CHAPTER 11
SAN JOSE BYPASS DESIGN

11.1 Highway Design

11.1.1 Design Policy

The design policy for San Jose Bypass is as follows:

- To put importance on traffic mobility.
- Exclusive tricycle / bike roads divided by island barriers with 2.5m in width will be provided at both outer sides of the carriageway throughout the bypass.
- At every intersecting point between an existing road and the bypass, an at-grade (Type-A) intersection will basically be provided.
- Such small/slow vehicles as tricycles and bikes entering the carriageway shall be strictly prohibited.

Figure 11.1-1 shows the standard cross-sections for the Initial and Ultimate Stages.

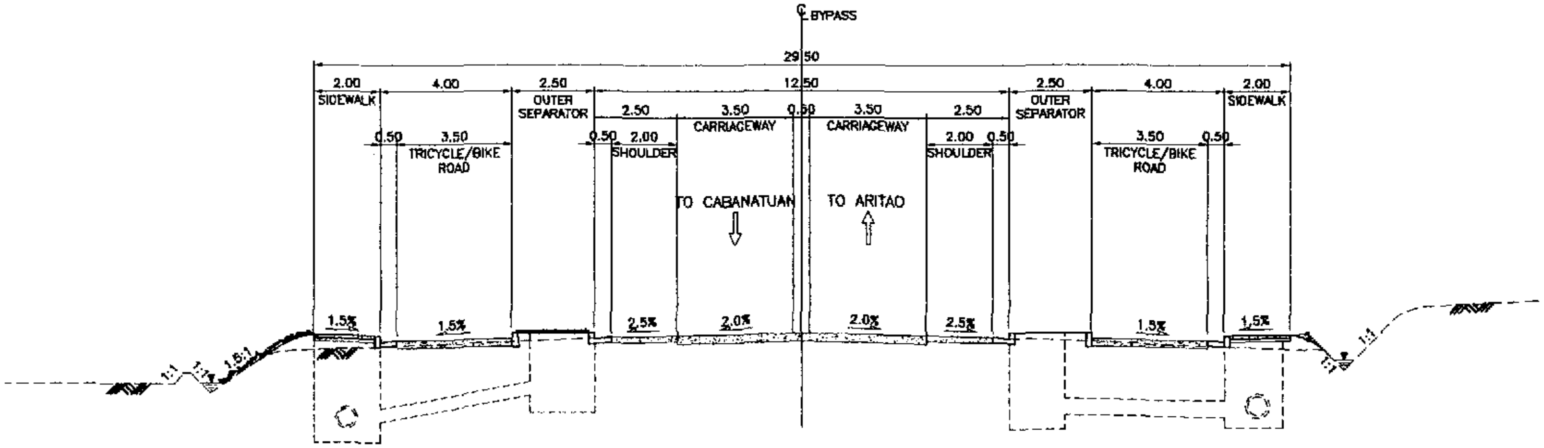
11.1.2 Alignment of the Bypass

Figure 11.1-2 shows the alignment of the bypass and the locations of intersections and bridge locations.

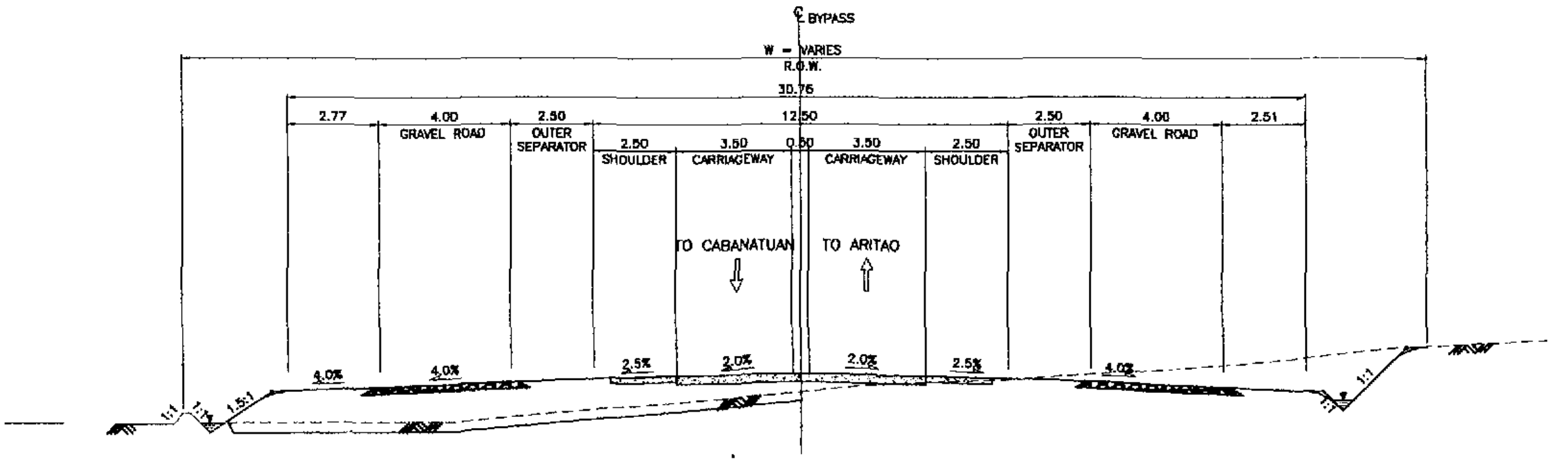
- A total length of the bypass is about 7.98 km.
- There are three (3) major intersections; A-1, A-4 and A-9. A-1 and A-9 are points intersecting with the Pan-Philippine Highway, and A-4 is the intersection with a national road of Bonifacio Highway.
- The minimum radius of the horizontal alignment is 400m. Transition curves were employed for a radius smaller than 2,500m in compliance with design standards of this study.
- C-Type intersections are provided only in case that the cross road has dead end at the bypass or it is better to give C-Type from a standpoint of traffic control and safety.

11.1.3 Intersection Layout

Intersections of San Jose Bypass are eleven (11) in number as shown in Figure 11.1-2. The features and roles of intersecting roads are explained in Table 11.1-1.



(a) NORMAL SECTION - ULTIMATE STAGE



(b) NORMAL SECTION - INITIAL STAGE

FIGURE 11.1-1 TYPICAL CROSS SECTIONS (SAN JOSE)

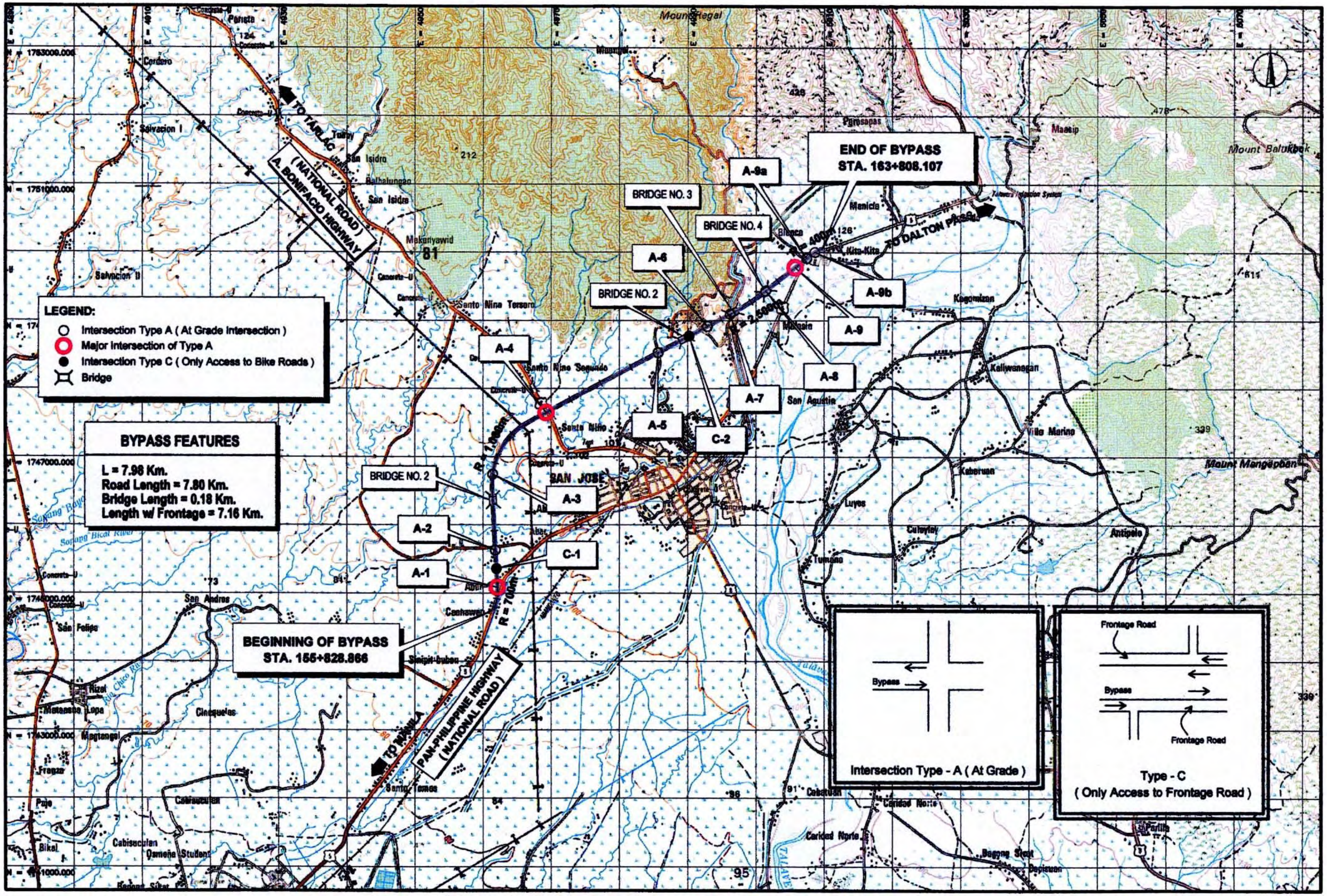


FIGURE 11.1-2 ALIGNMENT OF SAN JOSE BYPASS

TABLE 11.1-1 FEATURES AND ROLES OF INTERSECTING ROADS

Intersections	Descriptions
A – 1 (Major Intersection)	The starting point of the bypass. Pan-Philippine Highway that is a central backbone connecting Manila Metropolitan Area and and a northern part of Luzon Island. A traffic signal shall be installed.
C – 1	Dead end of community graveled road having a width of 3.0m. Only connected to the bike road and basically not allowed to cross the bypass. There are existing communities at both sides of the bypass. Thus, small opening will be provided for pedestrians or farmers crossing the bypass to avoid segregating those communities.
A – 2	A barangay road paved with PCC of 4.0m wide. This road is connected with Pan-Philippine Highway and a national road of Bonifacio Highway. A minor road.
A – 3	A barangay road paved with PCC of 4.0m wide. This road starts from and gets back to Bonifacio Highway, a minor local road.
A – 4 (Major Intersection)	Bonifacio Highway which is a national road having an important role to connect between the central and western backbones. A traffic signal will be installed.
A – 5	A minor barangay road graveled with 3m to 4m in width, which is connected with Pan-Philippine Highway. This road is planned to improve as an access road to the City Proper.
C - 2	A minor barangay road graveled with 3m wide. Only connected to the bike road for traffic, however, small openings will be provided for pedestrians and farmers crossing only in compensation for a certain portion of the existing road to be removed due to the bypass construction.
A – 6	A minor barangay road graveled with 3m wide. A minor road.
A – 7	The maintenance road of the irrigation canal graveled with 4.0m wide. This road will be realigned in order to improve the geometry in terms of traffic safety at the intersection and because of the construction of the bridge No. 3. The realigned section will be paved with PCC due to steep vertical grade and to avoid soil matter thereon entering the intersection. A minor road.
A – 8	A dirt road with 2.5m wide. A minor road along the river.
A – 9 (Major Intersection)	The end of the bypass. The same as intersection A-1.

