

**Table 2.3-24 Summary of Future Traffic Demands**

Section	Peak Hour	Direction	Year		
			2015	2020	2030
Tan Vu IC	AM	To Tan Vu IC	1,276	2,149	4,140
		From Tan Vu IC	745	1,451	3,967
Dinh Vu	PM	To Tan Vu IC	550	1,098	2,490
		From Tan Vu IC	1,125	1,874	3,772
Dinh Vu	AM	Cat Hai to Dinh Vu	927	1,494	2,002
		Dinh Vu to Cat Hai	351	745	1,350
Cat Hai	PM	Cat Hai to Dinh Vu	351	745	1,350
		Dinh Vu to Cat Hai	927	1,494	2,002

Source: Study Team

Note: Traffic volume in 2035 is estimated in Appendix-10.

### 2.3.6. Traffic Demand Forecast by Statistical Method for Comparison

In this section, the F/S traffic forecast using the statistical method is verified. Statistical method is based on the annual statistical data and forecast of socio-economic development index in the whole country and the researched area.

This method is based on the theory that traffic volume and gross domestic product (GDP) growth rate have good correlation since the resulting regional socio-economic development from the project will lead to a reasonable growing scenario of the traffic volume.

#### (1) Socio-economic and Transport Development Index in Whole County

Statistical data on the past volume of goods and passenger transport by road and GDP of the county are shown in Table 2.3-25 and Table 2.3-26.

According to statistical data, the Vietnamese economy, with continued growth from 1995 to 2007, encountered big depression for the first time due to the global economic depression in 2008. Although GDP growth rate fell to 3% in the first quarter of 2009, it recovered after that and became 6.5% at the end of the fourth quarter.

According to "Asian Development Outlook 2010" of ADB, under some assumption, GDP growth is projected to accelerate to 6.5% in 2010 and to 6.8% in 2011.

Trade with the People's Republic of China (PRC) is expected to expand rapidly now that a free trade agreement between the PRC and the Association of Southeast Asian Nations has come into force starting January 1, 2010. It will be linked to the economy of PRC through this, and GDP growth rate will be maintained up until 2011 and subsequent years.

**Table 2.3-25 Volume of Nationwide Transported and Circulated Goods, 1995-2008**

Year	GDP (price in 1994) (billion VND)	Volume of transported freight (thousand tons)	Volume of circulated freight (million tons/km)	GDP growing rate (%)	Growth rate/tons (%)	Growth rate/tons/km (%)
1995	195,567	140,709.9	30,910.5			
1996	213,833	157,201.9	38,710.0	9.3%	11.7%	25.2%
1997	231,264	176,258.8	45,306.7	8.2%	12.1%	17.0%
1998	244,596	189,184.0	46,336.7	5.8%	7.3%	2.3%
1999	256,272	203,212.7	50,054.6	4.8%	7.4%	8.0%
2000	273,666	223,823.0	55,629.7	6.8%	10.1%	11.1%
2001	292,535	252,146.0	63,164.4	6.9%	12.7%	13.5%
2002	313,247	292,869.2	69,417.9	7.1%	16.2%	9.9%
2003	336,242	347,232.7	80,029.5	7.3%	18.6%	15.3%
2004	362,435	403,002.2	90,504.8	7.8%	16.1%	13.1%
2005	393,031	460,146.3	100,728.3	8.4%	14.2%	11.3%
2006	425,373	513,575.1	113,550.0	8.2%	11.6%	12.7%
2007	461,344	596,800.9	134,883.0	8.5%	16.2%	18.8%
2008	489,833	648,681.5	180,694.7	6.2%	8.7%	34.0%
1995-2008				7.3%	12.5%	14.8%

