4 NORTH-SOUTH EXPRESSWAY NETWORK PLAN

4.1 Introduction

This chapter summarizes the results of the review of present expressway related documents, and proposes the North-South Expressway Network Plan mainly in the engineering viewpoint including planning standards, route selections, interchanges, expressway facilities and structures, and linking roads.

Since the commencement of VITRANSS 2 Study, all available reports have been reviewed and the summary was presented in the Sub-Sector Report.

In this chapter, the further intensive study, focused on the North-South Expressway, was carried out with reference to the following documents:

(i) Road Traffic Law (No.23/2008/QH12)

(ii) Expressway master plan (Decision No.1734/QĐ-TTg dated 1 December 2008)

(iii) Expressway master plan report (No.7056/TTr-BGTVT dated 5 November 2007)

(iv) Expressway design standards (TCVN5729-2007)

(v) Detailed planning report (No.4481/BGTVT-KHDT dated 2 July 2009)

4.2 Planning Standards

1) Background

The new "Road Traffic Law, No.23/2008/QH12", which is in force from 1st July 2009, superseded the old version (No.26/2001/QH10) with more modernization of terms to meet the current demand of road and road transport in response to the rapid socio-economic development in the country. Development policies and orientations are stipulated in Articles 5 and 6 of the said Law.

The approved expressway master plan (No.1734) shows the following goals:

(i) Steadily form the national expressway network, ensuring that key economic centers, main border gates and important traffic centers which have high speed and transportation needs are connected to each other. In particular, the master plan emphasized the need to concentrate on constructing the North-South Expressway, prioritize the expressways' connection with large cities (such as Ha Noi, HCMC, Da Nang) and ports;

(ii) Improve the connection of other transportation facilities and enhance regional and international integration;

(iii) Ensure connection with existing highway system, environment and landscape even though the expressways are constructed separately;

(iv) Priority reduction of traffic jam in Hanoi and HCMC; and

(v) Possible staging of the construction of expressways (despite the plan's ultimate scale) to be coherent with traffic volume and financing, and carry out land management including limits for future land acquisition costs.

The MOT master plan report (No.7056) studied in detail from the viewpoints of the above goals.

Also, the recent detailed planning report (No. 4481) is studying intensively the 1,811 km eastern North-South Expressway from Hanoi to Can Tho City.

With reference to the above-mentioned documents, this master plan likewise proposed the expressway network planning standards.

2) Planning Standards

(1) Planning Items

Items for expressway network planning include the following:

(i) Road density

(ii) Route selection

(iii) Interchange location

(iv) Expressway facilities location

(v) Expressway technical standards

Planning of road transport services and operation and maintenance are not described in this section.

(2) Road Density

Table 4.2.1 shows the comparison between master plan No. 7056 and No. 1734. There are some updates for the timing of implementation.

Table 4.2.1 Approved Expressway Master Plan (No.1734/QĐ-TTg)

No.			Section	Length (km)	No. of Lanes	Cost (Billion VND)	1734		7056	
							Before 2020	After 2020	Before 2020	After 2020
Eastern North-South Expressway	1	1	Cau Gie–Ninh Binh	50	6	9,300	Under Construction			
	2	2	Ninh Binh–Thanh Hoa	75	6	12,380	Yes		Yes	
	3	3	Thanh Hoa–Vinh	140	6	22,120	Yes		Yes	
	4	4	Vinh–Ha Tinh	20	4-6	2,580	Yes		Yes	
	5	5	Ha Tinh–Quang Tri	277	4	21,610	Yes			Yes
	6	6	Quang Tri–Da Nang	178	4	18,160	Yes		Yes	
	7	7	Da Nang–Quang Ngai	131	4	17,820	Yes		Yes	
	8	8	Quang Ngai–Quy Nhon	150	4	23,700	Yes		Yes	
	9	9	Quy Nhon–Nha Trang	240	4	24,960		Yes		Yes
	10	10	Nha Trang–Dau Giay	378	4-6	55,940		Yes	Yes	
	11	11	HCMC–Long Thanh–Dau Giay	55	6-8	18,880	Yes		Yes	
	12	12	Long Thanh–Nhon Trach–Ben Luc	45	6-8	12,340	Yes		Yes	
	13	13	HCMC- Trung Luong	40	8	13,200	Under Construction			
	14	14	Trung Luong–My Thuan–Can Tho	92	6	26,250	Yes			
Western North-South Expressway	15	1						Yes		Yes
	16	2	Ngoc Hoi–Chon Thanh	864	4-6	96,770		Yes		Yes
Northern Region	17	1	Lang Son–Bac Giang–Bac Ninh	130	4-6	12,220	Yes		Yes	
	18	2	Ha Noi–Hai Phong	105	4-6	16,800	Yes		Yes	
	19	3	Ha Noi–Lao Cai	264	4-6	15,580	Yes		Yes	
	20	4	Ha Noi–Thai Nguyen	62	4-6	4,220	Yes		Yes	
	21	5	Thai Nguyen–Cho Moi	28	4-6	2,940		Yes		Yes
	22	6	Lang–Hoa Lac	30	6	7,650	Under Construction			
	23	7	Hoa Lac–Hoa Binh	26	4-6	2,550		Yes	Yes	
	24	8	Bac Ninh–Ha Long	136	6	19,040	Yes		Yes	
	25	9	Ha Long–Mong Cai	128	4-6	13,820	Yes		Yes	
	26	10	Ninh Binh–Hai Phong–Quang Ninh	160	4	13,760		Yes		Yes
Central Region	27	1	Hong Linh–Huong Son	34	4	2,450		Yes		
	28	2	Cam Lo–Lao Bao	70	4	4,900		Yes		
	29	3	Quy Nhon–Pleiku	160	4	12,000		Yes		
Southern Region	30	1	Dau Giay–Da Lat	189	4	19,280	Yes			
	31	2	Bien Hoa–Vung Tau	76	6	12,160	Yes			
	32	3	HCMC–Thu Dau Mot–Chon Thanh	69	6-8	20,010		Yes		
	33	4	HCMC–Moc Bai	55	4-6	7,480		Yes		
	34	5	Soc Trang–Can Tho–Chau Doc	200	4	24,200		Yes		
	35	6	Ha Tien–Rach Gia–Bac Lieu	225	4	27,230		Yes		
	36	7	Can Tho–Ca Mau	150	4	24,750		Yes		
Ha Noi City Ring Road System	37	1	Ring road No 3	56	4-6	17,990	Yes			
	38	2	Ring road No 4	125	6-8	34,500		Yes		
Ho Chi Minh City Ring Road System	39	1	Ring road No 3	83	6-8	20,750	Yes			
Total				5,753		766,220				

Source: No. 1734/QD-TTg
Note: This table does not include Bac Ninh–Phap Van section (40 km), Phap Van–Cau Gie section (30 km), Noi Bai–Bac Ninh section (30 km), Lien Khuong–Da Lat section (20 km)

Although the expressway master plans already cover an extensive network, a review of the existing master plan revealed the following links that can be included for the further consideration:

(i) Danang–Ngoc Hoi (250 km)

(ii) Quang Ngai–Dak To (170 km)

(iii) Nha Tran–Da Lat (80 km)

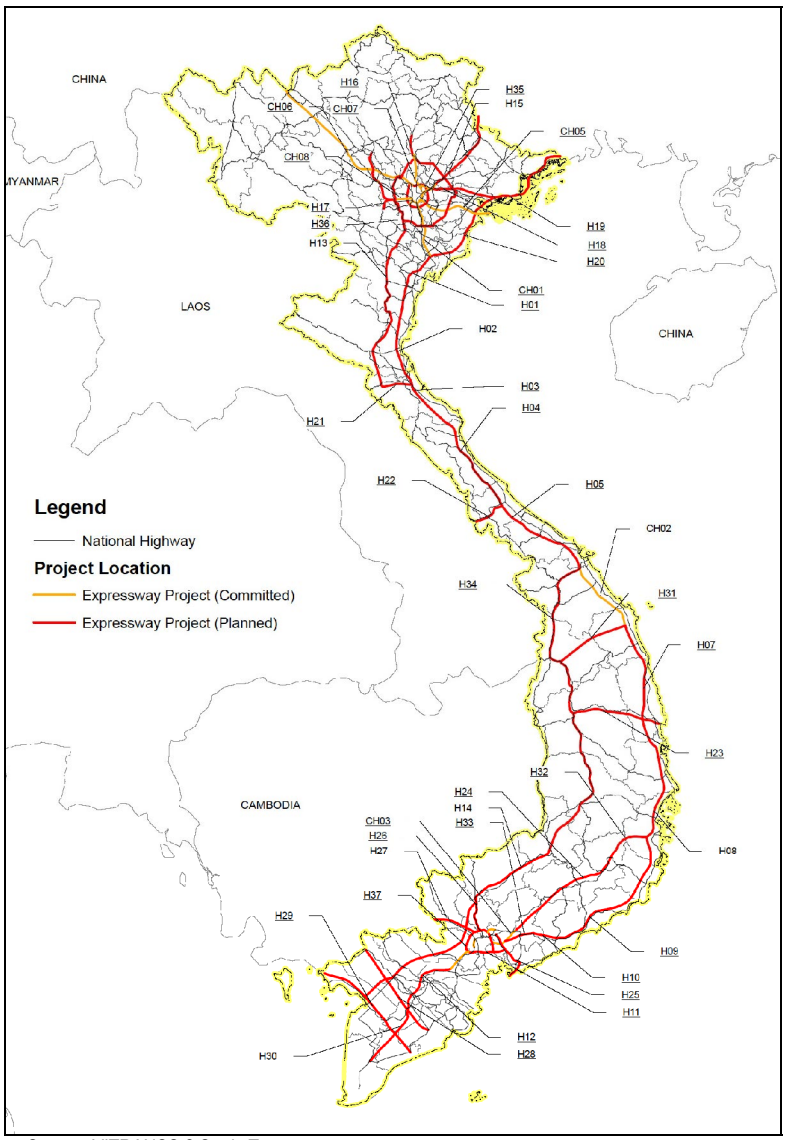
Figure 4.2.1 Newly Proposed Three (3) Additional Expressway Segments

Source: VITRANSS 2 Study Team

Figure 4.2.2 shows the overall expressway network in Vietnam that VITRANSS 2 is proposing including the above stated three (3) links.

In terms of expressway density, the proposed expressway network is deemed appropriate with sufficient coverage and redundancy to support national socio-economic development.

Figure 4.2.2 Expressway Network (VITRANSS 2)



Source: VITRANSS 2 Study Team

(3) Route Selection

Route selection shall be carried out taking into account the major design controls as shown in Table 4.2.2.

Route alternatives should be developed and discussed with local municipalities and all the other stakeholders so that an optimum route can be selected on the basis of consensus.

Table 4.2.2 Planning Controls for Route Selection

No.	Category	Controls	Countermeasure
A	Natural	Steep terrain, large river, lake and marsh, beach, preservation areas, etc.	Keep appropriate distance to avoid unnecessary structure and earthworks
B	Social	City, Town, Village, etc.	Keep appropriate distance to support regional socio-economic development.
C	Cultural	Cultural heritage, cemetery, temple/pagoda/church, etc.	Keep appropriate distance to avoid adverse effect to cultural activities
D	Industrial	Railways, port, airport, industrial zone, electric high voltage line, pipeline, etc.	Keep appropriate distance to avoid adverse effect to those facilities, consider appropriate connections to enable smooth transfer of people and goods.
E	Agricultural	Paddy field, etc	Minimize adverse effect to agricultural activities.
F	Others	International border, army area, etc.	Satisfy requirements, i.e. safety distance.

Source: VITRANSS 2 Study Team

(4) Interchange Location

Locating the interchanges shall be carried out taking into account the planning standards as shown in Table 4.2.3.

Table 4.2.3 Planning Standard for Interchange Locating

No.	Category	Proposed locating
A	Standard	Locate max 30 km interval, connection with major National Highways
B	City	
B1	City < 100,000	Locate min one (1) IC
B2	100,000< City < 1,000,000	Locate min two (2) ICs
B3	1,000,000< City	Locate ICs in consistent with city ring road system.
C	Cultural	Locate one (1) IC for major cultural place
D	Industrial	
D1	Industrial Zone	Locate ICs min 2 km interval in accordance with development scale and timetable
D2	1st class port	Desirable: locate within max 10 km distance Standard: locate within max 20 km distance
D3	Intl Airport	Desirable: locate within max 5 km distance Standard: locate within max 10 km distance
D4	Domestic Airport	Desirable: locate within max 10 km distance Standard: locate within max 20 km distance
D5	Tourism	Locate one (1) IC for major tourism place
E	Agricultural	Locate IC near major cargo collection point
F	Others	Locate one (1) IC for custom clearance at international border

Source: VITRANSS 2 Study Team

(5) Expressway Facilities Location

An expressway is a combination of many facilities that are much more than those in an ordinal road. Some of the expressway facilities require appropriate operation and maintenance to secure the standard Level of Service (LOS) for expressways.

Table 4.2.4 shows the standard expressway facilities.

Table 4.2.4 List of Expressway Facilities

No.	Category	Major Facilities
1	Civil	• Road • Bridge/Viaducts • Road Structure • Tunnel • Water Supply • Drainage
2	Traffic Safety	• Guardrail/cable • Lay-by • Traffic Sign • Slope Protection
3	Traffic Surveillance	• Vehicle Detector • CCTV Camera • Overloaded Monitoring • Meteorological Monitoring • Variable Message Sign • Wireless Radio • Emergency Telephone • Internet • Signal Control • Traffic Management Center • Traffic Operation Center
4	Road Service	• Service Area (Michi no Eki) • Parking Area • Expressway Bus Stop
5	Toll Collection	• Toll Gate (Manual) • Toll Gate (Touch&Go) • Toll Gate (ETC) • Toll Processing Center
6	Electrical	• Power Supply • Road Lighting
7	Mechanical	• Tunnel Ventilation • Tunnel Water Supply
8	Communication	• Optic Fiber Network • Wireless Radio for O&M • Highway Radio
9	Architectural	• Traffic Management Center • Traffic Operation Center • Maintenance Office • Service Area • Parking Area
10	Road Maintenance	• Maintenance Vehicles • Maintenance Equipment • Maintenance Materials • Maintenance Office

Source: VITRANSS 2 Study Team

Most of expressway facilities, as enumerated in Table 4.2.5, will be designed and located on the basis of the engineering design. The facilities should be provided in accordance with standards in order to secure consistent LOS for the entire expressway network in Vietnam in general and for the North-South Expressway in particular.

Standards for each information and communications system device should be established separately.

Table 4.2.5 Planning Standard for Expressway Facility Locating

No.	Category	Major Facilities	Proposed Locating
1	Traffic Surveillance	Traffic Management Center	• Ha Hoy (KM 0) • Ha Tinh (KM 350) • Da Nang (KM 750) • Nha Trang (KM1 250) • TP. Ho Chi Minh (KM 1600)
2		Traffic Operation Center	Locate max 70 km interval
3	Road Maintenance	Maintenance Office	Locate max 35 km interval
4	Road Service	Service Area (Michi no Eki)	Locate max 50 km interval
5		Parking Area	Locate max 25 km interval
6		Expressway Bus Stop	Locate min one (1) at city/town more than 10,000 people.

Source: VITRANSS 2 Study Team

(6) Expressway Technical Standards

Table 4.2.6 shows a comprehensive list of technical standards related to the expressway, from planning to maintenance.

In the last decade, various technical standards related to expressway development have been updated and/or developed based not only on lessons learned from real construction projects but also with reference to those of other countries.

With regards to the technical standards relative to the “Expressway Network Plan” in this chapter, “Route Planning Standards” should be developed for future development of expressway network plans other than the North-South Expressway in order to secure a consistent quality for route planning.

Table 4.2.6 List of Technical Standards for Expressway

Planning and Design Stage	
Items	Items
I. Civil Facilities	Iv. Road Service Facilities
I.1. Earthworks	Iv.1. Geometric Standard for Interchanges
I.1.1. Geometric Standard for Main Highway	Iv.2. Geometric Standard for Bus Stops
I.1.2. Earth Works	Iv.3. Resting Facilities
1) Earthwork Planning	V. Toll Collection Facilities
2) Embankment Section	V.1. Ordinary Tollgates
3) Cutting Section	V.2. Etc Tollgates
4) Slope Protection	V.3. Architectures for Tollgate Office Buildings
5) Embankment on Soft Ground	Vi. Electric Facilities
I.1.3. Pavement	Vi.1. Incoming and Switching Board Power Facilities
I.1.4. Drainage	Vi.2. Independent Power Supply Facilities
I.1.5. Retaining Walls	Vi.3. Dc Power Supply and Uninterruptible Power Supply Facilities
I.1.6. Culverts	Vi.4. Road Lighting Facilities
I.1.7 Landscape Gardening (Planting & Vegetation)	Vi.5. Tunnel Lighting Facilities
I.2. Bridges	Vi.6. Electric Cable Routes
I.2.1. Bridge Planning	Vii. Mechanical Facilities
I.2.2. Foundations	Vii.1. Emergency Facilities for Tunnel
I.2.3. Sub-Structures	Vii.2. Ventilation Facilities for Tunnel
I.2.4. Bearings and Bridge Accessories	Vii.3. Treatment Facilities for Cleaning Water of Tunnel
I.2.5. Super-Structures	Vii.4. Snow Thawing Facilities
I.2.6. Temporary Structures	Vii.5. Regulation Facilities for Weight Vehicle Weight Scale
I.3. Tunnels	Viii. Communication Facilities
I.3.1. Main Tunnel	Viii.1. Channel Exchange Equipment and Facilities
I.3.2. Ventilations	Viii.2. Mobile Radio Equipment and Facilities
I.3.3. Tunnel Interior Finish	Viii.3. Monitor and Control Equipment and Facilities
I.3.4. Tunnel Emergency Facilities	Viii.4. Highway Radio Equipment and Facilities
Ii. Traffic Safety Facilities	Viii.5. Cctv (Itv) Equipment and Facilities
Ii.1. Guard Fences	Viii.6. Am Radio Rebroadcasting Equipment and Facilities in Tunnel
Ii.2. Boundary Fences	Viii.7. Fm Radio Rebroadcasting Equipment and Facilities in Tunnel
Ii.3. Anti-Glaring Devices	Viii.8. Equipment and Facilities for Highway Information Terminal
Ii.4. Prevention Fences for Falling Objects	Viii.9. Etc Equipment and Facilities
Ii.5. Prevention Nets for Fallings at Median	Viii.10. Digital Mobile Radio Equipment and Facilities
Iii. Traffic Management Facilities	Ix. Architectures
Iii.1. Delineators	Ix.1. Architectures for Resting Buildings
Iii.2. Traffic Signs	Ix.2. Architectures for Management Buildings
Iii.3. Traffic Markings	Ix.3. Architectures for Other Buildings
Iii.4. Mile Posts	Ix.4. Electricity and Communication Facilities in Buildings
Iii.5. Noise Barrier	Ix.5. Water Supply, Sewerage and Hygiene Facilities and Air Conditioning Facilities
Iii.6. Variable Message Sign Boards	X. Operation and Maintenance Vehicles
Iii.7. Variable Speed Limit Signs	X.1. Operation and Maintenance Vehicles
Construction Stage	
Items	Items
I. Construction Work Management	Ii. Construction Recordings
I.1. Embankment	I.1. Microfilms Related to Technology
I.2. Cutting	I.2. Construction Record Photographs
I.3. Pavement	I.3. Construction Records
I.4. Concrete Works	I.4. Electronic As-Built Drawings and Documents
I.5. Bridges	I.5. Electronic Design Drawings and Documents
I.6. Tunnels	I.6. Drawing Preparation Manual by Cad
I.7. Culverts, Conduits and Hand Holes	I.7. Collection Data Preparation Manual for Buildings and Facilities
Operation And Maintenance Stage	
Items	Items
I. Routine Maintenance	Iii.3. Measures for Tunnel Deformations
I.1. Clearing	Iii.4. Protection Measures to Adjacent New Tunnel
I.2. Planting and Vegetations	Iv. Maintenance Work Management
I.3. Measures for Snow and Frost	Iv.1. Embankment
I.4. Working on the Road	Iv.2. Cutting
Ii. Inspections	Iv.3. Pavement
Ii.1. Structure Inspections	Iv.4. Concrete Works
Ii.2. Planting and Vesitations	Iv.5. Bridges
Iii. Design for Preservations	Iv.6. Tunnels
Iii.1. Bridge Widening	Iv.7. Culverts, Conduits and Handholes
Iii.2. Bridge Maintenance/Reinforcement	

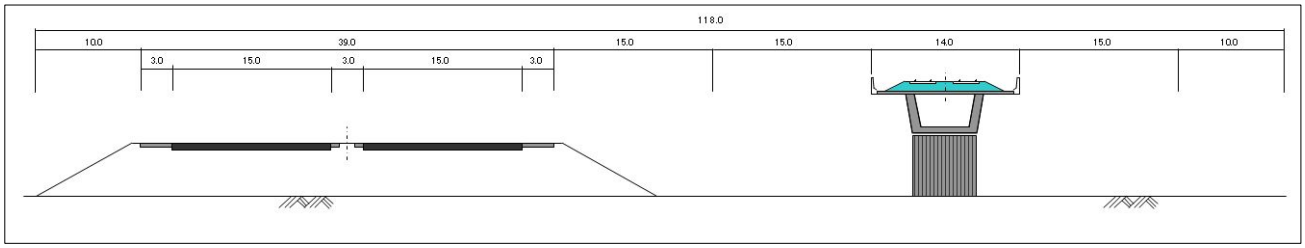
Source: VITRANSS 2 Study

(7) Space Arrangement with High Speed Rail

The High Speed Rail (HSR) is being planned in parallel with the North-South Expressway route selection process. Route alignment of the HSR should be considered in the North-South Expressway alignment setting for efficient and effective space arrangement since available lot spaces are limited.

In this master plan, which is conducted based on 1 to 50,000 topographic maps, a 250 m (5 mm on the map) route was secured for the parallel space arrangement where applicable. In reality, a 120 m wide corridor could be sufficient to accommodate these two (2) linear transport facilities (see Figure 4.2.3).

Figure 4.2.3 Space Arrangement between North-South Expressway and HSR



Source: VITRANSS 2 Study Team

4.3 Route Selection

1) General

The Detailed Planning by the Transport Engineering Design Incorporated (TEDI) was completed and submitted to MOT on 2 July 2009 (Letter No. 4481/BGTVT-KHDT).

In VITRANSS 2, apart from the Detailed Planning, a route alignment was studied and developed on the basis of 1 to 50,000 topographic maps (Digital Map, UTM84-48N Coordinate System) for the following two (2) sections:

(i) Section 1: Ninh Binh to Da Nang (633 km)

(ii) Section 2: Quang Ngai to Phan Thiet (616 km)

The main section between Hanoi and Ho Chi Minh was focused on in this chapter while Ho Chi Minh to Can Tho Section was not considered.

In addition, the following sections were not studied because other studies have already developed comprehensive alignments based on detailed site investigation.

(i) Da Nang and Quang Ngai (By World Bank)

(ii) Phat Thiet and Dau Giay (By BITEXCO)

(1) Section 1: Ninh Binh to Da Nang (633 km)

In accordance with the above planning standards, the following planning controls (Tables 4.3.1 to 4.3.5) were identified on the 1 to 50,000 topographic maps.

Considering these planning controls, the proposed route alignment and some alternatives were drawn, as shown in Appendix 4A.

There are several sections where route alignment studies should be carried out in order to select an optimum alignment.

Table 4.3.1 List of Planning Controls (Ninh Binh–Thanh Hoa)

No.	Category	Sta.	Control Points	Countermeasures
1	D	260	Cao Bo I/C	Connect smoothly with I/C
2	A	265	Day River	Cross the river at appropriate point
3	D	267	NH10	Cross the road perpendicularly
4	D	274	NH1A	Cross the road perpendicularly
5	D	274	Conventional Railway	Cross the railway perpendicularly
6	A	277	Ma Voi Mountain	Avoid steep terrain
7	B	279	Planned Residential Area in Doi Dai Village	Minimize project affected houses
8	D	280	NH12B	Cross the road perpendicularly
9	A	281	Tam Diep Hill	Avoid steep terrain
10	B	284	Quang Son Residential Area	Minimize project affected houses
11	A	288	Khe Cai Mountain	Avoid steep terrain
12	D	295	PH512	Cross the road perpendicularly
13	A	301	Dong Vac Lake	Avoid
14	A	301	Thung Thi Hill	Avoid steep terrain
15	A	303-314	Tam Quy Natural Preservation Zone	Minimize project affected area
16	D	306	NH217	Cross the road perpendicularly
17	A	309	Len River	Cross the river at appropriate point
18	A	309-319	Ma River	Avoid
19	A	319	Chu River	Cross the river at appropriate point
20	A	325	Cot Co Mountain	Avoid steep terrain
21	D	326	NH45	Cross the road perpendicularly
22	D	328	NH47	Cross the road perpendicularly
23	D		High Speed Railway	
24	A	335-340	Chua Mountain	Avoid steep terrain
25	A	335-340	Son Luong Mountain	Avoid steep terrain
26	B	340	Trung Chinh Residential Area	Minimize project affected houses
27	A	348-349	Muc River	Avoid large-scale crossing structure
28	B	348-353	Van Hoa Residential Area	Minimize project affected houses
29	A	365	Yen My Lake	Avoid large-scale crossing structure
30	D	365	Electric High Voltage Line	Avoid
31	A	367	Cac Mountain	Avoid steep terrain

Source: VITRANSS 2 Study Team refer to MOT letter No. 4481/BGTVT-KHDT

Table 4.3.2 List of Planning Controls (Thanh Hoa–Ha Tinh)

No.	Category	Sta.	Control Points	Countermeasures
1	D	384	Khe Nhoi Dam	Avoid
2	D		High Speed Railway	
3	A	385-387	Mong Ga Mountain	Avoid steep terrain
4	B	387-389	Residential Area	Minimize project affected houses
5	B	389-390	Residential Area	Minimize project affected houses
6	A	390	Hoang Mai River	Cross the river at appropriate point
7	D	398	Conventional Railway	Avoid crossing
8	A	399	Ba Chop Mountain	Avoid steep terrain
9	D	399	Dong Lam Dam	Avoid
10	A	403-405	Dai Mountain	Avoid steep terrain
11	B	408-426	Dien Doai Residential Area	Minimize project affected houses
12	A	410-415	Chua Den Mountain	Avoid steep terrain
13	D	412	NH48	Cross the road perpendicularly
14	B	419-424	Dien Lien and Dien Dong Residential Area	Minimize project affected houses
15	D	423	PH538	Cross the road perpendicularly
16	A	427	Bung River	Cross the river at appropriate point
17	D	428	NH7A	Cross the road perpendicularly
18	A	434-435	Va Mountain	Avoid steep terrain
19	A	434-435	Muc Mountain	Avoid steep terrain
20	A	436-437	Chach Mountain	Avoid steep terrain
21	A	437-440	Than Vu Mountain	Avoid steep terrain
22	D	441	O O Dam	Avoid large-scale crossing structure
23	D	446	NH534	Cross the road perpendicularly
24	A	453-455	Nuoi Hai Mountain	Avoid steep terrain
25	D	461	NH46	Cross the road perpendicularly
26	D	462	PH558	Cross the road perpendicularly
27	A	468	Non Mountain	Avoid steep terrain
28	A	469-471	Thanh Mountain	Avoid steep terrain
29	A	471	Lam River	Cross the river at appropriate point
30	D	476	NH8A	Cross the road perpendicularly

Source: VITRANSS 2 Study Team refer to MOT letter No. 4481/BGTVT-KHDT

Table 4.3.3 List of Planning Controls (Ha Tinh–Quang Binh)

No.	Category	Sta.	Control Points	Countermeasures
1	D	480	Electric High Voltage Line	Avoid crossing
2	D	483	PH12	Cross the road perpendicularly
3	C	491-492	Nga Ba Dong Loc Historical Area	Avoid
4	D	495-497	PH2	Cross the road perpendicularly
5	B	503-505	Thach Tien Residential Area	Minimize project affected houses
6	D	506	PH3	Cross the road perpendicularly
7	D	516	PH17	Cross the road perpendicularly
8	A	515-530	Ke Go Lake	Avoid
9	B	518-520	Cam Due Residential Area	Minimize project affected houses
10	D	525-544	Electric High Voltage Line	Avoid crossing
11	A	540-548	Lake	Avoid
12	A	543-545	Cay Mountain	Avoid steep terrain
13	A	552-553	Dong Theo Mountain	Avoid steep terrain
14	A	570	Lake	Avoid
15	D	573	PH22	Cross the road perpendicularly
16	A	580-587	Vuc Tron Lake	Avoid
17	D	598	NH12A	Cross the road perpendicularly
18	A	598-600	Gianh River	Cross the river at appropriate point
19	D		High Speed Railway	

Source: VITRANSS 2 Study Team refer to MOT letter No. 4481/BGTVT-KHDT

Table 4.3.4 List of Planning Controls (Quang Binh–Quang Tri)

No.	Category	Sta.	Control Points	Countermeasures
1	A	608-609	Cot Gau Mountain	Avoid steep terrain
2	A	611-612	Mountain	Avoid steep terrain
3	D	612	Electric High Voltage Line	Avoid crossing
4	D	620-732	Ho Chi Minh Road	Avoid crossing
5	A	640	Lake	Avoid
6	D	650-732	Electric High Voltage Line	Avoid crossing
7	A	661	Than Dinh Mountain	Avoid steep terrain
8	A	680-682	Mo Nhat Mountain	Avoid steep terrain
9	A	693	Lake	Avoid large-scale crossing structure
10	A	700-705	Lake	Avoid
11	A	705-710	Lake	Avoid large-scale crossing structure
12	E	719-724	Rubber plantation	Avoid
13	D	720	PH75	Cross the road perpendicularly

Source: VITRANSS 2 Study Team refer to MOT letter No. 4481/BGTVT-KHDT

Table 4.3.5 List of Planning Controls (Quang Tri–Da Nang)

No.	Category	Sta.	Control Points	Countermeasures
1	A	751	Thach Han River	Cross the river at appropriate point
2	A	768	My Chanh River	Cross the river at appropriate point
3	A	769	Cai Muong Mountain	Avoid steep terrain
4	A	774	Canh Gioi Mountain	Avoid steep terrain
5	A	774	Ho Boi Mountain	Avoid steep terrain
6	D	788	Electric High Voltage Line	Avoid crossing
7	A	793	Bo River	Cross the river at appropriate point
8	D		Hue Bypass	
9	A	795-800	Khe Trai Mountain	Avoid steep terrain
10	A	795-807	Thong Cung, Dong Ngang, Ky Nam, Don Dao Mountains	Avoid steep terrain
11	A	809	Huu Trach River	Cross the river at appropriate point
12	A	814	Gay Mountain	Avoid steep terrain
13	A	820	Ta Trach River	Cross the river at appropriate point
14	B	833	Xuan Loc Residential Area	Minimize project affected houses
15	A	835-875	Bach Ma National Park	Avoid
16	A	859	De Bay Pass	Avoid steep terrain
17	A	865-872	Diau Mountain	Avoid steep terrain
18	A	865-872	Ta Lang Mountain	Avoid steep terrain
19	A	880-885	Dong Den Mountain	Avoid steep terrain
20	D		Danang Bypass	

Source: VITRANSS 2 Study Team refer to MOT letter No. 4481/BGTVT-KHDT

(2) Section 2: Quang Ngai to Phan Thiet (616 km)

The following planning controls for this section (Tables 4.3.6 to 4.3.8) were identified on the 1 to 50,000 topographic maps, in accordance with the planning standards.

The proposed route alignment and alternatives were drawn out as presented in Appendix 4A.

There are also several sections where route alignment studies should be carried out in order to select an optimum alignment.

Table 4.3.6 List of Planning Controls (Quang Ngai–Binh Dinh)

No.	Category	Sta.	Control Points	Countermeasures
1	D	1050	PH625	Cross the road perpendicularly
2	D	1055	PH627	Cross the road perpendicularly
3	A	1066	Ve River	Cross the river at appropriate point
4	D	1071	Conventional Railway	Avoid crossing
5	D	1072	PH628	Cross the road perpendicularly
6	D		High Speed Railway	
7	D	1081	NH24	Cross the road perpendicularly
8	D	1086	Conventional Railway	Avoid crossing
9	A	1092	Da Den Mountain	Avoid steep terrain
10	A	1095	Mountain	Avoid steep terrain
11	A	1103-1108	Chu Mountain	Avoid steep terrain
12	B	1109-1137	Residential Area	Minimize project affected houses
13	A	1136	Lai Giang River	Cross the river at appropriate point
14	D	1140	Electric High Voltage Line	Minimize relocation
15	B	1140-1142	Tang Bat Ho Town	Minimize project affected houses
16	A	1144-1147	Lai Khan Mountain	Avoid steep terrain
17	B	1147-1152	Residential Area	Minimize project affected houses
18	A	1154	Da Moc Mountain	Avoid steep terrain
19	A	1155-1157	Giang Mountain	Avoid steep terrain
20	D		High Speed Railway	
21	A	1162	Conventional Railway	Avoid crossing
22	A	1172-1173	Mot Mountain	Avoid steep terrain
23	D	1178	PH634	Cross the road perpendicularly
24	D	1187	Phu Cat Airport	Avoid
25	D	1189	PH636	Cross the road perpendicularly
26	A	1193	Con River	Cross the river at appropriate point
27	D	1194	PH636B	Cross the road perpendicularly
28	A	1197-1198	Cha Ray Mountain	Avoid steep terrain
29	A	1197-1198	Thom Mountain	Avoid steep terrain
30	D	1200	NH19	Cross the road perpendicularly

Source: VITRANSS 2 Study Team refer to MOT letter No. 4481/BGTVT-KHDT

Table 4.3.7 List of Planning Controls (Binh Dinh–Nha Trang)

No.	Category	Sta.	Control Points	Countermeasures
1	A	1204-1206	Dung and Ong Dau Mountains	Avoid steep terrain
2	D	1211	Conventional Railway	Cross the railway perpendicularly
3	D	1211	PH638	Cross the road perpendicularly
4	A	1212	Ha Thanh River	Cross the river at appropriate point
5	A	1212-1217	Hon Cha Mountain	Avoid steep terrain
6	A	1220-1223	Hon Lup, Hon Vuong and Hon Quy Mountains	Avoid steep terrain
7	A	1226-1250	Chap Sai Che and Ca Xien Mountains	Avoid steep terrain
8	B	1236-1238	Van Canh Town	Minimize project affected houses
9	D	1245	Conventional Railway	Cross the railway perpendicularly
10	A	1248	Muc Thinh Pass	Avoid steep terrain
11	B	1266-1268	Lai Hai Town	Minimize project affected houses
12	A	1269	Ky Lo River	Cross the river at appropriate point
13	D	1270	PH641	Cross the road perpendicularly
14	D	1270	Conventional Railway	Cross the railway perpendicularly
15	A	1271-1276	Buong, Doc Lon and U Dong Bang Mountains	Avoid steep terrain
16	A	1294	Ba Non Mountain	Avoid steep terrain
17	D	1294	Electric High Voltage Line	Avoid crossing
18	A	1298	Mountain	Avoid steep terrain
19	A	1305	Chop Chai Mountain	Avoid steep terrain
20	D	1310	NH25	Cross the road perpendicularly
21	A	1313	Da Rang River	Cross the river at appropriate point
22	A	1320-1326	Chai Mountain	Avoid steep terrain
23	A	1327-1328	Mountain	Avoid steep terrain
24	A	1332-1336	Ca Pass Tunnel	Avoid steep terrain
25	A	1336-1340	Co Ma Tunnel	Avoid steep terrain
26	A	1343-1350	Da Trai, Doc De and Ba Trang Mountains	Avoid steep terrain
27	A	1354-1360	Hon Am and Hon Dua Mountains	Avoid steep terrain
28	A	1363	Mountain	Avoid steep terrain
29	A	1366	Hon Chao and Hon Trui Mountains	Avoid steep terrain
30	D	1390	NH26	Cross the road perpendicularly
31	A	1390-1393	Lake	Avoid
32	A	1395-1425	Hon Ong, Hon Long, Ao Ba, Van Coi Hon Gio Mountains	Avoid steep terrain
33	D	1430	PH8B	Cross the road perpendicularly
34	A	1431	Cai River	Cross the river at appropriate point
35	D	1431	PH2	Cross the road perpendicularly

Source: VITRANSS 2 Study Team refer to MOT letter No. 4481/BGTVT-KHDT

Table 4.3.8 List of Planning Controls (Nha Trang–Phan Thiet)

No.	Category	Sta.	Control Points	Countermeasures
1	B	1436-1440	Residential Area	Minimize project affected houses
2	A	1440-1442	Da Bac Mountain	Avoid steep terrain
3	A	1440-1442	Hon Cau Mountain	Avoid steep terrain
4	D	1443	Electric High Voltage Line	avoid crossing
5	B	1448-1451	Residential Area	Minimize project affected houses
6	A	1452-1457	Hon Nhom, Chuoi and Da Ma Mountains	Avoid steep terrain
7	B	1460	Residential Area	Minimize project affected houses
8	A	1461-1462	Hon Kho Mountain	Avoid steep terrain
9	B	1467-1469	Residential Area	Minimize project affected houses
10	A	1470-1474	Hon Ong Mountain	Avoid steep terrain
11	A	1476-1478	Ba Tu Mountain	Avoid steep terrain
12	A	1478-1479	Hon Dung Mountain	Avoid steep terrain
13	A	1485-1496	Phao Kich, Ba Rau and Ong Ngai Mountains	Avoid steep terrain
14	B	1494	Residential Area	Minimize project affected houses
15	A	1503	Lake	Avoid
16	D	1505-1511	Thanh Son Airport	Avoid
17	D	1513	NH27	Cross the road perpendicularly
18	A	1514	River	Cross the river at appropriate point
19	B	1516	Residential Area	Minimize project affected houses
20	B	1518-1524	Residential Area	Minimize project affected houses
21	A	1539-1547	Cay Sung, Gio Ca Na, Gieng Ong Don, Ong Mountains	Avoid steep terrain
22	D	1550-1633	Conventional Railway	avoid crossing
23	A	1560-1565	Mountain	Avoid steep terrain
24	A	1571-1574	Ken Ken and Mong Mountains	Avoid steep terrain
25	B	1586	Residential Area	Minimize project affected houses
26	A	1605	Hon Moc Mountain	Avoid steep terrain
27	A	1618	Chau Ta Mountain	Avoid steep terrain
28	A	1623	Chan Rong Mountain	Avoid steep terrain
29	A	1630	Xa Tho Mountain	Avoid steep terrain
30	B	1631	Residential Area	Minimize project affected houses
31	D	1633	NH28	Cross the road perpendicularly
32	B	1636	Ma Lam Town	Minimize project affected houses
33	A	1640-1645	Ti O Ha Mountain	Avoid steep terrain
34	A	1646	Banh Mountain	Avoid steep terrain
35	D	1646	Conventional Railway	avoid crossing
36	B	1654	Residential Area	Minimize project affected houses
37	A	1655	Co Nhi Mountain	Avoid steep terrain
38	D	1656	Conventional Railway	avoid crossing
39	D	1659	End Point	Connect smoothly with DG-PT Exp.