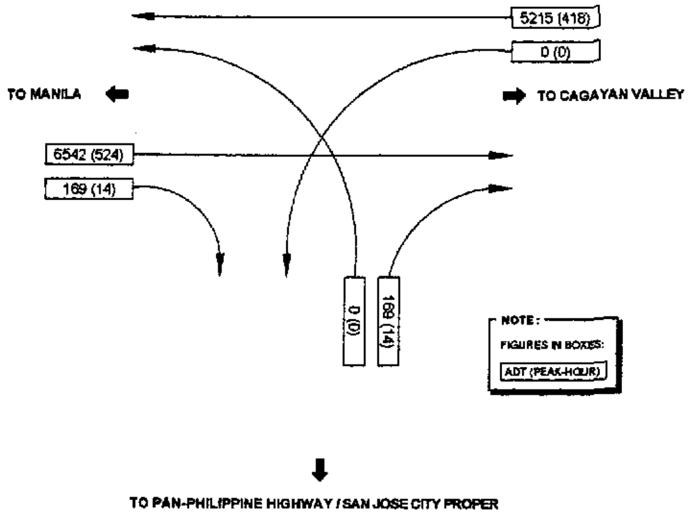
11.1.4 Directional Traffic Flow at Major Intersections

Figure 11.1-3 gives the forecasted directional traffic flow at the major intersections in year 2020; intersections A-1, A-4 and A-9. Figure 11.1-4 shows traffic movements along the bypass.

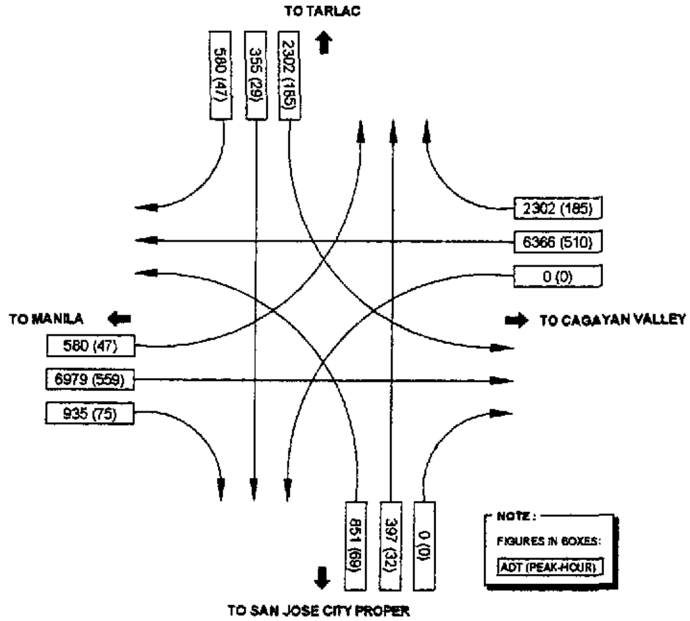
(1) Intersection A-1

Major traffic can be identified as follows:

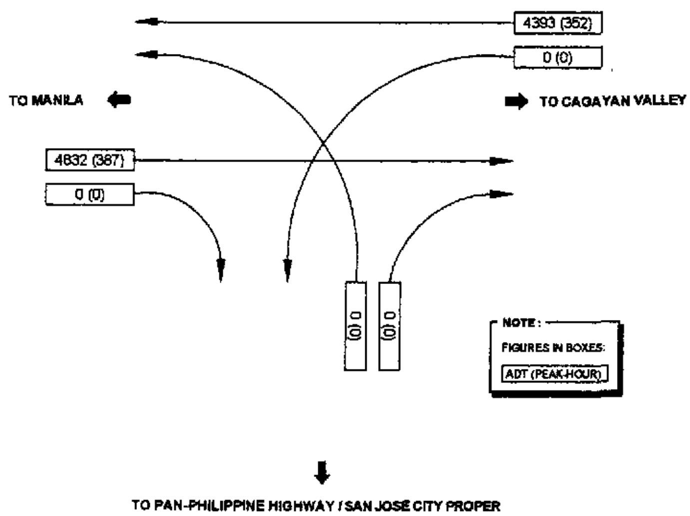
- Through traffic on the bypass from/to Cabanatuan City side.
- Right turn traffic on the bypass from Cabanatuan City side to San Jose City proper.
- Left turn traffic to Cabanatuan City side from San Jose City proper.



INTERSECTION A-1



INTERSECTION A-4



INTERSECTION A-8

FIGURE 11.1-3 DIRECTIONAL PEAK-HOUR TRAFFIC FLOW AT INTERSECTIONS (SAN JOSE BYPASS)

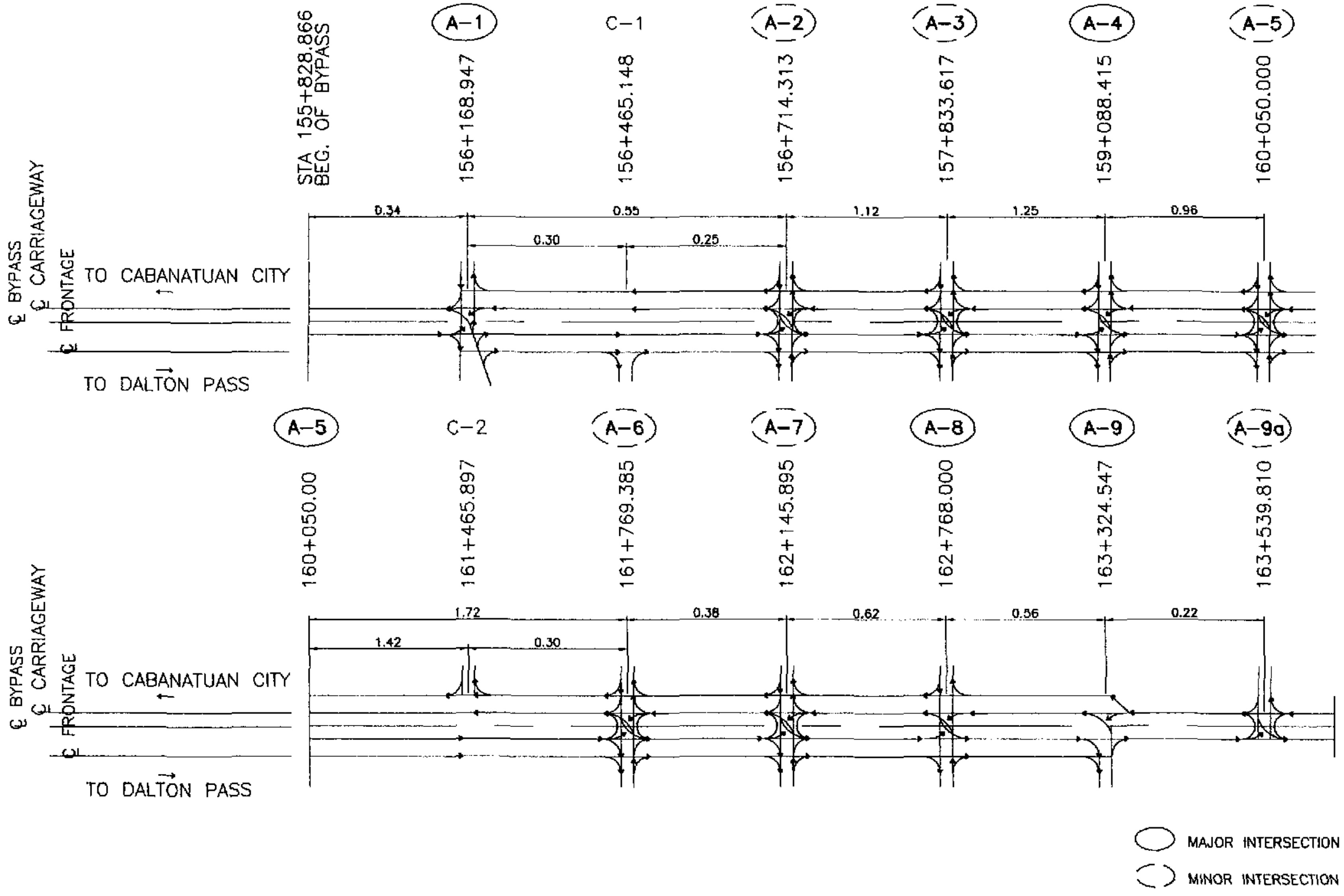


FIGURE 11.1-4 TRAFFIC MOVEMENTS AT INTERSECTIONS OF SAN JOSE BYPASS

Looking at the difference in major traffic volume, through traffic volume is about ten (10) times larger than left/right turn traffic.

(2) Intersection A-4

Major traffic flow is as follows:

- Through traffic on the bypass, which has about 560 vehicles/hour in volume.
- Left/right turn traffic from/to Tarlac side to/from Cagayan Valley side.

Traffic going to Cabanatuan City side on Bonifacio Highway is larger than through traffic thereon.

(3) Intersection A-9

- Through traffic on the bypass from/to Cabanatuan City side to/from Cagayan Valley side
- Left/right turn traffic on Pan-Philippine Highway from/to Cagayan Valley side to/from San Jose City side.

Looking at the difference in major traffic volume, through traffic volume is about twenty six (26) times larger than left/right turn traffic.

11.1.5 Alternative Study on Beginning Intersection

Establishment of the Basic Schemes

Based on the forecasted major traffic flow at the intersection, four (4) basic schemes were established as explained in Table 11.1-2. The conceptual diagrams of basic schemes are illustrated in Figure 11.1-5. In this figure, the directions of major traffic are indicated with arrows and major traffic conflict points, where a traffic signal will be installed, are symbolized with circles.

TABLE 11.1-2 DESCRIPTIONS AND COMPARISON ON BASIC SCHEMES

Basic Schemes	Descriptions (refer to Figure 11.1-5)
Basic Scheme-1	This gives the priority to the bypass and utilizes the existing Pan-Philippine Highway between point A and C for major traffic going into city proper.
Basic Scheme-2	This also gives the priority to the bypass, however the Pan-Philippine Highway between point A and C is not utilized for major traffic. This scheme is basically the same as the basic scheme-1 in that the bypass has the priority.
Basic Scheme-3	This gives the priority to the existing Pan-Philippine Highway. This scheme has disadvantage in terms of the difference of major traffic in volume on the approaches as compared to other schemes, because through traffic on the bypass is extremely larger than that on the existing Pan-Philippine Highway.
Basic Scheme-4	This gives the same priority to both highways. If traffic volume on both highways is almost the same, this scheme has advantage because all approaches to the major intersection D are one-way traffic. However, the traffic volume is quite different between them. And there are two (2) intersections with the existing minor roads close to the major intersection area. Those make the basic scheme inferior to the basic scheme-1 and 2.