Source: Statistic Yearbook 2008

**Table 2.3-26 Data of Nationwide Passenger Transport by Road, 1995-2008**

Year	GDP (price in 1994, billion VND)	Population (thousand person)	Transported passengers (billion person)	Circulated passengers (million person/km)	GDP growing rate (%)	Rate of transported passengers (%)	Rate of circulated passengers (%)
1995	195,567	71995.5	441.3	15,944.4			
1996	213,833	73156.7	478.2	18,024.8	9.3%	8.4%	13.0%
1997	231,264	74306.9	514.6	19,074.4	8.2%	7.6%	5.8%
1998	244,596	75456.3	549.9	20,179.3	5.8%	6.9%	5.8%
1999	256,272	76596.7	587.8	21,276.8	4.8%	6.9%	5.4%
2000	273,666	77635.4	620.7	22,375.8	6.8%	5.6%	5.2%
2001	292,535	78685.8	677.3	23,394.9	6.9%	9.1%	4.6%
2002	313,247	79727.4	727.7	25,597.5	7.1%	7.4%	9.4%
2003	336,242	80902.4	931.3	30,458.5	7.3%	28.0%	19.0%
2004	362,435	82031.7	1,041.9	34,265.6	7.8%	11.9%	12.5%
2005	393,031	83106.3	1,173.4	38,601.7	8.4%	12.6%	12.7%
2006	425,373	84136.8	1,331.6	43,569.1	8.2%	13.5%	12.9%
2007	461,344	85171.7	1,473.0	49,372.1	8.5%	10.6%	13.3%
2008	489,833	86210.8	1,602.7	53,420.6	6.2%	8.8%	8.2%
1995-2008					7.3%	10.6%	9.8%

Source: Statistic Yearbook 2008

(2) **Socio-economic and Transport Development Index of Hai Phong City**

Statistical data on the past volumes of goods transport and passenger transport by road and GDP of Hai Phong City are shown in Tables 2.3-27 and 2.3-28.

According to statistical data in the past eight years from 2000-2008, Hai Phong City has fair development level.

**Table 2.3-27 Volume of Transported and Circulated Goods in Hai Phong City, 2000-2008**

Year	GDP (price in 1994, billion VND)	Volume of transported freight (thousand tons)	Volume of circulated freight (million tons/km)	GDP growing rate (%)	Growth rate/tons (%)	Growth rate/tons/km (%)
2000	8,313.7	10,594.0	3,383.2			
2001	9,176.5	16,074.0	4,036.3	10.4%	51.7%	19.3%
2002	10,153.8	22,751.0	4,282.8	10.7%	41.5%	6.1%
2003	11,241.6	22,709.0	4,667.4	10.7%	-0.2%	9.0%
2004	12,536.0	24,319.0	5,638.7	11.5%	7.1%	20.8%
2005	14,043.1	25,373.0	6,419.4	12.0%	4.3%	13.8%
2006	15,801.4	26,123.0	7,030.0	12.5%	3.0%	9.5%
2007	17,814.6	31,871.0	8,137.8	12.7%	22.0%	15.8%
2008	20,133.2	37,395.0	9,595.0	13.0%	17.3%	17.9%
1995-2008				11.7%	18.3%	14.0%

Source: Study Team

**Table 2.3-28 Volume of Transported and Circulated Goods in Hai Phong City 2000-2008**

Year	GDP (price in 1994, billion VND)	Population (thousand person)	Transported passengers (thousand person)	Circulated passengers (million person/km)	GDP growing rate (%)	Rate of transported passengers (%)	Rate of circulated passengers (%)
2000	8,313.7	1700.5	11,013.0	244.7			
2001	9,176.5	1723.5	11,764.0	287.4	10.4%	6.8%	17.4%
2002	10,153.8	1743.4	12,347.0	326.2	10.7%	5.0%	13.5%
2003	11,241.6	1754.2	13,875.0	355.3	10.7%	12.4%	8.9%
2004	12,536.0	1770.8	15,677.0	393.4	11.5%	13.0%	10.7%
2005	14,043.1	1792.7	17,860.0	598.7	12.0%	13.9%	52.2%
2006	15,801.4	1812.7	22,692.0	756.0	12.5%	27.1%	26.3%
2007	17,814.6	1826.9	25,938.0	1,017.0	12.7%	14.3%	34.5%
2008	20,133.2	1845.9	27,562.0	1,081.0	13.0%	6.3%	6.3%
1995-2008					11.7%	12.4%	21.2%

Source: Study Team

**(3) Forecast of Transport Growth**

National GDP has recovered after the depression in 2008 to the same level as before. Also, the GDP level of 7% will be kept up from now on. Growth rate of Hai Phong City compared with the nationwide growth rate is as follows:

- GDP is 1.60 times.
- Transported freight is 1.46 times.
- Transported passengers are 1.17 times.

Project site, being located in Hai Phong, needs to assume a high growth rate to some extent. Along the Hanoi – Hai Phong Expressway, 1.2 and 1.05 times of nationwide growth rate are expected.