Source: VITRANSS 2 Study Team refer to MOT letter No. 4481/BGTVT-KHDT

2) Regional Connectivity

Most alignments of the North-South Expressway will be located parallel with NH1 and run through major cities. Future transportation will be built up along a network centered on the North-South Expressway to connect not only major cities but also other main transportation facilities, i.e., seaports and airports.

(1) Port Access

The North-South Expressway route alignment was developed to secure a maximum (in principle) 10 km long access road for the first class ports although there are some ports with access roads exceeding 10 km.

Table 4.3.9 Access to First Class Ports

No.	Province	Port	Distance (km)	Expressway
1	Quang Ninh	Cam Pha	10	Noi Bai-Mong Cai
2	Quang Ninh	Hon Gai	10	Noi Bai-Mong Cai
3	Hai Phong	Hai Phong	10	Hanoi-HaiPhong
4	Thanh Hoa	Nghi Son	15	North-South Expressway
5	Nghe Tinh	Cua Lo	12	North-South Expressway
6	Ha Tinh	Vung Ang	15	North-South Expressway
7	TT. Hue	Chan May	30	North-South Expressway
8	Da Nang	Da Nang	10	North-South Expressway
9	Quang Ngai	Dung Quat	6	North-South Expressway
10	Binh Dinh	Quy Nhon	16	North-South Expressway
11	Khanh Hoa	Van Phong	13	North-South Expressway
12	Nha Trang	Nha Trang	18	North-South Expressway
13	Dong Nai	Dong Nai	10	North-South Expressway
14	Ba Ria–Vung Tau	Vung Tau	5	Bien Hoa-Vung Tau
15	Ho Chi Minh	Sai Gon	10	North-South Expressway

Source: VITRANSS 2 Study Team

The geographic relation between the North-South Expressway and the first class seaports are shown in Appendix 4B.

(2) Airport Access

The North-South Expressway route alignment was developed to secure a maximum 15 km distance from airport access road, in principle. However some routes are distant from airport because alignment must avoid existing built-up areas and rugged terrain. Positional relations between the North-South Expressway and airports are shown in Table 4.3.10.

Table 4.3.10 Access to Airports along the North-South Expressway

No.	Province	Airport		Distance (km)
1	Nghe An	Vin	Domestic	12.0
2	Quang Binh	Dong Hoi	Domestic	7.0
3	Thua Thien Hue	Phu Bai	International	18.0
4	QuanNgai	Chu Lao	Domestic	10.0
5	Binh Dinh	Phu Cat	Domestic	2.0
6	Phy Yen	Tuy Hoa	Domestic	5.0
7	Khanh Hoa	Nha Trang	Domestic	10.0
8	Khanh Hoa	Cam Ranh	International	20.0

Source: VITRANSS 2 Study Team

(3) Major City Access

Similarly, the connectivity between the North-South Expressway and major cities was also considered to make the distances within 15 km as much as possible. Almost all major cities can access North-South Expressway within the 15 km limit, although some cities exceeded 15 km due to topographic and land use reasons.

Table 4.3.11 Access to Major Cities along the North-South Expressway

No.	Province	Seaport	Distance (km)
1	Ninh Binh	Ninh Binh	3.0
2		Tam Diep	6.0
3	Than Hoa	Bim Son	5.0
4		Thanh Hoa	5.0
5	Nghe An	Vinh	7.0
6	Ha Tinh	Hong Kinh	5.0
7		Ha Tinh	6.0
8	Quang Binh	Dong Hoi	10.0
9	Quan Tri	Dong Ha	12.0
10	Thua Thien Hue	Hue	6.0
11	Da Nang	Da Nang	5.0
12	Quan Nam	Tam Ky	5.0
13	Quan Ngai	Quan Ngai	5.0
14	Binh Dinh	Quy Nhon	20.0
15	Phu Yen	Tuy Hoa	5.0
16	Khanh Hoa	Nha Trang	10.0
17		Cam Ranh	10.0
18	Ninh Thuan	Ohan Rang Thap Cham	12.0
19	Lam Dong	Phan R Cua	12.0
20	Binh Thuan	Phan Thiet	20.0

Source: VITRANSS 2 Study Team

4.4 Alignment Planning

1) Introduction

The North-South Expressway is located in the eastern part of the traffic corridor, including roads along the eastern corridor (coastal) connecting to urban areas, economic zones, tourism area and seaports, railway and airports.

2) Specific Objectives

The objectives of the North-South Expressway alignment are as follows:

(i) To identify the function and role of North-South Expressway;
(ii) To coordinate North-South Expressway alignment with the infrastructure system of other transport modes, especially North-South HSR, seaports and airports;
(iii) To identify alignment, technical standards, and environmental solutions; and
(iv) To identify the location and type of main interchanges, and location of supporting road facilities (roadside station, toll plaza, control station).

3) North-South Expressway Alignment Planning

(1) Principle on Alignment Identification

The principles in selecting alignment are given as follows:

(i) The Expressway alignment must ensure connectivity with focal economic centers in the region and linkage to other transport modes through significant transport hubs of high traffic demand (seaports, HSR stations, airports);
(ii) Road network including North-South Expressway should have convenient linkage with other transport modes, interprovincial transport axis, focal economic zones and big cities;
(iii) Ensured integration and effective transport service and social cost saving; and
(iv) Secured sustainability and reduction of impacts on environment.

The alignment of North-South Expressway is designed separately but is integrated with the existing road network. It should be plotted close to NH1A, the main regional and national highway.

Also, the alignment should not pass through urban areas, residential areas, planned industrial zones and safe line of national facilities (irrigation, hydroelectricity, national garden, historical vestiges), as well as protect the environment where the alignment runs through.

(2) Condition of Alignment Study

(a) Selection of Two North-South Main Axis

The two main routes of road transport in the North-South direction are National Highway No.1 (NH1A) and Ho Chi Minh Road. The current higher traffic volume in NH1A, in comparison to that of Ho Chi Minh Road, indicates its significance as the main road axis. Thus, some expressways along NH1A are being constructed, such as those in the Phap Van–Cau Gie, Cau Gie–Ninh Binh and HCM–Trung Luong sections; while other sections are under investment preparation such as Ninh Binh–Thanh Hoa, Thanh Hoa–Ha Tinh, Cam Lo–Tuy Loan, Danang–Quang Ngai, Phan Thiet–Dau Giay, Dau Giay–Long Thanh, Long Thanh–Ben Luc and Trung Luong–My Thuan–Can Tho.

The Expressway network master plan of Vietnam was approved by the Prime Minister with two (2) expressway axis: The Eastern axis (which follows NH1A) and the Western axis (which follows Ho Chi Minh Road). According to the approved master plan, the construction of the sections in the Eastern axis should be given priority, thus, the study on said expressway axis.

(b) Starting Point

The Phap Van–Cau Gie and Cau Gie–Ninh Binh sections of North-South Expressway have been constructed and the starting point per VITRANSS 2 Study was selected from Ninh Binh at Cao Bo Interchange on the NH10.

(c) Ending Point

The construction of Danang–Quang Ngai section has already started and alignment was already fixed for the expressway project by JICA and the World Bank, such that this section is out of VITRANSS 2. Construction of the Phan Thiet-Dau Giay (BOT) and Dau Giay–Long Thanh-HCMC (JICA and ADB) sections has also started and alignment was likewise fixed for the expressway project. The end point, therefore, for this alignment study was set at Phan Thiet.

(d) Main Control of Access

Controls of access are mainly in towns, cities, economic zones, industrial zones along NH1A; tunnel works, bridges particularly those over rivers and at interchanges with national highways, provincial highways (control of terrain and residential area); and power facilities, irrigation works, historical vestiges, etc. These facilities should be reviewed in specific sections.

4) Alignment of the North-South Expressway

(1) Ninh Binh–Thanh Hoa (Nghi Son)

(a) **Starting Point:** Km 260 at the end of Expressway Cau Gie–Ninh Binh (Phase 1) at Cao Bo interchange in Nam Dinh Province.

(b) **Ending Point:** Km 382 is the end point at the interchange between Nghi Son–Bai Chanh Road and Ho Chi Minh Road.

(c) **Alignment:** The expressway alignment goes to the west of the North-South High Speed Railway as planned.

Starting at Cao Bo interchange (between Cau Gie–Ninh Binh Expressway in Phase 1 and NH10), a grad separation at the Expressway fly over NH10 through Day River at Trai Me (downstream of Ninh Phuc Port, 1300 m from existing Ninh Phuc Port to the downstream), and runs parallel to Ninh Binh City's present bypass (600 m from bypass to the southeast). To Khanh Hoa, the Expressway goes to the west and crosses Khoai Ha, Dong Hoi and Xuan Son villages over NH1A and the North-South existing railway at Vo Bridge (Km 271–272 QH1A) to the west of NH1A.

The Expressway continues to the northwest of Duyen Ha cement plant (but does not touch the planned new urban area of Yen Binh commune-Tam Diep Town) and passes through the planned residential area in Doi Dai village and transport battalion–Army ordnance administration, Army Corps No.1, crossing NH12B at Km 2+800. The Expressway goes to the Northwest of Tam Diep cement plant and crosses the material conveyor belt of the plant. The Expressway then crosses Tam Diep Hill to Ha Long

commune (Ha Trung farm) to the west-east of warehouse 894 and to the southwest of warehouse 82 at Rong temple (1,000 m to the South-North direction).

The Expressway then goes to the direction of Bim Son commune and out of the planned area of Bim Son Town, to the west of Division 390 that cover Ben Quan Lake and crosses PH 522 (Bim Son–Pho Cat–Thang Quang) at the site 4.5 km from NH1A; through Ha Giang commune, Ha Tan to the west of Dong Vac Lake via Thung Thi Hill and the west of natural preservation zone of Tam Quy Bassia Forest, and connects NH217 nearby Ha Linh Bridge that is to the west of stone production plant. The Expressway takes the following direction when there are rivers to cross:

(i) Cross over Len River at the confluence, 700 m to the east of Bong confluence in La Son Village, Hoang Khanh commune. The Expressway keeps following irrigational canal via Hoang Xuan, Hoang Phuong, and then the same as Plan 1A in Hoang Giang; and

(ii) Cross over Ma River at the upstream of Bong confluence, 500 m to the west side of Hoa Long Village in Hoang Khanh commune. The Expressway keeps following Ma River over Chu River, and then the same as Plan 1A in Van Tap village in Thieu Van commune.

From Hoang Giang commune, the Expressway crosses the left side of Ma River at Village No.6 (Hoang Giang commune) to the right side of Ma River at Thieu Duong (km 37 of embankment in the right side of Ma River, 700 m from the confluence of Ma River and Chu River to the downstream).

After crossing Ma River at Thieu Duong commune, the Expressway goes to the west of Dong Son pine forest and connects to NH45 and NH46 at Dong Xuan commune via Dong Thinh to Nui Chua in Tan Phuc commune. The route crosses Nh45 in Bi Kieu–Trung Chinh commune, over Nhon River in Yen Cach. Since the alignment goes along the North-South High Speed Railway and over Trieu Son railway in Dai Dong, Dong Thang commune, the Expressway enters the middle of Chua Mountain and Son Luong Mountain's interstice. The route continues to go through Te Thang commune and over Muc River in Minh Chau, Minh Nghia commune, 400 m from the expected High Speed Railway.

After Thang Tho commune area, the route separates from the North-South High Speed Railway, 1–2 km in average, crossing PH 505 at Cong Liem commune. The Expressway passes over Yen My Lake and parallel to Cable 110 KV. To village No.7 of Nam Son commune, the Expressway goes under Cable 110KV line and parallel to the North-South High Speed Railway, to Nghi Son economic zone. The route is planned to stop at interchange with Nghi Son–Bai Chanh Highway (under construction).

The total length is 121 km.

(2) Thanh Hoa (Nghi Son)–Ha Tinh (Hong Linh Town)

(a) **Starting Point:** connecting to the end point of Ninh Binh–Nghi Son Expressway (Thanh Hoa) at interchange with Nghi Son–Bai Chanh highway of Ho Chi Minh Road Project (under construction).
(b) **Ending Point:** at interchange with NH8A.
(c) **Alignment:** From interchange with Nghi Son–Bai Chanh highway, the route goes to the South side to Khe Nhoi dam and continues to the west side of the High Speed Railway through Khe Nhoi Dam to Mong Ga Moutain.

The route keeps running to the west of Hoang Mai cement plant (0.9 km from Hoang Mai cement plant). After crossing over Hoang Mai River at Hoang Mai station area to the northeast–parallel to the existing North-South railway line and the North-South High Speed Railway, close to Thuong Hoa Village, Quynh Trang commune, the route enters through residential areas downstream of Khe May Dam.

After passing through gaps between two (2) mountains of Ba Chop Mountain and Dong Lam dam, the route crosses the North-South High Speed Railway to the west of Quynh Hoa commune. The Expressway goes along N2 canal (1 km) and through Khe Su to enter Cat village, Dien Doan commune. The Expressway then connects to NH48 at area 1km from Khe Cat Bridge to the west side. In the whole area of Dien Chau District, the route goes to the North-South direction parallel to the North-South High Speed Railway (2–3.5 km from the North-South Expressway). The route connects to PH 538 at Si station area at the west (1.8 km). The Expressway crosses over Bung River in Dien Quan commune to the Nh7A direction and Dien Phu commune, and then goes into between Va Mountain and Muc Mountain.

The route goes into Chanh Mountain and Than Vu Mountain, to the east of Xuan Duong. After Than Vu Mountain, the route continues to the west of OO Dam, cutting through NH534 at Nghi Phuong commune. Out of Nghi Loc District, the route goes to Hung Nguyen District parallel to NH46 at area of Block 13, Hung Chinh commune, Hung Nguyen District.

From NH46 crossing, the route changes to the northwest-southeast and connects to PH 558, Dao River and Le Xuan Dao Canal. The route goes into between Non Mountain and Thanh Mountain through Lam River to area of Ha Tinh Province. The position of crossing Lam River is located at Village No.1 and Village No.2 – Hung Phu commune, Hung Nguyen District.

In Ha Tinh Province, the route goes through areas of Duc Tho District and ends at interchange with NH8A in Duc Thinh commune.

The total length is 97 km.

(3) Ha Tinh (Hong Linh Town)–Quang Binh (Bung)

(a) **Starting Point:** At interchanging point with NH8A in Duc Tho District, Ha Tinh Province.
(b) **Ending Point:** At interchanging point with Ho Chi Minh Road in area of Bo Trach District, Quang Binh Province.
(c) **Alignment:** From NH8A interchange, the route goes through Duc Thuy, parallel to the east side of NH15A and crosses PH6 (studying to improve PH6 for one-time crossing) to the east side of Nga Ba Dong Loc historical area, and then connects to PH2 at Km 6 + 000, PH3 at Km6 + 500, PH at Km 7 + 050, to the east side of Ke Go Lake via Cam Son, Cam Lac My to Ky Phong.

From Ky Phong, the route goes to the mountainous area of medium height, via Ky Van and crosses the road connecting to Vung Ang Port to Laos, parallel to the west of Electric cable 500KV in the west of Kim Son Lake and then directs to Road 22 in the west of Vuc Tron Lake via Quang Tien, Quang Luu and Quang Truong. The route connects to NH12A at Km9 + 000 and crosses over Gianh River in Con Ngua area and the North-South High Speed Railway in Tan Thanh, and then joins Ho Chi Minh Road at Km 959 (South Bung Bridge) in the area of Bo Trach District, Quang Binh Province.

The total length is 145 km.

(4) Quang Binh (Bung)–Quang Tri (Cam Lo)

The route follows the completed Ho Chi Minh Road (Phase 1)

(a) **Starting Point:** At km 959 of Ho Chi Minh Road (Southern Bung Bridge) in area of Bo Trach District, Quang Binh Province.

(b) **Ending Point:** At Cam Lo, Km 11 + 922 in Quang Tri Province

(c) **Alignment:** The route follows the completed Ho Chi Minh road (Phase 10) with a surface width of 9m/7m via Con, Long Dai, My Duc, and Ben Quan. On this section, it is necessary to have additional studies on constructing a parallel road (existing NH15A) for local traffic while Ho Chi Minh Road is being upgraded to be an expressway and a bypass of Dong Hoi City to reduce volume of ground clearance.

The bypass starts from Quyet Thang and turns right to downstream of Phu Vinh Dam, parallel to the west of Cabel 500 Kv via Dong Son precinct and then connects to Ho Chi Minh Road at Khe Cu Bridge area. Total length of bypass is 10 km.

Total length of Quang Binh (Bung)–Quang Tri (Cam Lo) is 117 km

(5) Quang Tri (Cam Lo)–Danang (Tuy Loan)

(a) **Starting Point:** Cam Lo, K 11 + 922 of NH9 in Quang Tri Province

(b) **Ending Point:** Km 24 + 100 of NH14B in Tuy Loan area (= Km 0 of Danang–Quang Ngai Expressway).

(c) **Alignment:**

(i) **Cam Lo–South Bo River Section (Km 6 of PH 16) (66.46 km):** From Km 11 + 922 of NH9, the route goes to the direction of Nghia Hy Dam, over Thach Han River, 3 km from Tram Dam to the upstream via Truong Phuoc mountainous area, and over My Chanh River, O Lau in Hoa My (avoiding Hoa My military area). After that, the route approaches the base of mountain and crosses over Bo River to Km 7 of PH16.

(ii) **South Bo River (Km 7–PH16)–La Son (36.77 km):** From Km 7 of PH16, the route approaches the mountain base to Km 7+300 of Hue bypass (length of this section is 5.04km), and joins bypass in 15.5km (constructed as Road – Class III Plain) to Km 22+800 where the route detaches from bypass, avoids microorganism fertilizer plant and Hue City's cemetery and military areas, and approaches the mountainous slope of Khe Lu Lake upstream to Km 4 + 500 of PH14B (La Son).

(iii) **La Son–Khe Tre Section (17.88 km):** From Km 4 + 500, the route goes through the right side of PH14B and parallel to the existing PH14B to Km 13 of PH14B. From there, the routes crosses La Hy pass to Khe Tre, a disadvantageous section of mountainous terrain alignment and many curvatures with gradient from 7–10%.

(iv) **Khe Tre–Hoa Lien Section (47.36 km):** From Khe Tre, the route enters the buffer zone of Bach Ma national garden and then goes to area of Danang City through De Bay pass, Mui Trau pass and joins at Km 4+400 of the South Hai Van–Tuy Loan (Hoa Lien) Expressway. The route passes through 11.5 km of buffer zone of Bach Ma National Park. This is a section of disadvantageous terrain and mountain (Bach Ma national park area, De Bay pass and Mui Trau pass).

(v) **Hoa Lien–Tuy Loan (14 km):** The route coincides with the newly constructed Hai Van–Tuy Loan (Km 0–Km18 + 283, 12) in flat road–class III and design speed of 80 km/h.

The total length of Cam Lo–Tuy Loan section is 182.48 km (in which 15.5 km of the route coincides with Hue City's bypass, 14 km coincides with section from South Hai Van to Tuy Loan)

(6) Da Nang–Quang Ngai Section

(a) **Starting Point:** Interchanging NH14B at Km 24 + 100 (NH1B) in Tuy Loan area, Danang

(b) **Ending Point:** Interchanging ring road in the West of Quang Ngai City

(c) **Alignment:** Alignment of this section is fixed by the other project.

(7) Quang Ngai–Binh Dinh Section

(a) **Starting Point:** Interchanging Ring Road at the west of Quang Ngai City.

(b) **Ending Point:** Interchanging NH19 in An Nhon District, Binh Dinh Province

(c) **Alignment:** From interchange (ending point of Danang–Quang Ngai Section) in area of An Hoi Bac and An Hoi Nam, Nghia Ky commune, Nghia Hanh District, the route connects to PH262 in the west of Cho Chua via Hanh Duc, Hanh Phuoc, over Ve River to Hanh Thinh. From Hanh Thinh, the route turns left close to the planned High Speed Railway, crossing PH628 and NH24 at the site 2.2 km from NH1A to the wWest. The route goes parallel to the High Speed Railway via Pho Ninh, Pho Hoa, Pho Cuong and over Chu Mountain with Huan Phong tunnel to Hoai Son commune (Tam Quan, Binh Dinh). It passes through Hoai Phu commune, Hoai Hao commune, Hoai Thanh Tay commune (Hoai Nhon District, Binh Dinh province), crossing Lai Giang River at the upstream of Lai Giang Dam 1 km to Hoai An District. The route goes to the west side of Tang Bat Ho Town, over Don Dong Mountain and Hoai Xay Mountain, and crosses PH 631 via An Tuong Dong commune. The route approaches the base of mountain and crosses over Ong Mountain and Giang Mountain to My Hoa commune. It turns to the left side and goes parallel to the west side of the planned High Speed Railway via My Hiep commune and connect to PH634 in the west of Mot Mountain. The route crosses over Con River in Tay Vinh commune and Nhon Phuc commune, connects to PH623 and approaches the slope of Cha Ray Mountain and Thom Mountain, and connects to NH19 in the area of Nhon Tan commune.

The total length of Quang Ngai–Binh Dinh is 169.5 km.

(8) Binh Dinh–Nha Trang Section

(a) **Starting Point:** At NH19 interchange in area of An Nhon District, Binh Dinh Province.

(b) **Ending Point:** At PH65–22 (PH2) in area of Dien Tho, Dien Khanh, Khanh Hoa Province.

(c) **Alignment:** From NH19 interchange, the route crosses over An Tuong River and Dung Mountain and Ong Dau Mountain. It also crosses over the existing North-South Railway and PH638, Ha Thanh River in the North side of Tan Vinh Station. The route continues parallel to the left side of Ha Thanh River, to the East side of Van Canh Town, over Muc Thinh pass to Phu Yen area. It goes parallel with the east side of Lai Hai Town, over Ky Lo, PH641, and North-South existing railway line to Xuan Son Nam

commune and to NH1A. The route goes behind JRD Company parallel to NH1A and connects to Tuy Hoa bypass and to NH25 and over Da Rang River by Da Rang Bridge. The routes continue passing through Hoa Xuan Tay to the downstream of Han dam, and connects to Ca pass' tunnel and Co Ma tunnel. The route follows the west side of NH1A and the downstream of Hoa Son dam and approaches the mountainous slopes via Van Binh commune, Van Phuc commune, Van Luong commune and Van Hung commune (Van Ninh, Khanh Hoa). The route continues to approach the mountainous slopes of Ninh Trung commune, Ninh Than commune, Ninh Xuan commune and connects to NH26 to the west of Ninh Hoa sugar plant for 1km, approaching Suoi Trau lake and mountainous slopes to connect to NH8B in Khanh Vinh commune area (Khanh Son) and connects to PH65–22 (PH2) in Dien Tho commune (Dien Khanh, Khanh Hoa).

The total length of Binh Dinh–Nha Trang Section is 215 km.

(9) Nha Trang–Phan Thiet Section

(a) **Starting Point:** Crossing DT65-22 (DT2) at Dien Tho, Dien Khanh, Khanh Hoa.

(b) **Ending Point:** Being on NH1 to Ba Bau (2.5 km far away from HN 1A), in the south of Nga Hai urban area and Ham Kiem Industrial Park–Binh Thuan.

(c) **Alignment:** From intersection of PH 65-22 (PH2), this route goes to the west of NH 1A, through Dien Loc, Suoi Tien, Suoi Cat, Suoi Tan (Cam Ranh), to the West side of Suoi Dau Industrial Park and Cam Ranh Thuong Lake to Cam Hiep. It is through Da Ma and straight to Cam An Bac, Cam Phuoc Tay, along the east side of Hon Ong Mountain to Cam Thinh Dong. It continues along the west side of Ba Tu Mountain and Hon Dung Mountain in Cam Thinh Tay to the east side of Giac Lan, ba Rau, Co Lo, Ong Ngai… to Phuoc Trung. It crosses HN27 and over Dinh River by Nhan Hoi Bridge to Phuoc Son commune, straight to Nhi Ha commune, over Vung Mountain by trench to Binh Thuan. It is straight to the west of Thong Nhat railway and NH railway through Phong Phu, Hai Ninh, Song Luy, Binh Tan, Hong Liem, Ham Tri (Ham Thuan Bac). It crosses NH 28 1km far away from Ma Lam town in the North, through Thuan Minh, over Thong Nhat and Phan Thiet railway, connecting HN 1A to Ba Bau 2.5 km far away from HN 1A.

The total length of this section 226 km.

(10) Phan Thiet–Dau Giay Section

(a) **Starting Point:** Being on NH1 to Ba Bau (2.5 km far away from HN 1A), in the south of Nga Hai urban area and Ham Kiem Industrial Park–Binh Thuan.

(b) **Ending Point:** connecting to NH Ho Chi Minh–Long Thanh–Dau Giay Project (about km 41+600 along Ho Chi Minh–Long Thanh–Dau Giay).

(c) **Alignment:** Alignment of this section is fixed by the other project.

(11) Dau Giay–Long Thanh Section

(a) **Starting Point:** From interchange with Ho Chi Minh–Long Thanh–Dau Giay Expressway at km41+600 (Ho Chi Minh–Long Thanh–Dau Giay).

(b) **Ending Point:** From interchange at Km 29 on NH Bien Hoa–Vung Tau.

(c) **Alignment:** Alignment of this section is fixed by the other project.

Table 4.4.1 Expressway Sections

No	Section	Starting Point	Ending Point	Length (km)	Number of Lane		Note
					In Decision No 1734/2008 QD-TTg	Expected Detail Plan	
1	Phap Van-Cau Gie	Phap Van Inter Section (Ha Tay)	Cau Gie (Ha Tay)	30		6	Constructed phase 1, 4 lanes
2	Cau Gie-Ninh BInh	Cau Gie (Ha Tay)	Cao Bo Inter Section (Nam Dinh)	50	6	6	On-going, Phase 1: 4 lanes, but formation for 6 lanes
3	Ninh Binh-Thanh Hoa (Nghi Son)	Cao Bo Inter Section (Nam Dinh)	Nghi Son	121	6	6	TEDI completed project proposal in 4/2008
4	Thanh Hoa (Nghi Son)-Ha Tinh (Hong Linh)	Nghi Son	Hong Linh Town	97	4-6	4-6	Thanh Hoa- Vinh: 6 lanes; Vinh-Ha Tinh: 4 lanes, TEDI completed project proposal in 4/2008
5	Ha Tinh(Hong Linh)-Quang Binh (Bung)	Hong Linh Town	Bung	145	4	4	Has no project yet
6	Quang Binh (Bung)-Quang Tri (Cam Lo)	Bung	Cam Lo, Quang Tri	117	4	4	Has no project yet
7	Quang Tri (Cam Lo)-Da Nang (Tuy Loan)	Cam Lo, Quang Tri	Da Nang City	182	4	4	Making investment plan
8	Da Nang-Quang Ngai	Da Nang City	Quang Ngai City	130	4	4-6	Alignment is fixed
9	Quang Ngai-Binh Dinh	Quang Ngai City	An Nhon, BInh Dinh	170	4	4	Has no project yet
10	Binh Dinh-Nha Trang	An Nhon, BInh Dinh	Dien Khanh, Khanh Hoa	215	4	4	Has no project yet
11	Nha Trang-Phan Thiet	Dien Khanh, Khanh Hoa	Phan Thiet City	226	4-6	4-6	Has no project yet
12	Phan Thiet-Dau Giay	Phan Thiet City	Dau Giay	98	4-6	4-6	Project proposal was approved
13	Dau Giay-Long Thanh	Dau Giay	Long Thanh, Dong Nai	43	6-8	6-8	Phase 1 on -going

Source: VITRANSS Study Team/refer to MOT detail planning

5) Volume of Bridges and Tunnels

The volume of bridges and tunnels is summarized in Table 4.4.2

Table 4.4.2 Volume of Bridge and Tunnel Works

No	Section	River Over Bridge	Viaduct Bridge	Crossing Bridges	Tunnel Work (each/Md)
1	Phap Van-Cau Gie	1 /74	3 /554	0 /0	0 /0
2	Cau Gie-Ninh Binh	2 /591	6 /2,045	5 /1,245	0 /0
3	Ninh Binh-Thanh Hoa	22 /7,113	0 /0	41 /11,696	2 /1,000
4	Thanh Hoa (Nghi Son)-Ha Tinh (Hong Linh)	18 /5,885	8 /5,040	29 /8,458	2 /1,150
5	Ha Tinh (Hong Linh-Quang Binh)	26 /7,700	7 /1,845	11 /3,110	5 /1,635
6	Quang Binh (Bung)-Quang Tri (Cam Lo)	17 /6,360	2 /810	5 /1,434	1 /150
7	Quang Tri (Cam Lo)-Da Nang (Tuy Loan)	97 /9,581	24 /7,000	0 /0	1 /1,280
8	Da Nang (Tuy Loan)-Quang Ngai	-	-	-	-
9	Quang Ngai-Binh Dinh	15 /5,979	0 /0	11 /3,094	1 /950
10	Binh Dinh-Nha Trang	28 /8,798	21 /7,735	8 /2,240	9 /3,896
11	Nha Trang-Phan Thiet	11 /3,120	11 /3,615	9 /2,154	6 /2,550
12	Phan Thiet-Dau Giay	-	-	-	-
13	Dau Giay-Long Thanh	-	-	-	-
Total		237 /55,221	182/28,644	119 /33,431	27 /12,511

Source: VITRANSS Study Team/refer to MOT detail planning

4.5 Interchange

Locating of interchanges shall be carried out taking into account the planning standards as shown in Table 4.5.1.

Table 4.5.1 Planning Standard for Interchange Locating

No.	Category	Proposed Locating
A	Standard	Locate max 30 km interval, connection with major National Highways
B	City	
B1	City < 100,000	Locate min one (1) Interchage
B2	100,000< City < 1,000,000	Locate min two (2) Interchanges
B3	1,000,000< City	Locate Interchanges in consistent with city ring road system.
C	Cultural	Locate one (1) Interchage for major cultural place
D	Industrial	
D1	Industrial Zone	Locate Interchages min 2km interval in accordance with development scale and timetable
D2	1st class port	Desirable: locate within max 10km distance Standard: locate within max 20km distance
D3	Intl Airport	Desirable: locate within max 5km distance Standard: locate within max 10km distance
D4	Domestic Airport	Desirable: locate within max 10km distance Standard: locate within max 20km distance
D5	Tourism	Locate one (1) Interchage for major tourism place
E	Agricultural	Locate Interchage near major cargo collection point
F	Others	Locate one (1) Interchage for custom clearance at international border

Source: VITRANSS 2 Study Team

In principle, the interchanges should have 10km intervals and connects to cities and towns in the vicinity. Even in case that there are no cities or towns, development of simple interchanges are desirable for emergency reasons. Access roads to interchanges make the most use of improved existing national highways and provincial roads, although new access roads development is still needed. A total of 104 interchanges are proposed for Ninh Binh–Da Nang and Quang Ngai–Phan Thiet sections as shown in Table 4.5.2.

Table 4.5.2 Proposed Interchange of the North-South Expressway

No.	Province	Nearby City/Town	Distance (km)
1	Nam Dinh	Ninh Binh (Cao Bo)	
2		Ninh Binh	6.70
3		Vo Br	7.30
4		Doi Dai	6.50
5		Tam Diep	14.50
6	Thanh Hoa	Bim Son	10.00
7		Ha Trung	9.00
8		Thanh Hoa	12.30
9		Quang Xuong	8.70
10		Nong Cong	15.50
11		Yen My Lake	14.50
12			14.40
13	Nghe An	My Hoa	10.00
14		Cau Giat	13.10
15		Kho Cat	10.00
16		Dien Chau	15.00
17		My Ly	8.00
18		Quan Hanh	9.50
19		Vinh	12.00
20		Vinh	6.00
21	Ha Tinh	Hong Linh	13.00
22		Nghen	16.00
23		Ha Yin	13.50
24		Ha Yin	10.00
25		Cam Xuyen	12.50
26			12.00
27			10.00
28		Ky Anh	10.00
29		Lac Vinh	13.00
30	Quang Binh	Ba Don	25.00
31		Hoan Lao	17.00
32		Hoan Lao	18.00
33		Dong Hoi	12.00
34		Quan Hau	7.50
35			10.50
36		Kien Giang	8.30
37		Kien Giang	18.70
38	Quang Tri	Ben Quan Ho Xa	15.80
39		Gio Linh	14.20
40		Cam Lo/Dong Ha	12.00
41			13.00
42		Quang Tri	10.00
43	Thua Thien Hue	Phong Dien	23.50
44		Hue	18.50
45		Hue	11.50
46			12.50
47			13.00
48		Khe Tre	9.00
49			12.00
50			24.00
51		Da Nang	11.00
52		Da Nang	8.50

No.	Province	Nearby City/Town	Distance (km)
53	Quang Ngai	Quang Ngai	-
54		Cho Chua	11.50
55		Mo Duc	11.00
56			9.00
57		Duc Pho	10.00
58			10.00
59	Binh Dinh	Tam Quan	10.50
60			11.00
61		Bong Son	11.50
62			16.50
63		Phu My	12.00
64			15.00
65		Ngo May	11.00
66		Binh Dinh	11.00
67		Quy Nhon	12.00
68			13.00
69		Van Canh	10.00
70	Phu Yen		17.00
71		La Hai	13.00
72		Chi Thanh	13.00
73			12.00
74			11.00
75		Tuy Hoa	9.00
76			11.00
77			10.00
78	Khan Hoa	Van Gia	15.00
79			16.00
80			13.00
81		Ninh Hoa	13.50
82			9.50
83			7.00
84		Nha Trang	13.00
85			22.00
86			8.00
87			12.00
88		Cam Ranh	7.00
89			11.00
90	Ninh Thuan	Phan Rang Thap Cham	8.00
91			11.00
92			16.00
93			15.00
94			10.00
95	Binh Thuan	Lien Huong	17.00
96			12.00
97		Han Ri Cua	18.00
98		Cho Lau	10.00
99			16.00
100			12.00
101		MaLam/Phan Thiet	7.00
102			14.00
103			7.00
104		Phan Thiet	10.00

Source: VITRANSS 2 Study Team

4.6 Feeder Access Roads

Access to the North-South Expressway from feeder roads is limited to interchanges because the North-South Expressway is a full access controlled expressway.

