2.4.7. Alternative Study on Construction Schedule

Construction schedule was agreed to be 32 months during the discussion between JICA and MOT as shown in Attachment-10.

The following is the result of the Study on the basis of 30 months construction.

(1) ***General***

In the Terms of Reference (the TOR) of this Study, it was assumed that the construction period is 30 months because the highway opening is highly expected in 2014.

In accordance with the TOR, in order to achieve the 30 month construction period, the Study Team has proposed some "Accelerated Construction Methods" in this Study as follows:

Table 2.4-28 List of Accelerated Construction Methods[1)]

No.	Structure Type	Accelerated Construction Method	Time saved (months)
1	Superstructure	Span-By-Span (SBS) Erection Method	6[2)]
2	Foundation (Main Bridge)	Steel Pipe Well	2-3
3	Foundation (Approach Bridge)	Steel Pile	3-4

Note:
1) Time saving amount for 4.5km long Approach Bridge.
2) Time saving amount against "standard cast-in-situ" balanced cantilever method.

In addition to the above, time savings through the application of stage construction should also be compared.

(2) ***Schedule Alternatives***

The following schedule alternatives were considered for the comparison study:

- Construction Period: 30 months (TOR)
- Construction Period: 36 months (F/S)

(3) ***Comparison Study***

Comparison results on the construction cost and time are summarized in Table 2.4-29.

Table 2.4-29 Comparison of Construction Schedule[1)]

No.	Structure Type	Construction Method		Applicability		Cost		Structure Durability	Construction Safety	Ranking	
				30 months	36 months	30 months	36 months			30 months	36 months
1	Superstructure	PC-Box	SBS	◎	◎	100	100	◎	◎	1	1
			MSS	○	◎	100	100		◎	2	2
			Cast-in Situ	×	○	×	100		○	-	3
		Super-T		○	◎	90	90	△	○	3	4
2	Foundation (Main Bridge)	Steel Pipe Well		◎	◎	100	100	◎	◎	1	1
		Temporary Coffer		×	○	-	80	△	△	-	2
3	Foundation (Approach Bridge)	Steel Pile		◎	◎	100	100	◎	◎	1	**2**
		Bored Pile		×	○	-	80	◎	◎	-	**1**

◎: Suitable/Very Good, ○: Possible/Acceptable, △: Doubtful, ×: Impossible/Not Acceptable

Note:

1) Comparison for 4.5km long Approach Bridge.

(4) ***Selection of Optimum Construction Schedule***

1) 30 Months (TOR Basis)

If 30 months construction period is required, accelerated construction methods shall be applied in order to timely complete the works.

2) 36 Months (Same as F/S)

If 36 month construction period is required, **bored pile could be used instead of the steel pile** due to economic reasons.

3) Construction Schedule of 6-lane Bridge

If 6-lane bridge is required, 30 months construction schedule can be achievable by utilizing the Span-by-Span method for the superstructure and steel pile for the foundation.

2.4.8. Summary of Alternative Studies

The Summary of the alternative studies is tabulated in Table 2.4-30.

Table 2.4-30 Summary of Alternative Studies

No.	Study Item		Study Result
1	Route Alignment		• End point is adjusted to the port works. • Other alignment was not changed from the F/S.
2	Stage Construction		• Application of Stage Construction is proposed in the view of updated traffic demand forecast. • Structural consideration for the stage construction was studied in depth. • Structural studies for the 6-lane bridge are also carried out.
3	Bridge Length		• Bridge length was decided: Approach Bridge (Hai An) = 4,434 m Main Bridge = 490 m Approach Bridge (Cat Hai) = 519 m Total = 5,443 m
4	Bridge Type (1), Main Bridge	Superstructure	Stage Construction (4-lane) PC Box Girder, separated type Full 6-lane PC Box Girder with strut, unified type
		Substructure	Double V-shaped Pier
		Foundation	Steel Pipe Well Foundation
5	Bridge Type (2), Approach Bridge	Superstructure	Stage Construction (4-lane) PC Box Girder, separated type Full 6-lane PC Box Girder with strut, unified type
		Substructure	Standard section: Double Wall Type Pier, Flyover section: Double V-shaped Pier
		Foundation	Steel Pile Foundation
6	Construction Schedule (30 months)	Stage Construction (4-lane)	• As proposed above.
		Full 6-lane	
7	Construction Schedule (36 months)	Stage Construction (4-lane)	• **Bored pile can be used instead of steel pile.** • PC-Box is selected for its durable structure. • Steel Sheet Pipe Pile Well Foundation is selected for construction safety with offshore construction at typhoon area.
		Full 6-lane	

