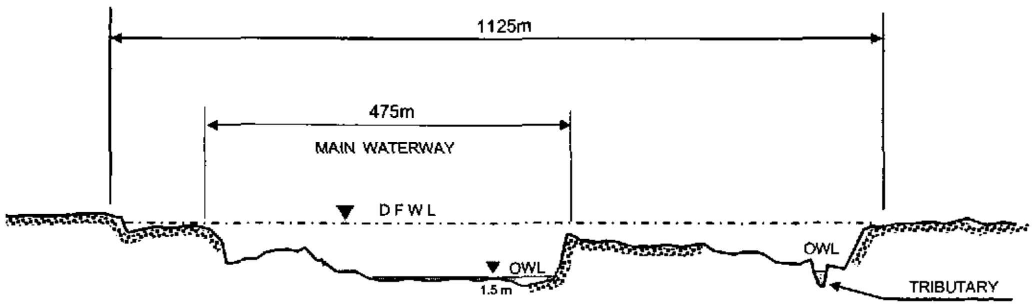


FIGURE 4.4-6 PAMPANGA RIVER SECTION AT PROPOSED SITE LOCATION

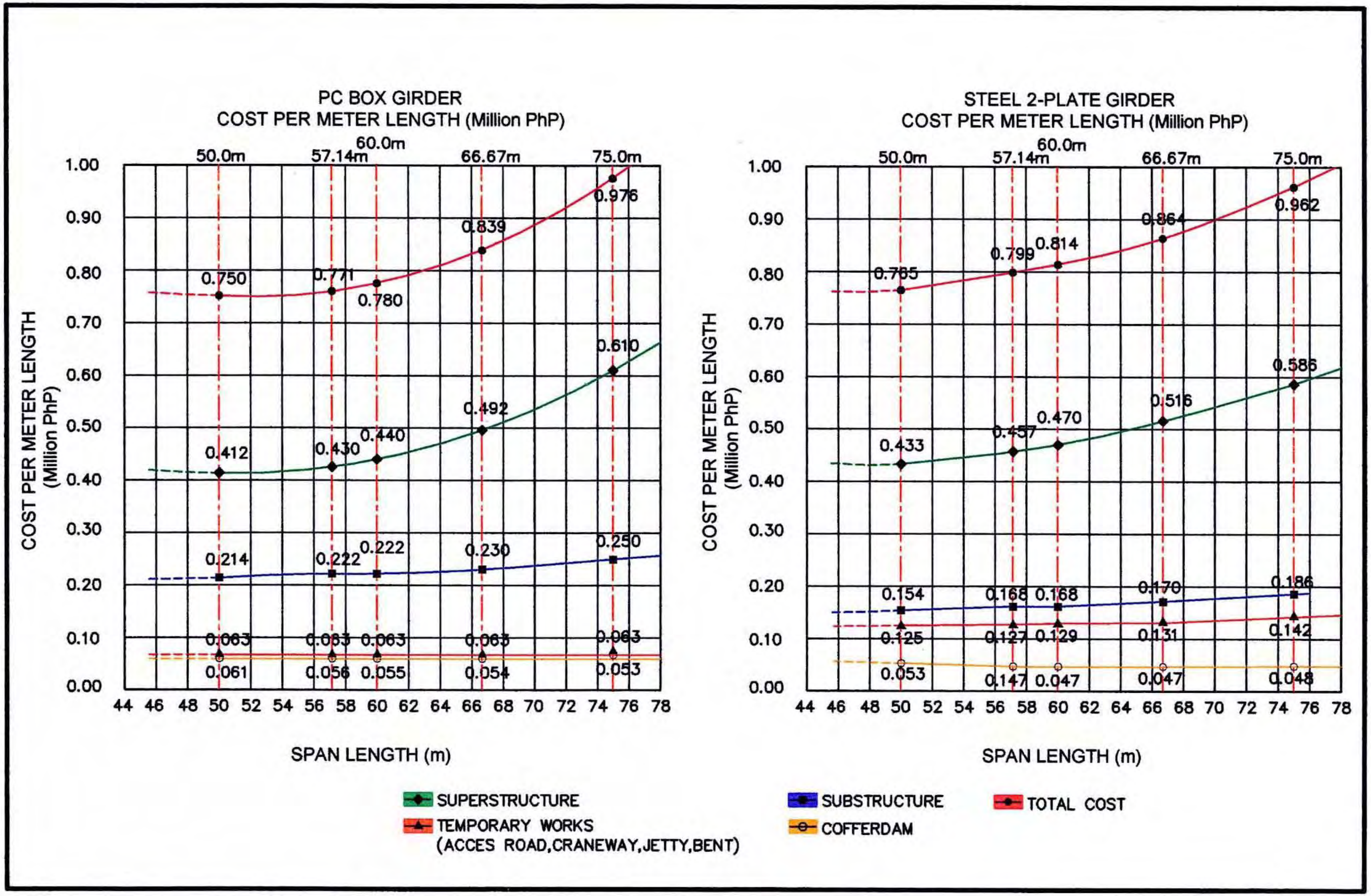


FIGURE 4.4-4 COSTS BREAKDOWN FOR ANGAT RIVER CROSSING

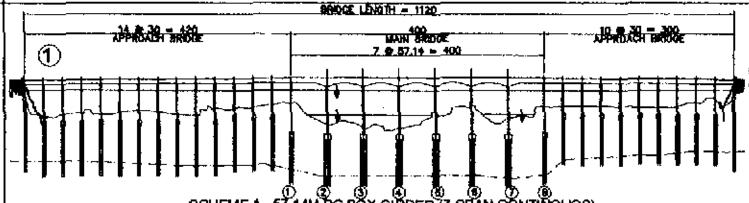
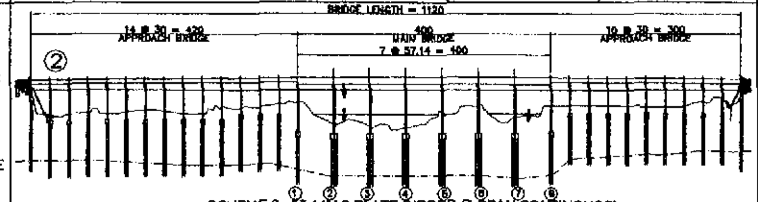
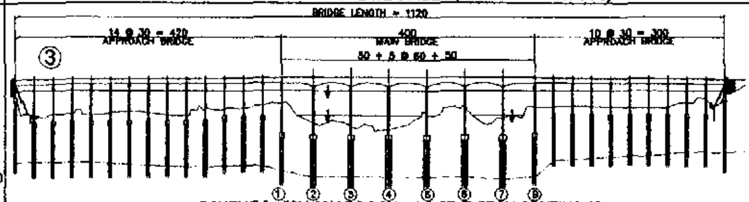
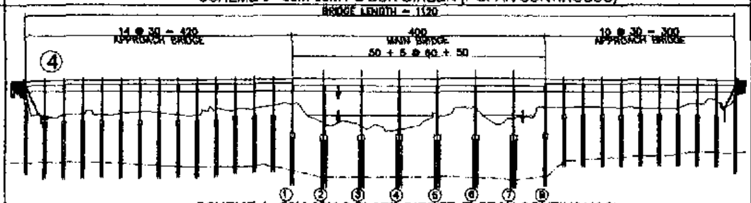
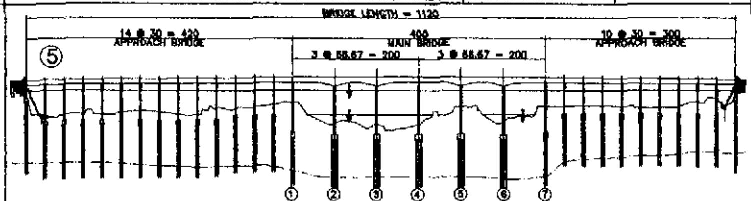
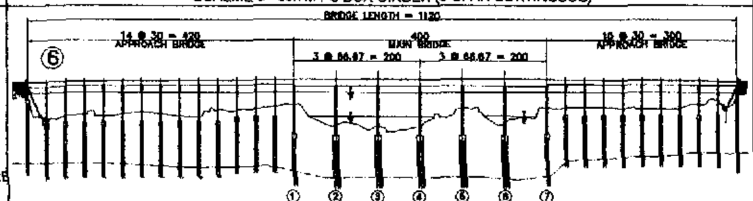
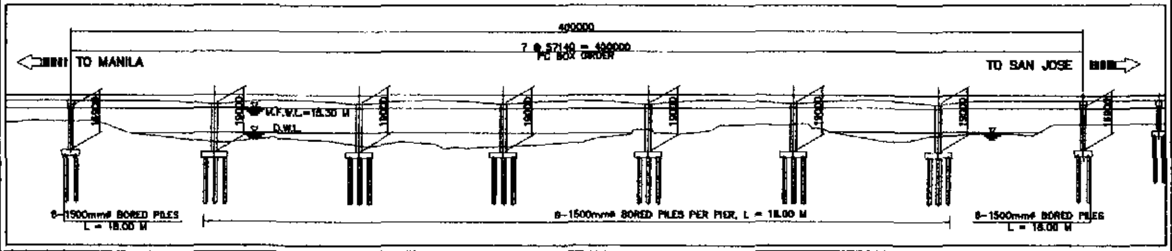
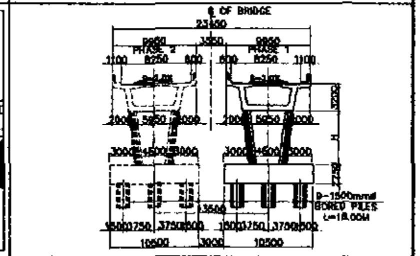
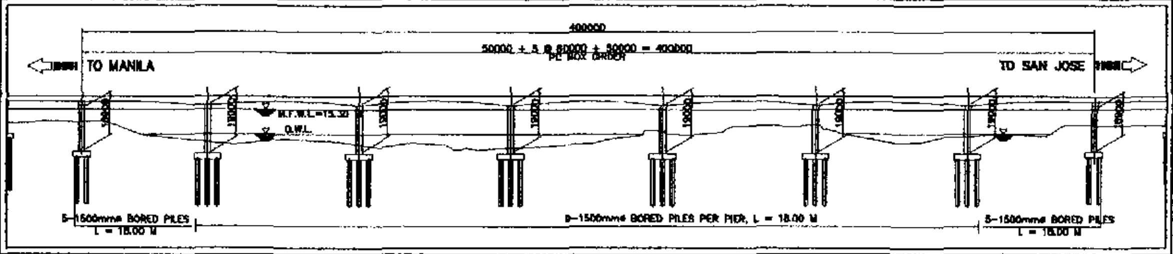
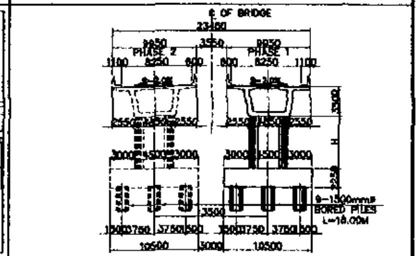
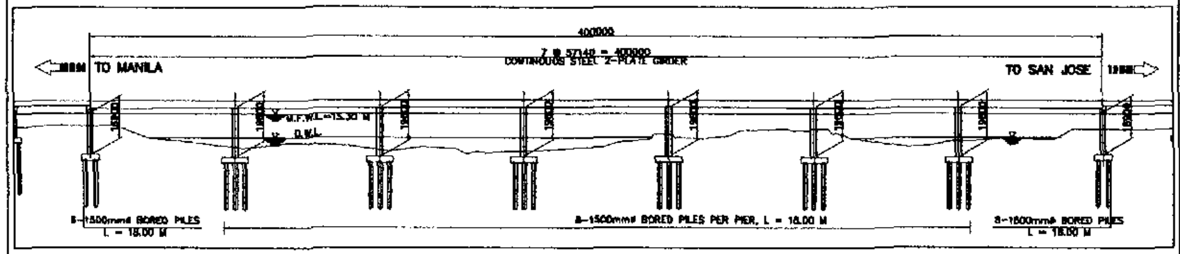
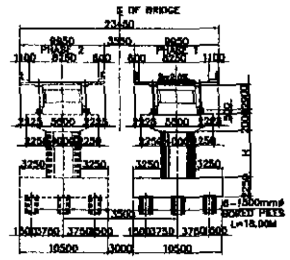
DESCRIPTION	SCHEME	STRUCTURAL ASPECT (MAIN BRIDGE)	CONSTRUCTION METHOLOGY	COST, Million PhP	COST FACTOR DIFFERENCE	RANK
MAIN BRIDGE SPAN LENGTH : 57.14 M SUPERSTRUCTURE TYPE : PRESTRESSED BOX GIRDER SUBSTRUCTURE TYPE : ø1.5M BORED PILE NO. OF PIERS : 8 SCHEME CONSIDERATION : MINIMUM SPAN LENGTH AT 400M RIVER WATERWAY	 SCHEME 1 - 57.14M PC BOX GIRDER (7-SPAN CONTINUOUS)	•HIGH ASEISMICITY DUE TO BOX GIRDER MONOLITHIC W/ PIERS (7 SPAN CONTINUOUS) •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING •APPROACH SPANS ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE SUPERSTRUCTURE BY C.I.P. BALANCED CANTILEVER METHOD.	MAIN SUPERSTRUCTURE : 172.00 SUBSTRUCTURE : 88.80 TEMPORARY WORKS CRANEWAY/JETTY : 37.60 ACCESS ROAD : 10.00 SUBTOTAL : 308.40 APPROACH : 398.40 TOTAL : 706.80	1.0 (-)	①
MAIN BRIDGE SPAN LENGTH : 57.14 M SUPERSTRUCTURE TYPE : 2-PLATE GIRDER WITH PC SLAB SUBSTRUCTURE TYPE : ø1.5M BORED PILE NO. OF PIERS : 8 SCHEME CONSIDERATION : MINIMUM SPAN BUT LIGHTER SUPERSTRUCTURE THAN SCHEME 1.	 SCHEME 2 - 57.14M 2-PLATE GIRDER (7-SPAN CONTINOUOS)	•7 SPAN CONTINUOUS PLATE GIRDER ON BEARING SUPPORT AT PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING. •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE GIRDER PREFABRICATED ON SEGMENTS, & WELDED TO CONTINUITY AT SITE •ERECTED USING TRUCK CRANE AND SUPPORT BENT. •PRECAST, PRESTRESSED SLAB ERECTED ON SITE W/ C.I.P. JOINTS	MAIN SUPERSTRUCTURE : 182.80 SUBSTRUCTURE : 67.20 TEMPORARY WORKS CRANEWAY/JETTY : 59.60 ACCESS ROAD : 10.00 SUBTOTAL : 319.60 APPROACH : 398.40 TOTAL : 718.00	1.016 (11.20)	③
MAIN BRIDGE SPAN LENGTH : 50M-60M SUPERSTRUCTURE TYPE : PRESTRESSED BOX GIRDER SUBSTRUCTURE TYPE : ø1.5M BORED PILE NO. OF PIERS : 9 SCHEME CONSIDERATION : MINIMUM SPAN LENGTH AT 400M MAIN RIVER WATERWAY W/ BALANCED STRUCTURE	 SCHEME 3 - 50M-60M PC BOX GIRDER (7-SPAN CONTINOUOS)	•HIGH ASEISMICITY DUE TO BOX GIRDER MONOLITHIC W/ PIERS (7 SPAN CONTINUOUS) •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING •APPROACH SPANS ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD •MORE BALANCED SIDE SPAN TO INNER SPAN RATIO THAN SCHEME 1	•MAIN BRIDGE SUPERSTRUCTURE BY C.I.P. BALANCED CANTILEVER METHOD.	MAIN SUPERSTRUCTURE : 173.20 SUBSTRUCTURE : 88.00 TEMPORARY WORKS CRANEWAY/JETTY : 38.10 ACCESS ROAD : 10.00 SUBTOTAL : 309.30 APPROACH : 398.40 TOTAL : 707.70	1.001 (0.90)	②
MAIN BRIDGE SPAN LENGTH : 50 M - 60M SUPERSTRUCTURE TYPE : 2-PLATE GIRDER WITH PC SLAB SUBSTRUCTURE TYPE : ø1.5M BORED PILE NO. OF PIERS : 9 SCHEME CONSIDERATION : MINIMUM SPAN LENGTH BUT LIGHTER SUPERSTRUCTURE THAN SCHEME 3.	 SCHEME 4 - 50M-60M 2-PLATE GIRDER (7-SPAN CONTINOUOS)	•7 SPAN CONTINUOUS PLATE GIRDER ON BEARING SUPPORT AT PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING. •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE GIRDER PREFABRICATED ON SEGMENTS, & WELDED TO CONTINUITY AT SITE •ERECTED USING TRUCK CRANE AND SUPPORT BENT. •PRECAST, PRESTRESSED SLAB ERECTED ON SITE W/ C.I.P. JOINTS	MAIN SUPERSTRUCTURE : 184.30 SUBSTRUCTURE : 65.80 TEMPORARY WORKS CRANEWAY/JETTY : 60.60 ACCESS ROAD : 10.00 SUBTOTAL : 320.70 APPROACH : 398.40 TOTAL : 719.10	1.017 (12.30)	④
MAIN BRIDGE SPAN LENGTH : 66.67 M SUPERSTRUCTURE TYPE : PRESTRESSED BOX GIRDER SUBSTRUCTURE TYPE : ø1.5M BORED PILE NO. OF PIERS : 7 SCHEME CONSIDERATION : ONE-SPAN REDUCTION FROM SCHEME 1	 SCHEME 5 - 66.7M PC BOX GIRDER (6-SPAN CONTINOUOS)	•HIGH ASEISMICITY DUE TO BOX GIRDER MONOLITHIC W/ PIERS (2@3 SPAN CONTINUOUS) •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE SUPERSTRUCTURE BY C.I.P. BALANCED CANTILEVER METHOD	MAIN SUPERSTRUCTURE : 196.80 SUBSTRUCTURE : 92.00 TEMPORARY WORKS CRANEWAY/JETTY : 36.80 ACCESS ROAD : 10.00 SUBTOTAL : 335.60 APPROACH : 398.40 TOTAL : 734.00	1.038 (27.20)	⑤
MAIN BRIDGE SPAN LENGTH : 50 M SUPERSTRUCTURE TYPE : 2-PLATE GIRDER WITH PC SLAB SUBSTRUCTURE TYPE : ø1.5M BORED PILE NO. OF PIERS : 7 SCHEME CONSIDERATION : ONE-SPAN REDUCTION FROM SCHEME 1. LIGHTER SUPERSTRUCTURE THAN SCHEME 3.	 SCHEME 6 - 66.7M 2-PLATE GIRDER (6-SPAN CONTINOUOS)	•2@3 SPAN CONTINUOUS PLATE GIRDER ON BEARING SUPPORT AT PIER •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING. •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE GIRDER PREFABRICATED ON SEGMENTS, & WELDED TO CONTINUITY AT SITE •ERECTED USING TRUCK CRANE AND SUPPORT BENT •PRECAST, PRESTRESSED SLAB ERECTED ON SITE W/ C.I.P. JOINTS	MAIN SUPERSTRUCTURE : 206.40 SUBSTRUCTURE : 68.00 TEMPORARY WORKS CRANEWAY/JETTY : 61.20 ACCESS ROAD : 10.00 SUBTOTAL : 345.60 APPROACH : 398.40 TOTAL : 744.00	1.053 (37.20)	⑥