Almost all of the major cities are located along NH1 and the alignment of the North-South Expressway is parallel with NH1 as much as possible for effective connectivity from/to North-South Expressway and cities in the vicinity. Feeder access roads to each Interchanges from vicinity cities and towns are shown in the following Table. In the absence of feeder access roads, the development of new access roads is indicated in Table 4.6.1. There are a total of 189 km long feeder access road to be improved and 262 km of new access roads to be constructed for minimum two lanes pavement road.

Table 4.6.1 Feeder Access Roads Connect to each Interchange

I/C No.	Vicinity City/Town	Feeder Access Road	Improvement (km)	New Construction (km)	Connected Road
1	Cao Bo	NH 10			NH 1
2		NH 10			NH 1
3	Vo Br	PH 1			NH 1
4	Doi Dai	NH 12B			NH 1
5		PH 512	4.50		NH 1
6		PH 217	10.00		NH 1
7				4.50	NH 1
8	Thanh Hoa	NH 45			NH 1
9				5.50	NH 1
10		NH 45			NH 1
11	Yen My Lake			15.00	NH 1
12				4.50	NH 1
13				4.00	NH 1
14				3.50	NH 1
15	Kho Cat	NH 48			NH 1
16	Dien Chau	NH 7			NH 1
17				3.50	NH 1
18	Quan Hanh	NH 534			NH 1
19	Vinh			5.00	NH 1
20	Vinh	PH 558	1.50		NH 1
21	Hong Linh	NH 8			NH 1
22		PH 6	7.00		NH 1
23	Ha Yin	PH 3	7.00		NH 1
24	Ha Yin	PH 17	5.50		NH 1
25	Cam Xuyen			3.50	NH 1
26				4.50	NH 1
27				3.00	NH 1
28	Ky Anh	PH 10	5.00		NH 1
29		PH 10			NH 1
30	Ba Don	NH 12A			NH 1
31	Hoan Lao	NH 15, PH 2	18.00		NH 1
32		PH 3	8.00		NH 1
33				10.00	NH 1
34		PH 4B	3.00	2.50	NH 1
35				3.00	NH 5
36				2.50	NH 5
37				2.00	NH 5

I/C No.	Vicinity City/Town	Feeder Access Road	Improvement (km)	New Construction (km)	Connected Road
38	Ben Quan Ho Xa	PH 7	12.00	0.50	NH 1, NH 5
39	Gio Linh	PH 75	11.00	1.50	NH 1, NH 5
40	Cam Lo Dong Ha	NH 9			NH 1
41				10.00	NH 1
42	Quang Try			10.00	NH 1
43	Phong Dien	PH 9	10.00		NH 1
44	Hue			14.50	NH 1
45	Hue	NH 49			NH 1
46				15.00	NH 1
47		PH 14B	15.00		NH 1
48	Khe Tre	PH 14B			PH 14B
49		PH 14B			PH 14B
50		PH 601			PH 601
51	Da Nang	PH 602	8.00		NH 1
52	Da Nang	PH 604	8.00		NH 1
Da Nang - Quang Ngai Expressway Section					
53	Quang Ngai	PH 625	7.00		NH 1
54				4.00	NH 1
55	Mo Duc	PH 628	3.00		NH 1
56		NH 24			NH 1
57				2.00	NH 1
58				6.00	NH 1
59				8.00	NH 1
60	Tam Quan			3.00	NH 1
61	Bong Son	PH 629	3.00		NH 1
62		PH 631			PH 631
63	Phu My	PH 632	2.00		NH 1
64		PH 634	3.00		NH 1
65	Ngo May	PH 634	8.50		NH 1
66	Binh Dinh	NH 19			NH 1
67	Quy Nhon	PH 638	4.50		NH 1
68		PH 638			PH 638
69	Van Canh	PH 638			PH 638
70		PH 638			PH 638
71	La Hai	PH 641			PH 641
72	Chi Thanh			8.00	NH 1
73				1.50	NH 1
74				2.00	NH 1
75	Tuy Hoa	NH 25			NH 1
76				3.00	NH 1
77				1.50	NH 1
78				1.50	NH 1
79	Van Gia			3.00	NH 1
80				4.00	NH 1
81	Ninh Hoa	NH 26			NH 1
82				3.00	NH 1
83				5.00	NH 1
84	Nha Trang	PH 2	8.00		NH 1
85				1.50	NH 1
86				2.50	NH 1
87				10.00	NH 1

I/C No.	Vicinity City/Town	Feeder Access Road	Improvement (km)	New Construction (km)	Connected Road
88	Cam Ranh	PH 2	9.00		NH 1
89				3.00	NH 1
90				2.00	NH 1
91				5.00	NH 1
92	Phan Rang Thap Cham			6.00	NH 1
93				6.00	NH 1
94				3.50	NH 1
95				2.00	NH 1
96	Lien Huong			10.00	NH 1
97	Han Ri Cua			7.00	NH 1
98				4.00	NH 1
99				4.00	NH 1
100		PH 711	7.00		NH 1
101		NH 28			NH 28
102				4.00	NH 1
103	Phan Thiet			5.50	NH 1
104				2.50	NH 1
Total			188.50	262.00	

Source: VITRANSS 2 Study Team

5 OPERATION AND MANAGEMENT

5.1 Operation and Maintenance (O&M)

1) Outline of Expressway Operation and Maintenance (O&M)

The expressway administrator should provide expressway O&M services for expressway users. As shown in Table 5.1.1, operation services include facility management, toll collection, traffic information/control, and communication system management while maintenance services include the upkeep or restoration of structures and facilities to their original state of function and performance.

Table 5.1.1 Expressway Operation/Maintenance Services

Operation	Maintenance
• Expressway/Facility Management Cleaning-up, green space management, disaster recovery, energy and water supply and checkups of structure and facility in order to secure safety and comfort in expressway use.	Maintenance for restoring structure and facility to their original state of function and performance. • Pavement • Bridge • Tunnel • Semi-underground structure • Architectural structure • Mechanical equipment • Electrical equipment.
• Toll Collection Toll collection from the expressway users and its management.	
• Traffic Information/Control Routine patrol, regulation against illegal vehicles, traffic surveillance/information- provision and traffic control in order to serve a safe and comfortable drive and smooth traffic flow.	
• Communication System Management Fiber optic cable network system operation and management.	

Source: VITRANSS 2 Study Team

The construction and O&M of the expressway can be carried out by a single administrative organization; however, some aspects (like toll collection) may be contracted out to other organizations to achieve greater efficiency and economy in operation.

2) Standardization of O&M Works

The standardization of the following works will be necessary to ensure the fineness of traffic information and management service

(i) Routine patrol

(ii) Enforcement based on the regulation on illegal vehicles

(iii) Traffic surveillance/information-provision

(iv) Traffic control

These services shall be provided by the expressway operator or contractors based on the relevant decrees/laws. By consulting required frequency and labor force carefully, the costs for such works can be minimized although the perspective of users and the actual traffic conditions (eg, the number of accidents) should be taken into considerations as well.

Especially, the regulation criteria on weight limits, speed limits and lane controls are indispensable. The speed limits are required to be corresponding to the weather conditions and road conditions like the existence of on-road obstructions or vehivle accidents.

Performance of the operation shall be evaluated based on the indicators as follows;

(i) Rate of accidents

(ii) Number of fatalities/injuries

(iii) Hours of delay due to traffic congestion.

Objects of maintenance works are as follows. The scopes and targets should be standardized.

(i) Pavement

(ii) Bridge

(iii) Tunnel

(iv) Architectural structure

(v) Mechanical equipment

(vi) Electrical equipment.

The evaluation criteria and evaluation frequency should be stipulated considering the actual condition.

3) Role Sharing on Expressway O&M

The expressway facility is supposed to be publicly owned but O&M may be shared between public and private organizations. The extent of role sharing should be properly determined. Table 5.1.2 provides a matrix of role-sharing between public and private organizations.

Table 5.1.2 Role Sharing between Public and Private Organizations

	Service Contract	Management Contract	Lease Contract	O/M Concession
Roles of Public Org.	• Ownership of the expressway facility. • Responsible for O&M service, funding capital investments and tariff setting.	• Ownership of the expressway facility. • Ultimately responsible for O&M service, and responsible for funding capital investments and tariff setting.	• Ownership of the expressway facility. • Responsible for new and replacement investments, establishing performance standard and monitoring.	• Ownership of the expressway facility. • Responsible for establishing performance standard and monitoring.
Roles of Private Org.	• Transferred O&M services only in working level by fee payment from public org.	• Transferred O&M services including daily management level by fee payment from public org. • Responsible for preparation of working capital.	• Responsible for service provision including O/M, collecting toll and making a specified lease payment to public org. • Responsible for working capital and rehabilitation cost.	• Responsible service provision including O/M and collecting toll based on the concession contract. • Responsible for all capital investment as well as for working capital.
Revenue Risk	Public	Public	Private	Private

Source: VITRANSS 2 Study Team

4) Necessity of Minimal Service Standard

Generally speaking, the higher quality of O&M needs more budget. Therefore, on the condition that willingness-to-pay of the expressway users for nicer O&M is obscure and it is not easy to judge whether the increase of toll will be acceptable to users or not,the expressway administrator tends to be effortless on improvement of the expressway O&M.

Minimal standard service levels for the expressway O&M should be defined. The minimal service standard allows the expressway administrator to control O&M service levels. Furthermore, in case O&M is proved to be implemented with much higher quality than minimal standard, a rise of toll amount shall be justified and be acceptable to road users.

5) Minimal Service Requirements for the Expressways

The following conditions are proposed as the minimal service requirements for the expressways.

(a) Expressway Conditions

- Overloading regulation to restrain the damage of expressway structures caused by heavy vehicles

(b) Mobility

- Average travel speed of more than 80 km/h
- Surveillance and information transmission on traffic congestion
- Updated information transmission

(c) Safety and Traffic Accident Information

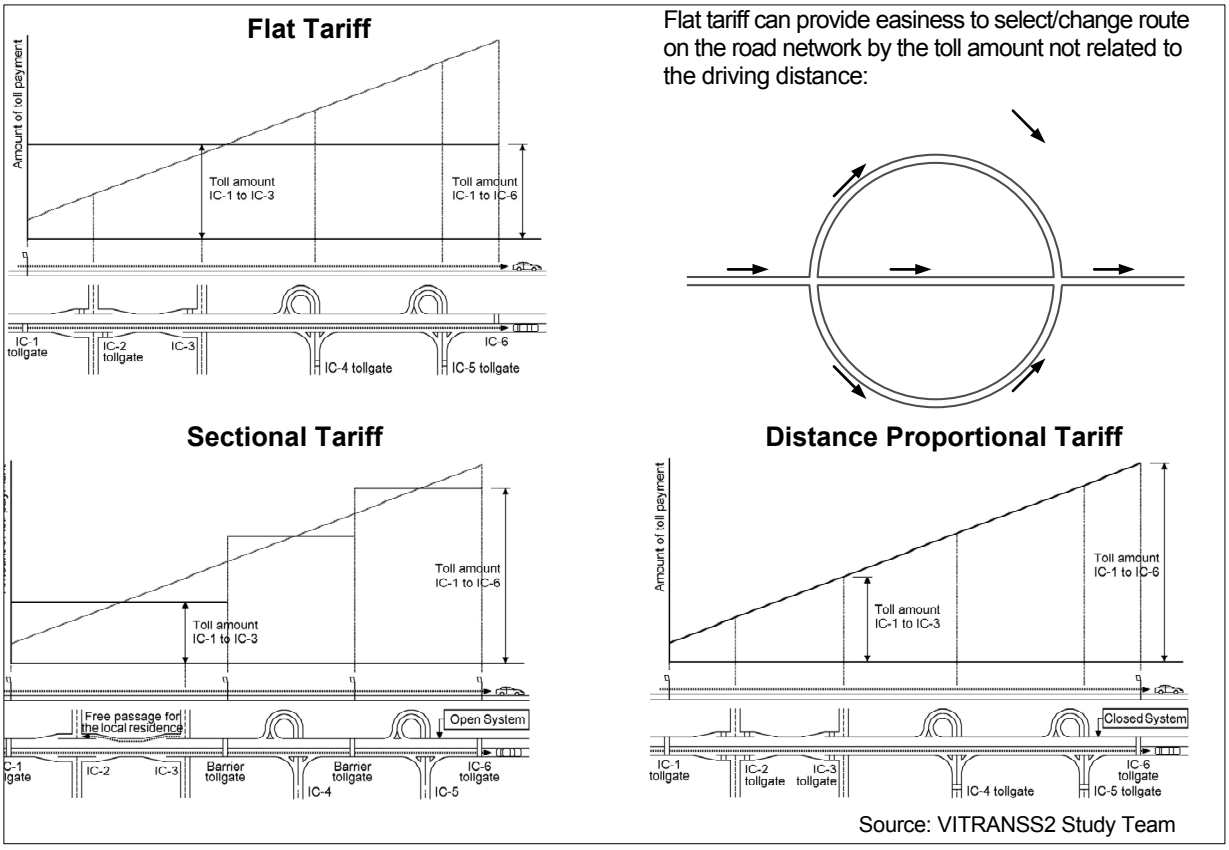
- Surveillance and traffic accident information transmission (including dropped obstructions on the surface and occurrence of natural disasters)
- Establishment of a management office facilitated by a monitoring equipment for surveillance and the operation vehicles (including patrol car, ambulance, and a maintenance car)

5.2 Toll Collection

1) Policy of Toll Rate System

Toll rate is an important pre-condition that should give a budgetary constraint on the construction and O&M of expressways. On the other hand, a toll rate system relates the arrangement of tollgates and roadside equipment. There are three typical toll rate systems (see Figure 5.2.1).

Figure 5.2.1 Three Typical Toll Rate Systems



Source: VITRANSS 2 Study Team

A comparison of these typical toll rate systems is shown in Table 5.2.1 below.

Table 5.2.1 Comparison on Typical Toll Rate Systems

	Flat Tariff	Sectional Tariff	Distance Proportional Tariff
Fairness for driving distance	Not secured	Secured	Secured
Evenness of alternative driving route	Secured	Not secured	Not secured
Free passage for the local residents	Not available	Available (Open system)	Not available (Closed System)
Need to stop on the through lanes	Few times	Many times	Few times
Total number of tollgates	Average	Average	Large
Applicability to the inter-city expressways	Not Suitable	Average	Suitable
Applicability to the metropolitan expressways	Suitable	Average	Not Suitable

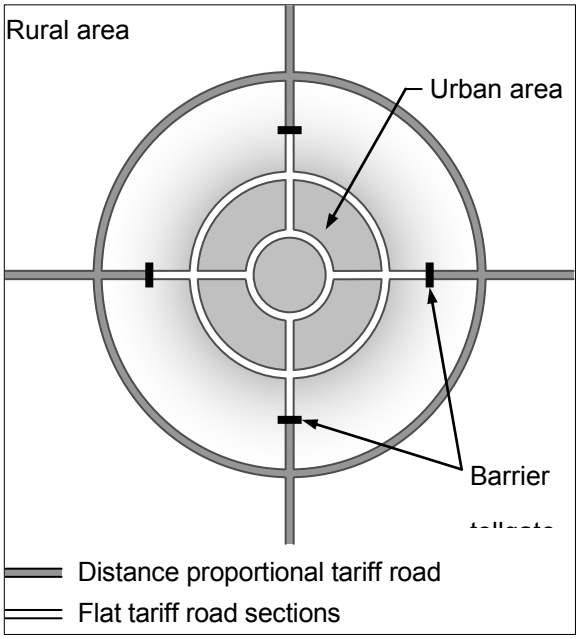
Source: VITRANSS 2 Study Team

Distance proportional tariff is suitable for the inter-city road network. On the other hand, in the near future, dispersing concentrating traffic effectively by the utilization of the road network will be a major target in the urban areas. Flat tariff is suitable for such target. A

combined toll rate system shown in Figure 5.2.2 should be adopted for metropolitan areas. This is commonly used in metropolises in other countries, such as Tokyo and Jakarta.

The three toll rate systems shall be considered in the discussion of a toll collection system.

Figure 5.2.2 Combined Toll Rate System for the Metropolitan Area



Source: VITRANSS 2 Study Team

2) Toll Levels

For the development of the expressway network in Vietnam, each section is/will be funded by respective investment body. Besides, construction cost will also be different due to structure, geography, land price etc. Therefore, toll fee will be inevitably different for each section.

The most desirable toll system from the perspective of expressway users is charge-free. Under this system, the utilization ratio of traffic volume and the effectiveness of expressway are high. However, government bears all construction and O&M expenses. Charge-free expressway is, thus, impractical on existing expressway development conditions in Vietnam.

The existing toll fee of 150 VND/km (passenger car) is too low to reimburse the construction cost of investors. A new toll fee regulation should be established for shifting the charge system in the future development of the expressway.

Generally, the toll fee per km should be determined by the financial internal rate of return (FIRR). Toll fee should take into account the costs of construction, O&M, traffic volume and benefits.

The specific toll amount should be defined considering the following factors. These are generally influenced by projected traffic volume:

(i) Costs of construction and O&M of the expressway;

(ii) Benefits to the expressway users;

(iii) Harmonization with the tariff rates of the existing national highways and the existing inter-city buses/railways; and

(iv) Financial independence or profitability of the expressway operator.

The toll amount can be set at different levels, as follows:

(i) **Toll Level [A]:** This level requires collecting the toll equivalent to the total economic benefits that expressway users can obtain by using the expressway. This level can be estimated through economic and financial analyses;

(ii) **Toll Level [B]:** This level requires collecting the toll for the total cost of the expressway including the cost of construction, and O&M. This level can be estimated by cost analysis;

(iii) **Toll Level [C]:** This level requires collecting the toll for O&M cost of the expressway. This level can be estimated by cost analysis; and

(iv) **Toll Level [D]:** This level requires collecting the toll amount which expressway users feel acceptable (considering the benefits obtained). The amount can be estimated by determining the willingness-to-pay of the expressway users.

3) Target Level of Toll Revenue

The policy on defining the target toll revenue for the expressway including the expressway network should be selected from the following alternatives:

(1) To Cover Total Cost of Investment

The target level of toll revenue can be set to cover the total cost of the expressway, less than or equivalently to the economic benefits that expressway users can totally obtain, where Toll Level [A] ≧Toll Level [B]. That is the suitable condition for collecting the toll. Financial independence or profitability of the expressway operator can be secured only by the toll revenue.

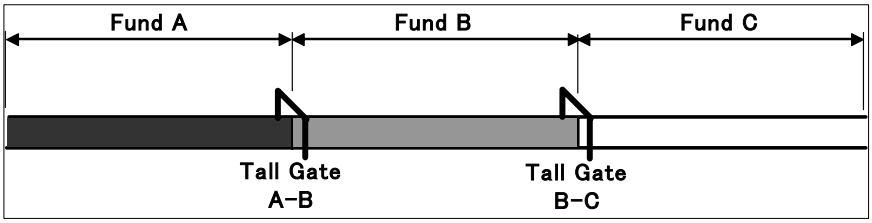
(2) To Cover O&M Cost

The target level of toll revenue can also be set to cover the O&M cost of the expressway, less than or equivalently to the economic benefits that expressway users can totally obtain, where Toll Level [B] > toll Level [A] > Toll Level [C]. That is likely to exist in Vietnam because the income level of the expressway users is relatively low. The financial independence or profitability of the expressway operator is secured by the revenue of toll and other subsidy and tax. Other funds should be secured by Government.

4) Toll Gate System

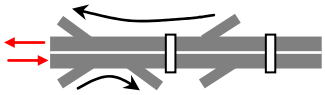
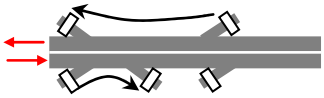
Toll gates should be installed on the main lane of the expressway to collect toll fee for each fund section. This will disturb smooth traffic flow, therefore the expressway operator should consider for new payment system such as the Electric Toll Collection System.

Figure 5.2.3 Concept of Main Lane Toll Gate



Source: VTRANSS 2 Study Team

Table 5.2.2 Difference with Toll Gate System on Expressway

System	Open System	Closed System
Conceptual Diagram □ : Toll gate		
Notes	• Even vehicle can access at limited interchange, Toll fee is collected at the barrier on expressway. • Some vehicles can run expressway without any toll fee if it does not pass barrier on its route. • If it is charged at each toll gate, it seems to be a distance based toll fee system. • This system is suitable for the section where there is no parallel national highway, because this section is necessary to be used for daily purpose for residential user.	• Toll fee is normally collected at the exit interchange, based on the record of entrance interchange information. • All vehicles should pay their expressway toll fee. • It is easy to apply distance based or proportional toll fee system. • This system is suitable for the section where there are some parallel national highways, because this section is used for their specific proposes, not daily purpose for residential user.

Source: VITRANSS 2 Study Team

5.3 Safety Measures

1) Introduction

The expressway development is expected to segregate long-distance heavy traffic from local traffic, and therefore, contribute to the significant improvement of traffic safety in Vietnam. Besides, because expressway shall target larger and faster vehicles and each traffic accident on expressways tends to be serious, the operation and maintenance should be conducted in the manner to ensure the high safety level.

For traffic safety, the following measures should be considered.

(i) Installing lighting at sections of interchanges, bus stops and relatively small curve alignments;

(ii) Maintaining drainage facilities to enhance safety during rain;

(iii) Improving road structure in sections where road alignment is severe;

(iv) Improving median and reinforced fence to prevent vehicles collision from opposite direction;

(v) Installing emergency access to support the emergency medical service system;

(vi) Constructing attractive rest facilities;

(vii) Expanding information services to include the provision of warnings on weather condition, construction work and traffic congestion; and

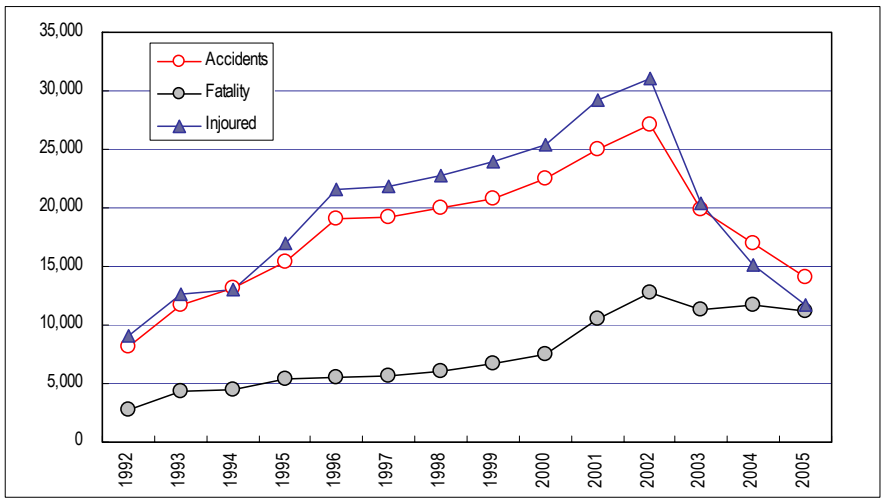
(viii) Improving and expanding the vehicle information and communication system.

2) Traffic Accident

(1) Traffic Accidents in Vietnam

During 1992 to 2005, the number of accidents, fatalities and injuries increased significantly (8,165 to 12,732, 2,755 to 11,223 and 9,040 to 10,047, respectively). Although the number of accidents has decreased since 2002, the number of fatality remains the same. It means that rate of death has been increasing. For example, the average number of fatality per day reaches more than 30 people. Figure 5.3.1 shows the historical trend of traffic accidents in Vietnam from 1992 to 2005.

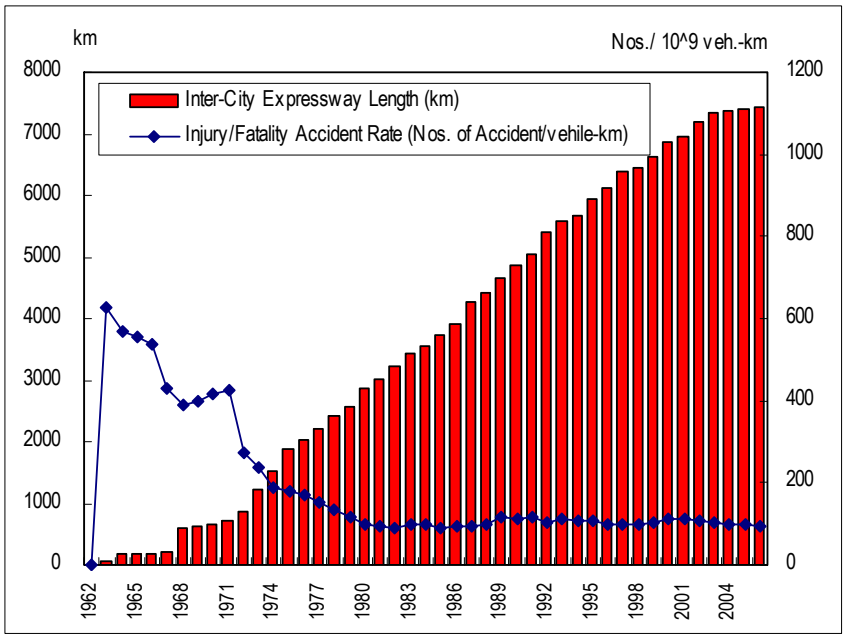
Figure 5.3.1 Historical Trend of Traffic Accidents in Vietnam (1992–2005)



Source: UBATGTQG

The historical data for traffic accidents in Japan is shown in Figure 5.3.2. At the early stage of expressway development, the possibility of occurrence of traffic accidents is high. The main reasons include the lack of experience of users in expressway driving and the lack of traffic accidents management system. This suggests that the countermeasure for traffic accidents must be installed from the first stage of expressway network development.

Figure 5.3.2 Historical Trend of Traffic Accidents in Japan (1962–2004)



Source: Ministry of Land, Infrastructure, Transport and Tourism of Japan

(2) Types of Traffic Accidents

The following are the characteristics of traffic accidents in Vietnam. These were generated from traffic records. It should be noted, however, that these are based on the records of accidents on national highways and not on expressways.

(a) Causes of Traffic Accidents

Table 5.3.1 shows the composition of traffic accidents by cause from 2002 to 2006. Most road traffic accidents in Vietnam were caused by road users' errors. Over-speeding is the primary cause accounting for 25%. Road infrastructure, especially national highways, has been improved and its performance and speed also significantly improved in the last decade, although the drivers' mindset has not changed accordingly.

Road users tend to speed up in highways where there is relatively less traffic. Trucks, buses and passenger cars inappropriately overtake low-speed vehicles such as motorbikes and bicycles, resulting in the increase of the accident risks in a mixed traffic situation. Under these circumstances, strict enforcement of traffic rules and effective traffic education of road users are crucial in reducing traffic accidents. In addition, physical measures such as the improvement of surface conditions, the pavement of shoulders, the re-design of roads, and the installation of traffic signs and signals are necessary.

Table 5.3.1 Traffic Accidents by Cause (2002–2006)

Causes	Proportion (%)				
	2002	2003	2004	2005	2006
1.Speeding	24.4	24.1	26.0	25.8	24.8
2. Wrong Overtaking	18.9	16.8	15.8	12.7	13.7
3. Wrong Lane Shifting	17.0	17.6	16.5	16.7	18.0
4. Turning Direction without Turning Signal	4.1	3.4	2.4	1.6	1.7
5. Passing Intersection with Red Signal	1.1	0.1	1.7	0.6	0.2
6. Not Keeping Safe Distance	6.9	0.9	2.4	1.8	0.4
7. Careless Driving	15.9	12.1	8.1	10.0	8.2
8. Careless Crossing of Pedestrians	0.7	2.3	2.9	3.2	2.6
9. Others	11.0	22.7	24.2	27.6	30.4

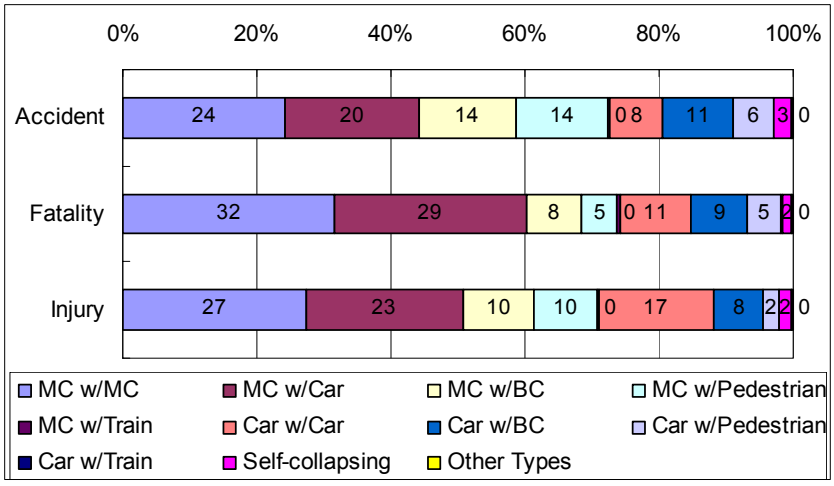
Source: Road and Rail Transport Division, MOPS

(b) Collision Type

In Vietnam, the total number of registered motorbikes is increasing from year to year. In 2008, it was reported that more than 20 million motorbikes were registered. This represents 95% of all registered vehicles in Vietnam. The consistently high percentage of registered motorbikes in the country shows that motorbikes are currently the most favorable transportation mode because motorbikes are relatively cheap to acquire and consume less fuel than other vehicles.

Figure 5.3.3 shows the composition of traffic accidents by collision type in 2001. More than 60% of the total number of fatality and injury involved motorbikes. In 2006, this figure has increased by 7%. Due to the high rate of motorbike fatalities in Vietnam, the GOV has taken numerous actions to reduce it. One of the significant measures taken was implementation of the regulation that calls for the compulsory wearing of helmets.

Figure 5.3.3 Traffic Accidents by Collision Type (2001)

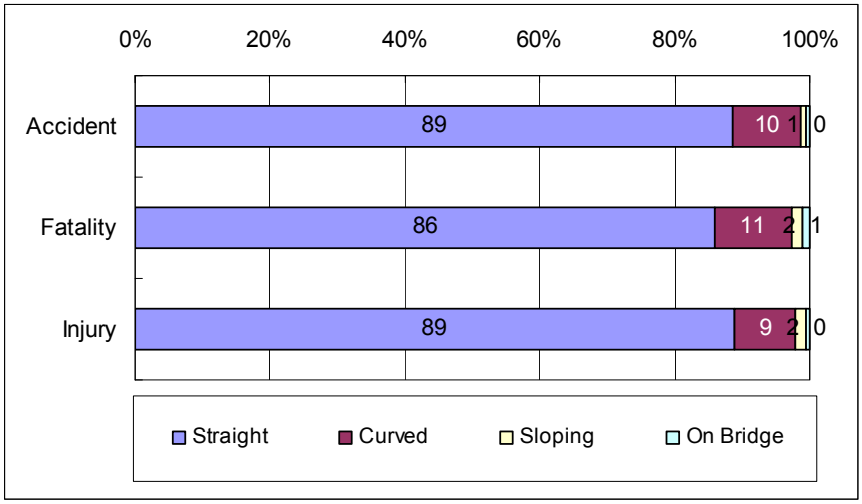


Source: People's Police Academy (Sampled Data Analysis)

(c) Occurrence Place

Figure 5.3.4 shows the composition of traffic accidents, which occurred on various road sections in 2001. About 90% of accidents occurred on the straight section of the road. The ratio of fatality and injury is higher on straight section in relative proportion.

Figure 5.3.4 Traffic Accidents by Road Section (2001)



Source: People's Police Academy (Sampled Data Analysis)

3) Traffic Safety Measure on Expressway

(1) Alignment

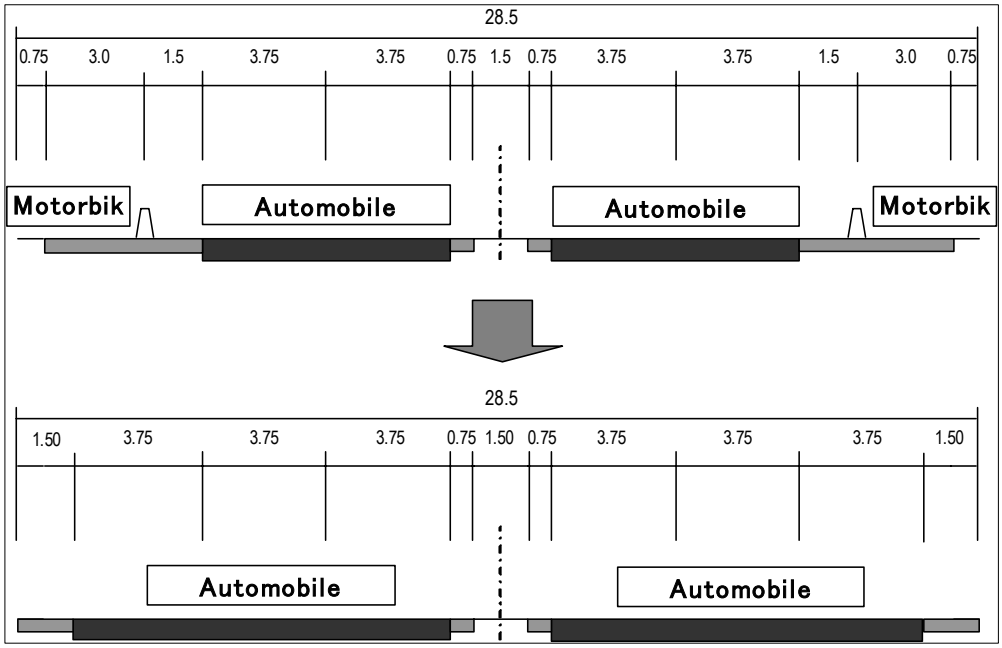
As described above, most accidents occur in straight sections especially when drivers overtake. Straight sections in expressways will be longer than ordinary roads, however, the number of lanes of expressways is expected to be more than two lanes in one direction. Thus, accidents in straight sections are reduced because the lane is divided for driving and passing.

(2) Passage of Motorbikes

Motorbikes account for approximately half of traffic accidents. In order to minimize motor-bike related accidents, there is a need to segregate motorbike traffic from the main traffic stream. Such segregation will reduce the exposure of motorcyclists to crashes with other motor vehicles. Most of the sustained injuries were due to collision with other motor vehicles rather than losing control due to stability. Therefore, the need to segregate is seen to improve safety of motorcyclists.

If the expressway administrator gives approval for passage of small motorbikes (currently, majority of motorbikes in Vietnam have 110 cc engine volume), different speed between motorbikes and other automobile will be dangerous. Exclusive lane for motorbikes in the expressway is essential. This can be done by providing a structural barrier on the expressway. Big motorbikes (more than 175 cc engine volume) can pass through the automobile lane. In the future, when the size of motorbikes will be upgraded, an exclusive motorbike lane will no longer be needed and one lane can be used for both motorbikes and automobile.

