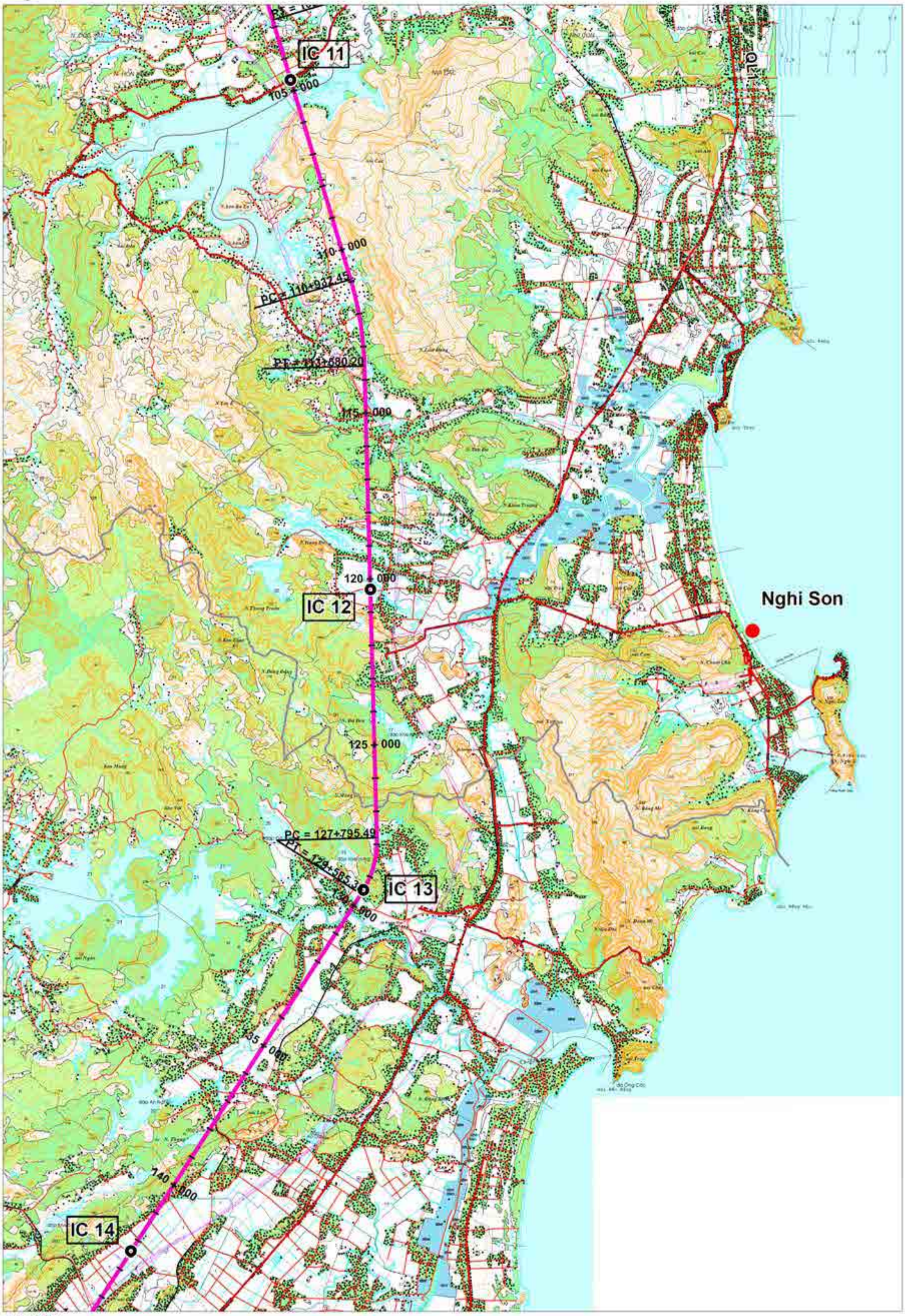
APPENDIX 4B

Expressway Alignment and Port Location

Appendix 4B
EXPRESSWAY ALIGNMENT AND PORT LOCATION

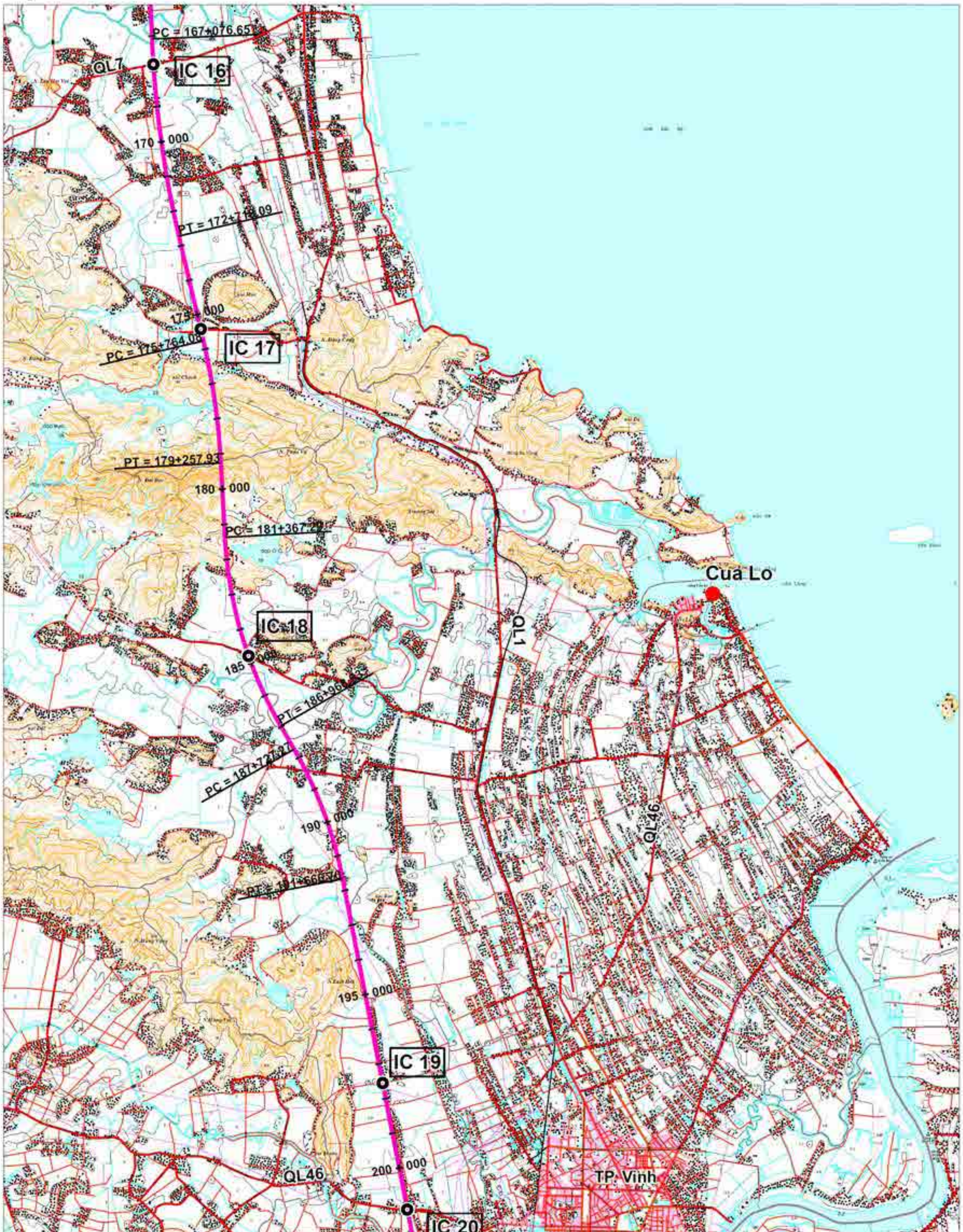
Index Map

Nghi Son Port



1:50,000

Cua Lo Port



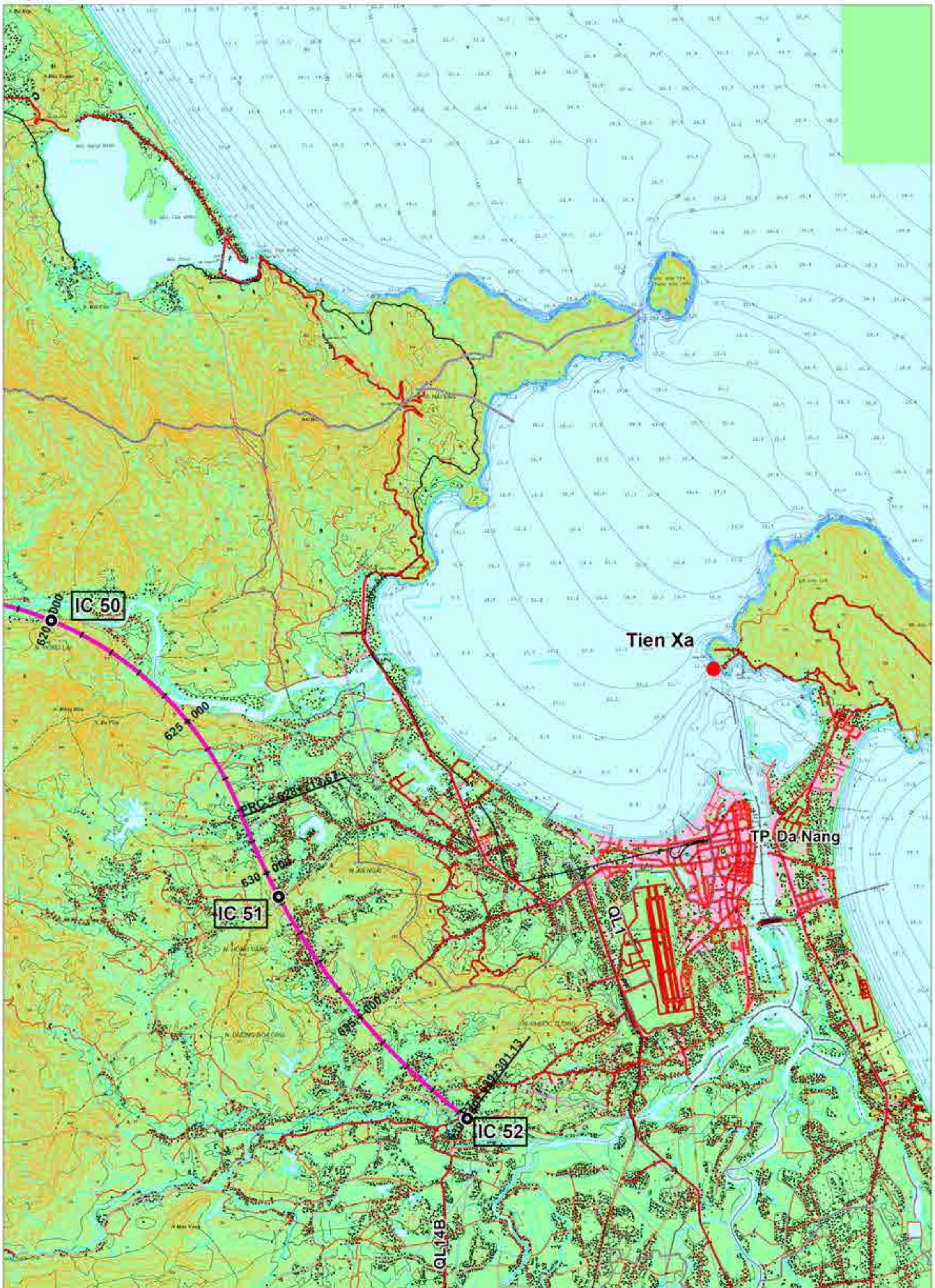
1:50,000

Vung Ang Port
vịnh bắc bộ
Vung Ang
QL 1
IC 27
IC 28
IC 29
PT = 294+741.88
PC = 301+046.59
PRC = 311+828.07
PT = 319+074.19
300+000
305+000
310+000
315+000
320+000
1:50,000