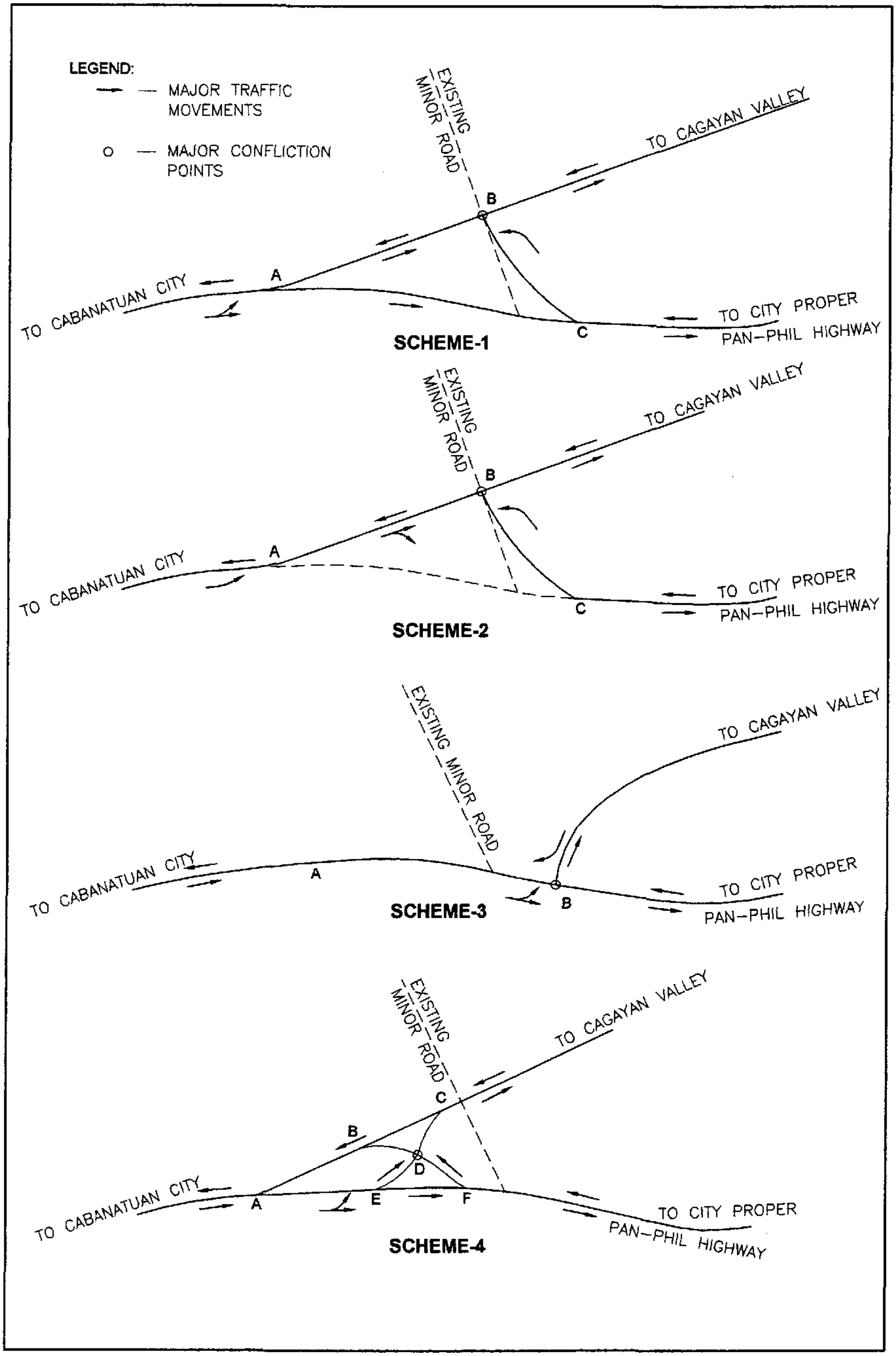


FIGURE 11.1-5 CONCEPTUAL DIAGRAMS OF SCHEMES

From Table 11.1-2, competitive schemes are schemes 1 and 2.

Selection of the best scheme

Figure 11.1-6 shows the schemes in detail, in which traffic conflict points are illustrated within the circles as easy to determine the degree of conflicts.

(1) Evaluation Criteria

Six (6) factors were prepared for evaluation as shown in Table 11.1-3. Each factor has sub-evaluation items. Maximum score allocated to each factor is shown in the Table. The factor of traffic safety was given the highest score because traffic safety is of quite importance when designing an intersection.

TABLE 11.1-3 EVALUATION CRITERIA FOR SELECTION OF THE BEST SCHEME

Symbols of Factors	Evaluation Factors and Items	Maximum Score Allocated
A	Traffic Safety • No. of Conflict Points (Exclusive of signalized intersection) * • Visibility	30
B	Major Traffic Movement • Priority to the Bypass • To / From City Proper	20
C	Cost • Construction Cost • R.O.W. Area	15
D	Social Impact (Affected Houses)	15
E	Traffic Service to Communities	10
F	Traffic Signalization (for Major Conflict Point) • No. of Phases • Delay Time (Level of Service)	10
Total Score		100

**Conflict points of signalized intersection shall be reflected in the factor of Traffic Signalization.*

(2) Evaluation and Selection of the Best Scheme

Evaluation results are shown in Table 11.1-4, and the ranking of the schemes is as follows:

Schemes	Ranking
Scheme – 1	1
Scheme – 2	2
Scheme – 3	3
Scheme – 4	4

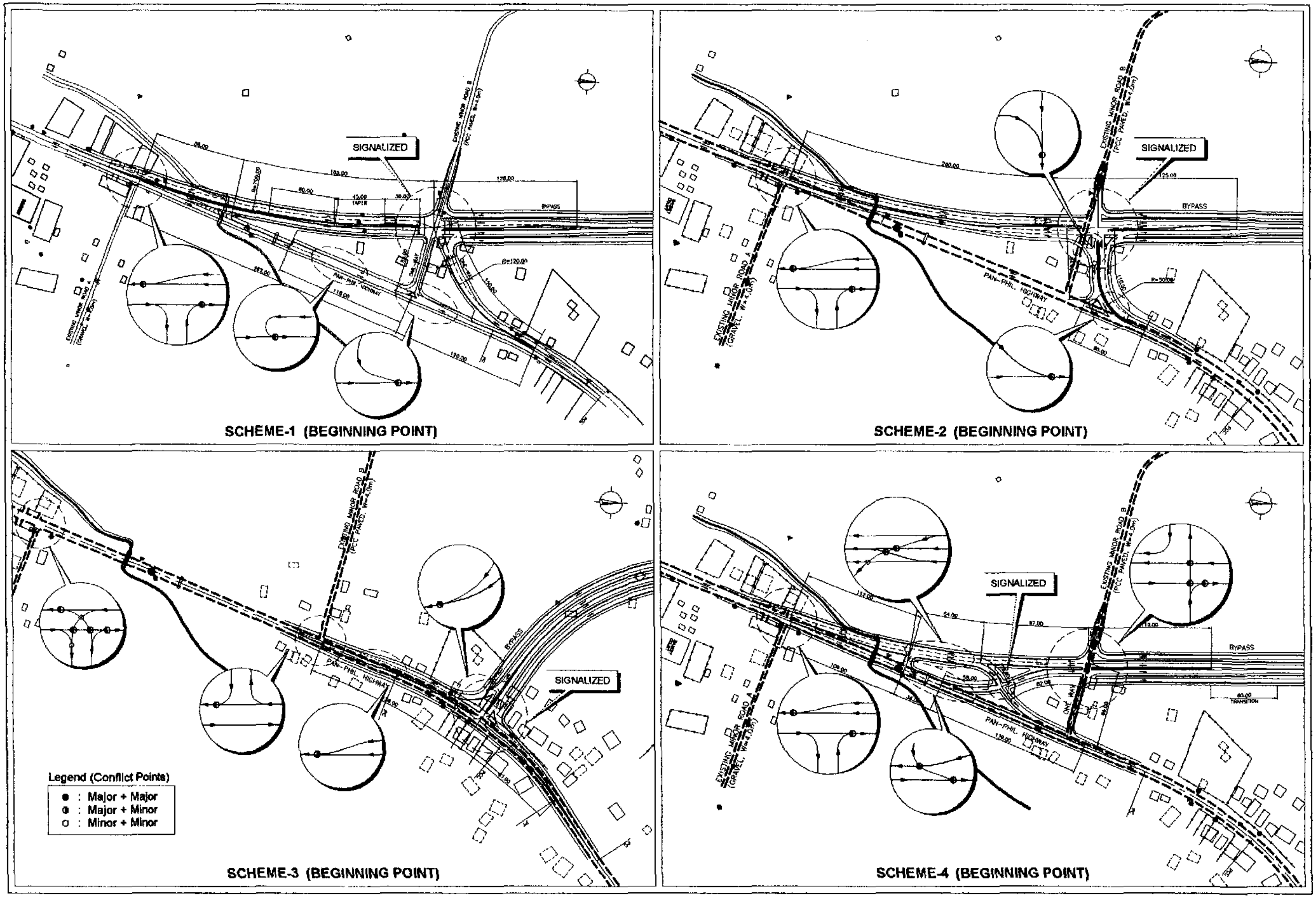


FIGURE 11.1-6 ALTERNATIVE INTERSECTION SCHEMES

TABLE 11.1-4 EVALUATION OF ALTERNATIVE SCHEMES (BEGINNING POINT)

	EVALUATION FACTOR	Maximum Allocated Points	SCHEME 1		SCHEME 2		SCHEME 3		SCHEME 4		REMARKS
Traffic Safety	(1) No. of Traffic Conflict Points (exclusive of signalized intersections)		4 conflict points	a	4 conflict points	a	9 conflict points	c	11 conflict points	c	a=50% of max. allocated points b=30% of max. allocated points c=20% of max. allocated points
	(2) Traffic Visibility		Better (flatter curve)	a	Good (Pan-Phil.Highway has a curve before the intersection)	b	Fair (Bypass has a curve before the intersection)	c	Better	a	
	Sub-Total	30	a + a =	30	a + b =	24	c + c =	12	c + b =	15	
Traffic Movement	(1) Priority to the Bypass		Yes	a	Yes	a	No	c	Both priorities at Bypass and Pan-Phil Highway	b	a=50% of max. allocated points b=30% of max. allocated points c=20% of max. allocated points
	(2) To/From City Proper		Traffic accessing from Cabanatuan City to City Proper is uninterrupted and traffic from city proper to Cabanatuan City side is interrupted at signalized intersection	a	Interrupted at signalized intersection from/to Cabanatuan City to/from City Proper	b	Interrupted at signalized intersection from/to Cabanatuan City to/from Cagayan Valley	c	Traffic accessing from Cabanatuan City to City Proper is uninterrupted and traffic from City Proper to Cabanatuan City is with lesser interruption than Scheme 1	a	
	Sub-Total	20	a + a =	20	a + b =	16	c + c =	14	b + a =	16	
Costs	(1) Construction Costs (Ratio)		1.4	b	1.5	b	1.00	a	1.77	c	a=50% of max. allocated points b=30% of max. allocated points c=20% of max. allocated points
	(2) R.O.W. Area		2.08 has.	b	2.02 has.	b	1.15 has.	a	2.03 has.	b	
	Sub-Total	15	b + b =	9	b + b =	9	a + a =	15	c + b =	7.5	
Social Impact (Affected Houses)			3 houses	a	5 houses	b	7 houses	c	3 houses	a	a=100% (50 x 2) of max. allocated points b=60% (30 x 2) of max. allocated points c=40% (20 x 2) of max. allocated points
	Sub-Total	15	a =	15	b =	9	c =	6	a =	15	
Traffic Service to Communities to/from Bypass (the symbols of minor roads are indicated in Figure 11.1-2)			Existing minor road A is partially controlled access (left turn); Existing minor road B is controlled access (left turn)	b	Existing minor road A is partially controlled access (left turn); Existing minor road B is controlled access (left turn)	b	Existing minor road A is uncontrolled access; Existing minor road B is partially controlled access (left turn)	a	Existing minor road A is partially controlled access (left turn); Existing minor road B is partially controlled access (left turn)	b	a=100% (50 x 2) of max. allocated points b=60% (30 x 2) of max. allocated points c=40% (20 x 2) of max. allocated points
	Sub-Total	10	b =	6	b =	6	a =	10	b =	6	
Traffic Signalization	Phases		3.0ϕ	b	3.0ϕ	b	3.0ϕ	b	2.0ϕ	a	a=50% of max. allocated points b=30% of max. allocated points c=20% of max. allocated points
	Delay Time (LOS)		7.5 sec (LOS A)	a	7.4 sec (LOS A)	a	10.1 sec (LOS B)	b	5.4 sec (LOS A)	a	
	Sub-Total	10	b + a =	8	b + a =	8	b + b =	6	a + a =	10	
TOTAL		100		88		72		63		69.5	
RANK			1		2		4		3		