2.5. Review of Preliminary Design

2.5.1. General

In this Study, the preliminary design of the F/S (July 2009) by JBSI JV was reviewed as follows. Correctness of most of the design contents was confirmed. Some works have been updated by the Study Team.

2.5.2. Road Design

(1) Road Classification of Tan Vu - Lach Huyen Highway

Classification of Tan Vu – Lach Huyen Highway is Technical Level 80 in Section 3.5 of TCVN4054-2005.

Table 2.5-1 Road Classification of Project Road

No.	Description	Value
1	Design Standard	TCVN4054-2005
2	Design Category	Technical Level 80
3	Design Speed	80 km/h

Source: Study Team

(2) Geometric Design Standards

The geometric design standards of Tan Vu – Lach Huyen Highway is set up as shown in the following Table 2.5-2.

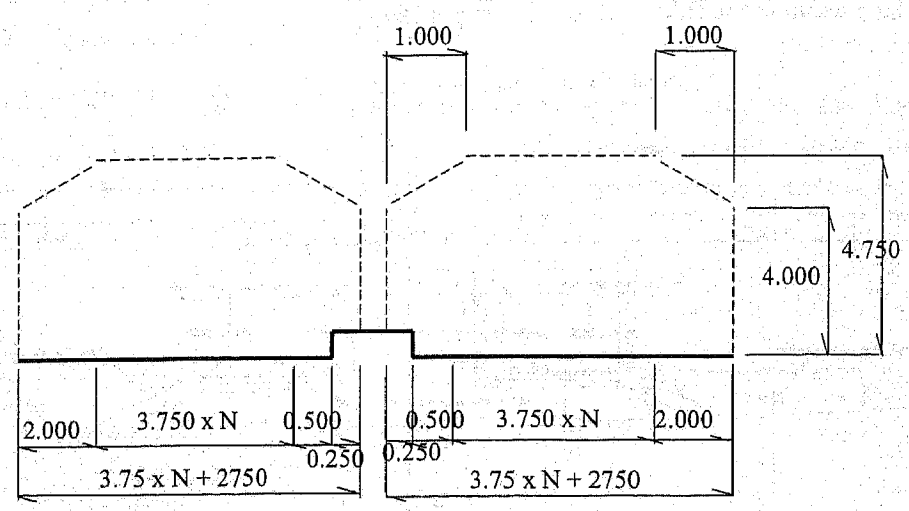
Table 2.5-2 Geometric Design Standards for Tan Vu – Lach Huyen Highway