The growth rate of future traffic along Tan Vu – Lach Huyen Highway is assumed as follows:

**Table 2.3-29 Forecast of Transport Growth Rate**

Stage	2010-2015	2016-2020	2021-2025	2026-2030
Nationwide	7.0%	6.5%	6.5%	6.0%
Hanoi-Hai Phong Expressway	7.67%	7.67%	6.67%	6.67%
Preparatory survey on Lach Huyen Port (Road and Bridge portion)	8.00%	8.00%	7.00%	7.00%

Source: Study Team

Note: Traffic volume in 2035 is estimated in Appendix-10.

It is estimated that the growth rate of the project is 1.3 times of the nationwide rate considering the high growth rate of Hai Phong City.

**(4) Traffic Demand Forecast for Comparison of Updated Traffic**

Based on the socio-economic data and summarized result of real traffic count at Cat Hai Island, the traffic volume, according to vehicle and passenger car unit (pcu) for future years, was calculated as shown in Tables 2.3-30 and 2.3-31.

**Table 2.3-30 Traffic Demand Forecast Based on Socio-economic Data**

Year	Dinh Vu-Cat Hai Ferry and Ninh Tiep Ferry terminal			Cat Hai Roa			Ben Got Ferry Terminal and Cat Hai-Cat Ba Ferry		
	Total (pcu/day-night)	To Tan Vu IC Direction (pcu/peak hr)	To Cat Ba Direction (pcu/peak hr)	Total (pcu/day-night)	To Tan Vu IC Direction (pcu/peak hr)	To Cat Ba Direction (pcu/peak hr)	Total (pcu/day-night)	To Tan Vu IC Direction (pcu/peak hr)	To Cat Ba Direction (pcu/peak hr)
2010	506	28	23	607	33	27	439	24	20
2011	547	30	25	655	36	29	474	26	21
2012	591	33	27	706	39	32	511	28	23
2013	638	35	29	763	42	34	551	30	25
2014	688	38	31	824	45	37	596	33	27
2015	3,913	215	176	4,060	223	183	643	35	29
2016	6,462	355	291	6,619	364	298	695	38	31
2017	9,026	496	406	9,196	506	414	751	41	34
2018	11,615	639	523	11,800	649	531	811	45	36
2019	14,216	782	640	14,417	793	649	875	48	39
2020	16,841	926	758	17,057	938	768	945	52	43
2021	23,032	1,267	1,036	23,263	1,279	1,047	1,011	56	45
2022	27,286	1,501	1,228	27,534	1,514	1,239	1,081	59	49
2023	31,852	1,752	1,433	32,116	1,766	1,445	1,156	64	52
2024	36,747	2,021	1,654	37,030	2,037	1,666	1,237	68	56
2025	41,965	2,308	1,888	42,268	2,325	1,902	1,323	73	60
2026*	33,743	1,856	1,518	34,066	1,874	1,533	1,416	78	64
2027*	37,885	2,084	1,705	38,231	2,103	1,720	1,515	83	68
2028*	42,254	2,324	1,901	42,626	2,344	1,918	1,622	89	73
2029*	46,851	2,577	2,108	47,248	2,599	2,126	1,735	95	78
2030*	51,703	2,844	2,327	52,128	2,867	2,346	1,857	102	84

Source: Study Team

2026\*-2030\*: Railway transportation is taken into consideration.

Note: Traffic volume in 2035 is estimated in Appendix-10.

The number of large-sized trailer is based on demand forecasting of Lach Huyen Port. Based on TEU forecast from the demand forecasting of the Lach Huyen Port, container traffic vehicles were calculated considering the following conditions:

- Ratio of 20-foot container to 40-foot container is set at 1:2 from statistics of an international harbor.
- Trailer has two types, namely, 20-foot and 40-foot container, from results of an investigation per unit time of container traffic.
- Rail transportation is taken into consideration at 30% in 2026 and afterwards.
- The peak rate is made at 10%.
- Freight demand in 2030 was set to 120 million tons as shown in MOT Decision No. 501.