TABLE 4.4-3 PRELIMINARY SCREENING FOR ANGAT RIVER MAIN BRIDGE CROSSING

ALTERNATIVES	ELEVATION	SECTION
SCHEME 1 APPROACH : 420m+300m – TYPE V AASHTO GIRDER @ 30m SPANS MAIN : 400m PC BOX GIRDER 57.14m SPANS TOTAL BRIDGE LENGTH : 1120m		
SCHEME 2 APPROACH : 420m+300m – TYPE V AASHTO GIRDER @ 30m SPANS MAIN : 400m PC BOX GIRDER WITH 50m AND 60m SPANS TOTAL BRIDGE LENGTH : 1120m		

EVALUATION CRITERIA		POINT ALLOCATION	SCHEME 1	POINTS	SCHEME 2	POINTS
CONSTRUCTION COST (IN MILLION PESOS)		40	APPROACH: Superstructure ₱ 191.02; Substructure ₱ 155.73; Craneway/Jetty ₱ 24.65; Access Road ₱ 27.00; Total ₱ 398.40 MAIN BRIDGE: Superstructure ₱ 172.00; Substructure ₱ 88.80; Craneway/Jetty ₱ 37.60; Access Road ₱ 10.00; Total ₱ 308.40	40	APPROACH: Superstructure ₱ 191.02; Substructure ₱ 155.73; Craneway/Jetty ₱ 24.65; Access Road ₱ 27.00; Total ₱ 398.40 MAIN BRIDGE: Superstructure ₱ 173.20; Substructure ₱ 88.00; Craneway/Jetty ₱ 38.10; Access Road ₱ 10.00; Total ₱ 309.30	39
CONSTRUCTION ASPECT	DIFFICULTY	15	• CRANEWAY AND COFFERDAM NEEDED TO CONSTRUCT BORED PILES AND PILE CAP. • SUPERSTRUCTURE CAN BE CONSTRUCTED USING BALANCED CANTILEVER EVEN DURING RAINY DAYS. • NEEDED CAREFULL MONITORING OF DISPLACEMENT DURING CANTILEVERING. • MORE STAGING WORKS THAN SCHEME 2.	14	• CRANEWAY AND COFFERDAM NEEDED TO CONSTRUCT BORED PILES AND PILE CAP. • SUPERSTRUCTURE CAN BE CONSTRUCTED USING BALANCED CANTILEVER EVEN DURING RAINY DAYS. • NEEDED CAREFULL MONITORING OF DISPLACEMENT DURING CANTILEVERING.	15
	PERIOD	10	SUBSTRUCTURE: • BY C.I.P. BORED PILES ON COFFERDAM. • DURATION – 8 MOS. SUPERSTRUCTURE: • BY BALANCE CANTILEVER. • DURATION – 12 MOS. TOTAL DURATION – 20 MOS	7	SUBSTRUCTURE: • BY C.I.P. BORED PILES ON COFFERDAM. • DURATION – 8 MOS. SUPERSTRUCTURE: • BY BALANCE CANTILEVER. • DURATION – 11 MOS. TOTAL DURATION – 19 MOS.	8
STRUCTURAL ASPECT		5	• HIGH ASEISMICITY DUE TO MONOLITHIC DECK & PIER CONSTRUCTION. • HIGH RIGIDITY & TORSIONAL RESISTANCE OF SUPERSTRUCTURE DUE TO PC BOX SECTION. • CONTINUITY OF SUPERSTRUCTURE W/ PIERS DISTRIBUTES SEISMIC FORCES TO TOP AND BOTTOM OF COLUMN.	4	• HIGH ASEISMICITY DUE TO MONOLITHIC DECK & PIER CONSTRUCTION. • HIGH RIGIDITY & TORSIONAL RESISTANCE OF SUPERSTRUCTURE DUE TO PC BOX SECTION. • CONTINUITY OF SUPERSTRUCTURE W/ PIERS DISTRIBUTES SEISMIC FORCES TO TOP & BOT. OF COL. • SIDE SPAN TO INNER SPAN RATIO MORE BALANCED THAN SCHEME 1.	5
USE OF LOCAL MATERIALS AND LABOR		5	• MOST MATERIALS ARE LOCALLY AVAILABLE EXCEPT PRESTRESS COMPONENTS. • HIGHLY SKILLED LABOR FORCE IS NEEDED IN CONSTRUCTING THIS TYPE OF STRUCTURE.	5	• MOST MATERIALS ARE LOCALLY AVAILABLE EXCEPT PRESTRESS COMPONENTS. • HIGHLY SKILLED LABOR FORCE IS NEEDED IN CONSTRUCTING THIS TYPE OF STRUCTURE.	5
MAINTENANCE		5	• MINIMAL MAINTENANCE IS REQUIRED BECAUSE OF LESS NO. OF JOINTS & BEARINGS. • INSPECTION OF JOINTS AND BEARINGS AT APPROACH IS NEEDED.	4	• MINIMAL MAINTENANCE IS REQUIRED BECAUSE OF LESS NO. OF JOINTS & BEARINGS. • INSPECTION OF JOINTS AND BEARINGS AT APPROACH IS NEEDED.	4
RIVER HYDRAULICS		5	• SPAN LENGTH GREATER THAN MINIMUM SPAN AND DOWNSTREAM SPAN LENGTH. • ENCROACHMENT ON RIVER SECTION 4.07 %	4	• SPAN LENGTH GREATER THAN MINIMUM SPAN AND DOWNSTREAM SPAN LENGTH. • ENCROACHMENT ON RIVER SECTION 4.07 %	4
INTRODUCTION OF NEW TECHNOLOGY		5	• USE OF BALANCED CANTILEVER METHOD CAN IMPROVE LOCAL CONTRACTOR'S CAPABILITY.	4	• USE OF BALANCED CANTILEVER METHOD CAN IMPROVE LOCAL CONTRACTOR'S CAPABILITY.	4
IMPACT TO ENVIRONMENT		5	• MINIMAL IMPACT DURING SUBSTRUCTURE CONSTRUCTION. • NO IMPACT DURING SUPERSTRUCTURE CONSTRUCTION.	5	• MINIMAL IMPACT DURING SUBSTRUCTURE CONSTRUCTION. • NO IMPACT DURING SUPERSTRUCTURE CONSTRUCTION.	5
AESTHETICS		5	• NEAT AND SMOOTH FROM ALL VIEWS. • VARIABLE GIRDER DEPTH PRESENTS POSITIVE APPEAL AND ELEGANCE AESTHETICALLY.	5	• NEAT AND SMOOTH FROM ALL VIEWS. • VARIABLE GIRDER DEPTH PRESENTS POSITIVE APPEAL AND ELEGANCE AESTHETICALLY.	5
OVERALL EVALUATION/ TOTAL POINTS		100		92		94
RANK			2		1	

TABLE 4.4-4(a) ANGAT RIVER MAIN BRIDGE COMPARISON OF ALTERNATIVES

ALTERNATIVES	ELEVATION	SECTION
SCHEME 3 APPROACH : 420m+300m – TYPE V AASHTO GIRDER @ 30m SPANS MAIN : 400m 2–PLATE GIRDER WITH PC SLAB @ 57.14M SPAN TOTAL BRIDGE LENGTH : 1120m		

EVALUATION CRITERIA		POINT ALLOCATION	SCHEME 3	POINTS
CONSTRUCTION COST (IN MILLION PESOS)		40	APPROACH: Superstructure ₱ 191.02; Substructure ₱ 155.73; Craneway/Jetty ₱ 24.65; Access Road ₱ 27.00; Total ₱ 398.40 MAIN BRIDGE: Superstructure ₱ 182.80; Substructure ₱ 67.20; Craneway/Jetty ₱ 59.60; Access Road ₱ 10.00; Total ₱ 319.60	36
CONSTRUCTION ASPECT	DIFFICULTY	15	•CRANEWAY AND COFFERDAM NEEDED TO CONSTRUCT BORED PILES AND PILE CAP. •CRANEWAY ALSO NEEDED FOR ERECTION OF GIRDERS AND SLAB. BENT NEED TO BE FOUNDED ON RIVER. •PLATE GIRDERS ARE PRE–ASSEMBLED & FABRICATED ON PLANT & JOINED & ERECTED ON SITE. •SITE WELDING NECESSARY TO JOIN PLATE GIRDERS. • PRECAST, PRESTRESSED DECK SLAB CAN ALSO BE FABRICATED ON PLANT & ERECTED ON SITE. •PC SLAB JOINT TO BE CAST–IN–PLACE.	13
	PERIOD	10	SUBSTRUCTURE: • BY C.I.P. BORED PILES ON COFFERDAM. • DURATION – 7 MOS. SUPERSTRUCTURE: •PREFABRICATED SEGMENTS ERECTED USING TRUCK CRANE & SUPPORT BENT. • DURATION – 8 MOS. TOTAL DURATION – 15 MOS.	10
STRUCTURAL ASPECT		5	•THE WEIGHT TO SPAN RATIO OF THE STRUCTURE IS SMALLER COMPARED TO SCHEME 1. •LESS SEISMIC FORCE DEMAND. •THE LONG'L & TRANSVERSE SEISMIC FORCES ARE TRANSFERED TO THE PIERS BY BEARINGS. •BOTTOM OF COLUMN TAKES ALL SEISMIC FORCES.	4
USE OF LOCAL MATERIALS AND LABOR		5	•PRECAST, PRESTRESSED DECK SLAB CAN BE LOCALLY PRODUCED W/ IMPORTATION OF P.S. STRANDS & ANCHOR BLOCKS. •MATER'LS FOR PLATE GIRDERS ARE IMPORTED. LOCAL SKILL CAN FABRICATE PLATE GIRDERS. • LOCAL SKILLS AVAILABLE FOR THE FABRICATION & PLATE GIRDER WELDING.	4
MAINTENANCE		5	•STEEL COMPONENTS ARE ALL–WEATHER, CORROSION RESISTANT. •MINIMAL MAINTENANCE NEEDED. •INSPECTION OF JOINTS AND BEARINGS NEEDED.	4
RIVER HYDRAULICS		5	•SPAN LENGTH GREATER THAN DOWNSTREAM SPAN LENGTHS. • ENCROACHMENT ON RIVER SECTION 3.50 % • FOUNDATION SIZE SMALLER THAN SCHEME 1.	5
INTRODUCTION OF NEW TECHNOLOGY		5	•RELATIVELY NEW BRIDGE CONSTRUCTION TECHNOLOGY INTRODUCED & WILL IMPROVE LOCAL CAPABILITY IN DESIGN & CONSTRUCTION.	5
IMPACT TO ENVIRONMENT		5	•MINIMAL IMPACT DURING SUBSTRUCTURE CONSTRUCTION. •WELDING DISCHARGE SHOULD BE CONTROLLED DURING SUPERSTRUCTURE CONSTRUCTION.	5
AESTHETICS		5	•CONSTANT DEPTH PRESENTS MONOTONOUS VIEW. •CLUTTERED ON UNDERSIDE DUE TO MANY LINES.	4
OVERALL EVALUATION/ TOTAL POINTS		100		90
RANK			3	