Geometric Items			UNIT	TCVN 4054-98	TCVN 4054-2005	TCVN5729-97	Adoption
Road classification				Technical class 80	Design category III	Class B-grade 80	Design category III
Topography				Flat, Rolling	Flat, Rolling	Flat, Rolling	Flat, Rolling
Design speed			km/h	80	80	80	80
Cross section	Carriageway		m	2 x 3.50	2 x 3.50	4 x 3.75	6 x 3.75
	Shoulder		m	2 x 3.00	2 x 2.50	2 x 3.25	2 x 2.50
	Paved portion		m	2 x 2.50	2 x 2.00	2 x 2.50	2 x 2.00
Minimum radius			m	400(250)	400(250)	240	400(250)
Minimum radius of horizontal curves depending on deflection angle			m	10,000(1 degree) 6,000(2 degree) 4,000(3 degree) 3,000(4 degree) 2,000(5 degree) 1,000(6 degree) 800(8 degree)	10,000(1 degree) 6,000(2 degree) 4,000(3 degree) 3,000(4 degree) 2,000(5 degree) 1,000(6 degree) 800(8 degree)	—	10,000(1 degree) 6,000(2 degree) 4,000(3 degree) 3,000(4 degree) 2,000(5 degree) 1,000(6 degree) 800(8 degree)
Minimum length of curve			m	174	220(250≤R≤275) 200(275<R<300) 170(300<R<350) 140(350<R)	340	220(250≤R≤275) 200(275<R<300) 170(300<R<350) 140(350<R)
Minimum length of clothoid			m	87 (L=Vc³/23.5R =80³/23.5x250)	110(250≤R≤275) 100(275<R<300) 85(300<R<350) 70(350<R)	170	110(250≤R≤275) 100(275<R<300) 85(300<R<350) 70(350<R)
Maximum grades			%	6	5	6	5
Maximum length of longitudinal grade			m	900(4%) 700(5%) 500(6%)	900(4%) 700(5%)	900(4%) 700(5%) 500(6%)	900(4%) 700(5%)
Vertical curves	Crest	Minimum	m	4000	4000	3000	4000
		Normal	m	—	5000	4500(12000)	5000
	Sag	Minimum	m	2000	2000	2000	2000
		Normal	m	—	3000	3000(8000)	3000
	Minimum Length of curves		m		70	70	70
Maximum super-elevation			%	6	8	7	8
Minimum Radius which allows an inverse super-elevation			%	1000	2500	2000	2500
Minimum stopping sight distance			m	100	100	100	100
Connecting interchange							
Minimum radius of the horizontal curve		Minimum	m	—	—	700	700
		Normal	m	—	—	1100	1100
Vertical curves	Crest	Minimum	m	—	—	6000	6000
		Normal	m	—	—	12000	12000
	Sag	Minimum	m	—	—	4000	4000
		Normal	m	—	—	8000	8000
Maximum grades		Minimum	%	—	—	4	4
		Normal	%	—	—	3	3

Source: Study Team

(3) Lateral and Vertical Clearances

According to TCVN4054-2005 (Section 4.10), the required clearance on highway is as shown in Figure 2.5-1.



Source: Section 4.10 of TCVN4054-2005

Figure 2.5-1 Traffic Clearance

The minimum vertical clearance for flyover or culvert is defined as follows:

Table 2.5-3 Required Vertical Clearance (Road) (Section 4.10, TCVN4054)

4.75m	Highway class I, II, III
4.5m	Highway class IV, V, VI
3.2m	District Road
2.7m	Bicycle way and sidewalk
2.5m	Pedestrian, bicycle and other non-motorized vehicles.