Notes : (1) Partially controlled access - partially allow movement such as U-Turn or access another route
(2) Controlled Access - controlled through signal or not allowed movement
(3) Uncontrolled Access - all movements are allowed

Evaluation results are summarized as follows:

- Scheme-1 is the best in the respect that utilizing the existing Pan-Philippine Highway and minor road can save the construction and ROW acquisition costs, and decrease the affected houses. This can eliminate the need for excess costs and mitigate the Social Impacts.
- Scheme-2 requires the wider bypass for traffic going to City proper and larger intersection area, which increases the construction and ROW costs, and affected houses.
- The thicknesses of PCC slab of the bypass, the existing Pan-Philippine Highway and the minor road are 25, 23 and 20cm, respectively. By utilizing the Pan-Philippine Highway and the minor road in the intersection area, costs for the pavement can be saved.
- The intersection of Scheme-1 looks like a five-leg intersection. However, by introducing the one-way traffic control, this intersection can be controlled sufficiently as a four-leg intersection. The triangle area between one-way roads can be regarded as a kind of divisional island or center median. Two (2) one-way roads actually function as a divided road.
- The several patterns of intersection type of Scheme-1 will be considered; intersection types of Scheme-1 and Scheme-2 shown in Figure 11.1-6 and that of Figure 11.1-7. The pattern of Scheme-1 shown in Figure 11.1-6 is considered best in terms of the following reasons, in addition to the merits mentioned above.
  - ➢ To give the better geometry to major traffic coming from City proper and minor traffic crossing the intersection, which is from the upper side of the minor road and from Cagayan Valley side.
  - ➢ If the upper side of the minor road is connected to the bypass at right angle or inclined toward left side, the intersection type shown in Figure 11.1-6 will bring out merits.

Figure 11.1-8 shows the best scheme drawing in detail based on the design criteria.

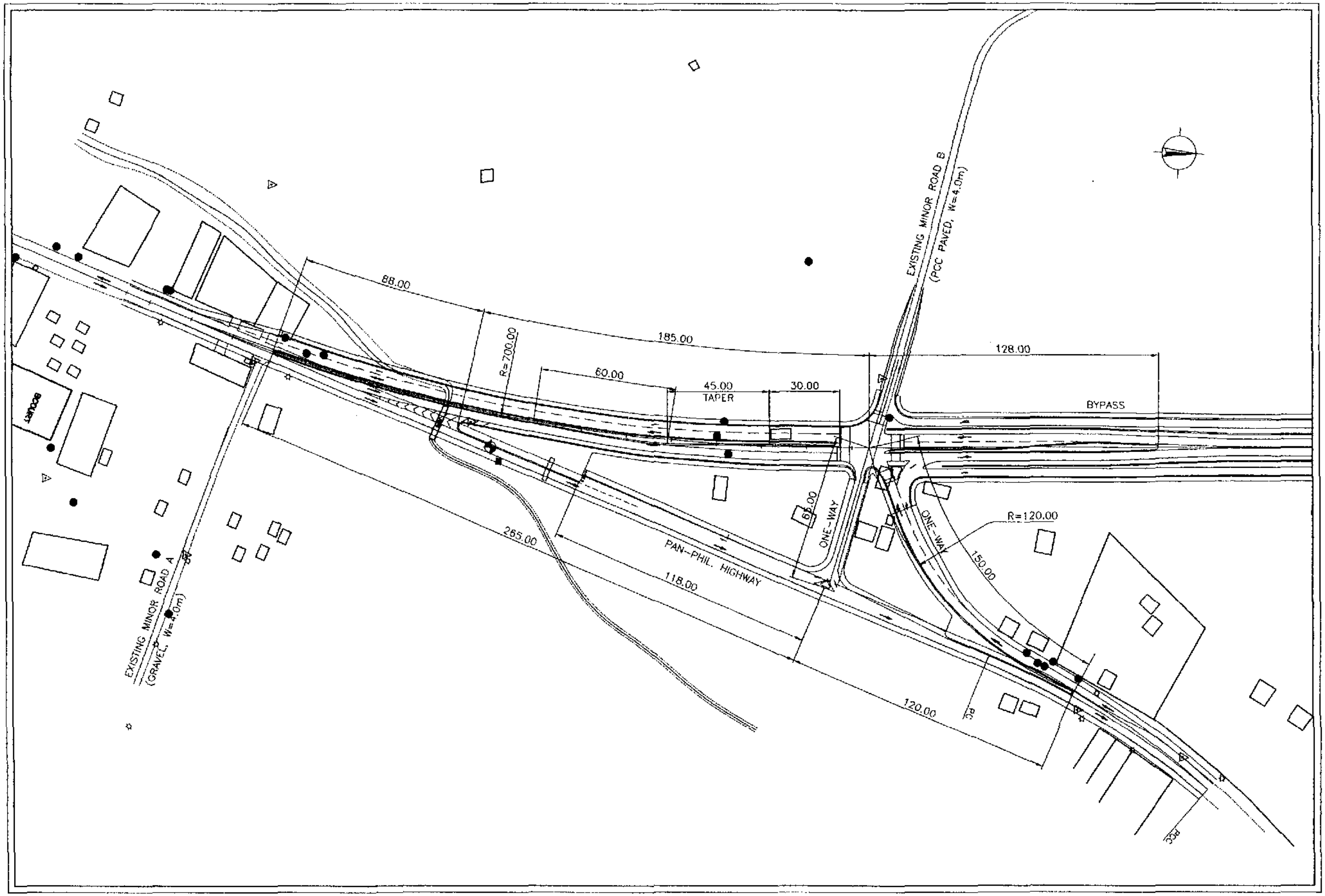


FIGURE 11.1-7 ANOTHER INTERSECTION TYPE OF SCHEME 1

CURVE ELEMENTS										
PI NO.	STATION	COORDINATES		Δ	R	T	Lc	E	e%	V (kph)
		NORTHING	EASTING							
0	155+940.947	1,744,858.502	496,196.528						NC	50
1	155+993.837	1,744,908.202	496,214.819						NC	50
2	156+046.032	1,744,954.294	496,237.171						NC	50
3	156+073.987	1,744,781.883	496,241.567						NC	50
4	156+158.589	1,745,030.081	496,270.419						NC	50
5	156+300.089	1,745,184.347	496,318.330	18°03'58"	360	57.231	113.513	4.521	2.50	50
6	156+356.370	1,745,239.706	496,353.228						NC	50

ROAD A1-1

CURVE ELEMENTS										
PI NO.	STATION	COORDINATES		Δ	R	T	Lc	E	e%	V (kph)
		NORTHING	EASTING							
0	0 + 000.000	1,745,084.244	496,209.995							
1	0 + 078.136	1,745,114.742	496,281.833	41°12'13"	120	45.109	86.287	8.198	2.50	40
2	0 + 144.450	1,745,177.973	496,312.330							

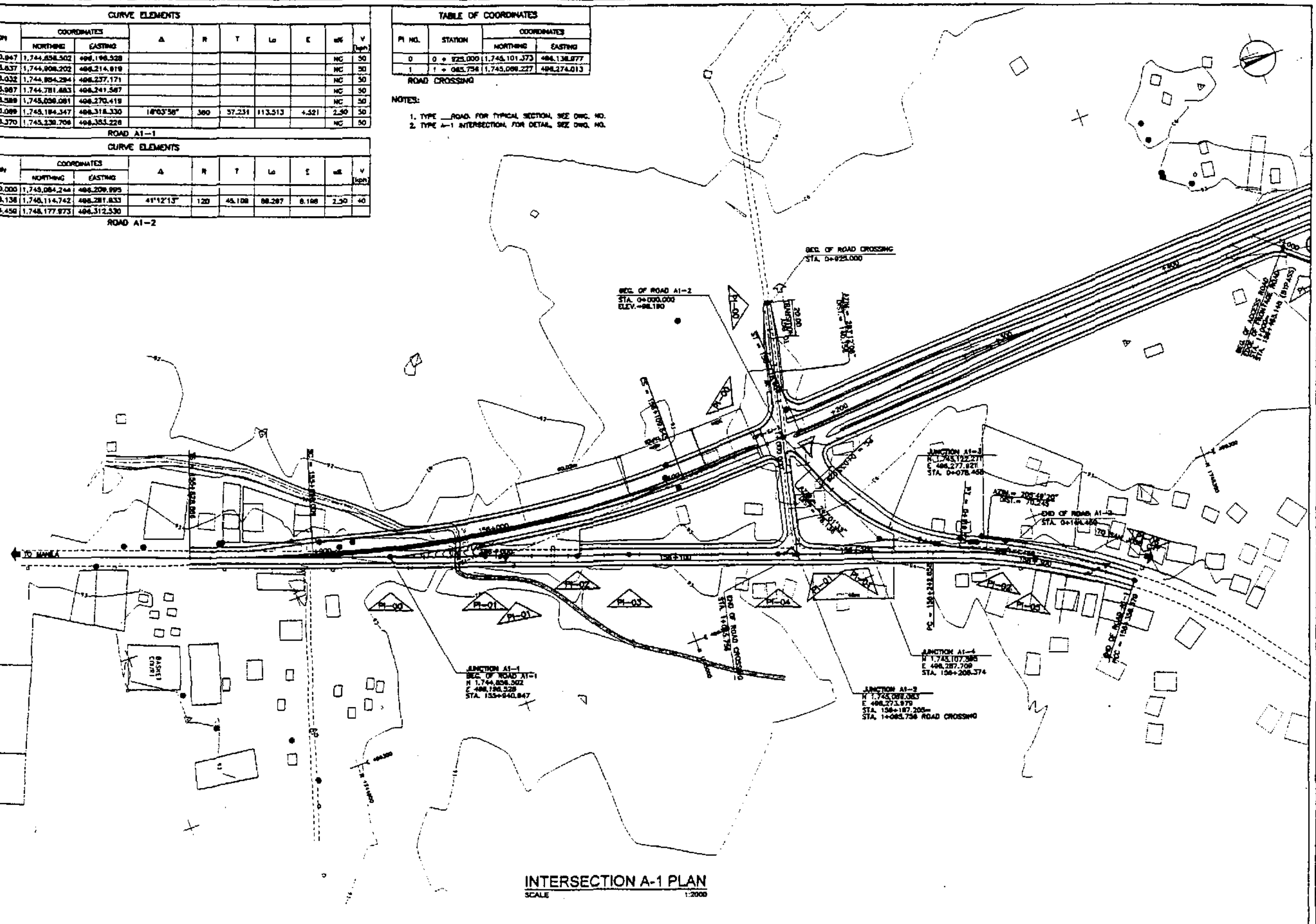
ROAD A1-2

TABLE OF COORDINATES			
PI NO.	STATION	COORDINATES	
		NORTHING	EASTING
0	0 + 925.000	1,745,101.373	496,138.977
1	1 + 065.756	1,745,069.227	496,274.013