TABLE 4.4-4(b) ANGAT RIVER MAIN BRIDGE COMPARISON OF ALTERNATIVES

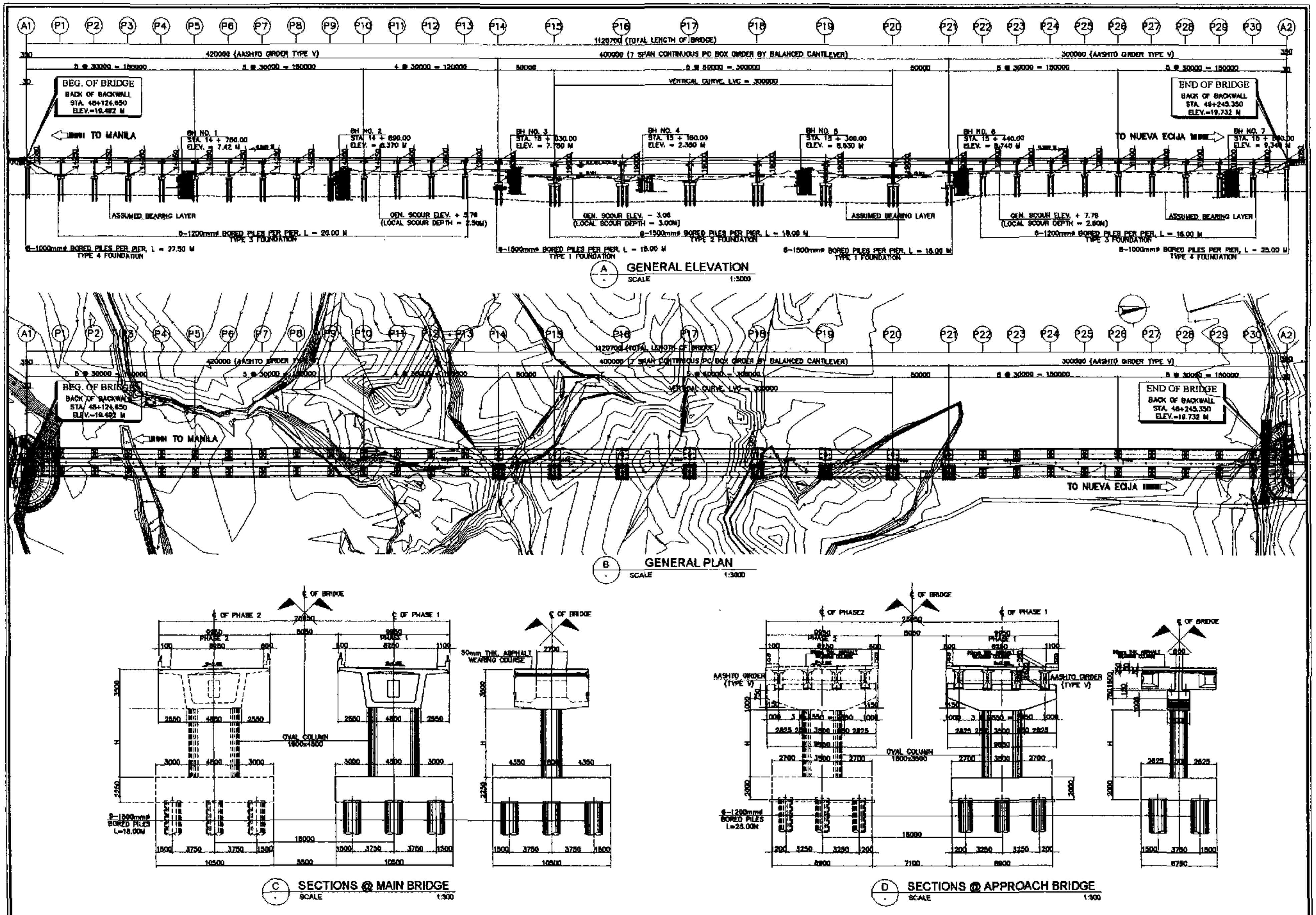


FIGURE 4.4-5 PROPOSED ANGAT RIVER BRIDGE CROSSING

The river hydraulics for the proposed bridge is presented in Table 4.4-5 below.

TABLE 4.4-5 RIVER HYDRAULICS FOR PAMPANGA RIVER CROSSING

50-year Discharge, $\mathbf{Q_{50}}$ (m^3/s)	6,990
Minimum Span, **S** (m) *S = 30 + 0.005Q*	65
Flow Velocity, $\mathbf{V_{50}}$ (m^3/s)	1.88
Design Flood Water Level, (EL +m)	32.30
Catchment Area , **CA** (km^2)	2,508.6

Similar to Angat river, a preliminary screening was conducted to determine appropriate bridge schemes that can be used for a more detailed comparison. Figure 4.4-7 is used to determine the costs of the different components of the main bridge for this river condition.

The preliminary screening of bridge alternatives is presented in Table 4.4-6. The first two highest ranks among the different alternatives are selected for a more detailed comparison. The two schemes for the main bridge are 9-span bridges with a total length of 585m consisting of 65m spans prestressed box girder bridge and a 2-steel plate girder.

As seen in Table 4.4-7, Scheme 2 which is a 9-Span 2-Steel Plate Girder Scheme (with span configuration of 5-span continuous @ 65m + 4-span continuous @ 65m) is taken as the most appropriate scheme due to:

- The minimum span requirement for river discharge is complied with,
- The 2-steel plate girder is the cheaper alternative,
- The steel plate girder and pre-cast slab erected by truck crane is a more appropriate construction method since the ordinary water level is shallow and does not cover the whole waterway,
- Construction period is faster than the box girder, and
- The superstructure is much lighter than the box girder thus lesser forces under seismic action is anticipated.

The final scheme for the bridge crossing the Pampanga river is shown in Figure 4.4-8. The proposed Pampanga river crossing is an 1125m long bridge with 180m + 360m long approaches using AASHTO Girders and a 585m long 9-span 2-plate girder with pre-cast prestressed slabs.