Source: Section 4.10 of TCVN4054-2005

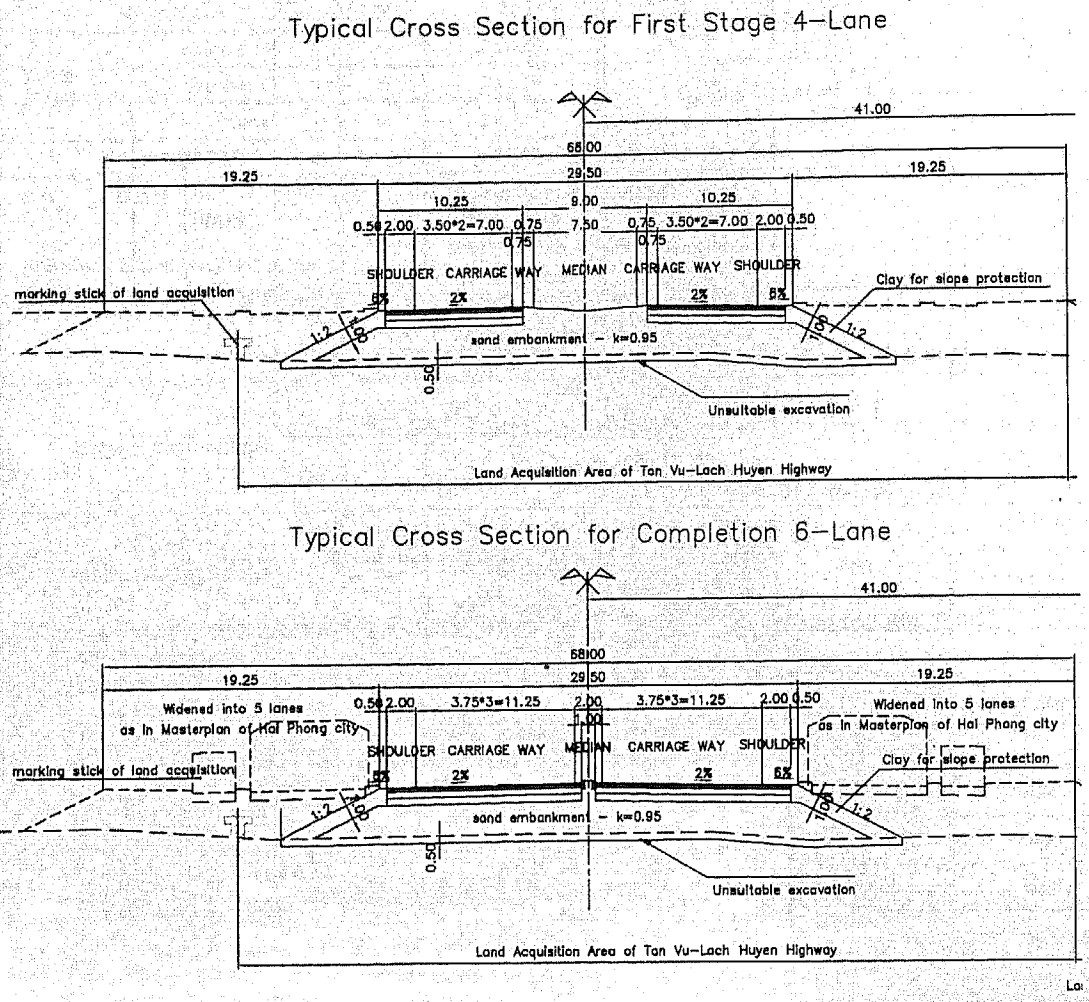
Table 2.5-4 Required Vertical Clearance (Railways)

	Railway (horizontal and vertical)	**Law of railway**
6,55m (vertical)	from the rail crest to the structure base	(Article 27-1)
7m (horizontal)	minimum horizontal clearance from the rail edge to the structure	(Article 27-2)
5m (horizontal)	from outer edge of the outermost rail applicable to unexcavated and unfilled embankment	
3m (horizontal)	from embankment footing to the structure from outer edge of the side ditch outwards applicable to the excavated embankment	

Source: Law of Railways

(4) Typical Cross Section

Typical cross sections, for the first stage and second stage, are as shown in the following figure. The lane width in the first stage is a 3.5 m per lane.