ROAD CROSSING

NOTES:

1. TYPE ___ROAD. FOR TYPICAL SECTION, SEE DWG. NO.
2. TYPE A-1 INTERSECTION, FOR DETAIL, SEE DWG. NO.



INTERSECTION A-1 PLAN

SCALE 1:2000

FIGURE 11.1-8 PLAN OF RECOMMENDED SCHEME

11.1.6 Alternative Study on End Intersection

Establishment of the Basic Schemes

Two (2) basic schemes as shown in Table 11.1-5 were established based on the forecasted directional traffic flow. The conceptual diagram of each basic scheme is illustrated in Figure 11.1-9, in which the directions of major traffic are indicated with arrows and major traffic points are symbolized with circles.

TABLE 11.1-5 DESCRIPTIONS ON BASIC SCHEMES

Basic Schemes	Descriptions (refer to Figure 6.1-9)
Basic Scheme-1	• This scheme treats the existing Pan-Philippine Highway as a subordinate road. • The section of the existing highway between point B and C is unutilized for major traffic to avoid major confliction at point C. • Major traffic going to point C to point A diverges before major conflict point A.
Basic Scheme-2	• This scheme has two (2) major confliction points at point A and C. • The section of the existing highway between point B and C is utilized for major traffic as one-way road.

Both basic schemes give the priority to the bypass. Difference in the schemes is whether or not to utilize the existing Pan-Philippine Highway between point B and C for major traffic.

Selection of the best scheme

Figure 11.1-10 shows the schemes in detail, in which traffic conflict points are illustrated within the circles as easy to determine the degree of conflicts.

(1) Evaluation Criteria

Evaluation criteria are the same as Table 11.1-3.

(2) Evaluation and Selection of the Best Scheme

Evaluation results are shown in Table 11.1-6, and the ranking of the schemes is as follows:

Schemes	Ranking
Scheme – 1	1
Scheme – 2	2

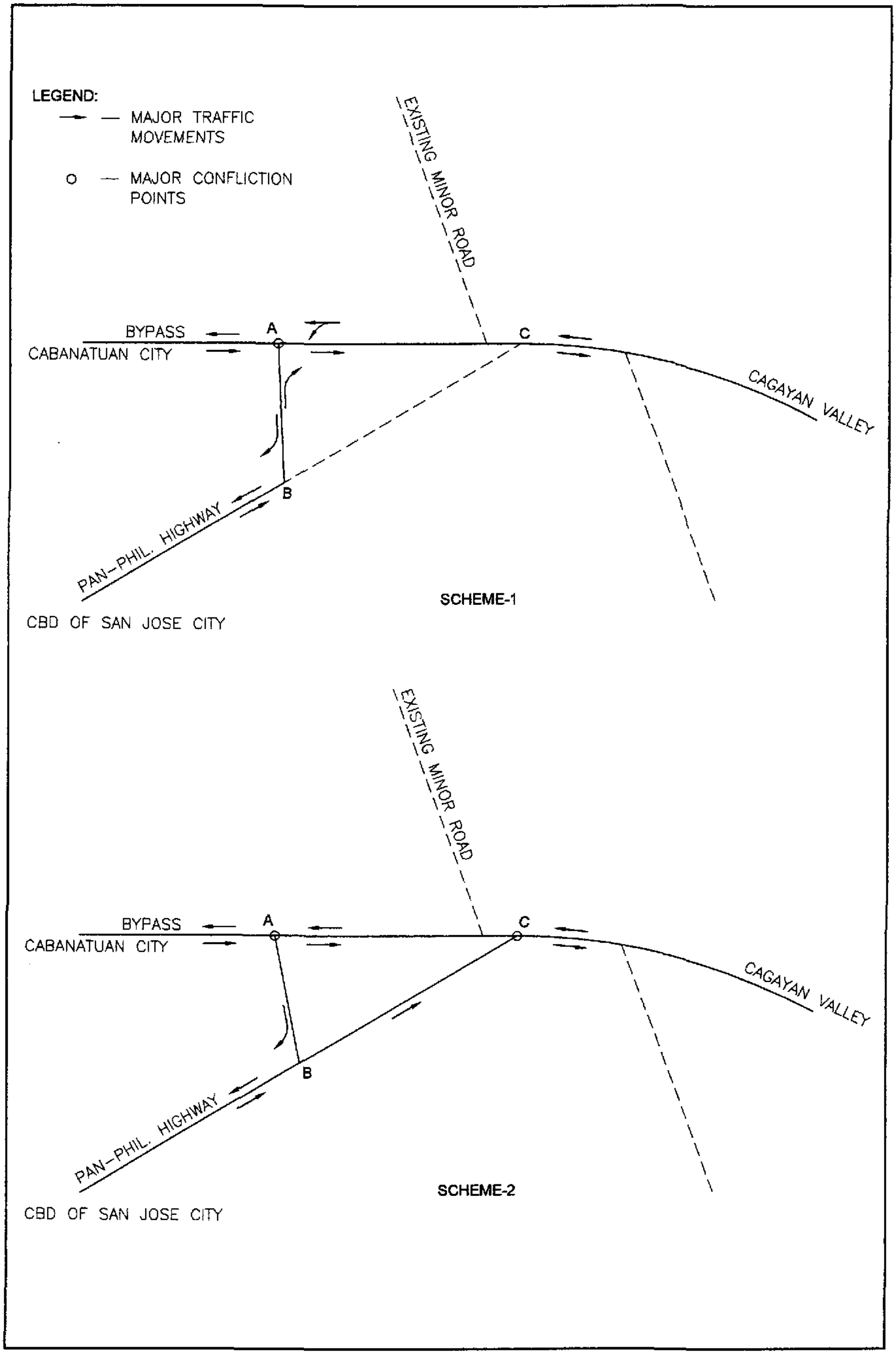
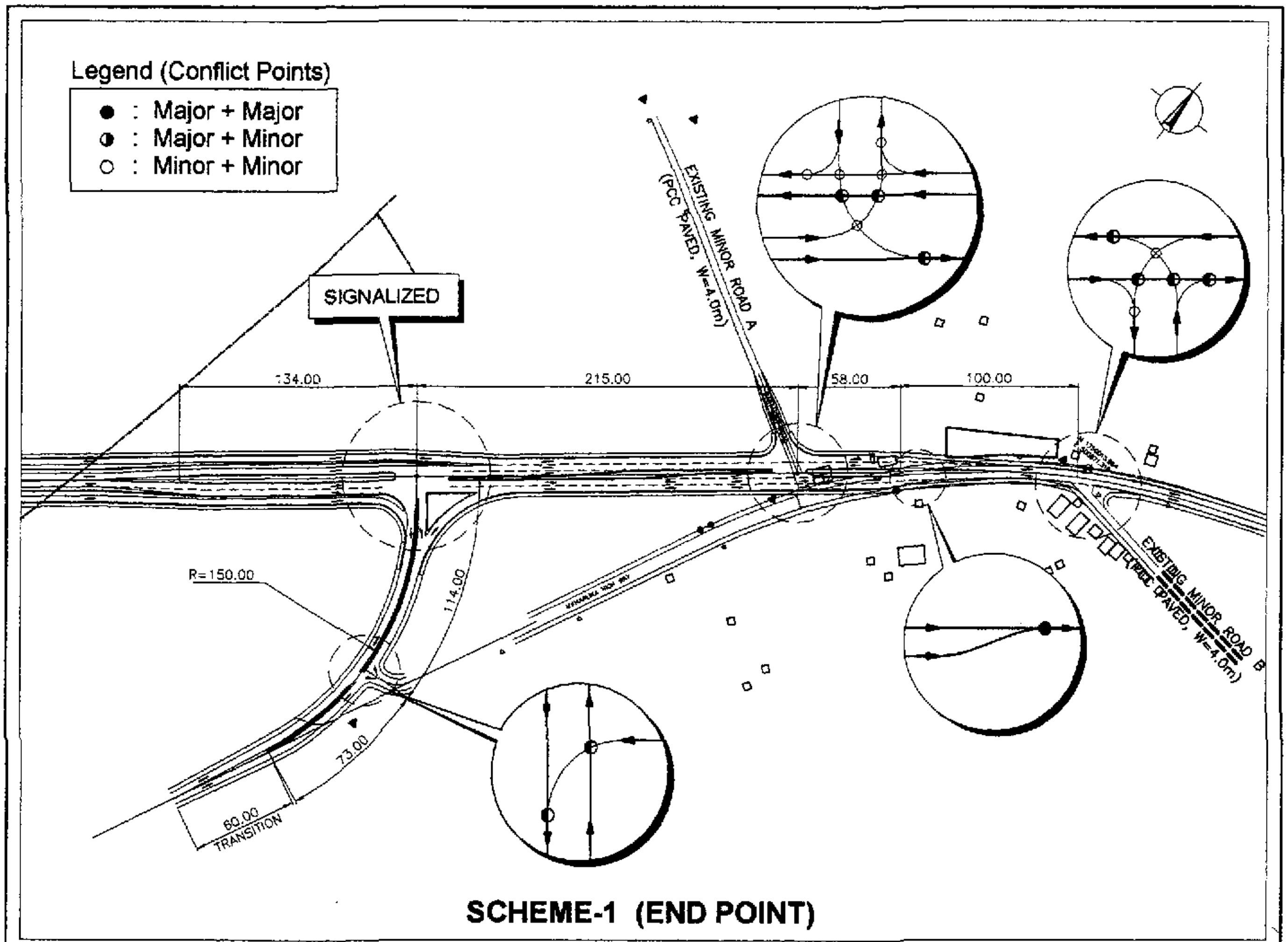