Figure 5.3.5 Typical Cross-Section Expressway with Exclusive Motorbike Lane



Source: VITRANSS 2 Study Team

(3) Passage of Dangerous Goods Transporters in Tunnel

Traffic accidents inside tunnels can have serious consequences.

Generally, dangerous goods transporters (oil/gas tanker) are banned to pass through a tunnel. For example, a more than 5,000 m long tunnel is not allowed by Japanese regulation. Dangerous goods transporters should make a detour to any existing mountain pass. It is therefore important to install an (before and after) interchange connecting existing mountain pass with the expressway. It is likewise important to improve existing pass for the passage of dangerous goods transporters.

5.4 Traffic Control and Monitoring

1) Traffic Signs

Traffic flow is controlled by principal traffic sign boards in the expressway. Design standard is regulated by 22TCN237-01 and 22TCN331-05 issued by MOT. Traffic signs are classified into five, namely: regulatory, warning, command, guide and minor signs (see Table 5.4.1).

Table 5.4.1 Classifications of Traffic Signs

No	Group Name of Traffic Signs	Shapes	Codes	Notes
1	Regulatory (Banning) Signs	Circular	101 to 139	
2	Warning Signs	Triangle	201 to 246	
3	Command Signs	Circular	301 to 309	
4	Guide Signs	Rectangle/Square	401 to 447	For conventional roads, applying 22TCN-237-01
				For Freeways and Expressways, applying 22TCN-331-05
5	Minor Signs	Rectangle/Square	501 to 509	

Source: VITRANSS 2 Study Team/referred to MOT regulation

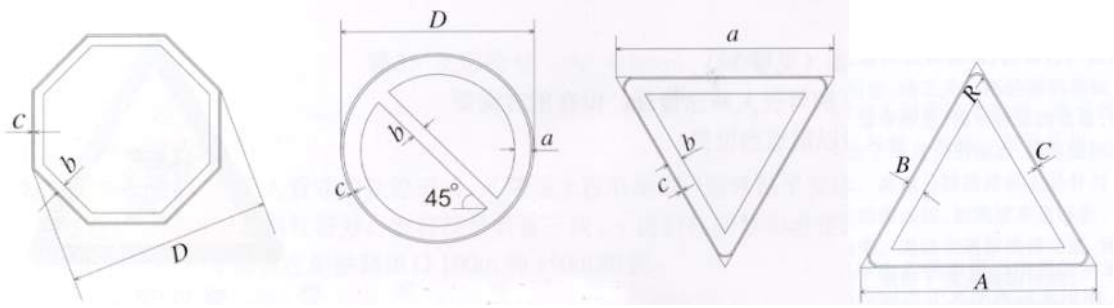
The size and types of traffic signs are regulated by 22TCN-237-01 as shown in Table 5.4.2.

Table 5.4.2 Size of Traffic Signs

Design Speed. km/h		Size
Circular Sign	Outer Diameter, D, in cm	70
	Width of outer Red circular strip, a in cm	10
	Width of Red bar, b in cm	5
Up-side-down Triangle Signs	Edge length, a in cm	70
	Width of outer Red strip, b in cm	7
Octagon Signs	Outer Diameter, D in cm	60
	With of outer White circular strip, b in cm	3, 5
Triangle Sign	Edge length, A in cm	70
	With of outer Black strip, B in cm	5
	Chamfer radius of angles, R in cm	3, 5

Source: VITRANSS 2 Study Team/referred to MOT regulation

Figure 5.4.1 Type of Traffic Signs



Source: VITRANSS 2 Study Team/referred to MOT regulation

In the case of the expressway where design speed is higher than 60km/h, all dimensions of traffic signs should be multiplied by corresponding factor as shown in Table 5.4.3:

Table 5.4.3 Multiplied Factor for Different Design Speed

Type of Signs	Design Speed (km/h)			
	100~120	80~100	60~80	< 60
- Regulatory Signs - Command Signs - Warning Signs	1.75	1.5	1.25	1
- Guide Signs	2.0	2.0	1.5	1.3

Source: VITRANSS 2 Study Team/referred to MOT regulation

The details of guide signs on expressways are provided for by Issuance No. 22TCN-331-05. This issuance has the following key points:

(i) Number of Guide Signs: 15 coded from 450 to 464

(ii) Color: Letters, Numbers, Figures: White on green background, Outer strip: white

(iii) Requirements for Guide Signs:

- Sizes of letters, numbers and symbols should be large enough to ensure that drivers can clearly see and read them within a distance of 150 m from the sign;
- Words on signs must be succinct and easily understandable;
- Light reflective materials; and
- At interchanges, the guide signs should be located to ensure that drivers can recognize them ten seconds earlier.

(iv) Guide Signs – Font style and size:

- The dimension of the sign's content (letters, numbers and figures) should be specified first. The size of the signs can be determined later;
- Names of places, streets, routes and notes must be written in CAPITAL LETTERS;
- The Guide Signs should be bilingual (Vietnamese and English) and the font of the Vietnamese words should be two times bigger than the English words;
- The size of Vietnamese letters varies from 300 mm to 500 mm (corresponding to Sign Distance from 250 m to 400 m);
- The space between words should be equal to the size of letters on the same line;
- Line spacing between Vietnamese and English lines should be three fourth of the size of the English letters;
- Spacing of all sign edges should be equal to the size of the Vietnamese letters; and
- All lines should be justified CENTER;

(v) Outer strip dimensions:

- Width: 50 mm for signs equal to or larger than 3000 x 1000 mm, 30 mm for other cases; and
- Chamfer radius of outer strip should be one eighth of the shorter dimension of sign and should be not less than 300 mm/

Figure 5.4.2 Sample of Sign Board in 22TCN-331-05

Source: MOT regulation

2) Traffic Monitoring

The accurate surveillance of traffic conditions on expressways and adjacent arterial roads should be monitored at roadsides and actual runs of probe cars. This service assists prompt action of the road operator and the emergency vehicles by notifying traffic accidents, vehicle breakdown and other obstacles. It also allows drivers en route and in advance to avoid the influence of such incidents by providing accurately updated information. This service also allows appropriate interchange/route selection by providing drivers en route with information; such as crowdedness and travel-time. This service makes it possible to measure actual traffic volume continuously.

5.5 Organization

1) Introduction

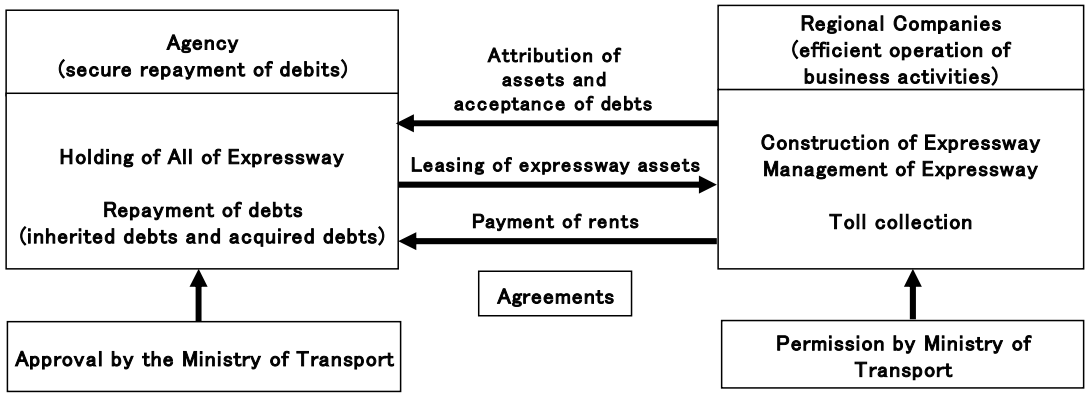
Many fund sources including Build-Operate-Transfer (BOT), Public-Private Partnership (PPP), Official Development Assistance (ODA) funds and/or state funds will be tapped for the development of the North-South Expressway that connects the northern city of Hanoi in Red River Delta and Can Tho in Mekong River Delta. This means that O&M and toll collection will be carried out by different organizations. Traffic efficiency of road and expressway will be affected by connectivity of each section of the expressway; however unitary O&M cannot be implemented by a separate organization.

The study team therefore proposes measures to establish unitary operation organization covered whole of Vietnam expressway for reference to the Japan case.

2) Expressway Holding and Debt Repayment Agency

The Expressway Holding and Debt Repayment Agency (hereinafter referred to as “the Agency”) was established along with regional private expressway companies (hereinafter referred to as “the Companies”), which were enacted following the government’s policy to the regional public corporations, as spelled out in the “Reorganization and Rationalization Plan for Special Public Corporations”.

Figure 5.5.1 Scheme of Expressway Organization of Business by the Agency and Company



Source: VITRANSS 2 Study Team

The objectives of the Agency were to reduce the burden concerning expressways on the general public and support the successful operation of expressway business activities by the Companies through holding and leasing highway assets related to expressways, and repaying debts in a secure manner at an early opportunity.

The debts inherited from the public before the construction of the expressways and debts acquired to develop new expressways were supposed to be fully repaid within contract years from the Agency with the rent paid by the Companies. Upon full repayment of the debts, the ownership of the expressways were transferred to the respective expressway administrators.

3) Basic Business Framework

(i) The Agency is established as an independent administrative agency responsible for the holding and leasing of expressway assets and performing the secure repayment of debts at an early opportunity;

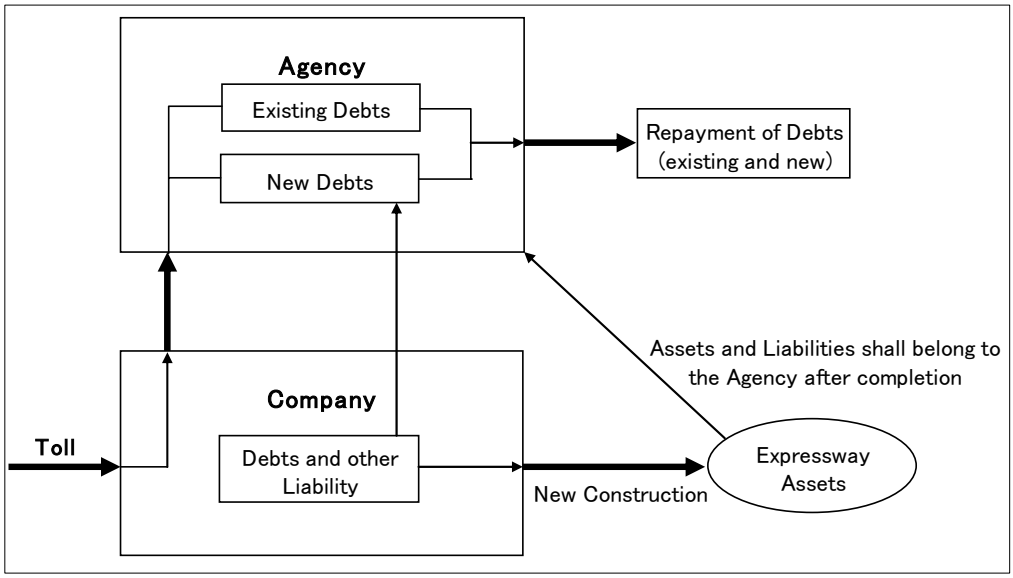
(ii) As a rule, highway assets constructed by the Company shall belong to the Agency after the completion of construction, and, at the same time, the debts borne by the companies for construction shall be accepted by the Agency;

(iii) The revenues of leases shall be set to pay off the costs for debt repayment within the terms of leases. (The toll revenues to be collected by the Companies shall be set to pay off the leases and the Companies' maintenance costs within the period of toll collection);

(iv) The government can invest and provide subsidies for restoration in the event of a disaster. The Agency shall provide interest-free loans, financed by such investments and/or subsidies, to the Companies;

(v) The Agency shall assume a part of the authority of the respective expressway administrators.

Figure 5.5.2 Basic Business Framework between Agency and Companies



Source: VITRANSS 2 Study Team

4) Agreement with Expressway Companies and Business Operation Programs

The Agency, when intending to undertake a business operation, is required to enter, in advance, into an agreement with the Company concerned, stipulating the conditions of lease regarding the expressway assets which the Agency shall lease to the Company for each section.

When an agreement has been entered into, the Agency is required to formulate a business operation program that specifies details of the income and expenditure budget (debt repayment plan) of the Agency in addition to the items prescribed in the agreement (except the sums of tolls to be collected by the Company and the duration of collection), and submit it to the MOT for approval.

In addition, the Company that enters into an agreement with the Agency is required to operate its business under the agreement subject to permission by the MOT.

The Agency obtained approval of business operation programs and the Companies obtained permission of their operations from the MOT.

6 EVALUATION OF PROJECT SECTIONS

6.1 Introduction

The main objective of this chapter is to evaluate the North-South Expressway projects (with other expressway projects) by applying scientific methods. This chapter also aims to discuss the implementation schedule and funding strategies as a result of the evaluation.

In VITRANSS 2, all the proposed projects of the six transport subsectors, which are road, rail, port & shipping, inland waterway, aviation, and logistics, were evaluated using multi-criteria analysis that allows projects to be evaluated holistically. The criteria used for project evaluation are presented in Table 6.1.1. These include demand, economic feasibility, financial feasibility, network composition, impacts on natural environment, maturity or progress, and consistency with Upper Plan or National Development Policy.

Table 6.1.1 Multi-criteria Analysis for Project Evaluation

Criteria		Indicator	No. of Categories
1	Demand	(ton-km + pax-km)/km	5
2	Economic feasibility	EIRR	5
3	Financial feasibility	FIRR or Demand/Cost	5
4	Network Composition	5: North-South National Highway	5
		4: National Highway (excluding above)	
		3: Main Provincial Road	
		2-1: Minor Roads	
5	Natural Environmental Impact	% of Length passing Restricted Area	5
6	Maturity/Progress	9: DD (completed)	9
		8: DD (ongoing)	
		7: FS (completed)	
		6: FS(ongoing	
		5: Pre-FS (completed)	
		4: Pre-FS (ongoing)	
		3: MP	
		2: Idea	
		1: No Progress	
7	Consistency with Upper Plan or National Development Policy	3: Listed in Formal Plan	3
		2: Seemingly Consistent	
		1: Unknown/ Inconsistent	

Source: VITRANSS 2 Study Team

The scoring methodology is as follows:

(i) **Demand:** By comparing demand volume (i.e., ton-km/km and PCU-km/km), the projects with top 10% demand are given 5 points, 4 points for the next the 20%, 3 points to the next 40%, 2 points for the next 20% and 1 point for the last 10%.

(ii) **Economic Feasibility:** In the same way as demand, each project is given points corresponding to the economic internal rate of return (EIRR).

(iii) **Financial Feasibility:** In the same way as economic feasibility, points are given based on the FIRR. In some cases, the FIRR is substituted by ratio demand and cost (demand/cost). No point was given to non-income generating project.

(iv) **Network Composition:** Points are based on the relative importance of the project in the network structure. 5 points were given to projects that compose the North-South

National Highway, 4 points for other national highways, 3 points for main provincial roads, and 2 or 1 point for other minor roads.

(v) **Natural Environmental Impact:** Restricted development areas were identified for the whole of Vietnam, considering topography, land cover, hazards, and protection areas. Approximately 35% of Vietnam is categorized as restricted area. Based on the percentage of length of the project, a score is assigned with a maximum of 5 points.

(vi) **Maturity/ Progress:** Progress is evaluated using the following scores: (9) Detailed Design (DD) completed, (8) DD in process, (7) Feasibility Study (FS) completed, (6) FS in process, (5) Pre-FS completed, (4)Pre-FS in process, (3) Listed in master plan, (2) Still in concept stage, (1) No progress, each point was given.

(vii) **Consistency Upper Plan or National Development Policy:** (Refer to Table 6.5.1)

An overall score is then derived by summing all scores. Twenty percent (20%) of the total score is based on demand, 30% on economic feasibility, 20% on financial feasibility and 10% each on network composition, natural environmental impact and maturity/progress. A score of 5 is attached to projects with the highest rating, and 1 for projects with the lowest rating.

Multi-criteria analysis was used only on the non-committed projects while committed projects are assumed to be part of the Master Plan already. Please refer to Chapter 8 of the VITRANSS 2 Main Report for details of the evaluation methodology and key assumptions on the calculation of economic benefits, among others..

The following sections explain the methodologies and results of cost estimation and economic & financial evaluation as well as the result of multi-criteria analysis.

6.2 Estimated Costs

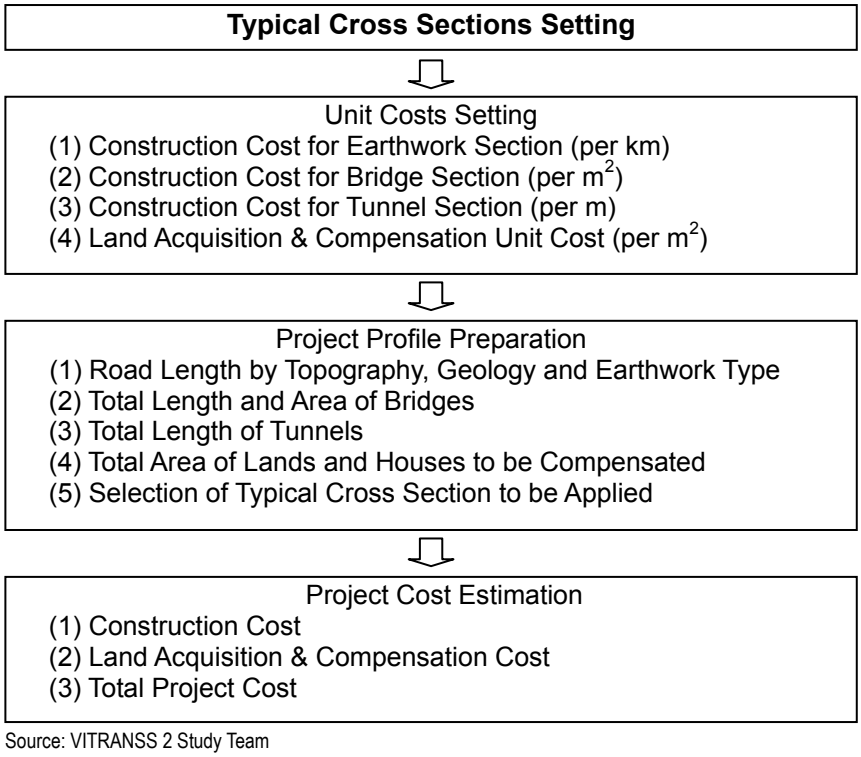
1) Introduction

Project cost estimation is a significantly important factor in road development planning since it is a basic element of economic and financial analysis and a key consideration of project fund sources. Several road development plans have been formulated and proposed by various related agencies in charge of development and management of roads in Vietnam. However, in many of such plans, detailed development scopes of projects are not clearly mentioned and thus, the basis of cost estimation remains unclear. The medium and long term plans should be revised to take into account changes in social and economic conditions. However, in case the detailed methodology of cost estimation is not clear, it is difficult to revise or modify the estimation. Consequently, it sometimes causes inefficient discussions on the overall road network development plans which based on the project costs estimated in the past, even after a period during which material prices or labor costs changed significantly. In order to cater to the above-mentioned issues, a simple and clear cost estimation system for road network development which would be easily applied to update costs was proposed in VITRANSS2.

2) Method of Development of Standard Cost Estimation System

Figure 6.2.1 shows the proposed a flow of standard cost estimation for road network development.

Figure 6.2.1 Flowchart of Standard Cost Estimation for Road Network Development



Source: VITRANSS 2 Study Team

For details of the methodology, please refer to Appendix 6A. The following table (Table 6.2.1) summarizes the results of the estimation.

Table 6.2.1 Results of the Cost Estimation of Expressway Projects

Project Code	Section	Length (km)				Construction Cost (Mil USD)[1]				Land Acquisition / Compensation Cost (Mil USD)	Economic Cost (Mil USD)	Financial Cost (Mil USD)
		Total	Earth work	Bridge	Tunnel	Total	Earth work	Bridge	Tunnel			
H01	Ninh Binh–Thanh Hoa	75	73	0.20	2.00	745	643	15	88	22	767.6	827.6
H02	Thanh Hoa–Vinh	140	124	2.90	13.60	1,927	1,115	215	597	41	1,968.4	2,128.0
H03	Vinh–Ha Tinh	20	19	1.40	0.00	181	112	69	0	6	187.0	201.5
H04	Ha Tinh–Quang Tri	277	265	3.10	9.00	2,368	1,879	153	336	82	2,449.9	2,641.2
H05	Quang Tri–Hue	73	71	1.60	0.00	640	560	79	0	22	661.2	711.9
H06	Hue–Da Nang	105	78	3.30	23.40	1,609	573	163	874	31	1,640.5	1,778.0
H07	Quang Ngai–Quy Nhon	150	135	1.10	13.60	1,610	1,048	54	508	44	1,654.6	1,787.8
H08	Quy Nhon–Nha Trang	240	199	4.20	37.00	3,061	1,472	208	1,381	71	3,132.1	3,390.1
H09	Nha Trang–Phan Thiet	280	266	1.50	12.60	2,597	2,052	74	470	83	2,679.5	2,890.2
H10	Long Thanh–Nhon Trach–Ben Luc	45	42	3.15	0.00	672	516	156	0	13	685.1	738.6
H11	Doan Hung–Hoa Lac–Pho Chau	457	444	9.14	4.00	4,333	3,731	452	149	135	4,467.8	4,813.1
H12	Ngoc Hoi–Chon Thanh–Rach Gia	864	847	17.28	0.00	7,151	6,297	855	0	255	7,407.0	7,974.4
H13	Thai Nguyen–Cho Moi	28	27	0.56	0.00	230	203	28	0	8	238.6	256.9
H14	Hoa Lac–Hoa Binh	26	25	0.52	0.00	191	165	26	0	8	198.8	214.0
H15	Bac Ninh–Ha Long	136	133	2.72	0.00	1,463	1,328	135	0	40	1,502.8	1,618.8
H16	Ninh Binh–Hai Phong–Quang Ninh	160	157	3.20	0.00	1,058	900	158	0	47	1,105.4	1,189.4
H17	Hong Linh–Huong Son	34	33	0.68	0.00	270	237	34	0	10	280.5	302.0
H18	Cam Lo–Lao Bao	70	69	1.40	0.00	629	559	69	0	21	649.3	699.1
H19	Quy Nhon–Pleiku	160	157	3.20	0.00	1,453	1,294	158	0	47	1,499.9	1,615.1
H20	Dau Giay–Da Lat	189	183	3.78	2.00	1,681	1,419	187	75	56	1,736.8	1,871.0
H21	Bien Hoa–Vung Tau	76	74	1.52	0.00	624	549	75	0	22	646.9	696.5
H22	HCMC–Thu Dau Mot–Chon Thanh	69	68	1.38	0.00	904	836	68	0	20	924.7	996.3
H23	HCMC – Moc Bai	55	54	1.10	0.00	365	311	54	0	16	381.5	410.5
H24	Soc Trang–Can Tho–Chau Doc	200	196	4.00	0.00	1,279	1,081	198	0	59	1,338.0	1,439.6
H25	Ha Tien–Rach Gia–Bac Lieu	225	221	4.50	0.00	1,439	1,216	223	0	67	1,505.2	1,619.5
H26	Can Tho–Ca Mau	150	147	3.00	0.00	1,586	1,437	148	0	44	1,630.0	1,755.7
H27	Quang Ngai–Dak To	170	161	3.40	6.00	1,872	1,480	168	224	50	1,922.6	2,073.6
H28	Nha Trang–Da Lat	80	72	1.60	6.00	960	657	79	224	24	983.9	1,062.5
H29	Da Nang–Ngoc Hoi	250	239	5.00	6.00	2,796	2,325	247	224	74	2,870.0	3,094.2
H30	Ring Road No.4 in Ha Noi	90	82	8.00	0.00	1,206	612	593	0	48	1,253.7	1,350.5
H31	Ring Road No.5 in Ha Noi	320	314	6.40	0.00	2,236	1,919	317	0	170	2,405.7	2,583.2
H32	Ring Road No.3 in HCMC	83	76	6.64	0.00	1,095	767	328	0	44	1,139.5	1,226.9
CH01	Cau Gie Ninh Binh	-	-	-	-	-	-	-	-	-	-	452.4[2]
CH02	Danang–Quang Ngai	-	-	-	-	-	-	-	-	-	-	1,048.2[2]
CH03	Phan Thiet–Dau Giay	100	97	0.90	2.40	902	768	45	90	30	931.4	1,003.8
CH04	HCMC–Long Thanh–Dau Giay	-	-	-	-	-	-	-	-	-	-	1,110.8[2]
CH05	HCMC–Trung Luong	-	-	-	-	-	-	-	-	-	-	776.5[2]
CH06	Trung Luong–My Thuan–Can Tho	92	86	6.44	0.00	1,373	1,055	318	0	27	1,400.7	1,510.0
CH07	Lang Son–Bac Giang–Bac Ninh	130	127	2.60	0.00	1,054	926	129	0	38	1,092.6	1,176.3
CH08	Ha Noi–Hai Phong	-	-	-	-	-	-	-	-	-	-	1,441.2[2]
CH09	Ha Noi–Lao Cai	-	-	-	-	-	-	-	-	-	-	1,218.7[2]
CH10	Ha Noi–Thai Nguyen	-	-	-	-	-	-	-	-	-	-	248.2[2]
CH11	Lang–Hoa Lac	-	-	-	-	-	-	-	-	-	-	450.0[2]
CH12	Ha Long–Mong Cai	128	125	2.56	0.00	1,127	1,001	127	0	38	1,165.3	1,254.7

Source: VITRANSS 2 Study Team

Note:

[1] Construction Cost includes Direct Construction Cost, Indirect Construction Cost, Engineering Cost/Project Management Cost/Other Cost, Contingency and Value Added Tax.

[2] Based on the cost estimation by Vietnam Government

6.3 Economic Analysis

Economic evaluation was carried out using the following assumptions:

(i) Each project will be open for service by 2020;

(ii) Evaluation period is 30 years from 2020 to 2049;

(iii) Project cost was newly estimated by the VITRANSS 2 Study Team using the latest cost information, and assumed to be reimbursed 10% by 2016, 30% by 2017, 30% by 2018, and 30% by 2019;

(iv) Annual operating cost would be 5% of project cost;

(v) Toll rate is assumed at US 5 cents/PCU/km after comparison with selected countries; and

(vi) Annual average growth rate of traffic would be 4.9% (the same as the overall growth rate of traffic by 2020 – 2030).

Economic benefits were generated from the savings from vehicle operating cost (VOC) and passenger time cost.

The results of the economic analysis are presented in Table 6.3.1 and Figure 6.3.2. Some of the North-South Expressway sections and sub-urban sections around HCMC show EIRRs of more than 12%. This means that these sections are economically feasible. Other sections, including the HCMC route sections show lower EIRRs.

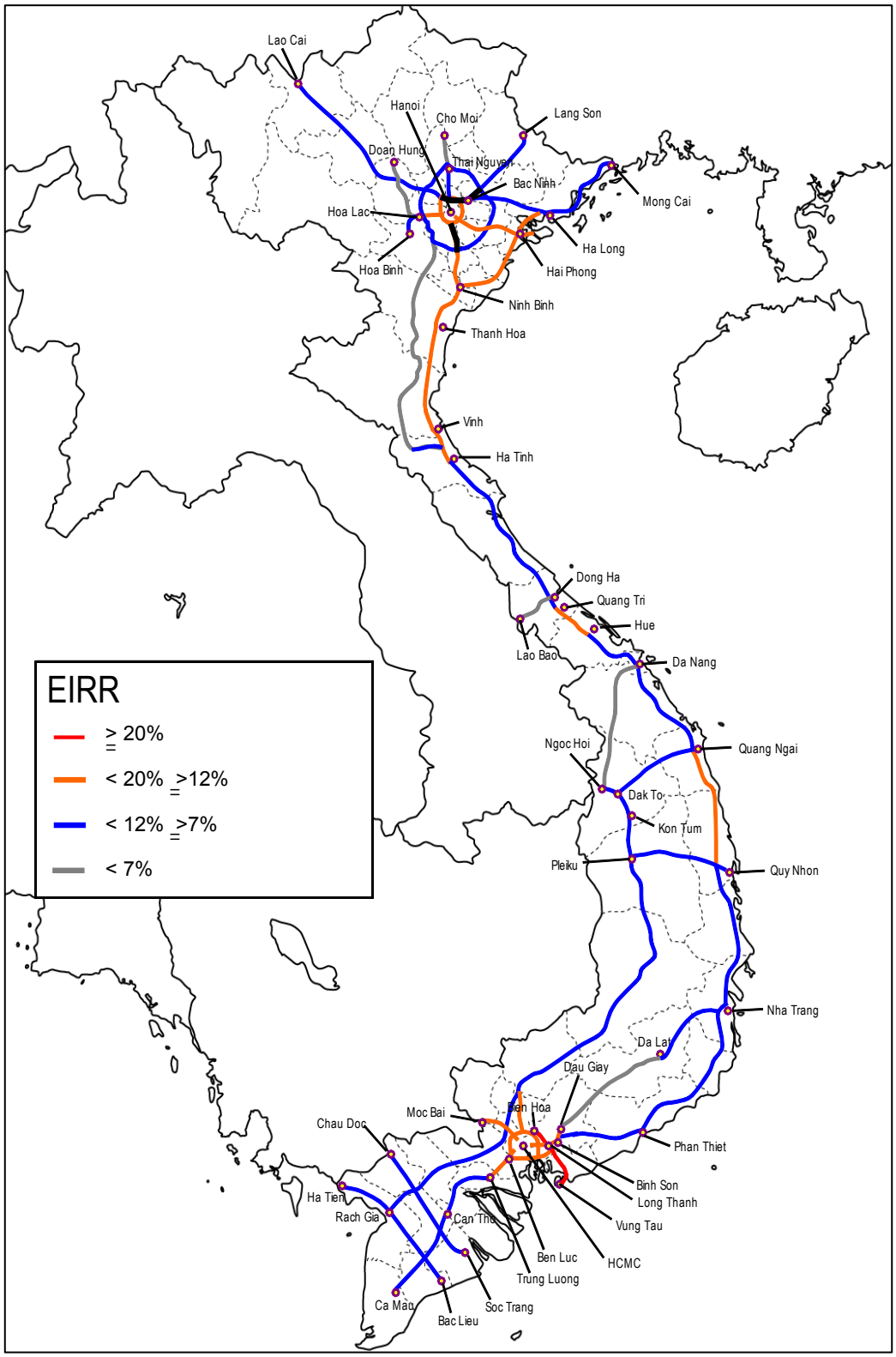
Based on the economic analysis, it is concluded that that the expressway development plan should be trimmed down into a less ambitious and more practical arrangement at least in the short to medium term up to 2020.

Table 6.3.1 Preliminary Economic Evaluation Results of MOT Expressway Projects

Project Code	Section	Distance (km)	V/C Ratio	PCUs (000/day)	Benefit (USD 1000/day)			Benefit (USD 000/day/km)	Economic Cost (USD mil/km)	E-IRR (%)
					VOC	TTC	Total			
H01	Ninh Binh–Thanh Hoa	75	0.66	80.1	61.2	116.5	177.7	2.4	10.2	15.3
H02	Thanh Hoa–Vinh	140	0.47	57.2	0.6	169.2	169.8	1.2	14.1	12.1
H03	Vinh–Ha Tinh	20	0.56	45.7	1.2	30.5	31.6	1.6	9.3	17.0
H04	Ha Tinh–Quang Tri	277	0.47	38.3	7.3	143.2	150.5	0.5	8.8	9.9
H05	Quang Tri–Hue	73	0.51	41.2	4.8	56.2	61.0	0.8	9.1	12.5
H06	Hue–Da Nang	105	0.46	37.5	1.7	86.8	88.5	0.8	15.6	10.3
H07	Quang Ngai–Quy Nhon	150	0.44	35.6	5.4	142.9	148.3	1.0	11.0	10.3
H08	Quy Nhon–Nha Trang	240	0.45	36.4	6.2	156.6	162.8	0.7	13.1	8.9
H09	Nha Trang–Phan Thiet	280	0.29	23.7	22.0	100.2	122.2	0.4	9.6	8.0
H10	Long Thanh–Nhon Trach–Ben Luc	45	0.25	30.2	-24.4	124.4	100.1	2.2	15.2	15.9
H11	Doan Hung–Hoa Lac–Pho Chau	457	0.03	2.4	-34.6	260.5	225.9	0.5	9.8	6.3
H12	Ngoc Hoi–Chon Thanh–Rach Gia	864	0.20	16.0	-12.2	479.5	467.3	0.5	8.6	7.4
H13	Thai Nguyen–Cho Moi	28	0.18	14.7	1.6	10.7	12.3	0.4	8.5	5.8
H14	Hoa Lac–Hoa Binh	26	0.11	8.5	-2.2	13.9	11.7	0.4	7.6	7.3
H15	Bac Ninh–Ha Long	136	0.06	6.8	-25.8	140.1	114.2	0.8	11.1	8.9
H16	Ninh Binh–Hai Phong–Quang Ninh	160	0.15	11.8	-28.3	189.0	160.6	1.0	6.9	13.5
H17	Hong Linh–Huong Son	34	0.06	4.7	-3.0	19.9	17.0	0.5	8.3	7.4
H18	Cam Lo–Lao Bao	70	0.04	2.9	-4.5	30.3	25.8	0.4	9.3	4.9
H19	Quy Nhon–Pleiku	160	0.01	0.6	-35.8	146.8	111.0	0.7	9.4	8.9
H20	Dau Giay– Da Lat	189	0.20	16.0	10.9	69.9	80.7	0.4	9.2	5.2
H21	Bien Hoa–Vung Tau	76	0.61	74.8	38.5	319.5	358.0	4.7	8.5	24.4
H22	HCMC–Thu Dau Mot–Chon Thanh	69	0.36	44.3	-4.4	84.8	80.4	1.2	13.4	12.2
H23	HCMC–Moc Bai	55	0.46	37.1	-10.7	69.9	59.2	1.1	6.9	16.4
H24	Soc Trang–Can Tho–Chau Doc	200	0.04	3.6	-29.3	142.4	113.1	0.6	6.7	9.7
H25	Ha Tien–Rach Gia–Bac Lieu	225	0.03	2.1	-50.4	201.0	150.6	0.7	6.7	10.9
H26	Can Tho–Ca Mau	150	0.27	22.1	-28.3	159.2	131.0	0.9	10.9	9.3
H27	Quang Ngai–Dak To	170	0.00	0.1	-60.7	184.7	124.1	0.7	11.3	8.3
H28	Nha Trang–Da Lat	80	0.31	25.4	1.2	41.0	42.2	0.5	12.3	7.8
H29	Da Nang–Ngoc Hoi	250	0.16	13.3	-1.2	72.9	71.7	0.3	11.5	1.8
H30	Ring Road No.4 in Ha Noi	90	0.06	7.7	-38.4	298.3	259.9	2.9	13.9	14.5
H31	Ring Road No.5 in Ha Noi	320	0.09	10.4	-9.4	262.2	252.7	0.8	7.5	7.9
H32	Ring Road No.3 in HCMC	83	0.39	47.2	-13.8	187.3	173.5	2.1	13.7	13.7
CH01	Cau Gie–Ninh Binh	50	0.60	73.3	46.2	104.3	150.5	3.0	8.1	18.1
CH02	Da Nang–Quang Ngai	131	0.33	39.6	2.3	110.2	112.6	0.9	7.2	11.3
CH03	Phan Thiet–Dau Giiay	100	0.49	39.6	10.5	68.2	78.7	0.8	17.7	11.9
CH04	HCMC–Long Thanh–Dau Giay	55	0.92	74.9	61.6	224.2	285.8	5.2	18.2	15.5
CH05	HCMC- Trung Luong	40	0.84	67.8	22.4	167.4	189.7	4.7	17.5	15.1
CH06	Trung Luong–My Thuan–Can Tho	92	0.32	39.1	-15.3	120.3	105.0	1.1	15.2	11.3
CH07	Lang Son–Bac Giang–Bac Ninh	130	0.03	2.6	-42.1	164.9	122.8	0.9	8.4	11.8
CH08	Ha Noi–Hai Phong	105	0.41	33.7	-27.6	196.3	168.7	1.6	12.4	12.0
CH09	Ha Noi–Lao Cai	264	0.11	9.0	-32.0	208.9	176.9	0.7	4.2	11.7
CH10	Ha Noi–Thai Nguyen	62	0.23	18.7	-1.9	37.8	35.9	0.6	3.6	11.5
CH11	Lang–Hoa Lac	30	0.18	14.7	-18.6	109.5	90.9	3.0	13.5	15.0
CH12	Ha Long–Mong Cai	128	0.10	8.5	-9.0	88.3	79.4	0.6	9.1	8.0

Source: VITRANSS 2 Study Team.
Note: V/C ratio, PCUs and benefit are as of 2030. Urban traffic was taken into consideration for calculating EIRRs (see VITRANSS 2 Final Report Chapter 8)

Figure 6.3.1 Expressway Projects with Estimated EIRRs



Source: VITRANSS 2 Study Team.