**Table 2.3-31 Estimated Cargo Volume and Container Vehicles**

	Cargo	TEU	Truck of more than 3 axles			
	1,000 ton/year	1,000 TEU	vehicle/year	vehicle/day	pcu/day	pcu/peak hr
2015	5,394	463	463,000	1,268	3,170	317
2016	9,607	826	826,000	2,263	5,658	566
2017	14,962	1,191	1,191,000	3,263	8,158	816
2018	19,816	1,559	1,559,000	4,271	10,678	1,068
2019	24,671	1,928	1,928,000	5,282	13,205	1,321
2020	29,525	2,299	2,299,000	6,299	15,748	1,575
2021	37,061	3,192	3,192,000	8,745	21,863	2,186
2022	44,126	3,801	3,801,000	10,414	26,035	2,604
2023	51,726	4,455	4,455,000	12,205	30,513	3,051
2024	59,863	5,156	5,156,000	14,126	35,315	3,532
2025	68,536	5,903	5,903,000	16,173	40,433	4,043
2026	54,421	4,687	4,687,000	12,841	32,103	3,210
2027	61,243	5,275	5,275,000	14,452	36,130	3,613
2028	68,439	5,895	5,895,000	16,151	40,378	4,038
2029	76,011	6,547	6,547,000	17,937	44,843	4,484
2030	84,000	7,235	7,235,000	19,822	49,555	4,956

Source: Study Team

Note: Traffic volume in 2035 is estimated in Appendix-10.

Comparison is made on the future traffic demand along the section between Dinh Vu and Cat Hai Island. The revised F/S transport demand forecasting and demand forecasting based on the traffic census carried out this time were summarized in Table 2.3-32.

**Table 2.3-32 Comparison of Traffic Forecast between Revised F/S and Traffic Survey Basis**

Forecast Method	Peak Hour	Direction	Year			
			2015	2020	2025	2030
Revised FS Traffic	AM	Cat Hai to Dinh Vu	927	1,494	1,748	2,002*
		Dinh Vu to Cat Hai	351	745	1,047	1,350*
	PM	Cat Hai to Dinh Vu	351	745	1,047	1,350*
		Dinh Vu to Cat Hai	927	1,494	1,748	2,002*
Based on Traffic Survey in Cat Hai	AM	Cat Hai to Dinh Vu	215	926	2,308	2,844*
		Dinh Vu to Cat Hai	176	758	1,888	2,327*
	PM	Cat Hai to Dinh Vu	176	758	1,888	2,327*
		Dinh Vu to Cat Hai	215	926	2,308	2,844*

Source: Study Team

2030\*: Railway transportation is taken into consideration.

Note: Traffic volume in 2035 is estimated in Appendix-10.

Lane operation:

- Revised F/S traffic can be operated with four lanes until 2025.



- In the forecast based on traffic census, four-lane operation will be possible until 2023.
- In both examination cases, six-lane operation will be realized in 2030.

### **2.3.7. Conclusion of Traffic Demand Forecast**

As a result of updating the conditions of the F/S study with the latest information, the forecasted traffic volume was decreased.

The reduction in each fiscal year is as follows:

- Tan Vu IC – Dinh Vu IZ section: 44% reduction in 2015, 43% reduction in 2020 and 10% reduction in 2030.
- Dinh Vu IZ – Cat Hai Island: 45% reduction in 2015, 44% reduction in 2020 and 31% reduction in 2030.

The F/S Study concluded that the period for four-lane operation is as short as five years and six lanes are built from the start. In this Study, it has been judged that the period for four-lane operation is ten years, and **provisional operation was effective**.

The result showed that four-lane operation is possible until 2023 based on the traffic census at Cat Hai Island. Provisional operation is also effective based on the result.

## 2.4. Alternative Studies of Civil Works

### 2.4.1. General

In this Study, the following alternative studies are carried out in order to examine the appropriateness of the F/S in terms of 1) Construction cost, 2) Construction period, 3) Constructability, and so on.

- Stage Construction
- Bridge Length
- Bridge Type (1), Main Bridge
- Bridge Type (2), Approach Bridge
- Construction Schedule

It is considered that other alternative studies should be carried out during the detailed design stage, if necessary.