FIGURE 11.1-9 CONCEPTUAL DIAGRAMS OF SCHEMES



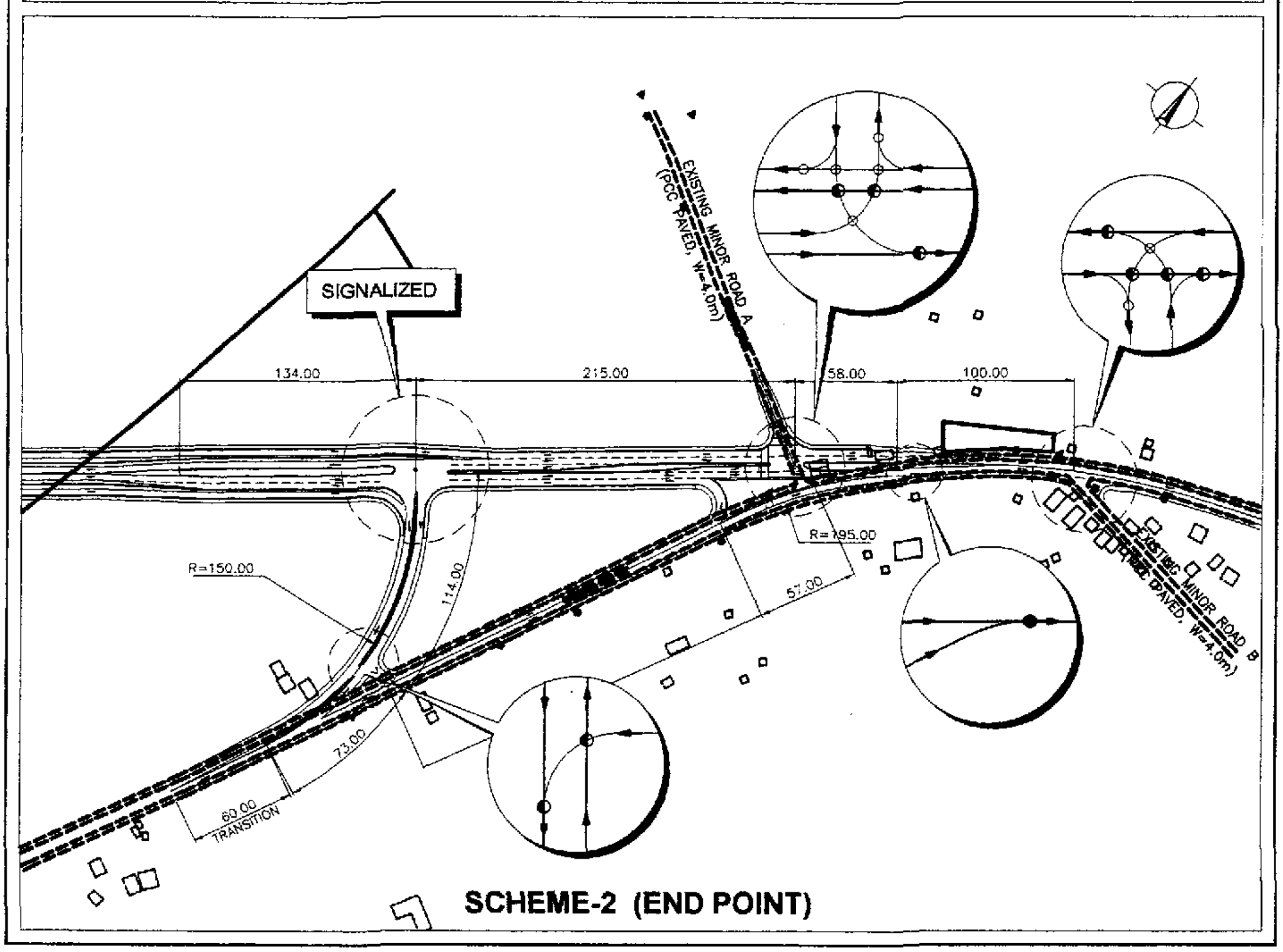
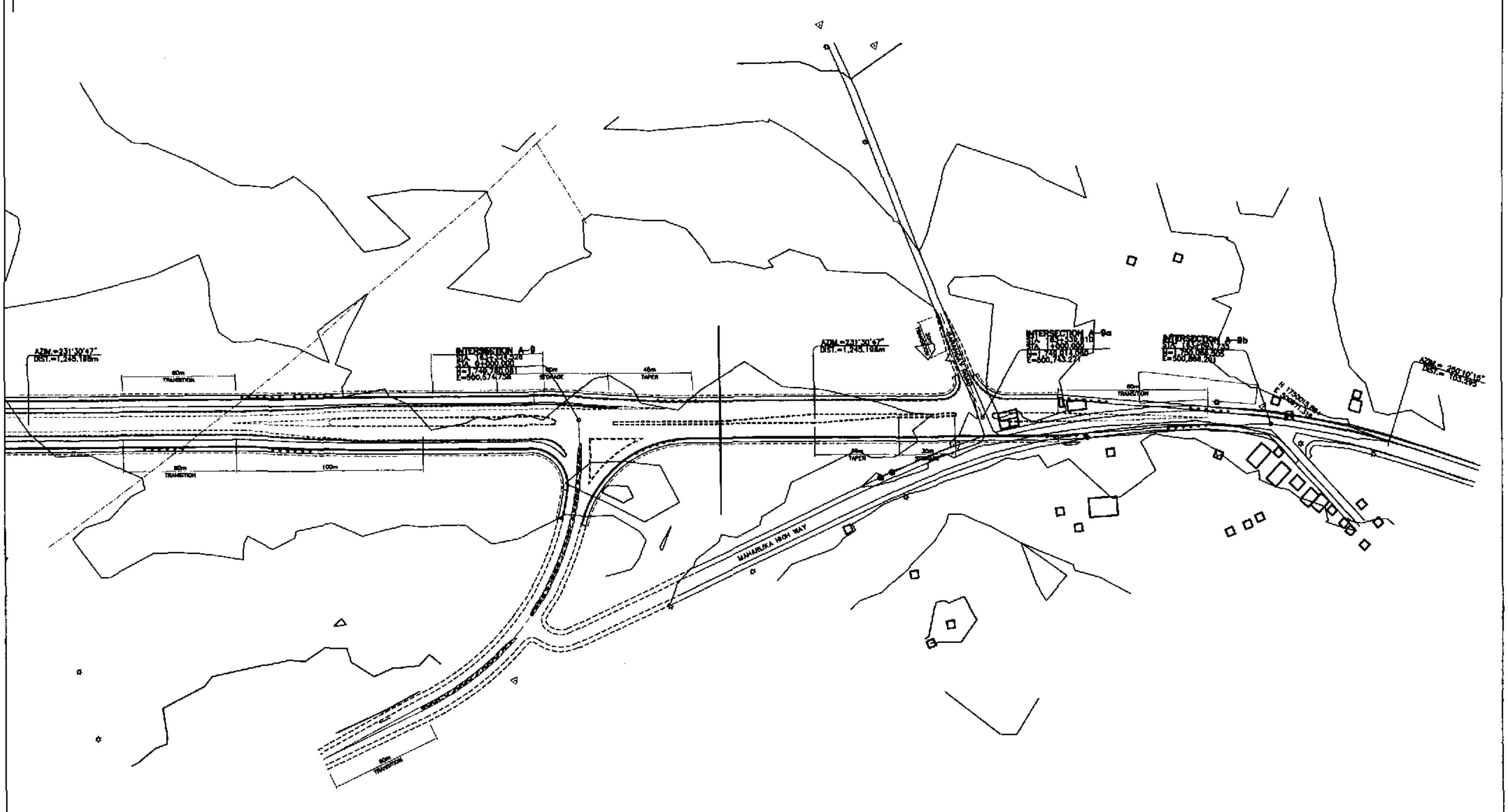


FIGURE 11.1-10 ALTERNATIVE INTERSECTION SCHEMES



INTERSECTION A-9 PLAN

FIGURE 11.1-11 PLAN OF RECOMMENDED SCHEME

TABLE 11.1-6 EVALUATION OF ALTERNATIVE SCHEMES (END POINT)

EVALUATION FACTOR		Maximum Allocated Points	SCHEME 1		SCHEME 2		REMARKS
Traffic Safety	(1) No. of Traffic Conflict Points (exclusive of signalized intersections)		17 conflict points	b	17 conflict points	c	a=50% of max. allocated points b=30% of max. allocated points c=20% of max. allocated points Although the number of conflict points of the both schemes is the same, the difference in the degree of traffic conflicts were taken into consideration.
	(2) Traffic Visibility		Good	b	Good (Visibility of minor traffic from/to Cagayan Valley. To/from Cabanatuan City on the bypass is the same as Scheme 1)	b	
	Sub-Total	30	b + b =	18	c + b =	15	
Traffic Movement	(1) Priority to the Bypass		Yes	a	Yes	a	a=50% of max. allocated points b=30% of max. allocated points c=20% of max. allocated points
	(2) To/From City Proper		Traffic accessing from/to Cagayan Valley to/from City Proper is interrupted at signalized intersection and traffic from City Proper to Cagayan Valley is uninterrupted (exclusive right-turn at signalized intersection	a	Traffic accessing from/to Cagayan Valley to/from City Proper is interrupted at signalized intersection and traffic to Cagayan Valley is uninterrupted (diverging at existing Pan-Phil Highway)	a	
	Sub-Total	20	a + a =	20	a + a =	20	
Costs	(1) Construction Costs (Ratio)		1.0	a	1.4	b	a=50% of max. allocated points b=30% of max. allocated points c=20% of max. allocated points
	(2) R.O.W. Area		1.80 has.	b	1.77 has.	b	
	Sub-Total	15	a + b =	12	b + b =	9	
Social Impact (Affected Houses)			1 house	a	1 house	a	a=100% (50x2) of max. allocated points b=70% (30x2) of max. allocated points c=50% (20x2) of max. allocated points
	Sub-Total	15	a =	15	a =	15	
Traffic Service to Communities to/from Bypass (symbols of minor roads are indicated in Figure 11.1-2)			Existing minor road A is uncontrolled (with auxiliary left turn lane at exit) and existing minor road B is also uncontrolled.	a	Existing minor road A is uncontrolled (without auxiliary left turn lane at exit) and existing minor road B is also uncontrolled.	a	a=100% of max. allocated points b=70% of max. allocated points c=50% of max. allocated points
	Sub-Total	10	a =	10	a =	10	
Traffic Signalization	Phases		3.0ϕ	b	3.0ϕ	b	a=50% of max. allocated points b=30% of max. allocated points c=20% of max. allocated points
	Delay Time (LOS)		2.9 sec (LOS A)	a	3.0 sec (LOS A)	a	
	Sub-Total	10	b + a =	8	b + a =	8	
TOTAL		100		83		77	
RANK			1		2		

Notes :
(1) Partially controlled access - partially allow movement such as U-Turn or access another route
(2) Controlled Access - controlled through signal or not allowed movement
(3) Uncontrolled Access - all movements are allowed

Evaluation results are summarized as follows:

- Scheme-1 is the best from the viewpoint of traffic safety because Scheme-2 has conflict between major traffic going to Cagayan Valley side at point C, which conflict is converging.
- Scheme-1 has also conflict between major traffic in the section from point A to C. However, this has the sufficient length for merging, and traffic from City proper once has to reduce the travel speed at the signalized intersection.

Figure 11.1-11 shows the best scheme drawing in detail based on the design criteria explained in Section 8.3 of Chapter 8.

The connecting point was determined from the following three (3) factors:

- The minimum radius of Pan-Philippine Highway to be realigned before the intersection (R=100m).
- Visibility. The minimum length is 130m from traffic on Pan-Philippine Highway to the traffic signal at the intersection. The line of visibility between traffic and the traffic signal shall be within road width.
- The minimum interval, 90m, between intersections. (JSTE)

The critical factor for fixing this connecting point is the length giving the minimal visibility. However, it is better to avoid taking minimum design values to the extent possible, because the larger the radius, the longer the interval between the intersections, and the more sufficient the visibility, the safer the traffic movement at the intersection becomes.