6.4 Financial Analysis

Based on the same assumptions made in the economic evaluation, a financial analysis was conducted for the candidate expressway projects. Assumed toll rates for 2030 are USD 0.05, 0.15, and 0.145 per vehicle-kilometer for car, bus, and truck, respectively. These correspond to about 10% of the expected time cost savings of car and bus users. The toll rate of truck was assumed to be the same as that of bus. These rates vary in proportion to the per-capita GRDP estimated for each year.

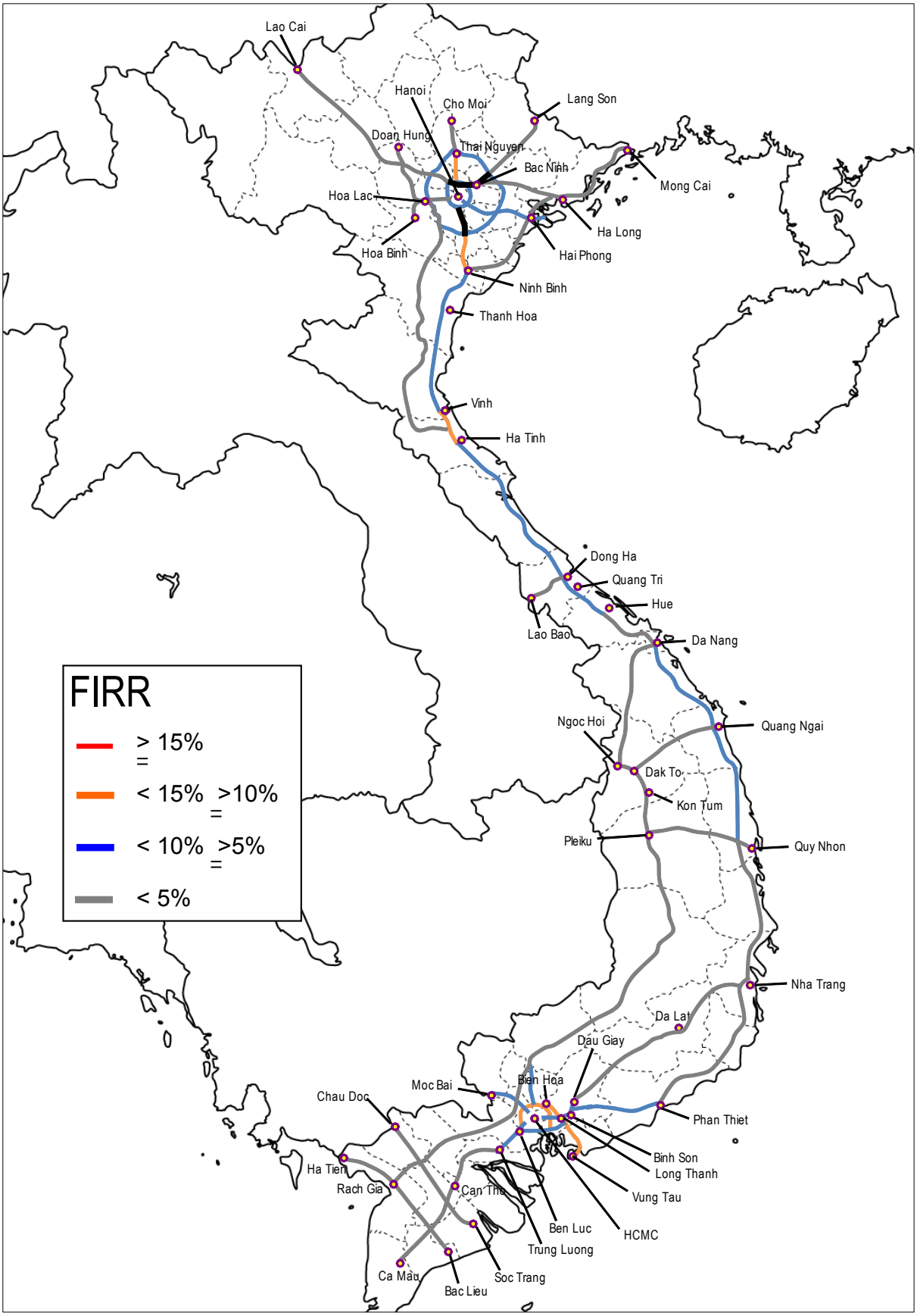
The results are presented in Table 6.4.1 and Figure 6.4.1. There is no project which shows an FIRR of more than 15%, suggesting the difficulty for BOT arrangements. However, there are many projects that could be implemented by PPP scheme, judging from the FIRRs calculated. The further investigation is necessary.

Table 6.4.1 Preliminary Financial Evaluation Results of MOT Expressway Projects

Project Code	Section	Distance (km)	V/C Ratio	No of Vehicles			Project Cost (USD mil/km)	FIRR (%)
				Car	Bus	Truck		
H01	Ninh Binh–Thanh Hoa	75	0.66	8,984	104,241	25,554	11.0	8.3
H02	Thanh Hoa–Vinh	140	0.47	7,748	71,349	17,826	15.2	6.5
H03	Vinh–Ha Tinh	20	0.56	5,772	48,952	14,626	10.1	12.6
H04	Ha Tinh–Quang Tri	277	0.47	4,951	34,684	12,367	9.5	5.2
H05	Quang Tri–Hue	73	0.51	4,905	34,762	13,578	9.8	7.5
H06	Hue–Da Nang	105	0.46	5,038	41,315	11,847	16.9	3.5
H07	Quang Ngai–Quy Nhon	150	0.44	4,537	37,399	11,374	11.9	5.2
H08	Quy Nhon–Nha Trang	240	0.45	4,534	39,688	11,633	14.1	3.9
H09	Nha Trang–Phan Thiet	280	0.29	2,037	17,084	8,180	10.3	2.6
H10	Long Thanh–Nhon Trach–Ben Luc	45	0.25	9,230	109,519	5,354	16.4	5.4
H11	Doan Hung–Hoa Lac–Pho Chau	457	0.03	567	3,898	614	10.5	-
H12	Ngoc Hoi–Chon Thanh–Rach Gia	864	0.20	2,312	22,936	4,850	9.2	1.9
H13	Thai Nguyen–Cho Moi	28	0.18	1,206	16,113	4,955	9.2	1.9
H14	Hoa Lac–Hoa Binh	26	0.11	2,365	13,997	2,082	8.2	-0.6
H15	Bac Ninh–Ha Long	136	0.06	2,046	17,473	1,415	11.9	-2.9
H16	Ninh Binh–Hai Phong–Quang Ninh	160	0.15	2,768	30,044	2,790	7.4	1.0
H17	Hong Linh–Huong Son	34	0.06	1,112	12,070	1,121	8.9	-2.4
H18	Cam Lo–Lao Bao	70	0.04	686	7,446	691	10.0	-
H19	Quy Nhon–Pleiku	160	0.01	310	878	104	10.1	-
H20	Dau Giay–Da Lat	189	0.20	1,291	17,214	5,388	9.9	2.6
H21	Bien Hoa–Vung Tau	76	0.61	17,271	182,910	17,981	9.2	13.4
H22	HCMC–Thu Dau Mot–Chon Thanh	69	0.36	6,483	80,214	12,924	13.4	6.3
H23	HCMC–Moc Bai	55	0.46	9,218	84,862	8,810	7.5	8.2
H24	Soc Trang–Can Tho–Chau Doc	200	0.04	1,314	8,646	694	7.2	-3.2
H25	Ha Tien–Rach Gia–Bac Lieu	225	0.03	1,084	3,919	297	7.2	-
H26	Can Tho–Ca Mau	150	0.27	6,518	49,482	4,848	11.7	2.0
H27	Quang Ngai–Dak To	170	0.00	94	0	0	12.2	-
H28	Nha Trang–Da Lat	80	0.31	2,828	35,979	8,023	13.3	2.5
H29	Da Nang–Ngoc Hoi	250	0.16	2,064	14,507	4,085	12.4	-1.3
H30	Ring Road No.4 in Ha Noi	90	0.06	1,726	14,532	1,982	15.0	8.0
H31	Ring Road No.5 in Ha Noi	320	0.09	1,626	13,989	3,132	8.1	6.3
H32	Ring Road No.3 in HCMC	83	0.39	7,217	98,407	13,270	14.8	10.9
CH01	Cau Gie–Ninh Binh	50	0.60	9,197	105,584	22,729	9.0	12.6
CH02	Da Nang–Quang Ngai	131	0.33	5,272	43,861	12,535	8.0	8.0
CH03	Phan Thiet–Dau Giay	100	0.37	3,090	30,712	10,023	19.1	6.8
CH04	HCMC–Long Thanh–Dau Giay	55	0.92	11,473	155,016	21,085	20.2	8.8
CH05	HCMC–Trung Luong	40	0.84	14,575	174,812	16,481	19.4	8.6
CH06	Trung Luong–My Thuan–Can Tho	92	0.32	8,334	82,955	10,004	16.4	2.8
CH07	Lang Son–Bac Giang–Bac Ninh	130	0.03	1,378	5,887	312	9.0	-3.8
CH08	Ha Noi–Hai Phong	105	0.41	7,587	78,925	8,251	13.7	5.9
CH09	Ha Noi–Lao Cai	264	0.11	2,136	23,826	2,100	4.6	2.6
CH10	Ha Noi–Thai Nguyen	62	0.23	2,923	29,056	5,490	4.0	10.1
CH11	Lang–Hoa Lac	30	0.18	4,061	35,776	3,288	15.0	3.4
CH12	Ha Long–Mong Cai	128	0.10	1,761	12,755	2,347	9.8	0.5

Source: VITRANSS 2 Study Team.
Note: V/C ratio and number of vehicles are as of 2030. Urban traffic was taken into consideration for calculating FIRRs (see VITRANSS 2 Final Report Chapter 8).

Figure 6.4.1 Expressway Projects with Estimated FIRRs



Source: VITRANSS 2 Study Team.

6.5 Strategic Environmental Assessment

A Strategic Environmental Assessment (SEA) was conducted for the North-South Expressway in relation to the overall transport development strategy of VITRANSS 2 up to the year 2030.

The significant environmental and social issues to be considered and the relevant mitigation measures are described below by factor. Most social and environmental issues are quite similar to those of ordinary roads. This project has significant national strategic importance because it links two major urban centers in Vietnam: Hanoi and Ho Chi Minh.

(1) Land Acquisition, Resettlement and Other Social Issues

The North-South Expressway would involve very significant land acquisition and resettlement requirement since it would mostly be constructed on a new alignment on lands with various current uses including agriculture. The expressway development strategy is slated for implementation on intermediate link basis of linking two major nearest urban areas like Danang and Hue. So during the detailed planning and implementation of the relevant intermediate sector of North-South Highway, efforts should be made to select alignment so as to minimize resettlement requirement (in developed areas) and to minimize the requirement of productive agricultural lands (in rural areas). The due process well established in Vietnam that has already been followed with ongoing similar works includes public consultation, RAP (resettlement action plan) formulation, implementation and monitoring along with EIA during detailed project planning and design. The RAP, at the minimum, requires that the quality of life or living conditions of the PAPS do not deteriorate as a result of involuntary resettlement.

Moreover, since the Expressway will be from four up to six to eight lanes on dedicated right-of-way (ROW), it has high potential to cause splitting of communities thereby inconveniencing access to various public facilities and services like schools and hospitals. Accordingly, due cross-accesses across the Expressway, preferably in the form of underneath bypass with ease of access to cross the Expressway, shall be an integral component of project design.

(2) Effect on Ecosystem

There are 129 protected areas in Viet Nam composed of 27 national parks, 60 nature reserves areas, 37 cultural-historical-environmental reservation areas and 5 World Heritage sites. Overlaying protected area in Vietnam with the VITRANSS 2 Expressway network shows that the planned alignments will run through Nature Reserves, National Parks and other cultural-historical-environmental reservation areas (refer to Sub-Sector Report No.7 Environment).

Expropriating at least some portions of the above-mentioned national parks and nature reserves for ROW of the expressway may be inevitable. This may result in split of national parks and nature reserves thereby affecting their functional ecological purpose and value. Hence any inevitable routing of ROW of expressway through these sensitive areas should be planned very carefully with a view of minimizing the length of ROW to the optimum possible extent. Under no circumstance should the ROW bisect right through the middle of such an area and every effort should be made to direct the ROW along or nearby the property boundary of nature reserves and national parks. Moreover, in order to minimize potential interference and safety of fauna (from traffic accidents), underground reserves should be provided. If it is impractical because of certain reasons such as occurrence of

flood then overhead passage across such areas should be provided (but on-grade passage shall not be permitted). These underground or overhead passages protect fauna from accidental risk and minimizes (entirely eliminates in case of underground passage) at least the required land surface area for Expressways.

Table 6.5.1 Nature Reserves, National Parks and Cultural-Historical-Environmental Reservation Areas Located along Expressway Routes

No.	Section	Protection Areas	Classification
I. Primary Arterial Network			
1.	Ha Tinh–Quang Tri	Nui Chung	Cultural-historical-environmental reserve
2.	Hue–Da Nang	Bach Ma	National Park
3.	Hue–Da Nang	Nam Hai Van	Cultural-historical-environmental reserve
4.	Hue–Da Nang	Bac Hai Van	Cultural-historical-environmental reserve
5.	Phan Thiet–Gia Rai	Ta Kou	Nature Reserve
II. Secondary Arterial Network			
1.	Doan Hung–Hoa Lac–Pho Chau	Nui Coc	Nature Reserve
2.	Dong Ha–Lao Bao	Phong Dien	Nature Reserve
3.	Da Nang–Ngoc Hoi	Song Thanh	Nature Reserve
4.	Da Nang–Ngoc Hoi	Ngoc Linh	Nature Reserve
5.	Dak To–Kon Tum	Nam Ca	Proposed protection area

Source: MONRE

(3) Effect due to Natural Disasters of Land Slide and Flooding

All sections of the North-South Expressway pass through flood prone areas due to storm, tidal effect and river inundation except for the Phap Van–Cam Lo and Nha Trang–HCMC sections. The Central Vietnam area and the Cuu Long (Me Kong) Delta in the South are particularly highly flood prone. The topography of the central area from Quang Binh to Ninh Thuan has narrow width and the rivers are short in length with steep slope. Hence the area is susceptible to flash floods. Moreover, Phap Van–Ha Tinh in the North area, which has a big river system, is also flood prone. Considering the fact that that the Expressway will have dedicated ROW (that could be raised to desired level), effective drainage system and non-interference with natural drainage pattern should be incorporated in the design of the Expressway to mitigate the flooding problem.

(4) Ambient Air Quality and Green House Gas Emission

In general, increased future demand for road transportation as a result of economic development will result in increase in both air pollutants and green house gas (CO_2) emissions. The rates of such increase can be controlled with effective road development that minimizes travel distance from origin to destination and controls traffic jams. Effective road development in combination with other more energy efficient transport modes such as improved railway and waterway transportation (as included in the overall transport development strategy of this VITRANSS 2) would optimize and limit the rate of increase of both air pollutants and green house gas emission consequent to increased overall energy efficiency in overall transport, including road transport. In this respect, the North-South Expressway would play a very significant role in minimizing the distance and travel time between the northern and southern parts of Vietnam thereby contributing to increased overall energy efficiency of road transport. This is expected to reduce overall emission of air pollutants and green house gases. This is evident; the maximum scenario that included the entire development of North-South Expressway resulted in lowest emission of both air pollutants and green house gases in road transport.

(5) Effect of Climate Change and Rise in Sea Level

As also noted in the similar Item 6 under road sub-sector of above, according to the Marine Resources and Environment Investigation and Management Department of the Ministry of Natural Resources and Environment, in Vietnam, seawater level due to global warming is predicted to increase in the range of 15 to 90 cm by 2070. In such scenario, the affected areas would include Ca Mau, Kien Giang, Ba Ria–Vung Tau, Thanh Hoa, Nam Dinh, and Thai Binh. Moreover, in the event of worst-case scenario with the rise in seawater up to 1 m, 23% of population will lose their land for living.

The adverse effects of the potential future rise in sea level on road infrastructure are deemed highly significant since road infrastructure, including the North-South Expressway, is also concentrated in the heavily populated lowland coastal regions including Cuu Long (Me Kong) and Red River deltas. These effects on the North-South Expressway could be serious and long-term. As such, it is strongly recommended to set the design criteria to have a minimum base elevation level of more than 1 m above sea level in order to facilitate long-term sustainability of the Expressway that links the northern part to the southern part of Vietnam.

(6) Pollution and Waste Management

No significant long-term water pollution or solid waste management issue and soil pollution is anticipated as a result of the direct vehicle movement on Expressways. Waste management at rest stop stations and restaurants toilets, among others, should be properly planned and implemented to to mitigate potential water (toilet and restaurant wastewater) and solid waste (principally food related waste and its putrefaction effects) pollution. Moreover, during construction of the Expressways, proper management of all solid and liquid wastes arising from construction related activities is very important and should be done with due construction planning and management, integrally in accordance with EHS (environment, health and safety) management and monitoring. This aspect should be dealt with in detail by the relevant EHS management and monitoring of project based Environmental Impact Assessment (EIA).

(7) Expressway Traffic Safety

Traffic safety is a very important issue and the major cause of high accident rate. Lack of awareness among drivers and also pedestrians on traffic rules is still widely prevalent. The importance of traffic safety in expressways does not require over emphasis to ensure its effective and efficient operational use. Lack of traffic safety would evidently lead to expressways to become “death-ways”. Basic safety requirement such as no tailgating, speed limits, proper use of signals during changing of lanes including no frequent changing of lanes for the purpose of just speeding should be strictly observed. Moreover, unauthorized entrance of pedestrians and vendors in the expressways should be strictly enforced. To promote traffic safety, educational campaigns and awareness raising through mass media like radio, TV, training of traffic police and other expressway management personnel are necessary and should continuously be done on a regular basis. Strict enforcement of traffic laws along with high penalty for traffic violations should also be done. In fact, this issue has already been widely recognized and recently a traffic safety improvement master plan was made. Prompt implementation of the plan to enhance traffic safety is very important along with both the expressway and new road development projects so as to fully realize the benefit of socio-economic development.

In the past, the basic road network in Vietnam was built with very narrow ROW. This permitted culturally important structures such as pagodas, churches and public facilities such as schools, post office and cemeteries to be located close to the road edge. Any road improvement project would probably involve road widening as basic requirement, which in turn would have potential adverse effects on historical and cultural relics. Many of these important historical and cultural relics, however, were simply destroyed in the recent past when road development projects, including expressways, were carried out without sufficient regard for the loss of historical and cultural heritage.

In this respect it is very important to take into consideration the minimization of loss of important historical and cultural relics in the planning of expressways alignments. This can be done by selecting alignments to be located away from such important cultural treasures. Sufficient attention should be given in identifying important historical and cultural relics and efforts should be provided, where possible, to relocate important relics elsewhere when such is inevitable for expressway development. Moreover, during construction work, care must be given in areas with potentially high archeological significance. Construction works should not cause any inadvertent destruction of any buried treasures. Construction contractors should be instructed to follow due protocol in carrying out excavation works in areas with potential archeological significance.

(8) Summary: Proposed Mitigation Measures

(a) Land Acquisition

- Selecting alignment that minimizes the impact such as resettlement and acquisition of farm land;
- Planning and implementing appropriate land acquisition plan and resettlement/ rehabilitation plan through public participation;
- Installing grievance mechanism to monitor and address social issues.

(b) Impacts on Natural Ecosystems

Selecting alignment or structure that avoids or minimizes impact on natural ecosystems, especially the section of alignment that passes though the buffer zone of Bach Ma National Park, Phong Dien Natural Reserve and Han Dam ecotourism, flyovers and bridges should be considered in design period.

(c) Landslide and Flooding

Proposed technical mitigation measures in the North-South Expressway will be the same as proposed technical mitigate measures in the road sector.

(d) Economic and Social Conditions

Cultural heritage: Selecting alignment or structure that avoids or minimizes impacts on culturally important sites or sceneries; Aesthetic design of flyovers and bridges.

(e) Air pollution and Greenhouse Gases

Proposed technical mitigation measures in the North-South Expressway will be the same proposed technical mitigation measurements in the road sector.

(f) Noise Pollution and Vibration

For expressways, the following additional solutions may be used:

(i) Building buffer space between transport line and residential area. This solution is popularly applied in constructing high-speed roads and expressways in Japan and other developed countries. The main purpose of this buffer zone is to reduce traffic noise which cause environmental problems in residential areas. The width of the buffer zone is around 10 to 20 m depending on the type of road surface and transport volume. The buffer zone is usually built along main transport roads and expressways with four or more lanes.

(ii) Planting trees and installing noise retaining signs, pavements, and bicycle lines inside buffer zones. The buffer zone is provided to reduce noise and dispersion of transport vehicle emission and restrict vibration transmittance.

6.6 Prioritization of Project Sections

The results of the multi-criteria analysis using the five indices are presented in Table 6.6.1. Basically, projects that earned a score of 5 are considered as Master Plan projects and are targeted to be implemented by 2020. Projects that earned a score of 4 are prioritized to be implemented after 2020.

Table 6.6.1 Comprehensive Evaluation of Expressway Projects

Project Code	Project	Cost (USD Mil.)	EIRR	Demand	Economic	Financial	Network Composition	Natural Environment	Maturity of Plan	Gov't Policy	Overall Evaluation
H01	Ninh Binh–Thanh Hoa Expressway (75 km)	827.6	15.3	5	5	4	5	5	6	3	5
H02	Thanh Hoa–Vinh Expressway (140 km)	2128.0	12.1	5	4	3	5	5	6	3	5
H03	Vinh–Ha Tinh Expressway (20 km)	201.5	17.0	5	5	5	5	5	6	3	5
H04	Ha Tinh–Quang Tri Expressway (277 km)	2641.2	9.9	4	3	3	5	5	3	2	3
H05	Quang Tri–Hue Expressway (73 km)	711.9	12.5	5	4	3	5	5	3	3	4
H06	Hue–Da Nang Expressway (105 km)	1778.0	10.3	4	3	2	5	5	7	3	4
H07	Quang Ngai–Quy Nhon Expressway (150 km)	1787.8	10.3	4	3	3	5	5	6	2	3
H08	Quy Nhon–Nha Trang Expressway (240 km)	3390.1	8.9	4	3	2	5	5	3	2	3
H09	Nha Trang–Phan Thiet Expressway (280 km)	2890.2	8.0	3	3	2	5	5	5	3	3
H10	Long Thanh–Nhon Trach–Ben Luc Expressway (45 km)	738.6	15.9	4	5	3	5	5	8	3	5
H11	Doan Hung–Hoa Lac–Pho Chau Expressway (457 km)	4813.1	6.3	1	3	1	4	5	3	2	2
H13	Thai Nguyen–Cho Moi Expressway (28 km)	256.9	5.8	3	3	2	4	5	3	2	3
H14	Hoa Lac–Hoa Binh Expressway (26 km)	214.0	7.3	2	3	1	4	5	6	2	3
H16	Ninh Binh–Hai Phong–Quang Ninh Expressway (160 km)	1189.4	13.5	3	4	2	4	5	3	2	3
H17	Hong Linh–Huong Son Expressway (34 km)	302.0	7.4	1	3	1	4	5	3	2	2
H18	Cam Lo–Lao Bao Expressway (70 km)	699.1	4.9	1	3	1	4	5	3	2	2
H20	Dau Giay–Da Lat Expressway (189 km)	1871.0	5.2	3	3	2	4	5	6	3	3
H21	Bien Hoa–Vung Tau Expressway (76 km)	696.5	24.4	5	5	5	5	5	7	3	5
H22	HCMC–Thu Dau Mot–Chon Thanh Expressway (69 km)	996.3	12.2	5	4	3	4	5	3	2	4
H23	HCMC–Moc Bai Expressway (55 km)	410.5	16.4	4	5	4	4	5	3	2	4
H24	Soc Trang–Can Tho–Chau Doc Expressway (200 km)	1439.6	9.7	2	3	1	4	5	3	2	2
H25	Ha Tien–Rach Gia–Bac Lieu Expressway (225 km)	1619.5	10.9	1	3	1	4	5	3	2	2
H26	Can Tho–Ca Mau Expressway (150 km)	1755.7	9.3	3	3	2	5	5	3	2	3
H27	Quang Ngai–Dak To Expressway (170 km)	2073.6	8.3	1	3	1	4	5	1	1	1
H28	Nha Trang–Da Lat Expressway (80 km)	1062.5	7.8	2	3	2	4	1	1	1	1
H29	Da Nang–Ngoc Hoi Expressway (250 km)	3094.2	1.8	1	2	1	4	3	1	1	1
H30	Ring Road No.4 in Ha Noi (90 km)	1350.5	14.5	4	4	4	5	5	6	3	5
H31	Ring Road No.5 in Ha Noi (320 km)	2583.2	7.9	2	3	3	5	5	6	1	3
H32	Ring Road No.3 in HCMC (83 km)	1226.9	13.7	5	4	4	5	5	6	3	5

Source: VITRANSS 2 Study Team.

7 IMPLEMENTATION STRATEGIES

7.1 Implementation Schedule

1) Current Implementation Status of the North-South Expressway

At present many sections of the North-South Expressway have been under various stages of development including feasibility study preparation, detailed design, and construction (see Table7.1.1 and Figure 7.1.1). While feasibility studies are currently being prepared or already completed for many sections, the preparation of detailed design is still limited.

Four North-South Expressway sections are considered as committed projects under VITRANSS 2. These are Cau Gie–Ninh Binh, Da Nang–Quang Ngai, Phan Thiet–Dau Giay, HCMC–Long Thanh–Dau Giay, HCMC–Trung Luong, and Trung Luong–My Thuan–Can Tho. Strictly speaking, Phan Thiet–Dau Giay and Trun Luong–My Thuan–Can Tho sections are not financially committed. However, through the discussion with MOT, it was decided that these two projects be added to the list of committed projects because these are already ready for implementation. The Phan Thiet–Gia Giay section was selected by the World Bank as one of its priority projects while the Trung Luong–My Thuan section is being considered by the Vietnam Investment Development Bank for BOT. A request for review of the feasibility study of the My Thuan–Can Tho section is being made by GOV to JICA.

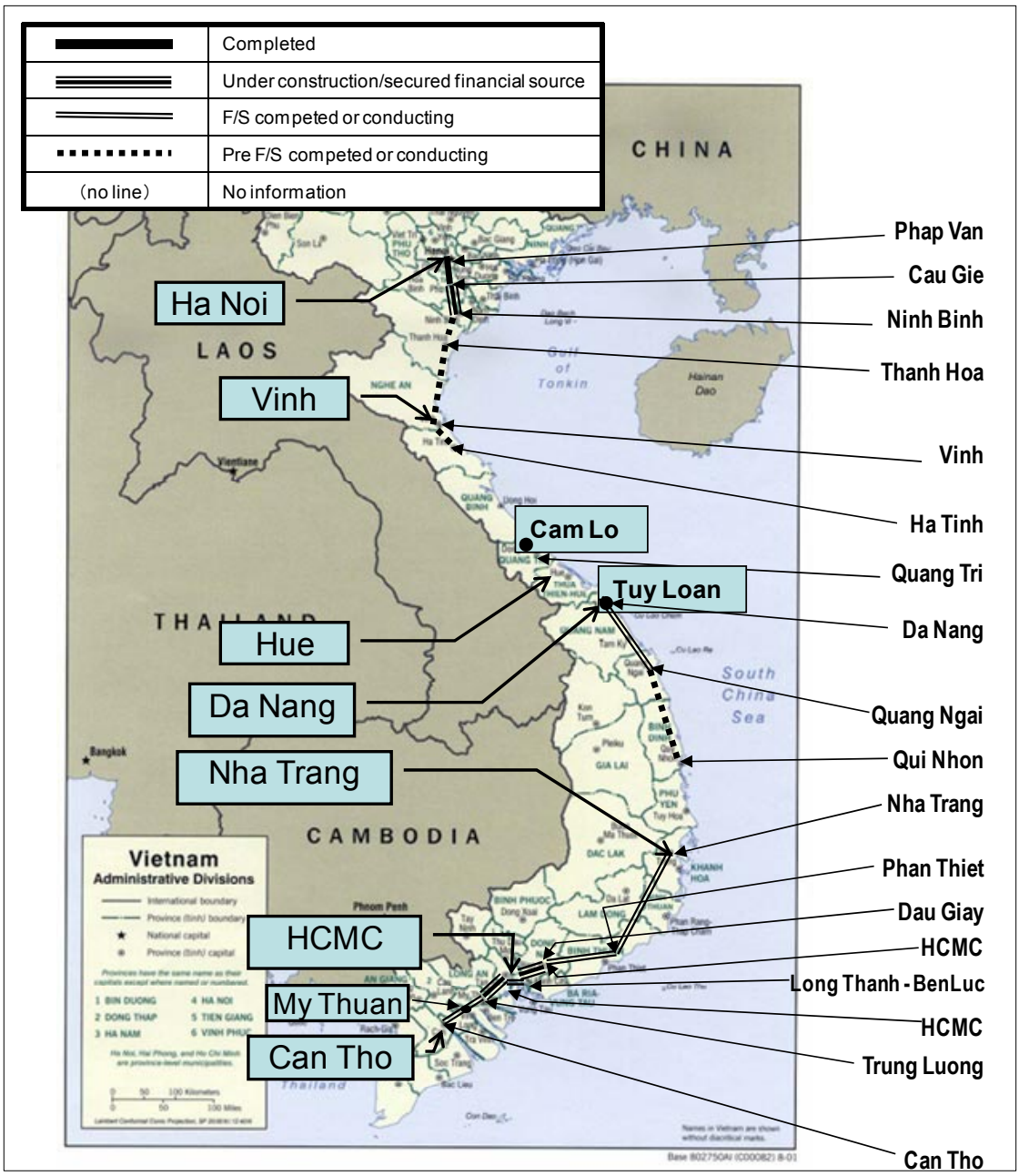
Table 7.1.1 Current Status of the North-South Expressway

Code[1]		Section	Length (km)	Status
NS-Code	VITRANSS 2			
NS01	H30	Ring Road No.4 in Ha Noi	90	F/S is ongoing (by TEDI)
NS02	CH01	Cau Gie–Ninh Binh	50	Under construction
NS03	H01	Ninh Binh–Thanh Hoa	75	F/S implementation (by VNCC) is approved by Prime Minister
NS04	H02	Thanh Hoa–Vinh	140	F/S implementation (by VNCC) is on application process
NS05	H03	Vinh–Ha Tinh	20	Pre F/S is completed (by TEDI)
NS06	H04	Ha Tinh–Quang Tri	277	No information
NS07	H05	Quang Tri–Hue	73	Cam Lo-Tuy Loan section: F/S implementation (by BT company) is on application process.
NS08	H06	Hue–Da Nang	105	
NS09	CH02	Da Nang–Quang Ngai	131	D/D is going to be implemented (by WB) Funding by WB and JICA is expected
NS10	H07	Quang Ngai–Quy Nhon	150	Pre F/S is ongoing (by TEDI)
NS11	H08	Quy Nhon–Nha Trang	240	No information
NS12	H09	Nha Trang–Phan Thiet	280	F/S is ongoing by a local consultant under MOD
NS13	CH03	Phan Thiet–Dau Giay	100	F/S is ongoing (by BITEXCO)
NS14	CH04	HCMC–Long Thanh–Dau Giay	55	D/D is ongoing (by ADB)
NS15	H33	Ring Road No.3 in HCMC	83	F/S is ongoing (by TEDI-S)
NS16	H10	Long Thanh–Nhon Trach–Ben Luc	45	F/S completed (by JETRO), F/S ongoing (by TEDI-S), PPTA Is ongoing (by ADB), D/D is going to be implemented (EOI was submitted by ADB) Funding by ADB and JICA is under consideration
NS17	CH05	HCMC–Trung Luong	40	Under construction
NS18	CH06	Trung Luong–My Thuan–Can Tho	92	F/S is completed (by VIDB) (Trung Luong–My Thuan: BOT by VIDB is expected) (My Thuan–Can Tho: ODA is expected)

Source: Worked out by the study team based on various information

[1] VITRANSS 2 Codes correspond to those in project list

Figure 7.1.1 Current Status of the North-South Expressway



Source: VITRANSS 2 Study Team from various sources

2) Proposed Implementation Schedule

Considering the results of the assessment and prioritization based on multi-criteria analysis (see chapter 6) as well as the current implementation status, VITRANSS 2 proposed an implementation schedule of the Vietnam Expressway network including the North-South Expressway (see Figure 7.1.3 and Table 7.1.2).

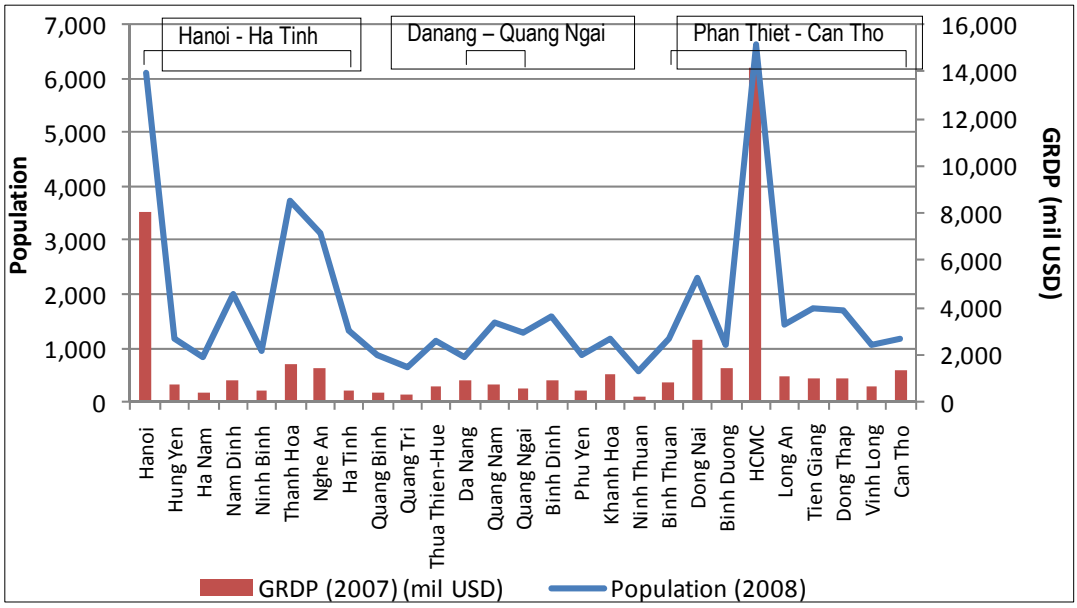
The feasibility of the implementation schedule should take into account some key considerations relating to finance, laws/institutions, environment, and resettlement, among others. The proposed schedule should be able to provide a good step-by-step scheme.

The basic development orientation of the North-South Expressway is summarized as follows:

(i) Construction should be implemented from three regional centers, namely Hanoi, Danang and HCMC in order to connect the entire section smoothly and effectively, and provide high quality service to the areas with higher traffic demand. In addition, considering land acquisition concerns, earlier development of the most urbanized sections is highly recommended. Resettlement issues in urban cities become more tedious through time as evident in the experiences of many developed countries. This orientation is currently being followed.