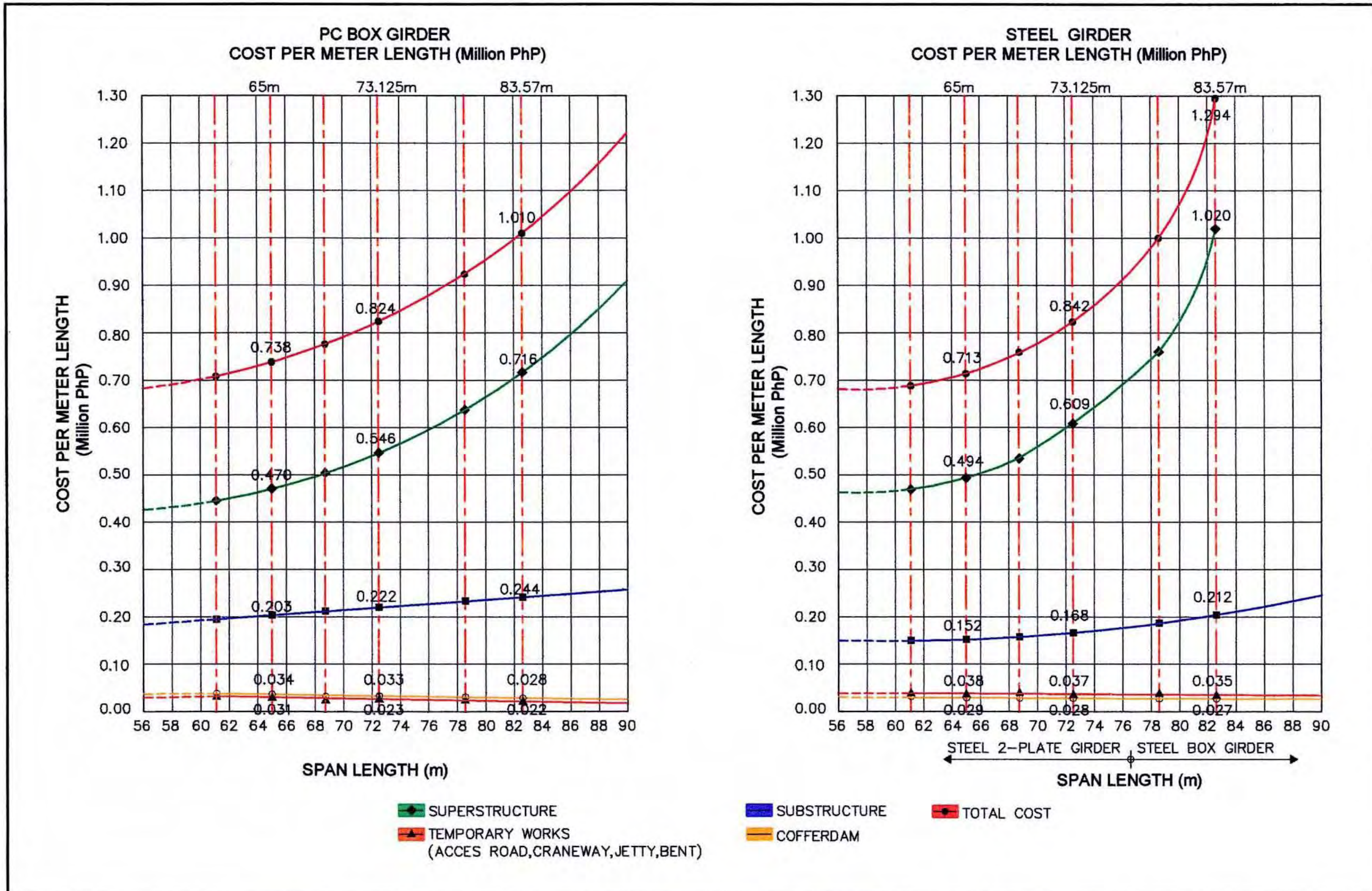


FIGURE 4.4-7 BRIDGE COSTS BREAKDOWN FOR PAMPANGA RIVER CROSSING

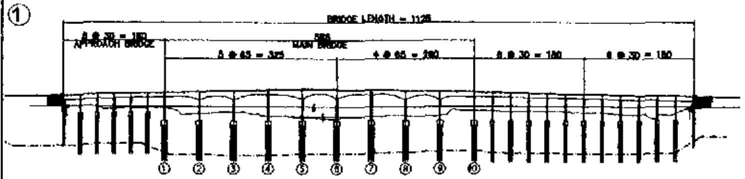
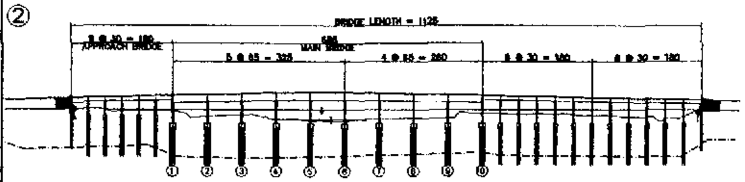
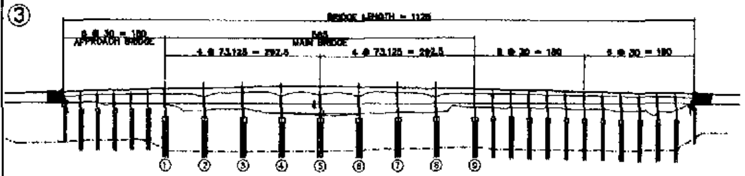
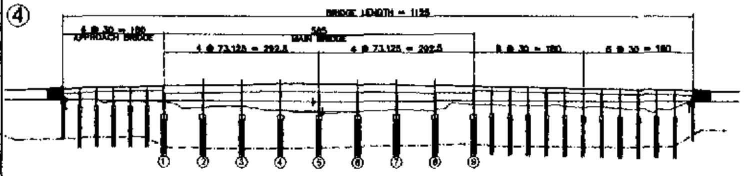
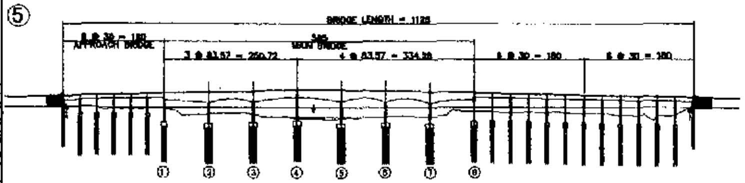
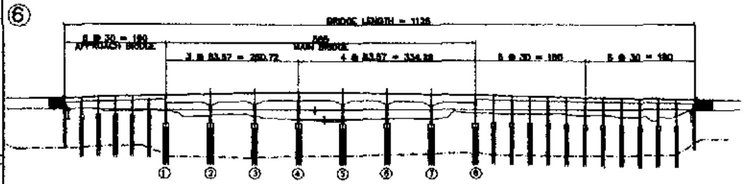
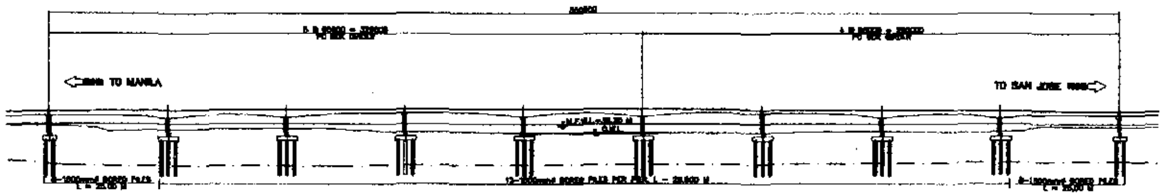
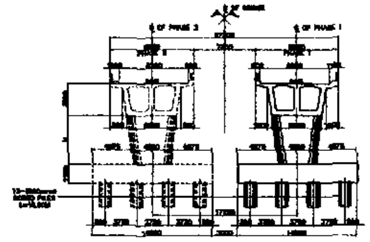
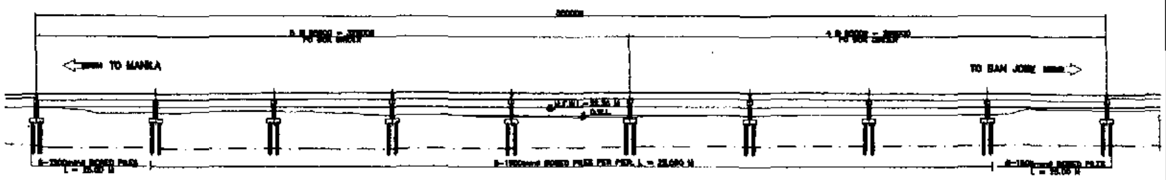
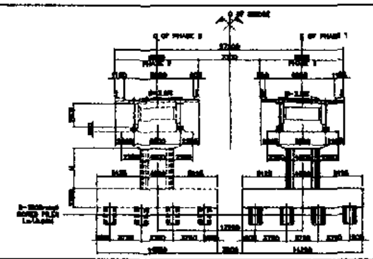
DESCRIPTION	SCHEME	STRUCTURAL ASPECT (MAINBRIDGE)	CONSTRUCTION METHODOLOGY	COST, Million PhP	COST FACTOR (DIFFERENCE)	RANK
MAIN BRIDGE SPAN LENGTH : 65.0 M SUPERSTRUCTURE TYPE : PC BOX GIRDER SUBSTRUCTURE TYPE : ø1.5M MULTIPLE BORED PILE NO. OF PIERS : 10 SCHEME CONSIDERATION : MINIMUM SPAN REQUIREMENT AT 585M MAIN RIVER WATERWAY	①  SCHEME 1 - 65.0M PC BOX GIRDER (9 SPANS)	•HIGH ASEISMICITY DUE TO BOX GIRDER MONOLITHIC W/ PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE SUPERSTRUCTURE BY PRECAST SEGMENTS USING BALANCED CANTILEVER METHOD OF CONSTRUCTION.	MAIN SUPERSTRUCTURE : 274.95 SUBSTRUCTURE : 118.76 TEMPORARY WORKS CRANEWAY/JETTY, ACCESS ROAD : 18.14 COFFERDAM : 19.89 SUBTOTAL : 431.74 APPROACH : 243.00 TOTAL : 674.74	1.02 (14.63)	②
MAIN BRIDGE SPAN LENGTH : 65.0 M SUPERSTRUCTURE TYPE : 2-PLATE GIRDER WITH PC SLAB SUBSTRUCTURE TYPE : ø1.5M MULTIPLE BORED PILE NO. OF PIERS : 10 SCHEME CONSIDERATION : SAME SPAN REQUIREMENT BUT LIGHTER SUPER-STRUCTURE THAN SCHEME 1.	②  SCHEME 2 - 65.0M 2-PLATE GIRDER (9 SPANS)	•CONTINUOUS PLATE GIRDER ON BEARING SUPPORT AT PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING. •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE GIRDER PREFABRICATED ON SEGMENTS & WELDED TO CONTINUITY AT SITE •ERECTED USING TRUCK CRANE AND SUPPORT BENT •PRECAST, PRESTRESSED SLAB ERECTED ON SITE W/ C.I.P. JOINTS	MAIN SUPERSTRUCTURE : 288.99 SUBSTRUCTURE : 88.92 TEMPORARY WORKS CRANEWAY/JETTY, ACCESS ROAD : 22.23 COFFERDAM : 16.97 SUBTOTAL : 417.11 APPROACH : 243.00 TOTAL : 660.11	1.00	①
MAIN BRIDGE SPAN LENGTH : 73.125 M SUPERSTURCTURE TYPE : PC BOX GIRDER SUBSTRUCTURE TYPE : ø1.5M MULTIPLE BORED PILE NO. OF PIERS : 9 SCHEME CONSIDERATION : 1-SPAN REDUCTION FROM SCHEME 1.	③  SCHEME 3 - 73.125M PC BOX GIRDER (8 SPANS)	•HIGH ASEISMICITY DUE TO BOX GIRDER MONOLITHIC W/ PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE SUPERSTRUCTURE BY PRECAST SEGMENTS USING BALANCED CANTILEVER METHOD OF CONSTRUCTION.	MAIN SUPERSTRUCTURE : 319.41 SUBSTRUCTURE : 129.87 TEMPORARY WORKS CRANEWAY/JETTY, ACCESS ROAD : 13.46 COFFERDAM : 19.31 SUBTOTAL : 482.05 APPROACH : 243.00 TOTAL : 725.05	1.10 (64.94)	④
MAIN BRIDGE SPAN LENGTH : 73.125 M SUPERSTRUCTURE TYPE : 2-PLATE GIRDER WITH PC SLAB SUBSTRUCTURE TYPE : ø1.5M MULTIPLE BORED PILE NO. OF PIERS : 9 SCHEME CONSIDERATION : LIGHTER SUPERSTRUCTURE THAN SCHEME 3.	④  SCHEME 4 - 73.125M 2-PLATE GIRDER (8 SPANS)	•CONTINUOUS PLATE GIRDER ON BEARING SUPPORT AT PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING. •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE GIRDER PREFABRICATED ON SEGMENTS & WELDED TO CONTINUITY AT SITE •ERECTED USING TRUCK CRANE AND SUPPORT BENT •PRECAST, PRESTRESSED SLAB ERECTED ON SITE W/ C.I.P. JOINTS	MAIN SUPERSTRUCTURE : 356.27 SUBSTRUCTURE : 98.28 TEMPORARY WORKS CRANEWAY/JETTY, ACCESS ROAD : 21.66 COFFERDAM : 16.38 SUBTOTAL : 492.59 APPROACH : 243.00 TOTAL : 735.59	1.11 (75.48)	③
MAIN BRIDGE SPAN LENGTH : 83.57 M SUPERSTURCTURE TYPE : PC BOX GIRDER SUBSTRUCTURE TYPE : ø1.5M MULTIPLE BORED PILE NO. OF PIERS : 8 SCHEME CONSIDERATION : 2-SPAN REDUCTION FROM SCHEME 1.	⑤  SCHEME 5 - 83.57M PC BOX GIRDER (7 SPANS)	•HIGH ASEISMICITY DUE TO BOX GIRDER MONOLITHIC W/ PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE SUPERSTRUCTURE BY PRECAST SEGMENTS USING BALANCED CANTILEVER METHOD OF CONSTRUCTION.	MAIN SUPERSTRUCTURE : 418.86 SUBSTRUCTURE : 142.74 TEMPORARY WORKS CRANEWAY/JETTY, ACCESS ROAD : 12.87 COFFERDAM : 16.38 SUBTOTAL : 590.85 APPROACH : 243.00 TOTAL : 833.85	1.26 (173.74)	⑤
MAIN BRIDGE SPAN LENGTH : 83.57 M SUPERSTRUCTURE TYPE : STEEL BOX GIRDER WITH PC SLAB SUBSTRUCTURE TYPE : ø1.5M MULTIPLE BORED PILE NO. OF PIERS : 8 SCHEME CONSIDERATION : LIGHTER SUPERSTRUCTURE THAN SCHEME 5.	⑥  SCHEME 6 - 83.57M 2-PLATE GIRDER (7 SPANS)	•CONTINUOUS STEEL BOX GIRDER ON BEARING SUPPORT AT PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING. •APPROACH SPAN ON BEARINGS MADE CONTINUOUS FOR LIVE LOAD	•MAIN BRIDGE GIRDER PREFABRICATED ON SEGMENTS & WELDED TO CONTINUITY AT SITE •ERECTED USING TRUCK CRANE AND SUPPORT BENT •PRECAST, PRESTRESSED SLAB ERECTED ON SITE W/ C.I.P. JOINTS	MAIN SUPERSTRUCTURE : 598.70 SUBSTRUCTURE : 124.02 TEMPORARY WORKS CRANEWAY/JETTY, ACCESS ROAD : 20.48 COFFERDAM : 15.80 SUBTOTAL : 757.00 APPROACH : 243.00 TOTAL : 1000.00	1.51 (339.89)	⑥

TABLE 4.4-6 PRELIMINARY SCREENING FOR PAMPANGA RIVER MAIN BRIDGE CROSSING

ALTERNATIVES	ELEVATION	SECTION
SCHEME 1 APPROACH : 180m+360m – TYPE V AASHTO GIRDER @ 30m SPANS MAIN : 585m PC BOX @ 65.0m SPANS TOTAL BRIDGE LENGTH : 1125.0m		
SCHEME 2 APPROACH : 180m+360m – TYPE V AASHTO GIRDER @ 30m SPANS MAIN : 585m 2-PLATE GIRDER WITH PC SLAB @ 65.0m SPANS TOTAL BRIDGE LENGTH : 1125.0m		

EVALUATION CRITERIA		POINT ALLOCATION	SCHEME 1	POINTS	SCHEME 2	POINTS
CONSTRUCTION COST (IN MILLION PESOS)		40	APPROACH: Superstructure ₱ 140.10; Substructure ₱ 89.15; Craneway/Jetty ₱ 0.00; Access Road ₱ 13.75; Total ₱ 243.00 MAIN BRIDGE: Superstructure ₱ 274.95; Substructure ₱ 118.76; Temp. Works ₱ 30.53; Access Road ₱ 7.50; Total ₱ 431.74	32	APPROACH: Superstructure ₱ 140.10; Substructure ₱ 89.15; Craneway/Jetty ₱ 0.00; Access Road ₱ 13.75; Total ₱ 243.00 MAIN BRIDGE: Superstructure ₱ 288.99; Substructure ₱ 88.92; Temp. Works ₱ 31.70; Access Road ₱ 7.50; Total ₱ 417.11	40
CONSTRUCTION ASPECT	DIFFICULTY	15	• CRANEWAY AND COFFERDAM NEEDED TO CONSTRUCT BORED PILES AND PILE CAP. • SUPERSTRUCTURE CAN BE CONSTRUCTED USING BALANCED CANTILEVER EVEN DURING RAINY DAYS. • NEEDED CAREFULL MONITORING OF DISPLACEMENT DURING CANTILEVERING.	13	•CRANEWAY AND COFFERDAM NEEDED TO CONSTRUCT BORED PILES AND PILE CAP. •CRANEWAY ALSO NEEDED FOR ERECTION OF GIRDERS AND SLAB. •PLATE GIRDERS ARE PRE-ASSEMBLED & FABRICATED ON PLANT & JOINED & ERECTED ON SITE. •SITE WELDING NECESSARY TO JOIN PLATE GIRDERS. • PRECAST, PRESTRESSED DECK SLAB CAN ALSO BE FABRICATED ON PLANT & ERECTED ON SITE. •PC SLAB JOINT TO BE CAST-IN-PLACE.	15
	PERIOD	10	SUBSTRUCTURE: • BY C.I.P. BORED PILES ON COFFERDAM. • DURATION – 10 MOS. SUPERSTRUCTURE: • BY BALANCE CANTILEVER. • *DURATION – 18 MOS.* TOTAL DURATION – 28 MOS.	7	SUBSTRUCTURE: • BY C.I.P. BORED PILES ON COFFERDAM. • DURATION – 9 MOS. SUPERSTRUCTURE: •PREFABRICATED SEGMENTS ERECTED USING TRUCK CRANE & SUPPORT BENT. • *DURATION – 10 MOS.* TOTAL DURATION – 19 MOS.	10
STRUCTURAL ASPECT		5	• HIGH ASEISMICITY DUE TO MONOLITHIC DECK & PIER CONSTRUCTION. • HIGH RIGIDITY & TORSIONAL RESISTANCE OF SUPERSTRUCTURE DUE TO PC BOX SECTION. • CONTINUITY OF SUPERSTRUCTURE W/ PIERS DISTRIBUTES SEISMIC FORCES TO TOP AND BOTTOM OF COLUMN.	5	•THE WEIGHT TO SPAN RATIO OF THE STRUCTURE IS SMALLER COMPARED TO SCHEME 1. •LESS SEISMIC FORCE DEMAND. •THE LONG'L & TRANSVERSE SEISMIC FORCES ARE TRANSFERED TO THE PIERS BY BEARINGS DOWELS. •BOTTOM OF COLUMN TAKES ALL SEISMIC FORCES.	4
USE OF LOCAL MATERIALS AND LABOR		5	• MOST MATERIALS ARE LOCALLY AVAILABLE EXCEPT PRESTRESS COMPONENTS. • HIGHLY SKILLED LABOR FORCE IS NEEDED IN CONSTRUCTING THIS TYPE OF STRUCTURE.	5	•PRECAST, PRESTRESSED DECK SLAB CAN BE LOCALLY PRODUCED W/ IMPORTATION OF P.S. STRANDS & ANCHOR BLOCKS. •MATER'LS FOR PLATE GIRDERS ARE IMPORTED. LOCAL SKILL CAN FABRICATE PLATE GIRDERS. • LOCAL SKILLS AVAILABLE FOR THE FABRICATION & PLATE GIRDER WELDING.	3
MAINTENANCE		5	• MINIMAL MAINTENANCE IS REQUIRED BECAUSE OF LESS NUMBER OF JOINTS & BEARINGS. • INSPECTION OF JOINTS AND BEARINGS AT APPROACH IS NEEDED.	4	•STEEL COMPONENTS ARE ALL-WEATHER, CORROSION RESISTANT. •MINIMAL MAINTENANCE NEED. •INSPECTION OF JOINTS AND BEARINGS NEEDED.	4
RIVER HYDRAULICS		5	• SPAN LENGTH GREATER THAN DOWNSTREAM SPAN LENGTH. • ENCROACHMENT ON RIVER SECTION 3.95 %	4	•SPAN LENGTH GREATER THAN DOWNSTREAM SPAN LENGTHS. • ENCROACHMENT ON RIVER SECTION 3.95 % •FOUNDATION SIZE SMALLER THAN SCHEME 1.	4
INTRODUCTION OF NEW TECHNOLOGY		5	• USE OF BALANCED CANTILEVER METHOD CAN IMPROVE LOCAL CONTRACTOR'S CAPABILITY.	4	•RELATIVELY NEW BRIDGE CONSTRUCTION TECHNOLOGY INTRODUCED & WILL IMPROVE LOCAL CAPABILITY IN DESIGN & CONSTRUCTION.	5
IMPACT TO ENVIRONMENT		5	•MINIMAL IMPACT DURING SUBSTRUCTURE CONSTRUCTION. •NO IMPACT DURING SUPERSTRUCTURE CONSTRUCTION.	5	•MINIMAL IMPACT DURING SUBSTRUCTURE CONSTRUCTION. •WELDING DISCHARGE SHOULD BE CONTROLLED DURING SUPERSTRUCTURE CONSTRUCTION.	4
AESTHETICS		5	•NEAT AND SMOOTH FROM ALL VIEWS. •VARIABLE GIRDER DEPTH PRESENTS POSITIVE APPEAL AND ELEGANCE AESTHETICALLY.	5	•CONSTANT DEPTH PRESENTS MONOTONOUS VIEW. •CLUTTERED ON UNDERSIDE DUE TO MANY LINES.	3
OVERALL EVALUATION/ TOTAL POINTS		100		84		92
RANK			2		1	