Chan May Port

1:50,000

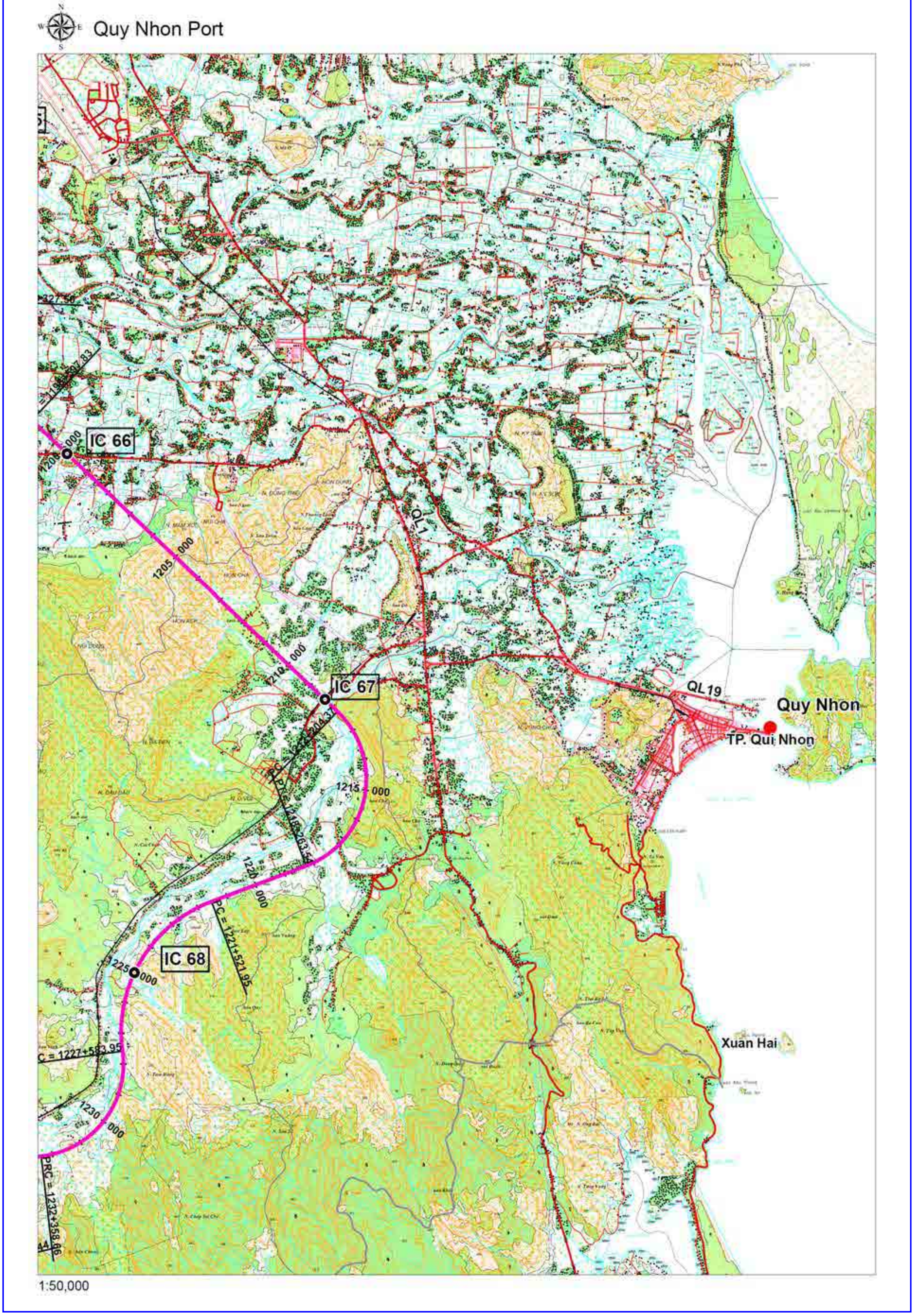
Tien Xa Port



1:50,000

Dung Quat Port

1:50,000


Quy Nhon Port
IC 66
IC 67
IC 68
QL1
QL19
Quy Nhon
TP. Qui Nhon
Xuan Hai
1205+000
1210+000
1215+000
1220+000
1230+000
1:50,000

Van Phong Port

1:50,000

Nha Trang Port

1:50,000

APPENDIX 6A

Proposal of Standard Cross-Section System

Appendix 6A

Proposal of Standard Cross-Section System

1) Introduction

Prior to setting up the standard unit cost system for road network development in Vietnam, a typical cross section system is proposed, as discussed below.

2) Premises and Assumptions Adopted

(1) Premises

For the proposed typical cross section system, classification of cross section follows the matrix of typical cross section for standard unit cost system. The matrix of typical cross section comprehended all types of representative case by road classification, number of lanes, road structure such as fill, cut, cut & fill, bridge and tunnel, and situation such as new construction and improvement corresponding to road network development strategy. According to the matrix of typical cross section, 46 typical cross sections should be set up.

The setting up of typical cross section complies with the following Vietnamese road standards:

(i) Expressway: TCVN 5729: 2007

(ii) National Highway: TCVN 4054: 2005

(iii) Urban Road: TCXDVN 104: 2007

(2) Assumptions Adopted

For setting up the typical cross section, representative class and design speed are selected to consider majority, moderate, universal, realistic and pertinent from the standards for each road category. The adopted classes and design speed are shown in the following table:

Table 1 Adopted Class for Typical Cross Section

Types	Road Category	No. of Lanes	Design Speed (km/h)	Classes
New Construction	Expressways	4 & 6-lane	100	Grade 100 with cover and column
	City Ring Roads	2-lane	50	Access urban road in construction class II
		4-lane	60	Secondary of main urban road in construction class II
		6-lane	70	Primary of main urban road in construction class II
	National Highways	2-lane	80	Category III in Flat & Rolling Terrain
		4-lane	80*	Category II in Flat & Rolling Terrain
Improvement	National Highways (Urban Section)	1-lane to 2-lane	50	Secondary of main urban road in construction class II
		2-lane to 4-lane	60	Primary of main urban road in construction class II
	National Highways (Non-Urban Section)	1-lane to 2-lane	80	Category III in Flat & Rolling Terrain
		2-lane to 4-lane	80*	Category II in Flat & Rolling Terrain

Source: VITRANSS 2 Study Team
Note: *: Design speed of category II is 100 km/h; however, 80 km/h is applied considering reality.

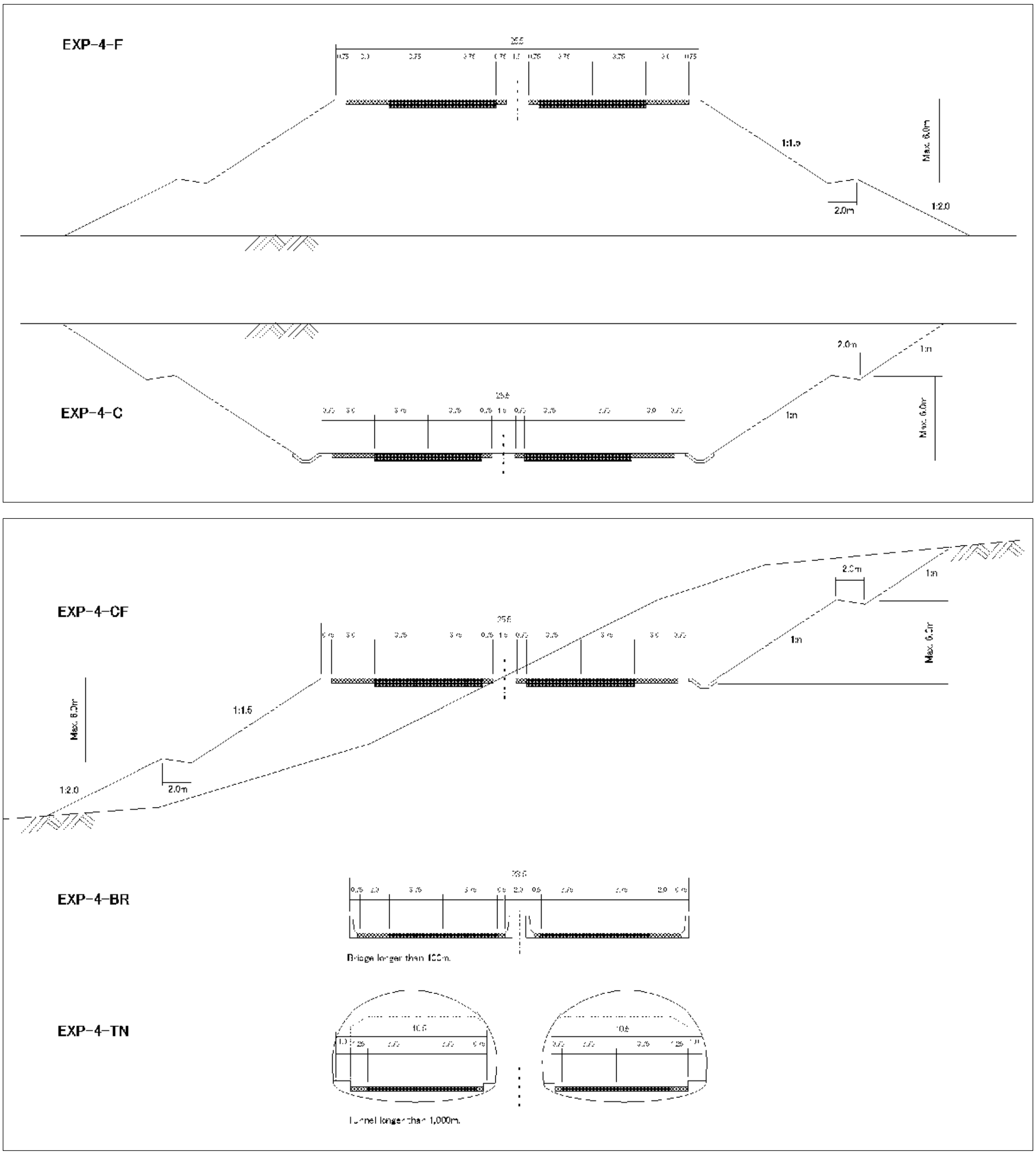
In urban road standard, there is no mention regarding the cross section on bridges. Thus, shoulder width in highway standard is applied with the measures on bridge for setting up typical cross section on bridge in urban road, i.e., the shoulder width on bridge can be reduced to 1.0 m from the shoulder of embankment but should be more than 0.5 m. Also, sidewalk on bridge for urban access road is applied 1.5 m in width, which is the same as the minimum sidewalk width on tunnels under highway standard and two persons can pass each other with one bag in hand. For sidewalk on bridges in main urban road, 2.0 m in width is applied considering that two persons can pass each other with a bag in each hand. Urban road standard is also applied along national highways in urban section.

3) Typical Cross Sections

The following typical cross sections were laid out according to the above-mentioned assumptions.

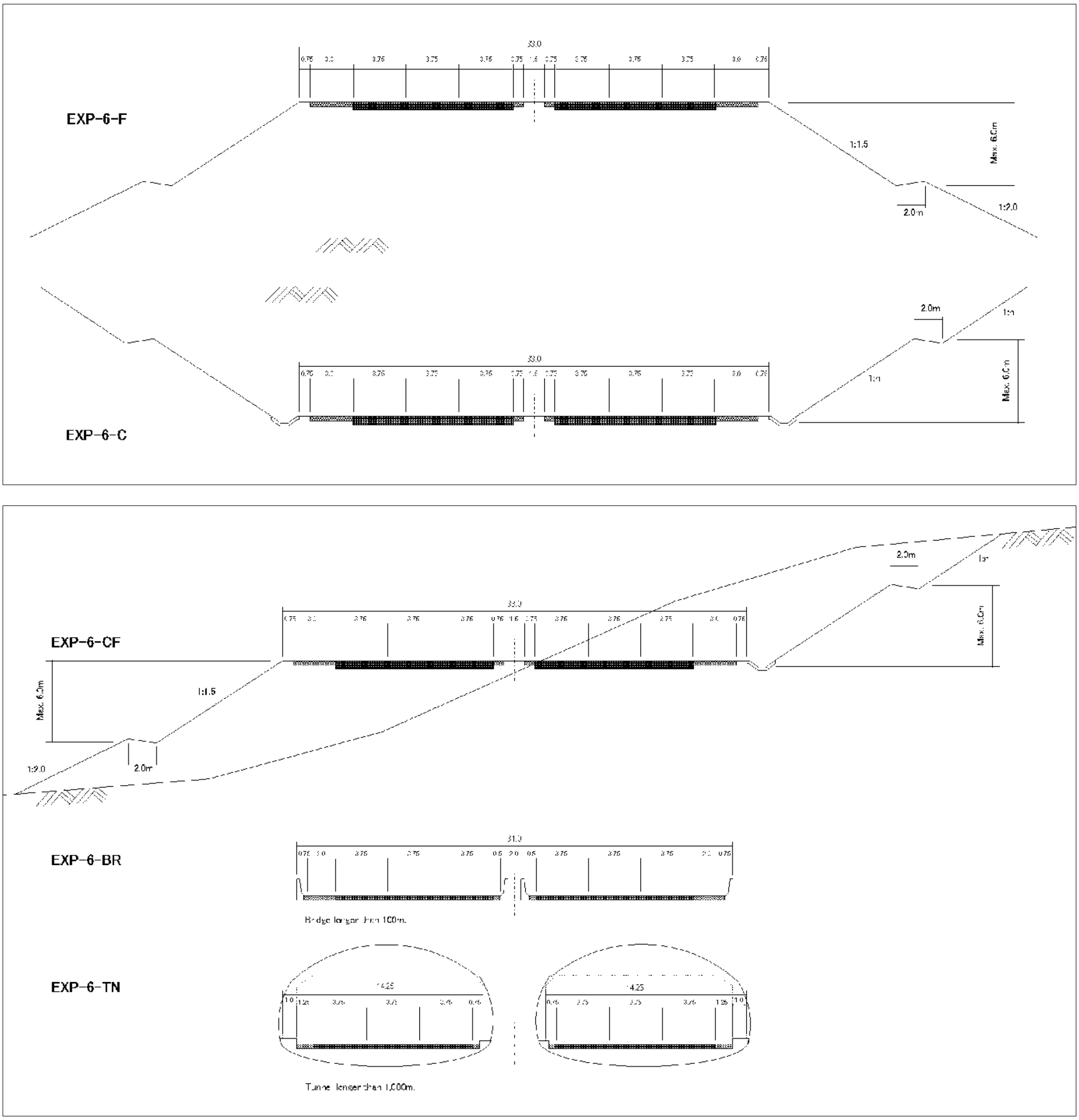
(1) New Construction of Expressways

Figure 1 Typical Cross Section of Expressway (New Construction, 4-lane)