11.2 Drainage Design

11.2.1 Cross Drainage

The same design concept and standards as Plaridel Bypass were adopted for this Bypass.

Catchment areas of San Jose Bypass are shown in Figure 11.2-1. There are 24 catchment areas identified including 4 locations where bridges will be constructed. The hydrological characteristics, estimated discharges for different return periods, and capacity of proposed drainage structures are presented in Appendix 11.2-1. Ten (10) years return period for RCPC and 25 years for RCBC was considered.

Figure 11.2-2 shows the drainage system along the Bypass.

11.2.2 Surface Drainage

1) System of Drainage

The same concept as Plaridel Bypass was adopted for surface drainage system of San Jose Bypass.

2) Curb Inlet Locations and Spacing

Tables 11.2-1 and 2 shows the estimated spread length of water in relation to inlet spacing for the main carriageway and bike road, respectively.

TABLE 11.2-1(1/2) SURFACE RUNOFF OF MAIN CARRIAGEWAY (CASE OF NORMAL CROWN)

Inlet Spacing	Drained Area	Runoff Discharge	Spread Length
S (m)	A (km^2)	Q (m^3/sec)	T (m)
10	0.00009	0.0032	0.47
15	0.00013	0.0048	0.70
20	0.00018	0.0064	0.91
25	0.00022	0.0079	1.05
30	0.00026	0.0095	1.17
35	0.00031	0.0111	1.28
40	0.00035	0.0127	1.38
45	0.00039	0.0143	1.46
50	0.00044	0.0159	1.54

Note: 50m is the maximum allowable spacing by DPWH Standard

TABLE 11.2-1(2/2) SURFACE RUNOFF OF MAIN CARRIAGEWAY (CASE OF SUPER ELEVATION)

Inlet Spacing	Drained Area	Runoff Discharge	Spread Length
S (m)	A (km^2)	Q (m^3/sec)	T (m)
10	0.00013	0.0045	0.65
15	0.00019	0.0068	0.95
20	0.00025	0.0091	1.15
25	0.00031	0.00114	1.30
30	0.00038	0.0136	1.43
35	0.00044	0.0159	1.54
40	0.00050	0.0182	1.64
45	0.00056	0.0204	1.73
50	0.00063	0.0227	1.82

Note: 50m is the maximum allowable spacing by DPWH Standard

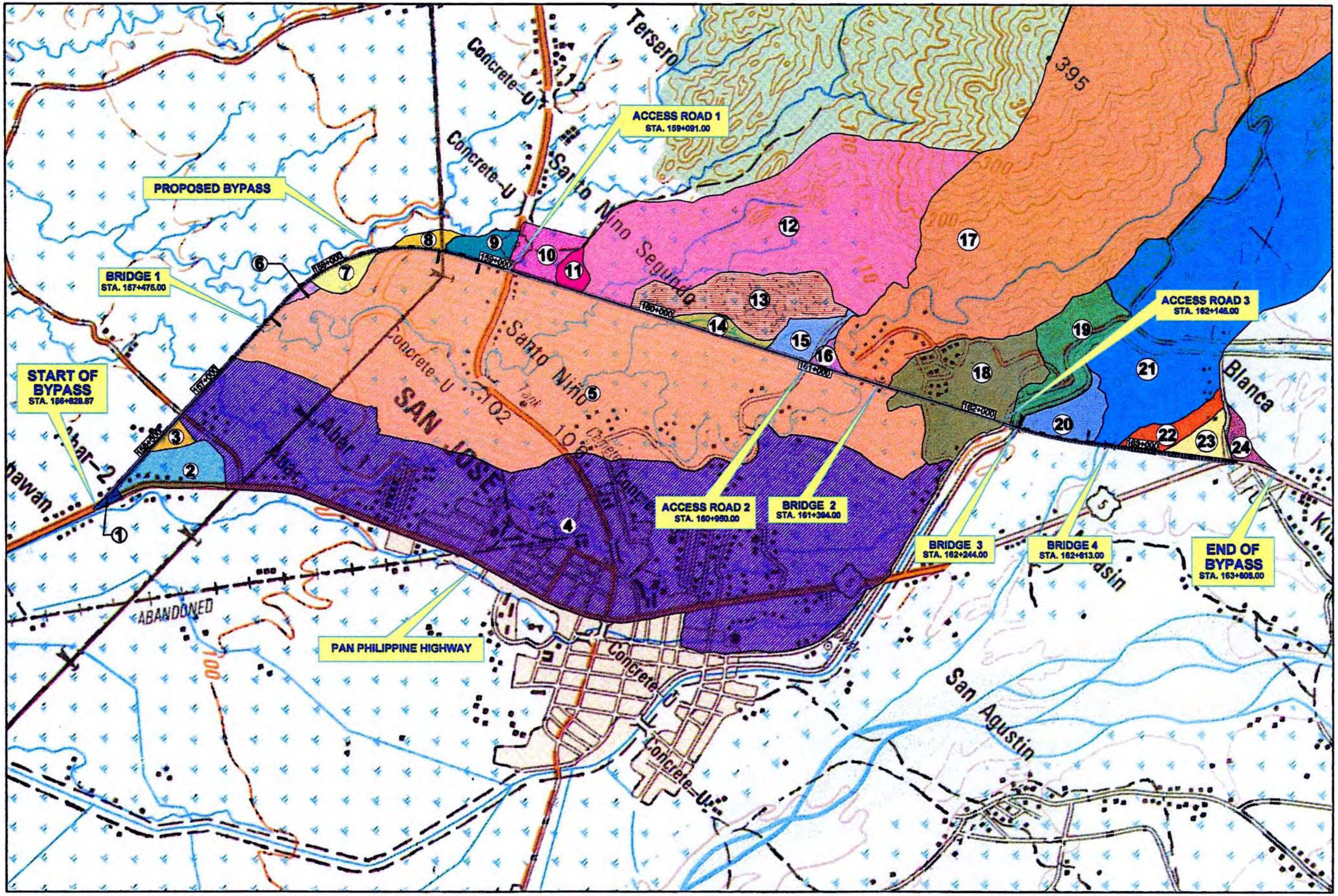


FIGURE 11.2-1 SAN JOSE BYPASS CATCHMENT AREA

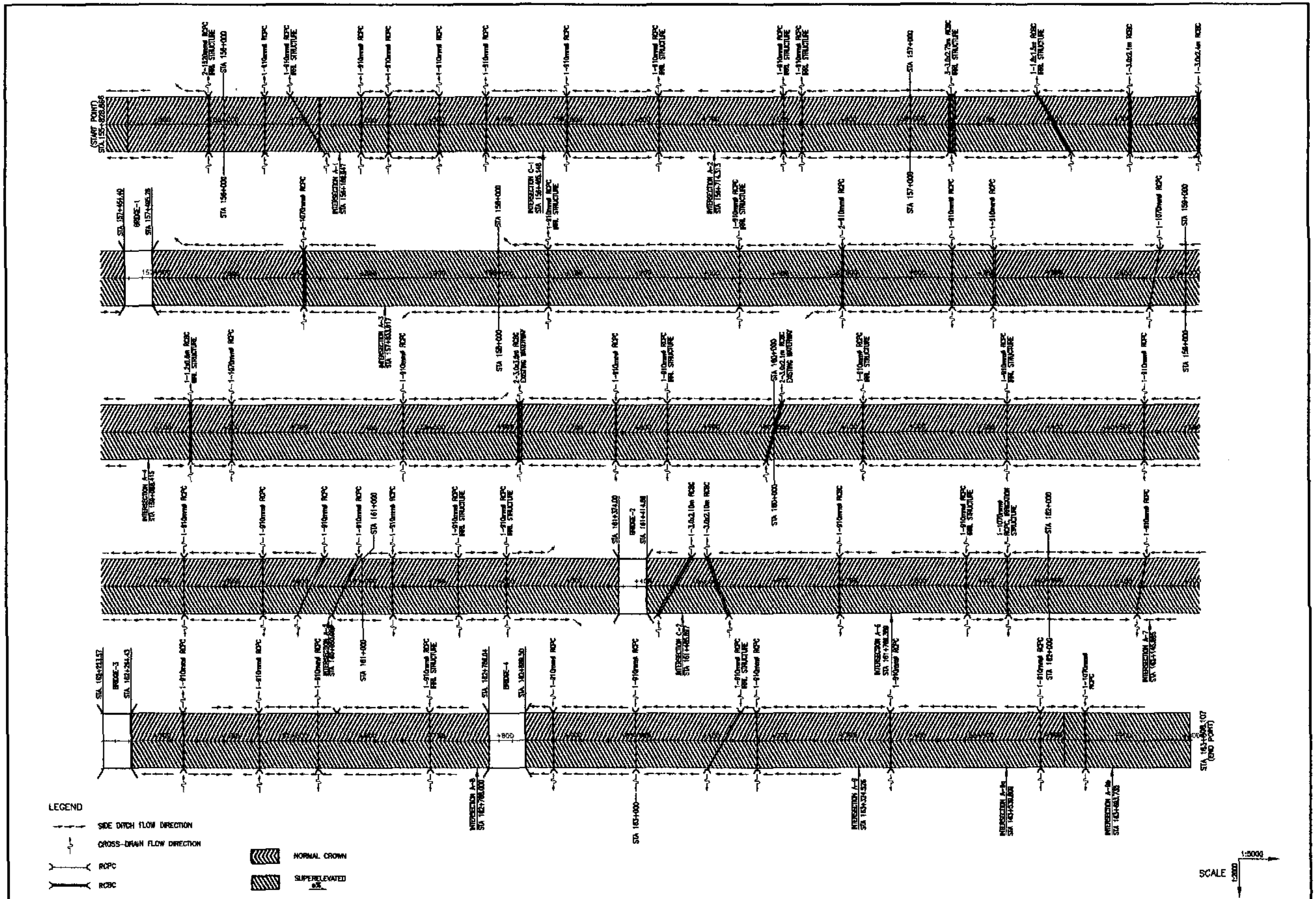


FIGURE 11.2-2 DRAINAGE SYSTEM ALONG SAN JOSE BYPASS (INITIAL STAGE)

TABLE 11.2-2(1/2) SURFACE RUNOFF OF MAIN CARRIAGEWAY SHOULDER (CASE OF SUPER ELEVATION)

Inlet Spacing	Drained Area	Runoff Discharge	Spread Length
S (m)	A (km^2)	Q (m^3/sec)	T (m)
10	0.00005	0.0018	0.38
15	0.00008	0.0027	0.44
20	0.00010	0.0036	0.49
25	0.00013	0.0045	0.65
30	0.00015	0.0054	0.79
35	0.00018	0.0064	0.91
40	0.00020	0.0073	1.00
45	0.00023	0.0082	1.07
50	0.00025	0.0091	1.15

Note: 50m is the maximum allowable spacing by DPWH Standard

TABLE 11.2-2(2/2) SURFACE RUNOFF OF TRICYCLE LANE

Inlet Spacing	Drained Area	Runoff Discharge	Spread Length
S (m)	A (km^2)	Q (m^3/sec)	T (m)
10	0.00009	0.0031	0.47
15	0.00013	0.0046	0.88
20	0.00017	0.0062	1.18
25	0.00021	0.0077	1.39
30	0.00026	0.0093	1.57
35	0.00030	0.0108	1.71
40	0.00034	0.0124	1.85
45	0.00038	0.0139	1.96
50	0.00043	0.0154	2.06

Note: 50m is the maximum allowable spacing by DPWH Standard

From the above analyses it can be concluded that:

- The maximum allowable inlet spacing as defined by DPWH Guidelines is 50 m. This spacing is acceptable by the abovementioned analyses but the maximum spacing is taken at 40 m.
- In case of the main carriageway, the spread water length from the curb edge will be always less than the shoulder width even in case of supper elevation.
- In case of tricycle lane, the spread of water from the curb edge will be always less than one half of the lane width that coincides with USBPR Practice.