(ii) Priority sections should be developed by 2020 and the entire section should be completed by 2030. Priority sections consist of Hanoi–Ha Tinh (including Hanoi Ring Road 4), Danang–Quang Ngai and Phan Thiet–HCMC–Can Tho (including HCMC Ring Road 3). These sections have relatively higher population, larger economic base and more extensive urban areas (see Figure 7.1.2).

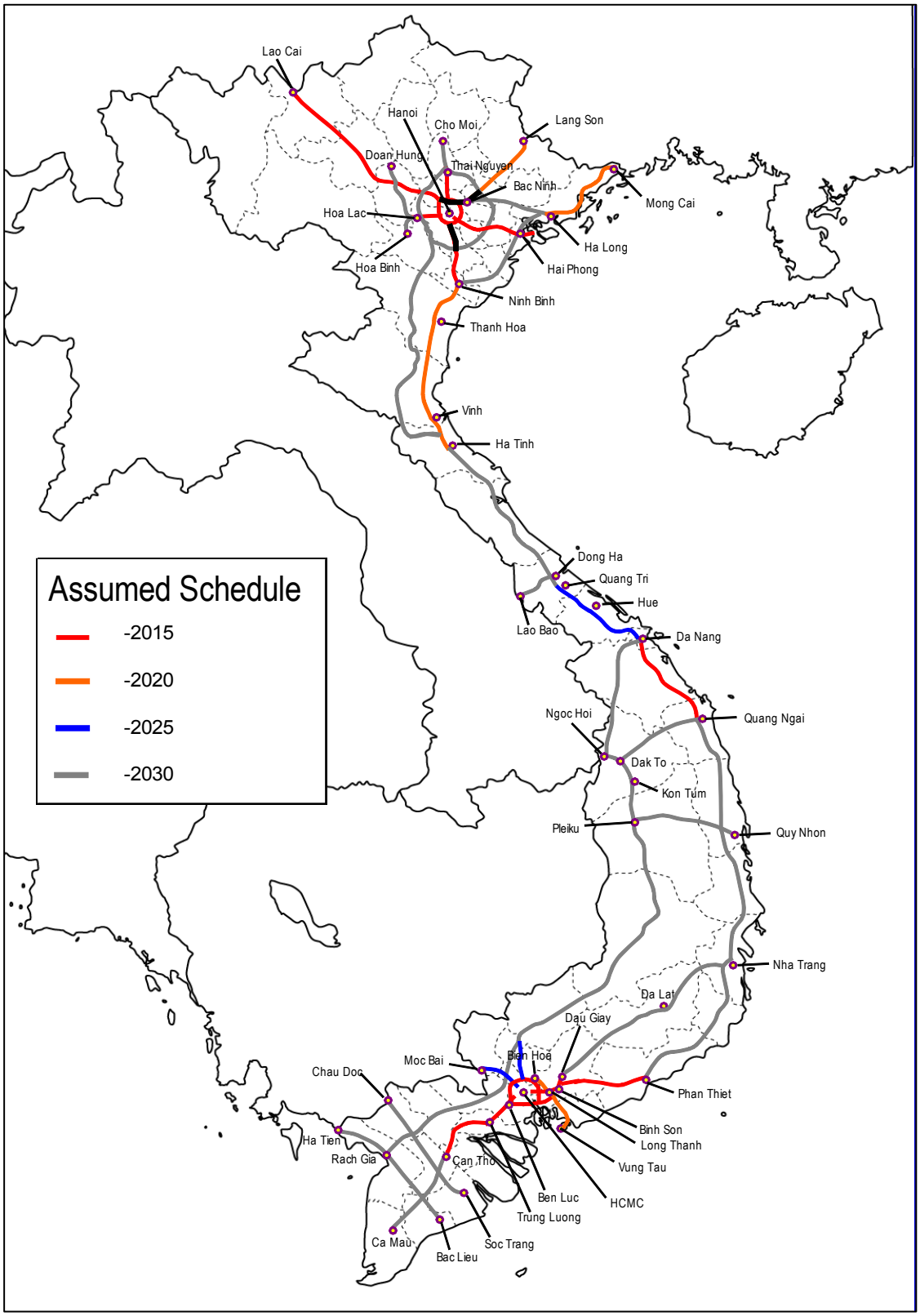
Figure 7.1.2 Socio-economic Profile of Provinces Located along the North-South Expressway



Source: VITRANSS 2 Study Team

(iii) The development of other sections should be coordinated with the North-South Expressway. Sections on two international gateway corridors (Hanoi–Hai Phong & Bien Hoa–Vung Tau) have high priority and early construction of these is desirable. On the other hand, construction of sections on land cross-border corridors has to consider international transport development coordination such as Asian Highway Network.

Figure 7.1.3 Implementation Schedule of Vietnam Expressway Network



Source: VITRANSS 2 Study Team

Table 7.1.2 Implementation Schedule of Vietnam Expressway Network

Code	Project	km	Cost (mil. USD)	Evaluation	Schedule		
					2011-2020	2020-2030	Original Schedul
CH01	Cau Gie – Ninh Binh Expressway (50km)	50	452.4	-			06-10
CH02	Da Nang – Quang Ngai Expressway (131km)	131	1048.2	-			-20
CH03	Phan Thiet – Dau Giay Expressway (100km)	100	1003.8	-			-15
CH04	HCMC – Long Thanh – Dau Giay Expressway (55km)	55	1110.8	-			08-12
CH05	HCMC- Trung Luong Expressway (40km)	40	776.5	-			04-09
CH06	Trung Luong – My Thuan – Can Tho Expressway (92km)	92	1510.0	-			-10
CH07	Lang Son – Bac Giang – Bac Ninh Expressway (130km)	130	1176.3	-			11-14
CH08	Ha Noi – Hai Phong Expressway (105km)	105	1441.2	-			08-11
CH09	Ha Noi – Lao Cai Expressway (264km)	264	1218.7	-			09-12
CH10	Ha Noi – Thai Nguyen Expressway (62km)	62	248.2	-			05-10
CH11	Lang – Hoa Lac Expressway (30km)	30	450.0	-			06-09
CH12	Ha Long – Mong Cai Expressway (128km)	128	1254.7	-			12-15
H01	Ninh Binh – Thanh Hoa Expressway (75km)	75	827.6	5			-20
H02	Thanh Hoa – Vinh Expressway (140km)	140	2128.0	5			-20
H03	Vinh – Ha Tinh Expressway (20km)	20	201.5	5			-20
H04	Ha Tinh – Quang Tri Expressway (277km)	277	2641.2	3			-20
H05	Quang Tri – Hue Expressway (73km)	73	711.9	4			-20
H06	Hue – Da Nang Expressway (105km)	105	1778.0	4			-20
H07	Quang Ngai – Quy Nhon Expressway (150km)	150	1787.8	3			-20
H08	Quy Nhon – Nha Trang Expressway (240km)	240	3390.1	3			20-
H09	Nha Trang – Phan Thiet Expressway (280km)	280	2890.2	3			20-
H10	Long Thanh – Nhon Trach – Ben Luc Expressway (45km)	45	738.6	5			-20
H11	Doan Hung – Hoa Lac – Pho Chau Expressway (457km)	457	4813.1	2			20-
H12	Ngoc Hoi – Chon Thanh – Rach Gia Expressway (864km)	864	7974.4	3			20-
H13	Thai Nguyen – Cho Moi Expressway (28km)	28	256.9	3			20-
H14	Hoa Lac – Hoa Binh Expressway (26km)	26	214.0	3			20-
H15	Bac Ninh – Ha Long Expressway (136km)	136	1618.8	3			-20
H16	Ninh Binh – Hai Phong – Quang Ninh Expressway (160km)	160	1189.4	3			20-
H17	Hong Linh – Huong Son Expressway (34km)	34	302.0	2			20-
H18	Cam Lo – Lao Bao Expressway (70km)	70	699.1	2			20-
H19	Quy Nhon – Pleiku Expressway (160km)	160	1615.1	2			20-
H20	Dau Giay – Da Lat Expressway (189km)	189	1871.0	3			20
H21	Bien Hoa – Vung Tau Expressway (76km)	76	696.5	5			-20
H22	HCMC – Thu Dau Mot – Chon Thanh Expressway (69km)	69	996.3	4			-
H23	HCMC – Moc Bai Expressway (55km)	55	410.5	4			-
H24	Soc Trang – Can Tho – Chau Doc Expreesway (200km)	200	1439.6	2			20-
H25	Ha Tien – Rach Gia – Bac Lieu Expressway (225km)	225	1619.5	2			20-
H27	Quang Ngai – Dak To Expressway (170km)	170	2073.6	1			-
H28	Nha Trang – Da Lat Expressway (80km)	80	1062.5	1			-
H29	Da Nang – Ngoc Hoi Expressway (250km)	250	3094.2	1			-
H30	Ring Road No.4 in Ha Noi (90km)	90	1350.5	5			-
H31	Ring Road No.5 in Ha Noi (320km)	320	2583.2	3			-
H32	Ring Road No.3 in HCMC (83km)	83	1226.9	5			-20
Total Cost up to 2020 (Master Plan) (mil. USD)			19927.2				

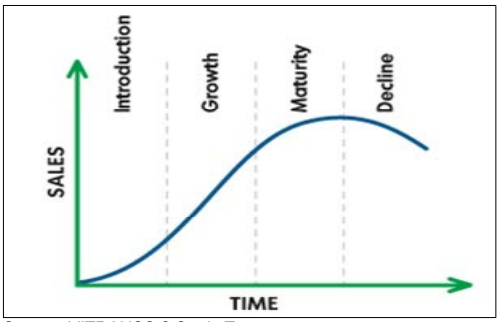
Source: VITRANSS 2 Study Team
Note: The projects with blue color are part of North-South Expressway

7.2 General Strategy based on Market Development Phase

1) Development Phase of Market Growth

Figure 7.2.1 illustrates a typical phasing of market growth or product life cycle. Growth of expressway network in Vietnam could be defined as a growth of expressway service market. The characteristics of each phase vary as the required expertise and resources also vary for the development each phase.

Figure 7.2.1 Development Phase of Market Growth



Source: VITRANSS 2 Study Team

2) General Strategy for Each Phase

The period up to 2030 could be defined as the Introduction and Growth phases as described in Table 7.2.1. The general strategy should be formulated based on the different characteristics of each phase of the expressway network development as described in the table below.

Table 7.2.1 General Strategy for Each Phase

Phase	Start Up	Growth	Mature
1. Characteristics	Present–2020	2021–2030	2031 onward
(1) Market Growth	• Small size and slow ramp up	• Rapid expansion • Start good recognition by users	• Growth stabilizes
(2) Organization	• Partial and not experienced	• Expansion of expressway management organization	• Full size organization for both expressway and non-expressway business
(3) Key Expertise	• Construction management and operation with good service quality	• Capacity to cope with rapid expansion • Expertise on development of non-expressway business	• Total management of expressway network and its efficiency
(4) Competition	• Competition and alliance among VEC, private and PMUs	• Leader share will be established	• Monopolization of the market • Privatization of the market
(5) Profitability	• Low due to slow ramp up of traffic	• Low due to heavy investment requirement	• High due to mature growth of traffic and network effect • High profitability may be undermined by development of unprofitable sections
2. General Strategy	• Concentrate on good construction management and rapid learning of O&M expertise • Proactive proposals and efficient financing on development of priority sections • Utilize concessional finances and fill the gap of financial viability for marginally profitable sections	• Construct efficient capacity to cope with the rapid expansion • Establish leader share and network manager in the market • Establish non- expressway business	• Efficient manager of total expressway network system • Recover the past investment • Initial public offering based on regional expressway service companies

Source: VITRANSS 2 Study Team

The general implementation strategy based on the market development phase should include the following:

(i) Utilizing low cost and long term concessional finance as much as possible for the development of expressway network until the country's per capita income would reach the threshold graduation level for concessional financing.

(ii) Establishing a strong network development and management system for the formation of total expressway network in order to materialize the aggressive network development plan.

(iii) Filling financial viability gaps by extending public funding support to improve the viability of marginally profitable sections and at the same time leverage various resources of the private sector.

(iv) Establishing independent and efficient market-based expressway service providers on a regional basis.

7.3 Funding Strategies

1) Investment Requirement

The North-South Expressway master plan proposes the development of 6,334 km of expressway network by 2030. Nineteen percent (19%) of which is already committed and 81% is being planned. The investment requirements for the development of the entire expressway network are approximately US$66 billion. Around US$12 billion (18% of the total investment requirements) already have committed funding sources. The remaining US$54 billion should be procured from various financing sources in order to materialize the development of North-South Expressway Network.

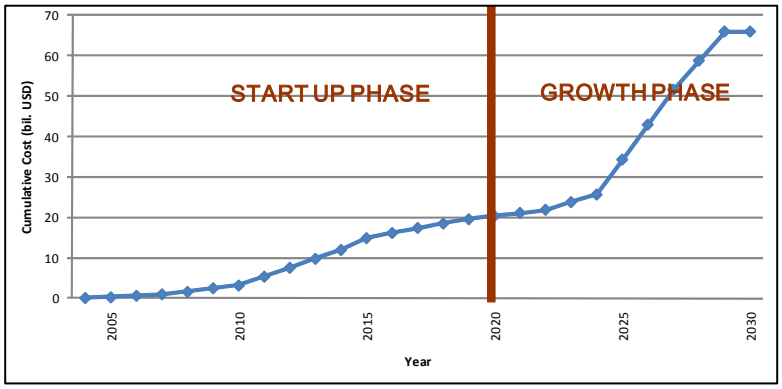
Table 7.3.1 Investment Requirement up to 2030

Status	Length (km)		Investment (US$ million)	
1. Committed Sections	1,187	19%	11,691	18%
2. Planned Sections	5,147	81%	54,202	82%
Total	6,334	100%	65,893	100%

Source: VITRANSS 2 Study Team

Figure 7.3.1 shows the cumulative investment requirements over the next 20 years based on the proposed development schedule of the North-South Expressway master plan. Around US$11.7 billion is already committed. This is expected to gradually reach US$25.0 billion in the next 15 years with an average annual increment of about US$1.0 billion.

Figure 7.3.1 Cumulative Investment Requirement



Source: VITRANSS 2 Study Team

2) Available Funding Sources

(1) General Assessment of Available Budget Envelop

An assessment of availability of public funding including ODA funds for the entire transport sector was assessed under VITRANSS 2. Assuming medium economic growth scenario, it was confirmed that the budget envelop would be sufficient to cover both the capital and recurrent expenditures of the VITRANSS 2 proposal up to 2020. The said assessment included the investment requirements of the road sector. Therefore, the available budget envelop, in general, would be able to cover the investment requirements for the development of North-South Expressway Network.

However, the availability of various funding sources should be further assessed in order to identify potential problems and constraints, and come up with appropriate funding strategy.

(2) Availability of Various Funding Sources

(a) **State Budget cannot be a Major Source of Funding:** In general, the average annual investment of GOV for the road sector is approximately US$0.6 billion while the average annual investment requirement of the North-South Expressway master plan of VITRANSS 2 is around US$1.0 to 2.0 billion up to 2020. This figure is two to three times as much as the past envelop of GOV for the entire road sector. The state budget available (state budget and state credit combined exclusive of ODA and bond issue) for MOT in transportation sector from 2001 to 2005 averaged US$0.32 billion annually (40% of the total investment). It is clear that state budget alone is not sufficient to finance the annual requirement of the North-South Expressway master plan.

(b) **Private Money cannot be a Major Financing Source:** Private money could only contribute a small portion (3.1% of the 2001–2005 transport sector investment) since it would take a long time, possibly more than a decade, to establish a proper institutional, legal and regulatory framework that provides for large volume of private sector investment in infrastructure development. It would also take time to build up successful track record to facilitate financial closure of project financing.

(c) **Bond Issue cannot be a Major Means to Finance Expressway development:** Bond issuance (27% of the 2001–2005 transport sector investment) may not be a promising source of funding since interest level and maturity are heavily regulated by the Ministry of Finance (MOF).

(d) **GOV Needs to Leverage the use of ODA Funding for Expressway Development:** ODA can be a major source of financing for the expressway development in terms of both cost and volume (25% of the 2001–2005 transport sector investment). GOV, however, will need to leverage ODA funding because there is a certain threshold level of per capita income for GOV to enjoy the privilege of donor soft loan and the per capita income level of Vietnam is likely to exceed this threshold level in the next 10 years.

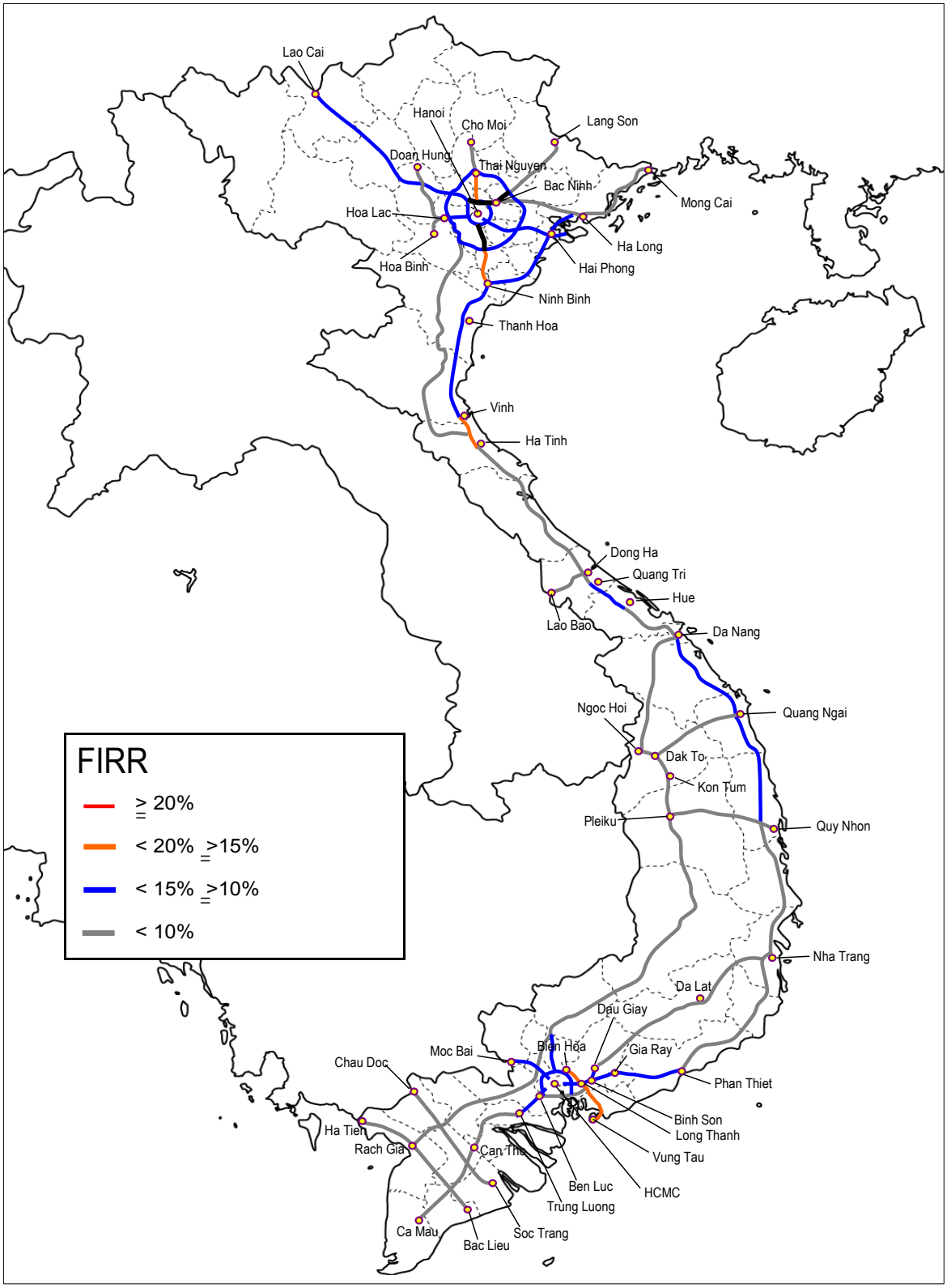
3) Financing Issues

The following issues should be considered in formulating the funding strategy for the North-South Expressway Master Plan of VITRANSS 2:

(a) Only a Few Expressway Sections could Self-finance its Initial Investment through Toll Revenues

Based on the financial evaluation of each section of the North-South Expressway only five (5) sections have exceeded the FIRR of 15%. This means that majority of the North-South Expressway network development will need some sort of public support. If the general rule regarding the degree of viability gap support by GOV is set at less than 50% of the total investment cost, the number of sections which may be financially feasible under the PPP format would become very small and would leave a majority of the expressway sections to be developed through public funding with some of them to be bid out for an O&M concession after completion.

Figure 7.3.2 FIRR of Each Section of the North-South Expressway Network



Source: VITRANSS 2 Study Team

This issue of financial viability is closely related to the problem which the Vietnam Expressway Corporation (VEC) is currently facing. The VEC is obliged to self-finance the development and operation of the sections with the privilege of utilizing ODA funds and proceeds from government guaranteed bonds. However, it is apparent that some of the

sections would need viability gap funding support from GOV in the initial investment. But, on the contrary, VEC is obliged to make full repayment of the ODA loan which VEC uses for construction of expressway sections. It is very likely that if this full repayment obligation rule continues VEC would face financial difficulty in the near future.

(b) Further Facilitation of Private Sector Participation, especially of Experienced International Players, in Financing the Development of Expressways is Necessary

The private sector needs firm commitment from the GOV for the implementation of public-private partnerships (PPP) and the establishment of a transparent investment and market environment and framework. These will help in making private investment profitable, robust and foreseeable. An enabling environment for PPPs has not yet been materialized in Vietnam. Thus the contribution of the private sector particularly by experienced international players remains limited. To promote a better environment for greater private sector participation, the GOV with the concerted efforts of the Ministry of Planning and Investment (MPI) and the World Bank, has started the formulation of a financing framework for PPP projects in Vietnam with viability gap financing mechanisms

(c) Need to Facilitate Fund Procurement from the Capital Market

Considering the country's low credit rating, the depth of fund procurement from the international capital market may not be expected, however GOV could improve the conditions at bond issue including enhancement of creditworthiness of the bond issuers.

(d) Need to Leverage Utilization of ODA Fund for the Development of Expressways with PPP

Although ODA funding can be a suitable source of financing for expressway development, its availability is limited in terms of country's borrowing limit and competition for funds with other sectors. Therefore, GOV needs to leverage its utilization of ODA funding by integrating it with PPP format. The effect of utilizing ODA funding could be leveraged in multi-fold.

(e) Need to Promote user Pay Principle and Earmarking of Funds for the Development of Expressways

The National Assembly recently passed the Road Traffic Law (resolution Nr. 23/2008/QH 12), which became effective in July 2009. The law establishes a road maintenance fund consisting of road user charges and supplemented by annual budget allocations. The law also instructs the government to decide on specific sources of the funds. An inter-agency group, headed by an MOT Vice Minister, is formulating the detailed content of the fund including the fund sources and utilization. This approach should be expanded to secure funding for the development of expressways.

4) Funding Strategies

Only a few expressway sections of the North-South Expressway master plan can recover initial investment through toll revenue. Majority of the network needs to be developed by using public funding and partially by utilizing private sector funds.

(1) Leveraging ODA Funding

Thus far, the VEC was able to mobilize US$2,065 million of ODA and International Finance Institution (IFI) funding for the development of several sections of the expressway.

In order to leverage ODA funding, the VEC should concession out the O&M of the completed section financed by ODA to potential investors. This will help the VEC to recoup a part of the initial cost of construction through the upfront concession fee payment of the concessionaire.

Another option is to use ODA funds to construct the VEC portion of expressway while the private investor will construct other portions and let them operate and maintain the entire section of the expressway. This is called PPP option. The VEC could enjoy a revenue sharing with the PPP concessionaire to repay the ODA loan which is on-lent to VEC through the MOF. However, as described earlier, very few sections are financially sustainable such that the VEC and/or the concessionaire would need viability gap funding support from the GOV. Funding support is needed by the VEC in order for it to avoid the risk of bankruptcy and obtain robust financial viability.

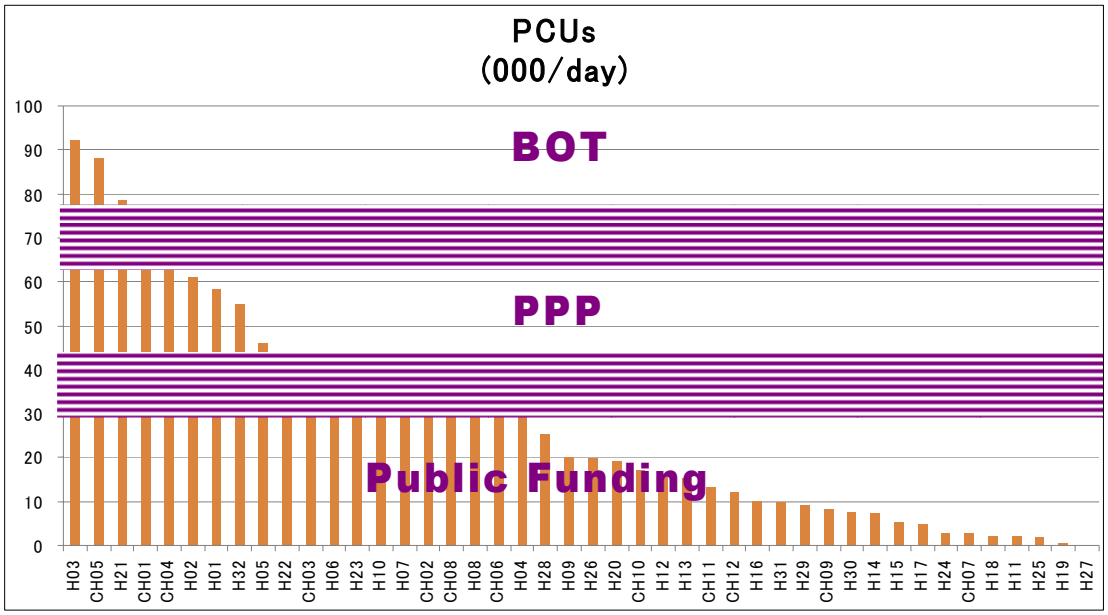
(2) Creating a Mechanism for GOV to Extend Support to the VEC

Based on the results of the cash flow analysis conducted, majority of the expressway sections are not financially sustainable including some sections already assigned to the VEC for development. This would seem more obvious when the expressway network development approaches the final stage such as the development of the west side of North-South Route and of Central Region. If the VEC continues its business with the current premise of “VEC is to finance everything”, then the VEC will likely face the risk of huge debt accumulation and bankruptcy. It could face a situation similar to that of the Japan Public Highway Corporation (JH, the former entity of three privatized NEXCOs in Japan) in the later stage of expressway network development.

Therefore, when required, the VEC should have a mechanism in which GOV could extend its financial support to VEC as stipulated in the Prime Minister Decision No.1202/QD-TTg.

Figure 7.3.3 shows forecast traffic level for each section of the expressway network by type of possible funding. The level of forecast traffic (PCUs/day) directly relates to the level of revenue, therefore, relates also to suitable financing modality for each section.

Figure 7.3.3 Traffic Forecast for Each Section by Type of Funding



Source: VITRANSS 2 Study Team

(3) Detaching Repayment Obligation for ODA Funding from the VEC

Currently, the VEC has signed on-lending agreement with the MOF regarding the loans with the Asian Development Bank (ADB) and Japan International Cooperation Agency (JICA) in which VEC's repayment obligation is based on with the original loan agreement. This means that VEC would need to repay everything. In future on-lending for the sections with low financial viability and for some PPP options, the VEC should detach or reduce its repayment obligation as currently practiced so as to avoid the risk of bankruptcy. Details of institutional improvement of the VEC will be further discussed in the next section.

(4) Establishing a Mechanism for Viability Gap Funding Support by GOV using ODA Fund

As discussed in the earlier section, GOV is now preparing the PPP Financing Framework to cope with the financial viability gap issue of the potentially profitable expressway sections. A mechanism should be established to use ODA funds as viability gap funding for implementing a PPP option for expressway sections with marginal financial viability. This will facilitate participation of both private sector and public entities.

(5) Contingent Financial Support Mechanism by GOV

Besides the financial support for individual project, the VEC may need a mechanism and/or legal arrangement for contingent financial support from the GOV if the VEC faces sudden and considerable fund shortage during its operation. Equity injection by GOV as practiced by Japan Public Highway Corporation could be one option. Extending ordinary or subordinated government loan could be another option.

7.4 Institutional and Organizational Issues

1) Current Status – Expressway Administration

(1) Expressway Master Plan

The master plan of Vietnam Expressway network by 2020 and the vision after 2020 was approved by Prime Minister Decision No. 1734 /QD-TTg, December 1st, 2008. In the plan a total of 5,873 km of expressway network should be developed with 22 routes (39 sections). Out of this, the master plan targets to develop 2,235 km by 2020 and the rest of 3,638 km after 2020.

In the approval process of this master plan, the name of VRA was mentioned in the draft Decision as an administrator for expressway development. However, the final Decision states as follows:

(i) The high priority is given to the North-South routes which links big cities (Hanoi–Da Nang–HCMC), and routes that connect with some main sea ports.

(ii) Mechanism to mobilize investment budget are as follows:

- State budget under the form of government loans or government guarantee for investment loan from donors, issuing construction bonds, etc.
- Budget arranged by investors themselves under the PPP forms of BOT, Build-Transfer-Operate (BTO), Build-Transfer (BT), or state and private sector cooperation, etc.

(iii) In cooperation with the MPI and MOF, the MOT will prepare a good mechanism to mobilize budget for expressway development with inclination of encouraging all internal and external economic sectors' involvement in expressway investment.

(iv) MOT will be the organization which will manage and monitor the investment, construction and operation of the entire expressway network.

(v) MOT will also take responsibility in establishing a suitable model for management of investment, construction, operation and exploitation of the whole expressway network. MOT will also give support for the development of VEC to become a leading firm in investment and development of expressways in Vietnam.

In summary, a role of VRA (GRA) with regards to expressway was not clearly defined and MOT is defined as a responsible general administrator of expressway in all aspects. The VEC was identified to be the leading firm in investment and development of expressway in Vietnam. Therefore, the governmental agency responsible for administration of expressway sector is still not clear.

(2) Major Stakeholders of the Expressway

The major stakeholders of the Expressway are as follows:

(a) **Policy Makers:** MOT with MPI for investment license, MOF for approval of toll rate and Local Governments for implementer of land acquisition and at the same time grantor of investment license for small projects.

(b) **Administrator/Regulator:** Currently MOT but there is a proposal on establishing Vietnam Expressway Administration which shall function as the administrator/regulator for the expressway market. Toll rate is regulated by MOF.

(c) **Investors for Expressway Development:** within the legal framework of the Expressway Master Plan anybody could become an investor of expressway development as far as the investment approval is obtained. Currently there are investors which utilize public funding such as VEC, Project Management Unit (PMU) My Thuan and other PMUs, and the investors such as VINACONEX, VIDIFI, IDICO-BIDV-Song Da which uses financial resources of its own mobilization.

(d) **Contractors:** Most of the large Vietnamese contractors and construction enterprises are currently active in forging joint ventures with Chinese and Korean contractors. Other foreign players have also participated in the bidding.

(e) **Financiers:** Vietnamese commercial banks such as BIDV, VDB, VCB, INCOM Bank, Agribank are active. No foreign commercial banks are active so far.

(f) **Donors:** ADB, JICA and the World Bank are major fund providers for the on-going expressway developments.

(g) **Consultants:** Most international consulting firms including those of Japan together with large domestic consulting and design firms are active in supporting the investors.

(3) Current Institutional Landscape in the Road Sector

Current institutional landscape and comparison between general road and expressway are summarized in Table 7.4.1. As of now, planning and policy making and technical regulation for the administration of expressway are not clear.

Table 7.4.1 Current Institutional Landscape in the Road Sector

	Roads	Expressways
A Planning and Policy		
- Multimodal	MOT	MOT
- Sectoral	Vietnam General Road Administration (GVRA), reports to MOT	MOT in general but not clear for Expressway
B1 Regulation: Technical		
- Safety, Standards, etc	GVRA	GVRA in general but not clear for Expressway, for O&M very limited standards is existing
- Licensing	Drivers licensing by Traffic Police	Drivers licensing by Traffic Police
- Registration Inspection	Motor vehicles registered by Traffic Police; Vehicle Inspection: VR, Traffic enforcement: GVRA	Motor vehicles registered by Traffic Police; Vehicle Inspection: VR, Traffic enforcement: GVRA
B2 Regulation: Economic		
- Entry & Competition	Transport Business on Road: PDOT and TUPWS of company registration (Bus and freight service, for cross border service: MOT) Toll Road Business: MOT in general but for concessioning: MOT, GVRA, VEC and PPC (PDOT and TUPWS) for PH and DH	Transport Business on Road: PDOT and TUPWS of company registration (Bus and freight service, for cross border service: MOT) Toll Road Business: MOT in general but for concessioning: MOT, GVRA, VEC and PPC (PDOT and TUPWS) for PH and DH
- Pricing	Fares on public transport set by respective Peoples Committees (PCs) Toll Rate: MOF	Fares on public transport set by respective Peoples Committees (PCs) Toll Rate: MOF
C Program Management		
- Investment and maintenance annual planning	MOT, MPI, MOF (by Government Budget) MOT is authorized Government Agency (for PPP)	MOT, MPI, MOF (by Government Budget) MOT is authorized Government Agency (for PPP)
D1 Infrastructure Delivery		
- Construction	PMU's under MOT and under GVRA (excl. expressways & local roads), Other Tender Winners	Awarding contractors under Expressway Owners including Concessionaires
- Maintenance	GVRA (excl. expressways & local roads)	Contractors under Expressway Owners including Concessionaires
- Concessioning (Issuer)	Authorized State Agencies (ASA): MOT, GVRA, Vietnam Expressway Corp. (VEC) and PPC (PDOT and TUPWS)	Authorized State Agencies (ASA): MOT, GVRA, Vietnam Expressway Corp. (VEC) and PPC (PDOT and TUPWS)
D2 Service Delivery		
- Carriers	Bus operators owned by LGU's, cooperatives, private companies	Bus operators owned by LGU's, cooperatives, private companies
- Public Users	Private cars, trucks, motorbikes	Private cars, trucks, motorbikes
Basic Law	Land Road Traffic Law 23/2008/QH12	Land Road Traffic Law 23/2008/QH12
Enforcement	Road Traffic Polices and Transport Inspectors of GVRA	Road Traffic Polices and Transport Inspectors of GVRA or others if any

Source: JICA Study Team

2) Current Status of PPPs

In the cooperation program between the GOV (MPI and MOF) and the World Bank with regards to the study on the Public-Private Partnership Program in Vietnam, the preparation of a PPP financing framework is now underway. In the Urban and Infrastructure Department of MPI, the PPP Program Development Office has been established to lead the Program with staff from MPI, MOF and sector agencies.

A draft PPP financing framework with (i) detailed administrative rules, procedures and guidance required to implement PPPs, and (ii) transparent Viability Gap Funding Mechanism (VGFM) to provide financial support to make well-prepared PPPs financially viable, has been presented in November 2009 to the major stakeholders for comments. Formal submission of the PPP financing framework to the GOV is scheduled by March 2010 for the Prime Minister's decision by September 2010.

Simultaneous preparation of selected pilot PPP project for competitive bidding through World Bank lending operation in 2010 is in progress to test the workability of the proposed PPP financing framework. This involves involve the following[1]:

(i) International Development Assistance resources to finance VGFM and support GOV in the management and development of PPP Program and pipeline
(ii) International Bank for Reconstruction and Development to provide long-term debt to private investors
(iii) International Finance Corporation as co-investor, assisting in preparing pilot PPP to international standards, establishing corporate governance structure of SPV
(iv) Hiring of advisors to assist MPI and MOT in processing pilot PPP
(v) Skills enhancement and training of GOV staff by World Bank in partnership with the Government of Singapore

3) Issues

The following are the critical organizational and institutional issues relating to the expressway:

(i) Administration, regulation and responsible organization regarding development, O&M and management of expressway are not clearly defined in the current legal, regulatory and institutional framework of the road sector in Vietnam;
(ii) There exists a conflict between MOT and MOC in the jurisdiction of national highway/expressway and urban highway;
(iii) There exists a conflict between GRA and VEC in terms of administration/planning of expressway;
(iv) There is no consolidated system and nationwide organization for quality control of construction and O&M for expressway nor for procurement of required human resources and expertise;
(v) Existing toll related regulations, including Circular 90 which controls the profitability of O&M concession, are becoming impediments for private sector participation;
(vi) Existing BOT related regulations are rigidly defined and not enabling variety of PPP options to improve profitability of the private sector;
(vii) There exists a confusion regarding concession granting route as both central and local government could become a concession grantor of expressway project.