Source: VITRANSS 2 Study Team based on TCVN 5729-07

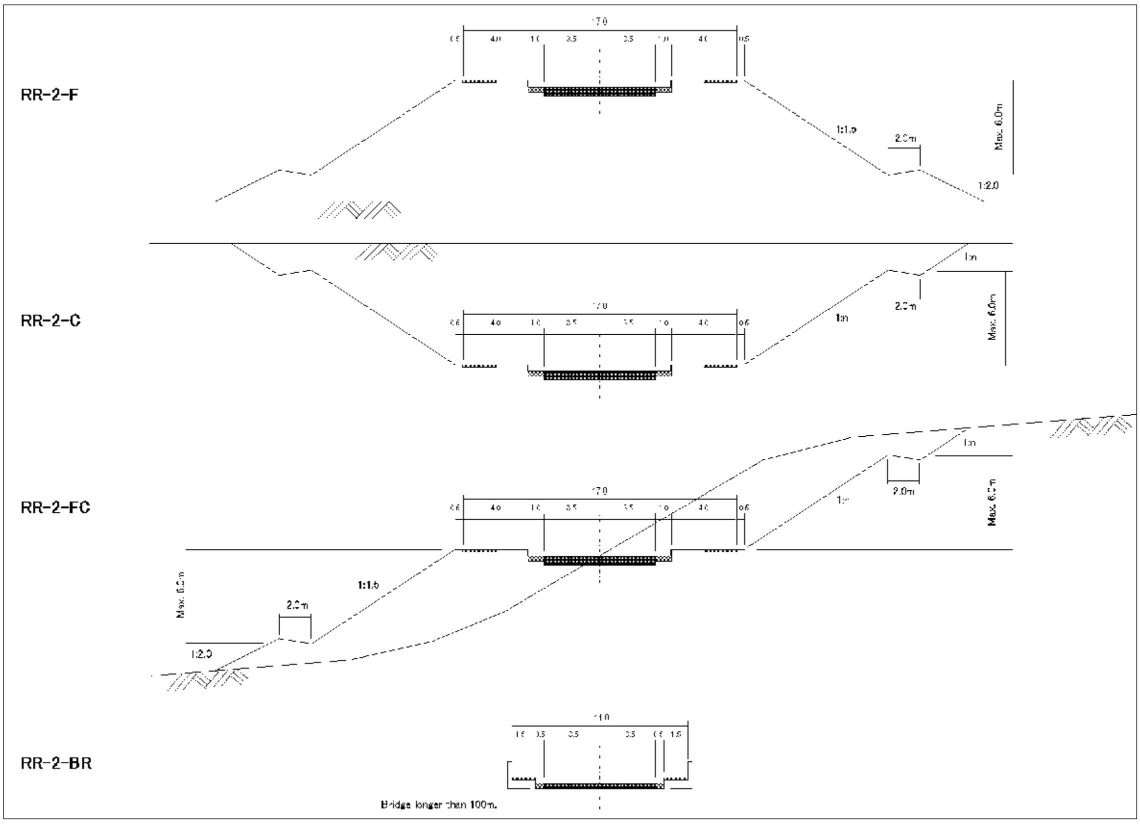
Figure 2   Typical Cross Section of Expressway (New Construction, 6-lane)



Source: VITRANSS 2 Study Team based on TCVN 5729-07

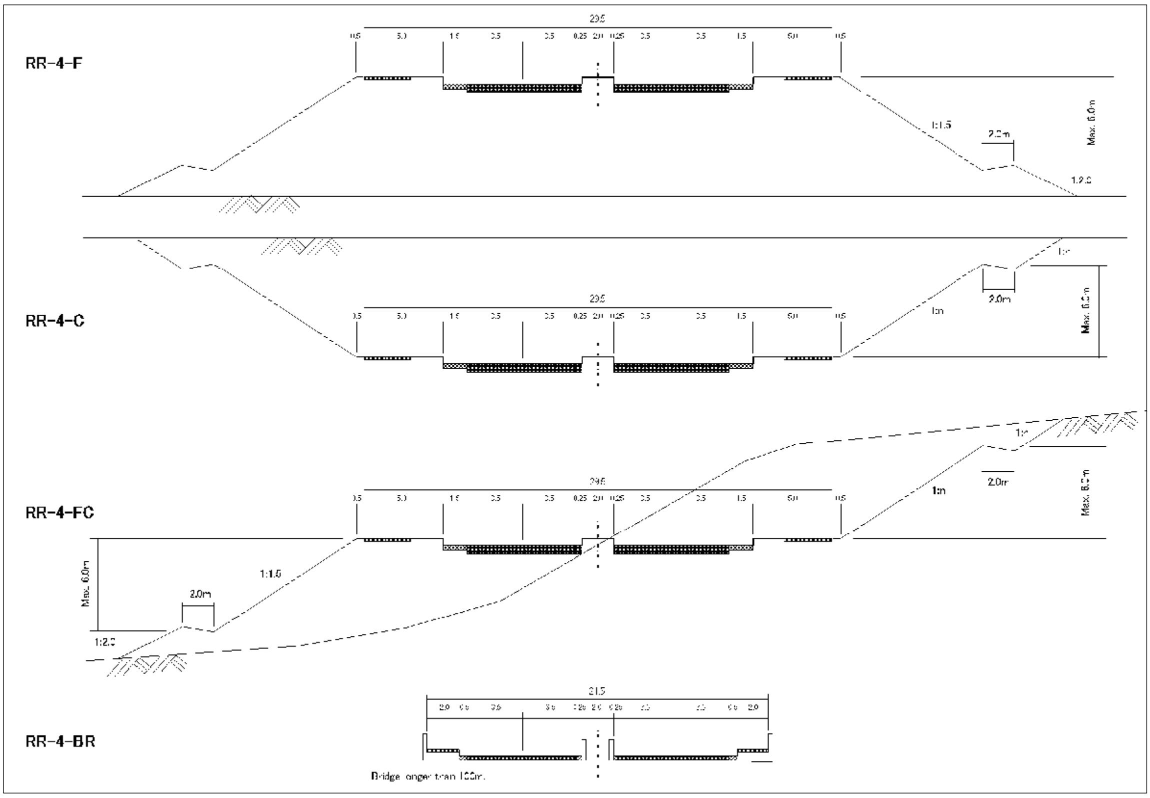
(2) New Construction of City Ring Roads

Figure 3 Typical Cross Section of City Ring Roads (New Construction, 2-lane)



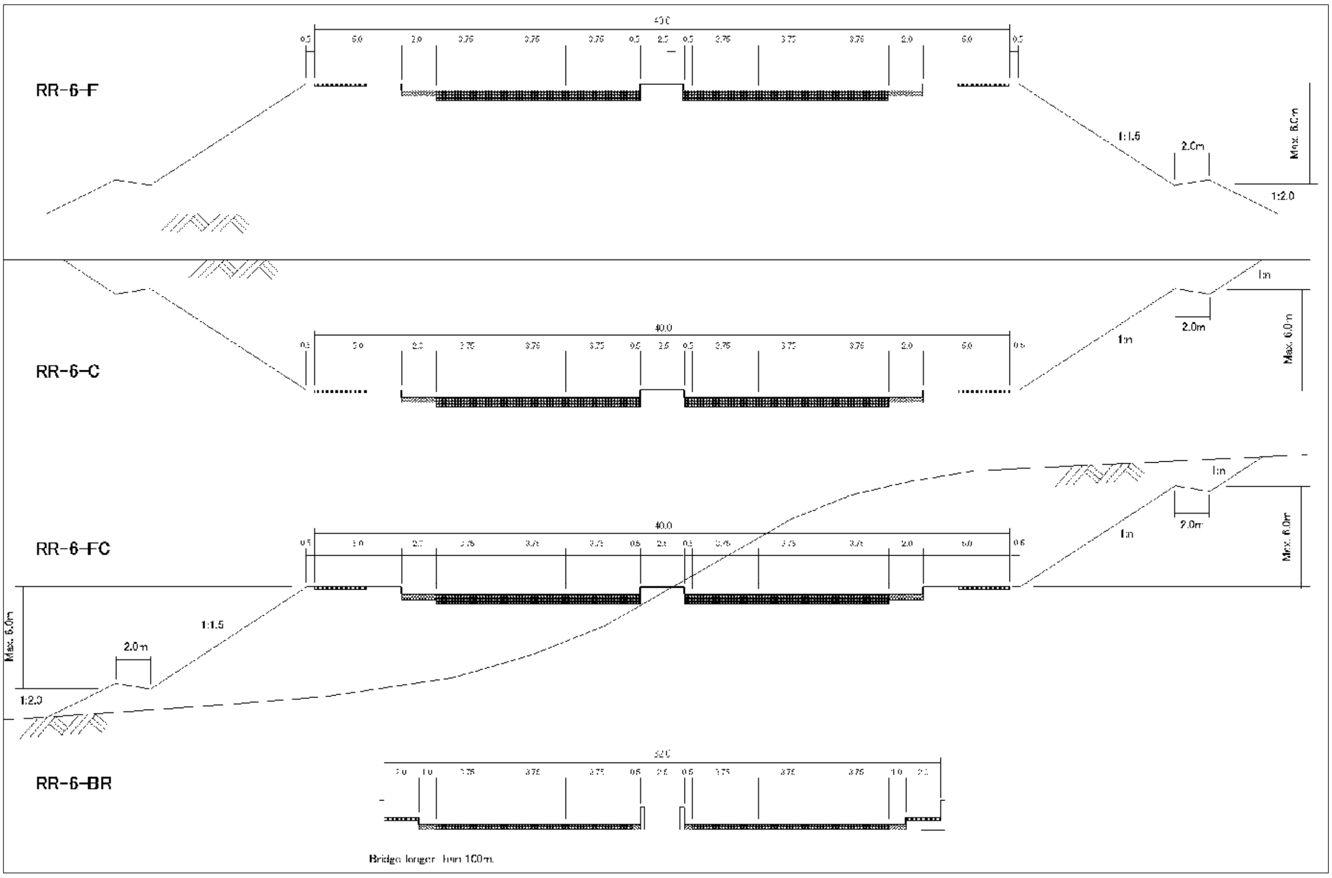
Source: VITRANSS 2 Study Team based on TCXDVN 104-07

Figure 4 Typical Cross Section of City Ring Roads (New Construction, 4-lane)



Source: VITRANSS 2 Study Team based on TCXDVN 104-07

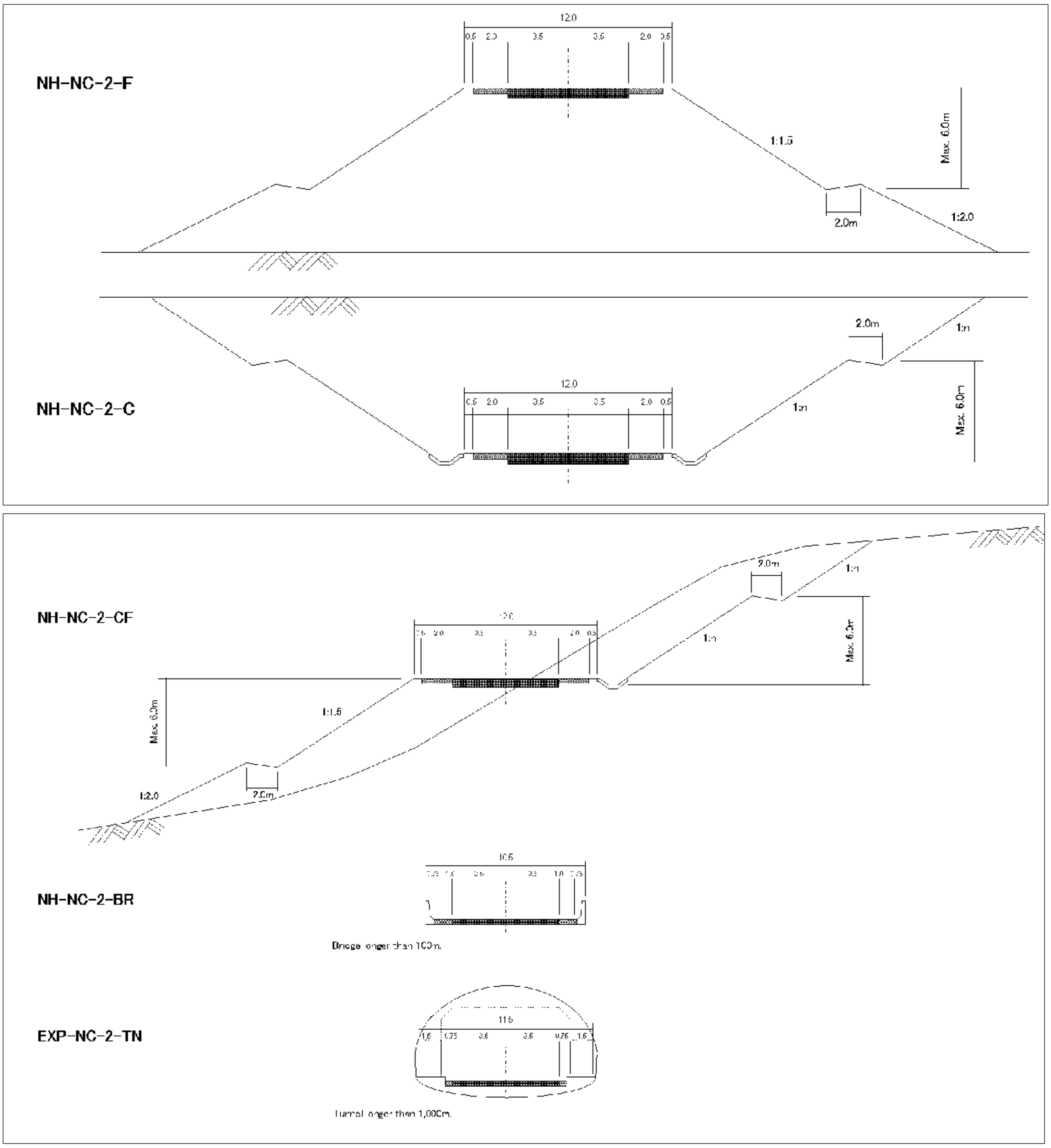
Figure 5   Typical Cross Section of City Ring Roads (New Construction, 6-lane)