TABLE 4.4-7 PAMPANGA RIVER MAIN BRIDGE COMPARISON OF ALTERNATIVES

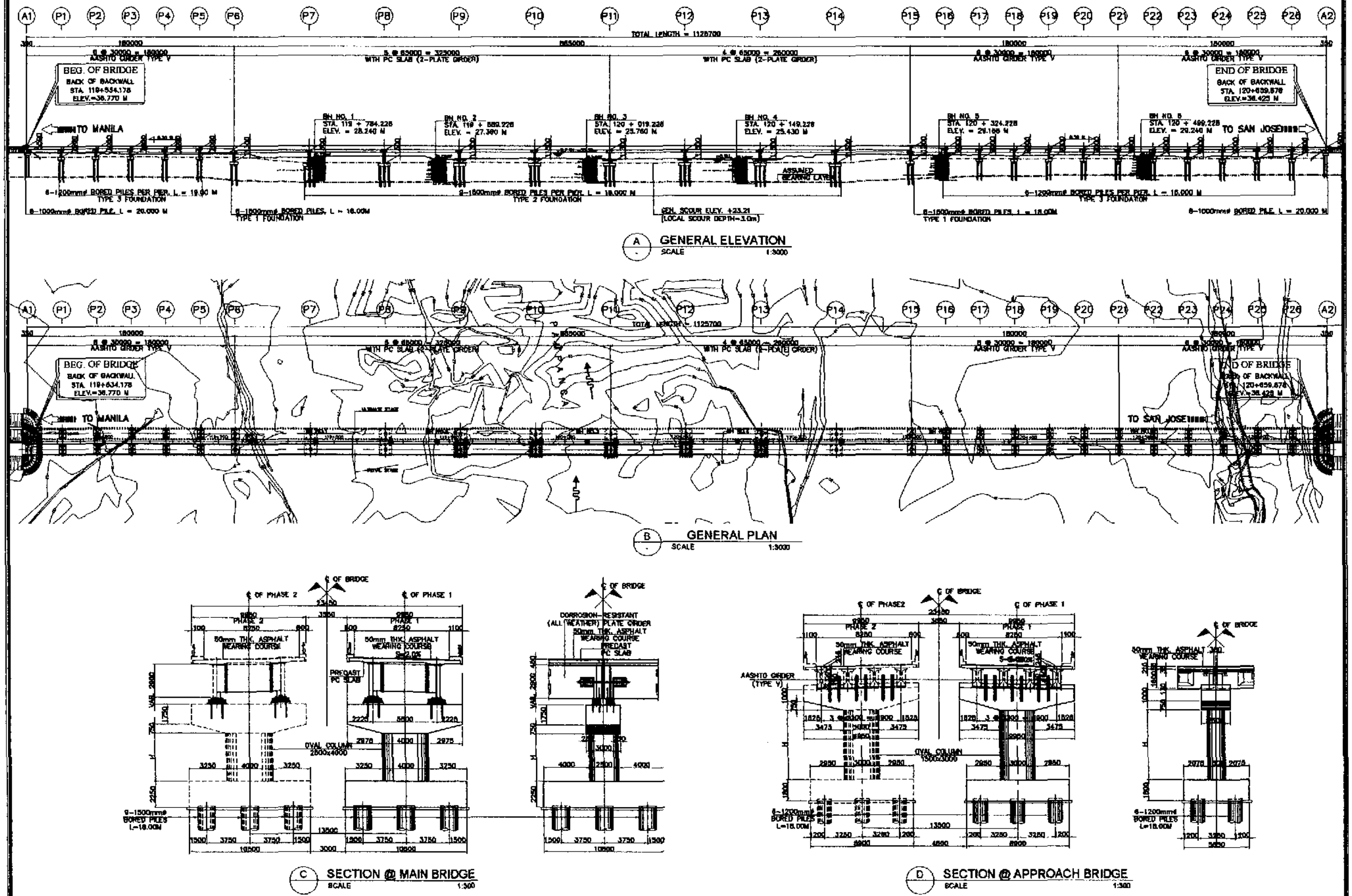


FIGURE 4.4-8 PROPOSED PAMPANGA RIVER BRIDGE CROSSING

4.4.4 Bridge Scheme for Talavera River Bridge Crossing

Similar to the Pampanga river, the Talavera river has a wide flood area but only a main river waterway width of about 360m as shown in Figure 4.4-9. Thus the bridge scheme alternatives will cover only 360m of the river section.

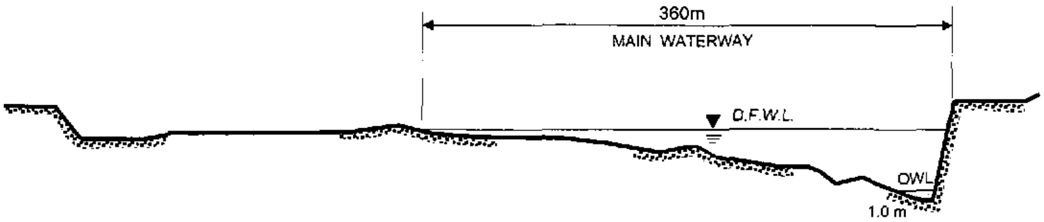


FIGURE 4.4-9 TALAVERA RIVER SECTION AT PROPOSED SITE LOCATION

The river hydraulics for the proposed bridge is presented in Table 4.4-8 below.

TABLE 4.4-8 RIVER HYDRAULICS FOR TALAVERA RIVER CROSSING

50-year Discharge, $\mathbf{Q_{50}}$ (m^3/s)	1,570
Minimum Span, **S** (m) *S = 30 + 0.005Q*	38
Flow Velocity, $\mathbf{V_{50}}$ (m^3/s)	2.08
Design Flood Water Level, (EL +m)	43.25
Catchment Area , **CA** (km^2)	463.0

Similar to the other two bridges and considering the above river requirements, a preliminary screening was conducted to determine appropriate bridge schemes that can be used for a more detailed comparison.

The preliminary screening of bridge alternatives is presented in Table 4.4-9. Using the minimum span length of 38m, a 9-span and 7-span bridge are identified and compared. The superstructures for the bridge schemes considered includes Type VI AASHTO Girders, Prestressed Box Girder and 2-Plate Girder.

The three alternative schemes are compared further as presented in Tables 4.4-10a and 10b. Scheme 1 which is a 9-span pre-cast prestressed AASHTO Girder is taken as the most appropriate scheme due to:

- The minimum span requirement for river discharge is complied with,
- This is the cheapest alternative among the schemes,
- Construction is the easiest using truck cranes to erect the girders and cast-in-place slab using suspended formworks from the girders, and
- The method is the easiest to implement since local contractors have much experience in constructing the proposed bridge scheme.

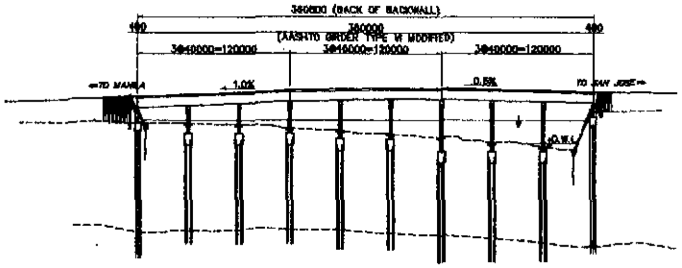
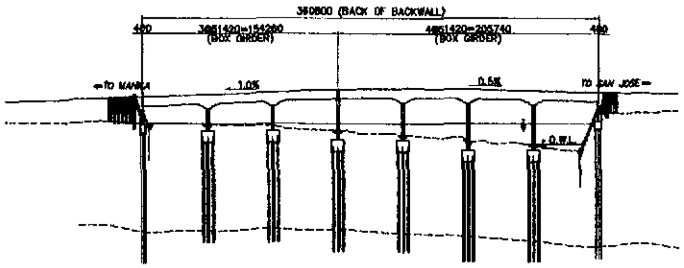
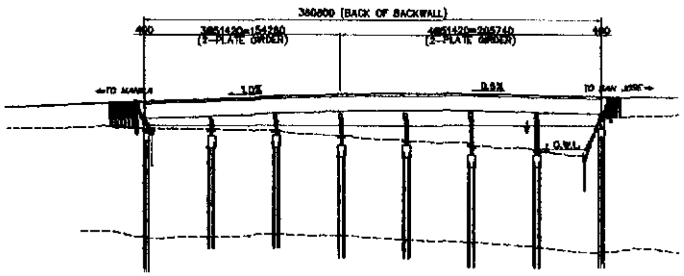
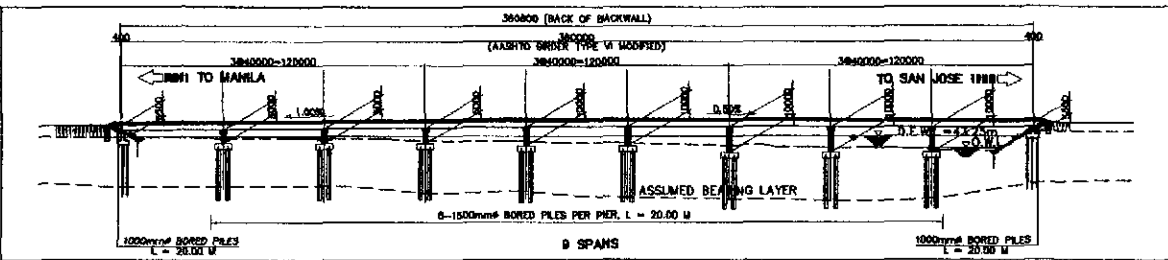
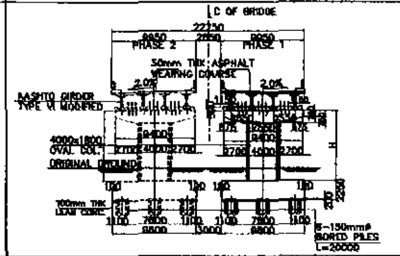
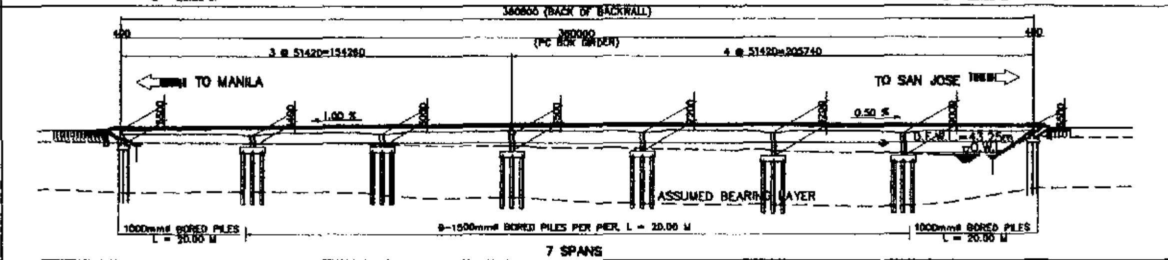
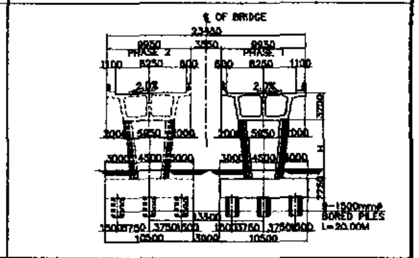
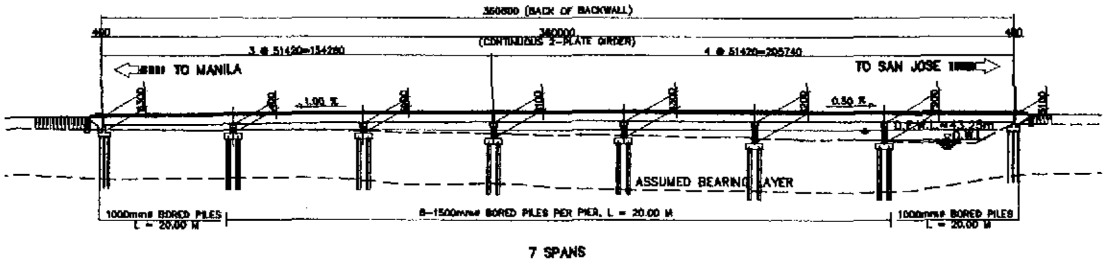
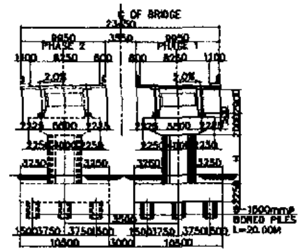
DESCRIPTION	SCHEME	STRUCTURAL ASPECT (MAINBRIDGE)	CONSTRUCTION METHODOLOGY	COST, Million PhP	COST FACTOR (DIFFERENCE)	RANK
MAIN BRIDGE SPAN LENGTH : 40M SUPERSTRUCTURE TYPE : AASHTO TYPE VI MODIFIED SUBSTRUCTURE TYPE : MULTIPLE BP ø1.5M NO. OF PIERS : 8 SCHEME CONSIDERATION: • MINIMUM SPAN OF 40M BASED ON EFFECTIVE SPAN OF DOWNSTREAM BRIDGE.	 SCHEME 1 - 40M AASHTO GIRDER	•SUPERSTRUCTURE ON BEARINGS BUT MADE CONTINUOUS ON LIVE LOAD (3 @ 3 SPAN CONT.) •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING	•FOUNDATION C.I.P. BORED PILES ON COFFERDAM •MAIN BRIDGE BY PRECAST AASHTO TYPE VI GIRDERS ERECTED USING TRUCK CRANE AND TEMPORARY SUPPORT. •DECK SLAB CAST-IN-PLACE ON SUSPENDED FORMWORK.	SUPERSTRUCTURE : 112.88 SUBSTRUCTURE : 69.82 TEMPORARY WORKS CRANEWAY : 5.6 COFFERDAM : 5.6 TOTAL : 193.70	1.00 (0.00)	①
MAIN BRIDGE SPAN LENGTH : 51.420M SUPERSTRUCTURE TYPE : PC BOX GIRDER SUBSTRUCTURE TYPE : MULTIPLE BP ø1.5M NO. OF PIERS : 6 SCHEME CONSIDERATION: • TWO-SPAN REDUCTION FROM SCHEME 1. • SIMILAR SPAN WITH DOWNSTREAM BRIDGE.	 SCHEME 2 - 51.42M PC BOX GIRDER	•3-SPAN & 4-SPAN CONTINUOUS BOX GIRDER •HIGH ASEISMICITY DUE TO BOX GIRDER MONOLITHIC WITH PIERS •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING	•FOUNDATION C.I.P. BORED PILES ON COFFERDAM •MAIN BRIDGE BY C.I.P. BALANCED CANTILEVER METHOD.	SUPERSTRUCTURE : 149.79 SUBSTRUCTURE : 75.99 TEMPORARY WORKS CRANEWAY : 2.8 COFFERDAM : 5.6 TOTAL : 234.18	1.21 (40.48)	③
MAIN BRIDGE SPAN LENGTH : 51.420M SUPERSTRUCTURE TYPE : 2-PLATE GIRDER SUBSTRUCTURE TYPE : MULTIPLE BP ø1.5M NO. OF PIERS : 6 SCHEME CONSIDERATION: • TWO-SPAN REDUCTION FROM SCHEME 1. • SIMILAR SPAN WITH DOWNSTREAM BRIDGE. • LIGHTER STRUCTURE THAN SCHEME 3	 SCHEME 3 - 51.42M 2-PLATE GIRDER	•3-SPAN & 4-SPAN CONTINUOUS PLATE GIRDER SUPPORTED BY BEARINGS ON PIER. •LIGHTER SUPERSTRUCTURE THUS LESSER SEISMIC FORCE DEMAND. •SUPERSTRUCTURE ON BEARINGS BUT MADE CONTINUOUS ON DEAD LOAD AND LIVE LOAD •FOUNDATION ON MULTIPLE BORED PILES ADVANTAGEOUS FOR LOCAL SCOURING	•FOUNDATION C.I.P. BORED PILES ON COFFERDAM •MAIN BRIDGE GIRDER PREFABRICATED ON SEGMENTS AND WELDED TO CONTINUITY AT SITE. •PRECAST, PRESTRESSED SLAB ERECTED ON SITE WITH C.I.P. JOINTS.	SUPERSTRUCTURE : 155.88 SUBSTRUCTURE : 57.91 TEMPORARY WORKS CRANEWAY : 5.6 COFFERDAM : 5.6 TOTAL : 224.99	1.16 (31.29)	②