### 2.4.2. Route Alignment

#### (1) Review of Previous Study

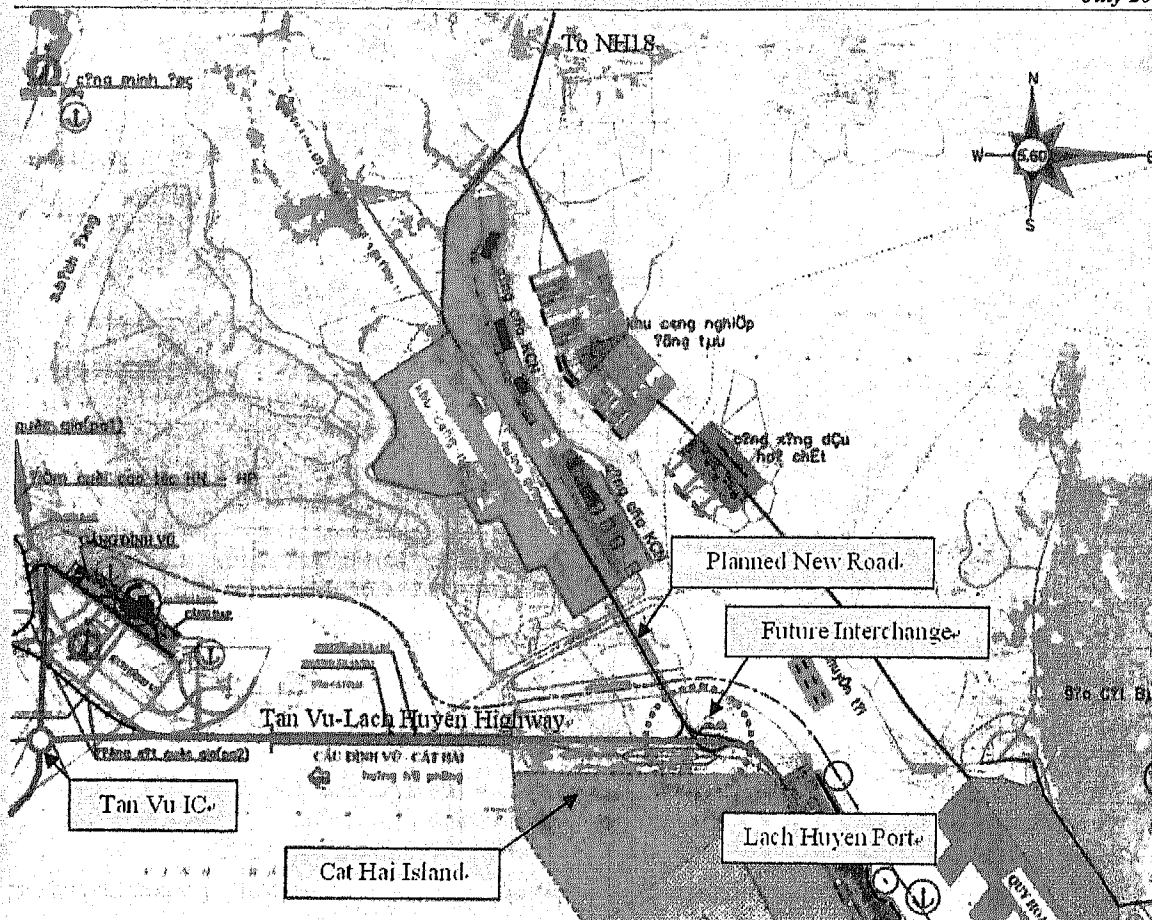
The concept of route alignment connecting Hoi An and Cat Hai Island was developed a long time ago. The wide area development plan was prepared by TEDI in 2007.

In the F/S, the horizontal alignment was developed on the basis of 1 to 1,000 topographic maps. The alignment was approved by MOT through Letter No. 273/TB-BGTVT dated June 24, 2008.

In this Study, the F/S alignment was reviewed. Moreover, its appropriateness was confirmed with regard to the following aspects:

- Considering the Hanoi – Hai Phong Expressway and spatial relationship, location of the Tan Vu IC is appropriate.
- Considering the Hai Phong City master plan, subsequent industrial zone development plan, and position of the intersection with the local road in Dinh Vu IZ area, the route alignment is appropriate.
- Considering the future connection with NH18 in Cat Hai Island and fixed intersection location, the alignment in the island is mostly fixed in the F/S and it is appropriate.