Source: VITRANSS 2 Study Team based on TCXDVN 104-07

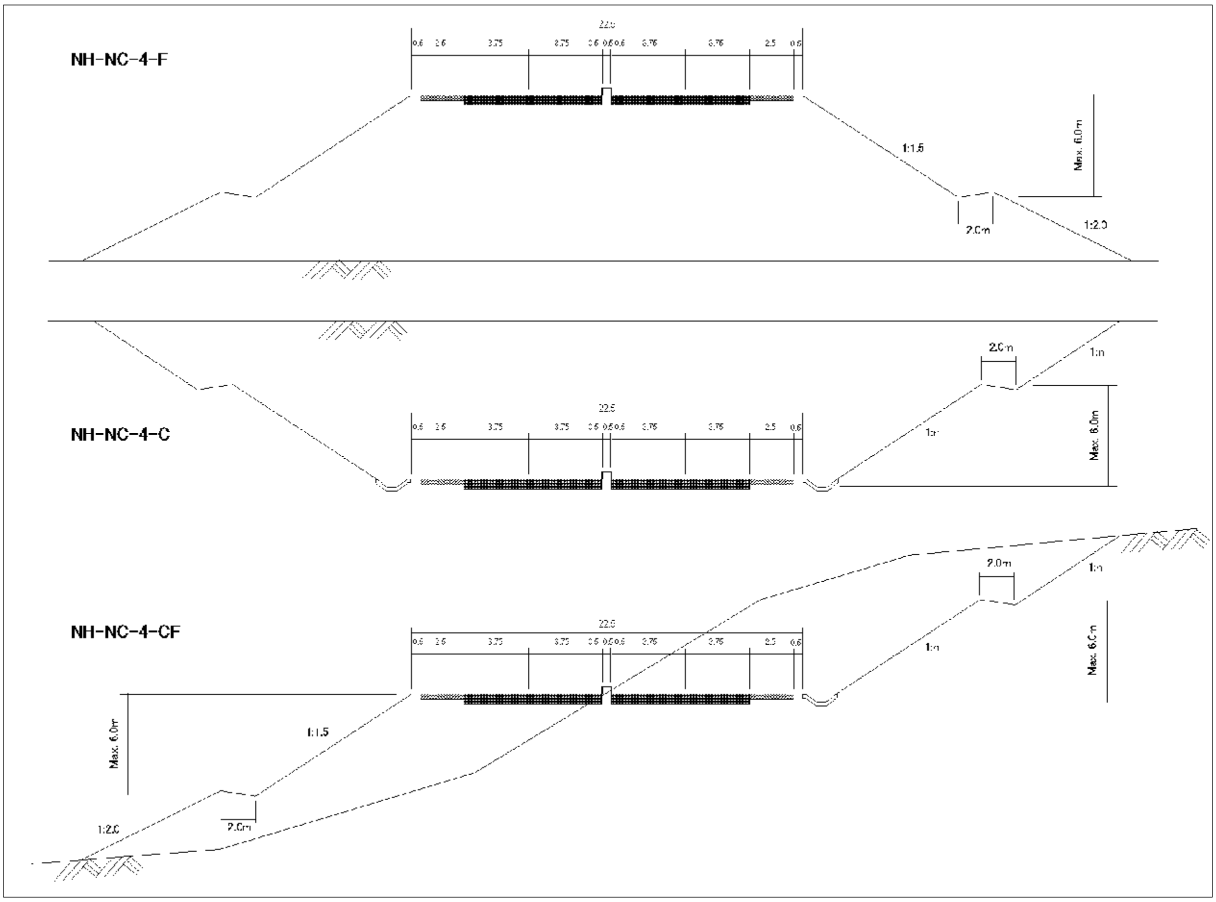
(3) New Construction of National Highways

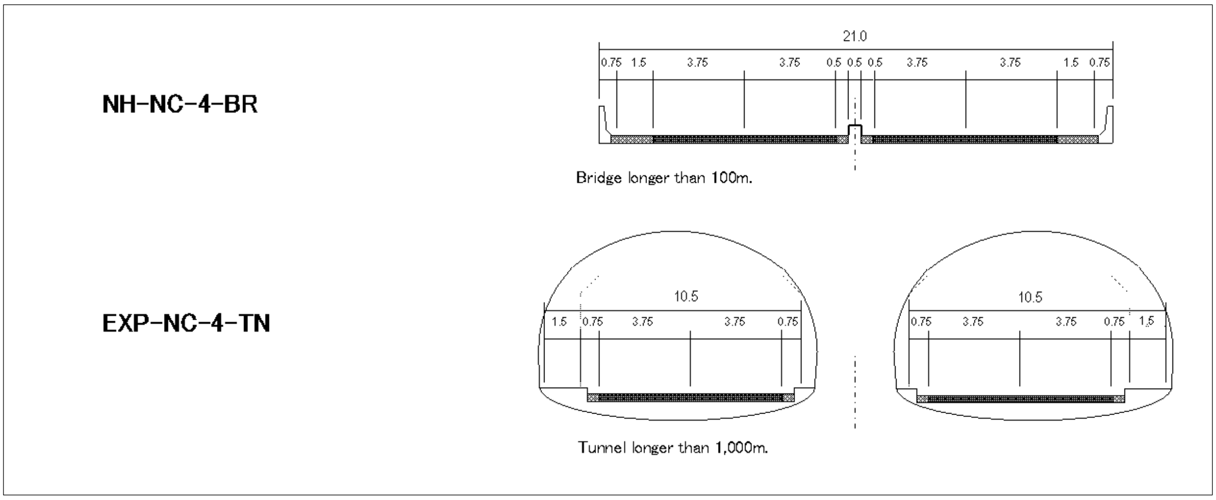
Figure 6 Typical Cross Section of National Highways (New Construction, 2-lane)



Source: VITRANSS 2 Study Team based on TCVN 4054-05

Figure 7 Typical Cross Section of National Highways (New Construction, 4-lane)

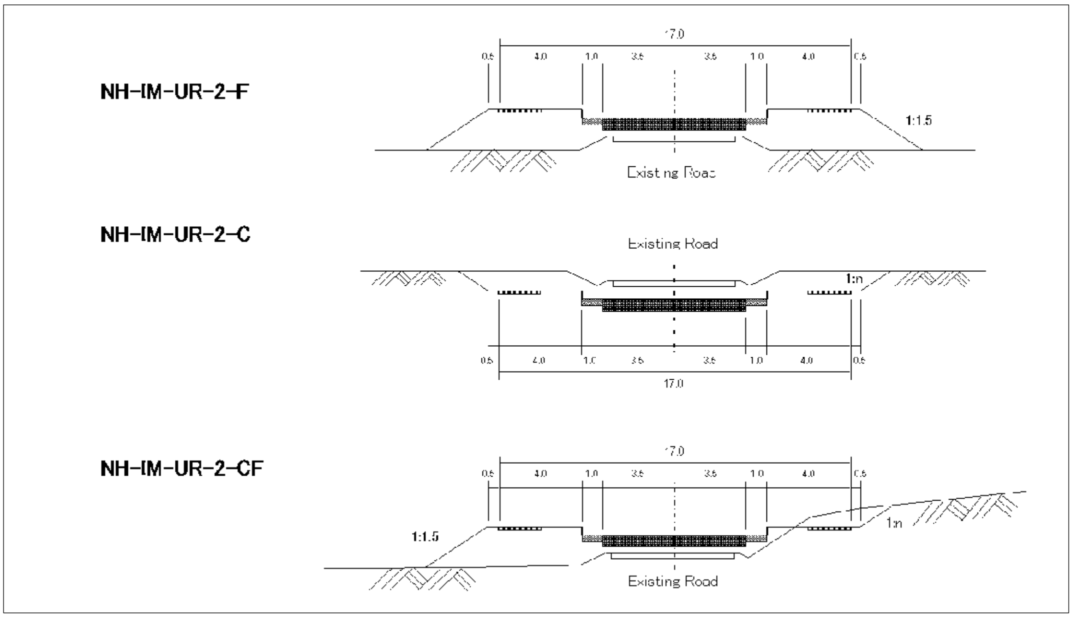




Source: VITRANSS 2 Study Team based on TCVN 4054-05

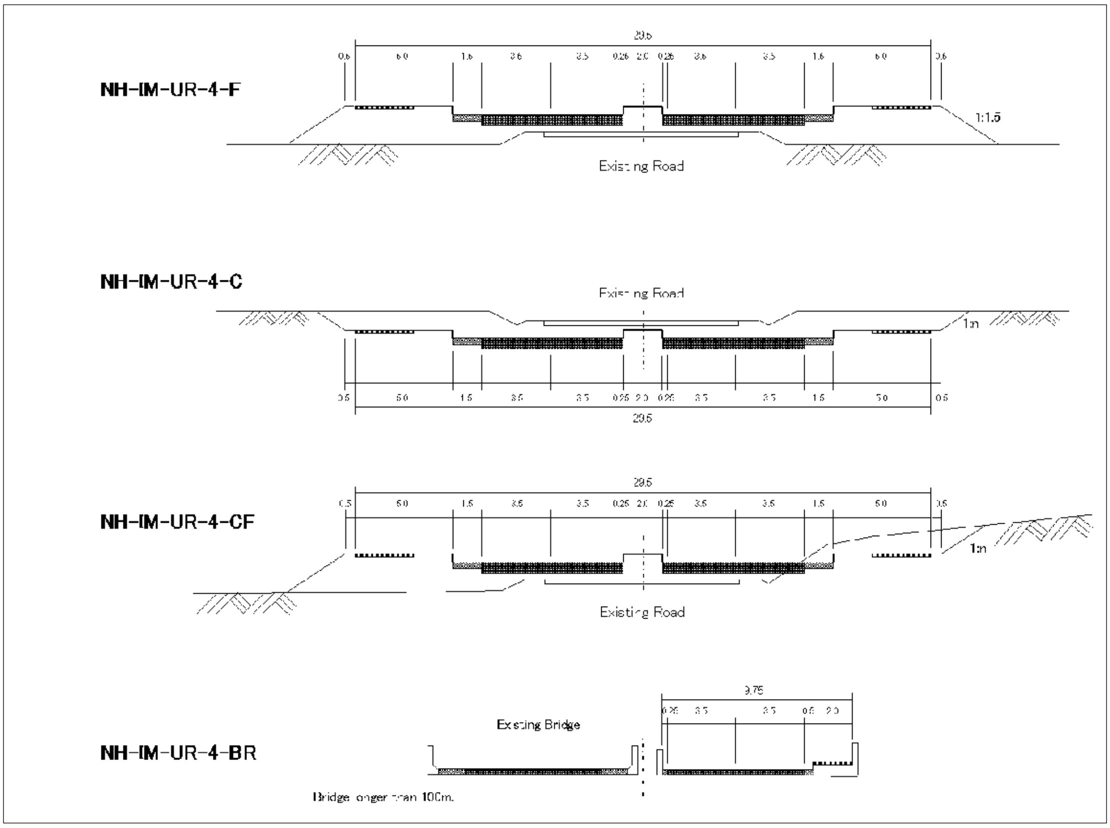
(4) Improvement of National Highways (Urban Section)

Figure 8 Typical Cross Section of National Highways in Urban Section (improvement, from 1-lane to 2-lane)