TABLE 4.4-9 PRELIMINARY SCREENING FOR TALAVERA BRIDGE CROSSING

ALTERNATIVES	ELEVATION	SECTION
SCHEME 1 360M – TYPE VI MODIFIED AASHTO GIRDER @ 40M SPAN. TOTAL BRIDGE LENGTH : 360M * SCHEME CONSIDERATION IS BASED ON DESIGN FLOOD WATER LEVEL AND MINIMUM SPAN LENGTH OF 40.0M.		
SCHEME 2 360M – PC BOX GIRDER @ 51.42M SPAN TOTAL BRIDGE LENGTH : 360M * SCHEME CONSIDERATION IS BASED ON TOTAL BRIDGE LENGTH AS SCHEME 1 AND SPAN LENGTH OF 51.42M SIMILAR TO EXISTING BRIDGE.		

EVALUATION CRITERIA		POINT ALLOCATION	SCHEME 1	POINTS	SCHEME 2	POINTS
CONSTRUCTION COST (IN MILLION PESOS)		40	MAIN BRIDGE: Superstructure ₱ 112.68 Substructure ₱ 69.82 Craneway/Jetty ₱ 5.60 Access Road ₱ 5.60 Total ₱ 193.70	40	MAIN BRIDGE: Superstructure ₱ 149.79 Substructure ₱ 75.99 Craneway/Jetty ₱ 2.80 Access Road ₱ 5.60 Total ₱ 234.18	20
CONSTRUCTION ASPECT	DIFFICULTY	15	• CRANEWAY AND COFFERDAM NEEDED FOR BORED PILES AND PILE CAP CONSTRUCTION ON WATER. • 2–150t CRANE NEED FOR ERECTING GIRDERS. • STAGING AREA NEEDED FOR FABRICATING & STRESSING GIRDER TENDONS. • DECK SLAB SHOULD BE CAST ON SUSPENDED FORMWORK FROM GIRDERS.	15	• CRANEWAY AND COFFERDAM NEEDED TO CONSTRUCT BORED PILES AND PILE CAP. • SUPERSTRUCTURE CAN BE CONSTRUCTED USING BALANCED CANTILEVER EVEN DURING RAINY DAYS. • NEEDED CAREFULL MONITORING OF DISPLACEMENT DURING CANTILEVERING.	13
	PERIOD	10	SUBSTRUCTURE: • BY C.I.P. BORED PILES ON COFFERDAM. • DURATION – 6 MOS. SUPERSTRUCTURE: • AASHTO GIRDERS ERECTED BY TRUCK CRANE AND DECK SLAB C.I.P. ON SUSPENDED FORMWORKS • DURATION 5–MOS. TOTAL DURATION – 11 MOS.	8	SUBSTRUCTURE: • BY C.I.P. BORED PILES ON COFFERDAM. • DURATION – 6 MOS. SUPERSTRUCTURE: • BY BALANCE CANTILEVER. • DURATION – 9 MOS. TOTAL DURATION – 15 MOS.	6
STRUCTURAL ASPECT		5	• GIRDER ON BEARING SUPPORT, COLUMN BOTTOM CARRIES ALL SEISMIC LOAD. • SUPERSTRUCTURE MADE CONTINUOUS ON LIVE LOAD.	4	• HIGH ASEISMICITY DUE TO MONOLITHIC DECK & PIER CONSTRUCTION. • HIGH RIGIDITY & TORSIONAL RESISTANCE OF SUPERSTRUCTURE DUE TO PC BOX SECTION. • CONTINUITY OF SUPERSTRUCTURE W/ PIERS DISTRIBUTES SEISMIC FORCES TO TOP AND BOTTOM OF COLUMN.	5
USE OF LOCAL MATERIALS AND LABOR		5	• MOST MATERIALS AVAILABLE LOCALLY EXCEPT PRESTRESSING STRANDS & ANCHOR BLOCK • LOCAL SKILLS CAPABLE OF CONSTRUCTING AASHTO GIRDER BRIDGE.	5	• MOST MATERIALS ARE LOCALLY AVAILABLE EXCEPT PRESTRESS COMPONENTS. • HIGHLY SKILLED LABOR FORCE IS NEEDED IN CONSTRUCTING THIS TYPE OF STRUCTURE.	4
MAINTENANCE		5	• LOW, EXCEPT THAT BEARING AND TRANSVERSE DECK JOINT DETAILS MAY REQUIRE ATTENTION	4	• MINIMAL MAINTENANCE IS REQUIRED BECAUSE OF LESS NUMBER OF JOINTS & BEARINGS. • INSPECTION OF JOINTS AND BEARINGS AT APPROACH IS NEEDED.	4
RIVER HYDRAULICS		5	• SPAN LENGTH 80% OF DOWNSTREAM BRIDGE • PIER ENCROACHMENT ON RIVER DISCHARGE IS 3.64 % • BRIDGE LENGTH 2.4 TIMES THAT OF DOWNSTREAM BRIDGE.	3	• SPAN LENGTH GREATER THAN DOWNSTREAM SPAN LENGTH. • ENCROACHMENT ON RIVER SECTION 4.41 %	4
INTRODUCTION OF NEW TECHNOLOGY		5	• AASHTO GIRDER CONSTRUCTION AVAILABLE ALREADY TO LOCAL CONTRACTORS.	2	• USE OF BALANCED CANTILEVER METHOD CAN IMPROVE LOCAL CONTRACTOR'S CAPABILITY.	4
IMPACT TO ENVIRONMENT		5	• MINIMAL IMPACT ON FOUNDATION CONSTRUCTION. • NO IMPACT OF SUPERSTRUCTURE CONSTRUCTION.	5	• MINIMAL IMPACT DURING SUBSTRUCTURE CONSTRUCTION. • NO IMPACT DURING SUPERSTRUCTURE CONSTRUCTION.	5
AESTHETICS		5	• TOO MANY LINES UNDERNEATH LOOKS CLUTTERED ON UNDERSIDE. • UTILITIES, PIPES, CONDUITS–VISIBLE BETWEEN GIRDERS.	3	• NEAT AND SMOOTH FROM ALL VIEWS. • VARIABLE GIRDER DEPTH PRESENTS POSITIVE APPEAL AND ELEGANCE AESTHETICALLY.	5
OVERALL EVALUATION/ TOTAL POINTS		100		89		70
RANK			1		3	

TABLE 4.4-10(a) TALAVERA RIVER MAIN BRIDGE COMPARISON OF ALTERNATIVES

ALTERNATIVES	ELEVATION	SECTION
SCHEME 3 360M – CONTINOUOS 2 PLATE GIRDER @ 51.42M SPAN TOTAL BRIDGE LENGTH : 360M * SCHEME CONSIDERATION IS BASED ON TOTAL BRIDGE LENGTH AS SCHEME 1 AND SPAN LENGTH OF 51.42M SIMILAR TO EXISTING BRIDGE.		

EVALUATION CRITERIA		POINT ALLOCATION	SCHEME 3			POINTS
CONSTRUCTION COST (IN MILLION PESOS)		40	MAIN BRIDGE	Superstructure	₱ 155.88	24
				Substructure	₱ 57.91	
				Craneway/Jetty	₱ 5.60	
				Access Road	₱ 5.60	
				Total	₱ 224.99	
CONSTRUCTION ASPECT	DIFFICULTY	15	•CRANEWAY AND COFFERDAM NEEDED TO CONSTRUCT BORED PILES AND PILE CAP. •CRANEWAY ALSO NEEDED FOR ERECTION OF GIRDERS AND SLAB. •PLATE GIRDERS ARE PRE-ASSEMBLED & FABRICATED ON PLANT & JOINED & ERECTED ON SITE. •SITE WELDING NECESSARY TO JOIN PLATE GIRDERS. •PRECAST, PRESTRESSED DECK SLAB CAN ALSO BE FABRICATED ON PLANT & ERECTED ON SITE. •PC SLAB JOINT TO BE CAST-IN-PLACE.			12
	PERIOD	10	SUBSTRUCTURE	•BY C.I.P. BORED PILES ON COFFERDAM. •DURATION – 5 MOS.	TOTAL DURATION – 9 MOS.	10
			SUPERSTRUCTURE	•PREFABRICATED SEGMENTS ERECTED USING TRUCK CRANE & SUPPORT BENT. •DURATION 4-MOS.		
STRUCTURAL ASPECT		5	•THE WEIGHT TO SPAN RATIO OF THE STRUCTURE IS SMALLER COMPARED TO SCHEME 1. •LESS SEISMIC FORCE DEMAND. •THE LONG'L & TRANSVERSE SEISMIC FORCES ARE TRANSFERED TO THE PIERS BY BEARINGS DOWELS. •BOTTOM OF COLUMN TAKES ALL SEISMIC FORCES.			4
USE OF LOCAL MATERIALS AND LABOR		5	•PRECAST, PRESTRESSED DECK SLAB CAN BE LOCALLY PRODUCED W/ IMPORTATION OF P.S. STRANDS & ANCHOR BLOCKS. •MATERIALS FOR PLATE GIRDERS ARE IMPORTED. LOCAL SKILL CAN FABRICATE PLATE GIRDERS. •LOCAL SKILLS AVAILABLE FOR THE FABRICATION & PLATE GIRDER WELDING.			3
MAINTENANCE		5	•STEEL COMPONENTS ARE ALL-WEATHER, CORROSION RESISTANT. •MINIMAL MAINTENANCE NEED. •INSPECTION OF JOINTS AND BEARINGS NEEDED.			4
RIVER HYDRAULICS		5	•SPAN LENGTH GREATER THAN DOWNSTREAM SPAN LENGTHS. •ENCROACHMENT ON RIVER SECTION 4.41 % •FOUNDATION SIZE SMALLER THAN SCHEME 1.			5
INTRODUCTION OF NEW TECHNOLOGY		5	•RELATIVELY NEW BRIDGE CONSTRUCTION TECHNOLOGY INTRODUCED & WILL IMPROVE LOCAL CAPABILITY IN DESIGN & CONSTRUCTION.			5
IMPACT TO ENVIRONMENT		5	•MINIMAL IMPACT DURING SUBSTRUCTURE CONSTRUCTION. •WELDING DISCHARGE SHOULD BE CONTROLLED DURING SUPERSTRUCTURE CONSTRUCTION.			4
AESTHETICS		5	•CONSTANT DEPTH PRESENTS MONOTONOUS VIEW. •CLUTTERED ON UNDERSIDE DUE TO MANY LINES.			3
OVERALL EVALUATION/ TOTAL POINTS		100				74
RANK			2			