Source: Detailed Design of Lach Huyen Port (TEDI Port, 2004)

**Figure 2.4-1 Future Road Network in Cat Hai Island**

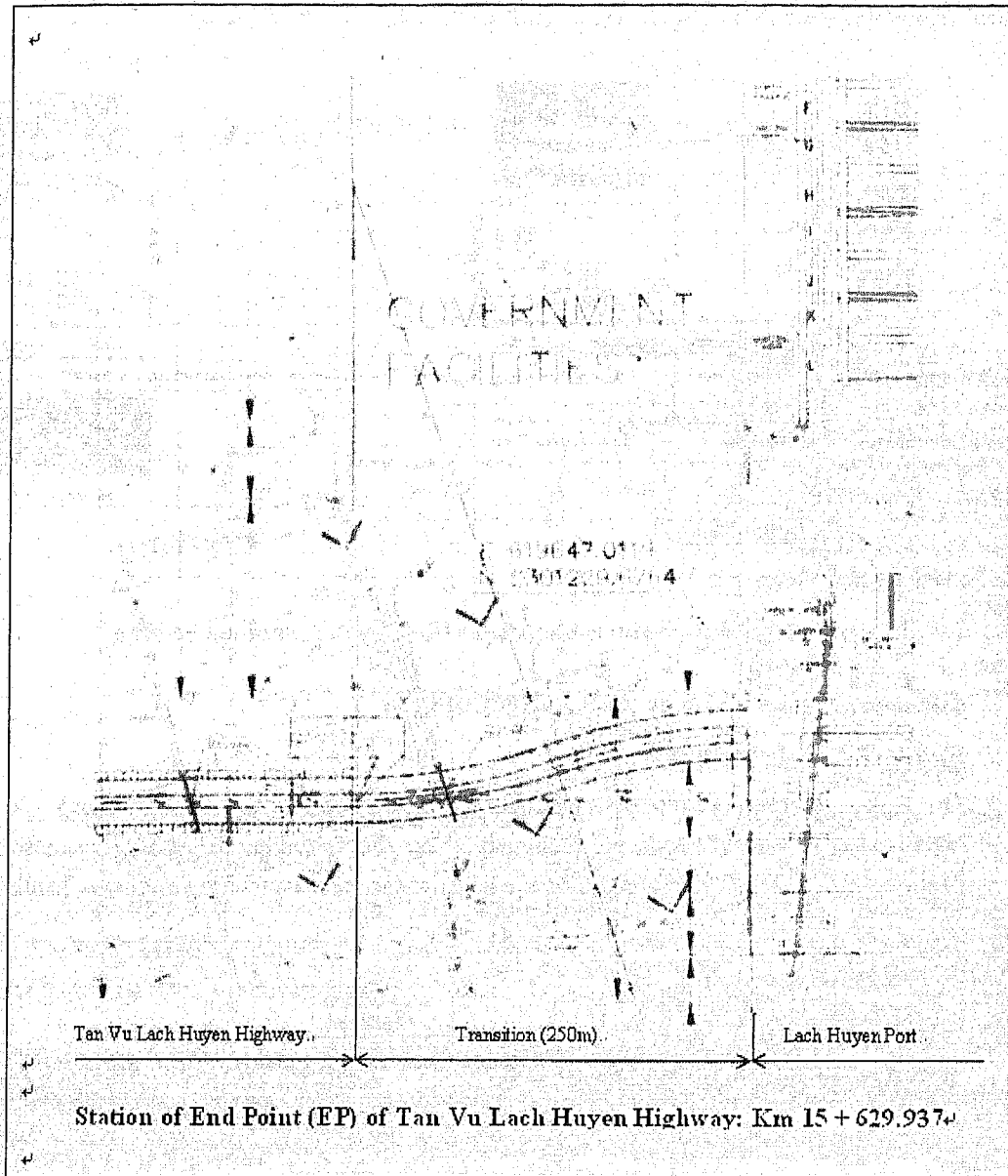
(2) **Change of Alignment at End Point**

The boundary between the road works portion and port work portion was confirmed with the Port Study Team.