Source: VITRANSS 2 Study Team based on TCXDVN 104-07

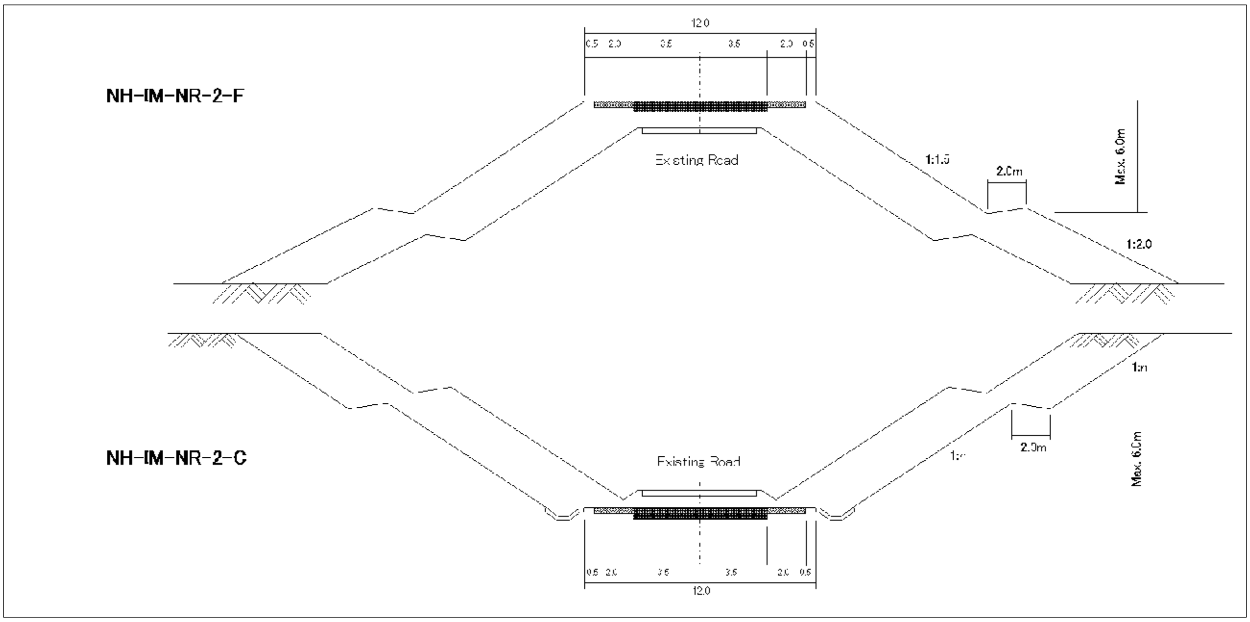
Figure 9 Typical Cross Section of National Highways in Urban Section (improvement, from 2-lane to 4-lane)

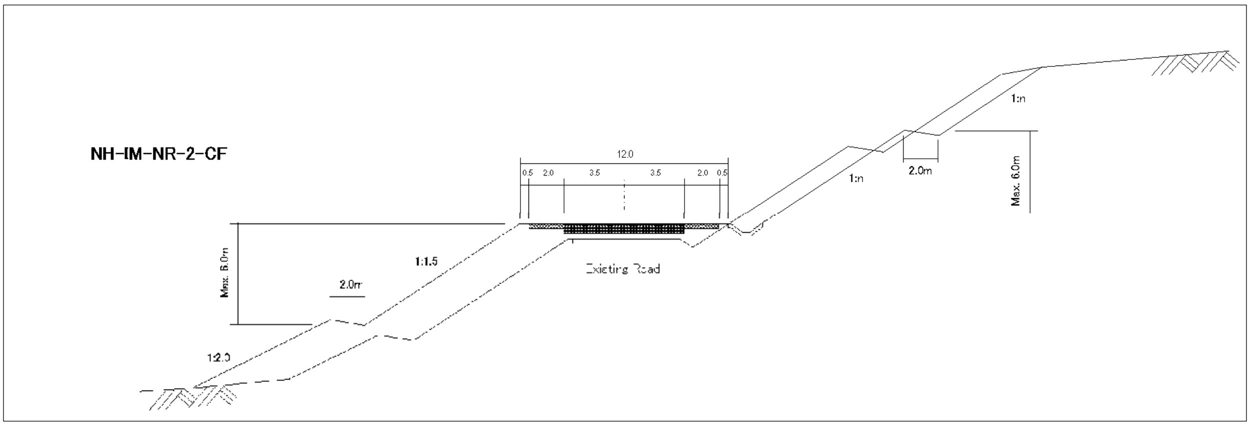


Source: VITRANSS 2 Study Team based on TCXDVN 104-07

(5) Improvement of National Highways (Non-Urban Section)

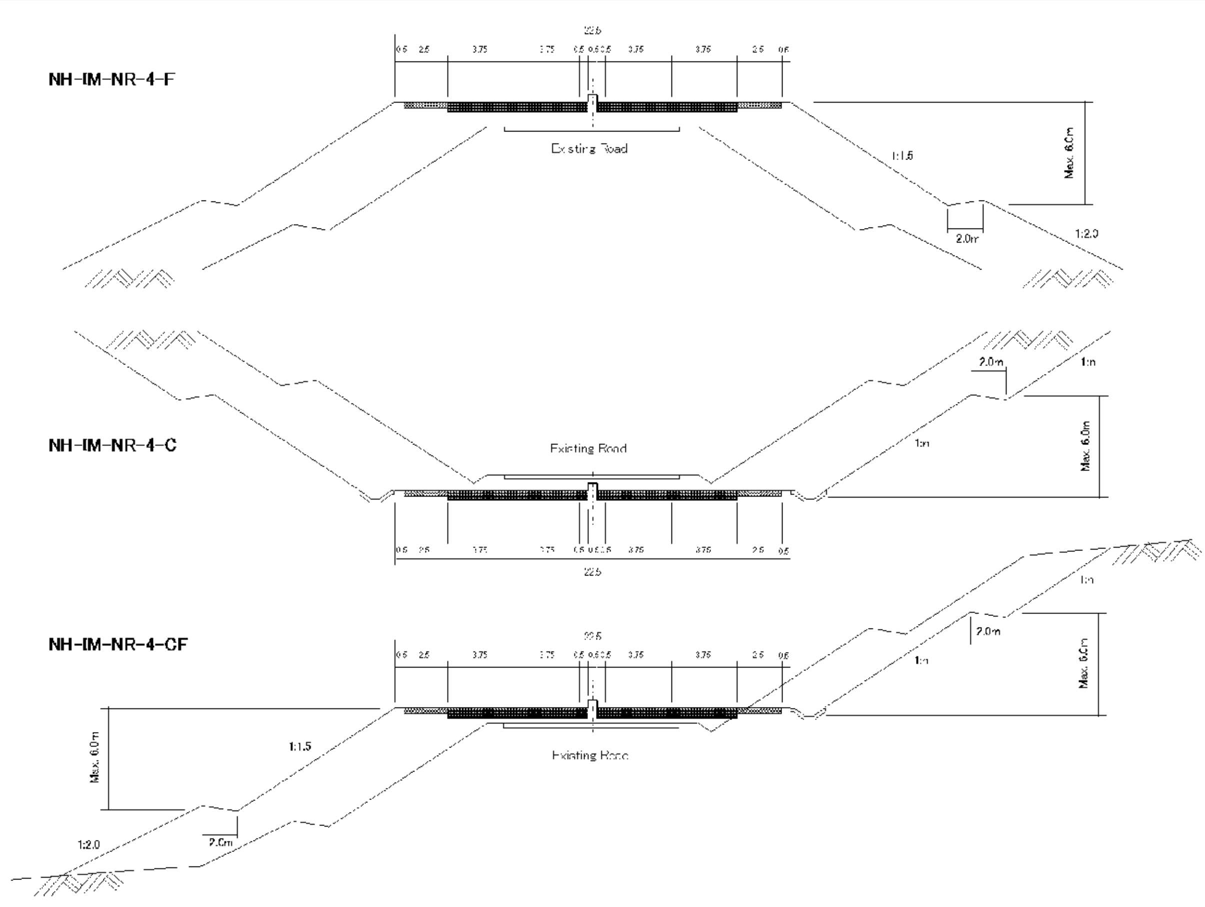
Figure 10 Typical Cross Section of National Highways in Non-Urban Section (improvement, from 1-lane to 2-lane)

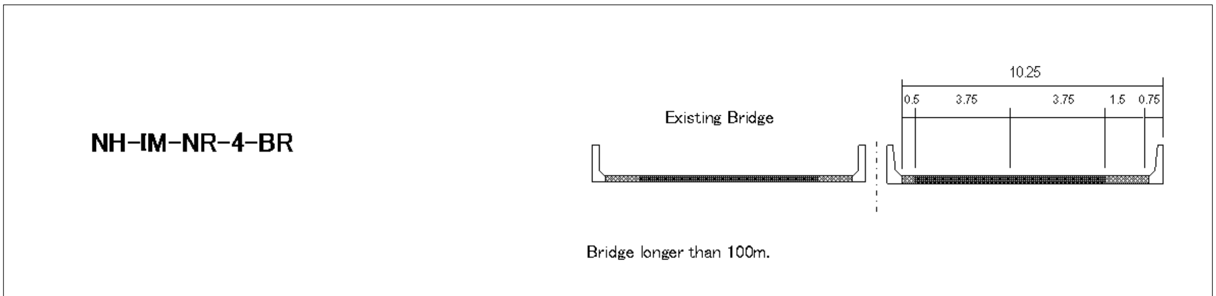




Source: VITRANSS 2 Study Team based on TCVN 4054-05

Figure 11 Typical Cross Section of National Highways in Non-Urban Section (improvement, from 2-lane to 4-lane)





Source: VITRANSS 2 Study Team based on TCVN 4054-05

4) Other Main Standardized Scale of Road Facilities for Setting Up Standard Unit Cost

(1) Expressways

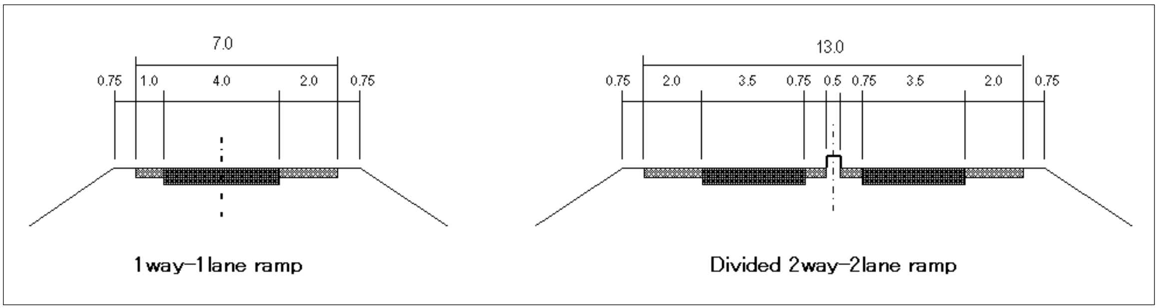
The following road facilities are the standardized scale for setting up standard unit cost.

(a) Interchanges

[Typical Cross Section on Ramps]

According to the expressway standard of Vietnam, the following typical cross sections on ramps are applied:

Figure 12   Typical Cross Section of Interchange Ramps on Expressways



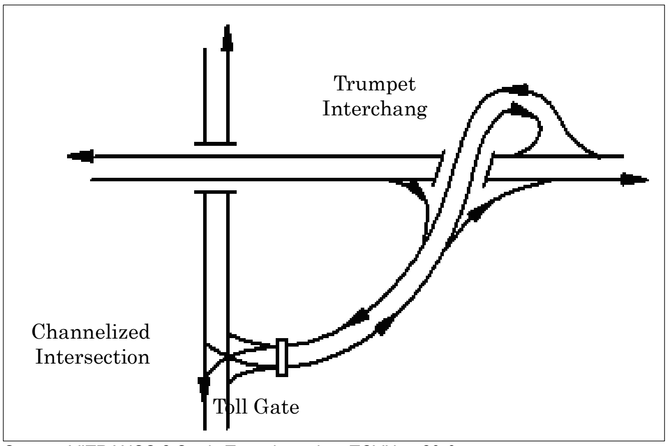
Source: VITRANSS2 Study Team based on TCVN 5729-07

A 2-way, 2-lane ramp is applied for the divided type for traffic safety. Also, the width of right side shoulder is adopted at 2.0 m considering the passing through of vehicles when another vehicle stops or slows down due to some trouble.

[Type of Interchanges]

As premised that the toll gate is located at interchange for setting up standard unit cost, the type of interchanges applied is the trumpet type. Also, for connection with ordinary roads, the type of intersection is assumed to be the channelized intersection. The typical arrangement for trumpet interchange with toll gate is shown in the following figure:

Figure 13   Typical Arrangement of Trumpet Interchange



Source: VITRANSS 2 Study Team based on TCVN 5729-07

[Design Speed of Ramps]

According to the Vietnamese expressway standard, the design speed of ramps should be as follows:

(i) Loop ramp: 40 km/h

(ii) Others: 60 km/h

[Ramp Terminals]

The width of speed change lane is 3.5 m in accordance with the Vietnamese expressway standard, Also, the width of shoulder next to speed change lane is applied the same width of main highway, namely 3.0 m in width.