TABLE 4.4-10(b) TALAVERA RIVER MAIN BRIDGE COMPARISON OF ALTERNATIVES

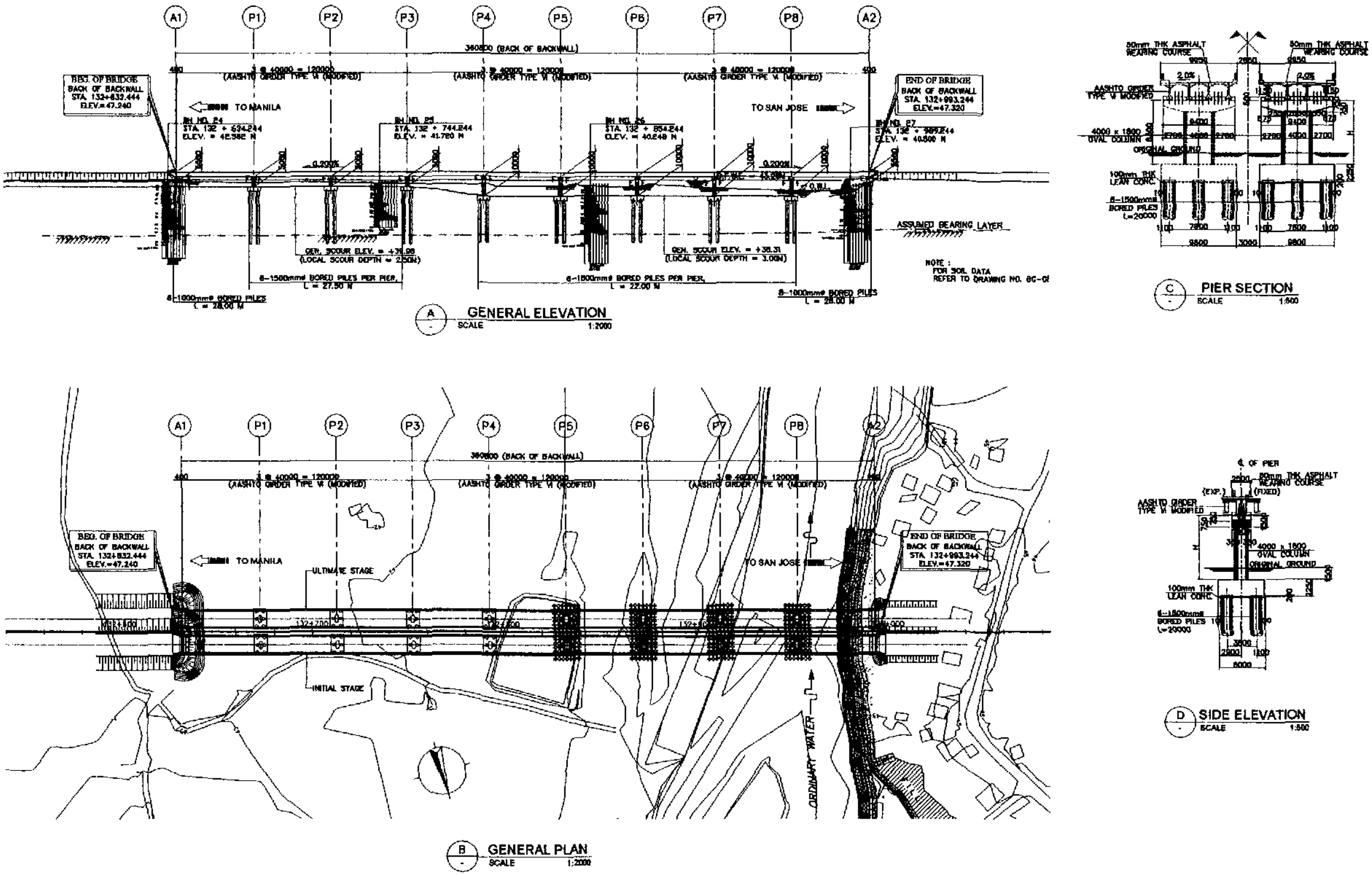


FIGURE 4.4-10 PROPOSED TALAVERA RIVER BRIDGE

The final scheme for the bridge crossing the Angat river is shown in Figure 4.4-10. The proposed bridge is 360m long consisting of 9-spans of Type VI AASHTO Girder at 30m spacing and founded on cast-in-place bored piles.

4.4.5 Bridge Scheme for Interchange Ramp C (NLE Overcrossing)

The beginning of Plaridel Bypass is connected to the North Luzon Expressway (NLE) at the proposed Interchange location. The bypass outbound ramp, Ramp C, will cross-over the Expressway (Photo 4.4-1) necessitating the construction of a bridge overcrossing. The proposed bridge overcrossing will have to clear the following control points:

• Minimum vertical clearance to be provided for the Expressway	:	5.10m
• Minimum horizontal clearance to be provided for the Expressway	:	Shoulder-to-shoulder of Expressway

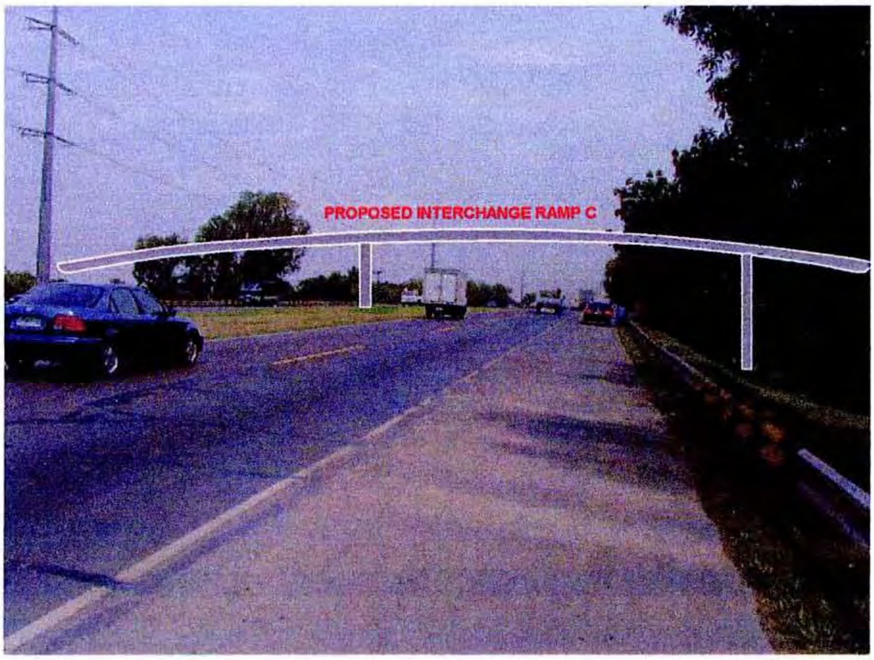


PHOTO 4.4-1 NORTH LUZON EXPRESSWAY

A study on the bridge length requirement for the NLE overcrossing is undertaken considering the following:

- the least cost to the project including ROW acquisition,
- the minimum number of span and length of the bridge,
- the horizontal and vertical clearance requirements,
- the construction period and difficulty,
- the structural performance, and
- functionality or impact to commuters using the expressway.

Three alternative schemes (Table 4.4-11) are compared to determine the bridge length appropriate for the proposed NLE overcrossing which includes:

(1) 2-Span, 60m long bridge to minimize the length resulting to a high abutment and *structures too close to the expressway*,

(2) 4-Span, 90m long bridge to move the abutment further from the expressway and lower the abutment height, and

(3) 13-Span, 325m long bridge to limit the embankment height to 5m.

Among the three schemes, Scheme 2 which is the 4-Span, 90m long bridge is taken as the most appropriate and cheapest among the alternatives.

A comparison of the superstructure type for the proposed overcrossing is also undertaken, as shown in Table 4.4-12, to determine the most appropriate scheme considering:

- the least cost,
- construction period and difficulty
- structural aspect considering the curve geometry of the superstructure,
- maintenance and aesthetics.

As indicated in Table 4.4-12, Scheme 1 or the cast-in-place Voided Slab is the most appropriate superstructure type.

The final scheme for the proposed NLE ramp overcrossing is shown in Figure 4.4-11. The proposed bridge is a 4-span, 90m long bridge (with span configuration as 20m + 2 @ 25m + 20m) with prestressed voided slab superstructure founded on bored piles.

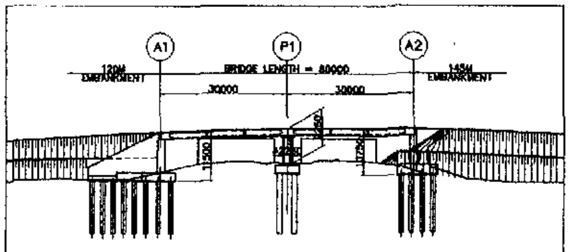
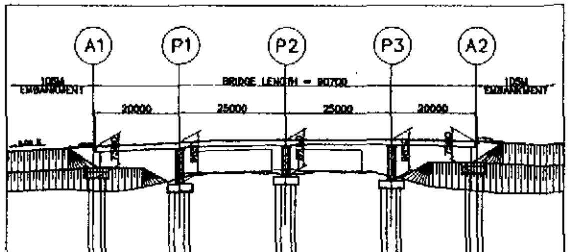
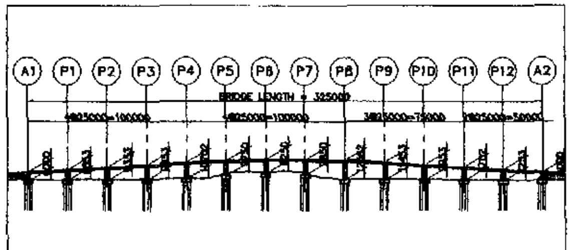
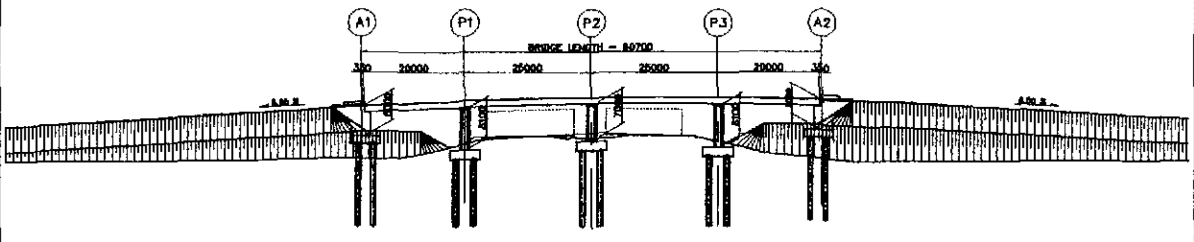
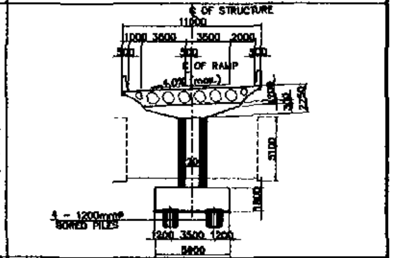
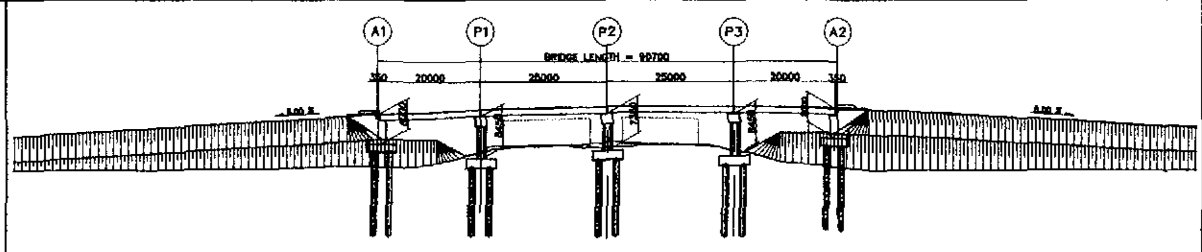
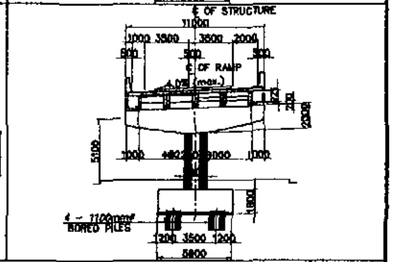
		SCHEME 1		SCHEME 2		SCHEME 3	
SCHEME ELEVATION		 60 M BRIDGE		 90 M BRIDGE		 325 M BRIDGE	
GENERAL FEATURE	SCHEME CONSIDERATION	• THIS SCHEME MINIMIZES THE BRIDGE LENGTH TO SPAN THE EXPRESSWAY RESULTING TO A 60M (2-SPAN) BRIDGE. HOWEVER, A RETAINING WALL IS NECESSARY AT SOUTHBOUND SIDE TO RETAIN THE HIGH EMBANKMENT.		• THIS SCHEME OPTIMIZES THE BRIDGE LENGTH BY ELIMINATING THE RETAINING WALL OF SCHEME 1 RESULTING TO A 4-SPAN, 90M LONG BRIDGE. HOWEVER, EMBANKMENT HEIGHT IS STILL 12.0M.		• THIS SCHEME LIMITS THE EMBANKMENT HEIGHT BEHIND THE ABUTMENT TO 5.0M (AS PREFERED BY B.O.D., DPWH) RESULTING TO A LONG VIADUCT WITH 325M LENGTH.	
	BASIC CHARACTERISTICS	• 2 - SPANS CONTINUOUS 1.50M DEPTH VOIDED SLAB SUPERSTRUCTURE ON SINGLE COLUMN PIERS WITH BORED PILES. • ABUTMENT HEIGHT : 11500/10750 • ABUTMENT TYPE : INVERTED T - CANTILEVER ABUTMENT • BRIDGE LENGTH : 60M BRIDGE + 265M EMBANKMENT. • ALIGNMENT : 52° SKEW WITH EXPRESSWAY		• 4 - SPANS CONTINUOUS 1.20M DEPTH VOIDED SLAB SUPERSTRUCTURE ON SINGLE COLUMN PIERS WITH BORED PILES. • ABUTMENT HEIGHT : 7500 • ABUTMENT TYPE : INVERTED T - CANTILEVER ABUTMENT • BRIDGE LENGTH : 90M BRIDGE + 235M EMBANKMENT. • ALIGNMENT : 52° SKEW WITH EXPRESSWAY		• 13 - SPANS 1.20M DEPTH VOIDED SLAB SUPERSTRUCTURE ON SINGLE COLUMN PIERS WITH BORED PILES. • EMBANKMENT HEIGHT LIMITED TO 5.0M. • ABUTMENT HEIGHT : 7000 • ABUTMENT TYPE : INVERTED T CANTILEVER ABUTMENT • BRIDGE LENGTH : 325M • ALIGNMENT : 52° SKEW WITH EXPRESSWAY	
EVALUATION CRITERIA		SCHEME 1 - 2 SPANS, 60M BRIDGE		SCHEME 2 - 4 SPANS, 90M BRIDGE		SCHEME 3 - 13 SPANS, 325M BRIDGE	
CONSTRUCTION COST (50 PTS.)	Substructure	₱ 8.01 MILLION	48	₱ 13.80 MILLION	50	₱ 55.16 MILLION	40
	Superstructure	₱ 17.00 MILLION		₱ 20.39 MILLION		₱ 73.64 MILLION	
	Abutment	₱ 31.80 MILLION		₱ 14.30 MILLION		₱ 12.14 MILLION	
	Embankment	₱ 9.95 MILLION		₱ 7.82 MILLION		₱ 0.27 MILLION	
	R-O-W	₱ 7.99 MILLION		₱ 6.03 MILLION		₱ 0.16 MILLION	
	Total	₱ 74.75 MILLION		₱ 62.34 MILLION		₱ 141.37 MILLION	
CONSTRUCTION ASPECT	DIFFICULTY (10 PTS.)	• 1.5M DEPTH VOIDED SLAB HAS LESSER VERTICAL CLEARANCE THAN SCHEMES 2 & 3. • ABUTMENT AND RETAINING WALL IS TOO CLOSE TO EXPRESSWAY, NEED MORE SAFETY MEASURE AND TRAFFIC CONTROL. • HIGH EMBANKMENT CONSTRUCTION NEEDS STRICT CONTROL.	6	• ABUTMENT IS FAR FROM EXPRESSWAY, MINIMAL IMPACT ON TRAFFIC. • HIGH EMBANKMENT CONSTRUCTION NEEDS STRICT CONTROL.	7	• MINOR IMPACT ON EXPRESSWAY TRAFFIC DUE TO ABUTMENT FAR FROM EXPRESSWAY. • LONGER BRIDGE THUS MORE CONSTRUCTION EFFORT.	9
	PERIOD (10 PTS.)	SUBSTRUCTURE : 3.5 MOS. SUPERSTRUCTURE : 2.5 MOS. EMBANKMENT : 9.0 MOS. TOTAL : 15 MOS.	10	SUBSTRUCTURE : 4.5 MOS. SUPERSTRUCTURE : 3.5 MOS. EMBANKMENT : 8.0 MOS. TOTAL : 16.0 MOS.	9	SUBSTRUCTURE : 10.0 MOS. SUPERSTRUCTURE : 8.0 MOS. EMBANKMENT : - TOTAL : 18 MOS.	7
STRUCTURAL ASPECT (20 PTS.)		• VERY HIGH ABUTMENT AND EMBANKMENT. MORE PRONE TO EMBANKMENT SETTLEMENT. • HIGH RETAINING WALL NECESSARY TO CONTAIN EMBANKMENT ADJACENT TO EXPRESSWAY. • NEEDS STABILITY ANALYSIS DUE TO HIGH EMBANKMENT. • PRE-LOADING NECESSARY FOR EMBANKMENT.	16	• VERY HIGH EMBANKMENT. MORE PRONE TO EMBANKMENT SETTLEMENT. • NEEDS STABILITY ANALYSIS DUE TO HIGH EMBANKMENT. • PRE-LOADING NECESSARY FOR EMBANKMENT. • ABUTMENT PILES PROTRUDING FROM NATURAL GROUND.	18	• LOWER ABUTMENT HEIGHT HAS MINIMAL SETTLEMENT TENDENCY. • FOUNDATION EMBEDDED ON NATURAL GROUND.	20
FUNCTIONALITY (10 PTS.)		• ABUTMENT TOO CLOSE TO EXPRESSWAY. • DRIVING SPEED AFFECTED DUE TO NARROW CLEARANCE BETWEEN ABUTMENT. • WINGWALL VERY NEAR THE SHOULDER, DISTRACTS DRIVER CONCENTRATION.	7	• MINIMAL IMPACT ON EXPRESSWAY TRAFFIC DUE TO ABUTMENT DISTANCE FROM EXPRESSSWAY. • BETTER VIEW FOR COMMUTERS USING THE EXPRESSWAY. • EMBANKMENT NEAR THE SHOULDERS.	9	• MINIMAL IMPACT ON EXPRESSWAY TRAFFIC DUE TO ABUTMENT DISTANCE FAR FROM EXPRESSSWAY. • BETTER VIEW FOR COMMUTERS USING THE EXPRESSWAY.	10
OVERALL EVALUATION POINTS		87 (RANK 2)		93 (RANK 1)		86 (RANK 3)	