**Table 2.4-1 Boundary between Road Works and Port Works**

Edge of Government Facility Area (250 m offset from the Edge of Port Terminal Area)
--

As the result in this Study, the road length is changed into **15 km 630m**



Source: Study Team

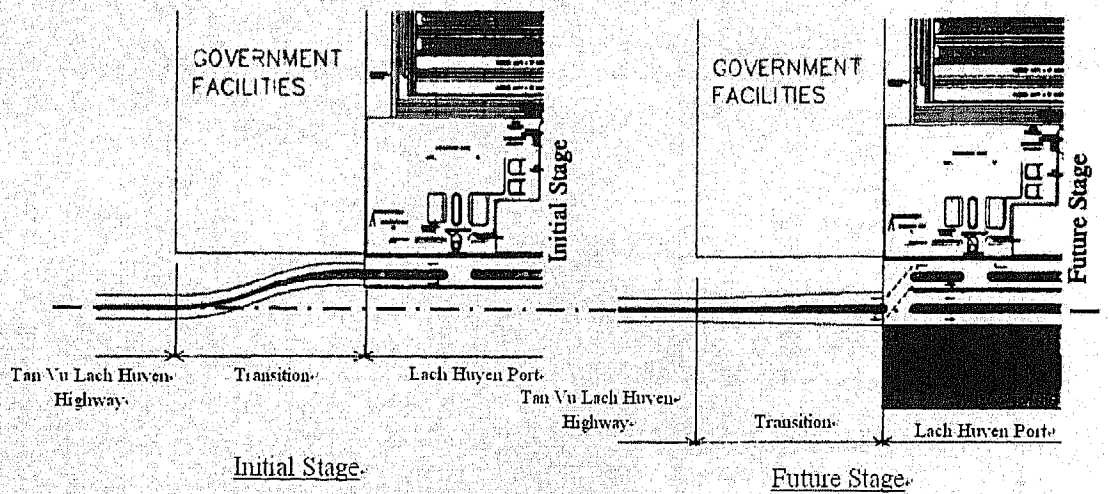
**Figure 2.4-2 Updated End Point Position of Tan Vu -Lach Huyen Highway**

**Table 2.4-2 Project Road Length**

Project Road Length = 15.630 km
---------------------------------

**(3) Future Alignment Updates**

In accordance with the port development plan shown in the report of Port Portion Preparatory Survey, the alignment of the “transition” section will be updated in the future in accordance with port development.



Source: Port Portion Study Team

Figure 2.4-3 Future Alignment Update at Transition Section

### 2.4.3. Alternative Study on Stage Construction Options

#### (1) Future Traffic Lane Requirements

The number of required lanes is calculated from peak traffic volume according to TCVN4054-2005. The number of lanes is calculated using the following formula, in accordance with Section 4.2.2 in TCVN4054-2005, on the basis of the forecast traffic volume of Table 2.3-30:

< Section 4.2.2 in TCVN4054-2005 >

Where:

$$n_{\text{lane}} = \frac{N_{\text{rush-hour}}}{Z * N_{\text{actual-capacity}}}$$

$n_{\text{lane}}$ : required number of lane

$N_{\text{rush-hour}}$ : peak-hour design traffic volume: (Section 3.3.3)  $N_{\text{Peak-hour}} = (0.10 \div 0.12) N_{\text{average daily}}$

Z: volume to capacity ratio

- $V_{it} = 80 \text{ km/h}, Z = 0.55;$
- $V_{it} = 60 \text{ km/h}, Z = 0.55$  for the flat area  
 $Z = 0.77$  for the rolling-mountainous areas;
- $V_{it} \leq 40 \text{ km/h}, Z = 0.85$   $V_{it}$  is Design Speed

$N_{\text{actual-capacity}}$ :

- 1800 pcu/hr/lane: When there is median separator between the vehicles in opposite directions and side separator between motor vehicles and non-motorized ones.
- 1500 pcu/hr/lane: When there is median separator between the vehicles in opposite directions but no side separator for motor vehicles and non-motorized ones.
- 1000 pcu/hr/lane: When there is median separator between the vehicles in opposite directions but no side separator for motor vehicles and non-motorized ones.

In accordance with the above, the future traffic lane requirements are calculated as shown in Table 2.4-3.

**Table 2.4-3 Number of Lane**

Section	Peak Hour	Direction	Year							
			2015		2020		2025		2030	
Tan Vu IC	AM	To Tan Vu Interchange	1,276	2	2,149	3	3,145	4	4,140	5
		From Tan Vu Interchange	745	1	1,451	2	2,709	3	3,967	5
Dinh Vu	PM	To Tan Vu Interchange	550	1	1,098	2	1,794	2	2,490	3
		From Tan Vu Interchange	1,125	2	1,874	2	2,823	3	3,772	4
Dinh Vu	AM	Cat Hai to Dinh Vu	927	1	1,494	2	1,748	2	2,002	3
		Dinh Vu to Cat Hai	351	1	745	1	1,047	2	1,350	2
Cat Hai	PM	Cat Hai to Dinh Vu	351	1	745	1	1,047	2	1,350	2
		Dinh Vu to Cat Hai	927	1	1,494	2	1,748	2	2,002	3

Source: Study Team

**(2) Alternative Study on Stage Construction Options**

**1) Stage Construction Assumed from Traffic Forecast**

As described in the above, four lanes of the highway would bear the traffic demand in the future. In order to reduce the initial construction cost, "stage construction method" should be applied for the road development.