Source: Study Team

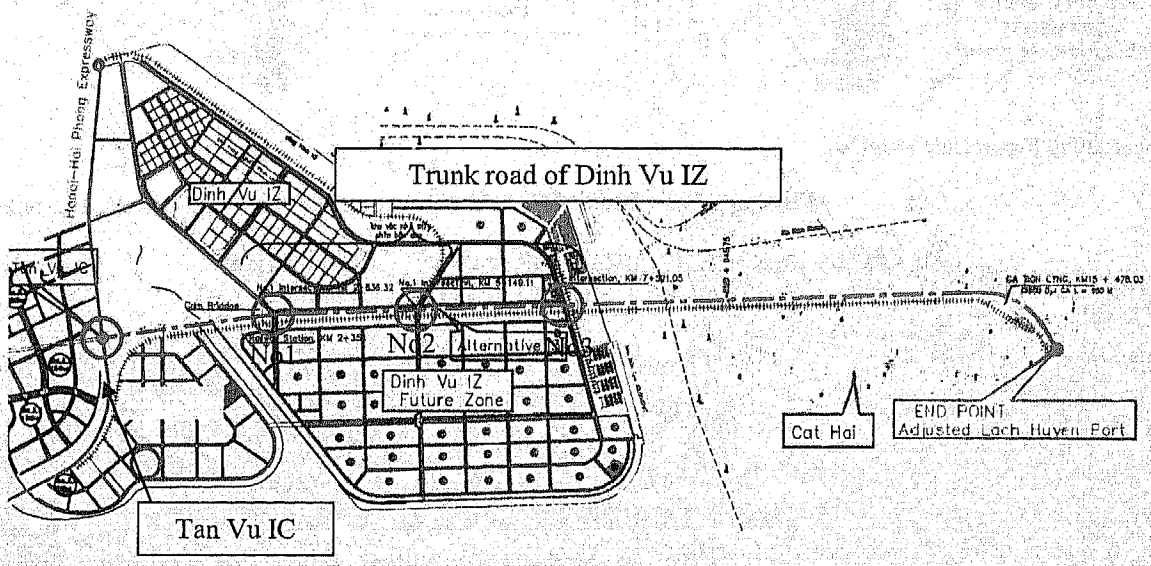
Figure 2.5-2 Typical Cross Section

2.5.3. Interchange and Intersections Design

(1) Interchange and Intersection Layout

For Hai An side, Tan Vu Interchange and three intersections with three arterial roads in the Dinh Vu Industrial Zone are updated.

For Cat Hai side, there is no major intersection except at the end point. The pavement elevation of the project road is the same level with the community road crossing, thus, local minor intersection will be connected without any major structural requirements. Such intersections will be designed during the detailed design stage.