3) Curb Opening Length

Since in design, the maximum inlet spacing is taken 40m and the curb opening length is taken 1m as an applicable one, it can be concluded based on the maximum estimated runoff discharge of about 0.018 m^3/sec (Table 11.2-1(2/2) for the case of super elevation) that the design is acceptable and have the enough safety margin. Under this flow rate the required opening length will be:

$L_T = 0.076\ Q^{0.42}\ S^{0.3}\ (1/nS_x)^{0.6}$

$L_T = 0.076 \times 0.018^{0.42} \times 0.02^{0.3} \times (1 / (0.013 \times 0.08))^{0.6}$

$L_T = 0.27$ m that is quite less than 1 m.

11.2.3 Surface Drainage of Highway Bridges

Maximum inlet spacing for bridges is shown in Table 11.2-3.

TABLE 11.2-3 DRAINAGE OF BRIDGES ALONG SAN JOSE BYPASS

Location	Max. Inlet Spacing (m)	Runoff (m^3/sec)	Spread (m)	Shoulder Width (m)
Main Carriageway (Initial-Stage)	12	0.0060	1.54	2.5
Tricycle Road (Ultimate-Stage)	12	0.0028	1.16	0

11.3 Short / Medium Bridge Design

There are four bridges along San Jose Bypass, all of which are classified as short / medium bridges. Bridge locations are shown in Figure 11.3-1.

Hydraulic and hydrological features of each bridge are summarized in Table 11.3-1. Summary of proposed bridges is shown in Table 11.3-2. Detailed description of each bridge is presented in Appendix 11.3-1.

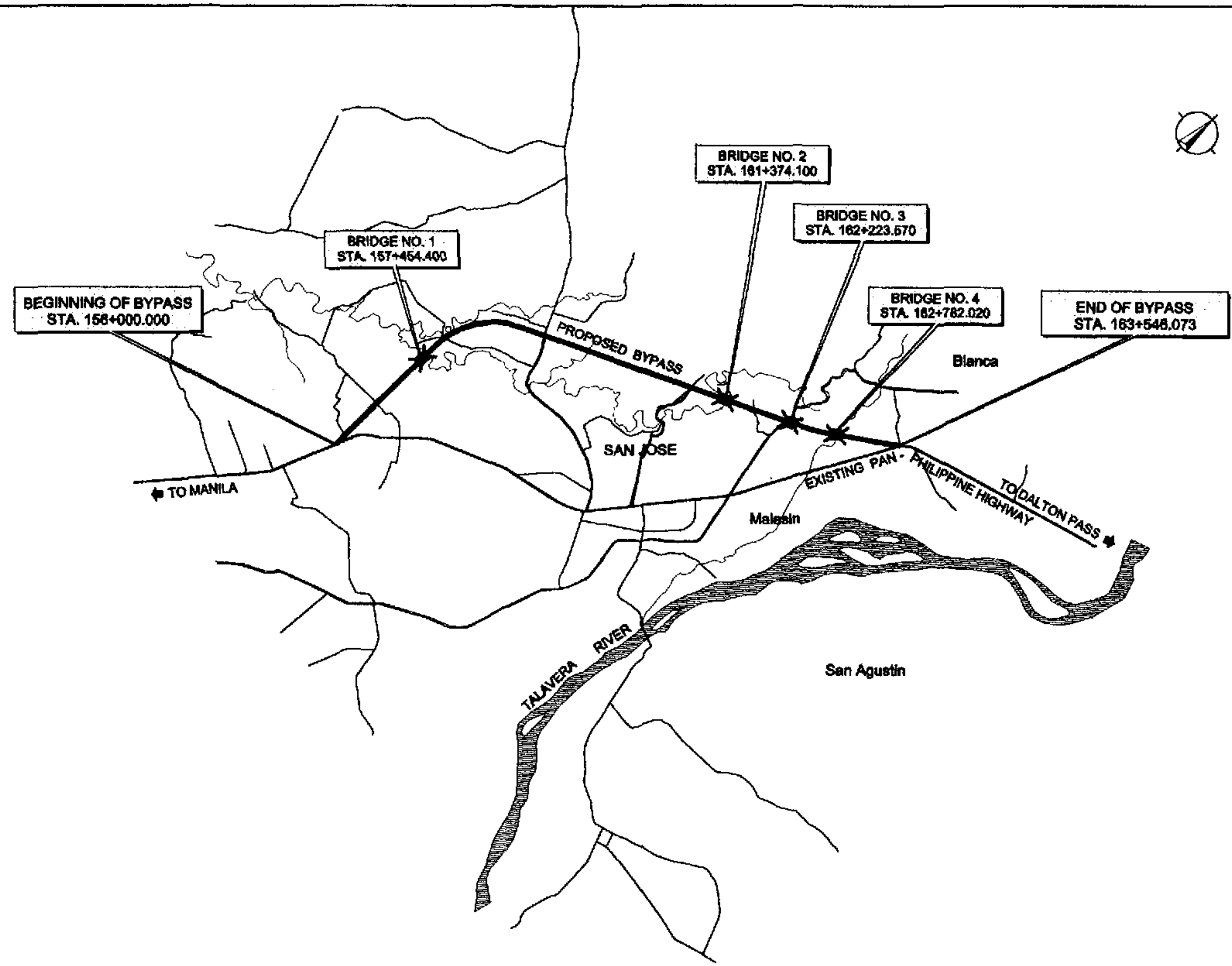


FIGURE 11.3-1 BRIDGE LOCATION : SAN JOSE BYPASS

TABLE 11.3 -1 HYDRAULIC AND HYDROLOGICAL RESULTS OF SMALL AND MEDIUM RIVERS (SAN JOSE BYPASS)

Bridge Number	Beginning Station	50 - year Design Hydraulics				River Width,W (m)
		M.F.W.L from Field Survey	Design Flood El.	Discharge Q (m3/s)	Velocity (m/s)	
1	157 + 454.400	94.80	94.820	101.80	1.945	26.20
2	181 + 374.000	114.80	114.960	148.10	3.147	27.10
3	162 + 222.709	121.70	118.800	IRRIGATION		21.80
4	162 + 782.020	122.70	123.000	165.00	3.448	35.80

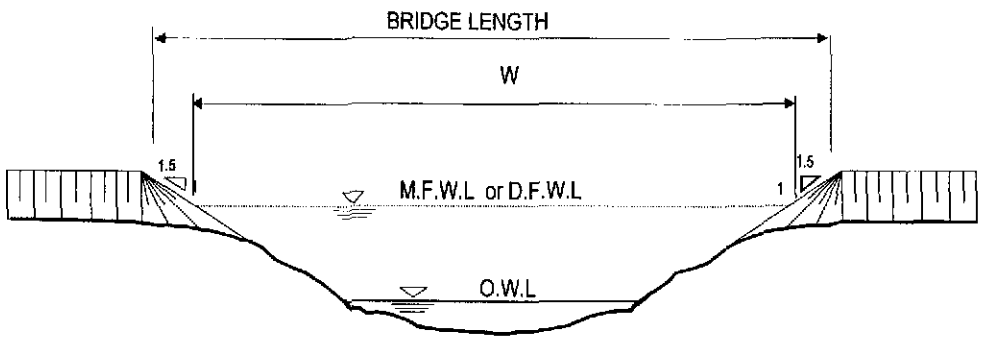


TABLE 11.3-2 SUMMARY OF PROPOSED BRIDGES FOR SAN JOSE BYPASS

INITIAL STAGE

Bridge No.	Type of Waterway	Beginning		End		Free Board	M.F.W.L EL. (+m)	Bridge Length	No. of Span	Span Length (m)	Superstructure	Substructure			
												Abutment		Pier	
		Station	Elev. (m)	Station	Elev. (m)							Type	Foundation	Type	Foundation
1	River	157+454.400	98.728	157+495.260	98.728	1.500	94.820	40.860	1-Span	40.000	PSCG (AASHTO Type VI Mod.)	Seat Type	Spread Footing	-	-
2	River	161+374.000	118.908	161+414.860	118.908	1.500	114.960	40.860	1-Span	40.000	PSCG (AASHTO Type VI Mod.)	Seat Type	Spread Footing	-	-
3	Irrigation	162+222.709	124.955	162+263.569	124.469	1.000	118.800	40.860	1-Span	40.000	PSCG (AASHTO Type VI Mod.)	Seat Type	Spread Footing	-	-
4	River	162+782.020	126.826	162+835.180	127.094	1.500	123.000	53.160	3-Span	15.75+21.00+15.75	RCDG	Seat Type	RC Pile (400 x 400) L_A = 20.0 m L_B = 21.0 m	Two Col	RC Pile (400 x 400) L_A = 20.0 m L_B = 21.0 m

ULTIMATE STAGE

Bridge No.	Type of Waterway	Beginning		End		Free Board	M.F.W.L EL. (+m)	Bridge Length	No. of Span	Span Length (m)	Superstructure	Substructure			
												Abutment		Pier	
		Station	Elev. (m)	Station	Elev. (m)							Type	Foundation	Type	Foundation
1	River	157+454.400	98.529	157+495.260	98.529	1.500	94.820	40.860	1-Span	40.000	PSCG (AASHTO Type VI Mod.)	Seat Type	Spread Footing	-	-
2	River	161+374.000	118.707	161+414.860	118.707	1.500	114.960	40.860	1-Span	40.000	PSCG (AASHTO Type VI Mod.)	Seat Type	Spread Footing	-	-
3 (L)	Irrigation	162+226.464	124.770	162+267.324	124.747	1.000	118.800	40.860	1-Span	40.000	PSCG (AASHTO Type VI Mod.)	Seat Type	ϕ 800 Bored Pile, L=8.0 m	-	-
3(R)	Irrigation	162+212.421	124.701	162+267.081	124.748	1.000	118.800	40.860	1-Span	15.00+24.00+15.00	RCDG	Seat Type	ϕ 800 Bored Pile, L=8.0 m	Single Col.	Spread Footing
4(L)	River	162+784.300	126.639	162+837.460	126.907	1.500	123.000	53.160	3-Span	15.75+21.00+15.75	RCDG	Seat Type	RC Pile (400 x 400) L_A = 20.0 m L_B = 21.0 m	Single Col.	RC Pile (400 x 400) P1 = 17.5 m P2 = 17.5 m
4(R)	River	162+779.770	126.616	162+832.900	126.884	1.500	123.000	53.160	3-Span	15.75+21.00+15.75	RCDG	Seat Type	RC Pile (400 x 400) L_A = 20.0 m L_B = 21.0 m	Single Col.	RC Pile (400 x 400) P1 = 17.5 m P2 = 17.5 m