The type of ramp terminals are as follows:

(i) Acceleration lane: parallel type

(ii) Deceleration lane: direct type

Comparing the calculated values based on the above assumptions and minimum length of speed change lane stipulated in the Vietnamese standard, the proposed lengths of speed change lane are shown in the following table:

Table 2 Typical Cross Section of Interchange Ramps on Expressways

Items	Acceleration Lane		Deceleration Lane	
Type of Ramp	Loop Ramp	Others	Loop Ramp	Others
Minimum Length by Standard	120m		30m	
Calculation	127m	50m	51m	20m
Applied (Rounded)	130m	120m	60m	30m
Tapering Length	60m		60m	

Source: VITRANSS 2 Study Team based on TCVN 5729-07

(b) Toll Plaza & Toll Gate Office

[Toll Plaza for Interchange Toll Gate]

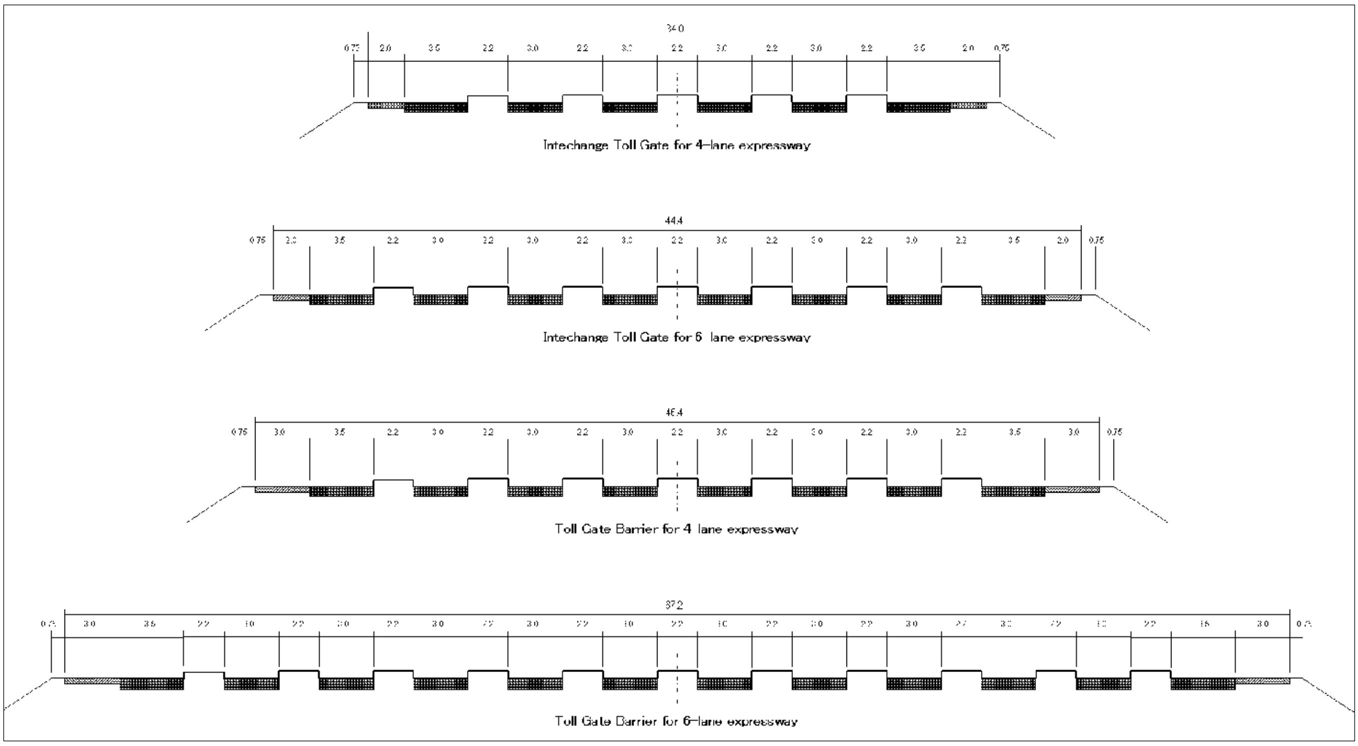
No. of Toll Lane

According to the Vietnamese expressway standard, the number of toll lane is computed at 1.5 times of main highway lanes for interchange toll gate, i.e., 6 toll lanes for a 4-lane expressway and 8 toll lanes for a 6-lane expressway. On the other hand, the number of toll lanes for toll gate barrier is computed at double the main highway lanes, i.e., 8 toll lanes for a 4-lane expressway and 12 toll lanes for a 6-lane expressway.

Typical Cross Section at Toll Gate

The width of toll lane is adopted at 3.0 m. However, a 3.5 m width is recommended for the outermost toll lane. Also, the width of toll gate island should be 2.2 m, and a shoulder width of 2.0 m for interchange toll gate which is the same as the one for normal cross section of ramps, with 3.0 m for toll gate barrier on main highway that are located at each side next to the outermost lane. Typical cross sections on toll gate are shown in the following figure:

Figure 14   Typical Cross Section on Toll Gate



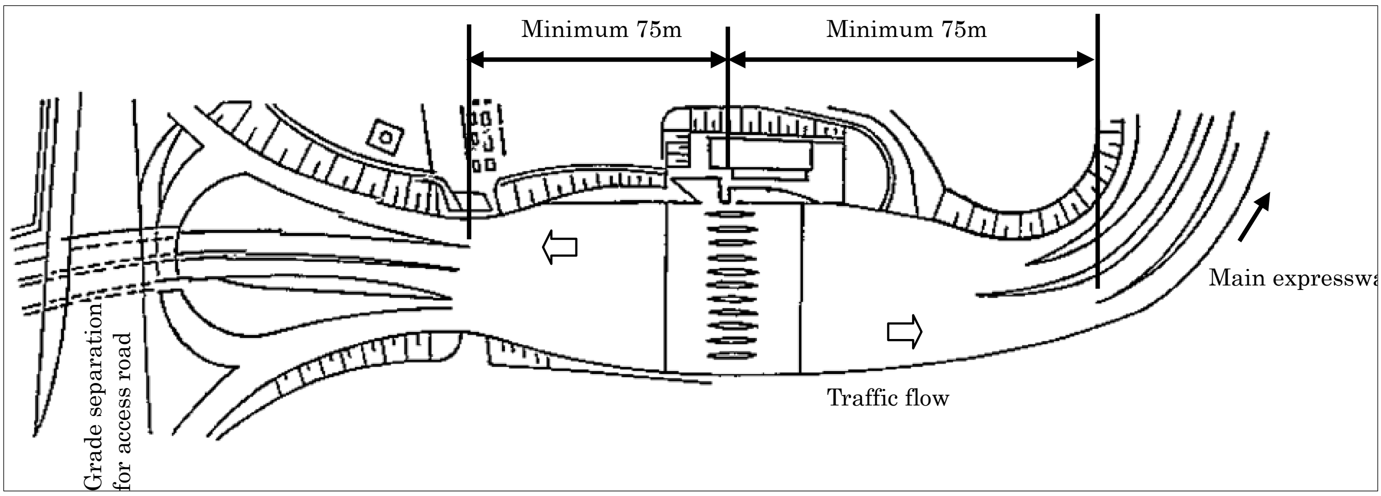
Source: VITRANSS 2 Study Team based on TCVN 5729-07

Toll Plazas

The length of toll gate islands should be 30 m and 40 m for interchange toll gate and toll gate barrier, respectively. Also, the width of toll gate should extend 15m and 25 m from the edge of toll gate island in both sides for interchange toll gate and toll gate barrier, respectively, for setting up standard unit cost. The pavement type in these areas is the cement concrete pavement.

For arrangement of toll gate, the distance between toll gate and nose point should be secured adequately for traffic safety because vehicles merge or diverge from/to toll gate. The minimum distance is proposed at 75 m according to the Japanese expressway standard as shown in the following figure.

Figure 15   Typical Cross Section on Toll Gate



Source: Design Standard for Expressway in Japan

Tolling Offices

Considering the efficiency of expressway management, the proposed tolling offices are classified into two types:

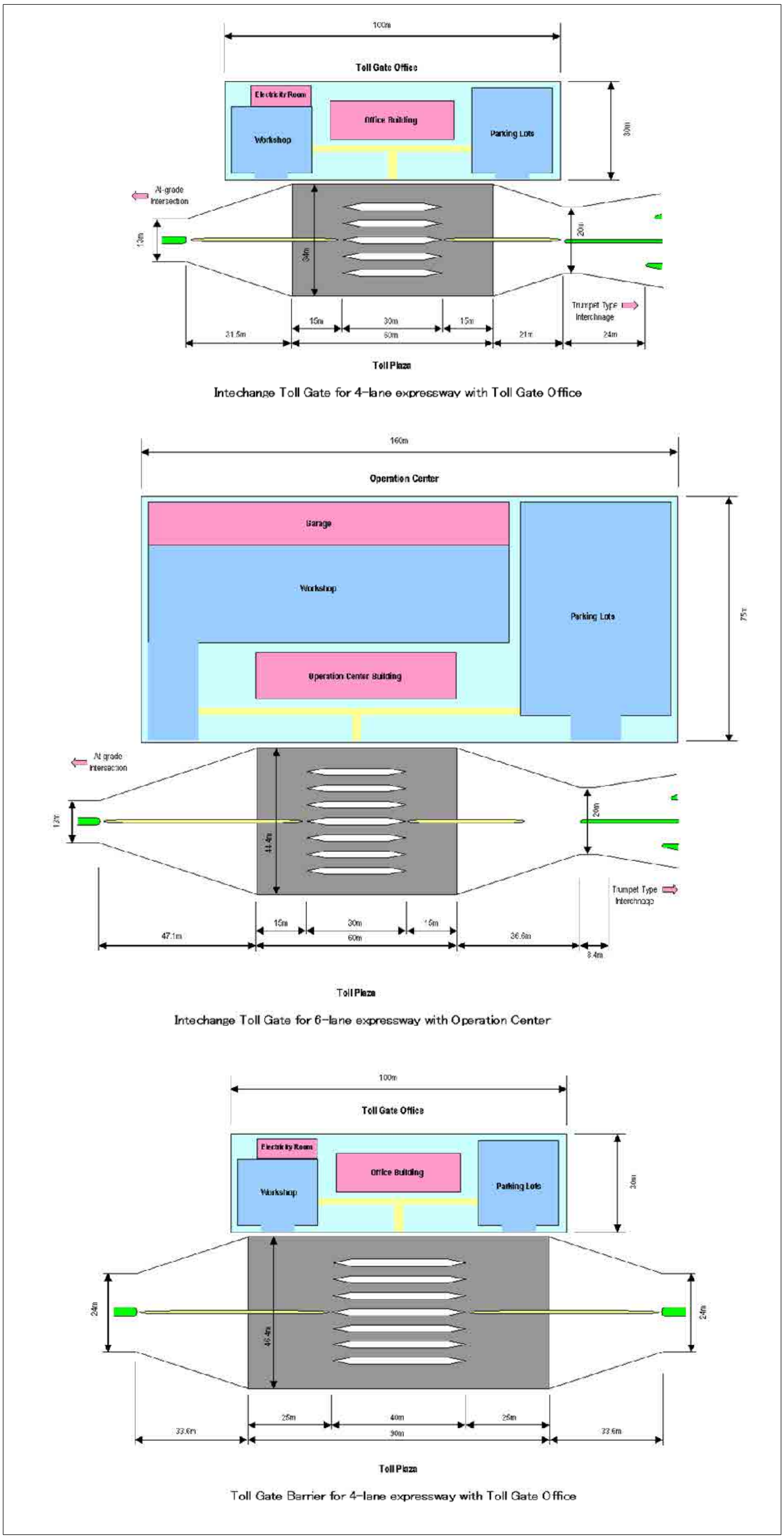
(i) Toll gate office: main purpose of this office is toll collection only.

(ii) Operation center: main purposes of this office are toll collection, operation and maintenance of expressway including emergency cases.

According to the Japanese expressway standard, the area of toll gate office is proposed from 3,000 to 5,000 sq.m,, and 3,000 sq.m is applied for setting up standard unit cost. Also, the area of operation center is proposed from 12,000 to 18,000 sq.m,, and 12,000 sq.m is applied. The maximum distance between operation centers is proposed at 100km considering that emergency vehicles can arrive at the site such as traffic accident and etc. within 30 minutes.

Typical layout of toll plaza and tolling office is shown in the following figure.