However, future widening should be considered in the planning at the initial stage so as to enable easier construction work at that time.

**2) Stage Construction Options (1) Tan Vu Intersection**

In the F/S, major traffic direction is between Hanoi – Hai Phong Expressway (HHE) and Lach Huyen Port (LHP), and this tendency will not be changed.

Ring Road No. 3 (RR3) of Hai Phong City is planned to connect to this intersection in the future, however, there is no time envisaged regarding its materialization.

**3) Stage Construction Options (2) Section between Tan Vu and Cat Hai**

These are the following alternatives for stage construction, in general, considering the 4-lane highway at the initial stage and 6-lane in the second development stage.

**Alternatives**

Considering the above traffic requirement and in order to reduce the initial construction cost reasonably, "stage construction method" is recommended and its application was studied.

**Table 2.4-4 Alternatives of Stage Construction**

Alternative No.	Hai An Side		Bridge	Cat Hai Side	
	Tan Vu IC	Pavement		Pavement	Embankment
		Embankment			
SC-1	At-grade	4	4	4	
		4		4	
SC-2	At-grade	4	4	4	
		6		6	

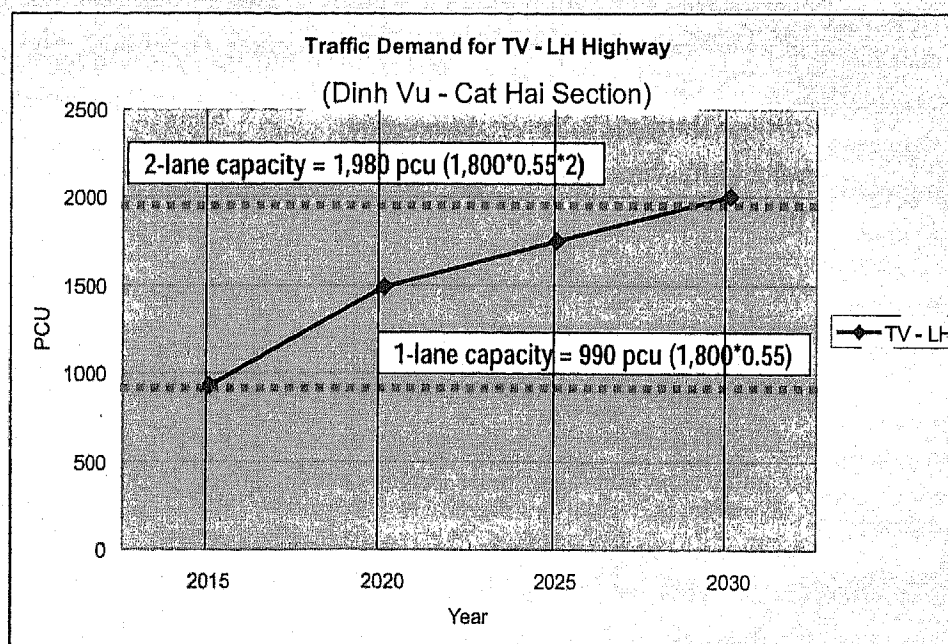
**Comparison Study**

Alternatives are compared in terms of 1) traffic demand, 2) construction cost, 3) construction period, 4) ease in future widening works in Table 2.4-5.

**Table 2.4-5 Alternatives of Stage Construction**

Alternative No.	Traffic Demand	Construction Cost	Construction Period	Future Widening
SC-1	- Sufficient	- VND 939 billion	- Controlled by bridge works	- Difficult to widen embankment
SC-2	- Sufficient	- VND 1,128 billion (+VND 189 billion (+20%))	- Controlled by bridge works	- No need to widen embankment

Source: Study Team



Source: Study Team

**Figure 2.4-4 Future Lane Requirement**