[1] "The Development of a Comprehensive PPP Financing Framework in Vietnam", Kamran Khan, The World Bank, Hanoi, November 24, 2009, International Conference on Vietnam PPP Program in Infrastructure

4) Way Forward

The following are possible directions regarding institutional and organizational aspects for expressway development in Vietnam:

(a) Establishment of a Legal, Regulatory and Institutional Framework which Clearly Defines Administration and Provision of Expressway Services Regarding Development, Operation, Maintenance and Management

A legal, regulatory and institutional framework should be established as soon as possible to clearly position expressway as a part of the overall transport framework in Vietnam. Related regulations regarding toll and other aspects of expressway should be amended in order to remove impediments and facilitate private sector participation for the development of expressway business.

(b) Establishment of a Public Financial Support System for the Development and O&M of Expressway for Marginally Profitable and Low Profitable Expressway Sections

GOV needs to clearly express its recognition that only a few expressway sections can sufficiently recover its initial investment. Therefore it is essential to establish a public financial support system which would work effectively for both public and private entities. The PPP financing framework could be a base system for this. However, a mechanism should be instituted in order for GOV to be effective in developing a total expressway network as soon as possible in the most efficient manner.

(c) Establishment of a Strong, Market based Management System for the Entire North-South Expressway Network

In order to materialize the aggressive expressway network development plan, the project needs a competent manager who could manage and control the development process and O&M to meet with sufficient quality level based on the market tested expertise.

Since the volume of private sector financial resources which could be tapped in the near future for expressway development is limited, there is a need to have a strong manager for the control of public funding so that its effective allocation including state budget, ODA funds and proceeds procured from the financial markets become possible. One potential direction could be reforming the existing VEC to be the manager of both network development and public fund allocation based on a nationwide expressway network management system and with a strong control on the provision of viability gap funding. Under such arrangement, the VEC needs to be monitored for funding by both the MPI and the MOF, and for network development and management by the MOT.

8 REVIEW OF THE FEASIBILITY STUDY ON THE WESTERN MISSING LINK OF THE EAST-WEST HIGHWAY

8.1 Introduction

1) Background of the Review

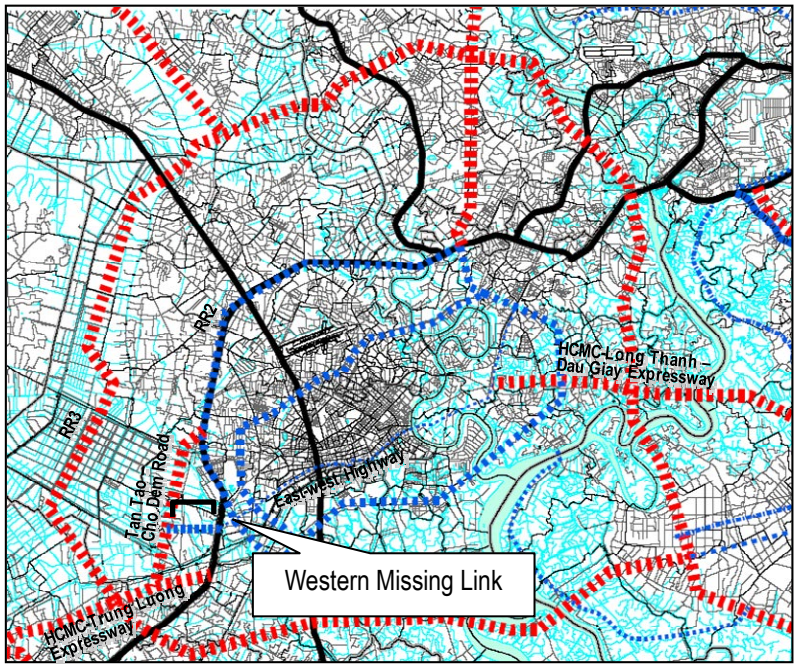
The Prime Minister approved the master plan on the development of transport and communications infrastructure in Ho Chi Minh City by 2020 and vision after 2020 in Decision No. 101/QD-TTg dated 22 January 2008. In recent years, HCMC has planned to pool a large amount of money from different sources/donors to invest and develop the city's transport and communications infrastructure in addition to the ongoing construction of ring roads 1 and 2, as well as the North-South Expressway and the East-West Highway.

The East-West Highway was approved by the Prime Minister in Decision No. 101/Qd-TTg dated 22 January 2007. It connects the Hanoi Expressway (at Cat Lai intersection) and NH1A through Thu Thiem tunnel–Ben Chuong Road–Ham Tu–An Lac. This is an important road for HCMC and its neighboring areas and is being constructed with a JICA loan. The NH1A-Ben Chuong section is already open and the remaining section includes Thu Thiem tunnel which is expected to be completed by the first half of 2011.

On the other hand, the Tan Tao–Cho Dem road is now under construction. It will connect Ring Road 2 and the HCMC–Trung Luong Expressway. When the East-West Highway is opened, traffic volume is expected to increase at the NH1A interchange.

To address the increasing traffic demand at the NH1A interchange and Binh Thuan intersection, there is a plan to extend the East-West Highway up to Tan Tao–Cho Dem road. This section is referred to as the "western missing link," which is expected to further extend up to Ring Road 3, thereby linking HCMC to Vietnam's western and southwestern provinces.

Figure 8.1.1 Location of Western Missing Link of the East-West Highway



Souse: VITRANSS 2 Study Team

2) Feasibility Study of the Western Missing Link

In 2008–2009, a feasibility study of the western missing link was carried out. The official project was titled "Construction of Connecting Road from East-West Highway to Ho Chi Minh City–Trung Luong Expressway" and was carried out by the TEDI for the My Thuan PMU (My Thuan PMU). In 2009, the reports were submitted to My Thuan PMU.

The study was implemented taking account of various legal documents on the following aspects:

(1) Basic Design

(i) Pursuant to Law on Construction No.16/2003/QH11 dated 26 November 2003 by the National Assembly of the Socialist Republic of Vietnam;

(ii) Decree No.209/2004/ND-CP dated 16 December 2004 by Government on quality management of construction work and Decree No.49/2008/ND-CP dated 18 April 2008 by Government on the adjustment and supplementation of Decree No.209/2004/ND-CP on quality management of construction works;

(iii) Decree No. 16/2005/ND-CP dated 7 February 2005 by Government on the management of construction projects and Decree No.112 dated 29 September 2006 by Government on the adjustment and supplementation of Decree No.16/2005/ND-CP on management of construction projects;

(iv) Decree No.99/2007/ND-CP dated 13 June 2007 on the management of investment expenses foe construction and Decree No.03/2008/ND-CP dated 7 January 2008 on the adjustment and supplementation of Decree No.99/2007/ND-CP on management of investment expenses for construction;

(v) Circular NO.04/2008/TT-BXD dated 20 February 2008 by the Ministry of Construction providing guidelines on the management of urban roads;

(vi) Decision No.101/QD-TTg dated 22 January 2007 by the Prime Minister on planning the development of communications and transport in HCMC up to 2020 and the vision after 2020;

(vii) Pursuant to Document No.1132/UBND-DT dated 28 February 2006 by the HCMC People's Committee approving the policy on the study for the construction project on an urban road connecting the city's East–West Highway with the HCMC–Trung Luong Expressway;

(viii) Notice No.1638/TB=SGTCC dated 12 July 2007 informing the Vice Director of the HCMC Department of Transportation and Public Works about the reporting methods to be adopted for the project on constructing the connecting road from the East-West Highway to the HCMC Expressway;

(ix) Notice No.88/TB –UBND dated 7 June 2007 informing the Chairman of the Binh Chanh People's Committee on the methods to be adopted to extend the East-West Highway from NH1A to the HCMC–Trung Luong Expressway; and,

(x) Economic contract No. ___/KQL4-HDKT dated ____ 2008 between Urban Transportation Management Unit No.4 and TEDI on the construction investment project on the connecting road from East–West Highway to the HCMC–Trung Luong Expressway.

(2) Investment Estimates

(i) Document prepared by Traffic Design Consulting Corporation in August 2008 on the construction of the connecting road from East-West Highway to the HCMC–Trung Luong Expressway;

(ii) Circular No.05/2007/TT-BXD dated 25 July 2007 by the MOC guiding the preparation and management of investment capital for construction works;

(iii) Decree No.99/2007/ND-CP dated 13 June 2007 on management of investment capital for construction works;

(iv) Standard No.1776/BXD-VP dated 16 August 2007 by the MOC;

(v) Standard for project management and consulting for investment in construction works (issued in accordance with Correspondence No.1751/BXD-VP dated 14 August 2007 by the MOC);

(vi) Price for machine shift based on Circular No.06/2005/TT-BXD dated 15 April 2005 by the MOC; price of machine shift by Ho Chi Minh City issued in accordance with Decision No.104/2006/QD-UBND dated 16 July 2006 by the People's Committee of Ho Chi Minh City;

(vii) Price of materials based on the MOF announcement on basic construction prices in HCMC for Quarter I/2008;

(viii) Other materials which are not included in the two above-mentioned correspondences were temporally calculated in accordance with other works;

(ix) Price of labor based on Decree No.166/2007/ND-CP and Decree No.167/2007/ND-CP dated 13 November 2007 by the Prime Minister on minimum wage;

(x) Decree No.205/2004/ND-CP dated 14 December 2004 regulating the salary rates, payroll, and allowances for state-owned companies;

(xi) Contingency costs based on Correspondence No.1601/BXD-VP dated 25 July 2007 announcing the construction price index;

(xii) Correspondence No.1599/BXD-VP dated 25 July 2007 announcing the method for defining the construction price index;

(xiii) Circular No.30/2008/TT-BXD dated 25 January 2008 by the MOC guiding the modification of cost estimates of construction works;

(xiv) Financial accounts of investment capital in accordance with Circular No.33/2007/TT-BTC dated 9 April 2007 guiding the method of financial accounts of investment capital;

(xv) Appraising fees in accordance with Circular No.109/200/TT-BTC dated 13 November 2000 by the MOF;

(xvi) Decree No.158/2003/ND-CP dated 10 December 2003 detailing the implementation of the Value-added Tax Law;

(xvii) Decision No.33/2004/QD-BTC dated 12 April 2004 by the MOF on rules and form of insurance fees for construction and installation; and,

(xviii) Other documents of the State on basic construction investment.

(3) Land Acquisition and Resettlement

(i) Land Law 2003 (Law No.13/2003 QH11 dated 26 November 2003) –Instruction No.23/2003/LCTN dated 10 December 2003 announcing the Land Law;

(ii) Circular No.01/2005/TT-BTNMT dated 13 April 2005 guiding the implementation of Decree No.181/2004/ND-CP dated 29 October 2004 by Government on executing the Land Law;

(iii) Correspondence No.1665/TTg-CN dated 17 October 2006 by the Prime Minister on clearing sites, treating mines, and using explosive materials to carry out traffic projects;

(iv) Correspondence No.8161/BGTVT-CGD dated 27 December 2006 by Ministry of Transport implementing Correspondence No.1665/TTG-CN by the Prime Minister;

(v) Decree No.181/2004/ND-CP dated 29 October 2004 by Government executing Land Law 2003;

(vi) Decree No.197/2004/ND-CP dated 3 December 2004 by Government on compensation, allowance and resettlement when land is recovered by the State;

(vii) Circular No.116/2004/TT-BTC dated 7 December 2004 by the MOF guiding compensation, allowance, and resettlement when land is recovered by the State;

(viii) Decree No.17/2006/ND-CP dated 27 January 2006 by Government amending and supplementing some articles of decrees guiding the implementation of the Land Law and Decree No.187/2004/ND-CP changing state-owned companies into joint stock companies;

(ix) Decision No.225/2005/QD-UBND dated 23 December 2005 by the People's Committee of HCMC regulating standards for recognizing land use right in accordance with Land Law 2003;

(x) Decision No.227/2005/QD-UBND dated 27 December 2005 by the People's Committee of HCMC regarding prices of land types in HCMC; and,

(xi) Decision No.17/2008/QD-UBND dated 14 March 2008 by the People's Committee of HCMC issuing regulations on compensation, allowance, and resettlement when land in the city is recovered by the State.

3) Scope of the FS Review

VITRANSS 2 reviewed the TEDI feasibility study to confirm the necessity of the western missing link and evaluate the appropriateness and accuracy of various important components such as the following:

(a) **Technical Design:** The review of the technical design covered natural conditions including soft soil measurement, road alignment and bridge structure based on applied road design standard, as well as types and connectivity of interchanges/intersections and other road facilities. Highway design standards, such as on road alignment, interchanges, and bridges/structures, applied to the East–West Highway was adopted. The VITRANSS 2 Study Team therefore considered the Western Missing Link as an extension of the East–West Highway.

(b) **Traffic Forecast:** Based on the traffic study done in VITRANSS 2, traffic demand was forecast for the western missing link. The traffic forecast review was done using the future road network around HCMC. Basically, traffic demand forecast includes traffic volume for each direction at the NH1A interchange, which is the starting point, and at

Tan Kien interchange, which is the ending point, based on updated VITRANSS 2 data.

(c) **Cost Estimates:** Total construction cost is composed of the quantities of each item and costs of each material and machine/labor. The Study Team checked the scope of the western missing link project; and based on design engineering, materials quantity, and unit prices, the cost estimates were checked.

(d) **Economic Analysis:** Based on the updated traffic forecast and construction cost mentioned above. The Study Team reviewed the project's economic effectiveness and feasibility.

(e) **Environmental Impact:** In December 2009, TEDI submitted an EIA report to My Thuan PMU. The VITRANSS 2 Study Team reviewed this report especially the impact of land acquisition.

4) Documents Received and Reviewed

Documents used in the feasibility study and made available to the VITRANSS 2 Study Team for its review are listed in the table below.

Table 8.1.1 Documents Received and Reviewed by the VITRANSS 2 Study Team

Document Description		Vietnamese	English
Volume 1	Project Interpretation	○	○
Volume 2	Basic Design	○	○
Volume 3	Profile of Hydrologic and Draining Calculation	○	○
Volume 4	Interpretation of Soft Soil Treatment	○	○
Volume 5	Total Investment	-	-
Volume 6.1	Appendix of Legal Document	○	-
Volume 6.2	Appendix of Structure Calculating Tables	○	-
	EIA Report	-	○

Source: VITRANSS 2 Study Team.

8.2 Traffic Demand Forecast

1) TEDI Forecast

(1) Methodology

The methodology to forecast demand which TEDI adopted for the feasibility study can be summarized as follows:

(i) Based on to the HOUTRANS (JICA, 2004), the conventional four-step model was used. This comprises trip generation/attraction, trip distribution, modal split, and traffic assignment using JICA STRADA. The methodology was basically an update of the HOUTRANS models. However, the values of model parameters are not shown in the report; and

(ii) Traffic surveys, such as traffic count and roadside OD interview, were not conducted. This implies the possibility of insufficient calibration of the models.

(2) Results

The traffic forecast for the western missing link of the East-West Highway is shown in Table 8.2.1.

Table 8.2.1 Traffic Volume Forecast for the Western Missing Link

Year	Traffic Volume (000PCUs/day)
2015	18,349
2020	22,370
2025	24,789
2030	27,204
2035	29,274

Source: Calculated by VITRANSS 2 Study Team based on TEDI report.

2) VITRANSS 2 Forecast

(1) Methodology

The VITRANSS 2 Study Team updated the demand forecast for the western missing link of the East-West Highway (refer to Appendix 8A for details). Its outline can be summarized as follows:

(i) As the basis of the review, interprovincial traffic demand was taken from VITRANSS 2 OD (origin-destination) matrices. VITRANSS 2's 2008 data was estimated using the results of the traffic count survey conducted at provincial boundaries;

(ii) For intraprovincial traffic which may form part of the highway traffic demand and was excluded from VITRANSS 2 interprovincial OD, trip generation/attraction and distribution models were developed and applied to Ho Chi Minh City. The socio-economic framework is consistent with VITRANSS 2's original models;

(iii) The above two OD tables were combined by vehicle type. This procedure was iterated for the years 2020 and 2030; and,

(iv) The "base network" was formed in consideration of ongoing and committed road projects and government plans. Traffic was then assigned to this network under "with" and "without" western missing link project scenarios.

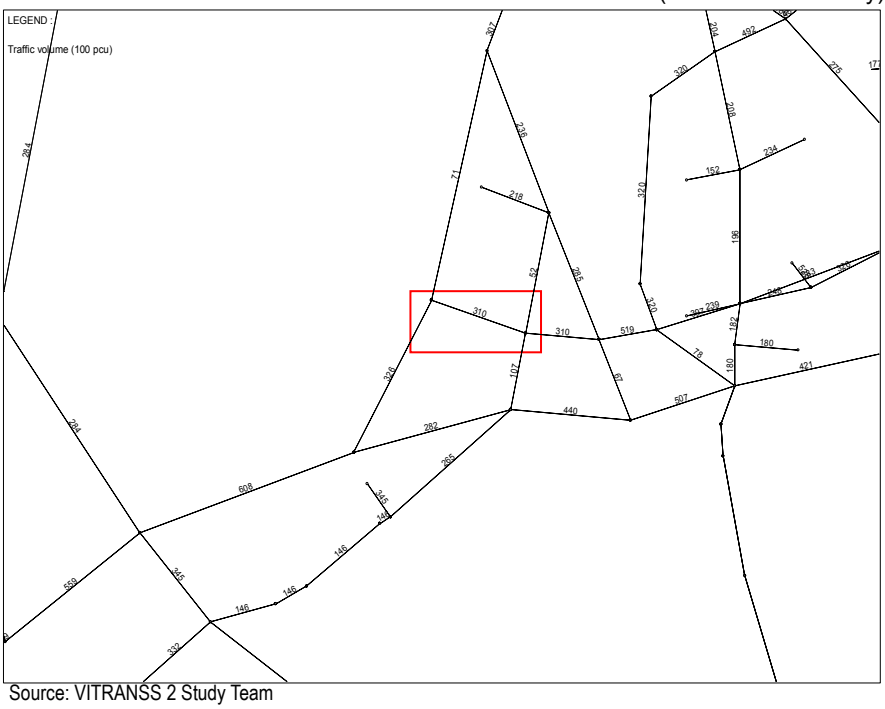
(2) Results

The traffic volume forecast for the western missing link is 31 and 49 thousand PCUs/day for 2020 and 2030, respectively, as shown in figures 8.2.1 and 8.2.2. This is substantially larger than TEDI's forecast by 38% and 80% for 2020 and 2030, respectively. Although further investigation may be needed, TEDI's forecast could well be underestimated.

Figures 8.2.3 and 8.2.4 illustrate the forecast on directional traffic flows on the eastern and western intersections at both ends of the missing link for 2020 and 2030.

Figure 8.2.1 Traffic Volume Forecast around the Western Missing Link, 2020

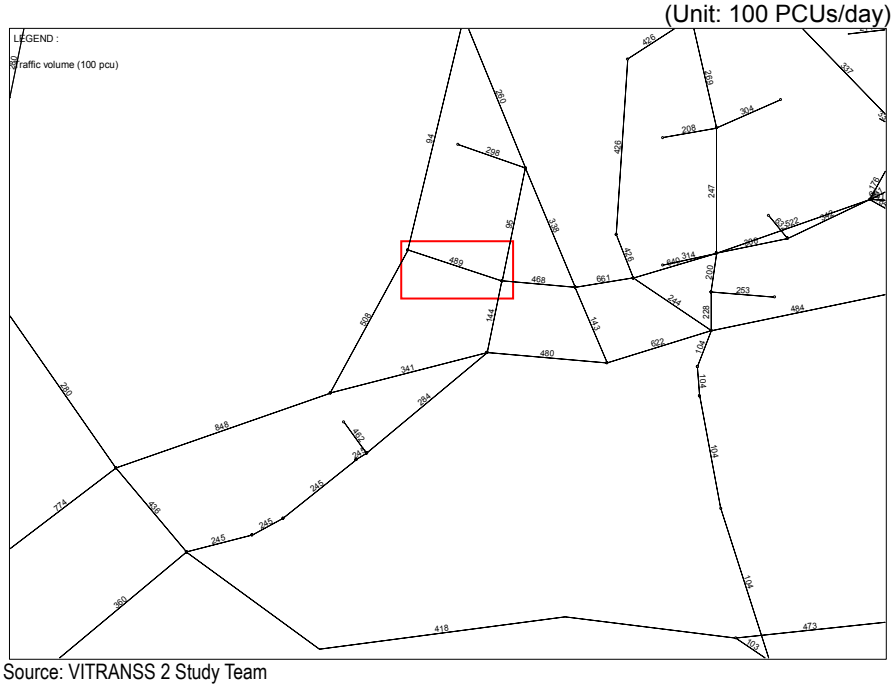
(Unit: 100 PCUs/day)



Source: VITRANSS 2 Study Team

Figure 8.2.2 Traffic Volume Forecast around the Western Missing Link, 2030

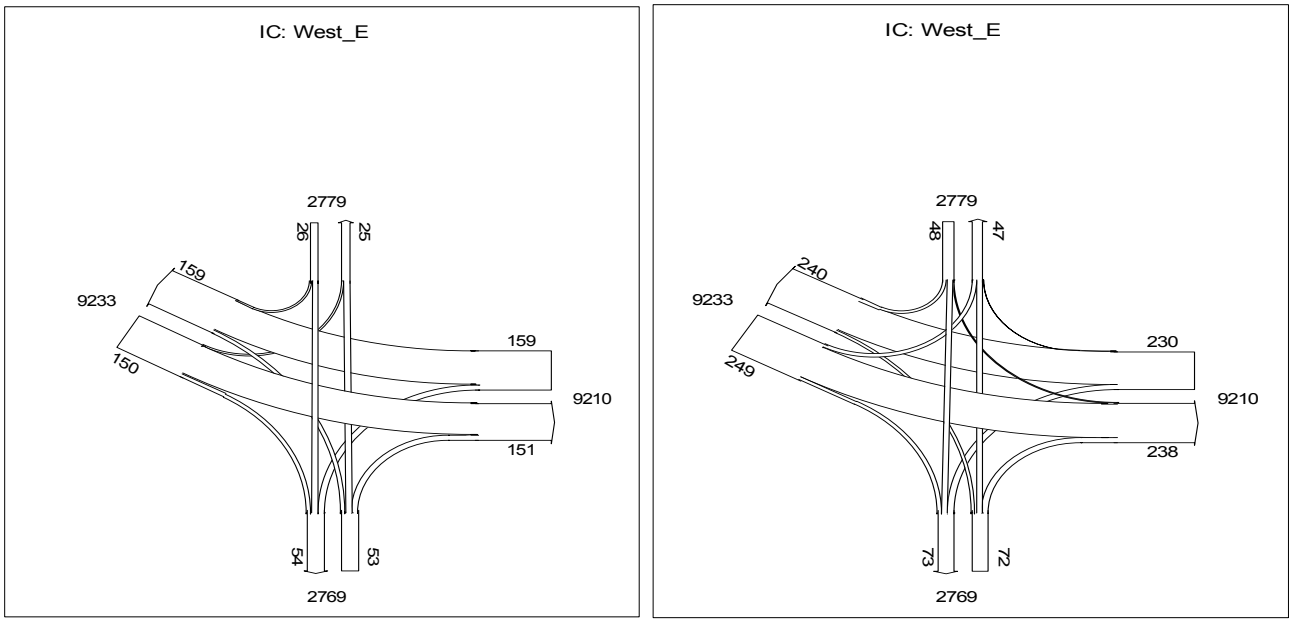
(Unit: 100 PCUs/day)



Source: VITRANSS 2 Study Team

Figure 8.2.3 Directional Traffic at the Eastern Intersection, 2020 and 2030

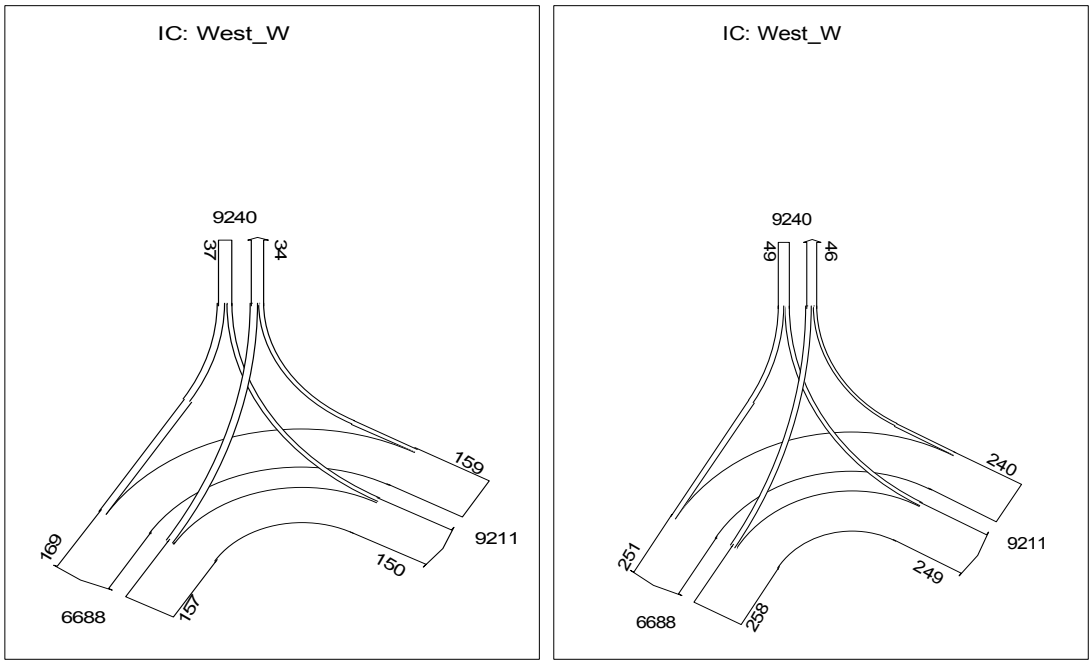
2020 **2030**



Source: VITRANSS 2 Study Team

Figure 8.2.4 Directional Traffic at the Western Intersection, 2020 and 2030

2020 **2030**



Source: VITRANSS 2 Study Team

8.3 Natural Conditions Surveys

The FS report done by TEDI merely provided an outline of the following surveys of the natural conditions prevailing in the project area, without details of the conducted survey and investigations:

(a) **Topographic Survey:** Chapter 4 of Volume 2 of the basic design report mentioned the outline of the project area, but there were no details about the topographic surveys done such as survey area, reference points, etc.

(b) **Geological Survey:** Boring was conducted in four sites. The explanation of the stratum was written based on the boring data. However, there is no summary about quantities, locations, investigation results, etc.

(c) **Hydrological Survey:** In Chapter 4 of Volume 2 of the basic design report, the outline of the project area was mentioned, but there are no details about hydrological investigations done such as meteorological points, high water level, rainfall intensity, etc. High water level in the project site was reported in the appendix.

8.4 Engineering Work

1) Highway Design

The same regulations and standards/criteria applied to the East-West Highway were used. The design speed of the main carriageway is 60 km/h and 40 km/h for frontage road based on TCXDVN 104:2007.

(1) Cross-section

Two alternatives were proposed for the completion phase, the difference being the number of lanes of the main carriageway. One alternative proposes three lanes and the other four lanes. Generally, the number of lanes should be based on the traffic demand forecast. If so, providing four lanes is deemed to exceed the demand. The VITRANSS 2 Study Team proposes a typical cross-section for the final phase, as shown in Table 8.4.1.

Table 8.4.1 Final Cross-section of the Western Missing Link

Item	Specification	Width (m)
Main Road		
Median strip	planting	9.0
Center shoulder	0.5 m x 2 directions	1.0
Carriageway	3.5 m @3 x 2 directions	21.0
Outside margin	0.5 m x 2 directions	1.0
Separator between main road and frontage road	2.0 m x 2 directions	4.0
Subtotal		36.0
Frontage Road		
Center shoulder	0.5 m x 2 directions	1.0
Motorized lane	3.5 m x 2 directions	7.0
Nonmotorized lane	3.0 m x 2 directions	6.0
Sidewalk	5.0 m x 2 directions	10.0
Subtotal		24.0
Total		60.0

Source: F/S Report by TEDI/PMU My Thuan

A two-phase construction and corresponding costs were proposed in the basic design report. However, a divided construction stage does not translate to cost efficiency.

(2) Horizontal Alignment

Two alignments were proposed although they differ only slightly and both meet the standards required. Alternative 1 is supposed to be approved. One important point is the need to relocate power lines. Twenty-three electric poles should be moved under Alternative 1, which is far more than under Alternative 2. More consultation is necessary among PMUs and related agencies.

(3) Vertical Alignment

The project area is flat; therefore, the gradient of the vertical alignment will almost be flat. About 75% of the total road length will have a gradient of less than 0.5%, while only 10% will have more than 3% gradient. The maximum gradient is 4.0%, which will be the flyover on Tan Kien Interchange. The height of the embankment will be higher than the calculated average water level which is 2.10 m to 2.30 m.

(4) Pavement Structure

While the main pavement structure was calculated based on the pavement specifications of the East-West Highway, more CBR (California Bearing Ratio) tests have to be done during the detailed design stage.

(5) Drainage System

Rain drainage system was offered in the basic design. Disgorging channels and calculated diameter of longitudinal culverts were proposed; however, the distance of catch pits is 40 m to 60 m. Since the vertical alignment is almost flat (i.e., gradient of 75% of the total length is less than 0.5%), catch pits should be designed at 20 m intervals to prevent road flooding.

A household sewage system is also proposed based on the population density which is not more than 2,000 people/hectare. After constructing the project road, land use along the road will develop and the population will increase. However, the maximum population density in urban area is 20,000 people/km^2 (200 people/hectare). Therefore, a clarification of the future population density will be necessary in the detailed design stage.

(6) Foundation Improvement

Foundation improvement through sand drain method was proposed on the entire route area before pavement construction. Sand drain is effective and essential to achieve a stable foundation for road construction and operation. However, applying it will increase construction costs. While the total investment cost is described in Chapter 13 of the basic design report, the cost of improving the foundation is not indicated; it should be clarified in the detailed design stage.

2) Interchange/Intersection Design

Two interchanges were proposed: one to connect with NH1A and another with the Tan Tao–Cho Dem Road (in Tan Kiem).

The NH1A interchange is the starting point of the western missing link and connects it to the East-West Highway. Land acquisition and a connecting ramp between the East-West Highway and NH1A were completed on the East-West Highway Project. However, a connecting ramp between the western missing link and NH1A is not completed yet, and the construction of two loop ramps should be included in East-West Highway Project.

The Tan Kiem interchange is the ending point of the western missing link and connects it to the Tan Tao–Cho Dem Road. Phase 1 of Tan Tao–Cho Dem Road is scheduled to be completed in February 2010. Phase 2 is to expand the width and includes the frontage road. The feasibility study proposed an interchange in Phase 1. Traffic from/to the east on Tan Tao interchange will use three lanes, two of which will be for traffic from the east-side. On the basic design drawing, the Phase 1 and final phase plans for the interchange differ. In the detailed design stage, the configuration of the interchange should be clarified including cost.

3) Design of Road Links

In the project section, four local roads are linked to the western missing link (see Table 8.4.2).

Table 8.4.2 Existing Roads Crossing the Western Missing Link

Name of Road	Station	Category of Road	Expansion Plan (m)
Khuant Van Buc	Km0+513.60	Local road	Expand width to 20
Cay Bang	Km0+714.09	Intervillage road	Expand width to 20
Rach Cai Trung	Km1+310.26	Intervillage road	Expand width to 20
Nguyen Cuu Phu	Km1+946.35	Inter-city road	Expand width to 40

Source: F/S report by TEDI/PMU My Thuan

Of these roads, Khuant Van Buc, Cay Bang, and Rach Cai Trung will be accessed from the highway through at-grade intersections. Although traffic flow on the main road will increase, access from/to the southern and northern sides will be blocked off by the western missing link, which means the surrounding areas will be split. Some alternative measures should be considered to avoid such occurrence.

4) Bridge Design

The bridge design was reviewed using the following documents: main design report, structure calculation appendix, and drawings.

While the FS report does not provide a comparison of nor a justification for the bridge structures selected for three sites, the VITRANSS 2 Study Team deemed the length of Hung Nhon Bridge as sufficient, that of Cai Trung as possible to be shortened, while that of Tan Kien Interchange Bridge as requiring verification because the shape of the interchange between the initial stage and the final stage differs.

(1) Location of Bridges

The planned three bridges are shown in Table 8.4.3.

Table 8.4.3 Locations of Bridges

No	Name of Road/ Flow	Station	Planned Bridge
1	Hung Nhon Canal	Km 0+638	Hung Nhon Bridge
2	Cai Trung Canal	Km 1+502	Cai Trung Bridge
3	Tan Tao–Cho Dem Road	Km 2+648	Overpass at Tan Kien Intersection

Source: F/S report by TEDI/PMU My Thuan

A flyover is planned over Nguyen Cuu Phu Road in the future. According to the topographic survey data and site survey, three bridges are sufficient for the initial stage.

(2) Design Standards

The latest bridge design standards and loads were applied (22 TCN 272-05 and HL93, respectively). The design load is also suitable for heavy vehicles. However, there is no mention about public utilities, such as water supply and sewerage systems and excluding fiber cables and low-voltage electric cables, which are attached to the bridge.

On the other hand, a freeboard of 0.5 m should be allotted for Hung Nhon and Cai Trung bridges, even though the local people's committees didn't request such clearance.

(3) Bridge Profiles

A short profile of the planned bridges is shown in Table 8.4.4.

Table 8.4.4 Bridge Profiles

No	Name of Bridge	Span Length (m)	Total Length (m)	Type
1	Hung Nhon	1@25	30.1	Post tension pre-stressed I-shaped girder
2	Cai Trung	3@25	80.2	Post tension pre-stressed I-shaped girder
3	Tan Kien Interchange			
3.1	Main road	2@(40+25)+6@40	377.5	Super tee girder
3.1	Ramp	2@24	53.1	Post-stressed hollow

Source: F/S report by TEDI/PMU My Thuan

The VITRANSS 2 Study Team believes the types of bridges are suitable to the design span. However, the FS report offered no comparisons with other types of bridges.

(4) Typical Cross-sections

(a) **Hung Nhon and Cai Trung Bridges:** Based on the bridge construction plan, two bridges approaching the frontage road will be constructed in the initial stage. However, the bridge cross-section, excluding sidewalks and parapets, does not meet the road cross-section in the initial stage (see Table 8.4.5). Total bridge width, excluding sidewalks and parapets, should be the same as that of the frontage road. Therefore, total bridge width, excluding sidewalks and parapets, is recommended at 8.0 m.

Sidewalk width is recommended to be 2.0 m, which is the same as the width of the bridge sidewalk on the East-West Highway.

Table 8.4.5 Cross-section Comparison between Bridge and Frontage Road in the Initial Stage

(Unit: m)

	Parapet (sidewalk) or Verge	Sidewalk	Safety Strip	Non-motorized Vehicle Lane	Motorized Vehicle Lane	Safety Strip	Parapet or Verge
Bridge	0.25	1.25	0.50	3.00	3.50	-	0.50
			7.00				
Road	0.50	-	0.50	-	2x3.50=7.0	0.50	0.50
			8.00				
Recommendations for Bridge	0.25	2.00	0.50	3.50	3.50	0.50	0.50
			8.00				

Source: VITRANSS 2 Study Team

In the final stage, the cross-section between roads and bridges is the same. However, it seems that the difference between the frontage road bridge and the main road bridge is only 0.5 m wide, which is narrow for a separate construction. To ease construction, main road abutments should connect with frontage road abutments; otherwise these abutments will be more than 2 m from each other.