Figure 16   Typical Cross Section on Toll Gate

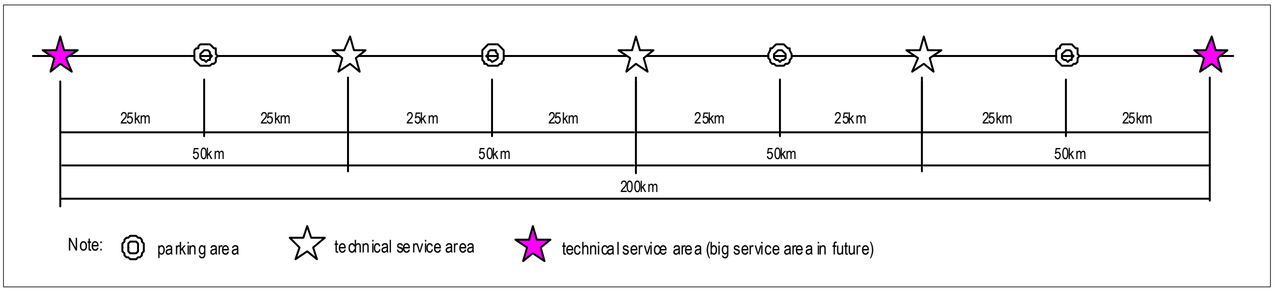


Source: VITRANSS 2 Study Team based on Vietnamese and Japanese expressway standard

(c) Rest Areas

Considering the main function of rest areas, as stipulated in the Vietnamese expressway standard, the rest area is divided into two types: one is parking area and the other is service area including small service and large service areas. The differences of service areas are mainly through aesthetics and better service in the long-term. Basic functions are almost the same. It is possible that the technical service area expands to big service area according to the demands of road users in the future. Therefore, technical service area is applied for setting up standard unit cost. Also, the conceptual spacing is assumed as shown in the following figure according to the Vietnamese expressway standard.

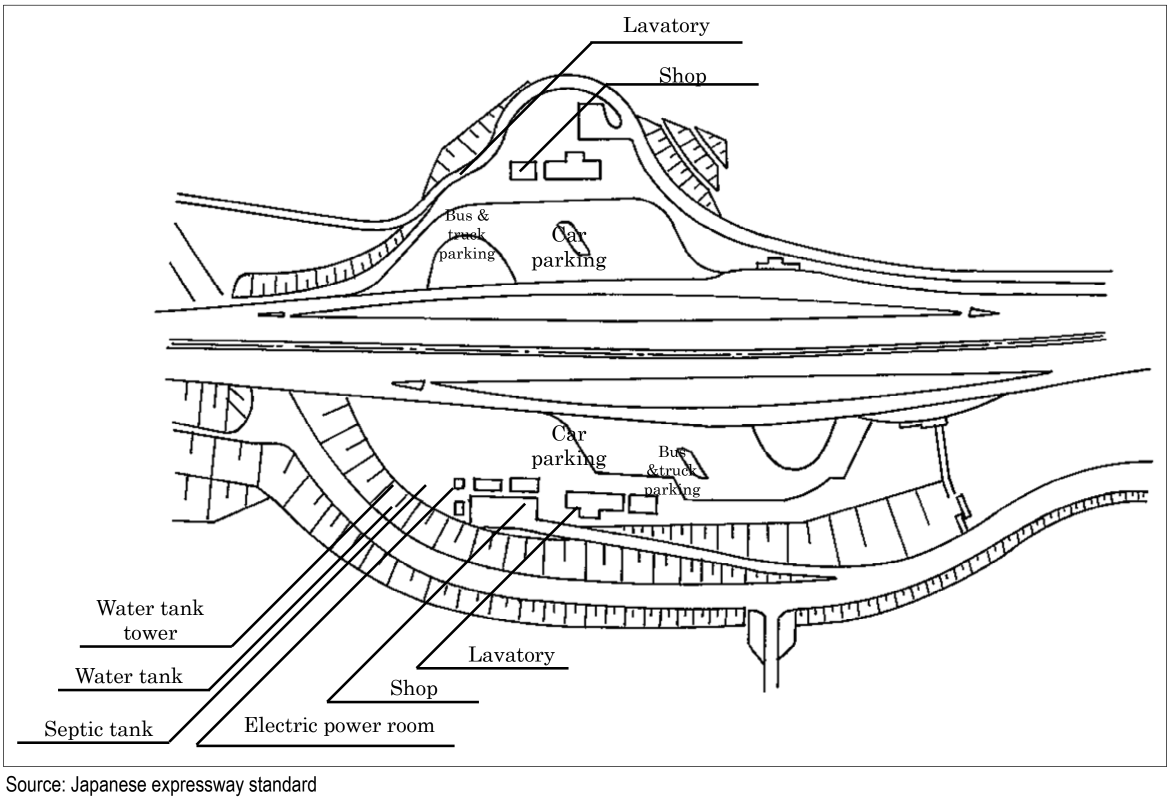
Figure 17 Conceptual Spacing of Rest Areas



Source: VITRANSS 2 Study Team based on Vietnamese expressway standard

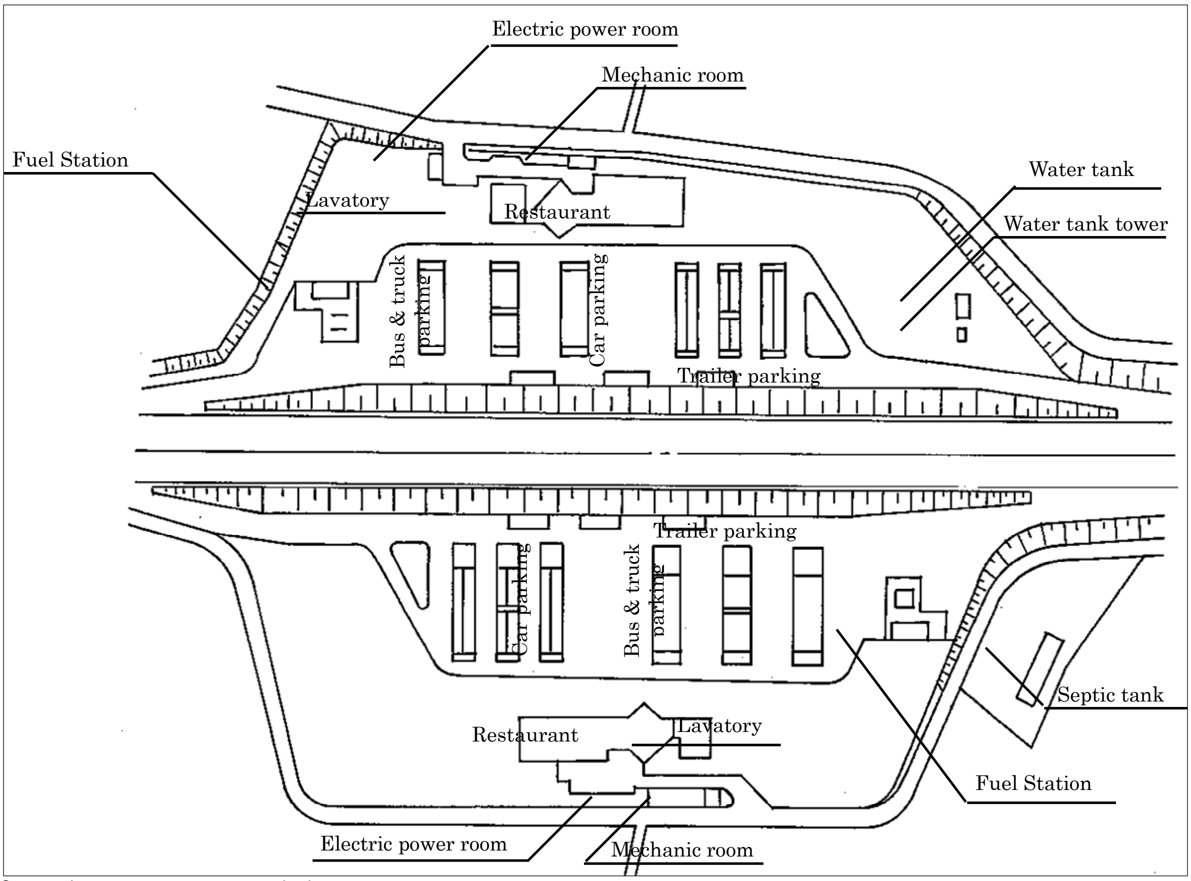
Scale of service areas is applied with the Vietnamese highway standard in the absence of a concrete Vietnamese expressway standard. The scales of parking area and service area are adopted at 3,000 sq.m and 5,000 sq.m, respectively. The following figures show the sample layouts of parking area and service area.

Figure 18 Sample Layout of Parking Area



Source: Japanese expressway standard

Figure 19   Sample Layout of Service Area



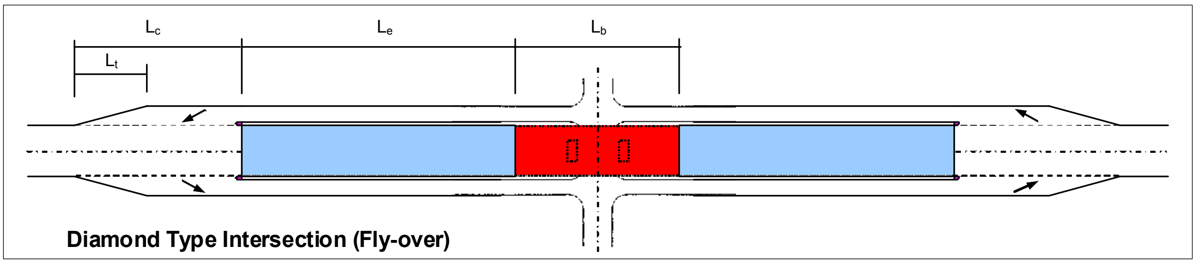
Source: Japanese expressway standard

(2) Urban Road Intersections

According to the Vietnamese urban road standard, the type of intersections between main urban roads, access urban roads and its combination depends on traffic conditions such as travel speed, the number of serious traffic accidents and etc. On the other hand, intersections of five types are formed with the combinations between typical cross sections of urban roads for setting up standard unit cost.

The intersections between 4-lane & 4-lane, 4-lane & 6-lane and 6-lane & 6-lane are proposed to apply the grade separation intersection among these intersections to secure smooth traffic and traffic safety, because these roads are categorized as main urban roads and have higher frequency of congestion and serious traffic accidents. For the setting up standard unit cost, the type of grade separation adopted is the diamond type intersection (fly-over) to minimize right-of-way and because it is suitable for the narrow urban roads in Vietnam. The basic layout of diamond type intersection (fly-over) is shown in the following figure.

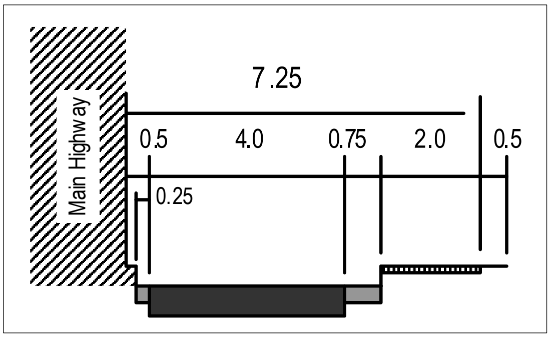
Figure 20 Layout of Diamond Type Intersection (Fly-over)



Source: VITRANSS 2 Study Team

Based on the Vietnamese urban road standard, the following is the typical cross section in intersection ramp;

Figure 21 Typical Cross Section of Intersection Ramp



Source: VITRANSS 2 Study Team based on TCXDVN 104-07

In the Vietnamese urban road standard, the right and left shoulders or marginal strip, which is safe line of median, are excluded. However, it is necessary to accommodate drainage facilities, markings, stopping car due to some trouble, etc., and to secure the clearance, among others. Therefore, 0.75 m and 0.25 m in width are added for right shoulder and marginal strip, respectively.

According to the premises, such as design speed and others, the length of each section is calculated and set out in the following table. Also, the grade separations require street lightings as among the main facilities.

Table 3 Each Section Length of Fly-over for Standard Unit Cost

Items	4-Lane x 4-lane	4-Lane x 6-lane	6-Lane x 6-lane
Bridge Section (Lb)	90 m	120 m	140 m
High Embankment Section (Le)	145 m	160 m	160 m
Merging/Diverging Section (Lc)	110 m	140 m	
Tapering Section (Lt)	90 m	120 m	

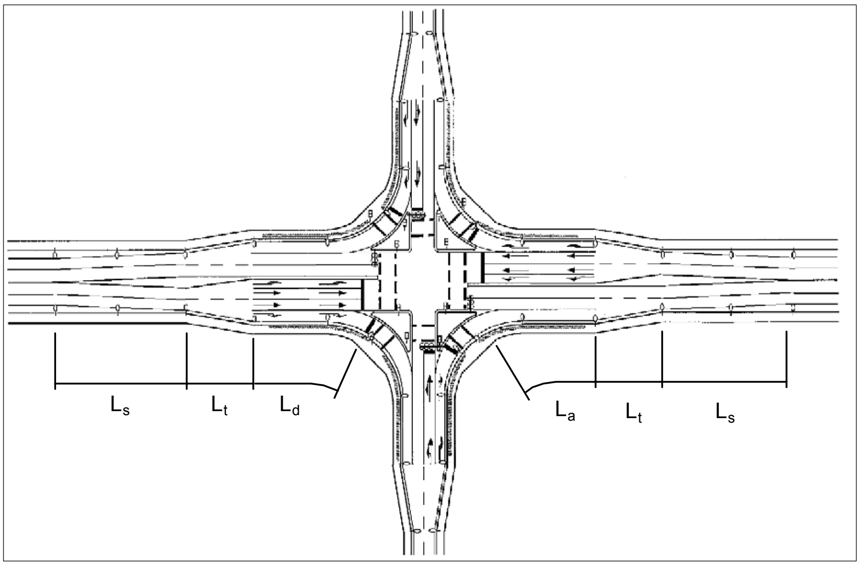
Source: VITRANSS 2 Study Team
Note: the height of abutment is assumed 7.0 m above minor road surface. The vertical grade is applied 6.0%.