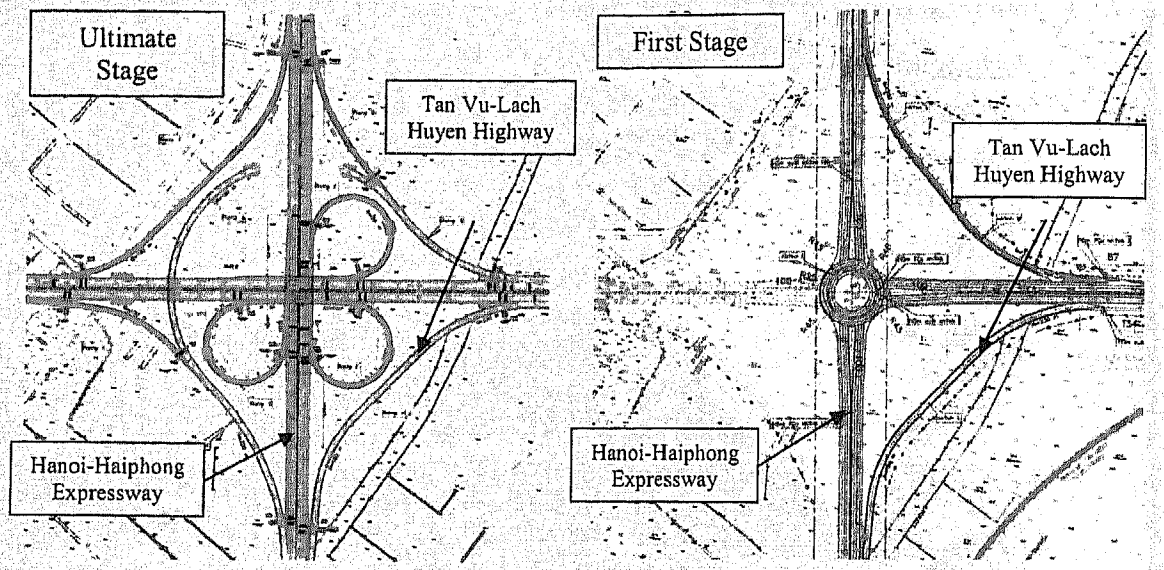


Source: Study Team

Figure 2.5-3 Location of Interchanges and Intersections

- **Tan Vu Interchange**

  Tan Vu IC is installed in Km 100+891.11 of Hanoi – Hai Phong Expressway. The ultimate development intersection type is "cloverleaf with semi-direct connection". Since in the provisional period, before connection with Hai Phong Ring Road No. 3, there is not much traffic, an at-grade intersection is planned during the first stage.



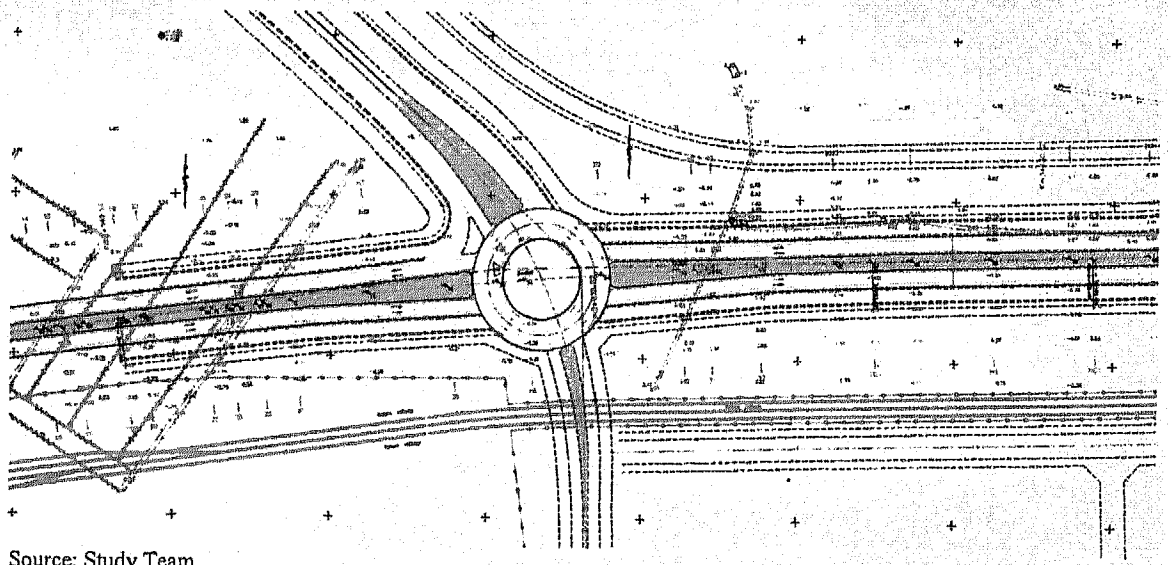
Source: F/S Report (July 2009)