TABLE 4.4-11 BRIDGE LENGTH COMPARATIVE STUDY FOR INTERCHANGE RAMP C (NLE OVERCROSSING)

ALTERNATIVES	ELEVATION	SECTION
SCHEME 1 CAST-IN-PLACE PC VOIDED SLAB		
SCHEME 2 CURVED STEEL PLATE GIRDER		

EVALUATION CRITERIA		POINT ALLOCATION	SCHEME 1 PC HOLLOW SLAB	POINTS	SCHEME 2 STEEL PLATE GIRDER	POINTS
CONSTRUCTION COST (IN MILLION PESOS)		40	Superstructure: ₱ 20.39 MILLION Substructure + Abutment: ₱ 28.10 MILLION Total: ₱ 48.49 MILLION	40	Superstructure: ₱ 26.35 MILLION Substructure + Abutment: ₱ 26.60 MILLION Total: ₱ 52.95 MILLION	34
CONSTRUCTION ASPECT	DIFFICULTY	15	• VOIDED SLAB TO BE CAST-IN-PLACE AND POST-TENSIONED. • FORMWORKS SUPPORTS /FALSEWORK NEEDED OVER N.L.E. TEMPORARY CLEARANCE OVER N.L.E. IS ABOUT 4.90m. • SAFETY IS MAJOR CONCERN DURING CONSTRUCTION.	12	• STEEL PLATE GIRDERS PREFABRICATED AND ERECTED BY TRUCK CRANE. • SAFETY IS MAJOR CONCERN DURING ERECTION. • PLATE GIRDERS CAN BE LAUNCHED IN A VERY SHORT PERIOD. NO NEED FOR SHORINGS/SUPPORTS. • 5.10m VERTICAL CLEARANCE CAN BE MAINTAINED DURING CONSTRUCTION. • NEED TO MAKE SOME PIERS SKEW TO MAINTAIN 5.10m CLEARANCE.	14
	PERIOD	10	SUBSTRUCTURE: 4 MOS. SUPERSTRUCTURE: 6 MOS.	9	SUBSTRUCTURE: 5 MOS. SUPERSTRUCTURE: 4 MOS.	10
STRUCTURAL ASPECT		10	• SUPERSTRUCTURE IS CONTINUOUS WITH PIER COLUMNS AND PERFORMS BETTER DURING EARTHQUAKE. TOP AND BOTTOM COLUMN SHARE SEISMIC FORCES. • *VOIDED SLAB HAS HIGHER TORSIONAL RESISTANCE ESPECIALLY FOR THIS CURVED BRIDGE.*	10	• SINCE SUPERSTRUCTURE IS ON BEARING, FORCES GOES MOSTLY TO BOTTOM OF COLUMN. LESS EFFICIENT THAN SCHEME 1. • SUPERSTRUCTURE CONSIST OF GIRDERS WHICH HAVE LESSER TORSIONAL RESISTANCE. • *CAN BE MADE CONTINUOUS AT SUPPORT FOR LIVE LOAD AND SUPERIMPOSED DEAD LOAD.* • SKEW PIER SUPPORTS LESS EFFICIENT FOR SUPERSTRUCTURE.	6
USE OF LOCAL MATERIALS AND LABOR		5	• LOCAL LABOR AND MATERIALS AVAILABLE FOR THIS TYPE EXCEPT PRESTRESSING STRANDS & ANCHORAGES WHICH NEED TO BE IMPORTED.	4	• SLAB MATERIALS AVAILABLE LOCALLY. • STEEL PLATES HIGH TENSION BOLTS, AND WELDING ELECTRODE NEED IMPORTATION.	4
MAINTENANCE		5	• MINOR MAINTENANCE NEEDED FOR BEARING & EXPANSION JOINT.	5	• MAINTENANCE (PAINTING, ETC.) NOT NEEDED FOR STEEL GIRDER EXCEPT IF ANTI-CORROSION STEEL. • MINOR MAINTENANCE ON BEARING & EXPANSION JOINT NEEDED.	4
INTRODUCTION OF NEW TECHNOLOGY		5	• TECHNOLOGY ALREADY AVAILABLE.	5	• USE OF ANTI-CORROSION STEEL.	5
IMPACT TO ENVIRONMENT		5	• MINIMAL.	5	• MINIMAL IMPACT FOR ANTI-CORROSION STEEL.	4
AESTHETICS		5	• GOOD VIEW DUE TO SHALLOW SLAB. SMOOTH LINES ON THE UNDERSIDE. • CONTINUOUS STRUCTURE FORM APPEARS VERY PLEASING AND STABLE.	5	• LOOKS CLUTTERED ON THE UNDERSIDE DUE TO STEEL GIRDRS. TOO MANY LINES. • DISCONTINUOUS SUPER & SUBSTRUCTURE HAS NEGATIVE IMPACT.	3
OVERALL EVALUATION/ TOTAL POINTS		100	• RECOMMENDED SCHEME.	95	• EXPENSIVE SCHEME.	84
RANK			1		2	

TABLE 4.4-12 SCHEME COMPARISON FOR INTERCHANGE RAMP C (NLE OVERCROSSING)

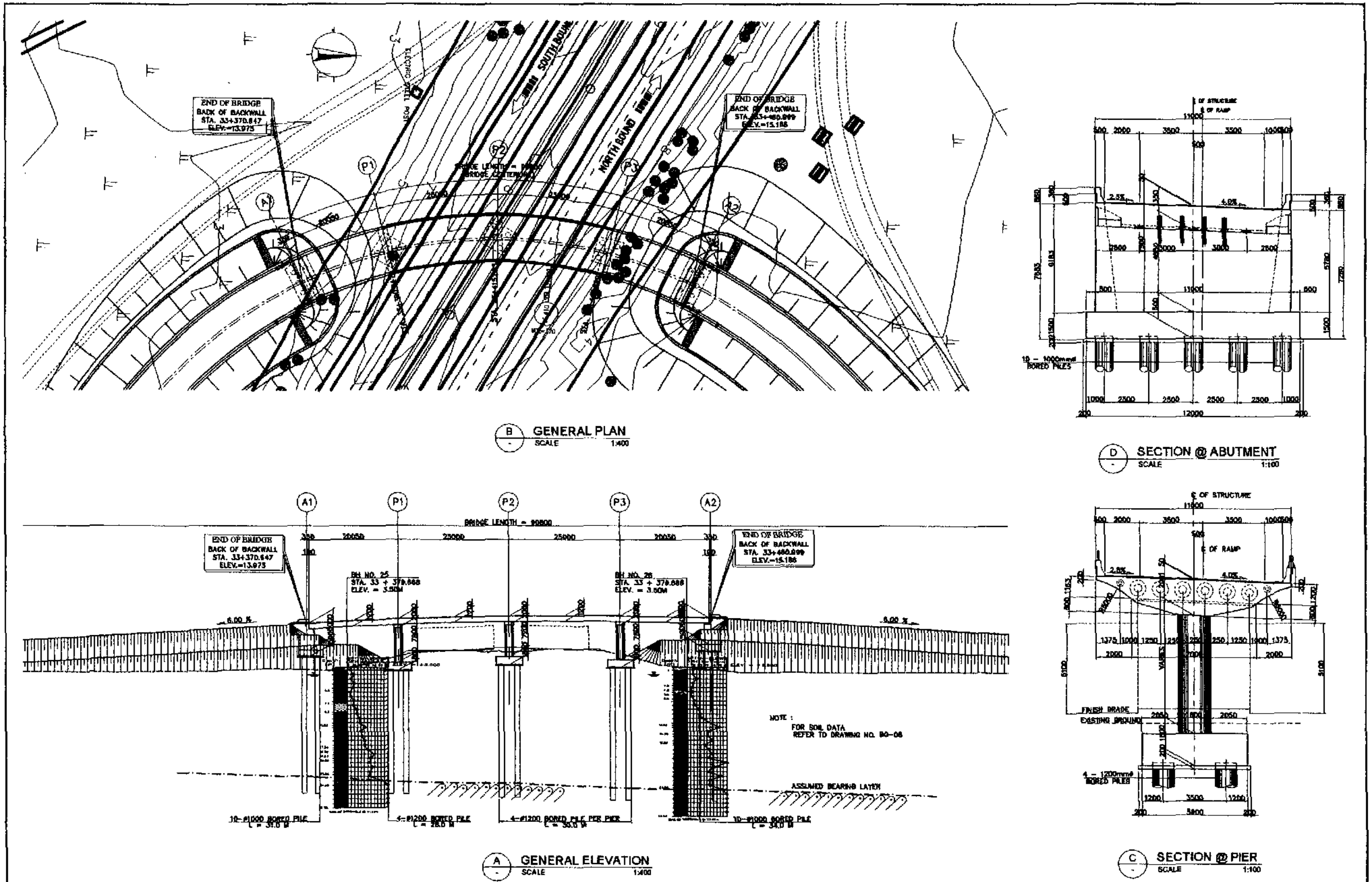


FIGURE 4.4-11 PROPOSED INTERCHANGE RAMP