(3) National Highway Intersections

According to the Vietnamese highway standard, the types of intersections are classified by traffic volume. On the other hand, three types of intersections are formed with the combinations between typical cross sections of highways for setting up standard unit cost.

The intersections between 2-lane & 4-lane and 4-lane & 4-lane are proposed to apply the channelized intersection among these intersections to secure smooth traffic and traffic safety, because the traffic volume of 4-lane highways is assumed to be high for the setting up standard unit cost. Also, the other types such as grade separation, etc. are applied when the traffic volume is higher. However, it is not required to be provided to comply with the target development levels in 2030. The sample layout of channelized intersection is shown in the following figure.

Figure 22 Sample Layout of Channelized Intersection (2-Lane & 4-Lane)



Source: VITRANSS 2 Study Team

In the Vietnamese highway standard, there is no mention about the shifting lane which enhances smooth shifting to secure traffic safety when the left turning lane doesn't accommodate within the median width. In the Japanese road standard, lane shifting length is stipulated as shown in the following table. The bigger value shall be applied after comparison with calculated value and minimum value.

Table 4 Lane Shifting Length (unit: m)

Design Speed (km/h)	Rural Area		Urban Area	
	Equation	Minimum	Equation	Minimum
80	V x W / 2	85	-	-
60		60	V x W / 3	40
50	V x W / 3	40		35
40		35		30
30		30		25
20		25		20

Source: Japanese Road Standard
Note: V- design speed, W- width of shifting

The width of speed change lane is stipulated as 3.5 m wide in the Vietnamese highway standard and it is followed for setting up standard unit cost. According to the premises such as design speed, etc., the length of each section are calculated and set out in the following table. Also, the channelized intersections require traffic signal, traffic signs and road markings at the least, and it is desirable to install street lightings and guardrails.

Table 5 Each Section Length of Channelized Intersection for Standard Unit Cost

Items	2-Lane	4-Lane
Shifting Section (Ls)*	100 m	85 m
Tapering Section (Lt)	35 m	
Deceleration Section (Ld)	50 m	
Acceleration Section (La)	120 m	

Source: VITRANSS 2 Study Team
Note: * - applied Japanese Road Standard.

APPENDIX 8A

Socio-Economic Framework and Forecast Models for Intra-Provincial Traffic Demand

Appendix 8A

SOCIO-ECONOMIC FRAMEWORK AND FORECAST MODELS FOR INTRA-PROVINCIAL TRAFFIC DEMAND

1 VITRANSS 2 SOCIO-ECONOMIC FRAMEWORK

VITRANSS 2 estimated province-wide population, urban population and Gross Regional Domestic Product (GRDP) in consideration of the following national and regional development directions.

(a) **National Development Directions:** The Central Party Executive Committee of Class VIII presented the Political Report at the Communist Party National Congress IX held in April 2001. This is called as "the Resolution No.9" that stated the main direction of the national socio-economic development up to 2010 and vision up to 2020.

(b) **Regional Development Directions:** The main goal of the Southern Focal Economic Zone (SFEZ)[1] is to be a dynamic developing zone with high and sustainable economic growth rate of the country. SFEZ plays role as the driving force of the nation, sharing the highest in the country's GDP and being the motive power of the Southeast region.

(i) Attaining GDP growth in period 2006–2010 and 2011–2020 by 1.2 and 1.1 times, respectively, in comparison with national average growth. Increasing GDP share to national from 36% at present to 40–41% by 2010 and 43–44% by 2020.

(ii) Developing average export value/capita from USD1,493 by 2005 to USD3,620 by 2010 and to USD22,310 by 2020.

(iii) Increasing the share in state budget revenue from 33.9% in 2005 to 38.7% by 2010 and 40.5% by 2020.

(iv) Attaining an average rate of 20–25% in renovating technology in the modernization process. 50% of the labor force should be trained by 2010.

(v) Creating of high quality manufacturing service and social centers to meet the demand of local and international tourism.

(vi) Reducing household poverty rate under 4% by 2010 and under 1% by 2020. Unemployment rate should be 4% by 2020.

(vii) Stabilizing regional population at 15–16 million by 2020. Social safety, political security, national defense and sustainable environment of urban and rural area are guarantee.

This study followed the socio-economic framework of VITRANSS 2, because the inter-provincial traffic demand that shares most of the traffic demand on the proposed expressway was taken from VITRANSS 2 in the form of OD matrices. This framework is shown in the following tables.

[1] SFEZ includes 7 provinces and cities: HCM city, Dongnai, Bariavungtau, Binhduong, Tayninh, Binhphuoc, Longan

Table 1.1 VITRANSS 2 Population Forecast by Region

Region	Population (000)				Growth Rate (%/yr)		
	2005	2010	2020	2030	2005—2010	2010—2020	2020—2030
Vietnam Total	83,120	88,971	101,439	113,954	1.4	1.3	1.2
1. Red River Delta	18,040	19,054	21,788	24,670	1.1	1.4	1.3
2. Northeast	9,358	9,763	10,552	11,382	0.8	0.8	0.8
3. Northwest	2,566	2,876	3,338	3,757	2.3	1.5	1.2
4. North Central Coast	10,620	11,162	12,378	13,673	1.0	1.0	1.0
5. South Central Coast	7,050	7,513	8,464	9,443	1.3	1.2	1.1
6. Central Highlands	4,759	5,395	6,261	6,747	2.5	1.5	0.8
7. Southeast	13,460	15,007	18,711	22,585	2.2	2.2	1.9
8. Mekong River Delta	17,267	18,202	19,948	21,697	1.1	0.9	0.8

Source: VITRANSS 2 (based on NCPFP projection, modified based on 2005 actual data)

Table 1.2 VITRANSS 2 Urban Population Forecast by Region

Region	Population (000)				Growth Rate (%/yr)		
	2005	2010	2020	2030	2005—2010	2010—2020	2020—2030
Vietnam Total	22,337	27,407	39,033	52,454	4.1	3.6	3.0
1. Red River Delta	4,356	5,805	8,700	11,837	5.3	4.1	3.1
2. Northeast	1,805	1,952	2,379	2,900	2.0	2.0	2.0
3. Northwest	357	400	474	561	2.3	1.7	1.7
4. North Central Coast	1,452	1,712	2,369	3,183	3.3	3.3	3.0
5. South Central Coast	2,108	2,580	3,819	5,233	4.0	4.0	3.2
6. Central Highlands	1,333	1,831	2,711	3,643	6.5	4.0	3.0
7. Southeast	7,321	8,788	12,158	16,340	3.7	3.3	3.0
8. Mekong River Delta	3,606	4,339	6,423	8,758	4.0	4.0	3.2

Source: VITRANSS 2 (based on NCPFP projection, modified based on 2005 actual data)

Table 1.3 Summary of VITRANSS 2 GDP Forecast

Sector	GRDP (1994 price, VND billion)				Annual Growth Rate (%)		
	2005	2010	2020	2030	05–10	10–20	20–30
	Medium Growth Scenario						
GDP Total	393,028	574,253	1,082,983	1,858,609	7.9	6.5	5.5
Primary	76,884	90,996	153,003	246,750	3.4	5.3	4.9
Secondary	157,869	239,214	439,731	744,809	8.7	6.3	5.4
Tertiary	158,275	244,043	490,249	867,050	9.0	7.2	5.9

Source: VITRANSS 2 Study Team

2 SOCIO-ECONOMIC FRAMEWORK OF THE STUDY AREA

In order to estimate the intra-provincial traffic demand, socio-economic framework was prepared by district for HCMC.

(a) **Population and Urban Population:** Based on the socio-economic framework and projection of VITRANSS 2 that forms the basis of the strategic development plan of the transport sector in Vietnam, the population and urban population of HCMC was projected up to 2030. Table 2.1 shows the population projection and urban population of HCMC up to 2030. This is consistent with VITRANSS 2. The total population of HCMC was around 6.6 million in 2009 and it is expected to increase to 10.0 million by 2020, and to 11.3 million by 2030. The urbanization rate of HCMC is projected to increase gradually.

Table 2.1 Population and Urban Population in Study Area

	Population (000)			Urban Population (000)			Urbanization Rate		
	2009	2020	2030	2009	2020	2030	2009	2020	2030
HCMC	6,642	10,001	11,293	5,792	8,790	10,049	0.872	0.879	0.890

Source: VITRANSS 2 Study Team

(b) **Population by District:** Table 2.2. shows the assumed population of HCMC by district.

Table 2.2 Assumed Population by District (Unit 000)

HCMC	2009	2020	2030
District 1	298	449	507
District 2	135	203	229
District 3	293	441	498
District 4	253	382	431
District 5	277	416	470
District 6	333	502	567
District 7	148	222	251
District 8	434	653	737
District 9	196	296	334
District 10	317	477	539
District 11	315	474	535
District 12	223	335	378
Go Vap	408	615	695
Tan Binh	423	637	720
Binh Thanh	532	801	904
Phu Nhuan	243	365	412
Thu Duc	277	417	471
Tan Phu	341	514	581
Binh Tan	189	285	322
Hyen Cu Chi	334	503	568
Hoc Mon	268	404	456
Binh Chanh	245	369	417
Nha Be	83	125	141
Huyen Can Gio	77	115	130
Total	6,642	10,001	11,293

Source: VITRANSS 2 Study Team

(c) **Urban Population by District:** The assumed urban population of HCMC by district is shown in Table 2.3.

Table 2.3 Assumed Urban Population by District (Unit 000)

HCMC	2009	2020	2030
District 1	299	463	518
District 2	135	209	234
District 3	294	455	509
District 4	254	393	440
District 5	277	429	480
District 6	334	517	579
District 7	148	229	256
District 8	435	673	753
District 9	197	305	341
District 10	318	492	550
District 11	316	489	546
District 12	223	346	386
Go Vap	410	634	709
Tan Binh	425	657	735
Binh Thanh	534	826	924
Phu Nhuan	243	377	421
Thu Duc	278	430	481
Tan Phu	32	32	58
Binh Tan	45	46	81
Hyen Cu Chi	56	57	102
Hoc Mon	44	45	81
Binh Chanh	45	46	82
Nha Be	343	530	593
Huyen Can Gio	105	108	191
Total	5,792	8,790	10,049

Source: VTIRANSS 2 Study Team

(d) **Economic Growth in GDP by Province:** Table 2.4 shows the projection of GRDP of HCMC up to 2030. This is consistent with VITRANSS 2, however this projection is moderate compared to the ambitious targets set by HCMC, reflecting the recent economic slowdown.

Table 2.4 GRDP of HCMC

	GRDP (VND billion, 1994 Price)			Growth Rate	
	2009	2020	2030	2009-20	2020-30
HCMC	124,883	232,171	381,778	1.058	1.051

Source: VITRANSS 2 Study Team

<National Average>
2011-20 6.5%
2021-30 5.5%
(VITRANSS 2)

(e) **GRDP by District:** The GRDP of HCMC by district was assumed to grow as shown in Table 2.5.

Table 2.5 Assumed GRDP by District (VND billion at 1994 constant prices)

HCMC	2009	2020	2030
District 1	19,513	36,277	59,653
District 2	9,756	18,138	29,826
District 3	6,504	12,092	19,884
District 4	6,504	12,092	19,884
District 5	6,504	12,092	19,884
District 6	6,504	12,092	19,884
District 7	6,504	12,092	19,884
District 8	6,504	12,092	19,884
District 9	6,504	12,092	19,884
District 10	6,504	12,092	19,884
District 11	6,504	12,092	19,884
District 12	6,504	12,092	19,884
Go Vap	5,203	9,674	15,907
Tan Binh	3,252	6,046	9,942
Binh Thanh	1,951	3,628	5,965
Phu Nhuan	1,951	3,628	5,965
Thu Duc	2,602	4,837	7,954
Tan Phu	5,203	9,674	15,907
Binh Tan	2,602	4,837	7,954
Hyen Cu Chi	1,951	3,628	5,965
Hoc Mon	1,951	3,628	5,965
Binh Chanh	1,951	3,628	5,965
Nha Be	1,301	2,418	3,977
Huyen Can Gio	650	1,209	1,988
Total	124,883	232,171	381,778

Source: VITRANSS 2 Study Team

3 FORECAST MODELS

Trip generation/attraction and distribution models were developed to estimate the demand of intra–provincial traffic. The model structure is outlined below:

(a) Regressional model to estimate generation and attraction:

$$Gi = a \times UPOPi + b \times GRDPi + c$$

$$Ai = d \times UPOPi + e \times GRDPi + f$$

Where:

Gi: generation of zone i

Ai: generation of zone i

UPOP: urban population

GRDP: Gross Regional Domestic Product

(GRDP for truck trips only)

(b) Gravity model to generate intra–provincial traffic:

$$T_{ij} = \frac{C \text{ X } G_i^a \text{ X } A_j^b}{d_{ij}^c}$$

Where:

Gi: generation of zone i

Aj: generation of zone j

dij: distance between zone i and j

C: constant

a, h, c: parameter

Tij: trips between zone i and zone j