Figure 2.5-4 Plan of Tan Vu Interchange

- **No. 1 Intersection**

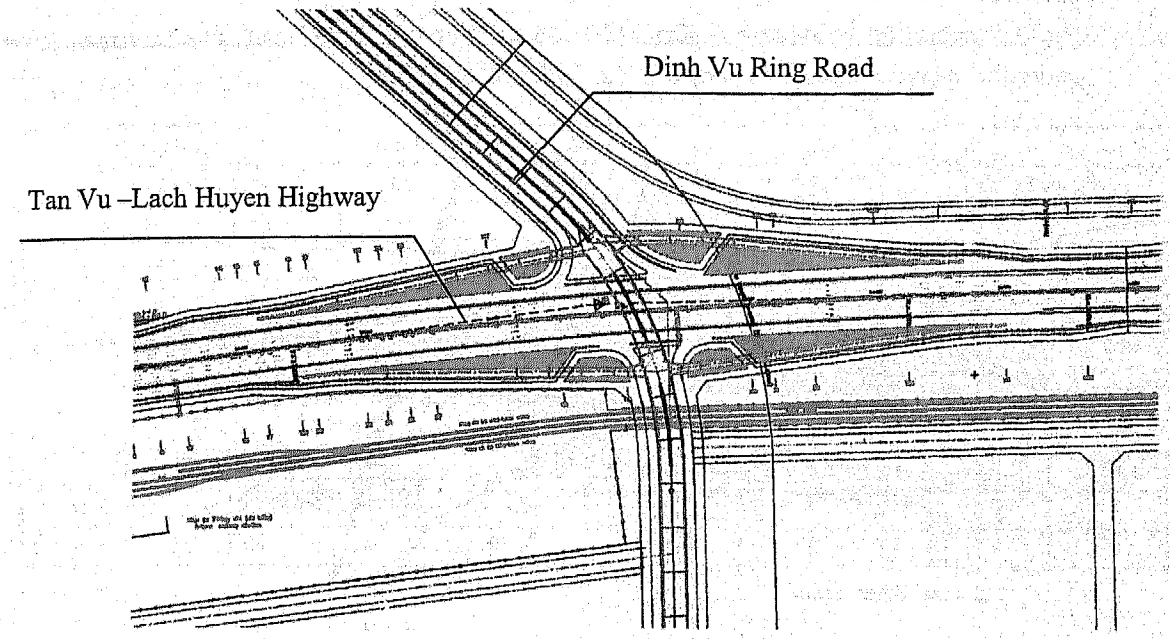
  No. 1 intersection is located at Km 2+836.32 of Dinh Vu Ring Road. Dinh Vu Ring Road is a trunk road of Dinh Vu IZ area, with four lanes per direction.

  As described in Section 4.3, the incoming and outgoing traffic volumes in the Dinh Vu IZ area will reach 3,859 pcu/hour in 2030. Accordingly, this intersection will be upgraded to grade-separated type by that time. In the F/S, the design consultant proposed the grade-separated type to Hai Phong City on February 11, 2009, which was then approved.