(b) **Tan Kien Interchange Bridge:** The main report does not mention the sidewalk on Tan Kien interchange bridge. Though there is a box culvert for vehicles, which is far at approximately 200 m from the bridge, it is far for pedestrians. Therefore, it is recommended that the sidewalks be added to the main road bridge at the Tan Kien Interchange. The ramp bridges are planned to have two lanes based on the traffic demand forecast.

(5) Superstructure

(a) **Hung Nhon Bridge:** There is no comparison of various types of superstructure. Span length is sufficient considering that floodwater is controlled by water gates.

(b) **Cai Trung Bridge:** There is no comparison of various types of superstructure. Considering that floodwater is controlled by water gates, the length of the bridge, which is longer than the width of the canal, can be reduced.

(c) **Main Road Bridge, Tan Kien Interchange:** The plan drawings of the interchange between the final and the initial stages, specifically the shapes of the ramps and the frontage roads, are different. The drawings of the bridge were prepared based on the plan drawings in the initial stage. If the plan drawing of the final stage is correct, the bridge length can be shortened because the position of the vertical clearance comes inside. It should be verified. There is no comparison with other types of superstructure.

(d) **Frontage Road Bridge, Tan Kien Interchange:** There is no comparison of various types of superstructure. Also, there is no mention about the radius of the horizontal curve. Span length is sufficient for hollow slabs.

(6) Substructure

(a) **Hung Nhon Bridge:** There is no comparison of various types of substructure. The heights of abutment seem sufficient because there are no dimensions for the depth of cover soil on footing.

(b) **Cai Trung Bridge:** There is no comparison of various types of substructure. The heights of abutments are insufficient because the top level of footing is the same as the existing ground level. Also, the depths of piers are insufficient because the top of the footing juts out from the canal bottom.

(c) **Main Road Bridge, Tan Kien Interchange:** There is no comparison of various types of substructure. The heights of abutments seem sufficient except for T5 pier.

(d) **Frontage Road Bridge, Tan Kien Interchange:** There is no comparison of various types of substructure. The heights of abutments seem sufficient.

(7) Foundation

There is no comparison of various types of foundation. The main report proposed various pile lengths, but the final decision should be made in the next stage of the project.

(8) Ancillary Work

The Hung Nhon and Cai Trung bridges were planned to have approach slabs behind abutments. On the other hand, driven piles of 40 x 40 cm were applied behind the abutments for the main road bridge at the Tan Kien Interchange. However, no mention was made about the driven piles; neither was a comparison made.

The description of other ancillary works, such as expansion joints, bearing, and waterproof layer, was not mentioned in detail.

(9) Construction Planning

There is no detailed mention about a construction plan except for the construction stage.

(10) Drawings

Conflicts in the drawings were pointed out above.

(11) Work Quantity

There are no details of quantities. However, it seems applicable.

5) Other Structural Designs

The main design report and drawings on the drainage system were made available to the VITRANSS 2 Study Team. Drawings of the box-retaining wall and miscellaneous documents were also reviewed.

(1) Location of Other Structures

(a) **Box-retaining Wall:** Based on the drawings, the locations of the box-retaining walls are shown in the table below. The box-retaining walls were planned to prevent ground settlement. On the other hand, sand drains were proposed behind the abutments (see Table 7-9 of the FS report). This is conflicting and should be verified after comparing them and/or other methods. The box-retaining walls are shown in Figure 8.4.1.

Table 8.4.6 Location of Bridges

No	Name of Bridge	Location	Planned Bridge
1	Hung Nhon Bridge	Behind Abutments	2@20 m=40 m
2	Cai Trung Bridge	Behind Abutments	2@10 m=20 m

Source: F/S report by TEDI/PMU My Thuan

(b) **Drainage:** The location of the drainage system was shown in the drainage plan, profile **drawings**, and typical cross-section drawings.

(c) **Miscellaneous Items:** Guardrails, sign posts, curbs, traffic signs, and road markings are indicated in the drawings. The locations of guardrails and traffic signs are shown in the traffic safety plan drawings. The location of road markings is also shown in the traffic safety **plan** drawings and typical cross-section drawings. The location of curbs is only shown in the typical cross-section in the final stage. On the other hand, the location of sign posts is not indicated. The location of delineators is shown in the traffic safety plan drawings, while the details of delineators are not shown. If the delineators and sign posts are the same, the name of devices should be unified. And, the traffic signals are shown in the traffic safety plan drawings without the details.

(2) Design Standards

(a) **Box-retaining Wall:** There is no mention about design standards in detail.

(b) **Drainage:** The design standard for drainage is not mentioned clearly**.**

(c) **Miscellaneous Items:** Regarding road markings and traffic signs, design standards are mentioned clearly. However, others are not mentioned.

(3) Design of Structures

(a) **Box-retaining Wall:** Box-retaining wall is a unique and interesting method to prevent ground settlement. However, it is necessary to justify adopting such method through a careful comparison. In Indonesia, the pile slab bridge is adopted to treat soft ground (see Figure 8.4.2). Also, a lateral installation of the box-retaining wall should be examined even as a vertical installation is being planned. There are many advantages to the former; for example, the openings are useful to mitigate flooding. It would be necessary, however, to compare the costs of the two types of installation, because while a lateral box-retaining wall does not need edge walls for openings, the top should be leveled with concrete to fit with the vertical alignment of the road.

(b) **Drainage:** Two kinds of drainage system are planned, namely, one for surface water and another for sewage. However, the sewage disposal facilities are not near the project area. Therefore, a joint system to treat both rainwater and sewage is applied. However, the main drainage line is used for surface water drainage. And, the depths of catch basins for surface water drainage are extremely deeper than those for normal surface water drainage. Considering the future stage when the joint system will be converted to the separating system, the main drainage line should be used for sewage.

(c) **Surface Water Drainage:** The intervals between inlets are approximately 40–60 m, and they are too far to allow smooth discharge. Intervals should be less than 20 m. The position of surface water drainage is basically under the curbs on frontage roads. However, the proposed elevation of the catch basin's top does not correspond with the vertical alignment of frontage roads. Also, drainage outlets seem to be lower than the bottom of canals. It should be verified. While, discharge gates 2 and 3 are next to each other; their distance is not well-balanced. The same applies to discharge gates 4 and 5. The bottoms of pipe culverts have the same elevation at the connection site with different sizes of pipe culverts. The tops of pipe culverts should have the same elevation to mitigate countercurrent, when it is happens. The foundation of pipe culverts combines the 90-degree precast concrete foundation with the cast-in-place concrete, and becomes a 120-degree concrete foundation. It might cause cracks due to uneven settlement. Therefore, the application of a 120-degree concrete foundation by cast-in-place concrete is recommended. In Appendix, the locations and sizes of pipe culverts are indicated, but there are no detailed calculations. In the initial stage, pipe culverts with a diameter of 800 mm will be placed under the cross roads. However, the drainage outlet is missing.

(d) **Sewage Drainage:** The dimensions of pipe culverts and the actual scales are not balanced. Also, the depths of pipe culverts should be considered to mitigate countercurrent. The size of house sewers is not specified in the FS report.

(e) **Miscellaneous Items:** The specifications of miscellaneous items seem appropriate in the FS stage. However, the width of the foundation for guardrails and signposts looks insufficient.

(4) Construction Planning

There was no detail mention about construction planning except for the construction stage.

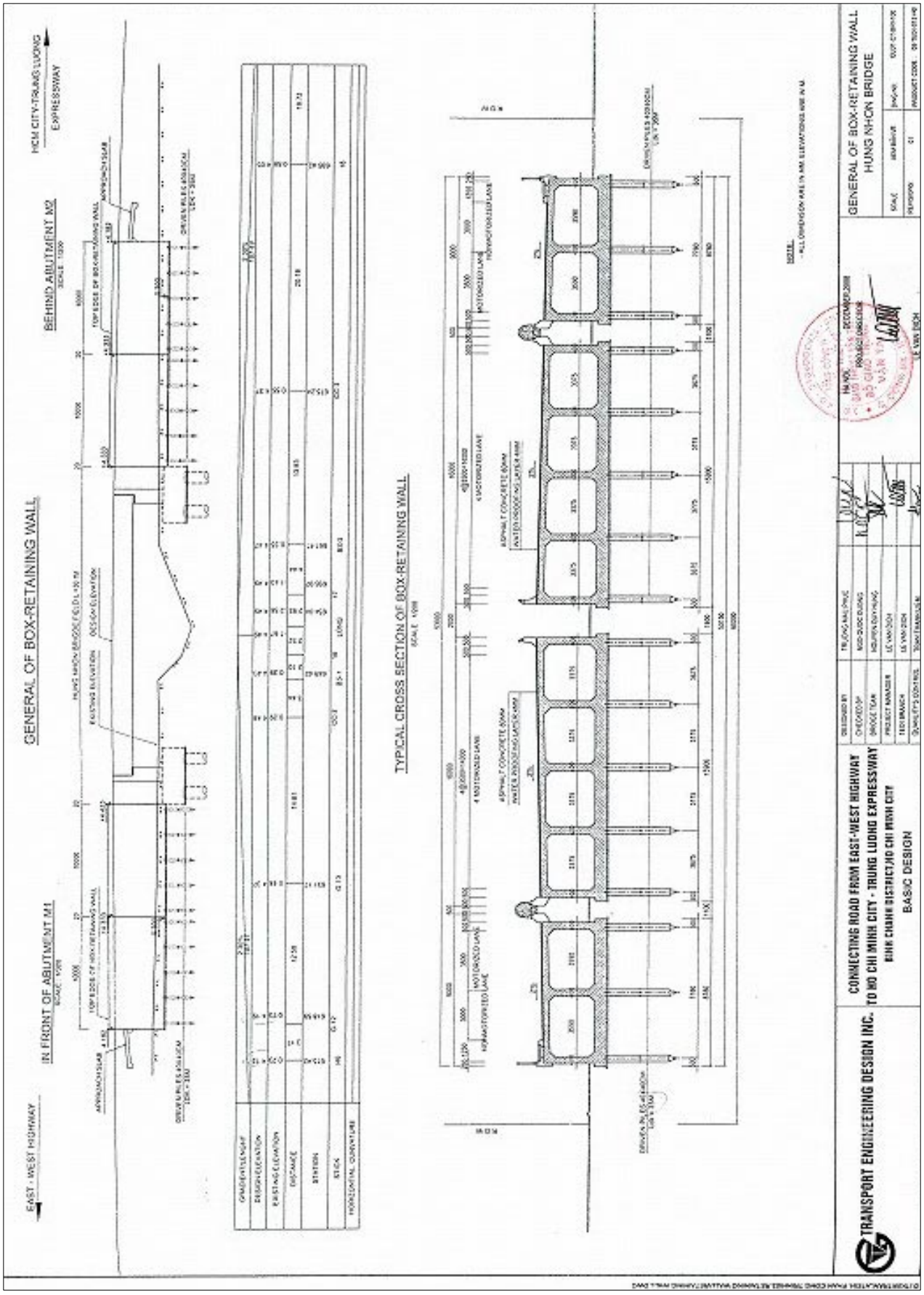
(5) Drawings

The drawings seem appropriate for an F/S stage.

(6) Work Quantity

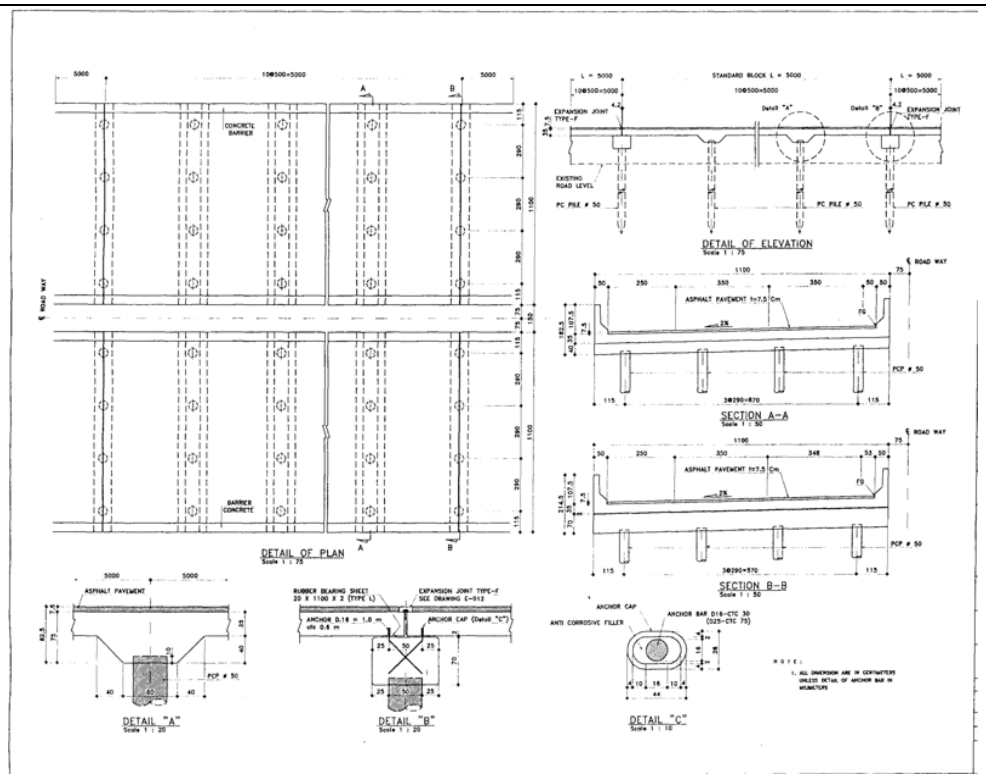
Although there are no detailed quantities, it seems applicable as a rough estimation excluding the sewage especially the sewage catch basins

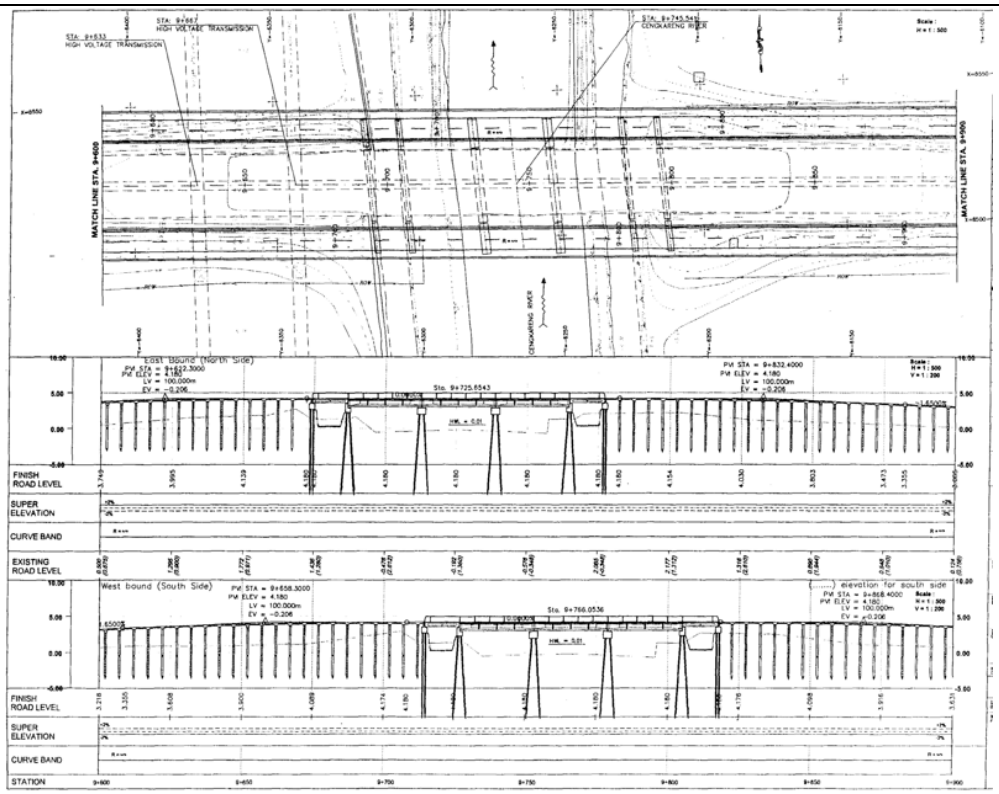
Figure 8.4.1 Box-retaining Wall



Source: F/S report by TEDI/PMU My Thuan

Figure 8.4.2 Pile Slab Bridge





Source: F/S report by TEDI/PMU My Thuan

6) Utilities Relocation Plan

The relocation of utilities is mainly necessary at the crossing points with local roads, and the process is not serious. However, public utility culverts are planned to accommodate power and street light lines, as well as communication cables. Also, instead of wood piles, concrete or steel piles should be applied to the foundation of the vertical and horizontal tunnels. Moreover, the size of manholes and the location of cable pipes should be reconsidered.

7) Design of Electrical Facilities

The layout of street lights should be rearranged to consider the landscape and their effectiveness. Also, light posts should be placed outside of the loop ramps to secure unobstructed sight distance.

8) ITS Design

Intelligent transport systems are not described in the feasibility study of the western missing link. For the East-West Highway, an electric toll collection (ETC) system is planned at the Thu Thiem tunnel. This project road is not an expressway in accordance with TCXDVN 104:2007; the main road will be designed as an urban road with a design speed of 60 km/h.

The VITRANSS 2 Study Team understands that particular ITS technologies will not be used on urban roads; however, appropriate traffic signs and signals should be installed, the designs of which are included in the feasibility study.

9) Construction Plan

The overall construction schedule is estimated at 30 months. However, the first 18 months will be spent only on soft-ground treatment. The VITRANSS 2 Study Team thinks that if construction simultaneously occurs from the two ends of the route, the construction schedule can be shortened.

8.5 Environmental Considerations

In December 2009, the draft EIA report for the Western Missing Link Project was submitted to VITRANSS 2 Study Team for its review. At that time, it was not yet submitted to the Department of Natural Resources and Environment in HCMC (DONRE–HCMC). The results of the EIA review are described below.

1) Contents of Draft EIA Report

The draft EIA report discussed the following:

(i) Chapter I: Brief Description of the Project;

(ii) Chapter II: Natural Environmental, Socio-economic Conditions;

(iii) Chapter III: Environmental Impact Assessment;

(iv) Chapter IV: Mitigation Measures of Negative Impacts, Prevention and Deal With Environmental Problems;

(v) Chapter V: Environmental Monitoring and Management Program; and,

(vi) Chapter VI: Environmental Processing Works, Environmental Management and Conclusion and Recommendation.

The draft EIA report is made by adequate manner in accordance with Vietnamese laws and regulations on EIA. The Project implementing body is able to finalize the report.

2) Rewriting of EIA

The FS report on the Project was submitted to VITRANSS 2 Study Team from the viewpoints of traffic demand forecast and transport engineering. From the results of theses reviews, the forecasted traffic volume and the design of the Project are modified. The main points of design modification are as follows:

(i) Setting two phases such as Phase 1: 4 lanes, and Phase 2: 8lanes

(ii) Design modification of the route in western part

3) Laws and Regulations

In accordance with Vietnamese regulation, the necessity of the establishment of EIA is as follows:

(i) **Case A: New Project with no EIA Report:** It is compulsory to make an EIA report which must be approved by DONRE-HCMC before the project is implemented.

(ii) **Case B: Project with Approved EIA Report:** If the project has not been implemented within two years after the EIA was approved, it is necessary to update the EIA report and revisit the baseline environment.

(iii) **Case C: Project with Approved EIA Report but Revised Design:** It is necessary to send an explanatory document to DONRE-HCMC to get their advice on applying for an environmental permit. If the design was substantially changed, the EIA report must be revised as well.

The western missing link is a Case A project, so it is necessary to make an EIA report in accordance with Vietnamese Laws/ Regulations and to submit it to DONRE-HCMC.

4) JICA's Environmental Guidelines

In March 2004, JICA issued environmental and social guidelines (http://www.jica.go.jp/english/publications/jbic_archive/environmental_guidelines/pdf/guide.pdf).

JICA implements cooperation activities in accordance with these guidelines, and JICA encourages recipient governments by conducting cooperation activities to implement appropriate measures in view of environmental and social considerations. At the same time, JICA supports the examination of its guidelines. If the Vietnamese government wishes to obtain Japanese assistance to implement the western missing link project, it has to follow these guidelines.

5) Comments on the Draft EIA Report

Following the modifications done by the VITRANSS 2 Study Team on the traffic demand forecast and project design i.e., (i) setting two construction phases (Phase 1=4 lanes and Phase 2=8 lanes), and (ii) design modification of the western section of the route, the Team recommends that the EIA report be revised. Below are the specific recommendations of the Team.

(a) **Submission and Approval of Final EIA Report:** It is necessary to submit the final EIA report to DONRE–HCMC and to get their approval of the same.

(b) **Explanation of the Illustrative List of Sensitive Areas:** Areas in and around the project area sensitive to development or use and designated by national or related local government units as critical areas, such as below, should be clearly shown. The expected environmental impacts from the project, necessary countermeasures, and a monitoring plan should also be discussed.

(i) Wetlands;
(ii) Areas for indigenous peoples;
(iii) Cultural heritage sites;
(iv) Areas for consideration as national parks or protected areas; and,
(v) Other areas deemed requiring careful consideration.

(c) **Detailed Explanation of Natural and Social Environment:** The following sensitive natural and social environment should also be illustrated:

(i) Primary forests or natural forests in tropical areas;
(ii) Habitats with important ecological value, such as wetlands and tidal flats;
(iii) Habitats of rare species requiring protection under domestic legislation and/or international treaties;
(iv) Areas in danger of large-scale salt accumulation or soil erosion;
(v) Areas with unique archeological, historical or cultural value; and,
(vi) Areas inhabited by indigenous peoples or nomadic societies with traditional ways of life and other areas with special social value.

(d) **Preparation of the Resettlement Action Plan:** One of the most significant impacts caused by the implementation of the project is resettlement. A proper implementation of compensation for affected people will minimize such impact. Toward this end, the VITRANSS 2 Study Team reviewed the draft Resettlement Action Plan (RAP) submitted by My Thuan PMU by end January, 2010, The Team believes the legal and

policy framework for land acquisition and resettlement for the draft RAP report is well prepared and that it took into account all RAP regulations, as well as implementation and monitoring requirements, in Vietnam into account and those necessary to obtain Japanese assistance. It will be enough to obtain a certification from relevant authorities. However, since the VITRANSS 2 Study Team modified the project's traffic demand forecast and transport design, some RAP items related to design should also be revised. .

(e) **Discussion of Alternatives:** JICA guidelines require a discussion of alternatives; therefore, the Vietnamese government should compare three or four alternatives relating to route and design. A justification for the selected alternative for the project should also be done.

(f) **Conduct of Public Consultation on the Modified Project Design:** The VITRANSS 2 Study Team modified the project in terms of traffic volume forecast and transport design. With the modifications, meetings with related stakeholders, such as administrative bodies, local residents, NGOs, etc., should be held, and the results of meetings should be reported in the final EIA.

(g) **Detailed Explanation of Air Pollution Forecast and Countermeasures:** In the existing draft EIA report, air pollution is forecast following Vietnamese standards but it includes some uncertain factors. The following should therefore be shown in accordance with JICA guidelines:

(i) Applied forecast formula;

(ii) Applied forecast conditions;

(iii) Forecast for the project area and its vicinity;

(iv) Forecast values in sensitive points, such as residents nearest to the project boundary, as well as schools, hospitals, places of worship, public facilities, and cultural heritage sites in the project area;

(v) Detailed countermeasures for areas that do not meet environmental standards and the cost of such countermeasures; and,

(vi) List and layout of monitoring stations during construction and operating stages.

(h) **Detailed Explanation of Noise/ Vibration Forecast and Countermeasures:** The following should be illustrated in accordance with JICA guidelines:

(i) Forecasts for the project area and its vicinity;

(ii) Forecast values and distance from project boundary at sensitive points, such as residents nearest to the project boundary, as well as schools, hospitals, religious facilities, public facilities, and cultural heritage sites in the project area;

(iii) Detailed countermeasures for areas that do not meet environmental standards and cost of such countermeasures; and,

(iv) List and layout of monitoring stations during construction and operating stages.

(i) **Additional Environmental Items for Forecast:** Since the global warming issue was not discussed in the existing EIA, the revised EIA should tackle it.

(j) **Implementation of Additional Investigations on Existing Natural Conditions:** The existing EIA described the results of investigations on the existing natural conditions, such as air quality, noise/ vibration, and soil, in the rainy season only and excludes the

investigation on flora and fauna biodiversity. Therefore, the following investigation should be implemented:

(i) Air quality, noise/ vibration, and soil condition in the dry season, and

(ii) Flora and fauna in both rainy and dry seasons.

(k) **Planning of the Detailed Construction Plan and Environmental Management Plan:** The significant impacts to be expected from project implementation are resettlement, air pollution, and noise/ vibration, which can be resolved by the implementation of a proper environmental management plan (EMP). The following should therefore be explained in the construction plan:

(i) Kinds and number of (total, at peak day/ hour) construction materials and vehicles;

(ii) Entry route to the site by construction vehicles;

(iii) Location and entry route to borrow pits, quarry sites, and disposal areas, if any;

(iv) Existing and future capacity of the public final disposal area, if used;

(v) Location of temporary road and stockyards for construction materials; and,

(vi) Location of, number of laborers in, and ways to dispose of wastewater/ solid waste generated from labor quarters.

8.6 O&M Plan

The O&M plan is not described in the feasibility design. This project road is the western extension of the East-West Highway to Tan Tao–Cho Dem road. However, the implementation agency is different from that of the East-West Highway which is the HCMC PMU, while for the western missing link, it is the My Thuan PMU.

After the completion of both roads, the O&M of both roads should be integrated under one agency. This should be discussed together by both PMUs.

8.7 Cost Estimates

The unit cost used on the FS report is relatively higher than that of the master plan, In the detailed design stage, it would be lower considering the current trend of the increase of the unit cost.. The construction cost of Phase 1 is expected to be lower than that of Phase 2.

1) Legal Basis

The legal basis for the cost estimates is listed in the main report.

2) Project Cost

The project cost is summarized in the main report and is shown in the table below. The cost was calculated using an exchange rate of VND18,500=USD1. Compared with the unit costs used in the Master Plan for this project, the unit costs used in the FS were higher, resulting in higher construction costs. Probably, the construction costs estimated in the FS report can be reduced. Regarding construction cost by phase, the shares are almost the same as those estimated in the Master Plan for this project, i.e., ____% for Phase 1 and ___% for Phase 2 . However, in the FS, the share of Phase 1 construction cost to the total construction cost is lower than that of Phase 2.

Table 8.7.1 Summary of Project Cost for Recommended Alternative

Items	Phase 1	Phase 2	Total (USD)
Subtotal	53,281,212	58,555,984	111,837,196
Construction Cost	33,171,738	45,498,045	78,669,783
Management and Consulting	3,317,174	4,549,804	7,866,978
Land Acquisition	9,050,585	0	9,050,585
Contingency	7,741,715	8,508,134	16,249,849
Share of Construction Cost to Total	42%	58%	

Source: F/S report by TEDI/PMU My Thuan

3) Optional Study

A total of 14 (7x2) options were estimated to compare phasing and soft-ground treatment.

8.8 Utility Relocation Plan

Since the alignment of the western missing link will traverse mainly paddy fields and ponds, and intersected by local roads, the relocation of utilities is not serious. Therefore, there are no descriptions about the relocation plan. However, culverts for public utilities were planned to accommodate electric and streetlight lines as well as communication cables. And, these will be constructed in the final stage. Meanwhile, there is no mention of the alignment crossing public utilities in the initial stage.

1) Location of Utilities to be Relocated

The locations of public utility culverts are shown in the FS drawings. Crossings with public utilities will be accommodated by using public utility culverts or so-called technical tunnels.

2) Design Standards

The design standards applied were shown in the main report.

3) Relocation and Design of Utilities

Utilities to be carried in public utility culvert are described in the main report, but the volume is not mentioned; this should be clarified. Also, it seems that consultations with suppliers should be carried out to decide on what utilities these should be. However, it is only the water supplier which was identified.

4) Drawings

Wood piles will be applied as foundation of the vertical and horizontal tunnels. These should be changed to concrete or steel piles. Also, the common ditch manholes in Option 1 do not cover common ditches, and the wall of the manhole is located in the middle of the common ditch. The partition will obstruct the easy installation and maintenance works because it is difficult the workers move smoothly. One of the cable pipes is planned to be located under one of the common ditch manhole, which will be difficult to construct. The location of the cable pipes should be reconsidered.

5) Work Quantities

Even though there are no details on the quantities, they seem appropriate.

8.9 Electrical Facility Design

Regarding streetlights, the main design report and drawings were reviewed.

1) Types of Electrical Facilities

The types of light poles and fixtures, as well as the control board, are described in the main report.

2) Location of Electrical Facilities

There is a layout plan for light poles which indicate their locations.

3) Design Standards

The design standards applied are shown in the main report.

4) Design of Electrical Facilities

The details on the light poles that are 25 m in height are unclear; such height seems too high. There is no calculation to justify the requirement for such height. The plan seems to be to install the light poles on the median but it is unclear on how many lamps each pole will have.

5) Drawings

The drawings provided in the layout plan should show the types of lighting fixtures. The intervals for the light poles are planned at 30–40 m, as indicated in the main report, while it is at 35-m intervals in the drawings. The layout should be rearranged to consider the landscape and effectiveness, especially at the intersection of Nguyen Cuu Phu Road and Cai Trung Bridge. The light poles are planned to be inside of the loop ramps at the Tan Kien interchange. To secure clear sight distance, these light poles should be placed outside of the loop ramps. In Drawing No. DLDT-CT-TR-040, the light poles at the loop ramp are missing.

6) Work Quantities

There are no details on the quantities. The missing light poles at the loop ramp should be added.

8.10 Construction Plan

The main design report and the descriptions about the construction methods written in the drawings were reviewed.

1) Road Works

There is no detailed mention about a construction plan except for the construction stage.

2) Bridge Works

There is no detailed mention about a construction plan except for the construction stage.

3) Electrical Works

There is no detailed mention about a construction plan except for the construction stage.

4) Overall Work Schedule

The possibility of organizing two construction groups each working on each end of the route to speed up construction should be studied. However, in the construction plan of the main report, one construction group was planned to work from one end.

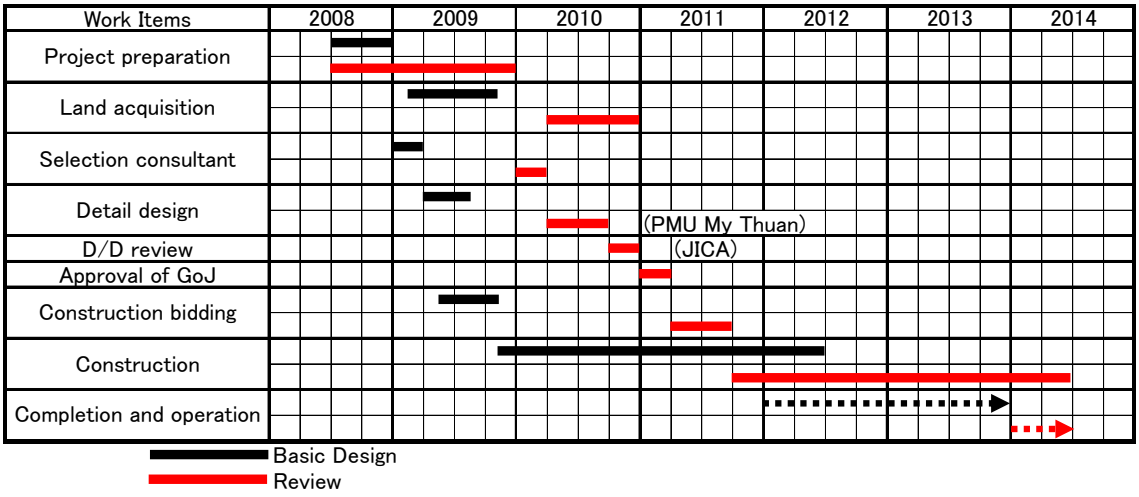
The construction period for the initial stage is estimated at 30 months. The soft-ground treatment is estimated at 18 months at the least. Other works start after 18 months. The time span for treating the soft ground is unclear. If 18 months is required, other soft-ground treatment should be considered. And, the bridge construction should start earlier. If so, the construction schedule can be shortened.

8.11 Implementation Plan

With the basic design, the implementation program is proposed, as shown in Figure 8.11.1 (black line), to be completed by the middle of 2012. However, the original schedule is already delayed because project preparation did not finish by end-2009.

If the project budget will be loaned from JICA, JICA can usually support a SAPROF (Special Assistance for Project Formation) after JICA's fact-finding mission makes a decision on a project's viability. Detailed design and construction can start after the SAPROF results are approved. However, this procedure will take a long of time. Alternatively, the Vietnamese government can carry out a detailed design using its own budget and getting local consultants, while JICA can support by providing the detailed design review. This procedure will take a shorter time.

Figure 8.11.1 Implementation Plan



Source: VITRANSS 2 Study Team

8.12 Economic Analysis

The methodology adopted by TEDI in carrying out the economic analysis of the project can be summarized as follows:

(i) Economic cost was assumed at 85% of the financial cost;

(ii) Economic benefit was taken from savings in VOC and passenger/goods time cost, as well as the reduction in traffic accidents. Except for VOC saving, however, no detail is shown in the report; and,

(iii) The methodology appears to be generally sound except for the lack of details as mentioned above.

The study calculated the project's EIRR at 12.3% and benefit–cost ratio at 1.02..

8.13 Conclusion and Recommendations

1) Conclusion

Based on the review of available documents, it can be concluded that the quality of the FS report for the western missing link which was prepared in 2009 is high.

The East–West Highway connects the Eastern Hanoi Expressway (Cat Lai intersection) to NH1A in the west, which is one of the important trunk roads in the east–west direction in the HCMC metropolitan area. However, since the highway ends on NH1A in the west, most of the traffic uses NH1A. When the traffic moving southwest is diverted to the HCMC–Trung Luong Expressway via NH1A, the traffic volume on NH1A will increase dramatically. If the western missing link is connected to the Tan Tao–Cho Dem road, the traffic volume on NH1A will significantly decrease. It can be concluded that the western missing link will be quite effective and is even recommended to extend farther up to Ring Road No.3.

The implementing agency and the consultant should carry out the detailed design based on the review to facilitate appropriate implementation of the project.

2) Recommendations

The recommendations of the VITRANSS 2 Study Team are as follows:

(a) **NH1 Interchange:** The construction of the East-West Highway was completed including a clover-type interchange connecting the highway and NH1A. However, the connection between the western missing link and NH1A by a loop lump was not considered in the feasibility study. In detailed design stage, this loop lump connection must be taken into consideration.

(b) **Tan Tao–Cho Dem Interchange:** Phase 1 of the interchange was designed in the feasibility study. Based on the updated traffic volume forecast for the western missing link and the Tan Tao-Cho Dem road, Phase 2 of this interchange must be prepared.

(c) **Project scale:** Two alternatives were proposed in the feasibility study. The VITRANSS 2 Study Team recommends the alternative with six (3+3) lanes of main road and four (2+2) lanes of frontage road (similar to the East-West Highway).

(d) **Smooth implementation:** The Tan Tao–Cho Dem road is scheduled to be opened in early 2010. Hence, road works for the western missing link must start soon. It is further recommended to:

  (i) Move to the detailed design stage using the current ADB technical assistance loan to accelerate the implementation of the design phase;
  (ii) Use JICA/ODA loan for the construction of the project for faster procurement and construction; and,
  (iii) Pay more attention to land acquisition to prevent unnecessary delays.

(e) **Items to be included in Detailed Design:** The following items should be included in the scope of the detailed design:

  (i) Study selected interchange for the Tan Tao–Cho Dem road based on the updated traffic demand forecast;
  (ii) Update the project cost using the latest market prices and include the cost of utilities relocation, electrical facilities, foundation improvement, and O&M