Source: Study Team

Figure 2.5-5 First Stage of No.1 Intersection

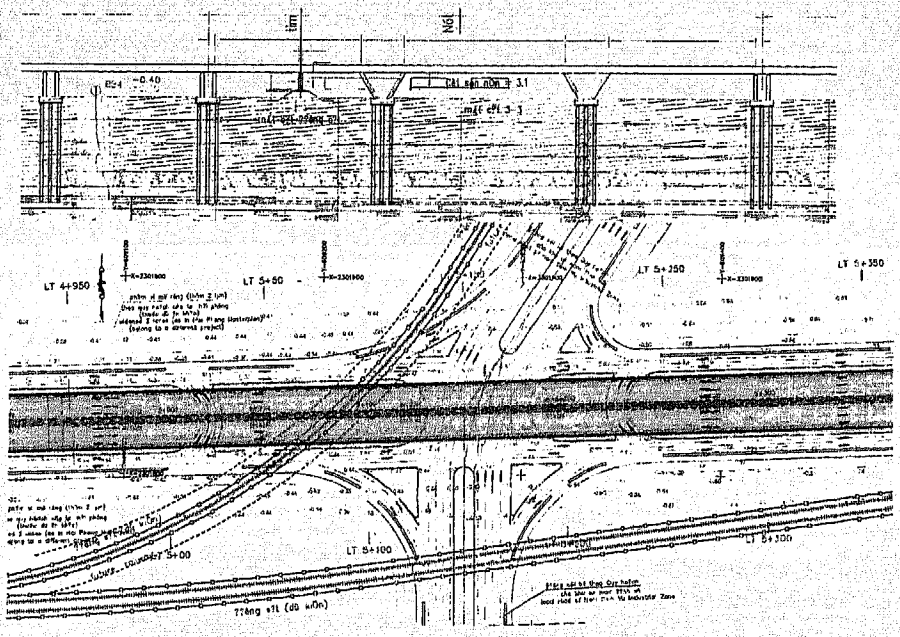


Source: F/S Report (July 2009)

Figure 2.5-6 Ultimate Stage of IC Plan of No.1 Intersection

- **No. 2 Intersection**

No. 2 intersection is located at Km 5+149.11 of Dinh Vu Ring Road. The ring road passes under the approach bridge as shown in the figure below. A flyover structure is planned and the piers are positioned so as not to disturb the intersection development.

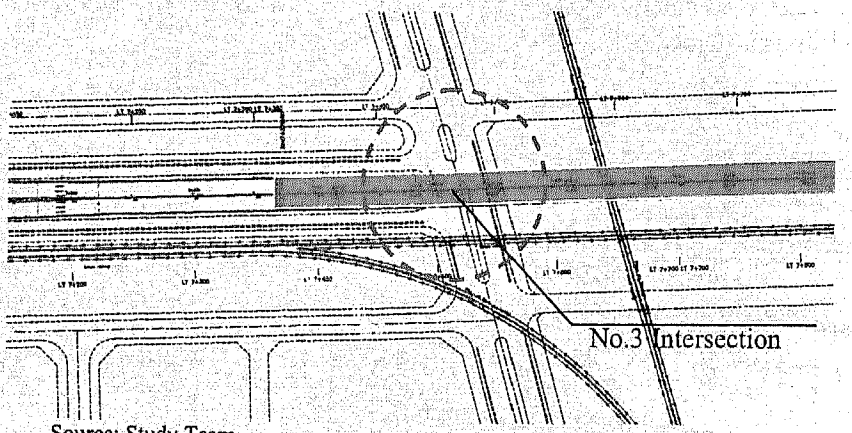


Source: Study Team

Figure 2.5-7 No.2 Intersection with Flyover Structure

- **No. 3 Intersection**

No. 3 intersection is located at Km 7+521.05 of Dinh Vu Ring Road. The ring road passes under the approach bridge as shown in the figure below.



Source: Study Team

Figure 2.5-8 No.3 Intersection

(2) Design Standards

The design standards for rampway at the intersection are based on Vietnamese Design Standards TCVN5729-97, 22 TCN 273-01 and TCVN4054-2005. The geometric items for this project are summarized in Table 2.5-5.

Table 2.5-5 Geometric Design Standard for Rampway at Intersection

Geometric Items			UNIT	TCVN 4054-2005	22TCN-273-01	Adoption
Design speed			km/h	40	40	40
Minimum radius		limited	m	60	50	50
		nomal	m	125	170	170
Minimum length of curve			m	---	82	82
Minimum parameter of spiral			m	---	45	45
Minimum length of spiral			m	---	41	41
Maximum grades			%	7	7	7
Vertical curves	Crest	Radius of curves	m	700 (limited) 1000 (nomal)	500	500
		Length of curves	m	35	24	24
	Sag	Radius of curves	m	450 (limited) 700 (nomal)	800	800
		Length of curves	m	35	24	24
Maximum super-elevation			%	8	8	8
Minimum Radius which allows an inverse super-elevation			%	600	800	800
Minimum stopping sight distance			m	40	60	60

Source: Study Team

The design standard for rampway of Tan Vu Interchange is TCVN5729-97. Geometric design standards for this interchange are shown in Tables 2.5-6 and 2.5-7